

PRODUCTION MODEL ANALYSIS ON ALBACORE STOCK IN THE SOUTH ATLANTIC, 1956-76

by

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SUMMARY

The albacore in the South Atlantic has been utilized exclusively by the longline fishery. The more fish had been caught in the adult fishing ground, more northern area of the South Atlantic, than the young ground until 1970, while since 1971, the catch of the young albacore has been greater than that of the adult. The production model analysis was conducted in this report for the Case-1 in which the effective effort was estimated by the cpue of the young and adult areas separately and for Case-2 in which the effective effort was estimated on the whole South Atlantic basis. The two cases were considered if there is any discrepancy in the results between the two types of effort estimations.

RESUME

Le germon se pêche exclusivement à la palangre dans l'Atlantique Sud. Jusqu'en 1970, la pêche a porté plus sur les adultes, dans la partie septentrionale de l'Atlantique Sud, que sur les juvéniles; à partir de 1971, par contre, cette situation s'est trouvée inversée. L'analyse du modèle de production a été effectuée dans le présent document dans les zones suivantes: cas n° 1 où l'effort effectif est estimé par la CPUE des juvéniles et des adultes considérés séparément, et cas n° 2, effort effectif estimé pour l'ensemble de l'Atlantique Sud. Les deux cas sont envisagés lorsque les résultats obtenus à la suite des deux types d'estimation de l'effort présentent des divergences.

RESUMEN

El atún blanco en el Atlántico Sur ha sido explotado exclusivamente por la pesquería de palangre. Hasta 1970 la mayor parte de los peces se capturaron en la zona de adultos, la más septentrional del Atlántico Sur; a partir de 1971 se ha capturado más cantidad de atún blanco joven que de peces adultos. En el presente documento se efectuó el análisis del modelo de producción para el Caso-1, en el cual el esfuerzo efectivo se estimó por la CPUE de las zonas de adultos y jóvenes por separado, y, para el Caso-2, se estimó tomando el conjunto del Atlántico. En los dos casos se consideró cualquier posible discrepancia en los resultados entre los dos tipos de estimación del esfuerzo.

1. Input data for the analysis

The details of the procedure for the estimation of the effective effort is given by Shiohama (1978), and the necessary data on catch, effective effort and cpue (hook rate) were obtained from Shiohama (MS). For the Case-1, each of the statistics on the adult and young grounds was first normalized by taking the average cpue for all the data as a unit, and next the effective effort was calculated and then both efforts for adult and young were combined for the total (Table 1). The data for the Case-2 was directly cited from the Appendix table 2 of Shiohama (op. cit.). The numbers of dominant ages in the catch (k) in Tables 1 and 2 were obtained by checking the age composition. As input for m , three parameters were selected: variable input, 1.001 and 2.0.

(Table 2)

2. Results

Case-1 The results of the calculation are shown in Figure 1 and Table 3. In all three cases of m 's, estimated maximum sustainable yields (MSY) were nearly 29,000 tons. As to optimum relative fishing effort, the amount (51×10^3) in case of m =variable (0.76) is about 1.4 times as much as that (37×10^3) in case of m =2.0. For the years 1969-1976, the catch ranged within $\pm 10,000$ tons of the level of MSY and the relative effort changed between 33×10^3 and 51×10^3 , indicating that both the catch and effort fluctuated to a great extent. The catch and effort in 1976 were 26,000 tons and 38×10^3 , respectively. The catch is a little lower than the estimated MSY, and the effort is close to the optimum value for the case of m =2.0.

Case-2 The results are shown in Figure 2 and Table 4. The calculated estimates of MSY were 28,000 tons for the cases m =variable (0.39) and m =1.001, and 31,000 tons for m =2.0. These are almost similar to those in the Case-1. The optimum fishing effort for m =variable is 119×10^3 , which is about 1.8 times as much as that of m =2.0 (68×10^3). The observed effort in 1976 positioned in the right hand side of the calculated optimum efforts for m =1.001 and 2.0, but did not reach to that point for m =variable.

3. Conclusion

According to the analyses for the Case-1 and Case-2, both of which resulted in about the same results, the albacore stock for the longline fishery in the South Atlantic appears to be exploited recently around the MSY level. This is very similar observation with the results presented in the preceding SCRS (Shiohama 1978). In 1974 and 1975, the catches were on the lower level than the estimated MSY, whereas in 1976 the catch and effort increased proportionally along the recent relation (cpue) between catch and effort, recovering close to the estimated MSY level for both catch and effort. It seems that the further increase of the effort of the recent level should be carefully monitored.

References.

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Table 1. Annual yield, CPUE and relative standardized effort for the adult and young albacore in the South Atlantic Ocean, 1956-1976. (Case-1)

Year	Adult			Young			Data for production model analysis				
	Yield in tons	1) R_{ik}	2) S_{ik}	3) E_{ik}	Yield in tons	1) R_{ik}	2) S_{ik}	3) E_{ik}	3) E_k	Yield in tons	Number of age
1956	21	0.510	0.9961	21					21	21	3
1957	725	1.044	2.0391	356					356	725	3
1958	1,047	0.855	1.6699	627					627	1,047	3
1959	3,015	0.550	1.0742	2,807					2,807	3,015	3
1960	10,473	1.060	2.0703	5,059					5,059	10,473	3
1961	10,346	0.783	1.5293	6,765	47	0.519	1.0196	46	6,811	10,393	3
1962	16,480	0.507	0.9902	16,643	642	0.509	1.0000	642	17,285	17,122	3
1963	15,447	0.654	1.2773	12,093	1,134	0.655	1.2868	881	12,974	16,581	4
1964	22,552	0.505	0.9863	22,865	2,853	0.565	1.1100	2,570	25,435	25,405	4
1965	18,835	0.605	1.1816	15,940	11,338	0.762	1.4971	7,573	23,513	30,173	5
1966	13,486	0.405	0.7910	17,049	13,002	0.561	1.1022	11,796	28,845	26,488	4
1967	11,737	0.436	0.8516	13,782	8,110	0.719	1.4126	5,741	19,523	19,847	4
1968	14,749	0.451	0.8809	16,743	12,487	0.467	0.9175	13,610	30,353	27,236	4
1969	21,333	0.467	0.9121	23,389	14,177	0.535	1.0511	13,488	36,877	35,510	4
1970	15,303	0.359	0.7012	21,824	12,809	0.538	1.0570	12,118	33,942	28,112	4
1971	16,252	0.281	0.5488	29,614	16,321	0.458	0.8998	18,138	47,752	32,573	4
1972	17,780	0.340	0.6641	26,773	21,368	0.454	0.8919	23,958	50,731	39,148	4
1973	11,935	0.219	0.4277	27,905	16,849	0.366	0.7191	23,431	51,336	28,784	4
1974	8,881	0.252	0.4922	18,043	11,859	0.352	0.6916	17,147	35,190	20,740	4
1975	6,552	0.219	0.4277	15,319	11,045	0.324	0.6365	17,353	32,672	17,597	4
1976	10,609	0.257	0.5020	21,133	15,702	0.352	0.6916	22,704	43,837	26,311	4
Mean		0.512				0.509					

- 1) R_{ik} ; cpue(Yield in tons/Effective effort)
- 2) S_{ik} ; cpue index
- 3) E_{ik}, E_k ; Relative fishing effort

Year	Data for production model analysis		Number of age
	Effective effort*	Yield in tons	
1956	34	21	3
1957	575	725	3
1958	1,015	1,047	3
1959	4,546	3,015	3
1960	8,187	10,473	3
1961	11,032	10,393	3
1962	28,503	17,122	3
1963	21,851	16,581	4
1964	43,747	25,405	4
1965	45,253	30,173	5
1966	58,368	26,488	4
1967	36,766	19,847	4
1968	66,940	27,236	4
1969	78,487	35,510	4
1970	66,663	28,112	4
1971	93,581	32,573	4
1972	107,192	39,148	4
1973	103,241	28,784	4
1974	74,420	20,740	4
1975	69,314	17,597	4
1976	93,147	26,311	4

* : Number of 1000 hooks

Table 2. Annual yield and effective effort used for production model analysis in the South Atlantic albacore, 1956-1976. (case 2)

Table 3. Result of production model analysis for the South Atlantic albacore, 1956-1976. (Case-1)

m	Residual sum of squares	Degree of fit index	Optimum cpue	Optimum relative fishing effort (in 10^3)	MSY (10^3 tons)
Variable (0.760)	0.4719	0.9864	0.56	51.3	28.7
0.0	0.4982	0.9895	--	∞	46.8
1.001	0.4756	0.9922	0.63	45.6	28.5
2.0	0.5489	0.9927	0.78	37.1	29.0

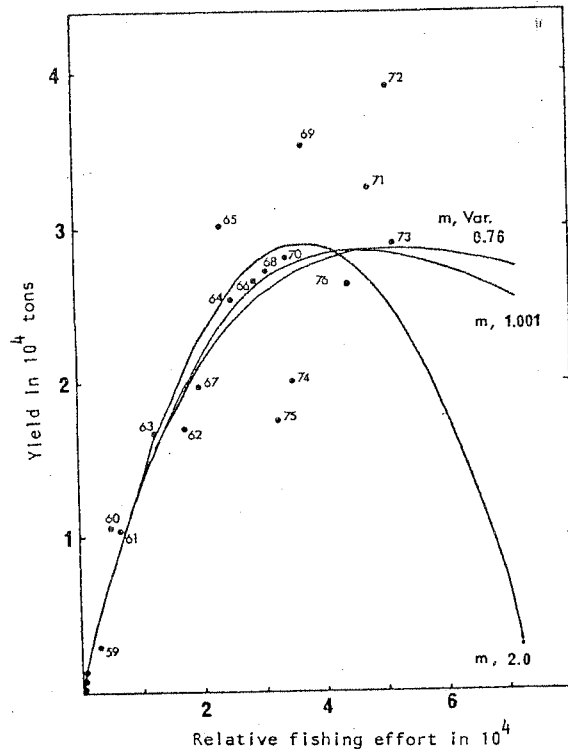


Fig. 1. Relation between yield and relative fishing effort obtained from production model analysis on the longline fishery for the South Atlantic albacore, 1956-1976. (Case-1)

Table 4. Result of production model analysis for the South Atlantic albacore, 1956-1976. (Case-2)

m	Residual sum of squares	Degree of fit index	Optimum cpue	Optimum effective effort (in 10^3)	MSY (10^3 tons)
Variable (0.390)	0.4745	0.9949	0.24	119.0	28.2
0.0	0.4914	0.9955	--	∞	39.4
1.001	0.5184	0.9959	0.37	73.2	27.5
2.0	0.7550	0.9947	0.45	67.8	30.5

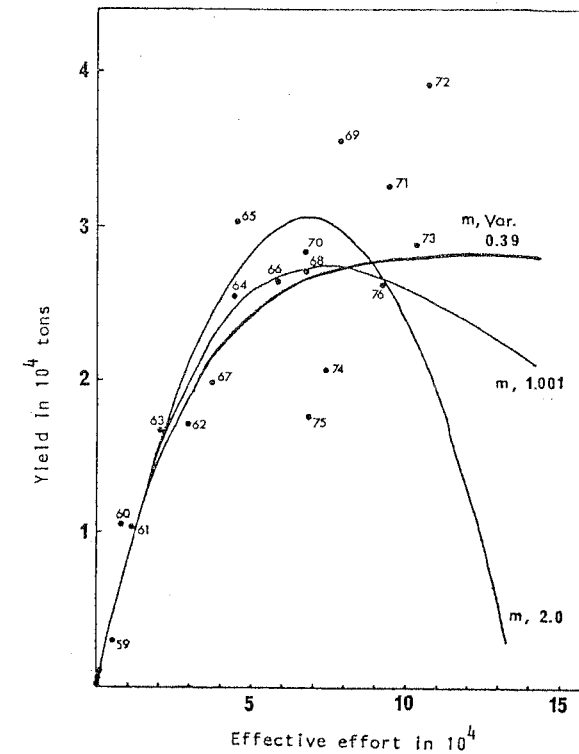


Fig. 2. Relation between yield and effective effort obtained from production model analysis on the longline fishery for the South Atlantic albacore, 1956-1976. (Case-2)