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Records of Echo-Sounder Tracing as Guide to Locate and Evaluate Good Fishing Grounds*

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Abstract

An echo-sounder is an effective method of location and evaluation of fishing grounds, although its scope of coverage is narrow and the intensity of its echogram tracing as a means of estimating the size of fish schools is still a problem.

Approximately 800 hours of echo-sounder recordings made in the South China Sea and Andaman Sea during the survey cruises of R/V CHANGI from 1970 to March 1973 were analysed. The results show that there is a definite correlation between fish catch and the gradings of fishing grounds as evaluated from the echograms obtained from the same area. This is especially so in areas where the values of mean catch per hour are more than 200 kg.

The presence of upwelling, current rip and boundary layer, important factors for the formation of good fishing grounds can be clearly detected by an echo-sounder.

During drifting, the growing size of fish schools attracted to the vessel's light in the hours of darkness, as appeared on the echogram, may indicate abundance of fish in that area.

The different modes and types of fish schools of some large fishes are easily recognisable on the echograms.

1. INTRODUCTION

An echo-sounder is one of the popular devices used for locating fish schools. Based on the study of echogram and the biology of fish schools the echo-sounder has made invaluable contribution to the promotion of fisheries development. As the correct interpretation of echo-sounder tracings is important in fisheries resources and oceanographic studies, an attempt is made to correlate the echogram records collected by R/V CHANGI since January 1970 with data on fish catch and environmental factors.

2. MATERIALS AND METHODS

The echo-sounder used is the Sr-11 type of 200 KC frequency made by Kaijo Electric Co. Ltd., Japan. Approximately 800 hours of recorded echogram were made and classified into run and drift records. Only spot traces representing more than 6 m^2 as calculated from the echogram were considered as fish schools. The degree of fish abundance based on the number of fish schools observed on 30 minutes continuous record of echogram per mile was graded as follows:-

Grade	Fish abundance	No. of fish schools
IV	Very abundant	>7
III	Abundant	4 – 7
II	Common	2 – 3
I	Rare	1
0	Absent	0

Separate evaluation of fish schools was made of run and drift records and graded in numbers to each half-a-degree block. Actual fish catch was also calculated to mean catch per hour for each half-a-degree block. The numbering system of block is as previously described (Anon., 1971).

Wherever possible, handline fishing was deployed to sample the fish in the vicinity where fish schools were recorded on the echogram for identification.

3. RESULTS

3.1 Fish schools and echogram

Table I illustrates the catch per hour for each haul obtained by CHANGI in April 1971 and teh degree of abundance of fish schools as evaluated from the echogram by the method mentioned in 2. Similarly, high mean catch per hour (>200kg) in areas where sounding records were since 1970 and the degree of abundance as evaluated from the echograms (Plate 1, A-D) are shown in Table II.

The result of the relationship between the evaluation and actual catch and their correlation is shown inTable III. The percentage of occurrence at different catch range is shown in figure 1.

From the result of analyses, there is a definite correlation between the actual catch and the evaluation of degree of fish abundance based on the records of echogram.

Some fishes are known to be attracted by light during hours of darkness. Echograms were continuously recorded during a 25-hour observation in April 1972 at a fixed position. Observation showed that during the day very few fish schools were recorded. However, there was a general upward movement of fish schools towards CHANGI's light shortly after dark and the size of schools, depending on the fish population in the area, grew with time. This

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

Table I. Catch and degree of abundance as evaluated from echograms during the trawl operation in the South China Sea in April 1971

Mean catch per hour (kg)	Fish abundance evaluated from echogram		Presence of current rip (+)	Mean catch per hour (kg)	Fish abundance evaluated from echogram		Presence of current rip (+)
	Demersal	Pelagic			Demersal	Pelagic	
70.0	1-2			49.0	1	2	
35.8	1	3		9.2	2		
113.4	2-(3)	2		71.8	1		
134.6	2-(3)			23.8	0	2	
7.8				31.1	0	1	
12.6	1	3	+	13.0	1		
115.5	2-(3)	0		70.5	1		
106.3	2-(3)			105.6	2	2	
55.9	2-(3)			40.8	2		
66.8	2	3		145.0	3	2	
154.6	2	3		50.4	1	2	
124.6	2			148.5	2		+
43.2	2	3	+	143.0	1		
228.8	3	2	+	66.3	1		
32.4	1			71.1	1		
176.5	2	2		223.7	3		
91.7	2	3		47.3	1		
72.0	1	2		58.7	1		
130.9	2	3		68.9	1	2	
96.9	1			143.7	2		+
91.6	1			146.0	2		
63.0	1			195.0	2		
27.7	1	2		212.0	1		
11.1	2-(3)		+				

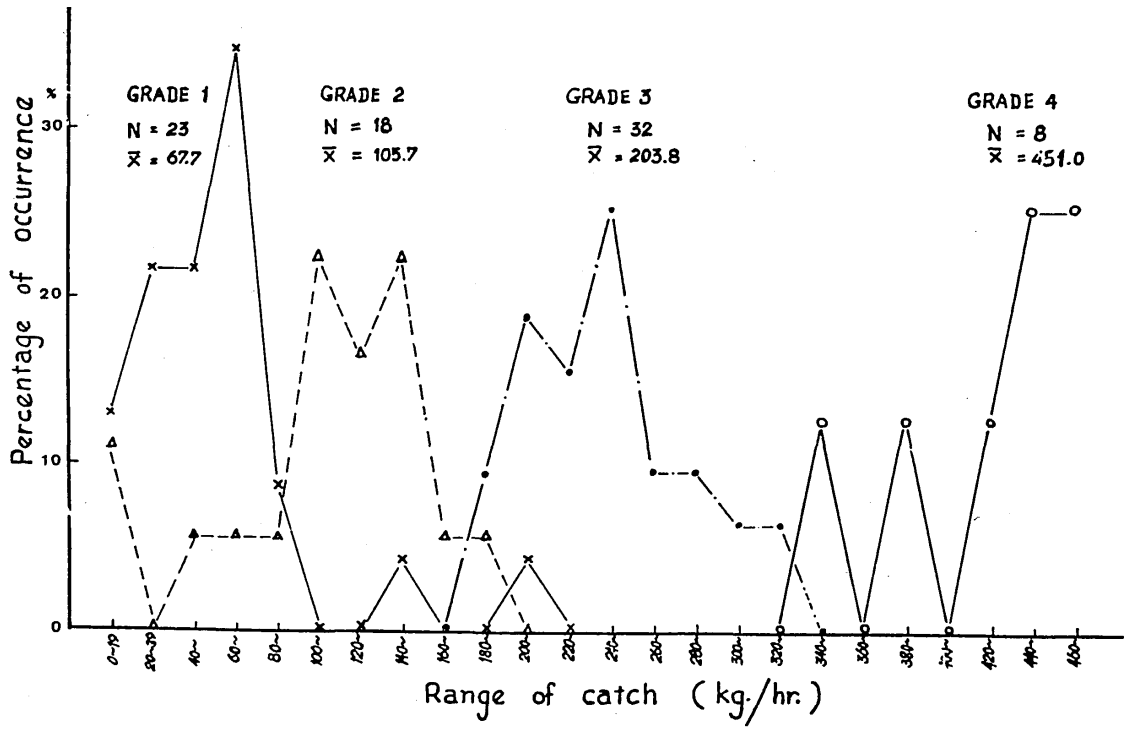

Fig. 1 Frequency distribution at different catch range for the four grades of echogram evaluation.

size increase of fish schools, which can be recorded and evaluated by echograms, may serve as an indicator of fish abundance in the area. Plate 2 (A & B) show the fish schools as appeared on echograms in the day and nighttime; at the same position, and plate 2 (C & D) show the pelagic and demersal fish schools being attracted to the vessel's light during the nighttime. Similarly, during the vertical handline fishing cruise carried out in February 1973 in the Andaman Sea, a large school of skipjack tuna was recorded on the echogram at night (Plate 2E). Angling by the crew and scientists on board CHANGI brought in several skipjack tuna.

The different modes and types of fish schools of some large demersal fishes are easily recognisable on echograms. Plate 3 (A & B) shows the presence of a large fish school and the features formed by vertical handline fishing. From the composition of fish catch thus obtained (Fig. 2), it was estimated that the fish school consisted mainly of white snapper.

3.2 Current rip and echogram

A current rip is formed when two masses of water having different physico-chemical properties meet. In Sibu Bay, a current rip was seen for miles on several occasions during the November cruise of CHANGI in 1972. The water on the coastal side of the current rip was yellowish green with surface salinity of 23.5% whereas on the other side of the current rip, the water was light blue with surface salinity of 30. Echo-sounding records were made as the vessel moved in a zig-zag fashion crossing the rip on several occasions. As shown in Plate 4 a thick dark band appeared at the surface of the echogram when the vessel crossed over the rip. According to the analysis by Ishida et al(1960) current rip is made up of high concentration of plankton, suspended particles and air bubbles.

Similarly, a boundary zone can also be detected by echo-sounder (Plate 5).

3.3 Upwelling and echogram

Upwelling has been known to occur in the Andaman Sea during the northeast monsoon (Wyrtki, 1961). During the exploratory fishing by vertical handline in February 1973 at the eastern part of the Andaman Sea, the echo-sounder was engaged for locating fish schools (Plate 6) in untrawlabe fishing grounds (Senta *et al*, 1973). During this survey, although the sea was very calm, many white caps were seen on the sea surface suggesting the presence of internal waves. These were seen on the sea surface suggesting the presence of internal waves. These were distinctly displayed on the echogram (Plate 7) recorded at the area around the shoulders of the continental slope.

It is interesting to note that the dark bands on the echogram were actually scattering layer of concentrated zooplankton and that the form of waves were the result of current coming from the deeper water. This evidently indicated the occurrence of upwelling.

4. CONCLUSION

From the above discussion it can be seen that the echo-sounder is an indispensable device not only for locating fish schools but also for the studies of environmental fac tors which may be important in the formation of fishing grounds.

Table II. Good catch (>200 kg/hr) and degree of fish abundance as evaluated from echograms in the South China Sea and adjacent waters, 1970 – 1973

Date		Mean catch/hour (kg)	Fish abundance evaluated from echograms
1970	May	266.8	3
	"	218.3	2
	"	248.3	3
	"	266.3	3
	June	440.0	4
	"	342.0	4
	July	305.3	3
	Oct.	282.4	3
	"	235.5	3
	"	202.4	3
	"	311.3	3
	Nov.	213.3	3
	"	250.3	3
1971	Aug.	210.3	3
	Oct.	325.1	3
	"	240.4	3
	Nov.–Dec.	232.3	3
	"	215.6	3
	"	292.3	3
	"	203.1	3
	"	211.2	3
	"	243.1	3
1972	Jan.	478.0	4
	"	215.5	3
	"	244.8	3
	Sept.	212.8	3
	Oct.	200.6	2
	"	257.0	3
	"	207.7	3
	"	293.7	3
	Nov.	241.9	3
	Dec.	437.2	4
	"	461.7	4
1973	Jan.	440.0	4
	Feb.*	245.7	3
	Feb.	627.9	4
	Feb.*	384.1	4

* by the bottom vertical handline fishing (kg/hr/50 hooks).

Table III. Correlation between echogram gradings and actual fish catch.

Degree of fish abundance evaluated from echograms (nos)	Actual catch		Correlation	
	No. of samples (N)	Mean ($\bar{x}$) kg/hr	Range (kg/hr)	Probability %
0 – I	23	67.7	0–80	88.8
II	18	105.7	80–180	77.7
III	32	203.8	180–320	100.0
IV	8	451.0	>320	100.0

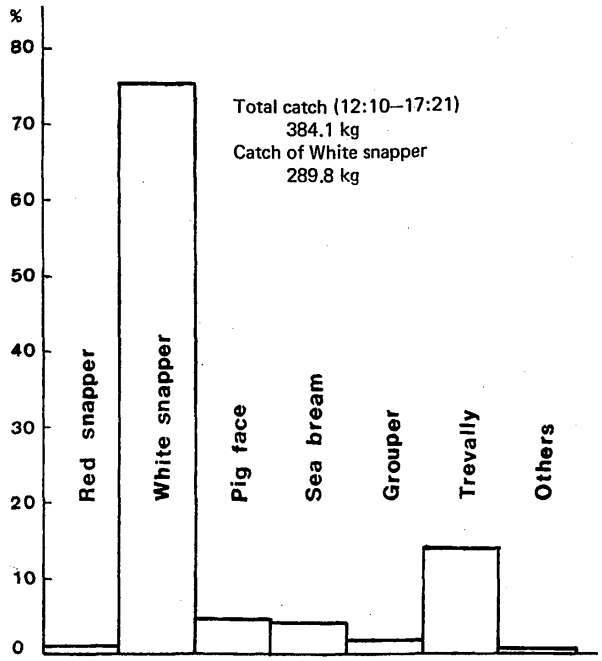

Fig. 2: Composition of the fishes obtained by vertical Handline fishing in the eastern part of the Andaman Sea in February 1973.

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A Study of the Catch Data of the JURONG in the South China Sea in 1971 and 1972

by

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Abstract

The semi-commercial bottom trawl fishing by the training vessel JURONG in the South China Sea in 1971 and 1972 was confined to three areas at its south western portion. The positively skewed frequency distributions of catch per hour assumed approximately the shape of a normal curve when the yield was transformed logarithmically. Sample statistics from these transformed values form the basis of discussion of the yields for 1971 and 1972 in relation to fishing seasons and types of nets used.

Yield records from JURONG showed that the catch in waters off Trengganu (northeast coast of West Malaysia) was poorer than that of Tioman and Sarawak. These yields were briefly discussed together with values obtained by the R/V CHANGI. In the area off Sarawak, the Engel II net obtained much better catches than the four seam net.

The percentage composition of dominant fish categories from Tioman and Sarawak are also discussed.

1. INTRODUCTION

For the purpose of providing shipboard training for the fishing technician trainees of the Fisheries Training Centre a joint Singapore FAO/UNDP project, the training vessel JURONG carried out bottom trawl operations in known fishing grounds in the South China Sea from 1971. The vessel tended to fish in grounds where good catches were anticipated and to continue fishing in grounds where good catches were obtained. The catches could therefore be regarded as semi-commercial in nature and probably good indicators of the conditions at the time the areas were fished.

A study of these catch data, made available to the Marine Fisheries Research Department, Southeast Asian Fisheries Development Center (SEAFDEC), is presented in this paper.