Preliminary results of the Sex- and Area-specific Age-Structured Production Model for the South Coast rock lobster population

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Preliminary results of the sex- and area-specific age-structured production model for the South Coast rock lobster, as described in Johnston and Butterworth (2008) are presented here.

The model explored to date incorporating time-varying selectivity with estimation in terms of the "MARAM" method (as reported in Johnston and Butterworth 2007). Future results will explore alternate methods.

Results

Table 1 reports various model parameter estimates and quantities of management interest. Further estimable parameters are illustrated graphically in Figures 1a-c.

Fits to the CPUE data are show in Figure 2 for each of the three areas. Fits to the CAL (catch-at-length) data are shown in Figures 3a-c – males and females separately. Here the plots reflect the average fits over the entire data-fitting period.

Figure 4a shows the estimated spawning biomass for the resource, and Figure 4b shows the estimated exploitable biomass trends in each area.

Figure 5 shows the estimated fishing proportions (F_y^A) for each area.

Note that the K^{sp} reported in Table 1 refers now to the female portion of the resource only, whereas in previous modeling approaches (where the two sexes were modeled together), the K^{sp} referred to males and females combined.

Natural mortality *M* is fixed here at 0.10. This is close to the values estimated in previous assessments (e.g. Johnston and Butterworth 2007). Future work will examine the sensitivity of the model results to different values of *M*.

Table 1: Model estimated parameters and quantities of management interest. Biomass quantities are in MT.

Parameter/quantity		**Global**	**Area 1**	**Area 2**	**Area 3**
K^{sp}	total female spawning biomass	973			
h	S/R steepness parameter	0.72			
λ^A	proportion R to Area A		0.39	0.40	0.21
μ^A	rel. female scaling parameter for Area A		1.18	1.23	1.29
$l_{50}^{m,A}$	length at 50% selectivity for male lobsters in Area A (mm)		69.79	64.00	56.98
$l_{95}^{m,A}$	length at 95% selectivity for male lobsters in Area A (mm)		79.61	70.82	61.92
$l_{50}^{f,A}$	length at 50% selectivity for female lobsters in Area A (mm)		67.09	63.32	56.40
$l_{95}^{f,A}$	length at 95% selectivity for male lobsters in Area A (mm)		74.08	70.96	61.09
β^*	growth function parameter	0.141			
$L_\infty^{m,A}$	L_∞ for male lobsters in Area A (mm)		102.04	105.66	112.74
$L_\infty^{f,A}$	L_∞ for female lobsters in Area A (mm)		97.66	98.96	111.63
κ	growth curve parameter (yr^{-1})	0.078			
t_0	growth curve parameter (yr^{-1})	-1.94			
-ln L (CPUE)		-83.99	-38.62	-22.23	-23.15
CPUE σ			0.160	0.281	0.273
-ln L (CAL)		-424.92	-175.46	-131.85	-117.61
CAL σ			0.064	0.090	0.086
SR residual penalty (Eqn 37)		7.98			
Time varying selectivity penalty (Eqn 39)		8.16			
Growth parameters penalty (Eqn 36)		7.73			
Time varying recruitment penalty (Eqn 38)		7.24			
Total –ln$L$ values		-477.07			
B_{06}^{sp} / K^{sp}		0.43			
$B_{06}^{\exp,A} / K_{1973}^{\exp,A}$		0.37	0.34	0.32	0.45
$B_{06}^{\exp,A}$		748	183	281	284

Figure 1a: Stock recruitment residuals.

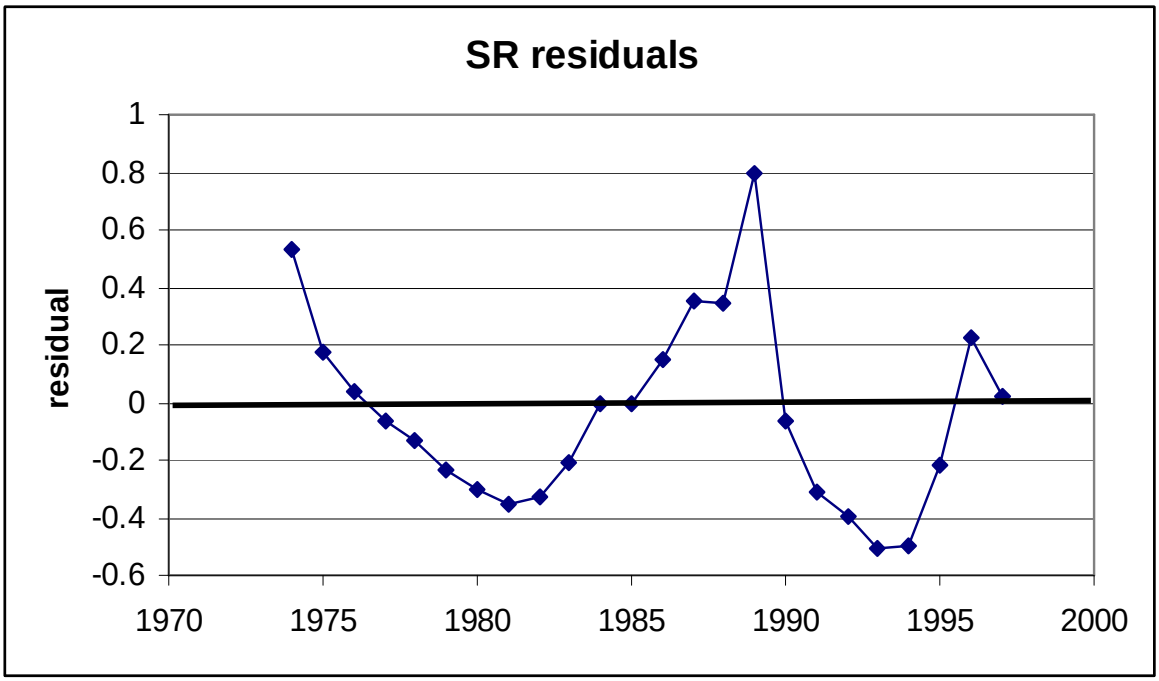


Figure 1b: Time-varying areal-proportions of global recruitment ($\lambda_y^{*,A}$). Values to the right of the vertical line are not estimated, but set equal to the 1973-2000 average.

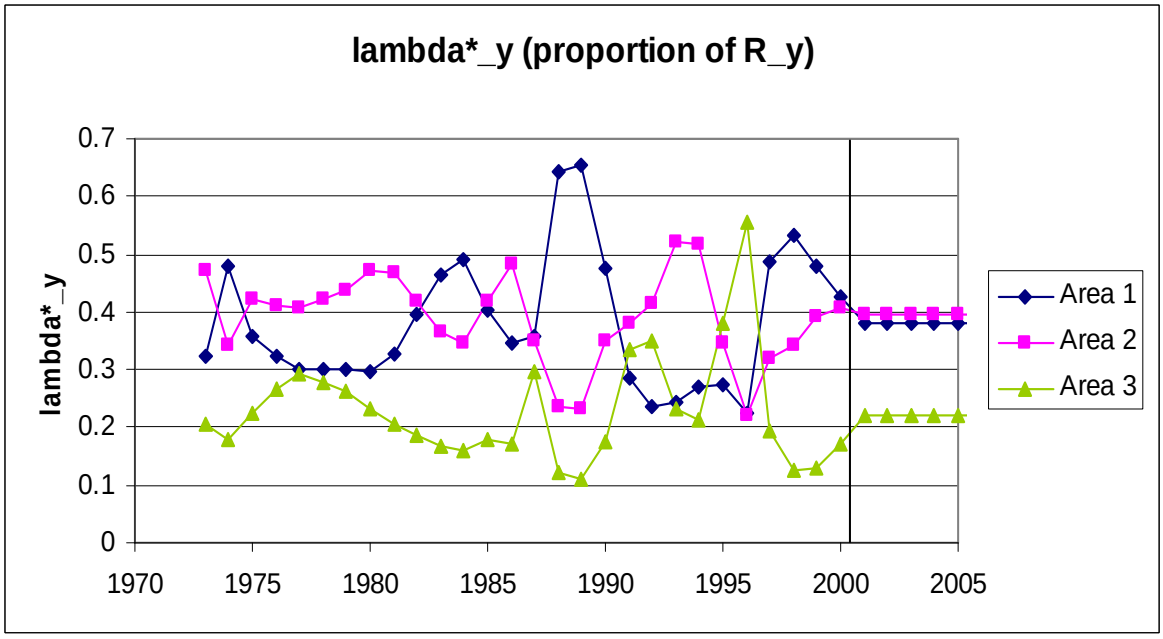


Figure 1c: Selectivity functions estimated for each Area for 1973.

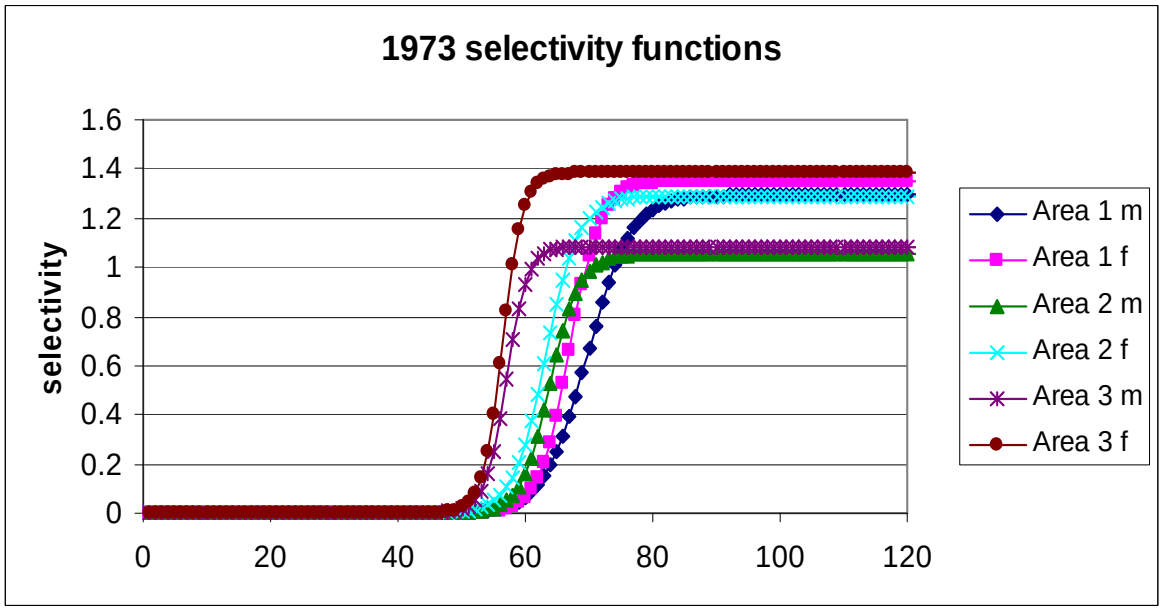


Figure 1d: Time varying selectivity $\delta_y^{m/f,A}$ values.

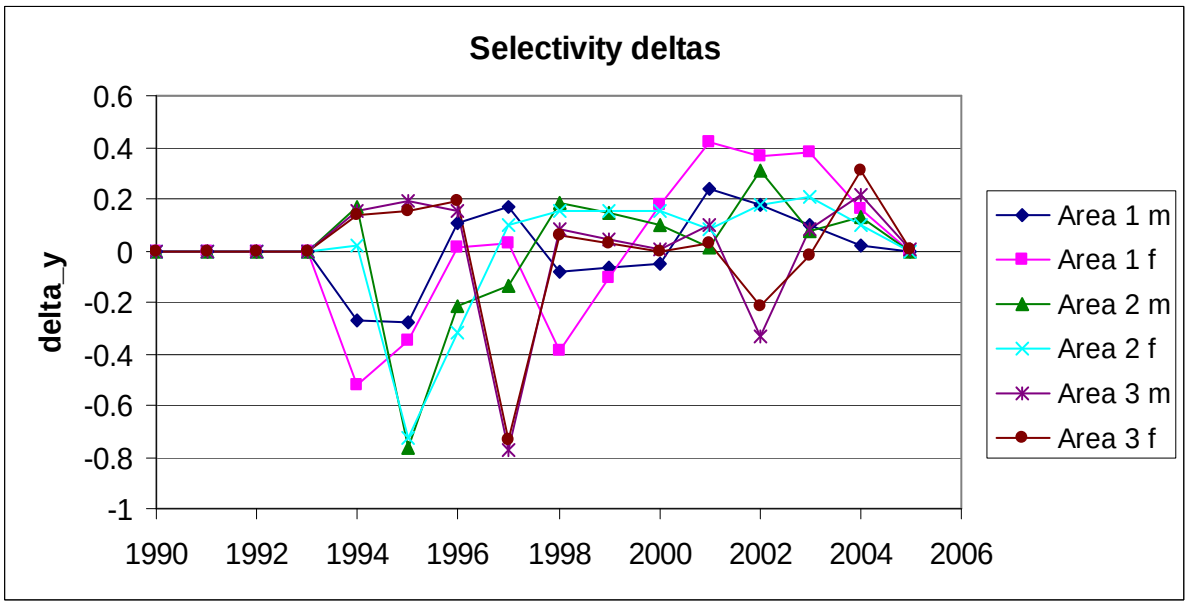
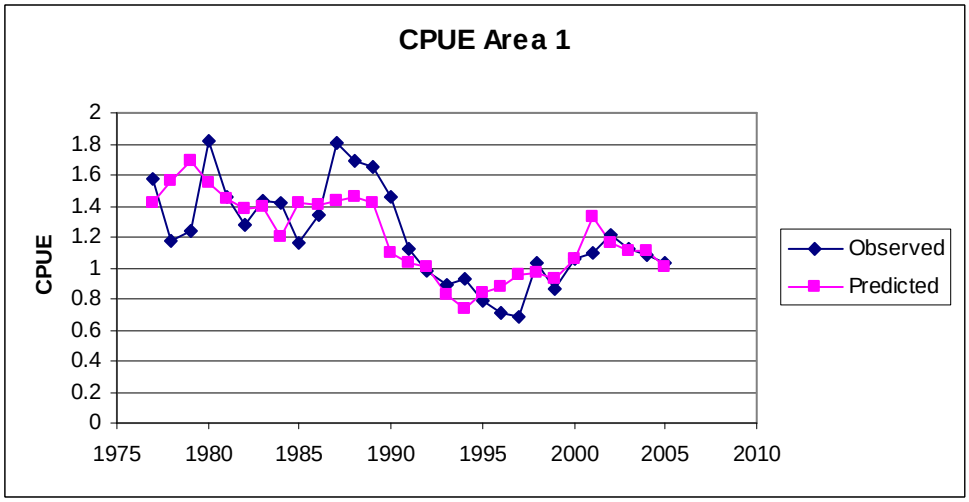
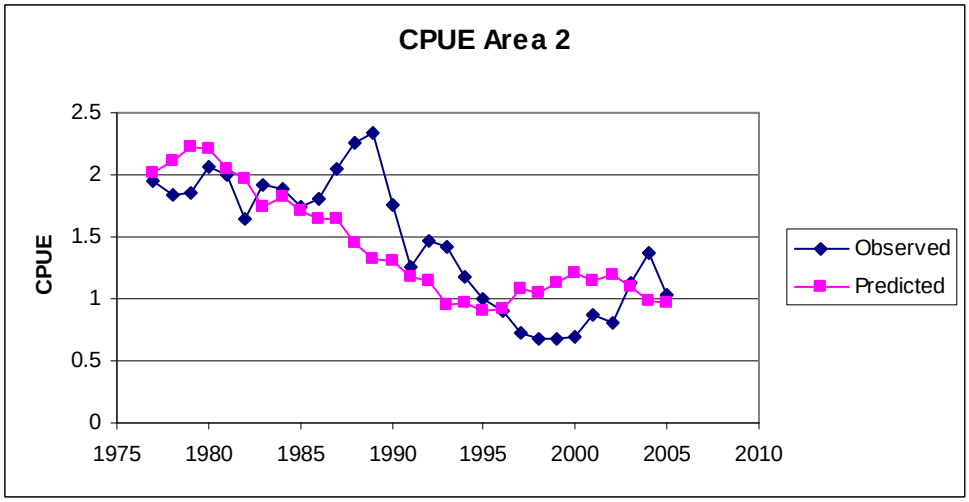


Figure 2: Model fits to observed CPUE trends in each Area.





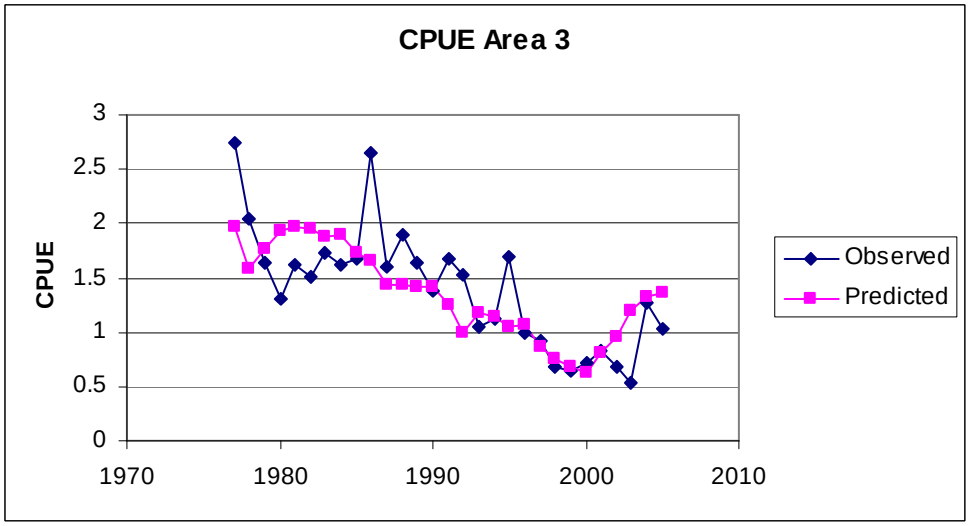


Figure 3a: Model fits to catch-at-length (CAL) data for male and female lobsters from Area 1. Results have been averaged over the data-fitting period.

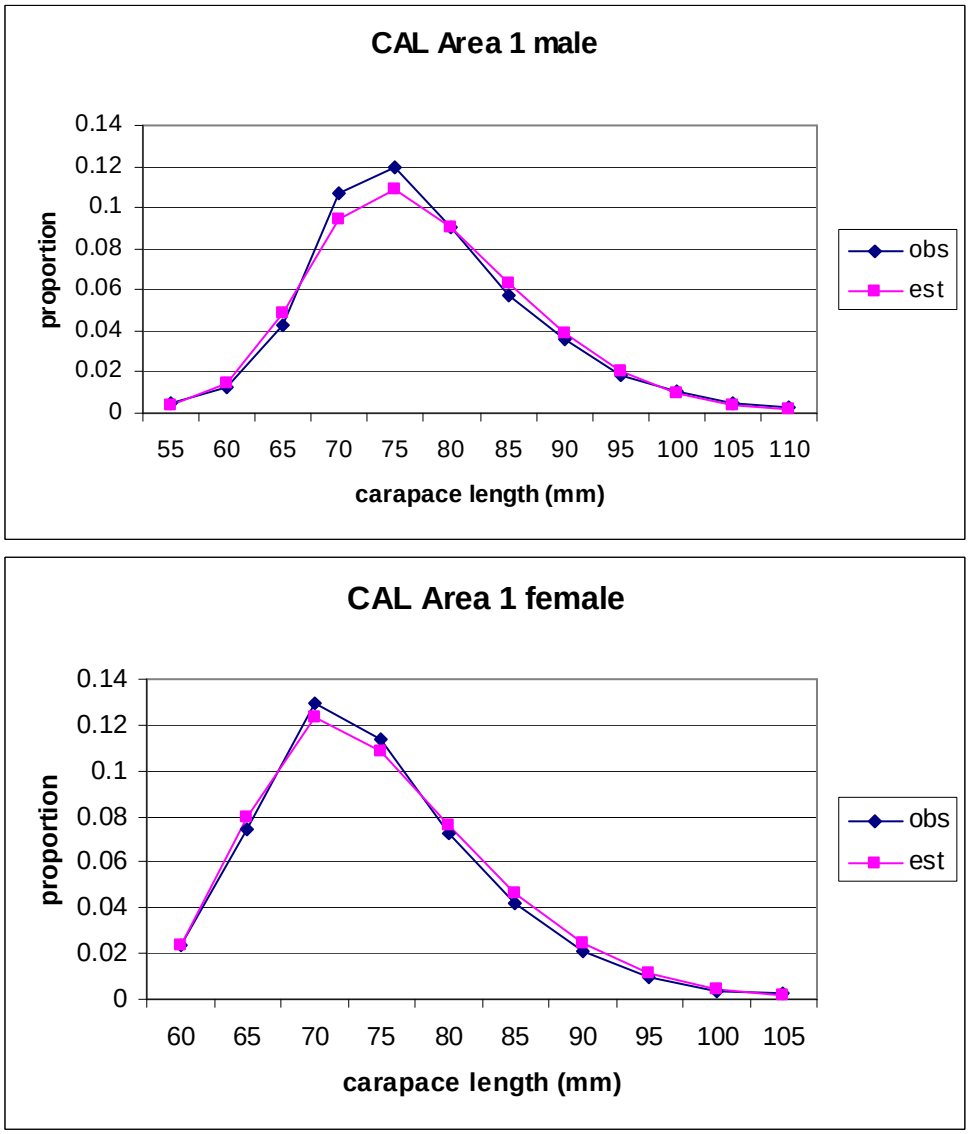
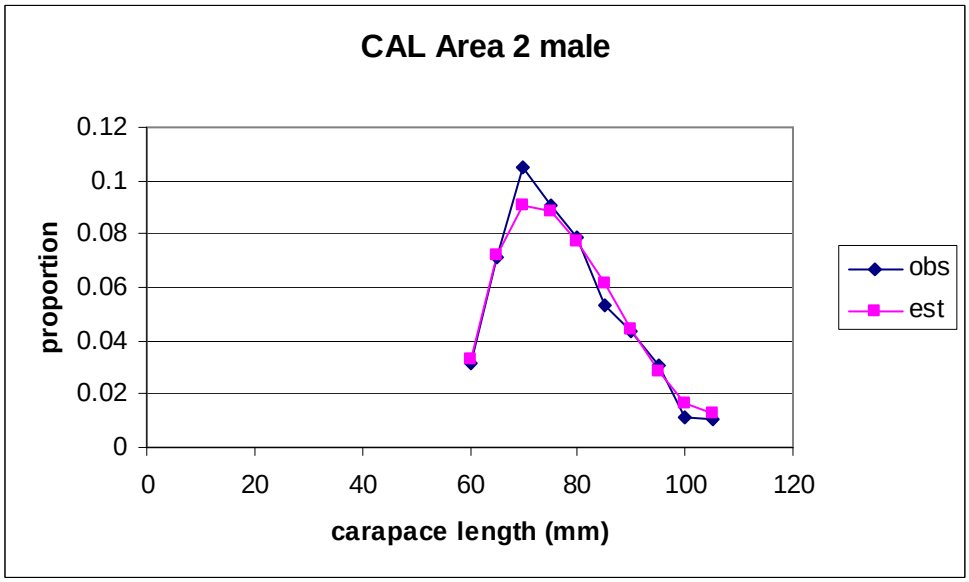


Figure 3b: Model fits to catch-at-length (CAL) data for male and female lobsters from Area 2. Results have been averaged over the data-fitting period.



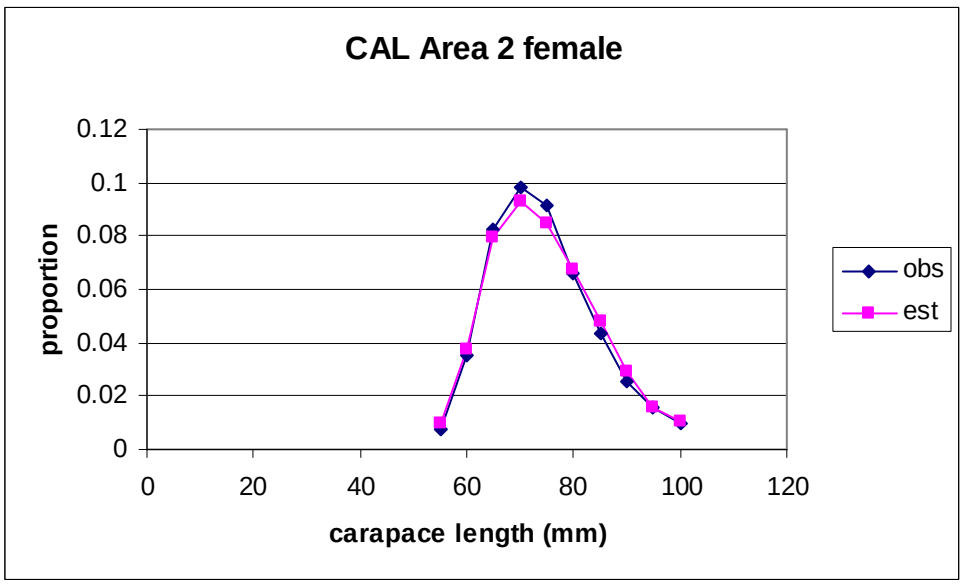


Figure 3c: Model fits to catch-at-length (CAL) data for male and female lobsters from Area 3. Results have been averaged over the data-fitting period.

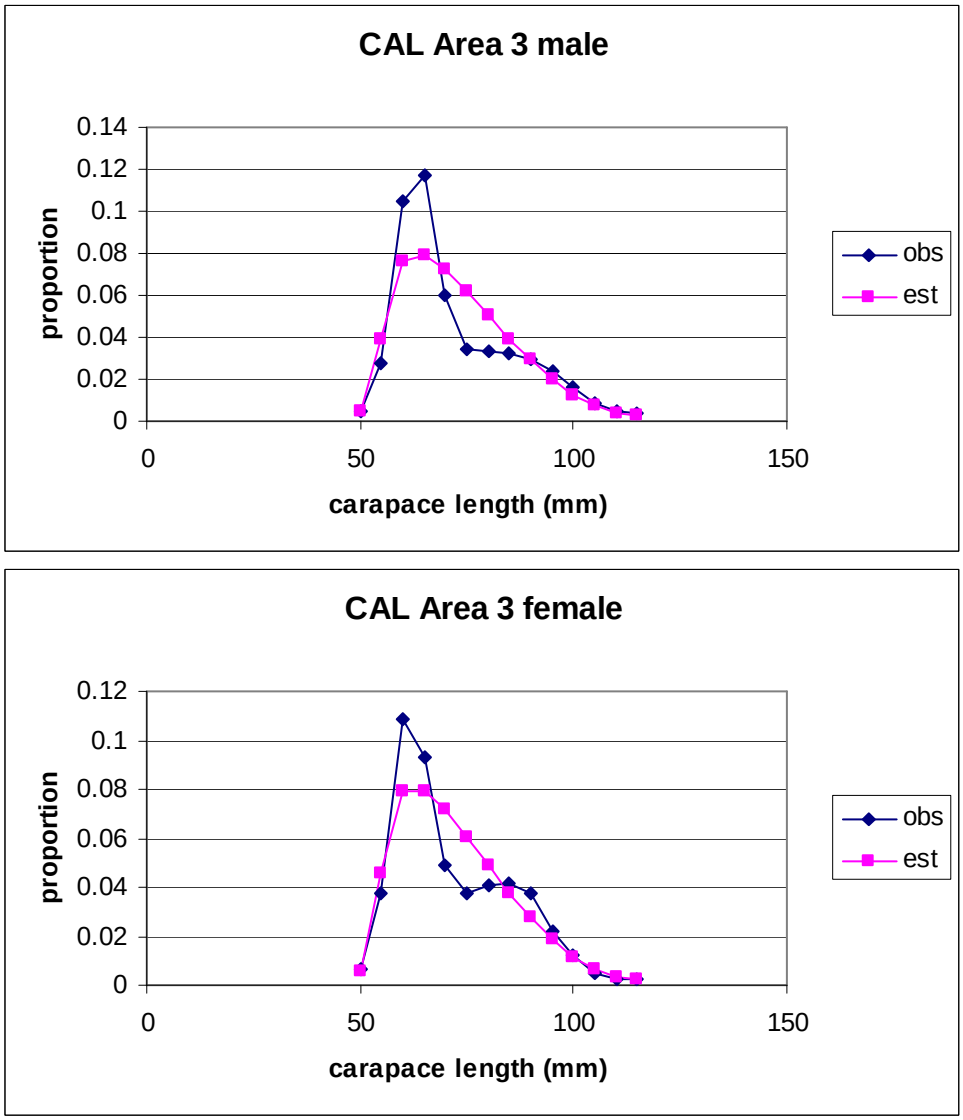


Figure 4a: Estimated female spawning biomass trend.

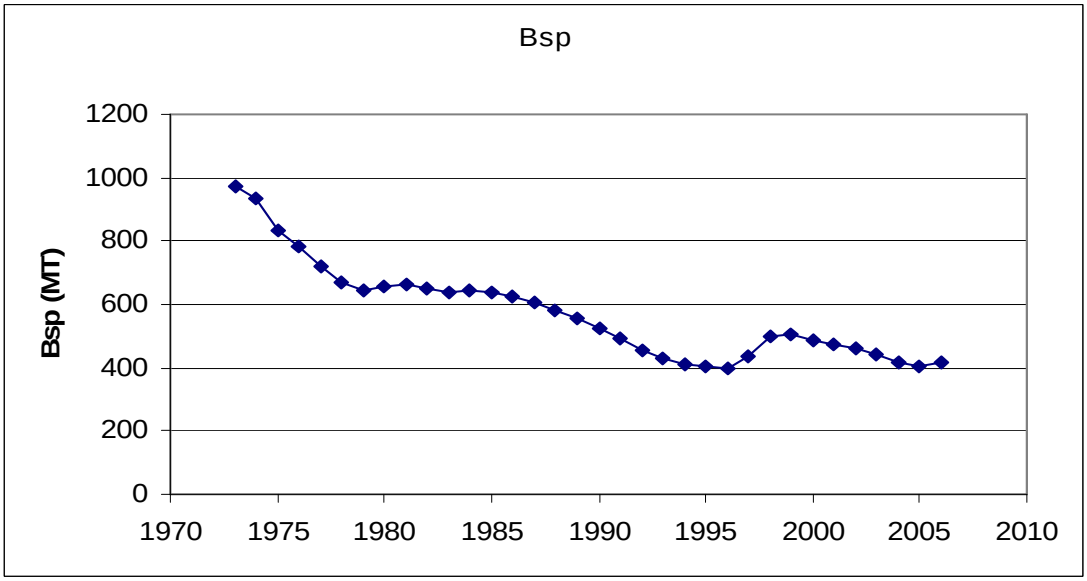


Figure 4b: Estimated exploitable (m+f) biomass trends for each Area.

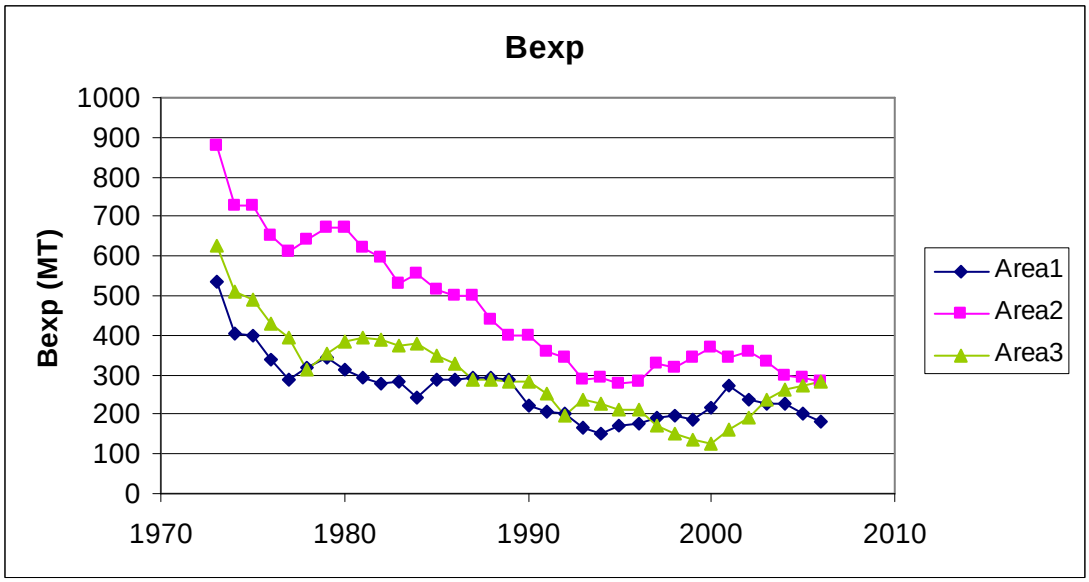
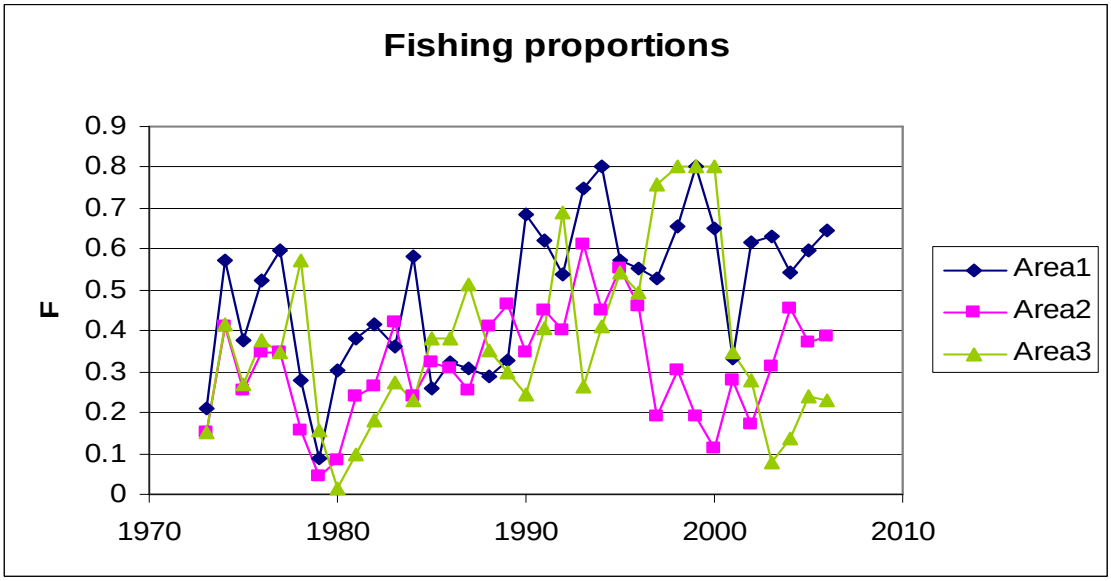


Figure 5: Estimated fishing proportions for each Area.



References

S.J. Johnston and D.S. Butterworth. 2007. The 2007 age-structured production model assessments and projections for the South Coast rock lobster resource – routine update using Popes's approximation model fitting to catch-at-age data including scenarios for time-varying selectivity. MCM document, WG/08/07/SCRL5, 29pp.

S.J. Johnston and D.S. Butterworth. 2008. The Age-Structured Production Model for the South Coast rock lobster population extended to be sex- and area-specific, to fit to catch-at-length data, and to use Pope's approximation. MCM document, WG/02/08/SCRL1.