Updated operating model results for Inaccessible islands using an age-structured production model approach.

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Note: Results presented in this document are updated results from those presented in MARAM/TRISTAN/2011/Feb/03. The updates include:

- Two further years of catch-at-length data (2008 and 2009) supplied by James Glass (pers. commn).
- One further year of catch data for the 2010/2011 season of 105 MT. The 2009/2010 catch value was adjusted slighted from 110 MT to 109.954 MT to reflect the true catch taken that season.
- Recruitment residuals are estimated for two further years and are now estimated for 1992-2005 period (the further data have allowed for further recruitment residuals to be estimated).

Two alternate RC models have been selected. For both, the most recent value of the fishing proportion F_{2009} is set equal to 0.3. As this is a somewhat arbitrary selection, two sensitivity models are reported for alternate values of F_{2009} of 0.2 (SEN1) and 0.4 (SEN2). Lower values of F_{2009} produced poor fit to due (evident in the much higher negative log likelihood value), and higher values of F_{2009} produced unrealistically high values of fishing proportion in earlier years.

- **RC1**: The relative weights of GLMM-standardised longline CPUE and CAL data in the –lnL function are **1.0** and 0.1 respectively.
- **RC2**: The relative weights of GLMM-standardised longline CPUE and CAL data in the –lnL function are **5.0** and 0.1 respectively, i.e. the CPUE data are up-weighted compared to RC1.

RC2 is included to provide a scenario that reflects a recent decline in CPUE more closely.

Results

Figure 1 shows the observed average size of the catch (in mm CL) of male and female lobsters from Inaccessible, as well as the percent females in the catch (by number). It is clear from these plots that there does appear to be a trend of decreasing size in the catch for both males and females since around 2005 to 2009.

Figure 2 shows the 2007, 2008 and 2009 observed catch-at-length frequencies for males and females (three most recent years for which data are available).

Figures 3a-c report model fits for RC1 and its two associated sensitivity analyses, and Figures 4a-c report model fits for RC2 and its two associate sensitivity analyses.

Figures 5a and b show the estimated exploitable biomass trends from each of the two RC models compared to the standardised longline CPUE trend (to which the models are fitted) as well as to nominal powerboat CPUE trend which is shown for comparative purposes only. The powerboat CPUE data are not included in the likelihood for the model fit as they pertain to only a small part of the areal distribution of the resource, though it is of interest that they do not show as steep an earlier increase or a recent decline as the longline CPUE, and appear more consistent with RC1.

Figure 4 shows the catch-at-length data for each of the three most recent years for which the data are available (2007, 2008 and 2009). These data appear to show a shift towards smaller lobster particularly for the males, and the relative proportion of females caught in 2009 appears to be much higher than for the previous two years.

Figures 6a and b show the RC1 and RC2 model fits to the 2007-2009 catch-at-length data (the three most recent years for which data are available). Whilst the models reported here appear to fit on average the catch-at-length data well, from these plots it is clear that the fit degenerates for data for more recent years for which the observed trend shows an increase in smaller lobsters.

Table 1: RC1 and RC2 model results with the associated sensitivity model results. (Shaded blocks show fixed model parameters.)

	RC1 (CPUE*1.0)			RC2 (CPUE*5.0)		
	RC1	**SEN1**	**SEN2**	**RC2**	**SEN1**	**SEN2**
	F_{2009}=0.3	**F_{2009}=0.2**	**F_{2009}=0.4**	**F_{2009}=0.3**	**F_{2009}=0.2**	**F_{2009}=0.4**
K	1188	1563	1035	1211	1661	987
h	1.00	1.00	0.993	1.00	0.998	0.999
M	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
σ_{length}	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
F_{2009} fixed at	**0.3**	**0.2**	**0.4**	**0.3**	**0.2**	**0.4**
Male selectivity μ	0.028	0.03	0.028	0.044	0.051	0.036
Female selectivity μ	0.172	0.17	0.176	0.176	0.180	0.176
θ	0.304	0.27	0.328	0.293	0.254	0.347
L_{∞}^{m}	125	125	125	125	125	125
L_{∞}^{f}	90	90	90	90	90	90
-lnL CPUE	-11.44	-10.45	-12.41	-16.23	-15.64	-16.51
-lnL CAL	-36.87	-35.30	-36.91	-10.10	-0.22	-22.50
-lnL total	-13.94	-12.96	-14.79*	-70.27	-65.47	-74.25
SR1	1.84	1.68	1.98	12.55	13.44	11.13
Bsp(1990)/Ksp	0.27	0.24	0.29	0.26	0.23	0.31
Bsp(2010)/Ksp	0.84	0.85	0.82	0.88	0.89	0.87
Bsp(2011)/Ksp	0.88	0.90	0.86	0.91	0.91	0.90
Bsp(2010)/Bsp(1990)	3.08	3.54	2.81	3.37	3.92	2.81
Bsp(2011)/Bsp(1990)	3.24	3.72	2.94	3.49	4.03	2.91
Bexp(2010)/Bexp(1990)	2.11	3.06	1.59	2.85	3.96	1.83
Program (ifitall.tpl)	Vn03.rep	Vn02.rep.rep	Vn04.rep	In03.rep	In02.rep	In04.rep

Figure 1: The observed mean catch-at-length of male and female lobsters from Inaccessible, and the percent females in the catch (by number).

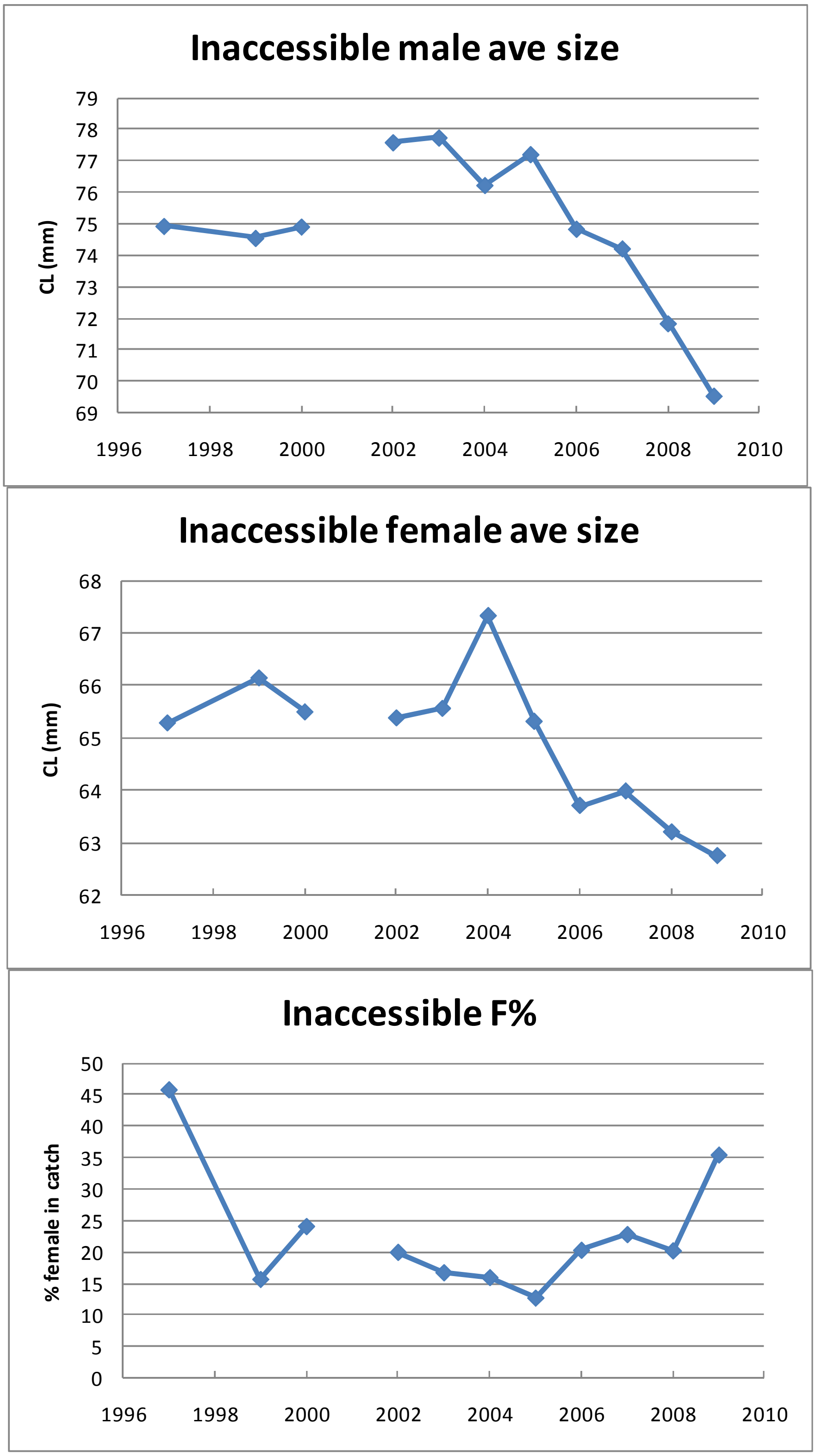

Figure 2: The 2007, 2008 and 2009 observed catch-at-length frequencies (three most recent years for which data are available).

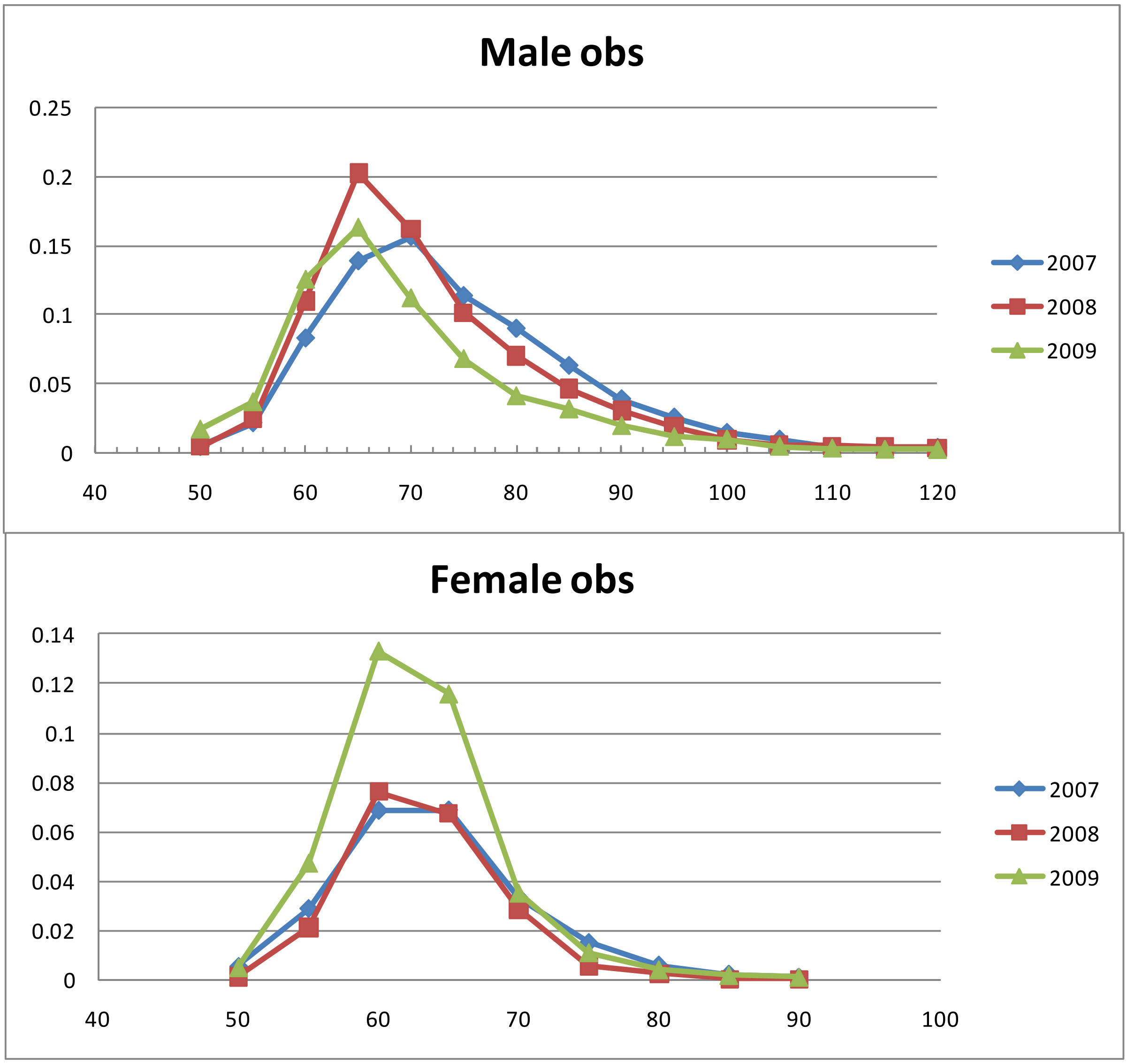

Figure 3a: RC1 (F_{2009}=0.3). Note that CPUE here and in Figure 2 refers to the longline CPUE.

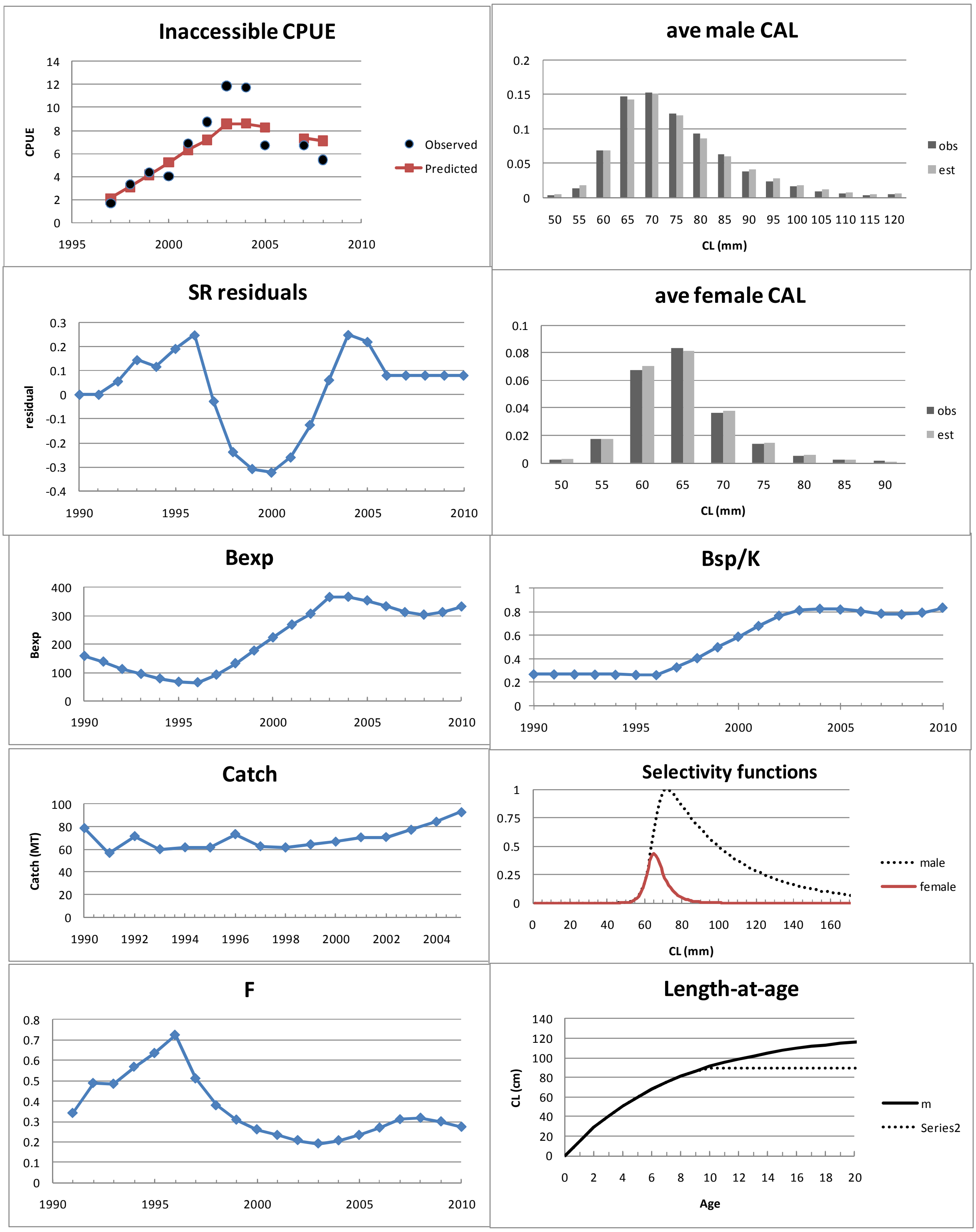

Figure 3b: RC1 SEN1 (F_{2009}=0.2)

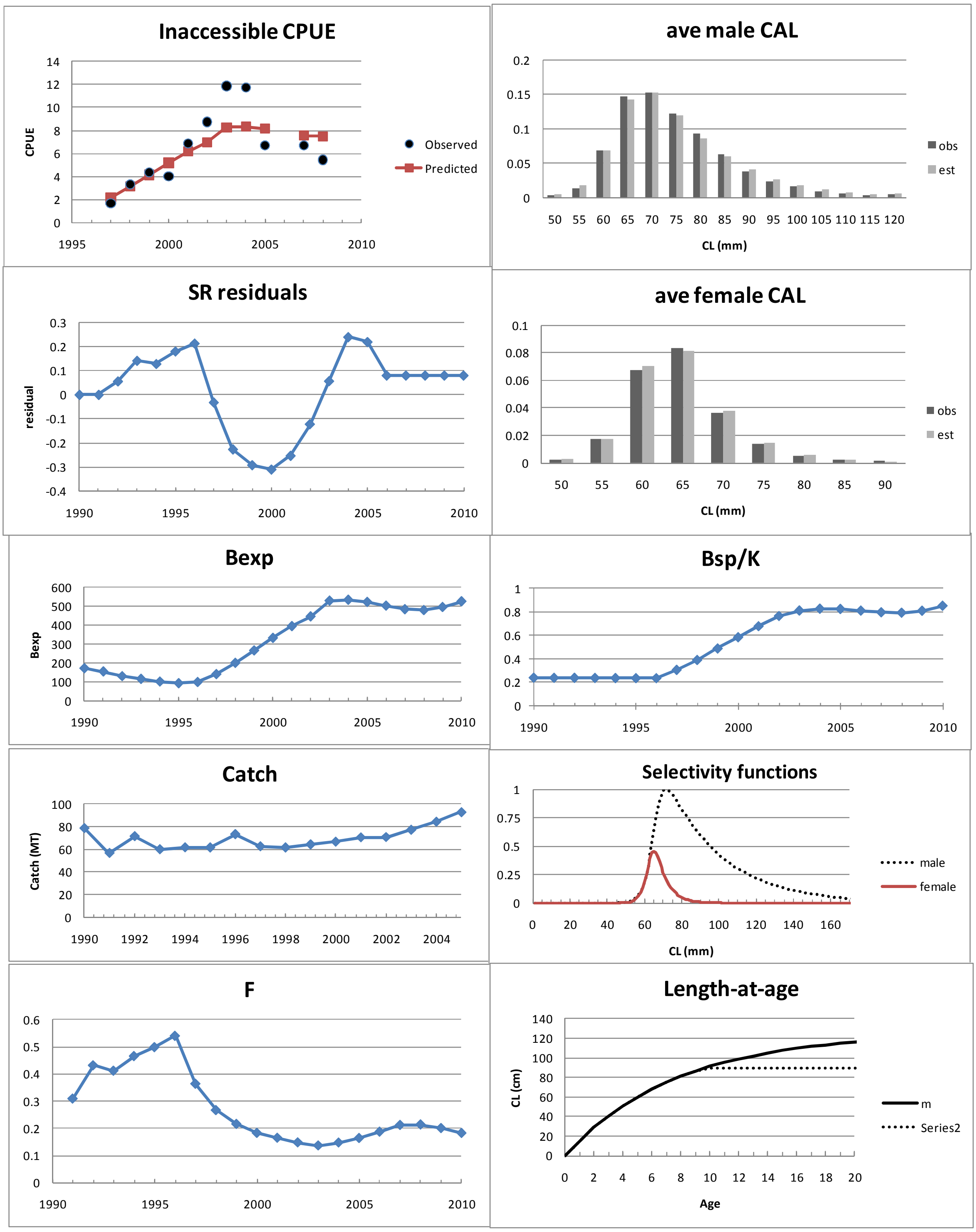

Figure 3c: RC1 SEN2 (F_{2009}=0.4)

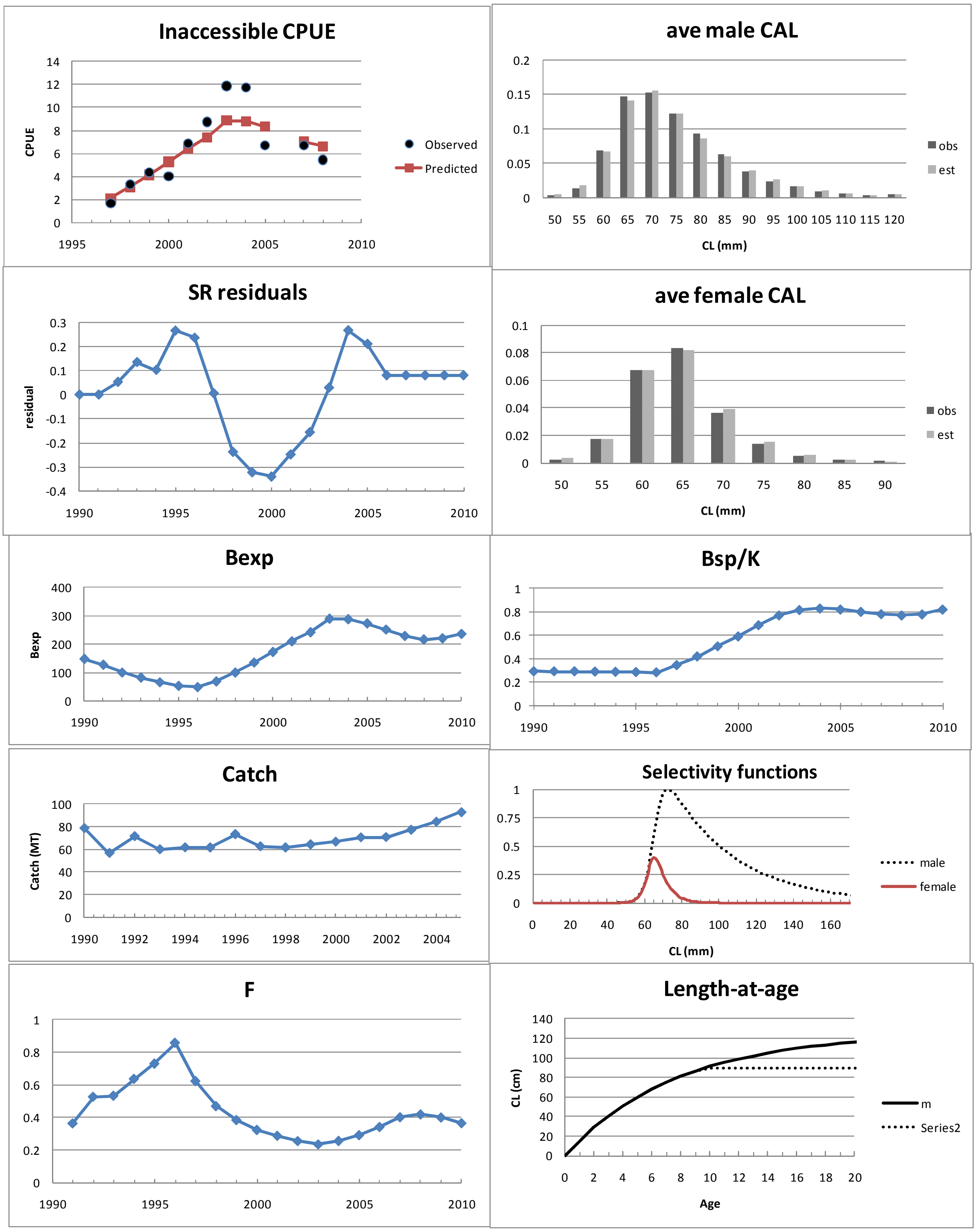

Figure 4a: RC2 (F_{2009}=0.3)

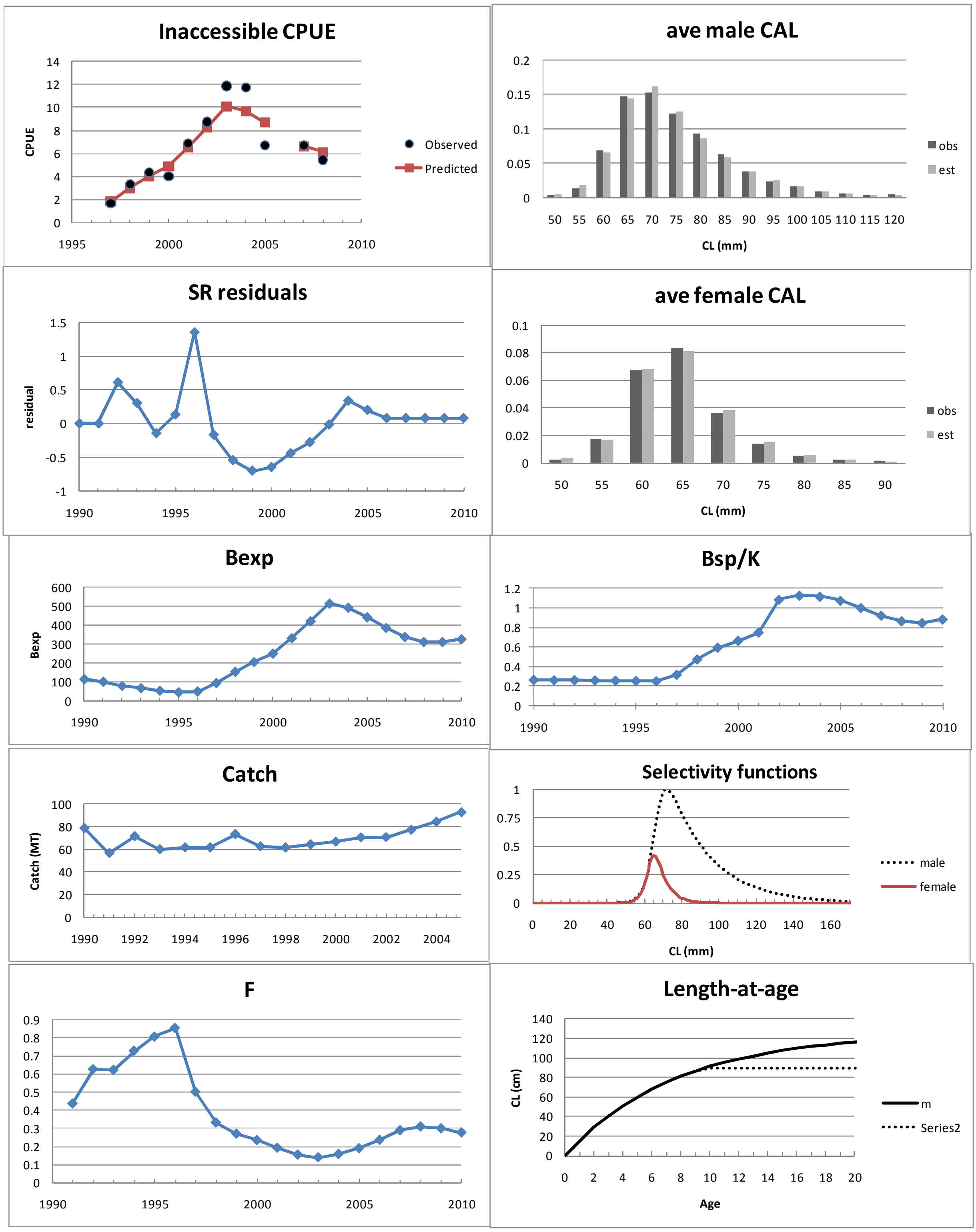

Figure 4b: RC2 SEN1 (F_{2009}=0.2).

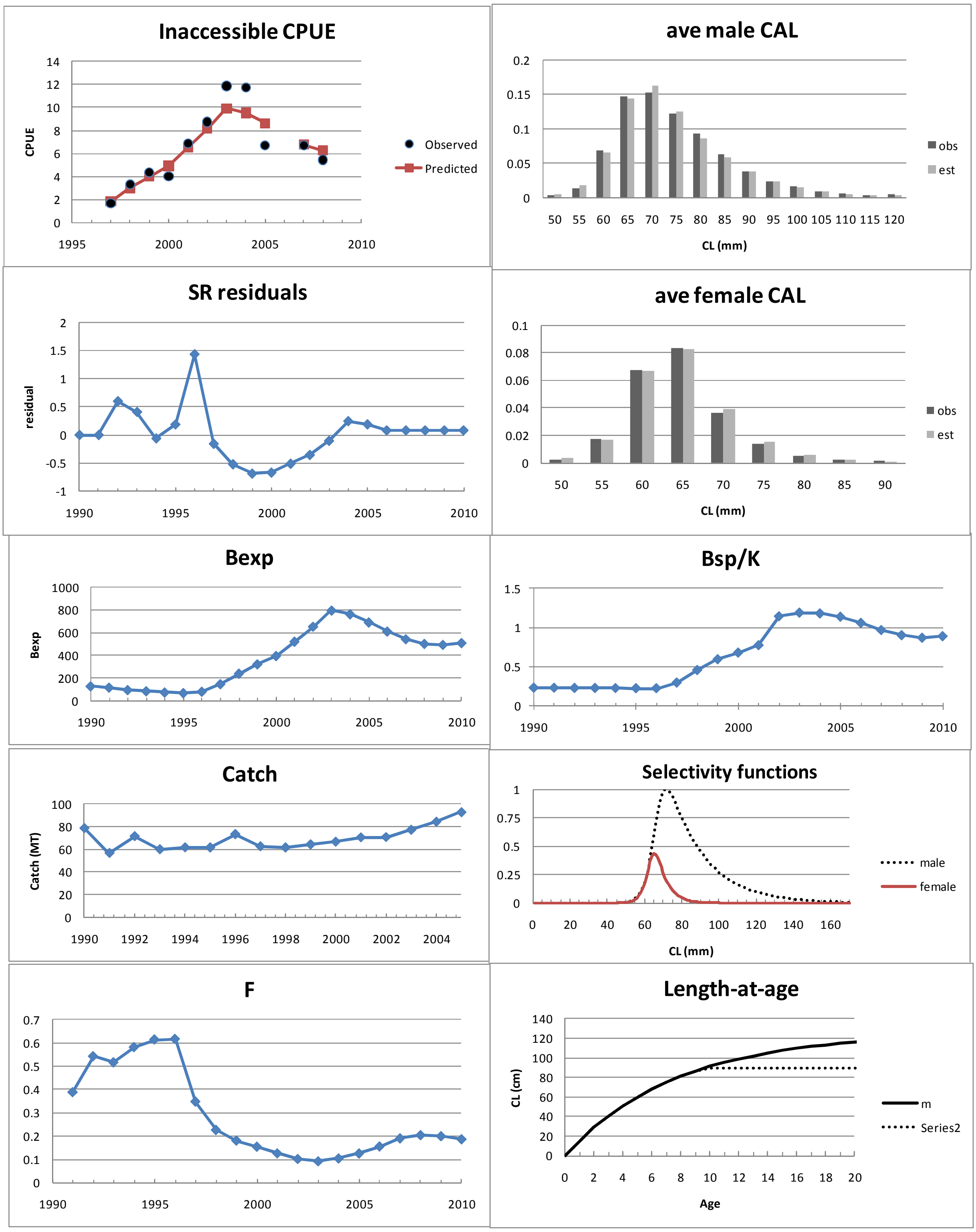

Figure 4c: RC2 SEN2 (F_{2009}=0.4).

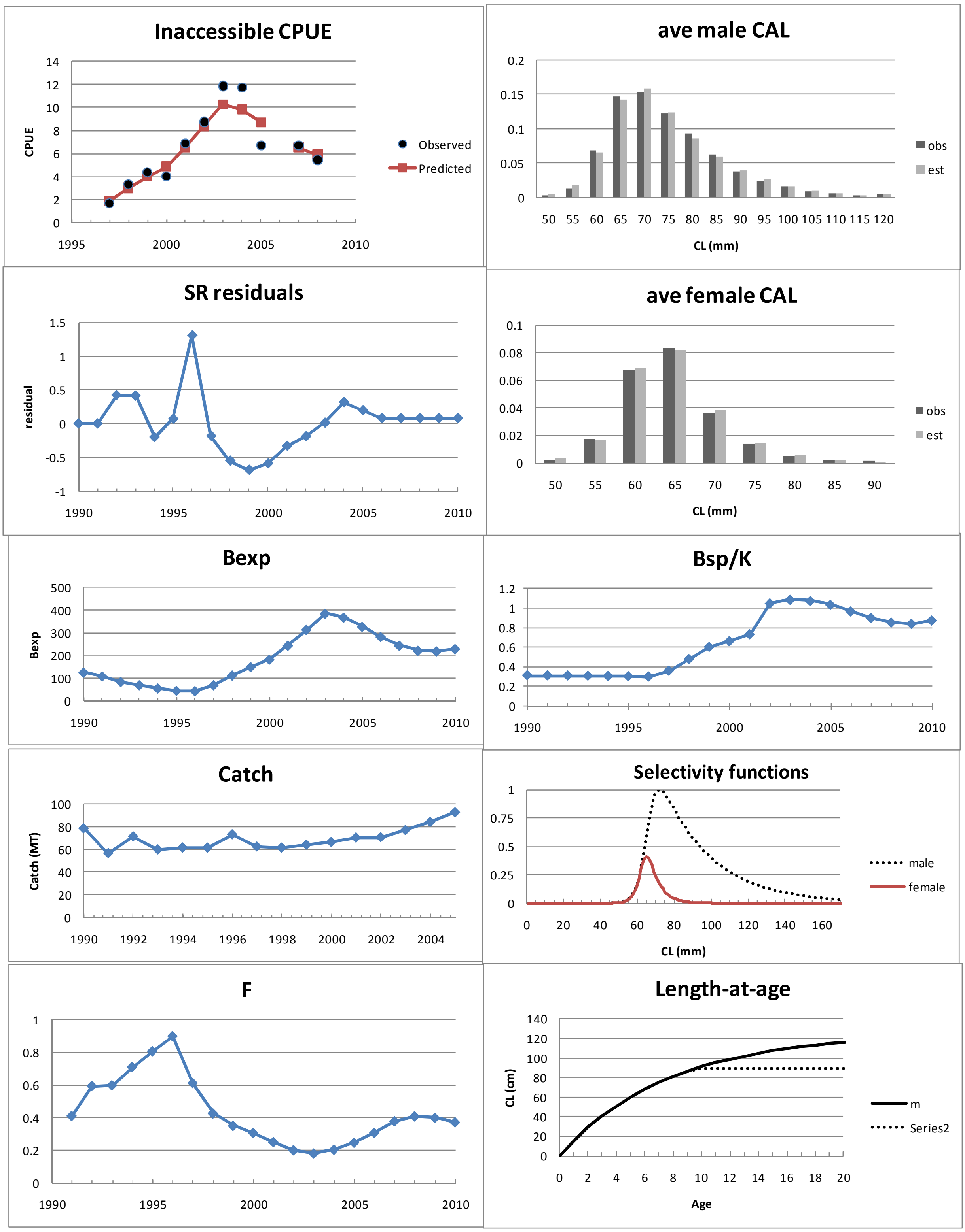

Figure 5a: Model RC1 estimated B_{exp} trend compared with both the GLMM-standardized longline CPUE trend (to which the model is fitted in minimizing the –lnL) and the nominal powerboat CPUE trend.

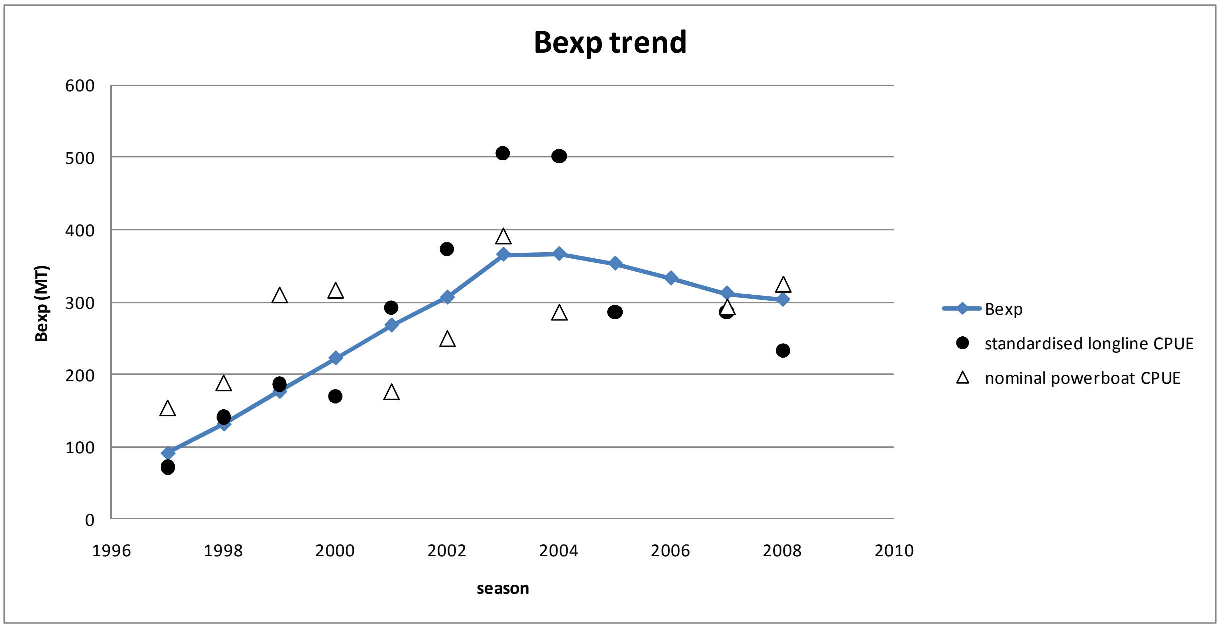

Figure 5b: Model RC2 estimated B_{exp} trend compared with both the GLMM-standardized longline CPUE trend (to which the model is fitted in minimizing the –lnL) and the nominal powerboat CPUE trend.

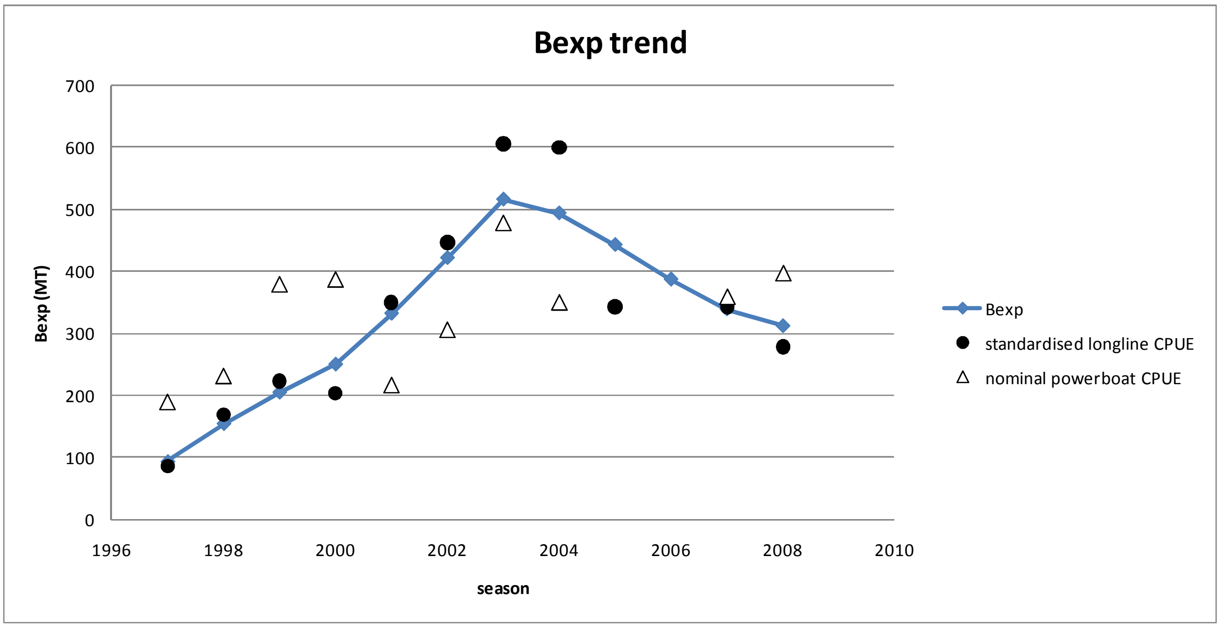

Figure 6a: RC1 fits to the last three years of catch-at-length data.

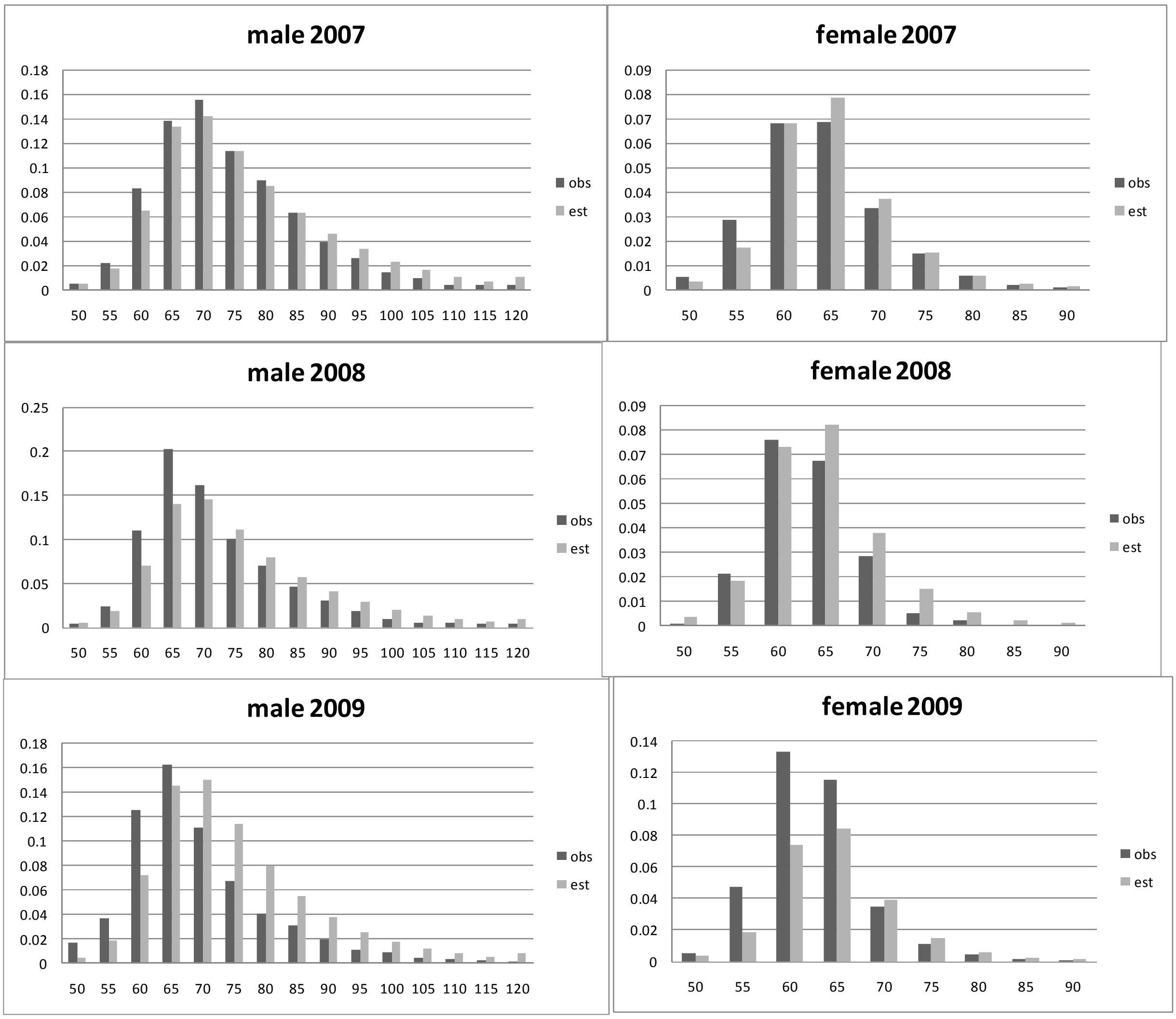

Figure 6b: RC2 fits to the last three years of catch-at-length data.