

Y/R ANALYSIS FOR THE SURFACE AND LONGLINE FISHERIES
OF THE NORTH ATLANTIC ALBACORE STOCK

by

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SUMMARY

Taking into account the influence of the two kinds of fisheries for North Atlantic albacore, the change in production on the Y/R basis for various sets of the fishing mortality coefficients between longline and surface fisheries has been evaluated. The calculation of Y/R was made using the program coded by M. Honma of the F.S.F.R.L.

RESUME

Les modifications de la production de germon dans l'Atlantique Nord ont été évaluées à partir du rendement par recrue pour divers jeux de coefficients de mortalité par pêche supposés pour la palangre et la surface, en tenant compte de l'influence de ces deux types de pêche. Le rendement par recrue a été calculé au moyen du programme codé par M. Honma du FSFRL.

RESUMEN

Considerando la influencia de dos tipos de pesquería para el atún blanco del Atlántico Norte, se han evaluado los cambios en la producción en base al rendimiento por recluta para varios grupos de coeficientes de mortalidad por pesca presupuestos en las pesquerías de palangre y de superficie. El cálculo del rendimiento por recluta se efectuó por medio del programa codificado por M. Honma del F.S.F.R.L.

Taking into account the influence of the two kinds of fishery for the North Atlantic albacore, the change in production, on the Y/R basis for various sets of the fishing mortality coefficients between longline and surface fisheries has been evaluated. The calculation of Y/R was made using the program coded by M. Honma of the F.S.F.R.L..

Parameters used

1) Bard's (1974) growth equation, i.e. $L_{\infty}=134.4$, $k=0.83$ and $t_0=-0.35$, was adopted in the present study. Using the L-W relation equation formulated by Suda (1961), L_{∞} was converted into W_{∞} as 56.74.

2) t_c
Average age at first capture was calculated using modal and younger ages weighted by corresponding percentage. For the surface fishery, the data of catch by age in the two years, 1974 and 1975, which were included in the annual catch data of surface fishery compiled by Bard (1977), were utilized to obtain t_c . The value which was estimated as 2.9 was almost similar to that of the average over the past 19 years. For the longline fishery, the data during 1971 to 1974, reported by Morita (1977) were used. Thus, the average value of t_c for the longline was obtained as 4.6. This is remarkably low compared to those values obtained before 1970. Although the surface fishery is usually operated during the summer season which is also the spawning period, no particular season for the longline fishery is specified. Therefore, t_c for the longline fishery has been modified to 5.1, 0.5 having been added to the average value.

3) t_d
The ages at the end of capture for the surface and longline fisheries were postulated arbitrarily as 6.5 and 12.5, respectively

4) M
The series of natural mortality coefficients by age, which were used by Le Gall (1977) were adopted as the basic data. In the present report, the author attempted to calculate the total mortality coefficient for each age from 7 to 9 years old fish, utilizing the change of average CPUE by age for 11 year-classes of the albacore from the longline catches for the period 1956 to 1966. Then, the values of Z were obtained as 0.8, 1.1 and 1.4 for 7, 8 and 9 years old, respectively. When the value of Z for 7 years old fish was applied to that of M (0.6) which was estimated by Le Gall, the value of F was observed to be 0.2. If F was assumed as 0.2, the value of M for 8 and 9 old fish were regarded to be 0.9 and 1.2 respectively, because there was no significant fluctuation of fishing effort during this period. Thus the series of M by age were adopted as shown in Table 1.

Result and consideration

The result of the study are shown in Figures 1 and 2. There is no remarkable difference between both the patterns for two series of M. By the cohort analysis based on average of catch by age of three cohorts (Table 2), 1960, 1961 and 1962, which have been utilized till the recent year, number of recruitment at the age of two years was assumed to be about 12-13 million fish. Therefore, it is assumed that the recent status of utilization of albacore in the North Atlantic Ocean was situated in the area shown in the Figures as shadowed, taking into account the recent total catch (about 40-50 thousand tons) by both the fisheries.

References

- Bard, F. X. : Etude sur le germon (*Thunnus alalunga*, Bannaterre 1788) de l'Atlantique nord elements de dynamique de population. ICCAT Collective Volume of Scientific Papers, Vol. II (SCRS-1973), 198-224. (1974)
- Bard, F. X. : Commentaires sur l'etat du stock de germon (*Thunnus alalunga*) nord Atlantique. Ibid. Vol. VI (SCRS-1976), 215-232. (1977)
- Le Gall, J. Y. : Production pondérale du stock nord-atlantique de germon (*Thunnus alalunga*) par l'ensemble des deux pecheries (surface et palangre). --Etude du mélange éventuel des deux stocks, nord et sud. Ibid., 184-189. (1977)
- Morita, S. : Estimated age composition of albacore harvests by Japanese and Taiwanese longline fisheries in the Atlantic Ocean. Ibid., 190-194. (1977)

Table 1 Two series of natural mortality coefficients used for the Y/R analysis.

Age	2	3	4	5	6	7	8	9	10	11	
	0.2	0.2	0.2	0.2	0.4	0.4	0.6	0.6	0.8	1.0	estimated by Le Gall(1977)
M	0.2	0.2	0.2	0.2	0.4	0.6	0.9	1.2	1.5*	2.0*	modified in this study

*hypothesized arbitrarily

Table 2 Average catch by age of the year-classes from 1960 to 1962 in the Atlantic Ocean, which was used for cohort analysis.

Age	2	3	4	5	6	7
Surface ¹⁾	832,367	4,488,528	2,003,404	122,281		
Longline ²⁾	185	12,594	36,934	57,416	91,431	88,825
Total	832,552	4,501,122	2,040,339	179,697	91,431	88,825

Age	8	9	10	11
LL.	57,737	19,480	3,882	518
Total	57,737	19,480	3,882	518

1) after Bard (1977)

2) after Morita (1977)

Table 3 Number of recruitment at 2 years old (N_2), corresponding with F at 11 years old (F_{11}) given arbitrarily in the cohort analysis.

F_{11}	0.05	0.1	0.15	0.2	0.25	0.3	0.5
$N_2 (10^4)$	1,249	1,249	1,207	1,202	1,198	1,196	1,192

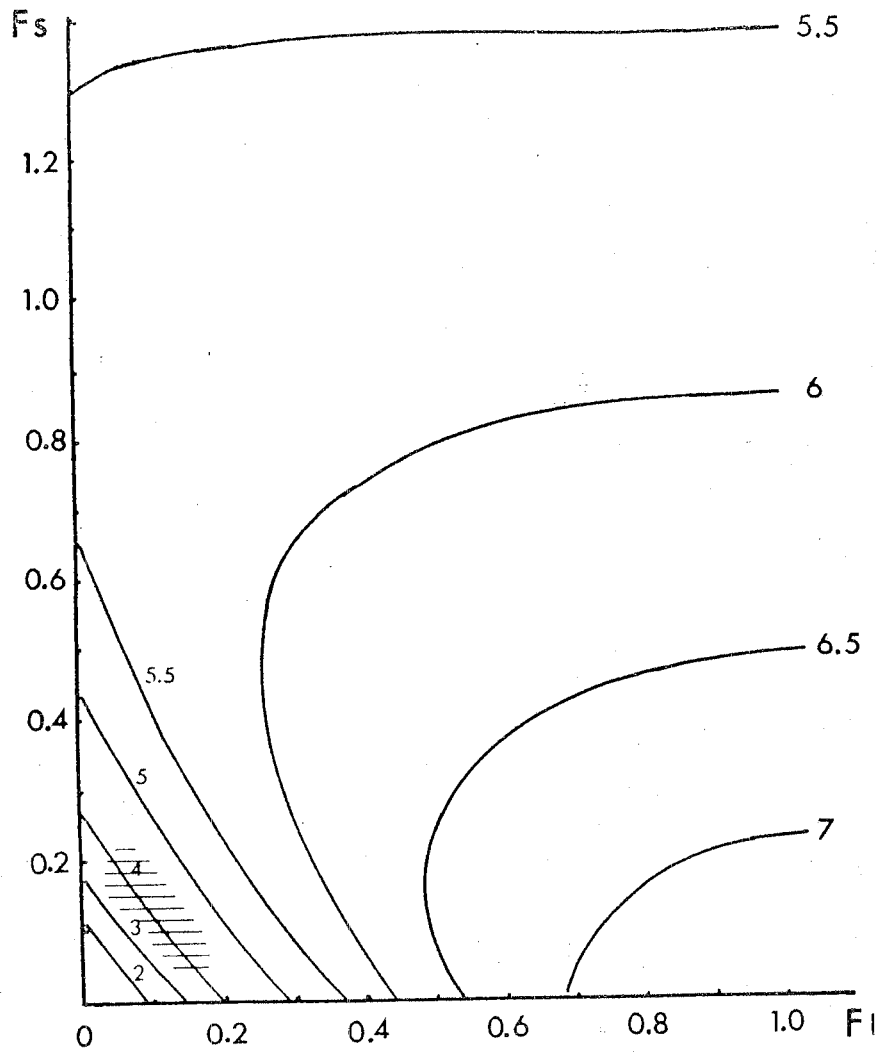


Figure 1

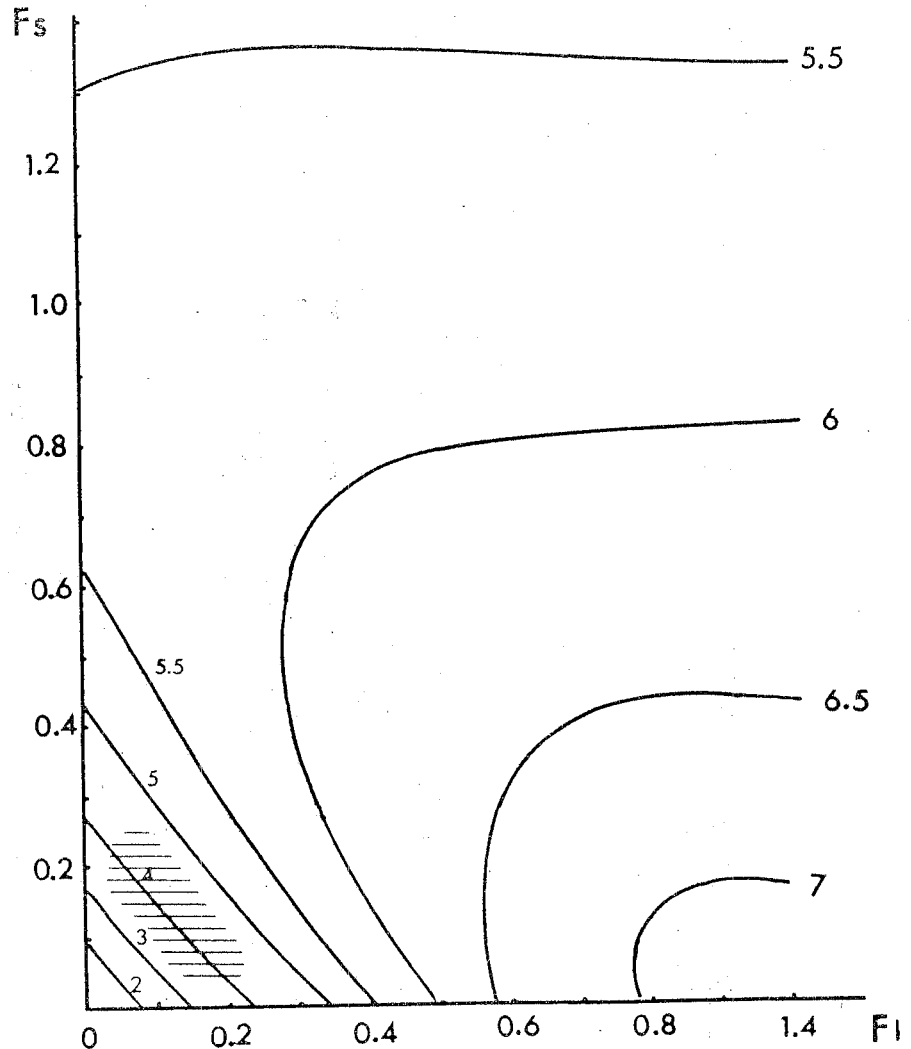


Figure 2

Yield-per-recruit in kg indicated by isopleth for the values of fishing mortality coefficient of the longline (F_l) and surface (F_s) fisheries in the North Atlantic Ocean. The series of M estimated by Le Gall (1977) and modified in the present study were applied to Fig. 1 and Fig. 2, respectively.