

BIOLOGICAL VIEWS FOR CONSERVATION OF YELLOWFIN TUNA IN THE ATLANTIC OCEAN
BASED ON INFORMATION UP TO SEPTEMBER 1974

by

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SUMMARY

Taking into account of most recently available data mainly of longline fishery, the recent status of the yellowfin stock seems to have remained on the same level as to be necessary for the introduction of further management measures besides the size limit regulation. Regarding taking the under sized yellowfin in excessive amount, it appears to be necessary to make every effort to understand the nature of the fishing ground and to re-examine the fishing strategy to lessen the catch of small-sized yellowfin. Catch quota system, especially that with national allocation, proposed by Gulland (1974, mimeo.), was discussed.

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RESUME

Compte tenu des données les plus récentes disponibles, surtout sur la pêche palangrière, l'état du stock d'albacore semble récemment être resté au même niveau qui demande que d'autres mesures de contrôle soient introduites, outre les réglementations de taille limite. En ce qui concerne la capture excessive d'albacore en-dessous de la taille admise, il semble nécessaire de faire tout ce qui est possible pour comprendre la nature des zones de pêche et pour examiner de nouveau la stratégie de pêche visant à amoindrir la prise d'albacore de petite taille. Le système de contingentement des prises, surtout avec allocation par pays, qui avait été proposé par J.A. Gulland (1974, mimeo.), fait l'objet d'un exposé.

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RESUMEN

Teniendo en cuenta los últimos datos disponibles, principalmente de la pesquería con palangre, parece que la situación reciente del stock de rabil se ha mantenido al mismo nivel, haciendo necesaria la introducción de otras medidas de ordenación, además de la regulación del límite de talla. En cuanto a la captura en cantidad excesiva de ejemplares de rabil de talla inferior a la reglamentada, parece necesario investigar al máximo la naturaleza de los caladeros de pesca y volver a examinar la estrategia pesquera, a fin de reducir la captura de rabiles de talla no reglamentaria. Se discutió el sistema de cupos de capturas, especialmente la asignación de cupos nacionales, propuesta por Gulland (multicopiado, 1974).

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✕ Figure 3 reproduced in Data Record Vol. 5.

Figure 3 reproduit dans le Recueil de Données Statistiques Vol. 5.

Figura 3 reproducido en el Vol. 5 de la Colección de Datos Estadísticos

The growing intensification of the effect of fishing on the Atlantic yellowfin tuna attracted the great concern of the member countries of ICCAT, and at the Council Meeting of ICCAT in 1972 was recommended the minimum size regulation, together with being established the "Working group on yellowfin tuna regulation" (ICCAT 1973). The minimum size regulation came into effect in July 1973. In May of 1974, FAO's scientist, J. A. Gulland, proposed that, besides the minimum size limit, the necessity of the introduction of a catch quota system be essential for the conservation of Atlantic yellowfin stock as the possible management measures to be taken. Having been considering the needs of the regulatory measures to sustain the said stock (e.g. Hayasi 1973 and 1974), we present in this report our consequence of the study of basic biological aspect by reviewing recent information including above-mentioned Gulland's document for the better understanding of the needs of the regulatory step.

1. Brief review of the status of the stock.

1.1. Recent catch and age composition

The catch of yellowfin tuna in the Atlantic Ocean has almost settled down on relatively high level between 74,000 and 93,000 tons during recent five years (Table 1). According to the length data presented at SCRS in 1973, the average size of yellowfin in catch has become smaller. The predominant age has been lowered from 2-years old until 1969 to 1 age since that year in the catch of surface fishery, and from 3 age until 1963 to 2 age since then in the catch of longline fishery. The Japanese length data of longline yellowfin in 1972 indicated no substantial change compared with that in 1971 (Honma ms).

1.2. Abundance of the yellowfin tuna in the longline ground

To examine the annual change in the amount of catch and hook rate of yellowfin caught by the longline fishery operating in extensively wide area, it is necessary to consider about the stock structure. There is unfortunately no appropriate measure to examine explicitly the relationship of the stocks between eastern and western Atlantic. Therefore it may be necessary to take both standpoints of one stock in the whole Atlantic and two separate stocks in the eastern and western Atlantic, as Fonteneau (personal communication*) proposed, the boundary of which is set at the longitudinal line of 30°W.

The total catch of longline fishery encountered its peak year in 1960, 52,300 tons, and then has declined with the introduction and development of the surface fishery. Since 1969, when the catch of the surface fishery reached to be 60,800 tons, the longline catch has become stabilized at around 30,000 tons (ICCAT 1974a and Table 1). The longline catch by eastern and western areas was here estimated for 1965-1972,

* Though his description on the boundary of the two stocks says at 20°W which is taken from Honma (1974), this should be read for 30°W, which Honma (op.cit.) adopted and also was pointed out by Rothschild (personal communication).

that are not provided from ICCAT statistics, as follows:

- 1) Yellowfin catch of Japanese longline fishery of eastern and western Atlantic, the boundary of which is located at 30°W, was divided by allocating whole Atlantic catch in weight in proportion to catch in number of each area.
- 2) With regard to other longline catch than Japanese, FAO catch statistics (FAO 1974, Vol. 34) was utilized in allocating the corresponding ICCAT yellowfin catch by using the ratio of the catch of northeastern, central eastern and southeastern areas for eastern Atlantic and of northwestern, central western and southwestern areas for western Atlantic, to the total catch.

During the best ^(yellowfin) yellowfin years, 1960-1966, about 70 % of longline yellowfin catch was taken from the eastern Atlantic on the average (Hayasi and Kikawa 1970). As is shown in Table 2, however, since 1966, though there observed a little year-to-year fluctuation, the catches of eastern and western Atlantic have become closer in amount to each other. In the early 1960's, yellowfin hook rate of longline fishery decreased remarkably, as was indicated from 4 % at the early years of exploitation to less than 1 % in 1964. This low hook rate continued at the level of around 0.8 % until 1969, and then again followed by a slight decline in 1970-1972 (Honma ms). Hook rates of each of eastern and western areas was calculated to examine the trends by area. It appears that the almost similar decreasing trend is apparently observed in both areas (Fig. 1). Further examination, on the correlation between areas on the deviation in each corresponding year from the linear trend line fitted on the transformed hook rates into logarithmic form (fig. 2), indicated that there is low correlation ($r = 0.533$). When the hook rate in the western area is shifted to the right side by one year, then the correlation coefficient resulted in fairly high value ($= 0.713$). It is suggested that the above observations are not inaccessible to the assumption that there be an intermingling between the both stocks.

1.3. Relation between catch and effort

It is unanimously recognized in 1968 that the yellowfin fishery, especially the surface fishery, in the Atlantic has reached to such a stage that an increase in the amount of fishing will not result in any appreciable increase in sustained yield (ICCAT 1974 b). The average catch of yellowfin for the years 1968-1972 amounts to 83,400 tons for whole yellowfin fishery and 56,300 tons for the surface fishery. The same average catch for the longline yellowfin fishery, that had been lowered since the development of the surface fishery, has been leveled off around 26,000-28,000 tons (Honma ms). During the years 1966-1972, while the stock level for longline fishery settled down on the low, the catch has varied between 11,000 and 16,000 tons in the eastern Atlantic and between 9,000 and 15,000 tons in the western Atlantic (Table 2).

2. The catch of small-sized yellowfin tuna in the surface fishery.

In connection with the size limit regulation that has carried into effect since July 1973, by area is reviewed the proportion of smaller size of yellowfin tuna than 3.2 kg in the surface catch. The referable data are obtained from the length compositions of Tema-based pole-and-line fleets flagged by Japan, Panama and Ghana (ICCAT 1974 c), the US purse seine fleet (NMFS unpublished data: ICCAT data circulation) and a Japanese purse seine fleet (JAMARC 1974). In comparison, the 1972 data was drawn from FIS fleet (ICCAT 1974 c), the US purse seine fleet (op. cit.) and the Japanese purse seine fleet (Honma and Suzuki ms). A fish with 3.2 kg in weight corresponds to about 55 cm in length according to Lenarz (1971) and to 18 cm in LD₁ by Le Guen (1973), so that by adopting these figures the proportion in number of

smaller size than 3.2 kg was calculated. The above data are summarized in Table 3. In Tema-based fleet, the proportion of individuals smaller than the size limit was remarkably high, about 80 %. In contrast with this, the proportion for the US fleet was 26 % in 1972, being followed by the lower value in 1973, 21 %. In FIS fleet, the percentage fluctuated between 8 and 27 % in 1972. Japanese purse seine operating in the area off Tema indicated 36.7 % in 1972 and 16.3 % in 1973.

According to the ICCAT communication dated March 21, 1974, the pole-and-line catch of Tema-based fleet in 1973 amounted to approximately 10,000 tons of yellowfin and 15,000 tons of skipjack, indicating the skipjack predominance. The yellowfin in the area off Tema caught mixed with skipjack are very small in size, and consequently the concern that such size limit on yellowfin tuna might hamper the exploitation of skipjack has become disclosed. Such barrier should be overcome technically for the development of skipjack fishery. At the same time, as has been discussed by many scientists, it is obvious that the fishery directing to the very small-sized fish is less efficient in utilization of the stock. It appears to be necessary to make every effort to understand the nature of fishing ground and to re-examine the fishing strategy to lessen the catch of small yellowfin in such fishing ground as off Tema (Fig. 3).

3. Consideration on regulatory measures.

In the Gulland's paper, he made an assumption that the equilibrium yield of 100,000 tons would be adequate when ideal catch be realized, and proposed by examining the administrative standpoint that the implementation of the catch quota system would be most appropriately carried out by national allocation of the quota. We would examine in this report the necessary information on the regulation as well as some of Gulland's view from the technical aspects here under:

First consideration is that in the establishment of catch quota it is very difficult to assume "the best distribution of fishing effort geographically and according to sizes of fish". The fishery is by itself an economical activity, and that does not harvest only single species. Thus for a particular species, the age of first capture would be too low in some case and too high in another. It is also noted that under present circumstances that the amount of effort has been kept stable on relatively high level, the average amount of catch during the past several years is assumed to be close to the actual maximum sustained yield. If the recent yellowfin fishery in the Atlantic continue as it is now, then the maximum sustained yield would be in close proximity to the average catch, e.g. 83,400 tons during the years 1968-1972. At present, the most likely maximum sustained yield may be in between 80,000 and 90,000 tons, rather than 100,000 tons proposed by Gulland. On the occasion when the technique for estimation of maximum sustained yield is established, taking into account of the amount of recruitment, the composition of the fleets and distribution of effort, through the further progress on research, the then estimated maximum sustained yield should replace the simply calculated maximum sustained yield as the recent average value. It goes without saying that the necessity for the regulation should be considered more severely, and if the possible increase in sustained yield is generated by the new expansion of the fishing ground and the modification of fishing method, it seems to be operative to make an attempt of the experimental excessive input of effort under the establishment of the inspection system such as adopted by Inter-American Tropical Tuna Commission (IATTC 1969).

Regarding enforcement of the fishery regulation, it is of interest about the Gulland's proposal that describes various regulatory measures including national

allocation. As the fishing method and ground are different by each country, that is the dominant ages to be taken are different, the effect of the fishing of each country on the stock would not be the same even if the amount of catch is equal, and the type of operation is related to many trials in enforcement of the regulation. It is, however, very difficult to evaluate the above matters in details on only scientific basis. It is also noted that taking into account of the rational utilization of the stock and resultant economical aspects, the effort by every country should be taken to keep the regulatory measures employed as fully as possible.

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Table 1. Catch by gear of yellowfin tuna in the Atlantic Ocean, 1969-1973.
(in 1,000 tons)

		1969	1970	1971	1972	1973
Gear \ Total		90.9	74.2	79.3	93.2	(85.5)
Surface	Subtotal	62.3	45.1	50.4	64.2	59.7
	Purse seine	45.5	34.9	39.2	50.4	44.2
	Baitboat	16.7	10.2	11.2	13.8	15.4
	Unspecified	0.0	0.0	0.0	0.0	0.1
Longline		28.3	28.4	28.5	27.1	25.7
Unclassified		0.4	0.7	0.4	1.9	0.1

Data source: ICCAT Statistical Bulletin, Vol. 4 (1974)

Table 2. Longline catch of yellowfin tuna in eastern and western Atlantic, 1965-1972.

(in 1,000 tons)

Year	Total	Eastern Atlantic	Western Atlantic
1965	39.4	26.2 (66)	13.2 (34)
1966	25.9	10.9 (42)	15.0 (58)
1967	20.2	11.3 (56)	8.9 (44)
1968	25.9	14.3 (55)	11.6 (45)
1969	28.3	16.0 (57)	12.3 (43)
1970	28.4	15.9 (56)	12.5 (44)
1971	27.1	13.1 (48)	14.0 (52)
1972	25.7	15.6 (61)	10.1 (39)

Remark: () indicates a percentage to yearly total.

Table 3. Percentage of smaller fish than 3.2 Kg in total yellowfin catch in number by surface fishery.

Fleet	Percentage	Remarks and Data Source	
U. S. purse sein fleet	20.9 26.1	1973 1972 56 cm > (ICCAT Data circulation)	
Tema based pole-and-line fleet	82.2	1973 (May-December mainly) (ICCAT Data Record, Vol. 3)	
FIS fleet			
Area 1	Pole-and-line with hold in ice (PI)	-	
	Pole-and-line with freezer (PF)	26.8	
	Regular purse sein (PR)	16.4	1972 (ICCAT Data Record, Vol. 3) LD ₁ = 18 cm >
	Large purse seine (PL)	22.8	" " 55 cm in fork length (according to Le Guen et al., 1973)
	Total	22.8	
Area 2	PI	26.5	
	PF	21.2	
	PR	9.1	
	PL	15.3	
	Total	14.8	
Area 3	PI	16.1	
	PF	12.2	
	PR	8.0	
	PL	12.0	
	Total	14.2	
Japanese purse sein fleet	36.7 16.3	1972 56 cm > (Honma and Suzuki, ms) 1973 (JAMARC, 1974)	

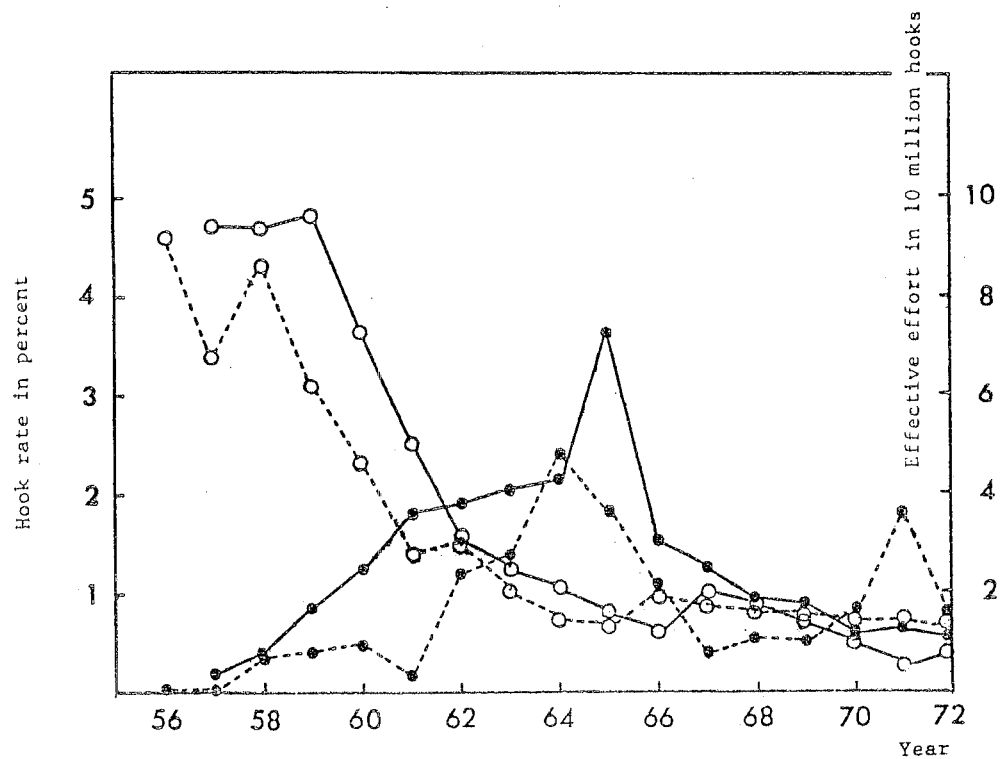


Fig. 1. Hook rates (Open circles) and amount of effort (Solid circles) for yellowfin tuna in Japanese longline fishery in the eastern (Solid line) and western (Dotted line) equatorial Atlantic, 1956-1972.

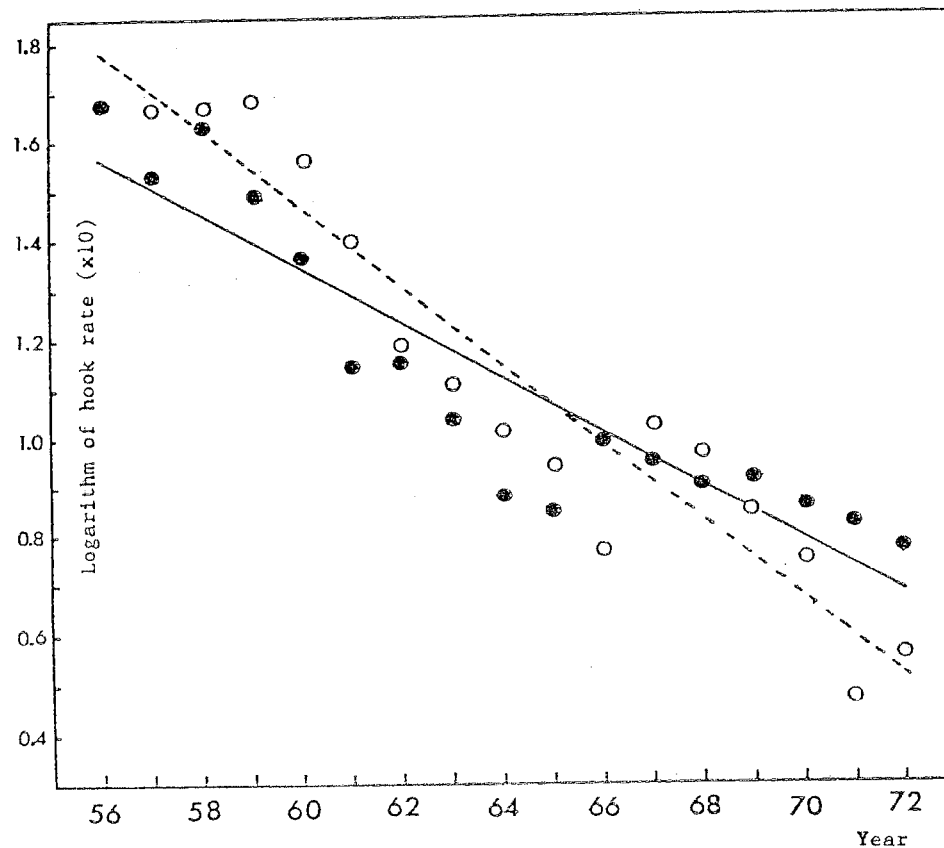


Fig. 2. Yearly change of hook rate transformed into logarithmic form and its regression line fitted for Guinea (open circles and dotted line) and Carib (shaded circles and straight line) areas.