A CHECK OF OPERATING MODEL PREDICTIONS FROM THE VIEWPOINT OF THE MANAGEMENT PROCEDURE IMPLEMENTATION IN 2017

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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 SBT operating model (OM). The most recent observations for the CPUE index and the AS index fall within the 95% probability envelopes predicted by the Base case OM in 2011. As regards a decision on implementation of the recommended TAC (calculated by the MP in 2016 for the 2018-2020 fishing seasons) for the 2018 season, it is considered that no modification of the value of this TAC is required because: 1) there is no evidence to support a declaration of Exceptional Circumstances from the view points of a check of the OM predictions, this year's in-depth stock assessment/projections, and other potential reasons (Indonesian small fish catch, overcatch of reported global TAC, unaccounted catch mortality); 2) no unexpected change has been detected in the fisheries' indicators examined; and 3) there are no indications of any appreciable decline in recruitment indices for 2017.

要旨： コア船延縄 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 指数および AS 指数の最近年の観測値は、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。2018 年漁期に対し勧告される TAC（2018-2020 年漁期のために 2016 年に MP により計算されたもの）の実施については、TAC の変更は必要ないと考えられる。理由は以下の通り：1) OM 予測の確認、本年の詳細資源評価/将来予測、ならびにその他の可能性のある要因（インドネシア小型魚漁獲、報告 TAC の過剰漁獲、未考慮死亡）の観点から例外的状況の宣言を支持する証拠がないこと；2) 精査した漁業指標に予期せぬ変化がなかったこと;3) 2017 年の加入量指数には感知できるほどの減少の兆候がないこと。

1. Introduction

Since 2011, the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) has used a management procedure[1] (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[2] under certain 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

[1] The CCSBT has decided to develop a new MP to replace the current MP because of probable termination of the scientific aerial survey from 2017. The aerial survey had provided an index of recruitment required for the input to the current MP. Although the new MP will be developed to give TAC advice for the 2021-2023 seasons in 2019 or 2020, the meta-rule process for the current MP still needs to be addressed as before for existing TAC advice for 2018-2020 seasons under the current MP.

[2] 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.

MP was adopted and/or the assumptions made then have not been violated subsequently. As a part of the "metarule" process for the MP (CCSBT 2012[3]), the Extended Scientific Committee (ESC): (1) annually reviews stock and fishery indicators, and any other relevant data or information on the stock and fishery; (2) every three years conducts an in-depth stock assessment (planned to be conducted this year); and then, on the basis of (1) and (2) above, 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 criteria used 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, Takahashi et al. 2016). As for 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 (especially stock status information from the every-three-year in-depth stock assessment and future projections being conducted this year) that is related to the possibility of the occurrence of Exceptional Circumstances.

2. Methods

Projections were rerun by O. Sakai using the previous projection code (sbtprojv120) with the same settings which were used when testing the MP. The LL1 CPUE[4] and AS indices predicted were compared to the most recent observations providing the core vessels' CPUE index (Itoh and Takahashi 2017) and the AS index (Eveson and Farley 2017), available under the data exchange in 2017, respectively[5]. We refer here to the results for the

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

[4] LL1 CPUE consists mainly of Japanese longline data.

[5] The file names for the core vessels CPUE and AS indices in the 2017 data exchange are 'JP_CoreVesselCPUE_6916.xlsx' and 'SEC_AerialSurvey_1993_2017.xlsx', respectively.

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

The 2014 and 2016 values for the AS index have shown large upturns and are the two highest values since 1992. Thus, in addition to comparison with the Base case results, the range of the 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. Is the longline CPUE index within the 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 about the trend of the median CPUE index predicted in 2011 when the MP was implemented.

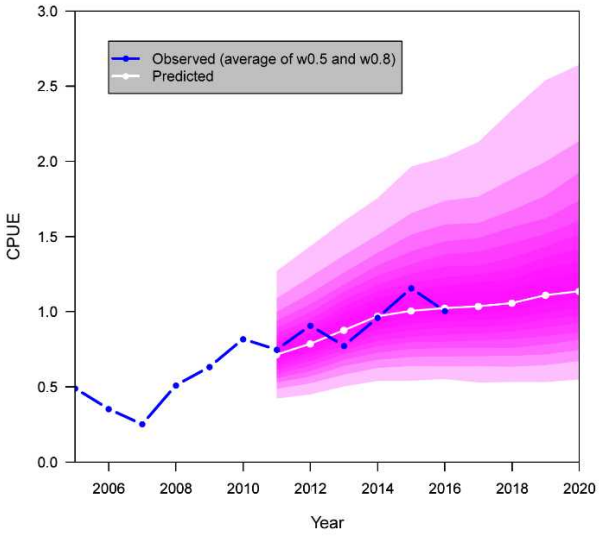

Fig. 1. The average of the two core vessels' longline CPUE series, "w0.5" and "w0.8", observed over 2005-2016 (blue line with dots) and the future index as projected in 2011 from 2011 to 2020 for the "Base case" ("Reference Set" OM), where the white line with points is the median projected CPUE, and the purple shades represent percentiles from 2.5% to 97.5% in increments of 5%.

3. 2. Is the aerial survey index within the 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 the OM Base case projections while the most recent value in 2017 falls within the predicted range (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.

When compared 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.

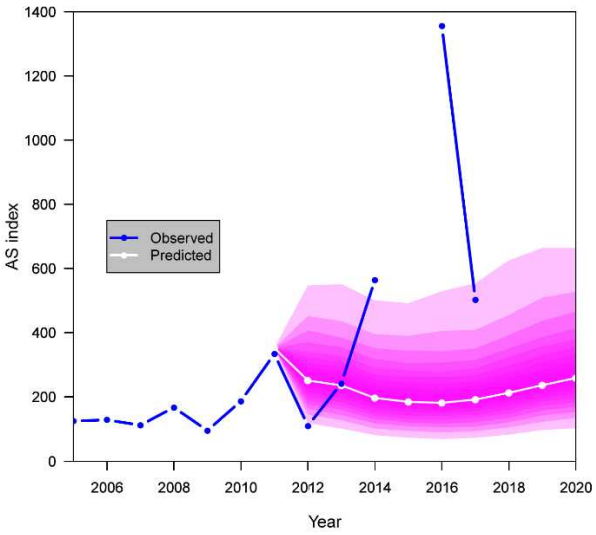

Fig. 2. The aerial survey (AS) index observed over 2005-2017 (blue line with dots) and the future index as projected in 2011 from 2011 to 2020 for the "Base case" ("Reference Set" OM), where the white line with points is the median projected AS index, and the purple shades represent percentiles from 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.

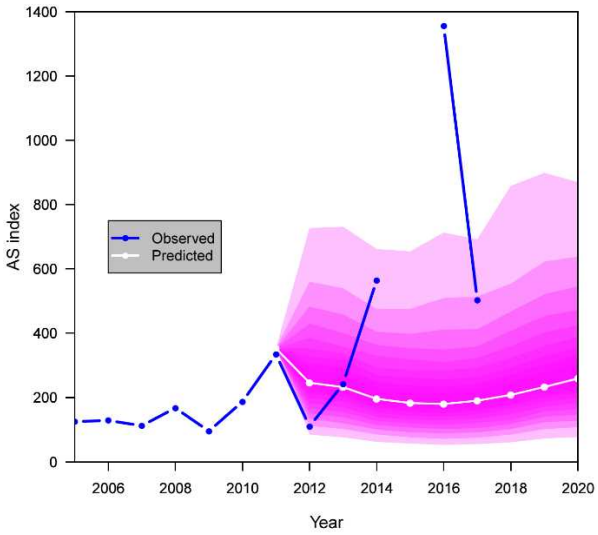

Fig. 3. The aerial survey (AS) index observed over 2005-2017 (blue line with dots) and the future index as projected in 2011 from 2011 to 2020 for the "high_aerial_cv" Robustness Test, assuming higher variability (CV=0.5 compared to 0.3 in the Base case) for the simulated AS index, where the white line 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.

On the other hand, the AS index values for 2012, 2014 and 2016 fall outside the range predicted by the OM Base case projections when 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). However, the 2016 ESC noted that although the 2016 AS index was outside the predicted range, this was in a positive direction and might be positive in indicating high recruitment (CCSBT 2016a). Investigations conducted during the 2016 ESC to examine the impact of the high AS value on the operation of the MP concluded that the high AS point was not influencing the TAC recommendation from the MP, and that the model in the MP was able to fit the data adequately; therefore this did not constitute a reason to declare Exceptional Circumstances. The 2017 AS point falls within the range predicted by the projections (Fig. 2), and thus does not constitute a reason to declare Exceptional Circumstances either.

In addition to the core vessels' longline CPUE and AS indices, other aspects considered as possible evidence for Exceptional Circumstances at past ESC meetings have been: 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); 3) the scale of unaccounted mortality (UAM); and 4) current stock status information from an in-depth stock assessment and future projections.

Since the 2012/13 season there have been increases in the catch of smaller size fish in Indonesian fishery (Farley et al. 2017). This is potential evidence for Exceptional Circumstances because, when testing the MP in 2011, the Indonesian fishery was assumed to occur entirely within the spawning grounds and thus has been 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 relates to catches in areas 2 and 8 (paragraph 14 in Appendix 2 of CCSBT 2015). Some earlier investigations also suggested that the catch of smaller size fish was likely to have come from catches made in the south of the spawning ground (Farley et al. 2016). Analyses to identify the catch location of these smaller fish using CDS data need to continue to be pursued as this could indicate potential evidence for Exceptional Circumstances.

The global TAC was exceeded by 485 t in 2013 and 354 t in 2014 (CCSBT Secretariat 2017). 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 and 2016, preliminary estimates for the reported catch were under the global TAC by 529 t and 520 t, respectively (CCSBT Secretariat 2017). Thus over this four year period, the cumulative catch has been less than the sum of the TACs awarded.

UAM was not also considered when adopting the MP. Identification of the scale of all UAM is still in progress. Results for some sources of UAM have been presented at recent (and now also at the current) ESC meetings (e.g., Itoh and Takeda 2015, Edwards et al. 2016, Itoh and Omori 2016, 2017). However, these results have still to be discussed in the ESC, and none are as yet definitive. Regarding the UAM of non-cooperating Non-Members (NCNM), the 23rd CCSBT agreed that 306 t (see paragraph 69 and Table 1 in CCSBT (2016a) for this estimate) would be set aside from 2018-2020 TAC to account for IUU catch by NCNM (i.e., the "direct approach", see paragraph 53 in CCSBT (2016b)). 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 possible occurrence of Exceptional Circumstances.

Recent population trends and current stock status based on the reference set result of the reconditioned OM using new and updated data indicate a clear increasing trend for the spawning stock from 2012 onward (Fig. 13 in CCSBT-ESC/1708/14 [Hillary et al. 2017]). For

the level of total reproductive output (TRO) in 2017 and that of age 10+ fish biomass (B10+) in 2017 relative to the unfished level, the median estimates are 0.13 (0.11-0.17 80% PI) and 0.11 (0.09-0.13 80% PI), respectively (Table 3 in CCSBT-ESC/1708/14 [Hillary et al. 2017]). This is an improvement of stock status compared to the 2014 assessment result which reported median estimates of 0.09 (0.08-0.12 80% PI) and 0.07 (0.06-0.09 80% PI) for the relative level (to pre-exploitation equilibrium) of TRO in 2014 and that of B10+ in 2014, respectively (CCSBT 2014). Future projections using the Bali Procedure[6] based on the reference set result of reconditioned OM indicates that the CCSBT interim management target of recovery to 20% of the unfished stock by 2035 (in terms of biomass of age 10+ fish) is achieved with a probability of 88% (Table 3 in CCSBT-ESC/1708/14 [Hillary et al. 2017]). This rebuilding probability for the reference set is higher than that of the 2014 assessment (74%; CCSBT 2014). In the 2014 assessment, projections for the sensitivity run considering unaccounted catch mortality (the run name was "Added Catch") showed that the probability of achieving the rebuilding target had fallen to 49% (CCSBT 2014), suggesting potential evidence for Exceptional Circumstances. However, projections conducted in 2017 for a similar sensitivity run (the run name is "UAM1") indicate that the probability of achieving the rebuilding target rises to 80%, and none of projection results for other sensitivity runs show appreciable decreases of rebuilding probability (Table 3 in CCSBT-ESC/1708/14 [Hillary et al. 2017]). A possible reason for this improvement of rebuilding probability for the UAM scenario would be more optimistic stock status in 2017 than in 2014 due to structural changes made in the OM and updated/new data sources used in the 2017 assessment. Therefore, with respect to current stock status information from an in-depth stock assessment and future projections, there is no evidence to support a declaration of Exceptional Circumstances.

Regarding a decision on implementation of the recommended TAC (calculated by the MP in 2016 to be applied to the 2018, 2019, and 2020 fishing seasons) to the 2018 season, it is concluded that no modification of the value of this TAC is required because: 1) there is no evidence to support a declaration of Exceptional Circumstances related to the factors discussed above; 2) no unexpected change has been detected in the fisheries' indicators examined (Takahashi et al. 2017); and 3) there are no indications of any decline in either the fishery independent or dependent recruitment indices for 2017 (see Fig. 3-2 in Takahashi et al. 2017).

[6] Although the aerial survey which has provided a recruitment index for the MP and OM conditioning will not be conducted in 2018 due to funding issues and possibly beyond (being planned to replace by a recruitment index from the gene-tagging and to develop a new MP), there is still a merit undertaking projections with the Bali procedure for providing some indication as to whether the overall estimate of stock productivity has changed since previous assessment.

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