

## Details of updates made to the Reference Case specifications from the time of the 2017 MSC audit

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The Reference Case assessment model presented to the panel for the 2017 MSC audit has been updated in the following respects.

### 1) Technical changes made to the code following an extensive checking exercise conducted by OLRAC (see Rademeyer and Butterworth 2017a).

- a) The bias correction factor for year  $y+1$  now uses the recruitment variance (recruitment sigma) for year  $y+1$ , where it used the value for year  $y$  previously.
- b) The code has been modified so that both the selectivities-at-lengths and the predicted proportions-at-length's computations use the begin-year age-length matrix for the summer and autumn surveys, and the mid-year age-length matrix for the other surveys.
- c) A correction was made to the MSY formula in the code (the previous code used total mortality in the exponent, while the corrected code uses natural mortality).

### 2) Data changes

- a) Commercial CPUE and catch series were updated using the most recent survey information and species splitting algorithms and now extend to 2016 (previously only to 2015).
- b) Commercial offshore and inshore catch-at-length data now extend to 2016.
- c) A correction was made to the 2001 and 2010 longline catch-at-length data (this correction has little impact on the assessment results).
- d) West Coast summer survey biomass and sex-disaggregated catch-ag-length data now extend to 2017.

### 3) Mortality-at-age vector

The panel for IWS 2017 recommended that the mortality-at-age vectors estimated in a model that explicitly takes hake-on-hake predation into account (Ross-Gillespie and Butterworth 2017) be used instead of the semi-arbitrarily selected mortality-at-age vectors used previously (Cox *et al.* 2017). After some further work on the hake predation model, the mortality-at-age vectors presented in (Ross-Gillespie and Butterworth 2018b) have been agreed upon by the Demersal working group to be used as input to the models in the Reference Set (DWG 2018b).

### 4) Treatment of catch-at-length data

Ross-Gillespie and Butterworth (2018a) reported on an investigation into the treatment of catch-at-length data and proposed two technical improvements. First, new plus and minus groups (the maximum and minimum ages considered when incorporating the catch-at-length data) were proposed in order to reduce the number of zeros included in the negative log-likelihood terms; these zeros resulted in an over-weighting of the contribution of these data to the negative log-likelihood. Second, the Rademeyer and Butterworth (2017b) model square-root transforms the catch-at-length data before including in the negative log-likelihood. Results of the investigation indicate that if the data are transformed to the power of 0.35 this improves the homoscedasticity of the residuals. Further details can be found in Ross-Gillespie and Butterworth (2017). Both these suggested changes were adopted by the Demersal Working group (DWG 2018a).

#### 5) Reference set specifications for the central years

The pre-1978 catches are not split by species, and the Reference Set includes models that test sensitivity to the assumption of when these historical catches switch from predominantly *M. capensis* to predominantly *M. paradoxus*. The original RS used 1950, 1958 and 1965 as the central years. An alternative set of years has been proposed, namely 1952, 1958 and 1963, since it was found that when the switch occurs later than 1963 the fit to the historical ICSEAF CPUE data becomes markedly worse (see Figure 1 and Figure 2 for the results of these runs). For the purpose of symmetry, it was proposed that the 1950 value also be changed by two years, i.e. that 1952 be used instead.

#### References

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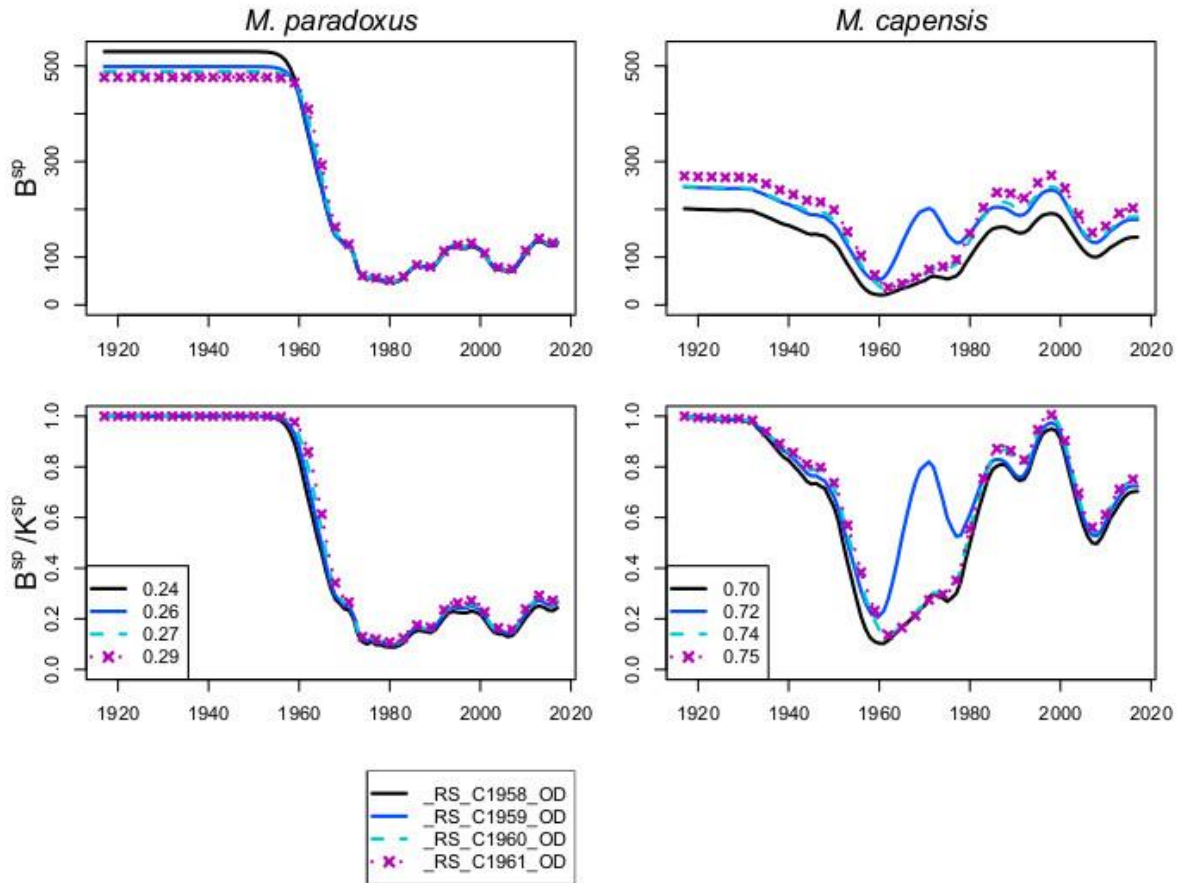
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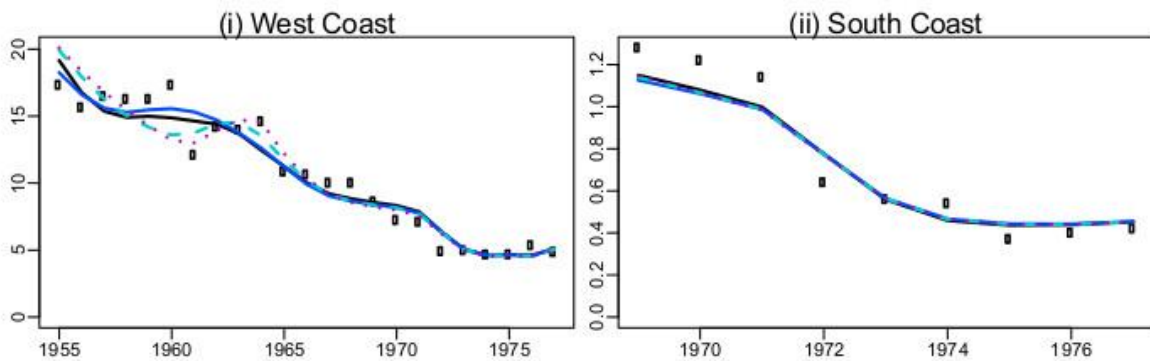
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**(A) Female spawning biomass trajectories**



**Figure 1:** Female spawning biomass trajectories for a selection of central years, the year when the historical catch is assumed to switch from predominantly *M. capensis* to predominantly *M. paradoxus*.

**(B) ICSEAF CPUE**



**Figure 2:** Fits to the historical ICSEAF CPUE data for the four assumptions for the central year of Figure 1.