Candidate Management Procedures Projections for the South African hake resource

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Different tunings for a target-based CMP

Results for a series of target-based Candidate Management Procedures (CMPs) under the Reference Set (RS) are compared in Table 1 and Figure 1. These five CMPs have been tuned to obtain an average 2015-2024 TAC (in median terms) ranging from 150 000t ($CMP1_{150}$) to 130 000t ($CMP1_{130}$). As would be expected, the higher the average TAC, the less the *M. paradoxus* recovery, with only $CMP1_{130}$ and $CMP1_{135}$ achieving MSYL in median terms. As the CMP tuning choice moves from $CMP1_{150}$ to $CMP1_{130}$ the projected CPUE ten years hence compared to now increases (in median terms) from about the same to an increase of about 15%; in contrast the fishing effort changes from about the same to some 25% less.

A surprising result of Figure 1 is that while over the next few years the spawning biomass of *M. paradoxus* is projected to decrease in median terms, the CPUE is predicted to increase. The reasons for that are explained in more detail in the Appendix; this apparent inconsistency is a reflection both of the CPUE reflecting trends in both species combined rather than one only, and further the exploitable component of the resource which relates to the CPUE differs in its age composition from the mature component for each species.

For illustration purposes, $CMP1_{135}$ has been chosen as the baseline CMP and associated median and 95% PI envelopes for a series of statistics are plotted in Figure 2 (note that many of these envelopes are quite wide). It must be emphasised that OMP2014 has not yet been chosen - $CMP1_{135}$ is merely one candidate which achieves a median annual TAC of 135 thousand tons over the next decade. However it is perfectly adequate as a basis to evaluate the differential effects considered here, whose magnitude will be relatively insensitive to what OMP is eventually selected. The “Base Risk” is then defined as the lower 2.5%ile of B^{sp}_{2024}/B_{MSY} for *M. paradoxus*, i.e. 0.63, see Table 1.

Maximum decrease constraint

The effect of imposing a maximum interannual decrease in TAC of 10% instead of 5% is illustrated in Figure 3 and Table 2. This CMP has been retuned to the Base Risk. (“Tuning” involves adjusting the values of the parameters in the formula (the OMP) used to set the TAC on the basis of survey and CPUE results to be more aggressive or more conservative, so as to achieve some target such as a particular abundance level by a certain target year.)

There is little change in the performance statistics shown under this modification. Unsurprisingly the initial TAC decline is faster but ends sooner (in median terms), while catch variably (AAV) increases from 5 to 7%.

Average abundance indices based on 3, 4 or 5 years

For CMP1, the average abundance indices used in the target formula are based on a 3 year average. Two alternative CMPs have been run, taking respectively 4 and 5 year averages. Results are given in Table 3 and Figure 4.

Apart from a very slight reduction under these alternatives in the TAC expected, very little difference in performance statistics is evident. Further work should nevertheless consider further statistics designed to measure the extent of delayed reaction to changing trends in resource indices of abundance exhibited by CMPs.

Constant catch projections

Constant catch projections have been run and compared to the target-based CMPs in Table 4 and Figure 5.

A constant catch of 150 thousand tons exhibits greater risk of resource depletion than the feedback-control alternative of $CMP1_{150}$. For the same Base Risk as for $CMP1_{135}$, a constant TAC would need to be set at about 129 thousand tons.

These results are based on the RS only. Once the robustness tests are included, the results will be more pessimistic for the constant catch projections relative to the CMPs, because the former lack feedback control mechanisms.

TAC capped at 150 000t

In this CMP, the TAC is not allowed above 150 000t. Results are shown in Table 5 and Figure 6.

There is very little response in the performance statistics to the addition of this cap. The most evident is slightly better resource recovery, though only after about 10 years.

Relative impact of possible changes in the sector splits of hake catch

As agreed by the Demersal Scientific Working Group, the relative impact of possible changes in the sector splits of hake catch during the period of OMP-2014 is evaluated here using two (extreme) sensitivity tests to provide an illustration of the maximum extent of possible impacts: the entire inshore trawl allocation is taken to either catch *M. capensis* exclusively (the "all *M. capensis*" scenario, to emulate the entire inshore trawl allocation being transferred to handline/subsistence/small scale) or catch *M. paradoxus* exclusively (the "all *M. paradoxus*" scenario, to emulate the entire inshore trawl allocation being transferred to offshore trawl with a focus on the deepwater species).

To evaluate this impact, $CMP1_{135}$ is used to project the resource forward under the base case assumption that the inshore trawl fleet catches on average 75% *M. capensis* under the Reference Set (RS) of Operating Models. This CMP is then retuned under the "all *M. capensis*" and "all *M. paradoxus*" scenarios so that the lower 2.5%-ile for B^{sp}_{2024}/B_{MSY} under that particular scenario equals the Base Risk.

Under the **"all *M. capensis*"** scenario, the 2015-2024 average annual TAC would **increase by about 3.7 thousand tons**, while under the **"all *M. paradoxus*"** scenario, it would need **to decrease by about 3.1 thousand tons** (Table 6). Thus continuation of recent trends towards catches made further offshore by rights holders linked to the inshore trawl allocation could see the hake TAC needing to decrease by up to some 2% to safeguard the *M. paradoxus* component of the resource.

Figure 7 plots the 95% PI envelopes and medians catch and spawning biomass trajectories under the RS for $CMP1_{135}$ and the two sensitivities above.

Table 1: Median and 95% PIs for a series of performance statistics under the RS, for five CMPs tuned to different 2015-2014 average TACs.

MP:		$CMP1_{150}$		$CMP1_{145}$		$CMP1_{140}$		$CMP1_{135}$		$CMP1_{130}$	
C_{2014}		155.3	(155.3; 155.3)	155.3	(155.3; 155.3)	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; 170.8)	147.5	(147.5; 170.8)	147.5	(147.5; 167.2)	147.5	(147.5; 157.2)	147.5	(147.5; 147.5)
C_{2016}	BS	143.5	(140.1; 170.8)	140.1	(140.1; 162.3)	140.1	(140.1; 159.0)	140.1	(140.1; 149.4)	140.1	(140.1; 140.1)
C_{2017}	BS	145.8	(133.1; 177.7)	137.3	(133.1; 168.4)	133.1	(133.1; 158.9)	133.1	(133.1; 152.5)	133.1	(133.1; 142.2)
$B^{sp}{}_{2014}/B_{MSY}$	para	0.83	(0.63; 1.26)	0.83	(0.63; 1.26)	0.83	(0.63; 1.26)	0.83	(0.63; 1.26)	0.83	(0.63; 1.26)
$B^{sp}{}_{2015}/B_{MSY}$	para	0.74	(0.59; 1.09)	0.74	(0.59; 1.09)	0.74	(0.59; 1.09)	0.74	(0.59; 1.09)	0.74	(0.59; 1.09)
$B^{sp}{}_{2016}/B_{MSY}$	para	0.68	(0.52; 1.07)	0.68	(0.52; 1.08)	0.68	(0.52; 1.08)	0.68	(0.52; 1.08)	0.68	(0.52; 1.08)
$B^{sp}{}_{2017}/B_{MSY}$	para	0.67	(0.47; 1.19)	0.67	(0.49; 1.21)	0.68	(0.50; 1.23)	0.68	(0.50; 1.23)	0.68	(0.50; 1.23)
avC: 2015-2024	BS	**150.0**	(127.9; 175.6)	**145.0**	(124.1; 170.2)	**140.0**	(120.6; 165.1)	**135.0**	(119.1; 159.0)	**130.0**	(118.4; 153.3)
C_{low}: 2015-2034)	BS	125.5	(102.4; 142.5)	122.1	(100.3; 140.1)	119.7	(97.8; 136.5)	114.1	(93.4; 133.1)	110.9	(91.0; 128.0)
AAV: 2015-2034	BS	0.05	(0.03; 0.06)	0.05	(0.03; 0.06)	0.05	(0.04; 0.06)	0.05	(0.04; 0.06)	0.05	(0.04; 0.06)
$B^{sp}{}_{low}/B^{sp}{}_{2014}$	para	0.63	(0.28; 0.89)	0.71	(0.37; 0.94)	0.76	(0.47; 0.98)	0.79	(0.52; 0.99)	0.81	(0.53; 1.00)
$B^{sp}{}_{low}/B^{sp}{}_{2014}$	cap	0.95	(0.68; 1.10)	0.97	(0.71; 1.10)	0.99	(0.73; 1.10)	1.01	(0.74; 1.10)	1.02	(0.75; 1.10)
$B^{sp}{}_{low}/B^{sp}{}_{2007}$	para	1.03	(0.46; 1.45)	1.16	(0.62; 1.55)	1.27	(0.74; 1.62)	1.30	(0.81; 1.65)	1.34	(0.81; 1.66)
$B^{sp}{}_{low}/B^{sp}{}_{2007}$	cap	1.57	(1.19; 1.86)	1.60	(1.22; 1.87)	1.63	(1.24; 1.88)	1.66	(1.26; 1.90)	1.68	(1.27; 1.91)
$B^{sp}{}_{2024}/B_{MSY}$	para	0.72	(**0.35;** 1.63)	0.84	(**0.45;** 1.81)	0.94	(**0.54;** 1.97)	1.05	(**0.63;** 2.09)	1.16	(**0.68;** 2.25)
$B^{sp}{}_{2024}/B_{MSY}$	cap	3.11	(1.59; 4.79)	3.23	(1.65; 4.88)	3.33	(1.70; 4.98)	3.41	(1.75; 5.06)	3.47	(1.78; 5.11)
$CPUE_{2024}/CPUE_{2013}$	BS	0.99	(0.76; 1.24)	1.02	(0.81; 1.28)	1.06	(0.85; 1.33)	1.10	(0.89; 1.37)	1.14	(0.92; 1.41)
E_{2024}/E_{2013}	BS	0.99	(0.75; 1.36)	0.93	(0.70; 1.28)	0.87	(0.64; 1.20)	0.81	(0.59; 1.13)	0.74	(0.55; 1.05)
Prob decl >20% (2015-2017)		0.00		0.00		0.00		0.00		0.00	
Prob decl >20% (2016-2018)		0.00		0.00		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)	0.00	(0.00; 0.00)	0.00	(0.00; 0.00)

Table 2: Median and 95% PIs for a series of performance statistics under the RS, for CMP135 (2015-2024 average TAC of 135 000t, maximum interannual decrease in TAC of 5%), and an equivalent CMP with a maximum interannual decrease in TAC of 10% which is tuned to the Base Risk.

MP:		$CMP1_{135}$		Max decrease constaint=10% Tuned to Base Risk	
C_{2014}		155.3	(155.3; 155.3)	155.3	(155.3; 155.3)
C_{2015}	BS	147.5	(147.5; 157.2)	139.8	(139.8; 162.4)
C_{2016}	BS	140.1	(140.1; 149.4)	125.8	(125.8; 148.6)
C_{2017}	BS	133.1	(133.1; 152.5)	123.1	(113.2; 153.6)
B^{sp}_{2014}/B_{MSY}	para	0.83	(0.63; 1.26)	0.83	(0.63; 1.26)
B^{sp}_{2015}/B_{MSY}	para	0.74	(0.59; 1.09)	0.74	(0.59; 1.09)
B^{sp}_{2016}/B_{MSY}	para	0.68	(0.52; 1.08)	0.70	(0.54; 1.11)
B^{sp}_{2017}/B_{MSY}	para	0.68	(0.50; 1.23)	0.72	(0.52; 1.31)
avC: 2015-2024	BS	**135.0**	(119.1; 159.0)	**135.1**	(112.2; 159.8)
C_{low}: 2015-2034)	BS	114.1	(93.4; 133.1)	111.7	(91.7; 128.9)
AAV: 2015-2034	BS	0.05	(0.04; 0.06)	0.07	(0.05; 0.09)
$B^{sp}_{low}/B^{sp}_{2014}$	para	0.79	(0.52; 0.99)	0.82	(0.57; 1.00)
$B^{sp}_{low}/B^{sp}_{2014}$	cap	1.01	(0.74; 1.10)	1.00	(0.74; 1.10)
$B^{sp}_{low}/B^{sp}_{2007}$	para	1.30	(0.81; 1.65)	1.35	(0.90; 1.66)
$B^{sp}_{low}/B^{sp}_{2007}$	cap	1.66	(1.26; 1.90)	1.66	(1.27; 1.89)
B^{sp}_{2024}/B_{MSY}	para	1.05	(**0.63;** 2.09)	1.06	(**0.63;** 2.24)
B^{sp}_{2024}/B_{MSY}	cap	3.41	(1.75; 5.06)	3.41	(1.75; 5.08)
$CPUE_{2024}/CPUE_{2013}$	BS	1.10	(0.89; 1.37)	1.09	(0.88; 1.38)
E_{2024}/E_{2013}	BS	0.81	(0.59; 1.13)	0.86	(0.63; 1.17)
Prob decl >20% (2015-2017)		0.00		0.52	
Prob decl >20% (2016-2018)		0.00		0.26	
Prob decl>20% (2015-2032)		0.00	(0.00; 0.00)	0.00	(0.00; 0.00)

Table 3: Median and 95% PIs for a series of performance statistics under the RS, for CMP135 (2015-2024 average TAC of 135 000t, 3 year average for the indices), and two equivalent CMPs taking either 4 or 5 year averages for the indices which are tuned to the Base Risk.

MP:		CMP1$_{135}$	4 yr average for indices Tuned to BaseRisk	5 yr average for indices Tuned to BaseRisk
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; 157.2)	147.5 (147.5; 147.5)	147.5 (147.5; 153.4)
C_{2016}	BS	140.1 (140.1; 149.4)	140.1 (140.1; 145.4)	140.1 (140.1; 145.7)
C_{2017}	BS	133.1 (133.1; 152.5)	133.1 (133.1; 147.0)	133.1 (133.1; 147.8)
B^{sp}_{2014}/B_{MSY}	para	0.83 (0.63; 1.26)	0.83 (0.63; 1.26)	0.83 (0.63; 1.26)
B^{sp}_{2015}/B_{MSY}	para	0.74 (0.59; 1.09)	0.74 (0.59; 1.09)	0.74 (0.59; 1.09)
B^{sp}_{2016}/B_{MSY}	para	0.68 (0.52; 1.08)	0.68 (0.52; 1.08)	0.68 (0.52; 1.08)
B^{sp}_{2017}/B_{MSY}	para	0.68 (0.50; 1.23)	0.68 (0.50; 1.23)	0.68 (0.50; 1.23)
avC: 2015-2024	BS	**135.0** (119.1; 159.0)	**133.9** (118.8; 157.6)	**133.5** (118.8; 157.0)
C_{low}: 2015-2034)	BS	114.1 (93.4; 133.1)	114.1 (93.9; 133.1)	115.5 (93.5; 133.1)
AAV: 2015-2034	BS	0.05 (0.04; 0.06)	0.05 (0.04; 0.06)	0.05 (0.03; 0.06)
$B^{sp}_{low}/B^{sp}_{2014}$	para	0.79 (0.52; 0.99)	0.79 (0.51; 1.00)	0.79 (0.50; 0.99)
$B^{sp}_{low}/B^{sp}_{2014}$	cap	1.01 (0.74; 1.10)	1.01 (0.74; 1.10)	1.01 (0.74; 1.10)
$B^{sp}_{low}/B^{sp}_{2007}$	para	1.30 (0.81; 1.65)	1.31 (0.79; 1.65)	1.31 (0.77; 1.65)
$B^{sp}_{low}/B^{sp}_{2007}$	cap	1.66 (1.26; 1.90)	1.66 (1.25; 1.90)	1.66 (1.25; 1.90)
B^{sp}_{2024}/B_{MSY}	para	1.05 (**0.63;** 2.09)	1.07 (**0.63;** 2.14)	1.08 (**0.63;** 2.17)
B^{sp}_{2024}/B_{MSY}	cap	3.41 (1.75; 5.06)	3.43 (1.76; 5.08)	3.43 (1.76; 5.10)
$CPUE_{2024}/CPUE_{2013}$	BS	1.10 (0.89; 1.37)	1.11 (0.89; 1.38)	1.11 (0.89; 1.40)
E_{2024}/E_{2013}	BS	0.81 (0.59; 1.13)	0.80 (0.58; 1.13)	0.80 (0.58; 1.10)
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)

Table 4: Median and 95% PIs for a series of performance statistics under the RS, for CMPs and constant catch projections.

MP:		$CMP1_{150}$	Constant catch: 150 000t	$CMP1_{135}$	Constant catch: 129 300t Tuned to BaseRisk
C_{2014}		155.3 (155.3; 155.3)	150.0 (150.0; 150.0)	155.3 (155.3; 155.3)	129.3 (129.3; 129.3)
C_{2015}	BS	147.5 (147.5; 170.8)	150.0 (150.0; 150.0)	147.5 (147.5; 157.2)	129.3 (129.3; 129.3)
C_{2016}	BS	143.5 (140.1; 170.8)	150.0 (150.0; 150.0)	140.1 (140.1; 149.4)	129.3 (129.3; 129.3)
C_{2017}	BS	145.8 (133.1; 177.7)	150.0 (150.0; 150.0)	133.1 (133.1; 152.5)	129.3 (129.3; 129.3)
$B^{sp}{}_{2014}/B_{MSY}$	para	0.83 (0.63; 1.26)	0.83 (0.63; 1.26)	0.83 (0.63; 1.26)	0.83 (0.63; 1.26)
$B^{sp}{}_{2015}/B_{MSY}$	para	0.74 (0.59; 1.09)	0.75 (0.59; 1.11)	0.74 (0.59; 1.09)	0.79 (0.62; 1.18)
$B^{sp}{}_{2016}/B_{MSY}$	para	0.68 (0.52; 1.07)	0.69 (0.53; 1.10)	0.68 (0.52; 1.08)	0.79 (0.60; 1.25)
$B^{sp}{}_{2017}/B_{MSY}$	para	0.67 (0.47; 1.19)	0.67 (0.49; 1.21)	0.68 (0.50; 1.23)	0.81 (0.58; 1.44)
avC: 2015-2024	BS	**150.0** (127.9; 175.6)	**150.0** (150.0; 150.0)	**135.0** (119.1; 159.0)	**129.3** (129.3; 129.3)
C_{low}: 2015-2034)	BS	125.5 (102.4; 142.5)	150.0 (146.1; 150.0)	114.1 (93.4; 133.1)	129.3 (129.3; 129.3)
AAV: 2015-2034	BS	0.05 (0.03; 0.06)	0.00 (0.00; 0.00)	0.05 (0.04; 0.06)	0.00 (0.00; 0.00)
$B^{sp}{}_{low}/B^{sp}{}_{2014}$	para	0.63 (0.28; 0.89)	0.66 (0.13; 1.00)	0.79 (0.52; 0.99)	0.93 (0.66; 1.04)
$B^{sp}{}_{low}/B^{sp}{}_{2014}$	cap	0.95 (0.68; 1.10)	0.95 (0.64; 1.10)	1.01 (0.74; 1.10)	1.04 (0.75; 1.11)
$B^{sp}{}_{low}/B^{sp}{}_{2007}$	para	1.03 (0.46; 1.45)	1.07 (0.22; 1.64)	1.30 (0.81; 1.65)	1.55 (1.01; 1.79)
$B^{sp}{}_{low}/B^{sp}{}_{2007}$	cap	1.57 (1.19; 1.86)	1.54 (1.17; 1.87)	1.66 (1.26; 1.90)	1.70 (1.30; 1.94)
$B^{sp}{}_{2024}/B_{MSY}$	para	0.72 (**0.35;** 1.63)	0.74 (**0.26;** 1.68)	1.05 (**0.63;** 2.09)	1.22 (**0.63;** 2.32)
$B^{sp}{}_{2024}/B_{MSY}$	cap	3.11 (1.59; 4.79)	3.12 (1.51; 4.84)	3.41 (1.75; 5.06)	3.49 (1.76; 5.20)
$CPUE_{2024}/CPUE_{2013}$	BS	0.99 (0.76; 1.24)	0.96 (0.75; 1.30)	1.10 (0.89; 1.37)	1.15 (0.90; 1.49)
E_{2024}/E_{2013}	BS	0.99 (0.75; 1.36)		0.81 (0.59; 1.13)	0.72 (0.56; 0.92)
Prob decl >20% (2015-2017)		0.00	0.00	0.00	0.00
Prob decl >20% (2016-2018)		0.00	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)	0.00 (0.00; 0.00)

Table 5: Median and 95% PIs for a series of performance statistics under the RS, for CMP_{135}, and an equivalent CMP for which the TAC is capped at 150 000t and which is tuned to the Base Risk.

MP:		$CMP1_{135}$		TAC capped at 150 000t Tuned to Base Risk	
C_{2014}		155.3	(155.3; 155.3)	155.3	(155.3; 155.3)
C_{2015}	BS	147.5	(147.5; 157.2)	147.5	(147.5; 150.0)
C_{2016}	BS	140.1	(140.1; 149.4)	140.1	(140.1; 145.5)
C_{2017}	BS	133.1	(133.1; 152.5)	133.1	(133.1; 150.0)
$B^{sp}{}_{2014}/B_{MSY}$	para	0.83	(0.63; 1.26)	0.83	(0.63; 1.26)
$B^{sp}{}_{2015}/B_{MSY}$	para	0.74	(0.59; 1.09)	0.74	(0.59; 1.09)
$B^{sp}{}_{2016}/B_{MSY}$	para	0.68	(0.52; 1.08)	0.68	(0.52; 1.08)
$B^{sp}{}_{2017}/B_{MSY}$	para	0.68	(0.50; 1.23)	0.68	(0.50; 1.23)
avC: 2015-2024	BS	**135.0**	(119.1; 159.0)	**135.3**	(119.4; 148.0)
C_{low}: 2015-2034)	BS	114.1	(93.4; 133.1)	116.9	(95.1; 135.4)
AAV: 2015-2034	BS	0.05	(0.04; 0.06)	0.04	(0.02; 0.05)
$B^{sp}{}_{low}/B^{sp}{}_{2014}$	para	0.79	(0.52; 0.99)	0.82	(0.53; 1.00)
$B^{sp}{}_{low}/B^{sp}{}_{2014}$	cap	1.01	(0.74; 1.10)	1.02	(0.75; 1.10)
$B^{sp}{}_{low}/B^{sp}{}_{2007}$	para	1.30	(0.81; 1.65)	1.35	(0.81; 1.66)
$B^{sp}{}_{low}/B^{sp}{}_{2007}$	cap	1.66	(1.26; 1.90)	1.68	(1.29; 1.91)
$B^{sp}{}_{2024}/B_{MSY}$	para	1.05	(**0.63;** 2.09)	1.06	(**0.63;** 2.15)
$B^{sp}{}_{2024}/B_{MSY}$	cap	3.41	(1.75; 5.06)	3.40	(1.75; 5.07)
$CPUE_{2024}/CPUE_{2013}$	BS	1.10	(0.89; 1.37)	1.11	(0.90; 1.40)
E_{2024}/E_{2013}	BS	0.81	(0.59; 1.13)	0.78	(0.60; 1.02)
Prob decl >20% (2015-2017)		0.00		0.00	
Prob decl >20% (2016-2018)		0.00		0.00	
Prob decl>20% (2015-2032)		0.00	(0.00; 0.00)	0.00	(0.00; 0.00)

Table 6: Median and 95% PIs for a series of performance statistics for $CMP1_{135}$ under the RS and two sensitivities related to the Inshore sector of the fishery.

MP:		$CMP1_{135}$=BaseRisk	Inshore all *M. capensis* Tuned to Base Risk	Inshore all *M. paradoxus* Tuned to Base Risk
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; 157.2)	147.5 (147.5; 162.9)	147.5 (147.5; 151.4)
C_{2016}	BS	140.1 (140.1; 149.4)	140.1 (140.1; 155.0)	140.1 (140.1; 143.8)
C_{2017}	BS	133.1 (133.1; 152.5)	133.1 (133.1; 154.7)	133.1 (133.1; 146.8)
B^{sp}_{2014}/B_{MSY}	para	0.83 (0.63; 1.26)	0.83 (0.63; 1.26)	0.83 (0.63; 1.26)
B^{sp}_{2015}/B_{MSY}	para	0.74 (0.59; 1.09)	0.74 (0.59; 1.10)	0.73 (0.58; 1.09)
B^{sp}_{2016}/B_{MSY}	para	0.68 (0.52; 1.08)	0.70 (0.53; 1.10)	0.68 (0.51; 1.08)
B^{sp}_{2017}/B_{MSY}	para	0.68 (0.50; 1.23)	0.70 (0.51; 1.26)	0.67 (0.49; 1.22)
avC: 2015-2024	BS	**135.0** (119.1; 159.0)	**138.7** (120.4; 163.3)	**131.9** (118.4; 155.6)
C_{low}: 2015-2034)	BS	114.1 (93.4; 133.1)	119.0 (97.9; 134.6)	112.3 (91.8; 129.7)
AAV: 2015-2034	BS	0.05 (0.04; 0.06)	0.05 (0.04; 0.06)	0.05 (0.04; 0.06)
$B^{sp}_{low}/B^{sp}_{2014}$	para	0.79 (0.52; 0.99)	0.80 (0.52; 1.00)	0.78 (0.52; 0.99)
$B^{sp}_{low}/B^{sp}_{2014}$	cap	1.01 (0.74; 1.10)	0.96 (0.70; 1.09)	1.03 (0.76; 1.10)
$B^{sp}_{low}/B^{sp}_{2007}$	para	1.30 (0.81; 1.65)	1.33 (0.83; 1.66)	1.30 (0.79; 1.65)
$B^{sp}_{low}/B^{sp}_{2007}$	cap	1.66 (1.26; 1.90)	1.59 (1.19; 1.87)	1.69 (1.28; 1.92)
B^{sp}_{2024}/B_{MSY}	para	1.05 (**0.63;** 2.09)	1.05 (**0.63;** 2.11)	1.08 (**0.63;** 2.14)
$CPUE_{2024}/CPUE_{2013}$	BS	3.41 (1.75; 5.06)	3.21 (1.65; 4.91)	3.54 (1.82; 5.16)
E_{2024}/E_{2013}	BS	1.10 (0.89; 1.37)	1.07 (0.88; 1.32)	1.12 (0.90; 1.40)
$CPUE_{2024}/CPUE_{2013}$		0.81 (0.59; 1.13)	0.86 (0.63; 1.20)	0.75 (0.56; 1.07)
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)

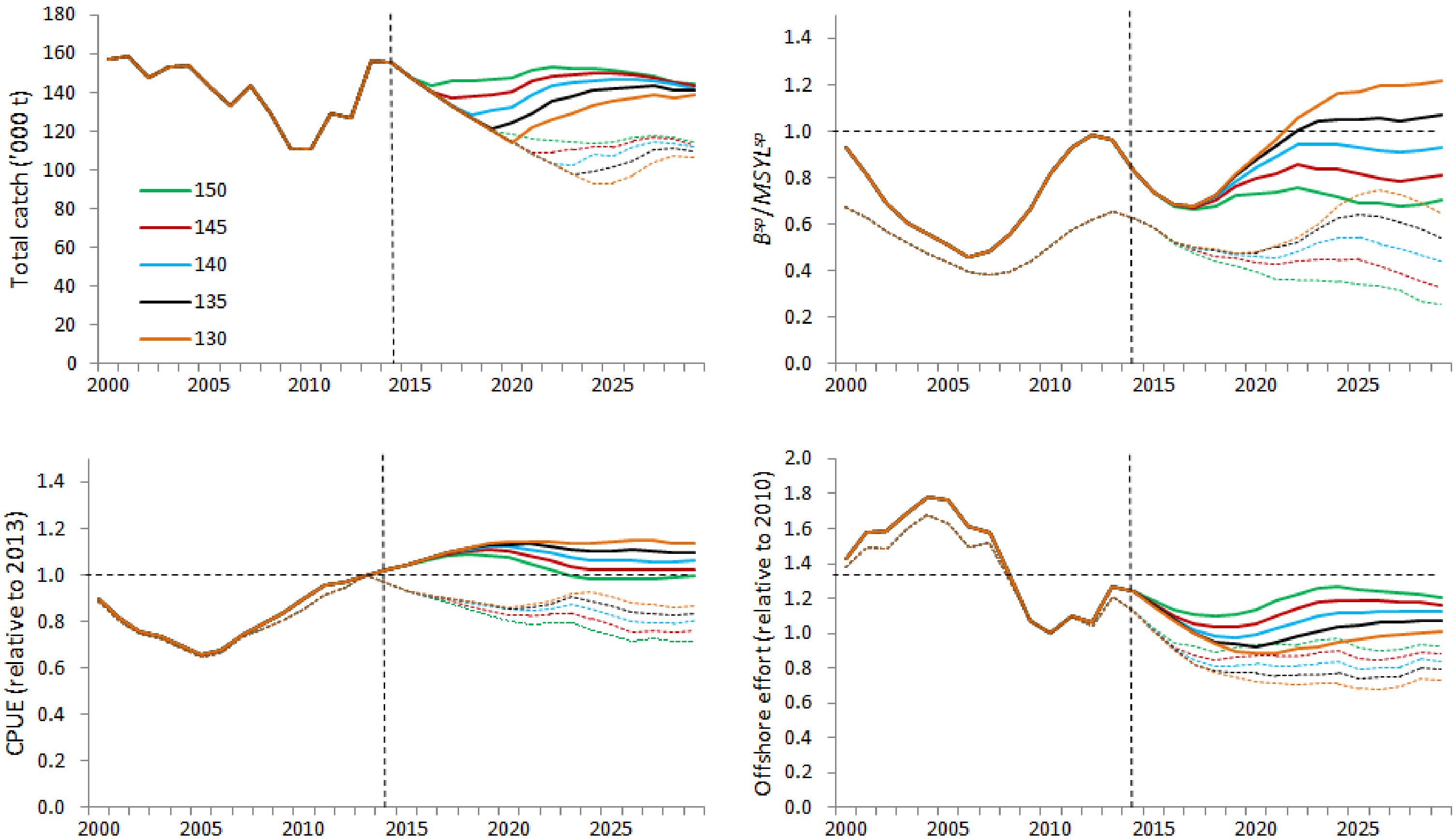

Figure 1: Medians (full lines) and lower 2.5%iles (dotted lines) for total catch (top row, LHS), *M. paradoxus* spawning biomass (relative to MSYL level - top row, RHS), CPUE (relative to 2013, bottom row, LHS) and effort (relative to 2010, bottom row, RHS) for the RS under **CMP1$_{150}$**, **CMP1$_{145}$**, **CMP1$_{140}$**, **CMP1$_{135}$** and **CMP1$_{130}$** (2015-2024 average TAC of 150 000t, 145 000t, 140 000t, 135 000t and 130 000t respectively).

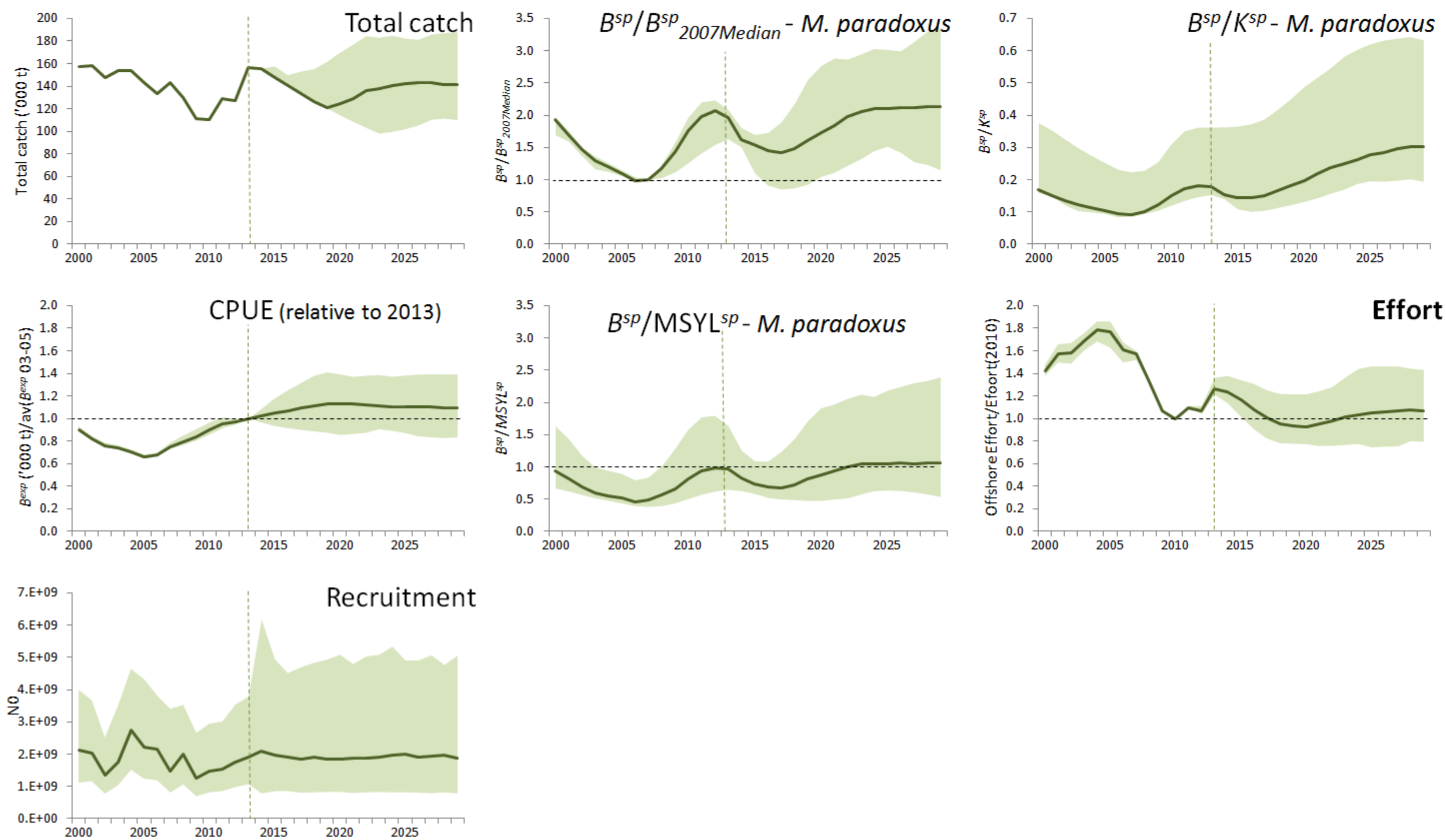

Figure 2: 95% PI envelopes and medians for the RS under **CMP1$_{135}$** (2015-2024 average TAC of 135 000t).

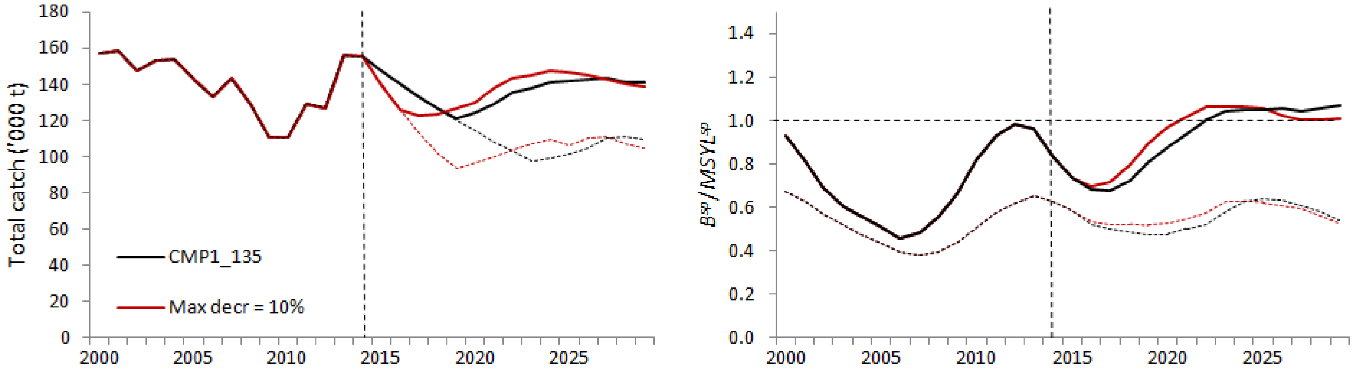

Figure 3: Medians (full lines) and lower 2.5%iles (dotted lines) for total catch (LHS) and *M. paradoxus* spawning biomass (relative to MSYL level - RHS) for the RS under **CMP1$_{135}$** (2015-2024 average TAC of 135 000t, maximum interannual decrease in TAC of 5%), and under an equivalent CMP with maximum interannual decrease in TAC of 10%, tuned to the Base Risk ("Max decr = 10%").

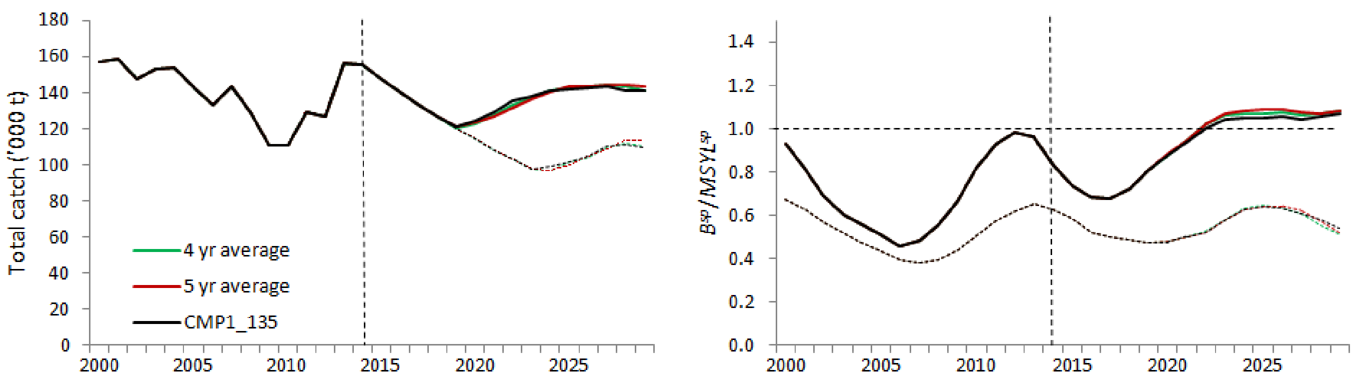

Figure 4: Medians (full lines) and lower 2.5%iles (dotted lines) for total catch (LHS) and *M. paradoxus* spawning biomass (relative to MSYL level - RHS) for the RS under **CMP1$_{135}$** (2015-2024 average TAC of 135 000t, 3 year average for the indices), and under two equivalent CMPs taking either 4 or 5 year averages for the indices.

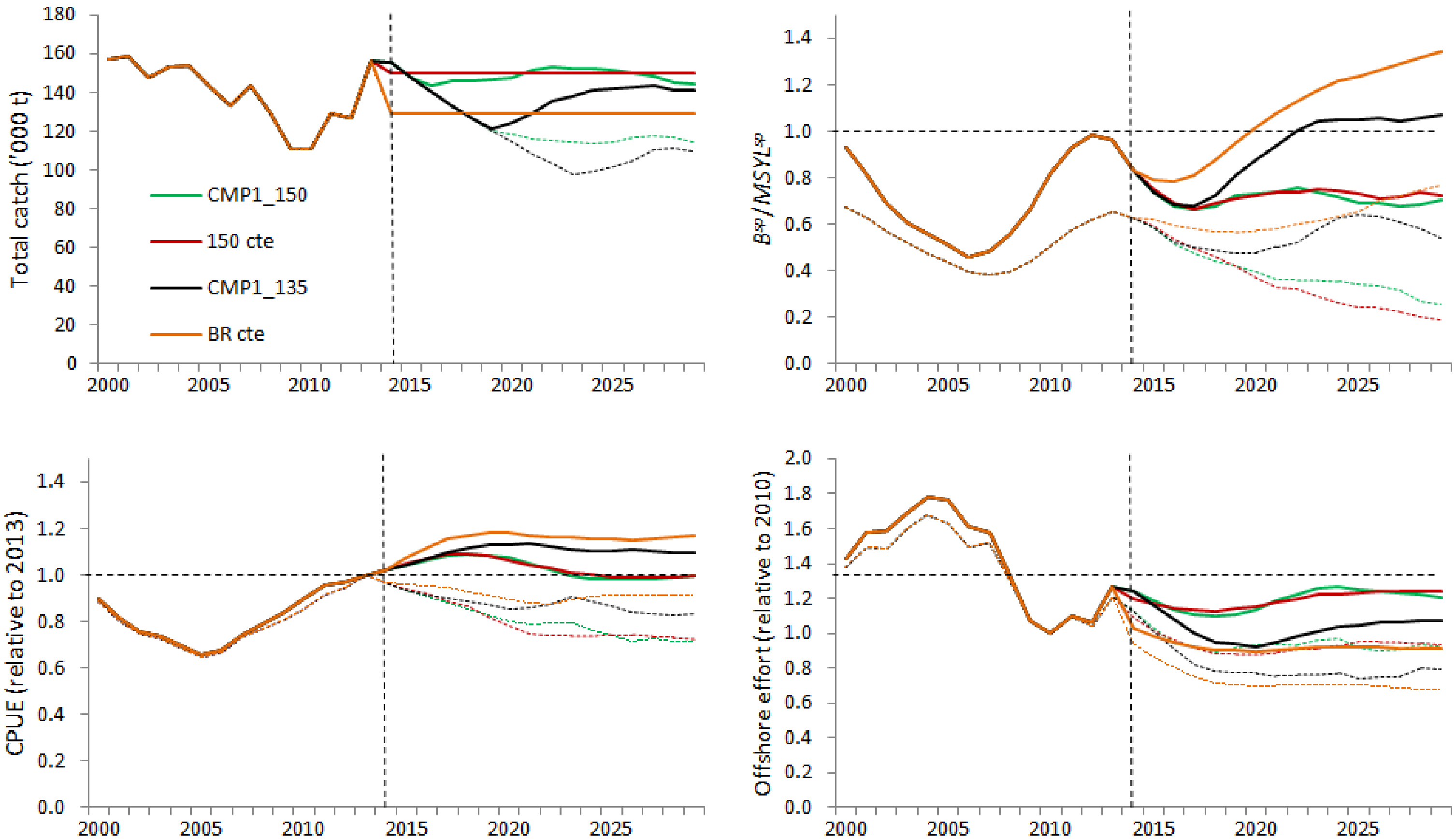

Figure 5: Medians (full lines) and lower 2.5%iles (dotted lines) for total catch (top row, LHS), *M. paradoxus* spawning biomass (relative to MSYL level - top row, RHS), CPUE (relative to 2013, bottom row, LHS) and effort (relative to 2010, bottom row, RHS) for the RS under **CMP1$_{150}$** (2015-2024 average TAC of 150 000t), **a constant catch of 150 000t** ("150 cte"), **CMP1$_{135}$** (2015-2024 average TAC of 135 000t).and a constant catch strategy leading to the same Base Risk as for CMP135 ("BR cte").

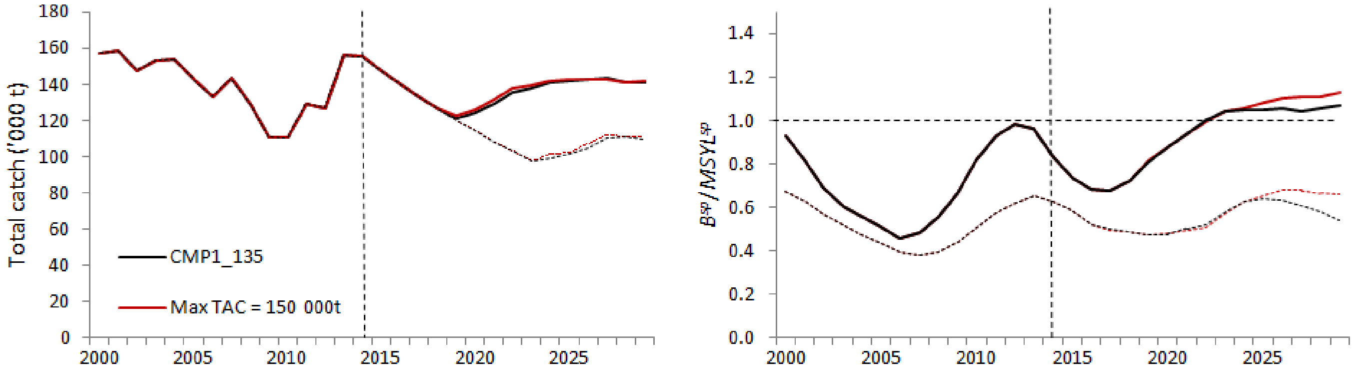

Figure 6: Medians (full lines) and lower 2.5%iles (dotted lines) for total catch (LHS) and *M. paradoxus* spawning biomass (relative to MSYL level - RHS) for the RS under **CMP1$_{135}$** (2015-2024 average TAC of 135 000t), and under an equivalent CMP in which the TAC is capped at 150 000t and which is tuned to the Base Risk.

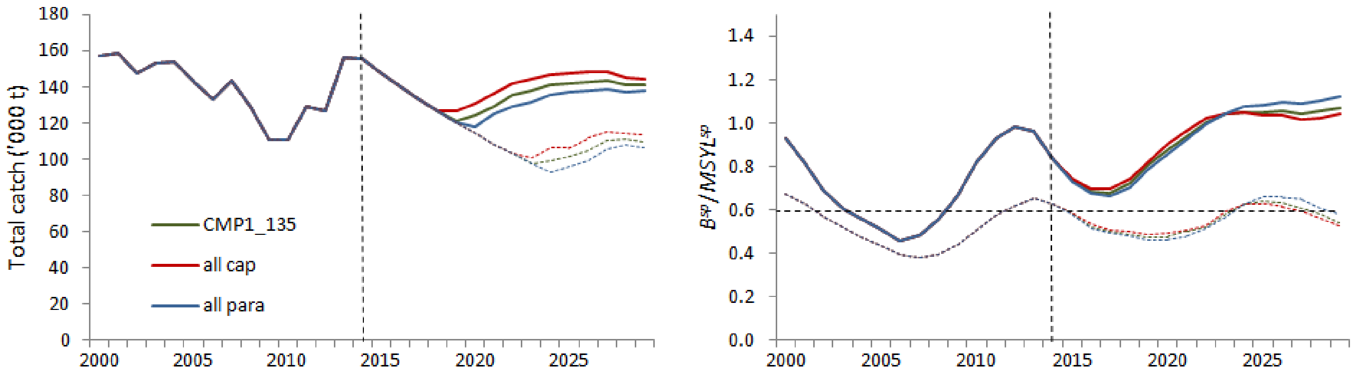

Figure 7: Medians (full lines) and lower 2.5%iles (dotted lines) for total catch (LHS) and *M. paradoxus* spawning biomass (relative to MSYL level - RHS) for the RS under **CMP1$_{135}$**, for the "all *M. capensis*" scenario and for the "all *M. paradoxus*" scenario for the inshore sector.

Appendix A

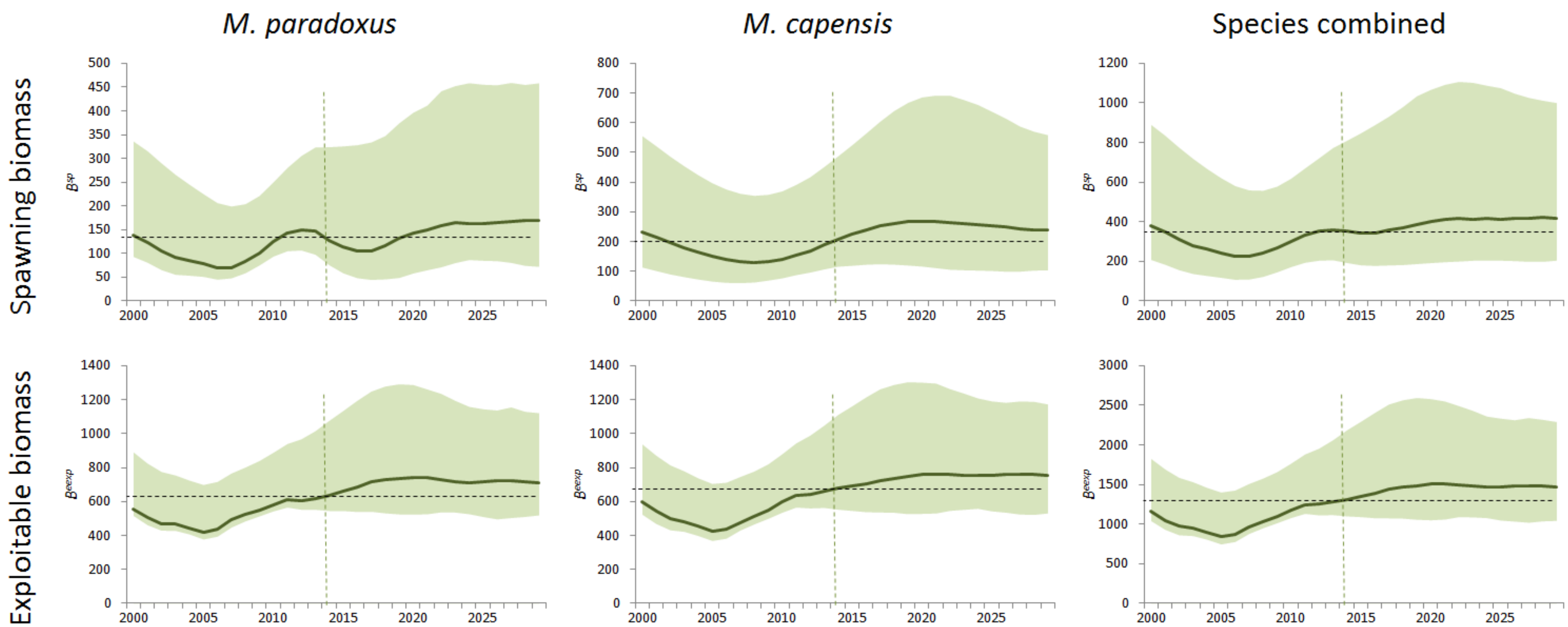

Figure A1: Spawning biomass and exploitable biomass medians and 95% PIs for *M. paradoxus*, *M. capensis* and species combined, for the RS under $CMP1_{135}$.