Commission for the Conservation of Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Fourteenth Meeting of the Scientific Committee

5 - 11 September 2009
Busan, Korea

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Agenda Item 1. Opening of meeting

1. The independent Chair, Dr Annala, declared the Scientific Committee meeting open and welcomed all participants.

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 Fourteenth 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 6:23 pm, on 11 September 2009.

List of Appendices

Appendix

1 List of Participants

2 Report of the Extended Scientific Committee for the Fourteenth Meeting of the Scientific Committee

Appendix 1

List of Participants
Fourteenth Meeting of the Scientific Committee

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みなみまぐろ保存委員会

Appendix 2

Report of the Extended Scientific Committee for the Fourteenth Meeting of the Scientific Committee

5 - 11 September 2009
Busan, Korea

Report of the Extended Scientific Committee for

the Fourteenth Meeting of the Scientific Committee

5-11 September 2009

Busan, Korea

Agenda Item 1. Opening

1. The meeting was opened by the Chair of the Extended Scientific Committee, Dr Annala, who welcomed participants.

1.1 Introduction of Participants

2. Participants introduced themselves. The list of participants is shown at **Attachment 1**.

1.2 Administrative Arrangements

3. There were no new administrative arrangements since the previous meetings.

Agenda Item 2. Appointment of Rapporteurs

4. Australia, Japan and New Zealand assigned 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. Members either tabled their national reports for questions, or provided brief presentations of their reports
8. In response to questions from participants, the following information was provided in addition to that in the national reports:-
   - Australia advised that recreational catch surveys have recently been conducted by South Australia and Tasmania and that the results of these surveys, if available, will be reported to the ESC in 2010.
   - Korea advised that observer costs had increased significantly between 2007 and 2009. This was caused in part by the increased transportation costs to

reach the fishing grounds since fishing effort had become concentrated off South Africa.

- It was noted from Table 1 of CCSBT-ESC/0909/04 that, according to the Trade Information Scheme (TIS), Korean SBT exports for 2008 were approximately 40% less than the total catch reported by Korea. Korea was asked if this was because of increased domestic consumption. The Secretariat advised that there are significant time lags in receiving TIS data, and it can take up to 2 years to receive all the data.
- Taiwan commented that its SBT fishery is a seasonally targeted fishery and is operating in different fishing areas from its yellowfin and bigeye tuna fisheries. Taiwan also noted that its observer coverage is not representative of its overall SBT fishery because it is difficult to deploy observers in the area off South Africa due to the short fishing season and poor ocean conditions at the time of year when that fishery operates.
- New Zealand advised that:
  - The increase in charter fleet CPUE in the last year was largely due to an increase in the number of small SBT,
  - It is intended to maintain high observer coverage of the charter fleet and that in 2009, the coverage had increased to include all vessels, and
  - The reduction in effort in the domestic fishery over the past few years was largely due to SBT being introduced to the Quota Management System in 2004 and the subsequent rationalisation of the fleet.
- Japan advised that its vessels must release any SBT caught if the vessel does not have SBT quota and that penalties would be imposed if any SBT were retained.
- Indonesia advised that:
  - Information on catch locations within the Indonesian EEZ recorded through the scientific observer program could be included in future data submitted to the Secretariat as part of the annual Data Exchange, and
  - Information on total landings together with information on observed vessels could be included in its national report to future meetings of the ESC.

9. Members updated the summary of observed catch and effort coverage reported by the previous ESC meeting. This update is provided at **Attachment 4**.
10. It was requested that for the next ESC meeting, Members and Cooperating Non-Members provide their national reports according to the agreed template format for reports to the Scientific Committee.
11. The ESC recommended that Members and Cooperating Non-Members attempt to achieve an observer coverage level at or above the target level of 10% in their fisheries; that such observer coverage is representative of the fishery wherever possible; and that high quality observer data is collected. The ESC noted the value of observer coverage for a range of purposes including collection of length, age, and other biological data for stock assessment; tag reporting, and monitoring of ERS catches.

4.2 Secretariat Review of Catches

12. The Secretariat presented paper CCSBT-ESC/0909/04. The estimated SBT catch for the 2008 calendar year was 12374t, including the unreported catch scenarios. The global SBT reported catch by flag is shown at **Attachment 5**. The unreported catch estimate scenarios have not been included in **Attachment 5**, and Attachment A of CCSBT-ESC/0909/04 will remain confidential.

13. Conversion factors used to produce the TIS summary requested by the ESC have been revised by the Secretariat and now include Members' conversion factors wherever possible.

14. Australia advised that its "Dressed" conversion factor reported in Table 2 of CCSBT-ESC/0909/04 was fresh gilled and gutted. Australia asked the Secretariat to regard its "Dressed" SBT as "Gilled and Gutted" SBT and use the conversion factor 1.2 in the future. It was noted that a description of product types would be useful and Members were asked to provide the Secretariat with such information. These descriptions will be presented at future meetings by the Secretariat.

15. Taiwan noted that according to its calculations, the estimated catch from the TIS is not higher than its reported catch in 2003. Taiwan will work with the Secretariat to check this figure.

Agenda Item 5. Report from intersessional CPUE modelling work

16. The Chair of the CPUE modelling working group reported on intersessional web-based meetings and discussions held in the margins of the Operating Model and Management Procedure Technical Meeting (OMMPTM) at Seattle (July 2009). A report is given in Attachment 5 of the OMMPTM report. Paragraphs 5-16 provide a summary of intersessional CPUE modelling work. Table 1 in Attachment 5 summarises progress against 6 CPUE tasks agreed to at the 13th Meeting of the Scientific Committee (SC13). The CPUE working group noted that further work was required to:
    - Extend the CPUE series to the most current year using RTMP data;
    - Monitor the number of cells fished for both core vessels and all vessels at the 5x5 and 1x1 scale;
    - Monitor changes in spatial patterns of fishing since the introduction of a new Japanese SBT longline management scheme in April 2006; and
    - Further analyse differential trends in observed and non-observed trips.

17. The CPUE modelling group met to consider its intersessional work. Its report is shown at **Attachment 6**. Proposed intersessional tasks, their timing and the people involved are shown at Table 1 of **Attachment 6**. The CPUE modelling working group recommended that it meet in the margins of the MP working group meeting proposed for mid 2010 (as it did in 2009). It recommended that in future the CPUE indicators used by ESC should be based upon, where possible, the new W0.5 and W0.8 CPUE series.

Agenda Item 6. Report from the Operating Model and Management Procedure Technical Meeting

18. The Chair of the Operating Model and Management Procedure Technical Meeting (OMMPTM) held in Seattle in July 2009 provided a summary of the outcome of the meeting. The aim of the meeting was to determine the input data and final structure of the OM for constant catch projections to be run at SC14. The selection of input data followed the agreed base case inputs decided at SC13, which are summarised in paragraph 18 of the OMMPTM meeting report. The main change made following SC13 was the structure of likelihoods for tagging data (CCSBT-ESC/0909/20). The model now incorporates tagging data disaggregated by cohort and tag-specific estimates of shedding rates. At the OMMPTM, the grid was collapsed by reducing the number of options for some parameters (omega, effective sample size, M_0). The natural mortality schedule was reviewed to allow senescence of older SBT (details provided in Attachment 7 of the OMMPTM report). A list of robustness trials was compiled in paragraph 43 of the OMMPTM report, to run with the full grid in addition to any subsequent robustness trials agreed to at SC14. It was confirmed that following the OMMPTM, a range of steepness values (0.3 to 0.9) were examined intersessionally by Australia and Japan.

Agenda Item 7. Australian SBT Farm Study

19. Paper CCSBT-ESC/0909/11 analysed available data that could be used to formulate a length-weight conversion factor for use with stereo-video monitoring systems. Existing literature on variability in the length-weight relationship of southern and northern bluefin tuna (NBT) was reviewed. While very little information was available for SBT, existing literature suggests that the length-weight relationship of NBT is fairly robust to changes in growth rate and sampling location.

20. The paper analysed four available length-weight data sets : poling data from the Great Australian Bight (1987-1998); research data from the Great Australian Bight (2004-06); 40-fish sample data (1995-2008); and Korean length-weight data provided through the CCSBT data exchange (2006-07). Variability both within and among data sets was explored, but analyses were somewhat inconclusive. Two conversion factors were provided; however, the paper concluded that better data may become available in the future once the CCSBT Catch Documentation Scheme (CDS) is implemented. Australia stated that final decisions regarding a length-weight conversion factor for potential use with stereo-video will require consultation with Australia’s SBT industry and other stakeholders in keeping with the Australian Government’s domestic fishery management practices.

21. In discussions, the Secretariat noted that CDS data possibly should not be relied on for length-weight relationships, particularly until such aspects as measurement collection protocols were clarified.

22. In relation to use of data from the 40-fish sample as reported in CCSBT-ESC/0909/11, Japan raised the possibility that uncertainties about whether fish weights change during towing could lead to possible bias in that data set. For

this reason it was suggested that it might be preferable to use data obtained from the fishing ground. One source of such information was observer measurements of mortalities. Australia noted that this was a possibility, although the data were very limited (e.g. 11 measurements from 17 mortalities in 2008), and would be unlikely to change the results.

23. It was noted that the length-weight relationships presented in the paper appeared robust to possible variability such as growth rates and seasonality. Nonetheless, general discussion was still required on how to collect length data from the surface fishery, to ensure that in the future better estimates of total catches could be obtained.

24. It was clarified that the paper presented did not use any direct measurements from stereo-video monitoring. Most of the scientific assessment for use of stereo-video monitoring has been completed. Trials under commercial operating conditions have not yet been carried out, and the nature and timing of future trials have not yet been determined.

25. Papers CCSBT-ESC/0909/29 and CCSBT-ESC/0909/30 were presented. The papers summarised analysis on age composition of farmed SBT based on size data at harvest in 2007 and 2008, respectively. CCSBT-ESC/0909/29 extended the analysis in paper CCSBT-ESC/0809/39, to address concerns over potential sampling bias discussed at ESC14. Fresh and frozen SBT were analysed separately to allow for possible difference in size distribution for the two types of product. Likewise frozen SBT was subdivided into two classes of markets/fates: freezer vessels and freezer containers.

26. CCSBT-ESC/0909/29 outlined that size frequencies of 187,706 farmed SBT were decomposed into age for each month and market/fates. Age compositions were estimated as 6% for age 2, 54% for age 3, 38% for age 4 and 3% for age 5. These estimated age compositions differed appreciably from age compositions reported from the 40-fish sample (9% for age 1, 43% for age 2, 44% for age 3 and 3% for age 4). The paper also estimated the total catch of Australian purse seine fisheries in the 2007 fishing season as 7,781 tonnes, which was 49% larger than the reported Australian purse seine catch (5,230 tonnes).

27. CCSBT-ESC/0909/30 summarised analysis on age composition of farmed SBT based on size data at harvest (N=94,403) in 2008. Estimated age compositions were 12% for age 2, 85% for age 3, 2% for age 4 and 1% for age 5 in a case which would be underestimated in age. These estimated age compositions differed appreciably from age compositions reported from the 40-fish sample (24% for age 2, 71% for age 3 and 4% for age 4). In the paper, the total catch of the Australian purse seine fisheries in the 2008 fishing season was also estimated to be within a range of 5, 798 to 6, 647t, which was 11-28% larger than the reported Australian purse seine catch (5211t). The paper emphasized the conclusion which was obtained in CCSBT-ESC/0909/29.

28. Japan suggested that the age-composition estimated in this analysis should replace the current adjustments made in age composition for historical data and be used in the stock assessment by the ESC. Japan also suggested that bias in the 40-fish sample be examined, and that methods of estimating age composition and total weight of catch in the Australian surface fishery needed to be improved.

29. Australia stated that it had several concerns about the methodology and data used in papers 29 and 30, including:

- The inappropriateness of applying an age composition from wild fish to estimate age distribution from harvested fish that have been reared for the purpose of increasing their weights and lengths (irrespective of the number of fish measured);
- Growth rates amongst farmed fish are likely to be variable, because of a range of factors including different operators, farming and feeding patterns; and different ways of treating fish depending on their size, e.g. retaining small fish in pens for longer;
- Farming practices in 2007 were atypical, with fish held in pens for several months longer than usual;
- The use of information on length-weight relationships from the 1960s (Robins 1963), despite evidence that growth rates have increased since then, as outlined in paper CCSBT-ESC/0909/11.

30. For these reasons, Australia considered it would not be appropriate to use the uncertain estimates contained in papers 29 and 30 as an input to the stock assessment.

31. Japan considered that while growth may vary depending on various factors, the data sets analysed in papers 29 and 30 are large. The larger sample size would dilute the differences in variability of growth rate of individual fishes. If growth rates between fish were appreciably variable, then a clear peak in the shape of the distribution would not be evident. Further, if faster growing SBT were preferentially harvested, only smaller size SBT would be seen in September and October, but such a pattern is not evident.

32. New Zealand considered that the methodology used in papers 29 and 30 was appropriate for decomposing mixtures of normal distributions. Similar comments had been made by the panel at ESC13 (see paragraph 45 of the report of ESC13). The combined distributions from the individual cohorts in the 2007 data appeared to fit the total length distribution well, showing increases in average length of the cohorts throughout the year. The data from 2008 was more unimodal in CCSBT-ESC/0909/30, and therefore the mixture analysis was more difficult and less convincing than the analysis of 2007 data (CCSBT-ESC/0909/29).

33. Paper CCSBT-ESC/0909/31 was presented. This paper summarised on growth increments of farmed SBT based on tag/recapture data. The CCSBT tagging database includes tag/recapture data for 141 SBT that were tagged between 2003 and 2007, which were caught by purse seine within 30 days of their tagging, and reported from the farming pontoons after fattening. Based on these tagging data, growth increments were calculated using the initial weight as estimated from the reported body length at tagging, and the final weight as reported from the farming pontoons. The results indicated a growth increment through farming as a multiplicative factor of 1.8±0.4 (average ± 1SD) for age 2 fish (the average period in the farm for these tagged fish was 161 days), 1.5±0.3 for age 3 fish (165 days), and 1.4±0.3 for ≥ age 4 fish (195 days). It was concluded in paper CCSBT-ESC/0909/31 that comparison of length-weight relationships suggests that fattening of farmed SBT is scarcely-affected by the presence or absence of

tag. The analysis concluded that growth increments which were reported by Australia in the Yearly TIS Farm summary, which range from 1.880 to 2.205, were overestimated.

34. It was noted that the individual growth rates reported were variable (the average growth increment was estimated as a multiplicative factor of 1.6, with a standard deviation 0.4; minimum 0.7, maximum 3.1) (for further details see Table 1 of CCSBT-ESC/0909/31) . Although the range of growth estimates from the yearly TIS farm summaries are considered to be within the variability about the mean growth increment, the mean estimates in all years are higher than the average of 1.6 reported in CCSBT-ESC/0909/31. The ESC briefly discussed but did not agree on whether or not the growth rate difference between tagged and untagged fish was significant.

35. Australia noted that the analysis used length-weight relationships reported in Robins (1963), though it is acknowledged that growth rates have likely changed since then. The sample size reported was also relatively low, and involved summing data over a number of years (2002-2007). Australia considered the growth rates of tagged fish in CCSBT-ESC/0909/31 fall within the growth rate reported by the Australian operators.

36. In response to a question from the panel, it was clarified that the paper reports standard deviations around the mean of 1.6, and that the standard error would be quite small (0.03), indicating a significant difference between the growth rates reported.

37. New Zealand noted the problem in knowing total catch from the surface fishery. This uncertainty is currently reflected through an agreed bias scenario of 20% in the surface fishery used in the model up until 2008. This situation needs to be managed in the future so there are not ongoing concerns about overcatch in the surface fishery. For this reason, there is a need for Australia to provide length data or total catch data for the surface fishery by proceeding with stereo-video monitoring or an equivalent. Australia confirmed its government and industry were still establishing the details of how improved monitoring may be implemented.

38. Japan invited a small working group to discuss possible improvements to the methods applied in papers CCSBT-ESC/0909/29 and 30. Although agreement could not be reached regarding the validity of the approaches used in these papers, panel members considered the age class modes to be sufficiently clear in the final distributions to warrant further use of the methodology, including consideration of possible improvements to the methods. Particular mention was made of the modes corresponding to age 2 and age 3 SBT in paper CCSBT-ESC/0909/29 (analysis based on 2007 data):

- Australia suggested that the most productive way to improve the analyses was for Japan to provide all data (lengths, weights and details on the receiver and vessel for each shipment etc), to other members. Australia requested that these data be provided so that the results could be reproduced and any inaccuracies identified.
- It was also noted that the modes presented in papers 29 and 30 did not seem to move, and if these were really related to age classes then it would be reasonable to assume that modes would track over months. The lack of

observed movement was potentially an artefact of the input data and methods used.

- It was further suggested that because normal mixture methods sometimes produce spurious modes (as observed in CCSBT-ESC/0909/30), it might be worth exploring other distribution methods that produce broader distributions (e.g. t-distributions, Cauchy distributions). Also, hierarchical methods would potentially allow the analysis to be done over multiple years, thus maximising information content and assessing consistency.
- Japan also invited comments on the methods applied in paper CCSBT-ESC/0909/31. Australia stated that it considered the range of individual growth rates presented in this paper captured the growth rates reported for farmed SBT through the Yearly TIS Farm Summary. However, panel members considered that the standard error of the growth rate presented in CCSBT-ESC/0909/31 was small (0.03), and that all of the growth rates reported for farmed SBT did not fall within the standard error.
- Australia suggested that because grow-out periods differed greatly from year to year, the methods could be refined by accessing public data on annual grow-out periods, such as those published by the Port Lincoln Times. Australia further suggested that Japan conduct a review of literature on the growth rates of northern bluefin tuna farmed in the Mediterranean, for which much more information is available.
- Japan thanked the small working group for their suggestions.

39. Comments on the analysis of possible bias in the Australian farm operations made by the scientific advisory panel and Members are provided at **Attachment 7**.

Agenda Item 8. Monitoring of Japanese markets

40. Paper CCSBT-ESC/0909/09 provided estimates of unreported longline catch of SBT for calendar years 2006, 2007 and 2008, which were left blank in the Secretariat's review of global catches at ESC13. Quantities of total in-market frozen SBT (t) sold through the Tokyo Metropolitan Central Wholesale Market and Yaizu Fish Market, were obtained from public statistics published on each market's website. From these market data, unreported catches by the LL1 fleet were estimated using the methods and assumptions of the 2006 Japanese Market Review (JMR) and the market-lag formula presented in CCSBT-ESC/0809/40. Estimates based on the JMR double-count case 1 were 2638t for 2006, 2913t for 2007, and 1047t for 2008 (whole weight), while estimates based on the JMR double-count case 2 are 3465t for 2006, 3697t for 2007, and 1601t for 2008 (whole weight). Additional market information (including sales of fresh and frozen SBT at other markets) was provided in Appendix 5 of the paper, together with a summary of current data availability for each market. Major changes to the management of the Japanese SBT longline fleet were implemented in April 2006 and a reduction in Japan's national allocation came into effect in 2007; thus, it is plausible that assumptions applied by the JMR—which were based on data available in 2005—need to be revised. However, if the proportion of domestic

wild, frozen SBT sold in-market has decreased, it is highly unlikely that this would be unaccompanied by a change in the ratio sold off-market. Furthermore, if the proportion of imported wild, frozen SBT sold in-market has increased significantly in recent years (e.g. to the extent that imported product represents more than 30% of in-market sales of frozen SBT, as proposed in CCSBT/CC/0810/21), it is possible that estimates of imported wild SBT sold in Japanese seafood markets will exceed reported quantities of imported frozen SBT.

41. Japan introduced CCSBT-ESC/0909/41. In April 2006, Japan changed its domestic regulations for SBT fisheries, which include 100% landing inspection by government officials and tagging of individual SBT caught. Japan stated that these regulations ensured the accuracy of its reported catch. Nonetheless, Japan has been conducting market monitoring and has presented its results to CCSBT to provide further assurance regarding domestic SBT fisheries management. Japan also stated that the calculation methods used in CCSBT-ESC/0909/41 and CCSBT-ESC/0909/09 were almost the same, but there were important differences between them regarding the information used on (1) in-market frozen farmed SBT and (2) in-market frozen wild imported SBT. To provide estimation for 2006, 2007, and 2008, CCSBT-ESC/0909/41 used updated information up to 2009, but CCSBT-ESC/0909/09 used information until 2005. With this updated information, CCSBT-ESC/0909/41 provided the estimated domestic catch based on the domestic market information. Japan stated that since new domestic regulations were introduced in 2006, differences between the estimated domestic catch and reported catch have decreased to the extent that, given the rough nature of the estimate of the domestic catch, they can be considered negligible. With the strict domestic regulations and the results of the market monitoring, Japan concluded that no adjustment was necessary for Japan’s reported catch and that all of the proposals and recommendations mentioned in CCSBT-ESC/0909/09 were unnecessary.

42. Australia indicated its support for the monitoring work that had been undertaken, although some limitations in the survey design were noted. For example surveying on the same day every month could lead to systematic bias. Additional Australian comments and concerns included:

- Although it was recognised that conditions in the market have changed since the JMR completed its analysis, the lag time between fish being caught and being present on the market suggested that information from the JMR might still be more relevant than the more recent monitoring information, at least in 2006 and probably also in 2007. Fish on the market in these years had likely been caught prior to the changes in catch limits and regulations, particularly in 2006. Thus, because of the market lag information provided by Japan, it would not be expected to observe the impacts of the 2006 changes to management until 2008 and, to a lesser extent, 2007. This is reflected in the declining estimates for 2008 in both CCSBT-ESC/0909/09 and CCSBT-ESC/0909/41.
- CCSBT-ESC/0909/41 indicated a substantial change in the portion of wild frozen imported SBT on the market (from 5% used in the JMR to 37% estimated for 2009). The import figures listed in Attachment 4 of paper 41, if extrapolated from the monitoring figures for one day per month to the total amount as listed on the Tokyo Central Wholesale Market websites (e.g.

Tsujiki market), would appear to exceed reported imports for 2006-08 calendar years. Furthermore, it would have to be assumed that 100% of imports from certain countries are being sold through Tokyo Central Wholesale Market, with no sales in other markets or off-market. Australia considered this unlikely, since some other markets e.g. Sapporo sell exclusively imported product. That is, the amount of SBT recorded as being sold through Tsujiki market in Attachment 4 of CCSBT-ESC/0909/41 has a ratio of imported fish that appears too high when compared to import statistics from the Japanese Ministry of Finance.

43. Japan stated that, taking into account effective use of human and fiscal resources, it conducted the market monitoring on Fridays because the volume of SBT sold on Friday is generally larger than on any other days of the week. Japan noted that the JMR did calculate amounts of imported wild SBT in-market, but that this was from available information sources rather than direct monitoring. Japan noted that it has been conducting market monitoring since December 2007, and Japan considered direct monitoring of the market was a more reliable basis for calculations.

44. Paragraph 17 of ECCSBT15 outlined that Australia and Japan would work together on improvement of monitoring of Japanese market and Australian SBT Farming and would report to the Extended Commission. This commitment was supported, but Australia did note the importance of ensuring all mortalities were accounted for within the assessment.

45. Comments on the market review papers presented under this agenda item from the scientific advisory panel and Members are provided at **Attachment 8**.

Agenda Item 9. SBT Assessment, Stock Status and Management

9.1 Final decision on OM structure and data inputs

46. Paper CCSBT-ESC/0909/39 presented stock assessments and constant catch projections conducted using the Operating Model specified at the OMMPTM. This analysis showed that (1) for the base case, higher steepness and lower M_{10} are preferred in the grid sampling based on the likelihood (in contrast to the prior-based weight for steepness), and this leads to more optimistic future projections despite lower current spawning stock biomass (3.7% of the unfished biomass for the likelihood-based and 4.9% for the prior-based approaches); (2) when a grid specification with a higher steepness (0.9) and a lower M_{10} (0.04) was explored, the high steepness is scarcely sampled, while the low M_{10} is sampled moderately; (3) when incomplete mixing of tagged SBT is taken into consideration, the model fit is improved, and projection results are somewhat more optimistic; (4) the low recruitment estimate in 2006 seemed to be primarily a consequence of LL1 catch-at-size data in 2008; (5) several sensitivity trials that accord less reliability to the Japanese longline CPUE favour higher M values and lead to more pessimistic results, while some trials such as L2 overcatch scenarios and a case where troll survey index is included show more optimistic future projections.

47. Paper CCSBT-ESC/0909/10 presented results for the base case model (sbtmod22) and agreed robustness trials. Posterior likelihoods for the base case indicated a strong preference for the higher grid values for steepness and lower value of M10, consistent with initial runs at the OMMPTM. However, more detailed analysis of the diagnostics for the base case indicated differences in the preferences among input data sets, particularly across natural mortality and steepness. These results are explored in more detail in CCSBT-ESC/0909/40. Results were consistent for the base case and all robustness trials considered, with the exception of the robustness trial that includes the trolling index of recruitment. The trolling index robustness trial warrants further examination by the ESC because of issues previously identified with the trolling survey (Anon. 2007, 2008). Results from the base case and agreed robustness trials indicate that: the SBT stock is at a low level (3–8% of median unfished spawning stock biomass); the SSB is more likely to have declined in recent years (2004–08) than increased; and the level of recruitments/year classes in the late 1990s and early 2000s, previously identified by the ESC as cause for concern, are very low and have been subject to high fishing mortality. These results indicate there is a very low probability that the short-term reference points (designed to reduce the risk of further decline in SSB and further weak recruitments) will be achieved under most of the levels of constant catch projections considered.

48. Paper CCSBT-ESC/0909/40 provides further consideration of the interaction between the functional form and grid values for natural mortality and steepness and a number of model variations used to explore these interactions. The results suggest that steepness and natural mortality at young ages (<age 10) are strongly positively correlated and that the functional form of the natural mortality schedule (rather than any 'real' information on steepness in the components of the likelihood) may determine the apparent preference for higher values of steepness. There is also a slight negative correlation between M at age 30 and steepness. When a more flexible natural mortality function is used for M_0 to M_{10}, such as the original 'power' functional form, M declines quickly after age 1 which results in the medium steepness level (0.55) being preferred. These results suggest that it may be appropriate to review the natural mortality function adopted at the OMMPTM. Figure 3 of the paper shows the negative log-likelihood profiles for a number of model parameters broken down to the nine likelihood components. Clearly, there are contradictions in the various data sets as to which parameter values are preferred; for example:

- high steepness is strongly preferred by the LL3 and Indonesia components, but low steepness is preferred by LL4 and, to a lesser extent, the surface, LL1 and aerial components;
- low M1 is strongly preferred by the LL1 and surface fishing components, but high M1 is strongly preferred by the tagging component.

49. Similar conflicts between likelihood components were seen for all models in the paper. These contradictory preferences among components make interpretation of the results and evaluation of model assumptions and appropriate grid values challenging.

50. Following on from the results presented in papers CCSBT-ESC/0909/10, 39 and 40, a working group reviewed additional runs to investigate the correlations between steepness and natural mortality. Following further analysis of likelihood

profiles and model fits the working group agreed on the final base case grid (**Attachment 9**) and the model structure for the OM. In addition to the changes to the OM agreed at the OMMPTM (see agenda item 6), the following changes were agreed at the ESC meeting (see **Attachment 9** for more details).

- a power function was accepted for natural mortality from age 1 to 10,
- a third value of natural mortality at age 1 was added to the grid (0.4),
- a range of 5 steepness values was evaluated based on relative likelihoods using a uniform prior,
- Length frequency data from the LL3 fishery was excluded for years where catch was less than 200t.

51. The working group ran comparable grids of the OM using 3 and 5 values of steepness. A uniform prior was assumed across the assumed values of steepness. The results were found to be very similar and therefore the sensitivity runs were only run with 3 values of steepness for reasons of time.

52. The working group considered the various sensitivity runs agreed at the OMMPTM (paragraph 43 of the OMMPTM report) and an additional 3 options proposed at the working group using updated CPUE data for 2007 and 2008. From the 16 alternative sensitivity tests (see **Attachment 9**) the following 6 scenarios were selected as sufficiently plausible for running the full grid (with different catch level projections) for comparison with the base case.

- CPUE S=0,
- LL1 Case 2 of MR,
- Omega=0.75,
- Tag F/Mixing,
- Including 2007-08 CPUE mean, and
- CPUE CV=0.3.

53. The rest of the sensitivities were only run using the current catch level and the results are presented in **Attachment 10**, except for those marked “*” which were excluded either because their plausibility was considered too low or because their results in papers CCSBT-ESC/0909/39 and CCSBT-ESC/0909/41 indicated considerable similarity to the base case (see **Attachment 9**).

- CPUE S=0.5,
- CPUE S=0.75*,
- Uncorrelated RDs*,
- Include Troll,
- Truncate CPUE,
- Alternative CPUE*,
- Break CPUE*,
- Priors for M1, M10*,
- The old Steepness prior,

- Including 2007-08 CPUE upper, and
- Including 2007-08 CPUE lower.

54. The results of the base case and projections are discussed in section 9.3 together with those for the 6 plausible scenarios.

9.2 Review of fisheries Indicators

55. Japan presented papers CCSBT-ESC/0909/27, 32, 34, 35 and 36 to the meeting, and tabled papers CCSBT-ESC/0909/24, 25, 26 and 28 for questions.

56. Paper CCSBT-ESC/0909/27 provided a summary of the fisheries indicators prepared by Japan. The various fisheries indicators examined generally support a view that the current stock levels for 4, 5, 6 and 7 age groups are the same as or lower than those observed in the late 1980s, which are the historically lowest levels. When looking at the most recent seven years, the indices for these age classes generally show steadily declining trends, with the exception of some upturns in the last two years. Other age classes (3, 8-11 and 12+) tend to increase or stay at the same level after 2003. Current stock levels for these age groups are, however, still at similarly low levels as observed in past. Many indices indicate recent low recruitments of the 1999, 2000, 2001 and 2002 cohorts. This is reflected in the index of past acoustic survey results, which also suggested sequential low recruitments for these four years. In contrast, some inconsistencies in recruitment level are observed in comparisons between some indicators and the results of the 2005 and 2006 acoustic surveys (corresponding to the 2004 and 2005 cohorts).

57. The result of the trolling survey in Western Australia for age 1 SBT in 2008/09 were presented in CCSBT-ESC/0909/32. In January 2009, the straight transect line (piston line) off Bremer Bay was surveyed repeatedly over six days. The area adjacent to the piston line and the area between Esperance and Albany were also surveyed during the cruise. Another research cruise to investigate general SBT distribution in Western Australia was also conducted over ten days. The trolling index (the number of schools of age 1 SBT per 100 km searched) was higher for the 2005-2008 year classes than the 1995-1998 year classes that were estimated with the trolling catch data in the earlier acoustic surveys.

58. The Secretariat was thanked for their assistance and support for this project. The ESC thanked Japan for their work on recruitment monitoring of age 1 SBT off Western Australia and encouraged Japan to continue this research in upcoming years. The ESC also endorsed continued Secretariat support of this project.

59. The recent decline in the trolling index was discussed in terms of whether this decline reflected a real trend in age 1 abundance or was perhaps a result of few SBT being in the area during the 10 day window in which the survey was conducted. Japan replied that no particular differences between 2009 and previous years were observed and that it might reflect a real trend in recruitment, but noted the wide confidence intervals for the index.

60. Australia offered to assist with the design of the trolling survey in the future to address uncertainties in double-counting of SBT and spatial and temporal coverage of the survey.

61. CCSBT-ESC/0909/34 was presented. Analysis of the acoustic tagging data from 2005 to 2007 revealed two distinct age 1 SBT migration patterns in southern Western Australia, where the trolling and acoustic surveys have been carried out. In addition, residence time of SBT was examined by using the acoustic tagging data from a hydrophone array along the piston line. 80% of individuals were found to disappear from the area 3.5 days after they were first detected in the piston line area. These findings provide useful information for the design of the recruitment monitoring survey in southern Western Australia.

62. Paper CCSBT-ESC/0909/35 reviewed the size and distribution of age 1 SBT off Western Australia (WA) from existing information. Age 1 SBT appear to be distributed in WA coastal areas only in summer. More age 1 SBT appear to be distributed in southern WA than in western coastal waters off WA. It was hypothesized that age 1 SBT begin to appear in coastal areas in December and extend their distribution towards the eastern part of southern WA in January. The trolling monitoring survey, which is conducted in southern WA in January, is considered to be appropriate in terms of survey area and survey season.

63. A proposal for recruitment monitoring research for age 1 SBT in Western Australia in 2009/10 was presented in CCSBT-ESC/0909/36. The research includes the trolling survey as well as acoustic and archival tagging. The troll survey will be carried out in a manner consistent with previous years. The CCSBT conventional tags will be used in the survey. Japan requested administrative support from Secretariat for the survey. The ESC supported this.

64. Paper CCSBT-ESC/0909/24 summarised the Japanese observer program for SBT in the 2008 fishing season. Five scientific observers were sent to six longline vessels. These scientific observers were employed by the Fisheries Agency of Japan. Three vessels with observers operated in Statistical Area 8, and seven vessels with observers operated in Statistical Area 9. The observer coverage of total Japanese SBT longline fishing activities was 4.8% of vessels, 4.3% of hooks, and 2.4% of SBT caught (observer coverage of hooks and number of SBT were calculated for April–December in Statistical Areas 4–9). Taking into account the duration of observer effort during hauling, the number of hooks observed was estimated to be 3.0% of all hauling durations by all SBT vessels in 2008. There were some differences in the length frequency distributions between vessels with observers and all vessels in area 8. Observers collected otoliths (from 301 individuals), stomachs (from 241 individuals), and muscle samples (from 354 individuals) and retrieved 10 conventional tags from 6 individuals.

65. In response to questions on length frequencies presented in CCSBT-ESC/0909/24, Japan informed the ESC that SBT not retained are not required to be recorded in logbooks.

66. Paper CCSBT-ESC/0909/28 described the change in operational patterns and number of operations of Japanese SBT longliners in 2008 resulting from the introduction of the individual quota system in 2006. While the number of operations per 5x5 degree square per month decreased considerably, the spatio-temporal distribution of operations did not change much from that observed in 2006. It was noted that it is difficult to interpret observed changes in operation and catch, because there are many possible causes. These factors include the change in fishery management, and the decrease of the Japanese quota as well as other socio-economic factors.

67. In relation to paper CCSBT-ESC/0909/28, comments were sought on how recent expansion of fishing grounds would affect CPUE in the future. Japan reiterated that new management arrangements implemented in April 2006 removed spatial and temporal closures, and that operational patterns were now similar to those in the 1980s. Therefore, over the long-term, operational patterns in different fishing grounds hadn't changed substantially. No consideration had yet been given to how this would affect CPUE.

68. Japanese otolith sampling and age estimation activities were described in CCSBT-ESC/0909/25. Japan collected otoliths from 322 SBT individuals in 2008. Ages were estimated from 184 SBT individuals, which had been caught between 2004 and 2006.

69. Paper CCSBT-ESC/0909/26 summarised Japan's tag and recapture activities. Japan tagged and released mostly age 1 SBT during the trolling survey in December 2008–January 2009. A total of 274 SBT were tagged with double CCSBT conventional tags, and 134 of these fishes were also tagged with archival tags. Forty-four individuals with conventional tags were also recovered from Japanese longline vessels between August 2008 and July 2009 (59 CCSBT tags from 35 individuals, and 12 CSIRO tags from 9 individuals). In addition, 3 archival tags were recovered from Japanese longline vessels. Over the past 8 years, Japan released 401 archival tags on large SBT from Japanese longline vessels in offshore areas, and 154 archival tags on juvenile SBT in coastal waters off southern Western Australia. Nineteen of these SBT have since been recaptured.

70. Australia presented papers CCSBT-ESC/0909/08, 16, 21, 38 to the meeting and tabled papers CCSBT-ESC/0909/12, 13, 14, 15, 18 and 19.

71. Paper CCSBT-ESC/0909/08 provided an update of the fisheries indicators available through the CCSBT data exchange. It is similar to the Australian update provided at SC13 (CCSBT-ESC/0809/16) and only discusses indicators thought to be unaffected by the 2006 Japanese Market Review and Australian Farm Review, which were:

- Aerial spotting data in the Great Australian Bight (scientific aerial survey and commercial spotting [SAPUE] index);
- Trolling index;
- NZ CPUE (charter and domestic);
- NZ longline fishery size composition;
- Indonesian longline fishery size/age composition; and
- Indonesian catch on the spawning grounds.

72. Because Indonesian catch on the spawning grounds is now managed under an interim catch allocation and may not provide a useful indicator of abundance in the future, the Indonesian catch data were not discussed in CCSBT-ESC/0909/08. The three indices of juvenile abundance in the GAB (scientific aerial survey and SAPUE) and in Western Australia (trolling index) all declined from 2008 to 2009. However, there were a number of caveats associated with these indices: the declines in the aerial survey and trolling index were not statistically significant, and some questions still remain over the survey design of the trolling index (SC13 report, paragraphs 114-117). Furthermore, the SAPUE is a fishery-

dependent index and is not considered to be as reliable as the scientific aerial survey. Indices of age 4+ SBT, particularly the NZ CPUE, exhibited some upward trends.

73. The dramatic increase in Taiwanese nominal CPUE in statistical areas 2, 14 and 15 since 2000 were discussed. Taiwan informed the ESC that changes to the collection of fisheries statistics was largely responsible for this increase, and the absence of a similar trend in statistical areas 8 and 9 was due to the lower level of effort in these areas.

74. The small proportion of age 3 and younger SBT in the Taiwanese catch and the possible discarding practices by the Taiwanese fleet was queried. Taiwan informed the ESC that observers had not reported any discards.

75. In response to queries regarding recent increases in New Zealand domestic longline CPUE, New Zealand informed the ESC that there was no clear explanation for this change except that New Zealand domestic fishers were possibly becoming better at targeting SBT. In 2008, more small fish were available to the fishery, which likely also contributed to increased CPUE.

76. Paper CCSBT-ESC/0909/16 provided an update on the monitoring program for SBT landings in Benoa, Indonesia. The long-term data series and the results of biological sampling have proven essential in identifying key trends in size/age structure of the spawning population and the likely decline in spawning capacity of the stock. The Benoa Tuna Research and Monitoring Station (BTRMS) monitors landings and undertakes biological sampling on a daily basis, and is also a base for the observer program for the longline fleet which has been in operation since mid 2005. Capacity development activities planned for BTRMS for 2009 and beyond include the provision of training for reading of otoliths for age determination and histology for studies of reproductive biology. During the past year, Indonesia has substantially increased its share in the responsibility for the fiscal and operational management of the research and monitoring program, but is not in a position to cover the full costs of the operations and the associated analyses (including the costs of the age determinations from otoliths). Australia has a long history of providing financial contributions to support the monitoring and sampling program at Benoa. Funding is not yet assured for continuation of the monitoring and sampling for the 2009/10 SBT spawning season, and it appears timely that discussions occur among CCSBT Member Countries about how best to ensure the continuation of the program through the coming season and beyond.

77. Paper CCSBT-ESC/0909/21 describes progress on estimating SBT spawner abundance using close-kin genetics data, following on from the study proposed in 2007 and updated at SC13 (CCSBT-ESC/0809/29). Table 1 of the paper provides the number of samples collected and extracted for DNA to date. Over 20,000 samples are held in the collection, with tissue subsampling complete for over 6000 fish and DNA extraction into bar-coded storage for over 4000 fish. Therefore, researchers are close to finalising preparations for genotyping the planned sample size of 7500. The project has a Steering Committee, including international expertise on population genetics, mark-recapture and fisheries assessment. The Steering Committee has agreed that the next stage of the project should be to check sibling incidence amongst a subsample of juveniles, because the CV of the adult abundance estimate could theoretically become excessive if a

high proportion of juveniles are siblings or half-siblings. This check needs to be conducted prior to embarking on large- scale genotyping of adults and juveniles, and hence before any abundance estimate can be made. A preliminary check for siblings on 100 juveniles did not suggest any problems. Once this check is completed and the selection of loci finalised, the mass genotyping and abundance estimation will be run to produce an abundance estimate for the ESC in 2010.

78. The question was raised as to whether any of the work done in the previous year had indicated any potential problems with using close-kin analysis to provide the ESC with an estimate of total spawning abundance for use within the operating model. The ESC was informed that none of the preliminary genetic work had cast doubt on the validity of the approach. As long as the potential sibling issue was not a major one (with work being done to assess the magnitude of this occurrence) and the required sample sizes were obtained, the work was expected to produce an estimate of spawning stock abundance with a 20% CV.

79. Paper CCSBT-ESC/0909/38 updated results obtained through the Global Spatial Dynamics project. This project involved the archival tagging of juvenile (2–4 year old) SBT from South Africa to New Zealand, with the objective of estimating movement and mixing rates and periods of residency in different parts of this range. The project has been implemented as a collaborative project between New Zealand, Taiwan and Australia, with a total of 559 archival tags being released in New Zealand, Australian, central Indian Ocean and South African waters with 61 tags recaptured. These recaptures include the first-ever recoveries from archival tags released in the central Indian Ocean and New Zealand. The fish tagged in 2007 and 2008 have not been at liberty long enough to expect substantial numbers of returns. The tag deployment phase of the project has been completed, and the main analysis phase has now commenced. The movement patterns of the archival tags returned to date differ from those seen from the archival tagged fish released during the 1990s in the extent of their eastward and westward movements. In particular, only 2 (7%) of the recaptured fish from tags released in South Australia moved into the Tasman Sea. This compares with 28% of the recaptures from prior archival releases in the 1990s. Also, none of the recaptured fish from releases after 2000 in South Australia moved into the more western part of the Indian Ocean (<55°E). This compares with 9% previously. Analyses of the archival data to estimate mixing rates in a spatial mark-recapture model are currently underway. Modelling of movement dynamics and seasonal residence times has also commenced.

80. The archival tagging work showed a potentially cyclic movement of age 2+ and 3+ fish from the GAB to the south-east Indian Ocean and back. The acoustic tag data showed potentially complex residency dynamics as well; however, given the different ages of the SBT involved it was difficult to make any linkages at this point. The appearance of fish visiting the Tasman Sea as well as the south-east Indian Ocean is suggestive of a more complex spatio-temporal dynamic for age 2+ and 3+ SBT. It was noted that the rapid increase in the quality of the technology used in the archival tagging work made such an approach an important one for improving understanding of the complex movement dynamics of these fish in the future.

81. Paper CCSBT-ESC/0909/12 provided an update on the scientific aerial survey of juvenile SBT in the Great Australian Bight. The preliminary point estimate from

the 2009 scientific aerial survey is lower than the 2008 estimate, and similar to the 2006 and 2007 estimates. Taking confidence intervals into account, the relative abundance estimates have remained similar since 2005, and are significantly lower than the average level in the mid 1990s. The models were modified to include random effects for the 2-way interaction terms between year, month and area. This revision to the 2008 model led to more stable model fits, relative to the model used in 2008, as there are a number of 2-way strata for which little (or sometimes no) data exist, and the revised models accommodate these situations more effectively. The time series of the index obtained using the revised models are similar to those obtained using the previous models.

82. The paper also reported preliminary results of a calibration experiment for the use of one or two spotters per plane in preparation for the contingency that future surveys may have only one observer. Analyses show that, on average, the calibration plane made approximately half as many sightings as the survey plane. There was no statistically significant difference in the results between years; however, there was a significant difference between spotter/spotter-pilot combinations (i.e., when the two dedicated spotters were swapped between the survey and calibration planes). Methods for using these results in future to correct the scientific survey analysis for having only one spotter are currently being explored and will be reported to the ESC in 2010.

83. Paper CCSBT-ESC/0909/13 provided an update of the commercial spotting index for the Australian surface fishery for the 2009 fishing season. Data on the sightings of SBT schools in the GAB were collected by experienced tuna spotters during commercial spotting operations between December 2008 and April 2009. Spotting data have now been collected over eight fishing seasons (2001-02 to 2008-09). The commercial spotting data were used to produce nominal and standardised fishery-dependent indices of SBT abundance (surface abundance per unit effort – a SAPUE). As seen in previous seasons, the estimated index is lowest in 2003 and 2004, and the estimate for 2009 is about average.

84. Paper CCSBT-ESC/0909/14 provided an update on SBT otolith sampling in Australia for 2008/09, and estimation of age and proportion at age of the surface fishery for the 2007–08 fishing season. Otoliths were sampled from 311 SBT caught by the Australian SBT surface fishery during the 2008–09 season, and an additional 162 otoliths were obtained from the recreational catch of SBT in Portland, Victoria. In previous seasons, the sampling protocols for the surface fishery did not provide a balanced sample of otoliths from all length classes in the fishery, and additional otoliths were sourced from those collected during CCSBT tagging operations where smaller fish are generally caught. Since CCSBT tagging operations were not conducted in 2009, there was no opportunity to collect these additional otoliths; thus, it is possible that the resulting age-length key will have ‘missing rows’ where there are no age estimates for the smaller length classes. Of the otoliths collected in the previous fishing season (2007–08), age was estimated for 100 fish ranging in size from 57–136 cm FL. Proportions at age in the catch were estimated using age-length keys.

85. Paper CCSBT-ESC/0909/15 updated previous analyses of SBT length and age data from the Indonesian longline fishery operating out of the port of Benoa, Bali. Length-frequency data for 2008–09 and age-frequency data for 2007–08 spawning seasons are now available for the fishery. As noted in previous reports

to the ESC, considerable change has occurred in the size distribution of SBT caught on the spawning ground since monitoring began.

- Length distribution: the mean of the size distribution declined from 188.1 to 166.8 cm between 1993–94 and 2002–03, and has fluctuated between 168.3 and 171.0 cm for the last 6 seasons.
- Age distribution: the mean of the age distribution declined from around 19–21 years in the mid- and late-1990s to around 14–15 years since 2001–02. In the latest season examined (2007–08), the mean age increased slightly to 16.8 years.
- Sex ratio: the data suggest that the Indonesia SBT catch is dominated by females, but this dominance has gradually declined from 72.0% in 1999–00 to 63.4% in 2006–07. The decline was more marked in 2007–08 with 50.8% of those measured identified as female, but this increased slightly to 53.3% in the 2008–09 season.

86. Paper CCSBT-ESC/0909/18 provides a report on the tag seeding conducted during the 2008–09 surface fishing season. The primary purpose of the seeding is to obtain estimates of tag reporting rates from this component of the global SBT fishery. During 2008–09 fish were tagged and seeded into farms from 26 of the 31 tow cages. Harvesting operations for 2008–09 are still under way and as such the total number of returns is unknown at this point. Analyses of data from the 2002–2003, 2003–2004, 2004–2005, 2005–2006, 2006–2007 and 2007–2008 fishing seasons yielded estimates of weighted mean reporting rates across cages of 0.640 (s.e. = 0.062), 0.503 (s.e. =0.053), 0.396 (s.e. =0.029), 0.215 (se = 0.025), 0.425 (s.e. = 0.037), and 0.534 (s.e. = 0.030), respectively. However, further consideration of the 2005–2006 estimate suggests that the estimate may be biased downward by the results of an inexperienced tagger and that an estimate of 0.303 is more appropriate. The most critical statistical estimation issues that need further exploration include representativeness of the cages tagged (particularly in the first year) and potential dependence in the shedding between the two tags in a seeded fish. If tagging of wild fish is resumed, then an experiment to test for the latter is recommended. While uncertainty exists in the estimates of reporting rates, the estimate of the reporting rates from the tag seeding experiment appear to provide a reasonable basis for analysing the tag return data from the surface fishery.

87. Paper CCSBT-ESC/0909/19 provides an updated summary of data from the CCSBT Scientific Research Program (SRP) tagging program, together with updated estimates of fishing mortality rates. SRP tagging was suspended in 2007, but the data and estimates can still be updated using tag returns that have occurred in the past 12 months. A tag attrition model was used to estimate cohort and age-specific fishing mortality rates for different groups of tag releases, conditional on estimates of natural mortality, tag shedding and reporting rates. The results show very high estimates of fishing mortality rates (many over 0.5) from 2003 to 2007 for SBT of ages 3 to 5 based on SBT tagged at age 2 and 3. More encouraging is that the age 3 to 5 estimates for 2008, as well as the age 3 estimate for 2007, are somewhat lower (between 0.25 and 0.3). These results hold true for a range of scenarios using alternative reporting rate estimates for the surface and longline fisheries and alternative natural mortality rate vectors. Comparison of these results with those from the 1990s RMP tagging indicates

that the fishing mortality being experienced by tagged fish has substantially increased compared to the early 1990s. Changes in the exploitation rate estimates and spatial patterns of returns between the 1990s and 2000s suggest possible negative consequences in terms of current stock status (e.g. increased exploitation rates and possible range contraction). Only through continued and improved tagging experiments can the longer term consistency, implications, and underlying sources of these observed changes be understood.

88. The following is a summary of the fishery indicators.

Trends in juvenile abundance

- All three current indices of juvenile abundance—the scientific aerial survey index and SAPUE index for age 2 to 4 in the GAB and trolling index for age 1 in Western Australia—exhibited declines over the past 12 months from values observed in the 2007–08 fishing season (austral summer)The updated median of the scientific aerial survey was below the 2005–08 average, the median of the trolling index was below the 2006–09 average of the piston line survey, and the median of the SAPUE index was below the 2002–09 average. However, the scientific aerial survey for ages 2-4 in the GAB has fluctuated with no clear trend over 2005-2009.
- The abundance estimates from an acoustic survey that ended in 2005/06 suggested continuous low recruitments for four years (the 2000-2003 acoustic surveys corresponding to the 1999-2002 cohorts).
- The results of these acoustic surveys are supported by longline fishery-related indicators that suggest considerable decline of recruitments of the 1999 - 2002 cohorts.
- However, there are some inconsistencies in recruitment indices observed in comparisons between standardised longline CPUE and the results of the 2005 and 2006 acoustic surveys (corresponding to the 2004 and 2005 cohorts). The CPUE indices for age 3 have shown increasing trends since 2006 for 2003-2005 cohorts (* see paragraph 89).
- The trolling index for the 2005-2008 year classes are higher than for the 1999-2002 year classes.
- Future monitoring of recruitment and serious consideration of the impacts of the potential low recruitments on stock management continue to be highest priority tasks.

Trends in age 4+ SBT

- Indicators of age 4+ SBT exhibited some upward trends.
- Catch per unit effort in both the New Zealand charter and domestic fisheries increased in 2008 compared with 2007, with ages 4 and 5 SBT comprising a greater proportion of the catch.
- Both mean and median age of SBT caught on the Indonesian spawning grounds increased in 2008 compared with 2007, continuing the trend in this portion of the stock evident since around 2004/2005.
- Standardised CPUE for age 4 and 5 show increasing trends in 2007-2008 for 2003-2004 year classes*

- CPUE indices for the ages 5 to 7 age classes show steadily declining trends over the most recent seven years, except for some increases in the last two years.*
- Other age classes (8-11, and 12+) show increases or remain the same after 2003 and also exhibited some upturns in the past two years.*
- Current stock levels for these latter age groups, however, are still low, similar to levels observed in the past.

89. *Fisheries management and operational changes since 2006 mean that the 2007 and 2008 CPUE series may not be directly comparable with earlier years. In addition, confidence in CPUE as an indicator has diminished considerably due to the uncertainty associated with catch anomalies.

90. Recent trends in the indicators summarised above are shown at **Attachment 11**.

9.3. Advice on stock status and short-term risks associated with various TACs based on scenario modelling

91. The 2009 ESC work program included the reconditioning of the CCSBT Operating Model (OM) as a basis for constant catch projections at SC14 (Report of SC13). This was the first substantial reconditioning of the OM since 2004 (Report of SC9) and included the OMMPTM and additional work at SC14. A number of revisions were made to the OM as part of the reconditioning process to improve the overall fit of the model to the data and to select the most plausible combination of model structure and uncertainty grid. This resulted in the selection of a new base case OM and uncertainty grid are described in **Attachment 9**.

92. In addition, the ESC identified a range of sensitivity analysis to examine the sensitivity of model results to model structure, assumption and data inputs. A subset of these were identified as “plausible scenarios” based on examination of the fits of the OM to the data and consideration by the ESC.

Current Stock Status

Spawning Stock Biomass

93. The results from the reconditioned OM indicate that the spawning stock biomass is at a very low level. For the base case, the spawning biomass is estimated to be at 4.6% of the unfished level (SSB_0), with a 90% probability interval of 3% to 8%. This very low spawning stock biomass is consistent across all the plausible alternative scenarios (median range: 3.6-5.1%) and is a little more than 15% of the level at which MSY could be obtained.

94. These results differ from those reported from SAG9. The results reported from SC13 indicated that the spawning stock biomass was most likely to be <10 % SSB_0 with a range of 6.6% to 13.2% (Report of SAG9). This difference reflects the revisions in the model structure and the incorporation of new data (**Attachment 9**). It does not imply that the actual spawning stock biomass has approximately halved in the period between reporting of results. Results from the new base case indicate that spawning stock biomass has been very low, but relatively stable, over the recent period (Figure 1).

95. The estimated trajectories of spawning stock biomass integrated over the grid for the base case over the full time series for the fishery are given in Figure 1. This shows a continuous decline from the late 1950s to the late 1970s, then a short period of stabilisation followed by a further decline from the early 1980s to mid 1990s to a very low level. The spawning stock biomass is estimated to have remained at this low level with relatively small annual variation until the early 2000s. For the more recent period, a decline in the median spawning stock biomass is evident from 2002 (Figure 3). There is no current evidence of the spawning stock rebuilding.

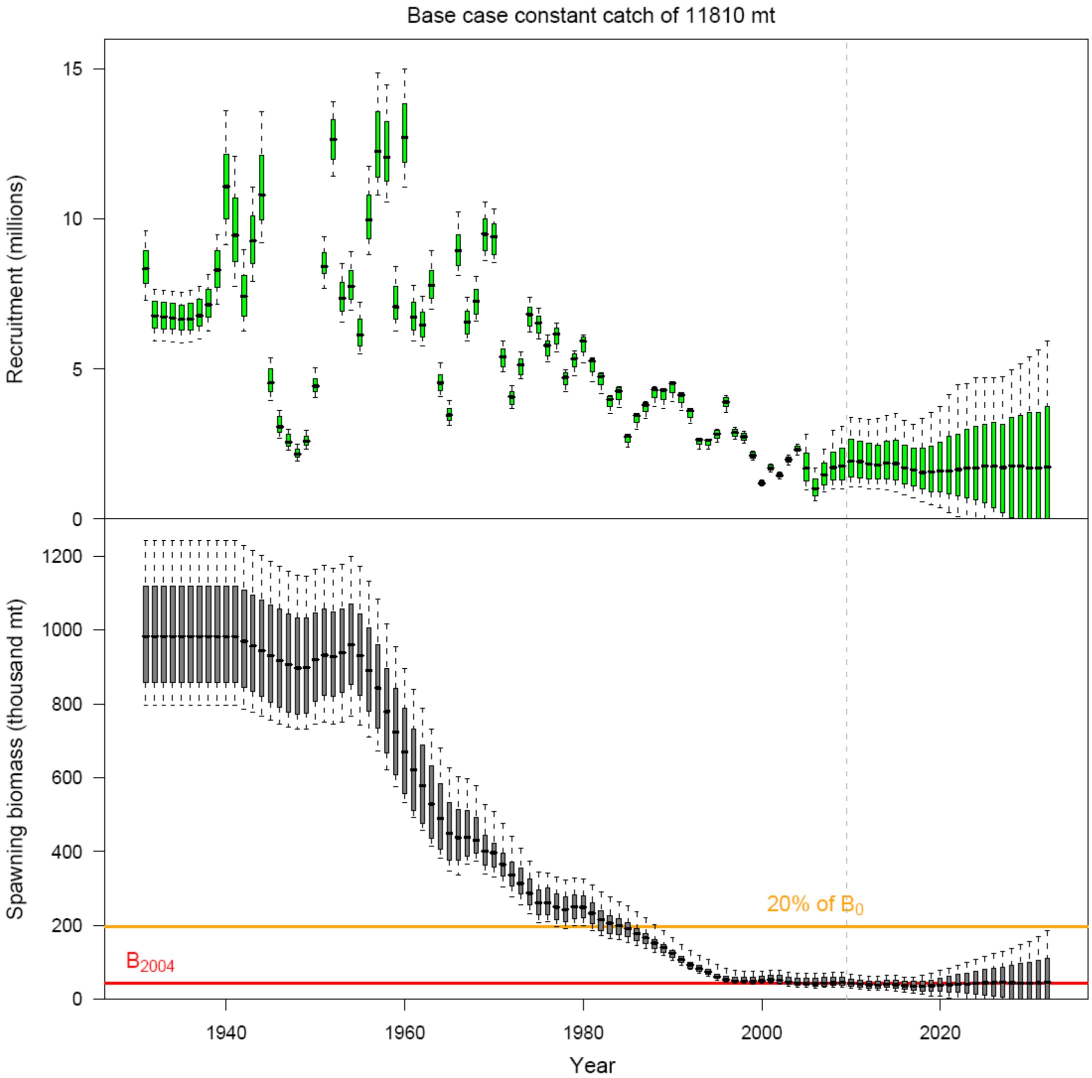

Figure 1. Recruitment and spawning stock biomass for the base case, showing the medians, quartiles and 90th percentiles, together with reference points of 20% of pre-exploitation spawning stock biomass (SSB_0) and the spawning stock biomass in 2004 (SSB_{2004}). Projections of future spawning stock biomass and recruitments commence at the dashed vertical line assuming a constant catch equal to the current TAC (11,810t).

Trends in Recruitment

96. Recruitments during the last two decades are estimated to be well below the levels over the 1950-1980 period. Recruitment in the 1990s fluctuated at a low level without any overall trend (Figures 1 and 3).

97. It is clearer, with the extra data now available since the last assessment, that the recruitments for 2000 to 2002 were poor (Figures 1 and 3). The two following year classes were somewhat stronger, though not as large as the average level evident during the 1990s (Figures 1 and 3).

98. Recruitments from 2005 onwards cannot be estimated precisely, as yet: although some data give positive signals, it is also probable that at least some of these year classes were as weak as in 2000-2002 (Figures 1 and 3).

99. The weak year classes from 2000-2002 (Figure 1) are now evident as a gap in the size composition of the fish taken by longline fleets. As these year classes move into the spawning stock over the next 5 years, this will have a negative impact on the spawning stock. This negative impact is evident as a dip in the spawning stock biomass for the base case under the current TAC (11,810t) in 2013 (Figure 3).

Current Fishing Mortality

100. The ratio of the current (2008) fishing mortality to the fishing mortality that would achieve MSY was calculated for the base case (Table 3), assuming that the 2008 selectivity pattern would remain constant in the long term. A time series of average fishing mortality for ages 2-15 years for the base case is provided in Figure 2.

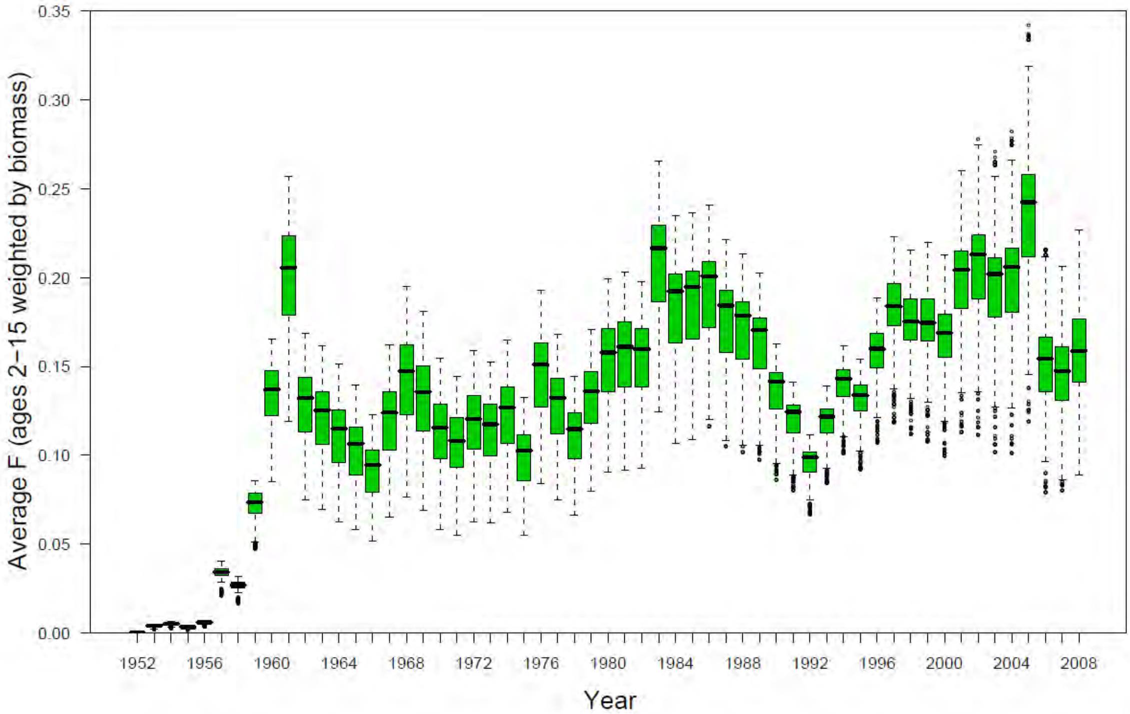

Figure 2. Instantaneous fishing mortality averaged over ages 2-15 (weighted by biomass) for the full base case from 1952 to 2008.

101. Figure 2 indicates that average fishing mortality reached a peak in 2005, decreased in 2006, and remained at approximately the same level over 2007 and 2008. This recent reduction in estimated average fishing mortality indicates that the management measures implemented in 2006 have had a positive impact over the period 2006-2008.

102. The current fishing mortality (2008) as a ratio of F_{MSY} (Table 3) for the base case is estimated to be approximately 1.9 times the fishing mortality that would achieve MSY (see **Attachment 12**).

103. The estimates for the plausible alternative scenarios are consistent with this estimate, with current fishing mortality estimated to be from 1.75 to 2.35 times F_{MSY} (Table 3).

Constant catch projections

104. The following points provide background on the reference levels referred to in this section:

- In 2005, it was decided to estimate the catch that would result in an estimated probability of 50% that the spawning stock biomass (SSB) would be above the 2004 level in 2014 (the year in which the SSB was estimated to reach a minimum), i.e. $P(SSB_{2014}>SSB_{2004})$ (paragraph 45 of the SAG6 report);
- In 2009, the Strategy and Fisheries Management Working Group (SFMWG) agreed that 20 percent of the original spawning stock biomass was an appropriate interim rebuilding target reference point (paragraph 10 of the SFMWG report); and
- The SFMWG also requested that the ESC provide advice on the consequence of future catch levels in the form of that provided in Table 2 of the report of the 11th meeting of the SC, but with the addition of a 30th percentile and inclusion of performance statistics for B_{2020}/B_{2010} and B_{2025}/B_{2010} (SFMWG, paragraph 11).

105. Estimates of current stock status and results for the range of constant catch projections for the base case are provided in Table 1 and Figures 3.

Table 1: Base case grid evaluation indicating the proportion of realisations that exceeded short-term (SSB_{2014}/SSB_{2004}) and longer term (SSB_{2025}/SSB_{2009}) relative reference levels for different constant catch levels (columns 2 and 3). Remaining columns represent the median and 30th and 10th percentile values for those relative reference levels.

			SSB_{2014}/SSB_{2004}			SSB_{2025}/SSB_{2009}		
Catch	$P(SSB_{2014}>SSB_{2004})$	$P(SSB_{2025}>SSB_{2009})$	Median	30th	10th	Median	30th	10th
15810	0.05	0.11	0.75	0.65	0.48	0.00	0.00	0.00
13810	0.12	0.23	0.82	0.73	0.58	0.31	0.00	0.00
11810*	0.23	0.45	0.89	0.80	0.67	0.88	0.42	0.00
10810	0.30	0.56	0.92	0.83	0.71	1.16	0.68	0.03
9810	0.38	0.68	0.95	0.87	0.75	1.43	0.96	0.35
8810	0.45	0.79	0.98	0.90	0.79	1.71	1.23	0.64
7810	0.55	0.87	1.01	0.93	0.83	1.97	1.50	0.91
5810	0.68	0.97	1.08	0.99	0.90	2.54	2.01	1.42
0	0.97	1.00	1.27	1.15	1.08	4.21	3.50	2.70

*Current TAC level

106. The projection results for the base case indicate that:

- the median spawning stock biomass in 2014 will be below the median spawning stock biomass in 2004 under the current TAC level (Table 1, SSB_{2014}/SSB_{2004}) and a decline in the spawning stock biomass of about 11% is expected;
- A future constant catch level of about 8300t or lower is estimated to meet the short term reference level of a 50% probability of median SSB in 2014 being above the median SSB in 2004;
- The interim rebuilding target of spawning stock biomass of 20% of SSB_0 is very unlikely to be met during a 20 year projection period under any of the future catch scenarios considered (Figure 3). Only the lowest catch level of 5810t approaches 20% of SSB_0 over the projection period; and
- Current TAC of 11,810t, or higher future catch levels, increase the risk of future recruitment remaining low or declining, relative to the catch scenarios with lower catches (Figure 3).

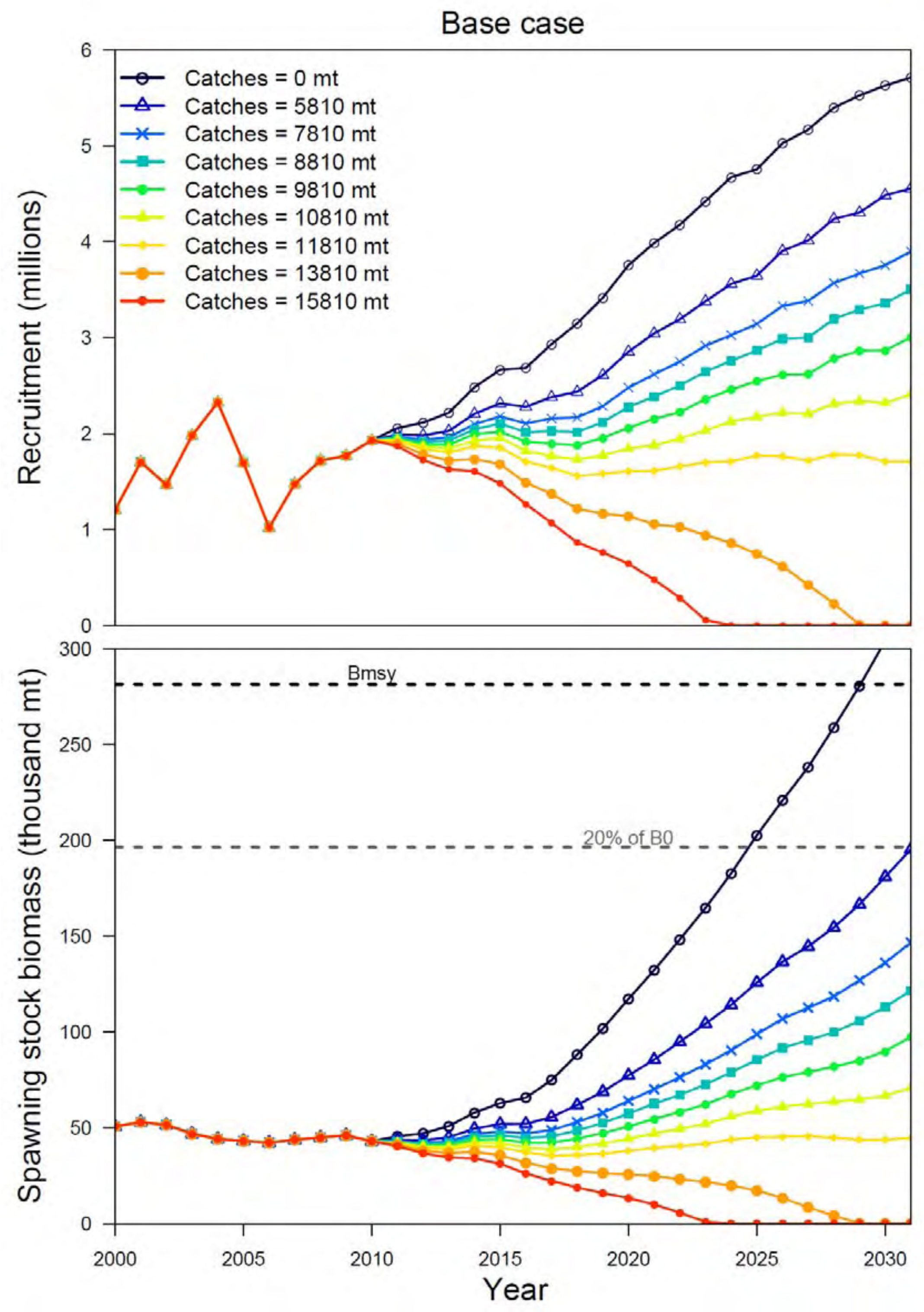

Figure 3. Median recruitment and spawning stock biomass for the base case projected for a variety of levels of constant catches. The 11,810t projection corresponds to the current TAC. Note that median recruitment from 2000-2008 is based on estimates of the abundance of year classes that have already entered the stock. Estimates of median recruitment beyond 2008 are estimated using the model stock - recruitment relationship and assume that this relationship holds for future levels of spawning stock biomass. Consequently, estimates of future recruitment are more uncertain.

Plausible Sensitivity Tests

107. The previous results relate to the base case model, which the ESC considers the most plausible model. As noted above, the ESC identified six alternative scenarios (changes in model structure, uncertainty grid and/or input data) that were also considered plausible and worthy of consideration in the context of assessing the status of the stock and implication of future constant catch projections.

108. Of the six plausible scenarios, it is worth noting that the "Omega = 0.75" scenario had previously been an element of the uncertainty grid. However, following detailed analysis of fits during reconditioning of the OM it was dropped from the grid due to poor model fits (report of the OMMPTM). In the case of the CPUE 2007-08 scenario, it was not possible to complete the standardisation of the 2007-08 LL1 catch and effort data in time for inclusion in this year's OM reconditioning (OMMPTM report and **Attachment 6**), hence this scenario was included to examine the potential implications of having this data available for next year's SC. Further details of these scenarios are provided in **Attachment 9**.

109. The results of these scenarios are provided in Table 2 and 3 and illustrated in Figures 4 and 5 indicate that:

- The current level of spawning stock biomass is very low across all scenarios and well below the level that would produce MSY;
- Under the more optimistic scenario (CPUE 07-08 mean) the spawning stock biomass is less depleted and declines less than other scenarios in the short term (e.g. 2014/2004 reference level). However, it does not reach 0.2 SSB_0 over the projection period for any of the future catch levels considered; and
- For the more pessimistic scenarios (CPUE CV=0.3, Omega=0.75), the current level of depletion is estimated to be lower (<4%) and the spawning stock biomass is predicted to continue to decline for most of the future catch levels considered.

Table 2: Ranges of estimates of relative spawning stock biomass across the 6 plausible scenarios. Estimates indicate the proportion of realisations that exceeded short-term (SSB_{2014}/SSB_{2004}) and longer term (SSB_{2025}/SSB_{2009}) reference levels for different levels of constant catch projections (columns 2 and 3). Remaining columns represent the median and 30th and 10th percentile values for those relative reference levels.

			SSB_{2014}/SSB_{2004}			SSB_{2025}/SSB_{2009}		
	$P(SSB_{2014}>SSB_{2004})$	$P(SSB_{2025}>SSB_{2009})$	Median	30th	10th	Median	30th	10th
15810	0.00 - 0.11	0.01 - 0.15	0.46 - 0.87	0.36 - 0.81	0.18 - 0.73	0.00 - 0.12	0.00 - 0.00	0.00 - 0.00
13810	0.00 - 0.29	0.03 - 0.32	0.55 - 0.94	0.47 - 0.88	0.31 - 0.81	0.00 - 0.66	0.00 - 0.28	0.00 - 0.00
11810*	0.00 - 0.53	0.11 - 0.59	0.64 - 1.01	0.57 - 0.95	0.42 - 0.89	0.00 - 1.19	0.00 - 0.78	0.00 - 0.29
9810	0.02 - 0.74	0.31 - 0.82	0.72 - 1.08	0.66 - 1.01	0.53 - 0.95	0.52 - 1.70	0.03 - 1.27	0.00 - 0.80
7810	0.09 - 0.91	0.63 - 0.96	0.81 - 1.15	0.75 - 1.08	0.62 - 1.00	1.28 - 2.22	0.86 - 1.74	0.24 - 1.25
5810	0.22 - 1.00	0.91 - 1.00	0.89 - 1.21	0.83 - 1.14	0.72 - 1.06	2.02 - 2.74	1.58 - 2.22	1.02 - 1.67
0	0.00 - 1.00	1.00 - 1.00	1.08 - 1.41	1.03 - 1.32	0.98 - 1.18	3.91 - 4.47	3.38 - 3.72	2.79 - 2.93

*Current TAC level

Table 3: Relative reference levels (medians) for the base case and selected plausible scenarios under current TAC level. For the base case 5th and 95th percentiles are shown in parentheses.

Sensitivity	F_{2008}/F_{msy}	SSB_{2009}/SSB_0	SSB_{2009}/SSB_{msy}	SSB_{2014}/SSB_{2004}	SSB_{2020}/SSB_{2009}	SSB_{2025}/SSB_{2009}
Base case	1.91	0.05	0.17	0.89	0.75	0.88
(5%, 95%)	(1.46, 2.45)	(0.03, 0.08)	(0.10, 0.24)	(0.62, 1.15)	(0.05, 1.64)	(0.00, 2.77)
Mixed tags	1.805	0.046	0.155	0.938	0.798	0.976
LL case 2 of MR	1.754	0.049	0.175	0.962	0.860	1.123
CPUE S=0	1.995	0.051	0.161	0.861	0.663	0.682
CPUE CV=0.3	2.018	0.039	0.145	0.790	0.591	0.511
CPUE 07-08 mean	1.753	0.051	0.178	1.011	0.882	1.187
Omega=0.75	2.351	0.036	0.117	0.641	0.290	0.000

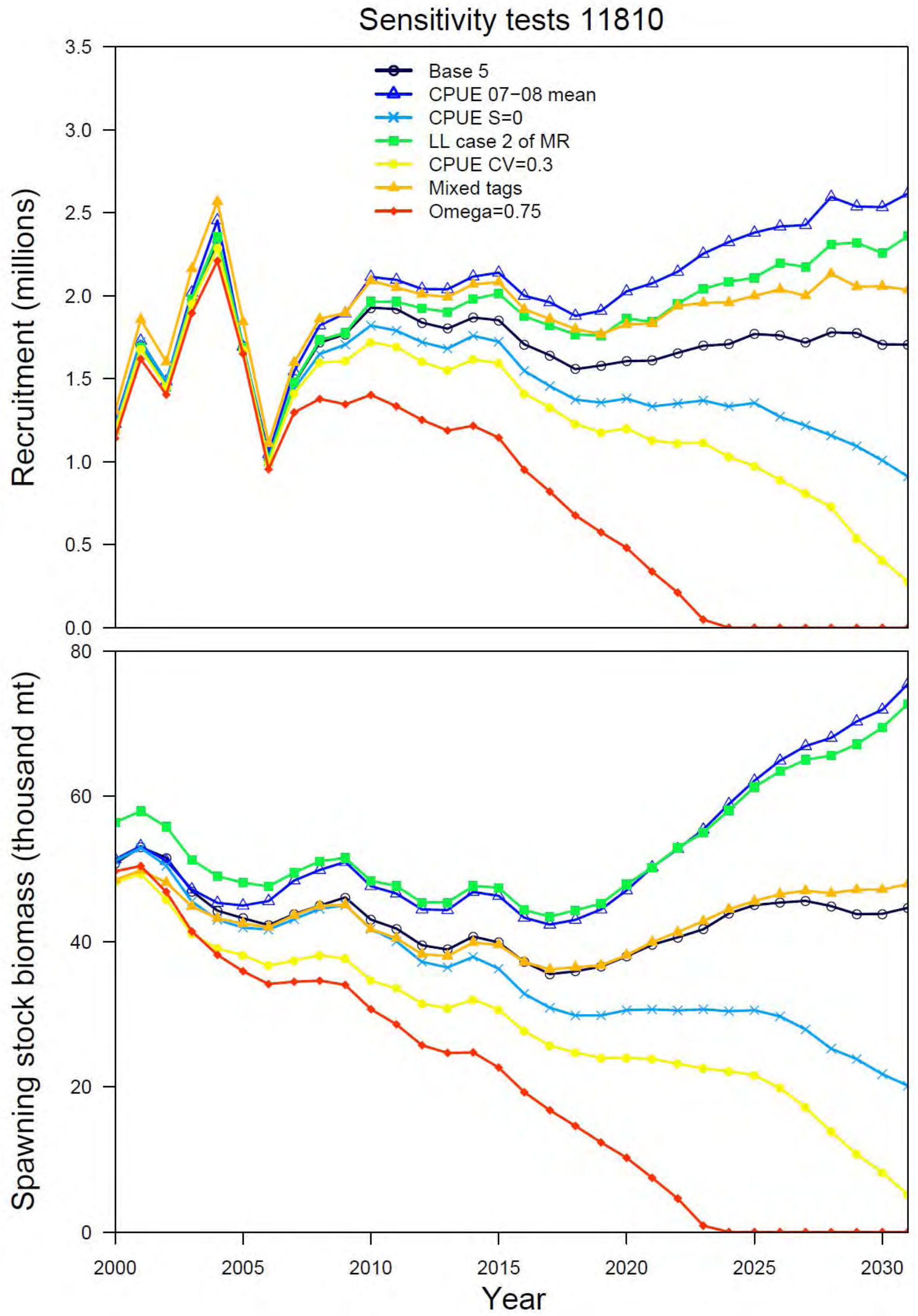

Figure 4. Median recruitment and spawning stock biomass for the 6 plausible scenarios for projections assuming future catches equal to the current TAC (11,810t). Note that median recruitments from 2000-2008 are based on estimates of the abundance of year classes that have already entered the stock. Estimates of median recruitment beyond 2008 are estimated using the model stock -recruitment relationship and assume that this relationship between holds for future levels of spawning stock biomass. Consequently, estimates of future recruitment are more uncertain.

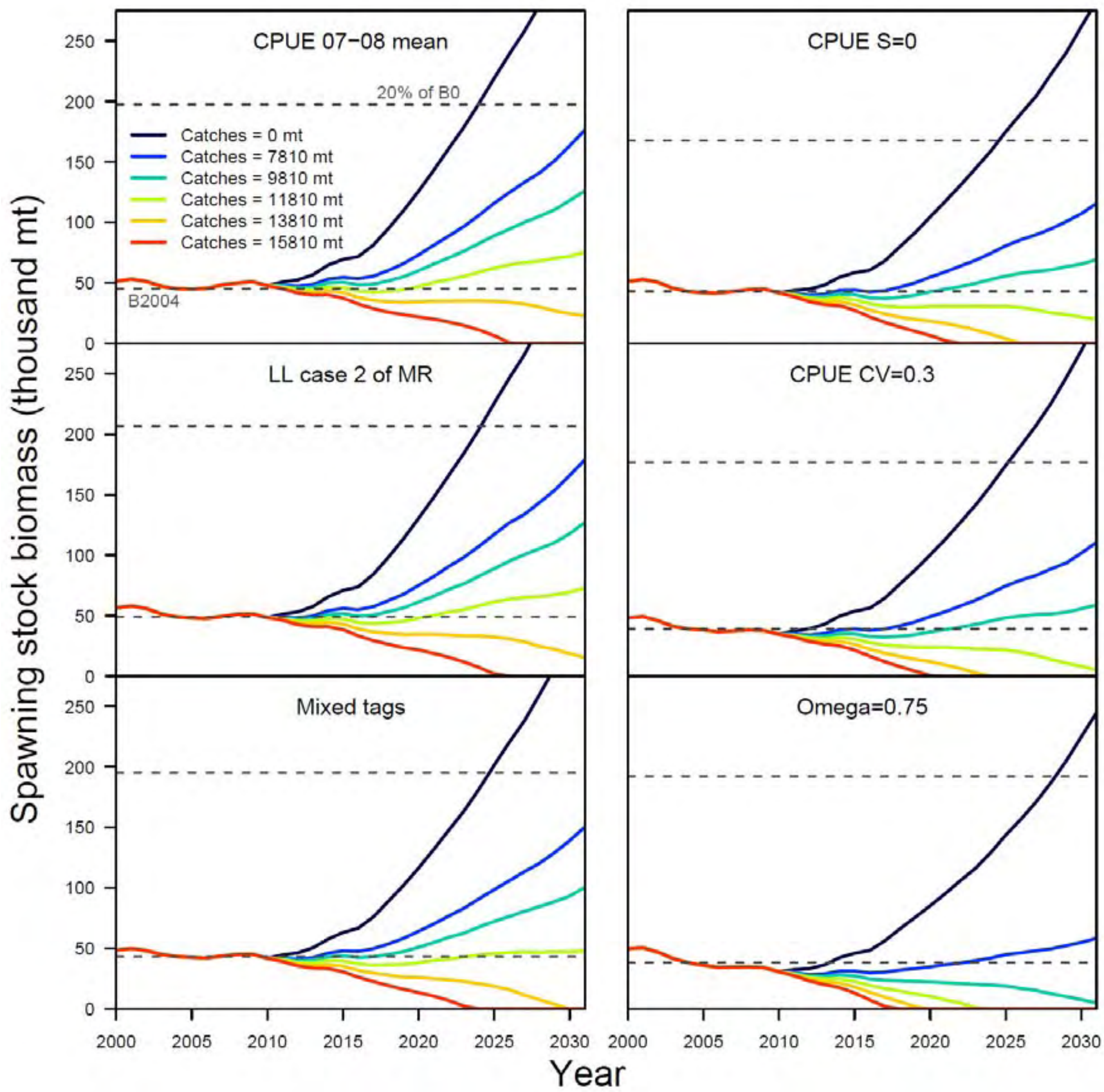

Figure 5. Effect of different future constant catch levels for the six plausible alternative scenarios. In each panel the lower dashed line is the spawning stock biomass in 2004 (SSB_{2004}), and the upper dashed line is 0.2 SSB_0.

9.4 Status of the SBT Stock

110. The SBT operating model used in 2008 was revised as described above, and then used to project future stock status under different constant annual catches (Table 1 and Figures 1 and 3). The base case scenario is considered the most probable, but account should also be taken of results for the six plausible scenarios reported in Tables 2 and 3 and Figures 4 and 5. These scenarios all indicate that the spawning stock biomass remains at a very low level: typically about 5% or less of SSB_0, which is a little more than 15% of SSB_{MSY}. There is no sign of the spawning stock rebuilding.

111. Recruitments during the last two decades are estimated to be well below the levels over 1950-1980. Recruitment in the 1990s fluctuated at a low level without any overall trend, but recruitments for 2000 to 2002 were poor. The two following year classes were somewhat stronger, though still below the average 1990s level. Recruitments since 2005 cannot be estimated precisely as yet.

Although some data give positive signals, it remains probable that at least some of these year classes were as weak as in 2000-2002. As the weak year classes in 2000-2002 move into the spawning stock over the next few years, there will be a negative impact on the spawning stock biomass.

112. The median projections under the current TAC (of 11810t) for the base case show a decline in spawning stock biomass in the short term (to 2013), and remain below the current level in the longer term (to at least 2025) (see Table 1 and Figures 1 and 3). The same is true for nearly all of the other plausible scenarios considered (see Tables 2 and 3 and Figure 4). To rebuild the spawning stock and thereby also reduce the risk in the short term of further poor recruitments, a reduction to the current TAC is required (see paragraph 106). Projection results for alternative future TAC levels, along with associated probabilities, are shown in these Tables and Figures, with further details to be found in **Attachment 10**.

113. While rebuilding of the spawning stock would almost certainly increase sustainable yield, the risks that this rebuilding might be jeopardised by further poor recruitments have probably increased since the last assessment. Because the spawning stock biomass is very low, it may not provide security against adverse environmental effects leading to a few years of poor recruitment. Short-term projections for the spawning stock biomass are relatively reliable because the year classes that will shortly join the spawning stock have already been observed in the fishery. However, longer term projections are more uncertain as they depend on future recruitments whose levels have to be determined by use of an estimated stock-recruitment relationship, and so should be treated with greater caution in terms of their implications for appropriate future catch limits.

114. 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 13**

9.5 SBT Management Recommendations

115. In the light of the current stock status and concerns, management advice is as follows.

116. Positive factors affecting sustainability of future catches are:

- the reported catch has reduced over recent years;
- indicators and the assessment suggest that the 2003 and 2004 year classes are not as low as the weak 2000, 2001, and 2002 year classes; and
- indicators of age 4+ SBT have exhibited some recent upward trends.

117. However, there remain serious sources of concern from new and previous information including:

- a very low spawning stock (about 5% of SSB_0 and 15% of SSB_{MSY});
- the three poor recruitments from 2000 to 2002, and indications of some further poor recruitments after 2004, which will lead to a further decline in spawning stock biomass;
- a general decline in recruitment since about 1970, coincident with declining spawning stock sizes; and

- Current fishing mortality is nearly double F_{MSY}.

118. The ESC **recommends** that the Extended Commission effect a meaningful reduction in catch below the current TAC of 11810t.

119. Noting the Extended Commission's intent to adopt a Management Procedure (MP) at its 2010 annual meeting, and given the high probability that such a MP will require catch and effort data as inputs, the ESC **recommends** that the Extended Commission take steps to ensure accurate future catch and effort reporting.

9.6. Discussion of possible technical measures for managing the SBT stock

120. No items were tabled for discussion under this agenda item.

Agenda Item 10. Development of Management Procedure

10.1 Report on technical issues associated with the development and evaluation of MPs based on fisheries independent indicators

121. Paper CCSBT-ESC/0909/22 provides a response to SC13's request for further development of the conceptual paper presented in 2008 (CCSBT-ESC/0809/30). Some of the intersessional work dealt with 2 substantive issues: (1) how to combine aerial survey and tagging data into a formal decision rule, and (2) how to relate an indicator-based decision rule to a framework for recommending changes to catch levels. Work to date has addressed a decision rule based on aerial survey data and tagging data in a spawner-per-recruit context; however, this work could not be completed before SC14 because of priority placed on OM work.

122. In response to a query on how the approach differed from the way the OM is conditioned at present, it was clarified that the decision rule proposed in CCSBT-ESC/0909/22 would act as a biological smoother using the aerial survey and tagging data sets, and would represent only one component of an MP rather than the assessment itself. It was further noted that because data would be obtained from juveniles migrating through the Great Australian Bight, the approach would only consider the first few age classes in the population.

123. Caution was urged when considering a decision rule based on aerial survey and tagging data when the future of the aerial survey and, in particular, the tagging program was uncertain. There was further discussion on how the approach proposed in –ESC/0909/22 could not proceed without the resumption of the CCSBT tagging program, and that further development of the approach would require an estimate of the future level of tagging required, the monitoring of reporting rates and the funding required.

124. There was further discussion on the data generation modules required for the tag return data. It was noted that a range of tag modules had already been developed by CSIRO and that good progress had been made in this area.

10.2. Further development of the MP

125. A small group was convened to discuss possible kinds of MPs to be used in the short term and to develop a work plan for MP development. The group discussed the proposal in paper CCSBT-ESC/0909/22 to develop a different form of MP that depended only on fishery-independent indicators such as the tagging and the aerial survey data.

126. Two possible classes of MPs were discussed:

- MPs that utilize CPUE, age composition and aerial survey data. These data are used to condition the current OM and the manner in which they can be generated by the OM in projections is reasonably well established. Short-term/interim MPs using simple decision rules based on fishery-independent indicators may also be evaluated as part of this group of MPs, as long as tagging data are not used.
- MPs that utilize Scientific Research Program tagging data and aerial survey data. The tagging data for the 2000s are not currently used in the conditioning of the OM due to some issues associated with uncertain stock structure (i.e. unexplained lower recapture rate of age-one fish released in Western Australia). Additional development work would be required to specify how to integrate these data into the OM and how to generate future data to be used by the MPs.

127. The ESC considered that further research focused on the identification of ways to integrate the tagging data from the 2000s in the conditioning of the OM would be very valuable. It also supported the development of MPs based on fishery-independent indicators to be used for management advice in the short to medium term. However, it recognized that the development of such class of MPs would take longer than a year, given the complications involved in the use of the tagging data. The ESC considered that in order to be able to complete the MP development in one year, the type of MPs to be considered would have to be restricted to those that only used CPUE, age-composition and/or aerial survey data. A one-year work plan was discussed to complete the testing of such MPs for recommending an MP at the ESC in 2010.

128. That proposed work plan involves a small technical inter-sessional meeting to be conducted around May/June of 2010 with the purpose of reviewing results of initial MP testing. That meeting would be essential if the work is to be completed in 2010. Further details about the work plan are provided in **Attachment 14**.

129. The small group specified assumptions related to how to generate future data for MP testing and specified an initial list of robustness trials (see **Attachment 14**). The only new data to be generated correspond to the aerial survey as other indicators would not be used at this stage following recommendations made by the SC13. In all other cases the same assumptions made for the MP trials conducted in 2005 would be maintained, as detailed in the report from the OMMPTM.

Resources and potential commission guidance required for MP work

130. Given that various delegations expressed a wish to participate in the development of future MPs, the ESC recommended that the consultant and panel be involved

in the conduct of the final MP trials prior to the ESC meeting in 2010, once a reduced set of MPs has been selected. This work would be in addition to their usual role in providing the OM code for the trials as well as the code for producing graphics used to compare performance across MPs.

131. The ESC emphasizes the importance of ongoing communication between scientists and managers in the formulation of options to be considered in the development of MPs. Given the compressed schedule that is necessary to deliver recommendations on MPs by 2010, it will be a challenge to maintain the level of communication that is needed. Therefore, the ESC strongly encourages the Extended Commission to consider how it will engage with the development process for the MP. Options include (a) Commissioners observing scientific sessions during the MP development period, (b) organising special sessions where scientists and Commissioners can exchange views on progress in the development of the MP, (c) arrangements at the National level for routine communication between managers and scientists on progress in the development of the MP, or (d) a combination of these options.

132. In terms of requested guidance from the Extended Commission there are several items that will require further clarification:

- The frequency of TAC changes. The MP recommended in 2005 allowed the TAC to change every three years. Considering the current low stock abundance, a more flexible MP that allows more frequent changes in TAC would be desirable to improve MP performance. There can be a trade-off between the size of the TAC changes and the frequency of those changes, the lower the frequency the larger the changes. The ESC recommends evaluation of a range of MPs that include changes every one, two and three years.
- The maximum/minimum change in a future TAC allowed from year to year once the MP is in place (both up and down). The values used in 2005 for MPs that changed the TAC every three years were 5000t maximum and 100t minimum.
- Time lag for implementation of TACs dictated by the MP. In past MP trials a two-year lag was allowed between the year the TAC was computed and the year it was applied to simulate the catch.

Agenda Item 11. Data Exchange

11.1. Requirements for Data Exchange in 2010

133. The requirements for the 2010 data exchange were discussed and agreed in the margins of the meeting. These requirements were endorsed by the ESC and are provided in **Attachment 15**.

Agenda Item 12. Research Mortality Allowance

134. Japan presented CCSBT-ESC/0909/37 concerning its utilisation of Research Mortality Allowance (RMA) in 2008/09 and a request for RMA in 2009/10. In 2008/09, Japan used 49.9kg of the 1 tonne of RMA that had been allocated to it.

Japan again requested 1 tonne of RMA for its trolling surveys off Western Australia in 2009/10.

135. The request from Japan was supported by the meeting.

136. Australia advised that it did not use any of the RMA that had been granted to it for 2008/09.

137. Australia presented paper CCSBT-ESC/0909/42 on its proposal and request for 10t of RMA to facilitate electronic and genetic tagging of SBT as part of its research for 2009/10. The ESC supported Australia's request.

Agenda Item 13. Report from the Eighth Meeting of the Ecologically Related Species Working Group

138. The Chair of the Ecologically Related Species Working Group (ERSWG) presented the report of the Eight Meeting of the ERSWG, focusing on its work to:

- provide initial estimates of ERS mortality;
- consider analyses to improve future estimates of the risks to ERS;
- provide recommendations to the Extended Commission; and
- provide a recommendation on the timing of the next ERSWG meeting.

139. The ERSWG Chair noted that the ERSWG was not able to provide scaled estimates of ERS mortality and that it provided a summary of observed mortalities instead.

140. Paragraph 8 of the ERSWG report concluded by recommending that progress towards the ERSWG's recommendations should be monitored at annual meetings of the Extended Commission and/or subsidiary bodies including the ESC. The ESC discussed issues regarding whether and how monitoring of progress or scaling of ERS estimates might be conducted at future ESC meetings. However, instead of providing a recommendation on the ESC's potential involvement (or not) to the Extended Commission, the ESC agreed that Members would consider these issues and develop proposals for consideration by the Extended Commission as appropriate.

Agenda Item 14. Workplan, Timetable and Research Budget for 2010

14.1. Overview, time schedule and budgetary implications of proposed 2010 research activities.

141. The ESC developed a workplan for 2010 that focuses on the need for the ESC to recommend a Management Procedure to the Extended Commission in 2010. In developing the workplan, the ESC also considered the request of the Strategy and Fisheries Management Working Group to keep the duration of the meeting to within 7 days. The workplan has the following key elements, which are described in Table 4.

- Continuation of tag recovery efforts, including freezer vessel observations;

- Provision of urgent CPUE inputs and development of monitoring for CPUE quality;
- Development and testing of Management Procedures to recommend an MP at SC15, including a small technical meeting to be held in May/June 2010 to evaluate preliminary results and refine testing protocols; and
- Holding an ESC meeting, with the principle agenda of testing alternative MPs and selecting an MP for recommending to the Extended Commission.

Table 4: Summary of the ESC workplan for 2010.

Activity	Approximate Period	Resources or approximate budgetary implications[1]
Continuation of tag recovery efforts.	Tag recovery is continuous.	$64,000 for tag recovery as per draft budget in Attachment C of CCSBT-ESC/0909/05.
Provide SBT Stock Status report to the other tuna RFMOs.	Sep.-Nov. 2009	N/A
CPUE Data inputs to be provided by Members.	31 Oct.	N/A
Scientific Data Exchange.	Apr. 10 – Jul. 10	N/A
Further development of consistency measures for the CPUE series. See **Attachment 6** for further details.	Nov. 09 to May/Jun. 10.	Intersessional work by Member scientists, particularly Japan. Meeting in conjunction with MP meeting held in May/June 2010. 6 panel days & associated costs.
Further intersessional development of the MP (see **Attachment 14** for further details), including a web meeting.	Sep. 09 to Aug 10 and a web meeting in Jan. 10.	Work to be conducted by National scientists, MP coordinator (15 days) and Consultant (15 days).
Intersessional MP meeting to review results of intial MP testing and possibly introduce a few further robustness trials.	A 5 day small technical meeting, probably held in Seattle in May/June.	A 5 day meeting to be held with: 1 interpreter; no Secretariat; 10 panel days (AP, JI), 5 consultant days (TB), plus associated expenses. An extra 3 days will be required for development and coordination.
Extended Scientific Committee for the 15th meeting of the Scientific Committee meeting.	7 days, Sep 4-10, Taipei.	ESC Chair, full panel including consultant, full interpretation and Secretariat involvement.

14.2. Timing, length and structure of next meeting

142. The next ESC meeting is recommended to be for 7 days and held from 4 September to 10 September 2010, in Taipei, Taiwan.

[1] These preliminary estimates will be refined in the proposed budget for 2010 that the Secretariat will submit to the Extended Commission.

Agenda Item 15. Other Matters

143. There was no other business

Agenda Item 16. Adoption of Meeting Report

144. The report was adopted.

Agenda Item 17. Close of meeting

145. The meeting closed at 6:22 pm on 11 September 2009.

List of Attachments

Attachment

1. List of Participants
2. Agenda
3. List of Documents
4. Summary of observer activities by country, year and sector
5. Global SBT catch by flag
6. Progress report from the CPUE modelling group
7. Comments on farm review papers
8. Comments on market review papers
9. Selection of operating model grids
10. Sensitivity trials
11. Recent trends in indicators of the SBT stock
12. Constant catch projections and stock status from operating model grid
13. Report on biology, stock status and management of southern bluefin tuna
14. Development of Management Procedure
15. Data exchange requirements for 2010

Attachment 1

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Extended Scientific Committee Meeting of the Fourteenth Meeting of the Scientific Committee

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Attachment 2

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

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

2. **Appointment of Rapporteurs**

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

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

5. **Report from intersessional CPUE modelling work**

6. **Report from the Operating Model and Management Procedure Technical Meeting**

7. **Australian SBT Farm Study**
   7.1. Australian farm study in 2008/09 season
   7.2. Scientific advice/recommendation on Australian SBT farm study from the ESC to the Extended Commission

8. **Monitoring of Japanese markets**

9. **SBT Assessment, Stock Status and Management**
   9.1. Final decision on OM structure and data inputs
   9.2. Review of fisheries Indicators
   9.3. Advice on stock status and short-term risks associated with various TACs based on scenario modelling and analysis of indicators
   9.4. Status of the SBT Stock
   9.5. SBT Management Recommendations
   9.6. Discussion of possible technical measures for managing the SBT stock

10. Development of Management Procedure

10.1. Report on technical issues associated with the development and evaluation of MPs based on fisheries independent indicators

10.2. Discuss possible MP options and assumptions used to simulate MP input data

10.3. Set up initial MP trials and refine workplan for future MP development

11. Data Exchange

11.1. Requirements for Data Exchange in 2010

12. Research Mortality Allowance

13. Report from the Eighth Meeting of the Ecologically Related Species Working Group

14. Workplan, Timetable and Research Budget for 2010

14.1. Overview, time schedule and budgetary implications of proposed 2010 research activities.

14.2. Timing, length and structure of next meeting

15. Other Matters

16. Adoption of Meeting Report

17. Close of Meeting

Attachment 3

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

(CCSBT-ESC/0909/)

1. Draft Agenda
2. List of Participants
3. List of Documents
4. (Secretariat) Secretariat Review of Catches (ESC agenda item 4.2)
5. (Secretariat) Surface Fishery Tagging Program – an update
6. (Secretariat) Data Exchange (ESC agenda item 11.1)
7. (Australia) Preparation of Australia's southern bluefin tuna catch and effort data submission for 2009. Hobsbawn, P.I., Sahlqvist, P.
8. (Australia) Fishery indicators for the southern bluefin tuna stock 2008-09. Phillips, K.
9. (Australia) Japanese market update 2009. Phillips, K., Begg, G.
10. (Australia) Conditioning of the southern bluefin tuna operating model and constant catch projections. Giannini, F., Eveson, P., Davies, C., Barnes, B., Hillary, R., Begg, G.
11. (Australia) Converting stereo-video length measurements to weight estimates for Australia's surface fishery. Humphries, J., Phillips, K., Rodriguez, V., Begg, G.
12. (Australia) The aerial survey index of abundance: updated analysis methods and results. Eveson, P., Farley, J., Bravington, M.
13. (Australia) Commercial spotting in the Australian surface fishery, updated to include the 2008/9 fishing season. Basson, M., Farley, J.
14. (Australia) An update on Australian otolith collection activities, direct ageing and length-at-age in the Australian surface fishery. Farley, J., Clear, N.
15. (Australia) Update on the length and age distribution of SBT in the Indonesian longline catch. Farley, J., Andamari, Proctor, C.
16. (Australia) Current and future monitoring of Indonesia’s Indian Ocean tuna fishery and SBT catch – Discussion paper. B. Iskandar Prisantoso, R. Andamari, C. Proctor, C. Davies, J. Farley
18. (Australia) Estimates of reporting rates from the Australian surface fishery based on previous tag seeding experiments and tag seeding activities in 2008/2009. Hearn, Eveson, P.
19. (Australia) Updated analyses of tag return data from the CCSBT SRP tagging program. Eveson, P.

20. (Australia) Summary of revisions to the tagging likelihood component of the CCSBT operating model. Eveson, P.
21. (Australia) Update on the close-kin genetics project for estimating the absolute spawning stock size of SBT. Bravington, M., Grewe, P., Davies, C.
22. (Australia) Further consideration of the potential for management procedures for SBT based on fishery independent indicators - short-term options using relative indices from the aerial survey and conventional tagging. Hillary, R., Basson, M., Davies, C., Eveson, P.
24. (Japan) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2008/2009 (Osamu Sakai, Tomoyuki Itoh, Shinichi Tashiro and Toshiyuki Tanabe)
25. (Japan) Activities of otolith collection and age estimation and analysis of the age data by Japan in 2008. (Tomoyuki Itoh, Osamu Sakai, Akio Hirai and Kenichiro Omote)
26. (Japan) Report of activities for conventional and archival tagging and recapture of southern bluefin tuna by Japan in 2008/2009 (Osamu Sakai and Tomoyuki Itoh)
27. (Japan) Summary of Fisheries Indicators in 2009 (Norio Takahashi and Tomoyuki Itoh)
28. (Japan) Change in operation pattern of Japanese SBT longliners in 2008 resulting from the introduction of the individual quota system in 2006. (Tomoyuki Itoh)
29. (Japan) Follow-up analysis on age composition of southern bluefin tuna used for farming in 2007. (Tomoyuki Itoh, Takaaki Sakamoto and Takahisa Yamamoto)
30. (Japan) Analysis of age composition of southern bluefin tuna used for farming in 2008. (Tomoyuki Itoh, Takaaki Sakamoto and Takahisa Yamamoto)
31. (Japan) Estimation of growth in farmed southern bluefin tuna using the CCSBT conventional tagging data (Osamu Sakai, Tomoyuki Itoh and Takaaki Sakamoto)
32. (Japan) Report of the piston-line trolling survey in 2008/2009. (Tomoyuki Itoh and Osamu Sakai)
34. (Japan) A preliminary analysis of acoustic tagging data for estimating the possibility of double counting same fish schools in recruitment monitoring survey by trolling (Ryo Kawabe, Ko Fujioka, Tomoyuki Itoh, Alistair J. HOBDAY and Yoshimi TAKAO)
35. (Japan) Distribution of southern bluefin tuna in Western Australia. (Tomoyuki Itoh and Osamu Sakai)
36. (Japan) Proposal for the recruitment monitoring survey in 2009/2010. (Tomoyuki ITOH, Osamu SAKAI, Ryo KAWABE, and Alistair J. HOBDAY)
37. (Japan) Report of the 2008/2009 RMA utilization and application for the 2009/2010 RMA. (Fisheries Agency of Japan)

38. (Australia) Update on the global spatial dynamics archival tagging project - 2009. Basson, M., Eveson, P., Hobday, A., West
39. (Japan) Examination of the SBT operating model to inform conditioning and projection specifications. (Hiroyuki Kurota, Osamu Sakai, and Doug S Butterworth)
40. (Australia) Re-conditioning of the CCSBT Operating Model: exploration of revised natural mortality and interaction with steepness. Paige Eveson, Campbell Davies
41. (Japan) Monitoring on Japanese markets. Takaaki SAKAMOTO, Osamu SAKAI and Tomoyuki ITOH
42. (Australia) Proposed use of CCSBT Research Mortality Allowance to facilitate electronic and genetic tagging of SBT as part of Australia's contributions to scientific research in 2009-10. Karen Evans

(CCSBT- ESC/0909/BGD)

1. (Japan) Analysis on age composition of southern bluefin tuna used for farming (Tomoyuki Itoh and Takaaki Sakamoto)

(CCSBT-ESC/0909/SBT Fisheries -)

Australia	Australia's 2007-08 southern bluefin tuna fishing season. Hobsbawn, P.I., Phillips, K., Begg, G.
Japan	Review of Japanese SBT Fisheries in 2008 (Osamu Sakai, Tomoyuki Itoh and Takaaki Sakamoto)
New Zealand	Annual Review of National SBT Fisheries for the Scientific Committee. New Zealand 2009
Taiwan	Review of Taiwan SBT Fishery of 2007/2008
Korea	Review of Korean SBT Fishery of 2007~2009
Indonesia	The Catch of SBT by the Indonesian Longline Fishery Operating Out of Benoa, Bali in 2008

(CCSBT-ESC/0909/Info)

(CCSBT-ESC/0909/Rep)

1. Report of the Operating Model and Management Procedure Technical Meeting (July 2009)

2. Report of the Strategy and Fisheries Management Working Group Meeting (April 2009)
3. Report of the Fifteenth Annual Meeting of the Commission (October 2008)
4. Report of the Thirteenth Meeting of the Scientific Committee (September 2008)
5. Report of the Ninth Meeting of the Stock Assessment Group and Fifth Meeting of the Management Procedure Workshop (September 2008)
6. Report of the Independent Expert on the Performance Review (September 2008)
7. Report of the Performance Review Working Group (July 2008)
8. Report of the Twelfth Meeting of the Scientific Committee (September 2007)
9. Report of the Eighth Meeting of the Stock Assessment Group (September 2007)
10. Report of the Second CPUE Modelling Workshop (May 2007)
11. Report of the Thirteenth Annual Meeting of the Commission (October 2006)
12. Report of the Eleventh Meeting of the Scientific Committee (September 2006)
13. Report of the Seventh Meeting of the Stock Assessment Group (September 2006)
14. Report of the Special Meeting of the Commission (July 2006)
15. Report of the Management Procedure Special Consultation (May 2005)
16. Report of the Fourth Meeting of the Management Procedure Workshop (May 2005)

Attachment 4

Table 1: Summary of observed catch and effort coverage by country, year and sector

Country	Year	Sector	Observers Deployed	Sea Days	Sets/Tows Observed	Observed Vessels	Observed Effort (%, units)	Observed Catch (%)	Total Cost
Australia	2002–03	Purse Seine[1]	N/A	47	24		11% (sets)	11% (est. total weight)	60,000 (A$)
Australia	2002–03	Towing[1]	N/A	19	1		2.6% (tows)		(included above)
Australia	2002	East Coast Longline	17	323	198		14.4% (hooks)	35.5% (no. retained catch)	NA
Australia	2002	West Coast Longline	N/A	N/A	N/A		N/A (hooks)	N/A (no. retained catch)	NA
Australia	2003–04	Purse Seine[1]	2	27	21		13% (sets)	12.8% (est. total weight)	60,000 (A$)
Australia	2003–04	Towing[1]	2	30	2		5.6% (tows)		(included above)
Australia	2003	East Coast Longline	10	242	168		14.9% (hooks)	55.2% (no. retained catch)	303,000 (60,000 A$ SBT component)
Australia	2003	West Coast Longline	4	72	54		2.0% (hooks)	4.5% (no. retained catch)	42,247 (A$)
Australia	2004–05	Purse Seine[1]	2	36	15		11.2% (sets)	8.5% (est. total weight)	60,000 (A$)
Australia	2004–05	Towing[1]	2	24	2		5.7% (tows)		(included above)
Australia	2004	East Coast Longline	11		68		11.7% (hooks)	5.4% (no. retained catch)	966,000 (150,000 A$ SBT component)
Australia	2004	West Coast Longline			59		3.9% (hooks)	0% (no. retained catch)	57,384 (A$)
Australia	2005–06	Purse Seine[1]	2	47	14		9.2% (sets)	10.1% (est. total weight)	78,000 (A$)
Australia	2005	East Coast Longline	14		128		37.5% (hooks)	62.8% (no. retained catch)	723,289 (160,000 A$ SBT component)
Australia	2005	West Coast Longline			47		9.1% (hooks)	(no observed catch)	0

Country	Year	Sector	Observers Deployed	Sea Days	Sets/Tows Observed	Observed Vessels	Observed Effort (%, units)	Observed Catch (%)	Total Cost
Australia	2006–07	Purse Seine[1]	2	50	9		5.6% (sets)	12.1% (est. total weight)	
Australia	2006–07	Towing[1]	2	41	2		6.5% (tows)		
Australia	2006	East Coast Longline	20		138		22.1% (hooks)	88.9% (no. retained catch)	
Australia	2006	West Coast Longline	1		8		17.4% (hooks)	(no observed catch)	
Australia	2007–08	Purse Seine[1]	2	19	16		11.8% (sets)	5.6% (est. total weight)	68,000 (A$)
Australia	2007–08	Towing[1]	2	38	2		6.0% (tows)		(included above)
Australia	2007	East Coast Longline	17		156		30.2% (hooks)	23.2% (no. retained catch)	180,000 (A$)
Australia	2007	West Coast Longline			10		1.9% (hooks)	No SBT caught	15,589 (A$)
Australia	2008–09	Purse Seine	2	27	11 (fish retained) 8 (aborted)	3	7.9% (sets, fish retained)	15.3% (est. total weight)	77,215 (A$)
Australia	2008–09	Towing	1	15	1	1	3.2% (tows)		(included above)
Australia	2008	East Coast Longline	31		676		47.9% (hooks)	34% (no. retained catch)	694,500 (A$ - 08/09 fin year)
Australia	2008	West Coast Longline	3		25		16.7% (sets)	No SBT caught	16,800 (A$ - 08/09 fin year)
Indonesia	2005	Longline	6	189	112		0.38% (hooks)	0.037%	91,391 ($AU)
Indonesia	2006	Longline	6	724	439		1.01% (hooks)	2.78%	72,858 ($AU)
Indonesia	2007	Longline	6	417	242		0.63% (hooks)	0.33%	70,171 ($AU)
Indonesia	2008	Longline	6	713	387	1.5%	1293 (hooks)	5286 (fish)	90,000 ($AU)
Japan	2002	Longline	16	1135	642	9%	3% (hooks)	3%	31,607,000 (Yen)
Japan	2003	Longline	15	1135	694	9%	6% (hooks)	5%	37,941,000 (Yen)
Japan	2004	Longline	14	1441	653	8%	5% (hooks)	4%	37,240,000 (Yen)
Japan	2005	Longline	16	1178	913	10%	5% (hooks)	4%	43,439,000 (Yen)
Japan	2006	Longline	14	1257	1092	10%	9% (hooks)	6%	43,500,000 (Yen)
Japan	2007	Longline	9	616	538	7%	8% (hooks)	7%	21,326,000 (Yen)
Japan	2008	Longline	6	418	315	5%	4% (hooks)	2%	14,444,000 (Yen)
Korea	2005	Longline	1	29	20	9%	2% (hooks)	-	6,459,000 (Won)

Country	Year	Sector	Observers Deployed	Sea Days	Sets/Tows Observed	Observed Vessels	Observed Effort (%, units)	Observed Catch (%)	Total Cost
Korea	2006	Longline	1	24	21	9%	2% (hooks)	-	8,400,000 (Won)
Korea	2007	Longline	1	95	76	9%	2% (hooks)	27.50%	16,350,000 (Won)
Korea	2009	Longline	2	109	97	10%	-	-	37,300,000 (Won)
New Zealand	2002	Charter	4	177	230	100%	100% (hooks)	100%	88,500 (NZ$)
New Zealand	2002	Domestic	5	104	59		8% (hooks)	NA	52,000 (NZ$)
New Zealand	2003	Charter	4	194	264	100%	100% (hooks)	100%	97,000 (NZ$)
New Zealand	2003	Domestic	5	127	84		7% (hooks)	NA	63,500 (NZ$)
New Zealand	2004	Charter	4	363	334	100%	96% (hooks)	100%	181,500 (NZ$)
New Zealand	2004	Domestic	10	231	131		15% (hooks)	16%	115,500 (NZ$)
New Zealand	2005	Charter	2	225	199	100%	89% (hooks)	100%	181,500 (NZ$)
New Zealand	2005	Domestic	8	260	80		12% (hooks)	9%	130,000 (NZ$)
New Zealand	2006	Charter	2	225	175	100%	88% (hooks)	100%	112,500 (NZ$)
New Zealand	2006	Domestic	14	214	48		6% (hooks)	4%	107,000 (NZ$)
New Zealand	2007	Charter	3	254	247	50%	55% (hooks)	60%	157,500 (NZ$)
New Zealand	2007	Domestic	11	242	71		13% (hooks)	16%	150,000 (NZ$)
New Zealand	2008	Charter	4	273	83	50%	45% (hooks)	46%	
New Zealand	2008	Domestic	11	247	85		15% (hooks)	9%	
Taiwan	2002	Longline	1	202	126	4.76%	6.57%	1.44%	560,000(NT$)
Taiwan	2003	Longline	2	177	133	2.63%	2.43%	0.86%	630,000(NT$)
Taiwan	2004	Longline	3	263	165	3.8%	4.17%	3.1%	940,000(NT$)
Taiwan	2005	Longline	4	681	444	8.16%	11.57%	9.62%	1,600,000(NT$)
Taiwan	2006	Longline	3	296	253	9.09%	10.46%	6.08%	1,250,000(NT$)
Taiwan	2007	Longline	4	441	394	14.81%	14.84%	13.72%	2,460,000(NT$)
Taiwan	2008	Longline	2	252	227	5.71%	6.65%	3.63%	1,393,000(NT$)

[1] Australian purse seine and towing observer statistics are for the SBT fishing year December–November

Table 2: Number of biological samples taken in observer programs separated by country, year and sector

Country	Year	Sector	Otoliths	Sex	Tags	Stomach contents	Length Measurement
Australia	2002	Longline	0	124	165	0	300
Australia	2003	Longline	0	51	229	1	388
Australia	2004	Longline	5	62	0	5	187
Australia	2004-05	Purse seine	2	2	0	0	3
Australia	2005	Longline	63	189	19	12	264
Australia	2005-06	Purse seine	46	46	0	0	23
Australia	2006	Longline	0	4	1	0	32
Australia	2006-07	Purse seine	9	17	0	16	19
Australia	2007	Longline	9	41	0	0	42
Australia	2007-08	Purse seine	4	4	0	0	4
Australia	2008	Longline	0	84	0	1	99
Australia	2008-09	Purse Seine	14	14	0	0	14
Indonesia	2005	Longline					7
Indonesia	2006	Longline					155
Indonesia	2007	Longline					38

Country	Year	Sector	Otoliths	Sex	Tags	Stomach contents	Length Measurement
New Zealand	2002	Combined	1201	3013	15	2340	2996
New Zealand	2003	Combined	842	1658	5	1537	1668
New Zealand	2004	Combined	1143	1961	5	1846	2008
New Zealand	2005	Combined	420	1099	4	972	1121
New Zealand	2006	Combined	444	1252	4	1071	1281
New Zealand	2007	Combined	716	1713	19 implantable; 15 pop-off	1513	1748
New Zealand	2008	Combined	745	1372	22 implantable; 2 pop off	1276	1404
Japan	2002	Longline	308	2683	2	229	2712
Japan	2003	Longline	338	4719	21	563	4757
Japan	2004	Longline	655	4112	20	671	4155
Japan	2005	Longline	522	3915	22	563	3949
Japan	2006	Longline	469	4244	13	766	4372
Japan	2007	Longline	620	3550	52	648	3926
Japan	2008	Longline	301	1059	10	241	1206
Korea	2007	Longline	-	494	-	-	494

Country	Year	Sector	Otoliths	Sex	Tags	Stomach contents	Length Measurement
Korea	2009	Longline	-	1048	-	-	1048
Taiwan	2002	Longline	-	-	0	-	338
Taiwan	2003	Longline	102	-	0	-	174
Taiwan	2004	Longline	316	86	0	93	1290
Taiwan	2005	Longline	210	131	0	257	2217
Taiwan	2006	Longline	56	51	0	57	1484
Taiwan	2007	Longline	197	144	0	189	4043
Taiwan	2008	Longline	73	13		45	1049

Global Reported Catch By Flag

Catches are presented as whole weights in tonnes. Numbers in **bold** font differ from those in Attachment 5 of the SC13 report.
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 Commission	Miscellaneous	Research & Other
1952	264		565	0		0	0	0	0	0	0	0	
1953	509		3,890	0		0	0	0	0	0	0	0	
1954	424		2,447	0		0	0	0	0	0	0	0	
1955	322		1,964	0		0	0	0	0	0	0	0	
1956	964		9,603	0		0	0	0	0	0	0	0	
1957	1,264		22,908	0		0	0	0	0	0	0	0	
1958	2,322		12,462	0		0	0	0	0	0	0	0	
1959	2,486		61,892	0		0	0	0	0	0	0	0	
1960	3,545		75,826	0		0	0	0	0	0	0	0	
1961	3,678		77,927	0		0	0	0	0	145	0	0	
1962	4,636		40,397	0		0	0	0	0	724	0	0	
1963	6,199		59,724	0		0	0	0	0	398	0	0	
1964	6,832		42,838	0		0	0	0	0	197	0	0	
1965	6,876		40,689	0		0	0	0	0	2	0	0	
1966	8,008		39,644	0		0	0	0	0	4	0	0	
1967	6,357		59,281	0		0	0	0	0	5	0	0	
1968	8,737		49,657	0		0	0	0	0	0	0	0	
1969	8,679		49,769	0		0	80	0	0	0	0	0	
1970	7,097		40,929	0		0	130	0	0	0	0	0	
1971	6,969		38,149	0		0	30	0	0	0	0	0	
1972	12,397		39,458	0		0	70	0	0	0	0	0	
1973	9,890		31,225	0		0	90	0	0	0	0	0	
1974	12,672		34,005	0		0	100	0	0	0	0	0	
1975	8,833		24,134	0		0	15	0	0	0	0	0	
1976	8,383		34,099	0		0	15	0	12	0	0	0	
1977	12,569		29,600	0		0	5	0	4	0	0	0	
1978	12,190		23,632	0		0	80	0	6	0	0	0	
1979	10,783		27,828	0		0	53	0	5	0	0	4	
1980	11,195		33,653	130		0	64	0	5	0	0	7	
1981	16,843		27,981	173		0	92	0	1	0	0	14	
1982	21,501		20,789	305		0	182	0	2	0	0	9	
1983	17,695		24,881	132		0	161	0	5	0	0	7	
1984	13,411		23,328	93		0	244	0	11	0	0	3	
1985	12,589		20,396	94		0	241	0	3	0	0	2	
1986	12,531		15,182	82		0	514	0	7	0	0	3	
1987	10,821		13,964	59		0	710	0	14	0	0	7	
1988	10,591		11,422	94		0	856	0	180	0	0	2	
1989	6,118		9,222	437		0	1,395	0	568	0	0	103	
1990	4,586		7,056	529		0	1,177	0	517	0	0	4	
1991	4,489		6,477	164		246	1,460	0	759	0	0	97	
1992	5,248		6,121	279		41	1,222	0	1,232	0	0	73	
1993	5,373		6,318	217		92	958	0	1,370	0	0	15	
1994	4,700		6,063	277		137	1,020	0	904	0	0	54	
1995	4,508		5,867	436		365	1,431	0	829	0	0	201	296
1996	5,128		6,392	139		1,320	1,467	0	1,614	0	0	295	290
1997	5,316		5,588	334		1,424	872	0	2,210	0	0	333	
1998	4,897		7,500	337		1,796	1,446	5	1,324	1	0	471	
1999	5,552		7,554	461		1,462	1,513	80	2,504	1	0	403	
2000	5,257		6,000	380		1,135	1,448	17	1,203	4	0	31	
2001	4,853		6,674	358		845	1,580	43	1,632	1	0	41	4
2002	4,711		6,192	450		746	1,137	82	1,701	18	0	203	17
2003	5,827		5,770	390		254	1,128	68	565	15	3	40	17
2004	5,062		5,846	393		131	1,298	80	633	19	23	2	17
2005	5,244		7,855	264		38	941	53	1,726	24	0	0	5
2006	5,635		4,207	238		150	846	50	598	9	**3**	0	5
2007	4,813		2,840	379	4	**521**	841	46	1,077	41	**18**	0	3
2008	5,051		2,952	319	0.4	1,134	876	45	926	45	7	4	10

European Commission: From 2006, estimates are from EC 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. For 2008, Miscellaneous includes 3703kg caught by Oman, reported by South Africa.
Research and other: Mortality of SBT from CCSBT research and other sources such as discarding practices in 1995/96.
*: JIS for 1993, 1994 and 1998 are higher than these official statistics and are: 117, 147 and 1897 respectively. Assessments would normally use the higher of these values.

Attachment 6

Report of the CPUE Modelling WG

Intersessional work in 2009.

The chair reported to the ESC the results of the 2 web-meetings and the meeting in Seattle held during 2009. Progress had been encouraging and all essential products provided to the OMP WG in good time.

Exchange of Data to calculate the new base CPUE series.

Japan agreed to provide to Members the core vessel data set at the 5x5 and monthly scale (including BET and YFT by-catch) as required for calculation of the new annual CPUE series. Australia and New Zealand, whose data are included in the core vessel data for the CPUE series, agreed for their data to be provided to Members who request the new CPUE series data set.

Intersessional work between ESC14 and ESC 15.-

A Task List of intersessional work and associated timing were provided to the ESC. Tasks are as follows.

Additional Data inputs to the OMP WG

The OMP WG requested that all data inputs for the final version of the conditioning model be available by September, 2009. CPUE results to 2006 have already been provided. However results for 2007 and 2008 which require the use of RTMP data cannot be promised until the 31st of October. (task list item A1). The same deadline would apply to associated estimates of corrections to apply to the RTMP based data and any estimates of the possible effects that post 2006 changes in fleet behaviour might have on CPUE (Task A2).
It should be possible to construct core fleet data for 2005 &2006 based on RTMP data. This would allow an estimate of the appropriate calibration to apply to the RTMP data by comparing log book with RTMP based estimates of core fleet CPUE for 2005 and 2006.

Some idea of the possible scale of post 2006 changes might be obtained by making alternative CPUE estimates based upon a smaller core (say 50 best vessels) fleet for 2007-2008? It may also be worth considering tracking which core vessels stayed in the fishery post 2006 and which left? Were they those with the highest or the lowest CPUE's?
These calibration estimates assume that sampling error is negligible compared to process error. It should be possible to estimate the size of estimation error for example by doing a jack –knife analysis (Task A3).

Interpretation of Monitoring Series.

The WG proposed at its Seattle 2008 meeting that the numbers of 5*5 and 1*1 cells fished by the total fleet and by the core fleet would be a useful routine monitoring tool to present to ESC. (Task B1)

These sets provide useful insights into fleet changes but the approach might be further developed by examining if fishing effort had in anyway changed its degree of concentration on hot spots within the strata used to standardize CPUE for the current base CPUE series. Thus ongoing collaboration on the development of concentration indices is to be encouraged. (Task B2). Monitoring for other changes in spatial patterns of fishing since the new management scheme was introduced in 2006 is also indicated (Task B3)

The WG also proposed 4 monitoring CPUE series that are currently available during its 2009 meeting. It is also agreed that the 5 “old” CPUE series should be maintained for monitoring purposes although it was felt that the new base CPUE series should in future be used to prepare CPUE indicators for ESC. Additional series could also be developed based upon ideas investigated during 2009.

We need to have a test of what constitutes a significant (statistical?, biologically meaningful? or Management relevant?) divergence between base CPUE and other similar and plausible CPUE series(Task B4).We note that of the 5 old series the ST Windows and Laslett CPUE series seemed to have diverged in recent years and might give some idea of scale of what seems a significant effect.

Further Investigations on the effects of Observers and Discarding on CPUE series.

It is proposed that the additional model runs indicated for this topic at the 2008 Seattle meeting of the WG would be conducted (Task C1) prior to the mid term meeting of the OMP WG and the results used to better formulate an additional CPUE S% robustness trial for the OMP WG (Task C2).

Intersessional meetings

It is proposed that the CPUE Modelling WG meet in the margins of the (May/June) mid term meeting of the OMP WG.

Task List for intersessional work of CPUE WG

Table 1

Code	Task	Responsible People	Timing
A	RTMP Corrections		
A1	Extend the CPUE series to the most current years using RTMP data for OMP WG by end of October.	TI	October 31 2009
A2	Provide error estimates of RTMP correction and any post 2006 effect	JP, TI, RH?	October 31 2009
A3	Estimation of sampling error in CPUE estimates (e.g. by jack knife analysis)	RH, DB, TI	
B	Development of Monitoring Series		
B1	Commence the annual monitoring of the numbers of cells fished for both core vessels and all vessels at the 5x5 and 1x1 scale.	TI	ESC 2010
B2	Develop concept of a concentration indices	JP, FG, Others	ESC 2010
B3	Monitoring for changes in spatial patterns of fishing since new management scheme was introduced in 2006.	TI, JP and others	ESC 2010
B4	Quantify the significance of divergences in monitoring series from the base series.	JP, TI and others	ESC 2010
C	Further Investigate effects of Observers and Discarding on CPUE series		
C1	Further analysis of differential trends in observed and non-observed trips..	TI	Mid term
C2	From results of C1 propose revised “S” Robustness Test.	JP, DB, CD	Mid term

Named People TI= Dr Itou, JP= John Pope, DB= Prof. Butterworth, RH=Dr Hillary,

Attachment 7

Comments on Farm Review Papers

Advisory Panel comments on Japanese analysis of length frequency in imported farmed SBT

Japan presented three papers exploring the potential for bias in the 40 fish samples used to estimate total landings in the Australian surface fishery. CCSBT-ESC/0909/29 used data on length frequency in farmed SBT imported into Japan in 2007 to estimate the age distribution of imported fish. The primary result of this analysis was the apparent lack of 2 year olds in the imported fish, despite 2 year olds constituting a high fraction of the estimated landings. CCSBT-ESC/0909/30 did a similar analysis for the 2008 imports. In this case the modes reported in the length frequency were less clear, and the estimated discrepancies in age composition between reported landings and imports were smaller. CCSBT-ESC/0909/31 analyzed the growth of tagged SBT that were recovered at the time of being killed in the Australian net pens. Using these 141 fish the estimated mean gain in weight from time of tagging to time of killing was 1.63 (standard error of mean of 0.03). This is significantly less than the implied growth rates suggested by the difference between reported landed weight and Australian exports.

The major potential weaknesses identified by the Advisory Panel in the Japanese approach to using length frequency is that the sample must be representative of the farmed SBT imported into Japan. Different Australian farms may be delivering appreciably different size distributions, and the differing fractions of the fish from each producer may arrive in Japan via freezer vessels, freezer containers and fresh shipments. Sampling almost certainly needs to cover all major farms and methods of arrival. If the samples are not representative then the subsequent analysis is clearly flawed. If Japan wishes to establish confidence in this approach to estimating surface catch then a detailed analysis of the sampling protocol needs to be presented establishing that it is truly representative of the imports of farmed SBT.

The most obvious potential problem with paper 31 and the use of the tagged fish is that tagged fish may not grow at the same rate as untagged fish as a result of the tagging process. The mean size at slaughter of the tagged fish was almost exactly the same as the modes of the age distribution in the farmed imports to Japan, which does suggest that the growth rates of tagged fish may be representative of untagged fish. The only potential for further development of this approach is from the tag seeding experiments done in Australia which could contribute to a larger sample size.

Overall the Advisory Panel feels that the combined papers 29-31 do support the view that the Australian surface fishery catch is underestimated by the current sampling regime. If the samples are indeed representative of the imports of farmed fish, we find the analysis of length modes for the 2007 data persuasive. The sample sizes were substantial, with 73% of fresh and 58% of frozen fish sampled in 2007. The estimated bias from the 2007 samples is considerably larger than the current agreement for data inputs that the samples are biased 20% low. In the 2008 data the modes were less clear and the estimated bias was much lower. However one single year is not strong evidence that the bias is consistently that high.

The Advisory Panel feels that the best solution to the concern about estimating surface fishery catch is not improved analysis of length frequency data of imports. Rather it is implementation of the stereo video monitoring protocol as a replacement for the current sampling system. We note that there is no need to measure the length of each fish from the video, but that even a small sample of perhaps 50 fish, systematically selected from the video of each tow cage ,would almost certainly be an improvement on the current system and would require minimal analysis of tapes from a stereo video system. If the stereo video system is not implemented then the Advisory Panel reiterates the opinion given in paragraph 45 of the 2008 ESC report "The Advisory Panel also considered that these estimates [from length frequency analysis] could replace adjustments now made in age composition for historical data if adequate samples could be obtained and the proportions in each category estimates."

Comments from Japan

At first, Japan would like to mention about the history of the Australian SBT Farming study. Then, Japan will explain our future plan. After that, Japan would like to propose one recommendation from the Extended Scientific Committee to the Extended Commission to cover agenda item 7.2 (Scientific advice/recommendation on Australian SBT farm study from the ESC to the Extended Commission).

At the 11th meeting of the Extended Scientific Committee in 2006, "It was suggested that comparisons of stereo video and 40 fish sampling results could be compared to estimate bias in 40 fish sample, which might help estimate past farm anomalies." (Paragraph 72 of the ESC11 report) "Australia stated that preliminary results had already been released in publicly available documents… Australia also noted that stereo video cameras had undergone extensive field testing and demonstrated reliable performance under experimental conditions. These cameras are expected to be implemented during transfers in the near future, as soon as the systems can be demonstrated to be robust enough for routine farm application. Operational trials will be implemented in the 2006/07 fishing season." (Paragraph 73 of the ESC11 report).

However, the operational trails were not implemented in the 2006/2007 fishing season.
At the 13th meeting of the Extended Commission meeting in 2006, Australian SBT farming study was discussed, and it was agreed that Australia would endeavour to complete work on the experimental design and experimental work as soon as practicable with an emphasis on finalizing the investigation and clarification of representativeness of the 40 fish sampling, which is used to estimate catch by Australian purse seine fisheries, in the first year.(paragraph 42-44 of EC13 report)

However, the representativeness of the 40 fish sampling has not been clarified yet.
At the 12th meeting of the Extended Scientific Committee in 2007, "the Independent panel strongly encouraged Australia to test the stereo-video system under commercial conditions as soon as possible and in parallel with the 40 fish sample so that the nature of any bias in the 40 fish sample can be determined."(paragraph 48 of the ESC12 report). Australia proposed a timetable, which included trial of stereo-video equipment used in commercial farm transfers in 2008-2009 season (paragraph 55 of ESC12 report). However, the trial of stereo-video equipment used in commercial farm transfers was not implemented in 2008-2009 season. During the 14th meeting of the Extended Scientific Committee in this week, Australia informed the meeting that trials of stereo-video equipment under commercial operations had not yet been carried out.

In short, three years have passed since the Extended Scientific Committee stared to discuss the usage of the stereo video camera. However, the Extended Scientific Committee still faces a problem of bias in the 40 fish sampling. There is no information on the exact timing when the stereo video camera will be implemented in commercial farm transfers. Under such circumstances, Japan believes that analysis of length frequency in imported farmed SBT is the best approach to estimate catch and size composition of the Australian purse seine fishery. Taking into account comments which were provided on CCSBT-ESC/0909/29 and CCSBT-ESC/0909/30 during this Extended Scientific Committee meeting, Japan will improve the length frequency analysis and provide its results at the next year's Extended Scientific Committee meeting.

Regarding CCSBT-ESC/0909/31, analysis of tagged fish can give a direct calculation of growth rate during farming. In addition to the data used in the document 31, Australia has been collecting data on growth rate of tagged fish through the 40 fish sampling. When the 40 fish sampling is conducted, more than 10 fish are tagged after length and weight measurements. Then these tagged fish are raised in farming pens. After that, weights of these tagged fish are measured when they are harvested. Based on the agreement at the 15th meeting of the Extended Commission, which is that "Australia and Japan expressed their intention to work for improvement of monitoring of… Australian SBT farming operations", Japan would like to work with Australia to improve and develop the analysis of tagged fish. Japan believes that collaborative analysis/work on the tagged fish by Australia and Japan could provide useful input to the next year's Extended Scientific Committee meeting.

Finally, Japan would like to propose one simple recommendation from Extended Scientific Committee to the Extended Commission. The proposed recommendation is follows;

Extended Scientific Committee recommends that the Extended Commission encourage full implementation of the stereo video technique by Australia as soon as possible.

The context of the proposed recommendation is same to an agreement at the last Extended Commission meeting. At the last the Extended Commission meeting, "The meeting welcomed the progress of Australia's research effort with the stereo video camera to improve its monitoring of SBT catches transferred into farms and encouraged full implementation of the stereo video technique by Australia as soon as possible." (paragraph 29 of EC15 report).

Japan seeks supports from other Members for this proposed recommendation.

Thank you

Comments from Australia

Any analysis of cohorts from exported, harvested product is inherently biased, and cannot be used to replace reported Australian estimates of age composition (derived from direct ageing) in the surface fishery. In paragraph 46 of the report of CCSBT-ESC13, Australia stated there had been no discussion of replacing current estimates of bias with analysis using length modes, and more importantly of applying the analysis retrospectively, noting changes over time in stock structure and catching and rearing practices.

There are limitations in applying the approach in CCSBT-ESC/0909/29 and 30 to farm-reared harvested fish, where final harvest weights (and lengths) at the individual pontoon and fish level are affected by a range of factors, including different farming, feeding and holding practices, as well as differential growth rates of fish at different ages, different grow-out periods and the variable size of fish going into farms. Consequently, there is an inherent bias in the input data irrespective of the number of fish sampled.

The modes presented in papers 29 and 30 do not seem to move, and if these were related to age classes then it would be reasonable to assume that these modes would track over months. The lack of observed movement is most likely a result of the input data used in the analyses, as well as differential and selective catching and farming practices.

To assist in resolving this issue, Australia requests that Japan supply the data used in the analyses of papers 29 and 30, including the details of receivers and vessels, so results can be reproduced and the validity of the data assessed.

With respect to paper CCSBT-ESC/0909/31, the estimates are based on very low sample sizes across a number of years. These estimates are considered to be within the range of reported Australian estimates and are lower than those estimated in the 2006 Australian Farm Review, which concluded there was no scope for misreporting. The natural growth rate of SBT is estimated to vary between 1.1–1.8; therefore, an estimate of 1.6 falls within this variability. It should be expected that the growth rate of farmed fish be significantly greater than this. Further factors that must be taken into consideration are the differences in growth rates between tagged and untagged fish, and the change to the growth rate of SBT since the 1960s.

Australia is continuing to examine and improve the catch monitoring programs in the surface fishery, and requests other members and cooperating non-members do likewise for their own fisheries. Australia will continue to support collaborative exercises in improving monitoring in all SBT fisheries. Lastly, Australia cannot support a recommendation from the ESC regarding specific domestic fisheries management issues.

Comments from New Zealand

New Zealand noted that the suggested recommendation encouraged full implementation of stereo video monitoring. New Zealand supported the need for accurate reporting of Members' catches, but suggested it might not be appropriate to specify the method that a Member should use to ensure its reported catches are accurate. An alternative recommendation reflecting this approach was therefore proposed. However, it was noted that the recommendation at paragraph 119 incorporated in a general sense the concerns that had been raised about ensuring accurate reporting of Members' catches.

Attachment 8

Comments on Market Review Papers

Comments from the Scientific Advisory Panel

Australia presented in paper CCSBT-ESC/0909/09 an analysis of the Japanese market data and estimated over-catch by Japan of 2,638 to 3,465 tonnes in 2006, 2,913 to 3,697 tonnes in 2007 and 1,047 to 1,601 tonnes in 2008. Australia concluded that this analysis provided evidence that reported landings, particularly in 2006 were underestimates. Japan presented paper CCSBT-ESC/0909/41 using similar methods with some different assumptions and estimated over-catch that was 747 to 1,357 tonnes in 2006, 132 to 576 tonnes in 2007 and -227 to 189 tonnes in 2008. Japan concluded that given the small discrepancies there was no evidence for underreporting of catch. Both papers relied heavily on assumptions and data from the market survey report in 2006. The major difference between the two methods is that Australia assumed that the proportion of frozen farmed SBT that went through the markets, and the proportion of the product on the markets that came from non-domestic suppliers (primarily Korea and Taiwan) were constant. In contrast, Japan conducted interviews with wholesalers to obtain their estimates of the proportion of the fish in the markets that were frozen farmed SBT, and conducted on-site inspections in the Tokyo market from December 2007 to June 2009 to obtain estimates of the number of fish that were of domestic and foreign origin.

It must be noted that the key estimates in the original market review are uncertain. For instance the market review acknowledged a possible range of estimates of the fraction of product on the market was of imported origin.

The other fraction in dispute is the proportion of the fish in the markets that are frozen farmed SBT. The Japanese Market Review obtained its estimates from interviews with wholesalers. The final assumption across all markets as used in the Australian paper was 6.48% at Tsukiji and 0% at Yaizu. Other key assumptions in the analysis of estimated total catch are fraction of fish subject to double counting (the market review and both Australia and Japan continued with two cases because of large uncertainty), the fraction of domestic fish sold off-market, the time lags from catch to market, and the market weight to wet-weight conversions. Thus any estimate of Japanese catch based on market sampling is uncertain given the combined uncertainty across all of the assumptions.

The Australian calculations assume that the proportion of fish in the market place that are farmed frozen SBT and non-domestic SBT is constant, despite the fact that the total volume of frozen SBT sold in Japanese markets (estimated from Tsukiji and Yaizu volumes by Japan) declined from 10,878 tonnes in 2005 to 9,466 tonnes in 2006, 6,479 tonnes in 2007 and 5,806 tonnes in 2008. Given that the production of farmed fish from Australia was roughly constant in that period, the assumption of constant farmed SBT fraction seems unlikely. The catch of Korea and Taiwan, lagged by the assumed fractions delivered to markets 0 to 3 years after capture, did decline from the early 2000s to 2006, but then increased by roughly 50% in 2008.

The Japanese estimates of the total volume of farmed frozen SBT based on their interviews at Tsukiji and applied uniformly over all Japanese markets, are that the volume increased from 1,377 t in 2005 to 2069 t in 2008. Australia estimates are that the volume of non-domestic SBT declined while the Japanese estimate is that non-domestic SBT increased.

It is the panels view that there are very large uncertainties in the methods employed in the Japanese Market Review, and in the follow-on calculations made by both Australia and Japan. While the very large discrepancies of 200-300% would be considered to be detectable given the uncertainties in the estimates, we do not feel that the relatively smaller discrepancies estimated by Australia make a convincing case that the reported landings are lower than actual landings. There are simply too many sources of uncertainty to believe that the series of calculations and assumptions involved in the analysis of market data for 2006-2008 provide reliable estimates of actual landings. In particular the Australian method takes estimates made primarily in the 2003-2005 market periods and assume that these are unchanged from 2006-2008 when many factors, especially volume of SBT available, were changing.

Australia has argued that because the changes in Japanese TAC had no effect on volume of fish reaching the market in 2006, the kind of change in proportions of farmed SBT or non-domestic SBT estimated by Japan would not have occurred. There was a 13% reduction in volume through the markets from 2005 to 2006 that would be expected to have some effect, all other things being equal. However, the primary reason the panel is not convinced that the market analysis for 2006 discrepancy is valid is the overall uncertainty in the analysis of market data.

Thus the panel thinks that due to the uncertainties in the estimates of catch from the market analysis for 2006-2008 additional sensitivities that include the possibility of Japanese over-catch would be uninformative for decision purposes.

Comments from Australia

It is difficult to accept the revised ratios of CCSBT-ESC/0909/41 without the supporting documentation and clear details of how and what data were collected. There are obvious limitations in sampling Tsukiji market only one day per month, though we encourage Japan to sample the markets more intensely to provide greater confidence in the revised ratios. Disagreements regarding proportions of frozen farmed and frozen wild imported product being sold through Tokyo Central Wholesale Market could be resolved if data on the country of origin, as compiled by the Tokyo Metropolitan Government, were made available to the SC.

Australia accepts that recent changes in management of the Japanese longline fleet and a reduction in the national allocation will have changed the proportions of different product being sold through Tsukiji market. However, because of the 2-3 year lag between time of catch and time of sale, these changes will not have impacted on the estimate for 2006 and, to a lesser extent, 2007. Notably, this is supported by the declining estimates of unreported catches from 2006 to 2008 in both CCSBT-ESC/0909/09 and CCSBT-ESC/0909/41.

Australia also notes that as a minimum, estimates from Japan’s paper CCSBT-ESC/0909/41 should be used to update the retrospective unreported catch scenario in the Secretariat’s Review of Global Catches. It is the role of the SC to assess total mortalities in the SBT stock, and the estimates given in Japan’s paper should be considered as significant, particularly in the context of other members’ and non-members’ allocations.

Australia is committed to continuing to work with Japan to understand and resolve uncertainties in global catches.

Comments from Japan

There are only three major differences between CCSBT-ESC/0909/41 and CCSBT-ESC/0909/09, which are (1) the information used on in-market frozen farmed SBT, (2) the information used on in-market frozen wild imported SBT, and (3) interpretation on differences between the estimated domestic catch based on market information and reported catch. Given the rough nature of the estimated domestic catch, the differences between the estimated domestic catch and reported catch can be considered negligible.

At the last CCSBT annual meeting, “Australia and Japan expressed their intention to work for improvement of monitoring of Japanese wholesale markets and Australian SBT farming operations and report back the results to the 16th Extended Commission Meeting.” (Paragraph 17 of the CCSBT 15 report).

Japan would like to work with Australia to improvement of monitoring of both Japanese wholesale markets and Australian SBT farming operations.

Comments from New Zealand

New Zealand thanked the panel for its work on comparisons of reported and estimated catch in the Japanese markets. New Zealand noted that the analysis had particularly focused on the aspect of how such estimates should be incorporated into the Operating Model, if at all. Nonetheless, these issues would be discussed further at the Compliance Committee and in this context New Zealand noted it did not at this stage agree, as suggested by Japan, that the differences between reported and estimated catch could be considered ‘negligible’.

Attachment 9

Selection of Operating Model grids

Note: A brief description of the acronyms for the sensitivity runs is provided at the end of this attachment.

Summary

The current base case includes five levels of steepness (0.385, 0.55, 0.64, 0.73, 0.82) and is referred to as “base” or “base 5”. Results for a reduced base case with three steepness levels (0.55, 0.64, 0.73) were also presented here, and called “base 3”. The reduced base case runs faster and were used as a basis for plausibility scenarios and the sensitivity results presented here as the results differed very little from base 5.

The ESC selected the final grid to be as follows:

Table 1. Specification of axes for the new base “grid.”

	Levels	Cumul N	Values	Prior	Simulation Weights
Steepness (h)	5	5	0.385 0.55 0.64 0.73 0.82	Uniform	Likelihood
M_1	3	15	0.30 0.35 0.40	Uniform	Likelihood
M_{10}	3	45	0.07 0.1 0.14	Uniform	Likelihood
Omega	1	45	1	NA	NA
CPUE series	2	90	w.5 w.8	Uniform	Prior
q age-range	2	180	4-18 8-12	0.67, 0.33	Prior
Sample Size	1	180	Sqrt	NA	NA

Some of the evaluations undertaken for making these refinements are presented below.

Natural mortality parameterization

Natural mortality parameterizations were selected with a view to retain plausible values. After a number of alternative runs, the ESC agreed to add an extra value at M_1=0.4 and to include a power function coefficient to provide smoothness in the transition of young SBT from age 1 to age 10. During these runs a variety of grid results were examined similar to Figure 1.

Development of alternative steepness levels

In developing new specifications for the operating model after the July 2009 Operating Model and Management Procedure Technical Meeting (OMMPTM), intersessional work identified a number of other refinements to the conditioning process of the OM. In particular, it became apparent that some data components of the model were having undue influence on information about steepness. For example, the longline fishery labelled LL3 which had very little catch for a period since 1971-2006 had an appreciable impact on the likelihood. Closer and more careful examination of these data provided an improved model specification by down-weighting the data for the period which catch was below 200 t and also with additional parameters for selectivity changes (since this fishery changed from a targeted SBT fishery to one in which SBT were taken incidentally with yellowfin and bigeye tuna targets). The ESC adopted these improvements to the OM conditioning and the impact of model changes relative to steepness is shown incrementally from Figures 2, 3, and 4 (the changes made little impact on the LL3 likelihood in relation to steepness). Results comparing the profiles relative to steepness show that some components of likelihood indicate that higher steepness (and hence stock productivity) are favoured whereas other data components indicate a lower value is favoured.

Figure 5 shows results from steepness likelihood-weighted (for steepness) shade plots for alternative specifications with the final selected grid of 5 steepness values (Table 1), the original 3 values from the previous operating model (h = 0.385, 0.55, and 0.7) and with steepness levels set to 0.55, 0.64, and 0.73.

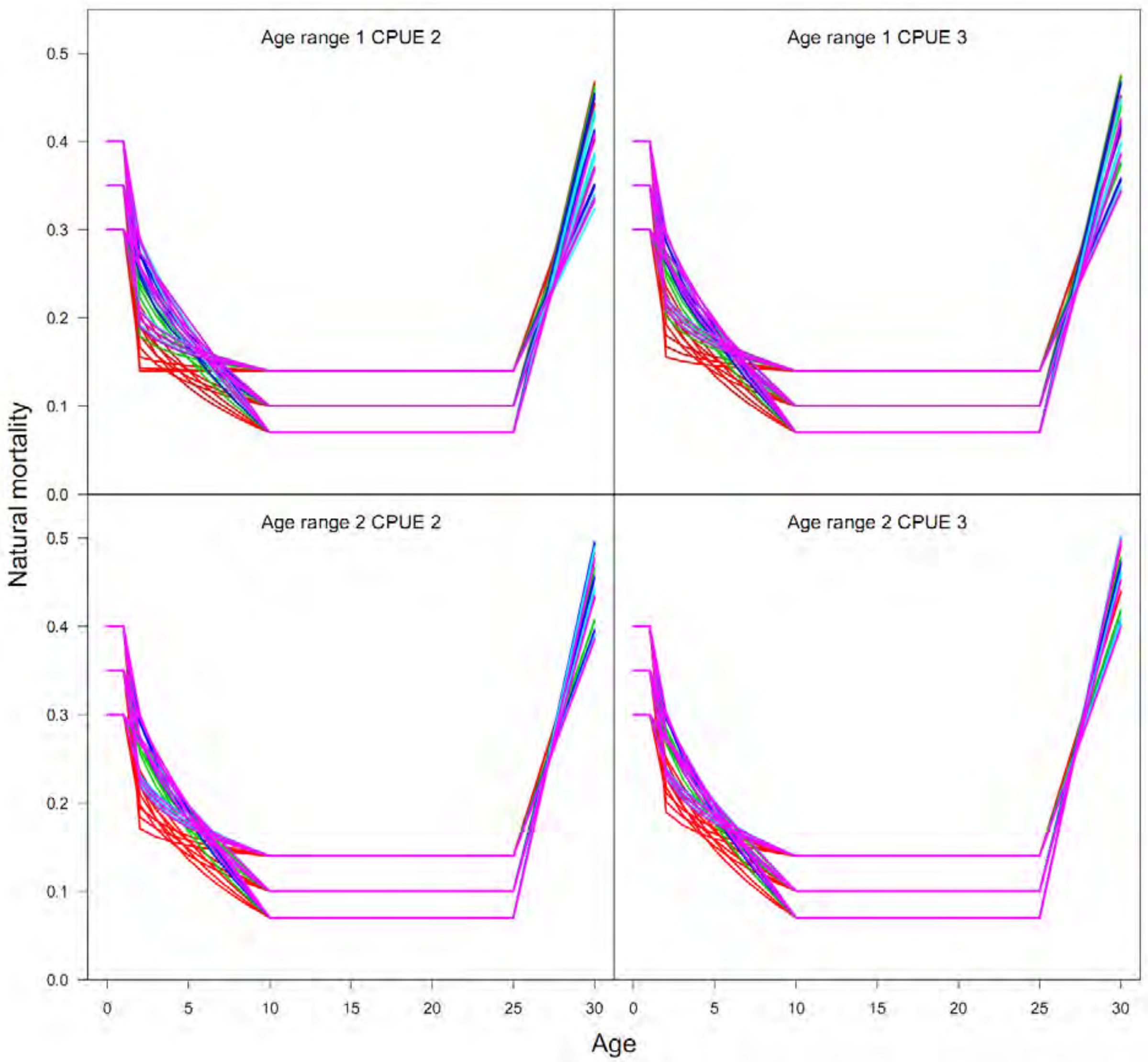


Figure 1. Vectors of natural mortality for the selected base-case grid and combinations of age-range and CPUE series from the final grid.

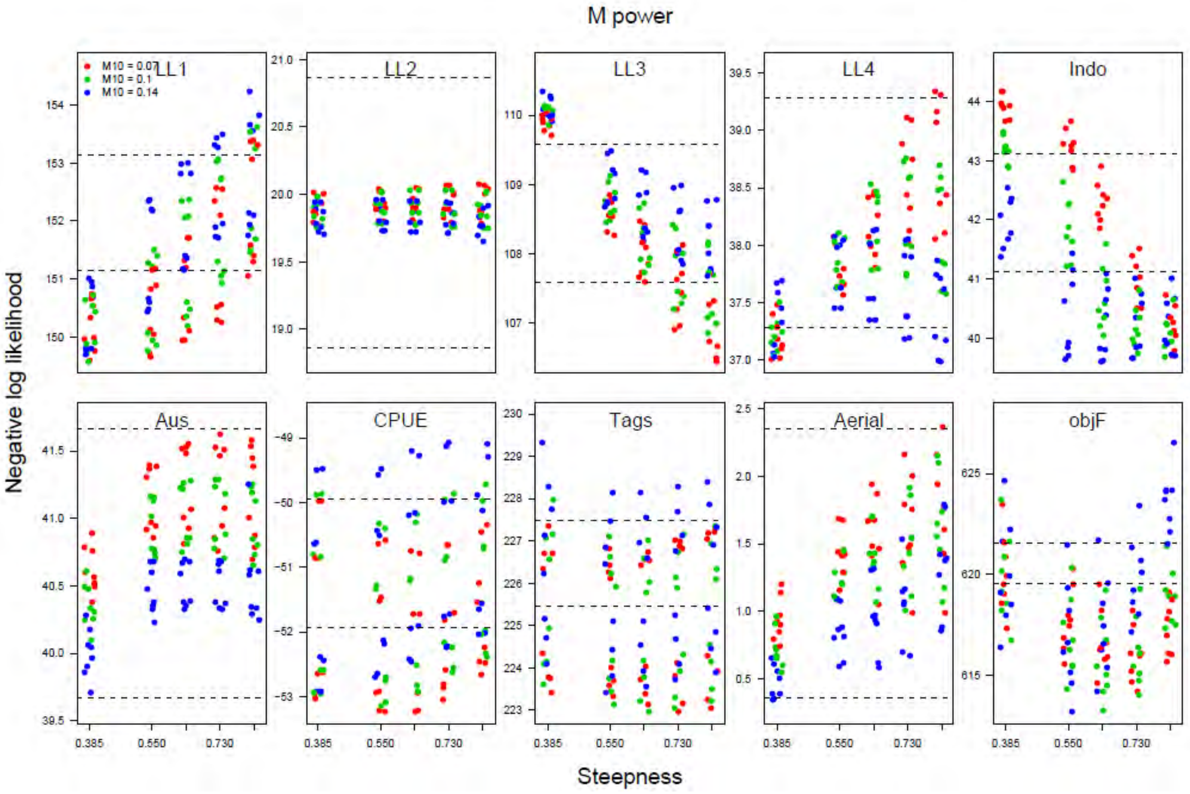


Figure 2. Likelihood profiles for OM data components and total (lower right) for an earlier version of the operating model examined during the week. The horizontal lines are spaced by two likelihood units for comparing relative significance of the points. Values are “jittered” horizontally to better reveal the density of grid results.

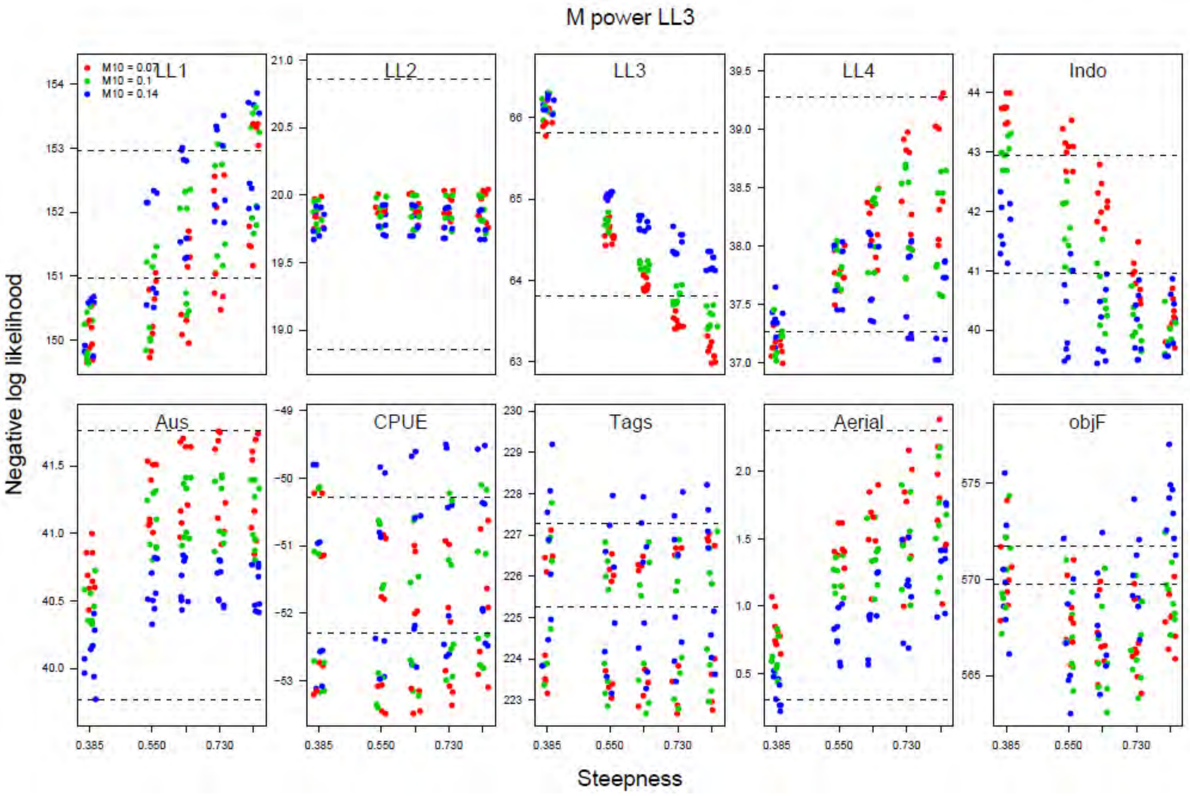


Figure 3. Likelihood profiles for OM data components and total (lower right) for an intermediate version of the operating model examined during the week. The horizontal lines are spaced by two likelihood units for comparing relative significance of the points. Values are “jittered” horizontally to better reveal the density of grid results.

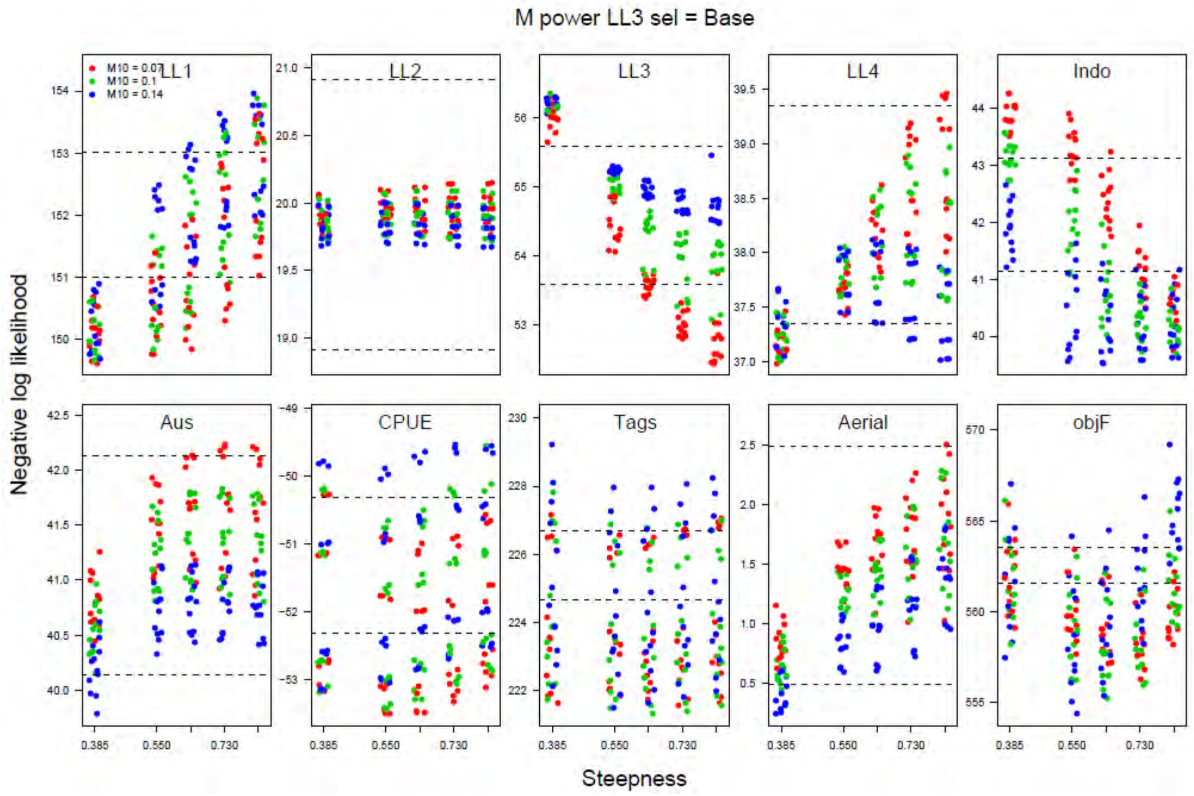


Figure 4. Likelihood profiles for OM data components and total (lower right) for the selected base case of the operating model. The horizontal lines are spaced by two likelihood units for comparing relative significance of the points. Values are "jittered" horizontally to better reveal the density of grid results.

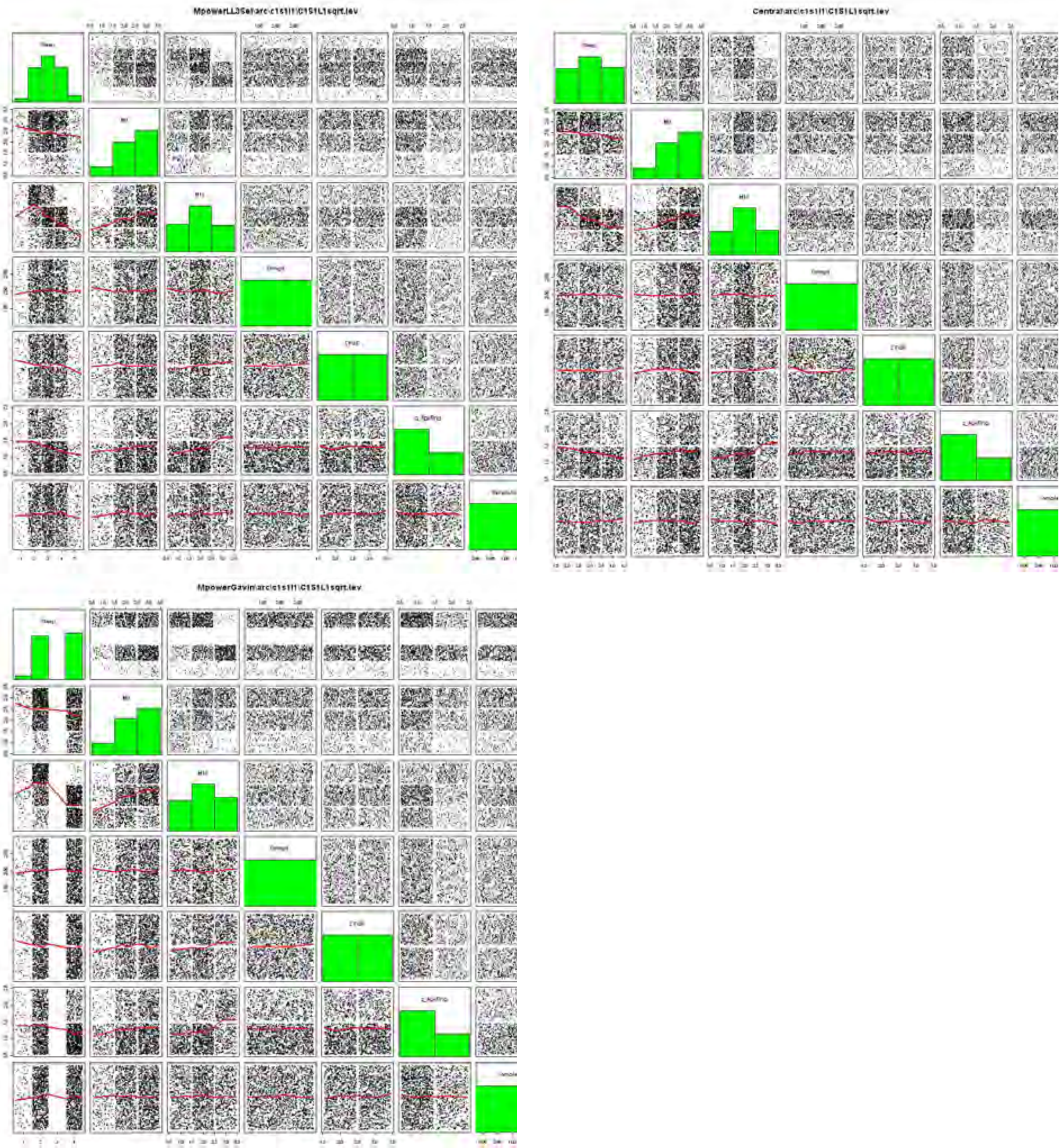


Figure 5. Likelihood-weighted (for steepness) shade plots for alternative specifications with the final selected grid of 5 steepness values (Table 1) in the upper left panel, the original 3 values from the previous operating model (lower left panel) and steepness levels set to 0.55, 0.64, 0.73 (upper right panel).

Brief Description of the sensitivity runs referred to in the report

CPUE S=0	Overcatch had no impact on CPUE
CPUE S=0.50	50% of LL1 overcatch associated with reported effort
CPUE S=0.75	75% of LL1 overcatch associated with reported effort
LL1 Case 2 of MR	LL1 overcatch based on Case 2 of the 2006 Market Report
Omega=0.75	a power function for the relationship between biomass and CPUE with power = 0.75
Tag F / Mixing	Increases the fishing mortality of tagged SBT by 50% relative to the F applied to the whole population. Account for incomplete mixing of the tagged fish.
Including the 2007-08 mean CPUE	Mean of the 5 traditional CPUE series for 2007 and 2008
CPUE CV=0.3	Increases the specified CV of the CPUE series to have a lower bound of 0.3
Uncorrelated RDs	Projected recruitment deviates are uncorrelated to historical estimates from the conditioned model
Include Troll	Includes the piston-line troll survey index
Truncated CPUE	CPUE series ends in 1992
Alternative CPUE	Uses CPUE series 3 and 6
Break CPUE	Two series of CPUE used, up to 1986 and after 1986
Priors for M1, M10	Use prior weights for M1 and M10 when sampling the grid
Old steepness prior	Use original prior weights for 3 values of steepness (0.385, 0.55, 0.73)
Include 2007-08 CPUE Upper	Uses most optimistic CPUE series (Laslett)
Include 2007-08 CPUE Lower	Uses most pessimistic CPUE series (ST Window)

Sensitivity Trials

PROJECTION spawning biomass ratios 15810 mt

Upper 90th percentiles	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.944	0.829	1.064	0.270	0.071	2.423	0.227
Base 3	0.922	0.798	0.912	0.270	0.071	2.285	0.227
Mixed tags	0.983	0.868	1.039	0.262	0.062	2.201	0.209
LL case 2 of MR	1.014	0.951	1.207	0.274	0.070	2.169	0.242
CPUE S=0	0.890	0.713	0.740	0.227	0.069	2.445	0.200
CPUE S=0.5	0.934	0.871	1.099	0.319	0.084	2.200	0.268
CPUE CV=0.3	0.808	0.605	0.398	0.232	0.065	2.412	0.190
Truncate CPUE	0.120	0.000	0.000	0.072	0.024	3.109	0.078
CPUE 07-08 upper	1.002	0.957	1.189	0.277	0.072	1.934	0.267
CPUE 07-08 mean	1.002	0.957	1.189	0.277	0.072	2.090	0.234
CPUE 07-08 lower	0.606	0.249	0.000	0.196	0.049	2.571	0.158
Omega=0.75	0.683	0.254	0.000	0.147	0.048	2.735	0.157
Include troll	1.019	1.872	2.050	0.271	0.072	2.183	0.232
Old steepness priors	0.867	0.681	0.597	0.269	0.084	3.193	0.228

Median (50th percentile)	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.751	0.266	0.000	0.193	0.046	1.910	0.171
Base 3	0.750	0.252	0.000	0.192	0.046	1.912	0.161
Mixed tags	0.787	0.285	0.000	0.193	0.046	1.805	0.155
LL case 2 of MR	0.837	0.384	0.031	0.195	0.049	1.754	0.175
CPUE S=0	0.712	0.142	0.000	0.176	0.051	1.995	0.161
CPUE S=0.5	0.785	0.369	0.018	0.226	0.053	1.847	0.183
CPUE CV=0.3	0.625	0.007	0.000	0.179	0.039	2.018	0.145
Truncate CPUE	0.002	0.000	0.000	0.065	0.021	2.843	0.062
CPUE 07-08 upper	0.867	0.410	0.118	0.210	0.051	1.614	0.201
CPUE 07-08 mean	0.867	0.410	0.118	0.210	0.051	1.753	0.178
CPUE 07-08 lower	0.468	0.000	0.000	0.148	0.035	2.226	0.122
Omega=0.75	0.459	0.000	0.000	0.102	0.036	2.351	0.117
Include troll	0.839	0.927	0.765	0.203	0.048	1.764	0.179
Old steepness priors	0.711	0.240	0.000	0.201	0.061	2.084	0.179

Lower 30th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.653	0.005	0.000	0.155	0.041	1.745	0.143
Base 3	0.652	0.002	0.000	0.155	0.041	1.745	0.141
Mixed tags	0.696	0.046	0.000	0.160	0.039	1.678	0.136
LL case 2 of MR	0.737	0.173	0.000	0.160	0.043	1.646	0.149
CPUE S=0	0.624	0.000	0.000	0.131	0.042	1.830	0.136
CPUE S=0.5	0.680	0.108	0.000	0.182	0.040	1.715	0.152
CPUE CV=0.3	0.531	0.000	0.000	0.148	0.037	1.818	0.125
Truncate CPUE	0.001	0.000	0.000	0.060	0.017	2.465	0.061
CPUE 07-08 upper	0.811	0.229	0.000	0.183	0.046	1.454	0.171
CPUE 07-08 mean	0.811	0.229	0.000	0.183	0.046	1.618	0.159
CPUE 07-08 lower	0.399	0.000	0.000	0.129	0.031	2.071	0.105
Omega=0.75	0.358	0.000	0.000	0.094	0.030	2.102	0.099
Include troll	0.765	0.656	0.274	0.163	0.045	1.616	0.148
Old steepness priors	0.636	0.033	0.000	0.168	0.050	2.002	0.145

Lower 10th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.480	0.000	0.000	0.120	0.034	1.488	0.119
Base 3	0.477	0.000	0.000	0.120	0.034	1.585	0.118
Mixed tags	0.525	0.000	0.000	0.114	0.032	1.534	0.111
LL case 2 of MR	0.575	0.000	0.000	0.123	0.037	1.503	0.124
CPUE S=0	0.482	0.000	0.000	0.103	0.037	1.607	0.115
CPUE S=0.5	0.478	0.000	0.000	0.121	0.030	1.528	0.108
CPUE CV=0.3	0.371	0.000	0.000	0.113	0.028	1.673	0.104
Truncate CPUE	0.000	0.000	0.000	0.057	0.015	2.306	0.050
CPUE 07-08 upper	0.728	0.000	0.000	0.147	0.038	1.330	0.148
CPUE 07-08 mean	0.728	0.000	0.000	0.147	0.038	1.491	0.137
CPUE 07-08 lower	0.285	0.000	0.000	0.106	0.025	1.901	0.095
Omega=0.75	0.184	0.000	0.000	0.069	0.025	1.882	0.084
Include troll	0.643	0.206	0.000	0.124	0.036	1.459	0.124
Old steepness priors	0.487	0.000	0.000	0.120	0.036	1.632	0.119

PROJECTION spawning biomass ratios 13810 mt

Upper 90th percentiles	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.014	1.110	1.642	0.270	0.071	2.423	0.227
Base 3	0.989	1.073	1.477	0.270	0.071	2.285	0.227
Mixed tags	1.055	1.151	1.626	0.262	0.062	2.201	0.209
LL case 2 of MR	1.079	1.219	1.735	0.274	0.070	2.169	0.242
CPUE S=0	0.959	0.994	1.326	0.227	0.069	2.445	0.200
CPUE S=0.5	0.986	1.088	1.572	0.319	0.084	2.200	0.268
CPUE CV=0.3	0.883	0.915	1.048	0.232	0.065	2.412	0.190
Truncate CPUE	0.228	0.000	0.000	0.072	0.024	3.109	0.078
CPUE 07-08 upper	1.265	1.378	2.200	0.314	0.081	1.934	0.267
CPUE 07-08 mean	1.080	1.215	1.783	0.277	0.072	2.090	0.234
CPUE 07-08 lower	0.676	0.589	0.291	0.196	0.049	2.571	0.158
Omega=0.75	0.758	0.580	0.308	0.147	0.048	2.735	0.157
Include troll	1.076	2.163	2.588	0.271	0.072	2.183	0.232
Old steepness priors	0.917	0.909	1.073	0.269	0.084	3.193	0.228

Median (50th percentile)	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.823	0.504	0.314	0.193	0.046	1.910	0.171
Base 3	0.823	0.484	0.280	0.192	0.046	1.912	0.161
Mixed tags	0.868	0.539	0.385	0.193	0.046	1.805	0.155
LL case 2 of MR	0.902	0.617	0.582	0.195	0.049	1.754	0.175
CPUE S=0	0.790	0.398	0.085	0.176	0.051	1.995	0.161
CPUE S=0.5	0.847	0.575	0.487	0.226	0.053	1.847	0.183
CPUE CV=0.3	0.711	0.293	0.000	0.179	0.039	2.018	0.145
Truncate CPUE	0.063	0.000	0.000	0.065	0.021	2.843	0.062
CPUE 07-08 upper	1.111	0.810	1.060	0.237	0.057	1.614	0.201
CPUE 07-08 mean	0.937	0.640	0.663	0.210	0.051	1.753	0.178
CPUE 07-08 lower	0.557	0.022	0.000	0.148	0.035	2.226	0.122
Omega=0.75	0.554	0.001	0.000	0.102	0.036	2.351	0.117
Include troll	0.892	1.211	1.259	0.203	0.048	1.764	0.179
Old steepness priors	0.762	0.432	0.159	0.201	0.061	2.084	0.179

Lower 30th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.729	0.283	0.000	0.155	0.041	1.745	0.143
Base 3	0.729	0.273	0.000	0.155	0.041	1.745	0.141
Mixed tags	0.780	0.320	0.000	0.160	0.039	1.678	0.136
LL case 2 of MR	0.811	0.424	0.142	0.160	0.043	1.646	0.149
CPUE S=0	0.707	0.175	0.000	0.131	0.042	1.830	0.136
CPUE S=0.5	0.755	0.373	0.011	0.182	0.040	1.715	0.152
CPUE CV=0.3	0.625	0.053	0.000	0.148	0.037	1.818	0.125
Truncate CPUE	0.004	0.000	0.000	0.060	0.017	2.465	0.061
CPUE 07-08 upper	1.029	0.636	0.657	0.205	0.051	1.454	0.171
CPUE 07-08 mean	0.883	0.460	0.276	0.183	0.046	1.618	0.159
CPUE 07-08 lower	0.502	0.000	0.000	0.129	0.031	2.071	0.105
Omega=0.75	0.467	0.000	0.000	0.094	0.030	2.102	0.099
Include troll	0.820	0.935	0.786	0.163	0.045	1.616	0.148
Old steepness priors	0.699	0.262	0.000	0.168	0.050	2.002	0.145

Lower 10th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.579	0.000	0.000	0.120	0.034	1.488	0.119
Base 3	0.578	0.000	0.000	0.120	0.034	1.585	0.118
Mixed tags	0.627	0.001	0.000	0.114	0.032	1.534	0.111
LL case 2 of MR	0.669	0.054	0.000	0.123	0.037	1.503	0.124
CPUE S=0	0.580	0.000	0.000	0.103	0.037	1.607	0.115
CPUE S=0.5	0.581	0.000	0.000	0.121	0.030	1.528	0.108
CPUE CV=0.3	0.485	0.000	0.000	0.113	0.028	1.673	0.104
Truncate CPUE	0.002	0.000	0.000	0.057	0.015	2.306	0.050
CPUE 07-08 upper	0.955	0.399	0.129	0.155	0.043	1.330	0.148
CPUE 07-08 mean	0.814	0.210	0.000	0.147	0.038	1.491	0.137
CPUE 07-08 lower	0.413	0.000	0.000	0.106	0.025	1.901	0.095
Omega=0.75	0.312	0.000	0.000	0.069	0.025	1.882	0.084
Include troll	0.710	0.553	0.079	0.124	0.036	1.459	0.124
Old steepness priors	0.574	0.000	0.000	0.120	0.036	1.632	0.119

PROJECTION spawning biomass ratios 11810 mt

Upper 90th percentiles	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.088	1.407	2.260	0.270	0.071	2.423	0.227
Base 3	1.059	1.350	2.067	0.270	0.071	2.285	0.227
Mixed tags	1.132	1.447	2.239	0.262	0.062	2.201	0.209
LL case 2 of MR	1.145	1.484	2.340	0.274	0.070	2.169	0.242
CPUE S=0	1.035	1.271	1.910	0.227	0.069	2.445	0.200
CPUE S=0.5	1.042	1.339	2.120	0.319	0.084	2.200	0.268
CPUE CV=0.3	0.963	1.237	1.755	0.232	0.065	2.412	0.190
Truncate CPUE	0.335	0.000	0.000	0.072	0.024	3.109	0.078
CPUE 07-08 upper	1.349	1.630	2.740	0.314	0.081	1.934	0.267
CPUE 07-08 mean	1.161	1.490	2.415	0.277	0.072	2.090	0.234
CPUE 07-08 lower	0.749	0.967	1.140	0.196	0.049	2.571	0.158
Omega=0.75	0.834	0.928	1.034	0.147	0.048	2.735	0.157
Include troll	1.134	2.483	3.182	0.271	0.072	2.183	0.232
Old steepness priors	0.983	1.157	1.605	0.269	0.084	3.193	0.228

Median (50th percentile)	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.891	0.748	0.884	0.193	0.046	1.910	0.171
Base 3	0.890	0.739	0.829	0.192	0.046	1.912	0.161
Mixed tags	0.938	0.798	0.976	0.193	0.046	1.805	0.155
LL case 2 of MR	0.962	0.860	1.123	0.195	0.049	1.754	0.175
CPUE S=0	0.861	0.663	0.682	0.176	0.051	1.995	0.161
CPUE S=0.5	0.902	0.792	0.961	0.226	0.053	1.847	0.183
CPUE CV=0.3	0.790	0.591	0.511	0.179	0.039	2.018	0.145
Truncate CPUE	0.200	0.000	0.000	0.065	0.021	2.843	0.062
CPUE 07-08 upper	1.184	1.043	1.536	0.237	0.057	1.614	0.201
CPUE 07-08 mean	1.011	0.882	1.187	0.210	0.051	1.753	0.178
CPUE 07-08 lower	0.643	0.363	0.001	0.148	0.035	2.226	0.122
Omega=0.75	0.641	0.290	0.000	0.102	0.036	2.351	0.117
Include troll	0.943	1.492	1.774	0.203	0.048	1.764	0.179
Old steepness priors	0.815	0.619	0.557	0.201	0.061	2.084	0.179

Lower 30th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.799	0.539	0.418	0.155	0.041	1.745	0.143
Base 3	0.802	0.537	0.410	0.155	0.041	1.745	0.141
Mixed tags	0.854	0.594	0.504	0.160	0.039	1.678	0.136
LL case 2 of MR	0.876	0.674	0.676	0.160	0.043	1.646	0.149
CPUE S=0	0.787	0.454	0.239	0.131	0.042	1.830	0.136
CPUE S=0.5	0.825	0.620	0.580	0.182	0.040	1.715	0.152
CPUE CV=0.3	0.714	0.370	0.038	0.148	0.037	1.818	0.125
Truncate CPUE	0.147	0.000	0.000	0.060	0.017	2.465	0.061
CPUE 07-08 upper	1.098	0.846	1.108	0.205	0.051	1.454	0.171
CPUE 07-08 mean	0.952	0.698	0.781	0.183	0.046	1.618	0.159
CPUE 07-08 lower	0.596	0.149	0.000	0.129	0.031	2.071	0.105
Omega=0.75	0.569	0.004	0.000	0.094	0.030	2.102	0.099
Include troll	0.872	1.211	1.270	0.163	0.045	1.616	0.148
Old steepness priors	0.752	0.459	0.248	0.168	0.050	2.002	0.145

Lower 10th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.671	0.201	0.000	0.120	0.034	1.488	0.119
Base 3	0.674	0.205	0.000	0.120	0.034	1.585	0.118
Mixed tags	0.716	0.273	0.000	0.114	0.032	1.534	0.111
LL case 2 of MR	0.754	0.352	0.018	0.123	0.037	1.503	0.124
CPUE S=0	0.673	0.158	0.000	0.103	0.037	1.607	0.115
CPUE S=0.5	0.677	0.271	0.000	0.121	0.030	1.528	0.108
CPUE CV=0.3	0.590	0.019	0.000	0.113	0.028	1.673	0.104
Truncate CPUE	0.054	0.000	0.000	0.057	0.015	2.306	0.050
CPUE 07-08 upper	1.016	0.612	0.614	0.155	0.043	1.330	0.148
CPUE 07-08 mean	0.887	0.462	0.286	0.147	0.038	1.491	0.137
CPUE 07-08 lower	0.530	0.000	0.000	0.106	0.025	1.901	0.095
Omega=0.75	0.425	0.000	0.000	0.069	0.025	1.882	0.084
Include troll	0.777	0.847	0.631	0.124	0.036	1.459	0.124
Old steepness priors	0.653	0.224	0.000	0.120	0.036	1.632	0.119

PROJECTION spawning biomass ratios 7810 mt

90th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2004}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.228	2.061	3.849	0.270	0.071	2.423	0.227
Base 3	1.202	1.976	3.548	0.270	0.071	2.285	0.227
Mixed tags	1.280	2.054	3.860	0.262	0.062	2.201	0.209
LL case 2 of MR	1.279	2.072	3.915	0.274	0.070	2.169	0.242
CPUE S=0	1.189	1.873	3.335	0.227	0.069	2.445	0.200
CPUE S=0.5	1.168	1.932	3.412	0.319	0.084	2.200	0.268
CPUE CV=0.3	1.127	1.946	3.279	0.232	0.065	2.412	0.190
Truncate CPUE	0.542	1.020	0.510	0.072	0.024	3.109	0.078
CPUE 07-08 upper	1.506	2.163	4.725	0.314	0.081	1.934	0.267
CPUE 07-08 mean	1.319	2.069	4.086	0.277	0.072	2.090	0.234
CPUE 07-08 lower	0.902	1.784	2.578	0.196	0.049	2.571	0.158
Omega=0.75	0.989	1.690	2.445	0.147	0.048	2.735	0.157
Include troll	1.249	3.138	4.708	0.271	0.072	2.183	0.232
Old steepness priors	1.155	1.723	2.950	0.269	0.084	3.193	0.228

Median (50th percentile)	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2004}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.015	1.286	2.001	0.193	0.046	1.910	0.171
Base 3	1.014	1.270	1.978	0.192	0.046	1.912	0.161
Mixed tags	1.080	1.358	2.189	0.193	0.046	1.805	0.155
LL case 2 of MR	1.086	1.380	2.271	0.195	0.049	1.754	0.175
CPUE S=0	0.990	1.211	1.812	0.176	0.051	1.995	0.161
CPUE S=0.5	1.007	1.278	1.996	0.226	0.053	1.847	0.183
CPUE CV=0.3	0.934	1.227	1.747	0.179	0.039	2.018	0.145
Truncate CPUE	0.446	0.114	0.000	0.065	0.021	2.843	0.062
CPUE 07-08 upper	1.315	1.513	2.926	0.237	0.057	1.614	0.201
CPUE 07-08 mean	1.150	1.393	2.434	0.210	0.051	1.753	0.178
CPUE 07-08 lower	0.800	1.079	1.313	0.148	0.035	2.226	0.122
Omega=0.75	0.808	0.996	1.112	0.102	0.036	2.351	0.117
Include troll	1.043	2.076	2.847	0.203	0.048	1.764	0.179
Old steepness priors	0.917	1.035	1.355	0.201	0.061	2.084	0.179

Lower 30th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2004}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.932	1.061	1.477	0.155	0.041	1.745	0.143
Base 3	0.936	1.062	1.479	0.155	0.041	1.745	0.141
Mixed tags	0.995	1.140	1.647	0.160	0.039	1.678	0.136
LL case 2 of MR	1.002	1.159	1.724	0.160	0.043	1.646	0.149
CPUE S=0	0.931	0.993	1.351	0.131	0.042	1.830	0.136
CPUE S=0.5	0.948	1.081	1.542	0.182	0.040	1.715	0.152
CPUE CV=0.3	0.866	1.006	1.257	0.148	0.037	1.818	0.125
Truncate CPUE	0.413	0.000	0.000	0.060	0.017	2.465	0.061
CPUE 07-08 upper	1.243	1.282	2.339	0.205	0.051	1.454	0.171
CPUE 07-08 mean	1.076	1.179	1.875	0.183	0.046	1.618	0.159
CPUE 07-08 lower	0.761	0.860	0.935	0.129	0.031	2.071	0.105
Omega=0.75	0.749	0.774	0.727	0.094	0.030	2.102	0.099
Include troll	0.970	1.760	2.194	0.163	0.045	1.616	0.148
Old steepness priors	0.856	0.850	0.976	0.168	0.050	2.002	0.145

Lower 10th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2004}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	0.831	0.790	0.849	0.120	0.034	1.488	0.119
Base 3	0.841	0.807	0.914	0.120	0.034	1.585	0.118
Mixed tags	0.891	0.878	1.020	0.114	0.032	1.534	0.111
LL case 2 of MR	0.910	0.904	1.118	0.123	0.037	1.503	0.124
CPUE S=0	0.837	0.743	0.784	0.103	0.037	1.607	0.115
CPUE S=0.5	0.854	0.855	1.035	0.121	0.030	1.528	0.108
CPUE CV=0.3	0.773	0.725	0.692	0.113	0.028	1.673	0.104
Truncate CPUE	0.369	0.000	0.000	0.057	0.015	2.306	0.050
CPUE 07-08 upper	1.119	1.028	1.667	0.155	0.043	1.330	0.148
CPUE 07-08 mean	1.005	0.939	1.328	0.147	0.038	1.491	0.137
CPUE 07-08 lower	0.715	0.610	0.484	0.106	0.025	1.901	0.095
Omega=0.75	0.624	0.468	0.193	0.069	0.025	1.882	0.084
Include troll	0.899	1.392	1.565	0.124	0.036	1.459	0.124
Old steepness priors	0.779	0.672	0.595	0.120	0.036	1.632	0.119

PROJECTION spawning biomass ratios 5810 mt

90th percentile	B_{2014}/B_{2004}	B_{2014}/B_{2009}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Mixed tags	1.357	1.209	2.378	4.213	0.262	0.062	2.201	0.209
LL case 2 of MR	1.350	1.213	2.407	4.229	0.274	0.070	2.169	0.242
CPUE S=0	1.270	1.163	2.195	3.742	0.227	0.069	2.445	0.200
CPUE CV=0.3	1.209	1.180	2.346	4.120	0.232	0.065	2.412	0.190
CPUE 07-08 mean	1.403	1.217	2.390	4.223	0.277	0.072	2.090	0.234
Omega=0.75	1.057	1.135	2.122	3.477	0.147	0.048	2.735	0.157

Median (50th percentile)	B_{2014}/B_{2004}	B_{2014}/B_{2009}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Mixed tags	1.152	1.110	1.658	2.694	0.193	0.046	1.805	0.155
LL case 2 of MR	1.151	1.105	1.660	2.724	0.195	0.049	1.754	0.175
CPUE S=0	1.048	1.044	1.489	2.347	0.176	0.051	1.995	0.161
CPUE CV=0.3	1.003	1.067	1.565	2.492	0.179	0.039	2.018	0.145
CPUE 07-08 mean	1.215	1.115	1.663	2.744	0.210	0.051	1.753	0.178
Omega=0.75	0.893	1.017	1.371	2.024	0.102	0.036	2.351	0.117

Lower 30th percentile	B_{2014}/B_{2004}	B_{2014}/B_{2009}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Mixed tags	1.061	1.075	1.422	2.182	0.160	0.039	1.678	0.136
LL case 2 of MR	1.056	1.062	1.410	2.178	0.160	0.043	1.646	0.149
CPUE S=0	0.996	1.011	1.265	1.885	0.131	0.042	1.830	0.136
CPUE CV=0.3	0.936	1.021	1.319	1.966	0.148	0.037	1.818	0.125
CPUE 07-08 mean	1.143	1.065	1.421	2.222	0.183	0.046	1.618	0.159
Omega=0.75	0.827	0.984	1.136	1.576	0.094	0.030	2.102	0.099

Lower 10th percentile	B_{2014}/B_{2004}	B_{2014}/B_{2009}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Mixed tags	0.969	1.012	1.149	1.614	0.114	0.032	1.534	0.111
LL case 2 of MR	0.977	1.011	1.147	1.628	0.123	0.037	1.503	0.124
CPUE S=0	0.912	0.989	1.028	1.361	0.103	0.037	1.607	0.115
CPUE CV=0.3	0.855	0.980	1.046	1.401	0.113	0.028	1.673	0.104
CPUE 07-08 mean	1.057	1.014	1.164	1.671	0.147	0.038	1.491	0.137
Omega=0.75	0.716	0.954	0.869	1.023	0.069	0.025	1.882	0.084

PROJECTION spawning biomass ratios 0 mt

90th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.523	3.468	6.378	0.270	0.071	2.423	0.227
Base 3	1.489	3.337	6.067	0.270	0.071	2.285	0.227
Mixed tags	1.579	3.400	6.232	0.262	0.062	2.201	0.209
LL case 2 of MR	1.556	3.395	6.243	0.274	0.070	2.169	0.242
CPUE S=0	1.518	3.184	5.700	0.227	0.069	2.445	0.200
CPUE S=0.5	1.424	3.366	6.203	0.319	0.084	2.200	0.268
CPUE CV=0.3	1.436	3.565	6.517	0.232	0.065	2.412	0.190
Truncate CPUE	0.967	4.443	7.812	0.072	0.024	3.109	0.078
CPUE 07-08 upper	1.818	3.267	6.001	0.314	0.081	1.934	0.267
CPUE 07-08 mean	1.638	3.329	6.084	0.277	0.072	2.090	0.234
CPUE 07-08 lower	1.221	3.650	6.653	0.196	0.049	2.571	0.158
Omega=0.75	1.283	3.561	6.374	0.147	0.048	2.735	0.157
Include troll	1.491	4.538	7.016	0.271	0.072	2.183	0.232
Old steepness priors	1.441	3.054	5.498	0.269	0.084	3.193	0.228

Median (50th percentile)	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.273	2.451	4.210	0.193	0.046	1.910	0.171
Base 3	1.273	2.431	4.154	0.192	0.046	1.912	0.161
Mixed tags	1.344	2.540	4.416	0.193	0.046	1.805	0.155
LL case 2 of MR	1.312	2.474	4.276	0.195	0.049	1.754	0.175
CPUE S=0	1.211	2.329	3.911	0.176	0.051	1.995	0.161
CPUE S=0.5	1.223	2.350	4.061	0.226	0.053	1.847	0.183
CPUE CV=0.3	1.210	2.589	4.475	0.179	0.039	2.018	0.145
Truncate CPUE	0.854	3.146	5.122	0.065	0.021	2.843	0.062
CPUE 07-08 upper	1.582	2.466	4.288	0.237	0.057	1.614	0.201
CPUE 07-08 mean	1.409	2.459	4.268	0.210	0.051	1.753	0.178
CPUE 07-08 lower	1.079	2.639	4.556	0.148	0.035	2.226	0.122
Omega=0.75	1.080	2.520	4.174	0.102	0.036	2.351	0.117
Include troll	1.255	3.244	4.871	0.203	0.048	1.764	0.179
Old steepness priors	1.100	1.943	3.056	0.201	0.061	2.084	0.179

Lower 30th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.148	2.108	3.496	0.155	0.041	1.745	0.143
Base 3	1.150	2.105	3.487	0.155	0.041	1.745	0.141
Mixed tags	1.251	2.242	3.716	0.160	0.039	1.678	0.136
LL case 2 of MR	1.220	2.155	3.578	0.160	0.043	1.646	0.149
CPUE S=0	1.174	2.077	3.381	0.131	0.042	1.830	0.136
CPUE S=0.5	1.174	1.992	3.315	0.182	0.040	1.715	0.152
CPUE CV=0.3	1.100	2.241	3.718	0.148	0.037	1.818	0.125
Truncate CPUE	0.816	2.756	4.373	0.060	0.017	2.465	0.061
CPUE 07-08 upper	1.467	2.167	3.655	0.205	0.051	1.454	0.171
CPUE 07-08 mean	1.323	2.140	3.568	0.183	0.046	1.618	0.159
CPUE 07-08 lower	1.039	2.308	3.805	0.129	0.031	2.071	0.105
Omega=0.75	1.029	2.227	3.563	0.094	0.030	2.102	0.099
Include troll	1.163	2.840	4.111	0.163	0.045	1.616	0.148
Old steepness priors	1.083	1.659	2.543	0.168	0.050	2.002	0.145

Lower 10th percentile	B_{2014}/B_{2004}	B_{2020}/B_{2009}	B_{2025}/B_{2009}	B_{2009}/B_{1980}	B_{2009}/B_{1931}	F_{2008}/F_{msy}	B_{2009}/B_{msy}
Base 5	1.083	1.746	2.700	0.120	0.034	1.488	0.119
Base 3	1.088	1.774	2.779	0.120	0.034	1.585	0.118
Mixed tags	1.134	1.876	2.931	0.114	0.032	1.534	0.111
LL case 2 of MR	1.122	1.798	2.826	0.123	0.037	1.503	0.124
CPUE S=0	1.113	1.795	2.792	0.103	0.037	1.607	0.115
CPUE S=0.5	1.055	1.626	2.524	0.121	0.030	1.528	0.108
CPUE CV=0.3	1.055	1.880	2.909	0.113	0.028	1.673	0.104
Truncate CPUE	0.802	2.367	3.560	0.057	0.015	2.306	0.050
CPUE 07-08 upper	1.294	1.812	2.903	0.155	0.043	1.330	0.148
CPUE 07-08 mean	1.179	1.796	2.808	0.147	0.038	1.491	0.137
CPUE 07-08 lower	0.947	1.892	2.998	0.106	0.025	1.901	0.095
Omega=0.75	0.975	1.875	2.891	0.069	0.025	1.882	0.084
Include troll	1.075	2.331	3.277	0.124	0.036	1.459	0.124
Old steepness priors	0.887	1.245	1.684	0.120	0.036	1.632	0.119

Attachment 11

Recent trends in selected indicators of the SBT stock
(Minimum and maximum values in the time series are also shown)
(taken from CCSBT-ESC/0909/08 and CCSBT-ESC/0909/27)

Indicator	Period	Min.	Max.	2006	2007	2008	2009	12 month trend 2007 to 2008	12 month trend 2008 to 2009
Scientific aerial survey	1993–2000 2005–09	0.491 (2007)	0.851 (2005)	0.513	0.491	0.821	0.545	↑	↓
SAPUE index	2002–09	0.55 (2004)	1.47 (2008)	0.92	1.05	1.47	0.94	↑	↓
Trolling index	1996–2003 2005–06 2006–09	0.0 (2002)	5.426 (2008)	2.817	4.723	5.426	3.580	↑	↓
NZ charter nominal CPUE (Areas 5+6)	1989–2008	1.339 (1991)	4.881 (2008)	2.011	1.746	4.881		↑	
NZ domestic nominal CPUE	1989–2008	0.000 (1989)	1.187 (1995)	0.458	0.715	0.870		↑	
NZ charter age/size composition (proportion age 0–5 SBT)	1989–2008	0.001 (2005)	0.414 (1993)	0.049	0.082	0.237		↑	
NZ domestic age/size composition (proportion age 0–5 SBT)	1980–2008	0.001 (1985)	0.404 (1995)	0.161	0.004	0.114		↑	
Indonesian age composition: mean age on spawning ground, all SBT	1993–94 to 2007–08	14 (2005–06)	24 (1995–96)	14	15	17		↑	
Indonesian age composition: median age on spawning ground	1994–95 to 2007–08	13 (2001–03)	21 (1994–97, 1998–99)	14	15	17		↑	

Standardised JP LL CPUE (age 3)[1]	1969-2008	0.159 (2003) 0.184 (2003)	2.692 (1972) 2.535 (1972)	0.491[2] 0.534[3]	0.493[2] 0.577[3]	0.612[2] 0.844[3]		↑	
Standardised JP LL CPUE (age 4)[1]	1969-2008	0.268 (2006) 0.298 (2006)	2.782 (1974) 2.588 (1974)	0.268[2] 0.298[3]	0.403[2] 0.467[3]	0.562[2] 0.776[3]		↑	
Standardised JP LL CPUE (age 5)[1]	1969-2008	0.271 (2006) 0.314 (2006)	2.627 (1972) 2.531 (1972)	0.271[2] 0.314[3]	0.302[2] 0.366[3]	0.487[2] 0.654[3]		↑	
Standardised JP LL CPUE (age 6+7)[1]	1969-2008	0.224 (2007) 0.272 (2007)	2.671 (1976) 2.594 (1976)	0.250[2] 0.274[3]	0.224[2] 0.272[3]	0.417[2] 0.541[3]		↑	
Standardised JP LL CPUE (age 8-11)[1]	1969-2008	0.258 (1992) 0.273 (1992)	3.291 (1969) 3.049 (1969)	0.410[2] 0.468[3]	0.269[2] 0.325[3]	0.455[2] 0.571[3]		↑	
Standardised JP LL CPUE (age 12+)[1]	1969-2008	0.412 (2007) 0.503 (2007)	3.187 (1970) 2.933 (1970)	0.580[2] 0.666[3]	0.412[2] 0.503[3]	0.618[2] 0.809[3]		↑	

[1] JP LL CPUE were standardized by the previously used GLM model (different from the current GLM model agreed in the SC13 for OM input) using CPUE input data for all vessels which were provided by the Secretariat. Values of the table were extracted from CCSBT-ESC/0909/27. This series may be affected by past anomalies in catch.

[2] w0.5 (B-ratio proxy)

[3] w0.8 (Geostat proxy)

Attachment 12

Constant catch projections and stock status from operating model grid

Summary

The figures below represent the process of evaluating the effect of constant future catch projections and relative stock status.

Figure 1 shows the projected recruitment and spawning stock biomass under different levels of constant future catch (on separate pages).

Figure 2 shows the median recruitment and spawning stock biomass for the base case projected for a variety of levels of constant catches.

Figure 3 shows the median recruitment and spawning stock biomass for the 6 plausible scenarios for projections assuming future catches equal to the current TAC (11,810t).

Figure 4 shows the effect of different future constant catch levels for the six plausible alternative scenarios.

Figure 5 shows the average harvest rate (fraction harvested per year) for three age ranges (over all fleets combined) for the base case over time.

Figure 6 shows the instantaneous fishing mortality averaged over ages 2-15 (weighted by biomass) for the full base case from 1952 to 2008

Figure 7 shows the spawning stock biomass per recruit (SPR) relative to unfished SPR for the base case grid. Note that lower values represent lower levels of spawning per recruit relative to the level of SPR under no fishing.

Figure 8 shows a "snapshot" phase-plane diagram of estimated fishing mortality in 2008 relative to the estimates of Fmsy (vertical axis) versus spawning stock biomass in 2008 relative to estimates of SSB_{msy} (horizontal axis) for SBT from the base 5, likelihood-steepness weighting grid.

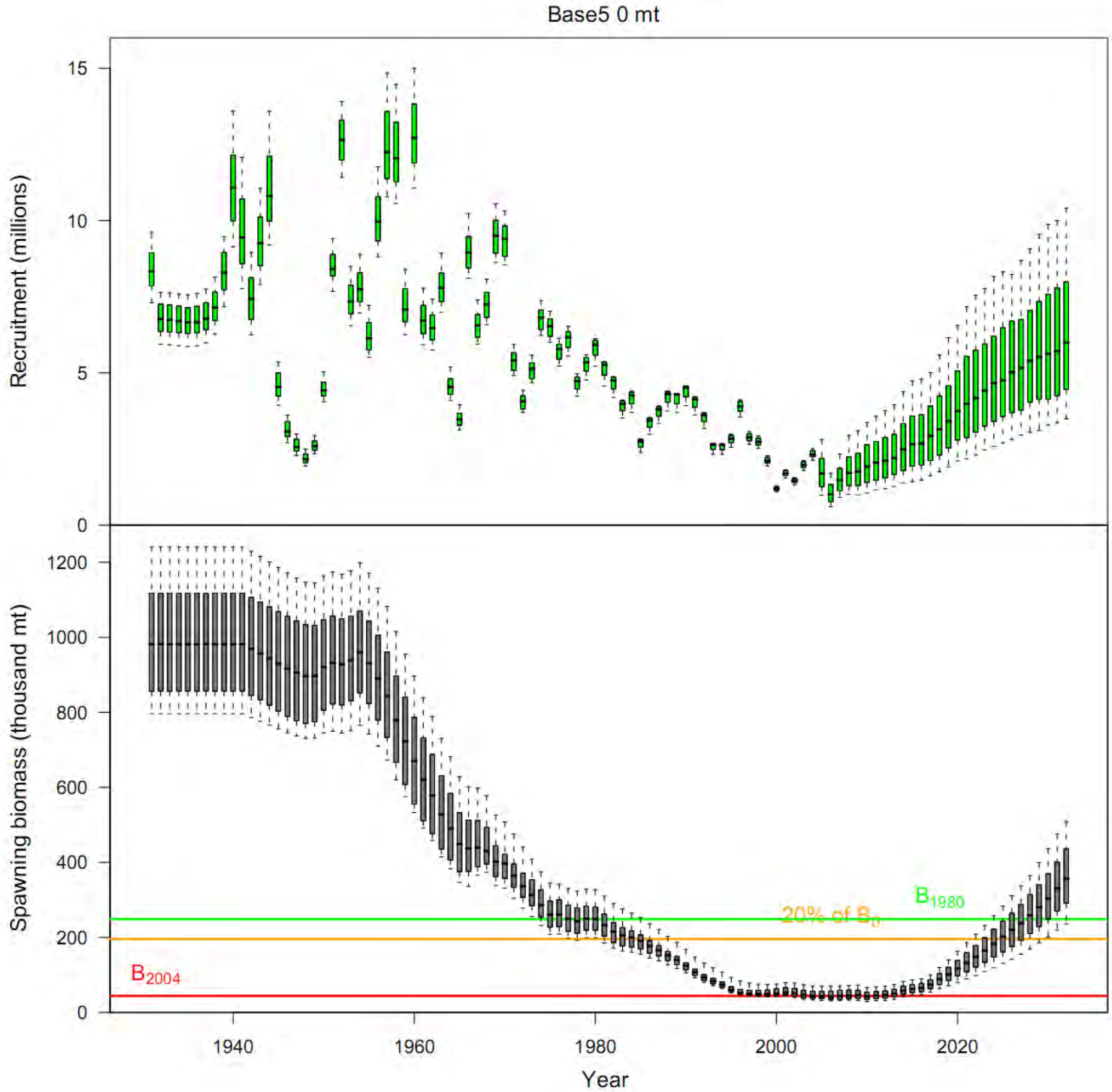
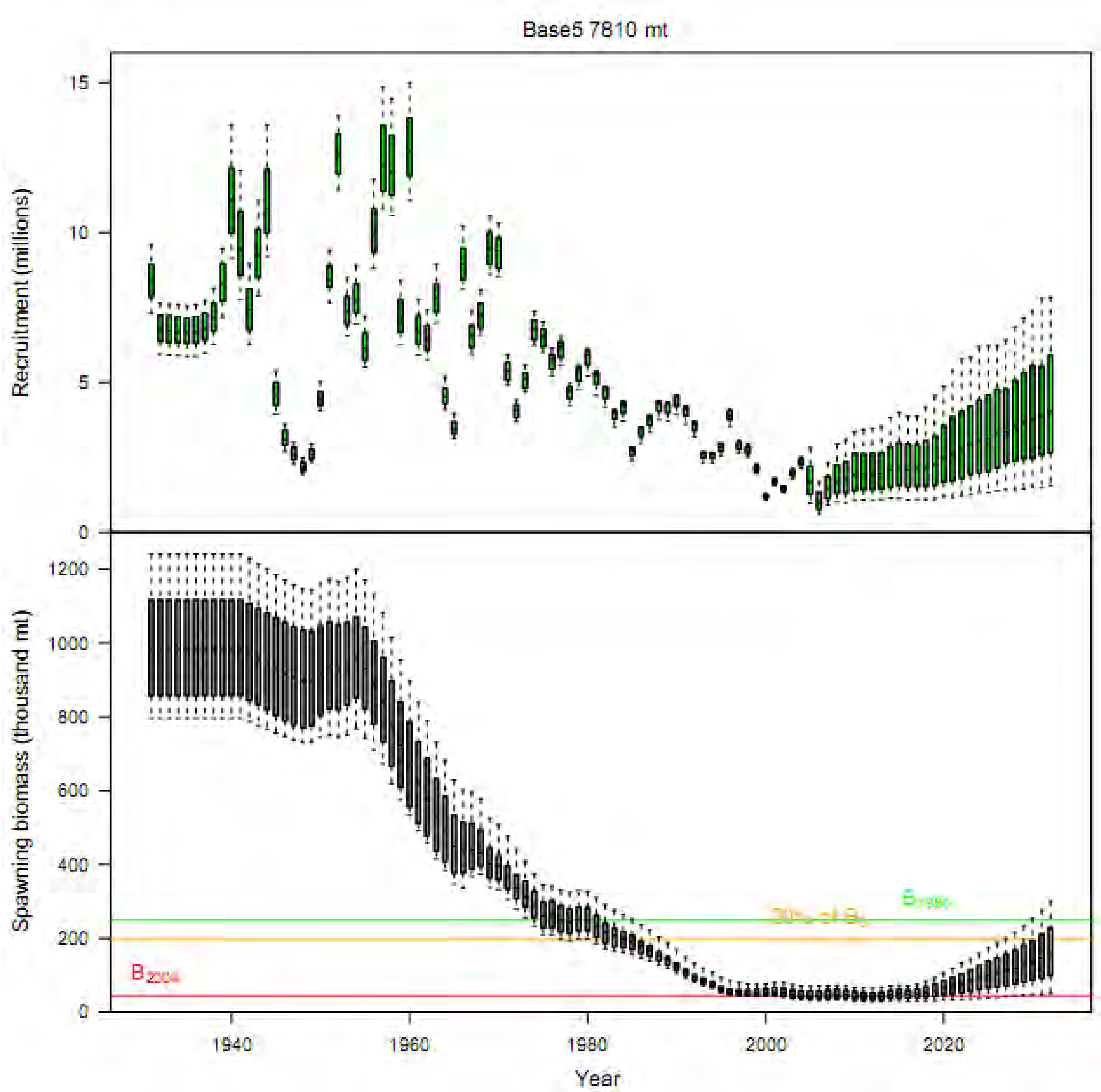
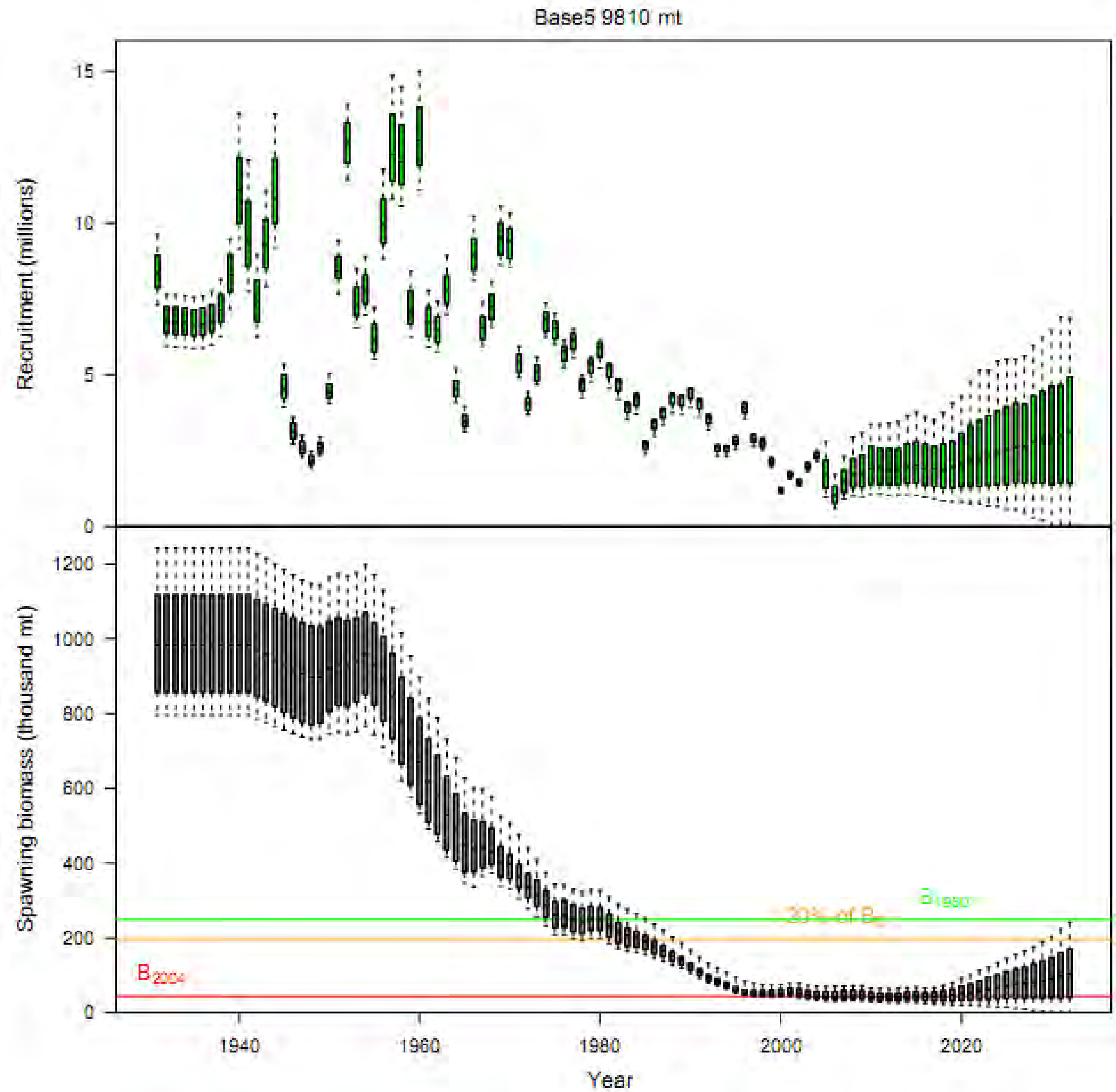


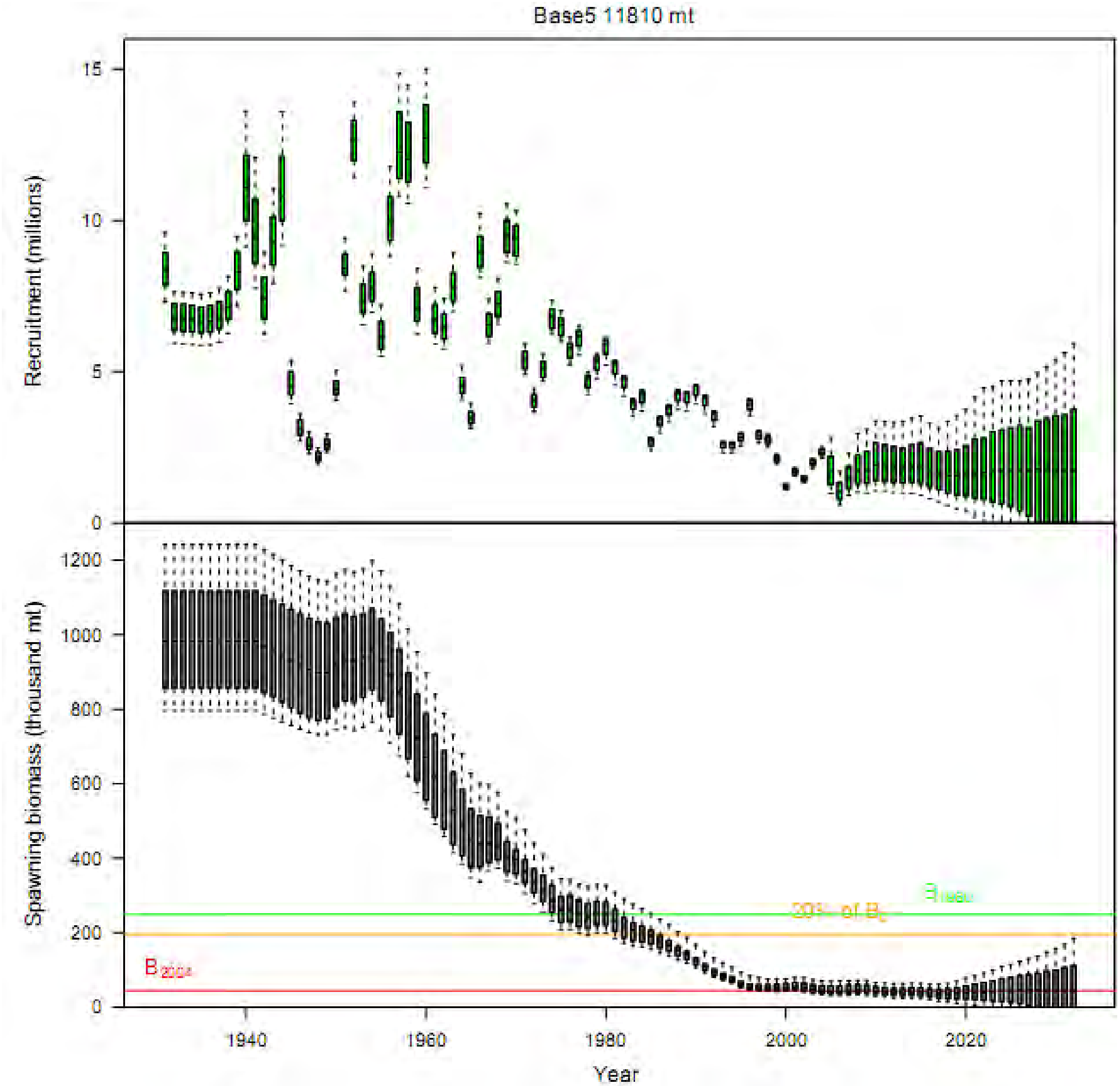
Figure 1. Boxplots of recruitment and spawning stock biomass for the base case grid projected for no catch.



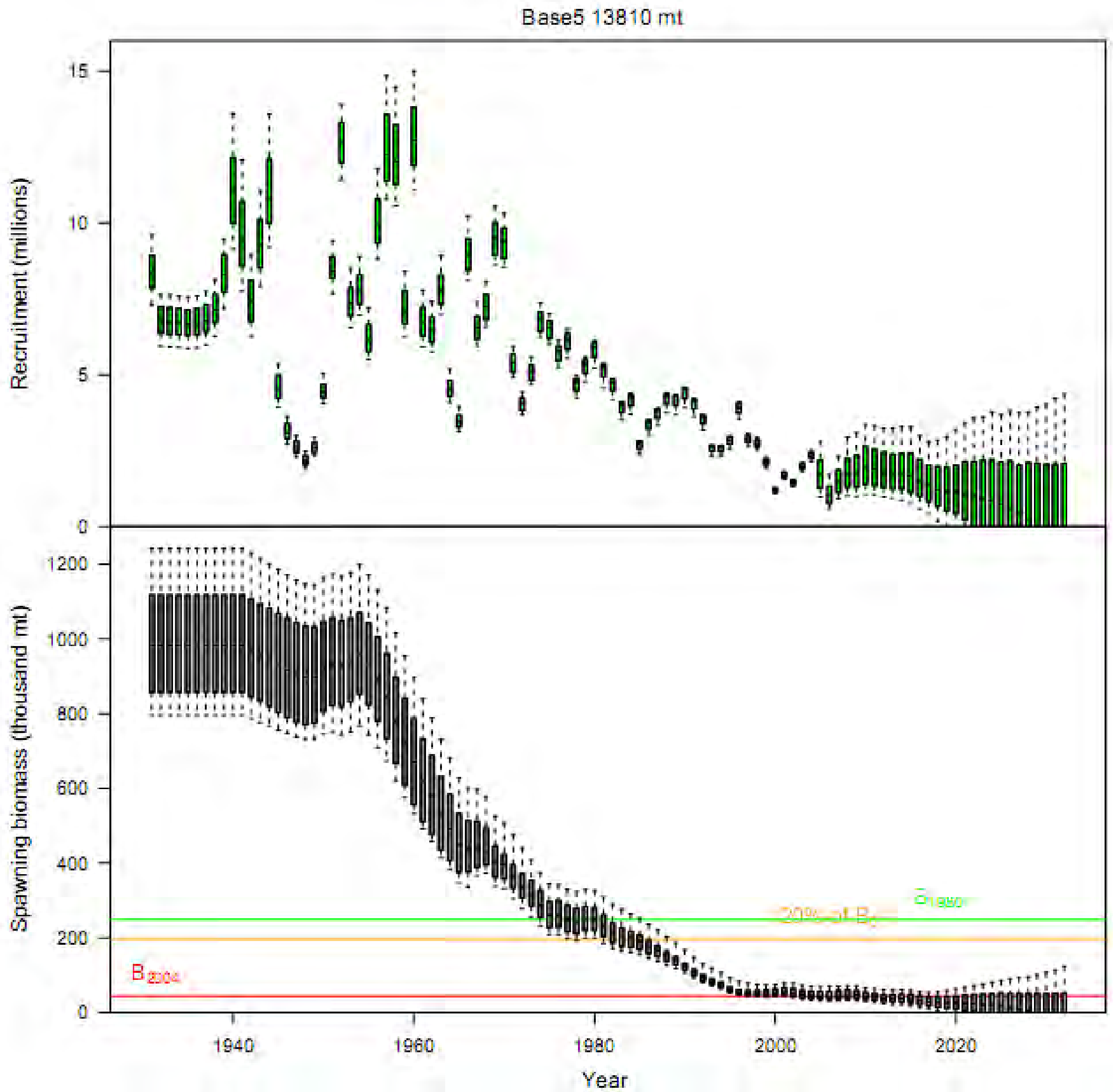
Continued. Boxplots of recruitment and spawning stock biomass for the base case grid projected for constant catches of 7810t.



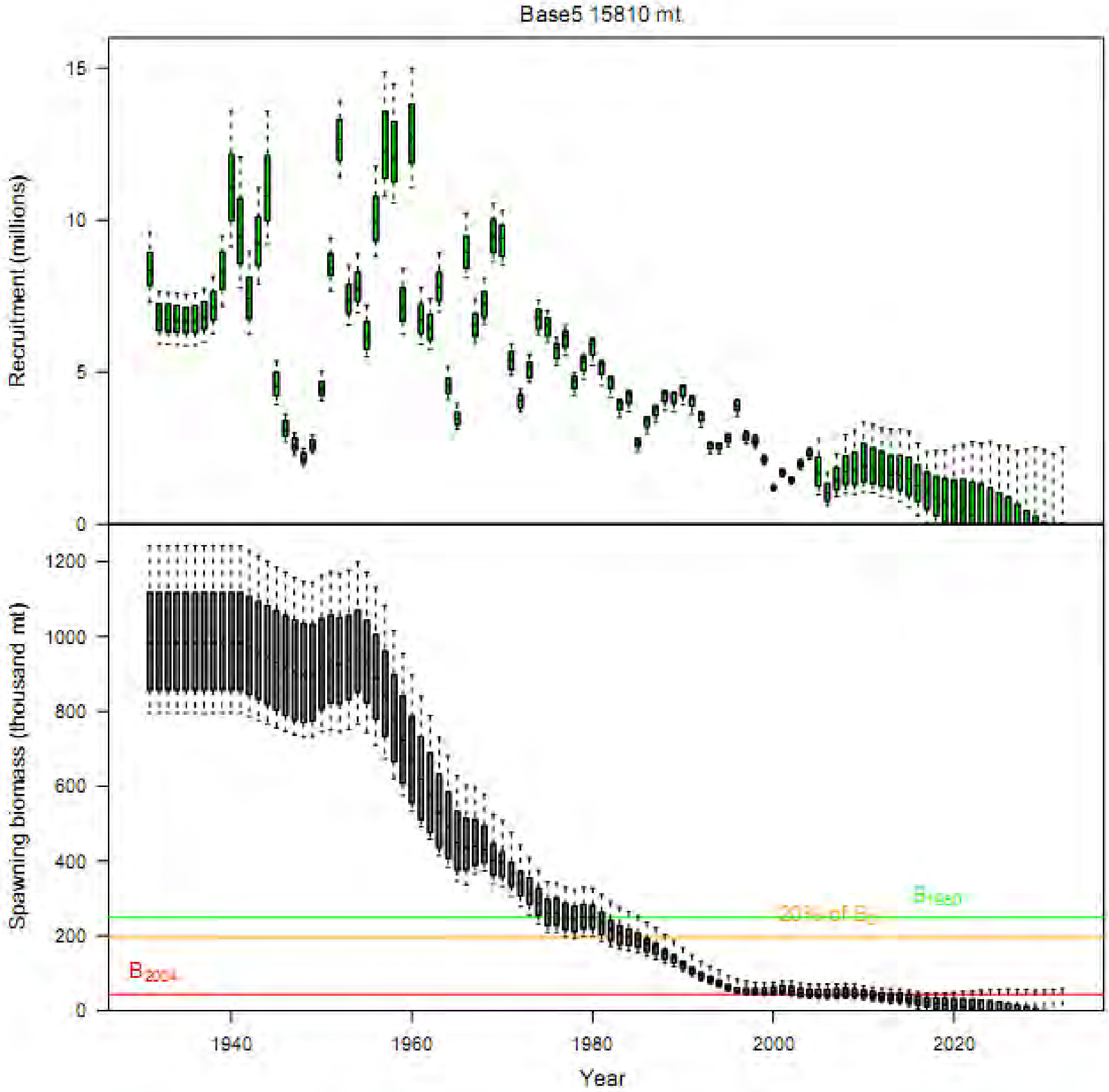
Continued. Boxplots of recruitment and spawning stock biomass for the base case grid projected for constant catches of 9810t.



Continued. Boxplots of recruitment and spawning stock biomass for the base case grid projected for constant catches of 11810t.



Continued. Boxplots of recruitment and spawning stock biomass for the base case grid projected for constant catches of 13810t.



Continued. Boxplots of recruitment and spawning stock biomass for the base case grid projected for constant catches of 15810.

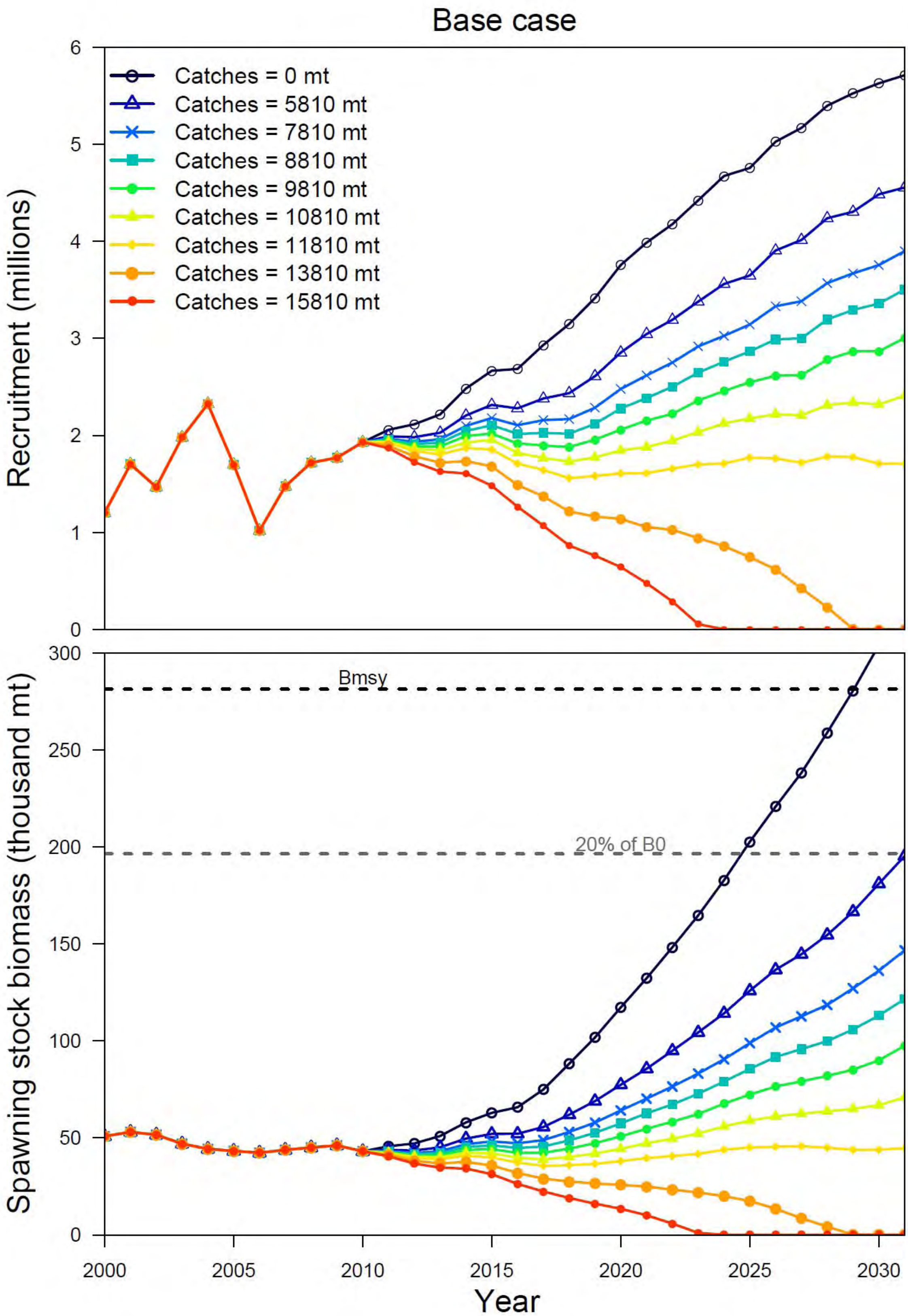


Figure 2. Median recruitment and spawning stock biomass for the base case projected for a variety of levels of constant catches. The 11810t projection corresponds to the current TAC. Note that median recruitment from 2000-2008 is based on estimates of the abundance of year classes that have already entered the stock. Estimates of median recruitment beyond 2008 are estimated using the model stock -recruitment relationship and assume that this relationship holds for future levels of spawning stock biomass. Consequently, estimates of future recruitment are more uncertain.

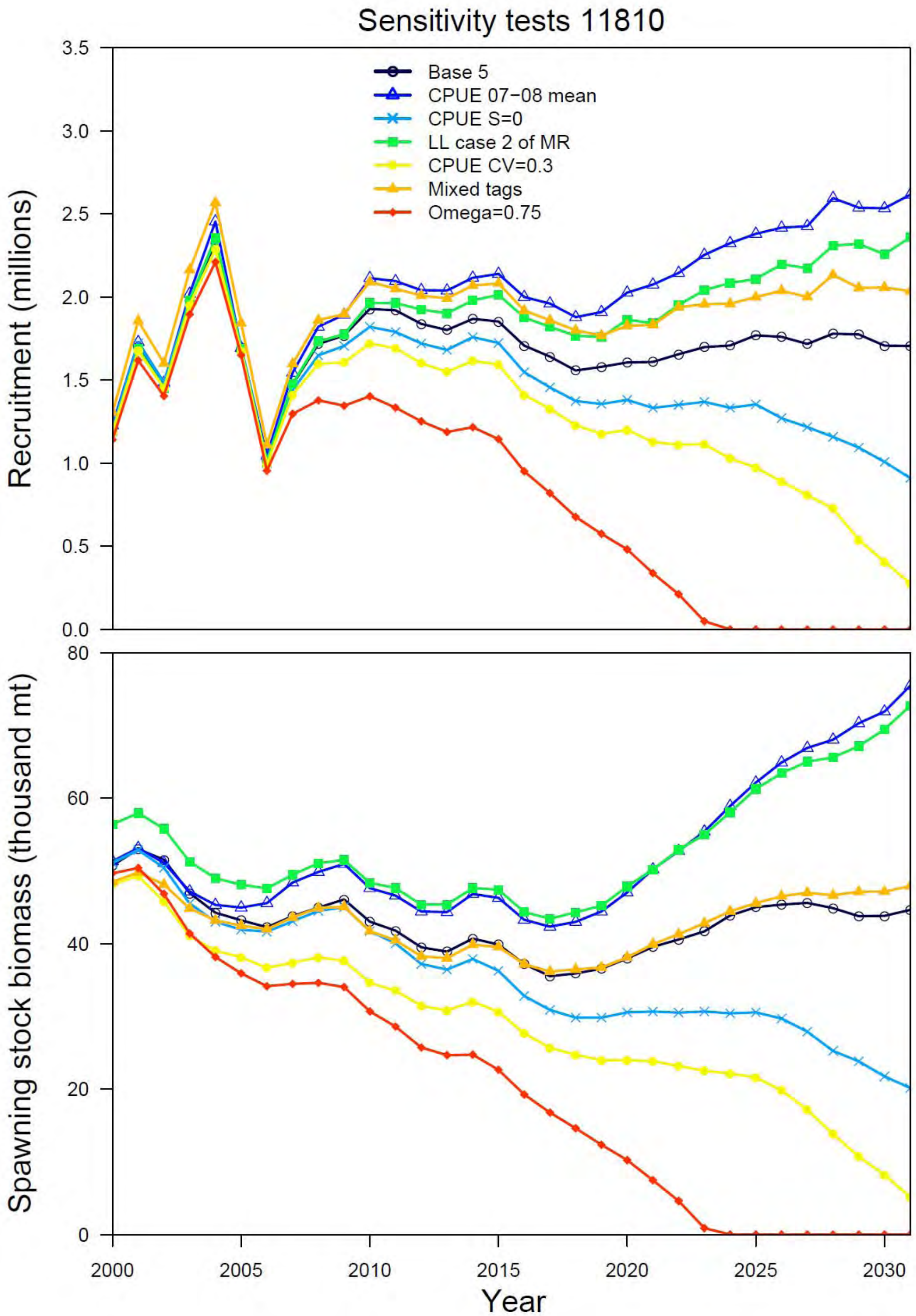


Figure 3. Median recruitment and spawning stock biomass for the 6 plausible scenarios for projections assuming future catches equal to the current TAC (11810t). Note that median recruitments from 2000-2008 are based on estimates of the abundance of year classes that have already entered the stock. Estimates of median recruitment beyond 2008 are estimated using the model stock -recruitment relationship and assume that this relationship between holds for future levels of spawning stock biomass. Consequently, estimates of future recruitment are more uncertain.

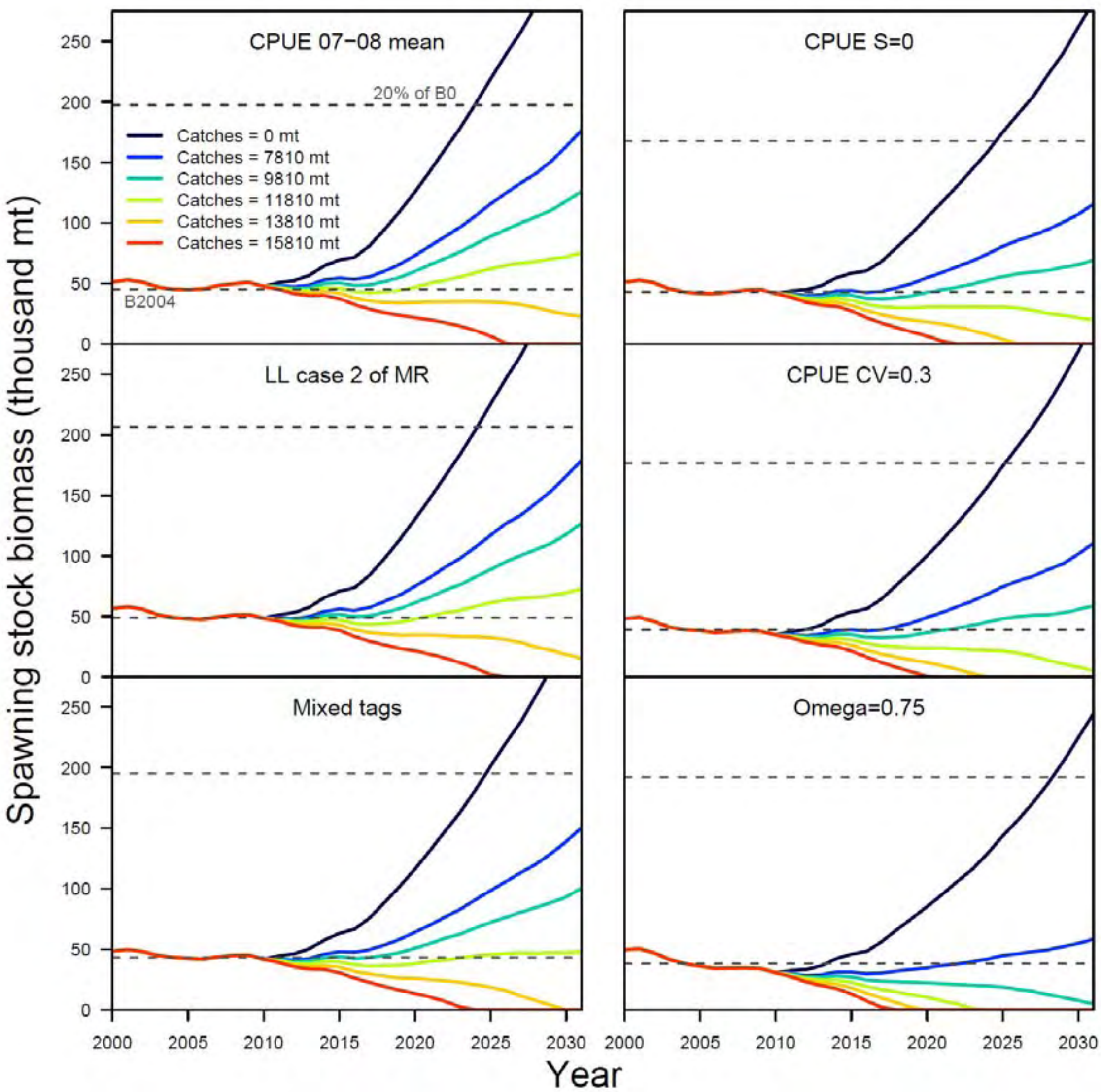


Figure 4. Effect of different future constant catch levels for the six plausible alternative scenarios. In each panel the lower dashed line is the spawning stock biomass in 2004 (SSB_{2004}), and the upper dashed line is 0.2 SSB_0.

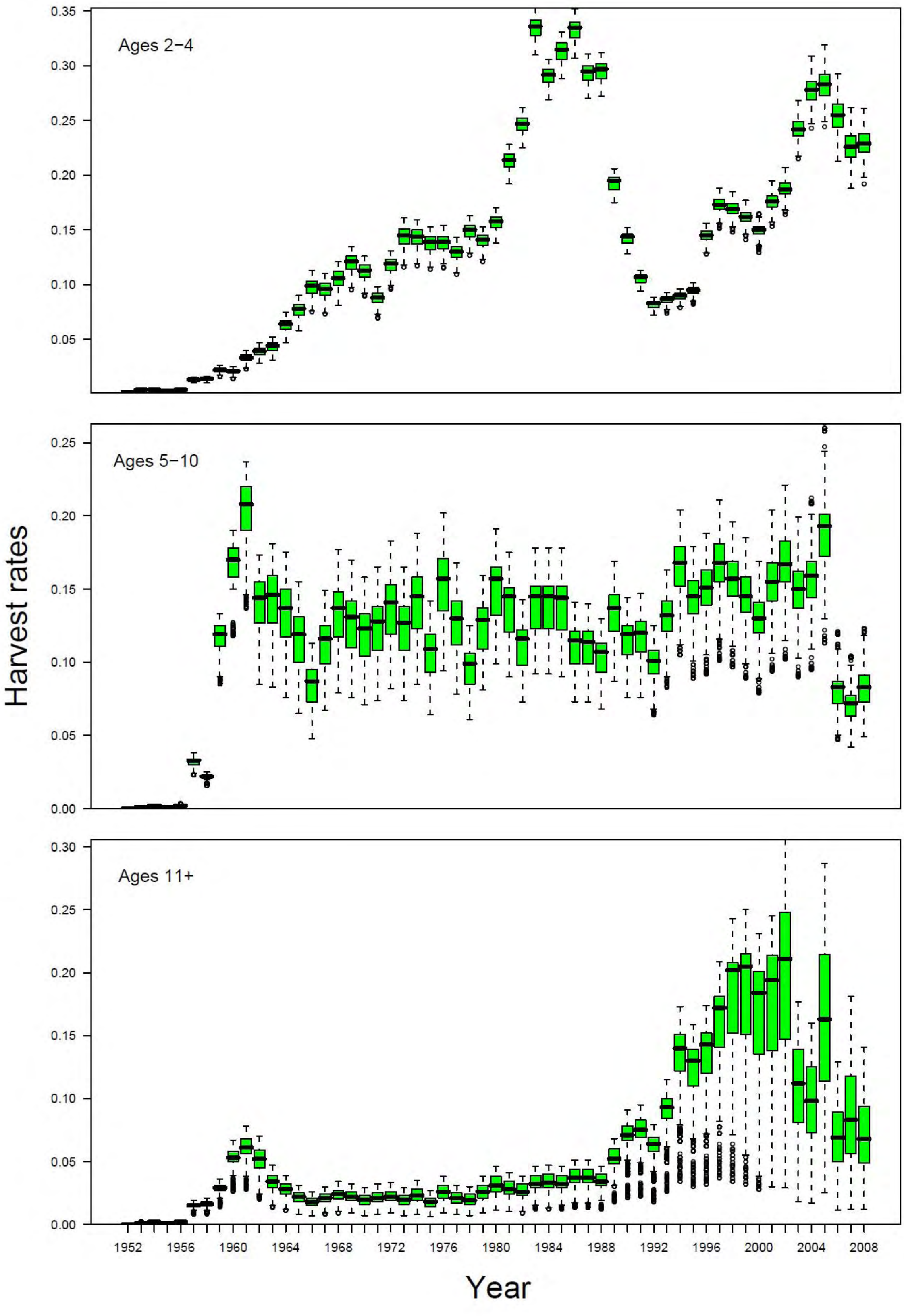


Figure 5. Average harvest rate (fraction harvested per year) for three age ranges for the base case over time.

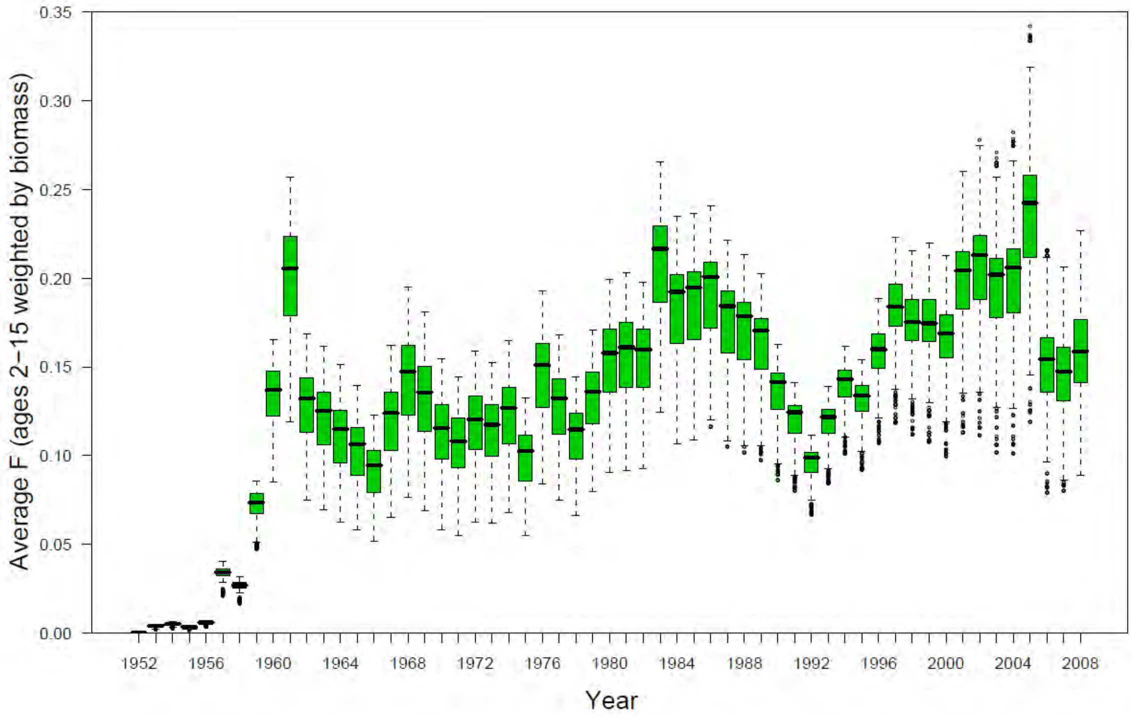


Figure 6. Instantaneous fishing mortality averaged over ages 2-15 (weighted by biomass) for the full base case from 1952 to 2008.

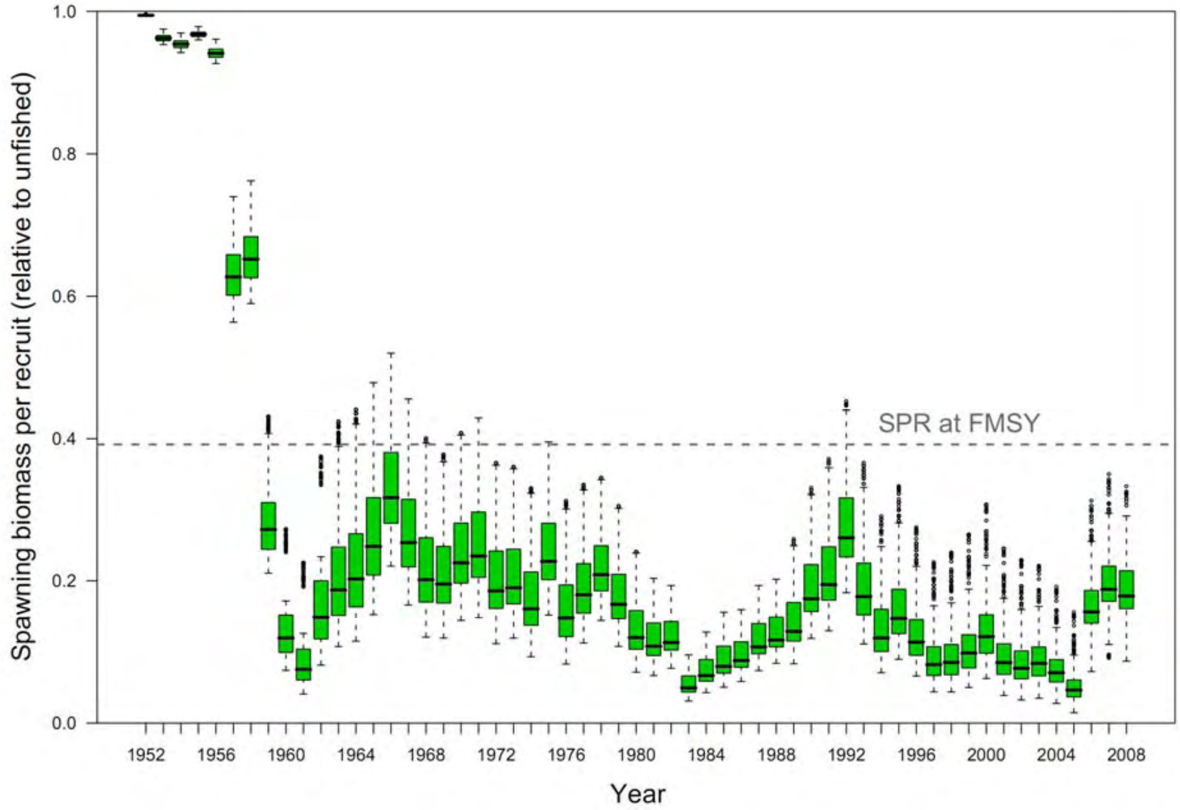


Figure 7. Spawning stock biomass per recruit (SPR) relative to unfished SPR for the base case grid. Lower values represent lower levels of spawning per recruit compared to the level of SPR under no fishing.

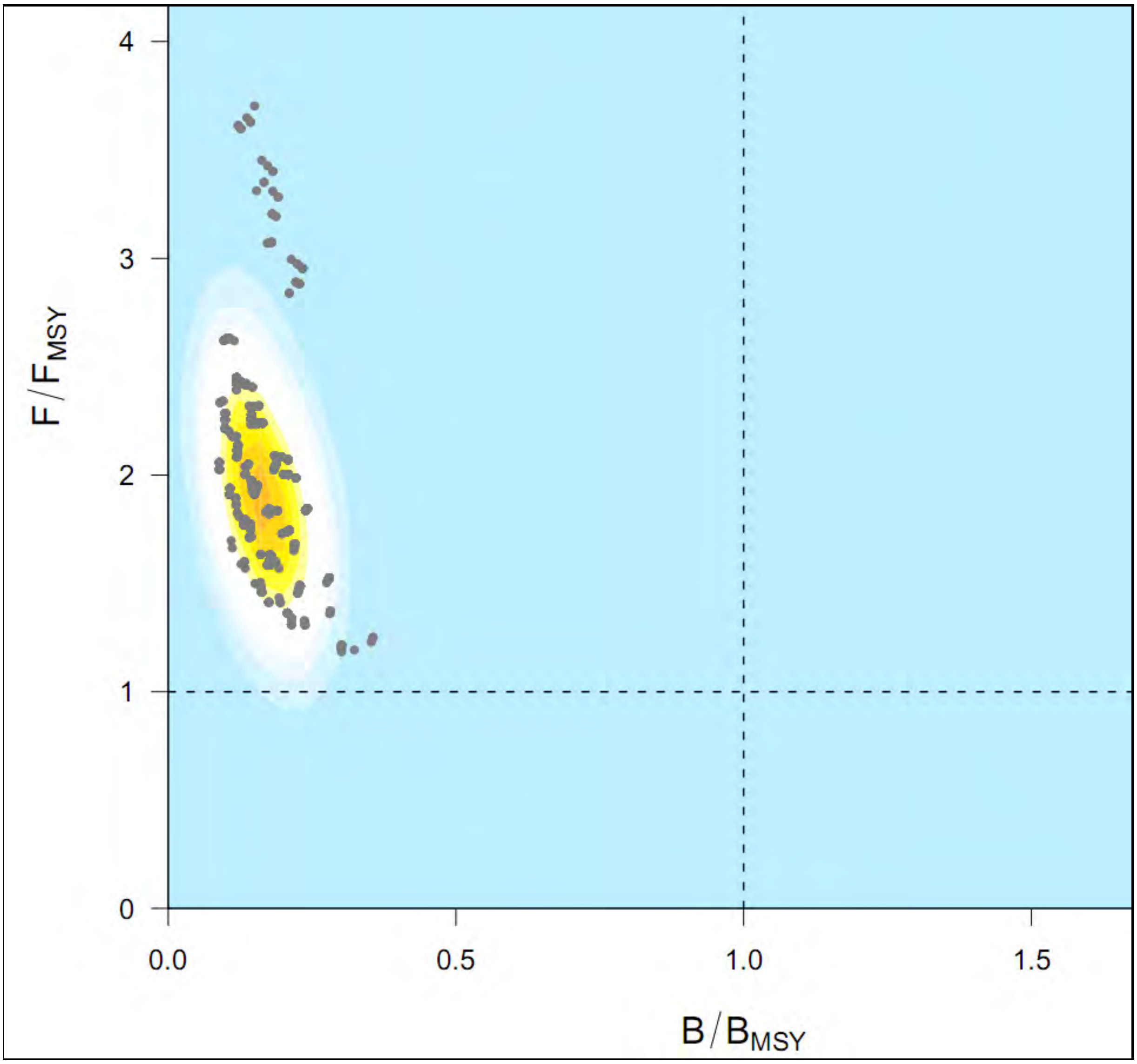


Figure 8. Estimated fishing mortality in 2008 compared to the estimates of F_{msy} (vertical axis) versus spawning stock biomass in 2008 relative to estimates of SSB_{msy} (horizontal axis) for SBT from the base 5, likelihood-steepness weighting grid. Contours represent density of values from the grid.

Attachment 13

Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2009

At CCSBT 16, the Extended Commission ruled this version of the stock status report as being confidential. A public version of this report is provided at Attachment 11 of the Report of the Extended Commission of the Sixteenth Annual Meeting of the Commission.

Attachment 14

Development of Management Procedure

A small working group was convened to develop a work plan for MP development. Two possible classes of MPs were discussed:

1. **MPs that utilize CPUE, age composition and aerial survey data**. These data are used to condition the current OM and the manner in which they can be generated by the OM in projections is reasonably well established. Short-term/interim MPs using simple decision rules based on fishery-independent indicators may also be evaluated as part of this group of MPs, as long as tagging data are not used.
2. **MPs that utilize SRP tagging data and aerial survey data**, as suggested in paper CCSBT-ESC/0909/22. It was noted that the use of tagging data as input to the MPs had not been attempted before. Two documents outlining the details of the approach were circulated to interested group members. Although the principle of the approach was agreed to be worth pursuing (both scientifically and in regards to MP development) there are several issues that need to be addressed in order to develop an OM that can be used for testing MPs that use the 2000s tagging data. Alternatives for how to use these data in conditioning of the OM must be investigated to guide the selection of a method to generate future tagging data that is consistent with past performance in conditioning. The formulation used to fit the 1990 tagging data cannot likely be used given some inconsistencies found in the estimates of *F* derived from the recent tagging data. There is a possibility that a spatial OM may be needed to accommodate the observed trends in *F*s, which are presumably due to lack of mixing. This would demand substantial development work. New robustness tests would also need to be developed to address specific issues with the tagging data. The time-line involved in the development of such an approach would certainly exceed one year.

The group considered that in order to be able to complete the MP development in one year, the type of MPs to be considered would have to be restricted to those that only used CPUE, age-composition and/or aerial survey data. A one-year work plan was discussed to complete the testing of such MPs in 2010, as detailed below.

Task	Due Date	Responsibility
Distribute conditioning code and input data, and R code	Sep 2009	Ana Parma Consultant
Distribute CPUE series up to 2008	end Oct 2009	T. Itoh
- Recondition OM (base and robustness trials) - Other specifications for simulating aerial data?		Member Scientists
Web-meeting I to discuss any possible changes to OM and robustness trials based on conditioning results and other considerations. Confirm bases for tuning	Jan 2010	
Distribute updated OM code and input files for base runs and robustness trials	end Jan 2010	Ana Parma
Update R code for associated graphics and outputs	end Jan 2010	Consultant
Develop and test MPs inter-sessionally	-	Member Scientists
Exchange of papers	May/June 2010	
Inter-sessional technical meeting to review results of initial MP testing and possibly introduced a few further robustness trials	May/June 2010	
Distribute modified code and files	after inter-sessional meeting	Consultant
Scientists conduct final MP testing		Member scientists
Exchange MP codes	early August 2010	Consultant and member scientists
SAG11/SC15 (2010) - Finalize MP selection to recommend at CCSBT. - Consultation with Commissioners to demonstrate tuning trade-offs	Sep 2010	

Data generation for MP in reference set

It was agreed by the group that, at least for the CPUE and age composition data, the previous MP development work on robustness tests should serve as a starting point for the current work. With respect to generating the age composition data and assumptions about future selectivity
patterns it was agreed to follow the approach adopted in the previous MP work, as described in the report of the July 2009 Operating Model and Management Procedure Technical Meeting (OMMPTM).

Aerial survey
At the time of the last MP development work the aerial survey data was not used in either the conditioning of the OM or in any of the MPs developed and tested. The intention is that these data will be used in future MPs.

An initial approach to generate these data was selected, similar to the one used to generate CPUE. It involves adding lognormal deviations to values predicted by the OM using empirical variance and autocorrelation estimated from residuals. Due to the fact that the series is short and discontinuous there may not be enough residuals to estimate autocorrelation. This will need to be checked before a decision is made. Members of the group confirmed their wish to investigate this matter further.

CPUE

A number of points were discussed:

1. For conditioning the series should be updated to 2008.
2. Within an MP the decision as to whether to use real or simulated CPUE for 2009 should be made at the interim meeting.
3. The 2007/2008 data used in the conditioning phase will need to be calibrated based on historic differences between RTMP and logbook data. The same calibration will be applied to the actual data in the future for implementation of an MP based on CPUE. Additionally a calibration factor might be considered for post 2006 changes. The CPUE modelling group have taken up these requirements.
4. The separation of observation error from process error (which is not currently done in the conditioning of the OM using these data). The assumption has been that process error dominates given large changes in catch/effort and spatial coverage over time. Suggestion to use some basic jacknife/bootstrapping process (over years) as a rough way to estimate the levels of observation error. It was suggested that the vessel/vessel-year interaction appears to be the primary source of variance in many CPUE standardisations and that jack-knife methods might be tried at the vessel level or the year level in the first case.

There was general agreement to initially proceed with the previously agreed process for generating future CPUE (see report of the OMMPTM for details).

Other potential indicators

Other potential indicators that could be used in an MP framework were the commercial aerial spotting data (SAPUE data) and the trolling survey data. With respect to the SAPUE series it was decided that the aerial survey possesses both a scientific survey design and more extensive spatial coverage of the population (at these younger ages) and should be used rather than the SAPUE data if available. The trolling data were agreed not ready for consideration for use in an MP setting given several survey design issues that would likely need to be addressed beforehand.

Selection of reference set and robustness trials for MP development

Table 1. Specification of axes for the new reference set

	Levels	Cumul N	Values			Prior	Simulation Weights
Steepness (*h*)	3	3	0.55	0.64	0.73	0.333, 0.334, 0.333	Likelihood
M_1	3	9	0.30	0.35	0.40	Uniform	Likelihood
M_{10}	3	27	0.07	0.1	0.14	Uniform	Likelihood
Omega	1	27		1		NA	NA
CPUE series	2	54		w.5	w.8	Uniform	Prior
q age-range	2	108		4-18	8-12	0.67, 0.33	Prior
Sample Size	1	108		Sqrt		NA	NA

The following robustness trials were selected, to be refined after an initial round of MP testing is finalized:

- *LL1* overcatch scenario based on Case 2 of Market Report.
- Projected recruitment deviates uncorrelated to historical estimates from conditioning
- Include troll survey data
- Incomplete tag mixing: assume that season-1 *F*'s (*H*) (during which the surface fishery occurs) used in the tagging likelihood are 50% higher than the corresponding F's applied to the whole population.
- Downweight the initial size composition data for LL1 and LL4 (see Polacheck and Kolody, 2003, CCSBT-MP/0304/07). Details are yet to be developed.
- Regime shift: the stock-recruitment relationship changes in 1978. The two relationships share the same steepness parameter but two separate B_0 are estimated, one for each period.
- Change selectivity of aerial survey (ages 2-4) throughout the series to [0.3,1,0.3] and [1,1,1] (instead of [0.5,1,1] assumed in the reference set). It was noted that it may be possible to reduce the options by closer inspection of the spotter data.

CPUE

- Effects of overcatch on *CPUE*: S = 0%, 50% and 75%.
- Substitute alternative CPUE series by Laslett and ST-windows (the most extreme trends) to represent alternatives for changes in spatio-temporal distribution of fishing effort.
- Omega value of 0.75 (CPUE non-linearity factor) or a higher value that is more supported by data (note that the value of that 0.75 has little support relative to the linear relationship).
- Increase the CV on *CPUE* to 0.30.
- Step function change in catchability 20% up and down between 2006 and 2007 unknown to the MP.
- Catchability goes down by 20% between 2006 and 2007 and returns to normal in 5 years as fishermen adjust to new management regime.
- Drop first 10 years of CPUE data.

Tuning levels

In the past decision rules were initially tuned to achieve three median rebuilding targets in year 2022: 0.9, 1.1 and 1.3 of current spawning biomass. The tuning levels to be used in the initial round of MP testing will need to be agreed inter-sessionally.

Schedule of TAC changes and constrains

The following options for how frequently TACs can be changed will be evaluated, subject to advice from Commission:

Option (a): first TAC for 2012, then every year
Option (b): first TAC in 2012, then every 2 years.
Option (c): first TAC in 2012, then every 3 years.

These options include a two-year lag between the year of decision when a TAC is computed and the year of implementation, as requested by CCSBT after October 2003. Input from the Commission will be requested at the next CCSBT meeting on whether this extra-year lag will be maintained.

The maximum and minimum changes in TAC used in the MP recommended in 2005 were 5000t and 100t. In the past, it was found that the maximum allowed changes appear to be real constraints so that for high tuning levels, there was little option but to cut TAC near to their maximum.

Selection process

A range of performance statistics will be examined similar to the evaluations conducted in 2005. The group discussed alternatives for choosing a MP among candidates that have little difference in performance. One potential suggestion is to use an averaging method (as used in other fora) of the candidate MPs to construct in essence a meta-MP – such meta_MPs have been seen to improve performance in comparison with its constituent MPs.

Attachment 15

Requirements for the 2010 Data Exchange

Catch effort and size data should be provided in the identical format as that were provided in 2009. 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 2010 to allow development of the necessary data loading routines.

Data listed in Attachment A should be provided for the complete 2009 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 2008 data or very minor corrections to older data, then the changed data will not be used until discussed at the next SAG/SC meeting (unless there was specific agreement to the contrary). Changes to past data (apart from a routine update of 2008 data) must be accompanied by a detailed description of the changes.

Prepared by the Secretariat

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
CCSBT Data CD	Secretariat	31 Jan 10	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 2009 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 2010 on request from individual members*); • Update the unreported catch estimates using the revised scenario (S1L1) produced at SAG9.
New Zealand joint venture summary of observed trips	New Zealand	23Apr 10	New Zealand to provide the secretariat with a summary of observed trips, by vesselID, for New Zealand joint venture vessels. <u>Secretariat Comment</u>: *These data are required so that the Secretariat can provide NZ with a summary of Observed catch and effort data , which is required for NZ preparation of joint venture shot by shot data.*
Total catch by Fleet	all Members and Cooperating Non-Members (excluding Indonesia – which is specified later)	30 Apr 10	Raised total catch (weight and number) and number of boats fishing by fleet and gear. These data need to be provided for both the calendar year and the quota year.
Recreational catch	all Members and Cooperating Non-Members that have recreational catches	30 Apr 10	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. Australia noted in plenary that it was not able to provide Recreational catch data to the Data Exchange.
SBT import statistics	Japan	30 Apr 10	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 10	The mortality allowance (kilograms) that was used in the 2009 calendar year. Data is to be separated by RMA and SRP mortality allowance. If possible, data should also be separated by month and location.

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

Type of Data to provide[1]	**Data Provider(s)**	**Due Date**	**Description of data to provide**
Catch and Effort	all Members (& Secretariat)	23 Apr 10 (New Zealand)[2] 30 Apr 10 (other members, South Africa & Secretariat) 31 July 10 (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. *It was noted that with the implementation of two new statistical areas (areas 14 and 15), that catch and effort data should be provided with all fishing effort in these new areas regardless of whether SBT were caught (as is done for areas 1-10).*
Historical effort for areas 14 and 15)	Korea	30 Apr 10	The complete historic time series for areas 14 and 15 of all Members needs to be revised to provide full fishing effort in areas 14 and 15. *This was to be provided as part of the 2007 data exchange (before SAG8) by all Members who had fished in areas 14 and 15. Only one Member has yet to provide (or advise in relation to) this information.*
Non-retained catches	All Members	30 Apr 10 (most Members) 31 July 10 (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. Australia noted in plenary that it can only provide raw data on Non-retained catches.
Research and 'other' mortalities	Japan	30 Apr 10	Research mortalities prior to 2001 and any other forms of mortalities up to 2006 that have not been provided as part of the data exchange. Data should be provided at 5*5 by month resolution if available, but otherwise at the best available resolution. *This due date was set at SC11. Therefore as at 30 April 2010, Members will have had nearly 44 months to comply with this requirement. From this date, these "other" mortalities will be counted as part of the total catches in future global catch tables produced by the Secretariat.*

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

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
RTMP catch and effort data	Japan	30 Apr 10	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 10	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	28 Apr 10	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.
New Zealand joint venture shot by shot data	New Zealand	30 Apr 10	Shot by shot data for New Zealand joint venture vessels in statistical areas 5 and 6 for 2009. 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.
Raised catch data for AU, NZ and KR catches	Australia, Secretariat	30 Apr 10	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).
Observer length frequency data	New Zealand	30 Apr 10	Raw observer length frequency data as provided in previous years.
Raised Length Data	Australia, Taiwan, Japan, New Zealand	30 Apr 10 (Australia, Taiwan, Japan) 7 May 10 (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.
RTMP Length data	Japan	30 Apr 10	The length data from the real time monitoring program should be provided in the same format as the standard length data is provided.
Raw Size Data	Korea	30 Apr 10	Raw length/weight measurement data should be provided by Korea instead of raised length data because Korea does not yet have a suitable sample size to produce raised length data. *However, Korea is encouraged to improve its sample sizes of length frequency data in the future.*

[3] The additional week provided for New Zealand is because New Zealand requires the raised catch data that the Secretariat is scheduled to provide on 30 April.

[4] The data should be prepared using the agreed CCSBT substitution principles where practicable. It is important that the complete method used for preparing the raised length data be fully documented.

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Indonesian LL SBT age and size composition	Australia Indonesia	30 Apr 10	Estimates of both the age and size composition (in percent) is to be generated for the spawning season July 2007 to June 2008. Length frequency for the 2008 calendar year and age frequency for the 2007 calendar year is also to be provided. Indonesia will provide size composition in length and weight based on the Port-based Tuna Monitoring Program. Australia will provide age composition data according to current data exchange protocols.
Direct ageing data	All Members	30 Apr 10	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 10	Estimates of the different trolling indices for the 2009/10 season (ending Jan 2010), including any estimates of uncertainty (e.g. CV).
Tag return summary data	Secretariat	30 Apr 10	Updated summary of the number tagged and recaptured per month and season.
Catch at age data	Australia, Taiwan, Japan, Secretariat	14 May 10	Catch at age (from catch at size) data by fleet, 5*5 degree, and month to be provided by each member for their longline fisheries. The Secretariat will produce the catch at age for New Zealand using the same routines it uses for the CPUE input data and the catch at age for the MP.
Total Indonesian catch by month and % of Indonesian LL catch that is SBT	Indonesia	15 May 10	The 2009 catch of SBT in numbers and weight and the number of vessels fishing for SBT for each port and month. Also the 2009 total catch by weight of each species.
Catch Locations within EEZ	Indonesia	30 Apr 10	Information on Catch locations (latitude/longitude) within the Indonesian EEZ, recorded through the Scientific Observer Program.
Global SBT catch by flag and by gear	Secretariat	22 May 10	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 10[7]	These data will be provided for July 2008 to June 2009 in the same format as previously provided.

[5] M1=1 minute, D1=1 degree, D5=5 degree.

[6] Scales (0-5) of readability and confidence for otolith sections as defined in the CCSBT age determination manual.

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

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Raised catch-at-age for Indonesia spawning ground fisheries. **For OM**	Secretariat	24 May 10	These data will be provided for July 2008 to June 2009 in the same format as on the CCSBT Data CD.
Total catch per fishery each year from 1952 to 2009. **For MP/OM**	Secretariat	31 May 10	The Secretariat will use the various data sets provided above together with previously agreed calculation methods to produce the necessary total catch by fishery data required by both the Management Procedure and the Operating Model.
Catch-at-length (2 cm bins) and catch-at-age proportions **for OM**	Secretariat	31 May 10	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).
Catch at Age **for MP**	Secretariat	31 May 10	Cohort slicing by month of the 5*5 raised length data provided by members. The data used is the data for LL1 fisheries only. For LL1 fisheries where raised length data are not available (i.e. Korea, Philippines, Miscellaneous), the Secretariat will use Japanese length frequency data as a substitute in the same manner as conducted when producing the length frequency inputs for the operating model.
Global catch at age	Secretariat	31 May 10	Calculate the total catch-at-age in 2009 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 10	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.

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

Type of Data to provide[1]	Data Provider(s)	Due Date	Description of data to provide
Tag releases / recoveries and reporting rates. **For OM**	Australia	31 May 10	The RMP tag/recapture data for the period 1991-1997 will be updated for any changed/new data in the database.
CPUE series.	Australia / Japan	15 Jun 10 (earlier if possible)[9]	5 CPUE series are to be provided for ages 4+, as specified below: • Nominal (Australia) • Laslett Core Area (Australia) • B-Ratio proxy (W0.5) (Japan) • Geostat proxy (W0.8) (Japan) • ST Windows (Japan) • The number of 1*1 degree fished squares in each 5*5 degree square. These data will be accessed only by the Secretariat[10]. (Japan) The operating model uses the median of these series.
Aerial survey index	Australia	31 Jul 10 (every attempt will be made to provide this at least 4 weeks earlier)	Estimate of the aerial survey index from the 2009/10 fishing season, including any estimates of uncertainty (e.g. CV).
Commercial spotting index	Australia	31 Jul 10	Estimate of the commercial spotting index from the 2009/10 season, including any estimates of uncertainty (e.g. CV).

[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] These data will be temporarily accessed, under Japan's supervision, by the Secretariat to allow the Secretariat to verify calculation of the ST Windows CPUE series.