Projections for the South African Hake Resource for the 2010 Reference Set of Operating Models under a Constant Catch Equal to the Current TAC

RA Rademeyer and DS Butterworth

May 2010

Outline

This paper reports performance statistics and plots for projections of the South African hake resource under the twelve operating models comprising the agreed Reference Set (RS) (Rademeyer and Butterworth, 2010a) and using the projection methodology set out in Rademeyer and Butterworth (2010b). The projections are calculated for a constant catch scenario, with that catch set equal to the current TAC of 118 500 t.

Results

Performance statistics related to spawning biomass projections relative to the levels estimated for 2007 and for MSY, together with the offshore trawler CPUE projection to 2016, are reported in Table 1. These are split by RSa (RS1 – RS10) and RSb (RS11 – RS12), where RSb includes scenarios for which the current status of the *M. capensis* resource is estimated to be poor.

Fig. 1 plots these projections: medians and 95% Probability Interval (PI) envelopes - for catch and spawning biomass (as estimated relative to its pre-exploitation level) by species for the Reference Case (RS1), together with CPUE for the offshore trawlers (taken to be proportional to the coast- and species-combined exploitable biomass) relative to its average value over 2003-2005.

Fig 2 contrasts median projections across different operating models, with a) covering RSa (RS1 – RS5), b) RSa (RS6 - RS10) and c) RSb (RS11 – RS12). Fig. 3 integrates results for spawning biomass and CPUE across each of RSa and RSb, where the component operating models within these sets each receive equal weighting.

Discussion

Under the current TAC, increases in spawning biomass above its 2007 level is "guaranteed" (at the 2.5% probability level) in the longer term for all the RS scenarios.

In median terms, spawning biomass for *M. paradoxus* reaches its MSYL within the next 10 years for all scenarios, and also at the lower 2.5%-ile by 2027. However for the RSb scenarios, this is not the case for the *M. capensis* resource, which fails to reach this level by 2027, even (marginally) at the upper 2.5%-ile.

The offshore trawl CPUE fails to reach its current target of a 50% increase (in median terms) by 2016 compared to the 2003-2005 average for seven of the twelve operating models, with this (median) increase ranging from 35% to 94% across the models.

Naturally performance statistics and plots will change for Candidate Management Procedures which adjust the TAC up or down in response to future CPUE and survey abundance data, rather than keep the TAC fixed as here.

References

Rademeyer RA and Butterworth DS. 2010a. Proposed Reference Set for the South African hake resource to be used in OMP-2010 testing. Unpublished report, Marine and Coastal Management, South Africa. MCM/2010/FEB/SWG-DEM/05.

Rademeyer RA and Butterworth DS. 2010b. Candidate Management Procedures for the South African hake resource: Draft objectives and testing methodology. Unpublished report, Marine and Coastal Management, South Africa. MCM/2010/MAY/SWG-DEM/22(Rev).

Table 1: Results (median, 95% PI) for the Reference Set under a projected constant catch of 118 500t.

		RS1		RS2		RS3		RS4		RS5		RS6		RS7		RS8		RS9		RS10	
C fixed		118.5		118.5		118.5		118.5		118.5		118.5		118.5		118.5		118.5		118.5	
$B^{sp}_{2027}/B^{sp}_{2007}$	both	2.37	(1.95; 2.83)	1.84	(1.57; 2.21)	1.90	(1.59; 2.30)	1.50	(1.30; 1.74)	1.75	(1.48; 2.05)	2.48	(2.03; 2.94)	2.24	(1.71; 2.95)	1.60	(1.35; 1.81)	2.14	(1.69; 2.66)	1.57	(1.36; 1.84)
	para	3.43	(2.54; 4.29)	3.20	(2.40; 4.20)	3.57	(2.48; 4.84)	1.86	(1.44; 2.34)	2.29	(1.75; 2.86)	3.73	(2.87; 4.71)	3.39	(2.31; 4.69)	2.86	(2.29; 3.36)	2.73	(2.13; 3.37)	1.78	(1.41; 2.22)
	cap	1.56	(1.28; 1.89)	1.41	(1.25; 1.63)	1.61	(1.36; 1.90)	1.33	(1.18; 1.52)	1.57	(1.33; 1.85)	1.34	(1.03; 1.73)	1.67	(1.08; 2.25)	1.11	(0.91; 1.35)	1.77	(1.31; 2.35)	1.49	(1.27; 1.73)
B^{sp}_{2020}/B_{MSY}	both	1.88	(1.53; 2.31)	2.15	(1.79; 2.57)	3.20	(2.67; 3.74)	2.99	(2.54; 3.45)	4.89	(4.20; 5.64)	1.57	(1.27; 1.93)	1.46	(1.15; 1.80)	2.30	(1.98; 2.60)	1.65	(1.37; 2.02)	2.47	(2.15; 2.81)
	para	1.44	(1.04; 2.08)	1.11	(0.79; 1.68)	1.35	(0.90; 2.06)	1.81	(1.40; 2.58)	3.96	(3.02; 5.37)	1.21	(0.89; 1.73)	1.38	(0.93; 2.10)	1.62	(1.27; 2.16)	1.37	(0.95; 1.89)	1.62	(1.29; 2.14)
	cap	2.67	(2.21; 3.22)	4.22	(3.63; 4.95)	5.23	(4.38; 6.28)	4.53	(3.92; 5.30)	5.39	(4.50; 6.45)	2.33	(1.97; 2.82)	1.49	(1.13; 1.99)	2.91	(2.52; 3.40)	1.96	(1.56; 2.52)	3.06	(2.56; 3.65)
B^{sp}_{2027}/B_{MSY}	both	1.92	(1.79; 2.29)	2.43	(2.31; 2.92)	3.38	(3.15; 4.08)	3.22	(3.09; 3.74)	4.96	(4.66; 5.81)	1.61	(1.51; 1.91)	1.53	(1.40; 2.01)	1.83	(1.73; 2.07)	1.90	(1.78; 2.36)	2.55	(2.41; 2.99)
	para	1.82	(1.35; 2.27)	1.52	(1.14; 1.99)	1.77	(1.23; 2.40)	2.25	(1.74; 2.82)	4.36	(3.34; 5.45)	1.62	(1.25; 2.05)	1.73	(1.18; 2.40)	1.87	(1.50; 2.20)	1.59	(1.24; 1.96)	1.85	(1.46; 2.30)
	cap	2.12	(1.75; 2.58)	4.26	(3.78; 4.91)	5.21	(4.42; 6.17)	4.54	(4.04; 5.21)	5.32	(4.52; 6.27)	1.52	(1.17; 1.96)	1.38	(0.89; 1.86)	1.79	(1.47; 2.17)	2.29	(1.69; 3.05)	3.06	(2.61; 3.56)
B^{sp}_{2030}/K^{sp}	both	0.55	(0.46; 0.69)	0.57	(0.50; 0.67)	0.63	(0.53; 0.74)	0.65	(0.57; 0.75)	0.69	(0.58; 0.80)	0.49	(0.41; 0.60)	0.53	(0.40; 0.66)	0.67	(0.57; 0.78)	0.83	(0.68; 1.01)	0.76	(0.66; 0.87)
	para	0.46	(0.36; 0.58)	0.40	(0.31; 0.50)	0.37	(0.27; 0.50)	0.47	(0.37; 0.58)	0.47	(0.37; 0.61)	0.44	(0.35; 0.54)	0.35	(0.25; 0.50)	0.61	(0.50; 0.74)	0.61	(0.49; 0.76)	0.54	(0.44; 0.68)
	cap	0.81	(0.64; 1.01)	0.84	(0.75; 0.97)	0.88	(0.75; 1.04)	0.89	(0.79; 1.02)	0.88	(0.75; 1.05)	0.67	(0.49; 0.89)	0.99	(0.73; 1.25)	0.73	(0.58; 0.90)	1.14	(0.91; 1.47)	0.92	(0.79; 1.09)
$CPUE_{16}/CPUE_{03\text{-}05}$		1.70	(1.39; 2.03)	1.46	(1.22; 1.69)	1.46	(1.20; 1.71)	1.41	(1.20; 1.65)	1.45	(1.23; 1.69)	1.87	(1.52; 2.23)	1.60	(1.27; 1.95)	1.95	(1.65; 2.35)	1.62	(1.33; 1.92)	1.36	(1.14; 1.60)
AAV		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)	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)

		RS11		RS12	
C fixed		118.5		118.5	
$B^{sp}_{2027}/B^{sp}_{2007}$	both	2.97	(2.16; 3.87)	2.95	(2.14; 3.86)
	para	3.24	(2.37; 4.26)	3.21	(2.34; 4.23)
	cap	2.04	(1.39; 2.75)	1.98	(1.30; 2.74)
B^{sp}_{2020}/B_{MSY}	both	0.96	(0.68; 1.37)	0.94	(0.67; 1.35)
	para	1.08	(0.75; 1.65)	1.08	(0.75; 1.65)
	cap	0.64	(0.49; 0.83)	0.58	(0.44; 0.76)
B^{sp}_{2027}/B_{MSY}	both	1.31	(1.21; 1.71)	1.28	(1.18; 1.68)
	para	1.50	(1.09; 1.97)	1.49	(1.09; 1.97)
	cap	0.79	(0.54; 1.07)	0.72	(0.47; 0.99)
B^{sp}_{2030}/K^{sp}	both	0.39	(0.31; 0.49)	0.38	(0.30; 0.49)
	para	0.40	(0.31; 0.50)	0.40	(0.31; 0.50)
	cap	0.36	(0.26; 0.49)	0.33	(0.23; 0.46)
$CPUE_{16}/CPUE_{03\text{-}05}$		1.37	(1.10; 1.75)	1.35	(1.09; 1.73)
AAV		0.00	(0.00; 0.00)	0.00	(0.00; 0.00)

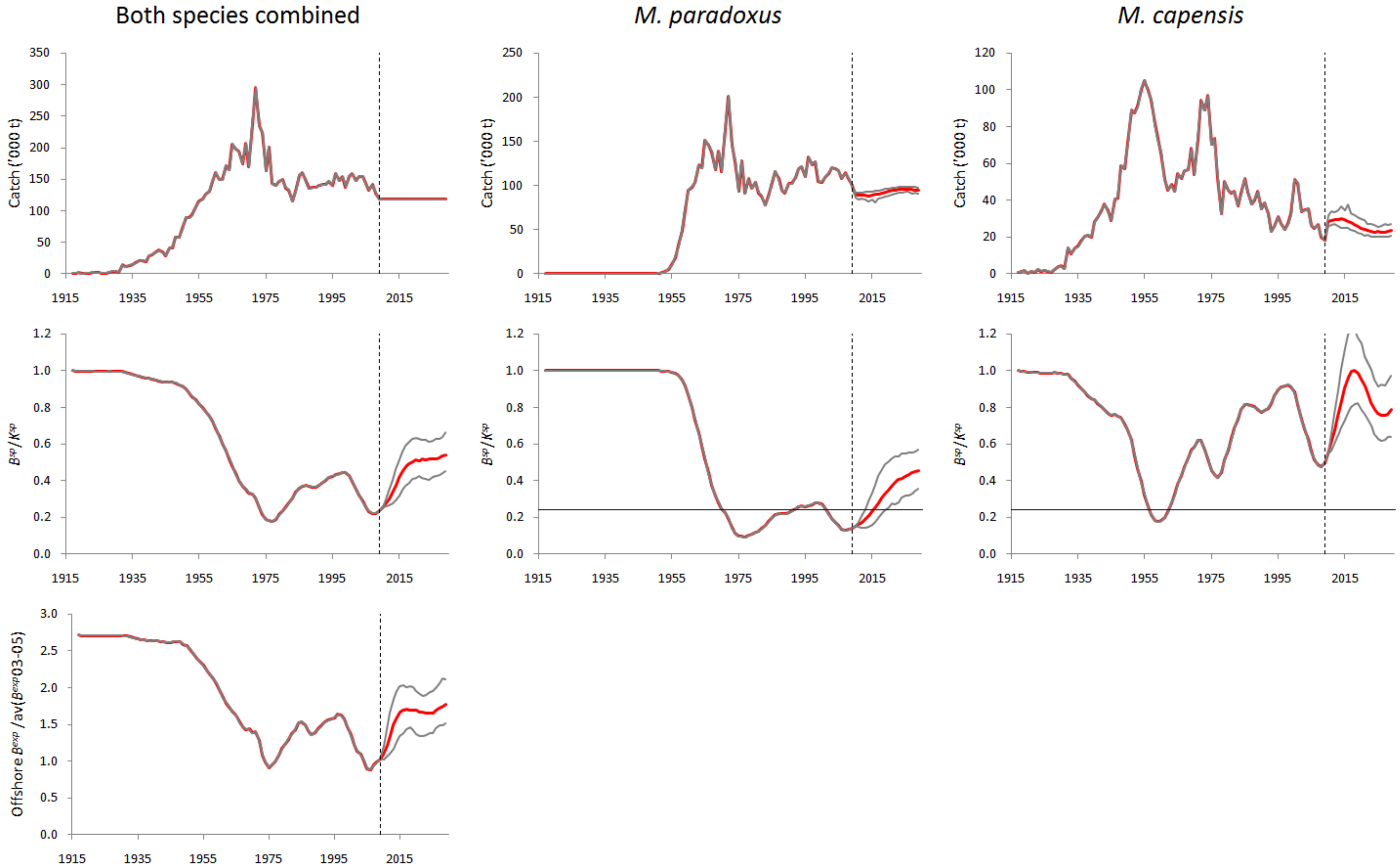

Fig. 1: For the Reference Case (RS1) under a projected constant catch of 118 500 t, time-trajectories (median and 95% PI) for the total catch (top row, species combined, then by species), the female spawning biomass relative to its pre-exploitation level (middle row, species combined, then by species) and offshore trawl exploitable biomass (species and coast combined). On the species-disaggregated spawning biomass plots, the estimated MSYLs are also shown.

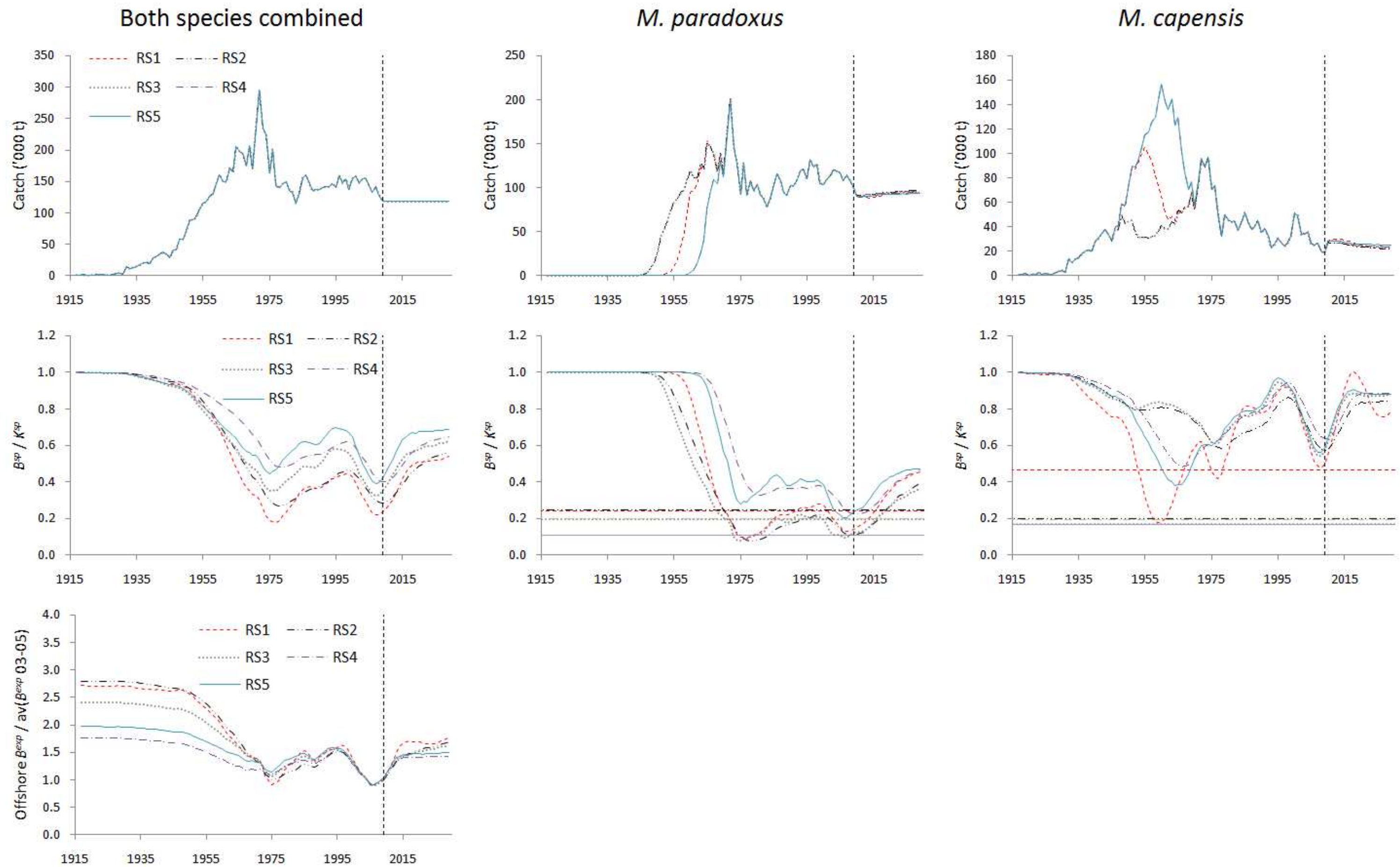

Fig. 2a: For the first five OMs of RSa (RS1 to RS5) under a projected constant catch of 118 500 t, median time-trajectories for the total catch (top row, species combined, then by species), the female spawning biomass relative to its pre-exploitation level (middle row, species combined, then by species) and offshore trawl exploitable biomass (species and coast combined). On the species-disaggregated spawning biomass plots, the estimated MSYLs are also shown.

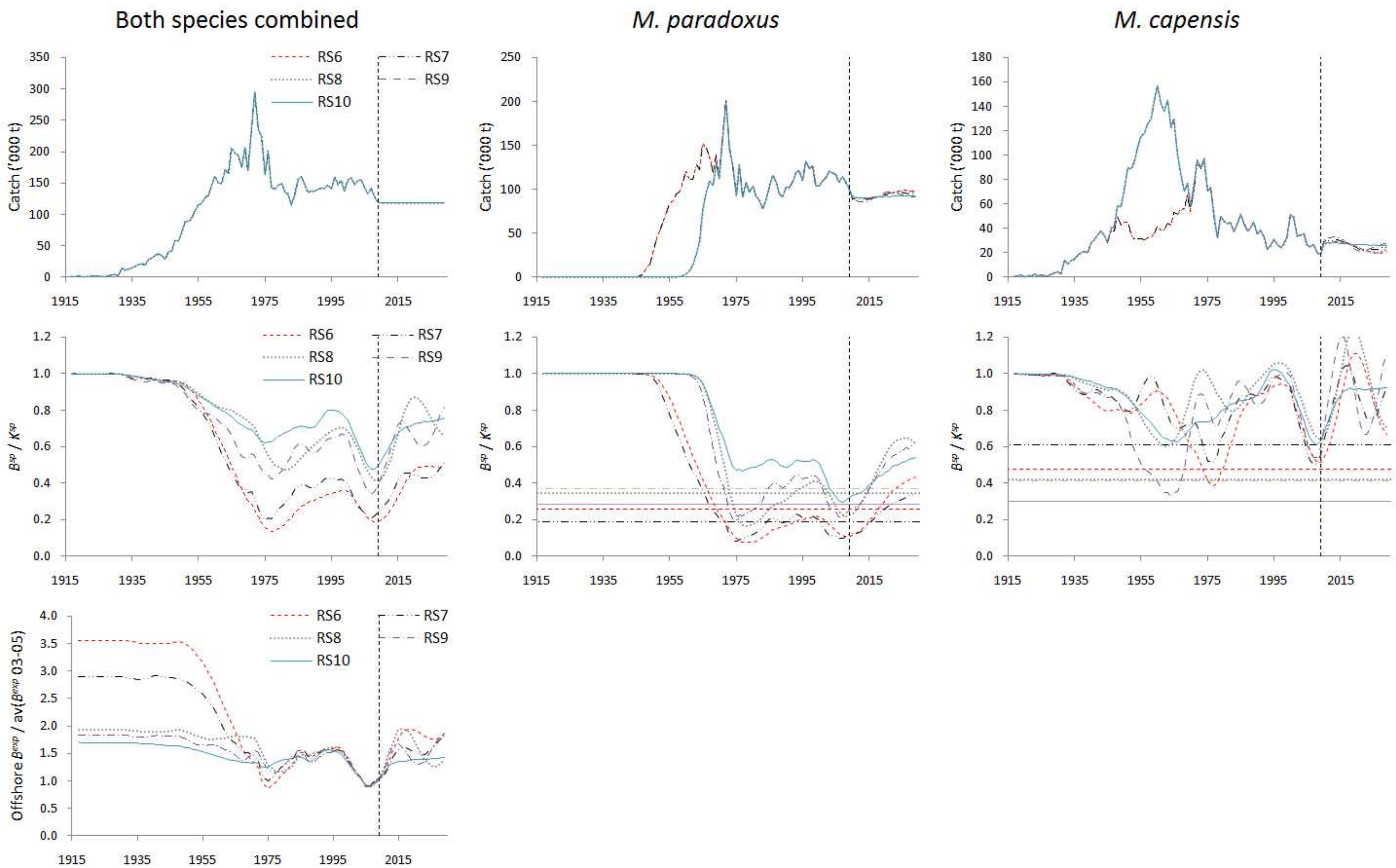

Fig. 2b: For the last five OMs of RSa (RS6 to RS10) under a projected constant catch of 118 500 t, median time-trajectories for the total catch (top row, species combined, then by species), the female spawning biomass relative to its pre-exploitation level (middle row, species combined, then by species) and offshore trawl exploitable biomass (species and coast combined). On the species-disaggregated spawning biomass plots, the estimated MSYLs are also shown.

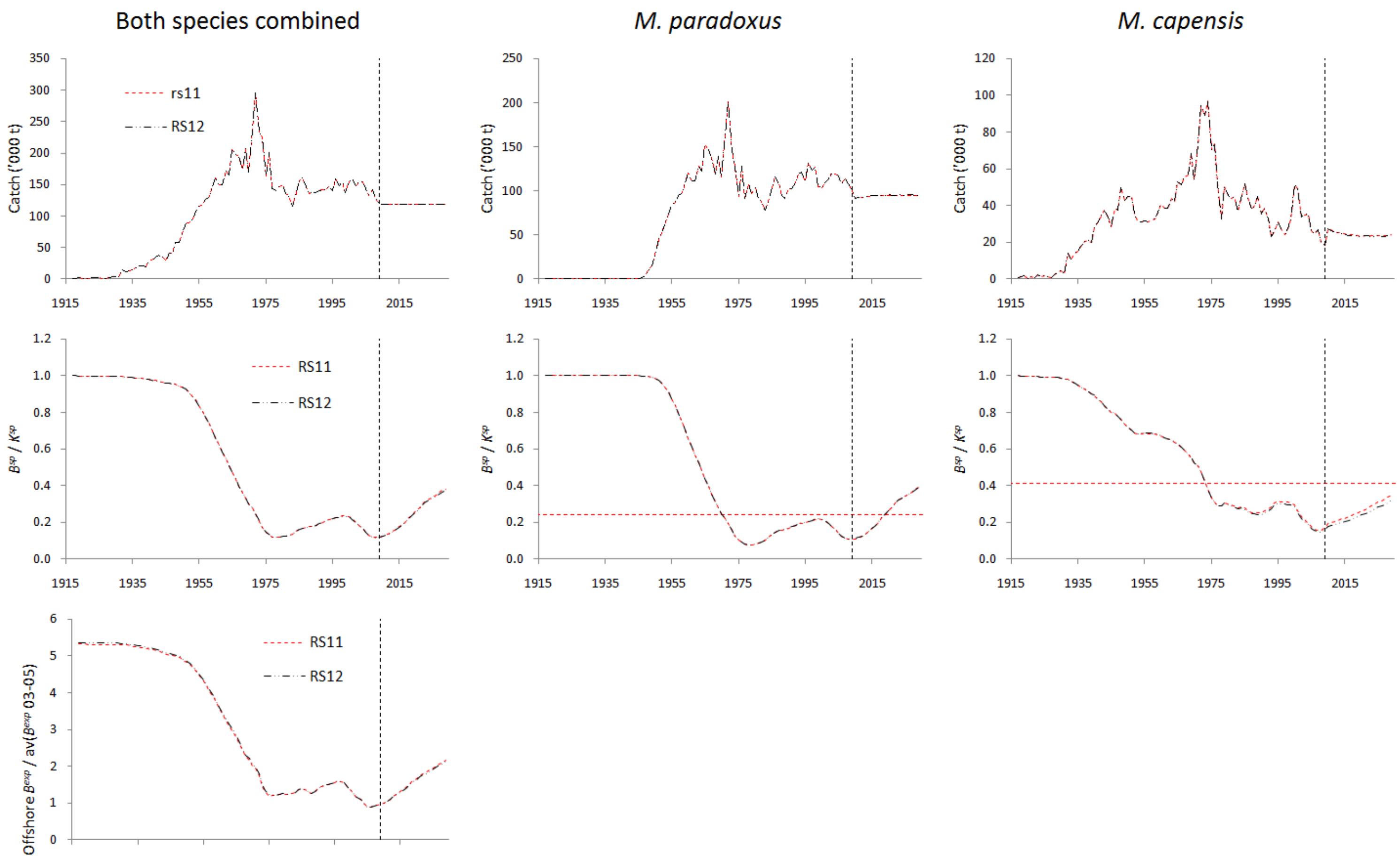

Fig. 2c: For the two OMs of RSb (RS11 and RS12) under a projected constant catch of 118 500 t, median time-trajectories for the total catch (top row, species combined, then by species), the female spawning biomass relative to its pre-exploitation level (middle row, species combined, then by species) and offshore trawl exploitable biomass (species and coast combined). On the species-disaggregated spawning biomass plots, the estimated MSYLs are also shown.

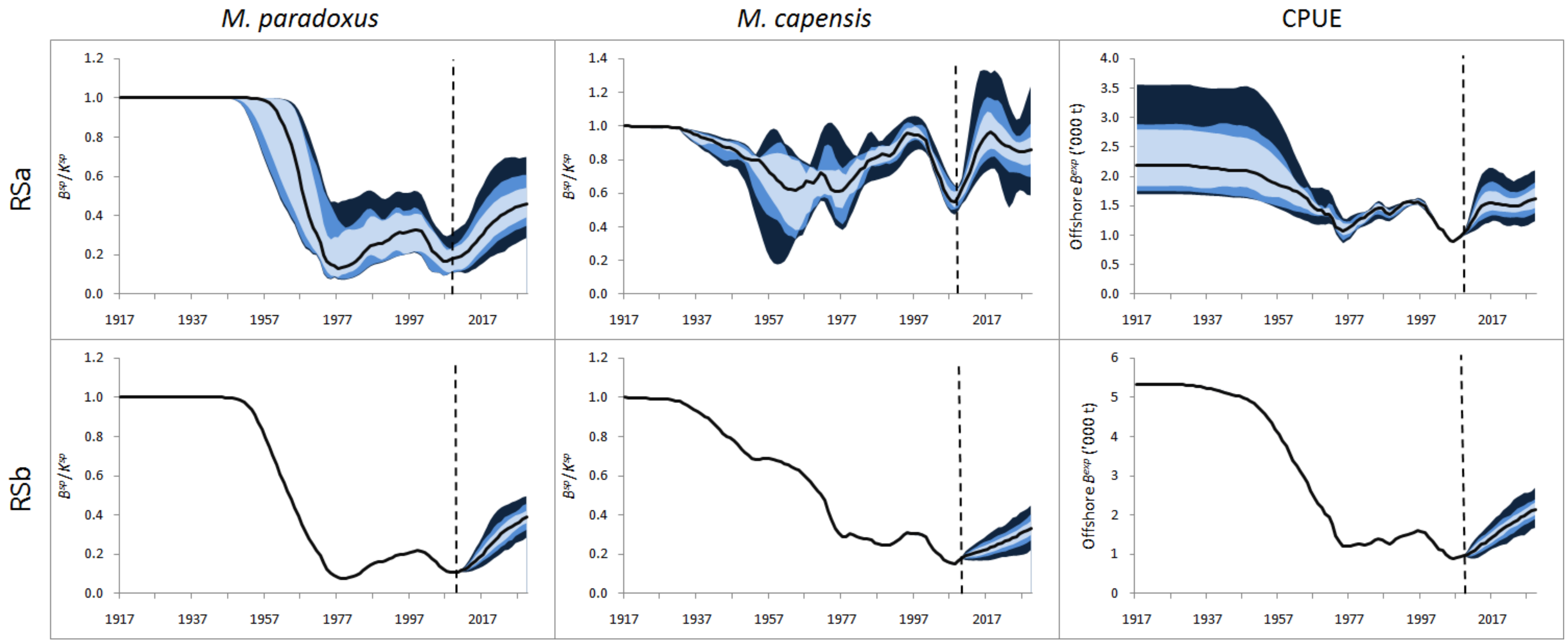

Fig. 3: 95%, 75% and 50% PI (from darker to lighter blue) and median (black line) accross RSa (top row) and RSb (bottom row) for spawning biomass relative to pre-exploitation level and for the CPUE improvement index.