A summary of key issues relating to MSC queries about the assessment of deep-water hake (*M. paradoxus*) as a stock shared between South Africa and Namibia

Butterworth, D.S., and Ross-Gillespie, A.[1]

Summary

There is debate concerning how best to address the issue of possible demographic sharing of deep-water hake, *M. paradoxus*, off Namibia and South Africa in the context of the requirements of MSC certification. These include both assessment and management aspects. While the latter would seem to have been adequately addressed, the former is not completely resolved. Analyses to date indicate that the estimated status of the overall resource under the one extreme of panmixia is always better than for the South African component considered in isolation. The Panel is requested to comment on the South African position that further plausible robustness tests, related especially to likely future resource monitoring data, are very unlikely to change the direction of this effect. This request includes suggesting possibilities for further investigation for which this conclusion might not follow.

KEY WORDS: South African hake, MSC certification; stock; mixing; genetic; demographic

Introduction

Genetic results for deep-water hake, *M. paradoxus*, unlike the situation for shallow-water hake, *M. capensis*, do not confirm that different stocks are harvested off South Africa and Namibia. There is no argument that *M. paradoxus* is a genetically shared stock between the two countries, but this does not imply that *M. paradoxus* is fully mixed demographically across this region. Possibilities for demographic mixing span the full range from no-mixing to panmixia.

The South African hake fishery received its MSC re-certification in 2020. One condition of this re-certification which has to date not yet been met is that the "assessment is appropriate for the [*M. paradoxus*] stock and for the harvest control rule". The reasons given initially that this condition has not been met related to "evidence" that the *M. paradoxus* stock may be shared to some extent between South Africa and Namibia and that no joint management structures are in place. Relevant extracts of the most recent MSC surveillance report have been included in the Appendix. South Africa has been addressing this concern in circumstances where the MSC rules refer to "shared stocks" without clarifying the distinction between genetically and demographically shared. South Africa has argued based on a position that for resource conservation, only possible demographic mixing is pertinent.

Given uncertainties about the extent of such possible demographic mixing, South African efforts to address this issue have been based on considering two extremes:

i)   No demographic mixing, so that the SA *M. paradoxus* stock status is as assessed in South African analyses which are restricted to the catch and resource monitoring data from South African waters.

ii)   Demographic panmixia, for which SA and Namibian data need to be taken into account together.

It is then argued that for partial demographic mixing , assessment results would be intermediate between those for these two extremes.

More specifically, efforts to date to address this issue further have included:

---

[1] Marine Resource Assessment and Management Group, Department of Mathematics and Applied Mathematics, University of Cape Town, Rondebosch, 7701

a) a robustness test for the 2018 hake OMP which confirmed that conservation performance was adequate under the extreme of panmixia if the future Namibian catch of *M. paradoxus* is increased by up to 40 000t (Hake/P6),

b) a variant of the South African Reference Case Operating Model (serving as a "best assessment") which takes into account Namibian catches of *M. paradoxus* (Hake/P7), and

c) the same variant of the SA RC OM as in b) that includes the Namibian *M. paradoxus* survey abundance series (Hake/P8).

Note that a joint management structure has recently been put in place which recognises the need for action if the constraint in a) above is violated.

Analyses a) and b) received external reviews (Hake/P9 and Hake/P10) and were formally considered in the 2020 recertification. The work for item c) was conducted slightly later, which turned out to be too late for formal consideration in the 2020 recertification. This was unfortunate as the lack of inclusion of a Namibian abundance series in b) was the single substantive concern in the reviews (Hake/P9) and was singled out by the CAB for the SA hake surveillance audit as the main reason that the assessment in b) failed to satisfy their requirements. While Hake/P8was considered in the most recent MSC audit, the surveillance team was prevented by MSC Derogation 6 from reviewing the status of the condition at this audit but will do so at the next audit.

It is the South African view that the work conducted under a)-c) is sufficient to demonstrate the following.

A. The SA OMP is robust to (reasonable) changes in future Namibian fishing activity, and furthermore "allowing for the possibility that there is sharing of the *M. paradoxus* resource between South Africa and Namibia results in an estimated status (current to pristine spawning biomass ratio) for that species which is (often considerably) better than indicated by the assessment of SA hake in isolation (in the RC OM)" (Hake/P7).

B. Further data inputs and updates as are likely to become available in the foreseeable future are highly unlikely to change this conclusion.

To be more specific in regard to A), the result that under the panmictic assumption, the status of the *M. paradoxus* stock is seen to be determined primarily by the full history of past catches as well as trends in indices of abundance, especially in earlier decades. The conclusion that future data are unlikely to change the conclusion of *M. paradoxus* stock status under some extent of demographic mixing always being better than that of the SA population viewed in isolation therefore follows.

What is therefore sought, to assist preparation for the next Surveillance audit, is a discussion of whether there are any further robustness tests of the SA-Namibia combined assessment that merit examination because there is some possibility that they might reverse the direction of results of the comparison of results with those of the isolated-SA resource reported above.

Key Question for the IWS Panel

1. What plausible robustness tests of the joint SA-Namibia *M. paradoxus* assessment in DEM/03 and DEM/11 have a possibility of resulting in a worse estimated current stock status than that for the SA resource in isolation?

List of IWS Documents:

Primary

Hake/P6: Butterworth, D.S. and Ross-Gillespie, A. 2020. On the robustness of the SA hake OMP2018 to an increased Namibian catch of *M. paradoxus.* Fisheries Branch document FISHERIES/2020/MAR/SWG-DEM/02.

This document is the first of a series of three (P6-P8) which explore the robustness of the South African assessment model and OMP to the inclusion of Namibian data. It reports on robustness of the SA hake OMP2018 to various levels of an increased future Namibian catch of *M. paradoxus*.

Hake/P7: Butterworth, D.S. and Ross-Gillespie, A. 2020. Simple variants of the SA hake Reference Case Operating Model (assessment) to take account of Namibian catches of *M. paradoxus.* Fisheries Branch document FISHERIES/2020/MAR/SWG-DEM/03.

Historical Namibian catches are included in the SA hake Reference Case Operating Model (RC OM).

Hake/P8: Butterworth, D.S. and Ross-Gillespie, A. 2020. A further variant of the South African hake 2019 Reference Case assessment model that includes the Namibian *M. paradoxus* survey abundance series as well as historical Namibian catches*.* Fisheries Branch document FISHERIES/2020/AUG/SWG-DEM/11.

Historcal Namibian catches and the Namibian *M. Paradoxus* survey abundance series are included in the SA hake RC OM. This analysis was conducted in response to critique in the external review of P6 and P8 (see P9).

Hake/P9: Punt, A.E. 2020. Review of two analyses related to the robustness of the management procedure for South African hake to assumptions related to a stock distribution for *M. paradoxus* that extends into Namibia. Fisheries Branch document FISHERIES/2020/MAR/SWG-DEM/04.

First external review of P6 and P7. Unfortunately, P8 was not available at the time of the review and is thus not considered here, or in P10.

Hake/P10: Wilberg, M.J. 2020. Review of the potential implications of a shared M. paradoxus stock between South Africa and Namibia on the performance of OMP2018. Fisheries Branch document FISHERIES/2020/MAR/SWG-DEM/05.

Second external review of P6 and P7.

Background

Hake/BG3: Ross-Gillespie, A. 2022. Update to the hake Reference Case Operating Model with corrected longline data, and 2021 commercial and 2022 survey data. Fisheries Branch document FISHERIES/2022/OCT/SWG-DEM/35rev.

The most recent SA Hake RC results, for background information.

Hake/BG4: Ross-Gillespie, A., and Butterworth, D.S. 2022. Road map for the 2022 hake OMP revision. Fisheries Branch document FISHERIES/2022/OCT/SWG-DEM/30rev.

Details fo the hake 2022 OMP, for background information.

Appendix: Extracts from most recent MSc surveillance report

Reference: Andrews, J., Scarcella, G. and Pierre, J. 2022. Marine Stewardship Council 1st surveillance report for the South African hake trawl fishery, August 2022.

The timeline here is perhaps confusing. Hence, the South African understanding thereof is hence summarised. This is that only documents DEM/02 and DEM/03, together with the review reports by Punt (DEM/04) and Wilberg (DEM/05) were available by the deadline to which the evaluation given under "Rationale" below applies.

Hence document DEM/11, produced in response to Punt's comments and to the CAB reaction to these four documents (as in "Rationale" below), is not taken into account there, but will be taken into account during the next surveillance audit. Note that the results in DEM/11 of including the extra survey series in the assessment, as requested, make no meaningful changes to the results in DEM/03.

From Page 10 of the report

The status of the conditions of certification for this fishery following this surveillance audit (and with MSC Derogation 6 applied) is briefly summarised below: -

a. **Condition 1[2]:Stock assessment (*Merluccius paradoxus*)**. At this surveillance audit South African scientists presented information on robustness tests that they have carried out, which confirm that the stock assessment model is robust to the exclusion of Namibian data. The Namibian client has agreed a contract for an independent scientist to carry out a review of their stock assessment, including robustness testing. Although the status of this condition is not reviewed under Derogation 6 at this audit, the available evidence is that good progress is being made in both South African and Namibia.

From Page 51 of the report

Condition 1 (UoA1) : Assessment of Stock Status - M. paradoxus

Performance Indicator	1.2.4: There is an adequate assessment of the stock status
	SIa: The assessment is appropriate for the stock and for the harvest control rule.
	SIb: The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.
Score	70
Rationale	**SI a:** In South Africa, the assessment model used is a sex-disaggregated Age-Structured Production Model (ASPM), which is fitted directly to age-length keys (ALKs) and length frequency distributions of *M. paradoxus*. The general specifications of the overall model are set out together details of data and parameterisation in Appendix A of Rademeyer, et al., 2018. The ASPM model has been extensively reviewed both in the context of this hake application and in stocks around the world. While all models are approximations, the ASPM evaluation approach appears to capture all significant features of the *M. paradoxus* biology, the nature of the fishery and the data at hand.
	In Namibia, assessment uses the same age-based model (ASPM), that makes use of survey data, catch at age data and commercial CPUE (Kirchner et al., 2012) considering both

[2] MSC Derogation 6 applies – milestones have been extended by 12 months at this audit. The status of these conditions (on target / behind target etc) is therefore not reviewed at this audit for the conditions covered by Derogation 6.

species together. The harvest control rule forms part of the assessment procedure and automatically calculates BMSY and the replacement yield as well as the catch corresponding to the HCR. As applied, the model fits a Beverton-Holt stock recruitment model within the assessment from which MSY is estimated and projections made. The assessment is appropriate for the stock complex (*M. paradoxus* and *M. capensis*) and was designed with these species and fisheries in mind. The assessment considers the main life history characteristics of the stock such as weight at age, age at maturity and natural mortality. However, the biological features considered represent a merging of two species and a more detailed assessment that explicitly modelled individual species is required.

However, taking into consideration the evidence that the stock is shared to some extent, and these assessments do not take this into account, they are not considered to be appropriate to estimate the overall status of the *M. paradoxus* stock and for the harvest control rule.

This conclusion is consistent with that outlined in Punt (2020), who concluded as follows:

- *The papers I reviewed* [Butterworth and Ross-Gillespie (2020a,b)]*are not the ideal I would wish for - an assessment / MSE that uses data for Namibia and South Africa is the ideal. However, this appears not to be feasible at present, but the requests for data to be provided should continue.*

- *While there are clearly policy considerations here, the Butterworth and Ross-Gillespie (2020a) analysis is appropriate to justify that the management procedure for South African hake shows robustness to the M. paradoxus stock being shared with Namibia. The analysis probably over-estimates risk because it assumes that no management action will be taken by Namibia irrespective of what monitoring may indicate. The analysis also over-probably over-estimates risk because the Expectational Circumstance provision will be triggered with higher probability for the cases where conservation performance is poorer than expected, but the consequences of such triggering are not explicitly taken into account.*

- *The assessment made under the assumption of complete demographic panmixia and homogeneity is technically correct in that if a population is perfectly homogenous, one does not need data over the whole range. The results should be interpreted with caution because it includes no abundance index data for a large portion of the range. Nevertheless, the conclusion that stock status is more optimistic follows from the assumptions made and the differences in the time-trajectories of historical catch.*

- *Overall, the analyses seem appropriate given the challenges of data availability and provide a reasonable basis to understand the consequences of the management system in place off South Africa if the M. paradoxus stock is shared demographically with Namibia.*

The MSC Fisheries Standard (v2.01 at GSA2.7) clearly states: "*Assessment teams should specifically take into consideration the appropriateness of the stock assessment in relation to the metapopulation structure*".

Therefore,taking into consideration the Punt (2020) conclusions and the relevant MSC Guidance, the team judges that at the moment the evidence is that the assessment is not appropriate for the metapopulation structure for this stock. Therefore, SG 80 is not met.

SI b: The 'default' reference points described in GSA2.2.3.1 are equivalent to the 'generic' reference points referred to in PI 1.2.4. MSY is an accepted framework for deriving reference points for gadoid fisheries.

In Namibia the B_{MSY} reference points are estimated from a Beverton-Holt stock-recruitment function which is a standard default model for many similar species. The biomass limit reference point is selected as the observed value in 1990 when Namibia

	assumed sole responsibility for stock within its EEZ. This represents one of the lowest values and appears to be in the region where recruitment may be impaired. The stock assessment model estimates the reference points and current stock status relative to these. Although the approach estimates combined reference points for both species, this approach appears to be precautionary for *M. paradoxus.* In South Africa the reference points are estimated directly in the framework of the assessment as B_{MSY} and unfished biomass (B_0). In both assessment methods stock status is expressed relative to MSY reference points and with associated CVs (measures of precision). The reference points employed both in the South African and Namibian models take into account the major features of the species and the productivity of this stock, and arethus considered appropriate for the species category (hake). Therefore SG 60 is met because stock status is measured relative to appropriate generic reference points. However, as outlined before in 1.2.4a the methodology applied also to estimate stock status relative to reference points is not "appropriate" (*sensu* MSC Standard v2.01 at GSA2.7, taking into account the conclusions from the independent review by Punt (2020).Therefore, SG 80 is not met.

Condition	Evidence shall be presented to show that here is an adequate assessment of the stock status that:
	
	  a) Is appropriate for both the stock assessment and for the harvest control rule;
	  b) Estimates stock status relative to reference points that are appropriate to the stock; and can be estimated.

Condition start	Public Certification report (12th February 2021)
Condition deadline	Year 4 of current certification (2025)
Milestones	Year 1 (2022):A proposal shall be presented for reviewing and if necessary, updating the current national assessments of the *M. paradoxus* stock carried out by South Africa and Namibia in the context of points a and b of the condition. Resulting score: 70 Year 2 (2023):Results of the review of the stock assessments shall be presented.This should: a) Consider whether the existing national stock assessments are able to meet the requirements of parts (a)-(b) of this condition; b) Whether a revised stock assessment (or stock assessments) are needed in order to meet the requirements of parts (a)-(b) of the condition; and c) Propose new stock assessment(s) that will meet parts (a)-(b) of the condition if these are considered necessary. Resulting score: 70 Year 3 (2024):Evidence shall be presented to show that, if necessary, revised stock assessment(s) are being carried out for the *M. paradoxus* stock. Resulting score: 70 Year 4 (2025):Evidence shall be presented to show that the stock assessment(s) meet the requirements of parts (a)-(b) of the condition.

		Resulting score: 80
		Note that if the Year 4 milestone is achieved earlier in the certification cycle it may be possible to re-score this PI and close this condition sooner than anticipated.
Progress on Condition (Year 1 - 2022)	In South Africa, a separate stock assessment for *M. paradoxus*, analysis has been carried out to evaluate whether the OMP is robust to fact that Namibian data and removals are not included in the analysis (Butterworth and Ross-Gillespie 2020a,b). This analysis, peer reviewed by Andre Punt (U. Washington) (Punt 2020), who concluded that it is robust. Morevoer, in the framework of the proposed approach for updating the Reference Set Operating Models to be used for the 2022 OMP revision (Ross-Gillespie and Butterworth, 2022), there is a clear intention to improve robustness tests which include Namibian data (i.e., catches and survey series of abundance). This assessment will be considered in the OMP revision using a similar approach to that applied previously (Butterworth and Ross-Gillespie, 2020a, 2020b, 2020c). In addition, it is clearly indicated that if any updates to the Namibian data are available, those would be valuable. In Namibia, according to NatMIRC, progress is underway on a species-split stock assessment model (Dr. John Kathena, NatMIRC, pers. comm.). The main barrier to this assessment is how to split historic catch data by species, but a methodology has been developed which uses observer sampling and the survey data (Jones et al., 2022). This is now being implemented to provide single species catch time series back to 1998, which will provide a key input for the individual-species model. In addition to this work on the stock assessment, the fishery has started to consider options for a HCR which is directly responsive to stock status of each species. A contract has been signed between the NHA and Dr James Ianelli (October 2021) with TORs as follows: a) Familiarize with the Current model, Assessment run and Datafiles b) Develop comparative catch patterns among the two species c) Develop a set of harvest control rules (HCRs) with triggers accounting for both species d) Include scenarios to account for the absence of survey data e) Include some level of threshold in *M. paradoxus* biomass f) Test for robustness and sensitivity of the model g) Draft report of findings h) Attend meetings (physical or virtual) to present results	
	Year 1	At this surveillance audit South African scientists presented information on robustness tests that they have carried out, which confirm that the stock assessment model is robust to the exclusion of Namibian data. The Namibian client has agreed a contract for an independent scientist to carry out a review of their stock assessment, including robustness testing. Although the status of this condition is not reviewed under Derogation 6 at this audit, the available evidence is that good progress is being made in both South African and Namibia.
Progress status	On target	
Remedial	N/A	

action	
Additional information	Milestones are revised above in accordance with MSC derogation 6.