

Bridge-building between the 2017 and 2018 hake RC assessment models

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Summary

A step-by-step set of results is given to indicate the various impacts of various changes made to the hake assessment Reference Case model over the past 12 months.

Steps in changing the model and results

Table 1 and Table 2 show key parameter estimates and negative log-likelihood components for seven different “snapshots” in the development of the hake assessment model, starting from the 2017 Reference Case model that was presented to MSC panel in 2017 to the current Reference Case model. The models are listed below.

1. The 2017 model
 - a. The 2017 Reference Case model presented to the MSC panel in May 2017.
 - b. The 2017 model presented to the DWG following some data updates (see FISHERIES/2017/OCT/SWG-DEM/51).
2. The model with corrections following the OLRAC code checking exercise (see FISHERIES/2017/NOV/SWG-DEM/55, although note that the results shown here have been updated from those reported in DEM/55 after it was established that the model had not run completely to convergence).
3. The model after updates were made to the treatment of the catch-at-length data, which consisted of updating the plus and minus length groups and using a power of 0.35 (instead of 0.5) in the negative log-likelihood calculations (see FISHERIES/2018/FEB/SWG-DEM/05).
4. The model from (3), with the hake predation model mortality-at-age vectors (see FISHERIES/2018/MAR/SWG-DEM/11).
5. New Reference Case
 - a. The model that uses the “new”¹ CPUE and catch data.
 - b. Re-run of (5a) with upper bound on steepness h increased from 1.5 to 2.

Table 3 lists the key parameter estimates for runs 4 and 5a above, along with four further runs that aim to ascertain to what extent the new CPUE and GLM data vs model changes are responsible for the different estimates of depletion for *M. paradoxus* (both in terms of biomass relative to pristine biomass, and relative to B_{MSY}) estimated in the 2018 model. Note that for this table, all runs have an upper bound of 1.5 on h , i.e. are variants of run 5a².

6. Run 5a with the old (non-predation) mortality-at-age vectors.
7. Run 5a with the new mortality-at-age vectors but old CAL treatment.
8. Run 5a with the old mortality-at-age vectors and the old CAL treatment.
9. Run 5a with the new data except for the old CPUE data for *M. paradoxus* South Coast.

Figure 1 to Figure 3 show the female spawning biomass trajectories, recruitment plots and fits to the CPUE data for a selection of the seven “snapshots”. Only the latest of the 2017 Models (Model 2) has been included in these plots as it is the corrected and updated version of Models 1a and 1b.

¹ The “new” catch and CPUE data (see “mass, S+O, size (Model17)” in the plots in FISHERIES/2018/FEB/SWG_DEM/08) arise from an updated species splitting algorithm (Model “LIW_SO_U” in FISHERIES/2018/FEB/SWG_DEM/07).

² Strictly speaking Runs 6-9 should have been carried out as variants on Run 5b with the upper bound on h of 2, which is the model in the Reference Set. However, Runs 6-9 were completed before Run5b and it was not considered worth the effort to redo the runs, as these are sufficient for the comparisons in relative terms which are the purpose of this document.

Table 1a: Key parameter estimates for the “snapshot” models. Spawning biomass values are given for the year 2016 as well as 2017 to be compatible with Model 1 which runs to 2016 only. Stars in the Bexp rows indicates that the values are not immediately available as they were not part of the standard output file.

			1. 2017 Model	1b. Oct 2017 Model	2. OLRAC corrections	3. CAL treatment	4. Predation mortality	5a. New CPUE data	5b. Run 5a with increased bound on h
	Data	Year	Old	Old	Old	Old	Old	New	New
<i>M. par</i>	Ksp		538	539	515	530	417	343	321
	BspMSY		127	121	115	109	76	61	63
	Bsp	2016	116	108	122	123	97	87	94
		2017	NA	112	127	129	104	93	101
	Btotal	2016	205	194	227	222	207	190	203
		2017	NA	207	245	238	227	205	222
	Bexp WC offshore	2016	184	*	*	220	226	206	212
	Bexp SC offshore	2017	122	*	*	134	149	143	151
	Bsp/K	2016	0.22	0.20	0.24	0.23	0.23	0.25	0.29
		2017	NA	0.21	0.25	0.24	0.25	0.27	0.31
Bsp/Bspmsy	2016	0.91	0.89	1.06	1.13	1.28	1.44	1.50	
	2017	NA	0.92	1.11	1.18	1.36	1.54	1.62	
BspMSY/Ksp		0.24	0.22	0.22	0.21	0.18	0.18	0.19	
MSY		123	122	137	140	146	143	146	
<i>M. cap</i>	Ksp		178	179	196	201	318	341	290
	BspMSY		34	34	63	63	106	119	83
	Bsp	2016	113	111	139	142	214	235	194
		2017	NA	112	141	142	219	242	199
	Btotal	2016	270	263	325	331	474	520	432
		2017	NA	269	334	336	489	539	447
	Bexp WC offshore	2016	230	*	*	278	334	368	311
	Bexp SC offshore	2017	230	*	*	278	334	368	311
	Bsp/K	2016	0.63	0.62	0.71	0.71	0.67	0.69	0.67
		2017	NA	0.62	0.72	0.71	0.69	0.71	0.69
Bsp/Bspmsy	2016	3.29	3.24	2.20	2.26	2.02	1.99	2.33	
	2017	NA	3.27	2.22	2.26	2.06	2.04	2.39	
BspMSY/Ksp		0.19	0.19	0.32	0.31	0.33	0.35	0.29	
MSY		63	64	81	80	71	78	83	

Table 2: Negative-log likelihood components for the “snapshot” models. Note the total negative log-likelihood and the catch-at-length components for Model 1a, 1b and 2 are not comparable with each other or with the remaining three models owing to the different treatment of the catch-at-length data. Cells highlighted in grey indicate that these negative log-likelihood components are not comparable with those from the other models, owing to the different treatment of the catch-at-length data.

	1. 2017 Model	1b. Oct 2017 Model	2. OLRAC corrections	3. CAL treatment	4. Predation mortality	5a. New CPUE data	5b. Run 5 with increased upper bound on h
Total	-3748.7	-3833.7	-5251.5	-3172.6	-3149.4	-3139.3	-3141.6
historical_CPUE	-41.2	-40.6	-40.8	-41.0	-40.2	-37.7	-36.8
GLM_CPUE	-188.8	-195.0	-191.4	-197.3	-191.9	-186.7	-190.7
Survey	-37.4	-38.4	-35.1	-35.7	-33.4	-34.0	-34.8
Commercial_SACAL	-1034.2	-1067.1	-1330.6	-833.2	-828.6	-825.1	-825.5
Commercial_SDCAL	-748.4	-748.3	-1110.6	-691.0	-682.2	-682.1	-681.8
Survey_SACAL	-544.7	-549.8	-709.7	-416.6	-413.6	-413.5	-413.4
Survey_SDCAL	-1283.6	-1325.3	-1968.3	-1088.8	-1089.6	-1091.1	-1090.3
Age-length keys	121.0	121.3	124.5	121.9	121.9	122.2	122.2
RecruitmentResiduals	8.8	9.5	10.4	9.1	8.3	8.6	9.5

Table 3: Key parameter estimates are repeated for the runs 4 and 5 from Table 1b. Parameter estimates are then provided for four additional runs with the aim to ascertain the impact of the new data compared to that of model changes.

		4. Predation mortality	5a. New CPUE data	6. Run 5a with old mortality vectors	7. Run 5a with old CAL treatment	8. Run 5a with old CAL treatment and old mortality vectors	9. Run 5a, with the new data but old M. paradoxus SC series
CAL treatment		New	New	New	Old	Old	New
Mortality-at-age vectors		New	New	Old	New	Old	New
CPUE and catch data		Old	New	New	New	New	Mix
<i>M. paradoxus</i>	Ksp	417	343	431	352	450	346
	BspMSY	76	61	82	62	85	60
	Bsp2017	104	93	121	94	123	85
	Btot2017	227	205	224	204	225	189
	Bexp WC offshore	226	206	205	206	199	205
	Bexp SC offshore	149	143	134	142	137	128
	Bsp2017/K	0.25	0.27	0.28	0.27	0.27	0.24
	Bsp2017/Bspmsy	1.36	1.54	1.47	1.52	1.45	1.41
	BspMSY/Ksp	0.18	0.18	0.19	0.18	0.19	0.17
	MSY	146	143	136	143	136	145
<i>M. capensis</i>	Ksp	318	341	191	340	194	341
	BspMSY	106	119	62	118	66	119
	Bsp2017	219	242	139	240	141	242
	Btot2017	489	539	331	534	336	540
	Bexp WC offshore	334	368	280	368	288	368
	Bexp SC offshore	334	368	280	368	288	368
	Bsp2017/K	0.69	0.71	0.72	0.71	0.73	0.71
	Bsp2017/Bspmsy	1.36	1.54	1.47	2.03	1.45	1.41
	BspMSY/Ksp	0.18	0.18	0.19	0.35	0.19	0.17
	MSY	71	78	88	78	87	78

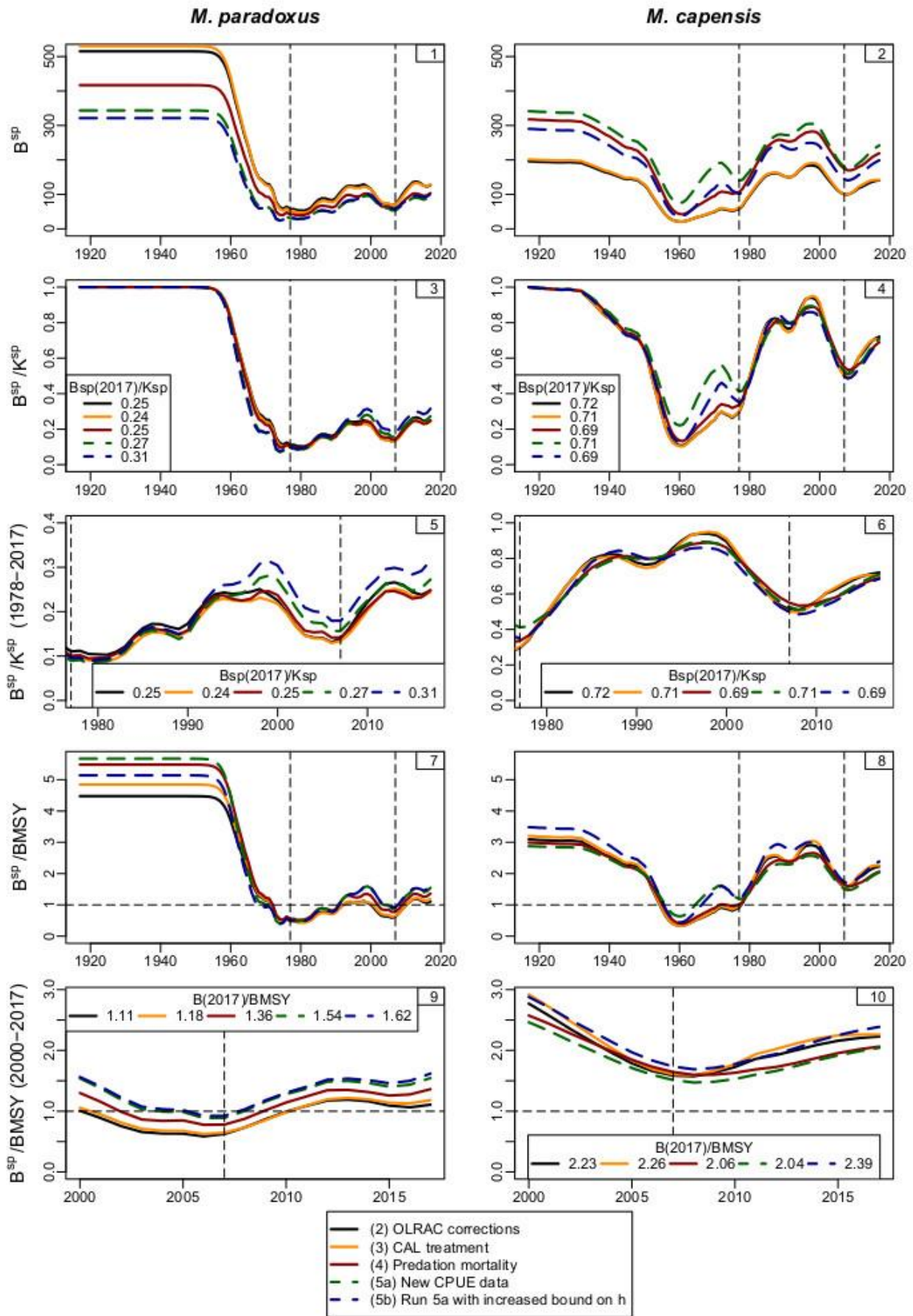


Figure 1: Female spawning biomass trajectories for a selection of the models in Table 1a. The last two models (shown with dashed lines) use the new CPUE and catch data.

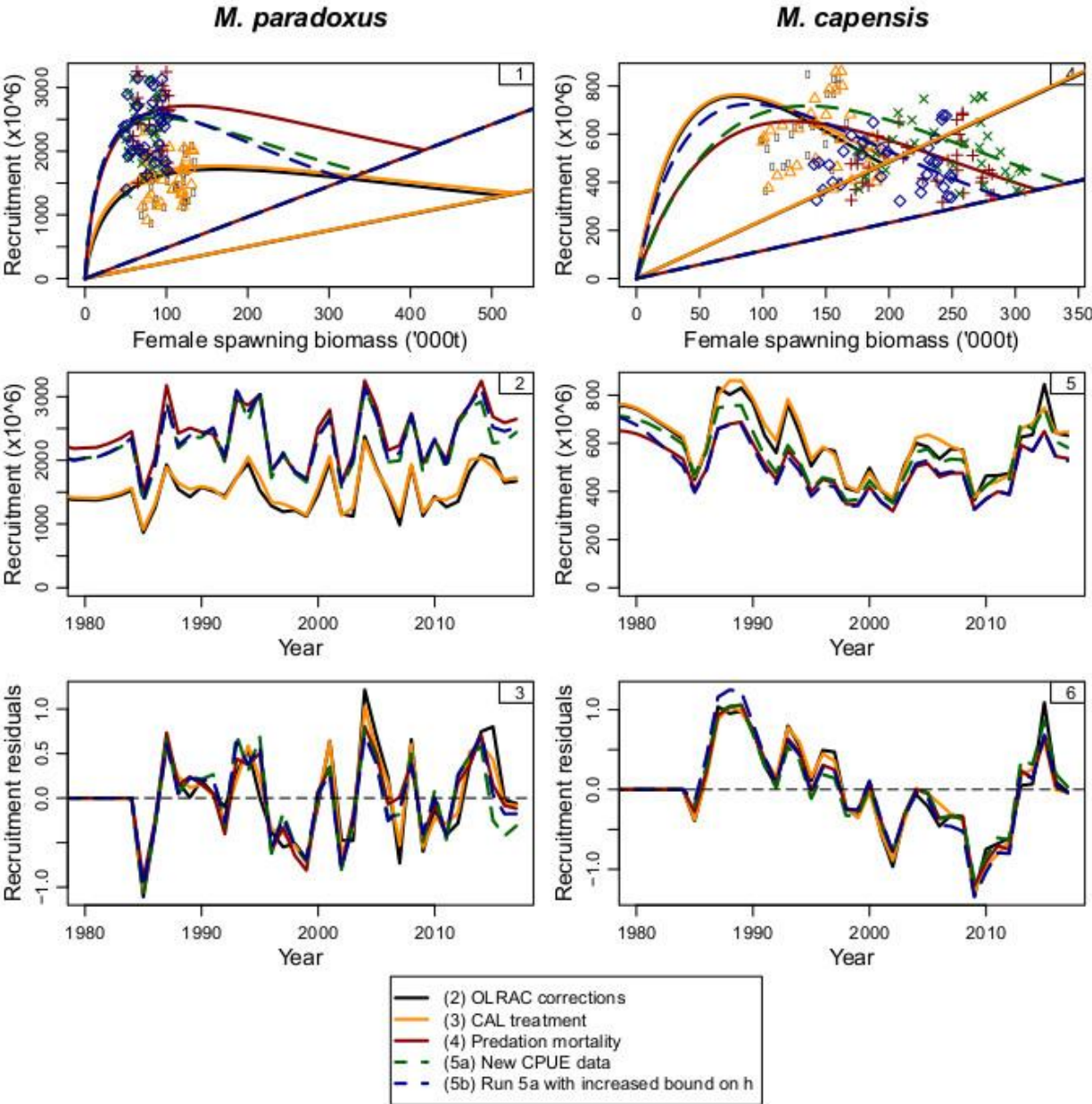


Figure 2: Recruitment plots for the selection of models from in Table 1a.

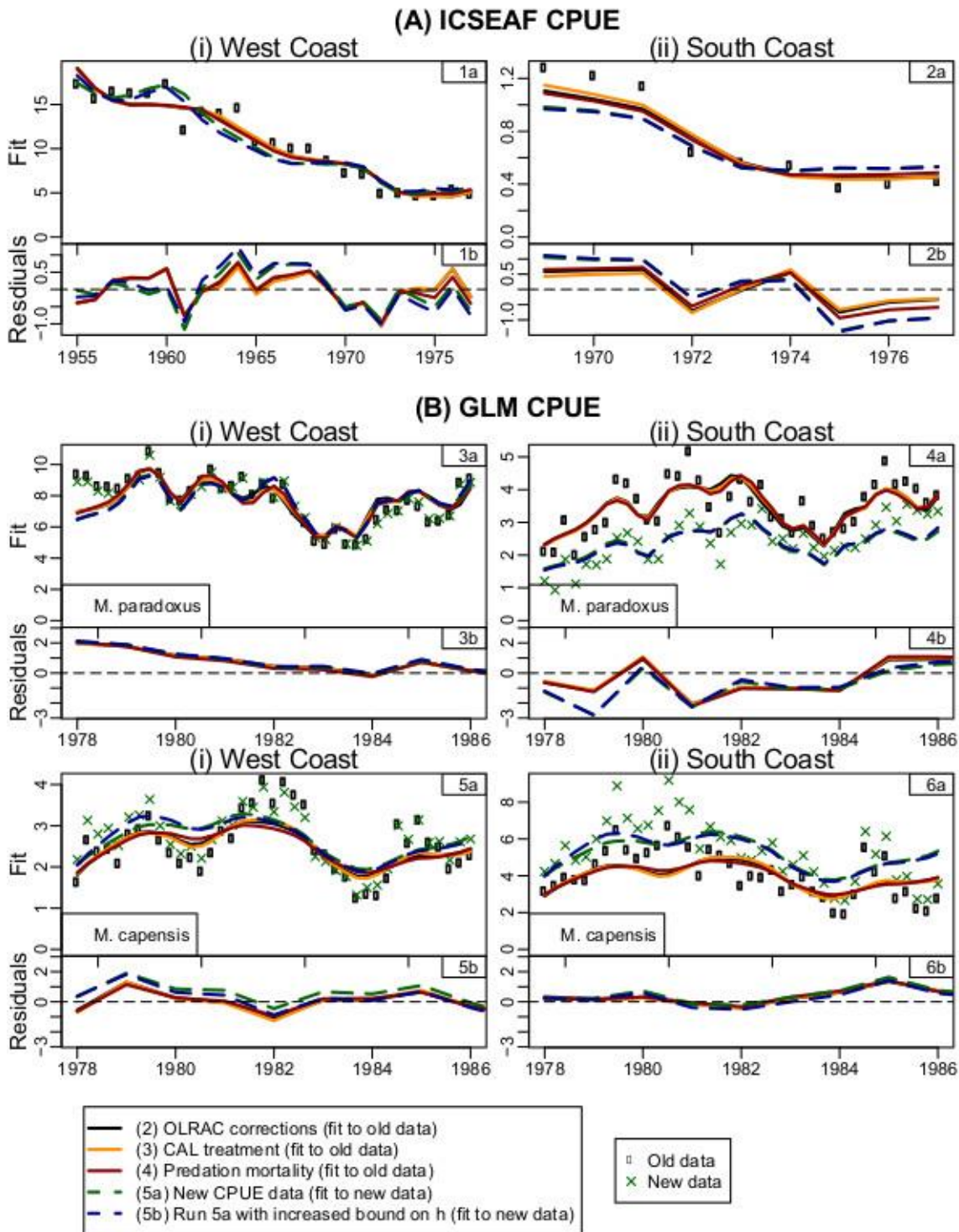


Figure 3: Fits to the historic and commercial CPUE data for the selection of models from Table 1a. In the GLM CPUE plots, Models 2, 3 and 4 (solid lines) fit to the old CPUE data (shown by solid black dots) and Models 5 and 5b (dashed lines) fit to the new Model A6 data (green crosses).