Management Procedure Projections under the Updated Reference Set

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July 2014

Introduction

This document compares projection results for combinations of:

a) three Reference Sets (RSs): the old RS used to develop the current OMP-2010, the updated RS (consisting of 11 Operating Models (OMs)), and a sensitivity to the updated RS (consisting of 13 OMs); and
b) the current OMP-2010 and a simple target-based-only candidate MP of the type to be investigated further.

The details of this CMP are not important at this stage. It has been constructed to show less short-term downturn in TAC than is the case for OMP-2010. Its purpose at this stage is simply to illustrate the typical performance and trade-offs to be expected given the recently updated assessment, to assist refine the objectives for OMP-2014.

Results and Discussion

Old RS vs Updated RS

Figure 1 compares the projected trajectories of a series of quantities under OMP-2010 (the current OMP) for the old RS and the updated RS (of 11 OMs, Rademeyer and Butterworth, 2014).

Note that TACs and *M. paradoxus* spawning biomass initially increased faster than expected to occur (in median terms) under OMP-2010 when that was adopted four years ago, but that short-term declines from 2014 are now projected under the updated RS.

Updated RS vs sensitivity to updated RS consisting of 13 OMs

Figure 2 compares the projected trajectories of a series of quantities under OMP-2010 the updated RS of 11 OMs and a sensitivity to that RS consisting of 13 OMs (see Rademeyer and Butterworth, 2014).

There is little difference, though the sensitivity shows marginally better *M. paradoxus* recovery.

OMP-2010 vs simple target based CMP

Figure 3 compares the projected trajectories of a series of quantities for the updated RS under OMP-2010 and a simple target-based only CMP (CMP1).

CMP1 mitigates the short-term TAC decline indicated for OMP-2010, and produces higher TACs in the longer term, though this is at the expense of lesser recovery of *M. paradoxus* and a lower CPUE in the longer term.

Results for OMP-2010 under the updated RS and the sensitivity to this RS consisting of 13 OMs, as well as for CMP1 under the updated RS are given in Table 1. Key features of these results are:

- Declines in the TAC over the next few years are likely
- A short-term reduction in *M. paradoxus* spawning biomass is to be expected, though with recovery to MSY level (in median terms) in about 8 years (a faster recovery would require reduced TACs)
- The reason for these anticipated drops is worse than expected recruitment for *M. paradoxus* over the last 5 years, as evidenced by Figure 1 for the updated RS and by Figure 4 for the Reference Case; this more than outweighs the better than expected recruitment for *M. capensis* over most of this period
- CPUE is projected (in median terms) to be broadly stable rather than to show a further increase as previously expected
- A drop in the fishing effort required, compared to the 2013 effort level, is projected. If faster recovery of *M. paradoxus* is sought, this drop will be larger.

References

Rademeyer RA and Butterworth DS. 2014a. Results leading to a Proposal for a Reference Set of Operating Models for testing the 2014 OMP revision of the South African hake resource. FISHERIES/2014/MAR/SWG-DEM14.

Rademeyer RA and Butterworth DS. 2014. Hake Candidate Management Procedures Testing Methodology. FISHERIES/2014/JULY/SWG-DEM22.

Table 1: Projections results (medians and 95%iles in parentheses) for a series of performance statistics for OMP-2010 (the current OMP) and a target-based-only CMP (CMP1), under the updated RS (11 OMs) and under the sensitivity to this RS consisting of 13 OMs (for OMP-2010 only). See FISHERIES/2014/JULY/SWG-DEM22 for a fuller description of some of the statistics listed; note that the Prob decl statistic refers to the probability of a decline in the TAC.

MP:		OMP-2010	OMP-2010	CMP1
RS:		New RS - 11 OMs	New RS Sens - 13 OMs	New RS - 11 OMs
C_{2014}		155.3 (155.3; 155.3)	155.3 (155.3; 155.3)	155.3 (155.3; 155.3)
C_{2015}	BS	147.5 (147.5; 151.5)	147.5 (147.5; 151.1)	147.5 (147.5; 170.8)
C_{2016}	BS	140.1 (140.1; 143.9)	140.1 (140.1; 143.5)	140.1 (140.1; 162.3)
C_{2017}	BS	133.1 (133.1; 144.1)	133.1 (133.1; 143.4)	136.1 (133.1; 167.8)
B^{sp}_{2014}/B_{MSY}	para	0.83 (0.63; 1.26)	0.85 (0.63; 1.26)	0.83 (0.63; 1.26)
B^{sp}_{2015}/B_{MSY}	para	0.75 (0.59; 1.09)	0.78 (0.59; 1.08)	0.75 (0.59; 1.09)
B^{sp}_{2016}/B_{MSY}	para	0.69 (0.53; 1.08)	0.74 (0.55; 1.07)	0.69 (0.53; 1.08)
B^{sp}_{2017}/B_{MSY}	para	0.69 (0.51; 1.23)	0.78 (0.52; 1.20)	0.68 (0.50; 1.22)
avC: 2015-2024	BS	136.4 (123.9; 151.7)	135.8 (124.0; 151.4)	145.0 (126.1; 167.9)
C_{low}: 2015-2034)	BS	122.6 (107.1; 134.5)	122.2 (107.2; 134.4)	125.1 (106.5; 140.4)
AAV: 2015-2034	BS	0.03 (0.02; 0.05)	0.03 (0.02; 0.05)	0.05 (0.03; 0.06)
$B^{sp}_{low}/B^{sp}_{2014}$	para	0.84 (0.55; 1.01)	0.85 (0.56; 1.01)	0.76 (0.45; 0.98)
$B^{sp}_{low}/B^{sp}_{2014}$	cap	1.01 (0.76; 1.09)	1.04 (0.77; 1.09)	0.96 (0.71; 1.09)
$B^{sp}_{low}/B^{sp}_{2007}$	para	1.40 (0.84; 1.68)	1.35 (0.85; 1.67)	1.26 (0.74; 1.61)
$B^{sp}_{low}/B^{sp}_{2007}$	cap	1.66 (1.28; 1.88)	1.62 (1.29; 1.88)	1.58 (1.21; 1.85)
B^{sp}_{2024}/B_{MSY}	para	1.10 (0.67; 2.11)	1.13 (0.68; 2.09)	0.90 (0.50; 1.90)
B^{sp}_{2024}/B_{MSY}	cap	3.27 (1.73; 4.80)	3.55 (1.74; 5.01)	3.10 (1.63; 4.66)
E_{2024}/E_{2013}	BS	0.81 (0.67; 0.97)	0.81 (0.66; 0.96)	0.94 (0.70; 1.26)
Prob decl >20% (2015-2017)		0.00	0.00	0.00
Prob decl >20% (2016-2018)		0.00	0.00	0.00
Prob decl>20% (2015-2032)		0.00 (0.00; 0.00)	0.00 (0.00; 0.00)	0.00 (0.00; 0.00)

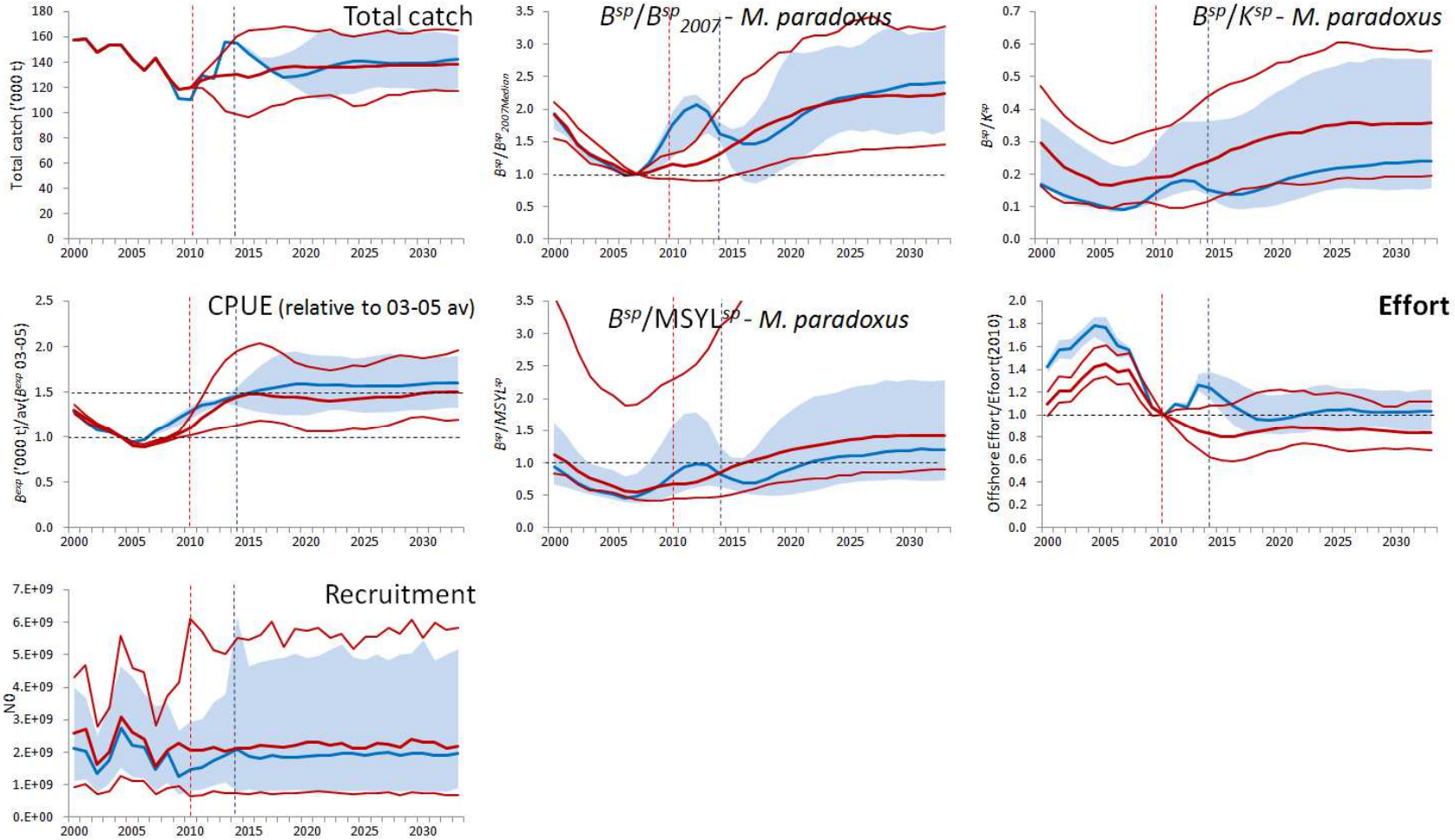

Figure 1: 95% PI envelopes and medians for the updated RS (11 OMs, in blue) and the old RS (in red) under **OMP-2010**.

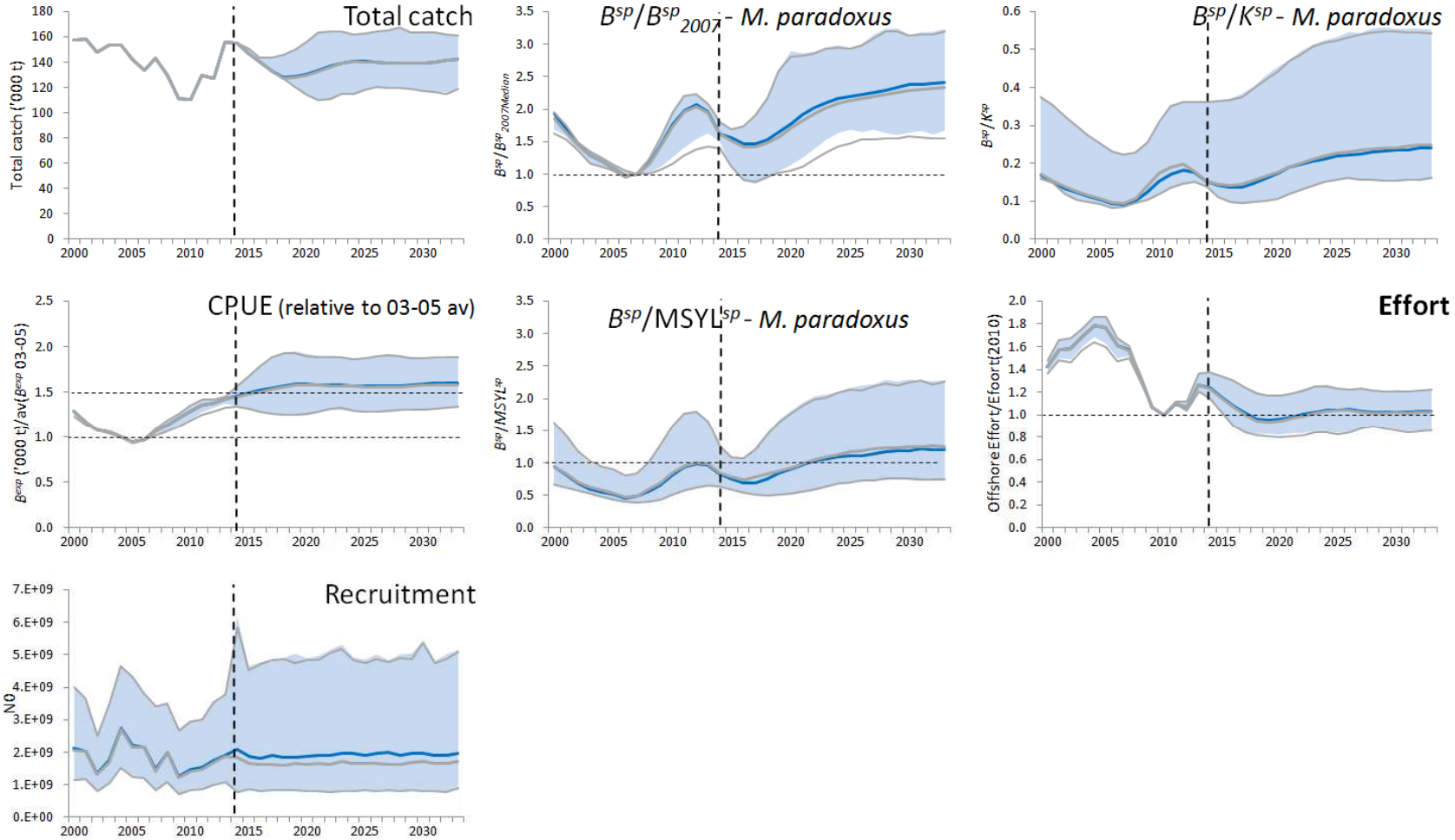

Figure 2: 95% PI envelopes and medians for the updated RS (11 OMs, in blue) and the sensitivity to that updated RS consisting of 13 OMs (in grey) under **OMP-2010**.

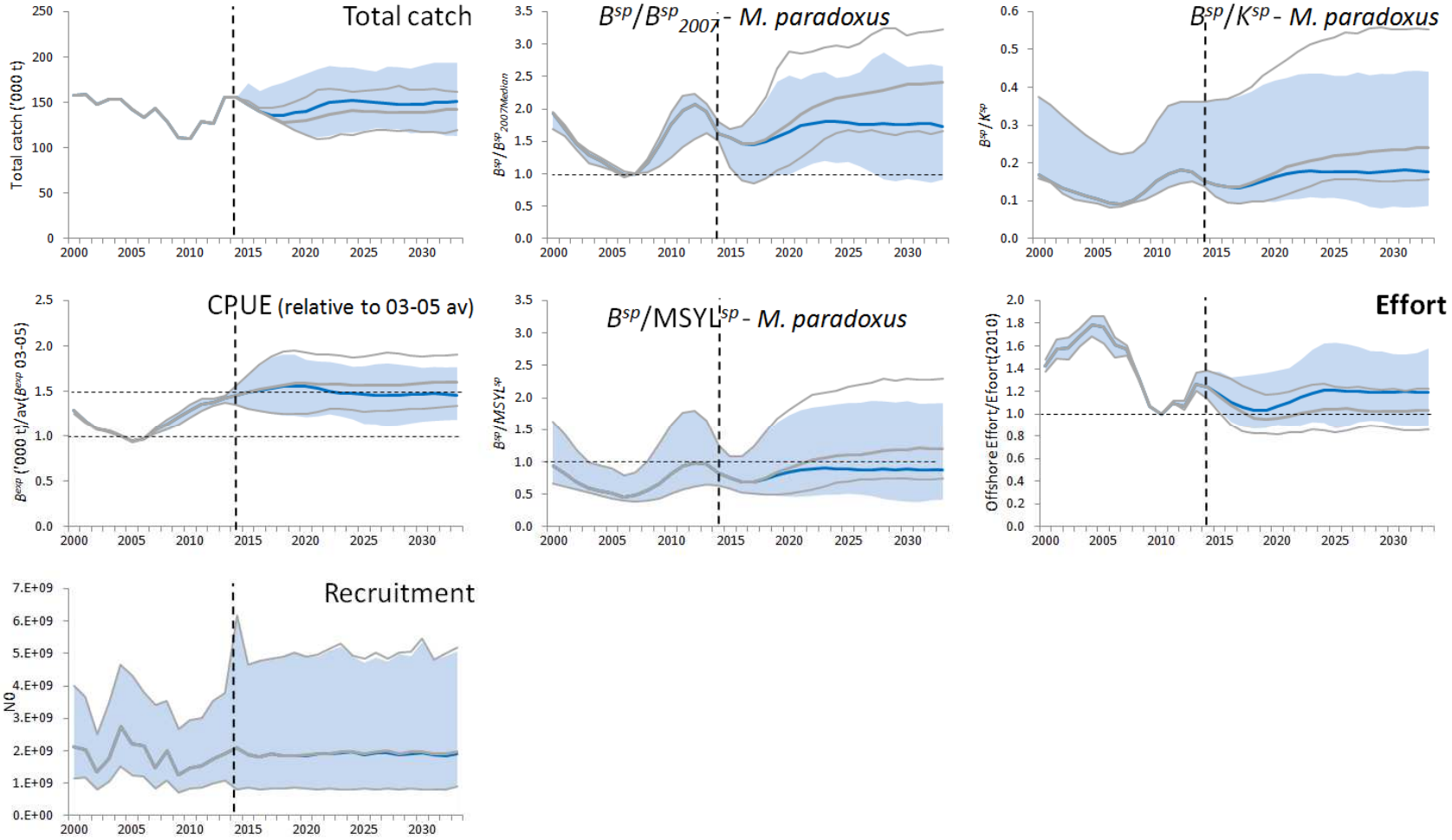

Figure 3: 95% PI envelopes and medians for updated RS (11 OMs) under a target-based-only CMP (in blue) and OMP-2010 (in light grey).

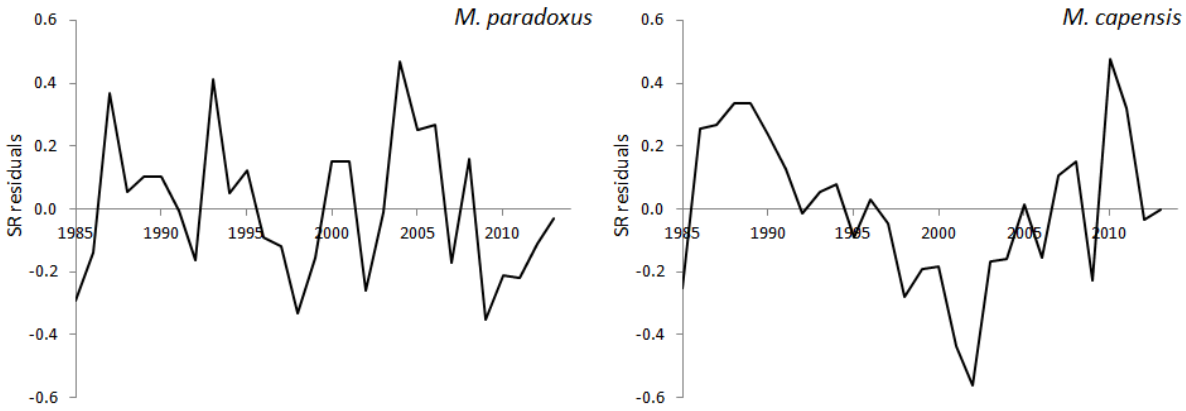

Figure 4: Estimated stock-recruit residuals for the Reference Case RS1.