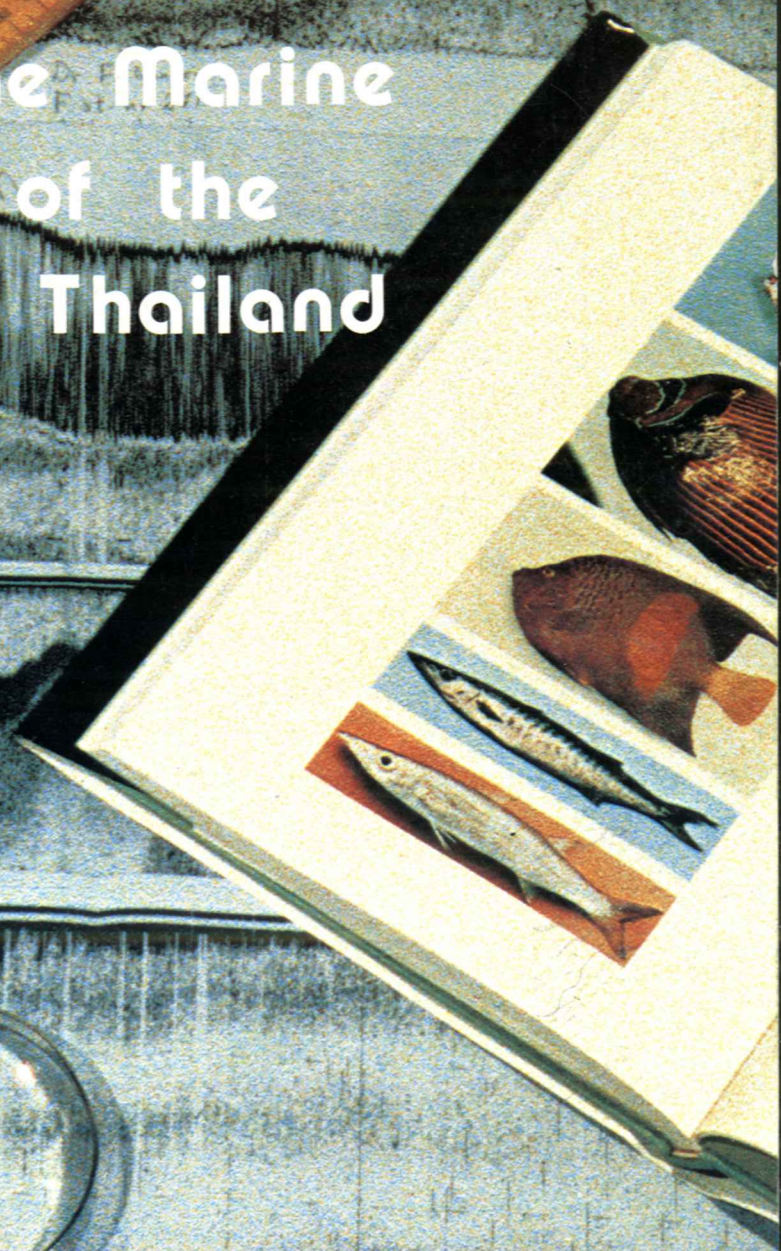


Reports on surveys with the R/V Dr Fridtjof Nansen.

A Survey of the Marine  
Fish Resources of the  
West Coast of Thailand  
July 1980



Institute of Marine Research, Bergen

1981



### **«Dr. Fridtjof Nansen»**

The fishery research vessel «Dr. Fridtjof Nansen» belongs to the Norwegian Agency for International Development (NORAD). It was designed and built for scientific and exploratory investigations of fishery resources of developing countries, under a joint plan with the Fisheries Department of FAO based on a funding of operation to be shared by FAO and Norway.

Reports on Surveys with the R/V "Dr. Fridtjof Nansen"

A SURVEY OF THE MARINE FISH RESOURCES

OF

THE WEST COAST OF THAILAND

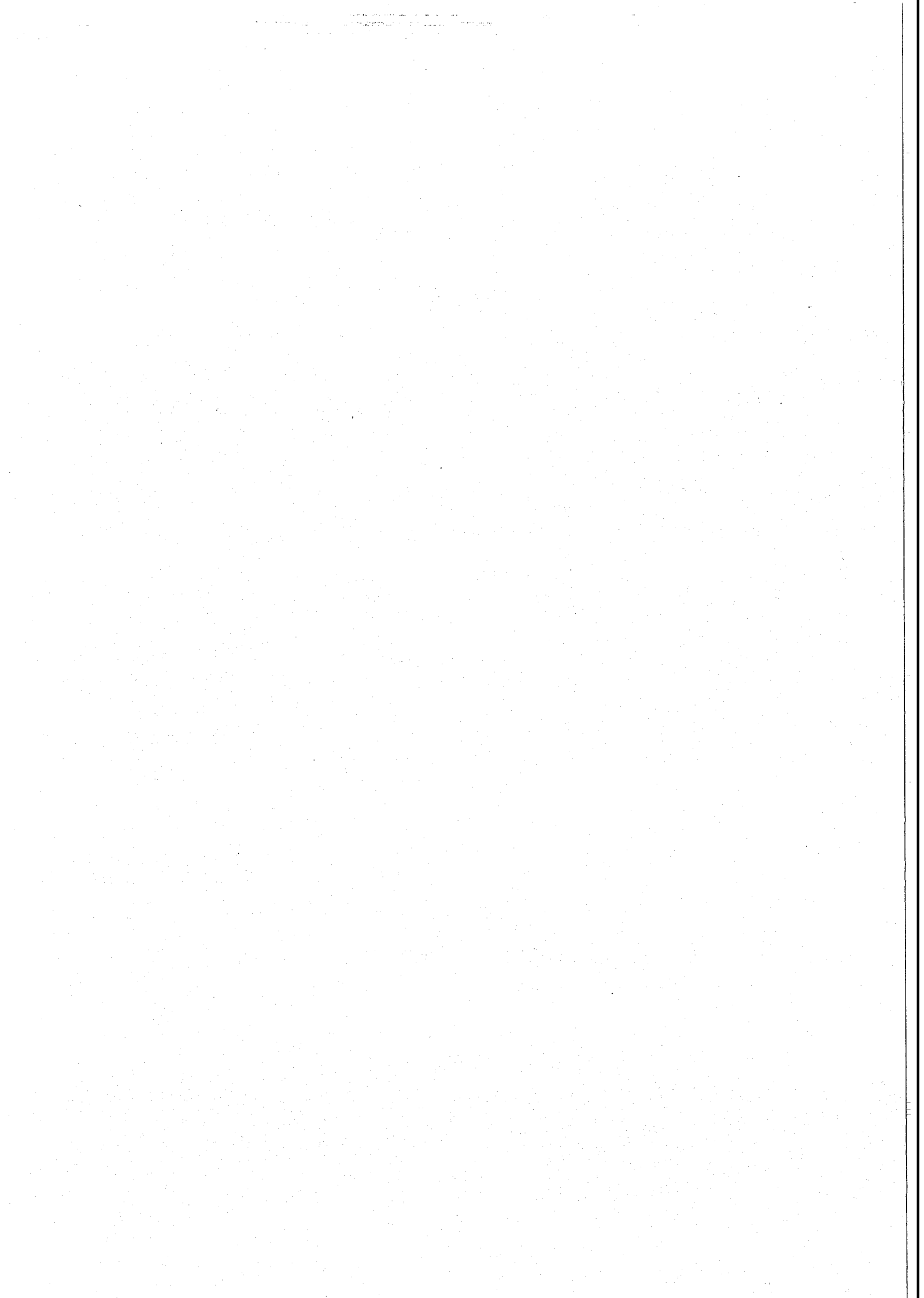
JULY 1980

by

A. Aglen, L. Føyn, O.R. Godø,  
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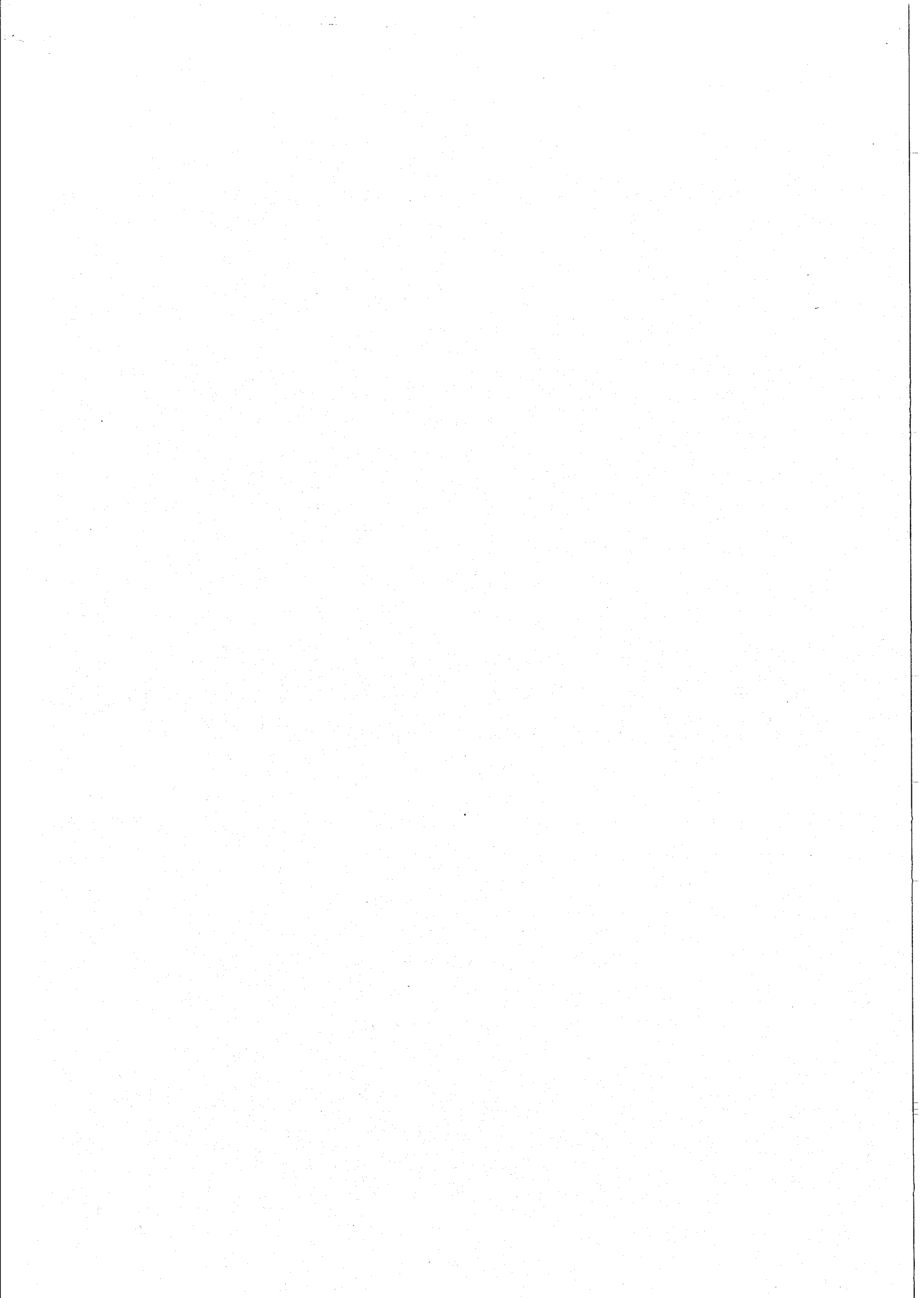
Institute of Marine Research

Bergen, December 1981



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## 1. INTRODUCTION

A programme of investigation of the marine fish resources of Thailand, Malaysia and Indonesia during the period June-August 1980 was agreed between the Food and Agriculture Organization of the United Nations (FAO) and the Norwegian Agency for International Development (NORAD). In accordance with this, the fisheries research vessel "Dr. Fridtjof Nansen" was commissioned to survey the west coast of Thailand between 16 July and 3 August 1980. The Institute of Marine Research, Bergen was responsible for the details of planning in consultation with UNDP/FAO South China Sea Fisheries Development and Coordinating Programme and the Government of Thailand.

The acoustic/exploratory fishing survey reported here includes the following observations:

Acoustic system      observing depth, bottom type, and fish biomass by categories.

Fishing system      observing catch, its amount and composition, biological data of fish, and fishability.

Oceanographic      observations (temperature, salinity, oxygen).

The analyses and processing of these data provide information on the quantity and distribution of the fish resources, their composition and aspects of their behaviour and their environment. The survey system has certain limitations, particularly as regards the interpretation of the acoustic observations. These will be discussed later. Similar work in other areas has, however, demonstrated that findings from this type of survey can provide good if often conservative indications of the availability of fish resources.

The participating scientific and technical staff is listed in Annex I. All the staff took part in observational work and carried out analyses and processing of the data to the extent

possible onboard the vessel. The preliminary results were presented in a short cruise report. The preparation of the final report was done at the Institute of Marine Research, Bergen.

## 2. METHODS

### 2.1 Vessel and equipment

The R/V "Dr. Fridtjof Nansen" is a 150 ft stern trawler with a main engine of 1 500 horsepowers. The vessel is equipped for acoustic surveying, bottom and mid-water trawling, hydrography, and plankton observations.

The bottom trawl was a 134 ft headrope shrimp trawl adapted for demersal fish trawling. The ground rope was equipped with 0.5 m rubber bobbins. Bridles of 40 m gave it a horizontal distance between the wings of about 20 m. The effective vertical opening of the net was about 6 m. The pelagic trawl had a circumference of about 120 m. The vertical opening was normally 13 m. The pelagic trawl had an inner net of mesh size 1 cm in the cod end. Pelagic trawl operations were usually monitored by aid of a 50 kHz acoustic net sonde. Because of an accident, the sonar could not be used and the possibility for catching schooling pelagic fish was limited.

Hydrographic observations were carried out with Nansen bottles with which temperature readings and samples for salinity and oxygen determinations were collected at standard depths, but never deeper than 500 m. The salinity was determined with an inductive salinometer and dissolved oxygen by the Winkler method.

Two echo sounders, 120 kHz and 38 kHz connected to echo integrators were run continuously. Settings and performance of the two acoustic systems were:



Frequency	120 kHz	38 kHz
Basic range	0-100 m	0-100 m or 0-250 m
Transmitter	1/1	Ext. transmitter
Transducer	10 <sup>0</sup> (circular)	8 <sup>0</sup> x 8 <sup>0</sup>
SL + VR	103 dB	133 dB
Bandwidth and pulse length	3 kHz, 0.6 m.sec.	3 kHz, 0.6 m.sec.
TVG and gain	20 logR+2αR -0 dB	20 logR+2αR -0 dB
Recorder gain	3	1
Integrator threshold	8 (0.2 volt peak)	8 (0.3 volt peak)
Integrator gain	20 dB (x 10)	10 dB (x 10)
Depth intervals	According to recordings	According to recordings

With these settings echoes from plankton and small fishes (less than about 5 cm) were integrated by the 120 kHz system only when they occurred in high volume densities, while bigger fish were always properly integrated. The settings chosen for the 38 kHz system made it more sensitive to smaller organisms, while signals from bigger fish sometimes saturated the receiver. Therefore integrator values from the 120 kHz system were used for abundance estimation of fish, while the 38 kHz values were used as an aid during the daily scrutinizing of the echo recordings.

## 2.2 Sampling and processing of data

For each trawl catch the weight, number and average total length of each species (or family) were estimated. Species determinations were mostly based on FAO Species Identification Sheets for Fishery Purposes (FISCHER & WHITEHEAD (eds) 1974), partly on Smith's Sea Fishes (SMITH 1972) and A Field Guide to the Coral Reef Fishes of the Indian and West Pacific Oceans (CARCASSON 1977). All fish belonging to the families Carangidae, Clupeidae, Engraulidae, Gerreidae, Leiognathidae and Scombridae were classified as pelagic fish whether they occurred in the pelagic trawl or the demersal trawl.

## The echo recordings and their interpretation

Assessment of the abundance of fish resources based on acoustic observations combined with experimental fishing is a method which especially lends itself to fish found in schools or other aggregations in mid-water. This is a type of behaviour which characterizes some of the fish species found in Malaysian waters. But there are also notable exceptions, e.g. surface schooling tunas and tuna-like species and strictly bottom-dwelling fish such as rays and flounders. Any fish found very close to the bottom (0.5-1 m) or in the very surface layer will escape echo sounder detection. For navigational reasons, the work with the R/V "Dr. Fridtjof Nansen" is limited to waters deeper than about 10 m. The extreme inshore waters could thus not be covered.

Because of differences in behaviour and size, different species or groups of species may give rise to different types of echo recordings. Small-sized pelagic fish are, for instance, often found in well-defined schools. These recordings can be distinguished from those of the looser aggregation in which semi-demersal large fish are often found. Such classification of the echo recordings is of considerable assistance in interpreting the acoustic observations, but the positive identification by fishing operations is still indispensable and also provides the only means of sampling fish in this type of combined survey.

Based on previous experience and on identification by fishing, the fish recordings in the Thailand west coast waters were classified as follows:

- (i) Recordings of true larger schools or dense layer mostly in upper water (Fig. 1). These will most often derive from pelagic schooling fish usually of smaller size, e.g. clupeoids, scads. This type was common in the coastal areas.

(ii) Fish recordings close to bottom which especially comprised looser aggregations of smaller and larger fish near the bottom. These are ascribed to demersal or semi-demersal fish such as croakers, grunts, breems, snappers, sharks, etc. This type of recordings was also common, and examples are shown in Fig. 2.

(iii) "Smoky" recordings of plankton and juvenile fish mostly distributed in scattered layers in upper water.

One should note, however, that the terms "pelagic" and "demersal" only indicate a general tendency of behaviour. Pelagic fish are often caught in quantities in bottom trawls and pelagic trawls can be used to catch demersal fish when distributed in midwater. An example of mixed recordings is shown in Fig. 3.

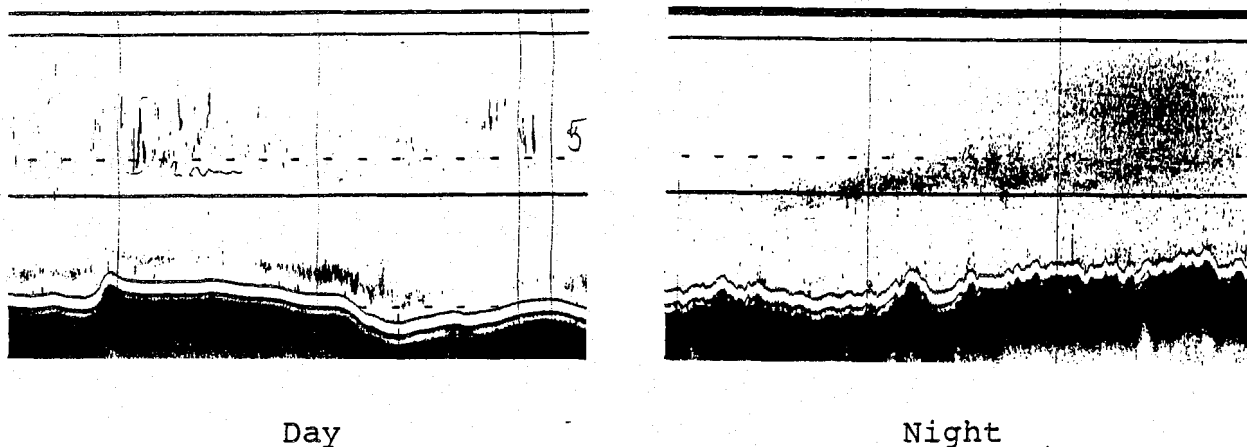


Fig. 1. Recordings of typical "pelagic" fish.

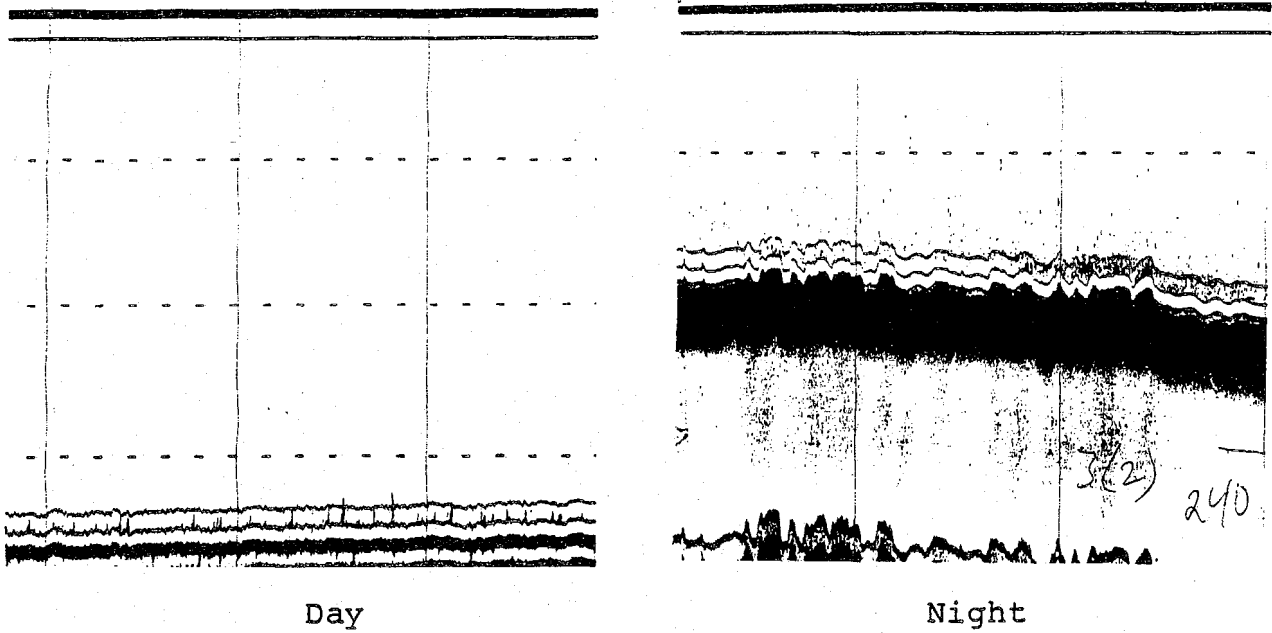


Fig. 2. Recordings of demersal fish.



Fig. 3. Mixed recordings of pelagic and demersal fish.

#### Acoustic abundance estimation

Average integrator deflection per nautical mile was calculated each five nautical miles steamed.

Average values ( $\bar{M}$ ) for pure pelagic fish and fish close to bottom were calculated within subareas, and average densities ( $\bar{D}$ ) were estimated by the formula  $\bar{D} = 0.25 \bar{L} \bar{M}$  (tonnes/nautical mile<sup>2</sup>).  $\bar{L}$  is the average fish length (cm) in the trawl catches

within the subarea. The conversion factor  $0.25 \bar{L}$  (tonnes/n.mile<sup>2</sup> per mm integrator deflection) were estimated from an intercalibration between the acoustic systems onboard R/V "Dr. Fridtjof Nansen" and R/V "Johan Hjort" in March 1979. This gave a conversion factor of 10 tonnes/n.mile<sup>2</sup> with reference to a cod type fish of 40 cm length. This becomes 0.25 L tonnes/n.mile<sup>2</sup> when the acoustic scattering cross section per unit weight is assumed to decrease linearly with fish length. This value corresponds to an average target strength of  $-10 \log L - 21$  dB per kg fish (at 120 kHz).

The fraction of pelagic fish included in the category "fish close to bottom" was estimated simply as the average weight percent of pelagic fish in the bottom trawl catches.

#### Abundance estimation of demersal fish by the swept area method

The swept area method is widely used in estimation of demersal fish abundance in the tropics. The method needs some assumptions concerning:

- the area swept by the trawl (a) per unit effort.
- the catchability coefficient, i.e. the proportion of the fish in the swept area caught by the trawl (c).

The fish density (D) is calculated according to the following formula:

$$D = \frac{d}{a \cdot c}$$

where d is catch per unit effort.

The following table shows assumptions used by various authors working in the tropics:

Authors	C	a	Area
ISARANKURA (1971)	0.5	a = distance between dannels x towing speed	West coast Thailand & Malaysia
SHINDO (1973)	0.5	a = (head rope length/1.5) x towing speed	South China Sea & Gulf of Thailand
SÆTRE & SILVA (1979)	0.5	a = distance between wings x towing speed	Mozambique
BLINDHEIM, DE BRUIN & SÆTERS DAL (1979)	0.5	- " -	Sri Lanka
ANON (1979)	1	- " -	Western Indian Ocean, South of Equator
STRØMME, NAKKEN, SANN AUNG & SÆTERS DAL (1981)	1	- " -	Burma
SAVILLE (1977)	$\leq 1$	- " -	

ANON (1979) refers a workshop discussing fish resources estimation in the tropics. It was suggested to use a catchability coefficient (c) for demersal fish equal to 1, while awaiting the results from further investigations. The total effect of herding and escapement is then assumed to be zero.

c=1 is used in the calculation of the demersal fish density from the bottom trawl catch rates of R/V "Dr. Fridtjof Nansen" in Malaysian, Thai and Indonesian waters in 1980, although experiences from other surveys with the same gear indicate that the catchability coefficient may be closer to 0.5 (SÆTRE 1981). The abundance estimates based on trawl data in this report are therefore most likely to be minimum estimates.

In this report, the area swept by the trawl is defined as the distance between the wings multiplied by the towed distance. The catch rate unit is kg per hour, and the area swept by the

trawl in one hour is estimated to be 0.03 n.mile<sup>2</sup> (STRØMME & al. 1981).

All other families than the Carangidae, Clupeidae, Engraulidae, Gerreidae, Leiognathidae, and Scombridae are included in "demersal fish".

### 3. RESULTS

#### 3.1 Survey coverage

The main objective of the cruise was to chart the fish resources in Thailand's economic zone along the west coast, the Andaman Sea. The cruise programme included acoustic observations combined with exploratory fishing for identification purpose and hydrographic observations. The survey was started in the south and a number of parallel sections 20 nautical miles apart were run across the continental shelf beyond the 200 m depth contour. Because of prevailing strong winds (southwest monsoon) during the two first weeks of the cruise, part of the area could not be surveyed as extensively as planned, and during some nights, trawling could not be done because of heavy swell.

On the return survey from north to south, a more detailed investigation was made, particularly in the inshore areas. However, to avoid interference with local fishing vessels and gears, the inshore areas were as far as possible mainly surveyed during daytime.

Fig. 4 shows the cruise tracks, fishing stations and hydrographic stations.

Three hydrographic sections were worked and a total of 80 trawl hauls were made, 64 demersal and 16 pelagic hauls. The total surveyed area has been estimated to approximately 11 600 n.miles<sup>2</sup>. The coastal area, defined as the area between 10-25 m depth was estimated to 1400 n.miles<sup>2</sup> and the offshore area, between 26-75 m to 5900 n.miles<sup>2</sup>.

For demonstration of the standard calibration technique for echo sounders using hydrophones, half a day was spent at anchor at Ko Sindarar Tai.

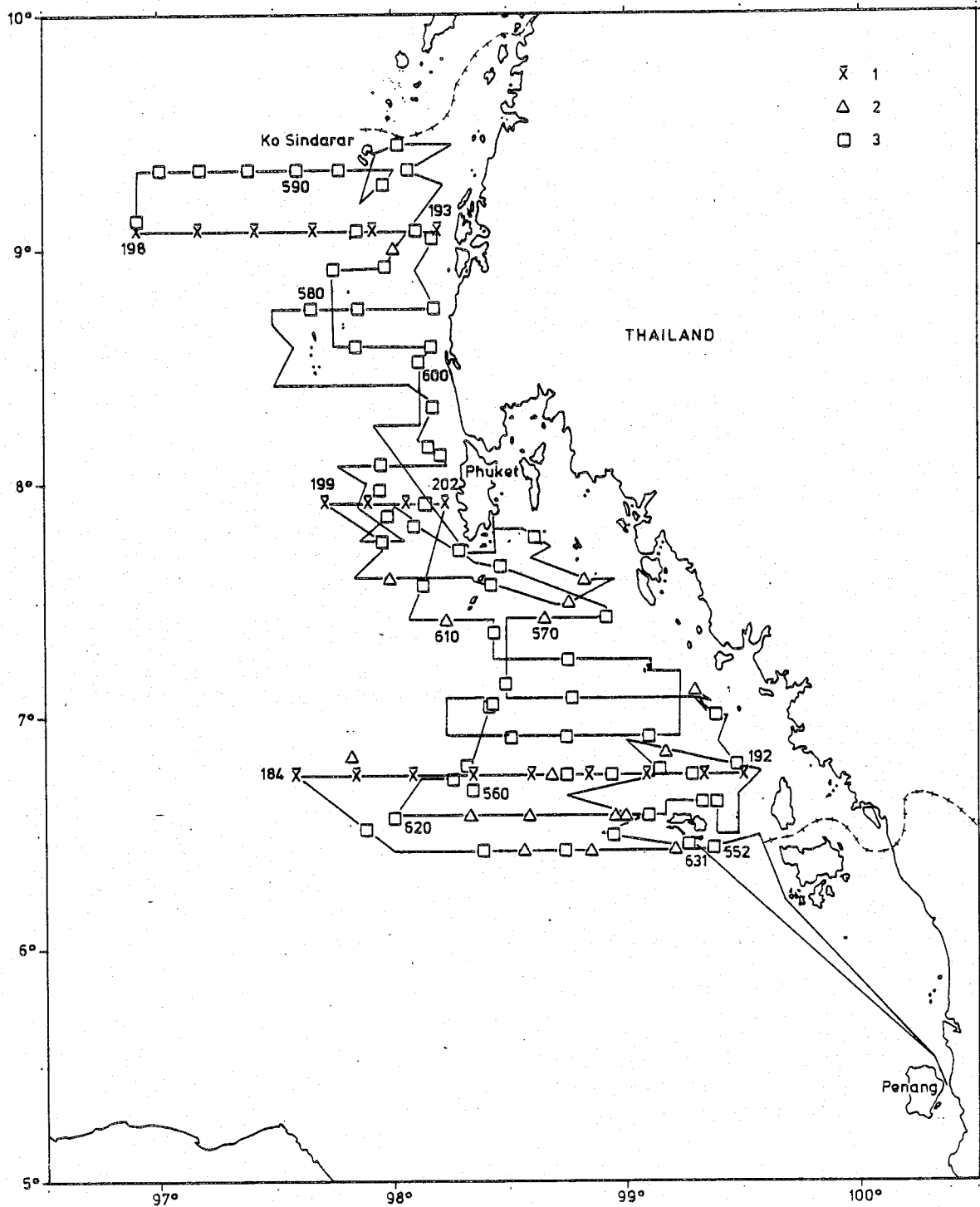


Fig. 4. Cruise tracks and stations. R/V "Dr. Fridtjof Nansen", Thailand west coast cruise, 16 July - 3 August 1980. 1) Hydrographic station, 2) pelagic trawl, 3) bottom trawl.



On Sunday 27 July a call was made at Phuket for landing of fish samples secured for further taxonomic studies by the Thai scientists.

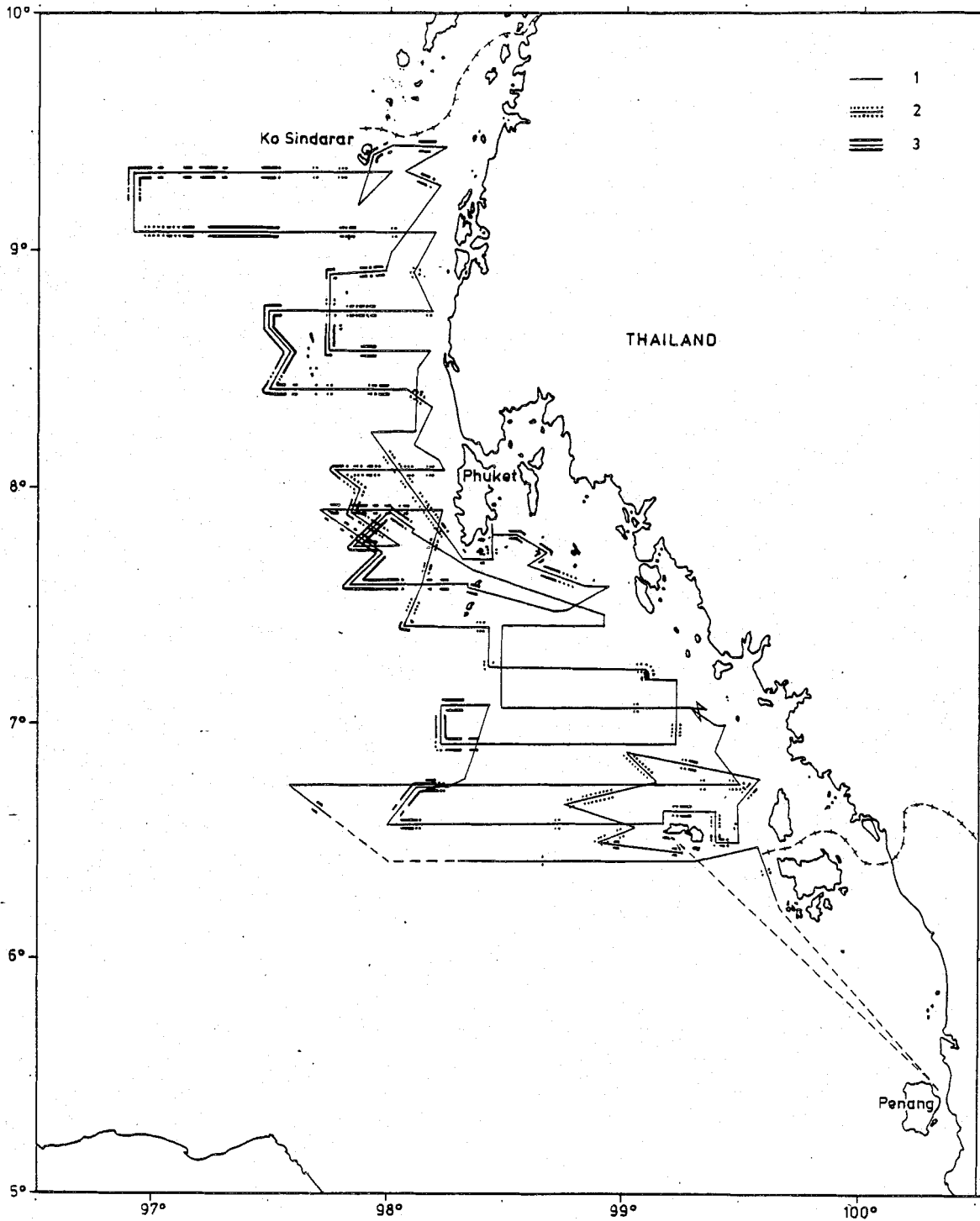


Fig. 5. Bottom condition. 1) Smooth, 2) Uneven, 3) Rough bottom. (Broken courseline: not recorded).

### 3.2 Bottom conditions

The type of bottom observed by echo sounder along the cruise tracks was classified according to its assumed suitability for bottom trawling as follows:

1. Even, flat bottom, suitable for all kinds of bottom trawl.
2. Generally smooth, but more uneven bottom where the use of bobbins would be preferable.
3. Rough bottom, unsuitable for trawling.

Fig. 5 show the total observations regarding bottom conditions from all cruise tracks. Inside the main shelf in waters of less than 50 m depth, some places with small rocks or corals unsuitable for trawling were observed. In most places along the cruise tracks except on the edge of the shelf between 100-200 m, the bottom was suitable for trawling.

### 3.3 Hydrography

The southwest monsoon (May-Oct) sets up a fairly strong current in a southeast-ward direction along the west coast of Thailand. According to Wyrcki (1961) the river discharges have a stronger influence on the surface salinities than the heavy rainfall following the southwest monsoon, and he reports average surface salinity values in the area for July-August to be between 32.7 and 32.5 S<sup>o</sup>/oo. The river discharges have a more pronounced influence closer to the shore. This is shown in our observations which was concentrated to three transects from the shore and beyond the shelf area (Fig. 6). Our maximum observation depth was 500 m and temperature, salinity and dissolved oxygen were determined at standard depths.

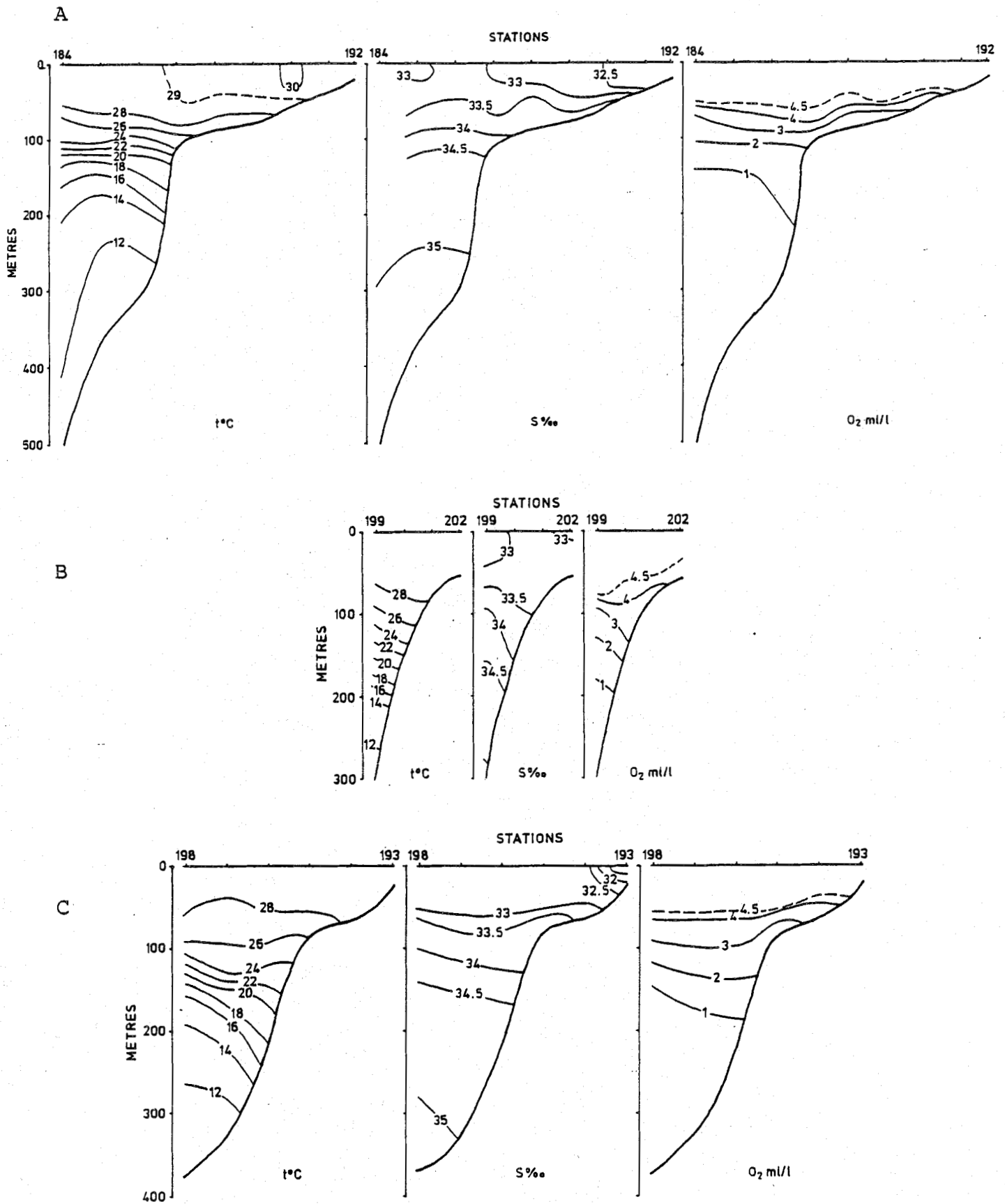


Fig. 6. Temperature, salinity and dissolved oxygen at hydrographic sections, (A)  $6^{\circ}45'N$ , 18-19 July 1980, (B)  $7^{\circ}55'N$ , 29 July 1980,  $9^{\circ}05'N$ , 23-24 July 1980.

The vertical temperature distribution showed a maximum at the surface of about 28-29°C. The depth to the thermocline was 100 m or more, but there was no sharp gradient, probably due to strong vertical mixing during the southwest monsoon. Salinity increased from surface downwards to 35 per mille below 300 m. The oxygen contents decreased with depth to 1 ml/l (minimum ca 0.7 ml/l) below 150-200 m. There were no significant differences in water masses from south to north as observed along the three transects. Two transects in the shallow waters off the west coast of Malaysia were worked during first part of June 1980 as reported by Aglen et al. 1981. These transects show the same pattern of the surface layers distribution as is found at this later cruise (Fig. 6).

### 3.4 Fish distribution and catch composition

As described under section 2.2 the integrated echo intensities were allocated to four main categories according to the appearance of the echo recordings and the composition of the trawl catches. The categories were:

- True pelagic fish
- Fish close to bottom
- Juvenile fish
- Plankton

The results of the survey are given in Figs 7-10, showing the integrator values in mm/n.mile ascribed to the four categories. The levels of echo abundance are given as isolines for different levels. In most areas the integrator readings allocated to fish were below 10 mm/n.mile.

The distribution of pelagic and demersal fish were patchy, but three areas of relative high abundance were observed: in the north near the Burma border, the inshore area south of Phuket, and in the south near the Malaysia border.

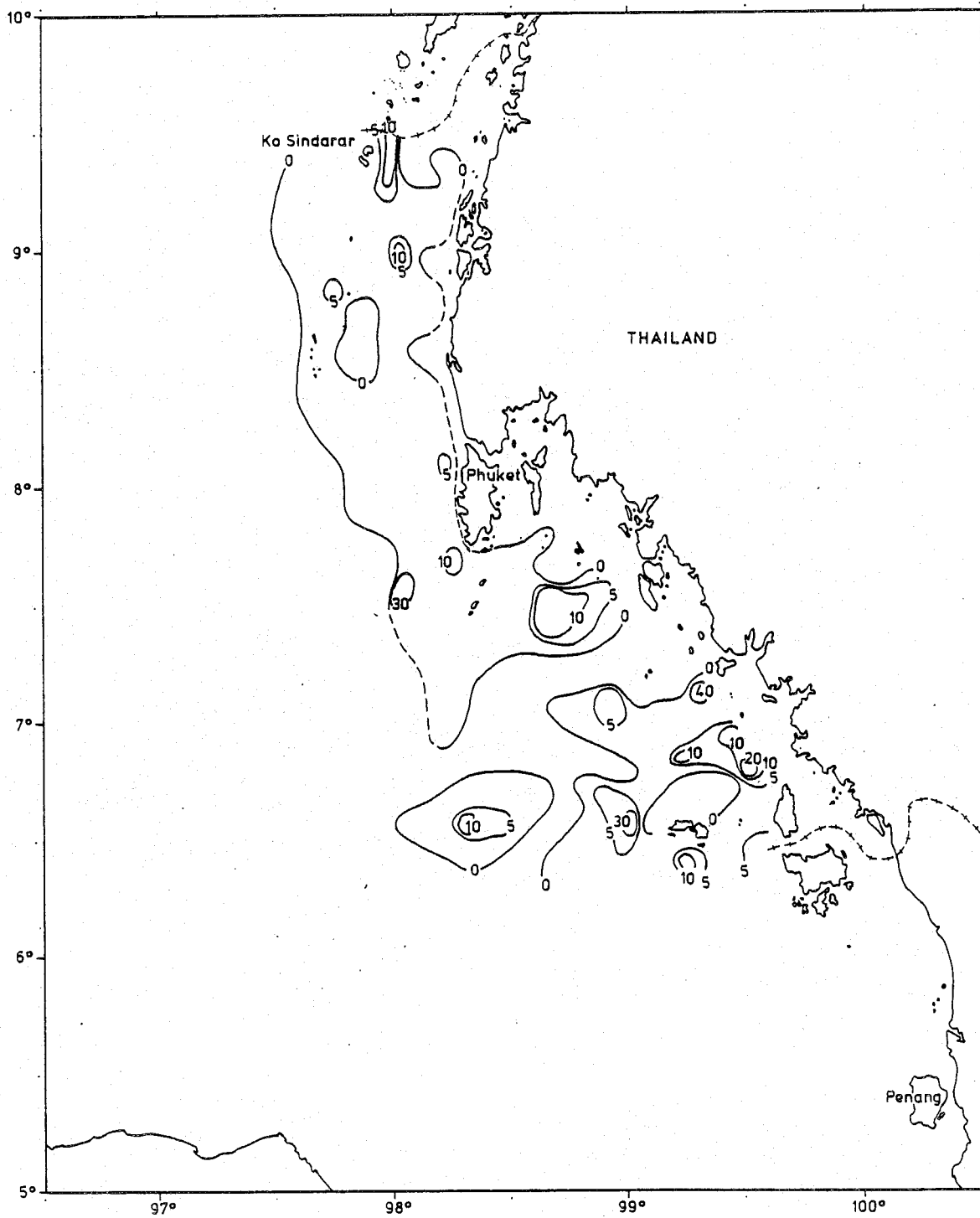


Fig. 7. Echo abundance of pure pelagic fish in mm integrator reading per nautical mile.

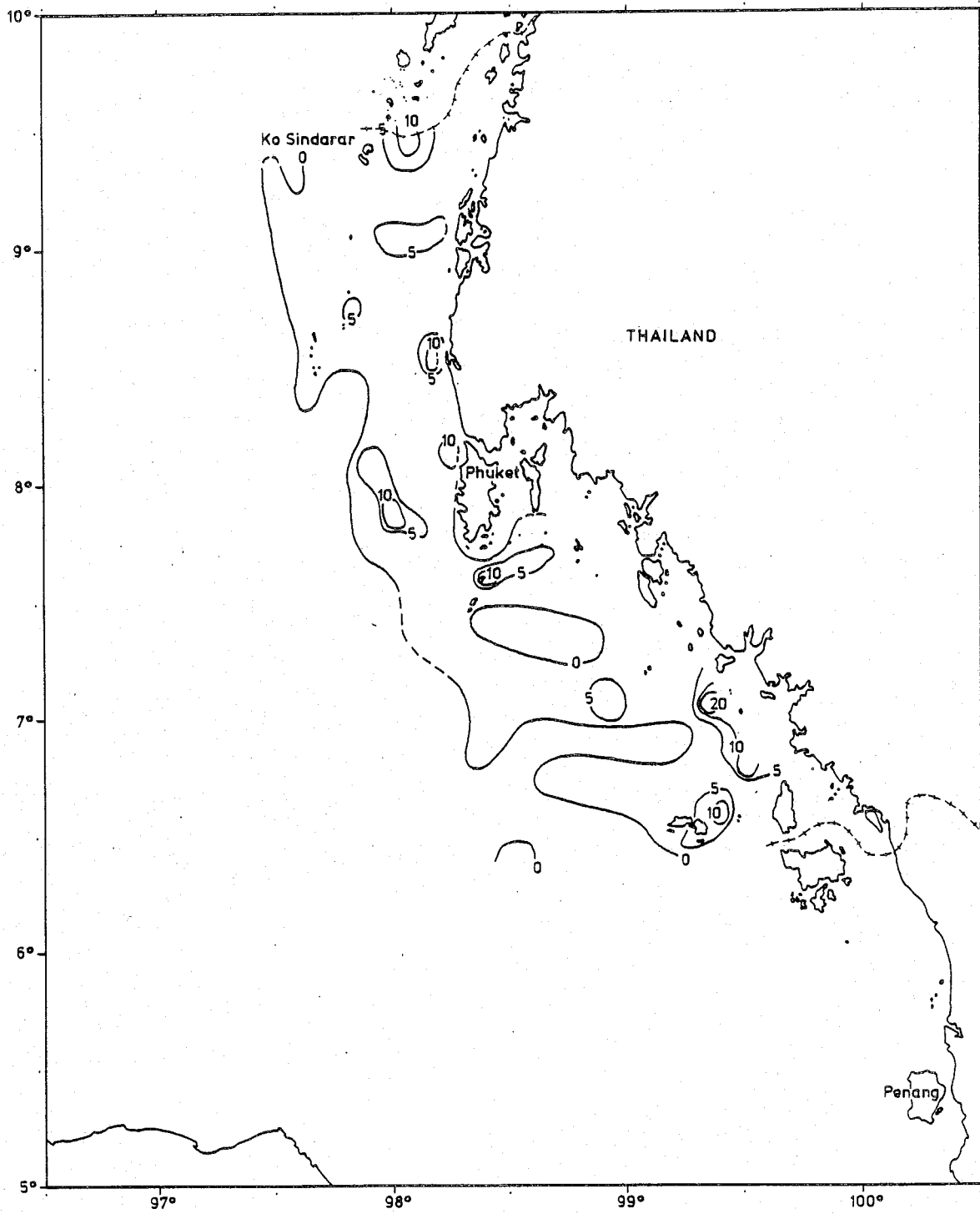


Fig. 8. Echo abundance of fish close to bottom in mm integrator reading per nautical mile.

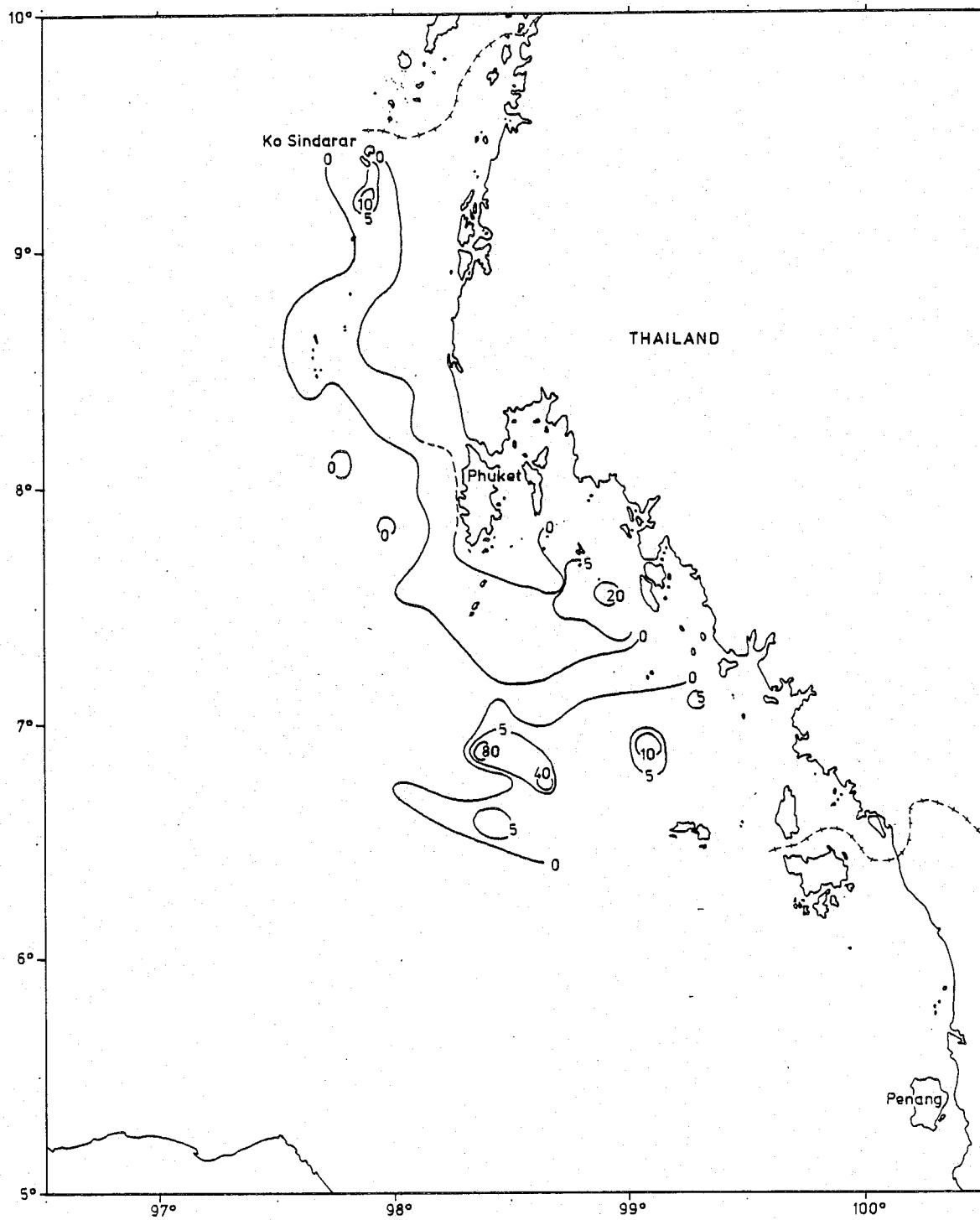


Fig. 9. Echo abundance of juvenile fish in mm integrator reading per nautical mile.

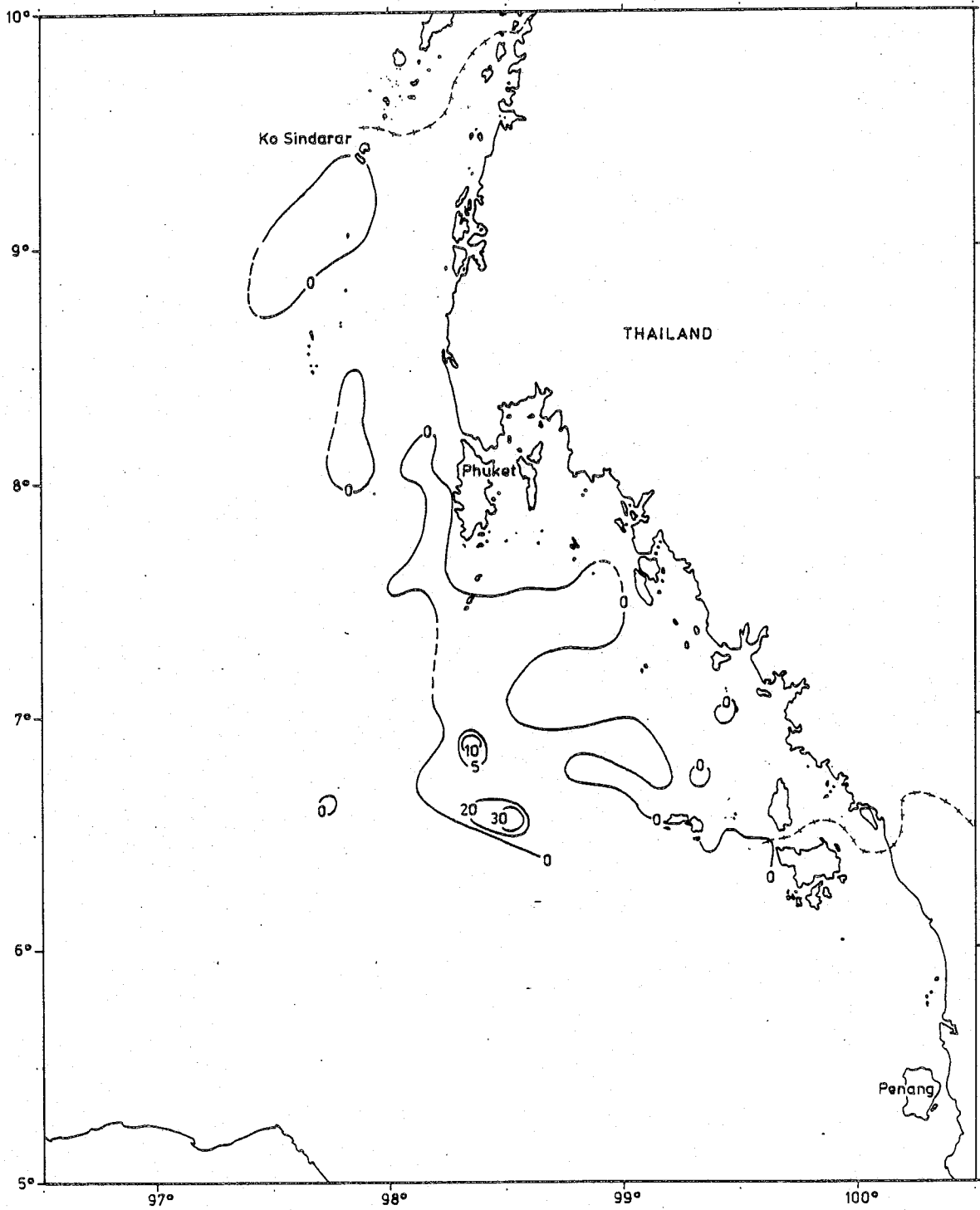


Fig. 10. Echo abundance of plankton in mm integrator reading per nautical mile.



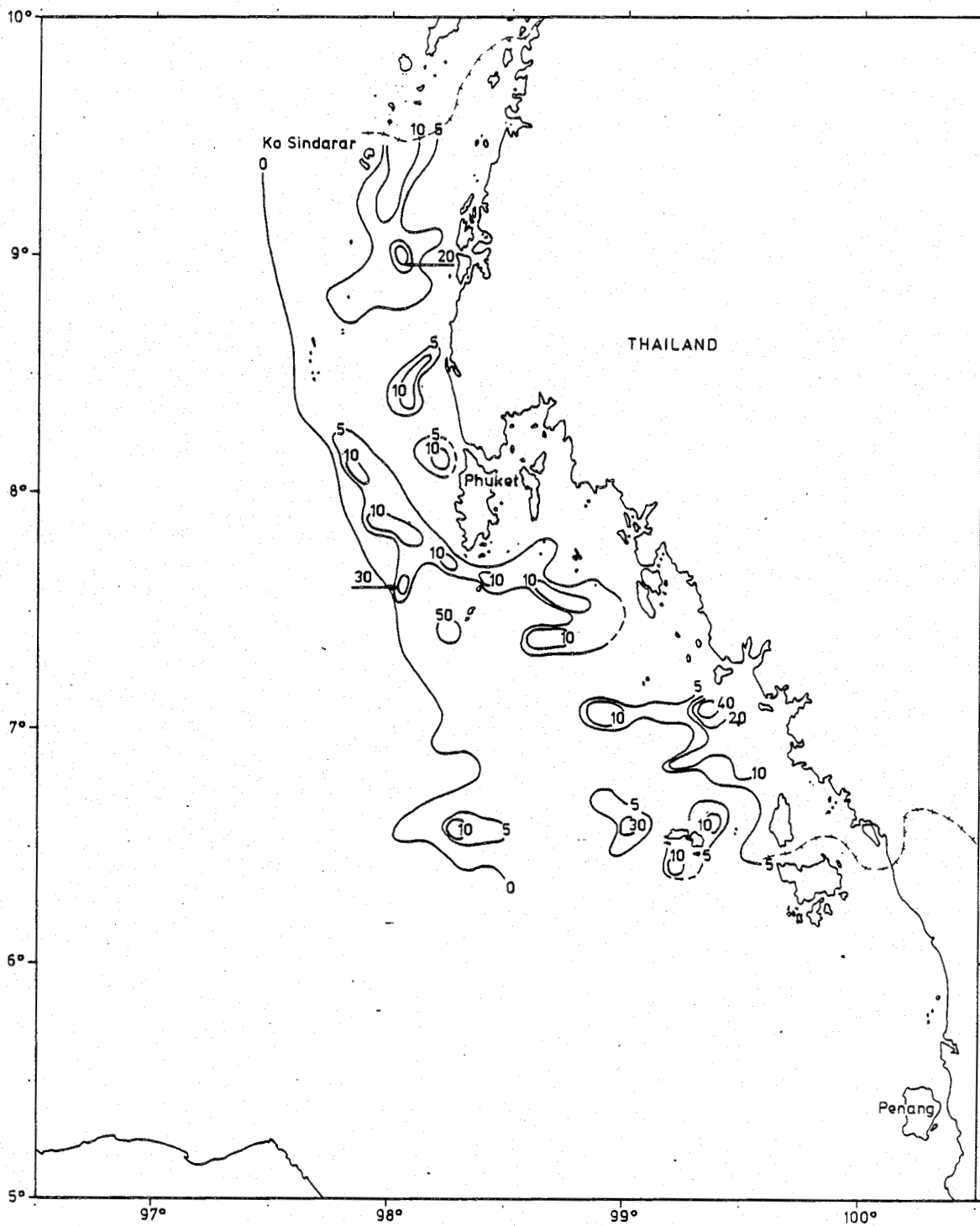


Fig. 11. Echo abundance of pelagic and demersal fish combined in mm integrator reading.

The species composition of bottom trawl catches indicate that the recordings ascribed to demersal fish were often pelagic or semi-pelagic species such as carangids which at daytime are found close to bottom while at night they occur as scattering layers in mid-water. The separation of echo integrator readings in pelagic and demersal fish where no catch is available may often be misleading. In Fig. 11 is given total echo intensity of pelagic and demersal fish combined.

Beyond the shelf area the echo intensity was in most areas recorded as zero. It should be noted, however, that the integrators were set to integrate fish recordings above 100 m depth only. In deeper water very little fish were recorded, and the catch by demersal trawl in deep water gave mainly deep water species living close to the bottom or shrimps which are not always recorded on the echo sounders.

For identification of the echo recordings a total of 80 trawl hauls, 64 demersal and 16 pelagic were made at different depths. The catch of the dominating species are listed for each fishing operation in Annex II, and all recorded fish species are listed in Annex IV. Length frequency distributions for some important species are given in Annex III. Tables 1 and 2 show the average catch rate within depth zones of each family in the bottom trawl hauls.

Of the typical pelagic species carangids dominated, mainly yellowstripe trevally (Selaroids leptolepis) and one-finlet scad (Atule mate). In a few hauls clupeids (Sardinella sp. and Dussumieria acuta) were well represented while anchovies (Stolephorus spp.) dominated some catches.

Several species of ponyfish (Leiognathidae) were represented in most catches and sometimes constituted the bulk of the catch.

Table 1. Average catch rate (kg/hr) within depth zones. Thailand west coast, July 1980. +: Less than 0.1 kg/hr.

Family	Average catch rate (kg/hr)					
	Depth: 10-25	26-50	51-75	76-100	101-200	201-380
Acanthuridae	-	0.7	-	0.1	-	-
Antennariidae	-	-	+	-	-	-
Apogonidae	0.1	0.3	+	+	-	0.1
Ariidae	-	5.8	0.1	-	-	-
Ariommidae	-	-	0.2	0.1	-	-
Balistidae	0.7	2.9	3.0	1.7	-	0.3
Bothidae	+	0.2	0.1	0.2	-	+
Bregmacerotidae	-	+	+	+	0.2	-
Callionymidae	-	-	+	-	-	-
Caproidae	-	-	-	-	0.2	-
Carangidae	26.1	123.4	1.6	5.5	0.4	-
Chaetodontidae	-	0.1	+	-	-	-
Chirocentridae	-	1.2	0.2	0.1	-	-
Clupeidae	1.8	4.3	-	-	-	-
Dactylopteridae	+	0.5	0.3	3.8	+	+
Diodontidae	-	0.1	0.3	0.7	-	-
Echeneidae	-	0.2	+	0.3	+	-
Emmelichthyidae	-	-	+	-	-	-
Engraulidae	0.1	0.1	+	+	0.1	-
Ephippidae	1.5	0.6	-	-	-	-
Fistulariidae	+	0.3	0.2	0.1	+	-
Formionidae	-	0.2	0.5	0.2	-	-
Gerreidae	3.1	1.8	0.8	2.5	-	-
Holocentridae	-	0.5	0.9	1.9	-	-
Labridae	-	+	0.2	+	-	-
Lactariidae	0.3	-	-	-	-	-
Leiognathidae	6.4	36.6	21.7	19.2	-	-
Lethrinidae	-	6.1	0.4	3.7	-	-
Lophiidae	-	-	0.1	0.1	0.2	-
Lutjanidae	0.5	19.9	9.6	11.9	0.6	-
Menidae	-	+	-	-	-	-
Mugiloididae	-	-	+	0.1	-	-
Mullidae	0.4	19.9	5.0	5.1	0.1	-
Muraenesocidae	-	-	1.2	+	-	-
Nemipteridae	2.1	13.5	8.4	12.5	1.7	-
Ogcocephalidae	-	-	0.2	0.1	-	+
Ophidiidae	-	+	+	-	-	0.1
Ostraciontidae	+	1.1	+	0.3	-	-
Pentapodidae	-	1.0	0.1	0.2	-	-
Platycephalidae	0.4	+	0.1	0.2	-	-
Pleuronectidae	-	+	0.1	+	-	-
Plotosidae	-	+	-	+	-	-
Polynemidae	-	+	-	-	-	-
Pomacentridae	-	0.1	+	-	-	-
Pomadasyidae	4.3	3.7	0.2	0.4	-	-
Priacanthidae	-	3.1	9.7	8.1	13.2	9.8
Psettodidae	-	0.2	0.3	+	-	-

Table 1. Continued.

Family	Average catch rate (kg/hr)					
	Depth: 10-25	26-50	51-75	76-100	101-200	201-380
Rachycentridae	0.3	0.1	-	4.1	-	-
Sciaenidae	0.5	0.2	+	-	-	-
Scombridae	2.8	7.4	2.0	0.1	37.0	-
Scorpaenidae	-	0.1	0.2	0.2	-	0.7
Serranidae	0.1	2.4	4.4	0.4	1.3	-
Siganidae	0.5	17.9	0.1	+	-	-
Sillaginidae	0.8	-	-	-	-	-
Soleidae	+	+	-	-	-	-
Sparidae	-	0.4	-	0.4	-	-
Sphyraenidae	0.9	4.0	1.4	0.6	-	-
Synanceiidae	-	-	+	+	-	+
Syngnathidae	+	+	+	-	-	-
Synodontidae	0.3	1.6	2.1	3.9	0.6	0.5
Tetraodontidae	0.4	0.4	0.1	0.4	-	-
Theraponidae	0.4	0.3	+	-	-	-
Triacanthidae	-	+	-	+	-	0.1
Trichiuridae	0.4	39.9	6.2	0.4	-	0.2
Triglidae	-	-	+	0.4	+	2.5
Uranoscopidae	-	-	1.1	0.3	-	0.2
Unidentified	-	-	-	-	1.0	0.5
Selachimorpha	-	1.4	-	5.9	0.3	0.2
Batoidimorpha	0.3	11.5	0.2	0.6	-	2.8
Cephalopoda	1.2	1.6	3.5	2.6	0.3	1.9
Crustacea	1.5	0.9	0.2	0.5	+	10.6
DEMERSAL FISH	11.5	168.8	56.3	69.7	19.5	17.6
PELAGIC FISH	40.3	173.7	26.1	27.4	37.6	0
DEEPWATER FISH (see Table 2)	-	-	-	-	-	37.8
TOTAL	54.5	345.0	86.1	100.2	57.3	68.4
Number of trawl hauls	3	20	16	14	5	6

Table 2.

Average catch rate (kg/hr) of typical deepwater fishes in 6 bottom trawl hauls at 200-380 m depth.  
Thailand west coast, July 1980.

Family	Average catch rate (kg/hr)
Acropomatidae	0.2
(Anotopteridae)	0.4
(Aploactinidae)	+
Chaunacidae	+
Chlorophthalmidae	4.3
(Cyclopteridae)	+
Gempylidae	6.6
Gonostomatidae	+
(Macrorhamphosidae)	0.1
Macrouridae	1.5
Melanostomiidae	+
Myctophidae	4.4
Neoscopelidae	2.6
Nomeidae	13.5
Paralepididae	0.6
Sternoptychidae	0.2
Trachichthyidae	2.4
Triacanthodidae	0.2
Zeidae	0.6
TOTAL	37.8
Other organisms (see Table 1)	30.6

+: Less than 0.1 kg/hr.  
Name in ( ) when identification doubtful.

Table 3.

Average catch rate (kg/hr) in 16 pelagic trawl hauls.  
Thailand west coast, July 1980.

Family	Average catch rate (kg/hr)
Anguilliformes (Larvae)	+
Apogonidae	+
Ariommidae	+
Balistidae	+
Bregmacerotidae	1.2
Carangidae	3.3
Chirocentridae	+
Clupeidae	17.7
Dactylopteridae	0.2
Emmelichthyidae	0.2
Engraulidae	45.0
Exocoetidae	+
Formionidae	0.1
Gerreidae	0.1
Gobiidae	+
Leiognathidae	2.6
Lutjanidae	0.1
Myctophidae	+
Priacanthidae	1.2
Scombridae	2.1
Siganidae	2.2
Sphyraenidae	1.8
Synodontidae	0.2
Tetraodontidae	+
Trichiuridae	0.1
Unidentified/juv. fish	0.2
Cephalopoda	0.3
Crustacea	+
TOTAL	78.9

Of demersal fish threadfin breams (Nemipteridae) and bigeyes (Priacanthidae) were the most abundant. Of snappers (Lutjanidae) mainly the smaller types were caught (Lutjanus lineolatus, L. vitta). Rock cods (Serranidae) and scavengers (Lethrinidae) were scarce. Spinefoot (Siganus sp.) and lizardfishes (Saurida spp.) were present in many hauls.

The average catch rate with demersal trawl was estimated for different zones. The maximum average catch rates occurred at 26-50 m depths, reaching a value of 345 kg/hr. At depths from 51-75 m and down to 100 m the catch rates were 80-100 kg/hr. In depth water below 200 m only about 70 kg/hr was obtained. Both shrimps and deep water lobster were caught at this depth, but the catch rates were too low to be of commercial interest.

Table 3 shows the average catch rate of each family in the pelagic trawl hauls. Some of the pelagic trawl hauls gave very small catches because the larger pelagic fish avoided the trawl.

### 3.5 Fish abundance

The average catch rates of demersal fish shown in Table 1 were used to estimate abundance of demersal fish by the swept area method. The results are shown in Table 4. The total standing stock of demersal fish was estimated to be 27 000 tonnes only. About 55% of demersal fish was found within the 50 m depth contour. Fish abundance estimated from the echo integrator values as described under section 2.2 are shown in Table 5. The surveyed area was divided in three subareas (Fig. 12), and the average fish densities were estimated for each subarea.

Table 4. Abundance of demersal fish estimated from bottom trawl catch rates. West coast of Thailand, July 1980.

Depth zone (metres)	Number of hauls	Area <sub>2</sub> (n.m <sup>2</sup> )	Catch rate (kg/hr)	Density (tonnes/n.m <sup>2</sup> )	Total abundance (1000 tonnes)
10- 25	3	1400	11.5	0.4	0.5
26- 50	20	2800	168.8	5.1	14.2
51- 75	16	3100	56.3	1.7	5.2
75-100	11	1500	18.5	0.6	0.8
<b>Total</b>	<b>64</b>	<b>11600</b>			<b>26.5</b>

Table 5. Fish abundance estimated from mean integrator values and fish lengths within subareas. West coast of Thailand, July 1980.

Sub-area	Area <sup>x</sup> (n.m <sup>2</sup> )	Mean integrator value (nn/n.m)		Mean fish length (cm)		Weight % "pelagic" fish in bottom trawl	Average fish density (tonnes/n.mile <sup>2</sup> )			Total abundance (1000 tonnes)	
		Pure pelagic	Close to bottom	Pure pelagic	Close to bottom		pelagic	bottom	"Pelagic" fish close to bottom	Pelagic	Demersal
I	3200	2.3	2.2	8	18	43	4.6	9.9	4.3	28.5	17.9
II	3300	3.5	2.4	12	16	38	10.5	9.6	3.6	46.5	19.8
III	5100	2.7	1.3	8	14	56	5.4	5.6	2.6	40.8	15.3
<b>Total</b>	<b>11600</b>						<b>6.6</b>	<b>7.9</b>	<b>3.4</b>	<b>115.8</b>	<b>53.0</b>

x) Area of 10-200 m bottom depth.

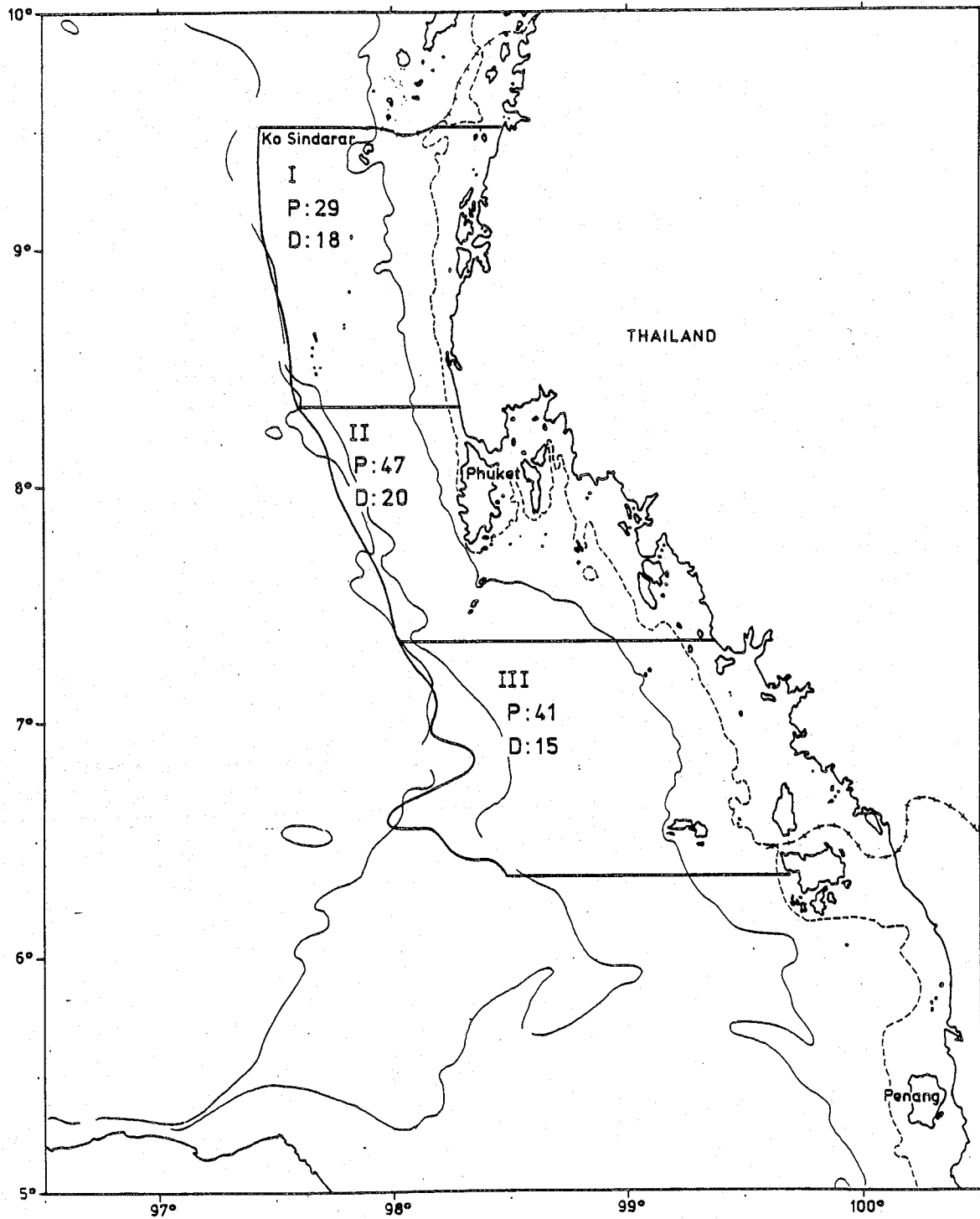


Fig. 12. Subareas used for acoustic abundance estimation. Estimates given in thousand tonnes. 20-50-100-200m isobaths drawn. Seaward limit of commercial fish recordings coincide approximately with 200m isobath.



#### 4. DISCUSSION AND CONCLUSIONS

The west coast of Thailand was surveyed during two weeks of July. The survey period fell within the southwest monsoon period, and the survey work was partly hindered by bad weather.

The observations made during this short period may not be representative for the rest of the year. Therefore one should be cautious in drawing definite conclusions about fish productivity and sustainable yields based on the abundance estimates obtained from the survey.

The acoustic recordings of fish were classified in two main categories: pure pelagic fish and fish close to bottom. The latter category was further separated in pelagic and demersal fish on the basis of bottom trawl catches. All fish belonging to the families Carangidae, Clupeidae, Engraulidae, Gerreidae, Leiognathidae and Scombridae were defined as "pelagic".

For navigational reasons, inshore areas of depth less than 10 m could not be covered in this survey. These uncovered parts comprise about 20% of the shelf. Assuming that the mean fish densities in the inshore shallow areas are the same as on the outer shelf, the biomass estimates are (thousand tonnes):

	Acoustic	"Swept area"
Pelagic fish	140	-
Demersal fish	70	(30)
Total	210	-

The acoustic system does not cover the depth layer from the surface down to about 10 m, nor does it separate echoes from fish very close (within about 0.5-1 m) to the sea bottom. The

conversion factor used for calculating fish abundance in tonnes from echo intensity (mm deflection) represents "cod-type" fish and may not be representative for the dominant fish species. Too little is known about the acoustic properties and behaviour of the fishes in the area for the evaluation of the total effect of these factors. In addition, the bad weather led to some loss of echo energy due to air bubbles. The acoustic abundance estimates have therefore to be used with some reservation.

The biomass estimated by the swept area method is likely to be much too low, because many of the areas could not be sampled due to local fishing activity or rough bottom, and because of uncertainties about the true value of the catchability coefficient.

These biomass estimates are very low compared to earlier estimates of maximum sustainable yield (MSY) and annual catches during the period 1968-1977 (Table 6). This is most pronounced for demersal fish. One should, however, note that in this report the terms "pelagic" and "demersal" have a taxonomic definition while in most fishery statistics the two groups are defined according to the kind of fishing gear used. This latter definition corresponds to the terms "pure pelagic fish" and "fish close to bottom" as described on pages 4-6. Table 6 shows the biomass estimates based on this separation compared to earlier MSY estimates and annual catches.

Table 6. Estimates of biomass and maximum sustainable yield (MSY) and approximate annual catches during 1969-1977 (thousand tonnes).

	Biomass*	MSY**	Annual catch** (1969-1977)
Pelagic	100	ca 60	ca 40
Demersal	110	80-200	ca 200
Total	210	150-200	ca 240

\* Estimated as "pure pelagic" and "close to bottom (Table 5) and increased by 25 percent to compensate for uncovered area.

\*\* BHATIA and CHULLASORN (1980).

Even if the statistics show rather stable landings at about 200 000 tonnes of demersal fish annually during 1969-1977, there is a tendency of decline from 1973 onwards. PAULY (1979) shows that in 1971 the catch per unit effort for the research vessels in the area was just one fourth of the 1966 level. This indicates over-exploitation, which means that the estimated MSY of 200 000 tonnes has been too optimistic. PAULY (1979) also shows changes of the ecosystem at the west coast of Thailand which are quite identical to changes of the ecosystem in the Gulf Thailand during heavy exploitation in the late 1960's. The findings from this survey indicate that the decline of biomass has continued.

The average (acoustic) fish densities observed on the shelf within the 200 m contour are, however, similar to density estimates obtained with "Dr. Fridtjof Nansen" in neighbouring areas during 1979 and 1980, but considerably lower than the estimates obtained at Sri Lanka during 1979-1980. These are compared in Table 7.

Table 7. Average fish densities within various areas of the shelf (at 10-200 m depth) along the Indian Ocean and south China Sea, estimated during cruises with R/V "Dr. Fridtjof Nansen" (tonnes/nautical mile<sup>2</sup>).

Area	Time period	Average fish density (tonnes/n.m. <sup>2</sup> )	References
Peninsular Malaysia			
East	Jun 1980	12	AGLEN & al. (1981a)
West	Jun-Jul 1980	19	AGLEN & al. (1981a)
Sumatra			
North and West	Aug 1980	15	AGLEN & al. (1981b)
Thailand			
West	Jul 1980	15	(Table 5)
Burma			
	Sep-Nov 1979	17	STRØMME & al. (1981)
	Mar-Apr 1980	34	STRØMME & al. (1981)
Bangladesh			
	Nov-Dec 1979	16	SÆTRE (1981)
	May 1980	19	SÆTRE (1981)
Sri Lanka			
	Aug-Sep 1978	84	SÆTERS DAL & DE BRUIN (1979)
	Apr-Jun 1979	60	BLINDHEIM & al. (1979)
	Jan-Feb 1980	58	BLINDHEIM & FØYN (1980)
Pakistan			
	Jan-Feb 1977	83	ANON 1978
	Feb-Mar 1977	47	ANON 1978
	Mar-Apr 1977	64	ANON 1978
	Apr-May 1977	48	ANON 1978
	May-Jun 1977	20	ANON 1978

The variation of the estimates from the repeated surveys in Burma, Bangladesh, Sri Lanka and Pakistan illustrates some of the seasonal fluctuations which are likely to occur in these areas. It should be stressed, therefore, that the present survey was completed in a very short time period and that pelagic species in particular may show considerable seasonal fluctuations. To fully assess the potential yield, additional investigations during other parts of the year are required.

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ANNEX I

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Thailand West Coast, 16 July - 3 August 1980

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## ANNEX II

## RECORD OF FISHING OPERATIONS

R/V "DR. FRIDTJOF NANSEN", THAILAND WEST COAST CRUISE, 16 JULY - 3 AUGUST 1980

BT: Bottom trawl, PT: Pelagic trawl

DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	NORTH	EAST	TOTAL	PR HR		TOTAL	MEAN
17.7	1750	552	BT	34	34	6°26'	99°23'	53.9	107.8	<u>Scomberomorus commersoni</u> <u>Leiognathus bindus</u> <u>Nemipterus hexodon</u> <u>Atule mate</u> <u>Priacanthus tayenus</u>	18.25	1.66
17.7	2040	553	PT	41	15	6°25'	99°14'	330.0	660.0	<u>Stolephorus sp.</u> <u>Sphyraena obtusata</u> <u>Gazza minuta</u>	310.50	
18.7	0045	554	PT	74	55	6°25'	98°53'	63.7	127.4	<u>Stolephorus heterolobus</u> <u>Decapterus maruadsi</u> <u>Decapterus macrosoma</u>	27.50	
18.7	0240	555	BT	86	86	6°25'	98°46'	0.0				
18.7	0510	556	PT	96	35	6°25'	98°35'	12.2	24.4	<u>Rastrelliger kanagurta</u> <u>Bregmaceros sp.</u>	7.40	0.071
18.7	0800	557	BT	106	106	6°25'	98°24'	105.4	210.8	<u>Rastrelliger kanagurta</u> <u>Priacanthus macracanthus</u> <u>Nemipterus japonicus</u>	92.60	0.070
18.7	1300	558	BT	317	317	6°30'	97°54'	21.0	36.0	<u>Priacanthus macracanthus</u> <u>Gephyroberyx sp.</u>	7.10	0.066
18.7	1935	559	PT	378	0	6°45'	97°48'	0.9	1.7	<u>Eel larvae</u> <u>Myctophidae</u>	0.35	
19.7	0225	560	BT	104	104	6°45'	98°20'	0.0				
19.7	0605	561	PT	81	26	6°45'	98°42'	0.01				
19.7	0730	562	BT	80	80	6°45'	98°46'	47.4	94.8	<u>Leiognathus bindus</u> <u>Pristipomoides typus</u> <u>Nemipterus japonicus</u>	23.50	0.017
19.7	1030	563	BT	70	70	6°45'	98°57'	138.6	277.2	<u>Leiognathus bindus</u> <u>Nemipterus japonicus</u> <u>Nemipterus nematophorus</u>	126.50	0.019
19.7	1355	565	BT	44	44	6°45'	99°16'	42.9	85.7	<u>Leiognathus bindus</u> <u>Secutor insidiator</u> <u>Selaroides leptolepis</u> <u>Saurida undosquamis</u>	20.80	0.016
19.7	1712	565	BT	19	19	6°47'	99°28'	23.2	46.4	<u>Selaroides leptolepis</u> <u>Atule mate</u> <u>Scomberomorus commersoni</u>	12.70	
19.7	2145	566	BT	18	18	7°00'	99°24'	22.7	45.3	<u>Gerres oyena</u> <u>Selaroides leptolepis</u> <u>Sardinella gibbosa</u> <u>Sepia sp.</u>	4.35	0.056
20.7	0325	567	PT	29	12	7°05'	99°19'	164.2	328.3	<u>Dussumieria acuta</u> <u>Sardinella gibbosa</u> <u>Stolephorus indicus</u> <u>Leiognathus bindus</u>	113.00	0.033
20.7	1110	568	BT	73	73	7°05'	98°46'	49.7	99.3	<u>Lutjanus sanguineus</u> <u>Nemipterus japonicus</u> <u>Nemipterus nematophorus</u> <u>Leiognathus bindus</u> <u>Priacanthus tayenus</u> <u>Priacanthus macracanthus</u>	7.10	3.550
20.7	1700	569	BT	84	84	7°09'	98°30'	75.0	150.0	<u>Pristipomoides typus</u> <u>Decapterus macrosoma</u> <u>Decapterus maruadsi</u> <u>Parupeneus heptacanthus</u> <u>Lethrinus sp.</u>	28.80	1.108
20.7	2205	570	PT	60	42	7°25'	98°39'	38.0	75.9	<u>Siganus canaliculatus</u> <u>Priacanthus tayenus</u> <u>Decapterus maruadsi</u> <u>Bregmaceros sp. (juv)</u>	17.50	0.035

DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	NORTH	EAST	TOTAL	PR HR		TOTAL	MEAN
21.7	0100	571	BT	48	48	7°25'	98°54'	62.3	124.6	<u>Lethrinus lentjan</u> <u>Upeneus sulphureus</u> <u>Nemipterus tambuloides</u> <u>Nemipterus nematophorus</u>	13.50 10.40 4.30 3.10	0.397  0.073 0.053
21.7	0835	572	BT	38	38	7°38'	98°27'	66.5	133.0	<u>Selaroides leptolepis</u> <u>Nemipterus devagoae</u> <u>Siganus canaliculatus</u>	58.30 3.20 2.65	0.045 0.086 0.039
21.7	1225	573	BT	50	50	7°43'	98°17'	274.4	548.7	<u>Upeneus sulphureus</u> <u>Lutjanus lutjanus</u> <u>Gazza minuta</u> <u>Leiognathus equulus</u> <u>Leiognathus splendens</u>	163.40 21.20 19.80 13.50 6.80	0.100   0.100 0.016
21.7	1615	574	BT	66	66	7°50'	98°05'	116.5	233.0	<u>Parupeneus heptacanthus</u> <u>Lutjanus lineolatus</u> <u>Epinephelus tauvina</u> <u>Pristipomoides typus</u> <u>Nemipterus delagoae</u>	26.80 24.40 21.75 11.75 4.75	0.114 0.045 5.438 2.938 0.093
21.7	1910	575	BT	87	87	7°53'	97°59'	115.4	230.8	<u>Parupeneus heptacanthus</u> <u>Nemipterus delagoae</u> <u>Pristipomoides typus</u> <u>Lutjanus argentimaculatus</u> <u>Dactyloptena orientalis</u>	18.70 12.20 11.50 11.05 10.00	0.156 0.197 2.875 5.525 0.114
22.7	0625	576	BT	83	83	8°05'	97°56'	65.0	130.0	<u>Priacanthus macroacanthus</u> <u>Saurida undosquamis</u> <u>Pristipomoides typus</u>	10.00 6.50 6.35	0.156 0.096 1.588
22.7	1010	577	BT	40	40	8°07'	98°13'	80.5	161.0	<u>Leiognathidae (3 spp.)</u> <u>Trichiurus haumela</u> <u>Upeneus sulphureus</u>	53.00 12.70 1.60	0.270  0.031
22.7	1215	578	BT	43	43	8°08'	98°09'	188.3	376.5	<u>Decapterus maruadsi</u> <u>Selar boobs</u> <u>Lutjanus lineolatus</u> <u>Rastrelliger kanagurta</u> <u>Selaroides leptolepis</u> <u>Pinjalo pinjalo</u>	37.80 33.10 30.10 12.25 11.75 10.85	0.086 0.047 0.047 0.121 0.028 0.172
22.7	1540	579	BT	42	42	8°18'	98°10'	240.3	360.4	<u>Selar boobs</u> <u>Leiognathus equulus</u> <u>Sphyræna forsteri</u> <u>Carangoides malabaricus</u> <u>Gnathanodon speciosus</u>	87.00 36.90 15.30 10.65 9.30	0.094 0.054 0.189 0.197 0.388
23.7	0415	580	BT	82	82	8°45'	97°38'	14.2	42.6	<u>Lethrinus nebulosus</u> <u>Parupeneus heptacanthus</u> <u>Sepia sp.</u>	10.80 0.85 0.95	5.400 0.106 0.950
23.7	0650	581	BT	71	71	8°45'	97°51'	82.7	165.3	<u>Trichiurus haumela</u> <u>Priacanthus tayenus</u> <u>Nemipterus delagoae</u>	41.30 12.10 9.50	0.567 0.048 0.161
23.7	1000	582	BT	17	17	8°46'	98°09'	34.5	69.0	<u>Atule mate</u> <u>Pomadasyds hasta</u> <u>Carangoides speciosus</u> <u>Gnathodon speciosus</u>	6.50 5.80 5.20 3.00	0.148 0.829 0.158 3.000
23.7	1305	583	BT	26	26	9°02'	98°09'	52.5	104.9	<u>Selaroides leptolepis</u> <u>Nemipterus delagoae</u> <u>Siganus canaliculatus</u> <u>Priacanthus tayenus</u>	17.50 10.90 5.80 5.00	0.042 0.092 0.043 0.058
23.7	1510	584	BT	29	29	9°05'	98°07'	451.2	1353.6	<u>Selaroides leptolepis</u> <u>Nemipterus delagoae</u> <u>Sardinella sim</u>	365.85 22.05 18.45	0.039 0.107 0.085
23.7	1905	585	BT	65	65	9°07'	97°52'	15.9	31.7	<u>Sphyræna barracuda</u> <u>Trichiurus haumela</u> <u>Sphyræna obtusata</u>	2.15 2.00 1.65	0.358 0.667 0.075
24.7	0755	586	BT	377	377	9°07'	96°55'	34.0	67.9	<u>Epinnula orientalis</u> <u>Puerulus sewelli</u> <u>Myctophidae</u> <u>Palinurichthys sp.</u>	8.00 7.90 5.50 3.95	0.050 0.075  0.068
24.7	1120	587	BT	348	348	9°20'	97°01'	74.0	148.0	<u>Palinurichthys sp.</u> <u>Deep water shrimps</u> <u>Epinnula orientalis</u>	26.50 6.50 5.00	0.057  0.045

DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	NORTH	EAST	TOTAL	PR HR		TOTAL	MEAN
24.7	1420	588	BT	262	262	9°20'	97°12'	23.9	47.7	<u>Priacanthus macracanthus</u> <u>Epinnula orientalis</u> Deep water shrimps	8.20 4.45 3.60	0.048 0.043
24.7	1755	589	BT	174	174	9°20'	97°22'	32.6	65.1	<u>Priacanthus macracanthus</u>	25.60	0.108
24.7	2035	590	BT	81	81	9°20'	97°35'	69.4	138.7	<u>Rachycentron canadus</u> <u>Nemipterus delagoae</u> <u>Parupeneus heptacanthus</u>	29.00 18.70 5.50	3.222 0.081 0.074
24.7	2320	591	BT	74	74	9°20'	97°46'	31.9	54.7	<u>Sepia sp.</u> <u>Nemipterus delagoae</u> <u>Pentaprion longimanus</u> <u>Saurida undosquamis</u>	5.80 4.65 4.10 3.40	0.322 0.057 0.024 0.092
25.7	0220	592	BT	45	45	9°17'	97°57'	80.0	160.0	<u>Lethrinus choerorhynchus</u> <u>Leiognathus smithursti</u> <u>Gazza minuta</u> <u>Priacanthus tayenus</u> <u>Plectorhynchus pictus</u>	10.90 7.50 7.30 6.65 5.20	0.495   0.074 1.300
25.7	1315	593	BT	26	26	9°27'	98°03'	337.5	674.9	<u>Siganus canaliculatus</u> <u>Selaroides leptolepis</u> <u>Arius sp.</u> <u>Decapterus maruadsi</u>	127.80 98.40 52.95 19.80	 0.041  0.044
25.7	1650	594	BT	30	30	9°21'	98°05'	252.5	505.1	<u>Selaroides leptolepis</u> <u>Taeniura melanospila (ray)</u> <u>Alepes djeddaba</u> <u>Alectis indicus</u>	102.17 100.00 19.50 10.00	0.035  0.092 10.000
25.7	2100	595	PT	41	24	9°00'	98°00'	4.9	19.4	<u>Stolephorus heterolobus</u> <u>Sphyraena obtusata</u>	3.50 1.00	0.004 0.059
25.7	2320	596	BT	48	48	8°55'	97°56'	298.2	596.3	<u>Lutjanus lentjan</u> <u>Luthanus lineolatus</u> <u>Sphyraena barracuda</u> <u>Lutjanus gibbus</u> <u>Epinephelus fuscoquattatus</u>	29.00 26.00 22.30 21.50 49.80	0.367 0.040 3.717 1.265 19.800
26.7	0230	597	BT	76	76	8°54'	97°45'	19.7	39.4	<u>Macolor niger</u> <u>Nemipterus delagoae</u> <u>Saurida undosquamis</u>	4.10 3.80 3.10	4.100 0.070 0.076
26.7	0630	595	BT	74	74	8°35'	97°50'	64.8	129.9	<u>Priacanthus tayenus</u> <u>Sepia sp.</u> <u>Nemipterus delagoae</u>	22.50 10.00 9.15	 0.769 0.086
26.7	1010	599	BT	34	34	8°35'	98°08'	560.0	119.9	<u>Trichiurus haumela</u> <u>Leiognathidae</u> <u>Selaroides leptolepis</u> <u>Carcharhinus sp. (shark)</u>	378.00 130.80 11.10 7.05	  0.033 3.525
26.7	1210	600	BT	40	40	8°33'	98°07'	96.7	193.4	<u>Siganus javus</u> <u>Epinephelus fuscoquattatus</u> <u>Alepes djeddaba</u> <u>Lutjanus malabaricus</u>	18.30 15.40 8.85 7.05	15.400 0.369 2.350
28.7	1335	601	BT	28	28	7°47'	98°35'	78.7	157.4	<u>Selaroides leptolepis</u> <u>Secutor ruconius</u> <u>Leiognathus bindus</u> <u>Siganus canaliculatus</u> <u>Rastrelliger kanagurta</u>	26.20 18.80 7.50 6.50 4.20	0.030 0.010 0.010 0.037 0.140
28.7	1740	602	PT	38	18	7°37'	98°47'	0.1	0.3	Fish fry (unidentified)		
28.7	2125	603	PT	50	27	7°30'	98°45'	3.6	7.2	<u>Sardinella gibbosa</u> <u>Decapterus maruadsi</u>	2.40 0.55	0.045 0.046
29.7	0150	604	BT	57	57	7°34'	98°26'	7.0	13.9	<u>Lutjanus lineolatus</u> <u>Abalistes stellaris</u>	4.10 0.90	0.035 0.450
29.7	0600	605	PT	175	45	7°35'	97°59'	0.0				
29.7	1000	606	BT	71	71	7°45'	97°57'	0.5	1.0	<u>Nemipterus delagoae</u>	0.35	0.175
29.7	1410	607	BT	254	254	7°55'	97°47'	15.2	30.3	<u>Priacanthus macracanthus</u>	10.20	0.067
29.7	1745	608	BT	75	75	7°55'	98°07'	0.0				
29.7	2210	609	BT	72	72	7°35'	98°07'	61.5	122.9	<u>Lutjanus lineolatus</u> <u>Abalistes stellaris</u> <u>Holocentrus rubrum</u> <u>Epinephelus sp.</u> <u>Lutjanus rivulatus</u>	10.40 13.00 7.50 8.20 4.90	0.044  0.174 8.200 4.900

DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	NORTH	EAST	TOTAL	PR HR		TOTAL	MEAN
30.7	0135	610	PT	76	53	7°25'	98°13'	3.3	5.0	<u>Emmelichthys sp.</u>	2.80	
30.7	0410	611	BT	73	73	7°22'	98°25'	4.2	8.3	<u>Formio niger</u>	4.00	0.267
30.7	0735	612	BT	68	68	7°15'	98°44'	22.2	44.4	<u>Leiognathus bindus</u> <u>Priacanthus macracanthus</u> <u>Scomberomorus commersoni</u>	11.00 4.45 3.85	0.018 0.068 1.925
30.7	2040	613	BT	54	54	6°55'	99°06'	16.6	33.2	<u>Nemipterus nematophorus</u> <u>Priacanthus tayenus</u> <u>Saurida undosquamis</u>	4.10 3.15 1.55	0.053 0.033 0.074
30.7	2355	614	BT	80	80	6°55'	98°43'	33.9	58.1	<u>Nemipterus nematophorus</u> <u>Saurida undosquamis</u> <u>Priacanthus tayenus</u>	8.80 4.60 4.10	0.044 0.072 0.034
31.7	0245	615	BT	87	87	6°55'	98°30'	46.0	92.0	<u>Carcharinus sp. (shark)</u> <u>Priacanthus tayenus</u>	40.00 3.05	40.000 0.027
31.7	0810	616	BT	77	77	7°04'	98°25'	8.8	17.5	<u>Nemipterus delagoae</u> <u>Echeneis naucrates</u> <u>Parupeneus heptacanthus</u>	2.20 1.70 1.60	0.092 0.213 0.123
31.7	1005	617	BT	87	87	7°03'	98°24'	118.7	237.4	<u>Leiognathus bindus</u> <u>Priacanthus macracanthus</u> <u>Decapterus maruadsi</u>	101.25 9.25 1.90	0.019 0.051 0.043
31.7	1310	618	BT	114	114	6°47'	98°19'	+	+	<u>Echeneis naucrates</u>		
31.7	1450	619	BT	116	116	6°46'	98°16'	5.3	10.5	<u>Epinephelus sp.</u>	3.35	3.350
31.7	1825	620	BT	320	320	6°35'	98°00'	40.7	81.3	<u>Chlorophthalmus agassizi</u> <u>Peristedion sp.</u> <u>Cubiceps sp.</u>	7.90 4.20 3.15	0.050 1.400 0.029
31.7	2215	621	PT	106	91	6°35'	98°19'	2.0	4.0	<u>Gazza minuta</u> <u>Dactylopera orientalis</u> <u>Rastrelliger kanagurta</u>	0.40 0.60 0.30	0.009 0.067 0.075
1.8	0105	622	BT	93	93	6°30'	98°20'	42.8	73.4	<u>Nemipterus nematophorus</u> <u>Dactylopera orientalis</u> <u>Lutjanus sanguineus</u> <u>Pentaprion longimnus</u>	12.10 5.20 3.30 3.50	0.049 0.063 3.300 0.022
1.8	0410	623	PT	75	45	6°30'	98°57'	1.4	2.4	Mainly 0-group bregmaceros		
1.8	0410	624	PT	72	50	6°35'	98°58'	1.2	2.3	Mainly 0-group bregmaceros		
1.8	0815	625	BT	59	59	6°35'	99°05'	54.0	107.9	<u>Leiognathus bindus</u> <u>Rastrelliger kanagurta</u> <u>Priacanthus tayenus</u>	26.30 7.80 6.00	0.015 0.069 0.029
1.8	1100	626	BT	40	40	6°38'	99°19'	24.3	48.5	<u>Selaroides leptolepis</u> <u>Lutjanus sanguineus</u> <u>Leiognathus bindus</u> <u>Secutor insidiator</u>	5.50 5.40 3.50 2.85	0.034 5.400 0.014 0.014
1.8	1235	627	BT	36	36	6°38'	99°23'	42.8	73.4	<u>Selaroides leptolepis</u> <u>Leiognathus bindus</u> <u>Sardinella gibbosa</u>	27.50 3.10 1.65	0.031 0.016 0.026
1.8	1940	628	PT	54	10	6°50'	99°11'	3.0	6.0	<u>Formio niger</u> <u>Rastrelliger kanagurta</u>	1.00 0.80	0.077 0.080
1.8	2310	629	BT	53	53	6°46'	99°08'	27.1	54.1	<u>Congresoz talabonoides</u> <u>Priacanthus tayenus</u> <u>Selaroides leptolepis</u>	9.60 6.70 1.70	4.800 0.034 0.027
2.8	0445	630	BT	75	75	6°29'	98°55'	23.0	91.8	<u>Nemipterus nematophorus</u> <u>Priacanthus macracanthus</u> <u>Leiognathus bindus</u> <u>Priacanthus tayenus</u>	4.30 3.30 3.15 2.95	0.052 0.083 0.030 0.030
2.8	0735	631	BT	41	41	6°26'	99°26'	1.0	2.0	<u>Scomberomorus guttatus</u>	1.00	0.500

## ANNEX III

Length frequency distribution of some important species (Lt, 1 cm groups).

(Part 1)

FAMILY/Species	Stn No	N	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34		
ARIOMMIDAE																																				
<i>Ariomma indica</i>																																				
<i>Indian driftfish</i>	568	26									2				3	12	6	3																		
BALISTIDAE <i>Abalistes stellaris</i> (Part 2)																																				
CARANGIDAE																																				
<i>Alepes djeddaba</i>																																				
<i>Djeddaba crevalle</i>	594	50																3	19	25	3															
<i>Atule mate</i>	552	23										2	2		1	1						2	7			5	2		1							
<i>Yellowtail scad</i>	553	26										6	12	5		3																				
	554	14									1	1	8	3		1																				
	564	16											1		5	8	1																			
	565	81										16	48	10		1		3				1		1		1										
	579	20											2		8	3	3	1				1	1	1												
	582	44											1		1		1	2	1		1	2	2	4	12	12	5									
	601	29											1	2	12	8						1	1	4												
<i>Carangoides ciliaris</i>	582	33									1	1	1				2	1		7	4	4	3	5		1	2		1							
<i>Longfin cavalla</i>																																				
<i>Carangoides malabaricus</i>	579	18									1	2	1		1	1	2	2			2	2						1		1					2	
<i>Malabar cavalla</i>																																				
<i>Decapterus macrostoma</i>	554	73										1				2	26		38	6																
<i>Layang scad</i>	556	5																	3	2																
	569	46													1	15	18	5		5	2															
	570	14													1	2	9	2																		
	604	8																1		4	3															
<i>Decapterus maruadsi</i>	554	124										1			3	22	62	27	8		1															
<i>Round scad</i>	569	79										4	2		9	41	16	5	2																	
	570	108										5	16	21		23	26	13	4																	
	574	28									2	5			1	16	4																			
	578	84													1			4	13		45	20	1													
	579	12															1	1	9			1														
	585	17															3	13			1															
	593	65											2		11	26	23	3																		
	603	12													1	5	4	2																		
	615	20														4	12	3			1															
	617	44														15	18	10	1																	
	622	34														4	11	13		6																
Gnathanodon speciosus (Part 2)																																				
<i>Megalaspis cordyla</i>	570	17																1		1	5	2	2		3	3										
<i>Hardtail scad</i>																																				
<i>Selar boops</i>	578	122														8	29	54		20	6	1	2	2												
<i>Oxeye scad</i>	579	32														6	8			10	1	1	4	2												
	594	18											1			3	6	7		1																
<i>Selar crumenophthalmus</i>	562	8																		2	5	1														
<i>Bigeye scad</i>	574	38									1	1			10	16	9	1																		
	593	49										1			29	16	2	1																		

FAMILY/Species	Stn No	N	03 04	05 06 07 08 09	10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33 34
<u>Selaroides leptolepis</u>	552	37			1 1 6 10	12 6 1			
Yellowstripe trevally	564	57			6 30	19 2			
	565	58			10 18 25 3	2			
	566	69			1 22 27 17 2				
	567	38		3 18	4 9 4				
	572	44			1	20 21 2			
	578	118		1	2 5 53 32 8	14 3			
	579	44			5 4 8	18 6 4			
	582	65			4	26 26 9			
	583	72			2 13	31 22 3 1			
	584	57			1 12	23 11 7 3			
	593	51			1 16	20 13 1			
	600	27			7 3 6	7 2 1 1			
	601	61			3 4 17 26	11			
	626	44			1 4 11 15	12 1			
	627	54			1 7 16 21	9			
<u>Uraspis helvolus</u> White-tongued crevalle	576	19				2 4	9 2 1 1		
CHLOROPHTHALMIDAE <u>Chlorophthalmus agassizi</u>	587	62				3 4 20	28 7		
CLUPEIDAE <u>Dussumieria acuta</u> Rainbow sardine	567	79			12 4	20 29 14			
	577	34			1	1 13 14 3 2			
<u>Sardinella albella</u> White sardinella	567	29			10	15 4			
<u>Sardinella gibbosa</u> Goldstripe sardinella	564	34			3	9 9 10 3			
	565	51			3 12 6 18	9 2 1			
	566	41			1 3 12 14	7 4			
	567	192			34 27 49 59	19 3 1			
	593	55				2 18 29 6			
	601	20				1 10 9			
	603	53			3	4 16 17 10 3			
	627	60			2 34 10	5 3 5 1			
<u>Sardinella sirm</u> Spotted sardinella	584	24				3 5	14 2		
ENGRAULIDAE <u>Stolephorus bataviensis</u> Batavian anchovy	567	7		6 1					
<u>Stolephorus heterolobus</u> Shorthead anchovy	567	12		2 10					
	595	65		3 20 28 14					
<u>Stolephorus indicus</u> Indian anchovy	554	23			1 19	3			
	556	12			3	9			
	567	131			10 81 37 3				
FORMIONIDAE <u>Formio niger</u> Black pomfret	562	23			1 4	12 5 1			
	611	15					4 3	5 2 1	
	628	13				7 4 2			
GEMPYLIDAE <u>Epinnula orientalis</u>	587	104				2 8 26 33 15	5 8 4 3		
	588	103			7	16 16 20 19 4	6 1 5 8 1		
	620	26				1 1 9 5 7	1 1 1		

FAMILY/Species	Stn No	N	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34						
<b>GERREIDAE</b>																																								
<u>Gerres filamentosus</u> Whipfin mojarra	594	24										7	15		2																									
<u>Gerres oyena</u> Common mojarra	566	77										2	20		20	20	10	5																						
<u>Pentaprion longimanus</u> Longfin mojarra	569	49									3	9	30	7																										
	571	86									14	49	20	1	2																									
	573	27										5	11	10	1																									
	591	60										13	25	22																										
	592	43										7	16	12	8																									
	597	43					1	1				12	24	5																										
	614	62						1	1		18	32	10																											
	621	36				6	22	8																																
<b>LEIOGNATHIDAE</b>																																								
<u>Gazza minuta</u> Toothed ponyfish	577	36									8	13	8	3	4																									
	579	12									1	1	5	1	2				1	1																				
	582	6										1	2	2					1																					
	621	43				1		20	22																															
<u>Leiognathus bindus</u> Orangefin ponyfish	563	139						5	10		53	63	8																											
	564	86	3		2	1	3	8	13		40	15	1																											
	579	20						2			5	10	2	1																										
	582	9						2			3	3	1																											
	612	56				1		1	7		22	25																												
<u>Leiognathus equulus</u> Common ponyfish	573	30									4	5	1		1	3	6	5		4	1																			
	577	15										3	1		2	2		1	1		3	1	1																	
	582	5															1					1	3																	
<u>Leiognathus fasciatus</u> Striped ponyfish	579	5									2	1	1					1																						
<u>Leiognathus leuciscus</u> Whipfin ponyfish	579	33					1	1			8	7	7	5	4																									
	582	9					1	1			1	1	1	2	1	1																								
<u>Leiognathus splendens</u> Splendid ponyfish	573	95					1	19	39		30	6																												
	577	132					1	5	39		27	26	19	10	5																									
	579	59						5	18		14	7	7	5	1	2																								
<u>Secutor insidiator</u> Pugnose ponyfish	564	30							7		22	1																												
	582	20				3	8	7	1	1																														
<b>LETHRINIDAE Lethrinus lentjan (Part 2)</b>																																								
<b>LUTJANIDAE</b>																																								
<u>Caesio chrysozona</u>	574	76									1	1	10	32	15	15	2																							
<u>Caesio sp. (red)</u>	574	44									1	8	23	6	6																									
	609	39									4	6	14	8	4	3																								
<u>Lutjanus gibbus</u> (Part 3)																																								
<u>Lutjanus lineolatus</u> Bigeye snapper	570	10										1	4	2	3																									
	574	43										1	4	9	20	7	2																							
	578	57										4	9	11	16	9	6	2																						
	604	42										1	15	20	6																									
	609	48											7	13	18	5	3	1	1																					
<u>Lutjanus lutjanus</u>	571	21													2	1	6	5	6	1																				
	573	48														4	13	8	9	10	2	1	1																	
	575	13														5	3	2			1	1	1																	
	579	26													1	8	12	3	2																					



FAMILY/Species	Stn No	N	03 04	05 06 07 08 09	10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33 34
<u>Pinjalo pinjalo</u> Pinjalo snapper	578	18					3 3 3	4 2 3	
<b>MULLIDAE</b>									
<u>Parupeneus</u>	569	18				1	1 2 1 7 1	1 4	
<u>heptacanthus</u>	574	44				4 3 3 10 5	7 3 1 5 2	1	
Spotted golden goatfish	575	25					4 3 6 5 2	2 3	
	576	15					1 1 1 2 6	2 1	
	590	74			2 1	8 8 24 10 6	7 2 1 2	2 1	
	609	54				8 6 9 6 11	3 1 3 4 1	2	
	616	13				1 3 1	1 1 3 1 1	1	
<u>Upeneus</u> <u>sulphureus</u>	571	75			7 34 28	5 1			
Yellow goatfish	573	44			5 12 17	5 4 1			
	577	52		4	12 8 8 8 7	1 3 1			
	592	45			2 20	14 6 2 1			
<u>Upeneus traquila</u> Darkband goatfish	574	69			6 15 27 14	4 3			
<b>NEMIPTERIDAE</b>									
<u>Nemipterus</u> <u>bleekeri</u>	565	13			2 2 3 1	1 2 1 1			
<u>Nemipterus</u> <u>delagoae</u>	572	37				1 3 5 7 2	3 2 1 1	5 2 4	1
Delagoa threadfin bream	574	51				2 9 11 2 3	6 7 4 3 1	1 1 1	
	575	62			1	2 1 4 1	2 1 3 4 9	2 5 7 4 3	1 10 2
	576	28				2 2	1 4 4 2 6	3 2	1 1
	581	86				1 7 9 5 5	17 8 15 7 1	2 4 1 1	1 1 1
	583	118			1 3 3	12 22 11 15 19	5 3 6 7 1	2 3 3 1	1
	590	26				2 5 3 1 7	2 1 3 1	1	
	591	81			1 1 1 3 6	13 23 11 7 7	1 1 1 1	2 1 1	
	597	54			1 2 2	5 11 6 8 6	4 2 2 2 2	1	
	601	38			3 9	4 4 3 1 1	3 2 1	3 1 1 1	1
	609	13				1 4 2 1 1	1 1	2	
	616	24				2 6 4 1	3 1 1 5		1
<u>Nemipterus</u> <u>hexodon</u>	552	31				6 8 4	2 3 2 1 2	2 1	
Ornate threadfin bream	566	16			4 3	2 1 3 2	1		
<u>Nemipterus</u> <u>japonicus</u>	552	13			1	5 4 2 1			
Japanese threadfin bream	557	67			2 2 6 15	13 8 6 7 6	2		
	563	24				2 1 4 2 3	3 4 2 1	2	
	566	10		3 3	1 1 1 1				
	568	55			1 1 2	7 7 4 2 7	6 4 7 1 2	1 1 2	
	571	12			2 3	1 1 1	1 1	1 1	
	573	4				1 1	1 1		
	625	32			4 10	3 5 6 2 1	1		
	630	22			1 5	5 7 1	2 1		
<u>Nemipterus</u> <u>mesoprion</u>	552	28			1 3 6 3	1 5 5 3 1			
Redfilament threadfin bream									
<u>Nemipterus</u> <u>metopias</u>	574	21				4 4 5	3 2 3		
Slender threadfin bream	575	20			1 2	4 1 1 6	5		
<u>Nemipterus</u> <u>nematophorus</u>	563	26			1 1 2	3 7 6 3 1	1 1		
Doublewhip threadfin bream	568	76			1 7	9 14 17 10 3	2 4 5 4		
	571	61		1	1 1 4 12 13	9 4 4 4 1	3 1 2 1		
	613	78		1	1 5 7 10	19 12 10 2 1	2 2 4 2		
	614	45			1 5 16	12 4 4 2	1		
	622	43			4 12	10 8 5 3	1		
	625	57			1 9 11 16	3 4 4 1 6	1 1		
	630	83			1 9 23	17 16 7 2 1	1 3 2 1		

FAMILY/Species	Stn No	N	03 04	05 06 07 08 09	10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33 34
<u>Nemipterus peronii</u> Rosy threadfin bream	566 583	7 13			1 1 1 1	4 3 1 2 1	2 1 2 1	1 1	1
<u>Nemipterus tambuloides</u> Five-lined threadfin bream	568 571 581 630	17 59 12 10			2 2 1 1	2 1 1 2 4 3 9 20 7 2 1 4 1 3 2 1 1 1	3 1 2 3 4 2 2 3 4 1 1	1 1 1 1 1	
<u>Nemipterus tolu</u> Notched threadfin bream	571	23				1 3 1 6 7	3 1 1		
<u>Scolopsis cancellatus</u>	566	25			8 9 3 2	2 1			
<u>Scolopsis sp.</u>	571	13			1	1 1 1 3	1 2 3		
<b>NOMEIDAE</b> <u>Cubiceps sp.</u>	587 588	35 17			4 14 1 2	16 1 8 5 1			
<u>Palinurichthys sp. (?)</u>	587 588	44 36			2 3 5 8	5 11 24 2 7 4 9			
<b>PRIACANTHIDAE</b> <u>Priacanthus macracanthus</u> Red bigeye	557 568 575 576 588 589 607 612 617 625 630	93 66 6 64 131 77 24 65 62 33 40			2 1 1	1 12 60 14 1 14 32 16 2 8 40 58 13 5 3 4 18 4 4 8 4 1 1 23 30 10 1 4 20 22 14 3 14 9 1 11 24 3	4 18 8 10 7 2 4 3 18 14 10 3 1 2 1 1 7 1	1 1 1 3 3 4 1 4 1 1 1	1 2
<u>Priacanthus tayenus</u> Purple-spotted bigeye	568 570 576 592 612 617 630	113 20 35 23 16 37 99			12 76 13 4 4 16 10 10 4 1 1 4 5 7 2 3 17 9 2 1 17 70 6 1	6 2 5 1 2 3 2 1 10 4 2 1 2 2 2 2 1			
<b>SCOMBRIDAE</b> <u>Rastrelliger brachysoma</u> Short-bodied mackerel	565 566 601	18 15 11				1 6 10 1 1 4 7 1 5	1 2 5		
<u>Rastrelliger kanagurta</u> Indian mackerel	553 554 556 557 563 564 568 578 593 601 625	23 12 104 142 17 10 45 28 25 30 113			1	1 3 1 1 34 63 27 109 9 7 1 1 13 31 2 1 1 1 2 1 1 1 4 54 52	2 1 7 7 2 2 4 2 1 6 1 6 1 3 3 1 2 5 6 5 5 2 6 8 2 2 5 1 15 6 2	1 1 2 2	
<b>SIGANIDAE</b> <u>Siganus canaliculatus</u> Whitespotted spinefoot	570 572	49 68			16 24 6 12 20	8 1 23 4 2 1			

FAMILY/Species	Stn No	N	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34									
SPARIDAE <u>Argyrops spinifer</u> (Part 2)																																											
SPHYRAENIDAE																																											
<u>Sphyraena barracuda</u> (Part 2)																																											
<u>Sphyraena forsteri</u> (Part 2)																																											
<u>Sphyraena obtusata</u>	553	103									1				4		5	8		21	20	19	17	7		1																	
Obtuse barracuda	554	53															1	2	4		13	9	9	9	3		2	1															
	577	19															1		5		1	2	2	1	5				1	1													
	579	32																					1	8	8				5	7	3												
	585	22																					1	3	8	4			3	1	2												
	595	17														1		4					3	2	3	4																	
SYNODONTIDAE																																											
<u>Saurida elongata</u>	585	4																1																						1	1		
Slender lizardfish																																											
<u>Saurida undosquamis</u>	562	41													1		5	2		3	4	6	4	3			2	3	3	4	1												
Brushtooth lizardfish	576	68									2				6	12	11	11	2		3	4	4	2	2			4	2		1	1									1		
	585	23									1	1	2		4	2	4	3	3				1	1	1																	2	3
	591	37														7	3	5		1	7	2	2	2			1	1	1													2	3
	597	43															3	3	1		5	7	4	7	4			5	3	1													
	614	64														2	7	2	7		8	9	9	10	3			3	1	1	2												
	622	22									2				1			2		2			1	5				6	1	2													
	625	26									1				1	5	6	3		1	1	2	2					2		2													
<u>Synodus sp.</u>	585	14									2	3	2	3		2		1		1																							
<u>Trachincephalus myops</u>	590	12														1	4	3		1	1							1		1													
Bluntnose lizardfish																																											

(Part 2)

FAMILY/Species	Stn No	N	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49												
BALISTIDAE																																												
<u>Abalistes stellaris</u>	574	8							1	1		1		1	1	1	1		1																									
Starry triggerfish																																												
CARANGIDAE																																												
<u>Gnathanodon speciosus</u>	579	8				1	1					2		2								1		1																				
Golden toothless trevally																																												
LETHRINIDAE																																												
<u>Lethrinus lentjan</u>	574	7								1	1	1		3																														
Redspot emperor	596	79												2	9	15	9	16	6		4	4	1						3	3	3	3		1										
PRIACANTHIDAE																																												
<u>Priacanthus sp.</u>	575	11																																										
( <u>arenatus</u> ?)																																												
SPARIDAE																																												
<u>Argyrops spinifer</u>	575	4									1	1					1						1																					
Longspine seabream																																												
SPHYRAENIDAE																																												
<u>Sphyraena barracuda</u>	585	6																																										
Great barracuda																																												
<u>Sphyraena forsteri</u>	554	5													1		2	1		1																								
Forster's barracuda	569	14													1		1	2	7		1	1		1																				
	574	14													2	1	6	3	2																									
	579	27															1	3		5	6	5	1																					
	581	19															2	2	7	4		2																						

(Part 3)

FAMILY/Species	Stn No	N	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59												
LUTJANIDAE																																												
<u>Lutjanus gibbus</u>	596	17																																										
Humpback red snapper																																												

## ANNEX IV

## List of fish species

R/V "Dr. Fridtjof Nansen", Thailand West Coast Cruise, July-August 1980

Identification and nomenclature mainly based on FISCHER and WHITEHEAD (eds) (1974), also on SMITH (1972) and CARCASSON (1977). Name in parenthesis when identification doubtful.

FAMILY		
SUB-FAMILY / TRIBE		
Species		English name
ACANTHURIDAE		Surgeonfishes
unspecified		
ACANTHURUNAE		Surgeonfishes
Acanthurus fowleri		Fowler's surgeon
Acanthurus sp.		
Ctenochaetus (strigosus)		
ACROPOMATIDAE		
Acropoma spp.		
<u>Anguilliformes</u>		
Leptocephali		Eel larvae
(ANOTOPTERIDAE)		Daggertooth
(Anotopterus pharao) - doubtful		
ANTENNARIIDAE		Frogfishes
ANTENNARIINAE		
Antennarius sp.		
APLOACTINIDAE		Velvetfishes
unspecified - doubtful (SCORPAENIDAE?)		
APOGONIDAE		Cardinalfishes
Apogon sp.		
Synagrops japonicus		
ARIIDAE		Sea catfishes
Arius thalassinus		Giant catfish
Arius sp.		
ARIOMMIDAE		Driftfishes, arionmids
Ariomma indica		Indian driftfish
BALISTIDAE		Triggerfishes, Filefishes
BALISTINAE		Triggerfishes
Abalistes stellaris		Starry triggerfish
MONACANTHINAE		Filefishes
Alutera monoceros		Unicorn filefish
Monacanthus sp.		

BOTHIDAE	Lefteye flounders
unspecified	
BOTHINAE	
<i>Bothus pantherinus</i>	Leopard flounder
<i>Chascanopsetta lugubris</i>	
PARALICHTHYINAE	
<i>Pseudorhombus dupliciocellatus</i>	Ocellated flounder
<i>Pseudorhombus elevatus</i>	Deep flounder
BREGMACEROTIDAE	Codlets
<i>Bregmaceros</i> sp.	
CALLIONYMIDAE	Dragonets
<i>Paracallionymus</i> ( <i>costatus</i> )	
CAPROIDAE	Boarfishes
CAPROINAE	
<i>Capros aper</i>	
CARANGIDAE	Jacks, cavallas, crevalles, pompanos, queenfishes, scads, trevallies
<i>Alectis ciliaris</i>	Pennantfish
<i>Alectis indicus</i>	Threadfin trevally
<i>Alepes djeddaba</i>	Djeddaba crevalle
<i>Alepes kalla</i>	Shrimp scad
<i>Alepes melanoptera</i>	Blackfin crevalle
<i>Atropus atropus</i>	Kuweh trevally
<i>Atule mate</i>	Yellowtail scad/Finlet scad
<i>Carangoides chrysophrys</i>	Longnose cavalla
<i>Carangoides ciliarius</i>	Longfin cavalla
<i>Carangoides ferdau</i>	Ferdau's cavalla
<i>Carangoides malabaricus</i>	Malabar cavalla
<i>Caranx</i> sp.	
<i>Decapterus kurroides</i>	Red-tailed mackerel scad
<i>Decapterus macrosoma</i>	Layang scad
<i>Decapterus maruadsi</i>	Round scad
<i>Gnathanodon speciosus</i>	Golden toothless trevally
<i>Megalaspis cordyla</i>	Hardtail scad
<i>Scomberoides commersonianus</i>	Talang queenfish
<i>Scomberoides lysan</i>	Doubledotted queenfish
<i>Scomberoides tol</i>	Slender leatherskin
<i>Selar boops</i>	Oxeye scad
<i>Selar crumenophthalmus</i>	Bigeye scad
<i>Selaroides leptolepis</i>	Yellowstripe trevally
<i>Seriolina nigrofasciata</i>	Black-banded trevally
<i>Uraspis helvolus</i>	White-tongued crevalle
CHAETODONTIDAE	Butterflyfishes, Angelfishes
unspecified	
CHAETODONTINAE	Butterflyfishes
<i>Heniochus acuminatus</i>	Pennant coralfish
CHAUNACIDAE	Sea toads
<i>Chaunax picta</i>	

CHIROCENTRIDAE	Wolf herrings
<i>Chirocentrus dorab</i>	Dorab wolf-herring
CHLOROPHTHALMIDAE	Greeneyes
<i>Chlorophthalmus agassizi</i>	
CLUPEIDAE	Herrings, shads, sardines, sardinellas, etc.
CLUPEINAE	
<i>Sardinella gibbosa</i>	Goldstripe sardinella
<i>Sardinella sirm</i>	Spotted sardinella
<i>Sardinella sp.</i>	
DUSSUMIERIINAE	
<i>Dussumieria acuta</i>	
PRISTIGASTERINAE	
<i>Ilisha elongata</i>	Elongate ilisha
<i>Ilisha melastoma</i>	Indian ilisha
(CYCLOPTERIDAE)	Lumpfishes, Snailfishes
(LIPARINAE)	Snailfishes
unspecified - doubtful (CHAUNACIDAE?)	
DACTYLOPTERIDAE	Flying gurnards
<i>Dactyloptena orientalis</i>	Purple flying gurnard
DIODONTIDAE	Porcupinefishes
<i>Cylichthys echinatus</i>	Fringed porcupinefish
<i>Cylichthys sp.</i>	
( <i>Dicotylichthys punctulatus</i> )	Three-bar porcupinefish
<i>Diodon sp.</i>	
ECHENEIDAE	Remoras
<i>Echeneis naucrates</i>	Slender suckerfish
EMMELICHTHYIDAE	Bonnetmouths
EMMELICHTHYINAE	
<i>Emmelichthys nitidus</i>	Red sea-haarder
ENGRAULIDAE	Anchovies
<i>Stolephorus indicus</i>	Indian anchovy
<i>Thryssa setirostris</i>	Longjaw thryssa
<i>Thryssa vitrirostris</i>	Orangemouth thryssa
EPHIPPIDAE	Spadefishes, Sicklefishes
DREPANINAE	Sicklefishes
<i>Drepane punctata</i>	Spotted sicklefish
EPHIPPINAE (PLATACINAE)	
<i>Platax (pinnatus)</i>	Roundfaced batfish
FISTULARIIDAE	Cornetfishes
<i>Fistularia petimba</i>	Smooth flutemouth
<i>Fistularia villosa</i>	
<i>Fistularia sp.</i>	
FORMIONIDAE	Black pomfrets
<i>Formio niger</i>	Black pomfret

GEMPYLIDAE	Snake mackerels
<i>Epinnula orientalis</i>	
( <i>Thyrsitoides marleyi</i> )	
( <i>Thyrsitoides</i> sp.)	
GERREIDAE	Mojarras, Silver-biddies
<i>Gerres filamnetosus</i>	Whipfin mojarra
<i>Gerres oyena</i>	Common mojarra
<i>Gerres</i> sp.	
<i>Pentaprion longimanus</i>	Longfin mojarra
GONOSTOMATIDAE	Bristlemouths, Lightfishes
unspecified	
HOLOCENTRIDAE	Squirrelfishes, Soldierfishes
HOLOCENTRINAE	Squirrelfishes
<i>Holocentrus rubrum</i>	Red squirrelfish
<i>Holocentrus</i> sp. (white)	
MYRIPRISTINAE	Soldierfishes
<i>Myripristis murdjan</i>	Crimson squirrelfish, blotch-eye soldier
LABRIDAE	Wrasses
<i>Choerodon azurio</i>	
<i>Choerodon</i> sp.	
LACTARIIDAE	False trevallies
<i>Lactarius lactarius</i>	False trevally
LEIOGNATHIDAE	Ponyfishes, slipmouths, slimys
<i>Gazza minuta</i>	Toothed ponyfish
<i>Leiognathus bindus</i>	Orangefin ponyfish
<i>Leiognathus elongatus</i>	Slender ponyfish
<i>Leiognathus equulus</i>	Common ponyfish
<i>Leiognathus fasciatus</i>	Striped ponyfish
<i>Leiognathus leuciscus</i>	Whipfin ponyfish
<i>Leiognathus smithursti</i>	Smithurst's ponyfish
<i>Leiognathus splendens</i>	Splendid ponyfish
<i>Leiognathus</i> (FAO LEIOG 7)	
<i>Leiognathus</i> sp.	
<i>Secutor insidiator</i>	Pugnose ponyfish
<i>Secutor</i> ( <i>ruconius</i> )	Deep pugnose ponyfish
<i>Secutor</i> sp.	
LETHRINIDAE	Scavengers, Emperors
<i>Lethrinus choerorhynchus</i>	Bluestreak emperor
<i>Lethrinus lentjan</i>	Redspot emperor
<i>Lethrinus miniatus</i>	Longface emperor
<i>Lethrinus nebulosus</i>	Blue emperor, spangled emperor
<i>Lethrinus</i> sp.	
LOPHIIDAE	Goosefishes
<i>Lophius</i> ( <i>piscatorius</i> )	

**LUTJANIDAE**

Caesio chrysozona  
 Caesio sp. (red)  
 Caesio sp.  
 Glabrilutjanus nematophorus  
 Lutjanus argentimaculatus  
 Lutjanus gibbus  
 Lutjanus johnii  
 Lutjanus kasmira  
 Lutjanus lineolatus  
 Lutjanus lutjanus  
 Lutjanus malabaricus  
 Lutjanus rivulatus  
 Lutjanus russelli  
 Lutjanus sanguineus  
 Lutjanus sebae  
 Lutjanus vitta  
 Macolor niger  
 Pinjalo pinjalo  
 Pristipomoides typus  
 (Tangia carnolabrum)

Snappers, fusiliers, jobfishes  
 Goldband fusilier

Chinaman snapper  
 Mangrove red snapper  
 Humpback red snapper  
 John's snapper  
 Bluebanded snapper  
 Bigeye snapper  
 Malabar red snapper  
 Blue-spotted sea-perch  
 Russell's snapper  
 Blood snapper  
 Emperor red snapper  
 Brownstripe red snapper  
 Black-and-white snapper  
 Pinjalo snapper  
 Sharptooth snapper

**(MACRORHAMPHOSIDAE)**

(Macrorhamphosus sp. & unspecified -  
 doubtful (= TRIACANTHODIDAE ?)

Snipefishes

**MACROURIDAE**

Coelorhynchus spp.  
 Lyconodes sp.  
 Macrouroplus sp.  
 Malacocephalus sp.

Grenadiers, whiptails

**MELANOSTOMIATIDAE**

unspecified

Scaleless Black Dragonfishes

**MENIDAE**

Mene maculata

Moonfishes  
 Moonfish

**MUGILOIDIDAE**

Parapercis (punctata)  
 Parapercis sp.

Sandperches

**MULLIDAE**

Parupeneus heptacanthus  
 Parupeneus (indicus)  
 Upeneus bensasi  
 Upeneus moluccensis  
 Upeneus sulphureus  
 Upeneus tragula

Goatfishes  
 Spotted golden goatfish  
 Indian goatfish  
 Yellowfin goatfish  
 Goldband goatfish  
 Yellow goatfish  
 Darkband goatfish

**MURAENESOCIDAE**

Congresox talabonoides

Pike Eels, Pike Congers  
 Indian pike-conger

**MYCTOPHIDAE**

unspecified (various spp.)

Lanternfishes



NEMIPTERIDAE

Nemipterus bleekeri  
Nemipterus delagoae  
Nemipterus hexodon  
Nemipterus japonicus  
Nemipterus mesoprion  
Nemipterus metopias  
Nemipterus nematophorus  
Nemipterus nemurus  
Nemipterus peronii  
Nemipterus tambuloides  
Nemipterus tolu  
Nemipterus spp.  
Parascolopsis (ineremis)  
Parascolopsis sp.  
Scolopsis cancellatus  
Scolopsis taeniopterus  
Scolopsis vosmeri  
Scolopsis sp.

Threadfin breams

Delagoa threadfin bream  
Ornate threadfin bream  
Japanese threadfin bream  
Redfilament threadfin bream  
Slender threadfin bream  
Doublewhip threadfin bream  
Redspine threadfin bream  
Rosy threadfin bream  
Fivelined threadfin bream  
Notched threadfin bream

Latticed monocle-bream  
Lattice monocle bream  
Whitecheek monocle bream

NEOSCOPELIDAE

Neoscopelus macrolepidotus

NOMEIDAE

Cubiceps (natalensis)  
Cubiceps sp.  
Palinurichthys sp.

OGCOCEPHALIDAE

Halieutaea (fitzimonsi)  
Halieutaea sp.

Batfishes

OPHIDIIDAE

Brotulas, Cusk-eels

BROTULINAE

(Hoplobrotula sp.)  
unspecified

OPHIDIINAE

unspecified

OSTRACIONTIDAE

Boxfishes

OSTRACIONTINAE

Ostracion tuberculatus  
Ostracion sp.  
Rhynchostracion nasus  
Tetrosomus gibbosus

Blue-spotted boxfish

Small-nosed boxfish

PENTAPODIDAE

Gymnocranius griseus

Large-eye Breams

Grey large-eye bream

PLATYCEPHALIDAE

Flatheads

PLATYCEPHALINAE

Platycephalus spp.

PLEURONECTIDAE	Righteye flounders
SAMARINAE	
<i>Samaris cristatus</i>	
PLOTOSIDAE	Plotosids, Catfish Eels
<i>Plotosus</i> sp.	
POLYNEMIDAE	Threadfins
<i>Polynemus sextarius</i>	Blackspot threadfin
POMACENTRIDAE	Damselfishes
POMACENTRINAE	
<i>Daya jerdoni</i>	
POMADASYIDAE	Grunts, Sweetlips
<i>Plectorhynchus pictus</i>	Painted sweetlip
<i>Pomadasys argyreus</i>	
<i>Pomadasys hasta</i>	Lined silver grunt
<i>Pomadasys maculatus</i>	Blotched grunt
<i>Pomadasys</i> sp.	
PRIACANTHIDAE	Bigeyes
<i>Priacanthus (arenatus)</i>	
<i>Priacanthus macracanthus</i>	Red bigeye
<i>Priacanthus tayenus</i>	Purple-spotted bigeye
<i>Priacanthus</i> sp.	
PSETTODIDAE	Psettods, Indian Halibuts
<i>Psettodes erumei</i>	Indian halibut
RACHYCENTRIDAE	Cobias, Sergeantfishes
<i>Rachycentron canadus</i>	Cobia
SCIAENIDAE	Drums, Croakers
<i>Otolithes ruber</i>	Tiger-toothed croaker
<i>Pennahia macrophthalmus</i>	Bigeye croaker
<i>Pennahia</i> sp.	
SCOMBRIDAE	Mackerels, Tunas
SCOMBRINAE	
<i>Rastrelliger brachysoma</i>	Short-bodied mackerel
<i>Rastrelliger faughni</i>	Faughn's mackerel
<i>Rastrelliger kanagurta</i>	Indian mackerel
<i>Scomberomorus commersonii</i>	Narrow-barred Spanish mackerel
<i>Scomberomorus guttatus</i>	Indo-Pacific Spanish mackerel
SCORPAENIDAE	Scorpionfishes
PTEROINAE	
<i>Pterois (russelli)</i>	
<i>Pterois</i> sp.	
SETARCHINAE	
( <i>Setarches</i> sp.)	

<b>SERRANIDAE</b>	Sea basses, Groupers
Cephalopolis miniatus	Vermilion seabass
Cephalopolis pachycentron	Brown-banded seabass
Epinephelus areolatus	Areolated grouper
Epinephelus bleekeri	Bleeker's grouper
Epinephelus fuscoguttatus	Brown-marbled grouper
Epinephelus sexfasciatus	Six-banded rockcod
Epinephelus tauvina	Greasy grouper
Epinephelus sp.	
Plectropomus leopardus	Bluespotted seabass
<b>ANTHIINAE</b>	
unspecified	
<b>SIGANIDAE</b>	Rabbitfishes
Siganus canaliculatus	Whitespotted spinefoot
Siganus javus	Streaked spinefoot
<b>SILLAGINIDAE</b>	Sillagos, Smelt-Whittings
Sillago maculata	Trumpeter sillago
Sillago sihama	Silver sillago
<b>SOLEIDAE</b>	Soles
<b>SOLEINAE</b>	
Zebrais zebra	Zebra sole
<b>SPARIDAE</b>	Seabreams, Porgies
Argyrops spinifer	Longspine seabream
<b>SPHYRAENIDAE</b>	Barracudas
Sphyraena barracuda	Great barracuda
Sphyraena forsteri	Forster's barracuda
Sphyraena jello	Banded barracuda
Sphyraena obtusata	Obtuse barracuda
<b>STERNOPTYCHIDAE</b>	Marine hatchetfishes
Polypinus sp.	
<b>SYNANCEIIDAE</b>	Stonefishes
unspecified	
<b>SYNGNATHIDAE</b>	Pipefishes, Seahorses
<b>HIPPOCAMPINAE</b>	Seahorses
unspecified	
<b>SYNODONTIDAE</b>	Lizardfishes
Saurida elongata	Slender lizardfish
Saurida longimanus	
Saurida undosquamis	Brushtooth lizardfish
Synodus (indicus)	
Synodus variegatus	Variegated lizardfish
Synodus spp.	
Trachinocephalus myops	Bluntnose lizardfish

TETRAODONTIDAE	Puffers
TETRAODONTINAE	
Arothron (immaculatus)	Narrow-lined toadfish
Gastrophysus lunaris	
Gastrophysus sp.	
Lagocephalus sp.	
THERAPONIDAE	Tigerperches
Therapon jarbua	Jarbua therapon
Therapon quadrilineatus	Fourlined therapon
Therapon theraps	Largescaled therapon
TRACHICHTHYIDAE	Slimeheads
Gephyroberyx (orbicularis)	
(Gephyroberyx sp.)	
TRIACANTHIDAE	Triplespines
Triacanthus striglifer	
TRIACANTHODIDAE	Spikefishes
unspecified (2 spp.)	
TRICHIURIDAE	Cutlassfishes
LEPIDOPINAE	
Benthodesmus sp.	
TRICHIURINAE	
Trichiurus haumela	Largehead hairtail
Trichiurus sp.	
(Diplospinus sp.)	
TRIGLIDAE	Searobins
PERISTEDIINAE	Armoured searobins
Peristedion sp. (red)	
Peristedion sp. (grey)	
Peristedion sp. (brown)	
Peristedion sp.	
TRIGLINAE	
Lepidotrigla spp.	
URANOSCOPIDAE	Stargazers
Uranoscopus sp.	
ZEIDAE	Dories
Cyttodes (mccullochi)	
(Cyttodes sp.)	
(Neocyttus sp.)	
Zenion sp.	
Zenopsis conchifer	

Chondrichthyes:

(Sharks)

CARCHARHINIDAE

Carcharhinus (limbatus)  
Carcharhinus sp.  
Mustelus sp.

Requiem Sharks, Smooth Dogfishes

ORECTOLOBIDAE

Chiloscyllium sp.

Carpet Sharks, Nurse Sharks

SCYLIORHINIDAE

(Halaelurus sp.)

Cat Sharks

SQUALIDAE

Squaliolus sp.  
Squalus (megalops)

Dogfish Sharks

(Rays, Guitarfishes)

DASYATIDAE

Dasyatis kuhlii  
Dasyatis sp.  
Taeniura melanospila  
Urotrygon daviesi

Sting Rays, Butterfly Rays,  
Round Rays  
Blue-spotted stingray

MYLIOBATIDAE

Myliobatus aquila

Eagle Rays

RHINOBATIDAE

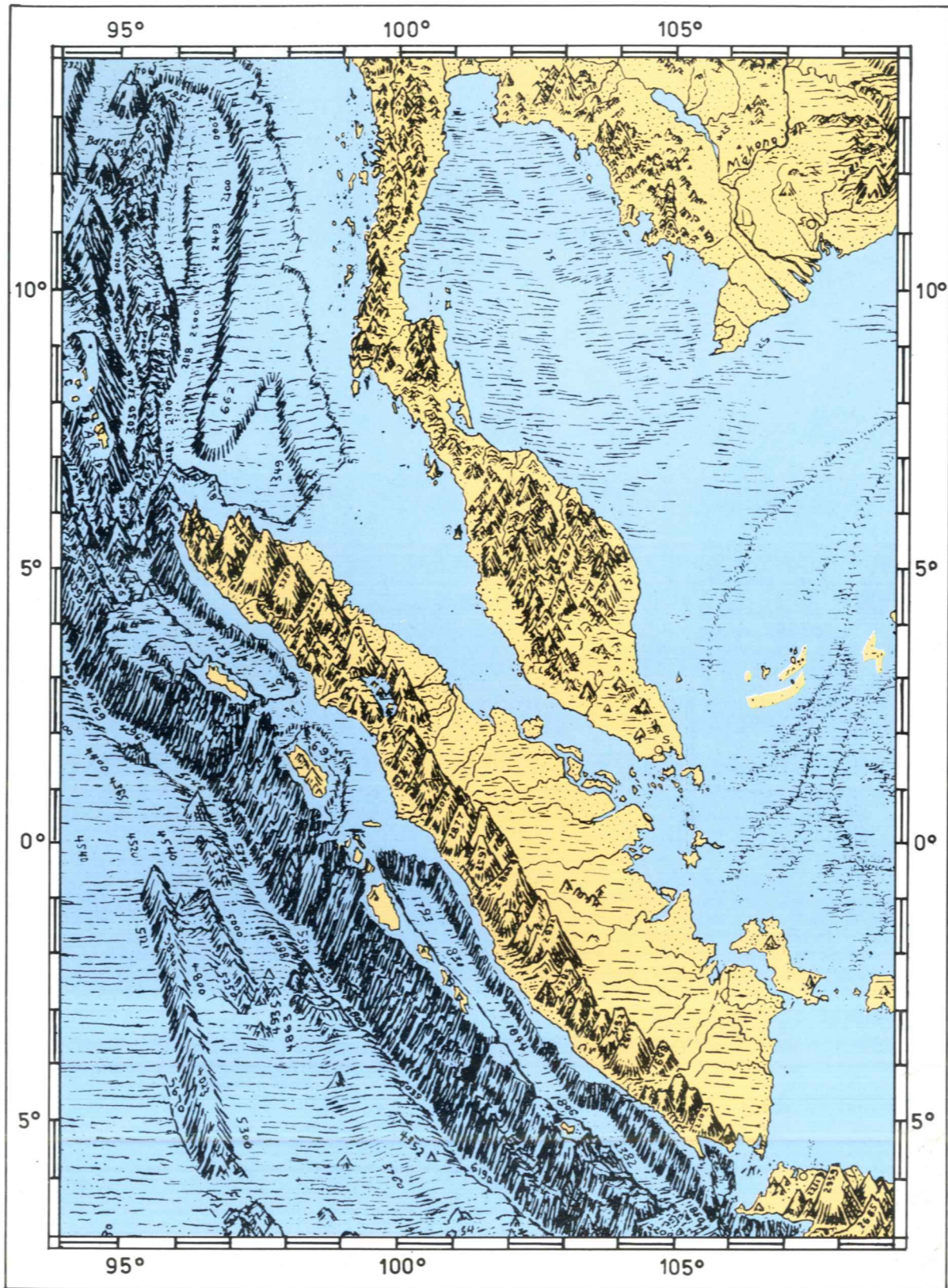
Rhinobatus holcorhynchus

Guitarfishes

TORPEDINIDAE

Narcine timleyi

Electric Rays



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