Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Twenty Fifth Meeting of the Scientific Committee

7 September 2020
Online

Report of the Twenty Fifth Meeting of the Scientific Committee
7 September 2020
Online

Agenda Item 1. Opening of meeting

1. The independent Chair, Dr Kevin Stokes, welcomed participants and opened the meeting. The Chair advised that the meeting this year is being held as a video conference due to the COVID-19 pandemic.
2. The list of participants is at **Appendix 1**.

Agenda Item 2. Approval of decisions taken by the Extended Scientific Committee

3. The Scientific Committee endorsed all the recommendations made by the Extended Scientific Committee for the Twenty Fifth Meeting of the Scientific Committee, which is at **Appendix 2**.

Agenda Item 3. Other business

4. There was no other business.

Agenda Item 4. Adoption of report of meeting

5. The report of the Scientific Committee was adopted.

Agenda Item 5. Closure of meeting

6. The meeting was closed at 11:46am (Canberra time), on 7 September 2020.

List of Appendices

Appendix

Appendix 1

List of Participants
Twenty Fifth Meeting of the Scientific Committee

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Appendix 2

Report of the Extended Scientific Committee for the Twenty Fifth Meeting of the Scientific Committee

31 August – 7 September 2020
Online

Extended Scientific Committee
for the Twenty Fifth Meeting of the Scientific Committee
31 August – 7 September 2020
Online

Agenda Item 1. Opening

1.1 Introduction of Participants

1. The Chair of the Extended Scientific Committee (ESC), Dr Kevin Stokes, welcomed participants and opened the meeting. The Chair advised that the meeting this year is being held as a video conference (VC) due to the COVID-19 pandemic, and that discussion for some agenda items had commenced in advance of the meeting by correspondence. The Chair thanked participants for their cooperation with this special arrangement.
2. Delegations introduced their key speakers. The list of participants is included at **Attachment 1**.

1.2 Administrative Arrangements

3. The Executive Secretary announced the administrative arrangements for the meeting.

Agenda Item 2. Appointment of Rapporteurs

4. Australia, Japan and New Zealand provided rapporteurs to produce and review the text of the substantive agenda items.

Agenda Item 3. Adoption of Agenda and Document List

5. The agreed agenda is provided at **Attachment 2**. Agenda items from the Provisional Agenda were renumbered and reordered to reflect the necessary workflow of the meeting. During discussion on the agenda, it was noted that small group discussion may be needed to decide how to make progress with CPUE analyses.
6. A modified document list, involving the reassignment of one paper to a different agenda item, was agreed. The agreed document list is provided at **Attachment 3**.

Agenda Item 4. Review of SBT Fisheries

4.1. Presentation of National Reports

7. The majority of discussion for this agenda item was conducted by correspondence in advance of the VC.

8. South Africa provided a letter on 3 August 2020 advising that due to loss of key personnel and the COVID-19 epidemic, South Africa did not expect to be able to provide its national report until the first week of September and apologised for not being able to meet the deadline. South Africa gave a further apology at the meeting and provided its report before the third day of the meeting.

9. Australia submitted its national report (CCSBT-ESC/2008/SBT Fisheries-Australia). Australia's allocation as agreed by the CCSBT was 6,165t for the 2018–19 fishing season. However, this was adjusted to account for undercatch in the previous fishing season, so the effective TAC was 6,284t. A total of 34 commercial fishing vessels landed SBT in Australian waters in the 2018–19 fishing season for a total catch of 6,074t. A total of 87.1% of the catch was taken by purse seine with the remainder taken by longline, pole-and-line, rod-and-reel and trolling. Seven purse seiners fished off South Australia for the Australian farming operations during the 2018–19 fishing season, with live bait, pontoon-towing and feeding vessels also involved. Most of the purse seine fishing commenced in mid-December 2018 and finished in mid-March 2019. Length frequency data from the purse seine fishery from 2005–06 to 2006–07 indicated a shift to smaller fish, but this trend has showed signs of reversal since 2007–08, possibly due to the targeting of larger fish. The average length of SBT transferred to farms in South Australia in 2018–19 was 90.6 cm. In the 2018–19 fishing season, observers monitored 14.3% of purse seine sets where fish were retained for the farm sector and 14.5% of the estimated SBT catch. In 2019, observers also monitored 12.1% of longline hook effort in the Eastern Tuna and Billfish Fishery (ETBF) during the months and in the areas of the SBT migration through that fishery. Observer coverage of longline hook effort in the entire Western Tuna and Billfish Fishery (WTBF) was 12.8% in 2019.

10. In response to questions on its national report, Australia advised:

- Approximately 95% of all shots conducted in both the ETBF and WTBF are recorded by its e-monitoring system.
- The baseline e-monitoring audit rate for all fisheries is a minimum 10% of shots per boat and a minimum of one shot per drive for each boat. The analyses include evaluation of full catch composition for each shot selected for review. Catch composition, discards and interactions with protected species on audited shots will be compared to logbook records with discrepancies flagged and reported. The focus of e-monitoring is on fishing activities. However, if behaviour that contravenes Australian or International law is observed in the process of viewing footage, it will be referred to the AFMA Compliance team for investigation.
- A number of factors can affect the determination of whether life status can be determined from e-monitoring observations, including camera angle, weather conditions, fish behaviour and lighting.
- The total number of other species of importance observed caught and retained by longline, south of 30°S and during the months of May to September, were albacore (3242), yellowfin tuna (1045), swordfish (334), Ray's bream (293), escolar (225) and bigeye tuna (203). ETBF logbooks for 2019, for the ETBF as a whole, showed 14,964 SBT (690.1 t) were retained and 3237 (17.8%) were released. No species other than SBT were caught and retained in significant numbers in the purse-seine fishery.

- Australia will discuss the recreational survey result and how it will account for the post release mortality going forward at the annual Extended Commission meeting.

11. Australia submitted paper CCSBT-ESC/2008/09 which describes its data preparation and validation procedures. The aggregated catch and effort, catch by fleet, raised catch, catch at size, and non-retained catch data sets submitted to the CCSBT by the Australian Bureau of Agricultural and Resource Economics and Sciences, on behalf of the Australian Government, are compiled from a number of databases. The daily fishing logbooks, catch disposal records and fisheries observer reports, collected and managed by the Australian Fisheries Management Authority, are the main data sources. The Australian catch of SBT from the surface (purse seine) fishery is also sampled by contracted field staff prior to release into farm cages. The sample data includes size and weight measurements that are used to calculate representative size distributions and average weights. Relational databases, spreadsheets and query scripts are used to integrate and process the source data sets and create the data files required for the CCSBT data exchange. The paper provides facsimiles of data collection forms, as well as flow charts illustrating the data integration procedures.

12. The European Union (EU) was not able to attend the VC, but did submit its national report (CCSBT-ESC/2008/SBT Fisheries-EU) to the meeting and answered questions on its national report in the pre-meeting discussion by correspondence. In response these questions, the EU advised:

- The CCSBT's scientific observer program standards apply to "the fishing activity of CCSBT Members and cooperating non-Members wherever Southern Bluefin Tuna is targeted or is a significant bycatch". This is not the case for EU vessels operating in the SBT distribution area, and therefore there is no specific SBT observer program applying to EU vessels as there are no EU fisheries targeting SBT and no substantial by-catches of SBT. However, there are observer programs implemented in accordance with the observer requirements of other tuna RFMOs (in general 5% coverage).
- The scientific observer data are not the only source of information providing evidence on SBT catches by EU vessels. Catches by EU vessels are recorded through logbooks (electronic) and the detection of any bycatches of SBT is anchored on information and cross checking of data, not only from logbooks, but also from landing declarations and sales notes, observer reports, port and high-seas inspections, electronic observation (when available), self-sampling and port sampling (when available) and, when necessary, investigations of any evidence or clear suspicion related to a misreport or non-declared catch.
- From both the above and the WCPFC Regional Observer Program, the EU has confidence that there are no SBT bycatches and discards by its three longline vessels in areas to the west and NNE of the New Zealand EEZ.

13. During the VC, some participants pointed out that EU's response on zero catch should be taken into account in the UAM estimation. Some other participants requested additional information on how the EU has determined that it has a zero catch of SBT. In particular, detailed information was requested on the spatial and temporal coverage of the EU fleet by scientific observers in the SBT distribution area. It was noted that there is considerable overlap between the distribution of SBT and the areas fished by the EU fleet and some participants

did not share the EU's confidence that it has no SBT catch. It was also noted that if the EU's estimate of zero SBT catch is correct, then the ESC's estimates of unaccounted mortality estimates for SBT should be reduced.

14. The Secretariat advised the meeting that a Quality Assurance Review of the EU is currently being conducted and that this review should provide additional information in relation to how the EU has determined its level of SBT catch.

15. Indonesia submitted paper CCSBT-ESC/2008/SBT Fisheries-Indonesia. Key details from Indonesia's national report include:

- Based on Catch Documentation Scheme (CDS) information for 2019, there were 150 active Indonesian longline vessels, 410 landings, with 1,206t and about 12,835 individual SBT being caught. The size ranged from 55-217 cm fork length (cm FL), with an average size of 163.8 cm FL in Area 1 (10,683 SBT) while the size range in area 2 was 42-194 cm FL with an average of 154.7 cm FL (2,152 SBT). The proportion of SBT with a size of less than 160 cm FL was 22.48%, and the proportion of SBT caught that was confirmed in Statistical Area 1 was 5.07%.
- Scientific observers were deployed on-board for nine trips in 2019, with days-at-sea ranging from 15-104 fishing days per trip. The number of hooks observed was slightly lower (18.5%), but the number of trips was higher (33.3%) compared to previous years. Geographically, the observation by scientific observers covered the fishing grounds of Statistical Area 1 and 2 equally. The dominant catches of Ecologically Related Species (ERS) that were recorded were lancetfishes and escolar.
- Regular port sampling showed that there was a decreased percentage of coverage from the previous year (44.63% compared to 53.69% in the previous year), and the measured specimens consisted of 25.2% fresh and 74.8% frozen SBT. Length frequency data were collected from 1,662 individuals with a size range from 108-200 cm FL. ERS monitoring recorded 24 species dominated by *Prionace glauca*.
- For monitoring of SBT Attributable catch, there are still no source data and information for recreational fishing. All SBT catches reported were fully utilised (i.e. no discards or releases reported) and no catch data were reported from traditional/customary fisheries. SBT catches from the artisanal fishery are already managed in the CDS, which is the main system for monitoring and recording SBT landed in fishing ports, particularly in Benoa Port where the main LL industry is based. No information on SBT landed/catches were reported outside of Benoa Port.

16. In response to questions on its national report, Indonesia advised:

- The catch of SBT in Statistical Area 1 has been increasing in recent years. This is likely to be due to the fishing strategy of several companies to reduce the number of days-at-sea in relation to vessel logistic support and limitation of refrigerator chamber size, as well as for targeting fresh tuna.
- Artisanal fisheries in Indonesia's EEZ (southern Indian Ocean) consist of hand-line, pole and line, and gill net fleets operating in territorial waters less than 24 nm from the coastline, and with fishing days per trip ranging from about 1-7. Longline artisanal fisheries (<30 GT) that were eligible to capture SBT in 2019 consisted of 43 fleets with fishing days per trip ranging from

about 15-30 and operated 60-200 nm from the coastline. Indonesia's SBT catch from the longline fishery is still considered as bycatch (less than 10% from total catch in Indian Ocean).

17. Indonesia submitted paper CCSBT-ESC/2008/16 which provides updated information on data validation for SBT catches data to confirm the location where SBT is caught in the spawning area. The data validation process was conducted by the same method as used the previous year, overlaying various data such as fishing vessel's logbook and VMS data to verify the catch locations declared in CDS data. Results from analysis of CDS data in 2019 showed that the proportion of SBT catches with a size of less than 160 cm FL (29%) decreased slightly compared with the previous 2018 season (34%).

18. Participants expressed their appreciation to Indonesia for the detailed response it provided to a question on this paper during the pre-meeting discussion by correspondence.

19. Indonesia submitted paper CCSBT-ESC/2008/Info01 which provides a summary of progress related to the Indonesian scientific observer program on the tuna fishing vessels operating in the Indian Ocean. The observer data provides the most detailed information not only regarding catch and effort, but also on fishing practices, gear configuration and environmental conditions. Only rather low fleet coverage was available from this data set. Hence this could be expanded to obtain more robust abundance indices from the fishery.

20. Indonesia submitted paper CCSBT-ESC/2008/Info02 which provided updated information about the SBT monitoring program in Benoa port in Bali, Indonesia, that was presented to the ESC in 2019 (CCSBT-ESC/1909/Info 03). The sampling coverage decreased from 53.69% in 2018 to 44.63% in 2019. The number of SBT observed also decreased in 2019 with only 1,662 individuals compared to 1,733 in 2018. The length of SBT also decreased from 121-210 to 108-200 cm.

21. Indonesia submitted paper CCSBT-ESC/2008/Info03 which provides updated information about reproductive studies of southern bluefin tuna (SBT) being undertaken in Indonesia. The standard reproductive classification was used to assess the ovaries of 54 females collected by Indonesian scientific observers and the port landing monitoring program in Benoa,. Samples were collected in March from the scientific observer program (n=5 samples) and in September to December (n=49 samples) from the port landing monitoring program. All samples had been caught in Statistical Area 1 by Indonesian tuna longline vessels. The length of SBT caught ranged between 136 and 186 cm FL. Gonad samples were fixed in 10% buffered formalin and then embedded in paraffin and standard histological sections were prepared (cut to 5 µm and stained with H&E). Histological sections were classified using the criteria for southern bluefin tuna and south Pacific albacore tuna. All samples were classified as mature fish. The development class were identified as spawning, spawning capable, regressing-potentially reproductive, and regressed 1. Based on their reproductive activity, 30% of the small fish (<150 cm FL) were spawning. Further ovary samples are required (and are currently being collected) from Areas 1 and 2 to examine the reproductive activity of SBT further.

22. Japan submitted paper CCSBT-ESC/2008/SBT Fisheries-Japan which described the Japanese commercial longline fishery for SBT in terms of catch, effort, nominal CPUE, length frequency, number of vessels and geographical distribution of fishing operations in 2019. In 2019, 85 vessels caught 5,851t and about 112,000 individual SBT. Scientific observers were deployed on 20 vessels and covered 17.6 % of the number of SBT caught by all vessels. Otoliths were collected from 301 SBT individuals.

23. In response to questions on its national report, Japan advised:

- The number of released or discarded SBT reported was 8,568 in 2019. 8,223 SBT (96.0%) were released live and 345 SBT (4.0%) were discarded as dead.
- The low number of hooks in 2019 was the result of two factors. First, data for non-SBT targeting comes from logbooks, while SBT target data come from the Real Time Monitoring Program. It is usual for the total hooks used to increase in the data update of the following year. Such an increase occurs especially outside of the main SBT areas (4-9). Secondly, nominal CPUE was higher in 2019 than in 2018.
- 44% of Japan's 2019 SBT catch were under 46 kg whole weight.
- Comparisons of catch rates, declared discards and life status between observed/unobserved vessels and observers on-board/not on-board were not conducted for the 2019 data. However, similar examination in the past has shown no obvious bias between observed and non-observed vessels in terms of proportions of retain, live release, and dead discards.

24. Korea submitted paper CCSBT-ESC/2008/SBT Fisheries-Korea (Rev.1). During the 2019 calendar year, the SBT catch by the Korean tuna longline fishery was 1,238t (1,238t in the fishing year) with 11 vessels active. In general, fishing occurs between 35°S-45°S and 10°E-120°E, in the western Indian Ocean (Statistical Area 9) from April to July/August and in the eastern Indian Ocean (Area 8) from July/August to December. However, since 2014, SBT fishing vessels have moved further westward than in previous years, and have operated mainly in the western Indian Ocean and eastern Atlantic Ocean between 20°W-35°E (Area 9). Until the early 2010s the CPUE was low but since 2012 has increased. In general, the CPUE in Area 9 is higher than in Area 8. Note that during 2017-2019 there has been no fishing in Area 8. In 2019, 4 observers were placed onboard 4 longline vessels targeting SBT. They observed an SBT catch of 208t and an effort of 530×10^3 hooks in 253 sets during 304 days in the fishing area. The observer coverage was estimated to be 22% of the total fishing effort. Since 1st September 2015, Korea has implemented an Electronic Reporting (ER) system, which includes release/discard information of not only SBT but also other species.

25. In response to questions on its national report, Korea advised:

- Its report that there were no discards or releases in 2019 is based on electronic reporting by fishermen.
- Recently, Korean fishing industries have encouraged fishermen to retain all SBT on board, if possible, without discarding or releasing. According to the data collected from fishermen, there is no record of discards or releases for the 2019 year. However, as Korea sets aside 5t of its quota to implement Attributable SBT Catch, Korea has deducted 5t from its 2019 quota.

26. New Zealand submitted paper CCSBT-ESC/2008/SBT Fisheries-New Zealand. Key details from New Zealand's national report include:

- New Zealand's country allocation for the year was 1,088t which was allocated within the various sectors in the following manner: 1,046t for commercial catch, 20t for the recreational sector, 20t for other sources of mortality including discards, and 2t for the customary sector.
- Commercial catch for the year was 959.4t, which continued a decrease from the previous year. For the first time since 2012, catch in Statistical Area 6 exceeded catch in Area 5. This was due to an increase in fishing effort on the east coast of New Zealand's South Island. The entirety of the commercial catch was taken by 29 domestic vessels.
- Nominal CPUE for catch within both Areas 5 and 6 showed a very small decline in CPUE in 2017 and 2018 with a marked decline of about 50% in 2019. The decline was less pronounced for the geometric index (about 30% between 2018 and 2019), but the standardised index exhibited a stronger decline beginning in 2017, with a pronounced decrease in 2019; the decline from 2016 to 2019 for the standardised index was about 55%.
- Since 1990, the proportion of the domestic fleet catch sized under 140 cm has varied from less than about 20% from 2003 to 2008 to over 60% from 2016 to 2019, suggesting that there have recently been fewer spawning-age fish.
- On average across Area 5 and Area 6, 17% of catch and 8% of effort was observed during the year. Observer reported released alive discards were 47 fish, with a scaled estimate of 512 fish. Observer reported dead discards were nine fish, with a scaled estimate of 98 fish, noting that dead discards can only occur when authorised by observers, so the scaled estimates should be treated with caution.
- New Zealand's estimate of recreational catch was 25.9t based on a research project with an overall objective to improve estimates of the recreational SBT catch and size composition in New Zealand. There was no reported customary catch for the year.

27. In response to questions on its national report, New Zealand advised:

- There has been an increase in effort off the east coast of the South Island since 2018. This seems to be primarily a market driven shift with some longline fishers from the North Island moving south during the earlier stages of the New Zealand season in the hope of reaching Tsukiji at a time when auction prices are more favourable. These are the same vessels and fishers that also fish the North East fishery and their operations do not differ in the two regions. This is a southern bluefin tuna target fishery that usually lands fish in the port of Dunedin which remains primarily destined for export to Japan. It is difficult to predict how much of the New Zealand effort will be directed to this area in the future, but it does appear to be likely to persist with the current (2020) season again showing effort in the South East fishery.
- It appears that 6 and 7 (and possibly 4 and 5) year-olds were relatively sparse in 2018 compared to previous recent years. This would be the 2011 to 2012 (or 2011 to 2014) year classes.

28. Taiwan submitted paper CCSBT-ESC/2008/SBT Fisheries-Taiwan. Key details from Taiwan's national report include:

- Since Taiwan became a Member of the Extend Commission of CCSBT in 2002, all SBT fishing vessels have to be authorised to access this fishery, and the authorisations are reviewed and renewed by Fishery Agency of Taiwan (FA) annually. In 2019, 72 fishing vessels were authorised to fish for SBT, which consisted of both seasonal target vessels and bycatch vessels. The SBT catch for both the calendar year and quota year was 1,230t.
- Observers were sent onboard SBT fishing vessels for collection and recording of the details of catch and effort information for fishing operation. In the 2018 calendar year, 12 observers were deployed on 12 of the 46 fishing vessels authorised to target SBT seasonally, and 4 were deployed on 4 of the 31 fishing vessels authorised to bycatch SBT. There were 2,712 fishing days with 1,994 days observed. Sixteen observers were deployed on 16 of the 44 fishing vessels authorised to target SBT, and 2 were deployed on 2 of the 28 fishing vessels authorised to bycatch SBT in 2019 with 2,747 days observed out of a total of 3,018 fishing days. In 2018, the coverage rate of observation was 20.78 % by vessels, 12.80 % by hooks and 10.78 % by catch. The coverage rate was accounted for 25.00 % by vessels in 2019, 15.15 % by hooks, and 14.02 % by catch. In recent years, Taiwanese SBT fishing vessels have operated mainly in the IOTC area, and partial SBT bycatch vessels operate in the ICCAT area. Therefore, the FA has imposed regulations which are based on the resolutions/recommendations adopted by these organisations and enforces longliners to comply with these regulations.

29. In response to questions on its national report, Taiwan advised:

- The numbers of discards reported by Taiwan were based on reports of fishermen through its e-loglook system and from scientific observers' reports. In order to estimate the discard amounts of SBT appropriately, Taiwan integrates the fishing operation data from Taiwanese commercial longline vessels with the discard information recorded by scientific observers in three basins, including the Atlantic, Pacific and Indian Oceans.
- The difference in Taiwan's reported 2019 catch between its "carry-forward" notification and its national report was due to different data sources (sum of monthly on-board data plus 10t of discarded catch compared to Traders' sales information); these preliminary estimates will be finalised in 2021.

30. Taiwan submitted paper CCSBT-ESC/2008/30 which describes the preparation of Taiwan's Southern bluefin tuna catch and effort data submission for 2020. SBT fisheries data submitted to the Extended Commission (EC) from Taiwan includes total catch by fleet, aggregated catch and effort, catch-at-size, catch-at-age and non-retained catch data. The data submitted are compiled from electronic logbook (E-logbook) data and catch documentation scheme (CDS) data collected from authorised SBT fishing vessels with cross checking against VMS data, observer data and traders' sales records. No discrepancy was found among the datasets on catch.

31. South Africa submitted its national report (CCSBT-ESC/2008/SBT Fisheries – South Africa). In the 2019/2020 season, SBT directed effort exceeded 900 000 hooks but total annual SBT landings declined to 160t. SBT were caught by 19

longline vessels (16 ZAD[1]; 3 ZAC[2]) and five Tuna Pole and Line vessels. ZAD longline vessels landed 113t and ZAC longline vessels landed 46t. A small portion of SBT landings of 1.3t was reported by the Tuna Pole-Line (Bait boat) fleet in 2019/2020. There were notable differences in the distribution of catch and effort between the domestic (ZAD) and chartered (ZAC) longline vessels. In 2019/20 the latter shifted their operation further offshore to higher latitudes in Statistical Area 9 east of Cape Agulhas (>20° Longitude). In contrast, the domestic fleet operated along the shelf edge off both the East (Area 14) and West coast of South Africa (Area 15), out of the two fishing ports cities of Cape Town and Richards Bay. The range of the ZAC fleet appears to have changed from the trend in previous years when it had been increasingly contracting closer inshore within South Africa's EEZ (Area 14). Similar to 2018/2019, a large proportion of SBT catch by the domestic fleet (ZAD) remains to be caught along the West coast of South Africa (Area 15). Availability of observer size data has steadily improved since 2013, particularly in Areas 9 and 14. The total number of SBT measurements taken by observers was N = 526 which equates to 20.4% of the total retained catch by longline vessels and represents a further improvement compared to the 12.2% measured SBT during the 2018-2019 season. Mean length in 2019/2020 has decreased further to a record low of 136.1 cm FL in Area 9 and to 155.4 cm in Area 14 as a result of an increased presence of smaller fish of 80-120 cm FL in these two areas. In Area 15, the sample was composed of larger SBT (> 150 cm FL), and the mean length changed only marginally from 160.6 cm FL to 164.3 cm FL. The effective observer coverage of SBT effort (number of hooks per set with at least one SBT) during the 2019/2020 fishing season was 6.5%. The observer coverage for joint-venture Chartered (ZAC) vessels has continued with 100% of fishing trips observed.

32. In response to questions on its national report, South Africa advised:

- South Africa's boat based recreational fishing fleet operates along the entire coast including areas of SBT presence. Data from the recreational fishery are scarce as there is no mandatory reporting of catches. There are a number of craft with the capacity to target SBT, but thus far there is little indication of SBT catches. Data from tuna-directed fishing competitions from 2000 onwards do not include any SBT among the total of 6684 specimens of tuna and tuna-like species caught. It is likely that SBT will become more regularly available in the range of the recreational fleet in the future, as the stock recovers. To account for possible recreational mortality of SBT among other sources, South Africa has set aside 5t of its SBT allocation for the 2019/2020 fishing season. South Africa's domestic legislation prohibits any discarding of dead tuna, and only live fish may be returned to the sea.

4.2. Secretariat Review of Catches

33. The Secretariat submitted paper CCSBT-ESC/2008/04. The estimated total catch for the 2019 calendar year was 17,922t, a decrease of 300t or 1.6% from the 2018 calendar year. The global reported SBT catch by flag is shown at **Attachment 4**. Australia and Indonesia exceeded their Total Available Catch

[1] Domestic fleet.
[2] Charter fleet.

for the 2019 fishing season by 40.291t and 181.916t respectively. Both Members advised the EC that they would repay these amounts by reducing their Total Available Catch for the 2020 fishing season. However, preliminary Monthly Catch Report figures indicate that by the middle of its 2020 fishing season, Indonesia had already exceeded its reduced Total Available Catch by nearly 203t.

Agenda Item 5. Report from the Eleventh Operating Model and Management Procedure (OMMP) Technical Meeting

34. The Chair of the Operating Model and Management procedure Technical Group (OMMP), Dr Ana Parma, briefly reviewed the progress made during the OMMP meeting and intersessionally.

35. The 11th meeting of the OMMP working group (OMMP WG) was conducted by video-conferencing in June 2020. The main purpose of the meeting was to prepare for the stock assessment to be presented at this ESC. In addition, the original intent had been to initiate discussions about the Scientific Research Program but those were postponed until this meeting.

36. Two webinars were conducted prior to the meeting in order to discuss and resolve issues about the data inputs required to prepare stock assessment input files. The first was a meeting of the CPUE working group, chaired by Dr. James Ianelli, and the second was a webinar on the issue of unaccounted mortalities (UAM).

37. In terms of CPUE, intersessional work was conducted by Japan; this clarified the source of the high value of CPUE estimated for 2018 by the GLM standardisation method which is currently adopted. The conclusion of this analysis was that the problem originated in the Constant-Squares (CS) version of the model, which calculates the CPUE index by integrating across all time-area strata fished in the past, including strata that have not been fished in recent years. In particular, the analysis showed that a shift in effort in 2018 resulted in unrealistically high estimates of CPUE for some unfished strata in Area 8 and consequently provided a high overall CPUE index.

38. CPUE indices are used in both the CCSBT stock assessment and as an input to the Management Procedure (MP). After discussion of the robustness tests in 2019, the first webinar decided that the regular CPUE series based on the GLM standardisation method adopted should still be used for the purpose of TAC calculation, i.e. as input to the Cape Town Procedure (CTP), because that MP had been selected using CPUE series based on that method.

39. However, these series were considered inadequate for the purpose of the stock assessment. Alternative methods based on GAMs and new selection criteria were developed by New Zealand (CCSBT-ESC/2008/29). The CPUE working group evaluated these new alternatives and selected one (GAM11) to be used as a base for the stock assessment. As in past assessments, two versions were considered to account for the uncertainty about time-area strata with no observations. This uncertainty is represented, in terms of extremes, by the constant-squares (CS) and variable squares (VS) hypotheses. It was agreed that the CS version of GAM11 was an improved index when compared to the

standard GLM Base-CS model. However, the new GAM model would still result in an upward bias if the contraction in the area fished was in part a reflection of a contraction of area occupied by the stock. The OMMP WG agreed that the VS hypothesis was too extreme, given the increased contraction of the area fished in recent years, and therefore decided to down-weight it and increase the relative weight given to the CS version. The two series selected correspond to W0.6 (0.6 CS + 0.4 VS) and W0.9 (0.9 CS + 0.1 VS).

40. The OMMP WG recommended that further CPUE analyses be given high priority among Member scientists. Specifically, further examination of spatio-temporal models that may improve upon the GAMs conducted for this meeting was encouraged.

41. In terms of UAM, a decision was needed on the scenario to be used in the reference set of models for the stock assessment. As background, it was noted that the reference set of Operating Models (OMs) used for MP testing in 2019 was based on the scenario known as UAM1. That scenario was chosen for application of the so-called “MP approach”; this involves adjusting the OMs used for MP testing for plausible extra catches so that the selected MP is robust to that level of potential UAM, and hence the MP-derived TAC can be implemented as calculated. For the purpose of stock assessment, on the other hand, the best available estimates of UAM need to be added to the reported historical catches for fitting the models.

42. The values of UAM used in the 2017 stock assessment were based on an analysis conducted by New Zealand and Australia, which used effort by non-cooperating, non-Member (NCNM) states and SBT catch rates by area to calculate plausible levels of UAM. A revised and updated version of that analysis, presented at ESC 24 (CCSBT-ESC/1909/33), resulted in substantial increases in UAM catch estimates compared to those used in 2017. The webinar reviewed the new results and concluded that in order to maintain consistency, the UAM for fishery LL1 would be calculated using the same approach used for the 2017 stock assessment, namely as the sum of the Indian/Atlantic Ocean and Pacific Ocean estimates for NCNM catches based on the GLM method and targeted (assumed from Japanese) catch rates, as detailed in the OMMP report (CCSBT-ESC/2008/Rep1). As before, a 20% overcatch was also added to the Australian surface fishery catches.

43. The WG acknowledged that possible biases may exist in both directions. On the one hand, concern was expressed that the reported effort by NCNMs could be underestimated which would result in an underestimate of UAM. Countering this potential bias, the use of the catch rates corresponding to a fleet that targets SBT (Japanese LL) to calculate SBT catches by NCNM fleets could lead to bias in the opposite direction. These issues should be examined as part of the research plan when the analysis is revised. For this year’s assessment, a sensitivity run was specified that replaces the estimates based on target catch rates by those derived using bycatch rates (based on the Taiwanese fishery).

44. Data-input files used in 2019 to condition the Operating Models used for MP evaluations were updated to reflect these decisions about CPUE and UAM, and to add one year of data for each of the other regular data components.

45. Despite the short time available to complete analyses, the OMMP WG was able to evaluate preliminary results of stock assessment models conditioned on these updated data inputs. The outputs from different model fits conducted prior to and during the meeting were uploaded to the web, and their results were explored using a new Shiny application developed by the consultant, Dr. Darcy Webber.

46. These results showed that:

- The fits to the different data inputs were generally good.
- The revised CPUE series resulted in a substantially reduced estimated strength of the 2013 cohort, which was still well above average, but not as extreme as estimated in 2019.

47. The OMMP WG evaluated the support provided by the data and prior assumptions to the range of parameter values considered in the grid. As a result, the reference set was revised to include lower values of steepness (h) and changes to the values of natural mortality at age 0 and 10.

48. A list of sensitivity runs to be discussed at this meeting was also specified. The list included runs designed for different purposes: (1) to evaluate the impact of using alternative data inputs (CPUE series and UAM scenarios) or assumptions (e.g., nonlinear relationship between CPUE and abundance, flat selectivity for the Indonesian fishery), (2) to acknowledge uncertainty in data inputs (e.g., overcatch scenarios); (3) to evaluate the information content and influence of different data sources (e.g., exclusion of different data components or data points), and (3) as a bridge to models used for MP evaluation (e.g., using old CPUE series and the UAM1 scenario).

49. Japan commented that the UAM estimated for non-Members may be an overestimate as it may not be appropriate to use Japanese catch rates in the estimation of potential catches for bycatch fisheries. This is because Japan targets SBT with dedicated vessels suitable for rough sea conditions, which would be unrepresentative of these other vessels.

50. The Chair of the OMMP noted Japan’s concern and explained that this was the reason for including the bycatch non-Member UAM sensitivity test that uses estimates of non-Member UAM from bycatch catch rates (Taiwanese catch rates) rather than the targeted rates (Japanese catch rates). This issue will be considered further during the stock assessment discussion. In addition, it was noted that for the 2017 stock assessment there was evidence of non-Member UAM, but there is no updated evidence for recent years.

Agenda Item 6. Consideration of farm and market issues

6.1. Farm uncertainties

51. The Chair introduced the agenda item noting that Australia submitted Circular #2020/073 on 13 August 2020 outlining how it intends to proceed in relation to the implementation of stereo video monitoring technology in the farming sector.

52. Australia advised that it did not intend to seek advice from the ESC on ways to improve confidence in the current sampling system (100 fish greater than or

equal to 10 kg sample), noting its commitment to implement stereo video, but that it will be providing an update to CCSBT 27 of its activity in relation to stereo video monitoring which will include a “roadmap” towards its implementation. As such, further discussion on this issue was deferred to the upcoming meetings of the Compliance Committee (CC) and the EC.

6.2. Market uncertainties

53. Japan presented CCSBT-ESC/2008/22 regarding the Japanese market monitoring update. Japan has conducted monthly monitoring and data collection for the major wholesale markets to validate the reported-catch amounts of SBT from Japanese longline fisheries. The information on total trading amounts, wild/farmed ratio, domestic/imported ratio of traded frozen wild SBT, and the time-lag between catch and sale were collected respectively from the official market statistics, hearing investigations, monthly monitoring in the wholesale market, and observations of catch tags in the market. Based on the information above, domestic SBT catch amounts for 2004-2019 were estimated with some assumptions and parameters for Japanese market behaviour as with the previous Japanese Market Review (e.g. double-counting, off-market selling rate, market share). These estimated annual catch amounts were compared to the official catch amounts reported by Japan. As the estimated catches have been smaller than the official catches since 2008, under-reporting of catch by fishermen has not been indicated by the market monitoring.

54. Japan presented CCSBT-ESC/2008/23 which proposed actions aimed at improving the existing methodology for monitoring of SBT product distribution in Japan. The ESC in 2019 recommended that the mechanism to verify the catch of not only Japan, but also of all Members should be developed by using information obtained from Japanese markets. Given this background, with a view to reduce uncertainties of SBT catch in the global market through verification of all Member’s SBT catch and utilisation of CDS as well as information of Japanese and other markets, Japan proposed the following actions based on agreement among Members.

(A) Verification of all Members’ catch in Japanese market that includes: (a1) Update of the estimation formulae for the product distribution of the amount of Japanese SBT catch in the Japanese market; (a2) Development of new estimation formulae for the product distribution of the amount of other Members’ catches in the Japanese market; (a3) Calculation of estimated amounts based on the formulae in (a1) and (a2) above; and (a4) Calculation of the proportion which the estimated amount in (3) contributes to the amount of SBT in the global market, and an assessment of the value of these estimation analysis.

(B) Further utilisation of CDS data that includes: (b1) Verification of SBT international trade and domestic distribution utilising CDS data; (b2) Development of a Resolution to seek cooperation of non-Members; and (b3) Verification of the reported catch using tag data.

(C) Development of a system to detect illegally caught products that includes: (c1) Improvement of tagging based on the current CDS Resolution; and (c2) Creation of an intersessional working group for future improvement of tagging specifications.

55. Japan further proposed that once agreement is reached on implementation of the proposed action(s), the implementation cost should be funded from the EC's budget.

56. Prior to the ESC meeting, Japan held a workshop about this proposal with interested ESC participants. The following summarises discussions during the workshop.

- Workshop participants appreciated the progress made in Japan's proposal toward verification of all Members' catch. It was generally agreed that the proposal captured the intent underlying previous discussions on this matter well, including ESC 24 recommendations, and that the scope covered verification of SBT catch not only by Japan but also by all other Members, including possible unaccounted mortalities.
- Most actions proposed by Japan received preliminary support from workshop attendees, with some reservations being expressed in relation to the development of a resolution to seek cooperation from non-Members and funding arrangements for ongoing monitoring.
- Workshop participants offered several comments and raised particular questions about the proposal. Their outline and Japan's responses are attached as **Attachment 5**.
- Workshop participants agreed that taking into account discussion in this ESC, the proposal should be considered further and discussed in the 2020 Finance and Administration Committee and EC Meetings, including the priority item(s) for implementation and their budgetary implications. The workshop participants considered that draft Terms of Reference (ToR) and cost estimates would be useful input to this discussion.

57. The Workshop outcomes were reviewed and accepted by the ESC.

Agenda Item 7. Review of results of the Scientific Research Program and other intersessional scientific activities

7.1. Results of scientific activities

58. Paper CCSBT-ESC/2008/06 provides an update on the gene-tagging program. The CCSBT gene-tagging program is designed to provide an absolute abundance estimate of the age-2 cohort in the year they were tagged (Preece et al., 2015). The process involves "tagging" fish by taking a very small tissue sample from a large number of 2-year-old SBT, releasing the fish alive, allowing 12 months for mixing with untagged SBT, and then taking tissue samples from the catch of 3-year-old fish at time of harvest. The two sets of samples are genotyped and then compared in order to find the samples with matching DNA; a match indicates that a tagged and released fish was recaptured. The abundance estimate is calculated from the number of samples in the release and harvest sets, and the number of matches found. In 2020 we report on the calculation of an absolute abundance estimate from the 2018 gene-tagging program which is the third full cycle of the CCSBT gene-tagging program. The analysis found 66 matches from 75.4 million comparisons across the tagging and harvest data sets. The abundance estimate for the age 2 cohort in

2018 is 1.143 million fish (CV 0.123). This abundance estimate is close to half of the estimate of age 2 fish in 2016 but is not as low as estimates for the age 2 cohorts from the years of very low recruitment in the stock assessment models (1999-2002). The next estimate of abundance (age-2 cohort in 2019) is on track to be provided in early 2021 with tagging and harvest sampling components completed. The 2020 tagging field work team had difficulties finding fish, and weather conditions were not ideal. The CSIRO field team were urgently recalled back to Hobart after 9 days of the 20-day field trip because of COVID-19 risks and border closure uncertainties at that time. Too few fish were sampled, which means that the gene-tagging program will not deliver an estimate of abundance in 2022. The completed data sets and abundance estimate have been provided to the CCSBT scientific data exchange in April 2020. The 2016-2018 abundance estimates will be used for the first time in the 2020 stock assessment, and in the new Cape Town Procedure for recommending the global total allowable catch.

59. In response to a question from Japan about problems besides COVID-19 affecting gene tagging, CSIRO responded that they are trying to address design considerations and logistical constraints to work around the issues identified.

60. On the issue of SBT moving east, CSIRO elaborated that the aerial surveys showed a trend of fish moving further east in recent years. It is not clear if this is a temporal shift or a longer-term shift in migration. It is also not clear what is driving these changes as there are a number of potential factors influencing this change.

61. In response to a question about the size range being targeted in the gene-tagging study, CSIRO commented that they use a conservative size range both for the fish being tagged and those being harvested, and monitoring this range is an ongoing process to capture any changes in growth.

62. Paper CCSBT-ESC/2008/07 provides an update on the SBT close-kin tissue sampling, processing and kin finding in 2019-20. Muscle tissue samples were collected from SBT landed by the Indonesian longline fishery in Bali, Indonesia (adults; n=1500) and from harvested SBT at tuna processors in Port Lincoln, Australia (juveniles; n=1600) in 2019/20. Samples collected in Indonesia are stored at -20°C during the harvest season (Sep-Apr). They will be transported frozen to Hobart and held at -20°C until they are processed. Muscle samples from the 2018/19 season were subsampled and DNA extracted. A portion of the DNA was sent to DArT for genotype sequencing. The remaining tissue and extracted DNA samples were archived in a -80°C archive freezer. DNA extracts from the 2017/18 muscle tissue samples selected for genotyping (Farley et al. 2019) were processed by DArT, and the genotype data sent to CSIRO in early 2020. The kin-finding analyses to identify parent-offspring pairs (POPs) and half-sibling pairs (HSPs) were updated to include these data using the same methods for genotype calling and kin-finding as last year, and the POPs and HSPs identified were provided to the CCSBT in April 2020. The total number of POPs to date is 89, and the total number of HSPs for which we have high confidence is 161, with a false negative probability estimated at 0.26. In order to keep the risk of false positives very low, the lower cut-off on the "PLOD" statistic used for determining HSPs was increased. This resulted in fewer HSPs, and a higher false negative rate, than last year. In future, we aim to make use of a genome assembly for SBT to improve the separation and "reclaim" some of

the HSPs currently being excluded: in the meantime, the number of HSPs is sufficiently large to provide reliable information for the MP.

63. In response to a question, CSIRO clarified that the increasing number of comparisons among juveniles, as overall sample sizes increase, means that to identify HSP with the same high level of confidence currently requires an increase in the false-negative probability. As a result, an increasing proportion of true HSP is being “left out” because of the potential of them overlapping with more distant kin, which it is not very efficient. CSIRO advised there are two initiatives that can be undertaken to address this issue and increase the efficiency of the analysis and cost-effectiveness of the program. First, reducing the uncertainty in HSP identification by acquiring a full genome sequence for SBT. As noted in CCSBT-ESC/2008/07 this work is currently in progress, funded by CSIRO. This will allow certain assumptions about the distribution and independence of loci used in the kin identification to be addressed, and is expected to improve power to separate HSP from other close-kin substantially. Second, currently every juvenile is compared with every other juvenile, which is inefficient, as some juveniles in the data set have a very low (or zero) probability of being HSP. In coming years, the selection of juveniles included in the HSP identification will be optimised so that comparisons are more efficient, which should also lead to “recovery” of many HSP excluded using the current approach.

64. Paper CCSBT-ESC/2008/08 updates previous analyses of southern bluefin tuna (SBT) length and age data from the Indonesian longline fishery operating out of the port of Benoa, Bali. Age frequency data are presented up to the 2018/19 season, based on length frequency data up to the 2018/19 season. The collection of SBT otoliths was conducted by RITF-CSIRO monitoring program for the longline fishery with otoliths collected from a total 1,500 SBT ranging from 134-199 cm fork length (FL) in 2018/19. Last year, the Directorate General of Capture Fisheries (DGCF) provided new SBT length and weight data from the Catch Documentation Scheme (CDS) for 2015/16 to 2018/19. The DGCF identified vessels operating in CCSBT statistical areas 1 and 2 using vessel monitoring system (VMS) tracking information. Only SBT caught by vessels operating in area 1 (containing the spawning ground) were included in the analysis. Preliminary examination of the data showed that a proportion of fish were measured to the nearest 10-cm length class, rather than 1 cm, which has the potential to bias estimates of the size distribution of the catch. Individual weight data are considered likely to be more to be accurate; since the data are used for export purposes, these data were used in the analysis, rather than the 10 cm binned data. Weight was converted to length using a weight-length relationship derived from SBT in the Benoa monitoring program over the same time period. As reported last year, the new size data for fish from area 1 showed a clear a progression towards larger fish in the catch in the two most recent spawning seasons. The pulse of SBT that was first observed in the spawning ground catches in 2012/13 appears to have moved through the fishery on an annual time step. New data for the 2019 calendar year were provided by the DGCF after the 2020 CCSBT data exchange. The new data included additional length/weight measurements collected between January and December 2019, which change the data for the 2018/19 spawning season. We re-ran the analysis using these new data and provide the results in Appendix A. The updated results

are similar to the those provided in the initial analysis, apart from a slight increase in the proportion of small/young SBT in the catch.

65. In response to a question about a shift in the spatial pattern of these data over time, CSIRO responded that since VMS was implemented in 2015 the source of the data included in the age and length data has been Area 1, and data from Area 2 to the south have been excluded. From 2012-2015, there is no VMS available to make a correction for the area of capture. The average proportion of the catch estimated to be taken outside Area 1 over the period 2015-2019 is 18%, ranging from 7-29% across the period.

66. In response to a further question about any other reasons for a change in selectivity in Area 1, CSIRO advised there is no information of which they were aware for a substantive change to the selectivity of the fishery on the spawning grounds in this period. SBT on these grounds are largely taken as bycatch from a much larger fishery for yellowfin tuna and bigeye tuna, historically accounting for only 2-5% of the catch. It was noted that Indonesia has introduced freezer vessels that catch SBT, but that these generally operate much further south, in Area 8, targeting a combination of SBT and albacore, and that these vessels largely operate from Benoa in Bali.

67. Japan presented CCSBT-ESC/2008/17 which summarises activities of Japanese scientific observer program for SBT in 2019. Scientific observers were dispatched on 20 vessels that operated in the main CCSBT statistical areas (areas 4－9). Observer coverages were 23.0% in terms of the number of vessels, 22.0% in terms of the number of hooks used, and 18.0% in terms of the number of SBT caught. When taking of the actual observation time during hauling into account, the coverage in the number of hooks observed was estimated as 17.6%. The length frequency distributions of SBT reported by the observers and those reported from all vessels in RTMP were generally consistent to each other. Observers collected various biological samples including otoliths from 246 SBT and muscle tissue from 289 SBT. Observers retrieved CCSBT conventional tags from three SBT individuals.

68. Japan presented CCSBT-ESC/2008/18 relevant to otolith collection and age estimation. Japan collected otoliths from 301 SBT individuals in 2019. The data for age estimated for 210 SBT were submitted in the 2020 data exchange. Age data for a total of 5,269 SBT individuals by Japan were analysed to show relationships between fork length and the age estimated.

69. Japan presented CCSBT-ESC/2008/19 which reports on the trolling survey conducted in January and February 2020. The trolling survey provides the data for the recruitment index for age-1 SBT and has been carried out in a similar manner since 2006. In the survey, a chartered Australian vessel steamed back and forth on the same straight line (piston-line) off Bremer Bay on the southern coast of Western Australia using trolling for a total of 10 lines. The area adjacent to the piston-line and the area between Albany and Esperance were also surveyed. During the survey, a total of 226 SBT individuals were caught. Among them, 118 fish had archival tags implemented and were released.

70. Japan presented CCSBT-ESC/2008/20 which reports the SBT age-1 recruitment indices. The two recruitment indices for age-1 SBT were developed using trolling catch data in two surveys off the southwestern coast of Australia, the

acoustic survey from 1996 to 2006, and the trolling survey from 2006 to 2014 and from 2016 to 2019. One index is the piston-line trolling index (TRP) which used data for only one transect line off Bremer Bay. The other is the grid-type trolling index (TRG) which was developed in 2014. TRG utilises all the trolling data that aggregates the trolling effort and the number of SBT schools caught by date, hour, area type, and 0.1 degrees square in latitude and longitude. The dataset included about 55,874 km total distance searched with 938 schools found. GLM using the delta-lognormal method was applied for CPUE standardisation because of the high percentage of zero catch data. TRG values were low for the 2016 to 2018 year classes but increased for the 2019 year class. Medium term trends in TRG in 23 years were in agreement with those of recruitment estimates from the operating model (OM) and both age-4 CPUE and age-5 CPUE from the Japanese longline fishery. The trends of TRG and TRP were similar.

71. Japan presented CCSBT-ESC/2008/21 which reports on the age-0 SBT distribution survey. The survey conducted for 10 days in December 2019 off the northwestern coast of Western Australia to investigate the distribution of small age-0 fish (< 25 cm in fork length) about which little has been known. Two SBT were collected by trolling, one of which was a 24.4 cm small age-0 fish

72. Korea presented paper CCSBT-ESC/2008/28. To investigate the age and growth of SBT we collected 174 otolith samples in 2019, hence totalling 745 otoliths since 2015. The fork length and weight were measured onboard for each specimen by sex, and the age was determined from annuli in the otolith, based on the CCSBT manual. The relationship between fork length (FL) and total weight (TW) was TW = 7.4E-05 x $FL^{2.731}$ (R^2 = 0.873). The von Bertalanffy growth curve parameters estimated were L_∞ = 170.5 cm, K = 0.197/year, t_0 = -1.668 years.

73. In response to a question from Japan asking whether all otoliths had been used for age estimation (174 in 2019 and total of 745), Korea responded that all otoliths collected were used for this study.

74. Taiwan presented paper CCSBT-ESC/2008/31. Using the discard information recorded by the Taiwanese scientific observer program and fishing effort data collected from Taiwanese large scale longline vessels in 2018-2019, we applied a procedure similar to the bootstrap approach to estimate the amount of southern bluefin tuna discarded by the Taiwanese longline fishery in three basins, i.e. the Atlantic, Pacific and Indian Oceans. The preliminary results indicated that the discards of SBT occurred mainly during June to August in the central Indian Ocean, the highest values occurred in July of those two years, and there were slightly lower estimates of discards in August for 2019 than for 2018. In the Pacific Ocean, the proportion of sets with discards and discard proportions are substantially lower than those in other areas. The total amount of discards estimated for the three oceans is around 8,605 kg in 2018 and 8,594 kg in 2019.

75. Japan noted that e-logbooks have items for discard weight and number for SBT (Appendix A-1 in document 30), and asked whether the estimates of document 31 differ from those reported by fishermen.

76. Taiwan responded that for the entries for discard weight and number for SBT on the e-logbook, fishermen usually recorded the discard number for SBT.

Unfortunately, it was difficult for the fisherman to measure the discard weight for SBT while releasing the non-retained SBT. Therefore, there were difference between the values of reported and estimated discard numbers. The discard catch reported by fishermen was included in the estimated discard catch.

77. New Zealand commented that they were unclear how the non-authorised effort in the Tasman Sea is taken into account in these estimates. The estimate for the Pacific region appears low given the level of longline effort declared through WCPFC.

78. Taiwan responded that they calculated the proportion of SBT fishing vessels in the core area using historical logbook data. Then they applied this proportion to select the vessels, which potentially fished SBT, for calculating and estimate of SBT discards in the Pacific Ocean in 2018 and 2019. Furthermore, according to the historical data, the core area for bycaught SBT in the Pacific Ocean was distributed from 30°S to 50°S and from 150°E to 170°W. Therefore, they focused on the core area for calculating estimates for the Pacific Ocean.

79. New Zealand also asked how the analysis differentiated between live, dead and moribund states in discards, i.e. are the data strictly confined to dead discarded SBT? Taiwan responded that in this study, they had not differentiated the status (live, dead, and moribund) of non-retained SBT. For the e-logbook data they used for the analysis, the status of non-retained SBT were not recorded, however the status (live or dead) of non-retained SBT has been recorded by observers in recent years.

80. Taiwan presented paper CCSBT-ESC/2008/32. A total of 745 gonad samples of southern bluefin tuna were collected during the period from April to September by the Taiwanese scientific observer program from 2010 to 2019. Most fork lengths were concentrated between 90 and 150 cm. For the monthly GSIs, the females' GSI showed an increasing trend from April to July and then a decline. The monthly GSIs for males reached the maximum value in May and then decreased gradually. For the determination of sexual maturity stages, 522 gonad samples were analysed during collection period from 2010 to2018, based on histological sections. The results allocated most samples to the immature stage, with about 15.5% samples designated as mature. However, these were at a reproductively inactive status. Most female samples reflected regressed or regenerating stages during April to June, and most of the male samples reflected regenerating stages during June to August.

81. Taiwan presented paper CCSBT-ESC/2008/33. The age of 312 SBTs caught in 2018 were determined by reading otolith annuli, and ranged from 2-18 years with the mean age of 3.9 ± 2.3 years. An age-length key based on the estimated age of these 312 fish and their fork lengths was constructed to convert length frequency data for the total catch to provide an age composition. The results suggested that the catch in 2018 consisted mainly of fish aged 3-5 years (75%). However, direct ageing data remained too few for fish >130 cm or > 6 years, which might lead to underestimation of the proportions of the fish ≥ 6 years. The sampling strategy still needs to be improved to collect more otoliths from large-sized SBT in the future.

82. Taiwan presented paper CCSBT-ESC/2008/34. The CPUE standardisation analyses were conducted using the data from Taiwanese longline fleets which

operated in the waters of the south of 20°S in the Indian Ocean for the period from 2002 to 2019. The SBT fishing ground is divided into the central-eastern area (Area E) and western area (Area W) based on previous results (Wang et. al. 2015). The cluster analysis conducted aimed to explore the targeting of fishing operations and also to produce a data filter for selecting the data for the CPUE standardisations. Cluster 1 was composed mainly of ALB and BET operations, and also included operations (of lesser proportion) including YFT, SBT, SWO and OTH were parts of components in the Cluster 1. The major operations in Cluster 2 were the ALB operations, and also included the operations for BET, SBT and OTH. The operations grouped in Cluster 3 belonged mainly to the ALB operations. Cluster 4 consisted primarily of SBT operation. For Area W, The ALB operations constituted the majority in Cluster 1. The ALB operations also contributed the most in Cluster 2, and contained the other operations such as for BET, YFT, SWO and OTH. The OTH operations belonging to Cluster 3 consisted mainly of oilfish. For CPUE standardisation, the pattern of CPUE trends in both area E and W were not changed greatly. For Area E, the standardised CPUE series increased gradually from 2004 to 2007, and after that showed decreasing trend from 2007 to 2011; it then increased substantially in 2012 but thereafter decreased gradually until 2015, and subsequently showed higher values for the most recent four years (2016-2019). For Area W, the standardised CPUE series has shown a gradually decreasing trend with fluctuations since 2002, and after 2013 has stayed stable though low pattern until the present. The results of retrospect analyses showed that the influence of including the updated data on the CPUE standardisation was negligible for Area E, while including these did change the series values for Area W although the trends were similar.

83. With reference to paper CCSBT-ESC/2008/Info-04, Japan commented that in previous studies for whales, epigenetic ageing had shown poor precision and consequently could not be used for stock assessments. They looked forward to further information being provided on potential use for SBT.

84. In response, Australia advised that a more specific approach is currently being developed, the precision for which should be improved. Hopefully some promising results from this work can be presented next year.

7.2. Updated analysis of SBT catch by non-Members

85. Paper CCSBT-ESC/1909/33 presented by New Zealand and Australia at ESC 24 revised and updated the previous analysis in CCSBT-ESC/1609/BGD02 (Rev.1) presented at ESC 21, resulting in catch estimates that were considerably higher than the estimates presented in 2016. Several requests for clarification and issues raised at ESC 24 were resolved during the course of that meeting, but it was agreed that two issues required further analysis and documentation: (1) A quantitative evaluation of the relative impacts of the main data changes on the results; and (2) A revision of the method for estimating the average weight of individual fish to account for the different weights of discarded and retained individuals.

86. At the 2020 OMMP meeting, New Zealand and Australia tabled paper CCSBT-OMMP/2006/04 (now relabelled ESC 25 – BDG 04) which addressed those

issues. The paper was presented at a pre-OMMP webinar, discussed during the OMMP meeting and briefly presented at ESC 25. Results showed that changes to the code used in processing the IOTC effort data had the most substantial impact on the revised estimates, increasing the predicted average catch for the Indian/Atlantic Oceans by 70 to 500t, with that range bounded by whether bycatch (using Taiwanese catchability) or targeted (using Japanese catchability) catch rates were assumed for the non-cooperating non-Member (NCNM) effort. Estimates of catches increased by 500-900% due to this single change to the analysis, which was by far the most substantial sensitivity detected. In the Pacific Ocean, changes were much smaller, with the largest difference being an increase of around 20-70% (1-20t more) as a result of changes to the WCPFC effort data, and a decrease of 20% (around 20t less) as a result of changes to the Japanese CCSBT data extract. The effect of using different estimates of weights for retained and discarded fish for Japanese catches led to a small decrease in the predicted catch rates for targeted fishing, with no noticeable consequences for the prediction of NCNM catches. The associated final numbers are therefore similar to those presented at ESC 24.

87. Numbers based on the Japanese catchability were adopted for use in the stock assessment by the OMMP. OMMP 11 also acknowledged that the analysis was substantially influenced and improved by the incorporation of the much more complete effort data collected by the CCSBT Secretariat, rather than simply using publicly available data as had been the case in the past.

Discussion

88. During the meeting, it was pointed out that the Compliance Committee has not provided robust information relating to UAM since 2016.

89. Meeting participants raised a number of factors that could bias estimates either up or down. These included the uncertainty in catches from EU vessels fishing in the Indian Ocean and other SBT areas, potential non-reporting from IUU vessels and other fleets, estimates of mortality rates for discarded SBT, the appropriateness of assuming Japanese target fishing catch rates for all other non-Member fisheries, and the effect of the recent ban on retention of SBT by China. The first two of these would likely lead to underestimates of non-Member UAM, while the last two could lead to overestimates. Regarding the retention ban by China, it was pointed out that there was a paragraph in last year's ESC report stating that the potential or likely impact of this ban needs to be examined; however, this has not happened. It was agreed that this point needs to be raised again and should be further investigated prior to the next iteration of updates to the non-Member UAM.

90. While the estimate of non-Member UAM is an issue that affects stock assessment results, it is not currently an issue for the CTP (and the resulting TAC), which is robust to the most recent estimate of non-Member. It was however agreed that additional work needs to be conducted to fully examine potential sources of bias and uncertainty, and to recommend refinements to be incorporated the next time the estimates are updated. This item is discussed further under Agenda item 13: the Scientific Research Plan.

Agenda Item 8. Evaluation of Fisheries Indicators

91. The ESC considered the updated indicators (**Attachment 6**). The overall results were summarised as follows:

- Three indicators of juvenile (age 1–2) SBT abundance were provided in 2020; the trolling indices (grid-type index and piston-line index) increased, and the gene-tagging abundance estimate decreased slightly compared to 2019.
- The Japanese longline CPUE indicators for the 4, 5, 6&7, and 8-11 age groups are well above the historically lowest levels observed in the late 1980s and the mid-2000s.
- The CPUE indicators for ages 4, 5, and 8-11 have fluctuated around the recent past 5-year mean, while the indicator for age 6&7 shows a decreasing trend over past three years.
- The indices for age class 12+ have declined gradually since 2011.
- The newly developed close-kin mark recapture (CKMR) index of abundance decreased for the latest year for which it was calculated (2015) relative to the index for 2014.
- The standardised CPUEs in area 9 for Korea increased in 2019 relative to 2018.
- For the Taiwanese CPUE standardisation, the CPUE for the area east of 60 degrees east decreased slightly in 2019 relative to 2018.
- The unstandardised New Zealand CPUE has been substantially higher in recent years (especially 2016-18) compared to earlier ones, but experienced a sharp drop in 2019. The standardised index, calculated for the first time this year, changed from a historically high level in 2016 to slightly lower levels in 2017 and 2018, and declined sharply in 2019.

92. Australia presented paper CCSBT-ESC/2008/11. The 2019–20 update of fisheries indicators for the SBT stock summarises indicators in two groups: (1) indicators unaffected by the unreported catch identified by the 2006 Japanese Market Review and Australian Farm Review; and (2) indicators that may be affected by that unreported catch. Data collected in the longline fisheries after 2006 are unlikely to be affected by unreported catches because of the catch documentation activities that have been undertaken by CCSBT Members, and therefore only the historical data and some standardised indicators are possibly affected. In this paper, interpretation of indicators is limited to subset (1), and to recent trends in some indices from subset (2). Two indicators of juvenile (age 1–4) SBT abundance were provided in 2020; the trolling index increased from 2019 while the gene-tagging abundance estimate decreased very slightly. Indicators of age 4+ SBT exhibited mixed trends. The newly developed close-kin mark recapture index of abundance decreased for the latest year for which it was calculated (2015). The standardised catch per unit effort (CPUE) from the New Zealand domestic longline fishery decreased while the Japanese longline nominal CPUE increased in 2019. In contrast, the Japanese standardised, normalised CPUE series for core vessels decreased substantially, but this decrease was not seen for the CPUE for all vessels, which remained stable. The mean length of SBT caught by Indonesia has generally decreased since 2011

and decreased slightly in 2019. The mean age of SBT decreased slightly in 2019.

93. Japan presented paper CCSBT-ESC/2008/25. In this paper, fisheries indicators along with fisheries-independent indices were examined to provide information for overviewing the current stock status of southern bluefin tuna. The Japanese longline CPUE indicators for 4, 5, 6&7, and 8-11 age groups are well above the historically lowest levels observed in the late 1980s and the mid-2000s. CPUE indices for the age 4, 5, and 8-11 classes have fluctuated more or less around the 5-year mean for the most recent years (2014-18). CPUE for the age 6&7 group shows a decreasing trend over the past three years. The indices for age class 12+ have declined gradually since 2011. This decline may relate to the very low cohorts from 1999 to 2001. The current level for this older age group remains low. Other age-aggregated (age 4+ group) CPUE indices that have been used in the OM and/or MP show increasing trends over recent years. The current levels of these indices are well above the historically lowest observed in the mid-2000s. Various recruitment indicators which were inspected suggest that recruitment levels in recent years have been similar to or higher than those observed in the 1990s (before very low recruitments corresponding to the 1999 to 2002 cohorts occurred) but the levels of recruitment have varied from year to year. It should be noted that among the two indices derived from the trolling survey for age-1 fish, the TRG recruitment index shows somewhat of a decreasing trend from 2011 to 2020 while the TRP recruitment index records zero values in 2018 and 2019, suggesting some concern that recruitment may be weak in recent years. A high recruitment level for the 2013 cohort estimated from the OM in the 2017 stock assessment (directly pertaining to the highest value of the 2016 AS index) is not confirmed by longline CPUE indices by age (4 and 5 years old) obtained in 2017 and 2018, and is also not confirmed by the TRG value in 2014.

94. Japan presented CCSBT-ESC/2008/26 which analysed characteristics of the new abundance index based on standardised CPUE using GAM. With regard to the divergence of this result for 2019, for which nominal CPUE was high , the last has been greater due to the concentration of operations in one spatio-temporal stratum (May 2019, 7 areas, 40°S, 150°E), the standardised abundance index was consequently considered the more appropriate. Since the new index includes many explanatory variables in the model, the absolute values of the residuals are small and the fit is good. However, there was also a poor fit to some of the data. The high 2013-2016 abundance index was attributed to the 45°S data for Area 6. There are few data in this area before 2015 and none after 2016, so the author advised that caution should be exercised in interpreting the estimates for 2013-2016.

95. New Zealand noted that the GAM analyses in the lead up to the OMMP were exploratory and used aggregated data. There is therefore a need for more work to develop CPUE indices further. The Chair of the CPUE Working Group agreed with New Zealand and advised that there was a need to sustain the momentum and continue to develop the GAM (and potentially other methods) for future assessments and MP consideration. An e-mail exchange will be conducted during this meeting to outline the main issues that need to be addressed in the future. It will be coordinated by the Chair of the CPUE

Working Group and involve all interested participants; it is discussed further under Agenda item 13: the Scientific Research Plan.

96. Japan expressed thanks for the work of the New Zealand consultant and for his feedback to Japan.

97. In response to Japan bringing some changes that have occurred in the fishery to the attention of the ESC, such as the termination of the bilateral agreement with New Zealand that has led to the cessation of the 45°S fishery, an issue with seabird bycatch in the Tasman Sea and a change in the fishing there from March-April to May as a result, and a reduction in fishing off Cape Town, Australia noted it would be useful to document substantial changes in all commercial fisheries. This includes regulatory, economic and environmental changes.

98. Such information could be very useful in formulating the models and also in interpreting the models and results. Given the extensive changes that have been seen in many fisheries, one should not expect that operations will return to what they were in the past and it is important that changes and drivers of changes are understood. It was noted that such examination should not impose too much burden on fisheries industry.

99. Paper CCSBT-ESC/2008/29 represents a minor elaboration of paper CCSBT-OMMP/2006/15 presented at the 2020 OMMP meeting. These papers both describe exploratory analyses conducted for the Japanese longline CPUE index, resulting from an exploration of the reasons for the high 2018 estimate. It was shown that an increasing concentration of effort had produced increasingly sparse fishing coverage of some areas within the catch and effort dataset. This led to unstable predictions from the 'Base' GLM model in strata without observations for CPUE values. A diagnostic for the magnitude of this issue was developed based on the number of extreme values predicted by the model. Spatio-temporal smoothing in a generalised additive model (GAM) provided more stable predictions for areas with no, or sparse, data and fitted the data better as measured by AIC. A model labelled GAM11 was recommended to meet the aims of the OMMP. Work to develop the model further and to continue to explore alternative CPUE approaches in the future was recommended for discussion at the ESC as part of the Scientific Research Program (SRP). The meeting agreed that the Variable Squares (VS) version of GAM11 was too extreme, given the increased contraction of the area fished in recent years, and that the previous standard weighting referred to as W0.5 (equal weights given to Constant Squares, CS, and to VS) and W0.8 (0.8 CS + 0.2 VS) would need to be reconsidered. After a review of the GAM11 CS and VS indices provided by Japan, it was agreed that re-weightings to generate W0.6 (0.6 CS + 0.4 VS) and W0.9 (0.9 CS + 0.1 VS) would be used for the stock assessment for the ESC. It was also agreed that these two series would be sampled with equal weight for the reference set.

100. The meeting recommended that further CPUE analyses be given high priority among Member scientists. Specifically, further examination of spatio-temporal models that may improve upon the GAMs conducted for this meeting was encouraged.

101. Japan presented CCSBT-ESC/2008/BGD01 which reported changes in the pattern of operation of Japanese SBT longliners in the 2019 fishing season by comparing the most recent year to the past 10 years. The author reported that no major change was found in the 2019 operational pattern in terms of the size of the catch, the number of vessels, the time and area covered by operations, proportions by area, length frequencies and concentration of operations, and concluded that the CPUE for the 2019 Japanese longline fishery can be regarded as reflecting stock abundance to the same extent as in previous years. In terms of the increase in the catch landed in 2019, the increase in CPUE contributed the most, while the expansion of the time and space of operation and the number of operations contributed to a lesser extent.

102. Japan presented CCSBT-ESC/2008/BGD02. This paper summarises the core vessel CPUE which is an abundance index for SBT used in the MP. It explains the data preparation, CPUE standardisation using GLM, and area weighting. The core vessel data were updated up to 2019. The index values in 2019, for W0.5 and W0.8 in terms of the base GLM model, are higher than the average over the past 10 years.

103. Japan presented CCSBT-ESC/2008/BGD03. Attempts had been made to determine the cause of the anomalously large increase in the 2018 value of the abundance index for SBT calculated from the CPUE for the core vessels. This was found to be caused by an abnormally large estimate for a year-area interaction term due to an imbalance in the amount of data by latitude in areas 8 and 9. This conclusion was confirmed by a slight manipulation of the dataset. The GLM model without the year-area interaction term, as well as a GLMM with a year-area interaction term treated as a random effect eliminated the anomalously high value.

104. Korea presented paper CCSBT-ESC/2008/BGD05 on CPUE standardisation for the Korean SBT longline fisheries. The CPUE from Korean tuna longline fisheries (1996-2019) was standardised using GLMs with set-by-set data. The data used for these GLMs were catch (number), effort (number of hooks), number of hooks between floats (HBF), fishing location (5° cell), and vessel identifier by year, month, and area. Areas 8 and 9 were identified as those in which Korean vessels have targeted SBT. SBT CPUE was standardised for each of these areas using two alternative approaches, data selection and cluster analysis, to address concerns about changes in targeting over time. Explanatory variables for the GLM were year, month, vessel identifier, location, moon phase, number of hooks and cluster (in some models). GLM results for each area suggested that location, year, targeting and month were the principal factors affecting the nominal CPUE. The standardised CPUEs for both areas decreased until the mid-2000s and have shown an increasing trend since that time.

Agenda Item 9. SBT Stock Assessment

105. Current and projected stock status reported in this section was estimated using a reference set of OMs that encapsulates key uncertainties defined by a grid specified at OMMP11 (CCSBT-ESC/2008/Rep1). The grid (Table 1) comprises 432 cells resulting from the crossing of four values of steepness (h), three values

of natural mortality at age 0 (M0), three values of natural mortality at age 10 (M10), a single value of Ω (implying a linear relationship between CPUE and LL1 exploitable biomass), two choices of the age range used to standardise LL1 selectivity over time, two alternative series of CPUE (W0.6 and W0.9 based on model GAM11), and three values of ψ (power parameter for relative reproductive contribution by age). In addition, a number of sensitivities were run to evaluate the impact of changing some data inputs and assumptions, as detailed in Table 1 of **Attachment 7**.

Table 1: Reference set grid used for the stock assessment. Sampling weight refers to how the grid of models is sampled to generate a distribution from 2000 parameter draws. The values for M_0, M_{10} and h below differ from those used in 2019 for MP testing, and also differ from the reference set used in the last full stock assessment in 2017. The lower values for $M_0 = 0.35$ and $M_{10} = 0.05$ used before were increased to 0.4 and 0.065, respectively, because of convergence issues. The upper $M_{10} = 0.12$ was dropped and the previous third highest value was increased. The h grid was expanded to include a lower value.

Parameter	Value	Cumul N	Prior	Sampling weight
h	0.55, 0.63, 0.72, 0.80	4	Uniform	Prior
M_0	0.4 0.45 0.5	12	Uniform	Posterior
M_{10}	0.065, 0.085, 0.105	36	Uniform	Posterior
Omega (Ω)	1	36	Uniform	Prior
CPUE	W0.6, W0.9 (weighting of CS:VS, GAM11)	72	Uniform	Prior
CPUE age range	4-18, 8-12	144	0.67, 0.33	Prior
Psi (ψ)	1.5, 1.75, 2.0	432	0.25, 0.5, 0.25	Prior

106. Other assumptions made for the reference set of OMs include:

- Non-Member UAM: estimated catches in Table 2 are added to the LL1 historical catches. As discussed under Agenda item 5, these values were estimated applying the GLM method and assuming targeted catch rates documented in CCSBT-OMMP/2006/04. These equate to a 14% NCNM-UAM catch to be added to LL1 catches in projections.
- An assumed 20% overcatch is added to the Australian surface fishery in conditioning (ramping up from 0 in 1992 to 20% in 1999) and in projections.
- Maintain the increased flexibility for Indonesian selectivity, commencing in 2012, to accommodate the sharp increase in abundance of younger fish (<age 7 yr) in the catch.
- The recruitment deviate simulated for the first year of projections is uncorrelated to historical deviates from the conditioned model; future recruitment deviates are simulated using an empirical estimate of autocorrelation.
- The Cape Town Procedure (CTP) is applied in projections to calculate TACs in three-year blocks with the first TAC block being 2021-2023.
- Catches for 2021 and beyond are allocated to four fisheries using the fractions specified in Table 3.

Table 2: Estimates of potential annual catches in t by NCNMs of CCSBT, provided by the GLM method assuming targeted effort (using LL1 catchability), from paper CCSBT-OMMP/2006/04.

Year	UAM added to LL1
2007	244
2008	124
2009	418
2010	756
2011	333
2012	613
2013	668
2014	443
2015	950
2016	1173
2017	1402
2018	1402
2019	1402

Table 3: Catch allocation used in projections corresponding to CCSBT's resolution on the nominal Allocation of the Global Total Allowable Catch to countries (Table 1 in report of CCSBT 26, nominal catch proportion) converted to the four OM fisheries considered in the projections.

Fishery in OM projections	LL1	LL2	Indonesia	Surface
Allocation	0.5752	0.0713	0.0607	0.3091

107. Australia presented paper CCSBT-ESC/2008/12 on behalf of Australia and Japan. The paper details the reconditioning of the CCSBT OMs for the 2020 stock assessment. It includes updated data series, up to and including 2019, and is the first stock assessment to include the gene-tagging estimates of 2-year-old abundance (2016-2018). The reference set of OMs and sensitivity tests agreed at the 11th OMMP meeting were run along with projections (using the adopted CTP, as endorsed by the 2019 EC) for the priority sensitivity tests.

108. The paper reports that the revised CPUE series are fitted well; and that the aerial survey was fitted fairly well apart from the very high 2016 index, as was the case for the previous assessment. Fits to the conventional tagging data are good, and the value assumed for the over-dispersion factor for these data is still considered appropriate. The gene tagging data are fitted well, with all three estimates falling within the predictive intervals of the OMs. The fits to the CKMR data – both parent offspring (POPs) and half-sibling pairs (HSPs) – are good with the overall number and age structure of POPs well explained so that no obvious adult capture year or juvenile cohort effects are apparent in the fits. The HSPs are also well explained with no obvious juvenile cohort effects and are consistent with the POP data as well. The fits to the size data for the main long-line fleets, LL1 and LL2, are good, as are the fits to the age data for the Indonesian and surface fisheries. In summary, there are no obvious issues with the fits to any of the data sets used in conditioning the reference set of OMs. **Attachment 7** contains a full set of figures showing the fits to the different data components.

109. Previous stock assessments have used the biomass of SBT aged 10+ (i.e. knife-edge maturity at age 10) to define the spawning stock biomass (SSB). With the inclusion of the close-kin mark-recapture (CKMR) data the model required the definition of the actual total reproductive output (TRO) of the adult population (for which SSB is a proxy). TRO corresponds to the total relative[3] reproductive output summed over all adults weighted by their relative individual contribution to reproduction. Specifically, it is the sum of abundance across all ages, where ages are weighted using a parametric relationship informed from the age distribution of parents in the POP data (see CCSBT-OMMP/1706/4 for specific details). For these OMs, the following median (and 80% CI) estimates are obtained: TRO(2020)/TRO(initial[4]) is 0.20 (0.16-0.24); relative biomass aged 10+ is 0.17 (0.14-0.21); the ratio of current fishing mortality relative to F_{MSY} and TRO relative to TRO_{MSY} are 0.52 (0.37-0.73) and 0.69 (0.49-1.03), respectively; the relative TRO at TRO_{MSY} is 0.30 (0.22-0.35); and estimates of MSY are 33,207 (31,471-34,564)t.

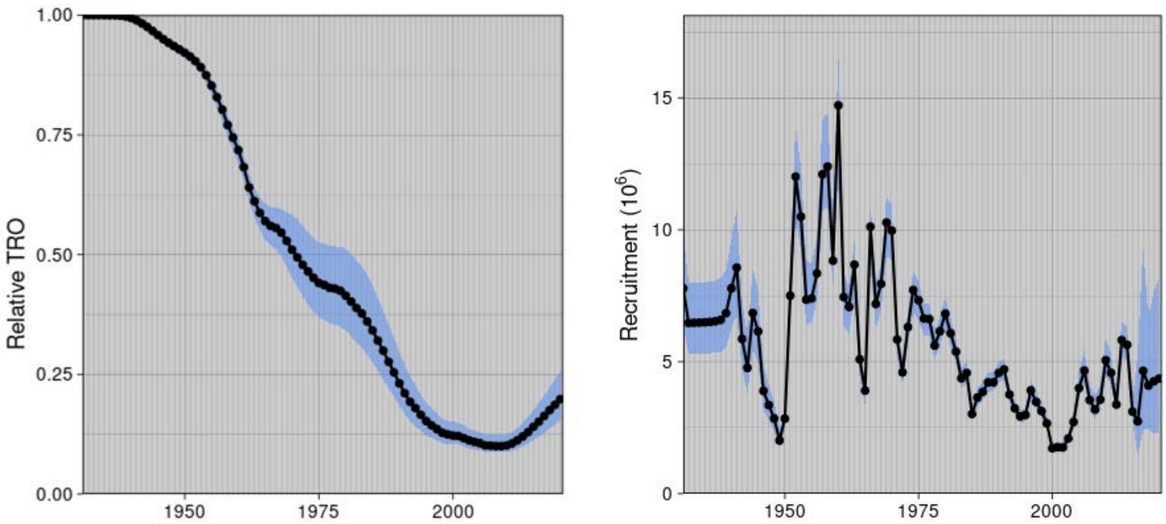

Figure 1: Trends in relative TRO (TRO_{2020}/TRO_0) and recruitment (number of 0+) from 1931-2020 estimated for the current reference set (base19) OMs (median and 5%-95%iles shown).

110. The estimated relative TRO and recruitment trajectories showed some differences with respect to results obtained for the 2019 base set of OMs used for MP testing (base18) (Figure 2). In particular, the replacement of the CPUE GLM series with the interim GAM 11 series (which corrected downward the very high 2018 point obtained with the GLM standardisation), resulted in a downward revision of the size of the 2013 cohort.

[3] "Relative" refers to a proportion of the corresponding initial value; thus for example, "relative TRO" refers to the value of TRO expressed as a proportion of the initial TRO value.
[4] "Initial" refers to the value before harvesting commenced, sometimes referenced as the "pristine", "pre-exploitation equilibrium" or "unfished" value.

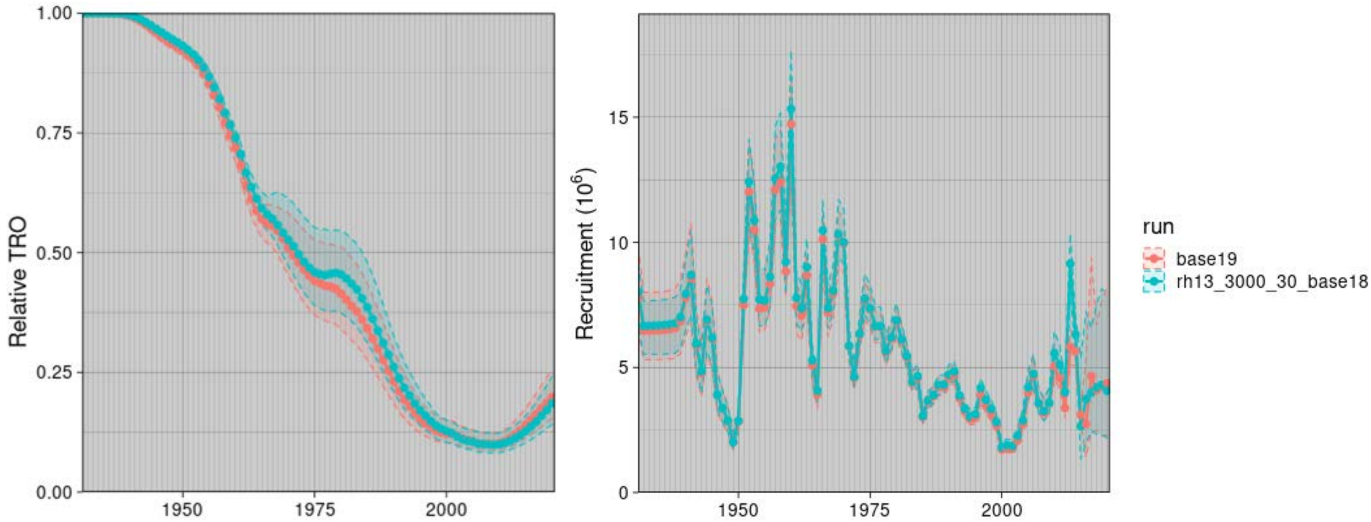

Figure 2: Comparison of trends in the relative TRO (TRO_{2020}/TRO_0)and recruitment from 1931-2020 (median and 5%-95%iles shown) estimated for the current reference set of OMs (run base19) and for the reference set of OMs used in 2019 for MP testing (run rh13_3000_30_base18).

111. These stock assessment results, as reviewed by the ESC, indicate that the 2020 estimates of current stock status are very similar to the projected rebuilding estimates from the 2017 stock assessment (Figure 3) and the updated OMs used for testing the MPs in 2019 (Figure 2). The stock has been rebuilding by approximately 5% per year since the low point in 2009, and the MP-based rebuilding plan for SBT appears to be on track towards achieving the Extended Commission's objective (Figure 1).

112. All the key stock status statistics are more optimistic than when the last assessment was completed (2017) and the results are consistent with projections made at the time (Figure 3).

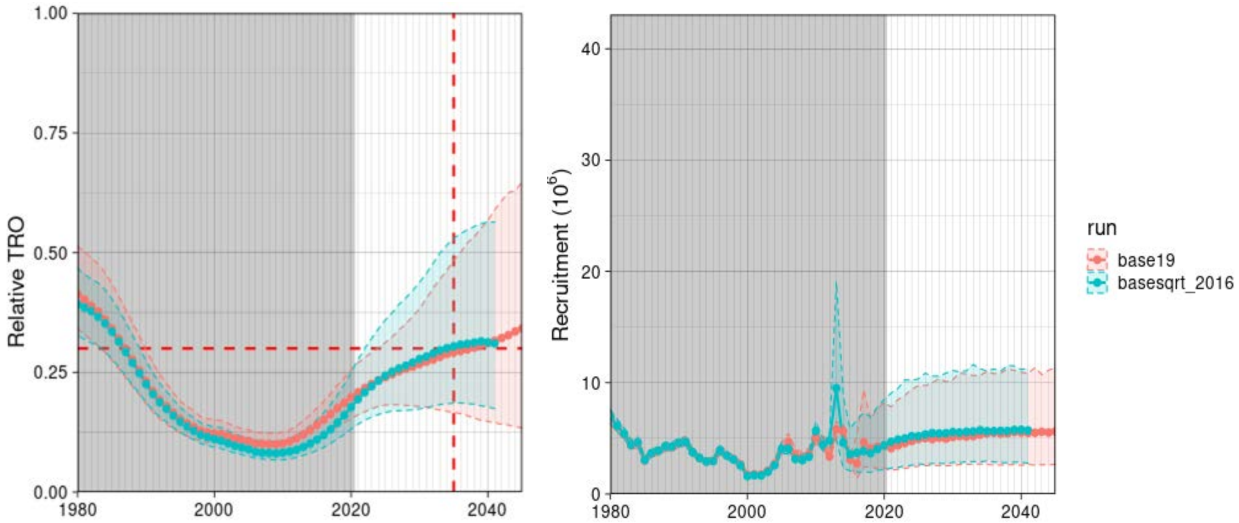

Figure 3: Recent and projected trends in the relative TRO (TRO_{2020}/TRO_0)and recruitment from 1980-2020 (median and 5%-95%iles shown) obtained with the current reference set of OMs (base19) compared to those obtained in 2017 when the last assessment was conducted (basesqrt_2016). A relative TRO index of 1 corresponds to the unexploited level (TRO_0). Red lines correspond to the target of 30% TRO_0 (horizontal) and the tuning year 2035 (vertical) which is the Extended Commission's new rebuilding objective.

113. Projections calculated using the CTP and the reference set of OMs result in a relative TRO of 0.29 (0.19-0.43) in 2035 – just below the previously tuned median value of 0.30 for the 2019 MP testing (Figure 3). Under the same projections the target (30% relative TRO) is projected to be achieved in 2037, with median catches of around 20,800t (compared to a median average catch of 19,308t estimated previously) for the 2020 to 2035 period. The probability of the relative TRO being above 20% by 2035 is 0.86, which is higher than the earlier interim rebuilding probability objective of 0.7 specified by the Extended Commission in 2010 (CCSBT 17). The slightly slower projected rebuilding is a result of the downward revision of the abundance of recent year classes, especially the 2013 year class, given updated data.

114. The sensitivity tests do not show any unusual or unexpected impacts on stock status. The current median relative TRO is 19-20% across the tests. The sensitivity tests that excluded the POPs and HSPs data are the most pessimistic. Approximately the same number of HSPs are included in the data used this year, compared with last year, but they span a wider range of years and therefore are more informative for the model. Further details on the result of the different sensitivity tests are included in **Attachment 7**.

115. Australia presented Paper CCSBT-ESC/2008/13 which provides a detailed examination of the information content on steepness in the SBT OM, with a particular focus on the role of the recruitment penalty. Strong decadal trends in the recruitment deviations are clear in the Reference OM estimates that deviate substantially from the assumed time-independent penalty used currently. When accounting for autocorrelation directly in the recruitment penalty, the preference for lower steepness values from the recruitment penalty (and in the overall objective function sampling density) disappears. In contrast, the data themselves show only a weak-to-moderate preference for higher steepness values, with the autocorrelation-corrected penalty preferring the central two values of steepness. Overall, this likely contributes to an overall sampling distribution closer to the uniform prior currently used for the reference set of OMs, rather than the sampling density shown at the OMMP meeting when objective function weighting was used. The paper recommends that this objective function weighting is not used to inform the choice about the range of plausible steepness values, until such time as the mis-specified recruitment penalty model currently used in the OM has been corrected.

116. Paper CCSBT-ESC/2008/13 also highlighted that the steepness parameter is highly influential for the results from the model. It is a primary determinant of estimates of MSY and correlates positively with the estimated level of depletion. However, steepness is virtually impossible to estimate precisely for almost all fisheries. For SBT, in particular, there is not sufficient contrast (very high and very low stock sizes and repeated depletion and rebuilding cycles) in the historical time-series to provide the information required to estimate steepness reliably, and this will likely continue to be the case in the foreseeable future. This necessitates a pragmatic approach, which the OMMP meeting strived to achieve through the grid approach and a range of plausible steepness values.

117. The reference grid of OMs and fits to data were carefully examined at the OMMP meeting (CCSBT-ESC/2008/Rep1). The ESC considered the additional

information provided by paper CCSBT-ESC/2008/13 and agreed with its conclusions and recommendations, which are summarised as follows: (1) there is a slight preference for higher steepness values from the data while the recruitment penalty prefers lower steepness values; (2) when these are combined in objective function weighting, the preference for lower values of steepness dominates; and (3) accounting for autocorrelation in the recruitment penalty removes the information on steepness, and no strong preference for lower or higher steepness values is apparent. These results indicate that objective function weighting should not be used to inform the range of steepness values or to sample across the range of values included in the grid. They support the use of the uniform prior for sampling of steepness, as used in the current stock assessment. The current range of steepness values used in the grid is considered reasonable based on equivalent life history traits in other species. Values of steepness below 0.5 would be equivalent to the life history of sharks, and not considered realistic for those for high fecundity broadcast spawners such as SBT. In addition, using values increasingly below 0.55 required changes in the starting values for the parameters to avoid the model running out of fish. Both the penalty and the overall likelihood begin to show increasingly lower preference for values of steepness lower than 0.55. Given this, the ESC is increasingly confident that the range of steepness values used (0.55, 0.63, 0.72 0.8) is reasonable and spans the plausible range; consequently the stock status advice is considered to be robust with respect to the uncertainty associated with this highly influential parameter.

118. As noted above, MSY calculations change with the value of steepness and there are several concerns when comparing MP-derived TAC recommendations with MSY. There is a partial disconnect between how MSY is calculated because it assumes no UAM and enforces the current quota share by fishery. Even in the absence of UAM, to attain long-term average catches at MSY requires TACs to be set and controlled perfectly to maintain fishing mortality at F_{MSY}, which in turn would require perfect information on stock abundance. This means that, in order to maintain TRO at the estimated level at which MSY could be achieved, by definition the catches required to achieve that would be below MSY. It is for these reasons that comparing TAC recommendations from the MP with estimates of MSY from the assessment is not recommended by the ESC.

119. Projections from the stock assessment conducted using the reference set of OMs (base model) were compared with those produced for four sensitivity tests. The aim of these sensitivity tests was to understand the likely impact on rebuilding performance of the main changes made for the 2020 stock assessment, relative to the previous assessment. These were: potential UAM scenarios, changes in the parameter values that define the grid of OMs, and using the GAM11 interim CPUE series instead of the GLM standardised series. The projection results indicated positive rebuilding in TRO within the expected range (details included in **Attachment 7**), in that they all reach 28-29% of TRO_0 by 2035, slightly under the 30% target, and the no-UAM scenario over-shoots the target, as expected. The updated estimates of recruitment in 2013 and 2016, which are influenced by the incorporation of gene-tagging, the revised CPUE estimates and new data, are lower than previously estimated, which contributes to slightly slower rebuilding relative to the 2019 OM projections.

120. The specific nature of the unaccounted mortality (UAM) scenarios was clarified. The reference set (base19) uses the updated estimates of potential non-Member catches, as calculated using the ‘targeting’ catch rates (New Zealand and Australia BGD paper) shown in Table 2. These updated estimates are ~1400t (in the most recent year), which in projections is assigned to the LL1 fishery as a constant proportional increase of 14%. The UAM1 scenario, originally developed in 2014 (See Report of ESC 19), includes 1000t of small fish and 1000t of large fish, which in projections are assigned to surface and LL1 fisheries as constant proportional increases of 10% and 19% respectively. The total catches in the UAM1 scenario are greater than the total catches associated with UAM in in the Non-Member UAM scenario used in the base model for this year’s assessment. All scenarios included an additional 20% surface fishery catch anomaly in conditioning and in projections (as described in 2008 ESC report). The sensitivity test scenarios are described in more detail in Table 1 of **Attachment 7**.

121. The 2020 stock assessment provides information on current stock status (i.e. depletion, fishing mortality, and other aspects of SBT population dynamics) based on the best currently available scientific information. This is used to monitor the rebuilding of the stock. The stock assessment does not provide information to be used in calculating the TAC. The role of the MP and calculation of the TAC recommendation are discussed in agenda item 10.

122. The Chair and Members thanked the presenters, authors and the OMMP participants for their contributions to the stock assessment and the substantial work at OMMP 11.

<u>Agenda Item 10. Operation of the new MP (Cape Town Procedure)</u>

10.1 Specification of the Cape Town Procedure

123. Australia and Japan submitted a series of six papers that comprise descriptions of the component parts and the final specification and documentation for the CTP (**Attachment 8**). The component parts include a preamble/introduction (CCSBT-ESC/2008/10-1), technical description of the MP (CCSBT-ESC/2008/10-2), specification of the gene-tagging (CCSBT-ESC/2008/10-3), CKMR (CCSBT-ESC/2008/10-4) and CPUE (CCSBT-ESC/2008/10-5) data inputs to the MP, and the revised meta-rules (CCSBT-ESC/2008/10-6). Background papers CCSBT-ESC/2008/BGD 06 and BGD 07 contain further information relevant to 10-3 and 10-5, respectively. This full specification of the CTP provides a consolidated documentation of the CTP and its operation within the CCSBT, similar to the documentation of the Bali Procedure (Report of ESC 18, Attachment 10).

124. Australia outlined the main areas where changes have been made to the meta-rules’ consideration of exceptional circumstances since the Bali Procedure. These include changes related to the use of gene tagging estimates, the cessation of aerial surveys and hence their associated estimates, clarification of the treatment of missing data points, updated guidelines for action, the risks associated with TACs being too high or too low, and updated guidance on the roles of the ESC and the EC. Examples of consideration of exceptional

circumstances by the ESC in the past have also been provided to help clarify the operation of the CTP.

125. The question was raised of how the case of one or more missing data point(s) for the input data series for the MP, for example the anticipated lack of a gene-tagging estimate in 2022, would be dealt with under the exceptional circumstances' provisions for the CTP. It was noted that the intention of the meta-rules was to identify any missing input data as an exceptional circumstance, followed by an assessment of the potential severity of the consequences for the TAC advice from the MP and appropriate action(s) determined by the ESC and, if necessary, the EC. Comments were made that this process had worked quite effectively for a range of different cases, including missing data, for the Bali MP. In addition, it was pointed out that the CTP has been designed and tested to accommodate missing data in the gene-tagging series. The meeting agreed to discuss at the following ESC meeting the possibility of adding to the recommended full specification of the CTP to clarify further how the TAC calculation will proceed in the event of missing input data.

126. Participants noted that it is important that the MP code is tested and can be run by individuals other than the particular MP developers (e.g. by non-technical participants) using the publicly available documentation, as this provides an independent test of the CTP and provides greater transparency about the process. It was noted that the standalone code for running the CTP is available on GitHub. Japan confirmed that they had been able to run the MP successfully using this code.

10.2 Evaluation of meta-rules and exceptional circumstances

127. At its Eighteenth annual meeting in 2011, the CCSBT agreed that an MP would be used to guide the setting of the SBT global total allowable catch (TAC). The CCSBT also adopted the meta-rule process as the method guiding the implementation of the MP and for dealing with exceptional circumstances in SBT fisheries (ESC 2013). The meta-rule process (updated for the new CTP, **Attachment 8**) describes: (1) the process to determine whether exceptional circumstances exist; (2) the process for action; and (3) the guidelines for action.

128. Exceptional circumstances are events, or observations, that are outside the range for which the MP was tested and, therefore, indicate that application of the total allowable catch (TAC) generated by the MP may be inappropriate.

129. Paper CCSBT-ESC/2008/14 provides an overview of the meta-rules of the CTP and reviews the evidence for exceptional circumstances for the calculation of the 2020 TAC. The annual review of the CCSBT MP input data series, and stock and fisheries indicators, is intended to identify conditions and/or circumstances that may represent a substantial departure from conditions under which the MP was tested, termed "exceptional circumstances", and where appropriate recommend action. In 2020, the ESC is to use the new Cape Town Procedure to calculate the recommended TAC for the 2021-2023 TAC block. In considering the potential for exceptional circumstances, the paper examines whether: 1) the inputs to the MP are affected, 2) the population dynamics are potentially significantly different from those for which the MP was tested (as defined by the 2019 Reference and Robustness sets of OMs), 3) the fisheries or

fishing operations have changed substantially, 4) total removals are greater than the MP's recommended TACs, and 5) if there are likely to be impacts on the performance of the SBT rebuilding plan as a result. The following current and historical issues are addressed:

- The high 2018 CPUE data point in the Base CPUE series used in the CTP is of concern (although not in the stock assessment where an interim series is being used), and the recommended action is to work on a new CPUE series in time for review and possible retuning of the MP before the TAC recommendation for the 2024-2026 quota block in 2022. The review of performance of the CTP adopted will need to be reconsidered when a new CPUE standardisation is agreed for use in the MP prior to the 2022 ESC. There are no concerns regarding the gene-tagging and close-kin mark-recapture inputs to the MP.
- Small changes in the estimates of the population's dynamics in the reconditioned OMs for the 2020 stock assessment do not affect running of the MP or the recommendation for the 2021-2023 TAC.
- Concerns in previous years about the impacts of catches above the recommended TAC, have been effectively dealt with by the Extended Commission. Members have a common definition for accounting for attributable catches, and the MP TAC recommendations are robust to the level of estimated non-cooperating non-Member catches.
- A potential change in selectivity in the Indonesian fishery, a concern in previous years, has been resolved. New data have been provided for 2015-16 to 2018-19 to identify which fish were caught in area 1 and the MP has been tested and tuned using OMs that included the updated data in 2019.

Based on this review, the authors concluded that no actions to change the 2020 TAC are required.

130. CCSBT-ESC/2008/24 reviewed observations of input index/data (longline CPUE, gene-tagging estimates, and close-kin mark recapture data) for the CTP by comparing to the 2019 OM predictions. These examinations indicated 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, the conclusion is reached that there is no major problem regarding use of the CTP for recommending TACs 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% relative TRO by 2035 with a 50% probability using the CTP needs to be further investigated at the ESC.

131. Based on the review of fisheries indicators (paragraph 91) and papers (CCSBT-ESC/2008/14 and 24), the ESC noted that the following four issues needed consideration in the context of the meta-rules for the TAC recommendation for the 2021-2023 quota block:

- Inputs to the MP, in particular the high 2018 CPUE data point and issues identified with the standardised Base CPUE series;
- Changes in population dynamics as indicated by the reconditioned OMs for the 2020 full stock assessment;
- The small/young fish in the Indonesian size/age data (2012/13 to 2014/15 seasons); and
- The potential scale of unaccounted mortalities.

Inputs to the MP

132. The ESC noted that the very high estimated CPUE value for 2018 had been of concern. As it was included in the 2019 reconditioning of OMs used in the MP testing, and the OMMP 11 meeting had agreed that it could still be used as input to the CTP for calculating the TAC in 2020. In light of the issues identified with the Base CPUE standardisation, a new CPUE series will be developed that is more robust to spatial and temporal variation in the distribution of catch and effort for the LL1 fleet. It is expected that a revised series will replace the current Base series before the CTP is implemented in 2022. A program of work has been developed to address this issue (C-R CPUE under SRP).

133. The gene-tagging (CCSBT-ESC/2008/06) and close-kin (CCSBT-ESC /2008/BGD07) input data series were reviewed and no issues were identified.

134. The ESC agreed that all three input data series could be used in the CTP to calculate the TAC.

Updated estimates of population dynamics

135. The ESC has completed a full stock assessment in 2020. All of the key stock status statistics are more optimistic than when the last full assessment was completed in 2017, and the results are generally consistent with projections made at that time (Figure 3). Projections using the CTP and the reference set of OMs resulted in relative TRO by 2035 of 0.29 (0.19-0.43) – slightly below the previously tuned median value of 0.30 from the 2019 MP testing. Under the same projections the target (median 30% relative TRO) is projected to be achieved in 2037. The probability of the relative TRO being above 20% by 2035 is 0.86, which is greater than the previous interim rebuilding probability objective of 0.70. The probability of the relative TRO being above 30% by 2035 is 0.47 which is below the target of 0.50 but considered acceptable, given that the difference is small when compared to the 90% probability interval for relative TRO which the adopted CTP is estimated to achieve by 2035, which is (0.18 – 0.48). The ESC agreed that there were no substantial changes in understanding of the SBT population’s dynamics or the projected rebuilding relative to the OM conditioning used to test and tune the CTP in 2019.

Indonesian size/age data

136. The ESC noted previously that the increase in the frequency of smaller and younger size and age classes in the spawning ground catch monitoring had been identified as an issue that influences the conditioning of the OMs. The ESC noted further that this issue has been addressed for more recent years, through use of VMS data to identify catches in Area 1 (CCSBT-ESC/2008/SBT Fisheries-Indonesia).

137. The ESC also noted that the CTP does not use these data directly, and that the MP testing in 2019 used the updated data from Indonesia in conditioning of the the OMs. The ESC concluded that this issue no longer needs to be considered under the meta-rules.

Unaccounted mortality

138. The reference set of OMs used in the testing of the CTP included UAM1 scenario (paragraph 120) and, hence, should be robust to unaccounted mortalities less than those included in this scenario. The best information available to the ESC indicates that potential unaccounted mortalities are less than those included in the UAM1 scenario used in MP testing; consequently, there is no need to modify the recommended TAC from the CTP for this reason.

139. Overall, the ESC concluded that there was no reason to take action to modify the 2021-23 TAC recommendation from the CTP in relation to these four possible exceptional circumstances.

140. The ESC reiterated the need to take urgent steps to quantify all sources of unaccounted mortalities, as well as the request to Members, the CC and EC to provide information that will assist the ESC in quantifying estimates of these mortalities and reviewing their plausibility in time for the 2022 ESC meeting when the MP will next be used to calculate the TAC.

141. The ESC recommended action to develop a new CPUE series in time for running the MP in 2022 for the next quota block (paragraph 132).

10.3 MP recommended TAC for 2021 – 2023

142. Australia presented paper CCSBT-ESC/2008/BGD06 which describes the operation of the Cape Town Procedure (CTP). The paper describes the three monitoring series used in the CTP, and how each series contributes to the calculation of the 2021-2023 TAC recommendation. The monitoring series in the CTP are: 1) the gene tagging abundance estimates of the age 2 cohorts and the number of matches associated with each estimate (2016-2018), 2) the arithmetic mean of the individual w0.5 and w0.8 Base CPUE series (2014-2018), 3) the updated CKMR parent-offspring pairs (POP) data, and 4) the updated CKMR half-sibling pairs (HSP) data. The MP TAC calculation for this year suggests no change to the current TAC (i.e. “status quo”) for the 2021-2023 block.

143. Australia presented paper CCSBT-ESC/2008/BGD07 which summarises the fit to the updated CKMR data in the simplified population dynamics model in the CTP. It provides details on the updated CKMR data, how they compare to the 2019 data, the fits to the data for the simplified CKMR model of adult abundance in the CTP, and the resulting estimated population dynamic variables. The updated CKMR data for 2020 are summarised and are found to be consistent with those used in the 2019 update utilised for MP testing. Both the POP and HSP data showed slight decreases in hit-rate (match-per-comparison) which is qualitatively consistent with a slightly more optimistic outlook for the adult component of the stock relative to 2019. The details of the adult-only population model and likelihoods for the POP and HSP data were reviewed, along with the assumed parameters and priors. Fits to the data were

generally quite good, with no obvious year or age effects for the POP data and no cohort specific effects for the HSP data. The time series of estimates of the adult abundance (TRO) was relatively flat with a very small recent increasing trend; the series of estimates of mean adult total mortality rate Z was also relatively flat but with a recent decreasing trend. Both series are consistent with a qualitatively positive trend in the adult abundance. Given the acceptable fits to the data, and estimates of the key population dynamics that are not inconsistent with previous stock assessment results, the CKMR part of the CTP is considered to be performing as expected and is acceptable for use in the CTP calculations for the TAC.

144. The annual TAC calculated using the CTP for the years 2021-2023 quota block was 17,647t. The ESC noted the review of exceptional circumstances under the meta-rules had not identified any actions to modify the TAC. The ESC therefore recommends that the annual TAC for the years 2021 to 2023 be 17,647t.

145. The ESC noted that the usual 1-year lag between TAC calculation and implementation did not apply this year. This absence of the lag year in the first year of implementation was built into the MP testing in 2019. The next TAC calculation is scheduled for 2022 for the 2024-2026 TAC quota block.

146. The ESC developed the following non-technical description of the operation of the CTP.

147. The CTP has 3 components based on the data inputs from the following monitoring programs: Gene-tagging, CPUE and Close-Kin Mark Recapture (CKMR). Gene-Tagging provides an index of recruitment (abundance of 2 year-olds), CPUE provides an index of abundance for the age-classes exploited by the Japanese longline fishery and CKMR provides two sources of information relating to the adult population abundance and total mortality.

148. For the gene-tagging component, the input is the most recent 5-year weighted average of the abundance estimates, where the weighting is proportional to the number of matches in each year. For the 2020 TAC decision only 3 estimates are available (2016-2018). The TAC change variable (ΔGT) for the gene-tagging component will be less than one if the recent average is below the fixed lower bound, or will be greater than one if the recent average is above the fixed upper bound. If the recent average is between the upper and lower bounds, then the TAC multiplier is equal to one. Missing data points have a weight of 0 in the calculation of the weighted average.

149. For the CPUE component, the TAC change variable (ΔCPUE) is also calculated based on fixed upper and lower bounds. It uses the average of the 4 most recent years from the specified standardised CPUE time-series. If this average value is between the bounds, the contribution to the overall TAC change is zero. If this average is below the lower bound, then the TAC change variable is negative, and if above the upper bound, the TAC change variable is positive. As the current rebuilding target of 30% TRO_0 is approached (approximated in the Close-Kin component), the MP is designed to become less reactive; i.e. the recommended TAC changes will be smaller, to minimise future fluctuations in TAC while maintaining the spawning stock close to the target level.

150. The Close-Kin Mark-Recapture (CKMR) Parent-Offspring-Pair and Half-Sibling-Pair data are used in a simple population dynamics model of abundance

and total mortality of adults, which provides a trend in adult abundance. This trend is compared to a threshold growth rate required to rebuild the adult abundance to the target in 2035. If the trend in adult abundance is above the threshold growth rate then the TAC change variable (ΔCK) will be positive, and if the trend is lower than the threshold growth rate, the TAC change variable will be negative. The threshold growth rate is not fixed, but is calculated in the population model. This TAC change variable also becomes less reactive as the target level of rebuilding of the stock is approached.

151. These three components are combined to give a single multiplier of the current TAC (Table 4). The final TAC recommendation is constrained to be within a maximum change of 3000t and minimum change of 100t.

152. The ESC discussed the calculation of the recommended TAC from the MP in 2020, and the details of the component parts:

- Gene-tagging: The weighted average of the 3 gene-tagging abundance estimates (1.29 million) is within the upper (2.6 million) and lower (1 million) bounds of the CTP, so that the gene-tagging TAC change variable (ΔGT) is one.
- CPUE: The recent 4-year average CPUE (1.39) is within the upper (1.42) and lower (0.45) bounds of the CTP, so that the TAC change variable is zero (ΔCPUE=0).
- CKMR: The population model of adult abundance has a positive trend, but this is slightly below the estimated target growth rate required to reach the 2035 target adult abundance, and therefore the TAC change variable (ΔCK) is a very small negative number (-0.00066).
- The combination of these three components ((1 + ΔCPUE + ΔCK) x ΔGT) gives an overall multiplier of 0.99934, which equates to a decrease in TAC of 11.6t from the current TAC. This decrease is less than the threshold of 100t, and therefore no change to the current TAC is recommended.

Table 4: Breakdown by HCR component, and the current and recommended TACs.

Harvest Control Rule (HCR) Components	**2020 Values**
ΔGT	1
ΔCPUE	0
ΔCK	-0.00066
TAC multiplier: (1 + ΔCPUE + ΔCK) x ΔGT	0.99934
Current TAC	17,647t
Recommended TAC	17,647t

153. Some Members noted that the positive increase in stock rebuilding identified in the stock assessment and the positive data inputs to the MP did not result in an increase in TAC for the 2021-2023 quota block.

154. It was explained that although some trends in the data were positive, the estimated trend in adult abundance growth rate within the CTP was just slightly below the growth required to reach the rebuilding target, the recent mean CPUE was close to but not above the upper threshold level specified in the CTP, and the recent mean gene-tagging abundance estimate was within the limits and not above the upper bound. The MP is designed for rebuilding of the stock to 0.3 TRO_0 and will allow for increases in the TAC only when the rebuilding signals

calculated in the CTP are higher than the minimum required to reach the target by 2035.

155. The values adopted for the upper and lower bounds of the CPUE and gene-tagging components of the CTP were selected based on historical information for ranges of these monitoring series that were associated with positive and negative recruitment and stock size estimates, respectively (see Anon 2019 for description of the CTP). Selection of these values and other parameters of the CTP was part of the tuning and optimisation of performance conducted in 2018-2019. These values, along with the other elements of the CTP, are fixed as part of the specification of the adopted MP.

156. The MP is now in the implementation phase, and the MP TAC calculation is dependent only on the values of monitoring series for the MP (CTP). The testing in 2019 indicated that 2021-2023 TAC would be in the range of (17609-20341, 5%-95%iles, Figure 4 from Paper 24). There were requests for information on how the TAC might change in the future. The projections from the current reference set of models indicate that mean TAC from 2021 to 2035 is 20,816 (17,834-21,282, 10%-90%ile, Table 8, paper CCSBT-ESC/2008/12). It was noted that the CTP may need to be retuned before 2022, to incorporate a new CPUE series (that is yet to be developed), which may affect these future projections.

157. The ESC concluded that the CTP is operating as intended for calculation of the TAC. The TAC recommendation is 17,647t.

Agenda Item 11. Summary of the SBT stock status

158. Based on the stock assessment results presented in item 9 the ESC compiled the summary stock status advice presented in Table 5. All the key stock status statistics are more optimistic than when the last assessment was completed (2017) and the results are consistent with projections made at that time. The relative TRO is estimated to be 20% (16-24 80% P.I.). The stock remains below the level estimated to produce maximum sustainable yield (MSY). There has been improvement since previous stock assessments conducted in 2017 which indicated the stock was at 13% (11-17% 80% PI) of initial biomass (Table 6). The fishing mortality rate is below the level associated with MSY. The results of sensitivity tests did not show any unusual or unexpected impacts on stock status (median relative TRO is 19-20% across the tests).

159. The current estimated trends indicate that the stock has been rebuilding by approximately 5% per year since the low point in 2009, and the MP-based rebuilding plan for SBT appears to be on track to achieving the Extended Commission's objective (Figure 4). Comparison with earlier assessments shows that this trend is consistent with past results (Table 6). The current TAC was set in 2016 (for the 2018-2020 quota block) following the recommendation obtained from the Bali Management Procedure adopted in 2011.

Table 5: Southern Bluefin Tuna summary of 2020 assessment of stock status; values in parenthesis are 80% PIs.

Southern Bluefin Tuna Summary of 2020 Assessment of Stock Status[5]	
Reported 2019 catch	**16,844t**
Current (2020) Total Reproductive Output (TRO)*	1,546,180 (1,397,040-1,759,312)
Current (2020) biomass (B10+)	204,596t (184,272-231,681)
Current condition relative to initial	
TRO	0.20 (0.16-0.24)
B10+	0.17 (0.14-0.21)
TRO (2020) relative to TRO_{MSY}	0.69 (0.49-1.03)
Maximum sustainable yield	33,207 (31,471-34,564) t
Current management measures	Effective catch limit for Members and Cooperating Non-Members: 14,647t in 2017, and 17,647t /yr for the years 2018-2020.

* TRO is the total relative reproductive output summed over all age classes weighted by their relative individual contribution to reproduction.

Table 6: Summary of stock status variables from SBT assessments (2014, 2017 and 2020) and the estimates from the OM update for MP testing in 2019. The TRO and B10+ estimates are for the start of final year+1 in the assessments (e.g. 2020 in 2020 stock assessment), and F estimates are for the final year of the assessment (e.g. 2019 in 2020 stock assessment).

Variable	2014 Status	2017 Status	2019 Status	2020 Status
Relative TRO	0.09 (0.08-0.12)	0.13 (0.11-0.17)	0.17 (0.15-0.21)	0.20 (0.16-0.24)
Relative B10+	0.07 (0.06-0.09)	0.11 (0.09-0.13)	0.14 (0.12-0.17)	0.17 (0.14-0.21)
F relative to F_{MSY}	0.66 (0.39-1.00)	0.50 (0.38-0.66)	0.55 (0.41-0.74)	0.52 (0.37-0.73)
TRO relative to TRO_{MSY}	0.38 (0.26-0.70)	0.49 (0.38-0.69)	0.64 (0.47-0.91)	0.69 (0.49-1.03)
TRO relative to TRO_{min} in 2009	n/a	n/a	1.79 (1.63-1.93)	1.91 (1.78-2.10)
B10+ relative to $B10+_{min}$ in 2009	n/a	n/a	1.57 (1.45-1.72)	1.73 (1.63-1.94)

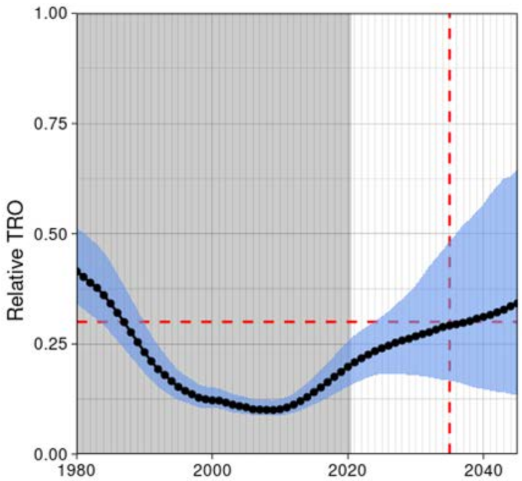

Figure 4: Recent and projected trends in relative TRO from 1980-2045 (median and 5%-95%iles) where a value of 1 corresponds to the initial level (TRO_0). Red lines correspond to the target of 30% TRO_0 (horizontal) and the tuning year 2035 (vertical).

[5] Values in parentheses are 10_{th} and 90_{th} percentiles.

160. The ESC considered the updated indicators (**Attachment 6**). The overall results are summarised as follows:

- Three indicators of juvenile (age 1–2) SBT abundance were provided in 2020; the trolling indices (grid-type index and piston-line index) increased, and the gene-tagging abundance estimate decreased slightly compared to 2019.
- The Japanese longline CPUE indicators for the 4, 5, 6&7, and 8-11 age groups are well above the historically lowest levels observed in the late 1980s and the mid-2000s.
- The CPUE indicators for ages 4, 5, and 8-11 have fluctuated around the recent past 5-year mean, while the indicator for age 6&7 shows a decreasing trend over past three years.
- The indices for age class 12+ have declined gradually since 2011.
- The newly developed close-kin mark recapture (CKMR) index of abundance decreased for the latest year for which it was calculated (2015) relative to the index for 2014.
- The standardised CPUEs in area 9 for Korea increased in 2019 relative to 2018.
- For the Taiwanese CPUE standardisation, the CPUE for the area east of 60 degrees east decreased slightly in 2019 relative to 2018.
- The unstandardised New Zealand CPUE has been substantially higher in recent years (especially 2016-18) compared to earlier ones, but experienced a sharp drop in 2019. The standardised index, calculated for the first time this year, changed from a historically high level in 2016 to slightly lower levels in 2017 and 2018, and declined sharply in 2019.

Report on biology, stock status and management of SBT

161. The ESC updated the annual report on biology, stock status and management of SBT that it prepares for provision to FAO and the other tuna RFMOs. The updated report is at **Attachment 9**.

<u>Agenda Item 12. SBT Management Advice</u>

162. At its 26th annual meeting in 2019, the CCSBT agreed to adopt a new MP, to be known as the CTP, which would be used to guide the setting of the SBT global total allowable catch (TAC) for 2021 and beyond. The CTP was developed by the ESC following advice developed at SFMWG5 and confirmed by the CCSBT. The adopted CTP was tuned to provide a probability of 0.50 of achieving 30% of the initial TRO by 2035 with a requirement also to exceed a probability of 0.70 of achieving the earlier (2010) interim rebuilding target of 20% of the initial TRO by 2035. The CTP specification includes a minimum and maximum TAC change of 100t and 3000t respectively. The TAC is to be set for three-year periods.

Stock status from 2020 assessment

163. According to the 2020 stock assessment (agenda item 9), the stock is estimated to be 20% of the initial TRO; this is 69% of the level required to produce maximum sustainable yield (MSY). The current depletion level is approximately equal to the interim rebuilding target of 20% of initial TRO, but is below the new rebuilding target, adopted in 2019, of 30% of the initial TRO. Fishing mortality is currently about half the level associated with MSY.

Implications from 2020 review of indicators

164. The review of indicators (agenda item 8) provides mixed messages on recruitment with (i) the gene tagging absolute abundance estimate showing a slight decrease, and (ii) the trolling survey index (piston-line index of age 1) increasing from the previous two estimates which were both zero. There are some consistently positive recent trends in the age-based longline CPUE estimates for a number of Members, including the Japanese (core vessels) and Korean fleets but overall the most recent estimates are near to recent estimates or have decreased slightly. For the first time in 2019, the ESC noted an increase from 2010 to 2014 in the CKMR empirical index derived from the POPs; However, in 2015 this decreased slightly.

Annual Review of implementation of current MP

165. In 2020 the ESC evaluated whether there are events, or observations, that are outside the range for which the CTP was tested, and the implications of this for TAC setting. The scope of this evaluation covered (i) all input data (gene-tagging, CPUE, and POP and HSP) used by the CTP to calculate a recommended global TAC; (ii) changes in estimates of the population's dynamics and productivity incorporated into the 2020 stock assessment; (iii) the shift in size distribution towards small fish in the Indonesian spawning ground fishery since 2013; and (iv) the potential for fishing mortality (from Members and non-Members) to be greater than that used to calculate the TAC recommended by the MP. Following the meta-rule review of exceptional circumstances, the ESC concluded there was no reason to declare exceptional circumstances, and hence to perhaps modify the TAC recommended by the CTP.

Non-Member catches

166. While the estimate of non-Member UAM has little effect on current stock status, it can affect rebuilding of the stock. This is not currently an issue for the CTP and the TAC calculated for recommendation for the period 2021-2023, because the CTP is robust to the most recent estimate of non-Member UAM, at least within the range tested. The 2020 TAC has an amount deducted as UAM, but the TAC now recommended for 2021-2023 already accounts for the latest UAM estimates, so that no UAM deduction is required.

Current TAC

167. CCSBT 23 adopted TAC values based on application of the Bali Procedure: 17,647t annually from 2018-2020.

MP TAC Recommendations

168. Application of the CTP adopted by CCSBT 26 results in an annual TAC of 17,647t for the period 2021-2023. Based on the review of the exceptional

circumstances, the ESC therefore recommended the annual TAC for the 2021-2023 quota block should remain as 17,647t.

Response to CCSBT 26 request for advice on reaching SSB_{MSY} under the current TAC

169. SSB_{MSY} (or TRO_{MSY} which is the related quantity estimated in the SBT stock assessment) is well estimated for only relatively few stocks globally and is sensitive to assumptions concerning stock productivity. In the stock assessment for SBT, estimates of TRO_{MSY} and TRO_{MSY}/TRO_0 are highly sensitive to the values of stock-recruitment steepness used in the stock assessment grid (agenda item 9). The current grid results in a TRO_{MSY}/TRO_0 estimate with a median of 0.30 (80% PI: 0.22-0.35), which happens to be the same as the CCSBT's agreed target to be reached by 2035 and as was specified for tuning of the CTP. The CTP is designed and tuned to achieve this target in median terms while allowing fishery development by varying how much surplus production can be used for TACs while ensuring continued rebuilding. If the TAC were kept constant at 17,647t, then currently the estimated year at which 30% TRO_0 would be achieved with 0.5 probability is 2033.

<u>Agenda Item 13. Update of the Scientific Research Plan (SRP)</u>

170. Australia presented paper CCSBT-ESC/2008/15 which provided a brief review of the 2014-2018 SRP activities and outlined some initial considerations for future activities under the SRP for 2021-2025. The review provided an initial summary of progress against the 2014-2018 activities that were listed in the plan developed in 2013. The review highlighted the substantial progress that has been made in the areas of i) characterisation of the catch, ii) indices of abundance, iii) estimation of biological parameters, iv) MP implementation, and v) stock assessment and OM development. Initial considerations for future activities outlined in the paper included i) quantifying different sources UAM, in particular methods for determining the plausibility of non-Member UAM, ii) a shift to using catch-at-age rather than cohort slicing, iii) completing work on size/age at maturity, iv) a design study for an e-tagging project to examine the potential effects of environmental change and spatial dynamics of the stock, and v) a strategic review and refinement of operation of the OM code.

171. The ESC considered that the review is a useful starting point for a more in-depth review and a focussed discussion on future priorities by the ESC in 2021, when it may be possible to allocate sufficient time towards a more thorough discussion of the SRP, as well as taking account of some preparatory work that could be undertaken in 2020/21.

172. In addition to the future activities identified in this review, the ESC commented that the continuation of recruitment monitoring through the Japanese trolling surveys, gene tagging, and the Taiwanese LL CPUE analyses are important for understanding the drivers of recruitment variability. These activities should be considered as part of the further development of the SRP.

173. The ESC discussed three main priority areas for the SRP: i) estimation of non-Member UAM; ii) progression of CPUE analyses and iii) a design study for an e-tagging project.

Non-Member UAM

174. The ESC noted that the minimum 3-vessel rule that applies to the provision of data from RFMOs may have been relaxed for some RFMOs. Specifically, it was noted that CCSBT now has an agreement with WCPFC for the provision of operational-level data, which allows access to data without the minimum 3-vessel restriction for CCSBT use.

175. The ESC also noted the important distinction between direct and indirect methods for estimating non-Member UAM. Indirect methods use information on non-Member effort distribution and catch rates from Members to estimate the potential scale of UAM. However, direct methods, such as market surveys, can provide information to evaluate the plausibility of these estimates.

176. The ESC noted that updated estimates of non-Member UAM could be influential for the OM and TAC settings, and agreed that updated estimates would be required by 2022 to be included in the next possible tuning of the MP. The ESC encouraged Members to prepare more detailed proposals for estimating non-Member UAM intersessionally that could be considered at ESC 26.

Indirect estimation of non-Member UAM

177. The report of OMMP11 in June 2020, as well as discussions at ESC 25 identified several issues that require further investigation before the next time non-Member-UAM is updated.

178. While the estimate of non-Member-UAM is an issue that affects stock assessment results, it is not currently an issue for the Management Procedure (and the resulting TAC), which is robust to the most recent estimate of non-Member-UAM. It was however agreed that further work needs to be conducted to examine potential sources of bias fully and to recommend refinements to be incorporated next time the estimates are updated – this should preferably occur in 2022 prior to the next scheduled stock assessment in 2023.

179. The list below is a preliminary, based on those two meetings that could bias the estimates either up or down, or are a source of uncertainty that may change the estimates in an unknown direction:

- Uncertainty in catches from EU vessels fishing in the Indian Ocean and other SBT areas;
- Potential non-reporting from IUU vessels and other NCNM fleets;
- The appropriateness of applying the targeted (Japanese) catch rate to the effort estimates, or the Taiwanese catch rate, or something in-between the two, or a combination of the catchabilities of all major fleets (Japan, Korea and Taiwan);
- If the estimated catches were made, what was their fate: were they retained or discarded (including potentially being released alive);
- If estimated catch is actually being discarded, is it composed of undersized fish or adults, and/or what are the likely proportions of each;
- Differences in the size compositions of Japanese and Taiwanese fleets, which is relevant to which fishery sector the estimates of UAM are assigned; currently all are assumed to belong to LL1;

- Fishing strategies both within and between fleets also differ depending on the species being targeted, which could be an important consideration;
- The effect of the recent ban on retention of SBT catch by China, which was identified as an analysis priority by ESC 24, but has not yet occurred and needs to be progressed; and
- Estimates of mortality rates for discarded catch which need to be examined further.

180. These sources of uncertainty should be discussed further at or prior to ESC 26 with a view to developing a research project to be undertaken in 2021/22.

Direct estimation of non-Member UAM

181. The ESC recalled that there have been no direct estimates of non-Member UAM since the trade and market reviews for the presence of SBT in non-Member markets (CCSBT- ESC/1609/37) were completed in 2016.

182. The ESC noted paper CCSBT-ESC/2008/23 from Japan that outlines a proposal for monitoring catches of SBT in the Japanese market and that this study would provide improved estimates of non-Member catches if they were distributed in the Japanese market. Although the current survey is limited to the Japanese market, the ESC noted the value of extending this survey to other markets to provide a wider perspective of potential non-Member catch, and that item a4 of the Japan's proposal relates to this point.

Progression of CPUE analyses

183. The OMMP working group recommended that further CPUE analyses be given high priority among Member scientists. Specifically, further examination of spatio-temporal models that may improve upon the GAMs conducted for this meeting was encouraged.

184. Based on the intersessional work that has been completed, the estimates used in this year's assessment resulted in substantially reduced estimates of CPUE for 2018, and therefore a reduced abundance for the 2013 cohort together with trends that differed from previous analyses. As noted in CCSBT-ESC/2008/26, there was little difference among CPUE standardisation approaches that used the variable squares approach, but substantial differences for the constant squares approach. In particular, the ESC concluded that methods are needed that are robust to a lack of data in marginal area-month strata.

185. Given that the CPUE working group identified an alternative CPUE methodology that is considered an improvement on the one adopted as input to the CTP, the ESC should evaluate this methodology and, if approved, discuss how to use it in the future (perhaps for MP re-tuning, if appropriate).

186. While some improvements can be made with aggregated data, a finer spatial scale would be more useful and, ideally, the full dataset of fishing events should be the basis for the most useful analysis. To more fully enable model improvement, the following were suggested most likely to provide insights and improvements:

- GAM
  - Further develop GAM method [priority: high / time requirement: medium]

        - Further investigate appropriate spatio-temporal smoothers for GAM models (alternatives to the te() smoother)
        - Investigate alternative ways of adjusting for effective sample size to reduce the propensity for overfitting (the exploratory analysis currently adopted simply divided the sample size by 2, but other approaches were not investigated)
        - Consider the "extreme prediction diagnostic" developed for the current GAM model, which could be improved with further analysis; it certainly alleviated the issue of high CPUEs being predicted for area-time cells with little or no data but was insufficiently explored
        - Further investigate the process for selecting squares to be included in the constant squares approach predictions

- GAM and GLMM
    - Use of the formulation, lognormal(CPUE + constant), has been superseded in recent years by adoption of hurdle or zero-inflated models to deal with zero-catch strata instead of adding a constant; these should be further investigated [priority: medium / time requirement: medium]
    - Identify factors that cause differences between nominal time series and the various indices [priority: high / time requirement: short]
- VAST
    - Develop an auto-regressive spatio-temporal standardisation application that can best deal with unbalanced data extent and availability [priority high / time requirement high]
- Other important considerations
    - Acquire a better understanding of the reasons for changes in fishing fleet behaviour and distribution for all fleets that catch SBT, both to formulate and to evaluate CPUE models; this should include economic, regulatory and environmental changes. For example, the effects of quotas on vessel behaviour and catch rates, particularly within-season, may be useful to investigate. [priority: medium, due to complexity of analyses and the difficulty of obtaining relevant data for all fleets / time requirement: high].
    - Examine potential effects of climate change, in particular whether changes in oceanic currents and temperatures are affecting fish (and fleet) distributions. [priority: low-medium / time requirement: medium].
- Data availability [prioritised according to the potential to affect indices]
    - Obtain data from other fleets operating in various areas, including non-core vessels, and vessels where SBT is a bycatch of other tuna and related fisheries (this may help to fill in gaps in the Japanese longline core vessel data). [priority: medium / time requirement: medium].
    - Enquire regarding the availability of 1x1-degree spatial data resolution data. [priority: medium / time requirement: medium].
    - Obtain coded vessel identification information to determine whether there is a vessel effect (often a key determinant of standardised CPUE in other fisheries). [priority: high / time requirement: medium].

  - Acquire additional information such as Hooks Between Floats (HBF), changes in technology that may influence catchability, and catches of other species to permit targeting analyses. [priority: high / time requirement: medium].

187. Potential development of other models should be considered, including ways to integrate over other fleets and areas. Progress on CPUE activities would ideally involve the EC supporting a small technical subgroup to develop a paper for next year's ESC meeting, with a full study to commence the following year. The logistics of working with different resolutions of datasets should be a high priority so that the requisite algorithms and approaches can be developed. One approach recently completed illustrates how multiple fleets and comparative approaches can be tackled (WCPFC-SC16-2020/SA-IP-07).

Discussion

188. It was noted that there may be difficulties in running CPUE standardisations with finer spatial scale CPUE data (e.g. shot-by-shot data) due to confidentiality requirements for accessing the data and the increased computer processing time required to analyse these larger data sets. Japan proposed that aggregated data should be used as the base case approach, and that the finer spatial scale data be used in sensitivity analyses to examine the differences in results for the two approaches.

189. The ESC recommended that sufficient resources be made available so that a small technical subgroup, including consultants, can be convened to progress the highest priority elements (at least) of the work on CPUE outlined above prior to ESC 26.

Design study for an e-tagging project

190. Australia presented paper CCSBT-ESC/2008/35 which outlined a proposal for a design study to evaluate alternative potential electronic tagging programs to understand the implications of changes in the migration of SBT. The proposed 1-year design study would refine the relevant outstanding questions about migration, movement and residency, and examine the feasibility and costs of alternative electronic tagging programs to answer these questions. The design study would use existing data to simulate likely return rates of tags, discuss opportunities for collaboration with CCSBT and other scientists and report back to ESC 26.

191. The ESC drew attention to the value of collaborating with CCSBT scientists and scientists from other RFMOs to share methods and experiences and to develop capacity in the design and analysis of electronic tagging projects.

192. The ESC noted that a budget had been developed for the 1-year design study but that it was difficult to estimate a budget for a full electronic tagging program when the specific questions to be addressed have not yet been identified, and the approach (e.g. tag types and numbers, tagging platform) to addressing the questions is also yet to be developed. It was noted that an electronic tagging program is likely to be a relatively large and expensive project, which highlights the importance of completing a design study to examine feasibility before implementing a full-scale project.

193. The ESC supported the proposal for a design study to evaluate the feasibility of an electronic tagging program and recommended that it be funded.

194. The ESC noted that a comprehensive review and planning for the SRP was not possible at the ESC 25 due to the priority accorded to reviewing the stock assessment and to running the MP for TAC setting. A comprehensive review of and planning for the SRP needs to be revisited at ESC 26, and Members are encouraged to discuss potential research priorities and develop proposals intersessionally.

Agenda Item 14. Requirements for Data Exchange in 2021

195. Discussion for this agenda item commenced by correspondence in advance of the ESC.

196. The Secretariat submitted paper CCSBT-ESC/2008/05 which proposed the data exchange requirements for 2021. These requirements were based on the 2020 data exchange requirements with all items rolled over and the dates incremented. One change was that the Core Vessel CPUE Series provided by Japan had been split into separate items for the MP and the OM, following changes to the OM series agreed at OMMP 11. These proposed data exchange requirements were endorsed by the ESC and are provided in **Attachment 10**.

Agenda Item 15. Research Mortality Allowance

197. Discussion for this agenda item commenced by correspondence in advance of the VC.

198. CSIRO submitted paper CCSBT-ESC/2008/06 on the CCSBT gene-tagging program. The research mortality allowance (RMA) approved for the gene-tagging program in 2020 was not used. The gene-tagging program requested 2t of RMA for field work in 2021. It was noted that mortalities will be minimised to the extent possible. The ESC endorsed this RMA request.

199. Japan presented paper CCSBT-ESC/2008/27. Japan reported 0.2402t of RMA usage for 2019/2020 from the RMA approval 1.0t. Japan requested 1.0 ton of RMA for the 2020/2021 research, including for an age-0 distribution survey and an age-1 trolling survey in Western Australia. Japan's RMA request was endorsed by the ESC.

Agenda Item 16. Workplan, Timetable and Research Budget for 2021 (and beyond)

16.1. Overview, time schedule and budgetary implications of proposed 2021 research activities and implications of Scientific Research Program for the work plan and budget

200. Resources required for the ESC's three-year workplan are provided at **Attachment 11**. Resource required for 2022 to 2023 are uncertain, particularly

with respect to the e-tagging program, which is dependent on outcomes of the design study proposed for 2021.

16.2. Timing, length and structure of next meeting

201. The tentative date for the next ESC meeting is from 30 August 2021 to 4 September 2021 inclusive, in Brisbane, Australia.

202. It was noted that there is no certainty that current travel restrictions associated with the COVID-19 pandemic will have eased sufficiently to allow a physical meeting to proceed by the date of the next ESC meeting. If a physical meeting cannot proceed, it is planned that a virtual meeting will be conducted instead, and that participants reserve two additional days (6 and 7 September 2020) as contingency days to allow the extra time required in the event of a virtual meeting.

203. Participants were requested to provide feedback to the Secretariat after the meeting on how the format and operation of the virtual meeting could be improved in case a virtual ESC meeting is required in 2021, and to assist with making arrangement for Compliance Committee and Extended Commission meetings in four weeks' time.

Agenda Item 17. Other Matters

204. Japan requested that the next ESC meeting consider how best information might be provided on a probability distribution for the size of the next TAC change for the period following 2023.

Agenda Item 18. Adoption of Meeting Report

205. The report was adopted.

Agenda Item 19. Close of meeting

206. The meeting closed at 11:43 am on 7 September 2020 Canberra time.

List of Attachments

Attachments

Attachment 1

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Extended Scientific Committee Meeting
of the Twenty Fifth Meeting of the Scientific Committee

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Attachment 2

Agenda
Extended Scientific Committee for the Twenty Fifth Meeting of the Scientific Committee

31 August - 5 September 2020 and 7 September 2020

1. **Opening**
   1.1. Introduction of Participants
   1.2. Administrative Arrangements

2. **Appointment of Rapporteurs**

3. **Adoption of Agenda and Document List**

4. **Review of SBT Fisheries**
   4.1. Presentation of National Reports
   4.2. Secretariat Review of Catches

5. **Report from the Eleventh Operating Model and Management Procedure (OMMP) Technical Meeting**

6. **Consideration of farm and market issues**
   6.1. Farm uncertainties
   6.2. Market uncertainties

7. **Review of results of the Scientific Research Plan and other inter-sessional scientific activities**
   7.1. Results of scientific activities
   7.2. Updated analysis of SBT catch by non-Members

8. **Evaluation of Fisheries Indicators**

9. **SBT Stock Assessment**

10. **Operation of the new MP (Cape Town Procedure)**
    10.1. Specification of the Cape Town Procedure
    10.2. Evaluation of meta-rules and exceptional circumstances
    10.3. MP recommended TAC for 2021 – 2023

11. **Summary of the SBT stock status**

12. **SBT Management Advice**

13. **Update of the Scientific Research Plan (SRP)**

14. **Requirements for Data Exchange in 2021**

15. **Research Mortality Allowance**

16. **Workplan, Timetable and Research Budget for 2021 (and beyond)**
    16.1. Overview, time schedule and budgetary implications of proposed 2021 research activities and implications of Scientific Research Plan for the work plan and budget
    16.2. Timing, length and structure of next meeting

17. **Other Matters**

18. **Adoption of Meeting Report**

19. **Close of Meeting**

Attachment 3

List of Documents
Extended Scientific Committee
for the Twenty Fifth Meeting of the Scientific Committee

(CCSBT-ESC/2008/)

1. Provisional Agenda
2. List of Participants
3. List of Documents
4. (Secretariat) Secretariat review of catches (Rev.1) (ESC agenda item 4.2)
5. (Secretariat) Data Exchange (ESC agenda item 14)
6. (CCSBT) Report of the SBT gene- tagging program 2020 (ESC Agenda item 7.1)
7. (CCSBT) Update on the SBT close-kin tissue sampling, processing and kin-finding (ESC Agenda item 7.1)
8. (CCSBT) Update on the length and age distribution of southern bluefin tuna (SBT) in the Indonesian longline catch (ESC Agenda item 7.1)
9. (Australia) Preparation of Australia's southern bluefin tuna catch and effort data submission for 2019 (ESC Agenda item 4.1)
10. The Cape Town Procedure specification (ESC Agenda item 10.1)
    - 10 - 1. (Australia) Introduction to the CCSBT Management Procedure
    - 10 - 2. (Australia) Specification of the population model and HCR used in the MP
    - 10 - 3. (Australia) Data analysis specification for the Gene-tagging abundance estimates used in the MP
    - 10 - 4. (Australia) Specification for the Close-Kin Mark-Recapture data used in the MP
    - 10 - 5. (Japan) Specification of Standardised CPUE for the MP
    - 10 - 6. (Australia and Japan) Meta-rule process
11. (Australia) Fishery indicators for the southern bluefin tuna stock 2019–20 (ESC Agenda item 8)
12. (Australia and Japan) The assessment of stock status in 2020 (Rev.2) (ESC Agenda item 9)
13. (Australia) Information breakdown for steepness parameter in the CCSBT OM (ESC Agenda item 9)
14. (Australia) Meta-rules: consideration of exceptional circumstances in 2020 (ESC Agenda item 10.2)
15. (Australia) CCSBT Scientific Research Program: A brief review (2014-2018) (ESC Agenda item 13)

16. (Indonesia) Proportion of SBT catches in Spawning Area from Indonesia fleets 2019 (ESC Agenda item 4.1)
17. (Japan) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2019 (ESC Agenda item 7.1)
18. (Japan) Activities of southern bluefin tuna otolith collection and age estimation and analysis of the age data by Japan in 2019 (ESC Agenda item 7.1)
19. (Japan) Report of the piston-line trolling monitoring survey for the age-1 southern bluefin tuna recruitment index in 2019/2020 (ESC Agenda item 7.1)
20. (Japan) Trolling indices for age-1 southern Bluefin tuna: update of the piston line index and the grid type trolling index (ESC Agenda item 7.1)
21. (Japan) Report of the age-0 southern bluefin tuna distribution in the northwest coast of Western Australia in 2019 (ESC Agenda item 7.1)
22. (Japan) Monitoring of Southern Bluefin Tuna trading in the Japanese domestic markets: 2020 update (ESC Agenda item 6.2)
23. (Japan) Proposal on monitoring of SBT distribution in Japan to verify catch of all Members (ESC Agenda item 6.2)
24. (Japan) A check of operating model predictions from the viewpoint of implementation of the management procedure in 2020 (ESC Agenda item 10.2)
25. (Japan) Summary of fisheries indicators of southern bluefin tuna stock in 2020 (ESC Agenda item 8)
26. (Japan) Examination of the abundance index for southern bluefin tuna calculated through GAM CPUE standardization (ESC Agenda item 8)
27. (Japan) Report of the 2019/2020 RMA utilization and application for the 2020/2021 RMA (ESC Agenda item 15)
28. (Korea) Korean SBT otolith collection activities in 2019 (ESCAgenda item 7.1)
29. (New Zealand) Investigation of potential CPUE model improvements for the primary index of Southern Bluefin Tuna abundance (ESC Agenda item 8)
30. (Taiwan) Preparation of Taiwan's Southern bluefin tuna catch and effort data submission for 2019 (ESC Agenda item 4.1)
31. (Taiwan) Preliminary estimated discarded amounts of southern bluefin tuna for Taiwanese longline fishery in 2018 and 2019 (ESC Agenda item 7.1)
32. (Taiwan) Updated analysis for gonad samples of southern bluefin tuna collected by Taiwanese scientific observer program (ESC Agenda item 7.1)
33. (Taiwan) Updated report of direct ageing of the SBT caught by Taiwanese longliners in 2018 (ESC Agenda item 7.1)
34. (Taiwan) CPUE standardization for southern bluefin tuna caught by Taiwanese longline fishery for 2002-2019 (ESC Agenda item 7.1)

35. (Australia) Proposal for a design study to evaluate potential electronic tagging programs to understand implications of changes in migration of SBT (ESC Agenda item 13)

(CCSBT- ESC/2008/BGD)

1. (Japan) Change in operation pattern of Japanese southern bluefin tuna longliners in the 2019 fishing season (*Previously* CCSBT-OMMP/2006/10) (ESC Agenda item 8)
2. (Japan) Update of the core vessel data and CPUE for southern bluefin tuna in 2020 (*Previously* CCSBT-OMMP/2006/11) (ESC Agenda item 8)
3. (Japan) Examination of an anomalously high value of the core vessel CPUE in 2018 for southern bluefin tuna (*Previously* CCSBT-OMMP/2006/12) (ESC Agenda item 8)
4. (New Zealand and Australia) Estimates of SBT catch by CCSBT non-cooperating non-member states between 2007 and 2017 (*Previously* CCSBT-OMMP/2006/04) (ESC Agenda item 7.2)
5. (Korea) Data Exploration and CPUE Standardization for the Korean Southern Bluefin Tuna Longline Fishery (1996-2019) (*Previously* CCSBT-OMMP/2006/13) (ESC Agenda item 8)
6. (Australia) Running the Cape Town Procedure for 2020 (Rev.1) (*Previously* CCSBT-OMMP/2006/08) (ESC Agenda item 10.3)
7. (Australia) Summary of updated CKMR data and model performance in the Cape Town Procedure (*Previously* CCSBT-OMMP/2006/14) (ESC Agenda item 10.3)

(CCSBT-ESC/2008/SBT Fisheries -)

Australia	Australia’s 2018–19 southern bluefin tuna fishing season
European Union	Annual Review of National SBT Fisheries for the Extended Scientific Committee
Indonesia	Indonesia Southern Bluefin Tuna Fisheries: A National Report 2019
Japan	Review of Japanese Southern Bluefin Tuna Fisheries in 2019 (Rev.1)
Korea	2020 Annual National Report of Korean SBT Fishery (Rev.1)
New Zealand	New Zealand Annual Report to the Extended Scientific Committee
South Africa	South African National Report to the Extended Scientific Committee of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), 2020
Taiwan	Review of Taiwan SBT Fishery of 2018/2019 (Rev.1)

(CCSBT-ESC/2008/Info)

1. (Indonesia) Indonesia scientific observer program activities in Indian Ocean 2019 (ESC agenda item 4.1)
2. (Indonesia) Update on SBT monitoring program in Benoa port, Bali, Indonesia 2019 (ESC agenda item 4.1)
3. (Indonesia) Update Study of the Reproductive Activity of SBT Caught in Indonesian Tuna Fisheries (ESC agenda item 4.1)
4. (Australia) Rapid epigenetic age estimation for southern bluefin tuna (ESC Agenda item 7.1)
5. (Australia) Next-generation Close-kin Mark Recapture: Using SNPs to identify half- sibling pairs in Southern Bluefin Tuna and estimate abundance, mortality and selectivity (ESC Agenda item 7.1)

(CCSBT-ESC/2008/Rep)

1. Report of the Eleventh Operating Model and Management Procedure Technical Meeting (June 2020)
2. Report of the Twenty Sixth Annual Meeting of the Commission (October 2019)
3. Report of the Twenty Fourth Meeting of the Scientific Committee (September 2019)
4. Report of the Tenth Operating Model and Management Procedure Technical Meeting (June 2019)
5. Report of the Twenty Fifth Annual Meeting of the Commission (October 2018)
6. Report of the Twenty Third Meeting of the Scientific Committee (September 2018)
7. Report of the Ninth Operating Model and Management Procedure Technical Meeting (June 2018)
8. Report of the Fifth Meeting of the Strategy and Fisheries Management Working Group (March 2018)
9. Report of the Special Meeting of the Commission (August 2011)
10. Report of the Sixteenth Meeting of the Scientific Committee (July 2011)

Global Reported Catch By Flag

Reviews of southern bluefin tuna data presented to a special meeting of the Commission in 2006 suggested that the catches may have been substanstially under-reported over the previous 10 to 20 years. The data presented here do not include estimates for this unreported catch.
All shaded figures are subject to change as they are either preliminary figures or they have yet to be finalised.
Blank cells are unknown catch (many would be zero).

	Australia			New Zealand									
Calendar Year	Commercial	Amateur	Japan	Commercial	Amateur	Korea	Taiwan	Philippines	Indonesia	South Africa	European Union	Miscellaneous	Research & Other
1952	264		565	0		0	0	0	0	0	0	0	
1953	509		3,890	0		0	0	0	0	0	0	0	
1954	424		2,447	0		0	0	0	0	0	0	0	
1955	322		1,964	0		0	0	0	0	0	0	0	
1956	964		9,603	0		0	0	0	0	0	0	0	
1957	1,264		22,908	0		0	0	0	0	0	0	0	
1958	2,322		12,462	0		0	0	0	0	0	0	0	
1959	2,486		61,892	0		0	0	0	0	0	0	0	
1960	3,545		75,826	0		0	0	0	0	0	0	0	
1961	3,678		77,927	0		0	0	0	0	145	0	0	
1962	4,636		40,397	0		0	0	0	0	724	0	0	
1963	6,199		59,724	0		0	0	0	0	398	0	0	
1964	6,832		42,838	0		0	0	0	0	197	0	0	
1965	6,876		40,689	0		0	0	0	0	2	0	0	
1966	8,008		39,644	0		0	0	0	0	4	0	0	
1967	6,357		59,281	0		0	0	0	0	5	0	0	
1968	8,737		49,657	0		0	0	0	0	0	0	0	
1969	8,679		49,769	0		0	80	0	0	0	0	0	
1970	7,097		40,929	0		0	130	0	0	0	0	0	
1971	6,969		38,149	0		0	30	0	0	0	0	0	
1972	12,397		39,458	0		0	70	0	0	0	0	0	
1973	9,890		31,225	0		0	90	0	0	0	0	0	
1974	12,672		34,005	0		0	100	0	0	0	0	0	
1975	8,833		24,134	0		0	15	0	0	0	0	0	
1976	8,383		34,099	0		0	15	0	12	0	0	0	
1977	12,569		29,600	0		0	5	0	4	0	0	0	
1978	12,190		23,632	0		0	80	0	6	0	0	0	
1979	10,783		27,828	0		0	53	0	5	0	0	4	
1980	11,195		33,653	130		0	64	0	5	0	0	7	
1981	16,843		27,981	173		0	92	0	1	0	0	14	
1982	21,501		20,789	305		0	182	0	2	0	0	9	
1983	17,695		24,881	132		0	161	0	5	0	0	7	
1984	13,411		23,328	93		0	244	0	11	0	0	3	
1985	12,589		20,396	94		0	241	0	3	0	0	2	
1986	12,531		15,182	82		0	514	0	7	0	0	3	
1987	10,821		13,964	59		0	710	0	14	0	0	7	
1988	10,591		11,422	94		0	856	0	180	0	0	2	
1989	6,118		9,222	437		0	1,395	0	568	0	0	103	
1990	4,586		7,056	529		0	1,177	0	517	0	0	4	
1991	4,489		6,477	164		246	1,460	0	759	0	0	97	
1992	5,248		6,121	279		41	1,222	0	1,232	0	0	73	
1993	5,373		6,318	217		92	958	0	1,370	0	0	15	
1994	4,700		6,063	277		137	1,020	0	904	0	0	54	
1995	4,508		5,867	436		365	1,431	0	829	0	0	201	296
1996	5,128		6,392	139		1,320	1,467	0	1,614	0	0	295	290
1997	5,316		5,588	334		1,424	872	0	2,210	0	0	333	
1998	4,897		7,500	337		1,796	1,446	5	1,324	1	0	471	
1999	5,552		7,554	461		1,462	1,513	80	2,504	1	0	403	
2000	5,257		6,000	380		1,135	1,448	17	1,203	4	0	31	
2001	4,853		6,674	358		845	1,580	43	1,632	1	0	41	4
2002	4,711		6,192	450		746	1,137	82	1,701	18	0	203	17
2003	5,827		5,770	390		254	1,128	68	565	15	3	40	17
2004	5,062		5,846	393		131	1,298	80	633	19	23	2	17
2005	5,244		7,855	264		38	941	53	1,726	29	0	0	5
2006	5,635		4,207	238		150	846	50	598	15	3	0	5

Calendar Year	Australia Commercial	Australia Amateur	Japan	New Zealand Commercial	New Zealand Amateur	Korea	Taiwan	Philippines	Indonesia	South Africa	European Union	Miscellaneous	Research & Other
2007	4,813		2,840	379	4	521	841	46	1,077	58	18	0	3
2008	5,033		2,952	319	0	1,134	913	45	926	44	14	4	10
2009	5,108		2,659	419	0	1,117	921	47	641	40	2	0	0
2010	4,200		2,223	501	0	867	1,208	43	636	54	11	0	0
2011	4,200		2,518	547	0	705	533	45	842	64	3	0	1
2012	4,503		2,528	776	0	922	494	46	910	110	4	0	0
2013	4,902		2,694	756	1	918	1,004	46	1,383	67	0	0	0
2014	4,559		3,371	826	0	1,044	944	45	1,063	56	0	0	1
2015	5,824		4,745	922	1	1,051	1,162	0	593	63	0	0	0
2016	5,962		4,721	951	1	1,121	1,023	0	601	64	0	0	2
2017	5,221		4,567	913	21	1,080	1,171	0	835	136	0	0	2
2018	6,401		5,945	1,008	12	1,268	1,218	0	1,087	207	0	0	2
2019	6,185		5,851	959	2	1,238	1,230	0	1,206	172	0	0	0

European Union: From 2006, estimates are from EU reports to the CCSBT. Earlier catches were reported by Spain and the IOTC.
Miscellaneous: Before 2004, these were from Japanese import statistics (JIS). From 2004, the higher value of JIS and CCSBT TIS was used combined with available information from flags in this category.
Research and other: Mortality of SBT from CCSBT research and other sources such as discarding practices in 1995/96.

Attachment 5

Outline of comments/questions to CCSBT-ESC/2008/23 and Japan's response

General matters

(Q1) How would the proposal contribute to "reduction of market uncertainty"?

(A) The primary objective of the proposal is "verification of catch reported by Members using information on SBT product distribution" and NOT "Reduction of market uncertainty." SBT product distribution (Market) information is no more than a mean to achieve the objective. As mentioned in page 5, the verification using market information should be conducted for the sole purpose of detecting potential over-catch exceeding certain level (or confirming non-existence of such a large over-catch). Even if some over-catch is reported, this would be less serious if it is accurately reported as numerical figure, because this may be factored in management. Also, item ***c*** *(development of system to detect illegally caught product) would contribute to measure (which may contribute to reduce) the degree of uncertainty relating to what is not reported: unaccounted mortalities.*

(Q2) Development of the Terms of References (ToR) will be useful for further consideration

(A) The drafting of ToR will be useful for further discussion and Japan is willing to draft it taking into account the discussion in the ESC.

(Q3) What will be expected budgetary implications?

(A) Preliminary and rough estimation is as follows:

- *Item a1-a4: 50,000 AUD as the consultation fee (tentatively the same amount as farm and market expert consultation fee combined) plus 6,000 AUD as the travel fee in the first year of implementation. It is possible that this will be multi-years project.*
- *Item b1-b2: No budgetary implication (except for staff cost in the Secretariat)*
- *Item b3 and c1: 50,000-60,000 AUD for management tag survey under the CCSBT budget*
- *Item b2: 18,900 AUD as the TCWG fee (as estimated in draft 2021 budget)*

(Q4) Primary destinations of some Member's catch is not Japan; e.g. USA. SBT product distribution survey focusing only Japan would not capture such SBT catch. Validity of regularly expending budget to this survey (especially in Toyosu market) would be discussion point.

(A) This is exactly what item a4 (with input information on global SBT product distribution obtained in b1) proposes; reassessment of the value of current survey focusing on Toyosu and possible development of a new survey system. If the a4 work reveals the specific necessity to conduct survey in other than Toyosu/Japan, it would be worth consideration. As mentioned in b3 of the proposal, this consideration would be necessary for future tag management survey design with a view to capture SBT which does not pass Toyosu market.

As mentioned in b3 and c1, purpose of Toyosu market survey includes detection of possible unaccounted SBT which is not quantitatively reported, not only estimation of SBT product distribution amount.

<u>Item by Item</u>

a. Verification of all Members' catch in Japanese market

(Q5) How the expert will be elected? Does Japan assume a particular expert as the candidate? Or the expert will be elected from the ground up?

(A) As mentioned in 2.a in page 4, given the importance of this matter to all CCSBT Members, the external experts should be elected once again based on consensus agreement (not voting) among all Members. Nominations from Members will be the basis for discussion.

(Q5 bis) In hiring external expert for this work, his/her neutrality is very important. We support that the expert should be elected based on consensus agreement among all Members.

(A) Thank you for your support.

(Q5 ter) We have been thinking about what information might be available to the expert. We understand that a lot of the market data is already available from the TMG. Can you advise whether the expert will be able to access that data, with JFA's support?

(A) Aggregated data on SBT traded in the Tokyo Metropolitan Central Wholesale Market is publicly available at the Tokyo Metropolitan Government (TMG) website. More detailed data would be available through procedures of information disclosure request to the Tokyo Metropolitan Government. Necessity of additional information disclosure request to TMG will be also considered by the Expert, taking into account the past discussions.

a1. Update of estimation formula of distribution amount of Japanese SBT catch in Japan

(Q6) This is what recommended by the Market Expert last year and understandable

(A) Thank you for positive comments.

a2. New development of estimation formulas for distribution amount of other Member's catch in Japan

(Q7) Would you expect that the expert considers this item from the ground up, or would there be any proposed basis for his/her consideration?

(A) The proposed basis for expert's consideration would be JMR estimation formula for Japan's catch. However, it should be taken into account that there are some statistical data which have been aggregated as "foreign (non-Japanese)" and are hard to separate by country. There would be some factors which require different considerations (e.g. difference of primary SBT product distribution route, transaction method and/or customers). We would like the expert to consider to what extent the precision of estimate for non-Japanese catch could be improved, including search for other available statistics.

(Q8) In some years in the figure for Korea at Attachment 2, import exceeds the reported catch. Does it include those SBT which is reexported to Japan?

(A) The figures in Attachment 2 is very simple plot on a pilot basis and this just an example for information to Members. There could be a need to take into account factors such as reexport and difference in year (time-lag).

a3. Calculation of distribution amount estimate based on formulas in (1) and (2) above

(Q9) How much budget will be required for calculation in every year? Who will do the regular calculation?

(A) The cost would depend on the outcome of a1 and a2 and it is hard to estimate at present. We assume the hired expert as the possible subject of initial calculation for input to a4 work. From the second calculation and beyond, it is hard to assume the subject at present.

a4. Calculation of the proportion of the estimated distribution amount in (3) to the global distribution amount of SBT and assessment of the value of the estimation works

(Q10) It is hard to specifically imagine “a new system to utilize SBT distribution data for compliance purpose.”

(A) The new system may include, for example, a new SBT product distribution amount estimation methodology which focuses on not only Toyosu but also other channels (e.g. off-market transactions, SBT product distribution to other economies than Japan) and/or a new market survey(s) in other destinations than Toyosu/Japan.

(Q) Is the cost for a4 separated from other elements?

(A) No. It is included in the cost for entire element “a” as shown in Q3 above.

<u>b. Further utilization of CDS data</u>

b1. Verification of SBT international trade and domestic distribution utilizing CDS data

(Q11) This work has been already undertaken by the Secretariat. Visual benefit of merging some tables which are currently separate is understandable, but how would it contribute to “reduction of market uncertainty?”

(A) As mentioned in the first question, the objective of the proposal is “Reduction of verification of catch reported by Members using information on SBT product distribution,” and NOT “Reduction of market uncertainty.” We consider that the proposed re-formatting of tables would provide more visually easy-to-understand information on global SBT product distribution than present, which is the important input to the objective. Also, this information will be necessary input to work in a4 (reassessment of the value of current survey focusing on Toyosu and proposal for a new survey system). For this reason, we propose giving it a try as the first step. Seeking advice or feedback from the expert hired in item a might be another possibility.

(Q12) With regard to Attachment 4, the row in the right end (A-B+C) would need clarification with regard to which of “Report,” “CDS” and “Comtrade” should be basis for calculation.

(A) CDS capturing all the legitimate SBT catch should be primarily used for the calculation. Other data sources (Report, Comtrade) will be the secondary information to verify the CDS data.

(Q12 bis) It may be a good idea to merge the relevant tables, but it should be taken into account that there is difference between reliability of different data sources. For example, there was a case where almost twice amount of SBT trade as CDS-based value is recorded and later it turns out to be due to miscoding in trade statistics.

(A) Yes, that point would need to be taken into account. It is possible that the lower reliability of trade data is improved through examination upon flagged large discrepancies by the merged table. Such improved trade data might become more useful for future catch verification purpose.

b2. Development of Resolution to seek cooperation of non-Members

(Q13) Primary action assumed in the Action Plan are trade restrictive measure against uncooperative non-Members. Such action is covered in the Resolution on Authorized Vessels and CDS Resolutions. It is uncertain how much it would contribute to strengthening the action against non-Members through developing the Resolution. Also, it is uncertain how much it would be appealing to non-CCSBT parties through exposure in the CCSBT website. Anyway, the EC should provide something like a format or guidance.

(A) Development of Resolution is proposed as an example of possible method for improvement. Whatever the method is, important point is to verify accuracy of suspected catch and/or trade information by non-Members with greater reliability. Given the importance of this, our proposal is to give it a try, as the first step. Of course, this will be EC matter and the discussion in EC would be necessary.

(Q13 bis) Before jumping to new Resolution for non-Members, more utilization of stipulations relevant to non-Members in the existing Resolutions should be considered. Relationship with the WTO Agreement should be also carefully considered.

(Q13 ter) The spirit of this item is understandable. Basic course of action to develop more standardized approach to non-Members seems reasonable. Nevertheless it seems a bit premature to use trade restrictive measures from the beginning.

(A) Thank you for comments. These points would need to be further discussed in EC.

b3. Verification of reported catch with tag data

(Q14) This would be a good proposal. This would be only one opportunity where CTF data and actual fish can be compared by third party. Because only the Secretariat can access CTF data without special authorization from relevant Members, it would be appropriate that the Secretariat undertakes this work.

(A) Thank you for positive comments.

(Q14 bis) Generally support this item for better implementation of the CDS Resolutions by Members. However, the idea to expend the implementation cost of tag management survey from the CCSBT budget would require careful consideration, as this may be a precedent which could lead to expansion of CCSBT's expense to a number of other national programs.

(A) Our proposal is to utilize tag management survey for verification of all Member's catch, which will be useful for all Members and proper management of SBT stock. The purpose of the survey would no longer be just a domestic monitoring scheme for Japan's catch and will be changed into international cooperation scheme for all Members, if the item is agreed. For this reason, we believe that it is sufficiently reasonable to expend from the CCSBT budget for the implementation.

(Q15 ter) Members raised the issue of cost and noted that in the interest of transparency it would be worthwhile considering the feasibility of any expanded tag survey being conducted by an independent third party. Would it replace the current tag survey by Japan?

(A) In case that the survey cost is funded by the CCSBT budget, of course the survey should be undertaken by an independent third party in terms of transparency and neutrality. If the expense from the CCSBT budget is agreed and implemented, it would replace the management tag survey currently conducted by Japan. If the survey coverage is sufficient would need to be considered in due course, taking account the examination result of item a4.

(Q15) It seems that Attachment 6 assumes that product type recorded in the CTF of a SBT individual and that of product sold in Toyosu market is always the same (the product type does not change in between). To what extent this assumption would be reliable?

(A) This would worth confirmation. In principle, the product type should not change especially with regard to frozen SBT in GG. The analysis result (good match) in Attachment 6 supports this assumption with regard to Japan's catch. It is not sure if there is cases where weight of imported fresh SBT in GG is measured in market after the product type is changed, and would worth confirmation to relevant Members.

(Q16) Is there any possibility of misunderstanding based on difference in method of tag numbering? Other Members than Japan use serial number, unlike Japan which uses numbering system by catch year and vessel. Would this difference affect the analysis result?

(A) Such a difference has been taken into account, and does not change the analysis result.

(Q17) Is Japan proposing to expend the cost for management tag survey (currently conducted by Japan) from CCSBT budget?

(A) Yes, as mentioned in the summary and page 4 of the proposal, once agreed on implementation of the proposal item(s), the implementation cost should be spent from the CCSBT Commission's budget, including that of management tag survey. The rough and preliminary estimate is 50,000-60,000 AUD. Meanwhile, even if the expenditure from the CCSBT budget is agreed immediately, it would be difficult to immediately move on to transformation from 2021. Given the current COVID-19 pandemic, there should be some preparatory period at least one more year for smooth and effective transformation for avoidance of confusion among relevant parties.

c. Development of system to detect illegally caught products

c1. Improvement of tagging based on current CDS Resolution

(Q18) This will be a good proposal and would like Japan to report the detected improper cases. Discussion for improvement would be also useful. With regard to Attachment 5-2, it is hard to understand the specific situation relating to N2, N3 and N4. Would it be possible to show some pictures as their example?

(A) The table in Attachment 5-2 is a mixture of multiple types of errors such as illegibility of the tag, error in recording by researchers at market and error in the data entry to Excel sheet. N2 is error in data entry (For example, the country row in the Excel indicates "Korea" but the management tag number starts from "TW"). N3 and N4 errors indicate limitation in recording by researcher due to illegibility of the tag information due to problem in the tag attachment. Therefore, the table is preparatory and preliminary information, not finalized result indicating definitive number of errors. Still, this table is presented to inform that tag-attachment method needs to be improved and the data contains multiple errors. It is expected that the number of errors will decrease through improvement in tag-attachment method and data quality control

Left: Half of the tag was embedded in frozen muscle. This tag tells us only that JP-19-J***-068-0***

Right: An example of when tag number could not be read and recorded.

(Q18 bis) One Member has introduced a new type of tag whose number can be read from the barcode on the tag by the dedicated scanner.

(A) Thank you for informative input for the discussion.

(Q18 ter) What about the idea to expand the tag attachment obligation beyond the first point of sale which was mentioned in last ESC?

(A) As mentioned in the proposal, it is unrealistic to impose tag-attachment obligation on all of a large number of companies handling with SBT. Before jumping to such new obligation, we should consider utilizing the existing stipulation of CDS Resolution which still requires Members to encourage tag retention after the first point of sale.

(Q18 quarter) Under the current CDS Resolution, are Members obligated to attach tag after export? Imported SBT should be attached with tags.

(A) This question may be further addressed by the Secretariat, or future discussion on this item, but our understanding is that para 1.7 of the CDS Resolution stipulates that Members shall not permit whole SBT to be exported or re-exported without a tag except for certain cases. Also, the para 1.10 obligates Members to encourage the retention of tags even after the first point of sale.

c2. Creation of intersessional working group for future improvement of tag specifications

(Q19) As electronic CDS is under development, it would be a good timing to consider transition to electronic tag (RFID tag). It would be necessary to do discussion for example in TCWG, with participation of technical experts not only Member government officials.

(A) Yes, it would be useful to discuss with participation from relevant technical experts. Taking into the discussion in CCSBT, we would like to introduce candidate technology or relevant information when identified and ready.

(Q19 bis) It would be a good idea to discuss possibility of using RFID tags.

(A) Thank you for positive comments.

(Q19 ter) It is interesting idea to considering possibility of integration of electronic tag to the CDS system. For the time being, current system should be maintained for avoidance of confusion.

(A) Thank you for positive comments.

Attachment 6

Recent trends in all indicators of the SBT stock

Indicator	Period	Min.	Max.	2016	2017	2018	2019	2020	12 month trend	Main Ages	NOTES
Scientific aerial survey	1993–2000 2005–17	0.25 (1999)	4.85 (2016)	4.85	1.80	–	–	–	–	2-4	Discontinued
Trolling index (piston line)	1996–2003 2005–06 2006–20	0.00 (2018)	5.09 (2011)	3.94	1.71	0.00	0.00	1.72	↑	1	
Trolling index (grid)	1996–2003 2005–06 2006–20	0.24 (2002)	1.69 (2008)	1.56	0.72	0.84	0.54	0.99	↓	1	
Gene tagging	2016–18	1.15 (2017)	2.27 (2016)	2.27	1.15	1.14	-		↓	2	
NZ domestic standardised CPUE	2003–2019	0.355 (2006)	2.99 (2016)	2.99	2.58	2.46	1.35		↓	all	
NZ domestic age/size composition (proportion age 0–5 SBT)*	1980–2019	0.001 (1985)	0.48 (2017)	0.47	0.48	0.33	0.27		↓	2-5	Peripheral Area
Indonesian mean size class**	1993–19	156 (2016)	188 (1994)	156	155	162	161		↓	spawners	
Indonesian age composition:** mean age on spawning ground, all SBT	1994–19	11.8 (2016)	21.2 (1995)	11.5	12.9	13.4	13.2		↓	spawners	
Indonesian age composition:** mean age on spawning ground 20+	1994–19	21.3 (2016)	25.3 (2004)	21.3	23.1	23.1	22.4		↓	Older spawners	
Indonesian age composition:** median age on spawning ground	1994–19	13 (2017)	21.5 (1994–95; 1996–97; 1998–99)	11.5	11.5	12.5	12.5		--	spawners	

Indicator	Period	Min.	Max.	2016	2017	2018	2019	12 month trend	Main Ages	Notes
Japanese nominal CPUE, age 4+	1969–2019	1.338 (2006)	22.123 (1965)	4.210	5.271	6.012	7.733	↑	4+	
Japanese standardised CPUE (W0.5, W0.8, Base w0.5, Base w0.8)	1969–2019	2007 (0.259–0.358)	1969 (2.284– 2.697)	0.097–1.292	0.926–1.307	0.925–2.269	0.888-1.756	↓	4+	
Korean nominal CPUE	1991–2019	1.312 (2004)	21.523 (1991)	5.451	6.552	7.406	8.702	↑	4+	Bycatch effects
Korean standardised CPUE (selected data) Area 8	1996-2019	0.45 (2002)	2.57 (2016)	2.57	–	–	–		4+	
Area 9	1996-2019	0.17 (2005)	2.68 (2019)	1.44	1.45	2.25	2.68	↑		
Korean standardised CPUE (clustered) Area 8	1996-2019	0.51 (2002)	2.43 (2016)	2.43	–	–	–		4+	
Area 9	1996-2019	0.19 (2005)	2.61 (2019)	1.49	1.50	2.22	2.61	↑		
Taiwanese nominal CPUE, Areas 8+9	1981–2019	<0.001 (1985)	0.956 (1995)	0.203	0.156	0.217	0.204	↓	2+	Bycatch effects
Taiwanese nominal CPUE, Areas 2+14+15	1981–2019	<0.001 (1985)	3.672 (2007)	2.042	1.588	1.686	1.638	↓	2+	Bycatch effects
Taiwanese standardised CPUE (Area E)	2002-2019	0.105 (2002)	1.115 (2012)	0.771	0.746	0.854	0.795	↓	2+	In development
(Area W)	2002-2019	0.185(2016)	0.913 (2002)	0.185	0.193	0.213	0.189	↓		Bycatch effects
Japanese age comp, age 0–2*	1969–2019	0.004 (1966)	0.192 (1998)	0.003	0.002	0.006	0.009	↑	2	Affected by release/discard
Japanese age comp, age 3*	1969–2019	0.011 (2015)	0.228 (2007)	0.033	0.044	0.047	0.082	↑	3	Affected by release/discards
Japanese age comp, age 4*	1969–2019	0.091 (1967)	0.300 (2010)	0.071	0.142	0.145	0.160	↑	4	
Japanese age comp, age 5*	1969–2019	0.072 (1986)	0.300 (2010)	0.160	0.126	0.123	0.196	↑	5	
Taiwanese age/size comp, age 0–2*	1981–2019	<0.001 (1982)	0.251 (2001)	0.004	0.002	0.009	0.015	↑	Mostly 2	
Taiwanese age/size comp, age 3*	1981–2019	0.024 (1996)	0.349 (2001)	0.118	0.121	0.123	0.126	↑	3	
Taiwanese age/size comp, age 4*	1981–2019	0.027 (1996)	0.502 (1999)	0.211	0.215	0.218	0.223	↑	4	
Taiwanese age/size comp, age 5*	1981–2019	0.075 (1997)	0.371 (2009)	0.216	0.217	0.219	0.222	↑	5	
Australia surface fishery median age composition	1964–2019	age 1 (1979–80)	age 3 (multiple years)	age 2	age 3	age 3	age 2	↓	1-4	

Indicator		Period	Min.	Max.	2016	2017	2018	2019	12 month trend	Ages	Notes
Jpn LL standardised CPUE (age 3)^	w0.5	1969–2019	0.234 (2003)	3.361 (1972)	0.428	0.435	0.578	0.697	↑	3	Affected by release/discard
	w0.8		0.265 (2003)	3.126 (1972)	0.571	0.576	0.779	0.870			
Jpn LL standardised CPUE (age 4)^	w0.5	1969–2019	0.272 (2006)	2.946 (1974)	0.626	0.946	1.141	1.092	↓	4	
	w0.8		0.292 (2006)	2.614 (1974)	0.839	1.276	1.540	1.342			
Jpn LL standardised CPUE (age 5)^	w0.5	1969–2019	0.228 (2006)	2.690 (1972)	1.221	0.878	0.887	1.246	↑	5	
	w0.8		0.247 (2006)	2.424 (1972)	1.564	1.153	1.172	1.542			
Jpn LL standardised CPUE (age 6&7)^	w0.5	1969–2019	0.184 (2007)	2.493 (1976)	1.343	1.374	1.061	0.924	↓	6-7	
	w0.8		0.208 (2007)	2.233 (1976)	1.767	1.751	1.359	1.159			
Jpn LL standardised CPUE (age8-11)^	w0.5	1969–2019	0.272 (2007)	3.829 (1969)	0.691	0.676	0.888	0.813	↓	8-11	
	w0.8		0.286 (1992)	3.382 (1969)	0.917	0.899	1.165	1.042			
Jpn LL standardised CPUE (age 12+)^	w0.5	1969–2019	0.451 (2017)	3.410 (1970)	0.521	0.451	0.567	0.463	↓	12+	
	w0.8		0.592 (1997)	2.934 (1970)	0.697	0.597	0.759	0.599			

*derived from size data; ** Indonesian catch not restricted to just the spawning grounds since 2012–13; na = not available

^ All the Jpn LL standardised CPUE indicators are based on the standardisation model by Nishida and Tsuji (CCSBT/SC/9807/13) using all vessel data. w0.5 and w0.8 refer to the weighting in the formula of the indicator calculation, w*VS + (1-w)*CS (VS and CS represent Variable Square and Constant Square hypotheses, respectively).

Note that the close kin mark recapture index is not provided in this table as the years for which the index is available do not match the years covered in the table. See the text in agenda item 8 for information on the index.

Attachment 7

Table 1: Sensitivity tests (and associated codes), role, and priority ranked from low (L), to medium (M) to high (H).

Test name	**Code**	**Conditioning and projection notes**	**Priority**
UAM1	UAM1	Same UAM scenario as used for MP testing in 2019. Added unaccounted catch mortality (UAM) in conditioning: 1000t of small fish + 1000t of large fish, ramping up from 1990 to 2013. The 20% increase in the surface fishery is also added to sensitivity tests. In projections, the UAM remains at the same proportion as in 2019: 10% in LL1 and total of 38% in surface.	H
UAMbycatch	UAMbycatch	LL1 UAM estimated using Taiwanese bycatch rates.	H
No UAM	noUAM	Removal of all UAM from conditioning and projections, the 20% surface fishery size anomaly correction is still included in this sensitivity test.	H
LL1 Case 2 of MR	case2	Alternative historical LL1 overcatch series based on Case 2 of the 2006 Market Report	L
SFO00	sfo00	Zero surface fishery overcatch	L
Old CPUE series	oldbase	Use the previous w0.5 and w0.8 CPUE series from GLM standardization	H
S50CPUE	cpues50	50% of LL1 overcatch associated with reported effort	M
Omega75	cpueom75	Power function for biomass-CPUE relationship with power = 0.75	H
Upq2008	cpueupq	CPUE q increased by 25% (permanent in 2008)	H
GLMM	glmm	Area-year mixed-model CPUE standardisation	M
Q age range	cpue59	Use ages 5 to 9 in LL1 *q* calculation	M
Bridging	bridge	As feasible, link 2017 assessment to 2020 assessment by using settings close to those used in 2017	H
IS20	fis20	Indonesian selectivity flat from age 20+	M
Aerial2016	as2016	Remove 2016 aerial survey index	H
No POP or HSP	noCKMR	Exclude both close-kin data (Parent-Offspring and Half-Sibling Pairs)	H
Omit GT	getout	Omit Gene Tagging data	H
GTI	troll	Includes the grid-type trolling index as additional recruitment index. Increase CV of aerial survey to preclude aerial survey dominating the fit, given apparent conflicts in the data	M
POPs only	justPOPs	Implemented by increasing the variance on other trend data or some other approach	H

Table 2: Estimated stock status in 2020 and MSY-related parameters for the different sensitivity tests described in Table 1.

Run	Relative TRO	Relative B10+	F-to-F_{msy}	TRO-to-TRO_{msy}	TRO_{msy}-to-TRO_0	MSY
base19	0.2 (0.16-0.24)	0.17 (0.14-0.21)	0.52 (0.37-0.73)	0.69 (0.49-1.03)	0.3 (0.22-0.35)	33,207 (31,471-34,564)
getout	0.2 (0.17-0.25)	0.17 (0.14-0.21)	0.43 (0.3-0.61)	0.71 (0.52-1.06)	0.3 (0.22-0.35)	33,663 (31,652-35,378)
noCKMR	0.16 (0.13-0.2)	0.13 (0.11-0.17)	0.62 (0.48-0.8)	0.56 (0.43-0.78)	0.3 (0.22-0.35)	33,407 (31,397-34,619)
justPOPs	0.18 (0.15-0.22)	0.16 (0.13-0.2)	0.55 (0.39-0.76)	0.64 (0.46-0.96)	0.3 (0.22-0.34)	33,003 (31,328-34,159)
as2016	0.19 (0.16-0.23)	0.17 (0.14-0.21)	0.56 (0.4-0.81)	0.67 (0.47-1)	0.3 (0.22-0.34)	32,686 (31,013-33,990)
Omega75	0.2 (0.16-0.24)	0.17 (0.14-0.21)	0.48 (0.38-0.68)	0.7 (0.5-1.06)	0.3 (0.22-0.34)	34,645 (32,650-36,320)
is20	0.22 (0.18-0.26)	0.19 (0.15-0.22)	0.53 (0.35-0.73)	0.73 (0.51-1.17)	0.31 (0.22-0.35)	34,003 (32,255-34,998)
a59	0.22 (0.18-0.26)	0.2 (0.16-0.23)	0.44 (0.32-0.61)	0.76 (0.57-1.13)	0.3 (0.22-0.34)	34,0.54 (32,302-35,793)
cpues50	0.19 (0.15-0.23)	0.16 (0.13-0.19)	0.55 (0.39-0.76)	0.65 (0.47-0.97)	0.3 (0.22-0.34)	32,666 (30,935-33,828)
UAM1	0.2 (0.16-0.23)	0.17 (0.14-0.20)	0.6 (0.43-0.85)	0.68 (0.49-1.01)	0.3 (0.22-0.35)	32,947 (31,153-34,347)
noUAM	0.2 (0.17-0.24)	0.18 (0.14-0.21)	0.52 (0.37-0.73)	0.7 (0.5-1.05)	0.3 (0.22-0.34)	32,642 (30,906-33,991)
bridging	0.18 (0.14-0.23)	0.15 (0.12-0.19)	0.54 (0.4-0.71)	0.64 (0.49-0.94)	0.27 (0.22-0.32)	33,405 (32,246-34,738)
case2	0.19 (0.16-0.23)	0.17 (0.14-0.2)	0.52 (0.37-0.72)	0.67 (0.48-1)	0.3 (0.22-0.34)	33,728 (31,878-35,066)
UAMbycatch	0.2 (0.16-0.24)	0.18 (0.14-0.21)	0.52 (0.37-0.73)	0.7 (0.5-1.04)	0.3 (0.22-0.34)	32,793 (31,062-34,134)
glmm	0.18 (0.14-0.22)	0.15 (0.12-0.18)	0.58 (0.4-0.79)	0.61 (0.44-0.92)	0.3 (0.22-0.34)	33,060 (31,337-34,506)
troll	0.21 (0.17-0.25)	0.19 (0.15-0.22)	0.54 (0.39-0.75)	0.72 (0.51-1.07)	0.3 (0.22-0.35)	31,952 (30,496-33,160)
oldbase	0.18 (0.14-0.22)	0.15 (0.12-0.19)	0.55 (0.39-0.76)	0.63 (0.46-0.95)	0.3 (0.22-0.34)	33,211 (31,427-34,656)
sfo00	0.19 (0.16-0.23)	0.16 (0.14-0.2)	0.47 (0.34-0.68)	0.68 (0.48-1.01)	0.3 (0.22-0.34)	32,083 (30,341-33,251)

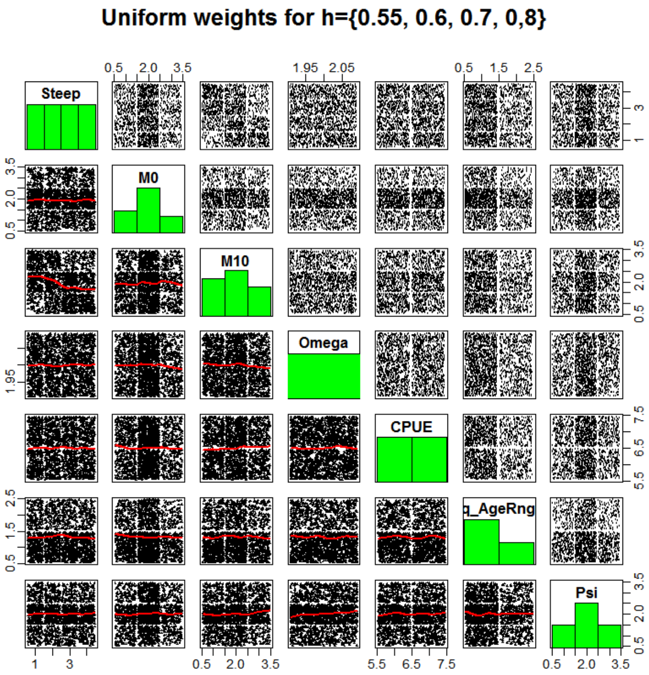

Figure 1. Level plots for the base19 reference set. Grid cells are sampled using uniform weights for h = {0.55, 0.6, 0.7, 0.8}, posterior weights for M_0 = {0.4,0.45,0.5} and M_{10} = {0.065, 0.085, 0.105}, and prior weights for q-age-range and for Psi. Values on the horizontal and vertical axes correspond to the levels of the different grid factors (not the actual parameter values) jittered within each level.

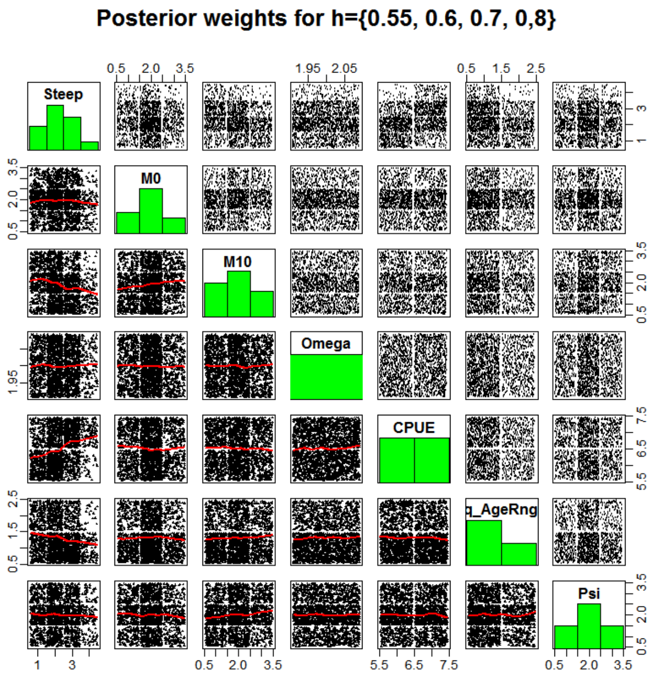

Figure 2. Level plots when grid cells are sampled using posterior weights for h = {0.55, 0.6, 0.7, 0.8}, M_0 = {0.4,0.45,0.5} and M_{10} = {0.065, 0.085, 0.105}, equal weights for the CPUE series, and prior weights for q-age-range and for Psi. Values on the horizontal and vertical axes correspond to the levels of the different grid factors (not the actual parameter values) jittered within each level.

Below is a selection of plots corresponding to fits to the different data components obtained with an intermediate grid cell of the base19 reference set.

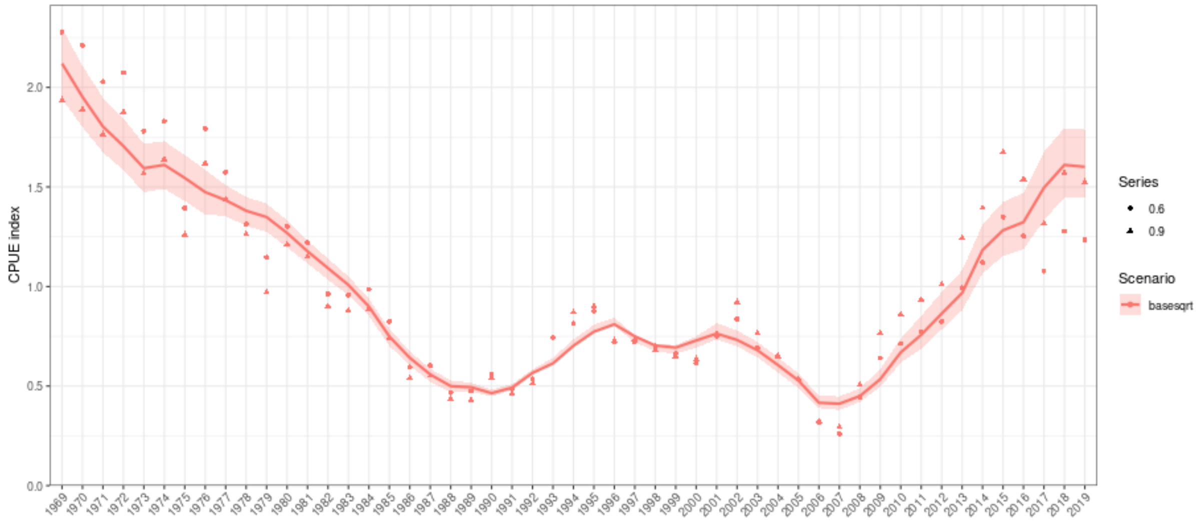

Figure 3. Model fit to catch per unit effort (CPUE) for the reference set of OMs showing the median (bold lines) and 80% confidence interval (shaded regions). The observations (points) are also shown, there are two of these per year which are for the constant squares and variable squares CPUE series.

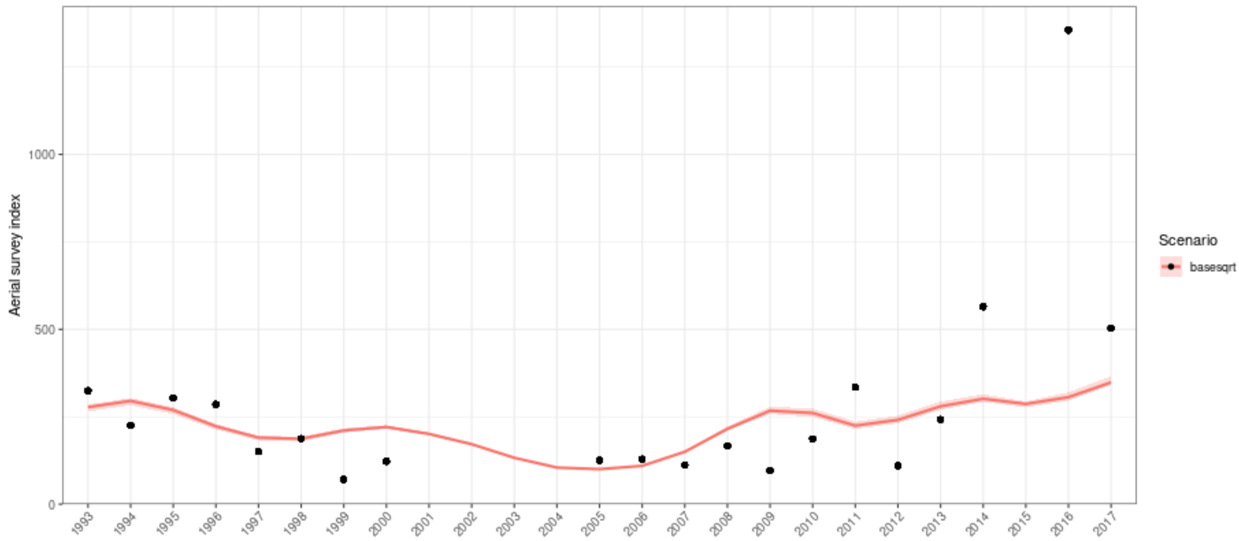

Figure 4. Model fit to the aerial survey index for the reference set of OMs showing the median (bold lines) and 80% confidence interval (shaded regions). The observations (black points) are also shown.

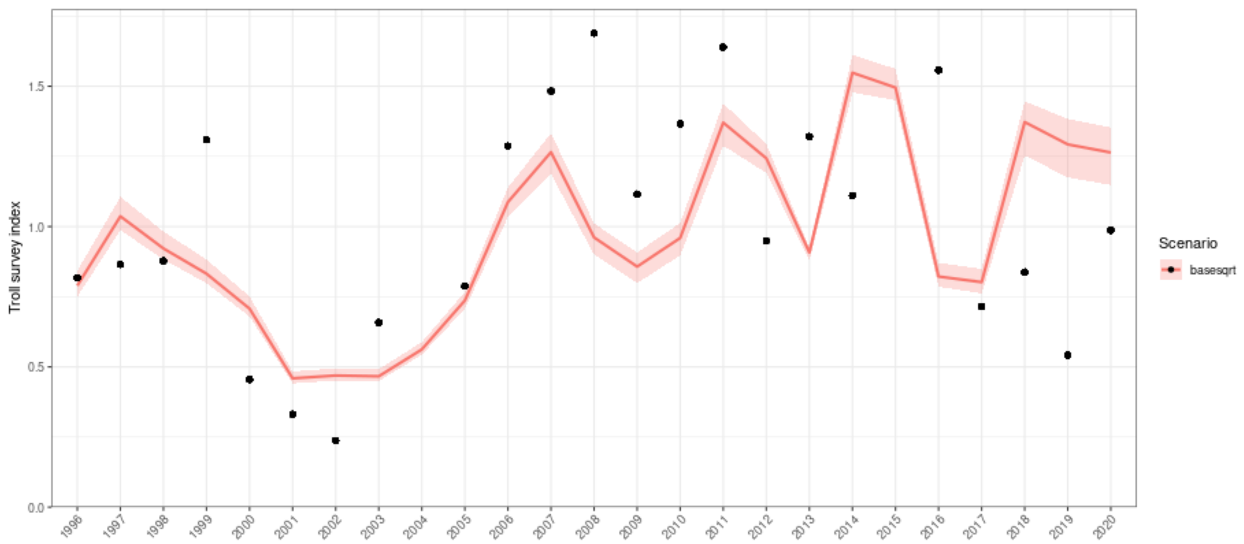

Figure 5. Fitted model scaled to the troll survey index for the reference set of OMs showing the median (bold lines) and 80% confidence interval (shaded regions). The observations (black points) are also shown.

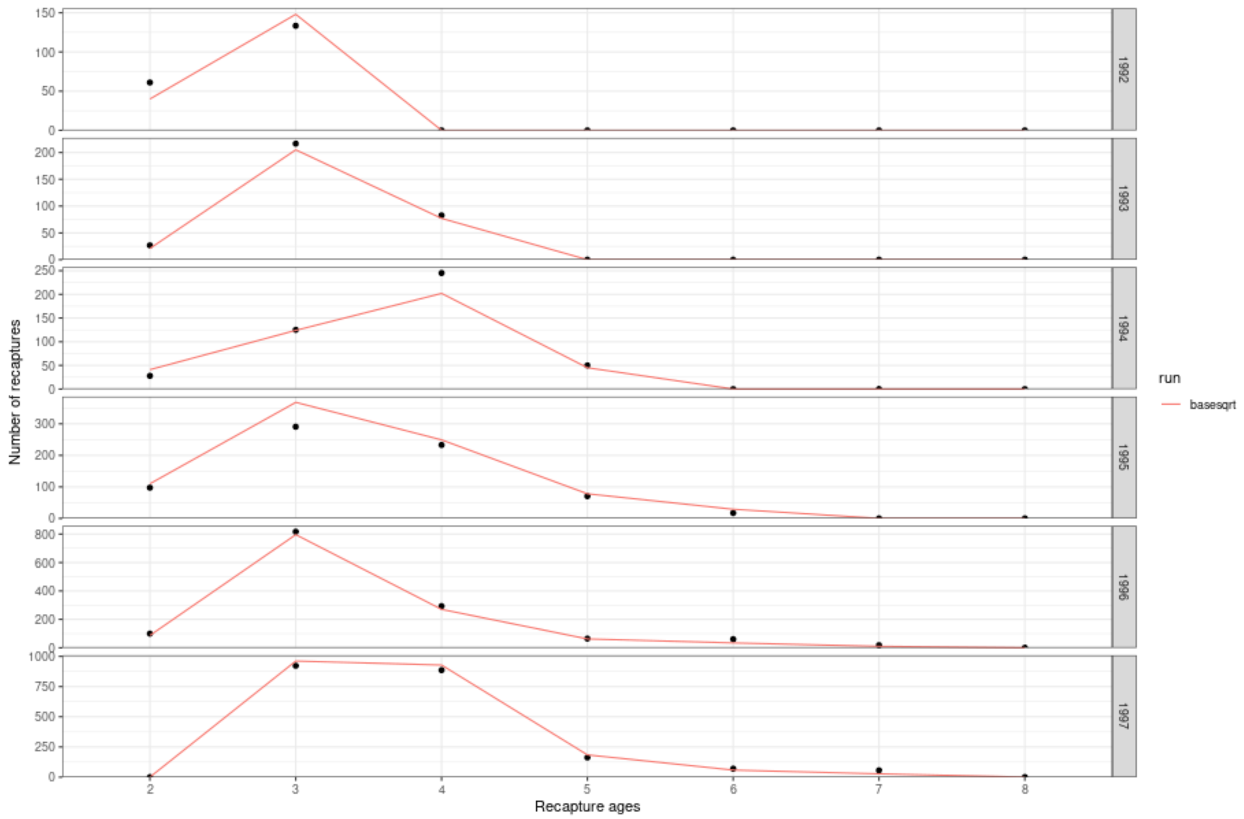

Figure 6. Fits to the conventional tag data (dots) for the pooled aggregation level for the best fitting grid cell in the reference set of OMs (h1m2M2O2C6a2p1).

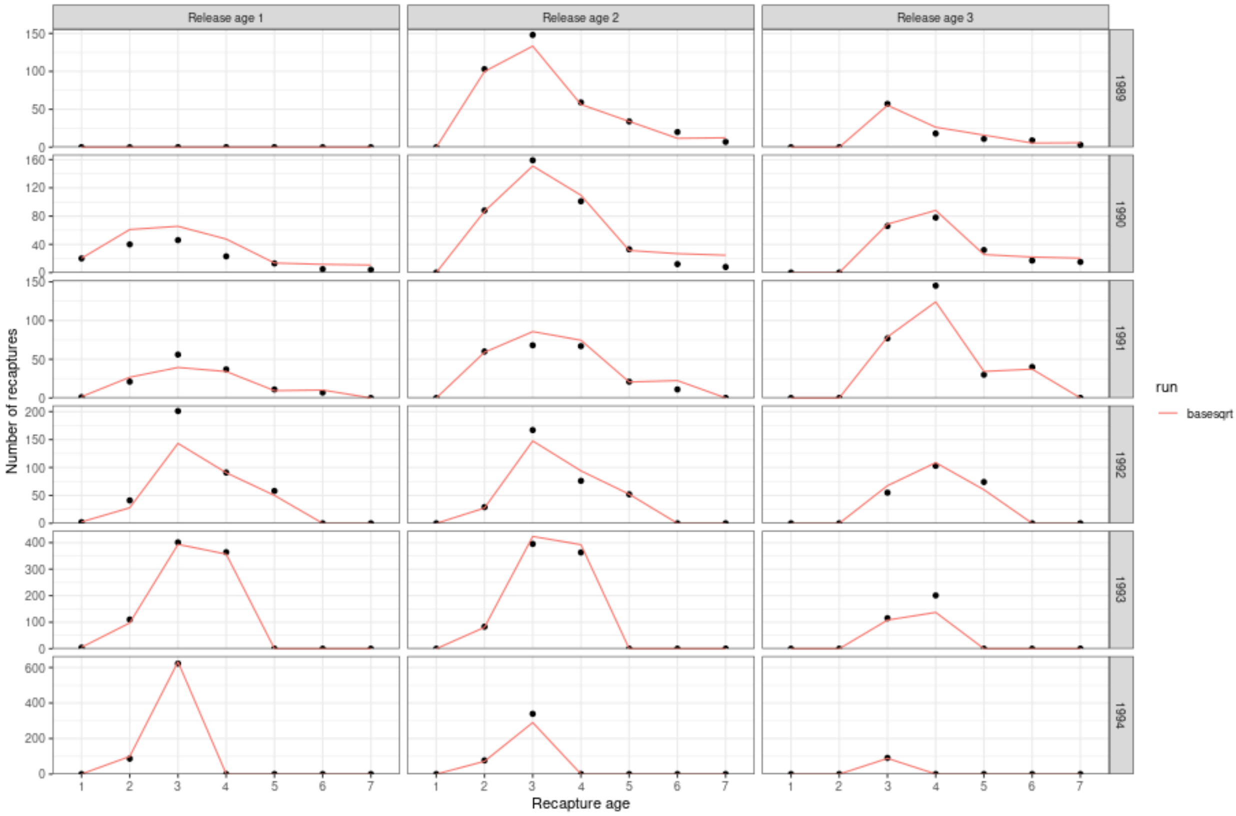

Figure 7. Fits to the conventional tag data (dots) for the cohort of release aggregation level for the best fitting grid cell in the reference set of OMs (h1m2M2O2C6a2p1).

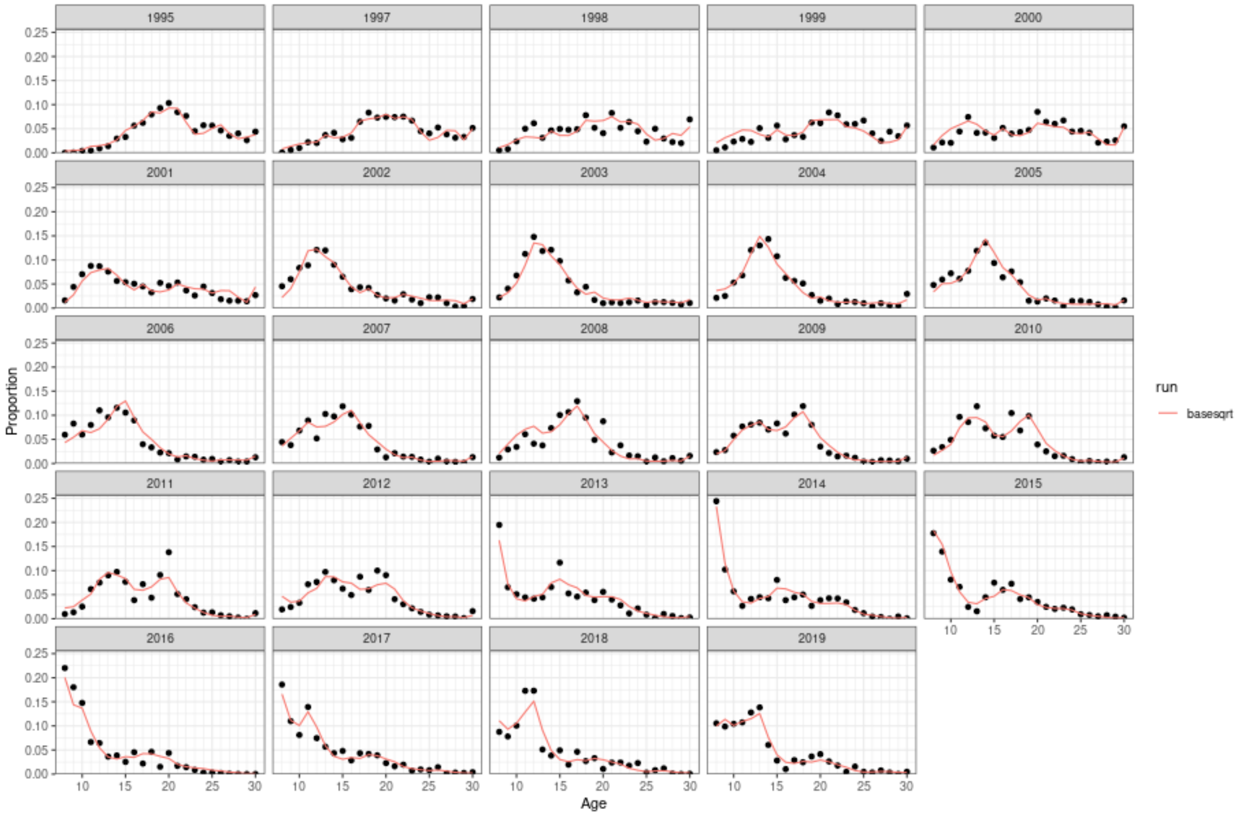

Figure 8. Model fit to Indonesian age-frequencies for the best fitting grid cell in the reference set of OMs (h1m2M2O2C6a2p1).

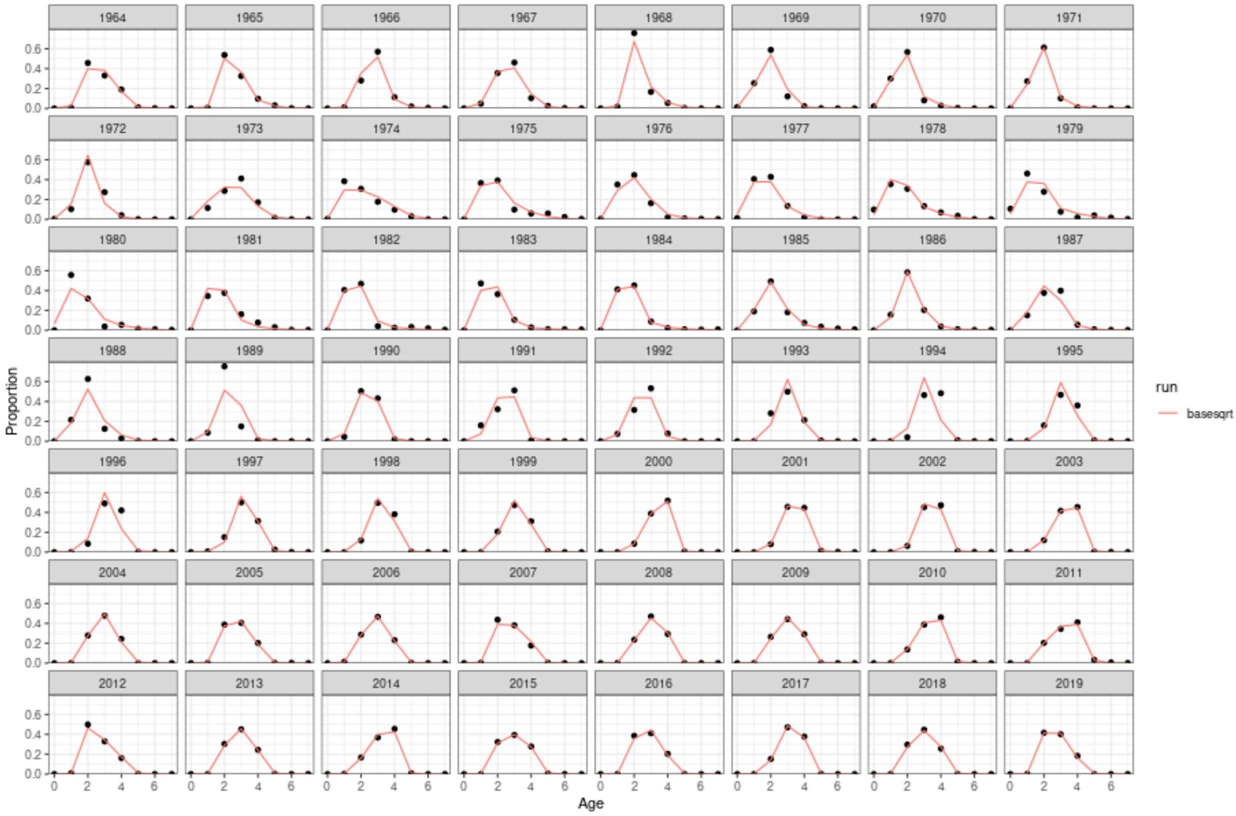

Figure 9. Model fit to surface age-frequencies for the selected run(s).

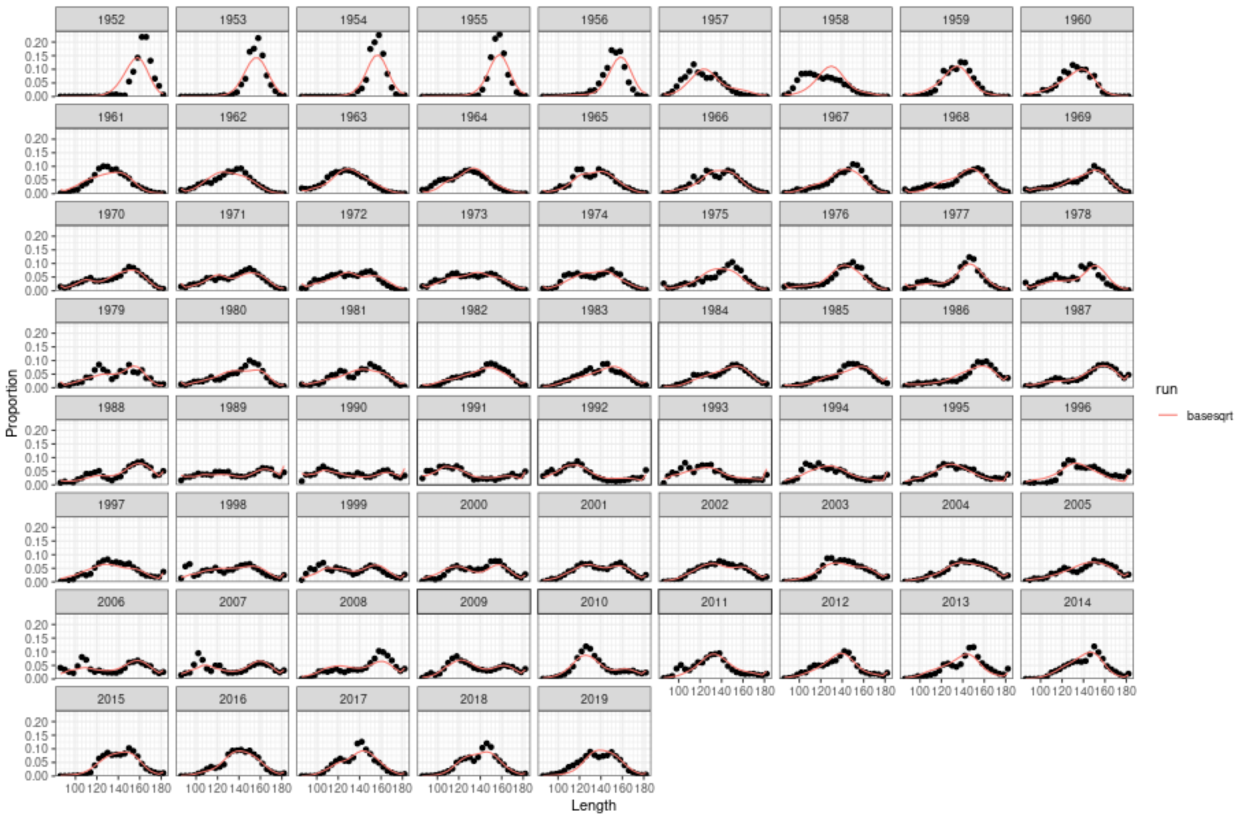

Figure 10. Model fit to LL1 length-frequencies for the selected run(s).

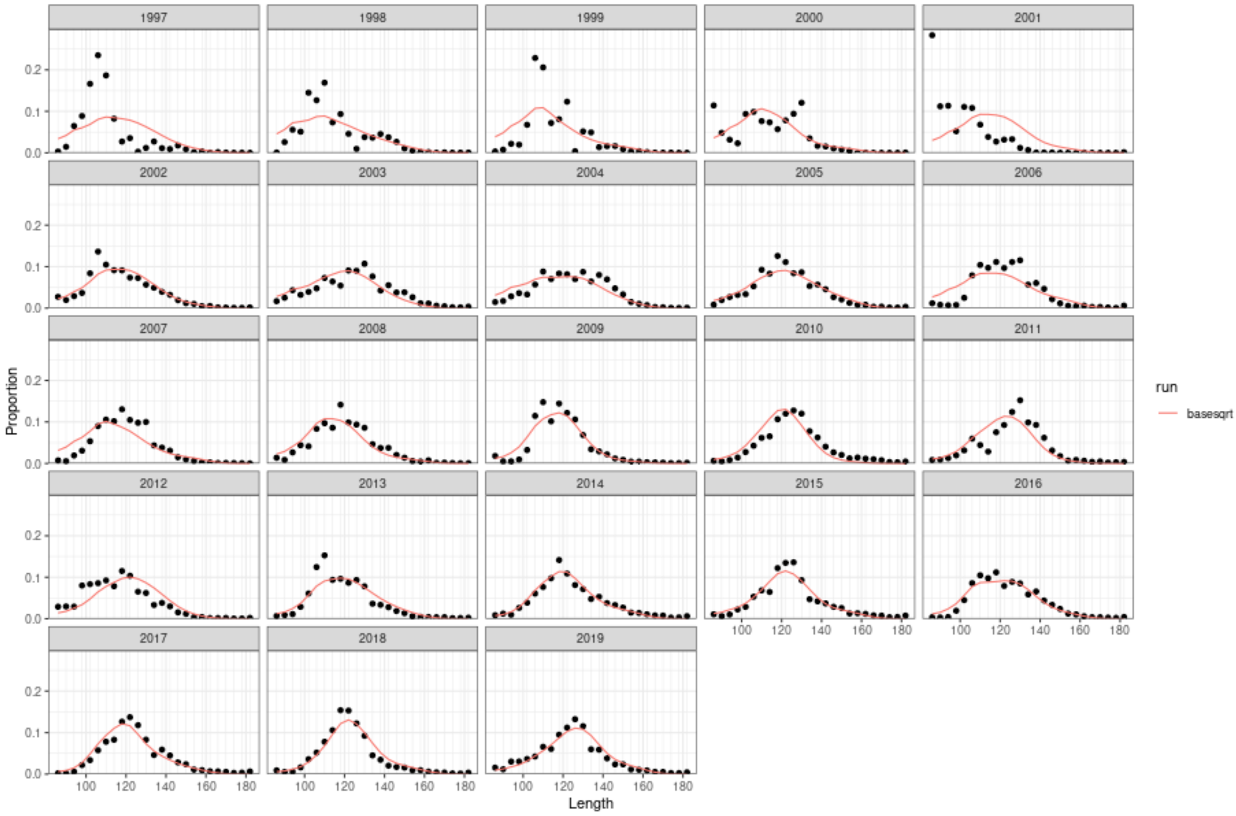

Figure 11. Model fit to LL2 length-frequencies for the selected run(s).

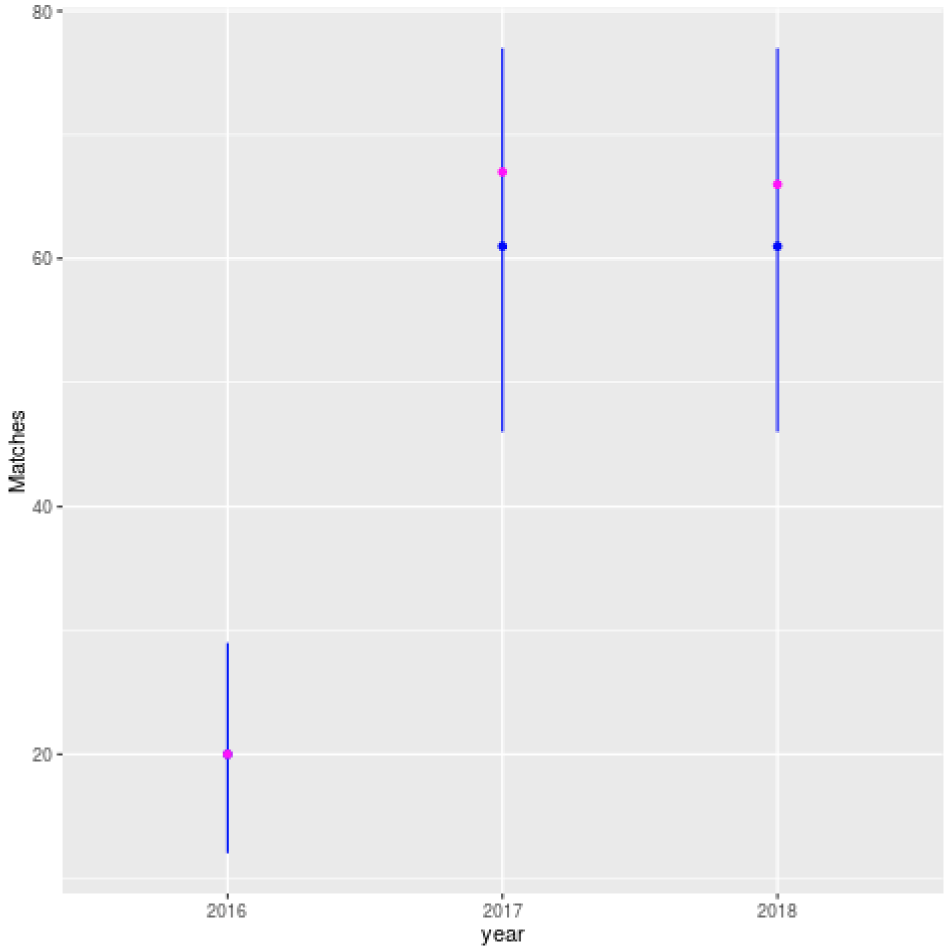

Figure 12. Predictive summary for the gene tagging data (magenta) included in the reference set of OMs. We plot only the predictive fits to the data as the series is currently too short to calculate a meaningful predictive p-value.

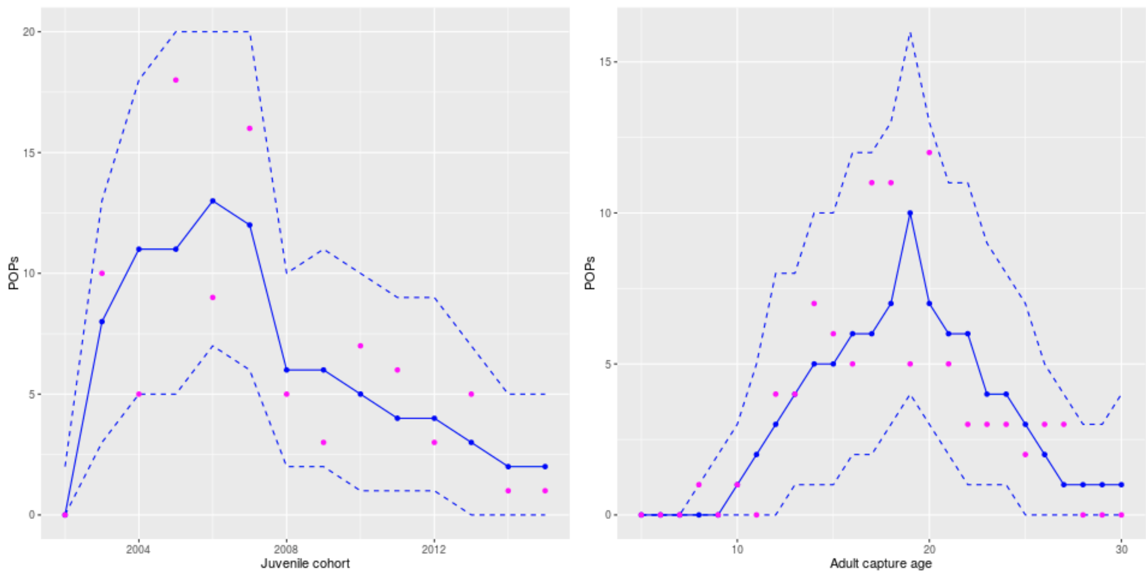

Figure 13. Predictive fits to the POP data (magenta) for the juvenile cohort aggregation level (top left), adult capture age level (top right).

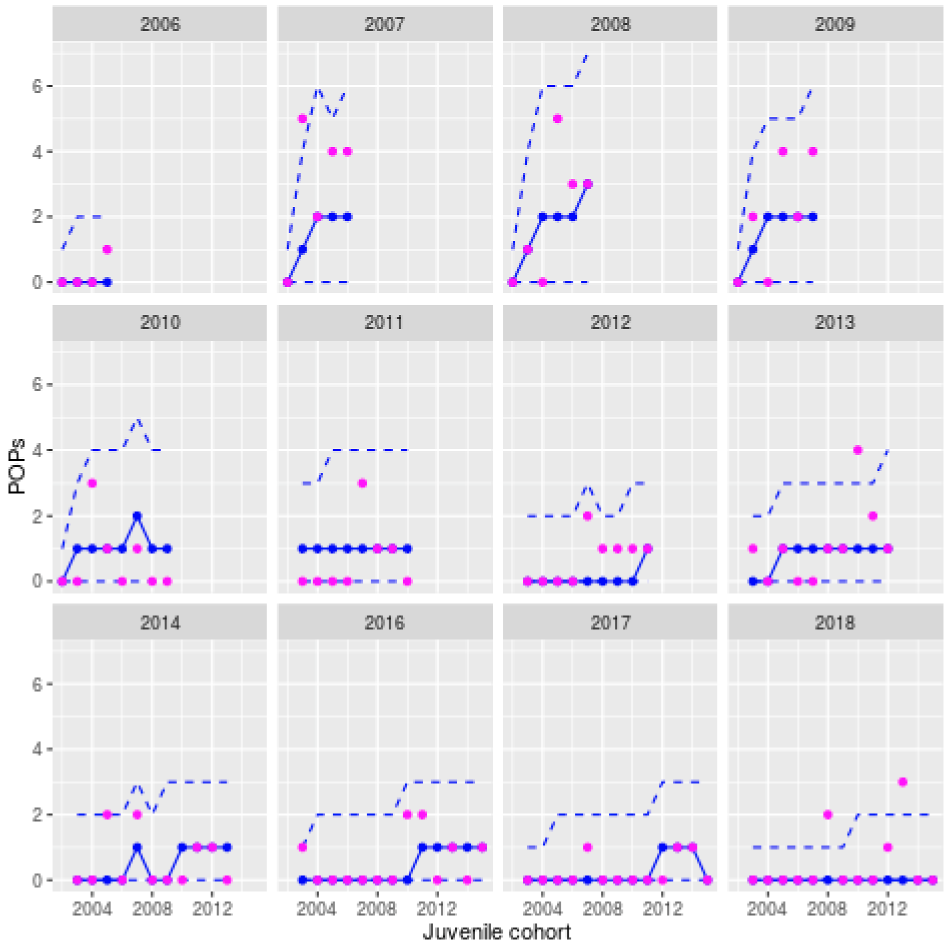

Figure 14. Predictive fits to the POP data for the juvenile cohort and adult capture year level.

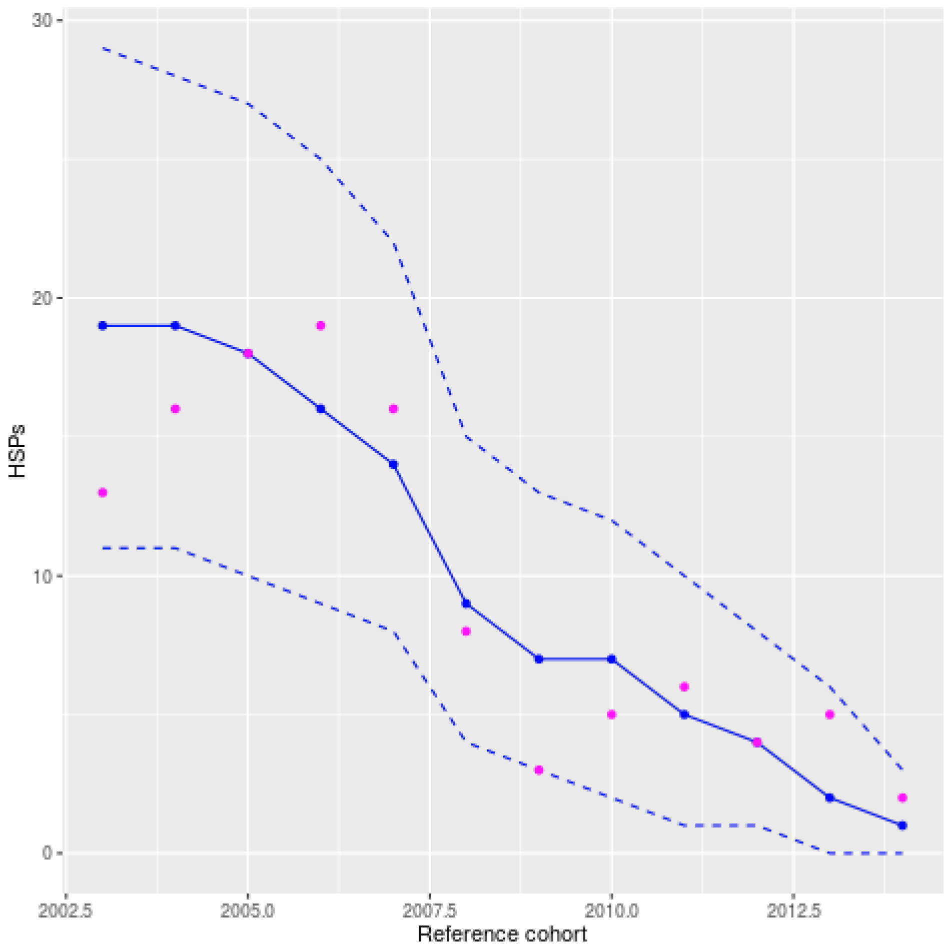

Figure 15. Predictive fits to the HSP data (magenta) for the initial cohort aggregation level.

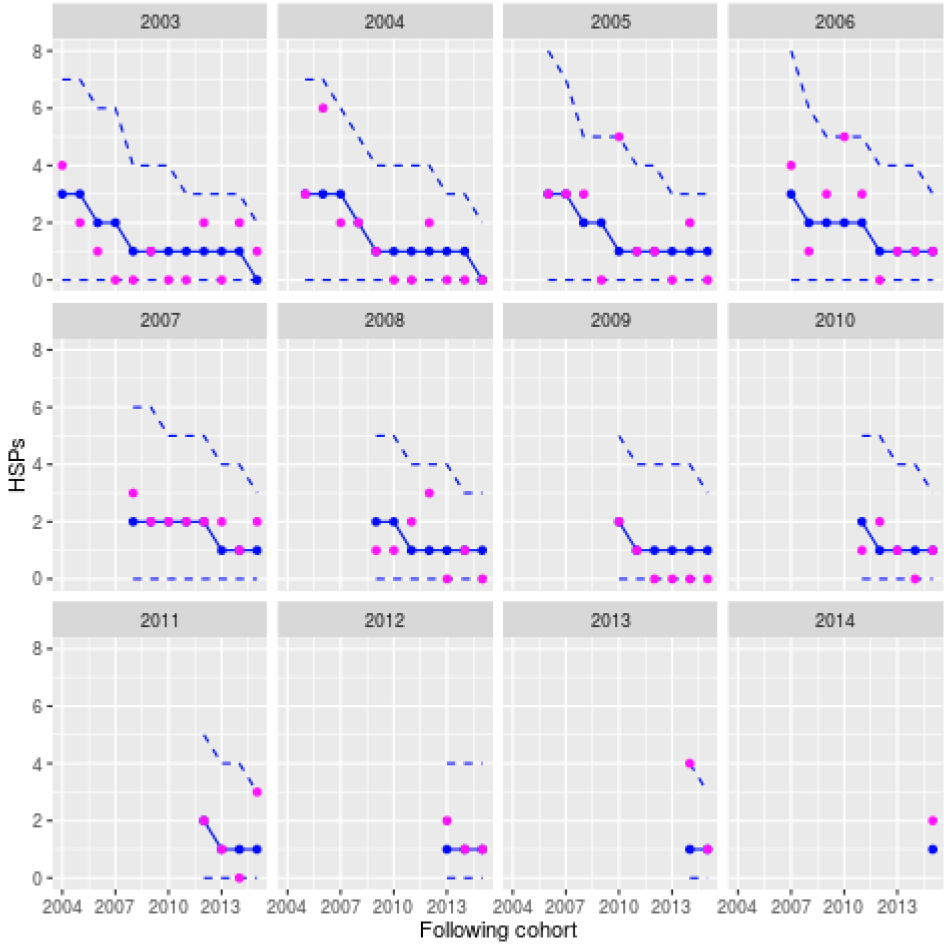

Figure 16. Predictive fits to the HSP data (magenta) for the full disaggregation level.

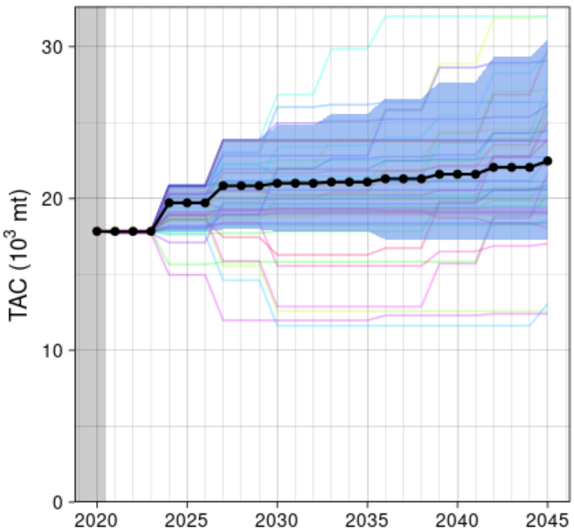

Figure 17. TAC projected using the Cape Town Procedure and the current reference set (base19) with randomly selected individual realisations in the simulation (coloured lines), the median (line with points) and 90% probability interval (shade).

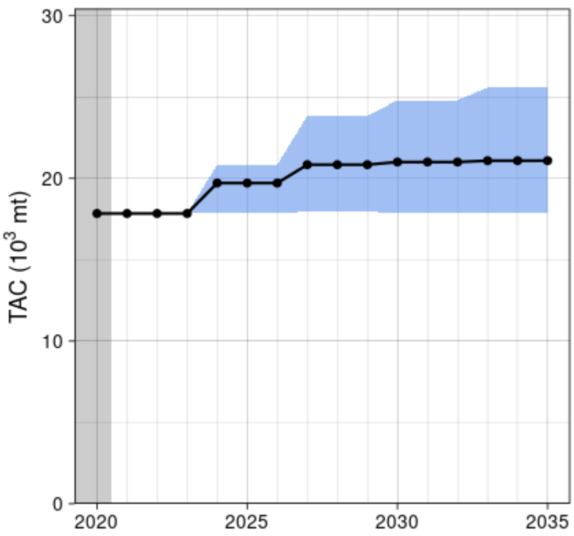

Figure 18. The same as in Figure 17, except without individual realizations in the simulation and ending in 2035.

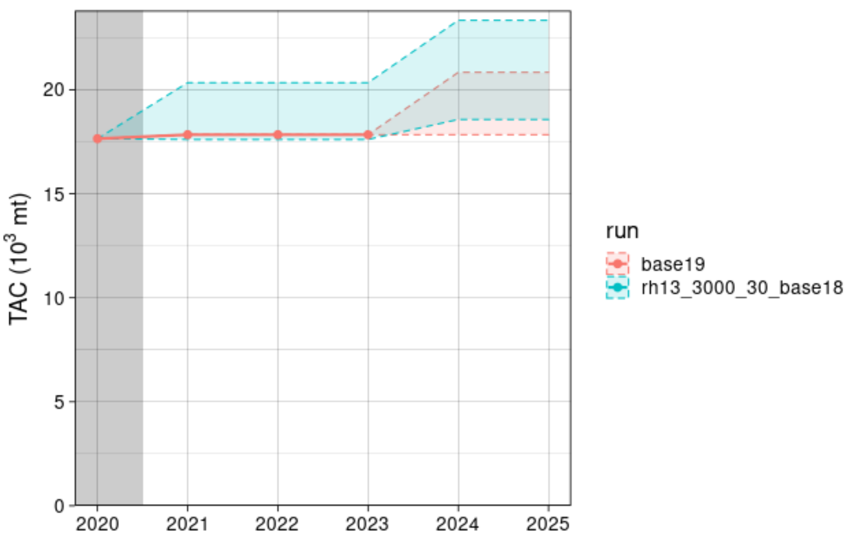

Figure 19. Total Allowable Catch (TAC) projected using the Cape Town Procedure and the reference set of models used for this year's assessment (base19) compared to TAC projections presented in 2019 (rh13_3000_30_base18) with the medians (lines) and 90% probability intervals (dashed lines and shades).

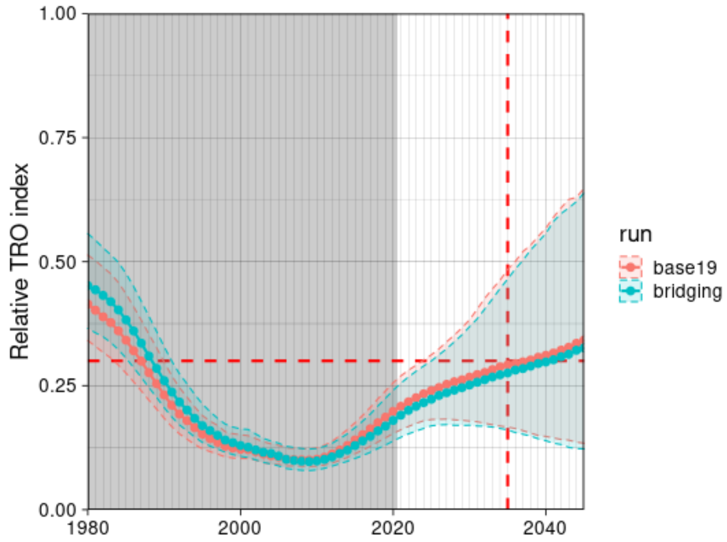

Figure 20. Comparisons of relative TRO between base19 and a bridging sensitivity run that used specifications similar to those of the 2017 assessment (bridging) with the medians (lines) and 90% probability intervals (dashed lines and shades). The vertical and horizontal red lines indicate the year 2035 and 30% relative TRO (TRO/TRO_0) level, respectively.

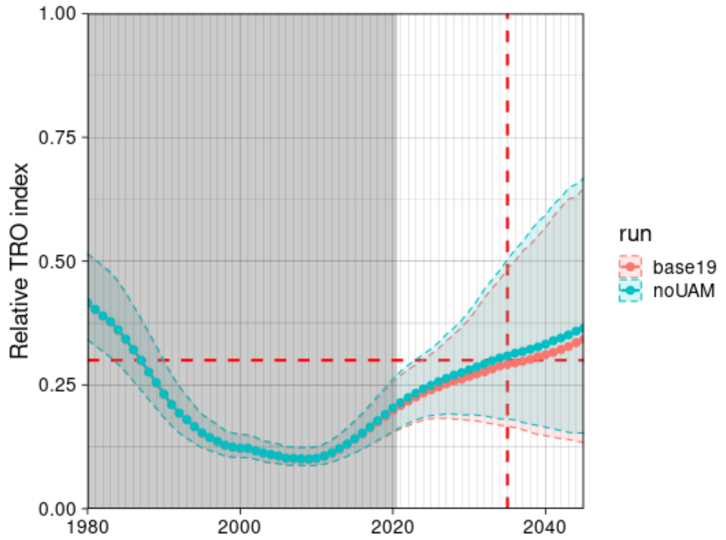

Figure 21. Comparison of relative TRO between the base19 run and a sensitivity run in which no UAM was included with the medians (lines) and 90% probability intervals (dashed lines and shades). The vertical and horizontal red lines indicate the year 2035 and 30% relative TRO (TRO/TRO_0) level, respectively.

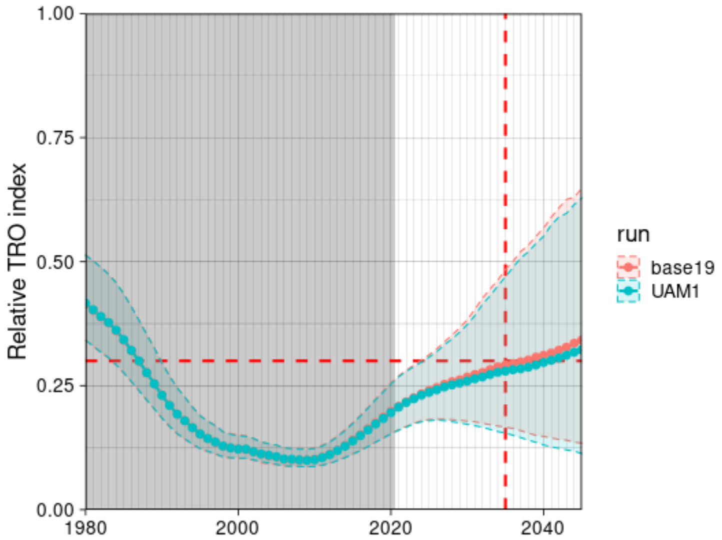

Figure 22. Comparison of relative TRO estimated using base19 with a sensitivity run conducted using the same UAM scenario as used for MP-testing in 2019 (UAM1) with the medians (lines) and 90% probability intervals (dashed lines and shades). The vertical and horizontal red lines indicate the year 2035 and 30% relative TRO (TRO/TRO_0) level, respectively.

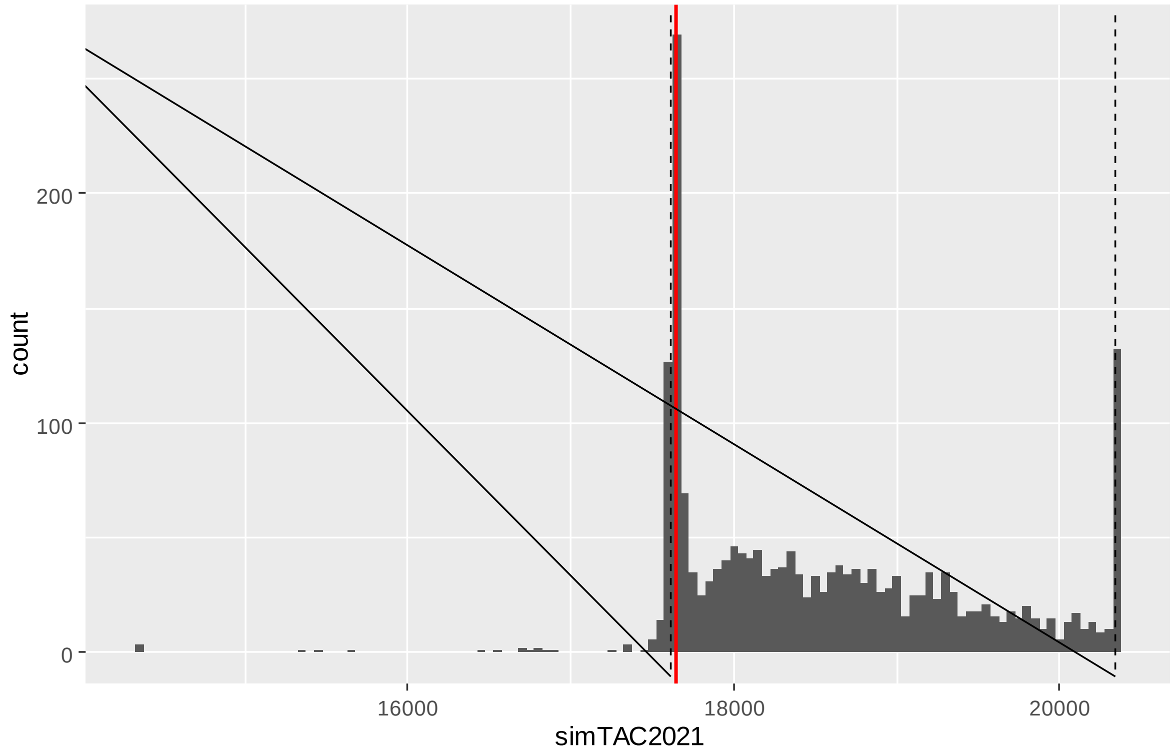

Figure 23. Histogram of simulated 2021 TAC from projections for testing the CTP, 5% and 95% probability intervals (black vertical dashed lines), and the recommended TAC from the CTP using actual input index/data available in 2020 (red vertical line).

Attachment 8

Specifications of the CCSBT Management Procedure

1. Introduction

The CCSBT adopted a Management Procedure (MP) to guide its global TAC setting process for southern bluefin tuna in 2011, known as the 'Bali Procedure'. The Bali Procedure has been used by the ESC to recommend the TAC for 2012-2020.

In 2019 the CCSBT adopted a new MP called the 'Cape Town Procedure' (CTP) which is described in this specification.

The CCSBT has been at the forefront of tuna RFMOs in development and implementation of Management Procedures as the basis for recommending changes in the level of fishing to meet the objectives of the Commission and its members (Hillary et al 2016). The impetus for this approach arose from a break-down in the institutional decision-making process arising from: a) high uncertainty in the status and productivity of the stock, b) conflicting views on the best approach to resolve this uncertainty, c) alternative methods for assessing the stock status, and d) lack of an agreed basis to determine the global TAC based on the scientific advice.

The issue of uncertainty in stock status and productivity was addressed by agreeing to develop a set of population dynamics models that encapsulated the range of plausible stock and fishery dynamics. This set of models are known as the CCSBT Operating Models (OMs). The SBT OMs have been modified and refined over the years to reflect the addition of data to existing datasets and new data streams (e.g. aerial survey (2009), close-kin (2013), gene-tagging (2019) and revision of assumptions as appropriate. The SBT OMs are used for i) periodic assessments of stock status, and ii) simulation testing of candidate Management Procedures.

The previously contentious issue of determining the global TAC, based on scientific advice and in a manner consistent with the Commission's objective, has been resolved via the development and testing of a wide variety of candidate Management Procedures and the selection and implementation of the "Bali Procedure" in 2011 (Anon. 2011, Hillary et al 2015, Hillary et al, 2016), and the "Cape Town Procedure" in 2019.

The role of stock assessment and the management procedure, for scientific advice to CCSBT, is distinct and is briefly explained below:

Assessment of stock status

The CCSBT Scientific Committee completes a "full stock assessment" every three years, as originally specified in the Meta-rules for the Bali Procedure. The stock assessment provides information on whether the stock is rebuilding, the projected timeframe to meet the objective of the rebuilding plan (i.e. 30% of TRO_0) and current stock size and fishing mortality relative to commonly used reference points. The stock assessment is **not** used to:

- Run the MP
- Recommend the TAC.

Running the MP for TAC advice

The Management Procedure is used to calculate the global TAC recommended by the ESC to the Commission for decision. The Cape Town Procedure uses **only** three monitoring series as inputs, the defined analyses and decision-rule to recommend the change in TAC. The MP is fully specified (as originally tested in the MSE process, 2019) and is not changed following selection by the Commission.

The running of the MP is independent of the SBT stock assessment. The MP is **not** used to:

- Estimate the spawning stock biomass
- Estimate if the rebuilding target has been met.

Technical details of the Cape Town Procedure, together with specifications of the monitoring data input to the MP, and the Metarule process that the Extended Commission has adopted for dealing with exceptional circumstances in the SBT fishery, are provided in the following sections of this document.

2. Non-Technical description of the Cape Town Procedure

3. Specification of the population model and HCR used in the MP

4. Data analysis specification for the Gene-tagging abundance estimates used in the MP

5. Specification for the Close-Kin Mark-Recapture data used in the MP

6. Specification of Standardised CPUE for the MP

7. Metarule Process

2. Non-Technical Summary of the Cape Town Procedure

The Cape Town Procedure (CTP) has 3 components based on the data inputs from the following monitoring programs: Gene-tagging, CPUE and Close-Kin Mark Recapture (CKMR). Gene-Tagging provides an index of recruitment (abundance of 2 year-olds), CPUE provides an index of abundance for the age-classes exploited by the Japanese longline fishery and CKMR provides two indices of spawning biomass (one from Parent-Offspring-Pairs and one from Half-Sibling-Pairs) as well as information on the total mortality on the spawning component of the population.

For the gene-tagging component, the input is the most recent 5-year weighted average of the abundance estimates, where the weighting is proportional to the number of matches in each year. For the 2020 TAC decision only 3 estimates are available (2016-2018). The TAC change variable for the gene-tagging component will be less than one if the recent average is below the fixed lower bound, or will be greater than one if the recent average is above the fixed upper bound. If the recent average is between the upper and lower bounds, then the TAC multiplier is equal to one. Missing data points have a weight of 0 in the calculation of the weighted average.

For the CPUE component, the TAC change variable is also calculated based on fixed upper and lower bounds. It uses the average of the 4 most recent years from the specified standardised CPUE time-series. If this average value is between the bounds, the contribution to the overall TAC change is zero. If this average is below the lower bound, then the TAC change variable is negative, and if above the upper bound, the TAC change variable is positive. As the current rebuilding target of 30% TRO0 is approached (approximated in the Close-Kin component), the MP is designed to become less reactive, i.e. the recommended TAC changes will be smaller, to minimise future fluctuations in TAC while maintaining the spawning stock close to the target level.

The Close-Kin Mark-Recapture (CKMR) Parent-Offspring-Pair and Half-Sibling-Pair data are used in a simple population dynamics model of abundance and total mortality of adults, which provides a trend in adult abundance. This trend is compared to a threshold growth rate required to rebuild the adult abundance to the target in 2035. If the trend in adult abundance is above the threshold growth rate then the TAC change variable will be positive, and if the trend is lower than the threshold growth rate, the TAC change variable will be negative. The threshold growth rate is not fixed in the CTP but is calculated in the population model. This TAC change variable also becomes less reactive as the target level of rebuilding of the stock is approached.

These three components are combined to give a single multiplier of the current TAC (see technical section below). The final TAC recommendation is constrained to be within a maximum change of 3000t and minimum change of 100t.

3. Specification of the population model and HCR used in the MP

Specification of the population model and HCR used in the MP

Abstract

The Cape Town Procedure (MP) uses CPUE, gene tagging and CKMR (POP and HSP) data in three components of the Harvest Control Rule. For the CKMR component a simplified adult population model (abundance and total mortality) is fitted to the CKMR data. The log-linear trend in TRO is then used in the HCR. For the Gene-tagging and CPUE components of the HCR an upper and lower limit specifies a zone where no change is recommended to the TAC and above or below these limits there is a linearly increasing or decreasing change in TAC.

Adult population model

The adult population model is defined as follows:

$$
\begin{aligned}
N_{y_{\min},a_{\min}} &= \bar{R}\exp\left(\xi_{y_{\min}} - \sigma_R^2/2\right), \\
N_{y,a_{\min}} &= \bar{R}\exp\left(\epsilon_y - \sigma_R^2/2\right), \\
\epsilon_y &= \rho\epsilon_{y-1} + \sqrt{1-\rho^2}\xi_y, \\
\xi_y &\sim N(0, \sigma_R^2), \\
N_{y+1,a+1} &= N_{y,a}\exp\left(-Z_{y,a}\right) \qquad a \in (a_{\min}, a_{\max}), \\
N_{y+1,a_{\max}} &= N_{y,a_{\max}-1}\exp\left(-Z_{y,a_{\max}-1}\right) + N_{y,a_{\max}}\exp\left(-Z_{y,a_{\max}}\right), \\
Z_{y,a} &= Z_y \qquad a \leq 25, \\
Z_{y,a} &= Z_y + \frac{a-25}{a_{\max}-25}\left(Z_{a_{\max}} - Z_y\right) \qquad a \in [26, a_{\max}], \\
Z_y &= \frac{Z_{\max}e^{\chi_y} + Z_{\min}}{1+e^{\chi_y}}, \\
\chi_{\text{init}} &\sim N(\mu_{\chi_{\text{init}}}, \sigma^2_{\chi_{\text{init}}}), \\
\chi_{y+1} &= \chi_y + \zeta_y, \\
\zeta_y &\sim N(0, \sigma_\chi^2), \\
TRO_y &= \sum_a N_{y,a}\varphi_a
\end{aligned}
$$

The fixed parameters and settings of this model are given by the following table:

Parameter	Value
a_{min}	6
a_{max}	30
σ_r	0.25
ρ	0.5
σ_χ	0.15
Z_{min}	0.05
Z_{max}	0.4
$Z_{a_{\text{max}}}$	0.5
$\mu_{\chi_{\text{init}}}$	-1.38
$\sigma_{\chi_{\text{init}}}$	0.2
q_{hsp}	1

The estimated parameters of this model are:

1. The mean adult recruitment, $\bar{R}$
2. The adult recruitment deviations, ϵ_y
3. The initial value, χ_{init}, that "starts" the random walk for Z_y (with an associated normal prior mean and SD)
4. The random walk deviations ζ_y

The likelihood for the POP data is similar to that used in the OM. The total reproductive output is calculated as follows:

$$TRO_y = \sum_{a=a_{\text{amin}}}^{a_{\text{max}}} N_{y,a}\varphi_a$$

and consider a juvenile-adult pair $\{i, j\}$, where $z_i = \{c\}$ is the juvenile covariate and c is it's cohort (year of birth) and $z_j = \{y, a\}$ is the adult covariate and y and a are the year and age at sampling, respectively. The probability of that pair being a POP is given by

$$\mathbb{P}\left(K_{ij} = POP \,|\, z_i, z_j\right) = \mathbb{I}\left(c < y < c + a\right) \frac{2\varphi_{a-(y-c)}}{TRO_c}$$

This probability is used to create the binomial likelihood for the POP data. For the HSP data the comparison is of a juvenile-juvenile pair i and i', where the key covariates are their respective years of birth - or cohorts - c. The probability of finding an HSP is defined as follows:

$$
\begin{aligned}
\mathbb{P}\left(K_{ii'} = HSP \,|\, z_i, z_{i'}\right) &= \frac{4\pi^{\eta} q_{\text{hsp}}}{TRO_{c_{\max}}} \left(\sum_a \gamma_{c_{\min},a} \left(\prod_{k=0}^{\delta-1} \exp\left(-Z_{c_{\min}+k,a+k}\right) \right) \varphi_{a+\delta} \right), \\
\gamma_{y,a} &= \frac{N_{y,a}\varphi_a}{TRO_y}, \\
\{z_i, z_{i'}\} &= \{c_i, c_{i'}\}, \\
c_{\min} &= \min\{c_i, c_{i'}\}, \\
c_{\max} &= \max\{c_i, c_{i'}\}, \\
\delta &= c_{\max} - c_{\min}.
\end{aligned}
$$

and this probability forms the basis of the binomial likelihood for the HSP data.

Harvest Control Rule

The general structure of the revised MP is as follows:

$$
TAC_{y+1} = TAC_y \left(1 + \Delta_y^{\text{cpue}} + \Delta_y^{\text{ck}}\right) \times \Delta_y^{\text{gt}}, \tag{1}
$$

Before detailing the functional form of the HCR we recap some useful variables:

- I_y^{ck}: moving average (of length τ^{ck}) of the estimated TRO from the MP population model (projected forward to the current year using the model to project forward for 4 years to avoid too much intertia in the signal when you need it)
- $\tilde{I}$: average estimated TRO from 2003 to 2014 (reference period w.r.t. relative rebuilding criterion)
- γ: proportional amount of TRO rebuilding we wish to achieve
- $\eta = I_y^{\text{ck}}/(\gamma\tilde{I}) - 1$: the variable at which passing from negative to positive indicates the point at which the TRO rebuilding has been achieved and the transition in the reactivity of the MP occurs (i.e. it goes from reactive to passive w.r.t. CPUE and CKMR signals *only*)

For the CPUE part of the HCR we used a density-dependent gain parameter:

$$
k^{\text{cpue}}(\eta) = w_1^{\text{cpue}} \left(1 - \left(1 + e^{-2\kappa\eta}\right)^{-1}\right) + w_2^{\text{cpue}} \left(1 + e^{-2\kappa\eta}\right)^{-1}
$$

This is using the logistic function approximation to the Heaviside step function $H[\eta]$ ($H[\eta < 0] = 0$, $H[\eta \geq 0] = 1$). We set $\kappa = 20$ so the transition between the two gain parameters, given η, happens within $\pm 5\%$ of $\delta = 1$. The CPUE multiplier is then just defined as follows:

$$\Delta_y^{\text{cpue}} = k^{\text{cpue}}(\eta)\left(\delta_y^{\text{cpue}} - 1\right)$$

and δ_y^{cpue} is actually very similar in form to the gene tagging part of the HCR

$$\begin{aligned}
\delta_y^{\text{cpue}} &= \left(\frac{\bar{I}_{\text{cpue}}}{I_{\text{low}}}\right)^{\alpha_1} & \forall \bar{I}_{\text{cpue}} \leq I_{\text{low}}, \\
\delta_y^{\text{cpue}} &= 1 & \forall \bar{I}_{\text{cpue}} \in (I_{\text{low}}, I_{\text{high}}), \\
\delta_y^{\text{cpue}} &= \left(\frac{\bar{I}_{\text{cpue}}}{I_{\text{high}}}\right)^{\beta_1} & \forall \bar{I}_{\text{cpue}} \geq I_{\text{high}},
\end{aligned}$$

where $\bar{I}_{\text{cpue}}$ is the (4 year) moving average LL1 CPUE, $\bar{I}_{\text{low}}$ and $\bar{I}_{\text{high}}$ are upper and lower threshold CPUE values, and α_1 and β_1 allow for an asymmetric response above or below the threshold zone.

For the CKMR part of the HCR we try to ensure a minimum rate of increase in the TRO *beneath* the target level, and once it is achieved we would like to maintain the TRO at that level. To include this kind of behaviour in the HCR we also include some density-dependence in the log-linear growth rate at which the HCR moves from a TAC increase to a TAC decrease:

$$\begin{aligned}
\Delta_y^{\text{ck}} &= k^{\text{ck}}(\eta)\left(\lambda^{\text{ck}} - \tilde{\lambda}(\eta)\right), \\
k^{\text{ck}}(\eta) &= k_1^{\text{ck}}\left(1 - \left(1 + e^{-2\kappa\eta}\right)^{-1}\right) + k_2^{\text{ck}}\left(1 + e^{-2\kappa\eta}\right)^{-1}, \\
\tilde{\lambda}(\eta) &= \lambda_{\min}\left(1 - \left(1 + e^{-2\kappa\eta}\right)^{-1}\right)
\end{aligned}$$

The threshold level at which the log-linear trend, λ^{ck}, goes from supporting a TAC decrease to an increase essentially begins at $\lambda_{\min} > 0$ and, as the estimated TRO approaches the target level, rapidly decreases to zero (in a similar way to the CPUE trend term). This is to ensure that a minimum level of rebuilding is encouraged for **all** trajectories below the target, and where above the target the *status quo* is preferred.

To calculate the recent mean age 2 abundance from the gene tagging data consider a weighted moving average approach:

$$\bar{N}_{y,2} = \sum_{i=y-1-\tau^{\text{gt}}}^{y-2} \omega_i \widehat{N}_{i,2}$$

where ω_i is a weighting proportional to the number of matches used to produce the GT estimate $\widehat{N}_{i,2}$ (basically inverse variance weighting). The 2 year delay between having the estimate and what year it actually refers to is factored into the calculation. The multiplier for the GT part of the HCR is as follows:

$$
\begin{aligned}
\Delta_y^{\text{gt}} &= \left(\frac{\bar{N}_{y,2}}{N_{\text{low}}}\right)^{\alpha} \quad \text{if} \quad \bar{N}_{y,2} \leq N_{\text{low}}, \\
\Delta_y^{\text{gt}} &= 1 \quad \text{if} \quad \bar{N}_{y,2} \in (N_{\text{low}}, N_{\text{high}}), \\
\Delta_y^{\text{gt}} &= \left(\frac{\bar{N}_{y,2}}{N_{\text{high}}}\right)^{\beta} \quad \text{if} \quad \bar{N}_{y,2} \geq N_{\text{high}}
\end{aligned}
$$

with N_{low} the limit level and N_{high} the upper level at where TAC increases are permitted. Table 2 details the parameter values for the HCR in the adqpted MP.

Parameter	Value
τ^{cpue}	4
w_1^{cpue}	0.9
w_2^{cpue}	0.005
I_{low}	0.45
I_{high}	1.42
α_1	1
β_1	1
τ^{gt}	5
N_{low}	1e+6
N_{high}	2.6e+6
α	1.5
β	0.25
τ^{ck}	3
k_1^{ck}	1.25
k_2^{ck}	0.05
γ	1.5
λ_{min}	0.001
κ	20

Table 2: *Fixed values of parameters of the HCR in the CTP.*

4. Data analysis specification for the Gene-tagging abundance estimates used in the MP

The CCSBT gene-tagging program provides an estimate of the absolute abundance of the age-2 cohort, in the year of tagging, and the number of matches (recaptures) detected for use in the Cape Town Procedure. The annual program which commenced in 2016 is described in the design study (Preece et al. 2015) and follows protocols for tagging and animal handling developed by CSIRO (Bradford et al. 2009).

Gene-tagging SBT involves “tagging” fish by taking a very small tissue sample (Bradford et al. 2015) from a large number of 2-year-old SBT and releasing the fish alive. A physical tag is not used. A year later, a second set of tissue samples is collected from the catch of 3-year-old fish at time of harvest, allowing time for the tagged fish to mix with untagged SBT throughout the population (Polacheck et al. 2006; Basson et al. 2012). The two sets of tissue samples are genotyped and then compared in order to find the samples with matching DNA (using the unique DNA fingerprint); a match indicates that a tagged and released fish was recaptured. The abundance estimate is calculated from the number of samples in the release and harvest sets and the number of matches found.

The genotype analysis involves filtering the data to exclude fish with incomplete or poor genotype information (too few SNP markers with good sequencing results). To be included, the sample must have at least 30 of the 59 markers with a genotype call with a total count of at least 20 (Preece et al. 2019). Any fish outside the target release and harvest length ranges are also excluded. The length range for 2-year-old fish is 75-85 cm FL, and for 3-year-old fish is 98-109 cm FL. These length ranges are regularly reviewed (Preece et al. 2019; Clear et al. 2019).

The process takes about 2 years from initial collection of tissue samples (‘tagging’) through to calculation of the abundance estimate.

An estimate of cohort abundance at the time of tagging (N) is given by:

(1) $N = T * S/R$

where T is the number of fish in the cohort that were tagged, R is the number of tagged fish “recaptured” in the harvest sample i.e. the number of ‘matches’, and S is the harvest sample size. Eq. (1) is often referred to as the Petersen (or Lincoln-Petersen) estimator of abundance (e.g. Seber 1982). Assuming a Poisson recapture process, the coefficient of variation (CV) of the abundance estimate can be approximated by:

(2) $CV = \mathrm{sqrt}(N/(T*S))$
$= \mathrm{sqrt}(1/R)$

Only the abundance estimates and number of matches each year are used in the Cape Town Procedure (Table 1, unshaded columns). These data are submitted annually as part of the CCSBT data exchange. The data in Table 1 are the gene-tagging results for the 3 years (2016-2018) available for use in the MP in 2020.

Table 1. The results of the gene-tagging programs 2016-2018 which provide the absolute abundance estimate for the age-2 cohort in the year of tagging. The unshaded columns indicate the data used in the Cape Town Procedure.

YEAR	COHORT AGE	N RELEASES	N HARVEST	N MATCHES	ABUNDANCE ESTIMATE (MILLIONS)	CV
2016	2	2952	15389	20	2.27	0.224
2017	2	6480	11932	67	1.15	0.122
2018	2	6295	11980	66	1.14	0.123

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Preece AL, Eveson JP, Bradford RW, Grewe PM, Aulich J, Clear NP, Lansdell M, Cooper S, Hartog J. (2019) Report on the gene-tagging juvenile abundance monitoring program: 2016-2019. CSIRO, Australia. CCSBT-ESC/1909/10.

Seber, G.A.F. (1982) The Estimation of Animal Abundance and Related Parameters, 2nd ed. Charles Griffin, London.

5. Specification for the Close-Kin Mark-Recapture data used in the MP

Close-Kin Mark Recapture (CKMR) uses modern genetics to identify close relatives (parent-offspring-pairs (POPs) and half-sibling-pairs (HSPs)) amongst large sample sizes of fish, in order to estimate adult abundance and make demographic inferences about the adult stock (Bravington et al. 2016). As part of the CKMR program for SBT, genetic samples have been collected annually since 2006 from adults on the Indonesian spawning grounds and from juveniles (3-year-olds) in the Great Australian Bight (Davies et al. 2018). Each year, updated numbers of POPs and HSPs, along with the numbers of comparisons made in identifying these kin pairs, are provided to the CCSBT data exchange. In the Cape Town Procedure, these data get used in a population dynamics model to provide an index of abundance of reproductive adults (or total reproductive output, TRO), which is then used to modify the TAC (Hillary et al., 2019).

In Indonesia, tissue samples are collected from adult SBT of all sizes at the Benoa Fishing Port each spawning season during processing of catches from the longline fishery. In Australia, tissue samples are collected from juvenile SBT each June-July at the tuna processors during harvest in Port Lincoln; samples are obtained from fish ranging from 98 to 109 cm fork length to ensure 3-year-olds are being sampled. In both sampling locations, sample collection is spread as evenly as practical throughout the harvest season.

DNA is extracted from the tissue samples selected for genotyping. Archived plates of extracted DNA are shipped to Diversity Arrays Technology (DArT) in Canberra for genotype sequencing, referred to as “DArTcap”, and when completed, the sequencing data are provided to CSIRO Hobart. These data are used to call the genotype (i.e., to infer the pair of alleles present) for each fish and locus in the data set using sophisticated algorithms developed at CSIRO specifically for DArTcap sequencing data. The genotyping error rate is also estimated for each locus (of which ~1500 are used in kin-finding), which is important in the identification of HSPs. A series of quality control (QC) steps are applied to the genotyped data to remove fish with unreliable genotype calls and provide a final data set for kin-finding. Note that the QC steps have evolved (and may continue to) over the course of the program, so the exact sample sizes used in kin-finding can change; Table 1 gives the sample sizes used in the 2020 analysis.

POPs are identified across all genotyped adult-juvenile pairs using a modified Mendelian-exclusion statistic referred to as the Weighted-PSeudo-EXclusion (WPSEX) statistic (see Appendix B of Bravington et al. 2017). The numbers of POPs obtained from the 2020 analysis, broken down by juvenile birth year and adult capture year, are given in Table 2 (note this includes POPs that were identified using microsatellites prior to the genotyping method changing in 2015 to DArTcap sequencing; see Bravington et al. 2015, 2017).

HSPs are identified among all genotyped juvenile pairs using a pseudo-log-odds-ratio (PLOD) statistic, which measures the relative probability of a pair of fish having their observed genotypes if they are HSPs compared to if they are unrelated (see Appendix C of Bravington et al. 2017). Unlike the WPSEX statistic for identifying POPs, the

PLOD statistic does not give a clear separation between HSPs and unrelated/less-related fish (see Figures 3 and 4 of Farley et al. 2019). Thus, the theoretical means and approximate variances of the PLOD distributions for HSPs and unrelated/less-related pairs are used to determine a lower cut-off PLOD value that minimises the number of false positive HSPs whilst still maintaining a large enough number of HSPs for the estimate to have good precision. An inevitable consequence of ensuring that false positives are rare is that a reasonable number of false negatives will be present; the false-negative rate is estimated using the expected PLOD distribution for HSPs, and is allowed for in modelling (Bravington et al. 2017). Note that the division between PLOD values for HSPs and more related fish (i.e., full-sibling-pairs) is clear. The numbers of high-confidence HSPs identified from the 2020 analysis, broken down by birth years of siblings, are given in Table 3.

Table 1. Number of fish available for kin-finding analyses in 2020 after quality control checks. For the adults, samples were collected from Indonesia in the fishing season ending in the year shown (i.e., samples collected over the 2005/06 fishing season are referred to as year 2006).

Year	Adults	Juveniles
2006	0	1317
2007	0	1325
2008	0	1356
2009	0	1347
2010	972	1315
2011	958	963
2012	536	876
2013	959	903
2014	922	899
2015	0	953
2016	951	854
2017	971	948
2018	700	777
Total	6969	13,833

Table 2. Number of POPs identified in the 2020 analysis (including those identified using microsatellites; see Bravington et al. 2016) broken down by juvenile birth year (rows) and adult capture year (columns). Note: The exact number of POPs identified, and the total number of comparisons made, may vary between each year's analysis, as the entire updated data set is quality controlled and re-analysed.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2016	2017	2018
2002	0	0	0	0	0	NA	NA	NA	NA	NA	NA	NA
2003	0	5	1	2	0	0	0	1	0	1	0	0
2004	0	2	0	0	3	0	0	0	0	0	0	0
2005	1	4	5	4	1	0	0	1	2	0	0	0
2006	NA	4	3	2	0	0	0	0	0	0	0	0
2007	NA	NA	3	4	1	3	2	0	2	0	1	0
2008	NA	NA	NA	NA	0	1	1	1	0	0	0	2
2009	NA	NA	NA	NA	0	1	1	1	0	0	0	0
2010	NA	NA	NA	NA	0	0	1	4	0	2	0	0
2011	NA	NA	NA	NA	0	0	1	2	1	2	0	0
2012	NA	NA	NA	NA	0	0	0	1	1	0	0	1
2013	NA	NA	NA	NA	0	0	0	0	0	1	1	3
2014	NA	NA	NA	NA	0	0	0	0	0	0	1	0
2015	NA	NA	NA	NA	0	0	0	0	0	1	0	0

Table 3. Number of HSPs identified in the 2020 analysis broken down by birth year of younger sibling (rows) and older sibling (columns). Note: The exact number of HSPs identified, and the total number of comparisons made, may vary between each year's analysis, as the entire updated data set is quality controlled and re-analysed.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2003	2	4	2	1	0	0	1	0	0	2	0	2	1
2004		6	3	6	2	2	1	0	0	2	0	0	0
2005			5	3	3	3	0	5	1	1	0	2	0
2006				8	4	1	3	5	3	0	1	1	1
2007					3	3	2	2	2	2	2	1	2
2008						5	1	1	2	3	0	1	0
2009							1	2	1	0	0	0	0
2010								2	1	2	1	0	1
2011									3	2	1	0	3
2012										3	2	1	1
2013											2	4	1
2014												2	2
2015													4

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6. Specification of Standardised CPUE for the MP

Data to be used

The CPUE dataset to be used in the MP is based on the longline catch and effort data of Japanese, Australian (Real-Time Monitoring Program in the 1990s) and New Zealand (NZ) charter vessels at the shot-by shot resolution. Southern bluefin tuna (SBT) aged 4 years or older are used in the CPUE dataset. In the most recent year of the dataset, CPUE (number of SBT individuals per 1000 hooks) is calculated from Japanese data available at the time which are mainly from RTMP. From this dataset, a set of core vessels are selected which meet certain conditions. These conditions are: CCSBT statistical areas (Area) 4-9, Month 4-9, x (top rank of SBT catch in a year) = 52, and y (number of years in the top ranks) = 3.

The dataset each year is further adjusted by:

- Deleting records from operations south of 50^0S;
- Combining operations of Area 5 into Area 4 and that of Area 6 into Area 7; and
- Deleting operations with extremely high CPUE values (>120).

The shot-by-shot data are then aggregated into 5x5 degree cells by month before standardization. Aggregated data cells with little effort (<10,000 hooks) are deleted.

CPUE standardization

Unweighted CPUE

The aggregated CPUE dataset is standardized using the following Generalised Linear Model (GLM) [1] :

$$log(CPUE+const) = Intercept + Year + Month + Area + Lat5 + BET\_CPUE + YFT\_CPUE + (Month*Area) + (Year*Lat5) + (Year*Area) + Error \qquad (1)$$

where

Area	is the CCSBT statistical area
Lat5	is the latitude in 5 degree
BET_CPUE	is the bigeye tuna CPUE
YFT_CPUE	is the yellowfin tuna CPUE
const	is the constant as 0.2 derived as 10% of the mean nominal CPUE in Nishida and Tsuji (1998)

Area weights

To obtain the area weighted CPUE indices described below, the area of SBT distribution was calculated based on a 1x1 degree square resolution. The area was calculated in the form of an area index such that an area size of 1x1 degree square along the equator was defined as 1, and the area size for other 1x1 degree squares of different latitudes was determined as the proportion of the square area along the

[1] Currently, there is no specification of the procedure to be followed for the GLMs here and below that have fixed interaction effects if in a future year one of the associated cells is empty of data.

equator. The area index for the Constant Square (CS) [2] was simply a union of fished 1x1 degree squares through all years (1969-present) and was calculated for each quarter, month, statistical area, and latitude (5 degree) combination. The area index for the Variable Square (VS) was the sum of fished 1x1 degree square areas and was calculated for each year, quarter, month, statistical area, and latitude combination. For VS, a square counts as fished only for the month in which fishing occurred. More details of the area index calculation are described in Nishida (1996).

Area weighted CPUE

With the estimated parameters obtained from the CPUE standardization above (1), the Constant Square (CS) and Variable Square (VS) CPUE abundance indices are computed by the following equations:

$$CS_{4+,y} = \sum_m \sum_a \sum_l (AI_{CS})_{(yy\text{-}present)}[\exp(Intercept + Year + Month + Area + Lat5 + BET\_CPUE + YFT\_CPUE + (Month*Area) + (Year*Lat5) + (Year*Area) + \sigma^2/2) - 0.2] \tag{2}$$

$$VS_{4+,y} = \sum_m \sum_a \sum_l (AI_{VS})_{ymal}[\exp(Intercept + Year + Month + Area + Lat5 + BET\_CPUE + YFT\_CPUE + (Month*Area) + (Year*Lat5) + (Year*Area) + \sigma^2/2) - 0.2] \tag{3}$$

where

$CS_{4+,y}$	is the CS abundance index for age 4+ and *y*-th year,
$VS_{4+,y}$	is the VS abundance index for age 4+ and *y*-th year,
$(AI_{CS})_{(yy\text{-}present)}$	is the area index of the CS model for the period *yy*-present (*yy*=1969 or 1986 depending on the period of standardization,
$(AI_{VS})_{ymal}$	is the area index of the VS model for *y*-th year, *m*-th month, *a*-th SBT statistical area, and *l*-th latitude,
σ	is the mean square error in the GLM analyses.

The w0.5 and w0.8 (B-ratio and geostat proxies) CPUE abundance indices are then calculated using the following equation (Anonymous 2001a):

$$I_{y,a} = wCS_{y,a} + (1-w)VS_{y,a} \qquad \text{where } w = 0.5 \text{ or } 0.8 \tag{4}$$

The final CPUE input series is the arithmetic average of the w0.5 and w0.8 series.

Data calibration

The estimated CPUE value in the most recent year, which is mainly derived from RTMP data, is corrected using the average of the “Logbook based CPUE / RTMP based CPUE” ratio for the most recent three years of logbook data.

The area weighted CPUE series between 1986 and the most recent year are then calibrated to the historical CPUE series between 1969 and 2008 using the following GLM (equation 5), described in Nishida and Tsuji (1998) for 5x5 degree cells by

[2] For explanation of Constant Square and Variable Square CPUE interpretations, see Anonymous (2001b).

month data for all vessels (i.e. both core and other vessels) in Areas 4-9 and Months 4-9:

$$\begin{aligned} log(CPUE+const) = {} & Intercept + Year + Quarter + Month + Area + Lat5 + \\ & (Quarter*Area) + (Year*Quarter) + (Year*Area) + Error \end{aligned} \quad (5)$$

where
const is 10% of the mean nominal CPUE.

CPUE series for monitoring

Two additional CPUE series will be used for monitoring purposes of the status of the stock and MP implementation. These include:

(1) Same procedure as specified above, but at the shot-by-shot level rather than the aggregated 5x5 level.
(2) Same procedure as specified above, but using the simpler GLM given by:

$$log(CPUE+0.2) = Intercept + Year + Month + Area + Lat5 + (Month*Area) + Error \quad (6)$$

Historical CPUE Series used as input to the Management Procedure

The CPUE series used in the MP is the average of the base CPUE series (w0.5 and w0.8) and is adjusted in the years 1989 -2005 for the case 1 LL over-catch. The overcatch correction is based on the same assumptions used in the base-case operating model used for MP testing, namely: (i) that 25% of the unreported catch was attributed to the LL1 reported effort and (ii) that the LL overcatch was distributed amongst LL1 subfleets, areas and months in proportion to the nominal catch, except for the Australian joint venture and New Zealand charter fleets (called Option A in Attachment 4 of OMMP 2009 meeting report). In 2009, the extent of LL1 overcatch corresponding to the Case 1 market estimates provided by Lou and Hidaka for 1985-2005 (with unreported catch in 2005 set equal to unreported catch in 2004) were re-estimated using a new equation for the lag from catch to market (documented in Attachment 4 of the OMMP2009 meeting report).

The resulting catch and CPUE multipliers are provided in Table 2. The CPUE multipliers are not exactly 0.25 because a small proportion of the CPUE catch (from the Australian joint venture and New Zealand charter fleets) is not affected by the overcatch. The historical CPUE series to be used as input of the MP is calculated using the following equation:

CPUE = (w0.5 + w0.8)/2 * (1+(Catch_multiplier-1)*CPUE_multiplier)

Table 2. Year, CPUE multipliers and Catch multipliers for the Case 1 LL CPUE adjustment.

	CPUE multiplier	Catch multiplier
Year	S=0.25-A	Case 1
1983	0.25	1
1984	0.25	1
1985	0.25	1
1986	0.25	1
1987	0.25	1
1988	0.25	1
1989	0.244	1.28
1990	0.249	1.8
1991	0.25	1.53
1992	0.275	1.24
1993	0.273	1.62
1994	0.266	2.66
1995	0.247	2.14
1996	0.25	2.2
1997	0.246	2.6
1998	0.247	1.82
1999	0.248	1.77
2000	0.247	2.13
2001	0.248	2.16
2002	0.249	2.13
2003	0.249	1.92
2004	0.248	1.75
2005	0.249	1.69
2006	0	1

Reference

Anonymous. 2001a. Report of the Fifth Meeting of the Commission for the Conservation of Southern Bluefin Tuna, Scientific Committee. 19-14 March 2001, Tokyo, Japan.

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Nishida, T. 1996. Estimation of abundance indices for southern bluefin tuna (Thunnus maccoyii) based on the coarse scale Japanese longline fisheries data. Paper submitted to the Commission for the Conservation of Southern Bluefin Tuna, Scientific Meeting. CCSBT/SC/96/12. 26 pp.

Nishida, T. and S. Tsuji. 1998. Estimation of abundance indices of southern bluefin tuna (Thunnus maccoyii) based on the coarse scale Japanese longline fisheries data (1969-97). Paper submitted to the Commission for the Conservation of Southern Bluefin Tuna, Scientific Meeting. CCSBT/SC/9807/13.27 pp.

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7. Metarules for the Cape Town Procedure

Preamble

Metarules can be thought of as a set of conventions for the implementation of the Management Procedure (MP). This includes "rules" which prespecify how to proceed in the event that exceptional circumstances arise when application of the total allowable catch (TAC) generated by the MP is considered to be highly risky or highly inappropriate. Metarules are not a mechanism for making small adjustments, or 'tinkering' with the TAC from the MP. It is difficult to provide very specific definitions of, and be sure of including all possible, exceptional circumstances. Instead, a process for determining whether exceptional circumstances exist and whether the implication(s) arising from them is sufficiently severe to warrant revising the TAC advice from the MP is described below. The need for invoking exceptional circumstances provisions should only be evaluated at the ESC based on information presented and reviewed at the ESC.

All examples given in this document are meant to be illustrative and are not meant as complete or exhaustive lists.

Process to determine whether exceptional circumstances exist

Every year the ESC will:

- Review stock and fishery indicators, and any other relevant data or information on the stock and fishery; and
- Consider and examine whether the inputs to the MP are affected
- Consider if the population dynamics are potentially substantially different from those for which the MP was tested (as defined by the 2019 Reference set of operating models, OMs)
- Consider if the fishery or fishing operations have changed substantially
- Consider if recent catches and other removals have been greater than the MP's recommended TACs

On the basis of this review, determine whether there is evidence for exceptional circumstances.

Examples of what might constitute an exceptional circumstance include, but are not limited to:

- A gene-tagging juvenile abundance estimate outside the range (95% probability intervals for projections)[3] for which the MP was tested (i.e. the 2019 reference set of OMs);
- A CPUE result outside the range for which the MP was tested;

[3] The "range" refers to 95% probability intervals for projections for the index in question made using the reference set ("grid") of the OMs during the testing of the MP (i.e. 2019 OMs).

- Substantial improvements in knowledge, or new knowledge, concerning the dynamics of the population which would have an appreciable effect on the operating models used to test the existing MP; and
- Missing input data for the MP[4], resulting in an inability to calculate a TAC from the MP (i.e. consistent with the manner in which it was tested).

Every three years (not coinciding with years when a new TAC is calculated from the MP) the ESC will:

- Conduct an in-depth stock assessment; and
- On the basis of the assessment, indicators and any other relevant information, determine whether there is evidence for exceptional circumstances (an example of exceptional circumstances would be if the stock assessment was substantially outside the range of simulated stock trajectories considered in MP evaluations, calculated under the reference set of operating models).

Every six years (not coinciding with years when a new TAC is calculated from the MP) the ESC will:

- Review the performance of the MP; and
- On the basis of the review determine whether the MP is on track to meet the rebuilding objective or a new MP is required.

If the ESC concludes that there is no or insufficient evidence for exceptional circumstances, the ESC will:

- Report to the Extended Commission that exceptional circumstances do not exist.

If the ESC has agreed that exceptional circumstances exist, the ESC will:

- Follow the "Process for Action".

Process for Action

Having determined that there is evidence of exceptional circumstances, the ESC will in the same year:

- Consider the severity of the exceptional circumstances (for example, how severely "out of bounds" is the CPUE) and, where possible, examine its potential impacts on the performance of the MP;
- Follow the Guidelines for Action if TAC change is considered necessary (see below);
- Formulate advice on the action required (for example, there may be occasions when the severity and impacts of the 'exceptional circumstances' are deemed to be low, so that the advice is not for an immediate change in TAC, but rather

[4] Missing years of gene-tagging data have zero weight in calculation of 5-year weighted average.

a trigger for a review of the MP or collection of ancillary data to be reviewed at the next ESC); and

- Report to the Extended Commission that exceptional circumstances exist and provide advice on the action to take.

Guidelines for Action

If there is a risk associated with TAC being too high, then consider TAC changes where:

a) The MP-derived TAC should be an upper bound;
b) Action should be at least an x% change to the TAC, depending on severity.

If there are risks associated with TAC being too low, then consider TAC changes where:

a) The MP-derived TAC could be a minimum;
b) Action should be at least an x% change to the TAC, depending on severity.

An urgent updated assessment and review of indicators will take place, with projections from that assessment providing the basis to select the value of the x% referred to above.

The Extended Commission will:

- Consider the advice from the ESC; and
- Decide on the action to take.

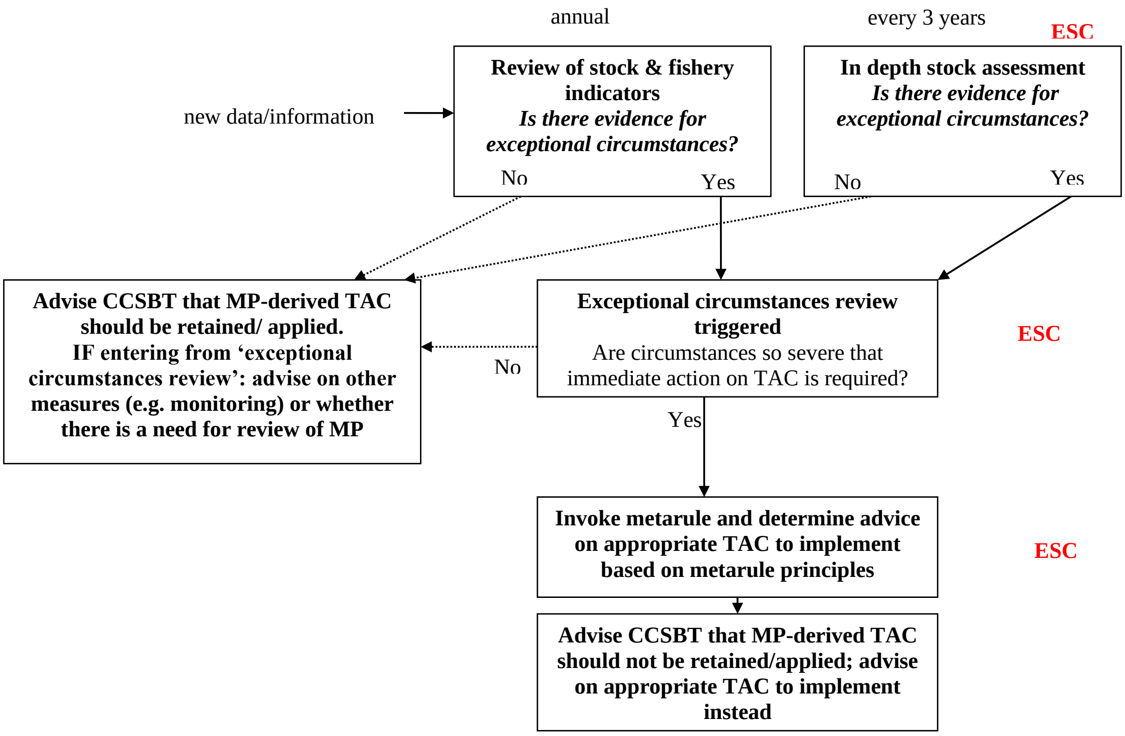
Examples of meta-rules implementation

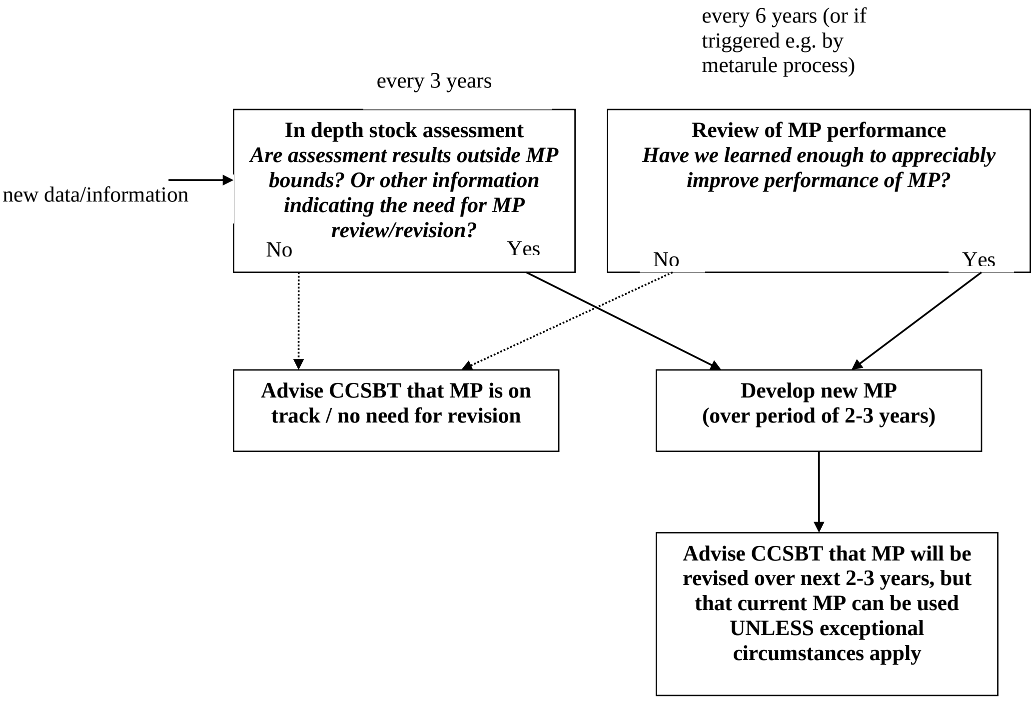
In 2012 a very low aerial survey data point in the timeseries was identified as on the border of the range of projections used for testing the Bali Procedure (NB this index is not used in the Cape Town Procedure). The ESC considered the data, analysis and additional information available on recruitment. Given that the Bali Procedure was shown to be robust to low recruitment scenarios, the ESC recommended to the Commission that there should be no action on TAC in that year, but that further analysis of environmental and fishery data should be considered at the next ESC.

In other years, exceptional circumstances (both negative and positive) have been identified but the ESC has not recommended action to alter the Bali Procedure derived TAC. Rather, the ESC has recommended gathering of additional information (e.g., implement gene tagging after suspension of the aerial survey) or alternative actions in the meta-rules process (e.g. development of a new MP), and the Commission has adopted these recommendations.

Meta-rules Flow Chart

Figure 1: Flowchart for Metarules process




every 6 years (or if triggered e.g. by metarule process)
every 3 years
new data/information
In depth stock assessment
Are assessment results outside MP bounds? Or other information indicating the need for MP review/revision?
No
Yes
Review of MP performance
Have we learned enough to appreciably improve performance of MP?
No
Yes
Advise CCSBT that MP is on track / no need for revision
Develop new MP (over period of 2-3 years)
Advise CCSBT that MP will be revised over next 2-3 years, but that current MP can be used UNLESS exceptional circumstances apply

ESC

Attachment 9

Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2020

The CCSBT Extended Scientific Committee (ESC) updated the stock assessment and conducted a review of fisheries indicators in 2020 to provide updated information on the status of the stock. This report updates the description of fisheries and the state of stock as advised in 2020 by the ESC.

1. Biology

Southern bluefin tuna (*Thunnus maccoyii*) are found in the southern hemisphere, mainly in waters between 30° and 50° S, but only rarely in the eastern Pacific. The only known spawning area is in the Indian Ocean, south-east of Java, Indonesia. Spawning takes place from September to April in warm waters south of Java and juvenile SBT migrate south down the west coast of Australia. During the summer months (December-April), they tend to congregate near the surface in the coastal waters off the southern coast of Australia and spend their winters in deeper, temperate oceanic waters. Results from recaptured conventional and archival tags show that young SBT migrate seasonally between the south coast of Australia and the central Indian Ocean. After age 5 SBT are seldom found in nearshore surface waters, and their distribution extends over the southern circumpolar area throughout the Pacific, Indian and Atlantic Oceans.

SBT can attain a length of over 2m and a weight of over 200kg. Direct ageing using otoliths indicates that a significant number of fish larger than 160cm are older than 25 years, and the maximum age obtained from otolith readings has been 42 years. Analysis of tag returns and otoliths indicate that, in comparison with the 1960s, growth rate has increased since about 1980 as the stock has been reduced. There is some uncertainty about the size and age when SBT mature, but available data indicate that SBT do not mature younger than 8 years (155cm fork length), and perhaps as old as 15 years. SBT exhibit age-specific natural mortality, with M being higher for young fish and lower for old fish, increasing again prior to senescence.

Given that SBT have only one known spawning ground, and that no morphological differences have been found between fish from different areas, SBT are considered to constitute a single stock for management purposes.

2. Description of Fisheries

Reported catches of SBT up to the end of 2019 are shown in Figures 1 - 3. Note that a 2006 review of SBT data indicated that there may have been substantial under-reporting of SBT catches and surface fishery bias in the previous 10 - 20 year period, and there is currently substantial uncertainty regarding the true levels of total SBT catch over this period. The SBT stock has been exploited for more than 50 years, with total catches peaking at 81,750t in 1961 (Figures 1 - 3). Over the period 1952 - 2019, 77% of the reported catch was taken by longline and 23% using surface gears, primarily purse-seine and pole and line (Figure 1). The proportion of reported catch made by the surface fishery peaked at 50% in 1982, dropped to 11-12 % in 1992 and 1993 and increased again to average 34% since 1996 (Figure 1). The Japanese longline fishery (taking a wide age range of fish) recorded its peak catch of 77,927t in

1961 and the Australian surface fishery catches of young fish peaked at 21,501t in 1982 (Figure 3). New Zealand, the Fishing Entity of Taiwan and Indonesia have also exploited southern bluefin tuna since the 1970s - 1980s, and Korea started a fishery in 1991.

On average, 78.5% of the SBT catch has been made in the Indian Ocean, 16.7% in the Pacific Ocean and 4.8% in the Atlantic Ocean (Figure 2). The reported Atlantic Ocean catch has varied widely between about 18t and 8,200t since 1968 (Figure 2), averaging 1292t over the past two decades. This variation in catch reflects shifts in longline effort between the Atlantic and Indian Oceans. Fishing in the Atlantic occurs primarily off the southern tip of South Africa (Figure 4). Since 1968, the reported Indian Ocean catch has declined from about 45,000t to less than 10,000t, averaging 18,263t, and the reported Pacific Ocean catch has ranged from about 800t to 19,000t, averaging 5,015t over the same period (although SBT data analyses indicate that these catches may be under-estimated).

3. Summary of Stock Status

Since 2017, CCSBT has measured reproductive capacity as Total Reproductive Output (TRO) rather than SSB. The 2020 stock assessment suggested that the SBT TRO is at 20% of its initial biomass as well as below the level that could produce maximum sustainable yield. However, there have been improvements since the 2011 stock assessment, which indicated the stock in 2011 was at 5.5% of initial B10+ (the biomass of fish aged ten and older, used as a proxy for SSB prior to adoption of TRO), and the 2017 stock assessment, which indicated the stock was at 13% of initial TRO in 2017.

A review of indicators in 2020 suggested that recruitment for the most recent year may have been lower than in recent years but that recruitment levels still remain above historical means. There are some consistent positive trends in the age-based longline CPUE estimates across a number of fleets. In 2019, for the first time, the ESC noted an increased TRO as evidenced by a significant increase in the close-kin mark recapture (CKMR) empirical index.

4. Current Management Measures

Total Allowable Catch (TAC)

The primary conservation measure for management of the southern bluefin tuna stock is the TAC.

At its eighteenth annual meeting in 2011, the CCSBT agreed that a Management Procedure (MP) would be used to guide the setting of the SBT global total allowable catch (TAC) to ensure that the SBT spawning stock biomass achieves the interim rebuilding target of 20% of the initial spawning stock biomass. The CCSBT has set TAC until 2020 based on the outcome of the MP, unless the CCSBT decides otherwise based on information that is not incorporated into the MP. At its twenty sixth annual meeting in 2019, the CCSBT agreed a new MP tuned to achieve a 0.5 probability of achieving 30% of initial TRO by 2035. In 2020 the ESC has advised on a TAC for 2021-2023 based on the new MP.

In adopting the first MP in 2011, the CCSBT emphasised the need to take a precautionary approach to increase the likelihood of the spawning stock rebuilding in the short term and to provide industry with more stability in the TAC (i.e. to reduce the probability of future TAC decreases). Under the adopted MP, the TACs were set in three-year periods. The TACs for 2015 to 2017 were14,647 tonnes and the TACs for 2018 to 2020 were 17,647 tonnes. In 2020, based on the new MP adopted in 2019, the ESC has advised TACs for 2021-2023 remain unchanged at 17,647 tonnes.

The allocations of the TAC to Members and Cooperating Non-Members of the CCSBT from 2015 to 2020 is summarised below. In addition, some flexibility is provided to Members for limited carry-forward of unfished allocations between quota years.

Current Allocations to Members (tonnes)

	2015	2016-2017	2018-2020
Japan	4,847	4,737	6,117[1]
Australia	5,665	5,665	6,165
Republic of Korea	1,140	1,140	1,240.5
Fishing Entity of Taiwan	1,140	1,140	1,240.5
New Zealand	1,000	1,000	1,088
Indonesia	750	750	1,023[1]
European Union	10	10	11
South Africa	40	150	450[1]

Current Allocations to Cooperating Non-Members (tonnes)

	2015	2016-2017[2]	2018-2020
Philippines	45	45	0

Monitoring, Control and Surveillance

The CCSBT has adopted a Compliance Plan that supports its Strategic Plan and provides a framework for the CCSBT, Members and Cooperating Non-Members to improve compliance, and over time, achieve full compliance with CCSBT's conservation and management measures. The Compliance Plan also includes a three-year action plan to address priority compliance risks. The action plan will be reviewed and confirmed or updated every year. The action plan is therefore a 'rolling' document and over time its emphasis will change.

The CCSBT has also adopted three Compliance Policy Guidelines, these being:

- Minimum performance requirements to meet CCSBT Obligations;
- Corrective actions policy; and
- MCS information collection and sharing

In addition, the CCSBT has implemented a Quality Assurance Review (QAR) program to provide independent reviews to help Members identify how well their management systems function with respect to their CCSBT obligations and to provide

[1] These figures reflect the voluntary transfers of 21t that Japan is providing to Indonesia and 27t that Japan is providing to South Africa for the 2018 to 2020 quota block. The starting point for Japan, Indonesia and South Africa in considering the allocation from 2021 will be 6165t, 1002t, and 423t respectively.

[2] Ceased 12 October 2017

recommendations on areas where improvement is needed. It is further intended that QARs will:

- Benefit the reviewed Member by giving them confidence in the integrity and robustness of their own monitoring and reporting systems;
- Promote confidence among all Members as to the quality of individual Members' performance reporting; and
- Further demonstrate the credibility and international reputation of the CCSBT as a responsible Regional Fisheries Management Organisation.

Individual MCS measures that have been established by the CCSBT include:

Catch Documentation Scheme

The CCSBT Catch Documentation Scheme (CDS) came into effect on 1 January 2010 and replaced the Statistical Document Programme (Trade Information Scheme) which had operated since 1 June 2000. The CDS provides for tracking and validation of legitimate SBT product flow from catch to the point of first sale on domestic or export markets. As part of the CDS, all transhipments, landings of domestic product, exports, imports and re-exports of SBT must be accompanied by the appropriate CCSBT CDS Document(s), which will include a Catch Monitoring Form and possibly a Re-Export/Export After Landing of Domestic Product Form. Similarly, transfers of SBT into and between farms must be documented on either a Farm Stocking Form or a Farm Transfer Form as appropriate. In addition, each whole SBT that is transhipped, landed as domestic product, exported, imported or re-exported must have a uniquely numbered tag attached to it and the tag numbers of all SBT (together with other details) will be recorded on a Catch Tagging Form. Copies of all documents issued and received will be provided to the CCSBT Secretariat on a quarterly basis for compiling to an electronic database, analysis, identification of discrepancies, reconciliation and reporting.

Monitoring of SBT Transhipments

The CCSBT program for monitoring transhipments at sea came into effect on 1 April 2009. The program was revised to include requirements for monitoring transhipments in port from 1 January 2015.

Transhipments at sea from tuna longline fishing vessels with freezing capacity (referred to as "LSTLVs") require, amongst other things, carrier vessels that receive SBT transhipments at sea from LSTLVs to be authorised to receive such transhipments and for a CCSBT observer to be on board the carrier vessel during the transhipment. The CCSBT transhipment program is harmonised and operated in conjunction with those of ICCAT and IOTC to avoid duplication of the same measures. ICCAT or IOTC observers on a transhipment vessel that is authorised to receive SBT are deemed to be CCSBT observers provided that the CCSBT standards are met.

Transhipments in port must be to an authorised carrier vessel (container vessels are exempted) at designated foreign ports and, amongst other things, require prior notification to Port State authorities, notification to Flag States, and transmission of the CCSBT transhipment declaration to the Port State, the Flag State and the CCSBT Secretariat.

Port State Measures

The CCSBT adopted a Resolution for a CCSBT Scheme for Minimum Standards for Inspections in Port in October 2015. The Resolution entered into force on 1 January 2017. The scheme applies to foreign fishing vessels, including carrier vessels other than container vessels. Under this scheme, Members wishing to grant access to its ports to foreign fishing vessels shall, amongst other things:

- Designate a point of contact for the purposes of receiving notifications;
- Designate its ports to which foreign fishing vessels may request entry;
- Ensure that it has sufficient capacity to conduct inspections in every designated port;
- Require foreign fishing vessels seeking to use its ports for the purpose of landing and / or transhipment to provide certain required minimum information with at least 72 hours prior notification; and
- Inspect at least 5% of foreign fishing vessel landings in their designated ports each year.

List of Approved Vessels and Farms

The CCSBT has established records for:

- Authorised SBT vessels;
- Authorised SBT carrier vessels; and
- Authorised SBT farms.

Members and Cooperating Non-Members of the CCSBT will not allow the landing or trade etc. of SBT caught by fishing vessels and farms, or transhipped to carrier vessels that are not on these lists.

List of Vessels Presumed to have carried out IUU Fishing Activities for SBT

The CCSBT has adopted a Resolution on Establishing a List of Vessels Presumed to have Carried Out Illegal, Unreported and Unregulated Fishing Activities For Southern Bluefin Tuna.

At each annual meeting, the CCSBT will identify those vessels which have engaged in fishing activities for SBT in a manner which has undermined the effectiveness of the Convention and the CCSBT measures in force.

Vessel Monitoring System

The CCSBT Vessel Monitoring System (VMS) came into effect immediately after the Fifteenth Annual Meeting of the Commission, on 17 October 2008. It requires CCSBT Members and Cooperating Non-Members to adopt and implement satellite-linked VMS for vessels fishing for SBT that complies with the IOTC, WCPFC, CCAMLR, or ICCAT VMS requirements according to the respective convention area in which the SBT fishing is being conducted. For fishing outside of these areas, the IOTC VMS requirements must be followed.

5. Scientific Advice

Based on the results of the MP operation for 2018-20 TAC in 2016 and the outcome of reviews of exceptional circumstances at its 2017, 2018 and 2019 meetings, the ESC recommended that there is no need to revise the EC's 2016 TAC decision regarding the TACs for 2018-20. The recommended annual TAC for 2018-20 was 17,647t.

Based on the new MP adopted in 2019 and implemented in 2020, and the outcome of reviews of exceptional circumstances at its 2020 meeting, the ESC recommended that there is no need to revise the current TAC. The ESC-recommended annual TAC for 2021-2023 is 17,647t.

6. Biological State and Trends

The 2020 stock assessment suggested that the SBT TRO is at 20% of its initial level and remains below the target and the level that could produce maximum sustainable yield. However, there has been improvements in the stock condition since the 2011 stock assessment, which indicated the stock in 2011 was at 5.5% of initial TRO, and the 2017 stock assessment, which indicated the stock in 2017 was at 13% of initial TRO.

Exploitation rate:	Moderate (Below F_{MSY})
Exploitation state:	Overexploited
Abundance level:	Low abundance

SOUTHERN BLUEFIN TUNA SUMMARY FROM ESC in 2020 (global stock)	
Maximum Sustainable Yield	33,207t (31,471-34,564t)
Reported (2019) Catch	16,843t
Current (2020) biomass (B10+)	204,596t (184,272-231,681)
Current condition relative to initial	
TRO	0.20 (0.16–0.24)
B10+	0.17 (0.14–0.21)
TRO (2020) Relative to TRO_{msy}	0.69 (0.49–1.03)
Fishing Mortality (2019) Relative to F_{msy}	0.52 (0.37–0.73)
Current Management Measures	Effective Catch Limit for Members and Cooperating Non-Members: 17,647t per year for the years 2018-2020

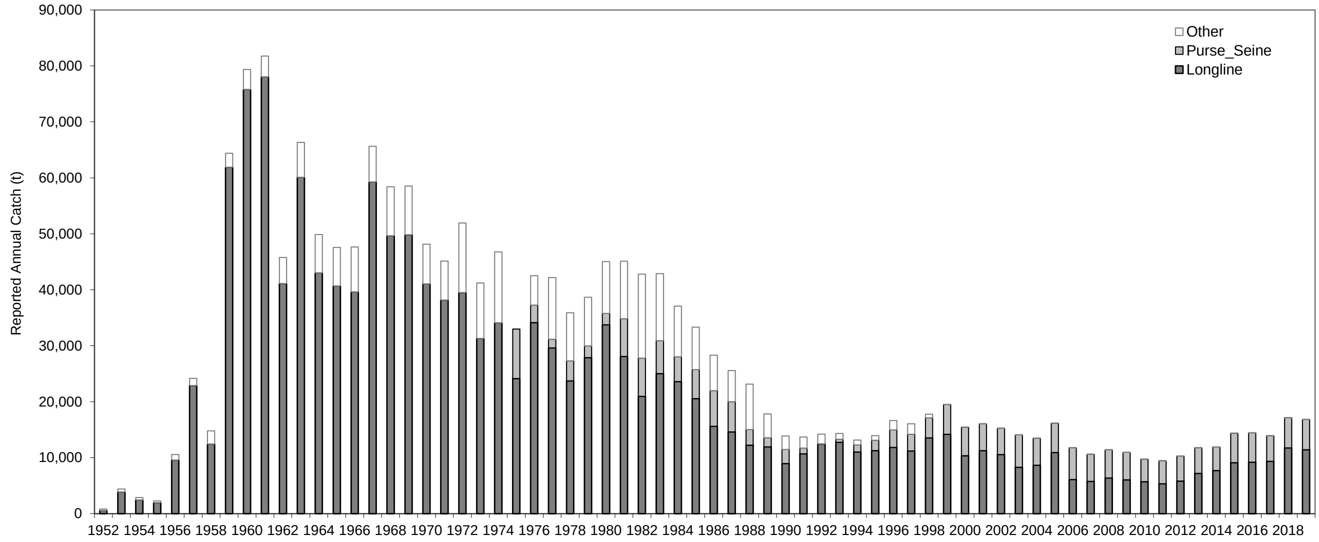


Figure 1: Reported southern bluefin tuna catches by fishing gear, 1952 to 2019. Note: a 2006 review of SBT data indicated that catches over the preceding 10 to 20 years may have been substantially under-reported.

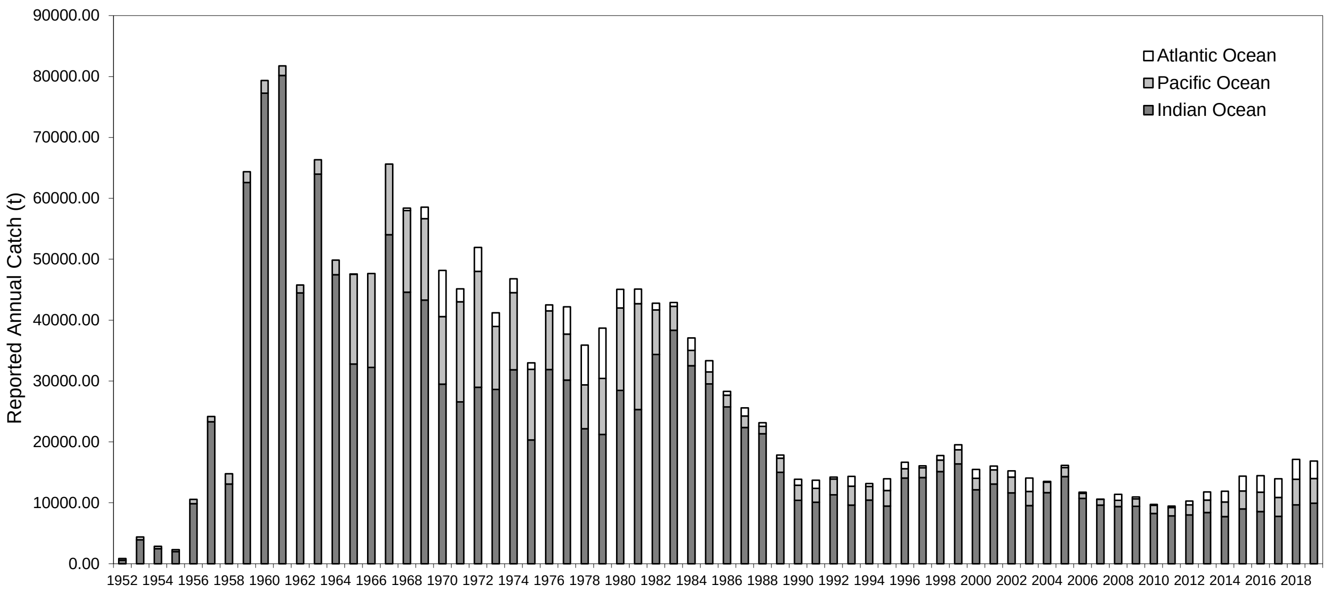


Figure 2: Reported southern bluefin tuna catches by ocean, 1952 to 2019. Note: a 2006 review of SBT data indicated that catches over the preceding 10 to 20 years may have been substantially under-reported.

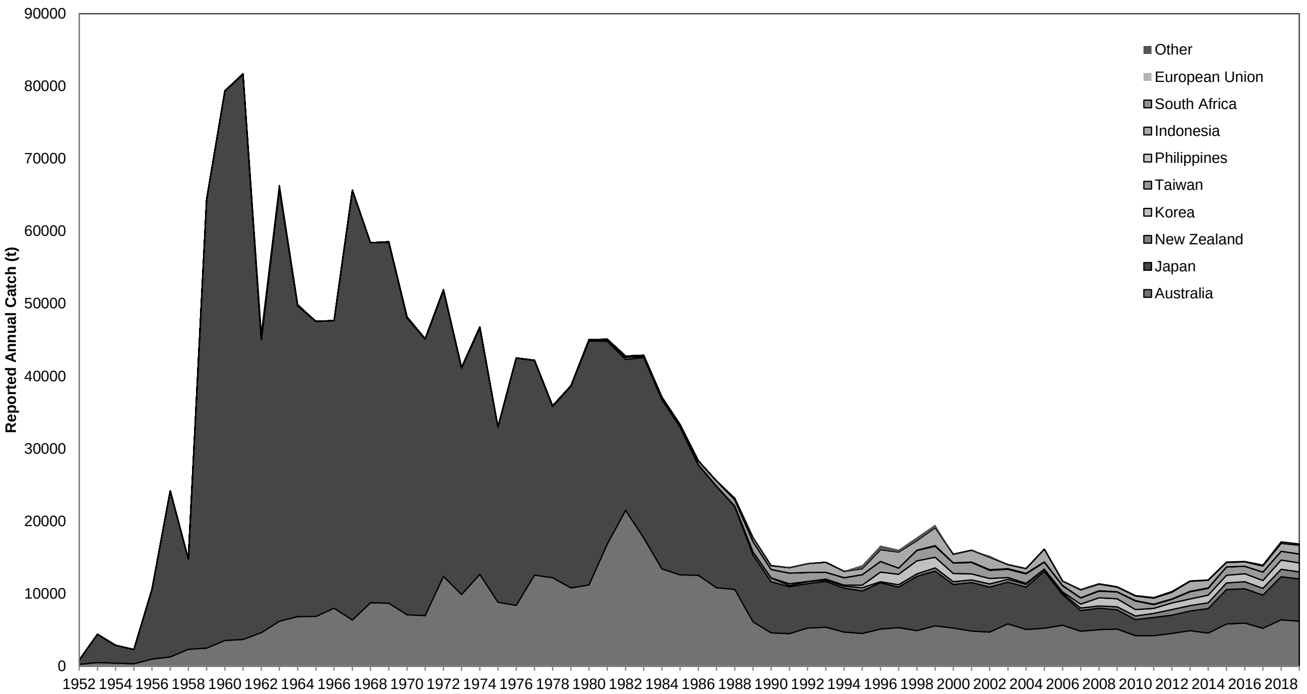


Figure 3: Reported southern bluefin tuna catches by flag, 1952 to 2019. Note: a 2006 review of SBT data indicated that catches over the preceding 10 to 20 years may have been substantially under-reported.

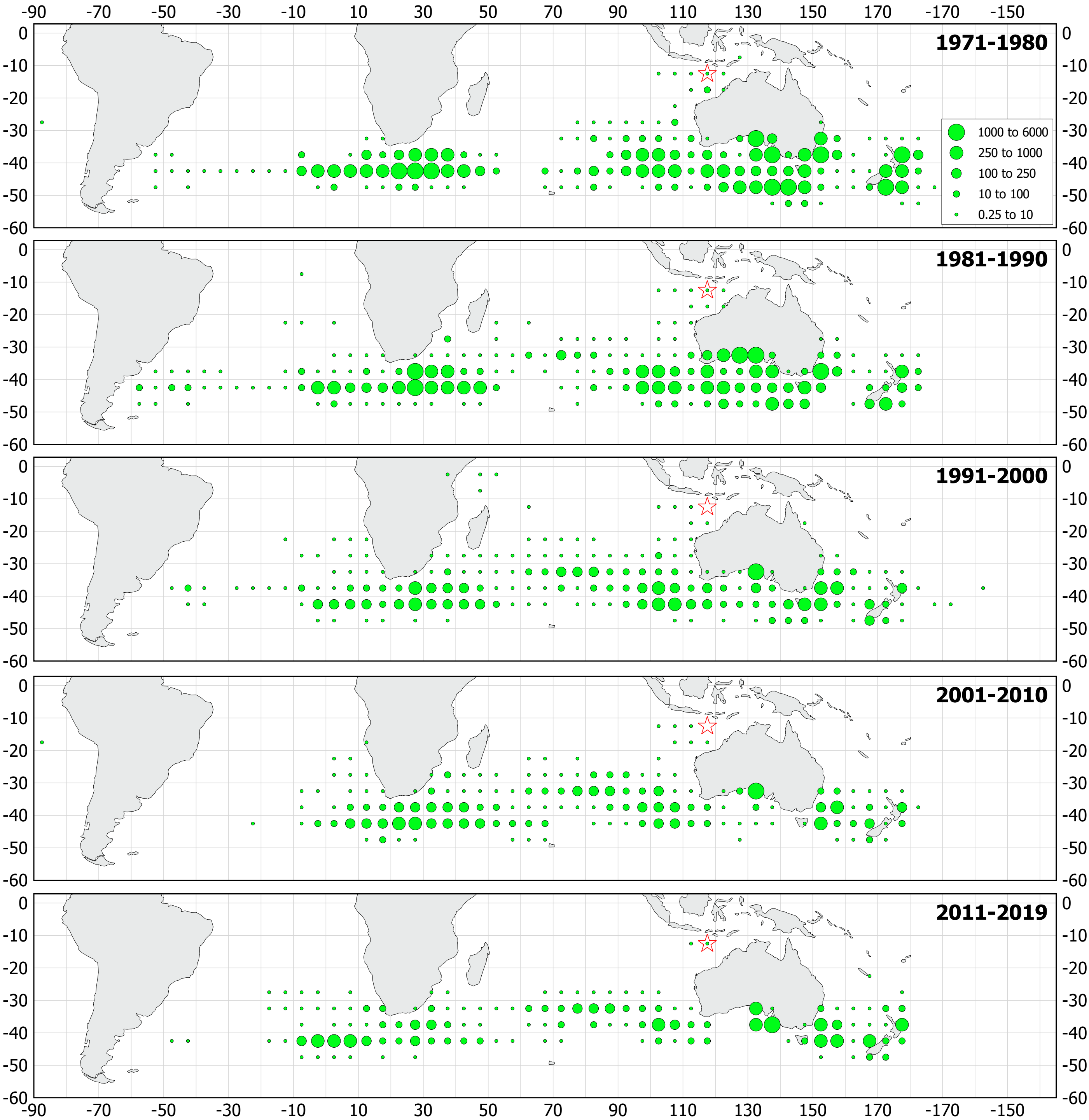


Figure 4: Geographical distribution of average annual reported southern bluefin tuna catches (t) by CCSBT members and cooperating non-members over the periods 1971-1980, 1981-1990, 1991-2000, 2001-2010 and 2011-2019 per 5° block. The area marked with a star is an area of significant catch in the breeding ground. Block catches averaging less than 0.25 tons per year are not shown. Note: This figure may be affected by past anomalies in catch.

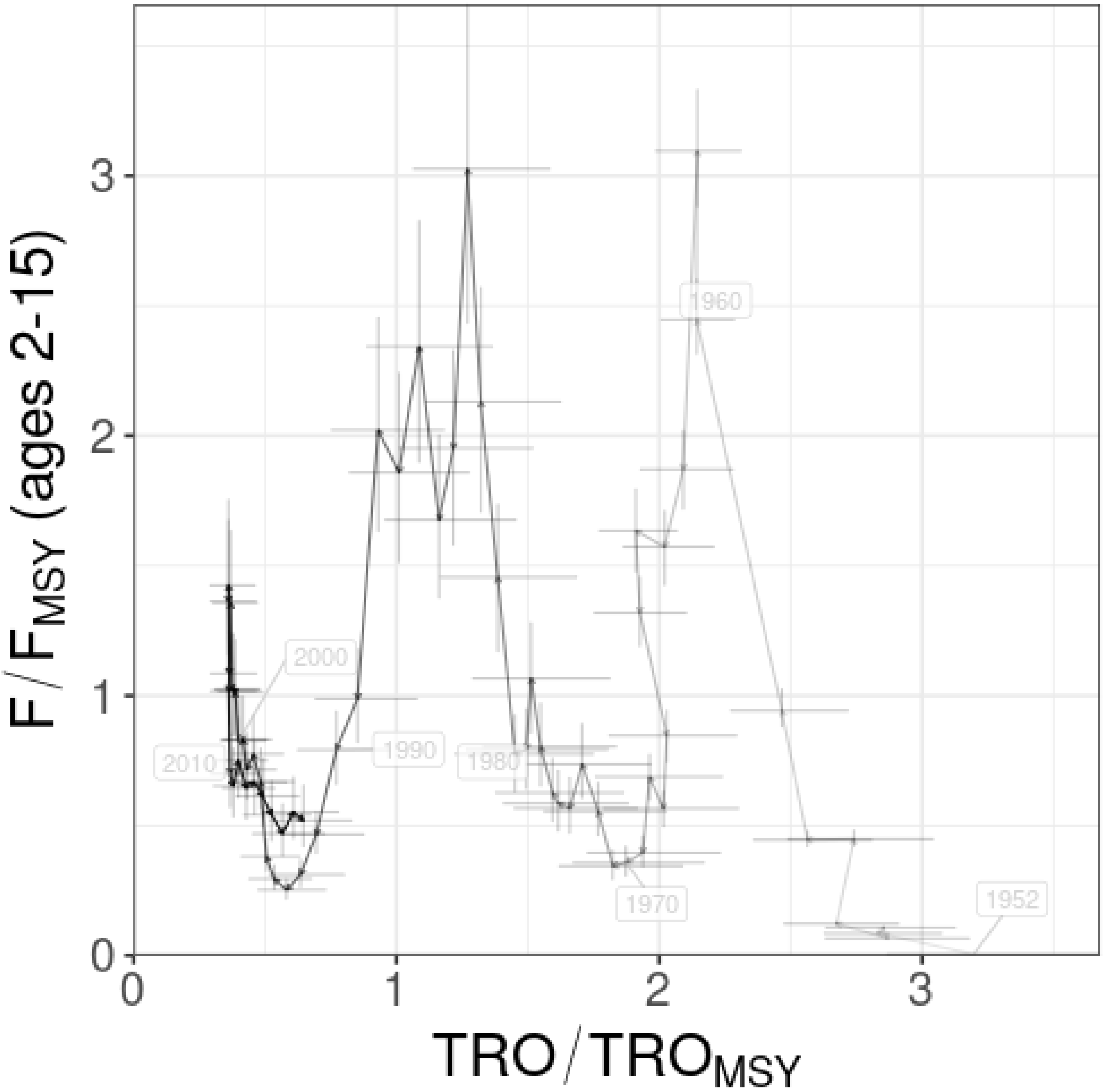


Figure 5. Time trajectory from 1952 to 2019 of median fishing mortality over the F_{MSY} (for ages 2-15) versus Total Reproductive Output (TRO) over TRO_{MSY}. The fishing mortality rates are based on biomass-weighted values and the relative fishery catch composition and mean SBT body weights in each year. Vertical and horizontal lines represent 25th-75th percentiles from the operating model grid.

Attachment 10

Data Exchange Requirements for 2021

Introduction

The data exchange requirements for 2021, including the data that are to be provided and the dates and responsibilities for the data provision, are provided in **Annex A**.

Catch effort and size data should be provided in the identical format as were provided in 2020. If the format of the data provided by a Member is changed, then the new format and some test data in that format should be provided to the Secretariat by 31 January 2021 to allow development of the necessary data loading routines.

Data listed in Attachment A should be provided for the complete 2020 calendar year plus any other year for which the data have changed. If changes to historical data are more than a routine update of the 2019 data or very minor corrections to older data, then the changed data will not be used until discussed at the next ESC meeting (unless there was specific agreement to the contrary). Changes to past data (apart from a routine update of 2019 data) must be accompanied by a detailed description of the changes.

Annex A

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
CCSBT Data CD	Secretariat	31 Jan 21	An update of the data (catch effort, catch at size, raised catch and tag-recapture) on the data CD to incorporate data provided in the 2020 data exchange and any additional data received since that time, including: • Tag/recapture data (*The Secretariat will provide additional updates of the tag-recapture data during 2021 on request from individual members*); • Update the unreported catch estimates using the revised scenario (S1L1) produced at SAG9,
Total catch by Fleet	all Members and Cooperating Non-Members	30 Apr 21	Raised total catch (weight and number) and number of boats fishing by fleet and gear. These data need to be provided for both the calendar year and the quota year.
Recreational catch	all Members and Cooperating Non-Members that have recreational catches	30 Apr 21	Raised total catch (weight and number) of any recreationally caught SBT if data are available. A complete historical time series of recreation catch estimates should be provided (unless this has previously been provided). Where there is uncertainty in the recreational catch estimates, a description or estimate of the uncertainty should be provided.
SBT import statistics	Japan	30 Apr 21	Weight of SBT imported into Japan by country, fresh/frozen and month. These import statistics are used in estimating the catches of non-member countries.
Mortality allowance (RMA and SRP) usage	all Members (& Secretariat)	30 Apr 21	The mortality allowance (kilograms) that was used in the 2020 calendar year. Data is to be separated by RMA and SRP mortality allowance. If possible, data should also be separated by month and location.
Catch and Effort	all Members (& Secretariat)	23 Apr 21 (New Zealand)[2] 30 Apr 21 (other members & Secretariat) 31 July 21 (Indonesia)	Catch (in numbers and weight) and effort data is to be provided as either shot by shot or as aggregated data (New Zealand provides fine scale shot by shot data which is aggregated and distributed by the Secretariat). The maximum level of aggregation is by year, month, fleet, gear, and 5x5 degree (longline fishery) or 1x1 degree for surface fishery. Indonesia will provide estimates based on either shot by shot or as aggregated data from the trial Scientific Observer Program.

[1] The text "**For MP/OM**" means that this data is used for both the Management Procedure and the Operating Model. If only one of these items appears (e.g. **For OM**), then the data is only required for the specified item.
[2] The earlier date specified for New Zealand is so that the Secretariat will be able to process the fine scale New Zealand data in time to provide aggregated and raised data to members by 30 April.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Non-retained catches	All Members	30 Apr 21 (all Members except Indonesia) 31 July 21 (Indonesia)	The following data concerning non retained catches will be provided by year, month, and 5*5 degree for each fishery: • Number of SBT reported (or observed) as being non-retained; • Raised number of non-retained SBT taking into consideration vessels and periods in which there was no reporting of non-retained SBT; • Estimated size frequency of non-retained SBT after raising; • Details of the fate and/or life status of non-retained fish. Indonesia will provide estimates based on either shot by shot or as aggregated data from the trial Scientific Observer Program.
RTMP catch and effort data	Japan	30 Apr 21	The catch and effort data from the real time monitoring program should be provided in the same format as the standard logbook data is provided.
Raised catch data for AU, NZ catches	Australia, Secretariat	30 Apr 21	Aggregated raised catch data should be provided at a similar resolution as the catch and effort data. Japan, Korea and Taiwan do not need to provide anything here because they provide raised catch and effort data. New Zealand does not need to provide anything here because the Secretariat produces New Zealand's raised catch data from the fine scale data provided by New Zealand.
Raised number of hooks data for NZ catches	Secretariat	30 Apr 21	Raised New Zealand number of hooks data, to be provided to NZ only, generated from NZ fine scale data by the Secretariat.
Observer length frequency data	New Zealand	30 Apr 21	Raw observer length frequency data as provided in previous years.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Raised Length Data	Australia, Taiwan, Japan, New Zealand, Korea	30 Apr 21 (Australia, Taiwan, Japan, Korea) 7 May 21 (New Zealand)[3]	Raised length composition data should be provided[4] at an aggregation of year, month, fleet, gear, and 5x5 degree for longline and 1x1 degree for other fisheries. Data should be provided in the finest possible size classes (1 cm). A template showing the required information is provided in Attachment C of CCSBT-ESC/0609/08.
Raw Length Frequencies	South Africa	30 Apr 21	Raw Length Frequency data from the South African Observer Program.
RTMP Length data	Japan	30 Apr 21	The length data from the real time monitoring program should be provided in the same format as the standard length data.
Indonesian LL SBT age and size composition	Australia Indonesia	30 Apr 21	Estimates of both the age and size composition (in percent) is to be generated for the spawning season July 2019 to June 2020. Length frequency for the 2019 calendar year and age frequency for the 2019 calendar year is also to be provided. Indonesia will provide size composition in length and weight based on the Port-based Tuna Monitoring Program. Australia will provide age composition data according to current data exchange protocols.
Direct ageing data	All Members except the EU	30 Apr 21	Updated direct age estimates (and in some cases revised series due to a need to re-interpret the otoliths) from otolith collections. Data must be provided for at least the 2018 calendar year (see paragraph 95 of the 2003 ESC report). Members will provide more recent data if these are available. The format for each otolith is: Flag, Year, Month, Gear Code, Lat, Long, Location Resolution Code[5], Stat Area, Length, Otolith ID, Age estimate, Age Readability Code[6], Sex Code, Comments. It is planned that the Secretariat will provide the direct age estimates for Indonesia through a contract with CSIRO.
Trolling survey index	Japan	30 Apr 21	Estimates of the different trolling indices (piston-line index and grid-type trolling index (GTI)) for the 2020/21 season (ending 2021), including any estimates of uncertainty (e.g. CV).

[3] The additional week provided for New Zealand is because New Zealand requires the raised catch data that the Secretariat is scheduled to provide on 30 April.
[4] The data should be prepared using the agreed CCSBT substitution principles where practicable. It is important that the complete method used for preparing the raised length data be fully documented.
[5] M1=1 minute, D1=1 degree, D5=5 degree.
[6] Scales (0-5) of readability and confidence for otolith sections as defined in the CCSBT age determination manual.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Tag return summary data	Secretariat	30 Apr 21	Updated summary of the number tagged and recaptured per month and season.
Gene tagging data	Secretariat	30 Apr 21	An estimate of juvenile abundance and mark-recapture data from the pilot gene-tagging study through a contract with CSIRO. The mark-recapture data will include the tagging release data (e.g. date of tagging, length of fish), tag recapture data (e.g. recapture sample date, length) and whether or not a genetic match with a release tissue was found.
Close Kin Data	Secretariat	30 Apr 21	Updated dataset of identified SBT parent-offspring pairs and half-sibling using SNPs. This is a deliverable of the SBT annual close-kin tissue sampling, processing, kin identification and Indonesian ageing project conducted by CSIRO under contract to the CCSBT.
Catch at age data	Australia, Taiwan, Japan, Secretariat	14 May 21	Catch at age (from catch at size) data by fleet, 5*5 degree, and month to be provided by each member for their longline fisheries. The Secretariat will produce the catch at age for New Zealand and Korea using the same routines it uses for the CPUE input data and the catch at age for the MP.
Global SBT catch by flag and by gear	Secretariat	22 May 21	Global SBT catch by flag and gear as provided in recent reports of the Scientific Committee.
Raised catch-at-age for the Australia surface fishery. **<u>For OM</u>**	Australia	24 May 21[7]	These data will be provided for July 2019 to June 2020 in the same format as previously provided.
Raised catch-at-age for Indonesia spawning ground fisheries. **<u>For OM</u>**	Secretariat	24 May 21	These data will be provided for July 2019 to June 2020 in the same format as on the CCSBT Data CD.
Total catch per fishery and sub-fishery each year from 1952 to 2020. **<u>For OM</u>**	Secretariat	31 May 21	The Secretariat will use the various data sets provided above together with previously agreed calculation methods to produce the necessary total catch by fishery and total catch by sub-fishery data required by the Operating Model.

[7] The date is set 1 week before 1 June to provide sufficient time for the Secretariat to incorporate these data in the data set it provides for the OM on 1 June.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Catch-at-length (2 cm bins) and catch-at-age proportions. **<u>For OM</u>**	Secretariat	31 May 21	The Secretariat will use the various catch at length and catch at age data sets provided above to produce the necessary length and age proportion data required by the operating model (for LL1, LL2, LL3, LL4 – separated by Japan and Indonesia, and the surface fishery). The Secretariat will also provide these catch at length data subdivided by sub fishery (e.g. the fisheries within LL1).
Global catch at age	Secretariat	31 May 21	Calculate the total catch-at-age in 2020 according to Attachment 7 of the MPWS4 report except that catch-at-age for Japan in areas 1 & 2 (LL4 and LL3) is to be prepared by fishing season instead of calendar year to better match the inputs to the operating model.
CPUE input data	Secretariat	31 May 21	Catch (number of SBT and number of SBT in each age class from 0-20+ using proportional aging) and effort (sets and hooks) data[8] by year, month, and 5*5 lat/long for use in CPUE analysis.
CPUE monitoring and quality assurance series.	Australia, Japan, Taiwan, Korea	15 Jun 21 (earlier if possible)[9]	8 CPUE series are to be provided for ages 4+, as specified below: • Nominal (Australia) • B-Ratio proxy (W0.5)[10] (Japan) • Geostat proxy (W0.8)[10] (Japan) • GAM (Australia) • Shot x shot Base Model (Japan) • Reduced Base Model (Japan) • Taiwan Standardised CPUE (Taiwan) • Korean Standardised CPUE (Korea)
Core vessel CPUE series **<u>for MP</u>**	Japan	15 Jun 21 (earlier if possible)	Provide both the w0.5 and w0.8 Core Vessel CPUE Series, which are calculated from the GLM Base model
Core vessel CPUE series **<u>for OM</u>**	Japan	15 Jun 21 (earlier if possible)	Provide CS, VS w0.6 and w0.9 of Core Vessel CPUE Series, which are calculated from GAM.

[8] Data restricted to months April to September, SBT statistical areas 4-9, and the Japanese, Australian joint venture and New Zealand joint venture fleets.

[9] When there are no complications, it is possible to calculate the CPUE series less than two weeks after the CPUE input data is provided. Therefore, if there are no complications, Members should attempt to provide the CPUE series earlier than 15 June.

[10] This series is based on the standardisation model by Nishida and Tsuji (1998) using all vessel data. Due to loss of data from Japanese-flagged charter vessels in the New Zealand fishery from 2016 onward, these indices are calculated combining areas 4 and 5, areas 6 and 7, respectively.

Attachment 11

Resources required from the CCSBT for the ESC's three-year Workplan

(abbreviations: Sec=Secretariat Staff, Interp=Interpretation, Ch=Independent ESC Chair, P=Independent Advisory Panel, C=Consultant, Cat=Catering only, FM=full meeting costs – venue & equipment hire etc., Contracted=CCSBT contract with CSIRO)

	2021	2022	2023
Contracted Work/Projects			
Routine OMMP Code Maintenance / Development	10 P days + 6 months Shiny App	5 P days + 6 months Shiny App	5 P days + 6 months Shiny App
Continued aging of Indonesian otoliths	Contracted	Contracted	Contracted
Gene Tagging	Contracted	Contracted	Contracted
Continued close-kin sample collection & Processing	Contracted + $17,500 Freezer	Contracted	Contracted
Close-kin identification & exchange	Contracted	Contracted	Contracted
Maturity study	$55,000[1]	$0	$0
UAM	-	14 days consultant	-
CPUE Analysis	28 days consultant	28 days consultant	-
E-tagging program[2]	$100,000	Uncertain ($150k-$500k)	Uncertain ($150k-$500k)
Meetings			
CPUE Webinar	6 Panel days	6 Panel days	6 Panel days
June/July OMMP Meeting in Seattle *(no Sec, no Interp)*	No	5 days Cat: 3P, 1C, 1Ch + 3C Prep Days	5 days Cat: 3P, 1C, 1Ch + 3C Prep Days
Informal technical workshop (immediately prior to ESC, *no Interp*)	No	No	No
ESC Meeting	6 days FM: 1Ch, 3P, 1C, 3 Interp, 3 Sec	6 days FM: 1Ch, 3P, 1C, 3 Interp, 3 Sec	6 days FM: 1Ch, 3P, 1C, 3 Interp, 3 Sec

The market proposal from Japan is not shown in these resource requirements because it is not considered to be an ESC project. This absence of that project from this workplan is not a reflection of the importance of that project.

[1] CCSBT provided funding for a statistician for the maturity study in 2019. However, the work has been deferred while waiting for ovary histology from Members and because it will be difficult to read the histology until laboratories open up further after COVID-19 restrictions ease. It is now planned to conduct this work in 2021.

[2] A design study for this program will be conducted during 2021. The actual tagging program will commence later depending on results of the tagging study.