A Response to Proposed Additional Ecosystem Considerations for Exceptional Circumstances Relating to the Sardine-Anchovy OMP-14

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A new Operational Management Procedure, OMP-14, was adopted at the end of 2014, subject to the finalization of the specific issues that should be considered annually regarding whether Exceptional Circumstances are deemed to exist, and if so, requiring a review and possibly a revision to OMP-14. The procedure for deviating from an OMP is general and applies across multiple Scientific Working Groups (Rademeyer *et al*. 2008). However, at the adoption of an OMP, specific issues regarding the underlying assumptions of the Operating Models (OMs) for the specific resources used to simulation test the associated OMP can be highlighted for monitoring as part of this procedure. The draft list of such specific issues was given in section 1.2 of Appendix B of de Moor and Butterworth (2014).

Hagen and Jarre (2015) raise some issues which are certainly pertinent to OMP-14. However, these are not necessarily most appropriately dealt with under the Exceptional Circumstances heading. The OMP has been simulation tested for a range of possible future scenarios, and the Exceptional Circumstances provisions are primarily intended to deal with instances where future data indicate a scenario to have arisen that are outside this range, or some assumptions made in the OMs used for testing are wrong. For example, a (very) low – or high – future survey estimate of abundance would not necessarily require these Exceptional Circumstances to be declared with possible deviation from the OMP recommendations. Exceptional Circumstances would only need to be declared if the low (or high) survey estimate is so extreme that it was not taken into consideration during simulation testing. If it was taken into consideration during OMP testing, and performance statistics were satisfactory such that the OMP was adopted, then the OMP has already been shown to provide the feedback necessary (through adjusting TACs) in such situations. To continue with this same example, one of the specific issues to be considered annually is "Whether survey estimates of abundance are appreciably outside the bounds predicted in the OMP testing" (Section 1.2 of Appendix B of de Moor and Butterworth (2014)). Typically, 90 or 95 percentiles have been used to bound this range (e.g. Cunningham and Butterworth 2006, de Moor 2012). Thus, for example, if a future November hydroacoustic survey estimate of sardine biomass is less than 202 000t (2.5th percentile) or 285 000t (5th percentile), Exceptional Circumstances may be declared (Figure 1).

Each of the specific issues listed in section 1.2 of the Appendix B of de Moor and Butterworth (2014) relate to a specific underlying assumption(s) of the OMs. Any further additional ecosystem considerations to be included should thus be of the same nature.

However, it is also important here to return to the objectives and performance statistics agreed to be used in selecting OMP-14 (de Moor and Coetzee 2012). Due to time constraints, the performance statistics for the secondary trade-off objectives E2 and E3 were not computed before OMP-14 was adopted.

Objective E2:

- Ensure the biomass of sardine remains sufficient over time both west and south of Cape Agulhas

Performance Statistics:
- The same performance statistic as used in E1 provides an index of the sardine biomass west of Cape Agulhas [this is given in Table 3 of de Moor and Butterworth (2014)]
- For a 1 stock model, which assumes full mixing, and provided that there is no sardine distribution shift away from the south coast, OMP control parameters that secure adequate performance for the west coast penguin performance statistics under E1 would be assumed to also secure such adequacy for predators south of Cape Agulhas
- For a 2-stock OM, in the absence of a predator model for south coast penguin colonies, biomass proportional reduction statistics for the south stock similar to those required for the west stock to achieve E1 will be used. [Note that it has been agreed that finalisation of a two-stock OM will await the process of developing OMP-16]
- Average number of years for which observed sardine biomass west of Cape Agulhas remains below a threshold of 336 000t[1], once it drops below this threshold

Objective E3:
- Ensure a combined sardine and anchovy biomass sufficient to avoid potential catastrophic ecosystem implications.

Performance Statistics:
- Proportion of times the future combined biomass drops below a[2] lower percentile of historic (1984-2011) combined biomass
- Proportion of times the future combined biomass of sardine and anchovy drops below one third[3] of their maximum historic (1984-2011) combined biomass, both in the presence and in the absence of fishing.

Inspection of the performance statistics above shows close similarity to some of the issues raised by Hagen and Jarre (2015). The appropriate approach to take this matter forward, should the SWG-PEL so desire, would therefore seem to be:

I)   to follow through with the computation of those performance statistics (and, if compelling rationale is offered, perhaps some further ones related to these and the issues raised by Hagen and Jarre (2015)) under the current OMP-14;

II) to consider whether the values of those statistics are considered to reflect adequate performance of OMP-14;

III) if yes to 2), the process ends;

IV) if no to 2), calculations under alternative candidate MPs would need to be considered in terms of the trade-offs between improved performance under these "secondary" E2 and E3 performance statistics against possible deterioration in other "core" and "secondary trade-off" statistics[4], leading perhaps to a recommendation to revise OMP-14; note that those alternatives might not only adjust

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[1] The threshold of 336 000t corresponds to the index of 0.25 of the maximum historic observed sardine biomass west of Cape Agulhas (Figures 4a, 5a and 6a of Robinson and Butterworth (2012)); their analyses indicate that it is below this threshold that Robben Island penguin natural mortality rates start to increase.

[2] The percentile (eg 10% or 20%) will be chosen once the operating models have been completed and the implication of the percentile on historic combined biomass can be determined.

[3] The fraction one third relates to the result on Cury *et al.* (2011) that seabirds experience consistently reduced and more variable productivity below this prey abundance level.

[4] Note, by design, the non-negotiable objectives of meeting the quantitative resource risk criteria will be met.

the values of the control parameters of OMP-14, but also add further specific meta-rules, perhaps along the lines implied by Hagen and Jarre (2015).

In linking this approach to the issues 1 to 4 of Hagen and Jarre (2015), the following technical points need to be kept in mind.
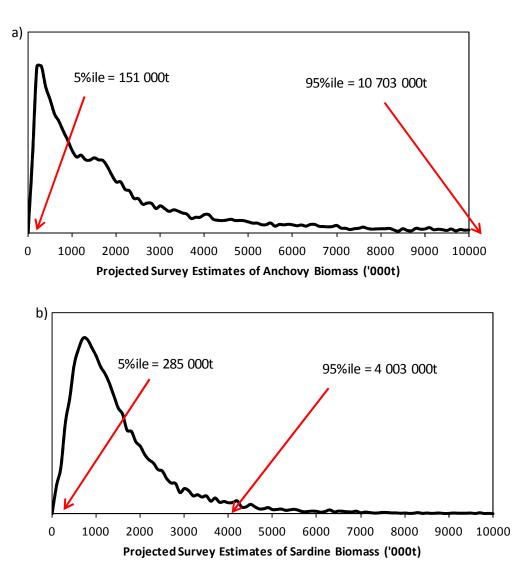
1. The calculation machinery, as specified for E3 (reproduced above) is already in place. However to extend this to east and west of Cape Agulhas will require agreement regarding an approach for anchovy, e.g. whether the same approach used for sardine in E1 is acceptable.
2. Procedures to mimic the sardine biomass in stratum C given a single-stock OM would need to be agreed.
3. No "threshold" was proposed by de Moor and Butterworth (2015). Clarification of what "threshold" is intended is required.
4. This aspect has essentially already been covered through the (range of) stock-recruitment functions for the single stock model used in developing and selecting OMP-14.

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a)

5%ile = 151 000t

95%ile = 10 703 000t

Projected Survey Estimates of Anchovy Biomass ('000t)

b)

5%ile = 285 000t

95%ile = 4 003 000t

Projected Survey Estimates of Sardine Biomass ('000t)

Figure 1. The distribution of simulated future November hydroacoustic survey estimates of a) anchovy and b) sardine under OMP-14.