A CHECK OF OPERATING MODEL PREDICTIONS WITH DISCUSSION OF AERIAL SURVEY INDEX ISSUES RELATED TO CONTINUING USE OF THE BALI MANAGEMENT PROCEDURE

Norio TAKAHASHI[1], Hiroyuki KUROTA[1,2], Osamu SAKAI[1], Tomoyuki ITOH[1], and Doug S BUTTERWORTH[3]

[1]*National Research Institute of Far Seas Fisheries, Fisheries Research Agency, JAPAN*

[2]*Seikai National Research Institute, Fisheries Research Agency, JAPAN*

[3]*University of Cape Town, SOUTH AFRICA*

Abstract : Values of the longline CPUE index (one of the series required input to the Bali management procedure) are compared to projection results obtained from the operating model (OM). Recent observations for this index fall well within the 95% probability envelope predicted by base case OM in 2011. As regards the aerial survey (AS) index (the other required input to the procedure), the consequences of the non-availability of this index in 2015, and of a future reduction in the scale of the survey providing this index, are examined by conducting some projections. We find that non-availability of the 2015 AS index and reduction of the scale of the associated survey have almost no impact on the performance of the procedure with respect to achievement of the management goal, stock conservation, and predicted TAC values. Accordingly we conclude that a declaration of the existence of Exceptional Circumstances is not essential at this time, and propose continuing the use of the Bali procedure to recommend the TAC for 2018-19 fishing seasons in 2016. Regarding the TAC to be recommended for the 2016 season, we conclude that no modification of the TAC value is required because no Exceptional Circumstances need to be declared and there seems to be no large sudden change observed in other recruitment indices for 2015.

要旨 : はえ縄 CPUE 指数（バリ方式への入力に必要なシリーズの 1 つ）の値を、オペレーティングモデル（OM）から得られた将来予測結果と比較している。この指数の近年の観測値は、2011 年のベースケース OM により予測された 95%の確率範囲に十分に入っている。航空機目視調査（AS）指数（バリ方式への入力に必要なもう 1 つのシリーズ）については、2015 年の AS 指数が入手不能だったこと、及びこの指数を提供する調査の規模縮小の結果を、いくつかの将来予測を行うことにより検討している。2015 年の AS 指数が入手不能だったこと、及び関連する調査の規模縮小は、管理目標の達成、資源保護、予測された TAC 値の点に関して、バリ方式のパフォーマンスにほとんど影響していないことが分かった。従って、今回は特に例外的状況を宣言する必要はないと結論付け、2016 年に 2018-19 年漁期の TAC を勧告するためにバリ方式を継続して使うことを提案する。勧告されている 2016 年漁期に対する TAC については、例外的状況を宣言する必要はなく、2015 年の他の加入指数に大きな突然の変化が見られないことから、TAC 値の変更は必要ないと結論付ける。

1. Introduction

Since 2011, the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) has used a management procedure (MP; called the “Bali procedure”) to guide the setting of the global total allowable catch (TAC) for southern bluefin tuna (SBT; *Thunnus maccoyii*). This MP was adjusted (tuned) and tested to achieve the interim management objective[1] under certain

[1] The CCSBT interim management objective is to rebuild the stock to the reference point of 20% of the

assumptions/predictions about SBT stock and fishery, and thus it is essential to check whether the current status of SBT stock and fishery falls within in the range predicted when the MP was adopted. As a part of the "metarule" process for the MP (CCSBT 2012[2]), the Extended Scientific Committee (ESC) annually (1) reviews stock and fishery indicators, and any other relevant data or information on the stock and fishery; and (2) on the basis of this, determines whether there is evidence for Exceptional Circumstances. If the ESC agrees that Exceptional Circumstances exist, then the ESC will (1) determine the severity of the Exceptional Circumstances; (2) formulate advice on the action required depending upon the severity; and (3) report to the Extended Commission (EC) that Exceptional Circumstances exist and provide the advice mandated in such an eventuality.

One of potential conditions to determine the existence of Exceptional Circumstances is the occurrence of "a scientific aerial survey or CPUE result outside the range for which the MP was tested", where the "range" is defined as the "95% probability intervals for projections for the index in question made using the reference set of operating models used during the testing of the MP" (CCSBT 2012). Japanese longline CPUE and aerial survey (AS) indices are the two indispensable inputs for the MP to be able to calculate a TAC value. These indices have been examined in this context since the 17th ESC meeting (Kurota et al. 2012, Sakai et al. 2013, Sakai and Takahashi 2014). Following these previous examinations, in this document the operating model (OM) predictions are compared with the most recent observations of longline CPUE. Since, as a result of budgetary issues, the AS was not conducted in 2015 (i.e. no 2015 AS index is available) and a decision has been made to reduce the scale of the survey for the 2016 AS and potentially beyond (CCSBT 2015b), this document also discusses some AS index issues related to the continuing use of the Bali procedure.

2. Methods

2. 1. Check whether observed CPUE is within the range predicted

Projections were rerun by O. Sakai using the previous projection code (sbtprojv120) with the same settings as when testing the MP. The LL1 CPUE[3] predicted was compared to the most recent observations providing the core vessel CPUE index (Itoh and Takahashi 2015), available under the data exchange in 2015. We refer to the results of the "MP3_2035_3000_inc" scenario, which applies MP3 (the name of computer code for the Bali procedure) under the specifications of a tuning year of 2035 and a maximum TAC change of

pre-exploitation spawning stock biomass by 2035 with a 70% probability

[2] The technical specifications of the MP were updated in 2013 (available from http://www.ccsbt.org/userfiles/file/docs_english/general/MP_Specifications.pdf)

[3] LL1 CPUE consists mainly of Japanese longline data

3000t, plus a 3000t TAC increment during first period. This is the “Base case” scenario which was adopted for tuning the MP.

2. 2. Examine the effects of no 2015 AS index and a future reduction in the scale of the AS on MP performance

For examining AS index issues in relation to the Bali procedure, the effects of no 2015 AS index and of a future reduction in the scale of the AS on MP performance, several projections were run using the current projection code (sbtproj V1.21 in the GitHub repository) and were related to OM results from the 2014 assessment. The reduction in survey scale (i.e. reduction in distance searched) was taken to give rise to an increase in observation error of the AS index. We compare results from the following three projections: (1) one that applied the MP3 (the Bali procedure) under the assumption that all the future AS indices are available (including the 2015 index) from full-scale surveys; (2) one that used the MP3a[4] (the name of computer code for MP3 without the 2015 AS index) under the assumption that all the future AS indices from 2016 and beyond are obtained from reduced surveys[5] (these assume a survey distance of 6,000 nautical miles and a constant process error for the AS index); (3) the same as (2) except assuming a larger process error for AS index (standard deviation (SD) of process error = 1.25 * SD of observation error), i.e. a larger overall variance for the index.

For (2) and (3), NO RE-TUNING took place, and the same set of tuning parameter values as for MP3 was used for MP3a for appropriate comparisons with the original predictions.

3. Results

3. 1. Longline CPUE index is within a predicted range?

The longline CPUE indices (w0.8, w0.5, and the average of the two) calculated from the data now available from 2011 to 2014 (JP_CoreVesselCPUE_6914.xlsx in 2015 data exchange) are within the 95% probability intervals for the base case OM predictions conducted in 2011 (Fig. 1).

[4] The computer code of MP3 was modified by R. Hillary to exclude use of the 2015 AS index and was named MP3a.

[5] This reduced survey design corresponds to the option 2 which was selected by the Strategy and Fisheries Management Working Group (SFMWG) (CCSBT 2015b). For a detailed description of the option 2 survey and the relationship between survey distance and the overall variance of the AS index, see CCSBT (2015a).

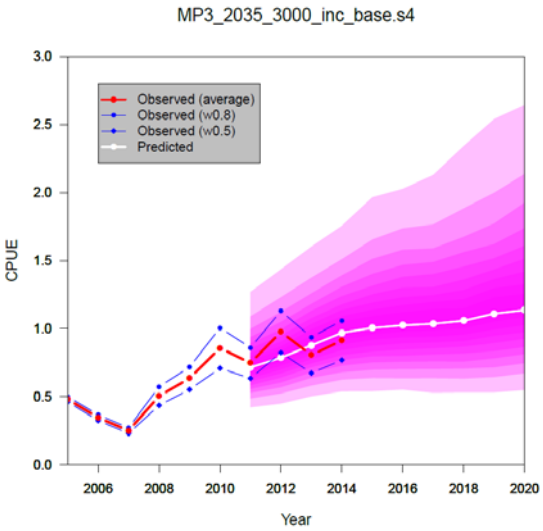

Fig. 1. Longline CPUE series (2005-2014) for w0.5 and w0.8 (blue lines), the average of the two (thick red line) and the future index as projected in 2011 for 2011 to 2020 for the "base case" scenario (reference set), where the white line with points is the median projected CPUE, and the purple shades represent percentiles from 2.5% to 97.5% in an increment of 5%.

3. 2. Effects of no 2015 AS index and a future reduction in the scale of the AS on MP performance

The effects of the non-availability of the 2015 AS index and a future reduction of the scale of the AS on MP performance as regards achievement of the interim management objective are negligibly small (Fig. 2). Probabilities for rebuilding the stock to 20% of the pre-exploitation spawning stock biomass by 2035 are 74% and 73% for MP3a cases with a constant process error and with a larger process error respectively, which hardly differ from the 70% specified by the Commission. Effects on MP performance were also negligible with respect to stock conservation (Fig. 3) and predicted catch (Fig. 4, also see Table A1-A3).

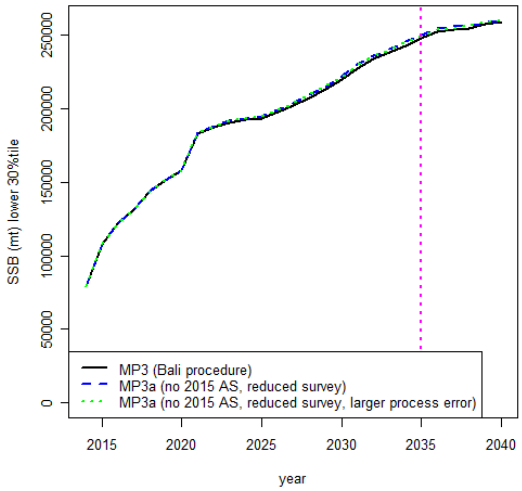

Fig. 2. Comparison of the lower 30%-ile stock trajectories of projections for: (1) MP3 (the Bali procedure) under the assumption that all the future AS indices are available (including the 2015 index) from full-scale surveys; (2) MP3a (MP3 without the 2015 AS index) under the assumption that all future AS indices from 2016 and beyond were obtained from reduced surveys; (3) same as (2) except assuming a larger process error for the AS index. The vertical dotted line indicates the target year (2035) for the interim management objective. See the text for more details.

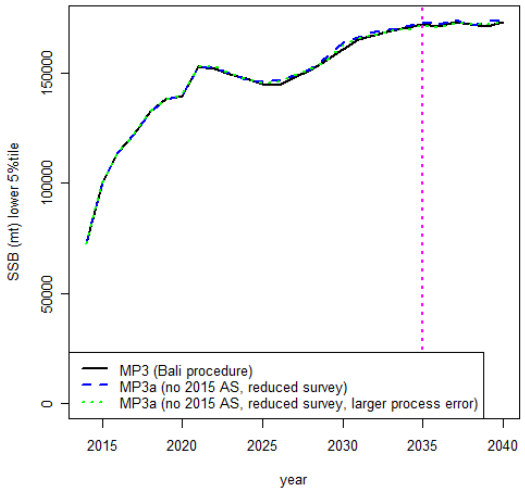

Fig. 3. Comparison of lower 5%-ile stock trajectories of projections for: (1) MP3 (the Bali procedure) under the assumption that all the future AS indices are available (including the 2015 index) from full-scale surveys; (2) MP3a (MP3 without the 2015 AS index) under the assumption that all future AS indices from 2016 and beyond are obtained from reduced surveys; (3) same as (2) except assuming a larger process error for the AS index. The vertical dotted line indicates the target year (2035) for the interim management objective. See the text for more details.

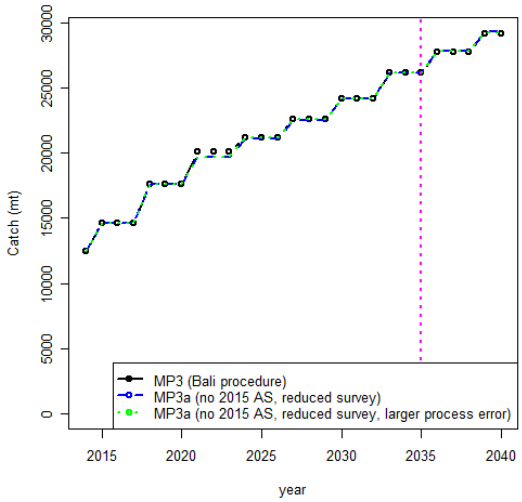

Fig. 4. Comparison of median catch trajectories of projections for: (1) MP3 (the Bali procedure) under the assumption that all the future AS indices are available (including the 2015 index) from full-scale surveys; (2) MP3a (MP3 without the 2015 AS index) under the assumption that all future AS indices from 2016 and beyond are obtained from reduced surveys; (3) same as (2) except assuming a larger process error for the AS index. The vertical dotted line indicates the target year (2035) for the interim management objective. See the text for more details.

4. Discussion

The longline CPUE indices calculated from data for the last three years all fall comfortably within the range that was predicted when testing the Bali procedure in 2011 (Fig. 1). In this respect, we can say that there is no evidence to support a declaration of Exceptional Circumstances.

As regards the other input series required for the MP, the 2015 AS index is not available due to cancellation of the survey, and at least for 2016 (and potentially beyond that year too) a decision has been made to reduce the scale of the survey for budgetary reasons (CCSBT 2015b). These facts alone do not immediately suggest the existence of Exceptional Circumstances, although when testing the MP in 2011, it was assumed that the 2015 AS index would be available and that future surveys would be conducted on the same scale as in the past. However, non-availability of the 2015 AS index and a future reduction in the scale of the AS (with a resultant increase in variance of AS index) have almost no impact on MP performance with respect to achievement of the interim management goal regarding stock recovery, conservation of stock, and predicted TACs (Figs. 2 to 4, Table A1 to A3), indicating an ability to calculate the TAC satisfactorily from the MP. This robustness of the MP is inherently attributed to its specification/structure (details were described in CCSBT 2015a).

Based on consideration above, we conclude that, regarding AS index, the existence of Exceptional Circumstances need not necessarily be declared at this time despite the deviation

from the assumptions made when the Bali procedure was tested, and propose continuing to use this MP with the modification for excluding the 2015 AS index (i.e. MP3a) to recommend the TAC for the 2018-19 fishing seasons in 2016. Because the effects of no 2015 AS index and a future reduction in the scale of the AS are very small, we consider that re-tuning of the MP is not necessary at this time.

Regarding the decision on application of the recommended TAC (calculated by the MP in 2013 to be applied to the 2015, 2016, and 2017 fishing seasons) to the 2016 season, we conclude that no modification is required of the value of this TAC because: 1) there is no need for Exceptional Circumstance to be declared (see discussion above); and 2) it seems that no sudden large change is observed in other recruitment indices for 2015 (see Fig. 3-2 in Takahashi et al. 2015). On the other hand, the decision of applying the recommended TAC to the 2017 season should be made based on all available information about stock status including the result from the AS in 2016.

5. References

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Appendix.

Table A1. Average predicted TAC over the next 4-year period.

Case	5%-ile	Median	95%-ile
MP3 (Bali procedure)	14379	14807	14807
MP3a, Survey option 2 Constant process error	14307	14807	14807
MP3a, Survey option 2 Larger process error than above	14291	14807	14807

Table A2. Average predicted TAC over the next 19-year period.

Case	5%-ile	Median	95%-ile
MP3 (Bali procedure)	14017	19819	22187
MP3a, Survey option 2 Constant process error	13891	19718	22187
MP3a, Survey option 2 Larger process error than above	13896	19723	22187

Table A3. Average annual variation (AAV) in the predicted TAC.

Case	5%-ile	Median	95%-ile
MP3 (Bali procedure)	0.035	0.044	0.061
MP3a, Survey option 2 Constant process error	0.035	0.044	0.061
MP3a, Survey option 2 Larger process error than above	0.035	0.044	0.061