

OVERALL FISHING INTENSITY OF ATLANTIC LONGLINE FISHERY  
FOR BIGEYE TUNA, 1956-1974

by

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SUMMARY

Catch, effort and fishing intensity on bigeye tuna exploited by the Japanese and other longline fleets in the Atlantic Ocean are summarized. These statistics were estimated on the basis of Japanese and Taiwanese catch and effort data by area up to 1974. An improvement in this report was the inclusion of Taiwanese data as basic data. Separation of the statistics was made between the North and South Atlantic Oceans.

The Concentration Index of the Japanese longline fleet on bigeye tuna has indicated high values in recent years. Since 1971, both yield and effort of the longline fleets in the whole Atlantic have remained at a high level, indicating a slight increase in hook rate in 1973 and 1974. The relationship between yield and fishing intensity in the northern and southern areas suggests that bigeye tuna in the North Atlantic may have a larger productivity and southern bigeye have recently been more heavily harvested than northern bigeye.

RESUME

Le présent document fait état de façon résumée des prises, de l'effort et de l'intensité de pêche du thon obèse exploité par les flottilles palangrières, japonaise et autres, dans l'Atlantique. Ces statistiques ont été estimées à partir de données japonaises et taiwanaises de capture et d'effort par secteur jusqu'à 1974. L'incorporation de données taiwanaises à l'information de base a représenté une amélioration. Les statistiques sont séparées entre Atlantique Nord et Atlantique Sud. L'indice de concentration de la flottille palangrière japonaise sur le thon obèse a été élevé ces dernières années. Depuis 1971, la production et l'effort de cet engin dans l'ensemble de l'Atlantique sont tous deux restés à un niveau élevé, indiquant un léger accroissement du taux par hameçon en 1973 et 1974. La relation entre la production et l'intensité de pêche au nord et au sud suggère que le thon obèse aurait peut-être une plus grande productivité dans le nord, et qu'il aurait dernièrement subi une exploitation plus intense au sud.

RESUMEN

Presenta un resumen de datos de captura, esfuerzo e intensidad de pesca referentes al patudo, explotado por flotas palangreras japonesas y otras, en el Atlántico. La estimación de las estadísticas se basa en los datos japoneses y taiwaneses de captura y esfuerzo, por zona, hasta 1974. Este informe introduce una mejora que consiste en incluir los datos de Taiwan como base. Se separan las estadísticas correspondientes al Norte y Sur del Atlántico.

El índice de concentración de la flota de palangre japonesa sobre el patudo señala valores altos durante los últimos años. Desde 1971, la producción y el esfuerzo de las flotas palangreras en el conjunto del Atlántico se ha mantenido a un nivel elevado, lo que indica un ligero aumento en la tasa por anzuelo en 1973 y 1974. La relación entre producción e intensidad de pesca en las zonas Norte y Sur, sugiere que la producción de patudo puede ser más importante en el Norte, y que esta especie ha sido explotada recientemente con más intensidad en el Sur.

### 1. Catch and effort in Japanese and Taiwanese longline fleet.

The main difference in this paper from the previous one (Kume 1976) is the inclusion of Taiwanese catch and effort data. Procedure of calculations for effective effort and fishing intensity was already described by Honma (1973). The new Japanese longline data for 1974 were provided by ICCAT (1976) on catch in weight and by Fisheries Agency (1976) on catch in number and effort statistics by area. The average density distribution for the calculation of effective hooks was selected for ten years of Japanese data from 1965 to 1974. Taiwanese catch and effort data, re-compiled by Honma (MS), were also processed by the same procedure. These data of two countries were incorporated as basic data for the estimation of overall fishing intensity.

"Concentration Index" on bigeye tuna fishing ground was calculated as the value of annual number of effective hooks divided by the corresponding number of nominal hooks, the results being shown in Fig. 1. The Index of Japanese longline fleet has been increasing sharply since 1970, being maintained still high in 1974. This trend indicates the specific species preference of the recent Japanese longline fleet which has been displaying continuing greater concerns on bigeye tuna. On the other hand, the trend in the Index of Taiwanese fleet has been remained on very low level less than 1.0.

The hook rate, annual catch in number divided by the corresponding number of effective hooks, was calculated for Japanese and Taiwanese data combined. It is shown in Fig. 2, that the hook rate of Atlantic bigeye tuna was on the gradual decrease until 1972 since 1961 when longline fishery expanded to cover nearly the bigeye tuna distribution. In 1973 and 1974, a little uprise of hook rate was observed.

### 2. Effort of whole fleet in the entire Atlantic Ocean.

Detailed catch and effort statistics, Task 2 in SCRS, have not been made available for all longline fleet except Japanese and Taiwanese longliners. Therefore, the overall fishing intensity of the whole longline fleet was estimated on the basis of "basic data", Japanese and Taiwanese data. An assumption was made that all longline fleet would be the same in operational pattern as summarized in basic data. The estimated overall fishing intensity and relevant data are tabulated in Table 1. This kind of extrapolation of the data for overall statistics is one of factors that generates a bias. Another factor is that the Japanese annual yields in weight in years up to 1970 and those of major non-Japanese longline fleet have been not of nominal catch but of landing. These landing statistics do not correspond exactly to the effort statistics which were obtained as nominal ones.

As shown in Fig. 3, longline catch of bigeye tuna has increased sharply since 1971. It is noted that the recent amount of catch since 1971 has been maintained on high level though the corresponding fishing intensity has also remained on the same high level.

### 3. North and south separation of catch and effort statistics.

Considering the possibility of two separated stocks in the north and south Atlantic (Kume and Morita, MS), catch and effort data of whole Atlantic were divided into two general areas, north Atlantic (ICCAT bigeye areas 1-4) and south Atlantic (ICCAT bigeye areas 5-8: p. 107 of proceedings of the Fourth Regular Meeting of the Comm.).

The data for whole Atlantic were divided as follows:

Yield in weight

- Japan and Taiwan.....proportionated by the number of catch in two areas obtained from catch statistics by area.
- Korea.....1956-71, proportionated by 25:75 = north:south; rounded ratio obtained from catch statistics by area (Anonymous 1970). 1972-, proportionated by 65:35 = north:south; ratio obtained from catch statistics by area presented at the ICCAT 1975 Meeting.
- Panama.....the same division as Korea.
- Argentine and Brazil.....south Atlantic.
- Cuba.....north Atlantic.

Effective effort and fishing intensity

Japanese and Taiwanese catch and effort statistics for north and south Atlantic were processed by the same procedure given to the whole Atlantic data. Both combined data are the basic data upon which overall fishing intensity in each Atlantic area was calculated. The results are tabulated in Table 3 and 4.

Annual change of both hook rates in north and south Atlantic indicates almost similar trend (Fig. 4). The uprise of hook rate observed in the entire Atlantic in 1973 and 1974 are attributable to the increased hook rate in north Atlantic. The relationship between yield and fishing intensity in both areas (Fig. 5) suggests that bigeye tunas in the north Atlantic may be larger in productivity and southern bigeye has been harvested heavier recently than northern one.

References

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Table 1. Catch, effective effort and fishing intensity of bigeye tuna caught by the longline fleet in the Atlantic Ocean, 1956-1974.

Year	Basic data (Japan and Taiwan combined)					Whole longline fleet			
	Catch in number (10 <sup>3</sup> ) (A)	Yield in weight (10 <sup>3</sup> tons) (B)	Effective hooks (10 <sup>6</sup> ) (C)	Intensity per 5 <sup>o</sup> square (10 <sup>3</sup> hooks) (D)	Hook rate (A)/(C)×100	Yield in weight (10 <sup>3</sup> tons) (E)	Effective hooks (10 <sup>6</sup> ) (B)/(C)×(C)	Intensity per 5 <sup>o</sup> square (10 <sup>3</sup> hooks) (E)/(B)×(D)	
1956	0.2	0.0	0.1	0.5	0.27	0.0	0.1	0.5	
1957	8.7	0.5	2.6	17.1	0.34	0.5	2.6	17.1	
1958	14.8	0.5	5.7	37.7	0.26	0.5	5.7	37.7	
1959	44.8	1.5	11.1	74.0	0.40	1.5	11.1	74.0	
1960	70.6	2.9	15.0	101.3	0.47	3.0	15.6	104.8	
1961	243.7	11.0	29.0	197.2	0.84	11.2	29.6	200.8	
1962	367.9	15.7	51.6	350.8	0.71	15.9	52.3	355.7	
1963	285.3	14.5	45.9	313.3	0.62	14.7	46.7	318.5	
1964	343.7	17.3	58.9	399.8	0.58	17.6	59.7	405.5	
1965	648.3	28.5	113.5	779.4	0.57	29.0	115.4	793.1	
1966	232.1	17.6	45.5	313.1	0.51	19.0	49.1	337.8	
1967	188.3	10.7	31.8	213.3	0.59	11.4	33.9	227.6	
1968	341.4	15.3	60.5	408.9	0.56	16.8	66.3	448.0	
1969	430.2	16.2	69.3	469.3	0.62	19.2	82.4	558.0	
1970	332.2	15.6	63.5	431.3	0.52	24.6	99.9	678.0	
1971	533.2	27.7	124.8	848.7	0.43	38.2	172.4	1172.1	
1972	430.4	22.2	111.3	758.0	0.39	30.0	150.5	1024.4	
1973	575.6	22.9	111.7	750.2	0.52	34.1	166.3	1116.7	
1974	551.2	24.6	106.9	716.5	0.52	36.3	158.1	1059.7	

Remark: Taiwanese data are comprised of those from 1967 to 1974.

Table 2. Amount of catch of bigeye tuna in the Atlantic Ocean, 1963-1975. (in 1,000 tons)

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Grand total		20.6	29.2	19.0	11.9	17.8	22.5	27.3	46.5	33.9	41.3	52.4	59.0
Longline	Sub-total	(17.6)	(29.0)	(19.0)	(11.4)	(16.8)	(19.2)	(24.6)	(38.2)	(30.0)	(34.1)	(36.3)	(39.6)
	Argentina	0.2	0.4	0.2	0.1	0.3	0.2	0.1	-	-	0.0	0.0	..
	Brazil	-	-	-	-	-	-	-	-	-	0.1	0.2	..
	Cuba	-	0.1	0.3	0.3	0.9	1.0	4.1	3.2	2.0	2.6	2.4	2.4
	Japan	17.3	28.5	17.6	8.5	10.3	10.3	9.0	20.8	18.5	20.2	21.4	18.0
	Korea	-	-	0.3	0.3	0.3	1.9	4.7	7.4	5.7	5.8	7.4	11.5
	Panama	0.0	-	-	-	-	-	-	-	0.1	2.7	1.8	-
Taiwan*	0.0	-	0.6	2.2	5.0	5.9	6.6	6.9	3.7	2.7	3.2	7.7	
Surface	Sub-total	( 3.0)	( 0.1)	( 0.0)	( 0.5)	( 1.1)	( 3.3)	( 2.7)	( 8.3)	( 3.9)	( 7.2)	(16.1)	(19.4)
	France(FIS)	2.8	-	-	-	-	1.6	1.2	0.5	0.3	2.5	1.3	1.4
	Japan	0.0	0.1	0.0	0.5	1.1	0.5	0.1	0.2	0.3	0.2	0.7	0.7
	Korea	-	-	-	-	-	-	-	-	-	-	-	1.4
	Panama	-	-	-	-	-	-	-	-	-	-	1.0	0.8
	Portugal	-	-	-	-	-	-	-	-	-	-	9.1	9.0
	Spain	-	-	-	-	-	1.1	1.2	7.0	3.1	4.4	3.2	5.7
	South Africa	0.2	-	-	-	-	-	-	-	-	-	-	-
	U.S.	-	-	-	-	0.0	0.1	0.2	0.5	0.2	0.1	0.9	0.1
Ghana	-	-	-	-	-	-	-	-	-	-	-	0.3	

Source of data: ICCAT STAT. BULL., Vol.5 (1976) and ICCAT Circ. 1976/10 for 1975 figures.

\* Taiwanese catch for 1967 and onward were taken from Taiwanese catch and effort statistics by area.

Table 3. Catch, effective effort and fishing intensity of bigeye tuna caught by the longline fleet in the Atlantic Ocean, for north Atlantic, 1956-1974.

Year	Basic data (Japan and Taiwan combined)					Whole longline fleet		
	Catch in number ( $10^3$ ) (A)	Yield in weight ( $10^3$ tons) (B)	Effective hooks ( $10^6$ ) (C)	Intensity per $5^{\circ}$ square ( $10^3$ hooks) (D)	Hook rate (A)/(C) $\times 100$	Yield in weight ( $10^3$ tons) (E)	Effective hooks ( $10^6$ ) (E)/(B) $\times$ (C)	Intensity per $5^{\circ}$ square ( $10^3$ hooks) (E)/(B) $\times$ (D)
1956	0.1	0.0	0.1	0.8	0.22	0.0	0.1	0.8
1957	7.3	0.4	1.9	23.9	0.38	0.4	1.9	23.9
1958	13.0	0.4	4.8	58.9	0.27	0.4	4.8	58.9
1959	39.9	1.3	9.2	111.7	0.44	1.3	9.2	111.7
1960	50.1	2.1	9.8	114.5	0.51	2.1	9.8	114.5
1961	67.6	3.1	8.7	100.4	0.77	3.1	8.7	100.4
1962	199.1	8.5	27.0	313.6	0.74	8.5	27.0	313.7
1963	166.0	8.4	24.9	294.7	0.67	8.4	24.9	295.0
1964	219.2	11.1	35.0	437.8	0.63	11.1	35.0	438.2
1965	339.1	14.8	53.4	669.8	0.64	14.9	53.8	674.3
1966	121.6	9.1	23.3	293.1	0.52	9.6	25.0	308.9
1967	76.4	4.0	14.2	174.7	0.54	4.3	15.5	191.4
1968	125.2	5.8	22.1	262.7	0.57	6.7	25.8	306.8
1969	131.3	4.9	23.6	282.3	0.56	6.4	30.7	366.5
1970	202.1	9.4	35.3	434.7	0.57	14.7	55.1	678.2
1971	318.1	16.5	78.4	961.0	0.41	21.5	102.4	1254.5
1972	241.2	12.8	60.2	767.5	0.40	18.6	87.3	1113.1
1973	247.4	12.2	49.4	626.1	0.50	20.4	82.2	1042.4
1974	422.5	19.7	71.3	901.8	0.59	27.7	100.3	1268.8

Table 4. Catch, effective effort and fishing intensity of bigeye tuna caught by the longline fleet in the Atlantic Ocean, for south Atlantic, 1956-1974.

Year	Basic data (Japan and Taiwan combined)					Whole longline fleet		
	Catch in number ( $10^3$ ) (A)	Yield in weight ( $10^3$ tons) (B)	Effective hooks ( $10^6$ ) (C)	Intensity per $5^{\circ}$ square ( $10^3$ hooks) (D)	Hook rate (A)/(C) $\times 100$	Yield in weight ( $10^3$ tons) (E)	Effective hooks ( $10^6$ ) (E)/(B) $\times$ (C)	Intensity per $5^{\circ}$ square ( $10^3$ tons) (E)/(B) $\times$ (D)
1956	0.0	0.0	0.0	0.1	0.10	0.0	0.0	0.1
1957	1.4	0.1	0.5	8.2	0.26	0.1	0.5	8.2
1958	1.8	0.1	0.8	12.2	0.23	0.1	0.8	12.2
1959	4.9	0.2	1.8	28.6	0.27	0.2	1.8	28.6
1960	20.5	0.8	6.1	85.4	0.34	0.9	6.8	95.5
1961	176.0	7.9	21.0	313.6	0.84	8.2	21.5	321.5
1962	168.8	7.2	26.7	395.5	0.63	7.4	58.3	407.2
1963	119.3	6.1	22.7	335.6	0.53	6.3	23.5	348.4
1964	124.6	6.2	24.9	354.1	0.50	6.5	25.9	367.6
1965	309.2	13.7	60.2	911.3	0.51	14.1	61.9	937.9
1966	110.5	8.4	22.2	337.1	0.50	9.3	24.6	372.7
1967	111.8	6.8	18.5	259.7	0.60	7.1	19.4	272.8
1968	216.2	9.5	39.4	585.0	0.55	10.0	41.5	615.4
1969	298.9	11.3	46.2	694.2	0.65	12.9	52.7	792.4
1970	130.2	6.2	28.8	427.2	0.45	9.8	45.7	679.1
1971	215.1	11.2	48.2	713.6	0.45	16.7	71.9	1064.9
1972	189.2	9.4	50.7	746.6	0.37	11.4	61.5	908.1
1973	228.2	10.7	60.5	899.7	0.38	13.8	77.8	1157.9
1974	128.7	5.3	32.9	493.6	0.39	8.7	54.2	813.1

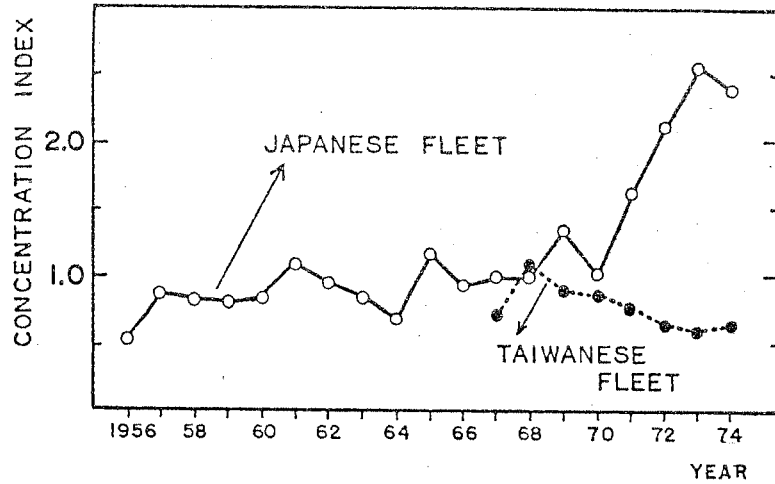


Fig. 1. Change in Concentration Index of Japanese and Taiwanese longline fleet on bigeye tuna in the Atlantic Ocean.

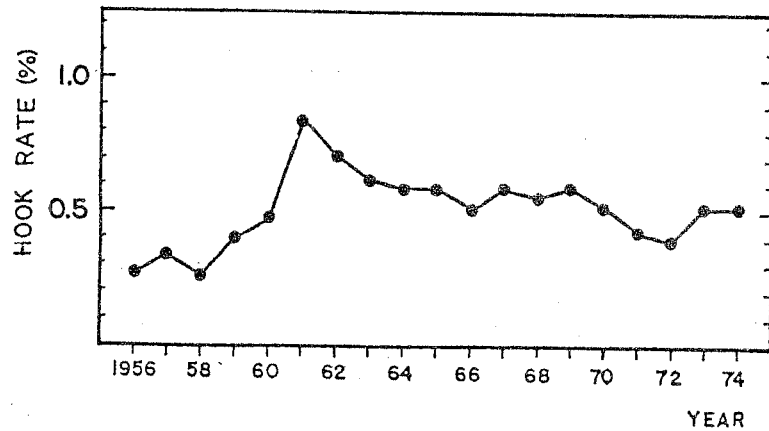


Fig. 2. Annual hook rate of whole Atlantic bigeye, based on the data of Japanese and Taiwanese longline fisheries.

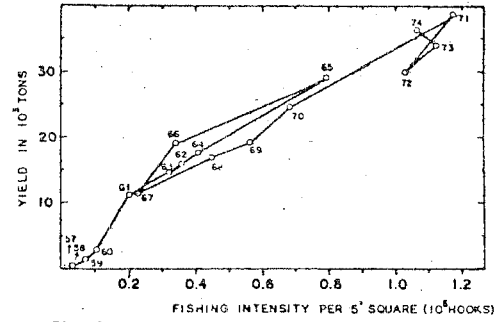


Fig. 3. Annual change in catch in weight against overall fishing intensity of the whole longline fleet in the Atlantic Ocean.

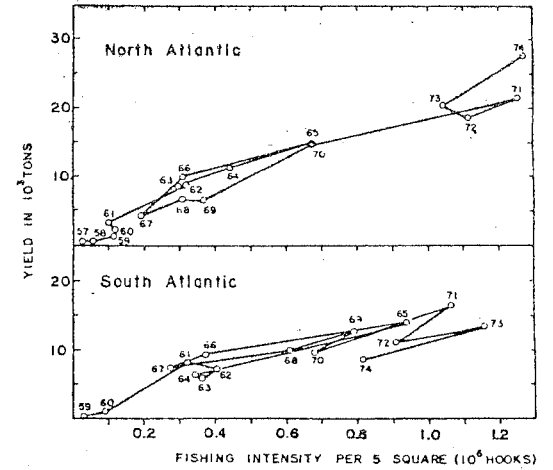


Fig. 5. Relationship between yield and fishing intensity on bigeye tuna in north and south Atlantic.

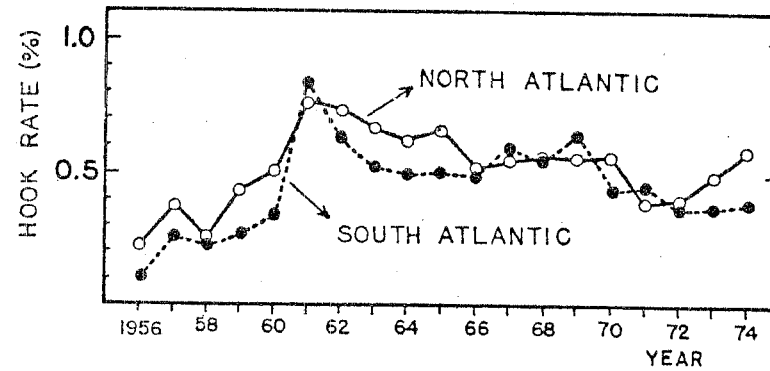


Fig. 4. Annual change in hook rate of bigeye tuna in respective north and south Atlantic.