A CHECK OF OPERATING MODEL PREDICTIONS FROM THE VIEWPOINT OF THE MANAGEMENT PROCEDURE IMPLEMENTATION IN 2016

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Abstract: Values of the core vessels' longline CPUE and aerial survey (AS) indices (two required inputs to the Bali management procedure) are compared to projection results obtained from the operating model (OM). Recent observations for the CPUE index fall within the 95% probability envelope predicted by the Base case OM in 2011. The AS index values for 2012, 2014 and 2016, however, are outside the range predicted by this Base case. The 2016 AS index value remains outside the 95% probability envelope predicted even for the Robustness Test which assumes higher variability for the projected AS index, though the index values for 2012 and 2014 fall within this envelope. This constitutes a possible indication of Exceptional Circumstances. Through discussion of the Exceptional Circumstances reflected by the 2016 AS index, together with the other elements contributing to Exceptional Circumstances and consideration of their severities, the ESC needs to formulate management advice for the action required to calculate TAC for 2018-2020 fishing seasons. Regarding the TAC to be recommended for the 2017 season, we consider that no modification of the TAC value is required given that there has been no unexpected change in the fisheries indicators examined and there are no indications of any decline in recruitment indices for 2016.

要旨： コア船はえ縄 CPUE および航空目視調査（AS）指数（バリ方式に必要な 2 つの入力）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する。CPUE 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%の確率範囲に入っている。しかし、航空目視調査（AS）指数の 2012 年、2014 年、および 2016 年の値はベースケースにより予測された 95%の確率範囲の外側にある。予測 AS 指数のより大きな変動を仮定した頑健性試験を参照しても、2016 年の AS 指数値は、依然、予測された 95%の確率範囲の外側であるが、2012 年および 2014 年の指数値はこの予測範囲の内側に納まる。これは例外的状況の可能性を示す要素となる。例外的状況を構成する他の要素とともに、2016 年の AS 指数で示される例外的状況に関する議論とそれらの深刻度の検討を通し、ESC は 2018-2020 年漁期の TAC を計算するための行動に関する管理勧告を考える必要がある。2017 年漁期に対し勧告される TAC については、精査した漁業指標に予期せぬ変化がなかったこと、また、2016 年の加入量指数には減少の兆候がないことから、TAC の変更は必要ないと考える。

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

assumptions/predictions about SBT stock and fishery. Thus it is essential to check whether the current status of SBT stock and fishery falls within 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 the most important 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 this "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). The Japanese core vessels' 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, Takahashi et al. 2015). Following these previous examinations, in this document the operating model (OM) predictions are compared to the most recent observations of the longline CPUE and AS indices to check whether these indices are within the ranges predicted by the OM projections, and the possible occurrence of Exceptional Circumstances and its severity are discussed along with other information that is related to the possibility of Exceptional Circumstances.

2. Methods

Projections were rerun by O. Sakai using the previous projection code (sbtprojv120) with the same settings used when testing the MP. The LL1 CPUE[3] and AS indices predicted were compared to the most recent observations providing the core vessels' CPUE index (Itoh and Takahashi 2016) and the AS index (Eveson and Farley 2016), available under the data exchange in 2016, respectively[4]. We refer to the results for the "MP3_2035_3000_inc" OM scenario, for which MP3 (the name of computer code for the Bali procedure) is applied to the "Base case" scenario (or "Reference Set" of OMs) under the specifications of a tuning year of

[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.

[4] The file names for the core vessels CPUE and AS indices in the 2016 data exchange are 'JP_CoreVesselCPUE_6915.xlsx' and 'SEC_AerialSurvey_1993_2016.xlsx', respectively.

2035 and a maximum TAC change of 3000t, plus a 3000t TAC increment during first period.

The most recent (2016) value for the AS index has shown a drastic upturn which constitutes the highest value since 1992. Thus, in addition to comparison with the Base case results, the range of AS index predicted by one of the Robustness Tests, “high_aerial_cv”, is also compared to the observed AS index. This “high_aerial_cv” test assumes higher variability (CV=0.5 compared to 0.3 in the Base case) for future simulated AS indices in projections (CCSBT 2010).

3. Results

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

When the core vessels’ longline CPUE indices, “w0.8” and “w0.5”, observed are used for input to the MP, the average of the two is calculated. This averaged CPUE index is within the 95% probability intervals for the Base case OM predictions conducted in 2011 (Fig. 1). The time series of the averaged CPUE index observed has fluctuated along the trend of the median CPUE index predicted in 2011 when the MP was implemented.

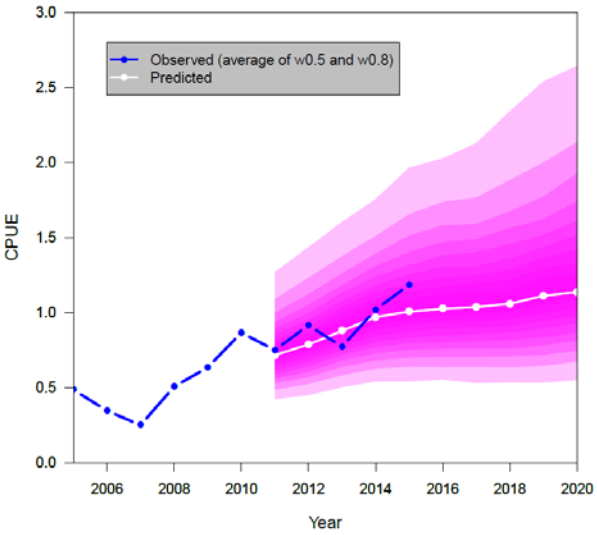

Fig. 1. The average of the two core vessels’ longline CPUE series, “w0.5” and “w0.8”, observed over 2005-2015 (blue line with dots) and the future index as projected in 2011 from 2011 to 2020 for the “Base case” (“Reference Set” OM), where the white line with points is the median projected CPUE, and the purple shades represent percentiles from 2.5% to 97.5% in increments of 5%.

3. 2. Aerial survey index is within a predicted range?

For the Base case (“MP3_2035_3000_inc” scenario), the AS index values observed in 2012, 2014 and 2016 are outside the range predicted by projections (Fig. 2). Although the 2012 and 2014 index are outside, however, they do remain near to the edges of the 95% probability envelope. In contrast, the 2016 index point is far higher than the upper bound of

the 95% envelope. Note that the AS was not conducted in 2015 for budgetary reasons, but resumed in 2016. The total distance searched in 2016 (7,813 nm) was notably less compared to those from 2010 to 2014 (about 10,000 nm to 12,000 nm). but similar to those for 2005 to 2008 (about 4,800 nm to 8,100 nm) (Eveson and Farley 2016).

In a comparison to the “high_aerial_cv” Robustness Test projections, the 2012 and 2014 index values fall within the 95% probability envelope (Fig. 3). The 2016 index, however, still remains outside the 95% envelope even for this high AS CV case.

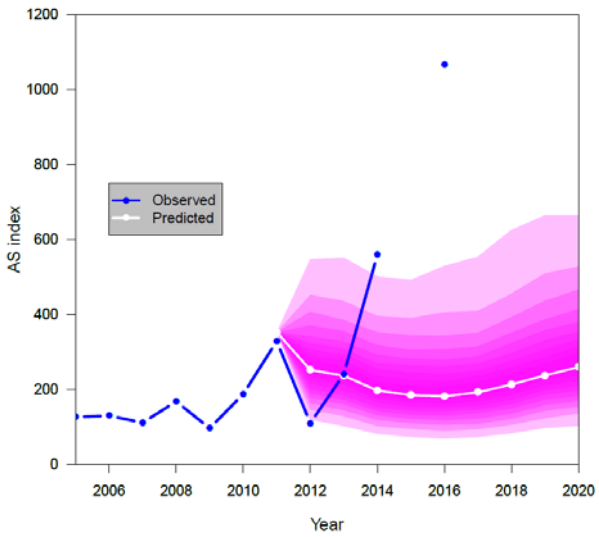

Fig. 2. The aerial survey (AS) index observed over 2005-2016 (blue line with dots) and the future index as projected in 2011 from 2011 to 2020 for the “Base case” (“Reference Set” OM), where the white line with points is the median projected AS index, and the purple shades represent percentiles from 2.5% to 97.5% in increments of 5%. The AS was not conducted in 2015 for budgetary reasons so that no point is plotted for that year. The AS resumed in 2016.

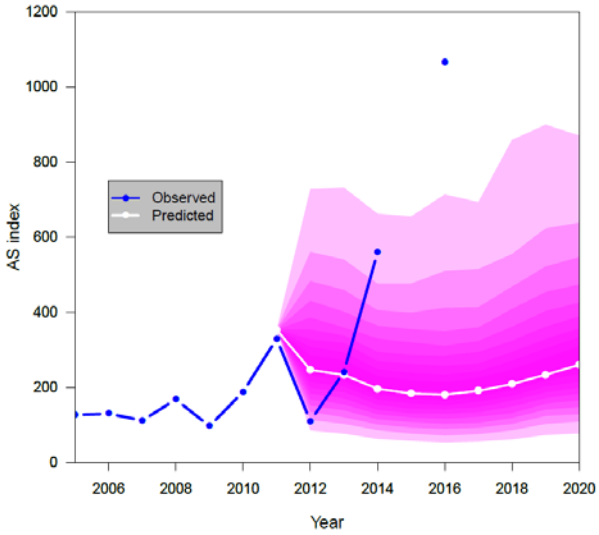

Fig. 3. The aerial survey (AS) index observed over 2005-2016 (blue line with dots) and the future index as projected in 2011 from 2011 to 2020 for the "high_aerial_cv" Robustness Test, assuming higher variability (CV=0.5 compared to 0.3 in the Base case) for the simulated AS index, where the white line with points is the median projected AS index, and the purple shades represent percentiles from 2.5% to 97.5% in increments of 5%. The AS was not conducted in 2015 due for budgetary reasons so that no point is plotted for 2015. The AS resumed in 2016.

4. Discussion

The core vessels' longline CPUE index values for last five years all fall comfortably within the range that was predicted when testing the MP (Bali procedure) in 2011 (Fig. 1). In this respect, there is no evidence to support a declaration of Exceptional Circumstances.

The AS index values for 2012, 2014 and 2016, however, fall outside the range predicted by the OM Base case for testing the MP (Fig. 2). The 2016 AS index value remains outside the 95% probability envelope predicted even for the Robustness Test which assumes higher variability for the simulated ("high_aerial_cv") AS index, although the index values for 2012 and 2014 fall within this envelope (Fig. 3). This constitutes a possible cause to declare Exceptional Circumstances.

In the CCSBT metarule process for the MP, if the ESC agrees that evidence for Exceptional Circumstances exists, then the ESC is to determine its severity, formulate advice for the action required depending upon this severity, and report this to the EC. Thus, first the ESC needs to agree whether the deviation of the AS index in 2016 from the 95% probability envelope predicted is indeed evidence of Exceptional Circumstances. Then the severity of this deviation needs to be discussed and determined by the ESC.

The following are some of our initial thoughts about the severity of this deviation associated with the 2016 AS index for further discussion in the ESC.

The severity of the Exceptional Circumstance arising from the 2016 AS index may depend upon how the validity of the 2016 AS is construed given the reduced survey effort

used. The survey effort for the 2016 AS was planned to be reduced for budgetary reasons, but to be maintained at a level sufficient for obtaining adequate data to estimate the index. Although, as matters turned out, total distance searched in 2016 (7,813 nm) decreased compared to those from 2010 to 2014 (about 10,000 nm to 12,000 nm), this level remained similar to those from 2005 to 2008 (about 4,800 nm to 8,100 nm) (Eveson and Farley 2016). Therefore, it seems reasonable to consider that the 2016 AS was conducted without any major problem, and that the resultant index is considered valid for input to the MP and for monitoring the current recruitment. Determination of the severity is not simple in this case because the 2016 AS index reflects a drastic increase in recent recruitment which is historically the highest observed in terms of this index. If that is indeed the case, the resource is certainly not placed under any risk by continuing to use the MP to recommend the TAC. Indeed it might be argued that the TAC could consequently be set higher than the MP indicates; however it would be premature to take such action given that it would be based on a single observation only.

In addition to the core vessels' longline CPUE and AS indices, other aspects considered as possible evidence for Exceptional Circumstances during the last ESC meeting were: 1) the Indonesian catch of smaller fish observed in recent years; 2) the difference between the total reported global catch and the TAC (overcatch of the TAC); and 3) the scale of unaccounted mortality (UAM) (CCSBT 2015).

In recent years, there have been increases in the catch of smaller size fish in Indonesian fishery (Farley et al. 2016). This is potential evidence for Exceptional Circumstances because, when testing the MP in 2011, the Indonesian fishery was assumed to occur entirely in the spawning grounds and thus assumed to catch larger mature fish only. In relation to this concern, at the 2015 ESC Indonesia advised that the increase in catch of smaller size fish in recent years probably came from catches in areas 2 and 8 (paragraph 14 in Appendix 2 of CCSBT 2015, also see Farley et al. 2016). Results of analyses to identify the catch location of these smaller fish using CDS data will be presented to the 2016 ESC (paragraph 114-115 in Appendix 2 of CCSBT 2015).

The global TAC was exceeded by 485 t in 2013 and 354 t in 2014 (CCSBT Secretariat 2016). When testing the MP, the assumption was made that TACs would not be exceeded in future years. The cumulative effect of these overcatches of TAC must be considered. In 2015, a preliminary estimate for the reported catch was under the global TAC by 549 t (CCSBT Secretariat 2016).

UAM was not also considered when adopting the MP. Identification of the scale of all UAM is still in progress. Some results for some sources of UAM were presented at the 2015 ESC and/or the 2016 CPUE web meeting (e.g., Edwards et al. 2016, Itoh and Takeda 2015).

However, these results have still to be discussed in the ESC, and none are as yet definitive or agreed. For some other sources of UAM such as the Australian recreational fishery, data collection is still underway. Therefore, the identification of the scale of all UAM components combined needs to continue to be pursued for determining their implications (if any) as regards the severity of Exceptional Circumstances.

Through in-depth discussion of the Exceptional Circumstance regarding the 2016 AS index, together with the other elements of Exceptional Circumstances mentioned above and consideration of their severities, the ESC will need to formulate management advice for the action required to calculate TAC for 2018-2020 fishing seasons.

Regarding the decision for application of the recommended TAC (calculated by the MP in 2013 to be applied to the 2015, 2016, and 2017 fishing seasons) to the 2017 season, we conclude that no modification of the value of this TAC is required because: 1) no unexpected change has been detected in the fisheries indicators examined (Takahashi et al. 2016); and 2) there are no indications of any decline in both fishery independent and dependent recruitment indices for 2016 (see Fig. 3-2 in Takahashi et al. 2016).

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