Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Eighth Meeting of the Stock Assessment Group

4 - 8 September 2007
Hobart, Australia

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Agenda Item 1. Opening

1.1 Introduction of participants and administrative matters

1. The Independent Chair, Dr. Joseph Powers, opened the meeting and welcomed participants.
2. Participants were introduced and the list of participants is at **Attachment 1**.

Agenda Item 2. Appointment of rapporteurs

3. Rapporteurs were appointed from the Members to produce the text of the report relating to agenda items 5 to 10 inclusive.

Agenda Item 3. Adoption of agenda

4. The agreed agenda is at **Attachment** 2.

Agenda Item 4. Admission of documents and finalisation of document list

5. The draft list of documents for the meeting was considered. Australia withdrew paper CCSBT-ESC/0709/26 ("Data requirements for stock assessment") from the list of documents, noting that most of that document was contained within other documents.
6. Japan opposed admission of paper CCSBT-ESC/0709/30 ("The southern bluefin tuna Japanese market follow-up study"). Japan stated that the company that produced this document was not a member of the Japanese Market Review Panel, that the company was provided with confidential information from the Japanese Market Review Panel and that such action breached Rule 10(10) of the CCSBT Rules of Procedure and the CCSBT agreement on confidentiality.
7. Australia disagreed with Japan's view and stated that Kroll was a Member of the Japanese market review panel. Australia proposed that all documents be admitted. Australia advised that the international company (with offices in Australia) was contracted to provide the paper and appropriate confidentiality agreements had been signed. It was Australia's view that such an arrangement was consistent with the arrangements used by several Members to engage international consultants. However, Australia accepted the consensus basis for admission of documents.

8. Australia was concerned that paper CCSBT-ESC/0709/40 ("Comparison of age frequencies for the Australian farmed southern bluefin tuna between 40 fish sampling and harvested") may also breach the confidentiality agreement in that it appeared that the confidential packing list data provided by Australia to the Japanese authors of the Australian Farm Review report may have been used in producing this paper. Consequently, Australia opposed admission of paper CCSBT-ESC/0709/40 while it worked to confirm the source of packing list data.

9. Japan advised that the packing list used for analyses in paper CCSBT-ESC/0709/40 was collected independently from Japanese importers by the Fisheries Agency of Japan and considered that it had completely followed the rules of procedure. Japan stated that the Australian claim was baseless and that Australian opposition to the admission of paper CCSBT-ESC/0709/40 was abuse of the consensus rule.

10. One of the authors of the paper CCSBT-ESC/0709/40 expressed his disappointment, as he conducted this analysison a purely scientific basis. He stated that it was very obvious that there were very few age 2 fish among the farmed fish exported to Japan. He further stated that this fact should not be forgotten when discussing the adequacy of age estimation for farmed fish.

11. New Zealand expressed its disappointment that both papers could not be accepted and discussed at the meeting. New Zealand considered that both papers contained important information and New Zealand did not believe that either paper breached the rules of procedure.

12. The Chair stated that he ruled that neither CCSBT-ESC/0709/30 nor CCSBT-ESC/0709/40 would be admitted to the meeting.

13. The list of admitted documents is at **Attachment 3**.

14. The meeting assigned individual documents from the list to relevant agenda items.

<u>Agenda Item 5. Report from CPUE modelling workshop</u>

15. The report of the Second CPUE modelling workshop was presented and recommendations from the workshop are provided at **Attachment 4**. The recommendations to the ESC were summarised against each of the six Terms of Reference (TORs) of the workshop.

16. Participants discussed the analyses comparing the shot by shot and aggregated (5x5/month) data. It was noted that, at the workshop, analyses were conducted comparing the differences between CPUE trends resulting from the use of finer scale data and then the addition of different explanatory variables and associated interactions in the GLM standardisation. It was noted that small differences in the CPUE trend were evident due to the level of data resolution; however large differences were seen with the addition of certain explanatory variables (Vessel ID and Hooks per Basket) at present only available in the fine scale data. It was suggested that vessel-alone factors may account for large differences in trends between shot-by-shot versus 5x5 data. Given the relatively short life-span of vessels

in the fishery (about 15-20 years) there was some concern about the importance and validity of including vessel effects. It was noted that treating the vessel factors as a random effect is preferred and this would overcome the aforementioned concern.

17. Participants also discussed the analysis in the workshop report comparing the standardized CPUE year trend of vessels with and without observers. Discrepancies between the two series were observed in 1995, 1996, and 1999. Japan indicated that the likely reason for the difference between the two series in 1995-96 was due to the policy by vessels without observers to release all live small fish. In contrast, vessels with observers retained all SBT including small fish. The discrepancy seen for 1999 was different as retention practices had changed. It was suggested that it could arise from the sampling undertaken by the Experimental Fishing Programme (EFP) that occurred around this time. Outside these two periods of differences between the series, the standardized CPUE with observers was noted to be consistently higher than the CPUE for vessels without observers between 1996 and 2000. However, CPUE of vessels with observers were slightly lower than vessels without observers after 2001 except for 2004. Questions were raised about possible differences between scientific observers who are ex-fishers and other scientific observers and it was suggested that further analyses should examine these differences.

18. Analyses relating to the 12 vessels identified in the Market Review to have mis-reported in December 2005 were discussed. It was noted that analyses comparing nominal CPUE for these 12 vessels to the core fleet were not conclusive. In some areas CPUE for the 12 vessels were lower than the core (as would be expected if they under-reported), but in other areas they were higher. Participants noted the conclusion of the CPUE workshop that the CPUE of these 12 vessels fell within the expected range of "noise". It was suggested that further analysis of vessels thought to have mis-reported would be of interest.

19. It was noted that a large amount of the discussion and analyses conducted at the workshop focused on the difference between the two datasets used to derive CPUE trends. Dataset A contained sets in areas 4-9 and months 4-9 while Dataset B contained sets in areas 4, 7, 8, and 9 and months corresponding to the variable Japanese fishing season. Participants discussed the differences between the standardised CPUE trends of the two datasets and agreed that the differences were not unexpected given the different spatial and temporal coverage of the datasets. It was noted that if the trends were integrated over area and averaged over month, as has traditionally occurred with CPUE series used in the operating model, the differences between the two series were likely to be much smaller.

20. CCSBT-ESC/0709/46 was presented. This paper further investigates the differences between Datasets A and B used during the CPUE workshop. Different year trends of CPUE were obtained in the early 1990s, especially 1993-1994. The paper states that "As a result of an investigation into nominal and standardized CPUE in detail, the difference seems to be mainly attributed to the gap of CPUE values of area 4 and 9 in the two datasets. Because there is little difference of nominal CPUE between the datasets developed from shot-by-shot data and 5x5 degree data, these and further investigation using the aggregated data (by 5x5/month) is also available for any of the ESC members. The year trend of standardized CPUE is dependent on the

explanatory factors included in the GLM model assumptions." Results from a simple validation suggest that the model fit to dataset-B is more robust than for dataset-A.

21. Some participants noted that this test indicated how well the different models fitted the data sets, rather than the robustness of the datasets. In addition, this test would be affected by the different levels of strata considered between the models and may not be a useful criteria for selecting datasets for future analysis. The participants expressed a desire to stay with the current convention for selecting season-area strata for CPUE considerations due to concerns about changes in seasonal aspects in some areas over time (e.g., Table A1 of CCSBT-ESC/0709/46).

22. Some participants were concerned that the effect of the Market Review on the CPUE has not been adequately addressed. It was noted that the Japanese Longline CPUE data provide the main index of abundance used in the operating model and that it is essential that this index is reliable in future. Whilst there may be value in exploring historical CPUE data further, it was noted that these approaches may still prove unable to produce a reliable historical CPUE series and alternative indicators may need to be developed.

23. It was noted that the Japanese fleet regulations changed in 2006. CPUE should be much more reliable from that point forward.

Recommendations on CPUE

24. The working group made the following recommendations:

- Create a table similar to Table A1 in CCSBT-ESC/0709/46 (page 7) using the observer data. This should include all months similar to the format for dataset A so that observed effort can be compared with total effort. This will help determine whether observer data provides adequate spatial and temporal coverage.
- Conduct further investigation into CPUE year trends with and without observers. This would include adding a category for 'observer type' (eg. '0' – no observer, '1' – ex-fisher scientific observer, '2' –other scientific observers). It was recommended that the model with many explanatory variables in Figure B5 in CCSBT-ESC/0709/46 be used as the basis for this analysis. NZ offered to provide Japan with shot by shot data of JV vessels in areas 5 and 6 to include in the analysis. This was agreed by the group to be a good idea.
- As a start, use data selected from the previously agreed core regions and time periods for CPUE standardizations.
- Methods to identify a core fleet that can be reliably used as an index of abundance should continue to be pursued.
- Further investigation of vessels found to be mis-reporting. Vessel specific residuals from a GLM analysis might be evaluated to highlight near-term changes in fishing practices.
- A table of observed number of hooks per setcompared to reported hooks per set (unobserved) was requested.

- Within an historical fishing season, evaluate fishing patterns by vessel before the Japanese fishing "season" closed with patterns after closure. Comparison of patterns for results with and without observers would be ideal.
- Further collaborative work is required on approaches for standardized CPUE modeling. For example, methods which account for zero catch should be pursued as should comparisons between fixed and random effects approaches to modelling.
- Monitoring of bigeye and yellowfin tuna in the catch data is important. Such catch data should be analysed for any fleets for which CPUE would be considered.
- Model diagnostics from GLM analysis should be provided to improve the ability to judge results.

25. Given the magnitude of the uncertainty caused by the catch anomalies, the SAG considered that it was important to develop a new CPUE index to replace the 5 series that had been used in the past to condition the model.

<u>Agenda Item 6. Report from Australian SBT farm study</u>

26. Japan referred to paragraph 44 of the CCSBT13 Report and asked Australia about the result of the 2007 experiment and a revised experimental design for 2008.

27. The meeting agreed to defer this item for discussion by the Extended Scientific Committee (ESC), which also has the report from the Australian SBT farm study on its agenda.

<u>Agenda Item 7. Review of fisheries data for stock assessment</u>

28. The focus of discussions under this agenda item was a review of the various data sources that could potentially be used in future projections or scenario modelling to inform the Commission or be included in the management procedure (MP) or operating model (OM). It was noted that the Commission has fixed the TAC for three years and will be reconsidering the TAC in 2009.

29. Documents CCSBT-ESC/0709/24 and CCSBT-ESC/0709/27 were not presented but Australia informed the SAG that they contained background material that might be useful for some of the discussions under this agenda item.

30. The SAG reviewed paragraphs 170-173 from the SAG 7 report to guide discussions. These discussions covered both fishery-dependent and fishery independent data.

31. There was recognition by the SAG of the importance to differentiate between what could be done with historical data, compared to what new data might be used going forward into the future, and discussions were structured in that way.

7.1 Implications of the Australian Farm Review and Japanese Market Review and any new information from fisheries on the SBT stock assessment process

Historical information

Total catch

32. The SAG noted that as last year's attempt at scenario modelling was the first chance to consider the catch anomalies, it was likely that there was further work that could and should be done.

33. In terms of the surface fishery, the SAG noted that the Australia farm experiment programme was ongoing and that this might provide information to clarify the nature of potential bias in the size sampling procedure.

34. In terms of the revised longline catch series, Australia noted that new information has become available since the Japanese market review suggesting that additional work is warranted on the catch history and on some of the technical aspects required to calculate the market anomalies, in particular the lag between the catch of fish and their appearance on the market. Australia hoped that relevant information would be considered prior to, or at, next year's meeting.

35. Japan noted that any modification of the scenarios considered last year should be based on good quality information that can be examined by the SAG/ESC.

36. In respect of any further investigation of the historical Japanese market anomalies it was noted that there were four types of information that would be important for stock assessment: level of anomalies over time, information to relate the year of the anomaly to the year of capture (i.e. the lag), the size distribution of the catch, and the proportion of the anomalies that could be attributed to different fleets as defined in the operating model and the strata used for CPUE calculation (e.g. months and areas 4-9).

37. It was noted that the uncertainty associated with the catch scenarios provided to the SAG could not be characterised, and the underlying or alternative assumptions could not be investigated through a scientific process. This was considered an important issue, particularly for testing MPs.

38. The SAG noted that any changes to the historical catches or catch scenarios would require refinement of the CPUE scenarios considered in the scenario modelling. Hence, the work on catch and CPUE would need to be conducted in parallel.

Commercial CPUE

39. Discussions under this agenda item mirrored many of the discussions had under agenda item 5 and the SAG noted that any recommendations for further analysis of historical Japanese longline data raised under that agenda item were relevant here. For this reason, discussions focussed on the potential to generate historic CPUE for other fleets.

40. New Zealand informed the SAG that it had two fleets, the domestic fleet and the charter fleet. It noted that any CPUE series using NZ data may not necessarily reflect changes in abundance at an overall stock level. It noted that the data for the charter fleet was already included in the CPUE index used in the stock assessment, but that given the high confidence in these data (due to the 100% observer coverage), it may be useful to generate a CPUE series for these vessels separately from other Japanese

vessels. Historical CPUE for the domestic fleet was likely to be less useful due to the larger changes in effort and potential non-linearity.

Size composition

41. The SAG noted that there was no information in the Japanese market review on the size composition of any catch anomaly. Previously it has been assumed that the available size composition data are unbiased, but change to this assumption may be required if new information comes to hand.

42. The SAG noted that as different longline fisheries are assumed to have different selectivity, any information on how any market anomalies were distributed among fleets would flow through into changes in the assumed size composition of the catch.

43. The SAG noted that the Australian farm experiments may provide some information that results in the revision of historical size/age data from the purse seine fisheries.

Industry-based scientifically-designed CPUE sampling

44. There were no historical data for consideration for use in an assessment.

Aerial survey

45. The SAG noted that as this indicator was not implicated in the market or farm reviews, there was no need to reconsider the historical data. However, given the uncertainty about stock structure and mixing rates, these factors would need to be considered if the information was included in any operating model. This point would apply to many indicators.

Tagging

46. There was considerable discussion on the difficulties in the interpretation of the fishing mortality rates for juveniles that come from the CCSBT tagging programme. Concerns included the lack of deployment of tags over the entire range of the juvenile stock, problems with the estimation of reporting rates from tag seeding in the surface fishery, the lack of estimates of reporting rates for the longline fisheries due to the current level of observer coverage, and the potential change in behaviour or mortality of age 1 fish tagged off western Australia between the historical (1990s) and more recent (2000s) tagging programmes.

47. It is not known if these concerns could be overcome by further analysis and this could limit the interpretation of the fishing mortality estimates (e.g. relative rather than absolute) and the ability to use these data in the operating model or a future MP. There were mixed views on what inferences could be drawn from these data, although it was agreed that F's were relatively high, particularly for those years/cohorts where there were reasonable returns and high and/or well estimated reporting rates.

48. It was noted that the Global Spatial Dynamics Programme aimed to deploy archival tags in juveniles (2-4 years old) across the distributional range, and that data from this programme could provide information that may assist in the interpretation of the conventional tag data.

Other indices

49. The SAG noted concerns over the interpretation of the acoustic survey results and the ability to include it in the OM or a future MP. There was some interest in considering the troll indices – their reliability relative to other indices may have increased, but there were concerns regarding the coverage of the survey given uncertainty in stock structure and mixing.

Future information

50. Document CCSBT-ESC/0709/39 was presented examining the impacts of the recent introduction of individual quotas and quota reductions on the operation of the Japanese longline fleet. This document presents the analyses for the fishery operations in 2007 using the newest data. In analysing the RTMP data up to mid-July 2007, no obvious changes were observed in the operations in the Area 4, Area 7 and Area 9 compared to the operations before 2005. However, Area 9 in April is a newly developing fishery and the number of operations decreased considerably in Area 4, Area 7 and Area 9 (7-33% of 2001-2005). It also pointed out that there would be changes caused by socio-economic factors (e.g. fuel price, price differential by size and species) that are difficult to quantify.

51. There was strong support from the SAG for these types of analyses and it was recommended that this work be continued as there are a variety of factors that could influence fishing behaviour and these could change over time.

52. In response to a question regarding the potential for discarding and high grading (or up-grading), Japan responded that actually high CPUE had been observed for small fish in the RTMP data in 2007 and that the domestic management (i.e. individual tagging, RTMP, patrol vessels) made high-grading very difficult.

53. It was recommended that all members should consider how current or any future management measures could impact on fishing practices or retention / discard behaviour and put appropriate monitoring systems in place.

Total catch

54. There was discussion of how far into the future the SAG would be restricted to ‘scenarios’ rather than actual catch data.

55. The SAG noted that the Australian farm experimental programme is ongoing and the uncertainty in reported catches remains until this work is complete. In relation to the treatment of Japan’s reported catches going into the future, Australia commented that it would be important that the catch data were verified and asked that Japan provide information to show that these new systems were robust.

56. The SAG noted that management of the Japanese SBT fishery changed in April 2006. All domestic SBT landings are now checked by national authorities and the trading or obtaining of illegally caught SBT is prohibited. It was Japan’s view that there is no need to consider any possible overcatch for their fleet since April 2006 and reported catches should be used.

57. Japan also commented that as there have been no changes in the management of the Australian surface fishery, that it should be considered under the same scenario previously used for scenario modelling.

58. The SAG noted the importance of incorporating all fishing-related mortality into catch estimates and reiterated that all members should consider the impacts of any existing or new management measures on fishing mortality and reporting.

59. The SAG noted that accurate catch estimates were critical to any stock assessment or management procedure and emphasised the importance of verification of these data. The importance of observer coverage and other monitoring and compliance measures were noted. It was also noted that further market monitoring might be undertaken in the future.

Commercial CPUE

60. The SAG noted that analyses discussed under Agenda item 5 would be relevant here.

61. There was discussion of whether it might be possible to connect / calibrate the historic and future CPUE series. Given the current uncertainties it is unlikely that the SAG will ever have full confidence in the historical data.

62. It was considered that that accurate CPUE data should be used in future, e.g. verified through the comparison of CPUE for observed and unobserved vessels or other means. The importance of monitoring impacts of management and other fishery operation changes was noted.

63. There was discussion of some of the important effects found when considering fine scale data, e.g. the importance of vessel effects, measures of targeting (i.e. hooks per basket and finer scale latitude information). It was noted that some of this information could be averaged over a 5x5 level so that it could be included in future CPUE models without compromising concerns over data confidentiality.

64. New Zealand indicated that it would look to develop a CPUE series for its domestic fleet going forward, but recognised that trends in the series may not necessarily reflect those of the overall stock. In terms of the charter vessels it was noted that these boats have been subject to different management than the other Japanese vessels (e.g. vessel quotas over a much longer period and high levels of observer coverage). There is a need to consider whether the charter vessel data should continue to be included in the Japanese longline series or in another series to be developed.

Size / age composition

65. The SAG noted that direct ageing has been undertaken for a number of years and ways to incorporate this information into any assessment or MP should be considered as it should alleviate some concerns over the use of the cohort-sliced age method. This would apply to both historical (e.g. period over which otoliths have been aged) and future data. The SAG agreed that direct ageing should continue into the future.

Industry-based scientifically-designed CPUE sampling

66. The SAG noted the importance of monitoring the spawning ground, and the concern that the Indonesian CPUE may not yield reliable information in the near future. The SAG was reminded of the considerable historical work done in designing feeding ground and spawning ground surveys.

67. The SAG agreed that if the ESC were to recommend such an approach to the Commission, that it would need to initiate a planning process to prepare a revised study design that included factors such as the likely costs and the number of fish that would need to be caught to provide a useful level of precision from such a survey.

68. It was noted that if a survey was operating on the spawning ground, it may be able to provide samples for the proposed close-kin genetics work (CCSBT-ESC/0709/18) as representative sampling of the spawning ground was a critical assumption of this work.

Aerial survey and commercial spotting

69. The SAG discussed the aerial survey and commercial spotting index. It was noted that there was a possible bias / variance trade-off with these series, i.e. the survey should have low bias but has a high variance and the commercial spotting index had lower variance, but it was unclear the extent to which it monitored juvenile abundance. Both analyses were considered to have some value going into the future.

Tagging

70. There was discussion on the merits of continuing the tagging programme compared to suspending the tagging for a few years to evaluate how best to further to this work. It was noted that there are still several thousand tags in the water and the project will continue to provide information going forward but that the full value of this tagging required accurate reporting of tag recovery from all fishers. Adequate observer coverage would be important to determine the level of reporting.

7.2 Base case scenarios for catch and effort in the global fishery

71. After considerable discussion it was suggested that we should continue with the same approach as last year (i.e. scenario modelling) given a lack of feasible alternative approaches. The number of scenarios should be reduced where possible for practical reasons.

72. The SAG agreed that the set of base case scenarios to be used in future analysis would be based on the same assumptions as scenarios “b”, “c” and “d” defined in the report of SAG7 (Table 6, page 17). Where new information becomes available, these various hypotheses would be modified as appropriate.

73. It was further hoped that concerns over procedural matters could be avoided so that the SAG/ESC are able to consider all relevant information on these matters. The Commission was encouraged to assist in this matter.

74. Any new CPUE series will be dependent on any additional work on CPUE (Agenda item 5, e.g. estimation of an observer effect) and any work on the extent and timing of any market anomalies (e.g. information on how to allocate catches among fleets).

75. The SAG noted that the method for adjusting the surface fishery in the overcatch scenarios was *ad hoc*, but agreed that this would be continued unless new information comes forward.

<u>Agenda Item 8. Stock assessment</u>

8.1 Analysis of fisheries indicators

76. Papers CCSBT-ESC0709/9, 10, 12, 13, 14, 19, 21, 38 and the New Zealand country report were listed for discussion under Item 8.

77. Paper CCSBT-ESC/0609/9 details the catch of SBT by the Indonesian longline fishery in 2006. Sampling during 2006 covered 51% of the estimated total Indonesian SBT landings. The estimated total catch of SBT was 598t in 2006, down from 1,741t in 2005, but similar to catches in 2003 and 2004. The proportion of SBT in the Indonesian landings decreased from 12.9% in 2005 to 4.5% in 2006, but was similar to 2004. The decrease in total catch of SBT appears to be largely the result of a lower level of longline fishing activity in general, and especially in the region to the south of the spawning ground, which was the source of large landings of SBT in 2005.

78. The SAG noted the reduction in catch in 2006 and questioned whether this was proportional to the reduction in effort. It was noted that an interpretation of the reduction in number of landings as a measure of effort should be done with caution due to the changes in the nature of fishing operations over recent years. As noted in CCSBT-ESC/0609/9 these include the installation of freezers to a number of vessels and transhipment of catches among vessels, both of which have resulted in longer trips for many of the vessels. As noted at SAG7, these changes are largely attributed to the increase in fuel prices in Indonesia.

79. Paper CCSBT-ESC/0609/10 was presented, updating the length and age distribution of SBT landings in the Indonesian fishery. Length measurements were obtained for 1,181 SBT in the 2005/06 spawning season and 1,586 SBT for 2006/07 season. The size distribution of SBT catches on the spawning grounds appears largely consistent with landings over the past three years. Figure 3 shows that while the mean size had increased marginally between 2003 and 2005, it has continued to decline since to 168cm. Otoliths were collected from all SBT with length measured in the 2005/06 season. Of these, 500 were selected for reading and 487 ages were successfully estimated. The age distribution of SBT catch is also consistent with landings over the past few years, ranging from 5-38 years and a median age of 14 years. Figure 9 shows the declining trend in mean age over the 12 years of the sampling program. This is the first season that a 5 year-old SBT has been sampled on the spawning ground. The sex ratio of SBT in the Indonesian catch continues to be skewed towards females and the size at age data (Figure 6) continues to indicate sexual dimorphism in growth.

80. The SAG noted that the Indonesian catch monitoring continues to provide valuable information on the status of the spawning stock and, in light of the uncertainties

associated with the historical longline catch and effort data, was essential to continue and improve where possible. A number of points were noted. The continued reduction in the number of fish over 190cm was raised as a point of concern and the extent to which this may be the result of a shift in the behaviour of the fishery. It was noted that, to the extent of the information available on the operations of the fleet this did not appear to be the result of a shift in behaviour. There have been shifts in fishing patterns over recent years, particularly vessels fishing further south of the spawning grounds, but catches by vessels fishing off the spawning grounds had been identified and were excluded from the data for the spawning grounds. The SAG noted that the smaller size and age classes of fish associated with these more southern ("oki") grounds would be important to consider in the context of future assessments and conditioning of the operating model, as they suggest spatial structure in selectivity that had not been incorporated previously.

81. CCSBT-ESC/0709/12 provided an update on the scientific aerial survey for juvenile SBT in the Great Australian Bight. Poor weather in February and March meant fewer transects could be completed this year than in the previous two years. Table 1 of the document provides a summary of search effort and sightings, and indicates that total survey effort has steadily declined since 1994. The same analysis methods as last year were used to estimate the relative index of juvenile abundance. The point estimate for 2007 was lower than in 2006, and suggests a declining trend over the past three seasons. However, it was noted that high uncertainty in recent estimates (due to lower search effort and number of sightings) mean the trend in the point estimates cannot be distinguished from random fluctuations. A random effects extension of the analysis is planned for next year, which is likely to reduce uncertainty in the estimates.

82. It was noted that the confidence intervals reflect a combination of pure sampling uncertainty in any year, plus uncertainty associated with the estimation of environmental and spotter effects (because the environmental and spotter effects are shared across years, there are correlations between years which are impossible to show in a simple diagram). The SAG noted that the inclusion of diagnostics for model fits would be useful in the future. There was some discussion about spotter effects and the accuracy with which the biomass of schools could be estimated. It was noted that spotter effects were included and estimated in the current analysis model, and the past experiments indicated consistency between estimates of school size from different spotters. Furthermore, this issue was the subject of active field trials in 2007 and 2008 to prepare for the eventuality that the current spotters were not available for future surveys.

83. Paper CCSBT-ESC/0709/13 was presented. Data on the sightings of SBT schools by experienced tuna spotters during commercial spotting operations in the GAB were again collected between December 2006 and March 2007. There are now six years of commercial spotting data which can potentially be standardised to obtain an index of juvenile abundance (ages 2-4 primarily) in the GAB. At the start, five spotters were involved, but in the past two seasons there have only been four spotters, of whom only two flew substantial hours. This change has implications for the analyses using general linear models, and the authors tested the sensitivity of results to

different subsets of the data was tested. Results are slightly sensitive to which spotters are included in the analyses, though the general temporal patterns of the indices are similar. The estimated index is lowest in 2003 and 2004. The 2005 estimate is the highest and those for 2006 and 2007 are both close to, or slightly above, the average over the past 6 seasons. It is unknown what proportion of all juveniles are in the GAB each year.

84. In discussion the question of the comparability of the commercial SAPUE index with the scientific aerial survey was raised. As had been noted previously, caution needs to be exercised in interpreting the commercial SAPUE index as an index of abundance due to the common issues associated with data sources from commercial operations: targeted search pattern, small focussed area of operation, differences in behaviour among spotters and years, lack of independence of sequential operations etc. The SAG noted that while there was a range of additional analyses that could be conducted to further investigate the nature of the commercial spotting data, this effort would be better focussed on refinements and improvements of the scientific aerial survey index.

85. CCSBT-ESC/0709/SBT Fisheries – The New Zealand country report was presented, focusing on information related to fishery indicators. Charter CPUE averaged around 3 SBT per 1000 hooks over 1997-2002. Associated with the lack of new recruitment to the New Zealand fishery, CPUE declined dramatically in 2003 and has stayed at these historically low levels apart from a slight increase in 2006 due to the appearance of some recruits of small size.

86. As noted at SC10 and SC11, there has been a very clear reduction in the range of sizes of SBT taken in the New Zealand fishery since 2001 and new data suggest that this has continued in 2007 (Figure 6). There is evidence of the progression of weak cohorts in the size distribution over this period from the charter fishery, but there is little evidence of recruitment of smaller fish to the New Zealand fishery, except for a scattering of smaller fish over the last two years. Due to lower levels of observer coverage in the domestic fishery, size composition data are not as well estimated for that fleet. Nevertheless, they show similar patterns to those observed in the charter fishery.

87. An examination of the proportion of the charter fleet catch under a given size since 1989 (Table 6; Figure 8) indicates that fish under 140cm generally represent over 25% of the catch from the charter fleet, but have been 10% or less since 2004. Overall, the proportions do fluctuate in a way consistent with periods of above and below average recruitment (e.g. two to three year cycles).

88. The lack of small fish reflected in the length data corresponds to a series of weak (or absent) cohorts in the proportional ageing data (Figure 9). The data suggest at least four consecutive extremely weak year classes in the New Zealand fishery from 1999 to 2002. While there is a scattering of 2 and 3 year old fish in 2006 (Figure 9) and 2007 (from length data in Figure 7), the abundance of these juveniles is still much weaker than seen historically (e.g. see relative abundance of three year olds in 2001).

89. CCSBT-ESC/0709/21 provides updated estimates of the tag reporting rate for the Australian surface fishery for 2003 to 2006 based on tag seeding experiments. These

estimates of reporting rates are an essential input into the analyses of fishing mortality rates from the recent SRP tagging programs. Analyses of the data, which incorporates tag shedding estimates and variances, indicate that reporting rates decreased significantly over the four years, from 64.0% in 2003, to 50.3% in 2004, to 39.6% in 2005 and, finally, to 21.5% in 2006. The CV was at most 11% for any estimate. The very low estimate of the reporting rate for 2006 is a concern and raises the question of whether the tag seeding results are providing unbiased estimates of the reporting rates; in particular, it raises concerns about shedding rates and lack of independence in shedding for double-tagged fish released directly into farm cages. This issue is further explored in CCSBT-ESC/0709/19.

90. CCSBT-ESC/0709/19 presents an updated analysis of the release and recapture data from the CCSBT SRP tagging program. The same analysis methods were used as in last year's report (CCSBT-ESC/0609/15). Reporting rate estimates from the surface fishery based on tag seeding results fell to a level of 0.21 in 2005/2006 (CCSBT-ESC/0609/21). Using this point estimate resulted in "unrealistically" high estimates of fishing mortality rates for some ages (possible reasons for this are discussed). Thus, a number of plausible assumptions about reporting rates were made and used to calculate a range of fishing mortality rate (F) estimates. In spite of the problems with reporting rates, the tag return results demonstrated high and possibly increasing fishing mortality rates in 2003, 2004, 2005 and 2006 for ages 3 and 4 for those fish tagged at ages 2 and above. Rates based on age 1 releases, which primarily occurred in Western Australia, tended to be lower. High rates of recovery were obtained from age 3 fish released in December in the Great Australian Bight (GAB) for the same season they were released. Overall the results suggest high fishing mortality rates for fish in the GAB.

91. CCSBT-ESC/0709/19 indicates that the number of returns from age 1 releases from the 2000, 2001, 2002 and 2003 cohorts were disproportionately low relative to returns from releases from other age classes and also relative to returns from the 1990s tagging experiments. This suggests higher tagging mortality, high natural mortality, or changes in the spatial dynamics for age 1 fish. The spatial distribution of longline returns also suggests a possible change in spatial dynamics with few tagged fish moving into the Tasman Sea (but this may be confounded by reporting rate issues). Estimates of fishing mortality rates at age 2 for age 1 releases were very low and appear inconsistent with the catch data from the surface fishery. Estimates of the number of tags returned per 1000 fish caught in the surface and longline fisheries also suggest possible inconsistencies with the catch data. In particular, not enough older fish appear to have been caught in the surface fishery relative to the number of tags returned from fish at older ages.

92. It was clarified that the estimates of tag shedding rate estimated from "wild recaptures" released into grow-out pens arose from wild tagged fish that were identified (recaptured) during the 40 fish sampling conducted to estimate the size distribution of the catch.

93. There was considerable discussion on the potential reasons for the apparent decline in the reporting rates and the implications for the estimates. It was noted that initial investigations suggested that one contributing factor was the level of training/skill of

personnel doing the tagging for the tag seeding trials in recent years and the increased difficulty in tag detection associated with freezer boat processing of fish from the farm cages. As this is a very high speed processing line, workers are less likely to notice tags and/have time to retrieve them and the associated information. The SAG noted that the CCSBT Secretariat has instigated additional tag recovery activities for the freezer boat processing in the 2006 and 2007 harvesting seasons to improve the recovery of tags and provide an estimate of reporting rate associated with this activity. The SAG emphasised the importance of resolving the issues responsible for the declining reporting rates and that this issue will need to be considered further by the SC as part of the SRP review.

94. Paper CCSBT-ESC/0709/14 presents a summary of the fisheries indicators. The presentation was limited to those indicators which were deemed to be unaffected by catch anomalies identified in the 2006 Japanese market and Australian Farm Reviews. All of the indicators discussed in this paper have been presented in more detail in other papers from Australia, except for the archival tag recapture rate and NZ JV catch rates, which are covered here. Table 2 describes the proportion of archival tags recovered since releases began in 1993. During that time there has been a high rate of recapture (maximum to date of 33% recovered for releases from 2000), suggesting that total fishing mortality has been high, and variable among cohorts. The archival tags are assumed to have higher reporting rates than conventional tags because of the large rewards, but the recovery numbers still represent a lower bound for the true number, since there are no reliable reporting rate estimates.

95. It was noted that in future updates Figure 4 should use the same format as Figure 5 (e.g. combines all data from CCSBT region 6) from the NZ national report, which indicates that catch rates have improved in 2006, but these are still at low levels when compared to the previous decade. Figures 6 and 7 (pages 12 and 13) show a small improvement in the availability of small fish to the New Zealand longline fleets. The set of unaffected indicators presented here and in previous papers continue to suggest that there have been a series of weak recruitments over 1999-2003. Subsequent cohorts may be stronger but still appear to be weak when compared with average cohort strength in the mid 1990s. Overall there were no indicators that suggested any marked improvement in stock status compared to advice from previous years, as is summarised in Table 4.

96. CCSBT-ESC/0709/38 for fisheries indicators in 2007 was presented. The indicators suggest that current stock levels for 4, 5, 6 and 7 age groups are the same as or lower than that observed in the late 1980s, which is the historically lowest level. When looking to the most recent four years, CPUE indices for these same age classes show steadily declining trends. Other age classes (3, 8-11, and 12+) tend to increase or maintain the same level after 2003. Current stock levels for these age groups, however, are still at low levels but similar to ones observed in past. Many indices indicate recent low recruitments for the 1999, 2000, 2001, and 2002 cohorts. Indices for the spawning stock are difficult to interpret and thus no specific conclusion was drawn.

97. In considering the range of indicators the SAG noted that there were still outstanding questions about the relative reliability of different indicators. In particular, there

were different views on the relative reliability of trolling and acoustic indices and the extent to which they reflected the trends seen in other indicators. These points were further discussed in Item 7, in the context of future inputs into the stock assessment and MP processes.

Synthesis of Indicators

98. The reviews of Japanese SBT market anomalies and Australian SBT farming anomalies in 2006 raised serious doubts on the reliability of the total catch and Japanese LL CPUE indicators, thus interpretation of many of the indicators is more difficult than in previous years. However, Japan has strengthened domestic management for its SBT fleet from 2006; consequently data from this fleet should be more reliable from that date.

Interpretation of Indicators of Recruitment

99. The indicators continue to support the previous conclusion of poor 2000 and 2001 year classes, and the evidence is stronger now that the 2002 year class was also poor. The size distribution in the NZ LL fishery and the Japanese LL fishery indicate poor 1999, 2000, 2001 and 2002 recruitments (noting potential catch anomaly bias in the Japanese data), and the aerial spotting survey is consistent with a reduction in average recruitment below the 1994-1998 levels. The high fishing mortality rate estimates for age 3 and 4 from recent SRP tagging are also consistent with low recruitments in these years. Trends in year class strength in the Japanese LL fleet show poor strength of the 2000, 2001 and 2002 year classes, but indicate the 2003 year class may be similar in size to the average between 1980 and 1999. However, this indicator could be biased by catch anomalies as in the case of the 2000-2002 year classes. SRP tag returns may suggest declining recruitment between 1999 and 2003. The GAB aerial survey indicates poor recruitment through to 2004.

Spawning stock biomass

100. Reported catch rates of fish aged 12 and older in the Japanese LL continue to indicate a drop in spawning stock biomass in about 1995, but this is of course potentially impacted by catch anomalies. Since the Japanese LL CPUE is the primary indicator of stock abundance the potential anomalies make the spawning stock status less certain. The increase in tonnage of the Indonesian catch in 2004-2005 as well as the increase in proportion of SBT in the Indonesian catch was associated with a possible shift in the behaviour of the Indonesian fleet to target SBT south of the spawning ground. This change in behaviour complicates the interpretation of the age and size structure of catches from the spawning stock. Catch tonnages in Indonesia declined in 2005-2006 to levels similar to 2003-2004. However, the SAG noted there has been a progressive decline in the age/size of fish taken by the Indonesian fleet since 2000-01.

Exploitable biomass for the longline fishery

101. Reported Japanese LL CPUE of SBT for all ages combined suggests that the exploitable biomass for these gears has remained fairly constant during the past 10 years, though this level is low compared to historical values. Confidence in this

indicator has diminished considerably due to the uncertainty associated with catch anomalies. Reported CPUE indicate increases in the CPUE of ages 8-11 since about 1992, but there is a slight decline in 2003 and 2004, with a slight increase in 2005, and 2006 is similar to 2005. Reported CPUE of fish aged 4-7 has increased since the mid 1980s but has been declining in recent years.

8.2 Other relevant analyses

102. No other analyses were discussed.

8.3 Overall assessment of stock status

103. No new model-based assessment was conducted in 2007. The indicators do not provide any appreciable sign of change in stock status. There is thus no basis to revise the SAG conclusions in 2006. Because of the uncertainty in historical catch and CPUE a series of alternative scenarios that encompass a range of possible circumstances was evaluated in 2006. The outcomes of these scenarios and their management consequences are consistent with each other. The scenarios are also consistent with the 2005 SAG report regarding overall stock status and suggest the SBT spawning biomass is at a low fraction of its original biomass and well below the 1980 level as well as below the level that could produce maximum sustainable yield. Rebuilding the spawning stock biomass would almost certainly increase sustainable yield and provide security against unforeseen environmental events. Recruitments in the last decade are estimated to be well below the levels in the period 1950-1980. All scenarios suggest that recruitment in the 1990s fluctuated with no overall trend. Analysis of several independent data sources and the scenarios indicate low recruitments in 2000 and 2001, and probably also in 2002 and 2003, although the low estimates of 2003 year class strength is inconsistent with the Japanese length frequency data from 2006.

104. While the scenarios are consistent with each other, there are conflicts between scenario output and some of the indicators, especially regarding the 2002 and 2003 year class strengths. The new indicator data available in 2007 suggest that the 2002 cohort is also weak.

105. The primary implication of the higher catch levels used in the scenarios in 2006 compared to the assumed catch history used in the 2005 SAG is that estimated absolute spawning stock size is more than double that assessed at the 2005 SAG.

106. In the scenarios considered, future total catches of 14,925t would result on average in a short-term decline followed by generally stable but not recovering spawning biomass, but it must be appreciated that there is the possibility that the stock will increase or decrease under this level of catch. Any continued catch over 14,925t poses very serious threats to the stock. Rebuilding the spawning biomass requires catch reductions to below 14,925t under all scenarios considered in 2006. The SAG

noted that the reported global catch in 2006 was 11,850t and that the Commission had set a global TAC of 11,810 t per year for the period 2007-2009.

8.4 New approaches to fishery independent estimates of stock size

107. CCSBT-ESC/0709/18 describes a method for estimating the absolute spawning stock size of SBT, based on genetic identification (DNA fingerprinting) of parent-offspring matches in samples from the spawning grounds off Indonesia and juveniles in the Great Australian Bight (GAB). The method is related to mark-recapture, and provides an estimate of true adult numbers (not the unrelated genetic concept of "effective population size"). No catch or CPUE data are used, so the estimate is not subject to the biases and interpretational problems associated with recent SBT assessments.

108. The project proposes four years' sampling from the Indonesian spawning ground fishery (2005/6-2008/9) using the infrastructure of the existing Indonesian catch sampling program in Benoa, and at least three years' sampling from the GAB juvenile fishery (2006-2008), with results expected by CCSBT 2009. The target is to have at least 7000 fish genotyped (about 50/50 adults/juveniles) which, under some base case scenarios, would include about 70 parent-offspring pairs giving an overall CV of ~12%. For a number of reasons the achieved CV will be different and likely larger than 12%, but the SAG noted that 12% is very good precision by any fisheries standards. At this stage about one third of the samples have already been collected. Careful preliminary genetic analyses have already been conducted to develop suitable loci, so that it will be possible to establish parent-offspring relationships with high confidence in a cost-effective way.

109. CCSBT-ESC/0709/18 first describes the principles and methods as they would apply to a single-year study where all adults have an equal probability of being sampled: how to estimate abundance, and how to estimate the CV. The reality of SBT is more complicated than the basic case, so the paper then outlines how the basic idea can be modified (or whether it needs to be) to deal with a number of potential complicating factors: sex-biased sampling, multi-year sampling, multi-year breeding cycles, age- or size-dependent catchability and fecundity, additional reproductive variability, and population substructure. For each factor, careful consideration is given to how to adjust the estimator to avoid bias (if any) due to that factor, and to how the overall CV would be affected. The paper concludes that none of the complicating factors presents an insurmountable obstacle to obtaining an unbiased and fairly precise estimate. A formal likelihood-based framework for estimation will be developed under the full project.

110. The paper states that the most immediate result for management will be the adult abundance estimate with associated estimate of precision. Such an estimate can be used directly in comparison with catches of adult (spawning size) SBT. There should also be a direct estimate of recent total mortality rate (Z) among the adults, corrected for differential availability on the spawning grounds. The paper comments on ways in which these pieces of information can be further used in a broader assessment sense, to estimate other relevant quantities relating to other age classes in

the stock. Regarding the longer term application of this approach, the paper notes the quadratic gain in efficiency with sample size. A time-series of estimates of absolute spawning abundance and absolute estimates of precision can play a crucial role in a stock assessment model or a management procedure in future.

111. The SAG noted the considerable potential of this approach. In particular participants noted that if successful the approach could provide the basis for developing a fisheries independent time series of absolute spawning abundance. The SAG noted that the approach was similar to conventional mark-recapture approaches with the genetics providing a "tag" linking juveniles to their parents. In this respect, there is no connection between this approach and genetics concepts such as "effective population size".

112. The SAG noted that initial "proof of concept" work involving the development of the necessary genetics library and refinement of candidate loci had been completed and initial samples of adults and juveniles collected with the assistance of the Indonesian catch sampling program and Australian industry.

113. Participants were generally excited about the potential application of this technique, though some of the genetics aspects of the work were outside the areas of expertise of some participants. It was noted that funding was not yet assured for this work. The SAG strongly welcomed the work and looked forward to reviewing the results in the future, as the development of an approach to more directly estimate the spawning abundance was a high priority.

Agenda Item 9. Management Procedure

114. Paper CCSBT-ESC/0709/17 was presented. The paper notes that the increased uncertainties in the historic catches, CPUE and size frequency data have important implications for the implementation of an MP. In particular, results from testing based on reported data can no longer be relied on, and an MP tuned on the basis of these data is no longer appropriate. The increased uncertainty in the data affects the conditioning and projection phases of the operating model for testing MPs, as well as the choice of indicator for use in the 'decision rule' part of an MP. The paper discusses the advantages and disadvantages of using a 'scenario' approach with the current operating model, or of developing a new approach (operating model) to take the uncertainties into account. The paper considers alternative indicators to Japanese longline CPUE as drivers of a decision rule. The paper concludes that progress can only be made, and further development and testing of MPs are only worth doing, if there are processes in place to ensure that the data used in the MP are reliable and verified. It also considers that there is a need to first explore whether it is in fact currently feasible to develop an MP, before embarking on such an exercise.

115. Participants discussed some of the advantages and disadvantages of having an interim (short term) or longer term MP or both. It was noted that in 2006 a three year TAC was set and that this will provide an opportunity to examine the effect of a constant TAC on the various indicators. It was also noted that due to the three year

TAC, developing a MP was not as high a priority as it was considered to be at the ESC in 2006.

116. It was noted that in 2006 the Extended Commission decided not to go ahead with a proposal made by SAG7 to hold a small technical meeting to progress the development of an MP and instead placed the emphasis on CPUE (through supporting a CPUE workshop held in May 2007), given the demonstrated effect of CPUE uncertainty on the operating model.

117. Some participants emphasized that while an MP is an appropriate goal, there would be little point in implementing one unless there are processes put in place to ensure that the data used as inputs are reliable and verified. It was agreed that a small working group would meet to set out a schedule of activities needed to progress the development of an MP and associated testing.

Future development of the Operating Model

118. The SAG first considered alternative options for providing advice on TACs in 2009. The SAG concluded that it would be unrealistic to implement an MP in 2009 given the short time frame available and the lack of reliable indicators of stock status. In particular, it was noted that because it would be difficult to link the future (2006 onwards) Japanese commercial longline CPUE series with any historical series, or historical series adjusted for catch anomaly effects, the new series would be too short to be used as an input into an MP in 2009. The SAG agreed that the most benefit would be achieved through making improvements to the conditioning for the operating model over the next two years, rather than rushing the development of an interim MP. Advice on TACs in 2009 would be provided based on constant-catch projections conducted using the new set of models developed.

119. The SAG recommended that participants undertake interim work on the conditioning for the operating model, using the scenario approach, between now and the next SAG. This work should include at a minimum investigating the conditioning aspects of the operating model using the input "data" components that are currently being fitted. These "data" components include:

- Catch by the 9 fleets
- Commercial CPUE (LL1; see CPUE WS2 report)
- Tagging data 1990s (including reporting rates)
- Age composition from Indonesia
- Age composition from surface fishery
- Size composition from other fleets
- Biological input data (eg. age-length, weight at age)

120. The components affected by the catch anomalies will be replaced by scenarios discussed in 7.2 as a minimum. If new information becomes available, other scenarios will be explored by the SAG.

121. The SAG also discussed conducting analyses to consider the potential of using other data that has not been used to condition the operating model in the past. These data may include:

- Aerial survey
- Commercial spotting
- Trolling survey
- Recent tagging data
- Direct ageing data (replace size composition from other fleets?)

122. The need to revisit other aspects of the conditioning was also discussed. These aspects may include:

- Revisiting priors on M (the most important of these aspects)
- Treatment of 1990s tagging data – (to treat yearly releases as separate cohorts instead of pooling them as is currently done in the fitting)
- Treatment of recruitment (eg. random effects)
- Catch equation
- Selectivity
- Spatial structure

123. The small group noted that it would be unwise at this stage to increase the complexity of the structure of the operating model (e.g. by including spatial structure) given other priorities related to the change in the main data inputs.

124. The results of this work will be reviewed at the next SAG and used as the basis for updating the operating model. Once the model structure and details about the data inputs and likelihood assumptions are specified, the conditioning code will be updated and made available to all participants as was done in the past. A process for testing new candidate MPs will be initiated after the next SAG. The projection code will need to be modified to include simulation of new indicators that may be used to drive the candidate MPs. Details will be specified at the next SAG.

Agenda Item 10. Update on SRP activities

125. Documents CCSBT-ESC/0709/16 and /23 relate to the SRP in general but will be presented at the SC.

10.1 Characterisation of SBT catch

126. Documents CCSBT-ESC/0709/09 and CCSBT-ESC/0709//11 were discussed under agenda item 8.

10.2 CPUE interpretation and analysis

127. Documents CCSBT-ESC/0709/29, 39 and 46 were presented and discussed under agenda items 5 and 8.

128. CCSBT-ESC/0709/15 is a follow-up to previous preliminary work presented in 2005 (Basson et. Al. 2005, CCSBT-ESC/0509/17) on data from the Indonesian Fisheries High Schools student ‘Observer’ program. The database now contains data from students’ logsheets spanning the years 2000 to the present, and at time of writing (July 2007), a total of 80,528 long line sets had been entered into the database. Further investigations of the data have raised some concerns about the quality of the data collected by the FHS students, particularly with respect to some of the fishing location information and some of the species identifications. The providers of the data had made it very clear from the beginning that these data should be treated ‘with caution’ in any scientific analyses as their FHS program was not originally designed to provide robust observer data. However, a thorough analysis of the FHS data is still considered to be worthwhile as it is likely there will be some useful CPUE information that can be extracted from the dataset. The concerns about the accuracy of location and species identification in the FHS dataset imply that it will be necessary to conduct extensive sensitivity analyses when conducting standardisation of the catch and effort data; such ‘data’ sensitivity analyses would be in addition to model sensitivity. This is not a straightforward task, but the intention is to conduct some preliminary investigations, in the hope that these would indicate whether it would be worth proceeding with a full analysis of the historic data. Improvements to the level of training provided to the FHS students before they depart are being made. There should improve the future data from this program, and together with the trial observer program, and any subsequent observer program, should provide important fisheries-related information on SBT from the spawning grounds, as well as any other areas being fished by the Indonesian longline fleet.

129. In discussion it was noted that the dataset does contain information on hooks per basket which can be used in standardisation. It was also noted that, if Indonesia were to join the CCSBT and export SBT to Japan, then Japan would be happy to try to collect necessary information from importers to assist in this task.

10.3 Scientific observer program

130. Japanese scientific observer activities in 2006/2007 are presented in CCSBT-ESC/0709/31. Fisheries Agency of Japan sent scientific observers to 13 longline vessels that fish for SBT (one in the Area 4, five in the Area 8, and nine in the Area 9). Coverage of observed against all of Japanese SBT longline fishing were 9.8% in the number of vessels, 8.8% in the number of hooks used (3.0% in 2002, 5.5% in 2003, 5.0% in 2004, 4.9% in 2005), and 6.1% in the number of SBT caught. Taking account of the duration of observed hauling, the number of hooks observed was estimated as 6.5% of all hauling durations by all SBT vessels. The length frequency distributions of SBT were compared between vessels with and without observer in each area. Observers retrieved SBT tags from 13 individuals. Due to the reduction of SBT quota and the introduction of an individual quota system, annual fishing operation plans of the Japanese longline vessels became more changeable. Therefore,

some operations of the vessels with scientific observers embarked were not targeting on SBT. There was difficulty for the scientific observer program to adequately cover areas with only a small number of vessels operating because of poor fishing conditions (such as Area 4 and Area 7) The total costs of the observer program in 2006/2007 were 43,500,000yen (US$395,000).

131. CCSBT-ESC/0709/SBT Fisheries - New Zealand was presented. The target for observer coverage was 10% of longline sets in each fleet and area, and 10% coverage of the catch. In 2006 observers were deployed on all charter vessels and 100% of the catch was observed with 98% measured. Due to the requirement for observers to take breaks during hauling on these vessels, only 89% of effort was observed. For domestic vessels only 4% of the domestic catch was observed despite 9% of the effort being observed. New Zealand was seeking to address the low domestic coverage during the 2007 season and hoped to report increased coverage next year.

132. CCSBT-ESC/0709/Info 04 reports on a trial scientific observer program for Indonesian commercial longline vessels based at Port Benoa. This program commenced in July 2005 to address the lack of CPUE information. The program is a collaboration between the Research Centre for Capture Fisheries, within Indonesia’s Ministry of Marine Affairs and Fisheries (MMAF), and CSIRO Marine and Atmospheric Research, and is funded by the Australian Centre for International Agricultural Research. Six observers have been recruited and trained prior to their first trips to sea for fish, cetacean, turtle, and bird identification, data collection and reporting protocols, sea and climate conditions reporting, and guidelines for safety at sea. To date, there were 41 trips completed by the observers. Data presented in the paper are for the first 29 trips. Average trip length was 34 days, vessels ranging in size from 61 to 140 GT, 21 sets/trip on the average with averages of 1454 hooks/set, 14 hooks between floats, and 126 floats/set. Areas of fishing operation included the Eastern Indian Ocean between 7°S and 35°S latitude, and 100°E and 130°E longitude, but also the Banda Sea. Averaged across all trips, catch composition was 43% tuna (BET, YFT, ALB and SBT), and 57% bycatch. The deployment of hook-timers and temperature depth recorders has commenced to obtain information that should assist in the analyses of CPUE and understanding of factors that influence catch success.

10.4 SBT tagging program

133. CCSBT-ESC/0709/19 and 21 were presented under agenda item 8.

134. CCSBT-ESC/0709/33 was presented for a Japanese tagging program for medium and large size of SBT from longline vessels in the south-eastern and south-western Indian Ocean. For six years, the number of SBT individuals released was 1159 with conventional tags only, 350 with archival tags and 15 with pop-up archival tags. An archival tagging survey has also been conducted since July 2007 in the same manner in 2006. 13 archival tags have been recovered over six years. Japan also conducted the conventional CCSBT tagging for the age 1 SBT (N=189) during the trolling

survey in January 2007. From the Japanese longline vessels, 70 individuals with CCSBT tags were recovered from August 2006 to June 2007.

135. The Secretariat provided a brief verbal update on the CCSBT surface fishery tagging. The number of fish tagged in 2007 was slightly lower than last year. This was partly due to a reduction in the number of charter days agreed by the Commission, and partly due to bad weather in Western Australia which affected the finding and tagging of fish. Just over 13,000 fish were tagged; approximately 5000 in Western Australia and 8000 in South Australia. This level of tagging is still in the range of the target that had been set for the project. The Secretariat continued with recovery efforts by providing rewards and feedback in response to tag returns. In addition, a company (Protec) was contracted to assist retrieval of tags from farming operations in Port Lincoln. Retrieval of tags from freezer vessels in the GAB also continued this year with 20 days observing contracted to Protec.

136. Information was sought on the costs involved in the tag recovery activities contracted to Protec. In response, the Secretariat advised that the costs were low relative to the rest of the tagging program, and involved a retainer of AU$3,500 per year, plus AU$1.50 per tag returned.

10.5 Recruitment monitoring

137. Japan presented the document CCSBT-ESC/0709/34 for the trolling survey. In January 2007, the trolling survey that provides the recruitment abundance level of age one SBT was conducted in similar manner to January 2006. In seven days, 34 SBT schools were found on the piston-line. A total of 241 SBT individuals were caught and 189 (78%) were tagged and released with CCSBT conventional tags.

138. CCSBT-ESC/0709/43, reporting on a collaborative project, between Japanese and Australian scientists, was presented. The acoustic monitoring project was initiated in response to concern about decline in the acoustic survey index in southern Western Australia, observed in 2000, 2001. Acoustic monitoring technology allows investigation of movement and residence on a scale suitable for both small scale habitat usage and large scale migration studies. Cross-shelf arrays of listening stations have been used in southern Western Australia for five years to estimate the cross-shelf location of SBT migration paths. Significant interannual variation in residence time, migration route and cross-shelf location were observed. This project has provided some key biological insight into the behaviour of the juvenile SBT, and supports the interpretation of abundance indices.

139. CCSBT-ESC/0709/36 was presented. This paper illustrates how the acoustic monitoring results may be used for the correction of the abundance index from the acoustic survey area (ASA). During summer in the 2004/05 and 2005/06 seasons, acoustic tagging research has been carried out on age 1 SBT on the south-west coast of Western Australia, in the same region that the acoustic survey and the trolling survey have been conducted. The annual differences in spatio-temporal distribution pattern revealed were characterized by two distinctive migration features; one is the shelf- and inshore-migrating, and the other is different residence time in the research

area. There is a possibility that these differences affect on the recruitment index in the area.

140. In response to questions about juvenile fish behaviour by size, it was noted that ongoing work in this regard is being conducted by a PhD student

141. It was also noted that results from acoustic tagging suggest that fish tagged on inshore lumps may have longer residence times than fish tagged along the shelf. This may have implications for mixing in the context of conventional tagging.

142. There was some discussion about the notion of correcting the piston line index for changes in the timing of the fish throughflow in the area of the survey. The concept is to release sufficient acoustic tags through the season so that the correction can be made. It was not clear whether the approach would however allow for appropriate estimation of the variance of such a corrected index.

143. CCSBT-ESC/0709/35 was presented. The trolling indices, which were recruitment indices for age one SBT were calculated from the trolling survey in 2006 and 2007, as well as the trolling catch data in the acoustic survey from 1996 to 2006. The indices are in increasing trend from the 2004 year class to the 2006 class. Because the change along years agreed between the indices and fishery information, it appears that the trolling indices can monitor the age one SBT recruitment abundance at least coarsely.

144. In discussion it was noted that the trolling survey does not have direct information on school size. Regarding the bootstrap results, it was noted that the unit used for bootstrapping was a single ‘transit’ (straight section of transect line). There was some discussion about the appropriateness of the assumption of independence between transits and the implication that the variance would be under-estimated if there was correlation between the transits (bootstrapping unit). One suggestion was to use several successive lines as the unit, which may indicate whether the variance is likely to be under-estimated. Another suggestion was to calculate the values of the correlation coefficients between bootstrap samples and if these values are high, to consider using multivariate parametric bootstraps.

145. Documents CCSBT-ESC/0709/12 and /13 are also relevant to this agenda item, but were presented and discussed under item 8.

10.6 Direct ageing

146. CCSBT-ESC/0609/11 provides an update on the collection of otoliths from the Australian surface fishery and the CCSBT tagging program in the 2006/07 fishing season. In total, 335 otolith samples were collected from the surface fishery and an additional 100 samples were collected from fish that died during CCSBT tagging operations in Western Australia and South Australia. As in previous years, there was a disproportionate number of large fish sampled for otoliths from the surface fishery. The reason for this is that the otoliths are collected from mortalities in each pen during, or soon after towing, and it appears that there are higher mortalities of larger fish in the towing and farming operations. However, the full size range of fish caught by the fishery was sampled for otoliths in adequate numbers to produce reliable age

length keys. There was no direct ageing of SBT caught in the surface fishery this year. Australia has already provided direct age data for the 2004 calendar year which was the requirement for the 2007 data exchange. It is anticipated that direct age data for the next two fishing seasons (2005/06 and 2006/07) will be provided in 2008.

147. In discussion the SAG was informed that observers on the East coast longline fishery are also collecting otoliths from SBT.

148. CCSBT-ESC/0709/45 provided the results of Taiwanese otolith collection and otolith direct ageing. In 2006, 56 otolith samples of SBT were collected from three observers set on three Taiwanese SBT longline vessels and most of samples were from the area with higher latitudes. The mean body size and the mean age of samples in 2006 were larger and older than those collected during 2003-2005. Since SBT were usually larger in the higher latitudes, this might explain why the samples of SBT in 2006 were larger than those collected during 2003-2005.

149. In CCSBT-ESC/0709/32, Japan reported that they collected otoliths from 511 SBT individuals in 2006. Age estimation data of otoliths from 531 SBT individuals which were caught between 2001 and 2005 were submitted to the CCSBT Secretariat in April 2007. Since 2005, age data of more than 2700 individuals were submitted by Japan.

150. CCSBT-ESC/0709/SBT Fisheries - New Zealand was presented. In 2004, 1153 otoliths were collected from SBT, but only 432 and 444 were collected in 2005 and 2006 respectively. The lower number is because only two charter vessels fished in 2005 and 2006 compared to 2004. A sub-sample of the otoliths from 2004 and 2005 have been aged, but there are currently concerns regarding the interpretation of these otoliths. Otoliths for years 2001-2004 have already been aged and data provided to the Commission. Otoliths for 2005 and 2006 were aged in 2007, but not in time to meet the data submission deadline so will be provided in 2008. New Zealand reminded the SAG of the discussion at ESC 10 (paragraphs 117-118) and the need for further work on the assignment of fish to cohorts for fish caught during winter when growth checks are laid down on the otoliths.

10.7 Other SRP activity

151. CCSBT-ESC/0709/20 provides an update of the archival tagging activities that have been undertaken as part of the collaborative Global Spatial Dynamics project between Australia, New Zealand and Taiwan. The project involves archival tagging 2-4 year old SBT throughout their range (from South Africa to New Zealand) in order to better understand movement patterns, migration rates and residency times. To date, 414 tags have been released in the areas of South Australia, Western Australia, the central Indian Ocean and the Tasman Sea, including one release off South Africa. A South African longline vessel was chartered in Nov/Dec 2006 but only succeeded in catching 13 SBT, of which only one was suitable size for this project. The reason for the lack of success is uncertain, but may be related to a shift in the target species of Taiwanese vessels to oilfish. The number of returns to date has been 34. For the 2005 releases, the recovery rate is currently 11%, which is

about half the recovery rate for the 2004 releases at this time last year, and is reason for concern. The paper notes that, of all the returns to date, there have still been no tags returned from the Tasman Sea from fish that were tagged in WA or SA. This differs from movement patterns seen for archival tagged fish released during the 1990s. Plans for 2007-2008 are for Taiwan and Australia to release the remaining tags available for this project and for a trained Taiwanese observer to release 25 tags off South Africa. The paper again encourages collaboration of other member countries, although it is noted that opportunities will be limited unless these countries are able to provide additional tags.

152. CCSBT-ESC/0709/33 also contains information about Japanese archival tagging activities. In 2006, 67 medium-large size SBT were implanted with archival tags from a Japanese longline vessel in the south-eastern Indian Ocean. Over the past six years, 350 SBT were tagged with archival tags and 15 with pop-up archival tags. An archival tagging survey has also been conducted since July 2007 in the same manner in 2006. 13 archival tags have been recovered for six years.

153. Attention was also drawn to CCSBT-ESC/0709/Info 01 which reports on movements and behaviour of large SBT in the Tasman Sea and Indian Ocean regions determined using pop-up archival satellite tags.

Agenda Item 11. Technical review of the conventional tagging program

154. The meeting considered that the review of the conventional tagging program was best undertaken as part of the review of the Scientific Research Program which is to be undertaken by the Extended Scientific Committee (ESC). Therefore this item was passed to the ESC.

Agenda Item 12. Other business

155. There was no other business.

Agenda Item 13. Finalisation and adoption of meeting report

13.1 Next meeting

156. The next meeting will be held in Rotorua, New Zealand towards the start of September 2008.

157. The report of the meeting was adopted.

Agenda Item 14. Close of meeting

158. The meeting was closed at 4:40pm, 8 September 2006.

List of Attachments

Attachment

1 List of Participants

2 Agenda

3 List of Documents

4 Extract from the Report of the Second CPUE Modelling Workshop

5 A selection of relevant indicators considered by the SAG8 meeting

Attachment 1

List of Participants
Eighth Meeting of the Stock Assessment Group
4 - 8 September 2007
Hobart, Australia

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Attachment 2

Agenda
Eighth Meeting of the Stock Assessment Group
4 - 8 September 2007
Hobart, Tasmania

1. Opening
   1.1 Introduction of participants and administrative matters

2. Appointment of rapporteurs

3. Adoption of agenda

4. Admission of documents and finalisation of document list

5. Report from CPUE modelling workshop

6. Report from Australian SBT farm study
   6.1 Possible implication of Australian SBT farm study results to the SBT stock assessment process
   6.2 others

7. Review of Fisheries Data for Stock Assessment
   7.1 Implications of the Australian Farm Review and Japanese Market Review and any new information from fisheries on the SBT stock assessment process
   7.2 Base case scenarios for catch and effort in the global fishery

8. Stock assessment
   8.1 Analysis of fisheries indicators
   8.2 Other relevant analyses
   8.3 Overall assessment of stock status
   8.4 New approaches to fishery independent estimates of stock size

9. Management Procedure
   9.1 Development of Interim Management Procedure
   9.2 Issues and workplan for development for a future MP

10. Update on SRP Activities
    10.1 Characterisation of SBT Catch
    10.2 CPUE Interpretation and Analysis
    10.3 Scientific Observer Program
    10.4 SBT Tagging Program
    10.5 Recruitment Monitoring
    10.6 Direct Ageing
    10.7 Other SRP Activity

11. Technical review of the conventional tagging program

12. Other business

13. Finalisation and adoption of meeting report
    13.1 Next meeting

14. Close of meeting

Attachment 3

List of Documents
8th Meeting of the Stock Assessment Group and
Extended Scientific Committee for the 12th Meeting of the Scientific Committee

(CCSBT-ESC/0709/)

01. Draft Agenda of the 8th SAG
02. List of Participants of the 8th SAG
03. Draft Agenda of the Extended SC for the 12th SC
04. List of Participants of the 12th SC and Extended SC
05. List of Documents - The Extended SC for the 12th SC & 8th SAG
06. (Secretariat) 4.2. Secretariat Review of Catches
08. (Secretariat) 11. Data Exchange
09. (Australia) The catch of SBT by the Indonesian longline fishery operating out of Benoa, Bali in 2006: Proctor, C., Andamari, R., Retnowati, D., Iskandar Prisantoso, B., Poisson, F., Herrera, M. and Fujiwara, S.
10. (Australia) Update on the length and age distribution of SBT in the Indonesian longline catch: Farley, J., Andamari, R. and Proctor, C.
11. (Australia) An update on Australian Otolith Collection Activities: 2006/07: Stanley, C., Clear, N. and Polacheck, T.
12. (Australia) Aerial Survey: updated index of abundance and preliminary results from calibration experiment: Eveson, P., Bravington, M. and Farley, J.
13. (Australia) Commercial spotting in the Australian surface fishery, updated to include the 2006/7 fishing season: Farley, J. and Basson, M.
14. (Australia) Fishery indicators for the SBT stock 2006/07: Hartog, J., Preece, A. and Kolody, D.
15. (Australia) An update on the use of the Indonesian Fishery school dataset to obtain a standardised CPUE series for SBT on the spawning grounds: Basson, M., Andamari, R., Sadiyah, L. and Proctor, C.
16. (Australia) A review of the Commission's Scientific Research Program, and considerations of current priorities and ways forward: Davies, C., Preece, A. and Basson, M.
17. (Australia) The management procedure: options for ways forward: Basson, M., Polacheck, T. and Davies, C.
18. (Australia) A method for estimating the absolute spawning stock size of SBT, using close-kin genetics: Bravington, M. and Grewe, P.
19. (Australia) Analyses of tag return data from the CCSBT SRP tagging program - 2007: Polacheck, T. and Eveson, P.

20. (Australia) Update on the Global Spatial Dynamics archival tagging project - 2007: Polacheck,T., Chang, K.S., Hobday. A., and West, G.
21. (Australia) Estimates of reporting rate from the Australian surface fishery based on previous tag seeding experiments and tag seeding activities in 2006/2007: Hearn, B., Polacheck, T. and Stanley, S. and Rowlands, M.
22. (Australia) Proposed use of CCSBT Research Mortality Allowance to facilitate electronic tagging of adult SBT as part of Australia's contributions to the CCSBT SRP in 2007-08: Evans, K.
23. (Australia) Update and summary of SRP-related work conducted by Australia over the period 2001-2007: Basson, M. and Evans, K.
24. (Australia) Tuna farm monitoring review: Mediterranean, Mexico and Australia: Sands, A., Hender, J.
25. (Australia) Genetic identification of SBT: Findlay, J.
27. (Australia) Preparation of the BRS component of Australia's data submission for 2007: Hobsbawn, P.
28. (Australia) Assessing operational feasibility of stereo video and Evaluating monitoring options for the SBTF Farm Sector: Hender, J., Murphy, R.
29. (Australia) Preliminary investigation into the Australian surface fishery CPUE data: Hender, J., Lawrence, E.
31. (Japan) Report of Japanese scientific observer activities for southern bluefin tuna fishery in 2006/2007: Osamu SAKAI, Tomoyuki ITOH, Yukito NARISAWA and Toshiyuki TANABE
32. (Japan) Activities of otolith collection and age estimation and analysis of the age data by Japan in 2006: Tomoyuki ITOH, Akio HIRAI and Kenichiro OMOTE
33. (Japan) Report of activities for conventional and archival tagging and recapture of southern bluefin tuna by Japan in 2006/2007: Osamu SAKAI, Tomoyuki ITOH and Shungo OSHITANI
34. (Japan) Report on the piston-line trolling survey in 2006/2007: Tomoyuki ITOH and Osamu SAKAI
35. (Japan) Some examination on the recruitment index of age 1 southern bluefin tuna derived from the trolling survey: Tomoyuki ITOH
36. (Japan) The effect of the spatial and temporal distribution of juvenile SBT on acoustic and trolling survey abundance estimates.: R. Kawabe, K. Fujioka, A. Hobday, Y, Takao, K. Miyashita and T. Itoh
37. (Japan) Proposal for the recruitment monitoring trolling survey in 2007/2008: Tomoyuki ITOH and Osamu SAKI
38. (Japan) Summary of Fisheries Indicators in 2007: Norio TAKAHASHI and Tomoyuki ITOH
39. (Japan) Change in operation pattern of Japanese SBT longliners in 2007 resulting the enforce of the individual quota system: Tomoyuki ITOH

41. (Japan) Review of CCSBT Scientific Research Program: Tomoyuki ITOH, Hiroyuki Kurota and Norio Takahashi
42. (Japan) Report of the 2006/2007 RMA utilization and application for the 2007/2008 RMA: Fisheries Agency of Japan
43. (Japan) Migration paths for juvenile southern bluefin tuna in southern Western Australia determined via acoustic monitoring . summary of 2003-2007 experiments: Hobday, Alistair J., Kawabe, Ryo., Takao, Yoshimi, Miyashita, Kazushi, and Itoh, Tomoyuki
44. (Japan) Proposal: Proportion of juvenile southern bluefin tuna moving into southern Western Australia - implications for fishery-independent assessment: Hobday, Alistair J., Kawabe, Ryo., Takao, Yoshimi, Miyashita, Kazushi, and Itoh, Tomoyuki
45. (Taiwan) Taiwanese otolith collection and otolith direct ageing
46. (Japan) Further investigation of the difference in two datasets raised by the second CPUE modeling workshop, used for CPUE analyses of SBT: Shono, H., and T. Itoh

(CCSBT-ESC/0709/SBT Fisheries)

Australia	Australia's 2005-06 Southern Bluefin Tuna Fishing Season, Hobsbawn, P. Hender, J., Findlay, J., McLoughlin, K.
Japan	Review of Japanese SBT Fisheries in 2006: Osamu SAKAI, Tomoyuki ITOH and Yukito NARISAWA
New Zealand	The New Zealand southern bluefin tune fishery in 2006
Taiwan	Review of Taiwanese SBT Fishery of 2005/2006
Korea	Review of Korean SBT Fishery of 2005/2006: Doo-Hae An, Seon-Jae Hwang, Dae-Yeon Moon, and Soon-Song Kim

(CCSBT-ESC/0709/Info)

01. (Australia) Movements and behaviour of large SBT in the Tasman Sea and Indian Ocean regions determined using pop-up archival satellite tags: a summary of results for 2006-07.: Evans, K. and Patterson, T

04. Ocean: Sadiyah, L., Andamari, R., Iskandar Prisantoso, B., Retnowati, D., and Proctor, C

05. (Australia) Southern Bluefin Tuna Aquaculture Subprogram: Tuna Environment Subproject: Evaluation of Waste Composition and Waste Mitigation.: Fernandes, M., Lauer, P., Cheshire, A., Svane, I., Putro, S., Mount, G., Angove, M., Sedawie, T., Tanner, J., Fairweather, P., Barnett, J. & Doonan, A.

06. (Australia) Southern Bluefin Tuna (Thunnus maccoyii) Aquaculture Environmental Monitoring Program 2005.: Loo, M., Ophel-Keller, K., McKay, A., Drabsch, S., Hartley, D. & Cheshire, A.

(CCSBT-ESC/0709/Rep)

01. Report of Tagging Program Workshop (October 2001)

02. Report of the CPUE Modeling Workshop (March 2002)

03. Report of the Special Management Procedure Technical Meeting (February 2005)

04. Report of the Fourth Meeting of the Management Procedure Workshop (May 2005)

05. Report of the Management Procedure Special Consultation (May 2005)

06. Report of the Sixth Meeting of the Stock Assessment Group (September 2005)

07. Report of the Tenth Meeting of the Scientific Committee (September 2005)

08. Report of the Special Meeting of the Commission (July 2006)

09. Report of the Seventh Meeting of the Stock Assessment Group (September 2006)

10. Report of the Eleventh Meeting of the Scientific Committee (September 2006)

11. Report of the First Meeting of the Compliance Committee (October 2006)

12. Report of the Thirteenth Annual Meeting of the Commission (October 2006)

13. Report of the First Meeting of the Compliance Committee Working Group (April 2007)

14. Report of the Second CPUE Modelling Workshop (May 2007)

15. Report of the Seventh Meeting of the Ecologically Related Species Working Group (July 2007)

Attachment 4

Extract from the Report of the Second CPUE Modelling Workshop
21-25 May 2007
Shimizu, Japan

The following is extracted from the CPUE modelling workshop report.

Terms of Reference 1: Description of any changes in fishing patterns

1. It was concluded that, despite the changes in the Japanese management system, from the evidence seen the Japanese effort distribution in 2006 was not markedly different from previous years. However, the response of the Japanese fleet to the new management system was still developing. Consequently there was a need both to understand what changes would be of most concern and to monitor how well new data corresponded to past distributions.

2. Given the uncertainties about the fishing patterns that the Japanese longline fleets may have in the 2007 fishing season it would be helpful if Japan could provide suitable details of its distribution to SAG/SC. Also, because of possible changes in fishing strategies of the Japanese fleet after the 2007 fishing season, depending heavily on Japanese fleet data in stock assessment process may lead to further uncertainty in the stock status. Therefore, it is necessary to develop reliable stock indices from the other fisheries and/or research, which will be used in the stock assessment process in addition to the Japanese CPUE (as discussed under Agenda item7). The following recommendations regarding ToR 1 are proposed:

    - Provide information on any changes in fishing patterns which might affect CPUE
    - Continued monitoring of:
        - SBT/sum(BET+YFT) catch by area for the areas and seasons which are selected for CPUE standardisation.
        - Median latitude and longitude by area the areas and seasons which are selected for CPUE standardisation.

Terms of Reference 2: Analyse past long line CPUE data to best specify one or more robust future CPUE series for high seas components of the SBT stock

3. Recommendations for ToR 2 are as follows:

    - The approach of sub-setting the fleet to a set a core vessels may provide more robust indices;
    - Consideration of bycatch data are clearly critical for the interpretation of CPUE and development of robust CPUE series. The workshop agreed that bycatch data be analysed for any fleets for which CPUE should be considered and some workshop members felt that these data should be submitted as part of the data exchange;

- When set-specific details are incorporated into GLMs (e.g. HPB and vessel ID), different trends are estimated to those implied by aggregated data that does not consider these factors.
- Further efforts should be directed at comparing shot by shot and aggregated data to see which provides a better reflection of the stock, but it is likely that the information provided by shot by shot data should lead to more robust indices.
- Efforts should be made to include better information in relation to targeting practices in CPUE analyses.
- There is a significant difference in the CPUE trends for the traditional CPUE strata compared to the Japanese fishery management areas (Figure 12). This problem requires collaborative intersessional work to resolve.
- Further collaborative work is required on approaches for modelling observed zeros and the comparisons between fixed and random effects approaches to modelling effects.

Terms of Reference 3: Is additional commercial sentinel fishing or scientific effort needed and is this practical?

4. These possible approaches were not developed further at the meeting. Document CCSBT-CPUE/0705/05, presented at the workshop, indicated that there were no remarkable changes in fishing patterns in 2006 following the introduction of individual quotas. The 2007 fishing season began on 1 April 2007, thus there is limited information on changes in the fishery for this year. Examination of changes in the fishery in 2007 as data become available throughout the year may reveal the need for developing these options further.
5. Since the situation for the 2007 season will become clearer as the season advances, recommendation on this Term of Reference are best left until the time of the SAG\SC meetings. This will also allow any decision on such initiatives to be taken in the context of the review of wider scientific research priorities. This should be considered simultaneously with the analysis of CPUE data for the Indonesian fleet.

Terms of Reference 4: Is it possible to calibrate future series to past series?

6. This Term of reference was dealt with concurrently with Term of reference 2 and is reported under that heading.

Terms of Reference 5: Is it possible to correct past CPUE series?

7. The data examined showed no clear evidence on if or how to correct CPUE series. It was suggested

   - Ideally CPUE would be based on vessels in which we have good confidence in their data.
   - It is unsuitable to develop CPUE based solely on observed vessels because the scientific observer program was not designed to collect CPUE solely.
   - Analyses undertaken at the workshop comparing observed and unobserved datasets on all and just the core vessels were not conclusive as to whether the

effects of the market anomalies could be detected – this is in part due to levels of observer coverage across the vessels varying from 4-9.6%.

- Analyses comparing nominal CPUE for the 12 vessels that had very high catch reporting at the end of 2005 to the core fleet were not conclusive. In some areas CPUE for the 12 vessels were lower than the core (as would be expected if they under-reported), but in other areas they were higher.
- Given the sensitivity of the assessment to the assumption that overcatch should impact on the CPUE used in the assessment, Japan is therefore encouraged to undertake future analyses of this kind for components of the fleet for which they have greater (or lesser) confidence in the accuracy of their catch reporting.

Terms of Reference 6: Analyse fisheries to try to develop or improve additional indices other than Japanese longline

8. Conclusions under this ToR were summarised under three categories based on the portion of the stock that could be monitored. Three categories were: juveniles (ages 1-4), longline vulnerable biomass (ages 5-9), and spawning biomass (ages 10+). The conclusions reached in this section are of direct relevance to ToR 2.

9. Juvenile stock: Fish of these ages are typically poorly selected by the longline fisheries and are predominantly taken in the Australian surface fishery. It was recognised that the nature of the purse seine fishery means that the CPUE (e.g. catch per set) from this fishery is not useful as an index of abundance. Further, it was noted that there were several issues relating to the analysis and interpretation of the commercial spotting data.

10. The partial and convoluted coverage of the GAB by commercial spotting makes it difficult to interpret these data and thus how much effort to devote to their future collection and analysis needs to be carefully prioritised against other more promising approaches to estimating the abundance of recruiting aged SBT in the GAB. This prioritisation could best be done at the SRP review to take place in 2007.

11. Juvenile SBT are taken as by-catch in the Taiwanese albacore fishery in the mid-Indian Ocean and can sometimes comprise up to 30% of the NZ longline fishery catch, so it may be possible to derive indices for these fisheries that provide information on juvenile abundance. In the case of the Taiwanese fishery, special care would be needed given that it is predominantly a bycatch fishery. In particular it will be important to incorporate any target information and appropriately model any observed zeros. In the case of the New Zealand fishery, it was noted that it may not be possible to derive historical indices, and that the interpretation of any indices that area developed will need to consider how abundance in the Tasman Sea relates to the broader stock. Series could be calculated separately for the domestic vessels and for those charter vessels that have carried observers (which is almost all).

12. It was also noted, however, that there are several fishery independent indicators of recruitment, such as estimates of Z from tagging, the GAB aerial survey and the other research programmes undertaken as part of the recruitment monitoring programme such as the trolling monitoring survey in Western Australia. Fishery independent research programmes that are appropriately implemented should

provide more reliable data than fishery dependent data (e.g. commercial CPUE) so this should be considered when prioritising resources for monitoring the juvenile stock.

13. Longline vulnerable biomass (intermediate ages): Both the NZ and Taiwanese data may provide useful information for this component of the population, but the same concerns noted above for these fisheries were also relevant here.

14. Spawning age fish: Indonesia is presently the only fleet to fish on or near the spawning ground. It was noted that there were problems in the historical data available from this fishery, but that considerable work was been undertaken to collect better data. Continuation of this work was strongly encouraged and this work may be enhanced by additional scientific initiatives (see discussion on ToR 3). The status of this key part of the SBT stock is the most serious gap in our knowledge of the stock. Further work with Indonesia to develop a viable CPUE series is to be strongly encouraged.

15. It was noted that the current size composition of the catch from the NZ fleet is very similar to that of the Indonesian fishery. Therefore, while noting the concerns raised above about limitations of the NZ data, it may be possible to develop an abundance index for spawning age fish from the NZ fishery.

16. **Summary:** Conclusions from discussions under this ToR are summarised in the table below. The methodological approaches for undertaking the analyses (e.g. aggregated versus shot by shot data were discussed under ToR 2).

Stock component	**Potential CPUE indices**	**Other information**
Juvenile	Taiwanese CPUE NZ domestic CPUE Australia commercial aerial spotting	Tagging GAB aerial survey Other recruitment monitoring programmes e.g. trolling monitoring survey
Longline vulnerable	Taiwanese CPUE New Zealand CPUE	Possible sentinel / scientific fishing effort
Spawning aged fish	Indonesian logbook and observer data New Zealand CPUE	Possible sentinel / scientific fishing effort

A selection of relevant indicators considered by the SAG8 meeting

The following are the list of agreed indicators presented at the SAG8 meeting.

Indicator 1 CPUE Indices

Figure 1. Fig. 1-1. Nominal CPUE of Japanese longline by age groups.. (from CCSBT–ESC/0709/38, Fig 1.1).

Figure 2. Comparison of age-specific nominal catch rates (number per 1000 hooks) in recent years for different fishing regions. Data is from Japanese longliners operating in months 4-9. (from CCSBT– ESC/0709/14, Fig 20).

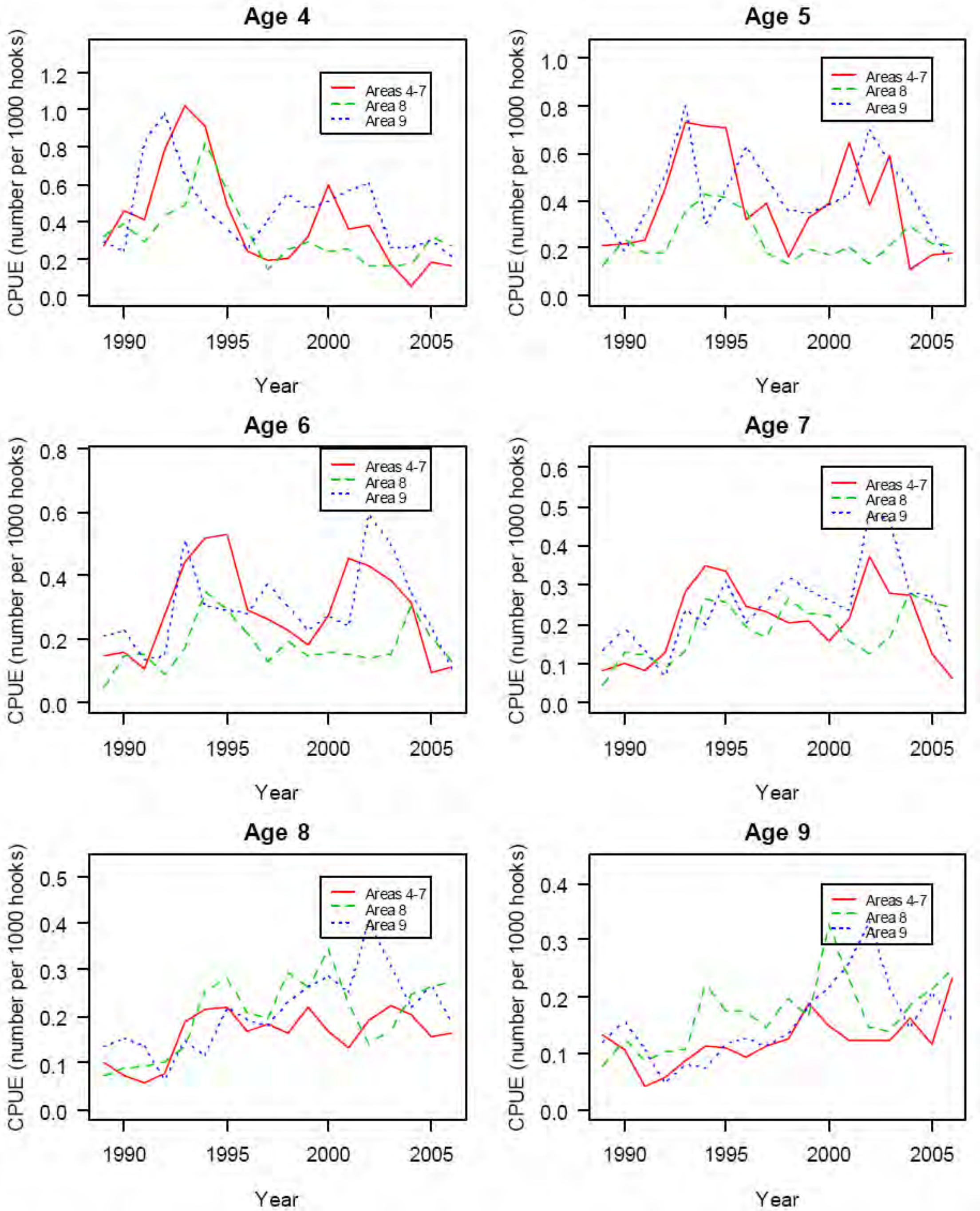


Figure 3. Catch per unit effort (number of SBT per thousand hooks) from the charter fleet in Region 6 (west coast South Island). (from ESC/0709/Fisheries-New Zealand Fig 5).

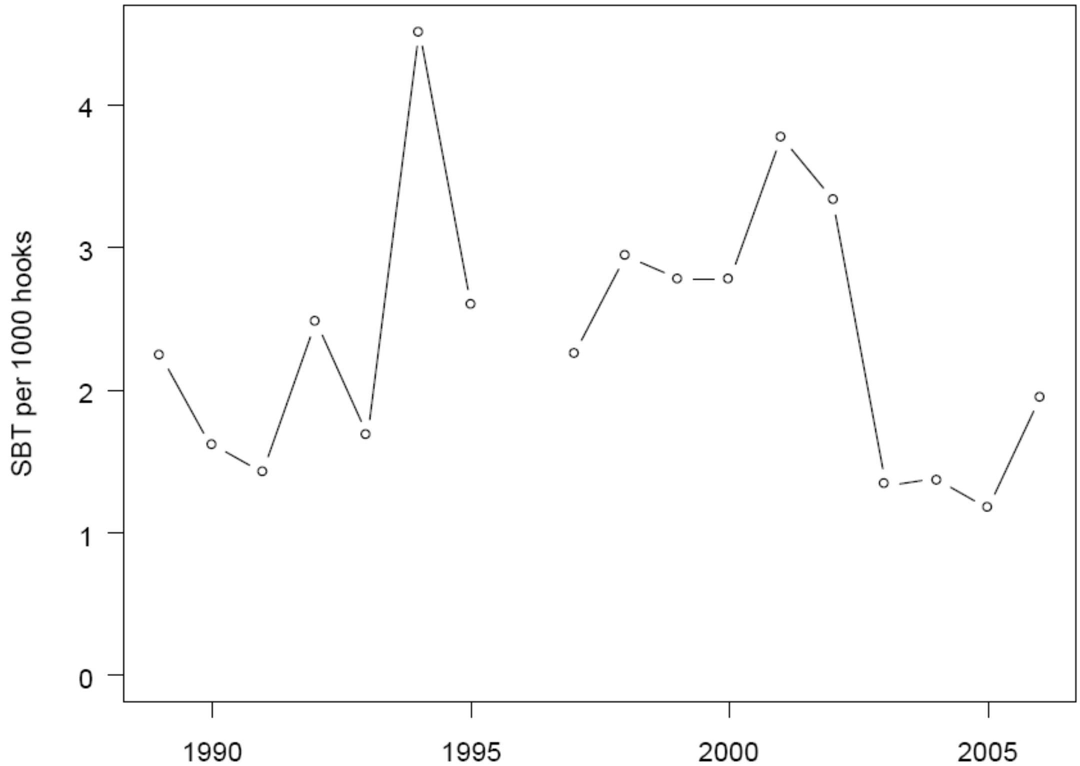
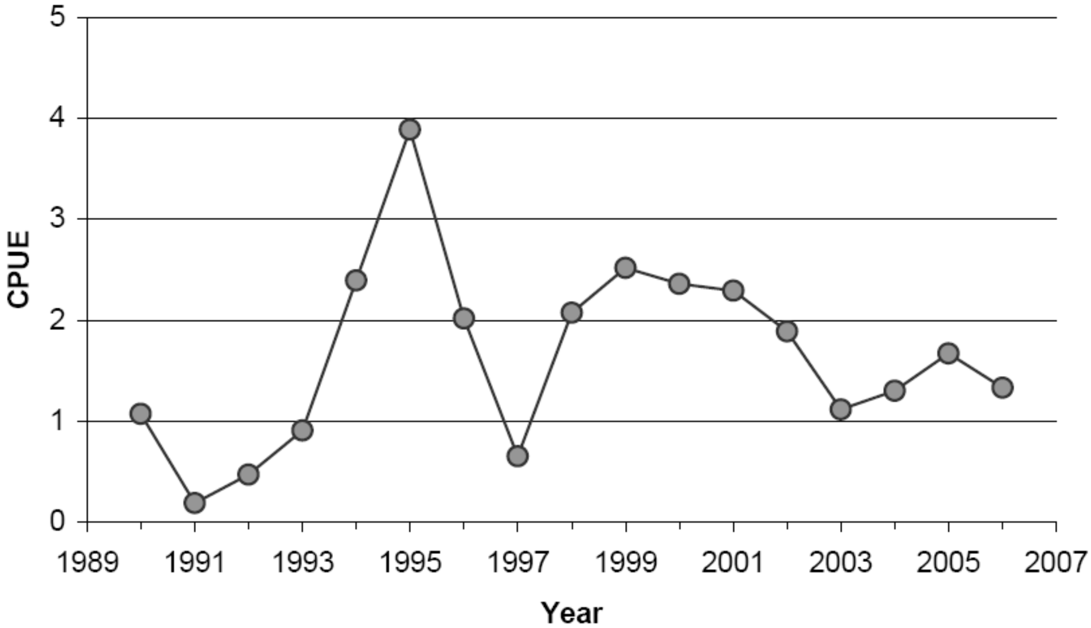
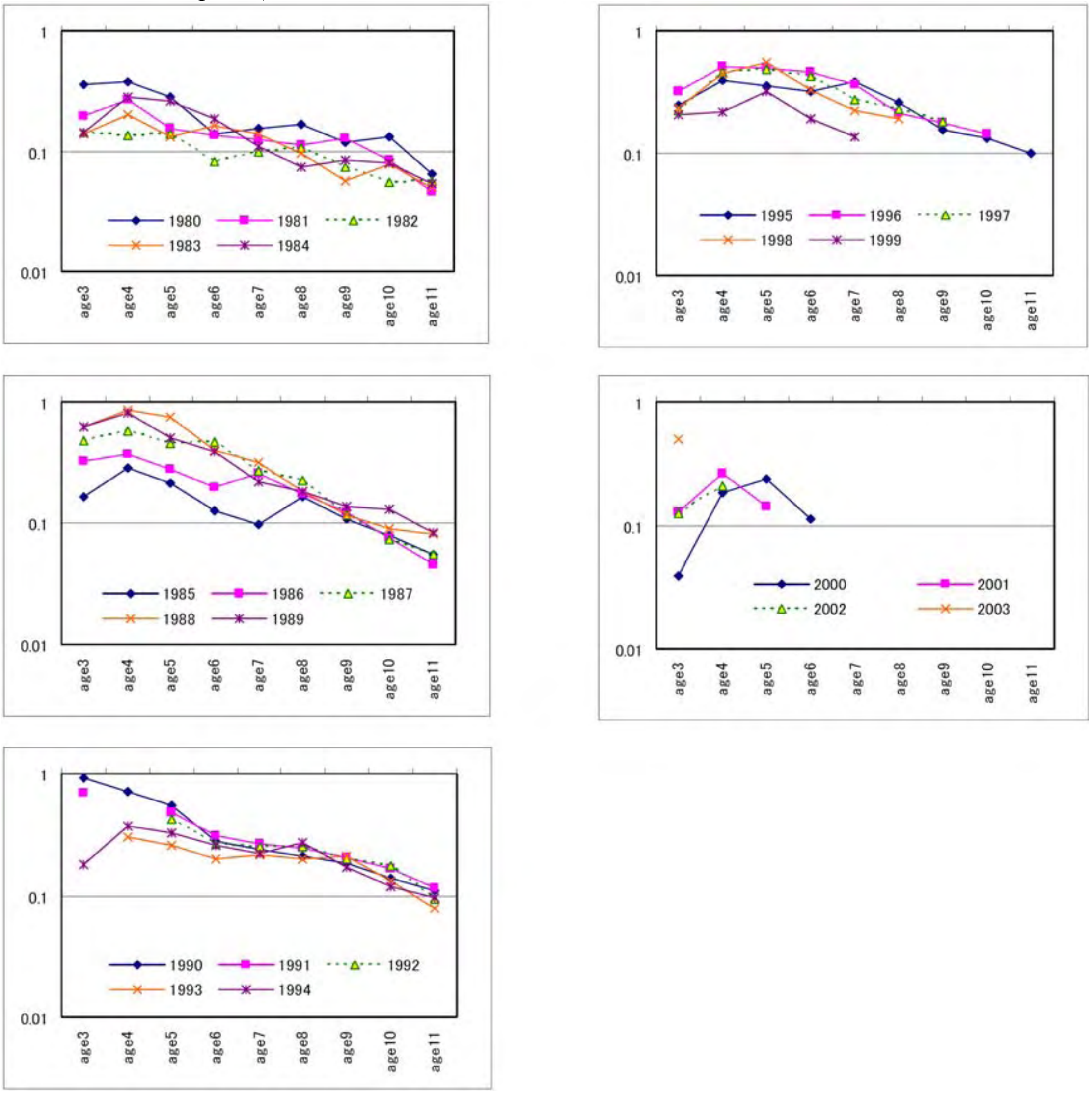


Figure 4. Nominal catch rates of SBT (numbers per 1000 hooks) caught by domestic New Zealand longline vessels. (from CCSBT-ESC/0709/14 Fig 5).



Indicator 2 CPUE by Cohort for Japanese Longline

Figure 5. Nominal CPUE of Japanese longline by cohorts in log-scale. (from CCSBT–ESC/0709/38, Fig. 1-3).



Indicator 4 & Indicator 5 Indonesian Catch and Age Composition

Figure 6. Length frequency (2 cm intervals) of SBT caught on the spawning ground (bars) by spawning season. The grey bar shows the median size class. For comparison, the length distribution of SBT thought to be caught south of the spawning ground (Processor A) is shown for the 2003/04 (n=121), 2004/05 (n=685), 2005/06 (n=311) and 2006/07 (n=411) seasons (grey line). Note that although some fish <130 cm have been measured in the last two seasons, they do not appear on these graphs as the numbers are too low to be visible (n=9; from CCSBT– ESC/0709/10, Fig 1).

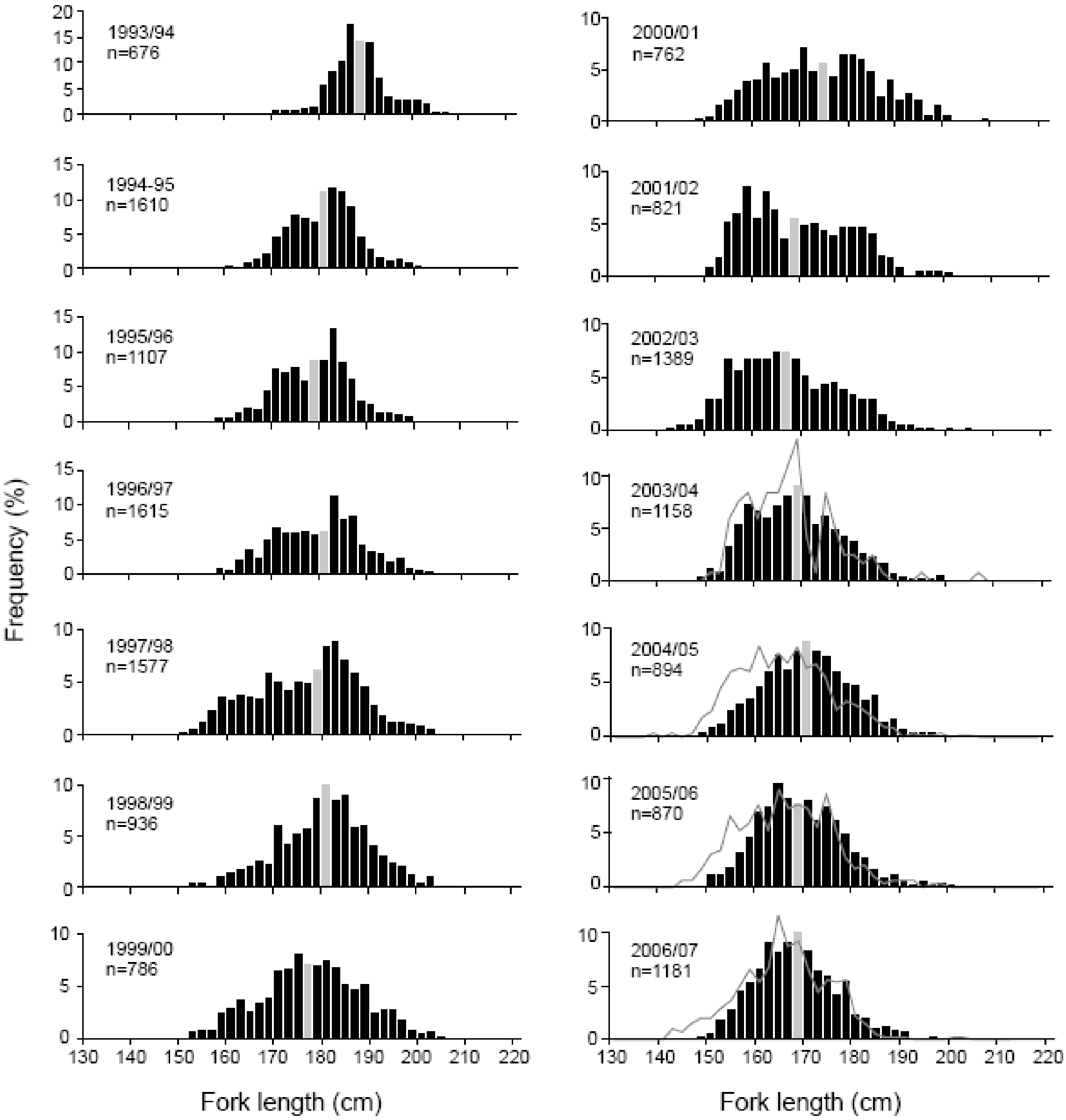


Figure 7. Age frequency distribution of SBT in the Indonesian catch on the spawning ground by spawning season. The grey bar shows the median age class. For comparison, the age distribution of SBT caught south of the spawning ground (Processor A) is shown for the latter two seasons (grey line). (from CCSBT– ESC/0709/10, Fig 7).

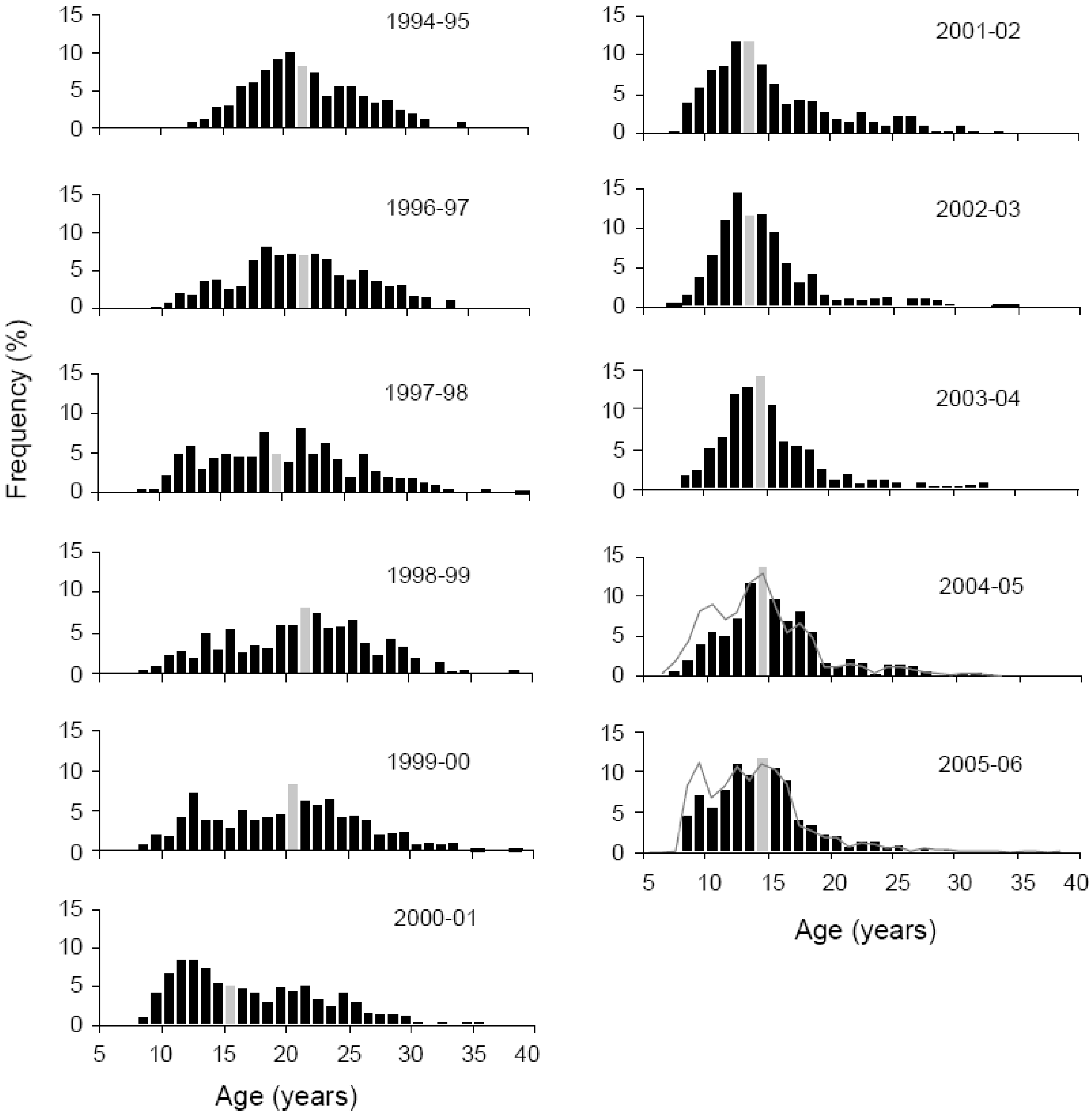


Figure 8. Estimated proportion of SBT by age class in the Indonesian catch on the spawning ground. Note there are no age data for the 1995/96 season (from CCSBT– ESC/0709/10, Fig 8).

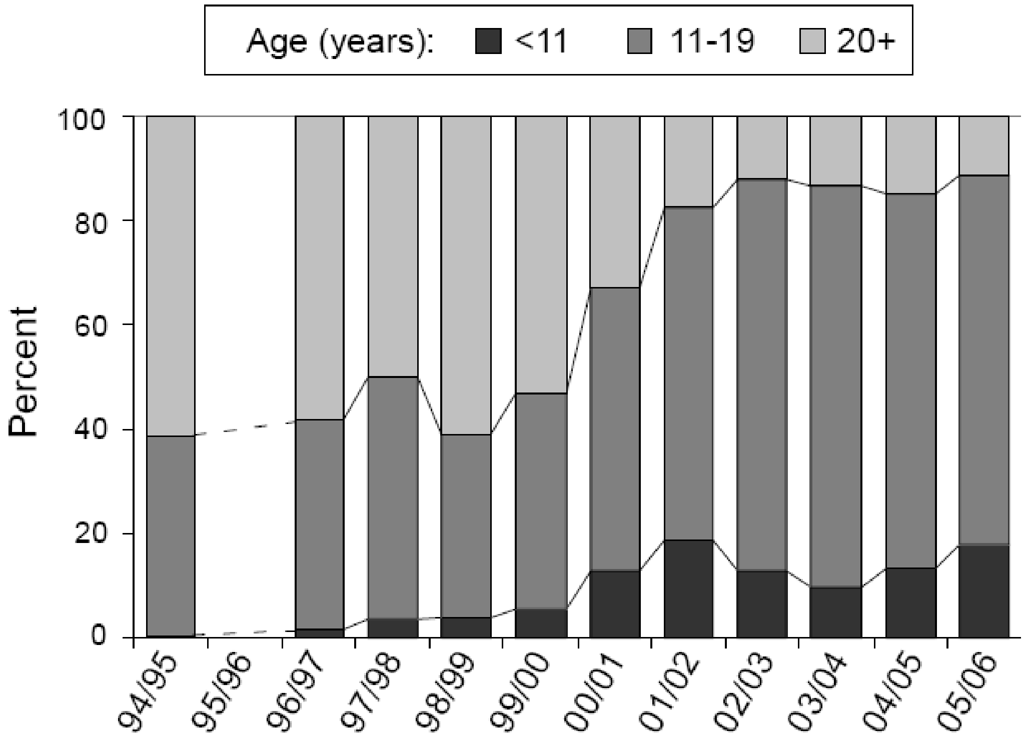
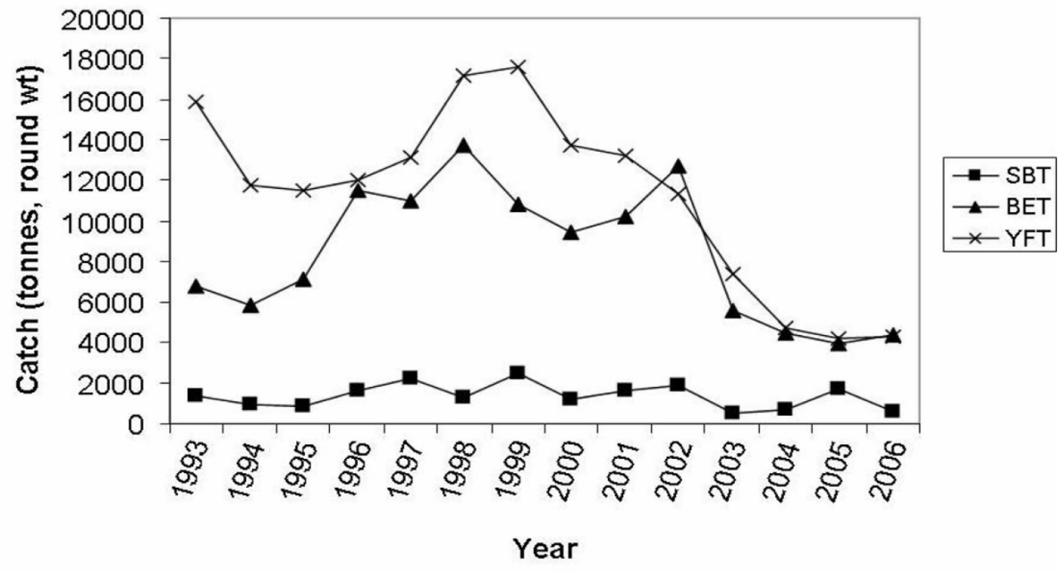
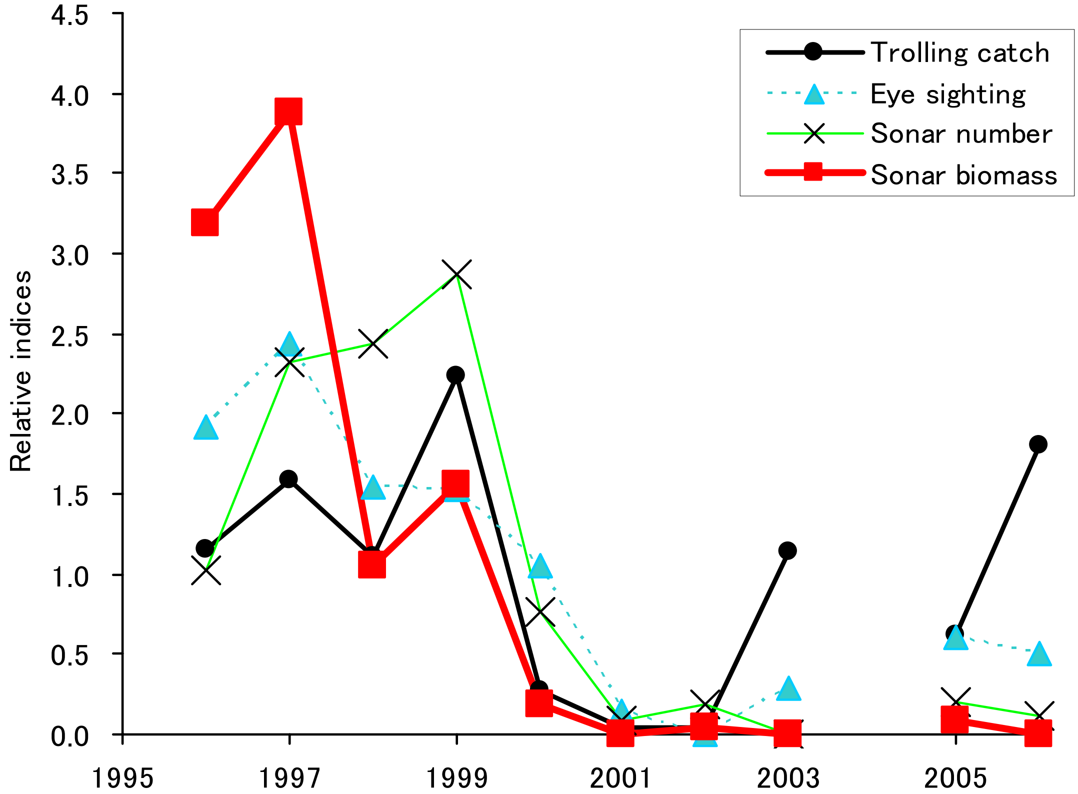


Figure 9. The estimated catch of southern bluefin, bigeye and yellowfin tunas landed at Benoa in the years 1993 to 2006. (from CCSBT– ESC/0709/09, Fig 2).



Indicator 7 Acoustic Estimates of Age 1 off Western Australia

Figure 10. Recruitment indices for age 1 SBT, standardized to the mean of each index, for one year old SBT off Western Australia from acoustic surveys (Itoh and Nishida 2003, Itoh 2005) (from CCSBT– ESC/0709/37, Fig 13).



Indicator 8 Aerial Survey Indices in the Great Australian Bight

Figure 11. Time series of relative abundance estimates based on January, February and March aerial line transect survey sightings data with 90% confidence intervals (from CCSBT–ESC/0709/12, Fig 7).

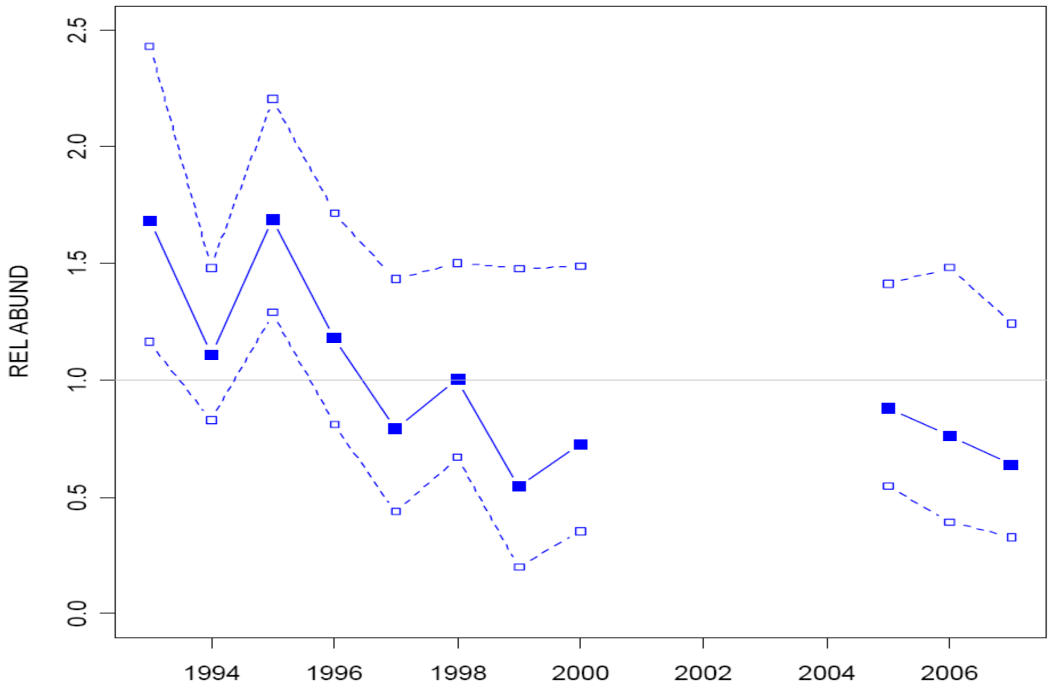
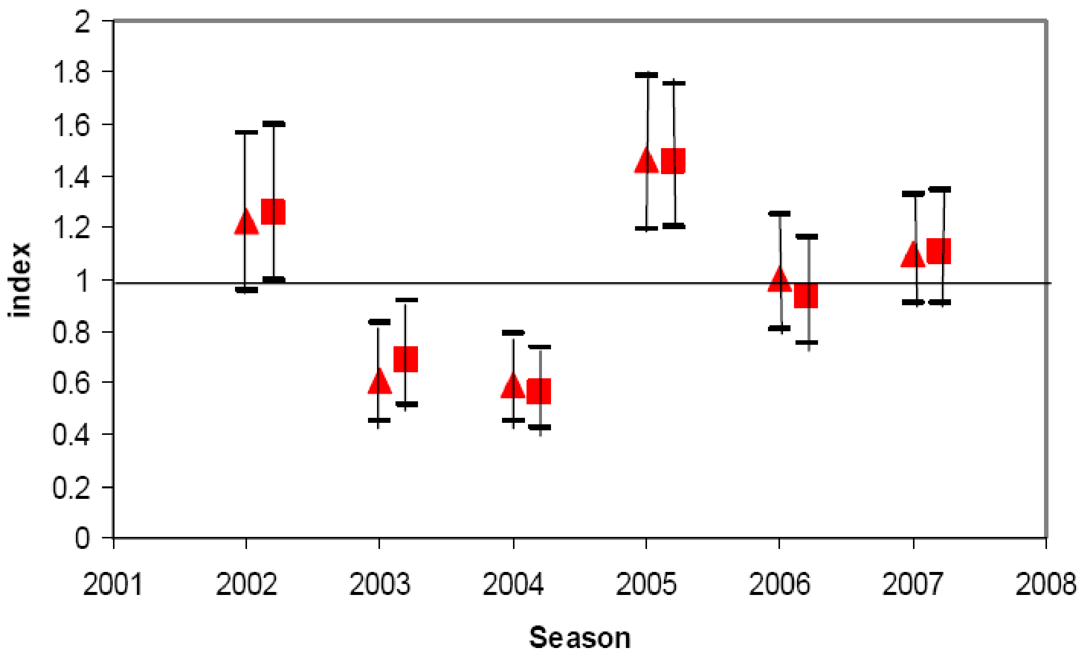


Figure 12. Estimates of standardised relative surface abundance, scaled to the mean over the period, for models with companies 1,2, 5 and 6 for (i) swell included as a covariate (triangles) and (ii) swell excluded as a covariate (squares). All months were included (December – March). The median and exp(predicted value + or – 2 standard errors) are shown. Values are scaled to the mean over the period, so the horizontal line at 1 indicates the mean. (from CCSBT– ESC/0709/13, Fig 11).



Other indicators

Indicator 1 Length Frequency by Fleet

Figure 13. Proportion at length of SBT from the New Zealand charter fleet for 2001 to 2007. Data for 2006 is preliminary (from CCSBT-ESC/0709/Fisheries-New Zealand, Fig 6).

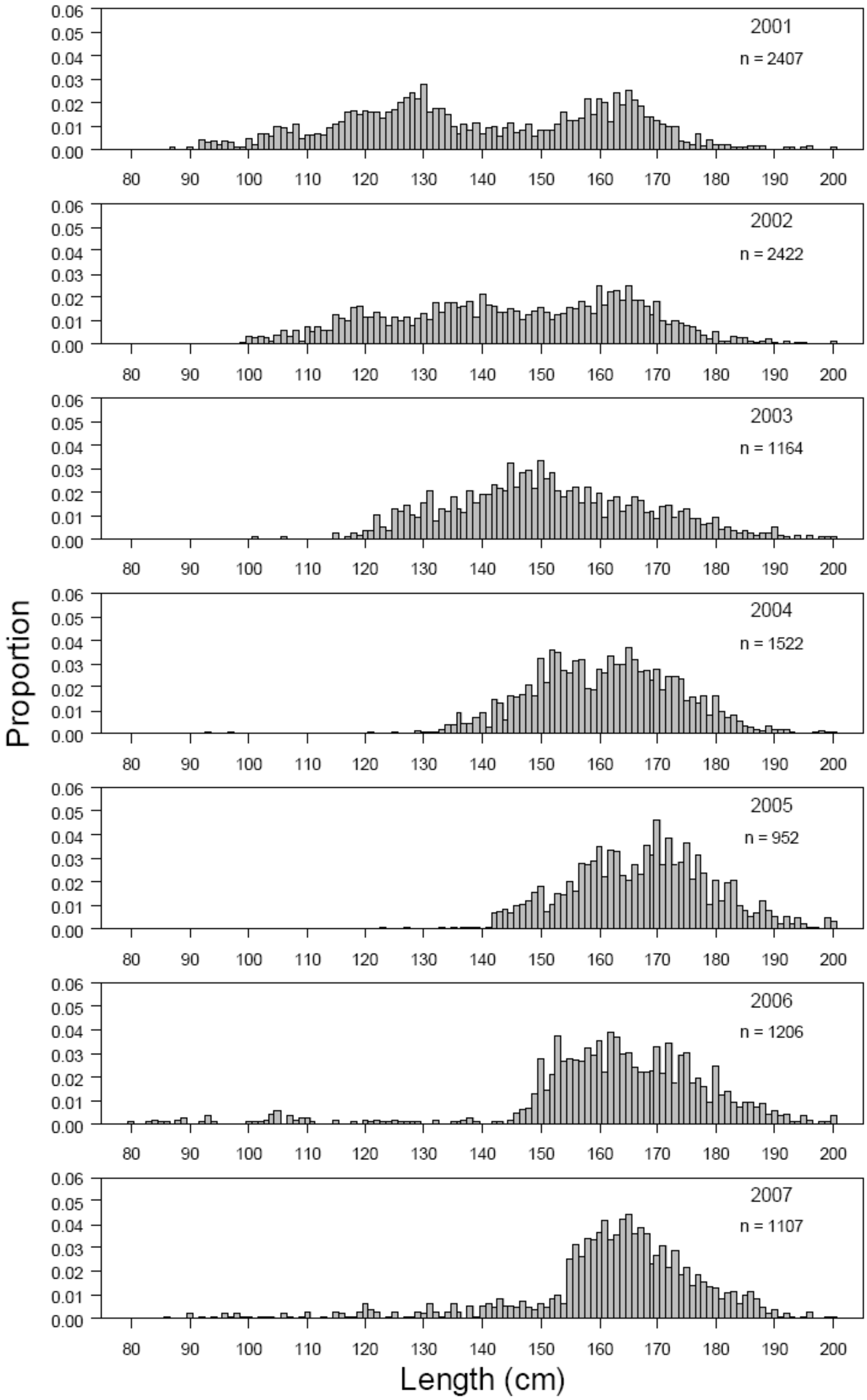


Figure 14. Proportion at age of SBT from the New Zealand charter fleet for 2001 to 2006 based on cohort slicing using the SC(2001) growth curve (from CCSBT-ESC/0709/Fisheries-New Zealand, Fig 9). Note that sample sizes reflect lengths measured (not number aged).

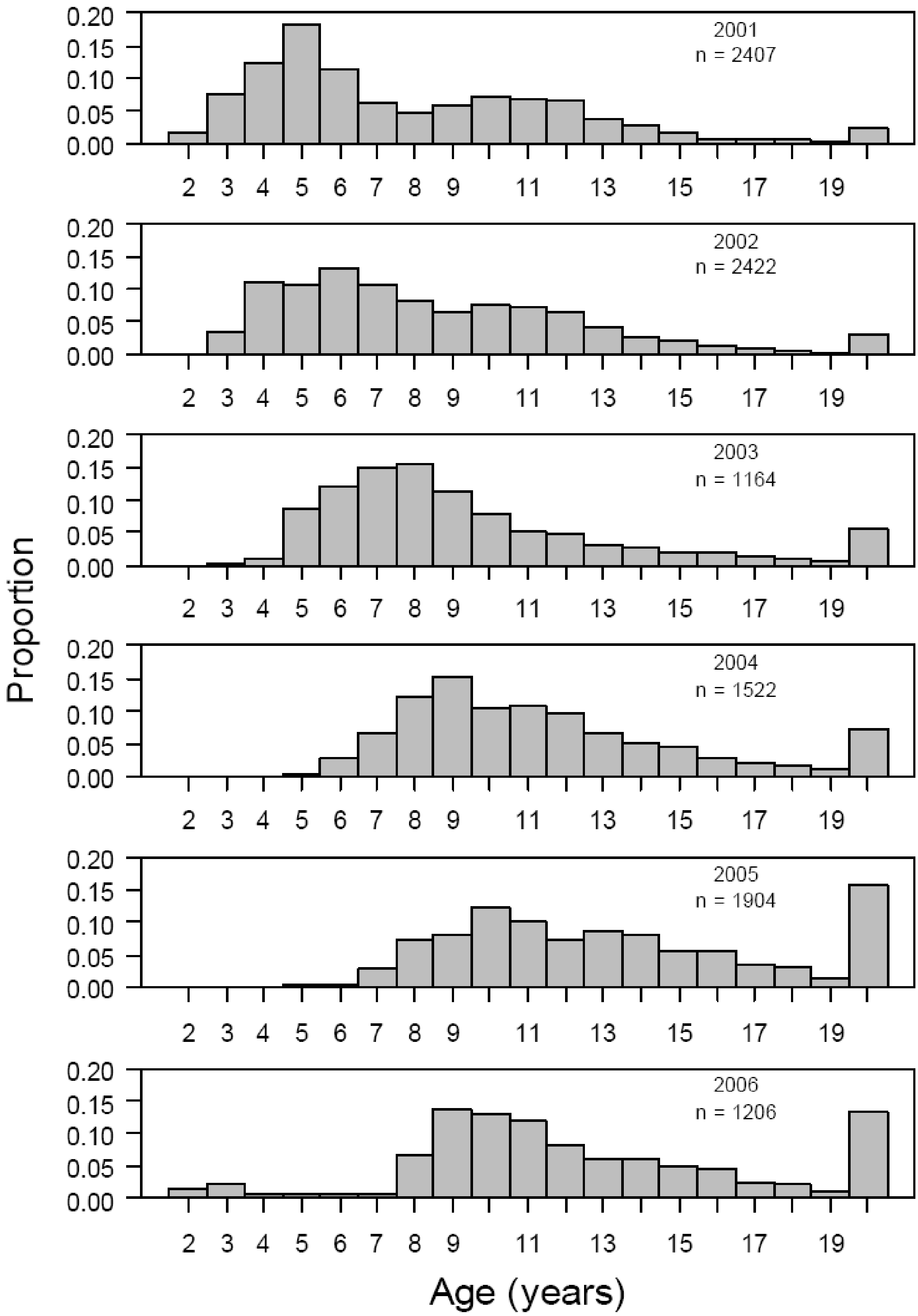


Figure 15. Age composition of nominal CPUE of RTMP data for recent seven years by month and areas. Note that the x-axes are age and shaded portions represent the year 2007. (from CCSBT– ESC/0709/38, Fig 1.4).

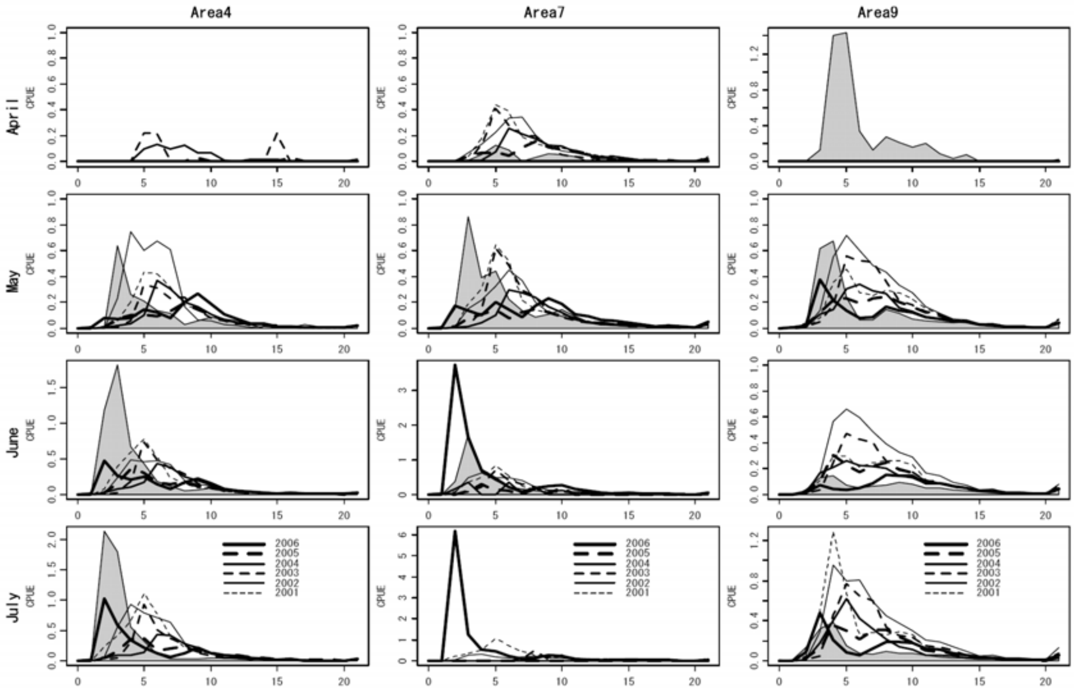


Figure 16 continued. Size composition of nominal CPUE of RTMP data for recent seven years (six years for Area 8) by month and area (from CCSBT– ESC/0709/40, Fig 1.4)

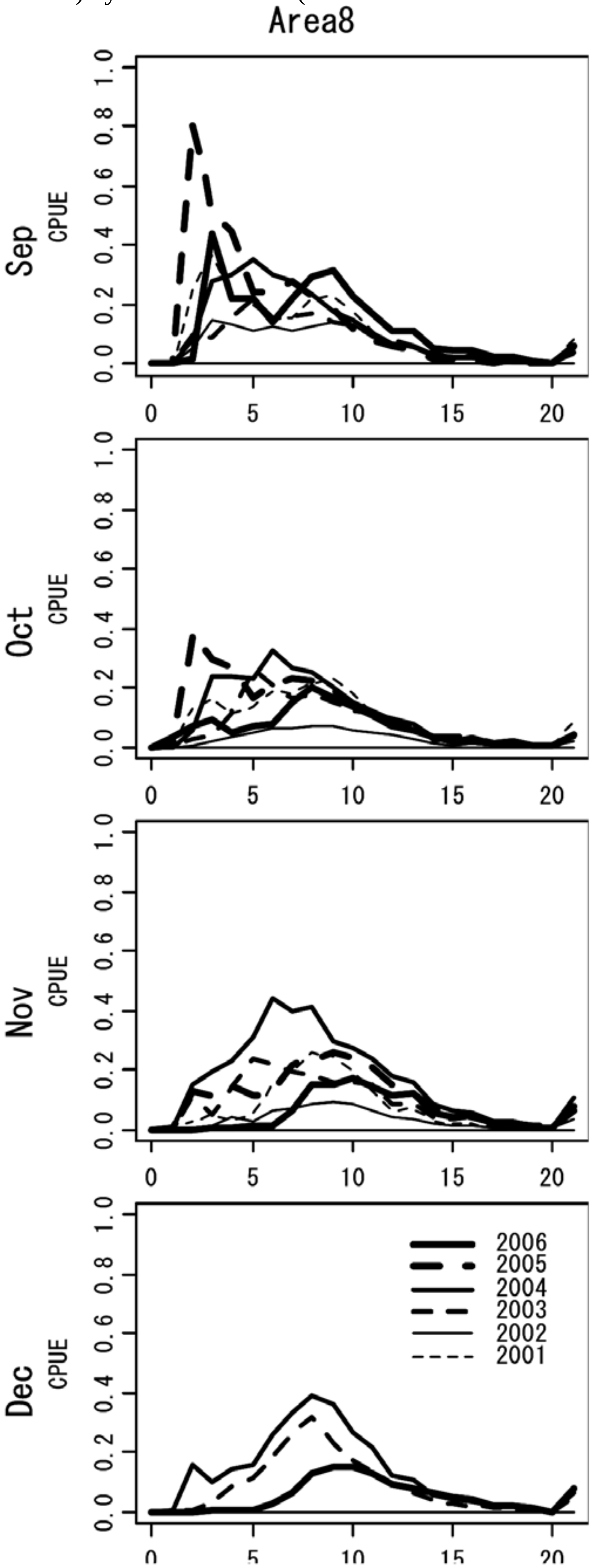
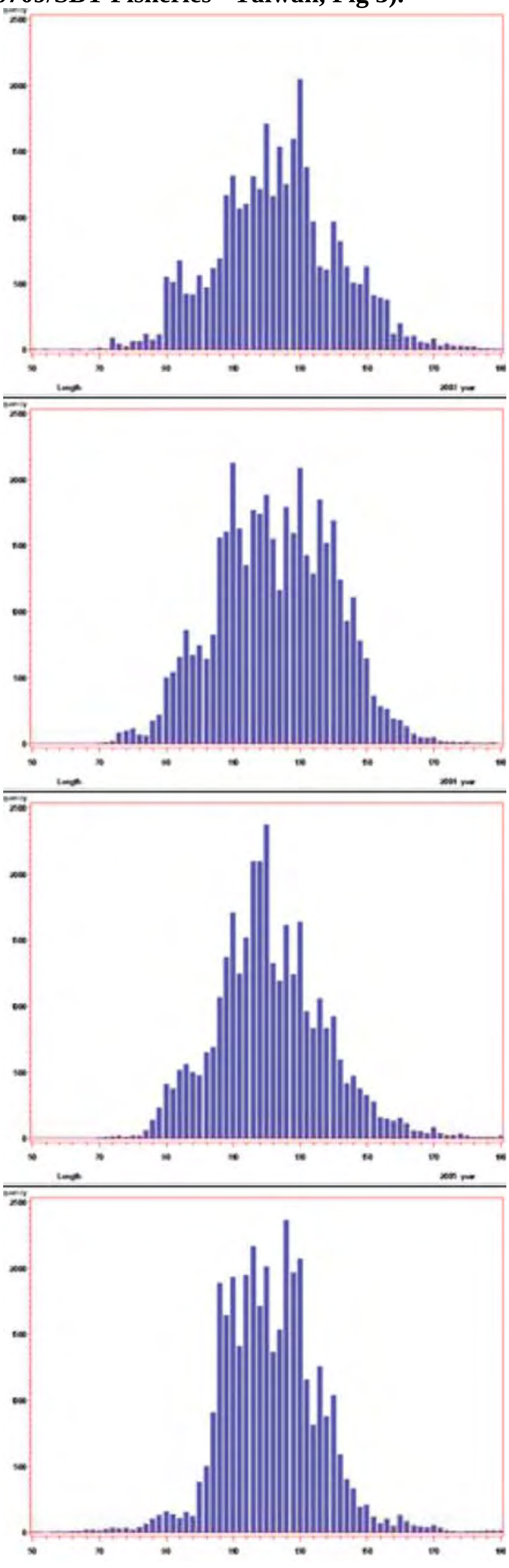
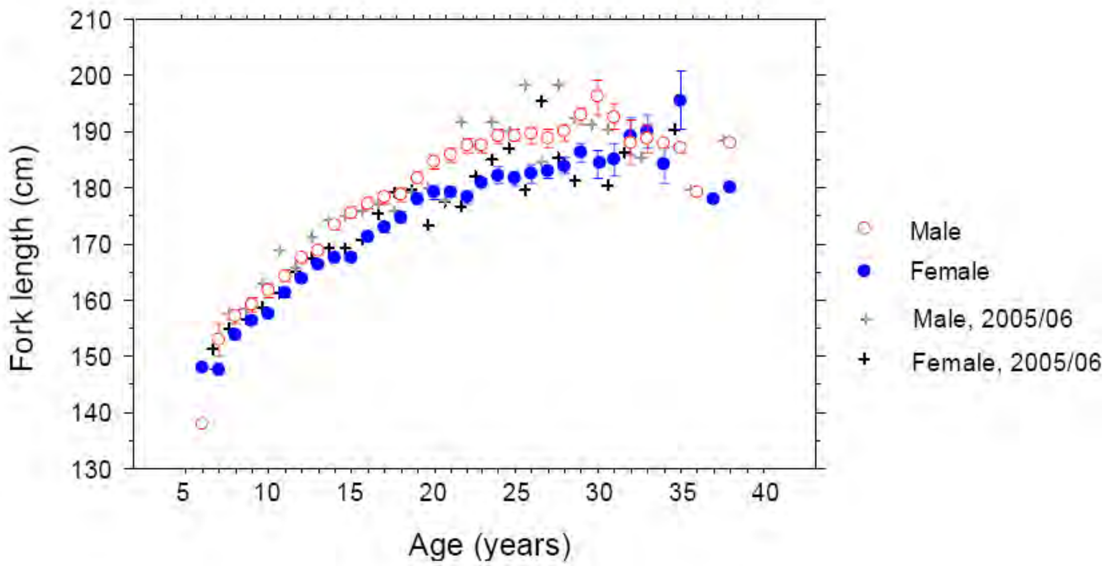


Figure 17. Changes in the size composition of the Taiwanese fishery from 2003 to 2006 (from CCSBT– ESC/0709/SBT Fisheries - Taiwan, Fig 3).



Indicator 7 Growth Rates

Figure 18. Mean length-at-age by sex (+/-se) for SBT in the Indonesian catch on the spawning ground for all seasons combined and for 2005/06. Note that sex was not recorded for all SBT with an age estimate (Table 1). (from CCSBT-ESC/0709/10, Fig 6).



Combined indicators (produced at meeting)

Figure 19: Non CPUE indicators by cohort year. All indicators are scaled to the mean of the series. We assume that the Aerial survey and SAPUE are measuring 3 year olds. The tagging data presents an index of abundance based on the calculated numbers of 2 year olds for that year.

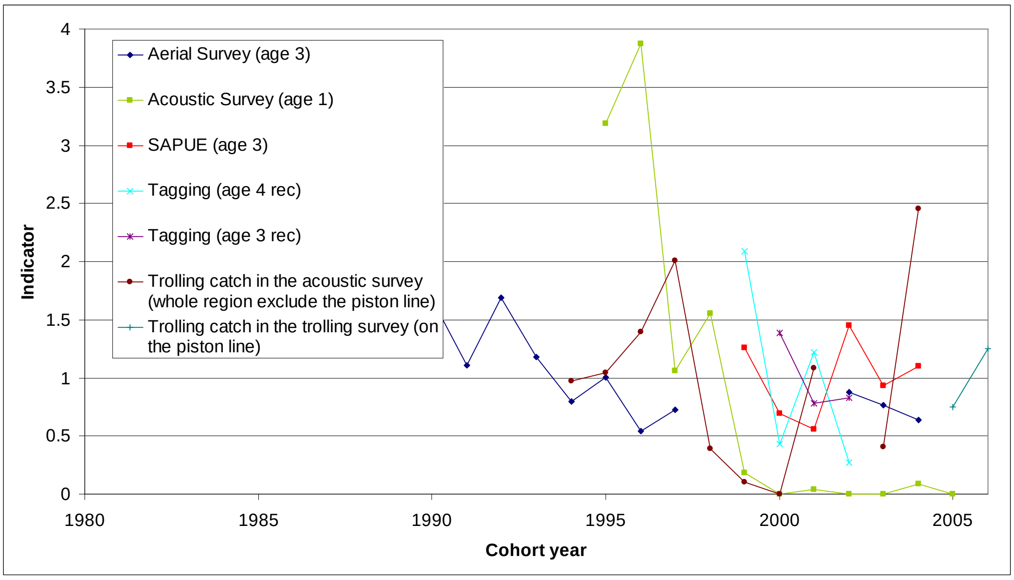


Fig 20: NZ JV CPUE by age and cohort year. Each aged based CPUE is scaled to the mean of the series for that age. These series are obtained by taking CPUE for Region 6 (Fig 5) from the NZ report (CCSBT0709/SBT Fisheries) and multiplying by the proportion at age for region 6.

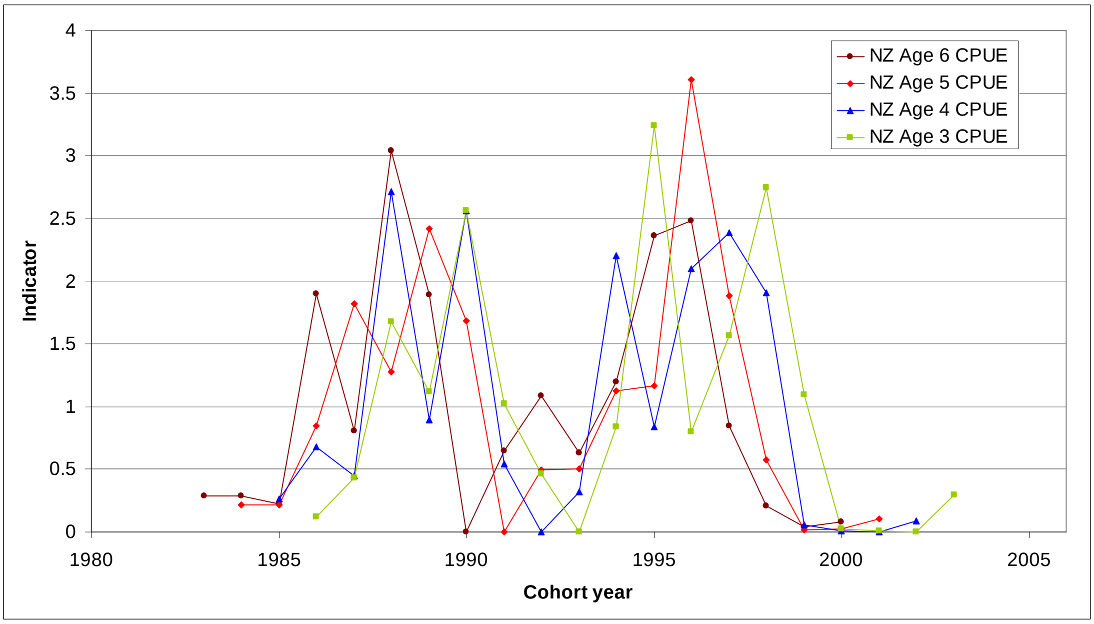


Fig 21: RTMP CPUEs for various age classes by cohort year in recent years

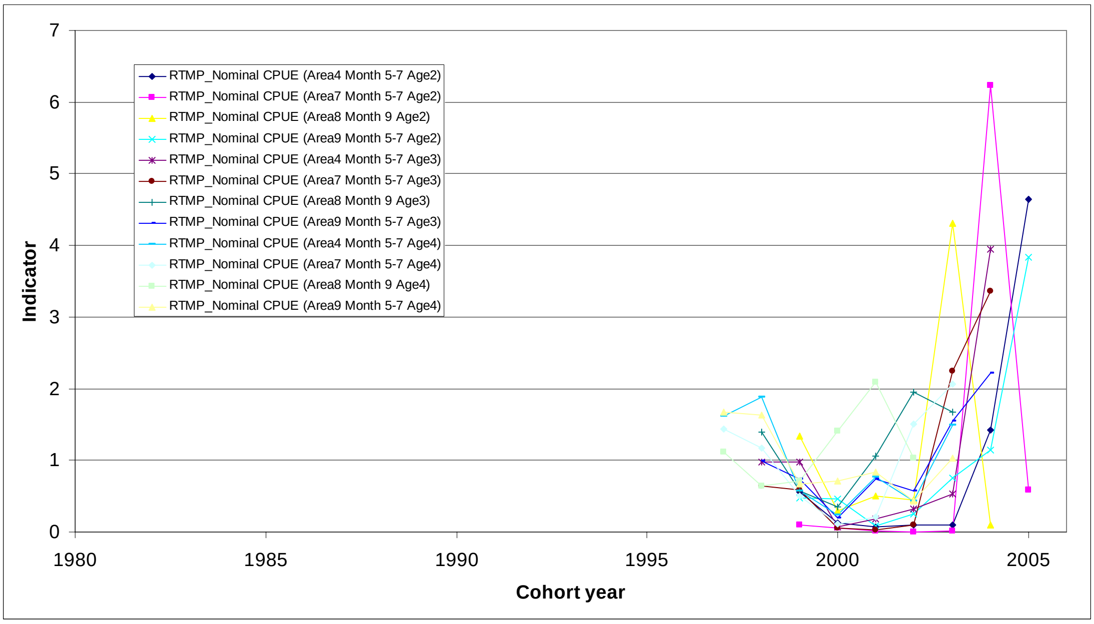


Fig 22: Japanese Longline CPUEs by cohort year for a variety of the standard methods for recent years

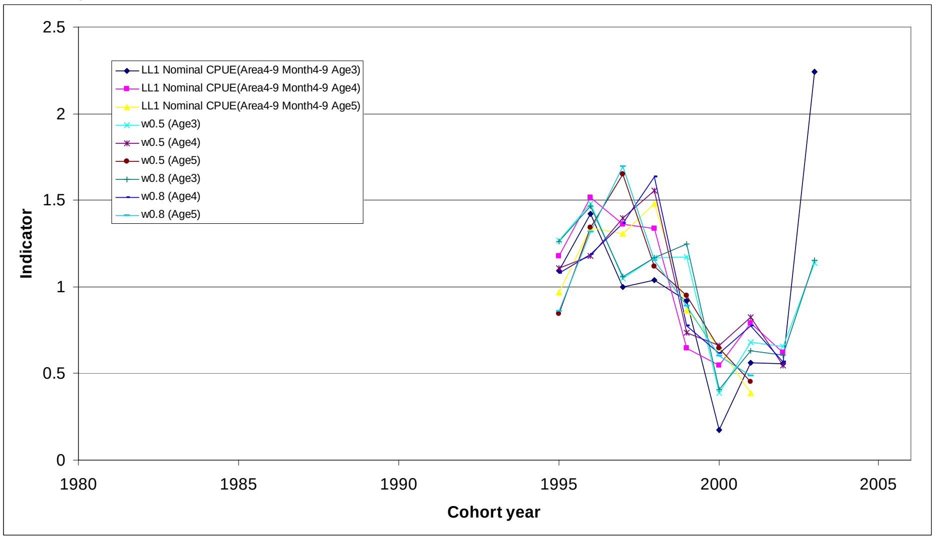


Fig 23: Histogram of a selection if indicators by cohort year (horizontal axis). All indices are standardised by the mean of the series.