



Preliminary consideration of methods for the sensitivity analysis of alternative catch series in stock assessments

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Abstract

The Extended Commission at its meeting in October, 2013, requested that the ESC evaluate the impacts of unaccounted mortalities on the stock assessment and consider the results in the context of the annual review of exceptional circumstances associated with the operation of the SBT management procedure. This paper discusses technical options for incorporating scenarios for unaccounted mortalities into the conditioning models, and estimating the impacts on stock status. Issues that should be considered in the ESC review of the potential for exceptional circumstances are also discussed. Additional scenarios for unaccounted mortalities for inclusion in the sensitivity analyses for the 2014 assessment of stock status are yet to be defined, but this method is flexible and can accommodate additional scenarios. Approaches to this issue will be discussed further at the OMMP5 meeting and the 2014 ESC, and various scenarios will likely be defined in papers to the ESC.

1 Introduction

The Extended Commission at its meeting in October, 2013, requested that the ESC evaluate the impacts of unaccounted mortalities on the stock assessment and consider the results into exceptional circumstances considerations associated with the operation of the SBT management procedure. This paper discusses technical options for incorporating historical unaccounted mortalities into the conditioning models, and the impacts on stock status that can be examined with the CCSBT operating model. Impacts of future unaccounted mortalities scenarios in projections are covered in Preece et al (2014) as the method and scenarios are slightly different.

It is worth noting that the Commission's request for advice on exceptional circumstances with respect to the unaccounted mortalities is only one of the potential sources of exceptional circumstances in this first assessment year since implementation of the MP. We have identified 5 potential sources of exceptional circumstances based on review of the input data for the MP, potential changes in fishery operations, initial results for the reconditioned operating models and potential sources of historical and future unaccounted mortality. We propose a framework for summarising each of these potential sources, the relevant model comparison and the potential impact on stock status and catches to facilitate consideration of the implications of each for exceptional circumstances and identification of required analysis for the ESC.

At the time of writing, scenarios for new historical unaccounted mortalities for inclusion in the assessment modelling are undefined. Approaches to this issue will be discussed further at the OMMP5 meeting and the 2014 ESC, and various scenarios will likely be defined and refined by the ESC and Commission over time.

2 Data

Data for inclusion in unaccounted mortality scenarios are being collated; available details are in Sullivan (2014) and Itoh (2014) and previous OMMP and ESC Reports. Data on historical unaccounted mortalities for sensitivity testing scenarios will need to be specified in terms of catch amount, which fishery selectivity they reflect most closely, and the years over which they are to be applied. Additional considerations for their technical implementation in the models include whether or not these scenarios might affect CPUE interpretation, age or length frequencies, or tag reporting rates. The estimates are likely to be uncertain, in both qualitative and quantitative sense, and approaches for incorporating this uncertainty need to be considered.

As noted above, the catch anomalies identified in 2006 have already been incorporated into the assessment models, including the SV_OverC scenario (defined in Att 8 ESC 2013).

3 Methods and Measures

To examine the implications of unaccounted mortalities on stock status, we suggest that we calculate current estimates of key stock status measures (e.g. depletion) using the conditioned OMs with and without scenarios for unaccounted mortalities. This raises some issues that will need to be considered and resolved by the OMMP Working Group, for example for some unaccounted mortality scenarios the OMs may need to be reconditioned if the ranges defined in the reference set grid of models, or some fixed parameters, are not consistent with the scenario data and need to be updated to give reasonable stock status estimates.

Stock status measures to consider are: depletion, total catch taken, including the unaccounted mortalities and the TAC (as set by the Commission) or accounted catches. Population dynamics estimates from the OM which may be impacted include: initial Biomass size (B_0), steepness and the mortality estimates selected in the grid.

For the purposes of investigating the potential implications of unaccounted mortalities, it may be necessary to include catches in fisheries with a similar selectivity to the UAM scenario, but this may not necessarily be the fishery from which the UAM are thought to arise. Some historical unaccounted mortality scenarios may be considered for inclusion in future projections but will need to be transformed to percent increase per fishery (from absolute estimates) for a reduced set of fisheries, if the method proposed in Preece et al (2014, OMMP/1406/6) is adopted.

We propose a stepwise examination of changes in various stock status measures from the conditioning models in order to systematically identify the impact/influence of i) addition of new data sets (e.g. close-kin), ii) updating of key monitoring data (e.g. Aerial Survey, CPUE, CAA from fisheries) and iii) sensitivity tests associated with unaccounted mortalities. In doing so, some impacts may be most appropriately measured relative to the 2011 stock assessment results (e.g. addition of close-kin data), while others are best made relative to the re-conditioned models with updated data in 2014 (impact of unaccounted for mortalities). Table 1 illustrates the proposed approach, with preliminary results included where available.

One example included here is the impact of the continuation of the surface fishery (SV) catch anomaly between 2011 and 2014. This has been done by running the 2014 operating models with the surface fishery catch anomaly switched off (1.2 is set to 1.0, P_T value remains unchanged) for the years 2012 and 2013.

Table 1 Proposed approach and measures for comparison between the 2011 and the 2014 stock status results with and without historical unaccounted mortalities. Catch and TAC are summed for the years shown.

Model	Grid effects/ population dynamics	Depletion	Catch* taken including UAM (2012- 2013)	TAC 2012-2013
2011	N/A	0.03-0.08 (B10+)		
2012-2013: +CK+grid changes	Lower M10, higher median B0, steepness uniformly weighted	-	-	-
2014 (data updated)	Unchanged from row above	~0.06-0.09 (B10+) 0.08-0.12 (SSB)	~22827	21398
2014 without SV anomaly in 2012 & 2013	Unchanged from row above	Unchanged from row above	~21073	21398
2014 +UAM scenario 1	-	-	-	-
2014 + UAM scenario 2	-	-	-	-

* Catch taken is based on the catches by season as used in the Operating Models and is not adjusted to match exactly with the quota year

4 Discussion

Sensitivity tests for examining potential impacts of historical unaccounted mortalities on stock status estimates are still being developed. Concurrently, the compliance committee is reviewing the formal definition of “catch”, which may alter the historical catch data reported to the CCSBT in the next few years, and the unaccounted mortality scenarios.

Depending on level of supporting information for each source of potential unaccounted mortalities, these data may be included in the catch series used in future stock assessments and OMs.

The decisions regarding historical unaccounted mortalities have implications for projections and what UAM to assume continues in the future. The proposed method for including unaccounted mortalities in projections assumes a multiplier on catches (i.e. a percentage increase), and the 6 fisheries defined in the conditioning model are reduced to 4 in the projections. Therefore the unaccounted mortality catch quantities (in tonnes) will need to be considered in terms of percentage increase per fishery for the projections. The fishery to apply these to is based on consideration of the selectivity of each fishery.

4.1 Exceptional circumstances

There is the potential for the additional data in the UAM to indicate exceptional circumstances for operation of the MP, and the Extended Commission specifically asked for results from the unaccounted mortality sensitivity tests to be incorporated into exceptional circumstances advice. To facilitate discussion we have explored the exceptional circumstances provisions in more detail here.

The Meta-rule and exceptional circumstances associated with management procedures (Anon 2011a, 2013) are intended to guide scientists and managers in the event that situations arise that are outside the range for which the management procedure was tested.

“The main reasons for deciding that such circumstances should apply would be either unexpected results (positive or negative) arising from monitoring data; or evidence becoming available that the true situation of the resource/fishery/monitoring differed (better or worse) from that envisaged by the operating models used for the testing.” (Anon. 2011b)

This is the first reconditioning of the CCSBT operating model since the MP was implemented. Hence, this is the first time that stock status updates are compared with the range of values used and estimated when the MP was adopted in 2011.

Potential sources of exceptional circumstances based on review of input data, preliminary results of reconditioned operating models and projections include:

1. Aerial survey or CPUE indicators data used in the MP that are outside the range simulated in the OM in 2011.
2. The updated stock assessment (which formally includes the CK data for the first time) may indicate that the stock size, recruitment estimates, population dynamics, or parameters are outside the range in the simulations in 2011.
3. Changes in the fisheries or fishing operations: e.g. changes to age or length frequency or selectivity patterns. For example, the Indonesian CAA appears to have changed in 2012/13 and 2013/14 towards younger/smaller fish.
4. Catches are greater than the TAC set by the Management Procedure. For example, in the MSE of the MP in 2011 it was assumed that SV would be implemented, and therefore the adjustments related to this that are in the historical catch series in the operating model, were not included in the MP projections.
5. Impacts of historical and future unaccounted mortalities on stock status or the SBT rebuilding plan and future projections.

The meta-rules process for the MP (ESC Report 2013, Appendix 10) involves a number of steps:

1. determining whether exceptional circumstances exist;
2. a “process for action” that considers the severity of the exceptional circumstances for the operation of the MP, and assessment of the types of actions that may be considered, and
3. “principles for action” that determine how recommendations from the management procedure might be altered, if at all.

The actions are determined through discussion and evaluation of the potential additional impact or risk to the stock and/or fishery by the ESC. For example, if an indicator is outside the range tested, but is positive in terms of the implications for the stock and how this would affect the MP decisions, then the appropriate recommendation to the Commission may be that the MP should continue to be implemented as there is unlikely to be any additional risk to the stock. The associated follow up action may include further

investigations of the data be undertaken, and/or monitoring activities be increased, and the results included in the next full stock status assessment or as part of the next schedule MP review. Alternatively, if a particular case of exceptional circumstances implied a strong negative signal for the stock, then the action may be to not proceed with a TAC increase recommended by the MP, or in extreme circumstances reduce the current TAC, while additional data is obtained and assessment of implications completed.

A strong advantage of having an extensively tested MP in place for setting catch limits is that it has been demonstrated, to the extent possible, to be robust to a wide range, but not all, circumstances. As such it should provide for orderly consideration and response to unforeseen situation and/or observations and prudent management action, if required.

5 Summary

Potential implementation of unaccounted mortality scenarios and measures of impact are outlined, but scenarios are still to be defined based on papers and data to be provided to the ESC. The rationale for evaluating whether exceptional circumstances have occurred and the actions required by the ESC, should they be triggered, is discussed. Positive but exceptional signals are more likely to trigger actions that involve further investigation and “watching brief” in preparation for the scheduled MP review. Links between the historical unaccounted mortality scenarios for investigation of stock status impacts and future unaccounted mortality scenarios for impacts in projections have been identified for consideration of the working group and advice to the ESC.

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