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

Surveys of the Marine Fish Resources of Peninsular Malaysia June - 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.

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by

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1. INTRODUCTION

In June-August 1980 a programme of investigation of the marine fish resources of Thailand, Malaysia and Indonesia was agreed between the United Nations Food and Agricultural Organization (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 east and west coast of Peninsular Malaysia between 10 June and 15 July 1980. The Institute of Marine Research, Bergen, was responsible for the details of planning in consultation with the UNDP/FAO South China Sea Fisheries Development and Coordinating Programme and the Government of Malaysia.

The acoustic/exploratory fishing survey which is here made use of 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, fishability.

Oceanographical observations of ambient characteristics (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 these types of surveys can provide good if often conservative indications of the availability of fish resources.

The first cruise with R/V "Dr. Fridtjof Nansen" in Malaysian waters was carried out off the east coast of Peninsular Malaysia during the period 10 June - 25 June 1980 and the second cruise off the west coast during the period 5-15 July.

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-foot stern trawler with a main engine of 1500 horsepower. The vessel is equipped for acoustic surveying, bottom and midwater trawling, hydrography and plankton observations.

The bottom trawl was a 134-feet headline shrimp trawl adapted for demersal fish trawling. The foot 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. At the east coast a pelagic trawl of about 120 m circumference was used. The vertical opening was normally 13 m. The pelagic trawl had an innernet of mesh size 1 cm in the cod end. Pelagic trawl operations were usually monitored by aid of a 50 kHz accoustic net sonde. In addition a 24 kHz searchlight sonar was used while fishing on pelagic schools.

Hydrographic observations were carried out with Nansen bottles with which temperature readings and samples for salinity and oxygen determinations were collected at standard depths. 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:

	120 kHz	38 kHz
Basic range	0-100 m	0-100 m or 0-250 m
Transmitter	1/1	Ext. transmitter
Transducer (ceramic)	10^{o} (circular)	$8^{o}x8^{o}$
SL + VR	102 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 -0dB	20 logR+2αR -0db
Recorder gain	3	1
Integrator threshold	8(0.2 volt peak)	8(0.3 volt peak)
Integrator gain	20 dB (x10)	10db (x10)
Depth intervals	According to recordings	According to recordings

With these settings echoes from plankton and small fishes (less than say 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 ANON (1974) and partly SMITH (1972). 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, moreover, 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 as rays and flounders. Any fish found very close to the bottom (½-1 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 fish species may give rise to different types of echo-recordings. Small-sized pelagic fish are, for instance, often found in well-defined schools, the recordings of which can be distinguished from those of the often looser aggregation in which semi-demersal larger fish are often found. Such classification of the echo recordings is of considerable assistance in interpreting the acoustic observations, but a 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 Malaysian waters were classified as follows:

(i) Recordings of true larger schools or dense layer mostly in upper water, Figure 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) Demersal fish recordings 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, breams, snappers, sharks etc. This type of recording was also common, and examples are shown in Figure 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 mid-water. An example of mixed recordings is shown in Fig. 3.

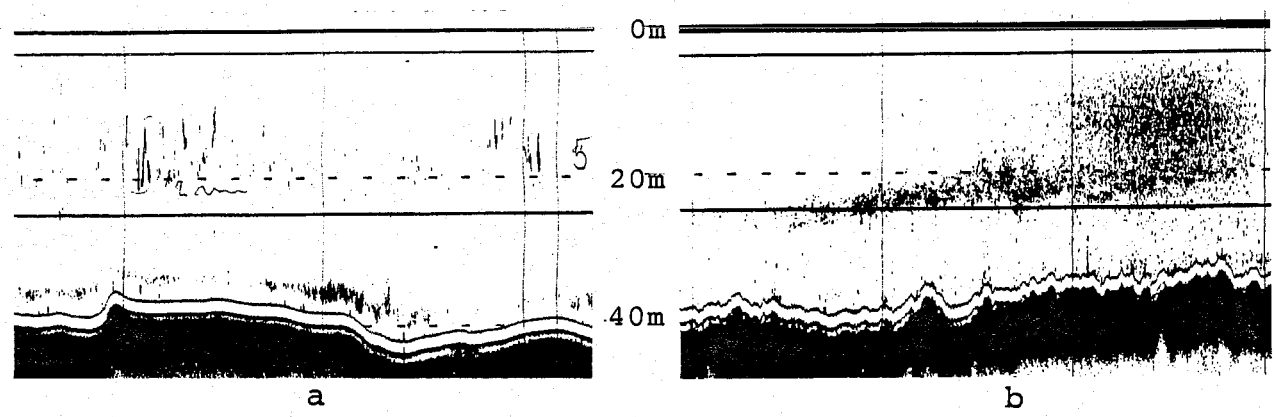

Fig. 1. Recordings of typical "pelagic" fish. a: Day b: Night

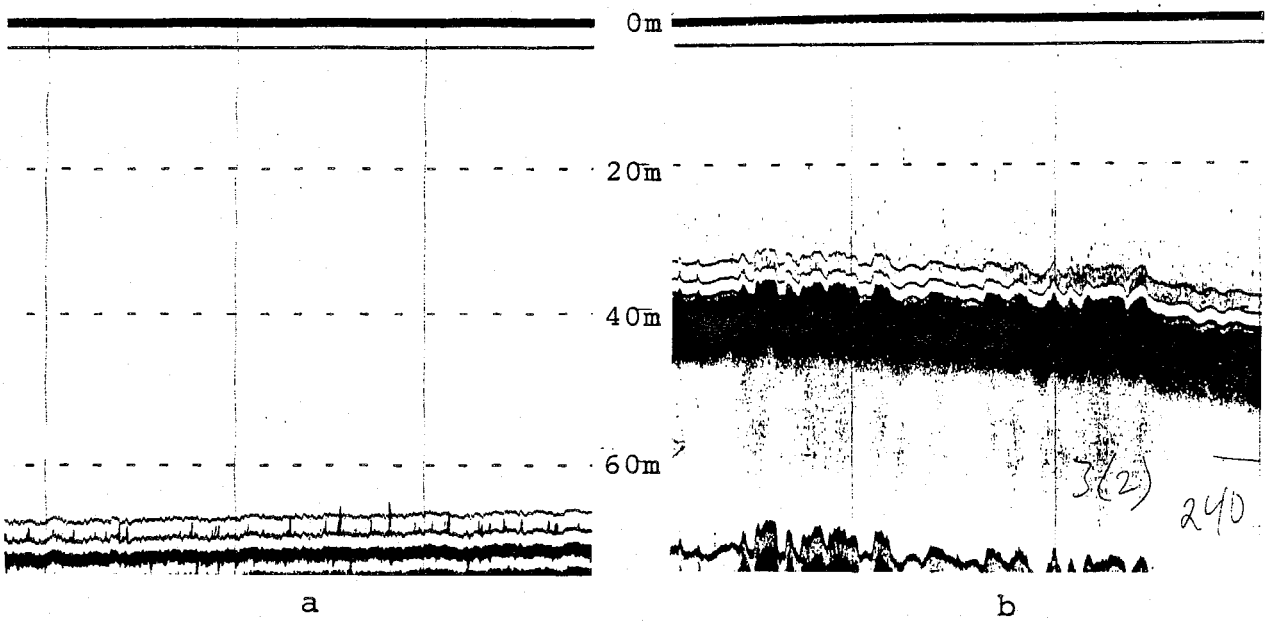

Fig. 2. Recordings of demersal fish. a: Day b: Night

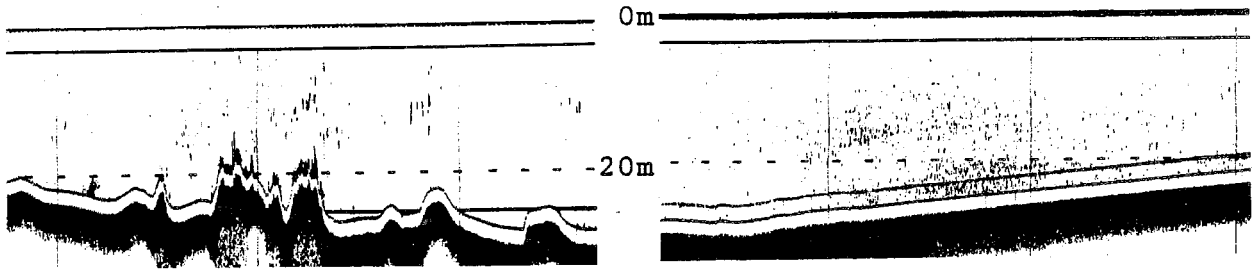

Fig. 3. Mixed recordings of pelagic and demersal fish.
a: Day b: Night

Acoustic abundance estimation

Average integrator deflection per nautical mile was calculated each five nautical mile steamed. As far as possible separate values for "pelagic" and "demersal" fish were obtained. When mixed recordings occurred, the values were allocated according to the trawl catch composition. In some areas echo contribution from plankton and juvenile fish had to be separated by a coarse evaluation of the intensity and the extension of the recordings.

Average integrator values ($\bar{M}$) for pelagic fish and demersal fish were calculated within subareas, and average densities ($\bar{D}$) were estimated by the formulae $\bar{D}=0.25\cdot\bar{L}\cdot\bar{M}$ (tonnes/nm^2). $\bar{L}$ is the average fish length (cm) in the trawl catches within the subarea. The conversion factor $0.25\cdot\bar{L}$ (tonnes/nm^2 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/nm^2 with reference to a cod type fish of 40 cm length. This becomes $0.25\cdot L$ tonnes/nm^2 when the acoustic scattering cross section per unit weight is assumed to decrease linearly with fish length. This corresponds to an average target strength of -10 log L-21 dB per kg fish (at 120 kHz).

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 (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 (year)	c	a	Area
ISARANKURA (1971)	0.5	a = distance between Danlenos x towing speed	West coast Thailand and Malaysia.
SHINDO (1973)	0.5	a = [head rope length/1.5] x towing speed	South China Sea and Gulf of Thailand.
SÆTRE and SILVA (1979)	0.5	a = distance between wings x towing speed	Mozambique
BLINDHEIM et al. (1979)	0.5	"	Sri Lanka
ANON. (1979)	1	a = distance between wings x towing speed	Western Indian Ocean
STRØMME, NAKKEN, SAN AUNG and SÆTERSDAL (1981)	1	a = distance between wings x towing speed	Burma
SAVILLE (1977)	1[x)]	a = distance between wings x towing speed	South of Equator

x) minimum estimate

ANON (1979) references a workshop discussing fish resources estimation in the tropics. Concerning the catchability coefficient for demersal fish, it was concluded that, while waiting the results from further investigations, the amount of fish escaping the opening between the wings is equal to that being herded by the bridles, e.g., c=1.

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 indicates 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.

The area swept by the trawl is 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 (Strømme et al. 1981) is estimated to be 0.03 n.mile^2.

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

3. RESULTS EAST COAST

3.1 Survey coverage

The programme included first a general survey of the area from Singapore to the border between Malaysia and Thailand and second, if time permitted, a closer study of the more interesting observations. Towards the end of the northern hydrographical section, however, 28 Vietnamese refugees were found adrift in a small vessel. The refugees were picked up and taken to Singapore and consequently the latter part of the programme had to be cancelled. Fig. 4 shows the cruise line followed during the survey and the location of the completed fishing stations and hydrographical stations. The main transects are spaced approximately 20 nautical miles apart and run from a depth of about 10 m seawards about 180 nautical miles. Three hydrographical sections were worked and fishing gears were operated at 89 stations mainly with bottom trawl.

The total surveyed area is approximately 34000 square nautical miles. The coastal area, defined as the area between 10-25 m depth was estimated as 6000 n.mile^2 and the offshore area, between 26-75 m, as 28000 n.mile^2.

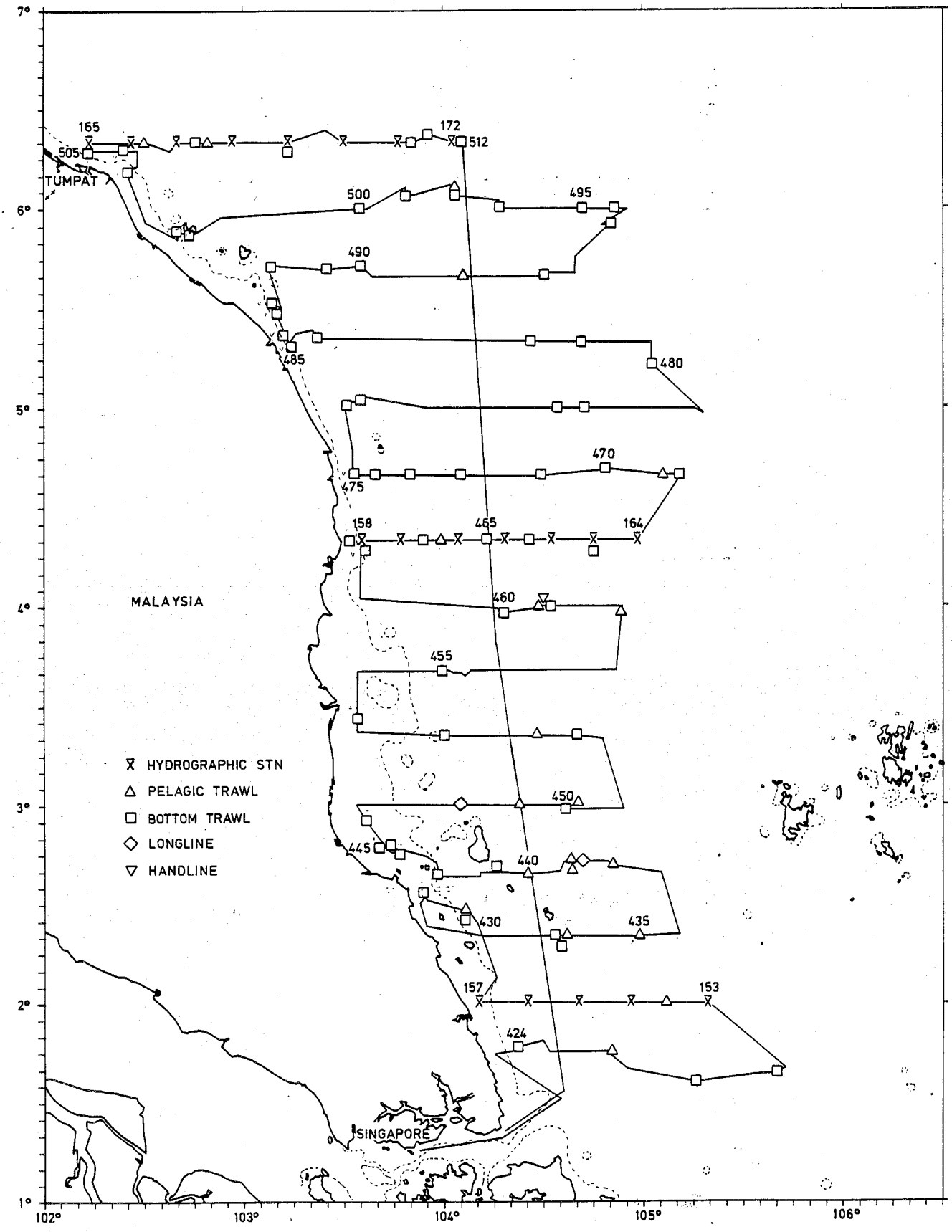

Fig. 4. Survey routes and stations. East coast of Peninsular Malaysia, 10 - 25 June 1980.

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, smooth bottom, suitable for all kinds of bottom trawls.

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. The shelf along the east coast is very wide and most of the shelf has suitable trawling grounds. Inside the main shelf, in waters of less than 50 m depth, many places with small rocks or corals unsuitable for trawling were observed.

3.3. Hydrography

The main hydrographical conditions in the region are summarized by Wyrtki (1961). According to him the surveyed area is part of the shallow Sunda Shelf Area which includes the southern parts of the China Sea, the Gulf of Thailand and the Java Sea, as well as the shallow parts of the Straits of Malacca. This area is characterized by shallow waters seldom deeper than 100 m.

Although local conditions along the coast may alter both the velocity and the direction of the currents, the surface currents are mainly governed by the monsoon regimes. During the southwest monsoon (May-Oct.) a current arises which runs north along the coast with velocities (according to Wyrtki (1961)) of up to 75 cm/sec; while during the northeast (Nov. - Apr.) monsoon the direction of the current is reversed, with speeds of the same order as during the southwest monsoon.

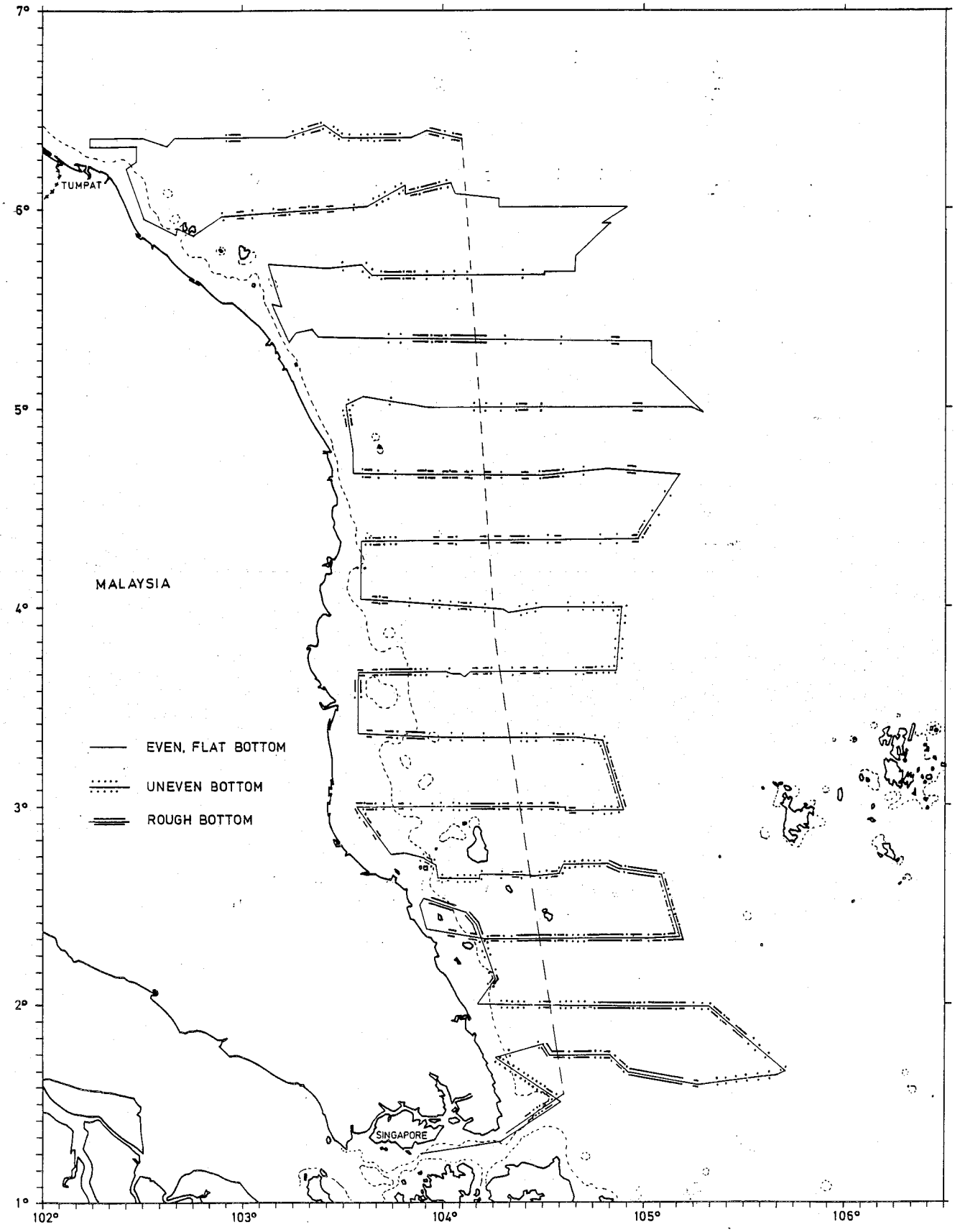

Fig. 5. Observations of the character of the bottom off the east coast of Peninsular Malaysia.

The surveyed area is characterized by shallow waters with depths never exceeding 80 m. The hydrographic cross-sections worked are shown in Fig. 4. The hydrography of the area, as shown in Fig. 6 a, b and c, is in good agreement with the general features set out by Wyrtki (1961) in his description of these shallow parts of the southeast Asian waters.

The homogeneous upper layer of the water masses extended down to about 40 m. In sections II and III the temperature profiles show a clear gradient beginning at a depth of about 45 m, indicating the beginning of the discontinuity layer. The salinity profiles show a lesser pronounced gradient, while the oxygen profiles indicate no clear gradient.

In the coastal area of the northern section our observations indicated a considerable fresh water influx from the rivers in the area. The salinity values obtained here were clearly lower (between 30-33^{o}/oo) than the average of 33 to 34^{o}/oo found in the rest of the surveyed area.

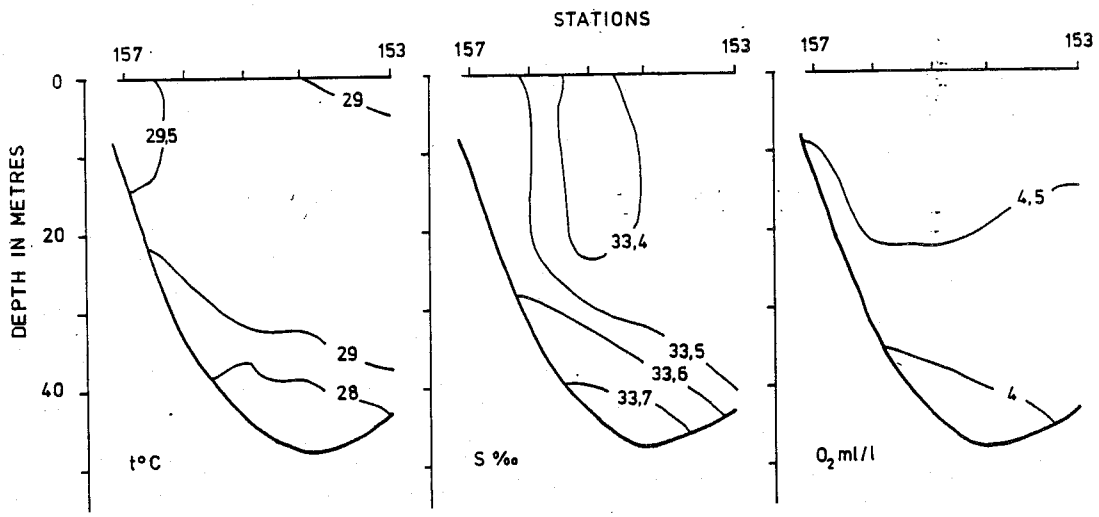

Fig. 6 a. Hydrographic section (I) at 2°00'N, East coast of Peninsular Malaysia, 11 June 1980.

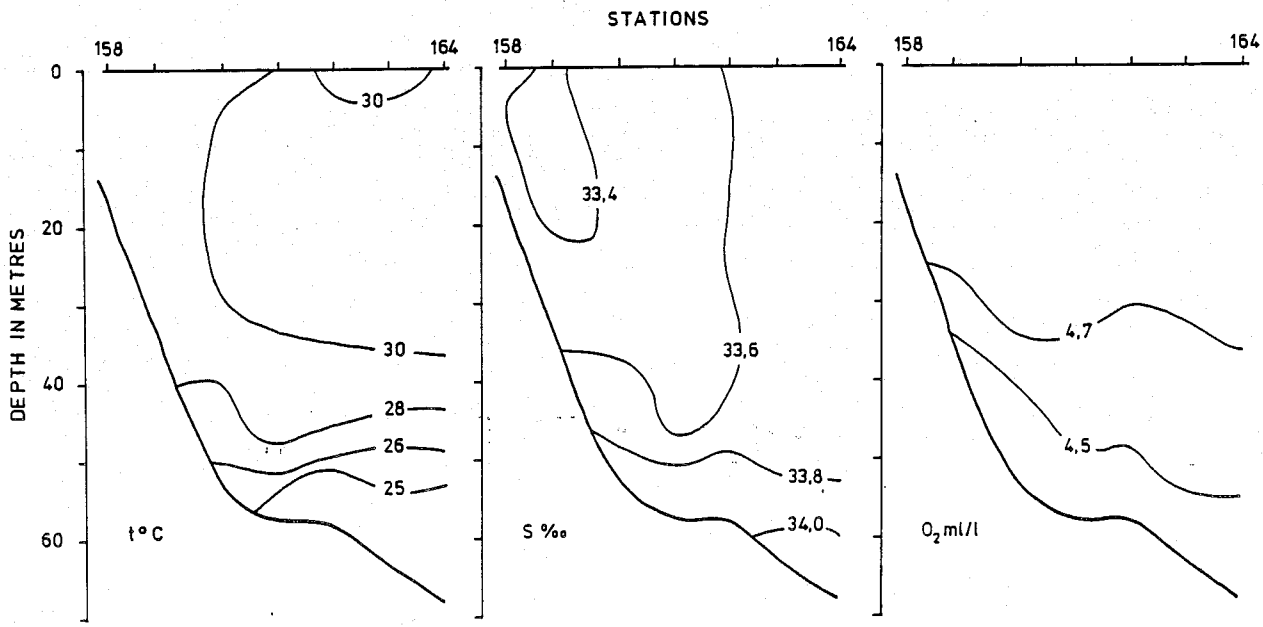

Fig. 6 b. Hydrographic section (II) at 4°20'N, East coast of Peninsular Malaysia, 16 June 1980.

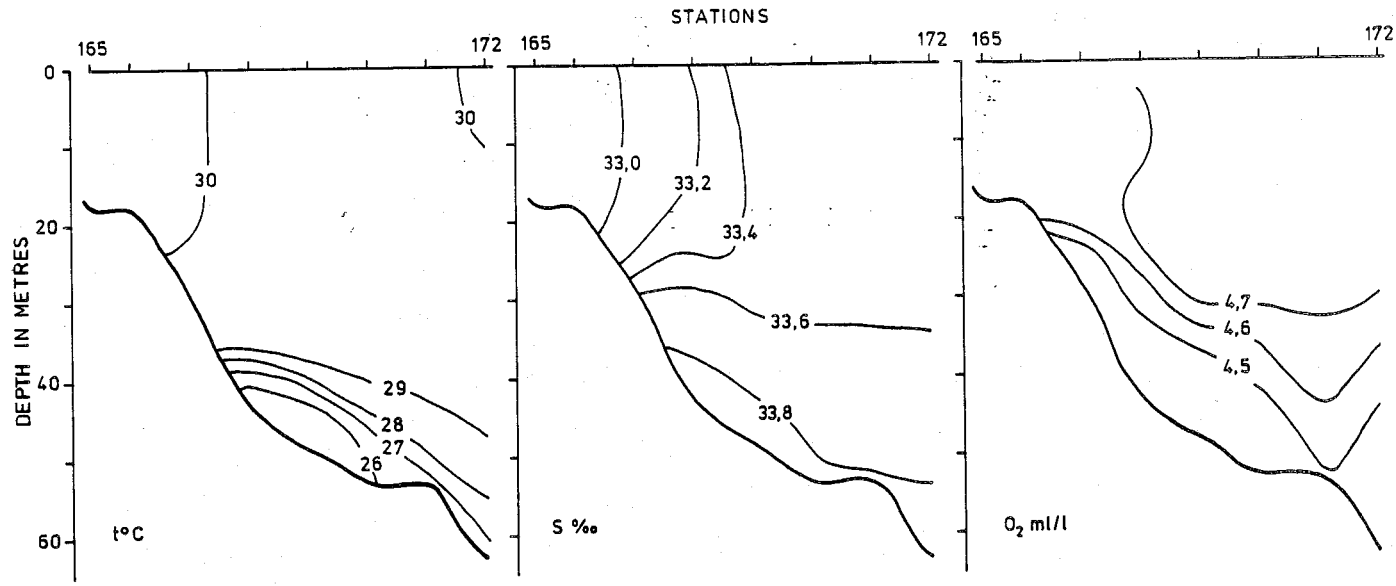

Fig. 6 c. Hydrographic section (III) at 6°20'N, East coast of Peninsular Malaysia, 22-23 June 1980.

3.4 Fish distribution and catch composition

Fig. 7 and 8 show the geographical distribution of echo-recordings of pelagic and demersal fish. Some small concentrations of pelagic fish were found near the shore at 10-25 m bottom depth, while the recordings in the offshore areas were very scattered. In some areas (Figure 7) much of the pelagic recordings were squid. The demersal recordings were more evenly distributed, but the denseties were rather low.

The pelagic schools were small and scattered, and sonar contacts were scarce. Occasionally visual schools of small tuna-like fishes showed up, but they were also small and scattered. Schools of pelagic fish were often observed close to the bottom. Therefore bottom trawl catches usually gave a mixture of pelagic and demersal fish, while the pelagic trawl hauls mainly gave jelly-fish and juvenile fish (Table 1). The distribution of echo recordings classified as juvenile fish is shown in Fig. 9.

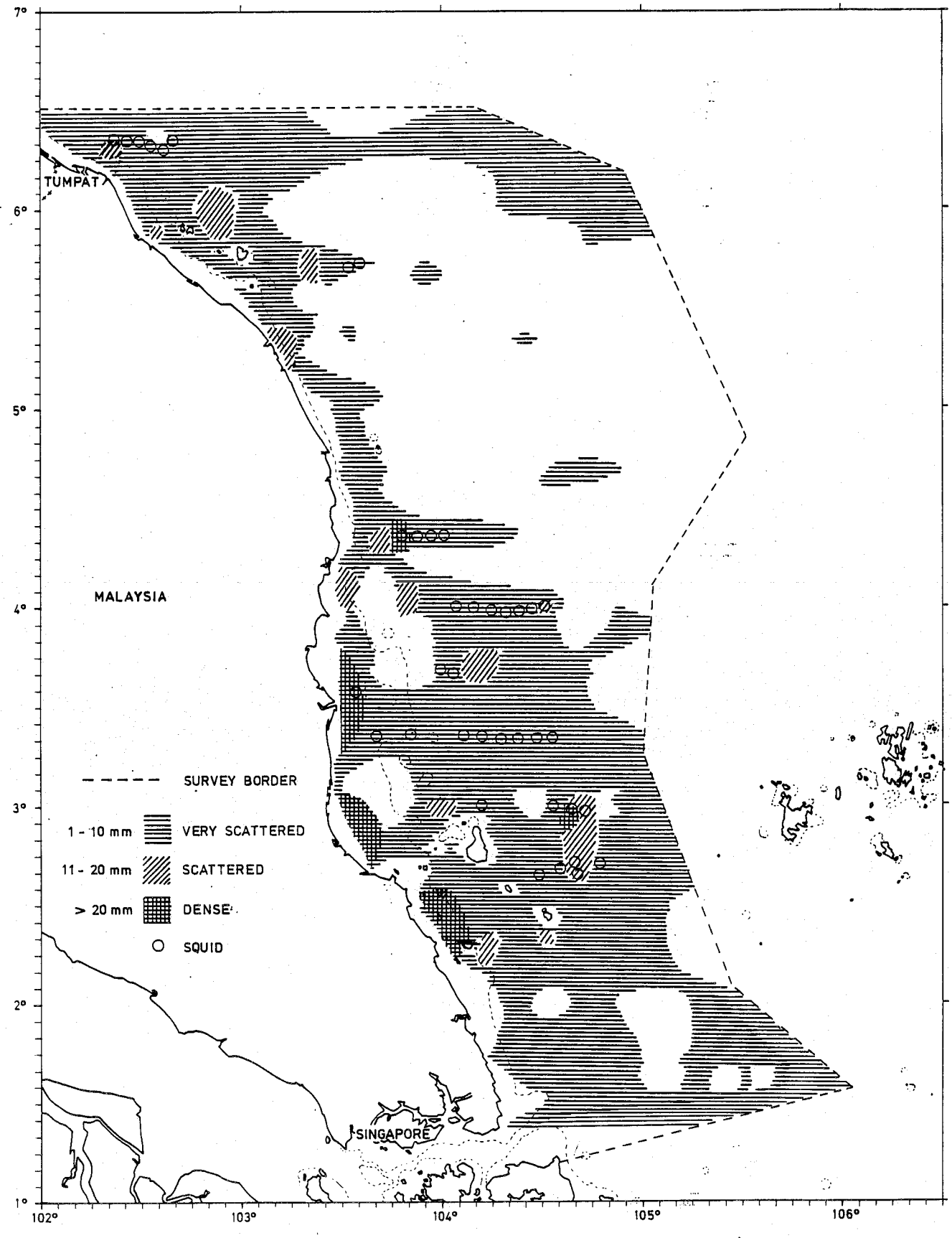

Fig. 7. Integrated echo intensities (mm/nautical mile) classified as pelagic fish.

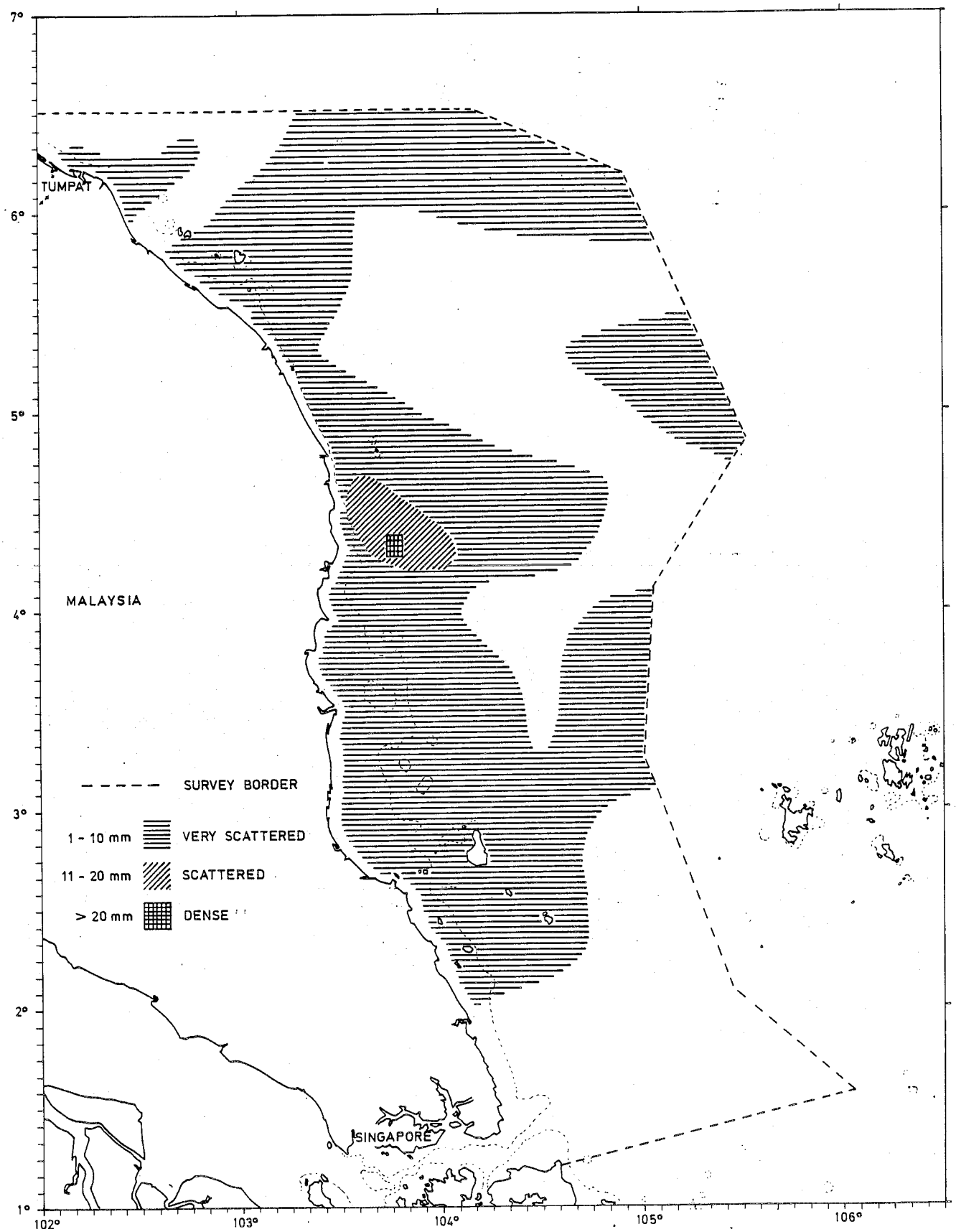

Fig. 8. Integrated echo intensities (mm/nautical mile) classified as demersal fish.

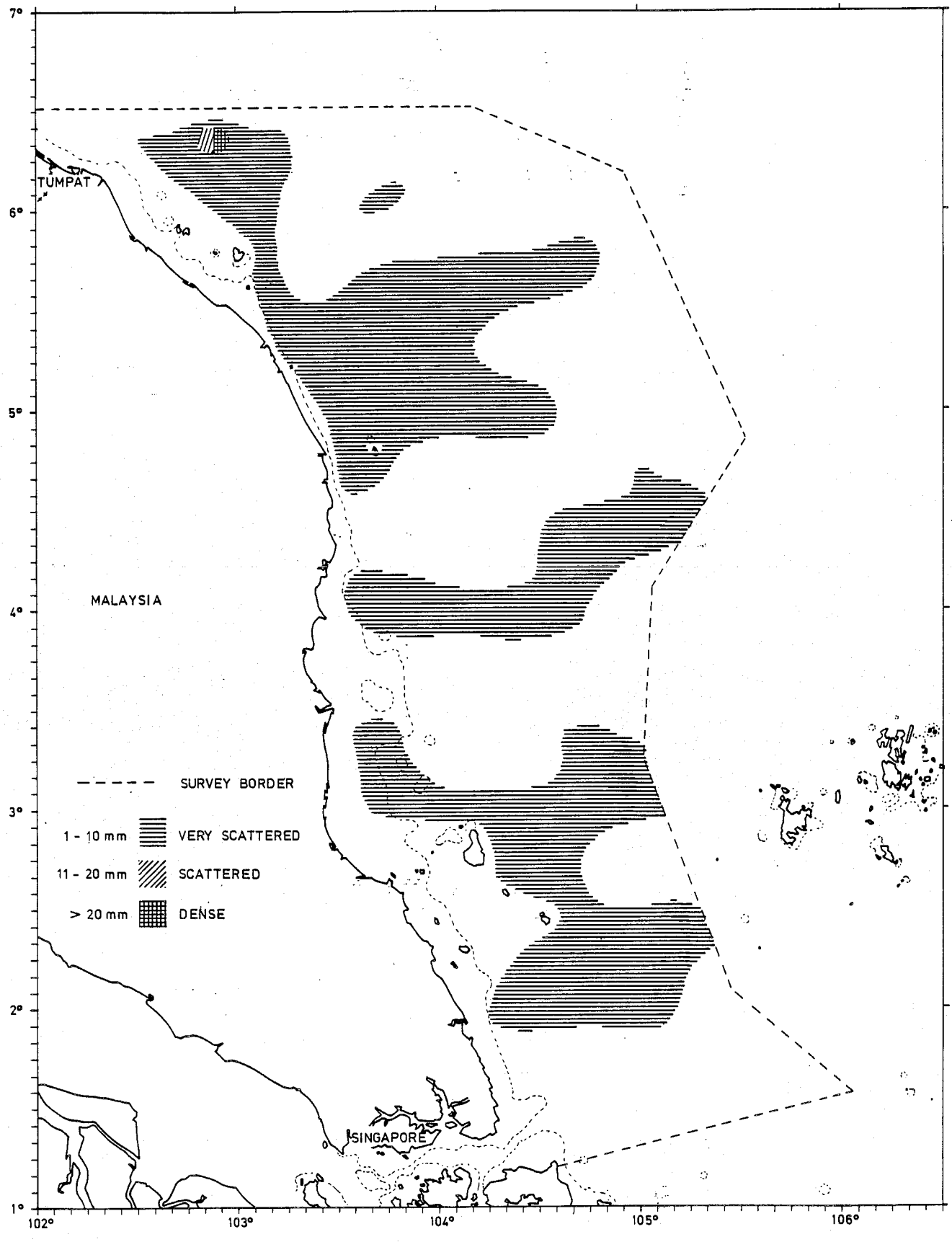

Fig. 9. Integrated echo intensities (mm/nautical mile) classified as juvenile fish.

Table 1. Average catch per hour for 22 pelagic trawl hauls at Peninsular Malaysia east coast. +: less than 0.1 kg/hr.

	CATCH (kg per hour)
APOGONIDAE	+
BALISTIDAE	+
BREGMACEROTIDAE	+
CARANGIDAE	0.6
CENTRISCIDAE	+
CLUPEIDAE	0.1
DIODONTIDAE	+
ECHENEIDAE	+
EMMELICHTHYIDAE	+
ENGRAULIDAE	0.3
EXOCOETIDAE	+
FISTULARIDAE	+
FORMIONIDAE	+
LEIOGNATHIDAE	+
LUTJANIDAE	+
MULLIDAE	+
PRIACANTHIDAE	+
SCOMBRIDAE	0.5
SPHYRAENIDAE	0.4
SYNODONTIDAE	0.1
TRICHIURIDAE	+
SHARKS	1.7
RAYS	+
Adult fish total	3.8
Juvenile fish	5.1
Cephalopoda	0.4
Jellyfish	101.6
TOTAL	111.0

The catch of the dominating species in each trawl haul are listed in Annex III. Table 2 shows average bottom trawl catch rates within depth zones for the dominating families. A complete list for all families are given in Annex IV. List of all species recorded is given in Annex II and length frequency distributions of some important species are given in Annex V.

Table 2. Average catch rates (kg/hr.) of dominating families within depth zones. Bottom trawl catches at the east coast of Peninsular Malaysia. +: less than 0.1 kg/hr.

	Catch rate (kg/hr.)		
	10-25m	26-50m	51-75m
"Pelagic" fish:			
CARANGIDAE	62.4	8.1	5.9
CLUPEIDAE	6.5	+	-
GERREIDAE	2.1	4.1	3.3
LEIOGNATHIDAE	11.9	1.5	3.1
SCOMBRIDAE	1.3	0.1	0.7
Other pelagic fish	0.8	+	-
Demersal fish:			
ARIIDAE	20.5	2.7	0.4
BALISTIDAE	0.4	3.1	3.7
LUTJANIDAE	4.2	10.8	4.0
MULLIDAE	11.2	2.7	4.4
NEMIPTERIDAE	11.2	9.8	8.4
POMACENTRIDAE	4.1	2.4	0.2
PRIACANTHIDAE	0.4	0.7	6.6
SIGANIDAE	26.8	0.7	0.1
SYNODONTIDAE	4.8	4.7	4.6
TETRAODONTIDAE	2.8	0.8	0.2
THERAPONIDAE	17.5	-	+
RAYS	28.8	3.1	0.8
Other demersal fish	22.8	11.2	11.9
Crustacea	3.7	1.5	0.7
Cephalopoda	4.7	8.2	4.4
Pelagic fish total	85.0	13.8	13.0
Demersal fish total	154.9	52.7	45.3
TOTAL	245.7	74.7	58.3
No of trawl hauls	10	15	28

Coastal Area

The highest integrator values were obtained from Tinggi Island to Paka. 14 bottom hauls were made here with a mean catch rate of 290 kg/hour. Occasionally trawling was not possible due to the rough bottom.

Of the typical pelagic fish, the horse mackerels were dominant. Yellow stripe trevally (Selaroides leptolepis) was the most frequent and gave the highest catch rates. Various pony fishes (Leiognathidae) and longfin mojarra (Pentaprion longimanus) were

found to have a wide distribution and occasionally made up the bulk of the catches. Of the typical demersal fishes, threadfin breams (Nemipteridae), goatfish (Mullidae) and snappers (Lutjanidae) were dominant. The catch rates of various commercially important species were low and only occasionally exceeded 40 kg/hour.

South of Tinggi Island no good recordings were obtained, and the single trawl haul gave no catch. Along the northern part of the coast the areas with considerable fish recordings were more limited compared to those made between Tinggi Island and Paka and the mean catch rate was only 209 kg/hr as compared to 290 kg/hr. The dominance of demersal and semi-pelagic fish was more prominent. The main fish families and species appeared to be the same as further south.

Offshore Area

With reference to pelagic fish registrations, the offshore area appeared to be the poorest. No rich concentrations were observed. In the areas with considerable integrator deflections, squid shoals were the most prominent recordings.

In all 41 bottom hauls were made in the area. The catch-rates reflect the observations from the echo survey by being considerably lower (mean rate less than 100 kg/hour) than those achieved along the coast. The catches were dominated mostly by demersal fish species: Threadfin breams (Nemipteridae), snappers (Lutjanidae), longfin mojarra (Pentaprion longimanus), lizard fishes (Synodontidae) and bigeyes (Priacanthidae). It should be noted, however, that squid were among the dominant groups in almost half of the bottom trawl catches. Various horse mackerels (Carangidae) occasionally made up a considerable part of the catches.

3.5 Fish abundance

The abundance estimates of demersal fish off the east coast of Peninsular Malaysia calculated by the swept area method, are summarized in Table 3.

Table 3. Abundance of demersal fish estimated from bottom trawl catch rates at the east coast of Peninsular Malaysia.

	No of hauls	Area ($n.m^2$)	Catch rate (kg/hr.) Mean	Catch rate (kg/hr.) S.Dev.	Density (tonnes/$n.m^2$)	Total abundance (1000 tonnes)
Coastal area (10-25m)	19	6000	160	47	5.3	31.8
Offshore area (26-75m)	41	28000	51	7	1.7	47.6
TOTAL		34000				79.4

The total area is roughly divided between the coastal (10-25 m depth) and the offshore area (26-75 m) using depth information both from the cruises and the charts.

Table 2 shows that the average catch rates of demersal fish in bottom trawl decreased with increasing depth. As the catch difference between the two deepest depth intervals are small, these are delt with as one area in the calculations (Table 3). The drop in the catches is most prominent from the coastal area to the first offshore area. The mean density of demersal fish in the coastal area (5.3 tonnes/$n.mile^2$) is about three times that of the offshore area (1.7 tonnes/$n.mile^2$). However, the estimated total biomasse in the offshore area is the larger because the offshore area is nearly 5 times larger than the coastal area. The catch rate variation of demersal fish was much higher in the coastal area than offshore, which is demonstrated by the calculated standard deviation (Table 3). The precision of the density estimates in the coastal area is much lower than in the offshore area.

Table 4. Fish density and abundance estimated from mean integrator values and fish length within subareas at the east coast of Peninsular Malaysia.

Subarea	Area ($n.mile^2$)	Mean integrator value (mm/n.mile) Pel.	Mean integrator value (mm/n.mile) Dem.	Mean fish length (cm) Pel.	Mean fish length (cm) Dem.	Mean fish density (tonnes/$n.m^2$) Pel.	Mean fish density (tonnes/$n.m^2$) Dem.	Total abundance (1000 tonnes) Pel.	Total abundance (1000 tonnes) Dem.
I	3570	4.4	0.9	13	17	14.3	3.8	51.1	13.7
II	7840	1.1	0.7	15	19	4.1	3.3	32.3	26.1
III	4390	3.6	2.5	14	15	12.6	3.8	55.3	16.5
IV	7800	0.8	0.9	13	17	2.6	3.8	20.3	29.8
V	4580	9.6	0.6	11	12	26.4	1.8	120.9	8.2
VI	6200	1.5	0.4	16	15	6.0	1.5	37.2	9.3
TOTAL	34380							317.1	103.6

Table 4 shows average density and abundance of fish estimated from average integrator values within 6 subareas. The subareas are shown in Fig. 10. This gives about 300 000 tonnes of pelagic

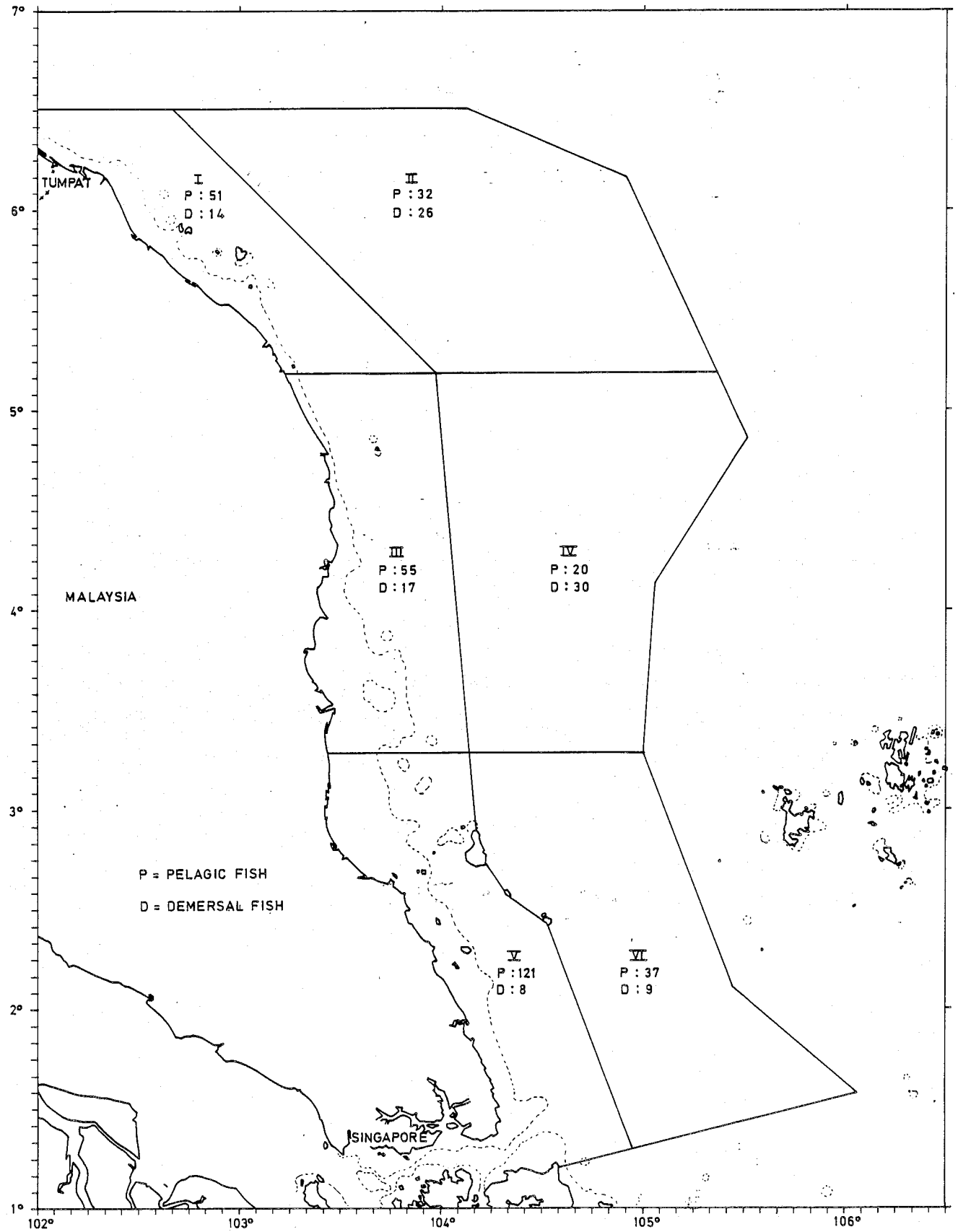

Fig. 10. Sub-areas used for acoustic abundance estimation. Estimates given in 1000 tonnes.

fish and 100 000 tonnes of demersal fish in the whole investigated area. This estimate for demersal fish is 25 % higher than the estimate based on catch rates.

It would be more reasonable to expect the trawl catch based estimate to be the higher one, because some fish very close to the bottom are inaccessible for echo integration. In addition, the trawl stations were not located strictly at random, but rather directed to the best concentrations (when the bottom conditions allowed). However, the applied catchability coefficient (c=1) probably introduces a bias resulting in an underestimate.

4. RESULTS WEST COAST

4.1 Survey coverage

The survey started on 5 July from Penang in the northern area of the West Coast of Peninsular Malaysia. At the beginning of the survey one day was spent anchored off Langkawa Island for hydrophone calibration of the acoustic equipment.

Cruise tracks, fishing stations and hydrographical sections are shown in Fig. 11. The total area under survey extended along the coast from latitude 6°N near the Malaysia-Thai border to 3°N off Port Kelang, extending seawards to the median line between Malaya and Sumatra. On the return survey from the south a more detailed survey of the coastal areas was made. The main transects were spaced approximately 20 n.miles apart and ran from a depth of about 10 m seawards to the median line, which in the southern part was only about 50 n.miles offshore. Fishing was performed at 38 stations. After three hauls with pelagic trawl it was severely damaged and could not be used during the later part of the cruise, hence all subsequent trawling operations were limited to bottom trawling.

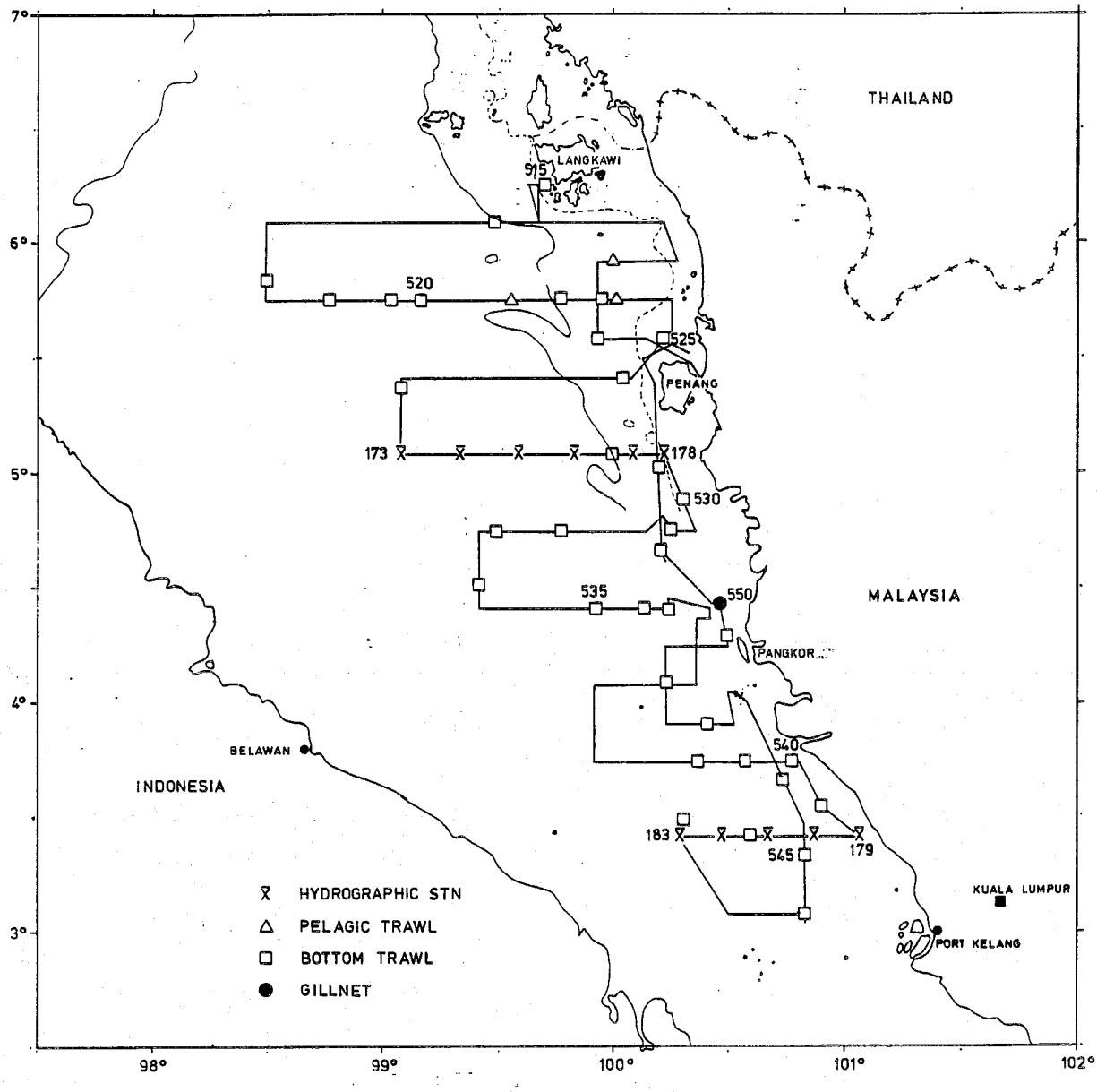

Fig. 11. Survey routes and stations. West coast of Peninsular Malaysia, 5 - 14 July 1980.

4.2 Bottom conditions

The bottom conditions as observed from the echo sounder were noted throughout the survey and classified as described on page 10. The results are shown in Fig. 12.

In most part of the area the bottom was suitable for trawling. The bottom tended to be more rough in the deepest areas (more than 50 m bottom depth). In the southern part of the investigated area small spots with rough bottom were occasionally observed.

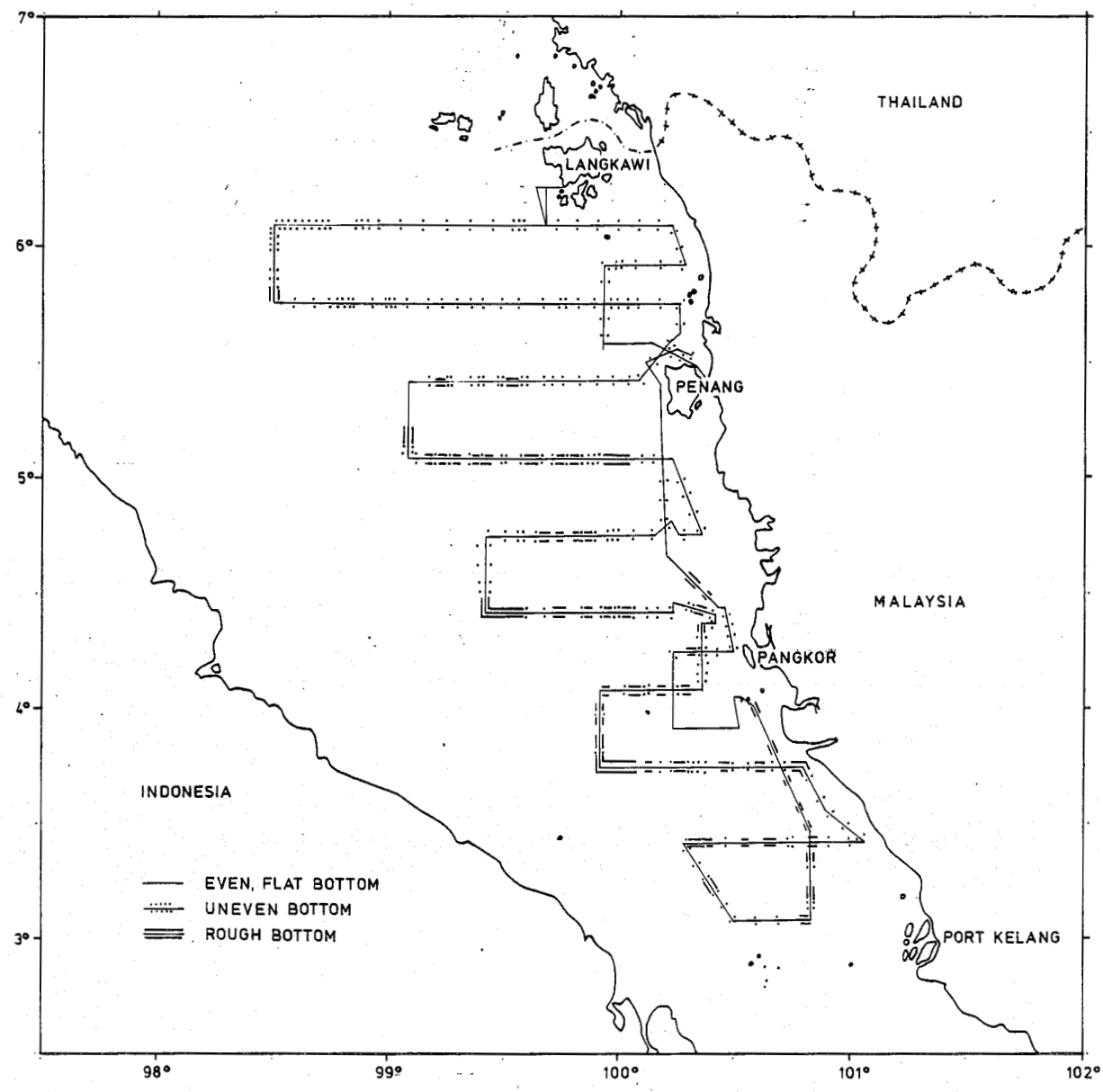

Fig. 12. Observations of the character of the bottom on the west coast of Peninsular Malaysia.

4.3 Hydrography

The waters surveyed off the west coast of Peninsular Malaysia may be defined according to Wyrtki (1961) as belonging both to the Sunda Shelf Area in the southern part and the Andaman Sea in the northern part.

The monsoons have less influence on the general pattern of the circulation of the water masses in this region than on the east

coast. There is a transport of water from east to west through the Strait of Malacca throughout the year, with the highest current velocities during the northeast monsoon (Nov. - Apr.). Wyrtki (1961) indicates that during the southwest monsoon (May - Oct.) the surface currents form an eddy as the water moves from the northwest, close to Peninsular Malaysia, and meets the westbound current in the Strait of Malacca. The watermasses thus joined form a westward transport closer to the coast of Sumatra.

Our hydrographic observations were limited to two cross-sections (Fig. 11). Figs. 13a and 13b show the profiles of salinity, temperature and oxygen. The temperature profiles show no clear gradients, while the salinity profiles indicate a considerable freshwater influence in the upper 40 m. This is most pronounced in the inner part of the southern section.

The oxygen profiles indicate more stagnant bottom water in comparison to the east coast of Peninsular Malaysia.

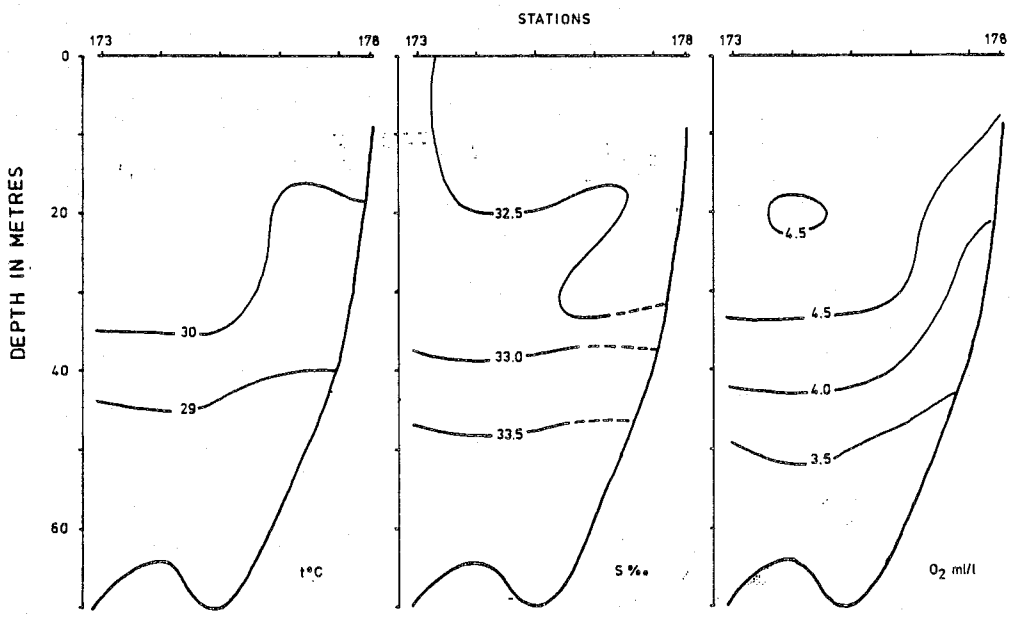

Fig. 13a. Hydrographic section at 5°05'N, West coast of Peninsular Malaysia, 5 - 14 June 1980

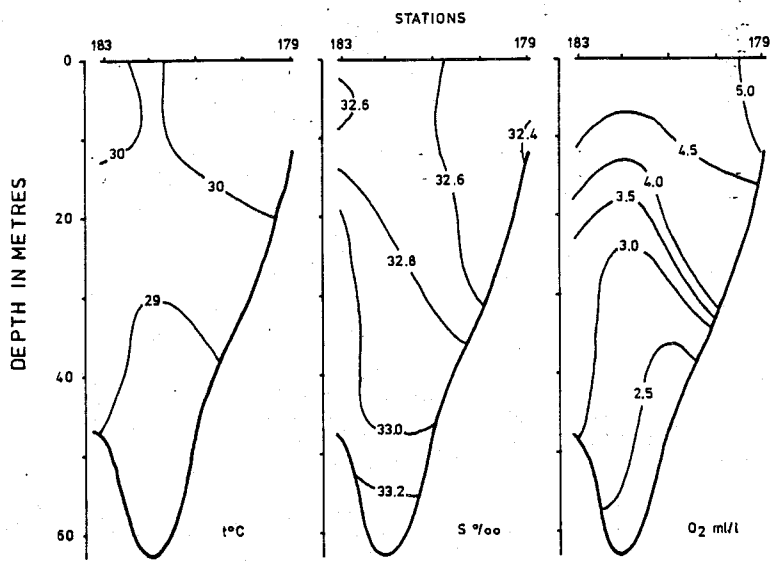

Fig. 13b. Hydrographic section at 3°25'N, West coast of Peninsular Malaysia, 5 - 14 June 1980

4.4 Fish distribution and catch composition

Fig. 14 and 15 show the geographical distribution of echo-recordings classified as pelagic and demersal fish. "Pelagic" fish were recorded in most of the investigated area. The densities were, however, low except for the coastal area north of Penang and some smaller patches further south.

Much of the "pelagic" fish was observed rather close to the bottom. Therefore a considerable portion of the bottom trawl catches was "pelagic" fish.

The recordings of "demersal" fish were very weak and showed little variations throughout the whole area. Recordings classified as juvenile fish were mostly restricted to the coastal areas (Fig. 16).

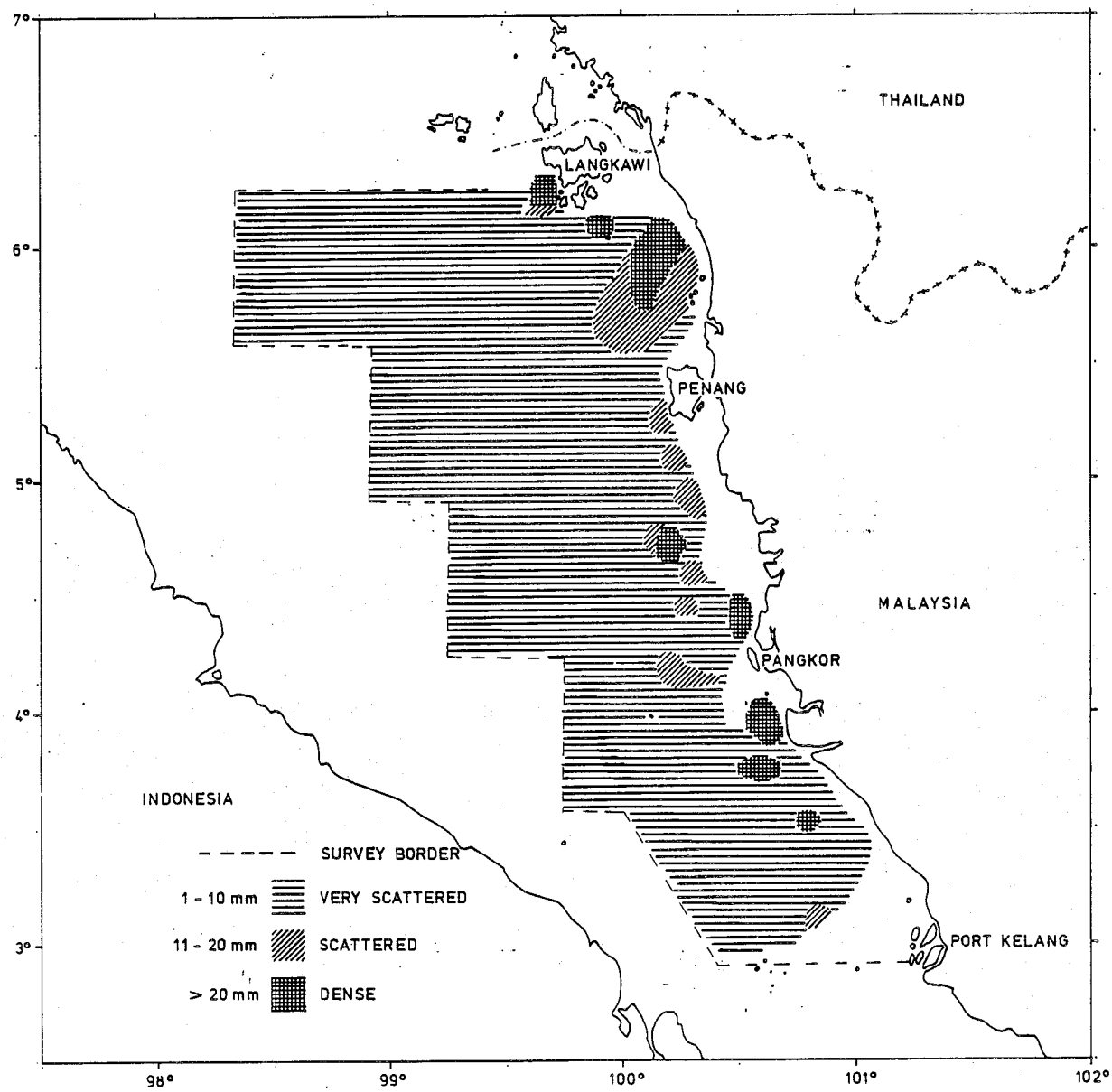

Fig. 14. Integrated echo intensities (mm/nautical mile) classified as pelagic fish.

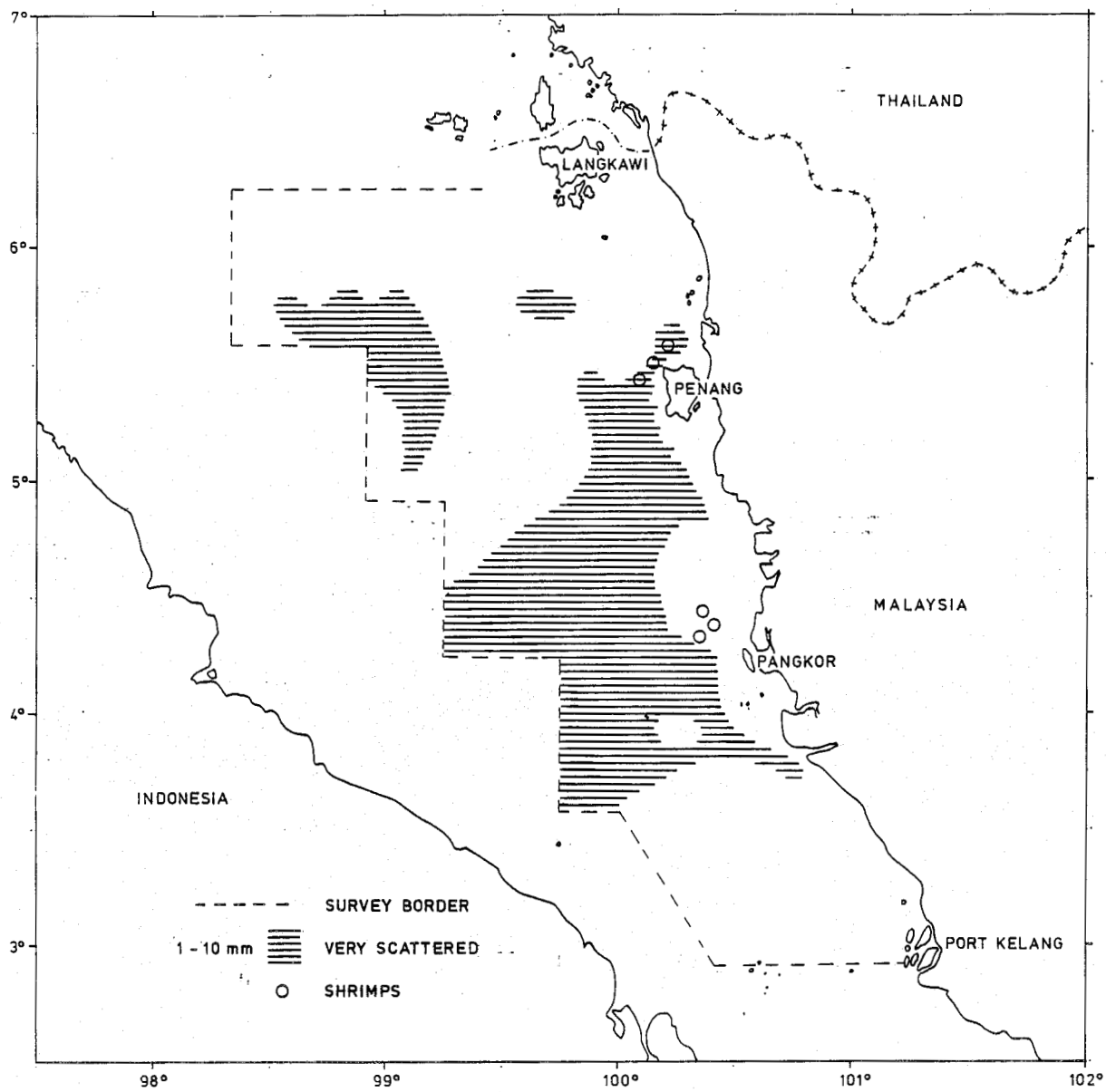

Fig. 15. Integrated echo intensities (mm/nautical mile) classified as demersal fish.

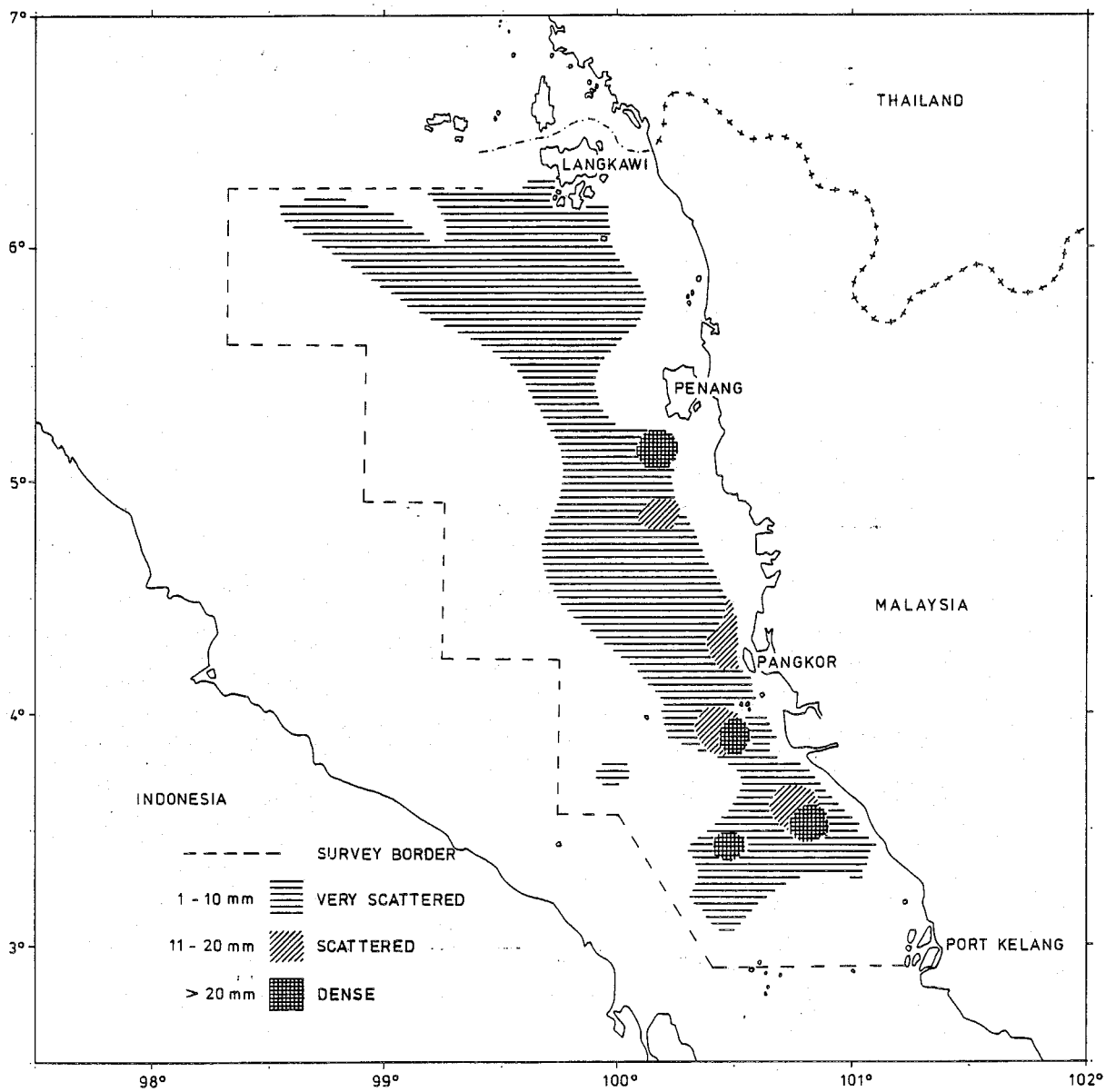

Fig. 16. Integrated echo intensities (mm/nautical mile) classified as juvenile fish.

Table 5 shows the average catch rates for the dominating families by depth zone. A complete list for all families are given in Annex IV. The catch of the dominating species in each trawl haul are listed in Annex III. List of all fish species recorded is given in Annex II and length frequency distributions of some important species are given in Annex V.

Table 5. Average catch rates (kg/hr) of dominating families within depth zones. Bottom trawl catches at the west coast of Peninsular Malaysia. +: less than 0.1 kg/hr.

	Catch rate (kg/hr)			
	10-25 m	26-50 m	51-75 m	76-100 m
Pelagic fish				
CARANGIDAE	8.7	23.9	7.8	4.8
CLUPEIDAE	3.9	1.9	+	-
ENGRAULIDAE	1.8	0.8	+	-
GERREIDAE	-	0.2	1.4	12.6
LEIOGNATHIDAE	20.2	5.4	1.4	-
SCOMBRIDAE	2.8	13.1	0.3	-
Demersal fish				
APOGONIDAE	0.2	4.7	0.9	-
BALISTIDAE	0.1	1.0	2.4	-
FORMIOMIDAE	1.7	0.2	5.3	-
LUTJANIDAE	0.1	4.7	4.0	4.4
MULLIDAE	0.1	1.7	0.8	3.0
NEMIPTERIDAE	0.7	8.6	9.4	17.7
PENTAPODIDAE	-	-	0.2	6.8
POMADASYIDAE	12.5	2.4	0.4	-
PRIACANTHIDAE	-	0.3	0.5	105.7
SCIAENIDAE	7.8	2.2	+	-
SPHYRAENIDAE	0.7	0.6	0.6	2.2
STROMATEIDAE	2.4	0.1	-	-
SYNODONTIDAE	0.9	6.4	1.9	1.3
TETRAODONTIDAE	5.0	7.5	1.9	2.4
THERAPONIDAE	2.5	-	1.6	-
TRICHIURIDAE	19.6	5.3	0.1	-
RAYS	1.0	1.1	2.7	50.0
Other demersal fish	4.3	8.0	5.0	3.6
Crustacea	4.5	3.2	1.1	0.1
Cephalopoda	5.4	2.6	2.4	3.4
Pelagic fish total	37.3	45.3	10.9	17.4
Demersal fish total	59.6	54.8	37.7	197.1
TOTAL	106.9	105.9	52.1	218.0
No of hauls	7	13	13	2

One fairly good pelagic trawl catch was obtained just north of Pulau Penang. This gave 1200 kg/hr consisting of 90% Triacanthus sp.

The results of the demersal trawl hauls gave low catch rates in most cases. The overall catch rate was only 136 kg/hour. The highest catch rate observed was 395 kg/hour, which was obtained

at a depth of 90 metres in the northern part of the area (Fishing Stn No 518). This catch was dominated by bigeyes (Priacanthus sp.) which made up about 50% of the total.

Of the typical pelagic fish, carangids dominated. As on the east coast, yellowstripe trevally (Selaroides leptolepis) was frequently caught in relative large numbers. Also the more semi-pelagic fish Leiognathidae had a wide distribution and was caught in almost every haul.

Of the more typical demersal species bigeye (Priacanthus sp.) and threadfin breams (Nemipteridae) were common and often made up the bulk of the catches.

Shrimps were found only in a few hauls near the shore off the islands of Pangkor and Penang, but only in small quantities. Dominant species were Parapenaeopsis sp. and Metapenaeus indicus.

4.5 Fish abundance

Abundance estimates of demersal fish off the west coast of Peninsular Malaysia calculated by the swept area method, are summarized in Table 6.

Table 6. Abundance of demersal fish estimated from bottom trawl catch rates at the west coast of Peninsular Malaysia.

	No of hauls	Area ($n.m^2$)	Catch rate (kg/hr) Mean	S.Dev.	Density (tonnes/$n.m^2$)	Total abundance (1000 tonnes)
Coastal area (10-25 m)	7	2 500	60	11	2.0	5.0
Offshore area (26-50 m)	13	3 500	55	11	1.8	6.3
Offshore area (51-100 m)	15	10 100	59	23	2.3	23.2
TOTAL	35	16 100				34.5

In contrast with the results from the east coast, no significant decrease in the catch rates with increasing depths was observed. The average total catch rate was about 50-60 kg/hr at all depth intervals. The density-estimates are at the same order of magnitude as the estimates for the offshore area at the east

coast. The number of trawl hauls was, however, low and the limitations on trawl operations caused by commercial fishing activity were considerable in the shallow water area. Therefore the estimates especially for the coastal area are rather uncertain.

Table 7. Fish density and abundance estimated from mean integrator values and fish length within subareas at the west coast of Peninsular Malaysia.

Subarea	Area ($n.mile^2$)	Mean integrator value(mm/n.m)		Mean fish length (cm)		Mean fish density (tonnes/$n.m^2$)		Total abundance (1000 tonnes)	
		Pel.	Dem.	Pel.	Dem.	Pel.	Dem.	Pel.	Dem.
I a	3 100	2.5	0.1	12	26	7.3	0.6	22.6	1.9
I b	2 230	8.9	0.1	10	21	22.0	0.5	49.1	1.1
II a	4 160	2.9	0.8	18	20	12.7	4.0	52.8	16.6
II b	2 960	7.1	0.4	15	26	26.3	2.6	77.8	7.7
III	4 210	5.5	0.2	15	16	20.5	0.8	86.3	3.4
TOTAL	16 660							288.6	30.7

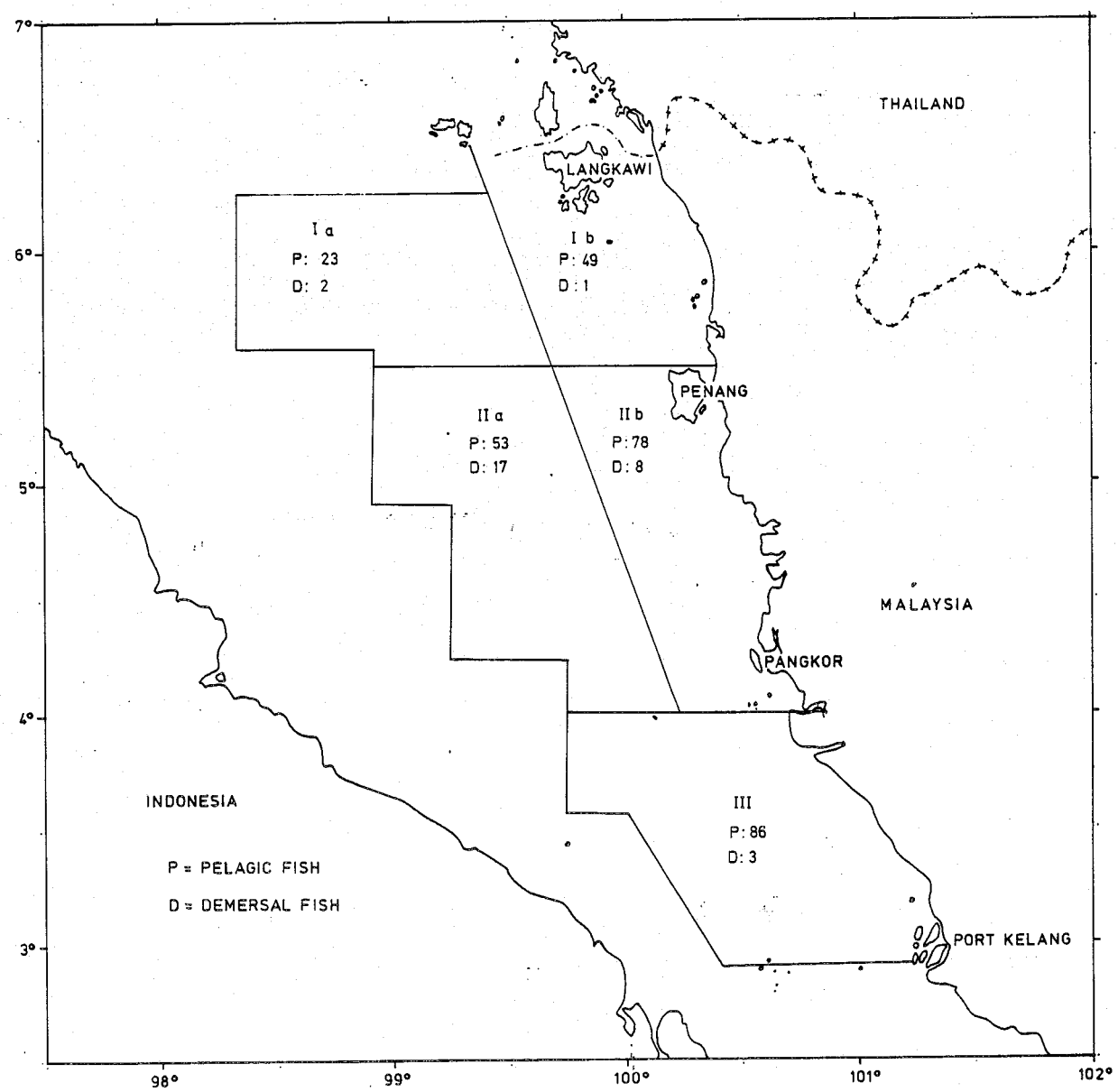

Fig. 17. Sub-areas used for acoustic abundance estimation. Estimates given in 1000 tonnes.

Table 7 shows average density and abundance of fish estimated from average integrator values within 5 subareas (Fig. 17). This gives about 300 000 tonnes of pelagic fish and 30 000 tonnes of demersal fish. This corresponds well to the demersal fish estimate based on catch rates.

5. SUMMARY AND CONCLUSIONS

The east and west coast of Peninsular Malaysia were surveyed during short periods only, in June and early July, respectively. The survey periods thus fall within the southwest monsoon period, but throughout both surveys the weather conditions were good.

Earlier observations of the hydrographical environment along Peninsular Malaysia have demonstrated clear seasonal changes during the monsoon periods with complete reversal of the current along the east coast. During the northeast monsoon (Nov.-Apr.) the main current along the east coast runs to the south, while during the southwest (May-Oct.) monsoon there is a strong northerly drift.

These seasonal changes affect productivity and fish distribution. The distribution of fish, as observed during the present survey, may therefore not be typical for other months of the year. Earlier investigations of the fish resources in Malaysian waters have mainly been carried out during the post-monsoon period. (LATIFF et al. 1974, 1976, LAM et al. 1975). During the south-west monsoon fishing is usually difficult on the west coast while on the east coast the northeast monsoon limits the fishing activities.

Acoustic observations together with information on species and size composition in the catches from 89 fishing stations on the east coast and 39 on the west coast form the basis for an assessment of the fish biomass.

The acoustic recordings of fish were classified into two main groups: "pelagic fish" and "demersal fish". All fish belonging to the families Carangidae, Clupeidae, Engraulidae, Gerreidae,

Leiognathidae and Scombridae were defined as "pelagic". The findings from this work is presented in a number of charts and tables.

A few words must be said about the likely systematic errors in these assessments. For navigational reasons inshore areas of depth less than about 10 m could not be covered in these surveys. These uncovered parts of the shelf comprised about 10% of the east coast shelf and 20% of the west coast. The biomass have been raised by simple area ratios to compensate for the uncovered shelf parts.

This adjustment is based on the assumption that the mean fish densities in the inshore shallow areas are the same as on the outer shelf. Inshore areas are often especially rich in fish and the correction factor may therefore be too small and underestimate the total fish biomass. There are two further sources of bias which also lead to underestimation. 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 ½-1 m) to the sea bottom. The conversion factor used for calculating fish abundance in tonnes from echo intensity (mm deflection) represents "cod-type" fishes (page 6), and may not be representative for the dominant fish species in Malaysian waters. Too little information about the acoustic properties and behaviour of the fishes in the area are available for evaluation of the total effect of these factors. The abundance estimates given below therefore have to be used with some reservation.

The assessments of total biomass of standing stock were (thousand tonnes):

	East coast		West coast	
	Acoustic	"Swept area"	Acoustic	"Swept area"
Pelagic fish	300	-	300	-
Demersal fish	100	80	30	30
Total (thousand tonnes)	400	-	330	-

The results from the acoustic surveys show that the abundances of pelagic fish were at the same level, almost 300 000 tonnes, on the east and west coast. The estimated biomass of demersal fish however, was much lower on the west than on the east coast. Similar results were obtained by using the catch rates (swept area method) from the trawl survey. The mean catch rate of demersal fish of all the trawl hauls on the west coast gave only 58 kg/hour as compared to 85 kg/hour on the east coast. To compare the fish abundance in the two areas it may, however, be more appropriate to consider fish biomass per unit shelf area in different depth strata based on the demersal trawl hauls:

Depth strata	Tonnes per square nautical mile	
	East coast	West coast
10 - 25 m	5.3	2.0
26 - 50 m	-	1.8
26 - 75 m	1.7	-
50 - 100 m	-	2.3

The results show that on the east coast the abundance of demersal fish was about three times higher in shallow waters than in deeper waters. On the west coast the mean densities were approximately the same in all depth strata. The number of trawl hauls in shallow water was however low, and the estimated fish abundance in the inshore area is rather uncertain.

Also the abundance of pelagic fish was found to be considerably higher in the coastal "sub-areas" (see Fig. 10 and 17). Both on the east and west coast about 70% of the total pelagic fish biomass was recorded in the "coastal" areas. It should be noted, however, that these estimates refers mainly to small pelagic fish. Larger tuna-like fish do not contribute representatively neither to the trawl catches nor to the echo recordings.

According to a study prepared by the South China Sea Programme (AOYAMA 1973) the standing stock of demersal fish in the coastal zone (shallower than about 50 m) of the southern Sunda Shelf area was estimated to be about 154 000 tonnes or 2 tonnes/km^2. Demersal fish was in this context defined as all those caught with demersal gears. In the present study with "Dr. Fridtjof

Nansen" semi-pelagic fish caught by bottom trawl were for comparison with the echo recordings classified as "pelagic fish" and not included in the estimated standing stock of demersal fish. By including all species caught with the bottom trawl as given in Table 2, the estimated standing stock on the east coast would be about 50% higher which corresponds to the estimate given in earlier studies.

When trawling was introduced in the mid-sixties the catch increased rapidly up to the present level, but in spite of increased effort the total catch has leveled off (ANON 1976). The present total annual catch of demersal and pelagic fish from the Peninsular Malaysia both east and west coast is about 300 000 tonnes.

Three different trawl surveys undertaken between 1970 and 1974 along the west coast, showed that in this period there had been 30-50% drop in catch per hour in the different sub-areas. Also the commercial fishery showed a similar decline of about 50% in the catch per boat per day during the period 1970-74 (LATIFF & LEONG 1976).

Most of the commercial fishery takes place close to the coast, and the results of the survey with "Dr. Fridtjof Nansen" show that the resources in offshore areas both on the east and west coast are relatively small. The density per unit area is also considerably lower than in inshore areas and the prospects for expansion of the fisheries to more offshore areas do not seem very promising.

Pelagic fish make up the major part of the fish resources along the Peninsular Malaysia. Most of these "pelagic" species are however, also exploited with demersal gears. An estimate of total standing stock of about 700 000 tonnes of demersal and pelagic fish along the entire coast of Peninsular Malaysia would therefore indicate that the limit of potensial yield from the area has been reached.

The relative higher proportion of pelagic fish and the drop in catch rate of commercial demersal trawling would suggest,

however, that some increase in catch might be achieved by diversion of effort from demersal fishing to fishing for more "pure" pelagic species.

It should be stressed, however, 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 of pelagic species investigations during other parts of the year are required.

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ANNEX I

Scientific and Technical Staff of the Surveys:

	Peninsular Malaysia	
	East coast	West coast
	10 - 25 June 1980	5 - 14 July 1980
Institute of Marine Research, Bergen:	O.R. Godø (cruiseleader)	O.R. Godø (cruiseleader)
	S. Myklevoll	S. Myklevoll
	K. Lauvås	K. Lauvås
	H. Abrahamsen	B. Bakken
	A. Roald	J.P. Maude
Fisheries Research Institute, Glugor, Penang:	S. Selvanathan (team leader)	Mustafa Bin Yunus
	Yang Chee Hang	Abdul Hamid Bin Yasir
	G. Yahya	
Fisheries Training Centre, Babu Maung, Penang:	W. Mansor	
Fisheries Department, Kota Kinabalu, Sabah:	L.M. Wong	

ANNEX II a

LIST OF SPECIES - R/V "DR. FRIDTJOF NANSEN" - PENINSULAR MALAYSIA EAST COAST

JUNE 1980

+: Also caught on the west coast, july 1980.

FAMILY SUB-FAMILY Species	English name
APOGONIDAE	Cardinalfishes
Apogin ellioti	
Apogon quadrifasciatus	Four-banded cardinalfish
Apogon spp.	
ARIIDAE	Sea catfishes
Arius thalassinus	Giant catfish
Arius sp.	
ARIOMMIDAE	Driftfishes
+ Ariomma indica	Indian driftfish
BALISTIDAE	Triggerfishes, Filefishes
BALISTINAE	Triggerfishes
+ Abalistes stellaris	Starry triggerfish
MONACANTHINAE	Filefishes
+ Alutera monoceros	Unicorn filefish
Monacanthus sp.	
+ Stephanolepis sp.	
unspecified juveniles	
unspecified larvae	
BOTHIDAE	Lefteye flounders
PARALICHTHYINAE	
Pseudorhombus malayanus	Malayan flounder
unspecified adults	
unspecified juveniles	
BREGMACEROTIDAE	Codlets
Bregmaceros sp.	
CARANGIDAE	Jacks, cavallas, crevalles, pompanos, queenfishes, scads, runners, trevallies
Alectis ciliaris	
+ Alectis indicus	Threadfin trevally
+ Alepes djeddaba	Djeddaba crevalle
+ Alepes kalla	
+ Alepes melanoptera	Blackfin crevalle
+ Atule mate	
Carangoides chrysophrys	Longnose cavalla
+ Carangoides ciliarius	Longfin cavalla
+ Carangoides ferdau	Ferdau's cavalla
+ Carangoides malabaricus	Malabar cavalla
Carangoides sp.	
Caranx stellatus	
Decapterus macrosoma	Layang scad
+ Decapterus maruadsi	Round scad
+ Megalaspis cordyla	Hardtail scad

CARANGIDAE (continued)	
+ Scomberoides commersonianus	Talang queenfish
Selar boops	Oxeye scad
Selar crumenophthalmus	Bigeye scad
Selar sp.	
+ Selaroides leptolepis	Yellowstripe trevally
+ Seriolina nigrofasciata	Black-banded trevally
Uraspis helvolus	Black ulua
unspecified juveniles	
unspecified larvae	
CENTRISCIDAE	Shrimpfishes
Aeoliscus scutatus	Guttersnipe-fish
Aeoliscus sp.	
unspecified adults	
unspecified juveniles	
CENTROPOMIDAE	Snooks, seaperches
Lates calcarifer	Giant seaperch
CHAETODONTIDAE	Butterflyfishes, angelfishes
CHAETODONTINAE	Butterflyfishes
Heniochus acuminatus	Pennant coralfish
Parachaetodon ocellatus	Six-spined Butterflyfish
CHIROCENTRIDAE	Wolf herrings
+ Chirocentrus dorab	Dorab wolf-herring
CLUPEIDAE	Herrings, shads, sardines, menhadens
CLUPEINAE	
+ Sardinella fimbriata	Fringescale sardinella
Sardinella leiogaster	Smoothbelly sardinella
+ Sardinella sirm	Spotted sardinella
Sardinella sp.	
DUSSUMIERIINAE	
+ Dussumieria acuta	Rainbow sardine
PRISTIGASTERINAE	
+ Opisthopterus tardoore	Tardoore
unspecified larvae	
CYNOGLOSSIDAE	Tonguefishes
CYNOGLOSSINAE	
+ Cynoglossus lingua	Long tongue sole
DACTYLOPTERIDAE	Flying gurnards
Dactyloptena orientalis	Purple flying gurnard
+ unspecified	
DIODONTIDAE	Porcupinefishes
+ Cyclichthys sp.	
+ Diodon sp.	
unspecified	
ECHENEIDAE	Remoras
+ Echeneis naucrates	Slender suckerfish

	EMMELICHTHYIDAE	Bonnetmouths
	EMMELICHTHYINAE	
	Emmelichthys nitidus	Red sea-haarder
	ENGRAULIDAE	Anchovies
+	Stolephorus (heterolobus)	Shorthead anchovy
	Stolephorus indicus	Indian anchovy
+	Stolephorus sp.	
	unspecified juveniles	
	unspecified larvae	
	EPHIPPIDAE	Spadefishes, Sicklefishes
	DREPANINAE	Sicklefishes
	unspecified juveniles	
	EPHIPPINAE	Spadefishes
+	Ephippus orbis	Spedefish
	EXOCOETIDAE	Flyingfishes, Halfbeaks
+	EXOCOETINAE	Flyingfishes
	unspecified	
	FISTULARIIDAE	Cornetfishes
	Fistularia petimba	Smooth flutemouth
	Fistularia villosa	Rough flutemouth
+	Fistularia sp.	
	FORMIONIDAE	Black pomfrets
+	Formio niger	Black pomfret
	GERREIDAE	Mojarras, Silver-biddies
	Gerres abbreviatus	Deep-body mojarra
+	Gerres filamentosus	Whipfin mojarra
+	Gerres oyena	Common mojarra
+	Pentaprion longimanus	Longfin mojarra
	GOBIIDAE	Gobies
	Gobius nebulosus	
	HOLOCENTRIDAE	Squirrelfishes, Soldierfishes
	HOLOCENTRINAE	Squirrelfishes
	Holocentrus lacteoguttatus	
	Holocentrus rubrum	Red squirrelfish
	Holocentrus sp.	
	MYRIPRISTINAE	Soldierfishes
	Myripristis murdjan	Crimsom squirrelfish
	LABRIDAE	
	LEIOGNATHIDAE	Slimys, Slipmouths, Ponyfishes
+	Leiognathus bindus	Orangefin ponyfish
	Leiognathus elongatus	Slender ponyfish
	Leiognathus smithursti	Smithurst's ponyfish
+	Leiognathus splendens	Splendid ponyfish
+	Leiognathus spp.	
+	Secutor insidiator	Pugnose ponyfish
	LETHRINIDAE	Scavengers, Emperors
	Lethrinus ornatus	Ornate emperor

	LUTJANIDAE	Snappers, Jobfishes, Fusiliers
	Caesio chrysozona	Goldband fusilier
	Caesio erythrogaster	Yellowtail fusilier
	Lutjanus duodecimlineatus	Blue-banded snapper
+	Lutjanus lineolatus	Bigeye snapper
+	Lutjanus malabaricus	Malabar red snapper
+	Lutjanus russelli	Russell's snapper
+	Lutjanus sanguineus	Blood snapper
	Lutjanus sebae	Emperor red snapper
+	Lutjanus vitta	Brownstripe red snapper
	Lutjanus sp.	
+	Pristipomoides typus	Sharptooth snapper
+	(Pristipomoides sp.)	
	MENIDAE	Moonfishes
	Mene maculata	Moonfish
	MUGILOIDIDAE	Sandperches
	Parapercis sp.	
	MULLIDAE	Goatfishes
	Parupeneus chryserydros	Goldsaddle goatfish
+	Parupeneus heptacanthus	Spotted golden goatfish
	Parupeneus sp.	
+	Upeneus bensasi	Yellowfin goatfish
+	Upeneus moluccensis	Goldband goatfish
+	Upeneus sulphureus	Yellow goatfish
	Upeneus sundaicus	Ochreband goatfish
+	Upeneus tragula	Darkband goatfish
	Upeneus sp.	
	unspecified	
	MURAENESOCIDAE	Pike Eels, Pike Congers
+	Muraenesox cinereus	Daggertooth pike-conger
	NEMIPTERIDAE	Threadfin breams
	Nemipterus bathybus	Yellowbelly threadfin bream
+	Nemipterus japonicus	Japanese threadfin bream
+	Nemipterus marginatus	Palefinned threadfin bream
+	Nemipterus mesoprion	Redfilament threadfin bream
	Nemipterus metopias	Slender threadfin bream
+	Nemipterus nematophorus	Doublewhip threadfin bream
	Nemipterus nemurus	Redspine threadfin bream
+	Nemipterus peronii	Rosy threadfin bream
+	Nemipterus tambuloides	Fivelined threadfin bream
+	Nemipterus tolu	Notched threadfin bream
	Nemipterus spp.	
	Pentapodus setosus	Paradise fish
	Scolopsis taeniopterus	Lattice monocle bream
+	Scolopsis vosmeri	Whitecheek monocle bream
	Scolopsis sp.	
	OGCOCEPHALIDAE	Batfishes
+	Halieutaea sp.	
	OPHIDIIDAE	Brotulas, Cusk-eels
	BROTULINAE	
	unspecified	

	OSTRACIONTIDAE	Boxfishes
+	OSTRACIONTINAE	
	Ostracion sp	
	Rhynchostracion nasus	Small-nosed boxfish
	Tetrosomus sp.	
	unspecified	
	PENTAPODIDAE	Large-eye Breams
+	Gymnocranius griseus	Grey large-eye bream
	PLATYCEPHALIDAE	Flatheads
	PLATYCEPHALINAE	
	Platycephalus indicus	Bar-tailed flatgead
	unspecified	
	PLOTOSIDAE	Plotosids, Catfish Eels
	Plotosus anguillaris	Striped catfish-eel
	POMACENTRIDAE	Damselfishes
	POMACENTRINAE	
	(POMACENTRINI)	
	Daya jerdoni	Jerdon's demoiselle
	(Pomacentrus sp.)	
	POMADASYIDAE	Grunts, Sweetlips
+	Plectorhynchus pictus	Painted sweetlip
+	Pomadasys hasta	Lined silver grunt
	Pomadasys maculatus	Blotched grunt
+	Pomadasys sp.	
	PRIACANTHIDAE	Bigeyes
+	Priacanthus macracanthus	Red bigeye
+	Priacanthus tayenus	Purple-spotted bigeye
	PSETTODIDAE	Psettodids, Indian Halibuts
+	Psettodes erumei	Indian halibut
	RACHYCENTRIDAE	Cobia
+	Rachycentron canadus	Cobia
	SCIAENIDAE	Drums, Croakers
	Johnius dussumieri	Bearded croaker
	Pennahia (pawak)	Pawak croaker
+	Pennahia sp.	
	unspecified	
	SCOMBRIDAE	Mackerels, Tunas
	SCOMBRINAE	
	(SCOMBRINI)	
	Rastrelliger faughni	Faughn's mackerel
+	Rastrelliger kanagurta	Indian mackerel
+	Rastrelliger sp.	
+	Scomberomorus commersoni	Narrow-barred Spanish mackerel
+	Scomberomorus guttatus	Indo-Pacific Spanish mackerel
	Scomberomorus sp.	
	unspecified juveniles	
	unspecified larvae	
	(THUNNINI)	
	Euthynnus (affinis)	Eastern little tuna

	SCORPAENIDAE	Scorpionfishes
	PTEROINAE	
	Pterois sp.	
	SCORPAENINAE	
	unspecified	
	SERRANIDAE	Sea Basses, Groupers, Rockcods
+	Epinephelus areolatus	Areolated grouper
+	Epinephelus sexfasciatus	Six-banded rockcod
+	Epinephelus sp.	
	SIGANIDAE	Rabbitfishes, Spinefeet
	Siganus canaliculatus	Whitespotted spinefoot
	SILLAGINIDAE	Sillagos, Smelt-whitings
+	Sillago sihama	Silver sillago
	Sillago sp.	
	SOLEIDAE	Soles
	SOLEINAE	
	Synaptura sp.	
	Zebrais zebra	Zebra sole
	SPARIDAE	Porgies, Seabreams
	unspecified	
	SPHYRAENIDAE	Barracudas
+	Sphyraena barracuda	Great barracuda
+	Sphyraena forsteri	Forster's barracuda
+	Sphyraena jello	Banded barracuda
	Sphyraena obtusata	Obtuse barracuda
	Sphyraena sp.	
	unspecified juveniles	
	SYNODONTIDAE	Lizardfishes
+	Saurida elongata	Slender lizardfish
	Saurida micropectoralis	Shortfin lizardfish
+	Saurida tumbil	Greater lizardfish
+	Saurida undosquamis	Brushtooth lizardfish
	Saurida wanieso	Wanieso lizardfish
	Synodus (variegatus)	Variegated lizardfish
+	Synodus sp.	
+	Trachinocephalus myops	Bluntnose lizardfish
	TETRAODONTIDAE	Puffers
	TETRAODONTINAE	
	Arothron aerostaticus	
	Gastrophysus sp.	
	Lagocephalus sp.	
	unspecified (various spp.)	
	THERAPONIDAE	Tigerperches
	Therapon jarbua	Jarbua therapon
+	Therapon theraps	Largescaled therapon
	TRIACANTHIDAE	Triplespines
+	Triacanthus striglifer	
+	Triacanthus sp.	
	TRIACANTHODIDAE	

TRICHIURIDAE	Cutlassfishes, Hairtails
TRICHIURINAE	
Trichiurus haumela	Largehead hairtail
TRIGLIDAE	Searobins
TRIGLINAE	
Lepidotrigla sp.	
unspecified	
URANOSCOPIDAE	Stargazers
Uranoscopus fuscomaculatus	
Uranoscopus sp.	
Chondrichthyes	Cartilaginous fishes
CARCHARHINIDAE	
CARCHARHININAE	Requiem sharks
Carcharhinus (obscurus)	Dusky shark
Carcharhinus sp.	
unidentified (various spp.)	
DASYATIDAE	
DASYATINAE	Stingrays, Whiprays
Dasyatis jenkinsii	
+ Dasyatis sp.	
unspecified	
GYMNURINAE	Butterfly Rays
Gymnura japonica	Butterfly ray
MYLIOBATIDAE	Eagle Rays, Cow-nosed Rays
MYLIOBATINAE	Eagle Rays
Pteromylaeus bovinus	Duckbill ray
RHINOBATIDAE	Guitarfishes
RHINOBATINAE	
(RHINOBATINI)	
Rhinobatos sp.	
RHYNCHOBATINAE	
(RHYNCHOBATINI)	
Rhynchobatus djeddensis	
(RHININI)	
Rhina ancylostoma	

CRUSTACEA

+	Charybdis cruciata	(Swimming crab)
	Palinurus sp.	(Rock lobster)
	Penaeus monodon	(Tiger prawn)
+	Thenus orientalis	
+	crabs	
+	small shrimps	
	horseshoe crab	
+	swimming crabs	
+	mixed shrimps	

Squilla — Mantis shrimp

CEPHALOPODA

- Loligo
- Squid
- Nautilus
- Sepia

Jellyfish

(various spp.)

ANNEX IIb

Additional species caught at the west coast of Peninsular Malaysia (July 1980).

FAMILY SUB-FAMILY Species	English name
BALISTIDAE	Triggerfishes, Filefishes
Paramonacanthus sp.	
CARANGIDAE	
Atropus atropus	Kuweh trevally
Decapterus kurroides	Scad
Scomberoides tala	Queenfish
CEPOLIDAE	Bandfishes
Acanthocepola abbreviata	
CLUPEIDAE	Herrings, shads, sardines
CLUPEINAE	
Sardinella gibbosa	Goldstripe sardinella
DOROSOMATINAE	
Anodontosoma chacunda	Chacunda gizzard-shad
PRISTIGASTERINAE	
Ilisha elongata	Elongate ilisha
Ilisha megaloptera	Bigeye ilisha
Ilisha melastoma	Indian ilisha
CYNOGLOSSIDAE	Toung fishes
Cynoglossus sp.	
ENGRAULIDAE	Anchovies
Setipinna taty	Hairfin anchovy
Thryssa malabarica	Malabar thryssa
Thryssa mystax	Moustached thryssa
Thryssa setirostris	Longjaw thryssa
Thryssa sp.	
LEIOGNATHIDAE	Ponyfishes
Gazza minuta	Toothed ponyfish
LETHRINIDAE	Scavangers, emperors
Lethrinus lentjan	Redspot emperor
LOBOTIDAE	Tripletails
Lobotes surimamensis	
LUTJANIDAE	Snappers
Lutjanus janthinuropterus	Yellowstreaked snapper
Pinjalo pinjalo	Pinjalo snapper
MURAENESOCIDAE	Pike eels, Pike congers
Congresox talabonoides	
Congresox sp.	
NEMIPTERIDAE	Threadfin breams
Nemipterus delagoae	Delagoa threadfin bream

Nemipterus hexodon	Ornate threadfin bream
Nemipterus virgatus	Golden threadfin bream
Parascolopsis sp.	
PENTAPODIDAE	Large-eye breams
Gymnocranius robinsoni	Blue-lined large-eye bream
PERCOPHIDIDAE	
SCIAENIDAE	Croakers, Drums
Dendrophysa russelli	Goatee croaker
Johnieops sp.	
Pennahia macrophthalmus	Bigeye croaker
SCORPAENIDAE	Scorpionfishes
Pterois russelli	
Scorpaenopsis sp.	
SERRANIDAE	Sea basses, Groupers, Rockcods
Epinephelus awoara	Yellow grouper
SPARIDAE	Seabreams, Porgies
Argyrops spinifer	Longspine seabream
TRICHIURIDAE	Hairtails, Cutlassfishes
Lepturacanthus savala	Smallhead hairtail
Trichiurus lepturus	Largehead hairtail
CHONDRICHTHYES	
SELACHIMORPHA	Sharks
ORECTOLOBIDAE	Nurse sharks
SPHYRNIDAE	Hammerhead sharks
BATOIDIMORPHA	Rays
DASYATIDAE	Stingrays, Whiprays
Dasyatis kuhlii	
Dasyatis urnak	
Dasyatis sp.	
RHINOBATIDAE	Guitarfishes
Rhinobatus holocorhynchus	
TORPEDINIDAE	Electric rays
Narcine timlei	
CRUSTACEA	
Metapenaeus affinis	
" indicus	
" lysianassa	
Penaeus indicus	
" merguiensis	
" monodon	
Parapemaeopsis hardwicki	
" sp.	
Scolonocera subnuda	
Trachypenaeus fulvus	

ANNEX III a

RECORD OF FISHING OPERATIONS

R/V "DR. FRIDTJOF NANSEN", MALAYA EAST COAST CRUISE, 10 - 25 JUNE 1980

BT: Bottom trawl, PT: Pelagic trawl, LL: Longline, HL: Handline

DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
11.6	0435	424	BT	32	32	1°40'	104°25'	0.50	1.0	Carangidae	0.50	
11.6	0858	425	PT		0	1°45'	104°51'	10.00	20.00	Stolephorus sp.(juveniles)	9.90	
11.6	1300	426	BT	42	42	1°36'	105°16'	20.00	40.00	Lutjanus russelli	2.15	0.04
										Daya jerdoni	16.00	0.01
11.6	1620	427	BT	49	49	1°38'	105°39'	6.00	12.00	Selaroides leptolepis	0.60	0.04
										Nemipterus tolu	0.65	0.07
										Squid	3.20	
11.6	2120	428	PT	53	12	2°00'	105°07'	4.20	8.40	Emmelichthys nitidus	0.10	
										Juveniles: Carangidae,Clupeidae, Engraulidae, Scombriadae,Squid	2.45	
12.6	0825	429	PT	28	0	2°28'	104°07'	20.00	40.00	Jellyfish	19.50	
12.6	0932	430	BT	28	28	2°27'	104°07'	22.50	45.00	Selaroides leptolepis	8.90	0.02
										Nemipteridae	2.40	
										Jellyfish	6.00	
12.6	1150	431	BT	14	14	2°33'	103°54'	154.25	308.50	Scomberoides commersonianus	13.00	6.50
										Leiognathus splendens	73.50	0.02
										Upeneus sulphureus	21.75	0.01
										Saurida tumbil	14.50	0.04
12.6	1735	432	PT	47	30	2°20'	104°36'	5.00	10.00	Jellyfish	4.90	
12.6	1916	433	BT	49	49	2°20'	104°35'			(Trawl open)		
12.6	2020	434	BT	47	47	2°20'	104°35'	48.00	96.00	Pentaprion longimanus	4.55	0.01
										Lutjanus lineolatus	3.05	0.06
										Nemipteridae	7.80	
										Synodontidae	4.95	
12.6	2325	435	PT	57	0	2°20'	104°58'	3.80	7.60	Engraulidae (juveniles)		
										Jellyfish	3.60	
13.6	0415	436	PT	61	30	2°42'	104°51'	35.00	70.00	Squid	0.40	0.02
										Jellyfish	34.00	
13.6	0540	437	LL	59	59	2°43'	104°41'	20.00		Carcharhinidae	18.80	4.70
13.6	0858	438	PT	59	35	2°40'	104°39'	100.00	133.00	Jellyfish	99.00	
13.6	1025	439	PT	62	0	2°43'	104°38'	50.00	100.00	Jellyfish	49.00	
13.6	1256	440	PT	47	0	2°37'	104°26'	30.00	60.00	Megalaspis cordyla (juveniles)		
										Jellyfish	29.00	
13.6	1505	441	BT	35	35	2°41'	105°16'	2.50	15.00	Selaroides leptolepis	0.30	0.04
										Squid	1.10	0.04
13.6	1830	442	BT	20	20	2°39'	103°58'	22.85	45.70	Selaroides leptolepis	2.55	0.02
										Pentaprion longimanus	3.60	0.01
										Upeneus sulphureus	2.70	0.02
										Nemipteridae	3.75	
13.6	2056	443	BT	19	19	2°47	103°44'	166.00	332.00	Arius sp.	6.00	0.05
										Selaroides leptolepis	4.50	0.01
										Upeneus sulphureus	9.50	0.01
										Nemipteridae	8.25	
										Psettodes erumei	9.25	0.37
										Dasyatis sp.	79.00	7.90
13.6	2158	444	BT	21	21	2°46'	103°46'	98.40	196.80	Selaroides leptolepis	5.40	0.01
										Pentaprion longimanus	6.45	
										Leiognathus elongatus	5.10	
										Ljutnaus sanguineus	3.00	0.50
										Upeneus sulphureus	30.75	0.01
										Pomadasys hasta	6.90	
13.6	2315	445	BT	16	16	2°47'	103°41'	405.00	810.00	Alepes djeddaba	16.20	0.01
										Atule kalla	16.20	0.01
										Selaroides leptolepis	51.30	0.01
										Siganus canaliculatus	213.30	0.10
										Dasyatis sp.	25.65	0.12

DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
14.6	0115	446	BT	12	12	2°55'	103°37'	355.00	1065.00	Selaroides leptolepis	243.20	0.01
										Sardinella fimbriata	38.40	0.02
										Saurida undosquamis	8.00	0.05
14.6	0540	447	LL	35	35	3°00'	104°06'	0.00	0.00	(No catch)		
14.6	0935	448	PT	54	37	3°00'	104°23'	600.00	1200.00	Juveniles: Carangidae		
										Jellyfish	590.00	
14.6	1155	449	PT	61	0	3°00'	104°39'	15.00	30.00	Juveniles: Carangidae, Lutjanidae, Priacanthidae		
										Jellyfish	14.80	
14.6	1300	450	BT	61	61	2°58'	104°37'	0.00	0.00	(No catch)		
14.6	1758	451	BT	63	63	3°21'	104°40'	16.00	32.00	Nemipterus marginatus	4.10	0.05
										Priacanthidae	3.30	
										Squid	3.45	
14.6	2006	452	PT	58	0	3°21'	104°28'	100.00	200.00	Selar crumenophthalmus	0.65	0.03
										Jellyfish	98.35	
14.6	2330	453	BT	36	36	3°20'	104°00'	53.00	159.00	Arius sp.	8.80	
										Apogonidae	4.20	0.01
										Balistidae	12.40	
										Nemipterus peronii	3.40	0.06
										Squid	4.50	
15.6	0255	454	BT	14	14	3°26'	104°34'	12.00	24.00	Selaroides leptolepis	1.50	0.04
										Siganus canaliculatus	6.60	0.02
15.6	0700	455	BT	36	36	3°40'	103°59'	116.00	232.00	Selaroides leptolepis	4.00	0.03
										Caesio chrysozona	6.80	0.02
										Lutjanus lineolatus	10.00	0.05
										Nemipteridae	7.60	
										Squid	10.20	
										Jellyfish	70.00	
15.6	1535	456	PT	70	15	3°58'	104°53'	30.00	60.00	Jellyfish	30.00	
15.6	1905	457	BT	65	65	4°00'	104°31'	40.40	80.80	Nemipterus marginatus	4.20	0.02
										Priacanthus tayenus	4.50	0.11
										Synodontidae	4.80	
										Gymnura japonica	4.30	4.30
15.6	2010	458	HL	65		3°59'	104°31'	0.00	0.00	(No catch)		
15.6	2100	459	PT		0	3°59'	104°29'	5.50	11.00	Decapterus maruadsi	0.40	
										Jellyfish	5.00	
16.6	0015	460	BT	53	53	3°58'	104°17'	60.00	120.00	Lutjanus malabaricus	9.00	2.25
										Lutjanidae	7.85	
										Nemipteridae	8.50	
										Priacanthus tayenus	5.10	0.15
16.6	0627	461	BT	20	20	4°18'	103°35'	173.50	347.00	Nemipteridae	6.40	
										Daya jerdoni	4.80	0.01
										Rhina ancyclostoma	100.00	100.00
										Taenuria melanospila	50.00	50.00
16.6	0727	462	BT	21	21	4°17'	103°36'	60.00	120.00	Lutjanidae	5.20	
										Mullidae	2.40	
										Jellyfish	50.40	
16.6	1053	463	BT	49	49	4°20'	103°54'	132.30	264.60	Selaroides leptolepis	8.00	0.04
										Lutjanus malabaricus	16.15	1.79
										Lutjanus sanguineus	13.00	4.33
										Lutjanidae	17.50	
										Nemipteridae	6.80	
										Squid	13.35	
16.6	1245	464	PT	51	30	4°20'	103°59'	150.00	300.00	Decapterus maruadsi (juveniles)		
										Jellyfish	149.00	
16.6	1605	465	BT	63	63	4°20'	104°13'	21.40	42.80	Selar crumenophthalmus	2.50	0.18
										Leiognathus bindus	3.25	
										Lutjanus sanguineus	3.10	3.10
										Squid	3.60	
16.6	1830	466	BT	63	63	4°20'	104°25'	16.90	33.80	Leiognathus sp.	1.30	
										Lutjanus lineolatus	2.10	0.07
										Nemipterus marginatus	1.90	0.04
										Squid: Loligo	2.20	0.02

DATE	TIME START	STN NO	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
16.6	2203	467	BT	67	67	4°20'	104°44'	33.30	66.60	Pentaprion longimanus	2.90	
										Lutjanus lineolatus	3.40	0.06
										Nemipteridae	3.30	
										Priacanthus tayenus	4.40	0.16
										Synodontidae	6.15	
17.6	0255	468	BT	70	70	4°40'	105°10'	50.00	100.00	Abalistes stellaris	6.30	0.27
										Pentaprion longimanus	5.60	0.03
										Leiognathus bindus	6.40	0.01
										Nemipterus nematophorus	4.60	0.04
										Nemipterus tambuloides	4.40	0.06
										Synodontidae	7.10	0.26
17.6	0405	469	PT	70	35	4°40'	105°06'	10.00	20.00	Jellyfish	9.30	
17.6	0622	470	BT	69	69	4°22	104°48'	93.15	184.30	Nemipteridae	4.30	
										Priacanthus tayenus	24.30	0.16
										Jellyfish	50.00	
17.6	0920	471	BT	63	63	4°39'	104°29'	24.40	48.80	Nemipteridae	3.50	
										Synodontidae	2.60	
										Squid: Loligo	3.65	0.02
										Jellyfish	10.00	
17.6	1226	472	BT	65	65	4°40'	104°05'	30.00	60.00	Leiognathus bindus	12.20	0.01
										Leiognathus sp.	6.10	0.01
										Nemipteridae	3.90	
17.6	1450	473	BT	56	56	4°40'	103°49'	39.25	78.50	Atule mate	3.90	0.22
										Decapterus maruadsi (juv.)	1.10	0.01
										Selar crumenophthalmus	6.10	0.20
										Lutjanus vitta	5.50	0.12
17.6	1630	474	BT	45	45	4°40'	103°40'	26.30	52.60	Arius sp.	5.50	0.46
										Carangoides ciliarius	1.90	0.02
										Pentaprion longimanus	3.35	0.01
										Nemipterus marginatus	2.00	0.04
										Carcharhinidae	4.20	2.10
17.6	1844	475	BT	25	25	4°39'	103°32'	22.80	45.60	Siganus canaliculatus	17.00	0.03
17.6	2201	476	PT	38	20	5°00'	103°31'	18.90	37.80	"Mixed small fish" mainly Stolephorus sp. and Emmelichthys nitidus	14.80	
17.6	2313	477	BT	47	47	5°02'	103°35'	109.20	218.40	Decapterus maruadsi	5.40	0.02
										Pentaprion longimanus	10.00	0.01
										Leiognathus bindus	9.20	
										Lutjanidae	6.80	
										Nemipterus peronii	8.80	0.15
										Nemipteridae	11.60	
										Epinephelus areolatus	3.20	0.46
										Synodontidae	19.70	
18.6	0535	478	BT	65	65	5°00'	104°34'	23.90	47.80	Pentaprion longimanus	1.90	0.03
										Nemipteridae	4.70	
										Priacanthus tayenus	4.00	0.14
										Jellyfish	5.00	
18.6	0727	479	BT	66	66	5°00'	104°42'	7.75	23.25	Nemipteridae	2.60	
										Saurida sp.	1.80	0.30
										Squid Loligo	1.45	0.02
18.6	1532	480	BT	62	62	5°13'	105°02'	29.75	59.50	Pentaprion longimanus	2.15	0.03
										Nemipterus marginatus	7.30	0.08
										Priacanthus tayenus	10.90	0.16
18.6	1845	481	BT	62	62	5°18'	104°41'	67.40	134.80	Abalistes stellaris	10.95	0.25
										Pentaprion longimanus	3.40	0.02
										Nemipterus marginatus	7.30	0.05
										Priacanthus tayenus	14.35	0.13
										Saurida elongata	4.20	0.16
18.6	2055	482	BT	66	66	5°20'	104°26'	33.60	67.20	Pentaprion longimanus	2.30	
										Mullidae	2.60	
										Nemipteridae	6.80	
										Synodontidae	8.80	
19.6	0425	483	BT	44	44	5°21'	103°22'	45.05	90.10	Decapterus maruadsi	1.30	0.02
										Pentaprion longimanus	4.65	0.02
										Lutjanus lineolatus	3.00	0.05
										Nemipterus peronii	7.70	0.15
										Nemipteridae	3.90	
										Sphyraena obtusata	4.05	0.09

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DATE	TIME START	STN NO	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
19.6	0713	484	BT	15	15	5°18'	103°14'	49.20	147.60	Bothidae	3.40	0.11
										Leiognathus sp.	12.85	
										Mullidae	5.75	
										Nemipterus pernoii	3.40	0.03
										Rhynchobatus djeddensis	4.10	4.10
19.6	0815	485	BT	15	15	5°21'	103°13'	18.95	37.90	Selaroides leptolepis	4.00	0.03
										Upeneus tragula	3.40	0.07
										Nemipterus peronii	3.00	0.10
19.6	0958	486	BT	21	21	5°28'	103°10'	84.80	169.60	Atule mate	8.80	0.13
										Selaroides leptolepis	33.90	0.03
										Daya jerdoni	10.50	0.02
19.6	1128	487	BT	23	23	5°31'	103°08'	393.75	787.50	Arius sp.	171.75	0.67
										Selaroides leptolepis	9.75	0.04
										Lutjanus lineolatus	19.50	0.05
										Nemipteridae	17.25	
										Therapon theraps	163.50	0.11
19.6	1420	488	BT	49	49	5°42'	103°09'	10.75	21.50	Selar crumenophthalmus	3.45	0.27
										Lutjanus lineolatus	1.65	0.03
										Nemipteridae	2.55	
19.6	1645	489	BT	50	50	5°40'	103°25'	9.00	18.00	Selar crumenophthalmus	2.00	0.22
										Pentaprion longimanus	1.30	0.02
										Squid	2.00	
										Jellyfish	3.00	
19.6	1847	490	BT	53	53	5°43'	103°35'	69.70	139.40	Pentaprion longimanus	5.10	
										Upeneus sulphureus	30.20	0.14
										Nemipteridae	5.50	
19.6	2325	491	PT	66	24	5°40'	104°05'	18.25	36.50	Decapterus maruadsi (juv.)	11.10	
										Rastrelliger kanagurta (juv.)	3.20	0.01
20.6	0308	492	BT	57	57	5°40'	104°30'	37.65	75.30	Abalistes stellaris	3.85	0.39
										Pentaprion longimanus	5.60	
										Nemipteridae	5.35	
										Synodontidae	5.65	
20.6	0644	493	BT	58	58	5°56'	104°49'	48.50	97.00	Abalistes stellaris	5.40	0.68
										Nemipteridae	2.20	
										Squid	4.40	0.03
										Jellyfish	26.40	
20.6	0845	494	BT	57	57	5°59'	104°51'	54.10	108.20	Selar crumenophthalmus	25.00	0.12
										Lutjanus lineolatus	3.00	0.08
										Lutjanus sanguineus	3.60	3.60
										Nemipteridae	5.00	
20.6	1054	495	BT	56	56	6°00'	104°41'	31.60	63.20	Selaroides leptolepis	2.40	0.03
										Nemipteridae	8.05	
										Squid	6.50	
20.6	1415	496	BT	61	61	6°00'	104°16'	10.75	21.50	Pentaprion longimanus	1.80	0.02
										Upeneus sulphureus	2.10	0.04
										Gymnocranius griseus	1.30	0.22
20.6	1620	497	BT	71	71	6°04'	104°03'	17.85	35.70	Priacanthus tayenus	1.80	0.23
										Squid	7.20	
20.6	1730	498	PT	67	0	6°06'	104°03'	15.20	30.40	Jellyfish	15.00	
20.6	1950	499	BT	59	59	6°05'	103°49'	21.4	64.20	Abalistes stellaris	2.00	0.50
										Selaroides leptolepis	4.30	0.03
										Nemipteridae	1.60	
										Priacanthus tayenus	3.50	0.08
										Jellyfish	2.30	
20.6	2222	500	BT	54	54	6°00'	103°35'	12.85	38.55	Lutjanus sebae	1.10	0.14
										Nemipteridae	1.80	
										Squid	1.40	
22.6	1036	501	BT	20	20	5°52'	102°44'	44.95	89.90	Atule mate	2.50	0.04
										Squid: Loligo	5.20	0.09
										Jellyfish	35.00	
22.6	1150	502	BT	15	15	5°53'	102°40'	50.00	100.00	Leiognathidae	5.00	
										Parupeneus heptacanthus	4.20	0.03
										Scolopsis taeniopterus	9.80	0.12
										Lobster: Thenus orientalis	4.60	0.14
										Squid	6.65	
										Jellyfish	4.60	

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DATE	TIME START	STN NO	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
22.6	1452	503	BT	20	20	6°10'	102°25'	54.40	108.80	Selar boops	6.00	0.04
										Selaroides leptolepis	11.00	0.03
										Mullidae	2.80	
										Scolopsis taeniopterus	6.45	0.13
										Daya jerdoni	14.70	0.02
										Lobster: Thenus orientalis	2.75	0.15
										Squid	3.00	
22.6	1625	504	BT	20	20	6°17'	102°24'	35.60	71.20	Selaroides leptolepis	10.70	
										Scolopsis taeniopterus	5.40	0.10
										Daya jerdoni	5.70	
										Rachycentron canadus	1.60	1.60
22.6	1824	505	BT	19	19	6°17'	102°14'	15.60	31.20	Chirocentrus nudus	11.00	0.15
										Squid	2.00	0.05
22.6	2225	506	PT	22	5	6°20'	102°31'	1.60	3.20	Stolephorus sp.(juveniles)	0.20	
										Squid: Loligo	0.70	
23.6	0122	507	BT	34	34	6°20'	102°46'	4.85	9.70	Decapterus maruadsi (juv.)	1.05	0.01
										Squid	1.55	
23.6	0255	508	PT	37	18	6°20'	102°49'	11.85	23.70	Stolephorus sp. (juv.)	3.00	
										Scomberomorus commerson	2.45	2.45
										Scomberomorus guttatus	1.35	0.68
										Squid	1.10	
23.6	0656	509	BT	48	48	6°20'	103°13'	18.50	37.00	Selar crumenophthalmus	2.40	0.17
										Squid	3.10	0.05
										Jellyfish	10.00	
23.6	1240	510	BT	61	61	6°20'	103°50'	0.20	0.40	Lobster: Thenus orientalis	0.20	0.20
23.6	1403	511	BT	60	60	6°22'	103°55'	0.00	0.00	(No catch)		
23.6	1640	512	BT	69	69	6°20'	104°05'	0.00	0.00	(No catch)		

ANNEX III b

RECORD OF FISHING OPERATIONS

R/V "DR. FRIDTJOF NANSEN", MALAYA WEST COAST CRUISE, 5 - 14 JULY 1980

BT: Bottom trawl, PT: Pelagic trawl, GN: Gill net

DATE	TIME START	STN No.	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
5.7	1750	513	BT	40	40	5°37'	99°56'	169.45	225.95	Atule mate	9.90	0.17
										Carangoides malabaricus	7.65	0.08
										Nemipteridae	12.15	
										Rastrelliger kanagurta	98.10	0.08
5.7	2205	514	PT	28	0	5°55'	100°00'	6.80	13.60	Stolephorus sp.	0.90	0.003
										Jellyfish	4.70	
6.7	1904	515	BT	15	15	6°15'	99°41'	45.70	68.55	Pennahia macrophthalmus	2.50	0.04
										Trichiurus haumela	35.10	0.17
6.7	2235	516	BT	55	55	6°05'	99°29'	27.50	55.00	Muraenesox cinereus	7.60	1.90
										Nemipterus japonicus	7.80	0.03
										Nemipterus nematophorus	3.50	0.04
7.7	0735	517	BT	97	97	5°50'	98°30'	42.20	84.40	Nemipterus japonicus	7.80	0.05
										Sphyraena forsteri	2.20	0.10
										Seaweed	21.70	
7.7	1040	518	BT	90	90	5°45'	98°45'	197.30	394.60	Pentaprion longimanus	12.00	0.02
										Nemipteridae (5 spp.)	9.10	
										Gymnocranius griseus	6.80	0.45
										Priacanthus tayenus	105.40	0.03
										Dasyatis uarnak	50.00	50.00
7.7	1340	519	BT	67	67	5°45'	99°01'	5.60	11.20	Atule mate	0.80	0.13
										Leiognathus sp.	0.70	0.02
										Nemipteridae (3 spp.)	1.70	
7.7	1600	520	BT	70	70	5°45'	99°09'	3.80	7.60	Jellyfish	3.75	
7.7	2030	521	PT	53	0	5°45'	99°33'	2.50	3.75	Stolephorus heterolobus	0.90	0.005
										Trichiurus haumela	0.80	0.11
7.7	2245	522	BT	45	45	5°45'	99°46'	50.60	101.20	Apogonidae	11.60	0.01
										Nemipterus japonicus	15.40	0.04
										Shrimps	5.30	
8.7	0220	523	BT	27	27	5°45'	100°01'	51.50	103.00	Leiognathus sp.	17.30	0.01
										Pomadasyidae (2 spp)	10.10	
										Sciaenidae	5.90	0.05
8.7	0400	524	PT	30	16	5°45'	99°59'	400.00	1200.00	Stolephorus (2 spp.)	32.00	
										Triacanthus striglifer	344.00	0.09
8.7	0845	525	BT	11	11	5°37'	100°15'	53.40	106.80	Alepes djeddaba	4.40	0.01
										Pennahia macrophthalmus	10.00	0.03
										Pampus argenteus	4.40	0.12
										Tetraodontidae	4.40	0.08
										Shrimp: Penaeus indicus	3.30	
										Squid: Sepia sp.	5.40	0.02
8.7	1110	526	BT	37	37	5°25'	100°02'	13.50	27.00	Chirocentrus dorab	1.00	0.25
										Gerres oyena	1.00	0.05
										Upeneus sulphureus	1.10	0.04
										Nemipterus japonicus	2.10	0.06
										Sphyraena barracuda	1.90	1.90
8.7	1840	527	BT	68	68	5°22'	99°05'	16.40	32.80	Ariomma indica	2.30	0.07
										Leiognathus bindus	6.00	0.02
										Priacanthus tayenus	1.70	0.03
										Sphyraena forsteri	1.30	0.10
9.7	0900	528	BT	46	46	5°05'	100°00'	64.70	129.40	Apogonidae	13.00	
										Atule mate	7.70	0.20
										Lutjanus lineolatus	6.40	0.40
										Lutjanus sanguieneus	19.30	2.04
9.7	1155	529	BT	19	19	5°04'	100°12'	118.80	237.60	Ilisha melastoma	6.30	0.02
										Tetraodontidae	8.10	0.12
										Trichiurus haumela	31.50	0.25
										Jellyfish	60.00	
9.7	1440	530	BT	11	11	4°54'	100°18'	137.50	275.00	Leiognathus sp.	51.00	0.007
										Trichiurus haumela	6.00	0.03
										Jellyfish	53.00	
9.7	1705	531	BT	45	45	4°45'	100°15'	25.20	50.40	Jellyfish	25.00	

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DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
9.7	2025	532	BT	62	62	4°45'	99°46'	58.00	116.00	Nemipterus delagoae	4.40	0.04
										Nemipterus peronii	7.70	0.10
										Sillago sihama	4.80	0.04
										Stingray:Dasyatis kuhlii ads.	15.30	0.67
										juv.	0.60	0.09
9.7	2335	533	BT	57	57	4°45'	99°29'	25.80	51.60	Dactyloptena orientalis	1.50	0.07
										Lutjanus sanguineus	5.00	5.00
										Nemipterus delagoae	6.00	0.08
										Saurida undosquamis	2.00	0.04
10.7	0215	534	BT	60	60	4°32'	99°25'	4.00	8.00	Abalistes sellaris	1.20	0.13
										Decapterus maruadsi	0.50	0.02
										Priacanthus tayenus	0.60	0.05
10.7	0705	535	BT	59	59	4°25'	99°55'	32.60	65.20	Alutera monoceros	4.90	0.98
										Lutjanus malabaricus	5.40	1.08
										Lutjanus vitta	6.40	0.24
										Argyrops spinifer	2.10	0.53
10.7	0955	536	BT	57	57	4°25'	100°08'	6.20	12.40	Atule mate	1.50	0.13
										Diodontidae	0.90	0.23
										Nemipteridae	1.40	
10.7	1200	537	BT	45	45	4°25'	100°15'	94.80	189.60	Alepes melanoptera	83.90	0.24
										Sardinella gibbosa	3.60	0.05
										Rastrelliger kanagurta	2.50	0.05
11.7	0740	538	BT	55	55	3°45'	100°22'	106.80	213.60	Atule mate	5.20	0.08
										Megalaspis cordyla	28.80	0.15
										Formio niger	34.40	0.08
										Nemipterus japonicus	6.80	0.08
										Tetraodontidae	10.40	0.03
										Therapon theraps	10.40	0.08
11.7	1020	539	BT	50	50	3°45'	100°34'	56.80	113.60	Decapterus maruadsi	6.60	0.04
										Selaroides leptolepis	8.40	0.03
										Sardinella gibbosa	6.20	0.05
										Rastrelliger kanagurta	11.60	0.10
										Tetraodontidae	20.00	0.03
11.7	1305	540	BT	20	20	3°44'	100°47'	55.60	111.20	Formio niger	4.50	0.24
										Leiognathus sp.	7.80	0.006
										Sciaenidae	10.20	
										Rastrelliger kanagurta	3.50	0.06
										Jellyfish	10.20	
11.7	1505	541	BT	12	12	3°34'	100°54'	27.30	47.40	Carangidae	2.80	
										Leiognathus sp.	1.60	0.003
										Nemipterus japonicus	1.70	0.08
										Pomadasys hasta	2.70	0.09
										Squid	4.80	
										Jellyfish	3.50	
11.7	2040	542	BT	44	44	3°25'	100°37'	48.70	97.40	Atule mate	2.40	0.02
										Upeneus sulphureus	5.60	0.02
										Saurida spp.	14.50	
										Tetraodontidae	3.60	0.04
										Shrimps	3.40	
12.7	0020	543	BT	54	54	3°25'	100°18'	17.60	35.20	Carangidae (6 spp.)	1.70	
										Nemipteridae	1.10	
										Saurida spp. (2 spp.)	3.70	
										Shrimps	3.20	
										Jellyfish	4.00	
12.7	0655	544	BT	16	16	3°05'	100°50'	69.20	166.10	Atule mate	7.30	0.05
										Carangidae (other)	6.80	
										Pomadasys hasta	10.70	0.15
										Pomadasys maculatus	21.70	0.04
										Therapon theraps	6.40	0.05
12.7	0910	545	BT	30	30	3°18'	100°50'	40.00	80.00	Apogonidae	2.40	
										Leiognathus sp.	9.60	
										Sciaenidae (3 spp.)	2.30	
										Tetraodontidae	2.50	0.04
										Stingray: Dasyatis sp.	4.70	2.35
										Shrimps	4.00	
										Jellyfish	7.00	
12.7	1205	546	BT	40	40	3°40'	100°44'	40.00	80.00	Carangidae (4 spp.)	6.30	
										Tetraodontidae	18.60	0.03
										Jellyfish	7.60	

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DATE	TIME START	STN NO.	GEAR TYPE	DEPTH (M) BOTTOM	DEPTH (M) GEAR	POSITION NORTH	POSITION EAST	CATCH (KG) TOTAL	CATCH (KG) PR HR	DOMINANT SPECIES	WEIGHT (KG) TOTAL	WEIGHT (KG) MEAN
13.7	1015	547	BT	57	57	3°55'	100°25'	11.30	22.60	Nemipteridae (3 spp.)	4.80	
										Squid: *Loligo* & *Sepia*	2.90	
13.7	1355	548	BT	62	62	4°05'	100°14'	32.60	65.20	Abalistes stellaris	3.00	0.25
										Pentaprion longimanus	8.00	0.02
										Nemipterus delagoae	4.50	0.06
										Nemipterus peronii	7.50	0.16
										Squid: Loligo	3.50	0.03
13.7	1740	549	BT	27	27	4°17'	100°29'	48.20	96.40	Thryssa setirostris	4.00	0.006
										Trichiurus haumela	29.50	0.27
										Shrimp:Parapenaeopsis sp.	3.10	
										Jellyfish	5.60	
13.7	2100	550	GN	36	0	4°22'	100°26'	2.10	0.84	Rastrelliger sp.	1.80	0.06
14.7	0200	551	BT	37	37	4°39'	100°12'	100.00	200.00	Percophididae	8.10	0.01
										Selaroides leptolepis	11.50	0.02
										Nemipterus japonicus	18.90	0.05
										Saurida undosquamis	14.80	0.08
										Pleuronectiformes	4.80	
										Shark: Orectolobidae	8.10	2.20

ANNEX IV

Average catch rates (kg. per hour) in bottom trawl at various depth intervals off the east and west coast of Peninsular Malaysia

	East coast			West coast			
Depths	10-25	26-50	51-75	10-25	26-50	51-75	76-100
AMMODYTIDAE	-	-	-	-	-	+	-
APOGONIDAE	0.2	1.7	0.6	0.2	4.7	0.9	-
ARIIDAE	20.5	2.7	0.4	-	0.5	0.1	-
ARIOMMIDAE	-	+	0.2	-	-	0.4	0.3
BALISTIDAE	0.4	3.1	3.7	0.1	1.0	2.4	-
BOTHIDAE	1.3	+	+	-	0.9	+	-
BREGMACEROTIDAE	-	+	-	-	0.2	0.1	-
CARANGIDAE	62.4	8.1	5.9	8.7	23.9	7.8	4.8
CENTRISCIDAE	+	+	-	-	-	+	-
CEPOLIDAE	-	-	-	-	-	+	-
CENTROPOMIDAE	+	-	-	-	-	-	-
CHAETODONTIDAE	-	+	0.1	-	-	0.2	-
CHIROCENTRIDAE	1.5	0.1	+	0.4	0.2	-	1.0
CLUPEIDAE	6.5	+	-	3.9	1.9	+	-
CYNOGLOSSIDAE	1.2	-	-	0.5	0.1	0.1	-
DACTYLOPTERIDAE	1.3	+	0.1	-	0.2	0.3	-
DIODONTIDAE	0.3	0.2	0.6	-	-	0.6	0.2
ECHENEIDAE	0.2	0.3	0.2	-	0.2	0.1	-
EMMELICHTHYIDAE	-	+	+	-	-	-	-
ENGRAULIDAE	0.8	+	-	1.8	0.8	+	-
EPHIPPIDAE	+	-	-	+	-	-	-
EXOCOETIDAE	-	-	-	-	-	-	-
FISTULARIIDAE	0.4	0.7	0.8	-	0.1	0.1	0.9
FORMIONIDAE	+	+	0.1	1.7	0.2	5.3	-
GERREIDAE	2.1	4.1	3.3		0.2	1.4	12.6
GOBIIDAE	-	+	-	-	-	-	-
HOLOCENTRIDAE	+	-	0.4	-	-	0.1	-
LABRIDAE	-	-	+	-	-	-	-
LEIOGNATHIDAE	11.9	1.5	3.1	20.2	5.4	1.4	-
LETHRINIDAE	-	0.1	+	-	-	0.2	-
LOBOTIDAE	-	-	-	1.0	-	-	-
LUTJANIDAE	4.2	10.8	4.0	0.1	4.7	4.0	4.4
MENIDAE	+	+	-	-	-	-	-
MUGILOIDIDAE	-	-	0.1	0.1	-	-	-
MULLIDAE	11.2	2.7	4.4	0.1	1.7	0.8	3.0
MURAENESOCIDAE	-	-	+	0.3	0.6	1.2	-
NEMIPTERIDAE	11.2	9.8	8.4	0.7	8.6	9.4	17.7
OGCOCEPHALIDAE	-	-	+	-	-	0.1	0.3
OPHIDIIDAE	-	-	+	-	-	-	-
OSTRACIONTIDAE	0.3	+	0.1	-	0.1	+	-
PENTAPODIDAE	+	+	0.4	-	-	0.2	6.8
PERCOPHIDAE	-	-	-	-	1.2	-	-
PLATYCEPHALIDAE	1.0	0.1	+	-	0.3	0.4	-
PLOTOCIDAE	-	-	+	0.1	-	0.1	-
POLYNEMIDAE	-	-	-	0.5	0.1	-	-
POMACENTRIDAE	4.1	2.4	0.2	-	-	-	+
POMADASYIDAE	1.4	0.3	0.2	13.5	2.4	0.4	-
PRIACANTHIDAE	0.4	0.7	6.6	-	0.3	0.5	105.7
PSETTODIDAE	1.8	0.2	+	0.1	0.1	-	-
RACHYCENTRIDAE	0.2	-	-	-	-	-	1.3
SCIAENIDAE	1.3	-	+	7.8	2.2	+	-
SCOMBRIDAE	1.3	0.1	0.7	2.8	13.1	0.3	-
SCORPAENIDAE	+	0.9	0.1	-	0.5	0.1	-
SERRANIDAE	+	1.0	1.2	0.2	0.6	0.3	-
SIGANIDAE	26.8	0.7	0.1	-	0.5	0.2	-
SILLAGINIDAE	1.2	-	-	-	-	0.8	-
SOLEIDAE	0.2	-	-	-	-	0.1	-
SPARIDAE	+	-	-	-	-	0.3	-
SPHYRAENIDAE	0.4	0.9	0.4	0.7	0.6	0.6	2.2
STROMATEIDAE	-	-	-	2.4	0.1	-	-
SYNODONTIDAE	4.8	4.7	4.6	0.9	6.4	1.9	1.3
TETRAODONTIDAE	2.8	0.8	0.2	5.0	7.5	1.9	2.4
THERAPONIDAE	17.5	-	+	2.5	-	1.6	-
TRIACANTHIDAE	1.1	-	+	0.1	-	-	-
THRIACANTHODIDAE	-	-	+	-	-	-	-
TRICHIURIDAE	+	0.5	+	19.6	5.3	0.1	-
TRIGLIDAE	-	-	0.4	-	-	-	-
URANOSCOPIDAE	-	0.2	0.1	-	-	-	-
"Mix"/unidentified	1.0	1.1	0.1	-	-	-	-
SHARKS	0.6	0.6	0.6	-	1.7	0.1	-
RAYS	28.8	3.1	0.8	1.0	1.1	2.7	50.0
CRUSTACEA	3.7	1.5	0.7	4.5	3.2	1.1	0.1
CEPHALOPODA	4.7	8.2	4.4	5.4	2.6	2.4	3.4
Demersal fish	154.9	52.7	45.3	59.6	54.8	37.7	197.1
Pelagic fish	85.0	13.8	13.0	37.3	45.3	10.9	17.4
TOTAL	245.7	74.7	58.3	106.9	105.9	52.1	218.0
No of trawl hauls	19	15	28	7	13	13	2

Annex Va. Length frequency distributions. R/V "Dr. Fridtjof Nansen", Peninsular Malaysia East Coast Cruise, June 1980. (Part 1)

FAMILY Species	Stn No.	n	Total length in cm 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	35 36
ARIIDAE Arius sp. (see Part 2)										
BALISTIDAE Abalistes stellaris	468	23					3 2 1 5	3 2 2 5		
	473	6				2	1 1	1 1		
CARANGIDAE Atule mate	473	18					1 3 1 3	5 3 1 1		
	477	5					1 3 1			
	486	23			1	1	3 2 3 7 3	1 2		
	501	70			1 3 12	22 15 12 2 1	2			
Decapterus macrosoma	483	24			1 5 9 7	2				
Decapterus maruadsi	473	191	1	1 87 55 26	14 6 1					
	477	114		2 5 1 1	15 33 33 8	4 4 4 1	2 1			
	483	71		2 24 5	1 4 23 5	2 1	1 3			
	491	53		2 42 9						
	507	116		5 46 44 5	2 3 3	4 2 2				
	508	46		22 15	1 2 4 1		1			
Selar boops	503	46			8	13 21 4				
	436	4					1 3			
Selar crumen-ophthalmus	465	14					1 2 1 1	7 1 1		
	473	30					1 3	11 6 6 3		
	488	13						2 5 4 2		
Selar crumen-ophthalmus (continued)	494	108				13 17 1	10 25 21 12 7	1 1		
	507	13			1	4 2 3	1 2			
	509	14					3 2 3	2 1 3		
Selaroides leptolepis	430	118			9 28 44 28 9					
	434	81		1	22 57 1					
	442	149		21	52 53 7 7	6 2 1				
	444	40		3 10 18	5 4					
	446	41			14 18 9					
	455	32		1 3 1	5 2 8 2 1	6 3				
	463	43			2 16	20 5				
	483	92	1	35 38 3 1 8	5	1				
	485	125		1	8 13 18 22 10	24 18 9 2				
	486	113			1 6 25 33 10	24 11 2 1				
	499	83			9 12 42	14 4 2				
	501	20			3 1	7 8 1				
	503	55			1 1 5 10 25	11 2				
Seriolina nigrofasciata (see Part 2)										
CHIROCENTRIDAE Chirocentrus dorab/nudus (see Part 2)										
CLUPEIDAE Dussumieria acuta	431	5			1 1 1 1	1				
Sardinella fimbriata	446	53			4 12 30	4 2 1				
	508	64		1 18 27 17	1					
Sardinella leiogaster	506	18		1 7 6 1	3					

(Part 1)

FAMILY Species	Stn No.	n	Total length in cm 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	35 36
Sardinella sirm	506	20		2 12 5	1					
ENGRAULIDAE										
Stolephorus sp.	425	71	19 47	5						
	443	19			2 10 6 1					
	506	55	30	25						
GERREIDAE										
Pentaprion longimanus	434	100		2 16 31	25 10 16					
	442	102		2 28	66 5 1					
	451	10		4	2 1 2 1					
	465	43		4 18	10 1 9 1					
	468	50			11 13 21 5					
	474	73		15 37	17 4					
	480	78		1	9 23 35 9	1				
	483	55		1 15	9 9 13 5 3					
	497	22			1 4 10 6 1					
HOLOCENTRIDAE										
Holocentrus sp.	468	8				1	2 2 2	1		
LEIOGNATHIDAE										
Leiognathus elongatus	442	156		11 92 41 12						
	485	45		2	1 19 16 6 1					
LUTJANIDAE										
Caesio chrysozona	455	78		4 13	6 2 15 29 6	3				
	494	32			1 15 14 2					
Lutjanus lineolatus	434	54			1 3 7	19 13 8 2	1			
	455	49		1	1 16	20 9 1 1				
	460	55			4 14	19 6 7 3 2				
	466	31				4 12 8 3 1	2 1			
	477	70		1	2 9 39	11 4 3	1			
	483	56		2 3	2 3 3 6	6 7 14 8 1	1			
	486	26	14	10 1 1						
	487	29			7 5 2 1	4 7 3				
Lutjanus russelli	426	58			12 21 15	6 4				
Lutjanus vitta	460	11				1 2 2 1	2 2			1
	463	14					1 2	4 2 1	2 1 1	
	473	48				1 2 16 14	9 2	2 1	1	
MULLIDAE										
Parupeneus heptacanthus	442	5			1 1 2 1					
	460	41		2 1	3 6 4 6 2	1 2 1 3	2 4 1 2 1			
	486	21			2 2 4	2 6 2 2	1			
	502	137		1	7 30 21 21 21	26 8 2				
Upeneus bensasi	434	90		2	13 25 31 5 1	5 2 6				
	457	40	2 4 6 7 3		9 6 1 1	1				
	460	82	2 1 3 3 4		15 20 13 11 6	2 2				
	484	90		2 4 13	18 23 17 7 4	2				
Upeneus moluccensis	468	67			6 10	22 13 10 5 1				
	482	35			6 6 8	6 5 3 1				

(Part 1)

FAMILY Species	Stn No.	n	Total length in cm 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	35 36
Upeneus sulphureus	431	100		1 1 10 37	46 5					
	442	153		9	76 67 1					
	444	112		1 1 48	57 5					
	490	88			1 6 18 30 24	6 3				
	496	50			6 16 12	9 4 3				
Upeneus tragula	442	63		9 17	20 16 1					
	453	61		4 4	7 20 18 4 1	2 1				
NEMIPTERIDAE Nemipterus bathybus	467	25		1	1 3 4 2 4	4 3 2 1				
	472	7				1 2 1 1	1 1			
Nemipterus japonicus	477	15		1	5 2 1 6					
Nemipterus marginatus	430	34			5 8 10 4 3	1 1 2				
	434	100		2 4	6 27 20 17 11	3 5 1 3	1			
	442	6			2 2 1 1					
	451	77		1	7 5 7 9 5	9 8 8 6 3	1 2 3 1	1 1		
	457	87		2 10 13	18 12 10 7 3	2 2 4 1	2 1			
	465	35		2 3	11 8 7 3	1				
	466	54		2	11 11 5 5 6	4 4 1 1 1	2 1			
	474	55		1	2 7 13 9 3	6 5 5 3	1			
	480	95			2	6 19 19 23 10	6 3 2 1 3	1		
	481	54		1 3 2	6 2 3 2 1	7 5 7 5 6	4			
	482	31		1	3 1 1 3	3 5 3 1 2	3 3	1 1		
	490	46		2	7 10 12 3 3	1 2 2 2 1	1			
Nemipterus mesoprion	430	12			2 1 2	2 3 2				
	434	28		1	7 6 4 4 3	3				
	442	37		3	7 9 7 3 1	1 3 3				
Nemipterus nematophorus	451	13			3 4	2 1 1	1 1			
	468	27			1 7 8	4 2 4 1				
	472	14		2 1	1 4 2 1	1 1 1				
	478	11			3	3 1 2 1 1				
	482	34			1 1 7 6	3 1 7 3 2	1 1 1			
Nemipterus nemurus	434	39		3	4 8 4 4 3	3 4 1 3	1 1			
	455	7			1	3	1 2			
	460	25			3 3 4	4 1 2 3	3 2			
Nemipterus peronii	434	24			1	3 2 3	2 3 2 3 2	2 1		
	442	7			1 1 3 2					
	455	11				1 3 3	2 1	1		
	460	37			1	1 3 2 8 6	1 1 3 4	3 1 2 1		
	472	5		1	1 1		1	1		
	477	57				1 2	7 7 10 8 7	5 4 4 2		
	483	53			1 1 1 1	1	2 4 11 7 4	7 8 3 1		
Nemipterus tambuloides	468	20			1 1 2	8 2 2 3	1			
	472	53		3	7 3 6 4 4	3 5 6 5 1	4 2			
	480	9				1 2	3 1	1 1		
	482	24				2 2 1 3 3	1 3 4 3	1 1		

(Part 1)

FAMILY Species	Stn No.	n	Total length in cm: 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	35 36
Nemipterus sp.	442	4		1	1 2					
Scolopsis taeniopterus	430	16			1 1 2 3	4 3 1 1				
	442	75		2	9 24 31 3	1 2 1	1 1			
	502	81			3 4	2 1 8 30	11 7 1 1 5	5 2 1		
	503	49			1 2 2	2 1 6 6	7 3 2 5 6	4 2		
Scolopsis sp.	503	11			1 2 3	1 2 1 1				
POMACENTRIDAE Daya jerdoni	430	33		1 3 10 13	2 4					
	442	62		8 26 20 6	2					
	461	108		3 11 31 39	16 7 1					
	486	111		3 29	49 18 11 1					
	503	75		2 6	13 24 25 5					
PRIACANTHIDAE Priacanthus macracanthus	434	34			1 6 6 1 8	3 4 2	2 1			
	451	9			1		1 1 2	4		
	473	11					1 4	4 2		
Priacanthus tayenus	442	31		1	13 13 4					
	451	12			1		1 3 1	4 2		
	457	20		1	1 1	2	2 3 2 3	2 3		
	460	34				1 1 1 5	4 10 5 5 2			
	468	7				1	1 1 1 2 1			
	478	28			2	1 1	2 8 1 3 3	2 4 1		
	480	67				2	2 7 6 9 5	14 13 9		
	499	45		1	1 9 9 1 2	2 2	3 5 3 1 4	2		
SCIAENIDAE Pennahia pawak	442	5				2 3				
SCOMBRIDAE Rastrelliger kanagurta	463	4					1 1	1 1		
	491	33		1 5	11 16					
	507	14		4 3 3	3 1					
	508	60		1 5 14 23	16 1					
SERRANIDAE Epinephelus areolatus (see Part 2)										
SIGANIDAE Siganus canaliculatus	475	77			8 38 30	1				
	485	44			1 2 5 22 12	1 1				
SPHYRAENIDAE Sphyraena jello (see Part 2)										
Sphyraena obtusata	483	17					2 1 6	6 2		
SYNODONTIDAE Saurida elongata (see Part 2)										
Saurida micro-pectoralis	482	15				1 1	2 1	1 1 3	1 2 1 1	
Saurida tumbil	431	67			1	3 12 16 15 8	4 4 1 1	1 1		
Saurida undosquamis	430	12			1 3	1 1 2 2	2			
	434	41			1 1 1	3 4 4 3 2	7 2 2 4 4	1 1 1		
	442	4		1	1	1	1			
	460	17			2	1 2 2	1 1 1 2	1 1	1 2	

(Part 1)

FAMILY Species	Stn No.	n	Total length in cm 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	35 36
Saurida sp. (see Part 2)										
THERAPONIDAE										
Therapon theraps	487	97		2	1	1 3 16 19 16	19 15 4	1		

(Part 2)

FAMILY Species	Stn No.	n	Total length in cm 14	15 16 17 18 19	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
ARIIDAE										
Arius sp.	443	24		5 13 6						
	468	6				2 2		1		1
	487	17				1	1 2 1	1 1	2 2 2	1 3
CARANGIDAE										
Seriolina nigrofasciata	473	5					1	3		1
	477	2					2			
CHIROCENTRIDAE										
Chirocentrus dorab/nudus	505	72					1 2 7 6	10 7 14 9 3	5 5 1 1 1	
SERRANIDAE										
Epinephelus areolatus	460	9		1	1 2 1	2 1	1			
	463	6		1	1		1	1 2		
	477	7				1	1 1 1	1 1	1	
SPHYRAENIDAE										
Sphyraena jello	491	9						2	4 3	
SYNODONTIDAE										
Saurida elongata	430	3		1	1	1				
	434	18		2	1 1 1 1 1	1 2 4 1	2	1		
	468	27				1 1 2	5 4 2 6 1	1 2 1	1	
	481	10	1 (+ 1 of 11 cm)	1 1		1	2 2 1			
Saurida sp.	460	5					1 1	1 1	1	
	482	25	1	1 1 1	2 1	1	3 1 2 2	1 1 2 2 1		1 1

Annex Vb. Length frequency distributions. R/V "Dr. Fridtjof Nansen", Peninsular Malaysia West Coast Cruise, July 1980. (Part 1)

FAMILY Species	Stn No.	n	Total length in cm 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	35	36
ARIOMMIDAE																																			
Ariomma indica	527	35											2	8	13	9	3																	
CARANGIDAE																																			
Alepes djeddaba	525	97						1	14	24	32	23	3																						
	544	18													1	6	10	1																	
Alepes kalla	544	12															2	3	4	2	1														
Alepes melanoptera	537	83																			1	2	1			6	16	11	12	15	5	8	1	2	3
	539	14											2	3	7	2																			
	546	7											1		1	3	1	1																	
Atropus atropus	544	13										1	2	3	3	2	2																	
Atule mate	513	13																			2	3	2	2	1	2								
	519	6																		1	5														
	528	25															1			2	2		1	4	4	5	6								
	536	12																		1	7	4													
	538	40												2	5	2	2	7	13	7	2														
	544	81							2	4	3	6	4	9	21	21	4	1		2	1	2	1												
	546	12								3	2	1		1	3	1					1														
Carangoides malabaricus	513	21				1				1	1	1		2	3	4	4	2	1	1															
	517	11													2	2		1	3	3															
	526	16							1	2	7	3	3																						
Carangoides malabaricus (continued)	535	5																									2	1			1		1	
	544	10						1		2	3	1	2	1																					
Decapterus maruadsi	528	96		11	40	15	13	8	8		1																								
	539	75											2	17	51	5																			
Megalaspis cordyla	538	47																				2	7	13	14	9	2								
Selaroides leptolepis	528	179	43	59	7	4	13	6	3	3		7	19	12	3																				
	532	19						1	1	10			2	1	2	2																				
	539	137									8	96	31	2																					
	544	36			5	9	7	5	3		4	2	1																						
	546	19									12	7																							
CLUPEIDAE																																			
Ilisha melastoma	515	12									2	4	4	2																					
	529	111				1	1	1	2	53	44	8	1																						
Sardinella fimbriata	514	32								23	8				1																				
Sardinella gibbosa	537	80													20	55	5																		
	539	64													1	40	23																		
Sardinella sirm	514	26								1	9	16																							
ENGRAULIDAE																																			
Setipinna taty	525	14										7	3	2	1	1																		

(Part 1)

FAMILY Species	Stn No.	n	Total length in cm 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
Stolephorus heterolobus	521	99	12 70 17					
Stolephorus sp.	514	79	33 46					
	529	15	1	13 1				
	530	37	7	27 3				
	540	27		8 19				
Thryssa setirostris	515	16		1 9 6				
	549	79	10 31	25 12 1				
FORMIONIDAE Formio niger	538	44		1 1	19 23			
GERREIDAE Gerres oyena	526	19		1 5 3	4 2 2 2			
Pentaprion longimanus	517	32	1 1 2 2 2	2 14 8				
	518	79	1 1 7	12 26 25 7				
	548	150	1 3	28 71 43 4				
LEIOGNATHIDAE Leiognathus bindus	527	70	8	25 27 10				
LUTJANIDAE Lutjanus lineolatus	528	98	3 6 2 1	1 8 5 21	25 13 7 3 3			
	532	26		1 6 8	9 1 1			
Lutjanus malabaricus (see Part 2)								
Lutjanus sanguineus	522	8			1 1	1 2 1 2		
Lutjanus vitta	532	8			1	2 1 2	1	1
	535	27				2 5 6	3 2 4 2 3	
MULLIDAE Upeneus sulphureus	542	67		22 22 15 8				
NEMIPTERIDAE Nemipterus delagoae	528	19		1 1	1 5 3 3 1	3 1		
	532	100	3 6 6	5 9 5 7 8	15 10 8 4 3	2 3 1 3 1	1	
	547	34		8	2 2 1	1 2 4 3	4 1 1 1 1	2 1
	548	77	2	4 4 2 3 9	4 2 3 5 1	10 3 8 6 7	4	
Nemipterus japonicus	513	31		6 9	7 3 5	1		
	516	135		6 38 44	36 9 2			
	517	71		1 2 5 9 10	17 11 2 4 5	4 1		
	522	118		8 3 10 38 31	10 5 3 1	1 1 5	1 1	
	526	36		1 5 4	12 6 3 3 1	1		
	528	20		2 2 6	7 1 1 1			
	538	21			4 5 2 2 1	3 3 1		
	541	22		1 1 4 4	2 4 1 2	2 1		
	542	42	1 4 11 9	3 5	1 1 2 1 1	2 1		
	547	8		1	3 1	1 1	1	
Nemipterus mesoprion	513	20		1 2	4 3 10			
	526	9		3 1 1	1 1 1 1			
Nemipterus nematophorus	516	93		4 28 31 3	5 9 4 1 2	3 2 1		

(Part 1)

FAMILY Species	Stn No.	n	Total length in cm 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
Nemipterus peronii	532	75		1 1	3 3 5 8 10	8 8 6 9 8	4 1	
	547	19	5	1 1 2	1	1 1 3 2 1	1	
	548	48	1	2 3 3	4 6 3 5 2	2 3 2 3 3	3 3	
Scolopsis vosmeri	532	17		1 1 4	5 6			
POMADASYIDAE Pomadasys hasta	523	149	11 32 76	25 2 3				
	541	31			6 3 12 9 1			
	544	40			1 2 5	8 5 7 5 4	2 1	
Pomadasys maculatus	544	87		5 26 31 16	6 2 1			
PRIACANTHIDAE Priacanthus tayenus	518	101		18 55 14 3	3 4 3 1			
	527	54		16 27 5 1	2 2 1			
SCIAENIDAE Johnieops sp.	515	15		1 2	4 2 5 1			
	540	32	1	1 6 5 2 7	6 4			
Nibea soldado	540	16			2 2 3 3 2	2 1	1	
Otolithes ruber	525	20		2 2 1 3	2 4 1 3	1 1		
Pennahia macrophthalmus	515	61		4 2 4 12 25	7 3 3 1			
	525	80	1	9 10 15 20 19	6			
	540	59	1	4 1 10 7 10	11 12 3			
SCOMBRIDAE Rastrelliger kanagurta	513	53			7 29	13 2 2		
	519	6				1 5		
	521	6		1 1	1 2	1		
	537	46			2 30 10	1 2 1		
	539	59			1 4 7 6	4 13 18 6		
	540	30			22 7 1			
	550	32		2	8 14 4 1 3			
SILLAGINIDAE Sillago sihama	532	36			4 9 7 9 6	1		
SPHYRAENIDAE Sphyraena forsteri	517	22				2	8 2 3 3 3	1
	527	13				1 1 2 3	2 2 2	
STROMATEIDAE Pampus argenteus	525	20		3	4 1 1 1 5	2 2 1		
SYNODONTIDAE Saurida tumbil	(see Part 2)							
Saurida undosquamis	516	30		1	3 2 7 9	3 3 1 1		
	517	14			2	2 4 1 1	1 1 1	1
	527	12			1 1 2	1 3 2 2		
	542	140		1 3 4 5	14 30 24 21 17	7 10 4		
	547	43	1 5 11	17 1 2	3 2 1			
TETRAODONTIDAE Tetrosomus gibbosus	545	62	8	4 3 20 14 6	1 5 1			

(Part 1)

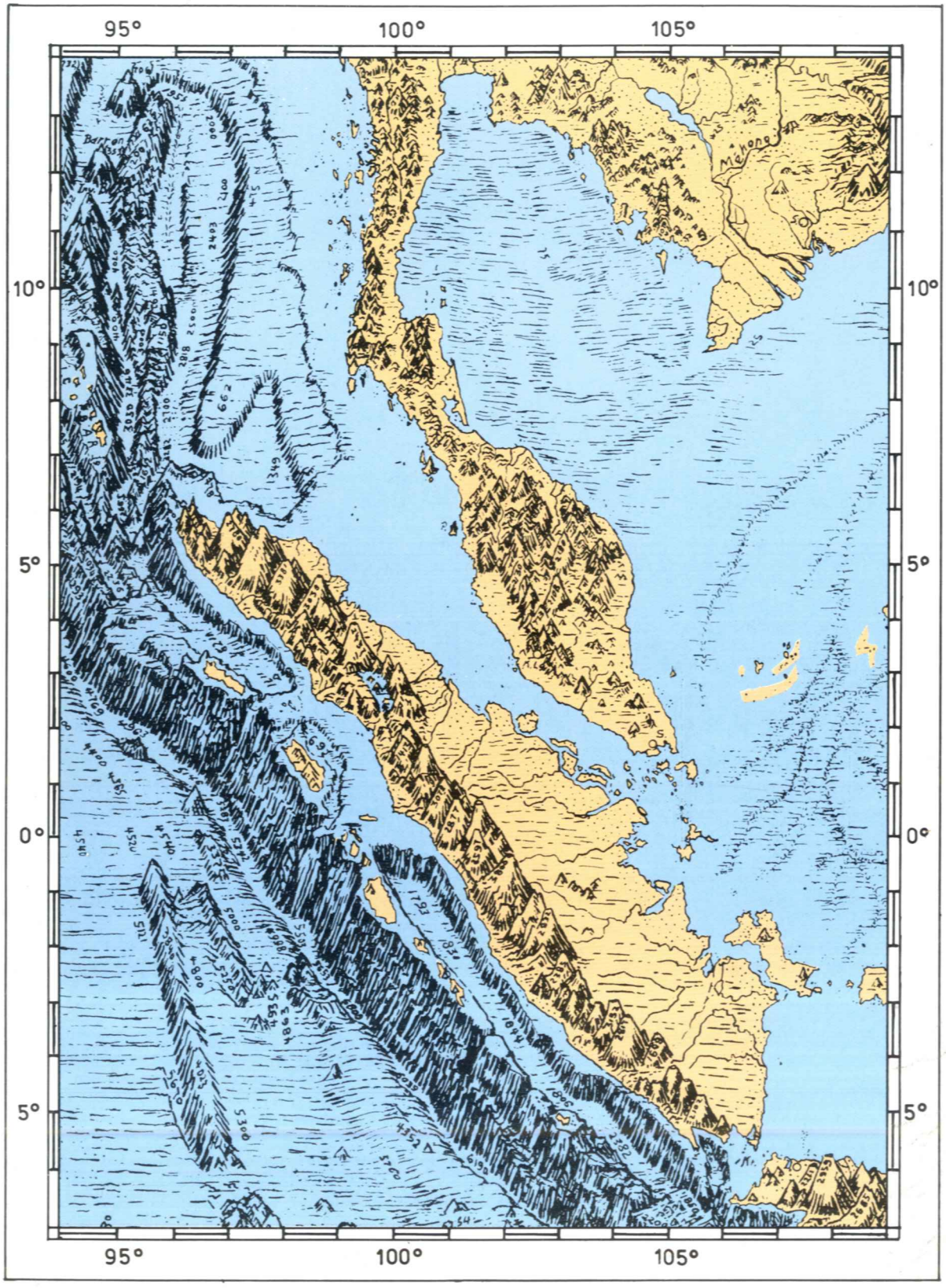
FAMILY Species	Stn No.	n	Total length in cm 05 06 07 08 09	10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33 34
THERAPONIDAE								
Therapon theraps	538	33		2	6 9 9 4 1	2		
	544	73		1 3 15 27	18 5 3 1			
TRICHIURIDAE								
Trichiurus haumela (see Part 3)								

(Part 2)

FAMILY Species	Stn No.	n	Total length in cm 15 16 17 18 19	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
LUTJANIDAE								
Lutjanus malabaricus	535	5						1 5
SYNODONTIDAE								
Saurida tumbil	542	60	1 1 3	4 6 10 3 2	5 4 4 3 2	2 1 3 2 1	1 1 1	

TRICHIURIDAE Trichiurus haumela (Part 3)

	Total length in cm 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67 68 69	70 71 72 73 74	75 76 77 78 79	80 81 82 83 84	86
Stn No. 515 (n: 61)	1 2 2 2	5 8 8 5	1 3 2 2 2	5 2 2		1 1 1	1 1 1	1 1	1
Stn No. 521 (n: 7)	1	1 1 1 1	1 1						
Stn No. 549 (n: 31)			1 1	1 1	2 1 2 3 3	3 1 5 2 4	1		



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A.S JOHN GRIEG