Impact of updated data in the southern bluefin tuna (SBT) operating model and projections for the 2014 assessment

2014 年の資源評価のために更新されたデータの
オペレーティングモデルと将来予測への影響

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Summary

The effects of input data updates on the operating model (OM) are examined. Because of the extremely high value of the most recent Aerial survey index, the OM estimates the high recruitment in 2011–2012. This high recruitment leads to more optimistic projection results.

要約

OMの入力データの更新の影響を検討した。最近年の極度に高い航空目視調査指数により、OMは2011年および2012年に高い加入量を推定した。これは将来予測を非常に楽観的にする。

This info paper is originally “working paper 2” of the OMMP5 meeting in June 2014.

1. Introduction

The data of most recent fishing season (for 2013 FY) was not used in the operating model (OM) analysis which was reported by the document CCSBT- OMMP/1406/07 (Sakai et al. 2014). In particular, following information was updated to include most recent data in OM and management procedure (MP) about one week before the OMMP5 meeting based on the CCSBT data exchange in 2014:

(1) Total catch amount of all fleets for 2013 fishing year;
(2) Catch at length (age) of all fleets for 2013 fishing year;
(3) Abundance index including the most recent year's data point (LL1 CPUE of 2013 and Aerial survey index of 2014) for OM and MP (Fig. 1);
(4) The q-ratio using MP3 (Bali procedure) based on the most recent abundance index.

In this working paper, we show the conditioning and projection results using MP3, and report the impact by most recent data updates for the base case and sensitivity trials specified in the 18th Extended Scientific Committee (ESC) (CCSBT 2013a).

2. Methods

Data and Model specification

In this analysis, we used most recent version of OM; sbtmod.tpl (UA version) downloaded from "GitHub" repository (UA branch). The input file is also most recent version (sbtdata2013.dat). Most recent version of MP3 program and its input data were obtained by Ms. Ann Preece (CSIRO). Projection code (sbtproj.tpl) was modified to use most recent grid file produced by the OM.

The projection period was the following 27 years (from 2014 to 2040), although the TACs for the first 4 years were fixed based on the TAC determination at the 12th annual Commission meeting (CCSBT 2013b): 12449t in 2014, and 14647t in 2015–2017 (TAC based on the MP). Quota allocations by fleet were based on the "nominal allocations". The grid specification used in this analysis is summarized in Table 1.

Base case and sensitivity runs

We examined the base case run and some of the sensitivity trials which were specified at the 18th ESC (CCSBT 2013a). Details of the specification of each run are summarized in Table 4 of CCSBT-OMMP/1406/07. In addition, we show the "doc9case1" sensitivity scenario in this working paper. This is alternative scenario for the Australian surface overcatch assumption specified by CCSBT-OMMP/1406/09 (Itoh et al. 2014). Details are summarized in Table 2.

Comparison with previous assessment result

The base case run was compared to the previous assessment result which is the "base case" run for

the MP tuning in 2011. Based on the "base.grid" calculated in 16th ESC, the "MP3_2035_3000_inc" scenario was re-run using the previous projection program (sbtprojv120) and the Bali procedure (MP3). The input file is the same as used for the MP evaluation in 2011 (catchability ratio AS vs CPUE = 838.2094).

3. Results and Discussion

Base case

Shad plots show that the middle M0 values (0.40 and 0.45) and lower M10 values are preferred in base case run (Fig. 2). Negative log-likelihood profiles show that the likelihood component for the tag data results in higher objective-function weights which are assigned to lower M10 values (Fig. 3). These results are similar to CCSBT- OMMP/1406/07.

The stock status in 2014 remains low at 0.07 B_0, but this is a little higher than for previous assessment/projection (0.05 B_0). The projections using the Bali Procedure (MP3) indicate that the age 10+ biomass will reach the interim rebuilding target of 0.20 B_0 with 91.6% probability by 2035 (Table 3). This probability is much larger and more optimistic compared to the result of CCSBT-OMMP/1406/07, which suggests that most recent input data affect the projection strongly (Fig. 4 and Fig. 5). There is large increase in recent recruitment estimates by OM, particularly for 2011-2012. This would lead to particularly rapid recovery of the spawning stock biomass in projections, and reflects the highest stock rebuilding probability. The large increase of the recent recruitment would result of the update of the Aerial survey index which has extremely high value in 2014 (Fig. 1).

Sensitivity run

All sensitivity scenarios indicate the optimistic result for the projection (Table 3). Even the most pessimistic scenario (upq2008) indicates the high rebuilding probability ($P[B_{2035} > 20\%B_0] = 80.7\%$). Even if the unaccounted mortality is assumed in the OM, future SBT stock will reach the rebuilding target (20% B_0 with a 70% probability in 2035). No danger of the stock collapsing is found in all scenarios.

Conclusion

The update of most recent input data (the data of 2013FY) makes the projection result optimistic. This is probably due to the influence of the extremely high value of Aerial survey index in 2014. The update of input data have relatively little effect on the estimation of current stock status; the SBT stock still remains low level (B_{2014}/B_0 = 0.06–0.09). Aerial survey index is one of the essential information for the current stock assessment, and its fluctuation makes the projection result uncertain. The background of its extremely high value should be discussed at the OMMP5 and/or next ESC to establish the adequateness as the indicator of SBT recruitments.

4. Reference

CCSBT (2013a) Report of the Eighteenth Meeting of the Scientific Committee. 7 September 2013. Canbera, Australia.

CCSBT (2013b) Report of the Twentieth Annual Meeting of Commission. 14-17 October 2013. Adelaide, Australia.

Itoh, T., Suzuki, K., and Takeda, S. (2014) Unaccounted catch mortality in Australian SBT farming fishery between 2001 and 2013 estimated from information of TIS and CDS. CCSBT-OMMP/1406/09(Rev.). 31p

Sakai, O., Takahashi, N., Kurota, H., and Butterworth, D. S. (2014) Examination of the southern bluefin tuna (SBT) operating model and preliminary projections for the 2014 assessment. CCSBT-OMMP/1406/07. 26p

Table 1. The grid structure which was specified at the 18th ESC.

	Levels	Cumulate Number	Values	Prior	Simulation weight
Steepness	5	5	0.55, 0.64, 0.73, 0.82, 0.90	Uniform	Prior
M_1	4	20	0.35, 0.40, 0.45, 0.50	Uniform	Likelihood
M_{10}	4	80	0.050, 0.075, 0.100, 0.125	Uniform	Likelihood
Omega	1	80	1	NA	NA
CPUE series	2	160	w0.5, w0.8	Uniform	Prior
q-age-range	2	320	4-18, 8-12	0.67, 0.33	Prior
Sample size	1	320	Sqrt	NA	NA

Table 2. Additional sensitivity run specification

<table>
<tr><th>Scenario</th><th>Description</th></tr>
<tr><td>[doc9case1]</td><td>

Alternative overcatch scenario specified in CCSBT-OMMP/1406/09.
Modify the surface overcatch rate of 2001-2013 as follows;

<table>
<tr><td>2001</td><td>2002</td><td>2003</td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td><td>2009</td><td>2010</td></tr>
<tr><td>1.32</td><td>1.25</td><td>1.28</td><td>1.25</td><td>1.37</td><td>1.30</td><td>1.42</td><td>1.20</td><td>1.35</td><td>1.39</td></tr>
<tr><td>2011</td><td>2012</td><td>2013</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1.61</td><td>1.26</td><td>1.48</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Modify the CAA (from 2001 to2013) of the Australian surface fishery based on the CCSBT-OMMP/1406/09. The CAA from 1992 to 2000 is adjusted according to the overcatch rate by the “p_t” estimated using solver.
Assuming the 34.5% overcatch for the projection period.

</td></tr>
</table>

Table 5. Comparison of conditioning and projection between the result of CCSBT-OMMP/1406/07 and the result using most recent input data. These analyses were conducted under the Bali Procedure (which was tuned at 2011 ESC) for the base case and sensitivity trials.

Scenario	Stock status based on the biomass of age 10+ (B2014/B0)		Probability of reaching the target by 2035 (P[B2035> 20%B0])	
	Data up to 2012FY (CCSBT-OMMP/1406/07)	Data up to 2013FY	Data up to 2012FY (CCSBT-OMMP/1406/07)	Data up to 2013FY
Base case	0.08	0.07	75.6%	91.6%
CKoff	0.07	0.06	69.9%	89.5%
IS20	0.10	0.09	85.1%	95.1%
upq2008	0.07	0.06	56.2%	80.7%
Constant	0.09	0.08	81.4%	94.2%
Omega75	0.07	0.06	69.7%	90.8%
TagFmixing	0.09	0.07	77.4%	92.7%
C0S1L1	0.09	0.08	82.3%	95.3%
C2S1L1	0.08	0.07	69.5%	87.8%
IncludeTroll	0.09	0.07	88.1%	92.5%
SV_overC	0.08	0.07	68.9%	87.9%
AddedC1p	0.08	0.07	74.9%	91.2%
C1p_overC	0.08	0.07	68.3%	87.6%
AddedC5p	0.08	0.07	72.6%	90.2%
C5p_overC	0.08	0.07	65.7%	86.2%
AddedC10p	0.08	0.07	70.0%	88.4%
C10p_overC	0.08	0.07	63.4%	84.2%
doc9case1	-	0.07	-	85.7%

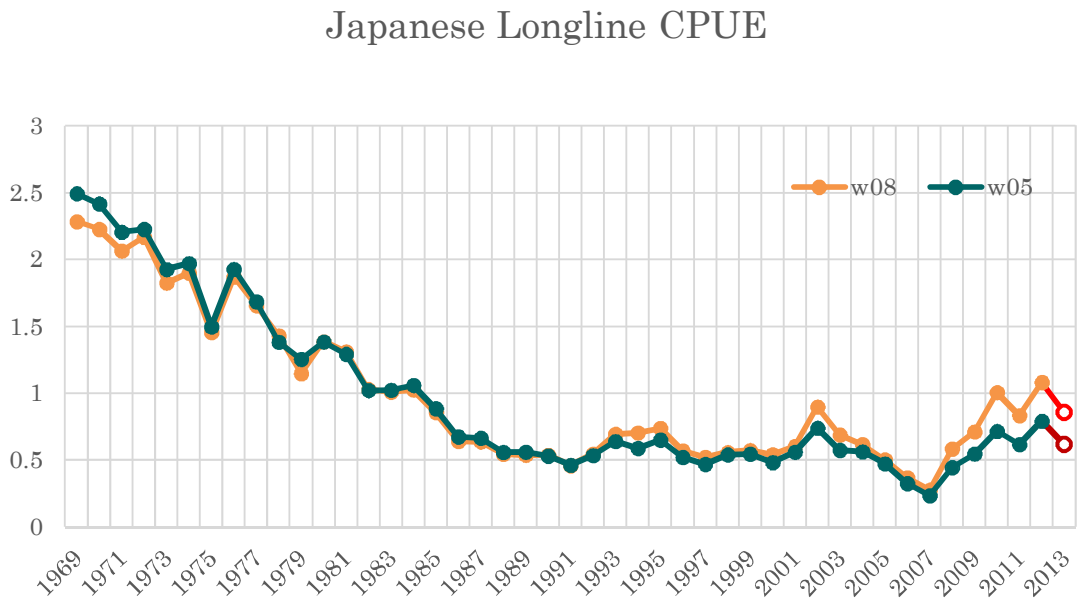

Fig. 1. Updated abundance indices.

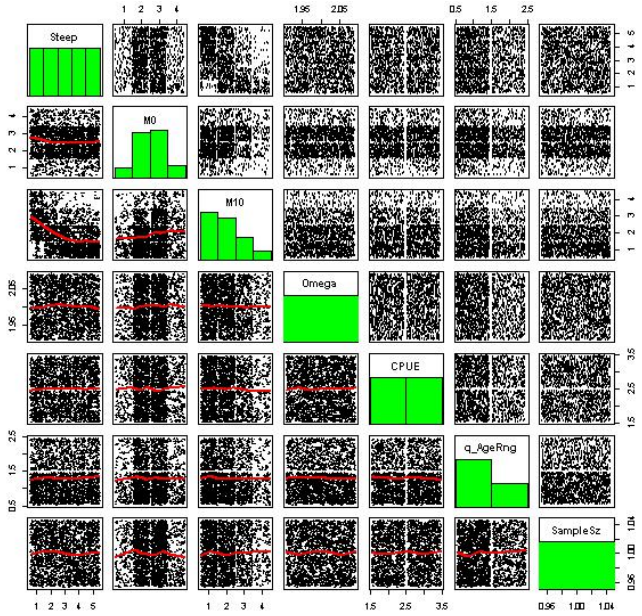

Fig. 2. Shad plots for the "Base case" run.

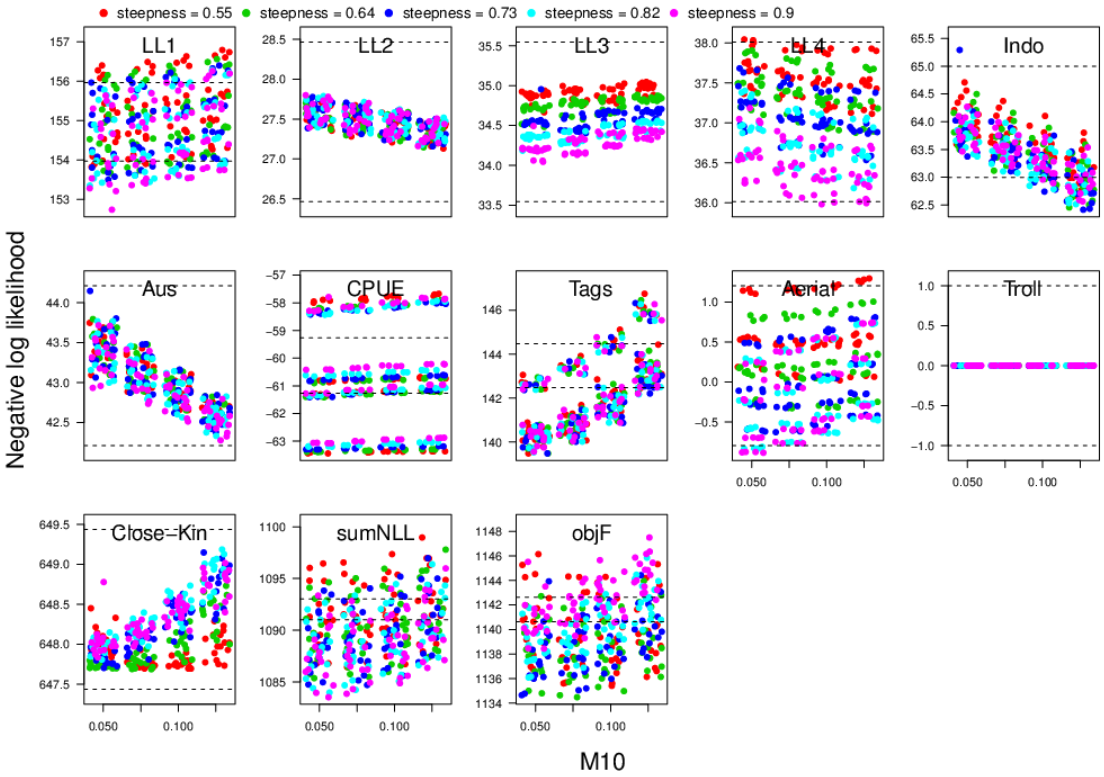

Fig. 3. Negative log-likelihood profiles for the base case.

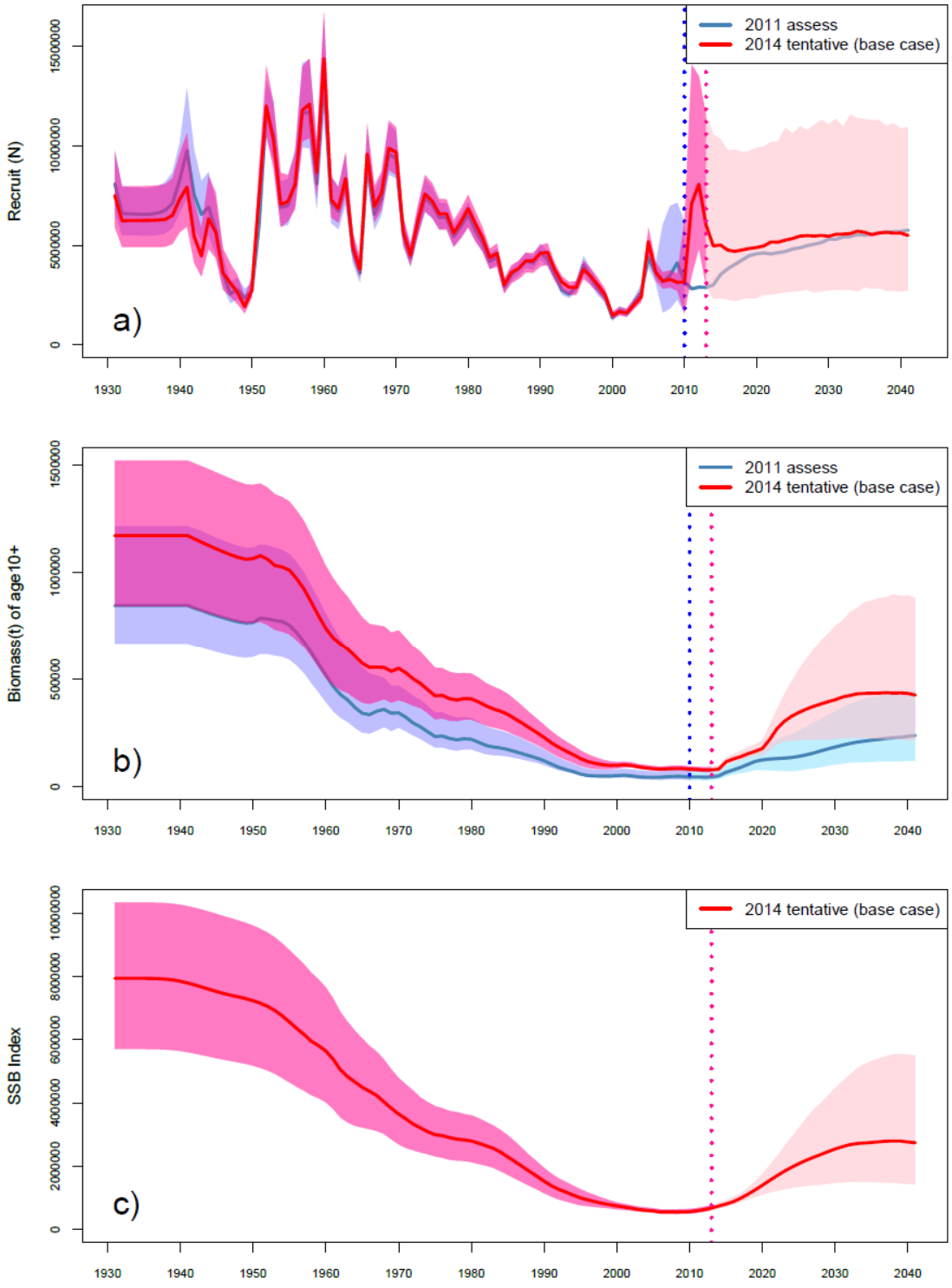

Fig. 4. Trajectories for a) recruitment, b) biomass of age 10+ fish, and c) "SSB index".

The red line with the pink region shows the median and 90% intervals of the current base case. The blue line with the light-blue region shows those for the previous assessment which was calculated in 2011. The dotted line shows the boundaries of the conditioning and projections.

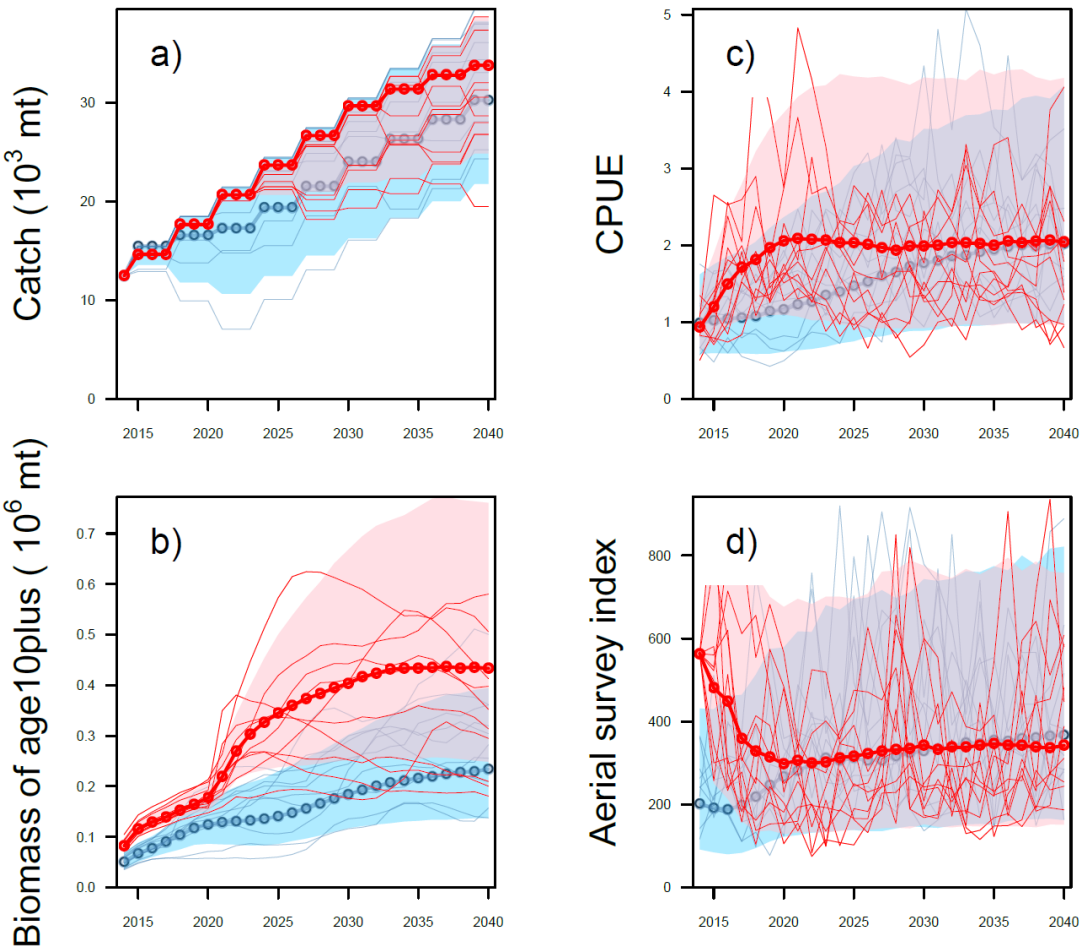

Fig. 5. Predicted values under the Bali Procedure; a) catch (10^3 tonnes), b) biomass of age 10+ fish (10^6 tonnes), c) CPUE of LL1, and d) Aerial survey index.

The red points with the pink regions show the median and 90% intervals of the current base case. The blue points with the light-blue regions show those for the previous assessment which was calculated in 2011.