Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Third Stock Assessment Group Meeting

3-7 September 2002
Canberra, Australia

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Agenda Item 1. Opening of Meeting

1. The independent chair, Dr. John Annala, opened the meeting and welcomed participants from Australia, Japan, Korea, New Zealand and Fishing Entity of Taiwan.

2. The Executive Secretary announced that Taiwan had advised the Commission that it had completed its domestic legal procedures and its membership of the Extended Commission and Extended Scientific Committee was now effective.

3. The Stock Assessment Group (SAG) is a subordinate body of the Scientific Committee (SC) and the Extended Scientific Committee (ESC). It was noted that all people participate at the SAG as individuals. Participants were introduced and the list of participants is at **Attachment 1**.

Agenda Item 2. Appointment of Rapporteurs

4. Each country appointed rapporteurs to produce the text of the report relating to technical discussions.

Agenda Item 3. Adoption of Agenda

5. The draft agenda was adopted. The agreed agenda is at **Attachment 2**.

Agenda Item 4. Admission of Documents and Finalisation of Document List

6. The draft list of documents for the meeting was considered. The agreed list is at **Attachment 3**.

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

8. The meeting confirmed the importance of submitting documents by the due dates to allow adequate time for the contents to be reviewed by Members.

Agenda Item 5. Review of Fisheries Indicators Analysis

9. In 2001 the Sixth Meeting of the Scientific Committee recommended, and the Commission endorsed, the SAG observation that it was not necessary to conduct a full assessment every year, and noted that current trends in the status of the SBT stock were not expected to change suddenly. It was agreed that fisheries indicators would be updated and evaluated to provide information on fisheries trends and that if these indicators suggested unexpected large changes, then the necessary modelling and

assessments would be conducted to determine the management implications of these changes. The agreed indicators for this purpose are documented in CCSBT-ESC/0209/06.

10. The indicators were updated and evaluated inter-sessionally by the Members and Advisory Panel and agreement reached that there were no unexpectedly large changes that warranted a model based stock assessment in 2002. These results therefore provide no reason to change the management advice given by the Sixth Meeting of the Scientific Committee to the Commission.

Agenda Item 6. Assessment Approach to be used in 2003

11. The SAG noted that, while a model-based stock assessment would allow more rigorous advice to be provided to the Commission, work on the operating model and management procedure is a high priority and the current work-plan is progressing well. If a full stock assessment is conducted in 2003, the SAG is of the view that this will considerably delay the progress on development and testing of the management procedure.

12. The SAG also noted that considerable additional effort would be required if the Commission wishes to proceed with a full, model-based assessment in 2003. In particular, agreement on the model, inputs and parameters was expected to require further meetings of those involved.

13. The review of indicators conducted in 2002 provided for a mechanism to identify any appreciable changes in stock status and hence the need for a model based assessment. On this basis, the SAG considered a review of these and/or other indicators could be used in 2003 to determine the need for a full stock assessment.

14. The SAG noted that, before the Commission considers this issue at the 9th annual meeting, the results of projections done with the current operating models under the scenario of various levels of catch, including current catch, would be available to members. The SAG noted that these results could assist members to decide at the 9th annual Commission meeting whether to conduct a full model based stock assessment in 2003.

15. The SAG identified two options for the development of stock status advice in 2003. A description of these options and their implications is given below.

    A. An update of fisheries indicators is conducted to provide information on fisheries trends, to determine whether there is a need for a model based assessment. This was the option followed during 2002, and a repeat of this process during 2003 would allow maximum progress to be made with development and testing of the Management Procedure.

    B. A model-based assessment will be conducted, primarily using new

assessment models and updated data. The results will be used as the basis for updating the management advice from the Scientific Committee. Pursuit of this option will substantially reduce the amount of effort that can be put into development of the Management Procedure during 2003.

Implications and preparatory requirements resulting from selection of either of the above options:

Option A

- Efforts will concentrate on the testing of various management procedures and further development of operating models at least until the second MPWS. Results of these analyses will be considered at the second MPWS.
- A set of fisheries indicators to be evaluated to determine whether a model based assessment is required will need to be selected and agreed upon. This will primarily be done at the September 2002 SC7 meeting, based on the list of indicators agreed on for 2002. If necessary, some additional discussion of preferred indicators could be held during the second management procedure Workshop. The 9th CCSBT Commission Meeting might also propose additional indicators or other information requirements.
- The existing standard data exchange process would take place.
- The agreed, updated fisheries indicators will need to be exchanged between members, and forwarded to the Advisory Panel, through the Secretariat, by mid-May 2003.
- Following review of the updated fisheries indicators, members and the Advisory Panel will need to inform the Secretariat by mid-June 2003 of their conclusions regarding fisheries trends, and whether these indicate the need for a model based assessment or not. Three possible conclusions could result from this review of indicators:
  - If there is agreement that there is no need for a model based assessment, efforts will remain focused on development and testing of the Management Procedure, in preparation for consideration of the management procedure testing results at the SAG 4 meeting.
  - If there is agreement on the need for a full assessment, further work on the Management Procedure would have to be postponed to 2004. Some discussion of models, inputs and parameters to be used in the assessments will be required, and possibly some discussion of additional data preparation and exchange requirements for a model based assessment. A short, additional meeting will be required for this, and this would have to be held by the end of June 2003.
  - If there is uncertainty or dispute regarding the fisheries trends apparent in the indicators, an additional short meeting will also be required to decide on whether a model based assessment is required and, if so, on the requirements for this assessment. This will have to be held by the end of June 2003. The outcome of this meeting would result in accepting one of the two conclusions above.
- If there is agreement by the end of June on the need for a model based assessment, an additional 14 weeks will be required for additional data preparation and

exchange, and the 2003 SAG 4 meeting will need to be postponed until mid-October 2003. The CCSBT 10 meeting would then also have to be postponed, perhaps until December 2003. Further work on the Management Procedure would have to be postponed to 2004.

Option B

- Preparation for a full assessment could commence immediately after the Commission meeting in October 2002.
- The second Management Procedure Workshop and further work on the Management Procedure, will have to be postponed until 2004.
- Models, inputs and parameter selections, and final data preparation and exchange requirements for a full assessment, will need to be discussed and agreed on during a short (2 day) meeting in early 2003.
- Data preparation and exchange will need to be completed by the end of April 2003, 14 weeks before a mid-August SAG 4 meeting.
- A model based assessment will be conducted using agreed models, inputs and parameters at the SAG 4 meeting proposed for mid-August 2003.

Agenda Item 7. Management Procedures

7.1 Overview of steps in the proposed process to develop a management procedure for SBT

16. Dr Parma presented a summary of progress to date for the completion of the development and testing phase of the SBT operating models and management procedures. The Workplan and timetable are detailed in Section 9 of the Report of the First Meeting of the Management Procedure Workshop is attached at **Attachment 4**. The goal for the first year of the process is to develop and test simple operating models that would be used to develop the management procedure. This SAG meeting is Step 9.5 of the tasks listed in Section 9 of the Report. The main goal for this SAG meeting is to agree on the full specifications of a set of operating models to be used in the first year of developing the management procedures.

17. The meeting agreed that for practical reasons a maximum of 12 operating models should be developed in this first phase in the development of the management procedures.

7.2 Performance of first stage of operating models in conditioning to historical data

18. Results from the first phase in the development of operating models to be used in the evaluation of management procedures for SBT (CCSBT-ESC/0209/7) were presented. Specifications for the operating model were those developed during a workshop held in Tokyo in March 2002. Results from the conditioning of the model to historical data were presented to facilitate further discussion with regard to the choice of models for the first phase of testing.

19. Although these initial results are not exhaustive, tentative conclusions drawn in CCSBT-ESC/0209/7 are: estimation of the stock-recruitment auto-correlation parameter is problematic and modeling results will be sensitive to how this parameter is treated; estimation of natural mortality rates captures the range of uncertainty that results from the V2, V6 and V9 natural mortality assumptions; and modeling results are sensitive to the parameterisation of fishing selectivity ogives, in particular the selectivity smoothing penalty function.

20. It was noted that the task at this SAG meeting, is to select a final set of operating models to use in the first phase of testing. For practical reasons, there should be a limit on the number of models to consider, whilst choosing the models to encompass a wide range of stock dynamics. The intention is to run each model through the different hierarchies defined in CCSBT-ESC/0209/Rep/09, starting at the simple "deterministic" level. The uncertainty will also be explored for each model in the final stage of the four hierarchies.

21. There was some discussion on how best to approach the selection of models. One approach is to identify those parameters which would be difficult to handle (i.e. data uninformative as to parameter value, which has a large influence on result) by Monte Carlo Markov Chain (MCMC), to make some choices for fixed levels of those parameters, and to integrate over the other parameters which are easily handled by MCMC. Consideration should also be given to parameter pairs which are orthogonal to one another when choosing which parameters to fix at different values. In this regard, it was considered useful to identify parameters which primarily affect the productivity of the stock, and those parameters which primarily affect the short term temporal dynamics of the stock.

22. The key issues to consider when selecting the initial set of models were identified as:
    1. steepness (h) in the stock-recruit relationship
    2. changes in selectivity
    3. adult mortality (M10 – the natural mortality of ages 10+)

23. With regard to steepness, it was noted that this parameter has an effect on estimates of other parameters, and that the interaction between the steepness parameter and other parameters of the stock-recruit relationship (variance and autocorrelation of recruitment) should also be considered. The estimate of steepness is sensitive to effective sample size and the frequency of changes in selectivity. There is also likely to be some interaction between steepness and natural mortality. These parameters essentially determine the productivity of the stock.

24. With regard to changes in selectivity it was agreed that an assumption of constant selectivity in the LL1 fishery (post 1957) was too strong, and that a change every 4 years should be considered. It was noted that the penalty in the objective function, associated with the change in selectivity implies that if the data do not indicate any change, then the selectivity would not change.

25. Preliminary results were based on a relatively tight prior on adult mortality (M10). The group suggested that more extreme constant values (0.05 and 0.15) should be used in testing.

26. During discussion of preliminary results from the operating model (CCSBT-ESC/0209/7 and CCSBT-ESC/0209/40) it was noted that the dynamics in the early part of the time-series, and prior to fishing, are strongly driven by (a) limited length-frequency data and (b) the intrinsic model structure and assumptions. The early dynamics suggest possible "regime shifts" in recruitment, and it was agreed to explore the implications of downweighting the early data for LL1 and LL4 (prior to 1965) on the stock dynamics.

27. The issue of choosing appropriate weights for the different length frequency data for the different fisheries was also raised in general, and it was noted that CCSBT-ESC/0209/33 provided information which could be considered in future.

28. The group flagged several additional issues which need to be borne in mind, particularly for future work. Assumptions about changes in catchability should be considered, but this work is intended for the second phase. Different assumptions about the relationship between CPUE and abundance should be considered, bearing in mind that assumptions about selectivity also interact with the relationship between CPUE and abundance. Ways of modeling changes in growth over time should also be considered. These issues were discussed further under agenda item 7.4

7.3 CPUE models

29. The Management Procedures workshop held in Tokyo, March 2002, (CCSBT-ESC/0209/Rep/09) requested that a single relative abundance index based on Japanese longline CPUE series needed to be adopted for management procedures. The CPUE working group held in Tokyo, March 2002 (CCSBT-ESC/0209/Rep/10) proposed four candidate CPUE interpretations (B-ratio proxy, Geo-statistical proxy, Takahashi Space-Time Window and Laslett Core Area) and it was proposed that additional work should be undertaken to try to reach agreement on the best series according to a number of agreed criteria (related to several statistical and pragmatic issues).

30. The CPUE steering committee met to review intersessional work on the CPUE issues and proposed future work (**Attachment 5**). Three distinct applications for the CPUE-based relative abundance indices were identified: 1) input for the conditioning of an SBT operating model for the development of robust management procedures, 2) a default input for the actual management procedure over the next 5-10 years (It would be sufficient that this gave a reliable quantification of the direction of abundance trends while the stock abundance and fishery practices remained close to those observed during the past 10 years), and 3) a definitive input to the actual management procedure over the medium to long term.

31. It was recognized that the required quality of the relative abundance index might differ for each CPUE application, and that different indices would probably need to be used for each of these phases for pragmatic reasons. A comparison of the four proposed time series (CCSBT-ESC/0209/08) suggested that the recent relative abundance trends were very similar to each other and the nominal CPUE series, and it was agreed in plenary that the median of the nominal CPUE and the proposed 4 CPUE series would be adopted for management procedure testing. It was felt that the selection of CPUE-based relative abundance indices for use in actual management procedures should be selected more carefully.

32. The CPUE steering committee proposed intersessional work to develop a CPUE time series that would be used until a definitive CPUE series could be developed. RTMP data have to be used in the last year because these are the only data that are available at the time the management procedure would need to be applied. Any series adopted will need to be adjusted to remove any bias caused by using the RTMP data to give CPUE results in the most recent year. Some sort of calibration to relate the RTMP to the other series will be developed. It would be desirable if the CCSBT Secretariat could take responsibility for the calculation of the time series, to avoid implementation discrepancies. The temporary nature of the default time series was emphasized. This would be replaced by a more appropriate time series by 2009 at the latest. The replacement definitive time series would be jointly developed by the Scientific Committee (including the advisory panel) over the next several years, and will attempt to take account of as much of the available data as appropriate. This analysis may ultimately include oceanographic data, fine-scale catch and effort data, and historical information about the development of the fishery (much of the analysis will likely have to be conducted in Japan for confidentiality reasons). There is hope that this final proposed CPUE analysis will result in a reasonably accurate relative abundance estimate that can be used as part of a management procedure to attain long term management objectives.

7.4 Identification of the set of operating models based on 7.2 and other considerations

33. Vivian Haist presented the results of a few initial model runs to demonstrate features of the operating model and to generate discussion on the range of parameters that should be run during the course of the SAG meeting. Models were run overnight, reviewed and the selection of further model runs agreed by a working group.

34. As a result of discussions, several further exploratory runs were performed at the meeting. In particular a set of runs with steepness (h) and adult mortality (M10) each fixed at 3 values (ie 9 runs), as well as, a set of runs with the variance of recruitment fixed (σ_r =0.1) for 2 values of h and 3 values of M10 were performed. The runs differed in several ways from the original runs presented in CCSBT-ESC/0209/7: (a) selectivity was allowed to vary every 4 years after 1957 for LL1, with an assumed CV

of 50%; (b) data prior to 1965 for LL1 and LL4 was downweighted. Some pairwise crosses of these factors were examined.

35. Results from this set of runs (see **Attachment 6**) with early data downweighted showed recruitment dynamics that did not suggest the presence of "regime shifts", and better fits of stock-recruit data to the stock-recruit curve. It was therefore considered that there was in fact no need to further consider scenarios with σ_r fixed at very low levels, since fixing σ_r at 0.1 was used to try to generate scenarios that did not show a "regime shift" in recruitment.

36. The operating model results of the 18 implementations were evaluated on the basis of their log-likelihood statistics, relative variation in the recruitment time series, fit to the stock-recruitment curve, fit to the CPUE time series, and predicted changes in length frequency distributions between 1952 and 2002. Based on the evaluation of these runs it was agreed that 9 operating model specifications would be used in the inter-session period leading to the second Management Procedure workshop in the initial evaluation of management procedures. It was recognised that the 9 models selected did not represent the full range of parameter space that might be needed to encompass the uncertainty in the dynamics of the SBT stock and fishery. Further consideration of other operating model implementations would be required at the second Management Procedure Workshop.

37. Given the present time constraints, however, the 9 models selected (see table below) provided a reasonable basis for the initial stage of development of the management procedure. Definitions of mathematical symbols used here can be found in CCSBT-ESC/0209/07.

Model	**Original Model No. in Attachment 4**	**h**	**M 10**	s_R	**Other Specifications**
h3M10	Mod1	0.3	0.10	Estimated	
h6M10	Mod2	0.6	0.10	Estimated	Uniform prior for M0 (from 0.2 – 0.6)
h9M10	Mod3	0.9	0.10	Estimated	Down-weight (sample size = 25) pre-1965 LL1 & LL4 data
h6M05	Mod5	0.6	0.05	Estimated	Selectivity change for LL1 every 4 years, CV about 50%
h3M15	Mod7	0.3	0.15	Estimated	Min. value for s_I in estimation = 0.1
h6M15	Mod8	0.6	0.15	Estimated	
h9M15	Mod9	0.9	0.15	Estimated	
h6mcmc		0.6	Estimated	Estimated	Final specifications to be decided upon by Management Procedure Steering Committee
h6M15d1	Mod17	0.6	0.15	Estimated	Same as above except fix M0 = 0.4

The results in **Attachment 6** were conditioned on the B-ratio Proxy CPUE series. The operating models that will used for the actual tests will be conditioned on the agreed upon CPUE series.

38. In the initial projections the following will be applied in the period prior to the second management procedure workshop:
    - $r = 0$;
    - $\sigma_R = 0.40$ if $\hat{\sigma}_R < 0.40$ else $\sigma_R = \hat{\sigma}_R$
    - Selectivity: fixed as those estimated for the last 4-year block;
    - $\sigma_I = 0.20$ if $\hat{\sigma}_R < 0.2$ else $\sigma_I = \hat{\sigma}_I$

39. It was noted that the set of operating models chosen for consideration at this meeting does not constitute a final set or a base case, since there remain other issues which need to be explored before making such final choices. The final set of operating models may be different from those used in the initial trials.

40. To demonstrate how a management procedure would work, forward projections of the SSB were run for each of the first 7 models in the table above showing deterministic trajectories from 2002 to 2020 for TAC = 0, a constant catch, and with a feedback rule that makes changes in TAC proportional to changes in CPUE. While these very simple runs were done only for demonstration purposes, it was clear that the trajectories for future spawning biomass were qualitatively reasonable (**Attachment 6**).

41. Based on a preliminary MCMC run based on model h6M10, the working group was concerned that the level of uncertainty was too small. For this reason a ninth model was specified – h fixed at 0.6 – where all other parameters (including M10) are to be estimated. The idea is to do one MCMC run which reflects more closely the magnitude of uncertainty expected when next sets are identified at the second management procedure meeting. The working group noted that MCMC runs for the other eight models would not be required. Runs for B0 set to + and – 2 standard deviations (hierarchy 1) would only be required for the model with h fixed at 0.6 and M10 (and other parameters) estimated.

42. A working group also began consideration of the next stage of specifying the management procedure operating models. A range of other issues various parties considered important for coding in the current version of the operating model was discussed in general terms and referred to a small group to recommend specific formulations for coding. The issues to be examined included:
    - the relationship between CPUE and abundance including plausible non-linear effects related to abundance and effort variations;
    - how to allow for technological developments and random components in catchability,
    - how to handle selectivity changes;
    - how to incorporate regime shifts in stock productivity (changes in h; changes in M0);
    - how to model depensation in the stock recruitment relationship;

- whether to model the Indonesian fishery as a non-regulated by-catch fishery (catches proportional to F);
- whether to incorporate the results of tagging experiments into the management procedure;
- whether recruitment indices could be incorporated into the management procedure;
- how to incorporate historic and future non-reported catch;
- whether to include year specific weights for catch at age / size historically; and
- develop the ability to control future sample size for each fishery catch at age / size.

43. The decisions on how to proceed with these issues will be advanced by the small group in the margins of the SC meeting immediately following the SAG.

7.5 & 7.6 Mechanics for conducting the evaluation tests and Testing management procedures

44. Vivian Haist reviewed her user's documentation for the SBT operating model showing how inputs and output files are linked with a sample control data file. In reviewing the output file "sbtOMdata" (Table A1 of the documentation) it was suggested and agreed that a definition line be added similar to that at the top of the operating model summary file "*.all" (Table A3 of the documentation).

45. It was noted that the outputs from the operating model provided data that could be used in a number of ways to evaluate alternative management procedures that members might wish to explore.

46. A demonstration of the computer program using simple management procedures specified at the previous management procedure workshop was given. Details for using the software are to be documented in a user manual by the end of SC7.

47. The code was distributed to members for use on their own PCs and they were encouraged to try the software during the meeting.

48. Several issues relating to details in the documentation of the workshop report were raised. Resolutions to these issues are given in **Attachment 7**.

49. The group discussed protocols for trials and for comparison of results from different candidate management procedures. Protocols are listed below.

50. With regard to runs under hierarchy level 1, it was agreed that there was no need to perform runs for + and – 2 standard deviations of B0 for this first set of trials given that h is fixed in the operating models chosen for the first set of trials because of the relatively small CV's for the corresponding estimated B0s.

51. Under hierarchies 2 and 3, it was agreed that 100 replicates would be sufficient at this stage since only a broad indication of variability is required. Members are, however,

required to do some runs with more than 100 replications. In all cases a projection period of 20 years will be considered as previously agreed (CCSBT-ESC/0209/Rep/09).

52. It was decided that hierarchy level 4 will only be used for tests based on model h6MCMC. A wide prior distribution covering the range 0.03 to 0.20 will be assumed for M10. A full set of 2000 samples will be generated from the posterior, but for practical reasons, results of management procedure trials will only be reported on the first 500 of the 2000.

53. During discussion of standard outputs from candidate management procedures, it was agreed that software to generate summary statistics, as well as graphics, from the raw "output" files would be highly desirable. The Management Procedures Steering Committee and the Secretariat will discuss how this will be achieved. The group indicated that software should ideally be available by mid-January 2003.

54. The group agreed that outputs for performance measures, as defined in CCSBT-ESC/0209/Rep/09, should be the median, the 10^{th} and the 90^{th} percentiles. For practical reasons a core set of performance measures which are required will be defined and agreed upon following the SAG meeting. The other performance measures defined in CCSBT-ESC/0209/Rep/09 will be optional for reporting at this stage.

55. In addition, trajectories for total catch and for spawning stock biomass should be given. For SSB, trajectories for the median and the envelope (10^{th} and 90^{th} percentiles in each year) should be produced. For total catch, the median and the envelope (10^{th} and 90^{th} percentiles in each year) should be produced, as well as, a few example trajectories. The number of trajectories shown should be small enough that individual trajectories can be distinguished when the figure is reproduced as a black and white graph.

56. The group noted that these suggestions are not final specifications for outputs, but are intended to be used for this first phase of testing. Further, development and specification will be required at the second management procedure workshop. These will need to incorporate any feedback from the Commission in terms of objectives and performance indicators.

7.7 Workplan and timetable

57. Vivian Haist will produce revised operating model software with simulations and some additional runs by 15 January 2003.

58. If the Commission decides on option A outlined in paragraph 15, the second management procedure workshop was tentatively scheduled for the second week of April 2003.

Agenda Item 8. Other Business

59. There was no other business.

Agenda Item 9. Finalisation of Meeting Report

60. The report of the meeting was adopted

Agenda Item 10. Close of Meeting

61. The meeting was closed at 5:00pm, 7 September 2002.

Agenda Item 11. Consultation with Industry

62. An industry consultation regarding management procedures was conducted at 9:00am, Saturday 7 September 2002. At the consultation, industry was informed of progress in the development of a CCSBT management procedure and the implications for fishery management. Japanese and Australian representatives of their respective fishing industries provided feedback on the management procedure, which will be used in further development processes.

List of Attachments

Attachment 1

List of Participants
CCSBT
3rd Stock Assessment Group Meeting
3 – 6 September 2002
Canberra, Australia

CHAIR

Dr John ANNALA
Science Policy Manager
Ministry of Fisheries
PO Box 1020
Wellington
New Zealand
Phone: +64 4 470 2661
Fax: +64 4 470 2669
Email: annalaj@fish.govt.nz

ADVISORY PANEL

Dr Ana PARMA
Centro Nacional Patagonico
Pueto Madryn, Chubut
Argentina
Phone: +54 2965 451024
Fax: +54 2965 451543
Email: parma@cenpat.edu.ar

Dr James IANELLI
REFM Division
7600 Sand Pt Way NE
Seattle, WA 98115
USA
Phone: +1 206 526 6510
Fax: +1 206 526 6723
Email: jim.ianelli@noaa.gov

Dr John POPE
The Old Rectory
Burgh St Peter
Norfolk, NR34 0BT
UK
Phone: +44 1502 677377
Fax: +44 1502 677377
Email: PopeJG@aol.com

Professor Ray HILBORN
School of Fisheries Box 355020
University of Washington
Seattle, WA 98195
USA
Phone: +1 206 543 3587
Fax: +1 206 685 7471
Email: rayh@u.washington.edu

SCIENTIFIC COMMITTEE CHAIR

Mr Andrew PENNEY
Pisces Environmental Services (PTY) LTD
22 Forest Glade
Tokai Road, Tokai 7945
South Africa
Phone: +27 21 7154238
Fax: +27 21 7154238
Email: apenney@pisces.co.za

CONSULTANT FOR MP

Ms Vivian HAIST
NS Seafood Industry Council
Private Bag 24-901
Wellington
New Zealand
Phone: +64 4 385 4005
Fax: +64 4 385 2727
Email: haistv@u.washington.edu

AUSTRALIA

Dr James FINDLAY
Senior Research Scientist
Fisheries & Marine Science Program
Bureau of Rural Sciences
Dept. of Agriculture, Fisheries & Forestry
PO Box 858, Canberra ACT 2601
Phone: +61 2 6272 5534
Fax: +61 2 6272 3882
Email: james.findlay@affa.gov.au

Dr John KALISH
Program Leader
Fisheries & Marine Science Program
Bureau of Rural Sciences
Dept. of Agriculture, Fisheries & Forestry
PO Box 858, Canberra ACT 2601
Phone: +61 2 6272 4045
Fax: +61 2 6272 3882
Email: john.kalish@affa.gov.au

Dr Tom POLACHECK
Senior Principal Research Scientist
Pelagic Ecosystems Sub-Program
Division of Marine Research
CSIRO PO Box 1538
Hobart, TAS 7001
Phone: +61 3 6232 5312
Fax: +61 3 6232 5012
Email: tom.polacheck@csiro.au

Ms Paige EVESON
Research Scientist
Pelagic Ecosystems Sub-Program
Division of Marine Research
CSIRO P.O. Box 1538
Hobart, Tas 7001
Phone: +61 3 6232 5015
Fax: +61 3 6232 5012
Email: paige.eveson@csiro.au

Dr Dale KOLODY
Research Scientist
Pelagic Ecosystems Sub-Program
Division of Marine Research
CSIRO P.O. Box 1538
Hobart, Tas 7001
Phone: +61 3 6232 5121
Fax: +61 3 6232 5012
Email: dale.kolody@csiro.au

Dr Marinelle BASSON
Senior Research Scientist
Pelagic Ecosystems Sub-Program
Division of Marine Research
CSIRO P.O. Box 1538
Hobart, Tas 7001
Phone: +61 3 6232 5336
Fax: +61 3 6232 5012
Email: marinelle.basson@csiro.au

Mr Jay HENDER
Policy Officer
Fisheries & Aquaculture Branch
Dept. of Agriculture, Fisheries & Forestry
PO Box 858, Canberra ACT 2601
Phone: +61 2 6272 3608
Fax: +61 2 6272 4875
Email: jay.hender@affa.gov.au

Mr Christian McDONALD
Policy Officer
Fisheries & Aquaculture Branch
Dept. of Agriculture, Fisheries & Forestry
PO Box 858, Canberra ACT 2601
Phone: +61 2 6272 5715
Fax: +61 2 6272 4875
Email: christian.mcdonald@affa.gov.au

JAPAN

Dr Sachiko TSUJI
Section Chief
Temperate Tuna Section
National Research Institute of
Far Seas Fisheries
5-7-1 Orido, Shimizu, Shizuoka 424-8633
Phone: +81 543 36 6042
Fax: +81 543 35 9642
Email: tsuji@affrc.go.jp

Dr Norio TAKAHASHI
Senior Reserchер
Temperate Tuna Section
National Research Institute of
Far Seas Fisheries
5-7-1 Orido, Shimizu, Shizuoka 424-8633
Phone: +81 543 36 6043
Fax: +81 543 35 9642
Email: norio@affrc.go.jp

Mr Tomoyuki ITOH
Temperate Tuna Section
National Research Institute of
Far Seas Fisheries
5-7-1 Orido, Shimizu, Shizuoka 424-8633
Phone: +81 543 36 6043
Fax: +81 543 35 9642
Email: itou@affrc.go.jp

Dr Hiroyuki KUROTA
Temperate Tuna Section
National Research Institute of
Far Seas Fisheries
5-7-1 Orido, Shimizu, Shizuoka 424-8633
Phone: +81 543 36 6043
Fax: +81 543 35 9642
Email: kurota@affrc.go.jp

Dr Kazuhiko HIRAMATSU
Section Chief
Mathematical Biology Section
National Research Institute of
Far Seas Fisheries
5-7-1 Orido, Shimizu, Shizuoka 424-8633
Phone: +81 543 36 6014
Fax: +81 543 35 9642
Email: hira@affrc.go.jp

Mr Hiroshi SHONO
Mathematical Biology Section
National Research Institute of
Far Seas Fisheries
5-7-1 Orido, Shimizu, Shizuoka 424-8633
Phone: +81 543 36 6039
Fax: +81 543 35 9642
Email: hshono@affrc.go.jp

Prof Doug BUTTERWORTH
Department of Mathematics and Applied
Mathematics
University of Cape Town
Rondebosch 7701
South Africa
Phone: +27 21 650 2343
Fax: +27 21 650 2334
Email: dll@maths.uct.ac.za

Mr Hisashi ENDO
Deputy Director
International Affairs Division
Resources Management Dept.
Fisheries Agency
1-2-1 Kasumigaseki, Chiyoda-ku
Tokyo 100-8907
Phone: +81 3 3591 1086
Fax: +81 3 3502 0571
Email: hisashi_endo@nm.maff.go.jp

Mr Hajime TAGUCHI
Section Chief
Resources and Environment Research
Division
Fisheries Agency
1-2-1 Kasumigaseki, Chiyoda-ku
Tokyo 100-8907
Phone: +81 3 3501 5098
Fax: +81 3 3502 1682
Email: hajime_taguchi@nm.maff.go.jp

Mr Yuji NISHIMOTO
Section Chief
Far sears Fisheries Division
Fisheries Agency
1-2-1 Kasumigaseki, Chiyoda-ku
Tokyo 100-8907
Phone: +81 3 3502 8479
Fax: +81 3 3591 5824
Email: yuji_nishimoto@nm.maff.go.jp

Mr Nozomu MIURA
International Division
Federation of Japan Tuna Fisheries
Cooperative Associations
3-22 Kudankita 2-chome, Chiyoda-ku
Tokyo 102
Phone: +81 3 3264 6167
Fax: +81 3 3234 7455
Email: section2@intldiv.japantuna.or.jp

Mr Tetsuya Tamai
Counsellor
Agriculture, Forestry & Fisheries
Embassy of Japan
112 Empire Circuit, Yarralumla,
Canberra, A.C.T. 2600 AUSTRALIA
Tel: +61 2 6272 7240
Fax: +61 2 6273 3686
E-mail: tetsuya.tamai@mofa.go.jp

NEW ZEALAND

Dr Talbot MURRAY
Pelagic Project Leader
National Institute of Watr & Atmospheric Research Ltd
PO Box 14-901, Kilbirnie, Wellington
Phone: +64 4 386 0300
Fax: +64 4 386 0574
Email: t.murray@niwa.cri.nz

REPUBLIC OF KOREA

Dr Dae-Yeon MOON
Senior Scientist
Distant-water Fisheries Research Div.
National Fisheries R & D Institute
408-1 Shirang-ri, Kijang-gun
Pusan 619-902
Tel: +82 51 720 2320
Fax: +82 51 720 2337
Email: dymoon@nfrda.re.kr

FISHING ENTITY OF TAIWAN

Dr Shui Kai CHANG(Eric)
Associate Researcher
Deep Sea Fisheries Research and Development Center
Fisheries Administration
Council of Agriculture
No. 1, Fishing Harbour North 1st Road
Chine Cheng District
Kaohsiung 80628, Taiwan
Tel: +886 7 8137437
Fax: +886 7 8136592
Email: skchang@mail.dsfrdc.gov.tw

Dr Shu-Hui WANG
Assistant Resercher
Overseas Fisheries Development Council of the Republic of China
19, Lane 113, Roosevelt Road
Sec. 4, Taipei, Taiwan
Tel: +886 2 2738 1522
Fax: +886 2 2738 4329
Email: jessica@ofdc.org.tw

CCSBT SECRETARIAT

PO Box 37, Deakin West ACT 2600
AUSTRALIA
Phone: +61 2 6282 8396
Fax: +61 2 6282 8407

Mr Brian MACDONALD
Executive Secretary
Email: bmacdonald@ccsbt.org

Mr Morio KANEKO
Deputy Executive Secretary
Email: mkaneko@ccsbt.org

Mr Robert KENNEDY
Database Manager
Email: rkennedy@ccsbt.org.

Ms Kozue LOGHEM
Administrative Officer
Email: kloghem@ccsbt.org

INTERPRETERS

Ms Saemi BABA
Ms Kumi KOIKE

Attachment 2

THIRD STOCK ASSESSMENT GROUP MEETING
CANBERRA, AUSTRALIA
3-6 September 2002

AGENDA

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. Review of fisheries indicators analysis results

6. Assessment approach to be used in 2003

7. Management procedure
   7.1 Overview of steps in the proposed process to develop a MP for SBT
   7.2 Performance of first step of operating models in conditioning to historical data
   7.3 CPUE models
   7.4 Identification of the set of operating models based on 7.3 and other considerations
   7.5 Mechanics for conducting the evaluation tests
   7.6 Testing management procedures
   7.7 Workplan and timetable

8. Other business

9. Finalisation of meeting report

10. Close of meeting

11. Consultation with industry

Attachment 3

List of Documents
Extended Scientific Committee for 7th Scientific Committee (SC) & 3rd Stock Assessment Group (SAG)

(CCSBT-ESC/0209/)

1. Draft Agenda of 3rd SAG
2. List of Participants of 3rd SAG
3. Draft Agenda of the Extended SC for 7th SC
4. List of Participants of the Extended SC for 7th SC
5. List of Documents- The Extended SC for 7thSC&3rd SAG
6. (Secretariat) 5.1.Review of Fisheries Indicators Analysis
7. Initial Specifications of Operating Models for Southern Bluefin Tuna Management Procedure Evaluation. : Haist,V., Parma, A.M. and Ianelli, J.
8. Discussion Document for the CPUE Group. : Pope, J.
9. (Secretariat) 6.1.1. Characterization of SBT Catch
10. (Secretariat) 6.1.3. Scientific Observer Program Standards
11. (Secretariat) 6.1.4.CCSBT Scientific Research program Tagging Program
12. (Secretariat) 6.2.1.Development of the CCSBT Central Database
13. (Secretariat) 6.3 Direct age estimation workshop
14. (Secretariat) 7.1 4th Meeting of the Ecologically Related Species Working Group
15. (Secretariat) 8.2 Monitoring and Estimation of Indonesian Catches
16. (Secretariat) 9. CCSBT Tagging Program- 2003 Cost Estimates
17. (Japan) Data Preparation for Management Procedure Development Work by Japan. : Tuji, S.
18. (Japan) Simulation model toward development of assessment procedures of tagging data. : Kurota., Hiramatsu. and Tsuji.
19. (Japan) Review of the current estimation procedures of Indonesian southern bluefin tuna catch.: Tsuji, S.
20. (Japan) Report of 2001/2002 spawning ground surveys.: Itho., Kurota., Takahashi. and Tsuji.
21. (Japan) Report of 2001/2002 pilot tagging program from longline vessel off Cape Area and proposal for 2002/2003 activity.: Itoh., Tkahashi., Tsuji. and Hosogaya.
22. (Japan) Proposal on Research Mortality Allowance (RMA) in 2002/2003 and Report on Result of RMA in 2001/2002.: JFA.
23. (not to be presented)
24. (Australia) Catch Monitoring of the Fresh Tuna Caught By the Bali-Based Longline Fishery in 2001.: T.L.O. Davis and Andamari, R.
25. (Australia) Length and age distribution of SBT in the Indonesian longline catch on the spawning ground.: Farley, J.H. and Davis, T.L.O.
26. (Australia) Trends in Catch, Effort and Nominal Catch Rates In the Japanese Longline Fishery for SBT – an update.: Daniel Ricard and Tom Polacheck.

27.(Australia) A Review of Recent Trends in Southern Bluefin Tuna Fishery Indicators. :Dale Kolody, Ann Preece, Tom Polacheck, Tim Davis, Jessica Farley, Clive Stanley and John Gunn.
28. (Australia) Further exploration of biomass dynamics models for SBT stock assessment.: Daniel Ricard, Dale Kolody and Marinelle Basson.
29. (Australia) Progress on a Simulation Study to Evaluate Stock Assessment Models for Fisheries Resembling Southern Bluefin Tuna.: Dale Kolody, Ann Preece, Daniel Ricard, Paavo Jumpannen, Tim Jones, Scott Cooper and Tom Polacheck.
30. (not to be presented)
31.(Australia) Estimating a CPUE Series for SBT using Enhanced Tree-based modelling methods.: Venables, W.N and Toscas, P.J.
32.(Australia) Modelling Catch and Effort in the Southern Bluefin Tuna Fishery. : Toscas, P.J., W.J. Venables, M.R Thomas and T. Polacheck.
33(Australia) A method for determining relative weighting factors for length-frequency data.: J. Paige Eveson and Tom Polacheck.
34.(Australia) Issues and process and observation models to be considered for the SBT fishery operating model used to evaluate management procedures.: Dale Kolody, Tom Polacheck, Marinelle Basson and Ann Preece.
35.(Australia) An integrated analysis of the growth rates of southern bluefin tuna for use in estimating catch at age in stock assessments (Main report and the Appendix 9, 10). Polacheck, T., G.M. Laslett and J.P. Eveson
36.(Australia) A pilot study to examine the feasibility of tagging of mature SBT in the western Tasman Sea
37. (Japan) Interpretation by Japan on various fisheries indicators. : Tsuji, Takahashi, Itoh and Shono
38. (Japan) Attempts for estimation of standardized CPUE by tree-regression models and neural network. : Shono
39. (Japan) Preliminary analysis of potential habitat distributions of southern bluefin tuna and fishing vessel. :Takahashi, Tsuji, Inagake, Gunn
40.(Australia) Some Additional Runs of the Initial Operating Model for Southern Bluefin Tuna Management Procedure

(CCSBT-ESC/0209/SBT Fisheries)

Australia…	Australia's 2000-01 Southern Bluefin Tuna Fishing Season.: Hender, J. and Findlay, J.
Japan…	Review of Japanese SBT Fisheries in 2001. : Itoh and Nishimoto.
Korea…	Korean SBT Fisheries in the Indian Ocean. : Moon, D.Y, Koh, J. R and An, D,H.
Fishing Entity of Taiwan…	Review of Taiwanese SBT Fishery.: Chang, S.K and Wang, S.H
New Zealand…	Trend in the New Zealand southern bluefin tuna fishery.: T. Murray and L.Griggs

(CCSBT-ESC/0209/BGD)

(CCSBT-ESC/0209/Info)

1. Report of the SC to CCSBT on the Scientific Research Program (Attachment D of 5th SC Report)
2. Development of a SBT scientific research program including a scientific fishing component by the CCSBT external scientists (Attachment L of the Special Meeting held in November 2000)
3. Research Mortality Allowance (RMA) within the Framework of CCSBT (Attachment M of the Special Meeting held in November 2000)
4. (Japan) Report of the 2001/2002 Shoyo-maru cruise: Southern Bluefin Tuna Spawning Area Survey.: Itoh., Kurota. and Uehara.
5. (Japan) Report of the 2001/2002 field survey activities of Southern Bluefin tuna Sub-group.: FRA, JAMARC and JFA
6. (Japan) Proposal of the 2002/2003 Shunyo-maru survey in the Australia waters.: Japan
7. (Japan) Proposal of the 2002/2003 No.2 Taikei-maru survey in the Australia waters.: Japan
8. Southern Bluefine Tuna Recruitment Monitoring and Tagging Program.: Report of the fourteenth workshop
9. (Australia) Spatio-temporal Trends of Longline Fishing Effort in the Southern Ocean and Implications for Seabird Bycatch.: Geoff N. Tuck, Tom Polacheck and Cathy Bulman.
10. (Australia) Application of an age-structured production model (ASPM) to the Indian Ocean bigeye tuna (Thunnus obesus) resource.: Daniel Ricard and Marinelle Basson
11. (Australia) Further considerations on the analysis and design of aerial surveys for juvenile SBT in the Great Australian Bight.: Mark Bravington.
12. (Australia) Commercial Aerial Spotting for Southern Bluefin Tuna in the Great Australian Bight by Fishing Season 1982-2000.: Neil Klaer, A. Cowling and Tom Polacheck.
13. (Australia) Aerial survey indices of abundance: comparison of estimates from line transect and "unit of spotting effort" survey approaches.: Farley. J. and Bestley, S.
14. Resolution to establish an Extended Commission and an Extended Scientific Committee (Attachment I of the Report of the Seventh Annual Meeting held in April 2001)

(CCSBT-ESC/0209/Rep)

1. Report of the Management Strategy Workshop (May 2000)
2. Report of the Fifth Meeting of the Scientific Committee (March 2001)
3. Report of the Seventh Annual Commission Meeting (April 2001)
4. Report of the Second Meeting of the Stock Assessment Group (August 2001)
5. Report of the Sixth Meeting of the Scientific Committee (August 2001)

6. Report of Tagging Program Workshop (October 2001)
7. Report of the Eighth Annual Commission Meeting (October 2001)
8. Report of the Fourth Meeting of Ecologically Related Species Working Group (November 2001)
9. Report of the First Meeting of Management Procedure Workshop (March 2002)
10. Report of the CPUE Modelling Workshop (March 2002)
11. Report of Direct Age Estimation Workshop (June 2002)

Classification of List of Documents

(CCSBT-ESC/0209/)
Documents to be discussed at the meeting and not yet given a document number of CCSBT, to be classified into this category.

(CCSBT-ESC/0209/BGD)
Documents to be discussed at the meeting and already given a document number of CCSBT in the previous meeting, to be classified into this category.

(CCSBT-ESC/0209/Info)
Documents not to be discussed at the meeting but presented for information and reference, to be classified into this category.

(CCSBT-ESC/0209/Rep)
The previous report of CCSBT to be classified into this category.

(CCSBT-ESC/0209/SBT Fisheries-)
SBT Fisheries Reviews of countries and entities to be classified into the category.

(CCSBT-ESC/0209/WP)
The draft of the document and report developed through the discussion of the meeting and documents of informal meetings, to be classified into this category.

Attachment 4

Section 9 of the Report of the First Meeting of the Management Procedure Workshop

9. Workplan and Timetable

59. The following was agreed to be the workplan and timetable for completion of the scientific tasks related to development and testing of SBT OM's and MP's. This timetable does not attempt to address the need for iterative consultation with industry and managers during this process, which is recognised as being essential.

	Task:	Completion by:
9.1	Compile conditioning data	May 1, 2002
9.2	Prepare/debug computer code	August, 2002
9.3	Estimate model parameters by conditioning on historical data	August, 2002
9.4	Conduct first set of simulation trials using a few simple MP candidates	August, 2002
9.5	Meet inter-sessionally to examine model fits and consider the choice of operating models	SAG meeting, September 2002
9.6	Make code and input parameters (for different operating models) available to national scientists so that they can test different MPs using chosen set of operating models	2 weeks after SAG meeting (may not include the posterior distributions for Step 4 initially)
9.7	Continue with MP trials and document results	
9.8	Hold Workshop II – update data for final conditioning estimations, produce final specifications of operating models (robustness tests), and consider results for initial candidate MPs	Feb/March, 2003
9.9	Continue with MP trials and document results	
9.10	Inter-sessional meeting – evaluate conditioning and assign weights to alternate hypotheses (new Step 5, old step 4.5) and consider results for penultimate candidate MPs	SAG meeting, September 2003?
9.11	Continue with MP trials and document results	
9.12	Hold Workshop III – consider results for final candidate MPs and evaluate results, formulate conclusions and provide advice	March 2004

60. It was noted that this is a very full work schedule, particularly for those national scientists involved in preparation of data and development and testing of candidate MPs.

Attachment 5

Report of the CPUE Steering Group.

The CPUE Group met from 0900 to 1230h- Wednesday 4th Sept. 02 and from 1700 to 1830h – Thursday 5th Sept. 02. Papers CCSBT-ESC/0209/ {8, 31, 32, 38 and 39} and reports CCSBT-ESC/0209/Rep {9 and 10} were relevant to the proceedings and had been presented or tabled in Plenary. Issues discussed were those concerned with providing inputs to Management procedures.

It was agreed that in order for a management procedures to be implemented it will be essential to have consensus on a single series of Long-Line CPUE to be used by the March 2004 MPWS III. As far as is possible a definitive CPUE series would need to meet the criteria agreed at the March 2002 CPUE workshop and set out in Table 1 of CCSBT-ESC/0209/Rep9. It should also be a consistent estimator of stock abundance independent of different age structure, spatial distribution and changes in catchability, particularly those that might be anticipated to result from successful rebuilding of the stock. It should also remain a consistent estimator despite changes in fleet behavior, particularly those that might result from the Management Procedure being adopted (e.g. restrictive harvest rates). Hence, the development of a definitive CPUE series should be focused upon achieving good future performance. However, to be useful it would certainly have to span the recent past (at least 10 years) and if possible further back in time. It is possible that its backward extension in time might be limited by the available time-series of any concomitant variables used in its construction (for example if sea temperature were used). If the definitive CPUE series is not capable of being extended back over all years then pragmatic extensions may be required. Results from earlier years might be obtained by inter-calibrating it to existing CPUE series to provide backward extensions of the CPUE series if these are required for use in any proposed Management Procedure.

Any satisfactory definitive CPUE series for use in MP should be robust and all parties must agree it. Therefore, joint development in a small working group was seen as the best way to arrive at a consensus decision on a robust CPUE series to be used operationally in the adopted Management Procedure. Such a working group would need to be organized in a fashion which allowed detailed analysis of catch and effort data and concomitant variables while respecting the confidentiality of Japanese commercial data and protecting the intellectual property of the Japanese fleet. The Working Group would necessarily need to meet in Japan, perhaps several times, for the work to be completed. Tentative Terms of Reference for such a working group are provided at Box 1.

Box 1. Tentative Terms of Reference for the Working Group for the Development of Robust CPUE Series.

A) To review and summarize literature on SBT CPUE and catchability and the relevant history of the Tuna L-L industry.

B) To analyze existing LL CPUE data to identify those factors (particularly those most likely to change as a result of the adoption of MP) which could change SBT catchability and hence bias CPUE series.

C) To propose a single agreed CPUE series, robust to the factors identified under B), for use in Management Procedure rules.

D) To indicate the likely bias and variance characteristics of the CPUE series proposed under C.

E) To propose any further research needed to quantify the bias and variance of the CPUE series identified.

For such a working group to provide the definitive CPUE time series by the March 2004 deadline obviously requires that it had met before that date. However, due to the lengthy and iterative nature of the analysis work and given the heavy commitments of key participants to other projects during 2002-04 it was considered impractical to hold a CPUE Working Group before March 2004. Hence, it will be necessary to depend upon a default series for the early years of operation of MP. The adoption of a default CPUE series would allow more time for detailed CPUE analysis to take place and for a definitive robust CPUE to be agreed.

It was agreed that either the default series should be the nominal CPUE series (a choice that would emphasize simplicity and transparency) or the median of the 5 series identified in CCSBT-ESC/0209/Rep10 (a choice that emphasizes stability and possibly consistency). It was considered that in the early years of managing by a management procedure the population level and harvest rates would likely remain close to existing levels and therefore these default CPUE series would not suffer unduly from changes in stock or fleet behavior. However, such pressures on the ability of these CPUE series to monitor stock biomass change will doubtless arise with time. It is thus imperative that any default series adopted should be replaced, no later than 2009, by a definitive CPUE series to be developed jointly by the proposed working group (i.e. after not more than 5 years from a management procedure being implemented). In the event of there being substantial changes in the timing or spatial distribution of long-line fishing it might become necessary to develop and adopt a robust CPUE on a more urgent time-scale.

The successful adoption of a default CPUE series will require attention to several tasks. It will be important to provide indications of the likely bias and variance characteristics of the agreed default series for use in data conditioning. Since it is likely that these characteristics will differ from those of the final adopted CPUE series, data conditioning and testing of Management Procedures will need to allow for these differences. It will also be imperative that the default series be adjusted to take account of problems of bias in the CPUE estimate of the most recent year. Such biases result from the most recent year's CPUE being calculated from data from the RTMP rather than from the logbook data that are not fully available within a year. It will also be important that definitive software be identified to allow the CCSBT Secretariat to calculate the agreed default CPUE series.

The discussions of the CPUE steering group indicated future work:-

A) To propose which default CPUE series is to be adopted for use in the first 5 years of a MP at the next MPWS.
B) To propose appropriate calibration methods for the most recent year's CPUE of the default series since these are based on RTMP data. (For discussion at the next MP)
C) To indicate appropriate bias and variance characteristics of the default series for use in data conditioning. (To be discussed intersessionally)
D) To identify the definitive software for calculating the default CPUE series and make it available to Secretariat. (no later than MPWS III)
E) To discuss suitable analyses to be conducted under ToR B of the working group.
F) To initiate the literature review proposed for the working group (ToR A) by developing a reference list of key papers on CPUE related topics and the historical development of the SBT fisheries. Members of the Steering group and other interested parties are invited to send references (and where appropriate copies) of 5 key papers on these subjects to Secretariat for circulation.

Attachment 6

Summary Figures from Alternative Model Specifications

The following summarizes the presentations of alternative model runs analyzed and discussed during the 3rd SAG meeting. These alternatives were derived from the initial specifications outlined in CCSBT-ESC/0209/7.

NOTE: an additional model (designated "h6mcmc") was specified for running an example of a full-integration for the management procedures. This model will be specified to estimate the natural mortality (with a diffuse prior) and with steepness (h) fixed a 0.6.

List of Figures

Figure 1. List of 18 initial model specifications (and defaults)

Initial Model Name	*h*	M10	SigmaR		New model name
Mod1	**0.3**	**0.10**	**Est**		**h3m10**
Mod2	**0.6**	**0.10**	**Est**		**h6m10**
Mod3	**0.9**	**0.10**	**Est**	**Defaults**	**h9m10**
Mod4	0.3	0.05	Est	Fix M10, uniform prior for M0, 0.2-0.6	
Mod5	**0.6**	**0.05**	**Est**	Downweight early data (including LL4), pre 1965	**h6m05**
Mod6	0.9	0.05	Est	LL1 Selectivity change every 4 years, CV~50%	
Mod7	**0.3**	**0.15**	**Est**	Minimum value for Sigma index = 0.1	**h3m15**
Mod8	**0.6**	**0.15**	**Est**		**h6m15**
Mod9	**0.9**	**0.15**	**Est**		**h9m15**
Mod10	0.6	0.1	0.1		
Mod11	0.9	0.1	0.1		
Mod12	0.6	0.05	0.1		
Mod13	0.9	0.05	0.1		
Mod14	0.6	0.15	0.1		
Mod15	0.9	0.15	0.1		
Additional runs				**Change from default**	
Mod16	0.3	0.15	Est	Fix m0=0.4	
Mod17	**0.6**	**0.15**	**Est**	**Fix m0=0.4**	**h6m15d1**
Mod18	0.9	0.15	Est	Fix m0=0.4	

Figure 2. Likelihoods and priors for initial 15 models

Likelihoods

Model	Total -lnL	LL1	LL2	LL3	LL4	Indon.	Aust.	CPUE	Tag data
1	1209.2	260.2	41.9	604.0	184.9	42.6	108.8	-47.1	13.9
2	1203.4	259.5	42.2	596.9	186.1	41.1	106.8	-42.9	13.6
3	1191.7	255.8	42.6	592.7	180.2	41.2	105.6	-39.8	13.4
4	1205.7	260.5	42.4	595.8	184.1	45.6	106.9	-43.2	13.7
5	1194.4	257.1	42.7	591.0	179.8	44.8	105.7	-40.3	13.6
6	1188.6	255.0	42.8	590.7	176.7	44.9	105.5	-40.4	13.5
7	1210.0	258.4	41.7	607.5	183.6	41.9	109.2	-47.0	14.7
8	1206.8	258.2	42.2	603.3	186.1	40.8	107.5	-44.8	13.6
9	1196.8	255.6	42.5	597.6	183.6	40.7	106.3	-42.8	13.4
10	1272.7	281.7	42.7	621.1	197.4	39.5	117.9	-42.3	14.7
11	1292.6	276.0	42.4	625.1	197.2	39.7	119.2	-20.5	13.6
12	1294.5	276.4	42.3	622.8	191.8	42.8	117.8	-12.7	13.4
13	1302.0	275.6	42.3	624.1	192.2	42.8	118.9	-7.4	13.6
14	1265.7	278.1	43.0	625.6	194.5	40.0	118.3	-47.4	13.7
15	1283.6	277.3	42.7	626.6	201.7	42.3	119.7	-43.7	17.0

Priors

Model	select change	select. smooth	Stock-Recruit	M0	M10	Rho	Steep-ness		Total
1	42.4	57.9	-76.0						1233.6
2	42.8	57.5	-57.8						1245.9
3	43.5	56.8	-36.2						1255.8
4	41.5	61.7	-60.7						1248.3
5	42.4	60.4	-36.5						1260.7
6	43.0	59.6	-25.7						1265.4
7	43.4	56.5	-75.6						1234.3
8	43.3	56.1	-66.6						1239.6
9	43.3	56.0	-48.3						1247.7
10	44.3	59.0	-105.5						1270.4
11	45.0	57.7	-97.5						1297.8
12	44.5	60.9	-102.6						1297.4
13	45.1	60.8	-99.5						1308.3
14	44.2	56.8	-108.3						1258.4
15	43.5	56.8	-89.0						1294.8

Figure 3. Parameter values for models 1-9.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
No. params.	413	413	413	413	413	413	413	413	413
value	1233.56	1245.85	1255.84	1248.26	1260.74	1265.42	1234.32	1239.58	1247.73
B0	1194.7	900.3	823.0	2084.7	1793.8	1761.5	955.1	691.1	579.1
(sd)	(86.8)	(69.5)	(93.6)	(166.4)	(193.5)	(238.7)	(86.4)	(49.3)	(31.6)
B1980	486.3	317.5	372.8	1082.6	994.2	1096.9	413.8	247.5	230.1
B2002	168.4	136.2	182.2	504.8	509.2	597.5	170.0	149.1	162.4
(sd)	(29.1)	(26.9)	(43.2)	(76.6)	(105.4)	(147.5)	(31.6)	(20.6)	(14.7)
B(1980)/B(0)	0.14	0.15	0.23	0.24	0.28	0.33	0.18	0.22	0.29
B(2002)/B(1980)	0.34	0.43	0.50	0.45	0.50	0.53	0.40	0.62	0.74
(sd)	(.02)	(.04)	(.05)	(.02)	(.03)	(.03)	(.03)	(.06)	(.1)
Emp. Rho	0.63	0.70	0.78	0.69	0.78	0.80	0.63	0.67	0.74
Steepness	0.30	0.60	0.90	0.30	0.60	0.90	0.30	0.60	0.90
SigmaR	0.21	0.27	0.36	0.26	0.36	0.42	0.21	0.24	0.31
(sd)	(.03)	(.04)	(.05)	(.04)	(.05)	(.05)	(.03)	(.03)	(.04)
Emp. SigmaR	0.21	0.27	0.36	0.26	0.36	0.42	0.21	0.24	0.31
Sigma Index	0.14	0.16	0.17	0.16	0.17	0.17	0.14	0.15	0.16
M age 0	0.33	0.30	0.26	0.38	0.34	0.33	0.22	0.20	0.20
M age 10	0.10	0.10	0.10	0.05	0.05	0.05	0.15	0.15	0.15
M slope	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.77	0.30

Figure 4. Parameter values for models 10-15.

	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15
No. params.	412	412	412	412	412	412
value	1270.44	1297.82	1297.35	1308.28	1258.41	1294.84
B0	992.6	1086.0	2885.3	3054.6	738.1	581.7
(sd)	(55.3)	(28.1)	(295.3)	(98.3)	(15.3)	(11.7)
B1980	281.6	340.0	1576.6	1711.5	215.7	137.3
B2002	132.7	275.7	938.6	1117.4	151.8	172.1
(sd)	(24.5)	(27.)	(170.6)	(86.1)	(11.)	(12.1)
B(1980)/B(0)	0.14	0.28	0.33	0.37	0.21	0.32
B(2002)/B(1980)	0.49	0.88	0.60	0.67	0.74	1.35
(sd)	(.04)	(.05)	(.02)	(.02)	(.04)	(.1)
Emp. Rho	0.67	0.71	0.68	0.70	0.66	0.74
Steepness	0.60	0.90	0.60	0.90	0.60	0.90
SigmaR						
(sd)						
Emp. SigmaR	0.13	0.14	0.13	0.13	0.12	0.14
Sigma Index	0.16	0.32	0.41	0.48	0.14	0.15
M age 0	0.26	0.20	0.20	0.20	0.20	0.20
M age 10	0.10	0.10	0.05	0.05	0.15	0.15
M slope	1.20	0.30	0.65	0.30	0.30	0.30

Figure 5. Model 16-18 results (with M0 fixed at 0.4, otherwise identical to model 8)

M0=0.4 Models

Likelihoods

Model	Total -lnL	LL1	LL2	LL3	LL4	Indon.	Aust.	CPUE	Tag data
16	1212.7	258.8	41.9	607.4	184.2	42.1	111.0	-47.0	14.3
17	1207.0	258.5	42.4	600.9	187.1	41.0	109.2	-45.4	13.6
18	1191.2	254.9	42.8	593.4	181.6	41.0	107.9	-44.3	13.9

Priors

Model	select change	select. smooth	Stock-Recruit	M0	M10	Rho	Steep-ness		Total
16	43.2	58.2	-76.4						1237.7
17	42.6	57.9	-62.0						1245.5
18	42.7	57.8	-35.7						1256.0

Figure 6. Model 16-18 results continued.

M0=0.4 Models

	Model 16	Model 17	Model 18
No. params.	412	412	412
value	1237.67	1245.46	1255.98
B0	903.6	618.9	492.9
(sd)	(69.9)	(30.1)	(30.2)
B1980	368.6	206.1	203.5
B2001	145.1	115.8	121.1
(sd)	(23.8)	(10.5)	(11.8)
B(1980)/B(0)	0.16	0.19	0.25
B(2002)/B(1980)	0.38	0.57	0.61
(sd)	(.03)	(.05)	(.07)
Emp. Rho	0.62	0.69	0.78
Steepness	0.30	0.60	0.90
SigmaR	0.21	0.25	0.37
(sd)	(.03)	(.03)	(.04)
Emp. SigmaR	0.14	0.15	0.37
Sigma Index	0.16	0.16	0.15
M age 0	0.40	0.40	0.40
M age 10	0.15	0.15	0.15
M slope	0.32	0.30	0.30

Figure 7. Model 1.

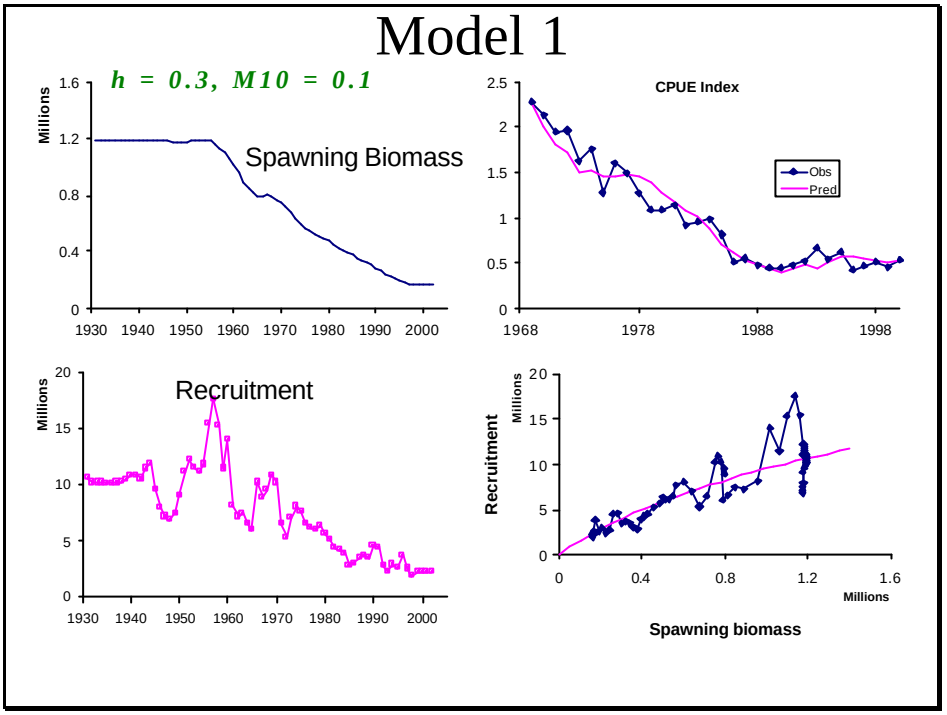


Figure 8. Model 2.

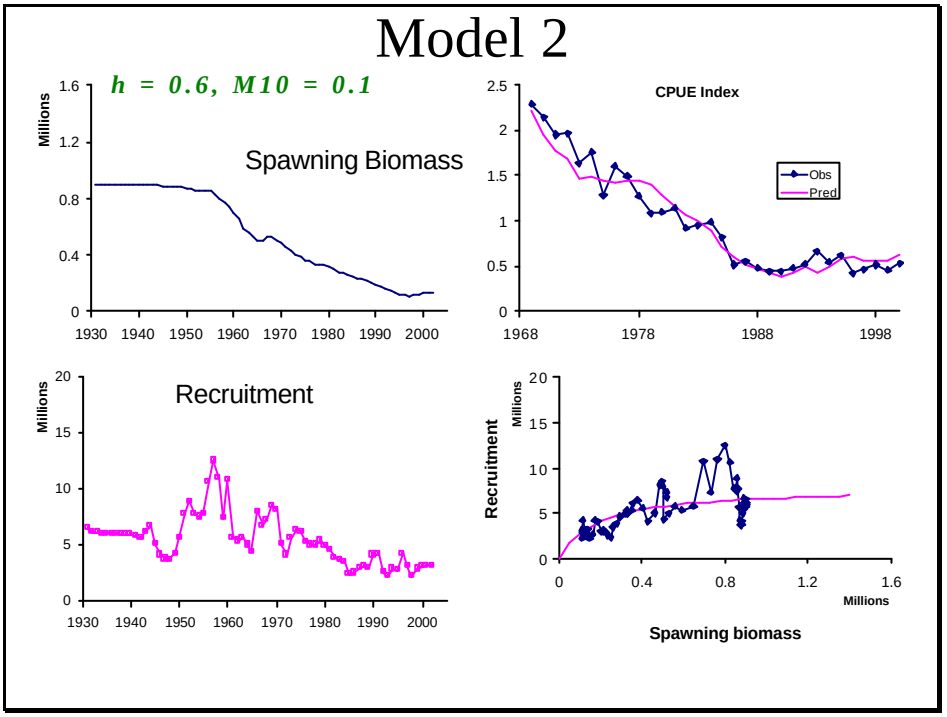


Figure 9. Model 3.

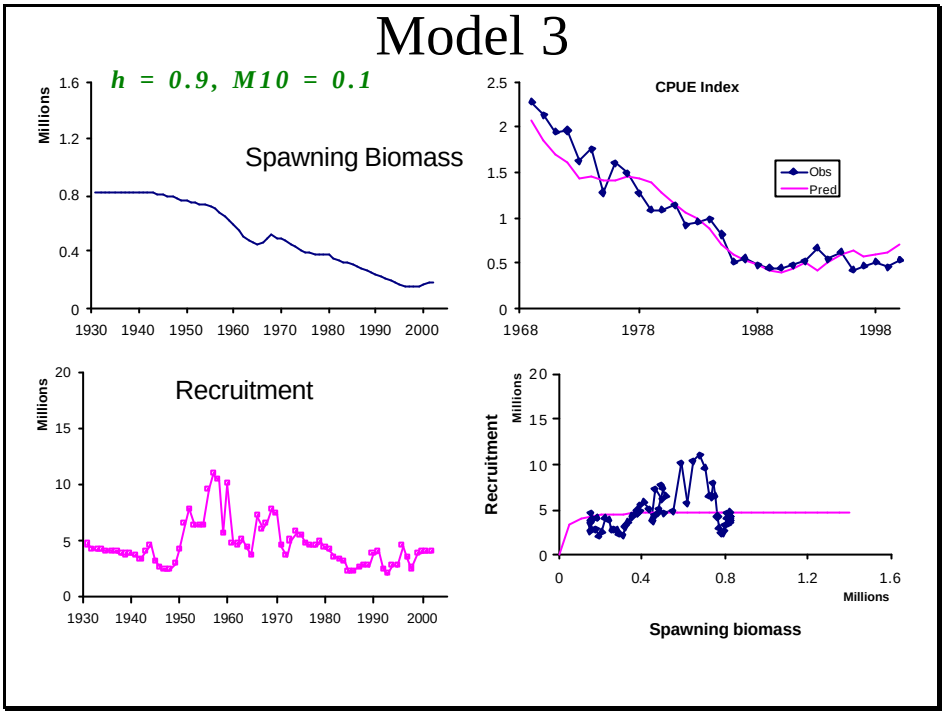


Figure 10. Model 4.

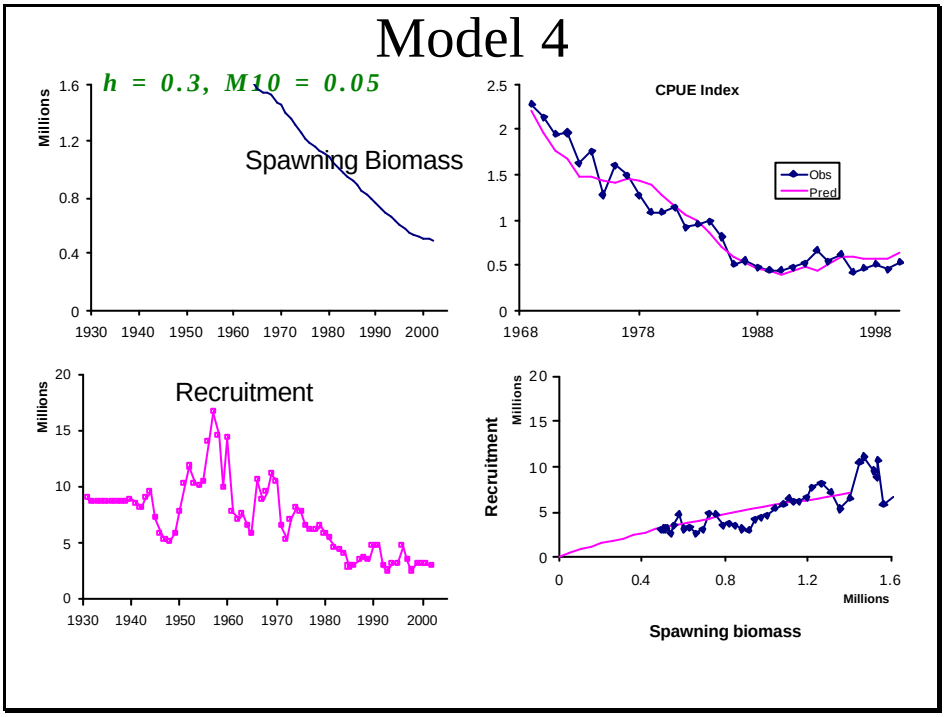


Figure 11. Model 5.

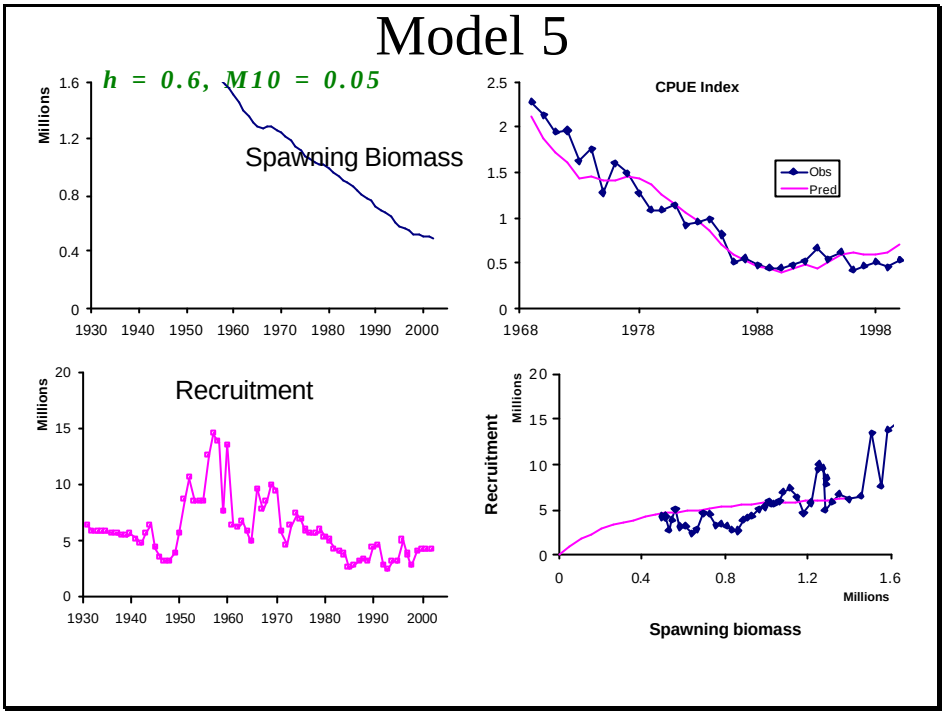


Figure 12. Model 6.

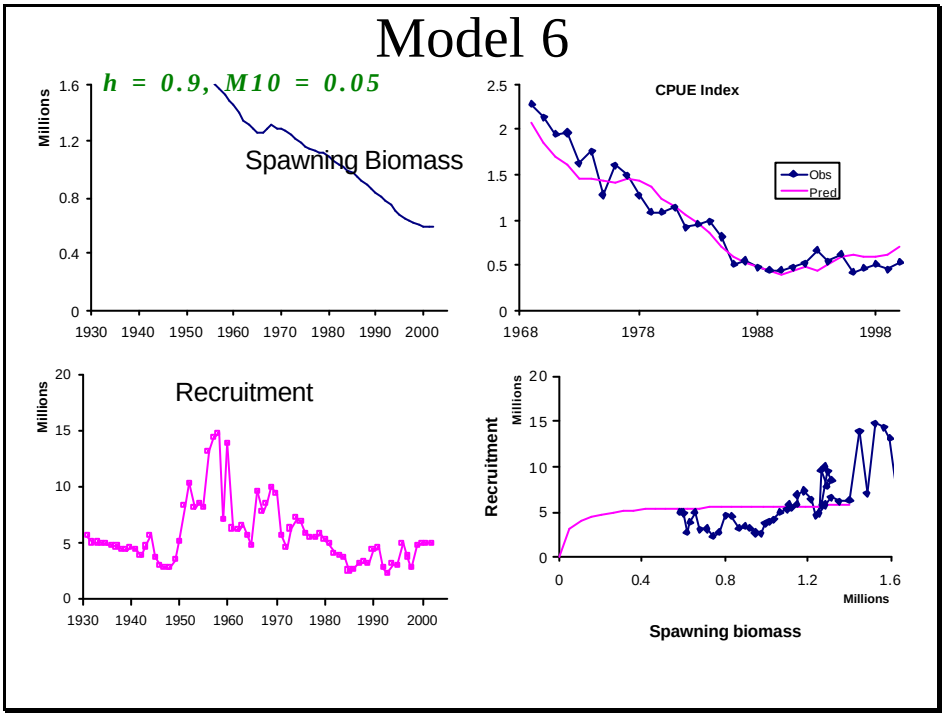


Figure 13. Model 7.

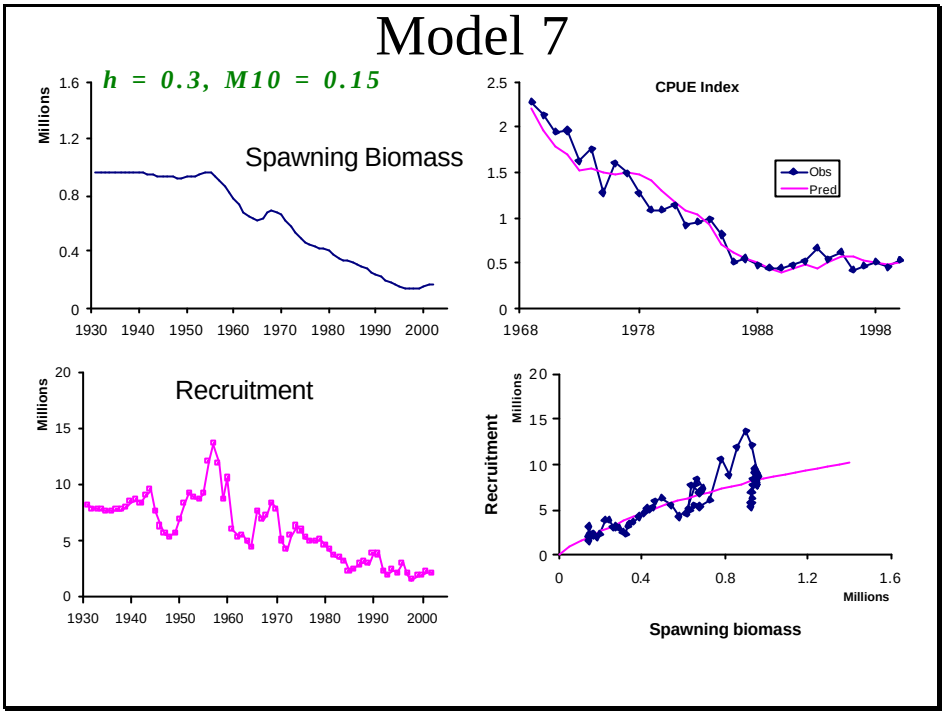


Figure 14. Model 8.

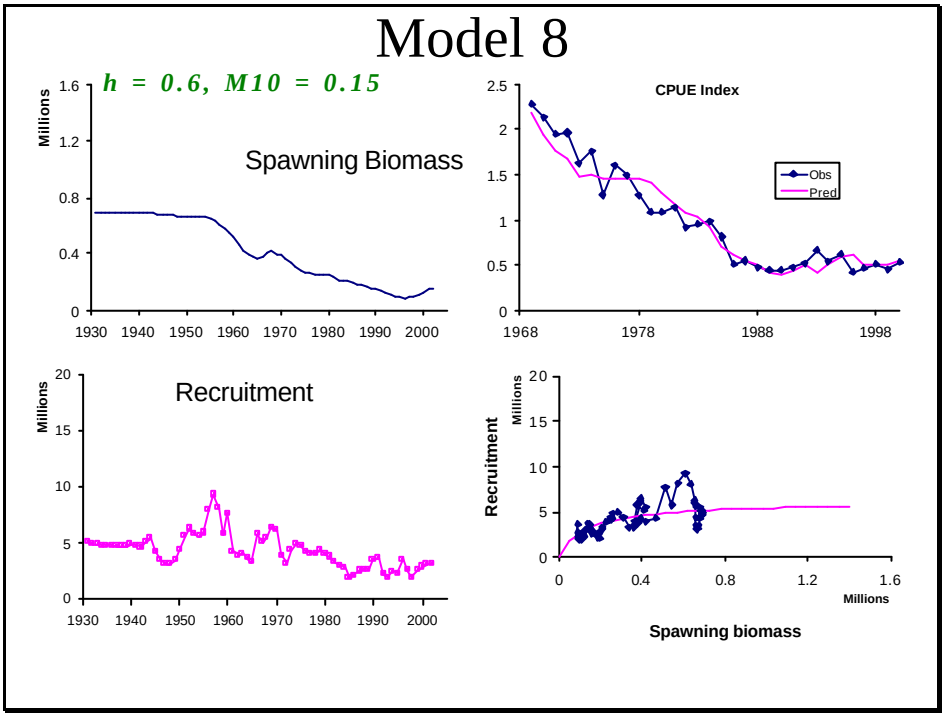


Figure 15. Model 9.

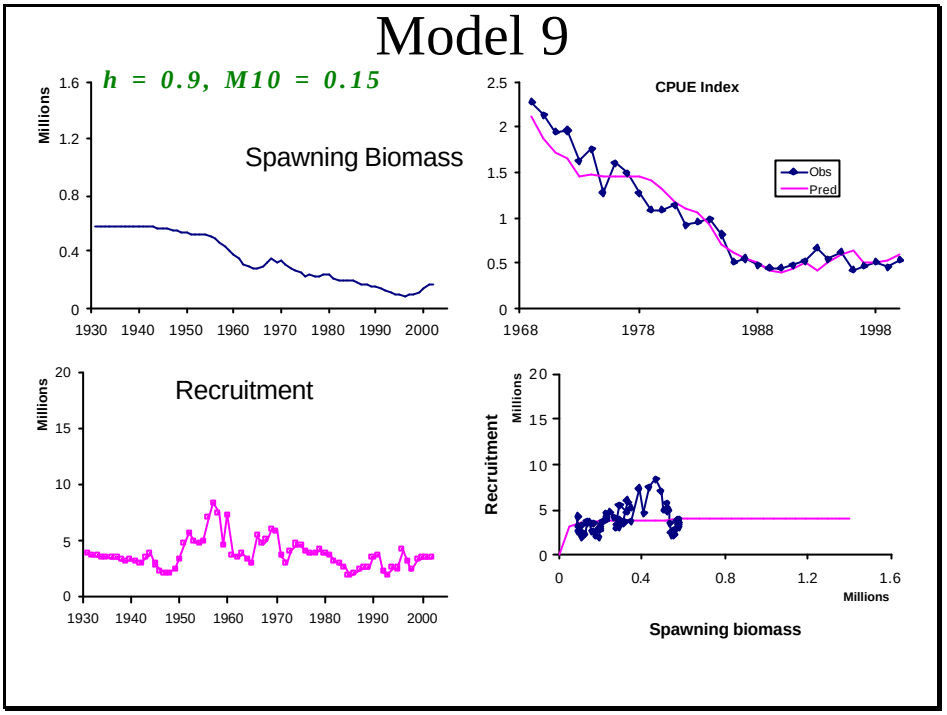


Figure 16. Model 10.

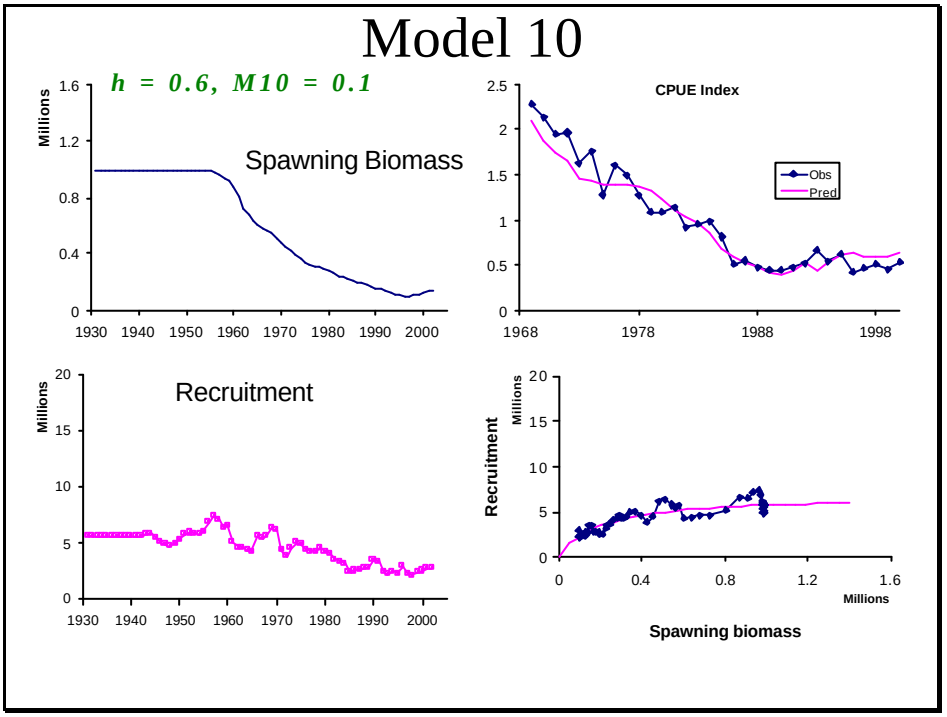


Figure 17. Model 11.

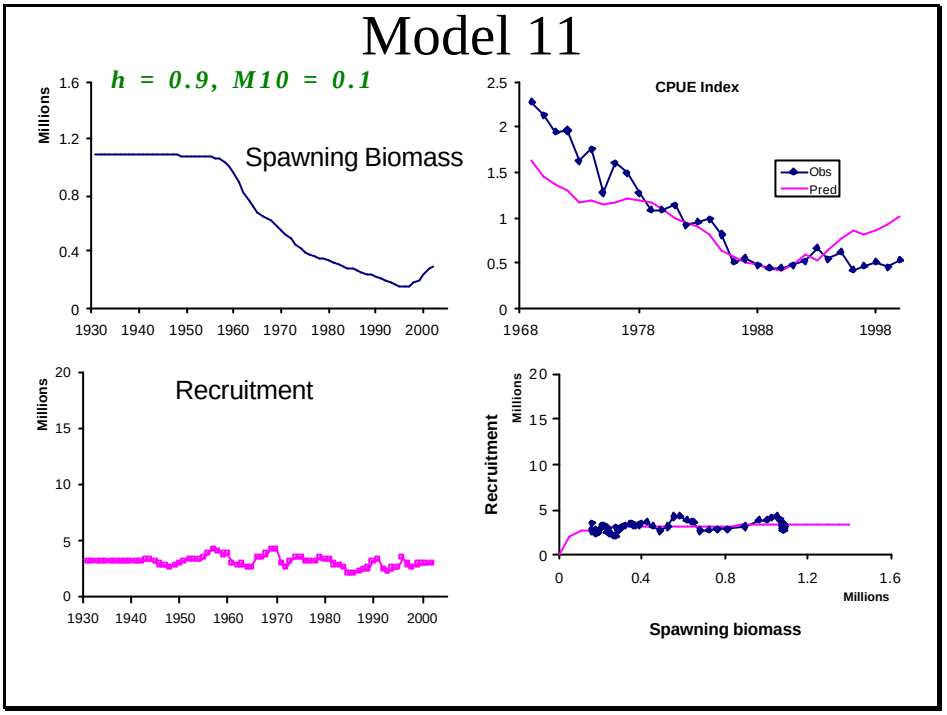


Figure 18. Model 12.

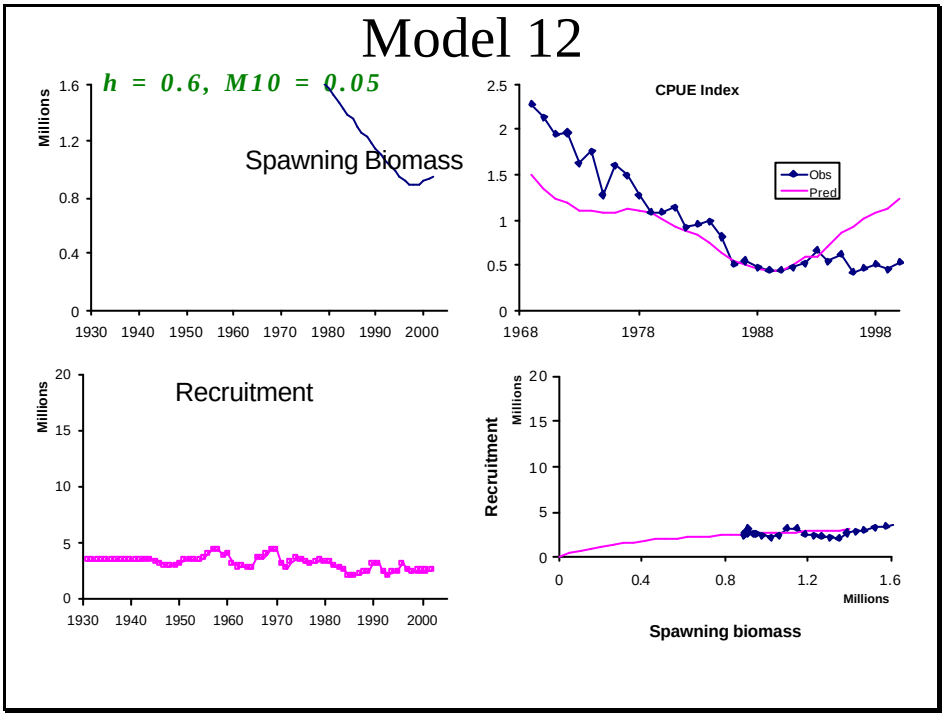


Figure 19. Model 13.

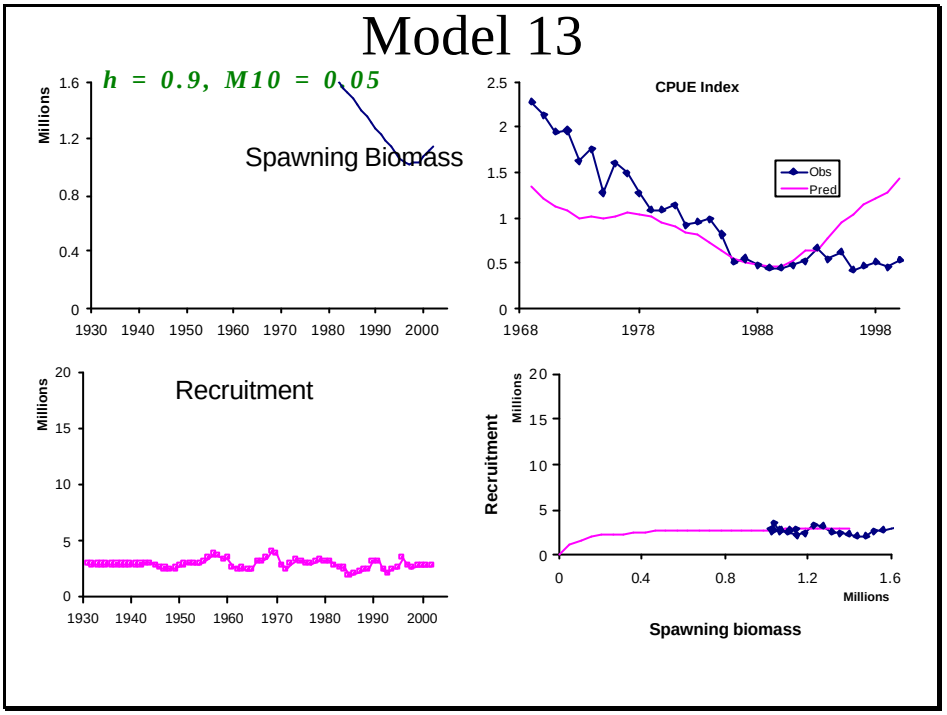


Figure 20. Model 14.

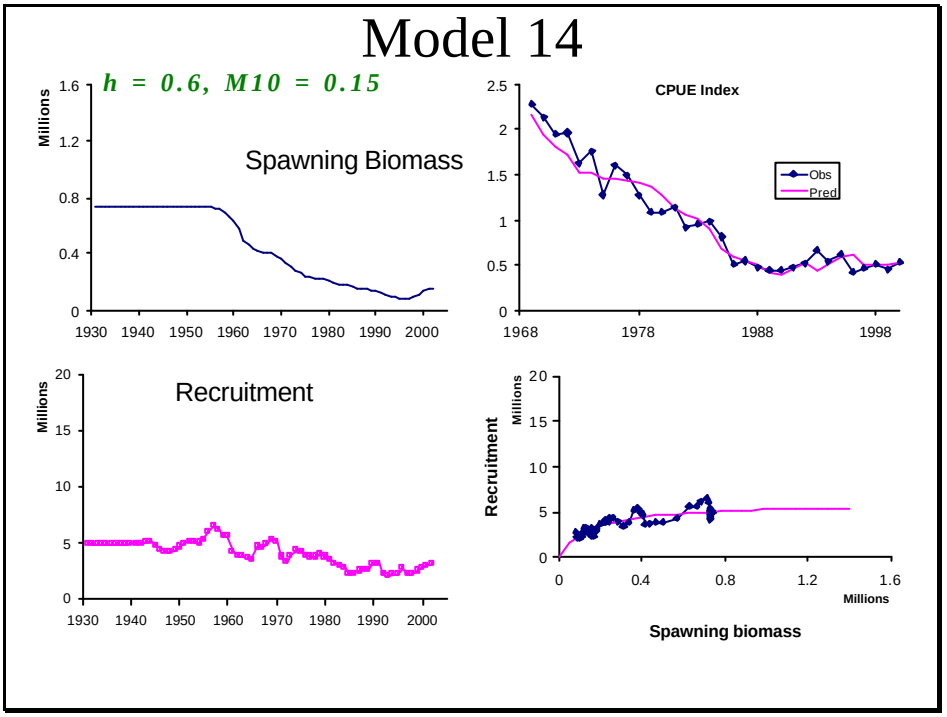


Figure 21. Model 15.

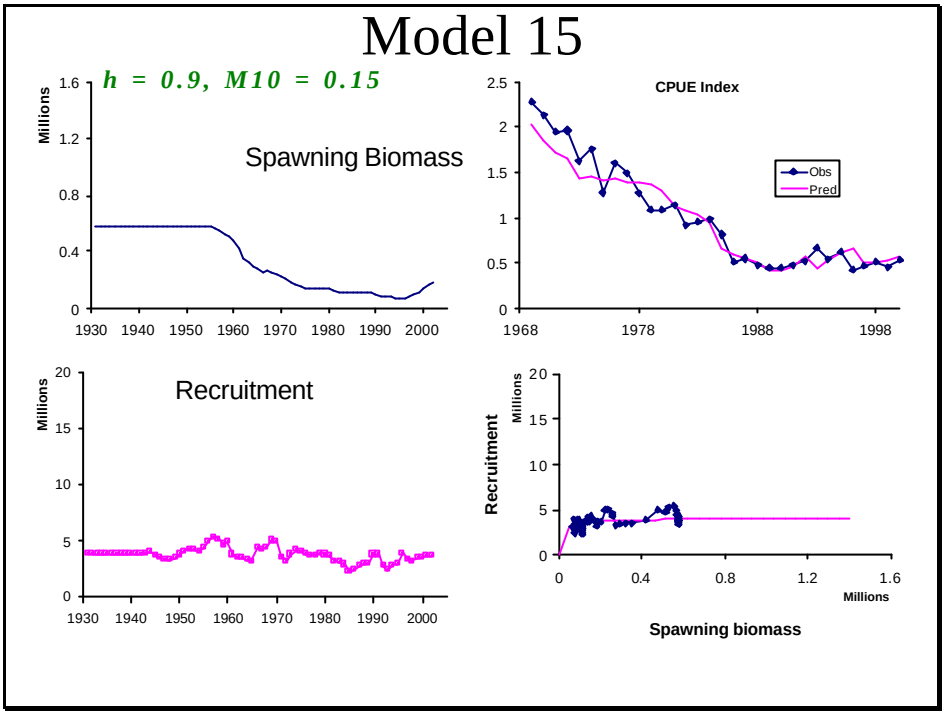


Figure 22. Model 16.

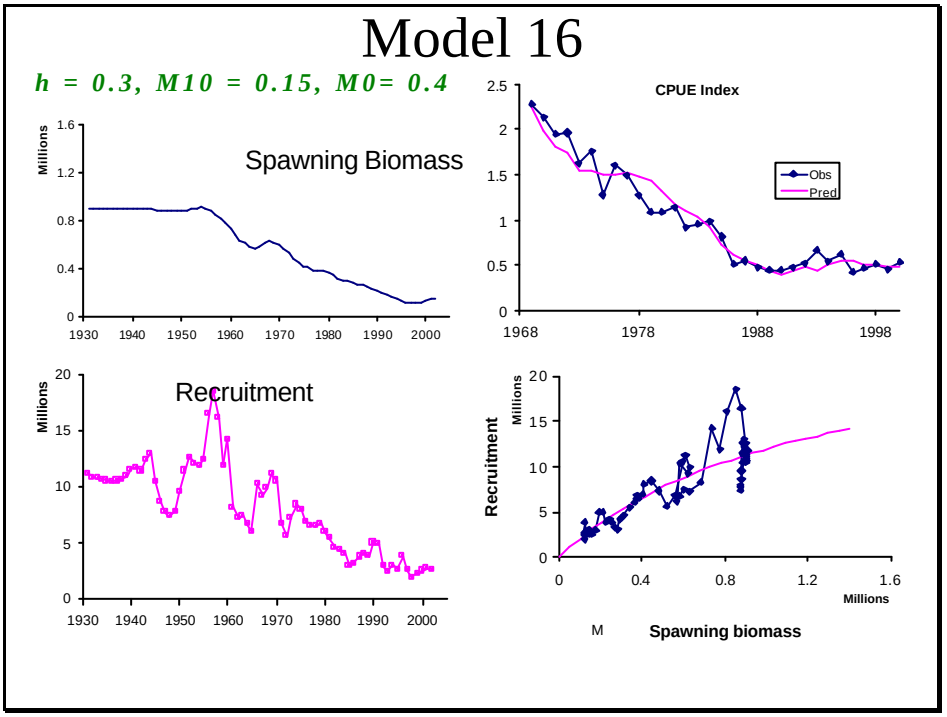


Figure 23. Model 17.

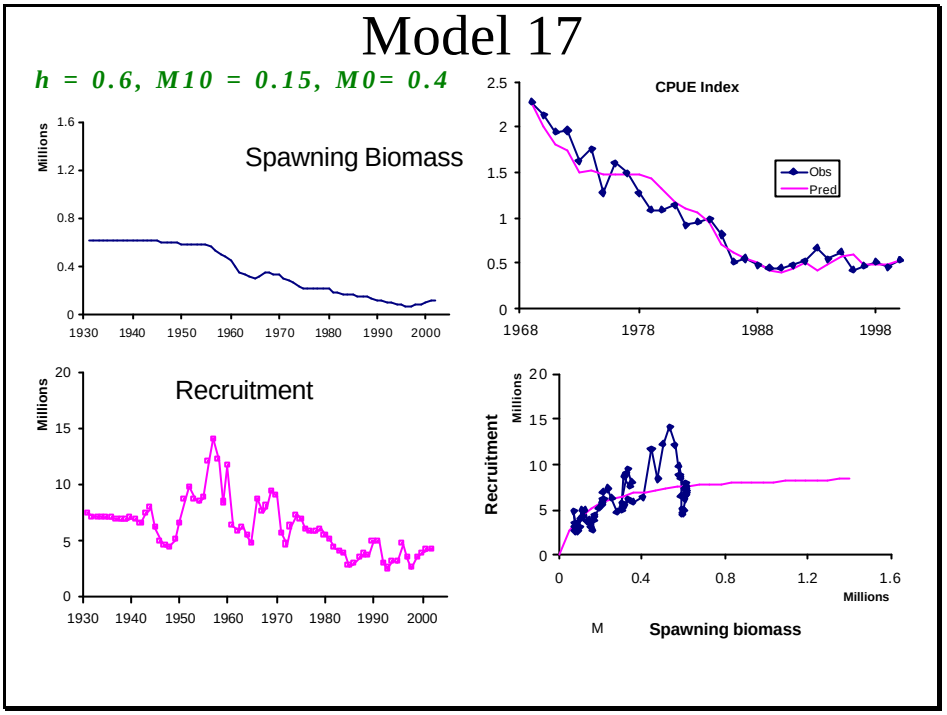


Figure 24. Model 18.

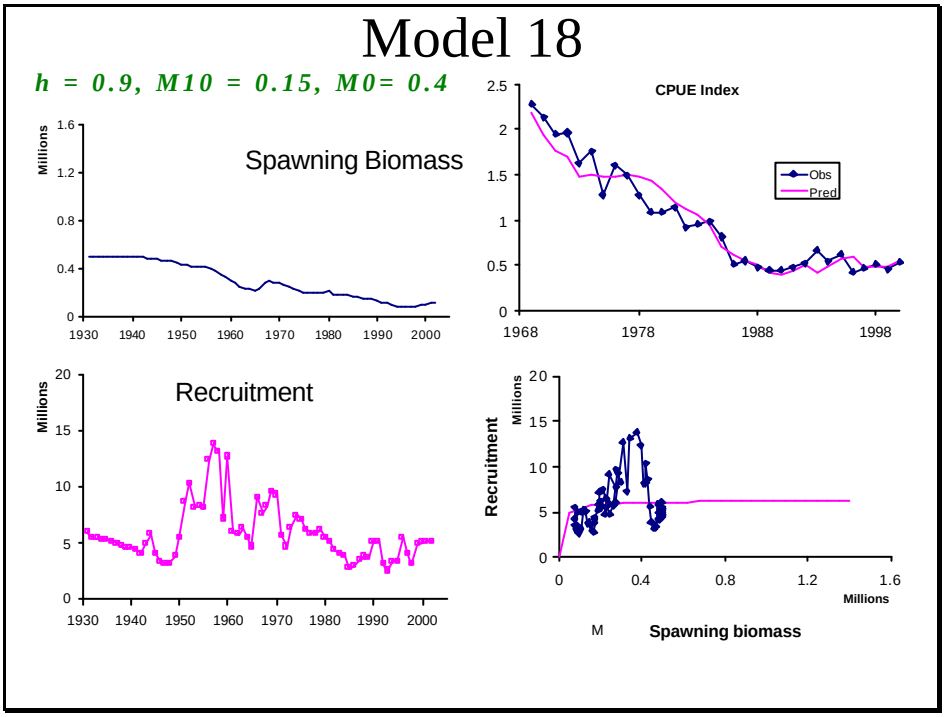


Figure 25. Comparisons of selectivity differences in Models 1 & 2.

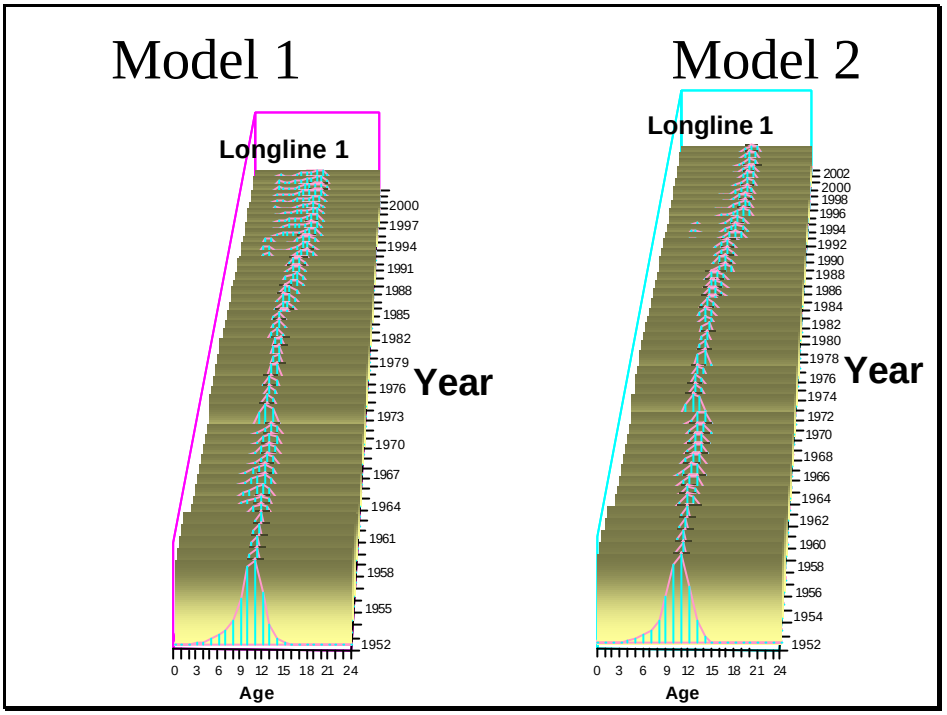


Figure 26. Comparisons of selectivity differences between Model 5 & 8.

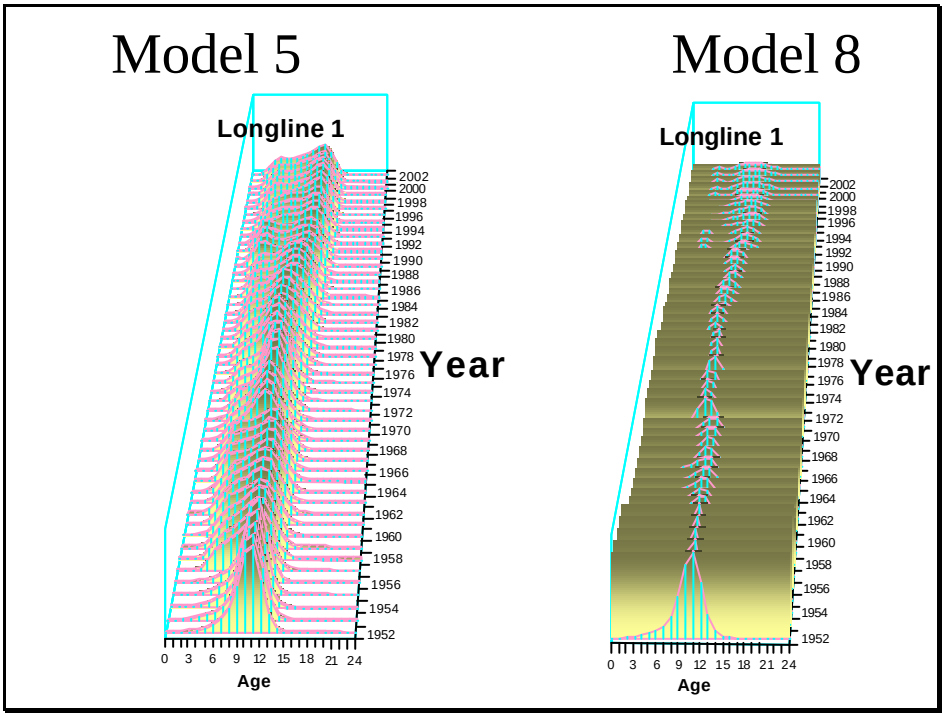


Figure 27. Comparisons of selectivity differences between Model 8 & 17.

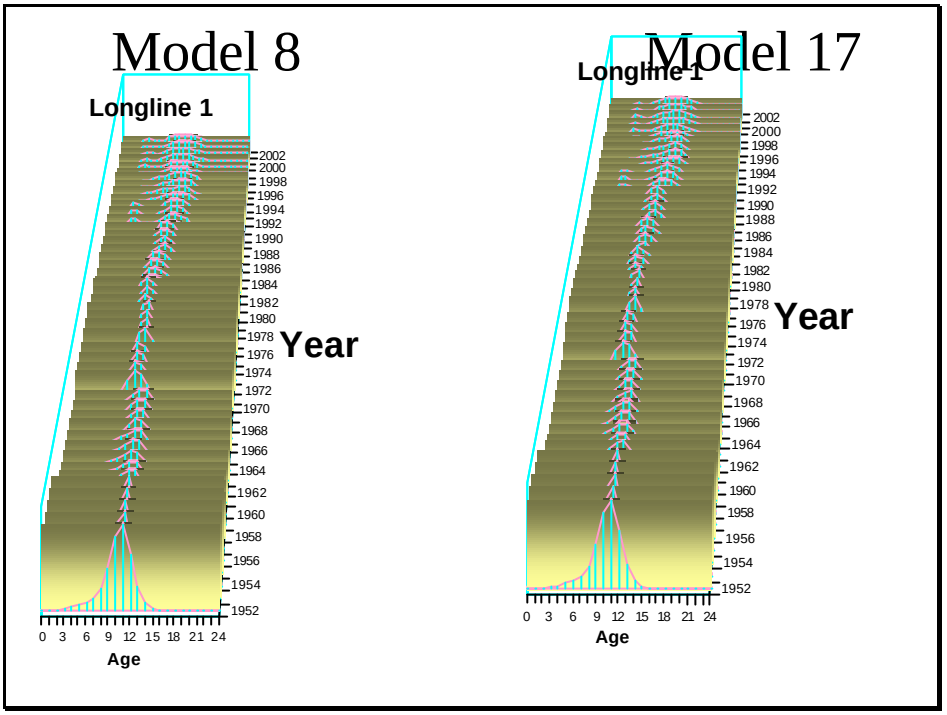


Figure 28. Comparisons of selectivity differences between Model 8 & 17.

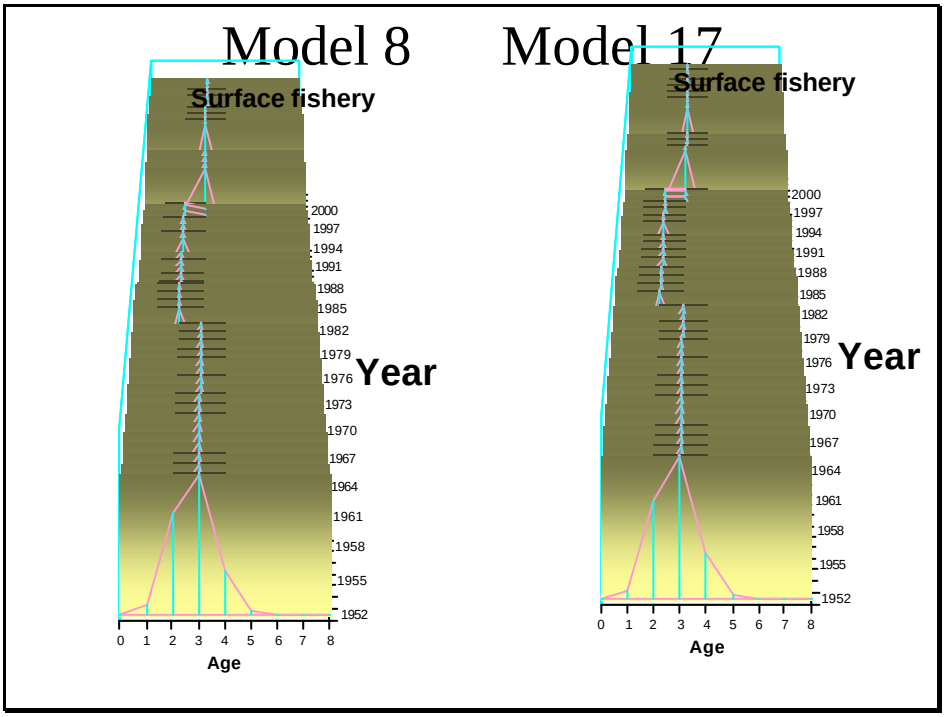


Figure 29. Plot showing bivariate joint-distributions of a sample MCMC run.

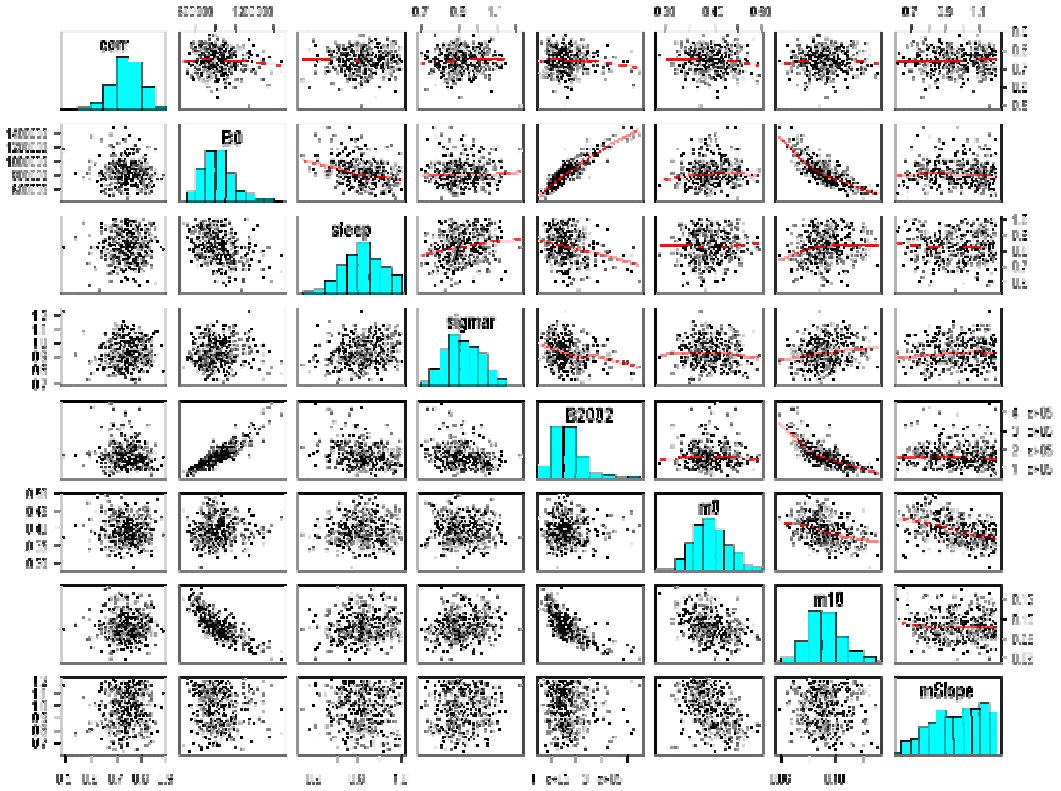
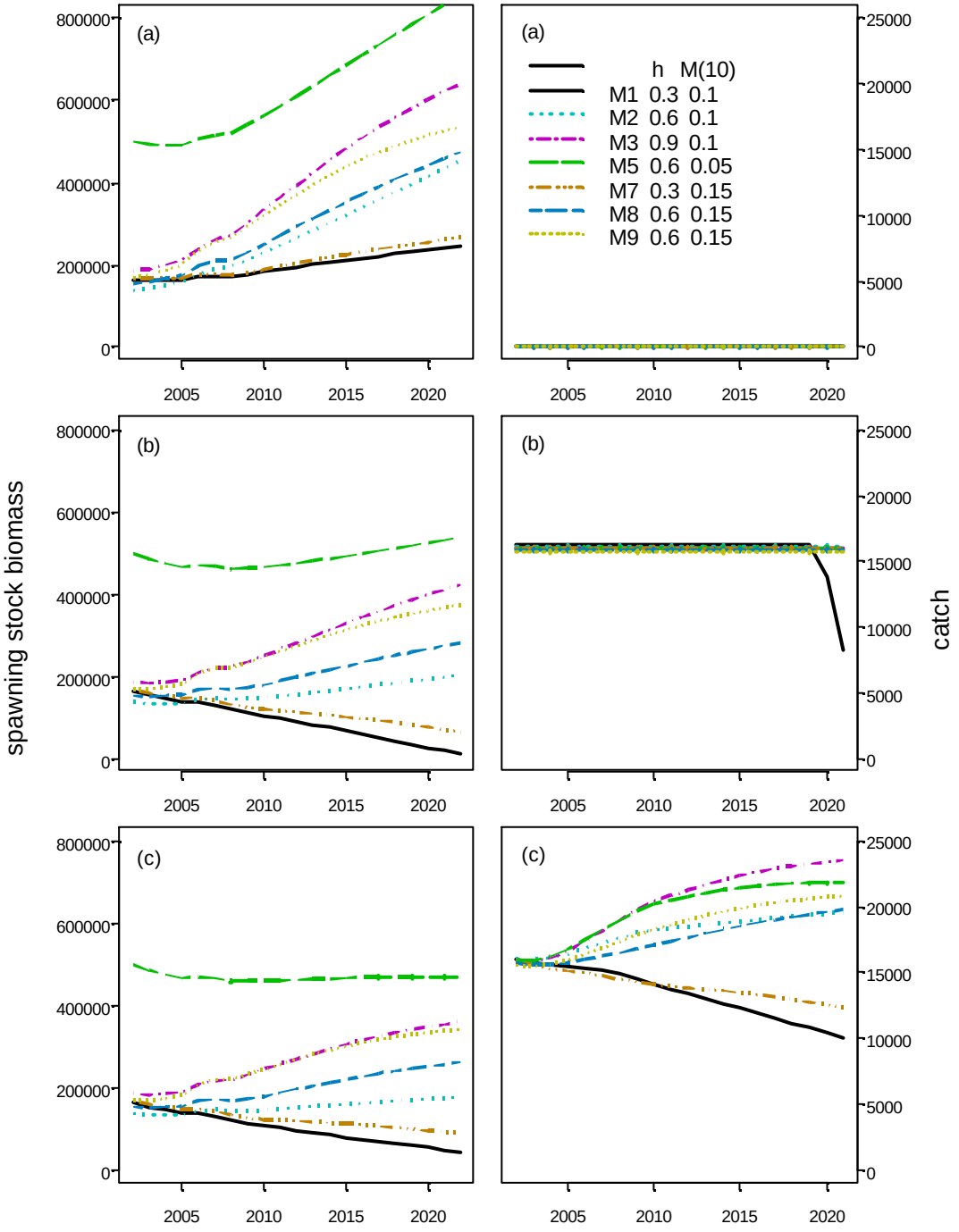


Figure 30. Models selected for further analyses.

Selected models

Defunct Model name	h	M10	SigmaR	Change from default	New model name
Mod1	**0.3**	**0.10**	**Est**	**-**	**h3m10**
Mod2	**0.6**	**0.10**	**Est**	**-**	**h6m10**
Mod3	**0.9**	**0.10**	**Est**	**-**	**h9m10**
Mod4	0.3	0.05	Est	-	
Mod5	**0.6**	**0.05**	**Est**	**-**	**h6m05**
Mod6	0.9	0.05	Est	-	
Mod7	**0.3**	**0.15**	**Est**	**-**	**h3m15**
Mod8	**0.6**	**0.15**	**Est**	**-**	**h6m15**
Mod9	**0.9**	**0.15**	**Est**	**-**	**h9m15**
Mod10	0.6	0.1	0.1	-	
Mod11	0.9	0.1	0.1	-	
Mod12	0.6	0.05	0.1	-	
Mod13	0.9	0.05	0.1	-	
Mod14	0.6	0.15	0.1	-	
Mod15	0.9	0.15	0.1	-	
Additional runs					
Mod16	0.3	0.15	Est	Fix m0=0.4	
Mod17	**0.6**	**0.15**	**Est**	**Fix m0=0.4**	**h6m15d1**
Mod18	0.9	0.15	Est	Fix m0=0.4	

Figure 31. Spawning stock biomass and catch (t) trends for simulation with selected deterministic model runs. The panels show results for the TAC fixed at zero (panel a), a fixed catch (panel b), and variable catch (panel c).



Attachment 7

Resolution of issues from Workshop Report documentation on projection approach

1) Numerous references to "catch" outputs from OM (C_t, eg. paragraphs 42, 49). I've assumed that these refer to the actual catches, not the TACs specified by the MPs.
Catch will be used.

2) I've set the maximum age-specific exploitation rate for a fishing pulse to 0.90. When the age-specific exploitation rate on any age-class exceeds 0.9, the overall harvest rate is reduced so that the exploitation rate on the age-class with the highest selectivity is 0.9. This can occur when the overall exploitation rate (calculated as catch divided by vulnerable biomass) is quite low.
Wait until later to address this issue, maybe until March.

3) When a simulated recruitment is greater than the maximum recruitment estimated for the historical time-series, that recruitment is set to the maximum historical recruitment. The MP Workshop Report does not provide direction on limiting the simulated recruitments, however I had made a note that "recruitment (prior to residual variance) within historical bounds". That note does not make sense to me.
Stick with the approach taken by the consultant.

4) The catch in the final year of the conditioning analyses is a random variable, not a constant (because catch for some fisheries is in numbers, not weight and therefore total biomass of catch is a function of selectivity ogives). Hence, the estimate of the catch in the final year is provided to the MP code, so that procedures based on incremental changes to catch have a starting point.
Fine, thanks for pointing this clarification on how model catches may be different from TACs. This issue will be revisited at a later date.

5) There is no CPUE data for 2001. (Historical time-series is to 2000, and simulated data begins in 2002).
Note that the decision rules shall be designed with realistic expectations on when data will be available.

6) The MP Workshop Report specifies output of the distribution of the inter-annual change in the catch (d[t]) "across years, within a single realization and across all realizations, will then be summarized as the 10^{th} and 90^{th} percentiles" (paragraph 51). The OM code outputs the 10^{th} and 90^{th} percentiles of the distribution of d[t] for each simulation (ie. each 20-year simulation horizon). Additional summary statistics require clearer specification.
Compute quartiles integrating over all runs..

7) Paragraphs 55 and 56 refer to an option for the MP to control the catch split. It is not clear if this control should be on an annual basis, or if the catch splits will be set once for the simulation series and then held fixed. The second alternative has been implemented.
Need to retain option to vary on an annual basis.

8) Paragraph 46 item 4 specifies the spawning potential in year $y+n$. "n" is not defined. I've generated output for n equal to 20.
Fine.

9) Paragraph 42 requests output of exploitation rates for each year and fishery. The exploitation rate was calculated as the fishery-specific catch divided by the fishery-specific vulnerable biomass.
Fine.

10) The calculation of the "observed" CPUE in biomass units uses different random error terms than the calculation of the "observed" CPUE in numbers. These two calculations should, perhaps, use the same set of random error values.
Make the random errors the same sequence for biomass and numbers.

11) Details were not provided for the cohort-slicing algorithm. As implemented, the code generates length frequency data with minimum and maximum length bins of 40cm and 200cm and bin widths of 4cm. The data output (after cohort-slicing algorithm) is age-composition for age-classes 0 through 30.
Four cm is fine for doing this.

12) Age-composition data is scaled to the sample sizes for each fishery.
Same as the conditioning model, and fine (since it's simply a scaling factor). Retain this so that it will be easy to determine the assumed sample size.

13) No specifications provided for the number of samples from the joint posterior distributions. Currently, this is 2000.
Fine. However, individuals may like to increase this in the future.

14) The random number data files each contain 100,000 random numbers (uniform and normal distributions). If more than 100,000 random numbers are required (as will be the case for the multinomial sampling) the code cycles through the sequence of 100,000 numbers.
Fine.

15) The inter-annual catch variability term $d_t = \frac{C_t - C_{t-1}}{C_t}$ is undefined when $C_t = 0$. This term has been programmed as: $d_t = \frac{C_t - C_{t-1}}{\left(C_t + 1^{-6}\right)}$.
Fine.

16) Auto-correlation is ignored in the simulations with deterministic recruitment (ie. simulation hierarchy 1 and 2). That is: $R_y = \frac{a S_y}{b + S_y}$.
Fine.