Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Twenty Second Meeting of the Scientific Committee

2 September 2017
Yogyakarta, Indonesia

Report of the Twenty Second Meeting of the Scientific Committee
2 September 2017
Yogyakarta, Indonesia

Agenda Item 1. Opening of meeting

1. The independent Chair, Dr John Annala, welcomed participants and opened the meeting.
2. The list of participants is at **Appendix 1**.

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

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

Agenda Item 3. Other business

4. There was no other business.

Agenda Item 4. Adoption of report of meeting

5. The report of the Scientific Committee was adopted.

Agenda Item 5. Closure of meeting

6. The meeting was closed at 12:03 pm, on 2 September 2017.

List of Appendices

Appendix

1. List of Participants
2. Report of the Extended Scientific Committee for the Twenty Second Meeting of the Scientific Committee
3. Glossary of Terms

Appendix 1

List of Participants
The Twenty Second Meeting of the Scientific Committee

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Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Appendix 2

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

28 August – 2 September 2017
Yogyakarta, Indonesia

Extended Scientific Committee
for the Twenty Second Meeting of the Scientific Committee
28 August – 2 September 2017
Yogyakarta, Indonesia

Agenda Item 1. Opening

1.1 Introduction of Participants

1. The Chair of the Extended Scientific Committee (ESC), Dr John Annala, welcomed participants and opened the meeting.
2. The Chairman for the Agency for Marine and Fisheries Research and Human Resources of Indonesia's Ministry of Marine Affairs and Fisheries (Mr Zulficar Mochtar) welcomed participants and provided introductory remarks for the meeting.
3. Each delegation introduced its participants. The list of participants is included at **Attachment 1**.

1.2 Administrative Arrangements

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

Agenda Item 2. Appointment of Rapporteurs

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

Agenda Item 3. Adoption of Agenda and Document List

6. The agreed agenda is provided at **Attachment 2**.
7. The agreed document list is provided at **Attachment 3**.

Agenda Item 4. Review of SBT Fisheries

4.1. Presentation of National Reports

8. Indonesia presented paper CCSBT-ESC/1708/SBT Fisheries – Indonesia together with its information papers CCSBT-ESC/1708/Info03 and Info 04. Southern bluefin tuna (SBT) is one of the tuna species seasonally caught by Indonesian tuna longliners operating in Indian Ocean. Based on Catch Documentation Scheme (CDS) figures for 2016, the number of active longline vessels was 107, with a catch of about 601 t or about 6,414 individuals. The length of SBT ranged from 80-250 cm FL, with mean of 163.24 cm FL. In the last two years (2015-2016), the proportion of small size (<150 cm) SBT caught was relatively stable at

around 20%. Paper CCSBT-ESC/1708/Info03 described Indonesia's Tuna Protocol Sampling conducted by the Research Institute for Tuna Fisheries in Benoa Port, Bali, which was initiated and established in 2005 through collaboration with Australia. Data collection for all tuna landed was conducted incorporated with processing company and the harbour officer. The information consists of the number of landed and sampled vessels, catch composition, length and weight information. The monthly coverage of sampled vessel in 2016 ranged from 47.96 – 78.57%. A summary of progress with Indonesia's scientific observer program on tuna fishing vessels operating in the CCSBT Statistical Area 1 was provided in CCSBT-ESC/1708/Info04. The data is the most detailed information not only associated with catch and effort spatially, but also on fishing practices, gear configuration and environmental conditions. Scientific observers were deployed on three vessels and covered 2.59% in term of total fleets.

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

   - The size of vessels in its longline fleet is becoming smaller.
   - Its total catches are based on CDS data. Its port sampling information records higher catches than the CDS but some vessels operate at sea for 4-5 months so further validation of those data is required.
   - Indonesian regulations require VMS to be fitted to vessels greater than 30 gross tonnes in size, but there are coverage problems even with these vessels.

10. Australia presented CCSBT-ESC/1708/SBT fisheries – Australia. The Australian 2015–16 SBT fishing season report summarised catches and fishing activities in the Australian Southern Bluefin Tuna Fishery up to and including the 2015–16 fishing season (December 2015 – November 2016) and some preliminary results of the 2016–17 season (December 2016 – November 2017). Australia's allocation as agreed by the CCSBT was 5665 t for the 2015–16 fishing season. However, this was adjusted to 5703 t after inclusion of the under catch in the previous fishing season. A total of 25 commercial fishing vessels landed SBT in Australian waters in the 2015–16 fishing season for a total catch of 5633 t. A total of 86.9 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 2015–16 fishing season, with live bait, pontoon-towing and feeding vessels also involved. The average length of SBT transferred to farms in South Australia in 2016–17 was 96.4 cm. In the 2016–17 fishing season, observers monitored 18.3 per cent of purse seine sets where fish were retained for the farm sector and 16.8 per cent of the estimated SBT catch. In 2016, observers also monitored 9.3 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 10.2 per cent in 2016.

11. In response to questions Australia advised that:

   - It plans to implement a national recreational fishing survey in December 2018 to estimate its recreational SBT catch. This will use a combination of boat ramp surveys, catch diaries from selected fishers and catch records from selected charter vessels. However, due to budget issues, Australia cannot guarantee when that survey will commence.

- Its research on automation of the collection of stereo video data so that interpretation of the footage is automatic is complete and is currently under review. Australia intends that this work will be provided to the 2017 meeting of the Extended Commission (EC). A key outcome is that semi-automation seems viable but that full automation still requires development work. For additional information, the ESC was referred to a recent paper published by Shafait et. al.[1]
- Any expansion of the longline fishery for SBT is the choice of quota holders and is likely to be determined by market forces. Consequently, it was not possible for Australia to advise on the likelihood of further expansion in this fishery. However, Australia does collect size data for the fishery and it will make those available if it has not already done so.

12. Korea presented paper CCSBT-ESC/1708/SBT Fisheries – Korea. In the 2016 calendar year, the SBT catch of the Korean tuna longline fishery was 1,121 t (1,121 t in fishing year) with 11 active vessels. In general, fishing occurs between 35ºS-45ºS and 10ºE-120ºE, especially in the western Indian Ocean from April to July/August and in the eastern Indian Ocean from July/August to December. However, since 2014, SBT fishing vessels have moved further westward than in previous years, and mainly operated in the western Indian Ocean and eastern Atlantic Ocean between 20ºW-35ºE. Recently, SBT catch and effort were relatively higher in the western part (Area 9) than in the eastern part (Area 8), and the fishing season had finished earlier in September/October. In 2016, three observers were placed on-board three longline vessels targeting SBT. They observed 178 t of SBT catch and effort of 660×103 hooks in 263 sets during 338 days. The observer coverage was estimated to be 19% in terms of fishing effort.
13. The European Union (EU) presented paper CCSBT-ESC/1708/SBT Fisheries – European Union. There is not an EU fishery targeting SBT and any interaction with SBT by EU vessels could occur as by-catch in the swordfish long-line fishery operating in Southern areas of Atlantic, Indian Ocean, and Pacific Oceans. Most of the effort of these fisheries occurs North of 35ºS with less effort occurring South 35ºS, 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, lower than the 10 t allocated to the EU under the CCSBT SBT TAC agreement. In 2016, no by-catch of SBT was reported by the EU fleets operating in all oceans in areas where incidental catch of SBT could occur. The sampling at sea program started at the beginning of the swordfish fishery in 1993. The observer coverage, in number of hooks observed, was around 2.5 % for the EU long-line fleet operating in the Indian Ocean in 2016 (1 % for Spanish LL, 9 % for Portuguese and there were not observers in the UK LL fishery).
14. South Africa presented paper CCSBT-ESC/1708/SBT Fisheries – South Africa. South Africa's tuna directed fishery is comprised of two fishing fleets, a bait-boat (pole and line) fleet of 151 vessels (164 fishing rights), and a longline fleet with a domestic (ZAD) and a Japanese flagged joint venture (charter boat; ZAC) component of currently a total of 34 vessels (59 fishing rights), a figure that is

[1] Shafait, F., Harvey, E. S., Shortis, M. R., Mian, A., Ravanbakhsh, M., Seager, J. W., Culverhouse, P. F., Cline, D. E., and Edgington, D. R. Towards automating underwater measurement of fish length: a comparison of semi-automatic and manual stereo–video measurements. – ICES Journal of Marine Science, doi:10.1093/icesjms/fsx007.

likely to change after the allocation of fishing right process has been concluded. The pole fleet mainly targets albacore and yellowfin tuna, when available, and the longline fleet targets tuna species, swordfish as well as mako and blue sharks. SBT has previously only been caught 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. Catches of 637 individual SBT of a total weight of 61.8 tons were made from April to November in 2016, with the majority occurring in June and July. (ZAC = 14.1 tons; ZAD = 47.7 tons; Tuna Pole= 3.7 tons). Only a fraction of the longline (ZAD = 17; ZAC = 3) and the pole (7) vessels landed SBT. There are notable differences in the distribution of catch and effort between the domestic (ZAD) and chartered (ZAC) longline vessels, with the latter predominantly operating east of Cape Agulhas (>20° Longitude). In contrast, the domestic fleet operates off both the East and West coast of South Africa, out of to the two fishing ports cities of Cape Town and Richards Bay. The range of the ZAC fleet has been contracting to South Africa's EZZ (Area 14) in recent years, whereas an increasingly large proportion of SBT catch by the domestic fleet (ZAD) has been derived from the West coast of South Africa (Area 15). Overall observer coverage of the longline fleet is high, with 53% of hooks observed.

15. Taiwan presented paper CCSBT-ESC/1708/SBT Fisheries – Taiwan. This paper introduced the development of Taiwanese SBT longline fishery and represented the historical patterns of catch, effort, nominal CPUE and size composition. The fishing efforts and SBT catches were mainly made in Areas 2, 14 and 9 in the second and the third quarters, and the fishing efforts deployed in Area 9 are mainly from the fishing vessels targeting Oilfish or Escolar with some targeting SBT in the first and the fourth quarters. In 2016, 60 fishing vessels were authorised to catch SBT and the SBT catch was 1,023 tons for calendar year and 1,026 t for quota year. The development and implementation of scientific observer programs was also described in this paper.

16. Taiwan also presented paper CCSBT-ESC/1708/31 which described the preparation for the data of Taiwanese SBT fishery, including the total catch by fleet, aggregated catch and effort, catch-at-size, catch-at-age and non-retained catch data. The data source consists of paper logbook data, electronic logbook data, SBT weekly catch reports, catch documentation scheme (CDS) data, observer data and vessel monitoring system (VMS) data of authorised SBT fishing vessels. The data compilation and validation were reported in this paper.

17. Taiwan advised that most vessels retain their SBT catch and that Taiwan uses observer data to estimate discards. In response to a question about why there was a large number of small fish in its Area 8 catch during 2015, but not in 2016. Taiwan advised that the industry did not change its operation very much between the two years, but in 2015. It might have fished further north within Area 8 than it did in 2016.

18. New Zealand presented paper CCSBT-ESC/1708/SBT fisheries – New Zealand which describes its SBT fishery for 2016 and the 2015–16 fishing season. Commercial landings were 949 t for the period 1 October 2015 to 30 September 2016. The commercial catch was entirely taken by the small domestic fleet since the foreign charter fleet that has operated in New Zealand waters in the past was not present in 2016. Domestic vessels operating in both Areas 5 and 6 have seen

an increase in their CPUE with those operating in Area 5 reaching nearly 14 fish per 1,000 hooks. The level of discarding in the domestic fleet increased, likely due to the large number of smaller fish (approx. 20kg) seen in the fishery. Observer coverage rates for the New Zealand fishery were 23% for catch and 14% in terms of effort.

19. In response to questions from the meeting, New Zealand advised that:

    - The small differences between the CDS length distribution and the one based on observer records could simply be due to the level of observer coverage or the impact of the small released fish which would not be included in the CDS data.
    - The commercial effort information presented in its report included effort where southern bluefin was declared as the target species and also sets where another species was targeted but SBT was caught.
    - New Zealand's regulations allowed live SBT to be discarded regardless of whether an observer is on board, but dead SBT may not be discarded without an observer being present.

20. It was noted that with the New Zealand charter fleet no longer operating and the subsequent loss of data from this sector, it would be useful if New Zealand could develop a CPUE index for its domestic fishery.

21. Japan presented paper CCSBT-ESC/1708/SBT Fisheries – Japan, which describes the Japanese commercial longline fishery for SBT in terms of catch, effort, nominal CPUE, length frequency, number of vessels and geographical distribution of fishing operations in 2016. In 2016, 88 vessels caught 4,721 t and about 80,000 individual SBT.

22. Japan also presented paper CCSBT-ESC/1708/19, which reported on the Japanese scientific observer program for SBT in 2016. Scientific observers were dispatched on 19 vessels that operated in the main CCSBT Statistical Areas (Areas 4-9). Observer coverage was 21.3% in terms of the number of vessels, 17.5% in terms of the number of hooks used, and 18.3% in terms of the number of SBT caught. Observers collected various biological samples including otoliths from 484 SBT and muscle tissues from 1,233 SBT. Observers retrieved conventional tags from 6 individual SBT.

23. In response to questions, Japan advised that:

    - It determines a suitable amount to reserve for mortality relating to discards and releases data and survival rate obtained by pop-up archival tagging survey, and that this amount is ultimately revised using reports from fishers on discards and releases.
    - The lack of SBT catch in Area 15 despite significant fishing effort is because the fishing effort in Area 15 is targeted at species other than SBT.
    - Japan does not report the catch of its vessels that are chartered by South Africa, so there should not be double counting of the catch and effort from those vessels. However, since errors could have occurred, Japan will double check these figures and report its results to South Africa and the Secretariat.

24. South Africa noted that distributional plots of fishing effort from Korea, Taiwan and Japan gave the impression that fishing by these Members may have been occurring within South Africa's EEZ or that there may be errors in the data. These Members advised that this was simply an artefact of the 5*5 degree grid that was used to plot the data.

25. The ESC revised its annual reporting template to incorporate details of the research and monitoring conducted by Members to improve estimates of their Attributable SBT Catch. The revised template is provided at **Attachment 4**.

4.2. Secretariat Review of Catches

26. The Secretariat presented paper CCSBT-ESC/1708/04 (Rev.1). The estimated total catch for the 2016 calendar year was 15,490t, an increase of 78.1 t or 0.5 % from the 2015 calendar year. The global reported SBT catch by flag is shown at **Attachment 5**. 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 434 t for the 2016 fishing season.

Agenda Item 5. Report from the OMMP meeting

27. The Chair reported on the 8th meeting of the OMMP technical group convened in Seattle (19-23 June, 2017) in order to: (i) conduct an initial evaluation and define the structure of the stock assessment models to be presented at this meeting; and ii) to advance the development of a new Management Procedure (MP) that will replace the Bali Procedure adopted in 2011 and used to calculate recommended TACs since then. The report from that meeting was provided as document CCSBT-ESC/1708/Rep01.

28. The re-conditioning of the Operating Model (OM) used for this year's assessment involved not only the usual update of catch, CPUE, aerial survey estimates and size and age-composition data, but also the incorporation of new close-kin data. These comprise a longer data series of Parent–Offspring Pairs (POPs) providing information on spawning stock biomass from 2002 to 2012, and a new data series of numbers of Half-Sibling Pairs (HSPs) encountered when sampling juveniles, which provides information on total mortality and on the size of spawning biomass for 2003-2011.

29. The meeting reviewed some structural changes made to the OM related to the modelling of the reproductive output used for fitting the close-kin data. These changes led to the inclusion of a new parameter in the grid which controls how reproductive success increases as a function of fish length.

30. The meeting agreed on the structure of the models, the configuration of the grid that defines the reference set of models for this year's stock assessment as well as a list of sensitivity runs.

31. Because there was not enough time to incorporate the HSP data series in the conditioning prior to the Seattle meeting, a special webinar was conducted in July 2017 to evaluate the initial results of fitting the OM to the HSP data series. This webinar recommended the inclusion of the HSP data in the stock assessment (see CCSBT-ESC/1708/36).

32. The base assessment and sensitivity runs specified at OMMP8 were completed intersessionally and results are reported in a paper produced jointly by Australia and Japan (CCSBT-ESC/1708/14). A one-day informal meeting of the OMMP technical group just prior to the ESC meeting allowed the group to evaluate technical aspects of the assessment results presented in that paper.

33. Overall results are very positive. The technical group concluded that the model was able to fit the new close-kin data well and there were no indications of data conflicts or inconsistencies between the old and the new data. The structural changes made to the models after the incorporation of the close-kin data, together with some positive signs in the CPUE and mainly in the recent aerial survey data resulted in a more optimistic outlook in terms of current stock status, recent recruitment trends and prospects for rebuilding. Much of the technical discussion revolved around evaluating the robustness of these more positive outcomes to changes in model assumptions and changing of the weight assigned to the recent very high aerial survey indices. The results of these evaluations would be completed and reported during this meeting.

34. In terms of the development of a new MP, OMMP8 discussed possible structures for candidate MPs. It developed technical specifications for the OM that will be used for MP testing including how to analyse close-kin data to enable these to be provide input to the MP, and an initial list of robustness tests. This list will be revised based on the new assessment results.

35. The OMMP8 also discussed the work program and time table developed by the ESC in 2016 in connection with the design of the new MP, which included achieving adoption and implementation of a new MP in 2019. The meeting concluded that this time table was too tight and would not allow sufficient time for consultation with stakeholders so that they could see initial results of projections and take them into account for specifying a range of realistic rebuilding and long-term management goals. A proposal was made to extend the implementation of the new MP to 2020. Details of this proposal would be refined during this meeting in order to present the commissioners with a revised work plan.

Agenda Item 6. Report from the CPUE modelling group

36. The Chair of the CPUE modelling group (Prof. John Pope) reported on the CPUE modelling group's intersessional work. The main intersessional work was the web-meeting (13/14 June 2017), which considered three main agenda items:

    - The impact of the loss of the NZ chartered Japanese longline vessel for the core CPUE series;
    - The behaviour of agreed core CPUE series; and
    - Development and encouragement of new CPUE series.

37. A summary of the discussion in the web-meeting was presented as CCSBT-ESC/1708/34, and the main conclusions agreed by the group were:

    - There would be little impact from the loss of data from the NZ chartered vessels on the CPUE series, and the proposed modification to the core CPUE series should be adopted. No marked change was found in the 2016 operational pattern in terms of catch amount, the number of vessels, time and area where operations took place, proportion by area, length frequency, and concentration of operations. CPUE could continue to be used as an abundance measure.
    - Progress in the development of Korean CPUE series are very useful in providing independent series to compare with the Japanese CPUE.
    - The development of the Taiwanese CPUE has the potential to provide a measure of recruitment from its east central area. This might be tested by comparison to assessed recruitment estimates or recruitment surveys as this CPUE time series is extended. Both the Korean and Taiwanese papers provided an illustration of alternative approaches to CPUE analysis. In addition, both are very valuable to knowledge of how these fisheries operates.
    - It was pointed out that the behaviour of operation of longline vessels have influence not only on CPUE but also for biological sampling (otoliths etc.).

38. In response to a question about the purpose of possible CPUE series from New Zealand and South Africa, the Chair of the CPUE modelling group mentioned that these CPUE series could be useful to confirm the existence of exceptional circumstances. For the Korean longline CPUE, the Chair considered that it is better to develop this separately from current core CPUE series; however it might be longer term value in developing joint series of longline CPUE. Comments were also made that the development of the other CPUE series has qualitative value to inform on concentration and the margins of the operation in regard to the discussion of "constant" and "variable" squares approaches.

39. Of the six papers presented at the CPUE web meeting, five of the papers were submitted to the ESC as background documents (CCSBT-ESC/1708/BGD04-07 &10) while Taiwan's paper CCSBT-ESC/1708/33 was presented under agenda 8.

40. A more detailed summary of the Report of the Web Meeting that includes summaries of the 6 papers and of the resulting discussion is provided at **Attachment 6**.

41. The CPUE modelling group also met in the Margins of the ESC on Monday 28th August to discuss its intersessional work program. The results of this meeting are also summarised in **Attachment 6**.

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

42. Australia presented paper CCSBT-ESC/1708/06 which provides the analysis methods and results for the scientific aerial survey time series. The methods of analysis used this year were the same as those used since 2012. The estimate of relative abundance of juveniles from the 2017 survey was similar to the 2014 estimate, and significantly above the long-term average when taking confidence

intervals into account. The 2017 estimate was much lower than the 2016 estimate. The survey was not conducted in 2015. The environmental conditions during the 2017 survey were average for the most part, except that wind speed tended to be lower and swell height slightly higher than usual. These variables will work in opposite directions in the standardisation process to adjust the observed sightings rate to an average set of conditions. Most sightings were made inshore in the eastern half of the survey area. As in the 2009-2013 surveys, a high percentage of the observed total biomass coming from schools comprised of small fish (<8 kg) was observed again this year.

43. The question was asked whether there was any new information that would inform further consideration of the high estimated aerial survey index for 2016. Australia responded that there was no further information to assist in the interpretation of this value and that the ESC conclusions from ESC 21 were still valid (ESC21 paragraphs 125-129).

44. The ESC acknowledged the work of Jessica Farley in coordinating the aerial survey in recent years. In particular ensuring successful implementation of the survey had been problematic during a period when uncertainty around the continuation and scheduling of the survey made logistical planning difficult.

45. CSIRO presented CCSBT-ESC/1708/07 on the CCSBT pilot gene-tagging program, which aims to test the feasibility and logistics of a large-scale mark-recapture program that uses DNA matching of tissue samples to estimate absolute abundance of juvenile SBT. The pilot program commenced in 2016 with the trial of at-sea tagging in February-March 2016. More than 3700 pole and line caught SBT were successfully biopsied and released. In 2017, “at-harvest” tissue collection was trialled, with over 15,000 samples collected (June-August 2017), exceeding the target of 10,000 samples. The tagging samples from the 2016 pilot releases have undergone DNA extraction, and the extracted DNA has been sent to Diversity Arrays Technology (DArT) for sequencing. The at-harvest tissue samples will be processed and sequenced over the next few months to provide data for analysis and identification of matches (i.e., recaptures) from the pilot phase of the program. The abundance estimate from this program is intended to be used in the SBT operating models and management procedure. The pilot program is scheduled for completion in early 2018, with an abundance estimate available in time for the 2018 data exchange.

46. The ESC noted that when the first estimate becomes available in 2018 it would be an absolute estimate of abundance for 2 year old fish, and that there would be limited information from other sources to put this estimate into context.

47. In response to a question regarding the value of collecting samples from older fish (e.g., age four fish), CSIRO indicated that the design work presented previously to the ESC indicated that there would be value in obtaining samples from known age fish. The current study aimed to obtain ten thousand samples of age-3 fish. Smaller samples sizes of older known-age fish would be required because at these ages there are fewer fish. Sample size would need to be calculated to determine the precision of the abundance estimates. CSIRO would be willing to do these calculations and discuss additional sampling with interested Members.

48. CSIRO presented CCSBT-ESC/1708/08, to report on the CCSBT gene-tagging recruitment monitoring program in 2017. During this second year of gene-tagging, nearly 8000 fish were tagged (via tissue biopsy) and released, during 20 days of sea-time in February-March 2017. The target sample size of 5000 fish was exceeded, due to substantial improvements in methods based on experience from the pilot tagging work in 2016, and a highly experienced fishing Master and more crew than the previous year. The gene-tagging project will provide an annual abundance estimate of juvenile SBT, from each year of tagging, for use in the SBT operating model and management procedure. A full trip report is provided in the paper.

49. CSIRO indicated that at this early stage of the program, the samples sizes of recovery data are unlikely to be sufficient to estimate any potential tagger effects (e.g., differential release mortality across taggers) but noted that there are few taggers. It was noted that the 'tagging' procedure is much less intrusive than conventional tagging and a priori release mortality should be less.

50. Paper CCSBT-ESC/1708/09 was presented, updating previous analyses of the length and age distribution of SBT landings by the Indonesian longline fishery, and describing the ongoing collection and genotyping of tissue samples from adults and juveniles for close-kin genetics in 2016/17. This work was undertaken as part of the CCSBT agreed work plan. DNA extraction and sequencing of muscle samples from the 2015/16 season is currently underway for use in future close-kin mark-recapture estimates of spawning stock biomass. DNA extracted from muscle samples collected in the previous season in Indonesia (2014/15) was of poor quality and it was agreed that the 2010 adults would be genotyped in lieu of the 2015 samples. Length- and age-frequency data for the Indonesian longline fishery indicates that the mode of small/young fish that first appeared in the catch in 2012/13 has progressed through the fishery and appears to be the same mode 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.

51. Paper CCSBT-ESC/1708/11 provides an update on otolith and ovary sampling activities in Australia over the past year. A total of 174 otolith samples were received and archived from the Australian surface fishery and age was estimated for 100 SBT collected in the previous year. The proportions-at-age were presented for all years since the 2001-02 season. For the most recent season (2015/16), the proportion at age estimates from the M&B method with unknown growth are 49% age 2 and 48% age 3. These estimates suggest a smaller proportion of age 2 and larger proportion of age 3 fish in the catches in 2015/16 than in the previous two seasons, but are similar to several other past seasons. Ovaries from 208 SBT for use in estimating size and age at maturity caught have been collected off SE Australia.

52. Australia presented CCSBT-ESC/1709/12 which updates progress with genotyping and identification of close-kin for the stand-alone assessment model used to estimate the absolute abundance of adult (i.e. spawning age) SBT in 2012 (Bravington et al 2016; CCSBT-ESC/1708/Info5). The previous study identified

Parent-Offspring Pairs (POPs) using highly-variable microsatellites. The value of those data and the associated stand-alone CKMR model for assessment and monitoring of the spawning stock have been recognised by the CCSBT. The CCSBT Scientific Research Program supports the annual collection and processing of tissue samples, as well as investing in design studies. The paper reports on (i) the application of a new method for identifying POPs and Half-Sibling Pairs (HSPs) using Single Nucleotide Polymorphisms (SNPs) genotyped with modern Next-Generation Sequencing methods, using specifically designed DArTcap assays; and (ii) the development of a new stand-alone CKMR model that uses these data in a population-dynamics framework that allows for length-, age-, and sex-structure among adults. A total of ~17,000 tissue samples from adult (Benoa, Indonesia) and juvenile (Port Lincoln, Australia) collected over the period 2005-2015 have been genotyped. From the ~16,000 genotypes remaining following quality-control checks, we identified 77 POPs, 140 definite HSPs and 4 Full-Sibling Pairs. 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. This is consistent with an equal sex-ratio among adult SBT. The POP and HSP data have been incorporated into the reference set of the CCSBT OMs for the 2017 stock assessment process (CCSBT-ESC/1709/14). It has not been possible to complete the new stand-alone CKMR model in time for the ESC, due to the extremely tight schedule for the project, the later-than-expected completion of genotyping, and the priority placed on completing quality control and diagnostic analysis for the identified HSP and POPs. The stand-alone CKMR model will be complete by the end of 2017, and will be available for review at OMMP9 and consideration by the ESC in 2018. The paper includes an overview of the benefits of the combined POP-and-HSP approach, including the challenges for extension of the previous POP-only model and initial considerations of solutions.

53. The ESC noted that as the program continues there may be additional data in the form of adult/adult pairs and grandparent / offspring pairs that may be informative and it will be useful to consider how these data could be included in the OM. The ESC further noted that the stand-alone CKMR model currently under development will produce estimates of absolute abundance and total mortality.

54. Japan presented paper CCSBT-ESC/1708/21, which reported on Japan otolith collection in 2016. Japan collected otoliths from 551 SBT individuals (484 from Observers, 67 from the trolling survey) in 2016. Ages were estimated from 197 SBT for individuals which were caught in 2015. The data were submitted to the CCSBT Secretariat in 2017. Age data totalling 4,726 SBT individuals collected by Japan were analysed to show relationships between fork length and age estimated.

55. Japan presented paper CCSBT-ESC/1708/22, 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 in the southern coast of Western Australia using trolling for a total of 10 lines. The area adjacent to the piston-line and the area between Bremer Bay and Esperance were also surveyed. During the cruise, a total of 259

SBT individuals were caught. Among them, 83 fish had archival tags implanted before release.

56. Japan presented paper CCSBT-ESC/1708/23 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 2016 to 2017. One index is the piston-line trolling index (PTI), which has been reported to CCSBT. The other index is the grid-type trolling index (GTI) which was developed in 2014. The dataset included about 52,260 km total distance searched with 902 schools encountered. A GLM using the delta-lognormal method was applied for CPUE standardisation because of high percentage of zero catch data. The year trend of GTI over 20 years was compared to those of recruitment estimates from operating model, age-4 standardised CPUE of Japanese longline. Trends of GTI and PTI were similar to each other. GTI and PTI data are expected to contribute to the CCBST stock assessment.

57. It was noted that it was unfortunate that no troll index was available for 2015 as this would have provided some comparison to the aerial survey index.

58. Japan presented paper CCSBT-ESC/1708/24 which provides a standardisation grid-type trolling index (GTI) of age-1 SBT using environmental factors. To develop a robust indicator which reflects recruitment of SBT, GTI was evaluated and standardised using weather factors such as air temperature, rainfall, wind, sunshine affecting the fishing process to the current GTI. A preliminary result standardising with the delta log normal GLM model using weather factors to the current GTI, the year trend of GTI including weather factors provided very similar trend to the current GTI. This means that the weather conditions have no major impact on catch of the trolling survey. GTI is a robust index against weather condition and consistent to year trend.

59. Korea presented paper CCSBT-ESC/1708/30. Since 2015, samples of SBT otoliths and ovaries have been collected through Korea's scientific observer program. A total of 298 SBT otoliths were collected for 2 years and used to investigate the age and growth of SBT. The relationship between fork length and total weight was TW = 1E-05 x FL3.1058 (R2 = 0.943), and the von Bertalanffy growth parameters were $L\infty$ = 176.6 cm, K = 0.168/year, t0 = -2.057 years. In addition, a total of 153 SBT ovaries were collected and analysed. The results will be presented at the next ESC meeting.

60. In request to a question as to whether SBT otoliths were aged according to the agreed CCSBT protocols, Korea responded that it aged the otoliths in accordance with the procedures in the CCSBT's otolith aging manual.

61. Taiwan presented paper CCSBT-ESC/1708/32. Taiwan continued the analysis of reproductive biology for SBT based on the gonad samples collected by Taiwanese scientific observer program. A total of 508 gonad samples were collected during April to September from 2010 to 2016. The fork length of samples concentrated between 90 and 150 cm. The GSIs of females increased from April to July and then showed a decreasing trend. The GSIs of males reached the maximum value and then decreased gradually. Based on the observation of the developmental stages of oocytes and spermatocyte, most

gonad samples were designated as immature and about 23% of the samples designated as mature although they were reproductively inactive.

62. Taiwan was asked if tissue samples were collected from those fish that had otoliths / gonads collected that could contribute to the gene tagging data set. Taiwan responded that they were not sure, but could make sure that this was in the data collection protocols for future sampling.

63. New Zealand provided a verbal presentation of the current status of its efforts to collect biological samples from SBT. It related to details provided in its country report (CCSBT-ESC/1708/SBT Fisheries – New Zealand). New Zealand reminded the ESC that in the past sampling had been almost entirely restricted to the Japanese Charter fleet. This was done because these vessels were much larger than the domestic vessels and therefore easier to work on and also the fleet processed its SBT in a way that made otolith collection much easier. In 2016 and 2017 efforts have been made to collect otoliths from fish taken on smaller domestic vessels, but the sample sizes are much lower. New Zealand will undertake a review at the end of the current fishing season to determine the best approach to collect sufficient samples in the future. This may involve taking samples from fish on shore rather than at sea.

64. Australia thanked New Zealand for its report and emphasised the importance of collecting biological samples from the longline fishery. It offered to provide New Zealand details of operational procedures that may assist in determining how best to take samples.

65. The ESC chair noted that there were several papers that related to matters of uncertainty in information from Australia farming operations and the Japanese market (list all the papers). The ESC agreed to a proposal from Australia that a small working group be formed to develop work programs to address these outstanding matters.

66. The small working group (SWG) developed a work plan to progress uncertainties associated with the methods used to estimate growth and catch sampling methods in SBT farming operations and those associated with the methods of the Japan Markets Analyses. CCSBT-ESC/1708/Info-01, CCSBT-ESC/1708/Info-02, CCSBT-ESC/1708/20, CCSBT-ESC/1708/25, and CCSBT-ESC/1708/BGD08 were tabled at the SWG. The discussion focussed upon areas where there was consensus among Members and options for resolving ongoing and outstanding issues of concern. The SWG agreed that a productive way forward was for the continuation of informal dialogue between Members intersessionally. The key topics for this discussion are identified in the work plan with an indicative timeline for completion (**Attachment 7**). The work completed intersessionally would then be presented back to ESC23 (preferably this could include joint paper(s) by Members). The Members were encouraged by the progress made by the SWG and suggested that ESC22 might wish to note that an efficient way for future meetings would be to convene a SWG on these topics at the commencement of the ESC to allow discussion on issues and consensus to be reached before a report back to plenary on outcomes.

67. New Zealand thanked Australia and Japan for the more constructive and collaborative approach used this year, but reminded them that New Zealand and the other Members of the EC are not simply interested observers, but rather potentially aggrieved parties. These matters represent a burden shared by all Members and New Zealand expects genuine and meaningful commitment to seeking a resolution and that all reasonable steps are taken to achieve the actions identified in **Attachment 7**.

68. Japan presented paper CCSBT-ESC/1708/20 about the potential unaccounted mortality of Australian farming. In the 21st ESC, opinions of Australian farmed SBT were exchanged between Australia and Japan in terms of growth, age composition and catch amount, which were very different from Japanese estimation to those Australia reported. In this paper, Japan responded further in order to promote the discussion. Arguments were presented that all points explained by Australia in 2016 have already been taken into account in Japanese analysis or are not applicable, including the linearity assumption for growth in body length, influence of tag implementation on fish growth, origin of age composition data, and interpretation of growth from Pacific bluefin tuna farming. Further explanation from Australia for the large biases were needed. To reduce uncertainty further, analysis of the detailed size data in CDS are preferable.

69. Japan presented paper CCSBT-ESC/1708/BGD08, which provides an update of unaccounted catch mortality in the Australian SBT farming in the 2015/2016 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 (see Fig.1 of 21st ESC Report). Using the SRP tagging growth rate, the annual amount of catch was estimated to be higher than reported by between 724 and 2,546 t, with a best estimate of 1,621 t. As a proportion of the reported catch, this excess ranged from 14% to 56% with a best estimate of 33.7%. 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.

70. Japan submitted CCSBT-ESC/1708/25. This document provides the 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 southern bluefin tuna (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 the wholesale market, and observation of catch tags in the market. Based on the information above, domestic SBT catch amounts for 2004-2016 were estimated with the same assumptions and parameters for Japanese market behaviour as for previous Japanese Market Review (e.g. double-counting, off-market selling rate, market share). These estimated annual catch amounts were compared to the official catch amounts reported by fishermen. As estimated catches have been smaller than official catches since 2008, under-reporting of catch by fishermen has not been indicated through the market monitoring.

71. Japan submitted CCSBT-ESC/1708/BGD09. In this document, the characteristics and structure of the Japanese fish market and possible data source relating to the Southern Bluefin tuna (SBT) trade in Japan were explained. The distribution channel of SBT in Japan is complex; thus the statistics of wholesale markets only partly cover the SBT trade. For this reason, many of assumptions of trade parameters (in-market farmed frozen SBT, auctioned frozen SBT from foreign countries etc.) are required for the analysis of market anomalies. The Independent Review of Japanese SBT market anomalies (JMR) in 2006 assumed these parameters roughly based on the limited information. Japan has updated these parameters for their market analysis using best available information and evidence obtained from monthly market monitoring. The detailed trade information which was requested from ESC 19 to Compliance Committee and EC is not included in publicly available information, and according to the JMR report, market organiser (Tokyo metropolitan government) also does not have this trade information. The estimated accuracy of market anomaly has been improved compared to the JMR report and indicates that there has not been any substantial market anomaly after 2006. On the other hand, the Catch Documentation Scheme (CDS) of CCSBT commenced in 2010, and covers all landing, import, and export of SBT. The analysis of CDS data might potentially be useful to examine the market trades, and it may be an alternative way to verify the accuracy of the reported catch using trade information.

Agenda Item 8. Evaluation of Fisheries Indicators

72. The ESC considered the updated indicators (**Attachment 8**). The overall results were summarised as follows:

- The two indicators of juvenile (age 1–4) SBT abundance (i.e. scientific aerial survey index and the trolling index) were available for 2017. Both the scientific aerial survey and trolling index decreased compared to 2016.
- Indicators of age 4+ SBT CPUE from the New Zealand domestic longline fishery increased in 2016.
- Recent Japanese longline CPUE indicators suggest that the current stock levels for the 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 age 8-11 group have increased steadily since 2011. The indices for age class 12+ have declined gradually since 2011.
- The Taiwanese standardised CPUE for the central-eastern and the western areas reveal quite different trends. For the central-eastern area, this CPUEs increased gradually before 2007, showed a decreasing trend from 2007 to 2011, increased substantially in 2012 before decreasing gradually and then increased again in 2016. For the western area, the standardised CPUE series indicates a generally decreasing trend with some fluctuation after 2002.
- The Korean standardised CPUE series has shown an increasing trend in recent years.

73. Australia presented paper CCSBT-ESC/1708/13 which provides a 2016–17 update of fishery indicators for the SBT stock. The paper summarises indicators for 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 this 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.

74. In this paper, interpretation of indicators was limited to subset 1, and recent trends in some indices from subset 2. Two indicators of juvenile (age 1–4) SBT abundance (i.e. the scientific aerial survey index and the trolling index) had become available for 2017. Both these indices had decreased since the previous update in 2016. Indicators of age 4+ SBT exhibited mixed trends with the CPUE from the New Zealand domestic longline fishery increasing in 2016. In contrast, the Japanese longline nominal CPUE for ages 4+ decreased, as did the standardised CPUE series. The mean length of SBT has generally decreased since 2011, although it increased slightly in 2016–17 compared to previous seasons. A strong need remains to understand the location of the catches of small SBT. The median age of SBT decreased in 2016.

75. Japan presented CCSBT-ESC/1708/26. In this paper, fisheries indicators along with fishery-independent indices were examined to provide additional information for overviewing the current stock status of southern Bluefin tuna. The Japanese longline CPUE indicators suggest that the current stock levels for the 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 the 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 index for the age 8-11 group has increased since 2011. The index for age class 12+ has declined gradually since 2011. This decline may relate to the very low strength cohorts of 1999 to 2001. The current index levels for these older age groups remain low at similar levels to those observed in past. Other age-aggregated (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 levels 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 for 1999 to 2002 cohorts occurred) but these levels of recruitment have varied from year to year to some extent.

76. Korea presented CCSBT-ESC/1708/BGD10 . In this study SBT CPUE from Korean tuna longline fisheries were standardised over1996-2016 using Generalised Linear Models (GLM) with data on the fishing operations. The data used for the GLMs were catch (number), effort (number of hooks), number of hooks between floats (HBF), fishing location (5° cell), and vessel identifier by year, quarter, and area. They explored CPUE by area, and identified two separate areas in which Korean vessels have targeted SBT. The SBT CPUE was standardised for each of these areas. Two alternative approaches, data selection and cluster analysis, were applied to address concerns about targeting changes through time which can affect CPUE indices. Explanatory variables for the GLM

analyses were year, month, vessel identifier, 5° cell and number of hooks. GLM results for the whole area suggested that location, year, targeting, and month effects were the most important factors affecting the nominal CPUE. The standardised CPUEs for both areas decreased until the mid-2000s and have shown an increasing trend since that time.

77. Taiwan presented paper CCSBT-ESC/1708/33. In this paper, the patterns of catch compositions and CPUE distributions were explored based on the data from the Taiwanese longline fleets which operated in the waters to the south of 20°S in the Indian Ocean during 2002-2016. Based on suggestions made in previous CCSBT meetings, the cluster analysis approach for selecting data and CPUE standardisations was implemented for the central-eastern and the western areas separately. To select data from SBT fishing operations, cluster analysis was performed based on the weekly-aggregated data instead of set-by-set data. For CPUE standardisations, the simple delta-lognormal models without interactions were applied to avoid confounding from interactions. The standardised CPUE series generally reveal quite different trends in two areas. For the central-eastern area, the standardised CPUEs increased gradually before 2007, showed a decreasing trend from 2007 to 2011, increased substantially in 2012 and then decreased gradually but increased again in 2016. For the western area, the standardised CPUE series shows a generally decreasing trend with some fluctuation since 2002.

Agenda Item 9. SBT assessment including review of Close Kin abundance estimates

78. Australia and Japan prepared a joint report on the 2017 reconditioning of the SBT operating models for the stock assessment CCSBT-ESC/1708/14.

79. Paper CCSBT-ESC/1708/14 detailed the updating of the CCSBT Operating Model for new and revised data sources, as well as a range of sensitivity tests agreed by the OMMP group in Seattle and after the intersessional web meeting. The most recent estimates of relative (to the unfished state) Total Reproductive Output (TRO, the new measure of the reproductive population) are a median of 0.13 with an 80% probability interval between 0.11 and 0.17. Recent annual recruitment (from 2010 onwards) has been estimated to be above average, especially in 2013, given the very high aerial survey index in 2016. Ratios of both the current TRO and current fishing mortality to their MSY level, are around 0.5. These results are very consistent across the range of sensitivity tests, with only the test relating to structural changes to Indonesian selectivity resulting in noticeably more optimistic current status. Projections across the range of sensitivity tests were explored, focussing on the relative levels of TRO and the biomass of aged 10+ fish in 2035, and average levels of future TACs. Projections for the reference set using the Bali Procedure indicated that the CCSBT interim management target of recovery to 20% of the unfished stock by 2035 is achieved with a probability of 91% (using the TRO measure, or 88% if using total biomass aged 10+). The results across the sensitivity tests are all consistent, with only the Upq2008, high aerial survey CV and removal of the 2016 aerial survey tests resulting in slightly lower rebuilding levels (though all the current objectives remain achieved). In terms of issues relating to data generation for future

Management Procedure testing, the likelihood functions in their current format seem more than adequate for this purpose, with the exception that for the gene tagging data, which is currently not available, so will not be evaluated until next year.

80. Japan presented CCSBT-ESC/1708/35. In this document, additional diagnostics for the southern bluefin tuna (SBT) operating model (OM) are examined. Retrospective analysis was used to conclude that the estimation of stock status (biomass of age 10+ fish and TRO) as well as of its trend was not biased substantially by a less availability of information for the terminal year. A likelihood profile across the population scale parameter (log(B0)) showed that the catch-at-size (and catch-at-age) data had strong influences on the population scaling. Non-convergence issues were encountered, which would need further analysis.

81. During the meeting, Japan also provided additional retrospective analysis for the recruitment estimate and grid sampling weighted by the objective function for steepness in addition to M0 and M10, in response to requests. The results suggested that the subsequent removal of the terminal year of data has an impact on the associated recruitment estimate and on preferences for steepness parameter value.

82. The ESC reviewed the assessment and projections results, the specification of the reference set and retrospective analyses (**Attachment 9**). Stock status results are presented in section 10 below. These results (**Attachment 10**) are consistent across the sensitivity tests defined at OMMP8. The ESC concluded that the 2017 reference set of operating models provided robust stock assessment advice. There is a recent upward trend in the adult population which is a positive signal of rebuilding, recent recruitment is above the expected level, and current levels of fishing mortality suggest future rebuilding will be somewhat faster than initially envisaged in 2011. These positive recent trends may have implications for considering robustness tests for MP testing. In relation to the Bali Procedure's performance across the sensitivities, in all cases the 2011 rebuilding objective was met and in some case exceeded (Figure 1).

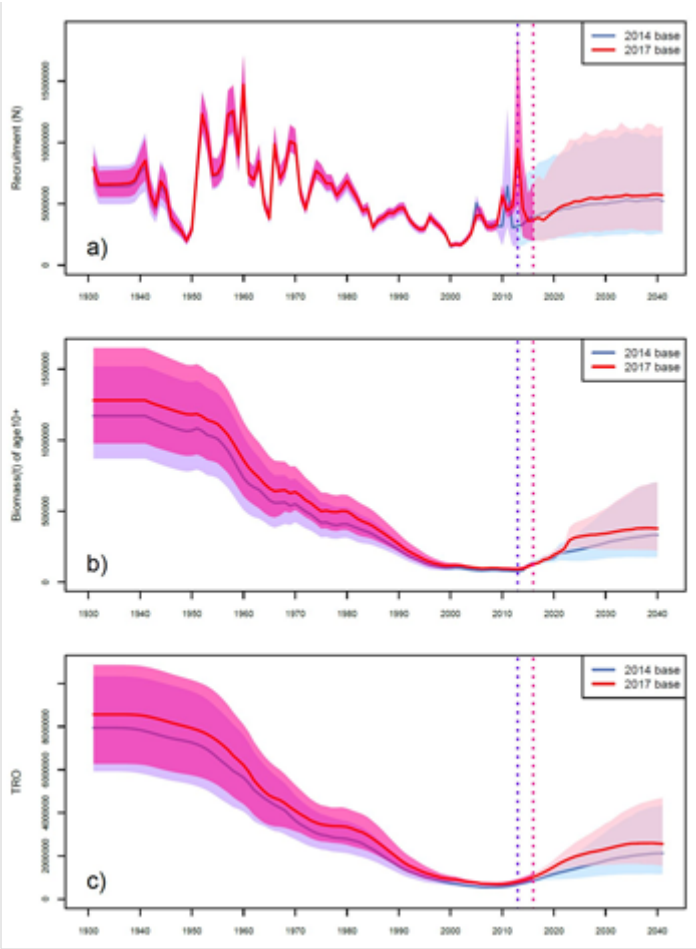

Figure 1: Historical and projected trajectories of the reference set for a) recruitment, b) biomass of age 10+ fish, and c) total reproductive output (TRO). The red line with the pink region represents the median and 90% probability intervals of the 2017 reference set (current assessment). The blue line with the light blue region represents those for the 2014 reference set (previous assessment). The dotted lines indicate the boundaries of the conditioning and projections.

83. The OMMP technical working group examined results of additional and more extreme scenarios to understand the data sources informing the productivity shift to higher values and recent positive trends. The ESC concluded that the reference set results are supported by the data.

84. The current reference set of OMs includes three values of steepness (h): 0.6, 0.7 and 0.8, with each given equal weight. This is a narrower range than assumed for the last stock assessment conducted in 2014, and for the OM used for testing the Bali MP. In both cases h ranged from 0.55 to 0.9. The extreme values (h= 0.9 and h=0.55) were dropped from the grid because they received very little support from the objective function (log likelihoods plus penalties). In particular, the support provided to values of h less than 0.6 has diminished since the 2014 assessment because of the upturn in estimated recent recruitments. These increases in recruitment estimates, to levels well above those predicted by any of the stock-recruitment models considered, were driven by the increase in the aerial survey indices since 2013. The LL1 fishery data have not yet shown evidence of above-average (over the past 2-3 decades) recruitments in recent (the past 5-10)

years. Nevertheless, the fit to the CPUE data is very good, which is facilitated by the high flexibility allowed in the estimation of the LL1 selectivity which results in somewhat lower selectivity of the young age classes in the last three years. The information provided by the CPUE data on the size of these incoming year classes will improve as they become more fully selected by the LL1 fishery.

85. The fits of the recruitment estimates to a stationary Beverton-Holt function seem poor (Fig. 2). Residuals have strong trends (Fig. 3) reflecting persistent periods of high and low productivity. However these can be well described as an autoregressive process of order 1 with an estimated coefficient around 0.7 (i.e. the Beverton-Holt form provides a satisfactory fit to these recruitment estimates if one is prepared to accept the presence of such high auto-correlation). The last pulse of strong estimated year classes, which results in positive residuals, was preceded by a period in the 1980s and 1990s where residuals were predominantly negative. The existence of such trends influence how much support the model gives to the different values of steepness under the stationarity assumption, as seen in the retrospective analysis (Fig. 4). While this implies that the penalised-likelihood weights are not a robust basis for weighting the values of steepness in the reference set of OMs, the appearance of the recent strong year classes when the spawning biomass is still low, particularly if confirmed with more years of data (especially from the LL1 fleet), would indicate that the preceding declines in recruitment cannot simply be explained as a result of low steepness and recruitment overfishing.

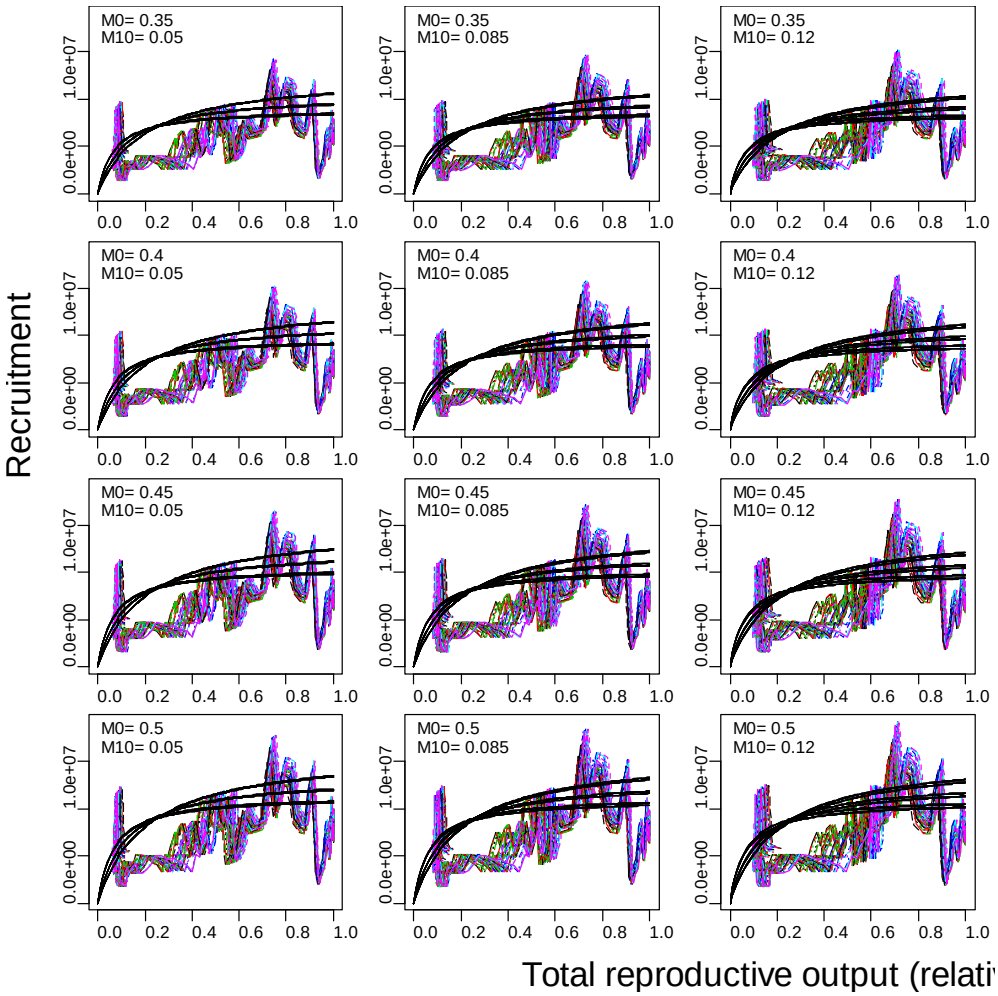

Figure 2: Fits to Beverton-Holt stock-recruitment functions for different values of M0 and M10 conditioned on three different steepness values (h=0.6, 0.7, 0.8).

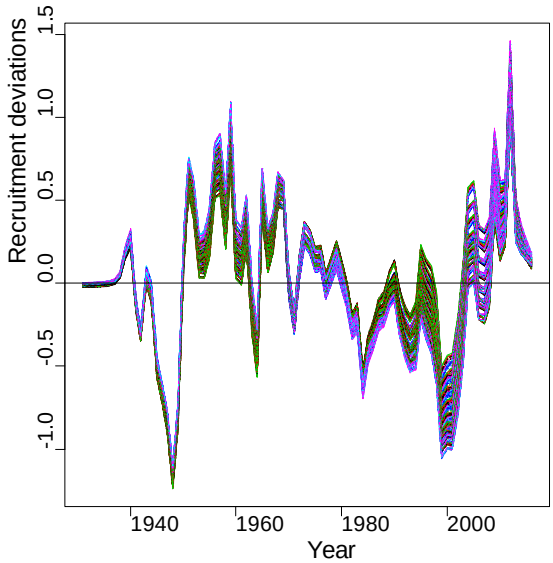

Figure 3: Residuals of the fits to Beverton-Holt stock-recruitment functions.

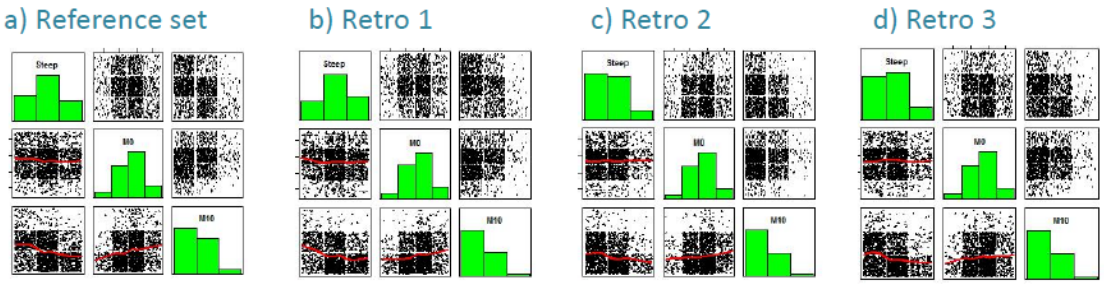

Figure 4: Changes in the support given by the model (objective function weights) to different values of steepness, M0 and M10 resulting from the successive removal of one-year worth of data in the conditioning of the OM (see paper CCSBT-ESC/1708/35 for a description of the retrospective analysis).

86. The penalty function for stock-recruitment residuals used for the assessment tends to favour intermediate values of steepness (around 0.6), rather than higher ones, but this is more than offset by the log likelihood contribution from the aerial survey indices. This penalty function treats the stock recruitment residuals as independent. Allowing for autocorrelation in these residuals (e.g. a fixed value) in the conditioning of the OMs would downweight the value of the overall stock-recruitment penalty, with consequent greater favour for higher values of steepness.

87. A new formulation for total reproductive output (TRO) is used in place of Biomass age 10+ (previous definition of spawning stock biomass) to represent relative reproductive success of spawning adults. Details are provided in paper CCSBT-OMMP/1706/04 and CCSBT-ESC/1609/BGD04.

88. The 2017 stock assessment incorporates, for the first time, the new half-sibling-pair data from the close-kin mark-recapture work, and additional parent-offspring-pair (POP) data that extend the existing POP data. The analysis of these data, which was funded by the CCSBT, provides information in the OMs on absolute abundance, on trends in abundance and information on natural mortality.

Agenda Item 10. SBT stock status

10.1. Evaluation of meta-rules and exceptional circumstances

89. At its Eighteenth annual meeting in 2011, the CCSBT agreed that a MP would be used to guide the setting of the SBT global total allowable catch (TAC). The CCSBT also adopted the meta-rule process as the method for dealing with exceptional circumstances in the SBT fishery (ESC 2013). 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.

90. 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.

91. Australia presented CCSBT-ESC/1708/15 on the meta-rules for the CCSBT Management Procedure (MP) which involves an annual review of the input

monitoring series for the MP and fishery and stock indicators. The purpose of the review is 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 2017 ESC would review MP implementation in the context of the TAC for 2018, recommended at the 2016 meeting of the ESC. Issues of potential concern in 2017 include: 1) changes in estimates of the population dynamics and productivity of the stock; 2) the unresolved shift in selectivity in the Indonesian fishery since 2013; and 3) potential for total catches (Members and non-Members) to be greater than the TAC (either annually or over the quota block). The projections for rebuilding the stock, using the Bali Procedure MP and reference set of reconditioned operating models, indicate that the population dynamics are different to the operating model conditioned when the MP was tested. The change is positive, in that rebuilding may potentially occur earlier or with higher probability. The operating model changes do not impact directly on the MP or TAC advice and therefore no action on the 2018 TAC is required. The potential changes in population dynamics will impact on testing candidate MPs to replace the existing MP in 2019. The second issue of change in selectivity in the Indonesian fishery is of continuing concern, but not for the operation of the MP and 2018 TAC advice; rather the concerns related to the monitoring of the spawning stock, close-kin sample collection, the impact on OM conditioning and advice on stock status. For the third issue, progress has been made by the EC to account for all sources of mortality; however, uncertainties remain and limited information is available on quantities of additional mortality that will be accounted for by Members in 2018, or the historical estimates for these sources. These data are required for reconditioning operating models and management strategy evaluation of candidate MPs in 2018.

92. Japan presented paper CCSBT-ESC/1708/27. In this document, values of the core vessels' longline CPUE and aerial survey (AS) indices (two required inputs to the Bali management procedure) were compared to projection results obtained from the SBT operating model (OM). The most recent observations for the CPUE index and the AS index fell within the 95% probability envelopes predicted by the Base case OM in 2011. Regarding a decision on implementation of the recommended TAC (calculated by the MP in 2016 for the 2018-2020 fishing seasons) for the 2018 season, it is considered that no modification of the value of this TAC is required because: 1) no unexpected change has been detected in the fisheries' indicators examined; 2) there are no indications of any appreciable decline in recruitment indices for 2017: and 3) there is no evidence to support a declaration of Exceptional Circumstances from the viewpoints of a check of the OM predictions, this year's in-depth stock assessment/projections, and other potential reasons (Indonesian small fish catch, over-catch of reported global TAC, unaccounted catch mortality(UAM)). Even if additional UAM was assumed for the UAM1 sensitivity scenario, it was projected that the stock can reach the rebuilding target with high possibility (80%). For this scenario, UAM was assumed +40% for small fish and +14% of large fish in projections (on average 3,054 – 5,671 t/year from 2017 to 2040).

93. Based on the review of fishery indicators (paragraph 72) and papers (CCSBT-ESC/1708/15 and 27), the ESC noted that the following three issues needed

consideration in the context of the meta-rules for the current TAC for 2017 and the TAC recommendation for the 2018-2020 quota block:

- Changes in population dynamics as indicated by the updated OMs and recent high recruitments.
- The small/young fish in the Indonesian size/age data (2012/13 to 2014/15 seasons)
- The potential scale of unaccounted mortalities

Updated estimates of population dynamics

94. The ESC conducted a full stock assessment as scheduled for the Bali Procedure. The structural changes made to the models after the incorporation of the close-kin data, together with some positive signs in the CPUE and, mainly, in the recent aerial survey data resulted in a more optimistic outlook in terms of current stock status, recent recruitment trends and prospects for rebuilding relative to the last full stock assessment (ESC19) and the conditioning of OMs used to tune the Bali Procedure (ESC16).

95. The ESC noted that updated estimates of rebuilding are strongly influenced by the estimates of recent recruitment, which are driven by the high aerial survey indices, and are not yet apparent in the long-line data. The ESC recalled that the impact of the high 2016 aerial survey data point was investigated at ESC21, as part of the implementation of the MP to provide the 2018-20 quota block, and the ESC concluded there was no reason to take action to modify the 2017 TAC or the TAC recommended for 2018-20 (ESC21, paragraph 142). The investigations at ESC21 demonstrated that the TAC increase recommended by the MP for the 2018-20 quota block was driven by the sustained positive trend in CPUE, with the aerial survey index having a relatively minor influence (ESC21, paragraphs 159, CCSBT-ESC/1609/18). 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 current TAC.

Indonesian size/age data

96. The increase in the frequency of smaller and younger size and age classes in the spawning ground catch monitoring was reviewed.

97. The ESC considers that this remains a priority issue to resolve for the monitoring of the spawning stock and conditioning the OMs. However, it is not an issue for the operation of the MP because the MP does not use these data directly. Hence, the ESC concluded there was no reason to take action to modify the 2018-20 TAC recommendation in relation to this exception circumstance.

Unaccounted mortality

98. Given the high uncertainty associated with the available information in 2016, ESC21 considered that the “Added Catch” sensitivity used in 2014 could not be ruled out as a plausible scenario for consideration of unaccounted mortalities. ESC22 reaffirms the view of ESC21.

99. The ESC noted that the potential for substantial levels of unaccounted mortality to have occurred were not considered in the design of the MP (ESC21, paragraph

145). If these levels are indeed true, they would amount to exceptional circumstances because the probability of rebuilding under the MP will be well below what was intended by the EC.

100. The ESC also noted that continuing to follow the MP as proposed does lead to continued rebuilding in the short term, even if the circumstances of the hypothesised additional unaccounted mortality are true (**Attachment 10**). Hence, the ESC advises the EC to continue to follow the MP as formulated but, as a matter of urgency, to take steps to quantify all sources of unaccounted SBT mortality.

101. The ESC noted the EC decision at CCSBT 23 to set aside 306 t of the recommended 2018-20 TAC for Non-Member catch.

102. Overall, the ESC concluded that there was no reason to take action to modify the 2018 TAC or the 2018-20 TAC recommendation in relation to these three possible exceptional circumstances.

103. The ESC also reiterated the need to take urgent steps to quantify all sources of unaccounted mortalities, as well as the request to Members, the CC and EC to provide information that will assist the ESC in quantifying estimates of these mortalities.

10.2. Summary of the SBT stock status

104. 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) from the updated reference set of operating models. 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 new proxy for SSB, and is based on a revised spawning potential estimate which has been 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; Fig. 5). 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. The 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.

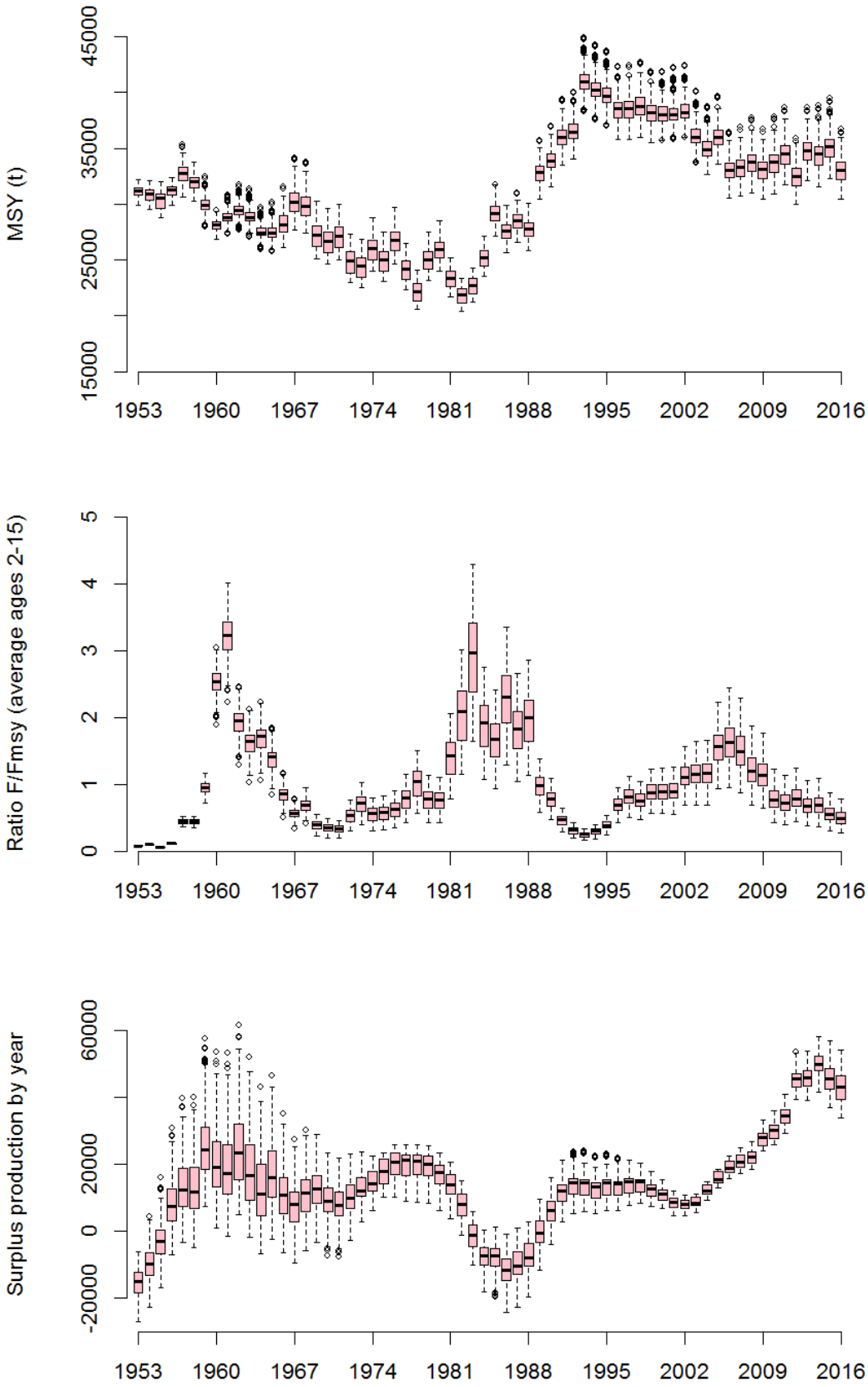

Figure 5: Summary of MSY (top), the ratio of F to F_{MSY} (middle), and surplus production (bottom) for the reference set of OMs. The surplus production is estimated by adding catch in year t and total biomass difference in year t from year t-1 together.

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

Southern Bluefin Tuna Summary of 2017 Assessment of Stock Status[2]	
Maximum sustainable yield	33,036t (30,000-36,000)
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: 14647 t in 2017, and 17647 t /yr for the years 2018-2020.

105. The ESC considered the updated indicators (**Attachment 8**). The overall results were summarised as follows:

- The two indicators of juvenile (age 1–4) SBT abundance (i.e. scientific aerial survey index and the trolling index) were available for 2017. Both the scientific aerial survey and trolling index decreased compared to 2016.
- Indicators of age 4+ SBT CPUE from the New Zealand domestic longline fishery increased in 2016.
- Recent Japanese longline CPUE indicators suggest that the current stock levels for the 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 age 8-11 group have increased steadily since 2011. The indices for age class 12+ have declined gradually since 2011.
- The Taiwanese standardised CPUE for the central-eastern and the western areas reveal quite different trends. For the central-eastern area, this CPUEs increased gradually before 2007, showed a decreasing trend from 2007 to 2011, increased substantially in 2012 before decreasing gradually and then increased again in 2016. For the western area, the standardised CPUE series indicates a generally decreasing trend with some fluctuation after 2002.
- The Korean standardised CPUE series has shown an increasing trend in recent years.

106. Overall there are signs of higher recruitment in recent years and there are some consistent positive trends in the longline CPUE. This suggests that some relatively strong cohorts are moving through the fishery, though they have yet to contribute to the spawning stock. The ESC noted that increased recruitment is of itself not necessarily indicative of increased spawning stock biomass.

[2] Values in parentheses are 10^{th} and 90^{th} percentiles.

Report on biology, stock status and management of SBT

107. 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 11**.

Agenda Item 11. SBT Management Advice

108. In relation to a New Zealand request, the ESC evaluated the potential impact of proposed changes to the carry-forward provisions (CCSBT-ESC/1708/29) on the operation of the MP. The proposed changes would remove the clause that currently prohibits the accumulation of carry-forward across multiple years. The change would not affect the existing safeguard which limits a Member's carry-forward to 20% of their country allocation in any given year.

109. The ESC recalled the analysis conducted during ESC19 where changes that allowed carry-forward across 3-year blocks were shown to have little impact on the MP performance. Members agreed that the changes proposed by New Zealand were also likely to have a limited impact on the MP. However, the ESC could not comment on the impact of any carry-forward provisions on the next MP that is currently being developed.

110. 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 (in particular to reduce the probability of future TAC decreases).

Stock status from 2017 assessment

111. 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 is estimated to be 11%, which is an increase from the estimate of 5% in 2011 and 7% in 2014. The current fishing mortality rate is below the level associated with MSY.

Implications from 2017 review of indicators

112. The review of indicators (agenda item 8) did not suggest any need for change to the conclusions drawn from the 2017 assessment. Overall there are signs of higher recruitment in recent years and there are some consistent positive trends in the age-based longline CPUE estimates (**Attachment 8**). This suggests that there may be some relatively strong cohorts moving through the fishery, though they have yet to contribute to the spawning stock. The ESC noted that increased recruitment is of itself 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.

113. The ESC noted the EC had deducted 306 t from the 2018-20 TAC recommended by the MP to account for Non-Member catch. Given the high uncertainty associated with the available information the ESC considered that the "Added Catch" sensitivity used in 2014 could not be ruled out as a plausible scenario for consideration of unaccounted mortalities and agreed to include an updated version of this scenario in development and testing of candidate MPs (paragraph 98).

Current TAC

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

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

Annual Review of implementation of current MP

115. In 2017 the ESC 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 aerial survey data), the question of unaccounted mortality, reported catch, length and age of Indonesian catches on the spawning ground and the results of reconditioning of the CCSBT Operating Models. The ESC concluded there was no reason to take action to modify the 2018 TAC recommendation in relation to its review of exceptional circumstances.

MP TAC Recommendations

116. Based on the results of the MP operation for 2018 – 20 undertaken in 2016 and the outcome of the review of exceptional circumstances in 2017 in Agenda Item 10.1, the ESC recommended that there is no need to revise the EC's 2016 TAC decision regarding the TAC for 2018-20. Therefore, the recommended TAC for 2018 and the 2018-20 quota block remains 17,647 t.

Agenda Item 12. Development of new MP

117. Australia presented CCSBT-ESC/1709/16 which provides an overview of the MP development and testing process that lead to the adoption of the "Bali Procedure" and its implementation as context for the ESC's consideration of the work plan for development of a new MP. The results of the most recent reconditioning of the CCSBT Operating Models (OMs) indicate incremental improvement in the stock status since the last full stock assessment and preliminary projections suggest substantially higher recent productivity (and associated rate of rebuilding) than estimated when the Bali Procedure was adopted and at the time of the 2014 full stock assessment. These results have implications both for what might be considered desirable attributes and behaviour of a new MP, in terms of "post-rebuilding" behaviour and performance, and for the likely consultation and engagement requirements between the ESC, EC and stakeholders to ensure that the tuning criteria and performance measures used to test likely performance of Candidate MPs (CMPs) adequately reflect the objectives of the EC. In light of this, the paper suggests that the ESC may wish to recommend extending the

process for the development of a new MP for one year to i) reduce the uncertainty in the estimates of strength of recent recruitments and related indication of increased productivity; ii) allow for sufficient iteration between the technical development of CMPs and ESC review and advice; and, iii) dialogue between the ESC and EC on desirable behaviour and performance measures for CMP to meet the objectives of a rebuilding strategy and longer-term goals for the management of the SBT fishery.

118. The small technical working group discussed the advice to the EC on the OM result for MP development, the reference set for MP testing, robustness trials and performance measures, and the MP development work plan. The current OM and projections results indicate that the stock remains depleted (13% of initial TRO), i.e. below commonly accepted limit reference points, but that it may rebuild to the interim target more quickly than anticipated in 2011. However, further exploration of the sensitivity tests indicated that the increased productivity was primarily driven by the AS time series (not just the most recent 2016 high point) and that extra years of data in the other time series would be needed to improve the reliability of these model estimates of high recruitment.

119. The current MP was developed in the context of the EC's decision and strategic plan. These involved an interim rebuilding objective (20%SSB0 by 2035 with 70% probability), and a limit below which the stock size should not be allowed to fall (SSB2010). Given that the current projections results indicate that the interim rebuilding target may be reached earlier than anticipated (in the next 1 or 2 TAC blocks), the ESC discussed the need for consultation and advice from the EC on:

- Objectives beyond the interim rebuilding target; and
- Desirable behaviour of candidate MPs pre- and post-rebuilding.

120. The ESC discussed the desirable behaviour and existing performance measures to consider and review for a new MP:

- Consideration of costs and benefits of alternative rebuilding strategies including those that favour stock rebuilding over short-term catch increase (as described in the CCSBT strategic plan, Strategy 1);
- Longer term behaviour of an MP with respect to biomass and catch levels;
- Continued avoidance of TAC decreases after increases;
- Continued avoidance of Spawning Stock Biomass falling below some specified minimum level; and
- Other operational requirements (e.g. maximum and minimum TAC changes)

The ESC requests that the EC Members give consideration to these matters intersessionally, given that specific guidance on these aspects will be requested from the 2018 EC meeting. The ESC will provide quantitative advice on trade-offs from MP trials conducted in the interim.

121. The ESC noted that the CCSBT strategic plan provides some guidance on longer term objectives that may be used for preliminary development of candidate MPs in 2018.

Reference set and robustness tests for MP testing

122. The ESC decided on the final structure of the grid to define the reference set of OMs to be used for MP testing:

Table 2: MP Base set.

Parameter	Value	Cumul N	Prior	Sampling
h	0.60,0.70,0.8	3	uniform	Prior
M_0	0.35,0.4,0.45,0.5	12	Uniform	ObjFn
M_{10}	0.05,0.085,0.12	36	Uniform	ObjFn
W	1	36	Uniform	Prior
CPUE	w0.5, w0.8	72	Uniform	Prior
CPUE age range	4-18,8-12	144	0.67,0.33	Prior
Psi	1.5,1.75,2.0	432	0.25,0.5,0.25	Prior

123. The ESC agreed to include unaccounted mortality as part of the reference set following the specifications in the current UAM1 scenario for the purposes of MP-testing in 2018.This will account for uncertainty in total catches in the MSE as agreed in 2016 with respect to discussion of the "MP approach". The "added-catch" (UAM1) scenario was defined by OMMP5 in 2014 based on the information available at the time. The scenario was updated in 2017 for the additional years in conditioning and is currently implemented as unaccounted catch increasing from 0 t in 1990 to 1,000 t in 2013, and 1000t in 2014-16, both for smaller fish and larger fish. The UAM1 scenario includes the reference set assumptions regarding surface fishery catches in conditioning and projections agreed at OMMP8. For future projections, the added catch was to remain at the same proportion of the TAC as in 2016. The unaccounted mortalities are assigned to the fisheries to whose size distributions there is the closest match (fishery 1 and 4 in the projection model). It should be understood that these fisheries are not necessarily the source of the unaccounted mortality; rather this is an expedient way to implement the scenario.

124. The ESC noted that additional information on UAM had become available since the original specification of UAM1, which may be used to refine this scenario for MP testing. Members were encouraged to undertake more comprehensive analyses intersessionally and provide specific proposals for revisions to OMMP9 (July 2018). This MP base set will ensure that the new MP is robust to uncertainty in total catches at this level.

125. A technical working group discussed robustness tests for testing candidate MPs. Working from the list developed at OMMP8, each robustness test was reviewed and updated, or deleted if no longer relevant, and additional robustness tests were added to the list. The new list of robustness tests is:

Table 3. List of robustness test for MP testing

Test name	Conditioning	Projections
SFOC40	40% overcatch by Australian surface fishery: ramps up from 1% in 1992 to 40% by 1999 and onwards to 2016. - Adjust the age composition as was done for the 20% method.	- Continued 40% overcatch in projections
SFO00	No historical additional catch in surface fishery	No future additional catch in surface fishery
LL1 Case 2 of MR	LL1 overcatch based on Case 2 of the 2006 Market Report	

IS20	Indonesian selectivity flat from age 20+	
High_aerialCV	In conditioning set process CV to 0.4	
Aerial2016	Remove the 2016 aerial survey data point	
CPUE related		
Upq2008	CPUE q increased by 25% (permanent in 2008)	
Omega75	Power function for biomass-CPUE relationship with power = 0.75 (retain)	
S00CPUE	Overcatch had no impact on CPUE	
S50CPUE	50% of LL1 overcatch associated with reported effort	
Updownq	Increase in catchability (0.5) in 2009 then returns to normal after 5 years	
GamCPUE	Use the "GAM CPUE" series provided from Australia under the 2017 CCSBT data exchange. This is the monitoring CPUE series 3.	
Base CPUE w/o area 7	As a sensitivity to note a possible concentration effect on CPUE.	
Constant squares CPUE		
Variable squares CPUE		
High future CPUE CV	Increase the future CPUE CV to 30% (currently 20%)	
Incomplete tag mixing	Sensitivity to incomplete mixing of tagged fish released in the WA and GAB. Increases fishing mortality of tagged fish by 50% relative to the whole population for the surface fishery (season 1).	
Piston line	Includes the piston-line troll survey index as additional recruitment index. Increase CV of aerial survey to preclude aerial survey dominating the fit, given apparent conflicts in the data.	
GTI	Includes the grid type trolling index as additional recruitment index. Increase CV of aerial survey to preclude aerial survey dominating the fit, given apparent conflicts in the data.	
Independent close-kin	TBD based on independent close-kin stand-alone estimates	
q_hsp1	Set HSP proportionality coefficient to 1	
Psi	Grid sampling using objective function weighting psi. Objective function weighting instead of uniform for psi.	
Noh.8	Change steepness (h) preference weighting to 0.5, 0.5, 0.0 to examine impact of excluding h=0.8 on projections.	
h=0.55		
Corrugated selectivity	Reversing order of estimates at decadal scale	
Bimodal selectivity	The most extreme case shown in Fig. 11 of the OMMP 8 report	
Alternate bimodal and recent selectivity		
Drop q increase	of 0.5% yr-1 in future years	
Gene tagging variant	To be decided	
POPs only	Implemented by increasing the variance on other trend data or some other approach	
AR-B0	AR process applied to B_0	
Non-stationarity in B_0	Non-stationarity in B_0 based on historical analysis	
Non-stationarity in the slope of the stock-recruitment relationship	Non-stationarity in the slope of the stock-recruitment relationship of B-H based on historical analysis of residuals	

Missing MP data inputs	To be decided	

126. The IS20 scenario was retained to provide a bound, although it was considered to have very low plausibility.

127. CPUE constant squares and variable square scenarios were added for robustness testing purposes as these are the extreme bounds of hypotheses for CPUE and will provide greater contrast than is available from the existing CPUE series. This also replaces the "ST-windows" CPUE which is not currently available.

128. A "high future CPUE CV" test was added, because of potential for changes in the longline fishery in future.

129. A scenario where steepness equal to 0.55 was added to test for MP robustness to lower productivity.

130. The "targeted selectivity" test was removed because examination of residuals indicated this was not occurring.

131. Methods to address non-stationarity in the stock-recruitment relationship were discussed. A technical group agreed that an auto-regression process added to either of the parameters in the stock-recruitment relationship (slope or B0) would constitute an adequate robustness tests for uncertainty in future recruitment dynamics.

132. The group discussed approaches for dealing with missing data and several suggestions were made.

The workplan

133. The following timetable, for scheduling of the MP development and consultation work with the EC, was developed and agreed by the ESC for consideration and adoption by the EC. This was based on work at OMMP8, in paper 16, and from prior experience in MP development in 2009-2011. It allows for an extra year of MP work before the 2021-2023 TAC recommendation, previously scheduled for 2019, is made in 2020. The delay in providing TAC advice until 2020, is to allow time for adequate, iterative MP development work and consultation between the ESC and the EC, and for the separation of adoption of the MP and the first TAC recommendation. The proposed workplan also allows for updated reconditioning of the operating models in 2019 to include updated data, including the gene-tagging estimates, which may provide more information on year classes that appear to be very strong in the current reconditioning. The delay will allow for an extra year of gene-tagging data, and other MP input data, to be included in the MP TAC recommendation in 2020, and has the consequence of dropping the 1 year lag (between TAC advice and implementation) for the initial TAC implementation of the new MP. This impacts in particular on Australia and New Zealand because their 2021 quota year will start prior to, or immediately after, the 2020 EC provides TAC advice. This lag was also dropped in 2011 when the Bali Procedure was adopted and first implemented. The ESC noted there was a contingency plan, in 2020, for an extra meeting should it be necessary, and the regular MP schedule of activities would resume with an updated stock assessment in 2020.

134. The session for interaction with stakeholders, which is planned in 2019, is intended to be a similar to the meeting in Busan, Korea in 2004. It was noted that this meeting should include participants from all Members, not only from the Members involved in the development of the new MP. Concern was expressed about the budget implications for convening the meeting and adequate attendance. The ESC emphasised the importance of sufficient prior consultation with stakeholders within Member States as well as for inter-Member consultation to ensure general acceptability of the revised MP.

135. Experience in both the CCSBT and other RFMOs has pointed to the value of having multiple groups tabling candidate management procedures (CMPs) for an iterative process that refines and improves these before a final MP selection is made. For this reason, Members are encouraged to contribute to the MP development process.

Workplan for MP development and consultation

2017		
October	CCSBT	Qualitative discussion of rebuilding objectives in the light of the updated projection results.
2018		
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. EC confirms or amends broad recovery objectives based on advice from the ESC.
2019		
June/July	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 and a session for interaction with stakeholders.
October	EC	Aim to select and adopt MP.
2020		
June	Special ESC/EC meeting	Contingency placeholder in case more time is needed to complete evaluation
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.

Agenda Item 13. Update of SRP

136. A 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). Sampling was classified as a high priority by the ESC with

the aim of establishing a combined collection of ovaries and otoliths 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 proposal was made that 10 ovaries should be collected in each of the 5cm length classes from 110-220cm, from each of the statistical areas 4-9 and 14. Sampling in the non-spawning months in areas off the spawning or staging grounds is central to obtaining an unbiased estimate of size and age at first maturity. The presence of 'maturity markers' in histological sections of the ovaries can be used to distinguish mature-resting from immature females. The presence of these maturity markers in SBT ovaries has been demonstrated in fish sampled in Australia in June 2014, confirming that the methods proposed are appropriate for SBT. Over recent years a number of Members have collected otoliths and ovaries from the proposed strata and some have initiated processing.

137. Provision of a representative estimate of size- and age-at-maturity of SBT has been identified as a priority by the ESC for the CCSBT Scientific Research Program. Interested Members of the ESC convened to review progress against the work plan originally proposed in CCSBT-ESC/1409/23. The proposed approach involved collection of ovaries from representative samples of SBT from the southern parts of the range during the austral winter, when both immature and mature fish are expected to be mixed. The aim was to collect ovaries from 10 individuals per 5 cm size class between 110 and 220cm, for a total of 220 individuals per statistical area. A summary of the gonad material collected to date is provided in Table 4. The group considered the number and distribution of the samples collected to date and agreed that it would be beneficial to continue to collect for another austral winter (May-August 2018) to provide a more complete and balanced data set for analysis in 2019. Japan noted that this timetable should provide sufficient opportunity for samples to be collected from the more southern latitudes of Areas 8 and 9, and potentially, Area 7.

Table 4: Number of SBT ovaries collected in austral winter by CCSBT statistical area.

Member	No. of ovaries	Statistical Area	Year	Size range (cm FL)
Taiwan	508	8	2010-2016	60-185
Korea	223	8 &9	2015-2016	66-178
New Zealand	122	6	2014	
Australia	208	4	2014-2017	
Total	1061			

138. In light of this discussion the ESC proposed that the maturity workshop be scheduled for March 2019, which would provide time for additional sample collection and processing, exchange of training histology slides and associated criteria (for identification of maturity markers), and initial classification of histological sections prior to the workshop (see **Attachment 12**). The purpose of the workshop would be to confirm consistency of identification of maturity markers and initial maturity classification of samples by Members, collation and exploratory analysis of the full data set across the SBT range and discussion and

design of final analysis. Following the workshop, the final data set will be analysed using the method described by Farley et al. (2014) to produce an updated maturity schedule.

Agenda Item 14. Requirements for Data Exchange in 2018

139. The Secretariat presented paper CCSBT-ESC/1708/05 (Rev.1). The requirements for the 2018 data exchange were discussed and agreed in the margins of the meeting. These requirements were endorsed by the ESC and are provided in **Attachment 13**.

140. The meeting also agreed to accept South Africa's revised catch and effort data for 2005-2015. The differences to South Africa's originally submitted data and reasons for the differences are summarised in Attachment B of paper CCSBT-ESC/1708/05 (Rev.1). The revised data will be incorporated into the CCSBT's catch and effort databases after the meeting.

Agenda Item 15. Research Mortality Allowance

141. The CCSBT request for RMA for the 2018 gene-tagging program (CCSBT-ESC/1708/08), is 3 tonnes for incidental mortalities that may occur during gene-tagging in February-March 2018. The 2018 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.

142. Australia presented paper CCSBT-ESC/1708/17 which requested 1.2 t of RMA for 2018 to continue a study on the health of wild SBT. In considering this request the ESC noted that the majority of the research published to date had been conducted on farmed SBT. In agreeing to the RMA request for the upcoming year the ESC requested that the researchers provide a paper to ESC23 which more clearly outlines the important scientific and ethical benefits to the assessment and management of wild SBT stocks that can come from this research. Australia advised that it would ensure that the researchers provide the paper requested next year.

143. Japan presented paper CCSBT-ESC/1708/28 which reported that 0.281 t out of 1.0 t of RMA approved for 2017 was used in the 2017 trolling survey (CCSBT-ESC/1708/22). Japan requested 1.0 ton of RMA for the 2018 trolling survey. Japan's request was endorsed by the ESC.

Agenda Item 16. Ecologically Related Species Working Group (ERSWG)

16.1. Report of the Ecologically Related Species Working Group

144. The Chair advised that the 12th meeting of the ERSWG was held from 21 to 24 March 2017, and that the Terms of Reference for the ERSWG specifies that the Ecologically Related Species Working Group will report to the Commission

through the Scientific Committee, and that the Scientific Committee may provide comments to the Commission on the report.

145. The report of 12th meeting of the ERSWG is provided at **Attachment 14**. The Secretariat advised that the recommendations and advice from the ERSWG to the EC are provided at paragraphs 154 to 161 of the ERSWG's report. The recommendations focused primarily on issues to do with seabird and shark population status and risk assessments, and seabird mitigation measures.

146. The ESC was invited to consider whether it wished to provide comments to the EC on any aspects of the ERSWG's report. The ESC did not provide any comments.

16.2. Review of the CCSBT Scientific Observer Program Standards

147. It was noted that the ERSWG had requested the ESC to perform a review of the Scientific Observer Program Standards. The requested review was to consider the incorporation of electronic monitoring, and harmonising the life status codes used by observers with the codes used by scientific observers for other tRFMOs. The ERSWG noted that for these aspects to be considered by the ESC, a Member would need to provide a specific proposal to the ESC.

148. Australia presented paper CCSBT-ESC/1708/18 which provided an initial examination of CCSBT observer program standards collected using electronic monitoring (EM). The paper assesses the capability of EM technologies to collect at-sea observer data fields as listed in the CCSBT Scientific Observer Program Standards. This assessment draws upon the work undertaken by participants at the Western Central Pacific Fisheries Commission (WCPFC) Electronic Monitoring (Longline) Technical Standard Workshop (see, SPC, 2016; ESC22_BGD03). The capability of EM to collect each data field is assessed as available now (EM Ready) to possibly available in the future (EM with Work) to unavailable (EM not likely) and not applicable (not assessed) if this field was not examined at the WCPFC technical standard workshop (i.e. unique CCSBT data field).

149. The ESC agreed to recommend that the CCSBT Compliance Committee form an EM Working Group to develop "Standards for electronic monitoring programs within CCSBT". The ESC would contribute to this EM Working Group by providing advice on the consequences of EM for scientific data collection. The proposed EM Working Group should liaise and collaborate with its equivalent group within the WCPFC to exchange information on the application of EM in tuna fisheries. Opportunities to collaborate with the IOTC should also be explored.

150. The meeting noted that it is also worth considering including this in a broader review of the Scientific Research Programme, as the last full review was conducted in 2013. This would allow full consideration of the relative priority of different activities. The ESC also note that the timing of such a review could usefully coincide with the requirements for a new MP.

Agenda Item 17. Workplan, Timetable and Research Budget for 2018 (and beyond)

17.1. Overview, time schedule and budgetary implications of proposed 2018 research activities and implications of Scientific Research Program for the work plan and budget

151. The ESC's three-year workplan for 2018 to 2020 is provided at **Attachment 15**.

152. CSIRO clarified that the current "collection and processing of close-kin samples" project covers the cost of sample collection, DNA extraction and sequencing of DNA Diversity Array Technologies Co. (DArT). This delivers to CSIRO the SNP data from which Close-kin are identified. To identify the kin there are two additional steps: i) genotyping and quality control of genotypes and ii) comparison of final genotypes among individual samples to identify Parent-Offspring and Half-Sibling pairs. The "Close-kin identification and exchange" project will fund the latter two steps so that the POPs and HSPs from the most recent 2 years of collection are available for the 2019 update of OMs and potential use in candidate MPs.

153. The ESC noted that a CPUE webinar may not be required in 2018 and that a decision would be made in May 2018 as to whether there was enough material for that to go ahead.

154. Resources required for the ESC's three-year workplan are provided at **Attachment 16**.

17.2. Timing, length and structure of next meeting

155. The next ESC meeting is proposed to be held from 3 – 8 September 2018, in San Sebastian, Spain.

156. In addition, a five-day intersessional OMMP meeting is planned to be held in Seattle, USA during June/July 2018 and a one-day informal OMMP meeting is scheduled to be held immediately prior to the 2018 ESC meeting.

Agenda Item 18. Other Matters

157. Australia tabled CCSBT-ESC/1708/Info-01 for discussion within the small working group formed on this issue. The CCSBT tries to ensure that complete and accurate data are available to the EC to support its decision-making. As shown in the 2006 Japan Market Review (JMR) (see reference Polacheck, 2012, in CCSBT-ESC/1609/BGD02), the information derived from markets provides an essential source of information on the actual level of SBT catch. The purpose of this paper to inform the discussion on apparent unaccounted for catch. This further update of the 2014 paper from Australia (CCSBT-CC/0910/BGD05) provides estimates of retrospective unreported catch of SBT for calendar years 2009 to 2015. It uses the core agreed methods and assumptions of the 2006 JMR. It also analyses the data gained in the monthly market monitoring at Tsukiji market (see last paper on this from Japan – CCSBT-CC/1410/19). This paper identifies how the uncertainties over the apparent continued large overcatch can be resolved, using existing information. The supply of the following existing

information held in Japan (and supplied to the 2006 JMR) would start to clarify the extent of the apparent overcatch identified in this paper: (1) An exact break-down of the SBT data supplied to the JFA by the 5 Tsukiji auctioneers - separated into auctioned and sold outside the auction, which is farmed and non-farmed, and the source country of the auctioned and non-auctioned frozen SBT. These data are held by both the auctioneers and by Tokyo Metropolitan Government (TMG); (2) From the Tokyo Metropolitan Government (TMG), the source country of frozen SBT auctioned at Tsukiji market. These raw data are held by both the auctioneers and TMG; (3) The source country of frozen SBT auctioned at Yaizu. These data are held by the owners of the market; and (4) Currently, some papers in recent years on this issue are declared confidential and this excludes them from consideration by external experts. Australia request that the confidential status be removed on these documents, and on the data in (1) to (3) above.

158. Australia tabled CCSBT-ESC/1708/Info-02 for discussion within the small working group formed on this issue. Since 2008, the ESC has reviewed papers that propose there is unaccounted catch mortality in the Australian SBT ranching process (i.e. the Australian surface fishery (ASF)). While these note that Australia is declaring the correct number of SBT caught, they propose that the method of the government taking the actual weight and length (of ~3,000 fish @ 100 fish ≥ 10kg sample/tow) is potentially under-stating the weight into the pontoons. This is based on the hypothesis that "*It seems highly unlikely that farmed SBT can obtain such high growth rates.*" This is based on the reasoning that there cannot be such a large difference in growth rates between wild and farmed SBT. The issue has been discussed in detail during official visits by the CCSBT Members, industry and scientists (invited) and by the CCSBT Quality Assurance Review (QAR) consultants in 2014 to report on the weight sampling process and all other parts of the supply chain. Until ESC/1409/11 in 2014, these hypotheses have never been tested against the very large public data base on tuna ranching and farming. As one base literature source on the issue notes – "Models for wild SBT are unlikely to be applicable to farmed fish." (Gunn et al. 2002). Growth rates are much faster in intensive farms than in the wild. This is not surprising – because accelerating the growth is one of the main purposes of aquaculture, particularly where it can take advantage of high seasonal growth. This Paper updates the Australian Papers submitted to the 2014, 2015 and 2016 ESC meetings. The aims of these reviews are to: (1) Outline some of the large literature base on growth in tuna farming and ranching, including the relevance of wild growth models to intensive, and often seasonal livestock production; (2) Test the plausibility of the "ASF unaccounted catch mortality" hypothesis conclusions against Feed Conversion Ratio (FCR), Condition Indices (CIs), the realities of fishing for farming in the Great Australian Bight (GAB), and other global Bluefin farming benchmarks; and (3) Note other issues with the methodology used to generate the "ASF unaccounted catch mortality" hypothesis (e.g. using wild tagged fish data). Information derived from scientific literature suggests farm growth performance of SBT is comparable with the growth performance of Atlantic Bluefin Tuna and Pacific Bluefin Tuna raised in farms in their respective areas. This is equally supported through an economic analysis and growth comparisons which do not support hypotheses of unaccounted catch mortality. To measure fish size into farms, there is a need to review use of data from catch and release studies for the determination of length / age coefficients

due to the stress as a direct result of handling and tagging. The resulting impacts could create incorrect length/age coefficients. Many of the issues/assumptions raised have been sufficiently addressed in this review using research information from all tuna ranching growing regions. The paper recommends, that Australia and interested Members continue intersessional information exchanges on the issue and that the Compliance Committee again considers the issue.

Agenda Item 19. Adoption of Meeting Report

159. The report was adopted.

Agenda Item 20. Close of meeting

160. The meeting closed at 12:02 pm on 2 September 2017.

List of Attachments

Attachments

Attachment 1

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

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Attachment 2

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

Yogyakarta, Indonesia
28 August - 2 September, 2017

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 OMMP meeting

6. Report from the CPUE modelling group

7. Review of results of the Scientific Research Program and other inter-sessional scientific activities

8. Evaluation of Fisheries Indicators

9. Stock assessment including review of Close Kin abundance estimates
- 9.1 Review of Close Kin abundance estimates
- 9.2 Update of stock assessment for SBT

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

13. Update of SRP

14. Requirements for Data Exchange in 2018

15. Research Mortality Allowance

16. Ecologically Related Species Working Group (ERSWG)

16.1 Report of the Ecologically Related Species Working Group

16.2 Review of the CCSBT Scientific Observer Program Standards

17. Workplan, Timetable and Research Budget for 2018 (and beyond)

17.1. Overview, time schedule and budgetary implications of proposed 2018 research activities and implications of Scientific Research Program for the work plan and budget

17.2. Timing, length and structure of next meeting

18. Other Matters

19. Adoption of Meeting Report

20. Close of Meeting

Attachment 3

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

(CCSBT-ESC/1708/)

1. Provisional Agenda
2. List of Participants
3. List of Documents
4. (Secretariat) Secretariat review of catches (Rev.1) (ESC agenda item 4.2)
5. (Secretariat) Data Exchange (Rev.1) (ESC agenda item 14)
6. (CCSBT) The aerial survey index of abundance: 2017 updated results (ESC Agenda item 7)
7. (CCSBT) Progress report on the CCSBT pilot gene-tagging program in 2017 (ESC Agenda item 7)
8. (CCSBT) Progress in stage 1 of gene-tagging 2017 and Research Mortality Allowance request for gene-tagging 2018 (ESC Agenda item 7 and 15)
9. (CCSBT) Update on the length and age distribution of SBT in the Indonesian longline catch and close-kin tissue sampling and processing (ESC Agenda item 7)
10. (Australia) Preparation of Australia's southern bluefin tuna catch and effort data submission for 2017 (ESC Agenda item 4.1)
11. (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 7)
12. (Australia) SBT Close-Kin Mark-Recapture with Parent-Offspring and Half-Sibling Pairs: update on genotyping, kin-finding and model development (ESC Agenda item 7)
13. (Australia) Fishery indicators for the southern bluefin tuna stock 2016–17 (ESC Agenda item 8)
14. (Australia and Japan) Reconditioning of the CCSBT Operating Model in 2017 (ESC Agenda item 9)
15. (Australia) Assessment of stock status 2017 and meta-rules review of exceptional circumstances considerations (ESC Agenda item 10)
16. (Australia) Further consideration on the development and testing of new Management Procedures for SBT (ESC Agenda item 12)
17. (Australia) Research mortality allowance: Proposed allowance for 2018 and 2017 usage report (ESC Agenda item 15)

18. (Australia) An initial examination of CCSBT observer program standards collected using electronic monitoring (ESC Agenda item 16.2)
19. (Japan) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2016 (ESC Agenda item 4.1)
20. (Japan) Further responses from Japan to the Australian responses on farming papers in Attachment 6 of ESC21 Report (ESC Agenda item 7)
21. (Japan) Activities of southern bluefin tuna otolith collection and age estimation and analysis of the age data by Japan in 2016 (ESC Agenda item 7)
22. (Japan) Report of the piston-line tolling monitoring survey for the age-1 southern bluefin tuna recruitment index in 2016/2017 (ESC Agenda item 7)
23. (Japan) Trolling indices for age-1 southern bluefin tuna: update of the piston line index and the grid type trolling index (ESC Agenda item 7)
24. (Japan) Standardization of the grid type trolling index by environmental factors (ESC Agenda item 7)
25. (Japan) Monitoring of Southern Bluefin Tuna trading in the Japanese domestic markets: 2017 update (ESC Agenda item 7)
26. (Japan) Summary of Fisheries Indicators of Southern Bluefin Tuna Stock in 2017 (ESC Agenda item 8)
27. (Japan) A Check of Operating Model Predictions from the Viewpoint of the Management Procedure Implementation in 2017 (ESC Agenda item 10.1)
28. (Japan) Report of the 2016/2017 RMA utilization and application for the 2017/2018 RMA (ESC Agenda item 15)
29. (New Zealand) Request to evaluate the effect(s) of a proposed revision to carry-forward rules on the operation of the CCSBT Management Procedure (ESC Agenda item 11)
30. (Korea) Korean SBT otolith and ovary collection activities in 2015 and 2016 (ESC Agenda item 7)
31. (Taiwan) Preparation of Taiwan's Southern bluefin tuna catch and effort data submission for 2017 (ESC Agenda item 4.1)
32. (Taiwan) Updated analysis for gonad samples of southern bluefin tuna collected by Taiwanese scientific observer program (ESC Agenda item 7)
33. (Taiwan) CPUE standardization for southern bluefin tuna caught by Taiwanese longline fishery for 2002-2016 (ESC Agenda item 8)
34. (CPUE Chair) Report of June 2017 CPUE Web Meeting (ESC Agenda item 6)
35. (Japan) Additional diagnostics of the CCSBT operating model for the 2017 assessment (ESC Agenda item 9)

36. (OMMP Chair) Report of the OMMP Technical Webinar on incorporation of half-sibling pairs in the CCSBT OMs for the 2017 update of stock status (ESC Agenda item 5)

(CCSBT- ESC/1708/BGD)

1. (Australia) SRP proposal: Estimating size/age at maturity of southern bluefin tuna (*Previously* **CCSBT-ESC/1409/23**) (ESC Agenda item 13)
2. (Australia) Catch reporting under e-monitoring in the Australian Pacific Longline Fishery (*Previously* **CCSBT-ERS/1703/Info 03**) (ESC Agenda item 16.2)
3. (Australia) Summary report for the second e-reporting and e-monitoring intersessional working group meeting (*Previously* **CCSBT-ERS/1703/Info 04**) (ESC Agenda item 16.2)
4. (Japan) Examination of influence of absence of data from New Zealand chartered Japanese longline vessels on the core vessel CPUE and proposal of its solution (*Previously* **CCSBT-OMMP/1706/06**) (ESC Agenda item 6)
5. (Japan) A recommendation on the all vessels CPUE series considering loss of data from Japanese-flagged charter vessels in the New Zealand fishery (*Previously* **CCSBT-OMMP/1706/07**) (ESC Agenda item 6)
6. (Japan) Update of the core vessel data and CPUE for southern bluefin tuna in 2017 (*Previously* **CCSBT-OMMP/1706/08**) (ESC Agenda item 6)
7. (Japan) Change in operation pattern of Japanese southern bluefin tuna longliners in the 2016 fishing season (*Previously* **CCSBT-OMMP/1706/09**) (ESC Agenda item 6)
8. (Japan) Update of estimation for the unaccounted catch mortality in Australian SBT farming in the 2016 fishing season (*Previously* **CCSBT-OMMP/1706/10**) (ESC Agenda item 7)
9. (Japan) A review of Southern Bluefin Tuna trade and monitoring research in Japanese domestic markets (*Previously* **CCSBT-CC/1510/19**) (ESC Agenda item 7)
10. (Korea) Data exploration and CPUE standardization for the Korean Southern bluefin tuna longline fishery (1996-2016) (*Previously* **CCSBT-OMMP/1706/11**) (ESC Agenda item 6)
11. (Australia) Close-kin for SBT: where to now? (*Previously* **CCSBT-ESC/1309/17**) (ESC Agenda item 7)
12. (CCSBT) Close-Kin Mark-Recapture for SBT: options for the longer term (*Previously* **CCSBT-ESC/1409/44 (Rev.1)**) (ESC Agenda item 7)
13. (CCSBT) SBT Close-Kin Mark-Recapture: options for the medium term (*Previously* **CCSBT-ESC/1509/19**) (ESC Agenda item 7)

(CCSBT-ESC/1708/SBT Fisheries -)

Australia	Australia's 2015–16 southern bluefin tuna fishing season
EU	Annual Review of SBT Fisheries for the Extended Scientific Committee
Indonesia	Indonesia Southern Bluefin Tuna Fisheries: A National Report Yeay 2016
Japan	Review of Japanese Southern Bluefin Tuna Fisheries in 2016
Korea	2017 Annual National Report of Korean SBT Fishery (Rev.1)
New Zealand	Annual Review of National Southern Bluefin Tuna Fisheries for the Extended Scientific Committee
South Africa	South African National Report to the Extended Scientific Committee of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), 2017
Taiwan	Review of Taiwan SBT Fishery of 2015/2016 (Rev.1)

(CCSBT-ESC/1708/Info)

1. (Australia) Japan Market Update 2017 (ESC Agenda item 18)
2. (Australia) An update Review of Tuna Growth performance in Ranching and Farming Operations (ESC Agenda item 18)
3. (Indonesia) Indonesian Tuna Protocol Sampling: Case Study on Catch Monitoring in Benoa Port, Bali, Indonesia (ESC Agenda item 4.1)
4. (Indonesia) Indonesian Scientific Observer Program: Activities For Indian Ocean In 2015 And 2016 (ESC Agenda item 4.1)
5. (Australia) Absolute abundance of southern bluefin tuna estimated by close-kin mark-recapture (ESC Agenda item 7)

(CCSBT-ESC/1708/Rep)

1. Report of the Eighth Operating Model and Management Procedure Technical Meeting (June 2017)
2. Report of The Twelfth Meeting of the Ecologically Related Species Working Group (March 2017)
3. Report of the Twenty Third Annual Meeting of the Commission (October 2016)
4. Report of the Eleventh Meeting of the Compliance Committee (October 2016)
5. Report of the Twenty First Meeting of the Scientific Committee (September 2016)
6. Report of the Seventh Operating Model and Management Procedure Technical Meeting (September 2016)
7. Report of the Twentieth Meeting of the Scientific Committee (September 2015)

8. Report of the Sixth Operating Model and Management Procedure Technical Meeting (August 2015)
9. Report of the Nineteenth Meeting of the Scientific Committee (September 2014)
10. Report of The Fifth Operating Model and Management Procedure Technical Meeting (June 2014)
11. Report of the Special Meeting of the Commission (August 2011)
12. Report of the Sixteenth Meeting of the Scientific Committee (July 2011)

Attachment 4

Revised Template for the
Annual Review of National SBT Fisheries for the Extended Scientific Committee

1. Introduction
   - Background
   - Summary of historical developments in the fishery
   - Overview of the most recent fishing season
2. Catch and Effort
   - Trends by gear type (surface and longline)
   - Trends by area and season

   (Table should include: catch & effort for above strata as well as totals for the entire history of the fishery)
3. Nominal CPUE

   Where appropriate:
   - Trends by gear type (surface and longline)
   - Trends by area and season

   (Table should nclude: nominal CPUE for above strata as well as totals for the entire history of the fishery)
4. Size composition
   - Trends by gear type (surface and longline)
   - Trends by area and season

   (Figures should include: average size frequency distributions by gear type for each 10 year period, as well as individually for each of the last 5 years)
5. Fleet size and distribution
   - Trends by season
   - Trends by area

   (Maps should include: historical catch and effort by gear type for the entire history of the fishery, as well as individually for each of the last 5 years)
6. Research and monitoring to improve estimates of attributable catch

   Any research or monitoring activities focused on better understanding the level of mortality related to:
   - *releases and/or discards;*
   - *recreational fishing;*
   - *other sources (e.g. customary, traditional and/or artisanal fishing)*
7. Development and implementation of scientific observer programs[1]
   - Provide a report containing the information specified in Annex 1 on the sampling scheme and arrangements for collecting data from the Member's/CNM's observer program.
8. Other relevant information

[1] Section 11 and Attachment 2 of the CCSBT Scientific Observer Program Standards.

Notes:

- *Data on catches should be presented by both calendar year and fishing year.*
- *Weight data should be reported as whole weight, conversion factors used should be specified.*
- *Nominal CPUE, particularly for longline fisheries, should be expressed in standard units (eg, number of SBT per 1000 hooks).*
- *State where estimates are scaled from sample data.*
- *Where appropriate measures can be calculated.*

Annex 1

FORMAT OF NATIONAL REPORT SECTIONS ON DEVELOPMENT AND IMPLEMENTATION OF SCIENTIFIC OBSERVER PROGRAMS

(from the CCSBT Scientific Observer Program Standards)

REPORT COMPONENTS

The observer program implementation report should form a component of the annual National Reports submitted by members to the Scientific Committee. This report should provide a brief overview of observer programs for SBT fisheries, and is not intended to replace submitted papers containing proper analyses of collected observer data. This observer program report should include the following sections:

A. Observer Training

An overview of observer training conducted, including:

- Overview of training program provided to scientific observers.
- Number of observers trained.
- Summary of qualifications / training and years of experience of the observers deployed in SBT fisheries during the past year.
- A copy of the latest version of relevant manuals in their original language for reference

B. Scientific Observer Program Design and Coverage

Details of the design of the observer program, including:

- Which fleets, fleet components or fishery components were covered by the program.
- How vessels were selected to carry observers within the above fleets or components.
- How was observer coverage stratified: By fleets, fisheries components, vessel types, vessel sizes, vessel ages, fishing areas and seasons.

Details of observer coverage of the above fleets, including:

- Components, areas, seasons and proportion of total SBT catch, specifying units used to determine coverage.
- Total number of observer employment days, and number of actual days deployed on observation work.

C. Observer Data Collected

List of observer data collected against the agreed range of data set out in Attachment 1. In broad structure this would include:-

- Effort data: Amount of effort observed (vessel days, sets, hooks, etc), by area and season and % observed out of total by area and seasons
- Catch data: Amount of catch observed of SBT and other species (if collected), by area and season, and % observed out of total estimated SBT catch by area and seasons
- Length frequency data: Number of fish measured per species, by area and season.
- Biological data: Type and quantity of other biological data or samples (otoliths, sex, maturity, Gonosomatic index, etc) collected per species.
- The size of sub-samples relative to unobserved quantities.

D. Tag Return Monitoring

Number of tags returns observed, by fish size class and area.

E. Problems Experienced

- Summary of problems encountered by observers and observer managers that could affect the CCSBT Observer Program Standards and/or each member's national observer program developed in the light of the Standards.

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	24	0	0	5
2006	5,635		4,207	238		150	846	50	598	9	3	0	5
2007	4,813	0	2,840	379	4	521	841	46	1,077	41	18	0	3
2008	5,033	0	2,952	319	0	1,134	913	45	926	45	14	4	10
2009	5,108	0	2,659	419	0	1,117	921	47	641	32	2	0	0

Calendar Year	Australia		Japan	New Zealand		Korea	Taiwan	Philippines	Indonesia	South Africa	European Union	Miscellaneous	Research & Other
	Commercial	Amateur		Commercial	Amateur								
2010	4,200	0	2,223	501	0	867	1,208	43	636	34	11	0	0
2011	4,200	0	2,518	547	0	705	533	45	842	49	3	0	1
2012	4,503	0	2,528	776	0	922	494	46	910	77	4	0	0
2013	4,902	0	2,694	756	1	918	1,004	46	1,383	66	0	0	0
2014	4,559	0	3,371	826	0	1,044	944	45	1,063	50	0	0	1
2015	5,824	0	4,745	922	1	1,051	1,162	0	593	63	0	0	0
2016	5,962	0	4,721	951	1	1,121	1,023	0	601	64	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.

Attachment 6

Report of the CPUE Modelling Group

The working group held a web meeting on June 13th/14th 2017. Its results are given in CCSBT-ESC/1708/34 (Report of the June 2017 CPUE Web Meeting).

The web meeting had three substantive agenda items:

Web meeting agenda item 2 was: To agree which of the revised core CPUE series (that exclude the NZ chartered Japanese Long Line vessel that will no longer be available) is the most suitable replacement for our previous core CPUE series as an input to OM, MP and annual status advice.

Two working papers were provided by Japan in a commendably timely fashion that allowed the working group adequate time to consider their advice prior to the web meeting. These papers were tabled at the ESC as:

- CCSBT-ESC/1708/BGD04 (Japan) Examination of influence of absence of data from New Zealand chartered Japanese longline vessels on the core vessel CPUE and proposal of its solution, by Dr Tomoyuki Itoh; and
- CCSBT-ESC/1708/BGD05 (Japan) A recommendation on the all vessels CPUE series considering loss of data from Japanese-flagged charter vessels in the New Zealand fishery, by Dr Norio Takahashi.

Both papers considered options of either excluding the results from Areas 5 and 6 or alternatively of combining their results with those of the adjacent areas. All options gave CPUE series for past years that were very similar to results based upon the full data set. Their authors both recommended that the option of combining results from Areas 5 and 6 with the adjacent areas was better in that it used all available data. The working group agree that this was the best option for estimating the Base CPUE series in the future.

Web meeting agenda 3 was: To check and agree that the agreed core series behaves adequately as an input to OM, MP and annual status advice. This was addressed by two papers. The first was tabled at the ESC as:

- CCSBT-ESC/1708/BGD06 (Japan) Update of the core vessel data and CPUE for southern bluefin tuna in 2017, by Dr Tomoyuki Itoh and Dr Norio Takahashi.

This paper summarises the update of the BASE core vessel CPUE which is the abundance index of southern bluefin tuna used for the Management Procedure in CCSBT. The approach is as adopted in past years except that the option of amalgamating Areas 5 and 6 with the adjacent areas was employed to deal with the loss of the NZ charter data. Two Monitoring CPUE series were also updated.

In discussing this paper, a divergence was noted, since about 2006, between the reduced base series and the base series. It was thought that this merited further investigation in the following years work.

The second paper was tabled at the ESC as:

- CCSBT-ESC/1708/BGD06 (Japan) Change in operation pattern of Japanese southern bluefin tuna long-liners in the 2016 fishing season, by Dr Tomoyuki Itoh.

In this paper the operation pattern of the long-line fishing was examined by comparison between the most recent year and the previous 10 years. It provides helpful tables and figures to aid this comparison. The paper concluded that no remarkable change was found in the 2016 operational pattern and that consequently the Japanese long-line CPUE in 2016 continues to represents the change of SBT stock abundance in a consistent fashion.
In discussion it was noted that the size composition of the catch should be further studied for any impact on CPUE. It was also thought that further work would be merited on the effects of vessel age on catchability since there seems to be increased turnover in the fleet composition. The CPUE modelling group agreed it was content to continue to endorse the Base CPUE series for use in assessment and OMMP work.

Web meeting Agenda 4 was: To develop and encourage new work on CPUE series.
Two papers were presented. The first was tabled at the ESC as:

- **ESC/1708/ BGD 10** (Korea) Data exploration and CPUE standardization for the Korean Southern bluefin tuna longline fishery (1996-2016), by Simon Hoyle, Sung Il Lee and Doo Nam Kim.

This paper shows approaches to standardising Korean southern bluefin tuna (SBT) CPUE using Generalised Linear Models.

Two alternative approaches were applied to address concerns about target change through time. These were data selection and cluster analysis. CPUE results were standardised for Areas 8 and 9. The authors concluded that:

- Both areas show increasing standardised CPUE trends over the last 5 - 10 years;
- Relatively small sample sizes, few vessels and small area fished increase the variability of these series;
- Targeting and potential target change are important issues for these series; and
- Both cluster analysis and data selection do a reasonable job and provide similar outcomes;

Comparisons of these series with Japanese LL1 CPUE results from these two areas suggested they showed broadly similar trends and the CPUE modelling group considered this very encouraging. In its discussion it considered both of technical issues and the possible future use of this data series. For now it considered it most likely use to be as a new stock indicator and as a monitoring series. The paper was considered very useful both in providing independent series to compare with the Japanese CPUE and as an illustration of alternative approaches to CPUE analysis.

The second paper was revised and presented to ESC under ESC agenda 8 as:

- CCSBT-ESC/1708/33)(Taiwan) CPUE standardization for southern bluefin tuna caught by Taiwanese longline fishery for 2002-2016, by Sheng-Ping Wang, Shu-Ting Chang and Shiu-Ling Lin.

In this paper, the patterns of catch compositions and CPUE distributions were explored based on the data of Taiwanese longline fleets operated in the waters south of 20°S during 2002-2016. Data selection was based upon cluster analysis. This allowed CPUE trends to be standardised for two areas, a central-eastern area and a western area. In the western area the trend declines which is rather contradictory to other countries CPUE results in this area. The

trend in the central eastern area is rather variable but there seemed to be some correspondence between it and the SAPUE survey results but this is very tentative and needs more years to test.

There was considerable technical discussion of this paper that the authors have considered in their ESC paper. It was particularly noted that the analysis gives us a very much clearer picture of how the Taiwan fishery operates. Such knowledge is a vital component of stock assessment. It was also noted that the Taiwan fishery is very mixed, is conducted at the Northern margin of the SBT distribution and has also changed its species targeting through time. This makes it a very difficult data series to interpret and the authors were congratulated on the progress they have made with this.

In conclusion it was thought that both these papers suggested that some comparative analyses of the different SBT fisheries would be useful. This might consider issues such as how much each focuses on SBT, how best to handle by-catch issues and how much variance is explained.

The meeting concluded after two hours of presentations and discussions. It was felt to have been a useful and fruitful meeting and had made important decisions about the core CPUE series and seen two interesting papers on new series. The Chair thanked the authors and the participants for their contributions.

The CPUE modelling group also held a small group meeting in the margins of the ESC during the lunch hour of 28th August. This was to arrange the inter-sessional work programme for 2018.

Following suggestions arising from the June web meeting it was noted that:

1) Following the loss of data from Japanese NZ Charter vessels

- It would be worthwhile to investigate how this and other changes might affect the constant squares and variable squares calculations since from now on Japanese LL effort in areas 5 and 6 were likely to be sparse.
- It was also noted that the New Zealand and South African fisheries that lay respectively towards the eastern and western boundaries of the SBTs distribution might provide particularly useful indicators series to identify any widening or narrowing of the stocks range. Such indicator series would not need the detailed standardisation required of the CPUE of used for model tuning but it would be useful if changes in catch rate, size composition and areal distribution of catch could be distinguished from those due to operational changes.

2) With respect to the core CPUE series it was noted that

- Discussions in the OMMP group suggested that it would be useful to develop a clearer understanding of how changes in timing and fleet distribution could modify the size selection of the catch.
- Investigate the reasons for differences between the base and the reduced base CPUE series.
- Consider the effect of vessel age (or length of participation in the core fleet) on catch rate.

- It might be worth considering other approaches to dealing with the effects of by-catch in SBT fisheries. For example the cluster analysis approaches used in the Korean and Taiwan papers offers a possible approach.

Of these the first bullet point appears to have the highest priority.

3) With respect to the Korean CPUE series this looked very useful in the first instance as a monitoring series and it would be useful to have this prepared annually in a similar fashion to this year's analysis.

4) With respect to the Taiwan CPUE series the group suggested that its authors should focus on the eastern central area as being the most useful results and attempt to compare this to running averages of recruitment data arising from the assessment or recruitment series.

South African Members emailed the CPUE modelling group a list of recent papers on subjects relevant to the work program.

Attachment 7

Table 1. Future work plan developed by the Farm and Market Survey small working group for 2018-2019. The [ ] refer to the documents in the ESC22 that are relevant for each identified issue of concern.

Growth Rates					
Issue	Detail of the issue and relevant documents	Consensus	Uncertainty	Resolution/ work plan	timeline
Data	Establish agreement that the number of fish and average weight out of farms are correct		Can this be agreed	Informal exchange of views to create a list of agreed data that could assist with resolving outstanding issues.	2018
Methods used to estimate the age after farmed	Applying weight at length relationships [20, BGD08]	Length-weight relationships is non-linear Excluding fish ≤10kg	What is valid wild comparison for change in L-W for farmed SBT at harvest. Are LW relationships for wild (Robins 1963) and farmed (Itoh et al. 2012) SBT are representative and suitable for analyses of farm related issues?	Complete a collation of information on LW relationships for wild and farmed SBT, and evaluate if they are suitable for use in proposed farm analyses.	2018
Methods used to estimate the growth rate of farmed SBT	[BGD08]	Growth rate of farmed fish in body weight is higher than wild fish., AND The growth in body length is higher than or equal to wild fish .	How much growth different between wild and farmed SBT. Growth may vary among farming environment and year.	Consideration should be given to developing alternate approaches to testing these uncertainties if consensus on farmed growth rates cannot be reached using existing information (e.g. well-designed mark-recapture experiments). First task should be a compilation and evaluation of information in the literature to allow precise hypotheses to be proposed and agreed upon before implementation of new data collection.	Information Review - 2018
	Inference of tagging effects on growth [20, BGD08, Info02]	Impacts of tagging on growth are not typically detectable in the long term There are many literatures that evaluate effect on growth by tag implementation	Does tagging have effects on growth for ≤ 6 months after tagging. Information over inter-annual periods.	Summarise the influence of tag implementation using literatures. Analyses of tagging effects spanning across differing environment and feeding conditions	2018
	Comparison with other species [BGD08]	Existing literature is available for analyses for wild and farmed *Thunnus* species	Would we expect rates to be similar given the extent of covariates that may influence growth	Summarise the global data on Bluefin growth (wild versus farmed) using meta-analyses to identify plausible rates and relevant co-variates.	2018

Age composition of farmed SBT	Is age composition of farmed SBT estimated from length frequency of grown out fish biased to older fish compare to the catch at age in Australian data and weight samples. [20, BGD08]	The original CDS data that including size information of individual fish may help. Review analyses to try to narrow the differences in view.	Exchange of views on the issue. Is the data provided in CCSBT data exchange adequate for estimating age composition? Are potential anomalies due to data aggregation in the CDS summary? Does AU confidentiality policy allow the original CDS to be shared	In addition to the literature that already exists Analyses to understand if data aggregation in the CDS summary influences result?	2018
Feed Conversion Rates (FCR) for farmed SBT	FCR could explain differences in growth estimates for farmed SBT [20, Info02]	Literature values	The global literature suggests, including research data, suggests reasonable consistency of FCR in feeding of Bluefin tunas. Where are the gaps in this data? FCR of Australian farmed SBT is largely based on public data. Review this data, and implications for entry weights to farms.	Continued provision of data	2018, 2019
Does 40/100 fish sampling have any bias	40/100 fish sampling potential to bias the sample to small or large fish. What is literature on feeding hierarchy? [20, BGD08]	Bias of excluding fish ≤10kg from sample.	What is acceptable bias or correction. What is the bias (if any) associated with the automation of stereo-video What is the bias associated with current 100 fishing sampling method	The results of the Australian study for automation of Stereo Video to measure length of farmed fish be presented to ESC23 The ESC23 may need to consider designing further Stereo Video analyses to better understand any bias in the application of automating this method (e.g. comparing Stereo Video measurements with known lengths in pen experiments and/or 100 fish sampling at harvest). Review literature First step - Information compilation on feeding hierarchy in farm pontoons – already submitted by Australia	2018 – feeding hierarchy

Implications for fish condition index (CI) of Japan's growth methodology	Use Japan methodology and Australian ex-farm length/weight to calculate CI [Info02]	CI formula and data for use in CI	CI formulas	Exchange information on this issue	2018
Estimate number of 4-year olds in GAB	Agree on global number of 4 year olds [20, Info02]	How many 4-year olds in GAB in Jan/March?	Basis for agreeing numbers	Exchange views	2018
Understand logistics of catching for farming	Agree on limits of targeting bigger fish	How to consult independent experts	Timetable to try to reach agreement	Australia to outline catching process and then dialogue between interested members	2018

References

20 (Itoh and Omori) Further responses from Japan to the Australian responses on farming papers in Attachment 6 of ESC21 Report. CCSBT-ESC/1708/20.

BGD08 (Itoh and Omori) Update of estimation for the unaccounted catch mortality in Australian SBT farming in the 2016 fishing season. CCSBT-ESC/1708/BGD08. (*Previously* CCSBT-OMMP/1706/10)

Info02 (Jeffriess) An update Review of Tuna Growth performance in Ranching and Farming Operations. CCSBT-ESC/1708/Info02.

Market Survey					Time line
Issue		Consensus	Uncertainty	Resolution/ work plan	
Catch by Members or potential non-member catch should be verified through the comparison to the total amount in including Japanese markets	[25, BGD09, Info01 Change of the market conditions and its influence on estimates Uncertain information on the current break-down of the SBT data supplied to the JFA by the 5 Tsukiji auctioneers – it needs to be separated into auctioned and sold outside the auction, which is farmed and non-farmed, and the source country of the auctioned and non-auctioned frozen SBT. [BGD09, Info01]]	Assumptions made to keep consistent with 2006 methodology (e.g. double count, ratio of on-market sales, market share of Tsukiji and Yaizu, etc.) Obtaining and utilize market and CDS data in joint analyses would be preferable.	Influence of aggregation/methodology on estimates Influence of time-lag between catch and sell. Influence of export from Japan Influence of change of market structure Willingness of auctioneers and TMG to provide data Each of current surveys cover only a part in the market supply net. (see BGD09 Fig. 9)	Update, by experts, of the JMR methodology that better reflects the current market conditions and makes use new information that was not present at the time of the original review, including the share of auction sales in total sales. [First step may be a feasibility proposal for review by Compliance Committee in 2018] Review of Japanese monthly monitoring activities. Immediate tasks could include: Interviews to confirm TMG databases. Document market changes through: questionnaire to the 5 Tsukiji auctioneers and major retailers. Examination on the fish size and source country of frozen SBT landed and auctioned at Yaizu. Utilize CDS data submitted from Members and some non-members, which allow connection of CDS tagID to quantify any anomalies.	Feasibility proposal 2018 CDS and market data analyses 2018

References

25 (Sakai, Tsuda, Itoh and Omori) Monitoring of Southern Bluefin Tuna trading in the Japanese domestic markets: 2017 update. CCSBT-ESC/1708/25.

BGD09 (Sakai, Itoh and Omori) A review of Southern Bluefin Tuna trade and monitoring research in Japanese domestic markets. CCSBT-ESC/1708/BGD09. (*Previously* CCSBT-CC/1510/19)

Info01 (Jeffriess) Japan Market Update 2017. CCSBT-ESC/1708/Info01.

Attachment 8

Recent trends in all indicators of the SBT stock

Minimum and maximum values in the time series are also shown. Japanese age composition refers to ages in statistical areas 4–9 for months 4–9 only.

Indicator	Period	Min.	Max.	2013	2014	2015	2016	2017	12 month trend
Scientific aerial survey	1993–2000 2005–16	0.25 (1999)	4.85 (2016)	0.87	2.02	na	4.85	1.80	↓
Trolling index	1996–2003 2005–06 2006–16	1.62 (2012)	5.09 (2011)	3.70	2.86	na	3.94	1.70	↓
Grid-type trolling index	1996–2003 2005–06 2006–16	0.1342 (2002)	2.2130 (2008)	1.3758	0.9901	na	1.9369	0.6638	↓
NZ domestic nominal CPUE	1989–2016	0.000 (1989)	8.78 (2016)	4.04	5.44	6.16	8.78		↑
NZ domestic age/size composition (proportion age 0–5 SBT)*	1980–2016	0.001 (1985)	0.404 (1995)	0.03	0.20	0.07	0.54		↑
Indonesian median size class**	1993–94 to 2014–15	162 (2012–13; 2013–14)	188 (1993–94)	164	162	160	163	163	-
Indonesian age composition:** mean age on spawning ground, all SBT	1994–95 to 2013–14	13.24 (2012–13)	21.2 (1994–95)	14.2	13.8	13.8	13.8		-
Indonesian age composition:** mean age on spawning ground 20+	1994–95 to 2013–14	21.8 (2010–11)	25.3 (2003–04)	22.3	22.3	22.9	22.6		↓
Indonesian age composition:** median age on spawning ground	1994–95 to 2013–14	13 (2001–03; 2012–13)	21 (1994–95; 1996–97; 1998–99)	15	14	14	13		↓

Indicator		Period	Min.	Max.	2013	2014	2015	2016	12 month trend
Japanese nominal CPUE, age 4+		1969–2016	1.338 (2006)	22.123 (1965)	3.355	3.624	5.052	4.256	↓
Japanese standardised CPUE (age 4+) (W0.5, W0.8, Base w0.5, Base w0.8)		1969–2016	2007 (0.259–0.358)	1969 (2.284– 2.697)	0.583–0.901	0.754–1.179	1.011–1.495	0.666–1.206	↓
Korean nominal CPUE		1991–2016	1.591 (2004)	20.409 (1991)	5.917	5.843	7.812	5.488	↓
Taiwanese nominal CPUE, Areas 8+9		1981–2016	<0.001 (1985)	0.956 (1995)	0.128	0.127	0.920	0.203	↓
Taiwanese nominal CPUE, Areas 2+14+15		1981–2016	<0.001 (1985)	3.672 (2007)	2.230	1.624	1.728	2.042	↑
Japanese age comp, age 0–2*		1969–2016	0.004 (1966)	0.192 (1998)	0.020	0.001	0.002	0.003	↑
Japanese age comp, age 3*		1969–2016	0.011 (2015)	0.228 (2007)	0.044	0.035	0.011	0.036	↑
Japanese age comp, age 4*		1969–2016	0.091 (1967)	0.300 (2010)	0.120	0.114	0.121	0.072	↓
Japanese age comp, age 5*		1969–2016	0.072 (1986)	0.300 (2010)	0.161	0.169	0.204	0.162	↓
Taiwanese age/size comp, age 0–2*		1981–2016	<0.001 (1982)	0.251 (2001)	0.007	0.009	0.011	0.004	↓
Taiwanese age/size comp, age 3*		1981–2016	0.024 (1996)	0.349 (2001)	0.108	0.114	0.116	0.118	↑
Taiwanese age/size comp, age 4*		1981–2016	0.027 (1996)	0.502 (1999)	0.366	0.204	0.208	0.211	↑
Taiwanese age/size comp, age 5*		1981–2016	0.075 (1997)	0.371 (2009)	0.274	0.211	0.213	0.216	↑
Australia surface fishery median age composition		1964–2016	age 1 (1979–80)	age 3 (multiple years)	age 3	age 3	age 2	age 2	-
Standardised JP LL CPUE (age 3)	w0.5	1969-2016	0.228 (2003)	3.263 (1972)	0.308	0.298	0.235	0.414	↑
	w0.8		0.262 (2003)	3.073 (1972)	0.388	0.371	0.299	0.552	
Standardised JP LL CPUE (age 4)	w0.5	1969-2016	0.275 (2006)	2.955 (1974)	0.544	0.726	0.891	0.642	↓
	w0.8		0.303 (2006)	2.691 (1974)	0.702	0.952	1.090	0.867	
Standardised JP LL CPUE (age 5)	w0.5	1969-2016	0.231 (2006)	2.692 (1972)	0.577	0.920	1.188	1.205	↑
	w0.8		0.255 (2006)	2.481 (1972)	0.762	1.230	1.510	1.554	
Standardised JP LL CPUE (age 6&7)	w0.5	1969-2016	0.190 (2007)	2.519 (1976)	0.675	0.948	1.197	1.402	↑
	w0.8		0.216 (2007)	2.311 (1976)	0.887	1.267	1.583	1.857	
Standardised JP LL CPUE (age 8-11)	w0.5	1969-2016	0.275 (2007)	3.767 (1969)	0.574	0.771	0.918	0.683	↓
	w0.8		0.290 (1992)	3.390 (1969)	0.785	1.038	1.239	0.908	
Standardised JP LL CPUE (age 12+)	w0.5	1969-2016	0.504 (2016)	3.292 (1970)	0.630	0.515	0.534	0.504	↓
	w0.8		0.587 (1997)	2.873 (1970)	0.858	0.694	0.717	0.672	

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

Attachment 9

Analyses conducted by the
Operating Model and Management Procedure technical group.

An informal meeting of the Operating Model and Management Procedure (OMMP) technical group took place on August 27. The results of the stock assessment were evaluated at that meeting. The following figures summarize the main stock assessment results reported in paper CCSBT-ESC/1708/14.

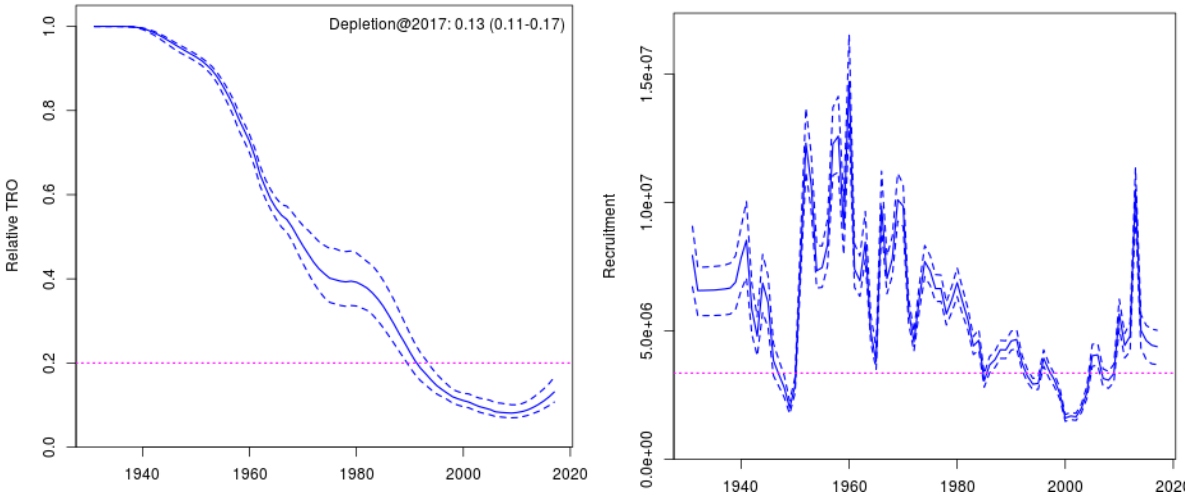


Figure 1. Relative level of total reproductive output (left) and recruitment (right) for the reference set of OMs and covering the years 1931-2017. Source: CCSBT-ESC/1708/14.

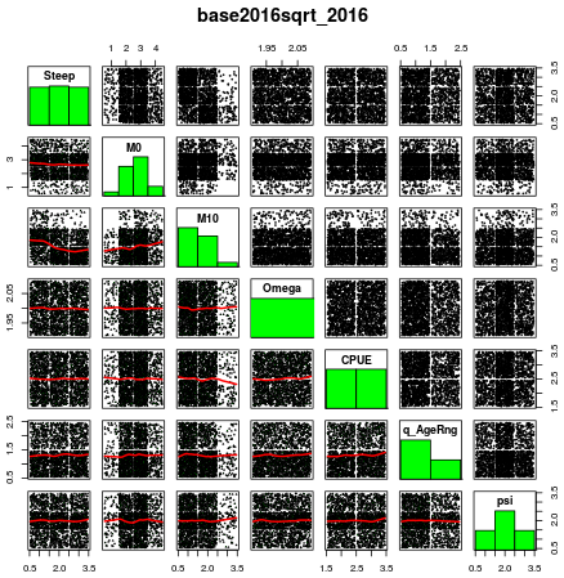


Figure 2. Level plot for the grid parameters in the reference set of OMs. Source: CCSBT-ESC/1708/14.

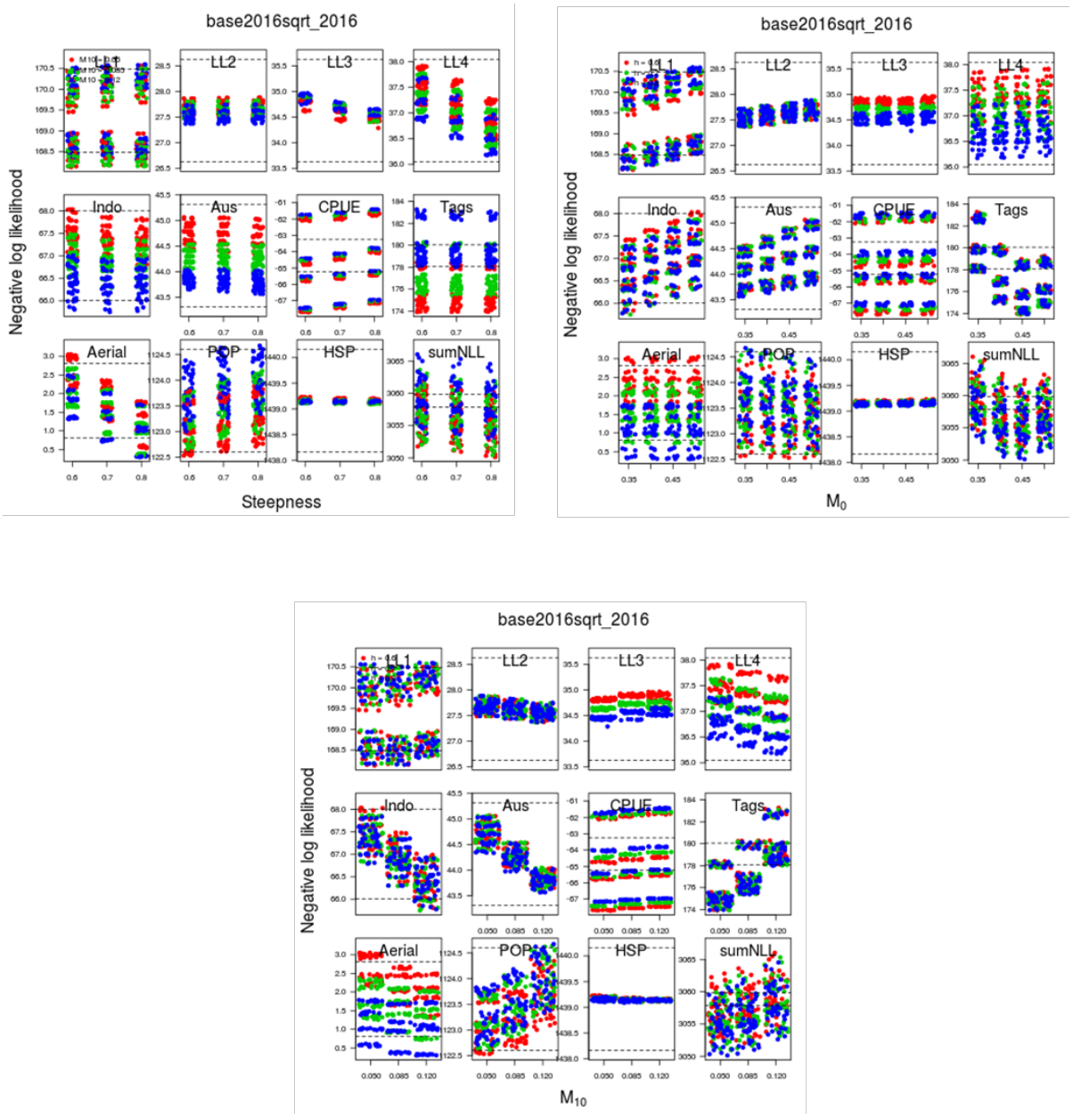


Figure 3. Likelihood profiles for steepness (top left), M0 (top right) and M10 (bottom). Source: CCSBT-ESC/1708/14.

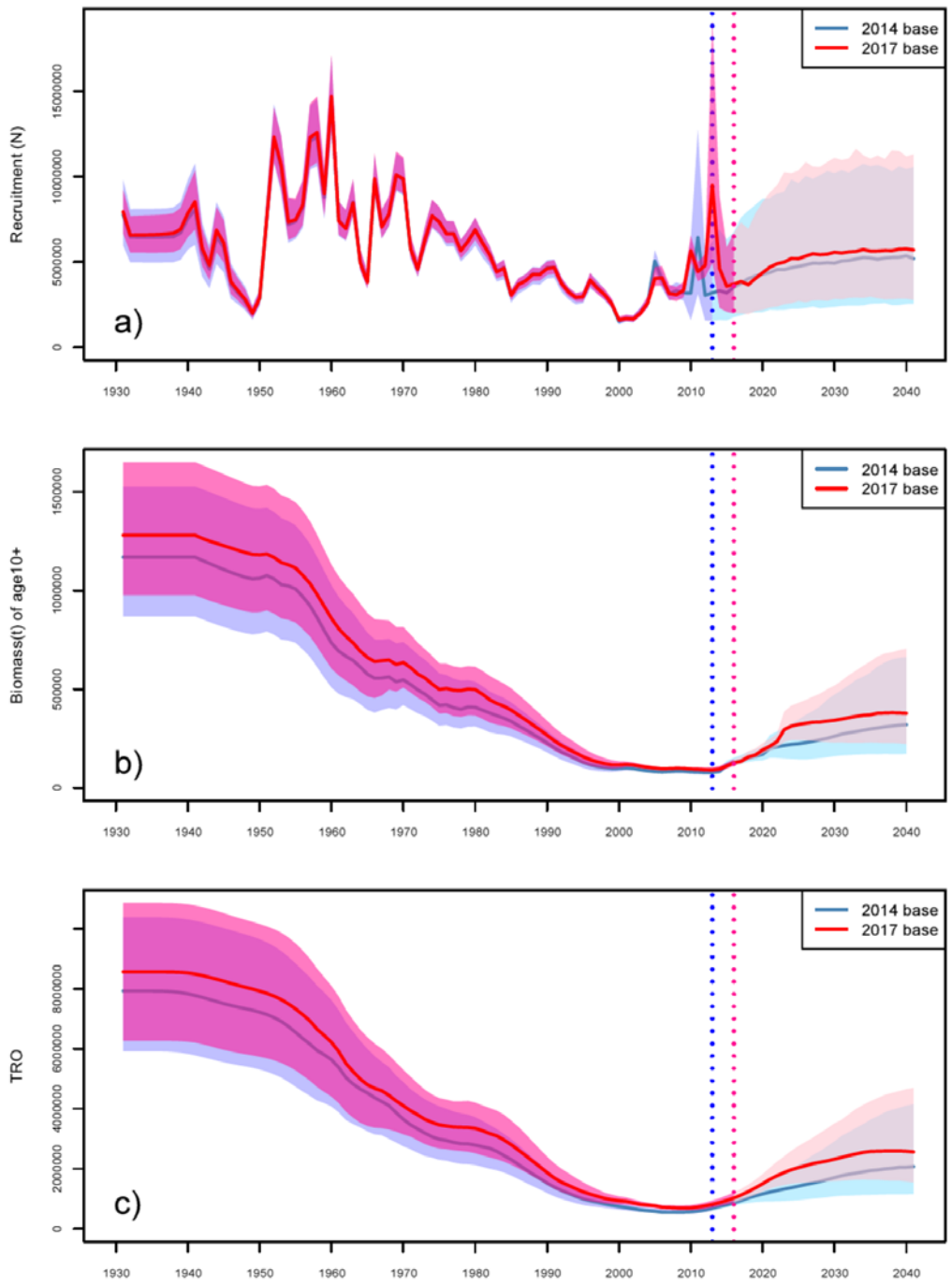


Figure 4. Historical and projected trajectories of the reference set for a) recruitment, b) biomass of age 10+ fish, and c) total reproductive output (TRO). The red line with the pink region represents the median and 90% probability intervals of the 2017 reference set (current assessment). The blue line with the light blue region represents those for the 2014 reference set (previous assessment). The dotted lines indicate the boundaries of the conditioning and projections. Source: CCSBT-ESC/1708/14.

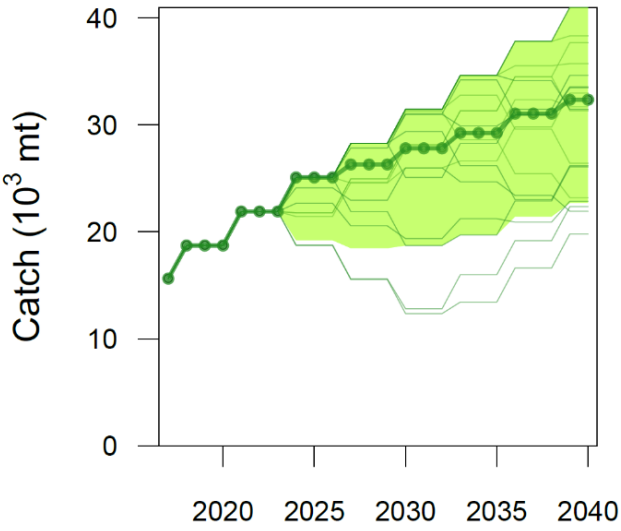


Figure 5. Future TAC trajectories for the reference set projections under the Bali MP. The bold green line with the greenish yellow region represents the median and 90% probability intervals. The thin greenish lines represent worm plots for each simulation trial. Source: CCSBT-ESC/1708/14.

Model fits

The following figures show the fits of the model (using the most likely grid cell) to the different data components, discussed in paper CCSBT-ESC/1708/14. The meeting considered that these fits were adequate.

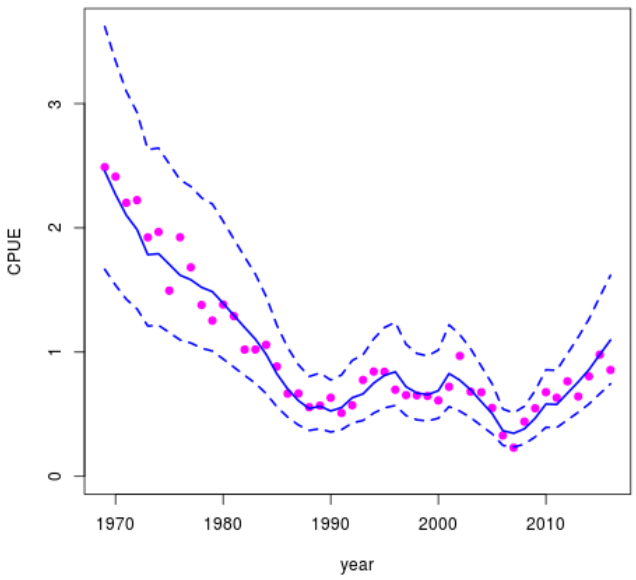
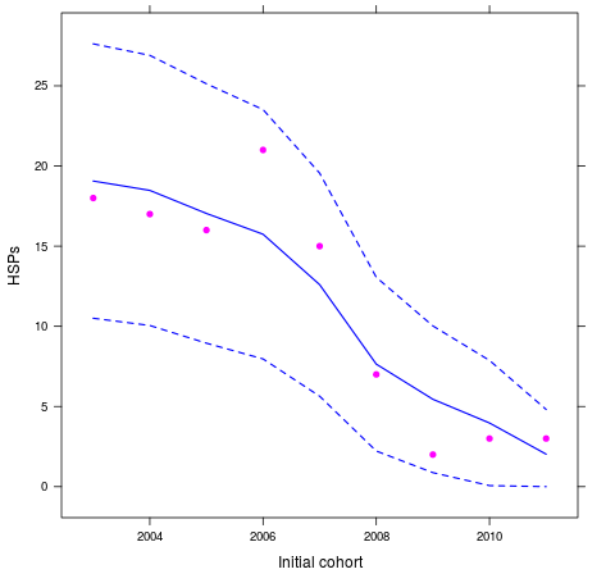


Figure 6. Fits to CPUE series. Source: CCSBT-ESC/1708/14.



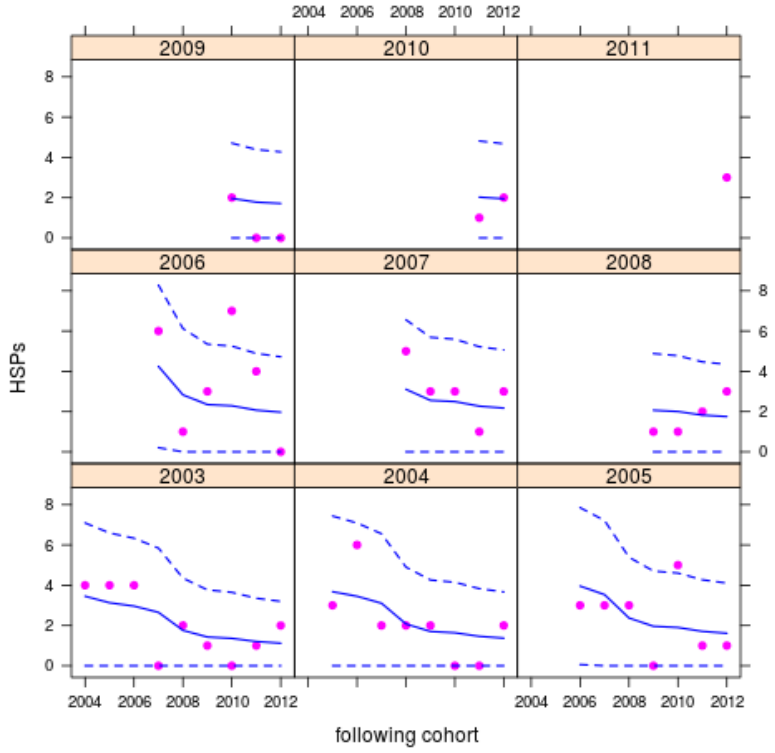


Figure 7. Fits to the CKMR HSP data at the full disaggregation (bottomt) and initial cohort (top) aggregation level (the initial cohort is the oldest animal in the juvenile comparison group). Source: CCSBT-ESC/1708/14.

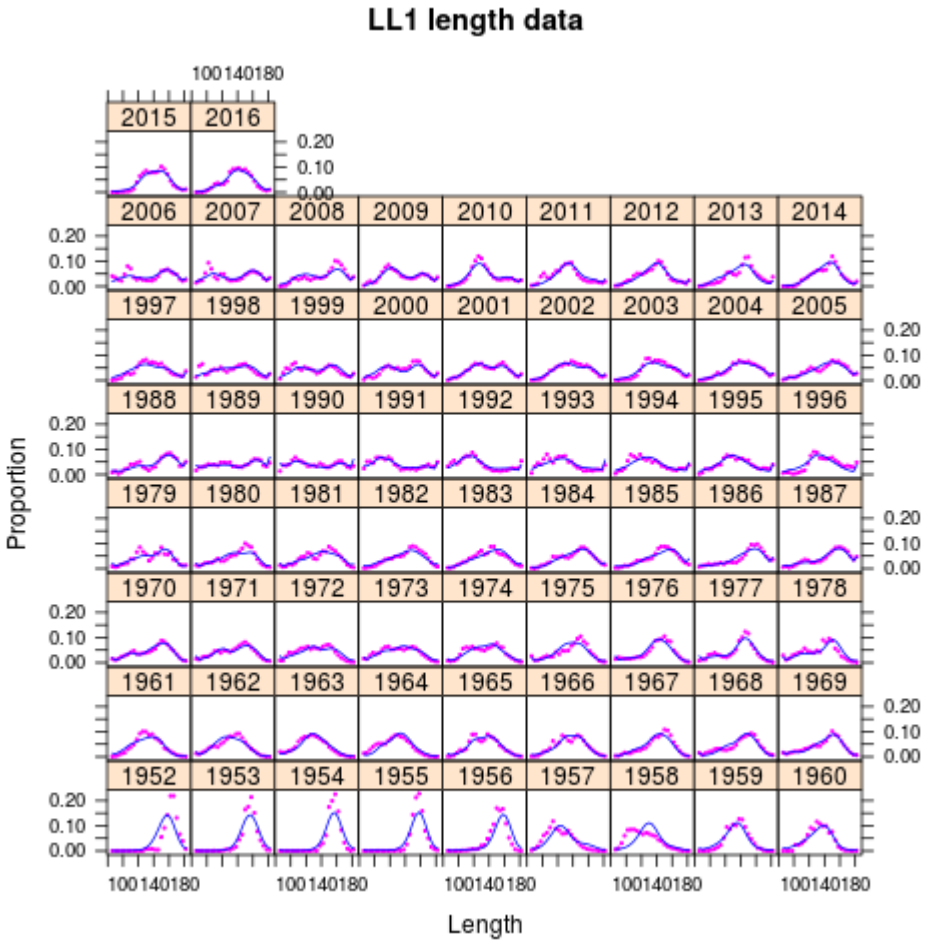


Figure 8. Fits to the length composition data for LL1 fishery. Source: CCSBT-ESC/1708/14.

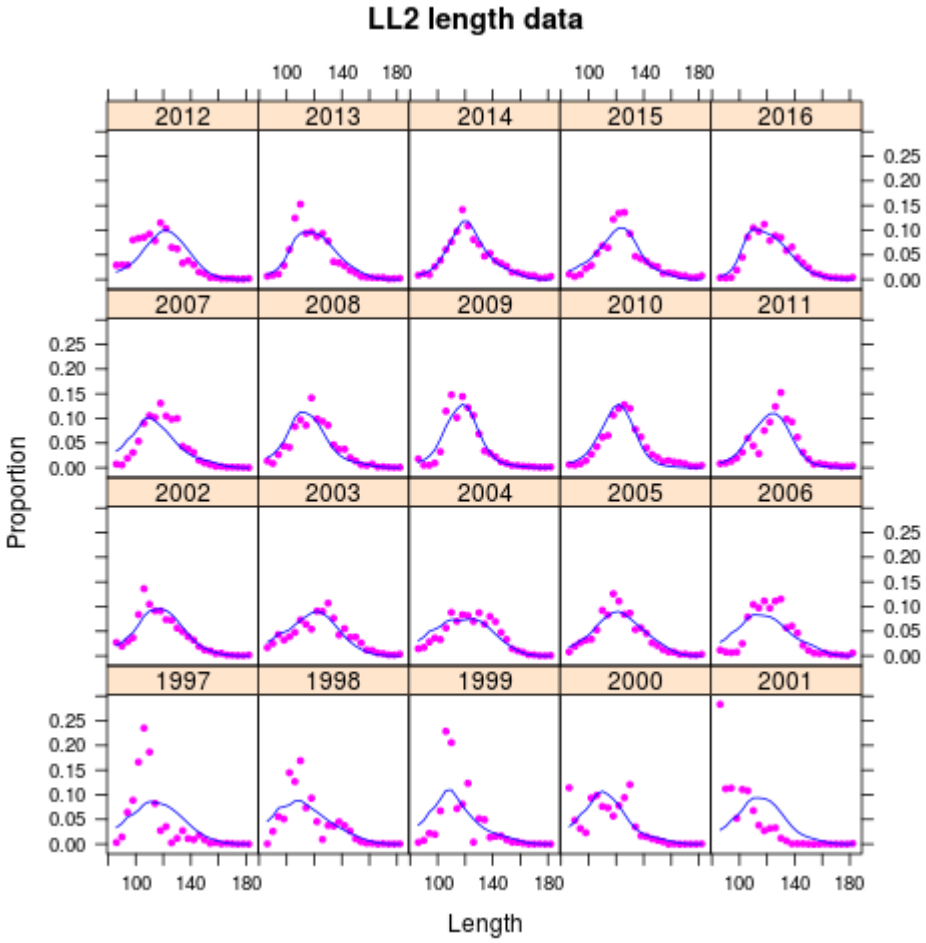


Figure 9. Fits to the length composition data for LL2 fishery. Source: CCSBT-ESC/1708/14.

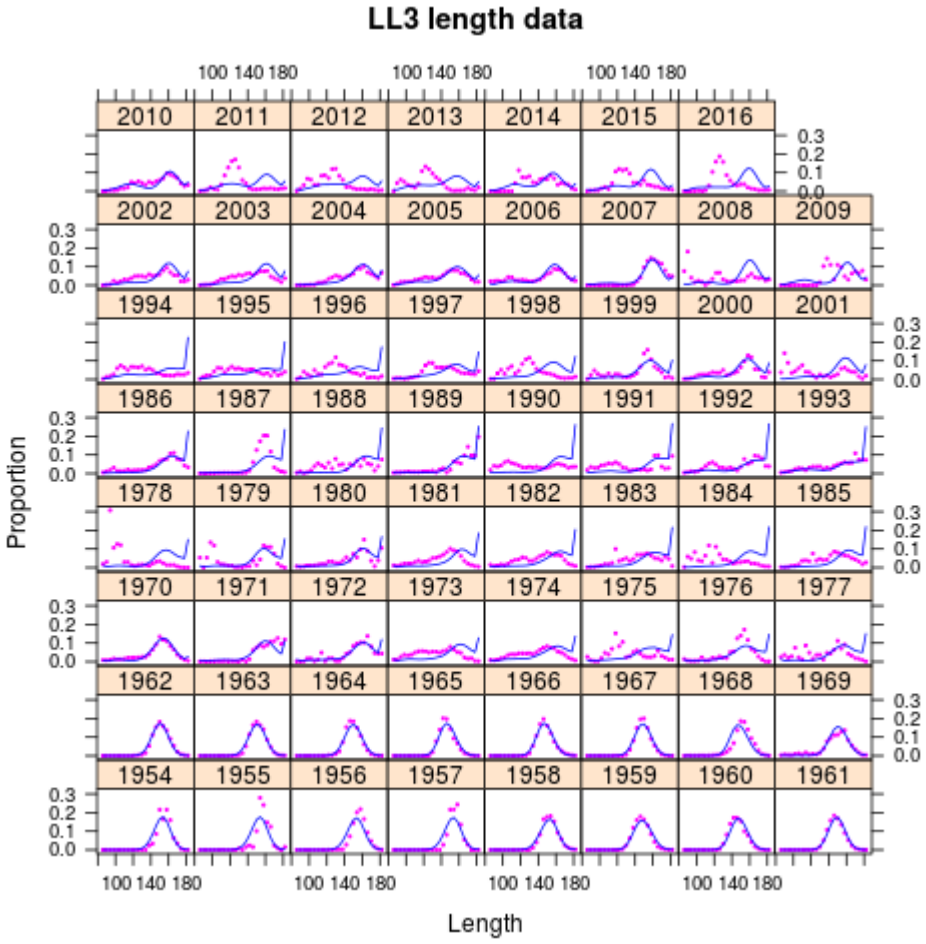


Figure 10. Fits to the length composition data for LL3 fishery. Source: CCSBT-ESC/1708/14.

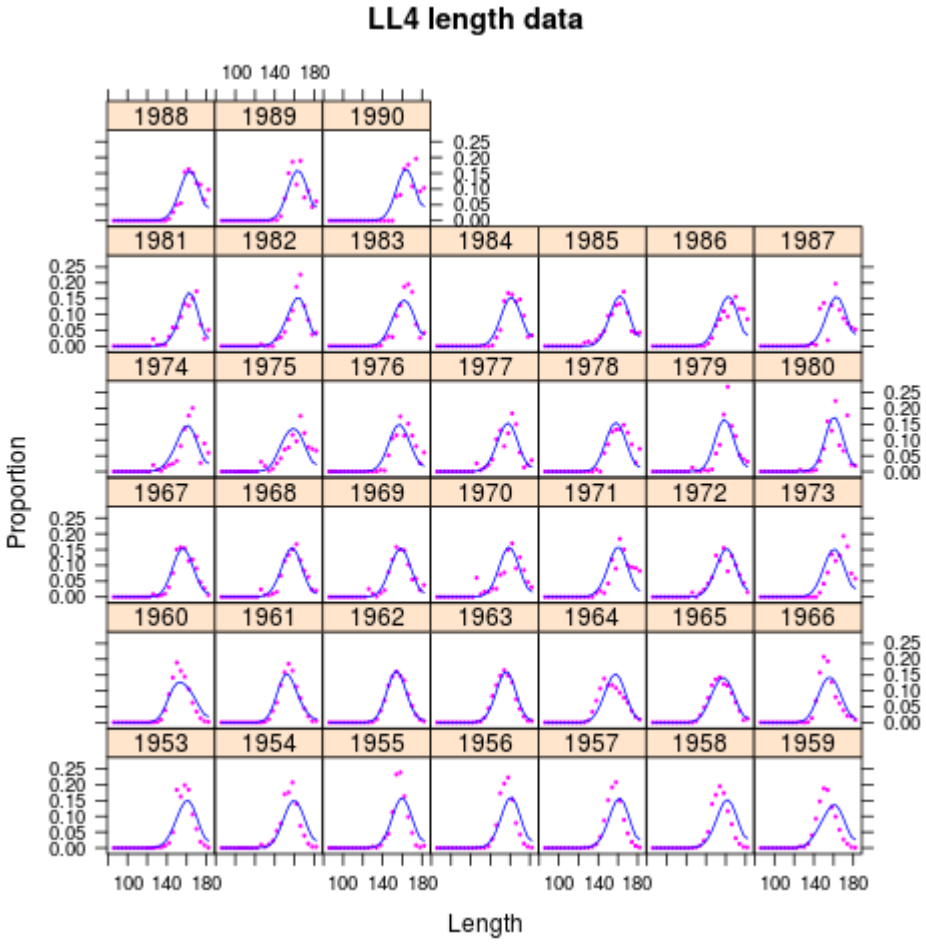


Figure 11. Fits to the length composition data for LL4 fishery. Source: CCSBT-ESC/1708/14.

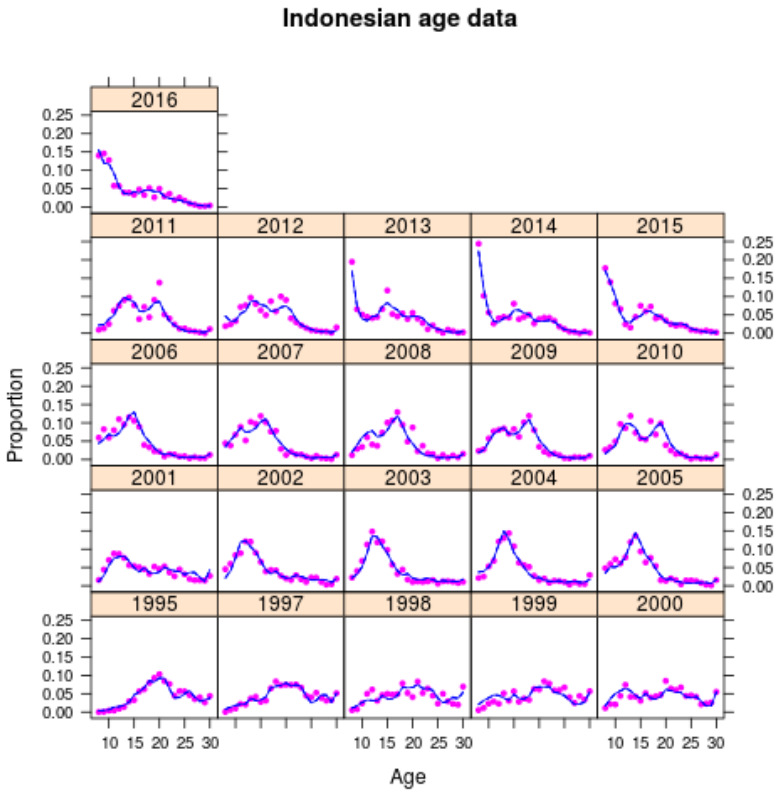


Figure 12. Fits to the age composition data for the Indonesian fishery. Source: CCSBT-ESC/1708/14.

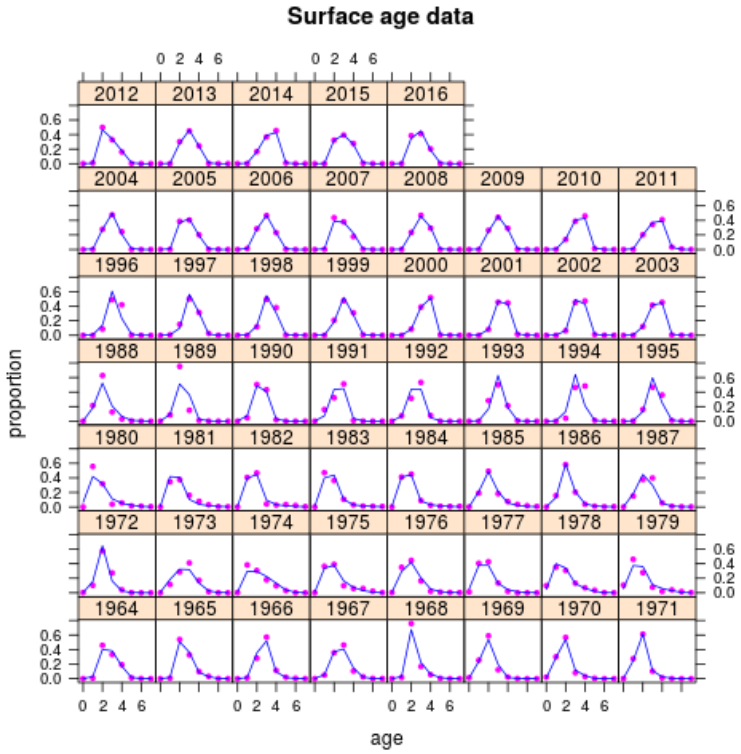


Figure 13. Fits to the age composition data for the surface fishery. Source: CCSBT-ESC/1708/14.

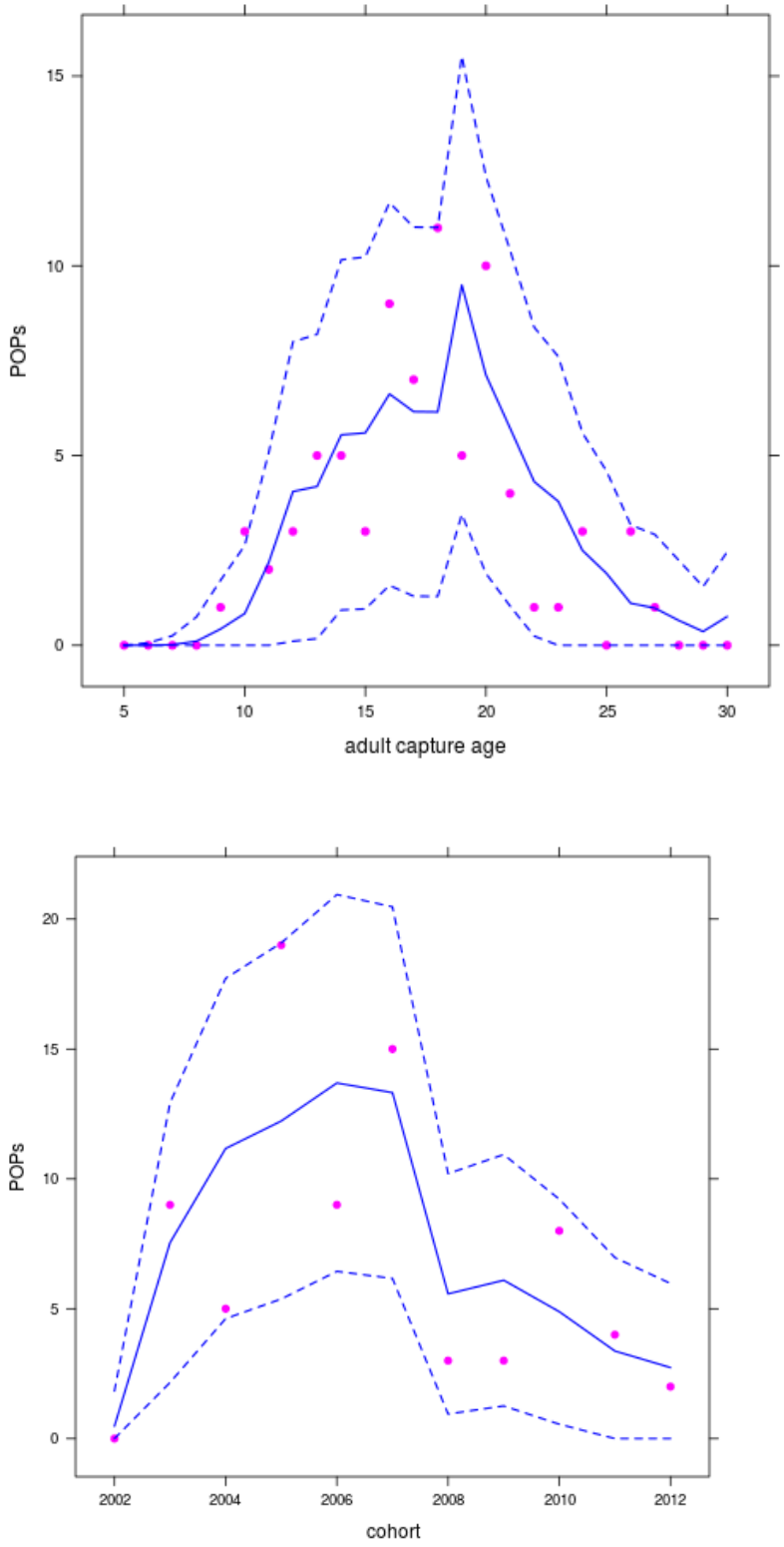


Figure 14. Fits to the . Source: CCSBT-ESC/1708/14.

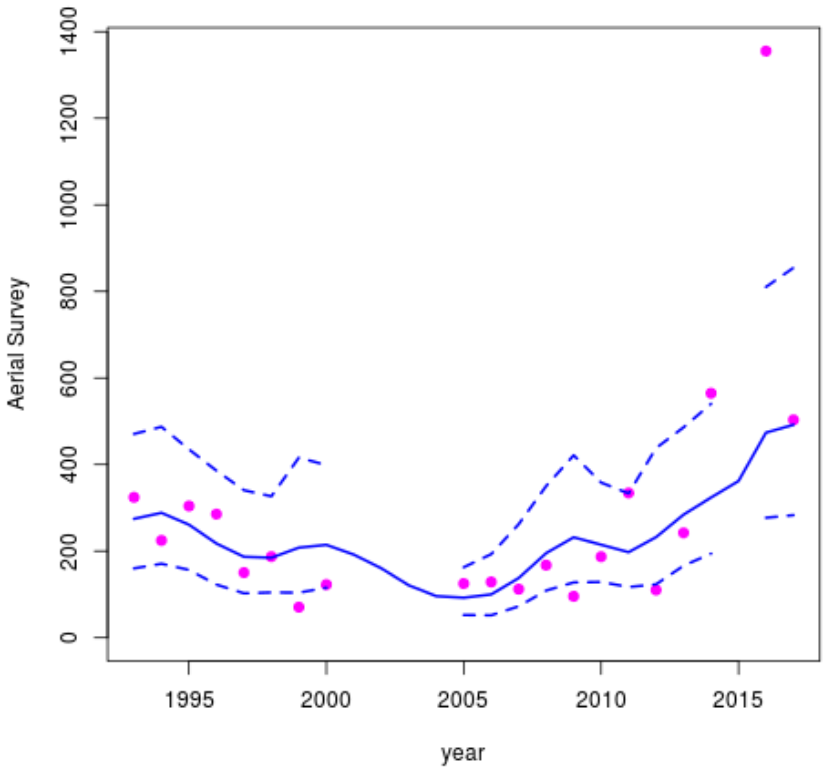


Figure 15. Fits to the aerial survey data. Source: CCSBT-ESC/1708/14.

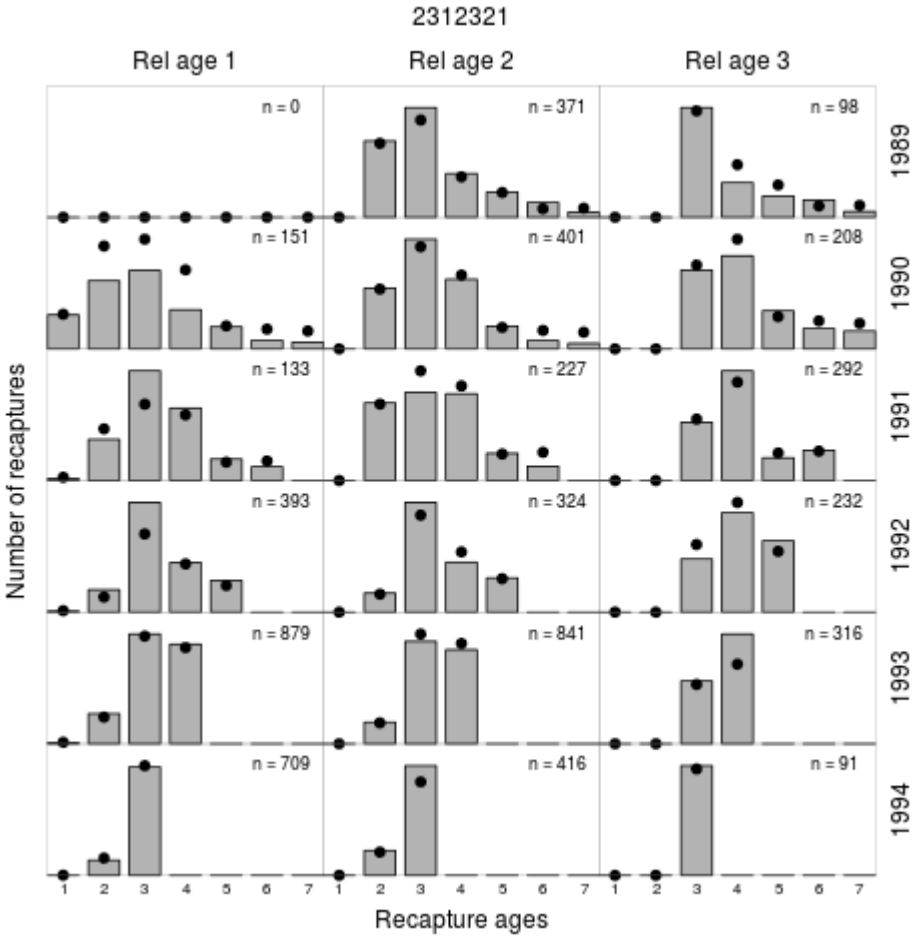


Figure 16. Fits to the tagging data, aggregated across taggers and at the release age and recapture age. Source: CCSBT-ESC/1708/14.

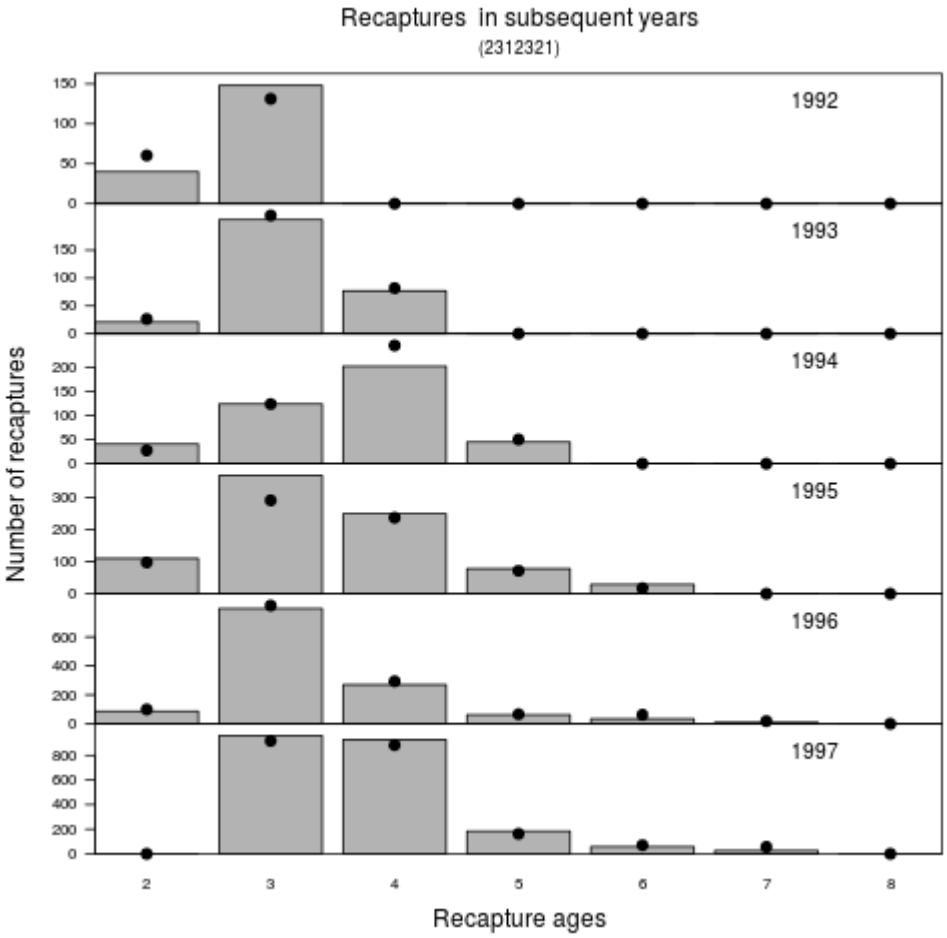


Figure 17. Fits to the tagging data, aggregated across taggers and at the release year and recapture age. Source: CCSBT-ESC/1708/14.

Sensitivity runs

A number of sensitivity runs were explored during the meeting, in addition to those reported in paper CCSBT-ESC/1708/14. The work initiated at the informal OMMP meeting continued through the ESC.

Steepness and recruitment estimates

The grid used for the stock assessment reported in paper CCSBT-ESC/1708/14 included three values of steepness: h=0.6, 0.7 and 0.8. The support for the different values of steepness was evaluated, including an additional value of h=0.55 as used for the evaluation and tuning of the Bali procedure.

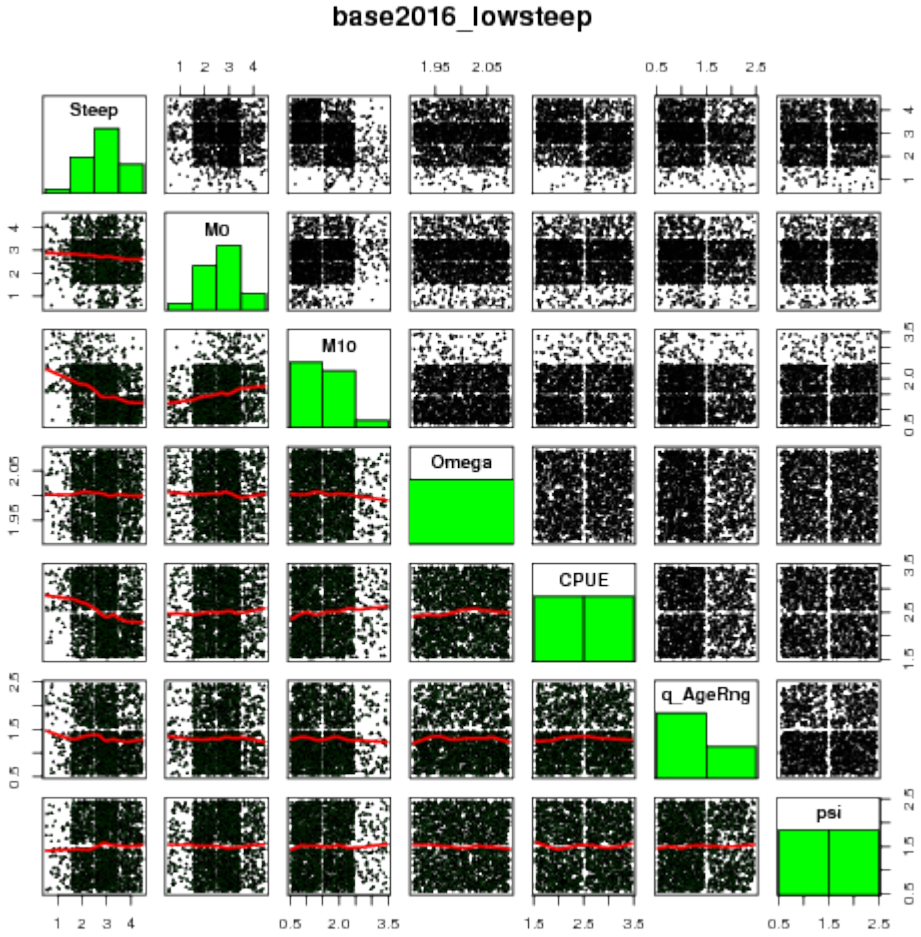
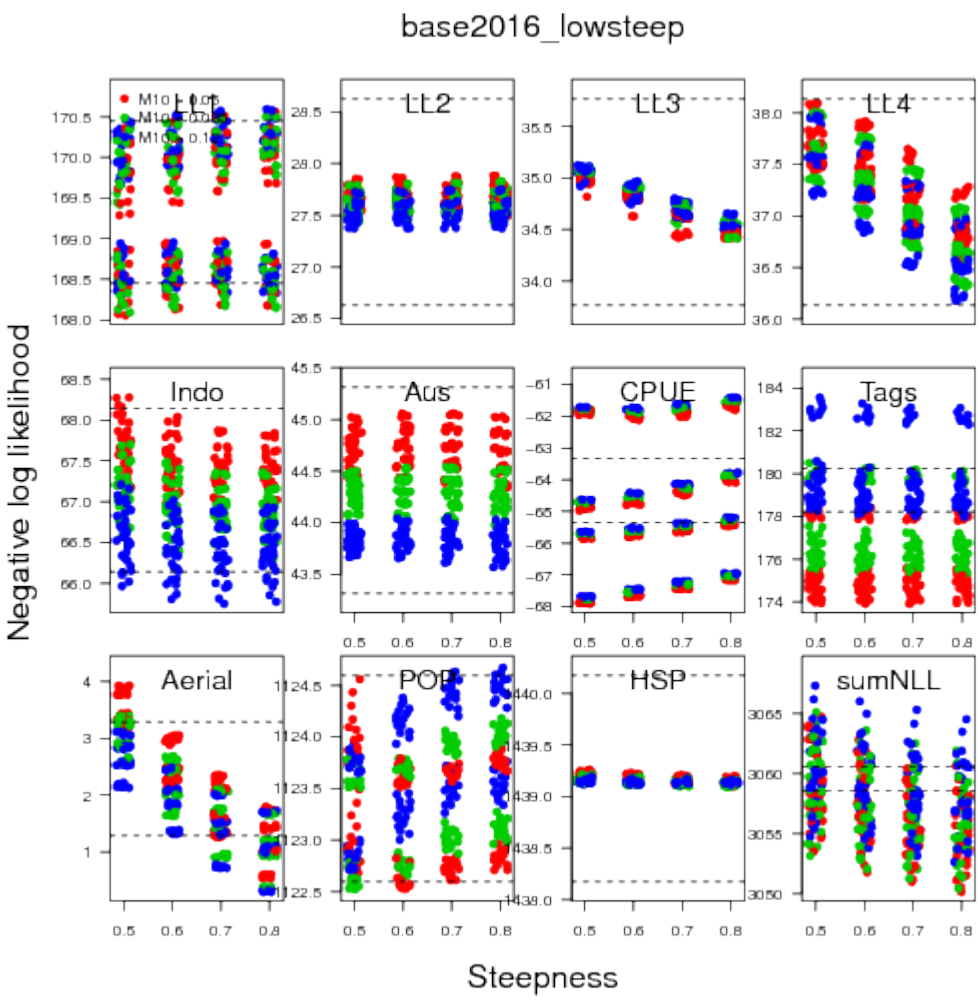


Figure 18. Results of sampling of grid cells using objective function weights when steepness values were *h*= 0.5, 0.6, 0.7 and 0,8.

Results indicate that the low value of steepness *h*=0.5 received little weight (Fig. 18). As decision was made to not include this additional value in the reference set grid.


base2016_lowsteep
Negative log likelihood
Steepness
LL1
LL2
LL3
LL4
Indo
Aus
CPUE
Tags
Aerial
POP
HSP
sumNLL

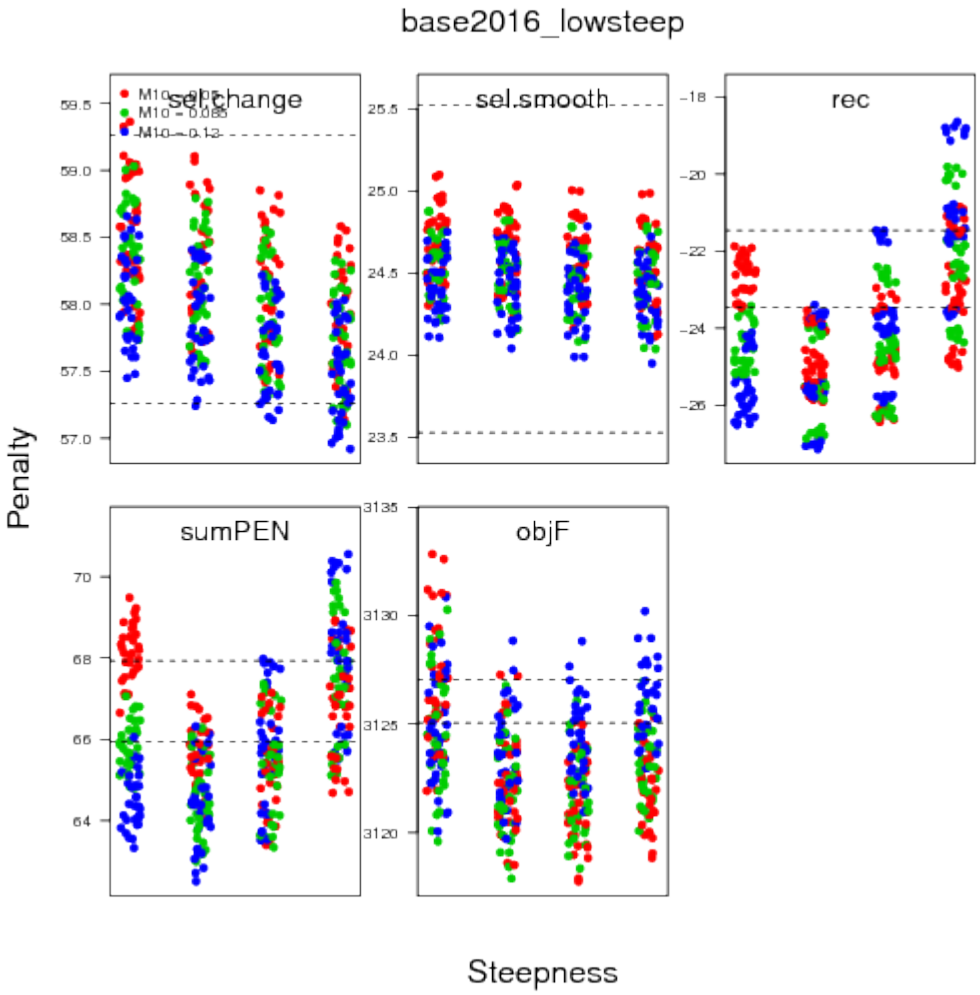


Figure 19. Likelihood profiles and penalties across steepness values from 0.5 to 0.8.

Likelihood profiles (Fig. 19) indicate that the preference for higher steepness is largely driven by the aerial survey (AS). This is due to the high AS indices in most recent years. The increase in estimated recruitment from low SSB results in a preference for higher steepness.

A sensitivity run was conducted where the AS data were removed. Recruitment estimates in that case did not show the pulse of strong year classes estimated when the AS was included (Fig. 20) and the objective function gave much higher weight to *h*=0.6 (Fig. 21). The fits to the CPUE series were largely unaffected; only the last data point showed an appreciable departure between the base reference set and the noAS run (Fig. 20). This indicates that, under the flexible assumptions made about LL1 selectivity (parameters are allowed to change in blocks of 3 years in the recent period), the CPUE contains little information about recent recruitments.

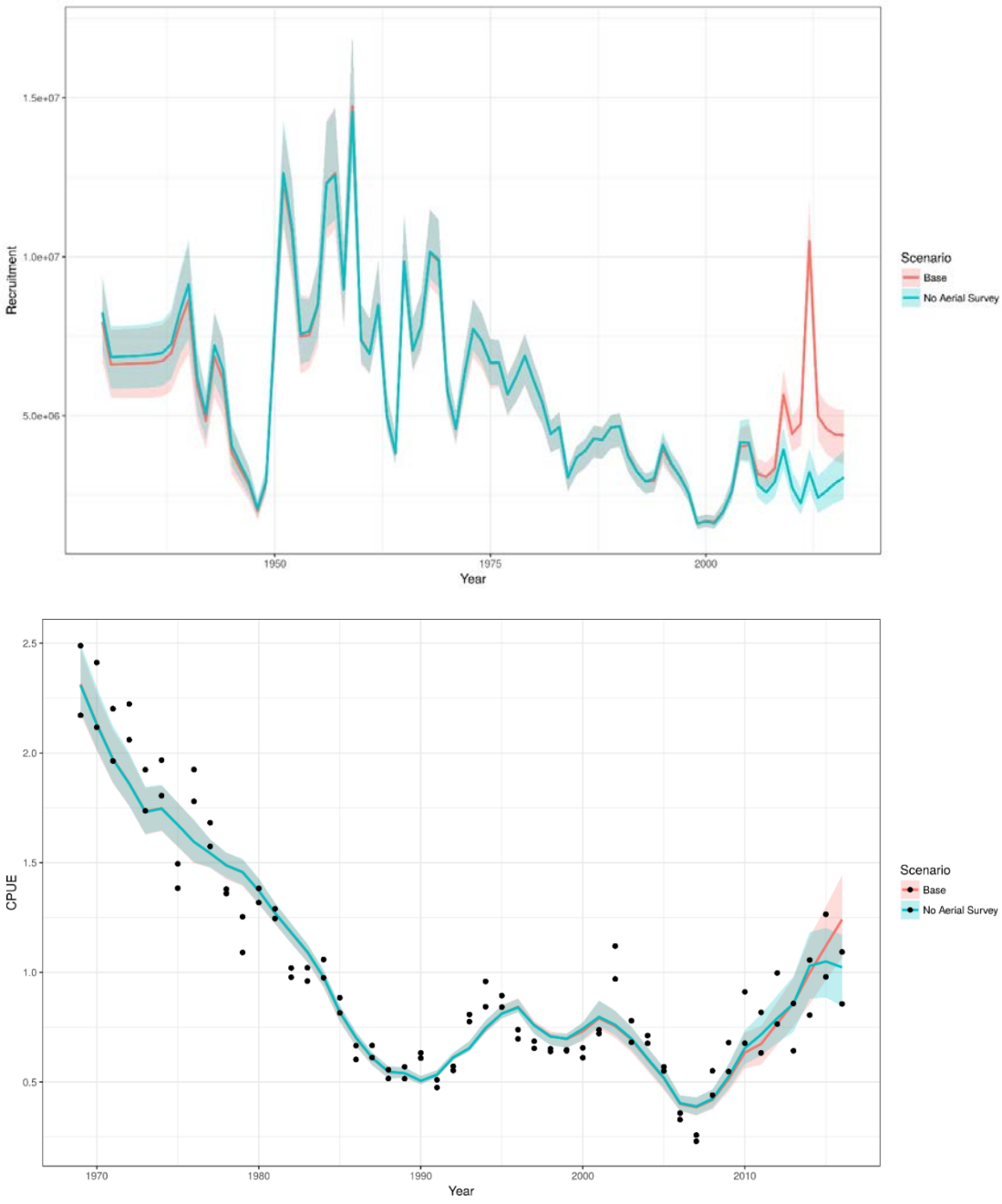


Figure 20. Comparison between base reference set and a sensitivity run in which all aerial survey data were removed.

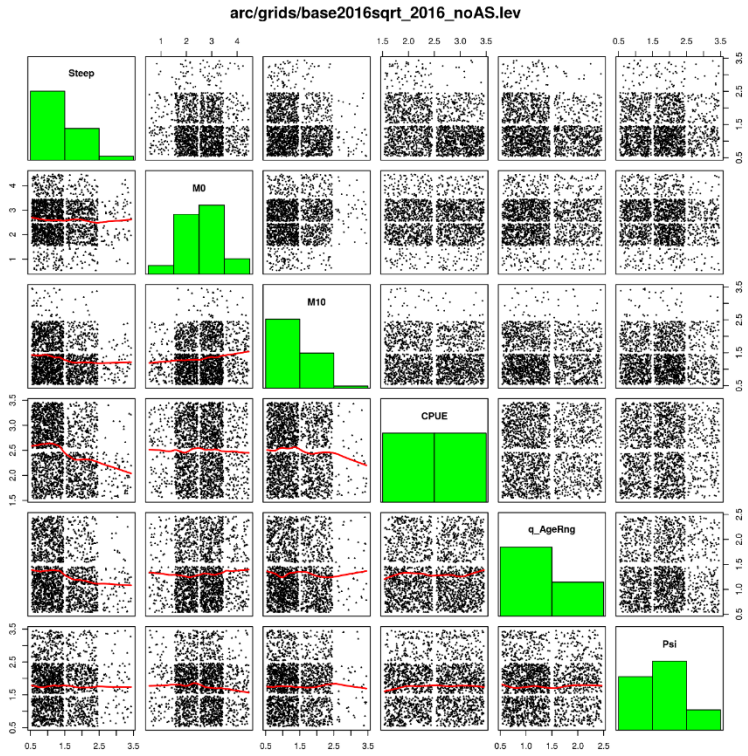


Figure 21. Results of sampling of grid cells using objective function weights when steepness *h*= 0.6, 0.7 and 0,8 and the aerial survey data were removed.

A retrospective analysis conducted with the base reference set (CCSBT-ESC/1708/35) showed increases in the recent recruitment estimates with the incorporation of the last three year of data (Fig. 22). This upturn in recruitment estimates resulted in a progressive shift in the support provided by the model to higher steepness values (Fig. 23) and a reduction in the support for the lowest value of steepness included in the grid (*h*=0.6).

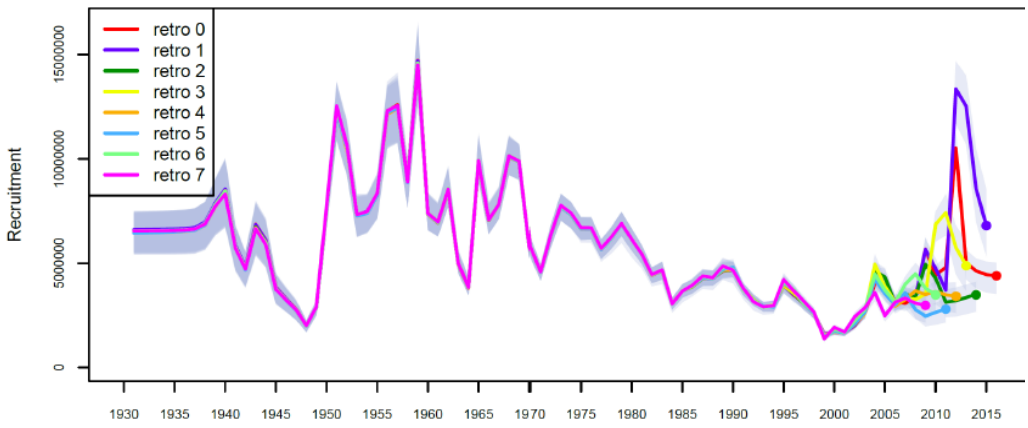


Figure 22. Recruitment series estimated when data are truncated at different times. Retro 0 corresponds to the current base assessment.

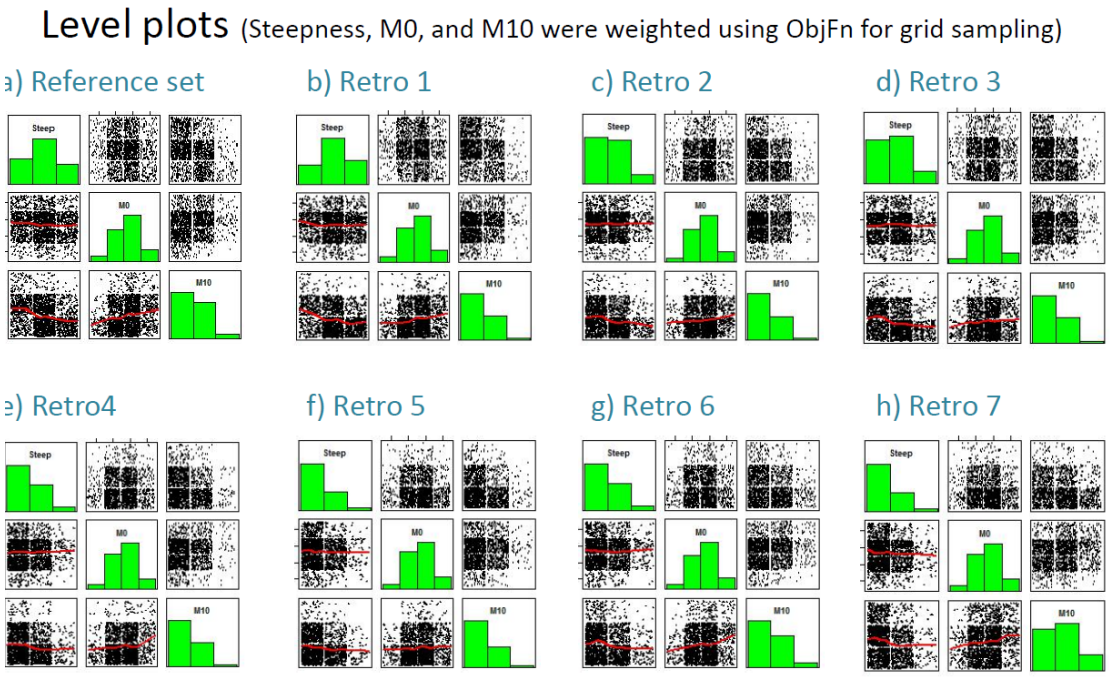


Figure 23. Retrospective analysis: results of sampling of grid cells using objective function weights when data is truncated at different points in time.

Restrict flexibility in LL1 selectivity

The selectivity of the LL1 fishery in the reference set is allowed to vary (in a constrained manner by 3-year blocks over the recent years. A set of sensitivity runs was conducted using a mid-cell grid to examine the effects on recruitment of reducing that flexibility by assuming: a) constant selectivity from 1969, b) constant selectivity for 1969-2008 and then for the last 8-year block (2009-2016) and c) ibid b) plus excluding the 2016 aerial survey data point. Results showed that recent recruitment estimates were much lower than in the base mid-cell run when the selectivity was assumed to be constant, and intermediate when it was constant only over the last eight years (Fig. 24). The base case had a small reduction in the selectivity of the young age year classes, which made the CPUE data more compatible with the increased aerial survey indices.

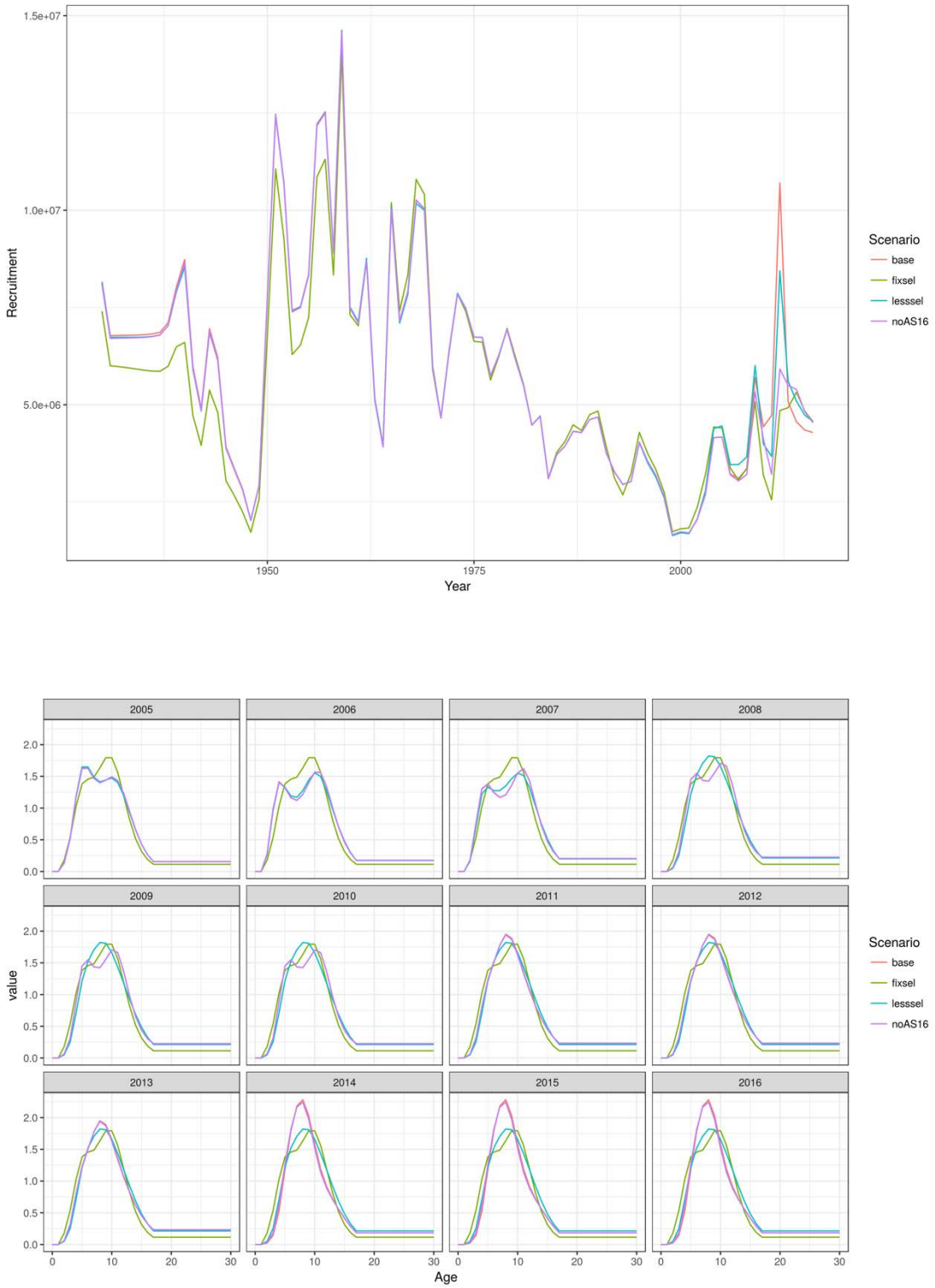


Figure 24. Sensitivity of recruitment estimates to restrictions in the flexibility of the LL1 fishery selectivity.

Stock recruitment

The fits to the stock-recruitment curves in the base reference set resulted in strong trends in the recruitment deviations affecting all grid cells. A partial autocorrelation analysis indicated that an autoregressive model of order 1 was sufficient to account for the pattern observed in residuals (Fig. 25). Empirical estimates of standard deviations and autocorrelation for the reference set are provided in Table 1.

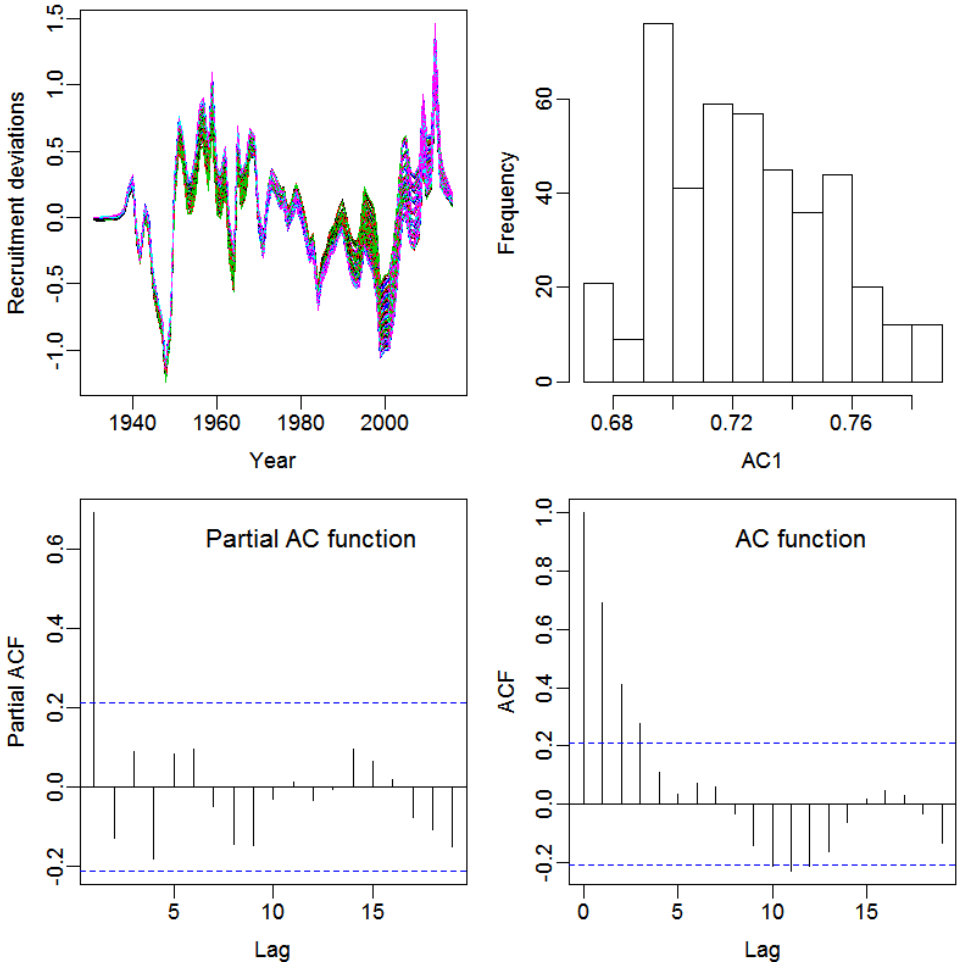


Figure 25. Residuals of the stock-recruitment fits in the base reference set of models.

Table 1: Estimates of recruitment deviations, autocorrelation in recruitment deviations and "raw" estimates of sigmaR for all 2,000 grid runs

Statistic	**50%**	**10%, 90% percentile**
sigma R	0.40	0.39, 0.43
Rho	0.72	0.69, 0.75
sigma.rho	0.28	0.28, 0.29

Within-cell uncertainty

The OMMP meeting discussed the advances made in the incorporation of within-cell uncertainty in the stock assessment and projections. An approximation based on the Hessian was used in the past to incorporate estimation uncertainty in the conditioning results, but not in the projections. The meeting decided to keep exploring alternative approaches for incorporating within-cell uncertainty in both, conditioning and projections, for MP testing.

Attachment 10

Summary table for Reference Set and the sensitivity tests

Summary table for Reference Set and the sensitivity tests from OMMP8 and webinar. Medians are listed first, with the 80%PI included in the bracket as appropriate.

Run	Rel. TRO (2017)	Rel. B10+ (2017)	TRO-to-TROmsy (2017)	TROmsy /TRO0	F-to-FMSY (2017)	Median MSY (t) (2017)	Rel. TRO (2035)	P(B10+ > 0.2B0) @ 2035	Mean TAC (2018-2035)
Reference	0.13 (0.11-0.17)	0.11 (0.09-0.13)	0.49 (0.38-0.69)	0.27 (0.22-0.32)	0.5 (0.38-0.66)	33,036	0.3 (0.21-0.46)	0.88	22,570
UAM1	0.13 (0.1-0.17)	0.11 (0.09-0.13)	0.49 (0/37-0.67)	0.27 (0.22-0.32)	0.57 (0.43-0.74)	33,471	0.28 (0.18-0.43)	0.80	22,025
SFOC40	0.14 (0.11-0.18)	0.11 (0.09-0.14)	0.52 (0.38-0.71)	0.27 (0.22-0.32)	0.53 (0.4-0.7)	35,120	0.31 (0.21-0.48)	0.89	22,707
SFOC00	0.12 (0.1-0.16)	0.1 (0.09-0.12)	0.46 (0.35-64)	0.27 (0.22-0.32)	0.48 (0.35-0.63)	30,865	0.29 (0.20-0.45)	0.87	22,319
LL1 Case 2	0.13 (0.11-0.16)	0.11 (0.09-0.13)	0.48 (0.37-0.66)	0.27 (0.22-0.32)	0.5 (0.38-0.63)	33,526	0.31 (0.21-0.47)	0.90	22,627
IS20	0.18 (0.15-0.22)	0.14 (0.12-0.17)	0.64 (0.46-0.97)	0.28 (0.23-0.33)	0.41 (0.3-0.57)	34,304	0.38 (0.26-0.59)	0.96	23,224
High Aerial CV	0.12 (0.1-0.16)	0.11 (0.09-0.14)	0.47 (0.35-0.67)	0.27 (0.22-0.32)	0.58 (0.43-0.78)	32,799	0.26 (0.16-0.41)	0.72	21,745
No AS 2016	0.13 (0.1-0.16)	0.11 (0.09-0.14)	0.47 (0.36-0.66)	0.27 (0.22-0.32)	0.59 (0.44-0.78)	33,140	0.26 (0.17-0.40)	0.74	21,455
Upq2008	0.11 (0.1-0.15)	0.09 (0.08-0.12)	0.42 (0.35-0.65)	0.27 (0.22-0.32)	0.56 (0.42-0.75)	32,552	0.26 (0.17-0.42)	0.73	22,635
Omega 75	0.12 (0.1-0.16)	0.1 (0.08-0.13)	0.46 (0.35-0.65)	0.27 (0.22-0.32)	0.49 (0.36-0.65)	33,799	0.31 (0.21-0.48)	0.88	21,847
S00CPUE	0.15 (0.12-0.19)	0.12 (0.1-0.15)	0.55 (0.41-0.76)	0.27 (0.22-0.32)	0.46 (0.35-0.6)	34,126	0.33 (0.23-0.52)	0.94	22,665
S50CPUE	0.12 (0.1-0.15)	0.1 (0.08-0.12)	0.45 (0.41-0.76)	0.27 (0.22-0.32)	0.54 (0.4-0.71)	32,458	0.28 (0.19-0.44)	0.82	22,444
Updownq	0.13 (0.11-0.17)	0.11 (0.09-0.13)	0.49 (0.38-0.69)	0.27 (0.22-0.32)	0.5 (0.38-0.66)	33,036	0.3 (0.21-0.47)	0.88	22,569
GAM CPUE	0.14 (0.12-0.18)	0.12 (0.1-0.14)	0.53 (0.43-0.76)	0.27 (0.22-0.32)	0.51 (0.36-0.62)	32,774	0.31 (0.22-0.47)	0.91	23,168
CPUE w/o A7	0.12 (0.1-0.15)	0.1 (0.08-0.12)	0.45 (0.35-0.62)	0.27 (0.22-0.32)	0.54 (0.4-0.71)	32,734	0.29 (0.19-0.44)	0.83	22,246
Tag mixing	0.13 (0.11-0.17)	0.11 (0.09-0.14)	0.49 (0.38-0.68)	0.27 (0.22-0.32)	0.48 (0.36-0.64)	33,165	0.31 (0.22-0.53)	0.90	22,540
Piston Line[1]	0.14 (0.11-0.2)	0.13 (0.1-0.18)	0.54 (0.4-0.81)	0.27 (0.22-0.32)	0.59 (0.44-0.8)	33,086	0.35 (0.22-0.53)	0.93	23,499
No HSPs	0.13 (0.11-0.17)	0.11 (0.09-0.13)	0.49 (0.38-0.68)	0.27 (0.22-0.32)	0.5 (0.38-0.66)	33,039	0.30 (0.21-0.47)	0.88	22,565
No POPs/HSPs	0.12 (0.1-0.15)	0.1 (0.08-0.11)	0.47 (0.34–0.61)	0.28 (0.22-0.33)	0.52 (0.4-0.67)	34.168	0.29 (0.19-0.45)	0.79	23,148
Psi (ObjFn)	0.13 (0.11-0.17)	0.11 (0.09-0.13)	0.49 (0.38-0.69)	0.27 (0.22-0.32)	0.5 (0.38-0.65)	33,064	0.30 (0.21-0.47)	0.88	22,601
No h = 0.8	0.13 (0.1-0.16)	0.11 (0.09-0.13)	0.44 (0.36-0.58)	0.31 (0.27-0.32)	0.57 (0.44-0.67)	32,512	0.28 (0.20-0.43)	0.83	22,220
q(HSP) = 1	0.15 (0.12-0.18)	0.12 (0.1-0.14)	0.54 (0.4-0.75)	0.27 (0.22-0.32)	0.48 (0.36-0.65)	33,396	0.31 (0.21-0.5)	0.92	24,585

Attachment 11

Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2017

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 description of fisheries and the state of stock, and provides 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 2016 are shown in Figures 1 - 3. However, 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. Historically, 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 - 2016, 77.1% of the reported catch was taken by longline and 22.9% 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 79.1% of the SBT catch has been made in the Indian Ocean, 16.5% in the Pacific Ocean and 4.4% 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 923t over the past two decades. This variation in catch is reflecting 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 9,000t, averaging about 19,000t, and the reported Pacific Ocean catch has ranged from about 800t to 19,000t, averaging about 5,100t over the same periods (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 he 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.

The results of the updated indicators are as follows:

- The two indicators of juvenile (age 1–4) SBT abundance (i.e. scientific aerial survey index and the trolling index) were available for 2017. Both the scientific aerial survey and trolling index decreased compared to 2016.
- Indicators of age 4+ SBT CPUE from the New Zealand domestic longline fishery increased in 2016.
- Recent Japanese longline CPUE indicators suggest that the current stock levels for the 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 age 8-11 group have increased steadily since 2011. The indices for age class 12+ have declined gradually since 2011.
- The Taiwanese standardised CPUE for the central-eastern and the western areas reveal quite different trends. For the central-eastern area, this CPUEs increased gradually before 2007, showed a decreasing trend from 2007 to 2011, increased substantially in 2012 before decreasing gradually and then increased again in 2016. For the western area, the standardized CPUE series indicates a generally decreasing trend with some fluctuation after 2002.
- The Korean standardised CPUE series has shown an increasing trend in recent years.

Overall there are signs of higher recruitment in recent years and there are some consistent positive trends in the longline CPUE. This suggests that some relatively strong cohorts are moving through the fishery, though have yet to contribute to the spawning stock. The ESC noted that increased recruitment is of itself not necessarily indicative of increased spawning stock biomass.

4. Current Management Measures

Total Allowable Catch (TAC)

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

At its eighteenth annual meeting, 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 otherwise 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 and the TAC for 2015 to 2017 is 14,647 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-

[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.

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 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 at Sea

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 a 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 in 2016 and the outcome of the review of exceptional circumstances at its 2017 meeting, 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

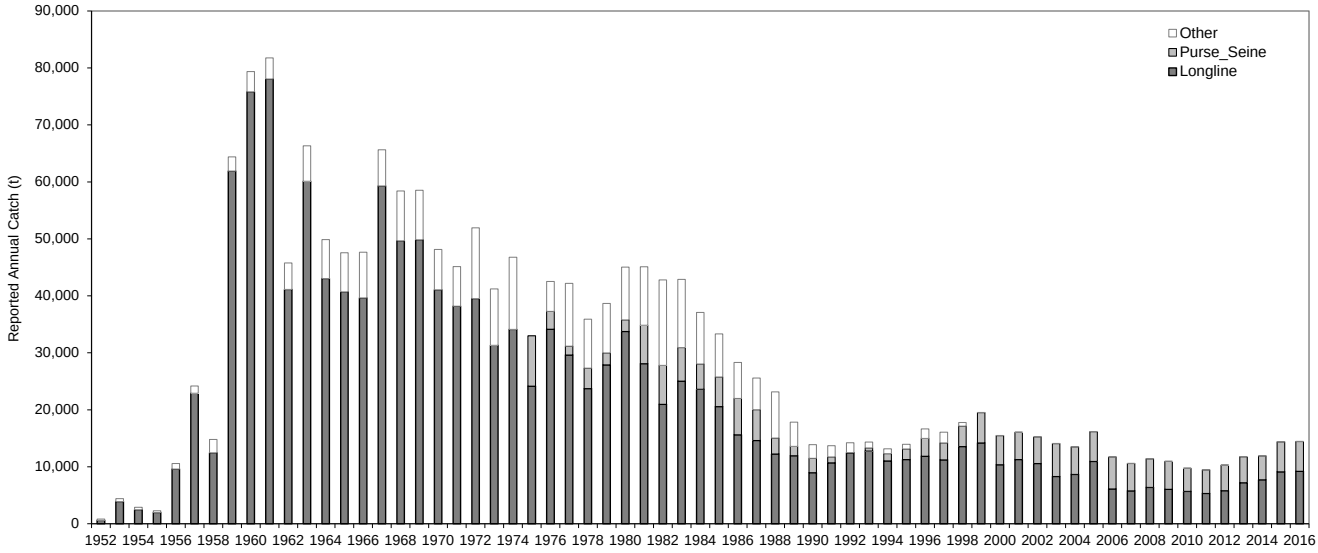


Figure 1: Reported southern bluefin tuna catches by fishing gear, 1952 to 2016. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

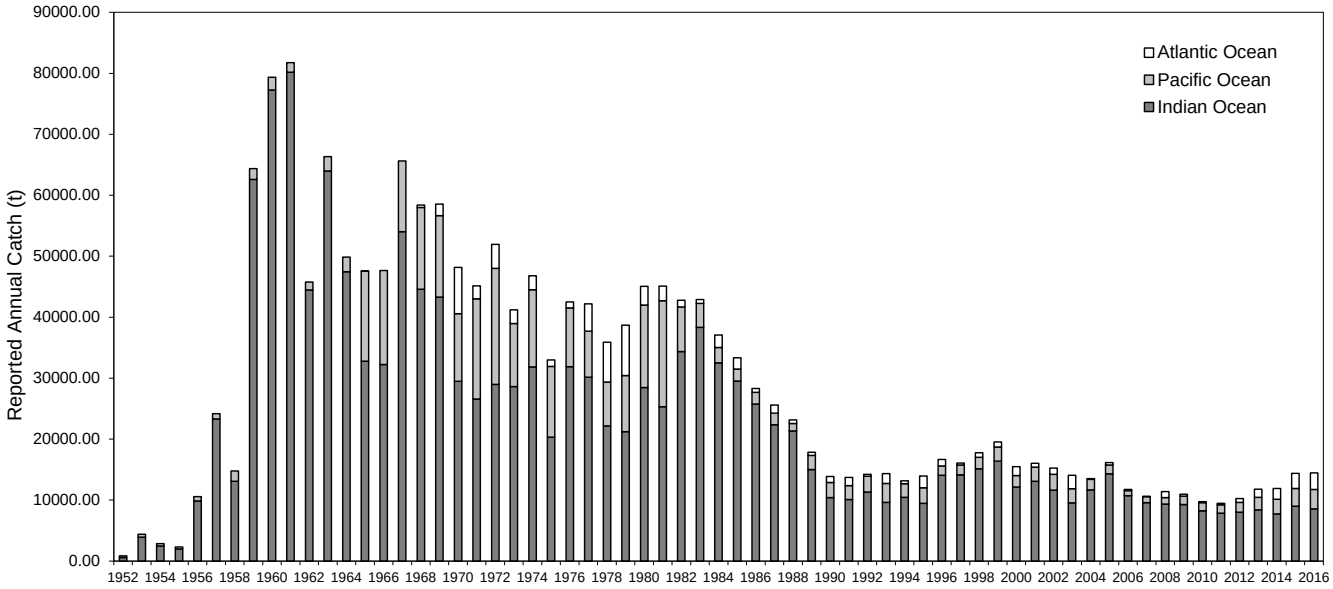


Figure 2: Reported southern bluefin tuna catches by ocean, 1952 to 2016. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

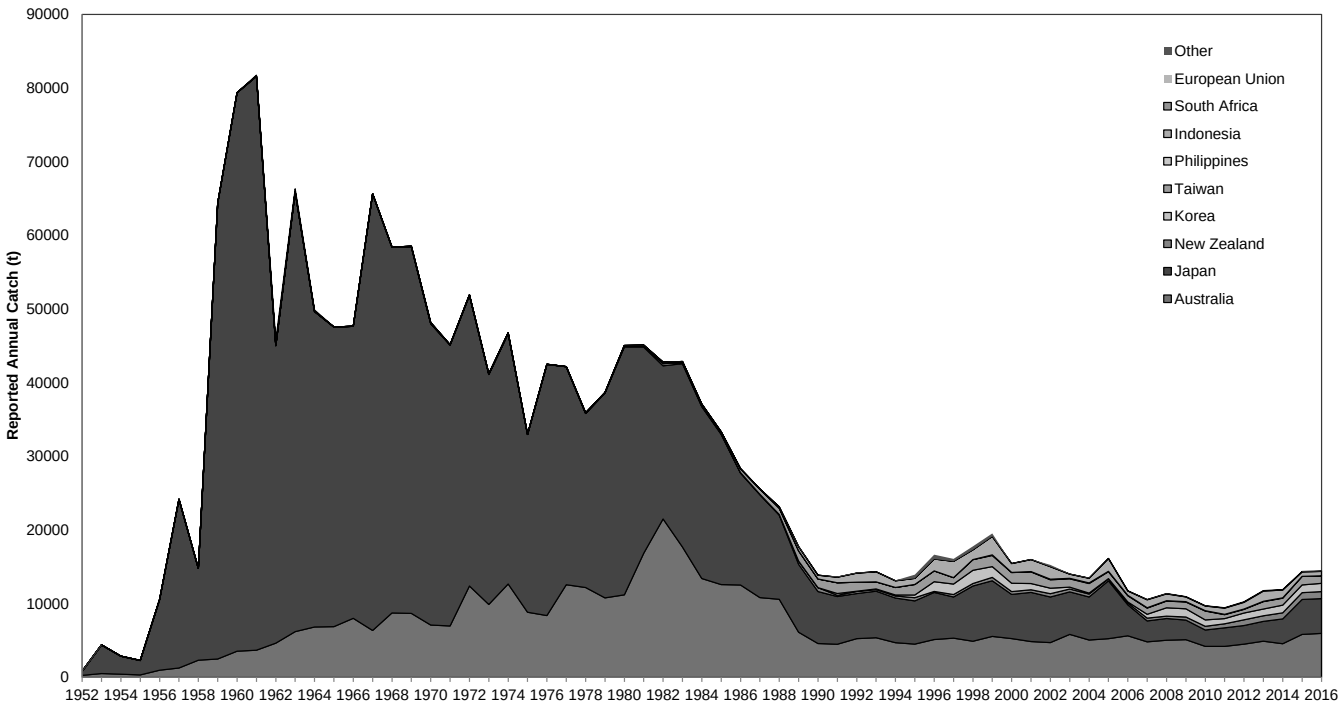


Figure 3: Reported southern bluefin tuna catches by flag, 1952 to 2016. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

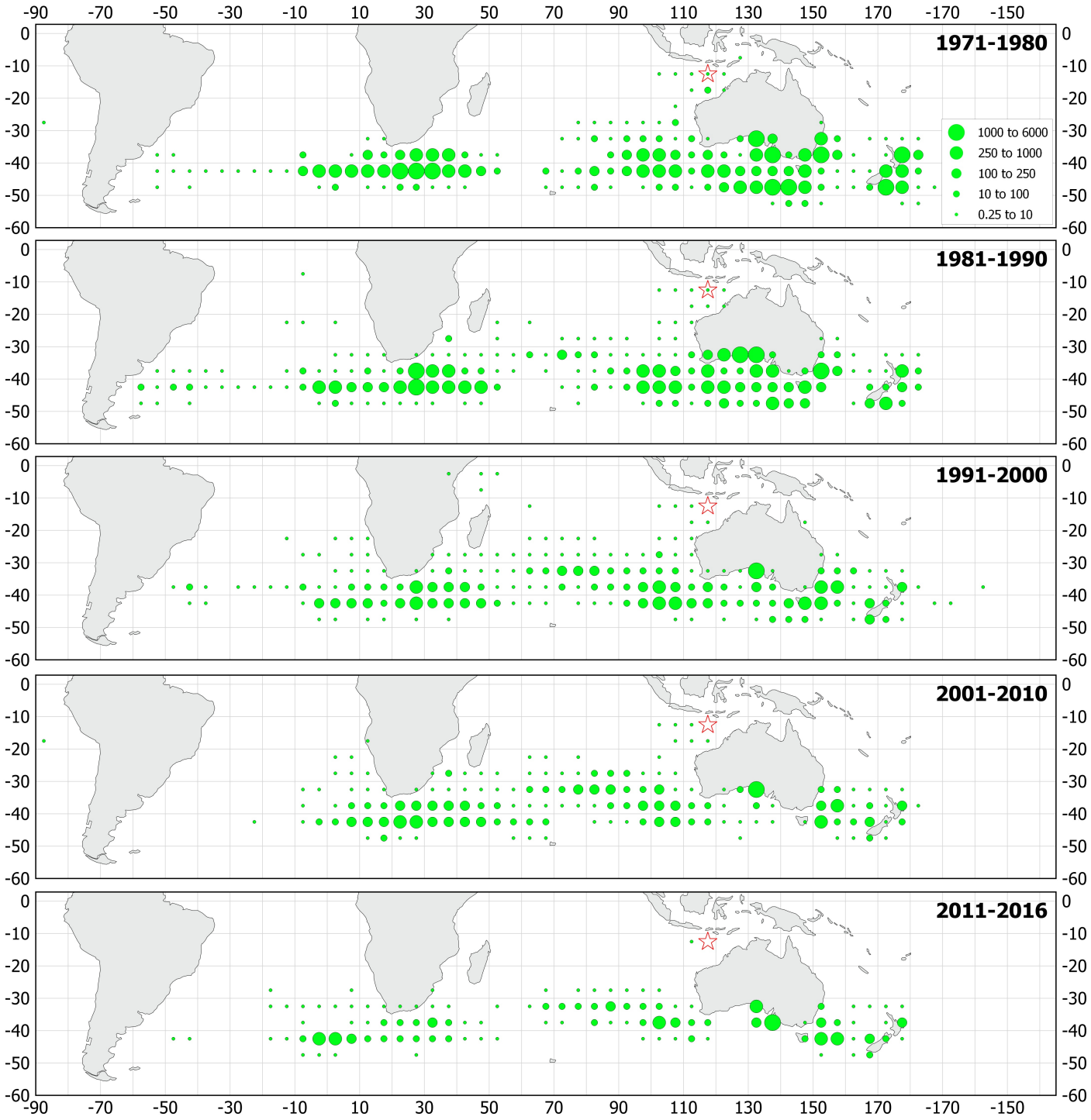


Figure 4: Geographical distribution of average annual reported southern bluefin tuna catches (t) by CCSBT members and cooperating non-members over the periods 1971-1980, 1981-1990, 1991-2000, 2001-2010 and 2011-2016 per 5° block by oceanic region. The area marked with a star is an area of significant 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.

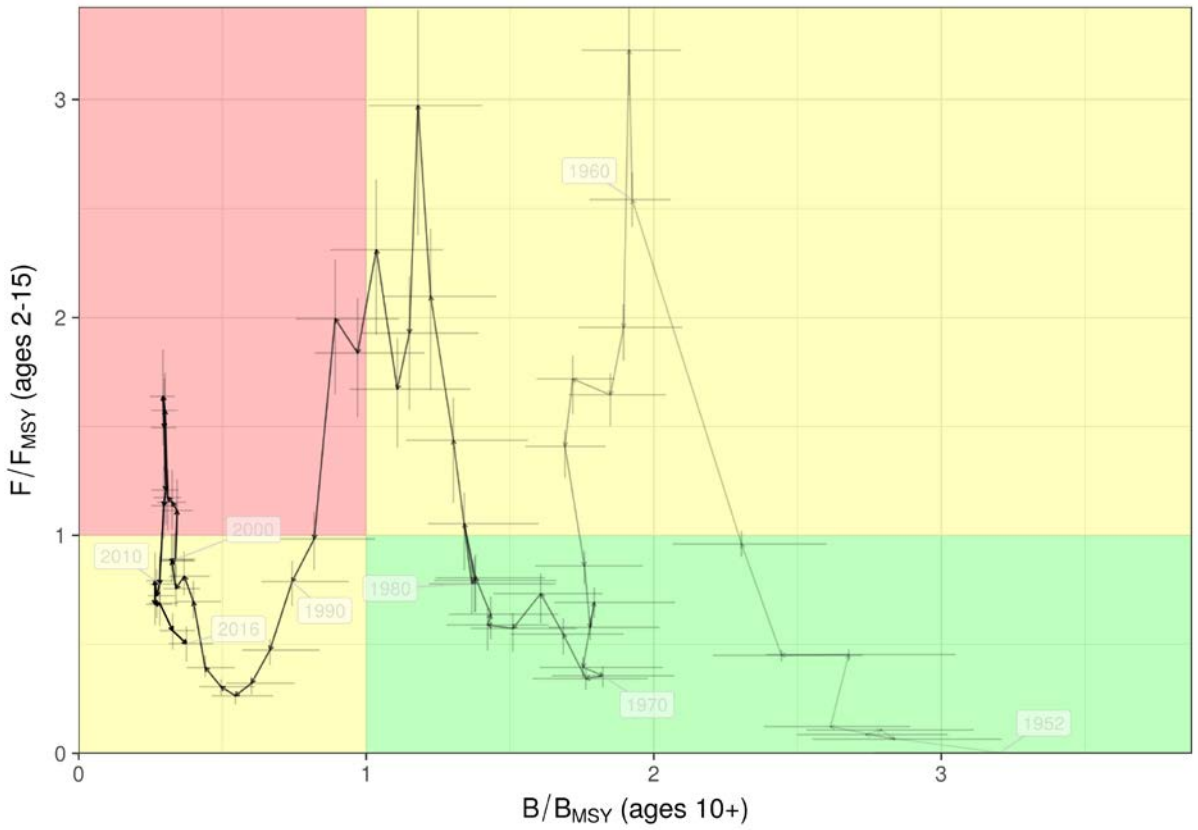


Figure 5. Time trajectory from 1952 to 2016 of median fishing mortality over the F_{msy} (for ages 2-15) versus spawning biomass (B) over B_{msy}. The fishing mortality rates are based on biomass-weighted values and the relative fishery catch composition and mean SBT body weights in each year. Vertical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

Attachment 12

Work plan for maturity study

The criteria to identify mature and immature albacore by histological identification of brown bodies is described in Farley et al. (2014). This method has subsequently been demonstrated to be applicable to SBT and other tunas Farley (*pers.com.*). It was agreed that a "reference collection" of histological slides would be prepared and distributed for the purposes of training and consistency of interpretation.

Laboratory analysis – preparation and interpretation of ovary histology and otolith sections

The original proposal suggested several options for reading of histology. Taiwan and Korea are planning to, or have already completed, the histology, using the methods proposed. NZ samples have been sent to CSIRO for analysis with Australian samples. Japan would process and complete the histology if they proceed with collection. The approach to otolith reading is yet to be finalised.

Workshop

The proposed workshop would bring together the histology scientists from each member to review the histology and method, collaborate on agreed criteria and collation of results from all the ovaries collected, and review the data collection stratification, and any gaps (including collection of matching otoliths to estimate age of the fish sampled). Indonesia have kindly offered to host the workshop at the Research Institute for Tuna Fisheries in Denpasar in March-April 2019. The final date for the workshop will be confirmed asap following the 2017 Commission meeting.

Data analysis: Modelling to estimate an unbiased maturity schedule.

Following the workshop work, the final data set can be statistically analysed to produce an updated maturity schedule. Given the migratory nature of SBT this is best done with the methods used by Farley et al. (2014).

The new maturity schedule will be used to update the reproductive schedule used in calculation of expected relative reproductive output for the close-kin abundance estimation (both in the OM and stand-alone model). In addition, the maturity schedule can be used for the calculation of SSB (a commonly used measure) for reporting purposes (in addition to TRO which includes additional components to reproductive output).

Activity	Budget Request
CCSBT maturity workshop, March-April 2019 – Hosted by Indonesian Research Institute for Tuna Fisheries, Denpasar, Bali.	$0
Histology and otolith reading – members to progress histological processing inter-sessionally.	$0
Preparation of workshop materials and statistical support for full analysis and reporting (2019 calendar year).	$50,000
Travel for workshop supported by individual members	$0
Total	50,000

Attachment 13

Data Exchange Requirements for 2018

Introduction

The data exchange requirements for 2018, 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 2017. 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 2018 to allow development of the necessary data loading routines.

Data listed in Annex A should be provided for the complete 2017 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 2016 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 2016 data) must be accompanied by a detailed description of the changes.

Annex A

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
CCSBT Data CD	Secretariat	31 Jan 18	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 2017 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 2018 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 18	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 18	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 18	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 18	The mortality allowance (kilograms) that was used in the 2017 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 18 (New Zealand)[2] 30 Apr 18 (other members & Secretariat) 31 July 18 (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 18 (all Members except Indonesia) 31 July 18 (Indonesia)	The following data concerning non retained catches will be provided by year, month, and 5*5 degree for each fishery: • Number of SBT reported (or observed) as being non-retained; • Raised number of non-retained SBT taking into consideration vessels and periods in which there was no reporting of non-retained SBT; • Estimated size frequency of non-retained SBT after raising; • Details of the fate and/or life status of non-retained fish. Indonesia will provide estimates based on either shot by shot or as aggregated data from the trial Scientific Observer Program.
RTMP catch and effort data	Japan	30 Apr 18	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.

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

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Raised catch data for AU, NZ catches	Australia, Secretariat	30 Apr 18	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 18	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 18	Raw observer length frequency data as provided in previous years.
Raised Length Data	Australia, Taiwan, Japan, New Zealand, Korea	30 Apr 18 (Australia, Taiwan, Japan, Korea) 7 May 18 (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 18	Raw Length Frequency data from the South African Observer Program.
RTMP Length data	Japan	30 Apr 18	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 18	Estimates of both the age and size composition (in percent) is to be generated for the spawning season July 2016 to June 2017. Length frequency for the 2016 calendar year and age frequency for the 2016 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 18	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 2015 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 18	Estimates of the different trolling indices (piston-line index and grid-type trolling index (GTI)) for the 2017/18 season (ending 2018), including any estimates of uncertainty (e.g. CV).
Tag return summary data	Secretariat	30 Apr 18	Updated summary of the number tagged and recaptured per month and season.

[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
Gene tagging data	Secretariat	30 Apr 18	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 18	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 18	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. **For OM**	Australia	24 May 18[7]	These data will be provided for July 2016 to June 2017 in the same format as previously provided.
Raised catch-at-age for Indonesia spawning ground fisheries. **For OM**	Secretariat	24 May 18	These data will be provided for July 2016 to June 2017 in the same format as on the CCSBT Data CD.
Total catch per fishery and sub-fishery each year from 1952 to 2017. **For OM**	Secretariat	31 May 18	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. **For OM**	Secretariat	31 May 18	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 18	Calculate the total catch-at-age in 2017 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 18	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 18 (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 18 (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.

Attachment 14

Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of
The Twelfth Meeting of the Ecologically Related Species Working Group

21-24 March 2017
Wellington, New Zealand

Attachment 15

ESC Workplan for 2018-2020

Activity	2018	2019	2020
Routine Activity			
Continuation of tag recovery efforts	Yes	Yes	Yes
Standard Scientific Data Exchange	Yes	Yes	Yes
Provide SBT stock status report to other t-RFMOs	Yes	Yes	Yes
Contracted Work/Projects			
Routine OMMP code maintenance and development	Yes	Yes	Yes
Continued aging of Indonesian otoliths	Yes	Yes	Yes
Gene tagging	1st GT estimate, Release 3, Recap 2	2nd GT estimate, Release 4, Recap 3	3rd GT estimate, Release 5, Recap 4
Continued collection & processing of close-kin samples	Yes	Yes	Yes
Close-kin identification & exchange	Yes	Yes	Yes
Maturity study	Collect additional samples where required	Lab analysis, workshop & data analysis	-
Meetings			
CPUE webinar	Yes	Yes	Yes
OMMP meeting (June/July)	Yes[1]	Yes[2]	-
Informal OMMP meeting[3]	Yes	Yes	-
ESC meeting[4]	Yes[5]	Yes[6]	Yes[7]
Extended Commission meeting	Yes[8]	Yes[9]	Yes[10]
Contingency meeting (June)	-	-	Yes[11]

[1] First presentation of candidate MPs (CMPs) evaluated using 2017 OMs.
[2] Recondition the OM and review initial updated versions of CMPs to develop a limited set to put forward to the ESC.
[3] One day, immediately prior to the ESC. No separate report of meeting.
[4] Each meeting includes: Regular review of indicators; Evaluation of meta-rules and exceptional circumstances; Review results of SRP activities.
[5] Evaluation of refined CMPs.
[6] Review and advice on a set of CMPs and a session for interaction with stakeholders.
[7] 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.
[8] Results on CMP performance and trade-offs presented to EC. EC confirms or amends broad recovery objectives based on advice from the ESC.
[9] EC Aim to select and adopt MP.
[10] EC agrees TAC advice for 2021-2023.
[11] ESC and/or special EC meeting in case more time is needed to complete evaluation.

Attachment 16

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)

	2018	2019	2020
June/July 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	-
Informal technical workshop (immediately prior to ESC, *no Interp*)	1 day FM: 2P, 1C, 1Ch, 2 Sec + 3C Prep Days	1 day FM: 2P, 1C, 1Ch, 2 Sec + 3C Prep Days	-
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
Special 1-day Meeting of the Commission (MP Consultation) after ESC	-	1.5 day FM, 1P, 1Ch, 3 Interp, 3 Sec	-
Contingency ESC/EC Meeting	-	-	5 days FM: 1Ch, 3P, 1C, 3 Interp, 3 Sec
CPUE Webinar	3 Panel days	3 Panel days	3 Panel days
Routine OMMP Code Maintenance / Development	5 P days	5 P days	5 P days
Maturity study	$0	$50,000[1]	-
Continued close-kin sample collection & Processing	Contracted	Contracted	Contracted
Close-kin identification & exchange	$33,000	$47,300	$48,950
Continued aging of Indonesian otoliths	Contracted	Contracted	Contracted
Long-term Gene Tagging	Contracted	Contracted	Contracted

[1] For Statistician and preparation of workshop materials.

Appendix 3

Glossary of Terms

AR: auto-regressive process, a model used for processes with correlations over time.

AS: aerial survey

ASF: Australian surface fishery

B10+: the total biomass of fish aged 10 and over

B_0: the spawning biomass (on average over time) in the absence of fishing.

CCAMLR: Commission for the Conservation of Antarctic Marine Living Resources

CC: Compliance Committee

CCSBT: Commission for the Conservation of Southern Bluefin Tuna

CDS: Catch Documentation Scheme

CI: Condition indices

CKMR: close-kin mark recapture

Close-kin: use of genetics to identify closely related fish, e.g. parent-offspring, siblings and half-siblings

Constant squares: assumption that the expected abundance in squares not being fished is equal to that in squares which are.

CMP: candidate management procedure

CPUE: catch (in either numbers or biomass) per unit of fishing effort.

CSIRO: Commonwealth Scientific and Industrial Research Organisation (Australia).

CV: Coefficient of Variation

DArT: Diversity Arrays Technology Pty Ltd.

DArTcap: a Next-Generation Sequencing assay developed by CSIRO and DArT Pty Ltd.

Delta-lognormal model: a CPUE standardisation method which estimates different covariates structure for sets with zero and non-zero catches, and assumes the latter to be log-normally distributed

EC: Extended Commission

EEZ: exclusive economic zone

EM: electronic monitoring

ERSWG: Ecologically Related Species Working Group

ESC: Extended Scientific Committee

F: rate of fishing mortality

FAO: Food and Agriculture Organization of the United Nations

FCR: Feed Conversion Ratio

FL: fork length

GAB: Great Australian Bight

GAM CPUE: standardisation approach for CPUE using a Generalised Additive Model

Gene-tagging: using genetic analysis of biopsies to identify individual fish, hence enabling them to be re-identified when captured later

GLM: General Linear Model or Generalised Linear Model

GSI: gonad somatic index

GTI: grid-type trolling index

h: the steepness of the stock-recruit relationship

HBF: hooks between floats

HSP: half-sibling pair

ICCAT: International Commission for the Conservation of Atlantic Tunas

IOTC: Indian Ocean Tuna Commission

IUU: illegal, unreported and unregulated fishing

JFA: Fisheries Agency of Japan

JMR: Independent review of Japanese southern bluefin tuna market data anomalies

k: the annual growth rate parameter of the von Bertalanffy length-at-age model

L_∞: the asymptotic length of the von Bertalanffy length-at-age model

LL: longline

LL1: the long-line 1 fleet (primarily Japanese long-line areas 4-9 plus all long-line catches not covered in LL2-LL4 including from Japan, Korea, Australia, New Zealand, Philippines, South Africa, European Union) from 1952, season: January 1st to December 31st

LL2: the long-line 2 fleet (Taiwanese albacore long-line fishery and Taiwanese gillnet catches) from 1969, season: January 1st to December 31st

LL3: the long-line 3 fleet (Japanese long-line in Area 2) significant until 1971, season: July 1st to June 30th

LL4: the long-line 4 fleet (historical Japanese spawning long-line fishery, Area 1) significant until about 1967, season: July 1st to June 30th and Indonesian longline fleet from 1976

LSTLV: a tuna longline fishing vessel with freezing capacity

M_0: rate of natural mortality at age 0

M_{10}: rate of natural mortality at age 10

MCS: monitoring, control and surveillance

MP: management procedure

MSE: management strategy evaluation

MSY: maximum sustainable yield

noAS: an assessment which excludes consideration of the aerial survey time series

OM: operating model

Omega (ω): power parameter on abundance in the relationship between LL1 CPUE and abundance

OMMP: Operating Model and Management Procedure group

PTI: piston line trolling abundance index

POP: parent-offspring pair

Psi (Ψ): power parameter on fecundity for allometric relationship between fecundity and reproductive success

q: the catchability coefficient of the long-line LL1 fleet

q_{hsp}: the adult abundance scaling constant for the half-sibling pair model, where a value of 1 corresponds to these data providing an unbiased estimate of absolute abundance

QAR: Quality Assurance Review

RFMO: regional fisheries management organisation

RMA: Research Mortality Allowance

SAPUE: surface abundance per unit effort derived from a commercial aerial spotting index

SBT: southern bluefin tuna

SC: Scientific Committee

SNP: single nucleotide polymorphisms

SPC: Pacific Community

SRP: Scientific Research Program

SSB: spawning stock biomass

TAC: total allowable catch

tRFMO: tuna regional fisheries management organisation

TMG: Tokyo Metropolitan Government

TRO: total reproductive output of the adult population, reflecting not only fecundity, but also frequency of spawning and spawning success

UAM: unaccounted catch mortality

UAM1: a specific set of assumptions for UAM that is used in operating models

Upq: a step increase in CPUE catchability q in a specified year

Variable squares: assumption that the expected abundance in squares not being fished in three month period in any year is zero

VMS: vessel monitoring system

WCPFC: Western and Central Pacific Fisheries Commission