

**PRELIMINARY ANALYSIS ON THE STANDARDIZED CPUE FOR SWORDFISH CAUGHT BY  
THE TAIWANESE LONGLINE FISHERY IN THE SOUTH ATLANTIC**

*Uozumi<sup>1</sup>, Y.*

**SUMMARY**

Some trials on the standardization of CPUE for swordfish were carried out using Task II data of the Taiwanese longline fishery from 1969 to 1992 in the south Atlantic. Standardization is carried out for the entire south Atlantic, western and eastern south Atlantic, respectively, for the investigations on the differences in CPUE trends among the areas where some potential differences in fishing strategy may be suspected. The standardized CPUE for the three areas shows a similar trend, the drastic decrease in 1976, an increase in the early 1980s, a gradual decrease in the late 1980s, and a significant increase in the 1990s. It is concluded that further investigations should be carried out on the effects of changes in fishing strategy and gear configuration for the CPUE before application to the stock assessment of south Atlantic swordfish.

**RÉSUMÉ**

Quelques essais sur la standardisation de la CPUE ont été menés à bien en utilisant les données Tâche II de la pêcherie palangrière taïwanaise de 1969 à 1992 dans l'Atlantique Sud. La standardisation est menée à bien pour la totalité de l'Atlantique Sud, Ouest et Est, en ce qui concerne les recherches sur les différences dans la tendance de la CPUE entre les zones où on suppose qu'il y a des différences éventuelles dans la stratégie de la pêcherie. La CPUE standardisée des trois zones présente une tendance similaire : baisse drastique en 1976, accroissement au début des années 80, baisse graduelle à la fin de ces années, et accroissement significatif dans les années 90. On en conclue qu'il serait souhaitable de poursuivre les recherches sur les effets du changement de stratégie de la pêcherie et de la configuration des engins sur la CPUE avant son application à l'évaluation du stock d'espadon Sud-Atlantique.

**RESUMEN**

Se llevaron a cabo algunos ensayos de estandarización de la CPUE del pez espada, usando datos de la Tarea II de la pesquería taiwanesa de palangre, de 1969 a 1992 en el Atlántico sur. La estandarización se hace para la totalidad del Atlántico sur, oeste y sudeste, en relación con las investigaciones de las diferencias en la tendencia de la CPUE entre las diversas zonas donde se supone que existen diferencias en la estrategia pesquera. La CPUE estandarizada de las tres zonas presenta una tendencia similar: descenso drástico en 1976, ascenso a principios de los años 80, descenso gradual a finales de esos años y un importante aumento en los años 90. Se llega a la conclusión que sería conveniente seguir investigando sobre los efectos de los cambios en la estrategia de la pesquería y configuración del arte para la CPUE, antes de su aplicación a la evaluación de stock de pez espada del Atlántico sur.

<sup>1</sup> National Research Institute of Far Seas Fisheries, 7-1 Orido, 5-chome, Shimizu-shi, 424 Japan.

## Introduction

For the stock assessment of the south Atlantic stock of swordfish by a production modeling, information on the historical trend of biomass CPUE for the fishery which has a long history is essential. There are some fisheries which have caught swordfish as a valuable by-catch, Japanese, Taiwanese, and Brazilian longline fisheries, but some of latter two fisheries began to target swordfish in the recent years. The CPUE of the Taiwanese longline fishery is one of the important information which may indicate the trend of abundance of swordfish in the south Atlantic Ocean. The standardization of CPUE, which makes it possible to use CPUE as an unbiased abundance index, is essential, because there were some changes on the operational strategy. Unfortunately the Task II data for the Taiwanese fishery expressed by weight is not available, but the some trials for the standardization of CPUE for swordfish in terms of catch number per 1000 hooks were carried out in the present study.

## Materials and methods

### A. Basic data

The basic data for this study were Task II database for the Taiwanese longline fishery from 1967 to 1992 which were supplied from ICCAT secretariat. Because the number of observations for 1967-68 were insufficient for area coverage, the data in these two years were eliminated for the analysis. Observations with less than 3,000 hooks were also excluded from the analysis.

### B. Standardization

Year, season, and subarea were incorporated as the main effects. Quarter-of-the-year was selected as season. Based on the distribution of fishing efforts and CPUE of swordfish, 13 subareas were selected as shown in Fig. 1.

The fittings for the model, CPUE model with log-normal distribution, was done through GLM procedure of SAS/STAT statistical package (Ver. 6.11).

The multiplicative CPUE model with log-normal distribution is as follows:

$$\log(\text{CPUE}_{ijk} + \text{Constant}) = \mu + \text{YR}_i + \text{QT}_j + \text{Area}_k + \text{Interactions} + \epsilon_{ijk} \quad (1)$$

where log : natural logarithm,

CPUE<sub>ijk</sub> : nominal CPUE (catch in ton per 1000 hooks, in year i, quarter j, and subarea k),

$\mu$  : overall mean, YR<sub>i</sub> : effect of year i, QT<sub>j</sub> : effect of quarter j,

Area<sub>k</sub> : effect of subarea k, Interactions : two-way interactions,  $\epsilon_{ijk}$  : normal error term.

As a constant used in this model, 10% of overall mean CPUE (0.019) was selected which was recommended in bluefin species group (1996a).

The trials of the standardization were done for whole south Atlantic, south-eastern (east of 20° W), and south-western (west of 20° W) Atlantic.

## Results and discussions

The final models for the entire south Atlantic included all two-way interactions, and the final ones for south-eastern, and south-western Atlantic also included all two-way interactions, except for year\*quarter interaction.

The standardized CPUE (number/1000 hooks) for each area are shown in Figs. 2-4. CPUE in Figs. 2-4 are expressed by re-scaled CPUE to the overall mean. All of them indicated a similar trend, the drastic decrease in 1976, increase in the early 1980s, gradual decrease in the later 1980s, and significant increase in the 1990s.

The drastic decrease in 1976 and increase in the 1990s may be unrealistic phenomena, considering the biological characteristics of swordfish and overall catch trend in the south Atlantic. Furthermore, there are significant difference in trend between the Japanese and Taiwanese standardized CPUE (Uozumi, 1996), especially in 1976 and the 1990s.

ICCAT (1996b) pointed out that there were some swordfish directed longline fishery by the Taiwanese fleet in the late 1980s and early 1990s. The shift of the target species may affect to the catchability for swordfish significantly. There is high possibility that some significant biases caused by the change of the fishery strategy may still exist in the standardized CPUE using Task II database. Furthermore, the deep longlining has developed since the late 1980, the analysis of the Japanese longline database suggested that the deep longlining affects positively on the swordfish CPUE (Uozumi,1996). In the present analysis, this gear effect was not considered.

The more detailed information on the target and gear configuration is desirable for the more appropriate standardization of CPUE, especially in the trend in the 1990s. Therefore, it should be postponed for the conclusion on the trend of standardized CPUE for the Taiwanese longline fishery, before the further detailed observation will be done..

**References**

ICCAT 1996a: Report of the bluefin tuna methodology session (Madrid, Spain -April 16 to 19, 1996). 28pp.  
 ICCAT 1996b: Report of the third ICCAT billfish workshop data preparatory meeting (Miami, USA -July 11-13, 1996). 18pp.  
 Uozumi, Y. 1996: Standardization of biomass CPUE for swordfish caught by Japanese longline fishery in the South Atlantic. SCRS/96/xx, 7pp.

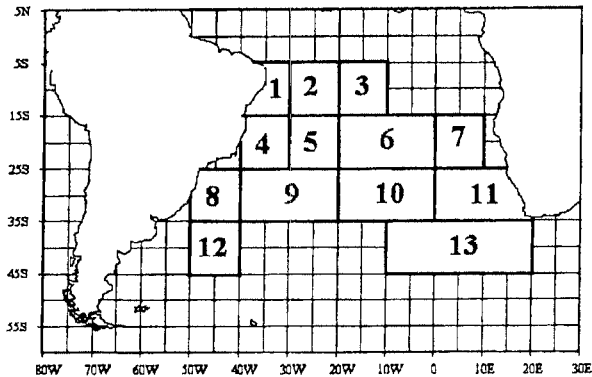


Fig. 1. Subareas used in the standardization.

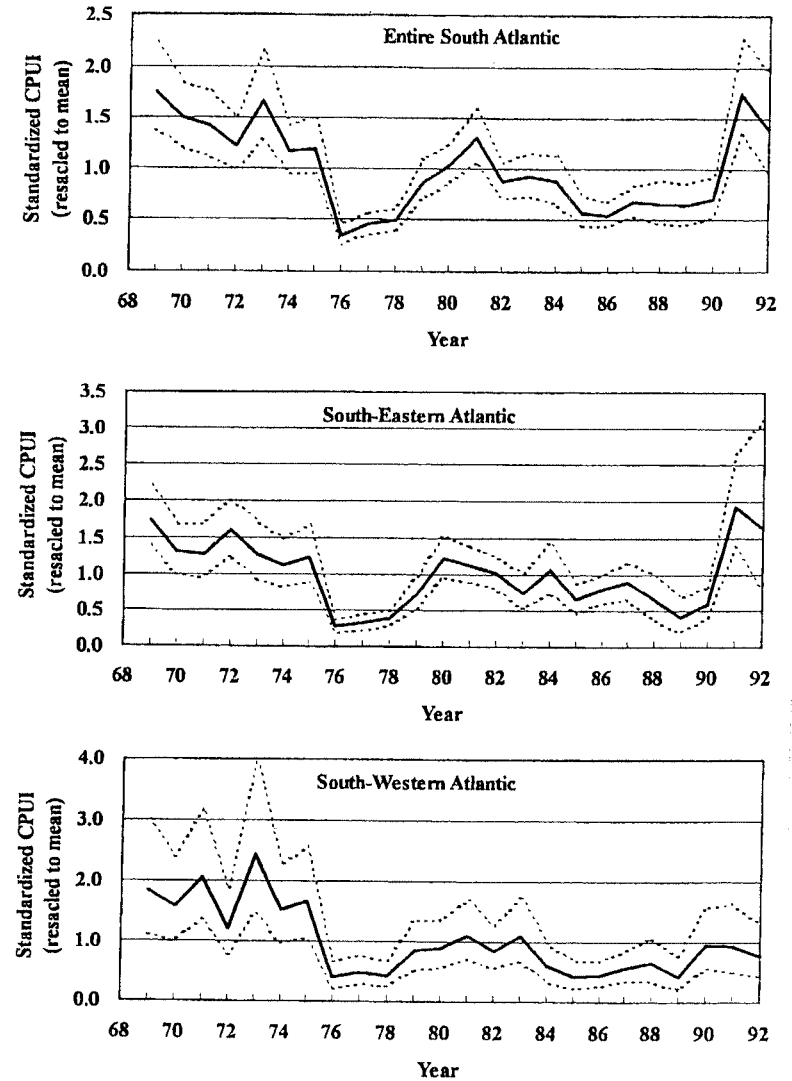


Fig. 2. Standardized CPUE for swordfish (number/1000hooks), re-scaled to mean, caught by the Taiwanese longline fishery.