Some Consideration on the Relationship between Environmental Factors and the Distribution of Fisheries Resources in the South China Sea and the Andaman Sea

by
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Abstract

This paper discusses the relationship between environmental factors and the distribution of fisheries resources in the South China Sea and the Andaman Sea, based on the oceanographic and fisheries resources data collected by R/V CHANGI from November, 1969 to Marvh, 1973.

The fish catch is related more to the bottom topography than the bottom feature of the sea. Good mean catch (> 200 kg/hr) was obtained in upwelling regions at the steep continental slope in areas off the north and the east coast of the Andaman Sea, and in areas with boundary zone at the flat area along the east coast of Malay Peninsula.

The distribution of fisheries resources was also related to the hydrological factors. In general, better catch (> 116 kg/hr) was obtained from areas having depths of 45–65 m, salinity range of 32.0 – 33,5 $^{0}/_{00}$ and bottom temperatures above 23°C. However, in the coastal waters off Sarawak and North Andaman Sea (off Burma), good fishing grounds were characterized by low salinity, low temperature and high nutrient contents, suggesting the influence of freshwater discharge in the area. Abundant occurrence of coastal water fishes were found in these areas.

From the present analysis, it appears that the combination and interaction of both hydrological and topographic conditions are important factors contributing towards the formation of good fishing ground in the surveyed areas.

1. INTRODUCTION

It is known that the environmental factors play an important role in the distribution of fisheries resources although the relationship is rather complex. In order to study this relationship the data from the oceanographic and fisheries resource survey carried out by the 387-ton research vessel CHANGI in the southern part of the South China Sea and the Andaman Sea from November 1969 to March 1973 were analysed. Special attention was paid to the various factors contributing towards the formation of good fishing grounds.

2. MATERIAL AND METHODS

Catch data for this study were obtained by experimental trawl fishing by CHANGI, with the use of a 4-seamed net having a head rope length of 36 m and towed at a speed of 2.5 to 4.5 knots. The original trawl catches obtained from each half-degree block of 30 square miles were converted into mean catch per hour for the respective monsoon and intermonsoon seasons.

Catch data obtained from the preliminary exploratory vertical headline fishing in the Andaman Sea in February 1973 were not converted.

Analyses of water samples collected by Nansen (Nansen) reversing bottles and mud samples collected by SK-type sampler were as described in a previous paper (Shirota et al., 1972).

3. RESULTS AND DISCUSSION

From the analyses of the catch data, a comparative study was made between the northeast monsoon, the southwest monsoon and the intermonsoon periods in the South China Sea. As no catch data were available during the southwest monsoon in the Andaman Sea, comparison of catch between the two monsoon seasons in the region was not possible.

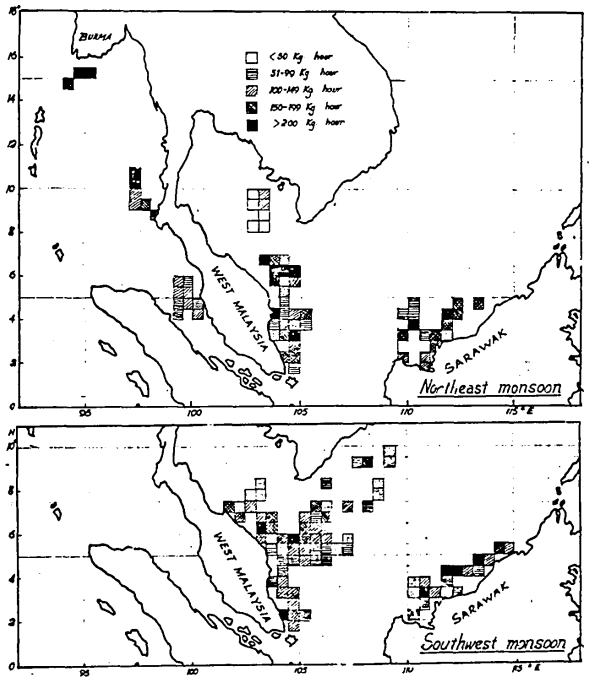

Fig. 1 Variation in trawl catch by block in the northeast and southwest monsoons (1969–73).

Fig. 1 shows the mean catch per hour per block during the northeast monsoon (October-March) and the southwest monsoon (May–August) season. On the whole the mean catch for the respective seasons fluctuated considerable in the South China Sea.

During the northeast monsoon season, high means catch per hour (more than 200 kg) was observed in the 7 blocks along the east coast of the Malay Peninsula and 2 blocks in the west coast of Sarawak, while in the southwest monsoon season, such high catch was observed in 3 blocks along the east coast of the Malay Peninsula and 4 blocks in the west coast of Sarawak. However, during the intermonsoon season, mean catch of similar magnitude was not observed in any block.

Taking into consideration of the above mentioned results the analysis of the environmental factors contributing towards the formation of good fishing grounds was carried out.

3.1 Bottom Feature

Since the distribution of demersal fisheries resources largely depends on the different types of sea beds, which in turn are related to different current movements, there may be a relationship between catch and bottom feature in the South China Sea. The catch data superimposed onto a map illustrating the bottom feature of the South China Sea is shown in Fig. 2. As far as the trawl catch in the South China Sea is concerned no clear relation between the catch and bottom obtained from both sandy and muddy areas.

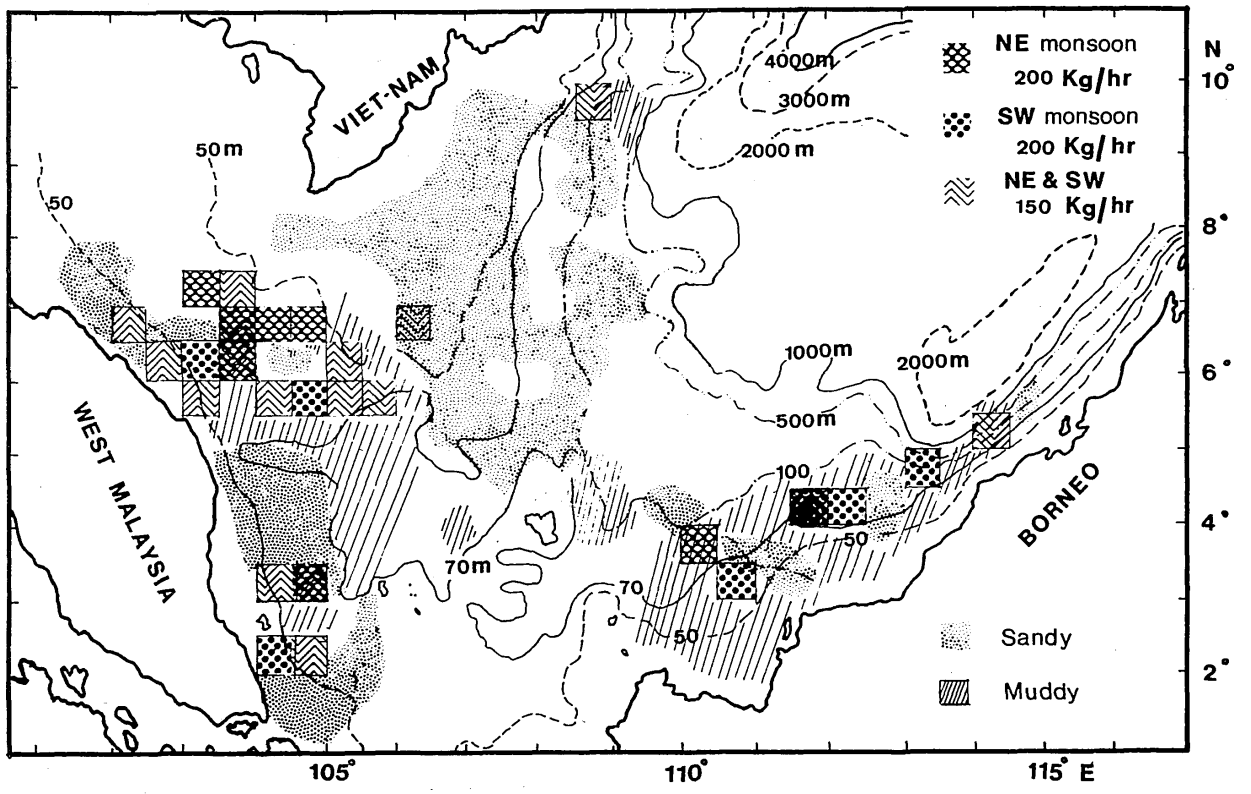

Fig. 2 Bottom feature and mean catch per hour.

3.2 Bottom topography

Fig. 3 shows the bottom topography of the South China Sea, the Straits of Malacca and the Andaman Sea with superimposed catch data. In the area off the Northeastern coast of Sarawak the depth increases sharply from 100 to 1000 m. Upwelling may easily occur when the offshore water moves towards coastal region across the steep continental slope. A similar pattern of bottom topography is also seen in the Andaman Sea from its north western to central part. It can be seen from the figure that good mean catch of more than 200 kg/hr was obtained from these areas. However similar catch was also obtained from the flat area in the southwestern part of the South China Sea where strong upwelling cannot be expected. This may be due to the pressence of a boundary zone formed along the east coast of the Malay Peninsula as explained in the next section.

3.3 Hydrological factors

Fig. 4 shows the relationship between fish catch and hydrological factors in 1971–1972 in the South China Sea. A better fish catch was obtained from areas having depths of 45–65 m, salinity range of 32.0–33.5% and bottom temperatures above 23 °C.

Fig. 5 illustrates the surface isohalines drawn from data collected in 1970–1973 by CHANGI during both northeast and southwest monsoons. From the figure it can be seen that the sharp gradient in salinity is located in some areas where the offshore water supposedly intrudes into the coastal water especially along the east coast of West Malaysia and the northwest coast of Borneo where good

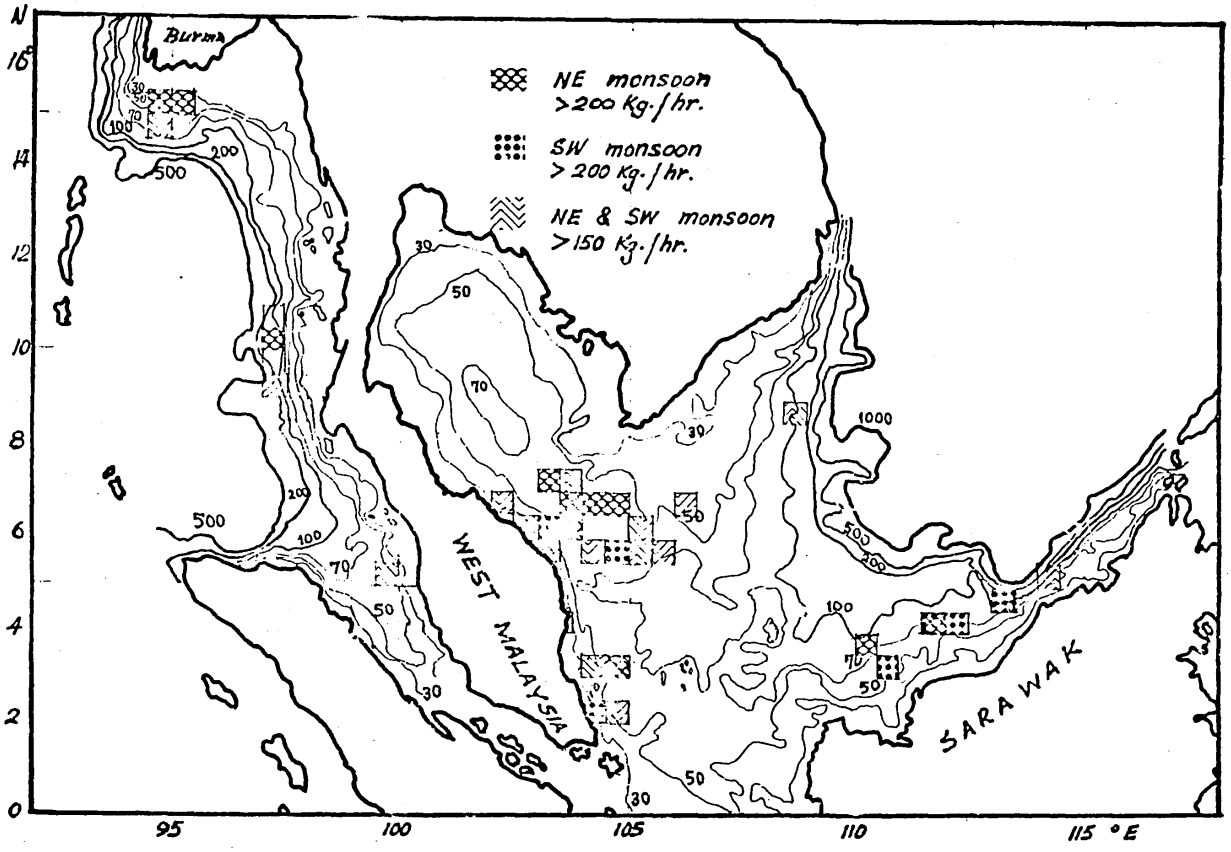

Fig. 3 Bottom topography and mean catch per hour.

mean catch per hour was obtained.

It may be of interest to note that the surface isohaline of 33.5% is situated close to the east coast of the Malay Peninsula. This pattern was also observed in both seasons in 1950–1955 (Wyrtki, 1961). Thus, a long and narrow strip of boundary zone is formed along the east coast of Malay Peninsula in both monsoon periods, and this may account for the relatively good catch in this area in the northeast and southwest monsoon seasons.

The good fishing grounds in the northwest region (15°00'N, 94-95°30'E) of the Andaman Sea displayed a different hydrological pattern (Fig. 6). This pattern is characterized by low temperature and salinity and high nutrient contents suggesting the influence of considerable freshwater discharge from the Irrawaddi and Sittang rivers.

The Phosphate-Salinity (P-S) diagrams show different patterns between coastal and offshore waters (Fig.7). Thre is a tendency that water with high salinity has low PO_4-P contents whereas water with low salinity is accompanied by high PO_4-P contents in coastal waters. However, in offshore waters such tendency has not been observed.

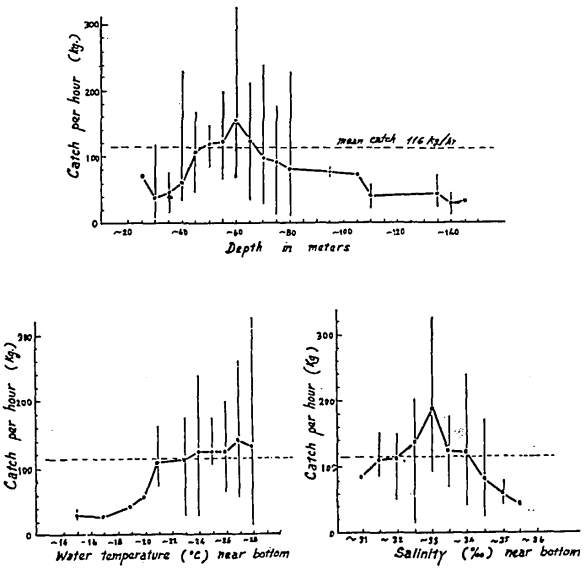

Fig. 4 Relationship between fish catch and environmental factors in the South China Sea (1971–72)

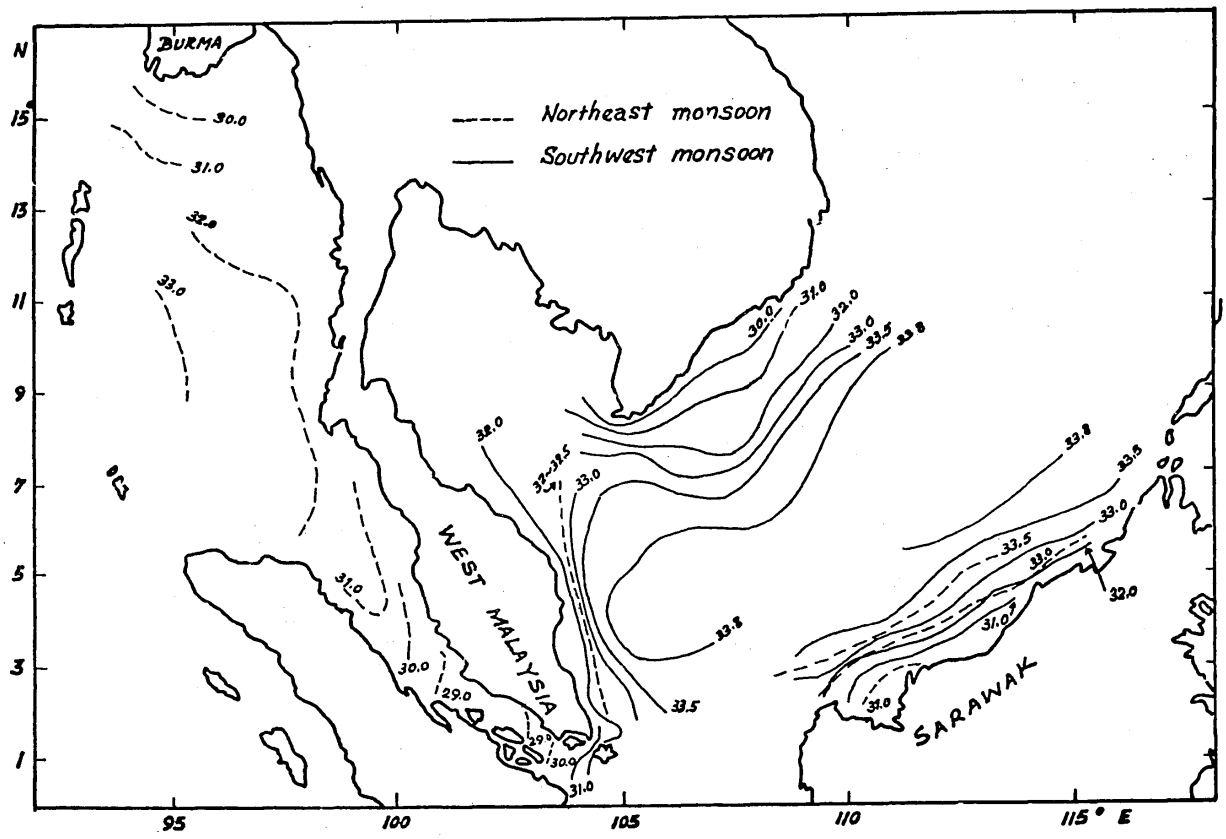

Fig. 5 Distribution of surface salinity in the northeast and southwest monsoons (1970–73)

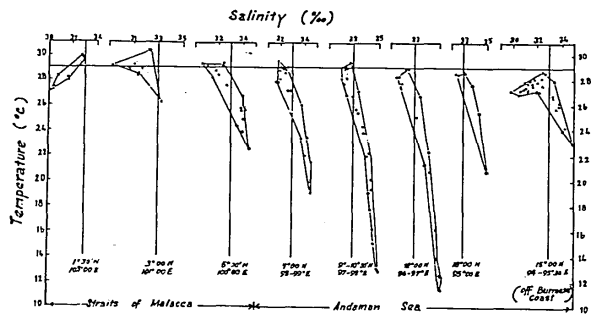

Fig. 6 Temperature-salinity diagrams for the Straits of Malacca and the Andaman Sea in the northeast monsoon.

In the coastal waters of Sarawak and north Andaman Sea good fishing grounds were characterized by low salinity, low temperature and high nutrient contents. In both areas the species composition in catch greatly differed from other areas of the South China Sea especially in the abundant occurrence of croaker, shad, grunter and pomfret. However, in the offshore waters although high PO_4-P contents accompanied by high salinity were found the relation between catch and hydrological condition in these areas were not known.

Recently a preliminary survey on vertical handline fishing was conducted in the eastern part of the Andaman Sea. The fishing grounds were located along the slope where the depth increased suddenly from 100 to 500 m.

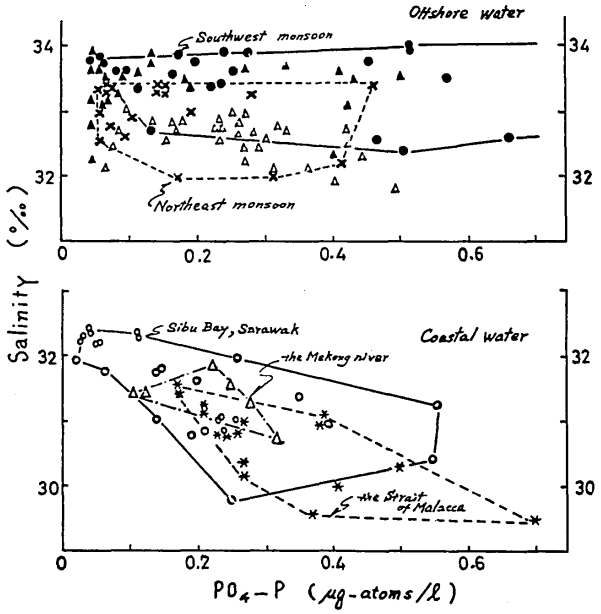

Fig. 7 Phosphate-salinity diagrams for offshore and coastal waters (1971–72)

The fish schools detected by the echo-sounder were very often observed along the edge of the slope. The results are summarized in Table I. Since the fish schools were located in a restricted area the topographical and hydrological factors seem to be important for the formation of good fishing ground.

Table I. Catch by bottom vertical handline fishing in the eastern part of the Andaman Sea in February, 1973.

Date	Location	Time Start	Time End	Operation Time (min)	Total catch (kg)
24 Feb.	997a	12:05	12:33	28	72.2
25 Feb.	1097a	13:15	13:33	18	96.8
26 Feb.	1097a	10:33	13:47	125	622.4
27 Feb.	1097c	15:27	17:28	67	149.8
28 Feb.	1097c	12:10	17:21	100	384.1
1 Mar.	1097a,c	07:01	07:48	47	79.8

4. CONCLUSION

From the above results and discussion it appears that the combination and interaction of environmental factors may determine to a certain extent the distribution of demersal fisheries resources and may contribute towards the formation of good fishing grounds. In this connection environmental factors should not be analysed separately but as a whole. However, in fishing ground along the edge of continental shelf and banks of submarine ridges the distribution of fish may depend to topographic condition primarily and hydrological condition secondarily.

In view of our limited knowledge further studies need to be carried out on the relationship of environmental factors and the distribution of demersal fisheries resources before such resources can be fully exploited.

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Brief Note on the Relationship of Scattering Layer and some Hydro-Biological Factors*

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Abstract

The analysis of echo-sounding records obtained from the South China Sea showed that scattering layer is caused by a concentrated layer of zooplankton and is related to thermocline. The occurrence of scattering layer may be used to indicate either the depth where thermocline occurs or the vertical movement of zooplankton.

Fish schools were reorded at the vicinity of the scattering layer and this phenomenon is probably associated with the feeding habits of the fish.

1. INTRODUCTION

A scattering layer as recorded on an echo-sounder paper (PLate 1) is caused by the presence of zooplankton. During the survey cruises of the research vessel CHANGI the depth of the scattering layer has been observed to be related to the depth of the thermocline as recorded by the bathythermograph. Since zooplankton is an important source of food for juvenile and plankton-feeding fishes, studies on the relationship of scattering layer and some hydro-biological factors are of some importance to fisheries development in the Southeast Asian region.

2. MATERIALS AND METHODS

CHANGI conducted an oceanographic survey cruise and occupied 21 stations in the South China Sea in April 1971 (Fig. 1). Three additional surveys were also carried out in April–May, June and September of 1972. The echo-sounder used was a SR-11 type (Kaijo-Electric Co. Ltd.) with 200 KC frequency. Continuous graphical records of water temperature in the sea were obtained by the bathythermograph (BT). Zooplankton samples were collected by vertical hauling with a closing net (mouth diameter = 25 cm, mesh size = 24/cm) from various strata of the sea and the wet weight of zooplankton biomass (mg/m^3) was recorded.

* We regret that it is not possible to publish the original "plates" as their condition is no longer suitable for printing.