

ASSESSMENT OF SOUTH ATLANTIC ALBACORE RESOURCE BY USING SURPLUS PRODUCTION MODELS, 1967-1990

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SUMMARY

Surplus production models were adopted to assess the status of the south Atlantic albacore resource. Abundance indices of the stock were derived from the 1967-1990 catch and effort data set of the Taiwan longline fishery. Results of the study show that: (1) a generalized production model with parameter m equaling 1.001 and significant year class k equaling 3 appears to be the best fit of the data set; (2) the MSY of the resource is around 28,120 MT per year.

Current catch (around 25,000 MT in 1989) and effort (115 million effective hooks in 1989) levels were close to the estimated MSY and optimum fishing levels. Since catch levels have reached the maximum potential yield of the stock since the mid-1980's and the catch rate of the Taiwanese longline fishery indicated an apparent decrease of about 25 percent since 1987, it is suggested that careful monitoring of the fisheries be continued.

RESUME

Les modèles de la production excédentaire ont été adoptés pour évaluer l'état du stock de germon de l'Atlantique sud. Les indices d'abondance de ce stock ont été dérivés du jeu de données de prise et effort de la période 1967-1990 de la pêcherie palangrière du Taiwan. Les résultats de l'étude indiquent que: (1) un modèle de production généralisé avec un paramètre m égal à 1.001 et une classe annuelle significative k égale à 3 semble être le meilleur ajustement du jeu de données; (2) la PME de la ressource est d'environ 28.120 TM par an.

Les niveaux de la prise actuelle (environ 25.000 TM en 1989) et de l'effort (115 millions d'hameçons effectifs de la même année) étaient près des niveaux de la PME estimée et de la pêche optimum. Etant donné que le niveau de prise a atteint la production maximale potentielle du stock depuis le milieu des années quatre-vingt, et que le taux de prise de la pêcherie palangrière taiwanaise indique une nette baisse d'environ 25% depuis 1987, il est suggéré de continuer à suivre de près ces pêcheries.

RESUMEN

Se adoptaron los modelos de producción excedente para evaluar el status del recurso de atún blanco en el Atlántico sur. Los índices de abundancia del stock se dedujeron del conjunto de datos de esfuerzo y captura 1967-1990, de la pesquería de palangre del Taiwan. Los resultados del estudio muestran que: (1) un modelo de producción generalizado con el parámetro m igual a 1.001 y una importante clase anual k igual a 3 parece ser el mejor ajuste del conjunto de datos; (2) los RMS del recurso son de unas 28.120 t por año.

La captura actual (alrededor de 25 mil t en 1989) y los niveles de esfuerzo (115 millones de anzuelos efectivos en 1989) se encontraban próximos al RMS estimado y a los niveles de captura óptimos. Dado que el nivel de capturas ha alcanzado el rendimiento potencial máximo del stock desde mediados los años 80, y la tasa de captura de la pesquería de palangre de Taiwan indicaba un descenso aparente de un 25% desde 1987, se sugiere que se prosiga observando muy de cerca a las pesquerías.

INTRODUCTION

Southern stock of albacore (*Thunnus alalunga*) is one of the most economically important and abundant tunas resources in the south Atlantic. Japanese longliners began exploitation of the resource since early 1950s but the fisheries have switched their target species to bigeye and bluefin tunas in early 1970s. Taiwanese longliners started early 1960s fishing for tunas in the south Atlantic and became targetting on albacore since late 1960s. The fishery developed rapidly in early 1970s and has leveled off since mid 1970s. Taiwanese catch of albacore, which composed the majority of harvested albacores in the south Atlantic, ranged from 10 to 29 thousand MT in past two decades. The emergence of south African bait boat fishery started mid 1980s has taking considerable amount of mainly juvenile albacores.

Studies on stock assessment of south Atlantic albacore have been carried out based on the catch and effort data set of Taiwanese longline fishery (Yang & Sun 1983; Liu 1985; Yeh & Liu 1988). The purpose of this study is thus to evaluate the current stock condition by using updated 1967-1990 catch and effort data series.

MATERIALS AND METHODS

ICCAT Statistical Bulletins (1967-1989) are the major source of data for annual catch and nominal effort statistics of south Atlantic albacore fisheries. Detailed 1967-1990 catch and effort data set of Taiwanese longline fishery are the major source of data for effective effort analyses.

Viewing that (1) the consistency in longline fishing method; (2) the continuity of historic catch and effort statistics; (3) magnitude of albacore caught from the south Atlantic longline fishery in the past two decades; longline catch rates derived from Taiwanese data set were thus adopted in this study as the abundance indices of the resource. Effective efforts of Taiwan longline fishery were derived by using Honma's algorithm (Honma 1973) and the abundance indices thus derived were used to justify whole effective efforts in the south Atlantic. The MSY of the resource were estimated by using the generalized stock production model (Pella & Tomlinson 1969).

RESULTS

Catch and Catch Rate

Annual total albacore catch from south Atlantic, as shown in Table 1, ranged from 24 to 33 thousand MT in years of 1968-1973. Catch level dropped to about 20-23 thousand MT in years of 1974-1981 yet increased again to levels of 25-35 thousand MT in the 1980s, except years 1983-1984.

Effective effort rose rapidly from 33 million effect hooks in 1968 to about 85 million effective hooks in 1974, then fluctuated between 40 to 70 million effective hooks in the years of 1974 to 1984. The effective hooks increased significantly to levels of 100-115 million effective hooks since 1985.

Based on Taiwanese longline data set and chose the period of 1967-1988 as standard years, catch rates of CPUE1 (number of albacore caught/100 effective hooks) and CPUE2 (Kg caught/100 effective hooks) thus obtained are shown in Table 1 and Figure 1. As shown in Figure 1, both catch rates decreased significantly from 1968 to 1973 and level off at about 2 fishes (or about 30 Kg) per 100 effective hooks in the period from 1974 to 1986. Catch rates dropped, however, about 25% (1.5 fishes per 100 effective hooks) since 1987.

Production Models Analyses

Catch and effective effort statistics of the south Atlantic albacore fisheries (Table 1) were analyzed by using generalized surplus production models. The best fit obtained from these models appeared when m value equals 1.001 and the significant year class k value set to 3. The surplus curve thus derived is shown in Figure 2. Maximum potential yields of the stock are estimated about 28,120 MT per year and the corresponding optimum fishing efforts were estimated as 102 million effective hooks per years.

DISCUSSION

It has well acknowledged that surplus production models are among the simplest and most widely used approaches in the assessment of exploited fish populations. Despite that requirements as (1) fishing capabilities remain constant and (2) there is an immediate responsive mechanism of the stock against environmental stress are generally difficult to verify, it is still authors' viewpoint that production models will continue for some time to serve as a basis for management of important fish stocks. Particularly when information as fisheries biological characters is still in rather poor situation.

It was not until mid 1980s, when other albacore fisheries developed significantly, Taiwanese longline fishery is the major fleet targetting on south Atlantic albacore. Biological interactions within the stock incurred by various fisheries groups and how these interactions may then affect stock renewal mechanisms are, in our viewpoint, very important fisheries research items worthwhile for further detail scrutiny. The significant decrease in catch rates of Taiwanese longline fishery in the past five years may already showed a sigh of aware in this regard.

Although the catch (about 25-26 thousand MT) and fishing levels in last couple of years were slightly less than estimated MSY and the optimum effective fishing effort, it is still highly recommended that a closely monitoring on status of the stock should be continued.

ACKNOWLEDGEMENTS

We are very grateful to express our thanks to the Council of Agricultural of the ROC for the financial support of this study through the contract of 1990-(7.1)-FISH-19(3).

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Table 1. Catch and effective effort analyses of the south Atlantic albacore fisheries based on the Taiwanese longline fishery data in the south Atlantic Ocean, 1967-1990.

Year	Taiwan Longline Fishery						All Fisheries	
	Catch in Number (x1000)	Catch in Weight (x1000 MT)	Mean Wt./fish (Kg)	Nominal Effort (x100000 Hooks)	Catch in Number per 100 Effective Hooks	Catch in Kg per 100 Effective Hooks	Catch in Weight (x1000 MT)	Effective Effort (x100000 Hooks)
1967	40.6	0.4	11.8	8.64	3.94	46.5	15.9	256.91
1968	711.5	10.1	14.2	163.75	4.85	69.0	25.7	325.39
1969	842.8	13.2	15.7	221.11	3.38	53.2	28.5	512.68
1970	629.9	9.9	15.7	191.77	2.96	46.6	23.7	531.27
1971	1221.8	18.6	15.2	305.10	3.83	58.2	25.0	437.48
1972	1139.8	16.8	14.7	352.20	2.42	35.5	33.3	870.22
1973	950.5	13.1	13.8	327.33	2.20	30.4	28.2	833.45
1974	903.4	13.4	14.9	308.90	2.30	34.2	19.7	545.32
1975	1015.0	14.9	14.6	285.22	2.68	39.3	17.5	417.20
1976	1441.3	18.5	12.8	418.13	2.58	33.1	19.3	526.91
1977	1692.9	24.3	14.4	534.18	2.29	32.9	21.6	594.53
1978	1740.5	23.7	13.6	487.96	2.48	33.7	23.1	595.05
1979	1076.0	14.6	13.6	331.53	2.21	29.9	22.5	655.57
1980	1113.0	16.3	14.6	339.54	2.40	35.1	22.5	597.80
1981	1119.1	16.8	15.0	396.72	2.17	32.5	23.6	693.96
1982	1319.9	18.9	14.4	476.61	2.06	29.6	29.1	904.76
1983	634.6	8.7	13.7	223.90	1.79	24.6	14.4	535.63
1984	535.8	8.0	14.8	168.61	2.52	37.3	13.2	360.53
1985	1365.5	18.9	13.9	481.75	2.04	28.3	28.4	944.45
1986	2017.3	27.6	13.7	682.68	2.06	28.2	34.6	1125.21
1987	2006.2	28.8	14.4	865.30	1.54	22.0	37.5	1605.59
1988	1398.3	20.4	14.8	727.54	1.41	20.9	25.9	1158.25
1989	1161.3	18.4	15.8	686.84	1.41	22.3	25.3	1154.95
1990	1108.7	16.0	14.4	606.85	1.51	21.9	na	na

Footnotes: (1) Catch and effort data set of Taiwanese longline fishery have been revised recently, especially for years 1976-1978;
 (2) na: not available currently.

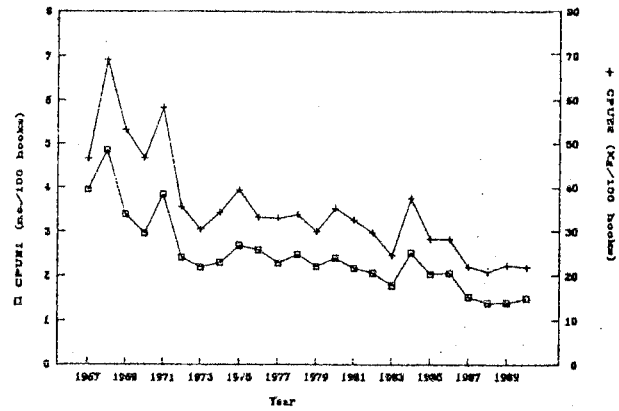


Fig. 1. Trends of annual CPUE1 (no. fish caught/100 effective hooks) and CPUE2 (Kg/100 effective hooks) of south Atlantic albacore in 1967-1990.

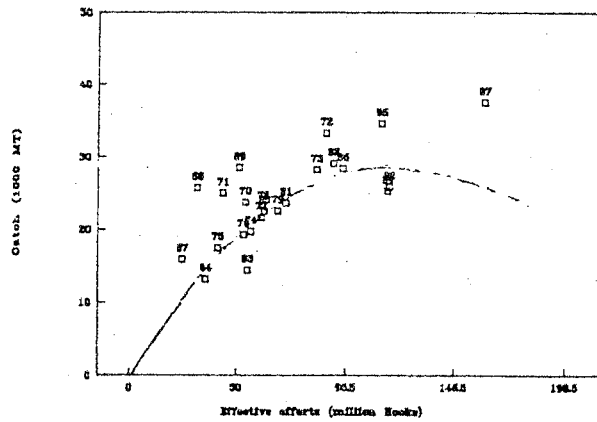


Fig. 2. Equilibrium yield curve and the observed data for south Atlantic albacore fisheries, 1967-1990.