

## 2.2 (B) Fishing Effort and Catch by Fishing Areas<sup>1)</sup> for Selected Important Fisheries

Type of Fishery _____		Tonnage Class of Boat _____						
Items		By Fishing Areas <sup>2)</sup>						
		Total	I	II	III	IV	V	.....
Fishing Effort	No. of Trips							
	No. of Days Absent							
	No. of Days fished							
	No. of Hauls							
	No. of Trawling HOURS							
Catch by Species	Total							
	a							
	b							
	c							

1) This statistical table is compiled separately for each tonnage class of boat even within a same fishery.

2) Fishing areas are those which were established to meet the national requirement. It is, however, assumed that such national fishing areas will be established within the area of "sub-area" which will be proposed by IPFC/IOFC JWP in the near future.

SEAFDEC/SCS.73: S-18

### Current Status of Research Activities of the Marine Fisheries Research Department, Southeast Asian Fisheries Development Center (1970 - 1972)

by  
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#### 1. INTRODUCTION

The Southeast Asian Fisheries Development Center (SEAFDEC), established in 1968, is one of the first concrete regional projects born out of a series of Ministerial Conferences for the Economic Development of Southeast Asia. The Center is governed by a Council, a policy making body, consisting of six Directors, representing six countries, viz. Japan, Malaysia, Philippines, Singapore, Thailand and Vietnam.

The Marine Fisheries Research Department (MFRD) hosted by Singapore is one of the departments of SEAFDEC, the other being the Training Department in Bangkok, Thailand. The functions of the Research Department are:

- (i) to develop the fishing grounds in Southeast Asia by experimental fishing
- (ii) to carry out research into fishing gears, equipment, fishing methods and general handling of fish at sea, in close cooperation with the Training Department
- (iii) to conduct investigation of fisheries resources and research in fisheries oceanography for Southeast Asian countries
- (iv) to train research personnel and technicians, and
- (v) to undertake such other activities as may be determined by the Council.

The Department consists of three sections, the Fish-

eries Resources Section, Fishing Ground Development Section and the Ocean Research Section, and owns a 387-ton stern trawler research vessel CHANGI. It has a staff of 47, including 10 scientists and a crew of 25.

Although the Department has been in operation since April 1969 its regular research activities commenced in January 1970. Research was mainly centred around trawl fisheries and oceanographic survey in the South China Sea. However, in 1972, a programme was set up to include exploratory survey of the Straits of Malacca and the Andaman Sea, and the use of other gear, such as tuna longline, bottom longline and vertical handline for studies of demersal fisheries resources in the Southeast Asian waters. Research scientists from member Countries also participated actively in the research programme of the Department.

Up to April 1973 CHANGI carried out 32 survey cruises in 370 navigational days. Raw data obtained from every cruise are compiled and circulated immediately to Member Countries as Quick Reports, while the Department's Quarterly Newsletter and Annual Report summarising the progress of its activities are published for wider circulation.

This paper summarises research findings of the Department while detailed results may be found in 15 papers presented at the Technical Seminar on the South China Sea of SEAFDEC.

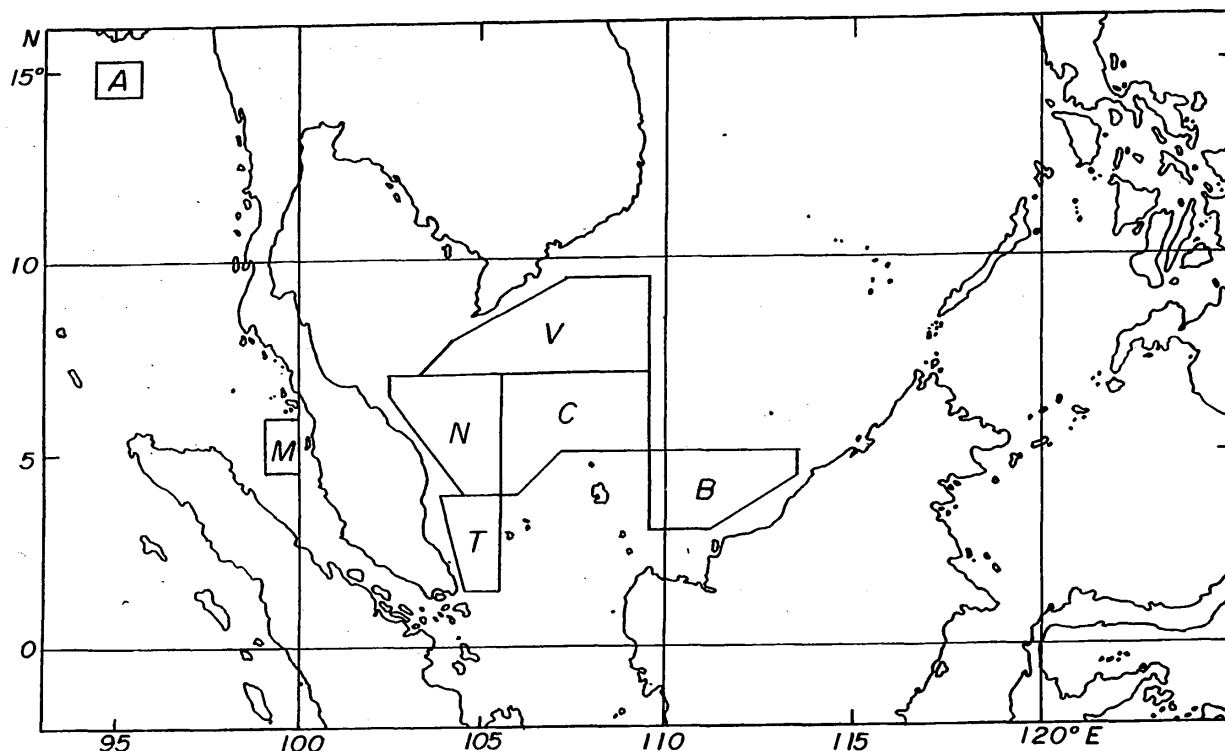


Fig. 1 Trawl fishing grounds surveyed by R.V. CHANGI (1970-73)

## 2. TRAWL FISHING SURVEY

### 2.1 Outline of survey

From January 1970 to September 1972 CHANGI carried out experimental bottom trawl fishing and oceanographic survey in the South China Sea. The purpose of the survey was to collect overall demersal fisheries resources and oceanographic information in an extensive area and not to investigate any particular area intensively. However, since October 1972 the survey cruises have been modified, placing greater emphasis on economic feasibility studies in known fishing grounds in the South China Sea. During the latter period, CHANGI has also expanded her survey area to the Straits of Malacca, and North Andaman Sea. The various areas surveyed (T, N, B, V, C, M and A) are illustrated in Figure 1 and the number of trawl hauls, total catch and mean catch per hour by area and by year are summarised in Tables I and II.

### 2.2 Catch per hour and its fluctuation

From the results of the quantitative and qualitative analyses of catch obtained from the designated areas in the South China Sea it has been found that mean catch per hour varies from area to area, with the catch fluctuating greatly from haul to haul even within the same area. However, these areas can roughly be divided into three types of fishing ground with high and comparatively stable catches, intermediate fishing ground and poor fishing ground. It is perhaps worth mentioning that even in the poor fishing ground some of the hauls yielded very good catches.

Catch records collected by CHANGI and the training vessels PAKNAM of the Training Department (SEAFDEC), and JURONG of the Singapore-FAO/UNDP

Fisheries Training Centre and the research vessel HAI-CHING of the Taiwan Fisheries Research Institute were analysed and some of the results on regional, seasonal and annual fluctuations of trawl catch presented at the SEAFDEC Seminar.

Table I. Number of trawl hauls by area and by year

Area	Year			
	1970	1971	1972	1973*
South China Sea	271	224	149	40
Straits of Malacca	—	24	24	7
North Andaman Sea	—	—	13	24
Total catch (ton)	47	50	40	21

\*Up to the end of March.

Table II. Mean catch per hour by area and by year (kg)

Year	Area*						
	T	N	B	V	C	M	A
1970	159.9	154.5	149.4	—	80.1	—	—
1971	175.9	126.0	175.7	74.2	91.1	130.6	—
1972	176.8	120.0	154.5	—	—	170.5	361.0
1973**	99.4	—	—	—	—	170.5	398.2

\* T: adjacent to Tioman Island, N: northern area of east coast of West Malaysia, B: north coast of Borneo, V: south coast of Vietnam, C: central part of south-western South China Sea, M: off Straits of Malacca, A: north Andaman Sea.

\*\* Up to the end of March.

### 2.3 Precise estimation of fish catch by experimental trawling

Because of the limited facilities in carrying out a wide range survey an attempt was made to find out the minimum number of trawl hauls required for the precise estimation of fish abundance. The method for estimating the

minimum number of trawl hauls derived from the analysis of the data collected from an intensive survey in a block of half degree square (900 square miles) near Tioman Island was 900 found to be applicable to a wider and more extensive area without losing its generality. The details of this study were also presented at the SEAFDEC Seminar.

Table III. Species composition of trawl catch by area (%)

Year	Area	T	N	B	V	C	M	A*
1970				Apr. May				
1971		Apr. June Sept. Oct. Nov. Dec.	Apr. June	Oct.	Sept.	Apr. June	July Dec.	Dec.
1972		Jan. Oct.		Nov.			Feb.	Jan. Nov. Dec.
1973		Mar.						Jan.
	No. of hauls	207	28	114	39	34	47	165
	Fish name							
	Red snapper	22.4	24.9	21.6	19.2	10.3	7.0	1.6
	Bigeyed snapper	17.0	10.6	13.1	1.1	18.2	12.5	0.0
	Threadfin snapper		2.4	5.0	3.9	10.5	7.2	1.2
	Goat fish	12.9	6.3	5.4	4.4	6.9	9.6	1.0
	Trigger fish	8.2	8.1	3.6	0.9	9.9	10.5	0.0
	Jacks & scads	7.4	8.4	5.4	11.7	6.3	7.0	6.0
	Nakedhead sea bream	5.0	3.9	3.4	3.5	5.1	3.0	0.0
	Thicklip grunt	4.2	3.2	5.8	6.1	0.6	3.1	0.0
	White snapper	4.2	3.7	2.1	4.1	2.5	2.5	0.0
	Lizardfish	3.9	3.1	2.7	14.6	5.9	1.4	1.4
	Catfish	3.3	1.6	3.7	0.0	3.7	11.1	14.2
	Grouper	2.1	1.8	2.2	2.6	2.2	2.5	0.0
	Rabbitfish	0.2	0.3	0.0	0.2	0.4	7.4	0.0
	Butterfish	0.0	0.0	1.5	17.3	0.3	0.0	0.0
	Groaker	0.0	0.1	3.8	0.0	0.5	0.0	27.7
	Grunter	0.0	0.0	0.8	0.0	0.0	0.0	8.2
	Golden snapper	0.0	0.0	1.8	0.0	0.0	0.0	7.6
	Clupeoids	0.0	0.0	2.6	0.0	0.0	0.0	7.2
	Soldier fish	0.0	0.3	0.0	0.1	0.1	0.4	0.0
	Barracuda	0.4	6.2	0.0	0.0	0.0	0.0	0.2
	Seabream	0.0	0.0	0.0	1.7	0.0	0.0	0.5
	Sharks & rays	3.4	3.5	2.9	2.2	8.5	1.3	4.4
	Spanish mackerel	0.1	1.3	0.5	0.0	0.0	0.4	2.2
	Others	5.3	10.3	12.0	6.4	8.1	13.1	16.6

\*including results obtained by training vessels PAKNAM of Training Department (SEAFDEC) of Singapore-FAO/UNDP Fisheries Training Centre.

### 2.4 Species composition in catch

Considerable differences in species compositions in catch in different areas are shown in Table III. From the calculated community similarity index  $C\lambda$  a remarkable difference of community in the South China Sea was recognised between area V and the other areas while higher similarity was seen between areas T and C, and B

and C. As the species composition in catch is affected not only by the difference in locality but also in depth, season and mode of distribution, studies on these factors have also been carried out. Tables IV and V show the results obtained from fishing operation in the areas bordering the coastal and offshore waters. Although these areas (a, b & c) were remarkable suggesting the influence

of coastal condition, different bottom features and depth.

Red snappers and bigeye snappers were the two most dominant groups of species occupying approximately 30 to 40% of trawl catch in the South China Sea, and were invariably found together in the same catch. However, the percentage of catch for either fish was different from haul to haul. Analysis of their catch and distribution shows that they form overlapping fish schools, the structures of which have also been studied mathematically.

Shrimp trawling surveys in international waters were also carried out but owing to shortage of information analysis has not been made.

### 3. BOTTOM LONGLINE AND VERTICAL HANDLINE OPERATIONS

For the purpose of developing and exploiting demersal fisheries resources in untrawlable fishing grounds the Research Department carried out some preliminary bottom longline and vertical handline fishing surveys in the South China Sea and Andaman Sea. The results obtained are summarised in Table VI.

#### 3.1 Bottom Longline

While the data collected by CHANGI were insufficient to draw any conclusion, communications with commercial bottom longliners suggested that the local type of bottom longline gave a better catch than the Japanese type although the catch of both types of gear was poor. Experimental results on bait preference showed that the overall catch by each type of bait was not significantly different although it appears that individual species had different bait preference.

Table VI. Summary of bottom long line and handline operations

Year	Area	Near Gulf of Thailand	Off Sarawak	West coast of Thailand
Month/Year		June 1972	Sept. 1972	Feb. 1973
Type of line		longline	longline	handline
Total no. of units used		200	224	20
No. of operations		11	9	39 hr. 30 min.
Total catch (kg)		558.6	676.4	1,725.1
Fish name				
Red snapper		26.5%	25.7%	0.2%
White snapper		27.6	18.9	57.2
Sea bream		0	0.1	20.9
Trevally		2.9	—	10.8
Grouper		0.9	0.1	4.8
Catfish		23.6	20.4	—
Shark		8.1	26.3	—
Pigface fish		—	—	3.9
Others		10.4	8.5	2.1

#### 3.2 Vertical handline

The interesting results obtained by CHANGI and three other Japanese research vessels on vertical handline operations in the South China Sea and the Andaman Sea are discussed in greater detail in another paper presented

at the SEAFDEC Seminar. However, it may be of interest to know that fish caught by vertical longline have high market value, especially the white snapper (*Pristipomoides* spp.) which constitutes about 60% of the total catch. As the fishing grounds are not fully developed and exploited attempts are being made by the Research Department to carry out further research in the South China Sea and Andaman Sea so that this method of fishing can be established for the benefit of the region.

### 4. TUNA LONG LINE OPERATION

Two tuna longline operations were carried out, one in the Indian Ocean and the other in the South China Sea. Owing to insufficient data no analysis has been made.

### 5. FISHERIES BIOLOGY OF ECONOMICALLY IMPORTANT SPECIES

Collection of biological and ecological data on economically important species is also an important part of the Department's research programme. Size frequencies, seasonal succession and distribution of these species were analyzed to estimate their age and growth. Gonadal development, fecundity as well as the feeding habits of fish selected from various trophic levels were also studied.

### 6. OCEANOGRAPHIC OBSERVATIONS

Surveys have been carried out in the South China Sea for the observation of physico-chemical characteristics of sea water, nutrient sources, bottom feature and topography, plankton biomass, fish eggs and larvae as well as benthic fauna. The number of oceanographic stations occupied by CHANGI is shown in Table VII.

Table VII. Number of oceanographic observation stations by area and by year.

Year	Area	South China Sea	Straits of Malacca	Indian Ocean	Andaman Sea
1970		57	—	—	—
1971		75	12	6	—
1972		130	10	—	6
1973*		3	15	—	7

\*Up to the end of April.

The results showed that physico-chemical characteristics of sea water were largely affected by the monsoon currents. Temperature-salinity diagrams and the depth of thermocline indicated the different characteristics of the water masses in the two monsoons. Differences between coastal and offshore waters were also recognized by the analysis of T-S diagrams.

Analysis of mud samples showed close relationship between bottom feature and types of current. The relationship between bottom conditions and distribution of benthic animals such as the shovel-nosed lobsters and large sponges was also studied.

**Table IV. Difference in species composition in adjoining areas a, b and c off Sarawak in November 1972.**

Area	a	b	c
Depth (m)	12	7	9
Fish name			
Grouper	1.2	0.5	1.0
Red snapper	18.8	11.7	9.6
Thicklip grunt	3.1	—	—
Lizardfish	1.1	1.2	8.7
Triggerfish	0.1	1.3	0.1
Threadfish snapper	1.3	0.6	2.4
Catfish	3.0	15.8	14.8
Caranx & scad	14.5	13.6	7.5
Bigeyed snapper	—	2.1	1.8
Shark & ray	7.7	10.5	0.6
Clupeoid	2.1	12.2	29.0
Jewfish	11.2	14.8	13.6
Golden snapper	13.2	0.6	1.2
Others	22.7	15.1	9.7

**Table V. Difference in species composition (%) in the north Andaman Sea according to the depth, Dec. 1972.**

Depth (m)	37-48	50-80
No. of hauls	9	4
Red snapper	1.0 %	14.7 %
Nakehead sea bream	0	1.4
Grouper	—	1.0
White snapper	0	1.6
Lizardfish	4.8	11.6
Goatfish	0.3	10.4
Catfish	6.1	3.3
Threadfin snapper	2.1	6.6
Caranx & scad	7.4	31.8
Clupeoids	13.7	0
Bigeyed snapper	0	1.5
Jewfish	48.1	0
White pomfret	7.8	0
Shark & ray	3.9	9.1
Others	4.8	7.0

With a few exceptions the plankton biomass was found to be high in the coastal area and decreased towards the open sea. The individuals of copepods and chaetognaths per cubic meter of water showed remarkable decrease in number from coastal water to the open sea. The variability of plankton catches and the diurnal vertical migration of zooplankton were studied. Taxonomical and ecological studies on fish eggs and larvae were also conducted. So far 137 species of fish larvae were identified to the generic and/or specific levels. The survey of distribution and seasonal fluctuation of fish eggs and larvae are being continued.

The results of sea water analysis showed that phos-

phate-phosphorus ( $PO_4\text{-P}$ ) content increased towards deeper water. Comparative studies of  $PO_4\text{-P}$  values and salinity suggest that nutrients in the coastal waters came from freshwater discharge of rivers, while the origin of high  $PO_4\text{-P}$  value at some areas in the open sea was unknown.

The dissolved oxygen of the water was also examined. Generally, the dissolved oxygen was high in the upper water layers and decreased with depth. However, oxygen maximum was recorded at depths of 20-80 m. and not at the surface. This suggests that intense solar radiation at the surface reduces the photosynthetic activities of phytoplankton.

The analysis of echo-sounding records confirmed that the scattering layer occurred within the depth range of thermocline detected by bathythermograph, and the value of plankton biomass at the scattering layer was higher than that obtained in waters outside the layer. It was also observed from the echograms that fish schools dispersed at the vicinity of the scattering layer.

Simultaneous oceanographic observations showed that good catches were located near the bordering area where cold water mass from deeper layers converged with warm surface water. However, the locations of good fishing grounds were found to fluctuate with seasonal changes in oceanographic conditions.

From the studies of echograms it appears that the echo-sounder is an important device not only for locating fish schools and scattering layers but also for the studies of environmental factors, such as current rip, boundary zone and upwelling, which may be important for the formation of good fishing grounds.

## 7. FUTURE PLAN

The results of the Department's research activities, as summarised above, are contained in 15 papers (Appendix I) presented at the SEAFDEC Technical Seminar on fisheries resources in the South China Sea and its adjacent waters. From these, it can be seen that the fisheries resources survey and other research activities of the Department were mainly confined to trawl fishing in the South China Sea. However, the Department extended its activities recently to other adjacent waters and to investigate various methods of exploiting demersal fisheries resources other than by trawling.

The trawl fishing survey in the South China Sea will now be limited to known fishing grounds where economic feasibility studies will be carried out in conjunction with the types and sizes of vessels from Member Countries presently operating in the region. Trawl survey on demersal resources in the Andaman Sea and shrimp resources in international waters will be intensified. In untrawlable fishing grounds the use of bottom longline, vertical handline, bottom gill-net and drift gill-net will be investigated.

Apart from the studies on demersal fisheries resources the Department will be conducting systematic hydro-acoustic surveys after the installation of a sonar in July 1973. This is in preparation for the investigation of pelagic fisheries resources in the SEAFDEC area. A

smaller research vessel is therefore necessary to carry out investigations on pelagic and coastal fisheries resources.

With these in mind it is hoped that SEAFDEC can contribute positively to the development of fisheries in the region.

#### Appendix I

##### Papers presented at the Technical Seminar on South China Sea Fisheries Resources

1. Results of the experimental trawl fishing in the South China Sea by R/V CHANGI in the years 1970 to 1972.
2. Trawl fishing grounds in North Andaman Sea.
3. Demersal fish resources in untrawlable waters, viewed through vertical-line fishing.
4. Biological study of red snapper, *Lutjanus sanguineus*.
5. Studies on the feeding habits of red snapper, *Lutjanus sanguineus* and *L. sebae*.
6. A study of the catch data of the JURONG in the South China Sea in 1971 and 1972.

7. A rational survey method for evaluation of trawl fishing ground.
8. Fish school structure of red snapper and bigeye snapper in the South China Sea.
9. Behaviour of the warm-water mass along the east coast of the Malay Peninsula.
10. Fishing condition and its oceanographic interpretation in bottom longline fishing grounds.
11. Preliminary observation on the distribution and catch of the shovel-nosed lobster, *Thenus orientalis* Lund in South China Sea.
12. Some consideration on the relationship between environmental factors and the distribution of fisheries resources in the South China Sea and the Andaman Sea.
13. Brief note on the relationship of scattering layer and some hydro-biological factors.
14. Records of echo-sounder tracing as guide to locate and evaluate good fishing grounds.
15. Preliminary report on the distribution of chaetognaths in the southern part of the South China Sea.

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### Harvesting of Marine Resources in the Philippines

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#### Abstract

The production from commercial and municipal fishing are presented for a period of 10 years showing a continuous increase. The commercial fishing production is broken down into production by major fishing grounds for a closer evaluation.

The trend by type of fisheries for the same period is also presented. Purse seine and trawl fisheries show advancement with increase in production and number of fishing vessels in operation.

#### 1. PRODUCTION FROM COMMERCIAL AND MUNICIPAL FISHING

Commercial fishing refers to fishing operations conducted on board fishing vessels more than 3 tons gross licensed by the Bureau of Fisheries. For municipal fishing, these are fishing operations mostly done in municipal waters with or without the use of a vessel 3 tons gross or below.

Fig.1 shows the trend of fish production from commercial and municipal fishing for a period of 10 years (1962-1971)\*. The trend is a continuous increase of production for both municipal and commercial fishing.

\* All figures were taken from the Fisheries Statistics, Bureau of Fisheries, 1962 to 1971.

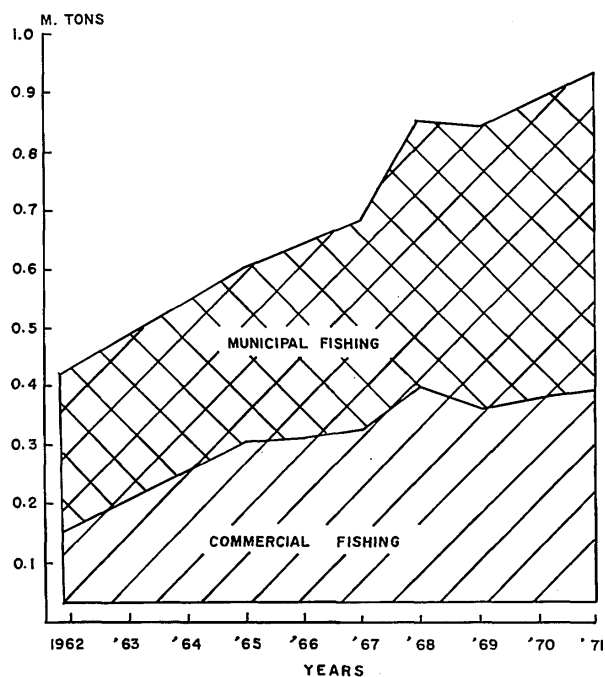


Fig. 1