CCSBT-ESC/2608/28
(ESC Agenda item 10.1)

A CHECK OF OPERATING MODEL PREDICTIONS FROM THE VIEWPOINT OF IMPLEMENTATION OF THE MANAGEMENT PROCEDURE IN 2026

Norio TAKAHASHI and Tomoyuki ITOH

Fisheries Resources Institute, Fisheries Research and Education Agency, JAPAN

Abstract: We examined observations/information of input index/data (Japanese longline GAM22 CPUE, age 2 abundance estimate from the gene-tagging [GT], and close-kin mark recapture data) for the Cape Town procedure (CTP) comparing to the 2019 operating model (OM) prediction. These examinations indicate that the most recent observation (2025) of GAM22 is outside the upper boundary of the Base case OM predictions in 2019 and it is an exceptional circumstance, while all the current observations of other inputs are consistent with the predicted ranges from the 2019 OM, representing no exceptional circumstance for the other inputs. Uncertainty of GAM22 is considered to get larger in recent years. However, the 2026 stock assessment which incorporated such uncertainty indicates further rebuilding of SBT stock compared to the 2023 assessment. Thus, the severity of the exceptional circumstance for GAM22 is considered low. Regarding a decision on implementation of the recommended TAC for the 2027 season (23,647 t, calculated by the CTP in 2025 to be applied to the 2027-2029 period), 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 with high severity 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 [UAM], results of stock assessment conducted in 2026, issues related to biological sampling in Indonesia and changes in operation pattern of Indonesian fishery, continuity of the GT and its budgetary issue); and 2) no unexpected change has been detected in the fisheries and scientific survey indicators examined. There are points to note concerning UAM, the current assumption/treatment of Indonesian fishery in the OM with respect to changes in operation pattern of this fishery, and GT continuity/budgetary issue. We advise these points should be reconsidered in 2027 MP review for the CTP.

要旨： ケープタウン方式（CTP）の入力指数／データ（日本はえ縄 GAM22 CPUE、遺伝子標識［GT］からの 2 歳魚資源尾数推定値、近縁標識再捕データ）の観測値／情報を 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，最近年（2025）の GAM22 の観測値が 2019 年のベースケース OM 予測範囲の上側境界の外側にあることを示しており，これは例外的状況である．一方，この精査では，その他の入力値の全ての現時点の観測値が 2019 年の OM の予測範囲と矛盾しないことを示しており，これは例外的状況ではない．GAM22 の不確実性は近年増大してきていると考えられている．しかし，この不確実性を取り込んだ 2026 年の資源評価は，2023 年の評価と比較して，SBT 資源の更なる回復を示している．したがって，GAM22 に関する例外的状況の深刻度は低いと考えられる．これらに基づき，2027 年漁期に対して勧告された TAC（2027-2029 年漁期間に適用するため 2025 年に CTP によって算定された 23,647 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，未考慮漁獲死亡［UAM］，2026 年に実施された資源評価の結果，インドネシアにおける生物サンプリングおよびインドネシア漁業の操業パターンの変化に関連した問題，および GT の継続性とその予算的問題）の観点から高い深刻度をともなう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) 精査した漁業ならびに科学調査指標に予期せぬ変化がなかったこと．UAM，操業パターンの変化に関連した OM におけるインドネシア漁業の現在の仮定／取り扱い，および GT の継続性／予算問題に関しては留意点がある．CTP に関する 2027 年の MP レビューではこれらの留意点について再検討することを助言する．

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 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 TACs for the 2021-2023 seasons in 2020, the 2024-2026 seasons in 2022, and the 2027-2029 seasons in 2025.

The CTP was adjusted (tuned) and tested to achieve the 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 developed in 2019, and whether any of the assumptions made then have subsequently been shown to be invalid. As a part of the "metarules" 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 (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 vessel longline CPUE (Itoh and Takahashi 2022), absolute abundance estimate (for 2-year old SBT) and the number of matches from the gene-tagging (GT) project (Preece et al., 2026), and parent-offspring pairs (POPs) and half-sibling pairs (HSPs) data from the close-kin mark recapture (CKMR) project (Farley et al. 2026a) were originally necessary inputs for the CTP (Hillary et al. 2020). As CPUE input for the CTP, the core vessels CPUE was replaced with a newly developed CPUE series in 2022 due to technical problems

[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.

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

recognized in the core vessels CPUE (CCSBT 2022a). The new CPUE series (called "GAM22") is based on standardization by generalized additive model (GAM) and all vessels data (Itoh and Takahashi 2026) whereas the core vessels CPUE was standardized by generalized linear model (GLM). The GAM22 CPUE index was used as an input for the CTP to calculate TACs for the 2024-2026 seasons in 2022 (CCSBT 2022b) and for the 2027-2029 seasons in 2025 (CCSBT 2025a).

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, regarding the TAC recommended for the 2027 season (2027-2029 period) in 2025.

2. Japanese longline GAM CPUE index

The GAM22 CPUE index for 2025 (Itoh and Takahashi 2026) lies outside the 95% probability intervals for the Base case OM predictions conducted in 2019 (Fig. 1). It clearly indicates an exceptional circumstance (for discussion, see *Discussion and conclusion* section).

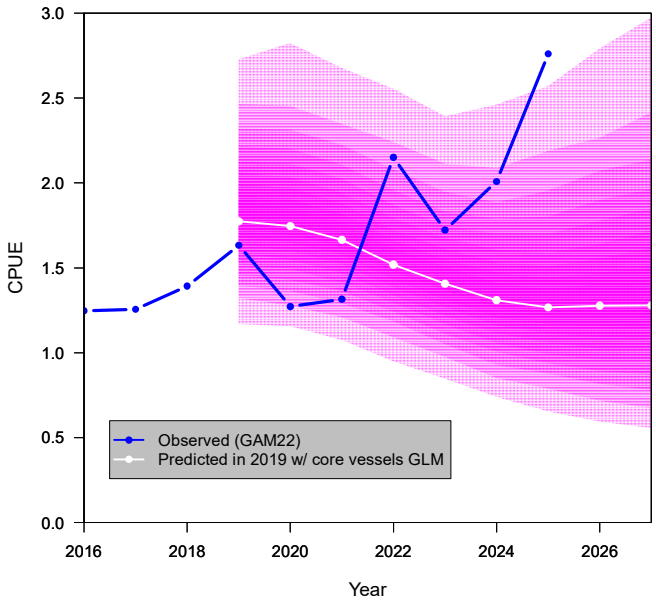


Fig. 1. The Japanese longline GAM22 CPUE series, observed over 2016-2025 (blue line with points) and the future index as projected in 2019 from 2019 to 2026 for the "Base case" ("reference set") OM, where the white line with points is the median projected CPUE, and the purple shades represent percentiles 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, eight estimates are available for age 2 SBT of 2016, 2017, 2018, 2019, 2021, 2022, 2023, and 2024 (Preece et al. 2026). There is no estimate for 2020, because the 2020 tagging field work was cancelled due to COVID-19 restrictions, poor weather conditions and difficulty finding fish (Preece and Bradford 2023). 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. 2025).

The abundance estimate for age 2 SBT and the number of matches for 2024 lie within the 95% probability intervals for the Base case OM predictions in 2019 (Fig. 2). The 2024 point of the number of matches is near the lower boundary of the probability interval.

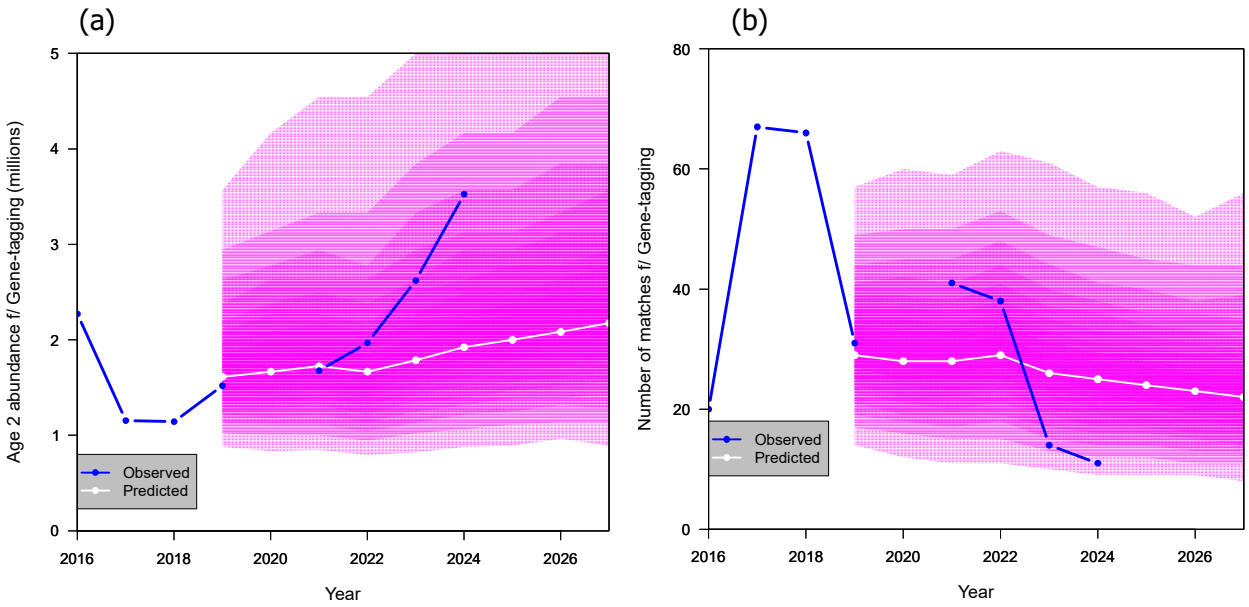


Fig. 2. The age 2 SBT abundance estimate (a) and the number of matches (b) for 2024 from this year's (2026) gene-tagging (GT) analysis, and the future abundance estimates and numbers of matches as projected in 2019 from 2019 to 2026 for the "Base case" ("reference set") OM, where the white lines with 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. 2025).

Muscle tissue samples of adult SBT for the CKMR have been collected in Indonesia since 2022/23 season but have not been analyzed yet[3] (Farley et al. 2026a). In contrast, muscle

[3] Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia and National Research and Innovation Agency (BRIN), Indonesia have progressed development of a Material Transfer Agreement

tissue samples were collected from harvested juvenile SBT at tuna processors in Port Lincoln, Australia, in 2024, and were analyzed (Farley et al. 2026a). Thus, the numbers of detected POPs and HSPs were updated to include the new juvenile data only.

For the CKMR data, observed CKMR data available in 2026 were compared with simulated data based on the OM used in the 2023 stock assessment (Hillary et al. 2023) since we could not retrieve simulated CKMR data from the 2019 OM. The 2023 assessment shows improvement of the stock status which is on track for the management objective, and thus the simulated CKMR data from the 2023 OM is consistent with that from the 2019 OM. Fig. 3 compares observed CKMR data available in 2026 and the predicted CKMR data from the 2023 OM. The observed CKMR POPs and HSPs data fall within the predicted range.

(MTA) to enable transport of the tissue samples collected since 2022/23 season to Australia for analysis (Farley et al. 2026a). It is anticipated that analysis will be completed for the 2027 and 2028 CCSBT data exchange.

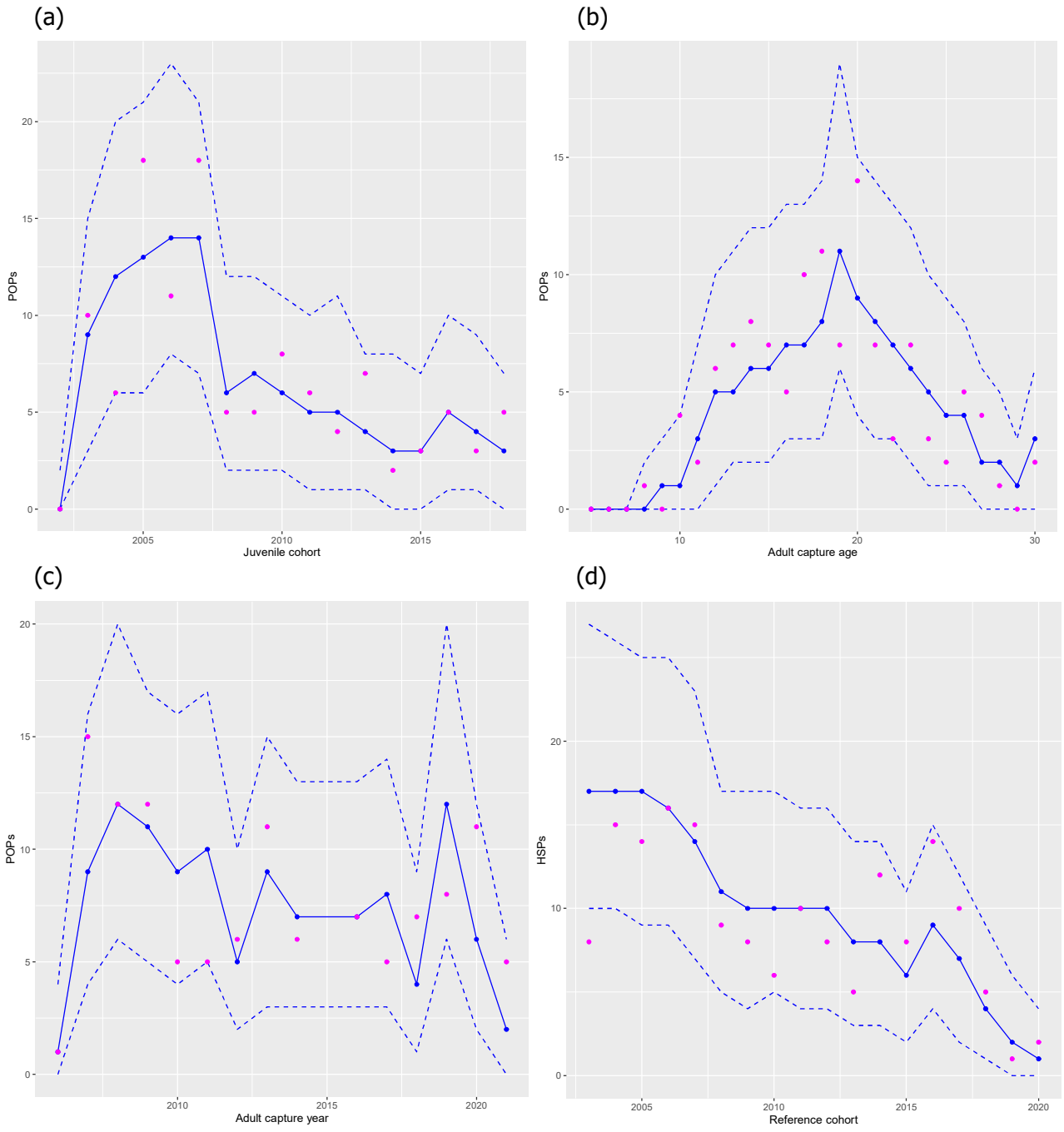


Fig. 3. Observations (magenta points) available in 2026 and predictions (blue solid and dashed lines indicate the median and 95% probability intervals) from the 2023 OM of CKMR POPs and HSPs data. POPs aggregated by juvenile cohort (a), POPs aggregated by adult capture age (b), POPs aggregated by adult capture year (c), HSPs aggregated by the initial (reference) cohort level (d), and total matches of POPs and HSPs (e).

(e)

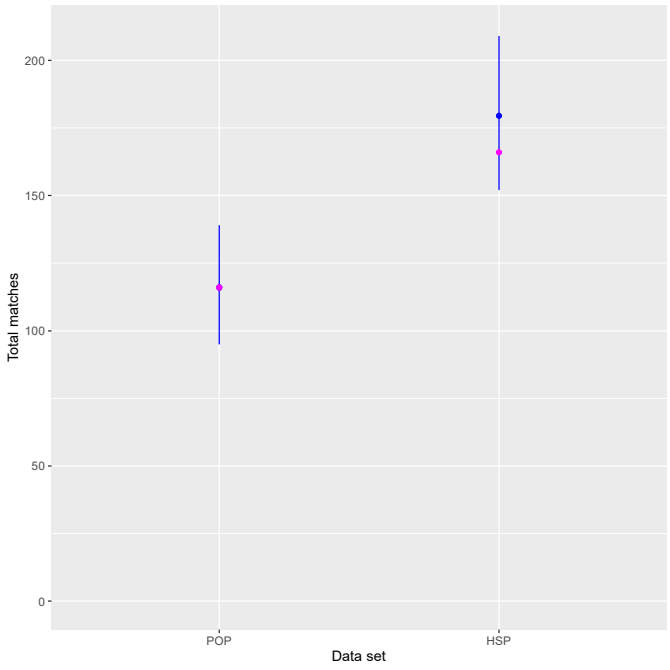


Fig. 3 (cont'd). Observations (magenta points) available in 2026 and predictions (blue solid and dashed lines indicate the median and 95% probability intervals) from the 2023 OM of CKMR POPs and HSPs data. POPs aggregated by juvenile cohort (a), POPs aggregated by adult capture age (b), POPs aggregated 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 available in 2026 (longline GAM22 CPUE, age 2 abundance from the GT, CKMR POPs and HSPs) for the CTP comparing to the 2019 OM predictions in the sections 2 to 4 above. These examinations indicate that the most recent observation (year 2025) of GAM22 CPUE is outside the 95% probability intervals for the Base case OM predictions in 2019 (Fig. 1) and it is an exceptional circumstance, while all the current observations of other inputs are consistent with the predicted ranges from the 2019 OM, representing no exceptional circumstance (Figs. 2 and 3). Uncertainty of GAM22 CPUE is considered to get larger in recent years (see Fig. A1 in Eveson et al. 2026). However, the 2026 stock assessment which incorporated such uncertainty indicates further rebuilding of SBT stock compared to the 2023 assessment (Eveson et al. 2026). It suggests that our current understanding of the stock is different from one when the OM conditioning was done in 2019. Therefore, the severity of the exceptional circumstance for GAM22 CPUE is considered low.

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); 3) current stock status information from in-depth stock assessment and future projections; 4) issues related to biological sampling in Indonesia and changes in operation pattern of Indonesian fishery; 5) continuity of the GT and its budgetary issue.

When testing the CTP in 2019, the assumption was made that TACs would not be exceeded in future years. The reported catches in 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, and 2025 were below the global TAC by 535 t, 386 t, 505 t, 1426 t, 1030 t, 1245 t, 627 t, 2518 t, and 1756 t (tentative for 2025), respectively (CCSBT Secretariat 2026). Accordingly, this does not provide evidence for exceptional circumstances.

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 2025 is approximately 1063 t. Estimates for NCNM UAM over 2021 to 2024 are 1104 (499, 1710) t, 1422 (642, 2201) t, and 1101 (498, 1704) t, respectively (the mean and range based on "adjusted" effort; Edwards and Hoyle 2026). These estimated means for NCNM UAM are all greater than the assumed value of 1063 t. However, the ranges of the estimated NCNM UAM are wide and thus uncertain. In addition, the 2026 stock assessment which incorporated these UAM estimates showed further rebuilding of SBT stock compared to the previous assessment (Eveson et al. 2026). Therefore, it does not seem to provide evidence for an exceptional circumstance. The ESC should continue to keep careful watch on changes of the scale of NCNM UAM. The current assumption of NCNM UAM needs to be reconsidered within MP review for the CTP in 2027.

The key stock status summary ratios resulted from the 2026 stock assessment are improved compared to previous assessments (median relative Total Reproductive Output, TRO, is 0.20 in 2019, 0.23 in 2022, and 0.28 in 2025[4]) (CCSBT 2020, Hillary et al. 2023, 2026). Future projections based on the 2026 assessment show that the CTP reaches a median TRO depletion of 0.30 with a probability of 0.71 by 2035, which indicates achieving the management objective. Thus, there is no evidence for exceptional circumstances with respect to updated stock status.

[4] Median relative TROs for 2019 and 2022 were estimated by using the previous OM based on AD Model Builder, and are the full-objective-weighted MLE-grid median. In contrast, median relative TRO for 2025 was estimated by using the newly developed OM based on RTMB (Native 'R' interface to 'TMB [Template Model Builder]', and is the MCMC (Markov chain Monte Carlo)-grid relative-TRO median.

Muscle tissue samples of adult SBT for the CKMR were not collected from the Indonesian longline fishery (from the spawning ground) in the 2021/22 season and only very limited samples were collected in the 2022/23 and 2023/24 seasons due to a combination of COVID-19 impacts and institutional restructuring within Indonesia (Farley et al. 2023, 2024, 2026b). The lack of these data did not trigger an exceptional circumstance because the CTP was still able to calculate TAC by using the available data updated with new samples from juvenile SBT. However, in the 2019 OM for testing the CTP, it was assumed that "data sampling and analysis" for the CKMR would be done as scheduled. In 2024/25 season, it still being slightly lower than the target sample size, but substantially higher muscle tissue samples than had been collected annually in the preceding three seasons were collected from adult SBT (Farley et al. 2025). In 2025/26 season, a total of 5,306 muscle tissue samples were collected which is well above the annual target of 1,500 samples and in line with the proposed number for this season to compensate for previous years' low coverage[5] (Farley et al. 2026a). This improvement indicates no evidence for exceptional circumstances.

A large portion of catch by Indonesian longline fleet had been from Area 1 since 2011 (Satria et al. 2026). Since 2021, however, catches in Area 2 have been considerably increased compared to those in Area 1. This may indicate some potential changes in operation pattern of Indonesian longline fleet. Indonesian fishery has been assumed to operate mainly in SBT spawning ground (Area 1) in the 2019 OM for testing the CTP. These data from Area 1 and 2 were included in the 2026 assessment and the result indicates further rebuilding of SBT stock (Eveson et al. 2026). Therefore, this change in operation pattern of Indonesian longliners does not need reconsideration of TAC recommended by the CTP, and this is not an exceptional circumstance. However, the current assumption and treatment of Indonesian fishery in the OM need to be reconsidered within MP review for the CTP in 2027. Future changes in the operation pattern of this fleet should continue to be monitored along with an effort for resolving the uncertainty associated with the size and age composition of this fishery (Farley et al. 2021, Davies et al. 2023).

In 2025, the ESC30 agreed that changes to the GT in 2025 and 2026 represented an exceptional circumstance and it might impact the CTP (CCSBT 2025a). In response to this, the Commission agreed to reinstate the 2026 GT budget (CCSBT 2025b). The budgetary issue for the GT remains, and thus future continuity of the GT is quite uncertain, still indicating the exceptional circumstance. Currently, tagging field works for 2025 and 2026, and harvest sampling of juveniles for 2026 were completed, and an estimate of age 2 abundance will be available in 2027 (Preece and Eveson 2026). As such, the severity of the exceptional circumstance for the GT does not matter in the present situation for this year.

[5] See footnote 3.

Future severity, however, totally depends upon Commission's decision on future budget for the GT. Related to this, impacts of changes to frequency and scale of the GT, including consideration of alternative MP as well, should be reconsidered in 2027 MP review for the CTP.

Regarding a decision on implementation of the recommended TAC for the 2027 season (23,647 t, calculated by the CTP in 2025 to be applied to the 2027-2029 period), 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 with high severity related to the factors discussed above; and 2) no unexpected change has been detected in the fisheries and scientific survey indicators examined (Patterson 2026, Takahashi and Itoh 2026).

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. 2022a. Report of the twelfth Operating Model and Management Procedure technical meeting, 20-24 June 2022 Hobart, Australia. The Commission for the Conservation of Southern Bluefin Tuna, Canberra, Australia. 33 pp.

CCSBT. 2022b. Report of the twenty seventh meeting of the Scientific Committee, 5 September 2022 Online. The Commission for the Conservation of Southern Bluefin Tuna, Canberra, Australia. 125 pp.

CCSBT. 2025a. Report of the Fifteenth Operating Model and Management Procedure technical meeting, 3-4 July 2025 Online. The Commission for the Conservation of Southern Bluefin Tuna, Canberra, Australia. 25 pp.

CCSBT. 2025a. Report of the thirtieth meeting of the Scientific Committee, 30 August 2025 Online. The Commission for the Conservation of Southern Bluefin Tuna, Canberra, Australia. 101 pp.

CCSBT. 2025b. Report of the thirty-second annual meeting of the Commission, 9 October 2025 Bali, Indonesia. The Commission for the Conservation of Southern Bluefin Tuna, Canberra, Australia. 106 pp.

CCSBT Secretariat. 2026. Secretariat review of catches. CCSBT-ESC/2608/04.

Davies, C., F. Satria, J. Farley, L. Sadihya, P. Suadela, R. Sulistyaningsih, B. Setyadji, and S. Mardi S. 2023. SBT catch monitoring and capacity building for biological sampling of spawning ground catches in Indonesia. CCSBT-ESC/2308/14.

Edwards, C. T. T. and S. D. Hoyle. 2026. Estimates of unreported SBT catch by CCSBT non-cooperating non-member states between 2007 and 2023. CCSBT-ESC/2608/BGD01 (*previously* CCSBT-OMMP/2606/04).

Eveson, J. P., R. M. Hillary, A. L. Preece, N. Takahashi, T. Itoh, and D. Webber. 2026. The southern bluefin tuna stock assessment in 2026. CCSBT-ESC/2608/20.

Farley, J., P. Eveson, and R. Gunasekera. 2023. Update on the SBT close-kin tissue sampling, processing and kin finding 2023. CCSBT-ESC/2308/07.

Farley, J., P. Eveson, and R. Gunasekera. 2024. Update on the SBT close-kin tissue sampling, processing and kin-finding 2024. CCSBT-ESC/2409/09.

Farley, J., P. Eveson, and R. Gunasekera. 2025. Update on the SBT close-kin tissue sampling, processing and kin finding 2025. CCSBT-ESC/2508/08.

Farley, J., P. Eveson, and R. Gunasekera. 2026a. Update on the SBT close-kin tissue sampling, processing and kin finding 2026. CCSBT-ESC/2608/11.

Farley, J., F. Satria, L. Sadiyah, P. Suadela, R. Sulistyaningsih, I. Jatmiko, J. Del l, S. Mardi, I G. Bayu, and C. Davies. 2026b. Update on SBT catch monitoring and biological sampling in Indonesia. CCSBT-ESC/2608/12.

Farley, J., R. Sulistyaningsih, B. Setyadji, S. Mardi, and C. Davies. 2021. Review of data to estimate the length and age distribution of SBT in the Indonesian longline catch. CCSBT-ESC/2108/07.

Hillary, R., A. Preece, and C. Davies. 2020. Running the Cape Town procedure for 2020. CCSBT-ESC/2008/BGD06 (*previously* CCSBT-OMMP/2006/08).

Hillary, R., A. Preece, and C. Davies. 2025. Running the Cape Town Procedure for 2025. CCSBT-ESC/2508/18.

Hillary, R. M., A. L. Preece, N. Takahashi, C. R. Davies, and T. Itoh. 2023. The southern bluefin tuna stock assessment in 2023. CCSBT-ESC/2308/16.

Itoh, T. and N. Takahashi. 2022. Update work of the core vessel data and CPUE for southern bluefin tuna in 2022. CCSBT-ESC/2208/BGD02 (*previously* CCSBT-OMMP/2206/06).

Itoh, T. and N. Takahashi. 2026. Update of CPUE abundance index using GAM for southern bluefin tuna in CCSBT (GAM22) up to the 2025 data. CCSBT-ESC/2608/BGD03 (*previously* CCSBT-OMMP/2606/06).

Patterson, H. 2026. Fisheries indicators for the southern bluefin tuna stock in 2025-26. CCSBT-ESC/2608/19.

Preece, A. L. and R. Bradford. 2023. Update on the gene-tagging program 2023 and RMA

request. CCSBT-ESC/2308/09.

Preece, A. L., and J. P. Eveson. 2026. Gene-tagging proposal 2027-2029. CCSBT-ESC/2608/13.

Preece, A. L., J. P. Eveson, J. R. Hartog, J. Dell, J. Aulich, N. Potter, S. Cooper, P. Grewe, and M. Lansdell. 2026. Update on the SBT gene-tagging recruitment monitoring program 2026. CCSBT-ESC/2608/10.

Satria, F., L. Sadiyah, B. Setyadji, A. Widodo, S. A. Raup, S. Mardi, P. Suadela, D. R. Slamet, A. Januar, Ed. S. Firmana, and Jimmy. 2026. Indonesia's tuna longline fishery interacted with Southern Bluefin Tuna in 2025. CCSBT-ESC/2608/SBT Fisheries - Indonesia.

Takahashi, N., and T. Itoh. 2026. Summary of fisheries and scientific survey indicators of southern bluefin tuna stock in 2026. CCSBT-ESC/2608/27.