Final Proposal for Reference Set for the Joint Assessment of the South African *Merluccius paradoxus* and *M. capensis* Resources

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Introduction

The Reference Set aims to take account of the factors that account for most of the model uncertainty regarding the key considerations of resource status and productivity and this is achieved by including the following variations:

M. Natural mortality:

>M1: upper bounds of 0.5 and 0.3 on ages 2 and 5/5+ respectively are implemented;

>M4: upper bounds of 1.0 and 0.5 on ages 2 and 5/5+ respectively are implemented.

C. Species catch split (see Fig. 1):

>C1: the logistic function used to split the pre-1978 offshore commercial catches by species has the parameters P_1=1965 and P_2=1.5;

>C2: the logistic function used to split the pre-1978 offshore commercial catches by species has the parameters P_1=1970 and P_2=1.5;

>C3: the logistic function used to split the pre-1978 offshore commercial catches by species has the parameters P_1=1950 and P_2=1.5;

>C4: as C1 but the post-1977 offshore trawl catches of *M. capensis* in the offshore commercial catches have been replaced by those in Table 6 of Glazer (2005) which introduces an upward bias in the *M. capensis* proportion by depth.

H. Steepness parameter

>H1: the steepness parameters (*h*) for both *M. capensis* and *M. paradoxus* are estimated in the minimisation process;

>H2: for *M. paradoxus*, *h* is fixed at 0.8 (lower than the 0.95 typically estimated), while this parameter is estimated for *M. capensis*;

>H3: for *M. capensis*, *h* is fixed at 0.6 (higher than the 0.4-0.5 typically estimated), while this parameter is estimated for *M. paradoxus*;

>H4: for *M. paradoxus*, *h* is fixed at 0.8 and for *M. capensis*, *h* is fixed at 0.6.

SR. Stock-recruitment residuals

>SR1: σ_R=0.25 throughout the period;

>SR2: σ_R=0.25 from the beginning of the fishery to 2000 and then decreases linearly to 0.1 in 2004.

Methods

The model used in these analyses is described in detail in Appendix B of WG/02/05/DH2 with the amendments listed in WG/04/05/DH10.

Results

Results are presented for the full Reference Set.

Table 1 compares the results of the different assessments for the *M. paradoxus* and *M. capensis* resources. The total negative log-likelihood and the contribution of each data source for each of these cases are compared in Table 2, while Fig. 2 plots the population trajectories (in terms of pre-exploitation level) for these assessments for each of the two species together with 20-year projections under a constant catch strategy (*C*=155 000t) for which the difision of this catch between the four fleets is: Offshore trawl=83.9%, Inshore trawl=6.2%, Longline=6.6% and Handline=3.3%.

Discussion

The 64 cases do cover reasonable ranges of MSY and current depletion (B_{2004}^{sp} / K^{sp}) for the two populations, and hence provide a reflection of the uncertainties concerning these quantities (see Table 3a).

Abundance projections under a constant catch of 155 000 tons also show a wide range including both appreciable increases and appreciable decreases. Contrasting Figs 2a,b with 2c,d shows that the SR1/SR2 distinction has a large effect. For the latter, with recent recruitments for *M. paradoxus* not as substantially above average, *M. paradoxus* in nearly all cases (as well as *M. capensis* for some) exhibits large declines.

In due course, consideration will need to be given to the relative weighting of these 64 cases in the OMP tests. For the moment, the default suggestion is one of equal weighting. Other possibilities include input weights for different levels of each factor, or likelihood-based weighting (strict weighting proportional to likelihood seems too extreme, but some monotonic relationship could be considered). Table 3b provides some idea of the relative plausibility of these different levels by averaging the –lnL over all different cases that include the level of interest.

References

Rademeyer RA and Butterworth DS. 2005. Joint assessment of the South African *Merluccius paradoxus* and *M. capensis* resources. Unpublished report, MCM, South Africa. WG/02/05/D:H:2.

Rademeyer RA and Butterworth DS. 2005 Proposed Reference Set for the Joint Assessment of the South African *Merluccius paradoxus* and *M. capensis* Resources. Unpublished report, MCMC, South Africa. WG/04/05/D:H:10.

Table 1a: Estimates of management quantities of the *M. paradoxus* and *M. capensis* coast-combined resources for the Reference Set cases. *MSY* and associated quantities are given in relation to the selectivity for the offshore fleet.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
		H1	H1	H1	H1	H2	H2	H2	H2	H3	H3	H3	H3	H4	H4	H4	H4
		SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1
M. paradoxus	K^{sp}	810	694	1201	629	871	859	990	755	806	694	1155	679	871	807	981	776
	h	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80
	MSY	126	115	136	106	122	109	136	106	127	115	136	104	122	112	137	99
	B^{sp}_{2004}/K^{sp}	0.12	0.15	0.07	0.13	0.14	0.23	0.11	0.13	0.12	0.15	0.07	0.15	0.14	0.16	0.12	0.19
	$B^{sp}_{2004}/MSYL^{sp}$	0.58	0.77	0.34	0.64	0.52	0.94	0.41	0.50	0.58	0.77	0.37	0.81	0.52	0.59	0.44	0.76
	M 0	0.40	0.50	0.45	0.50	0.50	0.50	0.50	0.50	0.39	0.50	0.45	0.37	0.50	0.50	0.50	0.50
	1	0.40	0.50	0.45	0.50	0.50	0.50	0.50	0.50	0.39	0.50	0.45	0.37	0.50	0.50	0.50	0.50
	2	0.40	0.50	0.45	0.50	0.50	0.50	0.50	0.50	0.39	0.50	0.45	0.37	0.50	0.50	0.50	0.50
	3	0.34	0.40	0.32	0.40	0.40	0.40	0.40	0.40	0.34	0.40	0.32	0.33	0.40	0.40	0.40	0.40
	4	0.31	0.34	0.24	0.34	0.34	0.34	0.34	0.34	0.31	0.34	0.25	0.31	0.34	0.34	0.34	0.34
	5+	0.28	0.30	0.19	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.19	0.30	0.30	0.30	0.30	0.30
M. capensis	K^{sp}	1175	1616	398	1239	1180	1667	376	1211	1028	1413	589	1223	1031	1420	581	1218
	h	0.44	0.45	0.95	0.50	0.45	0.49	0.95	0.48	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	MSY	74	105	51	91	76	121	48	85	91	124	52	108	91	125	52	108
	B^{sp}_{2004}/K^{sp}	0.49	0.67	0.48	0.55	0.55	0.70	0.43	0.38	0.70	0.78	0.59	0.62	0.70	0.78	0.58	0.61
	$B^{sp}_{2004}/MSYL^{sp}$	1.24	1.72	1.97	1.44	1.37	1.82	1.55	0.97	1.95	2.18	1.65	1.73	2.03	2.27	1.67	1.77
	M 0	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	1	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	2	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	3	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	4	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
	5	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	6	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	7+	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

Table 1b: Estimates of management quantities of the *M. paradoxus* and *M. capensis* coast-combined resources for the Reference Set cases. *MSY* and associated quantities are given in relation to the selectivity for the offshore fleet.

		17 M4 C1 H1 SR1	18 M4 C2 H1 SR1	19 M4 C3 H1 SR1	20 M4 C4 H1 SR1	21 M4 C1 H2 SR1	22 M4 C2 H2 SR1	23 M4 C3 H2 SR1	24 M4 C4 H2 SR1	25 M4 C1 H3 SR1	26 M4 C2 H3 SR1	27 M4 C3 H3 SR1	28 M4 C4 H3 SR1	29 M4 C1 H4 SR1	30 M4 C2 H4 SR1	31 M4 C3 H4 SR1	32 M4 C4 H4 SR1
M. paradoxus	K^{sp}	838	810	1261	559	733	536	963	485	826	531	1204	547	732	530	906	483
	h	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80
	MSY	124	126	135	106	121	110	130	102	125	114	132	108	122	110	126	102
	B^{sp}_{2004}/K^{sp}	0.11	0.12	0.06	0.13	0.16	0.26	0.11	0.21	0.11	0.20	0.06	0.14	0.17	0.27	0.12	0.22
	$B^{sp}_{2004}/MSYL^{sp}$	0.54	0.58	0.31	0.70	0.63	1.04	0.43	0.82	0.57	1.13	0.32	0.74	0.65	1.06	0.46	0.84
	M 0	0.46	0.40	0.45	0.50	0.56	0.62	0.70	0.62	0.44	0.51	0.52	0.44	0.52	0.61	0.80	0.59
	1	0.46	0.40	0.45	0.50	0.56	0.62	0.70	0.62	0.44	0.51	0.52	0.44	0.52	0.61	0.80	0.59
	2	0.46	0.40	0.45	0.50	0.56	0.62	0.70	0.62	0.44	0.51	0.52	0.44	0.52	0.61	0.80	0.59
	3	0.36	0.34	0.31	0.43	0.47	0.55	0.49	0.56	0.36	0.46	0.35	0.41	0.45	0.55	0.54	0.55
	4	0.30	0.31	0.23	0.38	0.41	0.51	0.36	0.52	0.30	0.44	0.25	0.39	0.41	0.52	0.39	0.52
	5+	0.26	0.28	0.18	0.35	0.37	0.48	0.28	0.49	0.27	0.42	0.18	0.38	0.38	0.49	0.28	0.50
M. capensis	K^{sp}	882	1175	289	928	896	1247	298	933	848	1085	387	904	857	1102	369	904
	h	0.40	0.44	0.95	0.44	0.40	0.38	0.95	0.44	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	MSY	76	74	49	92	77	103	47	92	96	128	53	103	97	131	50	103
	B^{sp}_{2004}/K^{sp}	0.64	0.49	0.50	0.68	0.67	0.75	0.48	0.68	0.77	0.85	0.68	0.74	0.77	0.87	0.65	0.74
	$B^{sp}_{2004}/MSYL^{sp}$	1.54	1.23	1.80	1.67	1.59	1.77	1.66	1.67	2.13	2.35	1.85	2.03	2.14	2.39	1.76	2.03
	M 0	1.00	0.50	0.44	1.00	1.00	1.00	1.00	1.00	0.10	1.00	1.00	1.00	0.10	1.00	1.00	1.00
	1	1.00	0.50	0.44	1.00	1.00	1.00	1.00	1.00	0.10	1.00	1.00	1.00	0.10	1.00	1.00	1.00
	2	1.00	0.50	0.44	1.00	1.00	1.00	1.00	1.00	0.10	1.00	1.00	1.00	0.10	1.00	1.00	1.00
	3	0.75	0.40	0.44	0.75	0.75	0.75	0.69	0.75	0.27	0.71	0.75	0.70	0.27	0.71	0.75	0.70
	4	0.60	0.34	0.44	0.60	0.60	0.60	0.51	0.60	0.37	0.54	0.60	0.52	0.37	0.54	0.60	0.52
	5	0.50	0.30	0.44	0.50	0.50	0.50	0.39	0.50	0.44	0.42	0.50	0.40	0.43	0.43	0.50	0.40
	6	0.50	0.30	0.44	0.50	0.50	0.50	0.39	0.50	0.44	0.42	0.50	0.40	0.43	0.43	0.50	0.40
	7+	0.50	0.30	0.44	0.50	0.50	0.50	0.39	0.50	0.44	0.42	0.50	0.40	0.43	0.43	0.50	0.40

Table 1c: Estimates of management quantities of the *M. paradoxus* and *M. capensis* coast-combined resources for the Reference Set cases. *MSY* and associated quantities are given in relation to the selectivity for the offshore fleet.

		33 M1 C1 H1 SR2	34 M1 C2 H1 SR2	35 M1 C3 H1 SR2	36 M1 C4 H1 SR2	37 M1 C1 H2 SR2	38 M1 C2 H2 SR2	39 M1 C3 H2 SR2	40 M1 C4 H2 SR2	41 M1 C1 H3 SR2	42 M1 C2 H3 SR2	43 M1 C3 H3 SR2	44 M1 C4 H3 SR2	45 M1 C1 H4 SR2	46 M1 C2 H4 SR2	47 M1 C3 H4 SR2	48 M1 C4 H4 SR2
M. paradoxus	K^{sp}	809	694	1197	630	872	860	991	756	805	694	1151	679	872	808	982	777
	h	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80
	MSY	126	115	136	106	122	109	136	106	127	115	136	104	122	112	137	99
	B^{sp}_{2004}/K^{sp}	0.11	0.14	0.07	0.12	0.14	0.23	0.11	0.13	0.11	0.14	0.07	0.14	0.14	0.15	0.11	0.19
	$B^{sp}_{2004}/MSYL^{sp}$	0.56	0.74	0.33	0.61	0.51	0.93	0.40	0.49	0.56	0.74	0.35	0.78	0.52	0.58	0.43	0.75
	M 0	0.40	0.50	0.44	0.50	0.50	0.50	0.50	0.50	0.39	0.50	0.45	0.37	0.50	0.50	0.50	0.50
	1	0.40	0.50	0.44	0.50	0.50	0.50	0.50	0.50	0.39	0.50	0.45	0.37	0.50	0.50	0.50	0.50
	2	0.40	0.50	0.44	0.50	0.50	0.50	0.50	0.50	0.39	0.50	0.45	0.37	0.50	0.50	0.50	0.50
	3	0.34	0.40	0.31	0.40	0.40	0.40	0.40	0.40	0.34	0.40	0.32	0.34	0.40	0.40	0.40	0.40
	4	0.31	0.34	0.24	0.34	0.34	0.34	0.34	0.34	0.31	0.34	0.25	0.31	0.34	0.34	0.34	0.34
	5+	0.28	0.30	0.19	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.20	0.30	0.30	0.30	0.30	0.30
M. capensis	K^{sp}	1174	1620	398	1245	1179	1667	376	1205	1027	1411	588	1222	1030	1418	580	1216
	h	0.44	0.44	0.95	0.48	0.44	0.49	0.95	0.48	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	MSY	74	104	51	89	76	120	48	85	91	124	52	108	91	125	52	108
	B^{sp}_{2004}/K^{sp}	0.48	0.66	0.48	0.50	0.53	0.69	0.42	0.37	0.69	0.77	0.58	0.61	0.69	0.77	0.57	0.60
	$B^{sp}_{2004}/MSYL^{sp}$	1.19	1.65	1.72	1.30	1.31	1.79	1.52	0.94	1.92	2.15	1.62	1.71	1.93	2.16	1.60	1.69
	M 0	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	1	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	2	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	3	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	4	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
	5	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	6	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	7+	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

Table 1d: Estimates of management quantities of the *M. paradoxus* and *M. capensis* coast-combined resources for the Reference Set cases. *MSY* and associated quantities are given in relation to the selectivity for the offshore fleet.

		49 M4 C1 H1 SR2	50 M4 C2 H1 SR2	51 M4 C3 H1 SR2	52 M4 C4 H1 SR2	53 M4 C1 H2 SR2	54 M4 C2 H2 SR2	55 M4 C3 H2 SR2	56 M4 C4 H2 SR2	57 M4 C1 H3 SR2	58 M4 C2 H3 SR2	59 M4 C3 H3 SR2	60 M4 C4 H3 SR2	61 M4 C1 H4 SR2	62 M4 C2 H4 SR2	63 M4 C3 H4 SR2	64 M4 C4 H4 SR2
M. paradoxus	K^{sp}	837	539	1256	558	732	537	956	483	824	531	1200	545	730	531	900	483
	h	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80	0.95	0.95	0.95	0.95	0.80	0.80	0.80	0.80
	MSY	124	114	135	106	121	110	130	102	125	114	132	108	123	110	127	102
	B^{sp}_{2004}/K^{sp}	0.10	0.19	0.06	0.13	0.16	0.26	0.11	0.20	0.11	0.19	0.06	0.14	0.17	0.26	0.11	0.21
	$B^{sp}_{2004}/MSYL^{sp}$	0.52	1.06	0.29	0.67	0.62	1.01	0.42	0.80	0.55	1.09	0.31	0.71	0.64	1.04	0.45	0.82
	M 0	0.46	0.52	0.45	0.50	0.56	0.61	0.70	0.62	0.44	0.50	0.51	0.43	0.52	0.60	0.80	0.59
	1	0.46	0.52	0.45	0.50	0.56	0.61	0.70	0.62	0.44	0.50	0.51	0.43	0.52	0.60	0.80	0.59
	2	0.46	0.52	0.45	0.50	0.56	0.61	0.70	0.62	0.44	0.50	0.51	0.43	0.52	0.60	0.80	0.59
	3	0.36	0.47	0.31	0.43	0.46	0.55	0.49	0.56	0.36	0.46	0.35	0.41	0.45	0.55	0.54	0.55
	4	0.30	0.43	0.23	0.38	0.41	0.51	0.36	0.52	0.30	0.44	0.25	0.39	0.41	0.52	0.39	0.52
	5+	0.26	0.41	0.18	0.35	0.37	0.48	0.28	0.49	0.27	0.42	0.18	0.38	0.38	0.50	0.29	0.50
M. capensis	K^{sp}	882	1222	289	929	896	1250	299	934	852	1084	386	904	862	1100	369	903
	h	0.40	0.38	0.95	0.44	0.39	0.38	0.95	0.44	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	MSY	76	101	49	92	77	102	47	91	96	128	52	103	96	132	50	103
	B^{sp}_{2004}/K^{sp}	0.63	0.71	0.49	0.67	0.65	0.73	0.47	0.67	0.75	0.84	0.67	0.72	0.76	0.85	0.63	0.73
	$B^{sp}_{2004}/MSYL^{sp}$	1.50	1.69	1.76	1.64	1.56	1.73	1.62	1.64	2.09	2.32	1.82	2.00	2.10	2.35	1.73	2.00
	M 0	1.00	1.00	0.44	1.00	1.00	1.00	1.00	1.00	0.10	1.00	1.00	1.00	0.10	1.00	1.00	1.00
	1	1.00	1.00	0.44	1.00	1.00	1.00	1.00	1.00	0.10	1.00	1.00	1.00	0.10	1.00	1.00	1.00
	2	1.00	1.00	0.44	1.00	1.00	1.00	1.00	1.00	0.10	1.00	1.00	1.00	0.10	1.00	1.00	1.00
	3	0.75	0.75	0.44	0.75	0.75	0.75	0.69	0.75	0.27	0.71	0.75	0.70	0.27	0.71	0.75	0.70
	4	0.60	0.60	0.44	0.60	0.60	0.60	0.51	0.60	0.37	0.54	0.60	0.52	0.36	0.54	0.60	0.52
	5	0.50	0.50	0.44	0.50	0.50	0.50	0.38	0.50	0.44	0.42	0.50	0.40	0.43	0.43	0.50	0.40
	6	0.50	0.50	0.44	0.50	0.50	0.50	0.38	0.50	0.44	0.42	0.50	0.40	0.43	0.43	0.50	0.40
	7+	0.50	0.50	0.44	0.50	0.50	0.50	0.38	0.50	0.44	0.42	0.50	0.40	0.43	0.43	0.50	0.40

Table 2a: Log-likelihood contributions for the Reference Set.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
		H1	H1	H1	H1	H2	H2	H2	H2	H3	H3	H3	H3	H4	H4	H4	H4
		SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1
-lnL: Total		-172.7	-165.9	-172.6	-173.1	-163.2	-160.6	-166.5	-157.2	-171.0	-165.1	-166.3	-170.9	-161.8	-153.5	-158.6	-161.3
-lnL: CPUE	WC historic (spp combined)	-11.2	-8.7	-11.2	-9.8	-10.1	-7.9	-10.4	-7.7	-11.2	-8.4	-10.8	-10.4	-10.1	-7.4	-9.5	-7.3
	SC historic (spp combined)	-24.4	-27.1	-27.1	-28.3	-26.2	-28.7	-29.1	-27.3	-22.7	-26.6	-28.0	-27.9	-24.8	-26.7	-29.3	-29.0
	M. paradoxus GLM	-42.3	-39.9	-42.1	-41.5	-41.7	-40.2	-41.9	-41.1	-42.3	-39.8	-42.4	-41.7	-41.7	-39.7	-42.6	-41.4
	M. capensis GLM	-42.7	-43.5	-37.8	-43.2	-42.8	-43.5	-38.8	-42.0	-43.5	-43.6	-33.0	-43.2	-43.4	-43.6	-32.9	-43.3
-lnL: Survey	*M. paradoxus*, WC summer	-8.9	-8.7	-8.8	-9.6	-8.7	-8.4	-8.7	-8.9	-8.9	-8.7	-8.9	-9.4	-8.7	-8.3	-8.9	-9.1
	M. paradoxus, WC winter	-4.2	-4.1	-4.1	-4.3	-4.1	-4.1	-4.0	-4.0	-4.2	-4.1	-4.2	-4.3	-4.1	-4.0	-4.1	-4.2
	M. paradoxus, WC Nansen	-2.0	-2.0	-2.0	-2.1	-2.0	-1.9	-1.9	-2.0	-2.0	-2.0	-2.0	-2.1	-2.0	-1.9	-2.0	-2.0
	M. paradoxus, SC spring	-0.7	-0.5	-0.6	-0.6	-0.5	-0.5	-0.5	-0.2	-0.7	-0.5	-0.7	-0.7	-0.5	-0.2	-0.6	-0.5
	M. paradoxus, SC autumn	6.3	6.4	6.3	6.3	6.4	6.6	6.5	6.3	6.3	6.4	6.2	6.3	6.4	6.4	6.4	6.5
	M. capensis, WC summer	-2.1	-1.9	-2.0	-2.0	-2.0	-2.1	-2.0	-2.2	-1.9	-1.8	-2.0	-2.2	-1.9	-1.8	-2.0	-2.2
	M. capensis, WC winter	0.3	0.3	0.5	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.3
	M. capensis, WC Nansen	-1.3	-1.3	-1.4	-1.3	-1.3	-1.3	-1.4	-1.3	-1.4	-1.4	-1.4	-1.3	-1.4	-1.4	-1.4	-1.3
	M. capensis, SC spring	-1.4	-1.4	-1.4	-1.4	-1.4	-1.3	-1.4	-1.3	-1.5	-1.5	-1.5	-1.3	-1.5	-1.5	-1.5	-1.3
	M. capensis, SC autumn	-7.1	-7.3	-7.6	-7.1	-7.2	-7.3	-7.6	-6.9	-7.4	-7.5	-7.7	-7.1	-7.5	-7.5	-7.7	-7.1
-lnL: commercial CAA	species combined, offshore	-42.4	-40.7	-41.7	-41.3	-38.4	-37.5	-37.5	-35.3	-42.2	-40.7	-41.5	-38.9	-38.2	-35.1	-37.7	-36.4
	M. capensis, inshore	-19.2	-17.6	-24.3	-19.1	-18.8	-17.7	-25.5	-20.8	-18.3	-17.4	-20.8	-19.0	-18.2	-17.4	-20.9	-19.0
	M. capensis, longline	-12.4	-10.9	-15.5	-12.6	-12.1	-11.2	-15.5	-14.1	-11.6	-10.7	-14.1	-12.8	-11.6	-10.7	-14.2	-12.9
-lnL: survey CAA	*M. paradoxus*, WC summer	-15.7	-15.1	-15.2	-14.6	-14.4	-15.1	-14.3	-13.6	-15.7	-15.1	-15.5	-15.1	-14.4	-14.1	-14.8	-14.4
	M. paradoxus, WC Nansen	-10.3	-10.5	-10.5	-10.4	-10.7	-10.6	-10.7	-10.9	-10.3	-10.5	-10.4	-10.3	-10.7	-10.9	-10.6	-10.6
	M. paradoxus, SC spring	-3.1	-2.9	-3.7	-2.8	-2.2	-1.9	-2.9	-2.1	-3.0	-3.0	-3.3	-2.4	-2.2	-2.3	-2.3	-1.8
	M. paradoxus, SC autumn	28.8	29.2	29.2	28.4	29.9	30.1	30.5	29.7	28.8	29.2	28.9	28.6	29.9	30.1	29.9	29.8
	M. capensis, WC summer	83.0	82.7	85.1	82.9	83.0	82.7	85.4	83.0	82.9	82.8	84.2	82.7	82.9	82.8	84.2	82.7
	M. capensis, WC winter	6.6	6.2	8.9	6.6	6.5	6.3	9.2	7.2	6.3	6.1	7.2	6.8	6.3	6.1	7.3	6.8
	M. capensis, WC Nansen	-6.1	-6.2	-5.8	-6.1	-6.2	-6.2	-5.7	-6.0	-6.2	-6.2	-6.1	-6.1	-6.2	-6.2	-6.1	-6.1
	M. capensis, SC spring	-8.8	-8.8	-9.2	-8.9	-8.8	-8.8	-9.3	-8.9	-8.8	-8.8	-8.9	-8.9	-8.8	-8.8	-8.9	-8.9
	M. capensis, SC autumn	-30.1	-30.1	-28.8	-30.1	-30.0	-29.7	-28.8	-30.2	-29.9	-29.9	-28.8	-29.6	-29.9	-29.9	-28.8	-29.7
Recruit residual penalty		14.2	13.5	13.0	14.0	14.7	14.3	13.1	16.7	13.6	13.2	14.2	14.1	14.2	14.3	14.6	15.0

Table 2b: Log-likelihood contributions for the Reference Set.

		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
		M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
		H1	H1	H1	H1	H2	H2	H2	H2	H3	H3	H3	H3	H4	H4	H4	H4
		SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1	SR1
-lnL: Total		-180.1	-172.7	-175.2	-182.3	-174.0	-176.4	-170.0	-176.1	-175.1	-177.6	-171.9	-180.4	-169.3	-172.4	-172.4	-165.2
-lnL: CPUE	WC historic (spp combined)	-11.1	-11.2	-11.2	-10.2	-10.6	-9.2	-10.6	-8.7	-11.1	-9.4	-10.8	-10.8	-10.7	-9.2	-9.2	-9.8
	SC historic (spp combined)	-23.7	-24.4	-26.6	-28.1	-26.0	-28.4	-28.9	-29.0	-21.5	-26.2	-28.2	-26.5	-23.9	-27.7	-27.7	-29.6
	M. paradoxus GLM	-42.2	-42.3	-41.2	-42.1	-42.6	-41.8	-42.4	-42.5	-42.3	-41.6	-41.3	-42.2	-42.7	-41.7	-41.7	-42.5
	M. capensis GLM	-42.6	-42.7	-40.9	-42.6	-42.3	-42.7	-41.2	-42.6	-43.0	-42.2	-34.8	-43.2	-42.8	-41.6	-41.6	-35.7
-lnL: Survey	*M. paradoxus*, WC summer	-8.9	-8.9	-8.6	-9.7	-8.9	-8.8	-8.9	-9.6	-8.9	-9.0	-8.8	-9.6	-9.0	-8.7	-8.7	-9.2
	M. paradoxus, WC winter	-4.2	-4.2	-4.0	-4.3	-4.1	-4.1	-4.1	-4.2	-4.2	-4.2	-4.1	-4.3	-4.1	-4.1	-4.1	-4.1
	M. paradoxus, WC Nansen	-2.0	-2.0	-1.9	-2.1	-2.0	-2.0	-2.0	-2.1	-2.0	-2.0	-2.0	-2.1	-2.0	-1.9	-1.9	-2.0
	M. paradoxus, SC spring	-0.6	-0.7	-0.4	-0.6	-0.6	-0.5	-0.5	-0.5	-0.7	-0.6	-0.5	-0.6	-0.6	-0.5	-0.5	-0.6
	M. paradoxus, SC autumn	6.3	6.3	6.4	6.3	6.5	6.6	6.6	6.6	6.3	6.5	6.4	6.3	6.5	6.7	6.7	6.7
	M. capensis, WC summer	-2.2	-2.1	-2.2	-2.2	-2.1	-2.1	-2.1	-2.2	-1.9	-1.9	-2.1	-2.0	-1.9	-1.8	-1.8	-2.1
	M. capensis, WC winter	0.4	0.3	0.6	0.4	0.4	0.3	0.6	0.4	0.3	0.3	0.5	0.3	0.3	0.3	0.3	0.5
	M. capensis, WC Nansen	-1.4	-1.3	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
	M. capensis, SC spring	-1.3	-1.4	-1.4	-1.3	-1.3	-1.4	-1.4	-1.3	-1.5	-1.5	-1.4	-1.4	-1.5	-1.5	-1.5	-1.4
	M. capensis, SC autumn	-7.3	-7.1	-7.7	-7.3	-7.4	-7.4	-7.6	-7.3	-7.6	-7.6	-7.7	-7.5	-7.6	-7.6	-7.6	-7.7
-lnL: commercial CAA	species combined, offshore	-43.1	-42.4	-41.1	-41.7	-38.8	-41.7	-35.9	-40.0	-42.3	-44.3	-41.8	-41.3	-38.0	-41.7	-41.7	-36.0
	M. capensis, inshore	-26.2	-19.2	-28.9	-26.2	-26.1	-25.3	-29.0	-26.2	-22.0	-23.0	-28.1	-23.4	-21.9	-23.1	-23.1	-28.6
	M. capensis, longline	-15.1	-12.4	-15.5	-15.2	-15.1	-15.0	-15.5	-15.1	-15.2	-15.1	-15.4	-15.2	-15.2	-15.1	-15.1	-15.4
-lnL: survey CAA	*M. paradoxus*, WC summer	-15.4	-15.7	-14.7	-14.5	-14.7	-14.4	-14.0	-13.9	-15.5	-14.9	-14.6	-14.8	-14.9	-14.4	-14.4	-14.0
	M. paradoxus, WC Nansen	-10.4	-10.3	-10.6	-10.3	-10.5	-10.5	-10.8	-10.5	-10.3	-10.3	-10.6	-10.3	-10.5	-10.6	-10.6	-10.7
	M. paradoxus, SC spring	-3.3	-3.1	-4.3	-3.2	-2.4	-2.3	-2.8	-2.4	-3.1	-3.0	-4.2	-3.1	-2.3	-2.4	-2.4	-2.8
	M. paradoxus, SC autumn	29.0	28.8	29.7	28.6	30.0	30.2	30.6	29.9	28.9	29.5	29.6	28.6	29.8	30.3	30.3	30.6
	M. capensis, WC summer	84.0	83.0	86.1	84.1	84.1	83.9	86.0	84.0	83.7	83.7	85.5	83.7	83.7	83.8	83.8	85.6
	M. capensis, WC winter	7.5	6.6	9.9	7.5	7.5	7.1	9.7	7.5	6.8	6.7	8.7	7.0	6.7	6.7	6.7	8.9
	M. capensis, WC Nansen	-6.0	-6.1	-5.4	-6.0	-6.1	-6.1	-5.5	-6.0	-6.1	-6.2	-5.8	-6.1	-6.1	-6.2	-6.2	-5.8
	M. capensis, SC spring	-9.2	-8.8	-10.0	-9.3	-9.2	-9.1	-9.9	-9.3	-9.0	-9.0	-9.6	-9.0	-9.0	-9.0	-9.0	-9.6
	M. capensis, SC autumn	-29.4	-30.1	-28.0	-29.2	-29.3	-29.4	-28.3	-29.3	-29.4	-29.3	-28.2	-29.4	-29.4	-29.3	-29.3	-28.3
Recruit residual penalty		13.4	14.2	12.5	12.8	13.7	13.5	12.9	13.3	13.3	13.0	13.5	12.6	13.7	13.6	13.6	13.6

Table 2c: Log-likelihood contributions for the Reference Set.

		33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
		M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
		H1	H1	H1	H1	H2	H2	H2	H2	H3	H3	H3	H3	H4	H4	H4	H4
		SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2
-lnL: Total		-166.5	-159.6	-166.4	-166.9	-156.9	-154.2	-160.2	-151.0	-164.8	-158.8	-159.9	-164.6	-155.4	-147.1	-152.3	-155.0
-lnL: CPUE	WC historic (spp combined)	-11.2	-8.7	-11.2	-9.8	-10.1	-7.9	-10.3	-7.7	-11.2	-8.4	-10.8	-10.4	-10.1	-7.4	-9.5	-7.3
	SC historic (spp combined)	-24.3	-27.1	-27.1	-28.3	-26.2	-28.7	-29.1	-27.3	-22.6	-26.5	-28.0	-27.9	-24.8	-26.7	-29.3	-29.0
	M. paradoxus GLM	-42.4	-40.0	-42.2	-41.5	-41.8	-40.4	-42.1	-41.2	-42.4	-39.9	-42.5	-41.8	-41.9	-39.8	-42.8	-41.6
	M. capensis GLM	-42.7	-43.4	-37.8	-43.0	-42.8	-43.5	-38.8	-42.0	-43.5	-43.6	-33.0	-43.2	-43.4	-43.5	-32.8	-43.3
-lnL: Survey	*M. paradoxus* , WC summer	-9.0	-8.7	-8.8	-9.6	-8.7	-8.4	-8.7	-8.9	-8.9	-8.7	-9.0	-9.4	-8.7	-8.3	-9.0	-9.1
	M. paradoxus , WC winter	-4.2	-4.1	-4.1	-4.3	-4.1	-4.1	-4.0	-4.0	-4.2	-4.1	-4.2	-4.3	-4.1	-3.9	-4.1	-4.2
	M. paradoxus , WC *Nansen*	-2.0	-2.0	-2.0	-2.1	-1.9	-1.9	-1.9	-2.0	-2.0	-2.0	-2.0	-2.1	-1.9	-1.9	-2.0	-2.0
	M. paradoxus , SC spring	-0.6	-0.3	-0.4	-0.4	-0.3	-0.3	-0.3	-0.1	-0.6	-0.3	-0.6	-0.6	-0.3	-0.1	-0.5	-0.4
	M. paradoxus , SC autumn	6.2	6.3	6.2	6.2	6.3	6.5	6.4	6.2	6.2	6.3	6.1	6.2	6.3	6.3	6.3	6.4
	M. capensis , WC summer	-2.0	-1.9	-1.9	-2.0	-2.0	-2.0	-1.9	-2.1	-1.8	-1.7	-1.9	-2.1	-1.8	-1.7	-1.9	-2.1
	M. capensis , WC winter	0.3	0.3	0.5	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.3
	M. capensis , WC *Nansen*	-1.3	-1.3	-1.4	-1.3	-1.3	-1.3	-1.4	-1.3	-1.4	-1.4	-1.4	-1.3	-1.4	-1.4	-1.4	-1.3
	M. capensis , SC spring	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.3	-1.5	-1.5	-1.5	-1.3	-1.5	-1.5	-1.5	-1.3
	M. capensis , SC autumn	-7.2	-7.4	-7.7	-7.2	-7.3	-7.3	-7.7	-6.9	-7.5	-7.5	-7.7	-7.2	-7.5	-7.6	-7.7	-7.2
-lnL: commercial CAA	species combined, offshore	-42.4	-40.8	-41.7	-41.4	-38.4	-37.6	-37.5	-35.4	-42.3	-40.8	-41.6	-38.9	-38.3	-35.2	-37.8	-36.5
	M. capensis , inshore	-19.2	-17.6	-24.3	-19.3	-18.9	-17.7	-25.5	-20.9	-18.2	-17.4	-20.7	-18.9	-18.2	-17.3	-20.9	-19.0
	M. capensis , longline	-12.5	-10.9	-15.5	-12.9	-12.2	-11.3	-15.5	-14.2	-11.6	-10.7	-14.1	-12.9	-11.6	-10.7	-14.2	-12.9
-lnL: survey CAA	*M. paradoxus* , WC summer	-11.0	-10.4	-10.5	-9.9	-9.6	-10.3	-9.6	-8.6	-11.1	-10.4	-10.8	-10.4	-9.6	-9.2	-10.0	-9.6
	M. paradoxus , WC *Nansen*	-11.1	-11.3	-11.3	-11.3	-11.8	-11.4	-11.7	-12.0	-11.1	-11.3	-11.2	-11.2	-11.8	-11.9	-11.6	-11.5
	M. paradoxus , SC spring	-3.2	-3.0	-3.9	-2.9	-2.2	-1.8	-3.1	-2.1	-3.2	-3.0	-3.5	-2.4	-2.2	-2.3	-2.4	-1.7
	M. paradoxus , SC autumn	30.1	30.5	30.5	29.7	31.4	31.5	32.0	31.2	30.1	30.5	30.2	29.9	31.3	31.6	31.4	31.2
	M. capensis , WC summer	83.3	83.1	85.4	83.2	83.3	83.0	85.7	83.3	83.2	83.1	84.6	83.0	83.2	83.1	84.6	83.0
	M. capensis , WC winter	6.6	6.2	8.9	6.6	6.5	6.3	9.2	7.2	6.3	6.1	7.2	6.8	6.3	6.1	7.2	6.8
	M. capensis , WC *Nansen*	-6.4	-6.5	-6.1	-6.4	-6.5	-6.5	-6.0	-6.3	-6.5	-6.5	-6.4	-6.4	-6.5	-6.5	-6.4	-6.4
	M. capensis , SC spring	-7.6	-7.6	-7.8	-7.7	-7.6	-7.6	-8.0	-7.7	-7.6	-7.6	-7.6	-7.7	-7.6	-7.5	-7.6	-7.7
	M. capensis , SC autumn	-30.1	-30.1	-28.8	-30.2	-30.0	-29.7	-28.8	-30.2	-29.9	-29.9	-28.8	-29.7	-29.9	-29.9	-28.8	-29.7
Recruit residual penalty		9.9	8.9	8.4	9.6	9.9	9.5	8.4	11.8	9.1	8.5	9.5	9.5	9.3	9.2	9.8	10.2

Table 2d: Log-likelihood contributions for the Reference Set.

		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
		M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4	M4
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
		H1	H1	H1	H1	H2	H2	H2	H2	H3	H3	H3	H3	H4	H4	H4	H4
		SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2	SR2
-lnL: Total		-173.9	-175.5	-169.0	-176.1	-167.8	-170.2	-163.8	-169.9	-168.8	-171.3	-165.7	-174.2	-163.0	-166.2	-158.9	-168.1
-lnL: CPUE	WC historic (spp combined)	-11.1	-9.6	-11.2	-10.2	-10.6	-9.2	-10.6	-8.6	-11.1	-9.4	-10.8	-10.8	-10.7	-9.2	-9.8	-8.8
	SC historic (spp combined)	-23.7	-27.2	-26.7	-28.1	-26.0	-28.4	-28.9	-29.0	-21.5	-26.2	-28.2	-26.5	-24.0	-27.8	-29.6	-28.0
	M. paradoxus GLM	-42.2	-41.7	-41.3	-42.2	-42.7	-41.9	-42.5	-42.6	-42.4	-41.7	-41.4	-42.3	-42.8	-41.7	-42.6	-42.7
	M. capensis GLM	-42.5	-43.0	-40.9	-42.6	-42.3	-42.7	-41.1	-42.6	-43.0	-42.1	-34.8	-43.1	-42.8	-41.5	-35.6	-43.1
-lnL: Survey	*M. paradoxus*, WC summer	-8.9	-9.0	-8.6	-9.7	-8.9	-8.8	-9.0	-9.6	-9.0	-9.0	-8.9	-9.7	-9.0	-8.6	-9.2	-9.7
	M. paradoxus, WC winter	-4.2	-4.2	-4.0	-4.3	-4.1	-4.1	-4.1	-4.2	-4.2	-4.2	-4.1	-4.3	-4.1	-4.0	-4.1	-4.2
	M. paradoxus, WC *Nansen*	-2.0	-2.0	-1.9	-2.1	-2.0	-1.9	-2.0	-2.0	-2.0	-2.0	-2.0	-2.1	-2.0	-1.9	-2.0	-2.1
	M. paradoxus, SC spring	-0.4	-0.4	-0.2	-0.4	-0.4	-0.3	-0.4	-0.4	-0.5	-0.4	-0.4	-0.5	-0.5	-0.3	-0.5	-0.4
	M. paradoxus, SC autumn	6.2	6.4	6.3	6.2	6.4	6.5	6.5	6.5	6.2	6.4	6.3	6.2	6.4	6.6	6.6	6.5
	M. capensis, WC summer	-2.1	-2.0	-2.1	-2.1	-2.1	-2.0	-2.0	-2.1	-1.8	-1.8	-2.0	-1.9	-1.8	-1.7	-2.0	-1.9
	M. capensis, WC winter	0.4	0.3	0.6	0.4	0.4	0.3	0.6	0.4	0.3	0.3	0.5	0.3	0.3	0.3	0.5	0.3
	M. capensis, WC *Nansen*	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
	M. capensis, SC spring	-1.3	-1.4	-1.4	-1.3	-1.3	-1.4	-1.4	-1.3	-1.5	-1.5	-1.4	-1.4	-1.5	-1.5	-1.4	-1.4
	M. capensis, SC autumn	-7.4	-7.4	-7.8	-7.4	-7.4	-7.5	-7.7	-7.4	-7.6	-7.7	-7.8	-7.5	-7.6	-7.7	-7.8	-7.5
-lnL: commercial CAA	species combined, offshore	-43.1	-44.5	-41.1	-41.7	-38.8	-41.8	-35.8	-40.0	-42.3	-44.3	-41.7	-41.4	-38.0	-41.8	-35.9	-40.0
	M. capensis, inshore	-26.1	-25.3	-28.8	-26.2	-26.0	-25.3	-28.9	-26.2	-21.8	-23.0	-28.1	-23.3	-21.7	-23.1	-28.5	-23.4
	M. capensis, longline	-15.1	-15.1	-15.6	-15.2	-15.1	-15.1	-15.6	-15.2	-15.2	-15.1	-15.4	-15.2	-15.2	-15.1	-15.4	-15.2
-lnL: survey CAA	*M. paradoxus*, WC summer	-10.7	-10.3	-10.1	-9.9	-10.0	-9.8	-9.4	-9.2	-10.9	-10.3	-10.0	-10.2	-10.2	-9.8	-9.4	-9.3
	M. paradoxus, WC *Nansen*	-11.2	-11.1	-11.5	-11.2	-11.5	-11.5	-11.8	-11.4	-11.1	-11.1	-11.5	-11.1	-11.4	-11.5	-11.7	-11.4
	M. paradoxus, SC spring	-3.4	-3.1	-4.6	-3.3	-2.5	-2.4	-3.0	-2.6	-3.2	-3.2	-4.5	-3.3	-2.3	-2.6	-2.9	-2.4
	M. paradoxus, SC autumn	30.3	30.8	31.1	29.9	31.5	31.6	32.1	31.3	30.2	30.8	31.0	29.8	31.3	31.8	32.0	31.1
	M. capensis, WC summer	84.3	84.1	86.4	84.3	84.3	84.1	86.2	84.3	84.0	84.0	85.8	84.0	84.0	84.1	85.9	84.0
	M. capensis, WC winter	7.5	7.1	9.8	7.5	7.5	7.1	9.6	7.4	6.7	6.6	8.7	6.9	6.7	6.7	8.9	6.9
	M. capensis, WC *Nansen*	-6.4	-6.5	-5.7	-6.4	-6.4	-6.5	-5.8	-6.4	-6.4	-6.5	-6.2	-6.4	-6.4	-6.5	-6.2	-6.5
	M. capensis, SC spring	-7.9	-7.8	-8.5	-7.9	-7.9	-7.8	-8.4	-7.9	-7.7	-7.6	-8.0	-7.7	-7.7	-7.6	-8.1	-7.7
	M. capensis, SC autumn	-29.4	-29.5	-28.1	-29.3	-29.3	-29.4	-28.3	-29.3	-29.4	-29.3	-28.2	-29.4	-29.4	-29.3	-28.3	-29.4
Recruit residual penalty		8.8	8.4	7.9	8.2	9.0	8.8	8.1	8.7	8.7	8.3	8.8	8.1	9.0	8.7	8.8	8.6

Table 3a: Average and range in parenthesis over 64 cases in RS.

	MSY	B^{sp}_{2004}/K^{sp}
M. paradoxus	119 (99; 137)	0.144 (0.059; 0.268)
M. capensis	87 (47; 132)	0.639 (0.366; 0.866)

Table 3b: Averages over individual factors

|		M1	M4	C1	C2	C3	C4	H1	H2	H3	H4	SR1	SR2
	-lnL: Total	-161.9	-171.7	-167.8	-165.4	-165.6	-168.3	-171.8	-164.9	-169.2	-161.3	-169.7	-163.8
M. paradoxus	K^{sp}	849	737	810	666	1081	614	833	774	805	761	798	788
	h	0.87	0.87	0.87	0.87	0.87	0.87	0.95	0.80	0.95	0.80	0.87	0.87
	MSY	119	118	124	113	134	104	121	117	120	116	119	118
	B^{sp}_{2004}/K^{sp}	0.13	0.15	0.13	0.19	0.09	0.16	0.11	0.17	0.12	0.17	0.14	0.14
	$B^{sp}_{2004}/MSYL^{sp}$	0.59	0.68	0.57	0.88	0.38	0.72	0.58	0.65	0.65	0.66	0.64	0.63
	M 0	0.47	0.55	0.47	0.52	0.55	0.50	0.47	0.56	0.45	0.56	0.51	0.51
	1	0.47	0.55	0.47	0.52	0.55	0.50	0.47	0.56	0.45	0.56	0.51	0.51
	2	0.47	0.55	0.47	0.52	0.55	0.50	0.47	0.56	0.45	0.56	0.51	0.51
	3	0.38	0.45	0.39	0.45	0.39	0.43	0.37	0.46	0.37	0.46	0.41	0.42
	4	0.32	0.39	0.34	0.40	0.30	0.39	0.31	0.39	0.32	0.40	0.36	0.36
	5+	0.28	0.35	0.31	0.37	0.24	0.37	0.28	0.35	0.29	0.36	0.32	0.32
M. capensis	K^{sp}	1085	821	988	1344	411	1070	966	976	935	935	952	954
	h	0.59	0.57	0.51	0.52	0.77	0.53	0.56	0.57	0.60	0.60	0.58	0.58
	MSY	87	86	85	115	50	98	78	81	94	95	87	87
	B^{sp}_{2004}/K^{sp}	0.59	0.69	0.65	0.74	0.54	0.62	0.57	0.57	0.71	0.71	0.64	0.64
	$B^{sp}_{2004}/MSYL^{sp}$	1.67	1.85	1.73	1.97	1.71	1.64	1.57	1.53	1.97	1.98	1.78	1.74
	M 0	0.50	0.84	0.52	0.72	0.68	0.75	0.65	0.75	0.64	0.64	0.66	0.68
	1	0.50	0.84	0.52	0.72	0.68	0.75	0.65	0.75	0.64	0.64	0.66	0.68
	2	0.50	0.84	0.52	0.72	0.68	0.75	0.65	0.75	0.64	0.64	0.66	0.68
	3	0.40	0.64	0.45	0.54	0.53	0.56	0.51	0.57	0.50	0.50	0.52	0.53
	4	0.34	0.53	0.41	0.44	0.44	0.45	0.43	0.46	0.42	0.42	0.43	0.44
	5	0.30	0.45	0.38	0.37	0.38	0.37	0.38	0.39	0.37	0.37	0.37	0.38
	6	0.30	0.45	0.38	0.37	0.38	0.37	0.38	0.39	0.37	0.37	0.37	0.38
	7+	0.30	0.45	0.38	0.37	0.38	0.37	0.38	0.39	0.37	0.37	0.37	0.38
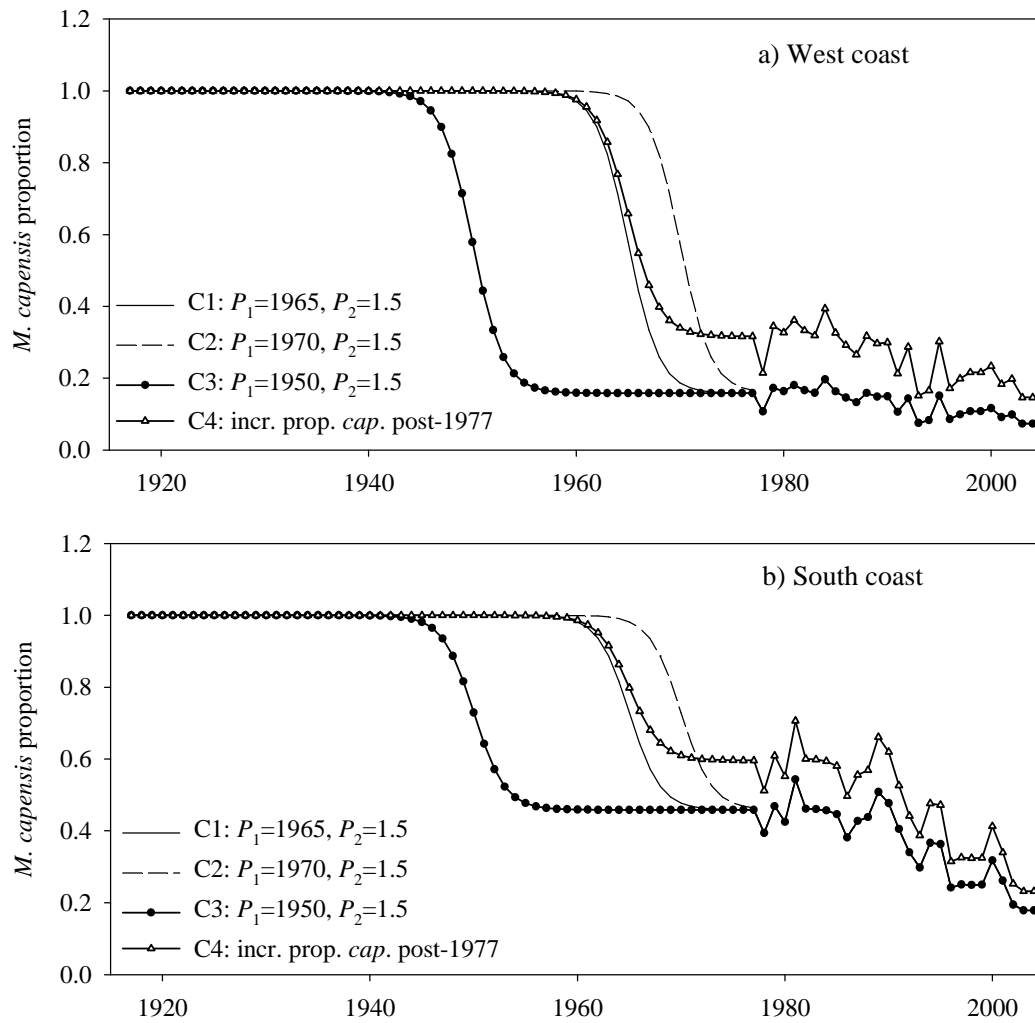
Fig. 1: Assumed proportion of *M. capensis* in the offshore catches for a) the west coast and b) the south coast for the sensitivities C1,C2,C3 and C4 (see text for details).
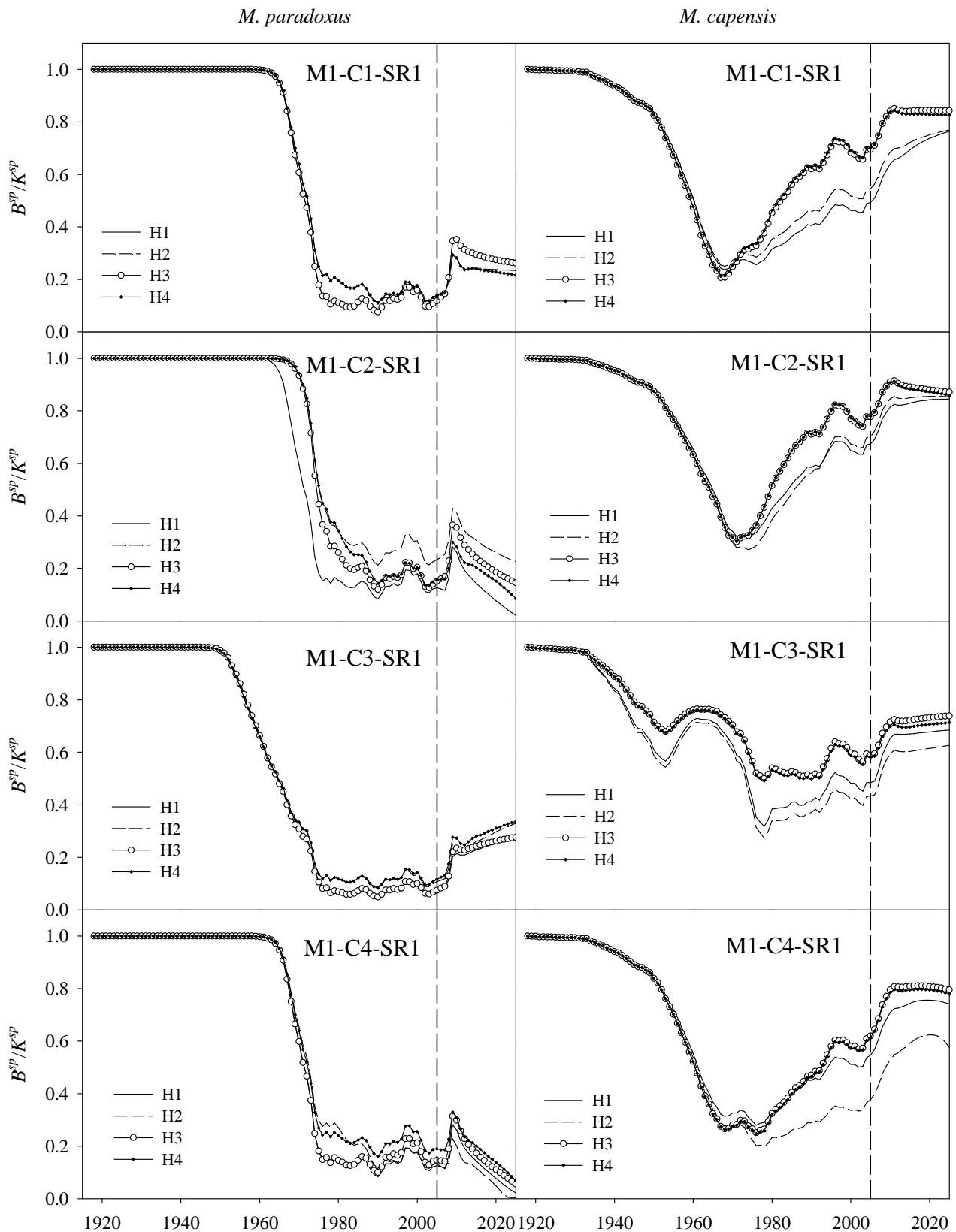
M. paradoxus   *M. capensis*

Fig. 2a: Coast-combined *M. paradoxus* and *M. capensis* resource abundance trajectories and projections under a constant catch of 155 000 t for the Reference Set.
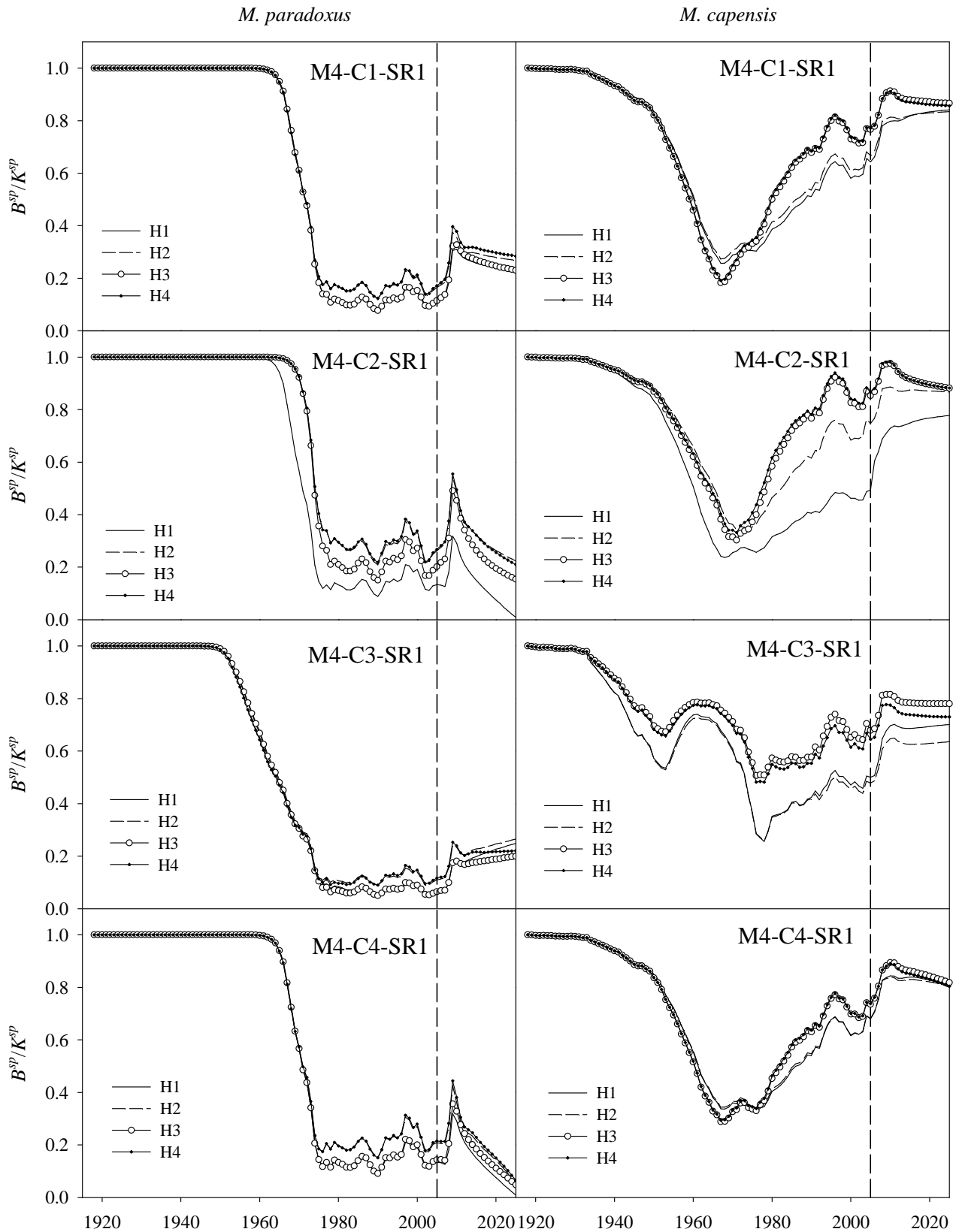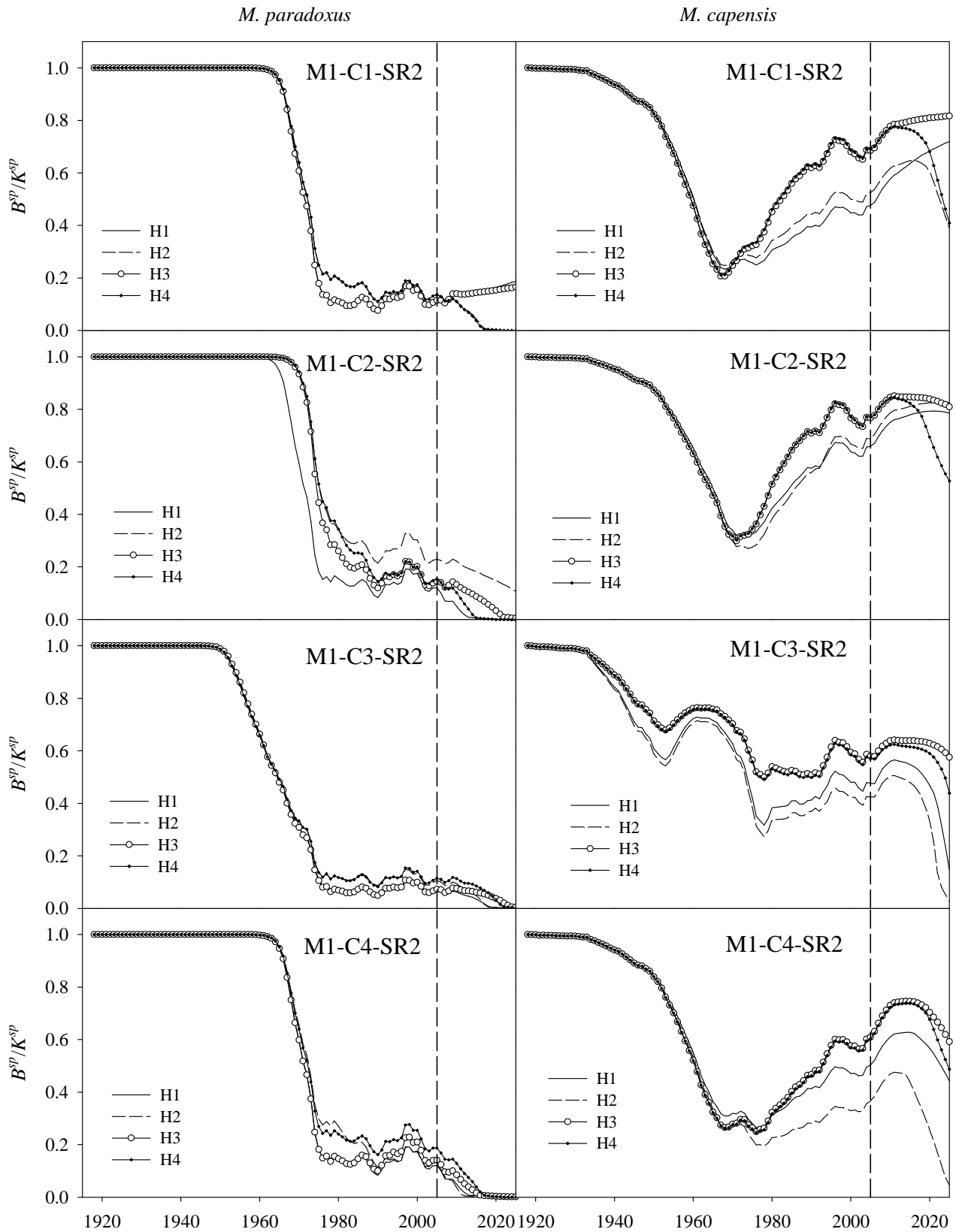
M. paradoxus   *M. capensis*

Fig. 2b: Coast-combined *M. paradoxus* and *M. capensis* resource abundance trajectories and projections under a constant catch of 155 000 t for the Reference Set.

M. paradoxus

M. capensis

Fig. 2c: Coast-combined *M. paradoxus* and *M. capensis* resource abundance trajectories and projections under a constant catch of 155 000 t for the Reference Set.
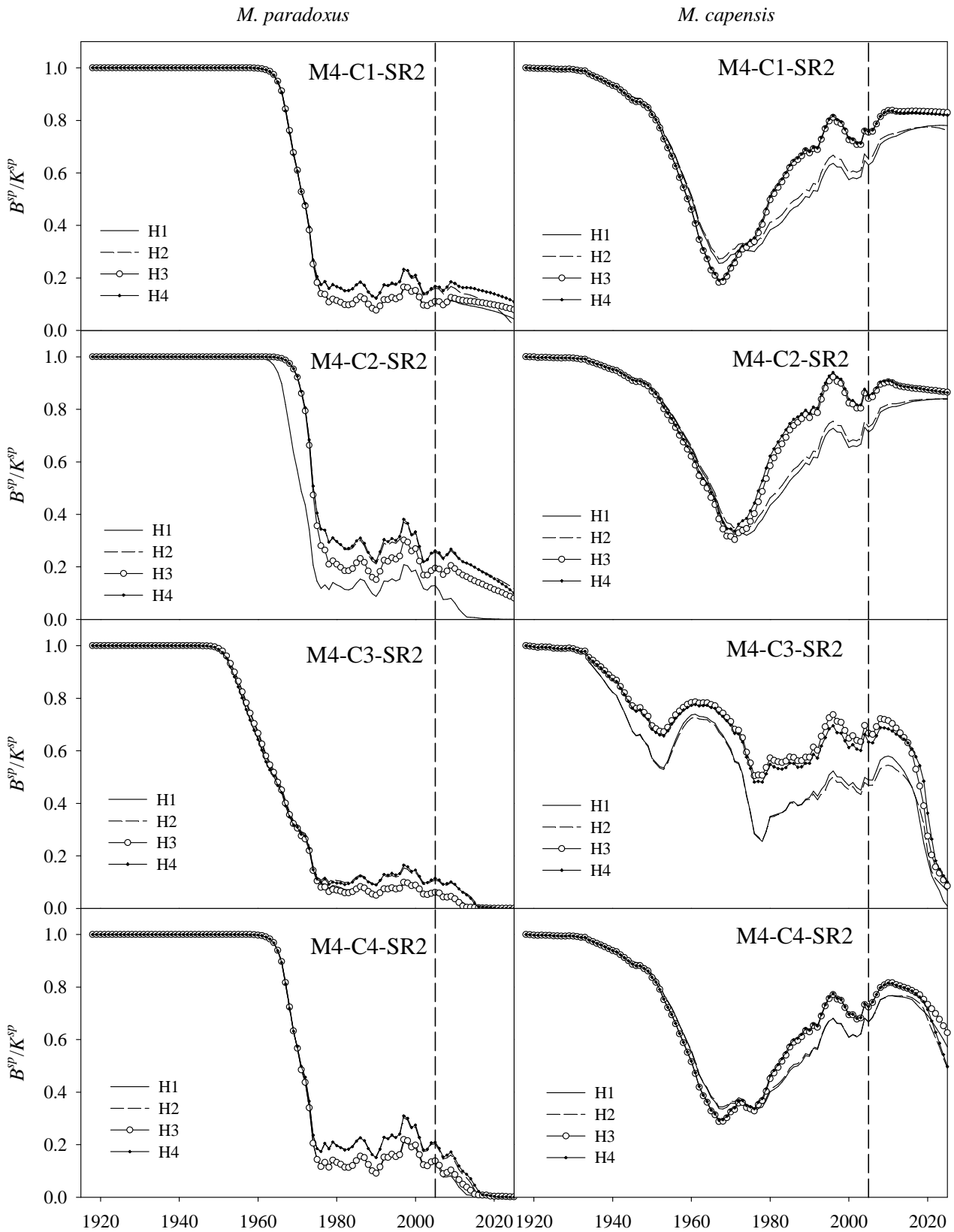
M. paradoxus

M. capensis

Fig. 2d: Coast-combined *M. paradoxus* and *M. capensis* resource abundance trajectories and projections under a constant catch of 155 000 t for the Reference Set.