

## STANDARDIZATION OF AGE SPECIFIC CPUE OF SWORDFISH CAUGHT BY JAPANESE LONGLINERS IN THE NORTH ATLANTIC

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### SUMMARY

*The standardization of age specific CPUEs of the swordfish in the north Atlantic (north of 5N) caught by Japanese longliners were updated to 2000 (2001?). Because Japanese longliners started to discard/released all their swordfish catch after February 2000, and reported number of sum of discard and released swordfishes in this periods were assumed to be same as catch number in the CPUE analysis. Processed weight data of swordfish in log book (1994 - 2000) were used for catch at size estimation, in addition to length data reported by observers and fishermen. In most age classes, relative value of CPUE in early years (late 1970's) changed largely by models used for CPUE standardization. This was supposed to be come from shortages of horizontal and vertical coverage of historical data series.*

### RÉSUMÉ

*La standardisation des CPUE spécifiques de l'âge de l'espadon dans l'Atlantique nord (nord de 5°N) capturé par les palangriers japonais a été actualisée jusqu'en 2000. Comme les palangriers japonais ont commencé à rejeter/remettre à l'eau toutes leurs captures d'espadon après février 2000, on a postulé que le total déclaré d'espadons rejetés et remis à l'eau au cours de cette période était identique au nombre de poissons capturés qui est utilisé dans l'analyse de CPUE. Les données de poids manipulés de l'espadon consignées dans les carnets de bord (1994-2000) ont été utilisées pour estimer la prise par taille, en sus des données de taille déclarées par les observateurs et les pêcheurs. Dans la plupart des classes d'âge, la valeur relative de CPUE au cours des premières années (fin des années 70) a changé, principalement en raison des modèles employés pour la standardisation de la CPUE. On a postulé que ce phénomène était dû aux manques de couverture horizontale et verticale des séries de données historiques.*

### RESUMEN

*Se actualizó hasta 2000 la estandarización de las CPUEs específicas de la edad del pez espada del Atlántico norte (norte de 5° Norte) capturado por los palangreros japoneses. Debido a que los palangreros japoneses empezaron a descartar/liberar todo el pez espada capturado desde febrero de 2000, se asume que el número comunicado de la suma de peces espada descartados y liberados en ese periodo es el mismo que el número de peces capturados utilizado en la CPUE. Se utilizaron datos de peso transformado de pez espada consignados en los cuadernos de pesca (1994-2000) para realizar una estimación de capturas por talla, además de los datos de talla comunicados por observadores y pescadores. En la mayor parte de las clases de edad, cambió el valor relativo de la CPUE en los primeros años (finales de los setenta), sobre todo debido a los modelos utilizados para la estandarización de la CPUE. Se asumió que esto se había producido debido a la escasez de cobertura vertical y horizontal de series de datos históricos.*

### KEYWORDS

*CPUE, swordfish, CPUE standardization*

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## 1 INTRODUCTION

Standardization of age specific CPUE of swordfish caught by Japanese longliners have obtained (Yokawa, 1999a) by using log book data, size data which were collected through observer program and voluntary reports by fisherman, and an area specific sex ratio keys by 5cm length class (Figure 1 and Ortiz *et al.*, 1998). In the last study, a serious problem of shortage of Japanese size data of swordfish was pointed out in estimating catch at size data (Yokawa, 1999b).

In the beginning of February 2000, all Japanese longliners started to release/discards all their swordfish catch in the north Atlantic (north of 5N) because of the over quota (Yokawa and Fukuda, 2001).

In the present study, estimation of new catch at size data for 1994 – 2000 by catch weight information in the log book, as well as catch and effort for 2000 by discards report, and updated age specific CPUE up to 2000 with them.

## 2 MATERIALS AND METHODS

### 1) Estimation of catch at age for 1994 – 2000

New log book reporting system for Japanese longliners was commenced from 1994. In this new system, fisherman was mandated to report not only catch number but also average processed weight by species for each operation (Miyabe and Uozumi, 2001). Reported average catch of swordfish in the new log book can be regarded as individual processed weight of swordfish when catch number of swordfish is one in an operation. If appropriate conversion factors were available, this information of processed weight can be used for the estimation of size of swordfish.

In the present study, lower jaw fork length (LJFL) of swordfish were estimated from reported processed weight with conversion factor between processed and whole weight in Miyabe and Uozumi(2001), and conversion factor between whole weight and LJFL in ICCAT (which can be found in the table of conversion factors distributed by ICCAT secretariat in their web site). These estimated sizes were combined with other size data, which were reported by observers and fishermen, and used for the estimation of catch at size. Method for estimating catch at age of swordfish by size data was the same as in Yokawa (1999b).

### 2) Calculation of catch and effort in 2000

Numbers of discarded and released swordfish were reported by each vessel in aggregated from of 10 days period since February in 2000. Operational area and pattern of each ten days period of each vessel were checked with the log book, and if a vessel stayed in one area and used same operation pattern, 10 days aggregated discarded/released number of swordfish and number of hooks were used as catch and effort data in the CPUE standardization. In this study, same subarea stratification as estimation of sex-ratio key of swordfish (Figure 1 and Ortiz *et al.*, 1998) was used in compiling data. Operation pattern was classified into 2 categories as described in 3).

The logbook data pre-2000 was also re-aggregated by same format as 2000. Because Japanese distant-water longliners usually do not change their operational area and their gear configuration during one trip, more than 90% of the log book data of each year were adopted for the analysis.

### 3) CPUE standardization

CPUE standardization was done assuming lognormal error with or without random effect with small constant to avoid the problem of zero. Since Japanese longline data in the Atlantic has severe historical spatial coverage problem. It is necessary to have special consideration as we described later.

Factors used in the CPUE standardization in this study were, year, area (Figure 1), season (quarter), and gear configuration which was expressed by the number of hooks between floats (NBF).

Operation with number of hooks between floats with 3 and 4 were excluded from the analysis, as there is no way to distinguish night setting from day time setting. Operation with number of hooks between floats being 5 to 24 were divided into two operational pattern followed by discussions in IOTC methodology working group (IOTC, 2000). They were;

In periods before 1993;      NBF = 5-9 were normal setting  
   NBF = 10-20 were deep setting

In periods of 1994 – 2000;    NBF = 5-13 were normal setting  
   NBF = 14 – 24 were deep setting

Because subarea stratification used in the CPUE standardization was not decided by distributions of swordfish CPUE of Japanese longliners, interaction terms between year and area is necessary to introduce into the model for the standardization. In this study interaction term between year and area was introduced as random effect.

Analysis was conducted using the MIXED procedure available in the SAS statistical computer software (Version 8.02).

### **3 RESULTS AND DISCUSSIONS**

Standardized CPUEs in each age were shown in Figure 2. There are weak indications of strong cohort in 1999 class from CPUE of Age 0 and 1. But not so strong compared with the historically strongest recruit observed by the Spanish longline in the north Atlantic (Mejuto et al 2002). This different trend may be due to the facts that primary target of Japanese longliners operating in the north Atlantic is not swordfish and they spread ocean wide compared with Spanish longliners. In some age classes that occupy minor proportion in the total swordfish catch, very few catch resulted in negative standardized CPUE. In order to overcome this difficulty it would be necessary to use error structure that allows zero catch explicitly. Application of delta-lognormal or negative binomial might be good future trial. But unfortunately current catch and effort data prepared for this analysis was aggregated one and it prevents from such trial in this study. As we pointed out that younger age classes, in particular age 0 occupy very small portion of swordfish catch by Japanese longline, CPUE of such age classes are difficult to represent over all trend of the stock of this age, authors do not recommend to use younger age classes Japanese longline CPUE of north Atlantic swordfish for tuning indices of tuned population dynamics models. The dramatic difference compared to the results presented in the last assessment was the introduction of interaction term between year and area (see Figure 3).

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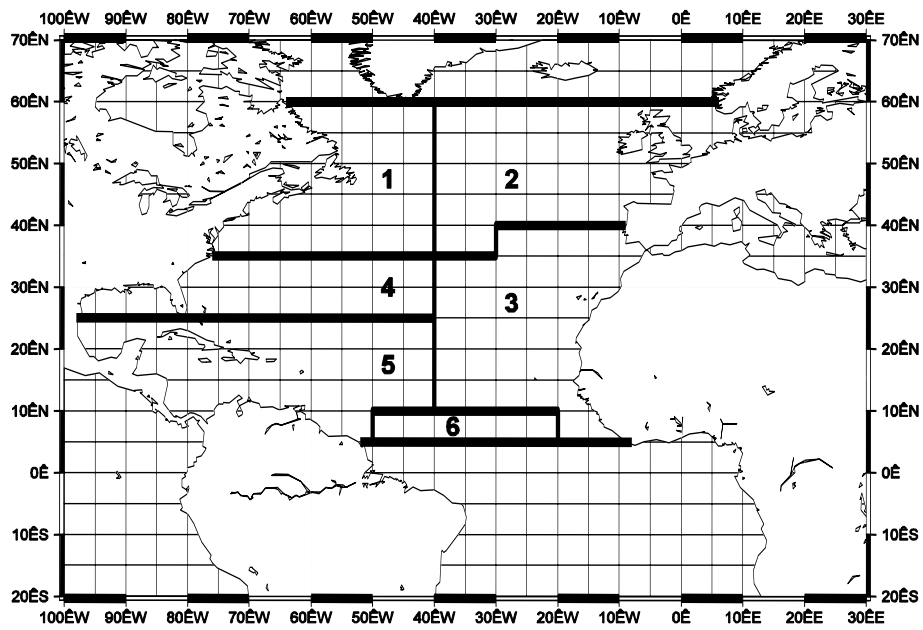


Figure 1 Area definition used in this study

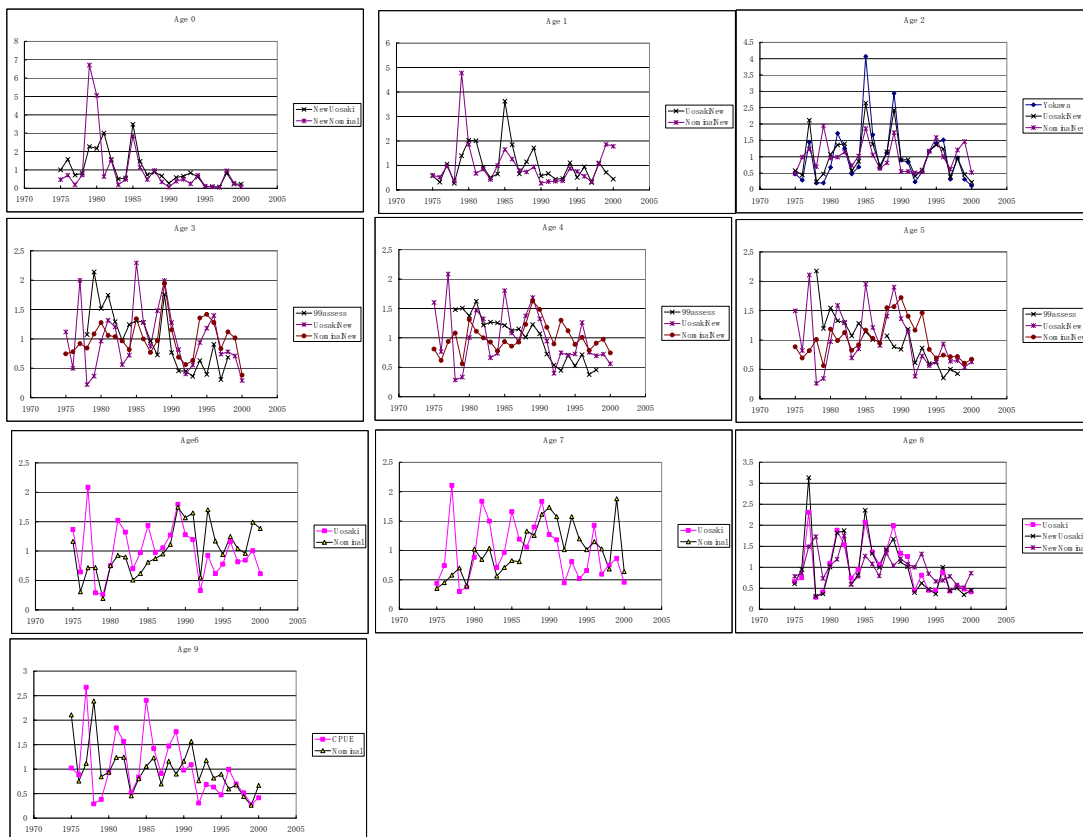
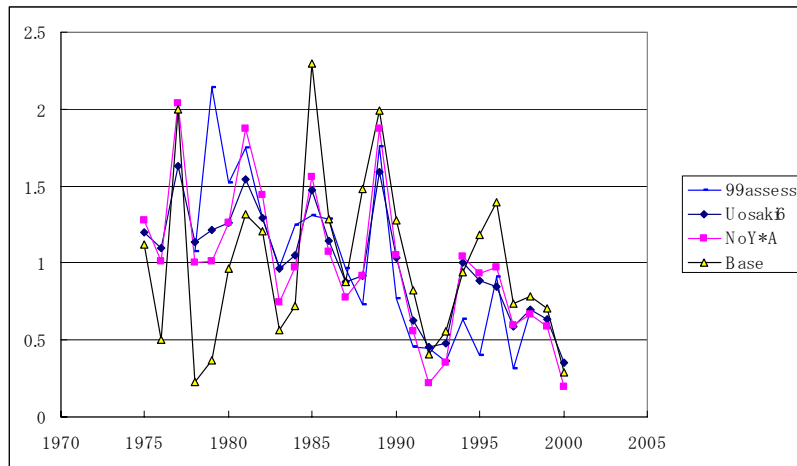


Figure 2 Standardized and nominal age specific north Atlantic swordfish CPUE of Japanese longliners



**Figure 3** Comparison of standardized CPUE with and without interaction of year and area. CPUEs of Age 3 are shown as an example. Age 3 standardized CPUE presented last assessment was also shown (data was taken from detailed report of the last assessment)