

An Outline of the Primary Objective for Hake Discussions during the 2014 International Stock Assessment Review Workshop

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Summary

This outline provides a broad summary, with illustrations, of the four sequential steps to be taken in developing the output desired from the International Workshop in specifying models to be implemented for the joint assessment of the hake resources off South Africa and Namibia. These are: i) finalise the broad stock structure hypotheses to form the basis for these assessment models; ii) specify the spatio-temporal framework for these models; iii) confirm the data to be used in fitting these models; and iv) specify the dynamics of and fitting criteria for these models in detail to the extent that time permits.

INTRODUCTION

The Workshop discussions on hake have the broad aim of advancing the development of assessment models for hake (both *M. capensis* and *M. paradoxus*) off South Africa and Namibia. This is to assist determine whether there is a need for joint management of these resources, and if so to move from there towards formal joint assessments. In doing so, the Workshop is contributing to research under the Benguela Current Commission (BCC), and more specifically the ECOFISH Research Programme.

The primary objective of the Workshop is to develop specifications for initial joint assessment models for the hake resources off the South African and Namibian coasts, which will subsequently be implemented using the data available. Because there are possibly (indeed perhaps probably) multiple reproductive units (“stocks”) of each species in the region, an important initial step will be specifying alternative stock structure models based on the available data (such as those from genetics).

What follows is an **illustration** of how this work is envisaged to proceed. It is based on an analogous situation. This is the development of the *Implementation Simulation Trials* for North Pacific minke (NPM) whales (Allison *et al.*, 2014 – MARAM/IWS/DEC14/Hake/BG1), which describes how these *Trials* (which essentially amount to alternative assessment models covering a range of different possible stock structures) were developed. This **illustration** should not be over-interpreted, however. The intent is to explain the overall structure of the process and to clarify the order in which certain steps need to be undertaken. But where examples are given, there is no intention to imply that these are necessarily of the forms that might ultimately be recommended.

THE SEQUENTIAL STEPS

1) *Alternative Stock Structure Assumptions at a Broad Level*

Initial discussions about possible stock structures for these hake resources have already taken place at a BCC-ECOFISH Workshop held in Cape Town in March 2014 (BCC 2014 – MARAM/IWS/DEC14/Hake/BG2).

Unsurprisingly, this Workshop came up with a number of alternatives not immediately resolvable with the available data (see Figure 11 of the report thereof referenced above).

This step, which is to be refined at a further BCC-ECOFISH Workshop in mid-November (where in particular further genetics results are to be reported), is analogous to the specification of the three alternative NPM stock structure hypotheses, as listed at the bottom of the opening page (pg 133) of Allison *et al.* (2014 - MARAM/IWS/DEC14/Hake/BG1).

The December Workshop will review the analyses considered and conclusions reached at this mid-November BCC-ECOFISH Workshop, and finalise the broad stock structure hypotheses to form the basis for the assessment models to be developed.

2) *The Spatio-Temporal Structure for the Assessment Models*

For each stock within any of the broad stock structure hypotheses, allowance has to be made for movement (age- and species dependent) over time at an annual level at least, and perhaps even at a finer temporal scale within a year. This requires the setting up of a spatial “box” framework to be able to specify this movement.

For NPM whales, this is provided by the demarcation of the “sub-areas” shown in Figure 1 of the opening pg 133 of MARAM/IWS/DEC14/Hake/BG1. The lower part of pg 135 of that document describes how movement is modelled by the use of “mixing matrices”, which specify for each age-group and gender within a stock what proportion is to be found in each sub-area at various times during year, with the mixing matrices themselves set out in Adjunct 2.

The current Reference Case assessment for the South African hake resource (see Rademeyer and Butterworth, 2014a - MARAM/IWS/DEC14/Hake/P2) models this movement implicitly through use of selectivity functions in the widely used “fleets-as-areas” approach.

An alternative approach for South African hake, with some similarities to that used for NPM whales, models movement explicitly (Rademeyer, 2013 - MARAM/IWS/DEC13/Hake/P9).

The BCC-ECOFISH Workshop in March 2014 has already taken some initial steps towards setting up such a spatial framework by specifying “stock boundaries” and associated overlap regions (see Figure 11 of MARAM/IWS/DEC14/Hake/BG2). This will be refined to some extent at the mid-November Workshop, but finality will be reached only during the December Workshop.

3) *Data to be Used in Fitting Assessment Models*

In the next step the data available for fitting the assessment models need to be specified. Thus for NPM whales, for example, (see MARAM/IWS/DEC14/Hake/BG1) estimates of abundance by sub-area and by month(s) obtained from sighting surveys are listed in Table 6a; past catches on a similarly dis-aggregated basis in Adjunct 1; and the proportional breakdown of different stocks in a sub-area in a certain month(s) in Table 7, where these proportions are as determined from the analysis of genetic data that is set out in Adjunct 3.

For the current South African Reference Case hake assessment, the data used are set out in Appendix A of MARAM/IWS/DEC14/Hake/P2. Provision of a similar compilation from Namibia will be most helpful.

The December Workshop will need to confirm which of these data sets from South Africa and Namibia, together with information on the extent of stock mixing as perhaps provided by, for example, genetic data, are to be used in fitting the assessment models. (Note that some forms of model, such as the explicit

movement model of Rademeyer (2013), may require data at a finer level of disaggregation than provided in, for example, Appendix A of MARAM/IWS/DEC14/Hake/P2.)

4) *Specification of the Dynamics and Fitting Criteria for the Assessment Models*

The final step for the December Workshop will be developing the technical specifications (as far as possible in the time available) for these two aspects for the models associated with each of the stock structure hypotheses.

For NPM whales, the corresponding material is to be found in Sections B-D for the dynamics and section F for fitting criteria of MARAM/IWS/DEC14/Hake/BG1.

For the current Reference Case assessment of the South African hake resources, these specifications are to be found in Appendix B of MARAM/IWS/DEC14/Hake/P2. Rademeyer and Butterworth (2014b – MARAM/IWS/DEC14/Hake/BG3) shows the assessment results that followed from these specifications.

5) *Possible Future Extensions*

MARAM/IWS/DEC14/Hake/BG1 extends further in specifying trials for the testing of alternative candidate management procedures for NPM whales, and how simulated future resource monitoring data are to be generated towards this end. Such possible developments are, however, beyond the scope of what is envisaged for the December Workshop.

REFERENCES

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