Commission for the Conservation of
Southern Bluefin Tuna

みなみまぐろ保存委員会

Report of the Eighth Operating Model and Management Procedure Technical Meeting

19-23 June 2017
Seattle, USA

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Opening

1. The Chair of the Eighth Operating Model and Management Procedure Technical Meeting (OMMP), Dr Ana Parma opened the meeting and welcomed participants.
2. The list of participants is shown at **Attachment 1.**
3. The draft agenda was discussed, amended and adopted (**Attachment 2**).
4. The list of documents for the meeting is shown at **Attachment 3**.
5. The specifications of the CCSBT operating models used for assessments and management procedure evaluations can be found at https://github.com/CCSBT/sbtmod/blob/develop/docs/model/sbtmod.pdf.
6. Campbell Davies, Simon Hoyle and Ann Preece agreed to co-ordinate the preparation of the report.

Agenda Item 1. Conditioning of OM using updated data

7. The Chair introduced the current timetable of events and benchmarks associated with updating the stock assessment and developing a new management procedure for setting the 2021 TAC (Table 1).

Table 1: Timetable for updated stock assessment and development for management procedure agreed at ESC 21.

Year	Meeting	
2016	ESC	TAC recommended based on Bali MP using 2016 aerial survey
	CCSBT	TAC set for 2018-2020
2017	ESC	Full stock assessment using extended CK data, HSP and aerial survey up to 2017
2018	OMMP & ESC	Develop new MP First estimate of age-2 from gene tagging
2019	ESC	Recommend TAC 2021-2023

8. Australia presented paper CCSBT-OMMP/1706/04 on updates required for new data sources and reconditioning of the CCSBT OM.

1.1 Review of data inputs

Revisions to LL1 Core CPUE series

9. The CPUE Working Group convened via webinar on the 13th/14th of June to consider options for altering the specification of the LL1 CPUE series used in the Bali MP due to the discontinuation of the Charter fisheries in New Zealand. Jim Ianelli provided a summary of the meeting outcomes. The relevant papers are CPUE CCSBT-OMMP/1706/06 and CCSBT-OMMP/1706/07. The full report of the CPUE WG meeting will be tabled at ESC 22.

10. The agreed modification to the CPUE standardisation was to combine the statistical areas in which the charter fishery operated historically with those immediately adjacent (Area 5 into 4 and Area 6 into 7; Fig. 1). This option was considered preferable to others suggested in CCSBT-OMMP/1706/06 and CCSBT-OMMP/1706/07 as it retained the historical data in the standardisation and does not have an appreciable impact on the index (CCSBT-OMMP/1706/06).

11. During OMMP8, the impact of dropping area 7 from the CPUE series was evaluated as the CPUE trends were different by area. Specifically, area 7 showed an increase since 2008 coinciding with increased effort concentration in that area (CCSBT-OMMP/1706/08)**.** Results suggested that the core vessel CPUE with area 7 deleted be included as a sensitivity test to reflect the potential effects of effort concentration on CPUE (Fig. 2).

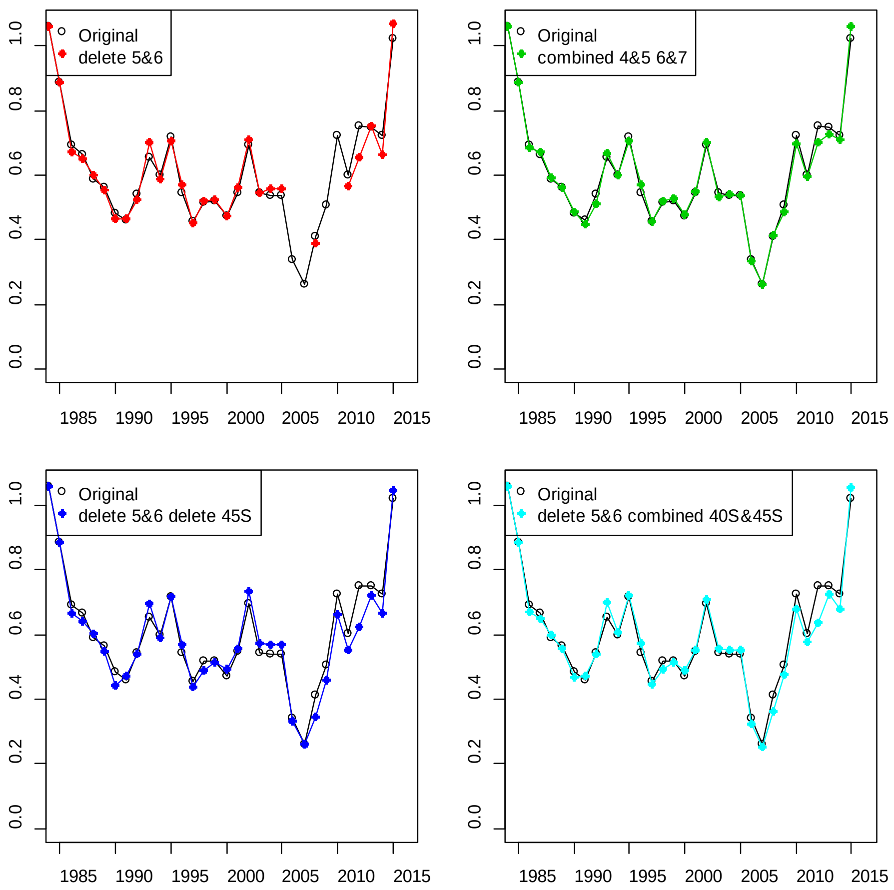

Figure 1: Core vessel base CPUE series (w0.5) illustrating the impact of combining, or deleting, the data associated with the NZ Charter fishery (taken from Fig. 4, CCSBT-OMMP/1706/06).

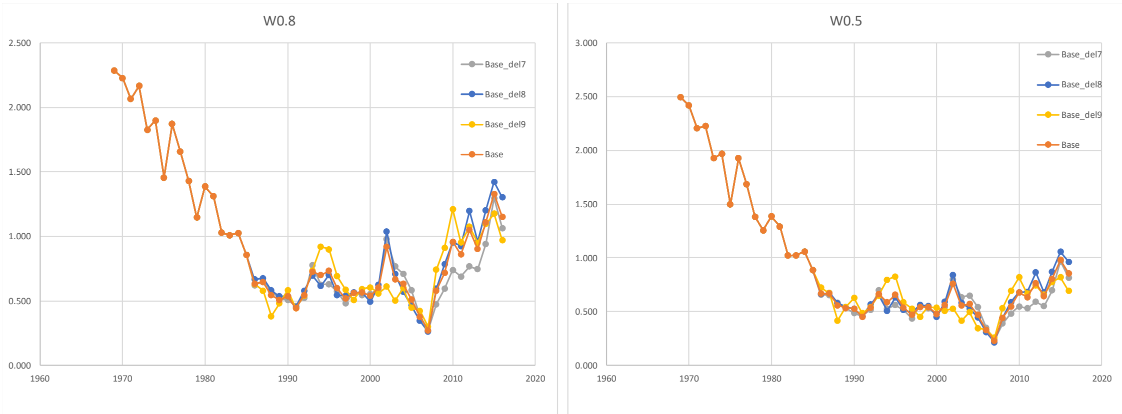

Figure 2: Core vessel base CPUE series for w0.8 and w0.5. The usual base series (Base) and those deleting area 7, 8, or 9 (Base del 7, 8, or 9) were compared.

Indicator CPUE series

12. The group reviewed a calibrated fit of the Korean CPUE in areas 8 and 9 (and combined) for the LL1 exploitable abundance trend (Fig. 3). Based on these plots, the consistency between the trends seemed reasonable, but the meeting noted that the effort required to include these series in the assessment would not be justified because of insufficient information gain.

13. It was noted that the GAMM CPUE indicator series (CCSBT-ESC/1309/13 (Rev.1)) had been adopted as a replacement for the Laslett series (CCSBT-SC/0103/06), which had previously been used as one of the indicator series aimed at capturing spatial effects in fleet dynamics. Australia noted that the GAMM CPUE standardisation (CCSBT-ESC/1309/13 (Rev.1)) had been updated and exchanged as part of the 2017 data exchange. OMMP8 agreed that the GAMM CPUE series will be included as a sensitivity test for the 2017 stock assessment.

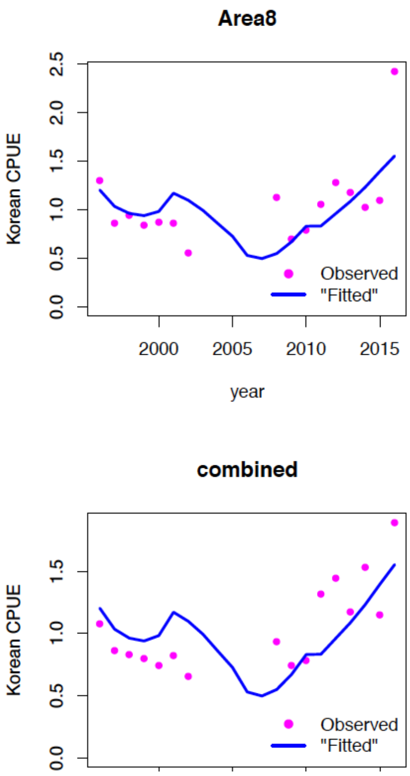

Figure 3: Plot of a mid-cell model "fit" to Korean LL CPUE data as if they were included in the model (nominal CPUE by area).

Aerial survey

14. The scientific aerial survey was completed using a single plane between 1 January and 31 March. The number of hours flown was similar to those for previous single-plane surveys. The updated index is shown in Figure 4 and the full results will be presented at ESC 22.

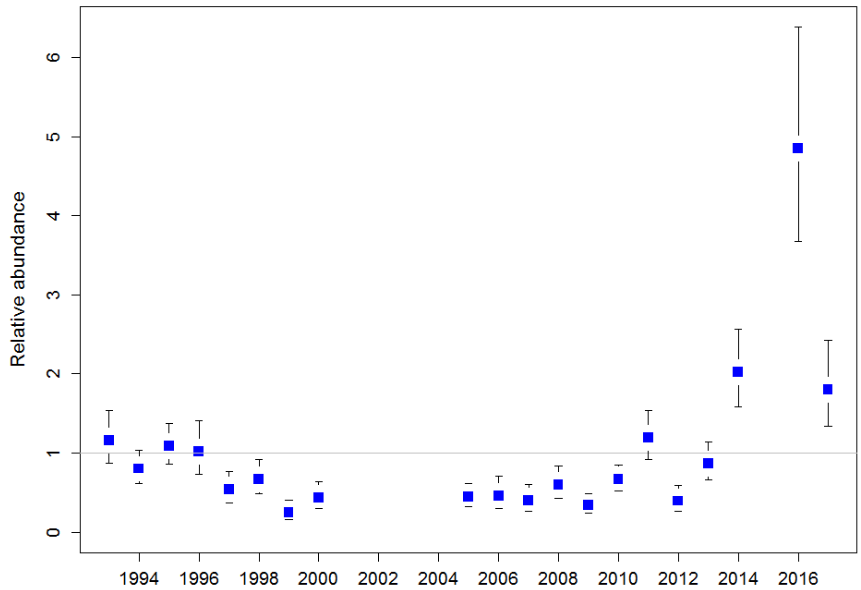

Figure 4: Time series of relative abundance estimates from the aerial surveys with 90% confidence intervals.

Close-kin

15. The preliminary estimates of Parent-Offspring (POPs) and Half-Sibling Pairs (HSPs) from the close-kin mark-recapture project were presented in CCSBT-OMMP/1706/12 and CCSBT-OMMP/1706/04. A summary of the number of juvenile and adult samples genotyped is given in Table 2.
16. The original POP data were generated using microsatellites, and contained information on the spawning abundance for 2002–2007. The new POP data are identified using next generation sequencing of single nucleotide polymorphisms (SNPs), which samples thousands of loci from across the genome. The new SNP-derived POP data have some overlap with the previous data set, in terms of both juvenile and adult coverage, and this has been taken into account in both the selection of the samples (years of coverage of adults and juveniles) and the comparisons included in the analysis. For the updated SNP data (less the overlap with the previous microsatellite data) 32 additional POPs were identified from 40,542,889 comparisons (the previous study (Bravington et al. (2016) found 45 POPs from 38,180,182 comparisons).
17. The simple empirical POP "index" (ratio of comparisons to POPs with summation across adult ages and capture years) is a little higher with the addition of the new POPs and the trend is consistent, where there is overlap with the previous POP data (see CCSBT-OMMP/1706/04, Figure 6.2).

Table 2: Number of adults (Indonesia) and juveniles (Port Lincoln) genotyped for the current application of close-kin mark recapture analyses (CCSBT-OMMP/1706/12)

	Indo	Port L
2006	0	1281
2007	0	1305
2008	0	1315
2009	0	1317
2010	943	1284
2011	931	938
2012	527	844
2013	933	873
2014	904	873
2015	0	922
Total	4328	10952

Table 3: Number of identified POPs summarised by juvenile cohort and year.

	2006	2007	2008	2009	2010	2011	2012	2013	2014
2002	0	0	0	0	0	0	0	0	0
2003	0	5	1	2	0	0	0	1	0
2004	0	2	0	0	3	0	0	0	0
2005	1	4	5	4	1	0	1	1	2
2006	0	4	3	2	0	0	0	0	0
2007	0	0	3	4	1	3	2	0	2
2008	0	0	0	0	0	1	1	1	0
2009	0	0	0	0	0	1	1	1	0
2010	0	0	0	0	0	3	1	4	0
2011	0	0	0	0	0	0	1	2	1
2012	0	0	0	0	0	0	0	1	1

Table 4: Number of identified HSPs summarised by year of capture.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2006	2	4	4	4	.	2		.	1	2
2007	.	6	3	6	2	2	2	.	.	2
2008	.	.	4	3	3	3	.	5	1	1
2009	.	.	.	8	6	1	3	7	4	.
2010	.	.	.	.	3	5	3	3	1	3
2011	.	.	.	.	.	6	1	1	2	3
2012	.	.	.	.	.	.	1	2	.	.
2013	.	.	.	.	.	.	.	2	1	2
2014	.	.	.	.	.	.	.	.	3	3
2015	.	.	.	.	.	.	.	.	.	3

18. The preliminary numbers of identified POPs, aggregated by cohort and year of capture, are given in Table 3 and the preliminary numbers of HSPs are summarised in Table 4. These results are not expected to change substantially, but are preliminary because:

    - The new POP data are currently based on both direct aging and age estimates from the individual lengths and the current length-at-age relationship. The length-derived ages will be updated based on otolith readings before ESC22;
    - The false positive and false negative probabilities for the HSP data are preliminary and currently being refined. These will determine the final number of HSPs included in the data set and the value for the false-negative probability for the likelihood (see CCSBT-OMMP/1706/04).

19. The meeting reviewed the diagnostics for the POP data. These are consistent with the model expectations and showed no sign of systematic misfit. The meeting agreed the updated data should be included in conditioning the OMs.

20. In the case of the HSP data, the meeting reviewed the preliminary estimates and the proposed approach for their inclusion in the OM. It was agreed that these data would be a valuable addition to the OM reconditioning, particularly given their potential information on adult mortality and selectivity. The meeting noted that

there had not been time to incorporate these data into the preliminary reconditioning and that there is the potential for complicated interactions with existing data. It was agreed that these data would be incorporated in the OM inter-sessionally and that an OMMP webinar be scheduled to review the fits and the impact of the new data series. If any model fit/inconsistencies can be resolved to the satisfaction of the group at that point, then the HSPs should be incorporated into the Reference Set. In the case that there are outstanding issues that cannot be resolved at the webinar, then the HSPs will be excluded from the reference set of OMs for the generation of scientific advice on stock status for ESC22 and further technical work to be completed after ESC22 will be undertaken with the intent of including HSP data in the reference set of OM for MP development during 2017/18.

1.2. Unaccounted sources of mortality

21. The 2016 Commission agreed to a “direct approach” for UAM of 306 t of non-member catch to be included within the 2018-2020 TAC. Therefore, this amount should be taken into account in the OM reference set as part of the LL1 catch. In addition, the workshop agreed to add the estimates of UAM provided in Table 1 of the 2016 ESC 21 report as part of the LL1 total removals used for conditioning the OM. It was agreed to use the estimates of catches from the “targeted” method for 2007-2014 and an average equal to 306 for 2015-2016.

1.3. Model structure

22. A bridging analysis examined the effect of OM sequential updates and changes to the OM. Two changes were examined: 1) inclusion of new POP data, 2) and changes to size-specific reproductive output (SRO) to take changes in length at age distribution over time into account (Fig. 5). A small subset of the OM grid combinations was used to show estimates of depletion in total reproductive output for the updates to the OM. The new SRO method was considered an improvement over the old method. Depletion results indicated small differences between the two approaches, which appeared to reflect the effects of changes in growth over time. It was agreed to proceed with the new method for the reference set. The inclusion of the new POP data did not result in appreciable differences. These new data are included in the reference set models.

23. The steepness values in the reference set were reconsidered following preliminary reconditioning and examination of the diagnostic shade plots with objective function weighting for steepness (Fig. 6), and likelihood plots (Fig. 7). The h=0.9 option was removed from the reference set of OMs because of low representation in the grid sample. Steepness of 0.55 was also removed, because of difficulties with convergence for this low value of steepness. The reference set will include h=0.6, 0.7, 0.8, which will be equally weighted. A sensitivity test (noh0.8) was agreed where weightings for these three values of steepness would be 0.5, 0.5, and 0.0, respectively, given the lower representation of h=0.8 in the shade plot results examined and the fact that this value may be unduly influenced by recent high aerial survey estimates which might rather reflect positive correlation in recruitments.

24. The meeting agreed that the M_0, M_{10}, Omega (ω) and CPUE options remain unchanged.

25. In considering the range of values for M_{10}, the likelihood plots indicated that these values were informed by the tag data and the POPs data. To assess the impact of the tag data, an incomplete tag mixing sensitivity test was run during the meeting to compare to the base set (also run during the meeting). The incomplete tag mixing sensitivity test did not have an appreciable effect on model results.

26. The new formulation for the SRO proposed in Hillary et al. (CCSBT-OMMP/1706/04, 2016)

$$\varphi_l \propto w_l^{\psi} m_l$$

where w_l and m_l are the length-specific weight and maturity relationships, was adopted and the parameter Psi (ψ) was included as a new axis of the reference set grid. Three values of ψ (1.5, 1.75, 2) were considered, with respective weights 0.25, 0.5 and 0.25. These values will be re-evaluated after inclusion of the HSP data, and examination of reconditioning results, at the web meeting proposed for July, 2017.

27. The conclusion from examination of a single OM run without the 2016 aerial survey data point (which is a very high point in the time series (Fig. 8)) was that the noAS (no aerial survey 2016) models should be run as a sensitivity test.

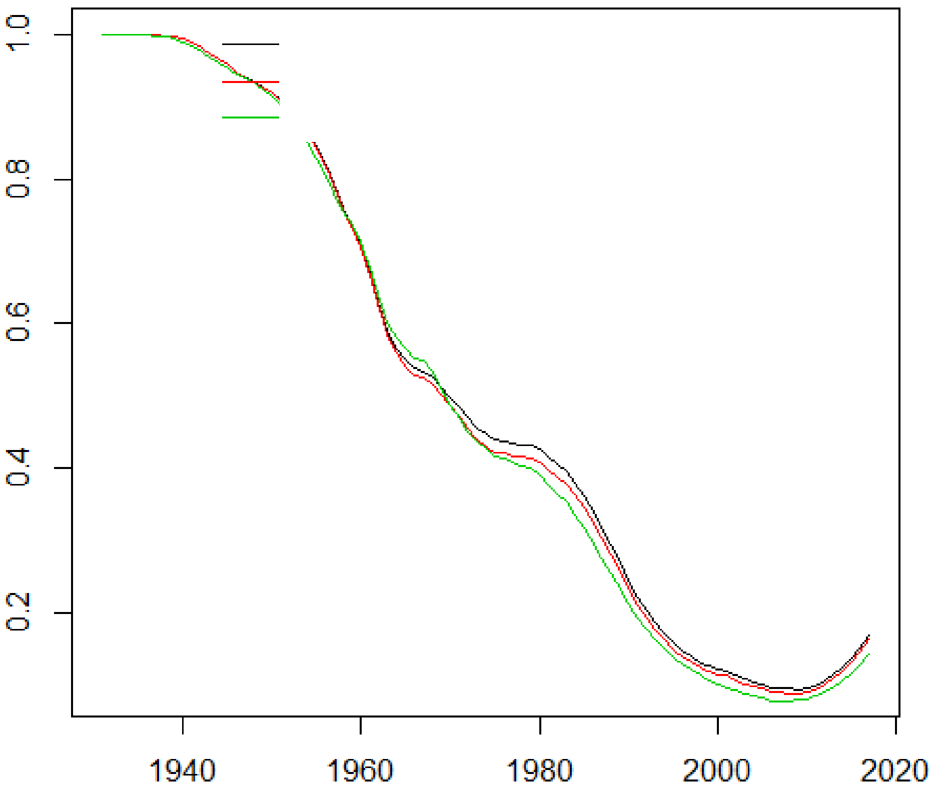

Figure 5: Bridging analysis of structural changes to the OM between last assessment (2014) and proposed revisions to grid and Reference Set. Estimates of relative reproductive output from a small subset of OMs: with and without the new POP data and without the new formulation for calculation of relative reproductive output. The highest relative reproductive output (black) is predicted by the new model with the updated POP data, whereas the second highest (red) corresponds to the new model without the new POP data and the lowest (green) corresponds to the old OM (using the old method for calculating reproductive output) without the updated POP data.

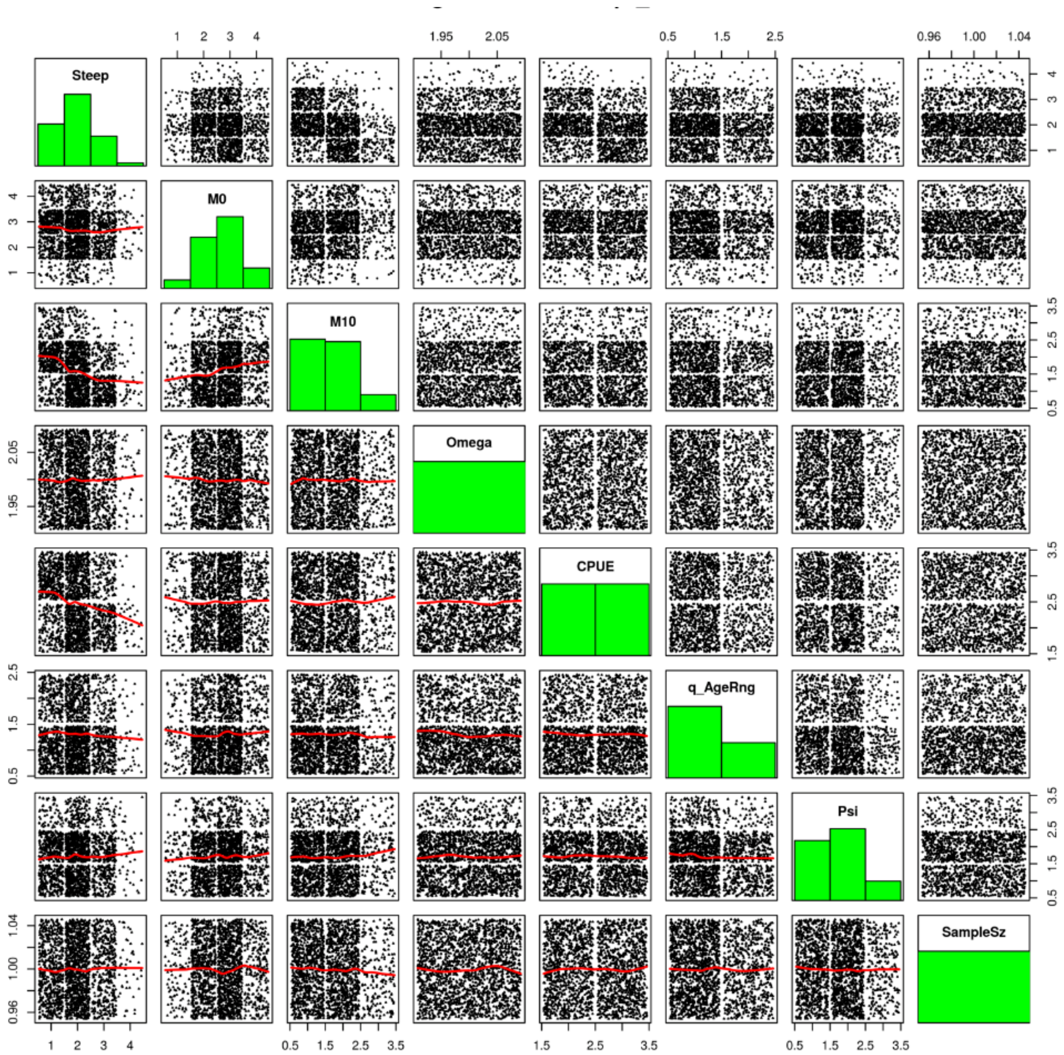

Figure 6: Shade plot used to evaluate likelihoods to aid in the selection of the new grid. Note that likelihood weights are used to indicate the relative influence of different grid cell shading (i.e., dot frequency) rather than the imposed prior distribution used for some parameters for projection purposes over the grid uncertainty.

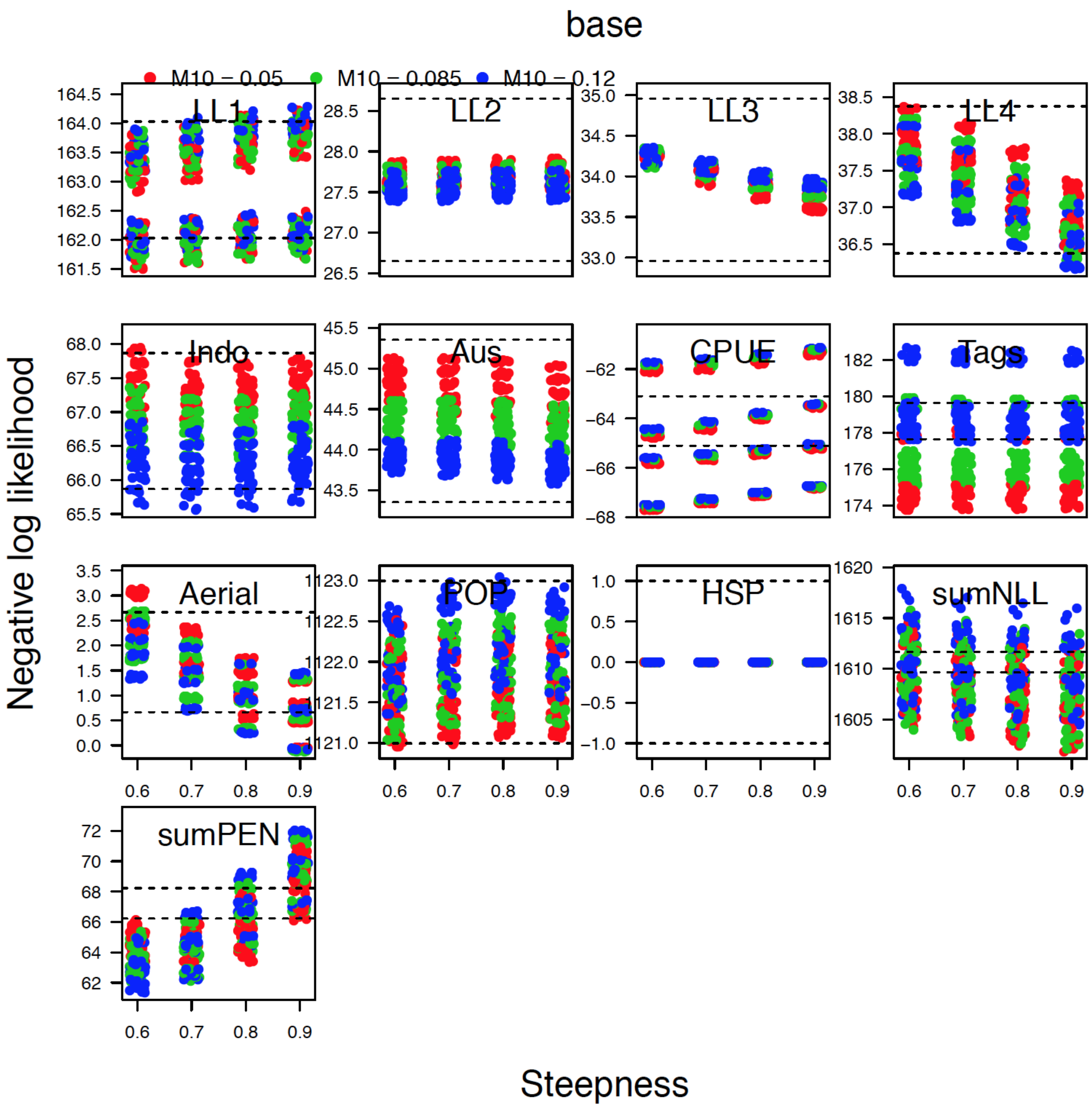

Figure 7: "Profile" plots to evaluate relative log likelihood contributions of different data components.

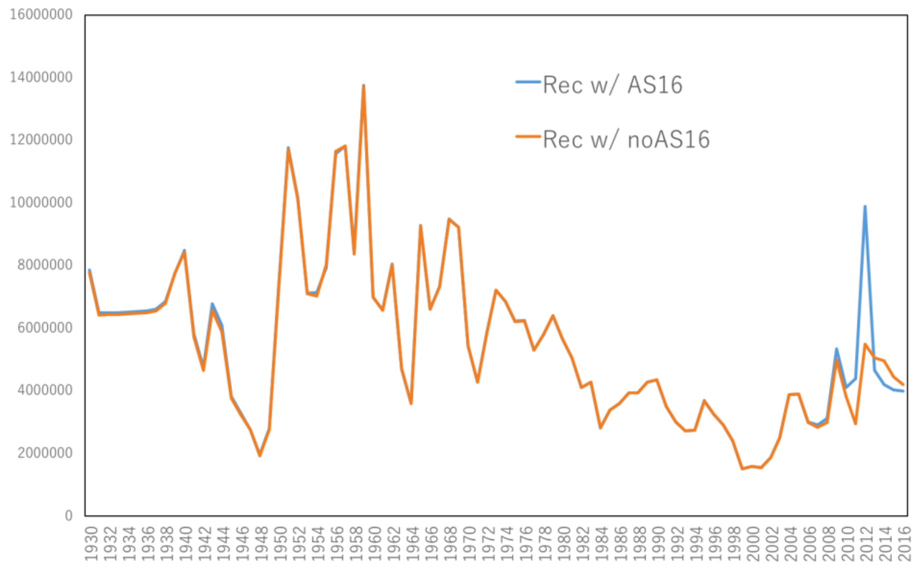

Figure 8: Recruitment estimates with and without the 2016 Aerial Survey estimate included.

1.4. Diagnostics and weights of likelihood components

28. These topics were covered in the previous section.

1.5. Structure of Reference Set

29. Based on diagnostic plots and discussion of sensitivity results, the group selected a final grid that comprised seven dimensions and 432 cells (Table 5). Sensitivity runs are shown in Tables 6 and 7.

30. The group considered and agreed elements of the reference set of operating models from the 2017 assessment including:

- Maintain the increased flexibility for Indonesian selectivity, commencing in 2012, to accommodate the sharp increase in abundance of younger fish (<age 7 yr) in the catch, which may reflect changes in fleet behaviour (e.g. targeted fishing outside spawning grounds).
- An updated tag over-dispersion parameter.
- Projected recruitment deviates for the first year of the projection are uncorrelated to historical estimates from the conditioned model, but the empirical correlation is taken into account for future years after this first year.
- Reduced standard deviation for the LL1 selectivity parameters (from 0.2 to 0.05) to improve smoothness of estimated selectivities used for projections.
- Addition of HSPs from close-kin mark recapture.
- To avoid inconsistencies with the reference-set OM conditioning, continue 20% overcatch assumption for the Australian surface fishery in projections.
- TAC allocation for 2018-2020 TAC block as per the Report of the Extended Commission of CCSBT 23, (Table 1), effective catch limit (column 3), converted to OM fisheries.

- Include the estimated UAM catches from reported effort (CCSBT-ESC/1609/BGD 02) for the period 2007-2014 presented in Table 1 of the ESC 21 report.
- Allocation of catches beyond 2020 as per EC23 Table 1 (Table 8 here), nominal catch proportion (column 2), to OM fisheries to countries and hence to OM fisheries.

Table 5: Revised reference set grid for 2017 assessment.

Parameter	Value	Cumul N	Prior	Sampling
h	0.60, 0.70, 0.8	3	Uniform	Prior
M_0	0.35, 0.4, 0.45, 0.5	12	Uniform	ObjFn
M_{10}	0.05, 0.085, 0.12	36	Uniform	ObjFn
Omega (ω)	1	36	Uniform	Prior
CPUE	w0.5, w0.8	72	Uniform	Prior
CPUE age range	4-18, 8-12	144	0.67, 0.33	Prior
Psi (ψ)	1.5,1.75,2.0	432	0.25, 0.5, 0.25	Prior

Table 6: Sensitivity tests for 2017 assessment and stock status advice.

Run name	Conditioning	Projections
UAM1	Added unaccounted catch mortality (UAM) in conditioning: 1000 t of small fish + 1000 t of large fish, ramping up from 1990 to 2013 in addition to 20% increase in the surface fishery.	Additional catch remains at the same proportion as in 2016.
SFOC40	40% overcatch by Australian surface fishery: ramps up from 1% in 1992 to 40% by 1999 and onwards to 2016. Adjust the age composition as was done for the 20% method.	Continued 40% overcatch in projections
SFO00	No historical additional catch in surface fishery	No future additional catch in surface fishery
LL1 Case 2 of MR	LL1 overcatch based on Case 2 of the 2006 Market Report	
IS20	Indonesian selectivity flat from age 20+	
High_aerialCV	In conditioning set process CV to 0.4	
Aerial2016	Remove the 2016 aerial survey data point	
CPUE related		
Upq2008	CPUE q increased by 25% (permanent in 2008 due to individual quota system that went into effect in 2006)	
Omega75	Power function for biomass-CPUE relationship with power $\omega = 0.75$ (retain)	
S00CPUE	Overcatch had no impact on CPUE	
S50CPUE	50% of LL1 overcatch associated with reported effort	
Updownq	Increase in catchability (0.5) in 2009 then returns to normal in 2012 (when the pertinent quota was restored to pre-2009 level)	
GamCPUE	Use the “GAM CPUE” series provided from Australia under the 2017 CCSBT data exchange. This is the monitoring CPUE series 3.	
Base CPUE w/o area 7	As a sensitivity to note a possible concentration effect on CPUE	
Incomplete tag mixing	Sensitivity to incomplete mixing of tagged fish released in the WA and GAB. Increases fishing mortality of tagged fish in the surface fishery by 50% relative to the whole population for fishing season 1 (surface fishery).	
Piston line	Includes the piston-line troll survey index (updated to 2017) included as alternative sensitive to recruitment index (2017 data exchange)	
NoPOP&HSP	Exclude both close-kin data sets (POPs and HSPs)	
NoHSP	Exclude HSP close-kin data	
Psi	Grid sampling using objection function weighting psi	
Noh0.8	Change steepness (*h*) preference weighting to 0.5, 0.5, 0.0 to examine impact of excluding h=0.8 on projections.	

Table 7: Sensitivity runs from 2014 assessments dropped for 2017 assessment.

Run name	Conditioning
SbySCPUE	Use CPUE based on the shot-by-shot daily level. This is the "Base with SxS model" which uses the monitoring CPUE series 2 (CCSBT-OMMP/1406/13). Intermediate to others, keep as indicator but monitor rather than include explicitly in assessment
ReduceBaseCPUE	Replaced by Base without Area 7 which provided a better representation of potential impact of effort concentration
Include 2007-08 CPUE Upper	Uses most optimistic CPUE series (Laslett). Drop because the core areas have changed over time (CCSBT-ESC/1309/13 (Rev.1) and CCSBT-ESC/1409/09)
Include 2007-08 CPUE Lower	Uses most pessimistic CPUE series (ST Windows). Drop (CCSBT-ESC/1309/13 (Rev.1) and CCSBT-ESC/1409/09)
CPUE CV=0.3	Increases the specified CV of the CPUE series to have a lower bound of 0.3 Drop unless fitting issues show conflict

Table 8: Catch allocations as determined from EC23 Table 1.

Member	(1) Adjusted Allocation	(2) Nominal Catch Proportion	(3) Effective Catch Limit
Japan	6165	0.355643	6117
Australia	6165	0.355643	6165
New Zealand	1088	0.062779	1088
Korea	1240.5	0.071568	1240.5
Taiwan	1240.5	0.071568	1240.5
Indonesia	1002	0.057785	1023
European Union	11	0.000628	11
South Africa	423	0.024387	450

1.6. Handling of within-cell uncertainty

31. Further work was conducted to ensure that within-cell variability was developed and asymptotic covariance estimates are functioning for all grid-cell options. For assessment evaluations, approximate marginal distributions of the posterior are now feasible and can be part of the assessment evaluation.

32. The solution to the problem of how best to include within-cell variability in projection and MP testing purposes has been challenging. There are developments in more efficient MCMC sampling routines which may be promising for generating posterior distributions from conditioning the OM.

Agenda Item 2. Design of a new MP

33. Australia presented CCSBT-OMMP/1706/05 which provides some points meriting consideration in the process for development, testing and selection of a new Management Procedure (MP) for SBT. At its 2016 meeting the Extended Commission revised the work plan for development of a new MP, with candidate

MP testing postponed until after the 2017 ESC. Three new data sources for potential inclusion in new candidate MPs were considered at the 2016 ESC: i) gene-tagging, as an absolute index of 2-year-old recruits, ii) POPs and iii) HSPs from the Close-Kin Mark Recapture method to inform the estimate of natural mortality for spawning ages as well as absolute estimates of spawning adult abundance. The Japanese longline CPUE series, used in the current MP, will also be considered for use in a new MP. The paper describes a range of MP indices that can be derived from these data series, and general functional forms of harvest control rules that could be used in candidate MPs based on these series are considered. Preliminary methods to combine some, or all, of these inputs and rules into candidate MPs are discussed.

2.1. MP structure

34. In terms of the likely form of any future MP, the meeting noted that a ‘simple swap’ of the gene tagging for the aerial survey was not possible within the existing MP framework due to the difference in age classes covered by each data source (e.g., ages 2-4 for the aerial survey compared to age 2 for the gene tagging). The meeting considered options for calibrating the two recruitment indices (aerial survey and gene-tagging), in a manner that would allow retention of all/the majority of the technical specifications of the Bali MP. The meeting concluded that retaining the technical basis of the Bali MP was not possible due to the need for a time series of gene-tagging estimates to calibrate with the historic aerial survey series and the additional complexity required in the decision rule.

35. Notwithstanding these technical issues, the conceptual underpinning of the Bali MP, i.e. the combination of an index of recruitment and, either, the harvested component of the stock, or the spawning stock, should be retained.

36. The meeting considered the benefits of alternative MP approaches including empirical and model-based MPs. The meeting noted that empirical MPs are more readily understood, whereas model-based rules are less transparent and more difficult to communicate to stakeholders and decision makers. However, there is often a trade-off in additional TAC variability for purely empirical MPs unless a suitable smoother is applied. Hierarchical MP approaches (decision-tree type) may be an alternative approach that relies less on weighting. The meeting agreed that it would be useful to explore a broad range of forms of candidate MPs and that performance under MSE testing was the primary selection criterion. Poorly performing candidate MPs will nevertheless be useful to show contrast in performance.

37. The meeting noted with interest a proposal for a surplus production model approach that combines multiple indices for MP application.

38. The meeting noted that for empirical MPs, mean estimates are likely to be less variable than those based on slope. However, the more important issue is whether the slope is a more useful estimator of the behaviour sought to be captured when implemented in the MP.

39. The meeting reconfirmed its views expressed in OMMP7 that:

> *"The meeting noted the potential to develop candidate MPs that use either empirical (indicator) approaches or model-based approaches, as developed in earlier MP development exercises, including scope to combine indices from different monitoring series to form a composite index. It was noted that the current Biomass Random Effects Model underpinning the Bali Procedure requires checks of model fit diagnostics and recalculation of the "q-ratio" each time the MP is run. There was some concern that this additional complexity associated with model-based MPs may make them less accessible to the wider ESC and more difficult to communicate to stakeholders and decision makers. This contrasts with the attraction of simple empirical MPs which are more accessible and generally easier to explain in plain language; however, there is often a trade off in TAC variability. The meeting agreed it would be useful to explore a broad range of forms of candidate MPs and that performance under MSE testing was the primary test."*

2.2 Input data series

40. The meeting discussed the range of monitoring series and potential indices that could be used within the MP. The meeting recalled the ESC20's agreement that an MP requires at least a recruitment index and an index of older fish in order to take account of information on abundance trends for these components of the population.

CPUE

41. The meeting noted the need for scenarios that vary the relationship between CPUE and total reproductive output, given the potential for further selectivity shifts to complicate the relationship which may be expected as reproductive output increases. MP testing needs to include possibilities that CPUE fails to index abundance adequately into the future. It was noted that the absolute level of CPUE may have value as an input for candidate MPs, given the evidence that the observed decline in CPUE was influential in ESC and EC considerations during the period of the historical low recruitments around the turn of the century.

42. In this context, the meeting discussed possible forms of an index of age-4 CPUE, as a potential recruitment indicator, for inclusion in candidate MPs. The suggested formulation of such an index was the proportion of 4-year-old fish (by number) in the Core Vessel catches (relative to the 4+ catch) multiplied by the 4+ core vessels base CPUE. The statistical properties of the time series of age-4 proportions relative to model predictions will need to be examined in order to specify the assumptions for OM data generation.

Gene- tagging

43. The gene-tagging data for the OM and MP should be available in March each year. The first estimate from the pilot program, available in March 2018, will be an estimate of absolute abundance of 2-year-old fish in 2016 ($N_{2,2016}$). Two such gene-tagging data points, $N_{2,2016}$ and $N_{2,2017}$, (Table 9) will be available for the implementation of the new MP in 2019 (i.e., to decide the 2021-2023 TACs).

Table 9: Availability of proposed data for MP testing in 2018 and implementation in 2019.

Data for MP	Data available	Index
Gene tagging	March 2018	Abundance of 2 year-olds in year 2016
	March 2019	Abundance of 2 year-olds in year 2016 and 2017
Japanese longline CPUE	June 2018	Index 4+, 1969-2017
	June 2019	Index 4+, 1969-2018
Age 4 CPUE	June 2018	Index age 4, 1969-2017
proportion	June 2019	Index age 4, 1969-2018
Close kin	May 2018	Adult abundance 2002-2013
	May 2019	Adult abundance 2002-2014*

* Collection and genetic sequencing of the 2014 samples is funded by CCSBT, but there is currently no plan to genotype and identify POPs.

Close-kin POP and/or HSP

44. The meeting noted that it would be useful to have an indicator derived from the close kin POPs because this is directly related to the primary SBT management goal: to rebuild the spawning biomass.

45. The meeting noted that the POP analyses will become less informative as abundance rises. There may be value in exploring changes in future sampling to maintain both the information content of these analyses and the "stakeholder credibility" of numbers of identified POP and HSP. There is a trade-off between investment in surveys and the resultant TAC. It would be useful to explore this trade-off with alternative sample sizes in simulation testing. The POP analyses provide a pseudo-index value for each year that is correlated with the spawning abundance, and could be used to generate indicators both for a target (absolute) and for a trend.

46. Dr Robin Waples provided an overview presentation on the population genetics concepts underpinning close-kin abundance estimation (POPs and HSPs) and the estimation of effective population size (Ne). This included consideration of within and between cohort sampling and impacts population structure of skip spawning. The meeting thanked Dr Waples for a very clear and informative presentation.

2.3. Operating model and testing methods

47. The meeting discussed how a "target" for tuning the candidate MPs would be specified. In the case of the Bali procedure, the MP was tuned to achieve "rebuilding" to 20% of B_0 with 70% probability by 2035.

48. The meeting proposed that median values from projections were preferable to probabilities, given how sensitive the smaller quantiles of projected distributions are to the inclusion of different components in the reference set of OMs. Managers should preferably specify a range of years over which a target (e.g., 20% of SB0) is to be met in median terms, and eventually choose within this range.

49. The meeting considered that the current limits on TAC changes (100 min and 3000 or 5000 max) might be changed, e.g., to percentages, given the potential for increases as TACs rise. Members were requested to seek responses about possible changes to these.

50. It was assumed that the actual total removals are taken into account in the OM. Consideration should be given to robustness tests where this assumption is not met, to indicate how large a departure from the TAC might be tolerated before Exceptional Circumstances would need to be considered.

Initial considerations on MP robustness testing

51. Robustness tests that account for future changes in projected LL1 selectivities were considered important, especially because of their effect on CPUE inputs to candidate MPs. Alternative approaches to modelling these were discussed.

52. The assumptions about LL1 selectivities made in the reference set specified in the OM model description document (extracted below) were selected based on qualitative tests. It was agreed that annual-changes for future simulations were most reasonable given variances for $n_{a,y}$ modified from 0.2^2 to 0.05^2 (Fig. 9).

> Selectivities
>
> Random-walk processes as assumed in conditioning are not appropriate because they may result in the selectivities wandering off into implausible regions. Instead, the current projection model starts with most recent estimates of selectivity and adds autocorrelated process error according to:
>
> $$s_{1,a,y+1} = s_{1,a,y} \exp\{\varepsilon_{a,y}\} \quad \text{for} \quad a_1^{\min s} \geq a \geq a_1^{\max s} \quad \text{where} \quad a_1^{\min s} = 2,\ a_1^{\max s} = 17$$
>
> $$\varepsilon_{2,y} = \eta_{2,y}$$
>
> $$\varepsilon_{a+1,y} = \rho_{\text{sel1}}\,\varepsilon_{a,y} + \sqrt{1-\rho_{\text{sel1}}^{\;2}}\;\eta_{a,y}, \quad \text{where} \quad \eta_{a,y} \sim N(0, 0.2^2) \quad \text{and} \quad \rho_{\text{sel1}} = 0.7$$
>
> (note that first subscript corresponds to fishery *f*=1). Selectivities only change every four years so that $s_{1,a,y+3} = s_{1,a,y+2} = s_{1,a,y+1} = s_{a,y}$.

53. The first alternative for incorporating changes in selectivity was to select the two most extreme LL1 selectivity patterns from those estimated over 1995-2016 (shown in Fig. 10). These corresponded to the current selectivity (estimated for 2014-2016) and a highly bi-modal selectivity estimated for 2000. Two robustness tests were proposed: one that would alternate between these two extremes with the changes every 10 years, and the other that would set a constant selectivity equal to the bi-modal one.

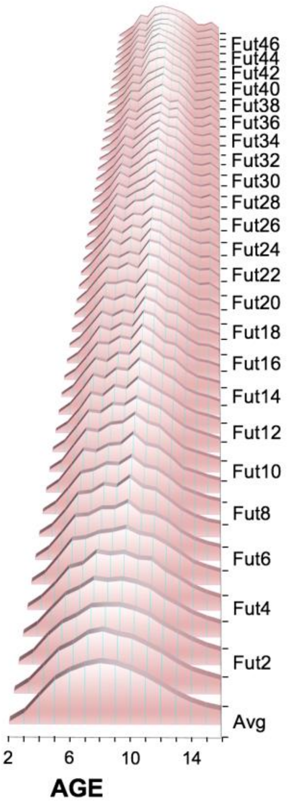

Figure 9: A single simulated selectivity projection for LL1 given the specifications for the OM projections with a modified variability of 0.05 (sigma) and rho of 0.7.

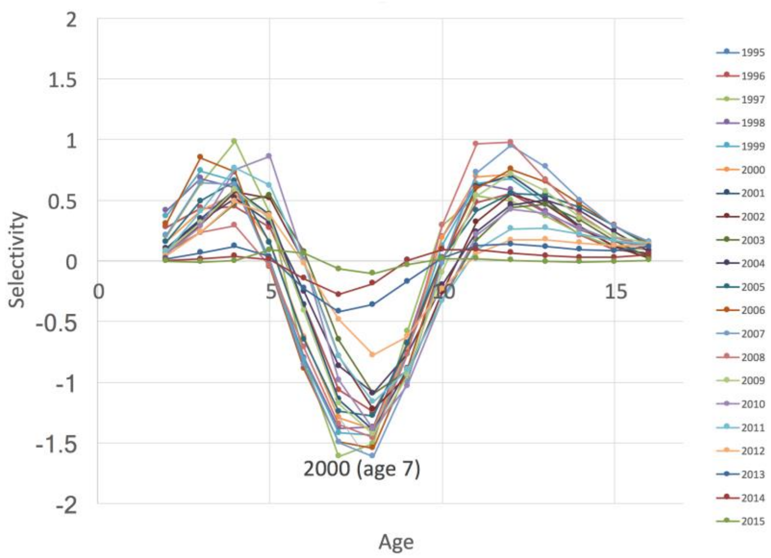

Figure 10: Selectivity differences relative to the final (2016) selectivity estimated, over 1995-2013.

54. As regards selectivity "targeting" the group proposed two approaches. One was to build a "cohort" effect within the model and use that coefficient to project future fishing patterns. The other was to examine historical residual patterns as follows:

- For years y = 1997 to 2016 and ages a = 4 to 12 compute
  R(y) = N(y, a=0) and selectivity S(y,a)
- Average these over years to get Rbar and Sbar(a) and compute residuals
  Rres(y) = R(y) – Rbar and
  Sres(y,a) = S(y,a) – Sbar
- For each age a correlate Sres(y,a) against Rres(y-a) – provide plot and associated correlation coefficient

The results from this will be reviewed at ESC22 as part of the OM specification.

55. The group reviewed and added robustness tests for MP development purposes (Table 10).

Table 10: Additional list of robustness tests for MP testing in addition to the sensitivity tests listed in Table 7.

Test name	Conditioning
Corrugated selectivity	Reversing order of estimates at decadal scale
Bimodal selectivity	The most extreme case shown in Fig. 11.
Alternate bimodal and recent selectivity	
Targeted selectivity	Match annual varying case with YC strength
Drop q increase of 0.5% yr^{-1} in future years	
Gene tagging variant	TBD
POPs only	Implemented by increasing the variance on other trend data or some other approach
Trolling index (GTI)	Include

Agenda Item 3. Code refinements and version control system

56. A small group met to discuss managing code changes in the github version control system, and will continue to work inter-sessionally. A review of the work undertaken and changes to the repository structure were explained. Several new collaborators were added.

Agenda Item 4. Workplan and timetable

57. The working group reviewed the work plan for stock assessment and MP development from ESC 21 in light of the material and results presented at the meeting and tasks arising (Table 11).

58. In discussing the workplan the group developed and considered a set of options (Table 12).

59. The down-side of option 2 is that the MP would be selected at the same time as the TAC advice; this may bias the MP selection to overly favour short-term considerations.

60. Option 1 would require additional meetings increasing costs, and limits iterative consultations for selecting an MP.

61. The meeting noted that in Option 3, there is no lag between TAC decision and implementation. Also, if implementation is delayed then the 2020 ESC would be providing both MP TAC advice and updated stock assessment results. The current scheduling separates these activities, which is useful for both spreading out the workload and also to avoid confusion about the role of the two activities.

62. In considering the trade-off between these factors, the meeting preferred Option 3 followed by Option 2, and then by Option 1.

Confirmation of final Half-Sibling Pair data set for 2017 reconditioning of OMs

63. In preparation for the HSP web meeting, the HSP data will be provided (in approximately 2 weeks, ~7 July, 2017). Preliminary reconditioning with HSP data will be trialled and a working paper on fits, diagnostics, etc. will be provided in preparation for the web meeting. Dates for the web meeting were discussed: Thurs 20/Fri 21st July (using the same timing as for the CPUE webinar). The HSP web meeting will decide if there are any issues that preclude the inclusion of the HSP data in the 2017 stock assessment. The final reference set of OMs and sensitivity tests for the 2017 stock assessment will be specified at this web meeting.

Table 11: Activity plan and timelines for OMMP leading to TAC recommendations

Activity	Dates	Notes
2017		
Web meeting	July 20th/21st	Decision on whether to include HSPs in 2017 stock assessment model based on fits and impact
One-day OM meeting	Aug 27th	In Yogyakarta prior to ESC; main purpose to refine MP testing process and consultation schedule. Specify list of robustness tests for MP development
ESC22	Aug 28-Sep 2nd	Focus on stock assessment/status, with some projections done to initially inform on tuning and rebuilding targets
2018		
Update data for OM	May	Include update of CPUE and gene tagging data
Intersessional	May	MP developers interact and coordinate/discuss with each other
OMMP9	June	• Review of candidate MP (CMP) performance • Finalize robustness tests • Improve CMPs • Informal dialogue with Commissioners on preliminary results of CMPs
Intersessional	Prior to ESC	Refine reduced set of CMPs
ESC	Sept	Includes presentation of refined CMPs and a session for interaction with stakeholders
Commission	October	Confirms or amends broad recovery objectives etc. based on advice from ESC
2019		
OMMP	June	Review final versions of CMPs to develop limited set to put forward to ESC
ESC	September	Select final set of CMP options
Commission	October	Selects and adopts MP
2020		
ESC	September	Implementation of agreed MP to provide TAC advice for 2021 (i.e., no standard 1-year lag) Note, this implementation will include data to June 2020, rather than just to 2019. Update assessments including projections using adopted MP
Commission	October	Agrees TAC advice for 2021. Perhaps with option to have MP implemented sooner, e.g., via a special meeting should the Commission desire.

Table 12: Options considered for developing workplan timeline.

OPTION 1	
2018	
June	OMMP – first presentation of candidate MPs (CMPs)
September	ESC - includes presentation of refined CMPs and a session for interaction with stakeholders
October	Commission – confirms or amends broad recovery objectives etc. based on advice from ESC
2019	
April	Special ESC session – to review final versions of CMPs and recommend selection to Commission
June	Special Commission meeting - selects and adopt MP
September	ESC - Implementation of agreed MP to provide TAC advice
October	Commission – agrees TAC advice
OPTION 2	
2018	
June	OMMP – first presentation of candidate MPs (CMPs)
September	ESC - includes presentation of refined CMPs and a session for interaction with stakeholders
October	Commission – confirms or amends broad recovery objectives etc. based on advice from ESC
2019	
June	OMMP – reviews final versions of CMPs to develop limited set to put forward to ESC
September	ESC – selects final set of CMP options and implements each to provide TAC advice associated with each
October	Commission – adopts MP and agrees TAC advice
OPTION 3	
2018	
June	OMMP – first presentation of candidate MPs (CMPs)
September	ESC - includes presentation of refined CMPs and a session for interaction with stakeholders
October	Commission – confirms or amends broad recovery objectives etc. based on advice from ESC
2019	
June	OMMP – reviews final versions of CMPs to develop limited set to put forward to ESC
September	ESC – selects final set of CMP options
October	Commission—selects and adopts MP
2020	
September	ESC - Implementation of agreed MP to provide TAC advice for 2021 (i.e., no standard 1-year lag) Note, this implementation will include data to June 2020, rather than just to 2019. Update assessments including projections using adopted MP
October	Commission – agrees TAC advice for 2021. Perhaps with option to have MP implemented sooner, e.g., via a special meeting should the Commission desire.

Adoption of report

64. The report was adopted.

Close of meeting

65. The meeting closed at 5:17pm, 23 June 2017.

References

Bravington, M.V., Grewe, P.M., and Davies, C.R. 2016. Absolute abundance of southern bluefin tuna estimated by close-kin mark-recapture. Nature Communications 7:13162. https://doi.org:10.1038/ncomms13162

List of Attachments

Attachments

1. List of Participants
2. Agenda
3. List of Documents

Attachment 1

List of Participants
The Eighth Operating Model and Management Procedure Technical Meeting

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Attachment 2

Agenda
The Eighth Operating Model and Management Procedure Technical Meeting
19-23 June 2017
Seattle, USA

1. **Conditioning of OM using updated data**
   1.1 Review of data inputs

   The group reviewed the CPUE indices and clarified several points. The issue that Korean data reflects all sizes of SBT and the Japanese is for age 4+.

   Omega 0.75 as robustness

   1.2 Unaccounted sources of mortality

   1.3 Model structure (size-age, fleets, seasons, etc.)

   1.4 Diagnostics and weights of likelihood components

   1.5 Structure of Reference Set

   1.6 Handling of within-cell uncertainty

2 **Design of a new MP**
   2.1 MP structure
   2.2 Input data series
   2.3 Operating models and testing methods

3. **Code refinements and version control system**

4. **Workplan and timetable**

Attachment 3

List of Documents
The Eighth Operating Model and Management Procedure Technical Meeting

(CCSBT-OMMP/1706/)

1. Provisional Agenda
2. List of Participants
3. List of Documents
4. (Australia) Updates required for new data sources and reconditioning of the CCSBT OM (OMMP Agenda Item 1)
5. (Australia) Potential forms of candidate management procedures and data generation methods (OMMP Agenda Item 2)
6. (Japan) Examination of influence of absence of data from New Zealand chartered Japanese longline vessels on the core vessel CPUE and proposal of its solution (OMMP Agenda Item 1.1)
7. (Japan) A recommendation on the all vessels CPUE series considering loss of data from Japanese-flagged charter vessels in the New Zealand fishery (OMMP Agenda Item 1.1)
8. (Japan) Update of the core vessel data and CPUE for southern bluefin tuna in 2017 (OMMP Agenda Item 1.1)
9. (Japan) Change in operation pattern of Japanese southern bluefin tuna longliners in the 2016 fishing season (OMMP Agenda Item 1.1)
10. (Japan) Update of estimation for the unaccounted catch mortality in Australian SBT farming in the 2016 fishing season (OMMP Agenda Item 1.2)
11. (Korea) Data exploration and CPUE standardization for the Korean Southern bluefin tuna longline fishery (1996-2016) (OMMP Agenda Item 1.1)
12. (Australia) SBT kin-findings and genotyping update

(CCSBT-OMMP/1706/Rep)

1. Report of the Twenty Third Annual Meeting of the Commission (October 2016)
2. Report of the Twenty First Meeting of the Scientific Committee (September 2016)
3. Report of the Seventh Operating Model and Management Procedure Technical Meeting (September 2016)
4. Report of the Twentieth Meeting of the Scientific Committee (September 2015)
5. Report of the Sixth Operating Model and Management Procedure Technical Meeting (August 2015)
6. Report of the Nineteenth Meeting of the Scientific Committee (September 2014)

7. Report of the Fifth Operating Model and Management Procedure Technical Meeting (June 2014)
8. Report of the Fourth Operating Model and Management Procedure Technical Meeting (July 2013)
9. Report of the Special Meeting of the Commission (August 2011)
10. Report of the Sixteenth Meeting of the Scientific Committee (July 2011)