A CHECK OF OPERATING MODEL PREDICTIONS FROM THE VIEWPOINT OF IMPLEMENTATION OF THE MANAGEMENT PROCEDURE IN 2020

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Abstract: We examined observations of input index/data (longline CPUE, gene-tagging estimate, close-kin mark recapture data) for the Cape Town procedure (CTP) comparing to the 2019 operating model (OM) prediction. These examinations indicate that all the observations are consistent with the predicted ranges from the 2019 OM. Regarding the input index/data for the CTP, therefore, there is no evidence to support a declaration of Exceptional Circumstances. Accordingly, it is concluded that there is no major problem regarding operation of the CTP for recommending TAC advice for the 2021-2023 season because: 1) there is no conclusive evidence to support a declaration of Exceptional Circumstances from the viewpoints of a check of the OM predictions and other potential reasons (the Indonesian small/young fish catch, the extent by which the total reported global catch exceeds the TAC, unaccounted mortality, results of stock assessment conducted in 2020); and 2) no unexpected change has been detected in the fisheries' indicators examined. However, cause(s) of the projection result not achieving the interim management objective of median 30% spawning stock depletion by 2035 with a 50% probability using the CTP needs to be further investigated at the ESC.

要旨： ケープタウン方式（CTP）の入力指数／データの観測値を 2019 年のオペレーティングモデル（OM）の予測値と対比させて精査した。この精査では全ての観測値が 2019 年の OM の予測範囲と矛盾しないことを示している。したがって、CTP の入力指数／データに関しては、例外的状況の宣言を支持する証拠はない。これに基づき、2021-2023 年漁期の TAC を勧告するための CTP の運用に関して大きな問題はないと考えられる。理由は以下の通り：1) OM 予測の確認ならびにその他の可能性のある要因（インドネシア小型/若齢魚漁獲、総報告全球漁獲が TAC を超過する程度、未考慮死亡および 2020 年に実施された資源評価結果）の観点から例外的状況の宣言を支持する決定的な証拠がないこと;2) 精査した漁業指標に予期せぬ変化がなかったこと。ただし、CTP を用いて 50%の確率で 2035 年に初期親魚資源量の 30%水準まで回復させるとする暫定管理目標を達成しない将来予測結果は ESC でさらに調査することが不可欠である。

1. Introduction

Since 2011, the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) has used a management procedure (MP) to guide the setting of the global total allowable catch (TAC) for southern bluefin tuna (SBT; *Thunnus maccoyii*). The previous MP ("Bali procedure") was replaced with a newly developed and adopted MP ("Cape Town procedure (CTP)") in 2019. The CTP was developed because of termination of the scientific aerial survey from 2018 which had provided an index of recruitment required for the input to the Bali procedure. This year (2020) is the first year of using the CTP to recommend a TAC (for the 2021-2023 seasons). The Bali procedure had been used to provide TAC recommendations up to the 2018-2020 season.

The CTP was adjusted (tuned) and tested to achieve an interim management objective[1] under certain assumptions/predictions about SBT stock and fishery. Thus, it is essential to check whether the current status of SBT stock falls within the range predicted when the CTP was adopted in 2019, and whether any of the assumptions made then have subsequently been shown to be invalid. As a part of the "metarule" process for the MP (CCSBT 2012[2]), the Extended Scientific Committee (ESC): (1) annually reviews stock and fishery indicators, and any other relevant data or information on the stock and fishery; and (2) every three years conducts an in-depth stock assessment. Then, on the basis of (1) and (2) above, the ESC 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 whether input index/data (observations) for the CTP are outside the predicted (simulated) range for which the CTP was tested, where this "range" is defined as the 95% probability intervals for projections for the index/data in question made using the reference set of operating models (OMs) during the testing of the MP (CCSBT 2012). The Japanese core vessels longline CPUE (Itoh and Takahashi 2020), absolute abundance estimate (for 2-year old fish) from the gene-tagging (GT) project (Preece et al. 2020), and parent-offspring pair (POP) and half-sibling pair (HSP) data from the close-kin mark recapture (CKMR) project (Farley et al. 2020, Hillary et al. 2020a) are necessary inputs for the CTP. In this paper, the Base case (reference set) OM prediction is compared to the most recent observations of the input index/data for the CTP to check whether these index/data are within the range predicted by the OM projection. Based on this examination, the possible occurrence of Exceptional Circumstances and its severity are discussed along with other factors that are also related to the possibility of the occurrence of Exceptional Circumstances.

2. Japanese core vessels longline CPUE index

When the core vessels observed longline CPUE indices, "w0.8" and "w0.5", are used for input to the CTP, the average of the two is calculated. This averaged CPUE index for 2019 lies within the 95% probability intervals for the Base case OM predictions conducted in 2019 (Fig. 1).

[1] The CCSBT interim management objective is to rebuild the stock to the reference point of 30% of the pre-exploitation spawning stock biomass by 2035 with a 50% probability.

[2] The technical specifications of the CTP will be updated in 2020 (will be available from http://www.ccsbt.org/).

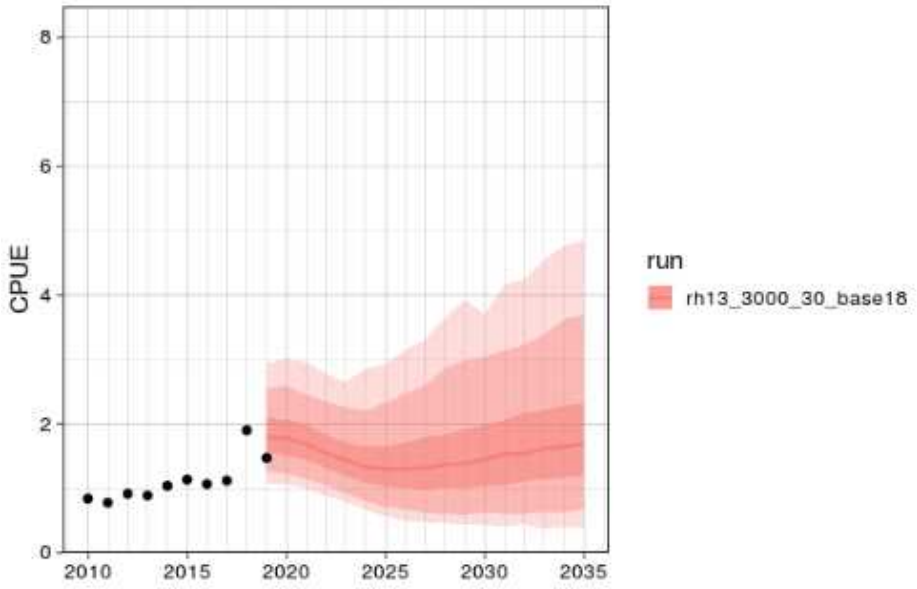

Fig. 1. The average of the two core vessels' longline CPUE series, "w0.5" and "w0.8", observed over 2010-2019 (black points) and the future index as projected in 2019 from 2019 to 2035 for the "Base case" ("reference set") OM, where the brown thick line is the median projected CPUE, and the brown shades represent 80%, 90%, and 98% probability interval.

3. Abundance for 2-year old fish estimated from the gene-tagging (GT)

Absolute abundance estimates for age 2 SBT obtained from the GT are used as a recruitment indicator in the CTP. Currently, three estimates are available for age 2 SBT of 2016, 2017, and 2018 (Preece et al. 2020). Abundance estimate for age 2 SBT of 2018 obtained from this year's (2020) analysis is 1,142,638 with a CV of 0.123.

When testing the CTP last year (2019), GT data for 2018 could not simulated in projections due to a technical issue of OM conditioning and projection codes, and so the GT data for 2018 was treated as missing data. For the purpose of checking the age 2 estimate for 2018 is within the predicted range, we examine whether the actual 2018 estimate obtained this year (2020) lies within the estimated range from the OM used for testing the CTP (the 2018 estimate was not used in OM conditioning in 2019). Fig. 2 compares the age 2 estimates from the 2019 OM (pink), the age 2 estimates calculated from the stock-recruitment relationship (green), and the age 2 estimates from the actual GT data (information was provided from R. Hillary). The age 2 estimate of 2018 is lower than the estimates from the OM, but the confidence intervals overlap.

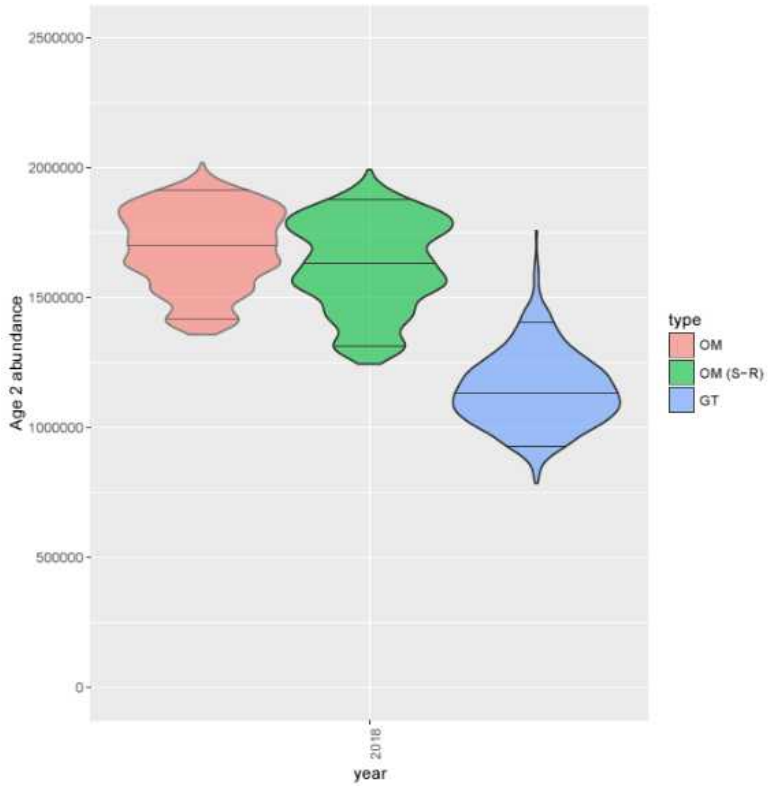

Fig. 2. The gene-tagging (GT) age 2 abundance estimates for 2018 from this year's (2020) analysis (blue), age 2 estimate predicted from the 2019 OM (pink), and age 2 estimates predicted from the stock-recruitment relationship (green). (Information was provided from R. Hillary)

4. Data from the close-kin mark recapture (CKMR)

Parent-offspring pair (POP) and half-sibling pair (HSP) data from the CKMR are used to estimate time series of spawning stock abundance in the CTP (Hillary et al. 2020a, 2020b). Fig. 3 compares observed CKMR data available in 2020 and the predicted 2020 CKMR data from the 2019 OM (Information was provided from R. Hillary). The observed CKMR POP and HSP data fall within the predicted range from the 2019 OM.

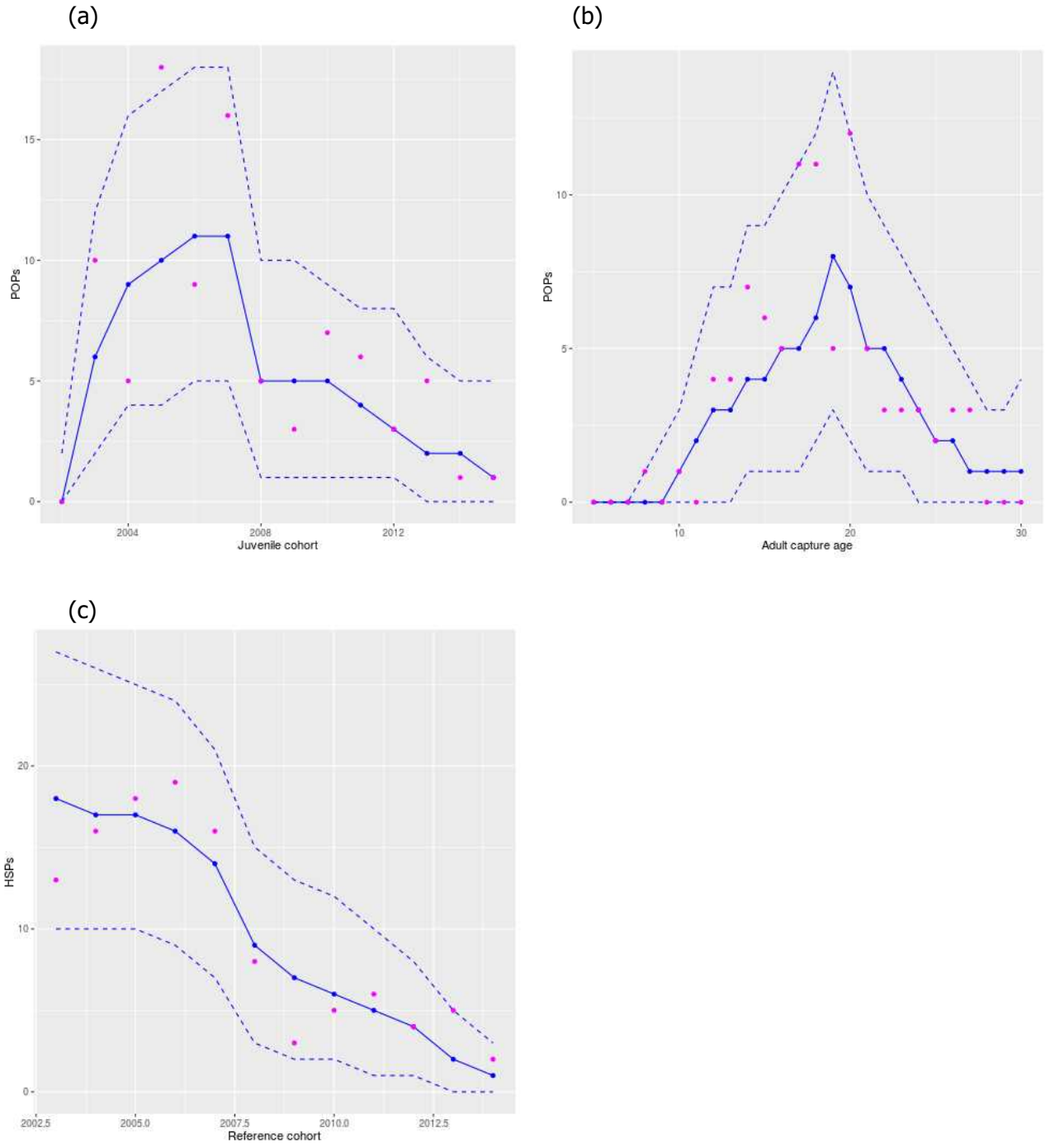

Fig. 3. Observations (magenta points) available in 2020 and predictions (blue solid and dashed lines indicate the median and 95% probability intervals) from the 2019 OM of CKMR POP and HSP data. (a) POP aggregated by juvenile cohort, (b) POP aggregated by adult capture year, and (c) HSP aggregated by the initial cohort level. (Information was provided from R. Hillary)

5. Discussion and conclusion

We examined observations of input index/data (longline CPUE, GT estimate, CKMR POP and HSP) for the CTP comparing to the 2019 OM prediction in sections 2 to 4 above. These examinations indicate that all the observations are consistent with the predicted ranges from the 2019 OM (Fig. 1, 2, and 3). Regarding the input index/data for the CTP, therefore, there is no evidence to support a declaration of Exceptional Circumstances.

In addition to those input index/data for the CTP, the following factors are considered as possible evidence for Exceptional Circumstances: 1) the Indonesian catch of small/young SBT observed in recent years; 2) the extent by which the total reported global catch exceeds the TAC (the overcatch of the TAC); 3) unaccounted mortality (UAM); and 4) current stock status information from an in-depth stock assessment and future projections.

From the 2012/13 to the 2016/17 season there were increases in the catch of small/young SBT in Indonesian fishery (Sulistyaningsih et al. 2020). This is potential evidence for Exceptional Circumstances because, when testing the CTP in 2019, the Indonesian fishery was assumed to occur entirely within the spawning grounds and thus had been assumed to catch larger and mature SBT only. Some earlier investigations suggested that the catch of small/young SBT was likely to have come from catches made to the south of the spawning ground (Farley et al. 2017). However, based on revised length data analyzed up to the most recent spawning season (2015/16 to 2018/19) which included only SBT catches by vessels predominantly operating in Area 1 (the spawning ground), Sulistyaningsih et al. (2020) advise that catches of small/young SBT appear to be from this spawning ground. Although this suggests some evidence for Exceptional Circumstances, the strength of evidence is still uncertain (the severity of the Exceptional Circumstances, if any, seems likely to be low). Moving forward, further examination to resolve identified uncertainties in the catch location of these small/young fish and refinement/improvement of the quality control of the monitoring program need to continue to be pursued.

The global TAC was exceeded by 484 t in 2013 and 354 t in 2014 (CCSBT Secretariat 2019). When testing the previous Bali procedure (provided TAC recommendations up to the 2018-2019 season) and the CTP (will provide TAC recommendations for the 2021-2023 in 2020 and for future years), the assumption was made that TACs would not be exceeded in future years. The cumulative effect of these overcatches of TAC must therefore be considered. In 2015, 2016, 2017, 2018, and 2019, estimates for the reported catch were under the global TAC by 529 t, 520 t, 535 t, 385 t, and 491 t, respectively (CCSBT Secretariat 2020). Thus, over this seven-year period, the cumulative overcatch has been well below than any single year's TAC awarded, would consequently not have impacted resource rebuilding greatly, and accordingly does not seem to provide evidence for Exceptional Circumstances.

UAM was also not considered explicitly when adopting the previous Bali procedure in 2011 (the Bali procedure recommended TAC up to the 2018-2020 season). Identification of the scale of all UAM is still in progress in the ESC. Results for some sources of UAM have been presented at past and the current ESC meetings. However, these results have still to be discussed in the ESC, and none are as yet considered to be 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 (recommended by the Bali procedure) to account for IUU catch by NCNM (i.e., the "direct approach", see paragraph 53 in CCSBT (2016b)). The CTP, however, was developed and tested considering NCNM UAM (i.e., the "MP approach"), and thus it is not necessary to care NCNM UAM as far as its scale is smaller than that was assumed. 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.

Most of the key stock status summary ratios resulted from this year's (2020) stock assessment are improved compared to the last (2017) assessment (e.g., median relative Total Reproductive Output, TRO, is 0.13 in 2016 and 0.20 in 2019) (Hillary et al. 2020c). Future projections show that the CTP reaches a median TRO depletion of 0.29 with a probability of 0.47, which does not quite achieve the interim management objective of a median TRO depletion of 0.30 by 2035. Although this would raise a concern of evidence of Exceptional Circumstances, it should be considered that there are possibly influential changes of data/settings given to the OM used in the 2020 assessment (e.g., changes of standardization method for CPUE and OM grid configuration). This issue needs to be further discussed at the ESC.

It is therefore concluded that there is no major problem regarding operation of the CTP for recommending TAC advice for the 2021-2023 season because: 1) there is no conclusive evidence to support a declaration of Exceptional Circumstances related to the factors discussed above; and 2) no unexpected change has been detected in the fisheries' indicators (primarily CPUE) examined (Takahashi and Itoh 2020). However, cause(s) of the projection result not achieving the interim management objective of median 30% TRO depletion by 2035 with a 50% probability using the CTP needs to be further investigated at the ESC.

The code of the CTP for TAC calculation is available to CCSBT members. We ran the code and could obtain 17,647 t that is same as in Hillary et al. (2020b). This value of TAC is within the predicted range from the 2019 MP testing (Fig. 4).

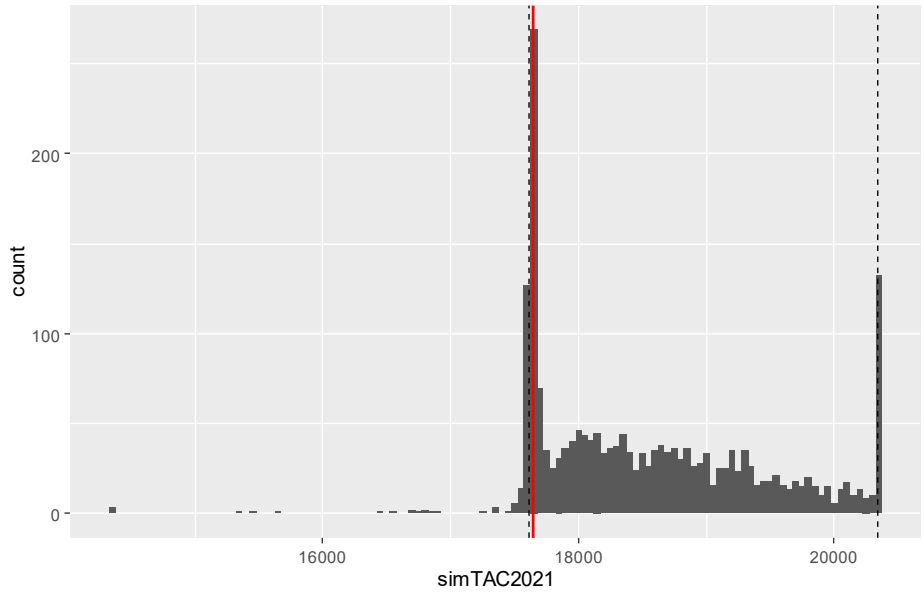

Fig. 4. Histogram of simulated 2021 TAC from projections for testing the CTP, 5% and 95% probability intervals (black vertical dashed lines), and the recommended TAC from the CTP using actual input index/data available in 2020 (red vertical line).

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