

MONTHLY AVERAGE DISTRIBUTION OF FISHING EFFORT AND CATCH PER UNIT EFFORT FOR YELLOWFIN TUNA AND BIGEYE TUNA IN INDONESIAN WATERS OF THE INDIAN OCEAN, 1978-1990

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ABSTRACT

The geographical monthly average distribution of fishing effort for yellowfin tuna and bigeye tuna caught by longline owned by the P.T. Samodra Besar in the Indian Ocean are analysed and discussed. The fishing grounds of yellowfin and bigeye tuna are found along the west coast of Sumatra and the west coast of Java, Bali and Nusa Tenggara. The average hook rates for yellowfin tuna and bigeye tuna are 0.49 and 0.29, respectively.

INTRODUCTION

The government of Indonesia supports the development of its tuna fisheries, encouraging the export of non-fuel and natural gas commodities such as shrimp, skipjack and other tuna by providing loans to the fishermen.

Emphasis was placed on the industrial fisheries, which utilize larger and more powerful vessels for harvesting resources, including tuna and tuna-like fishes for export purposes, during the first five-year development plan, 1969-1974. From 1972 onward the government has been promoting its involvement in tuna fishing in the Indian Ocean by establishing the longline state enterprise, "P.T. Samodra Besar," in the fishing bases located in Sabang (Aceh Provinces) and in Benoa (Bali). The company started fishing with three 120 GT (400 HP) longliners in 1973, and increased to 17 vessels in 1977. Since then, the Indonesian longline fishery has developed very remarkably, as can be seen from the increasing number of longline vessels over the period 1986-1993, from 36 vessels to 423 vessels, as listed in Table 1.

The number of foreign longliners also increased, to almost 508 in 1993 compared to two vessels in 1986 (Table 1). Catch and effort data of P.T. Samodra Besar have been published by many authors (Marcille *et. al.*, 1984; Marcille and Uktolseja, 1984; Merta, 1985; Uktolseja, 1989; Saila and Uktolseja, 1991; Naamin and Gafa, 1991).

This paper presents the geographical distribution of catch, effort and catch-per-unit-effort of yellowfin and bigeye tuna in the Indian Ocean based on the information collected from the logbooks of the longliners owned by the above-mentioned state enterprise.

MATERIALS AND METHODS

1. Source of Data

The data were collected from the daily catch and effort reports from the logbooks of the longline vessels owned by P.T. Samodra Besar based in Benoa, Bali, during the period 1978-1990.

2. Method of Data Analysis

1) Daily catch and effort of each boat in a month

- From daily catch effort of each longliner the following data were extracted: Name of vessel
- Month and year
- Days fishing
- Position of set (longitude and latitude)
- Number of baskets and hooks
- Sea temperature
- Setting and hauling times
- Catch of species by number (for this report only yellowfin and bigeye tuna were analysed).

2) Daily catch, effort and hook rate of each vessel in a month

Hook rate (HR) = (number of fish taken/number of hooks) x 100.

Formatted data 1) are computed to obtain the daily hook rate of species and percentage of species composition. Type of effort concentration requires space and time divisions of the catch and effort statistics (hook

Table 1. Number of Indonesian fishing vessels operated in Indonesian waters and Indonesian EEZ.

No.	Fishing Gear	1986	1987	1988	1989	1990	1991	1992	1993
1.	Longline	36	49	89	120	155	216	314	423
2.	Longline (foreign vessels)	5	6	219	341	438	446	670	508
3.	Pole and line	60	60	64	88	4	111	119	121
4.	Purse seine	23	29	36	204	432	474	510	524
5.	Gillnet	-	-	23	40	47	110	169	204
6.	Fish trawl	2	10	143	203	413	408	461	543
7.	Shrimp trawl	168	188	211	237	259	253	250	244
8.	Fish carrier	26	26	26	35	35	35	45	11
9.	Other gear	-	-	3	4	9	5	10	57
	Total	317	368	804	1,272	1,842	2,058	2,548	2,635

rate/area/time). In this case, area is setting position and time is day or hook rate/day for each vessel, and the total of hook rate/day gives the average hook rate/month/vessel.

3) Monthly catch and hook rate in five-degree square

The area is five-degree square of latitude and longitude and month (five-degree month form). The total catch, number of species caught, hook rate by species and percentage of species composition of all the vessels operating in a five-degree square by month in a year were computed from (2).

4) Catch and hook rate by five-degree square in a year

The total number of species caught, average percentage of species composition, and average hook rate by species (yellowfin and bigeye tuna, for five-degree square in one year by summing up 3). This result shows the distribution of longline catch (hook rate, fish species and five-degree square by year).

5) Monthly average hook rate by five-degree square.

Monthly average hook rate for each month was computed by dividing total hook rate by number of years for each month for a given area.

RESULTS AND DISCUSSION

Fishing Ground

The monthly average hook rate, number of fish taken, and number of hooks (x1000) are given in Figures 1 to 8. These figures show that the fishing ground for yellowfin and bigeye tuna extends from 05°N -15°S to 90-130°E and can be divided into two areas bordered by longitude 105°E, namely the waters adjacent to the west coast of Sumatra (fishing ground FG-I) and the waters adjacent to the west coast of Java, Bali and Nusa Tenggara (FG-II).

1. Yellowfin Tuna

The monthly average hook rate catch effort for yellowfin tuna, number of fish and number of hooks ($\times 10^3$) are shown in Figures 1, 2 and 3. Figure 1 shows that the monthly average hook rate for FG-I ranges between 0.31 (October) and 1.17 (January), with an average of 0.57. The above-average hook rates are found in January, February, March, April, and May (1.17, 0.81, 0.59, 0.60, and 0.66, respectively). The higher hook-rate in January (1.17), when only 190 fish were caught and 16,100 hooks were used, does not mean that that month is a good fishing season for this area. It may depend on the fishing activities (frequency of fishing) which are related to the number of hooks being used, and the number of fish caught. The number of fish caught monthly ranges from 40 (July) to 1520, with an average of 540 fish. The number of hooks used monthly ranges from 7,700 (July) to 216,500 (April) with an average of 90,000 hooks. As shown in Figure 1, good catches (above the average) were made in February, March, April, May, and November (1,520, 1,200, 1,310, 600, and 620 fish, respectively). Based on this information, the fishing season for yellowfin tuna in the fishing ground along the west coast of west Sumatra occurs during February to May, with the peak season in February. The fishing activities can be carried out all year round, but the off season is from June to December.

The hook rate of yellowfin tuna for the FG-II ranges between 0.27 (October) to 0.76 (January), with an average of 0.50. The good hook rates are found in November, December, January, February, May, and June (0.70, 0.69, 0.76, 0.54, 0.70, and 0.62, respectively). A comparison of the hook rates shows that the average hook rate for yellowfin tuna in the FG-I is higher than in FG-II (0.57 vs. 0.50). The monthly average number of fish caught ranges between 3,450 in October and 12,910 in May, averaging 7,950, and the monthly number of hooks used ranges between 695,700 in November and 2,755,600 in March, with an average of 1,683,100. The ratios between the number of fish caught and the number of hooks used between FG-II and FG-I are 14.7 and 18.7, respectively, showing that the FG-II is very dominant in fishing

activities in comparison to the FG-I. Unlike the FG-I, there are two fishing seasons in FG-II, the first one during November to February, with the peak season in February, and the second from May to June, with the peak season in May.

2. Bigeye Tuna

The monthly average hook rate catch effort for bigeye tuna, number of fish and number of hooks ($\times 10^3$) are shown in Figures 6, 7 and 8. As with yellowfin tuna, the fishing ground for bigeye tuna extends from the west coast

of Sumatra to the west coasts of Java and Nusa Tenggara. The fishing season for bigeye tuna for the adjacent waters along the west coast of Sumatra occurs in November and from May to April. The peak season for the waters adjacent to the west coast Sumatra, Java and Nusa Tenggara occurs during June to December, with the peak in November.

The hook rates of bigeye tuna range between 0 to 1.6, with an average of 0.29. The highest frequency of hook rate is found between 0.3 and 0.4 (Figure 5).

REFERENCES

- MARCILLE, J., T. BOELY, M. UNAR, G.S. MERTA, B. SADHOTOMO, J.C.B. UKTOLSEJA, 1984. Tuna Fishing in Indonesia . Editions de l'ORSTOM. Institute Francais de Recherche Scientifique Pour le Developpement en Cooperation. 125 p.
- MARCILLE, J. AND J.C.B. UKTOLSEJA, 1984. Industrial tuna longline fishing in Indonesia and expected of introducing deep tuna longline gears. FAO/UNDP/IPTP Ad-hoc Workshop on the Stock Assessment of tuna in the Indo-Pacific Region, Jakarta, 20-22 August 1984: 16 pp.
- MERTA, I.G.S. 1985; The Status of Tuna Fisheries in the Indonesian Part of the Indian Ocean. Collective Volume of Working Documents Presented at the Expert Consultation on Stock Assessment of Tunas in the Indian Ocean Held in Colombo, Sri Lanka, 28 November - 2 December 1985: 304-315.
- NAAMIN, N. AND B. GAFA, 1991. Present Status of Yellowfin tuna fishery in Indonesia Collective Volume of Working Documents Vol. 6. Presented at the Workshop on Stock Assessment of Yellowfin tuna in the Indian Ocean, Colombo, 7-12 October 1991. IPTP/FAO/UNDP: 154-162.
- SAILA, S.B. AND J.C.B. UKTOLSEJA, 1991. Progress report of tuna assessment program. Fisheries Research and Development Project. Jakarta, Indonesia. USAID #497-0352-c-00-8096-00. 12 p.
- UKTOLSEJA, J.C.B. 1989. The Status of The Indonesian Tuna Fisheries. Report of The 3rd Southeast Asian Tuna Conference. Bali, Indonesia. 22 - 24 August, 1989. IPTP-FAO: 66-81 pp.

Figure 1. *Monthly distribution of average hook rates for yellowfin tuna caught by “P.T.Samodra Besar” in the Indian Ocean over the period 1978-1990.*

Figure 1. (Continued)

Figure 2. *Monthly distribution of average number for yellowfin tuna caught by "P.T.Samodra Besar" in the Indian Ocean over the period 1978-1990.*

Figure 2. (Continued)

Figure 3. *Monthly distribution of average number of hooks (in thousands) for yellowfin tuna caught by “P.T.Samodra Besar” in the Indian Ocean over the period 1978-1990.*

Figure 3. (Continued).

Figure 4. Monthly average hooking rate frequency distributions of yellowfin tuna caught by industrial longliner in the Indian Ocean, 1978-1990.

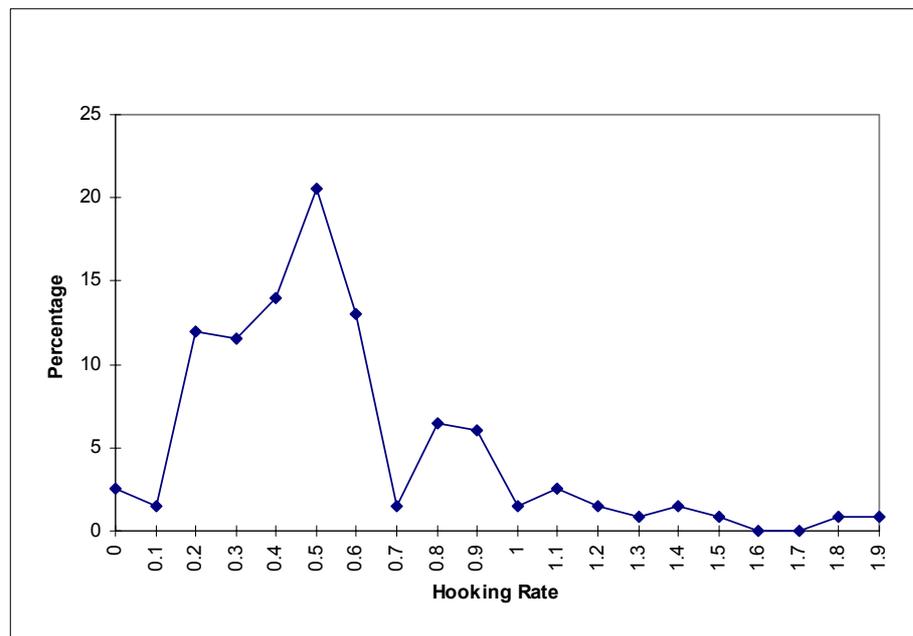


Figure 5. Monthly average hooking rate frequency distributions of bigeye tuna caught by industrial longliner in the Indian Ocean, 1978-1990.

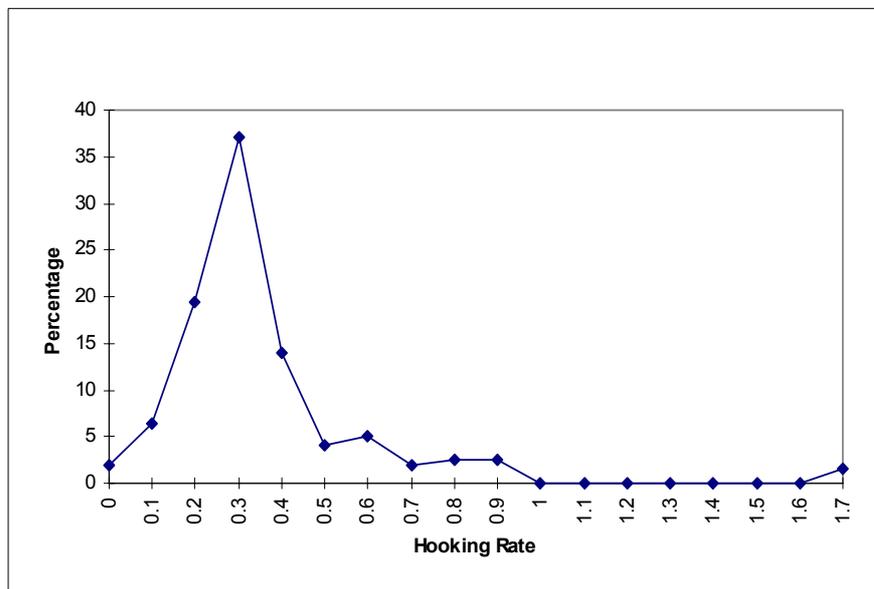


Figure 6. *Monthly distribution of average hook-rates for bigeye tuna caught by “P.T. Samodra Besar” in the Indian Ocean over the period 1978-1990.*

Figure 6. (Continued)

Figure 7. Monthly distribution of average number of bigeye tuna caught by “P.T.Samodra Besar” in the Indian Ocean over the period 1978-1990.

Figure 7. (Continued).

Figure 8. *Monthly distribution of average number of hooks (x103) for bigeye tuna caught by “P.T. Samodra Besar” in the Indian Ocean over the period 1978-1990.*

Figure 8. (Continued)

