Working Paper: Further work on hake

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1. Further diagnostic for RC with downweighting of new longline CAL data (including *F*s trajectories, selectivities-at-age plots, fits to longline CAL by periods)

Tables 1 and 2, Figs 1 to 9

2. Comparison of RS1-2012-oops with RS1-2012-corrected

Table 3, Figs 10 and 12

3. Implied fit to the CAA data

Fig. 13
Commercial CAA data:

- WC offshore, species combined: 1978-1996
- SC offshore, species combined: 1978-1996
- SC inshore, *M. capensis*: 1989-2000
- SC longline, M. capensis: 1997-2000

Survey CAA data: for years up to 1999

4. Length-independent calibration result correcting the 2006 gear

Table 4

5. Plot implied selectivities for movement model

Still needs to be done.

Table 1: Comparison of estimates of management quantities of the *M. paradoxus* and *M. capensis* coast-combined resources for the new RC (RS1-2013e) and the run downweighting the new longline CAL data. *MSY* and associated quantities are given for the offshore trawl fleet. Biomass units are thousand tons. Note that the –lnL values are not comparable given that different data are used. K^{sp}, B_y^{sp}/K^{sp}, B_{MSY}^{sp}/K^{sp} and B_y^{sp}/B_{MSY}^{sp} are all in terms of the female component of the spawning biomass only.

		RC	Down-weighting new longline CAL
	-lnL total	-172.3	-125.3
	CPUE historic	-39.9	-40.2
	CPUE GLM	-168.6	-170.3
	Survey	-32.1	-33.4
	Commercial CAL - trawl	-45.1	-44.8
	Commercial CAL - longline	-68.9	-17.2
	Survey CAL (sex-aggr.)	-3.0	-5.4
	Survey CAL (sex-disaggr.)	42.9	43.1
	ALK	117.4	118.4
	Recruitment penalty	8.6	8.4
	Selectivity smoothing penalty	15.5	15.9
M. paradoxus	K^{sp}	754	855
	h	0.96	0.93
	B^{sp}_{2012}	114	163
	B^{sp}_{2012}/K^{sp}	0.15	0.19
	B^{sp}_{2013}	108	160
	B^{sp}_{2013}/K^{sp}	0.14	0.19
	B^{sp}_{MSY}	158	173
	B^{sp}_{MSY}/K^{sp}	0.21	0.20
	$B^{sp}_{2012}/B^{sp}_{MSY}$	0.72	0.94
	$B^{sp}_{2013}/B^{sp}_{MSY}$	0.68	0.92
	MSY	113	116
M. capensis	K^{sp}	239	242
	h	1.03	0.99
	B^{sp}_{2012}	152	153
	B^{sp}_{2012}/K^{sp}	0.64	0.63
	B^{sp}_{2013}	170	172
	B^{sp}_{2013}/K^{sp}	0.71	0.71
	B^{sp}_{MSY}	96	100
	B^{sp}_{MSY}/K^{sp}	0.40	0.41
	$B^{sp}_{2012}/B^{sp}_{MSY}$	1.58	1.53
	$B^{sp}_{2013}/B^{sp}_{MSY}$	1.76	1.72
	MSY	63	63

Table 2: Contribution to the negative log-likelihood for the new RC (RS1-2013e) and the assessment downweighting the new longline CAL data.

		RS1-2013e			Downweighting new LL CAL		
		spp combined	para	cap	spp combined	para	cap
-lnL total	WC	-173.49			-125.26		
CPUE historic	WC	-29.61			-29.74		
	SC	-10.32			-10.45		
CPUE GLM	WC		-49.92	-38.21		-46.93	-39.54
	SC		-42.58	-37.86		-46.75	-37.08
Survey	WC summer		-11.21	-3.94		-12.02	-4.03
	WC winter		-3.22	1.01		-3.34	1.02
	SC autumn		1.70	-7.49		1.98	-7.56
	SC spring		6.72	-15.62		6.31	-15.77
Commercial CAL	WC offshore	-22.50			-22.88		
	SC offshore	2.24			2.40		
	BC offshore	-3.17			-3.36		
	SC inshore			-21.61			-20.96
	WC longline (1994-1997)	-11.08			-11.27		
	WC longline (2000-2005)		-15.79	-6.47		**-8.80**	**-0.84**
	WC longline (2006-2010)		-9.03	-6.19		**-5.59**	**-0.82**
	SC longline (1994-1997)	-4.79			-5.75		
	SC longline (2000-2005)			-10.29			**-7.09**
	SC longline (2006-2010)			-5.92			**1.63**
Survey CAL							
Sex-aggregated	WC summer		-6.89	11.65		-7.40	11.37
	WC winter		-2.96	6.02		-3.07	5.87
	SC autumn		2.64	-6.31		2.52	-7.04
	SC spring		3.69	-10.81		3.62	-11.23
Sex-disaggregated	WC summer		-0.40	51.57		-1.08	51.07
	WC winter		-	-		-	-
	SC autumn		3.08	-5.66		3.09	-5.31
	SC spring		17.64	-23.26		18.43	-23.12
ALK		117.40			118.41		
Recruitment penalty			3.65	4.96		3.38	5.05
Sel. smoothing penalty		15.46			15.95		

Table 3: Comparison of estimates of management quantities of the *M. paradoxus* and *M. capensis* coast-combined resources for RS1-2012-oops, RS1-2012-corrected and RS1-2013a (new catches and CPUE).

		RS1-2012-oops	RS1-2012-corrected	RS1-2013a
	-lnL total	-58.1	-77.8	-123.4
	CPUE historic	-38.1	-37.2	-40.2
	CPUE GLM	-143.0	-147.0	-170.3
	Survey	-38.0	-35.8	-33.8
	Commercial CAL - trawl	-51.9	-50.1	-60.1
	Survey CAL (sex-aggr.)	-2.3	-4.9	-5.2
	Survey CAL (sex-disaggr.)	66.7	47.2	43.1
	ALK	124.0	124.6	118.2
	Recruitment penalty	8.8	9.4	8.7
	Selectivity smoothing penalty	15.5	15.6	16.0
M. paradoxus	K^{sp}	586	699	834
	h	1.23	1.10	0.93
	B^{sp}_{2012}	134	162	161
	B^{sp}_{2012}/K^{sp}	0.23	0.23	0.19
	B^{sp}_{2013}	-	-	158
	B^{sp}_{2013}/K^{sp}	-	-	0.19
	B^{sp}_{MSY}	134	167	164
	B^{sp}_{MSY}/K^{sp}	0.23	0.24	0.20
	$B^{sp}_{2012}/B^{sp}_{MSY}$	0.98	0.98	0.98
	$B^{sp}_{2013}/B^{sp}_{MSY}$	-	-	0.96
	MSY	113	113	116
M. capensis	K^{sp}	251	263	288
	h	1.40	1.29	1.02
	B^{sp}_{2012}	240	248	186
	B^{sp}_{2012}/K^{sp}	0.96	0.94	0.65
	B^{sp}_{2013}	-	-	207
	B^{sp}_{2013}/K^{sp}	-	-	0.72
	B^{sp}_{MSY}	89	99	109
	B^{sp}_{MSY}/K^{sp}	0.36	0.38	0.38
	$B^{sp}_{2012}/B^{sp}_{MSY}$	2.00	1.92	1.71
	$B^{sp}_{2013}/B^{sp}_{MSY}$	-	-	1.91
	MSY	70	70	62

Table 4: Estimates of catchability ratios for *Africana* new compared to old gear, with their associated standard errors in parenthesis, for the length-independent model correcting the 2006 data.

	M. paradoxus		*M. capensis*	
Brandão *et al.* (2004)	0.948	(0.117)	0.610	(0.141)
Model 1	1.176	(0.097)	0.718	(0.054)
Model 1 (excluding 2006 data)	0.938	(0.085)	0.597	(0.050)
Model 1 - corrected	0.883	(0.082)	0.652	(0.073)

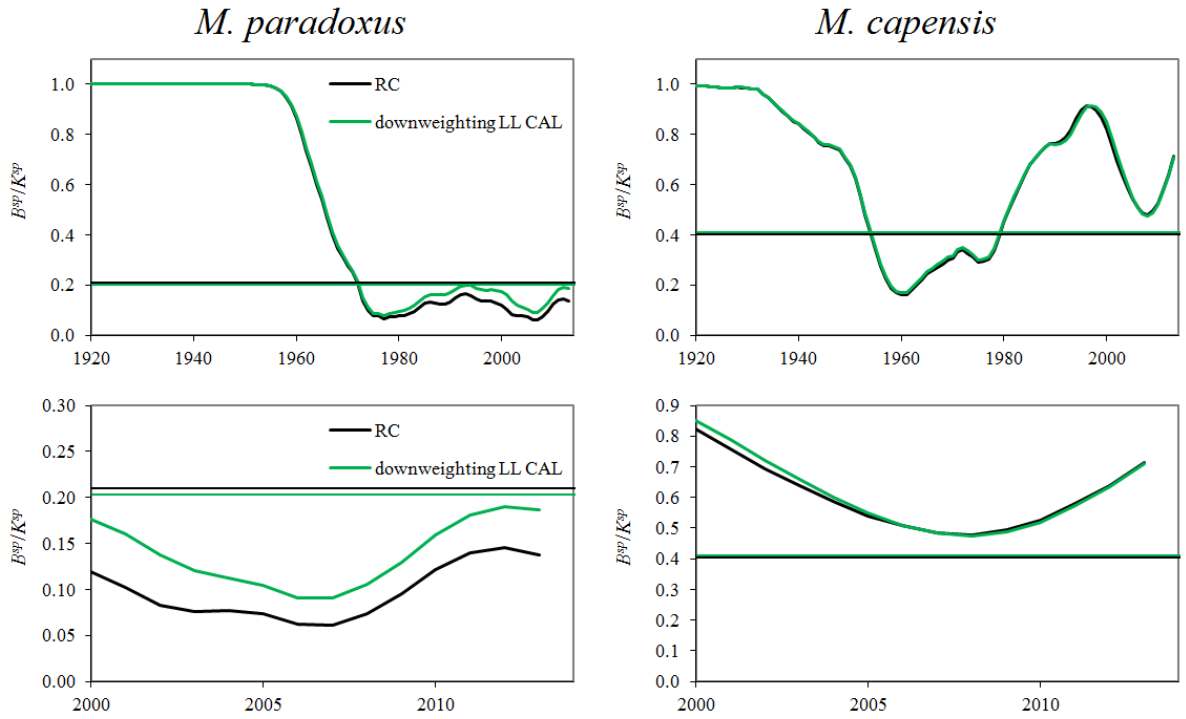

Fig. 1: Trajectories of female spawning biomass (in terms of its pre-exploitation level) for the RC and the "new longline downweighted" run.The horizontal lines represent *MSYL*.

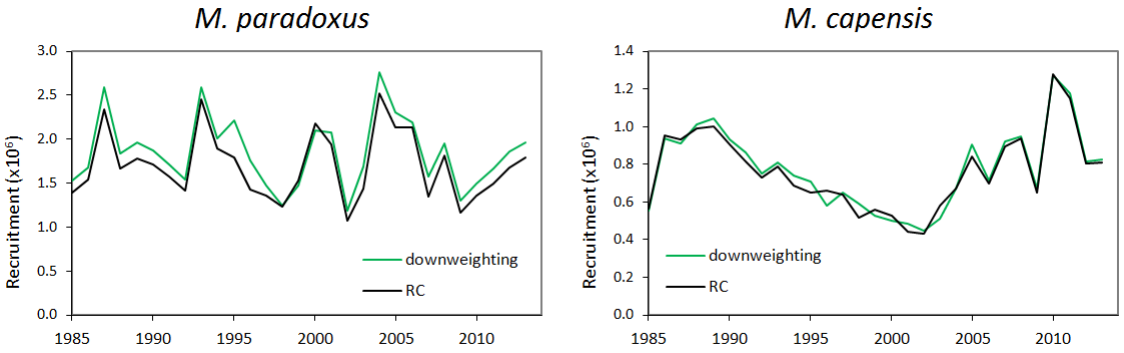

Fig. 2: Time series of recruitment for the new RC compared to downweighting new longline CAL. Note that the decrease in σ_R from 0.25 to 0.1 has been moved one year forward for the new RC compared to RS1-2012.

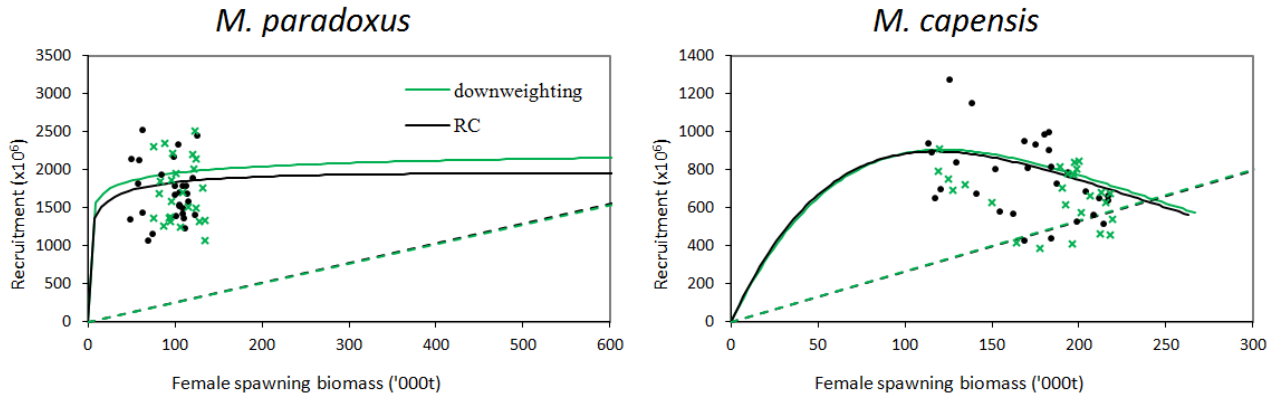

Fig. 3: Estimated stock-recruitment relationships for RS1-2012 (dashed blue line and blue crosses) and the new RC (RS1-2013e) (solid black line and black dots).

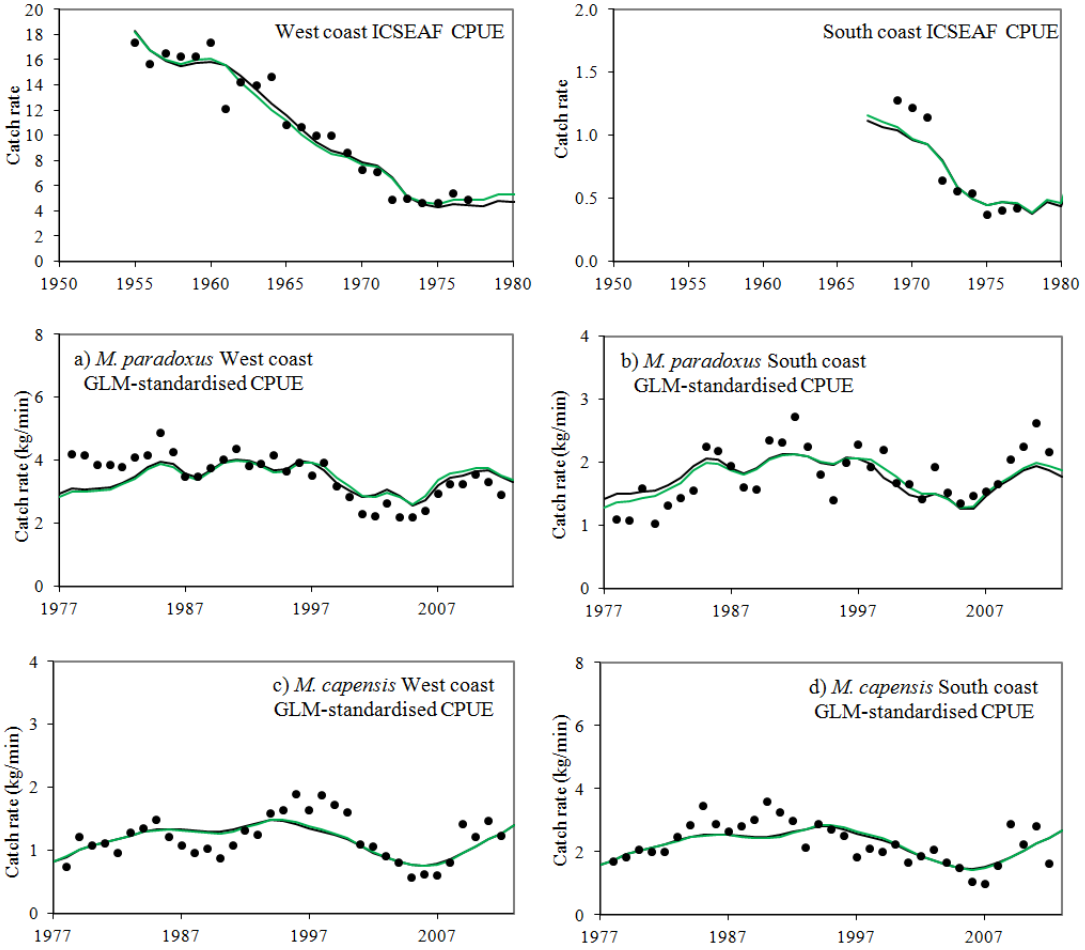

Fig. 4: Fits to the CPUE abundance indices for the RC and the downweighting.

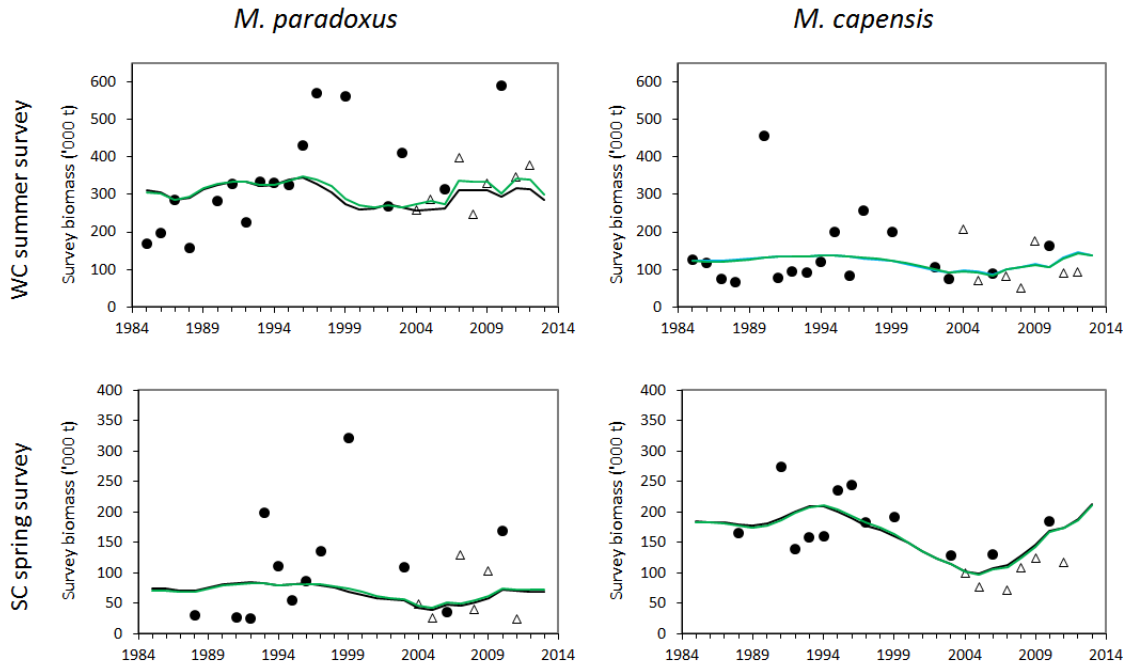

Fig. 5: Fits to the west coast summer and south coast autumn abundance series from surveys by *Africana* (the two longest series) for the RS1-2012 (dashed blue line) and the new RC (solid black line) assessments. The observed values shown as Δ were conducted by the *Africana* with the new gear and have been rescaled by the agreed calibration factor for the species concerned.

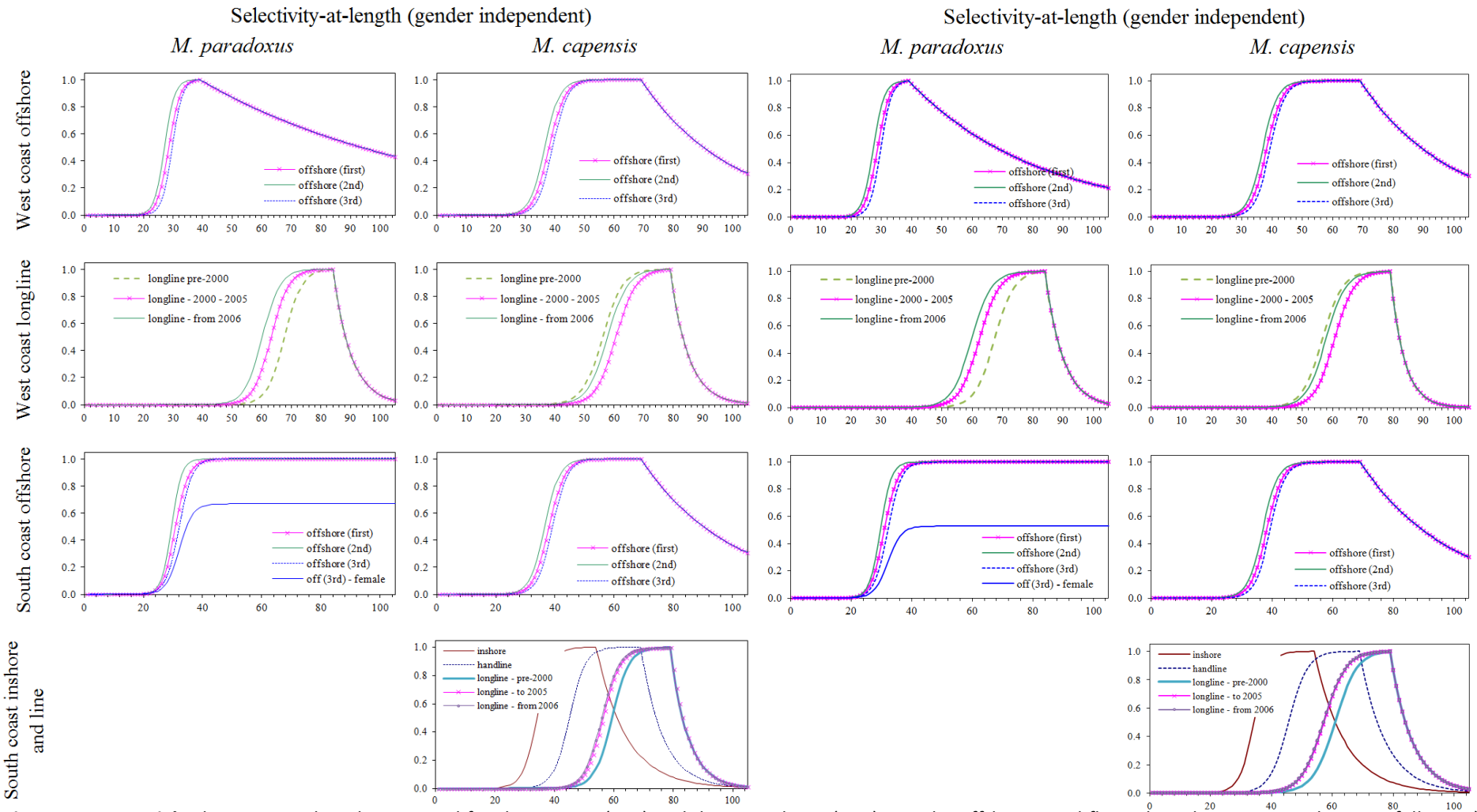

Fig. 6a: **Commercial** selectivities-at-length estimated for the new RC (LHS) and downweighting (RHS). For the offshore trawl fleet, the selectivity periods are as follows: i) first period: 1917-1976, ii) second period: 1977-1984 and iii) third period: 1993-2013. A linear change is taken between 1984 and 1993.

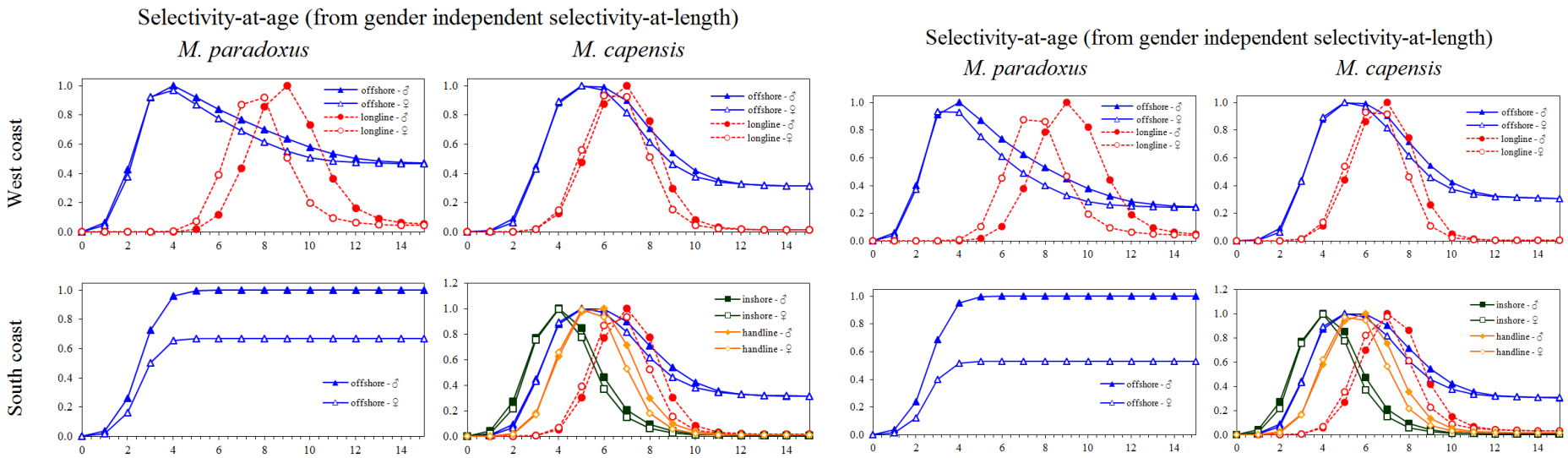

Fig. 6b: **Commercial** selectivities-at-age estimated for the new RC (LHS) and downweighting (RHS). For the offshore trawl fleet, the selectivity periods are as follows: i) first period: 1917-1976, ii) second period: 1977-1984 and iii) third period: 1993-2013. A linear change is taken between 1984 and 1993.

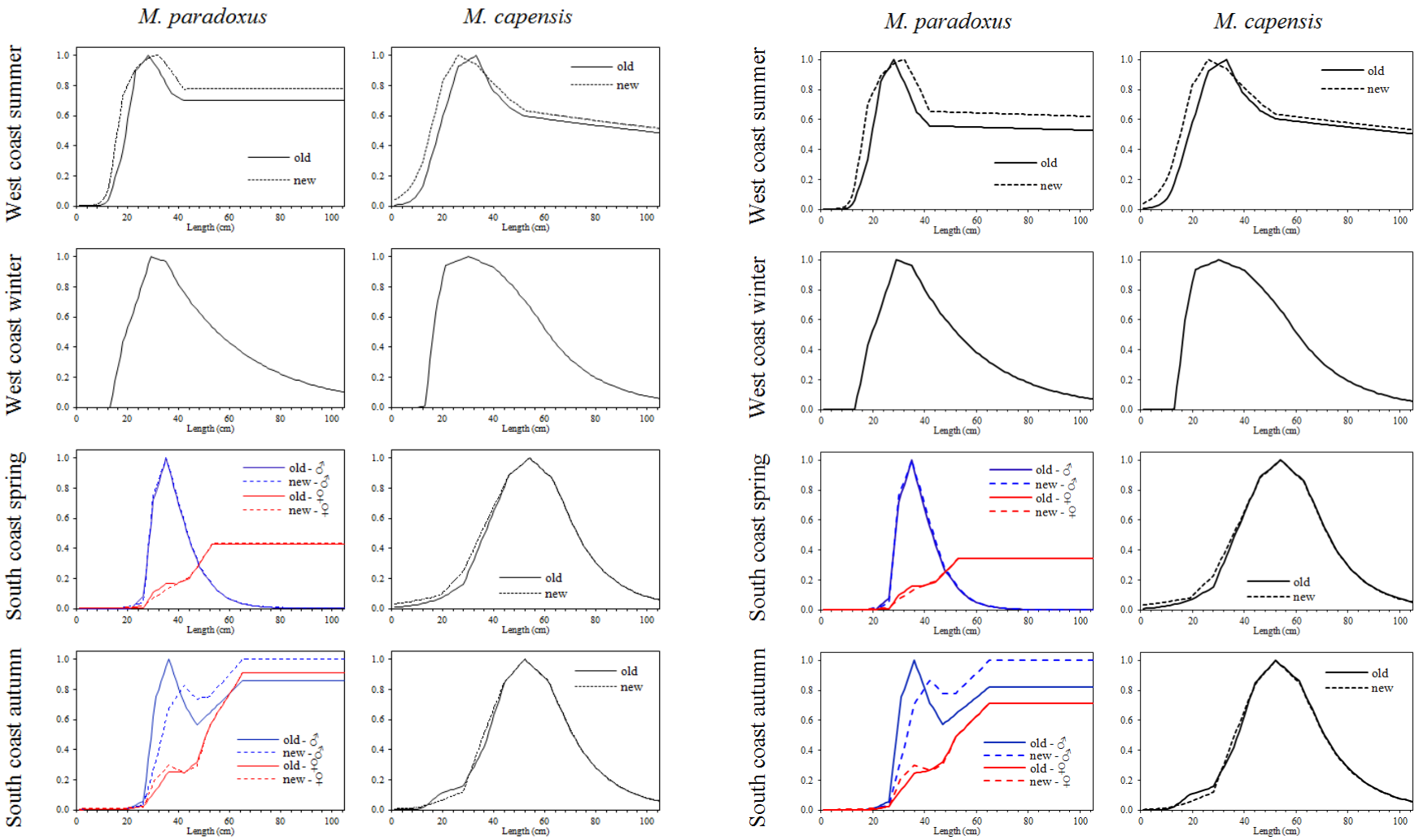

Fig. 6c: **Survey** selectivities-at-length estimated for the new RC (LHS) and the downweighting (RHS).

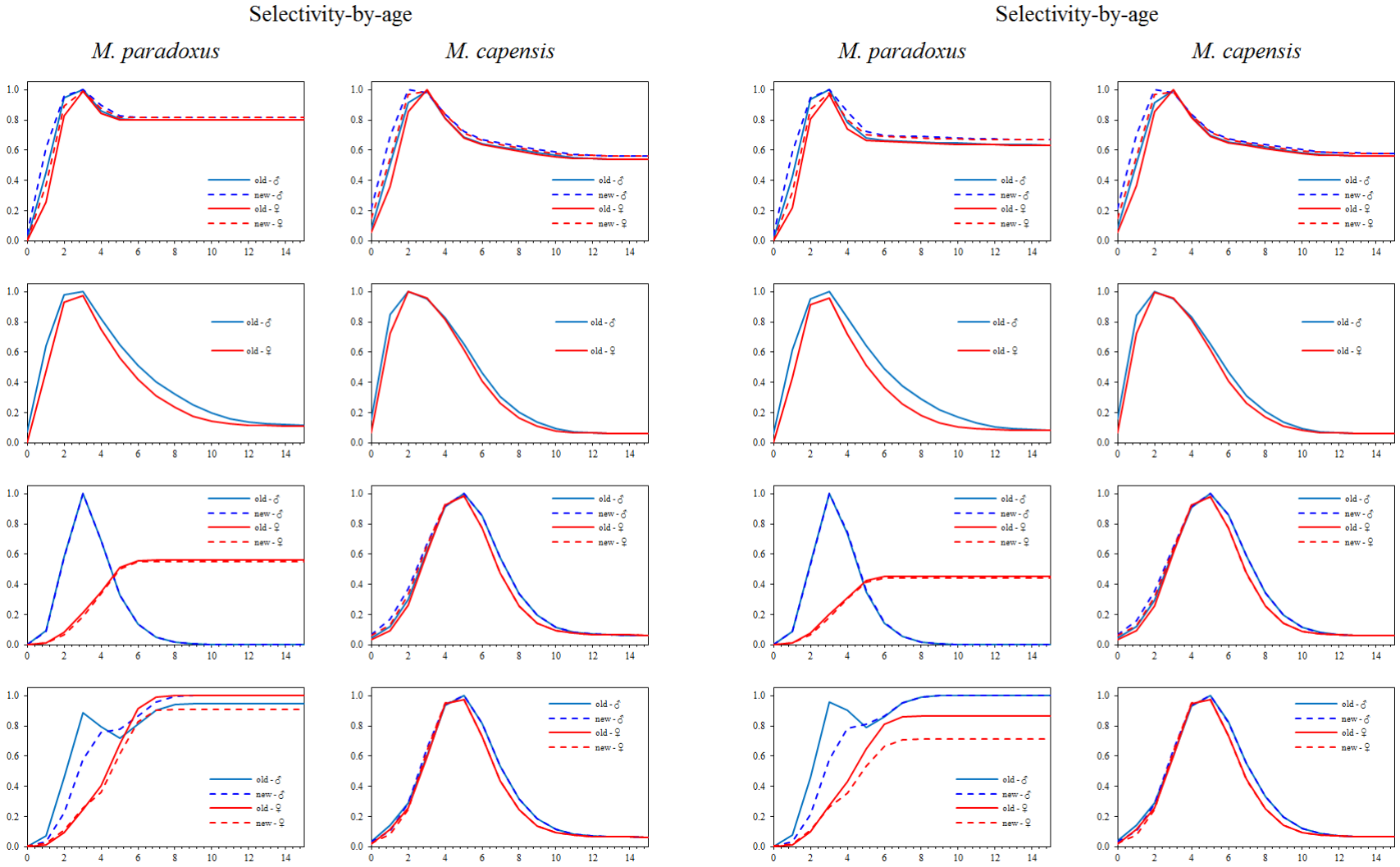

Fig. 6d: **Survey** selectivities-at-age estimated for the new RC (LHS) and the downweighting (RHS).

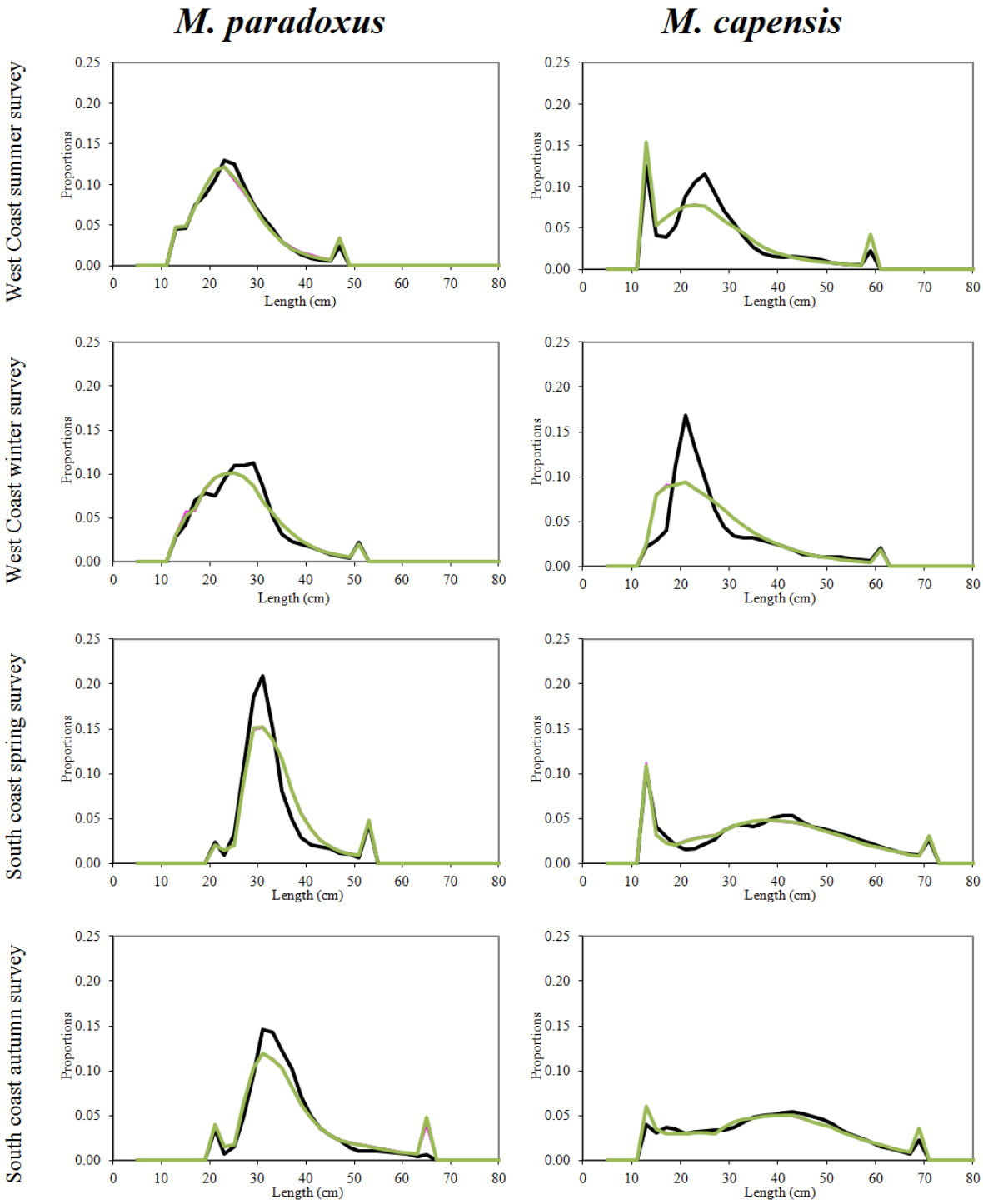

Fig. 7a: Fit of RC (pink line) and downweighted (green line) to the **survey** gender-aggregated surveys proportion-at-length data, aggregated over years for which data are available.

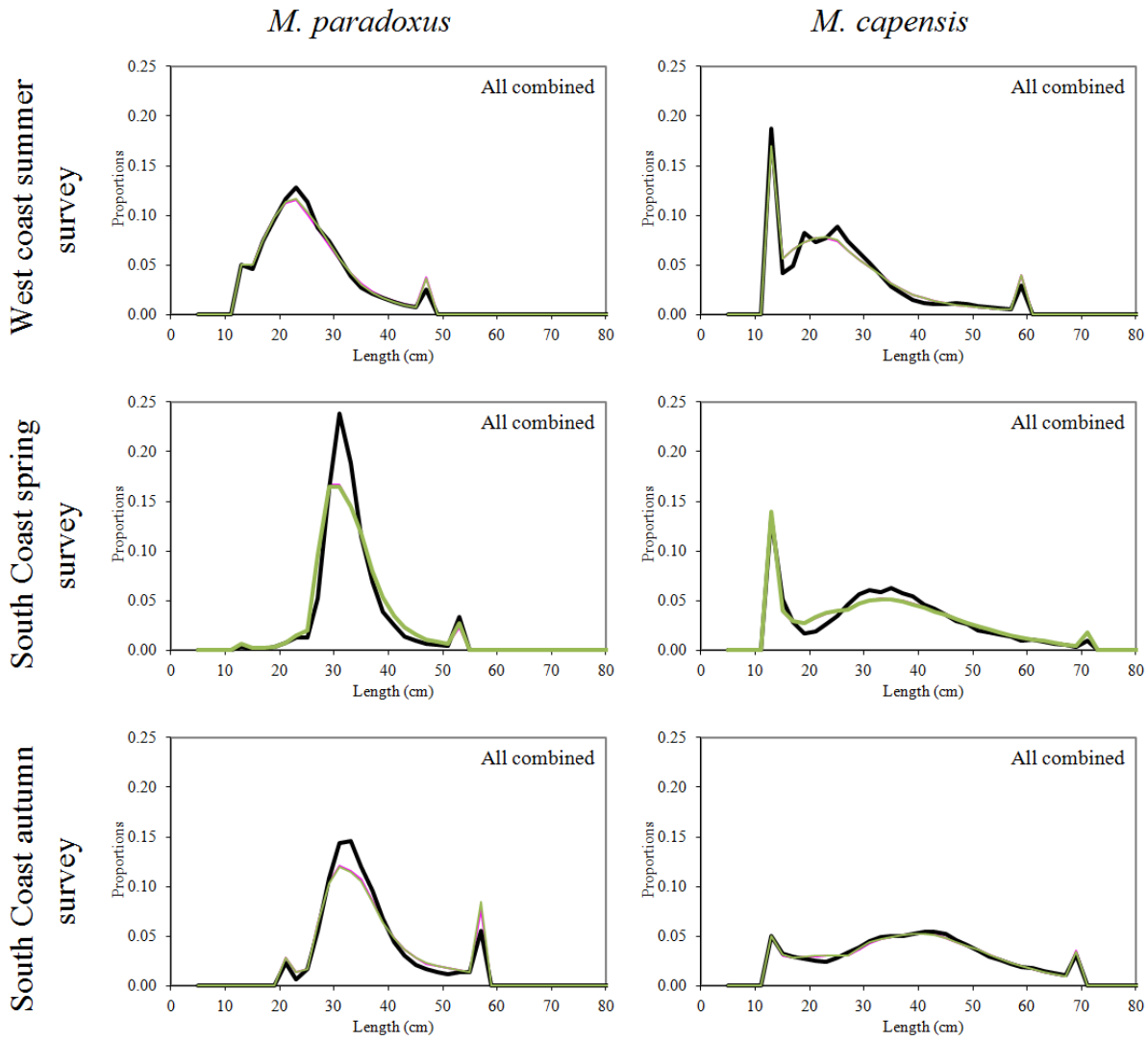

Fig. 7b: Fit of RC (pink line) and downweighted (green line) to the **survey** gender-disaggregated surveys proportion-at-length data, aggregated over genders and over years for which data are available.

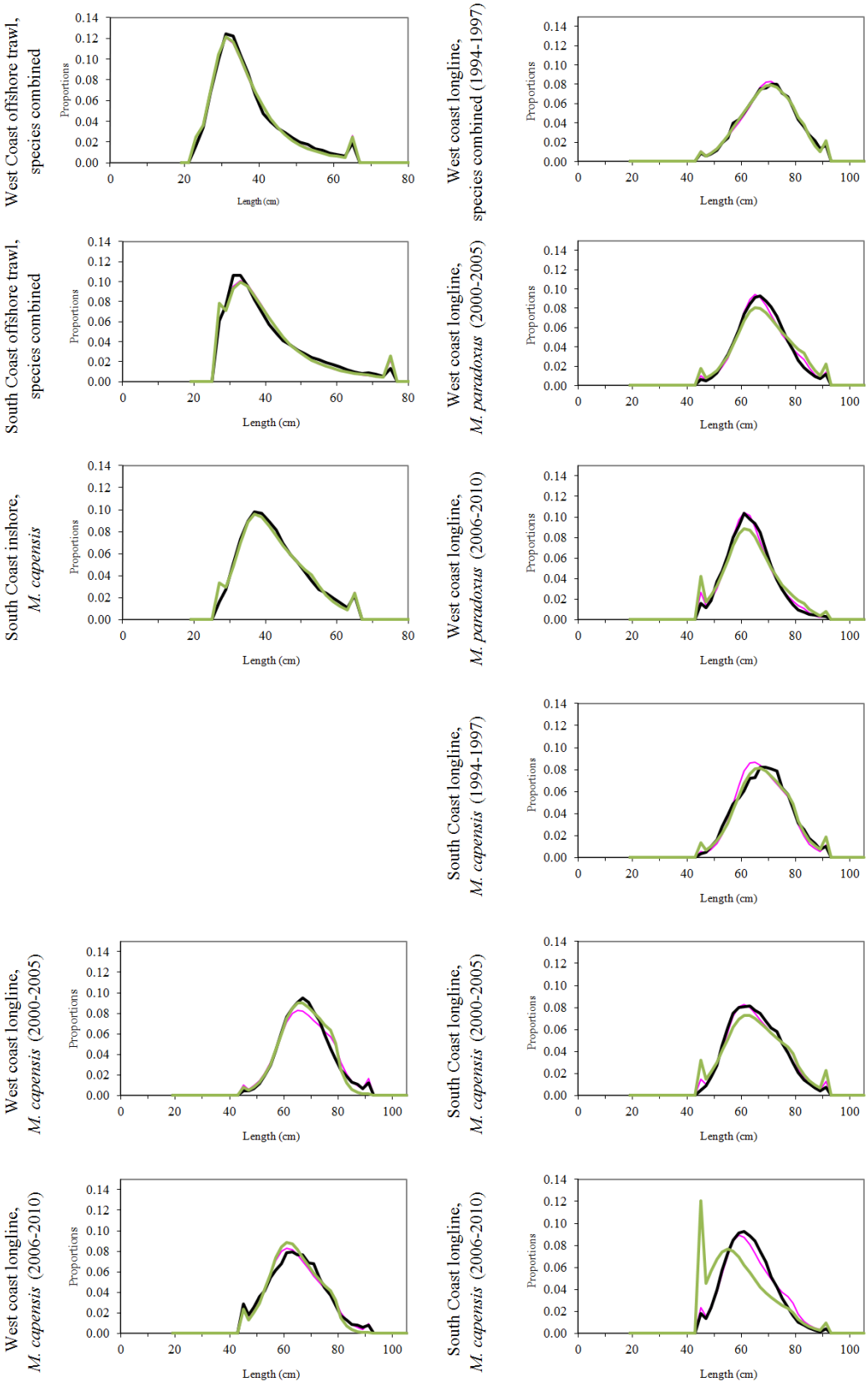

Fig. 8: Fit of RC (pink line) and downweighted (green line) to commercial proportion-at-length data, aggregated over years for which data are available.

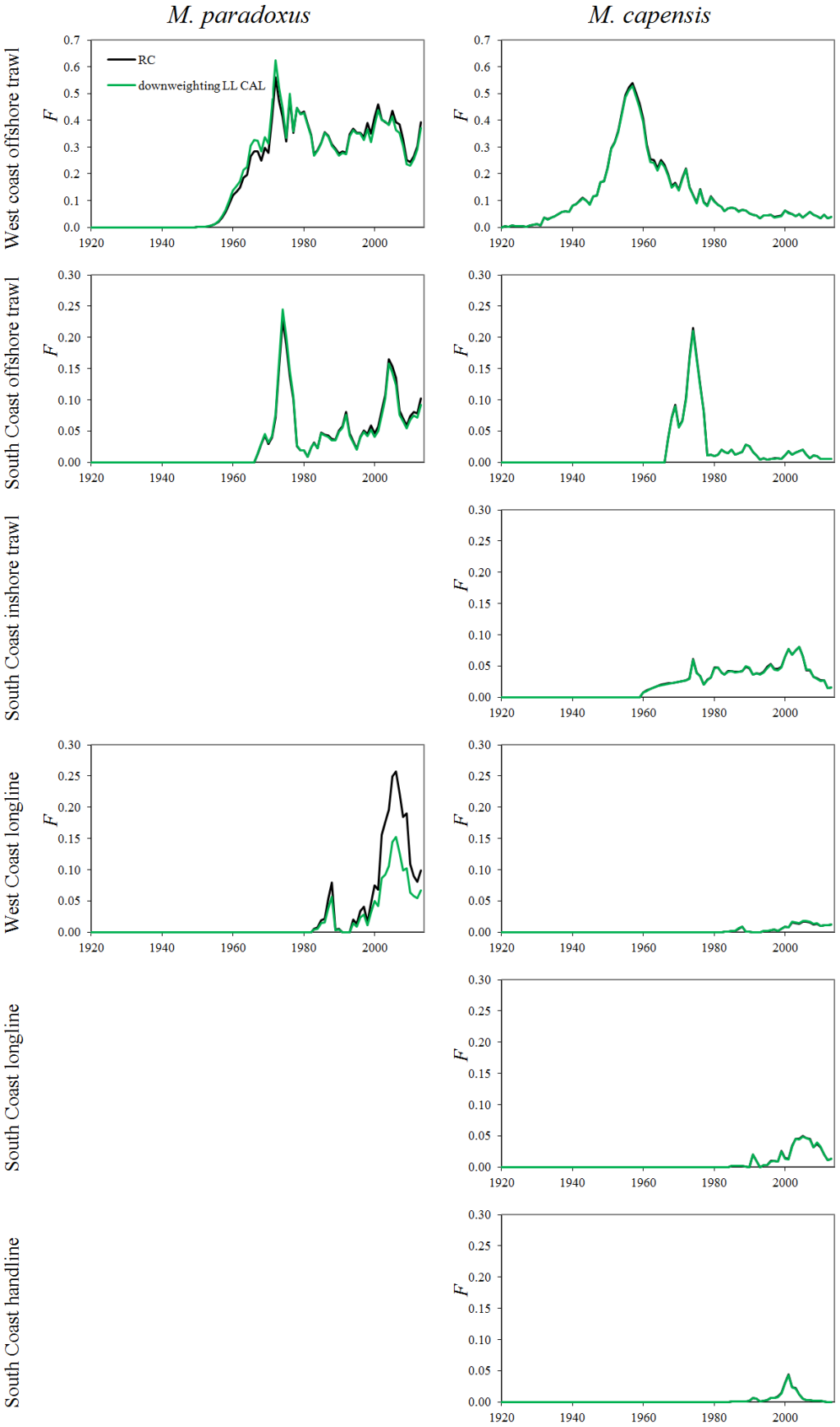

Fig. 9: Time series of fishing proportions for each fleet for the RC and the downweighting.

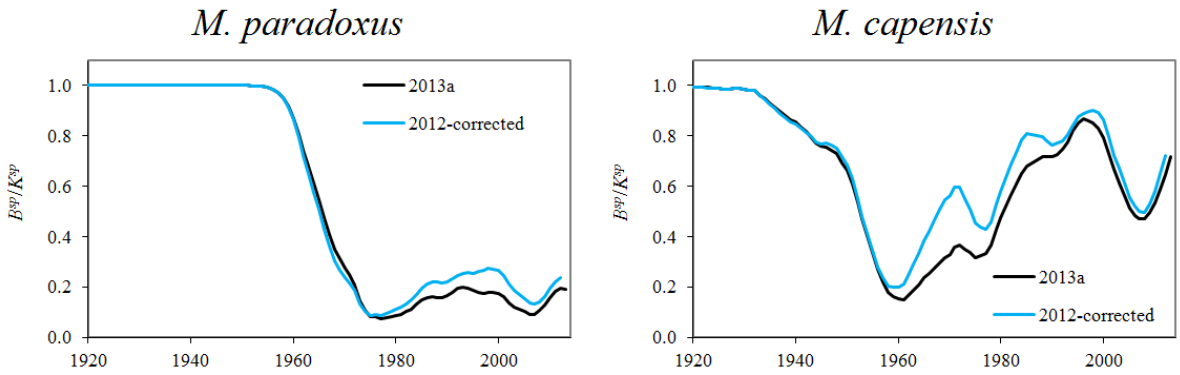

Fig. 10: Trajectories of female spawning biomass (in terms of its pre-exploitation level) for RS1-2012-corrected and RS1-2013a.

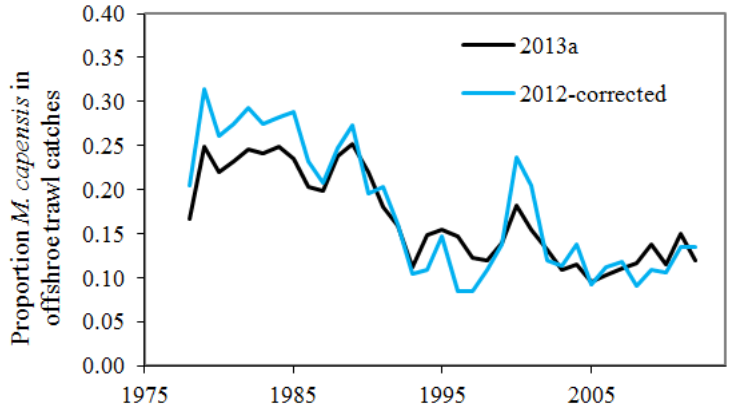

Fig. 11: Proportions of *M. capensis* in the offshore trawl catches for RS1-2012-corrected and RS1-2013a.

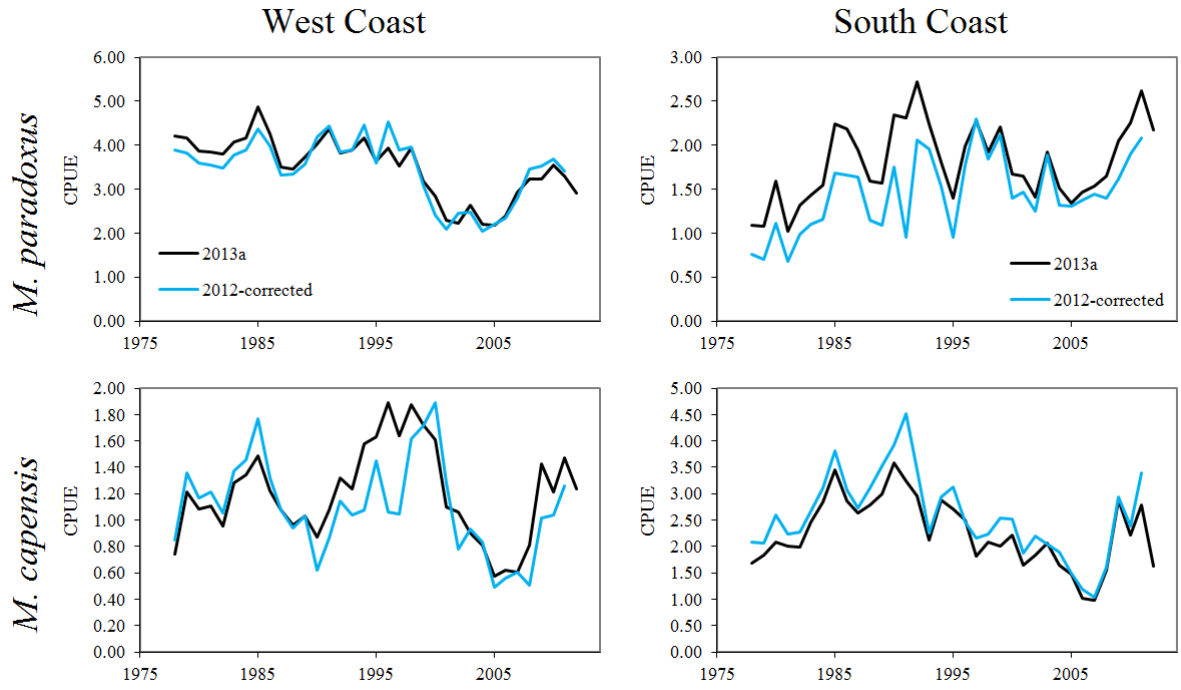

Fig. 12: GLM-CPUE series for RS1-2012-corrected and RS1-2013a.

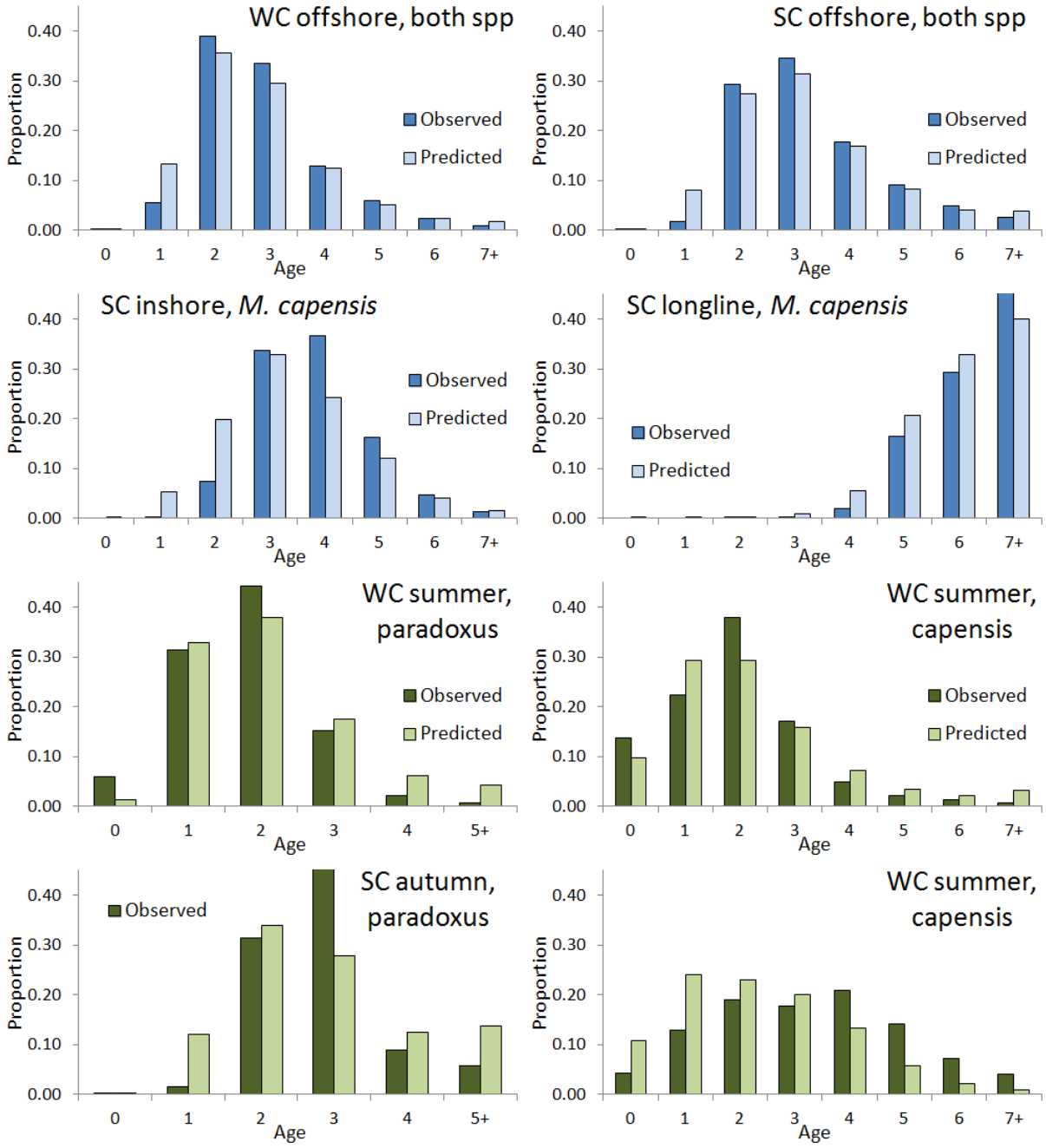

Fig. 13: Plot of implied fit to the CAA data for the 2013 RC, as averaged over all the years for which data are available.