West Coast Rock Lobster 2010 updated assessments

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2010 updated assessments

The 2010 updated assessment involved included new (2009) data in the likelihood, as well as using updated FIMS data (a recent review of the methodology had produced new FIMS CPUE, catch-at-length and *F*% (percentage of the catch by number which is female) data series). Updated somatic growth data are also included. The historic catch series were slightly modified to take recent updates into account.

Two variants have so far been produced for the 2010 updated assessment, both of which include all the new data since the 2009 assessment.

1. **Original Variant**: Here the only change from the 2009 assessment is the inclusion of new data, i.e. the same selectivity functions are kept (note these are not the functions described in IWS/DEC10/WCRLA/P2 which are simplified functions). Results of the 2010 updated assessment for the original variant are reported in Table 1.

   Closer examination of the A5+6 fits to the CPUE data and F% data showed that this model fit was most likely not fully converged. Attempts have been made to reach convergence, and the new model fits for Area 5+6 are reported in the appendix, along with B_{75}^{m} trends for all five super-areas, and for the combined resource.

2. **New variant**: Here the selectivity functions have been re-parameterised so that selectivity functions are 5mm piece-wise linear functions (the rationale is to see what the data suggest, and then later to re-parameterise with suitable more parsimonious functions). These functions are described in IWS/DEC10/WCRLA/P2. These results are reported in Table 2.

2010 assessment results for the resource as a whole

Updated 2010 assessment results for resource as a whole for both variants are provided in Table 3. Figures 1-4 show the updated 2010 OM "new variant" fits to data, although Figures 1a-e compare the "new variant" and "original variant" selectivity functions. Figure 5 shows the combined (over all five super-areas) B_{75}^{m} population estimates for the "new variant" and the "original variant", and also indicate the intended biomass recovery targets for OMP 1997 and OMP 2007.

Output statistics and quantities shown

B_{75} is the male+female biomass above 75mm carapace length

B_{75}^{m} is the male biomass above 75mm carapace length

Egg is the female egg production where egg production is a function of the female spawning biomass.

Table 1: Comparative contributions to the –ln*L* value, sigma values, biomass and egg production estimates for each super-area for the **2010** updated assessment "original variant" i.e. no change to selectivity function specifications compared with 2009 assessment.

Model	**A1-2**	**A3-4**	**A5-6**	**A7**	**A8**
Female annual survival rate	0.890	0.890	0.890	0.890	0.890
R_{1910}	3.978×10^{7}	2.612×10^{0}	2.412×10^{8}	1.205×10^{8}	3.531×10^{8}
R_{1920}/R_{1910}	4.548	0.934	0.803	0.537	0.382
R_{1950}/R_{1910}	0.015	0.110	0.212	0.145	0.065
R_{1970}/R_{1910}	0.069	0.105	0.139	0.104	0.103
R_{1975}/R_{1910}	0.001	0.211	0.235	0.163	0.279
R_{1980}/R_{1910}	0.035	0.032	0.058	0.047	0.231
R_{1985}/R_{1910}	0.035	0.138	0.029	0.046	0.736
R_{1990}/R_{1910}	0.017	0.071	0.013	0.078	0.597
R_{1995}/R_{1910}	0.010	0.045	0.006	0.086	0.719
R_{2000}/R_{1910}	0.048	0.019	0.001	0.085	0.829
R_{2003}/R_{1910}	0.007	0.017	0.001	0.085	0.519
Trap CPUE σ	-	0.585	0.334	0.252	0.179
Hoop CPUE σ	0.163	0.506	0.714	-	0.239
FIMS CPUE σ	-	1.538	1.417	0.777	0.302
Male Trap Size σ	-	0.228	0.150	0.240	0.265
Female Trap Size σ	-	0.183	0.229	0.171	0.269
Male Hoop Size σ	0.301	0.316	0.203	0.346	0.171
Female Hoop Size σ	0.374	0.224	0.235	0.800	0.440
Male FIMS Size σ	-	0.558	0.150	0.257	0.150
Female FIMS Size σ	-	1.685	0.150	0.291	0.150
Male Sublegal size σ	-	-	-	-	0.150
Female Sublegal size σ	-	-	-	-	0.150
Trap F% σ	-	0.150	0.150	0.150	0.150
Hoop F% σ	0.150	0.150	0.150	0.150	0.150
FIMS F% σ	-	0.150	0.150	0.150	0.150
Total *–lnL*	-28.05	95.49	109.97	70.89	-61.24
B_{75}(1910) MT	47 318	132 473	153 172	191 785	135 665
B_{75}(2010) MT	830	1 419	393	2 958	11 429
B_{75}(2010)/B_{75}(1910)	0.018	0.011	0.002	0.015	0.082
B_{75}(2010)/B_{75}(1996)	0.904	0.807	0.189	0.572	0.891
B^m_{75}(1910) MT	35529	121 176	141 502	178 353	122 480
B^m_{75}(2010) MT	401	1 384	115	2 118	11 233
B^m_{75}(2010)/ B^m_{75} (1910)	0.011	0.011	0.001	0.012	0.092
B^m_{75}(2010)/ B^m_{75}(1996)	1.867	0.921	0.155	0.593	0.988
B^m_{75}(2010)/ B^m_{75}(2006)	0.518	0.742	0.129	0.638	0.937
Egg (2010)/Egg (1910)	0.026	0.023	0.015	0.071	0.343

Table 2: Comparative contributions to the –ln*L* value, sigma values, biomass and egg production estimates for each super-area for the 2010 updated assessment "new variant" which allows for differently specified selectivity functions.

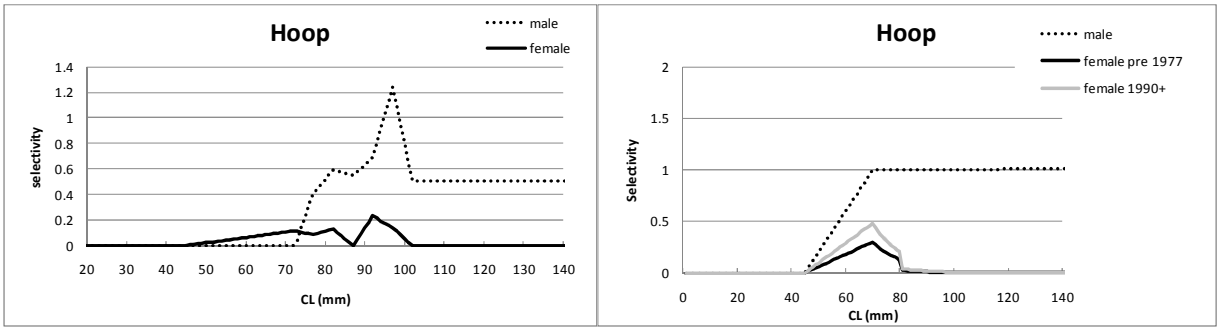
Model	**A1-2**	**A3-4**	**A5-6**	**A7**	**A8**
Female annual survival rate	0.881	0.904	0.906	0.917	0.901
R_{1910}	3.291×10^{7}	2.837×10^{0}	2.448×10^{8}	1.377×10^{8}	5.144×10^{8}
R_{1920}/R_{1910}	4.915	0.790	0.780	0.456	0.351
R_{1950}/R_{1910}	0.008	0.095	0.197	0.117	0.010
R_{1970}/R_{1910}	0.060	0.119	0.134	0.211	0.178
R_{1975}/R_{1910}	0.019	0.153	0.194	0.160	0.580
R_{1980}/R_{1910}	0.039	0.040	0.058	0.035	0.090
R_{1985}/R_{1910}	0.046	0.137	0.038	0.044	0.712
R_{1990}/R_{1910}	0.001	0.070	0.013	0.073	0.472
R_{1995}/R_{1910}	0.026	0.050	0.022	0.091	0.571
R_{2000}/R_{1910}	0.057	0.012	0.001	0.059	0.675
R_{2003}/R_{1910}	0.004	0.016	0.001	0.080	0.431
Trap CPUE σ	-	0.530	0.271	0.263	0.192
Hoop CPUE σ	0.166	0.455	0.429	-	0.186
FIMS CPUE σ	-	1.525	1.291	0.810	0.273
Male Trap Size σ	-	0.222	0.150	0.204	0.255
Female Trap Size σ	-	0.276	0.256	0.161	0.275
Male Hoop Size σ	0.280	0.294	0.171	0.470	0.184
Female Hoop Size σ	0.708	0.546	0.366	0.441	0.199
Male FIMS Size σ	-	0.572	0.181	0.266	0.150
Female FIMS Size σ	-	1.560	0.326	0.310	0.150
Male Sublegal size σ	-	-	-	-	0.150
Female Sublegal size σ	-	-	-	-	0.150
Trap F% σ	-	0.150	0.150	0.150	0.150
Hoop F% σ	0.150	0.150	0.150	0.150	0.150
FIMS F% σ	-	0.150	0.150	0.150	0.150
Total $-lnL$	-23.44	107.24	71.54	40.39	-71.62
B_{75}(1910) MT	37 303	151 386	163 470	238 662	206 333
B_{75}(2010) MT	711	2 168	1 496	6 572	23 646
$B_{75}(2010)/B_{75}(1910)$	0.019	0.014	0.009	0.028	0.115
$B_{75}(2010)/B_{75}(1996)$	1.465	0.566	0.367	0.511	0.677
B^m_{75}(1910) MT	29 392	131 628	143 515	203 119	178 411
B^m_{75}(2010) MT	431	1 567	660	3 109	22 128
$B^m_{75}(2010)/ B^m_{75}$ (1910)	0.015	0.012	0.005	0.015	0.124
$B^m_{75}(2010)/ B^m_{75}(1996)$	1.841	1.038	0.685	0.573	0.740
$B^m_{75}(2010)/ B^m_{75}(2006)$	1.117	0.775	0.676	0.911	0.960
Egg (2010)/Egg (1910)	0.026	0.041	0.027	0.072	0.305

Table 3a: Combined super-area B_{75} and B_{75}^{m} results for the updated 2010 assessments.

	Original variant	**New variant**
B_{75}(2010)	17 029	34 593
B_{75}(2010)/B_{75}(1910)	0.026	0.043
B_{75}(2010)/B_{75}(1996)	0.748	0.616
B_{75}^{m}(2010)	15 251	27 895
B_{75}^{m}(2010)/ B_{75}^{m}(1910)	0.025	0.041
B_{75}^{m}(2010)/ B_{75}^{m}(1996)	0.840	0.733
B_{75}^{m}(2010)/ B_{75}^{m}(2006)	**0.968**	**0.935**

Figure 1a: A1+2 estimated selectivity functions (hoopnets only) for “new variant” and “original variant”.

“new variant” **“original variant”**



Note: These selectivities were calculated without normalisation to remove the confounding with overall fishing mortality F. This error will be corrected later but does not influence assessment results or trends with lengths or between sexes.

Figure 1b: A3+4 estimated selectivity functions for “new variant” and “original variant”.

“new variant” **“original variant”**

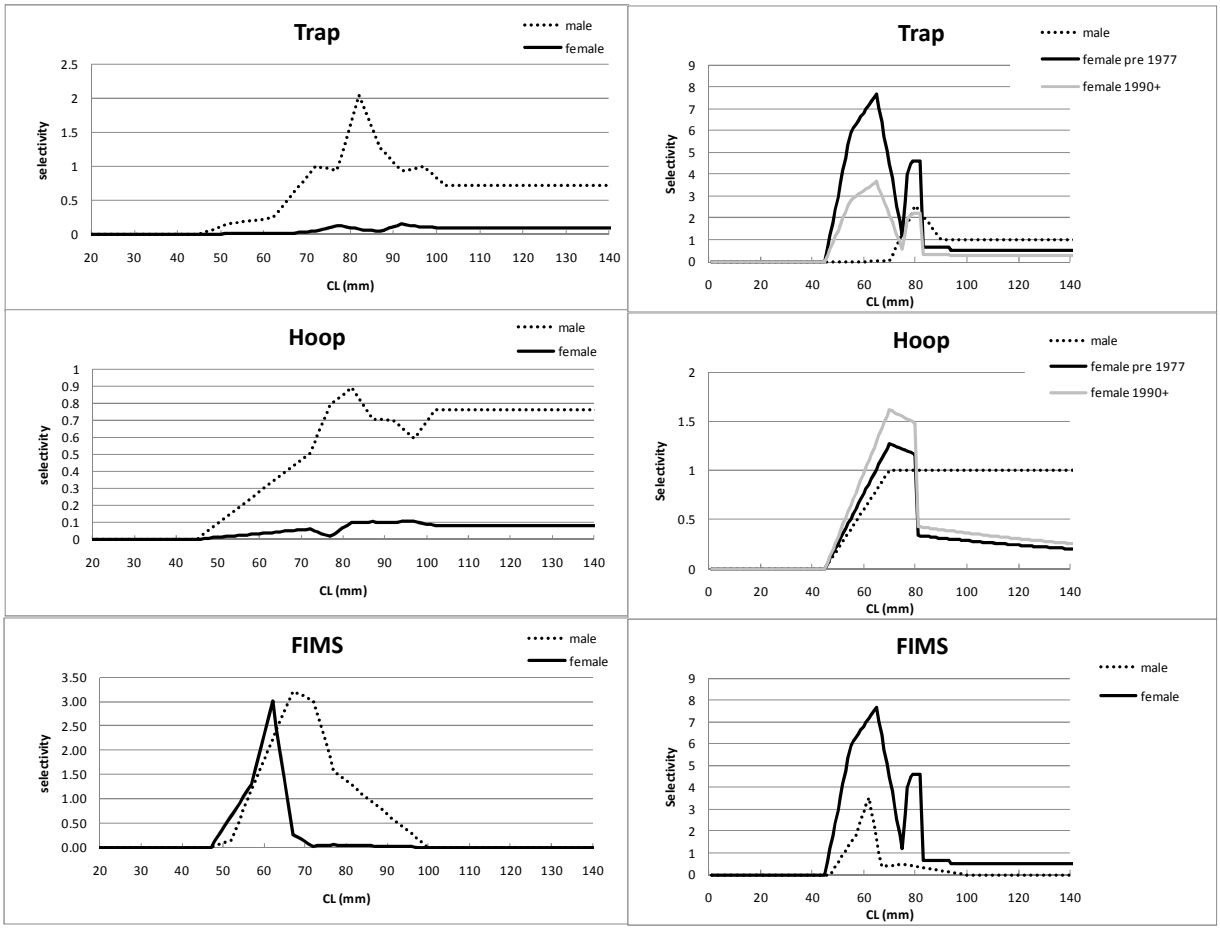


Figure 1c: A5+6 estimated selectivity functions for “new variant” and “original variant”.

“new variant” **“original variant”**

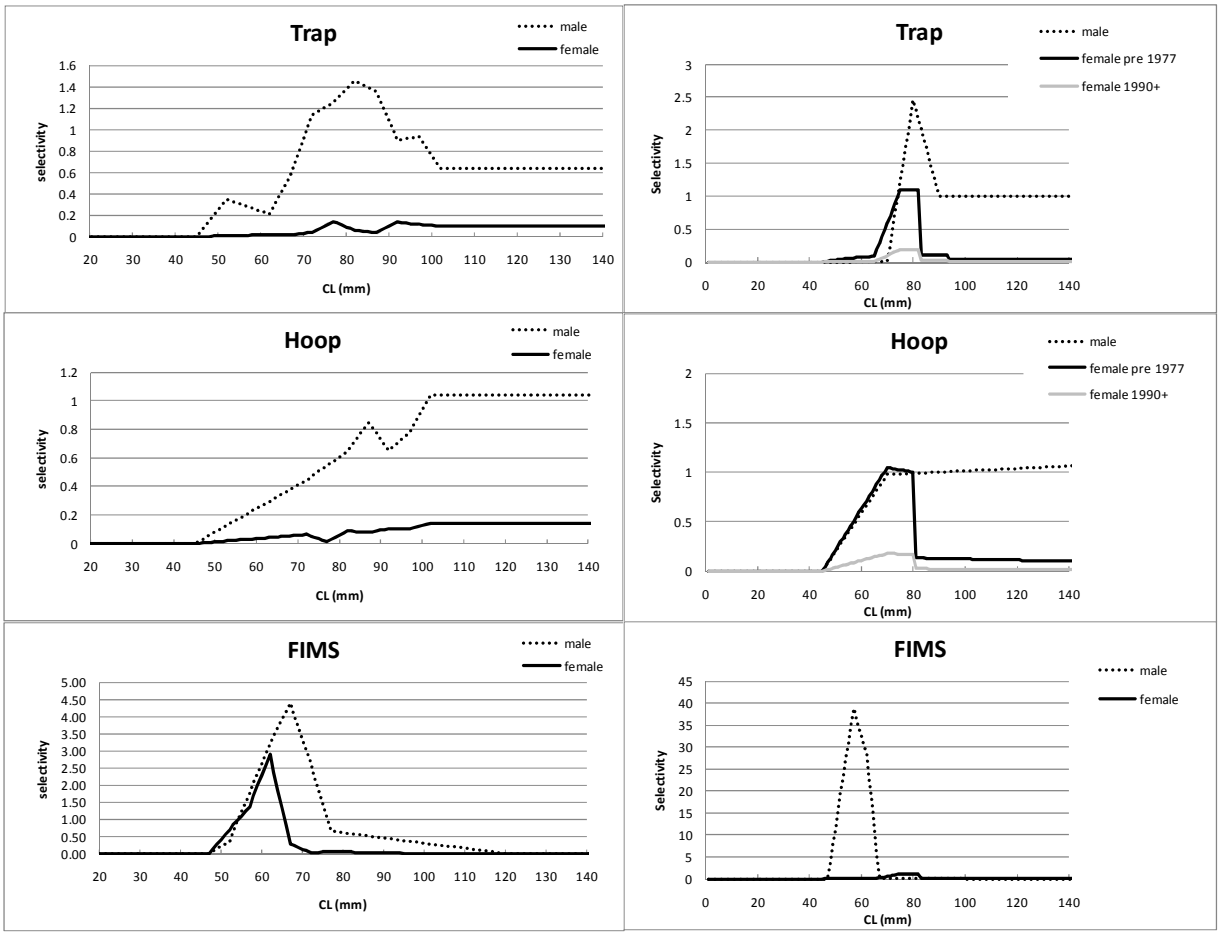


Figure 1d: A7 estimated selectivity functions for “new variant” and “original variant”.

“new variant” **“original variant”**

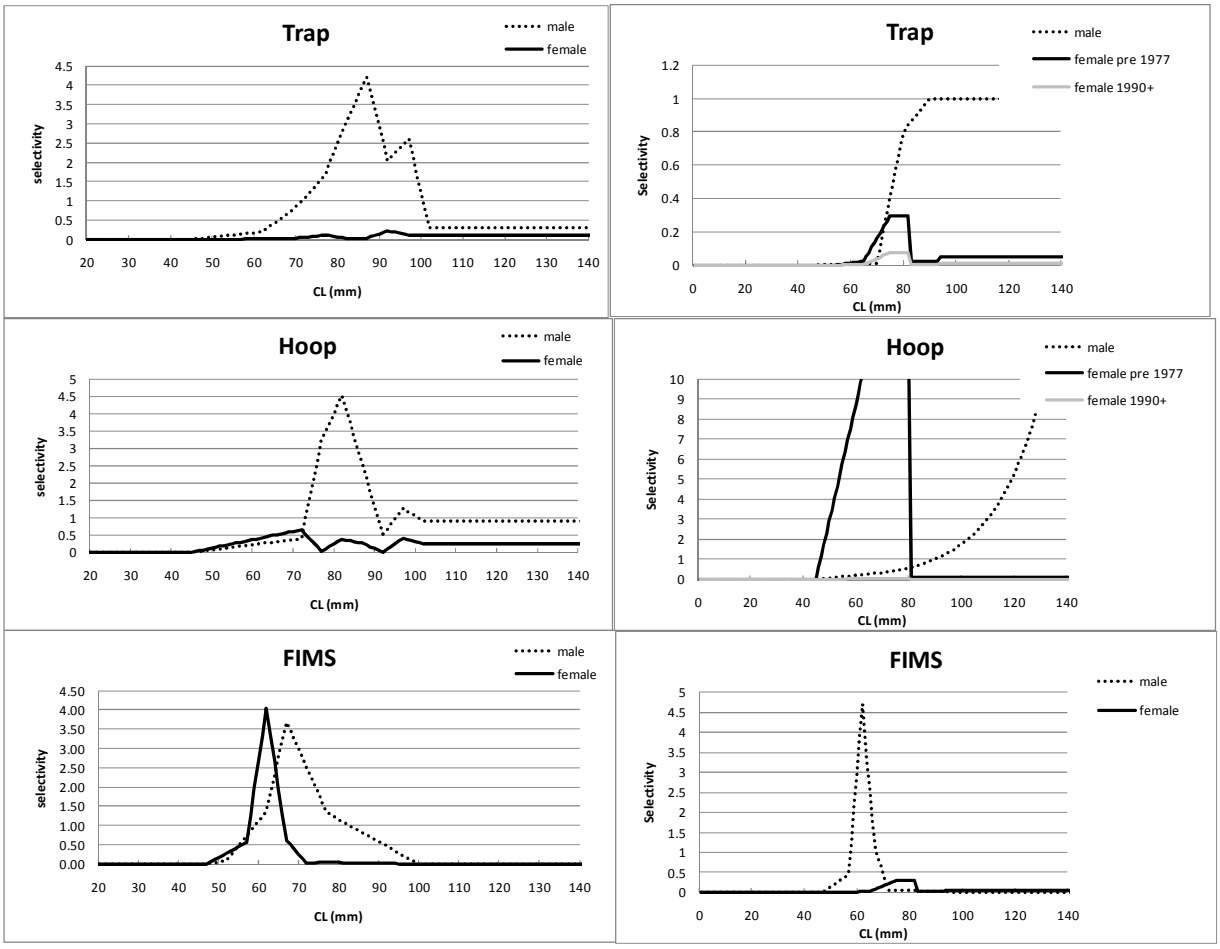


Figure 1e: A8 estimated selectivity functions for “new variant” and “original variant”.

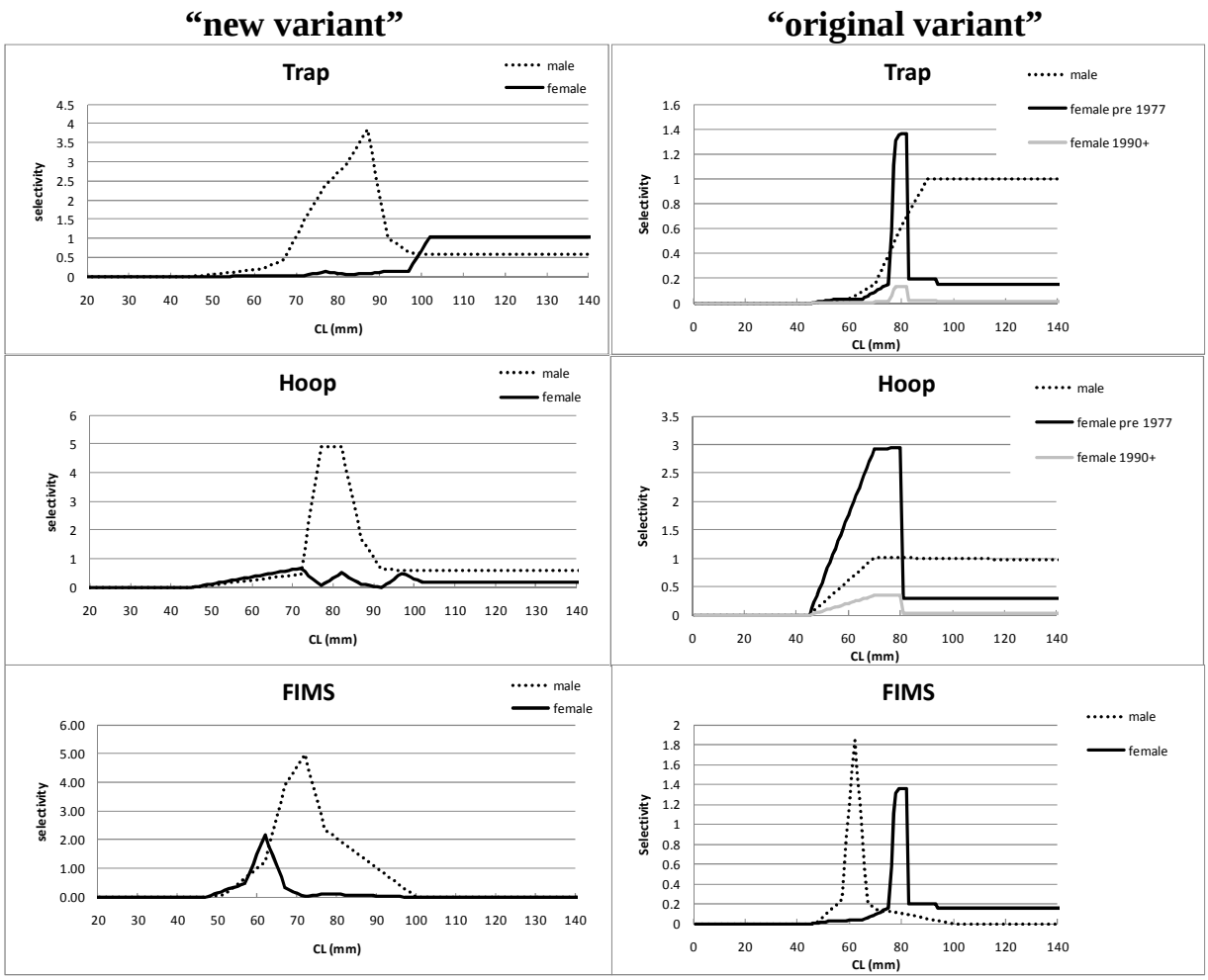


Figure 2a: A1+2 model fits to CPUE and *F*% for “new variant”.

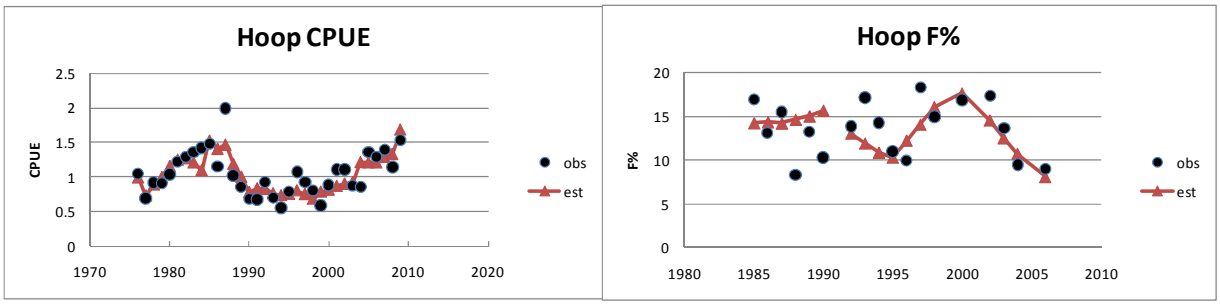


Figure 2b: A3+4 model fits to CPUE and *F*% "new variant".

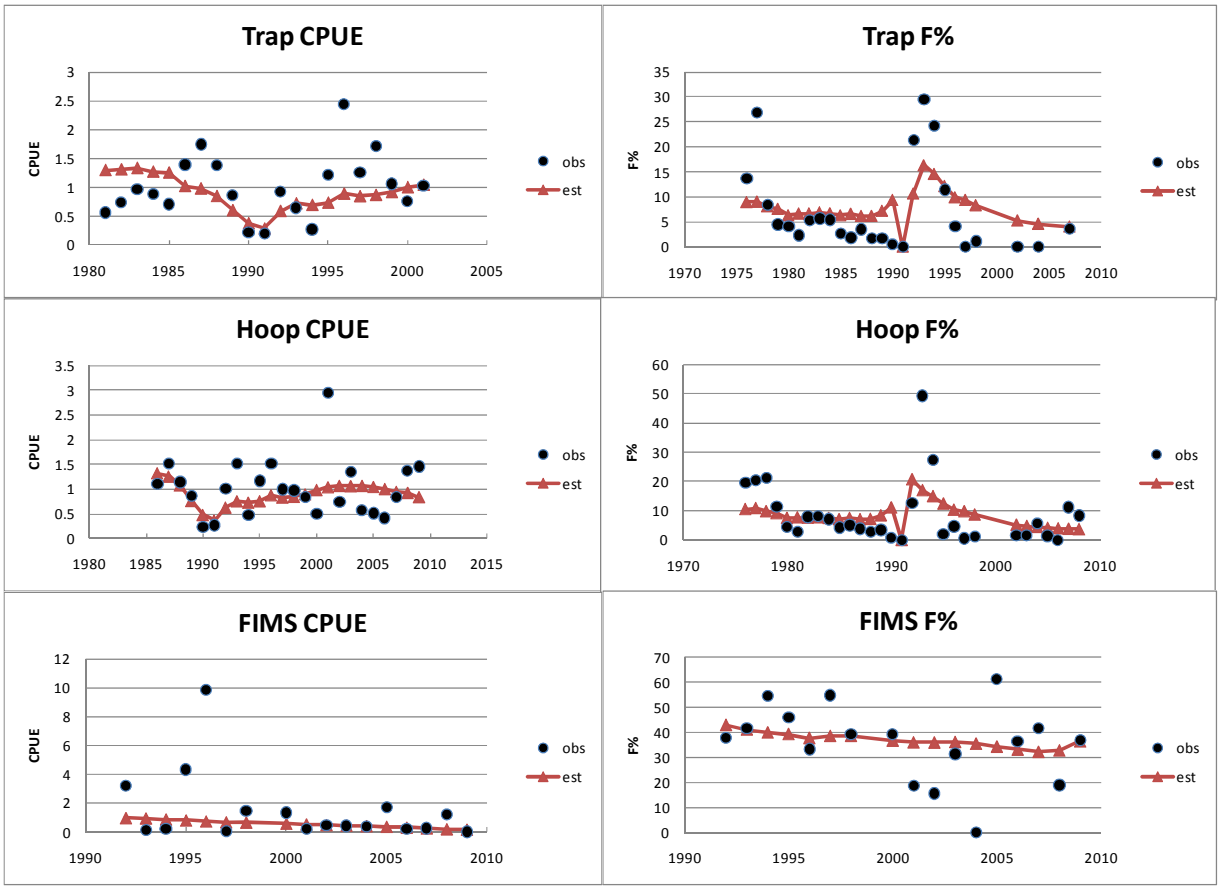


Figure 2c: A5+6 model fits to CPUE and *F*% "new variant".

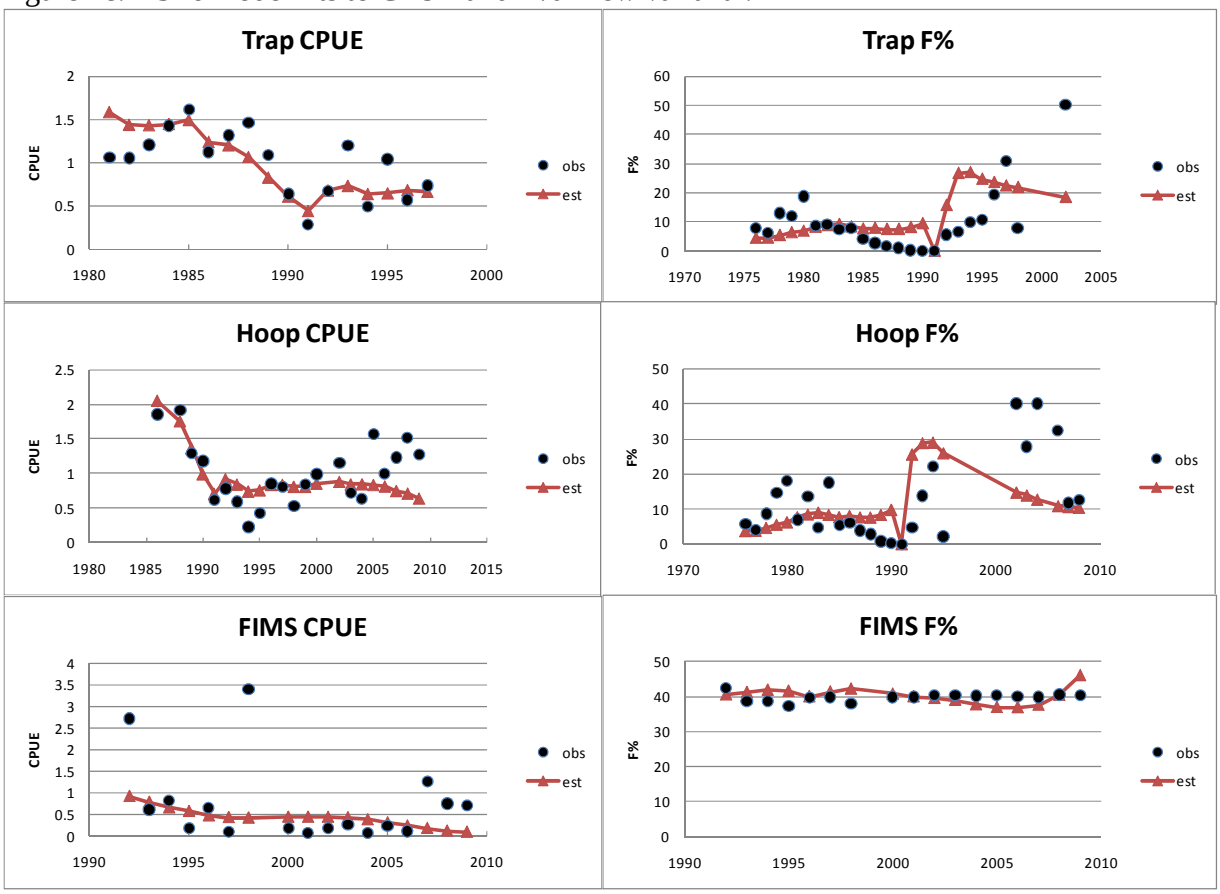


Figure 2d: A7 model fits to CPUE and *F*% “new variant”.

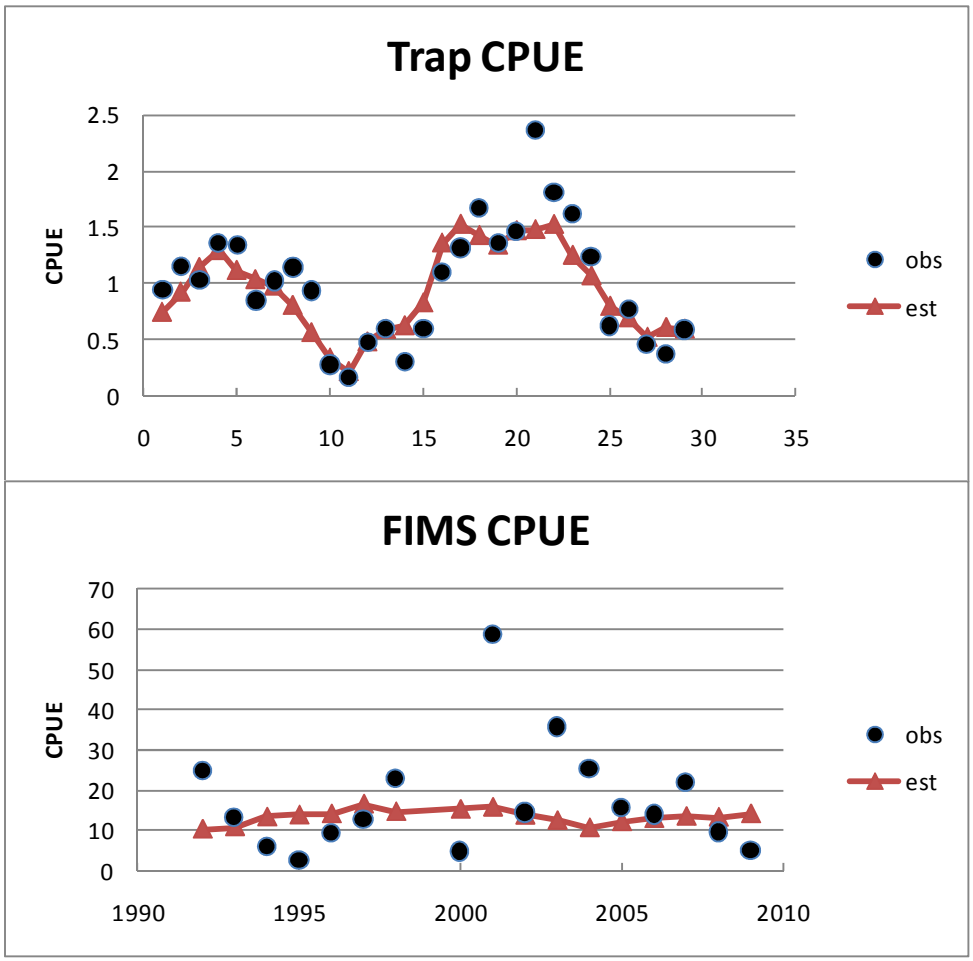


Figure 2e: A8 model fits to CPUE and *F*% “new variant”.

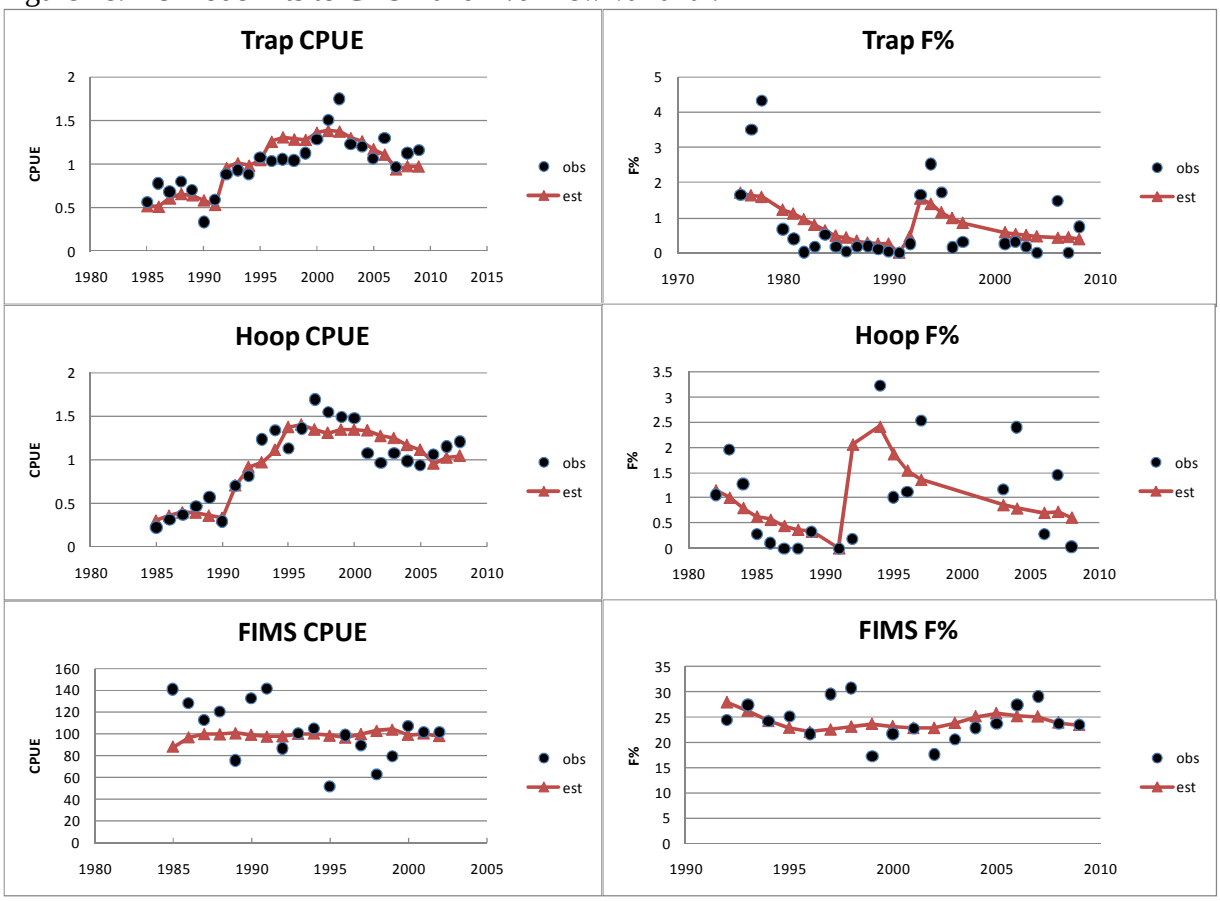


Figure 3a: A1+2 CAL (catch-at-length) residual bubble plots. [white = negative values i.e. model>obs] “new variant”.

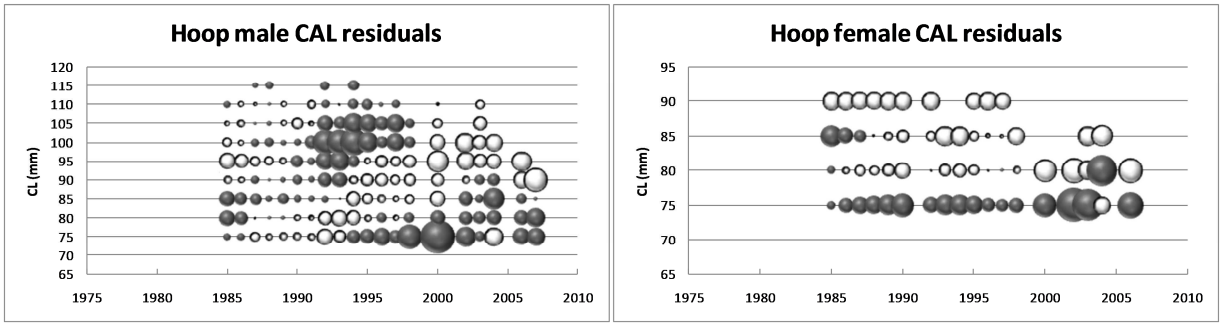


Figure 3b: A3+4 CAL (catch-at-length) residual bubble plots. [white = negative values i.e. model>obs] “new variant”.

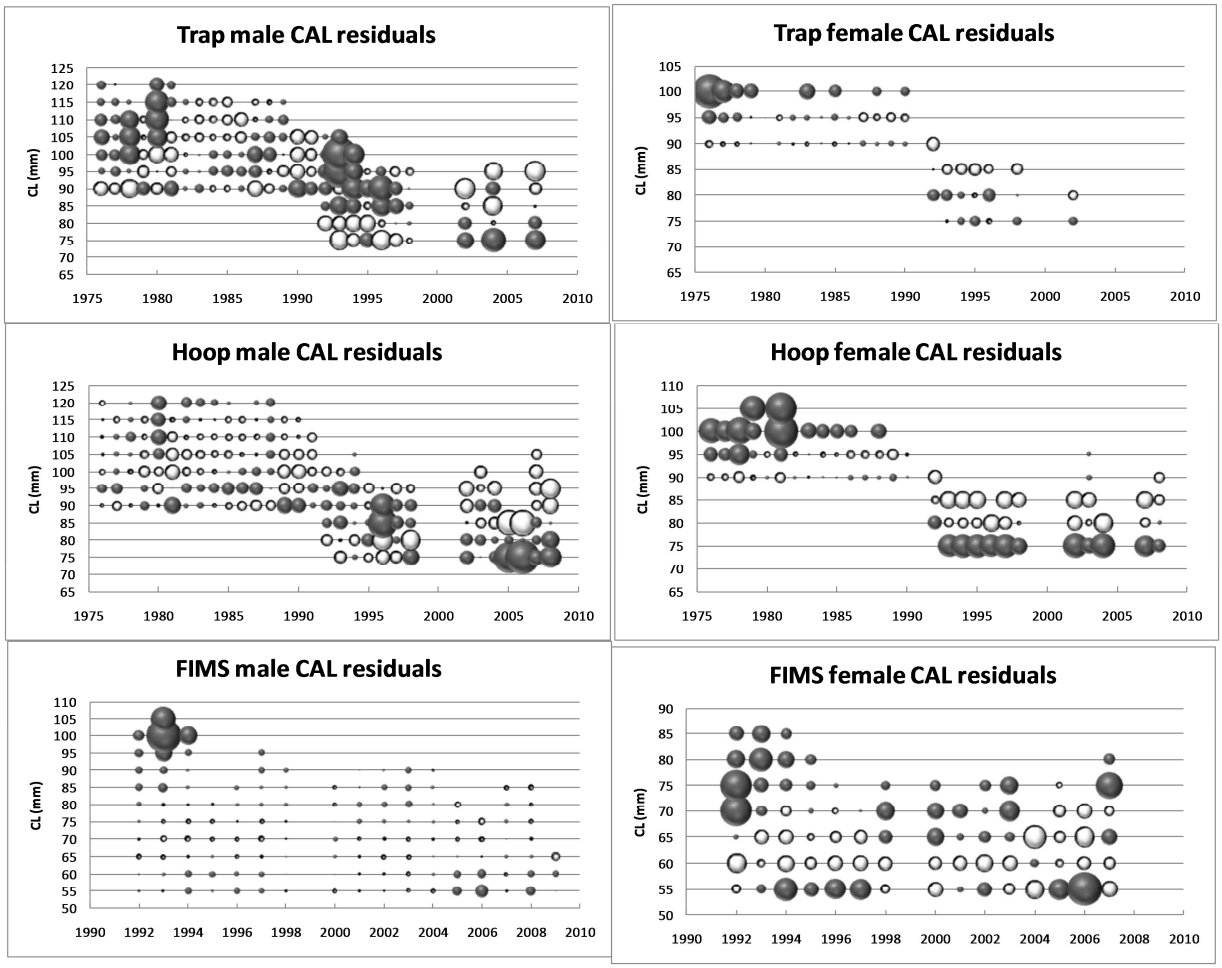


Figure 3c: A5+6 CAL (catch-at-length) residual bubble plots. [white = negative values i.e. model>obs] “new variant”.

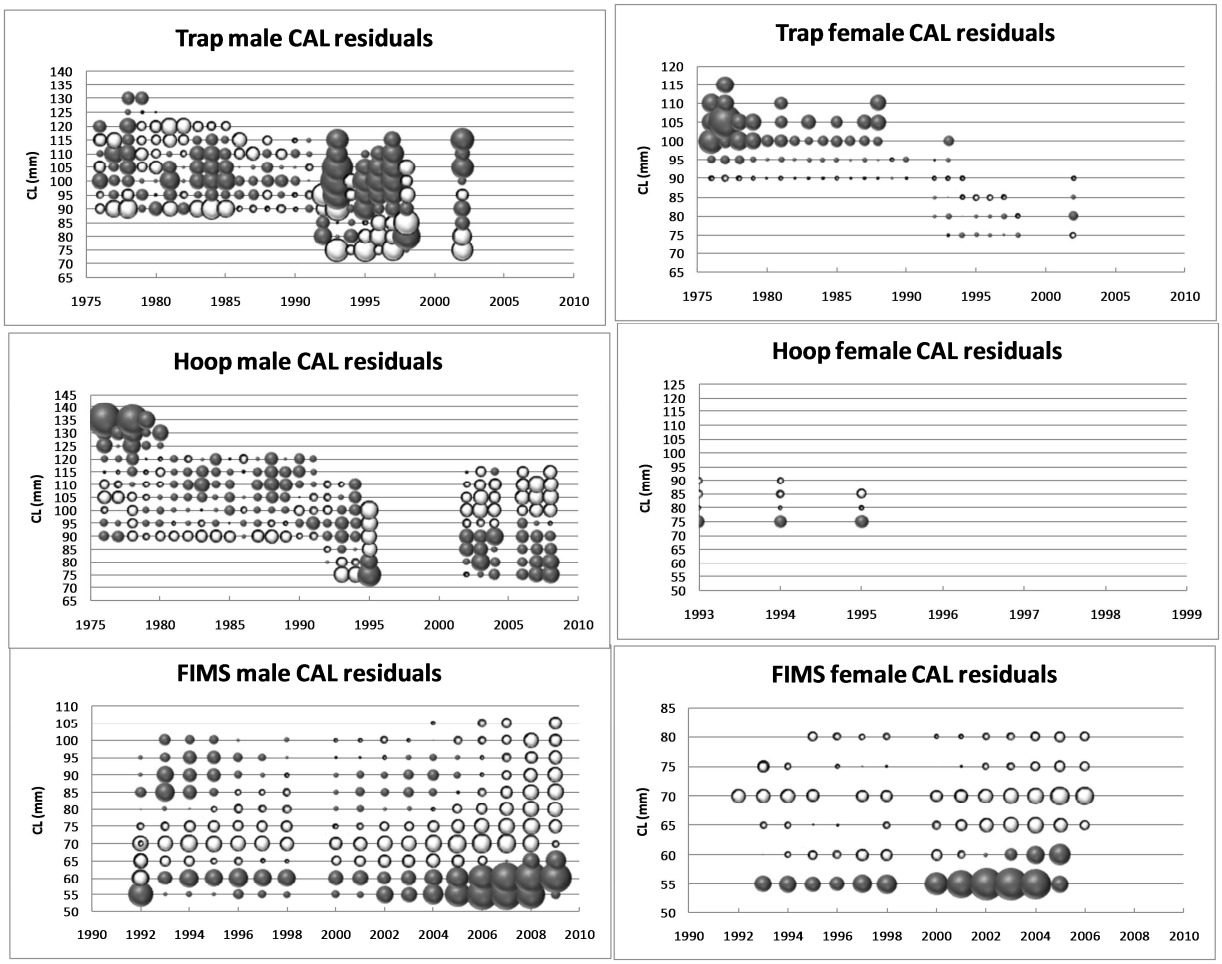


Figure 3d: A7 CAL (catch-at-length) residual bubble plots. [white = negative values i.e. model>obs] “new variant”.

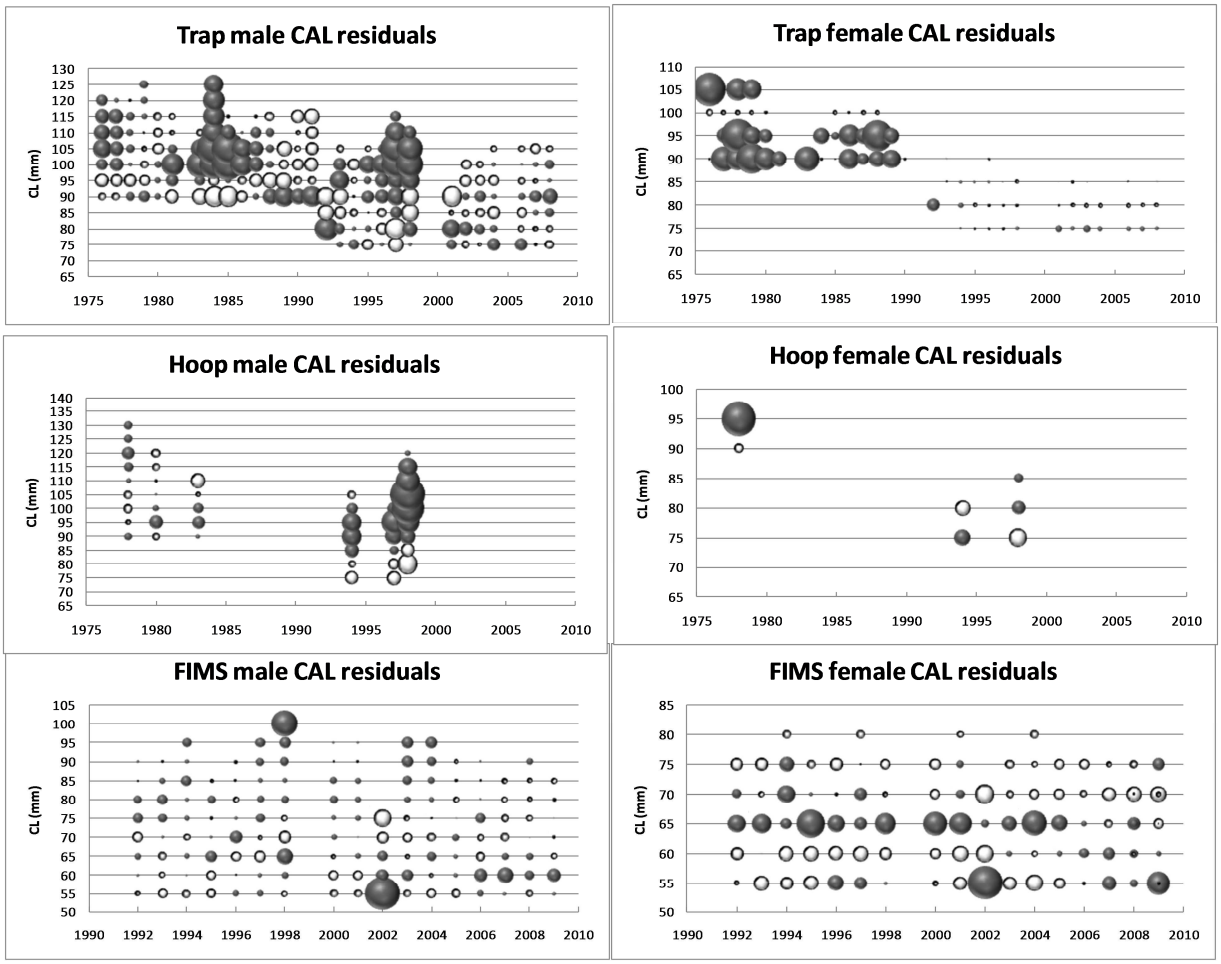


Figure 3e: A8 CAL (catch-at-length) residual bubble plots. [white = negative values i.e. model>obs] “new variant”.

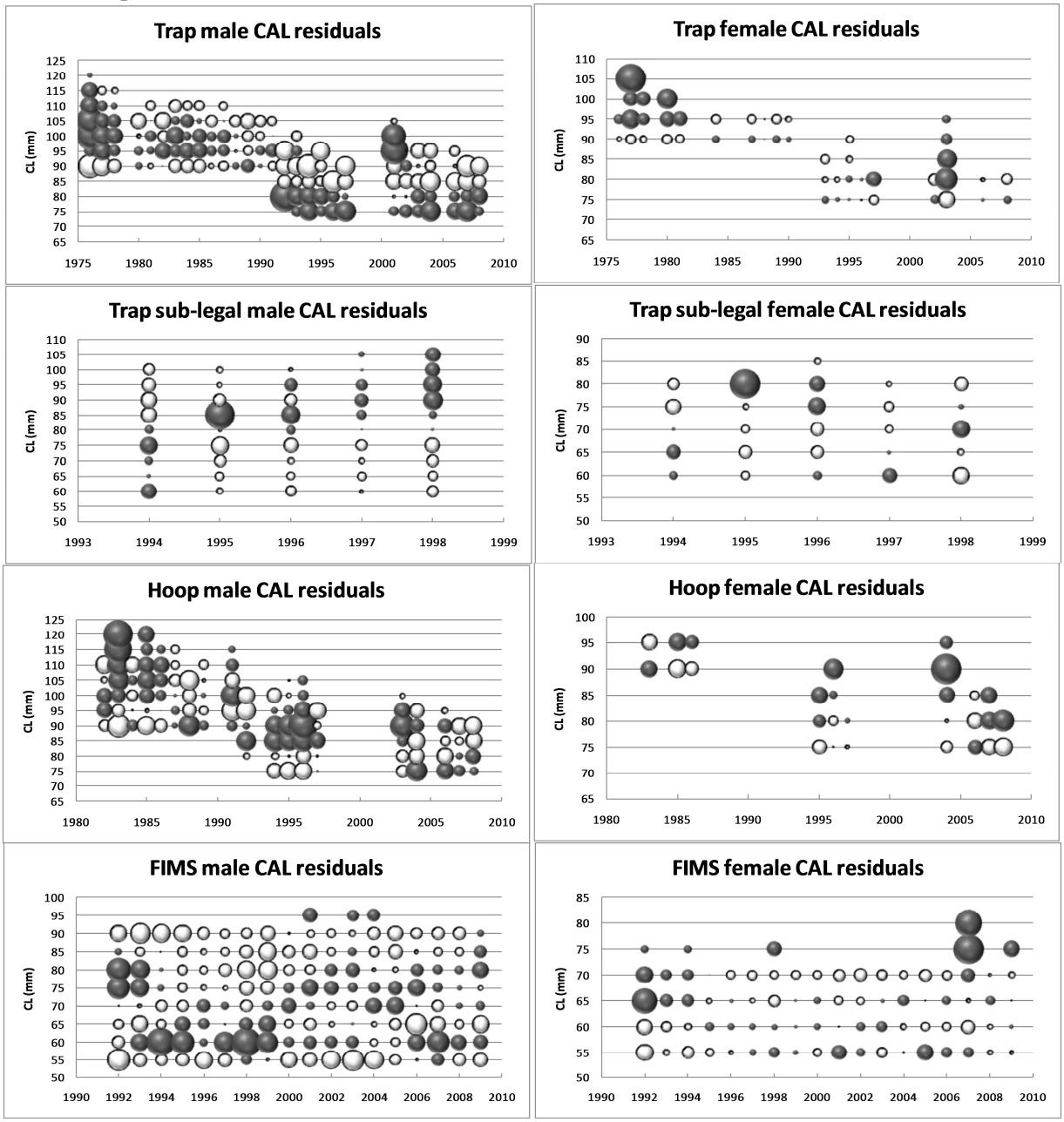


Figure 4a: A1+2 model estimates of egg production, B_{75} and recruitment levels relative to pristine "new variant". The RHS shows the 1980+ period only.

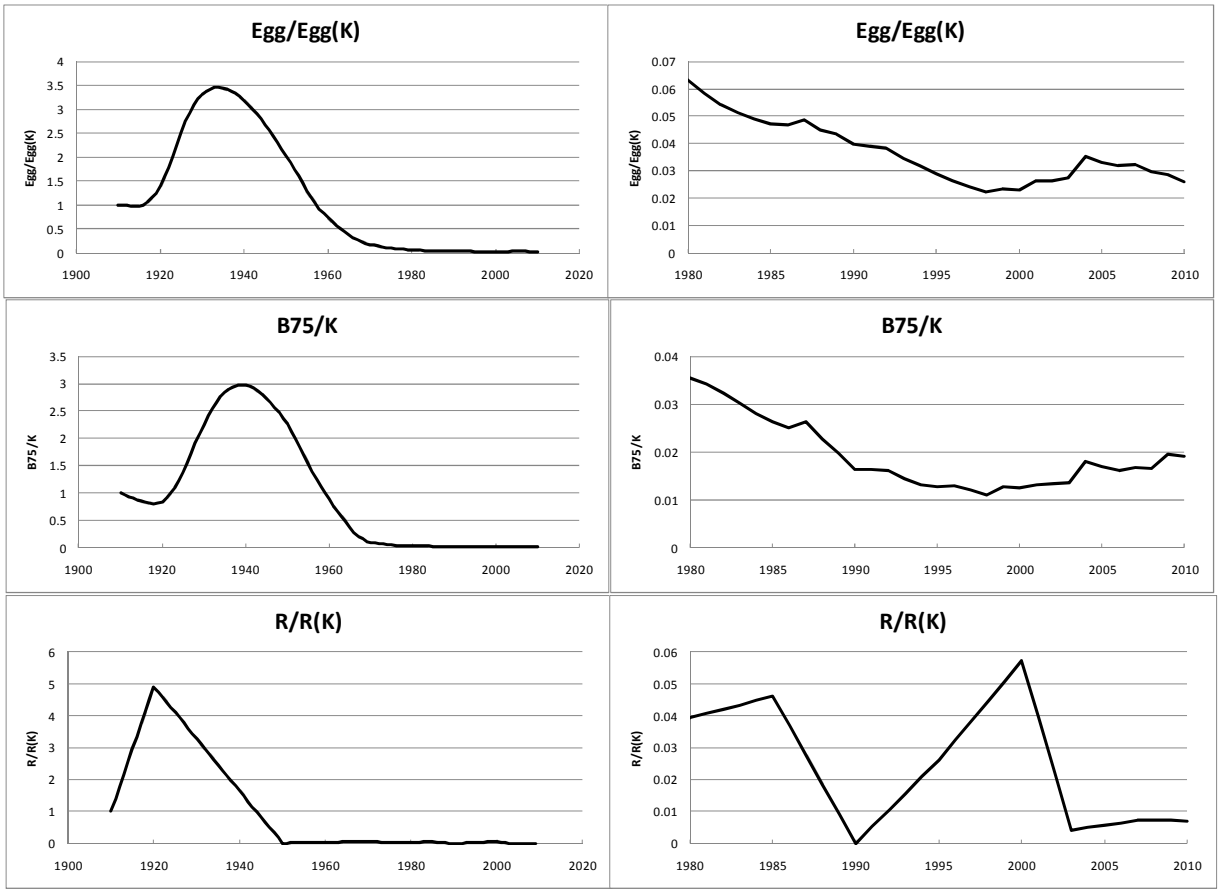


Figure 4b: A3+4 model estimates of egg production, B_{75} and recruitment levels relative to pristine "new variant".. The RHS shows the 1980+ period only.

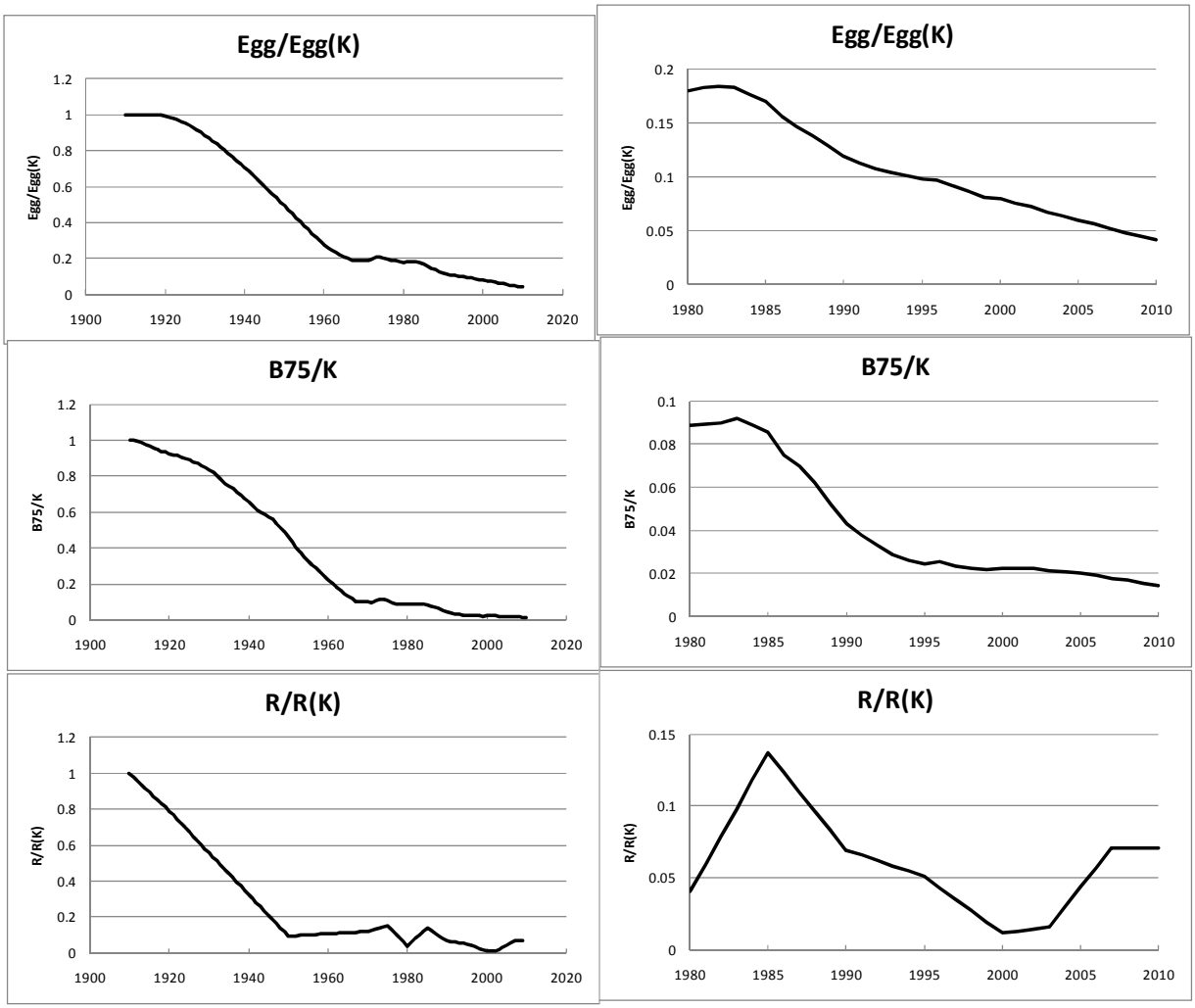


Figure 4c: A5+6 model estimates of egg production, B_{75} and recruitment levels relative to Pristine "new variant". The RHS shows the 1980+ period only.

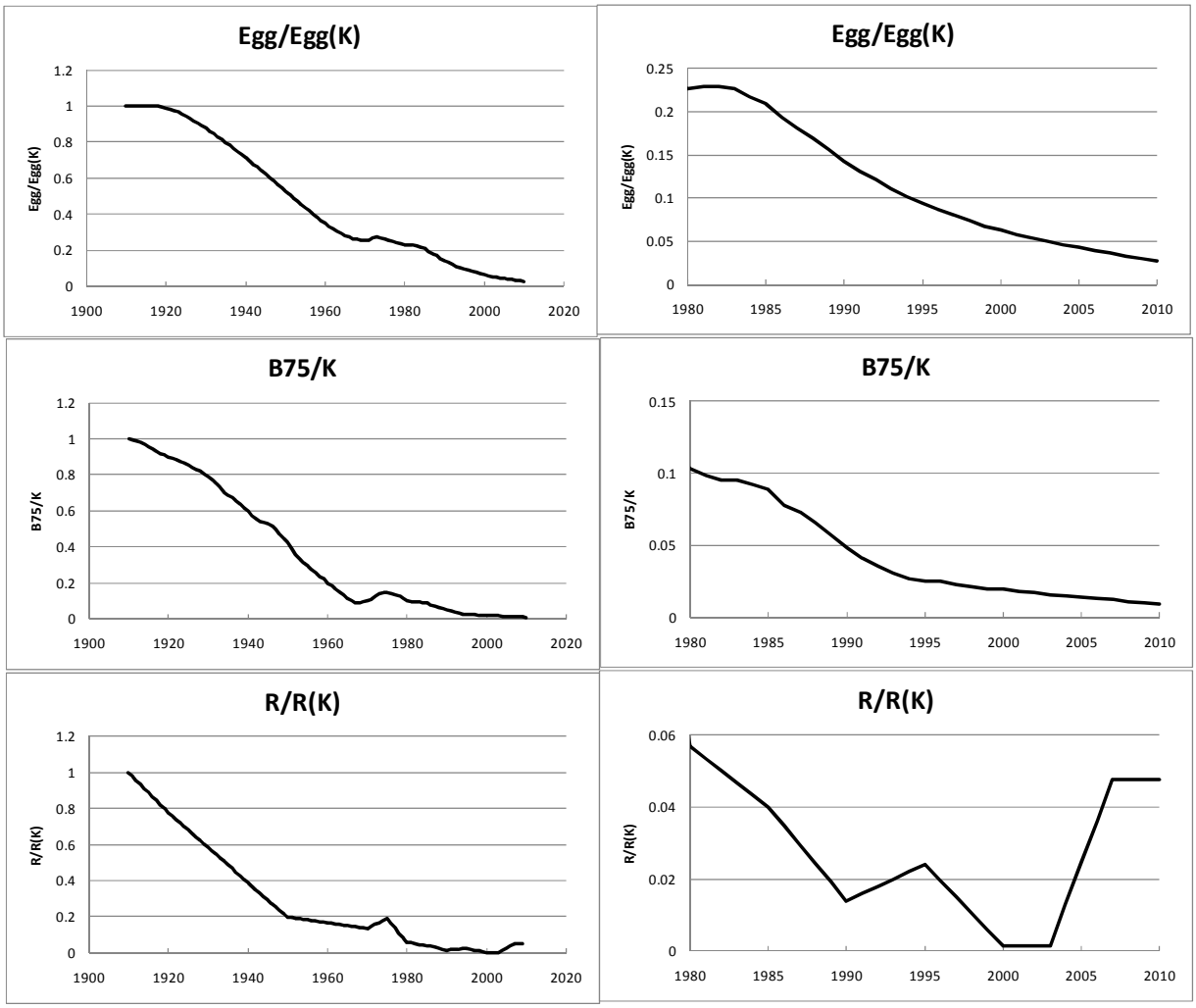


Figure 4d: A7 model estimates of egg production, B_{75} and recruitment levels relative to pristine "new variant". The RHS shows the 1980+ period only

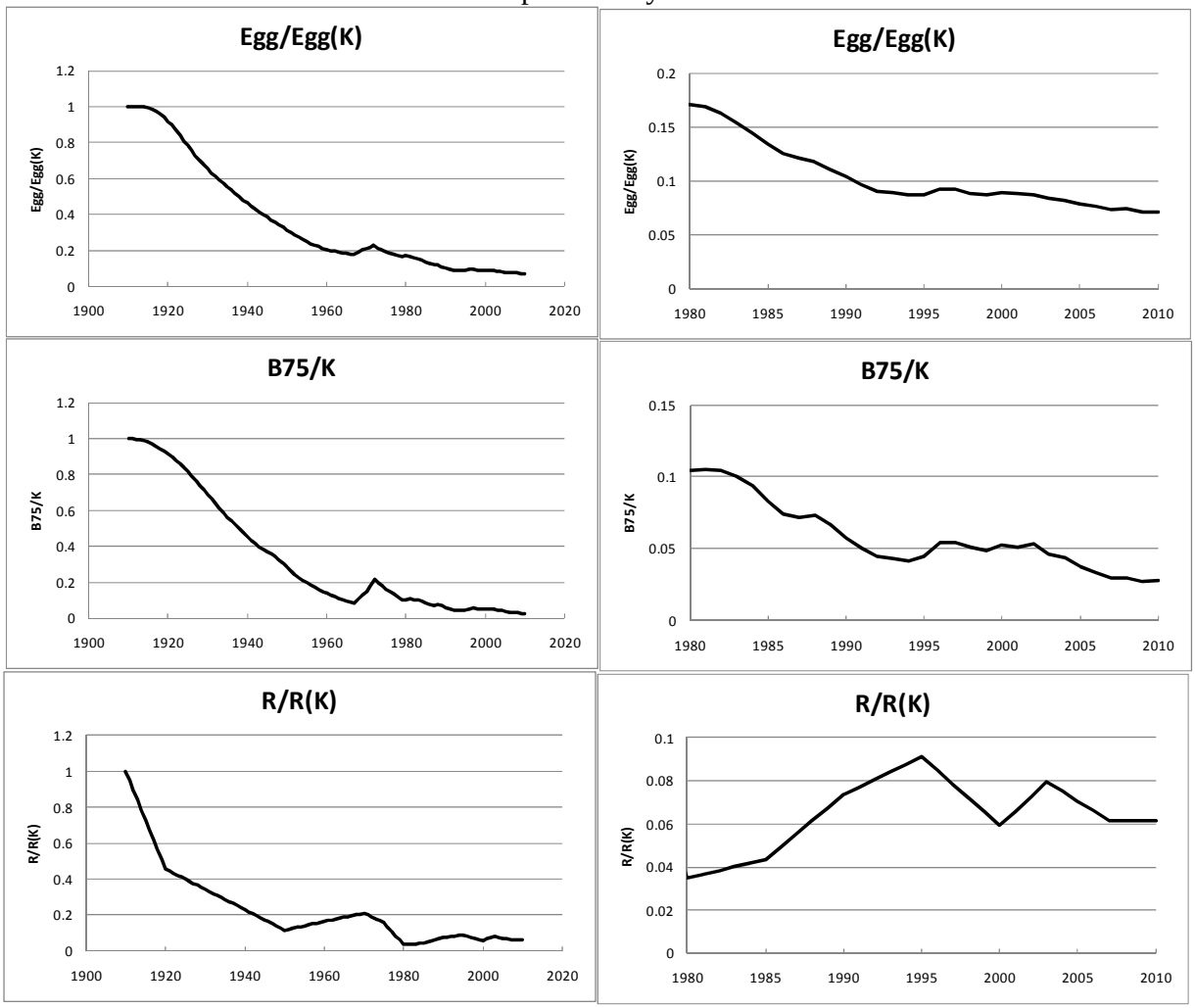


Figure 4e: A8 model estimates of egg production, B_{75} and recruitment levels relative to pristine "new variant". The RHS shows the 1980+ period only.

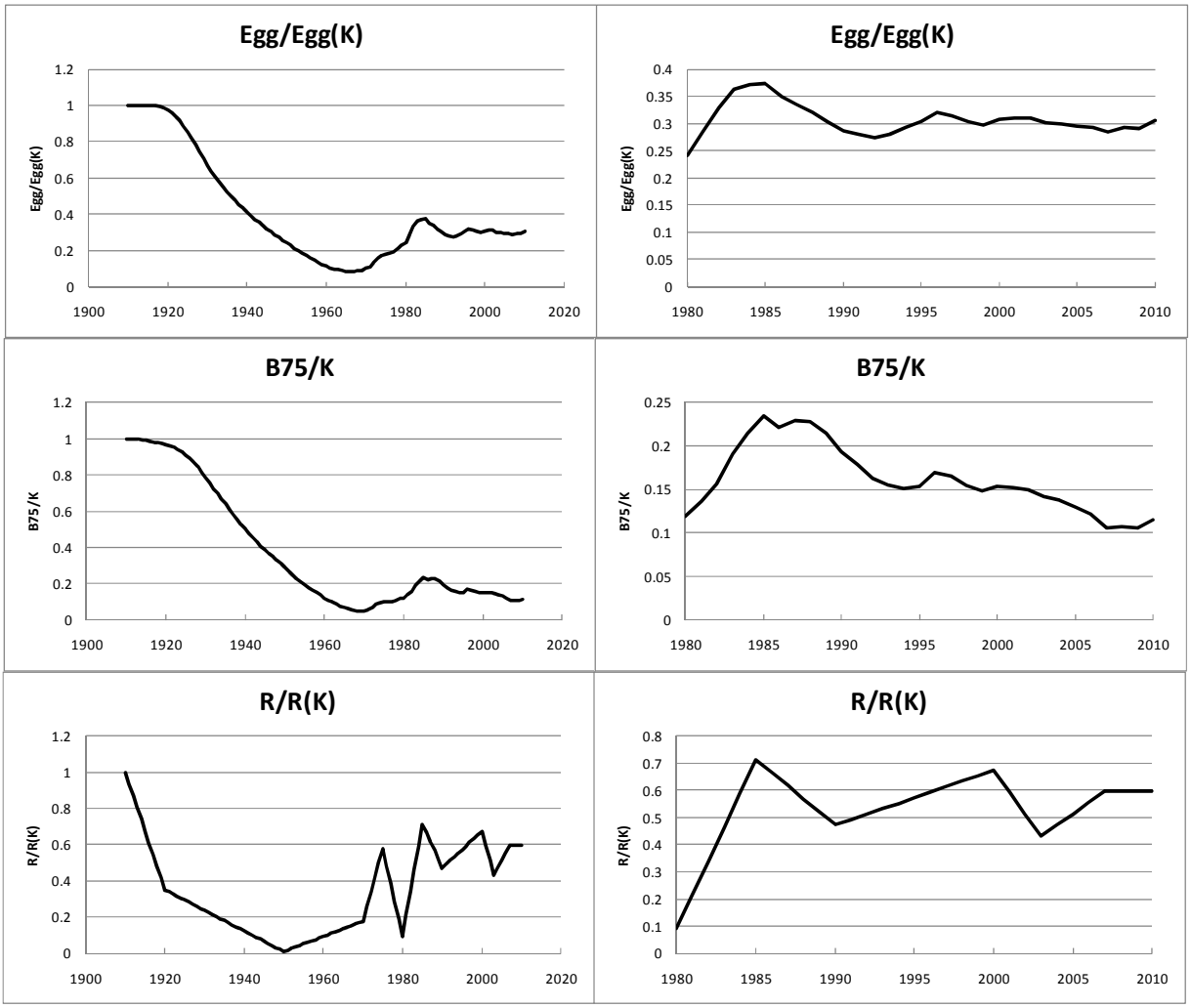
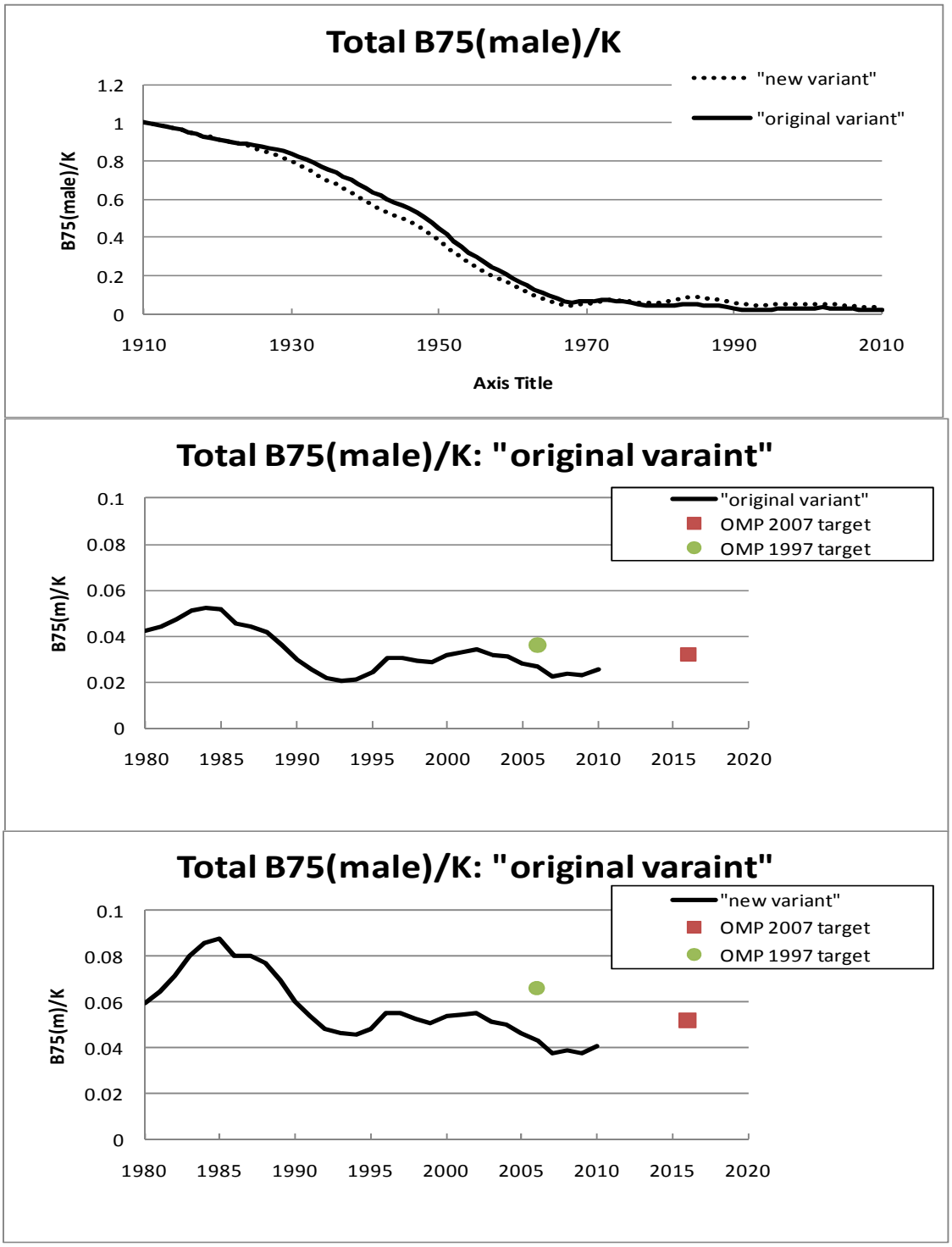


Figure 5: B_{75}(male) combined population trend for both the "new variant" and "original; variant" 2010 updated assessments. The single circle shows the intended OMP 1997 biomass recovery target, and the single square shows the OMP 2007 intended biomass recovery target.



Appendix

Further outputs for a re-look at the "original" model fits for Area 5+6 and some further plots of combined resource estimates

Figure A1: Fits to CPUE and F% ("n" refers to the new variant, and "o*" refers to the updated original model variant.

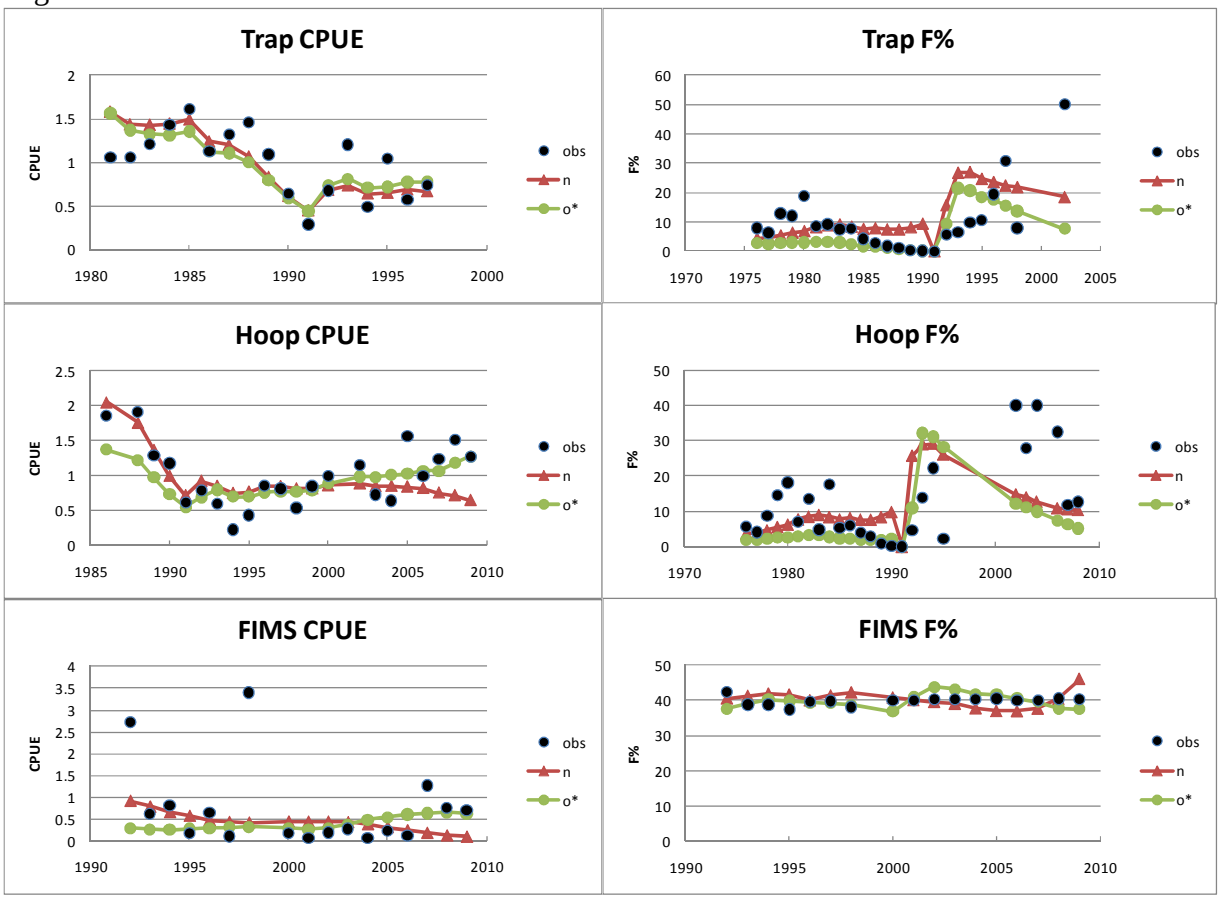


Figure A2; Area 5+6 “o*” population trends. The right panel is a 1980+ “zoom in”.

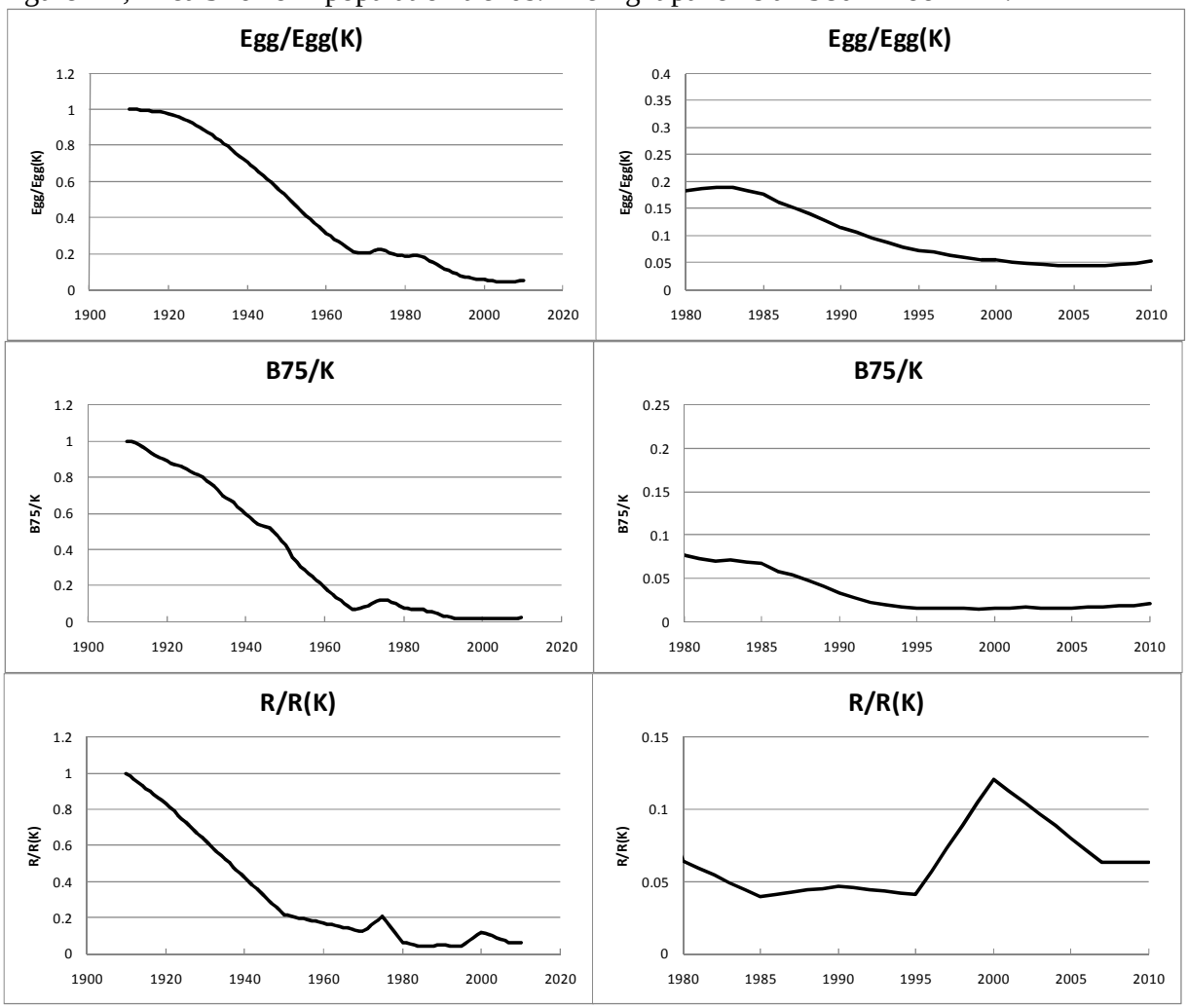


Figure A3a: B_{75}^{m} trends for all five super-areas and the combined resource for the 2010 updated assessments using the "original" model variant. The right panel is a 1980+ "zoom in".

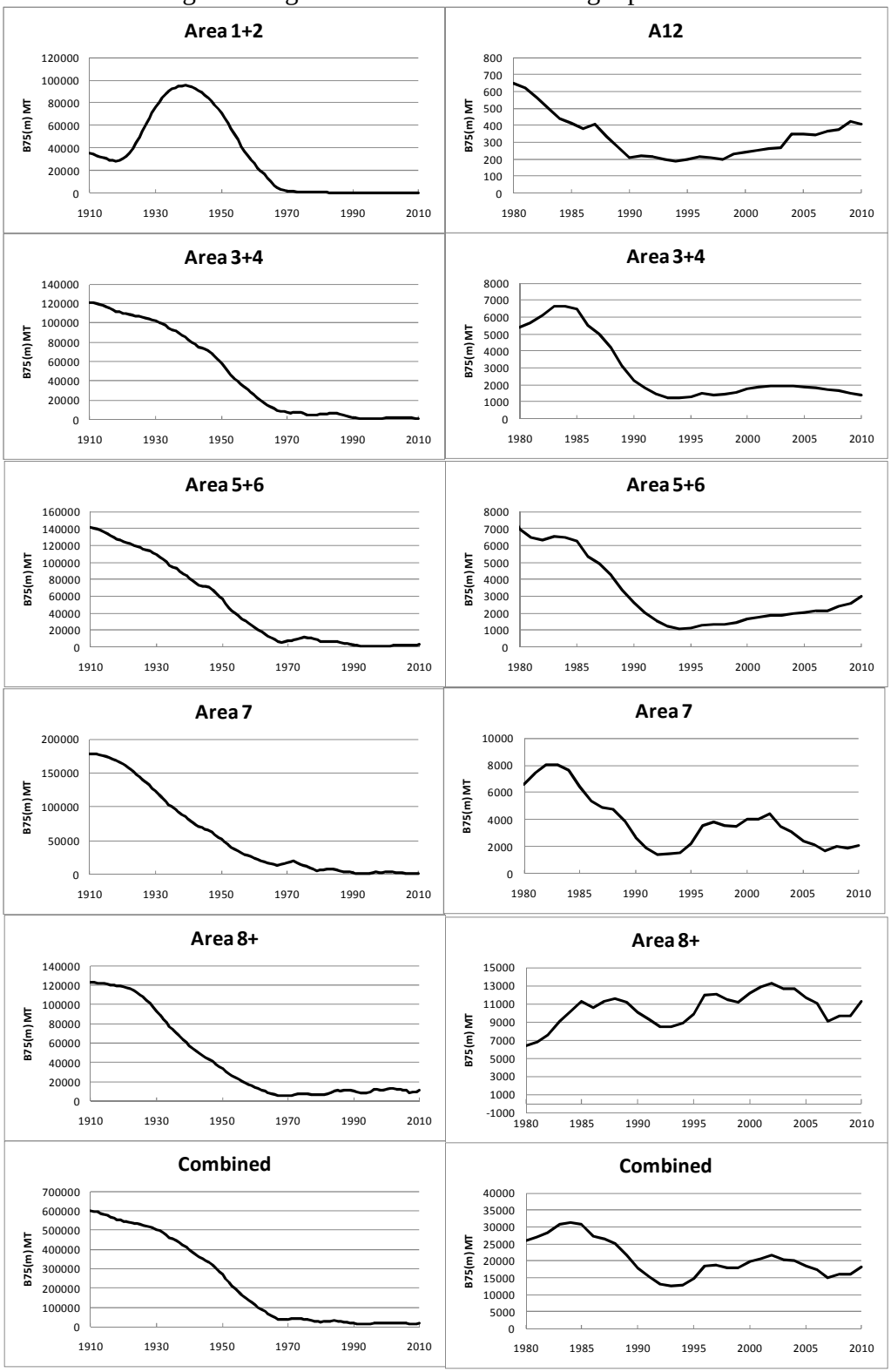


Figure A3a: B_{75}^{m}/K trends for all five super-areas and the combined resource for the 2010 updated assessments using the "original" model variant. The right panel is a 1980+ "zoom in".

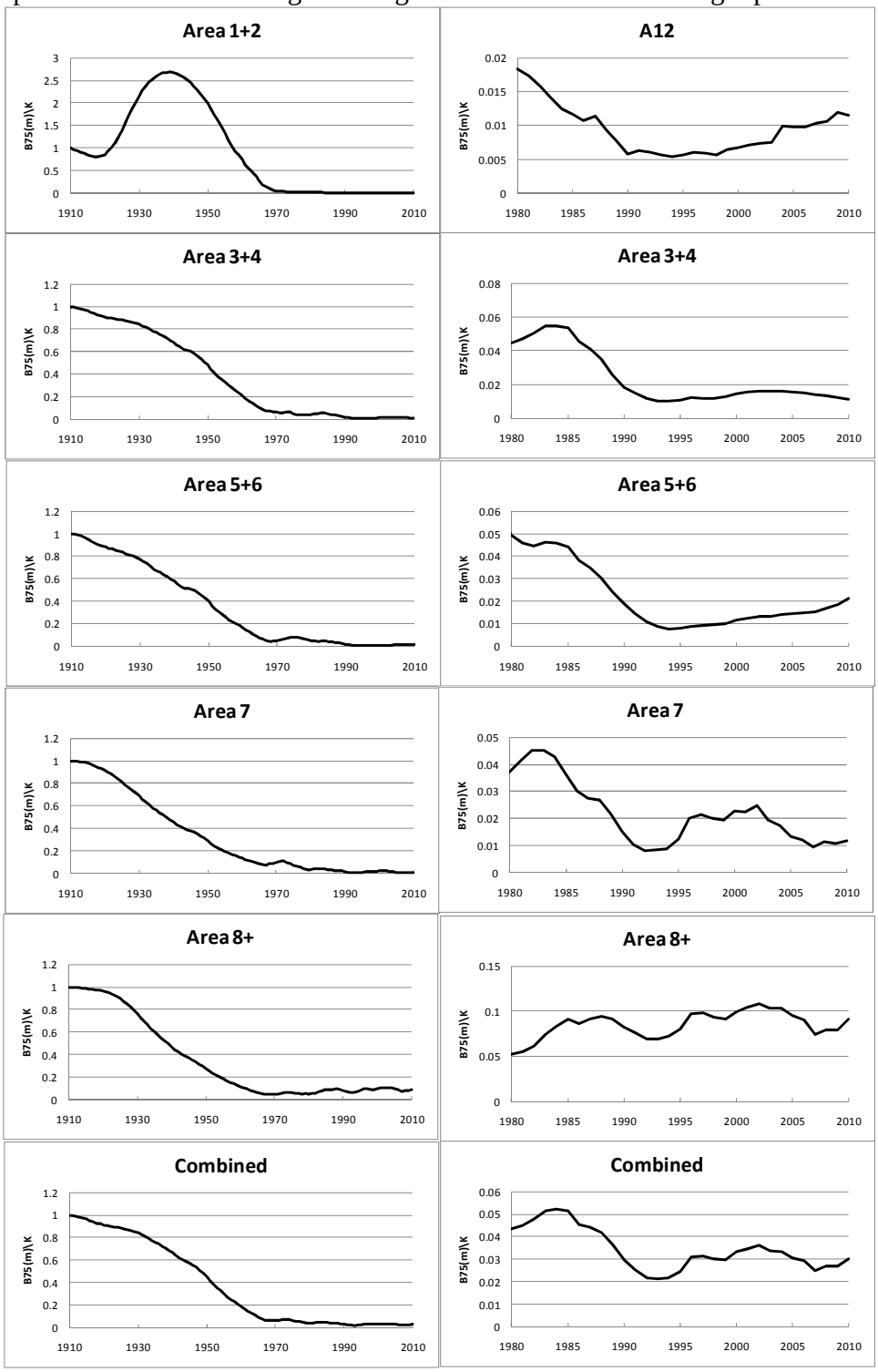


Figure A3c: Comparison of B_{75}^{m} and B_{75}^{m}/K trends for all five super-areas for the 2010 updated assessments using the "original" model variant. The right panel is a 1980+ "zoom in".

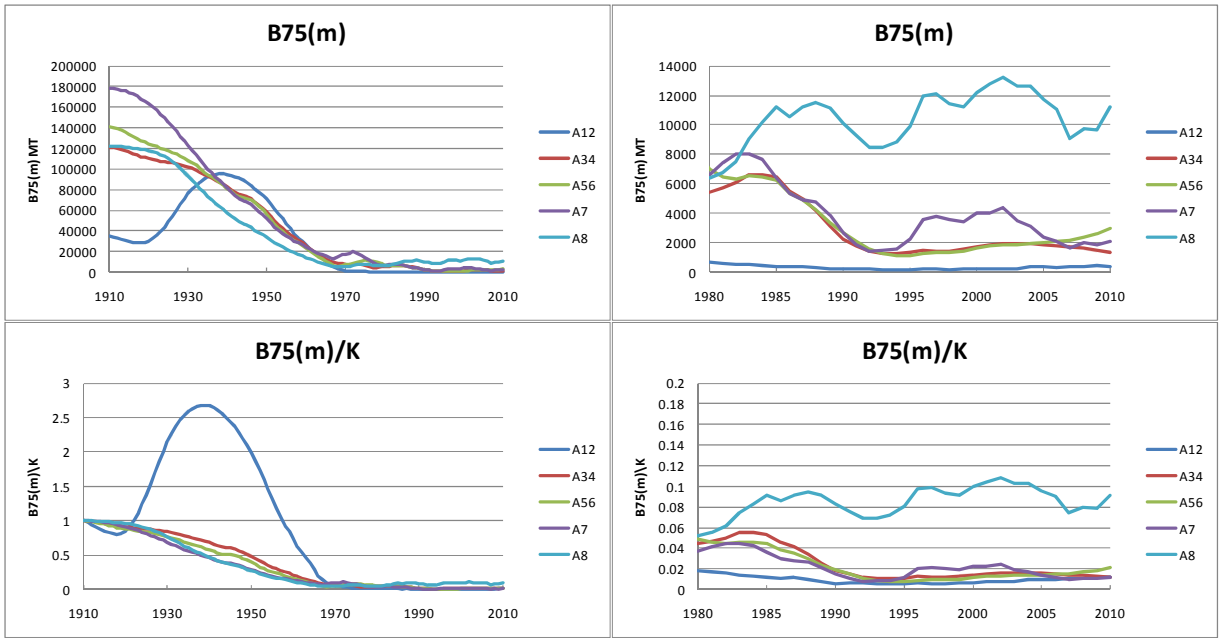


Figure A4: Comparison between the "new" and "original" model variants combined B_{75}^{m}/K trends. The bottom plot is the 1980+ "zoom in".

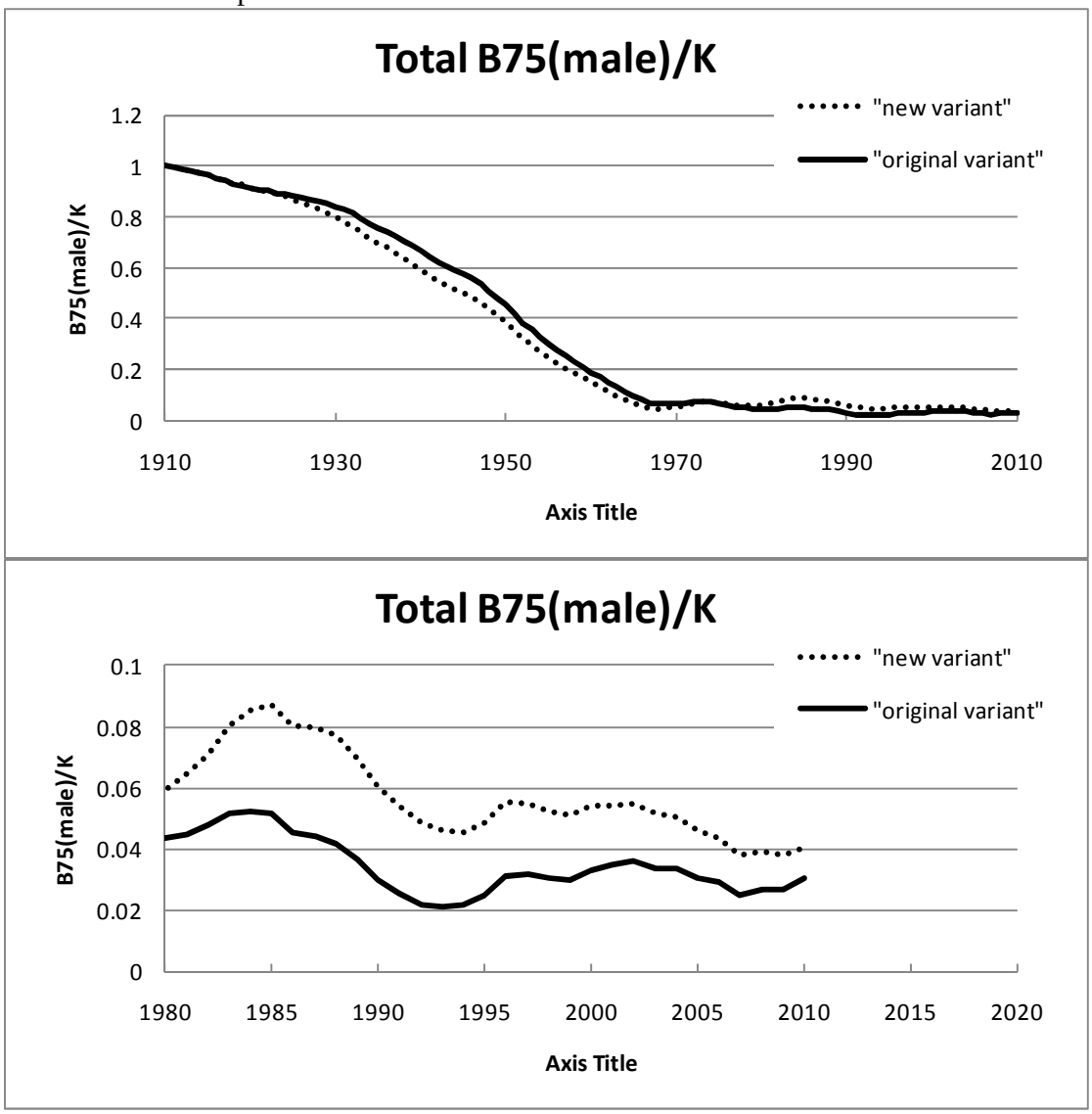


Figure A5: The combined B_{75}^{m}/K trend relative to the unexploited level (K). The green circle shows the intended biomass recovery target level for OMP 1997, and the red square shows the intended biomass recovery target for OMP 2007.