

Sample Survey for The Estimation
of Marine Catch in Thailand

1970

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PREFACE

In Thailand, the First Marine Fisheries Census was undertaken in April, 1967 successfully by the Department of Fisheries in close collaboration with the National Statistical Office. The purpose of the census was not only to clarify the economic structure of marine fisheries in this country but also to secure a basic frame necessary for the planning of the marine fisheries production survey.

Although the census provide us with an adequate frame for the designing of a sample survey to estimate marine catch, a considerable preparatory works were needed to initiate its actual survey, e, g, for the establishment of field organization, the training of supervisors and enumerators, an introduction of fishing unit registration system for major type of fisheries to trace the change of its number and size composition and so forth.

Basically the marine fisheries production survey consists of three types of sample survey, i, e, (1) log book survey, (2) fishing community survey and (3) coastal culture survey. However, owing to some difficulties to implement such new sample surveys at the same time, only the log book survey and the fishing community survey were initiated since June in 1969 on a national wide basis. During the year of 1969 technical and administrative problems relating to the field work were carefully studied, and hence some parts of the survey method and questionnaires were revised so as to fit to the actual status of the field work. In the mean time, the survey method to estimate a yield from coastal culture was carefully studied.

The survey could not continue from January to March in 1970, due to the lack of the budget. Then, since June in 1970, the marine fisheries production survey was taken up in fully scale in order to estimate total catch of the marine fisheries and now these surveys are going on fairly well, although there may have some problems to be solved.

More detail explanation in this survey are shown in the "Instruction of Annual Sampling Survey on Marine Fisheries" and the "Manual for Questionnaires".

I would like to express my sincerely gratitude to Dr. T. Yamamoto, FAO. Regional Fisheries Statistician, gave me many valuable advices in

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1. Basic Conditions to be taken into Account in Designing the Survey

A survey method is necessary in order to accomplish a clearly designated aim, and is limited by the character of marine fisheries and socio-economic conditions prevailing in the country under survey. Objectives of this survey, present industrial structure of marine fisheries and socio-economic conditions prevailing in Thailand will be dealt with in more detail hereafter.

1) Purpose of the Survey

The purpose of the survey is to estimate monthly catch and fishing effort so that the survey can be utilized in fisheries administration and fish stock assessment throughout the country. For this purpose the survey must comply with the following form:

- (1) Estimate of catch according to fishing method.
- (2) Estimate of catch according to the species of fish.
- (3) Fishing effort according to the fishing method used.
- (4) When dealing with major fishing method, catch data must be shown in each stratum and fishing area.
- (5) Above-mentioned facts can be used only in dealing with each fisheries region, not by province. The coastal line in this country is divided into five geographical regions as follows:

<u>Region</u>	<u>Name of Region</u>	<u>Provinces covered</u>
No. 1	Eastern	Trad to Rayone
No. 2	Central	Chantaburi to Prachuab Kirikhan
No. 3	Middle	Chumporn to Nakhon Srithammarat
No. 4	Southern	Songkhla to Narathivet
No. 5	Western	Along the coast of the Indian Ocean

2) Marine Fisheries Characteristics

Since the 1960's trawl fisheries have been remarkably well developed and the industrial structure of marine fisheries has been changed from the level of small family business to that of big business. Many types of old fashioned fishing gear, such as set

bag net, bamboo stake trap, lift net, scoop net, cast net, etc., have been replaced by modern fishing gear such as otter trawl and purse seine. The fishing ground has also been expanded from the coastal area to the South China Sea and the Indian Ocean. The majority of the fish are caught by using modern fishing gear. However, according to the 1967 first marine fisheries census, the ratio of enterprise fisheries was only 5% of all fisheries households. By far the greater number of fishermen are still engaged in coastal fishing using many types of miscellaneous fishing gear. Such fishing gear and the species caught may be changed according to the fishing season.

In addition, various types of aqua-culture, such as shrimps, oysters, arkshells and seamussels are well developed as the tropical sea is favorable for their culture. Especially, as the number of farmers in shrimp culture are increasing in accordance with the increasing demand for their product.

Marine fisheries encompasses many types of fishing methods and aqua-cultures, so it is difficult to apply a sampling survey to all types.

3) Characteristics of Fish Marketing

There are about one thousand and five hundred (1,500) fishing communities along the coast of the Gulf of Thailand and the Indian Ocean.

Coastal fishermen land their fish at their own fishing communities. Trawlers and purse seiners are mostly based at the large fishing ports situated near the fishing grounds or large consumer markets.

There is no fish auction available at the above communities with the exception of Bangkok and Samutsakhorn.

Transactions are made directly between the fishermen and the dealers or the fish is sent to Bangkok directly on consignment. The wives of the coastal fishermen deliver the fish to buyers or to the morning market.

In Japan and Taiwan there are fishermen's cooperatives which carry on the fish marketing activities, however, there is no such

organization in this country and therefore, fish marketing is completely controlled by private dealers. These dealers are principally Chinese and are reluctant to disclose their transactions to Government. It is therefore, extremely difficult to obtain accurate data from said dealers.

4) Socio-Economic Conditions to be Taken into Account

To be applicable, a survey method must be both theoretical and practical. Should a survey method be difficult to adapt to field work it should not be adopted, even though the method may be superior from the viewpoint of methodology.

In making a field survey there may be many obstacles to be taken into account, such as, transportation problems, inability of field workers, insufficient budget and inefficient system of accounting in the Government offices, etc.

For these, and other reasons, it is necessary to find a practical method, even though it be more primitive than desired.

5) Type of Surveys Adopted

After taking into account the above-mentioned conditions necessary for the field work, the marine fisheries in Thailand may be classified into three groups, i. e. important fisheries (to be designated hereafter), other marine fisheries and coastal culture.

The following methods are to be adopted for each group:

<u>Type of Survey Method</u>	<u>Survey objective</u>
Log book survey	Important fisheries
Fishing community survey	Other marine fishing
Coastal culture survey	Aqua-culture

2. Log Book Survey

Log book survey is applied to the important fishing method, i. e. trawls, purse seines, and bamboo stake traps. Although the ratio of these fishing boats to the total number of boats is comparatively small, the catch ratio amounts to about 60% of the total marine production. It is therefore, necessary to obtain data as accurate as possible by using the log book method for these methods.

1) Survey Objects

The following types of fishing are included in this group:

- | | |
|------------------------|---|
| (1) Trawls | Otter board trawls
Pair trawls |
| (2) Purse Seines | Thai purse seines
Chinese purse seines |
| (3) Bamboo stake traps | |

2) Sampling Unit

Fishing units 1/ employed in these fishing methods as aforementioned are regarded as sampling units.

1/ A Fishing Unit is defined as the smallest unit used to carryout a fishing operation, and usually consists of boats, gear and crew. The number of fishing units is counted according to the fishing method adopted. In the case of pair-trawl, these two boats are counted as one unit. As for Chinese purse seine, one mechanized boat and two non-powered boats are regarded as a fishing unit. Each set of bamboo stake trap is regarded as one unit.

3) Sampling Method

A stratified sampling method is applied to the trawls and purse seines. Fishing units using these methods are classified into three strata in terms of the length of the boats employed 1/

A simple estimation method is applied to the survey.

Estimates of the total catch can be obtained by using the following formula;

$$\frac{\hat{\Lambda}}{T} = \frac{N}{n} \sum_{k=1}^n x_k$$

Giving:

- | | | |
|---------------------------|---|--------------------------------|
| $\frac{\hat{\Lambda}}{T}$ | = | Total estimate of catch |
| N | = | Total number of fishing units |
| n | = | Number of sample fishing units |
| x_k | = | Catch of sample fishing units |

Estimates of total fishing efforts, such as number of hauls or fishing days can be obtained by using the same formula.

The estimated catch for each species is calculated according to the species composition in terms of percentage which can be estimated by the sample fishing units.

1/ The size of the fishing boats in Thailand is traditionally measured in terms of length of the boats, hence, there is no record of fishing boats in terms of gross tonnage.

4) Allocation of Samples

(1) The following number of samples are decided upon for each type of fishing, based on the present scale of budget available.

- a. Trawls 150
- b. Purse seines 40
- c. Bamboo stake traps 40

(2) Due to the number of fishing units and the size of the fishing craft varying in each fisheries region, the number of samples in trawls and purse seines are allocated in each fisheries region and stratum by using the Neyman method, so that the number of samples could be proportional to the amount of the catch to ensure more accuracy.

(Otter Trawls)

According to the 1968 Ad-Hoc Survey on Trawl Fisheries, the average yearly catch and catch rate in each stratum of the otter board trawls were as follows:

<u>Size of Boat</u>	<u>Average yearly catch</u>	<u>Rate of catch</u>
Less than 14m	104 tons	1.0
14m to 18m	192 tons	1.9
18m or over	382 tons	3.7

The following formula is used for calculating the total number of fishing units weighted:

$$x = n_1 + n_2 \times 1.9 + n_3 \times 3.7$$

Giving:

- x = Total number of fishing units weighted
- n₁ = Number of fishing units using a boat 14m in length
- n₂ = Number of fishing units using a boat 14m to 18m in length

n_3 = Number of fishing units using a boat 18m or over
in length

The number of samples are allocated in each fisheries region and stratum according to the number of fishing units weighted, as shown in Appendix 1.

(Pair Trawls)

According to the 1968 Ad-Hoc Survey on Trawl Fisheries, the annual catch rate in each stratum was as follows:

<u>Size of Boat</u>	<u>Catch rate</u>
Less than 14m	1.0
14m to 18m	1.5
18m or over	2.4

The number of samples of pair trawls are allocated in each stratum in terms of the number of fishing units weighted, as shown in Appendix 2.

All fishing units of pair trawls are concentrated in region No. 2.
(Purse Seine)

Due to the Purse Seine catch rate varying according to the types of fishing employed, the number of samples are allocated by each type of purse seine by applying the Neyman method.

<u>Type of fishing</u>	<u>Catch rate</u>
Thai Purse Seine <u>1/</u>	1.0
Chinese Purse Seine <u>2/</u>	0.55

The catch-rate abovementioned was obtained by the log-book survey initiated in August, 1969. According to the survey, the catch efficiency of Thai purse seine was nearly twice as high as that of Chinese purse seine. The number of samples are allotted in each type of fishing in terms of the number of fishing units weighted, as shown in Appendix 3.

1/ The Thai purse seine fishing method is the same as one boat purse seine; one mechanized boat is used in fishing.

2/ One fishing unit of Chinese purse seine consists of one mechanized boat and two non-powered boats. When the crew find the school of fish, two non-powered boats are used for net operation.

(Bamboo stake trap)

The number of samples are allocated into each fishing region in proportion to the number of fishing gears. This is because the catch efficiency of stational gears vary based upon the location of the fishing area.

The number of samples in each fisheries region are shown in Appendix 4.

5) Method of Enumeration

In principle, owners of sample fishing units are requested to keep up to date the monthly log book for each catch. As the sorting of caught fish is made after landing at the pier, it is difficult to record the weight of each day's catch in kilograms.

In cases where the owner cannot record the catch themselves, the respective enumerators are requested to borrow the transaction record from said owner and complete it for each special, or, to await the sample boat at the pier in order to count the fish boxes and baskets.

3. Fishing Community Survey

1) Survey Objects

All marine fisheries other than important ones as designated earlier in this report, and Coastal culture as hereafter.

2) Sample Unit

A fishing community is regarded as a sample unit, due to the appliance of the log book method to such miscellaneous fishing gear as appears to be difficult, i. e.

(1) A complete list of fishing units for various types of fishing is not available. Also, the number of boats for such miscellaneous fishing methods fluctuate according to the season.

(2) It is not possible to rely on the fishermen recording their daily catch in the log book.

3) Sampling Method

(1) Stratification of the fishing communities.

The stratified sampling method is applied in this survey.

The stratification of fishing communities is based on the following:

- a. Due to the difference in number, size of fishing boats and types of gear employed in each community, the amount of catch monthly also differs.

Generally, the monthly catch in a large fishing community is larger than that in a smaller community.

- b. A fishing boat is the most important means of production in marine fishing, with the exception of stationary gear and aqua-culture. The catch is larger in accordance with the size of the boat.

From the aforementioned all marine fishing communities in Thailand are classified into four strata in terms of the number of boats weighted. In weighting the boats, the average monthly catch by a mechanized boat is assumed to be twice that of a non-powered boat.

Therefore, the formula in calculating the number of boats weighted in each community is:

$$x = a + 2b$$

where:

- x = number of boats weighted
- a = number of non-powered boats
- b = number of powered boats

In calculating the number of boats weighted in each community, the number of boats engaged in the following types of fishing are excluded from the total number based on the First Marine Fisheries Census in 1967:

- a. The number of fishing boats engaged in trawls, excepting beam trawls.
- b. Fishing boats employed in purse seine.
- c. Number of fishing boats employed in bamboo stake trap
- d. Number of fishing boats engaged in aqua-culture, i. e. shrimp culture, oyster culture, shell and seamussel culture.

(2) Frequency distribution of fishing communities.

The frequency distribution of the fishing communities in terms of the number of boats weighted is made in each region as shown in Appendix 5.1 to 5.5, based on the 1967 Marine Fisheries Census. According to these tables, it is noted that:

- a. The percentage of small fishing communities with less than 25 weighted boats was 40% to 60% in each region, but the percentage of weighted boats was only 10 to 22 per cent of the total.
- b. The percentage of larger fishing communities with boats weighting 200 or over was less than 3%, and the percentage of weighted boats was 5% to 18% of the total.

<u>Fishing Reg.</u>	<u>No. of Comms.</u>	<u>No. of boats</u>		<u>No. of boats</u>	
		<u>Weighted</u>	<u>No. of Comms.</u>	<u>Weighted</u>	<u>No. of Comms.</u>
		<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
1	59	19	1	8	
2	50	10	3	18	
3	57	15	2	11	
4	48	10	1	5	
5	60	23	-	-	

This shows that there are many small marine fishing communities in Thailand, but their share of the catch was extremely low. More attention should be paid to the large fishing communities in order to obtain more accurate data for the survey.

4) Allocation of Samples

(1) Allocation of samples in each region

150 samples are allocated in each fishing region, in proportion to the number of fishing boats weighted, as follows:

<u>Region</u>	<u>No. of Boats Weighted</u>	<u>Percent</u> %	<u>Sample Size</u>
1	6,395	13.4	20
2	12,933	27.2	41
3	10,749	22.5	34
4	9,049	18.9	28
5	8,540	18.0	27
Total	47,666	100.0	150

(2) Allocation of samples in each stratum

After the samples have been allocated to each region, they are again allocated in each stratum in terms of the number of boats weighted.

The strata are classified as follows:

<u>Strata</u>	<u>No. of boats weighted</u>
1	200 or over
2	100 to 200
3	25 to 100
4	1 to 25

The number of samples in each region and stratum is shown in Appendix 6.

5) Method of Enumeration

(1) The preparation of a complete list of fishing households.

The Fisheries Inventory Survey is undertaken in the same sample communities prior to the fishing community survey every year. Then the name of the head of a fishing household, house number, name and length of boats, type of fishing in which engaged mainly, are copied from the particulars collected by the Fishing Inventory Survey, with the exception of the following households

- a. Households which are not engaged in fishing.
- b. Households whose family members are employed by others as fisheries labourers and do not engage in their own fishing.

- c. Households whose family members engage in fishing as partners with others.
- d. Households exclusively engaged in the following types of fishing:
 - 1. Trawls
 - 2. Purse seines
 - 3. Bamboo stake traps
 - 4. Shrimp culture, Oyster Culture, Arkshell and Seamussel culture.

(2) Calculating the number of fishing units.

For each fishing household in the sample community the major type of fishing engaged in during the previous month is researched with the help of the community chief. When a household is engaged in two or more different types of fishing the major type of fishing for the previous month is checked in terms of the volume of catch. The number of fishing units in each type of fishing is then enumerated per sample community.

(3) Selection of five samples.

Five sample fishing units are selected at random for each type of fishing followed the previous month. The number of trips per month and average catch per trip are noted for each sample, so that it is possible to calculate the average catch per month by multiplying the number of trips by the average catch per trip.

The catch by species of the last trip of the previous month is noted by kilograms for each sample in order to calculate the percentage of fish species composition.

6) Estimation of Catch

(1) Estimation of the monthly catch in a sample community.

Estimation of the catch per each type of fishing in a sample community is made by the following formula:-

$$\hat{Y} = N \times X$$

where:

- $\hat{\uparrow}$ = Estimated catch by each type of fishing
- N = Number of fishing units for each type of fishing
- X = Average catch per units per month

The total catch is arrived at by adding the catches for all types of fishing engaged in for the previous month.

(2) Estimation of monthly catch at the regional base.

The ratio estimation method is applied in this survey. Estimate of the total catch can be obtained by the following formula:

$$\hat{\uparrow} = y \times \frac{\sum_{k=1}^n x_k}{\sum_{k=1}^n Y_k}$$

where:

- $\hat{\uparrow}$ = Total estimated of catch
- Y = Total number of fishing boats weighted
- y = The number of fishing boats weighted in sample communities
- x = Total catch of sample fishing communities

(3) Estimation of the monthly catch per type of fishing at the regional base.

After estimating the monthly catch at the regional base, the monthly catch per type of fishing is estimated the following way:

- a. Total catch by type of fishing in sample fishing communities is calculated.
- b. The ratio of catch in each type of fishing is secured in terms of percentage.
- c. Total estimate of catch in each type of fishing is secured by multiplying the total estimated catch by the percentage of catch.

4. Coastal Culture Survey

1) Survey Objects

The following types of aqua-culture are included in this survey:

- (1) Shrimp culture
- (2) Oyster culture
- (3) Seamussel culture
- (4) Arkshell culture

2) Sampling Unit

Operators engaged in the aqua-culture mentioned above are regarded as sample units.

3) Application of Booking Method

The booking method is applied to record daily harvests. As the water temperature in this country is almost constant all the year round, the spawning and harvesting seasons for shrimp culture and arkshell culture are not clearly defined. For instance, the farmers pump up fry shrimp into ponds together with sea-water almost every night, and also harvest large shrimp. Arkshell culture farmers spread seeds in their own ground and collect big ones during low-tide.

It is necessary, therefore, to apply a recording method in order to check daily products.

4) Sampling Method

A stratified sampling method is applied to the culture of shrimp, arkshell and oyster, in order to obtain more accurate data. For these three types of culture, the total number of operators are classified into three strata in terms of the area of farmland being used, as the techniques applied in each case appear to be the same. The unstratified sample method is applied to seamussle culture.

5) Allocation of Samples

(1) Shrimp culture

a. Stratification of operators

The area distribution of shrimp farms in each province is shown in Appendix 7, based on the First Marine Fisheries Census in 1967.

As the majority of shrimp operators are concentrated in Region 2, i. e. Smutsakhorn, Smutprakarn and Smutsongkhlam Provinces, the total number of operators in this region are classified into the following three strata:-

Strata	Area <u>1/</u> of Farm
1	200 rai or over
2	50 to 200 rai
3	1 to 50 rai

$$\underline{1/} \quad 1 \text{ Rai} = 1,600 \text{ m}^2$$

b. Allocation of sample size in each region.

40 samples are allocated in each region, proportional to the acreage in each region, in order to secure more accurate data.

Region	Area Rai	Weight	Sample size
Total	35,237	100.0	40
I	34,424	97.0	37
II	813	3.0	3

c. Allocation of sample size in each stratum in the region 2.

37 samples are allocated in each stratum, so as to proportional the amount of acreage of the pond in each stratum.

Strata	Area Rai	Weight	No. of Operators	No. of Samples
Total	34,424	100.0	825	37
A	5,849	17.1	17	6
B	13,625	39.5	136	15
C	14,950	43.4	673	16

(2) Arkshell culture

a. Stratification of operators

The distribution of the area for arkshell culture in each province is shown in Appendix 8, based on the 1967 First Marine Fisheries Census.

The total number of operators are classified into the following three strata in terms of cultured area:-

<u>Strata</u>	<u>Acreage (Rai)</u>
1	50 or over
2	20 to 50
3	1 to 20

b. Allocation of sample size for each strata

18 samples are allocated in each stratum, proportional to the amount of acreage of the culture in each stratum as follows:

Strata	Amount of Acreage	Weight %	No. of Operators	Sample Size
1	994	28.2	11	5
2	1,186	33.6	35	6
3	1,343	38.2	125	7
Total	3,523	100.0	171	18

(3) Oyster culture

The number of culture operators and the amount of acreage in each province are shown in the following table.

Province	No. of Operators	Amount of Acreage m ²	Percentage %	Sample Size
Chonburi	14	5,200	3.7	2
Chantaburi	77	124,600	89.5	20
Surathani	13	9,400	6.8	3
Total	104	139,200	100.0	25

The number of samples are allocated in each province so as proportional the acreage of the culture.

6) Method of Enumeration

The selected operators are requested to enter the weight of products on the form daily. For arkshell culture an operator should also complete the date when the seeds were spread.

Enumerators are requested to visit the operators once a month to receive the completed form.

7) Estimation of Total Yield.

(1) The estimate of the total monthly yield can be obtained by the following formula:

$$\hat{T} = Y \times \frac{\sum_{k=1}^n X_k}{\sum_{k=1}^n y_k}$$

where:

\hat{T} = Total estimate of yield

Y = Total acreage based on the census

x_k = Yield reported by sample operators

y_k = Pond acreage of sample operators

Appendix 1.

Allocation of Samples of Otter Board Trawls

(1) Number of Fishing Units

Region	Total	Less than 14 m	14m - 18m	18m or over
Total	1,974	636	935	403
No. 1	486	232	248	6
No. 2	807	193	364	250
No. 3	336	105	158	73
No. 4	164	81	69	17
No. 5	178	25	96	57

(2) Allocation of Samples in each Fishing Region & Stratum

Region	No. of Fishing Units Weighted				Sample Size ^{1/}				Sample Ratio		
	Total	<14 _m	14-18 _m	≥18 _m	Total	<14 _m	14-18 _m	≥18 _m	<14 _m	14-18 _m	≥18 _m
Total	3,903	636	1,776	1,491	120	20	55	45	1/32	1/17	1/9
No. 1	725	232	471	22	21	7	14	0	1/33	1/18	
No. 2	1,810	193	692	925	56	6	21	29	1/32	1/17	1/9
No. 3	675	105	300	270	21	4	9	8	1/26	1/18	1/9
No. 4	275	81	131	63	8	2	4	2	1/40	1/17	1/8
No. 5	418	25	182	211	14	1	7	6	1/25	1/14	1/9

^{1/} Average catch per units in each stratum was as follows according to the Ado-hoc Survey on Trawlers, 1968:

Strata	Average catch per unit	Catch rate
< 14m	104 tons	1.0
14-18m	192 tons	1.9
18m or over	382 tons	3.7

Appendix 2.

Allocation of Samples of Pair Trawl

Strata	No. of Fishing Unit	Weighting Factor	No. of Fishing units Weighted	Sample Size	Sample Ratio
Less than 13m	16	1	16	2	1/8
13 to 18m	77	1.5	119	9	1/8.5
18m and over	102	2.4	245	19	1/5.4
Total	195		380	30	1/6.5

Appendix 3.

Allocation of Sample Size of Purse Seines

Type of Fishing	No. of Fishing Units	Weighting Factor	No. of Fishing Units Weighted	Sample Size	Sample Ratio
Thai Purse Seine	502	1	502	37	1/13.5
Chinese Purse Seine	69	0.55	38	3	1/12.7
Total	571	-	540	40	1/13.5

Appendix 4.

Allocation of Sample Size of Bamboo Stake Traps

Region	Population Size	Sample Size	Sample Ratio
Total	312	40	
No. 1	89	12	1/7.4
No. 2	172	22	1/7.8
No. 3	41	5	1/8.2
No. 4	2		
No. 5	8	1	1/8

Distribution of the Fishing Communities

5 - 1 Region No. 1

	Distribution		Percentage		Accumulated No. of		Accumulated Percentage	
	No. of Community a	Weighted No. of Boats b	a'	b'	Fishing Communities C	Weighted Boats D	C'	D'
10 - 25	125	1,206	59.2	18.9	15	6,395	100.0	100.0
26 - 50	47	1,693	22.3	26.5	86	5,189	40.8	81.1
51 - 75	21	1,250	9.9	19.5	39	3,496	18.5	54.7
76 - 100	7	619	3.3	9.7	18	2,246	8.6	35.1
101 - 125	5	547	2.4	8.5	11	1,627	5.3	25.4
126 - 150	2	257	0.9	4.0	6	1,080	2.9	16.9
151 - 175	1	152	0.5	2.4	4	823	2.0	12.9
176 - 200	1	184	0.5	2.9	3	671	1.5	10.5
201 - 225	1	216	0.5	3.4	2	1,487	1.0	7.6
226 - 250								
251 - 275	1	271	0.5	4.2	1	271	0.5	4.2
276 - 300								
301 or over								
Total	211	6,395	100	100	211	6,395	100	100

Appendix 5.

Distribution of the Fishing Communities

5 - 2 Region 2

	Distribution		Percentage		Accumulated No. of			Accumulated Percentage	
	a No. of Communities	Weighted No. of Boats	a'	b'	C Fishing Communities	D Weighted No. of Boats	C'	D'	
0 - 25	147	1,337	50.5	10.3	291	12,933	100.0	100.0	
26 - 50	61	2,363	21.0	18.4	144	11,596	49.5	89.7	
51 - 75	35	2,222	12.1	17.2	83	9,233	28.5	71.3	
76 - 100	21	1,814	7.3	14.0	48	7,011	16.4	54.1	
101 - 125	10	1,101	3.5	8.5	27	5,197	9.1	40.1	
126 - 150	4	548	1.4	4.2	17	4,096	5.6	31.6	
151 - 175	1	174	0.3	1.2	13	3,548	4.2	27.4	
176 - 200	3	570	1.1	4.4	12	3,374	3.9	26.2	
201 - 225	1	224	0.3	1.7	9	2,804	2.8	21.8	
226 - 250	1	228	0.3	1.8	8	2,580	2.5	20.1	
251 - 275	1	268	0.3	2.1	7	2,352	2.2	18.3	
276 - 300	2	577	0.7	4.5	6	2,084	1.9	16.2	
301 - 325	1	308	0.3	2.4	4	1,507	1.2	11.7	
326 - 350	1	330	0.3	2.6	3	1,199	0.9	9.3	
351 - 375	1	352	0.3	2.7	2	869	0.6	6.7	
376 - 400									
401 or over	1	517	0.3	4.0	1	517	0.3	4.0	

Appendix 5.

Distribution of the Fishing Communities

5 - 3 Region 3

	Distribution		Percentage		Accumulated No. of		Accumulated Percentage	
	a No. of Communities	Weighted	a'	b'	Fishing Communities	Weighted at No. of Boats	c'	d'
0 - 25	157	1,578	56.5	14.7	278	10,749	100.0	100.0
26 - 50	44	1,538	15.8	14.3	121	9,171	43.5	85.3
51 - 75	31	1,950	11.1	18.2	77	7,633	27.7	71.0
76 - 100	19	1,603	6.8	14.9	46	5,683	16.5	52.8
101 - 125	11	1,241	4.0	11.6	27	4,080	9.7	37.9
126 - 150	6	827	2.2	7.7	16	2,849	5.8	26.3
151 - 175	3	494	1.1	4.6	10	2,012	3.6	18.6
176 - 200	2	364	0.7	3.4	7	1,518	2.5	14.0
201 - 225	2	421	0.7	3.8	5	1,154	1.8	10.6
226 - 250	1	228	0.4	2.1	3	733	1.1	6.8
251 - 275	2	505	0.7	4.7	2	505	0.7	4.7
276 - 300								
301 or over								
Total	278	10,749	100	100	276	10,749	100	100

Appendix 5.

Distribution of the Fishing Communities

5 - 4 Region 4

	Distribution		Percentage		Accumulated No. of		Accumulated Percentage	
	a No. of Communities	Weighted No. of Boats	a'	b'	C Fishing Communities	D Weighted No. of Boats	C'	D'
0 - 25	97	857	48.0	9.6	202	8,898	100.0	100.0
26 - 50	39	1,546	19.3	17.4	105	8,041	52.0	90.4
51 - 75	24	1,501	11.9	16.9	66	6,495	32.7	73.0
76 - 100	15	1,314	7.4	14.8	42	4,994	20.8	56.1
101 - 125	15	1,720	7.4	19.3	27	3,680	13.4	41.3
126 - 150	6	808	3.0	9.1	12	1,960	6.0	22.0
151 - 175	2	329	1.0	3.7	6	1,152	3.0	12.9
176 - 200	2	371	1.0	4.2	4	823	2.0	9.2
201 - 225	1	217	0.5	2.4	2	452	1.0	5.0
226 - 250	1	235	0.5	2.6	1	235	0.5	2.6
251 - 275								
276 - 300								
301 or over								
Total	202	8,898	100.0	100.0	202	8,898	100	100

Appendix 5.

Distribution of the Fishing Communities

5 - 5 Region 5

	Distribution		Percentage		Accumulated No. of			Accumulated Percentage	
	a No. of Communities	Weighted No. of Boats	a'	b'	C Fishing Communities	D Weighted No. of Boats	C'	D'	
0 - 25	171	1,925	60.0	22.5	285	8,540	100.0	100.0	
26 - 50	67	2,547	23.5	29.8	114	6,615	40.0	77.5	
51 - 75	22	1,332	7.7	15.6	47	4,068	16.5	47.7	
76 - 100	13	1,109	4.6	13.0	25	2,736	8.8	32.1	
101 - 125	6	687	2.1	8.0	12	1,627	4.2	19.1	
126 - 150	3	398	1.1	4.7	6	940	2.1	11.1	
151 - 175	1	158	0.3	1.9	3	542	1.0	6.4	
176 - 200	2	384	0.7	4.5	2	384	0.7	4.5	
201 - 225									
226 - 250									
251 - 275									
276 - 300									
301 or over									
Total	285	8,540	100.0	100.0	285	8,540	100.0	100.0	

Appendix 6.

Allocation of Samples in Each Stratum

(Fishing Community Survey)

6 - 1 Region No. 1

Strata	No. of Boats	Weight (%)	Total No. of Communities	No. of Samples	Sample Ratio
Total	6,395	100.0	211	20	
A	487	7.6	2	2	1/1
B	1,140	17.8	9	3	1/3
C	3,562	55.7	75	11	1/7
D	1,206	18.9	125	4	1/31

6 - 2 Region No. 2

Strata	No. of Boats	Weight (%)	Total No. of Communities	No. of Samples	Sample Ratio
Total	12,933	100.0	291	41	
A	2,804	21.7	9	9	1/1
B	2,393	18.5	18	8	1/22
C	6,399	49.5	117	20	1/6
D	1,337	10.3	147	4	1/37

6 - 3 Region No. 3

Strata	No. of Boats	Weight (%)	Total No. of Communities	No. of Samples	Sample Ratio
Total	10,749	100.0	278	34	
A	1,154	10.7	5	5	1/1
B	2,926	27.2	22	9	1/2
C	5,091	47.4	94	16	1/6
D	1,578	14.7	157	4	1/39

6 - 4 Region No. 4

Strata	No. of Boats	Weight (%)	Total No. of Communities	No. of Samples	Sample Ratio
Total	9,049	100.0	203	28	
A	452	5.0	2	2	1/1
B	3,395	37.5	26	10	1/2.6
C	4,361	48.2	78	13	1/6
D	841	9.3	97	3	1/32

6 - 5 Region No. 5

Strata	No. of Boats	Weight (%)	Total No. of Communities	No. of Samples	Sample Ratio
Total	8,540	100.0	285	27	
A					
B	1,627	19.1	12	5	1/2
C	4,988	58.4	102	16	1/6
D	1,925	22.5	171	6	1/28

Appendix 7.

Acreage Distribution of Shrimp Culture

	Smuth-Prakarn		Smuth-Sakorn		Smuth-Songklam		Chantaburi		Total	
	No. of Operators	Acreage	No. of Operators	Acreage	No. of Operators	Acreage	No. of Operators	Acreage	No. of Operators	Acreage
1 - 25	180	2,757	257	3,435	35	436	2	22	474	6,650
25 - 50	101	4,054	83	3,593	17	675	4	470	215	8,792
50 - 75	27	1,623	6	425	8	436	3	171	44	2,655
75 - 100	36	3,125	10	925	8	725			54	4,775
100 - 125	6	704	6	735					12	1,439
125 - 150	9	1,259	1	132	1	150	1	150	12	1,691
150 - 175	1	160	2	325	1	170			4	655
175 - 200	8	1,600	3	589	3	542			14	2,731
200 - 225	3	657							3	657
225 - 250	1	240	1	237					2	477
250 - 275										
275 - 300	2	600	4	1,194					6	1,794
300 - 325	1	311							1	311
325 - 350			1	350					1	350
350 - 375	1	360							1	360
375 - 400	1	400							1	400
400 and over					1	1,500			1	1,500
Total	377	17,850	374	11,940	74	4,634	20	813	845	35,237

Appendix 8.

Acreage Distribution of Arkshell Culture

Interval	Smuth-Songklam		Phetburi		Total	
	No. of Operators	Acreage	No. of Operators	Acreage	No. of Operators	Acreage
0 - 10	10	66	44	273	54	339
10 - 20	21	368	50	636	71	1,004
20 - 30	13	357	7	186	20	543
30 - 40	9	352	2	96	11	448
40 - 50	4	195	.		4	195
50 - 60	3	172			3	172
60 - 70	2	140			2	140
70 - 80						
80 - 90			2	168	2	168
90 - 100	1	100			1	100
100 - 110						
110 - 120	1	120			1	120
120 - 130						
130 - 140						
140 - 150	1	150	1	144	2	294
Total	65	2,020	106	1,503	171	3,523

Appendix 9.

Instruction of Annual Sample Survey
on Marine Fisheries
December, 1969

Fisheries Statistical Section
Department of Fisheries
Ministry of Agriculture, Government of Thailand

Chapter I. General

1.1 Objectives

The present survey aims at achieving the following two objectives:

- 1) To secure an inventory of the basic means of the marine fisheries production, such as the number of fishing households, fishing craft and sea-going fishermen on annual basis for reviewing the trend of the marine fishery development during the period following fisheries census, and
- 2) To estimate the total catch and effort of marine fisheries in Thailand for each type of fishing method on monthly basis.

1.2 Areal Coverage

The survey covers the fishing communities indentified by the marine fisheries census in 1967, excluding the Pattalung Province.

Note: Marine fisheries is defined as an economic activity to capture or culture of aquatic animal and plants in the sea water.

Practically, however, it is difficult to draw a demercation between marine and fresh water in the river or canal, due to the existing of long stretches of brackish water area.

Therefore, the fishing communities which were identified by the 1967 marine fisheries census are regarded as the area of the survey.

1.3 Field Organization

The survey is conducted by the field personnel under the Department of Fisheries, Ministry of Agriculture.

1.4 Commencement of the survey

The survey is launched from January of 1970.

1.5 Type of surveys and frequency

The survey consists of the following components:

<u>Type of Survey</u>	<u>Frequency</u>
1) Fishing inventory survey	Yearly
2) Catch and fishing effort survey	
(1) Fishing log book survey	Monthly
(2) Fishing community survey	Monthly
(3) Culture survey	Monthly or quarterly

1.6 Type of fishing method to be adopted for each type of survey.

Type of fishing method to be adopted for each survey is shown in the following table:

Type of Survey		Type of Fishing Method covered
1) Fishing inventory survey		All marine fisheries
2) Catch and fishing effort survey	(1) Fishing log book survey	a. Trawls Otter trawl Two-boat trawl b. Purse seines Thai purse seine Chinese purse seine c. Bamboo stake traps
	(2) Fishing community survey	Fisheries other than put in above (1) and the culture below (3)
	(3) Culture survey	a. Shrimp culture b. Oyster culture c. Arkshell culture d. Sea mussel culture

1.7 Survey items

The items to be surveyed in each type of survey are noted below:

1) Fisheries inventory survey

(1) Type of fisheries households

- a. Engaged in own fishing.
- b. Participated in partnership fishing undertaking.
- c. Employed by others as a fishing labourer.

(2) Fishing manpower

- a. Number of family member.
- b. Number of family member directly engaged in fishing.

Full time

Part time

Occasional

- (3) Fishing boat
 - a. Number of boats by type
 - b. Length of boat
 - c. Gross ton
 - (4) Type of fishing method mainly employed.
 - (5) Source of income of household.
- 2) Catch and fishing effort survey.
- (1) The following three items are enumerated in each type of fishing method 1/
 - a. Number of fishing units.
 - b. Number of trips per month.
 - c. Catch by species.

1/ Number of fishing days out for fishing and the number of hauls are enumerated for trawls and purse seines, while the number of fishing days is enumerated for bamboo stake traps.
 - (2) The following two items are enumerated in each type of culture:
 - a. Acreage of pond or farm used.
 - b. Yield.

1.8 Classifications

The survey utilize the following classifications:

- 1) Classification of fishing method (See Appendix 1)
- 2) Classification of Aquatic Animal & Plant (See Appendix 2)
- 3) Classification of fishing area (See Appendix 3)
- 4) Classifications of Fisheries region (See Appendix 4)

1.9 Restriction on the use of data collected.

All information and data collected by this survey would be treated as confidential. These data would be used for statistical purpose only and are not intended for general circulation.

Chapter 2. Fisheries Inventory Survey

2.1 Selection of sample fishing communities

Sample fishing communities are selected by the statistical section of the Department of Fisheries, and a list showing the name of sample fishing communities is prepared and distributed to the enumerators through provincial fisheries officers.

150 samples are selected in view of the limitation of budget and field personals.

2.2 Period of the survey and the date of enumeration

Enumeration is done in January of every year by referring to the facts appeared in the preceding year.

2.3 Objects of the survey

The survey covers the following three objects which were engaged in capture or culture of marine animals and plants in the past one year prior to the date of survey.

- 1) The fisheries households or firms which were engaged in the capture or culture of aquatic animal or plants regardless of sale or home use, excluding sport fishing households.
- 2) The households whose family member were employed by others as fishing labourers, and
- 3) The households whose family member were engaged in fishing as representative or partner of fishing partnership.

2.4 Procedure of enumeration

1) Preparatory works

List of the name of head of households in sample fishing communities are prepared on the basis of the findings of the 1967 marine fisheries census. The assigned enumerator of the fishing community survey should meet the chief of "Tambol" to check and revise the list of head of households referring to the particulars of the register of residence.

2) Complete enumeration in the sample fishing communities

In order to avoid any omission of the fishing households, the enumerators are requested to make an interview with all households located in the area of the community one by one.

Chapter 3. Catch and Fishing Effort Survey

Section 1. Fishing Log Book Survey

3.1.1 Choice of sample fishing units

A sample fishing units is chosen by the statistical section of the Department of Fisheries, and a list indicating the sample fishing units is prepared and distributed to the enumerators through provincial fisheries officers.

The size of samples in each type of fishing method are as follows:

	<u>Type of Fishing Method</u>	<u>Sample Size</u>
1.	Trawls	150
2.	Purse seines	40
3.	Bamboo stake traps	40

3.1.2 Keeping the list of fishing units up-to-date

In order to incorporate any change that might have occurred in the list of fishing units, the concerned provincial fisheries officer should prepare a fresh and complete list of the fishing units by the fishing method cited above on the first of November every year based on the record of the Fishing unit Registration which would be conducted in 1970.

- 2) As the number of fishing units engaged in the designated fishing method are likely to undergo change, the respective fisheries officer is requested to revise those list of fishing units in every three months with the help of the respective district fisheries officers.

The provincial fisheries officer is requested to instruct the district fisheries officer to pay visit designated fishing communities 1/ to check and modify the fishing units in the light of change that has already accrued by using Form 1-4.

The following ground should be regarded as the constituents of change in the list of fishing unit:

- (1) Employment of new fishing unit.
- (2) Abandoning the fishing.
- (3) Transfer the fishing boat to others.
- (4) Shifting the residence to other province.

3) The district fisheries officer on revising the list of fishing units should sent the form 1-4 to the provincial fisheries officer concerned who in turn after through scruting should send a copy of the same to the statistical section of the Department of Fisheries.

3.1.3 Procedure of enumeration

In principle, a owner of sample fishing units is requested to maintain a log book which contain survey items pertaining in each trip.

However, when a sample owner is unable to keep and maintain it, a enumerator is requested to borrow the transaction record and take note of the catch in the required forms. In addition, he would also collect the date of sailing and arrival. Serial number of fishing area and the number of hauls made from the owner or the skipper.

When a owner does not have any kind of record of catch, the respective enumerator should visit the landing spot of the sample boat and counts the number of fish boxes for each type of fish species, and fill the catch by species in the form in terms of kilogram.

3.1.4 Principal of enumeration

- 1) Counting the catch and fishing effort should be based on the residence of the owners of sample fishing units irrespective of the place where sample boats land their catches.
- 2) Treatment of the seasonally changing of fishing base.

Smaller midium size of trawls and purse seines change their fishing bases seasonally depending upon the chang of fishing ground.

When a sample fishing boat has moved her fishing base from her domicile community to other province and stay there more than one month continuously, it is defficult to recieve the form of log book.

Therefore, the following steps are to be followed in each case.

- (1) A owner of sample boat is requested to inform the following items to the respective enumerator before the sample boat has been moved to other province.

- a. Name of fishing base to where the boat is going to be moved.
- b. Period of time the boat is likely to stay at the new fishing base.
- c. Name of fish dealer with whom transaction of captured fish is planned to be effected.

The moment the enumerator receives above information from the owner he must bring it to the knowledge of the provincial fisheries officer at once.

- (2) In the case where new fishing base of the sample boat is located in the same fisheries region the respective enumerator is requested to go to see the sample boat at fishing base and receive the log book from the owner or skipper.
- (3) In the case where the landing place is located in other fisheries region, the provincial fisheries officer is requested to report it to the Department of Fisheries as quickly as possible.

The Department of Fisheries orders the respective provincial fisheries officer who holds the charge of that fishing base to contact the owner or skipper of the sample boats taking delivery the form of log book. Then, the respective provincial fisheries officer should send it to the Department of Fisheries. The Department of Fisheries send the form back to the provincial fisheries officer who looks after the area in which the domicile of the owners of sample boat locating.

- 3) Treatment of completely Moved Fishing Base.

Some of the owners of sample boats may move their residence or change his fishing base completely. In that event, the Department of Fisheries would send a list of sample boats to the respective provincial fisheries officer and request to take care of that boat.

- 4) Treatment of fishing units which have abandoned fishing.

Whenever a owner of sample boat abandoned it's fishing,

the respective enumerator is required to report it to the Department of Fisheries through the provincial fisheries officer.

Section 2. Fishing Community Survey

3.2.1 Selection of Sample Communities.

A sample fishing community is chosen by stratified sampling method by the Department of Fisheries, and a list showing the sample fishing communities is prepared and distributed to enumerators through provincial fisheries officer.

The size of samples in each province is shown in Appendix 7.

3.2.2 Period of Survey and Date of Enumeration.

The enumerator who have responsible for conducting the survey is requested to visit sample fishing communities at least once per month for estimating the catch and fishing effort of preceding month. Field work of the survey should be completed before 20th in each month.

3.2.3 Procedure of Enumeration

1) Preparation of complete list of fishing households.

Before the field work of the survey is undertaken name of head of fishing households, house number, name and length of fishing craft and type of fishing method mainly engaged are to be obtained from the particulars collected by the Fisheries Inventory survey, excluding the following households:

- (1) The households which did not engaged in fishing,
- (2) The households whose family member are employed by others as fisheries labourers and did not engage in own fishing,
- (3) The households whose family member engaged in fishing only as a partner of the fishing partnership undertaking, and.
- (4) The fishing households which exclusively engaged in the following types of fishing methods:

1. Trawls

2. Purse seines
3. Bamboo stake traps
4. Shrimp culture
5. Oyster culture
6. Arkshell culture
7. Sea mussel culture

2) Keeping the list up-to-date

The enumerator is requested to see the chief of fishing community in every three months to check and revise the list of fishing households, referring to the informations available in the registered of residence.

3) Survey on number of fishing units

The enumerator is requested to record the type of fishing method in previous month for each fishing households by using a Form II-1, with a help of chief of fishing community or any person who is well acquainted with the fishing activity of the community.

When a fishing household employed two or more type of fishing method in the previous month, the major type of fishing method is to be selected. The volume of catch would determine the dominance of fishing method, the fishing method caught the highest volume is to be chosen.

Thus, the number of fishing units in each type of fishing method is tabulated.

4) Survey on the number of trips per month and average catch per trip and its species composition.

For each type of fishing method employed in the previous month, five samples of fishing unit are selected at random. The name of sample boats or the name of owners of sample fishing units are filled in the form II-2.

For each sample, the number of trips per month in the previous month (a) and the average catch per trip (b) is inquired. The average catch per month is counted multiplying the number of trips by the average catch per trip.

Name of species caught in last trip is inquired in terms of kilogram for each sample, and average percentage of each

species is calculated.

3.2.4 Estimation of catch in a Sample Community.

- 1) The number of fishing units in each type of fishing method is taken down based on the Form II-1.
- 2) The average catch per month in each type of fishing method is taken down based on the Form II-2.
- 3) Estimated catch per month is calculated multiplying the number of fishing units by the average catch per unit per month.
- 4) Catch by fish species in each type of fishing method is secured by splitting the estimated catch to each species by using the percentage of each species.

3.2.5 Principle of Enumeration

The principle that the catch is sought on the basis of boats based at sample fishing communities irrespective of the place where they land their catches.

It may often happen that when a sample community is located near the large city, the catches taken by their boat are not landed at their community, but directly landed at the large city: on the other hand, when a sample community lies in a large town, catches taken by boats from other fishing communities are landed in the area of sample community.

According to the above principle, the former should be counted as catches in connection with the sample community, but the latter should be disregarded.

When many boats in sample community land the catch at other fish landing places, the enumerator should attend the landing spot place to check the catch per trip along with fish species composition.

Section 3. Culture Survey

3.3.1 Selection of Sample

A sample household or establishment is chosen by stratified sampling method by the Department of Fisheries, and a list showing the sample households or establishments is prepared and distributed

to enumerators through provincial fisheries officer.

The total number of samples in each type of culture would be as follows:

	Type of culture	Population size	Sample size
1.	Shrimp	854	40
2.	arkshell	173	18
3.	Oyster	131	25
4.	Sea mussel	45	10

3.3.2 Keeping the list of households up-to-date

- 1) List of households engaged in aqua culture is copied down based on the results of the 1967 marine fisheries census.
- 2) A enumerator is requested to see the chief of community to check the name of operator and acreage of pond in use.

3.3.3 Procedure of enumeration

1) Shrimp survey

A sample operator selected is requested to fill in daily yield in the form every day.

The enumerator is requested to see the operator of samples once per month to receive the form from operators.

2) Oyster, mussel, arkshell culture

A sample operator selected is requested to fill the daily yield in the form. As to the arkshell culture, a operator should also fill the date in which seeds were spread out.

A enumerator is requested to see the operators once in every month to receive the form from the operators.

Chapter 4. Scrutiny and Submission of Report

4.1 Scrutiny

(1) Scrutiny by the enumerator himself.

Whenever the field work has been completed enumerators are requested to check the content of the survey results in the forms and submit it to the respective provincial fisheries officer.

- (2) Whenever a provincial fisheries officer has received the forms from the enumerators, he is requested to examine the survey results in the forms. If any error or inconsistency is marked the form should be sent back to the enumerators for rectification.
- (3) Upon the completion of the forms, a provincial fisheries officer is requested to submit the forms to the Department of Fisheries. As regard to the fishing community survey, form II-3 should be sent back to the Department of Fisheries and form II-1, are to be retained at the provincial fisheries office.

Chapter 5. Estimation and Publication of Survey Results

5.1 Estimation Procedure

Every estimation is made for the time being by the Department of Fisheries. Detail procedure of the estimation is shown in the "Manual on Estimation Procedure".

5.2 Publication of the Survey Results

1) Fishing inventory survey

The survey results of the fishing inventory survey is released by the end of May in every year.

2) Catch and fishing effort survey

a. The results of monthly survey is published by the end of 3th months after the end of survey month.

b. The annual survey results is released by the end of April in every year.

Date of reporting for each survey is indicated in the following table:

Type of survey \ Date	Date of completion of field work	Date of reporting by provincial fisheries officer
Fishing Inventory Survey	Within January	15th of February
Catch and Fishing Effort Survey	20th the next month	End of next month
1. Log book survey		
2. Fishing community survey		
3. Culture survey		

Manual For Questionnaires
Annual Sample Survey on Marine Fisheries
in Thailand

Fisheries Statistics Section
Department of Fisheries, Ministry of Agriculture
Thailand Government.

Chapter 1. Fisheries Inventory Survey

1. Item 1 & 2

Before starting the interview, house number (item 1) and the name of head of household is inquired and fill it in the respective column.

Definition of household

A household is defined as a family who are eating together within the same house and with same living expenditure.

In filling the name of head of household, the following items should be taken into account:

- 1) When more than two households are living in the same compound or in the same house, the name of head of those households should be separately filled into the column, even though the house number is the same.
- 2) Servants, employed workers, etc, who are living in the servant quarter of the house should not regarded as a household.
- 3) Public buildings, such as hospitals, schools, temples and governmental offices should be excluded.

2. Item 3

- 1) The survey items are inquired for every households in a sample fishing community regardless fishing households or not.

Firstly, an enumerator should ask the head of households whether the family member of the household engaged in fishing or not during the last one year. Whenever, the answer is not, " _/" mark is inserted into the column of "did not engaged in" and not necessary to continue further inquiry.

However, in the case where the family member of a household did not engaged in fishing during the last year but have engaged in fishing this year, " X " mark should be filled in the respective column.

For the fishing house, inquiry should be continued from item to item, However, in the case of a household only engaged in fishing as partner of the partnership fishing or engaged in fishing only as labourers, not necessary to inquire the item No. 5 & No. 6

2) . Fishing household is classified into following three types:

(1) Engaged in own fishing ^{1/}
with three or more employees
mainly by family member

(2) Participated in partnership fishing ^{2/}
as a representative
as a partner

(3) Employed by others as fishing labourers

1/ . Engaged in own fishing means that an owner possess the means of fishing production, such as boat, engine and fishing gear, and engaged in fishing under his own account.

In the case where an owner employed three or more permanent sea-going employees, the fishing household is regarded as a enterprise.

In the case where an owner employed less than three permanent employees and/or engaged in fishing only by his family member, the fishing households are regarded as home business.

2/ Partnership fishing is defined as an economic unit in which its fishery is managed by two or more persons either by sharing its capital for acquiring a fishing craft and fishing gear or having their own fishing craft and/or fishing gear to operate a fishing unit.

"_ / " mark is inserted wherever applicable.

3. Item 4.

1) Number of family member

The number of family member are inquired and fill it into the column.

Definition of family member

(1) Family members are defined as a group of persons who usually live together in the same household. In other words, family member are the persons those living are based at the households with which interview is being held.

(2) The following persons are included in the family member:

The persons who stay outside their home for a short period at the time of interview, such as the person who went out for fishing, children attending to the high school or university which are located outside the community, patients staying at the hospital, etc.

(3) The following persons are to be excluded from the family member: the persons who are continuously away from the household beyond one year and labourers including fishing labourers and maids.

2) No. of family member engaged in fishing.

(1) Out of the family member, the following persons are included in this category:

- a. Sea-going fishermen including engineer,
- b. Engaged in capture the aquatic animal or plants on the beach, such as a fisherman engaged in cast net and crab trapping etc.
- c. Directly engaged or manage in aquatic culture.

(2) The following persons to be excluded.

- a. The family member who work on land for auxiliary works relating to fishing, such as net repairing, unloading fish from the boat, sorting catch etc.

3) The number of family member engaged in fishing is split out into following three types:

- (1) Full time $\frac{1}{}$
- (2) Part time $\frac{2}{}$
- (3) Occasional $\frac{3}{}$

1/ Full time means that a man who spent all of their working time for fishing. The time spent on shore works directly connected with fishing operations should be considered as fishing time.

2/ Part time means that a man who engaged in other jobs but spent major part of his working time for fishing.

3/ Occasional means that a man who mainly engaged in other jobs and spent minor part of his working time for fishing.

4. Item 4. Fishing boat Currently in Use.

1) Coverage of fishing boat.

A fishing boat means a boat engaged in fishing for capture and landing aquatic animal or plants in sea water. Fishing boats engaged in aquatic culture operations should also be included.

2) A name of fishing boat currently in use is inquired regardless of a possessed boat or a hired boat. When a boat has no name, not necessary to fill in the name.

3) When an owner has two or more boats, name of each boat should be separately filled in each row.

4) Type of boats are classified into inboard engine, outboard engine, without engine. " _ / " mark is filled in only for one type which applicable.

5) Length and gross ton of each boat is inquired.

5. Item 6. Type of Fishing Gear Mainly Used.

1) Name of fishing gear employed in last year is inquired. When a fishing household engaged in two or more types of fishing gear in the last year, a major type of fishing gear is inquired in terms of catch value obtained.

2) Cod. No. of the fishing gear classification is filled by enumerators after completion field works.

6. Item 7. Income Source of Household.

1) The objective of the survey item is to classified the extent of dependency on fishing for each fishing household based on the income obtained during last one year.

Some fishing households obtained a income only from the fishing activity, but some of them obtained income from other business or jobs. Such difference may occur based on the scale of fishing management or the number and age composition of the family members in each household.

2) Firstly, an enumerator should inquire that whether a household obtained an income only from fishing activity or not, during last one year. When a household obtained a certain income from other

business or jobs, an enumerator should ask which income was larger compare the income between fishing and other jobs ^{1/} during the last one year.

1/ When a family member processed or soled the fish which was caught by his family member, the income from fish processing or fish saling should be included in the category of fishing income.

However, when a family member bought fish from others as materials of fish processing, the income should be regarded as other income.

1) In the case where a household obtained income only from fishing, " _ / " mark is to be filled in "Fully from fishing".

2) In the case where a household obtained larger income from fishing, " _ / " mark is to be filled in "Mainly from fishing"

3) In the case where a household obtained larger income from other jobs, " _ / " mark is to be filled in "partly from fishing".

Note) In the case of the households engaged in own fishing the wages obtained from the fishing labour should be excluded from the income of fishing. However, in the case of labour's household the wages acquired from fishing labour should be included.

7. After completion of the interview in the sample community, total is counted for each survey item respectively.

Chapter II. Fishing Log Book Survey

Section. 1. Catch Report on Trawling

1. Before filling the catch an enumerator should fill the following items in the record:

1) Type of trawling

2) Fishing boat ^{1/}

a. Name of boat

b. Length of hull

c. Gross ton

d. Horse power

1/ For the case of two-boat trawle the name and size of each boat is filled in the respective column.

2. The catch in each trip is filled in the monthly form based on the fishing boat arriving day. Therefore, when a fishing boat sailed out within the previous month and arrived in this month is to be filled in the record of this month.

So, in the case of a boat sailed out within this month and will be arrived in next month is to be excluded.

3. A enumerator inquire the fishing area operated and fill the cod. number of fishing area.

4. A numerator should inquire the number of hauls in each trip and filled in the respective column.

5. Catch by species is inquired in each trip in terms of kilogram.

6. After finished the month, an enumerator is requested to fill in the following items:

- 1) Number of trips made in the month,
- 2) Number of fishing days out in the month,
- 3) Number of hauls made in the month,
- 4) Total catch,
- 5) Total value.

The number of fishing days out is the total days went out to the sea in the month irrespective operate fishing or not.

Therefore, whenever the date of sailing in the first trip was in the previous month, the counting of the number of fishing days and hauls should start from the sailing day of the first trip.

7. As the Chinese name of fish is used very popularly in fish marketing and the Malay name is also used in southern part of Thailand, so it is necessary to confirm the name of each species before filling the catch in the form.

Section 2. Catch Report on Purse Seines

1. Before filling the catch, an enumerator should fill in the following items into the record:
 - 1) Type of purse seine,
 - 2) Fishing boat ^{1/}
 - a. Name of boat,
 - b. Length of hull,
 - c. Gross ton.

1/ For the case of Chinese purse seine, non-powered boats are not necessary to fill in.
2. The catch in each trip is filled in the monthly record based on the fishing boat arriving day. The way of filling is as same as trawlers mentioned Section 1, 2.
3. A enumerator should inquire the number of hauls, and fishing area in each trip and fill in the respective column.
4. Catch per trip is filled in terms of kilogram.
5. Usually, a purse seine boat sail out from fishing base in the afternoon and come back in the next morning, so, the number of fishing day is counted in terms of the number of nights absent.

Section 3. Catch Report on Bamboo Stake Trapping

1. Depth of water at the month of body net of the sample trap is inquired in terms of meter.
2. Catch record is filled in every day engaged in fishing.
3. In the case where an owner of the sample trap has two or more traps and a fishing boat go arround these gears for fishing one by one it is difficult to separate the catch into each trap on land.

Therefore, it is necessary to ask the number of traps operated by same fishing boat and fill it into the respective column.

Chapter III Culture Survey

1. General

- 1) Before distributing forms to the operators, the following items are to be filled in previously:
 - (1) No. of region
 - (2) Province
 - (3) District
 - (4) "Tambol"
 - (5) Month
 - (6) Acreage.
- 2) In the case where a operator did not harvest during previous month, the enumerator is requested to fill that "did not harvest during last month" in the form.

If not, it is difficult understanding whether or not a operator harvested during the last month.

2. Shrimp Culture

- 1) There are two types of harvesting in the shrimp culture:
 - (1) Harvested once every one or two months.
 - (2) Harvested nearly every day.

In the case of above (1), a farmer harvest shrimp after drained out the water from the pond.

In the case of above (2), a farmer introduce the water with shrimp fry every day and harvest big shrimp in the night time using traps with light. In such case, harvest is done almost of all year round. So, it is necessary to request the operators of the culture to keep the form and fill the daily yield in it.

- 2) Quantity of shrimp is filled in the form in terms of kilogram.

3. Oyster Culture

- 1) A stone with spat spreading method is predominant in Thailand. A farmer of oyster culture spread the stones on the shallow sea. The stones are kept by wood or wooden floor to avoid it into the muddy bottom of the sea.

As a ratio estimation method is applied in this survey, an enumerator should ask the acreage of culture in used.

- 2) The quantity of the harvested oyster is shown in terms of kilogram with shell, as when an operator sold the oyster in terms of the number of pieces of oyster, it is necessary to calculate in terms of weight in kilogram.

The following exchange rate can be applied for the case of oyster culture as a provisional measure:

(1) Surathani Province

No. of oysters	Weight of oyster with shell
1) 100 pieces with shell	30 kg.
2) 100 pieces without shell	30 kg.

(2) Cholburi Province

1 kg. of oyster without-shell $\hat{=}$ 6 kg. of oyster with shell

4. Arkshell Culture

- 1) A farmer of the culture buy seed from others and sow the seed on the farm ground. So, when the farmer sowed the seed, the farmer is requested to fill the number of baskets and the acreage of farm ground in the form.
- 2) When, the farmer harvested the shell, the number of baskets, average weight of basket, yield are to be field in each harvest day.

5. Seamussel Culture

Poles made by wood or bamboo are used for the culture, so when he harvested seamussel, the number of poles harvested, the number of baskets, average weight per basket are to be field in each day.

The total weight is calculated multiplying the number of baskets by the average weight per kilogram.

1) Classification of Marine Fishing Method

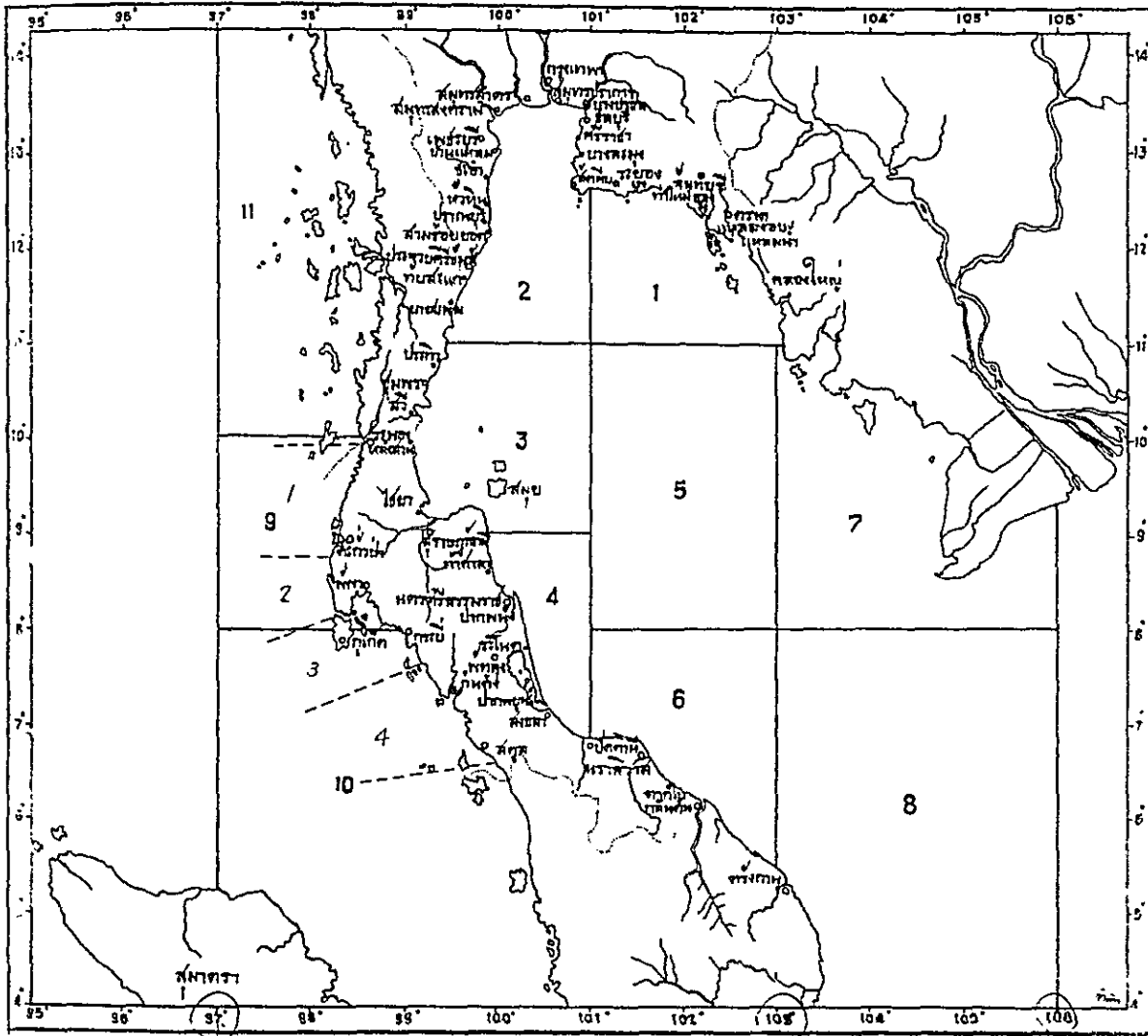
1st	2nd
1. Trawls	1.1 Otter trawl 1.2 Two-boat trawl 1.3 Beam trawl
2. Surrounding nets	2.1 Thai purse seine 2.2 Chinese purse seine 2.3 Anchovy purse seine
3. Gill nets	3.1 Spanish mackerel drift gill net 3.2 Pomfret drift gill net 3.3 Mackerel encircling gill net 3.4 Shrimp gill net
4. Luring lift net	4.1 Luring lift net
5. Other mobile net	5.1 Squid cast & dip net with light 5.2 Push net 5.3 Scoop net 5.4 Other net
6. Hook & line	6.1 Long line 6.2 Hand line
7. Stational gears	7.1 Bamboo stake trap 7.2 Set bag net 7.3 Fish trap 7.4 Crab trap
8. Shellfish & seaweeds collection	
9. Others	

2) Classification of Aquatic Animals and Plants

No	Item	Thai name	English name	Scientific name	
1	<u>FRESH WATER FISHES</u>				
		(carp)	Pla-tapein	Carp	Cyprinidae
			Pla-nai	Common carp	Cyprinus carpio
		(Air-breathers)	Pla-chon	Snake head fish	Channidae
			Pla-duk	Fresh water cat fish	Clariidae
			Pla-muor	Climbing perch	Anabas testudineus
	(Others fish)				
2	<u>MARINE FISHES</u>				
			Pla-tu	Chub mackerel	Rastrelliger neglectus
			Pla-lung	Rake-gilled mackerel	Rastrolliger kanagurta
			Pla-intree	Spanish mackerel	Scomberomoridae
			Pla-tu-kek	Round scad	Decapterus russelli
			Pla-hangkang	Hardtail	Megalaspis cordyla
			Pla-sikul	Caranx	Carangidae
			Pla-o	Bonito	Thunnidae
			Pla-oxlair	Sardine	Clupeidae, dussumieridae
			Pla-katuk	Anchovy	Anchoviella spp.
			Pla-chalamet-kao	Silver promfret	Pampus argenteus
			Pla-chalamet-dum	Black pomfret	Parastromatcus niger
			Pla-dablao	Dorab	Chirocentrus dorab
			Pla-dabgnearn	Hair tail	Trichiurus haumela
			Pla-namdokmai	Barracuda	Sphyraenidae
			Pla-kapong kao	Sea bass	Lates calcarifer
			Pla-kapongdang	Snapper	Lutianidae
			Pla-karang	Grouper	Serranidae
			Pla-Soynokhou	Sweetlip	Plectorhynchidae
			Pla-juad	Jewfish	Sciaenidae
	Pla-seye-dang	Threadfin bream	Nemipteridae		
	Pla-seye-kao	Lattice monocle bream	Scolopsis cancellatus		
	Pla-tato	Spot finned bigeye	Priacanthus Tayenus		
	Pla-tukkair	Lizard fish	Saurida tumbil		
	Pla-kod tale	Sea cat fish	Techysuridae, Plotosidae		

No	Item	Chri name	English name	Scientific name
		Pla-chalam	Sharks	Orectolobidae, Carcharhinidae
		Pla-kaben	Rays	Trygonidae, Myliobatidae
		"Pla-ped"	"Duck's fishes"	
3	<u>MOLLUSCS</u>	(Others fishes)		
	(Marine water)	Hoy-malang-poo	Sea mussel	Mytilus smaragdious
		Hoy-krang	Ark-shell	Anadana granosa
		Hoy-nang-rom	Oyster	Grassostrea sp.
		Muik-kradong	Cattle fish	Sepia sp.
		Muik-klouy	Squid	Loligo sp.
		(Other molluscs)		
4	<u>CRUSTACEANS</u>			
	(Fresh water)	(fresh water prawns and shrimps)		
	(Marine water)	Kung-kao	White shrimp	Penaeus indicus
		Kung-kula	Green tiger shrimp	Penaeus sp.
		Kung-Hang-mong	Purple tail shrimp	Penaeus longistylus
		Kung-ta-kad	Pink shrimp	Metapenaeus monoceros
		(Others shrimp)		
		Koei	Brine shrimp	Sengestidae
		Kang	Lobsters	
		Pu-ma	Swimming crab	Portunus pelagicus
		Pu-tale	Blue crab	Scylla serrata
		(Others crab)		
5	<u>AQUATIC PLANT</u>			
		Salai-tale	Sea weed	

3) Division of Fishing Area



4) Division of Fishery Region

1. Region No. 1
Trad, Chantaburi and Rayong Provinces are covered.
2. Region No. 2
Cholburi, Chacheongsao, Samudprakarn,
Samudsakorn, Samudsongkram Phetburi and
Prachuabkiridan Provinces are covered.
3. Region No. 3
Chumporn, Surasdhani and Nakorn-Sridhammaraj Provinces are
covered
4. Region No. 4
Songkhla, Pattani and Narathiwat Provinces is covered
5. Region No. 5
Ranong, Pangnga, Phuket, Krabi, Trang and Satul Provinces
are covered.

5) Allocation of the Enumerators in 1970

No.	Province	No. of Enumerators
1	Trad	5
2	Chantaburi	3
3	Rayong	2
4	Chonburi	2
5	Chacheongsao	1
6	Samut Prakarn	5
7	Samut sakorn	6
8	Samut Songkram	4
9	Phetburi	2
10	Prachuab Kiri Khan	2
11	Chumporn	5
12	Suraskhani	3
13	Nakorn Sri Thammarat	4
14	Songkhla	5
15	Pattani	2
16	Ranong	3
17	Phuket	3
18	Pang-Nga	2
19	Krabi	1
20	Trung	4
21	Satul	3
Total		67

Monthly Survey on Fishing Unit

Region _____ Serial No. _____ Community _____ District _____
 Tambol _____ Province _____

No.	House No.	Name of Head of Household	Fishing Boat		Type of Fishing Gear Used		Remark
			Name of Boat	Length Wa Sock	Name	Cod No.	

Serial No. _____

Name of Community _____

Month _____

Type of fishing gear _____

(1) Estimation of Average catch per trip.

Name of sample boat Items	1	2	3	4	5	Total	Average catch per boat
	No. of trips in a month <i>a</i>						
Average catch per trip <i>b</i>							
Catch per month $a \times b = c$							

(2) Estimation of Species Composition (ask catch by species for last trip)

Catch by fish species	Total						Total	100 %
	Chub mackerel							
Rake gilled mackerel								
Caranx								
Sourcline Anchovy								
Bonito								
Silver pomfret								
Black pomfret								
Snapper								
Sea cat fish								
Mullet Shark								
Ray								
Duck's fish								
Other fish								
White shrimp								
Jomb tiger shrimp								
Green tiger shrimp								
Banana shrimp								
Acepes								
Others shrimp								
Blue crab								
Swimming crab								
Squid								
Sea mussel								
Arkshell								

Questionnaire for Arkshell Culture

Serial No. _____ Name of owner _____ District _____

Month _____ Province _____ Tambol _____

Name of Enumerator _____

Area of culture _____ Rai	Total Amount of the seed spread No. of basket _____		Average weight of a basket _____ kg. 1 Pickle 18 kg		
Date of harvest	Yield (basket)	Average weight per basket _____ kg.		Yield in kg.	Value
Total					

Seamussel Culture

Region _____ Serial No. _____ Name of owner _____ District _____
 Month _____ Province _____ Tambol _____
 No. of Poles _____ No. of Bamboo _____ No. of other Poles _____

Date of Harvest	No. of poles stocked	No. of Basket harvested	Weight per basket in Kg.	Total Yield in Kg.
Total				

5.1. Estimated Catch and its Precision

Region _____ Type of Fishing _____ Stratum _____

Month _____

	$\frac{1}{x_k}$ ton	$\frac{2}{x_k}$		$\frac{1}{x_k}$ ton	$\frac{2}{x_k}$
1			21		
2			22		
3			23		
4			24		
5			25		
6			26		
7			27		
8			28		
9			29		
10			30		
11			31		
12			32		
13			33		
14			34		
15			35		
16			36		
17			37		
18			38		
19			39		
20			40		
Total			(1)	(2)	
			(3) $\bar{x} = \frac{(1)}{n} =$	(5) $n\bar{x}^2$	
			(4) $\frac{\bar{x}^2}{x} = (3)^2$	(6) (2) - (5)	
			(7) $S_x^2 = \frac{(6)}{n-1}$		
			(8) $S_x = \sqrt{S_x^2} = \sqrt{(7)}$		
			(9) $C_x = \frac{S_x}{\bar{x}}$		

5.2 Estimate Catch & Precision in each Stratum

Region _____ Type of Fishing _____ Stratum _____
 Month _____

1) Estimate of Catch in each Stratum

$$\frac{\hat{\Delta}}{\hat{T}} = \frac{N}{n} \sum_{k=1}^n x_k = \frac{N}{n} \bar{x} \quad (1)$$

2) Variance (Sx^2 come from Form 1 (7))

$$V\left(\frac{\hat{\Delta}}{\hat{T}}\right) = N^2 \frac{N-n}{N-1} \frac{Sx^2}{n}$$

3) Standard of Error

$$s\left(\frac{\hat{\Delta}}{\hat{T}}\right) = \sqrt{V\left(\frac{\hat{\Delta}}{\hat{T}}\right)}$$

=

4) Precision Attained for each stratum

$$C.V\left(\frac{\hat{\Delta}}{\hat{T}}\right) = \frac{s\left(\frac{\hat{\Delta}}{\hat{T}}\right)}{\frac{\hat{\Delta}}{\hat{T}}}$$

5.3 Estimate catch & Precision in each Region

Month _____ Type of Fishing _____

Region	Strata	Estimate Catch	Variance	C. V
I	1	a1	b1	$C. V = \frac{\sqrt{V(\hat{A})}}{\hat{A}} = \frac{\sqrt{B1}}{A1}$
	2	a2	b2	
	3	a3	b3	
	Total	A1	B1	
II	1	a4	b4	$C. V = \frac{\sqrt{B2}}{A2}$
	2	a5	b5	
	3	a6	b6	
	Total	A2	B2	
III	1	a7	b7	$C. V = \frac{\sqrt{B3}}{A3}$
	2	a8	b8	
	3	a9	b9	
	Total	A3	B3	
IV	1	a10	b10	$C. V = \frac{\sqrt{B4}}{A4}$
	2	a11	b11	
	3	a12	b12	
	Total	A4	B4	
V	1	a13	b13	$C. V = \frac{\sqrt{B5}}{A5}$
	2	a14	b14	
	3	a15	b15	
	Total	A5	B5	

Form III. Estimate Catch & Precision for a Country

Region	Estimate \hat{A}	Variance $V(\hat{A})$
1	A1	B1
2	A2	B2
3	A3	B3
4	A4	B4
5	A5	B5
Total	A6	B6

$$C. V = \frac{\sqrt{B6}}{A6} =$$

Coefficient of Correlation Between Catch and No. of boats weighted

Region _____ Strata _____ Month _____

1. Formula

$$\sum_{K=1}^N x_k y_k - N \bar{x} \bar{y}$$

$$\rho_{xy} = \frac{\sum_{K=1}^N x_k y_k - N \bar{x} \bar{y}}{\sqrt{(\sum_{K=1}^N x_k^2 - N \bar{x}^2)(\sum_{K=1}^N y_k^2 - N \bar{y}^2)}}$$

No	Catch (x_k)		No. of Boats Weighted (y_k)		$x_k \cdot y_k$
	x_k ton	x_k	y_k	y_k^2	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
$\sum_{k=1}^N$	$\sum x_k =$	$\sum x_k^2$	$\sum y_k =$	$\sum y_k^2 =$	$\sum x_k y_k =$
	$\bar{x} =$ $\bar{x}^2 =$	$N\bar{x}^2 =$ $\sum x_k^2 - N\bar{x}^2$ =	$\bar{y} =$	$N\bar{y}^2 =$ $\sum y_k^2 - N\bar{y}^2$ =	$N\bar{x} \bar{y} =$ $\sum xy - N\bar{x} \bar{y}$ =

Calculation of Coefficient of Correlation
Precision on Fishing Community Survey

$$S_x = \sqrt{\frac{\sum x^2 - N\bar{x}^2}{n - 1}} \dots\dots\dots (1)$$

$$C_x = \frac{S_x}{\bar{x}} = \frac{\textcircled{1}}{\bar{x}} \dots\dots\dots (2)$$

$$S_y = \sqrt{\frac{\sum y^2 - N\bar{y}^2}{n - 1}} \dots\dots\dots (3)$$

$$C_y = \frac{S_y}{\bar{y}} = \frac{\textcircled{3}}{\bar{y}} \dots\dots\dots (4)$$

$$B = \frac{C_y}{C_x} = \frac{\textcircled{4}}{\textcircled{2}} \dots\dots\dots (5)$$

$$C.V \left\{ \frac{\Delta}{\bar{I}} \right\} = C_x \sqrt{\left(\frac{1}{n} - \frac{1}{N}\right) (1 + B^2 - 2\rho_{xy}\beta)} \dots\dots\dots (6)$$

