Preliminary consideration of methods for the sensitivity analysis of alternative catch series in projections.

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CCSBT-OMMP/1406/06 - revised

CCSBT Fifth Operating Model and Management Procedure Technical Meeting, Seattle, USA

June 2014

Acknowledgments

This work has been funded by the AFMA and CSIRO Wealth from Oceans Flagship.

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Abstract

The Extended Commission in 2013 requested that the Scientific Committee provide preliminary advice on the impact of unaccounted mortalities on the SBT stock assessment projections and possible future Management Procedure (MP) recommendations. At the 2013 ESC new sensitivity tests for the purposes of the 2014 stock assessment were defined (Table 1, Attachment 8, ESC18), which had implications for the projections code. We have implemented code changes to accommodate these sensitivity tests. In terms of the Extended Commission's request, the code for potential unaccounted mortality scenarios has been tested and documented here. Using this method, we have examined the impact of current unaccounted mortality scenarios on the probability of rebuilding to 20% SSB_0 by 2035, catch (which includes any unaccounted mortalities), TAC and biomass measures. This method allows further exploration of any additional unaccounted mortality scenarios, as may be agreed by the Commission and ESC. Results are provided for a preliminary evaluation of the impacts of the "SV_OverC" scenario as defined in Table 1 in Attachment 8, ESC18.

1 Introduction

The Extended Commission in 2013 requested that the Scientific Committee provide preliminary advice on the impact of unaccounted mortalities on the SBT stock assessment projections and possible future Management Procedure (MP) recommendations. Potential sources of unaccounted mortality have been defined (CCSBT20 and ESC18), but the scenarios for evaluation have not yet been agreed upon. In this paper we discuss the method for inclusion of unaccounted mortality scenarios into the CCSBT projections software.

At the 2013 ESC meeting new sensitivity tests for the purposes of the 2014 stock assessment were defined, that are related to the Commission request described above. Two of these are new and have implications for the projections code. The first is a sensitivity run for unaccounted mortality (defined as "Added catch", Att 8 ESC 2013), which may define scenarios for unaccounted mortalities that are included in both the historical conditioning model and the future projections. The second sensitivity test ("SV_OverC") is defined as: "continue the 20% overcatch from the Australian fishery if the stereo video (SV) system is not implemented", which affects projections only.

The Commission is seeking advice on the impacts of these uncertainties for the purpose of confirming the 2016 and 2017 TAC (as recommended by the management procedure in 2013), and for discussion of the MP recommendations beyond the current 2015-17 block. The results of these sensitivity tests may also inform the exceptional circumstances consistent with the meta-rules adopted as part of the management procedure.

For these projection related sensitivity tests we have compared the results with and without unaccounted mortalities using the updated reference set of OMs and examined the impact on: the probability of rebuilding to 20% SSB0 by 2035, and catch (which include unaccounted mortalities), TAC (which does not include unaccounted mortalities) and biomass measures.

Several code changes are required to implement these sensitivity tests, and these are described here. We have implemented and tested these code changes, and provide examples of results for the "SV_OverC" sensitivity test.

2 Method

2.1 Data

Hypotheses for unaccounted catch mortalities (UAM) in sensitivity analysis defined as "Added catch" will be discussed and refined at the OMMP5 and ESC meetings in 2014 and potentially beyond, based upon the papers presented to the meeting as requested at ESC 2013 and the Commission meeting. For the sensitivity analysis defined as "SV_OverC", a hypothesis for additional catch has already been defined (ESC report Att

8, 2013). We have used this hypothesis for unaccounted mortality for the purpose of designing and testing changes in the projections code and outputs from the models.

The "SV_OverC" sensitivity test specifies that the 20% additional catch added to the surface fishery in the conditioning model, be continued in the projections model. The 20% additional catch is a hypothesis for the catch anomaly (in biomass) from a potential bias in the 40-fish farm size sampling methodology. It was anticipated by the ESC that the anomaly would be resolved by the implementation of the Stereo Video (SV) size monitoring system. To account for the anomaly, the age-frequency of the Australian fishery is adjusted in the input data file for the conditioning model, and therefore the estimated selectivity of the Australian fishery in the projections needs no further adjustment to accommodate this particular sensitivity analysis.

2.2 Measures

We propose that the evaluation of the impact of unaccounted mortalities on the SBT rebuilding plan be measured by calculating the probability of recovery to the rebuilding target level of 0.2 SSB by 2035, for the full reference set of OMs, using the MP to set TACs. The measure of impact of the unaccounted mortality scenarios can be made by comparing the probability of rebuilding to the target with and without the inclusion of unaccounted mortality scenario data, using the MP as it was tuned and adopted in 2011.

Impacts of the unaccounted mortality scenarios on projections can be measured by comparing median biomass, sum of catch and sum of TAC over the period of the projections, with and without the unaccounted mortality scenario data.

2.3 Code Changes

In an initial implementation of this method, a multiplier for additional catch has been added to the projections control file. The projections code has been modified to read the vector of multipliers (one per fishery, value = 1 if there is no additional catch). If future hypotheses include temporal changes in the unaccounted mortality scenarios over the period of the projections, then the vector can be modified to a matrix (yr x fishery) and the input data modified accordingly.

In the projections code, a variable that holds a copy of the quota amount is increased according to the multiplier for each fishery, and fishing mortality is estimated and total catch calculated from the total mortalities. Both catch (which includes UAM) and the TAC estimated by the management procedure (which does not include UAM) are reported in output files. Selectivities for each fishery are determined by the conditioning model, and in the examples shown here do not include any new scenarios for historical unaccounted mortalities.

The projections code calls the MP code which is unchanged from when it was adopted in 2011. The MP data files have been updated with: 1) the new time series for the Aerial Survey (AS), 2) the new time series for the CPUE (average of the base series and adjusted for historical over catch scenarios), and 3) the qratio value, updated to reflect the new AS scaled index. The simulated CPUE and AS data in future years are from the projections of each of 2000 OMs in the reference set. TAC allocations which are currently hardwired in the projections code have been updated to reflect allocations for the years for which the TAC has already been set, and also for approximate nominal allocations.

3 Results

These results are preliminary and may change when the OM is re-conditioned. They are based on the re-conditioned operating models described in Preece et al (2014, OMMP5/1406/4), which incorporate all the new data including aerial survey and CPUE.

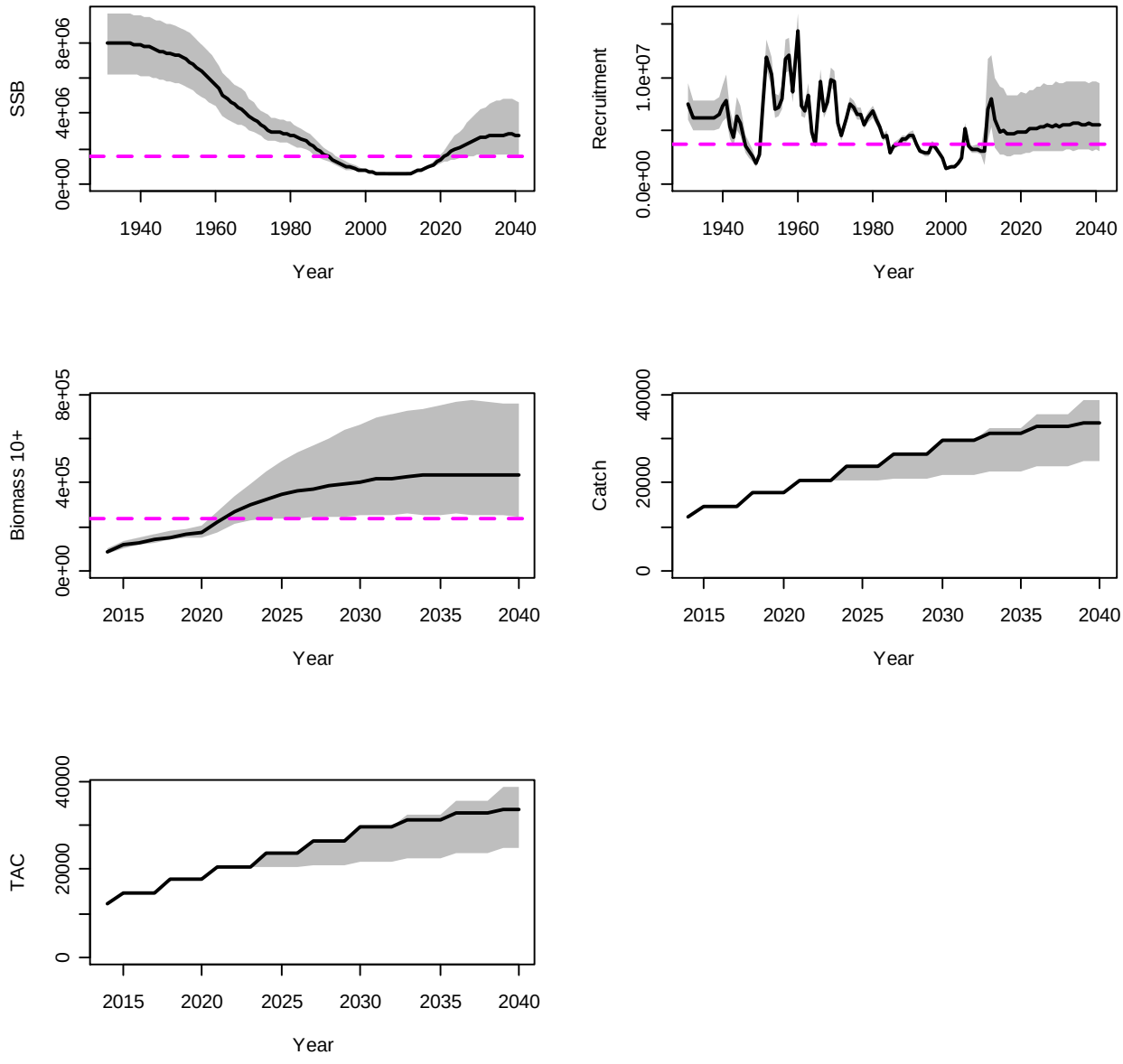

Figure 1 Projections with no unaccounted mortality, using the MP to set TACs. SSB (new definition from inclusion of close-kin), Recruitment, Biomass 10+ (definition used in 2011), Catch and TAC. In each plot the black line is the median of the simulations, grey area is 80th percentile, and the pink dashed line is 0.2*SSB(0) in the SSB plot, 0.5*median R(0) in the recruitment plot, and 0.2*median B10+(0) in the Biomass10+ plot.

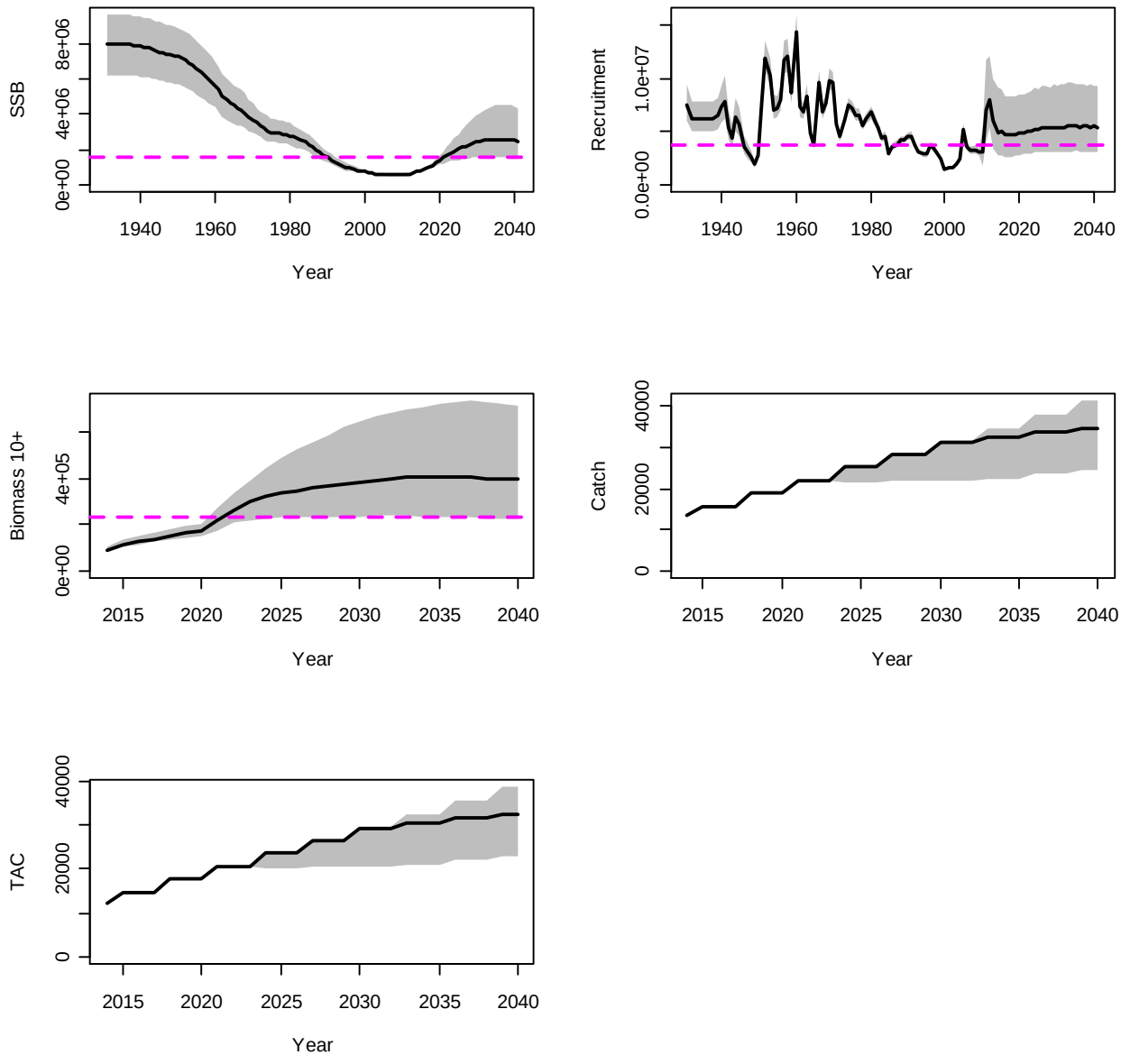

Figure 2 Example projections of the SV_OverC unaccounted mortality sensitivity test, using the MP to set TACs. SSB (new definition from inclusion of close-kin), Recruitment, Biomass 10+ (definition used in 2011), Catch which includes the unaccounted mortality and TAC which does not include unaccounted mortality. In each plot the black line is the median of the simulations, grey area is 80th percentile, and the pink dashed line is 0.2*SSB(0) in the SSB plot, 0.5*medianR(0) in the recruitment plot, and 0.2*medianB10+(0) in the Biomass10+ plot.

Table 1 Impacts on rebuilding and projections with and without unaccounted mortality, where SV_UAM is the SV_OverC sensitivity test. The SBT MP was tuned to B10+, and therefore impacts are reported for B10+. Catch reported from this modified projections code includes the unaccounted mortality. TAC is the recommendation from the MP and the amount used in the MP to calculate the recommended TAC for the next 3 year block.

SENSITIVITY TEST	P[B10+(2035) > 0.2*B10+(0)]	P[B10+(2025) > 0.2*B10+(0)]	SUM OF CATCH 2014:2035 10^{TH} 50^{TH} 90^{TH}	SUM OF TAC 2014-2035 10^{TH} 50^{TH} 90^{TH}	MEDIAN B10+ 2014-2035 10^{TH} 50^{TH} 90^{TH}
Reference set updated data no_UAM	92%	88%	433000 503000 509000	433000 503000 509000	211000 297000 432000
SV_UAM	88%	86%	448000 532000 544000	419000 498000 509000	202000 286000 421000

The results for this preliminary example indicate that probability of the spawning biomass, using the B10+ definition, reaching 0.2 SSB0 (the rebuilding target) by 2035 is 0.92 in the absence of any UAM and is 0.88 if the SV_OverC hypothesis continues into the future. Catches include unaccounted mortalities, and are therefore greater for the SV_OverC sensitivity test. TACs recommended by the MP are less under the SV_OverC run, and there are some impacts on the Median Biomass10+.

4 Discussion

The additional 20 percent of catch from the Surface fishery specified in the SV_OverC sensitivity test is already included in the historical catch scenarios used in the SBT conditioning model. Based on the assumption at the time of adoption of the management procedure that the Stereo Video size sampling system would be implemented and resolve any outstanding uncertainty, the additional catch scenario was not carried forward into the projections used in the evaluation of MPs. Hence, the performance and robustness of the adopted MP (the Bali Procedure), as tested by MSE, does not account for this, or any other source, of unaccounted for mortality.

The results of the example given here to test the modifications to the projections software indicate that the SV_UAM hypothesis has an impact on the SBT rebuilding performance. For the set of conditioning models used here there still is a high probability that the rebuilding target will be reached by 2035. Examination of the impacts on the sum of the TAC and catches over the projection period, and on the median Biomass from this example indicate that these are lower under the SV_OverC sensitivity test, with corresponding impacts across the fishery. The reconditioning of the OMs is yet to be completed, and therefore these results may change with reconditioned OMs to be considered by the OMMP Working Group and the ESC.

These preliminary results indicate that the current probability of recovery to 0.2 SSBT by 2035 is higher than the value to which the Bali Procedure was tuned. This is to be expected given the new data source incorporated into the OMs (e.g. CK) and from updated data since 2011 (i.e. from the CCSBT data exchange 2014). The implications of this will be considered further by the ESC and examined as part of preparation for the MP review scheduled for 2017.

References

Anon, 2013a. Report of the 18th Scientific Committee Meeting.

Anon, 2013b. Report of the 20th CCSBT Extended Commission Meeting.

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