

CATCH, FISHING EFFORT AND LENGTH COMPOSITION OF THE ATLANTIC BLUEFIN
CAUGHT BY JAPANESE LONGLINE FISHERY

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SUMMARY

Catch and effort, CPUE and length composition of bluefin tuna caught by the Japanese longline boats by various regions of the Atlantic were analyzed. CPUE for this species has not shown any consistent decreasing or increasing trends in major fishing grounds. It is noteworthy that in addition to appearance of small fish about 100 cm. in a significant amount, a sizable amount of the catches of medium sized fish between about 150 and 200 cm. that was usually represented poorly in the catches was observed for northwestern Atlantic longline fishing grounds in the recent years. The giant bluefin fishery of the Japanese longline boats in the Gulf of Mexico has been stable both in terms of CPUE and length composition. From these observations, it is inferred that the Atlantic bluefin stock exploited by the Japanese longline fishery is in a relatively stable condition at least after the mid 1970's.

RESUME

Les prises et effort, cpue et composition par taille du thon rouge capturé par les palangriers japonais dans plusieurs secteurs de l'Atlantique sont analysés. La CPUE de ces espèces n'a pas montré de tendance cohérente à la baisse ou à la hausse dans les lieux de pêche importants. Il convient de souligner qu'outre la présence d'une quantité significative de petits poissons mesurant environ 100 cm, une quantité appréciable de poissons de taille moyenne entre 150 et 200 cm environ, lesquels représentaient auparavant un faible pourcentage des prises, a pu être observée ces dernières années dans les lieux de pêche à la palangre de l'Atlantique nord-ouest. La pêche au thon rouge géant des palangriers japonais dans le golfe du Mexique est restée au même niveau pour ce qui est de la cpue et de la composition par taille. On déduit de ces observations que l'état du stock de thon rouge de l'Atlantique exploité par la pêcherie palangrière japonaise est relativement stable, du moins depuis le milieu des années 70.

RESUMEN

Se analizaron la captura y esfuerzo, y la CPUE y composición por tallas del atún rojo capturado por los palangreros japoneses en diversas regiones del Atlántico. La CPUE de esta especie no ha mostrado ninguna tendencia uniforme de aumento o disminución en las zonas de pesca importantes. Vale la pena señalar que, además de la aparición de una cantidad significativa de peces más pequeños -de unos 100 cms.-, se ha observado, en años recientes, en las zonas de pesca de palangre del Noroeste del Atlántico, que antes

eran generalmente poco fecundas, una cantidad importante de capturas de peces de tamaño medio -entre 150 y 200 cms.- La pesquería de atún rojo gigante de los barcos palangreros japoneses en el Golfo de México permanece estable, tanto en lo referente a la CPUE como a la composición por talla. De esto se deduce que el stock de atún rojo del Atlántico, explotado por la pesquería japonesa de palangre, se mantiene relativamente estable, por lo menos a partir de mediados de la década de los 70.

Introduction

Uncertainty about population structure and low reliability of various parameters used for the estimations of changes in stock size could be pointed out as major factors which hamper a reliable assessment of the Atlantic bluefin stock.

Up to the present moment, there are no conclusive studies on the population structure of this species to indicate whether two separate stocks are distributed in each side of the Ocean or bluefin in the entire Atlantic belong to a single stock. Further, this situation in the study of the stock structure would not be improved in the near future.

Cohort analysis (e.g., Parrack 1981) and analysis of catch-effort statistics and sizes of the catches for a specific fishery (e.g., Shingu and Hisada 1981) have been utilized for the assessment of the stock status of the Atlantic bluefin. Cohort analysis is one of the effective methods, if input parameters and catches by age data are reliable, to study history of exploitation by the fisheries for a species such as bluefin that has long life history, fished by several different gears during their various segments in life history.

However, one of the major weakness of this method is difficulty in making estimates of recruitment until cohorts pass through the exploitation of several important fisheries. The difficulty is well expressed in Table 1 which indicates considerable fluctuations, a magnitude of several folds, of recruitment at the beginning of age 1 for the same cohorts estimated during the three consecutive years (Parrack et al. 1979, Parrack 1980 and 1981). These estimates are based mainly on the results obtained from tagging for the small fish caught by the U.S. purse seine fishery for the purpose of estimating recruitment strength of younger cohorts in earliest opportunity. However, it is likely that fishing mortality rates derived from this method is subject to considerable bias due to intensified fishing regulations, emigration of the fish to offshore areas, tag sheddings etc.

The example shown in Table 1 indicates limitation of estimating the recruitment strength for only partially fished cohorts at younger ages and implies little validity for the projection of future stock status basing on these estimates.

Practical method for the stock assessment of this species appears to be crosschecking of the results from the cohort analysis and information obtained through fisheries such as catch-effort trends, cpue and size composition which, as a matter of fact subject to bias due to changes in fishing strategy. To make the comparison meaningful, detailed description of actual aspects of individual fishery is essential so that the effects of the changes in fishery are accounted for in the analysis although sometimes they are hopelessly large to be done.

This paper analyzes catch-effort statistics, hook rates and size composition by areas for the bluefin caught by the Japanese longline fishery which captures nearly every sizes of the fishes except for age 1 fish and operates over the vast areas of the Atlantic. The figures for 1980 to 1981 are provisional ones.

Results and discussion

Catch of bluefin tuna 1979-1981

Japanese bluefin catches from the entire Atlantic including the Mediterranean Sea amounted about 25000 fish (4350 tons) in 1979 and roughly the same catches, 27000 fish (4200 tons) in 1980.

Areal breakdown (Figure 1) of the total catches for 1979 and 1980 were 6700 fish (700 tons) and 4400 fish (800 tons) for northeastern Atlantic (E1-E4) and 11000 fish (1100 tons) and 15000 fish (800 tons) for northwestern Atlantic (W1-W3), respectively. Decrease of average weight from 100kg to 53kg for the latter areas during the two years indicates appearance of smaller fish in the catches of 1980. Catch from the Gulf of Mexico (W5) have been reduced and about 8000 fish (2400 tons) and 7000 fish (2000 tons) were captured in 1980 and 1981.

Trends of fishing efforts and hook rates

Northeastern Atlantic and Mediterranean Sea (Fig. 2)

Number of hooks by the Japanese longline fleet used for the entire areas of the E1 to E4 has increased from 1970 to 1975, followed by a consistent decreasing period and were stabilized at a level of 2 million hooks annually during the years 1978-1980.

Hook rates (catch in number of fish/1000 hooks) in the area E2 appear to show a steady increase from 1978 to 1980. In the areas including the Strait of Gibraltar (E3), hook rates in the major fishing season which encompasses first and second quarters fluctuated with the figures 2.7, 3.7, 2.1, 4.0,

2.9 for the years from 1976 to 1980. Similar fluctuation in the hook rates from the area E3 was observed with those in the Mediterranean Sea (E4) which varied on an annual basis, 3.4, 6.9, 3.2, 4.3, 2.5 since 1976.

Northwestern Atlantic (Fig. 3)

About 10-14 million hooks have been exerted to the northwestern Atlantic (W1-W5) during the period 1976-1980. Fishing effort has increased in the recent years in the area W1 and W2 while it remained more or less at the same level in the area W3. In all areas of W1-W3, steady increasing trends of the hook rates during the major fishing season of the first quarter are shown since 1979.

A significant change in the fishing strategy has occurred in the Gulf of Mexico in 1980 and 1981. Second quarter used to be the major fishing season of this area up to 1979. However, due to catch limit imposed, key fishing season shifted to the first quarter in these two years in addition to drastic changes of areas fished within the Gulf. These changes are more clearly explained in the Figure 4 which shows finer areal breakdown by lat. 5° x long. 5° squares with ratio of catches to the total made in the Gulf for three years from 1979 to 1980.

Usual operation pattern in and before 1979 was that most of the catches were from inner parts of the Gulf west of 85°W during March to May whereas about 75 % of the catches to the total were attained in 1980 in the areas east of 85°W in February. The distribution of percentages in 1981 indicated further shift of the fishing ground to the north of Cuba in January and February although the data for 1981 consisted of only six boats' reportings. Both in 1980 and 1981 the longliners returned to the usual inner parts of the Gulf after February.

From the above descriptions, only data obtained from March and April in the inner parts of the Gulf are comparable throughout the entire time series (Fig. 5).

Hook rates of bluefin in the Gulf of Mexico

	1975	1976	1977	1978	1979	1980	1981
full season	3.7	2.8	2.1	2.8	2.2	4.8	1.7
March	2.7	0.9	1.5	2.9	1.9	4.2	1.4
April	3.8	2.6	2.0	3.8	3.3	no data	2.2

Hook rates in March and April in 1981 were as low as those in 1976 and 1977 whereas hook rates in 1980 appear quite high. During the entire period, no consistent trends were observed. Therefore, the fluctuation of hook rates seems to indicate relatively stable stock condition, on an average sense, of giant fish taken by the Japanese fishery after 1975. It should be pointed out, however, that the

trends thus shown may not be postulated conclusively to reflect the changes of spawning population in the Gulf because of short comparable period picked up from the entire fishing season.

Length composition of catch

Northeastern Atlantic (Figs 6 and 7)

No additional data to the previous report of this series were available yet. The points which should be mentioned are marked shift of length class from giant fish in the catches of 1977 to the medium sized fish in the catches of E3 and E4 in 1979 and subsequent shift of the length composition to the bigger sizes from 1979 to 1980 for the two areas. It is noteworthy in view of stock structure to mention nearly simultaneous appearance of the medium sized fish in the catch of the longline in each side of the Ocean.

Northwest Atlantic (Fig. 8)

There are two separate bluefin fishing grounds in the northwestern Atlantic one in the north of 35°N (W1-W3) fished mainly from October to March of the next year and the other in the Gulf of Mexico (W5) operated during January to June. Since bluefin catches in other seasons specified above are small after 1974, length frequency during these major fishing seasons for the two areas are shown (Fig. 8).

In the areas W1-W3, appearance of medium sized fish from 150 to 200 cm in fork length is remarkable in the winter season after 1978-1979 period. With in the areas W1-W3, most of the medium sized fish tend to be caught offshore areas. Although modal progressions of the medium sized fish cannot necessarily be traced for all cohorts every year on the basis of age-length relation by Parrack and Phares (1979), probably due to fluctuations in availability of the fish to the longline fishery or different growth rates by cohorts, it would be certain that the longline fishery have been exploiting relatively strong year classes assumed to have originated in the years 1971 to 1973. It is of interesting whether these medium sized fish appear to be traced in a measurable amount in the longline catches for spawning adults as they are expected to recruit into that category of fish in a few years. It is noted that in the past no recruitment to the spawning stock was expressed due to lack of the medium sized fish but recent stabilized catch of giant bluefin in the Gulf of Mexico seems to prove continuous recruitment of the medium sized fish to the spawning stock.

The observations of the length composition in the northwestern Atlantic seem to support a hypothesis that the medium sized fish between 150 and 200 cm are distributed offshore areas of middle to higher latitudes so scattered that they are represented in the longline catches only when strong cohorts appeared.

Small fish less than 120-130 cm have been scarcely represented in the catches in 1978-1979 winter season but sizable catches of this length classes were made again in 1979-1980 and 1980-1981 seasons.

Size composition of the bluefin in the Gulf of Mexico in 1981 showed similar or slightly wider ranges of size with the previous years. However, relative frequency of the fish between 230 and 270 cm, usually most dominant classes, decreased considerably in 1981. The reason of this might be shift of fishing area and season but is not certain due to provisional nature of the data.

References

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Parrack, M.L. and P.L. Phares. 1979: Aspects of the growth of Atlantic bluefin tuna determined from mark-recapture data. ICCAT CVSP 8, 356-420.

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Parrack, M.L. 1981: An assessment of the Atlantic bluefin tuna resource. ICCAT CVSP 15, 259-272.

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Table 1. Fluctuation on estimates of stock size at the beginning of age 1 for recent cohorts of the west Atlantic bluefin tuna

Unit: 10³ fish

Estimated in	1978	1979	1980
Cohort 1970	646	296	341
1971	358	317	254
1972	204	387	241
1973	500-956	733	1817
1974	105-234	327	574
1975	68-274	190	449
1976	2-235	44	198
1977		24	208
1978			191
1979			285

Data from Parrack et al. 1979, Parrack 1980 and 1981

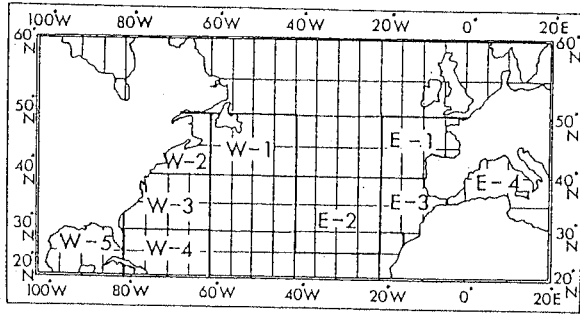


Fig. 1. Division of Japanese longline fishing grounds for bluefin tuna.

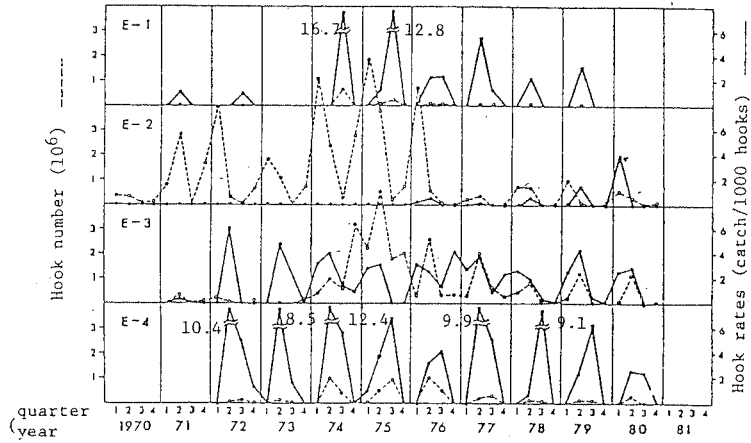


Fig. 2. Trends on fishing effort and hook rates of bluefin in the Japanese longline fishing grounds of northeastern Atlantic.

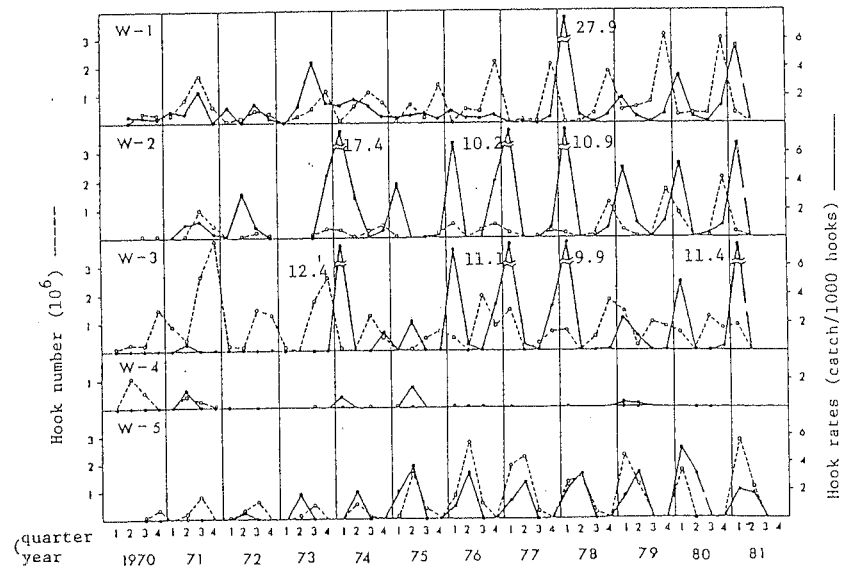


Fig. 3. Trends on fishing effort and hook rates of bluefin in the Japanese longline fishing grounds of northwestern Atlantic.

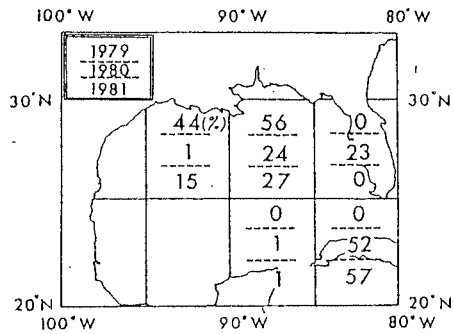


Fig. 4. Catch distribution of bluefin in percentage by 5° x 5° squares in the Gulf of Mexico during the years 1979-1981.

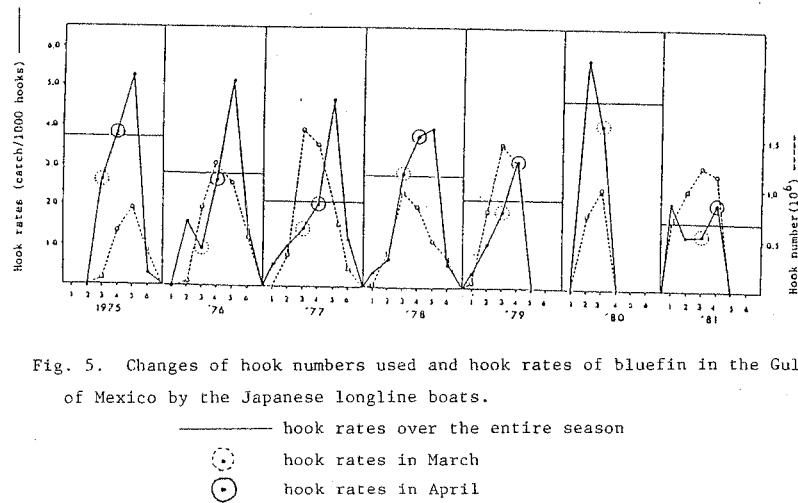


Fig. 5. Changes of hook numbers used and hook rates of bluefin in the Gulf of Mexico by the Japanese longline boats.

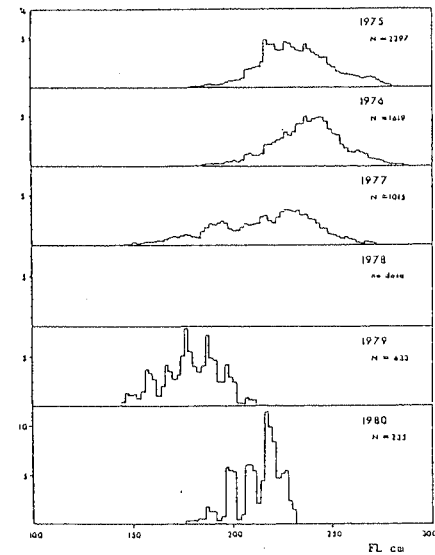


Fig. 6. Length frequency of bluefin caught by the Japanese longliners in the area E3 (Strait of Gibraltar).
N: Number of fish measured.

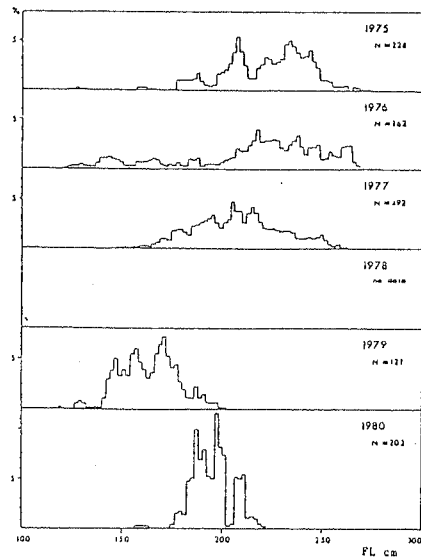


Fig. 7. Length frequency of bluefin caught by the Japanese longliners in the area E4 (Mediterranean Sea).

N: Number of fish measured.

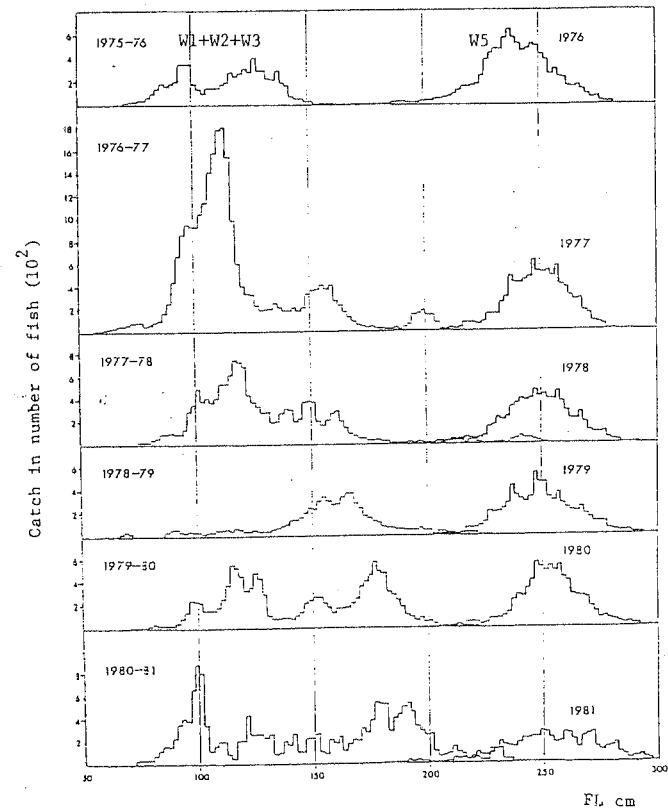


Fig. 8. Number of bluefin catches by 2 cm class from northwestern Atlantic by the Japanese longline boats.

Catches from W1, W2 and W3 are combined and shown by fine lines while those from W5 by thick lines.