Further projections under the Reference Set for the South African hake resource

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Summary

OMP-2014 projections for the Reference Set are considered for variants which impose a further 5 000 or 10 000 ton TAC reduction for 2018 for comparison to performance under the unadjusted OMP. These reduce the number of further years for which a TAC decrease can be expected, but *M. paradoxus* reaches \( B_{MSY} \) only one year earlier.

Introduction

The RS is projected forward under OMP-2014 (see Appendix A for OMP-2014 formulae) with two modifications for the 2018 TAC:

a) OMP-2014_5: The TAC output from OMP-2014 is reduced by a further 5000t for 2018,

b) OMP-2014_10: The TAC output from OMP-2014 is reduced by a further 10000t for 2018,

Results and Discussion

Medians and lower 2.5% percentiles are compared for OMP-2014, OMP-2014_5 and OMP-2014_10 in Figure 1 for the projected TAC, annual TAC changes, *M. paradoxus* female \( B_{SP} \) relative to \( B_{SP}^{MSY} \) and CPUE relative to 2013 level for the RS. Further results are given in Appendix A.

These OMP modifications reduce the number of further years for which a TAC decrease can be expected, but *M. paradoxus* reaches \( B_{MSY} \) only one year earlier (2025 rather than 2026).

Table 1: Projection results for the RS under OMP-2014, OMP-2014_5 (further 5000t reduction in 2018) and OMP-2014_10 (further 10 000t reduction in 2018).
Figure 1a: Medians and lower 2.5%iles for the RS under OMP-2014, OMP-2014_5 (further 5000t reduction in 2018) and OMP-2014_10 (further 10000t reduction in 2018).
Figure 1b: Medians and lower 2.5%iles for the RS under OMP-2014, OMP-2014_5 (further 5000t reduction in 2018) and OMP-2014_10 (further 10000t reduction in 2018).
Appendix A – More detailed projection results

Figure A1: Projection results for the RS under OMP-2014.
Figure A2: Projection results for the RS under OMP-2014_5 (further 5000t reduction in 2018).
Figure A3: Projection results for the RS under OMP-2014_10 (further 10000t reduction in 2018).
Appendix A: OMP-2014

The algorithm for the 2014 Operational Management Procedure (OMP) to provide TAC recommendations for the South African *Merluccius paradoxus* and *M. capensis* resources is empirical. It calculates an increase or decrease of the TAC in relation to the level of an index combining recent CPUE and survey abundance estimates compared to a target level for that index. The basis for the associated computations is set out below, with the tuning parameters given in Table A1.

\[
\text{TAC}_{y+1} = \text{C}^{\text{panu}}_{y+1} + \text{C}^{\text{cap}}_{y+1} \quad (A1)
\]

with

\[
\text{C}^{\text{pp}}_{y+1} = b^{\text{pp}} \left( J^{\text{pp}}_{y} - J^{\text{pp}}_{0} \right) \quad (A2)
\]

where

- \( \text{TAC}_{y} \) is the total TAC recommended for year \( y \),
- \( \text{C}^{\text{pp}}_{y} \) is the intended species-disaggregated TAC for species \( \text{spp} \) year \( y \),
- \( J^{\text{pp}}_{0} \) and \( b^{\text{pp}} \) are tuning parameters (see Table A1), and
- \( J^{\text{pp}}_{y} \) is a measure of the immediate past level in the abundance indices for species \( \text{spp} \) that is available to use for calculations for year \( y \).

**Measure of recent level**

The measures of the immediate past level \( J^{\text{pp}}_{y} \) for the abundance indices are computed as follows (note that these \( J \) indices reflect averages over the most recent three years for which the data in question are available):

\[
J^{\text{panu}}_{y} = \frac{1.0 J^{\text{WC/SC CPUE, panu}}_{y} + 0.75 J^{\text{SC, CPUE, panu}}_{y} + 0.5 J^{\text{WC, surv, panu}}_{y} + 0.25 J^{\text{SC, surv, panu}}_{y}}{2.5} \quad (A3)
\]

\[
J^{\text{cap}}_{y} = \frac{1.0 J^{\text{WC/SC CPUE, cap}}_{y} + 0.75 J^{\text{SC, CPUE, cap}}_{y} + 0.5 J^{\text{WC, surv, cap}}_{y} + 1.0 J^{\text{SC, surv, cap}}_{y}}{3.25} \quad (A4)
\]

with

\[
J^{\text{WC/SC CPUE, spp}}_{y} = \frac{\sum_{y'=y-1}^{y-3} J^{\text{WC/SC CPUE, spp}}_{y'}}{\sum_{y'=2012}^{y=2010} J^{\text{WC/SC CPUE, spp}}_{y}} \quad (A5)
\]

\[
J^{\text{WC/SC surv, spp}}_{y} = \frac{\sum_{y'=y-1}^{y-3} J^{\text{WC/SC surv, spp}}_{y'}}{\sum_{y'=2011}^{y=2011} J^{\text{WC/SC surv, spp}}_{y}} \quad (A6)
\]

Thus the weighting of the different indices (denoted by \( I_{y}^{j} \)) is taken to be the same as for OMP-2010 (Rademeyer *et al.*, 2010), and the normalization is such that a value of \( J=1 \) reflects resource abundance at about the same level as in 2011/2012.

**Constraints on TAC change**

The maximum allowable annual increase in TAC is 10%, and the maximum allowable annual decrease in TAC is 5% unless the *M. paradoxus* average biomass index falls too low, in which case the maximum allowable annual decrease becomes:
\[
\text{MaxDecr}_y = \begin{cases} 
\frac{5\%}{\text{if } J_y \geq J_{\text{thresh}1}} \\
\text{linear between } x\% \text{ and } 5\% \quad \text{if } J_{\text{thresh}2} \leq J_y < J_{\text{thresh}1} \\
\frac{x\%}{\text{if } J_y < J_{\text{thresh}2}} 
\end{cases}
\] (A7)

\(x\), \(J_{\text{thresh}1}\) and \(J_{\text{thresh}1}\) are tuning parameters (see Table A1).

Two further constraints are included in OMP-2014:

i. An upper cap on the TAC is imposed, so that the TAC cannot exceed 150 000t.

ii. The TACs for 2015 and 2016 are fixed at 147 500t.

Table A1: Tuning parameters for OMP-2014

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<th>(M. \text{paradoxus})</th>
<th>(M. \text{capensis})</th>
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<td>(J_0)</td>
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<td>(x)</td>
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