Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Eighteenth Meeting of the Scientific Committee

7 September 2013
Canberra, Australia

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Canberra, Australia

Agenda Item 1. Opening meeting

1. The independent Chair, Dr 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 Eighteenth 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 1:05 pm, on 7 September 2013.

List of Appendices

Appendix

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

Appendix 1

List of Participants
The Eighteenth Meeting of the Scientific Committee

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
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Commission for the Conservation of Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of
The Extended Scientific Committee for the Eighteenth Meeting of the Scientific Committee

2-7 September 2013
Canberra, Australia

Extended Scientific Committee for the Eighteenth Meeting of the Scientific Committee
2 - 7 September 2013
Canberra, Australia

Agenda Item 1. Opening

1.1 Introduction of Participants

1. The independent Chair, Dr Annala, welcomed participants and opened the meeting.
2. Each delegation introduced its participants. The list of participants is at **Attachment 1**.

1.2 Administrative Arrangements

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

Agenda Item 2. Appointment of Rapporteurs

4. Australia and Japan assigned rapporteurs to produce and review the text of the substantive agenda items.

Agenda Item 3. Adoption of Agenda and Document List

5. The agenda was adopted and is shown in **Attachment 2**.
6. The agreed document list is shown in **Attachment 3**.

Agenda Item 4. Review of SBT Fisheries

4.1 Presentation of National Reports

7. Members made brief presentations of their National Reports.
8. Japan presented paper CCSBT-ESC/1309/SBT Fisheries-Japan. The number of Japanese longline vessels targeting SBT has decreased over recent years. In the 2012 fishing year, 94 longline vessels caught 2,467t SBT. In the calendar year, 93 vessels caught 2,528t. Nominal CPUEs have been at a high level in the CCSBT statistical areas 4, 7, 8, and 9 since 2009. In recent years, Japanese longline vessels have tended to catch and retain mainly small or middle sized fish (110-150 cm fork length) in areas 4 and 7. Middle or large sized fish were caught in Area 8. Smaller fish were also caught in area 9. Details of release activities are summarised in CCSBT-ESC/1309/33.

9. A total of 10 vessels with scientific observers operated in areas 4 to 9 in 2012. Observer coverage was 10.4% of the number of vessels, 7.9% of the number of hooks used, and 6.9% of the number of SBT caught and retained. Observer activity is detailed in CCSBT-ESC/1309/22. Observers reported the recapture of 11 conventional tags from 8 individuals.

10. In CCSBT-ESC/1309/23, Japan reported its tag and recapture activity in the 2012 season. A total of 89 SBT (averaging 53.6 cm FL) were tagged with both CCSBT conventional tag and an archival tag in the trolling survey conducted in January and February 2013. In addition, pop-up archival tags were deployed on 6 individuals (Ave. 67.8 cm FL) during the survey. A total of 14 individuals with conventional tags were recaptured between September 2012 and August 2013 (12 CCSBT tags from 10 individuals, one CSIRO tag from one individual, and 3 NSW tags from 3 individuals) by Japanese longline vessels. In the past 12 years, Japan has released 401 archival tags on larger SBT from offshore regions by Japanese longline vessels, and 448 archival tags on juvenile SBT from south coast of Western Australia. To date, 22 tags released offshore and 2 tags released from Western Australia have been recaptured.

11. New Zealand presented paper CCSBT-ESC/1309/SBT Fisheries – New Zealand that describes the New Zealand SBT fishery for 2012 and the 2011/12 fishing year. Commercial landings were 775t for the period 1 October 2011 to 30 September 2012. From scaled observer data, it is estimated that 65 dead SBT were discarded from the domestic fleet and none from the charter fleet during 2011/12. CPUE increased for both the domestic fishery and for the charter fleet. In 2011 and 2012 there has been a change in the distribution of fishing by the domestic fleet with more catch taken from the west coast of the South Island (CCSBT Area 6). All four charter vessels were covered by observers in 2011/12. Coverage by the observers was 80% of catch (numbers) and 84% of effort (hooks). For the domestic fishery in 2011/12 coverage was 9% and 7% of catch and effort respectively. The length frequency data from 2008 to 2012 shows the progression of a dominant size mode (now at about 145 cm), that is probably mainly comprised of the 2005 cohort. Only six fish were reported as non-commercial SBT catch from four recreational charter vessels in 2012. Four of which were landed (estimated total weight 131kg) and two were released alive (estimated total weight of 165kg). A total of 1252 otolith pairs were collected in 2012 and 235 were aged.

12. In response to questions, New Zealand noted that the SBT in New Zealand waters are large fish which occur in offshore waters. Consequently, it is difficult for recreational fishers to catch SBT in New Zealand unless from a recreational charter vessel. Since 2010 there has been compulsory reporting by operators of recreational charter vessels.

13. Taiwan presented paper CCSBT-ESC/1309/SBT Fisheries - Taiwan. In 2012, Taiwan’s annual catch of SBT decreased substantially to 497 t for the calendar year and 505 t for the quota year due to good catch rates for bigeye tuna in tropical Indian Ocean waters. Most Taiwanese fishing vessels operating in the Indian Ocean shifted to target bigeye tuna, so the active vessels seasonally targeting SBT decreased. The active vessels decreased from 56 in 2011 to 36 in the 2012 fishing season with 12 seasonal target SBT vessels, and 24 bycatch vessels.

14. Taiwan stated that the distribution of its fishing ground did not change in 2012. Based on the catch distribution of Taiwanese SBT fishing vessels, the fishing ground could be roughly divided into two areas: Area 1 is around the waters of the southern central Indian Ocean, and Area 2 is around the south eastern waters off South Africa shown as Figure 3 of Taiwan's report. The nominal CPUE in Area 1 showed an historical high level of about 4.14 SBT per thousand hooks in 2012.

15. Taiwan stated further that for 2012, the threat of piracy still existed in the tropical Indian Ocean. Considering the safety of observers, most of Taiwan's observers were deployed in the southern Indian Ocean, so that the observer coverage rate for SBT fishing vessels increased greatly. The observer coverage rates were about 31% by hooks, and 35% by catch.

16. In response to a request for information, Taiwan advised that it has submitted catch composition data of other tuna under data exchange procedures to the Secretariat every year and that it did include this information in its CPUE standardisation paper of CCSBT-ESC/1309/37. Taiwan also advised that the large differences in CPUE between its areas 1 and 2 (Figure 3 of Taiwan's report) was because in area 2, many vessels target oil fish other than SBT. Taiwan advised that 227 individual SBT were released and discarded in 2012 according to logbooks.

17. Australia presented paper CCSBT-ESC/1309/SBT Fisheries - Australia. The paper summarises catch and fishing activities in the Australian SBT Fishery up to and including the 2011–12 fishing season (December 2011 to November 2012), with some preliminary results for the 2012–13 season. A total of 16 commercial fishing vessels landed SBT in Australian waters in the 2011–12 fishing season for a total catch of 4543 t. A total of 98.7% of the catch was taken by purse seine with the remainder taken by longline. Five purse seiners fished off South Australia for farm operations during the 2011–12 fishing season. Most of the purse seine fishing commenced in mid December 2011 and finished in mid March 2012. In the 2012-13 fishing season observers monitored 12.7% of purse seine sets where fish were retained and 13.9% of the estimated SBT catch. Australia also provided an update on the project to provide an estimate of national recreational catches.

18. Australia noted that the implementation of the stereo video would be reported to the Compliance Committee and Australia will continue to provide all data as required by the CCSBT.

19. In response to questions, Australia advised that its fish release trials were observed by an AFMA Compliance Officer and a representative of Protec Marine, the government contractor, but that once the fish are released, they were free swimming and that there were no further observations on their fate. A participant asked whether there is information that reports the effect of increasing sample size (40 to 100 fish) to estimate purse seine catch. Australia responded that currently there is no information available.

20. The ESC asked about the increased area over which fishing effort in 2012-13 was spread in the Great Australian Bight, noting that this area of effort seemed larger than in other years. Australia responded that early in the season some catch was taken in the west, but with schools available to the east, effort moved there as it was closer to Port Lincoln.

21. Korea presented paper CCSBT-ESC/1309/SBT Fisheries - Korea. In 2012, seven longline vessels were actively fishing for SBT and caught 922 t in the calendar year and 889 t in the fishing year. The 2012 catch was a 30.8% increase from 2011. Distribution of fishing effort did not differ from the historical pattern and was relatively higher in statistical area 9 than in area 8. The observer coverage was estimated to be 12%. With regard to data collection and reporting requirements, progress was made by revising the applicable Act; this was put into effect from 5 December 2012. The Act ensures that the required data is recorded in logbooks and that monthly reporting to the NFRDI occurs. During this year, the logbook reporting rate attained almost 100% and improvement of data quality is now being undertaken. Under this improvement process, the NFRDI has developed a program to enable monitoring and cross-checking of the data reported in terms of timeliness and accuracy.

22. In response to questions, Korea clarified that with the exception of 2011, reported length frequency data were from observers. In 2011, no observers were deployed and the length frequency data were obtained from the Catch Documentation Scheme. From 2013, length frequency data will be collected by logbook and observers in accordance with new requirements in the Korean domestic Act. The numbers of releases and discards have been reported in the Data Exchange process.

23. The ESC noted that national reports were provided by Indonesia and South Africa. There were no ESC comments on these.

24. The ESC recognised that the national reports from some Members did not completely follow the agreed template for the Annual Review of National SBT Fisheries. Members and Cooperating Non-Members were encouraged to fully follow the template for the next ESC meeting. The next ESC meeting will consider whether any changes should be made to the template.

25. In CCSBT-ESC/1309/35, Japan reported the cross-verification of the scientific data-sets from Japanese SBT longline fishery in 2012 fishing season. Reporting of this verification had been encouraged under the “High-level Code of practice for Scientific Data Verification” by ESC17. Total annual catches by Japanese vessels were recorded in the Catch Documentation Scheme (CDS) which were based on the real time monitoring program (RTMP) data, and where landing weights were verified using landing inspections. The data source of Japanese longline catch, effort, and size data were based on the Logbook data and RTMP data, and these data-sets were verified using the scientific observer data. No substantial discrepancies or inconsistencies were found among these data-sets.

26. The ESC considered Japan’s paper to be a useful paper and Members agreed to provide similar information next year in accordance with the High-level Code of practice for Scientific Data Verification agreed by ESC 17.

27. Japan presented CCSBT-ESC/1309/34 on the estimation of post-release survival of SBT released from Japanese longline vessels. The survival rates in 48 hours after release were determined by pop up archival tag (PSAT) data (n=61; for 88-188cm FL fish). The data from 45 tags were available to estimate post release survival. Among these, 4 tags showed the time-depth pattern indicating mortality, and 41 tags showed the dive pattern of living SBT. These data showed that post-release survival rate was roughly 91%. A GLM analysis suggested that the post-release survival was able to be explained well by the fork length of released SBT and the method of landing on the deck. When only the branch line is used to pull the SBT hooked on to the deck, a high survival rate (> 90%) was expected for small fish (<105 cm FL). If the fish were scooped by the spoon-net using human power, a survival rate of more than 90% was expected even for 165 cm FL. In addition, if the system which lifts up the fish with the steel basket using electro-hydraulic power — called the "scooper" — was used, a survival rate of almost 100% was expected regardless of the size of fish. These results suggested that the post release survival rate could be kept on a high level if the proper landing method on the deck was used. According to fishermen, the large sized SBT were released by cutting the line without landing on the deck. The handling time and effort of cutting the line is less than landing by scoop-net and/or basket, so that cutting the line may be a more effective method for release with less handling stress. This suggests that the larger SBT actually released by Japanese commercial longline vessels would have higher survival rate than that was indicated by the analysis. Moreover, the tagging which was used in this study may have a negative effect on post release survival, because of the extra stress by tagging and handling. Therefore, the results for post release survival in this study may be considered underestimates.

28. Participants showed enthusiasm for the work presented by Japan. There appeared to be confounding effects in the factors observed, but there was encouragement to conduct more work with larger sample sizes to allow the relative importance of these different factors to be determined. In addition to interest in the work in relation to estimation of post release survival, there was also considerable interest in the techniques used to bring large SBT to the deck since these techniques have the potential to enable tagging of large SBT to obtain improved information on spawning behaviour.

29. In CCSBT-ESC/1309/33, Japan reported that 10,101 SBT were released and discarded by Japanese longline vessels in 2012. According to visual size measurements by the fishermen, 78% were less than 20 kg (corresponding to age ≤4). Based on the scientific observer data, 83% of SBT caught by longline were in a "Vigorous condition". Therefore, even if Japanese fishermen release/discard SBT regardless of fish condition (dead or alive), it was estimated that 83% of them were "Live-release".

30. The large number (10,101) of SBT released/discarded in the 2012 calendar year was noted by participants, as was the difference of the releases and discards between observer data and RTMP report. In response to queries, Japan commented that the releases and discards were mainly small SBT, but it was not yet clear why the number of these releases and discards had increased so much. Further investigation would be useful to know reasons for this trend, such as whether this is related to recruitment strength or changed commercial strategy of fisherman.

31. Japan also noted that its CPUE is based on the number of SBT retained, so it does not account for the number of releases and discards. The meeting agreed that the CPUE working group should consider the issue of releases and discards in relation to the CPUE. In response to a suggestion from Australia, Japan advised that there would be valuable in considering the impact of soak time on survival rates.

32. Australia presented paper CCSBT-ESC/1309/07 on data preparation which details how the aggregated catch and effort, catch by fleet, raised catch, catch at size, and non-retained catch data sets are compiled from a number of databases. The daily fishing logbooks, catch disposal records and fisheries observer reports, collected and managed by the Australian Fisheries Management Authority (AFMA), are the main data sources. The Australian catch of SBT from the surface (purse seine) fishery is also sampled by government contracted field staff prior to release into farm cages. The sample data includes size and weight measurements that are used to calculate representative size distributions and average weights. Relational databases, spreadsheets and query scripts are used to integrate and process the source data sets and create the data files required for the CCSBT data exchange. The paper provides facsimiles of data collection forms and flow charts illustrating the data integration procedures. The paper also includes a new section on the data validation procedures used and a section detailing an error detected in one of the queries used to derive the length frequency component of the data submission. As described in the paper, this error resulted in a slight underestimate of the proportion of small fish in the length frequency data in the years 2006-10. The error has been corrected and the length frequency data submitted for 2011 and 2012 are not affected.

33. The ESC considered the proposed resubmission of the historical length frequency data identified by Australia. The ESC accepted the corrections of the 2006-10 length frequency described by Australia for inclusion in CCSBT's data in advance of next year's Data Exchange.

4.2 Secretariat Review of Catches

34. The Secretariat presented paper CCSBT-ESC/1309/04. The Secretariat advised that Attachment A of CCSBT-ESC/1309/04 should remain confidential due to the unreported catch and surface fishery bias scenarios contained in that Attachment. The reported catch for the 2012 calendar year was 10,937t, excluding the unreported catch scenarios. The global SBT reported catch by flag is shown at **Attachment 4**. The reported catch for Indonesia for 2010 and 2011 has increased by 165 t and 166 t respectively. This is due to Indonesia working with the Secretariat and recounting its 2010 and 2011 catches and applying conversion factors to convert net weights to whole weights.

Agenda Item 5. Evaluation of Fisheries Indicators and SBT stock status

5.1 Indicators of the state of the SBT stocks

35. Australia presented paper CCSBT-ESC/1309/08 on fishery indicators. The three indices of juvenile (age 1 to 4 yr old) abundance in the Great Australian Bight (GAB)—the scientific aerial survey (AS) index, commercial SAPUE index and trolling index—exhibited increases over the past 12 months from values observed in the 2011–12 fishing season (austral summer). The AS index in particular exhibited a substantial increase compared to 2012 and is the second highest index obtained for the scientific aerial survey over the past 9 years. Similar to the overall trends observed in age 1–4 yr old SBT, indicators of age 4+ yr old SBT were generally positive. The CPUE in both the NZ domestic and charter fisheries increased in 2012 compared with 2011. The catch rate in the NZ charter fishery for statistical area 6 increased slightly in 2012, and remains well above the 10 year mean. Juvenile fish also comprised a slightly larger portion of the NZ charter catch in 2012. Indonesian otoliths were not aged for 2012–13. The median length class of SBT on the spawning grounds decreased slightly in 2011–12, but has fluctuated around the same values since 2001–02. In addition, the nominal CPUE for the Japanese longline fishery for 4+ yr old SBT increased in 2012 and remains above the 10 year mean.

36. Paper CCSBT-ESC/1309/09 provides an update on the commercial spotting index (surface abundance per unit effort or SAPUE) for the Australian surface fishery in the 2012/13 fishing season. Data on sightings of SBT surface schools in the GAB have now been collected for 12 fishing seasons (2001-02 to 2012-13). In 2009, 2011 and 2012, a significant amount of search effort occurred to the east of the usual core fishing area. In 2013, almost all search effort was undertaken in this eastern area. The modelling approach used in previous years was updated with the 2013 data. Due to the changes in spotter effort between years, it was necessary to include data for all spotters over all years in the analysis and treat spotters as a random effect, rather than just two spotters as has been done in recent analyses. Previously analyses explored the sensitivity of results to the inclusion/exclusion of data from different spotters and results showed that the index is not sensitive to this. Only data for 2003-2013 were included since both target and visibility seem to be important, and they were not recorded in 2002. The estimated SAPUE index for 2013 is 'average' for the 2003 to 2013 period. It was noted that while the SAPUE index and scientific aerial survey index had tracked each other relatively closely in previous years the SAPUE was somewhat lower than the scientific aerial survey in 2013 and the two indices pertained to substantially different areas.

37. The ESC noted that because the SAPUE was a commercial index, and thus subject to operational changes of the industry, it was not a replacement for a standardised aerial survey. The shift in search effort and catches by the purse seine fleet since 2009 was a particular example of such a change. It was emphasised, however, that it was a useful diagnostic tool to compare to the scientific aerial survey as it would provide a "red flag" in the case that the indices showed substantially different trends.

38. There was a discussion of the changes in locations of schools over time and the movement of catch to the east (outside the traditional fisheries grounds). It was noted that while there was limited analysis completed at this time, the faster movement of the schools though the GAB in recent years may be related to the unusually strong flow of the Leeuwin Current over 2011-2013. In addition, it was noted that the purse seine fishery had adjusted their fishing patterns in response to this change, and opted to catch more to the east of the historical core fishing grounds. This shift is illustrated in Figures 1 and 2 of paper 9. The authors agreed to provide any results of more detailed investigation of the potential drivers of juvenile movements at future meetings.

39. The fact that there were fewer commercial spotters contributing to the SAPUE over time was noted. This has resulted from the consolidation of spotting and catching roles in the purse seine sector. This has two consequences: fewer spotters being required for commercial spotting operations and a shrinking pool of experienced spotters to draw on for the scientific aerial survey.

40. Paper CCSBT-ESC/1309/10 presents the results from the 2013 scientific aerial survey of juvenile SBT in the GAB. The survey records estimated biomass of 1-4 year old SBT. However, only 2-4 year olds are included in the relative abundance index used in the OM and MP. In 2013 one year olds constituted a large proportion of the SBT observed in the survey (17.7%) as has been the case since 2009. The index estimate for 2013 is significantly higher than the 2012 estimate (the second lowest of all survey years), but lower than the 2011 estimate (the highest of all survey years). Taking confidence intervals into account, the 2013 estimate is above the long-term survey average. The methods of analysis used in the paper were the same as those used in the previous year. Methods to account for uncertainty in the observer effect for the sightings per nautical mile of transect line (SpM) model have yet to be implemented; hence, the CVs for the relative abundance indices do not yet include uncertainty in the observer effects for the SpM model and are slightly too narrow as a result. The environmental conditions during the 2013 survey were generally favourable, with the average SST over all months being the highest of all survey years and the wind speed being close to average of other years. It was noted that process error (for example, the proportion of 2-4 year old SBT in the GAB in any year) is not accounted for in the estimation of the index. It is, however, accounted for in the way the relative abundance index is incorporated into the OM and MP by the addition of log process error with a standard deviation of 0.18.

41. It was noted that the confidence intervals for the AS index appeared smaller than expected. Australia responded that there are two sources of uncertainty that are not included in the index as presented: i) the uncertainty associated with the spotter effect, and ii) the process uncertainty associated with the proportion of the juvenile SBT population that is present in the GAB and the inter-annual variation in this. The latter source is explicitly separated from the index and is incorporated in the fitting of the index in the OM.

42. Paper CCSBT-ESC/1309/11 provides an update of the otolith collection activities and direct ageing of otoliths from the Australian surface fishery. Age was estimated for 100 SBT caught by the surface fishery in the 2011/12 fishing season, and the proportions-at-age of SBT caught in the fishery were estimated and compared with previous seasons. The estimates suggest that in recent

seasons (2010/11 and 2011/12) there has been a higher proportion of age 2 fish and smaller proportion of age 3 fish than in previous seasons. The estimates for ages 2 and 3 are quite precise (CVs generally less than 10%), but less so for age 4 and 5 (ranging from 14% to 57%) since these older age classes have less data available. An exception is for the 2010/11 season, where the CVs of the age 2 and 3 estimates are higher than for previous seasons. This is most likely due to a contrast between the direct age-length data and the length-frequency data, with the former suggesting larger average lengths at age for fish of ages 2 and 3 than the latter. The age 3 estimate for 2011/12 also has a higher CV than most seasons, which may in part be due to the lack of separation in the length modes for age classes 2 and 3 in this season. The work continues to highlight the need for further discussion within the CCSBT regarding the technical details of how the direct age data could be incorporated into the stock assessment model in the future. Australia continued to collect and archive otoliths from SBT caught by the Australian surface fishery during the 2012/13 fishing season.

43. Paper CCSBT-ESC/1309/12 provides an update on the SBT length and age data from the Indonesian longline fishery operating out of the port of Benoa, Bali. Length-frequency data up to the 2012–13 season, and otoliths from the 2011–12 spawning seasons are available. As ageing of 500 otoliths collected in the 2011–12 season was not undertaken this year, it was not possible to build a direct age-length-key (ALK) for the season. The 2011–12 age distribution presented in the paper is based on an ALK developed using the direct age data for the 2009–10 and 2010-11 seasons. The length frequency data for 2011–12 was then applied to that key. As noted previously, considerable change has occurred in the size and age distribution of SBT caught on the spawning ground since monitoring began. Both the mean length and age of SBT landed declined from the mid-1990s to the early-2000s. The mean size decreased from around 188 cm to 168-171 cm, and the mean age from 20 to 14-16 years. In 2012-13, however, a relatively large proportion of SBT monitored were <150 cm in length. The mean length of SBT was only 162.1 cm, which is the lowest since monitoring began. Investigations are in progress to determine whether these small SBT landed were caught on or south of the SBT spawning ground, and whether they can be considered part of the SBT spawning population.

44. The ESC discussed whether the smaller size classes observed on the spawning grounds in 2012 may be the result of the strong year class of 2005 arriving on the spawning grounds. It was noted that while this was a possibility, there may also have been some Indonesian vessels fishing further south and outside the actual spawning grounds. This is being investigated further and any additional information should be provided at ESC 19, and/or made available in the 2014 data exchange process.

45. CCSBT-ESC/1309/24 was presented, providing an update on otolith collection. Japan collected otoliths from 209 SBT individuals in 2012. Ages were estimated from 270 SBT individuals that were caught between 2007 and 2011. The data were submitted to the CCSBT Secretariat during the 2013 data exchange.

46. In response to a question to collect a large number of otoliths from one specific area, Japan noted that it causes issues with observer research other than otolith collection.

47. Japan presented paper CCSBT-ESC/1309/27, detailing the trolling research survey that has been carried out in the southern Western Australia in January and February 2013 in similar manner since 2006. The trolling index (the number of age-1 SBT school per 100 km searched on the pre-determined straight line) based on 13 lines was 3.5 with a 90% confidence range of 3.3-4.7, which was a moderate level in the series. The paper noted length frequency distributions in recent three years were quite different to those in previous years.

48. The ESC discussion focused on the potential causes of multiple modes seen in the length frequency data for age-1 fish of the survey. Early and late spawning peaks within the spawning season were noted as a possibility. Japan commented that historical data showed that the early and late peaks had been observed in longline CPUE on the spawning grounds. Similar spawning peaks can also been seen in the landing data for the Indonesian catch and in otolith data in daily increment analysis. It was also noted that not all the age-1 fish from the whole range of spawning period may be available to the trolling survey.

49. Japan presented paper CCSBT-ESC/1309/26 on fisheries indicators. Various indicators were examined to overview the current status of the southern bluefin tuna stock. The indicators suggested that the current stock levels for the 4, 5, and 6 & 7 age groups were well above the historically lowest levels of the late 1980s to the mid-2000s. When looking at recent years, the standardised Japanese longline CPUEs for these age classes, especially age classes 5 and 6 & 7, showed marked increases. The CPUE indices for age 8-11 had declined slightly and gradually since 2008 but increased in 2012. Age class 12+ CPUEs have also gradually decreased since 2008. The current stock level for these older age groups is still very low.

50. The ESC noted that the CPUE of the 12+ age class was declining slightly. However, this is consistent with OM predictions and reflects the series of poor recruitments of the 1999 to 2002 cohorts. This has been previously noted by the ESC. It was also noted that the three indices of recruitment of younger age classes are not all consistent in their trends. It was suggested that it would be useful to examine the residuals of the indices when updating the assessment in order to better understand the information they provide. Consideration could also be given to constructing a composite recruitment index as an indicator. It was noted that there were a number of factors that needed to be considered in interpreting the different indicators of recruitment. These include the different age and geographical locations covered and the proportion of the total 1-4 year old population covered by each of the indices.

51. CCSBT-ESC/1309/28 was presented, which examined changes in operation pattern of Japanese SBT longliners in recent years. No appreciable change was found in the 2012 operational pattern in terms of the amount of catch, the number of vessels, the time and area of operations, proportion by area, length frequency and concentration of operations. In recent years, the number of operations in Area 7 has increased, and the average fish size has increased.

52. It was noted that while there was a decline in the number of vessels operating in the RTMP, and that it was difficult to predict if the decline would continue because it was closely related to socio-economic factors, Japan nevertheless did not anticipate any large changes in the future.

53. The ESC noted that since 2006, appreciable effort has occurred in more months than previously, and this is not captured in the standardised CPUE series, which only includes data from April to September. Japan responded that the strata and season of most of the effort has not changed, although the seasonal area closure for the Japanese longline fishery had been removed in 2006. The paper was noted as important for monitoring any operational fleet changes.

54. CCSBT-ESC/1309/29 was presented, which summarised the core vessel CPUE that is an abundance index for SBT utilised in the MP. It described data preparation, CPUE standardisation using GLM and area weighting. The data were updated to 2012. The index values in 2011, i.e. w0.8 and w0.5 for the base GLM model, are higher than the average over the last 10 years.

55. The Advisory Panel thanked Japan for this paper and noted that this information would be useful when discussing Agenda Item 7.2 on quality control of the CPUE base series.

56. CCSBT-ESC/1309/38 was presented. Taiwanese SBT longline fishery data were described in detail to help in CPUE interpretation. A substantial amount of data has been accumulated, especially since 2002. There was little overlap in the Taiwanese main area of SBT catch in the south eastern Indian Ocean to that of Japanese longline. The fishing grounds do not correspond closely with the boundaries of the CCSBT statistical areas. The SBT caught were mainly age 3, 4, and 5 so that the data are expected to provide information on recruitment levels. The paper concluded that the data are worthwhile for further analysis.

57. The ESC discussed the length frequency data presented. It was noted that while there was a large increase in sample size in 2002 of the data Taiwan collected and provided to the CCSBT, the overall smoothness of the length frequency distributions presented did not improve. This may be the result of fishers providing rough measurements of the fish, rather than in 2cm bins. Communication with the fishers on what was required could improve the data in the future. Taiwan advised this may be the result of raising the data based on the length frequency with small sample size before 2002. For future analyses it was suggested that a check of the raw length frequency data would be useful. Taiwan noted that such check is possible only for data after 2002 due to data availability.

58. The ESC also discussed how these data could potentially be used given that the effort is in a different area than that of the Japanese fleet, and that the vessels are likely targeting species other than SBT, such as bigeye tuna and albacore. It was suggested that examining the proportion of the catch that was SBT and other species could provide an indication of targeting. It was noted that the series could be viewed as a potential indicator of 3, 4 and 5 year olds.

59. Taiwan presented CCSBT-ESC/1309/37, on the CPUE analysis for SBT caught by the Taiwanese longline fleet. The data of Taiwanese longline vessels, which deployed more effort for catching SBT, were selected for conducting the CPUE analysis. Comparing the amounts of catch and effort of all active longline vessels authorised to seasonally target SBT operating in the southern area of 20°S of the Indian Ocean, the implementation of vessel selection can exclude large amounts of effort but still keep relatively high proportion of SBT catches. The CPUE standardisation was performed based on the data from selected vessels. Both CCSBT statistical areas and Taiwanese SBT fishing grounds were adopted

as the factors for GLM analysis. Standardised CPUEs generally reveal quite different trends for different areas. It is apparent that the CCSBT statistical areas are not appropriate for analysis of the Taiwanese SBT data since the main fishing grounds are split by the CCSBT statistical area boundaries. Redefining statistical sub-areas based on the temporal and spatial analysis for the characteristics of Taiwanese SBT fishery would be helpful to further CPUE standardisation for Taiwanese SBT fishery.

60. The ESC expressed appreciation for the good progress made on the Taiwanese CPUE standardisation.

61. The ESC noted technical aspects of the standardisation model including the way in which latitude and longitude are defined and the correction factors applied for species other than SBT. It was suggested that this standardisation could be further developed and considered in detail. It may provide a potential indicator in the future. In response to a question on the substantial shift in the proportion of SBT in the catch in 2010, Taiwan advised that many vessels had shifted their effort to the southern Indian Ocean to target SBT and albacore as a result of the piracy activities. It was reported that even those vessels that were actively targeting SBT took greater catches of albacore than SBT.

62. Korea presented CCSBT-ESC/1309/40, on the southern bluefin tuna (SBT) CPUE standardisation of Korean tuna longline fisheries (1996-2012) conducted by a Generalised Linear Model (GLM) using operational data to prorate the abundance index. SBT CPUEs were standardised for the whole area and the core area where Korean longline vessels have mainly been fishing for SBT. The core area was defined as the areas where fishing for SBT had occurred 10 times or more during 1996-2012. Explanatory variables for the GLM analyses were year, season, area and hooks between floats (HBF). GLM results for the whole area suggested that area and year effects were the factors most affecting the nominal CPUE. The standardised CPUEs for both the whole area and the core area decreased until the mid-2000s and have been showing an increasing trend since then to 2012.

63. The ESC thanked Korea for providing this paper and encouraged further development of the CPUE series. It was noted that because Korea seems to be fishing in similar areas as the Japanese fleet, some informative comparisons could be made in the future. In addition, it may also provide some information on CPUE in areas where the Japanese longline fleet operated in the past but have not operated recent years (i.e. constant squares and variable squares).

5.2 Indicators of exceptional circumstances for the MP

64. Japan provided CCSBT-ESC/1309/BGD2. In this document, the recent aerial survey (AS) index and longline CPUE index values were compared to the projection results that were obtained from operating models (OMs) for the implementation of the management procedure (MP) in the context of the calculation of the next TAC for 2015-2017. Although the updated AS index value for 2012 was outside the 95% probability interval predicted using base case OM, it was located within the 95% probability interval for the robustness trial (high aerial CV scenario). The 2013 index was close to the median value predicted by the base case OM. The most recent two years' longline CPUE

values were also within that OM's predicted 95% probability envelope. Hence these results do not provide evidence to support the existence of exceptional circumstances for the SBT stock at this time.

65. The ESC thanked Japan for providing this paper. The ESC encouraged that such a paper should be provided regularly in the future. The ESC noted the conclusion of no indications of exceptional circumstances in the data series.

66. Paper CCSBT-ESC/1309/19 detailed the estimation and predictive performance of the mini-assessment model at the heart of the MP in relation to the two key MP data inputs: standardised Japanese long-line CPUE and the scientific aerial survey. The model was found to perform well, with all the key parameters being clearly updated from their prior and with precise standard errors. In terms of predictive performance, a Bayesian posterior predictive approach was explored and the model was found to predict the data well. In conclusion, there are no reasons evident why the MP cannot be used as specified and adopted to calculate the next TAC schedule.

67. The ESC concurred with the conclusions of the paper that there are no issues that would preclude running the MP based on predictive performance.

68. Based on the information presented in this agenda item, the ESC concluded that there were no indications of exceptional circumstances. Therefore, there were no impediments to running the MP to set the TAC for the years 2015-17.

5.3 Summary of the SBT stock status

69. The ESC did not conduct a model based assessment at its 2013 meeting, so the information presented here is from the 2011 stock assessment and information from indicators presented to the 2013 ESC. The 2011 assessment suggested that the SBT spawning biomass is at a very low fraction of its original biomass as well as below the level that could produce maximum sustainable yield. Rebuilding the spawning stock biomass would almost certainly lead to greater sustainable yields and provide security against unforeseen environmental events. 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 of 20% of the original spawning stock biomass by 2035.

Stock prognosis from the 2011 stock assessment

70. There is a positive outlook for the SBT stock based on the 2011 assessment:

- Current fishing mortality has been reduced below F_{msy}
- The stock is expected to increase at current catch levels, and future catch levels determined by the MP.

71. The stock assessment will be updated in 2014.

Southern Bluefin Tuna Summary from 2011 ESC (global stock)	
Maximum sustainable yield	34,500 t (31,100 – 36,500 t)[1]
Reported 2010 catch[2]	9,547 t
Current replacement yield	27,200 (22,200 – 32,800 t)
Current (2011) spawner biomass	45,400 (31,022 – 72,700 t)
Current (2011) depletion	0.055 (0.035 – 0.077)
Spawner biomass (2011) relative to SSB_{msy}	0.229 (0.146 – 0.320)
Fishing mortality (2010) relative to F_{msy}	0.76 (0.52 – 1.07)
Current management measures	Effective catch limit for Members and Cooperating Non-members: combined averaged 9,449 annually over 2010-11; 10,449 in 2012; 10,949 in 2013

Summary of indicators

72. There were both positive and neutral signals from the indicators in 2013 (**Attachment 5**):

- Longline CPUE for the Japanese fleet for ages 6 and 7 has continued to increase since 2007. The 12+ year old CPUE shows a slight recent decrease, but this is expected given the weak recruitment from 1999 to 2002. There are no obvious recent trends in the CPUEs for the other age groups.
- Although there was a decline in the scientific aerial survey index in 2012, the index for 2013 has increased and is the second highest over the last nine years. A similar pattern of a decline followed by an increase is evident in the commercial SAPUE and troll survey results from 2011 to 2013.
- There has been a decline in the mean length of SBT on the spawning ground. There are indications that this may be the result of some Indonesian vessels fishing further south, outside the spawning grounds. This may also reflect the strong 2005 year class arriving on the spawning ground. This is being investigated further and any additional information will be provided to the 2014 ESC meeting.

73. The close-kin genetics project has now been completed, and the inclusion of the close-kin data within the OM has been reviewed by the ESC and approved for inclusion. Both the stand-alone abundance estimator from the close-kin project and the OM with the close-kin data included suggest that the current spawning biomass may be appreciably higher than was previously estimated. Indications in the OM incorporating the close-kin data are that biomass depletion (i.e. $B_{current}/B_0$) and also absolute biomass are not as low as previously estimated. However, associated estimates of the probable levels of sustainable yield are very similar. When these two aspects are considered in combination, the indications are that the estimated recent productivity of the resource (upon which TAC advice is based) differs only slightly from previous estimates. The ESC confirmed the decision made at the OMMP4 workshop that the CCSBT OM would remain as the assessment approach for the provision of stock status advice.

[1] Median and range from lower 5^{th} and upper 95^{th} percentile of 320 models contained in the base case.
[2] More recent catch figures are provided in **Attachment 4.**

Agenda Item 6. Report on intersessional scientific activities

74. Australia gave a brief presentation on the Great Australian Bight Science Research Program. The $20 million program is collaboration between CSIRO, the South Australian Research and Development Institute, Flinders University, the University of Adelaide and British Petroleum. The program commenced earlier in 2013 and is scheduled to run until late 2016. The program has been developed to improve the understanding of the GAB ecosystem and inform large-scale oil and gas exploration that is currently taking place in the GAB. It includes seven research themes: physical oceanography, biological oceanography, benthic biodiversity, ecology of iconic species and apex predators, petroleum geology and geochemistry, socio-economic analysis and integration and modelling. The theme on iconic species and apex predators includes a project focussed on the spatial dynamics and behaviour of SBT in the GAB. The aim will be to provide further baseline information of foraging and diving behaviour of SBT using historical archival tag data from the global spatial dynamics project. The project will also collect new data using archival tags and PSAT tags deployed in 2-4 year olds in the GAB. The main focus will be to provide a time series of historic and contemporary behaviour during oil and gas deployment. It was noted that information from this project will be relayed to the ESC as available. Further information on the program can be found at http://www.csiro.au/en/Organisation-Structure/Flagships/Wealth-from-Oceans-Flagship/Great-Australian-Bight.aspx.

75. In addition to the GAB Science Program, Australia noted there was another project of relevance to the ESC, particularly in the context of potential environmental effects on the distribution of SBT in the GAB. The project "Forecasting spatial distribution of SBT habitat in the GAB" aims to provide an online forecasting capability for the Australian surface fishery based on existing methods, habitat models developed from the global spatial dynamics of juvenile SBT project and the "Bluelink" oceanography model. This approach has been in use in operational forecasting for the "SBT management zone" for the management of SBT bycatch in the Australian east coast longline fishery and the project will focus on applying the same approach to the GAB.

Agenda Item 7. Report from the CPUE working group

76. Australia presented working paper CCSBT-ESC/1309/13 which describes a CPUE index for SBT based on a generalised additive model (GAM). The index was suggested as a possible monitoring series and was developed in response to requests for new monitoring series at the ESC17. The fitted GAM allows CPUE to vary smoothly over space at each point in time and the spatial distribution of CPUE is allowed to change smoothly over time. An index was calculated by using the fitted model to estimate CPUE over a constant spatial grid each year. The calculation of the index is similar in some respects to the Laslett Core Area (LCA) index (CCSBT-SC/0103/06). It differs in that the LCA model is fitted independently each year, whereas the GAM model is fitted once to catch and effort data from all years. The proposed GAM model assumes quasi-Poisson distributed errors whereas the LCA model and the model used to calculate the core vessel w0.5 and w0.8 indices assume lognormally distributed errors with

adjustments for cells where zero catch with non-zero effort was observed. The resulting index was not very different to those used in the operating model to assess the global population of SBT and the management procedure that sets the global TAC. Generalised additive models of CPUE with spatial covariates, such as the one described, can be used to produce maps of modelled CPUE. However, the scope for modelling the spatial distribution of CPUE is currently limited by the spatial resolution of the CPUE data currently provided to the CCSBT.

77. The discussion noted that this monitoring series was useful for investigating the performance of the core CPUE series used for conditioning of the OM in the base case and as a data input for the MP. With regard to the availability of data at a finer spatial scale, Japan said it would be difficult to provide the longline catch and effort data at this scale. Japan advised it would be willing to collaborate on fitting the GAM model to catch and effort data held by Japan at the finer scale.

78. Japan presented CCSBT-ESC/1309/32 responding to the request made at the OMMP4 meeting to illustrate the distribution of Constant Square (CS) cells which did not overlap with Variable Square (VS) cells. This information of the distribution was provided to examine how to deploy research effort for a possible experiment by commercial vessels which would clarify appropriate weighting for CS versus VS indices. The distribution of CS cells not overlapping with VS cells varied spatially and temporally within the same year. Patterns of the CS cell distribution also fluctuated even within the same month among different years. From this inspection, it became evident that 45-50S 120-160E cell and 40-45S 120-160E cell of Area 7 and 40-45S 60-120E cell of Area 8 had tended to be consistently non-overlapping with VS cells, and to contribute higher proportions to the index value.

79. It was noted that this work was requested of Japan because of previous suggestions to conduct a designed commercial longline survey. Such a survey has previously been proposed with the aim of addressing issues around variable spatial distribution of commercial longline fishing effort used to construct the core vessel w0.5 and w0.8 CPUE indices for SBT. It was suggested that the information provided in paper CCSBT-ESC/1309/32 could potentially be useful for designing such a survey. Australia commented that this type of analysis was useful for monitoring the w0.5 and w0.8 assumptions as well.

7.1 Report of April web meeting and other intersessional work

80. The Chair of the CPUE Working Group presented background paper CCSBT-ESC/1309/BGD01. An account of the 2013 intersessional work is provided in **Attachment 6**, The Report of the CPUE Working Group.

81. It was noted that one role of the CPUE Working Group was in quality control for the core CPUE series. Another role is to develop and explore new series.

7.2 Quality control of Base CPUE series

82. No papers were presented under this agenda item, but papers CCSBT-ESC/1309/18, 28 and 29 discussed under agenda item 5 are very relevant to this item. Relevant issues were progressed during the CPUE Working Group meeting.

The report from this meeting is provided in **Attachment 7**. It was concluded at the web meeting that the base CPUE series is suitable for the MP.

7.3 Progress with developing new CPUE series

83. Australia presented paper CCSBT-ESC/1309/14 summarising results from a retrospective study using the SBT operating model (sbtmod25) and projection model (sbtprojv119). The aim was to investigate whether projections of future spawning stock biomass might be more consistent if the current CPUE series used for operating model conditioning were replaced by temporally smoothed equivalent series. Data approximating what was submitted to the CCSBT data exchange for 2008 to 2013 were used to condition the operating model and project spawning stock biomass to 2035. Six sets of Base and six sets of Smoothed projections were then compared in terms of consistency of projected spawning stock biomass in 2035. The study suggested the variability in data observed over the period considered did not result in extreme variation in projections of future spawning stock biomass. Furthermore, smoothing CPUE was found to make little difference in either projected spawning stock biomass or to the consistency of spawning stock biomass projections over the period considered. The performance of the projection model in predicting the aerial survey index was also examined retrospectively. The range of future aerial survey indices generated by the projection model appears to do a good job of capturing the true variability in the aerial survey index. Deviation of observed aerial survey indices from the expected value does appear to drive variability in future spawning stock biomass, but the between year variability in future spawning stock biomass suggested by the retrospective study was not excessive.

84. With regard to a suggestion in CCSBT-ESC/1309/14 that the influence of the aerial survey index values on estimates of cohort size and projections of future spawning stock biomass it was noted that in general it was undesirable to incorporate shrinkage or smoothing of data inputs to assessment models. It was suggested that the presentation of retrospective analyses might be valuable every year or at least in years when the stock is being assessed.

85. Papers CCSBT-ESC/1309/37, 38 and 40 discussed under agenda item 5 resulted from work encouraged under this agenda item.

Agenda Item 8. Evaluation of new data sources and operating models to be used in 2014

8.1 Report from the Portland Technical meeting

86. The Chair of the OMMP4 meeting presented the report of the meeting in Portland Maine USA in July 2013 (CCSBT-ESC/1309/Rep01). The focus of the OMMP4 meeting was to consider the structure of the OM in preparation for the 2014 stock assessment. Progress was made at the meeting against the terms of reference:

- Examination of alternative approaches for applying close-kin data for stock assessment purposes;
- Examination of the impacts of the use of the close-kin data in the OM; and

- Re-evaluation of the grid structure given incorporation of the close-kin data.

87. The OMMP4 meeting evaluated progress on examining the sensitivities in the stand-alone close-kin assessment model that were suggested by 2012 ESC. These included the equilibrium assumption for initial age structure and mean recruitment in the original model, and differences in the approaches to maturity in the standalone close-kin model and the OM.

88. The OMMP4 meeting examined the sensitivity of the OM to several alternative schedules for maturity. The different maturity schedules did not have a strong effect on the OM results. After the meeting the method for defining the maturity schedule was further clarified, and a new maturity schedule adopted for work at the ESC.

89. The OMMP4 meeting examined the effect of inclusion of the close-kin data in the OM and on the levels for factors in the grid. The inclusion of the close-kin data results in higher preferences for low natural mortality at age 10 (M10), which is associated with a larger 25+ age group and domed-shaped selectivity in the Indonesian spawning ground fishery. The close-kin standalone assessment assumes a flat selectivity in the Indonesian spawning ground fishery.

90. The OMMP4 meeting examined the grid structure and addressed concerns that the steepness values that were sampled in the grid were largely a result of the prior distribution used for the stock-recruitment relationship. The meeting recommended that uniform weights be used to sample the steepness factors rather than the weightings derived from the model's objective function which were used in the past. With respect to natural mortality (M0 and M10) the group recommended that the weightings continue to be based on the model's objective function since these values are informed by the tagging, the Indonesian age composition, and the close-kin data. The range of natural mortality to include in the grid, including two low M10 values (0.03 and 0.04), was evaluated after the OMMP4 meeting in preparation for the ESC.

91. The OMMP4 meeting defined work to be done before or at the 2013 ESC. This included the evaluation of consistency between data sources in the OM, through excluding the different sources of information and examining log-likelihood profiles and levels of factors in the grid.

8.2 Incorporation of results from close-kin genetics analysis into the OM

92. A technical working group met to discuss incorporation of the close-kin data into the OM and reported progress to the ESC.

93. The ESC noted that a new maturity schedule based on the available biological information (CCSBT-ESC/0108/20) was adopted for use in the 2014 assessment and was used in OM runs conducted at ESC18. There is currently no independent estimate of maturity schedule; however a method for developing this has been supported in the Scientific Research Program (CCSBT-ESC/1309/41).

94. The work conducted since the 2012 ESC on the stand-alone close-kin assessment to examine sensitivity of the results to assumptions in the model was presented to the meeting.

95. Analysis of over-dispersion in the Indonesian length and age data. An over-dispersion model was developed to evaluate variability in samples over time. The stand-alone close-kin assessment assumed a sample size of 300, but the analysis indicated that a much larger sample size could be assumed. This result suggested that there was less over-dispersion in the Indonesian length and age data than originally considered.

96. Treatment of the strength of incoming recruitment to the adult population (i.e. at age 8 according to close-kin results) in the close-kin model. In the updated version of the stand-alone close-kin assessment, recruitment to the adult population at age 8 is modelled as a time series of random effects with constant mean after 2002 (which is the first relevant year in the study). As a result, the stand-alone assessment provides estimates of annual recruitment as well as mean recruitment over the period of the study (i.e. 2002-2010) (Tables 1-3 CCSBT-ESC/1309/Rep01).

97. Examine uncertainty associated with fecundity. The propagation of uncertainty of daily reproductive output from females was examined in three GLMs, by allowing the true parameters to be random effects based on known points.

98. The outcome of these changes in the stand-alone close-kin assessment was that the spawning population estimate was more precise (i.e. the CV of the estimate decreased). The approach taken meant that there was no need to investigate a large number of different models.

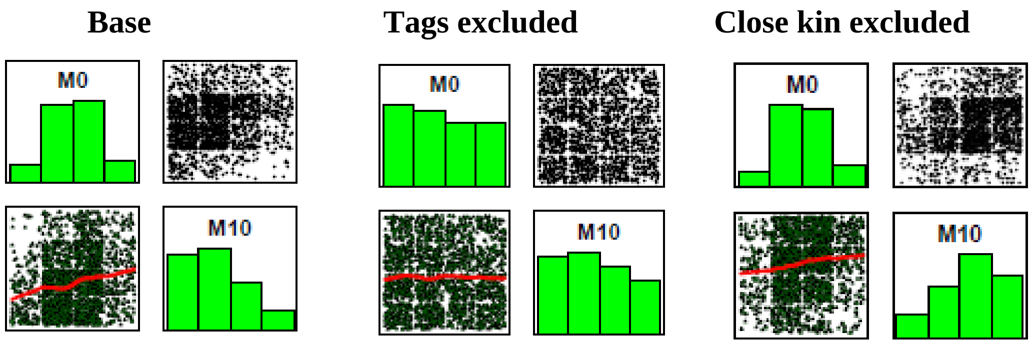
99. Paper CCSBT-ESC/1309/15 detailed the key issues for the development of the OM relating to data weighting, grid resampling, and the inclusion of new data sources – particularly the close-kin data. In relation to data weighting, the historical approaches were detailed and suggestions were made about either keeping the current approaches, as well as new approaches that might be utilised. In regards to grid resampling, for steepness the detailed work done in the Portland OMMP4 meeting was covered, as well as issues relating both the M0 and M10 natural mortality parameters. With respect to the close-kin data, the exploration of what defines appropriate effective reproductive output conducted in Portland was summarised, as well as some issues relating to the fitting and predictive performance of the OM in relation to the close-kin data were also covered.

100. The ESC agreed on inclusion of the close-kin data in the OM using the format and OM structure proposed.

101. In CCSBT-ESC/1309/36, Japan examined impacts of specifications for the age-specific natural mortality schedule and the selectivity curve for Indonesian fishery on the SBT stock assessment when using low M10 values (0.03 and 0.04), which had been newly proposed in the Portland meeting. This analysis showed that the low M10 values were sampled to some extent under the grid weighting. For these samples, more marked dome-shaped selectivity and a larger size of plus-group were evident. Sensitivity analyses to examine interaction effects of natural mortality of older fish and Indonesian selectivity showed that an assumption of earlier senescence led to less marked dome-shaped selectivity and, on the other hand, an assumption of flatter selectivity resulted in higher M10 values.

102. The OM grid structure was further examined by comparing the base grid with grids that exclude the close-kin data or tagging data, to determine the range of M0, M10 values for the grid (Figure 1 below). In the base set, results favour the low M10 value. When tagging data are removed, the information in the models for M0 and M10 is much reduced; the mode is the same but the distribution is much flatter. The tagging data are highly informative concerning M. When the close-kin data are excluded high M10 values are strongly favoured compared with the base. To summarise, when these two data sources are included in the OM the low M10 values are clearly favoured.

Figure 1. Sensitivity of grid results to exclusion of different likelihood components. The left-most panel (containing four figures) is for the base case, the middle shows results when the tag data were excluded, and the right-most are for when the close-kin data are excluded. The histograms within each panel represent the marginal probabilities for discrete values of age specific natural mortality. The four values for M0 plots were 0.35, 0.40, 0.45 and 0.50 whereas the M10 values were 0.050, 0.075, 0.100, and 0.125. The mirrored off-diagonal plots (with dots) within each of the three panels represent an approximation of the bivariate (between M0 and M10) density.



103. The technical working group reviewed the likelihood profile results and assumptions in the OM affecting M10, including the assumption for the age at which senescence starts to occur (currently age 25), which affects estimates of the size of the plus group, and the age at which the selectivity in the Indonesian fishery becomes constant (flat rather than dome shaped). In 2009 (OMMP 2009, figure 2) the natural mortality rate for age 30+ fish was estimated from the age structure to be 0.5. Additional runs examining higher M10 are proposed in a sensitivity test. The ESC noted that there are two alternative explanations for why a large plus group is not observed in the Indonesian catches; they either have lower vulnerability due to a dome shaped selectivity or they die due to senescence (higher M).

104. The decisions of the ESC were not to include the two low values (0.03 and 0.04) of M10 that were proposed for further investigation at OMMP4 because of numerical issues which arose when trying to fit to these low values, and that the schedules of M when these values are incorporated were considered biologically unrealistic. It was agreed that the senescence age would remain at age 25, because a younger age does not seem biologically realistic. The age at which Indonesian selectivity becomes constant will remain the same in the base case, and a sensitivity test of this assumption will be conducted using age 20.

105. Sample sizes and likelihood weights were also discussed, and the technical group reached the decision that these would stay the same as those made the OMMP4 meeting (steepness changed to uniform weighting, M weighting unchanged). However, it was agreed that the over-dispersion factor applied to the 1990s tagging component would use a re-calculated value (for example the value calculated this year would be 1.83 down from 2.35).

106. Input data were reviewed to inform sensitivity runs for the 2014 assessment. Several new sensitivity runs were agreed and a subset of the sensitivity runs used in previous assessments were agreed. The details of the agreement are in **Attachment 8**.

8.3 Direct ageing data

107. This agenda item was addressed in 2012, and there was no further discussion at this meeting.

8.4 Evaluation of use of commercial spotting data

108. This agenda item was addressed in 2012, and there was no further discussion at this meeting.

Agenda Item 9. Operation of MP to produce recommended TACs for 2015 – 2017

109. The steps in running the MP were worked through in an informal subgroup session to ensure all members understood the inputs and associated method. Further information can be found in paper CCSBT-ESC/1309/BGD04. The input values to the MP are provided in **Attachment 9**. The ESC noted that the q-ratio value should be checked as part of the MP review in 2017. The technical documentation of the MP was updated to include the information on how the CPUE multipliers for over-catch scenario case 1 are applied to the CPUE series used in the MP. The update is in **Attachment 10**. The technical documentation will be updated on the CCSBT website.

110. The Advisory Panel confirmed that the MP was not affected by the initial starting values in the MP code by simulation testing (1000 runs with alternative starting values). All 1000 runs converged to the same result.

111. The Advisory Panel formally ran the MP on behalf of the CCSBT Secretariat for the TAC recommendation. The recommended annual TAC for the years 2015-2017 is 14,647.4 t. This is a 2198.4t increase from 12,449t TAC (18%) in 2014, which is less than the maximum step of 3000t allowed under the MP. The increase in TAC calculated by the MP is a result of recent positive trends in CPUE and Aerial Survey (AS) indices. The MP uses the CPUE and AS indices data to estimate relative biomass and recruitment over time (see **Attachment 10**). The TAC is calculated in the MP by adjusting the previous TAC based on the trend in relative biomass, the most recent biomass estimate relative to a target level, and the most recent five year average recruitment relative to the historical average.

Agenda Item 10. SBT Management Advice

112. At its Eighteenth annual meeting in 2011, the CCSBT agreed that a Management Procedure (MP) would be used to guide the setting of the SBT global total allowable catch (TAC) to ensure that the SBT spawning stock biomass achieves the interim rebuilding target of 20% of the original spawning stock biomass. The CCSBT will set the TAC from 2012 and beyond based on the outcome of the MP, unless the CCSBT decides otherwise based on information that is not incorporated into the MP.

113. The CCSBT also adopted the meta-rule process described in Attachment 10 of the Report of the 15th Meeting of the Scientific Committee as the method for dealing with exceptional circumstances in the SBT fishery. 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.

114. 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).

Current TAC

115. For the first three-year TAC setting period (2012-2014), the 2011 meeting of the Extended Commission adopted TAC values as follows:

	Year		
	2012	2013	2014
TAC (t)	10,449	10,949	12,449[3]

Review of MP implementation in 2013

116. The Advisory Panel formally ran the MP on behalf of the CCSBT Secretariat for the TAC recommendation. The recommended annual TAC for the years 2015-2017 is 14,647.4 t. This is a 2198.4t increase from 12,449 t TAC (18%) in 2014, which is less than the maximum step of 3000t allowed under the MP.

117. Based on the information presented in Agenda 5.2, the ESC concluded there were no indications of exceptional circumstances. Therefore, there were no impediments to running the MP to set the next TAC.

MP TAC Recommendations

118. Based on the results of the MP operation for 2015 – 17 in Agenda Item 9 and the outcome of the review of exceptional circumstances in Agenda Item 5.2, the ESC recommended that there is no need to revise the Extended Commission's 2011 TAC decision regarding the TAC for 2014. Therefore the recommended TAC for 2014 is 12,449 t. The recommended annual TAC for the years 2015-2017 is 14,647.4 t.

Other Advice

[3] The 2014 TAC shall be either 12,449t or the output of the MP for 2015 – 2017 (whichever is less).

119. The ESC recommends to the Extended Commission that an allocation of 10 t per year be made to cover mortality associated with approved research projects.

120. 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. Update of MP and OM codes

11.1 Discuss issues related to the update of the MP and OM codes

121. CCSBT-ESC/1309/BGD04 documents the standalone version of the MP software provided in January 2013 by CSIRO, using version control software. The paper documents the MP software and data inputs. This was provided to the OMMP 4 meeting and as background documentation to the ESC.

122. Dr. Jim Ianelli from the Advisory Panel gave a presentation on GitHub which is the new version control software that is being used to track changes in the OM, MP and projections code and documentation files. The Secretariat will download copies of the files on GitHub to the private area of the CCSBT website at the end of important code changes or events (e.g. at the end of the ESC). To get more up to date changes or to contribute to the code or documentation, Members can sign up to GitHub and send their username to Dr. Ianelli (as the current administrator), who will grant access to the GitHub SBT repository (named “sbtmod”).

Agenda Item 12. Finalise Scientific Research Program

123. Paper CCSBT-ESC/1309/17 on potential future directions for the close-kin abundance estimation was presented. The SBT close-kin project has successfully delivered fishery-independent estimates of adult abundance, reproductive output as a function of size, and adult survival. The CCSBT ESC 2012 agreed the close-kin data should be incorporated into the OM. There are procedures for obtaining samples, expertise in the genetics processing and quality control and a substantial catalogue of genotyped (2006-2010) and unprocessed samples (2007-2013). It would be possible to extend the program to provide a time series of spawning stock biomass, or effective reproductive potential, towards the goal of CCSBT's interim rebuilding plan. Future sampling and genotyping levels (and cost) could be considerably lower than in the past while still yielding precise abundance estimates; the precision of other important quantities, such as the effect of body size on reproductive output, would also improve with an extended time series of data. Adult mortality means that after some years the existing bank of samples will become irrelevant to estimating the then-current adult abundance; while this is not an immediate issue, it does suggest that an ongoing low-level program might be more sensible than restarting a close-kin program from scratch sometime in the future. This paper discusses options and issues, showing in broad terms how the information content of samples varies with date of collection and length of study. There appears to be merit in a detailed investigation of cost-effective options for an ongoing close-kin program to monitor the spawning stock directly and to provide valuable abundance indices

and other parameters for the OM. Such a study should consider: the interaction between the close-kin and other data sources in the OM, what precision will accrue to which parts of the OM, the balance of sample sizes between adults and juveniles, the value of genotyping existing archived samples (2006-2012), the cost-effectiveness of alternative genetic markers, and potential cost-savings if sample collection and genotyping are shared with a gene-tagging program.

124. It was suggested that it may be possible to develop an index of relative recruitment (age 8) from the close-kin data if a time-series was developed. It was noted that one of the refinements to the stand-alone close-kin abundance estimation model since ESC 17 was the incorporation of a random effects component to allow for variation in initial age structure and estimation of absolute abundance of annual recruitment to the spawning stock and the trend in this recruitment over time. The estimates from this model are provided in Tables 1-3 and Figure 5 in of the OMMP4 report (CCSBT-ESC/1309/Rep01).

125. Paper CCSBT-ESC/1309/18 focuses on the potential for gene-tagging programs to provide estimates of absolute abundance and mortality of juvenile and sub-adult SBT. The advantages of the gene-tagging method is that it can provide data for use in stock assessments, operating models and potentially future management procedures that are quasi-fishery independent (for most outputs), and will not suffer from the reporting rate issues that lead to the cessation of the CCSBT conventional tagging program in 2006.

126. Paper CCSBT-ESC/1309/18 provides preliminary cost estimates for a variety of gene-tagging sampling designs. The cost of the genetic techniques component of the work has declined rapidly in recent years. An absolute abundance estimate for a cohort is the minimum information that could be provided from the simplest project design. Extensions to this basic design include multi-cohort, multi-year “releases”, similar to those used in the previous SRP conventional tagging program. This could deliver estimates of fishing and natural mortality, in addition to absolute abundance, for each cohort tagged. Gene-tagging programs have the potential to contribute to catch characterisation, future management procedures and, if undertaken on a juvenile component of the SBT stock, could potentially provide a contingency for the scientific aerial survey, should that program fail to provide a relative abundance estimate for logistical reasons. Gene-tagging of older age classes (i.e. 4-10) could also be considered for its potential to provide a fishery-independent monitoring series as an alternative to CPUE in future models.

127. Paper CCSBT-ESC/1309/18 suggests further collaborative work to examine potential sampling options, refine cost and sample size estimates, and evaluate different designs to identify the most cost-effective options. The consideration of multiple age classes and release areas, and the nature of the field operations, means that a gene-tagging program provides considerable scope for participation and collaboration among members.

128. The ESC noted that a potential issue for a gene-tagging program focussed on 2-4 year olds would be whether all juveniles enter the Great Australian Bight and, if not, whether the proportion of juveniles in the Great Australian Bight is constant or varies randomly over time. Multiple resampling over years would address some of the issues related to mixing. If the juveniles do not mix randomly and only a sub-set enters the Great Australian Bight, it may be possible to get samples

at a later time from the longline fishery or release sufficient samples from other areas of high 2-3 year old abundance. This emphasises the potential for collaborative work among members in the design and implementation of such a program.

129. As noted in paper CCSBT-ESC/1309/18 there is the option of using the existing micro-satellite markers developed for the completed close-kin project for gene-tagging and this could be considered for any design study/pilot work. However, there is likely to be considerable benefit in considering the use of next generation "SNP" (Single Nucleotide Polymorphisms) markers as they are: i) cheaper per sample; ii) less reliant on technical genetic expertise once developed, so provide much higher repeatability between laboratories; and iii) provide for high quality control and quality assurance. Given the much larger sample sizes required for gene tagging, it is likely that moving to SNP markers at some time in the near future would be cost-effective and the large back-catalogue of processed samples from the completed close-kin project provides a sound basis for comparison of performance and marker validation. These same SNP markers could then also be applied to future close-kin work. As fewer markers will be required for identification of parent-offspring pairs (POPs) for close-kin, the combination of close-kin and gene tagging would create synergies and potential cost savings in sample collection and genetic processing.

130. An advantage of gene tagging, depending on the experimental design, is that it can provide an absolute estimate of abundance for individual year classes, rather than a relative estimate of three year classes (i.e. 2-4 year olds), as provided by the scientific aerial survey. This could reduce the uncertainty in recent recruitments estimated in the OM and, in the longer-term context of the review of the MP, potentially provide additional, complementary inputs to the recruitment index used as input the MP.

131. It was noted that while the estimation methods and genetic matching procedures are well developed, there are a range of detailed implementation, field and logistic issues that would need to be worked through and resolved before a fully designed and costed program could be provided to the ESC and Extended Commission. Given this and the potential value of the approach, the ESC considered that further discussion among interested participants, together with an initial pilot study to design and refine field and logistic protocols would be useful. Some participants observed there may be opportunities to conduct some pilot work as part of field activities associated with existing projects.

132. Australia presented paper CCSBT-ESC/1309/20 that provides suggestions for furthering discussion on the Scientific Research Program (SRP). The paper notes that the 2013 ESC is scheduled to recommend an updated five year SRP, 2014¬-18, for consideration by the Extended Commission. The paper assumes that the SRP aims to identify the longer term research priorities in line with the Convention's objective and the vision, goals and action plan outlined in the 2011 CCSBT strategic plan. The paper suggests a framework to focus the consideration of the SRP on the objectives and rationale for the potential components. The suggested structure separates the regular ESC work program from strategic, longer term research activities that may be required to address key uncertainties. The paper proposes a structure based around: 1) scientific monitoring, 2) MP implementation, 3) stock assessment (OM development). The

paper lists uncertainties and possible research activities for ESC discussion and prioritisation. These have been identified based on previous ESC discussions, technical work in revising the OM and the outcomes of recent research.

133. Paper CCSBT-ESC/1309/41 presents a method to estimate a maturity ogive for the SBT population, independent of the spawning ground. The method requires ovaries and otoliths to be collected from females caught on feeding grounds across the southern oceans during the non-spawning season. The paper suggests that recently identified ‘maturity markers’ in histological sections of tuna ovaries could be used to differentiate histologically between immature and mature-resting females at that time of year. The advantage of the proposed work is that ovaries can be collected and stored until funding is available for histological processing and data analysis. The paper also suggested that sampling could be achieved through the national scientific observer programs, which already have ongoing otolith sampling responsibilities (to minimise the cost of sampling). Such a sampling program would maximise the potential to collect ovaries from the largest spatial area, allowing for spatial variation in maturity-at-length/age to be taken into account for in the models, and providing a representative estimate of size/age at maturity for future assessments.

134. It was noted that this sampling would relate to longline fleets as the purse seine fishery would not provide mature fish. The highly migratory nature of SBT means that it would be important to have as comprehensive sampling coverage of the range of the population as possible and, ideally, a basis to weight the area specific estimated maturity ogive by the abundance in the areas. It was noted that a method for estimating an unbiased maturity ogive has recently been developed and applied to South Pacific Albacore, and that the suggested sample sizes and protocols in CCSBT-ESC/1309/41 were based on this approach.

135. Further logistical issues would need to be discussed, such as if the selectivity of the Japanese longline fleet was such as to provide fish of sufficient age. It was noted that due to selectivity in the Japanese longline fleet, fish of 10+ years old are sampled infrequently. Australia clarified that there is greater need to sample the younger age classes 5-12 years and length classes from 110-220 cm. It was noted that obtaining samples at the higher end of this range would be difficult; however, the primary range of interest (110-160cm) accounts for a large proportion of the recent catches in the longline fishery (e.g. >70%).

Priorities for the SRP for 2014 to 2018

136. The ESC discussed research priorities under the SRP. These are in addition to the on-going scientific monitoring (e.g. the scientific aerial survey) and annual work program activities which are undertaken by the CCSBT, members and the ESC (Table A, **Attachment 12**).

137. The technical working group discussions identified potential priorities and approaches for the SRP based on uncertainties in current understanding of the stock and fisheries, as identified in the technical discussion on development of the OM. These were further discussed by the ESC along with a broader discussion of research priorities. The ESC adopted a modified framework for the SRP structured around: 1) On-going Scientific Monitoring; 2) MP Implementation and 3) Stock Assessment (OM development), and identified potential research activities as listed in Table B, Attachment 12.

138. In summary, the ESC identified key research areas described in paragraphs (139-145):

139. Stock Assessment (OM development) - selectivity of the Indonesian Spawning ground fishery. Investigating potential processes that influence the selectivity in the Indonesian spawning ground fishery (understanding the dome-shaped selectivity in the OM).

- Further investigation of existing data from the Indonesia spawning ground fishery (Indonesia may be able to undertake this compilation of data/information at low cost, high priority for 2014 preferably prior to the technical meeting)
- Deployment of electronic tags on larger fish (160cm+) for direct observation of behaviour on the spawning ground (higher cost, likely timeframe 3-5 yrs).

140. Abundance indices – spawning biomass. Providing ongoing close-kin results for estimating the absolute value and trend of the spawning biomass. Absolute estimates are most useful for conditioning the OM, as done currently, while trend information is potentially useful for the MP. An index of spawning biomass (whether based on the stand-alone close-kin assessment or a simpler indicator based on the POPs) could provide a potential additional index for future MP. This has three research components:

- Conducting a design study based on simulation testing within the current OM framework to plan on-going close-kin sampling and processing, and to evaluate the value of additional information in terms of improving MP performance (e.g. potential increases in yield for a given risk level) (approximately $75,000, 2014).
- Ongoing collection and archiving of tissue samples for close-kin genetics (approximately $30,000 annually, 2014 and ongoing).
- Processing of current archived tissue samples to detect further POPs. This would capitalise on the investment in marker development and current microsatellite expertise (cost for 2000 samples is approximately $60,000 if done in the next 1-2 years; timing may depend on design study).
- Evaluate the use of more recent genetic markers/approaches (possibly moving from microsatellite markers to 'SNPs' which are lower cost and more repeatable across readers and laboratories). Moving to the use of SNPs is a longer term application and depends on synergies with any gene-tagging program (longer term).

141. Abundance indices – Recruitment. Estimating the proportion of juveniles that move into the GAB to clarify uncertainty in stock structure and absolute abundance index for recruitment/juveniles. This could be addressed with gene-tagging (by sampling from longline fleets as well as within the GAB) or otolith microchemistry approaches.

- Conduct of a design study based on simulation testing within the current OM framework (there are opportunities to combine with close-kin design study) to evaluate relative cost effectiveness and sampling design for a gene-tagging program (high priority, approximately $75,000, 2014).
- Conduct of a pilot (logistic feasibility) study, possibly as part of planned field activities under existing projects (low-medium cost, next 1-2 years).

- Otolith microchemistry, the ESC noted Australia's initial research on the use of fine-scale laser ablation on 30 fish (collected from the spawning ground, off Perth and the Great Australian Bight) to determine whether a within year location signal can be detected. The results are expected to be finalised within a year (determine priority based on outcomes).
- Larger scale stock structure (e.g. is there a separate subpopulation off South Africa). This could be addressed with gene-tagging or otolith microchemistry approaches depending on the logistics of tagging/sampling from fleets in other areas.

142. Stock Assessment (OM development) – mortality of adults. Information on the mortality of older age classes. A time series of close-kin information may provide estimates of total mortality which could contribute to this issue (longer term depending on close-kin time series data).

143. Biological parameters. Independent information on the maturity schedule as an input to the OM. The ESC noted that the OMMP4 meeting results indicated the OM was not particularly sensitive to different assumptions regarding the maturity schedule. However, a robust estimate of size at maturity would be important for estimating MSY.

- Collection and preservation of ovary samples following the protocols in CCSBT-ESC/1309/41 (across fisheries and size classes) (~low cost if collected by observers, starting in 2014).
- Histological processing and analysis of ovary samples (~$50,000-100,000, after sufficient sample collection, preferably before 2016).

144. Characterisation of catch – total mortalities. Improved estimates of total mortalities, including catch from fleets outside of CCSBT members and cooperating non-members (the ESC requested information from the 2013 Compliance Committee) and accounting for recreational catches and releases/discards from all fleets (Ongoing medium priority).

145. MP implementation. Preparation for the first formal review of the MP (scheduled for 2017).

146. The ESC agreed that pursuing an industry based survey was a lower priority for the SRP in comparison to the genetic tagging approaches.

147. The advisory panel recommended that when video camera system is installed it will be important to compare results to the previous approach (40 or 100 fish sample) for estimating the size composition of the Australian catch and correction factors as needed.

148. The ESC recommended that the highest priorities for commencing in 2014 under the SRP are the continued collection and archiving of samples for close-kin genetics (in Australia and Indonesia), the design study for potential close-kin and gene-tagging programs, initiating collection and preservation of ovary samples (across fisheries and size classes) and further collation and analysis of existing data on selectivity in the Indonesian spawning ground fishery. The ESC has included these in the proposed 2014 workplan. The ESC recommended that the Commission note **Attachment 12** and the progress made on the SRP. The ESC agreed that at the next meeting the finalisation of the SRP (2014-18) would be a

substantive agenda item, involving the review of proposals and detailed costings for the SRP components.

Agenda Item 13. Requirements for Data Exchange in 2014

149. The requirements for the 2014 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**.

150. It was noted that the 2011/12 Indonesian otoliths were collected and archived but have not been aged. Hence, the age structure for the 2011/12 Indonesian longline catch had been generated using age-length keys developed from the previous two years length at age data, which is an approach preferably avoided. There is currently no resourcing to age these 2011/12 otoliths for the 2014 data exchange. Australia noted that there is resourcing to age the otoliths collected in 2012/13, with these data available for the 2014 data exchange. In the past, it has been a priority to have the direct aging data available for use in the stock assessment.

151. The ESC noted that the 2012/13 length frequency data from the spawning ground fishery show a reduction in average size (discussed under agenda item 5.1). As noted in CCSBT-ESC/1309/12, there is concern that a proportion of the samples for 2012/13 were taken south of the spawning ground. Further investigations are underway and if required, an updated length frequency distribution (and associated age distribution) will be provided for the 2014 data exchange.

Agenda Item 14. Research Mortality Allowance

152. Japan tabled CCSBT-ESC/1309/31 concerning the utilisation of its Research Mortality Allowance (RMA) during 2012/2013 and an application for 1 t of RMA for 2013/2014. Japan used 295.6 kg of its 2012/13 RMA. The 2013/14 RMA request is for a trolling survey in the Japan to estimate a relative abundance index for age 1 SBT in Western Australia.

153. Australia advised that it did not use any of the RMA that it had been allocated for 2012/13. Australia presented CCSBT-ESC/1309/21 in which it proposed an allocation of 5.95 t RMA for four projects in 2013/14, these being:

- Electronic tagging and effect of seismic exploration (3.0t);
- Status, distribution and abundance of iconic species and apex predators in the Great Australian Bight (1.25t);
- Health assessment of wild southern bluefin tuna (1.2t); and
- Post-release survival of southern bluefin tuna from recreational fishing (0.5t).

154. The ESC endorsed Japan's request for a RMA of 1 t and Australia's request for a RMA of 5.95 t for the purposes specified.

155. The ESC requested that Members provide progress or final reports to the next ESC meeting on all projects that were granted RMA.

Agenda Item 15. Report of the Ecologically Related Species Working Group

156. The Chair of the Ecologically Related Species Working Group (ERSWG), Mr Morison, presented the report of the 10th meeting held from 28-31 August 2013. He noted that the Terms of Reference for the ERSWG contained the requirement that they report to the Commission through the Scientific Committee, which may provide comments to the Commission on the reports including any advice and recommendations. The ERSWG had received 7 National Reports, 22 substantive papers and 13 information papers. These covered a broad range of ERS issues. The advice and recommendations from the ERSWG (provided below) was summarised by the Chair:

- The ERSWG advises that:
  - The updated information on the critical status of some seabird populations reinforced previous statements from ERSWG 9 on the concerns about the effects of fishing for SBT on seabirds;
  - The current ERA identified higher risk areas south west of Australia, east of South Africa and in the Tasman Sea; and
  - The key points in CCSBT-ERS/1308/16 reinforce the advice from ERSWG 9 as there have been no major changes to advice concerning best practice for seabird mitigation measures.
- The ERSWG reiterated its previous advice that implementation of effective seabird bycatch mitigation measures should not be delayed while ERAs are progressed.
- The following recommendations were made by the meeting:
  - Further improvement of risk assessments should be explored, in particular, those referred to in paragraph 39 above;
  - Species identification could be improved using DNA technology; and
  - The effectiveness of current mitigation measures needs to be measured and monitored.
- Recognising the importance of measuring and monitoring effectiveness of seabird mitigation measures in SBT longline fisheries, the ERSWG recommends that a Effectiveness of Seabird Mitigation Measures Technical Group be formed to provide advice to the ERSWG on feasible, practical, timely, and effective technical approaches for measuring and monitoring the effectiveness of seabird mitigation measures in SBT longline fisheries. The suggested Terms of Reference for this group is provided at Attachment 4 of the ERSWG 10 Report.
- The ERSWG recommended that a small intersessional working group be formed to progress the assessment of porbeagle sharks.
- The ERSWG requested the Extended Commission consider actions to reinvigorate the Joint Technical Bycatch Working Group as its work may assist in the ERSWG's work on sharks and other ERS.
- Other outcomes of the meeting included
  - A first data exchange undertaken and an attempt at a synthesis of ERS data;
  - A review of sections of observer standards concerning ERS with some additional input expected intersessionally;

- Finalisation of ERS pamphlets with version in all Member languages available on the CCSBT website;
- Substantial progress with a Seabird Identification guide for all tuna RFMOs (which ACAP is leading);
- The future workplan was updated; and
- The next meeting was proposed to be held in March 2015.

157. The ESC thanked the Mr Morison for his presentation of the report of the ERSWG's meeting.

158. The ESC was reminded that the ERSWG is considering revisions to the CCSBT Scientific Observer Program Standards that were likely to increase the workload of longline observers and that this could impact on the amount of observing that could be conducted during hauls. Consequently the ERSWG and ESC will need to consider each other's requirements as part of the revision of the standards.

159. The meeting noted that future outputs of the ERSWG, such as the assessment of porbeagle sharks and the evaluation of effectiveness of mitigation measures may warrant more involvement from the ESC in the ERSWG's work than has been the case in the past.

Agenda Item 16. Workplan, Timetable and Research Budget for 2014

16.1 Overview, time schedule and budgetary implications of proposed 2014 research activities and implications of Scientific Research Program for the work plan and budget

160. Japan presented CCSBT-ESC/1309/30. The paper proposed the plan of the piston-line trolling survey off the south coasts of Western Australia in 2013/2014. The ESC endorsed the proposed survey.

161. The ESC developed the following workplan for 2014.

Activity	Approximate Period	Resources or approximate budgetary implications[4]
Continuation of tag recovery efforts.	Tag recovery is continuous.	$1,500 for tag rewards on the basis that few recaptures are expected to occur.
Provide SBT Stock Status report to the other tuna RFMOs.	Aug - Nov 13	No additional cost
Collation of information on unreported mortalities and categorising this information in accordance with OM "fleets"	Jan - Jun 14	New Zealand
Proposed SRP activities for 2014: • Continued collection of close-kin (CK) samples • Design study for future gene-tagging and CK studies • Collation of information on selectivity for Indonesian spawning ground fishery (ideally completed prior to the 2014 technical meeting) • Sampling for maturity studies (gonads etc.)	Jan - Dec 14	• Close –kin: CCSBT ($30,000) • Design study: CCSBT ($150,000) • Selectivity: Indonesia • Maturity samples: Members
Continuation of the development of the OMMP Code. Update input files including all sensitivity tests (e.g., alternative catch histories) for OM in advance of 2014 technical meeting and ESC.	Jan-Jul 14 (Data inputs after data exchange)	Australia / Consultant 5 days.
CPUE Webinar to review progress of the intersessional CPUE work (see **Attachment 7**)	Apr 14	Intersessional work by Japan, Australia, New Zealand, Taiwan, Korea and possibly Indonesia. Three panel days.
Standard Scientific Data Exchange.	Apr - Jul	No additional costs
Small technical meeting in relation to the full SBT stock assessment and updated of Operating Model in advance of ESC meeting. See **Attachment 14** for details.	4 days, July (Seattle, USA)	Three panel members, OM/MP consultant, 1 interpreter.
Extended Scientific Committee for the 21st meeting of the Scientific Committee. The meeting will conduct its regular review of indicators and evaluation of whether exceptional circumstances exist. The meeting will focus on conducting a full SBT stock assessment and developing an updated comprehensive SRP.	1-6 Sep 14 (Auckland, New Zealand)	ESC Chair, all 4 panel members, full interpretation and 3 Secretariat staff.

16.2 Timing, length and structure of next meeting

162. The next ESC meeting is proposed to be held from 1 - 6 September 2014, in Auckland, New Zealand.

Agenda Item 17. Other Matters

163. There was no other business.

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[4] Where a Member is listed, it is assumed that the Member will cover any associated costs.

Agenda Item 18. Adoption of Meeting Report

164. The report was adopted.

Agenda Item 19. Close of Meeting

165. The meeting closed at 1:05 pm on 7 September 2013.

List of Attachments

Attachment	
1.	List of Participants
2.	Agenda
3.	List of Documents
4.	Global Reported Catch by Flag
5.	Trends in selected indicators of the SBT stock
6.	Report of April 2013 CPUE Web Meeting and other Intersessional Work
7.	Discussions of the CPUE Working Group at SC 18
8.	Summary of Technical Working Group Discussions
9.	Actual Data used in the Management Procedure calculations conducted at SC18
10.	Updated Specifications of the CCSBT Management Procedure
11.	Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2013
12.	Scientific Research Plan (2014-18)
13.	Data Exchange Requirements for 2014
14.	Terms of reference for OMMP5

Attachment 1

List of Participants
Extended Scientific Committee Meeting
of the Eighteenth Meeting of the Scientific Committee

First name	Last name	Title	Position	Organisation	Postal address	Tel	Fax	Email
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Attachment 2

Agenda
Extended Scientific Committee for the Eighteenth Meeting of the Scientific Committee

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. Evaluation of Fisheries Indicators and SBT stock status

5.1. Indicators of the state of the SBT stock

5.2. Indicators of exceptional circumstances for the MP

5.3. Summary of the SBT stock status

6. **Report on intersessional scientific activities**

7. Report from the CPUE modelling group

7.1. Report of April web meeting and other intersessional work

7.2. Quality control of Base CPUE series

7.3. Progress with developing new CPUE series

8. Evaluation of new data sources and operating models to be used in 2014

8.1. Report from the Portland Technical meeting

8.2. Incorporation of results from close-kin genetics analysis into the OM

8.3. Direct ageing data

8.4. Evaluation of use of commercial spotting data

9. Operation of MP to produce recommended TACs for 2015 – 2017

10. SBT Management Advice

11. Update of MP and OM codes

11.1. Discuss issues related to the update of the MP and OM codes

12. Finalise Scientific Research Program

13. Requirements for Data Exchange in 2014

14. Research Mortality Allowance

15. Report of the Ecologically Related Species Working Group

16. Workplan, Timetable and Research Budget for 2014

16.1. Overview, time schedule and budgetary implications of proposed 2014 research activities and implications of Scientific Research Program for the work plan and budget

16.2. Timing, length and structure of next meeting

17. Other Matters

18. Adoption of Meeting Report

19. Close of Meeting

Attachment 3

List of Documents
Extended Scientific Committee
for the Eighteenth Meeting of the Scientific Committee

(CCSBT-ESC/1309/)

1. Draft Agenda
2. List of Participants
3. List of Documents
4. (Secretariat) Secretariat review of catches (ESC agenda item 4.2)
6. (Secretariat) Data Exchange (ESC agenda item 13)
7. (Australia) Preparation of Australia's southern bluefin tuna catch and effort data submission for 2013 (ESC agenda item 4.1)
8. (Australia) Fishery indicators for the southern bluefin tuna stock 2012–13 (ESC agenda item 5.1)
9. (Australia) Commercial spotting in the Australian surface fishery, updated to include the 2012–13 fishing season (ESC agenda item 5.1)
10. (Australia) The aerial survey index of abundance: updated results for the 2012/13 fishing season (ESC agenda item 5.1)
11. (Australia) An update on Australian otolith collection activities, direct ageing and length at age keys for the Australian surface fishery (ESC agenda item 5.1)
12. (Australia) Update on the length and age distribution of SBT in the Indonesian longline catch (ESC agenda item 5.1)
13. (Australia) A generalized additive model for southern bluefin tuna CPUE (Rev.1) (ESC agenda item 7)
14. (Australia) The effect of smoothed CPUE on projections of SSB for southern bluefin tuna – a retrospective study (ESC agenda item 7.3)
15. (Australia) Updates to the CCSBT Operating Model including new data sources, data weighting and re-sampling of the grid (ESC agenda item 8)
17. (Australia) Close-kin; where to now (ESC agenda item 12)
18. (Australia) Preliminary cost and precision estimates of sampling designs for gene-tagging for SBT (ESC agenda item 12)
19. (Australia) MP estimation performance relative to current input CPUE and aerial survey data (ESC agenda item 9)
20. (Australia) Scientific research program for CCSBT (ESC agenda item 12)
21. (Australia) Proposed use of CCSBT Research Mortality Allowance (ESC agenda item 14)

22. (Japan) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2012/2013 (ESC agenda item 4.1)
23. (Japan) Report of activities for conventional and archival tagging and recapture for southern bluefin tuna by Japan in 2012/2013 (ESC agenda item 4.1)
24. (Japan) Activities of southern bluefin tuna otolith collection and age estimation and analysis of the age data by Japan in 2012 (ESC agenda item 5.1)
26. (Japan) Summary of fisheries indicators of southern bluefin tuna stock in 2013 (ESC agenda item 5.1)
27. (Japan) Report of the piston-line trolling monitoring survey for the age-1southern bluefin tuna recruitment index in 2012/2013 (ESC agenda item 5.1)
28. (Japan) Change in operation pattern of Japanese southern bluefin tuna longliners in 2012 (ESC agenda item 5.1, 7)
29. (Japan) Description of CPUE calculation from the core vessel data for southern bluefin tuna in 2013 (ESC agenda item 5.1, 7)
30. (Japan) Proposal for the recruitment monitoring survey in 2013/2014 (ESC agenda item 5.1 or 16.1)
31. (Japan) Report of the 2011/2012 RMA utilization and application for the 2013/2014 RMA (ESC agenda item 14)
32. (Japan) Spatiotemporal distribution of Constant Square cells not overlapped with Variable Square cells (ESC agenda item 7)
33. (Japan) Releases and discards of Southern Bluefin Tuna from the Japanese longline vessels in 2012 (ESC agenda item 4.1)
34. (Japan) Post-releases survival of Southern Bluefin Tuna released from longline vessels (ESC agenda item 4.1)
35. (Japan) Cross-verification of Japanese data-sets for the Southern Bluefin Tuna: 2012 fishing season (ESC agenda item 4.1)
36. (Japan) Impacts of assumptions about the natural mortality schedule and the Indonesian fishery selectivity on the SBT stock assessment (ESC agenda item 8.2)
37. (Taiwan) CPUE analysis for southern bluefin tuna caught by Taiwanese longline fleet (ESC agenda item 5.1)
38. (Japan, Taiwan) Progress in analysis of historical fishery data for Taiwanese southern bluefin tuna fleet (ESC agenda item 7)
39. (Indonesia) Proposed use of Weight Ratio between Whole (WHO) and Gilled and Gutted (GGT) *Thunnus maccoyii*
40. (Korea) Southern bluefin tuna CPUE standardization of Korean tuna longline fisheries (1996-2012) (ESC agenda item 5.1)
41. (Australia) Estimating size/age at maturity of southern bluefin tuna

(CCSBT- ESC/1309/BGD)

1. (CPUE Chair) Summary Report of the CPUE web meeting held on the 25/26 April 2013. Pope J.G. (*Previously* **CCSBT-OMMP/1307/10**) (ESC agenda item 7.1)
2. (Japan) A check of operating model predictions from the viewpoint of the management procedure implementation in 2013 (*Previously* **CCSBT-OMMP/1307/09 Rev.**) (ESC agenda item 5.2)
3. (Australia) The draft final report of the close kin research (*Previously* **CCSBT-OMMP/1307/Info 01**) (ESC agenda item 8.2)
4. (Australia) Standalone MP software and data inputs in 2013 (*Previously* **CCSBT-OMMP/1307/04**))(ESC agenda item 11.1)

(CCSBT-ESC/1309/SBT Fisheries -)

Australia	Australia's 2011–12 southern bluefin tuna fishing season
Indonesia	Indonesia Southern Bluefin Tuna Fisheries A National Report Year 2012
Japan	Review of Japanese SBT Fisheries in 2012 (Rev.)
Korea	2013 Annual National Report of Korean SBT Fishery
New Zealand	Annual Review of National SBT Fisheries for the Scientific Committee
Taiwan	Review of Taiwan SBT Fishery of 2011/2012
South Africa	Annual Review of the South African SBT Fishery for the Extended Scientific Committee

(CCSBT-ESC/1309/Info)

1. (Australia) Reproductive Dynamics and Potential Annual Fecundity of South Pacific Albacore Tuna (*Thunnus alalunga*) (ESC agenda item 12)

(CCSBT-ESC/1309/Rep)

1. Report of the Fourth Operating Model and Management Procedure Technical Meeting (July 2013)
2. Report of the Nineteenth Annual Meeting of the Commission (October 2012)
3. Report of the Seventh Meeting of the Compliance Committee (September 2012)
4. Report of the Seventeenth Meeting of the Scientific Committee (August 2012)
5. Report of the Ninth Meeting of the Ecologically Related Species Working Group (March 2012)
6. Report of the Eighteenth Annual Meeting of the Commission (October 2011)

7. Report of the Sixth Meeting of the Compliance Committee (October 2011)
8. Report of the Special Meeting of the Commission (August 2011)
9. Report of the Sixteenth Meeting of the Scientific Committee (July 2011)
10. Report of the Fifteenth Meeting of the Scientific Committee (September 2010)

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 & Othe
1952	264		565	0		0	0	0	0	0	0	0	
1953	509		3890	0		0	0	0	0	0	0	0	
1954	424		2447	0		0	0	0	0	0	0	0	
1955	322		1964	0		0	0	0	0	0	0	0	
1956	964		9603	0		0	0	0	0	0	0	0	
1957	1264		22908	0		0	0	0	0	0	0	0	
1958	2322		12462	0		0	0	0	0	0	0	0	
1959	2486		61892	0		0	0	0	0	0	0	0	
1960	3545		75826	0		0	0	0	0	0	0	0	
1961	3678		77927	0		0	0	0	0	145	0	0	
1962	4636		40397	0		0	0	0	0	724	0	0	
1963	6199		59724	0		0	0	0	0	398	0	0	
1964	6832		42838	0		0	0	0	0	197	0	0	
1965	6876		40689	0		0	0	0	0	2	0	0	
1966	8008		39644	0		0	0	0	0	4	0	0	
1967	6357		59281	0		0	0	0	0	5	0	0	
1968	8737		49657	0		0	0	0	0	0	0	0	
1969	8679		49769	0		0	80	0	0	0	0	0	
1970	7097		40929	0		0	130	0	0	0	0	0	
1971	6969		38149	0		0	30	0	0	0	0	0	
1972	12397		39458	0		0	70	0	0	0	0	0	
1973	9890		31225	0		0	90	0	0	0	0	0	
1974	12672		34005	0		0	100	0	0	0	0	0	
1975	8833		24134	0		0	15	0	0	0	0	0	
1976	8383		34099	0		0	15	0	12	0	0	0	
1977	12569		29600	0		0	5	0	4	0	0	0	
1978	12190		23632	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		2,840	379	4	521	841	46	1,077	41	18	0	3
2008	5,033		2,952	319	0	1,134	913	45	926	45	14	4	10
2009	5,108		2,659	419	0	1,117	921	47	641	32	2	0	0
2010	4,200		2,223	501	0	867	1,208	43	636	34	11	0	0
2011	4,200		2,518	547	0	705	533	45	839	49	3	0	1
2012	4,503		2,528	776	0	922	497	46	700	77	0	0	0

European Union: From 2006, estimates are from EU reports to the CCSBT. Earlier catches were reported by Spain and the IOTC.

Miscellaneous: Before 2004, these were from Japanese import statistics (JIS). From 2004, the higher value of JIS and CCSBT TIS information was used combined with available from flags in this category.

Reseach and other: Mortality of SBT from CCSBT research and other sources such as discarding practices in 1995/96.

Attachment 5

Trends in selected indicators of the SBT stock

Indicator	Period	Min.	Max.	2009	2010	2011	2012	2013	12 month trend	
									2011-12	2012-13
Scientific aerial survey (age 2 – 4)	1993–2000 2005–13	0.38 (1999)	1.82 (2011)	0.53	1.03	1.82	0.52	1.32	↓	↑
SAPUE index (age 2 – 4)	2003–13	0.39 (2003)	1.70 (2011)	0.96	1.46	1.78	0.57	1.01	↓	↑
Trolling index (age 1)	1996–2003 2005–06 2006–13	2.817 (2006)	5.65 (2011)	3.58	2.92	5.65	1.55	3.48	↓	↑
NZ charter nominal CPUE (Areas 5+6)	1989–2012	1.339 (1991)	7.83 (2010)	4.33	7.81	6.30	7.33		↑	
NZ domestic nominal CPUE	1989–2012	0.000 (1989)	4.06 (2012)	1.26	1.90	2.28	4.06		↑	
NZ charter age/size composition (proportion age 0–5 SBT)*	1989–2012	0.001 (2005)	0.414 (1993)	0.33	0.25	0.11	0.19		↑	
NZ domestic age/size composition (proportion age 0–5 SBT)*	1980–2012	0.001 (1985)	0.404 (1995)	0.09	0.19	0.15	0.21		↑	
Indonesian median size class	1993–94 to 2012–13	166 (2002–03)	188 (1993–94)	170	168	170	168	162	↓	↓
Indonesian age composition: mean age on spawning ground, all SBT	1994–95 to 2010–11	14 (2005–06)	21 (1994–95)	15.6	15.3	16.8			-	
Indonesian age composition: median age on spawning ground	1994–95 to 2010–11	13 (2001–03)	21 (1994–97, 1998–99)	15	15	17	---		-	

*derived from size data

Indicator	Period	Area weighting	Min.	Max.	2009	2010	2011	2012	2013	12 month trend 2011-12	12 month trend 2012-13
Standardised JP LL CPUE (age 3)	1969-2012	W0.5	0.197 (2003)	2.843 (1972)	0.579	0.267	0.457	0.688		↑	
		W0.8	0.225 (2003)	2.670 (1972)	0.699	0.316	0.534	0.808		↑	
Standardised JP LL CPUE (age 4)	1969-2012	W0.5	0.259 (2006)	2.954 (1974)	0.864	0.685	0.769	0.794		↑	
		W0.8	0.286 (2006)	2.696 (1974)	1.116	0.845	0.951	1.002		↑	
Standardised JP LL CPUE (age 5)	1969-2012	W0.5	0.230 (2006)	2.620 (1972)	0.769	1.312	1.187	1.030		↓	
		W0.8	0.257 (2006)	2.446 (1972)	1.023	1.767	1.508	1.380		↓	
Standardised JP LL CPUE (age 6+7)	1969-2012	W0.5	0.201 (2007)	2.557(1976)	0.449	0.845	1.085	1.413		↑	
		W0.8	0.237 (2007)	2.406 (1976)	0.587	1.178	1.454	1.912		↑	
Standardised JP LL CPUE (age 8-11)	1969-2012	W0.5	0.271 (2002)	3.591 (1969)	0.370	0.323	0.320	0.459		↑	
		W0.8	0.296 (1992)	3.262 (1969)	0.474	0.442	0.441	0.629		↑	
Standardised JP LL CPUE (age 12+)	1969-2012	W0.5	0.446 (2012)	3.129 (1970)	0.629	0.483	0.515	0.446		↓	
		W0.8	0.596 (2012)	2.813 (1970)	0.791	0.634	0.698	0.596		↓	

Attachment 6

Report of April 2013 CPUE Web Meeting and other Intersessional Work

The chair of the CPUE Working Group (John Pope) presented the report of the web meeting held 25/26th April 2013 to discuss and forward CPUE issues (CCSBT-ESC/1309/BGD01) and the report of follow up discussions conducted in the margin of the 2013 OMMP meeting in Portland, Maine, USA (Annex 5, CCSBT-ESC/1309/Rep01).

For both meetings two broad subject areas were considered:

1. To check that the current base series continues to behave adequately
2. To develop and encourage new work on CPUE series.

Under item 1 the CPUE Working Group agreed five Monitoring Series that could be used to compare with the base CPUE series used in MP work. These were:

a) The base model but without bycatch terms (i.e. with the YFT and BET terms removed)
b) A bycatch model (as 1) but including the proportion of hauls with zero SBT as a by-catch indicator
c) The base model with all interaction terms removed (main effects only).
d) The base model with interaction terms treated as random effects
e) A model based upon GAM / spatio temporal splines to provide new series,

It was also noted that the 1° x 1° and the shot by shot series that Japan provides might also be seen as a monitoring series.

Series a) and c) were made available to the Portland meeting (and the ESC) and series e to the ESC.

It was also agreed that the annual checks on fleet behavior should be made and these were provided to the Portland meeting (and to the ESC).

On the basis of the monitoring series available at Portland and the annual checks, the Working Group concluded that the updated base CPUE series is suitable for the MP and there was no reason to change the model being used.

Under item 2 the Working Group encouraged the development of new CPUE data and new ideas for the analysis of CPUE series. Sub items considered under this heading included:

a) to plan a comparison of Taiwan CPUE by area with the Japan CPUE,
b) to see plans for any analysis of Korean CPUE data,
c) to discuss new ideas for CPUE work and series,
d) to decide if the use of longline research sets could be a basis for providing consistent time/area distribution of longline CPUE.

Under a), detailed plans were made at Portland to compare Taiwanese and Japanese data by area, resulting in two papers at the SC18.

Under b) Korea reported that explorations of their CPUE data are underway to see if they can be used in a standardization (a paper was presented on this to the ESC).

Under c) 4 papers were presented on new ideas for CPUE work and series. These provided:

- a first attempt at smoothing CPUE,
- a consideration of how differences in catchability between areas might affect CPUE series and if these could be treated,
- ideas for developing a CPUE model based upon an explicit description of the migratory behavior of the SBT.

In discussion a need to develop size based CPUE data was noted.

Under d) there was a discussion on whether longline research sets could be a basis for providing consistent time/area distribution of longline CPUE. The discussion was focused around the questions:

- are there any previous examples of this approach used elsewhere -
- is the objective “to provide an alternative CPUE series?” or “to check for changes in fish distribution i.e. explore CS versus VS?”
- in either case how would we estimate variation of individual hauls? How many shots we would need a year to provide a viable program?
- finally, could fishermen agree to such plans.

Although provisional answers were provided to the first three questions the last question was seen as being the key and scientists in member countries were requested to ask their industry informally if some form of directed effort for CPUE purposes is at all feasible.

Two papers were provided to explore the feasibility of the approach.

Attachment 7

Discussions of the CPUE Working Group at SC 18

The Chair of the CPUE working group summarised progress with the CPUE analyses and outlined the intersessional activities that were important for the next 12 months.

1. Base model quality assurance

The core base model CPUE is used in the MP and needs to be checked for impacts of any changes in fishing pattern. CCSBT-ESC/1309/28 reviews the operation of the Japanese SBT longline fishery. The WG has five proposed CPUE monitoring series plus the 1º x 1º and Haul x Haul series; four of these series were available to the ESC but alternative by-catch series and the random effects series have not yet been run.

The smoothing method proposed in CCSBT-ESC/1309/14 can provide added tests of the CPUE e.g. retrospective patterns. The impact of discards on CPUE trends (for ages 4+) needs to be evaluated. The WG has agreed in previous years to drop the Laslett model in its current formulation. Other model options could be tried.

A comparison of CPUE for the whole fleet with the core fleet was suggested (month/area comparisons). This had already been presented in CCSBT-ESC/1309/28 and 29 for the Japanese longline data. The quality assurance work was well in hand but new approaches giving fresh insights were always welcome.

2. New Taiwan CPUE indices

CCSBT-ESC/1309/38 compared the overlap of the Taiwanese and Japanese longline fisheries. Rather little overlap was evident, which suggests that the Taiwanese CPUE data should be developed as an independent series which focuses upon younger ages (3-5) of SBT. CCSBT-ESC/1309/37 presented the new CPUE indices for providing an index for the Taiwan fishery. The method used for the selection of the Japanese core fleet was not appropriate for the Taiwanese data. The WG considered that alternative vessel selection criteria should be investigated.

The model included CPUE data for BET and ALB but these are not minor by-catch species in this fishery. A careful definition of the Taiwanese SBT fishery will be required and the consequence to the series explored.

The linear model adopted in ESC/1309/37 was

$$\ln(CPUE_{SBT}) = Y + M + A + Lon + Lat + BET + ALB + Y\times A + M\times Lon + M\times Lat + M\times BET + M\times ALB + error$$

Suggested changes to the model were:

- Add Month*Area (M×A) interactions (may be infeasible due to sparse data, alternative may be to use random effects option)
- Make Lon & Lat categorical variables
- Develop CPUE by size or age

The WG considered that the CPUE indices could potentially be a good indicator of recruitment as the catch is mainly of 3-5 year old fish.

3. New Korean CPUE indices

CCSBT-ESC/1309/40 presented the CPUE indices for the Korean longline fishery. The linear model applied:

$$\ln(CPUE + c) = \mu + Y + S + A + HBF + Y\times A + S\times A + S\times HBF + error$$

used season (S) rather than month because of sparse data.

The Chair requested a comparison between the 5º x 5º data with the Japanese fishery, and suggested a collaborative approach between Korea and Japan to review the model predictions from the two CPUE series and prepare a joint paper (using currently available catch and effort data) for the webinar meeting.

In terms of using the Korean fishery CPUE data it could be used either as an independent series or included with the Japanese data if appropriate.

4. Other new CPUE series

(a) GAM
CCSBT-ESC/1309/13 presented the generalized additive model. Currently the observations are weighted by the number of hooks. The Chair suggested different yearly weighting as the series appeared to be oversmoothed. Mark Chambers could develop this model further and also supply code for the analysis of 1º x 1º data by Japan

(b) Migration model
No further work has been carried out with this model since the Webinar, but the Chair would consider developing a simple working version and also consider the incorporation of size information.

(c) Other CPUE indices
The Working Group considered that running the base model by size or age might help account for size based changes in SBT distribution. Other size or age based models could also be developed.

(d) Industry based CPUE
The feasibility of industry targeted fishing sets was discussed again but the WG agreed this was a lower priority than, for example, genetic tagging.

5. Next meeting

The Chair suggested another webinar meeting to be held in April 2014 as these have proved a low cost way of encouraging intersessional work. The WG agreed to add this to the Scientific Research Plan.

Attachment 8

Summary of Technical Working Group Discussions

The technical working group discussed the OM issues with the aim of preparing for the 2014 stock assessment. The following items discussed and the decisions made are noted.

OM issues:

1) Assumptions about adult natural mortality in connection to effects on Indonesian selectivity and the size of the plus group.

   Decisions:
   - Range of M10 values to include in grid
     (previously six values examined: 0.03 0.04 0.05 0.075 0.1 0.125)
     Drop 0.03 and 0.04 for the base
   - Age at which M starts to increase (currently 25)
     Keep at 25, already a quite complex natural-mortality at age set of options, no support for alternatives (cross-reference 2009 findings and how we arrived at senescence as a plausible scenario)
   - Age at which Indonesian selectivity becomes constant (currently 25)
     Conduct a sensitivity in which the age of Indonesian selectivity becomes constant at age 20, and for this grid of M10 values along a reasonable range that is sampled and is numerical stable.

2) Close-kin assumptions
   - ***Sensitivity analyses conducted in Portland indicate the results were not too sensitive to alternative assumptions about maturity ogives.***

3) Sample sizes and likelihood weightings

   Decisions needed:
   - Keep same "pragmatic" approach for LL/Age sample sizes?
     Yes
   - Keep CV=0.18 for aerial survey?
     Yes
   - Recalculate tag overdispersion parameter?
     Yes but preferably recalculate with updated OM data
   - Endorse Portland decision about uniform weights on steepness?
     Yes
   - CK overdispersion
     Recompute the parameter given updated OM data

4) Input data
   - Close kin data
     Yes; likely unchanged from 2013
   - Catch (currently using Case 1 overcatch scenario)
     Evaluate as a sensitivity and include all sources of unreported catch mortalities, see table and discussion below.
   - CPUE (alternative series, effect of overcatch on CPUE)
     Candidate series including Taiwan, Korea that are under development but premature to include in OM at this time
   - Tagging
     Only 1990s tagging, 2000s tagging data not to be included until cohort/mixing issues can be resolved through an appropriate spatial model
   - Aerial survey
     Include updated values

- Indonesian size/age composition
  Evaluate the source of the smaller fish seen in the 2013 size composition, age the otolith collection and apply to the size data (after evaluating and correcting if needed). Use age-length keys only from the years in which they were collected.

5) Candidate sensitivity runs and possible addition of grid axes.
   See table 1 below.

Table 1. Sensitivity runs to be conducted for assessment purposes.

"Assessment" Run	**Description**	**Results from 2009**
Added catch	Unaccounted catch mortality (see below)	New
SV_OverC	Continue 20% overcatch from Australian fishery if the stereo video (SV) system is not implemented	New
IS20	Indonesian selectivity flat from age 20+ and using an appropriate range of M10 values	New
Upq2008	CPUE q increased (permanent from 2008 35% increase) BUT re-evaluate the extent of increase apparent in nominal CPUE by age, to be done prior to the 2014 technical meeting	From 2011
Omega=0.75	A power function for the relationship between biomass and CPUE with power = 0.75	From 2009
Tag F / Mixing	Increases the fishing mortality of tagged SBT by 50% relative to the F applied to the whole population. Account for incomplete mixing of the tagged fish.	From 2009
CPUE S=0	Overcatch had no impact on CPUE	From 2009
CPUE S=0.50	50% of LL1 overcatch associated with reported effort	From 2009
Include Troll	Includes the piston-line troll survey index	From 2009

Notes on unaccounted catch mortality

These include 1) catches by non-members, 2) released/discarded fish, 3) recreational fisheries catch, and 4) mortality from other sources. The following approach might be considered

Catch mortality	Approach	Responsibility
From non-Members	Various approaches	CC
Release/discarded fish	ESC paper, informed assumption	ESC and CC
Recreational fisheries	ESC, informed assumption	ESC and CC
Other sources	ESC, informed assumption	

It was noted that all sources of mortality are to be reported by Members and Cooperating Non-Members (including the sources highlighted here). Such reporting is to cover the historical period as well as for future reporting but may have periods of missing data.

Each of these sources should include the most appropriate category of existing fishery to which they should be added. Allocating to specific fisheries may be difficult, especially in areas where different size ranges are caught. The New Zealand delegation agreed to make an initial cut at this. It was noted that the approach should be sourced from the data exchange with scientifically defensible estimates.

The approach of incorporating this sensitivity in the model is less straightforward and some modeling work will be required. Ana agreed to review the code but the work will need to be prioritized and sourced accordingly.

Attachment 9

Actual Data used in the Management Procedure calculations conducted at SC18

The following information is the data input file used in the Bali Procedure MP in 2013 to calculate the 2015-2017 TAC. This provides the CPUE series, the Aerial Survey series, the q ratio value, the last TAC year and last TAC set, which were used in the 2013 calculations.

```
# Control file for SBT Bali Procedure - with 2013 data.
# Last year TAC already set
2014
# TAC in that year
12449
# catchability ratio AS vs CPUE - updated 2013
#838.2094 #2011 value
849.843
# CPUE series for MP (1969-2013) -ave of BASE w0.8 w0.5 x multipliers
2.3887
2.3219
2.1354
2.1971
1.8767
1.9349
1.4765
1.8997
1.6703
1.4060
1.2015
1.3857
1.3010
1.0253
1.0165
1.0432
0.8720
0.6666
0.6664
0.5581
0.5889
0.6625
0.5315
0.6076
0.8037
0.9703
0.9000
0.7062
0.6965
0.6101
0.5419
0.6484
0.7397
1.0562
0.7718
0.6810
0.5714
0.3540
```

```
0.2690
0.5269
0.6387
0.8573
0.7421
0.7676
#historical aerial survey (1993-2013) (-11.0 = missing data)
 348.2291
 239.245
 315.3104
 292.9836
 154.1827
 184.9522
 73.2641
 130.8224
 -11.0
-11.0
-11.0
-11.0
128.9778
 130.5659
 112.7744
 174.1606
 102.1017
 200.3936
 352.9442
 101.2156
 255.694
```

Attachment 10

Updated Specifications of the CCSBT Management Procedure

Introduction

From 2002 to 2011, the CCSBT conducted extensive work to develop a Management Procedure (MP) to guide its global TAC setting process for southern bluefin tuna. The final MP, known as the "Bali Procedure", was recommended by the CCSBT's Extended Scientific Committee (ESC) in July 2011. Management parameters of the Bali Procedure could be adjusted to set different time horizons for rebuilding, and to constrain the maximum TAC changes allowed every time the TAC is updated. Simulation tests results for a range of parameter options were presented to CCSBT's Extended Commission for its consideration.

The Extended Commission adopted the Bali Procedure together with the following associated management parameters as its MP at the CCSBT's eighteenth annual meeting in October 2011:

- The MP is to be tuned to a 70% probability[1] of rebuilding the stock to the interim rebuilding target reference point of 20% of the original spawning stock biomass by 2035;
- The minimum TAC change (increase or decrease) will be 100 tonnes;
- The maximum TAC change (increase or decrease) will be 3,000 tonnes;
- The TAC will be set for three-year periods, subject to paragraph 7 of CCSBT's Resolution on the Adoption of a Management Procedure[2]; and
- The national allocation of the TAC within each three-year period will be apportioned according to CCSBT's Resolution on the Allocation of the Global Total Allowable Catch[2].

The CCSBT used the MP to compute the TAC for 2012 to 2014 inclusive and decided that MP will be used to guide the setting of the global SBT TAC for 2012 and beyond[3]. For the second (2015-2017) and subsequent three-year TAC setting periods, there will be a one year lag between the TAC calculation by the MP and implementation of that TAC (i.e. the 2015-2017 TAC will be calculated in 2013).

[1] Probabilities were computed across a weighted set of operating models defined as the "Reference Set", which represented the most important uncertainties in the model structure, parameters, and data. These included alternative values for natural mortality and steepness parameters (model weights proportional to their maximum posterior density), alternative CPUE series (given equal weights), and two different age ranges used to normalize selectivity for CPUE predictions (given pre-determined weights). Specifications about the reference set used for the final tuning of MPs are provided at paragraph 92 of Appendix 2 of the Report of the Sixteenth Meeting of the Scientific Committee.

[2] Report of the Eighteenth Annual Meeting of the Commission (10-13 October 2011, Bali, Indonesia).

[3] The TAC for 2012 and 2013 was set at the value computed using the MP in 2011. The Extended Commission decided that the TAC for 2014 will either be the value computed in 2011 or the value of the MP outcomes for 2015 – 2017 (whichever is the less), unless the Extended Commission decides otherwise based on the assessment of the Compliance Committee.

Technical details of the MP, together with specifications of how the CPUE and Aerial Survey indices that are to be provided as input to the MP are to be calculated, and the Metarule process that the Extended Commission has adopted for dealing with exceptional circumstances in the SBT fishery, are provided in the following sections of this document.

1. Background and Technical details of the Bali Procedure

Concept

The ESC experienced difficulty in choosing between the two preferred MPs that it had identified (MP1 and MP2) and it subsequently decided to recommend an alternative which was a combination of MP1 and MP2. There were features of each of MP1 and MP2 that appealed to the ESC, and an integrated combination of those features was considered to be a suitable approach for providing a single MP (the Bali Procedure) that is a genuine representation of all the work Member scientists had conducted.

Details

There were several key features that differed between MP1 and MP2:

- Empirical versus model based;
- CPUE target versus CPUE trend; and
- Use of historical aerial survey data

Empirical MPs have the virtue of being (usually) simpler to understand and compute, but their output recommendations can often be over-strongly influenced by noise in the data. Model-based MPs can "filter" the signal (and key parameters) from the noise in the MP data, but if that process is too complex or over-parameterised, it can sometimes behave strangely in the testing phase, as a result of non-convergence or hitting boundaries due to complex likelihood surfaces. The simple Biomass Random Effect Model (BREM) part of MP1 did not exhibit any of these properties: it always converged and without any apparently strange parameter estimates. Given that in both rounds of MP testing it demonstrated an ability to reduce variance in both catch and spawning stock biomass (SSB), this suggested that it would form a sensible base point for an MP.

CPUE

MPs that act (primarily) on trends in CPUE have the advantage of acting "locally", in that they do not depend on the absolute level of the abundance index, unlike target-based MPs where target mis-specification can be a problem. However, trend-based MPs can get "lost" by failing to recognise a spuriously positive trend at very low stock biomass levels and thus potentially fail to secure resource recovery. Both MP1 and MP2 are target and trend driven (in relation to CPUE), so a combination of the two should have a mix of both trend and target driven behaviour at their core.

Aerial survey

The historical aerial survey data points (1993-2000, 2005-2011) cover the years for which estimated recruitments were the lowest on record. As such, they represent levels of the aerial survey index to preferably stay above and ideally, never be below. In MP2 the tuning parameter was effectively a target level of the future aerial survey which was a multiple of the average historical level of the survey given real data. From paper CCSBTESC/1107/34 in Table 1 it was seen that the tuned level of this multiplier was always less than 1 and mostly between 0.6-0.8. This meant, in effect, that the target level of aerial survey was actually less than that observed in the historical data. This is perhaps not ideal, as it is not desirable for the recruitment level to decrease below the levels seen in the last two decades, so it was suggested that the average historical level of the aerial survey should form a kind of limit reference point, and that below this point any MP (including MP2) should act strongly to ensure that the stock is brought above this level as was done in MP1.

Form of the new HCR

To combine the features of both MP1 and MP2 two candidate TACs are calculated, based on the key aspects of each of MP1 and MP2, and the (arithmetic) mean of the two TACs are taken. The key MP variables are not the raw CPUE and aerial survey, but their "filtered" counterparts the adult (B_y) and juvenile (R_y) relative biomass, respectively, that come from the BREM estimation framework of MP1. The first candidate TAC is based upon the trend in adult relative biomass:

$$TAC^1_{y+1} = TAC_y \times \begin{cases} 1 - k_1 |\lambda|^{\gamma} & \lambda < 0 \\ 1 + k_2 \lambda & \lambda \geq 0 \end{cases} \qquad (1)$$

where λ is the slope in the regression of $\ln B_y$ against year (from years $y\text{-}\tau_B\text{+}1$ to year y). The second TAC is defined as follows:

$$TAC^2_{y+1} = 0.5 \times \left(TAC_y + C^{t\arg}_y \Delta^R_y \right), \qquad (2)$$

where

$$C^{t\arg}_y = \begin{cases} \delta \left[B_y / B^* \right]^{1-\varepsilon_b} & B_Y \geq B^* \\ \delta \left[B_y / B^* \right]^{1+\varepsilon_b} & B_y < B^* \end{cases} \qquad (3)$$

where $\varepsilon_b \in [0,1]$ represents the degree to which the response to a biomass level above or below the target level B^* is asymmetric. The recruitment adjustment Δ^R_y is defined as follows:

$$\Delta^R_y = \begin{cases} \left[\overline{R} / \Phi \right]^{1-\varepsilon_r} & \overline{R} \geq \Phi \\ \left[\overline{R} / \Phi \right]^{1+\varepsilon_r} & \overline{R} < \Phi \end{cases} \qquad (4)$$

and $\varepsilon_r \in [0,1]$ is the level of asymmetry in response to the current moving (arithmetic) average - and this has been changed to include up to year y - recruitment levels, $\overline{R}$:

$$\overline{R} = \frac{1}{\tau_R} \sum_{i=y-\tau_R+1}^{y} R_i \ , \qquad (5)$$

of length τ_R relative to the average, Φ, calculated over the years for which the estimates are based on the most up to date observed data (1993-2000 and 2005-2011). Most of the fixed parameters of this MP are kept at their respective levels as used in MP1 and MP2 with the single tuning parameter δ. However, the parameter k_2 is reduced to a value of 3 to reduce reactivity to positive CPUE trends, but to ensure tuning is possible for the most difficult tuning settings requested by the Extended Commission, the parameter ε_b is reduced from 0.5 to 0.25. Table 1 details the fixed parameter values in the combined Bali Procedure and their values in the individual procedures. Finally, the Bali Procedure TAC is defined as:

$$TAC_{y+1} = 0.5 \times \left(TAC^{1}_{y+1} + TAC^{2}_{y+1}\right). \qquad (6)$$

Table 1: Fixed values and tuning parameter for the combined Bali Procedure and their respective values for the two original MPs.

Parameter	Bali Procedure	MP1/MP2
Δ	Tuned	Tuned (MP1)
k_1	1.5	1.5 (MP2)
k_2	3	5 (MP2)
Γ	1	1 (MP2)
τ_B	7	7 (MP2)
B^*	1.2	1.2 (MP1)
ε_b	0.25	0.5 (MP1)
ε_r	0.75	0.75 (MP1)
τ_R	5	5 (MP1)

2. Specification of Standardised CPUE for the MP

Data to be used

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

The dataset each year is further adjusted by:

- Deleting records from operations south of 50^0S;
- Combining operations from Area 5 and Area 6 into one area (Area 56); and
- Deleting operations with extremely high CPUE values (>120).

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

CPUE standardization

Unweighted CPUE

The aggregated CPUE dataset is standardized using the following Generalised Linear Model (GLM)[4]:

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

where

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

Area weights

To obtain the area weighted CPUE indices described below, the area of SBT distribution was calculated based on a 1x1 degree square resolution. The area was calculated in the form of an area index such that an area size of 1x1 degree square along the equator was defined as 1, and the area size for other 1x1 degree squares of different latitudes was determined as the proportion of the square area along the equator. The area index for the Constant Square (CS)[5] was simply a union of fished 1x1 degree squares through all years (1969-present) and was calculated for each

---

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

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

quarter, month, statistical area, and latitude (5 degree) combination. The area index for the Variable Square (VS) was the sum of fished 1x1 degree square areas and was calculated for each year, quarter, month, statistical area, and latitude combination. For VS, a square counts as fished only for the month in which fishing occurred. More details of the area index calculation are described in Nishida (1996).

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

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

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

where

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

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

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

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

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

The area weighted CPUE series between 1986 and the most recent year are then calibrated to the historical CPUE series between 1969 and 2008 using the following GLM (equation 5), described in Nishida and Tsuji (1998) for 5x5 degree cells by month data for all vessels (i.e. both core and other vessels) in Areas 4-9 and Months 4-9:

$$\log(CPUE+const) = Intercept + Year + Quarter + Month + Area + Lat5 + (Quarter*Area) + (Year*Quarter) + (Year*Area) + Error \quad (5)$$

where

const is 10% of the mean nominal CPUE.

CPUE series for monitoring

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

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

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

Historical CPUE Series used as input to the Management Procedure

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

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

$$CPUE = (w0.5 + w0.8)/2 * (1+(Catch\_multiplier-1)*CPUE\_multiplier)$$

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

	CPUE multiplier	Catch multiplier
Year	S=0.25-A	Case 1
1983	0.25	1
1984	0.25	1
1985	0.25	1
1986	0.25	1
1987	0.25	1
1988	0.25	1
1989	0.244	1.28

1990	0.249	1.8
1991	0.25	1.53
1992	0.275	1.24
1993	0.273	1.62
1994	0.266	2.66
1995	0.247	2.14
1996	0.25	2.2
1997	0.246	2.6
1998	0.247	1.82
1999	0.248	1.77
2000	0.247	2.13
2001	0.248	2.16
2002	0.249	2.13
2003	0.249	1.92
2004	0.248	1.75
2005	0.249	1.69
2006	0	1

Reference

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

Anonymous. 2001b. Report of the SC to CCSBT on the Scientific Research Program. Attachment D in Report of the Fifth Meeting of the Commission for the Conservation of Southern Bluefin Tuna, Scientific Committee. 19-14 March 2001, Tokyo, Japan.

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

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

Parma, A. (2009). Catch and CPUE scenarios. Attachment 4, Report of the CCSBT Operating Model and Management Procedure Technical Meeting, 13 - 17 July 2009, Seattle, USA.

3. Data and Model Specifications for the Aerial Survey Index used in the MP

Data

The scientific aerial survey data are estimates of the biomass of SBT patches in the Great Australian Bight (GAB) as observed by experienced spotters. The aerial survey is conducted in January through March of each year, and consists of an aircraft flying along 15 north-south transect lines running from the coast to continental shelf (from 128E to 134E degrees longitude). Trained tuna spotters (historically, one dedicated spotter and one spotter-pilot) search for surface schools of SBT. When a school or group of schools is spotted (termed 'a sighting'), the plane flies out to the sighting and each spotter independently estimates the biomass of each school. The plane then returns to the transect line to continue the survey. The survey data consists of distance flown, location of sightings, biomass estimates of each school in a sighting, and environmental observations that might affect the number and size of sightings, such as sea surface temperature (SST), swell, haze, wind speed, and sea shadow. The aim is to complete four to six replicates of the survey region, but this is not always possible because planes can only fly when minimal environmental conditions are met.

From 2011 there were no spotter-pilots in the survey, only dedicated spotters and a non-spotting pilot. Calibration experiments were carried out in 2008 and 2009 to assess the impact of this change on the standardised index (Eveson et al. 2008, 2009). Based on data from these calibration experiments, a method for accounting for the fact that a plane with one spotter makes fewer sightings than a plane with two spotters was developed and subsequently refined (Eveson et al. 2011). Unless further data comes available regarding the one spotter calibration issue, the approach detailed in Eveson et al. (2011) will be used in the aerial survey standardisation.

Standardisation model

The raw survey data are standardised in two stages, in terms of biomass-per-sighting (BpS) and sightings-per-mile (SpM), and then combined together to produce a single standardised abundance index with accompanying CV-by-year (see Eveson et al.(2011) for the details of this combination process). Since environmental conditions affect what proportion of tuna are available at the surface to be seen, as well as how visible those tuna are, and since different observers can vary both in their estimation of school size and in their ability to see tuna patches, the models include 'corrections' for environmental and observer effects in order to produce standardized indices that can be meaningfully compared across years. The coefficients of the GLM model used are updated each year by making use of the data from the most recent survey.

Biomass-per-sighting (BpS) model

For the biomass-per-sighting (BpS) standardisation, the spatio-temporal and environmental covariates which are most statistically appropriate have been explored, and the following model determined:

$$\log(BpS) \sim Year*Month*Area + SST + WindSpeed \qquad (1)$$

The model is fitted using a GLMM with a log link and a Gamma error structure. The Year, Month and Area effects are treated as factors, with the term Year*Month*Area covering all 1-, 2- and 3-way interactions. The main (1-way) effects are treated as fixed effects, and the 2- and 3-way interactions are treated as random effects to deal with sometimes sparse data coverage.

Given the changing nature of the environmental information in each year, and the shortness of the time series, the environmental covariates determined as most appropriate can change with time. Thus, there may be minor variations in the model structure (the same applies to the SpM model); however, the standardisation routine will always use the same set of covariates for all years in the analysis (i.e., each year, the BpS and SpM models are fit to the data from all survey years to produce a time-series of relative abundance indices). This is in line with the primary goal of the derivation of an unbiased index of the juvenile biomass in the GAB as assumed in the operating model and for the MP testing.

Sightings-per-mile (SpM) model
For the sightings-per-mile (SpM) model, as with the biomass-per-sighting model the spatio-temporal and environmental covariates which are most statistically appropriate have been explored, and the following model determined[6]:

$$\log(\text{N\_sightings}) \sim \text{offset}(\log(\text{Distance})) + \text{Year*Month*Area} + \log(\text{ObsEffect}) + \text{SST} + \text{WindSpeed} + \text{Swell} + \text{Haze} + \text{MoonPhase} \quad (2)$$

The SpM model is fitted using a GLMM with the number of sightings (N_sightings) as the response variable, as opposed to the sightings rate. The model can then be fitted assuming an overdispersed Poisson error structure[7] with a log link and including the distance flown (Distance) as an offset term to the model (i.e. as a linear predictor with a known coefficient of one), given SpM = N_sightings/Distance. As with the BpS model, the main spatio-temporal effects (Year, Month and Area) are fitted as fixed effects, and the 2- and 3-way spatio-temporal effects are fitted as random effects.

Generating the standardised index
The specific details of the combination of the two standardised indices into one index can be found in Eveson et al. (2011). Combining the index to obtain a mean index is straightforward, with a weighted average of the biomass in each stratum being summed to obtain the total index. The calculations to obtain the CV-by-year for the index are more complex, involving the delta method, given the lack of independence of both the SpM and BpS estimates across strata.

Issue of inter-annual scale changes
Unlike CPUE, the overall scale of the standardised aerial survey can change from year to year, and sometimes substantially. This is because it is a weighted sum of the abundance in the various survey strata not some kind of weighted average. In an OM context there is no issue as the estimation of the catchability coefficient takes care of the any scale changes. This scale change

[6] These were the environmental covariates used in the 2011 analysis. Note that, as for the BpS model, the covariates included in the SpM model and the functional nature of their inclusion (linear/polynomial) can change over time as new data are recorded and future analyses are undertaken.
[7] Note that the standard Poisson distribution has a very strict variance structure in which the variance is equal to the mean, and it would almost certainly underestimate the amount of variance in the sightings data, hence the use of an overdispersed Poisson distribution to describe the error structure.

does have to be taken into account when either running the MP or when attempting to ascertain whether the new aerial survey data point is inside or outside of the bounds of what we have tested for in the MP evaluation work. This can very easily be dealt with using robust but simple statistical bootstrap techniques and, when required, this process and any required scale changes in the MP will be detailed.

Reference

Eveson, P., Bravington, M. and Farley, J. 2008. The aerial survey index of abundance: updated analysis methods and results. CCSBT-ESC/0809/24.

Eveson, P., Farley, J., and Bravington, M. 2009. The aerial survey index of abundance: updated analysis methods and results. CCSBT-ESC/0909/12.

Eveson, P., Farley, J., and Bravington, M. 2010. The aerial survey index of abundance: updated analysis methods and results for the 2009/10 fishing season. CCSBT-ESC/1009/14.

Eveson, P., Farley, J., and Bravington, M. 2011. The aerial survey index of abundance: updated analysis methods and results for the 2010/11 fishing season. CCSBT-ESC/1107/15.

4. Metarule Process

Preamble

Metarules can be thought of as "rules" which prespecify what should happen in unlikely, exceptional circumstances when application of the total allowable catch (TAC) generated by the management procedure (MP) is considered to be highly risky or highly inappropriate. Metarules are not a mechanism for making small adjustments, or 'tinkering' with the TAC from the MP. It is difficult to provide firm definitions of, and be sure of including all possible, exceptional circumstances. Instead, a process for determining whether exceptional circumstances exist is described below. The need for invoking a metarule should only be evaluated at the ESC based on information presented and reviewed at the ESC.

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

Process to determine whether exceptional circumstances exist

Every year the ESC will:

- Review stock and fishery indicators, and any other relevant data or information on the stock and fishery; and
- On the basis of this, determine whether there is evidence for exceptional circumstances.

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

- Recruitment, or a series of recruitment values outside the range[8] for which the MP was tested;
- A scientific aerial survey or CPUE result outside the range[8] for which the MP was tested;
- Substantial improvements in knowledge, or new knowledge, concerning the dynamics of the population which would have an appreciable effect on the operating models used to test the existing MP; and
- Missing input data for the MP, resulting in an inability to calculate a TAC from the MP.

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

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

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

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

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[8] The "range" refers to 95% probability intervals for projections for the index in question made using the reference set of the operating models during the testing of the MP.

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

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

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

- Determine the severity of the exceptional circumstances; and
- Follow the "Process for Action".

Process for Action

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

- Consider the severity of the exceptional circumstances (for example, how severely "out of bounds" is the CPUE or recruitment);
- Follow the Principles for Action (see below);
- Formulate advice on the action required (for example, there may be occasions, if there appears to be 'exceptional circumstances', but the severity is deemed to be low, when the advice is not for an immediate change in TAC, but rather a trigger for a review of the MP or collection of ancillary data to be reviewed at the next ESC); and
- Report to the Extended Commission that exceptional circumstances exist and provide advice on the action to take.

The Extended Commission will:

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

Principles for Action

If the risk is to the stock, principles may be:

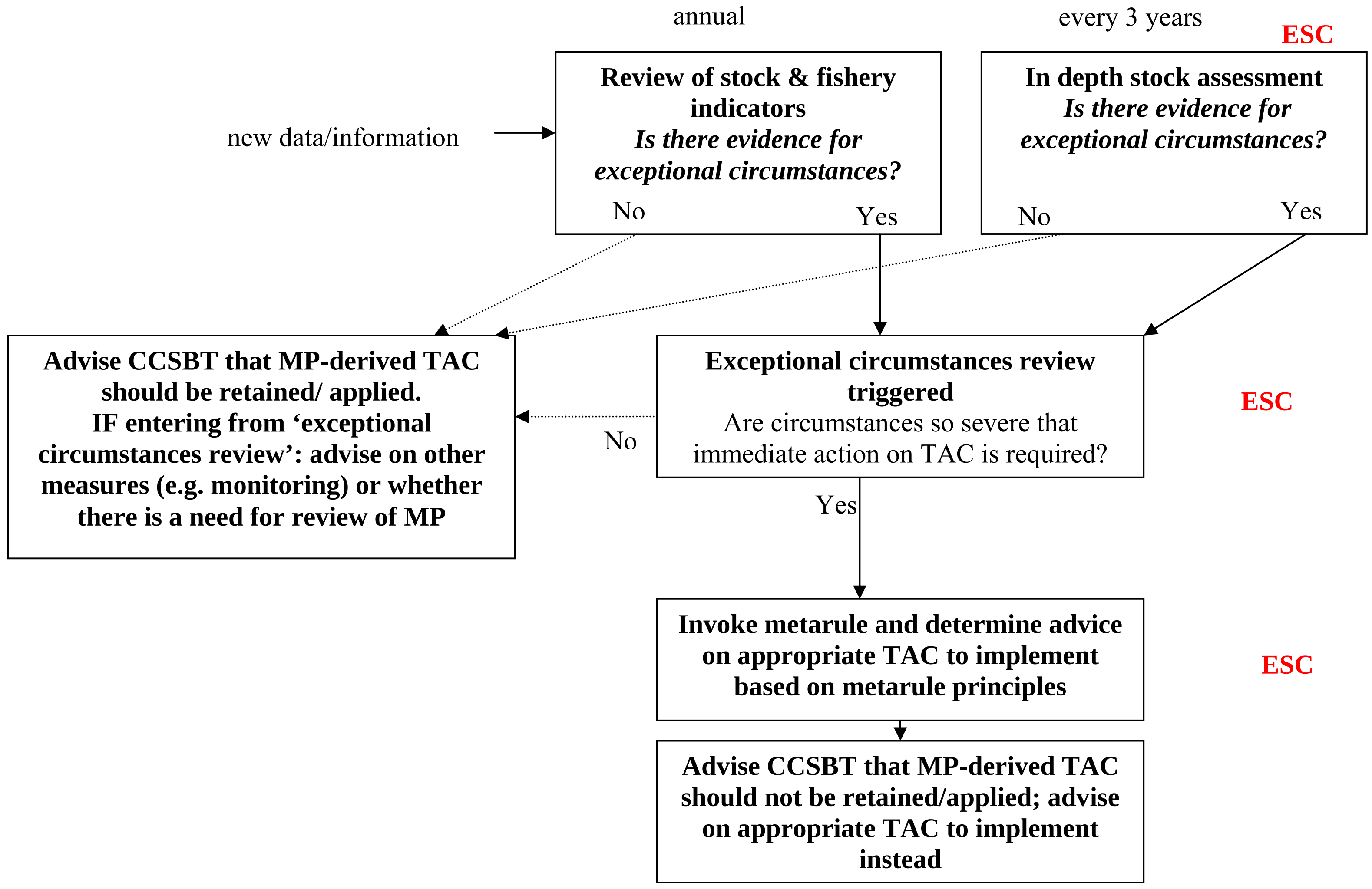
a) The MP-derived TAC should be an upper bound;
b) Action should be at least an x% change to the TAC, depending on severity.

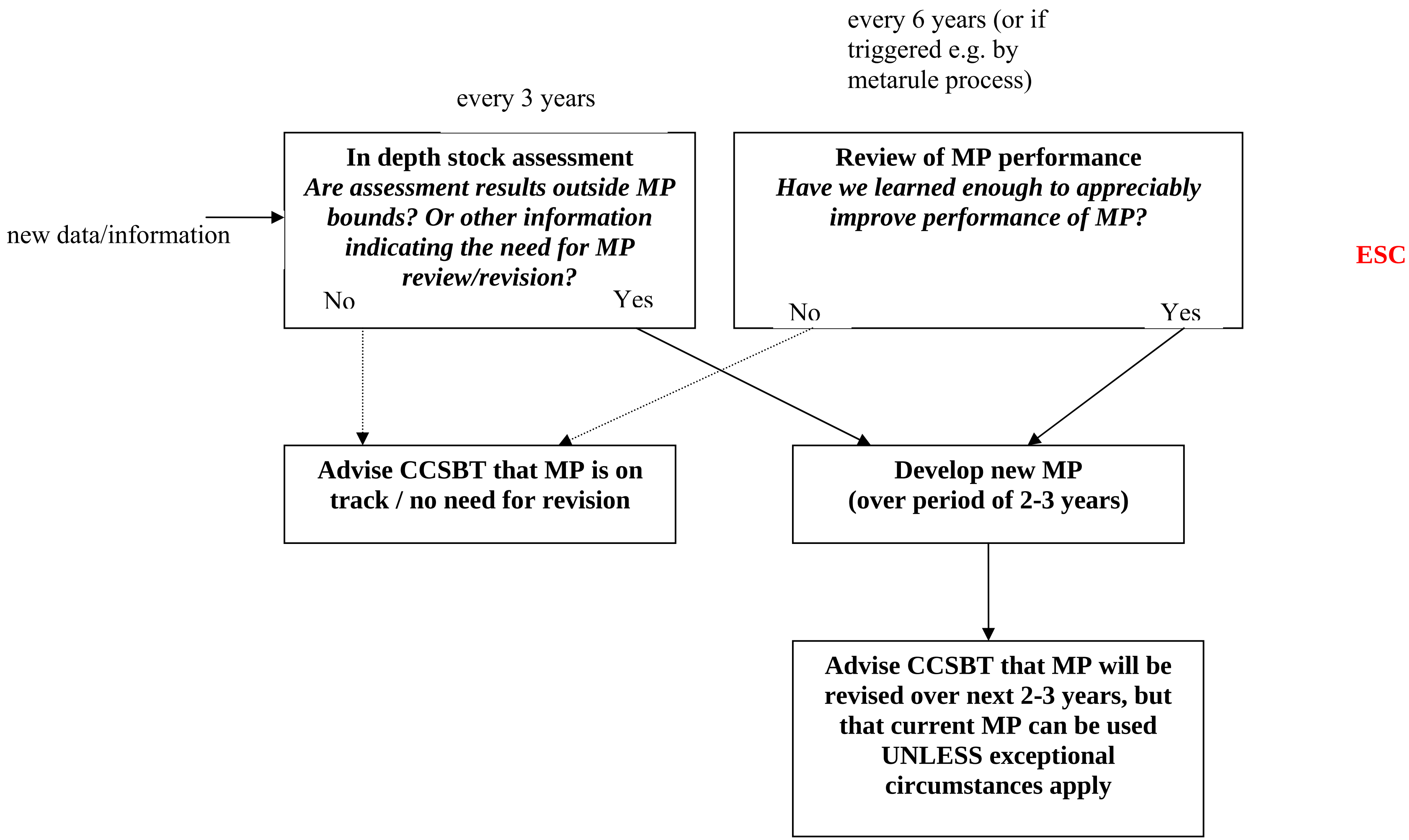
If the risk is to the fishery, principles may be:

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

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

Figure 1: Flowchart for Metarules process




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

Attachment 11

Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2013

The CCSBT Extended Scientific Committee (ESC) conducted a review of fisheries indicators in 2013 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 2012 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 - 2012, 79% of the reported catch was taken by longline and 21% 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 35% 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 80% of the SBT catch has been made in the Indian Ocean, 16% in the Pacific Ocean and 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 about 817t over the past two decades. This variation in catch 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 8000t, averaging about 20,000t, and the reported Pacific Ocean catch has ranged from about 800t to 19,000t, averaging about 5500t, over the same periods (although SBT data analyses indicate that these catches may be under-estimated).

3. Summary of Stock Status

The 2011 assessment suggested that the SBT spawning biomass is at a very low fraction of its original biomass as well as below the level that could produce maximum sustainable yield. Rebuilding the spawning stock biomass would almost certainly increase sustainable yield and provide security against unforeseen environmental events. 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 stock assessment is due to be updated in 2014.

Stock prognosis

There is a positive outlook for the SBT stock based on the 2011 assessment, including:

- the current fishing mortality has reduced to below F_{msy}; and
- Stock is expected to increase at current catch levels, and future catch levels determined by the MP

Summary of indicators in 2013

There were both positive and neutral signals from the indicators in 2013:

- Longline CPUE for the Japanese fleet for ages 6 and 7 has continued to increase since 2007. The 12+ year old CPUE shows a slight recent decrease, but this is expected given the weak recruitment from 1999 to 2002. There are no obvious recent trends in the CPUEs for the other age groups.
- Although there was a decline in the scientific aerial survey index in 2012, the index for 2013 has increased and is the second highest over the last nine years. A similar pattern of a decline followed by an increase is evident in the commercial SAPUE and troll survey results from 2011 to 2013.

- There has been a decline in the mean length of SBT on the spawning ground. There are indications that this may be the result of some Indonesian vessels fishing further south, outside the spawning grounds. This may also reflect the strong 2005 year class arriving on the spawning ground. This is being investigated further and any additional information will be provided to the 2014 ESC meeting.

4. Current Management Measures

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 will set the TAC from 2012 and beyond based on the outcome of the MP, unless the CCSBT decides otherwise based on information that is not otherwise incorporated into the MP. The adopted MP (Attachment 10, Report of the Eighteenth Meeting of the Scientific Committee) has the following management parameters:

- The MP is tuned to a 70% probability of rebuilding the stock to the interim rebuilding target reference point of 20% of the original spawning stock biomass by 2035;
- The minimum TAC change (increase or decrease) is 100 tonnes;
- The maximum TAC change (increase or decrease) is 3,000 tonnes;
- The TAC will be set for three-year periods, subject to paragraph 7 of CCSBT's Resolution on Adoption of a Management Procedure; and
- The national allocation of the TAC within each three-year period will be apportioned according to CCSBT's Resolution on the Allocation of the Global Total Allowable Catch.

The CCSBT also adopted the meta-rule process described in Attachment 10 of the Report of the 15th Meeting of the Scientific Committee as the method for dealing with exceptional circumstances in the SBT fishery. 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.

Based on the information presented at its 2013 meeting, the ESC concluded that there were no indications of exceptional circumstances. Therefore, there were no impediments to running the MP to set the TAC for the years 2015-17

Catch Limits for future Seasons

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). For the first three-year TAC setting period, the TAC will be 10,449 t, 10,949 t and 12,449 t for 2012, 2013 and 2014 respectively.

At the 2013 ESC meeting, the Advisory Panel formally ran the MP on behalf of the CCSBT Secretariat for the TAC recommendation. The recommended annual TAC for the years 2015-2017 is 14,647.4 t. This is a 2198.4 t increase from 12,449 t TAC (18%) in 2014, which is less than the maximum step of 3,000 t allowed under the MP.

In addition, some flexibility is provided to Members for limited carry-forward of unfished allocations within the three year period. This flexibility is described in CCSBT's Resolution on Limited Carry-forward of Unfished Annual Total Allowable Catch of Southern Bluefin Tuna within Three Year Quota Blocks.

Monitoring, Control and Surveillance Measures

On 1 June 2000, the CCSBT implemented a Trade Information Scheme (TIS) for SBT, in which a CCSBT TIS document must be issued for all exports of SBT. The scheme also required all Members of the CCSBT to ensure that all imports of SBT were to be accompanied by a completed CCSBT TIS Document, endorsed by an authorised competent authority in the exporting country, and including details of the name of fishing vessel, gear type, area of catch, dates, etc. Shipments not accompanied by this form were to be denied entry by Members and Cooperating Non-Members. Completed forms were lodged with the CCSBT Secretariat where they were used to maintain a database for monitoring catches and trade and for conducting reconciliations between exports and imports of SBT.

On 1 July 2004, the CCSBT established a list of fishing vessels over 24 metres in length which were approved to fish for SBT. The list was extended to include all vessels, regardless of size, from 1 July 2005.

On 31 December 2008, the CCSBT established a list of authorised farms that are approved to operate for farming SBT and on 1 April 2009, the CCSBT established a list of carrier vessels that are authorised to receive SBT at sea from large scale fishing vessels. Members and Cooperating Non-Members will not allow the trade of SBT caught by fishing vessels and farms, or transhipped to carrier vessels that are not on these lists.

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.

The CCSBT Transhipment monitoring program came into effect on 1 April 2009. The program applies to transhipments at sea from tuna longline fishing vessels with freezing capacity (referred to as "LSTLVs"). It requires, amongst other things, for 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 harmonized 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.

The CCSBT Catch Documentation Scheme (CDS) came into effect on 1 January 2010 and replaced the existing TIS system. 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.

5. Scientific Advice

Based on the results of the MP operation for 2015 – 17 in Agenda Item 9 of its 2013 meeting and the outcome of the review of exceptional circumstances in Agenda Item 5.2 of the same meeting, the ESC recommended that there is no need to revise the Extended Commission’s 2011 TAC decision regarding the TAC for 2014. Therefore the recommended TAC for 2014 is 12,449 t. The recommended annual TAC for the years 2015-2017 is 14,647.4 t.

6. Biological State and Trends

The ESC did not conduct a model based assessment at its 2013 meeting, so the information presented here is from the 2011 meeting of the ESC. The 2011 assessment suggests the SBT spawning biomass is at a very low fraction of its original biomass as well as below the level that could produce maximum sustainable yield. Rebuilding the spawning stock biomass would almost certainly increase sustainable yield and provide security against unforeseen environmental events. Catches at the current TAC are expected to achieve rebuilding.

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

SOUTHERN BLUEFIN TUNA SUMMARY FROM ESC in 2013 (global stock)	
Maximum Sustainable Yield	34,500 t (31,100-36,500t)[11]
Reported (2010) Catch[2]	9,547 t
Current Replacement Yield	27,200 t (22,200–32,800 t)
Current (2011) Spawner Biomass	45,400 (31,022–72,700 t)
Current (2011) Depletion	0.055 (0.035–0.077)
Spawner Biomass (2011) Relative to SSB_{msy}	0.229 (0.146–0.320)
Fishing Mortality (2010) Relative to F_{msy}	0.76 (0.52–1.07)
Current Management Measures	Effective Catch Limit for Members and Cooperating Non-Members combined averaged 9449t annually over 2010-2011, 10449t in 2012, and 10949t in 2013.

[1] Median and range from lower 5th to upper 95th percentile of 320 models contained in the base case

[2] More recent catch figures are provided in Attachment 4 of the Report of the Eighteenth Meeting of the Scientific Committee.

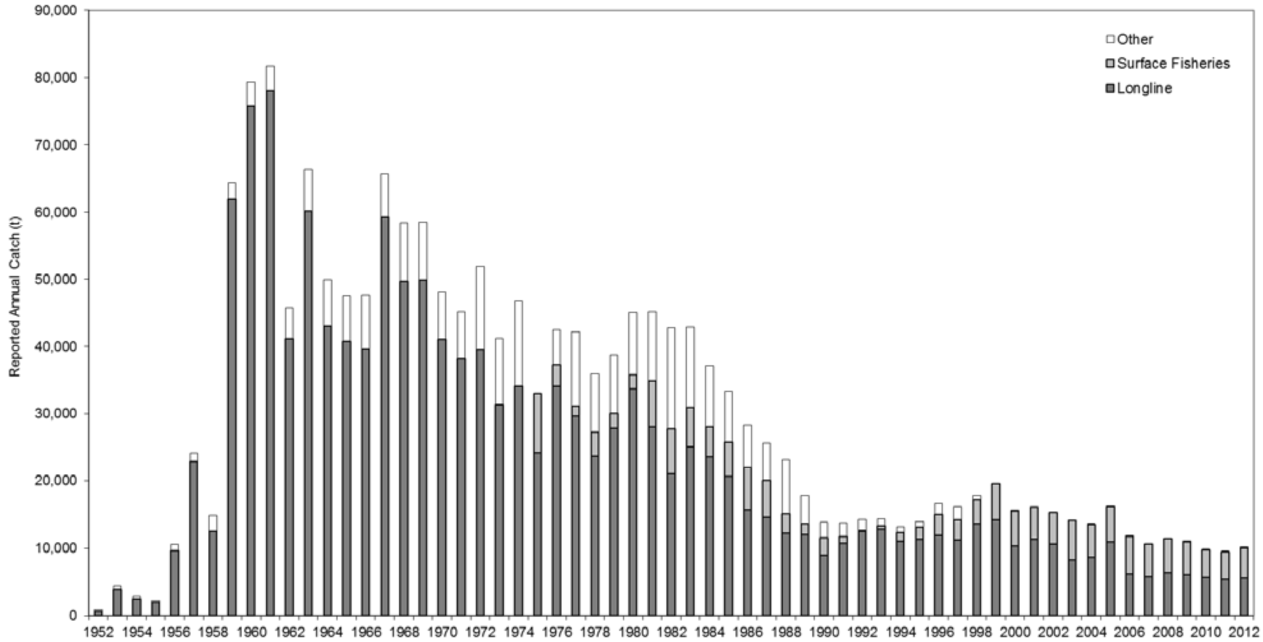


Figure 1: Reported southern bluefin tuna catches by fishing gear, 1952 to 2012. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

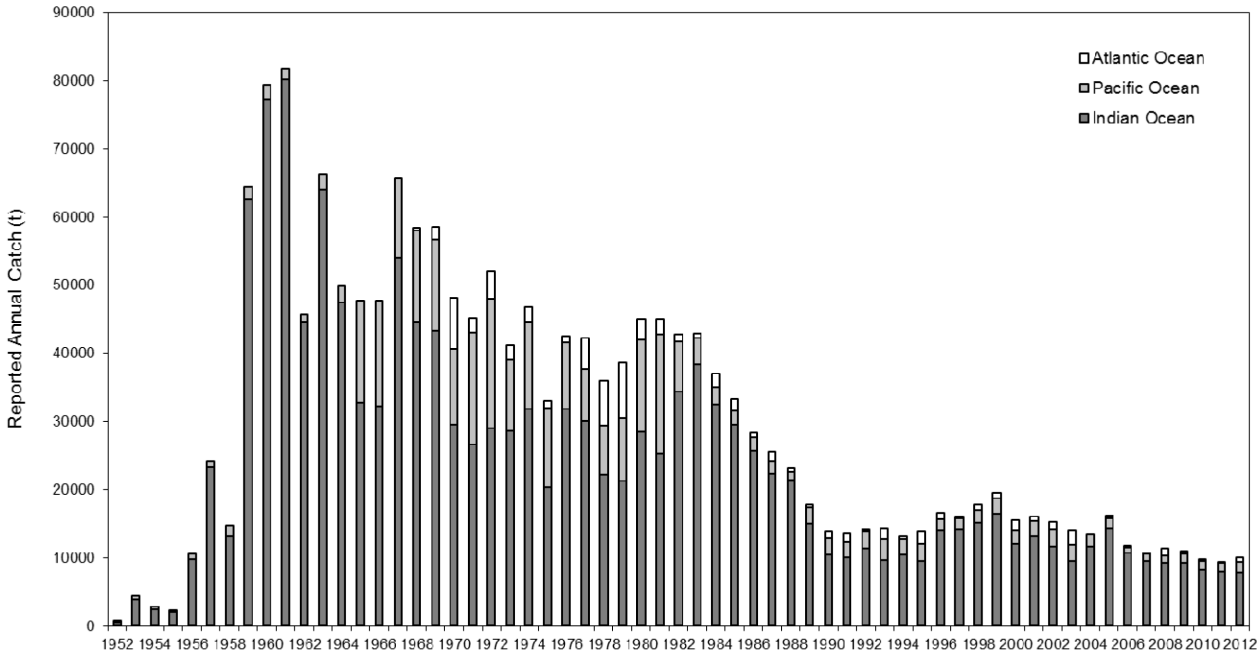


Figure 2: Reported southern bluefin tuna catches by ocean, 1952 to 2012. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

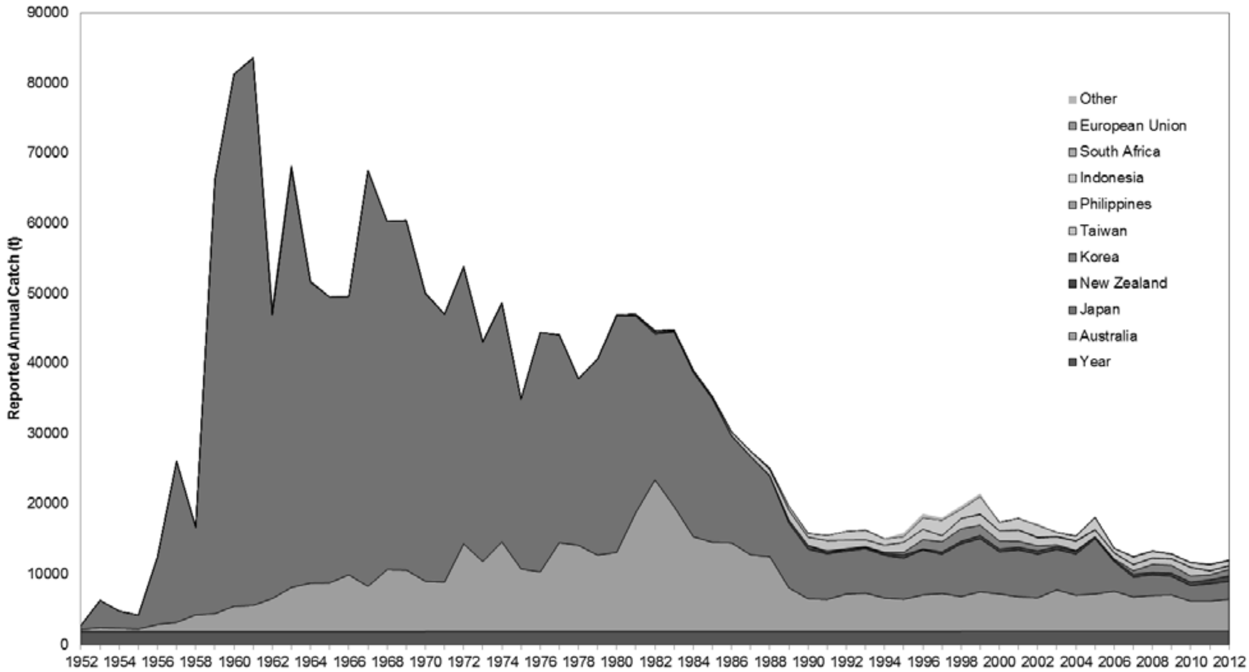


Figure 3: Reported southern bluefin tuna catches by flag, 1952 to 2012. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

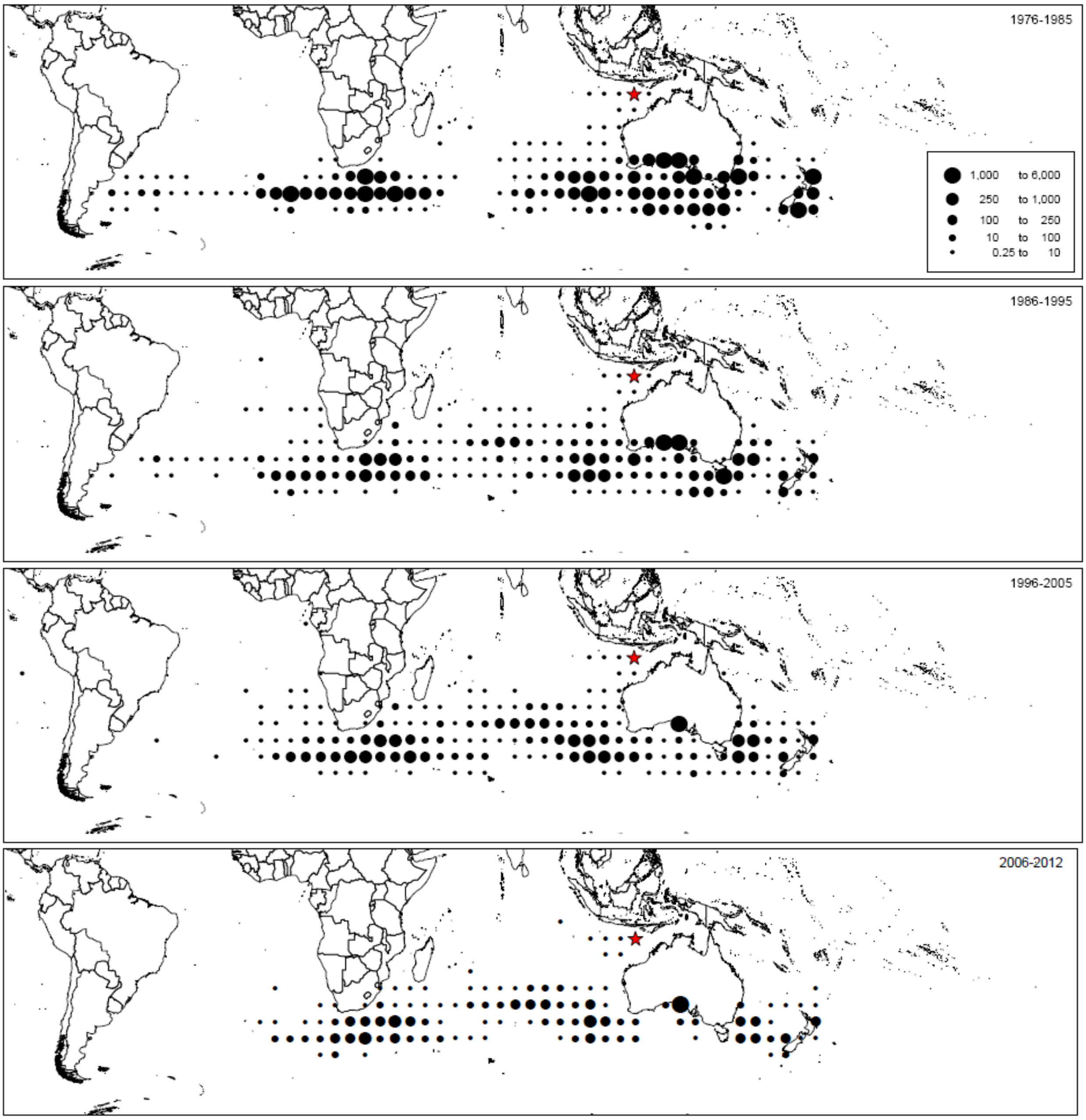


Figure 4: Geographical distribution of average annual southern bluefin tuna catches (t) by CCSBT members and cooperating non-members over the periods 1976-1985, 1986-1995, 1996-2005 and 2006-2012 per 5° block by oceanic region. The area marked with a star is an area of significant catch in the breeding 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.

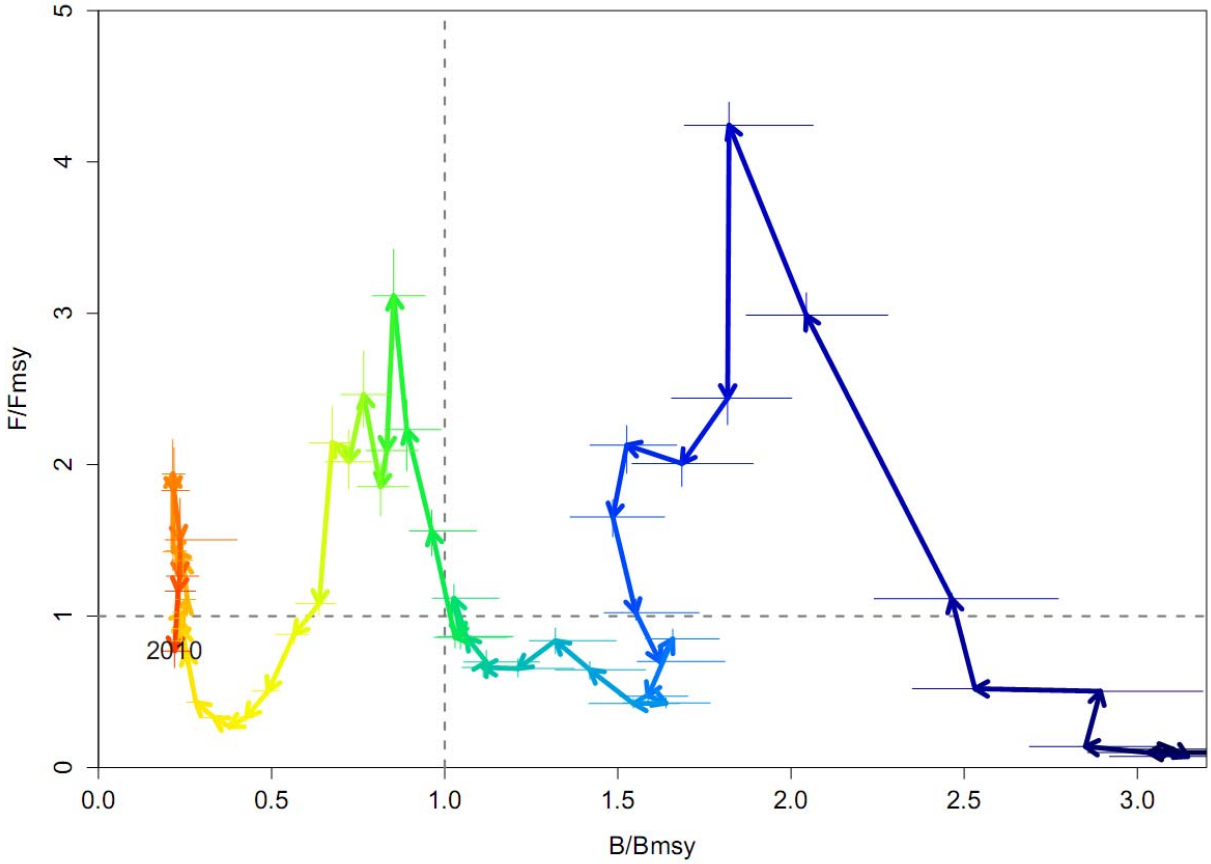


Figure 5. Time trajectory from 1952 to 2010 of median fishing mortality over the F_{msy} (for ages 2-15) versus spawning biomass (B) over B_{msy}. The fishing mortality rates are based on biomass-weighted values and the relative fishery catch composition and mean SBT body weights in each year. Vertical and horizontal lines represent 25th-75th percentiles from the operating model grid.

Attachment 12

Scientific Research Plan (2014-18)

Table A: The on-going scientific monitoring and annual work program activities, undertaken by the CCSBT, members and the ESC. The activities (shown in shaded cells) were identified during discussions at 2012 ESC, with the associated preliminary ESC priority (CCSBT-ESC 2012, Attachment 8).

Activity	Preliminary ESC Priority	Input to	Timeframe
1. Ongoing scientific monitoring			
i) **Characterization of catch (Future)**			
Catch amount	Essential	OM and annual status advice	annual
Size structure	Essential	OM and annual status advice	annual
Age structure (Indonesian catch, Indonesian and Australian updated age-length keys)	High	OM and annual status advice	annual
Stereo Video	High	OM and annual status advice	
Scientific observer program	High	OM, annual status advice, ERS assessments	annual
ii) **Abundance Indices**			
a) Recruitment			
Scientific Aerial Survey	Essential	OM, MP and annual status advice	annual
Piston line	Medium	Annual status advice	annual

Activity	Preliminary ESC Priority	Input to	Timeframe
SAPUE	Medium	Annual status advice	annual
b) Sub-adults			
Monitoring and review of the core CPUE for the MP	Essential[b]	OM, MP and annual status advice	annual
Monitoring series ('reduced base' and 'shot by shot' stated in the MP specifications	Essential[b]	Annual status advice and MP implementation	annual
c) Spawning biomass			
Indonesian catch and effort data	High	OM and annual status advice	annual
Current close kin data (incorporation of the results from the completed research into the OM)	High	OM 2014	2014
iii) **Biological parameters**			
Age-length relationship			
2. MP Implementation			
Review of exceptional circumstances	Essential[b]	MP and annual status advice	annual
Consideration of the implications of the 2014 updated assessment for the MP	Essential[b]	MP implementation	2014
2016 MP run to estimate 2018-21 TAC	Essential[b]	MP	2016
Review of MP performance (2017)	Essential[b]	MP	2017

Activity	Preliminary ESC Priority	Input to	Timeframe
3. Stock Assessment (OM development)			
New data in OM (2013) and reconditioning of OM (2014)	High/Essential	OM 2014	2014
Revised stock assessment (2017)	Essential[b]	OM 2017	2017

[a] It has been assumed the reference to this in Attachment 8 of CCSBT-ESC (2012) refers to the collection of catch at age for the Indonesian catch and the direct aging information that is used to inform Australian and Indonesian age-length keys.

[b] It is assumed these are essential as they are stated in the CCSBT MP specifications (CCSBT 2012).

Table B: Research activities identified by the ESC as components of the 2013 Scientific Research Program (2014-18). These are in addition to the on-going scientific monitoring and annual work program activities, undertaken by the CCSBT, members and the ESC (Table A). These have been identified to improve on-going scientific monitoring and address key uncertainties in the stock assessment, annual status and future MP development/refinement.

Activity / Potential research	Relevance	Reference	Timeframe and Feasibility (Priority)
1. On-going scientific monitoring			
i. Characterization of catch (Future)			
Catch amount			
Mortalities from fleets outside of CCSBT members and cooperating non-members. Seek information from the Compliance Committee.	Improved estimate of total mortalities for the OM and annual status advice.	ESC 2013	Ongoing (Medium)
Information on total removals, including accounting for recreational catches, releases, discards, discard mortalities	Improved estimate of total mortalities for the OM and annual status advice	Para. 112 ESC 2012	Ongoing (High)
Size structure			
Value of using the CDS data as a comprehensive sample of the size structure of removals	OM and annual status advice	Para. 112 ESC 2012	Longer term (Medium)
Age structure			
Feasibility of moving towards catch at age data rather than using cohort slicing in the OM.	Improved estimates of recruitment and selectivity from the longline fisheries, OM and annual status advice.	Para. 76-79 & 120 ESC 2012.	Cost and logistic implications (Low)
ii. Abundance indices			
a) Recruitment			
Proportion of juvenile population that move into the Great Australian Bight (otolith microchemistry, gene tagging)	Stock structure for the OM and assumptions for recruitment indices and close-kin analysis.	Para. 81-83 ESC (2012)	Design study/feasibility study (2014) (High)

Activity	Potential research	Relevance	Reference	Timeframe and Feasibility (Priority)
Alternative measures of absolute juvenile recruitment (gene-tagging approaches)		Estimates of absolute abundance of cohorts for the OM	ESC 2013	Longer term (High) Dependent on design study
Environmental interactions with the scientific aerial survey		Improved relative recruitment index; MP implementation	Para. 29 ESC (2012)	Underway (Agenda item 6) (Medium)
b) Sub-adults				
Exploration and refinement of alternative CPUE monitoring series		MP implementation	Para. 50-53 & 60 ESC 2013	Ongoing, CPUE working group (High)
Monitoring and exploration of changes in fleet operations over time		MP implementation and OM	Para. 58-60 ESC 2013	Ongoing , CPUE working group (High)
Monitoring/research sets – longline surveys. Feasibility studies for using research sets as a basis for providing consistent time/area distribution of longline CPUE		Improved CPUE standardisation and interpretation; MP implementation and OM	Para. 60 ESC 2013 OMMP	(Low)
Standardised CPUE series for other longline fleets (e.g. Taiwanese & Korean fleets)		Annual status advice	Para. 54-56 & 60 ESC 2012 OMMP	Ongoing , CPUE working group (High)
c) Spawning biomass				

Activity	Potential research	Relevance	Reference	Timeframe and Feasibility (Priority)
Close-kin abundance estimation (design study for sampling framework)		Design study provide costs and benefits of a time series of close-kin data collection for the OM	Para. 114 ESC 2012	2013-14 (High)
Collection of further close-kin samples		Need to take advantage of present opportunity		2014 and ongoing (High)
Processing of additional close-kin samples		To update stand-alone close-kin assessment model		Within 2-3 years (High)
Updating close-kin estimation (trend), alternative genetic approach (SNPs)		Cost savings with newer technologies		Long term (Medium)
iii. Biological parameters				
Independent estimate of maturity schedule		Defining effective reproductive contribution in the OM, MSY estimation	OMMP workshop ESC 2013	Sample collection, 2014 and ongoing (High) Processing 2-3 y (Medium)
Understanding within season spawning behaviour and potential skip spawning behaviour (e.g. electronic tagging approaches and otolith microchemistry for spawning frequency)		Defining effective reproductive contribution in the OM	Para. 118 ESC 2012	2014 (Medium)
2. MP Implementation				
Indicators of MP performance		Preparation for first formal review of the MP (2017).	ESC 2013	2016 ESC – substantive agenda item (High)
Feasibility of alternative indices for input to the MP (estimated trends from the stand-alone close kin assessment)		For revised MP	ESC 2013	Longer term (Medium)
2016 MP run to estimate 2018-21 TAC		For ongoing management	ESC 2013	2016 (High)

Activity	Potential research	Relevance	Reference	Timeframe and Feasibility (Priority)
3. Stock Assessment (OM development)				
Selectivity of the fishery on the spawning grounds. Potentially informed by the collation and analysis of existing data on fleet operations (shifts in targeting, spatial temporal distributions in effort, species composition, hook setting depth) and within season spawning behaviour (electronic tagging approaches)		OM – basis for domed selectivity and defining effective reproductive contribution	Para. 115 ESC 2012, OMMP report	Short-term, 2014 (High)
Mortality estimates for mature fish (10+ years old)		Current OM does not have data sources that provide substantial information on M10.	ESC 2013	Longer term, potentially high cost (Medium)
Improved information on cohort abundance, fishing mortality and natural mortality (e.g. gene-tagging approaches)		OM – mortality estimates	Para. 88-89, 117, OMMP workshop	Longer term (Medium)
Potential costs and benefits of a spatially explicit stock assessment		OM, review in light of otolith microchemistry and gene-tagging results	Para. 89 ESC 2012	Longer term (Medium)
Strategic review and refinement of operation of the OM code		Update and improve efficiency of code	ESC 2013	3-5 years (Medium)
Incorporation of SRP tagging data from 2000s		Related to spatially explicit model	ESC 2013	Longer term
Evaluation of the use of SAPUE in the OM for informing recruitment		OM	Para. 87 ESC 2012	Low

Attachment 13

Data Exchange Requirements for 2014

Introduction

Data exchange requirements for 2014 are provided in Annex A. The Annex shows the data that are to be provided during 2014 and the dates and responsibilities for the data provision.

Catch effort and size data should be provided in the identical format as they were provided in 2013. 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 2014 to allow the development of the necessary data loading routines.

Data listed in Annex A should be provided for the complete 2013 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 2012 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 2012 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
Corrected raised length data for 2006-2010	Australia	30 Nov 13	Corrected historical length frequency data for the error reported in CCSBT-ESC/1309/07. These revised data have been approved by ESC18 and will therefore be available for use in 2014.
CCSBT Data CD	Secretariat	31 Jan 14	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 2013 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 2013 on request from individual members*); • Update the unreported catch estimates using the revised scenario (S1L1) produced at SAG9.
New Zealand joint venture summary of observed trips	New Zealand	23Apr 14	New Zealand to provide the secretariat with a summary of observed trips, by vessel ID, for New Zealand joint venture vessels. <u>Secretariat Comment</u>: *These data are required so that the Secretariat can provide NZ with a summary of Observed catch and effort data which is required for NZ preparation of joint venture shot by shot data.*
Total catch by Fleet	all Members and Cooperating Non-Members (excluding Indonesia – which is specified later)	30 Apr 14	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 14	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 14	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 14	The mortality allowance (kilograms) that was used in the 2013 calendar year. Data is to be separated by RMA and SRP mortality allowance. If possible, data should also be separated by month and location.

[1] The text "**<u>For MP/OM</u>**" means that this data is used for both the Management Procedure and the Operating Model. If only one of these items appears (e.g. **<u>For OM</u>**), then the data is only required for the specified item.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Catch and Effort	all Members (& Secretariat)	23 Apr 14 (New Zealand)[2] 30 Apr 14 (other members, South Africa & Secretariat) 31 July 14 (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. Commencing in for the 2014 Data Exchange, Korea will be providing raised catch and effort data.
Historical Catch and Effort	Korea	30 Apr 14	Provision of updated raised historical data which includes data from all available logbooks (previously the coverage level has been low due to the long time it takes for vessels to return to port and submit logbooks). The resubmitted data will be considered by the ESC before replacing the current data in assessments.
Non-retained catches	All Members	30 Apr 14 (most Members) 31 July 14 (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 14	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.
NZ joint venture catch and effort data at 1x1 spatial resolution	Secretariat	30 Apr 14	Aggregated New Zealand catch and effort data, to 1x1 degrees of resolution instead of 5x5 degrees. The Secretariat will produce and provide these data to Japan only for use in the $W_{0.5}$ and $W_{0.8}$ CPUE indices produced by Japan. *Other members may request approval from New Zealand to be provided with access to these data for necessary analyses.*

[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
NZ joint venture catch and effort with Observers	Secretariat	27 Apr 14	A summary of NZ joint venture catch and effort data, to be provided to New Zealand only, specifying which shots had an observer on board. Secretariat Comment: *These data are required so that New Zealand can provide shot by shot data for the NZ joint venture to Japan.*
New Zealand joint venture shot by shot data	New Zealand	30 Apr 14	Shot by shot data for New Zealand joint venture vessels in statistical areas 5 and 6 for 2013. These data should specify which shots had an observer on board. These data are only being provided to Japan and are for use in the core vessel CPUE index.
Raised catch data for AU and NZ catches	Australia, Secretariat	30 Apr 14	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 do/will 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.
Observer length frequency data	New Zealand	30 Apr 14	Raw observer length frequency data as provided in previous years.
Raised Length Data	Australia, Taiwan, Japan, New Zealand	30 Apr 14 (Australia, Taiwan, Japan) 7 May 14 (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 14	Raw Length Frequency data from the South African Observer Program.
RTMP Length data	Japan	30 Apr 14	The length data from the real time monitoring program should be provided in the same format as the standard length data is provided.
Raw Size Data	Korea	30 Apr 14	Raw length/weight measurement data should be provided by Korea instead of raised length data because Korea does not yet have a suitable sample size to produce raised length data. *However, Korea is encouraged to improve its sample sizes of length frequency data in the future.*

[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.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Indonesian LL SBT age and size composition	Australia Indonesia	30 Apr 14	Estimates of both the age and size composition (in percent) is to be generated for the spawning season July 2012 to June 2013. Length frequency for the 2012 calendar year and age frequency for the 2012 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 for 2012/13
Direct ageing data	All Members	30 Apr 14	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 2006 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.
Trolling survey index	Japan	30 Apr 14	Estimates of the different trolling indices for the 2013/14 season (ending 2014), including any estimates of uncertainty (e.g. CV).
Tag return summary data	Secretariat	30 Apr 14	Updated summary of the number tagged and recaptured per month and season.
Catch at age data	Australia, Taiwan, Japan, Secretariat	14 May 14	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 using the same routines it uses for the CPUE input data.
Total Indonesian catch by month and % of Indonesian LL catch that is SBT	Indonesia	15 May 14	The 2013 catch of SBT in numbers and weight and the number of vessels fishing for SBT for each port and month. Also the 2013 total catch by weight of each species.
Global SBT catch by flag and by gear	Secretariat	22 May 14	Global SBT catch by flag and gear as provided in recent reports of the Scientific Committee.
Raised catch-at-age for the Australia surface fishery <u>**For OM**</u>	Australia	24 May 14[7]	These data will be provided for July 2012 to June 2013 in the same format as previously provided.
Raised catch-at-age for Indonesia spawning ground fisheries. **For OM**	Secretariat	24 May 14	These data will be provided for July 2012 to June 2013 in the same format as on the CCSBT Data CD.

[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.
[7] The date is set 1 week before 31 May to provide sufficient time for the Secretariat to incorporate these data in the data set it provides for the OM on 31 May.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Total catch per fishery each year from 1952 to 2012. **For OM**	Secretariat	31 May 14	The Secretariat will use the various data sets provided above together with previously agreed calculation methods to produce the necessary total catch by fishery data required by the the Operating Model.
Catch-at-length (2 cm bins) and catch-at-age proportions f**or OM**	Secretariat	31 May 14	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 14	Calculate the total catch-at-age in 2013 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 14	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.
Tag releases / recoveries and reporting rates. **For OM**	Australia	31 May 14	The RMP tag/recapture data for the period 1991-1997 will be updated for any changed/new data in the database.
CPUE monitoring and quality assurance series.	Australia / Japan	15 Jun 14 (earlier if possible)[9]	6 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)
Core vessel CPUE series for **For OM/MP**	Japan	15 Jun 14 (earlier if possible)	Provide both the w0.5 and w0.8 Core Vessel CPUE Series. The OM & MP use the average of these series.
Aerial survey index	Australia	31 Jul 14 (every attempt will be made to provide this at least 4 weeks earlier)	Estimate of the aerial survey index from the 2013/14 fishing season, including any estimates of uncertainty (e.g. CV).
Commercial spotting index	Australia	31 Jul 14	Estimate of the commercial spotting index from the 2013/14 season, including any estimates of uncertainty (e.g. CV).

[8] Data restricted to months April to September, SBT statistical areas 4-9, and the Japanese, Australian joint venture and New Zealand joint venture fleets.
[9] When there are no complications, it is possible to calculate the CPUE series less than two weeks after the CPUE input data is provided. Therefore, if there are no complications, Members should attempt to provide the CPUE series earlier than 15 June.
[10] This series is based on the standardisation model by Nishida and Tsuji (1998) using all vessel data.

Attachment 14

Terms of reference for OMMP5

The purpose of the OMMP5 technical meeting is to update the model with new data so as to conduct an in-depth stock assessment for presentation to the SC19. The assessment, along with indicators and any other relevant information, will be used to determine whether there is evidence for exceptional circumstances (an example of exceptional circumstances would be if the stock assessment was substantially outside the range of simulated stock trajectories considered in MP evaluations, calculated under the reference set of operating models).

The following terms of reference for the OMMP5 were agreed:

1. Complete specification of OM structure and sensitivity runs. The main pending issues are:
    a. *The sensitivity for flat Indonesian selectivity*
    b. *Specify the upq2008 by estimating the change in q using the OM and examining the CPUE by age and year using bubble plots or other approach (e.g., the Shepherd Nicholson method)*
    c. *Incorporation of unaccounted catch mortality*
    d. *Others as deemed appropriate during the meeting*
2. Further consider comparability of OM results with the independent close-kin assessment.
    a. *Size of SSB*
    b. *Survival rates for similar age ranges*
3. Refine OM where possible; e.g.,
    a. *Continue to evaluate OM residuals and effective sample sizes*
    b. *Better numerical scaling, an evaluation of which parameters are causing the Hessian to be non-positive definite*
    c. *Add the capability to use alternative likelihood components for the CK data*
    (e.g., the Beta-Binomial)
    d. *Evaluate retrospective patterns*
    e. *Check MSY calculations and reference points*
    f. *Refine use of version control for all code (MP, OM and R scripts)*
    g. *Evaluate how to incorporate within-cell uncertainty in OM grid*
    h. *Evaluate sensitivity to exclusion of the assumed linear increment in q over time*
4. Further refine diagnostic outputs
    a. *Fits to size compositions*
    b. *CPUE residuals*
5. Evaluate productivity shifts; e.g.,
    a. *Recruits per spawner over time*
    b. *Alternative initial conditions*