Initial results of an age-structured assessment model for Zone F

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Introduction

This document provides preliminary results from fitting a simpler version of the spatial- and age-structured production model (ASPM) for abalone for Zones A-D to data for Zone F.

Data

The following data have been used:

- CPUE, Commercial catches and Commercial catch-at-age data: 1981 to 2012
- Poaching trend: values from analyses of policing effort and the number of confiscations for 2008 to 2012 (Brandão and Butterworth, 2012) and a linear increase in poaching from zero in 1995 to the average of the 2008 and 2009 trend values in 2007
- FIAS abundance indices: 1995 to 2012.

Methodology

A simpler form of the spatial- and age-structured production model used for assessing abalone in Zones A-D (full details are provided in Brandão and Butterworth (2009) as well as in Plagányi and

Butterworth (2010) has been used. In the present case the spatial structure in terms of the inshore and offshore component has not been taken into account. The selectivity function for the poaching sector has been assumed to be the same as that estimated for Zones A-D as no poaching catch-at-age proportions were available for the present modelling exercise. Problems with obtaining realistic estimates of abundance of the resource when most model parameters were freed to be estimated led to the Basecase model presented in this document in which most parameters are fixed, including values of *K* and the poaching scalar value.

Results

The negative log-likelihood values for the Basecase model and various other options for values *K* and for the poaching scalar value are reported in Tables 1. Fits to CPUE for Zones F are shown in Figure 1, selectivity functions for the commercial, FIAS and poaching sectors in Figure 2, FIAS data in Figure 3, spawning biomass trajectory in Figures 4, and annual poaching estimates (by number and biomass) in Figure 5. Legal and illegal catches as well as commercial exploitable biomass are shown in Figure 6. Fits to the catch-at-age proportions for the commercial sector are shown in Figure 7 and for the FIAS surveys in Figure 8. Bubble plot of the standardised residuals for these catch-at-age proportions are shown in Figure 9. Figure 10 shows the comparison of spawning biomass trajectories for 5 variants of fixed values of K and the poaching scalar value, while Figure 11 shows the comparison for the annual poaching estimates.

References

Brandão, A. and Butterworth, D.S. 2009. Results for the Reference-case abalone spatial- and age-structured assessment model for Zones A, B, C and in 2009. Marine and Coastal Management document: MCM/2009/OCT/SWG-AB/08.

Plagányi, É.E. and Butterworth, D.S. 2010. A spatial- and age-structured assessment model to estimate the impact of illegal fishing and ecosystem change on the South African abalone *Haliotis midae* resource. African Journal of Marine Science, 32(2):207-236.

Table 1. Values of the negative of the log-likelihood function (-*ln* L) for the Basecase model for Zone F and various options for values of *K* and the poaching scalar value.

	Values for the poaching scalar				
Values of *K*	**30 000**	**100 000**	**950 000**	**1800 000**	**2500 000**
9 000			-11.27		
6 000			-17.81		
5 400	-15.77	-16.00	**-17.80**	-16.31	-15.08
4 000			-17.39		
3 500			-17.24		

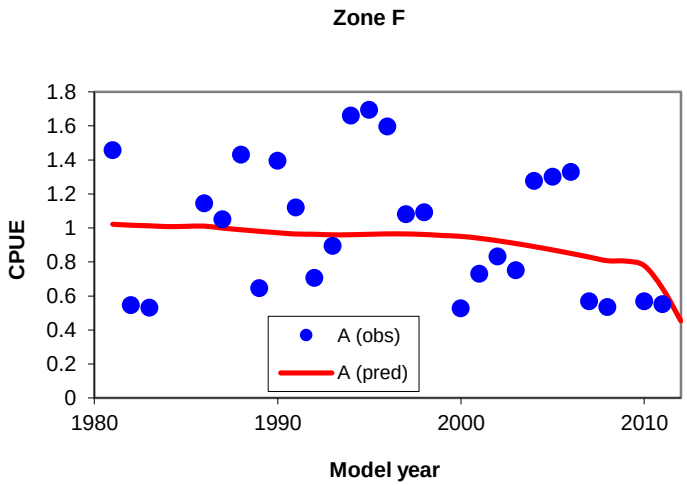

Figure 1. Comparisons between the standardised CPUE (obs) and model-predicted CPUE values for the Basecase for Zones F.

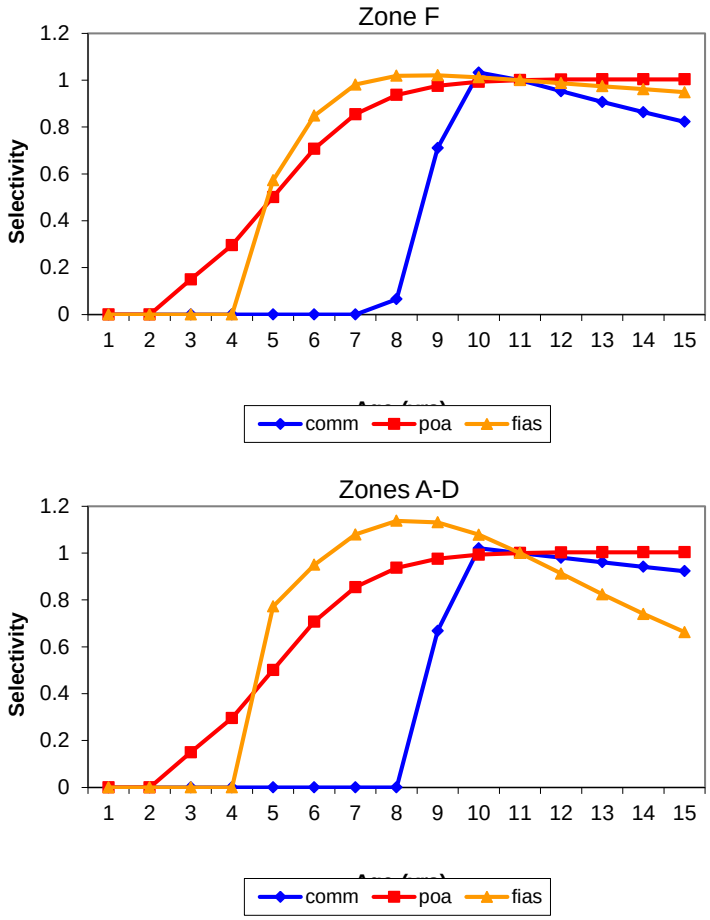

Figure 2. Plots of the Basecase for Zone F selectivity functions estimated for the commercial and FIAS sectors and the selectivity function for the poaching sector fixed to be the same as that estimated for Zones A-D. For comparison the bottom plot shows the selectivity functions estimated for Zones A-D.

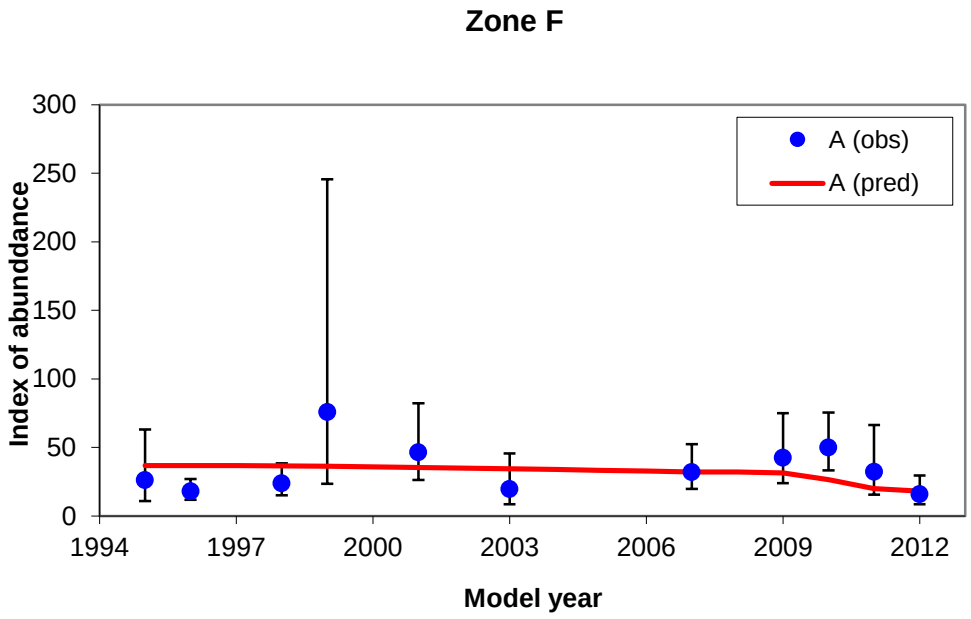

Figure 3. Comparison of observed FIAS and model-predicted trends for the Basecase for Zones F. Note that the 95% confidence intervals shown have been computed as: estimate*exp(±1.96*CV).

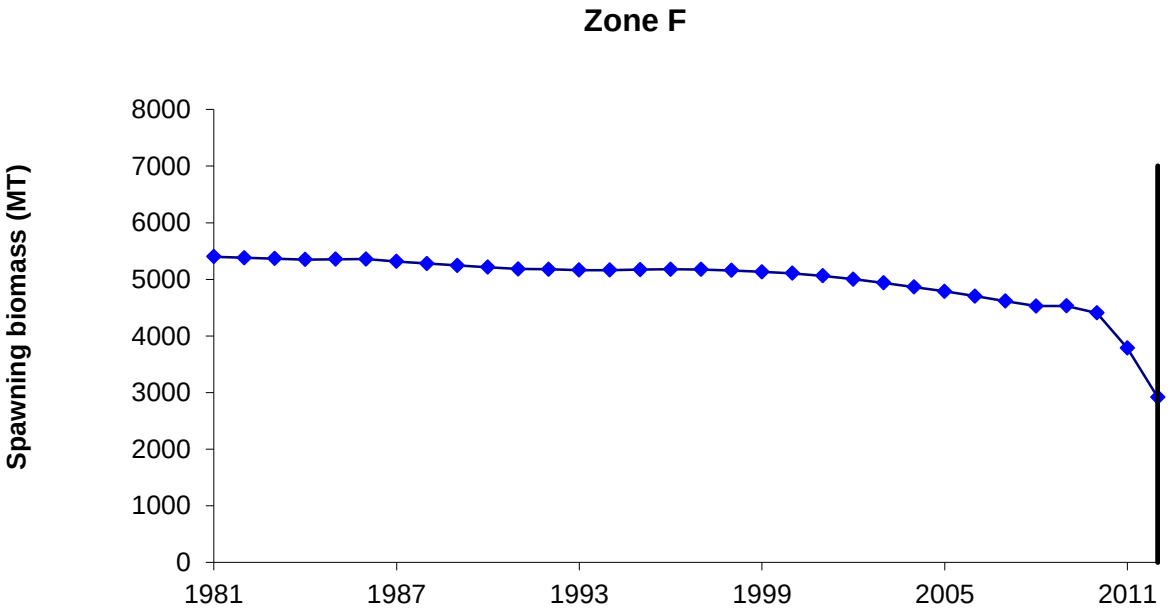

Figure 4. Spawning biomass trajectories shown for Zone F for the Basecase model.

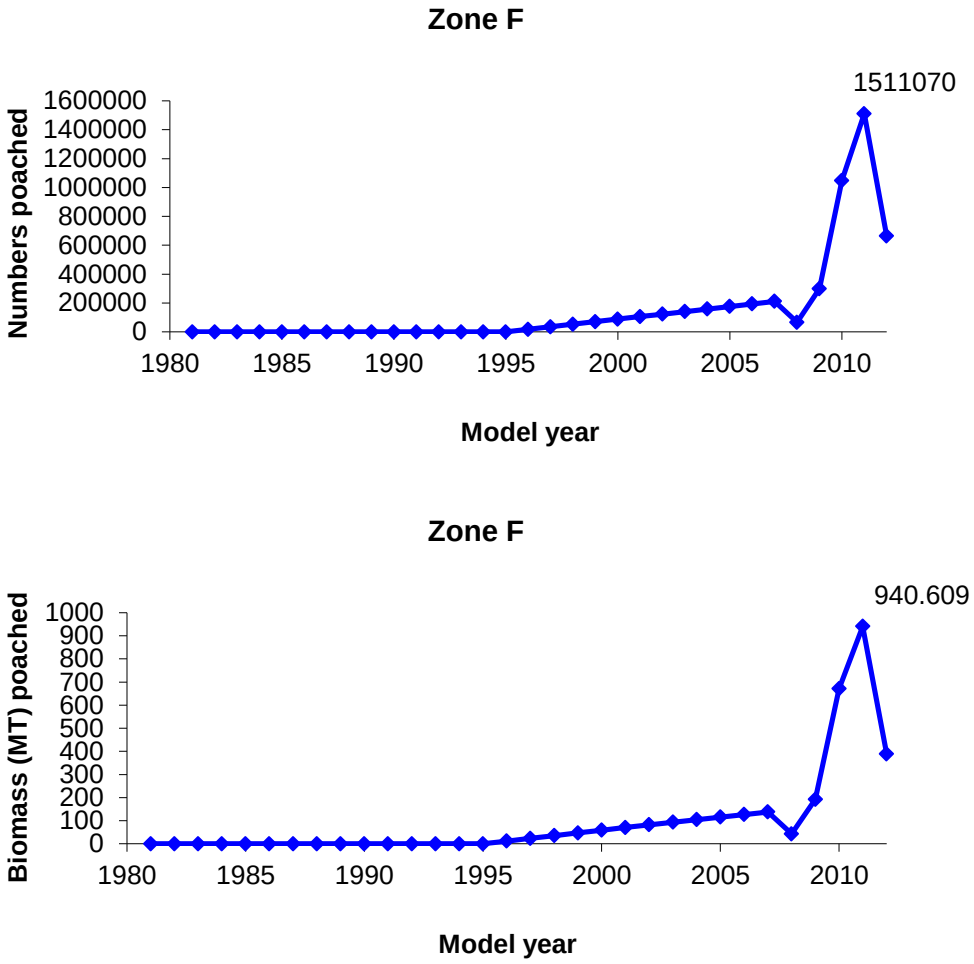

Figure 5. Model-predicted numbers (top) and biomass (bottom) of abalone poached for Zone F for the Basecase model.

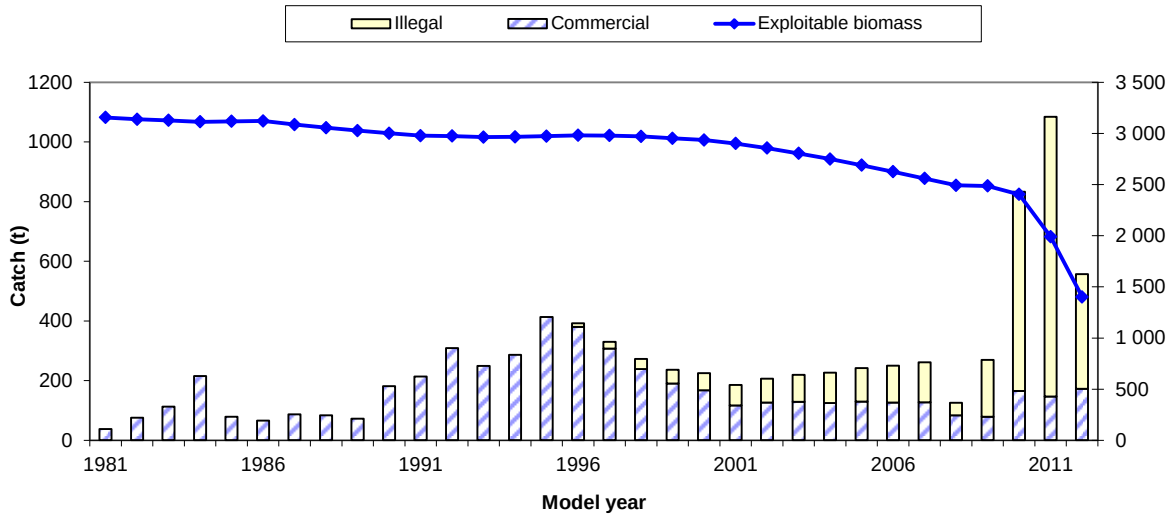

Figure 6. Estimated commercial exploitable biomass for the Basecase model for Zone F (right hand axis) and total catches (commercial + estimated illegal) for Zone F (left hand axis).

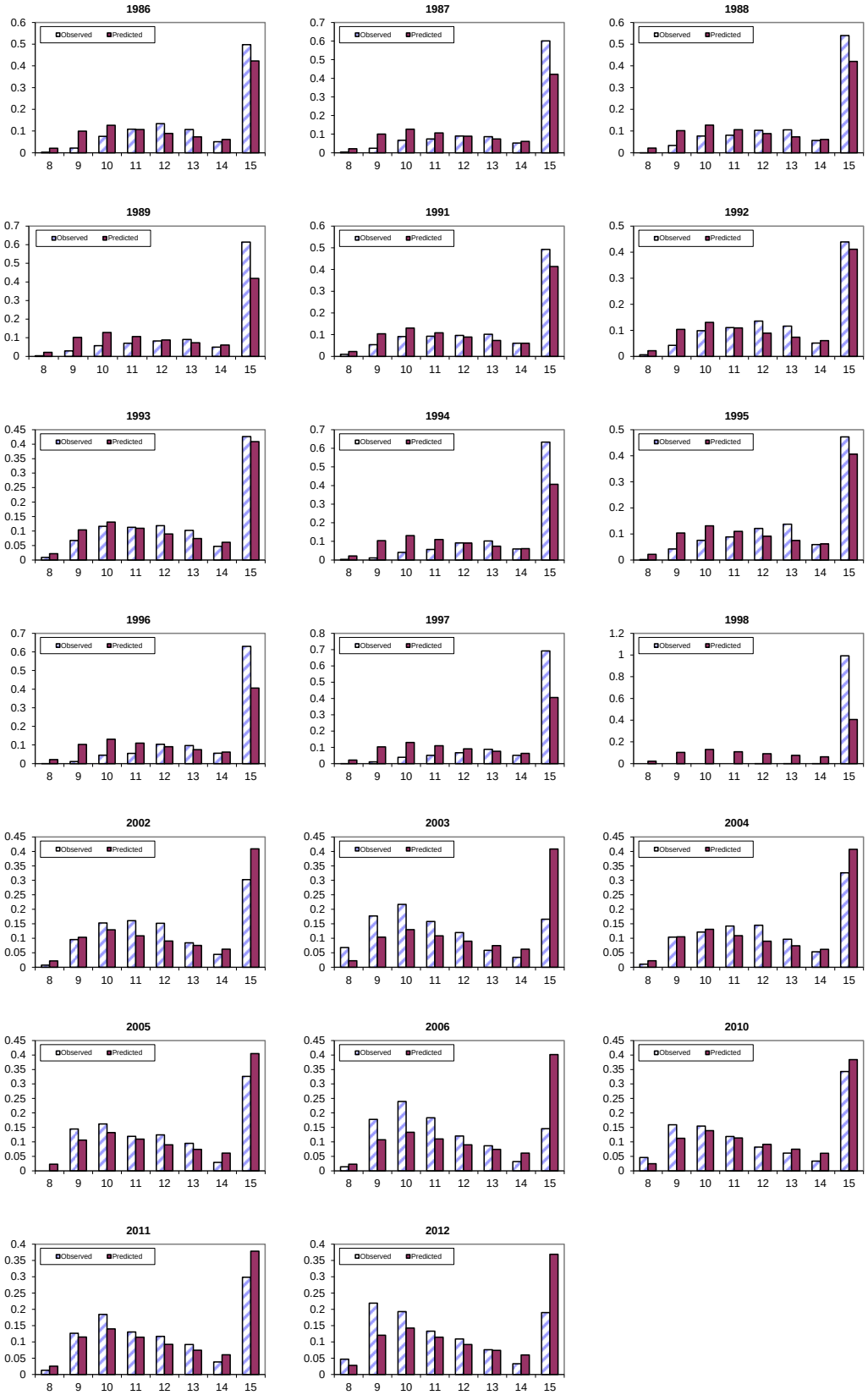

Figure 7. Comparison between observed and model predicted catch-at-age proportions for the commercial sector for Zone F.

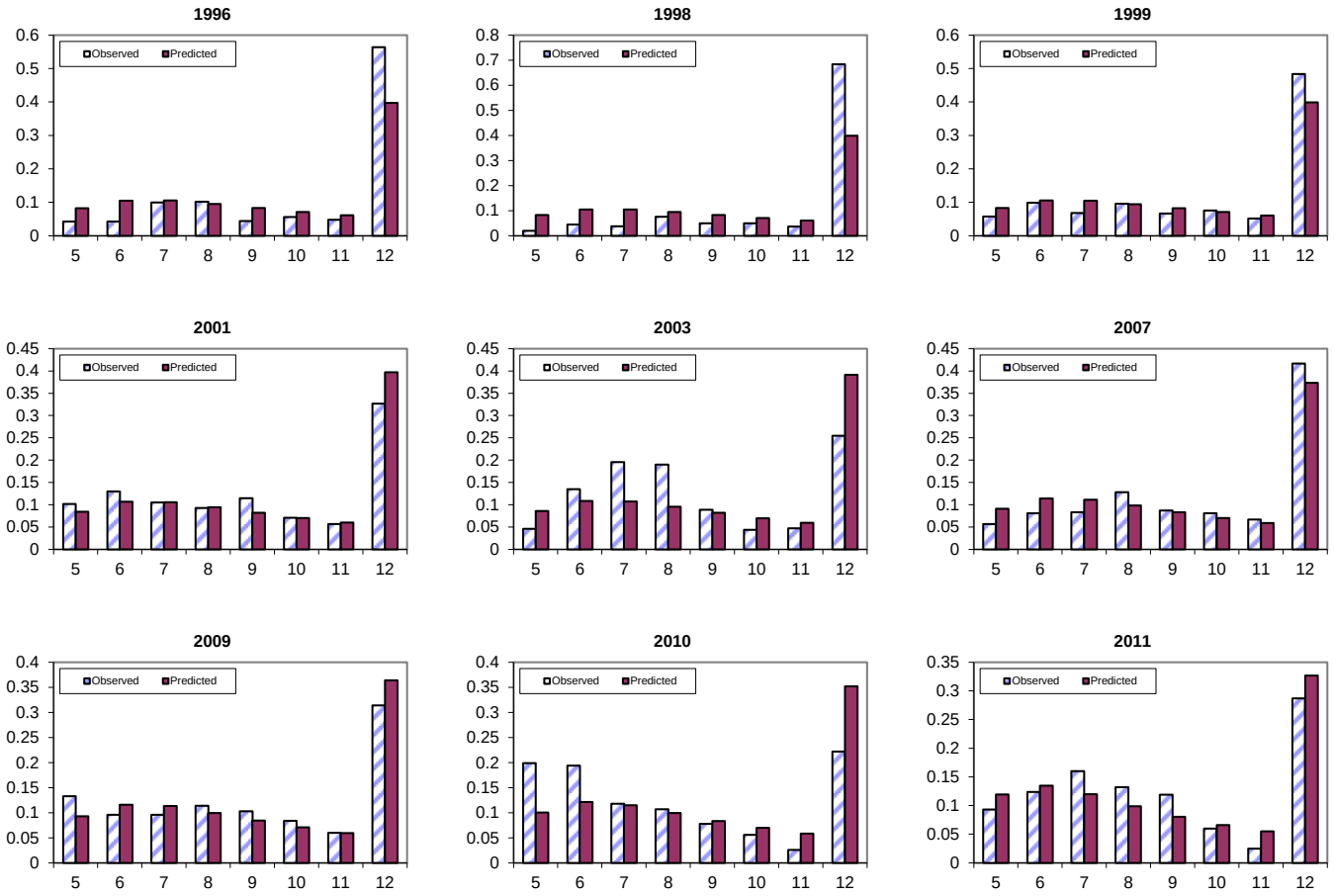

Figure 8. Comparison between observed and model predicted catch-at-age proportions for the FIAS survey data for Zone F.

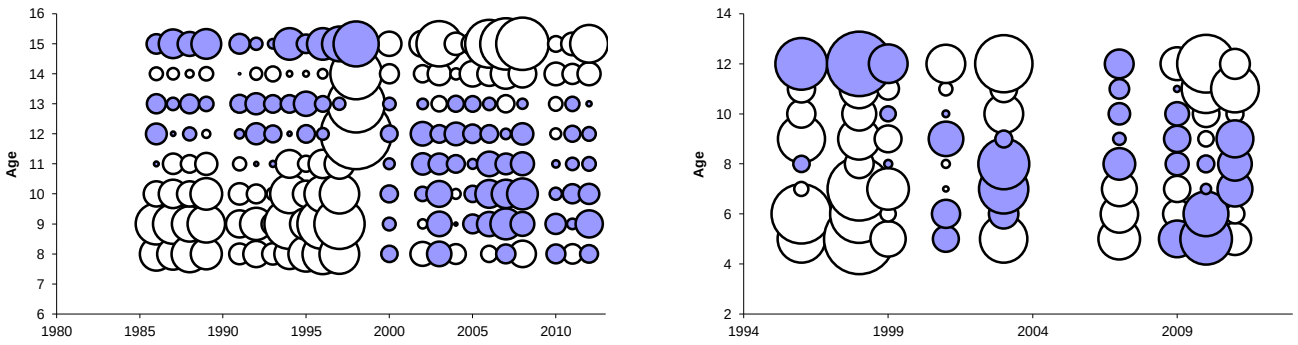

Figure 9. Catch-at-age residuals for Zone F for a) the commercial data and b) the FIAS data for the Basecase model. The size (radius) of the "bubble" in the plots is proportional to the corresponding standardized residual ((ln(obs)-ln(pred))/(sigma/sqrt(pred))). White bubbles represent negative residuals and grey bubbles represent positive residuals.

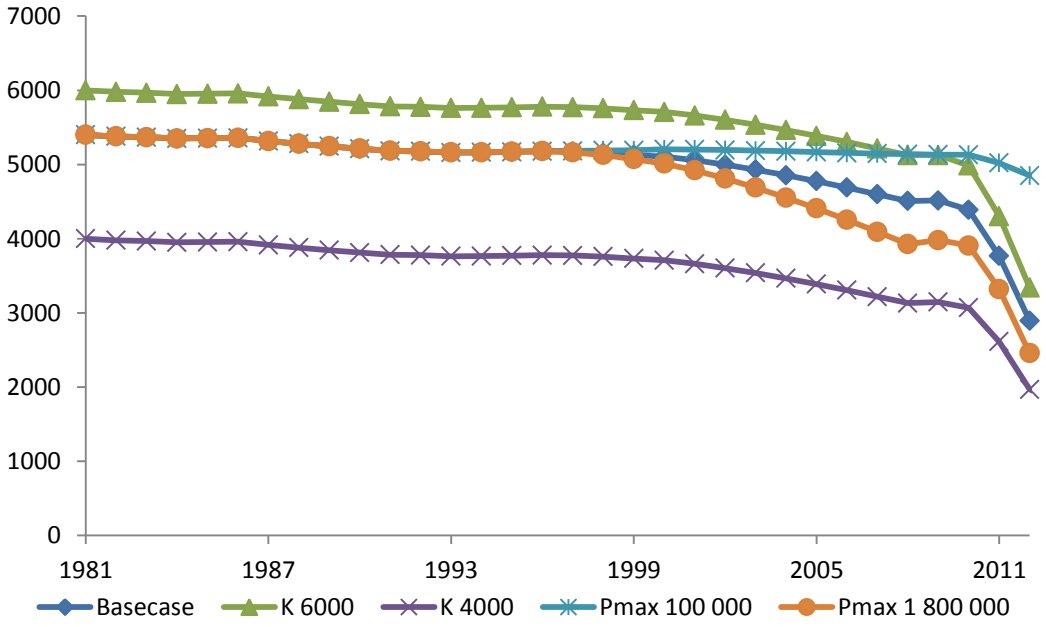

Figure 10. Comparison of spawning biomass trajectories for Zone F for the Basecase mode and for variants of *K* and the poaching scalar value.

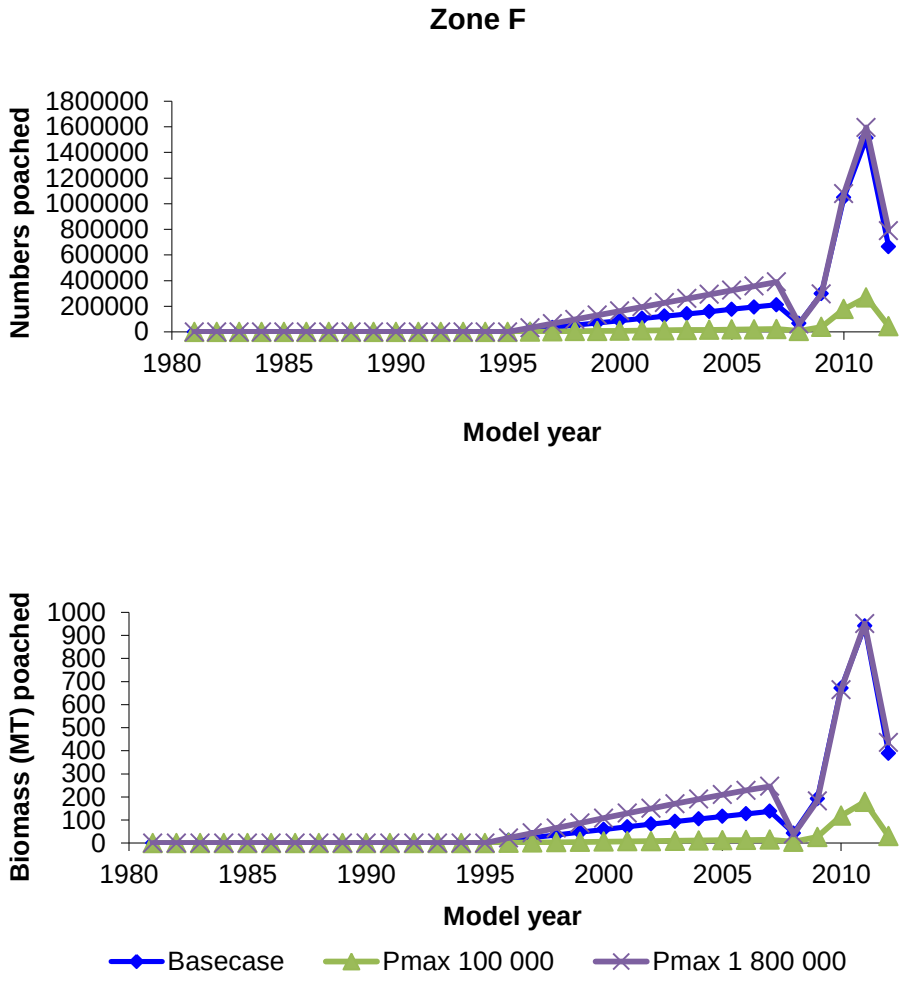

Figure 11. Comparison of model-predicted numbers (top) and biomass (bottom) of abalone poached for Zone F for the Basecase model and for variants of the poaching scalar value.