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).

	Number of years median TAC drops (incl. 2016 to 2017 drop)	Year *M. paradoxus* median $B^{sp} > B^{sp}_{MSY}$	*M. paradoxus* median B^{sp}/B^{sp}_{MSY} in 2026	Median TAC in 2026	Lower 2.5%ile TAC in 2026	Median CPUE relative to 2013 in 2026	Median effort relative to 2010 in 2026
OMP-2014	4	2026	1.02	145.60	103.58	1.29	0.92
OMP-2014_5	3	2025	1.03	147.06	104.47	1.29	0.92
OMP-2014_10	2	2025	1.05	148.29	105.34	1.29	0.92

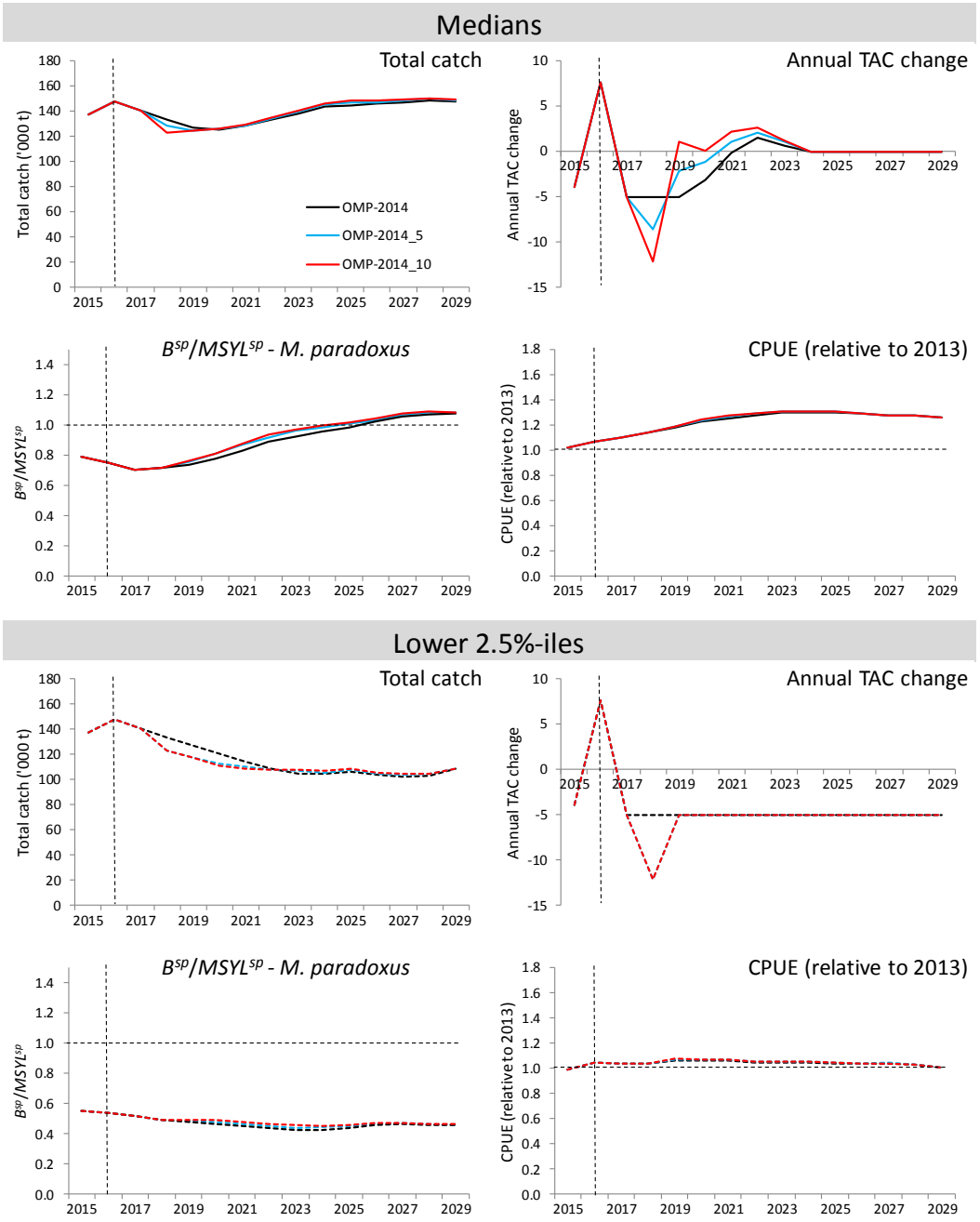

Figure 1a: Medians and lower 2.5%iles for the RS under OMP-2014, OMP-2014_5 (further 5000t reduction in 2018) and OMP-2014_10 (further 10000t reduction in 2018).

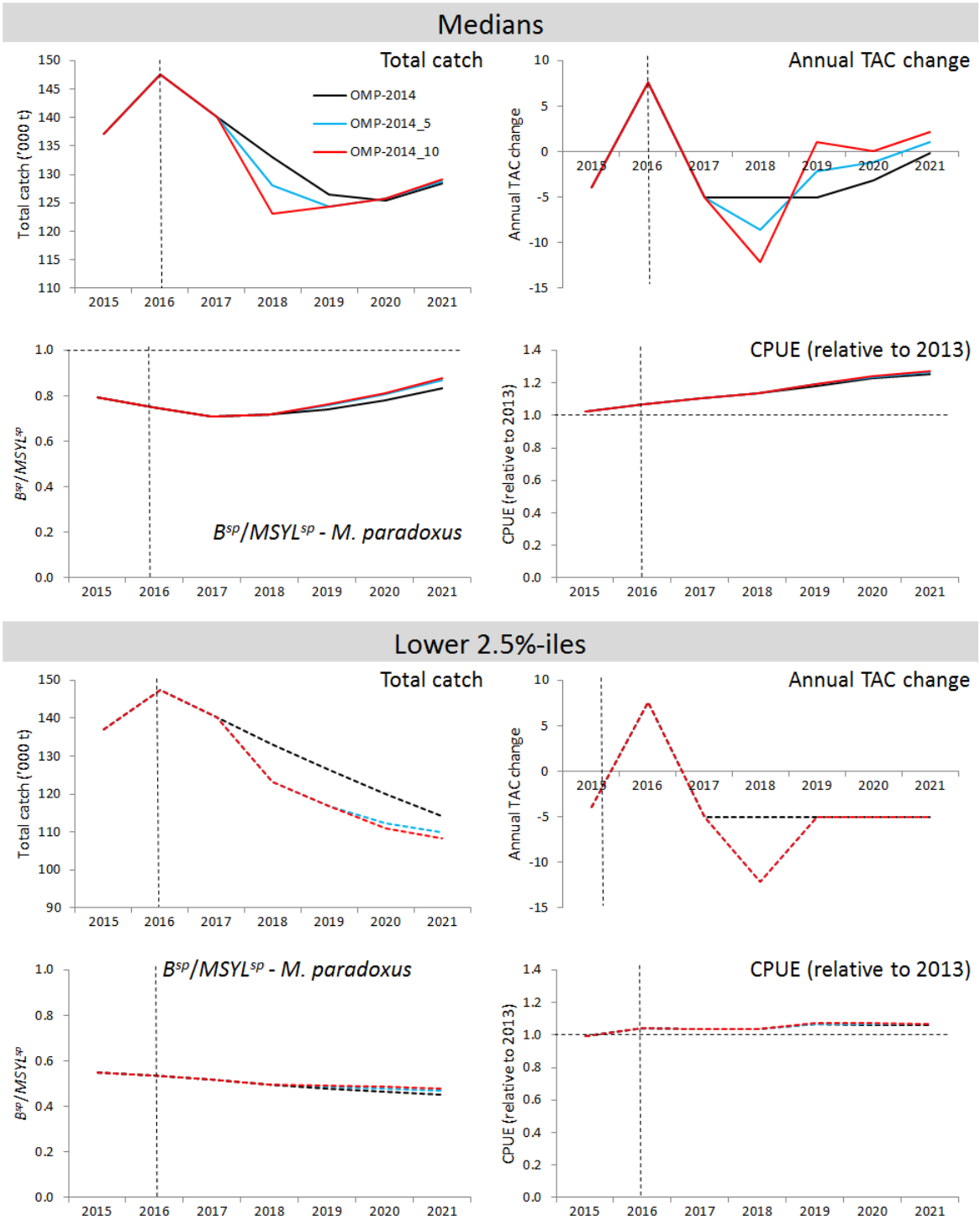

Figure 1b: Medians and lower 2.5%iles for the RS under OMP-2014, OMP-2014_5 (further 5000t reduction in 2018) and OMP-2014_10 (further 10000t reduction in 2018).

Appendix A – More detailed projection results

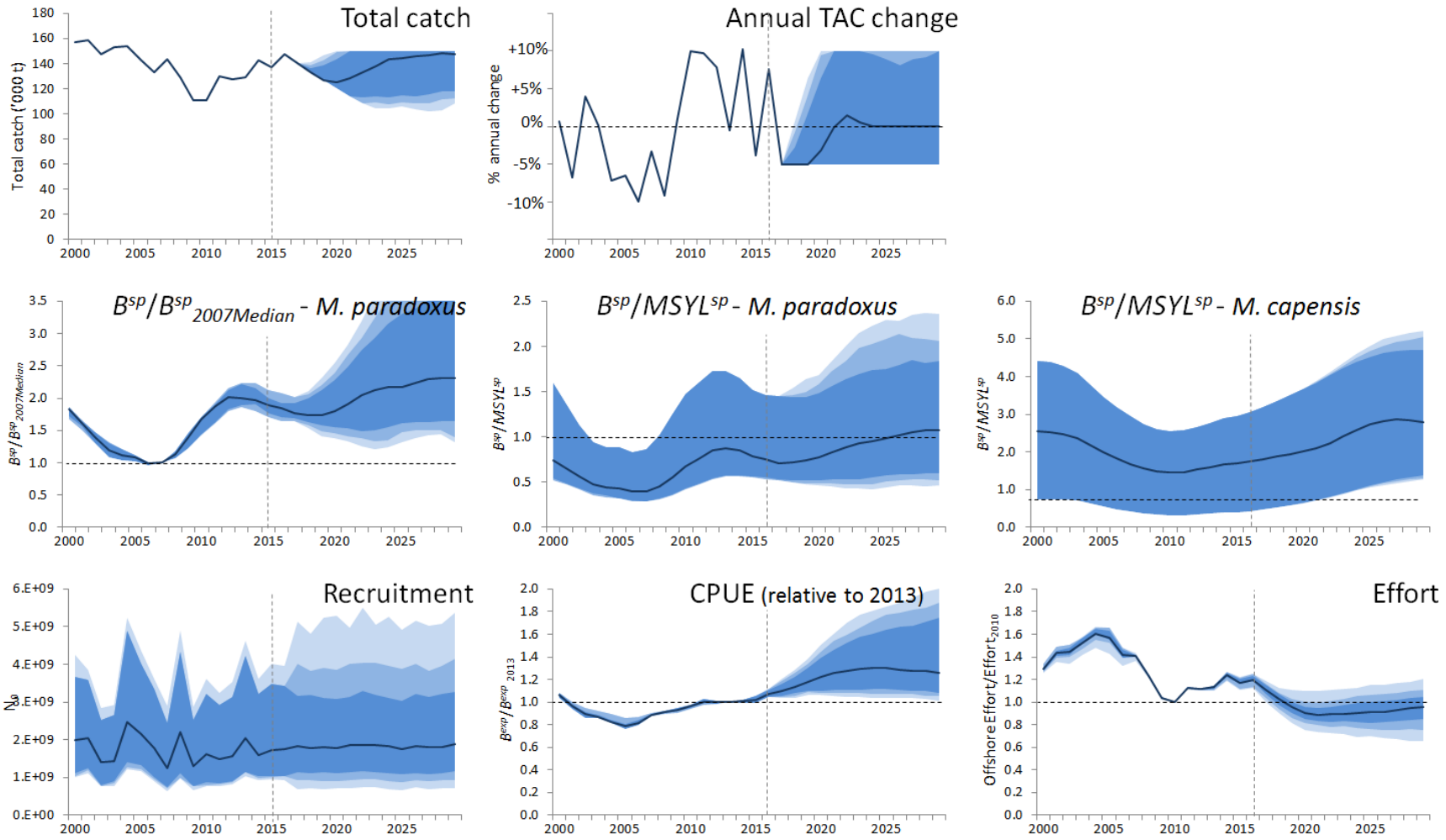

Figure A1: Projection results for the RS under **OMP-2014.**

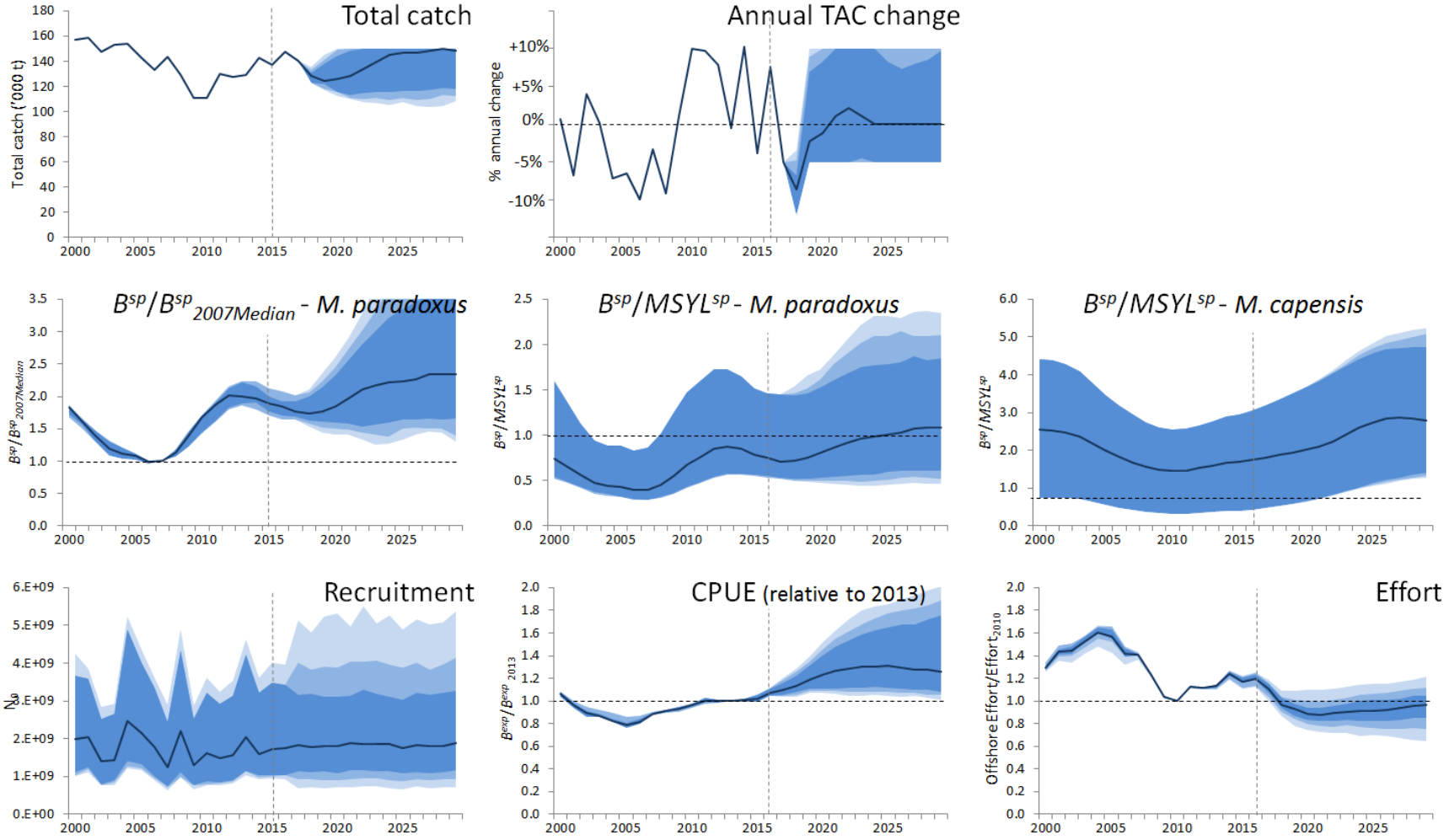

Figure A2: Projection results for the RS under **OMP-2014_5** (further 5000t reduction in 2018).

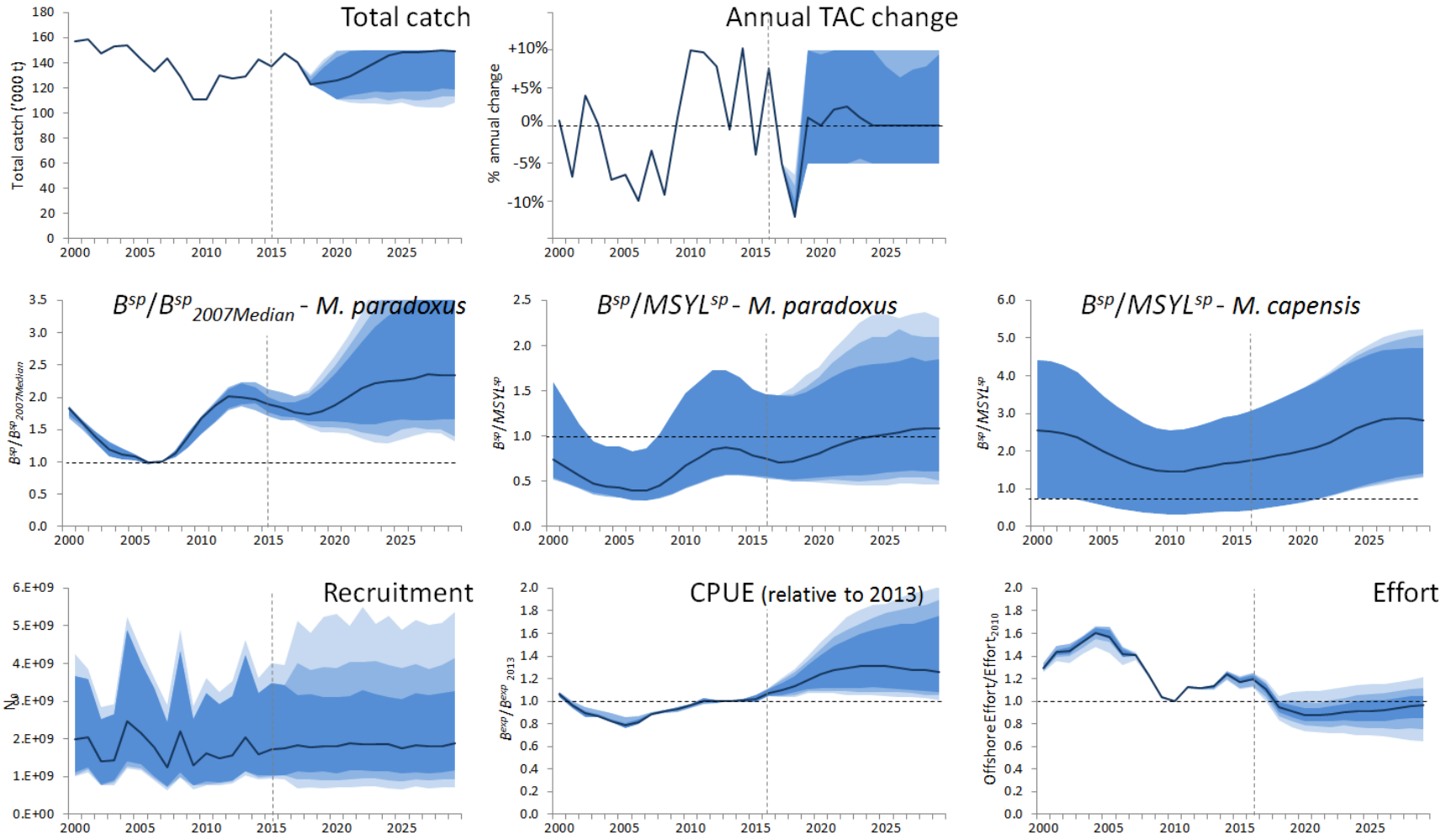

Figure A3: Projection results for the RS under **OMP-2014_10** (further 10000t reduction in 2018).

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.

$$TAC_{y+1} = C_{y+1}^{para} + C_{y+1}^{cap} \quad \text{(A1)}$$

with

$$C_{y+1}^{spp} = b^{spp}\left(J_y^{spp} - J_0^{spp}\right) \quad \text{(A2)}$$

where

TAC_y is the total TAC recommended for year *y*,

C_y^{spp} is the intended species-disaggregated TAC for species *spp* year *y*,

J_0^{spp} and b^{spp} are tuning parameters (see Table A1), and

J_y^{spp} is a measure of the immediate past level in the abundance indices for species *spp* that is available to use for calculations for year *y.*

Measure of recent level

The measures of the immediate past level J_y^{spp} 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):

$$J_y^{para} = \frac{1.0J_y^{WC\_CPUE,para} + 0.75J_y^{SC\_CPUE,para} + 0.5J_y^{WC\_surv,para} + 0.25J_y^{SC\_surv,para}}{2.5} \quad \text{(A3)}$$

$$J_y^{cap} = \frac{1.0J_y^{WC\_CPUE,cap} + 0.75J_y^{SC\_CPUE,cap} + 0.5J_y^{WC\_surv,cap} + 1.0J_y^{SC\_surv,cap}}{3.25} \quad \text{(A4)}$$

with

$$J_y^{WC/SC\_CPUE,spp} = \sum_{y'=y-4}^{y-2} I_y^{WC/SC\_CPUE,spp} \Big/ \sum_{y=2010}^{2012} I_y^{WC/SC\_CPUE,spp} \quad \text{(A5)}$$

$$J_y^{WC/SC\_surv,spp} = \sum_{y'=y-3}^{y-1} I_y^{WC/SC\_surv,spp} \Big/ \sum_{y=2011}^{2013} I_y^{WC/SC\_surv,spp} \quad \text{(A6)}$$

Thus the weighting of the different indices (denoted by I_y^i) 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:

$$MaxDecr_y = \begin{cases} 5\% & \text{if } J_y \geq J^{thresh1} \\ \text{linear between } x\% \text{ and } 5\% & \text{if } J^{thresh2} \leq J_y < J^{thresh1} \\ x\% & \text{if } J_y < J^{thresh2} \end{cases} \quad \text{(A7)}$$

x, $J^{thresh1}$ and $J^{thresh1}$ 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

	M. paradoxus	*M. capensis*
J_0	0.132	0.240
b	83.83	33.33
$J^{thresh1}$	0.75	
$J^{thresh2}$	0.65	
x	25	