

A CHECK OF OPERATING MODEL PREDICTIONS FROM THE VIEWPOINT OF IMPLEMENTATION OF THE MANAGEMENT PROCEDURE IN 2021

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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, regarding a decision on implementation of the recommended TAC (17,647 t, calculated by the CTP in 2020 to be applied to the 2021, 2022, and 2023 fishing seasons) for the 2022 season, it is concluded that no modification of the value of this TAC is required 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 factors (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.

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、2022年漁期に対して勧告されたTAC（2021、2022、ならびに2023年漁期に適用するため2020年にCTPによって算定された17,647トン）の実施の決定に関して、このTAC値の変更は必要ないと判断される。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（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。

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 cessation of the scientific aerial survey in 2018 which had provided an index of recruitment required for the input to the Bali procedure. The CTP was used to recommend a TAC for the 2021-2023 seasons in 2020.

The CTP was adjusted (tuned) and tested to achieve the management objective¹ 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

¹ The CCSBT 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.

developed 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 2012²), 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 (projected) 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 2021), absolute abundance estimate (for 2-year old SBT) and the number of matches from the gene-tagging (GT) project (Preece et al. 2021), and parent-offspring pairs (POPs) and half-sibling pairs (HSPs) data from the close-kin mark recapture (CKMR) project (Farley et al. 2021) are necessary inputs for the CTP (Hillary et al. 2020b). In this paper, the Base case (reference set) OM prediction done in 2019 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 2020 lies within the 95% probability intervals for the Base case OM predictions conducted in 2019 (Fig. 1).

² The technical specifications of the CTP are available from <http://www.ccsbt.org/>.

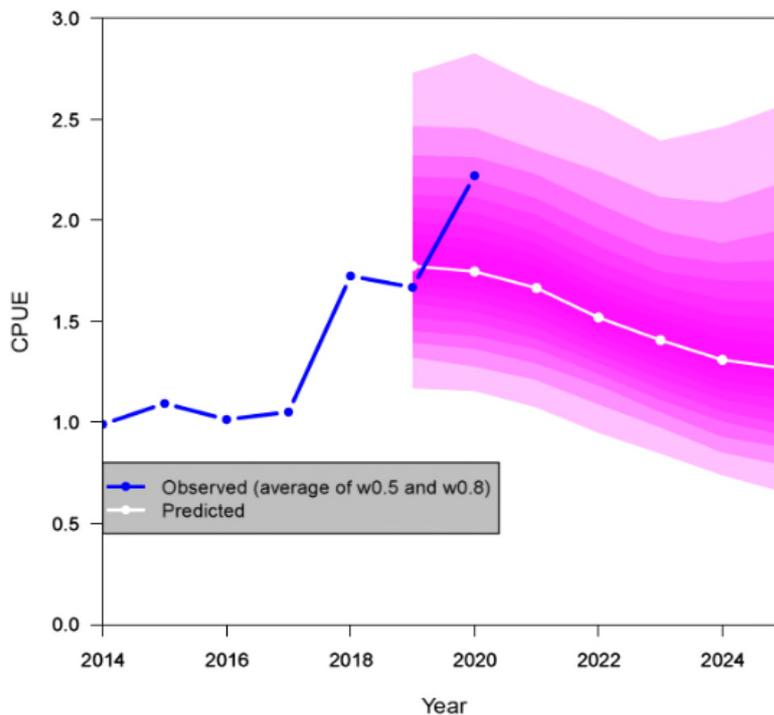


Fig. 1. The average of the two core vessels' longline CPUE series, "w0.5" and "w0.8", observed over 2014-2020 (blue line with points) and the future index as projected in 2019 from 2019 to 2025 for the "Base case" ("reference set") OM, where the white line with points is the median projected CPUE, and the purple shades represent percentiles from 2.5% to 97.5% in increments of 5%.

3. Abundance for 2-year old SBT 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, four estimates are available for age 2 SBT of 2016, 2017, 2018, and 2019 (Preece et al. 2021). The abundance estimate for age 2 SBT of 2019 obtained from this year's (2021) analysis is 1.52 million with a CV of 0.18. The CTP uses the number of matches and the abundance estimates for age 2 in TAC calculation (as the 5-year average weighted by the number of matches; Hillary et al. 2020b).

The abundance estimate for age 2 SBT and the number of matches for 2019 lie within the 95% probability intervals for the Base case OM predictions conducted in 2019 (Fig. 2).

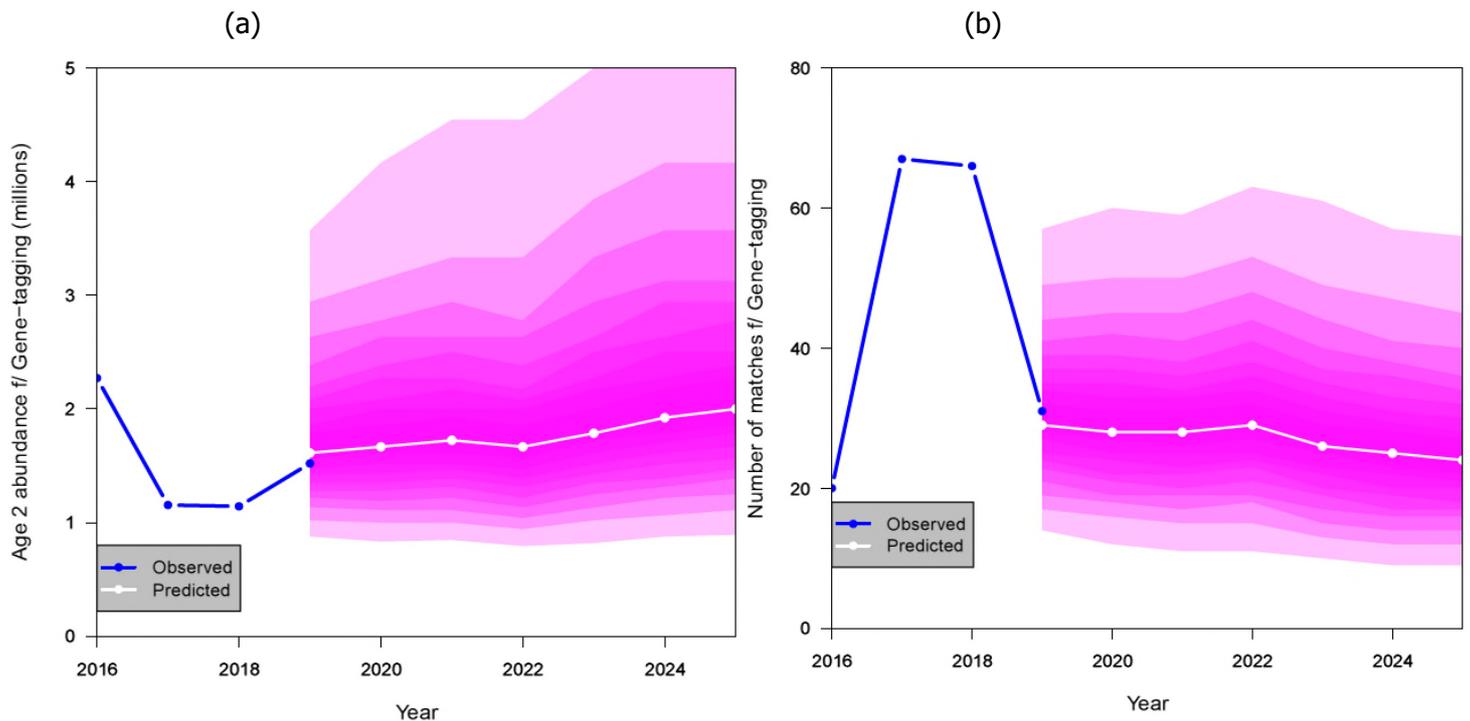


Fig. 2. The age 2 SBT abundance estimate (a) and the number of matches (b) for 2019 from this year's (2021) gene-tagging (GT) analysis, and the future abundance estimates and numbers of matches as projected in 2019 from 2019 to 2025 for the "Base case" ("reference set") OM, where the white lines with points are the medians, and the purple shades represent percentiles from 2.5% to 97.5% in increments of 5%.

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

Parent-offspring pairs (POPs) and half-sibling pairs (HSPs) 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 2021 (Farley et al. 2021) and the predicted 2021 CKMR data from the 2019 OM. The observed CKMR POPs and HSPs data fall within the predicted range from the 2019 OM.

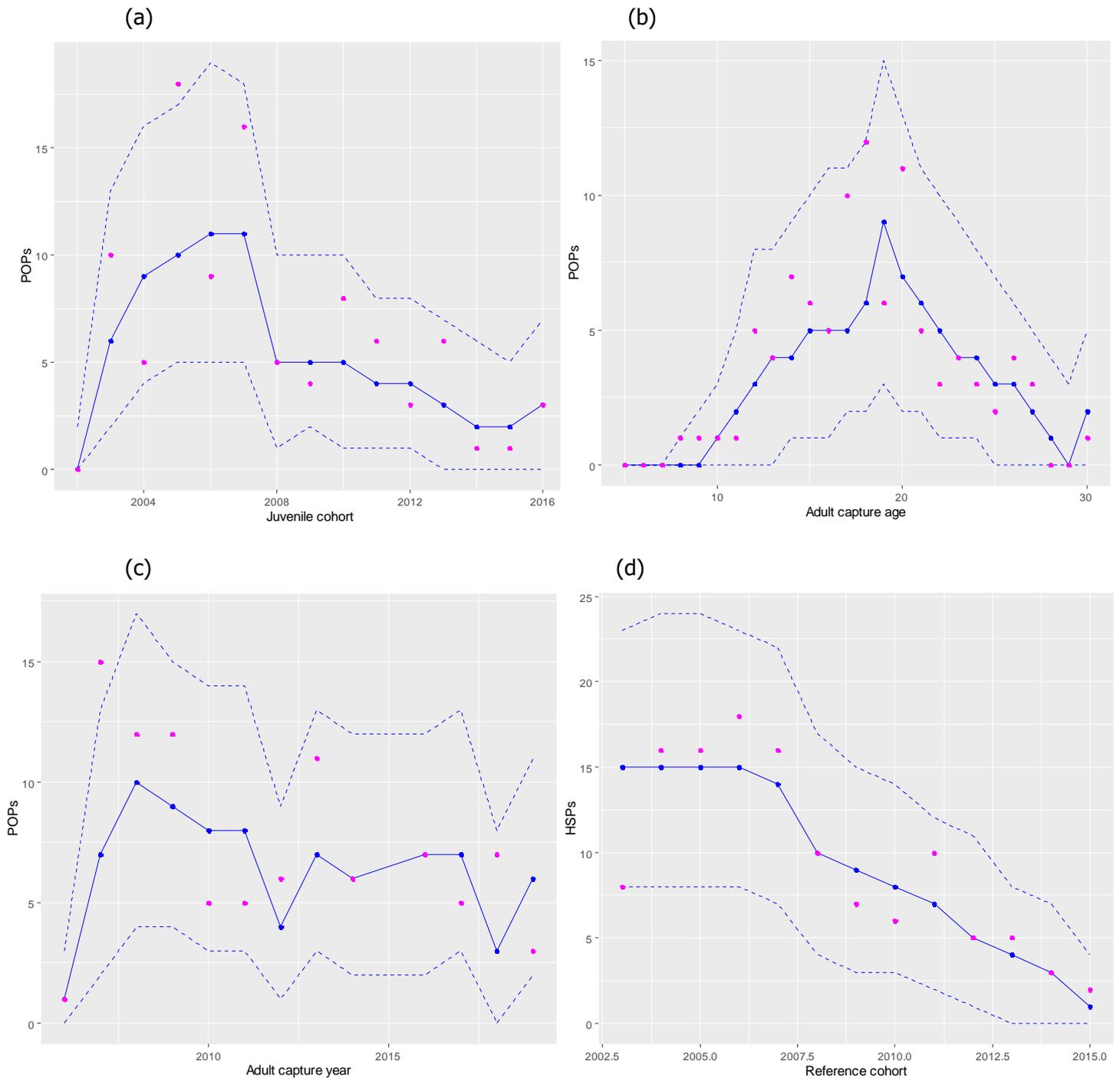


Fig. 3. Observations (magenta points) available in 2021 and predictions (blue solid and dashed lines indicate the median and 95% probability intervals) from the 2019 OM of CKMR POPs and HSPs data. POPs aggregated by juvenile cohort (a), POPs aggregated by adult capture age (b), POPs aggregated by adult capture year (c), HSPs aggregated by the initial (reference) cohort level (d), and total matches of POPs and HSPs (e).

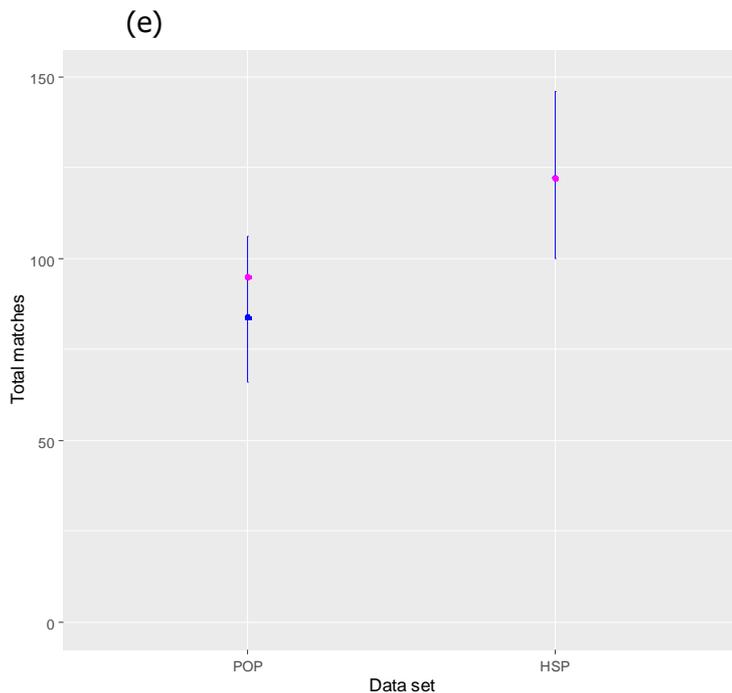


Fig. 3 (cont'd). Observations (magenta points) available in 2021 and predictions (blue solid and dashed lines indicate the median and 95% probability intervals) from the 2019 OM of CKMR POPs and HSPs data. POPs aggregated by juvenile cohort (a), POPs aggregated by adult capture age (b), POPs aggregated by adult capture year (c), HSPs aggregated by the initial (reference) cohort level (d), and total matches of POPs and HSPs (e).

5. Discussion and conclusion

We examined observations of input index/data (longline CPUE, GT estimate, CKMR POPs and HSPs) 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. There is one thing about the longline CPUE that should be noted here. Although 2019 and 2020 estimates of the CPUE lie within the predicted range, a large increase of the CPUE from 2017 to 2018 was identified not normal and raised a concern in the ESC (Fig. 1). Causes of the large increase were examined and exploration to improve the CPUE index is under way by the CPUE modeling group in the ESC.

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

The global TAC was exceeded by 484 t in 2013 and 354 t in 2014 (CCSBT Secretariat 2021). When testing the CTP (provided 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. The reported catches in 2015, 2016, 2017, 2018, 2019, and 2020 were under the global TAC by 529 t, 520 t, 535 t, 399 t, 505 t, and 1472 t (tentative), respectively (CCSBT Secretariat 2021). Thus, over this eight-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. However, although the total reported catch of Members in 2020 was under the global TAC, the reported catch from Indonesia exceeded their quota by 275 t for calendar year (852 t³ for 2019/20 fishing season), and thus this would provide possible evidence for Exceptional Circumstances if such overcatch continues in the future.

The CTP was developed and tested considering non-cooperating Non-Members (NCNM) UAM (i.e., the "MP approach", see paragraph 53 in CCSBT (2016)), and thus it is not necessary to care NCNM UAM as far as its scale is smaller than that was assumed when the CTP was tested in 2019. The amount which is equal to a 10% of LL1 catch was assumed as NCNM UAM in the OM. A 10% of the quota for LL1 (Japan, New Zealand, Korea, European Union, and South Africa longlines) for 2021 is approximately 890 t. The average actual estimate for NCNM UAM over 2007 to 2017 ranges 94 t to 648 t, depending on estimation method (GLM or Random Forest) and catchability (of Japanese or Taiwanese longlines) used (Edwards et al. 2020). On average, the actual scale of the estimates for NCNM UAM is smaller than the assumed, and accordingly does not seem to provide evidence for Exceptional Circumstances. However, yearly estimates for NCNM UAM appear to increase recent years (Edwards et al. 2020), and thus the ESC should continue to keep a careful watch on changes of the scale of NCNM UAM.

Most of the key stock status summary ratios resulted from the 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 by 2035, which is still within an acceptable range of achieving the interim management objective of a median TRO depletion of 0.30 by 2035. Thus, there is no evidence for Exceptional Circumstances.

³ This number of 852 t was calculated from information in 'ccsbt_monthly_catch_reporting.xls' by fishing season (July 2019 through June 2020) corresponding to fishing season (1 July through 30 June) and pulse fishing (1 January) for Indonesia longline fishery defined in the OM.

Regarding a decision on implementation of the recommended TAC (17,647 t , calculated by the CTP in 2020 to be applied to the 2021, 2022, and 2023 fishing seasons) for the 2022 season, it is therefore concluded that no modification of the value of this TAC is required 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 examined (Patterson 2021, Takahashi and Itoh 2021).

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References

- CCSBT. 2012. Report of the seventeenth meeting of the Scientific Committee, 27-31 August 2012 Tokyo, Japan. The Commission for the Conservation of Southern Bluefin Tuna, Canberra, Australia. 87 pp.
- CCSBT. 2016. Report of the twenty third annual meeting of the Commission, 13 October 2016. The Commission for the Conservation of Southern Bluefin Tuna, Canberra, Australia. 91 pp.
- CCSBT Secretariat. 2021. Secretariat review of catches. CCSBT-ESC/2108/04.
- Edwards, C., M. Parsa, A. Williams and S. Hoyle. 2020. Estimates of SBT catch by CCSBT non-cooperating non-member states between 2007 and 2017. CCSBT-ESC/2008/BGD04 (Previously CCSBT-OMMP/2006/04).
- Farley, J., P. Eveson, R. Gunasekera, P. Grewe and M. Bravington. 2021. Update on the SBT close-kin tissue sampling, processing and kin finding 2021. CCSBT-ESC/2108/06.
- Hillary, R., A. Preece and C. Davies. 2020a. Summary of updated CKMR data and model performance in the Cape Town Procedure. CCSBT-ESC/2008/BGD07 (Previously CCSBT-OMMP/2006/14).
- Hillary, R., A. Preece and C. Davies. 2020b. Running the Cape Town procedure for 2020. CCSBT-ESC/2008/BGD06 (Previously CCSBT-OMMP/2006/08).
- Hillary, R., A. Preece, C. Davies, N. Takahashi, and T. Itoh. 2020c. The 2020 assessment of stock status. CCSBT-ESC/2008/12.
- Itoh, T. and N. Takahashi. 2021. Update work of the core vessel data and CPUE for southern bluefin tuna in 2021. CCSBT-ESC/2108/27.
- Patterson, H. 2021. Fisheries indicators for the southern bluefin tuna stock in 2020-21.

CCSBT-ESC/2108/12 (Rev.1).

Preece, A. L., J. P. Eveson, R. Bradford, J. Aulich, M. Lansdell, P. M. Grewe, F. Devloo-Delva, S. Cooper, J. Hartog, and K. Maguire. 2021. Report of the SBT gene-tagging program 2021. CCSBT-ESC/2108/08.

Takahashi, N., and T. Itoh. 2021. Summary of fisheries indicators of southern bluefin tuna stock in 2021. CCSBT-ESC/2108/31.