

ANALYSIS ON THE ATLANTIC BLUEFIN TUNA STOCK CAUGHT BY LONGLINE FISHERY

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SUMMARY

Trends on catch, catch-per-unit-effort and length frequency distribution of bluefin tuna were analyzed for major longline fishing grounds in the Atlantic Ocean. Annual changes in length frequency distribution and CPUE suggest that recruitment of adult bluefin is more stable for the northwestern Atlantic than for the northeastern Atlantic including the Mediterranean Sea.

RESUME

On a analysé la tendance des captures, la prise par unité d'effort et la distribution des fréquences de taille du thon rouge pour les principaux lieux de pêche de l'océan Atlantique. Les modifications annuelles de la distribution des fréquences de taille et de la CPUE suggèrent que le recrutement du thon rouge adulte est plus stable pour l'Atlantique nord-ouest que pour l'Atlantique nord-est, Méditerranée comprise.

RESUMEN

Se analizan tendencias de capturas, captura por unidad de esfuerzo y distribución de frecuencias de talla del atún rojo, en los principales caladeros de palangre del Océano Atlántico. Los cambios anuales de distribución de frecuencia de talla y la CPUE, sugieren que el reclutamiento de atún rojo adulto es más estable en el Atlántico noroeste que en el nordeste, incluyendo el Mar Mediterráneo.

1. Japanese bluefin catch in 1979 and 1980

The Japanese bluefin catches from the Atlantic and Mediterranean Sea totaled about 3930 metric tons (provisional) during 1979. Of these catches 90 tons (900 fish) or so was made in the Mediterranean Sea. The catch from the mouth of the Strait of Gibraltar (E-3, Fig. 1) increased from 2,600 fish in 1978 to 5,800 fish in 1979. The catch off New York (W-1 to W-3) decreased from 12,000 fish in 1978 to 9,400 fish in 1979. About 8,300 bluefin tuna, equivalent to 2,400 tons, was caught by Japanese longliners in the Gulf of Mexico (W-5) during 1979 fishing season. On the wireless report, in 1980 fishing season in the Gulf of Mexico the longline fishery attained the quota (8,000 bluefin) and was closed up to the beginning of April because of high hook rate (catch-per-effort) of giant fish.

2. Trend in longline fishing effort and hook rate (catch-per-1000 hooks) in 1979 and 1980

Northeastern Atlantic

As a whole the longline fishing effort in the northeastern Atlantic (including E-4) showed a decreasing trend from 1975 to 1978 (Fig. 2). In 1979 fishing effort (in number of hooks) was about the same as that in 1978 in the areas E-1 to E-4. The increase of catch from the E-3 in 1979 resulted from increasing of hook rate in the second quarter of the year. In 1979 hook rate for the area E-4 showed a sharp decline in the second quarter but high in the third quarter compared with the previous years. However, in this area data is lacking for the peak season from May to June in recent years.

Northwestern Atlantic

There was no remarkable change in fishing effort between 1978 and 1979 for each area (W-1, W-2, W-3 and W-5, Fig. 3). For the areas W-1 to W-3, hook rate decreased in the first quarter of 1979 but increased

again in 1980 (data based on logbooks from 6 to 14 longliners for each area).

Hook rate in the area W-5 (Gulf of Mexico) from 1975 to 1980 are summarized as follows:

| Year | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 ^{1/} |
|-----------|------|------|------|------|------|--------------------|
| Hook rate | 3.0 | 2.4 | 2.0 | 2.8 | 2.5 | 6.5 |

As mentioned above, hook rate in the Gulf of Mexico showed particularly high value on February and March in 1980, 7.4 and 5.7 respectively. No decreasing trend on spawning group is observed as far as hook rate is concerned. For lack of data after April in this year the hook rate for the whole fishing season cannot be estimated here.

3. Length frequency distribution of the longline catches

Northeastern Atlantic

Figures 4 and 5 show the length frequency distribution of longline catches from 1975 to 1980, in terms of percentage, for the areas E-3 and E-4 respectively. No data is available for 1978 in both of the areas. In the area E-3 medium and large size bluefin tuna are caught by longline, ranging from 150 cm to 230 cm in body length (Fig. 3). However, major modal group in annual catch varies year after year. An average size of fish was from 230 to 240 cm in 1975 and 1976 and then became smaller to about 220 cm in 1977. The modal group was much smaller, around 180 cm in length, in the 1979 catch ranging from 150 to 200 cm. In 1980 major component of the catch are the fish of 215 cm or so. It is suggested that remarkable fluctuation of recruitment or availability occurs in this area, although data in 1979 and 1980 is provisional and small in sample size. The size of fish caught in the area E-4 (Mediterranean Sea) ranges

^{1/} Based on the logbooks from 15 longliners (about 65 % of the total longliners fished in the area W-5).

from 130 to 220 cm in body length and size compositions show a similar annual changes to those in the area E-3. In general average size of the catch is smaller than that in the area E-3. The big fluctuation of size composition is also observed in this area.

Northwestern Atlantic

In Figure 6 shows the number of catch by length class in the northwestern Atlantic (W-2, W-3 and W-5). The fish larger than 200 cm in body length was caught in the Gulf of Mexico and the others in the areas W-2 and W-3. Since 1976 the length frequency distribution from the area W-5 has showed fairly stable state, suggesting that regular sized-fish recruited every year to the fishing ground. The size composition of the fish less than 200 cm varies year by year. It is mentioned that 1973 year class which appeared in the longline catch in 1977 has been maintained and grown to 170-180 cm in length in 1980. The catch of the fish around 120 cm was exceptionally small in 1979 but made again in 1980.

For the northwestern Atlantic the fish from 180 cm to 220 cm (spawner or pre-spawner ?) is scarcely caught in the longline fishing grounds. Therefore, it must be examined whether they "distribute but unavailable" or "do not distribute" in the longline fishing grounds. Also it is of interest to know where they spawn, with examination of biological minimum, if they are spawners.

4. Estimation of recruitment of longline available population in the Gulf of Mexico

In the Gulf of Mexico rather stable hook rate and length frequency distribution has been observed compared with those in the other fishing grounds. Under the status of stable recruitment there is a linear relationship between X and X/C (Doi 1962):

$$\frac{X}{C} = \frac{1}{R} \cdot \frac{M}{q} + \frac{1}{R} X$$

Where ; X: Fishing effort
C: Catch
M: Natural mortality coefficient
q: Catchability coefficient
R: Recruitment

The data (nominal catch and effort) from the Gulf of Mexico (north of 25°N) was fitted to the equation. Figure 7 shows a relation between X and X/C for the Gulf of Mexico ($r^2 = 0.91$). If recruitment significantly change in some year a point of X/C in that year would drop far above or below the line. Estimated R is 14,100 fish which is slightly smaller than R = 15,200 fish obtained from the data for 1975-1979 (Shingu and Hisada, SCRS/79/58). Annual F and E and an average q are estimated, assuming M = 0.18 based on Parrack (1979, SCRS/79/98), as follows:

| q = 0.9247 x 10 ⁻⁴ | 1975 | 76 | 77 | 78 | 79 | 80 |
|-------------------------------|------|-----|-----|-----|-----|-----|
| F: | .16 | .33 | .42 | .27 | .29 | .16 |
| E: | .14 | .26 | .32 | .22 | .23 | .14 |

The result suggests that the exploitation rate (E) by longline fishery is about 20 % in recent years within the limits of the longline available population entered the Gulf of Mexico.

Literature cited

- DOI, T. 1962. Diagnosis of king crab resources off the Western Kamchatka coast. Bull. Tokai Reg. Fish. Res. Lab., (33), 11-20.
- PARRACK, M. L. 1979. Trends on the abundance and age structure of Atlantic bluefin tuna. SCRS/79/98.
- SHINGU, C. and K. HISADA 1979. Analysis on the Atlantic bluefin tuna stock. SCRS/79/58.

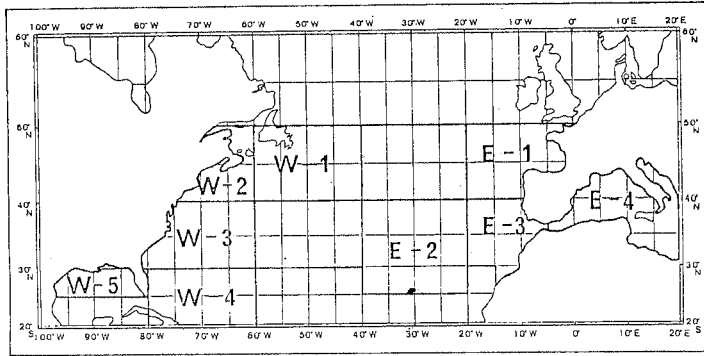


Figure 1. Fishing areas of Japanese longline fishery for bluefin tuna.

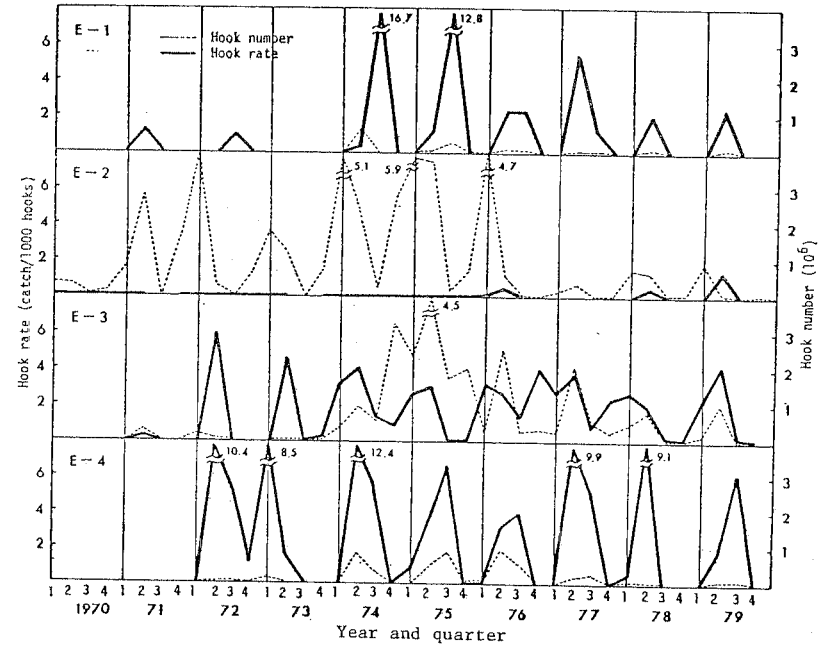


Figure 2. Changes in fishing effort and catch-per-1000 hooks in the Japanese longline fishery for the northeastern Atlantic.

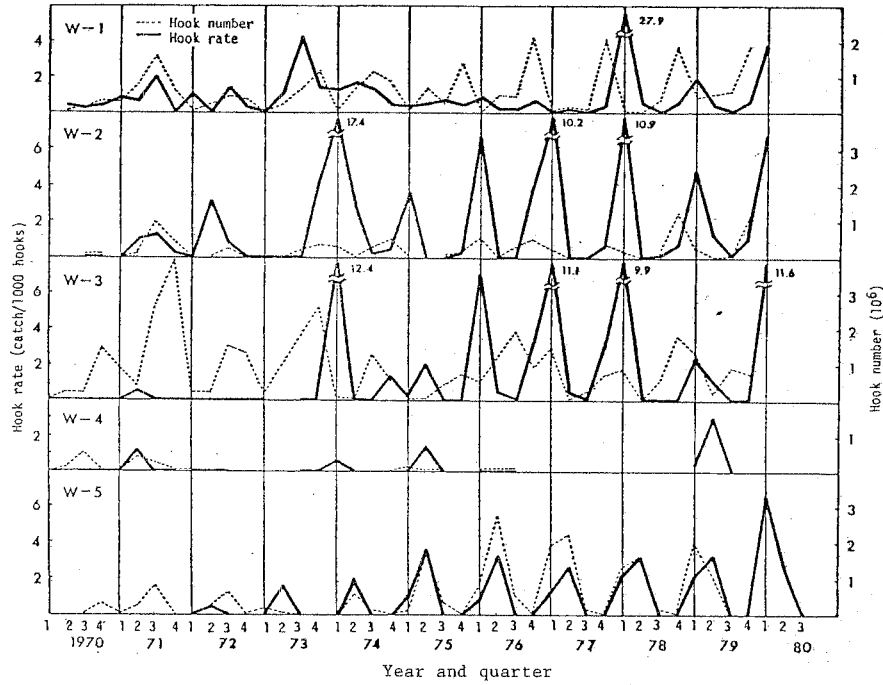


Figure 3. Changes in fishing effort and catch-per-1000 hooks in the Japanese longline fishery for the northwestern Atlantic.

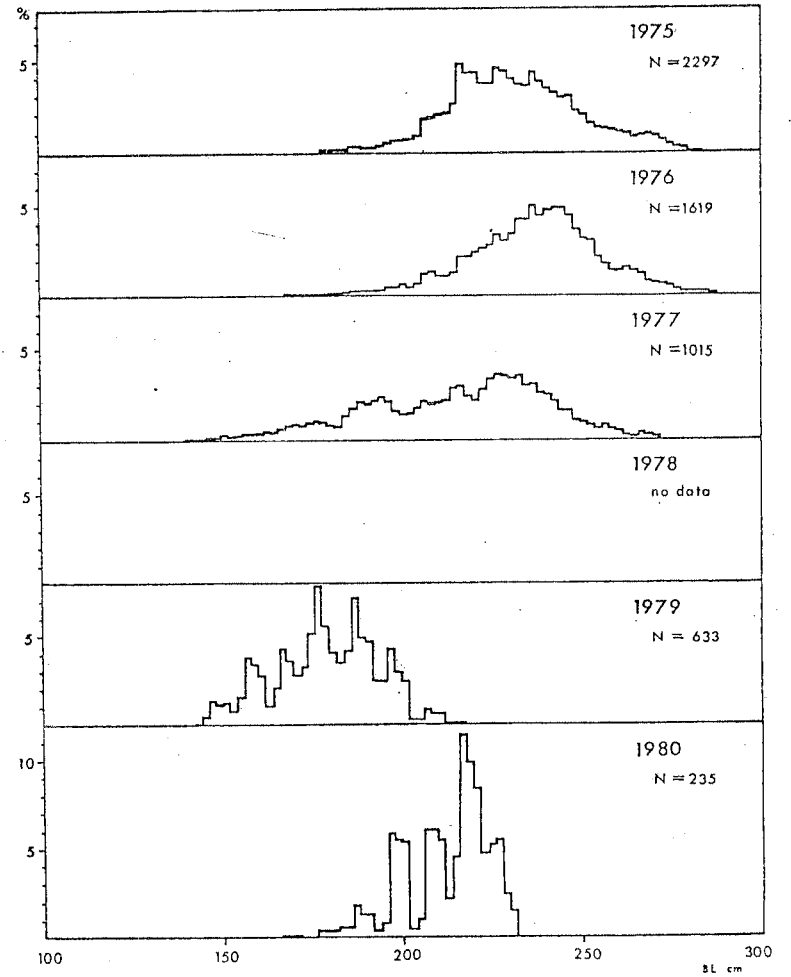


Figure 4. Length frequency distribution of longline catch from the Strait of Gibraltar (E-3).
N : Number of fish measured.

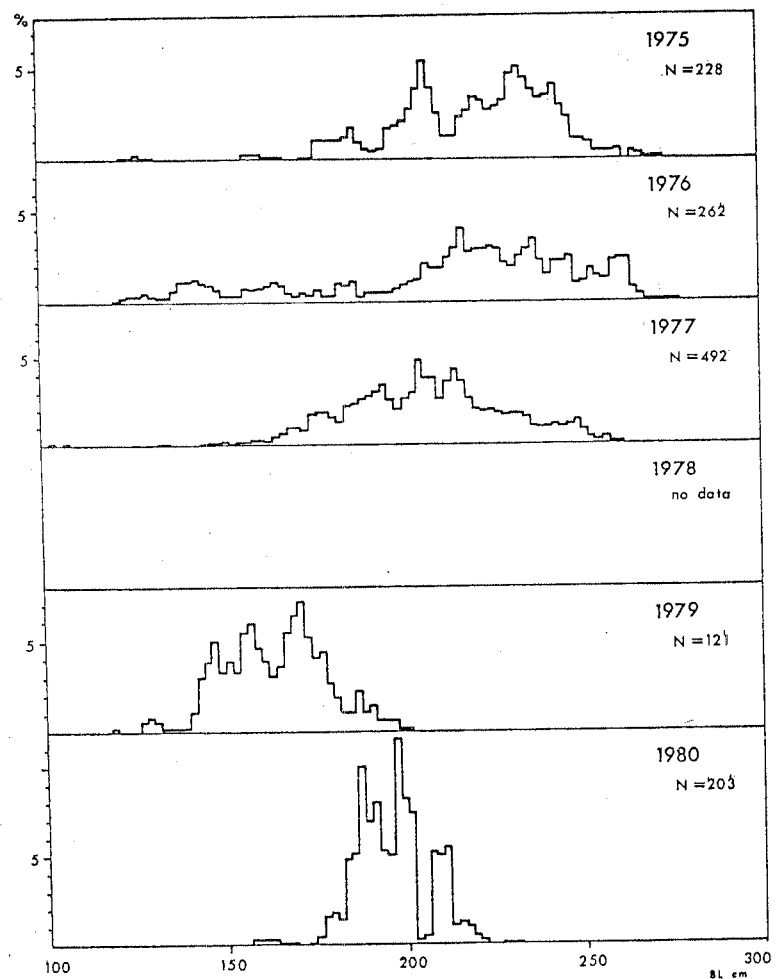


Figure 5. Length frequency distribution of longline catch from the Mediterranean Sea (E-4).
N : Number of fish measured.

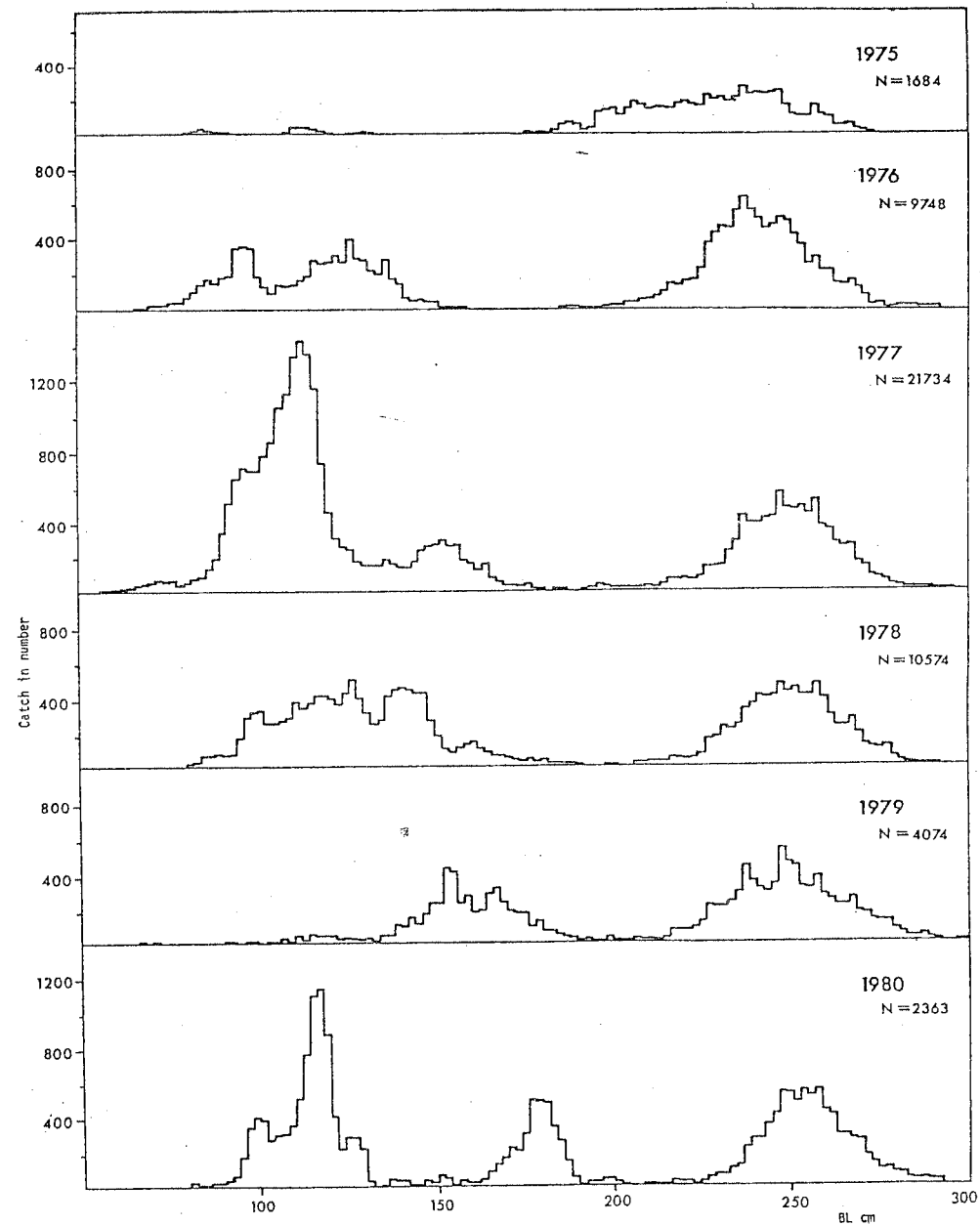


Figure 6. The number of catch by 2 cm size class from the northwestern Atlantic (W-2, W-3 and W-5) by longline fishery.
N : Number of fish measured.

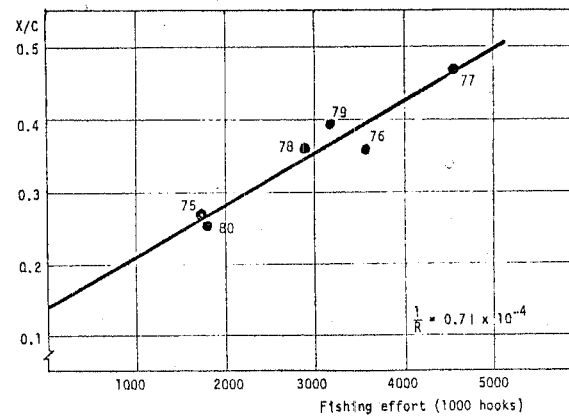


Figure 7. Relation between X (fishing effort) and X/C (fishing effort/catch) from 1975 to 1980 in the Gulf of Mexico in Japanese longline fishery.