PRELIMINARY STANDARDIZED CATCH RATES FOR THE NORTH ATLANTIC SWORDFISH (Xiphias gladius) FROM THE SPANISH LONGLINE FLEET FOR THE PERIOD 1983-2000

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SUMMARY

Standardized catch rates by age (sex combined) were preliminary updated using General Linear Modeling (GLM) procedures from trips carried out by the Spanish surface longline fleet fishing swordfish in the North Atlantic from 1983-2000. Indices by age were developed for ages ranging from 1 to 5+, using a sex combined growth model. The criteria used for these indices to define areas, time periods and models were very similar to those used in previous papers. However, the model used to obtain CPUE by age did not take into account the important changes in the fishing strategy of the Spanish fleet which has primarily occurred in more recent years. This source of bias affects the CPUEs by age obtained and presented. A new methodological approach including a target intensity factor will be developed for future age specific analyses in order to reduce systematic bias.

RÉSUMÉ

Le taux de capture standardisé par âge (sexes combinés) a été actualisé à titre préliminaire au moyen de la modélisation linéaire généralisée (GLM) de sorties de la flottille espagnole de surface qui a pêché l'espadon dans l'Atlantique nord entre 1983 et 2000. Des indices par âge ont été élaborés pour les âges de 1 à 5+ au moyen d'un modèle de croissance sexes combinés. Les critères utilisés pour ces indices pour définir les zones, époques et modèles étaient très semblables à ceux qui avaient servi dans des travaux antérieurs. Toutefois, le modèle utilisé pour obtenir la CPUE par âge ne tenait pas compte des importantes modifications de la stratégie de pêche de la flotte espagnole qui se sont surtout produites ces dernières années. Cette source de biais affecte la CPUE par âge obtenue et présentée. Une nouvelle approche méthodologique comprenant un facteur de 'intensité de ciblage' sera élaboré pour les analyses futures spécifiques de l'âge afin de réduire le biais systématique.

RESUMEN

Tasas de captura normalizadas fueron obtenidas de forma preliminar mediante técnicas de Modelo Lineal Generalizado (GLM) a partir de mareas individualizadas realizadas por la flota española de palangre de superficie en el Atlántico Norte entre los años 1983-2000. Los índices por edad (sexos combinados) fueron desarrollados para las edades entre 1 y 5+, usando un modelo de crecimiento por sexos combinados en los procesos de transformación de las distribuciones de tallas en edades. Los criterios usados en los análisis para la definición de áreas, periodos temporales y modelos fueron muy similares a los usados en documentos anteriores. Sin embargo, el modelo usado para obtener valores de CPUE no tienen en consideración la información reciente de las denominadas “especies asociadas” ni considera los importantes cambios en la estrategia de pesca de la flota española que han sucedido de forma especial en los años más recientes. Estas fuentes de sesgo afectan a las estimaciones de CPUE por edad obtenidas. Por tanto, una nueva aproximación metodológica incluyendo un factor de “intensidad de direccionamiento” deberá ser desarrollada para los futuros análisis por edad de cara a reducir los sesgos sistemáticos.

KEYWORDS

Swordfish, CPUE, GLM, longline

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1. INTRODUCTION

The consistency over time in the fishing patterns of the fleets is one of the most important elements to facilitate the interpretation of the catch rates as indices of abundance from commercial fleets. Major changes in the fishing strategy of the traditional Spanish longline fleet have been recently observed and reported (Mejuto et al., 1997, 1998, 1999, 2000; Mejuto and De la Serna, 1997, 2000).

The Generalized Linear Modeling technique (GLM) (Robson, 1966; Gavaris, 1980; Kimura, 1981) was used in previous papers as an instrument in the estimation of standardized catch rates, based on data from commercial longline fleets. The standardized catch rates of the Atlantic swordfish were obtained in the last decade on a routine basis by means of GLM based on data from commercial fleets, some of which targeted this species while others did not (Hoey et al., 1989, 1993; Anonymous, 1989, 1991; Nakano, 1993; Mejuto, 1993, 1994; Scott et al., 1993; Mejuto and de la Serna, 1995, 2000; Mejuto et al., 1999).

The impact produced by the changes in the fishing strategy of the Spanish fleet on the trend of the biomass index in comparison with the results obtained using the traditional methodology, have been evaluated in recent papers (Mejuto and De la Serna, 2000; Mejuto et al., 2000). So, considerable bias in the general CPUE trend(slope) obtained in this paper would be expected for some ages, because these changes in the fishing strategy were not taken into consideration.

On the other hand, only some trip records from the year 2000 were available for this analysis, so the results must be considered preliminary. In any case, the qualitative information provided could be useful in order to evaluate the general trend of several CPUE indicators which could be interpreted as a qualitative indicator of the North Atlantic stock.

2. MATERIALS AND METHODS

The records used in the analysis are from the Spanish longline activity in the North Atlantic area (swordfish BIL94) from years 1983 to 2000. However, only a limited number of records from the year 2000 were available at this time. Data are mostly provided by records per trip obtained by the Spanish Oceanography Institute (IEO) when fish are landed at the different base ports used by the traditional North Atlantic fleet. Additional information on the records used is provided in previous papers.

The analysis by ‘age’ (number of fish / thousand hooks) was developed using the method traditionally applied in previous ICCAT swordfish working groups and reported in several papers (Mejuto, 1993; Mejuto et al. 1997, 1999; Mejuto and De la Serna 2000) which do not incorporate any corrections in terms of recent changes in the fishing strategy. The Gompertz type equation (Anonymous, 1989) was used to obtain standardized indices by ‘age’ for males and females combined, ages 1 to 5+ (or proxy of ages). The transformation procedures from size to ‘age’ were carried out using specific software (Restrepo pers. comm.) applying the technique known as "slicing". The spatial and temporal definition for final GLM runs was determined by using a criterion similar to that used in previous documents (Mejuto and De la Serna, 2000; Mejuto et al, 2000).

The surface longline gear of the Spanish fleet has remained relatively constant over decades in terms of general structure and configuration (Rey et al., 1988; Hoey et al., 1988). However, there have been some small technological improvements in the fishing gear during the last decade. The most common upgrade consisted of introducing new elements in order to make it easier to carry out handling, involving setting out and hauling back the fishing gear. These improvements generally tended to allow for a greater number of hooks per set which are considered as nominal effort. Monofilament units (“Florida style longline”, the so-called “palangre americano”) have been progressively introduced in the North Atlantic fleet in recent years. The number of boats with the new
gear was increased year after year and most of the records available for the year 2000 already pertain to this new fishing gear. However, these gear-records were not included in the GLM runs.

Additionally, as was previously reported, in more recent years we have noticed a major progressive change in the fishing strategy of most of the skippers of the traditional fleet carrying out their activity in the North Atlantic, targeting swordfish and/or blue shark (Mejuto and De la Serna, 2000; Mejuto et al, 2000).

3. RESULTS AND DISCUSSION

A total number of around 8,300 trips were available for the period 1983-2000. However, only 134 trips using traditional gear were available for the year 2000 (around 30% of previous years). In general the number of observations per cell (spatial-temporal) may be considered satisfactory for most of the years. However, due to the progressive geographical expansion of this fleet, some cells were not properly represented, especially at the beginning of the time series used. The standardized residual patterns by age obtained in each run show a normally distributed shape, except for the year 2000 because of the low number of observations available.

The CPUEs by age were obtained using a traditional model which does not incorporate any targeting factor. So, results are presented only for simple comparison with previous papers in order to evaluate trends qualitatively and they should be considered with utmost caution when assuming standardized catch rates as abundance indices of the stock. These indices by age are not recommended for tuning procedures.

In any case, the analysis confirms the high level of recruitment (age 1) observed in the most recent years (1997-1998-1999-2000) - the highest on record - probably linked to a new environmental cycle. These recruits have already been incorporated into the age 2 group - which reached the highest level on record- and ages 3, 4 and even 5+ (figure 1). The good transition of the recruits observed in the different age groups suggest that the high level of recruits obtained from the analysis is not a simple artefact of the fleet’s data and models. A summary of the ANOVA results obtained is provided (table 1). Additional information on output data from long print-out results is available from the authors upon request.

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LITERATURE CITED


Table 1. Summary of ANOVA for each analysis by age. Number of positive observations, R square, mean square error (root) and F statistics for each run considered.

<table>
<thead>
<tr>
<th>AGE</th>
<th>#OBSERV.</th>
<th>R-Square</th>
<th>RMSE</th>
<th>F-stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7510</td>
<td>0.356</td>
<td>0.969</td>
<td>114.60</td>
</tr>
<tr>
<td>2</td>
<td>8090</td>
<td>0.248</td>
<td>0.766</td>
<td>73.79</td>
</tr>
<tr>
<td>3</td>
<td>8103</td>
<td>0.233</td>
<td>0.712</td>
<td>68.34</td>
</tr>
<tr>
<td>4</td>
<td>7913</td>
<td>0.288</td>
<td>0.695</td>
<td>88.55</td>
</tr>
<tr>
<td>5+</td>
<td>7796</td>
<td>0.352</td>
<td>0.748</td>
<td>117.19</td>
</tr>
</tbody>
</table>

Figure 1. Annual change of the standardized catch rates in number of fish per thousand hooks (North Atlantic, ages 1-5+, sex combined, Gompertz growth model), and 95% confidence intervals obtained.

Note: The CPUE included in these plot do not take into consideration any corrections of "targeting intensity factor" (see SCRS/99/056 for details). These indices are recommended for use only in a qualitative comparison over the time series. Do not use these values for tuning.