CROSS TESTING OF A BIOMASS DYNAMIC STOCK ASSESSMENT MODEL

Laurence T. Kell[1], Haritz Arrizabalaga[2], Gorka Merino[2], and Paul De Bruyn[1]

SUMMARY

In this study a cross-test of a biomass dynamic stock assessment procedure is performed. In a cross test a model is fitted to data generated by a model and then fitted to a different model and the estimates compared. To generate the data we use the North Atlantic albacore integrated assessment based on Multifan-CL.

RÉSUMÉ

Dans le cadre de la présente étude, une vérification croisée de la procédure d'évaluation de la dynamique de la biomasse est réalisée. Dans une vérification croisée, un modèle est ajusté aux données générées par un modèle et ensuite ajusté à un autre modèle et les estimations sont comparées. Pour générer les données, l'évaluation intégrée du germon de l'Atlantique Nord reposant sur Multifan CL a été utilisée.

RESUMEN

En este estudio, se realiza un test cruzado de procedimiento de evaluación de dinámica de biomasa. En un test cruzado se ajusta un modelo a los datos generados por un modelo y después se ajustan a un modelo diferente y se comparan las estimaciones. Para generar los datos utilizamos la evaluación integrada de atún blanco del Atlántico norte basada en Multifan CL.

KEYWORDS

Albacore, Biomass Dynamic; Cross-Test;
Multifan-CL; Stock Assessment;

1 ICCAT Secretariat, C/Corazón de María, 8. 28002 Madrid, Spain.
2 AZTI Tecnalia, Marine Research Division, Herrera Kaia, Portualdea z/g E-20110, Pasaia, Gipuzkoa, Spain

Introduction

The objective of Management Strategy Evaluation (MSE) is to evaluate alternative Management Procedure (MP), where a Management Procedure is the combination of pre-defined data, together with an algorithm, e.g. to estimate stock status and reference points from the data to set management. An important part of the MP is the algorithm used to estimate stock estimation relative to reference points. In the case of the North Atlantic Albacore MP assessment and advice on the total allowable catch (TAC) is performed using a biomass dynamic model. A biomass dynamic model is fitted to a time series of total catch biomass and indices of relative abundance, e.g. catch per unit effort (CPUE). We show how a cross test can be used to validate biodyn by generating indices of abundance from the Multifan-CL assessment conducted in 2013. We then fit biodyn to these data and compare the estimates obtained from the two models.

The example is not extensive but we discuss how the method could be extended to evaluate choices when setting up an MP for testing.

Methods

To evaluate the biomass dynamic assessment model estimates the OM described in SCRS/2016/023 is used in non-feedback mode to generate psuedo data, i.e. three CPUE series corresponding to i) total catch/effort; ii) a juvenile index catch of immature fish/effort; and iii) a mature index corresponding to the catch of mature fish/effort. No measurement error was simulated. These series (along with the total catch time series) are then used by biodyn to estimate stock status and the estimates compared to the OM values.

The setting of the biomass dynamic model were the same as used by the 2013 WG, i.e. a logistic production curve was assumed. The initial value of biomass was set to the OM value at the begining of the series

Results

The simulated CPUE series are shown **Figure 1** Simulated CPUE Series. The indices based on total biomass show, low frequency fluctuation, which are also present in the adult biomass series. While the juvenile series show higher frequency variability. This is because in Multifan-CL, production variability is driven by recruitment.

As this paper is only intended to be an example only two cross tests were run. **Figure 2** compares of the biomass dynamic model fits to the Multifan-CL OM, individual lines are the OM scenarios. Since no process error is modelled in the biomass dynamic assessment model the trends are smoother. The assessment procedure captures the main trends but not the large changes every ten years, driven by incoming cohorts. The difference between using a juvenile or total biomass index are not huge, but it appears that using the total biomass is more able to capture the fluctuations driven by year-class strength.

Discussion and Conclusions

The example here was limited to two examples (based on different indices), however, the same procedure could be used to evaluate other sources of uncertainty on the ability of a biomass dynamic model to capture stock trends. For example a major uncertainty in a biomass dynamic stock assessment model is the shape of the production function, i.e. is it skewed to the left? A biomass dynamic model simplifies recruitment, growth and natural mortality into a single function, and life history arguments have been used to show that the Schaefer production model is probably not appropriate for tunas (Maunder, 2003). The Pella-Tomlinson form (Pella and Tomlinson, 1969) where $B_{MSY}<0.5B_0$ is probably more realistic due to high steepness. A cross test could be used to evaluate the robustness of the logistic production function compared to using a Pella-Tomlinson form.

Another problem is the non-stationarity was identified in the OM in SCRS/2016/023, this could be evaluated by truncating the time series used. Running a cross-test is useful step when setting up an MSE, as it may allow MP options that will not perform well to be excluded from the full simulation trails.

References

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Figure 1. Simulated CPUE Series.

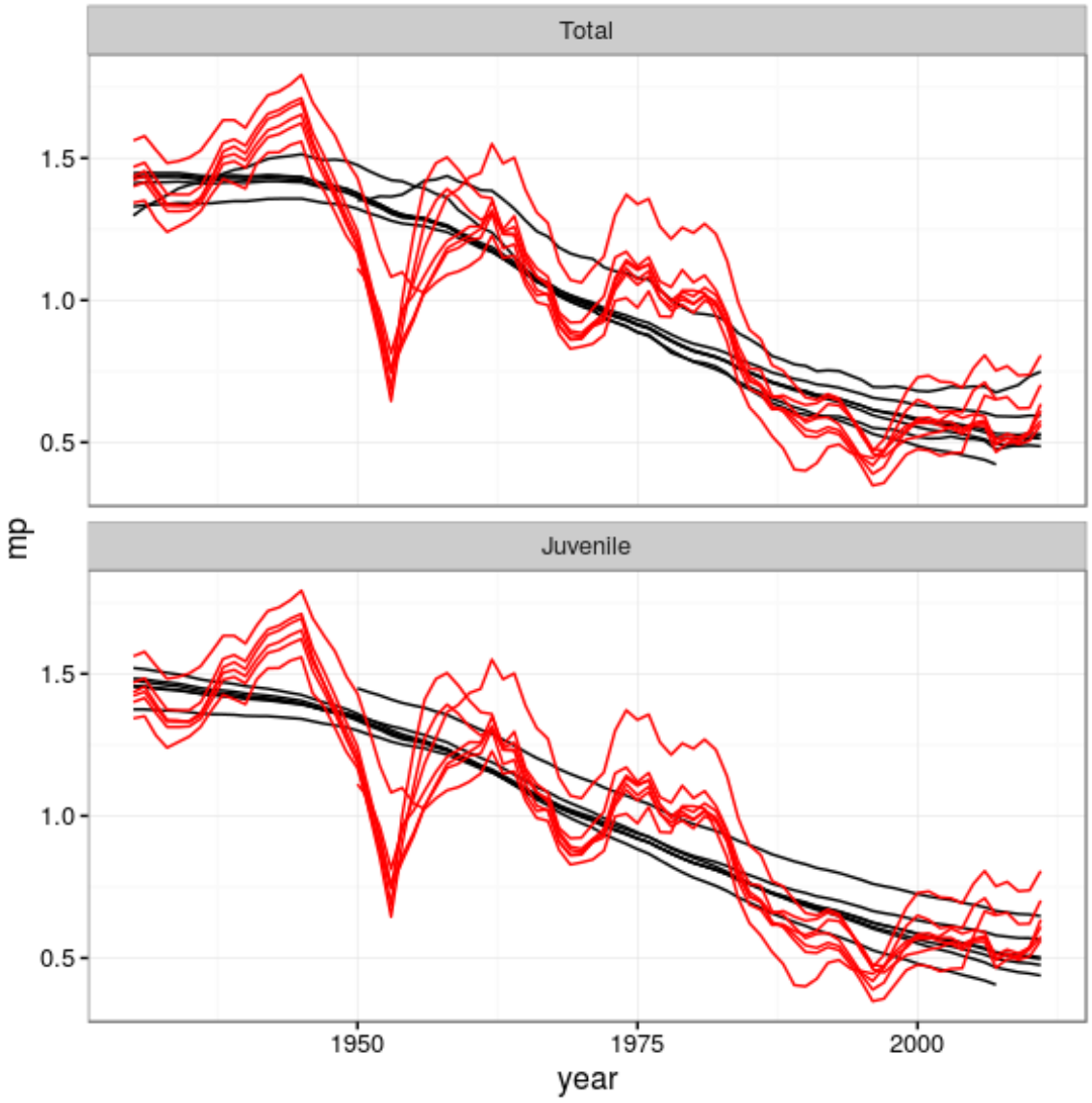

Figure 2. Simulated stock time series.