Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Nineteenth Meeting of the Scientific Committee

6 September 2014
Auckland, New Zealand

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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 Nineteenth 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 6:06 pm, on 6 September 2014.

List of Appendices

Appendix

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

Appendix 1

List of Participants
The Nineteenth 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

Appendix 2

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

1-6 September 2014
Auckland, New Zealand

Extended Scientific Committee for the Nineteenth Meeting of the Scientific Committee
1 - 6 September 2014
Auckland, New Zealand

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

Agenda Item 3. Adoption of Agenda and Document List

5. The agreed agenda is 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. Australia presented paper CCSBT-ESC/1409/SBT Fisheries-Australia. The paper summarises catch and fishing activities in the Australian SBT Fishery up to and including the 2012–13 fishing season (December 2012 – November 2013) and some preliminary results of the 2013–14 season (December 2013 – November 2014). A total of 25 commercial fishing vessels landed SBT in Australian waters in the 2012–13 fishing season for a total catch of 4539 t. A total of 92.5 per cent of the catch was taken by purse seine with the remainder taken by longline. Five purse seiners fished off South Australia for the Australian farming operations during the 2012–13 fishing season. Most of the purse seine fishing commenced in mid December 2012 and finished in mid-March 2013. Australia's allocation as agreed by the Commission for the Conservation of Southern Bluefin Tuna was 4698 t for the 2012–13 fishing season. However, Australia voluntarily reduced this to account for an overcatch of 34.6 t in the previous season. Length

frequency data from the purse seine fishery from 2005–06 to 2006–07 indicated a shift to smaller fish, but this trend has showed signs of reversal since 2007–08, possibly due to the targeting of larger fish. The average length of SBT transferred to farms in South Australia in 2013–14 was 95.8 cm. In the 2013–14 fishing season, observers monitored 17.0 per cent of purse seine sets where fish were retained and 21.9 per cent of the estimated SBT catch. In 2013, observers also monitored 10.4 per cent of longline hook effort and 19.5 per cent of catch in the Eastern Tuna and Billfish Fishery during the months and in the areas of the SBT migration through that fishery. The paper provides a summary of information on recreational catch and an update on the research to design and test a method to estimate the national recreational catch. The paper also details the Australian investment in CCSBT related research, noting that in recent years this has exceeded one million Australian dollars per annum.

8. Japan presented paper CCSBT-ESC/1409/SBT Fisheries-Japan that described the Japanese commercial longline fishery. In 2013, 87 vessels caught 2,695 t of SBT comprising about 50,000 individuals. Careful monitoring of the operation pattern change of the Japanese longline fleet was described to the CPUE Modelling Group meeting (CCSBT-ESC/1409/Info03); this reported that no marked change was found in the 2013 operation pattern. Release activities of SBT, mainly small fish less than 20 kg, were reported from fishermen through the RTMP system and a summary was presented to OMMP5 (CCSBT-ESC/1409/BGD03), which estimated about 30 t of mortality per year including dead discards (5.3% of release and discard in 2013) and estimated survival rate of 91% of vigorous condition fish.

9. Korea presented paper CCSBT-ESC/1409/SBT Fisheries-Korea. During 2013, nine Korean SBT tuna longline vessels were active with a total catch of 918 t for both the calendar and fishing years. Fishing occurred mainly in the western Indian Ocean (CCSBT Statistical Area 9) from April to July/August, and in the eastern Indian Ocean (Area 8) from July/August to December. The nominal CPUE increased sharply in Area 9 from 2011. During 2013, three observers were placed on board three longline vessels targeting SBT in Areas 2, 8 and 9. The observer coverage in effort was estimated to be 24% of the number of hooks. In cross-checking the SBT catches collected from logbooks and the CDS from the National Fishery Product Quality Management Service and the CCSBT Secretariat, no differences were found in 2013. Improvements in Korean data collection and management being undertaken continuously; for example the present monthly reporting is planned to be elevated to weekly reporting from September 2014 and to daily reporting from September 2015.

10. New Zealand presented paper CCSBT-ESC/1409/SBT Fisheries-New Zealand which describes its SBT fishery for 2013 and the 2012/13 fishing year. Commercial landings were 758t for the period 1 October 2012 to 30 September 2013. Twelve fish were reported as non-commercial SBT catch in 2013, all of which were landed (estimated total weight 550kg). From scaled observer data, it is estimated that 5 dead SBT were discarded from the charter fleet and none from the domestic fleet during 2012/13. Nominal CPUE remained around the same level as the past three years for the charter fleet and remained at a similar level to 2012 for the domestic fishery. In recent years 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). Overall, 24% of the total catch

(numbers) and 22% of the total effort (hooks) was observed in New Zealand in 2013. All four charter vessels were covered by observers in 2012/13, resulting in 84% of the catch and 78% of the total effort being observed. For the domestic fishery in 2012/13, coverage was 5% of catch and 4% of effort.

11. Taiwan presented paper CCSBT-ESC/1409/SBT Fisheries-Taiwan. For the 2012 and 2013 calendar years, the catches of SBT accounted for 494 t and 1,044 t, respectively. The catches for the 2012 and 2013 quota years were 496 t and 1,032 t respectively. The catches for these two years were below Taiwan's allocated catch. Because most fishing vessels remained in the tropical area for fishing bigeye tuna, the number of vessels fishing for SBT was only 36 in 2012. As the bigeye tuna catch rate decreased in 2013, some fishing vessels returned to engage in the SBT fishery and the number of SBT longline fishing vessel increased substantially to 76. The threat of Somalian piracy still exists in the tropical Indian Ocean. For the safety of observers, most were deployed on fishing vessels which operate in the southern Indian Ocean, so that the observer coverage rate for SBT fishing vessels increased substantially. For 2013, 10 observers were deployed on 11 fishing vessels authorized to target seasonally SBT. In 2013, the observer coverage rates were about 13.2% by vessel and 11.3% by hook.

12. Indonesia presented paper CCSBT-ESC/1409/SBT Fisheries-Indonesia. Southern Bluefin Tuna is one of the tuna species caught seasonally by Indonesian Tuna longliners. There are no data available yet for vessels active in 2013, however 125 active fishing vessels were listed in 2012. The last two years CDS data showed catch above the national allocations. The annual catch in 2013 at about 1,383 t showed that the landed SBT were 84% over the current allocation TAC (750 t). Weaknesses in understanding the importance of complying with TAC to ensure the rebuilding process of SBT is one of the main causes for catches exceeding allocations. Better implementation of CDS since 2010 could probably influence reporting of annual catch in 2011 and 2012. The increased catch of younger age (< 150 cm) that occurred in September – December 2013 indicated there is some probability that some fishing vessels operating in a different statistical area. Further clarification on operational aspects that term led to catches from this length group is still ongoing as identified by Research Institute for Tuna Fisheries (Benoa). Improving research capacity include an archiving data base system is needed to provide main reliable data exchanges for SBT and other ecological related species.

13. In response to questions from participants, the following was provided to clarify the information in reports:

    - Australia's project to develop a methodology to obtain robust estimates of the total Australian recreational SBT catch is a methods development and testing project that will not provide estimates of the recreation catch. The aim is to develop a method for future use, not to estimate past recreational catch. However, the project has been conducting expert interviews, so there may be some information on historic catches. Participants supported the work, but noted that Members are obligated under existing Resolution to provide best estimates of catches.
    - Japan noted a media article that claimed the Australian longliners are dumping SBT dead on hooks due to lower market value and that about ¼ of SBT die

while being hooked. Australia noted that a media article was not a reliable source and drew attention to the level of observer coverage and data reported in the national report.

- Australia's longline vessels are permitted to release SBT only if they are alive and vigorous. Dead fish must be retained on board.
- The increase in the Australian longline catch for 2012/13 was due to the availability of quota from the purse seine sector.
- The extent of fishing effort by Japan shown for the spawning ground (CCSBT Statistical Area 1) was not considered to be targeting for SBT.
- New Zealand had observers on board all charter fleet vessels during 2013. The 84% observer coverage value for the charter fleet reflects the fact that it was not physically possible for the observers to observe all the hauls despite being on board 100% of vessels.
- New Zealand reaffirmed its commitment to attaining 10% coverage for the domestic fleet portion of its fishery and stated that the lower levels seen in this latest year were largely attributable to operational constraints.
- New Zealand highlighted the comparison of the length distribution of SBT reported through the CDS for the last 3 years with the distribution of fish measured by observers during the same years. This comparison shows very similar distributions for the charter fleet data but in the most recent year there is a substantial difference between the length frequency distributions of the CDS data and the observer data from the domestic fishery. New Zealand strongly supports the use of CDS data by the Extended Scientific Committee (ESC) as input to the stock assessment models.
- The small SBT seen in Indonesia's catch during 2013 appear to be frozen SBT that come from vessels that are at sea for extended periods. The actual catch location for these fish has yet to be determined, but it does not appear to be from the spawning grounds.
- The European Union (EU) reported SBT catch of 0 t for 2013, but it was noted that the EU usually revises its data once final figures are received, and that the total reported catch should be revised by the EU at that time.
- The low reported scientific observer coverage during 2012 of 0.16% of effort (7,451 hooks) in the EU's swordfish fishery was checked and is correct. In the preceding years of 2008 to 2011, the number of hooks observed was 13,725, 73140, 106,619 and 63,139 respectively. The observations were affected and restricted to areas with regular commercial activity. The concerns about piracy is also affecting this program.

14. Australia presented paper CCSBT-ESC/1409/03 which details the preparation of the aggregated catch and effort, catch by fleet, raised catch, catch at size, and non-retained catch data sets submitted to CCSBT. These data are compiled from a number of relational databases and the paper describes the data integration procedures. The paper also details the data validation procedures

15. Japan presented paper CCSBT-ESC/1409/29 which reported on Japanese scientific observer activities for southern bluefin tuna fishery in 2012 and 2013. The revised observer coverage for 2012 was 8.9% of effort, with the coverage for 2013 being 10.2% of effort.

16. Korea presented paper CCSBT-ESC/1409/41 which described revised historical catch and effort data for Korean longline vessels fishing for SBT with updated logbook coverage from 1996 to 2013.

17. The meeting noted that the revision of these data was a very positive step forward. The ESC protocol for revised historic data requires that the revised data be reviewed by the ESC before it is accepted for use in stock assessments. The data were provided in the week before the ESC meeting, which did not provide Members with sufficient opportunity to review the data. Consequently, it was agreed that:

    - members be given approximately two months to conduct further examination of these data and ask any questions of Korea;
    - to aid in interpretation of these data, Korea would provide details of the data extraction rules used for these data, particularly in relation to what effort data was included when SBT was not targeted; and
    - if no concerns are raised regarding the revised data by 15 November 2014, these data would be accepted as the replacement for past Korean catch and effort data, and they may be used in future assessments.

18. It was noted that the revised catch and effort data do not use the same CCSBT data extraction rules as applied to other distant water longline fleets (for example, to include all effort for a month/5*5 cell if 1 SBT was caught within that cell). As a later step (for 2015), it was recommended that a new extract of the complete revised data set be prepared that uses common CCSBT data extraction rules so that these data are fully compatible with existing data sets.

19. Taiwan presented paper CCSBT-ESC/1409/45, which had been encouraged under the "High-level Code of practice for Scientific Data Verification" by ESC17. Taiwan provided a procedure for data preparation and verification for data reported annually to CCSBT, including total catch by fleet, aggregated catch and effort, catch at size, catch at age and non-retained catch data. The main data sources of the data report were the logbook, weekly report and catch certification data. The weekly report data were used to connect the logbook data for preparing the aggregated catch and effort report, the catch at size report and the catch at age report. In addition, non-retained SBT catch was also acquired from the weekly data system. Catch certification data was compiled to prepare the total catch by fleet. All data would be cross-checked against VMS, fisheries observer report, catch monitoring documentation scheme records and traders' sales records to examine the accuracy. All data submissions are cross-referenced to ensure accuracy of results. There were no substantial discrepancies revealed in the process of cross-checking.

4.2. Secretariat Review of Catches

20. The Secretariat presented paper CCSBT-ESC/1409/04. The reported SBT catch for the 2013 calendar year was 11,726 t, an increase of 1,468 t or 14.3% from the 2012 calendar year. The global reported SBT catch by flag is shown at **Attachment 4**. The paper included late upward revisions of Indonesia's and South Africa's 2013 catches which were provided after the annual data exchange was completed. It was noted that the revised Indonesian catch estimate for 2013

(of 1,383 t) was substantially greater than its allocation of 709 t and that this is an escalation of the trend in which Indonesia has exceeded its national allocation since 2010. This has implications on the CCSBT's ability to maintain catches within the level specified by the Management Procedure.

Agenda Item 5. Report from the OMMP meeting

21. The Chair of the OMMP5 meeting provided a report on progress made in Seattle (June 24-27, 2014). The report of the meeting is paper: CCSBT-ESC/1409/Rep 01. The Terms of Reference for the OMMP meeting were to undertake a complete specification of the OM for the 2014 stock assessment, update input data, review model diagnostics and consider possible adjustments to the OM, and define the robustness tests to be undertaken. In addition there was a request from the CCSBT Extended Commission (EC) to conduct sensitivity analyses of all sources of unaccounted catch mortality on the assessment of current stock status and evaluate impacts on projections and rebuilding of the stock.

22. For the preliminary reconditioning of the OM, all input data were updated and the OM testing worked well. The meeting re-examined the weights assigned to the different likelihood components and the fits to different data inputs to the OM. Minimal changes were made to the model.

23. Two items were noted at the OMMP meeting:

    - There was a marked increase in the last point for the aerial survey index (2014), which resulted in very strong recruitment estimates in 2012 and had a strong impact on projections.
    - There was a sharp increase in the proportion of smaller fish observed in the Indonesian catch in 2012/2013 and 2013/14, and therefore, the meeting decided to "free-up" the selectivity of the Indonesian fishery in 2013, which led to an improved fit of the recent age compositions.

24. For the work on sensitivity tests for unaccounted mortalities, members prepared the code to allow for unaccounted catches to be assimilated into the existing model fisheries (4 fisheries in the projection model and the 6 fisheries in the conditioning model) based on the size of the fish. The fishery into which the unaccounted catches were incorporated was not considered the source of the unaccounted mortalities, rather it just had a comparable size composition.

25. The OMMP5 meeting discussed the sources for potential unaccounted mortalities. The effect on catches of a possible bias in the age composition of the Australian surface fishery was examined in a paper to the OMMP using three different methods (1) mixture analysis to identify modes in the size distribution of fish harvested to estimate age composition, 2) cohort slicing, and 3) use of growth rates in pens (estimated from 141 SBT tagged in the wild and caught within 30 days for farming) and numbers caught to evaluate how much the reported age proportions would need to be shifted in order to match the reported catch statistics in weight at harvest. All three methods indicated that the effect of possible bias on catch may be greater than the 20% assumed in the OM. It was noted that there were uncertainties in the underlying assumptions required in each method. It was suggested that the best method of the three was the mixture analysis of modes provided the size data were representative of the size

composition of the catch. The CDS data, which contain individual length measurements, would be most suited for these analyses.

26. The workshop requested, via the ESC Chair, that the CDS Data from all fleets be reclassified so it could be made available, to improve the analysis of unaccounted mortalities from all sources.

27. The workshop also made recommendations on approaches to estimating the scale of unaccounted mortalities from non-member fleets and asked for data to refine estimates of releases/discards by Member countries.

28. The OMMP5 meeting noted the lack of information with which to proceed with the request from the EC regarding unaccounted mortalities, and therefore the meeting developed a set of scenarios. The added-catch scenario, developed to comprise all sources of unaccounted mortalities, includes 1000t of small fish, plus 1000t of large fish, ramping up from 1990 to 2013 in addition to the 20% surface fishery additional catch assumed in the reference set of OMs. In projections, it was assumed that the future unaccounted catch in this scenario would stay at the same fraction of the accounted catch assumed for 2013. Three scenarios for surface fishery unaccounted mortalities were also defined.

29. The CCSBT secretariat provided the ESC with an update on the result of the request for access to the CDS data made after the OMMP meeting. The request to re-classify the CDS, to allow it to be made available to the ESC, was not agreed by all Members, and therefore the data remain confidential. However, if member scientists wish to request access to the data, they could complete a confidentiality form and submit reasons for access to the data, and send those requests directly to the relevant member.

30. It was agreed that the CDS data would make a large improvement in available data for use by the ESC in updating the stock assessment.

Agenda Item 6. Report from the CPUE modelling group

31. The Chair of the CPUE modelling group (John Pope) reported on the CPUE modelling group's inter-sessional work (CCSBT-ESC/1409/46). The main inter-sessional work was the web-meeting (15/16th April), which considered two main agenda items:

    - Checking that the base CPUE series currently adopted for OMMP calculations had no serious errors, was likely still to represent a coherent picture of CPUE through time and hence of stock abundance and was consistent with available monitoring series (i.e. other plausible interpretations of the CPUE data).
    - Encouraging the development of new CPUE series and the development of new ways of modelling CPUE data.

32. Under the first of these items two papers were presented. ESC/1409/Info04 identified 3 problems with the CPUE data. These were:

    - A duplicated record for a NZ charter vessel;
    - To get CPUE numbers to correspondence with 4+ catch numbers; and
    - Instances of mis-coding of east and west longitude in Area 9.

33. All of these problems were minor and correcting them caused insignificant changes to recent CPUE trends. However, their identification provides confidence that the data are being scrutinized carefully. The second paper presented under this item ESC/1409/info 3 provided the annual review of changes in the Japanese longline fleet, which is the main data source of the CPUE series. This considered changes in fleet statistics and fish size, changes in the timing and area of fishing operations, changes in concentration indices and consideration of the continuity of core vessels included in the CPUE index through time. It also proposed a new descriptor of fleet distribution. In addition relevant members of the CPUE modelling group were requested to provide the monitoring CPUE series that had been previously proposed.

34. Under the second agenda item, two papers on new methods of analysis of CPUE data were also presented. As a result of discussion at the web meeting these have been further refined and presented to the ESC as CCSBT-ESC/1409/09 and CCSBT-ESC/1409/10. Also under the second agenda point, the possibility of new CPUE series being provided by Taiwan and Korea was discussed. Korea and Taiwan reported that plans for these series were being developed, and their possible form and potential use was discussed both at the Web Meeting and later at the Seattle OMMP meeting in June. The papers on these series were presented at the ESC (see below).

35. The CPUE group Chair presented a paper that reworked his earlier Shepherd-Nicholson model fits to CPUE at age data. This was provided to give input to the OMMP meeting on the question of the likely scale of upq2008. It suggested that the recent increases in CPUE were likely a consequence of the reduction in fishing mortality in the fishery. The Chair regretted that he had not had time to pursue his idea of a migration based CPUE model. However, he considered this and other new ideas were worth pursuing in order to find improved approaches to CPUE fitting in time for future revisions of the MP. He considered that methods that included size (or possibly age) in the fit would be the most likely to be valuable, because these might enable year classes to be tracked.

36. Australia presented CCSBT-ESC/1409/9, which describes a CPUE index based on a Generalised Additive Mixed Model (GAMM). The CPUE index is derived from a GAMM fitted to monthly sums of Japanese longline catch and effort aggregated at the 5 degree squares of latitude and longitude level stored on the CCSBT database. The statistical model described, updates the GAM used to calculate CPUE indices described previously (CCSBT-ESC/1208/17 and CCSBT-ESC/1309/13). The revised model assumes that the inter-annual variation in the spatial distribution of CPUE is described by a random interaction effect between Year and 5-degree grid cell. The random effect replaces a spatio-temporal spline used in the previous GAM. Aggregated CPUE observations are weighted according to number of hooks set by a relationship suggested by a smooth fitting to absolute residuals. A CPUE index calculated using the fitted GAMM to predict CPUE over the Laslett Core Area (CCSBT-SC/0103/06) is similar to the w0.8 Core Base CPUE index used in the stock assessment operating model, although arguably smoother. The new model provides more stable estimation of the seasonal distribution of longline CPUE than the previous GAM as evidenced by smoother CPUE isopleths. The GAMM was found to have much lower mean squared error than alternative GLM and GLMM CPUE

models (see CCSBT-ESC/1409/10) considered. The GAMM index is suggested as a monitoring index for SBT CPUE.

37. Feedback to this paper was provided in a subsequent small group meeting. In particular it was suggested that a more detailed examination of the cell by year random effects might be plotted geographically by year. It was also noted that the approach of a restrictive total area of study, and smoothing over the area distribution, had relevance to the variable versus fix squares debate.

38. Australia presented CCSBT-ESC/1409/10, which examines CPUE models with interaction terms estimated as random effect instead of fixed effects. Estimating interactions as random effects potentially provides improved robustness, especially in years and areas where effort is low. The fitted Generalised Linear Mixed Model incorporated random Year-by-Area, Year-by-Latitude and Month-by-Area interactions and was fitted to monthly sums of Japanese longline catch and effort aggregated at the 5 degree squares of latitude and longitude level stored on the CCSBT database. Apart from the random effects the fitted model was intended to be as similar as possible to the models used to calculate the Core Base CPUE indices (CCSBT-ESC/1309/29). However, since bycatch data were not available a comparable fixed effects model was also fitted to allow direct comparison. The fitted models were used to calculate w0.8 and w0.5 weighted averages of Constant Squares (CS) and Variable Squares (VS) type indices for comparison with the Core Base CPUE indices. Plots of residuals versus fitted values highlight two-component residual distributions for both the random effects and fixed effects model and the distributions of residuals are not symmetric about zero for either model. Year-by-Area and Year-by-Latitude interaction effects were found to be approximately normally distributed, but the distribution of Month-by-Area interaction effects exhibited fat tails. Weighted w0.8 and w0.5 indices calculated using the random effects model appeared to be smoother than a fixed effect model fitted to the same data, and also smoother than the corresponding Core Base indices over the last five years or so. The w0.8 indices and w0.5 indices have diverged since 2008. This period coincides with historic lows in both average and total Variable Squares area weights. Overall, there is no evidence that a model with interactions estimated as random effects would be less appropriate than an equivalent fixed effects model; however, it is suggested that the Area-by-Month interactions are best treated as fixed effects. There is some suggestion that a CPUE model with Year-by-Area and Year-by-Latitude interactions estimated as random effects might provide a CPUE index that is more robust and less variable than that provided by the current model.

39. In the discussion, Australia clarified that the CPUE series presented were not proposed as alternatives for the current series. Rather they represented an exploration of alternative models that could inform a better series in the future, and which quantified differences between the CS and VS approaches. Feed back to this paper was provided in a subsequent small group meeting. The main suggestion was that the author test the assumption that the effects were random since some possibly showed trend in in recent years.

40. Paper CCSBT-ESC/1409/36, presented by Korea, explained a comparison of CPUE in time and areas of Korean and Japanese longliners for SBT to understand their fishing characteristics and to provide information for developing the CPUE series using their fishery data during 1991-2013. This paper is an

outcome of collaborative analysis by Korea and Japan. The result indicated that their fishing grounds had considerable overlap. The main Korean fishing grounds were areas 8 (July-November) and 9 (April-July), suggesting that there were good spatio-temporal agreements between both fisheries and could be used to develop a useful Korean SBT CPUE series.

41. Feed back to this paper was provided in a subsequent small group meeting. The meeting noted that the Korean series showed broadly similar trends in nominal CPUE in areas 8 and 9. Discussion focussed on how best to advance the data analysis. It was thought that in the first case Korea should attempt to develop a parallel series rather than merging Japanese and Korean data into one series. The meeting encouraged further collaborative work on these data by Japan and Korea, and hoped to see further analysis at the proposed web meeting. It was noted that Korean and also Taiwanese data might be used to help with constant squares versus variable squares decisions by examining whether cells unfished by Japan in particular months were perhaps fished by Korea or Taiwan.

42. CCSBT-ESC/1409/42 was presented by Taiwan. This study conducted the CPUE standardization for southern bluefin tuna caught by the Taiwanese longline fishery using a general linear model. Standardized CPUEs generally reveal quite different trends for different area. It is apparent that the CCSBT statistical areas may not be appropriate for Taiwanese SBT fishery. In addition, the CPUEs of other tunas may not be explanatory effects when conducting CPUE standardization for Taiwanese SBT fishery.

43. The discussion noted the different CPUE trends shown in the Taiwanese CPUE series compared to the Korean CPUE series. Feedback to this paper was also provided in a subsequent small group meeting. It was noted that this dataset might provide an additional recruitment series since the catch is mostly of young (age 2 to age5) fish. Hence it might be useful to examine size distributions and possibly make an analysis of a restrictive size range. It was also suggested that given the areal distribution of the Taiwan fishery, it might be best to work with 5 by 5 degree rectangles rather than with CCSBT Statistical Areas and lat and long. The meeting looked forward to seeing a revised analysis at the 2015 web meeting.

44. In reporting back from small group discussion on the CPUE working group, the CPUE Chair noted there was agreement of the value of a 2015 CPUE web meeting. It was noted that the current core CPUE series appear to be working well, but the web meeting should discuss:

    - The weighted average approach (CS or VS) was an issue deriving from a contracting stock. However, assuming the stock may now be expanding, CS may now be a preferred option. Also, a period of stock expansion may allow a teasing apart of the effect of fleet size and stock size on the area fished. There was also value in discussing the approach to cells where fishing had not occurred, and whether those in the middle of the stock's spatial distribution should be treated differently from those on the margin of the spatial distribution. Further exploration into whether the Korean CPUE data should be a separate series or incorporated into the core series, was also considered worthwhile.

- It has been observed that SBT stock changes distribution between years. Thus an exploration of the effect of size on year*area interaction terms in the model might give new insights. This could include determining separate CPUE series for size classes, and Japan agreed that this is possible with current data.
- Since there are these periodic redistribution of stock between areas it was suggested that an exploration of the possibilities of using mass balance approaches between areas might be valuable. This might be attempted by studying the partitioning of cohort between areas and might contribute to an improved CPUE series.
- Further development of the new analytical techniques in developing the series (such as CCSBT-ESC/1409/09), with a longer term perspective of developing an alternative base series.

45. Other matters: It was also noted that targeting of fishing on SBT was an issue that needed further consideration. The issue of the inability of other countries' scientists to have the data needed to replicate some elements of the core series, such as the inclusion of bycatch terms, was discussed. The CPUE Chair suggested that when confidentiality issues meant CPUE data are unavailable for provision to other member countries (due to data classification), that member countries could collaborate, share code, ideas for analysis, and the interpretation of results. The small group meeting were shown plots of a size by area analysis developed by NZ. This emphasised the utility of adding a size component to CPUE analysis.

Agenda Item 7. Estimation of all sources of unaccounted catch mortality

46. The discussion was structured around the potential sources of unaccounted catch mortality as identified in the EC's request.

Unreported/uncertain retained catch by members

47. Australia presented paper CCSBT-ESC/1409/11 reviewing the tuna growth rates in farming operations of SBT, Atlantic Bluefin Tuna (ABT), and Pacific Bluefin Tuna (PBT), as well as data from Mexico on bigeye and yellowfin tunas. The paper aimed at testing the scenarios being considered by the ESC by testing them against the literature on growth in farming and in the wild. The literature indicates that the length and weight growth of bluefin tunas in the farms is much faster than in the wild, particularly growth in weight. This appeared to be due to intensive feeding in farms and the energy being directed more into growth rather than large scale migrations, chasing feed and avoiding predators in the wild. The paper also noted that for the ESC scenario (40% overcatch) to be valid, the Feed Conversion Ratio (FCR) in SBT farms would need to be around double that shown in the literature for all bluefins. In addition, the FCR levels implied in the scenario would mean that SBT farming could not be profitable or competitive with the alternative uses of the Australian quota (e.g. longlining) and with farming of PBT and ABT. Therefore the ESC scenarios were not consistent with the literature on growth in farms or with the economic viability of operations.

48. The Australian paper (CCSBT-ESC/1409/11) also notes the substantial literature showing a negative impact on growth for 2-3 months after tagging. Therefore, the use of tagged fish as a basis for estimating growth in farms was not valid.

49. Australia again requested that Japan provide the full data it used in its calculations. Japan was unable to agree to provide the full detailed data unless it was aggregated.

50. In discussion comments were made that increased growth rates in certain species of farmed fish (such as salmon) are partly due to selective breeding but this is not relevant for wild stock such as SBT. Australia responded again that the faster growth in farms than the wild appeared to be due to intensive feeding in farms and the energy being directed more into growth, rather than large-scale migrations, chasing feed and avoiding predators in the wild.

51. Australia presented paper CCSBT-ESC/1409/12 on the data gathered on the official visit by Australian industry to Tsukiji market on 4 July 2014 to view the monthly monitoring of the frozen SBT auction by Japan Fisheries Agency and the industry body, the Organisation for the Promotion of Responsible Tuna Fisheries (OPRT). Australia noted its appreciation for the opportunity to view the monitoring. The data from the monitoring on the day showed no frozen Australian farmed SBT, contrasting with Japan's monitoring since 2008 showing that farmed SBT was now 34.7% of the annual frozen SBT auctioned. The independent Japan Market Review (JMR) Panel had agreed in 2006 that the share of frozen farmed tuna in the Tokyo Metropolitan Government (TMG) market data was 0-6.4%. Even the 6.4% was product sold outside the auction market by auctioneers but included in the TMG data. Japan's monitoring reported to the ESC also showed wild imported frozen SBT was now 29.7% of the total auctioned – compared with the 5% agreed by the JMR Panel and 13% on the visit on 4 July 2014.

52. Paper CCSBT-ESC/1409/12 commented that Japan's major revision of the JMR conclusions appeared to be based on verbal advice from auctioneers rather than the written advice by these auctioneers to the JMR. It appears necessary to further clarify whether the JMR assessment and the 4 July 2014 data were more typical of the current frozen SBT auction market than the revised assumptions being made by Japan. This could be achieved by the auctioneers supplying detailed and written confirmation of the actual situation for the information of the CCSBT.

53. In response to Australia's paper CCSBT-ESC/1409/12, Japan noted that there had been a misunderstanding, and the reference in their papers since 2008 to auction sales was auction plus so-called back-to-back sales outside the auction. In the Tokyo wholesale market, frozen tuna are sold by auction ("SERI") and normal trading ("AITAI") from the auctioneers to buyers. Almost all FARMED frozen SBTs are sold by the AITAI sales due to consistent quality. We cannot observe the AITAI sales at the auction place, because all of the trade are conducted using papers and the actual fishes remain in the cold storage warehouse during the trading. In contrast, the WILD frozen SBTs are sold by the SERI after the check of the meat quality at the auction place. The wild frozen SBTs include not only domestic SBT but also imported SBT (i.e. from Taiwan and Korea), and the proportion of SBT by flags sold by SERI are monitored by the monthly observation by Japan. This proportion changes day by day depending on fishing

season, timing of landing, market price, etc. Thus it should be difficult to understand the condition of the market by one time visit. The frozen SBT sales data published by the Tokyo Metropolitan Government includes both SERI and AITAI sold SBT by the auction companies. In order to interpret the data correctly, it is necessary to understand the annual proportion of farmed frozen SBT sold through the market (i.e. AITAI sales in the market) which does not appear in the auction place. As the results of our regular structured interview to the wholesalers, the above mentioned proportion is around 30%.

54. Japan presented paper CCBST-ESC/1409/BGD4 (OMMP/1406/09), which provides estimates of unaccounted catch mortality relating to farming in the Australian surface fishery. Using statistics between 2001 and 2013 reported by Australia, including the number and weight at the time of the wild catch, the start of farming (caging) and the end of farming (harvesting), growth rates by year were estimated in terms of parameter of K of von Bertalanffy growth equation (VBK). The VBK values estimated ranged from 0.456 to 0.825. It seems highly unlikely that farmed SBT can attain such high growth rates compared to other Thunnus species. As an alternative explanation, by using available information on growth rates of farmed SBT, the Australian surface catches were estimated to be higher than reported catches by annual amounts ranging from 1054 tonnes to 2366 tonnes, with a mean of 1640 tonnes. The proportion of this excess of the reported catch ranged from 20% to 61% with a mean of 34.5%, and has been increasing over time. Using another calculation approach, the mean excess catch was estimated to be 2021 tonnes corresponding to a proportion of 42.4%. The paper suggested immediate implementation of the stereo video camera system to provide reliable length data.

55. Australia reiterated that it disagrees with the results of paper CCBST-ESC/1409/BGD4.

56. The Secretariat noted that, while the CDS data had not been reclassified, similar to other confidential data, the CDS data could be requested directly. Japan indicated that aggregated data (the length frequency by month and fresh/frozen) used in their work were available, and that Japan was willing to make progress in the sharing of data. In response to questions about the ICCAT information on growth rates referenced in the presentation in regard to the same growth in length of farmed and wild fish, and younger and older fish, Japan responded that information concerning growth rates had been based on results for both large and small fish farmed in the Mediterranean.

57. Japan presented paper CCSBT-ESC/1409/40, which was a report of the international observation on the 100-fish sampling in Australian SBT farming conducted in February 2014, responding to Australia's invitation related to postponement of the implementation of Stereo Video Monitoring. Although the observation provided a good opportunity to understand the procedure, it was unclear whether the 100-fish sampling provides sufficient representativeness for 10,000–12,000 fish in one towing cage. The international observation could not be enough to resolve the concern on the uncertainty in reported SBT catch for the farming sector.

58. Japan noted that the data relating to the auditing of counting operations was unavailable at the time, and Australia agreed to provide this information.

Mortality from release/discards

59. Australia presented paper CCSBT-ESC/1409/14 which reviewed the literature available on at life status at the time of hauling and post-release survival rates in tuna and tuna-like (i.e. billfish) species in pelagic longline fisheries. This paper aimed to inform the discussion around the potential unaccounted mortality from discards/releases. In terms of information on life status, the paper notes the high mortalities observed in tuna and tuna-like species after 8 hours soak time in the available study on commercial pelagic longlines. In terms of the post-release survival of 'live releases', the paper notes that studies designed to track the movement of released fish are likely to have a different sample design in comparison to studies with the objective of assessing post-release survival. Estimates of post-release survival from tracking studies are likely to be more optimistic (i.e. under-estimate mortality rates). This is evident from the literature reviewed. This is likely to be due to differences in the process of selecting fish, the operational conditions and handling techniques used; in tracking studies these may not be representative of day-to-day commercial longline fishing operations.

60. Japan presented paper CCBST-ESC/1409/BGD3 (CCSBT-OMMP/1406/08), which provides estimated amounts of the mortalities of SBT that are released and discards from Japanese longline fishery for sensitivity analysis at the OMMP5 meeting. It was assumed that release/discard started in 2006 when IQ system was implemented for SBT fishery in Japan. The number of released/discarded reported from longline fishermen included in the RTMP data since 2009 were used. Mortality rates were estimated from the RTMP data, the scientific observer data and pop-up archival tagging experiments which showed 91% survival rate for released fish that in were vigorous condition when retrieved on to the vessel. The estimated annual mortality was about 30 tonnes in average.

61. The discussion noted that the soak times during the capture of the individual fish from this analysis would be useful. Whether the methods used to bring fish on board were different from those used in commercial fishing operations was discussed. Japan responded that the pop-up tag releases were conducted for fish caught in usual commercial operations using commercial vessels, and thus the results from the experiment are representative of the conditions on commercial vessels. Further discussion was referred to a smaller group. Korea asked if the study was continuing, but Japan informed them that it had ceased due to its high cost.

Catch by non-member fleets

62. Australia presented paper CCSBT-ESC/1409/13, which provides an initial analysis of fleet overlap in the area of competence of the Indian Ocean Tuna Commission (IOTC). The paper aims to contribute to the discussions of the potential unaccounted catch mortality from non-member fleets. The OMMP5 working group proposed that scenarios could be developed by applying SBT bycatch rates in longline fleets to the effort by non-Members in the same areas and months. The OMMP5 meeting agreed that Members should evaluate the bycatch rate of their own longline fleets to inform this analysis. In line with these discussions, this paper provides an initial exploration of the potential for unreported longline catch in the Indian Ocean by fleets that are not members of the CCSBT but are fishing in areas and at times when there is a reasonable expectation that SBT would be caught. The paper considers the reported fishing

effort for the years 2000 to 2012 in the area of competence for the Indian Ocean Tuna Commission (IOTC) which was the primary source of data. The analysis identified an increasing amount of effort from non-member fleets in these peak areas and times that may indicate catch of SBT. In the future, this method may be refined, if SBT bycatch rates are available, to provide estimates of SBT catch by non-Member fleets. A similar approach could also be applied to the Convention Area of the Western and Central Pacific Fisheries Commission.

63. There was discussion of whether the increase in effort in the IOTC was the result of changes in reporting. Australia agreed to follow this up with IOTC; however, it was noted that the IOTC had reported substantial changes in effort in southern latitudes due to piracy. Further, it was highlighted that the IOTC summaries of species catch/effort distributions may provide useful information, and are available on the IOTC website. It was suggested that the Taiwanese data could be useful in ascertaining the catch of SBT from a bycatch fishery primarily targeting albacore. Taiwan pointed out that its data only provide details of SBT taken south of 20 degrees since 2002. Korea advised that it may be possible to discuss this issue through the IOTC Secretariat and the Temperate Tuna Working Party which reviews and analyses the fisheries and the stock status of albacore tuna in the Indian Ocean.

64. New Zealand noted that it had conducted a similar analysis of effort distribution in the WCPFC area of competency. New Zealand noted that the WCPFC database does not provide any SBT catch data.

65. The Secretariat informed the meeting that the most up to date data within CCSBT can be obtained from the private area of the website and cautioned against using the publicly available data as it was not always representative, due to the requirement of releasing data to the public only for cells of three boats or more.

66. The Chair noted that the consideration of unaccounted catch mortalities by non-member fleets is important for achieving the goals and time-frames of the CCSBT. The Chair also noted that it may be useful to request the CCSBT Compliance Committee to provide more data relating to non-member catch of SBT.

67. **Attachment 5** provides details of general discussion by the ESC, while **Attachment 6** outlines an approach to estimating unaccounted catch mortality by non-members. However, these methods will not provide any estimates of IUU SBT catch where there is no effort reported to the relevant RFMOs.

68. Australia presented a paper (CCSBT-ESC/1409/12) suggesting there may be discrepancies in the market data related to unreported catch. This is based on the change in fish reported to be domestic, imported wild caught from foreign fleets and farmed. Actually resolving this issue is beyond the scope of the ESC, but it is a very important issue for the reliability of the stock assessment and performance of the MP. A high proportion of the ESC work is dependent on reliable data on actual removals. The ESC requests that the compliance committee provide a report back to the ESC on the potential for, and estimates of, unreported catch by members.

Implications of Unaccounted Mortalities

69. The ESC draws attention to the suggestions made in **Attachment 5** in regard to further possible initiatives to improve the estimation of any unaccounted

mortality in the surface fishery, of catches by non-members, and of (unreported) catches by members by improved market monitoring. The ESC encourages all countries to make their CDS data and information on market monitoring available to facilitate and improve analyses. However, any items related to the details of individual vessels are not required.

Agenda Item 8. Evaluation of Fisheries Indicators

70. There were mixed signals from the indicators in 2014, with no issues of concern (**Attachment 7**). The overall results can be summarised as follows:

    - The 2014 scientific aerial survey index of relative juvenile (2-4 year old) abundance is the highest value seen in the time series. Between 2010 and 2014 the index has shown more variation but with an increasing trend. The commercial SAPUE index also increased from 2013 to 2014, but to a lesser extent. The trolling survey index for age 1 declined slightly between 2013 and 2014.
    - Longline CPUE for the Japanese fleet for ages 6 and 7 increased steadily from 2007 to 2012 but decreased in 2013. The CPUE index values for ages 8-11 decreased slightly and gradually from 2008 to 2011 but have increased in more recent years. The CPUE indices for age 12+ has showed a decline from 2008 to 2010 and then fluctuated around a low level afterward; this is expected given the weak recruitment from 1999 to 2002.
    - In 2012-13 and 2013-14 there was a decline in the mean length of SBT on the spawning ground, with a new mode of relatively small/young fish in the Indonesian catch. It remains to be determined whether the catch of smaller fish comes from the spawning ground and whether they are mature.

71. Japan presented paper CCSBT-ESC/1409/32. In this paper, various fisheries indicators were examined to overview the current status of SBT stock. The longline CPUE indicators suggested that the current stock levels for 4, 5, and 6&7 age groups were above the historically lowest levels of the late 1980s and the mid-2000s. However, the indicators for these age classes, especially age 5, showed decreasing trends in recent years. The CPUE indices for age 8-11 group declined slightly from 2008 to 2011, upturned in 2012 and remained at the same level in 2013. CPUEs for age class 12+ also decreased from 2008 to 2010 and have fluctuated around a low level afterward. The current stock levels for these older age groups are still very low.

72. Japan clarified that age composition in CCSBT-ESC/1409/32 was based on cohort slicing not direct aging. It was also noted that trends from these results should be interpreted with caution considering confidence intervals.

73. Japan presented paper CCSBT-ESC/1409/33, detailing the trolling research survey for age-1 SBT that has been carried out in the southern Western Australia in January and February 2014 in similar manner since 2006. In 18 days, trolling operations were conducted on a determined transect line (piston line) 14 times and SBT distribution in other areas were surveyed. A total of 198 SBT individuals were caught, with 44 fish tagged and released with archival tags, and 3 others released with pop-up archival tags.

74. CCSBT-ESC/1409/34 was presented by Japan, providing two recruitment indices of age-1 SBT using trolling catch data in two surveys on the south western coast of Australia, the acoustic survey from 1996 to 2006 and the trolling survey from 2006 to 2014. One index is the piston-line trolling index (PTI), which has been reported to CCSBT, but some adjustments were made. The other index is grid-type trolling index (GTI) which utilized all of the trolling data that aggregated the trolling effort and the number of SBT schools caught by date, hour, area type and 0.1 degrees square in latitude and longitude. Dataset included about 49,000 km total distance searched with 943 schools. GLM of delta-lognormal method was applied for CPUE standardization because of high percentage of zero catch. Year trend of GTI in 17 years were agreed to those of recruitment estimates from operating model and age-4 standardized CPUE of Japanese longline. Trends of GTI and PTI were similar to each other.

75. In discussion it was noted that there was value continuing to develop these indicators of recruitment strength.

76. CCSBT-ESC/1409/35 was presented by Taiwan. In order to examine the targeting issue for the abundance index of southern bluefin tuna from Taiwanese longline fishery, catch of other tunas in relation to SBT were described. Catches of albacore, bigeye, yellowfin and swordfish were proportional to the amount of hooks used. No strong correlation was observed between SBT and other tunas. Since Taiwanese SBT statistics system was reformed from the logbook report system before 2001 to SBT weekly report system introduced in 2002, it should be noted that the data analyses should be divided into two time periods by year of 2002. It also should be noted that SBT catch data become available immediately by the weekly report system, but catch data of other species do not become available until logbooks are reported and data compiled. Therefore, catch data of other species in 2013 are incomplete.

77. During discussion, Taiwan noted that caution was required in interpreting the time series of SBT catch as proportion of total catch, in particular the large increase after early 2000s seen in Figure 1, may not be real. It was noted that SBT catch data prior to 2002 are not reliable for reporting reasons; furthermore for the most recent year, the data are preliminary and may be revised when logbook data become available.

78. Australia presented paper CCSBT-ESC/1409/16, which summarises the update of fishery indicators. The 2013-14 update of fishery indicators summarises indicators in two groups: (1) interpretation of the long term trends in indicators unaffected by the unreported catch identified by the 2006 Japanese Market Review and Australian Farm Review; and (2) indicators that may be affected by the unreported catch, where interpretation is limited to recent trends that are less likely to be affected by unreported catches. The paper notes that two of the three indicators of juvenile (age 1-4) SBT abundance in the Great Australian Bight exhibited increases over the past 12 months (scientific aerial survey index, surface abundance per unit effort (SAPUE) / commercial spotting index); the trolling index indicated a slight decline. Indeed, the scientific aerial survey index is the highest index obtained in the past 10 years of the survey. Indicators of age 4+ SBT exhibited mixed trends with the catch per unit effort (CPUE) from the New Zealand domestic and charter fisheries both decreasing slightly in 2013. However, the New Zealand domestic longline fishery nominal CPUE has

generally exhibited a sharp increase since 2007. Similarly, the Japanese longline nominal CPUE for ages 4+ increased. The median length class of SBT on the spawning ground decreased in 2012-13 and 2013-14 compared to the previous seasons, with a large increase in small fish reported in the fishery. The mean and median age of SBT also decreased in 2012-13.

79. In discussion it was noted that there had been little fishing by the New Zealand charter fishery in Area 5, but that this is where the domestic fishery occurred. However, the main trend in the CPUE from these fisheries was the consistent observation of increased numbers of smaller fish in recent years.

80. Australia presented paper CCSBT-ESC/1409/20, updating the length and age distribution of SBT landings by the Indonesian longline fishery operating out of the port of Benoa, Bali. Length-frequency data up to the 2013–14 season and age-frequency data to the 2012–13 spawning seasons are available for the fishery. However, direct age data are not available for the 2011-12 season, so the age distribution is based on an age-length-key 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 and 2013-14, however, the length frequencies show a new mode of relatively small fish at about 145-155 cm FL in the landed catch, as well as the usual mode of larger fish at around 165-175 cm. The mean length of SBT was 162.1 cm and 161.6 cm respectively in 2012-13 and 2013-14, which is the lowest since monitoring began. The mean age of SBT was 13.2 years in 2012-13, the latest season we have data for. Investigations are in progress to determine whether these small/young SBT were caught on or south of the SBT spawning ground, and whether they can be considered part of the SBT spawning population.

81. It was noted that in the 2012-13 and 2013-14 seasons a large number of smaller fish have been taken by the Indonesian fleet. It was noted that this had occurred previously (2003-2006), when relatively large numbers of smaller fish had been reported. However, in that case it had been possible to ascertain that the smaller fish had been caught outside the spawning area fishing grounds. Indonesia is currently collecting data that may establish where these recent smaller fish (2012-14) were caught. However, this may be difficult to establish as vessels can be at sea for extended periods of time. A suggestion made by Japan was to split the analysis into two age classes to avoid the problem. The split was suggested to make a class less than and including age 14, and for a class greater than and including 15 year olds for which greater stability might be expected. This may be resolved by additional information on the location and size classes of these catches, and they can then be assigned to the appropriate fishery (in the OM).

82. The ESC reiterated the importance of determining where these smaller fish had been caught and also whether they were mature.

83. Australia presented paper CCSBT-ESC/1409/18 which provides an update of the analysis methods and results for the scientific aerial survey. The methods of analysis used were the same as last two years. The 2014 estimate of relative abundance of 2-4 year olds is significantly higher than for any previous survey

year. The environmental conditions during the 2014 survey were average for the most part, except that the level of haze was higher than in past years. Because increased haze is unfavourable for making sightings, the raw estimate was adjusted upwards slightly in the standardization process. In 2014, the percentage of schools that were comprised of small fish (<8 kg; estimated to be 1-year-olds) was 4.1%; much lower than the unusually high percentage recorded in 2009-2013 of between 13.1-30.7%. 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

84. The ESC noted that the most recent point in the aerial survey (AS) series is particularly high, and that the standardisation for spotter and environmental conditions appeared to increase the index disproportionately, relative to the unstandardised data. The question was raised as to the mechanisms by which haze and swell impacted on the sight-ability of SBT and how they are incorporated in the standardisation (e.g. whether nonlinear effects had been taken into account). It was noted that the calibration of pilot-spotter to spotter, estimated from calibration experiments in previous years was responsible for a substantial proportion of the up-scaling of the index and that this value was assumed to be constant. It was suggested that model selection of covariates for the AS analysis, which were last updated in 2012 year (ESC 17), could be revisited to ensure the most appropriate model was used in the index as more data become available on a wider range of environmental conditions. It was suggested that a review workshop, or webinar or briefing, might be useful in this process.

85. Australia presented paper CCSBT-ESC/1409/17, updating the commercial spotting index (surface abundance per unit effort or SAPUE) for the Australian surface fishery in the 2013-14 fishing season. Data on SBT sightings have now been collected by experienced tuna spotters for 13 fishing seasons (2001-02 to 20113- 14). In 2002-2008 and 2010, most search effort occurred in a core fishing area inside of the continental shelf break between the 130° and 133°east. In 2009 and 2011-2013 a significant amount of search effort occurred to the east of this area following the shelf break. In 2014, almost all search effort occurred between longitudes 134° and 138° east. The surface abundance of SBT (per unit of search effort) in 2014 was spread throughout the search area, rather than being concentrated near the shelf break as observed in previous years. The standardisation approach used in 2013 was updated with the 2014 data. Only data for 2003-2014 were included in the analysis since both target species and visibility seem to be important in the standardisation, and these factors were not recorded in 2002. The estimated SAPUE index for 2014 is higher than the average for the 2003 to 2014 period but slightly below the 2011 estimate which was the highest for all seasons.

86. The meeting noted that, unlike the aerial survey, the sighting conditions experienced by spotters during the commercial spotting flights were better than average. It was suggested that weather conditions in the east (outside the area of the scientific aerial survey) where the commercial spotters operated were different from those experienced by spotters working in the area of the central Great Australian Bight. Australia noted that 92% of the Australian catch for

farming was caught east of the area previously defined as the 'core fishing area'. There was discussion on whether this could result in a substantial proportion of the biomass not being observed in the scientific aerial survey, if a substantial proportion of the biomass does not migrate through the GAB from the west. Australia noted that given the timing of the scientific aerial survey, it was expected to see these fish as they moved from the west to the east. It was further noted that, in recent years, some anecdotal evidence suggests that the fish in the area covered by the SAPUE may have moved in from the south. The group noted that the differences relating to the location of fish spotted between the two indexes, and the movement of fishing effort further east outside the aerial survey transects should continue to be discussed. It was acknowledged that resolving this uncertainty would require further information on the migration of juvenile SBT to and from the GAB, and that the archival tagging programs of Japan and GAB science research program (see inter-sessional science agenda items) will provide additional information.

87. Australia presented paper CCSBT-ESC/1409/19 which provides an update of the collection of otoliths and direct ageing of otoliths from SBT caught in the Australian surface fishery. Australia continued to collect and archive otoliths from SBT during the 2013-14 fishing season. Age was estimated for 95 SBT caught in the previous (2012-13) fishing season, and the proportions-at-age of SBT caught in the fishery were estimated using three methods and compared with previous seasons. The results from applying the "M&B method with unknown growth" suggested there was a much higher proportion of age 2 and smaller proportion of age 3 fish for the 2010-11 and 2011-12 seasons than in previous seasons (except 2004-05). However, in 2012-13, the estimated proportion of fish at ages 2 and 3 (0.16 and 0.75 respectively) returning to levels more commonly seen in the past. The proportion at age estimates are quite precise for ages 2 and 3 (CVs generally less than 10%), although there have been some exceptions in recent seasons. In particular, the CVs of the age 2 and 3 estimates for the 2010-11 season were higher than usual due to a contrast between the direct age-length data and the length-frequency data. The age 3 estimate for 2011-12 and age 2 estimate for 2012-13 also have higher CVs 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 these seasons. 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

Agenda Item 9. Updated stock assessment and projection results

88. Australia presented paper CCSBT-ESC/1409/21 which describes the reconditioning of the SBT operating models and the current estimates of stock status, following initial work for the OMMP meeting. This is the first stock assessment since the MP was implemented in 2011, and the first stock assessment with the close-kin data formally included. Current stock status (2014) has improved since the last assessment and SSB is currently estimated to be at 9% of initial SSB (i.e. SSB(2014)/SSB(0) range 8-12%). To compare the new assessment with the 2011 results, total biomass 10 years and above (B10+)

is reported, and the current estimate is now 7% relative to B0 (range 6-9%), an increase from 5% (range 3-8%) in 2011. The new spawning biomass calculation (SSB) is used in the OM to be consistent with the close-kin method and definition of spawning potential (Hillary et al, 2012). The ratio of current median F to Fmsy is around 0.65 and mostly less than 1 in terms of distribution, but highly variable (CV of 0.33). The fitting performance to each data set in the model and the parameters estimated have all been examined in detail. The inclusion of close-kin data has reduced the uncertainty in the OM and made it more stable. The probability that the observed 2014 aerial survey is outside the simulated distribution used to test the MP is high for the reference set, but when considering the robustness testing in 2011, the observed point would be inside the range of values tested (Note: the qratio value for the MP was updated in 2014). Therefore, with respect to the data input series used in the MP, the authors conclude that exceptional circumstances have not been triggered this year. Across all robustness trials MP rebuilding performance was generally quite good and arguably better than when the MP was adopted in 2011.

89. Japan presented CCSBT-ESC/1409/38. This paper provides the examination of results of the base case and sensitivity scenarios specified at OMMP5. The stock status, historical trajectories of the biomass and recruitment, and future projection results were compared to the result from the previous stock assessment conducted in 2011. For the new base case scenario, the stock status in 2014 remains at a low level (B10+2014/B10+0 =0.072), but the stock rebuilding probability was a little more optimistic (P[B10+2035> 20%B10+0]=74.3%) compared to the previous stock assessment. The estimated historical trajectory of age 10+ biomass was greater in absolute terms compared to the previous assessment, which was due to the inclusion of the CK data. Estimated recruitment for 2011 was higher than that for the previous assessment due to the extremely high value of the most recent Aerial survey index. Unaccounted mortality (UAM) had a low impact on estimates of current stock status, but it had the strongest impact on the stock rebuilding projection under the current assumption among the sensitivity runs examined (P[B10+2035> 20%B10+0]=49.6%). All sensitivity trials indicated no danger of the stock collapsing if managed under the MP, even for the pessimistic scenarios (e.g. “AddedCatch” and “upq2008”) considered. The authors concluded that the MP as currently specified can manage the SBT stock adequately, so that there is no need for re-tuning at this time.

90. The higher biomass estimates in the model were confirmed as being a result of incorporation of the close–kin data.

91. Australia presented paper CCSBT-ESC/1409/15. In 2013 the EC requested that the ESC conduct sensitivity analysis of the potential impacts of unaccounted mortalities (UAM) on the assessment of stock status and incorporate this in their advice on exceptional circumstances. In addition, the EC requested that the ESC provide preliminary advice on the impact of unaccounted mortalities on the rebuilding plan for SBT and recommendations beyond the current TAC block (2015-2017). The authors note that the UAM scenarios that have been defined are based on limited available data on current or historical estimates and almost no information on how the unaccounted mortalities might vary over time, or continue into the future. The impacts of the UAM scenarios on current stock status estimates are not substantial. The reference set of OMs appear to be robust to a variety of levels of hypothetical additional sources of fishing mortality. In

the case of projections, for some scenarios the impact on the probability of rebuilding to the target level was substantial and this impact may be considered severe, if it is occurring. Projection estimates, such as future relative TACs and potential future catch losses, also indicate substantial impacts for some scenarios. The EC requested that the ESC incorporate the information on impacts of unaccounted mortalities in advice on the existence of exceptional circumstances. The paper works through the 3 stages of the meta-rules process, that assess whether conditions are outside the range against which the MP was tested, severity of circumstances, and process and principles for action. The authors note that, if the total mortalities due to fishing are greater than the TACs recommended, then the impact on the rebuilding plan may potentially be substantial. The authors suggest, given the estimates of stock status indicate that spawning biomass has improved since the last full reconditioning and that the management procedure appears to respond to reductions in biomass from additional catches being taken (at least in the scenarios tested to date), that there is no urgent management action required (on TAC setting), but resolving the veracity of the current set of scenarios and provision of more detailed data is urgent and essential for reassessment of these impacts.

92. In early August a late update of the Indonesian catch was provided to the CCSBT and due to timing, these catches have not been included in the 2014 stock assessment. In inter-sessional discussion of these data it was decided not to include them for the following reasons; 1) it was not clear where the fish were caught (on or off the spawning ground), and 2) there were no data on the size of the fish in the catch and therefore it was unclear which fishery to allocate them to in the operating model. There was insufficient time to resolve these issues before the ESC meeting, but further investigation of these data is a high priority for 2015, and these catches will be included in future reconditioning of the operating models. The ESC noted that the added-catch scenario for unaccounted mortalities included additional catch levels in excess of the update for the Indonesian catch, and therefore the relative impacts of these catches have been considered by the ESC in formulating advice on current stock status. The ESC noted that there would be little impact on current stock status of the additional Indonesian catch, but that there may be impacts on projections and rebuilding.

93. Assessment and projection results were discussed. Current stock status estimates are provided below in section 10.2, and appear to be unaffected by the robustness tests and from unaccounted mortality scenarios. There are impacts on the projections and rebuilding performance from the robustness tests and unaccounted mortality scenarios, and these are provided in more detail in **Attachment 8**. From the analysis of the impacts of unaccounted mortality scenarios on projections the ESC notes that if total mortalities are as large as those considered in the added-catch scenario, then impacts on the rebuilding plan may be substantial. There is a differential impact from catches of large and small fish; unaccounted catch mortalities of large fish impact directly or early, and impacts from unaccounted small fish catches have a substantial lag-time before the impacts will be observed. The ESC noted that the added catch scenario was potentially plausible given the available data, information and anecdotal market reports. The probability of rebuilding for this scenario was similar to but not worse than the most pessimistic scenario tested in 2011 (upq sensitivity run). The ESC noted that the current analysis is based on a different reference set, but

the equivalent level of performance of the MP to sensitivities was accepted by the EC in 2011.

94. The ESC also noted that under the projections of the different scenarios, the MP appeared to be working in reducing TAC when unaccounted mortalities were occurring, however, this is not enough to continue to meet the target rebuilding level. It was noted that the stock condition had improved in recent years, and the impacts of the unaccounted mortality scenarios would be worse if there was not the current upward fluctuation in surplus production.

95. The ESC is concerned about the implications and impacts of the unaccounted mortality scenarios and requests the Extended Commission and Compliance Committee urgently provide detailed information and data to properly assess impacts of unaccounted mortalities.

Agenda Item 10. SBT stock status

10.1. Assessment of exceptional circumstances

96. 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 to a 70% probability. The CCSBT has set the TAC from 2012 to 2017 based on the outcome of the MP. The EC will confirm the provisional TAC for 2016-2017 at its 2014 (CCSBT21) meeting following consideration of advice from the ESC and other relevant information.

97. The CCSBT also adopted the meta-rule process as the method for dealing with exceptional circumstances in the SBT fishery (ESC 2013). The meta-rule process describes: (1) the process to determine whether exceptional circumstances exist; (2) the process for action; and (3) the principles for action.

98. The ESC noted that there were a number of items to be considered in the context of exceptional circumstances in 2014. These were summarized into the following categories:

- Inputs to the MP;
- Inputs to assessment;
- Population dynamics;
- Fleet operations; and
- Impacts on the rebuilding plan.

10.1.1 Inputs to the MP

99. Paper CCSBT-ESC/1409/39 provides an assessment of whether exceptional circumstances have been triggered for the scientific aerial survey index and/or standardized CPUE inputs to the MP.

100. Paper CCSBT-ESC/1409/21 also examined the 2014 scientific aerial survey data point in relation to the simulated distribution from the reference set. This demonstrates that when the 2014 data is incorporated into the series, and the q-

ratio in the MP re-scaled appropriately, the 2014 lies outside the projected bounds used in testing.

101. The ESC noted, however, that the 2014 value is within the bounds covered by robustness tests conducted during MP testing as presented in both papers CCSBT-ESC/1409/21 and 39. Given this, and consistent with the ESC decision in 2012, the 2014 aerial survey value was not considered to trigger exceptional circumstances.

10.1.2 Inputs to the assessment

102. Two issues were identified for consideration with respect to inputs to the assessment: i) The 2014 scientific aerial survey data point, and ii) the potential for unaccounted for mortalities. i.e. catches greater than the TAC recommended by the MP and determined by the EC.

103. The conclusion above (10.1.1) for the aerial survey in the context of the MP applies in the context of input to the assessment, i.e. the 2014 data point was not considered to trigger exceptional circumstances provisions.

104. The testing of the adopted MP did not include explicit allowance for catches to be greater than the TAC recommended by the MP. In this context, the ESC considered the extent to which the potential unaccounted mortality used in the sensitivity tests requested by the EC represents exceptional circumstances.

105. The ESC noted that the results of the unaccounted mortality sensitivity tests presented in papers (CCSBT-ESC/1409/15 and 38) indicated that the potential impact on current stock status was not substantial, relative to the results for the reference set for the current stock assessment. The potential impact on stock rebuilding and future TACs, however, was more substantial and varied among the sensitivity tests (Table 2 of CCSBT-ESC/1409/15). In particular, the ESC noted that the "Added Catch" sensitivity had the most substantial impact on the probability of the stock rebuilding to the EC's interim rebuilding target.

106. In considering whether the potential unaccounted sources of mortality should trigger action under the meta-rules process the ESC noted:

- The MP tuning assumed that catches adhere to TAC recommendations based on the MP, but it seems likely that this is not always the case.
- The rebuild probability from the "Added Catch" scenario falls to 49% from the 74% seen in the base case. This potential reduction in rebuilding probability is substantial, however the rebuilding probability is comparable to the most pessimistic robustness trial ("Upq") considered during MP tuning (Table 1 of attachment 9, ESC Report 2011).
- The management procedure responds to reductions in biomass from additional catches being taken, though without compensating entirely.
- The spawning stock status has improved and the harvested component was currently benefitting from a recent series of high recruitments (Figure 3, from Paper CCSBT-ESC/1409/38). As a result, the expected stock trajectory is still positive (i.e., there should be rebuilding although at a slower rate) in spite of the potential level of unaccounted for mortality considered by the ESC.

107. Thus, it appears that significant levels of unaccounted mortality may have occurred which were not considered in the design of the MP. If these levels are

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

108. The ESC also notes that continuing to follow the MP as proposed does lead to continued rebuilding in the short term even if the circumstances of the hypothesised additional unaccounted mortality are true. Hence, the ESC advises the EC to continue to follow the MP as formulated but, as a matter of urgency, to take steps to quantify all sources of unaccounted SBT mortality. If substantial levels of unaccounted mortality are confirmed, then there will be a need to retune the MP to achieve the EC's stated rebuilding objective. In addition, the ESC advises that the EC take steps to ensure adherence to its TACs.

10.2. Summary of the SBT stock status

109. Based on the stock assessment results presented to the ESC in 2014, the following stock status advice for the reference set of operating models was compiled (Table 1). Two measures of the current spawning stock size are presented. The new method used in the operating model is presented as spawning stock biomass (SSB), and is based on a revised spawning potential estimate which has been introduced into the operating model along with incorporation of the close-kin data. The biomass aged 10 and older (B10+) is also presented, because this is the same measure used in previous stock assessments and therefore allows for comparisons.

110. The stock remains at a very low state estimated to be 9% of the initial SSB, and below the level to produce maximum sustainable yield (MSY), however there has been some improvement since the 2011 stock assessment and the fishing mortality rate is below the level associated with MSY. B10+ relative to initial is estimated to be 7% which is up from the estimate of 5% in 2011. The current TAC has been set following the recommendation from the management procedure adopted in 2011.

Table 1

Southern Bluefin Tuna Summary of 2014 Assessment of Stock Status[1]	
Maximum sustainable yield	33,000t (30,000-36,000)
Reported 2013 catch	11,726 t
Current replacement yield	44,600t (35,500-53,600)
Current (2014) spawner biomass ($B10^{+}$)	83,000 (75,000-96,000)
Current depletion (Current relative to initial)	
SSB	0.09 (0.08-0.12)
B10+	0.07 (0.06-0.09)
Spawner biomass (2014) relative to SSB_{msy}	0.38 (0.26-0.70)
Fishing mortality (2013) relative to F_{msy}	0.66 (0.39-1.00)
Current management measures	Effective catch limit for Members and Cooperating Non-members: 12449t in 2014, and 14647 t /yr for the years 2015-2017.

[1] Values in parentheses are 10th and 90th percentiles.

Agenda Item 11. Report on intersessional scientific activities

111. Japan reported the tag-recapture activity in CCSBT/1409/30. During the trolling survey in Jan.-Feb. 2014, a total of 44 SBT individuals were tagged with both a CCSBT conventional tag and an archival tag. In addition, 3 pop-up tag were deployed on 3 individuals. Japanese longline vessels recovered 8 conventional tags from 7 individuals and an archival tag which was released by CSIRO.

112. Japan presented paper CCSBT-ESC/1409/31 that described activities of collection of otoliths and age estimation. In 2013, otoliths were collected from 275 SBT individuals and ages were estimated for 109 SBT individuals which were caught between 2011 and 2012. The data were submitted to the CCSBT Secretariat in 2014.

113. Taiwan presented CCSBT-ESC/1409/43. A total of 152 gonad samples of southern bluefin tuna were collected by the Taiwanese scientific observer program during April to September in the years 2010-2013. This paper provided the basic information on these samples, including sample collection, length-frequency, gonad weight, and gonado-somatic indices. The sexual maturity for these samples will be further determined based on histological examination.

114. Australia noted the link between this work and the work in the SRP proposal to estimate the age and size at maturity, and welcomed SRP proposal participation. Taiwan responded that they have collected over 100 samples, and more will be collected.

115. Australia provided an update on the GAB Science Research Program , which is a $20 million project jointly funded by BP, CSIRO and MISA (Marine Science Agencies in South Australia). The project is on the ecology and oceanography in the GAB. Within this larger project there is a sub-project on the spatial dynamics and impacts of noise on SBT, which is led by Dr Campbell Davies at CSIRO. The focus is on the movement and feeding behaviour of SBT in the GAB and the program involves the use of pop-up and archival tags. The wider spatial dynamics research will be of interest to this committee and CSIRO will report results over the next three years.

116. Paper CCSBT-ESC/1409/22 reported on a pilot study on otolith micro-chemistry under agenda item 13 in conjunction with an SRP proposal (CCSBT-ESC/1409/27) for further work in this area.

Agenda Item 12. SBT Management Advice

117. 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. 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 stock status

118. The stock remains at a very low state estimated to be 9% of the initial SSB, and below the level to produce maximum sustainable yield (MSY), however there has been some improvement since the 2011 stock assessment and fishing mortality is below the level associated with MSY. B10+ relative to initial is estimated to be 7% which is up from the estimate of 5% in 2011.

Review of MP implementation in 2013

119. In 2013 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.

Current TAC

120. For the three-year TAC setting period (2015-2017), the 2013 meeting of the EC adopted TAC values shown below. The EC will confirm the 2016-2017 TAC at CCSBT 21 following the EC consideration of the advice from the ESC and other relevant information.

Year	2015	2016	2017
TAC (t)	14,647	14,647	14,647

Exceptional circumstances

121. As detailed in Agenda Item 10.1, it appears that significant levels of unaccounted mortality may have occurred which were not considered in the design of the MP. If these levels are indeed true, they would amount to exceptional circumstances because the probability of rebuilding under the MP will be well below what was intended by the EC.

122. The ESC also notes that continuing to follow the MP as proposed does lead to continued rebuilding in the short term even if the circumstances of the hypothesised additional unaccounted mortality are true. Hence, the ESC advises the EC to continue to follow the MP as formulated but, as a matter of urgency, to take steps to quantify all sources of unaccounted SBT mortality. If substantial levels of unaccounted mortality are confirmed, then there will be a need to retune the MP to achieve the EC's stated rebuilding objective. In addition, the ESC advises that the EC take steps to ensure adherence to its TACs.

MP TAC Recommendations

123. Based on the results of the MP operation for 2015-17 in 2013 and the outcome of the review of exceptional circumstances in Agenda Item 10.1, the ESC recommended that there is no need to revise the EC's 2013 TAC decision regarding the TACs for 2016-17. The recommended annual TAC for the years 2016-2017 is 14,647.4 t.

Other Advice

124. The ESC recommends to the EC that an allocation of 5.95 t in 2015 be made to cover mortality associated with approved research projects.

125. The ESC draws attention to the suggestions made in **Attachment 5** in regard to further possible initiatives to improve the estimation of any unaccounted mortality in the surface fishery, of catches by non-members, and of (unreported) catches by members by improved market monitoring. The ESC encourages all countries to make their CDS data and information on market monitoring available to facilitate and improve analyses. However, any items related to the details of individual vessels are not required.

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

Agenda Item 13. Develop an updated, comprehensive Scientific Research Program

127. In 2013, the ESC developed a new Scientific Research Program (SRP – see **Attachment 10**) for SBT. At the 2013 ESC a work plan of 4 items was identified for work in 2014; 1) the continued collection and archiving of samples for close-kin genetics (in Australia and Indonesia), 2) the design study for potential close-kin and gene-tagging programs, 3) initiating collection and preservation of ovary samples (across fisheries and size classes) and further collation, and 4) analysis of existing data on selectivity in the Indonesian spawning ground fishery. The close-kin sample collection and close-kin design study were funded by the CCSBT, and funding the design study for the gene-tagging program was deferred to 2015.

128. The 2013 ESC requested costed proposal for Scientific Research Projects for consideration at the 2014 ESC, and 5 costed proposals were presented and discussed:

- The results of the close-kin design study on Close-Kin Mark-Recapture for SBT: options for the longer term;
- Estimating size and age of maturity;
- Second workshop on otolith-based ageing;
- Estimating absolute abundance of juvenile SBT from gene-tagging: A pilot study; and
- Identification of spatial distributions of fish by age from otolith microchemistry.

Close-kin (CK)

129. Paper CCSBT-ESC/1409/44 considers options for future use of Close-Kin, as a tool for directly monitoring spawning stock biomass (i.e. as a time series) and for providing more information about important assessment parameters such as fecundity-at-age, adult mortality and selectivity. Because genotyping techniques have advanced greatly in reliability and reduced in cost since the previous SBT Close-Kin study began in 2006, it is important to consider now whether there could be long-term benefits, in terms of cost savings and consistency of methodological approach, in changing from the microsatellite-based technique used previously, to either targeted SNP arrays ("SNP chips"), as used for Pacific salmonids in the USA, or to a Next-Generation-Sequencing approach such as

DArT (Distributed Array Technology). With the latter, it may be possible to identify Half-Sibling Pairs as well as the Parent-Offspring Pairs approach used so far. This would have two benefits: more close-kin pairs found per sample, so lower sample size needed; and it becomes possible to separately estimate adult mortality and selectivity, which has been a long-standing difficulty in projecting changes to SSB in the OM. The results in the paper (CCSBT-ESC/1409/44) from simulation modelling indicate that the long-term annual sample size required to achieve precise estimates may be of the order of 1500-2500 fish per year (made up of juveniles in the GAB and adults on the spawning grounds off Indonesia), depending on what genetic technique is adopted and on exactly how the data are used by CCSBT.

130. Discussion focussed on the future costs for the alternative science directions and components of future close-kin research as described in the presentation and when decisions need to be made to have new results available; these have been clarified below. The pros and cons of three alternative genotyping technologies were discussed and their medium and long term costs. The DArT technology has the potential to provide more information than the other methods and to cost less in the long run, but requires the genotyping error rates to be below a specified level. The ESC noted that current work by Dr Bravington on other species has demonstrated the ability to detect HSP (Half-Sibling Pair) with DArT genotyping. Very preliminary work on 100 SBT POP (Parent-Offspring Pair) samples from the earlier CK study, funded by CSIRO, suggests that the genotyping error rate from DArT may be higher than initially thought; but more thorough analysis and consultations with the sequencing laboratory are required. These will be completed in the coming months.

131. The ESC noted that this was a very specialised and highly technical area and that there was not the necessary expertise within the ESC to review and advise on the details of the alternative genotyping technologies. The ESC recommended a review meeting, which would include internationally recognised experts in this developing field, be included in the SRP work program to evaluate the technologies and methods and report to the ESC in 2015 on the costs, benefits and implications.

132. The Advisory Panel noted the relatively low cost and very high value of this research in its ability to directly monitor the spawning component of the stock, and potential to provide additional information on key parameters in the operating models. There was unanimous support from members for the project and ongoing collection of close-kin data for incorporation in the operating model. The ESC also supported the further work on evaluating the feasibility of the DArT technology.

133. New Zealand noted that this is the best method for providing information on stock status. Australia agreed that it was desirable to be able to directly measure and monitor spawning biomass, but in addition, a recruitment series is also important, especially because for SBT most fishing mortality occurs on the juvenile and sub-adult components of the stock and therefore, there are substantial lags (4-7 years) between the impacts of catches and the signal becoming apparent in the spawning stock. In addition, the ESC noted the importance of the close-kin method for also potentially proving information on

key uncertainties in the OM on the Indonesian fishery selectivity, fecundity, and adult mortality for use in the OM.

134. The decisions and future steps required to proceed with the close-kin work were mapped out in the meeting and are described in **Attachment 11**. High priority items for 2015 are 1) further work on the genotyping approaches to inform decisions on the longer-term approach, 2) an expert review workshop on the approaches, and 3) continued collection of close-kin samples.

SRP Maturity

135. Paper CCSBT-ESC/1409/23 updates a SRP proposal presented to the ESC in 2013 on a method to estimate an unbiased maturity schedule for SBT, independent of the spawning ground. The proposal suggests that recently identified 'maturity markers' in tuna ovaries could be used to differentiate histologically between immature and mature-resting females caught during the non-spawning season. The proposal recommends that ovaries and otoliths are collected from females >110 cm fork length in April to August, through a collaborative sampling program across the Southern Ocean. The paper proposes that ~220 females are sampled from 6 CCSBT Statistical Areas (4-9) possibly through the national scientific observer programs. Preliminary work confirmed that maturity markers were present in SBT ovaries sampled off eastern Australia in June, and can be used to identify mature-resting females. A short reproductive biology workshop is recommended to finalise a reproductive/maturity classification scheme and develop a manual with the classification scheme for future maturity work by members. Indonesia's Research Institute for Tuna Fisheries in Bali was proposed as a possibly location to hold the workshop.

136. Japan noted that they were interested in this work and will discuss the practical needs of the project and collection of ovaries. Korea is also interested in this work, and would like to discuss the sample sizes needed. Taiwan noted that they had already collected ovaries and had commenced some histology work although sample sizes were quite small. New Zealand indicated that they would be happy to collect samples in the next year. Further discussions clarifying collection of gonads will be held intersessionally. Cost components for the proposed workshop in Bali to review the histology work on the samples were revised on advice from the CCSBT Secretariat and are shown in **Attachment 12**.

SRP Ageing workshop

137. Paper CCSBT-ESC/1409/24 presents a draft proposal to hold a second SBT age determination workshop possibly at Indonesia's Research Institute for Tuna Fisheries in Bali. The aims of the workshop would be to briefly review otolith extraction, sectioning and reading protocols including recent age validation work; provide capacity building and training for members not involved in SBT ageing; improve age estimation protocols and quality control procedures (i.e., checking precision, bias and drift among readers via an otolith exchange undertaken before and during the workshop); update the CCSBT otolith reference set and determine a future quality control agenda; and revise the age determination manual with respect to standardising methods for interpretation of the otolith edge and converting increment counts to age estimates amongst member laboratories. The project will improve age-based parameters for assessment and management advice for SBT.

138. There was interest in the updated validation of direct ageing, and consideration given to combining the maturity and ageing workshop in order to reduce costs if some of the participants would be attending both.

Gene-tagging proposal

139. Paper CCSBT-ESC/1409/25 presents a collaborative proposal for estimating absolute abundance of juvenile SBT from a gene-tagging pilot project. The proposal is for a mark recapture tagging method using genetics as "tags". A genetic mark recapture (gene-tagging) program to provide fishery independent absolute abundance estimates of juveniles was classified as high priority in the 2013 ESC work on the SRP. The proposal is based on work presented in 2013 on costs and feasibility of various experimental designs. The pilot gene-tagging project proposed here would test the logistics and demonstrate the feasibility of gene-tagging to provide a fishery independent absolute abundance estimate, and demonstrate the integration of the data into the SBT operating model and potential for use as an input data series for a future management procedure. A design study would demonstrate the integration and value of data in the SBT OM and MP. The field pilot study would test logistics and feasibility of tagging (wild capture, tissue sampling and release), recapture tissue sampling (from landed fish), and genotyping tissue samples to identify genetic matches of individuals. The genotyping is simpler than that required for the close-kin work, but the sample sizes are much larger (release of 5000 2 year old fish, recaptures of 7000 3 yr old fish, 1 year later). It is anticipated that gene-tagging could reduce the costs of monitoring juvenile recruitment in the fishery in comparison to the current scientific aerial survey. The gene-tagging absolute abundance estimate could be used in place of the aerial survey data in the SBT OM and potentially in future MPs. Information on juvenile abundance is extremely important for understanding rebuilding of stock.

140. Australia noted that from a scientific perspective there would be no need in principle to include both the aerial survey and the absolute abundance estimate from gene-tagging in the SBT OM. Although, if the aerial survey abundance estimates were still formally required for operation of the MP (i.e. a new MP hadn't been implemented), then both may be required.

141. The question of East versus West migration of some juveniles and mixing of tagged fish were raised as potential issues for this project. The global spatial project (archival tagging of juvenile SBT throughout their range) and conventional and other electronic tagging experiments have addressed these issues to some extent. The Global spatial project (Basson et al 2012) concluded that "*... the majority of juvenile SBT are likely to return to the GAB each summer, and that based on current evidence it is unlikely that a large proportion of juvenile SBT remain off South Africa over summer*". Examination of mixing in previous SBT tagging projects has concluded that there is reasonably good mixing of juveniles throughout their range. Recaptures samples will be collected after 1 year to allow for mixing. This is similar to the use of conventional tagging data in the OM, which excludes the within year recaptures because of mixing issues. After 1 year the fish are considered well mixed. These issues will be further addressed in the design study.

142. If it is possible to release fish off South Africa that would also answer the question of age 2 and 3 fish migration into the Great Australian Bight (GAB), but

the logistics of this may not be feasible. The logistics of tagging juveniles in South Australia are well known. As noted in paper 25, if an additional recapture sample was collected for age 5 fish (e.g. in the New Zealand fishery, or across the full range of the fishery), then the abundance estimates from the recapture sample at age 3 could be compared, and this would clarify whether there was a proportion of the stock that was not present in the GAB at the time of tagging.

143. Japan indicated that they are supportive of this proposal and its potential to replace the aerial survey. Korea are also supportive and queried whether there were any cost savings from overlapping components of the close-kin work. There are some savings in sampling of 3 year old recaptures at harvesting and in DNA extraction and archiving of samples.

144. New Zealand are supportive of the project but noted the importance of the design study to answer some of the feasibility questions. The potential ongoing monitoring costs were discussed. The proposal is for a staged approach: first a design study followed by pilot tagging, recaptures and abundance estimation. The pilot study will demonstrate feasibility and test logistics of the field work and genotyping. From this there will be improved estimates of the potential on-going monitoring costs, and logistics and methods of operationalising the work in the field, and the genotype processing.

145. It was noted that in comparison to an aerial survey relative abundance estimate of ~ 38% CV, the proposed project sample sizes were for an absolute abundance estimate with CVs of ~25%, and the design study and pilot project would re-consider the appropriate sample sizes, relative to their use in the OM and potentially in the MP.

146. Paper CCSBT-ESC/1409/22 provides a report on a pilot project to determine if it is possible to differentiate otolith chemical fingerprints of SBT caught from three different locations: the Great Australian Bight (GAB), west coast of Australia and the spawning grounds. There is potential for the technique to address questions of juvenile migration dynamics. An analysis of a larger number of otoliths from a more comprehensive spatial and temporal design will aim to quantify the average fraction of the juvenile population that spends the summer in the GAB and the extent to which this varies systematically over time. The results from this pilot study suggest it is possible to differentiate otolith chemical fingerprints of juvenile SBT caught in the Great Australian Bight (GAB) from those caught on the west coast of Australia. However, there is also evidence of age and year effects that may be confounding difference between locations. These issues could be addressed with otolith chemistry traces from a larger sample of fish specifically selected for this purpose (e.g., with a sufficient overlap between years, ages and locations).

147. Paper CCSBT-ESC/1409/27 is a proposal for further research on otolith micro-chemistry to address the long-standing question in SBT spatial dynamics on the proportion of the population of juvenile SBT (age 2-5 years) that spend the summer in the Great Australian Bight (GAB) foraging grounds. Otoliths may be able to provide such information about movements and residency because they act as a natural archive of the environmental conditions experienced over the life history of fish. An initial examination of 21 SBT otoliths collected from 3 locations (the GAB, the spawning grounds and the western coast of Australia, described above (CCSBT-ESC/1409/22), explored the trace element

concentrations from laser ablation transects at the otolith core and outer margin. This study indicated that significant differences can be detected between fish collected at different sites and in different years. Having seen the potential of this technique, the analysis of a larger number of otoliths, from a more comprehensive spatial and temporal design, will aim to quantify the average fraction of the juvenile population that spends the summer in the GAB and the extent to which this varies systematically over time.

148. Discussion focussed on the method for detecting if there was a GAB signal or WA signal and how precisely that signal can be isolated to a particular date or season. It was noted that this might be answered by using daily rather than annual ageing along the transect of the otolith.

149. Next steps would be to undertake state-space analyses of the micro-chemistry signatures, on a large sample size, to further evaluate the ability of otolith microchemistry to answer questions about SBT movements.

150. The best way to answer the other questions of interest such as whether SBT are going to the spawning ground every year was also discussed. Archival tags were suggested as an alternative method, but their working lives are generally too short, and they are expensive because few are returned from older fish. For example, from 30 deployed in the Indian Ocean, none have been returned.

151. The ESC recommends that the EC note the following:

- The ESC has revised the Scientific Research Program (**Attachment 10**) including an indicative three year work plan for 2015-2017 (**Attachment 12**).
- The ESC noted the importance of the close-kin method for also potentially proving information on key uncertainties in the OM on the Indonesian fishery selectivity, fecundity, and adult mortality for use in the OM.
- High priority items for 2015 are 1) further work on the genotyping approaches to inform decisions on the longer-term approach for CK, 2) an expert review workshop on the CK approaches, 3) gene tagging design study, 4) aging of otoliths and 5) continued collection of close-kin samples.
- The costs of the SRP will increase over the three years of the program, but notes that the Performance Review of the CCSBT suggests that the CCSBT costs are extremely low compared to the value of the fishery (paragraph 172~~173~~) and that the cost increase for the ESC's proposed 3 year research plan is well justified.
- The ESC has recommended the priorities for the first year of this work plan in its annual workplan (paragraph 167~~168~~).

Agenda Item 14. Evaluation of whether or not the carry-forward of unfished allocations between three year quota blocks will have a negative impact on the operation of the Management Procedure

152. The Secretariat presented paper CCSBT-ESC/1409/05 which outlined the request from the Compliance Committee Working Group (CCWG) to evaluate whether or not the carry-forward of unfished allocations between three year quota blocks would have a negative impact on the operation of the Management Procedure.

153. Projections on the impact of carry-forward between three year quota blocks were run for the base case assuming:

- No carryover (i.e., the standard base run); and
- Carryover of 20% of the TAC from the third year of each three year block to the first year of the following three year block. The full TAC was caught in the second year for these projections.

154. There was negligible difference between the projections, with carry-forward of unfished allocations between quota blocks having no adverse impact on the outcomes as shown below.

Run	$P(B_{2025}>0.2B_0)$	$P(B_{2035}>0.2B_0)$	10% B_{2035}/B_0	50% B_{2035}/B_0
No carryover	0.484	0.743	0.155	0.269
20% carryover	0.488	0.754	0.159	0.272

155. The ESC noted that these calculations were conducted for the current situation where the stock is improving so that further consideration would be required if the stock was not improving.

156. It was further noted that a review of the MP is scheduled for 2017 and that the carry-forward provisions and any other catch-related management changes being considered by the EC should be considered in that review.

157. The ESC recommended that any catch-related management changes proposed by the EC should be evaluated by the ESC for impact on the performance of MP before such changes are implemented.

Agenda Item 15. Modifications to the CCSBT Scientific Observer Program Standards

158. The Secretariat presented paper CCSBT-ESC/1409/06 concerning draft modifications of the Scientific Observer Program Standards (SOPS) by the Ecologically Related Species Working Group (ERSWG), Compliance Committee and CCWG. The paper also presented the suggestion of the CCWG that the ESC could consider whether a target observer coverage level based on effort instead of catch would be suitable, and the CCWG's request that the ESC conduct analysis to determine the level of SBT bycatch that should be subject to the provisions of the SOPS.

159. The ESC addressed the request from the CCWG3 that it consider whether a coverage level based on effort instead of catch would be suitable. In response to the request, ESC members considered the text from the draft revised CCSBT Scientific Observer Program Standards (SOPS) in order to ensure that an effort based target would not negatively affect the scientific process.

160. The draft text provides specific guidance in relation to representativeness of different vessel-types in distinct areas and times. The text also addresses the need for higher coverage in order to meet specific information needs and the importance of periodic review. Based on this information, members concluded that the draft text provided sufficient safeguards to ensure that concerns over

representativeness of coverage and scientific data needs were adequately captured.

161. Similarly, the ESC found that the text in the draft revised SOPS adequately addressed any concerns surrounding "significant bycatch". The ESC did not conduct the analysis suggested by the CCWG and does not believe that setting a specific rate or quantity that would be considered "significant" is an appropriate approach to use in this case. The obligation remains on individual members to design their observer coverage in a way that is representative of all SBT fisheries whether they be targeted or the result of bycatch.

162. The ESC also discussed the use of information from other RFMOs observer programmes in order to achieve coverage in bycatch fisheries and emphasised the importance of having access to such information particularly in cases where SBT coverage is low and confidence in the data is an issue

Agenda Item 16. Requirements for Data Exchange in 2015

163. The Secretariat presented paper CCSBT-ESC/1409/06. The requirements for the 2015 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**.

Agenda Item 17. Research Mortality Allowance

164. Australia presented paper CCSBT-ESC/1409/28 which requests 5.95 t research mortality allowances (RMA) in 2015. The RMA request covers four projects, most of which aim to avoid SBT mortality and are requesting RMA to cover any incidental mortality. Three of the projects received RMA allowance in 2014. The projects requesting RMA are focused on 1) investigating the spatial dynamics and mortality rates of SBT utilising electronic tagging techniques and the impacts of noise associated with oil and gas exploration on SBT in the Great Australian Bight; 2) examining the molecular basis for endothermy using SBT as a novel model; 3) examining iconic and apex predator species in the Great Australian Bight as part of a larger ecosystem project and 4) investigations into the health of wild SBT. In 2014, Australia was granted 5.95 t of RMA for four projects and Australia reported that to date, 1.1 t of RMA had been used by two projects.

165. There was unanimous support for Australia's request for 5.95 t of RMA for these projects.

166. Japan presented paper CCSBT-ESC/1409/33. Japan reported usage of RMA in the trolling survey as 102 SBT, totalling 256.2kg which were killed for biological sampling.

Agenda Item 18. Workplan, Timetable and Research Budget for 2015

18.1. Overview, time schedule and budgetary implications of proposed 2015 research activities and implications of Scientific Research Program for the work plan and budget

167. The ESC developed the following workplan for 2015.

Activity	Approximate Period	Resources or approximate budgetary implications[2]
Continuation of tag recovery efforts.	Tag recovery is continuous.	$1,000 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 14	No additional cost
Collation of information on unreported mortalities and categorising this information in accordance with OM "fleets"	Jan - Jun 15	Members
Proposed SRP activities for 2015 (*priorities <u>for new</u> CCSBT funded projects are shown in parentheses*): • Continued collection of close-kin samples *(1)* • Work on genotyping approaches to inform decisions on long-term approach *(2)* • Expert review workshop on long-term approach to genotyping • Design study for future gene-tagging studies *(3)* • Aging Indonesian otoliths[3] *(4)* • Scientific aerial survey	Jan - Dec 15	• Close-kin: CCSBT ($35,000) • Genotyping: CCSBT $85,000 • Australia (CSIRO) • Design study: CCSBT ($75,000) • Aging: CCSBT $15,000 • Survey: CCSBT contribution up to $800,000
Routine OMMP code Maintenance/Development	Jan-Jul 15	Australia / Consultant 5 days.
CPUE Webinar to review progress of the intersessional CPUE work.	Apr 15	Intersessional work by Japan, Australia, New Zealand, Taiwan, Korea and possibly Indonesia. Three panel days.
Develop requirements for MP review in 2017	Jan – Jul 15	Members
Standard Scientific Data Exchange.	Apr – Jul 15	No additional costs
Evaluation of possible changes in the OM structure	2 day technical W/S immediately prior to ESC (30-31 Aug)	Two panel members, 1 Secretariat staff
Extended Scientific Committee for the 21st meeting of the Scientific Committee. The meeting will conduct its regular review of: fishery indicators; evaluation of MP meta-rules; specify requirements for the MP review in 2017; and review results of SRP activities.	5 day ESC 1-5 Sep (Incheon, Korea)	ESC Chair, full panel, full interpretation and 3 Secretariat staff.

18.2. Timing, length and structure of next meeting

168. The next ESC meeting is proposed to be held from 1 – 5 September 2015, in Incheon, South Korea.

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

[3] If aging of these otoliths is deferred to 2016, it is assumed that $30,000 would be spent in 2016 to age an additional year of otolith samples.

Agenda Item 19. Other Matters

169. The Chair introduced a letter from the ADMB Foundation (CCSBT-ESC/1409/Info01 that requested funding support by the CCSBT of US$10,000 per year for five years, for the following main activities:

- Development of the open source project to ensure the ADMB code remains viable as computer software and hardware evolve;
- the transition to new coding standards so the ADMB software will continue to work with modern compilers; and
- Outreach, where ODMB training and workshops would support the next generation of ecosystem and fisheries stock assessment modellers.

170. Members commented on the high importance of the ADMB software to their work and considered that it was important to provide funding support to the ADMB Foundation. However, it was noted that at least one Member is currently considering providing financial support and the ESC recommendation that the EC should consider whether it was better for support to be provided by individual Members or by the CCSBT.

171. The Chair referred participants to the report from the 2014 Performance Review of the CCSBT.

172. It was noted that recommendations PR-2014-13 and PR-2014-60 from the Performance Review were particularly relevant to discussions by Members held during the current meeting:

- Recommendation "PR-2014-13" states that "*As long as the confidentiality problem will hamper the quality of the scientific assessment efforts CCSBT should continue to improve the accessibility of 'confidential' data for this purpose, with appropriate safeguards. A time limit should be adopted in the data confidentiality rules, putting most if not all data in the public domain after a given period of time sufficient to reduce sufficiently or eliminate any risk from its broader use*". At the present meeting, confidentiality issues have limited the data available for analyses that the ESC would otherwise have conducted. The ESC would like to see more progress in this area and would like data provided to be as close to the raw data as possible in order to improve the ESC's assessments and analyses, while taking care of commercial confidentiality of raw data.
- Recommendation "PR-2014-60" states that "*Considering the values generated and the costs supported one might suspect that real 'efficiency' might be made more by accelerating stock rebuilding than reducing administrative and research costs. As a consequence, considering that the CCSBT deals with one single species and few markets. It might be in a better position than other tuna RFMOs to consider undertaking at least a preliminary economic analysis of implications of its rebuilding strategy (taking into account, first, only market values) in order to shed some light on the economic implications of the parameters presently used for the Management Procedure and the planned rebuilding trajectory (still undefined)*". The performance review presented some simple extrapolations which suggested that the cumulative value of the SBT catch for the 2014-2035 period would be around 22 billion dollars while the cumulative cost of the CCSBT for the same period (with a 5% yearly

increase in budgets) would be around 77 million dollars or 0.004% of the value managed. This suggests that the CCSBT costs are extremely low compared to the value of the fishery and that the cost increase for the ESC's proposed 3 year research plan is well justified.

173. The ESC noted that some of the other recommendations, such as testing the robustness of the MP to climate change, reflects an understandable lack of knowledge regarding the large extent and specific nature of robustness testing (e.g. robustness to carrying capacity changes) that has been undertaken in relation to the MP. The ESC will evaluate the recommendations of the Performance Review at its next meeting if requested by the EC and report the outcomes of the evaluation to CCSBT 22.

Agenda Item 20. Adoption of Meeting Report

174. The report was adopted.

Agenda Item 21. Close of Meeting

175. The meeting closed at 6:05 pm on 6 September 2014.

List of Attachments

Attachment

1. List of Participants
2. Agenda
3. List of Documents
4. Global Reported Catch by Flag
5. Unaccounted mortality
6. Approach to estimation of unaccounted catch mortality by non-members of CCSBT
7. Trends in selected indicators of the SBT stock
8. Stock Assessment and Projection Results
9. Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2014
10. CCSBT Scientific Research Program
11. Timeline and decisions for future close-kin work
12. Three year workplan for projects to be funded by the CCSBT
13. Data Exchange Requirements for 2015

Attachment 1

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Extended Scientific Committee Meeting
of the Nineteenth Meeting of the Scientific Committee

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Attachment 2

Agenda
Extended Scientific Committee for the Nineteenth Meeting of the Scientific Committee
Auckland, New Zealand
1 – 6 September, 2014

1. **Opening**
   - 1.1. Introduction of Participants
   - 1.2. Administrative Arrangements
2. **Appointment of Rapporteurs**
3. **Adoption of Agenda and Document List**
4. **Review of SBT Fisheries**
   - 4.1. Presentation of National Reports
   - 4.2. Secretariat Review of Catches
5. **Report from the OMMP meeting**
6. **Report from the CPUE modelling group**
7. **Estimation of all sources of unaccounted catch mortality:**
8. **Evaluation of Fisheries Indicators**
9. **Updated stock assessment and projection results**
10. **SBT stock status**
    - 10.1. Assessment of exceptional circumstances
    - 10.2. Summary of the SBT stock status
11. **Report on intersessional scientific activities**
12. **SBT Management Advice**
13. **Develop an updated, comprehensive Scientific Research Program**
14. **Evaluation of whether or not the carry-forward of unfished allocations between three year quota blocks will have a negative impact on the operation of the Management Procedure**
15. **Modifications to the CCSBT Scientific Observer Program Standards**
16. **Requirements for Data Exchange in 2015**

17. Research Mortality Allowance

18. Workplan, Timetable and Research Budget for 2015

18.1. Overview, time schedule and budgetary implications of proposed 2015 research activities and implications of Scientific Research Program for the work plan and budget

18.2. Timing, length and structure of next meeting

19. Other Matters

20. Adoption of Meeting Report

21. Close of Meeting

Attachment 3

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

(CCSBT-ESC/1409/)

1. Provisional Agenda
2. List of Participants
3. List of Documents
4. (Secretariat) Secretariat review of catches (Rev.1) (ESC agenda item 4.2)
5. (Secretariat) Request from CCWG 3 to evaluate whether carry-forward of unfished allocations between three year quota blocks will have a negative impact on the operation of the CCSBT Management Procedure (ESC agenda item 14)
6. (Secretariat) Modifications to the CCSBT's Scientific Observer Program Standards (ESC agenda item 15)
7. (Secretariat) Data Exchange (ESC agenda item 16)
8. (Australia) Preparation of Australia's southern bluefin tuna catch and effort data submission for 2014 (ESC agenda item 4.1)
9. (Australia) A CPUE index based on a GAMM: A proposed monitoring series (ESC agenda item 6)
10. (Australia) A CPUE model with interactions as random effects (ESC agenda item 6)
11. (Australia) A Review of Tuna Growth performance in Ranching and Farming Operations (ESC agenda item 7)
12. (Australia) Data from Australian industry visit to Tsukiji market with JFA and OPRT – 4 July 2014 (ESC agenda item 7)
13. (Australia) Fleet overlap in the IOTC area (ESC agenda item 7)
14. (Australia) Post-release survival of tuna and tuna-like species in longline fisheries (ESC agenda item 7)
15. (Australia) Implications of unaccounted mortalities on stock status and projected rebuilding using the management procedure (Rev.1) (ESC agenda item 9 and 10)
16. (Australia) Fishery indicators for the southern bluefin tuna stock 2013–14 (ESC agenda item 8)
17. (Australia) Commercial spotting in the Australian surface fishery, updated to include the 2013–14 fishing season (ESC agenda item 8)
18. (Australia) The aerial survey index of abundance: updated analysis methods and results for the 2013–14 fishing season (Rev.1) (ESC agenda item 8)

19. (Australia) An update on Australian otolith collection activities, direct ageing and length at age keys for the Australian surface fishery (ESC agenda item 8)
20. (Australia) Update on the length and age distribution of SBT in the Indonesian longline catch (ESC agenda item 8)
21. (Australia) Assessment of stock status of southern bluefin tuna 2014 with reconditioned operating model (ESC agenda item 9)
22. (Australia) Identifying residence signals of SBT in the spawning ground and the Great Australian Bight: initial insights from trace elements in otoliths (ESC agenda item 11)
23. (Australia) SRP Proposal: Estimating size/age at maturity of southern bluefin tuna (ESC agenda item 13)
24. (Australia) SRP Proposal: Second workshop on otolith-based ageing of southern bluefin tuna (ESC agenda item 13)
25. (Australia, Japan and Korea) SRP Proposal: Estimating absolute abundance of juvenile SBT from gene-tagging: A pilot study (ESC agenda item 13)
26. (Australia) SRP Proposal: Continued sampling and analysis for a time series of close-kin abundance estimates of the spawning population (ESC agenda item 13)
27. (Australia) SRP Proposal: Identification of spatial distributions of fish by age from otolith micro-chemistry (ESC agenda item 13)
28. (Australia) Research mortality allowance: Proposed allowance for 2015 and 2014 usage report (ESC agenda item 17)
29. (Japan) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2012 and 2013. O. Sakai, T. Itoh, H. Minami and O. Abe (ESC agenda item 4.1)
30. (Japan) Report of activities for conventional and archival tagging and recapture for southern bluefin tuna by Japan in 2013/2014. O. Sakai and T. Itoh (ESC agenda item 11)
31. (Japan) Activities of southern bluefin tuna otolith collection and age estimation and analysis of the age data by Japan in 2013. T. Itoh, O. Sakai, A. Hirai and K. Omote (ESC agenda item 11)
32. (Japan) Summary of fisheries indicators of southern bluefin tuna stock in 2014. N. Takahashi and T. Itoh (ESC agenda item 8)
33. (Japan) Report of the piston-line trolling monitoring survey for the age-1 southern bluefin tuna recruitment index in 2013/2014. T. Itoh and D. Tokuda (ESC agenda item 8 or 11)
34. (Japan) Update of piston line index and new standardized CPUE for the age-1 southern bluefin tuna off Western Australia. T. Itoh and O. Sakai (ESC agenda item 8 or 11)

35. (Taiwan and Japan) By-catch tuna of Taiwanese longline that catch southern bluefin tuna. S. P. Wang, N. Takahashi and T. Itoh (ESC agenda item 8)
36. (Korea and Japan) CPUE in the time and area common in Korean and Japanese longliners for southern bluefin tuna. S. I. Lee, N. Takahashi, T. Itoh and Z.G. Kim (ESC agenda item 8)
37. ~~(Japan) Examination of effect of length-weight relationships on estimates of age-composition and catch amount for southern bluefin tuna farming. T. Itoh and S. Takeda (ESC agenda item 7)~~
38. (Japan) Examination of the southern bluefin tuna (SBT) operating model and projections for the 2014 assessment. O. Sakai (ESC agenda item 9)
39. (Japan) A check of operating model predictions to perceive the current circumstances of the abundance indices using stock assessment in 2014. O. Sakai (ESC agenda item 9, 10)
40. (Japan) Report of the International Observation on the 100-fish Sampling Process and the Transfer of SBT in Australian SBT Farming. C. Fukugama, S. Takeda and T. Itoh (ESC agenda item 7)
41. (Korea) Review of catch and effort for SBT by Korean tuna longline fishery in the CCSBT convention area. S.I. Lee, Z.G. Kim, J.E. Ku, M.K. Lee and D.W. Lee. (ESC agenda item 4)
42. (Taiwan) CPUE standardization for southern bluefin tuna caught by Taiwanese longline fleet. Sheng-Ping Wang, Shu-Ting Chang, Shiu-Ling Lin, I-Lu Lai (ESC agenda item 8)
43. (Taiwan) Preliminary analysis for gonad samples of southern bluefin tuna collected by Taiwanese scientific observer program. Sheng-Ping Wang, Hung-Hung Hsu, Wei-Chuan Chiang, Shiu-Ling Lin, I-Lu Lai (ESC agenda item 11)
44. (CCSBT) Close-Kin Mark-Recapture for SBT: options for the longer term (Rev.1) (ESC agenda item 13)
45. (Taiwan) Preparation of Taiwan's Southern bluefin tuna catch and effort data submission for 2014 (ESC Agenda Item 4.1)
46. (CPUE Chair) Report of the 15/16 April 2014 CPUE Web Meeting of the CCSBT CPUE Modelling Group (ESC Agenda Item 6)

(CCSBT- ESC/1409/BGD)

1. (Australia) Estimating size/age at maturity of southern bluefin tuna (*Previously* **CCSBT-ESC/1309/41**) (ESC agenda item 13)
2. (Australia) Preliminary cost and precision estimates of sampling designs for gene-tagging for SBT (*Previously* **CCSBT-ESC/1309/18**) (ESC agenda item 13)

3. (Japan) Mortality estimation for southern bluefin tuna released and discarded from Japanese longline fishery. T. Itoh, K. Suzuki and O. Sakai (*Previously* **CCSBT- OMMP/1406/08**) (ESC agenda item 7)
4. (Japan) Unaccounted catch mortality in Australian SBT farming fishery between 2001 and 2013 estimated from information of TIS and CDS. T. Itoh, K. Suzuki and S. Takeda (*Previously* **CCSBT- OMMP/1406/09 (Rev)**) (ESC agenda item 7)

(CCSBT-ESC/1409/SBT Fisheries -)

Australia	Australia's 2012–13 southern bluefin tuna fishing season (Rev.1)
Indonesia	
Japan	Review of Japanese southern bluefin tuna fisheries in 2013. T. Itoh, O. Sakai and S. Takeda
Korea	2014 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 2012/2013 (Rev.1)
EU	EUROPEAN UNION Annual Review of SBT Fisheries for the Extended Scientific Committee
Philippines	
South Africa	

(CCSBT-ESC/1409/Info)

1. (ADMB Foundation) Request for Financial Support for the ADMB Software (ESC agenda item 19)
2. (Australia) Southern bluefin tuna (*Thunnus maccoyii*) shed tags at a higher rate in tuna farms than in the open ocean — two-stage tag retention models (ESC agenda item 19)
3. (Japan) Change in operation pattern of Japanese southern bluefin tuna longliners in 2013. T. Itoh (ESC agenda item 4,8)
4. (Japan) Correction of the core vessel dataset for SBT CPUE. T. Itoh (ESC agenda item 8)
5. (Japan) Impact of updated data in the southern bluefin tuna (SBT) operating model and projections for the 2014 assessment. O. Sakai (ESC agenda item 9)

(CCSBT-ESC/1409/Rep)

1. Report of the Fifth Operating Model and Management Procedure Technical Meeting (June 2014)
2. Report of the Third Meeting of the Compliance Committee Working Group (April

2014)

3. Report of the Twentieth Annual Meeting of the Commission (October 2013)
4. Report of the Eighth Meeting of the Compliance Committee (October 2013)
5. Report of the Eighteenth Meeting of the Scientific Committee (September 2013)
6. Report of the Tenth Meeting of the Ecologically Related Species Working Group (August 2013)
7. Report of the Fourth Operating Model and Management Procedure Technical Meeting (July 2013)
8. Report of the Seventeenth Meeting of the Scientific Committee (August 2012)
9. Report of the Sixteenth Meeting of the Scientific Committee (July 2011)

Global Reported Catch By Flag

Reviews of southern bluefin tuna data presented to a special meeting of the Commission in 2006 suggested that the catches may have been substanstially under-reported over the previous 10 to 20 years. The data presented here do not include estimates for this unreported catch.

All shaded figures are subject to change as they are either preliminary figures or they have yet to be finalised.
Blank cells are unknown catch (many would be zero).

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

Calendar Year	Australia		Japan	New Zealand		Korea	Taiwan	Philippines	Indonesia	South Africa	European Union	Miscellaneous	Research & Other
	Commercial	Amateur		Commercial	Amateur								
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	842	49	3	0	1
2012	4,503		2,528	776	0	922	494	46	910	77	4	0	0
2013	4,835		2,694	756	1	918	1,044	46	1,383	50	0	0	0

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

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

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

Attachment 5

Unaccounted mortality

The possibility of unaccounted for mortality raises important issues for the rebuilding of the stock and the success of the management procedure. The current MP was tuned assuming that future catches equaled the amount indicated by the procedure. In addition a series of robustness trials have been run to show performance for some other possible levels of historic and future unaccounted mortality, as well as anomalies in inputs to the MP. Unfortunately, estimates of unaccounted for mortality are either incomplete, unreliable or disputed, or they do not exist. This Attachment summarizes (1) the possible sources of unaccounted mortality, (2) what data currently exist that could be used to estimate unaccounted catch, (3) what data could be collected that would improve understanding of unaccounted catch, and (4) what analytic procedures could be used to calculate unaccounted catch.

The following potential types of unaccounted for catch have been identified

Source of unaccounted catch	
Unreported or uncertainty in retained catch by Members	• Small Fish Surface fishery • Artisanal catch • Large fish: members exceeding catch allowance
Mortality from releases and/or discards	Small fish Discarded catch Large fish: discarded catch
Recreational fisheries	All sizes: recreational catch
Catches by non-Members	Large fish: Non-member catch
Research Mortality Allowance	No additional -already included
Other sources of mortality	Possible depredation

Small fish: Surface fishery

Existing data and analysis

Data are needed on the number, size, age and weight at transfer into grow-out cages.

Number at transfer is measured by counting fish as they are transferred from tow cages to rearing cages. Observers record mortality during the towing process.

Size and weight at the time of introduction into rearing cages is measured by the 40 (prior to 2013) or 100 (since 2013) fish samples, adding to a total sample of about 3,000 SBT per season. SBT under 10kg are not included in the samples. Australia applies the mean weight in the samples to the number of fish captured (number transferred from the towing cage plus number of fish that die during catching, towing and transfers) to estimate the total weight of fish captured. The exclusion of fish less than 10kg from the estimate of mean weight tends to positively bias the estimate of catch weight.

Japan has used mixed normal modal analysis to estimate the age composition of farmed fish sold into Japan using length frequency data of imports. The source of the length frequency data is considered confidential by Japan. The estimated age composition of imports is used to impute the weight of catch using information on length at age of wild fish and a weight-length function. Such estimates of catch have been challenged by some members because of concerns about the source and representativeness of length frequency data and other assumptions. This approach could be improved by using CDS data (length and weight at time of harvest), which are held by CCSBT but are, at present, not available to members. There are modes in length representing ages in the 40/100 fish sampling data and length frequency data of imports reported by Japan, in some years. If these modes are identified in the CDS data, modal analysis could be used to estimate catch and possible bias in catch reports resulting from the 40/100 fish samples.

Other data that exists and would need to be taken into account to assess results.

(1) Data on when fish are put into farms and how long fish are held in the farms
(2) Growth rate data from fish in farms compared to wild fish (other studies not CCSBT)
(3) Growth rates of tagged fish from SRP that are subsequently harvested in farms
(4) Feed conversion ratios for the farms
(5) Differences in growth rates of each age group
(6) Current wild growth rates

New data sources and analysis

Uncertainty in the surface fishery catch may be reduced by the use of a stereo video system to address estimates of Australian catch by the surface fishery. Australia has demonstrated the potential utility of this method which it had planned to use to replace 100 fish samples. However, the method has not been made operational to date.

Experimental trials comparing stereo video to the 100 fish sample could be used to investigate the accuracy of 100 fish sample.

Another approach would be to take a 100 fish sample just prior to harvesting all the fish in pens. The estimated weight from the 100 sample could be compared to the calculated weight of harvested fish using their length frequency and a weight-length relationship or the sum of the weight of harvested fish.

Process aspects

The ESC encourages all countries to make their CDS data available to facilitate and improve analyses.

Small Fish: Release and discard mortality:

Japan reports releases during its RTMP programme. At present there are observer estimates of the number of small fish released or discarded from some other fleets. These numbers could be evaluated under a range of estimated/assumed release mortality to estimate the mortality from release and discard.

Japan put forward a methodology and an associated estimate of 9% for release mortality. Other members noted that some studies of other tuna species suggest that this may be an underestimate. Some suggested that bounds on release mortality be 9% to 100%, given uncertainly on mortality rates. The same approach could be applied to other fleets.

Small and Large fish Catch by non members

At the meeting of the Operating Model and Management Procedure Working Group (OMMP5) in Seattle in July the working group discussed the request from the Extended Commission and noted that the working group did not have the information required to estimate all unaccounted mortalities. The working group summarised the methods and sources of information required to better inform unaccounted mortality scenarios (Attachment 5, OMMP5 report), and encouraged the ESC, Compliance Committee and Extended Commission to work towards filling the gaps in the information base.

The working group proposed that scenarios could be developed by applying SBT bycatch rates in longline fleets to the effort by non-Members in the same areas and months. The meeting agreed that Members should evaluate the SBT by-catch rate of their own longline fleets which target other species to inform this analysis (CCSBT 2014). These approaches are documented in WP 13. It is noted that these methods will not provide any estimates of IUU catch, where there is no effort reported to the relevant RFMOs.

The ESC requests that the Compliance Committee consider approaches to monitor and review markets in order to provide further information that may inform the ESC considerations.

Reported catch exceeding current allowances

Over the last few years members reported catch has been very close to the catch allocations.

Indonesia has reported that their catch exceeded their allowance for a total of 1074 t. over the four years 2010 to 2013.

Unreported catch by members

Member countries report effort to CCSBT for all targeted SBT fishing. Although, there is some additional fishing effort by some member countries in areas where SBT are known to occur, such bycatches are expected to be included in the SBT catches reported.

Australia presented a paper (ESC/1409/12) suggesting there may be discrepancies in the market data and there may be unreported catch. This is based on the assumptions in the Japan Market Review, agreed by the CCSBT, on fish reported to be domestic, imported wild caught from foreign fleets and farmed. Japan suggested that these imbalances are due to the difference between fish that go through the auction and those that are traded only on paper. Actually resolving this issue is beyond the scope of the ESC, but it is a very important issue for the reliability of the stock assessment and performance of the OMP. A high proportion of the ESC work is dependent on reliable data on actual removals.

New data sources and analysis

Other data and analyses exist that would assist in resolving this uncertainty. Given the scientific technical expertise of the ESC, further consideration of market monitoring is more appropriately considered by the Compliance Committee. The ESC requests the EC and CC consider reviews and analyses that will clarify key assumptions of market monitoring. This should include consideration of:

a) a review of the data from Japan's monthly monitoring at Tsukiji since 2008 to verify the assumptions regarding number, weight and source of fish;
b) monthly data on the number, weight and source country of frozen SBT auctioned and not auctioned at Tsukiji; and
c) undertaking independent market reviews at significant markets.

The ESC encourages all countries to make their CDS data and information on market monitoring available to facilitate and improve analyses.

The ESC requests the Compliance Committee provide the results of these to the ESC for consideration in future assessments of stock status, projects and reviews of the performance of the MP.

Recreational fishing

Australia makes some estimates of their recreational catch but is currently in the final year of a project to develop a better methodology.

Other Sources

Marine mammal depredation was raised as a possible other source of unaccounted catch. This could be considered a source of background natural mortality, but if the rate of depredation has been rising (for instance due to increasing marine mammal populations and learning by these animals) then it is a potential concern.

Attachment 6

Approach to estimation of unaccounted catch mortality by non-members of CCSBT

Background

At the meeting of the Operating Model and Management Procedure Working Group (OMMP5) in Seattle in July the working group discussed the request from the Extended Commission to conduct sensitivity analyses around all sources of unaccounted mortality (UAM) of southern bluefin tuna (SBT) as part of the 2014 stock assessment. The working group noted they did not have the information required to estimate all unaccounted mortalities. However, the working group summarised the methods and sources of information required to better inform unaccounted mortality scenarios (Attachment 5, OMMP5 report), and encouraged the ESC, Compliance Committee and Extended Commission to work towards filling the gaps in the information base.

In the case of catches by non-members of CCSBT, the working group proposed that scenarios could be developed by applying SBT bycatch rates in longline fleets to the effort by non-Members in the same areas and months. The meeting agreed that Members should evaluate the bycatch rate of their own longline fleets to inform this analysis.

The ESC also noted that as the SBT stock increases, bycatch of SBT in non-target fisheries may increase and that lack of information on SBT bycatch is of concern.

Catch by non-members

There is no reliable information available on SBT catch by non-Members. Anecdotal information from a number of sources has indicated that a market for SBT exists in China. Although a small amount of catch in this market is supplied by catch from members it is likely that this market is also supplied with SBT that is not reported to CCSBT.

Analysis of the effort data reported to the IOTC and WCPFC tuna commissions shows a large degree of overlap with SBT fishing grounds for these tuna fisheries. However, SBT catch by non-members of CCSBT is not reported to WCPFC although these tuna fleets may take quantities of SBT bycatch in the albacore, bigeye and yellowfin target fisheries. Observer reports presented at the recent scientific committee of WCPFC did show SBT catch on some trips in the other tuna target fisheries but only a very small proportion is reported. There also may possibly be bycatch of SBT in ICCAT fisheries in the south Atlantic.

IOTC tuna fisheries

CCSBT-ESC/1409/13 examines the overlap of non-Member fleets in areas and times identified as peak SBT areas and times within the area of competence of the Indian Ocean Tuna Commission (IOTC) during peak SBT seasons. This analysis identified an increasing amount of effort in these peak areas and times that suggests probable catch of SBT. Figures 1 and 2 show the total distribution of SBT catch by members of CCSBT and the core areas where 90% of the catch is taken for 2000-12. Figure 3

shows the effort distribution of all IOTC fishing for the same period; non-member effort has increased over the last decade, in areas and times that overlap with core SBT areas and times.

To provide estimates of likely catch of SBT in these fisheries, information on SBT bycatch rates is required. One approach would be to base these rates on catches by Member fleets in the same areas in the same months. A similar approach is proposed for the tuna fisheries in the Convention Area of the Western and Central Pacific Fisheries Commission. It may also be important to review any overlap of the IOTC fishery in Area 1 at the time of the Indonesian catches on the spawning grounds for non-member catch of SBT.

WCPFC tuna fisheries

New Zealand has been reviewing the overlap of the WCPFC tuna fisheries with the known fishing grounds for SBT in the south Pacific. It is apparent from the effort data from WCPFC that some countries have increased fishing effort further south than previously. These vessels are believed to be targeting albacore but the core area of SBT catches by CCSBT Members overlaps with this area.

Proposed methodologies

1. Bycatch rates scaled up to total effort by area (latitude bands or 5 x 5 degree areas) by month each year since 2000.

- Effort by each country targeted at all tuna species is determined for time (months) and area strata (latitude or 5 degree squares).
- By-catch rates of SBT for member fleets in these strata are estimated using total effort in the strata (includes both SBT target and other tuna target effort).

Potential catch of non-member in strata = Total effort by non-member x bycatch rate in strata by member
Total catch by non-member = Sum across all strata

2. Alternative method (more detailed)

(a) Effort

- From WCPFC and IOTC, obtain data on effort by month and 5 degree square for the time series (since 2000).

(b) CPUE

- Fit GLM to Japanese aggregated catch and effort data, and estimate spatial and temporal covariates contributing to CPUE. Use the approach in papers by Mark Chambers (paper 9), or an updated version.
- Use GLM for Japan to predict CPUE by 5 degree square and time across the whole fishery. Assume this represents CPUE for targeted effort (this may not be the case).
- Apply cluster analysis to NZ set by set data (charter and domestic) based on species composition, and identify target and non-target effort.
- Use set by set NZ data to estimate spatial and temporal components of CPUE for target and non-target fisheries in the NZ region.

- Estimate the relative CPUE of non-target and target effort in the same locations, to use as an offset.
- Use this difference/offset to predict CPUE for non-targeted effort in all times and locations.

(c) Catch

- Predict total catch based on two alternate assumptions: all effort is targeted, and all effort is non-targeted. Use these as upper and lower bounds for unreported catch.

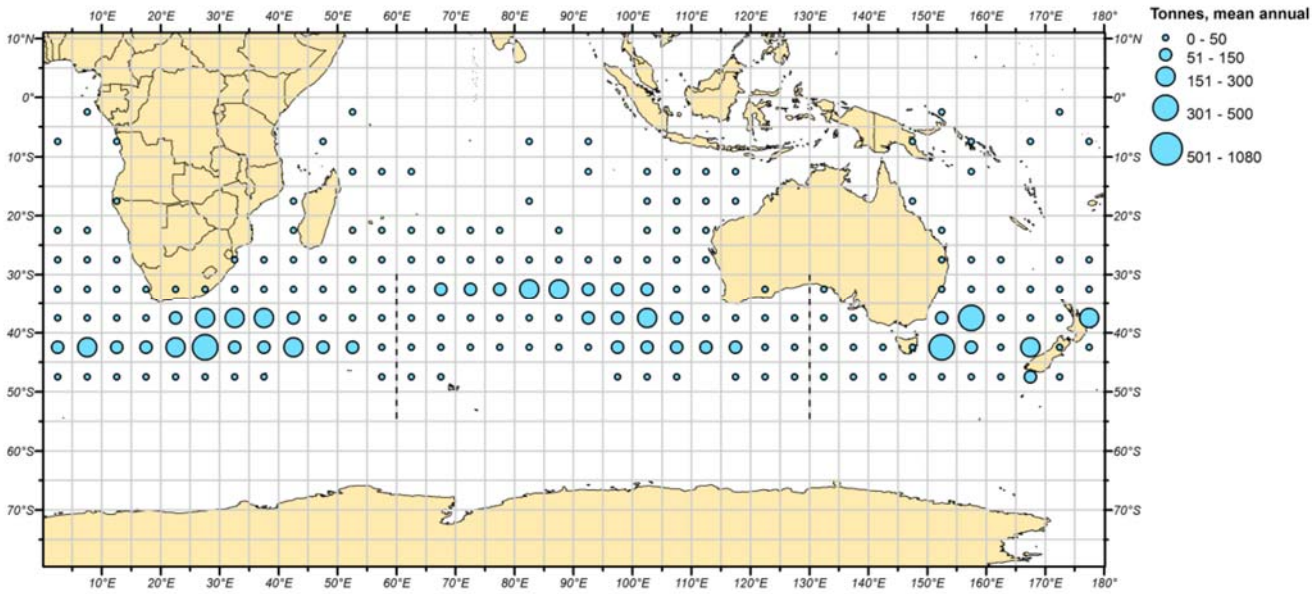


Figure 1: Mean annual SBT catch by five degree grid 2000–2012 and all months.

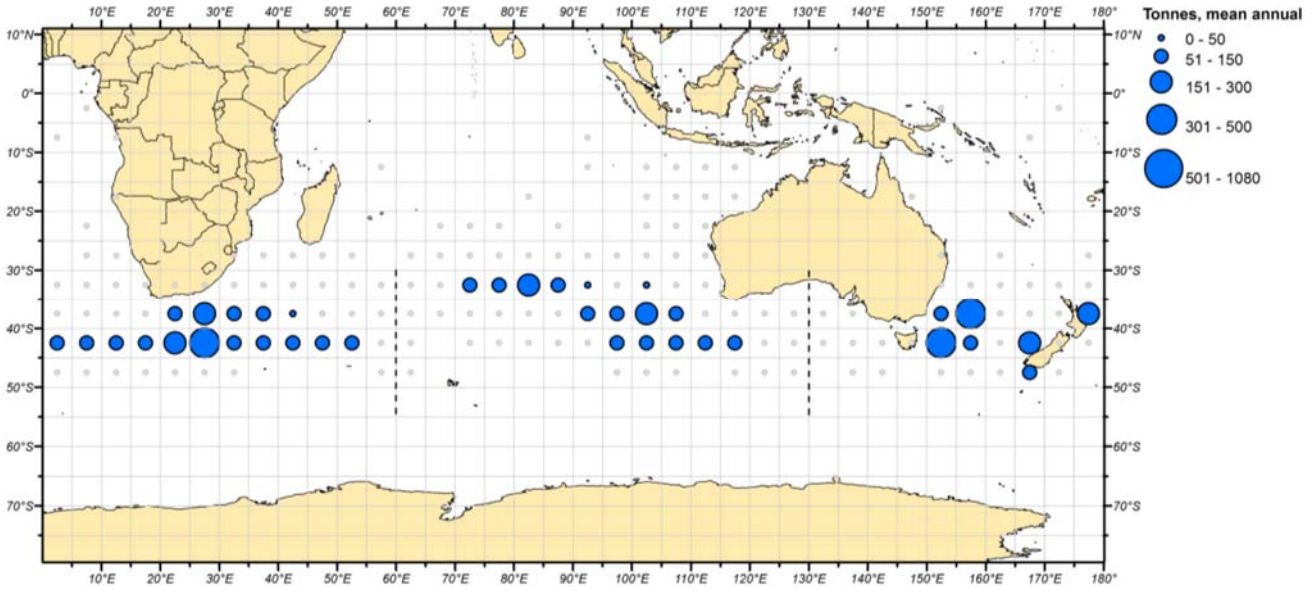


Figure 2: Mean annual SBT catch by five degree grid during peak months within each longitude band region 2000–2012. The main SBT grounds are identified by the blue circles which represent 90 per cent of the SBT catch (90th percentile) while grey circles represent the remaining 10 per cent.

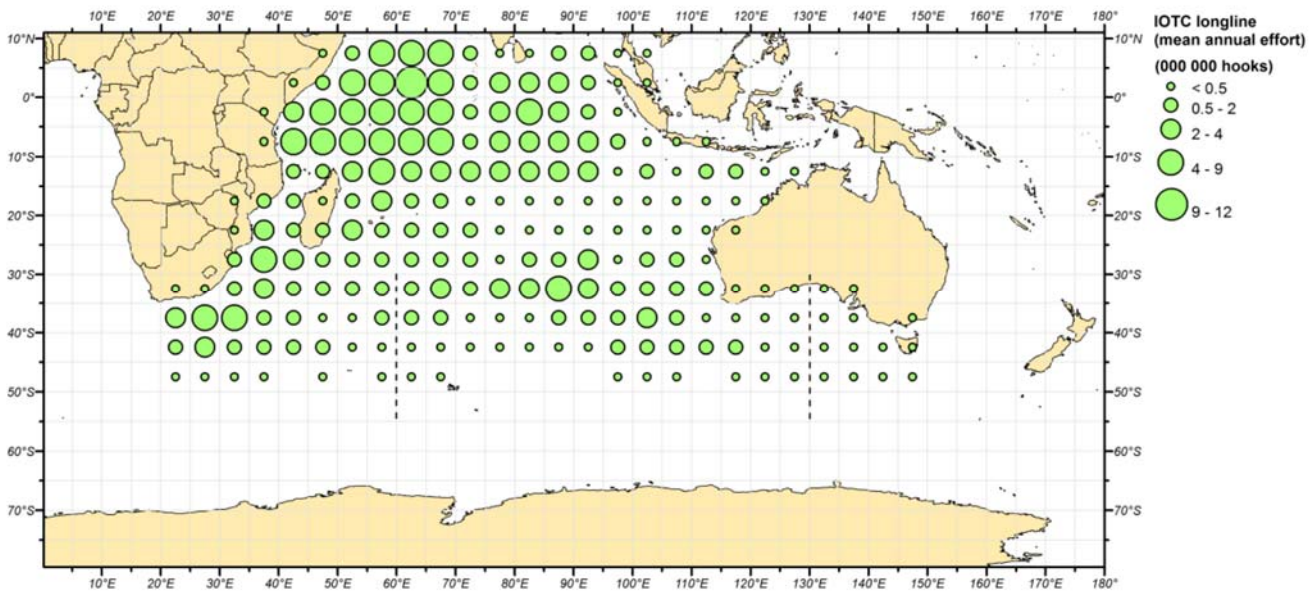
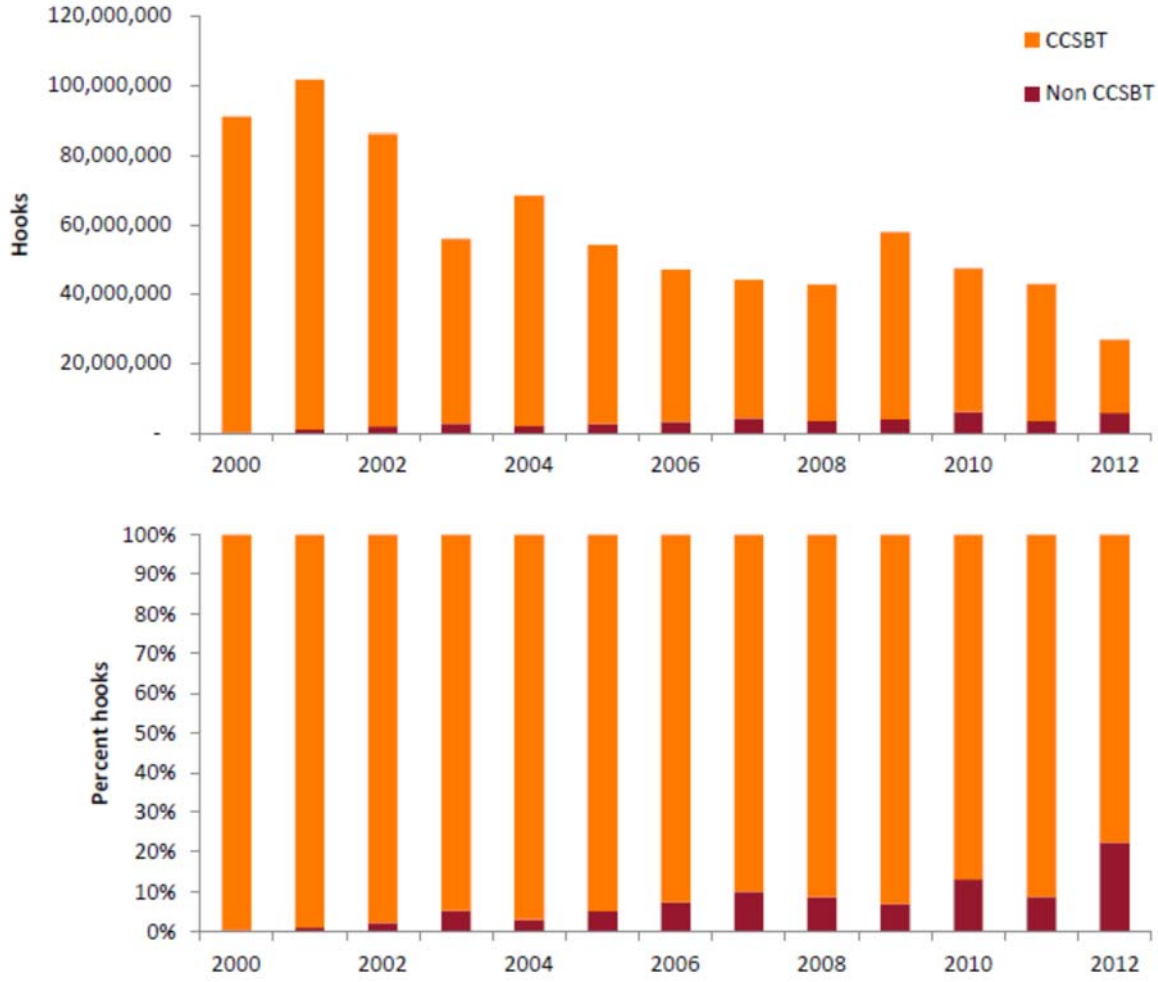


Figure 3: Mean annual longline effort (number of hooks) in the IOTC tuna fisheries by five degree grid 2000–2012 and all months.



Source: IOTC effort data IOTC-2014-WPTmT-DATA-CELongline.xlsx

Figure 4: Annual effort (number of hooks and percentage of total number of hooks) within the main SBT grounds (peak months in peak grids) from CCSBT Members and non-members.

Attachment 7

Trends in selected indicators of the SBT stock

Indicator	Period	Min.	Max.	2010	2011	2012	2013	2014	12 month Trend	
									2012-13	2013-14
Scientific aerial survey	1993–2000 2005–14	0.34 (1999)	2.71 (2014)	0.91	1.61	0.52	1.15	2.71	↑	↑
SAPUE index	2003–14	0.38 (2003)	1.80 (2011)	1.36	1.80	0.58	0.95	1.52	↑	↑
Trolling index	1996–2003 2005–06 2006–14	2.82 (2006)	5.65 (2011)	2.92	5.65	1.55	3.48	3.18	↑	↓
NZ charter nominal CPUE (Areas 5+6)	1989–2013	1.339 (1991)	7.83 (2010)	7.81	6.30	7.33	6.02		↓	
NZ domestic nominal CPUE	1989–2013	0.000 (1989)	4.06 (2012)	1.90	2.28	4.06	3.99		↓	
NZ charter age/size composition (proportion age 0–5 SBT)*	1989–2013	0.001 (2005)	0.414 (1993)	0.25	0.11	0.19	0.15		↓	
NZ domestic age/size composition (proportion age 0–5 SBT)*	1980–2013	0.001 (1985)	0.404 (1995)	0.19	0.15	0.21	0.03		↓	
Indonesian median size class	1993–94 to 2013–14	162 (2012–13; 2013–14)	188 (1993–94)	168	170	168	162	162	-	
Indonesian age composition: mean age on spawning ground, all SBT	1994–95 to 2012–13	13.24 (2012–13)	21.2 (1994–95)	15.3	16.8	16.0	13.2		↓	
Indonesian age composition: mean age on spawning ground 20+	1994–95 to 2012–13	21.8 (2010–11)	25.3 (2003–04)	23.1	21.8	22.4	22.4		-	
Indonesian age composition: median age on spawning ground	1994–95 to 2012–13	13 (2001–03; 2012–13)	21 (1994–95; 1996–97; 1998–99)	15	17	16	13		↓	

*derived from size data

Indicator		Period	Min.	Max.	2010	2011	2012	2013	2014	12 month Trend 2012-13
Standardised JP LL CPUE (age 3)	w0.5	1969-2013	0.201 (2003)	2.917 (1972)	0.271	0.459	0.678	0.262		↓
	w0.8		0.229 (2003)	2.717 (1972)	0.321	0.536	0.789	0.327		
Standardised JP LL CPUE (age 4)	w0.5	1969-2013	0.261 (2006)	2.986 (1974)	0.690	0.761	0.800	0.608		↓
	w0.8		0.288 (2006)	2.713 (1974)	0.848	0.940	1.002	0.796		
Standardised JP LL CPUE (age 5)	w0.5	1969-2013	0.230 (2006)	2.639 (1972)	1.311	1.181	1.055	0.733		↓
	w0.8		0.257 (2006)	2.450 (1972)	1.759	1.496	1.403	0.991		
Standardised JP LL CPUE (age 6&7)	w0.5	1969-2013	0.201 (2007)	2.568 (1976)	0.843	1.078	1.478	0.766		↓
	w0.8		0.236 (2007)	2.401 (1976)	1.171	1.440	1.981	1.021		
Standardised JP LL CPUE (age 8-11)	w0.5	1969-2013	0.273 (2007)	3.640 (1969)	0.327	0.324	0.478	0.495		↑
	w0.8		0.298 (1992)	3.324 (1969)	0.447	0.446	0.650	0.674		
Standardised JP LL CPUE (age 12+)	w0.5	1969-2013	0.470 (2012)	3.169 (1970)	0.487	0.515	0.470	0.514		↑
	w0.8		0.609 (1978)	2.836 (1970)	0.639	0.698	0.622	0.697		

Attachment 8

Stock Assessment and Projection Results

Table 1. The default grid structure specified at the 18th ESC.

	Levels	Cumulate Number	Values	Prior	Simulation weight
Steepness	5	5	0.55, 0.64, 0.73, 0.82, 0.90	Uniform	Prior
M_1	4	20	0.35, 0.40, 0.45, 0.50	Uniform	Likelihood
M_{10}	4	80	0.050, 0.075, 0.100, 0.125	Uniform	Likelihood
Omega	1	80	1	NA	NA
CPUE series	2	160	w0.5, w0.8	Uniform	Prior
q-age-range	2	320	4-18, 8-12	0.67, 0.33	Prior
Sample size	1	320	Sqrt	NA	NA

Table 2. The list of base case and sensitivity scenario specifications.

Scenario	Description
#0 Base case	- Base case setting was agreed in 5th OMMP. - Including the Close-Kin (CK) data and new maturity schedule and fecundity assumption (See CCSBT ESC18 report). - Free Indonesian selectivity for 2013 (in addition to 2012) to accommodate the observed sharp increase in smaller/younger fish in the catch (age 7+). - Tag over-dispersion parameter is 1.82 (changed from 2.35), and the process error for the aerial survey is 0.22 (changed from 0.18). - Projected recruitment deviates are unlinked to historical estimates.
#1 Added Catch	- Inclusion of the unaccounted catch mortalities (UAM) in conditioning. - Assuming that the additional catch remains at the same proportion as in 2013 in the projection. The surface fishery is additionally increased by 20% as the SCFO20 sensitivity scenario.
#2 SFOC20	- Continued 20% overcatch by Australian surface fishery in projections.
#3 SFOC40	- Apply 40% overcatch by the Australian surface fishery: ramps up from 1% in 1992 to 40% by 1999 and onwards to 2014. - Adjust the age composition as was done for the 20% method. - Continued 40% overcatch in projection.
#4 SFOC00	- No historical nor future additional catch in surface fishery.
#5 S00CPUE	- Past longline overcatch had no impact on LL1 CPUE.
#6 S50CPUE	- 50% of lonline overcatch associated with reported effort for LL1 CPUE.
#7 Ind Sel Flat 20	- Change of the maximum age from 25 to 20 to start flat selectivity in Indonesian LL fishery.
#8 High Aerial CV	- Set the process CV of the Aerial Survey Index to 0.4 for the conditioning phase.

#9 No 2014 Aerial	- Remove the 2014 aerial survey data point from the conditioning (keep for MP input data).
#10 Upq2008	- Assume an increase in catchability of 0.25, using a step function, from 2008 onwards.
#11 Omega75	- Relationship between biomass and CPUE with power=0.75.
#12 High Lat Agg CPUE	- Combine Lat 45S and 40S in the GLM standardization of LL1 CPUE which was specified in 5th OMMP.
#13 No Interact CPUE	- Use CPUE trend from GLM without interactions year x area & year x latitude. This is the "reduced base case model" which uses the monitoring CPUE series 1 (See CCSBT-OMMP/1406/13).
#14 CK off	- Exclude the CK data.
#15 Tag F mixing	- Increase 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.
#16 Troll Surv	- Include the piston-line troll survey index.
#17 Steepness Wts	- For continuity with previous assessment, weight steepness h by the objective function.
#18 Corr Hist Rec Devs	- Projected recruitment deviates are correlated to the historical estimates from the conditioned model.
#19 Grid Troll	- Including the alternative troll survey index (grid-type troll index) specified in CCSBT-ESC/1409/34.
#20 SbyS CPUE	- Use CPUE based on the shot-by-shot daily level. This is the "Base with SxS model" which uses the monitoring CPUE series 2 (See CCSBT-OMMP/1406/13).
#21 GAM CPUE	- Use the "GAM CPUE" series provided from Australia under the 2014 CCSBT data exchange. This is the monitoring CPUE series 3.

Table 3. Assessment results for base case and the unaccounted catch mortality (UAM) scenarios.

#	Scenario		Current relative spawning stock index SSB_{2014}/SSB_0	Current relative biomass of age 10+ $B10+_{2014}/B10+_0$	F_{2013}/F_{msy}	SSB_{msy}/SSB_0	SSB_{2014}/SSB_{msy}	MSY	Replacement Yield	$B10+_{2014}$	$B10+_{2035}/B10+_0$	TAC_{2035}/TAC_{2014}	TAC_{2035}/MSY	Average $C_{2015-2035}$	Probability of reaching the target by 2035
0	Base case	10%ile	0.077	0.061	0.391	0.156	0.259	30167	37096	74591	0.17	1.42	0.56	16126	
		50%ile	0.093	0.072	0.657	0.242	0.378	33358	44605	83289	0.28	2.18	0.81	21259	74.3%
		90%ile	0.116	0.087	0.997	0.318	0.700	35665	52676	96070	0.50	2.62	0.95	23647	
1	Added Catch	10%ile	0.076	0.059	0.459	0.156	0.255	30493	38067	71728	0.12	1.12	0.43	17875	
		50%ile	0.091	0.070	0.769	0.243	0.367	33648	45495	80655	0.21	1.90	0.70	24830	49.6%
		90%ile	0.113	0.086	1.165	0.318	0.674	36140	54034	93115	0.39	2.62	0.91	29789	
2	SFOC20	10%ile	0.077	0.061	0.391	0.156	0.259	30167	37096	74591	0.15	1.30	0.51	16594	
		50%ile	0.093	0.072	0.657	0.242	0.378	33358	44605	83289	0.26	2.10	0.78	22175	68.7%
		90%ile	0.116	0.087	0.997	0.318	0.700	35665	52676	96070	0.47	2.62	0.95	25248	
3	SFOC40	10%ile	0.079	0.062	0.424	0.155	0.280	31179	38396	72604	0.15	1.29	0.49	17499	
		50%ile	0.096	0.073	0.719	0.242	0.398	34257	46216	82412	0.26	2.06	0.75	23535	67.0%
		90%ile	0.120	0.090	1.068	0.317	0.703	36802	54598	95777	0.45	2.62	0.92	26850	
4	SFOC00	10%ile	0.075	0.059	0.351	0.157	0.253	28899	35398	77429	0.17	1.38	0.56	15474	
		50%ile	0.090	0.071	0.604	0.243	0.361	32304	42774	86452	0.29	2.14	0.83	20884	69.5%
		90%ile	0.110	0.086	0.932	0.317	0.687	34415	50136	99520	0.50	2.62	0.98	23647	

Table 4. Assessment results for base case and the other sensitivity scenarios.

#	Scenario		Current relative spawning stock index SSB_{2014}/SSB_0	Current relative biomass of age 10+ $B10+_{2014}/B10+_0$	F_{2013}/F_{msy}	SSB_{msy}/SSB_0	SSB_{2014}/SSB_{msy}	MSY	Replacement Yield	$B10+_{2014}$	$B10+_{2035}/B10+_0$	TAC_{2035}/TAC_{2014}	TAC_{2035}/MSY	Average $C_{2015\text{-}2035}$	Probability of reaching the target by 2035
0	Base case	10%ile	0.077	0.061	0.391	0.156	0.259	30167	37096	74591	0.17	1.42	0.56	16126	
		50%ile	0.093	0.072	0.657	0.242	0.378	33358	44605	83289	0.28	2.18	0.81	21259	74.3%
		90%ile	0.116	0.087	0.997	0.318	0.700	35665	52676	96070	0.50	2.62	0.95	23647	
5	S00CPUE	10%ile	0.081	0.064	0.361	0.157	0.290	30859	39905	76951	0.18	1.45	0.56	16556	
		50%ile	0.101	0.078	0.596	0.243	0.414	34087	47386	85847	0.31	2.19	0.80	21430	81.7%
		90%ile	0.132	0.096	0.917	0.318	0.751	36910	54819	100150	0.54	2.62	0.94	23647	
6	S50CPUE	10%ile	0.075	0.060	0.411	0.156	0.254	29507	35137	73117	0.16	1.40	0.56	15793	
		50%ile	0.090	0.070	0.701	0.242	0.362	32903	42979	81387	0.28	2.17	0.82	21138	68.9%
		90%ile	0.110	0.085	1.063	0.317	0.684	34880	51157	96051	0.48	2.62	0.97	23647	
7	IndSelFlat20	10%ile	0.094	0.069	0.335	0.155	0.302	31032	37467	60986	0.18	1.55	0.58	17315	
		50%ile	0.122	0.087	0.568	0.242	0.480	34195	47123	67363	0.30	2.22	0.82	21933	86.4%
		90%ile	0.152	0.108	0.933	0.317	0.937	36726	53426	76054	0.57	2.62	0.95	23647	
8	HighAerialCV	10%ile	0.077	0.061	0.399	0.157	0.257	29358	24438	75472	0.15	1.27	0.51	14692	
		50%ile	0.095	0.073	0.715	0.243	0.382	32818	31568	85049	0.27	2.07	0.78	20256	69.9%
		90%ile	0.121	0.091	1.125	0.318	0.723	35219	39320	97382	0.48	2.62	0.95	23647	
9	No2014Aerial	10%ile	0.075	0.061	0.457	0.157	0.254	28341	15890	74157	0.15	1.14	0.47	13233	
		50%ile	0.092	0.072	0.796	0.243	0.375	31839	21205	83744	0.25	1.93	0.75	18846	65.0%
		90%ile	0.117	0.089	1.233	0.318	0.709	34063	25841	96808	0.45	2.58	0.96	23355	
10	Upq2008	10%ile	0.070	0.056	0.428	0.156	0.236	29773	34701	68549	0.13	1.37	0.54	16027	
		50%ile	0.086	0.066	0.728	0.242	0.343	32987	42518	76770	0.24	2.24	0.84	21639	59.8%
		90%ile	0.106	0.080	1.107	0.317	0.649	35354	50738	87678	0.47	2.62	0.97	23647	
11	Omega75	10%ile	0.067	0.052	0.401	0.156	0.232	30585	37162	66279	0.15	1.29	0.49	15007	
		50%ile	0.082	0.063	0.694	0.242	0.333	34160	44777	73936	0.28	2.05	0.75	20258	70.1%
		90%ile	0.104	0.077	1.074	0.317	0.633	36880	53342	86787	0.51	2.62	0.90	23647	
12	High Lat Agg CPUE	10%ile	0.078	0.062	0.393	0.156	0.259	30031	36942	75139	0.16	1.42	0.56	16104	
		50%ile	0.093	0.072	0.663	0.242	0.378	33349	44490	83669	0.28	2.17	0.81	21220	73.7%
		90%ile	0.116	0.087	1.013	0.318	0.698	35653	52537	95976	0.49	2.62	0.95	23647	

Table 4 Cont.

#	Scenario		Current relative spawning stock index SSB_{2014}/SSB_0	Current relative biomass of age 10+ $B10+_{2014}/B10+_0$	F_{2013}/F_{msy}	SSB_{msy}/SSB_0	SSB_{2014}/SSB_{msy}	MSY	Replacement Yield	$B10+_{2014}$	$B10+_{2035}/B10+_0$	TAC_{2035}/TAC_{2014}	TAC_{2035}/MSY	Average $C_{2015-2035}$	Probability of reaching the target by 2035
13	No Interact CPUE	10%ile	0.072	0.058	0.430	0.156	0.245	29756	34440	70087	0.15	1.27	0.50	15004	
		50%ile	0.088	0.067	0.737	0.242	0.347	32907	42451	78028	0.26	2.05	0.78	20425	67.2%
		90%ile	0.107	0.082	1.113	0.317	0.652	35317	50637	89338	0.47	2.62	0.95	23647	
14	CK off	10%ile	0.066	0.045	0.486	0.162	0.256	30313	36179	36599	0.16	1.51	0.58	16322	
		50%ile	0.082	0.058	0.708	0.243	0.327	34339	41752	52795	0.28	2.30	0.84	21671	68.1%
		90%ile	0.102	0.078	0.987	0.318	0.511	36073	49361	91663	0.50	2.62	0.93	23647	
15	Tag F mixing	10%ile	0.080	0.064	0.375	0.156	0.268	30127	37922	75436	0.18	1.44	0.56	16010	
		50%ile	0.096	0.075	0.633	0.242	0.390	33465	45654	84288	0.30	2.18	0.81	21272	76.0%
		90%ile	0.119	0.090	0.961	0.317	0.725	35966	54072	96287	0.51	2.62	0.95	23647	
16	Troll Surv	10%ile	0.086	0.063	0.343	0.156	0.295	29976	34466	74069	0.19	1.48	0.57	16384	
		50%ile	0.103	0.076	0.560	0.243	0.430	33274	37775	84196	0.31	2.20	0.83	21524	85.5%
		90%ile	0.132	0.094	0.861	0.318	0.765	35636	41137	97078	0.54	2.62	0.97	23647	
17	Steepness Wts	10%ile	0.073	0.058	0.515	0.202	0.258	31295	37708	73595	0.17	1.48	0.57	16037	
		50%ile	0.089	0.070	0.702	0.243	0.345	33078	43102	83882	0.25	2.14	0.81	20852	72.3%
		90%ile	0.111	0.084	0.957	0.281	0.488	34390	49195	96903	0.41	2.62	0.98	23647	
18	Corr Hist Rec Devs	10%ile	0.077	0.061	0.391	0.156	0.259	30167	37096	74591	0.21	1.71	0.67	19292	
		50%ile	0.093	0.072	0.657	0.242	0.378	33358	44605	83289	0.38	2.48	0.91	23106	87.7%
		90%ile	0.116	0.087	0.997	0.318	0.700	35665	52676	96070	0.67	2.62	0.99	23647	
19	Grid Troll	10%ile	0.091	0.066	0.338	0.156	0.308	29887	32019	74744	0.20	1.51	0.59	16952	
		50%ile	0.111	0.078	0.530	0.243	0.456	33098	34812	84510	0.33	2.23	0.84	21795	89.1%
		90%ile	0.141	0.096	0.828	0.318	0.797	35493	37157	97967	0.56	2.62	0.98	23647	
20	SbyS CPUE	10%ile	0.077	0.061	0.386	0.156	0.263	30201	37376	74099	0.17	1.43	0.56	16254	
		50%ile	0.094	0.073	0.651	0.243	0.378	33419	44977	83753	0.29	2.20	0.82	21372	75.5%
		90%ile	0.117	0.088	0.986	0.318	0.703	35750	53153	96155	0.50	2.62	0.95	23647	
21	GAM CPUE	10%ile	0.089	0.074	0.383	0.157	0.302	29957	37504	88651	0.18	1.66	0.64	17726	
		50%ile	0.104	0.084	0.620	0.243	0.421	33280	45016	98709	0.29	2.31	0.87	22205	79.3%
		90%ile	0.128	0.099	0.942	0.318	0.743	35154	52650	111757	0.51	2.62	0.98	23647	

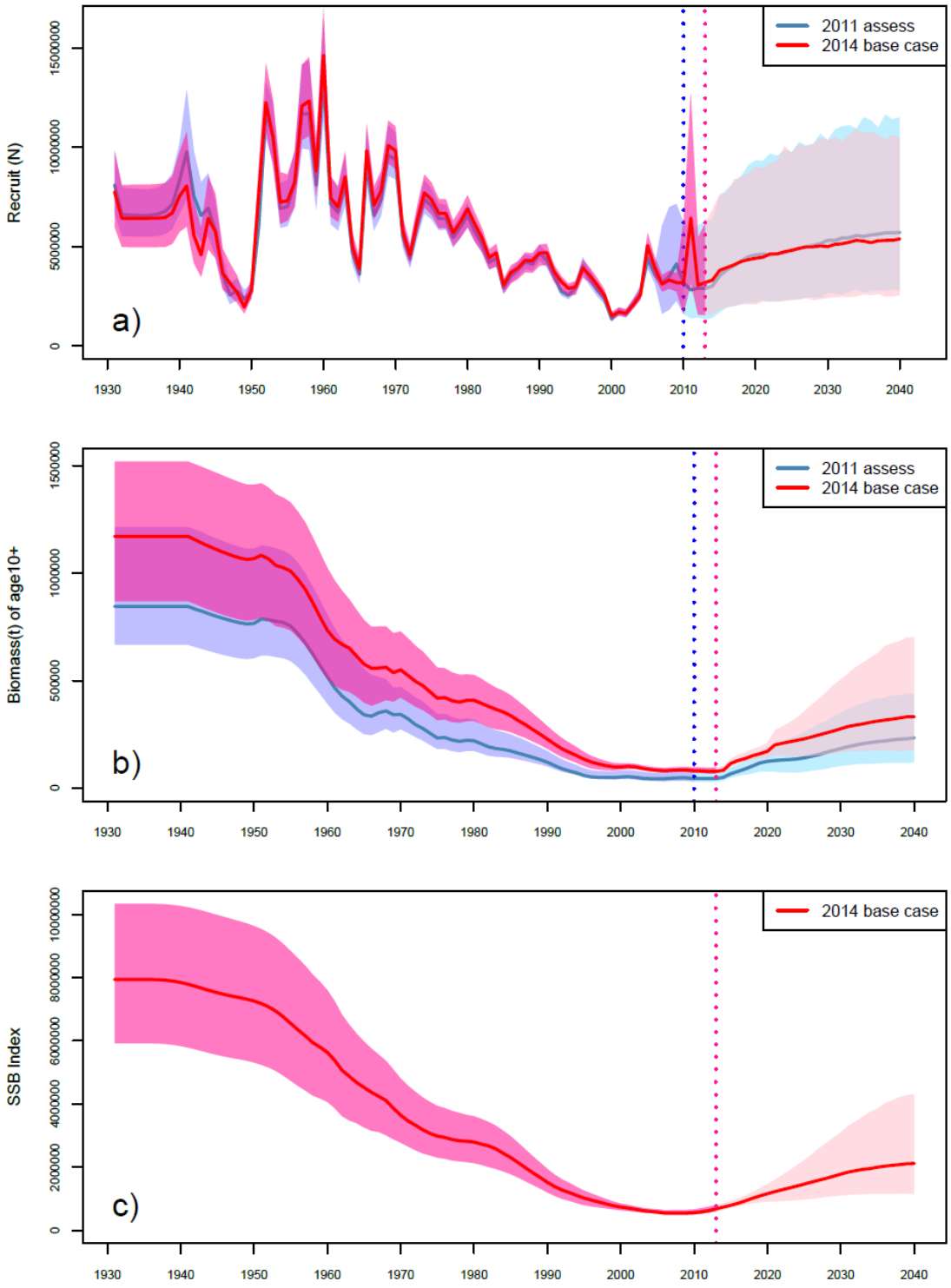


Fig. 1. Base case trajectories for a) recruitment, b) biomass of age 10+ fish, and c) SSB.

The red line with the pink region shows the median and 90% intervals of the current base case. The blue line with the light-blue region shows those for the previous assessment which was calculated in 2011. The dotted line shows the boundaries of the conditioning and projections.

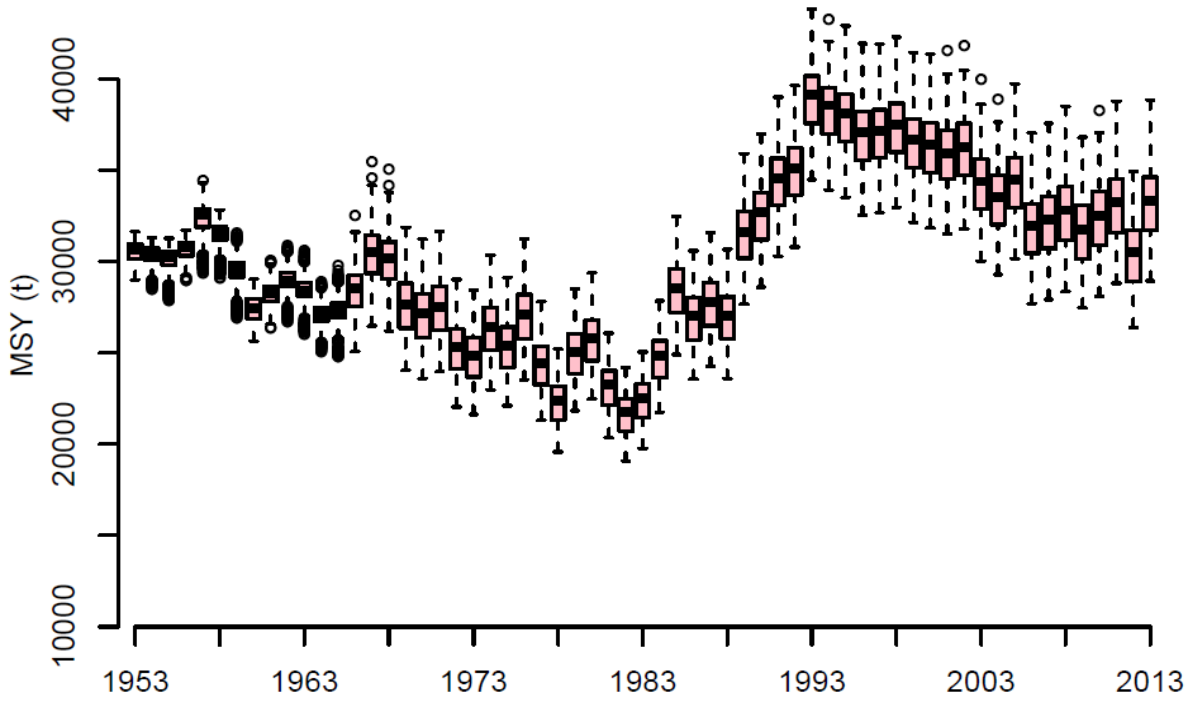


Fig. 2. Estimated MSY based on annual age-specific mean weight and selectivity as estimated using the base case

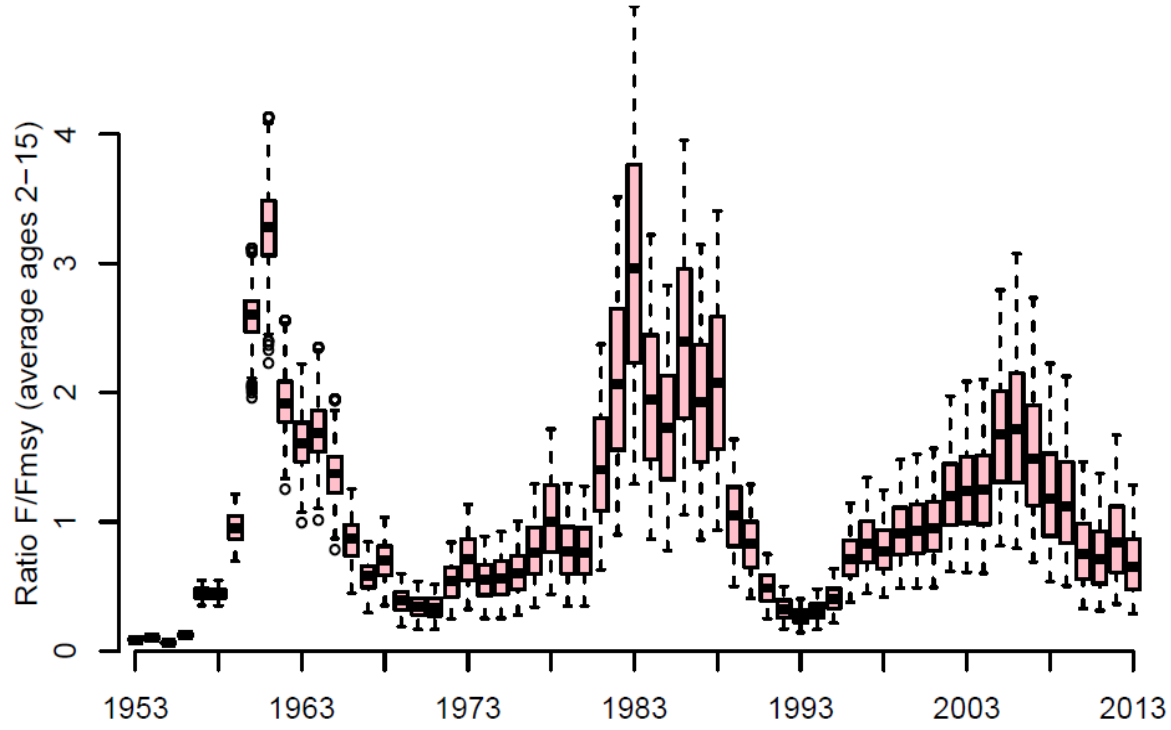


Fig. 3. Boxplot of the fishing mortality over the Fmsy (for ages 2-15) as estimated using the base case of the OM

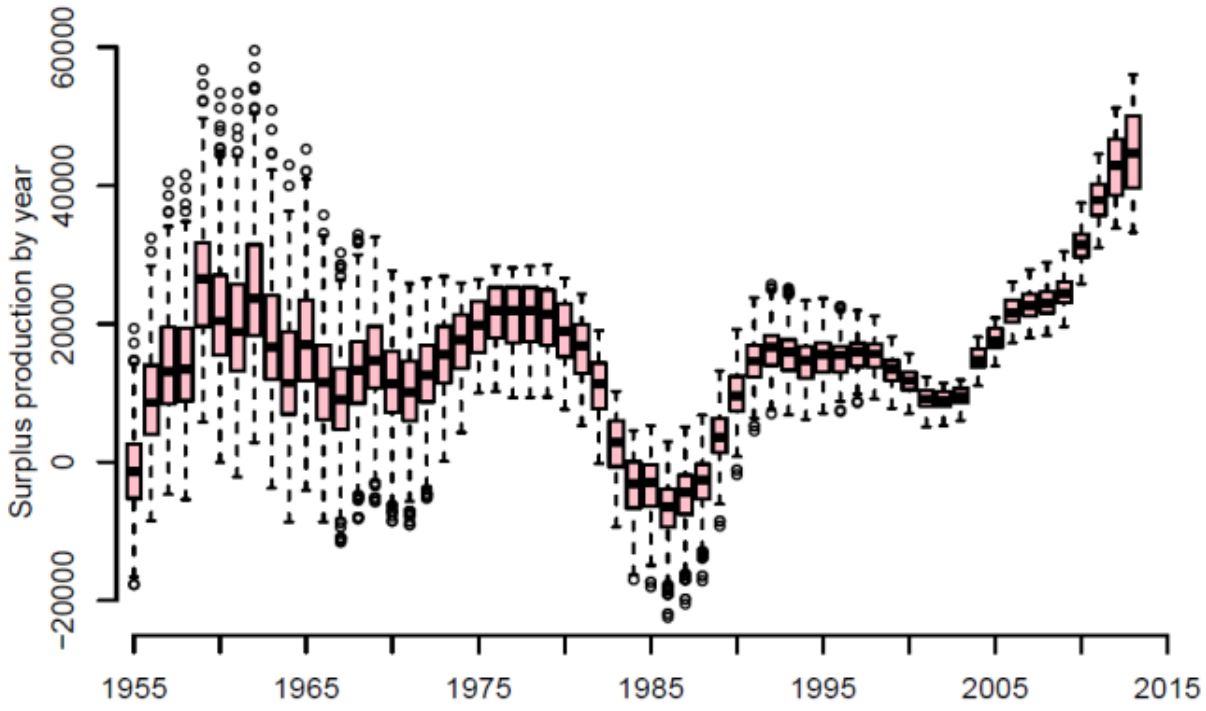


Fig. 4. Boxplot of the surplus production (catch in year t + biomass difference in year t from year t-1) as estimated using the base case of the OM.

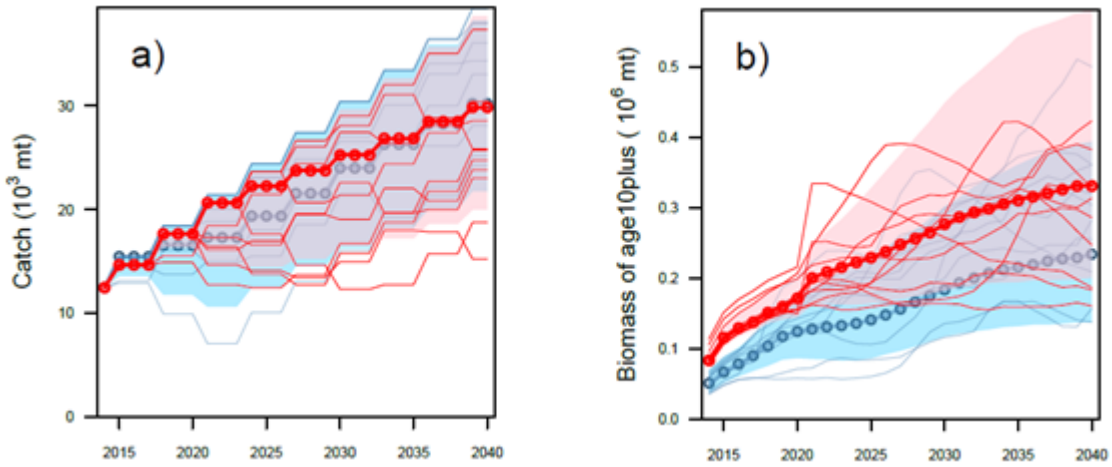


Fig. 5. Predicted values of base case under the Bali Procedure; a) catch (10^3 tonnes), b) biomass of age 10+ fish (10^6 tonnes)

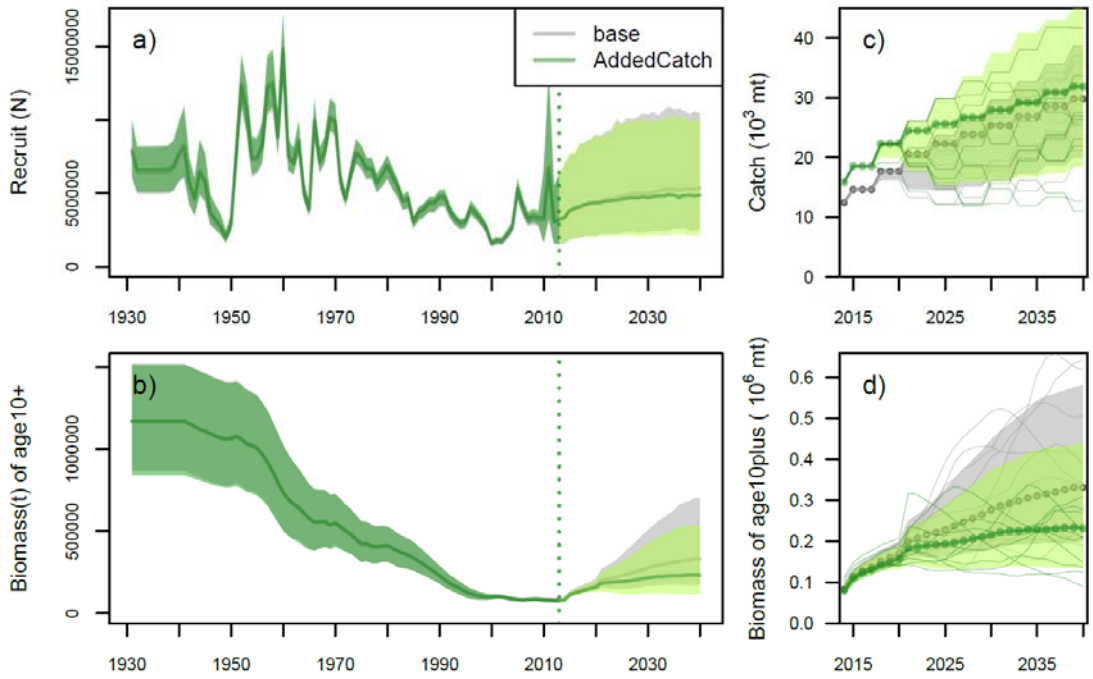


Fig. 6. Trajectories of a) recruitment, b) biomass of age 10+ fish, c) predicted catch, and d) biomass for the "Added Catch" sensitivity scenario.

The green line with the greenish yellow region shows the median and 90% intervals of each scenario. The grey line and region shows the base case result.

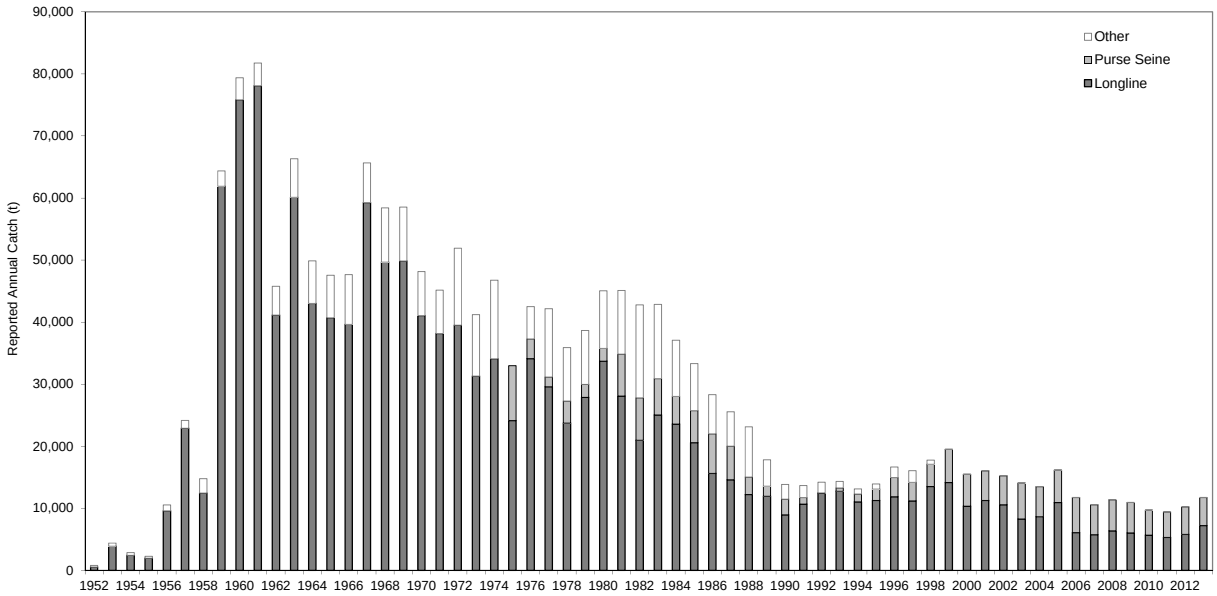


Figure 1: Reported southern bluefin tuna catches by fishing gear, 1952 to 2013. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

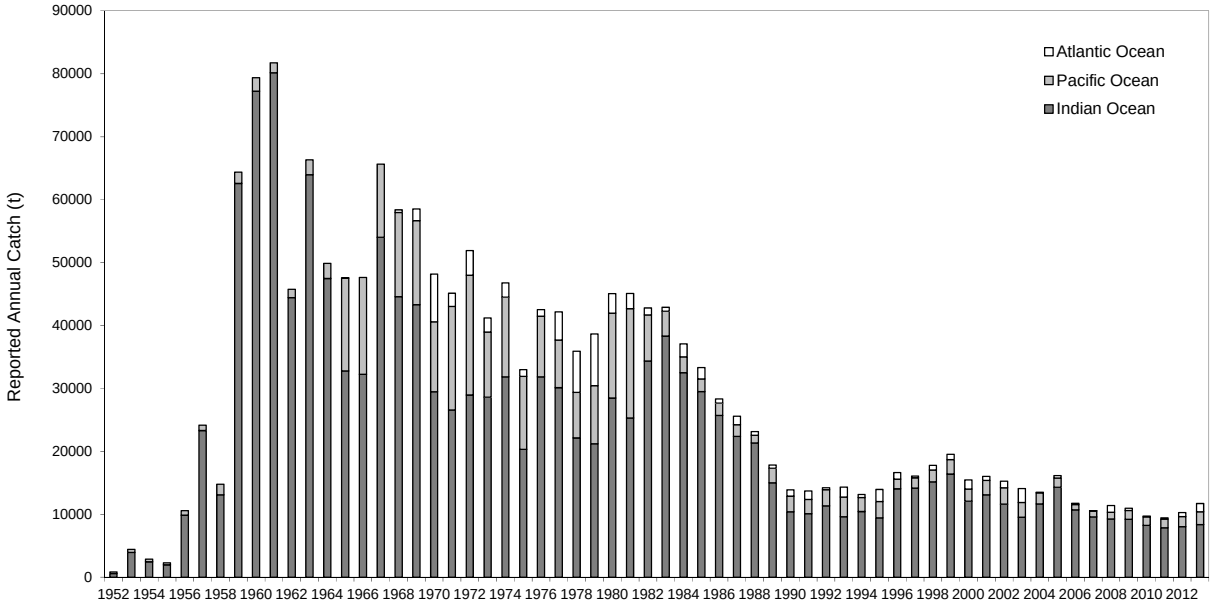


Figure 2: Reported southern bluefin tuna catches by ocean, 1952 to 2013. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

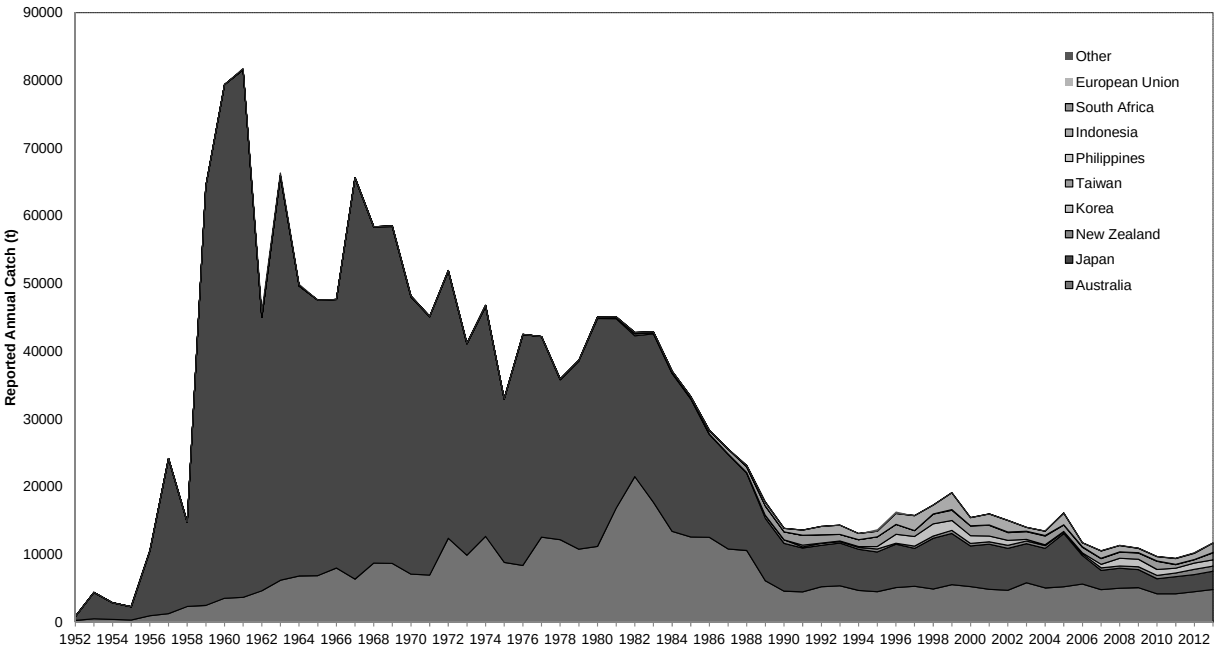


Figure 3: Reported southern bluefin tuna catches by flag, 1952 to 2013. Note: a 2006 review of SBT data indicated that catches over the past 10 to 20 years may have been substantially under-reported.

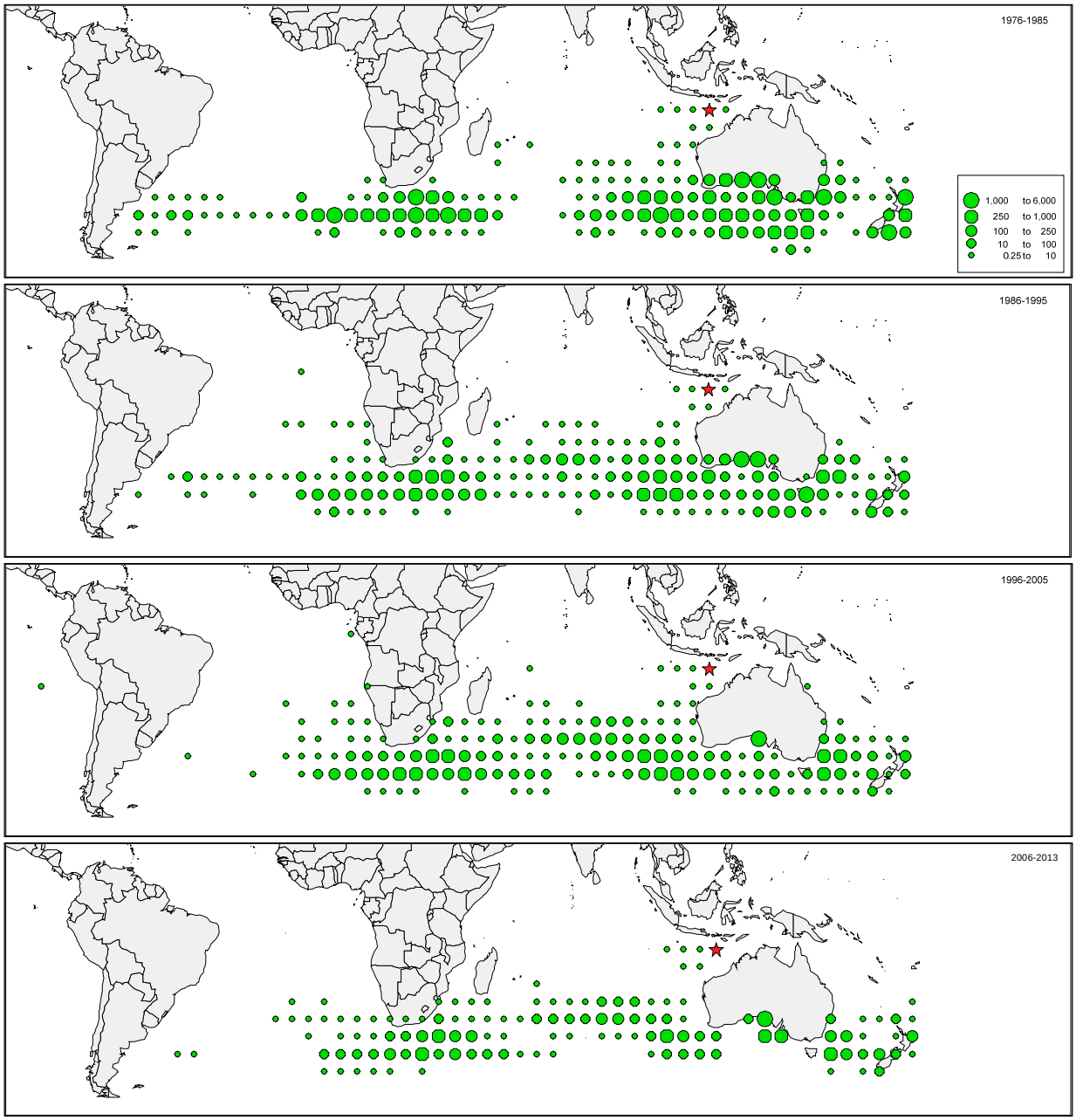


Figure 4: Geographical distribution of average annual southern bluefin tuna catches (t) by CCSBT members and cooperating non-members over the periods 1976-1985, 1986-1995, 1996-2005 and 2006-2013 per 5° block by oceanic region. The area marked with a star is an area of significant catch in the breeding 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.

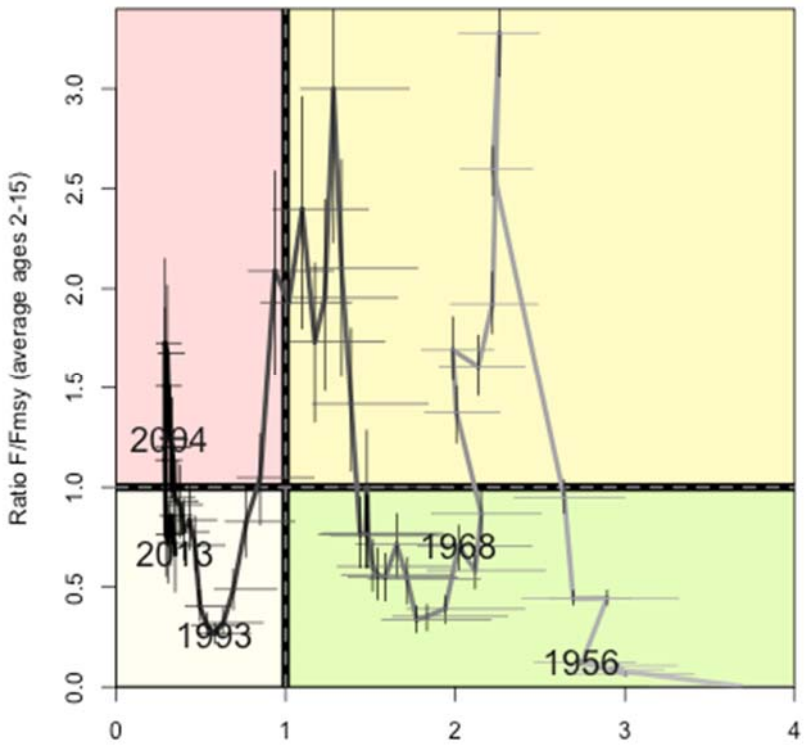


Figure 5a. Time trajectory from 1952 to 2013 of median fishing mortality over the F_{msy} (for ages 2-15) versus spawning biomass (B) over B_{msy}. The fishing mortality rates are based on biomass-weighted values and the relative fishery catch composition and mean SBT body weights in each year. Vertical and horizontal lines represent 25th-75th percentiles from the operating model grid.

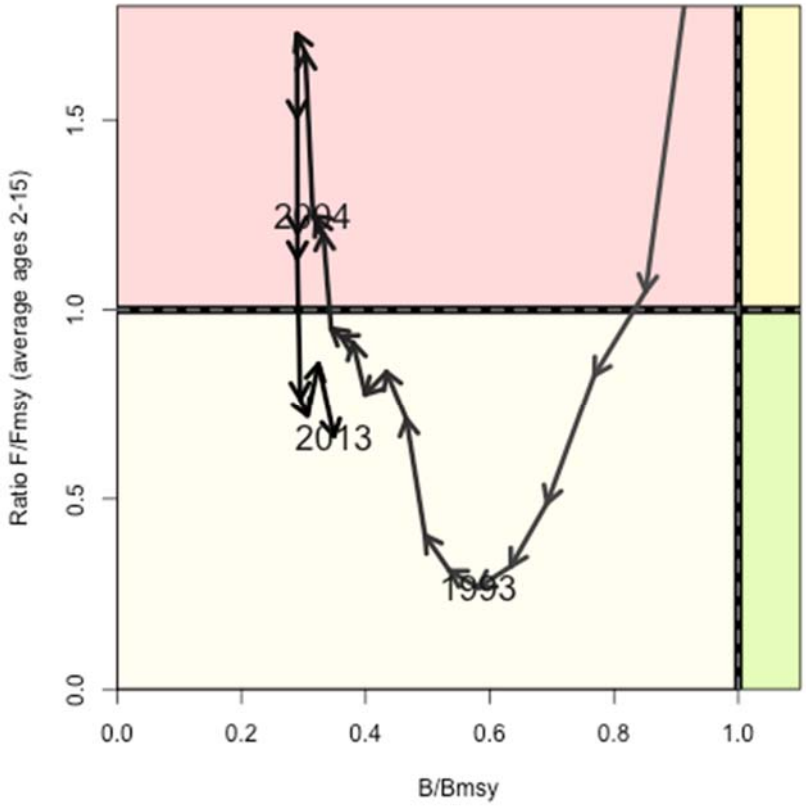


Figure 5b. Expansion of left hand quadrants of Figure 5a, focusing on the lower left quadrant.

Attachment 9

Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2014

The CCSBT Extended Scientific Committee (ESC) conducted a review of fisheries indicators and updated the operating model in 2014 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 2013 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 - 2013, 77.5% of the reported catch was taken by longline and 22.5% 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 36% since 1996 (Figure 1). The Japanese longline fishery (taking a wide age range of fish) recorded

its peak catch of 77,927 t in 1961 and the Australian surface fishery catches of young fish peaked at 21,501 t in 1982 (Figure 3). New Zealand, the Fishing Entity of Taiwan and Indonesia have also exploited southern bluefin tuna since the 1970s - 1980s, and Korea started a fishery in 1991.

On average 79% of the SBT catch has been made in the Indian Ocean, 17% 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 804t over the past two decades. This variation in catch is reflecting shifts in longline effort between the Atlantic and Indian Oceans. Fishing in the Atlantic occurs primarily off the southern tip of South Africa (Figure 4). Since 1968, the reported Indian Ocean catch has declined from about 45,000t to 8,000t, averaging about 19,500t, and the reported Pacific Ocean catch has ranged from about 800t to 19,000t, averaging about 5,200t, over the same periods (although SBT data analyses indicate that these catches may be under-estimated).

3. Summary of Stock Status

The 2014 assessment suggested that the SBT spawning biomass is at a very low fraction (9%) of its original biomass as well as below the level that could produce maximum sustainable yield. However, there has been some improvement since the 2011 stock assessment. 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.

Summary of indicators in 2014

There were mixed signals from the indicators in 2014, with no indication of concern. The overall results can be summarised as follows:

- The 2014 scientific aerial survey index of relative juvenile (2-4 year old) abundance is the highest value seen in the time series. Between 2010 and 2014 the index has shown more variation but with an increasing trend. The commercial SAPUE index also increased from 2013 to 2014, but to a lesser extent. The trolling survey index declined slightly between 2013 and 2014.
- Longline CPUE for the Japanese fleet for ages 6 and 7 increased steadily from 2007 to 2012 but decreased in 2013. The CPUE index values for ages 8-11 decreased slightly and gradually from 2008 to 2011 but have increased in more recent years. The CPUE indices for age 12+ has showed a decline from 2008 to 2010 and then fluctuated around a low level afterward; this is expected given the weak recruitment from 1999 to 2002.
- In 2012-13 and 2013-14 there was a decline in the mean length of SBT on the spawning ground, with a new mode of relatively small/young fish in the Indonesian catch. It remains to be determined whether the catch of smaller fish comes from the spawning ground and whether they are mature.

4. Current Management Measures

Total Allowable Catch (TAC)

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

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

In adopting the MP, the CCSBT emphasised the need to take a precautionary approach to increase the likelihood of the spawning stock rebuilding in the short term and to provide industry with more stability in the TAC (i.e. to reduce the probability of future TAC decreases). Under the adopted MP, the TAC will be set in three year periods. For the first three-year TAC setting period (2012-2014), the TAC was set as follows:

- 2012: 10,449 tonnes;
- 2013: 10,949 tonnes; and
- 2014: 12,449 tonnes.

For the second three-year TAC setting period (2015-2017), the CCSBT has set the TAC to 14,647 tonnes per year, with the TAC for 2016-2017 to be confirmed at CCSBT 21 (October 2014).

The current allocations of the TAC to Members and Cooperating Non-Members of the CCSBT for 2014 and 2015 is summarised below. In addition, some flexibility is provided to Members for limited carry-forward of unfished allocations within the three year period.

Current Allocations to Members

	2014	2015[1]
Japan	3,403	4,737
Australia	5,193	5,665
Republic of Korea	1,045	1,140
Fishing Entity of Taiwan	1,045	1,140
New Zealand	918	1,000
Indonesia	750	750[2]

[1] The allocations for 2015 assume that South Africa accedes to the Convention for the Conservation of Southern Bluefin Tuna in time for its allocation to be increased.

[2] The allocation to Indonesia from 2015 will be re-assessed once the planned independent Quality Assurance Review of Indonesia is completed. The above allocations do not take the re-assessment into account.

Current Allocations to Cooperating Non-Members

	2014	2015
Philippines	45	45
South Africa	40	40[3]
European Community	10	10

Monitoring, Control and Surveillance

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

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

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

In addition, the CCSBT has implemented a Quality Assurance Review (QAR) program to provide independent reviews to help Members identify how well their management systems function with respect to their CCSBT obligations and to provide recommendations on areas where improvement is needed. It is further intended that QARs will:

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

The Extended Commission may also consider the outcomes of QARs for fisheries management decision making. The 2014 QAR program has a significant development and continuous improvement dimension.

During 2014, the CCSBT will be giving consideration to:

- Develop a revised Transhipment Resolution;
- Developing a Port State Measures Agreement; and
- Strengthening its Observer Program Standards.

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

[3] The allocation for South Africa will increase to 150 tonnes if it accedes to the Convention by 31 May of the respective year.

Catch Documentation Scheme

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

Monitoring of SBT Transhipments at Sea

The CCSBT 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 harmonised and operated in conjunction with those of ICCAT and IOTC to avoid duplication of the same measures. ICCAT or IOTC observers on a transhipment vessel that is authorised to receive SBT are deemed to be CCSBT observers provided that the CCSBT standards are met.

List of Approved Vessels and Farms

The CCSBT has established records for:

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

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

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

During October 2013, the CCSBT adopted a Resolution on Establishing a List of Vessels Presumed to have Carried Out Illegal, Unreported and Unregulated Fishing Activities For Southern Bluefin Tuna.

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

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

5. Scientific Advice
Based on the results of the MP operation for 2015 – 17 in its 2013 meeting and the outcome of the review of exceptional circumstances in its 2014 meeting, the ESC recommended that there is no need to revise the Extended Commission's 2013 TAC decision regarding the TAC for 2015 – 17. The recommended annual TAC for the years 2015-2017 is 14,647.4 t.

6. Biological State and Trends

The 2014 assessment suggested that the SBT spawning biomass is at a very low fraction (9%) of its original biomass as well as below the level that could produce maximum sustainable yield. However, there has been some improvement since the 2011 stock assessment and the fishing mortality rate is below the level associated with MSY. The current TAC has been set using the management procedure adopted in 2011, which has a 70% probability of rebuilding to the interim target biomass level by 2035.

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

SOUTHERN BLUEFIN TUNA SUMMARY FROM ESC in 2014 (global stock)	
Maximum Sustainable Yield	33,000 t (30,000-36,000t)
Reported (2013) Catch	11,726 t
Current Replacement Yield	44,600 t (35,500 – 53,600)
Current (2014) Spawner Biomass	83,000 t (75,000 – 96,000)
Current depletion (current relative to initial)	
SSB	0.09 (0.08 – 0.12)
B10+	0.07 (0.06 – 0. 09)
Spawner Biomass (2014) Relative to SSB_{msy}	0.38 (0.26 – 0.70)
Fishing Mortality (2013) Relative to F_{msy}	0.66 (0.39–1.00)
Current Management Measures	Effective Catch Limit for Members and Cooperating Non-Members: 12,449t in 2014 and 14,647t for the years 2015-2017

Attachment 10

CCSBT Scientific Research Program

Table 1: The 2014 ESC noted the **completed** components of the work identified by 2013 ESC for the SRP 2014-18 (CCSBT-ESC Report Attachment 12).

Activity	ESC Priority	Input to	Status
Recruitment Proportion of juvenile population that move into the Great Australian Bight (potential otolith microchemistry component)		Stock structure for the OM and assumptions for recruitment indices and close-kin analysis.	Design/feasibility study completed for otolith microchemistry (CCSBT-ESC/1409/22)
Subadults Standardised CPUE series for other longline fleets (e.g. Taiwanese & Korean fleets)		Annual status advice	Initial work presented in CCSBT-ESC/1409/36 and CCSBT-ESC/1409/42
Spawning biomass Current close kin data (incorporation of the results from the completed research into the OM)	High	OM 2014	Completed in 2013 and 2014 (OMMP5 report)
Close-kin abundance estimation - design study for sampling framework	High	Fishery independent index of spawning stock	Initial design study completed and presented in CCSBT-ESC/1409/44
Collection of further close-kin samples	High	Fishery independent index of spawning stock	Completed in 2014 as funded by CCSBT

Activity	ESC Priority	Input to	Status
1. MP Implementation			
Consideration of the implications of the 2014 updated assessment for the MP	Essential[b]	MP implementation	COMPLETED at ESC 2014
2. Stock Assessment (OM development)			
New data in OM (2013) and reconditioning of OM (2014)	High/Essential	OM 2014	COMPLETED at ESC 2014

2015 Update of the Scientific Research Plan (2014-18)

Table 2A: The on-going scientific monitoring and annual work program activities, undertaken by the CCSBT, members and the ESC as updated in 2015 ESC. Most of these activities are undertaken directly by members, where the research may require CCSBT investment an estimated cost is included.

#

Activity	ESC Priority	Input to	Timeframe
3. 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) CCSBT request: Aging Indonesian otoliths (~$15k/y)	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 $800k/yr	Essential	OM, MP and annual status advice	annual
Trolling survey indices	Medium	Annual status advice	annual
SAPUE	Medium	Annual status advice	annual
b) Sub-adults			

Activity	ESC Priority	Input to	Timeframe
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	Essential	OM and annual status advice	annual
iii) **Biological parameters**			
Age-length relationship (keys)	High	OM	annual
4. MP Implementation			
Review of exceptional circumstances	Essential[b]	MP and annual status advice	annual
2016 MP run to estimate 2018-21 TAC	Essential[b]	MP	2016
Review of MP performance (2017)	Essential[b]	MP	2017
5. Stock Assessment (OM development)			
Revised stock assessment (2017) CCSBT investment?	Essential[b]	OM 2017	2017

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

Table 2B: Research activities identified by the 2015 ESC as components of the 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 (Priority)	Possible CCSBT investment
1. On-going scientific monitoring					
i. Characterization of catch (Future)					
Catch amount					
Unaccounted catch mortality - Unreported or uncertainty in retained catch by members Unaccounted catch mortality - Mortality from releases and/or discards Unaccounted catch mortality - Recreational fisheries Unaccounted catch mortality - Catches by non-members Any other sources of unaccounted mortality		2014 Extended Commission request, OM and annual status advice		Ongoing potentially with more work for MP Review and OM revision (High for all categories)	Possibly some are a broader CCSBT responsibility (e.g. catches by non-members, mortalities of releases/discards)
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	As soon as possible then ongoing (High)	

Activity	Potential research	Relevance	Reference	Timeframe (Priority)	Possible CCSBT investment
Age structure					
Review of sampling design for otolith sampling		Current sampling too sparse to be representative			
Calibration of age estimation (workshop)		Long time since previous workshop and relatively low cost		2016 (High)	Draft proposal paper 24
Instigate moves 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 – outside current timeframe, post 2018)	

Activity	Potential research	Relevance	Reference	Timeframe (Priority)	Possible CCSBT investment
ii. Abundance indices					
	a) Recruitment				
Proportion of juvenile population that move into the Great Australian Bight (gene tagging in the longterm,)		Stock structure for the OM and assumptions for recruitment indices and close-kin analysis.	Para. 81-83 ESC (2012)	(Medium)	
Migration of age 1 SBT (electronic tagging during troll survey)				Ongoing (Medium)	
Design study on alternative measures of absolute juvenile recruitment (gene-tagging approaches)		Estimates of absolute abundance of cohorts for the OM	ESC 2013	Design study 2015 (High)	Draft proposal paper 25 $75k design study
Pilot gene-tagging program: Absolute abundance estimates of juvenile recruitment		Demonstration feasibility obtaining absolute abundance estimates of cohorts via gene-tagging for use in the OM	ESC 2013	Pilot gene-tagging 2016 and 2017 (High, dependent on outcomes of design study)	Draft proposal paper 25 $260k year 1, $265 year 2 for pilot tagging
Environmental interactions with the scientific aerial survey		Improved relative recruitment index; MP implementation	Para. 29 ESC (2012)	Partly underway in the Australian GAB project (Medium)	
Review scientific aerial survey standardisation; Previous papers provide the details of calibration and model selection		OM and MP		(High) Members review previous papers and discuss at ESC 2015	

Activity	Potential research	Relevance	Reference	Timeframe (Priority)	Possible CCSBT investment
Standardised CPUE series for Taiwanese longline fleet		Annual status advice	Para. 54-56 & 60 ESC 2012 OMMP	Ongoing, CPUE working group (High)	
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 (Essential)	
Standardised CPUE series for Korean longline fleet		Annual status advice	Para. 54-56 & 60 ESC 2012 OMMP	Ongoing, CPUE working group (High)	
c) Spawning biomass					
Close-kin abundance estimation (revise after further discussion, possibly refer to a more detailed document)				(High)	
Continued close-kin sample collection				Ongoing (High)	$35k/yr
Further work (some laboratory, some desk top) on the potential genetics approach to inform an expert review/workshop		Further work on genotyping approaches to inform the decision on long-term approach.		2015 (High)	$80k
Expert review workshop (ESC and experts familiar with the techniques and their use in this context)		This will review and decide on the long-term approach to genotyping		2015 (High)	Workshop costs to be estimated with Secretariat, including the cost of experts.

Activity	Potential research	Relevance	Reference	Timeframe (Priority)	Possible CCSBT investment
Follow-up to review process and dependent on review outcome.		Further locus development, and validation Timing for 2017 assessment may be advantageous given uncertainties generated by unaccounted mortality scenarios (Option 1)		(High) Option 1: 2015 Option 2: 2016	<$230k
Medium term: process the accumulated back catalogue of samples (4-6 years of accumulated samples)		Timing for 2017 assessment may be advantageous given uncertainties generated by unaccounted mortality scenarios (Option 1)		Option 1: 2016 to input to the 2017 assessment. Option 2: 2017 to input to the 2020 assessment.	Cost – decided post review, indicative cost $250/yr (this cost will occur across several years depending on the timeframe decisions)
Long-term time series		Fishery independent index of spawning stock, information on fecundity, adult selectivity and mortality		Ongoing, once previous stages are completed	Cost: to be decided post review, indicative cost $150k/yr
Associated OM refinement/development associated with incorporating close-kin time series etc.		This requires discussion and further consideration at 2015 ESC			

Activity	Potential research	Relevance	Reference	Timeframe (Priority)	Possible CCSBT investment
iii. Biological parameters					
Independent estimate of maturity schedule		Defining effective reproductive contribution in the OM, MSY estimation	OMMP workshop ESC 2013	Sample collection, 2015 and ongoing (High) Processing & analysis prior to 2017? (Medium)	Draft proposal paper 23 Workshop on maturity criteria & lab analysis (2016 or possibly combine with otolith workshop)
Understanding within season spawning behaviour and skip spawning behaviour (e.g. electronic tagging approaches and otolith microchemistry for spawning frequency). Note this may draw on close-kin future work (if half-sibling pairs are identified)		Defining effective reproductive contribution in the OM	Para. 118 ESC 2012	Reconsider in 2015 (Medium)	
2. MP Implementation					
Terms of reference for formal MP review [Indicators of MP performance/improvement]		Preparation for first formal review of the MP (2017).	ESC 2013	2015 ESC – substantive agenda item to discuss what should be done before 2017 (High)	
Feasibility of alternative indices for input to the MP (estimated trends from the stand-alone close kin assessment, gene-tagging)		For revised MP	ESC 2013	Longer term (Medium)	

Activity	Potential research	Relevance	Reference	Timeframe (Priority)	Possible CCSBT investment
3. Stock Assessment (OM development)					
	Selectivity of the fishery on the spawning grounds (note potential link to close-kin). 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)	OM – basis for domed selectivity and defining effective reproductive contribution	Para. 115 ESC 2012, OMMP report	Prior to 2017 (High)	
	Mortality estimates for mature fish (10+ years old) (Note the potential through close kin)	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	Design/feasibility study for gene-tagging could consider cohort abundance 2015 (High) Longer term (Medium)	Draft proposal paper 23
	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 (Low)	
	Strategic review and refinement of operation of the OM code	Update and improve efficiency of code	ESC 2013	Before 2017? (Medium)	

Activity	Potential research	Relevance	Reference	Timeframe (Priority)	Possible CCSBT investment
Evaluating possible changes in the OM (model structure)				High 2015 ESC Discussion or jointly with review meeting of close-kin	
Incorporation of SRP tagging data from 2000s		Related to spatially explicit model	ESC 2013	Longer term (medium)	

Attachment 11

Timeline and decisions for future close-kin work

The decisions and future steps required to proceed with the close-kin work were mapped out in the meeting and are described here:

Background: There is now the opportunity to extend CK into a time-series for monitoring SSB in future, as a way (in fact the only way) to provide a direct monitoring of SSB. Because genotyping techniques have advanced rapidly since the previous CK project began in 2006, there are now several alternatives, which need to be considered: microsatellites (as used already on SBT); targeted SNP arrays ("SNP-chips") as used e.g. in large-scale genotyping of salmon in the Western USA;
There already exist 14 000 genotyped fish tissue samples from 2006-2010, and a further 12,000 tissue samples from 2011-2014 that are frozen but not genotyped. It is quite cheap to collect more samples every year (the main expense is at the time of genotyping) and therefore collection should continue while the decision on genotyping technologies are being resolved.

Issues: New techniques could be cheaper and more reliable in the long term; especially, DArTs would address long-standing difficulty in estimating adult selectivity and mortality, which are particularly important in e.g. projecting SSB rebuilding rates, through the identification of HSP. Even though a change of method would incur some cost in having to re-genotype some fish from 2006-2010 with a different techniques, from a medium-to-long-term perspective it may still be cheaper and more reliable to change.

Decisions: The ESC need to make a wise decision about the best (i.e. most cost-effective and reliable in the long-term) genotyping method before genotyping more fish. For example, we don't want to re-genotype in future more fish than strictly necessary because of making an unwise choice now.

Future short-term steps: The decision to be made is subtle and technical, and therefore it would be useful to have external expert review of proposed options, in a workshop.

Step 1: Some preparatory work is needed before hosting an expert workshop: preliminary calculation of numbers of loci needed in different techniques; lab- and desk-based investigation of Dart genotyping results; preparation of report suitable for non-CCSBT experts.

Step 2: The workshop could happen in 2015, and would produce a report and recommendations, for consideration by the 2015 ESC.

Step 3: Post ESC 2015, some further lab work might be needed, depending on the methods adopted:

– if microsatellites are chosen, then we may need to develop an extra set of about 5 loci to safeguard against false-negatives and false-positives in the long term (when the number of fish being compared will be much larger than it has been so far with CK).
– if "SNP-chips" are chosen, then there is the need to select exactly which SNPs to use and which proprietary company to use.
– if "Darts" are chosen, then we need to validate that it really does show Half-Siblings in SBT, by trialling on a set of 3000 juveniles to confirm that HSP can be reliably identified. (This would become part of the long-term data).

Future medium-term steps: The future medium term close-kin work will involve ongoing large-scale genotyping, which could start after ESC 2016. The actual timing for this stage would be influenced by the outcomes of the workshop and the desired timing of results by the ESC and EC in the context of the next assessment and MP review. Further large-scale genotyping would involve:
– collecting and genotyping perhaps around 1500 tissue samples (using Darts methods) or 2500 samples (using other methods, which are less informative) fish per year.
– gradually working through the "back-catalogue" of samples accumulated from 2011 onwards. This can be done gradually; the time scale for completing it can be reviewed along with final consideration of appropriate long-term sample sizes.

Attachment 12

Three year workplan for projects to be funded by the CCSBT

(abbreviations: WS=Workshop, Sec=Secretariat Staff, Interp=Interpretation, Chair=ESC Chair, P=Independent Advisory Panel, IE=Invited Expert, P=Participants, Cat=Catering)

		Costs and/or resources required for projects to be funded by CCSBT		
		2015	2016	2017
1	ESC Meeting	5 days, Chair, full panel, full Interp, 3 Sec	6 days, Chair, full panel, full Interp, 3 Sec	6 days, Chair, full panel, full Interp, 3 Sec
2	OMMP Meeting		4 days, 3 Panel, OMMP consultant, Cat for 20 P, no Interp, No Sec	4 days, 3 Panel, OMMP consultant, Cat for 20 P, no Interp, no Sec
4	CPUE Webinar	3 Panel days	3 Panel days	3 Panel days
5	Routine OMMP Code Maintenance / Development	5 Consultant days	5 Consultant days	5 Consultant days
6	Evaluation of possible changes in the OM structure	2 day technical WS, immediately prior to ESC. 2 Panel, Cat for 20 P, no Interp, no Sec		
7	Continued close-kin sample collection[1]	$35,000	$35,000	$35,000
8	Scientific Aerial Survey[2]	Up to $800,000[3]	Up to $800,000[3]	Up to $800,000[3]
9	Aging Indonesian Otoliths[1]	$15,000[4]	$15,000	$15,000
10	Review of otolith sampling design & age estimation calibration		3 day WS in Bali[5], 2 Interp (whispering), 1 IE[6], Cat for 15 P, no Sec	
11	Design/feasibility study of gene tagging for providing absolute recruitment estimates[1]	$75,000		
12	Pilot gene tagging project for for providing absolute recruitment estimates[1]		$265,000	$265,000

[1] This work would be conducted by CSIRO under contract to the CCSBT.
[2] This work would be conducted by the Australian Department of Agriculture and its sub-contractors under contract to the CCSBT.
[3] $800,000 is the total cost for this survey. CCSBT is currently contributing $100,000/year. Australia has paid the remaining amount but has requested full funding from CCSBT.
[4] If aging of Indonesian otoliths is not funded in 2015, this will add an additional $15,000 to this item for 2016.
[5] Venue to be provided for free at Indonesia's Research Institute for Tuna Fisheries.
[6] from Fish Ageing Services Pty Ltd, Australia.

13	Preparatory work for expert review of which genotyping technique to use for further Close-Kin (see item 14): preliminary calculation of numbers of loci needed in different techniques; lab- and desk-based investigtions of Dart genotyping results; preparation of report suitable for non-CCSBT [1]	$85,000		
15	Further locus development and validation (conditional on 13-14) [1]		<$230,000	
16	Process accumulated backlog of close-kin samples (4-6 years), then conduct annual processing for long-term time series. (conditional on 13-14) [1]			$250,000/year (~6 years to process back log), then $150,000/year for annual processing
17	Independent estimate of maturity schedule		3 day WS on maturity criteria in Bali[5], Cat for 15 P, no Interp, no Sec + $70,000 for otolith preparation & reading[1] + $30,000 - 0.2 FTE for histology reading biologist[1]	$15,000 – 0.1 FTE for experienced statistician[1]

Attachment 13

Data Exchange Requirements for 2015

Introduction

Data exchange requirements for 2015 are provided in Annex A. The Annex shows the data that are to be provided during 2015 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 2014. 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 2015 to allow the development of the necessary data loading routines.

Data listed in Annex A should be provided for the complete 2014 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 2013 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 2013 data) must be accompanied by a detailed description of the changes.

Annex A

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
CCSBT Data CD	Secretariat	31 Jan 15	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 2014 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 2015 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	23 Apr 15	New Zealand to provide the secretariat with a summary of observed trips, by vesselID, for New Zealand joint venture vessels. *Secretariat Comment: 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 15	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 15	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 15	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 15	The mortality allowance (kilograms) that was used in the 2014 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 "**For MP/OM**" means that this data is used for both the Management Procedure and the Operating Model. If only one of these items appears (e.g. **For OM**), then the data is only required for the specified item.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Catch and Effort	all Members (& Secretariat)	23 Apr 15 (New Zealand)[2] 30 Apr 15 (other members, South Africa & Secretariat) 31 July 15 (Indonesia)	Catch (in numbers and weight) and effort data is to be provided as either shot by shot or as aggregated data (New Zealand provides fine scale shot by shot data which is aggregated and distributed by the Secretariat). The maximum level of aggregation is by year, month, fleet, gear, and 5x5 degree (longline fishery) or 1x1 degree for surface fishery. Indonesia will provide estimates based on either shot by shot or as aggregated data from the trial Scientific Observer Program.
Non-retained catches	All Members	30 Apr 15 (most Members) 31 July 15 (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 15	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 1*1 spatial resolution	Secretariat	30 Apr 15	Aggregated New Zealand catch and effort data, to 1*1 degrees of resolution instead of 5*5 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.*
NZ joint venture catch and effort with Observers	Secretariat	27 Apr 15	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 15	Shot by shot data for New Zealand joint venture vessels in statistical areas 5 and 6 for 2014. 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 new CPUE index.

[2] The earlier date specified for New Zealand is so that the Secretariat will be able to process the fine scale New Zealand data in time to provide aggregated and raised data to members by 30 April.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Raised catch data for AU, NZ and KR catches	Australia, Secretariat	30 Apr 15	Aggregated raised catch data should be provided at a similar resolution as the catch and effort data. Japan and Taiwan do not need to provide anything here because they provide raised catch and effort data. New Zealand does not need to provide anything here because the Secretariat produces New Zealand's raised catch data from the fine scale data provided by New Zealand. Similarly, the Secretariat will be calculating and providing the raised catch data for Korea (based on raising Korea's catch effort data to its total catch).
Raised number of hooks data for NZ catches	Secretariat	30 Apr 15	Raised New Zealand number of hooks data, to be provided to NZ only, generated from NZ fine scale data by the Secretariat.
Observer length frequency data	New Zealand	30 Apr 15	Raw observer length frequency data as provided in previous years.
Raised Length Data	Australia, Taiwan, Japan, New Zealand, Korea	30 Apr 15 (Australia, Taiwan, Japan) 7 May 15 (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 15	Raw Length Frequency data from the South African Observer Program.
RTMP Length data	Japan	30 Apr 15	The length data from the real time monitoring program should be provided in the same format as the standard length data is provided.
Indonesian LL SBT age and size composition	Australia Indonesia	30 Apr 15	Estimates of both the age and size composition (in percent) is to be generated for the spawning season July 2013 to June 2014. Length frequency for the 2013 calendar year and age frequency for the 2013 calendar year is also to be provided. Indonesia will provide size composition in length and weight based on the Port-based Tuna Monitoring Program. Australia will provide age composition data according to current data exchange protocols.

[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
Direct ageing data	All Members	30 Apr 15	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 15	Estimates of the different trolling indices for the 2014/15 season (ending 2015), including any estimates of uncertainty (e.g. CV).
Tag return summary data	Secretariat	30 Apr 15	Updated summary of the number tagged and recaptured per month and season.
Catch at age data	Australia, Taiwan, Japan, Secretariat	14 May 15	Catch at age (from catch at size) data by fleet, 5*5 degree, and month to be provided by each member for their longline fisheries. The Secretariat will produce the catch at age for New Zealand and Korea using the same routines it uses for the CPUE input data and the catch at age for the MP.
Total Indonesian catch by month and % of Indonesian LL catch that is SBT	Indonesia	15 May 15	The 2014 catch of SBT in numbers and weight and the number of vessels fishing for SBT for each port and month. Also the 2014 total catch by weight of each species.
Global SBT catch by flag and by gear	Secretariat	22 May 15	Global SBT catch by flag and gear as provided in recent reports of the Scientific Committee.
Raised catch-at-age for the Australia surface fishery **For OM**	Australia	24 May 15[7]	These data will be provided for July 2013 to June 2014 in the same format as previously provided.
Raised catch-at-age for Indonesia spawning ground fisheries. **For OM**	Secretariat	24 May 15	These data will be provided for July 2013 to June 2014 in the same format as on the CCSBT Data CD.
Total catch per fishery and sub-fishery each year from 1952 to 2014. **For MP/OM**	Secretariat	31 May 15	The Secretariat will use the various data sets provided above together with previously agreed calculation methods to produce the necessary total catch by fishery and total catch by sub-fishery data required by both the Management Procedure and the Operating Model.

[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 1 June to provide sufficient time for the Secretariat to incorporate these data in the data set it provides for the OM on 1 June.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Catch-at-length (2 cm bins) and catch-at-age proportions **for OM**	Secretariat	31 May 15	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 15	Calculate the total catch-at-age in 2014 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 15	Catch (number of SBT and number of SBT in each age class from 0-20+ using proportional aging) and effort (sets and hooks) data[8] by year, month, and 5*5 lat/long for use in CPUE analysis.
CPUE monitoring and quality assurance series.	Australia / Japan	15 Jun 15 (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 OM/MP**	Japan	15-Jun-15 (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 15 (every attempt will be made to provide this at least 4 weeks earlier)	Estimate of the aerial survey index from the 2014/15 fishing season, including any estimates of uncertainty (e.g. CV).
Commercial spotting index	Australia	31 Jul 15	Estimate of the commercial spotting index from the 2014/15 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.