Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Twenty Third Meeting of the Scientific Committee

8 September 2018

This meeting of the Scientific Committee and the Extended Scientific Committee was substantially funded by the CCSBT and the European Union.

Report of the Twenty Third Meeting of the Scientific Committee
8 September 2018

Agenda Item 1. Opening of meeting

1. The independent Chair, Dr Kevin Stokes, welcomed participants and opened the meeting.
2. The list of participants is at **Appendix 1**.
3. The Chair advised that the Twenty Third meeting of the Scientific Committee (SC 23) is being opened in San Sebastian, Spain, but that report adoption and closing of SC 23 will be conducted electronically through the intersessional decision-making process after Members have returned from the meeting.

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

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

Agenda Item 3. Other business

5. There was no other business.

Agenda Item 4. Adoption of report of meeting

6. The report of the Scientific Committee was adopted.

Agenda Item 5. Closure of meeting

7. The meeting was closed on 12 September 2018 electronically through the intersessional decision-making process.

List of Appendices

Appendix

1. List of Participants
2. Report of the Extended Scientific Committee for the Twenty Third Meeting of the Scientific Committee

Appendix 1

List of Participants
The Twenty Third Meeting of the Scientific Committee

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
CHAIR								
Kevin	STOKES	Dr			NEW ZEALAND			kevin@stokes.net.nz
ADVISORY PANEL								
Ana	PARMA	Dr		Centro Nacional Patagonico	Pueto Madryn, Chubut Argentina	54 2965 451024	54 2965 451543	parma@cenpat.edu.ar
John	POPE	Professor			The Old Rectory Burgh St Peter Norfolk, NR34 0BT UK	44 1502 677377	44 1502 677377	popeJG@aol.com
CONSULTANT								
Darcy	WEBBER	Mr	Fisheries Scientist	Quantifish	72 Haukore Street, Hairini, Tauranga 3112, New Zealand	64 21 0233 0163		darcy@quantifish.co.nz
MEMBERS								
AUSTRALIA								
Simon	NICOL	Dr	Senior Scientist	Department of Agriculture & Water Resources	GPO Box 858, Canberra ACT 2601 Australia	61 2 6272 4638		simon.nicol@agriculture.gov.au
Bertie	HENNECKE	Dr	Assistant Secretary	Department of Agriculture & Water Resources	GPO Box 858, Canberra ACT 2601 Australia	61 2 6272 4277		bertie.hennecke@agriculture.gov.au
Heather	PATTERSON	Dr	Scientist	Department of Agriculture & Water Resources	GPO Box 858, Canberra ACT 2601 Australia	61 2 6272 4612		heather.patterson@agriculture.gov.au
Campbell	DAVIES	Dr	Senior Research Scientist	CSIRO Marine and Atmospheric Research	GPO Box 1538, Hobart, Tasmania 7001, Australia	61 3 6232 5044		Campbell.Davies@csiro.au

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
Ann	PREECE	Ms	Fisheries Scientist	CSIRO Marine and Atmospheric Research	GPO Box 1538, Hobart, Tasmania 7001, Australia	61 3 6232 5336		Ann.Preece@csiro.au
Rich	HILLARY	Dr	Principal Research Scientist	CSIRO Marine and Atmospheric Research	GPO Box 1538, Hobart, Tasmania 7001, Australia	61 3 6232 5452		Rich.Hillary@csiro.au
Matt	DANIEL	Mr	Southern Bluefin Tuna Fishery Manager	Australian Fisheries Management Authority	GPO Box 7051, Canberra, ACT 2601, Australia	61 2 6225 5338		Matthew.Daniel@afma.gov.au
Brian	JEFFRIESS	Mr	Chief Executive Officer	Australian SBT Industry Association	PO Box 1146, Port Lincoln, SA 5606, Australia	0419 840 299		austuna@bigpond.com
INDONESIA								
Zulkarnaen	FAHMI	Mr	Head of Research Institute for Tuna Fisheries	Ministry of Marine Affairs and Fisheries	Jl. Mertasari No. 140 Br Suwung Kangin, Sidakarya, Denpasar, Bali 80224, Indonesia	62 21 726201	62 21 726201	fahmi.p4ksi@gmail.com
Satya	MARDI	Mr	Fisheries Inspector for Directorate of Fish Resource Management	Ministry of Marine Affairs and Fisheries	Jl. Medan Merdeka Timur No. 16 Jakarta Pusat, 10110 Indonesia	62 21 3453008	62 21 3453008	sdi.djpt@yahoo.com
JAPAN								
Tomoyuki	ITOH	Dr	Group Chief	National Research Institute of Far Seas Fisheries	5-7-1 Orido, Shimizu, Shizuoka 424-8633, Japan	81 54 336 6000	81 543 35 9642	itou@fra.affrc.go.jp
Norio	TAKAHASHI	Dr	Senior Scientist	National Research Institute of Fisheries Science	2-12-4 Fukuura, Yokohama, Kanagawa 236-8648, Japan	81 45 788 7501	81 45 788 5004	norio@fra.affrc.go.jp
Yuichi	TSUDA	Dr	Researcher	National Research Institute of Far Seas Fisheries	5-7-1 Orido, Shimizu, Shizuoka 424-8633, Japan	81 54 336 6000	81 543 35 9642	u1tsuda@fra.affrc.go.jp

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
Doug	BUTTERWORTH	Professor		Dept of Maths & Applied Maths, University of Cape Town	Rondebosch 7701, South Africa	27 21 650 2343	27 21 650 2334	Doug.Butterworth@uct.ac.za
Takahiro	ARA	Mr	Assistant Director	Fisheries Agency	1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8907, Japan	81 3 3502 8459	81 3 3502 0571	takahiro_ara020@maff.go.jp
Nozomu	MIURA	Mr	Deputy Director	Japan Tuna Fisheries Cooperative Association	31-1, Eitai 2 Chome, Koto-ku, Tokyo 135-0034, Japan	81 3 5646 2382	81 3 5646 2652	miura@japantuna.or.jp
Michio	SHIMIZU	Mr	Executive Secretary	National Ocean Tuna Fishery Association	1-1-12 Uchikanda, Chiyoda-ku, Tokyo 101-8503, Japan	81 3 3294 9634	81 3 3294 9607	mic-shimizu@zengyoren.jf-net.ne.jp
NEW ZEALAND								
Shelton	HARLEY	Dr	Manager – Fisheries Science	Fisheries New Zealand	PO Box 2526, Wellington, New Zealand	64 894 0857	N/A	shelton.harley@mpi.govt.nz
Dominic	VALLIÈRES	Mr	Manager - Highly Migratory Species	Fisheries New Zealand	PO Box 2526, Wellington, New Zealand	64 4 819 4654	N/A	dominic.vallieres@mpi.govt.nz
REPUBLIC OF KOREA								
Doo Hae	AN	Dr	Director of Distant-water Fisheries Resources Division	National Insittute of Fisheries Science	216, Gijanghaean-ro, Gijang-eup, Gijang-gun, Busan, 46083, Republic of Korea	82 51 720 2310	82 51 720 2337	dhan119@korea.kr
Sung Il	LEE	Dr	Scientist	National Insittute of Fisheries Science	216, Gijanghaean-ro, Gijang-eup, Gijang-gun, Busan, 46083, Republic of Korea	82 51 720 2331	82 51 720 2337	k.sungillee@gmail.com
SOUTH AFRICA								
Qayiso	MKETSU	Mr	Deputy Director Management Large Pelagic Fisheries	Department of Agriculture, Forestry & Fisheries	Foretrust building, Martin Hammerschlag Way, Foreshore, Cape Town, 8001, South Africa	27 214 023 037		QayisoMK@daff.gov.za

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
Sven	KERWATH	Dr	Specialist Scientist Finfish	Department of Agriculture, Forestry & Fisheries	Foretrust building, Martin Hammerschlag Way, Foreshore, Cape Town, 8001, South Africa	27 214 023 017		SvenK@daff.gov.za
Henning	WINKER	Dr	Scientist: Large Pelagic Fisheries	Department of Agriculture, Forestry & Fisheries	Foretrust building, Martin Hammerschlag Way, Foreshore, Cape Town, 8001, South Africa	27 214 023 515		HenningW@daff.gov.za
OBSERVERS								
EUROPEAN UNION								
Hilario	MURUA	Dr	Principal Researcher	AZTI Marine Researh Division	Herrera Kaia, Portualdea z/g Pasaia Gipuzkoa 20110 Spain	34 667 174 433		hmurua@azti.es
FISHING ENTITY OF TAIWAN								
Ching-Ping	LU	Dr.	Assistant Professor	National Taiwan Ocean University	2 Pei-Ning Road, Keelung 20224, Taiwan	886 2 2462 2192 ext 5035	886 2 2463 3920	michellecplu@gmail.com
Shu-Ting	CHANG	Ms.	Statistician	Overseas Fisheries Development Council	3F., No. 14 Wenshou St., Taipei, Taiwan	886 2 23680 889 ext133	886 2 23681 530	lisa@ofdc.org.tw
INTERPRETERS								
Kumi	KOIKE	Ms						
Yoko	YAMAKAGE	Ms						
Kaori	ASAKI	Ms						
CCSBT SECRETARIAT								
Robert	KENNEDY	Mr	Executive Secretary					rkennedy@ccsbt.org
Akira	SOMA	Mr	Deputy Executive Secretary		PO Box 37, Deakin West ACT 2600 AUSTRALIA	61 2 6282 8396	61 2 6282 8407	asoma@ccsbt.org
Colin	MILLAR	Mr	Database Manager					CMillar@ccsbt.org

Commission for the Conservation of
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Appendix 2

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

3 – 8 September 2018
San Sebastian, Spain

Extended Scientific Committee
for the Twenty Third Meeting of the Scientific Committee
3 – 8 September 2018
San Sebastian, Spain

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.
2. Each delegation introduced its participants. 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, Korea, New Zealand and South Africa provided rapporteurs to produce and review the text of the substantive agenda items.

Agenda Item 3. Adoption of Agenda and Document List

5. The Chair noted that the Provisional Agenda had accidently excluded the item on SBT Management Advice, which has been included in past ESC agendas. The meeting agreed to add this agenda item after agenda item 10. The agreed modified agenda is provided at **Attachment 2**.
6. The final document list is provided at **Attachment 3**.

Agenda Item 4. Review of SBT Fisheries

4.1. Presentation of National Reports

7. South Africa presented paper CCSBT-ESC/1809/SBT Fisheries – South Africa. South Africa's tuna directed fishery is comprised of two fishing fleets, a bait-boat (pole and line) fleet of 165 vessels (163 fishing rights holders), and a longline fleet with a domestic (ZAD) and a Japanese flagged joint venture (charter boat; ZAC) component of currently a total of 35 vessels (60 fishing rights holders). The pole fleet targets mainly albacore and yellowfin tuna, when available, and the longline fleet targets tuna species, and swordfish as well as mako and blue sharks. SBT has previously been caught only by the longline fleet but the pole fleet has started catching SBT in small quantities since South Africa has become a full Member of CCSBT

in 2016. South Africa continues to develop its SBT directed performance within its large pelagic directed fishing sectors. In the Longline Fishery, SBT directed effort exceeded 600 thousand hooks for the first time in the 2017-2018 fishing season, and the total annual SBT landings attained a new maximum of 136.2t. SBT was caught by 14 longline vessels (11 domestic ZAD; 3 chartered ZAC) in 2017. ZAD vessels landed 115.8t (N = 1,353) and ZAC vessels landed 22.1t (N = 221). The longline fishery operates mostly within South Africa's EEZ from April to November; however, the majority of the SBT catch is typically taken over a three month period; June, July and August. Consistent with previous years, all catches of SBT for the 2017/2018 season occurred from April to November, but contrary to previous years, SBT catches were fairly low in June. Also, in contrast to the previous season there were no reported SBT catches from the Tuna Pole and Line fleet in 2017-2018. There are notable differences in the distribution of catch and effort between the domestic (ZAD) and chartered (ZAC) longline vessels, with the latter operating exclusively east of Cape Agulhas (Area 14 and 9, >20° Longitude) in recent years. In contrast, the domestic fleet operates off both the East (Area 14) and West coast of South Africa (Area 15), out of to the two fishing port cities of Cape Town and Richards Bay. In general, the range of the ZAC fleet appears to have been contracting increasingly closer inshore within South Africa's EEZ (Area 14) in recent years. Similar to the 2016/2017, a large proportion of SBT was caught by the domestic fleet (ZAD) along the West coast of South Africa (Area 15). Availability of observer size data has improved since 2013, particularly in Areas 9 and 14. Area 14 typically appears to produce a large proportion of SBT > 150 mm FL, and there is some indication the SBT in Area 9 may be smaller on average. The strongest contrast between the two areas is evident from the size frequency distribution from 2012, which included a large proportion of SBT between 100 and 150 cm FL. Length information from CDS reporting is not presented this year because it is currently undergoing an internal review process. South Africa continues to increase its observer coverage for its Large Pelagic Longline Fishery, from 31.1% in 2016-2017 to 39.9% in the 2017-2018 season. South Africa has developed a new Catch Documentation Scheme (CDS) database to minimise data capturing errors and to exclude invalid data formats and duplicates. To account for possible recreational mortality of SBT among other sources, South Africa has set aside 5t of its SBT allocation for the 2018-2019 season for unaccounted mortality, but information taken from recreational tuna fishing competitions revealed that there have not been any catches of SBT among 6684 recorded tuna since 2000, indicating a low possibility of unaccounted mortality of SBT in the recreational fleet under the current stock distribution.

8. In response to questions, South Africa advised that:

- It is reporting length frequency (LF) data collected by observers, and not CDS LF data, since it has noticed some irregularities with the CDS data which it is investigating. These are possibly due to measurements being taken from processed fish. Its observer coverage has increased appreciably, and it considers these data to be much more reliable than the CDS data at this stage.

- It had planned a two-week scientific voyage in 2018 focussed on SBT but was unable to undertake this due to logistical problems. It hopes to undertake the voyage next year, which will provide the opportunity to take otoliths and biological samples that could be used for genetic analyses.
- Observer data from 2012 indicated there were small fish caught on the southern EEZ border, with larger fish caught inshore, which may suggest an inshore/offshore distribution pattern.

9. Australia presented paper CCSBT-ESC/1809/SBT Fisheries-Australia. The 2016–17 Southern Bluefin Tuna (SBT) fishing season report summarises catches and fishing activities in the Australian Southern Bluefin Tuna Fishery up to and including the 2016–17 fishing season (December 2016 – November 2017) and some preliminary results of the 2017–18 season (December 2017 – November 2018). Australia's allocation as agreed by the CCSBT was 5665t for the 2016–17 fishing season. However, this was adjusted to account for under-catch in the previous fishing season, so that the effective TAC was 5697t. A total of 22 commercial fishing vessels landed SBT in Australian waters in the 2016–17 fishing season for a total catch of 5333t. A total of 87.8 per cent of the catch was taken by purse seine with the remainder taken by longline. Six purse seiners fished off South Australia for the Australian farming operations during the 2016–17 fishing season, with live bait, pontoon-towing and feeding vessels also involved. Most of the purse seine fishing commenced in mid-December 2016 and finished in late February 2017. 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 2017–18 was 93.4 cm. In the 2017–18 fishing season, observers monitored 20.9 per cent of purse seine sets where fish were retained for the farm sector, and 19.0 per cent of the estimated SBT catch. In 2017, observers also monitored 9.0 per cent of longline hook effort in the Eastern Tuna and Billfish Fishery 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 was 11.7 per cent in 2017.

10. In response to questions, Australia advised that it would provide more detailed information on the longline fishery in future reports, and would provide actual rather than raised numbers for length frequency graphs. Australia reiterated that it was not willing to provide length frequency information from its CDS data in future reports as these data do not currently satisfy Australian policy for public domain data.

11. Paper CCSBT-ESC/1809/11 which describes Australia's data preparation and validation process was noted.

12. The European Union presented paper CCSBT-ESC/1809/SBT Fisheries-EU. There is no EU fishery targeting SBT and any interaction with SBT by EU vessels would occur as by-catch in the swordfish long-line fishery operating in Southern areas of Atlantic, Indian and Pacific Oceans. Most of the effort of these fisheries occurs North of 35ºS with less effort occurring South of 35 ºS, and mainly in the Indian Ocean. Since 2011 the level of SBT by-catches by the EU fleet has been very limited or close to zero, and lower than the 10t

allocated to the EU under the CCSBT SBT TAC agreement. In 2017, no by-catch of SBT was reported by the EU fleets operating in all oceans in areas where incidental catch of SBT could occur; this could be explained by the night setting and surface longline configuration of the swordfish LL fishery. The sampling at sea program started when the swordfish fishery began in 1993. The observer coverage, in number of hooks observed, was around 5 % for the EU long-line fleet operating in the Indian Ocean (2 % for Spanish LL, 9 % for Portuguese and 10 % for UK LL fishery), and around 10 % in the Western Central Pacific in 2017.

13. The meeting noted that the EU has not reported SBT catch, but the geographical areas of its swordfish longline fishery partly overlaps with SBT distribution, and hence questioned the possibility of mis-reported SBT catches. The EU replied that the fishing fleet targets swordfish fishing mostly 35°S with different fishing practices to SBT fleets, such as surface longline setting at night, which may explain the lack of interaction, and had had no reports of SBT catch in logbook, landings or observer data.

14. Taiwan presented paper CCSBT-ESC/1809/SBT Fisheries-Taiwan. Taiwan's catch of SBT for 2017 was 1,172t and 1,175t for the quota year, which was below Taiwan's allocated catch. The number of SBT longline fishing vessels was 75. For 2017, 14 observers were deployed on 14 fishing vessels authorised to target SBT seasonally or bycatch SBT. In this regard, the observer coverage rates were about 18.67% by vessel and 9.89% by hooks for that year.

15. In addition, Taiwan presented paper CCSBT-ESC/1809/36 which describes preparation of Taiwan's Southern bluefin tuna catch and effort data submission for 2018. The data of E-logbooks were used to prepare the report of aggregated catch and effort, non-retained catch, catch at size and the catch at age. Catch certification data are compiled to prepare the total catch by fleet. All data are cross-checked against VMS data, fisheries observer reports, catch documentation scheme records and traders' sales records to ensure the accuracy.

16. In response to the questions from Japan, Taiwan advised that:

- It is not able to provide the precise percentage of Taiwan's SBT catch that goes through the processing plant in Kaohsiung;
- The SBT catch processed by the plant are consumed domestically; and
- The catch of SBT going through the processing plant is not representative of Taiwan's total SBT catch.

17. It was noted that Taiwan's national report indicated no fishing effort by its SBT fleet in the Tasman sea during 2017 and for most of 2016, despite Taiwan reporting appreciable effort during 2016 and 2017 in this area where one would be expected to catch SBT to WCPFC. Taiwan advised that the catch and effort data it submitted to the CCSBT was for the vessels that were authorised to catch SBT. The catch and effort data in the WCPFC report included multiple species and was for all Taiwanese longliner fleets in the Pacific Ocean. That is why the WCPFC report shows appreciable catch and effort in Tasman sea during 2017. To cater for the expectation of catching SBT in Tasman sea, in 2017, Taiwan took multiple actions to combat illegal

fishing and enhance its fishery management. For unauthorised SBT fleets, if they catch SBT, it is illegal to keep the SBT. Furthermore, they have to report SBT discards to Fishery Agency of Taiwan. Otherwise, they will be subject to a penalty.

18. Indonesia presented paper CCSBT-ESC/1809/SBT Fisheries-Indonesia. Based on its 2017 Catch Documentation Scheme (CDS) data, the number of active longline vessels was 109 units, which caught 835t or about 9,617 individuals of SBT. Their size ranged from 70 to 244 cm (fork length), with an average of 157.1cm. The proportion of fish with a size of less than 150 cm in area 1 was around 25%, 77% in area 2, and 35.3% for the overall catch.

19. Indonesia tabled paper CCSBT-ESC/1809/Info 05 which updated on the tuna monitoring program in Benoa port, Bali, Indonesia 2017. The regular port sampling program showed an increasing percentage of coverage of 75.05% (60.28% previous year), with the measured specimens consisting of 25.2% fresh and 74.8% frozen SBT. The length frequency data were collected from 2,444 individuals with a range from 111 to 209 cm fork length. Specimens for maturity, genetic and otolith study were collected regularly, with results expected to be presented in the next ESC meeting.

20. Regarding attributable catch for SBT, there is still no source data or information from artisanal fishing. The national CDS system currently records SBT landed in Benoa Port, particularly from the longline industry, while to calculate the probabilities of fish landed in other areas by artisanal fisheries still requires efforts to consolidate, verify and validate data.

21. Indonesia tabled paper CCSBT-ESC/1809/Info 06 on Indonesian Scientific Observer Program Activities in Indian Ocean from 2015 – 2017. In 2017, four trips with scientific observers onboard were completed, with days-at-sea ranging from 49 to 69 fishing days per trip. A total of 192,188 hooks were deployed from 232 settings. The observer coverage was 3.6% in terms of total active vessels. Geographically, the scientific observer trips were in the fishing grounds of statistical areas 1 and 2.

22. Indonesia was requested to use the ESC's National Reporting template for its future annual reports to the ESC.

23. At the request of Japan, Indonesia provided length frequency data obtained from its Scientific Observer Program in statistical area 2 to determine whether catches in area 2 might be the source of small SBT appearing in Indonesia's data. However, the observed length frequency information did not contain many small SBT.

24. Japan presented paper CCSBT-ESC/1809/SBT Fisheries-Japan that describes the Japanese longline SBT fishery. In 2017, 86 vessels caught 4,567t and about 85,000 individual SBT. The document also describes the effort, nominal CPUE, length frequency and geographical distribution of the fishing operations.

25. Japan presented paper CCSBT-ESC/1809/23, which reported on the Japanese scientific observer program for SBT in 2017. Scientific observers were dispatched on 12 vessels that operated in the main CCSBT Statistical Areas (Areas 4-9). Observer coverage was 13.6% in terms of the number of vessels, 12.6% in terms of the number of hooks used, and 12.6% in terms of the

number of SBT caught. The length frequency distributions of SBT reported by the observers and those reported from all vessels in the RTMP were generally consistent with each other. Observers collected various biological samples including otoliths from 251 SBT and muscle tissue from 392 SBT. Observers retrieved CCSBT conventional tags from three individual SBT.

26. Japan presented paper CCSBT-ESC/1809/24, which proposed a revision of Japanese historical data. It describes that because it was found that South African joint venture ships and a part of New Zealand's joint venture ships were mistakenly mixed, revision of data of catch and effort, catch-at-length, and catch-at-age from 2007 to 2015 was needed.

27. The meeting questioned whether the data revision affected the core vessel data. Japan replied that it had not considered this point, but that the core vessel CPUE data were generated with the corrected data and analysis had not detected a difference to previous data.

28. It was noted that these data were reviewed at the CPUE webinar and no concerns were raised in relation to these revised data replacing the previous data entered in the CCSBT's database.

29. Korea presented paper CCSBT-ESC/1809/SBT Fisheries-Korea. In 2017, SBT catch of the Korean longline fishery was 1,080t (1,102t in fishing year), with 12 fishing vessels active. In general, Korean vessels targeting SBT operate in area 9 from April to July/August and in area 8 from July/August to December. However, since 2014 they have moved further west compared to previous years, and mainly operated in the Western Indian Ocean and Eastern Atlantic Ocean between 20°W-35°E. In 2017, all Korean vessels fishing for SBT operated in area 9. In 2017, three observers were placed onboard three longline vessels, and the observer coverage was 18% of fishing effort.

30. New Zealand presented paper CCSBT-ESC/1809/SBT Fisheries-New Zealand, which describes its SBT fishery for 2017 and the 2016–17 fishing season. Commercial landings were slightly lower than they were in the previous year and continue to have a significant proportion of small fish (110-135 cm). Observer coverage rates for the New Zealand fishery were at or above 20% of catch and effort - much higher than the 10% target.

31. The most significant change in the New Zealand fishery in 2017 was the emergence of a recreational fishery dedicated to the targeting of southern bluefin tuna. Historically, recreational catches of southern bluefin tuna have been nominal and somewhat opportunistic but this no longer appears to be the case.

32. In response to questions from the meeting, New Zealand advised that the differences between the CDS and observer-collected length distributions are relatively minor and could be related to rounding in the CDS data.

4.2. Secretariat Review of Catches

33. The Secretariat presented paper CCSBT-ESC/1809/04. The estimated total catch for the 2017 calendar year was 14,861t, a decrease of 629t or 4% from the 2016 calendar year. The global reported SBT catch by flag is shown at

Attachment 4. The paper also included comparisons of global adjusted TAC against reported catch by fishing season, which showed that reported catch was less than the TAC by 130t for the 2017 fishing season.

Agenda Item 5. Report from the Fifth Meeting of the Strategy and Fisheries Management Working Group

34. Dr Ana Parma reported on discussions at the Fifth Meeting of the Strategy and Fisheries Management Working Group (SFMWG 5), held from 6 – 8 March 2018 in Canberra, in relation to the agenda item on the Desirable Behaviour and Specification of the new Management Procedure (MP). Dr Parma noted that:

- Several Member scientists and two members of the Advisory Panel attended, which provided a very good opportunity to initiate discussions with CCSBT managers and advisors on long-term goals for SBT, the process for developing a new MP and features desired for new candidate management procedures (CMPs), including a range of tuning levels and probabilities of rebuilding.
- With respect to tuning levels, scientists expressed their preference to use the median instead of the 70% probability used for tuning the Bali MP.
- Following extensive discussion, the meeting agreed to use the following specifications during the initial round of CMP testings in order to explore a range of possible rebuilding and post-rebuilding objectives:
    - Tuning biomass levels of 0.25, 0.30, 0.35 and 0.40 of unfished spawning biomass SSB_0 (here interpreted as initial Total Reproductive Output; TRO0).
    - CMPs tuned to a 50% probability of achieving the tuning biomass levels.
    - Tuning year set to 2035, provided the projection period was not too short and did not lead to numerical issues.
    - Projections extended to 2045 to evaluate post-2035 performance.
    - All CMPs achieving at least a 70% probability of reaching 20% of initial spawning stock biomass (SSB_0) by 2035, the current interim objective, and providing a high probability that the stock would not fall below this level after 2035.
- A list of performance statistics were recommended by the SFMWG, which included the probability of meeting the interim rebuilding target by 2035, in addition to the standard statistics for characterising the distribution of catch and SSB.
- In terms of features of the CMP, the meeting agreed to conduct the test with the following specifications:
    - Set TACs in 3-year blocks.
    - Set the TAC for 2021-2023 in 2020 as the first TAC decision, noting that the usual lag between TAC setting and implementation will be reduced by 1 year to allow more time for MP development. The usual schedule would apply after that (i.e., in 2022 set TAC for 2024-2026).

    - Set maximum TAC changes of 2,000t, 3,000t and 4,000t, and add 5,000t if the previous three did not provide sufficient contrast. Each level of maximum TAC change would not necessarily be applied in combination with all tuning levels. The OMMP group would decide on the appropriate scenarios to test each level of Maximum TAC change in this initial round.
- It was emphasised that the decisions made by the meeting regarding tuning levels and MP constraints were not final, and would be revisited after the initial round of trials had been completed, and the Operating Model (OM) had been updated to incorporate new data exchanged before June 2019.

35. The Secretariat presented the other agenda items from the report of SFMWG 5, which included: a CCSBT Fisheries Management Plan; consideration of a future allocation model (particularly in relation to new Members); CCSBT's processes with respect to Ecologically Related Species; and a Review of the form and function of the Compliance Committee.

36. The Secretariat noted that little progress was made with most of these agenda items and that:

- There was consensus that consolidating information about the CCSBT's management approach into a Fisheries Management Plan would be useful. However, this was not considered a priority at the present time.
- There was no consensus for the CCSBT to develop detailed allocation rules in preparation for possible new Members in the future.
- There was no consensus on a proposal to change the timing of meetings of the Compliance Committee. However, New Zealand will be developing a proposal regarding ad-hoc expert compliance meetings for consideration at the annual meeting.

37. Finally, the Secretariat advised that there was substantial debate regarding CCSBT's processes with respect to Ecologically Related Species at the SFMWG meeting. The most relevant discussion for the ESC was regarding whether the ERS Working Group should report directly to the Extended Commission (EC), while providing the opportunity for the ESC to comment on its reports, as per the current practice, or whether the ERS Working Group should be a subsidiary body of the ESC and report to the ESC, with the ESC then reporting to the Extended Commission on ERS matters. No agreement has been reached on this. However, it is a decision that could impact on the future work and composition of the ESC.

Agenda Item 6. Report from the Ninth OMMP Technical Meeting

38. The Chair of the OMMP technical group reported on the 9th meeting of the OMMP technical group convened in Seattle (18-22 June, 2018) in order to evaluate results of initial testing of candidate management procedures (CMPs) and to refine testing protocols. Three teams, two from Japan and one from Australia, presented various forms of CMPs that used different combinations of data to drive changes in TACs: gene tagging as an index of

recruitment (age 2 abundance), close-kin data (both half siblings and parent-offspring matches) as an index of the spawning biomass, and age 4+ CPUE.

39. The CMPs evaluated during the OMMP meeting provided a good diversity of approaches in terms of how these data were used to drive changes in TAC. Some used the input data to inform on trends, others to inform on distance from a target value, and yet others used a combination of trends and targets. In all cases targets were set either empirically or they were treated as tuning parameters.

40. For the CKMR data both empirical and model-based approaches were explored. A population model fitted to the CK data was proposed in CCSBT-OMMP/1806/05 (Rev.1), which resulted in a marked reduction in catch variability. The code for that model was made available so that the other teams could also use it in their CMPs.

41. The OMMP meeting reviewed the simulated trajectories of TACs and SSB for a subset of the CMPs using the full set of tuning levels requested by SFMWG: 0.25, 0.30, 0.35, 0.40.

42. The review of preliminary CMP results raised the issue of whether the behaviour exhibited by the CMPs for the 0.25 and 0.40 targets would be considered acceptable, given the guidance provided by the SFMWG. In order to achieve the 0.40 target by 2035, each CMP was required to immediately reduce the TAC to substantially lower levels (e.g., ~10,000t) than the current TAC. The 0.25 target showed the reverse effect: in the short-term CMPs consistently increased TACs to much higher levels, which then required substantial TAC decreases once the target level was achieved.

43. This behaviour was consistent for each of the preliminary CMPs for the 0.25 and 0.40 target levels. Given the general guidance from the SFMWG on the desirability of incremental increases in TAC, the undesirability of large TAC decreases and, in particular, a preference for relative stability beyond the rebuilding target, the group assumed this behaviour for these two tunings was likely to be unacceptable and hence decided to focus attention on the 0.30 and 0.35 target levels.

44. Preliminary results for the 0.35 tuning level by 2035 demonstrated that to achieve this target level would require progressive TAC decreases in the short-term, which would lead to an “overshoot” in biomass rebuilding once this had been achieved. This undesirable behaviour was removed when the tuning year was extended to 2040. Given the clear direction from the SFMWG to consider target levels above 0.30 and to explore tuning periods beyond 2035 if required, the group agreed to evaluate performance of CMPs tuned to 0.35 in 2040 instead of 2035.

45. In conclusion, the OMMP meeting agreed that, in refining CMPs for the presentation to the ESC, developers would focus on two combinations of target level and tuning year: i) 0.30 by 2035 and ii) 0.35 by 2040. The other combinations of tuning level and year could be run for a subset of CMPs to provide the ESC and Extended Commission with results for the full range of options to consideration and further guidance.

46. The OMMP meeting revised the list of robustness tests and specified the full list of performance statistics following requests from SFMWG. The MP

consultant developed an application for plotting catch and TAC trajectories, as well as distributions of the performance statistics for the different CMPs and tuning levels. The application was fined tuned during the meeting and made available on the web for use by the developers intersessionally.

47. It was considered important that the ESC provide feedback to the EC on the initial results obtained when the CMPs were tuned to the 4 levels requested by the SFMWG, and the reasons for deciding to focus further efforts on the 2 intermediate tuning levels. This advice is included under Agenda Item 12.

Agenda Item 7. Report from the CPUE modelling group

48. The Chair of the CPUE Modelling Group (John Pope) reported on intersessional work. It was noted that due to the pressure of OMMP work, the intersessional work of the group was confined to topics that had a direct impact on OMMP 9. A CPUE modelling group web meeting was therefore held during the course of OMMP 9 at Seattle on the 18th June 2018 and only two agenda items were considered.

49. The first web meeting agenda item was "To check that the base CPUE series continues to provide a good index of SBT abundance and is suitable for inclusion in MPs". Two papers were considered. The first (CCSBT-OMMP/1806/08 now CCSBT-ESC/1809/BGD02) described how the Base CPUE series and two monitoring series were updated and the second (CCSBT-OMMP/1806/10 now CCSBT-ESC/1809/BGD04) described the operational patterns of the Japanese longline fleet. Following these presentations and the resulting discussion, the web meeting agreed that the base CPUE series continues to provide a good index of SBT abundance and continues to be suitable for inclusion in MPs.

50. The second web meeting agenda item was "To examine the proposed LL CPUE based recruitment series." One paper (CCSBT-OMMP/1806/09 now CCSBT-ESC/1809/BGD03) was presented. This described ways to use the longline CPUE series to provide indices of recruitment. These were made with two approaches to disaggregating the CPUE series by age. The earlier approach takes the base CPUE series and then applies the CCSBT age distributions. The later approach disaggregates catches by age and then fits the model to each age. These approaches were applied both with no correction for the release/discard of younger fish and with two possible methods of correcting for such losses. The author suggested using the earlier method for the MP and using the later method for a sensitivity analysis. He also noted that Age 3 were not suitable for inclusion in an index and that Age 5 fish were not affected by releasing. In discussion the group felt that it would also be a good idea to compare these results with modelled and other observed measures of recruitment. It was noted though that some indices of recruitment are composites of several ages.

51. A report of the web meeting is appended (annex 4) to the report of OMMP 9 and was available to ESC 23.

52. A CPUE small group meeting was held in the margins of the ESC to discuss details of CPUE series developed by Taiwan and by Korea. These are

available in CCSBT-ESC/1809/39 and CCSBT-ESC/1809/41, respectively, that are reported under ESC agenda item 9. It was noted that both made good use of cluster analysis to try to identify fishing effort directed towards SBT.

53. In the case of Taiwan, cluster analyses were conducted for an Eastern and a Western area. The Eastern area cluster analysis detected a cluster that corresponded to mainly SBT effort. However, in the Western area fisheries were far more mixed and SBT catch formed a small proportion of total catch in each cluster. Thus, it will be difficult to separate trends in SBT abundance in this Western area from trends in targeting, and the downward trend in SBT CPUE in this area is likely to be misleading. Results from the SBT cluster in the Eastern area seem more likely to be useful. It was noted that since Taiwan longliners fish areas where smaller SBT are caught, it would be very useful to disaggregate the CPUE by age, possibly by using one of the approaches suggested for the Japan longline data in CCSBT-ESC/1809/BGD03. This may allow additional recruitment series to be developed.

54. In the case of Korea, the tuned series for areas 8 and 9 based upon the SBT clusters seem coherent and broadly consistent with results from the Japan core series (See figure 1.8 of CCSBT-ESC/1809/32). Thus, these CPUE series from Korea seem very valuable as CPUE monitoring series that are completely independent of the core CPUE series used in MP work. In the most recent year the Korea results for areas 8 and 9 are somewhat more optimistic than the core CPUE series.

55. With respect to intersessional work for 2019, unless exceptional circumstances arise that affect the Japan core vessel CPUE series, no intersessional CPUE Modelling Group Web meeting will be required. In the absence of any such problem, the intersessional work of the CPUE modelling group in 2019 will, as in 2018, be confined to preparing updates of CCSBT-ESC/1809/BGD02 to 4 that can be considered at OMMP 10 to provide the critical review of the CPUE data inputs to OMMP work. Other CPUE results will be considered in the course of ESC 24.

Agenda Item 8. Review of results of the Scientific Research Program and other inter-sessional scientific activities

8.1. Results of scientific activities

56. CSIRO presented paper CCSBT-ESC/1809/6. The southern bluefin tuna (SBT) pilot gene-tagging program commenced in 2016. The aims of the pilot study were to test the logistics and feasibility of large-scale gene-tagging of SBT and to provide a fisheries-independent estimate of absolute abundance of juveniles. A total of 3,768 fish were tagged and released in 2016. The number of fish tagged did not meet the original target of 5,000 fish, but it was possible to compensate for this by taking extra samples at harvest. A total of 16,490 tissue samples were collected during harvest in 2017, well in excess of the design study target of 10,000 samples. Protocols were refined for DNA digestion, robotic extraction and quality controls. The extracted DNA was sequenced using specifically designed SNP markers. In total,

3,456 fish were included in the tagged sample set, 15,391 fish were included in the harvest sample set, and a total of 22 recaptures were detected. The abundance of age 2 fish was estimated to be 2,417,786 with a CV of 0.21. The gene-tagging abundance estimate is close to the median estimate of age 2 fish in 2016 (2,102,853 fish aged 2 in 2016) from the 2017 stock assessment. Additional work, outside the scope of the pilot project, is underway to refine the length classes used for age 2 fish (for release samples) and age 3 fish (at harvest) and may result in revision of the data used in the analysis and final abundance estimate. The gene-tagging pilot project has demonstrated the technical feasibility and logistics of a large-scale genetic tagging program for SBT and its potential to provide an absolute abundance estimate for monitoring and management purposes.

57. In response to questions, CSIRO advised that there is little overlap with the length frequencies of the commercial fishery as they are targeting bigger fish than those that were used for gene tagging.

58. To detect any spatial stock structure effect, additional harvest samples could be collected from different areas and at older ages to compare with the pilot study results, noting that determining age becomes more difficult for older fish and reasonably large sample sizes are required.

59. CSIRO presented CCSBT-ESC/1809/7. The CCSBT gene-tagging recruitment monitoring program will provide an annual abundance estimate of juvenile SBT, from each year of tagging, for use in the SBT operating model and management procedure. The program commenced a third year of tagging at sea in 2018. Nearly 8,200 fish were tagged (via tissue biopsy) and released during 20 days of sea-time in February-March 2018. There were few mortalities (39 fish) due to the careful landing of fish by the vessel crew and modifications made to the landing table and return chute. Biological samples were collected from these mortalities, including otoliths and vertebrae to provide age-length information. The second year of harvest sampling in June and July 2018 has been completed with 15,000 tissue samples collected. The samples will be processed to extract the DNA which will then be sent for genotyping using the SNP makers developed by CSIRO. The full data set from fish tagged and released in 2017 and harvested in 2018 should be complete late in 2018. The abundance estimate will be provided through the CCSBT Scientific data exchange in May 2019.

60. In response to a question on the bi-modality in length frequency of tagged fish in 2018, CSIRO responded that they will examine the data further and will report the result in the next year's ESC. Otoliths and vertebrae have also been collected to during tagging and harvest sampling to provide direct ageing data to refine the length classes to target for age 2 and 3 fish. CSIRO also advised that they could use correction factors to exclude some fish if required, although this would reduce the sample size.

61. Australia presented paper CCSBT-ESC/1809/14. This paper reports on the completion of a second stand-alone Close-Kin Mark Recapture model for SBT that uses Parent Offspring (POP) and Half-sibling Pairs (HSP) identified using specifically designed SNiP assays for SBT and samples of adults and juveniles collected between 2006 and 2015. DNA was extracted from ~ 17,000 individuals with a total of ~15,000 individuals (4,238 adults

and 10,952 juveniles) analyses for POP and HSP following DNA and genotyping quality control. A total of 77 POPs (including the 45 found in the original CKMR study) and 140 definite HSPs and 4 Full-Sibling Pairs were identified. The true number of HSPs is estimated to be about 10% greater, because of the stringent criteria required to exclude false-positives. Examination of mitochondrial DNA indicates that about 65 of the 140 HSPs shared a mother whereas 75 shared a father, consistent with an equal sex-ratio in adult SBT. The stand-alone CKMR model used in the original study was extended to include: i) HSP, ii) the extended time series, iii) to allow selectivity to vary and iv) to free selectivity from fecundity, as well as some other minor revisions for consistency with the CCSBT Operating Models. The estimates of abundance from the new POP+HSP model and data are fairly similar to the values from the previous POP-only study, with the new estimates of SSB about 10% higher on average— a degree of change which is consistent with that expected from sampling variability, given there were 45 POPs available in the original study, whereas there are 76 in total in the updated data series. The overall summary statistics of biomass and numerical abundance varied relatively little across the model options explored, but there were differences in the age-specific components (n16p, nPLUS, Rcts), whereby models with estimated, rather than fixed, selectivity predict more older and fewer young adult fish. All options explored, with one exception, show very strong incoming cohorts of 8yo from about 2012 onwards and, by 2014, those cohorts have started to make an impact on overall spawning stock biomass and total reproductive output (TRO), so substantial upward trends in TRO and spawning stock biomass would be expected from 2015 onwards as these recent adults continue to grow. A key difference from the original study is that the HSPs are now providing a direct signal on overall adult Z, and this seems broadly consistent with the overall Z that was inferred under the assumptions of the POP-only model. However, the new model does show some preference for a somewhat higher survival for young adults, and an overall dome-shaped selectivity. This difference would have some effect on turnover rates and estimated incoming 8yo recruitments. What is not yet clear is how seriously to take that dome-shape. Since the treatment of selectivity for the LSfreq data is still not fully satisfactory, especially with respect to the observed sex ratios, this warrants further investigation. Lastly, the best practical fits with estimated selectivity are consistent with αHSP = 1. Since there is no strong a priori reason to expect αHSP < 1 and there is no current evidence that it is below 1, despite reasonable sample sizes (numbers of POPs and HSPs), it seems fair to assume αHSP = 1 for the Reference set of the CCSBT OMs until there might be any clear evidence to the contrary. Periodic updates of the stand-alone CKMR model could be used to review this assumption regularly.

62. In response to a question about how mortality could be estimated if catch was excluded in the stand-alone model, Australia explained that the mortality information was derived from the number of years between observations of juveniles involved in half-sibling pairs and reflected total mortality of adults.

63. The Scientific Advisory Panel asked how the 10% increase between the original POP-only and new POP+HSP model results came about. Australia advised this was the combined result of two factors: additional parent-

offspring-pairs for proportionally more total comparisons (which leads to an increase in the adult abundance estimate) and the information from the half-siblings indicated a reduction in the total mortality of adults. It was further commended that big fish caught south of the spawning ground noted in CCSBT-ESC/1809/SBT Fisheries - Indonesia could be an issue and needs to be examined further to determine where they are landed and if they are being sampled as part of the monitoring in Benoa, Bali. It was noted that there are two other ports where Indonesian vessels land southern bluefin tuna, Muara Baru (Jakarta), and Cilacap (south cost Central Java).

64. Finally, it was noted that the observed changes in fishing pattern by some components of the Indonesian fleet means it may be necessary to split the catches and selectivity in the OM (spawning grounds and non-spawning grounds), as the current OMs assume that all these fish are caught in Area 1.

65. CSIRO presented paper CCSBT-ESC/1809/8. 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 2017/18. Samples collected in Indonesia are stored at -20°C at the RIMF facility 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 2016/17 season were subsampled and the DNA subsequently extracted. A portion of the DNA was sent to DArT for genotype sequencing. The remaining tissue and extracted DNA samples were moved to -80°C where they currently remain. DNA extracts from the 2015/16 muscle tissue samples selected for genotyping (Farley et al. 2017) were processed by DArT and the genotype data sent to CSIRO in October 2017. The kin-finding analyses to identify parent-offspring pairs (POPs) and half-sibling pairs (HSPs) were updated to include these data, and the identified POPs and HSPs were provided to the CCSBT in April 2018. Note, however, that the DArTcap data added to the analysis this year were not entirely consistent with the previous data. CSIRO is still investigating why this was the case, and what the implications might be for ongoing kin finding in the future. There may need to be further modifications to the genotyping and/or analytical processes to improve quality control and consistency. The outcomes of the further investigations will be reported in 2019. Assuming the CKMR (and gene tagging) projects remain part of the ongoing monitoring of the stock, long term storage needs for archived tissue and extracted DNA samples must to be considered. Ultra-low temperature freezer space (and space to house freezers) at CSIRO is a finite resource, and as far as CSIRO was aware, there are no commercial facilities that store samples at -80℃ in Hobart. Investigation of alternatives storage solutions and maximum retention time for samples are recommended.

66. Australia presented paper CCSBT-ESC/1809/9. This paper 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 to the 2016/17 season and length frequency data to the 2017/18 season. The collection of SBT length data and otoliths was conducted using the existing Indonesia-CSIRO monitoring program for the longline fishery. A total 1,500 SBT ranging from 134-209 cm fork length (FL) were sampled in 2017/18. Analysis of the length and age data from the

Indonesian longline fishery shows that since the 2012/13 spawning season, the proportion of small/young SBT (<160 cm FL/12 years old) in the catch landed in Bali has increased substantially compared to previous years. The data indicate that the mode of small fish has progressed through the fishery over the past 6 years, which is also observed in the New Zealand charter fleet catch data. Investigations have shown that SBT caught by Indonesia have occurred in CCSBT statistical areas 1, 2 and 8, so it is plausible that the small/young SBT in the monitoring series were caught south of the SBT spawning ground. At this stage it is not possible to identify the catch location of individual SBT sampled as part of the regular the catch monitoring program. Australia recommends that the CCSBT consider a study in the Scientific Research Plan (SRP) to resolve (to the extent possible) the issue of where the small SBT are being caught (to the extent possible) and to refine/update the monitoring program, given the central importance this has for the stock assessment and close-kin mark recapture.

67. Australia presented CCSBT-ESC/1809/12. This report provides an update on otolith and ovary collection in the Australian fishery in 2018 and proportion at age from direct ageing for the 2016/17 season. Otoliths from 211 SBT caught in the Great Australian Bight (GAB) in 2018 were archived into the CSIRO hard-parts collection. Age was estimated for 125 SBT from the 2016/17 fishing season and the proportions-at-age were estimated using standard age-length-keys and by applying the method developed by Morton and Bravington (2003) (M&B method) to the combined age-length data and length frequency data obtained from the catch sampling program. For the 2016/17 season, the proportion at age estimates are 63% age 2 and 33% age 3. These estimates suggest a larger proportion of age 2 and smaller proportion of age 3 fish in the catches in 2016/17 than in previous seasons, with the exception of 2013/14 and 2014/15. A further 39 sets of SBT ovaries were collected from SBT caught by commercial longline operations off southeast Australia in July 2018, bringing the total collected by Australia to 247. Histological analysis of the ovaries will be undertaken in preparation for the proposed maturity workshop in March-April 2019.

68. In response to a question from Japan about the size of age 2 and age 3 fish relative to mean length at age estimates for ages 2-4 (derived from the 2000s growth model in Eveson 2011), Australia commented that the fish sampled are targeted by the commercial fishery, so they are not expected to be representative of the wider population of these age classes. In addition, commercial operations in the Australian surface fishery have shifted to the east which may also impact the size of the fish being caught. Further, there is no overlap with the size class of fish selected for gene tagging.

69. Japan noted that in going forward it is important to be mindful of the assumption that gene-tagged fish are representative of the whole stock, and noted that this assumption remains to be validated.

70. The Scientific Advisory Panel also asked about the hypothesis of sub-cohorts, as described by Japan, and what might be driving that, for example two spawning peaks or two groups of fish moving through the area. Japan commented that the two peaks were relatively weak, but there were data from the Japanese longline fleet in the 1960s and 1970s that demonstrated two

CPUE peaks during the spawning season. Further, the spawning period is in September through April, and is continuous.

71. Japan presented paper CCSBT-ESC/1809/25, which reported on Japan otolith collection in 2017. Japan collected otoliths from 301 SBT individuals in 2017. Ages were estimated from 198 SBT in individuals which were caught in 2016. The data were submitted to the CCSBT Secretariat in 2018. Age data in a total of 4907 SBT individuals taken by Japan were analysed to show relationships between fork length and age estimated.

72. Japan presented paper CCSBT-ESC/1809/26, which reported the trolling survey in 2017. The trolling research survey that provides the data for recruitment index of age-1 SBT was carried out in January and February 2017. In the survey, a chartered Australian vessel went 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 9 lines. The area adjacent to the piston-line and the area between Bremer Bay and Esperance were also surveyed. During the cruise, a total of 257 SBT individuals were caught. Among them, 66 fish had archival tags attached and were released.

73. Japan presented paper CCSBT-ESC/1809/27, which provides two recruitment indices of age-1 SBT using trolling catch data in two surveys on the southern coast of Western Australia: the acoustic survey from 1996 to 2006 and the trolling survey from 2006 to 2014; and from 2016 to 2018. One index is the piston-line trolling index (TRP) which has been reported to CCSBT. The other is the grid-type trolling index (TRG) which was developed in 2014. TRG utilises all of the trolling data that aggregates the trolling effort and the number of southern bluefin tuna schools caught by date, hour, area type, and 0.1 degrees square in latitude and longitude. The dataset included about 54,159 km total distance searched with 928 schools sighted. GLM in the form of delta-lognormal method was applied for CPUE standardisation because of the high percentage of zero catch data. Year trends of TRG over 21 years were compared to those of recruitment estimates from the operating model and from standardised CPUE of Japanese longline. The trends of TRG and TRP were similar to each other. TRG and TRP are expected to contribute to the CCBST stock assessment in future.

74. In response to a question about the survey design, Japan stated they were confident that they were getting good coverage of the fish and were sampling far enough out. However, this was the first time in the survey’s history where there was a zero result for the piston-line index and it was not clear what the cause of that was. This result, and the potential impacts, will need to be examined further. It is possible that the survey was affected by same environmental factor and this also requires further analysis.

75. Japan further explained, in response to a question on archival tagging, that they had released many tags and had had about 10 tags returned. They are currently analysing the data from the tags. Japan noted that the tags are retrieved by Australian purse-seine vessels and thanked the Australian industry for their assistance.

76. Taiwan presented paper CCSBT-ESC/1809/37. Taiwan started the observer project to collect fishery data and biological samples for southern bluefin

tuna (SBT) in the Indian Ocean in 2002. The direct aging of SBT otoliths collected in 2006–2013 was reported to ESC 21. The paper presented the updated otolith information for the SBT caught by Taiwanese longliners over 2014-2017. The observers collected 126, 122, 64 and 23 SBT otoliths in 2014, 2015, 2016 and 2017 respectively. In 2014, the size of the SBT sampled for otoliths covered the size range of the majority of the total catch, except for size > 155 cm. The age composition based on otolith direct aging ranged from 2 to 7 years, with 2 fish aged 10 and 11 years. SBT aged 3–6 years contributed > 70% of the samples. However, the SBT sampled for the otoliths were skewed toward small-sized fish in 2015-2017. In addition, the numbers of otoliths were reduced in 2016 and 2017. Therefore, the estimated ages of the SBT were also skewed toward the younger age groups of 2–4 years, and aging data based on the otoliths collected by the observers over 2015–2017 could not effectively represent the age compositions of the total catch for these 3 years. In order to increase the number of otoliths, Taiwan applied an alternative method to collect more otoliths in Kaohsiung harbor and processing factories. The estimated age composition based on 153 SBT (from this alternative collection) ranged from 1–23 years with the majority of fish aged between 2-5 years and a minority of fish aged > 6 years.

77. In response to a question about young fish being caught in the Taiwanese longline in the Indian Ocean, it was pointed out that juveniles spend the austral summer in the Great Australian Bight, but then move to the southeast Indian Ocean for the winter where they were caught.

78. Taiwan presented paper CCSBT-ESC/1809/38. 569 gonad samples of SBT were processed and analysed in this study. The collection period was from April to September in the years of 2010-2017. The fork length of samples concentrated between 90 and 150 cm. The trend of female gonadosomatic indices (GSIs) showed an increase from April to July and a declining trend. The male GSIs reached a maximum value in May and then exhibited the decreasing trend thereafter. As regards the designation of the sexual maturity stages, a total of 442 samples were collected in 2010-2016. According to the results, most samples were designated as an immature stage, and about 18% samples designated as mature, but these GSI were reproductively inactive. More mature female samples were regressed or in regenerating stages during April to June, while most of male samples were in regenerating stages during June to August.

79. In response to a question from Australia about the availability of otoliths, Taiwan advised they would check as they are being processed for a different project, but some may be available.

80. Korea presented paper CCSBT-ESC/1809/40 on Korean SBT otolith and ovary collection activities in 2017. To investigate the age and growth of southern bluefin tuna (SBT), Korea collected 146 otolith samples in 2017, totaling 444 otoliths since 2015. The relationship between fork length (FL) and total weight (TW) was $TW = 2E\text{-}05 \times FL^{2.984}$ ($R^2 = 0.928$). The von Bertalanffy growth parameters estimated were $L_\infty = 178.0$ cm, $K = 0.173$/year and $t_0 = -1.829$ years. In addition, since 2015 Korea has collected 297 SBT gonad samples, and are analysing the gonadosomatic index (GSI), maturity stages, fecundity, etc.

81. It was suggested that it would be interesting for Korea and Taiwan to compare their results as the Korean fish were taken in the Atlantic Ocean while the Taiwanese fish were taken in the Indian Ocean.

82. CCSBT-ESC/1809/Info01 was noted. Australia's National recreational catch of SBT has not been quantified. Acknowledging that good stock management requires consideration of all sources of mortality, Australia has established a formal methodology to estimate mortality of SBT resulting from recreational fishing. This will include a series of on-site and off-site surveys of the SBT recreational catch over the 12-month period from 1 December 2018 to 30 November 2019. The survey methods described here have been extensively tested and reviewed and are deemed to be the most cost effective and scientifically robust methods to assess the recreational catch of SBT in Australia. A number of methodological components, including final sampling coverage rates for on-site and off-site surveys, questionnaires and some survey output specifications are still being refined. Potential survey biases have been considered and mitigated where possible, noting that recreational fishing surveys generally necessitate finding a balance between cost and accuracy. It needs to be acknowledged that such a survey will provide one data point only and recreational catch of SBT in Australia is likely to vary from year to year due to the influence of environmental, oceanographic and other variables.

83. CCSBT-ESC/1809/Info02 was also noted. In 2016, it was agreed to draft an electronic monitoring concept paper that explored what a WCPFC EMonitoring Programme would look like and what may be needed to ensure that data collected under an E-Monitoring Programme could be used by the Commission. The paper is informed by key decisions of the Commission and draws on previous related conservation and management measures or directions that the Commission has made. The paper also recognises that vessel monitoring systems are a form of electronic monitoring (EM) and the Commission has an established data collection/verification programme through the regional observer programme (ROP). Furthermore, in recent years many CCMs have committed significant resources to actively undertake trials to further explore the application and necessary requirements to support the implementation of E-monitoring technologies as part of their national or subregional fisheries monitoring activities in the WCPF Convention Area. The concept paper recognises that these approaches can form the basis of a Commission-level E-Monitoring Programme built around minimum standards that would apply at a national and possibly subregional level. The concept paper also includes a number of placeholders where further discussion is expected to be required. This paper provides the basis of discussions at the Electronic Reporting and Electronic Monitoring WG meeting in August and if supported, could form a starting point for discussions around a WCPFC Conservation and Management Measure for a regional electronic monitoring programme.

8.2. Report from the Farm and Market Survey Small Working Group on progress with its work plan

84. Australia tabled paper CCSBT-ESC/1809/15 which provided an updated review of tuna growth performance in Australia's Farming operations. The paper noted that the plausibility of the hypothesis by Japan that Australia may be under-estimating the average weight of SBT into farms needed to be tested against the normal benchmarks. In this case, the six initial tests covered in the Paper were: (1) The wide range of published research on the issue, including the accuracy and precision of the Australian farming; (2) The published research on wild and farmed Pacific Bluefin; (3) The published research on wild and farmed SBT; (4) The global tuna farming benchmark on Feed Conversion Ratio (FCR); (5) The global tuna benchmark on Condition Index (CI); and (6) The fishing logistics of catching for farming. CCSBT-ESC/1809/15 argued that all the literature on the issue, including that on farming of all bluefin tunas, suggested that Japan's hypothesis was implausible. On the FCR, CCSBT-ESC/1809/15 provided the benchmarks used by all bluefin farming and this was consistent with the data provided by Australia from the annual 3,000 fish sample (≥10kg) which took actual weight and length. Regarding the Condition Index, CCSBT-ESC/1809/15 noted that the information provided by Japan was implausible and invited the ESC to Port Lincoln to view the proof of this first hand. Regarding Japan's hypothesis that the Australian purse seiner operators knew exactly where the older age groups were in the Great Australian Bight (GAB) and could target them, CCSBT-ESC/1809/15 argued that this was implausible because: In 2013, Japan's conclusion was that the average catch age was 4 years, when that age was only 15% of the total global stock. A tow pontoon takes 5-7 shots to fill, but after the first shot the pontoon could only move at one knot so could not move between areas of older fish. There was no consistent data showing specific areas of older fish in the GAB, and the weather restricted fishing to one in three days.

85. The author of CCSBT-ESC/1809/15 stated his opinion that Japan's position had changed a number of times, for example, from estimating that Australia's farm weight gain was too high to hypothesising that length growth in farms was not feasible. Japan had also not raised farm growth in any other RFMO, despite the evidence of farm growth of 5-7 times over 18 months in farming in other RFMOs.

86. Australia tabled paper CCSBT-ESC/1809/16, Japan Market Update 2018. Using the 2006 Japan Market Review (JMR) Case 2, the paper concluded that the domestic overcatch in the Japanese market had continued at a high level since 2009, and in recent years was 2,261 whole tons in 2014; 1,640t in 2015; 2,822t in 2016; and 2,592t in 2017. The paper noted that some of the JMR estimates may have now changed (e.g. share of imports at Tokyo market) but that the change to a greater share of the total market coming from non-auction sales was highly likely to be substantial. Therefore, the estimates above are highly likely to considerably understate the actual overcatch. CCSBT-ESC/1809/16 suggested that Japan supplies the actual data supplied by auctioneers to the Tokyo Metropolitan Government (TMG).

87. The author stated that paper CCSBT-ESC/1809/16 includes analyses of Japan's declared catch (including discards), with the market data. There had been a major shift in the auction market from SBT under 40kg to SBT over 40kg, despite Japan fishing similar areas. In his opinion this indicated much higher discarding (and post-release mortality) than declared and/or a much higher percentage of catch being sold outside the auction system than assumed in the Japan Market Review. He also suggested that the only way to fully address the uncertainty over the data was for Japan to introduce a full Electronic Monitoring (camera) system which measures the actual catch and the life status of discards.

88. Japan presented paper CCSBT-ESC/1809/28, which provides an update of unaccounted catch mortality in the Australian SBT farming in the 2016/2017 fishing season. Estimated growth rates based upon the 40/100 fish size sampling were very much higher than those from SRP tagging data and those of other farmed *Thunnus* species including Pacific bluefin tuna, and hence appear to be highly unlikely. Using the SRP tagging growth rate, the annual amount of catch was estimated to be higher than reported by between 253 and 2,546t, with a best estimate of 1,533t. As a proportion of the reported catch, this excess ranged from 5% to 56% with a best estimate of 31.9%. The authors suggested that it is valuable to evaluate catch sizes further by analysing CDS data, which include individual body weight information for all of the farmed individuals that Australia has reported to the Secretariat. Further they suggested that the ESC should dispel concern regarding this uncertainty about catch by recommending immediate implementation of the stereo video camera system to provide reliable length data.

89. Japan presented paper CCSBT-ESC/1809/29. This addressed discussion points relevant to the uncertainties of the size, age and total catch weight of Australian farmed SBT in the ESC in 2016 and 2017. The authors provided a detailed review information to address each of those 12 issues. In particular, they showed length-weight relationship for wild fish in Robins (1963) was suitable for recent data. They emphasised that the size data of individual fish included in CDS is highly beneficial. They requested a review of the Australian paper of FCR calculations (CCSBT-ESC/1809/15) which in unlikely because it leads to a large deficit regardless of assumption of fish growth rates. They noted that Fulton's condition index of farmed fish in their calculation is larger than that of wild SBT, contrary to Australia's claim.

90. Japan presented the CCSBT-ESC/1809/30, which provides updated information of Japanese market. Japan has conducted monthly monitoring and data collection for the major wholesale markets to validate the amounts of catch of SBT reported from the Japanese longline fisheries. The information of total trading amounts, wild/farmed ratio, domestic/imported ratio of traded frozen wild SBT, and time-lag between catch and sale were collected respectively from the official market statistics, hearing investigation, monthly monitoring in wholesale market, and observation of catch tags in the market. Based on the information above, domestic SBT catch amounts in 2004-2017 were estimated under certain assumptions and parameters for the Japanese market behaviour as with the previous Japanese Market Review (e.g. double-counting, off-market selling rate, market share). The estimated annual catch amounts were compared to the official catch

quantities reported by fishermen. As the estimated catches have been smaller than the official catch since 2008, under-reporting of catch by fishermen has not been indicated through the market monitoring.

91. Japan presented CCSBT-ESC/1809/31, which provided the information on the changes in the Japanese market after Japan Monitoring Research in 2006 (2006 JMR). The paper also provided the available data sources for improving the method for analysis of the market anomaly. Japan conducted some works in 2017-2018 as requested in Attachment 7 in ESC 22: (1) An interview with the TMG to confirm TMG databases; (2) Market changes were documented through a questionnaire to the 5 Tsukiji auctioneers and major retailers; and (3) the examination on the fish size and source country of frozen SBT landed and auctioned at Yaizu market. These results indicated some recent changes in the Japanese market from the time of the original review by 2006 JMR: (1) The proportion of imported-farmed-frozen SBT to the whole frozen-SBT in the Tsukiji market was increased with decreasing the amount of wild-frozen SBT due to reduced catch of Japan since 2007; and (2) The proportion of domestic-wild-frozen SBT to the whole frozen-SBT in the Tsukiji market fluctuates monthly according to the timing and the amount of frozen SBT imported. Some new data sources have become available (e.g. the time-lag from catch to sale and the amount of frozen-SBT exported from Japan), which did not exist at the time of the original review by 2006 JMR. The authors suggested that the ESC should update the 2006 JMR methodology and available data sources to reflect the current the Japanese market conditions for better estimation of catch by country.

92. The Farm and Market Survey Small Working Group (SWG) convened for substantive discussion on the Farm and Market Workplan after the papers for Agenda item 8.2 were presented to plenary. Farm and Market Workplan items specified in the attachment 7 of ESC 21 Report are numbered as follows:

Farm Workplan

- Item 1: Establish agreement that the number of fish and average weight out of farms are correct
- Item 2: Applying weight at length relationships (each of wild and farmed fish)
- Item 3: Methods used to estimate the growth rate of farmed SBT
- Item 4: Age composition of farmed SBT biased
- Item 5: Feed Conversion Rates (FCR) for farmed SBT
- Item 6: Does 40/100 fish sampling have any bias
- Item 7: Implications for fish condition index (CI)
- Item 8: Estimate number of 4-year olds in GAB
- Item 9: Understand logistics of catching for farming

Market Workplan

- Item 1: Influence of aggregation/methodology on estimates
- Item 2: Influence of time-lag between catch and sale

Item 3: Influence of export from Japan

Item 4: Willingness of auctioneers and Tokyo Metropolitan Government (TMG) to provide data

Item 5: Each of current surveys cover only a part in the market supply net

93. The SWG discussed some of items above; however due to time constraints, the SWG could not cover all the items, and only a short time could be allocated for discussion of some of the items in Farm and Market Workplan.

94. Japan noted that, with respect to the Farm Workplan item 1 (consensus on the number of wild fish caught and the total weight at harvest), current arrangements for data sharing meant that it had to be assumed that the CDS data summary was appropriate for use and was not biased. Australia noted that its CDS data complies with CCSBT standards, and companies are also audited to ensure that those standards are maintained.

95. Australia noted that use of its fisheries data (including CDS tagging form data) requires adherence to its confidentiality rules and policies. These prevent data considered to be of "commercial value and hence confidential" from becoming available in the public domain without the prior approval of the government. Australia emphasised that this requirement should not be interpreted as a lack of willingness for such data to be used, but their use requires a case by case determination of the benefits of the analyses compared to the risk of any commercial disadvantage from release of the data. Australia's preferred approach to such requests for use of confidential data includes consultation with stakeholders potentially impacted by the release of such data before making its determination on data release. An SWG attendee advised that the way that Australia's annual farm price negotiations occurred made the growth data extremely sensitive, and any breach of confidentiality would have major economic and statutory implications.

96. The SWG agreed that if the Australian CDS data, at the individual fish level in the sample of each company, were made available, they could be analysed with a range of scientific methods to verify catch estimates for the Australian purse-seine fishery. These methods could be more robust to various uncertainties and assumptions than those that can currently be applied.

97. The SWG discussed Workplan item 2, that length-weight (L-W) relationship for wild fish and agreed that the Robins (1963) L-W relationship was consistent with recent data, such as those from the trolling surveys and RTMP. However, the SWG considers that a study to update the estimate of the L-W relationship and the influence of season was warranted. The benefits of such a study would be greater if it could access individual wild fish information from CDS as well as all other length and weight information (e.g. trolling survey, longline catch from CDS data, recreational catch, 40/100 fish sampling, etc). Testing for influences that resulted in systematic bias in the L-W relationship should be the priority. Estimating annual and intra-annual variation in the L-W relationship for Australia and between farming companies was considered a low priority. It was suggested that this

activity could be included in the SRP discussion of ESC 23. There was no time to discuss L-W relationships for farmed fish.

98. The SWG agreed that there is no methodology being currently conducted to directly measure growth rates of farmed fish (Farm Workplan item 3), and that growth can only be inferred by indirect data sources (including CDS data). The SWG agreed that the actions in the workplan had been completed to the extent feasible and reported in the papers presented to the ESC 23 and previous ESC meetings.

99. The SWG agreed that it was beneficial to continue to provide updated information on Feed Conversion Rates (Farm Workplan item 5) and condition indices (Farm Workplan item 7) as it becomes available. However, further discussion was not possible on these items (for which different views exist) due to time constraints. Similarly, the SWG agreed that it was beneficial to continue to provide updated information on farming logistics as it becomes available (Farm Workplan item 9). Australia suggested that the SWG did not have the expertise to assess this information and how it affected the plausibility of any analysis by the ESC.

100. Australia advised that it was unaware of any analyses completed in the last year that could inform discussions on the use of stereo-video methods to measure fish length during the transfer from tow cages to grow-out pens (Farm Workplan item 6). Australia commented that stereo video should be considered as a form of electronic monitoring (EM). It advised that global work in the last year on EM (see CCSBT-ESC/1809/Info02) had recommended that the application of EM requires data standards to be developed for the collection and use of EM data.

101. The SWG noted that there may still be uncertainty in the Australian surface catch estimates due to the potential for bias in the sampling methodology to estimate the sizes of fish transferred from tow-cages to grow-out pens. The SWG noted further that in the absence of direct length and weight measurement of all fish transferred, estimation (and validation of estimates) was restricted to methods that use indirect data.

102. The SWG recognised the need for commercially sensitive information to be carefully managed and proposed an option that the SWG would make use of an independent panel that would advise the ESC on the appropriate methods that could be applied to the analysis of the data available (including CDS data) for the purpose of assisting with catch estimation. The SWG provided a draft Terms of Reference for such a panel to support the Extended Commission's consideration of implementing this approach. A view was expressed that the SWG does not have the access to the skills in fishing or farming of wild fish to assess whether any of the results of current analyses were plausible.

103. Draft Terms of Reference for the Independent Panel for Farm Analyses:

- To provide advice to the ESC and the Extended Commission on the appropriate methods that could be applied to the analysis of the data available (including CDS data) to assist with catch estimation for the Australian Purse-Seine Fishery. The advice would also detail any assumptions that would need to be satisfied for each method to be applicable.

- The panel could be comprised of specialists from CCSBT Members and/or trusted experts. The panel should include relevant expertise which may include fish husbandry and practical experience in the farming of wild fish.
- The panel could conduct or assist with the analyses, subject to agreement on data confidentiality. Alternatively, the panel could facilitate interpretation of any results coming from analyses of the data.
- Where possible and efficient the panel should attempt to operate electronically.

104. The SWG acknowledged the progress made by Japan to address the Market Analyses workplan items. The SWG noted that interviews to confirm TMG databases, and market changes documented through a questionnaire to the 5 Tsukiji auctioneers and major retailers, and the examination on the fish size and source country of frozen SBT landed and auctioned at Yaizu market had been undertaken. Australia took note of the summary of results provided but requested to see the original responses of those surveyed as well. Australia noted that CCSBT-CC/1510/19 does not provide the responses requested from Australia, (not from Attachment 7 in ESC 22 report).

105. Australia noted that it remains concerned that the data submitted to TMG may vary significantly from the official data reported to CCSBT and uncertainty remained about actual domestic catch (including discards) reported by Japan. One SWG participant reiterated that this required substantial analysis which could be submitted within an agreed time.

106. The SWG noted that little progress had been made on the following two workplan items:

- Feasibility proposal for a methodology that better reflects the current market conditions and makes use of new information that was not present at the time of the original review, including the share of auction sales in total sales. However, some new information on the fluctuation of the proportion of domestic and imported wild-frozen SBT, the time-lag from catch and sale and the amount of exported frozen-SBT from Japan was provided by Japan.
- Utilise CDS data submitted from Members and some Non-Members, which allow connection of CDS tagID to quantify any anomalies.

107. Similar to the farming component of the workplan, the SWG noted that data confidentiality and availability limited the ability to progress these items and hence that an independent panel approach may also be a useful option to progress this work. The SWG provided a draft Terms of Reference for such a panel if a decision was made to pursue this option further.

108. Draft Terms of Reference for the Independent Panel for Market Analyses:

- To provide advice to the ESC and the Extended Commission on the range of methods that could be applied to allow connection between CDS data submitted from Members and some Non-Members, to CDS tagID and sale

of fish. The advice would detail the assumptions that would need to be satisfied for each method to be applicable.
- To provide advice to the ESC and CCSBT Members on a methodology that takes better account of the current market conditions.
- The panel could be comprised of specialists from CCSBT Members and/or trusted experts. The panel should include relevant expertise; this may include forensic accounting and market analyses.
- The panel could conduct or assist with the analyses, subject to agreement on data confidentiality. Alternatively, the panel could facilitate interpretation of any results coming from analyses of the data.
- Where possible and efficient the panel should attempt to operate electronically.

109. Australia noted that similar to the discussion concerning farming where direct measurement of the fish transfer could resolve uncertainties, the application of EM on longline vessels, availability of shot-by-shot data, and independent observers on all boats could assist with verification of catch and discarding and reduce the reliance of market analyses to verify catch.

110. The SWG also discussed emerging issues that are likely to influence its workplan and that of the ESC into the future. These SWG discussions identified the need to consider broader market analyses to assist with understanding the potential volume of Non-Member markets that may not currently be reported to CCSBT. The SWG noted the validation of reported catch using market information is pertinent not only to Japan but also to all Member and Non-Member countries.

111. Australia commented that EM is likely to become a commonly applied tool for monitoring fisheries into the future and that developing standards as described in CCSBT-ESC/1809/Info02 could be prioritised in the SRP discussion of ESC 23.

112. The SWG proposed the following Work Plan for Farming and Market Analysis:

- 2018 Extended Commission
    - Member agrees to the conditional[1] release of CDS data for analysis.
    - Member agrees to the conditional[1] release of market data for analysis.
- Prior to 2019 Extended Scientific Committee
    - Members and panel to develop candidate methodology for analysis of farming data.
    - Members and panel to develop candidate methodology for analysis of market data.
- 2019 Extended Scientific Committee
    - ESC reviews Panel's selection of preferred candidate methodology (or methodologies) for farming analysis.

[1] These may include conditions related to scope, methodology, personnel, data management and security or any other condition deemed necessary to ensure the safe release of the information.

    - ESC reviews Panel's selection of preferred candidate methodology (or methodologies) for market analysis.
  - Prior to 2020 Extended Scientific Committee
    - Conduct farming analysis using agreed methodology.
    - Conduct market analysis using agreed methodology.
  - 2020 Extended Scientific Committee
    - Present results of farming analysis.
    - Present results of market analysis.
- For budgeting purposes, the SWG considered that panel members would be expected to allocate 10-14 days each to assist with the implementation of the workplan in 2019 and that one in-person meeting of each panel and attendance by the panel chairs at the ESC would be required.

113. The ESC noted that the Scientific Research Program will need to be amended accordingly if the Extended Commission endorses the work plan proposed.

Agenda Item 9. Evaluation of Fisheries Indicators

114. The ESC considered the updated indicators (**Attachment 5**). The overall results were summarised as follows:

  - The standardised Korean CPUEs for both areas described have shown an increasing trend since the mid-2000s.
  - For the Taiwanese CPUE standardisation, the standardised CPUEs for Area E (eastern area of 60 deg E) have been increasing since 2015.
  - For the Taiwanese CPUE standardisation, the standardised CPUEs for Area W (Western area of 60 degrees East) generally revealed a decreasing trend with a fluctuation since 2002. It should be noted that the Taiwanese SBT fishery in Area W is a small component of a very mixed fishery where SBT are primarily bycatch and as such any trends should be interpreted with caution at this time.
  - One indicator of age 1 SBT abundance (i.e. trolling index of piston line) was undertaken in 2018; the trolling index of piston line decreased since the last update.
  - The first data point in the gene tagging project indicated that in 2016 there were 2,417,786 age 2 SBT in the stock, which was similar to median estimates from the 2017 stock assessment.
  - Indicators of aggregated CPUE from the New Zealand domestic longline fishery increased in 2017.
  - The Japanese longline CPUE indicators suggest that the current stock levels for 4, 5 and 6 - 7 age groups are well above the historically lowest levels observed in the late 1980s or the mid-2000s. The CPUE indices for the age 8-11 group show some decreases in recent years. The indices for age class 12+ have declined gradually since 2011. This decline may relate to very low cohorts of 1999 to 2001.

115. Taiwan presented paper CCSBT-ESC/1809/39 Rev1. In this study, Taiwan attempted to explore the temporal and spatial patterns of catch and effort data of the Taiwanese longline fishery that operated in the waters South of 20°S in the Indian Ocean and also conduct CPUE standardisation for SBT caught by the Taiwanese longline fishery for the years of 2002-2017. Catch and effort data with 5x5 degree fishing location grids of Taiwanese active longline vessels authorised to seasonally target SBT operating in the Indian Ocean in the period of 2002-2017 were provided by OFDC. The SBT fishing ground is divided into the central-eastern area (Area E) and western area (Area W) based on the previous results (Wang et. al. 2015). For the results of cluster analyses, three clusters were selected for the Area E. Cluster 1 belonged mainly to the ALB operations but also contained the operations for BET, SBT and OTH; Cluster 2 was mainly the ALB operation; Cluster 3 was the SBT operation. The highest SBT catch proportion occurred in Cluster 3. Also, according to the spatial distribution of SBT catch proportion, the SBT catch proportion of Cluster 3 was obviously higher than the others. For Area W, cluster analysis was also conducted. Cluster 1 comprised ALB operations; Cluster 2 mainly belonged to the ALB operations but also contained the operations for BET, YFT, SWO and OTH; Cluster 3 included operations for OTH (mainly for oilfish). Most SBT catches fell in Cluster 2 and Cluster 3, while Cluster 1 contained very few SBT catches. For the spatial distribution of SBT catch proportion, the SBT of Cluster 2 was higher than others. For the CPUE standardisation, the standardised CPUEs for Area E gradually increased before 2007, revealed a decreasing trend from 2007 to 2011, substantially increased in 2012, then gradually decreased until 2015, and increased again after 2015. For Area W, the standardised CPUE series generally revealed a decreasing trend with fluctuation since 2002. For the results of retrospect analysis, the influence of including the updated data on the CPUE standardisation was negligible for Area E, while including updated data changed the standardised CPUE series for Area W although the trends were similar.

116. It was noted that the CPUE working group had also discussed the paper and concluded that as the Taiwanese SBT fishery in the western area (Area W) was a small component of a very mixed fishery where SBT were primarily bycatch, any trends should be interpreted with caution at this time. In contrast the data from the central-eastern area (Area E) were considered to be from a targeted SBT fishery and provided a more reliable indication of trends. It was noted, however, that it may be useful to try and disaggregate the series by age to see if there were any signals.

117. Korea presented paper CCSBT-ESC/1809/41 Rev1. In this study Korea standardised SBT CPUE of Korean longline fisheries from 1996 to 2017 using GLM applied to set by set data. In developing the index, it compared two alternative methods, data selection and cluster analysis, for differentiating targeting practices in the Korean longline data. Patterns were broadly similar for both approaches to addressing target change. However, in area 9, there were differences in the 2004-2006 period, with standardised catch rates higher for the clustered analysis. The clustering approach may be accounting better for the apparent switch towards targeting albacore during this time. For the area 8, the largest change is in the most recent years, where

the ‘selected data’ standardised indices dipped below the nominal CPUE and then climbed above it. The ‘clustered data’ indices were more stable overall, but also increased strongly in 2016. This would be because the recent effort in area 8 is so low and those estimates are likely to be highly variable.

118. It was noted that both the Korean and Taiwanese indices reported in the two papers presented were newer indices from smaller fisheries with slightly different target ages and as such would be expected to be more variable. It was concluded that they were reasonably compatible with the main indices used in the stock assessment and provided a useful way of using independent data to contrast the primary indices.

119. Australia presented paper CCSBT-ESC/1809/17. This paper provides a 2017–18 update of fishery indicators for the SBT stock. The paper 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 the 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 the paper, interpretation of indicators is limited to subset 1, and to recent trends in some indices from subset 2. The one indicator of juvenile (age 1) SBT abundance (TRP) that is reported here decreased since the last update. Indicators of age 4+ SBT exhibited mixed trends, with both the catch per unit effort (CPUE) from the New Zealand domestic longline fishery and the Japanese longline nominal CPUE increasing in 2017. In contrast, the Japanese standardised, normalised CPUE series for all vessels decreased while the CPUE for core vessels remained the same. The mean length of SBT has generally decreased since 2011, although it increased slightly 2017–18 compared to the previous seasons. There remains a strong need to understand the location of the small SBT catches. The median age of SBT caught increased in 2017.

120. Japan presented paper CCSBT-ESC/1809/32. In this paper fisheries indicators along with fishery-independent indices were examined to provide information for overviewing the current stock status of southern bluefin tuna. The Japanese longline CPUE indicators suggest that the current stock levels for 4, 5 and 6-7 age groups are well above the historically lowest levels observed in the late 1980s or the mid-2000s. CPUE indices for age 5 and 6-7 classes show increasing trends in recent years while the index for age 4 has fluctuated around the recent past 5-year mean. The CPUE indices for the age 8-11 group show some decreases in recent years. The indices for the age class 12+ have declined gradually since 2011. This decline may relate to the very low cohorts of 1999 to 2001. The current index levels for these older age groups are still low similar to ones observed in past. Other age-aggregated (age 4+ group) CPUE indices that have been used in the operating model and/or management procedure show increasing trends in recent years. The current levels of these indices are well above the historically lowest observed in the mid-2000s. Various recruitment indicators inspected suggest that recruitment levels in recent years have been similar to or higher than those observed in the 1990s (before very low recruitments of

1999 to 2002 cohorts occurred) but the levels of recruitment have varied from year to year. A high recruitment level of the 2013 cohort estimated from the operating model in the 2017 stock assessment is not supported by longline CPUE indices by age (4 and 5 years old) obtained in 2017 and 2018.

121. The group discussed both the Australian and Japanese papers. It was noted that the indicators table in the Australian paper did not provide any data on close kin or gene tagging, and it was agreed that these data sets would be incorporated in the future. Japan noted that it mentioned gene tagging in paper CCSBT-ESC/1809/32 and the estimate of 2,417,786 age 2 SBT with a CV of 0.21 was consistent with the numbers estimated in the 2017 stock assessment. Australia noted that CCSBT-ESC/1809/14 Figure 6 provides a breakdown of close-kin estimates for the different components of the adult population. This could be included in review of indicators in future.

122. Japan was asked whether their longline CPUE of age 4 and age 5, which corresponded to a high 2013 year class recruitment signal, took account release/discard. Japan replied they did. Japan also advised that no remarkable change of release/discard was observed in 2017.

Agenda Item 10. SBT stock status

10.1. Evaluation of meta-rules and exceptional circumstances

123. In 2011, the CCSBT adopted the meta-rule process as the method for dealing with exceptional circumstances in the SBT fishery (ESC 18). The meta-rule process describes: (1) The process to determine whether exceptional circumstances exist; (2) The process for action; and (3) The principles for action. Exceptional circumstances are events, or observations, that are outside the range for which the management procedure was tested and, therefore, indicate that application of the total allowable catch (TAC) generated by the MP may be inappropriate.

124. Australia presented CCSBT-ESC/1809/18. The annual review of the MP input series, stock and fishery indicators is intended to identify conditions and/or circumstances that may represent a substantial departure from which the MP was tested, termed "exceptional circumstances", and where appropriate recommend the required action. The 2018 ESC review of meta-rules is to provide advice on the TAC set for 2019 which was recommended at the 2016 meeting of the ESC. The issues of potential concern in 2018 are: (1) Changes in estimates of the population dynamics and productivity of the stock identified in 2017; (2) The unresolved shift in selectivity in the Indonesian fishery since 2013; (3) Potential for total catches (Members and Non-Members) to be greater than the TAC (either annually or over the quota block), and (4) The planned absence of the aerial survey in 2018. The paper suggests that no change is required in the TAC for 2019. The meta-rules provide a safety-net around the MP TAC recommendations and will continue to be an essential component of the new MP being developed.

125. Japan presented paper CCSBT-ESC/1809/33. In this paper, values of the core vessels' longline CPUE index (one of the series required for input to the Bali management procedure [MP]) are compared to projection results obtained

from the operating model (OM). Recent observations for this index fall well within the 95% probability envelope predicted by the Base case OM in 2011. As regards the aerial survey (AS) index (the other required input to the procedure) this is not available after 2017. Therefore, to evaluate this year's recruitment level and consider the possible occurrence of Exceptional Circumstances in the absence of the 2018 AS index, information from the estimate from the gene-tagging project in 2018, the result of the 2017 stock assessment, and the past AS index values are examined in combination. A hypothetical 2018 AS index inferred from this examination (as if the AS had been conducted in 2018) would fall within the 95% probability envelope predicted by the projections. Accordingly, in regard to a decision on implementation of the recommended TAC (calculated by the Bali MP in 2016 for the 2018-2020 fishing seasons) for the 2019 season, it is considered that no modification of the value of this TAC is required because: 1) there is no evidence to support a declaration of Exceptional Circumstances from the 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 (the overcatch of the TAC) and the scale of unaccounted mortality (UAM)); 2) no unexpected change has been detected in the fisheries' indicators examined; and 3) there are no indications of any appreciable decline in the recruitment indices available in 2018.

126. The ESC noted that the revision of historical catch and effort data by Japan and impact on CPUE advised in 2018 (CCSBT-ESC/1809/24) should also be considered in the meta-rules process.

127. The ESC reviewed the following four issues in the context of the meta-rules for the TAC recommendation for 2019, noting that the first 3 were reviewed in 2017 (at ESC 22):

- Changes in population dynamics as indicated by the 2017 stock assessment;
- The small/young fish in the Indonesian size/age data since 2013;
- The potential impacts from unaccounted mortalities; and
- Changes to input data to the current MP (aerial survey and CPUE).

Updated estimates of population dynamics

128. The 2017 stock assessment indicated that there were substantial differences in the rebuilding timeframe and estimates of stock productivity from the 2011 operating model results used to test and tune the current MP. The most recent years showed an improvement in stock status (relative depletion) and potential for much earlier rebuilding to the interim target (70% probability of rebuilding to 20%B_0 by 2035) than anticipated when the MP was tested. Sensitivity tests identified that recent high aerial survey results (2014 and 2016) were the most influential factors in the change in population dynamics.

129. The ESC 22 noted that with respect to the impact on the MP TAC advice, the changes to the operating model do not affect the operation of the MP and that the operating model changes are positive and lead to earlier rebuilding, even when the 2016 Aerial Survey data are excluded from sensitivity tests. The ESC 21 had noted that TAC recommended by the MP for the 2018-20 quota

block was not driven by the high aerial survey index but by trend in CPUE (Anon, 2016).

130. There is no change in the advice from the ESC 22; given that the updated estimates of rebuilding probability are positive and do not impact on the operation of the current MP. The ESC concluded there was no reason to modify the 2019 TAC in relation to this exceptional circumstance.

The small/young fish in the Indonesian size/age data since 2013

131. The ESC has discussed the increase in the frequency of smaller and younger size and age classes in the spawning ground catch monitoring, since it was first noted in 2015.

132. The ESC considers that this remains a priority issue to resolve for the monitoring of the spawning stock historically and in the future, and in conditioning the OMs. The previously recommended need for action to resolve this uncertainty should be urgently pursued so that the shift may be addressed in the next reconditioning of the operating models in 2019 for management strategy evaluation of candidate MPs. Indonesia will try to provide more information on whether the small fish are caught on or off the spawning ground and, in the future, the degree to which these fish contribute to the catches monitored (length frequency, otoliths, tissue samples) in Benoa. This is, however, not an issue for the operation of the current MP because the MP does not use these data directly. Hence, the ESC concluded there was no reason to take action to modify the 2019 TAC recommendation in relation to this exception circumstance.

The potential impacts from unaccounted mortalities

133. The design and simulation testing of the current MP assumed that all removals from the stock were accounted for, i.e. the implementation of the TAC was exact. Additional unaccounted mortality by Members and Non-Members has the potential to undermine the MP-based rebuilding strategy of the Extended Commission. The ESC 22 noted that the “Added Catch” scenario developed in 2014 could not be ruled out as a plausible scenario for consideration of unaccounted mortalities. Impacts of unaccounted mortality on rebuilding of the stock were severe in 2014, but results from sensitivity tests in 2017 using the reconditioned models for the 2017 stock assessment indicated that additional catches would impact rebuilding of the stock but the target would still be met (given the optimistic population dynamics in the 2017 reconditioning). No new information on potential levels of unaccounted mortality were provided to the 2018 ESC. The agreements at previous ESC meetings were that if these unaccounted catches are occurring they would trigger exceptional circumstances. The 2018 ESC reaffirmed the 2017 ESC agreement that the scenario was still considered plausible (Anon, 2017). The ESC concluded there was no reason to take action to modify the 2019 TAC recommendation in relation to this potential exceptional circumstance.

134. The ESC noted the actions by the EC to address unaccounted mortality, through the definition of attributable catches. In addition, the Extended Commission has set a reduction of 306t in the annual TAC available for allocation to Members for the 2018-2020 TAC block. This ‘direct approach’ aims to mitigate impact of unaccounted fishing mortality on performance of

the MP while a new MP is being developed that will be more robust to these uncertainties. The ESC has agreed that unaccounted mortality estimates will be included in the base set of operating models used for testing and tuning candidate MPs. This mechanism is intended to ensure that the new MP will be robust to uncertainty in total mortality and, therefore, avoid the triggering of exceptional circumstances from this uncertainty in the future.

Changes to input data in the current MP (aerial survey and CPUE)

135. The aerial survey was discontinued after completion of the final survey in 2017. This was a planned cessation, agreed by the Extended Commission in 2016. Members recognised the risks involved in foregoing future aerial survey results (Anon, 2016), and that this cessation would mean that a new recruitment monitoring program and management procedure would need to be developed.

136. In the context of the 2019 recommended TAC and exceptional circumstance advice, the absence of the aerial survey index in 2018 means that there is no information on whether the aerial survey index would have been inside or outside the bounds of the trajectories from the operating models used when testing and tuning the MP adopted in 2011. The ESC examined the potential impact of this exceptional circumstance on the rebuilding plan, and whether there will be replacement recruitment data in the near future from the gene-tagging recruitment monitoring program. The key points on recent recruitment are: (1) The recent 3 points in the aerial survey index (2014, 2016, 17) are substantially higher than the long term average of the series; (2) There has been an increasing trend in stock assessment recruitment estimates since 2002, and a hypothetical 2018 AS index inferred from this would have been within the bounds tested in 2011; (3) The gene-tagging program has been established and the pilot project has delivered an estimate of abundance; and (4) The first abundance estimate from the pilot gene-tagging program is similar to recruitment estimates in the 2017 stock assessment. These 4 positive outcomes suggest that no action is needed on the recommended 2019 TAC in light of the absence of the 2018 aerial survey data.

137. An update of historical Japanese longline catch and effort data were reported to the ESC (CCSBT-ESC/1809/24). This change to MP input data has also been reviewed through the meta-rules process. It was reported that the data change had very little impact on the CPUE series used in the MP, and therefore no modification of TAC 2019 is recommended.

Summary

138. In summary, the ESC concluded there was no reason to take action to modify the 2019 TAC recommendation in relation to its review of exceptional circumstances.

10.2. Summary of the SBT stock status

139. At its previous meeting in 2017 the ESC expressed the following views:

- Based on the stock assessment results presented to the ESC in 2017, the following stock status advice was compiled (Table 1) and updated. Two measures of the current spawning stock size are presented. The new method used in the operating model is presented as total reproductive output (TRO) as a proxy for spawning stock biomass (SSB)[2], based on a revised spawning potential estimate introduced into the operating model along with incorporation of the close-kin data. The biomass aged 10 years and older (B10+) is also presented, because this is the same measure used in previous stock assessments and therefore allows for comparisons.

- The stock remains at a low state estimated to be 13% (11-17 80% P.I.) of the initial SSB, and below the level to produce maximum sustainable yield (MSY). There has been improvement since previous stock assessments which indicated the stock was at 5% (3-8%) of original biomass in 2011 and 9% (7- 12%) in 2014. There are positive indicators on fishing mortality in that fishing mortality rate is below the level associated with MSY. The current TAC was set in 2016 following the recommendation from the management procedure adopted in 2011.

Table 1: Southern Bluefin Tuna Summary of 2017 Assessment of Stock Status

Southern Bluefin Tuna Summary of 2017 Assessment of Stock Status

Maximum sustainable yield	yield 33,036t (30,000-36,000)
Reported 2016 catch	14,445t
Current (2017) biomass (B10+)	135,171t (123,429-156,676)
Current depletion (Current relative to initial)	
SSB	0.13 (0.11-0.17)
B10+	0.11 (0.09-0.13)
SSB (2017) relative to SSBmsy	0.49 (0.38-0.69)
Fishing mortality (2017) relative to Fmsy	0.50 (0.38-0.66)
Current management measures	Effective catch limit for Members and Cooperating Non-Members: 14647t in 2017, and 17647t/yr for the years 2018-2020.

140. The review of indicators (agenda item 9) did not suggest new conclusions from those drawn in 2017. Overall, there is a low trolling (piston-line) index of age 1 in 2018, mixed signals of higher recruitment in recent years, and there are some consistent positive trends in the age-based longline CPUE estimates (**Attachment 5**). There may be several relatively strong cohorts moving through the fishery, although these have yet to contribute to the spawning stock. The ESC noted that increased recruitment is not necessarily indicative of increased spawning stock biomass. The ESC noted that it will take a few more years before there is sufficient data to confirm the recent apparent strong recruitments evident in the aerial survey.

Report on biology, stock status and management of SBT

141. 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 6**.

[2] For the remainder of the report SSB will refer to TRO.

Agenda Item 11. SBT Management Advice

142. 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 provide a probability of 0.70 of achieving the interim rebuilding target of 20% of the original spawning stock biomass by 2035. In adopting the MP, 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).

Stock status from 2017 assessment

143. The stock remains at a low state, estimated to be 13% of the initial SSB, and below the level to produce maximum sustainable yield (MSY). There has been improvement since previous stock assessments which indicated the stock was at 5.5% of original biomass in 2011 and 9% in 2014. B10+ relative to initial (from the 2017 stock assessment) is estimated to be 11%, which is an increase from the estimate of 5% in 2011 and 7% in 2014. There are positive estimates of earlier rebuilding of the stock than anticipated in 2011, because fishing mortality rate estimates are below the level associated with MSY.

Implications from 2018 review of indicators

144. The review of indicators (agenda item 9) did not suggest new conclusions from those drawn in 2017. Overall, there is a low trolling (piston-line) index of age 1 in 2018, mixed signals of higher recruitment in recent years, and there are some consistent positive trends in the age-based longline CPUE estimates (**Attachment 5**). There may be several relatively strong cohorts moving through the fishery, although these have yet to contribute to the spawning stock. The ESC noted that increased recruitment is not necessarily indicative of increased spawning stock biomass. The ESC noted that it will take a few more years before there is sufficient data to confirm the recent apparent strong recruitments evident in the aerial survey.

Annual Review of exceptional circumstances

145. In 2018 the ESC has evaluated whether there are events, or observations, that are outside the range for which the management procedure was tested and the implications of this for TAC setting. The scope of this evaluation covered input data to the MP (CPUE and absence of the 2018 aerial survey data), the question of unaccounted mortality, reported catch and length and age of Indonesian catches on the spawning ground, the higher productivity of the stock noted in 2017, and the update to historical CPUE data in 2018. Following the meta-rule review of exceptional circumstances, the ESC concluded there was no reason to take action to modify the 2019 TAC recommendation.

Current TAC

146. For the three-year TAC setting period (2018-2020) the 21st EC adopted TAC the values shown below (the recommended TAC from the MP).

Year	2018	2019	2020
TAC (t)	17,647	17,647	17,647

MP TAC Recommendations

147. Based on the annual review of the exceptional circumstances and fishery indicators, the ESC recommended that there is no need to revise the EC's 2016 decision regarding the TAC for 2018-20. Therefore, the recommended TAC for 2019 and the 2018-20 quota block remains 17,647t.

Agenda Item 12. Development of new MP

12.1. Evaluation of refined Candidate Management Procedures (CMPs)

148. CCSBT-ESC/1809/19 outlines the structural changes made to the SBT Operating Model to accommodate the simulation of new data sources and the additional robustness trials agreed on at the OMMP 9. In terms of new data sources there was gene tagging and close-kin mark-recapture (both parent-offspring and half-sibling pairs). In terms of new robustness trials a number relate to potential bias and additional variability in the gene tagging data, as well as two trials that explore alternative hypotheses about changes in long-line selectivity in the projections.

149. It was noted that CMP development and evaluation is based on a particular intensity of sampling for gene tagging (GT), the CPUE index, and close-kin mark-recapture (CKMR), and currently relies on the assumption that comparable sampling intensity will continue into the future. Hence, the level and frequency of future sampling is an issue that needs to be considered in the technical design and evaluation of the revised CMPs and, also, in the priorities for the future Scientific Research Program.

150. Japan presented paper CCSBT-ESC/1809/34. This paper provides results of further development and performance evaluation of a new CMP for SBT. The CMP considered is a simple empirical one called “NT4”. NT4 utilises CPUE, GT estimates, and a close-kin mark recapture parent-offspring pairs (POP) index. Characteristics of NT4 are: (1) until the tuning year of achieving the stock level target, NT4 suppresses increase of TAC, and after the tuning year, it tries to increase TAC as possible; and (2) if recruitment level becomes declining to a very low level, then NT4 drastically reduces TAC to avoid decrease of the stock. Comparisons of results between the reference set and some selected robustness tests (“reclow5”, “cpueupq”, “cpueom75”, “as2016”, and “cpuehcv”) are presented. Projected median trends of both TAC and SSB are more or less similar between the reference set and the selected robustness tests except that the trend of TAC (reducing) under “reclow5” is different from the reference set case reflecting reaction to low recruitment. Although it depends on the robustness tests, probability intervals of TAC and SSB are wider than those for the reference set.

151. Japan noted, in response to a question, that the primary focus of further refinements to the CMP would be to aim to improve performance with respect to the catch variability (the P(2up/1down) performance measure).

152. CCSBT-ESC/1809/20 details the changes made to the original suite of candidate MPs presented to the OMMP9, and their performance across the reference set of OMs and for key robustness trials. We explored three MPs: (1) rh11 using CPUE and gene tagging data; (2) D25 using CKMR and gene tagging data; and (3) rh12 using CPUE, CKMR and gene tagging data. A general design feature was that MPs switched from being reactive in the period before the tuning objective is reached, and less reactive afterwards. We also imposed a maximum TAC (32,000t) to avoid reactive MPs following very positive future scenarios, raising catches to levels that will have to come down substantially at some point in the future. For the 2035 tuning objective (median 30% SSB_0) average TACs (2022-2035) were around 20,000t; for the 2040 tuning objective (median 35% SSB_0) average TACs (2022-2035) were around 18,000t. The standout important robustness trial was reclow5 (mean recruitment reduced by 50% in first five years), and the limit-type form for the gene tagging part of the HCR used in all the MPs appeared to work relatively well in maintaining future SSB above current levels, while still attaining the previous rebuilding objective (SSB in 2035 above 20% of SSB_0 with probability 0.7).

153. CCSBT-ESC/1809/43 refined target-type CMPs for SBT that had been presented to the OMMP meeting and extended these to include the input of CKMR information through use of the associated SSB index presented in CCSBT-OMMP/1806/5. Essentially CMPs, tuned to median recovery to 30% of SSB_0 in 2035, are developed for each of the CPUE, gene tagging and CKMR data sets alone, and then weighted combinations of these are considered. A subset of the robustness tests which show the greatest differences in performance compared to the base/reference case (RC) OM are selected. Overall the CMP based on the CKMR data only seems to perform best for the RC, but when the selected robustness test results are also taken into account, a variant based on a weighted combination of CMPs using all three data types seems marginally preferable.

154. In extensions to paper CCSBT-ESC/1809/43 tabled at the meeting, a similar CMP tuned to 35% of the initial SSB in 2040 was reported, as well as a demonstration that the trends in TAC and SSB from 2035 onwards could be readily altered by varying the value of a single control parameter.

155. The ESC noted that, in general, the CMPs that included the CKMR data generally exhibited lower variability, particularly in the earlier period of projection through to 2030, and that this effect was stronger for those CMPs using the model-based form of CKMR. One explanation for this general behaviour is that, of the three data series available as input to the CMPs, the CKMR data is the only series that indexes the SSB directly and, for the model-based CMPs, this index is relatively precise.

156. In light of this result, the question was raised whether the lower variability in TAC associated with CKMR procedures may reflect too great a structural similarity between the models and the OM and these CMPs. An initial exploration of the impact of the CKMR data on the OM conditioning we

carried out by excluding the CKMR data from the OM and projecting under the current TAC (Figure 1). Exclusion of the CKMR data resulted in a consistent downward shift in the median and 80% CIs of SSB, but without any evident difference in precision. It was noted, that the exclusion of the CKMR data from the OM did not reflect the full impact of including the CKMR on the conditioning of the OMs, as the inclusion of these data also included substantial structural revisions to the grid and maturity ogive (OMMP 4, Portland).

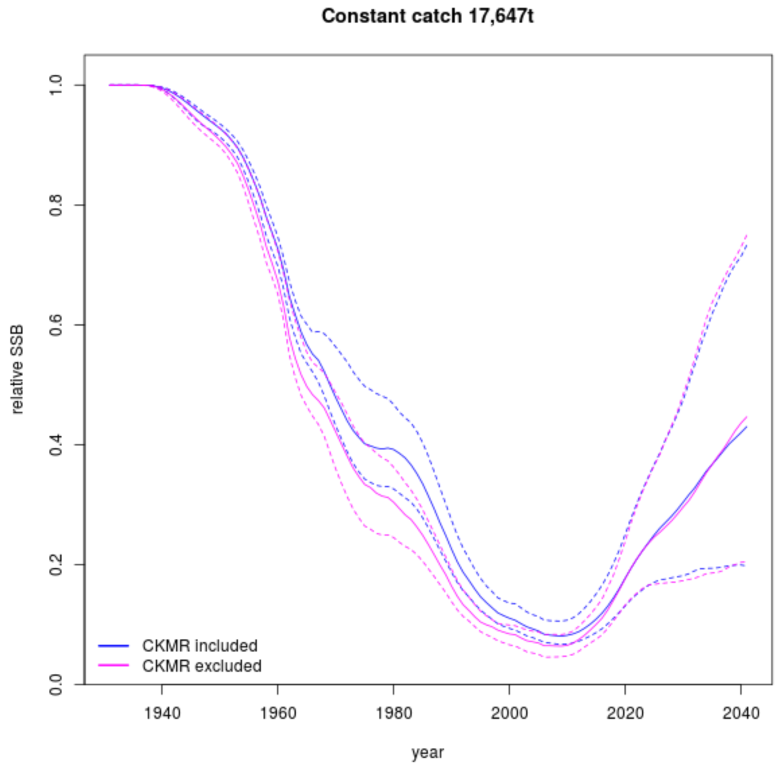


Figure 1: Impact of excluding CKMR POP and HSP data from the operating models (Base2016) on historical and future depletion of SSB. Projections were conducted under continuation of the current TAC.

157. It was noted that some CMPs had incorporated a maximum TAC constraint (see CCSBT-ESC/1809/20) their harvest control rules (HCR). The maximum TAC allowed for the CMP to react to positive signals (for example, for more productive scenarios in the grid) by increasing the TAC, but not to levels above the highest estimates of sustainable catches that would subsequently result in large TAC decreases in the latter part of the projection period. The ESC noted that this may be a feature that other developers may wish to explore, particularly for the more reactive forms of CMP, while noting that other CMPs have achieved similar performance without the use of a maximum TAC.

158. The ESC reviewed the results of CMPs for the robustness test agreed at OMMP and noted that four robustness tests had the most impact: “reclow5”, “as2016”, “CPUEw0”, and “h55”. In addition, runs for the crossed combinations of these most influential robustness tests were examined at the meeting (**Attachment 7**). Results for runs available at the meeting were reviewed via the Shiny App and a selection of results illustrating the main issues considered by the ESC is shown in **Attachment 7**. The ESC noted

that, qualitatively, the relative differences between the CMPs were the same between the two tuning combinations (i.e 0.30 by 2035 and 0.35 by 2040); however, the absolute differences are somewhat less between the two tuning levels. In addition, it was noted that the average catches are slightly lower for the second tuning levels.

159. A subset of robustness tests was selected for further CMP testing (Table 2) based on results indicating a substantial impact on CMP performance. The ESC noted that this list included scenarios that were more or less plausible and some that represented rather extreme situations. Thus, it would not be reasonable to require that CMPs be similarly robust to all scenarios. Rather, the degree of robustness of the different CMPs should be judged in relative terms. For the specific objective of having a probability > 70% of attaining the interim rebuilding target by 2035, the meeting discussed and reached consensus on the relative importance that developers should place to achieving robustness with respect to this objective for the different robustness tests (Table 2).

160. Additional robustness tests may be considered in 2019 in light of the potential conflicts between data sources in the future (e.g. estimates of recruitment from the aerial survey and CPUE). The ESC agreed that the relative importance of the robustness tests would be reviewed at OMMP 10 and in light of new data and the reconditioning of the OMs.

161. The ESC considered that the proposed revisions to the CMPs discussed (and some tested) during the meeting, and the contrasts in short and medium-term performance demonstrated by the different CMPs indicates that further improvements in performance may be achieved in the inter-sessional period prior to OMMP 10.

162. The workplan for MP development proposed by the ESC is detailed in **Attachment 8**.

Table 2: Subset of robustness tests selected by the ESC and relative importance of achieving robustness with respect to the probability of attaining the interim rebuilding target by 2035.

Name	High priority robustness tests	Importance
as2016	Remove the 2016 aerial survey data point	H
h55	Just check any estimation tweaks that might be required	M
cpuew0	Variable squares	L
reclow5	Reduce future recruitment by half during the first n years. For 2018, n was set to 5.	H
reclow5as2016	Combo	H
reclow5h55	Combo	M
reclow5cpue0	Combo	L
TRG	Troll grid used as index of age-1 abundance and aerial survey removed	To be determined

12.2. Selection of a subset of CMPs, tuning variants and results for presentation at the Extended Commission meeting

163. The ESC noted that the OMMP 9, in the review of initial results for CMPs, considered that the behaviour exhibited by CMPs when they were tuned to

0.25 and 0.40 of SSB_0 was unlikely to be acceptable, given the guidance provided by the SFMWG. In order to achieve the 0.40 target by 2035, each of the CMPs considered by the OMMP was required to immediately reduce the TAC to levels substantially lower (~10,000t) than the current TAC over the evaluation period (Figure 2). In the case of the 0.25 target, the situation was the reverse: in the short-term this tuning level required CMPs to increase TACs to about 30,000t by 2035. This is higher than 23,850t, the level of constant catch that would result in a median 0.25 SSB_0 in 2035 (CCSBT-OMMP/1806/05). Hence, after 2035 the TAC would need to be reduced rapidly below 24,000t to maintain the SSB above the target level. These behaviours were consistent for each of the preliminary CMPs for the 0.25 and 0.40 tuning levels examined at OMMP 9. They are predominantly determined by the "starting conditions" in the OMs (i.e., the current SSB, recent high recruitments), stock productivity, the length of tuning period (2020-2035) and the constraints on the number and maximum size of changes in TAC during the projection period (i.e., three-year TAC blocks and 3000t maximum TAC change).

164. Given the general guidance from the SFMWG on the desirability of incremental increases in the TAC, the undesirability of large TAC decreases, a preference for relative stability in catches beyond the rebuilding target year and, in particular, the desire to stay above the interim rebuilding target (70% probability of exceeding $0.2SSB_0$ by 2035) once the target level is achieved (Table 3), the ESC agreed that the general behaviour of CMPs for these two tuning levels (0.25 and 0.40 SSB) was unlikely to be acceptable and that further CMP development should focus on the 0.30 and 0.35 SSB target levels.

165. The OMMP 9 review of preliminary results of CMPs for tuning to 0.35 SSB_0 by year 2035 demonstrated that to achieve this tuning level would require TAC decreases in the short-term. The CMPs tuned to this level reviewed at OMMP 9 led to continued stock increases above 0.35 SSB_0 in the period beyond the tuning year. Given the clear direction from the SFMWG to consider target levels above 0.30 SSB_0 and to explore tuning periods beyond 2035 if required, OMMP 9 explored the impact of extending the tuning period to 2040 for the 0.35 SSB_0 target level. This combination was run for one of the CMPs (NT1)[3] and the results for the 0.30 and 0.35 SSB_0 levels and 2035 and 2040 tuning years are shown in Figure 3. The lower panel, middle column shows that the combination of 2035 tuning year and 0.35 target results in progressive TAC decreases to achieve the target SSB rebuilding and an "overshoot" in SSB rebuilding once this level has been achieved. The right-side panel shows that extending the tuning period to 2040 (for the 0.35 SSB_0) removes this undesirable behaviour for both catch and SSB rebuilding, and results in similar SSB trajectories to those for the 2035 tuning year and 0.3 SSB_0 combination.

[3] Note that it was necessary to "re-tune" a CMP for the new combination of target SSB and year (0.35 by 2040) during the OMMP9 meeting, which is a time-consuming process. Hence, the CMP that was likely to be fastest to tune was selected by the OMMP for this comparison.

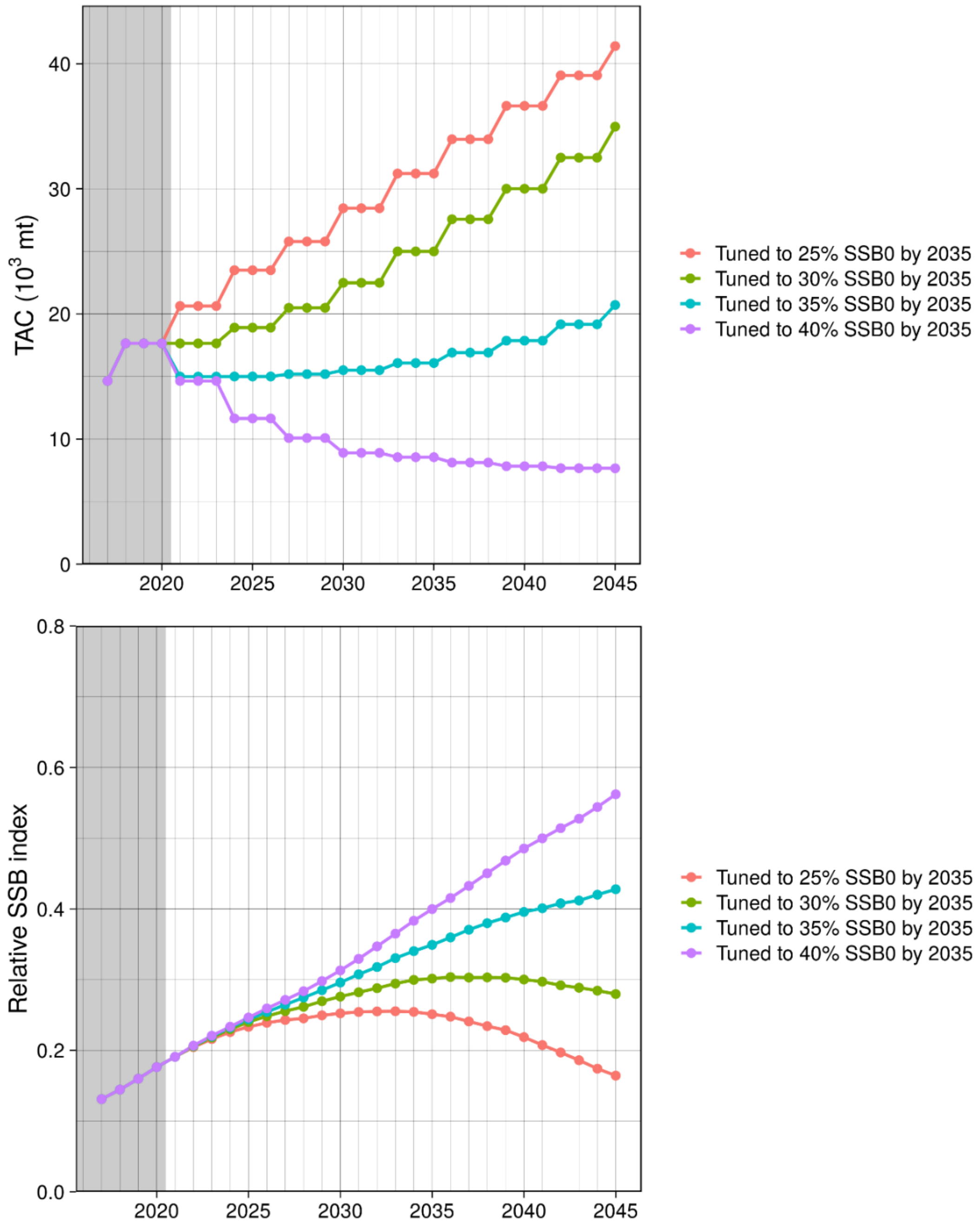


Figure 2: Trajectories of median TAC and median SSB0 for the four SSB0 tuning levels (0.25, 0.30, 0.35 and 0.40 SSB_0) requested by the SFMWG for 2035 tuning year for an example Candidate Management Procedure from OMMP 9. The shaded region reflects TAC decisions already made.

Table 3: Probability of SSB being greater than the interim rebuilding target (0.2 SSB_0) in 2035 and 2045 when the example CMP was tuned to achieve various levels (0.25, 0.30, 0.35 and 0.40 of SSB_0) in year 2035. For the CMPs examined at OMMP 9 there was a high probability of the SSB declining below 0.2 SSB_0 in the period beyond the tuning year (2045) for the 0.25 SSB tuning level.

Tuning value	$P(SSB_{2035} > 0.2SSB_0)$	$P(SSB_{2045} > 0.2SSB_0)$
0.25	0.69	0.40
0.30	0.85	0.70
0.35	0.95	0.96
0.40	0.99	1.00

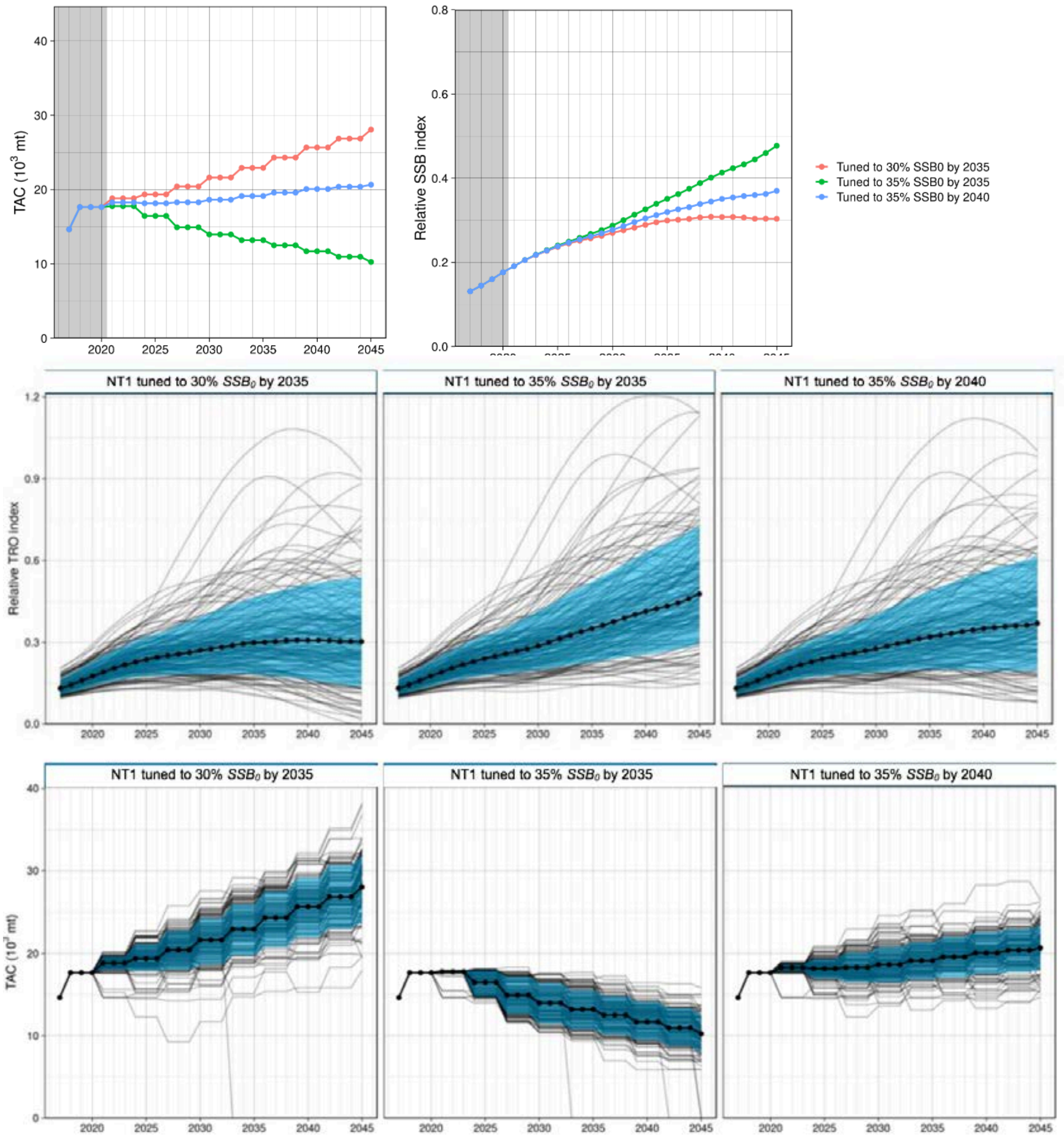


Figure 3: Results for a selected example CMP (in this case, NT1) for three combination of tuning level from OMMP 9: i) 0.30 SSB_0 by 2035 (LHS); 0.35 SSB_0 by 2035 (centre), and iii) 0.35 SSB_0 by 2040 (RHS) to examine the impact of extending the tuning period from 2035 to 2040 for the 0.35 SSB_0. Top: Median TAC (left) and SSB (right) trajectories for each combination of SSB target and tuning year. Bottom: Selected run(s) showing a random selection of individual iterations, or worms (thin black lines), the median (bold lines and points) and 80% confidence intervals (shaded region) for SSB (top) and TAC (bottom)[4].

[4] In Figure 3 a small number of TAC worms rapidly go to zero. This is not a function of the SSB collapsing, as can be seen in the figure as no corresponding worms in the SSB hit zero. It is simply an error in the candidate MP that, when age 2 abundance is very high, there are zero matches found in the simulated gene tagging data. This means the index is essentially missing, which is reflected in the simulated data as -11 to indicate it is missing for developers. This particular MP did not have code to deal with this outcome and the gene tagging index is used as if it really was -11 age 2 fish. This made those TAC values negative and, in the code, negative TACs are not allowed and a value of zero is enforced as we see here. The modified version of this MP has now been fixed and can accommodate the few instances where the gene tagging data is missing

166. The ESC agreed that the CMP development and testing completed for presentation at the ESC demonstrates that CMPs tuned to the combinations of tuning levels and years chosen by the OMMP 9 (0.30 SSB_0 by 2035 and 0.35 SSB_0 by 2040) are able to:

- achieve the interim rebuilding target set by the EC (70% probability of SSB > SSB_0 by 2035); and
- have a high probability of staying above the interim target in the longer term.

167. Furthermore, most CMPs evaluated by the ESC that were able to achieve those tuning levels (i.e. 0.3 or 0.35 by 2035 or 2040) were sufficiently reactive to the possibility of low future recruitments while maintaining relative stability in the catch trajectories. That is, they were able to meet the performance criteria articulated by the SFMWG in March 2018.

168. Figure 4 and Table 4 illustrate the behaviour and summarise performance statistics for catch, catch variability and probability meeting the interim rebuilding target of the Extended Commission, of one example CMP tuned to the two target levels reviewed by the ESC.

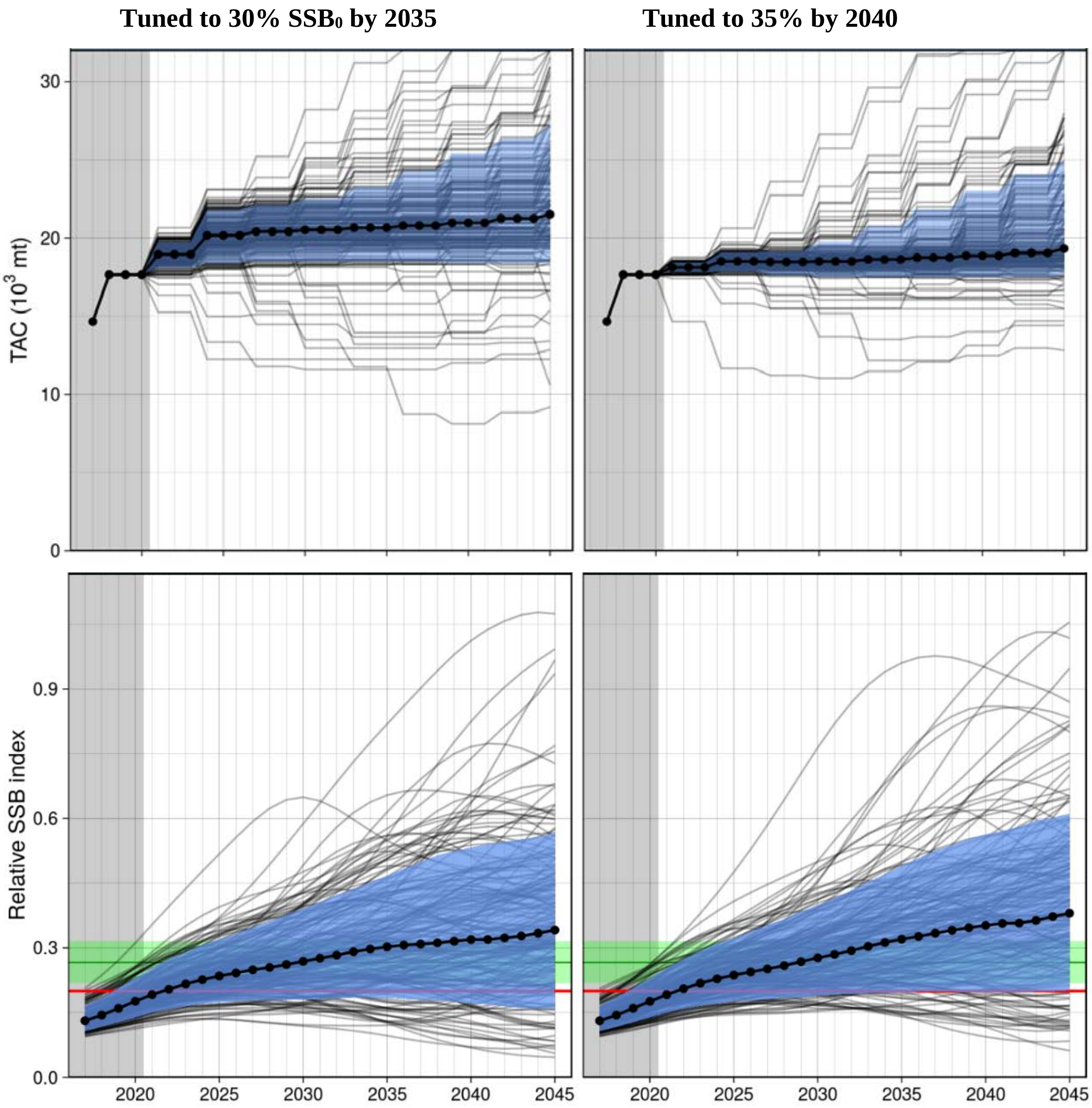


Figure 4: Illustrative example of CMP TAC and SSB behaviour for two tuning levels (0.30 SSB_0 by 2035 and 0.35 SSB_0 by 2040) for a CMP reviewed at ESC 23. Median trajectories (bold lines and points) of TAC (top panel) and SSB (bottom panel) for each combination of SSB target and tuning year. Selected run(s) showing a random selection of individual realisation, or "worms" (thin black lines), the median and 80% confidence intervals (shaded region) for TAC (top) and SSB (bottom). The shaded green bar shows the estimated range of SSB that would produce MSY (under current selectivity). The red line is the SSB level corresponding to the interim rebuilding target (0.20 SSB_0) of the Extended Commission.

Table 4: Summary performance statistics for two tuning levels (0.30 SSB_0 by 2035 and 0.35 SSB_0 by 2040) for an illustrative example of a CMP reviewed at ESC 23.

Tuning	Mean TAC (2021-2035)	AAV (2021-2035)	P(2up/1down)	P(SSB2035 > 0.2SSB_0)
Tuning to 30% SSB by 2035	20,181	2.5%	0.01	0.85
Tuning to 35% SSB by 2040	18,453	1.3%	0.04	0.89

169. The ESC agreed that further development of CMPs in the inter-sessional period prior to OMMP 10 would continue to focus on the two combinations of target level and tuning year: i) 0.30 by 2035 and ii) 0.35 by 2040. The availability of new data and the reconditioning of the OMs in 2019 may require further exploration of alternative tuning criteria.

Agenda Item 13. Update of the Scientific Research Plan

170. Australia presented paper CCSBT-ESC/1809/13. The paper summarised in two tables the activities of the Scientific Research Program (SRP). Table 1 of CCSBT-ESC/1809/13 described the on-going scientific monitoring required for the work of ESC. Table 2 of CCSBT-ESC/1809/13 described potential research activities that may improve on-going scientific monitoring or address key uncertainties in the stock assessment. The last SRP (2014-2018) was developed in 2013 and the ESC anticipates conducting a detailed review of the SRP at ESC 24/ESC 25. The ESC noted that the SRP has an integral part in moving the ESC work-plan forward and is vital in prioritising resource allocations and securing funding. The aim of the paper is to provide Members with the opportunity to update the research program summarised in the tables.

171. New Zealand advised the ESC that it had engaged in bilateral discussions with Australia to update the analysis on Non-Member catch that was conducted jointly by the two Members in 2016. New Zealand encouraged participation from other Members in developing a revised estimate. New Zealand remains committed to the ongoing monitoring of Non-Member catch and aims to undertake the analysis in the coming year. Australia also pointed to the importance of an update to the estimate of Non-Member catch for future consideration under the meta-rules for the application of the MP.

172. For efficiency, given the time constraints of ESC 23, Members evaluated Table 1 and Table 2 of CCSBT-ESC/1809/13 to assess which items in Table 2 had been sufficiently developed to be included in Table 1 and whether there were any items currently in Table 1 that were no longer required. ESC 23 also identified new activities that should be included in Table 2. This was used as a basis for identifying the intersessional work that may need to be undertaken by Members in preparation for substantive discussion on these items at ESC 24/ESC 25 when a full review of the SRP is expected to occur.

173. Monitoring activities now considered on-going and identified as candidates to be moved into Table 1 from CCSBT-ESC/1809/13 include the items in the table below. Discussions on whether items could be removed from Table 1 were postponed to ESC 24/ESC 25.

Activity	Preliminary ESC Priority	Input to	Timeframe
Non-Member Catch	High	OM & MP (exceptional circumstances)	Annual
Attributable catches/mortalities Discards Recreational Fishing	High	OM & MP (exceptional circumstances)	Annual
Trolling index- piston line (TRP) for age 1 fish	High	Annual status advice	Annual
Trolling index- grid type (TRG) for age 1 fish	High	Annual status advice	Annual
Standardised CPUE series for Taiwanese longline for the east	High	Annual status advice	Annual
Standardised CPUE series for Korean longline	High	Annual status advice	Annual
Standardised CPUE series for Taiwanese longline for the west	Low	Annual status advice	Annual

174. Research activities identified as candidates to be included in Table 2 from CCSBT-ESC/1809/13 include:

Activity	Descriptors
Stock Structures	Evaluate if more than one stock
Age-length relationship	Needed for catch estimation
Environmental/Climate Influences	SBT range through fast changing marine environment. Impacts on recruitment (indices) proposed as priority
Maturity Ogive	Needed for OM
Compendium of information for gap analyses	Readily available resource on what we know and don’t know
Age structure	Alternate data for OM
Close kin	Sample size for MP
Gene tagging	Sample size for MP

175. The ESC noted that there was no independent estimate of maturity and recognised this uncertainty and the importance of obtaining an updated and unbiased estimate of the proportion of the population that is sexually mature by age and length. A draft proposal to estimate an unbiased maturity schedule for SBT was presented to the ESC in 2013 and the methods were supported in the Scientific Research Program (2014-18). The maturity proposal recommended that ovaries and otoliths be collected across the full range of SBT in the southern latitudes from fish ≥110 cm fork length during the non-spawning months of April to August. The presence of ‘maturity markers’ in histological sections of the ovaries would be used distinguish mature resting females from immature females.

176. The ESC discussed plans for the workshop in late-April 2019 at the Research Institute of Tuna Fisheries laboratory in Bali. The program will be developed with Members over the next few months (2018). Members will send (via courier) their histology slides to Indonesia for comparisons during the workshop. The aim is to provide training in the method for identification of markers and in staging and scoring of the histology. Following the workshop, the statistical analysis will collate the results from the workshop to provide an updated maturity schedule. Members will cover their own travel costs. More details are available in CCSBT-ESC/1809/BGD06 and Attachment 12 of the ESC 22 report.

Agenda Item 14. Requirements for Data Exchange in 2019

177. The Secretariat presented paper CCSBT-ESC/1809/05. The requirements for the 2019 data exchange were discussed and agreed in the margins of the meeting. These requirements were endorsed by the ESC and are provided in **Attachment 9**.

178. The meeting agreed to accept Japan’s revised catch and effort data for 2007-2015. The differences to Japan’s originally submitted data and reasons for the differences are summarised in paper CCSBT-ESC/1809/24. The revised data will be incorporated into the CCSBT’s catch and effort databases after the meeting.

Agenda Item 15. Research Mortality Allowance

179. CSIRO presented the relevant component of paper CCSBT-ESC/1809/07 on gene-tagging recruitment monitoring in 2018. For CCSBT’s 2019 gene-tagging program, a research mortality allowance (RMA) of 3 tonnes is requested for gene-tagging in February-March 2019. The 2019 program will follow the specifications and sample sizes calculated in the design study (Preece et al, 2015). This program will provide an annual abundance estimate of juvenile SBT, from each year of tagging, for use in the SBT operating model and management procedure. The ESC endorsed this RMA request.

180. Australia presented paper CCSBT-ESC/1809/22 on proposed allowance for 2019 and 2018 usage report by Australia. In 2017, Australia was granted 1.2t of RMA for the continuation of one project in 2018. As of 15 June 2018, a total of 1.2t had been used. Australia did not request any RMA for 2019.

181. Japan presented paper CCSBT-ESC/1809/35 which reported it had used 0.229t of its 1t RMA allowance for 2018 and requested 1.0t RMA for a trolling survey for juvenile SBT in Western Australia in 2018/19. Japan’s request was endorsed by the ESC.

Agenda Item 16. Workplan, Timetable and Research Budget for 2019 (and beyond)

16.1. Overview, time schedule and budgetary implications of proposed 2019 research activities and implications of Scientific Research Program for the work plan and budget

182. The ESC's three-year workplan for 2019 to 2021 is provided at **Attachment 10**. The resources required for the ESC's three-year workplan are provided at **Attachment 11**.

183. The meeting agreed that between the 2019 OMMP and ESC meetings, CMP developers should upload their results to GitHub and use the Shiny App so that they can see the results of other CMP developers without needing to wait for ESC papers to be developed. This will enable developers to learn from each other in a timely manner and enable CMPs to be adjusted in advance of the ESC.

184. The ESC expects that reconditioning of the operating model for the 2019 OMMP meeting will proceed without any severe unexpected outcomes. Instead of making contingency plans for such unexpected outcomes, the ESC noted that the Extended Commission has an intersessional decision-making process and that consultation regarding such outcomes could be conducted as the circumstances require.

185. The ESC noted that it is important for Member scientists to consult with their Commissioners prior to the 2019 ESC meeting so that the ESC can be fully informed of the requirements of Commissioners.

186. The workplan has made provision for a possible web-based consultation to be held with Commissioners after the 2019 ESC to present the chosen set of CMPs if such consultation is requested by the Extended Commission. However, it was noted that Member scientists would be expected to fully brief their Commissioners.

16.2. Timing, length and structure of next meeting

187. The next ESC meeting is proposed to be held from 2-7 September 2019, in Cape Town, South Africa.

188. A five-day intersessional OMMP meeting is planned to be held in Seattle, USA from 24-28 June 2019 and a one-day informal OMMP meeting is scheduled to be held immediately prior to the 2019 ESC meeting.

Agenda Item 17. Other Matters

17.1. Report from the ISSF Stock Assessment Workshop and tRFMO MSE Working group meeting 2018

189. The International Sustainable Seafood Foundation's (ISSF) stock assessment workshop was held in Lisbon, Portugal, 21-23rd of March. A representative from each of the five tuna Regional Fisheries Management Organisations (tRFMOs) was asked to make a presentation on the process for providing

stock assessment and management advice to their Commission. Ann Preece was selected to represent the CCSBT, and she presented an outline and distinction between the Extended Scientific Committee's (ESC's) stock status advice from stock assessments; and management advice from the SBT management Procedure. The ISSF was seeking recommendations for harmonising the details reported from each tRFMO. Improving documentation within tRFMOs was discussed, noting the difficulty of the time constraints at meetings. The CCSBT OMMP working group may wish to consider updating the documentation of the SBT OM and including this as a paper to the ESC so that it can be referenced. The meeting was a useful forum for bringing tRFMO scientists and fisheries experts together. A report of the ISSF workshop (Anon., 2018) can be found at: www.iss-foundation.org.

190. Australia presented paper CCSBT-ESC/1809/21 on Report on tRFMO MSE Working group meeting 2018. The ICCAT secretariat facilitated the preparation of a meeting of the Joint Tuna Regional Fisheries Management Organisations (RFMOs) Management Strategy Evaluation (MSE) Working Group, in June 2018. This was the second meeting of the group. Several ESC members were present. There are increasing links between tuna RFMOs, with managers, stakeholders, Commissioners and scientists attending meetings in multiple RFMOs, and there is an identified need to ensure communication and terminology are consistent. Recommendations from the working group are now available and a link to the final report of the meeting will be circulated when available. The items of specific interest to the ESC potentially include: the joint tuna RFMO initiatives to discuss commonalities and differences in approaches; validation of code, documentation and transparency; spatial stock structure as a potential source of uncertainty in OMs and MPs; trials of visualisation of MSE results; sharing of methods and code across tuna RFMOs; further work on a broader glossary of terms; and contributions to work plans and future activities of the joint tuna RFMO MSE working group.

17.2. Scientific Advisory Panel

191. The ESC considered the need to replace the retiring member of CCSBT's Scientific Advisory Panel, Professor John Pope. The view was expressed that to fulfil its Terms of Reference (see Attachment 11 of the ESC 20 Report), the Panel required 3 experts, and that it was therefore necessary to replace Professor Pope.

192. The ESC endorsed the skills previously specified in the Selection Criteria for members of the Panel, which are:

- Must have excellent technical ability in stock assessment.
- Must have adequate working experience as a scientist involved in stock assessment and fisheries management at the international level.
- Should ideally have working experience with large pelagic fish resources.
- Should ideally have familiarity with assessment procedures; harvest strategy and management procedure development and operation; and scientific procedures used in international fishery commissions.

- Should ideally have specialist skills and experience in CPUE modelling and analysis.

193. The ESC also recommended that it would also be advantageous for the new Panel member to have skills or experience in:

- Geospatial analysis;
- Population genetics and/or mark recapture theory; and
- Incorporation of the implications of environmental change in assessments.

194. The meeting noted that the procedural arrangements for appointment of the Panel is a matter for the Extended Commission but wished to advise that the consistency of expertise and corporate memory of the current Panel is a strength of the ESC. Consequently, a longer term of appointment, such as that recently agreed for the Chairs of CCSBT subsidiary bodies, would provide appreciable benefits over a shorter 2-3-year term.

195. The ESC expressed its sincere appreciation to Professor John Pope for his substantial contribution to the ESC over a long period of time through his role as a member of CCSBT's scientific advisory panel.

Agenda Item 18. Adoption of Meeting Report

196. The report was adopted.

Agenda Item 19. Close of meeting

197. The meeting closed at 12:40 pm on 8 September 2018.

List of Attachments

Attachments

Attachment 1

List of Participants
Extended Scientific Committee Meeting
of the Twenty Third Meeting of the Scientific Committee

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
CHAIR								
Kevin	STOKES	Dr			NEW ZEALAND			kevin@stokes.net.nz
ADVISORY PANEL								
Ana	PARMA	Dr		Centro Nacional Patagonico	Pueto Madryn, Chubut Argentina	54 2965 451024	54 2965 451543	parma@cenpat.edu.ar
James	IANELLI	Dr		REFM Division, Alaska Fisheries Science Centre	7600 Sand Pt Way NE Seattle, WA 98115 USA	1 206 526 6510	1 206 526 6723	jim.ianelli@noaa.gov
John	POPE	Professor			The Old Rectory Burgh St Peter Norfolk, NR34 0BT UK	44 1502 677377	44 1502 677377	popeJG@aol.com
CONSULTANT								
Darcy	WEBBER	Mr	Fisheries Scientist	Quantifish	72 Haukore Street, Hairini, Tauranga 3112, New Zealand	64 21 0233 0163		darcy@quantifish.co.nz
MEMBERS								
AUSTRALIA								
Simon	NICOL	Dr	Senior Scientist	Department of Agriculture & Water Resources	GPO Box 858, Canberra ACT 2601 Australia	61 2 6272 4638		simon.nicol@agriculture.gov.au
Bertie	HENNECKE	Dr	Assistant Secretary	Department of Agriculture & Water Resources	GPO Box 858, Canberra ACT 2601 Australia	61 2 6272 4277		bertie.hennecke@agriculture.gov.au
Heather	PATTERSON	Dr	Scientist	Department of Agriculture & Water Resources	GPO Box 858, Canberra ACT 2601 Australia	61 2 6272 4612		heather.patterson@agriculture.gov.au

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
Campbell	DAVIES	Dr	Senior Research Scientist	CSIRO Marine and Atmospheric Research	GPO Box 1538, Hobart, Tasmania 7001, Australia	61 3 6232 5044		Campbell.Davies@csiro.au
Ann	PREECE	Ms	Fisheries Scientist	CSIRO Marine and Atmospheric Research	GPO Box 1538, Hobart, Tasmania 7001, Australia	61 3 6232 5336		Ann.Preece@csiro.au
Rich	HILLARY	Dr	Principal Research Scientist	CSIRO Marine and Atmospheric Research	GPO Box 1538, Hobart, Tasmania 7001, Australia	61 3 6232 5452		Rich.Hillary@csiro.au
Matt	DANIEL	Mr	Southern Bluefin Tuna Fishery Manager	Australian Fisheries Management Authority	GPO Box 7051, Canberra, ACT 2601, Australia	61 2 6225 5338		Matthew.Daniel@afma.gov.au
Brian	JEFFRIESS	Mr	Chief Executive Officer	Australian SBT Industry Association	PO Box 1146, Port Lincoln, SA 5606, Australia	0419 840 299		austuna@bigpond.com
Terry	ROMARO	Mr	Managing Director	Ship Agencies Australia	PO Box 1093, Fremantle, WA 6160, Australia	61 8 9335 5499		terryromaro@aol.com
EUROPEAN UNION								
Hilario	MURUA	Dr	Principal Researcher	AZTI Marine Researh Division	Herrera Kaia, Portualdea z/g Pasaia Gipuzkoa 20110	34 667 174 433		hmurua@azti.es
Haritz	ARRIZABALAGA	Dr	Principal Researcher	AZTI Marine Researh Division	Herrera Kaia, Portualdea z/g Pasaia Gipuzkoa 20110	34 667 174 477		harri@azti.es
Gorka	MERINO	Dr	Senior Researcher	AZTI Marine Researh Division	Herrera Kaia, Portualdea z/g Pasaia Gipuzkoa 20110	34 667 174 447		gmerino@azti.es
FISHING ENTITY OF TAIWAN								
Ching-Ping	LU	Dr.	Assistant Professor	National Taiwan Ocean University	2 Pei-Ning Road, Keelung 20224, Taiwan	886 2 2462 2192 ext 5035	886 2 2463 3920	michellecplu@gmail.com
Shu-Ting	CHANG	Ms.	Statistician	Overseas Fisheries Development Council	3F., No. 14 Wenshou St., Taipei, Taiwan	886 2 23680 889 ext133	886 2 23681 530	lisa@ofdc.org.tw

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
INDONESIA								
Zulkarnaen	FAHMI	Mr	Head of Research Institute for Tuna Fisheries	Ministry of Marine Affairs and Fisheries	Jl. Mertasari No. 140 Br Suwung Kangin, Sidakarya, Denpasar, Bali 80224, Indonesia	62 21 726201	62 21 726201	fahmi.p4ksi@gmail.com
Satya	MARDI	Mr	Fisheries Inspector for Directorate of Fish Resource Management	Ministry of Marine Affairs and Fisheries	Jl. Medan Merdeka Timur No. 16 Jakarta Pusat, 10110 Indonesia	62 21 3453008	62 21 3453008	sdi.djpt@yahoo.com
JAPAN								
Tomoyuki	ITOH	Dr	Group Chief	National Research Institute of Far Seas Fisheries	5-7-1 Orido, Shimizu, Shizuoka 424-8633, Japan	81 54 336 6000	81 543 35 9642	itou@fra.affrc.go.jp
Norio	TAKAHASHI	Dr	Senior Scientist	National Research Institute of Fisheries Science	2-12-4 Fukuura, Yokohama, Kanagawa 236-8648, Japan	81 45 788 7501	81 45 788 5004	norio@fra.affrc.go.jp
Yuichi	TSUDA	Dr	Researcher	National Research Institute of Far Seas Fisheries	5-7-1 Orido, Shimizu, Shizuoka 424-8633, Japan	81 54 336 6000	81 543 35 9642	u1tsuda@fra.affrc.go.jp
Doug	BUTTERWORTH	Professor		Dept of Maths & Applied Maths, University of Cape Town	Rondebosch 7701, South Africa	27 21 650 2343	27 21 650 2334	Doug.Butterworth@uct.ac.za
Takahiro	ARA	Mr	Assistant Director	Fisheries Agency	1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8907, Japan	81 3 3502 8459	81 3 3502 0571	takahiro_ara020@maff.go.jp
Nozomu	MIURA	Mr	Deputy Director	Japan Tuna Fisheries Cooperative Association	31-1, Eitai 2 Chome, Koto-ku, Tokyo 135-0034, Japan	81 3 5646 2382	81 3 5646 2652	miura@japantuna.or.jp
Michio	SHIMIZU	Mr	Executive Secretary	National Ocean Tuna Fishery Association	1-1-12 Uchikanda, Chiyoda-ku, Tokyo 101-8503, Japan	81 3 3294 9634	81 3 3294 9607	mic-shimizu@zengyoren.jf-net.ne.jp

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
NEW ZEALAND								
Shelton	HARLEY	Dr	Manager – Fisheries Science	Fisheries New Zealand	PO Box 2526, Wellington, New Zealand	64 894 0857	N/A	shelton.harley@mpi.govt.nz
Dominic	VALLIÈRES	Mr	Manager - Highly Migratory Species	Fisheries New Zealand	PO Box 2526, Wellington, New Zealand	64 4 819 4654	N/A	dominic.vallieres@mpi.govt.nz
REPUBLIC OF KOREA								
Doo Hae	AN	Dr	Director of Distant-water Fisheries Resources Division	National Insittute of Fisheries Science	216, Gijanghaean-ro, Gijang-eup, Gijang-gun, Busan, 46083, Republic of Korea	82 51 720 2310	82 51 720 2337	dhan119@korea.kr
Sung Il	LEE	Dr	Scientist	National Insittute of Fisheries Science	216, Gijanghaean-ro, Gijang-eup, Gijang-gun, Busan, 46083, Republic of Korea	82 51 720 2331	82 51 720 2337	k.sungillee@gmail.com
SOUTH AFRICA								
Qayiso	MKETSU	Mr	Deputy Director Management Large Pelagic Fisheries	Department of Agriculture, Forestry & Fisheries	Foretrust building, Martin Hammerschlag Way, Foreshore, Cape Town, 8001	27 214 023 037		QayisoMK@daff.gov.za
Sven	KERWATH	Dr	Specialist Scientist Finfish	Department of Agriculture, Forestry & Fisheries	Foretrust building, Martin Hammerschlag Way, Foreshore, Cape Town, 8001	27 214 023 017		SvenK@daff.gov.za
Henning	WINKER	Dr	Scientist: Large Pelagic Fisheries	Department of Agriculture, Forestry & Fisheries	Foretrust building, Martin Hammerschlag Way, Foreshore, Cape Town, 8001	27 214 023 515		HenningW@daff.gov.za
OBSERVERS								
INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS								
Ai	KIMOTO	Dr	Population dynamics expert	International Commission for the Conservation of Atlantic Tunas (ICCAT)	Corazón de María 8. 28002 Madrid SPAIN	34 914 165 600	34 914 152 612	ai.kimoto@iccat.int

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
INTERPRETERS								
Kumi	KOIKE	Ms						
Yoko	YAMAKAGE	Ms						
Kaori	ASAKI	Ms						
CCSBT SECRETARIAT								
Robert	KENNEDY	Mr	Executive Secretary					rkennedy@ccsbt.org
Akira	SOMA	Mr	Deputy Executive Secretary		PO Box 37, Deakin West ACT 2600 AUSTRALIA	61 2 6282 8396	61 2 6282 8407	asoma@ccsbt.org
Colin	MILLAR	Mr	Database Manager					CMillar@ccsbt.org

Attachment 2

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

San Sebastian, Spain
3 - 8 September 2018

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 Fifth Meeting of the Strategy and Fisheries Management Working Group**

6. **Report from the Ninth OMMP Technical Meeting**

7. **Report from the CPUE modelling group**

8. **Review of results of the Scientific Research Plan and other inter-sessional scientific activities**
   8.1. Results of scientific activities
   8.2. Report from the Farm and Market Survey Small Working Group on progress with its work plan

9. **Evaluation of Fisheries Indicators**

10. **SBT stock status**
    10.1. Evaluation of meta-rules and exceptional circumstances
    10.2. Summary of the SBT stock status

11. **SBT Management Advice**

12. **Development of new MP**
    12.1. Evaluation of refined Candidate Management Procedures (CMPs).

12.2. Selection of a subset of CMPs, tuning variants and results for presentation at the Extended Commission meeting

13. Update of the Scientific Research Plan

14. Requirements for Data Exchange in 2019

15. Research Mortality Allowance

16. Workplan, Timetable and Research Budget for 2019 (and beyond)

16.1. Overview, time schedule and budgetary implications of proposed 2019 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

17.1. Report from the ISSF Stock Assessment Workshop

17.2. Scientific Advisory Panel

18. Adoption of Meeting Report

19. Close of Meeting

Attachment 3

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

(CCSBT-ESC/1809/)

1. Provisional Agenda
2. List of Participants
3. List of Documents
4. (Secretariat) Secretariat review of catches (ESC agenda item 4.2)
5. (Secretariat) Data Exchange (ESC agenda item 13)
6. (CCSBT) Final Report: The Pilot Gene-tagging Project (ESC Agenda item 8.1)
7. (CCSBT) Gene-tagging recruitment monitoring in 2018: Progress report and RMA request for gene-tagging in 2019 (ESC Agenda item 8.1, 14)
8. (CCSBT) Update on the SBT close-kin tissue sampling, processing, kin finding and long-term sample storage (ESC Agenda item 8.1)
9. (CCSBT) Update on the length and age distribution of southern bluefin tuna (SBT) in the Indonesian longline catch (ESC Agenda item 8.1)
10. (CCSBT) Report on ISSF Stock Assessment meeting 2018 (ESC Agenda item 16.1)
11. (Australia) Preparation of Australia's southern bluefin tuna catch and effort data submission for 2018 (ESC Agenda item 4.1)
12. (Australia) An update on Australian otolith and ovary collection activities, direct ageing and length at age keys for the Australian surface fishery (ESC Agenda item 8.1)
13. (Australia) The CCSBT Scientific Research Program (ESC Agenda item 8.1, 12)
14. (Australia) Close-kin project report (ESC Agenda item 8.1)
15. (Australia) An updated review of tuna growth performance in ranching and farming operations (ESC Agenda item 8.2)
16. (Australia) Japan market update 2018 (ESC Agenda item 8.2)
17. (Australia) Fisheries indicators for the southern bluefin tuna stock 2017–18 (ESC Agenda item 9)
18. (Australia) Meta-rules: consideration of exceptional circumstances in 2018 (ESC Agenda item 10.1)
19. (Australia) Data generation & changes to SBT OM (ESC Agenda item 11.1)
20. (Australia) Performance of Revised CMPs (ESC Agenda item 11.1)
21. (Australia) Report on the Joint tuna RFMOs MSE working group meeting (ESC Agenda item 11, 16)

22. (Australia) Research mortality allowance: Proposed allowance for 2019 and 2018 usage report (ESC Agenda item 14)
23. (Japan) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2017 (ESC Agenda item 4.1)
24. (Japan) Proposal for revision of the historical data of Japanese SBT fishery between 2007 and 2015 (ESC Agenda item 4)
25. (Japan) Activities of southern bluefin tuna otolith collection and age estimation and analysis of the age data by Japan in 2017 (ESC Agenda item 8.1)
26. (Japan) Report of the piston-line tolling monitoring survey for the age-1 southern bluefin tuna recruitment index in 2017/2018 (ESC Agenda item 8.1)
27. (Japan) Trolling indices for age-1 southern bluefin tuna: update of the piston line index and the grid type trolling index (ESC Agenda item 8.1)
28. (Japan) Update of estimation for the unaccounted catch mortality in Australian SBT farming in the 2017 fishing season (ESC Agenda item 8.2)
29. (Japan) Summary points of farm uncertainty relevant to size and total catch estimation of southern bluefin tuna, based on Attachment 7 in Report of ESC 22 (ESC Agenda item 8.2)
30. (Japan) Monitoring of Southern Bluefin Tuna trading in the Japanese domestic markets: 2018 update (ESC Agenda item 8.2)
31. (Japan) Summary points of market monitoring of southern bluefin tuna, based on Attachment 7 in Report of ESC22 (ESC Agenda item 8.2)
32. (Japan) Summary of Fisheries Indicators of Southern Bluefin Tuna Stock in 2018 (ESC Agenda item 9)
33. (Japan) A Check of Operating Model Predictions from the Viewpoint of the Management Procedure Implementation in 2018 (ESC Agenda item 10.1)
34. (Japan) Further improvement and performance evaluation of Management Procedure candidate (ESC Agenda item 11)
35. (Japan) Report of the 2017/2018 RMA utilization and application for the 2018/2019 RMA (ESC Agenda item 14)
36. (Taiwan) Preparation of Taiwan's Southern bluefin tuna catch and effort data submission for 2018 (ESC Agenda item 4.1)
37. (Taiwan) Otolith collection and direct aging of SBT caught by Taiwanese longliners in 2014–2017 (ESC Agenda item 8)
38. (Taiwan) Updated analysis for gonad samples of southern bluefin tuna collected by Taiwanese scientific observer program (ESC Agenda item 8)
39. (Taiwan) CPUE standardization for southern bluefin tuna caught by Taiwanese longline fishery for 2002-2017 (Rev.1) (ESC Agenda item 9)

40. (Korea) Korean SBT otolith and ovary collection activities in 2017 (Rev.1) (ESC Agenda item 8.1)
41. (Korea) Data exploration and CPUE standardization for the Korean Southern bluefin tuna longline fishery (Rev.1) (1996 - 2017) (ESC Agenda item 9)
42. (Secretariat) Report from the Strategy and Fisheries Management Working Group (ESC Agenda item 5)
43. (Japan) Further Exploratory Investigations of some Simple Candidate Management Procedures for Southern Bluefin Tuna. D.S Butterworth, M. Miyagawa and M.R.A. Jacobs (ESC Agenda item 11.1)

(CCSBT- ESC/1809/BGD)

1. Desirable Behaviour and Specifications for the Development of a New Management Procedure for SBT. Campbell Davies, Ann Preece, Richard Hillary and Ana Parma (*Previously* CCSBT-SFM/1803/04) (ESC Agenda item 5)
2. (Japan) Update of the core vessel data and CPUE for southern bluefin tuna in 2018 (*Previously* CCSBT-OMMP/1806/08) (ESC Agenda item 7)
3. (Japan) Development of recruitment index of SBT longline for MP input (*Previously* CCSBT-OMMP/1806/09) (ESC Agenda item 7)
4. (Japan) Change in operation pattern of Japanese southern bluefin tuna longliners in the 2017 fishing season (*Previously* CCSBT-OMMP/1806/10) (ESC Agenda item 7)
5. (Japan) Initial trials of a new candidate management procedure for southern bluefin tuna (*Previously* CCSBT-OMMP/1806/11) (ESC Agenda item 11)
6. (Australia) SRP proposal: Estimating size/age at maturity of southern bluefin tuna (*Previously* CCSBT-ESC/1409/23) (ESC Agenda item 8.1)

(CCSBT-ESC/1809/SBT Fisheries -)

Australia	Australia's 2016–17 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 Year 2017
Japan	Review of Japanese Southern Bluefin Tuna Fisheries in 2017
Korea	2018 Annual National Report of Korean SBT Fishery
New Zealand	Annual Report of the New Zealand Southern Bluefin Tuna Fishery
South Africa	South African National Report to the Extended Scientific Committee of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), 2018
Taiwan	Review of Taiwan SBT Fishery of 2016/2017 (Rev.1)

(CCSBT-ESC/1809/Info)

1. (Australia) Survey design for catch estimation of southern bluefin tuna in recreational fisheries in Australia 2018–2019 (ESC agenda item 8.1)
2. (Australia) Data considerations for applications of electronic monitoring in southern bluefin tuna fisheries (ESC agenda item 8.1)
3. (Australia) Overview of recent research on the health of southern bluefin tuna (ESC agenda item 14)
4. (Australia) Annual variability of infection with *Cardicola forsteri* and *Cardicola orientalis* in ranched and wild southern bluefin tuna (*Thunnus maccoyii*) (ESC agenda item 14)
5. (Indonesia) Update on tuna monitoring program in Benoa port, Bali, Indonesia 2017 (ESC Agenda item 4.1)
6. (Indonesia) Indonesian Scientific Observer Program Activities in Indian Ocean from 2015 - 2017 (ESC Agenda item 4.1)

(CCSBT-ESC/1809/Rep)

1. Report of the Ninth Operating Model and Management Procedure Technical Meeting (June 2018)
2. Report of the Fifth Meeting of the Strategy and Fisheries Management Working Group (March 2018)
3. Report of the Twenty Fourth Annual Meeting of the Commission (October 2017)
4. Report of the Twelfth Meeting of the Compliance Committee (October 2017)
5. Report of the Twenty Second Meeting of the Scientific Committee (August – September 2017)
6. Report of the Eighth Operating Model and Management Procedure Technical Meeting (June 2017)
7. Report of the Twenty First Meeting of the Scientific Committee (September 2016)
8. Report of the Seventh Operating Model and Management Procedure Technical Meeting (September 2016)
9. Report of the Special Meeting of the Commission (August 2011)
10. Report of the Sixteenth Meeting of the Scientific Committee (July 2011)

Attachment 4

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
2007	4,813	0	2,840	379	4	521	841	46	1,077	58	18	0	3
2008	5,033	0	2,952	319	0	1,134	913	45	926	44	14	4	10
2009	5,108	0	2,659	419	0	1,117	921	47	641	40	2	0	0

	Australia			New Zealand									
Calendar Year	Commercial	Amateur	Japan	Commercial	Amateur	Korea	Taiwan	Philippines	Indonesia	South Africa	European Union	Miscellaneous	Research & Other
2010	4,200	0	2,223	501	0	867	1,208	43	636	54	11	0	0
2011	4,200	0	2,518	547	0	705	533	45	842	64	3	0	1
2012	4,503	0	2,528	776	0	922	494	46	910	110	4	0	0
2013	4,902	0	2,694	756	1	918	1,004	46	1,383	67	0	0	0
2014	4,559	0	3,371	826	0	1,044	944	45	1,063	56	0	0	1
2015	5,824	0	4,745	922	1	1,051	1,162	-	593	63	0	0	0
2016	5,962	0	4,721	951	1	1,121	1,023	0	601	64	0	0	2
2017	5,221	0	4,567	913	21	1,080	1,172	0	835	136	0	0	2

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.

Recent trends in all indicators of the SBT stock

Indicator	Period	Min.	Max.	2014	2015	2016	2017	2018	12 month trend	Main Ages	NOTES
Scientific aerial survey	1993–2000 2005–17	0.25 (1999)	4.85 (2016)	2.02	na	4.85	1.80	–	–	2-4	Discontinued
Trolling index (piston line)	1996–2003 2005–06 2006–18	0.00 (2018)	5.09 (2011)	2.86	na	3.94	1.71	0.00	↓	1	
Trolling index (grid)	1996–2003 2005–06 2006–18	0.16 (2002)	2.03 (2011)	1.05	na	1.71	0.59	0.75	↑	1	
NZ domestic nominal CPUE	1989–2018	0.000 (1989)	9.18 (2017)	5.44	6.17	8.80	9.18		↑	all	
NZ domestic age/size composition (proportion age 0–5 SBT)*	1980–2018	0.001 (1985)	0.48 (2017)	0.20	0.07	0.47	0.48		↑	2-5	Peripheral Area
Indonesian mean size class**	1993–94 to 2014–18	160 (2015; 2018)	188 (1993–94)	162	160	163	163	160	↓	spawners	
Indonesian age composition:** mean age on spawning ground, all SBT	1994–95 to 2013–18	13.24 (2012–13)	21.2 (1994–95)	14.2	13.8	13.8	13.8	14.8	↑	spawners	
Indonesian age composition:** mean age on spawning ground 20+	1994–95 to 2013–18	21.8 (2010–11)	25.3 (2003–04)	22.3	22.3	22.9	22.6	23.4	↑	Older spawners	
Indonesian age composition:** median age on spawning ground	1994–95 to 2013–18	13 (2017)	21 (1994–95; 1996–97; 1998–99)	15	14	14	13	14	↑	spawners	

Indicator		Period	Min.	Max.	2014	2015	2016	2017	12 month trend	Main Ages	Notes
Japanese nominal CPUE, age 4+		1969–2017	1.338 (2006)	22.123 (1965)	3.624	5.052	4.210	5.253	↑	4+	
Japanese standardised CPUE (W0.5, W0.8, Base w0.5, Base w0.8)		1969–2017	2007 (0.259–0.358)	1969 (2.284– 2.697)	0.835–1.195	0.964–1.315	0.927–1.282	0.828–1.294	↑	4+	
Korean nominal CPUE		1991–2017	1.312 (2004)	21.523 (1991)	6.512	8.169	5.451	6.552	↑	4+	Subject to by-catch effects
Korean standardised CPUE	Area 8	1996-2017	0.39 (2002)	2.82 (2016)	1.84	1.05	2.82	-	-	4+	
(selected data)	Area 9	1996-2017	0.10 (2005)	2.37 (2014)	2.37	1.25	1.76	1.87	↑		
Korean standardised CPUE	Area 8	1996-2017	0.50 (2002)	2.56 (2016)	1.02	1.11	2.56	-	-	4+	
(clustered)	Area 9	1996-2017	0.23 (2005)	2.05 (2014)	2.05	1.13	1.56	1.63	↑		
Taiwanese nominal CPUE, Areas 8+9		1981–2017	<0.001 (1985)	0.956 (1995)	0.128	0.920	0.203	0.156	↓	2+	Subject to by-catch effects
Taiwanese nominal CPUE, Areas 2+14+15		1981–2017	<0.001 (1985)	3.672 (2007)	1.624	1.728	2.042	1.588	↓	2+	Subject to by-catch effects
Taiwanese standardised CPUE (Area E)		2002-2017	0.163 (2004)	1.184 (2012)	0.547	0.474	0.771	0.689	↓	2+	Under Development Subject to by-catch effects
	(Area W)	2002-2017	0.186 (2016)	0.913 (2002)	0.379	0.343	0.186	0.196	↑		
Japanese age comp, age 0–2*		1969–2017	0.004 (1966)	0.192 (1998)	0.001	0.002	0.003	0.002	↓	2	Affected by release/discard
Japanese age comp, age 3*		1969–2017	0.011 (2015)	0.228 (2007)	0.035	0.011	0.033	0.043	↑	3	Affected by release/discards
Japanese age comp, age 4*		1969–2017	0.091 (1967)	0.300 (2010)	0.114	0.121	0.072	0.143	↑	4	
Japanese age comp, age 5*		1969–2017	0.072 (1986)	0.300 (2010)	0.169	0.204	0.160	0.127	↓	5	
Taiwanese age/size comp, age 0–2*		1981–2017	<0.001 (1982)	0.251 (2001)	0.009	0.011	0.004	0.002	↓	Mostly 2	
Taiwanese age/size comp, age 3*		1981–2017	0.024 (1996)	0.349 (2001)	0.114	0.116	0.118	0.121	↑	3	
Taiwanese age/size comp, age 4*		1981–2017	0.027 (1996)	0.502 (1999)	0.204	0.208	0.211	0.215	↑	4	
Taiwanese age/size comp, age 5*		1981–2017	0.075 (1997)	0.371 (2009)	0.211	0.213	0.216	0.217	↑	5	
Australia surface fishery median age composition		1964–2017	age 1 (1979–80)	age 3 (multiple years)	age 3	age 2	age 2	age 3	↑	1-4	

Indicator		Period	Min.	Max.	2014	2015	2016	2017	12 month trend	Ages	Notes
Jpn LL standardised CPUE (age 3)	w0.5	1969–2017	0.231 (2003)	3.312 (1972)	0.297	0.234	0.424	0.497	↑	3	Affected by release/discard
	w0.8		0.263 (2003)	3.103 (1972)	0.372	0.300	0.568	0.664			
Jpn LL standardised CPUE (age 4)	w0.5	1969–2017	0.275 (2006)	2.971 (1974)	0.717	0.873	0.641	1.027	↑	4	
	w0.8		0.300 (2006)	2.678 (1974)	0.939	1.074	0.867	1.388			
Jpn LL standardised CPUE (age 5)	w0.5	1969–2017	0.231 (2006)	2.709 (1972)	0.913	1.171	1.248	0.900	↓	5	
	w0.8		0.252 (2006)	2.474 (1972)	1.218	1.494	1.610	1.197			
Jpn LL standardised CPUE (age 6&7)	w0.5	1969–2017	0.186 (2007)	2.521 (1976)	0.935	1.177	1.379	1.151	↓	6-7	
	w0.8		0.212 (2007)	2.292 (1976)	1.251	1.559	1.829	1.482			
Jpn LL standardised CPUE (age8-11)	w0.5	1969–2017	0.272 (2007)	3.814 (1969)	0.771	0.917	0.699	0.580	↓	8-11	
	w0.8		0.291 (1992)	3.414 (1969)	1.041	1.241	0.934	0.776			
Jpn LL standardised CPUE (age 12+)	w0.5	1969–2017	0.405 (2017)	3.350 (1970)	0.519	0.537	0.519	0.405	↓	12+	
	w0.8		0.543 (2017)	2.911 (1970)	0.700	0.722	0.698	0.543			

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

Attachment 6

Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2018

The CCSBT Extended Scientific Committee (ESC) updated the stock assessment and conducted a review of fisheries indicators in 2017 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 2018 by the ESC following a review of indicators in 2018. It provides the latest fishery and catch information.

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 2017 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 81,750 t in 1961 (Figures 1 - 3). Over the period 1952 - 2017, 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 77,927 t in

1961 and the Australian surface fishery catches of young fish peaked at 21,501 t 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, 78.9% of the SBT catch has been made in the Indian Ocean, 16.6% in the Pacific Ocean and 4.5% 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 1063t 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 8,000t, averaging about 18,600t, and the reported Pacific Ocean catch has ranged from about 800t to 19,000t, averaging 5,056t over the same period (although SBT data analyses indicate that these catches may be under-estimated).

3. Summary of Stock Status

The 2017 assessment suggested that the SBT spawning biomass is at 13% of its original biomass as well as below the level that could produce maximum sustainable yield. However, there has been improvement since the 2011 stock assessment which indicated the stock was at 5.5% of original biomass. The current TAC has been set using the management procedure adopted in 2011, which has a 70% probability of rebuilding to the interim target biomass level by 2035.

There was no stock assessment in 2018 but the ESC considered a wide range of indicators. The review of indicators did not suggest new conclusions from those drawn in 2017. Overall, there is a low trolling (piston-line) index of age 1 in 2018, mixed signals of higher recruitment in recent years, and there are some consistent positive trends in the age-based longline CPUE estimates. There may be several relatively strong cohorts moving through the fishery, although these have yet to contribute to the spawning stock. The ESC noted that increased recruitment is not necessarily indicative of increased spawning stock biomass. The ESC noted that it will take a few more years before there is sufficient data to confirm the recent apparent strong recruitments evident in the aerial survey.

4. Current Management Measures

<u>Total Allowable Catch (TAC)</u>

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

At its eighteenth annual meeting, 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 original spawning stock biomass. The CCSBT now sets the TAC based on the outcome of the MP, unless the CCSBT decides otherwise based on information that is not incorporated into the MP.

In adopting the MP, 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 TAC is set in three year periods. The TAC for 2014 was 12,449 tonnes, the TAC for 2015 to 2017 was 14,647 tonnes and the TAC for 2018 to 2020 will be 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	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.

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 and was revised in October 2014 to include requirements for monitoring transhipments in port. These come into effect 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 the review of exceptional circumstances at its 2017 and 2018 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 17,647.4 t.

6. Biological State and Trends

The 2017 assessment suggested that the SBT spawning biomass is at 13% of its original biomass as well as below the level that could produce maximum sustainable yield. However, the fishing mortality rate is below the level associated with MSY. There has been improvement since the 2011 stock assessment which indicated the stock was at 5.5% of original biomass. The current TAC has been set using the management procedure adopted in 2011, which has a 70% probability of rebuilding to the interim target biomass level by 2035.

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

SOUTHERN BLUEFIN TUNA SUMMARY FROM ESC in 2017 (global stock)	
Maximum Sustainable Yield	33,036 t (30,000-36,000t)
Reported (2016) Catch	14,445 t
Current (2017) biomass (B10+)	135,171 t (123,429-156,676)
Current depletion (current relative to initial)	
SSB	0.13 (0.11–0.17)
B10+	0.11 (0.09–0.13)
SSB (2017) Relative to SSB_{msy}	0.49 (0.38–0.69)
Fishing Mortality (2017) Relative to F_{msy}	0.50 (0.38–0.66)
Current Management Measures	Effective Catch Limit for Members and Cooperating Non-Members: 14,647t in 2017 and 17,647t per year for the years 2018-2020

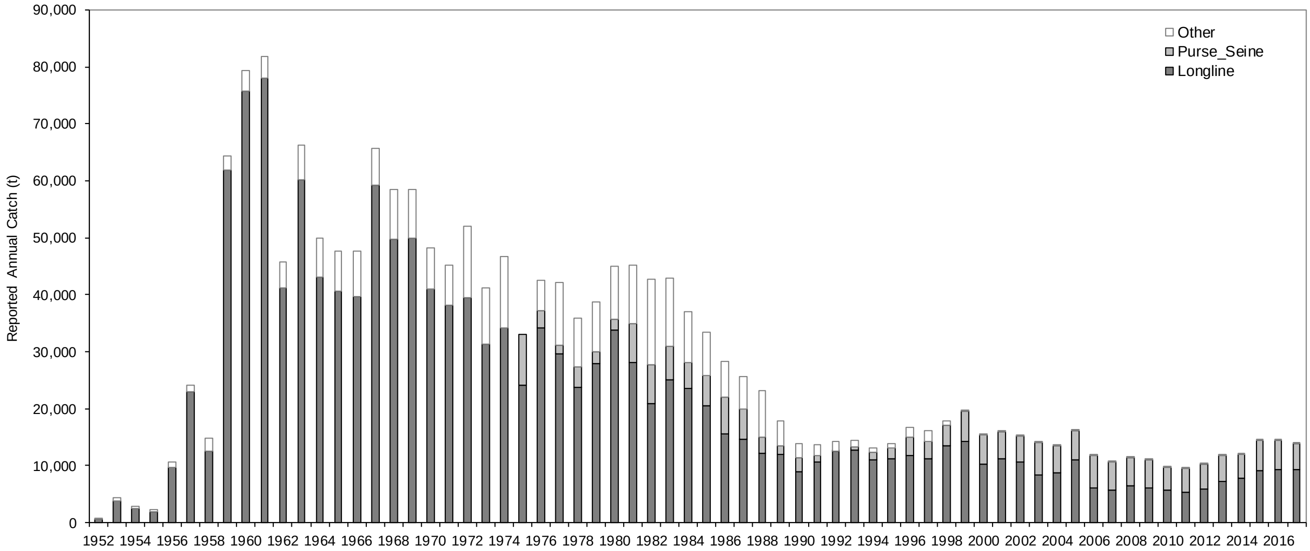


Figure 1: Reported southern bluefin tuna catches by fishing gear, 1952 to 2017. Note: a 2006 review of SBT data indicated that catches over the preceding 10 to 20 years may have been substantially under-reported.

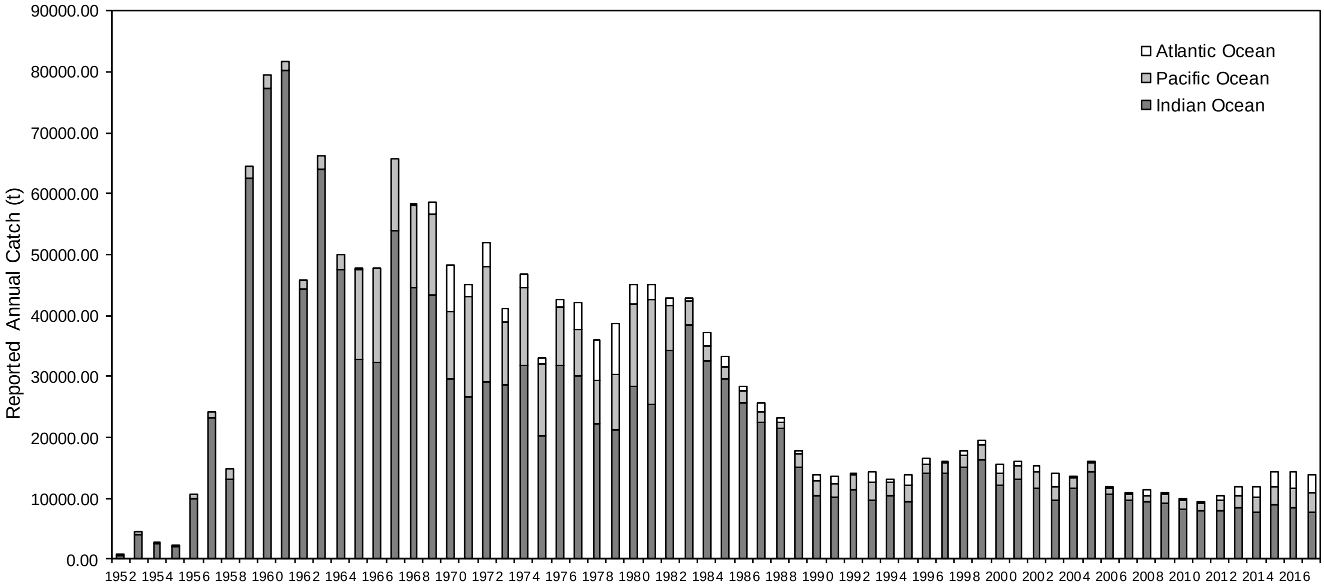


Figure 2: Reported southern bluefin tuna catches by ocean, 1952 to 2017. Note: a 2006 review of SBT data indicated that catches over the preceding 10 to 20 years may have been substantially under-reported.

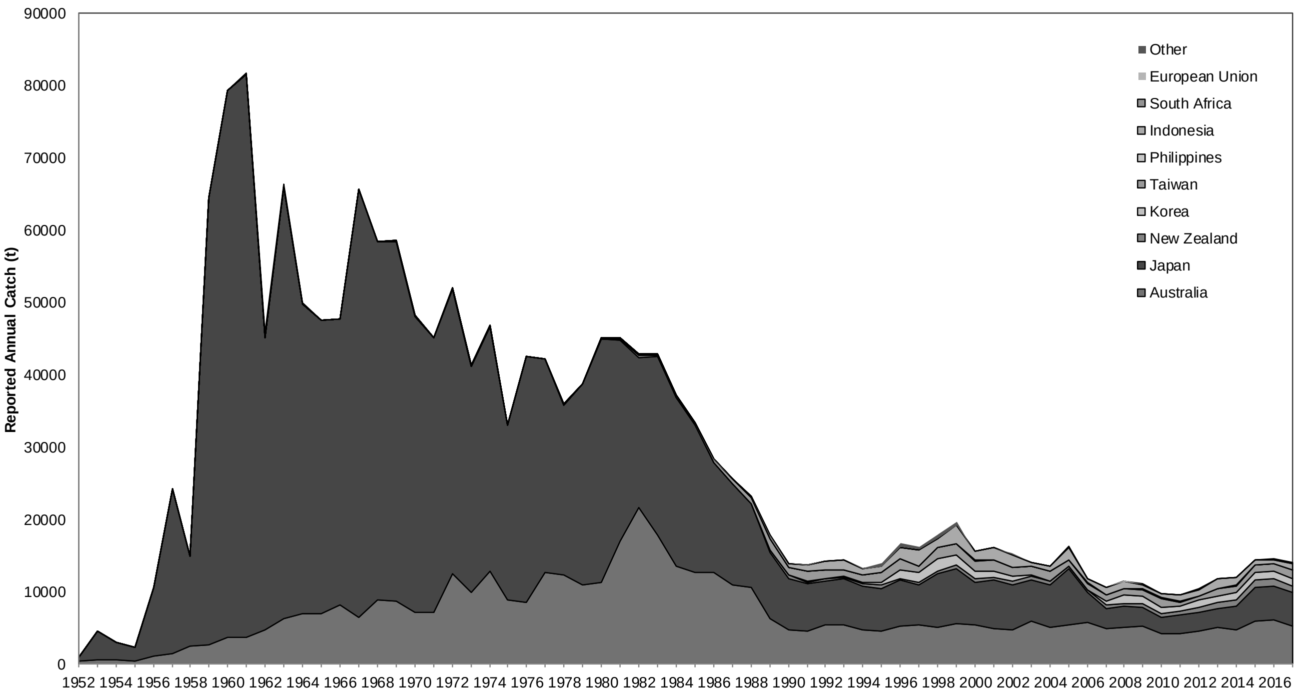


Figure 3: Reported southern bluefin tuna catches by flag, 1952 to 2017. Note: a 2006 review of SBT data indicated that catches over the preceding 10 to 20 years may have been substantially under-reported.

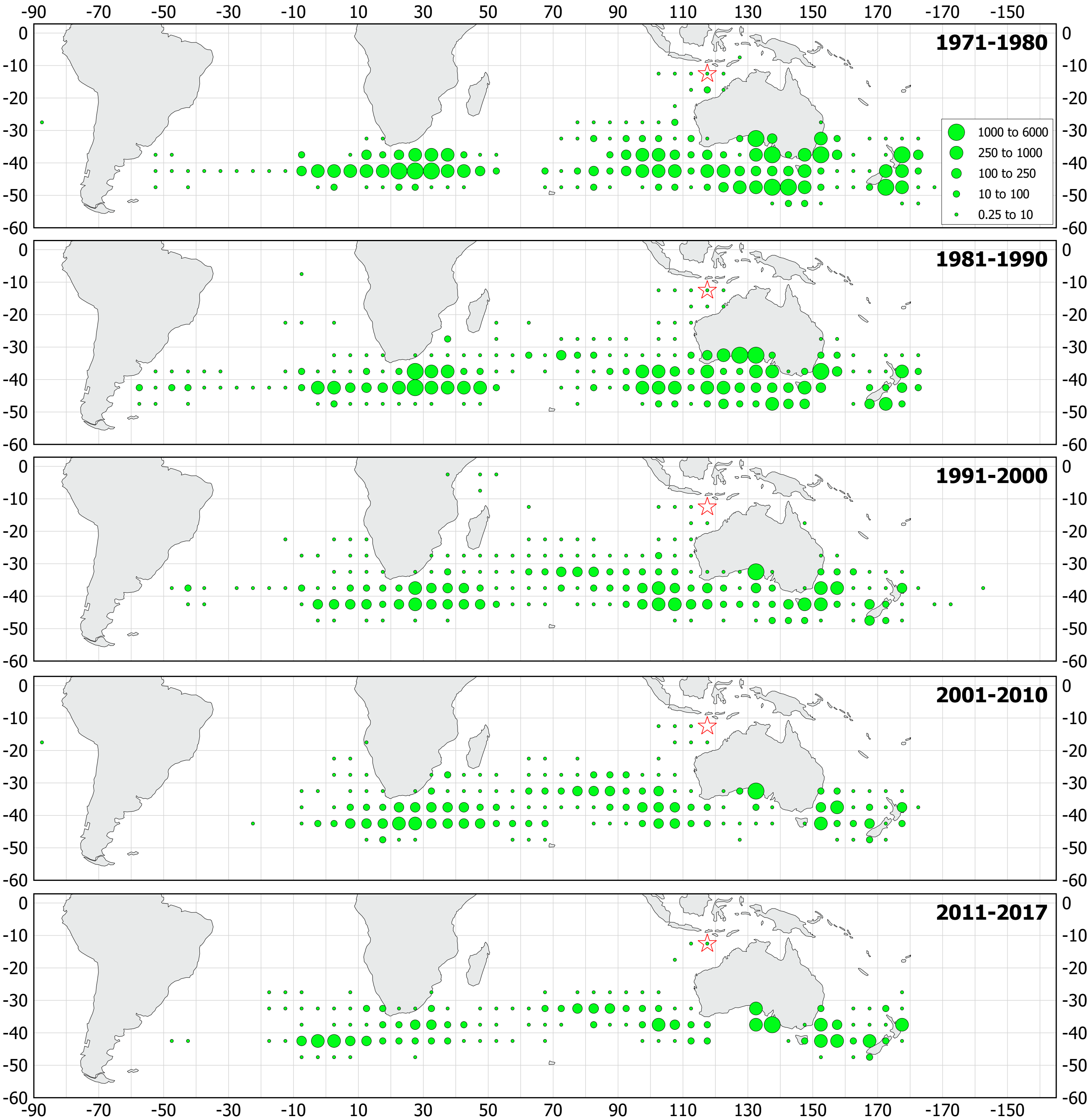


Figure 4: Geographical distribution of average annual reported southern bluefin tuna catches (t) by CCSBT members and cooperating non-members over the periods 1971-1980, 1981-1990, 1991-2000, 2001-2010 and 2011-2017 per 5° block. The area marked with a star is an area of significant catch in the breeding 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.

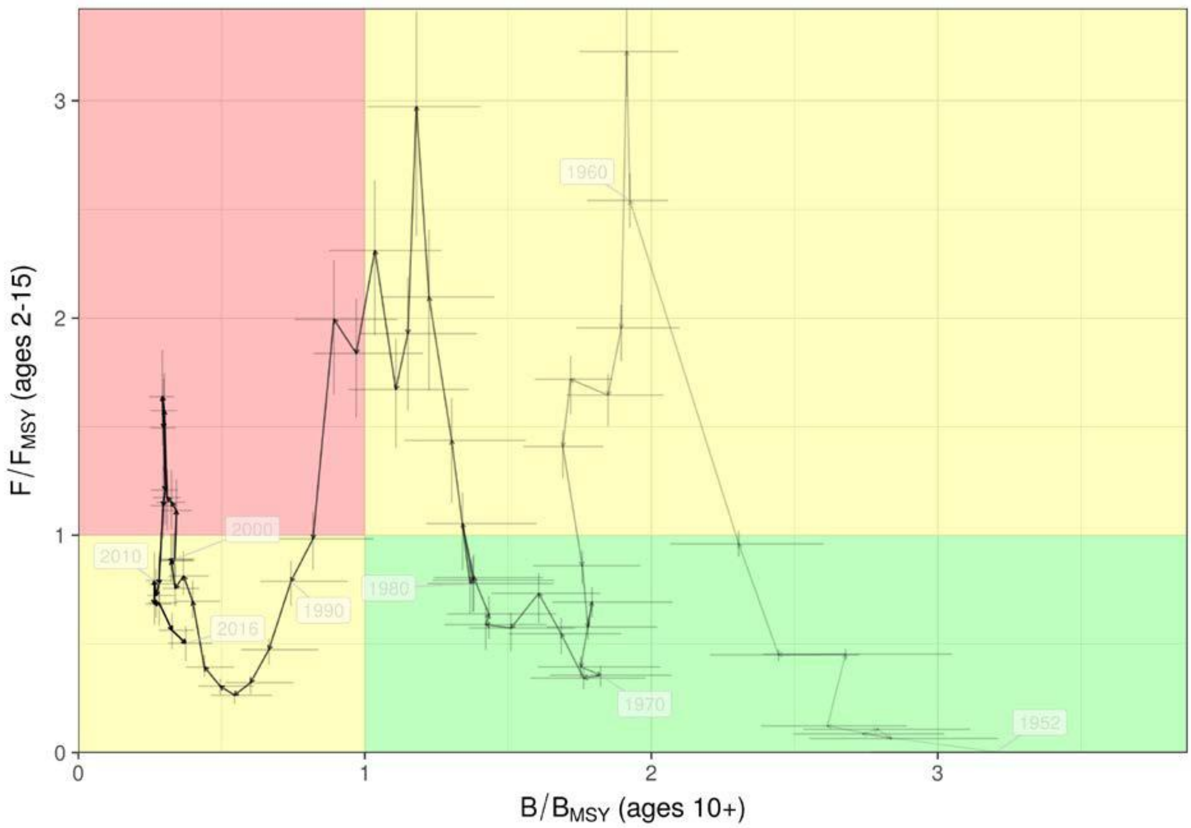
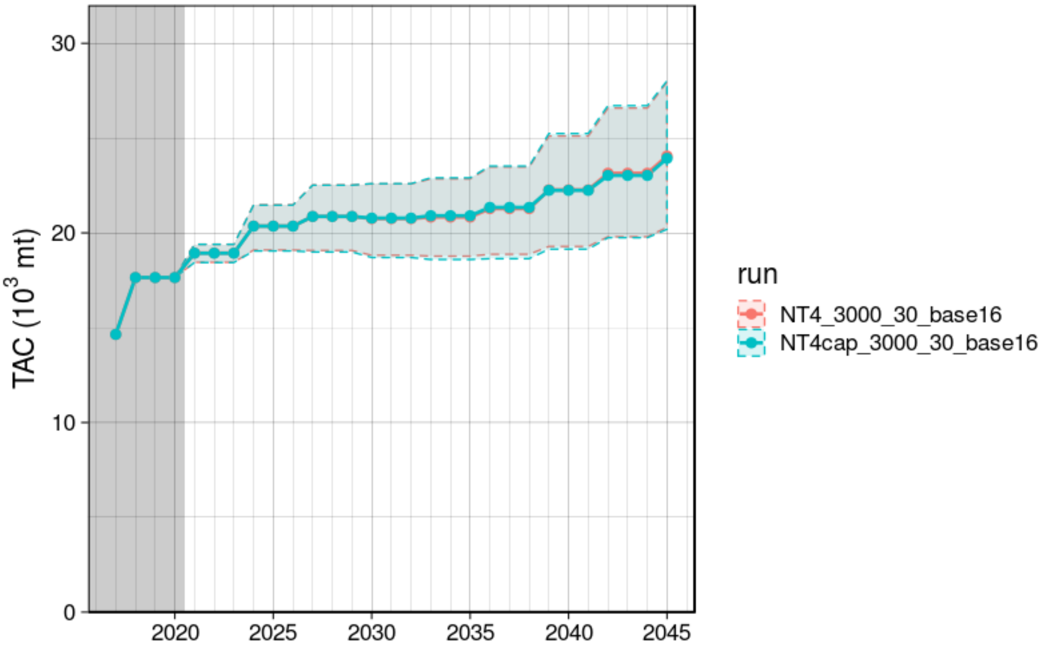


Figure 5. Time trajectory from 1952 to 2016 of median fishing mortality over the F_{msy} (for ages 2-15) versus spawning biomass (B) over B_{msy}. The fishing mortality rates are based on biomass-weighted values and the relative fishery catch composition and mean SBT body weights in each year. Vertical and horizontal lines represent 25th-75th percentiles from the operating model grid.

Attachment 7

CMP Development and Robustness Tests



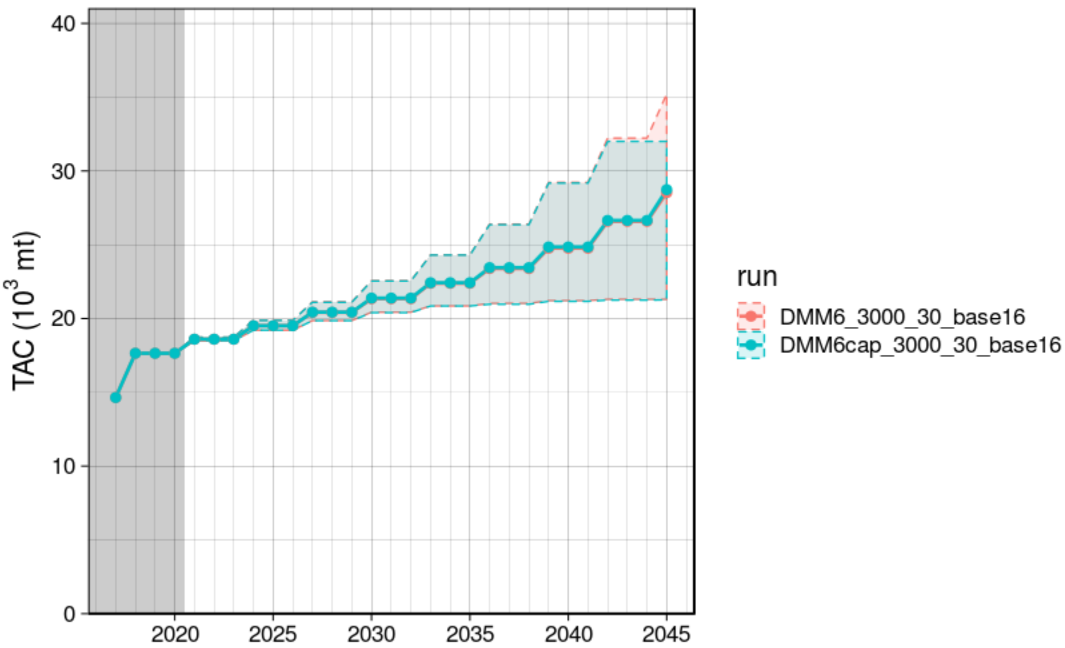


Figure 1. TAC trajectories projected using NT4 (top) and DMM6 (bottom) with the reference set with and without a 32,000 tonne maximum TAC.

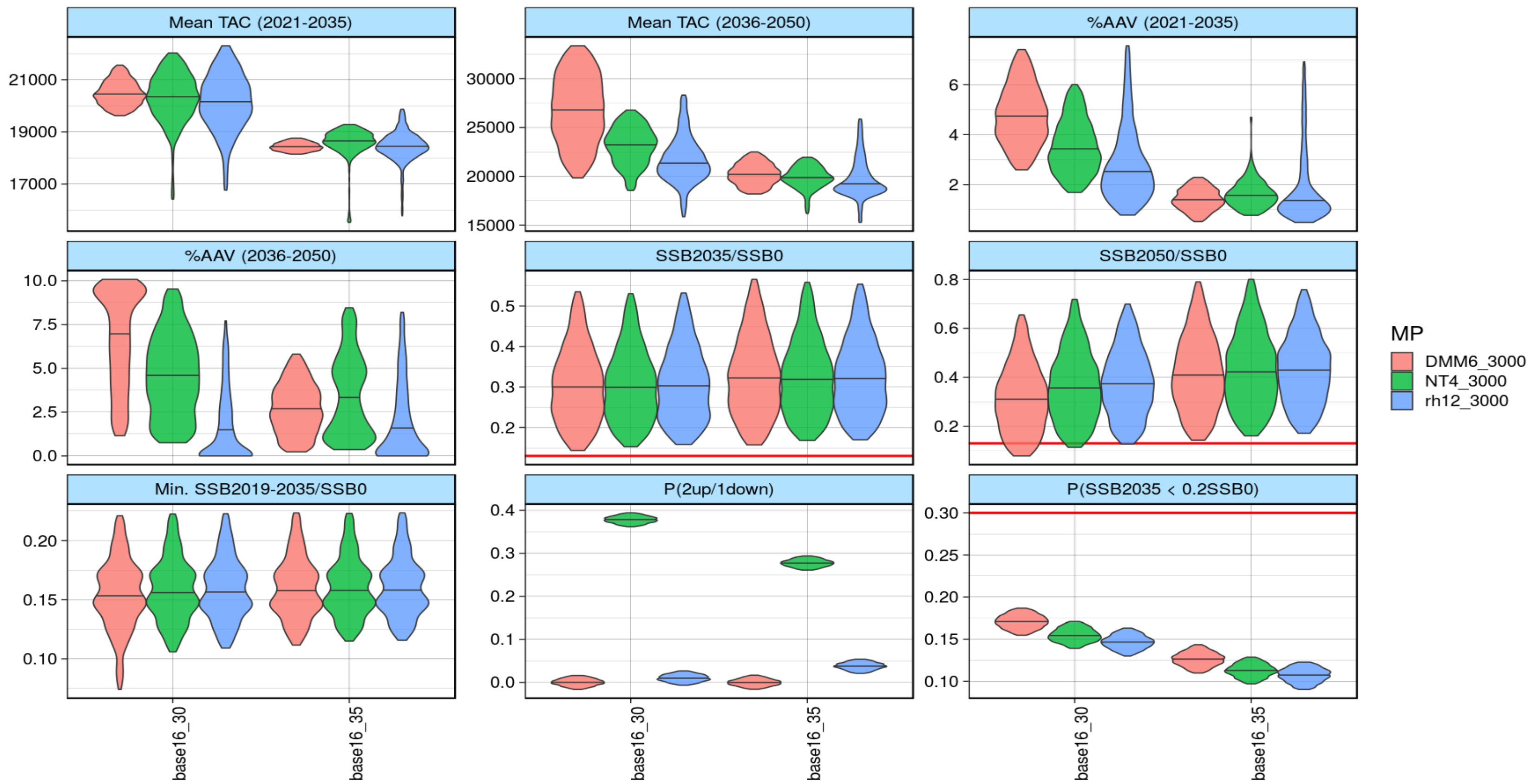


Figure 2. Output statistics for the DMM6, NT4 and rh12 CMPs for the base case for the 0.30 and 0.35 SSB_0 tuning levels. Coloured shapes, commonly referred to as violins, within each panel represent the distribution of values for each output statistic; the horizontal lines within each violin represents the median. The red horizontal lines on the SSB/SSB_0 panels indicate the current (13%) level; the red horizontal line in the $P(SSB_{2035} < 0.2SSB_0)$ panel represents the 70% probability of meeting the interim rebuilding target. Output statistics include: the mean TAC between 2021 and 2035; the mean TAC between 2036 and 2050; the percent annual average variation (AAV) in TAC between 2021 and 2035; the percent AAV in TAC between 2036 and 2050; SSB_{2035}/SSB_0; SSB_{2050}/SSB_0; the minimum SSB bewteen 2019 and 2035 divided by SSB_0; the probability of two increases in TAC followed by a decrease in TAC; and the probability that the SSB in 2035 is less than 0.2 SSB_0.

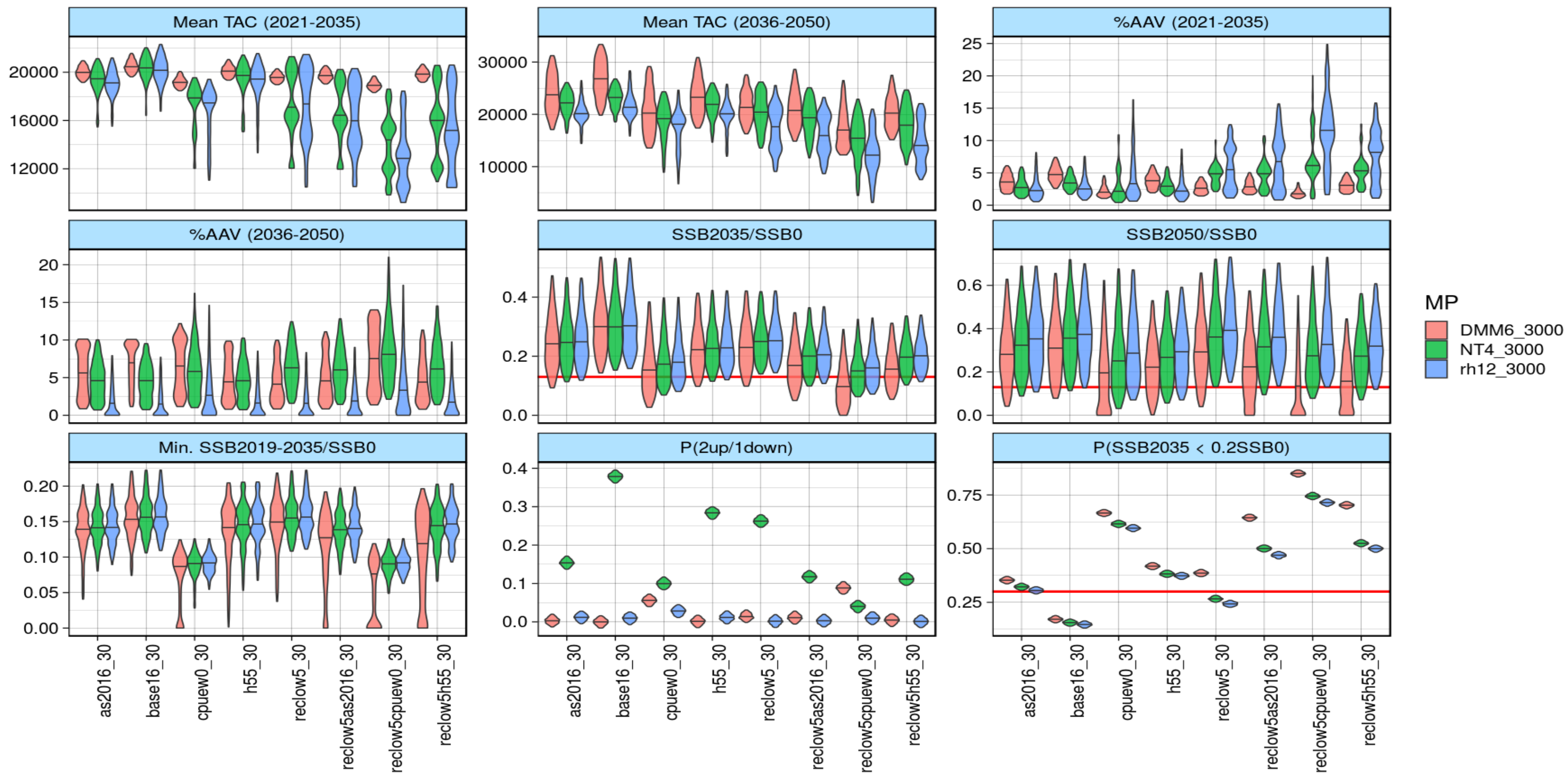


Figure 3. Output statistics for the DMM6, NT4 and rh12 CMPs for the base case and robustness tests for the 0.30 SSB_0 tuning level. The violins within each panel represent the distribution of values for each output statistic; the horizontal lines within each violin represents the median. The red horizontal on the SSB/SSB_0 panels indicate the current (13%) level; the red horizontal line in the $P(SSB_{2035} < 0.2SSB_0)$ panel represents the 70% probability of meeting the interim rebuilding target. Output statistics include: the mean TAC between 2021 and 2035; the mean TAC between 2036 and 2050; the percent annual average variation (AAV) between 2021 and 2035; the percent AAV between 2036 and 2050; SSB_{2035}/SSB_0; SSB_{2050}/SSB_0; the minimum SSB bewteen 2019 and 2035 divided by SSB_0; the probability of two increases in TAC followed by a decrease in TAC; and the probability that the SSB in 2035 is less than 0.2 SSB_0.

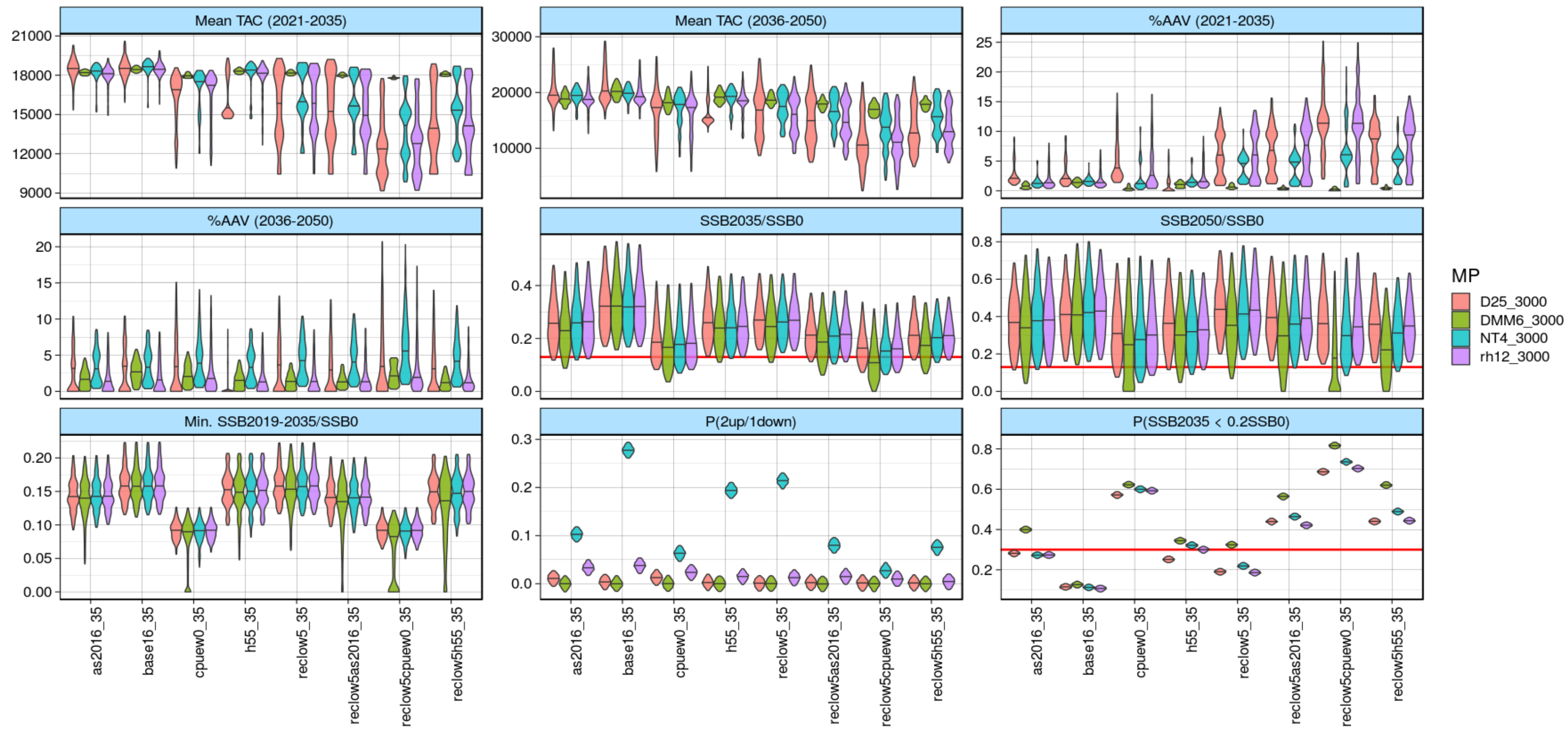


Figure 4. Output statistics for the DMM6, NT4, rh12, and D25 CMPs for the base case and robustness tests for the 0.35 SSB_0 tuning level. The violins within each panel represent the distribution of values for each output statistic, the horizontal line within each violin represents the median. The red horizontal on the SSB/SSB_0 panels indicate the current (13%) level; the red horizontal line in the $P(SSB_{2035} < 0.2SSB_0)$ panel represents the 70% probability of meeting the interim rebuilding target. Output statistics include: the mean TAC between 2021 and 2035; the mean TAC between 2036 and 2050; the percent annual average variation (AAV) between 2021 and 2035; the percent AAV between 2036 and 2050; SSB_{2035}/SSB_0; SSB_{2050}/SSB_0; the minimum SSB bewteen 2019 and 2035 divided by SSB_0; the probability of two increases in TAC followed by a decrease in TAC; and the probability that the SSB in 2035 is less than 0.2 SSB_0.

Attachment 8

Workplan for MP development and consultation

2018		
March	SFMWG5	Initial discussions of rebuilding goals and MP features
June	OMMP9	First presentation of candidate MPs (CMPs) evaluated using 2017 OMs.
September	ESC + 1 day informal OMMP	Evaluation of refined CMPs.
October	EC	Results on CMP performance and trade-offs presented to EC. Consultation with stakeholders. Commission confirms or amends broad recovery objectives based on advice from the ESC.
2019		
May		Data exchange will be advanced to try to complete it by mid May
June (24-28th)	OMMP10	**Recondition the OM** and review initial updated versions of CMPs to develop a limited set to put forward to the ESC.
September	ESC + 1 day informal OMMP	Review and advice on set of CMPs
	Possible Webex	Possible webex for consultation with Commissioners
October	EC	Aim to select and **adopt MP**.
2020		
June	Special EC	Contingency placeholder in case the EC needs more time to agree on an MP
June	OMMP11	Stock assessment
September	ESC	Implementation of adopted MP to provide **TAC advice for 2021** (i.e., no standard 1-year lag) (note, this MP implementation will include the 2020 data exchange). **Updated assessments including projections using adopted MP**
October	EC	Agrees TAC for 2021-2023.

Attachment 9

Data Exchange Requirements for 2019

Introduction

The data exchange requirements for 2019, 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 2018. 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 2019 to allow development of the necessary data loading routines.

Data listed in Annex A should be provided for the complete 2018 calendar year plus any other year for which the data have changed. If changes to historic data are more than a routine update of the 2017 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 2017 data) must be accompanied by a detailed description of the changes.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
CCSBT Data CD	Secretariat	31 Jan 19	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 2018 data exchange and any additional data received since that time, including: • Tag/recapture data (*The Secretariat will provided additional updates of the tag-recapture data during 2019 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 19	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 April 19	Raised total catch (weight and number) of any recreationally caught SBT if data are available. A complete historic 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 19	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 19	The mortality allowance (kilograms) that was used in the 2018 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 19 (New Zealand)[2] 30 Apr 19 (other members & Secretariat) 31 July 19 (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.
Non-retained catches	All Members	30 Apr 19 (all Members except Indonesia) 31 July 19 (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.

[1] The text "**<u>For MP/OM</u>**" means that this data is used for both the Management Procedure and the Operating Model. If only one of these items appears (e.g. **<u>For OM</u>**), 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
RTMP catch and effort data	Japan	30 Apr 19	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 19	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 19	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 19	Raw observer length frequency data as provided in previous years.
Raised Length Data	Australia, Taiwan, Japan, New Zealand, Korea	30 Apr 19 (Australia, Taiwan, Japan, Korea) 7 May 19 (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 19	Raw Length Frequency data from the South African Observer Program.
RTMP Length data	Japan	30 Apr 19	The length data from the real time monitoring program should be provided in the same format as the standard length data is provided.
Indonesian LL SBT age and size composition	Australia Indonesia	30 Apr 19	Estimates of both the age and size composition (in percent) is to be generated for the spawning season July 2017 to June 2018. Length frequency for the 2017 calendar year and age frequency for the 2017 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 19	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 2016 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 19	Estimates of the different trolling indices (piston-line index and grid-type trolling index (GTI)) for the 2018/19 season (ending 2019), 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 19	Updated summary of the number tagged and recaptured per month and season.
Gene tagging data	Secretariat	30 Apr 19	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.
Catch at age data	Australia, Taiwan, Japan, Secretariat	14 May 19	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 19	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 19[7]	These data will be provided for July 2017 to June 2018 in the same format as previously provided.
Raised catch-at-age for Indonesia spawning ground fisheries. **<u>For OM</u>**	Secretariat	24 May 19	These data will be provided for July 2017 to June 2018 in the same format as on the CCSBT Data CD.
Total catch per fishery and sub-fishery each year from 1952 to 2018. **<u>For OM</u>**	Secretariat	31 May 19	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.
Catch-at-length (2 cm bins) and catch-at-age proportions. **<u>For OM</u>**	Secretariat	31 May 19	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 19	Calculate the total catch-at-age in 2018 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 19	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.

[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.
[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.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
CPUE monitoring and quality assurance series.	Australia, Japan, Taiwan, Korea	15 Jun 19 (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 **for OM/MP**	Japan	15 Jun 19 (earlier if possible)	Provide both the w0.5 and w0.8 Core Vessel CPUE Series. The OM & MP use the average of these series.

[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 10

ESC Workplan for 2019-2021

Activity	2019	2020	2021
Routine Activity/Projects not requiring additional CCSBT Resources			
Continuation of tag recovery efforts	Yes	Yes	Yes
Standard Scientific Data Exchange	Yes[1]	Yes	Yes
Provide SBT stock status report to other t-RFMOs	Yes	Yes	Yes
Update length/weight relationships for wild SBT	Yes	No	No
Contracted Work/Projects			
Routine OMMP code maintenance and development	Yes	Yes	Yes
Continued aging of Indonesian otoliths	Yes	Yes	Yes
Gene tagging	2nd GT estimate, Release 4, Recap 3	3rd GT estimate, Release 5, Recap 4	4th GT estimate, Release 6, Recap 5
Continued collection & processing of close-kin samples	Yes	Yes	Yes
Close-kin identification & exchange	Yes	Yes	Yes
Maturity study	Lab analysis, workshop & data analysis	-	-
Develop methodology for analysis of farming and market data	Independent panel develop methodology	Subject to agreed method being developed	Subject to agreed method being developed
Meetings			
CPUE webinar	No[2]	?	?
OMMP meeting (June)	Yes[3]	Yes[4]	No
Informal OMMP meeting[5]	Yes[7]	No	No
ESC meeting[6]	Yes[7]	Yes[8]	Yes
Commissioner interaction Webex on CMPs	Possible	No	No
Extended Commission meeting	Yes[9]	Yes[10]	Yes
Contingency EC Special meeting (June)	No	Possible[11]	No

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[1] This Data Exchange will be advanced to try to complete it by mid-May.
[2] Instead, intersessional work of the CPUE modelling group in 2019 will be confined to preparing updates of CCSBT-ESC/1809/BGD02 to 04 that can be considered at OMMP10 to provide the critical review of the CPUE data inputs to the OMMP work.
[3] Recondition the OM and review initial updated versions of CMPs to develop a limited set to put forward to the ESC.
[4] Stock Assessment.
[5] One day, immediately prior to the ESC. No separate report of meeting.
[6] Each meeting includes: Regular review of indicators; Evaluation of meta-rules and exceptional circumstances; Review results of SRP activities.
[7] Review and advice on a set of CMPs.
[8] Implementation of adopted MP to provide TAC advice for 2021 (i.e., no standard 1-year lag). Note, this implementation will include the 2020 Data Exchange. Update assessments including projections using adopted MP.
[9] EC Aim to select and adopt MP.
[10] EC agrees TAC advice for 2021-2023.
[11] Special EC meeting in case the EC needs more time to agree on the MP.

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)

	2019	2020	2021
June OMMP Meeting in Seattle *(no Sec, no Interp)*	5 days Cat: 2P, 1C, 1Ch + 3C Prep Days	5 days Cat: 2P, 1C, 1Ch + 3C Prep Days	No
Informal technical workshop (immediately prior to ESC, *no Interp*)	1 day FM: 2P, 1C, 1Ch, 2 Sec + 3C Prep Days	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
Commissioner interaction Webex on CMPs	2P, 1Ch	No	No
Contingency EC Special Meeting	No	5 days FM: 1Ch, 3P, 1C, 3 Interp, 3 Sec	No
CPUE Webinar	No	?[1]	?[1]
Routine OMMP Code Maintenance / Development	5 P days + 12 months Shiny App	5 P days + 12 months Shiny App[2]	5 P days + 12 months Shiny App[2]
Maturity study	$50,000[3]	$0	$0
Continued close-kin sample collection & Processing	Contracted	Contracted + $20,000 freezer space	Contracted
Close-kin identification & exchange	Contracted	Contracted	Contracted
Continued aging of Indonesian otoliths	Contracted	Contracted	Contracted
Long-term Gene Tagging	Contracted	Contracted	Contracted
Develop methodology for analysis of farming and market data	2 panels of 3 experts. 10-14 days/expert. 1 in-person meeting per panel. Chair of each panel to attend ESC.	Subject to agreed method being developed. Resource requirements are not known as this is dependent on the method.	

[1] Requires 3 panel days if held.

[2] Usage of Shiny App to be evaluated after first year to determine the required period of licensing in the future.

[3] For Statistician and preparation of workshop materials.