A CATCH CURVE ANALYSIS FOR EAST ATLANTIC AND MEDITERRANEAN BLUEFIN TUNA

Laurence T. Kell,[1] Sylvain Bonhommeau,[2] Jean-Marc Fromentin,[3]

SUMMARY

A catch-curve analysis using catch-at-age (CAA) data is performed to evaluate recent changes in selection pattern of the eastern Atlantic and Mediterranean bluefin tuna fishery. This was done in order to detect changes following the implementation of the Recovery Plan.

RÉSUMÉ

Une analyse des courbes de captures utilisant la prise par âge (CAA) a été réalisée afin d'évaluer les changements récents du schéma de sélection de la pêcherie de thon rouge de l'Atlantique Est et de la Méditerranée. Cette analyse a été réalisée dans le but de détecter les changements survenus suite à la mise en œuvre du Programme de rétablissement.

RESUMEN

Se realizó un análisis de curva de captura utilizando datos de captura por edad (CAA) para evaluar los cambios recientes en el patrón de selección de la pesquería de atún rojo del Atlántico este y Mediterráneo. Esto se realizó con el propósito de detectar cambios tras la implementación del plan de recuperación.

KEYWORDS

Bluefin tuna, catch curves, management, selectivity, stock assessment

1. Introduction

The objective of the eastern Atlantic and Mediterranean Sea bluefin management plan is to ensure that effective steps are taken to help rebuild the stock. The plan includes a range of measures designed to reduce catches and fishing mortality particularly on younger age classes. We conduct a catch curve analyses (see Fromentin *et al*. 2007 and Restrepo *et al*. 2007). On the catch-at-age matrix generated by the ICCAT Secretariat in August 2012 to evaluate whether there has been a change in the selection pattern since the last assessment (i.e., 2010:2011) and the implementation of the recovery plan.

2. Materials and Methods

Catch curve analysis Sstongo and Larkin (1973) can use catch (as in this study) or indices of abundance at age to estimate total mortality (Z). Data may be from a cohort or from a single or several years. As in VPA it is assumed that the stock is homogeneous with no immigration or emigration and that data are unbiased and that individuals can be accurately aged. Although catch curve analyses is usually conducted to estimate Z it can also use to estimate selectivity.

If pa denotes the fraction of the total catch corresponding to age a, then regressing pa over a range of ages i.e.,

$$\ln(p_a) \sim b_1 + b_2 \times a \quad (1)$$

can be used to estimate total mortality (Z) from b2 .

[1] ICCAT Secretariat, C/Corazón de María, 8. 28002 Madrid, Spain; Laurie.Kell@iccat.int.
[2] IFREMER-UMR EME, 212, Av. Jean Monnet 34200 Sète, France; sylvain.bonhommeau@ifremer.fr
[3] IFREMER UMR EME, 212, Av. Jean Monnet,34200 Sète, France; jean.marc.fromentin@ifremer.fr

The age range when estimating Z should correspond to ages that have fully recruited (i.e., are vulnerable) to the fishery. Ages that are not fully selected do not follow a linear relationship and this relationship can be used to determine the selection pattern since they do not follow a linear relationship and selectivities can be estimated. from the ratio of observed to predicted catch proportions:

$$\hat{p}_a \sim e^{b_1 + b_2 a} \qquad (2)$$

$$\hat{S}_a \sim \frac{p_a}{\hat{p}_a} \qquad (3)$$

Selectivity is 1 when there is no difference between the observed and expected values.

The approach can be extended to estimate partial fishing mortality and selectivity by fishery using the catch ratios and total selectivity.

Data used were the 2000-2011 catch-at-age matrix for ages 1 to 20. The selectivity patterns are calculated for blocks of three years (for 2000 to 2009) and for the recent period 2010-2011 corresponding to the years since the last assessment.

The selection patterns obtained from catch-curve analysis are compared to those used in the 2010 projections to construct the Kobe Strategy Matrix. Various scenarios were considered in the projections, related to the level of historic catches, choice of CPUE indices for tuning the VPA and implementation of management measures in the projection period.

3. Results and Conclusion

The catch-at-age data are shown in **Figure 1**. These were used to estimate catch proportions by age and years. The log of catch proportion by age is plotted against age in (**Figure 2**); the slope provides an estimate of Z. Estimates of selectivity are plotted in **Figure 3**. In 2001-2003 and 2004-2006 there were two peaks in the selectivity curve, this was less marked in 2007-2009 and in 2010-2011. Selectivity declines at after about age 12, suggesting that fishing mortality in the plus group (10+) is lower than the last true age (i.e., 9).

The selectivity patterns assumed in the 2010 projections from 2010 are plotted in **Figure 4**. It appears that in 2010-2011 the selection pattern is closer to that intended by the management measures implemented.

It was not possible to draw any conclusions about changes in Z from the analysis, either because Z has not changed or else because recent recruitment has increased.

References

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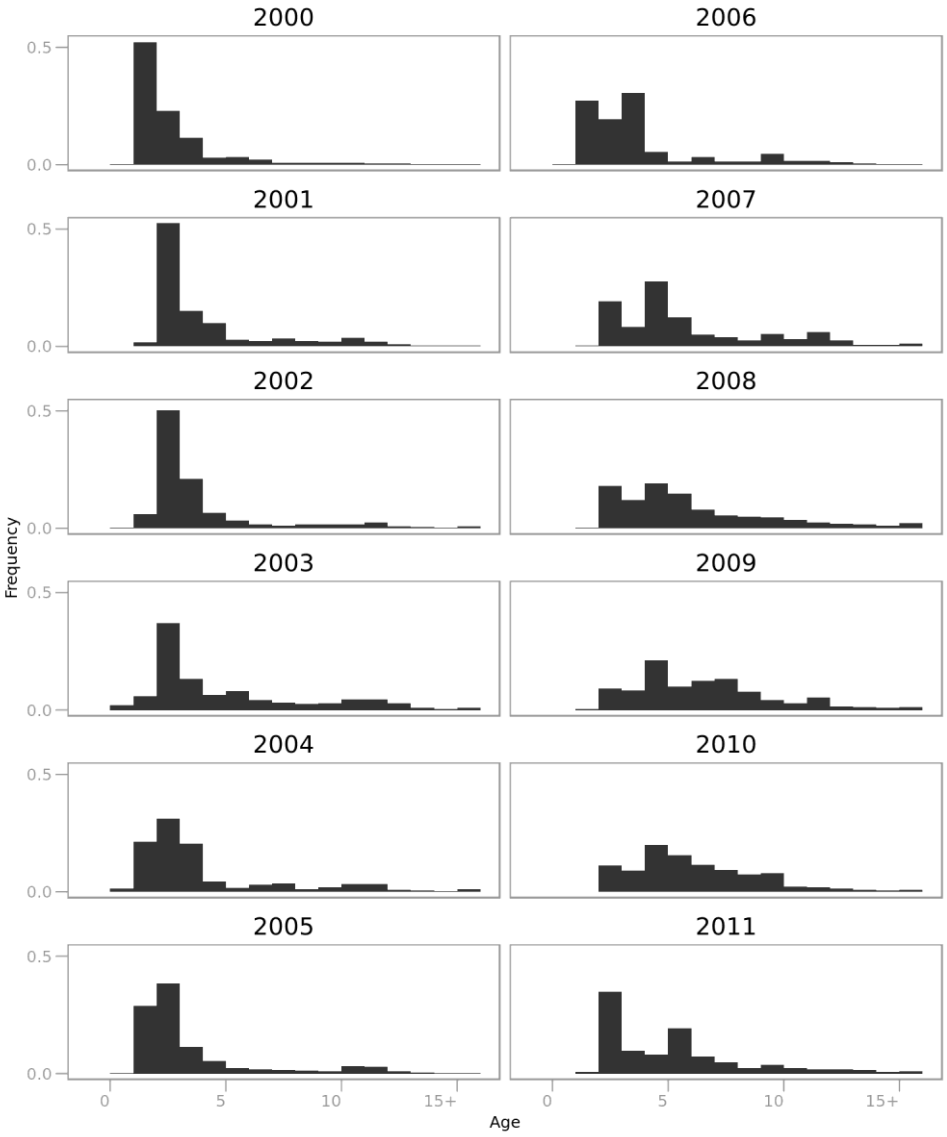

Figure 1. Catch-at-age data by year.

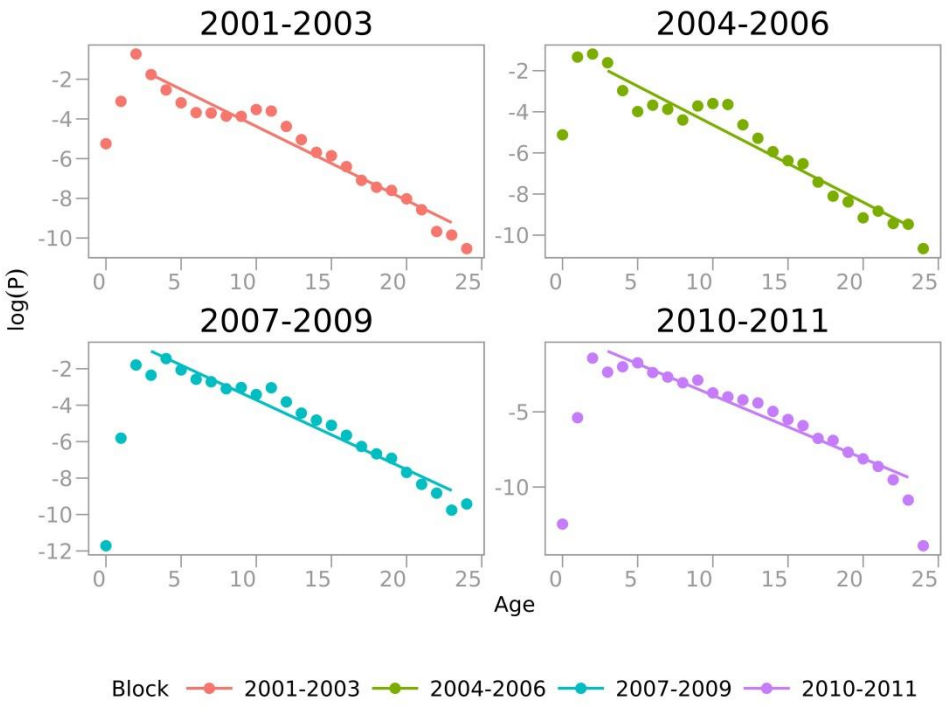

Figure 2. Catch curves for the 4 periods.

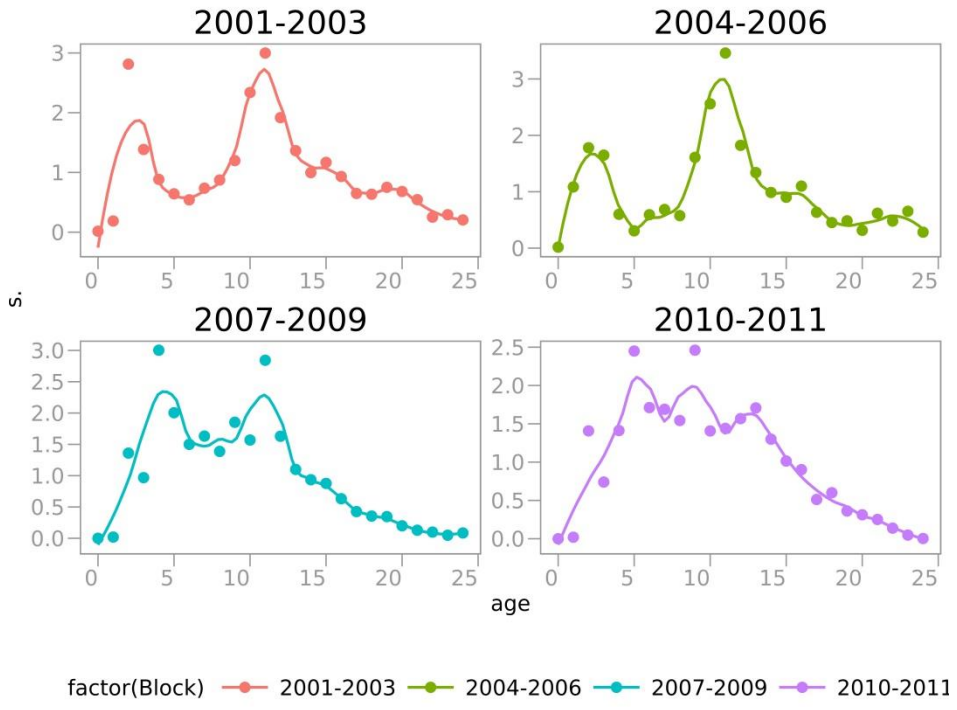

Figure 3. Estimates of selectivity for the 4 periods.

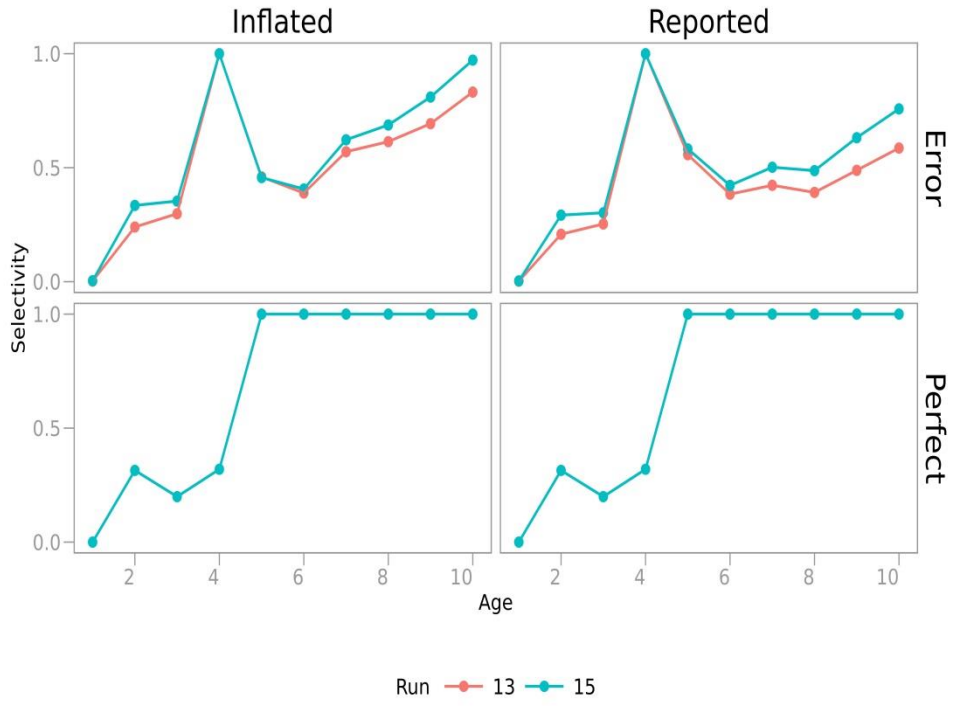

Figure 4. of selectivity for the 4 periods.