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REVISIT TO ATLANTIC ALBACORE STOCK ASSESSMENT APPLIED BY STOCK SYNTHESIS 3

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SUMMARY

This paper provides the scientific suggestions from revisit to previous Atlantic Albacore stock assessment applied by Stock Synthesis 3. In this paper, we review the potential matter in the Atlantic Albacore stock assessment and give some notations of description. We find that the setting of size selectivity has influential to the diagnostics of the model and recommend being more careful about the setting of size selectivity functional form.

RÉSUMÉ

Le présent document fournit les suggestions scientifiques du réexamen de l'évaluation antérieure du stock de germon de l'Atlantique réalisée par Stock Synthèse 3. Dans ce document, nous examinons les problèmes potentiels dans l'évaluation du stock de germon de l'Atlantique et nous en fournissons quelques descriptions. Nous estimons que l'établissement de la sélectivité des tailles a une influence sur les diagnostics du modèle et nous recommandons de faire preuve de davantage de prudence en ce qui concerne l'établissement de la forme fonctionnelle de sélectivité des tailles.

RESUMEN

Este documento proporciona sugerencias científicas procedentes de volver a examinar la evaluación anterior del stock de atún blanco del Atlántico realizada aplicando Stock Shynthesis 3. En este documento, se revisa el posible problema de la evaluación del stock de atún blanco del Atlántico y se ofrecen algunas descripciones. Se descubrió que establecer la selectividad de tallas tiene influencia en los diagnósticos del modelo y se recomienda tener más cuidado a la hora de establecer la forma funcional de la selectividad de tallas.

KEYWORDS

Age and growth, Bluefin tuna, Thunnus thynnus, *Dorsal spine, Tag-recovery*

1 Introduction

The Atlantic Albacore stock assessment meeting was held in 2009 (Anon. 2009). In the stock assessment, there are three types of stock assessment models are applied to evaluate the stock status and forecast the stock, 1) VPA-2BOX model, 2) Multifan-CL and 3) Stock Synthesis (Anon. 2009). In this paper, we revisits to the description of the Stock Synthesis model. Since the Stock Synthesis model have possibility to evaluate the stock status by added new functions after the previous Atlantic Albacore Stock assessment (see. Stock Synthesis model version history, http://nft.nefsc.noaa.gov/SS3.html#Version, and Methot, 2012).

In the previous stock assessment, the calculation method of F was not efficiency for Stock Synthesis 3 (Anon. 2009). At first, we make the setting of calculation to be more efficient than previous description. After that the treatment of the data and treatment of size composition data are one of matters in the Atlantic Albacore Stock Assessment.

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For the data matter, there is lack of data which provide stock trend and noisy fluctuation within effort or CPUE data. To improve the former matter, the stock assessment period were changed to the only data rich period 1975-2007. On the other hand, to reduce the noisy fluctuation, we revise the input data and combining several quarterly data.

The setting of functional form of size selectivity curve is also important for correct understanding of stock status. As major issue, there may occur unexpected dynamics (i.e. misfit, discontinuous likelihood change etc.) if the noisy fluctuation of size composition data is high. So we have to consider appropriate way to get information from size composition data. In this paper, 1) combined two seasonal data, 2) to apply two types of functional form are investigated.

Finally, it is important for Atlantic Albacore stock assessment to reduce the high noisy fluctuation by treatment of data (e.g. only use data during major season, combined seasonal data etc.) and the function of model.

2 Materials and Methods

In this paper, stock assessment period is 1975-2007, but 2009 stock assessment was 1930-2007 (Anon. 2009). Since, data during the 1930-1975 indicated the lack of stock trend information (i.e. only two fleets). Furthermore, we apply CPUE data of four fleets instead of effort data; Spain Bait Boat, Spain & France Troll, Japanese Long Line and Chinese Taipei Long Line. By using CPUE data, it is expected to reduce of noisy fluctuation rather than standardized efforts. The other data is same as previous stock assessment.

In this paper, Stock Synthesis 3.2.4f is applied to stock assessment model, and Stock synthesis 3.0.3b was applied in previous stock assessment.

3 Problems and improvements

From the previous stock assessment, the data and descriptions for Stock Synthesis 3.2.4f were updated. Through the updating process from Stock Synthesis 3.0.3b, we change the treatment of time steps from yearly (12 month/season) to 4 seasons (3 month/season). And for improvement of computation efficiency, seasonal F for each fisheries was estimated based on the catch data for each season. Since Multifan-CL can estimate seasonal catchability by each year. On the other hand, Stock Synthesis model can only estimate same seasonal catchability during whole stock assessment periods. We cannot treat noisy CPUE if calculation based on the catch did not accept. The other minor settings are summarized in **Table 1**.

Except above matters, we summarize the two matters, 1) data matter and 2) descriptions of size selectivity.

3.1 Data matter

In the previous stock assessment, the standardized effort data was applied to estimate the stock trend; however it is hard to catch the stock trends by its noisy fluctuation. CPUE data is relatively useful than standardized effort data. Therefore, we suggest two ways to improve. First, by reviewing CPUE data, we recommend to use CPUE data for Spain Bait Boat, Spain and France Troll, Japanese Long Line and Chinese Taipei Long Line. Criteria for applying are followings; 1) There is continuous data, 2) there are few outliers. Second way to improve the computation efficiency is combining seasonal data. In **Table 2**, the fishing season, main season are summarized. From **Table 2**, data for quarter 3 for Spain Bait Boat and Spain & France Troll is applied to estimate. For Chinese Taipei, treatment of "super period" was applied (combined two seasonal data: qt 1&4 and qt 2&3qt).

3.2 Description of Selectivity functional form

To improve fit to the size composition data for each season, we applied two types of size selectivity function; 1) “Double Normal” and 2) “Exponential Logistic” (Methot, 2012). The characteristics of two functional forms are number of parameters. “Double normal” have to estimate 6 (in this paper, two parameters are fixed, so we have to at least 4), but “Exponential Logistic” have to estimate 3.

However, by the differences between these functional forms, the dynamics will be dramatically changing (see **Figure 1**). In this case, settings of except the size selectivity function of Portugal Bait Boat are same. The SPB at terminal year (2007) and log (R0) was dramatically change for each jitter run if we use the Exponential Logistic functional form. In the Exponential logistic case, such change does not occur. So, from **Figure 1**, “Exponential Logistic” is more robust functional form than “double normal”. For the SPB and Recruitment dynamics, we cannot recognize the trend differences by the setting of functional form. So the important point for size selectivity is the effect to the stability of population dynamics.

4 Summary

In this paper, we revisit to the description of Atlantic Albacore stock assessment with previous stock assessment data. By reviewing data, the important point of Atlantic Albacore is to get trend and biomass level information from noisy data (i.e. CPUE, standardized effort, and size composition data). As several options to get stock trend information, we show the data restriction, combining seasonal data and size selectivity functional form.

The important point of this paper is to show some setting may bring on the unstable dynamics of population dynamics (see **Figure 1**). So we recommend checking not only fit to the data but also the stability of setting by several methods (i.e. jitter run etc.).

References

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Table 1. The setting of the model.

	Setting in this paper
Upper and Lower bounds of R deviations	Lower -7, Upper7
B_0	1975
Start year of Recruitment deviation	1975
Recruitment	Quarter 1
Steepness	Fixed: 0.847547 by MFCL-result
Growth	Fixed: Bard (1981), L_{inf}=124.74, K=0.23, t_0=-0.9892
M	Fixed: 0.3
Maturity	50%, 90 cm (age 5) Bard (1981)

Table 2. The characteristics of each fishery.

Country	Gear	Period	Season	Main Season
Spain	Bait Boat	1981-2007	3 & 4	3
Spain and France	Troll	1930-2007	3 & 4	3
Japan	Long Line (non target)	1976-2007	1 & 4	1 & 4
Chinese Taipei	Long Line	1975-2007	All	1+4, 2+3

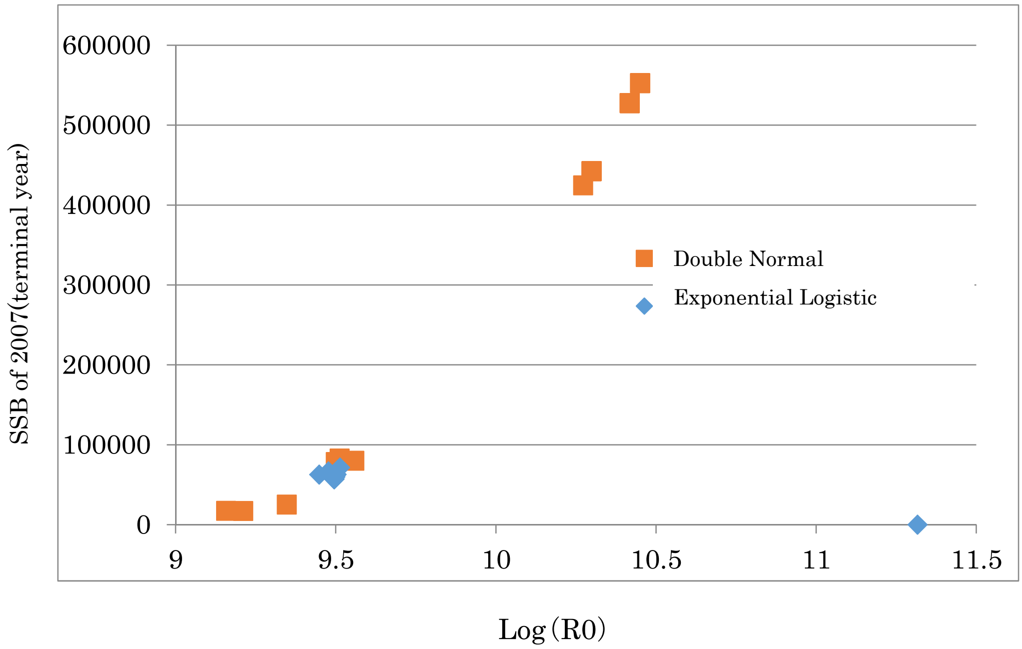

Figure 1. The Log(R0) versus SSB of 2007(terminal year) plot for results of 50 jitter runs.

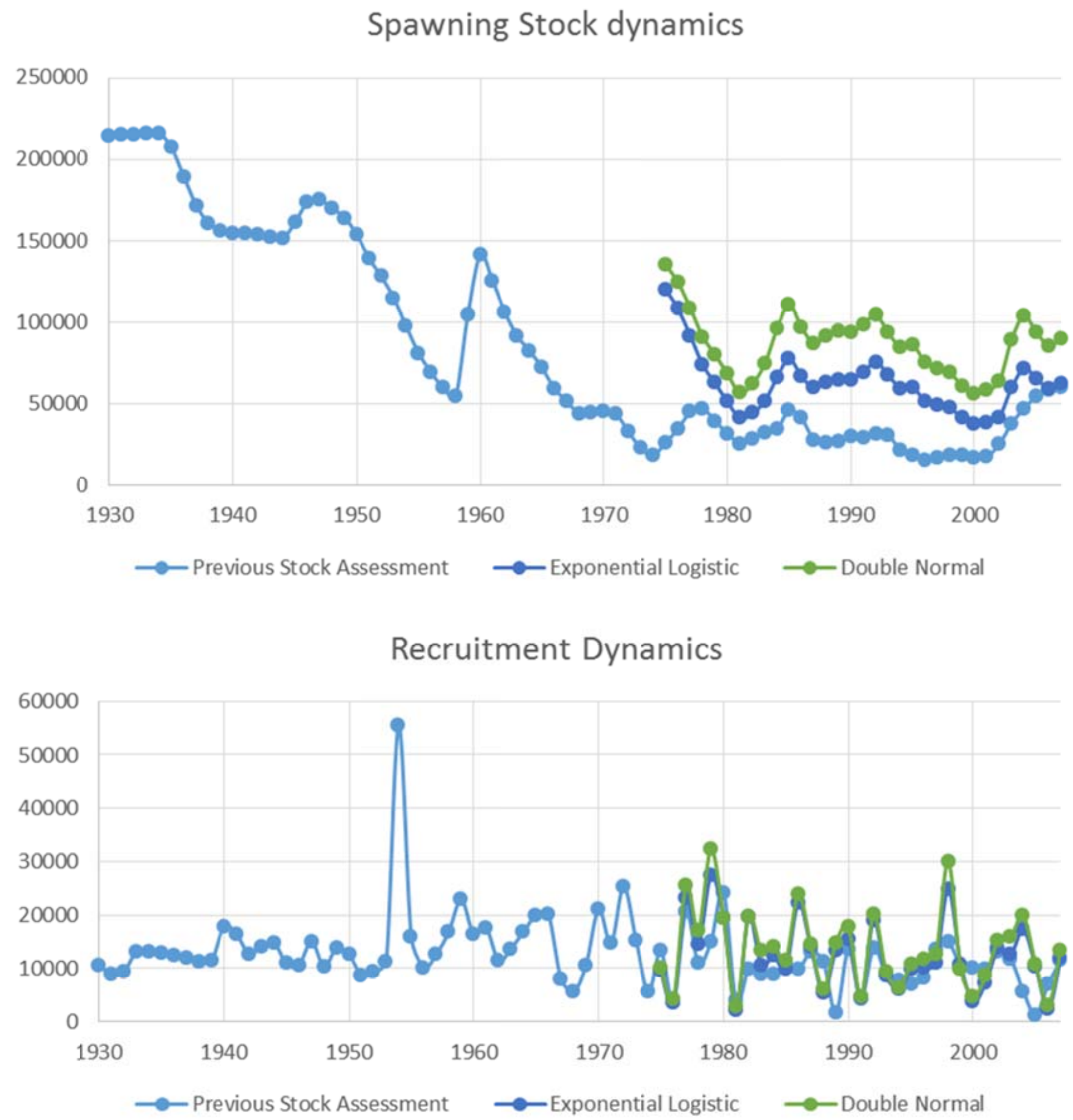

Figure 2. Upper graph shows Spawning Stock dynamics, and bottom graph shows Recruitment dynamics.