

Updated 2013 assessments for West Coast rock lobster

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Assessments of the five sub-stocks of the West coast rock lobster resource were last performed in 2011. The 2011 assessments utilized data from the fishery up to and including the 2009/10 season. These assessments formed the underlying “Operating Models” which were used to simulation test a range of candidate OMPs for resource.

Since 2011 a number of important data updates have become available and in order to revise the current OMP the SWG has decided that the underlying operating models are to be updated with the most recent data. The updated input data that has been used for the corresponding 2013 updated assessment are as follows:

- Commercial catches – see FISHERIES/2013/AUG/SWG/WCR/15.
- Estimates of recreational takes – see FISHERIES/2013/AUG/SWG-WCRL/10.
- Updated poaching scenarios – see FISHERIES/2013/AUG/SWG-WCRL/17,18, AND 19.
- Interim relief estimates – see FISHERIES/2013/AUG/SWG-WCRL/23.
- Commercial CPUE – see FISHERIES/2013/AUG/SWG-WCRL/11, 12 AND 13.
- FIMS CPUE – see FISHERIES/3013/AUG/SWG-WCRL/22.
- Somatic growth rate – see FISHERIES/2013/AUG/SWG-WCRL/16.

The catch-at-length data have not been updated due to time constraints.

Estimation of recruitment trend

Previously (in 2001) the recruitment trend was modeled by assuming recruitment was linear between a set of estimated recruitment values over time. Recruitment was estimated as follows for the following years:

R1910, R1920, R1950, R1970, R1975, R1980, R1985, R1990, R1995, R2000 and R2003

- R2007+ was set equal to the geometric mean (\bar{R}) of the R1975, R1980, R1985, R1990, R1995 and R2000 estimated values.
- The R2003 value was constrained by a penalty added to the $-lnL$ based on the geometric mean as follows:

$$pen = \frac{1}{2} \frac{(\ln R_{2003} - \ln \bar{R})^2}{\sigma_{\bar{R}}^2} \quad \text{where}$$

$$\sigma_R^2 = \frac{\sum_{y=1975}^{y=2000} (\ln R_y - \ln \bar{R})^2}{5}$$

- Constrain such that all recruitments relative to R1910 ≤ 1.0 (this was previously only a problem with the A1+2 estimates)

Updated estimation of recruitment

The recruitment trend is now modeled by assuming recruitment is linear between a set of estimated recruitment values over time. Recruitment is estimated for the following years:

R1910, R1920, R1950, R1970, R1975, R1980, R1985, R1990, R1995, R1998, R2001 and R2004

- R2008+ is set equal to the geometric mean (\bar{R}) of the R1975, R1980, R1985, R1990, R1995, R1998, R2001 and R2004 estimated values.
- The R2004 value is constrained by a penalty added to the $-lnL$ based on the geometric mean
- Constrain such that all recruitments relative to R1910 ≤ 1.0

Note that it takes eight years for the recruitment to impact the CPUE data (which reflect lobsters 75mm and larger), so that R2004 corresponds to the last year for which the current data some influence: More frequent estimation over the final decade was introduced to allow a little more flexibility without overfitting the data.

Results

Tables 1-5 report the updated 2013 assessment results for each of the five super-areas respectively. Both the RC1 (total historic poaching = 500 MT) and RC2 (total historic poaching = 250 MT) results are reported, as well as the previous 2011 results for comparison. Table 5 gives summary statistics of the B75m(2012)/K and B75m(2012)/B75m(2006) for each super-area (with RC1 having 65% weight and RC2 having 0.35% weight). Statistics for the resource as a whole are also given.

Figures 1-5 show the RC1 model fits to CPUE data, as well as Egg%, recruitment and B75m trends for each super-area. Figure 6a compares the RC1 B75m trends for each super-area between the 2011 and 2013 assessments. Figure 6b shows the total male biomass trends for the resource as a whole between the 2011 and 2013 assessments (both in absolute tonnage and biomass relative to pristine). Figure 6c compares the B75m contribution from each area to the overall total resource biomass. Finally, Figure 7 compares the 2011 and 2013 estimated biomass trends (B75m) in recent years, with the current OMP predicted biomass trend that would get the resource to the required B75m(2021)/B75m(2006) target of 1.35.

Table 1: Updated 2013 assessment results for super-area A1+2.

	2013 Historic Poaching= 500 MT	2013 Historic Poaching= 250 MT	2011 Historic Poaching= 500 MT	2011 Historic Poaching= 250 MT
$B_{75}^m(1910)$ MT	51 119	48 819	51 302	48 951
$B_{75}^m(2010)$ MT	472	373	591	431
$B_{75}^m(2013)$ MT	445	328	-	-
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.092	0.008	0.012	0.006
$B_{75}^m(2013)/ B_{75}^m(1910)$	0.009	0.007	-	-
$B_{75}^m(2010)/ B_{75}^m(1996)$	1.462	1.262	1.984	1.732
$B_{75}^m(2013)/ B_{75}^m(1996)$	1.382	1.104	-	-
$B_{75}^m(2010)/ B_{75}^m(2006)$	1.379	1.107	1.192	1.094
$B_{75}^m(2013)/ B_{75}^m(2006)$	0.866	0.766	-	-
Egg (2010)/Egg (1910)	0.019	0.017	0.022	0.021
Egg (2013)/Egg (1910)	0.018	0.015	-	-

Table 2: Updated 2013 assessment results for super-area A3+4.

	2013 Historic Poaching= 500 MT	2013 Historic Poaching= 250 MT	2011 Historic Poaching= 500 MT	2011 Historic Poaching= 250 MT
$B_{75}^m(1910)$ MT	143 338	143 764	142 271	141 891
$B_{75}^m(2010)$ MT	3 702	3 737	3 990	4 330
$B_{75}^m(2013)$ MT	3 771	3 794	-	-
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.026	0.026	0.028	0.031
$B_{75}^m(2013)/ B_{75}^m(1910)$	0.026	0.026	-	-
$B_{75}^m(2010)/ B_{75}^m(1996)$	1.640	1.632	1.1773	1.819
$B_{75}^m(2013)/ B_{75}^m(1996)$	1.671	1.657	-	-
$B_{75}^m(2010)/ B_{75}^m(2006)$	0.961	0.960	1.037	1.060
$B_{75}^m(2013)/ B_{75}^m(2006)$	0.979	0.974	-	-
Egg (2010)/Egg (1910)	0.060	0.060	0.057	0.053
Egg (2013)/Egg (1910)	0.061	0.060	-	-

Table 3: Updated 2013 assessment results for super-area A5+6.

	2013 Historic Poaching= 500 MT	2013 Historic Poaching= 250 MT	2011 Historic Poaching= 500 MT	2011 Historic Poaching= 250 MT
$B_{75}^m(1910)$ MT	197 025	197 025	183 018	184 938
$B_{75}^m(2010)$ MT	4 689	4 840	3 230	3 244
$B_{75}^m(2013)$ MT	5 174	5 315	-	-
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.024	0.024	0.018	0.018
$B_{75}^m(2012)/ B_{75}^m(1910)$	0.026	0.027	-	-
$B_{75}^m(2010)/ B_{75}^m(1996)$	1.751	1.749	1.669	1.752
$B_{75}^m(2012)/ B_{75}^m(1996)$	1.932	1.921	-	-
$B_{75}^m(2010)/ B_{75}^m(2006)$	1.294	1.279	1.132	1.160
$B_{75}^m(2012)/ B_{75}^m(2006)$	1.428	1.404	-	-
Egg (2010)/Egg (1910)	0.054	0.054	0.040	0.041
Egg (2012)/Egg (1910)	0.054	0.054	-	-

Table 4: Updated 2013 assessment results for super-area A7.

	2013 Historic Poaching= 500 MT	2013 Historic Poaching= 250 MT	2011 Historic Poaching= 500 MT	2011 Historic Poaching= 250 MT
$B_{75}^m(1910)$ MT	117 147	115 839	89 744	90 839
$B_{75}^m(2010)$ MT	767	607	1 941	1 812
$B_{75}^m(2013)$ MT	226	142	-	-
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.006	0.005	0.022	0.020
$B_{75}^m(2013)/ B_{75}^m(1910)$	0.002	0.001	-	-
$B_{75}^m(2010)/ B_{75}^m(1996)$	0.154	0.124	0.341	0.337
$B_{75}^m(2013)/ B_{75}^m(1996)$	0.045	0.029	-	-
$B_{75}^m(2010)/ B_{75}^m(2006)$	0.329	0.301	0.824	0.823
$B_{75}^m(2013)/ B_{75}^m(2006)$	0.097	0.071	-	-
Egg (2010)/Egg (1910)	0.077	0.073	0.156	0.123
Egg (2013)/Egg (1910)	0.062	0.059	-	-

Table 5: Updated 2013 assessment values of contributions to the $-\ln L$ value, sigma values, biomass and egg production estimates for super-area A8+.

	2013 Historic Poaching= 500 MT	2013 Historic Poaching= 250 MT	2011 Historic Poaching= 500 MT	2011 Historic Poaching= 250 MT
$B_{75}^m(1910)$ MT	193 566	182 038	140 737	140 689
$B_{75}^m(2010)$ MT	9 001	8 524	9 469	9 396
$B_{75}^m(2012)$ MT	8 628	8 328	-	-
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.047	0.047	0.067	0.067
$B_{75}^m(2012)/ B_{75}^m(1910)$	0.045	0.046	-	-
$B_{75}^m(2010)/ B_{75}^m(1996)$	0.743	0.738	0.734	0.722
$B_{75}^m(2012)/ B_{75}^m(1996)$	0.707	0.721	-	-
$B_{75}^m(2010)/ B_{75}^m(2006)$	0.955	0.939	0.979	0.959
$B_{75}^m(2012)/ B_{75}^m(2006)$	0.909	0.917	-	-
Egg (2010)/Egg (1910)	0.215	0.209	0.305	0.283
Egg (2012)/Egg (1910)	0.208	0.204	-	-

Table 6: Summary statistics for the combined RC1 (65% weight) and RC2 (35% weight) resource trends in each super-area and the resource combined as a whole.

	B75m(2012)/K	B75m(2012)/B75m(2006)
A1+2	0.008	0.835
A3+4	0.026	0.977
A5+6	0.027	1.420
A7	0.002	0.089
A8	0.045	0.916
Total resource	0.026	0.925

Figure 1a: Fits to A1+2 CPUE data.

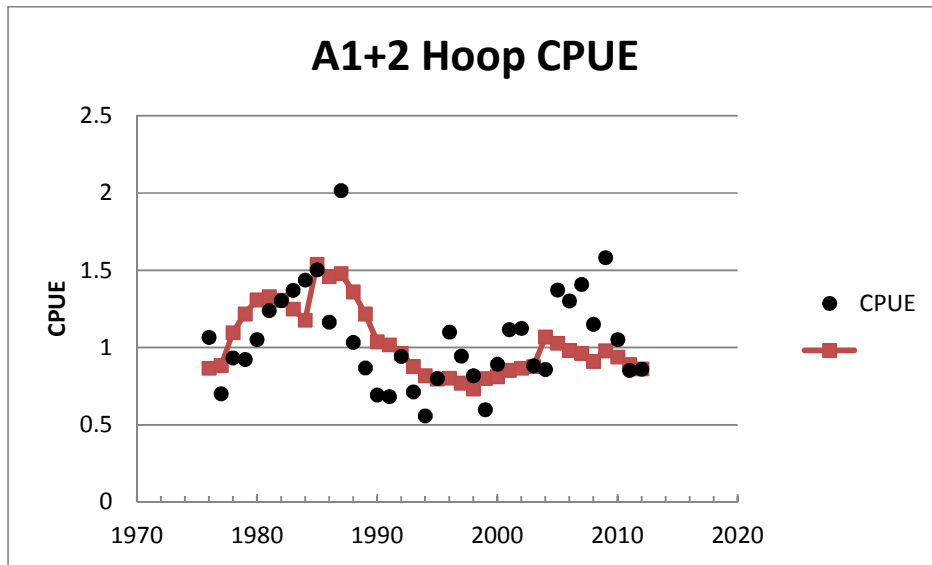


Figure 1b: A1+2 B75m and Bsp estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used in the geometric mean value to be used in projections which is shown as a dashed line.

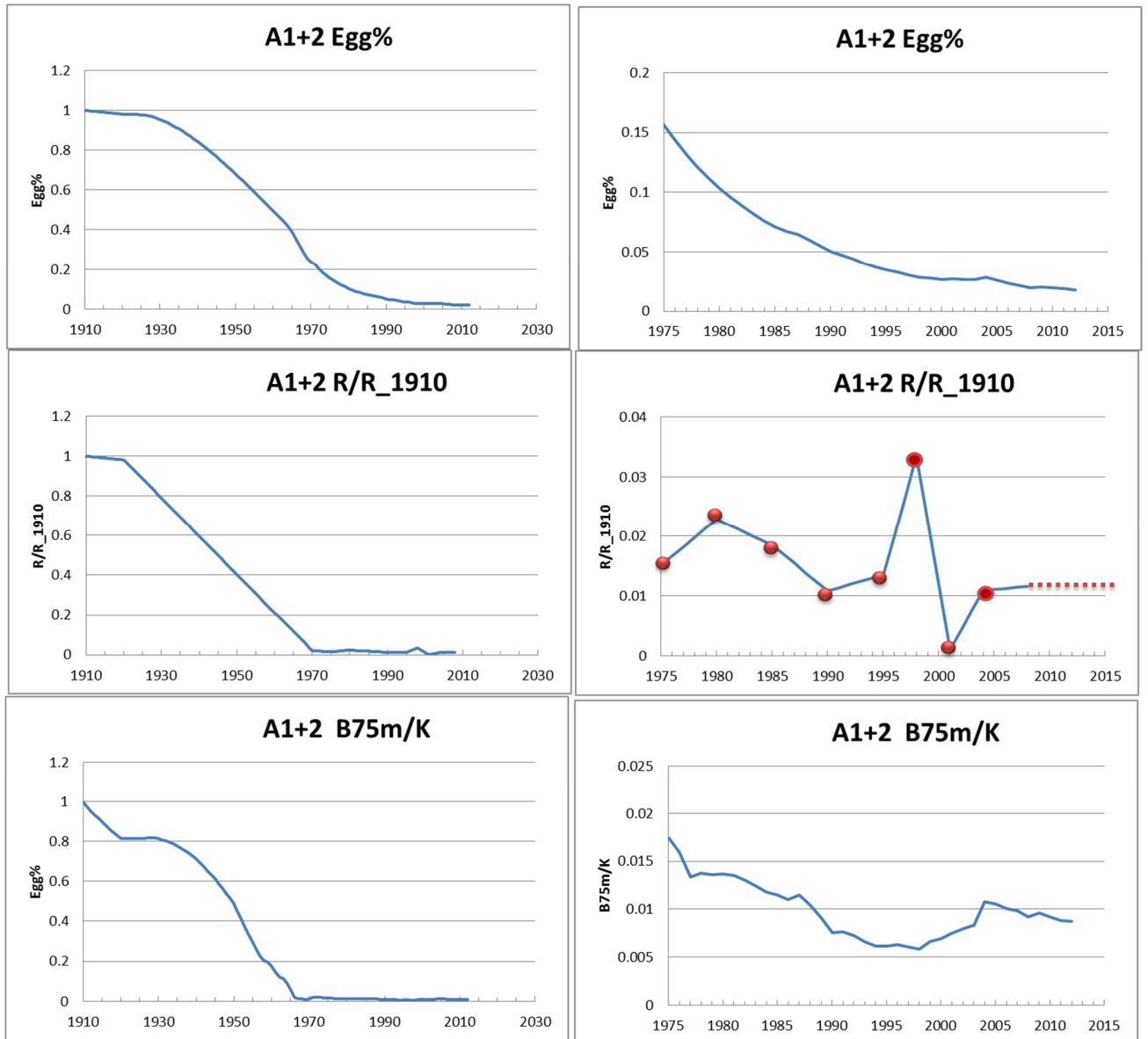


Figure 2a: Fits to A3+4 CPUE data.

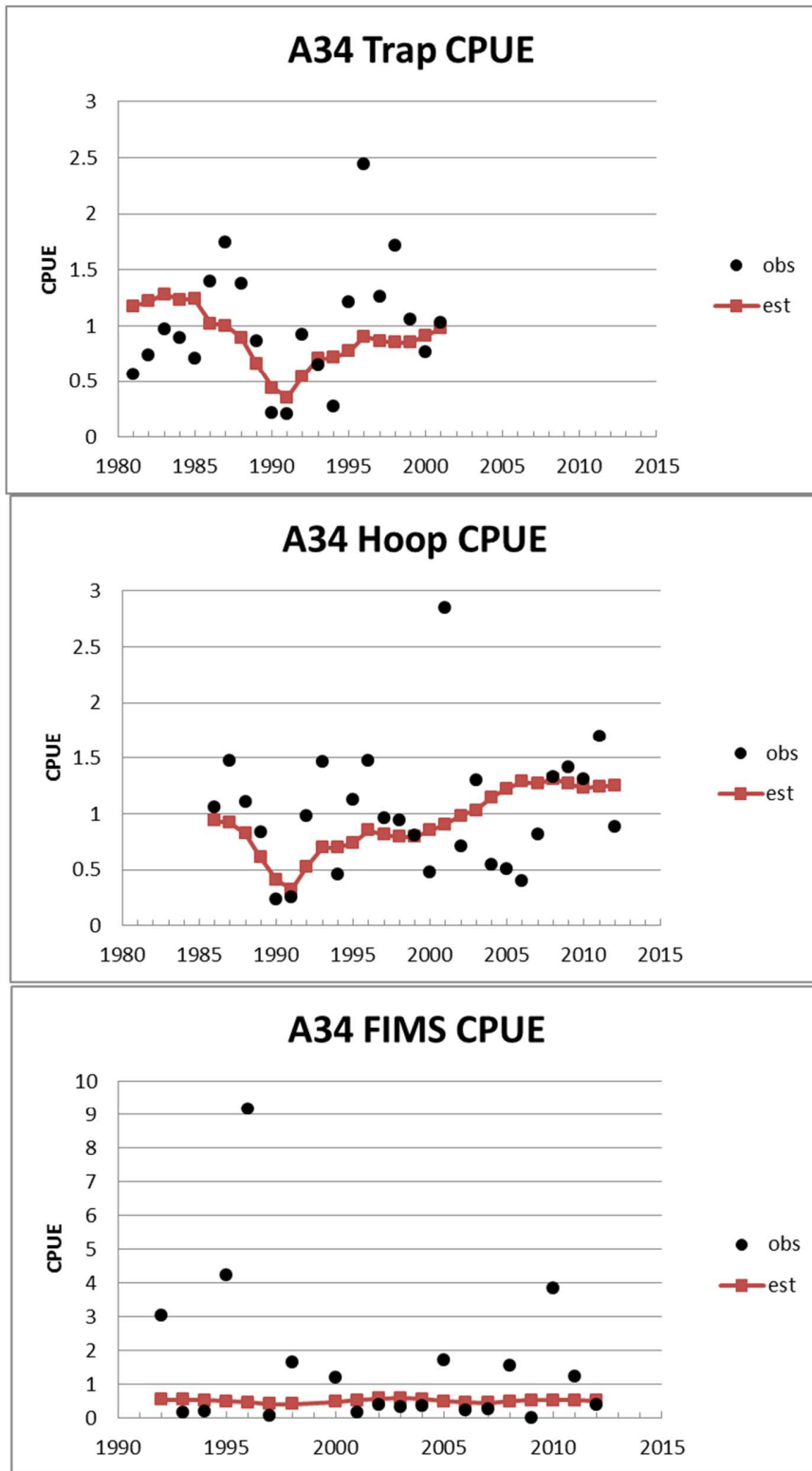


Figure 2b: A3+4 B75m and Bsp estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used in the geometric mean value to be used in projections which is shown as a dashed line.

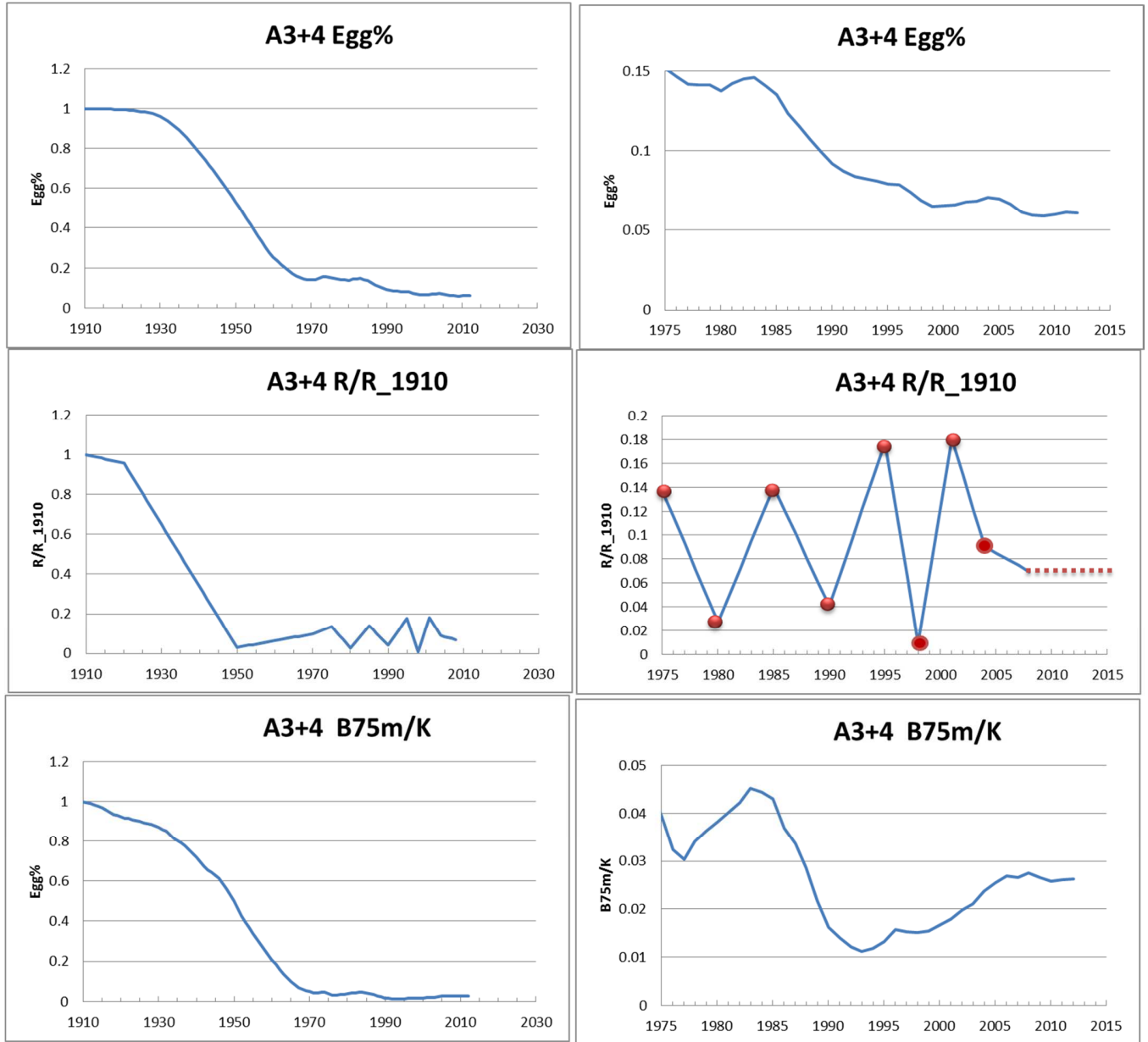


Figure 3a: Fits to A5+6 CPUE data.

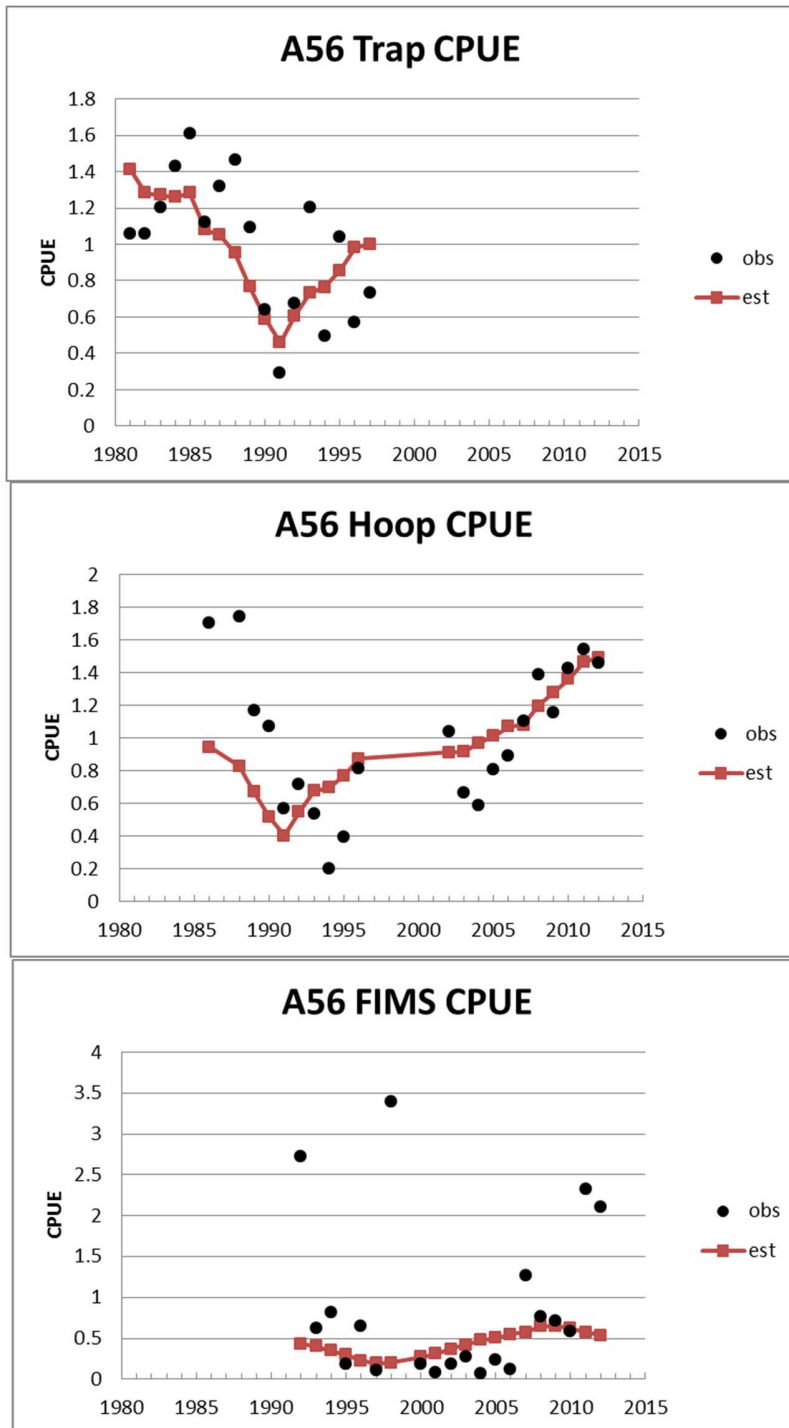


Figure 3b: A5+6 B75m and Bsp estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used in the geometric mean value to be used in projections which is shown as a dashed line.

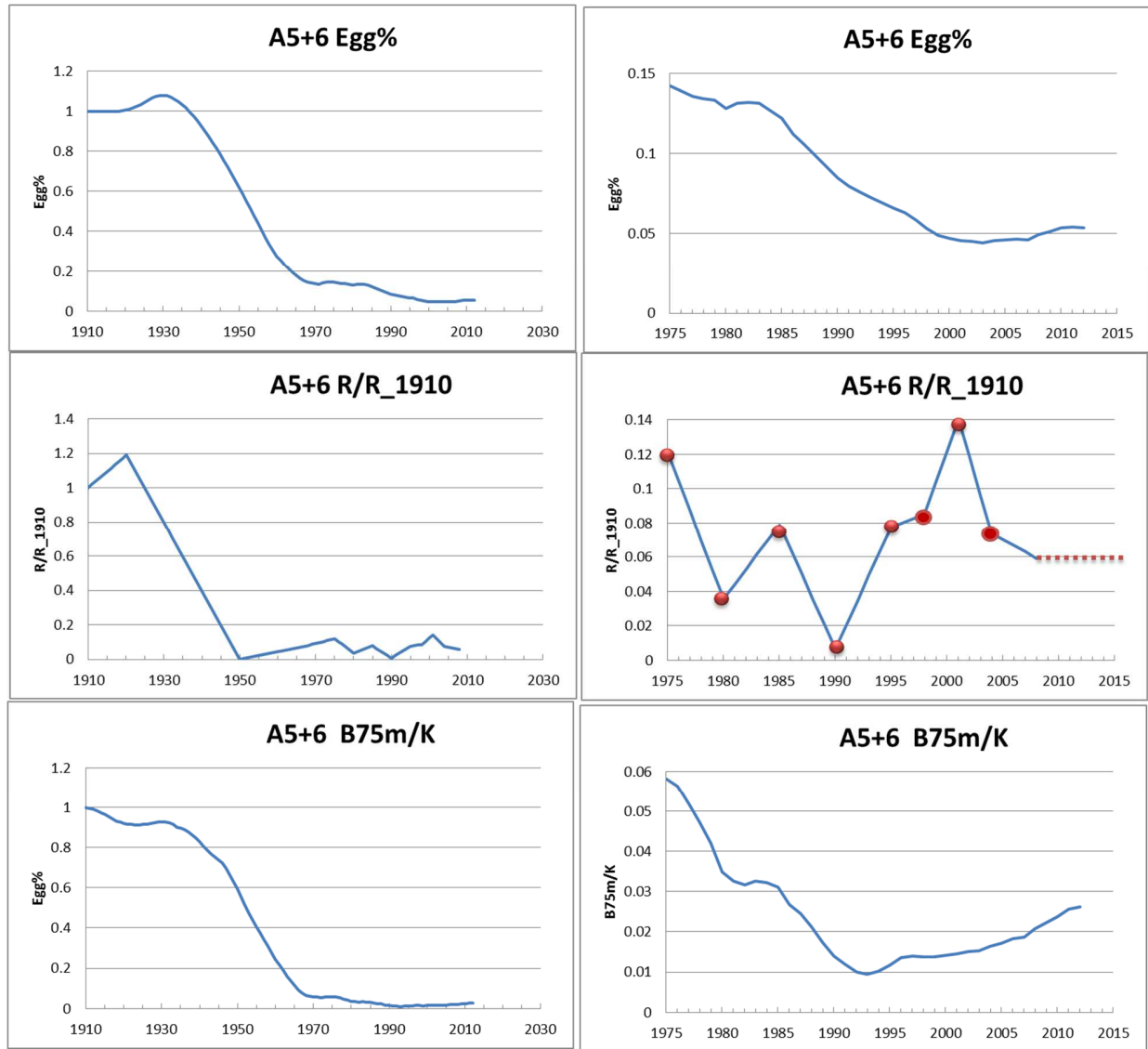


Figure 4a: Fits to A7 CPUE data.

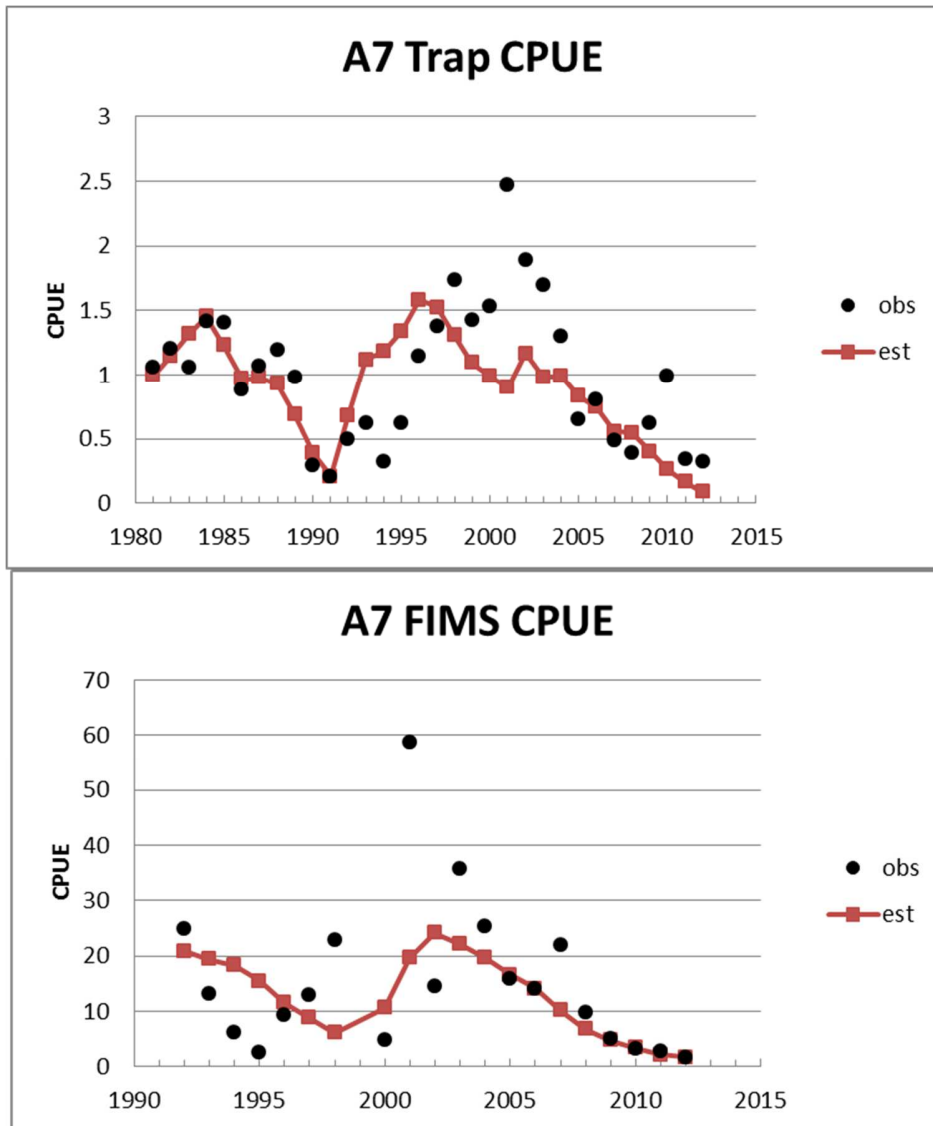


Figure 4b: A7 B75m and Bsp estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used in the geometric mean value to be used in projections which is shown as a dashed line.

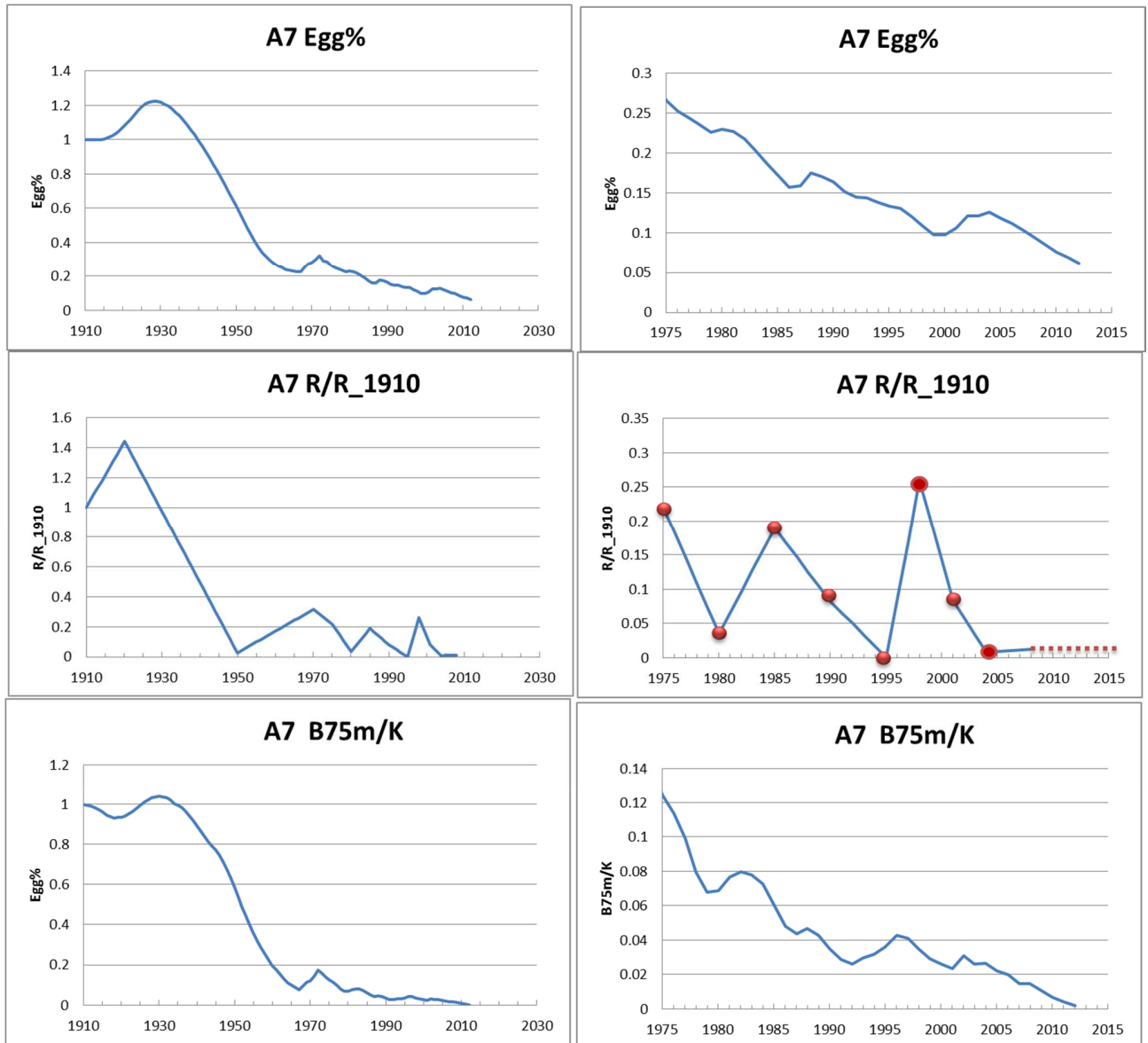


Figure 5a: Fits to A8+ CPUE data.

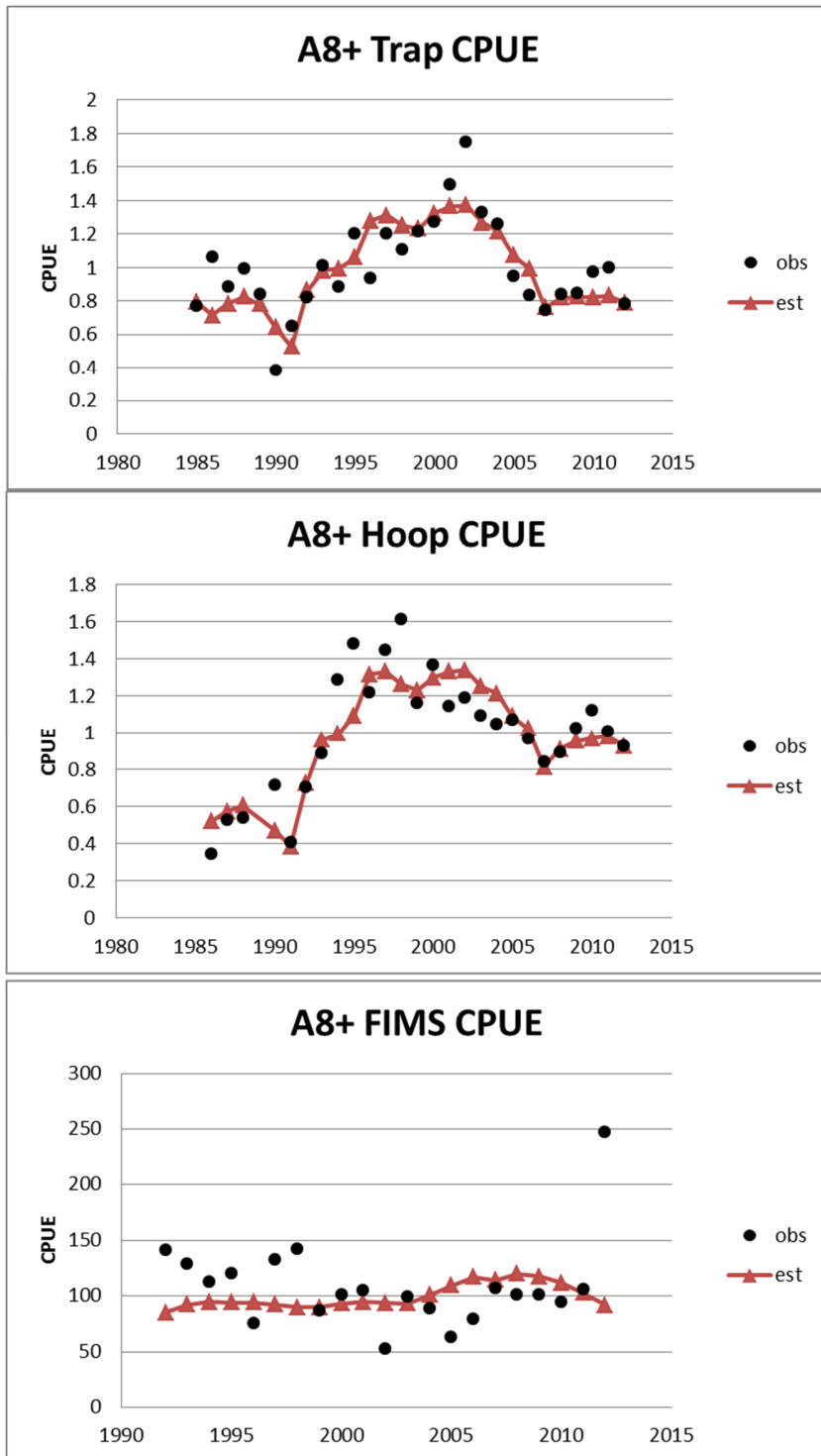


Figure 5b: A8+ Egg%, recruitment and B75m estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used in the geometric mean value to be used in projections which is shown as a dashed line.

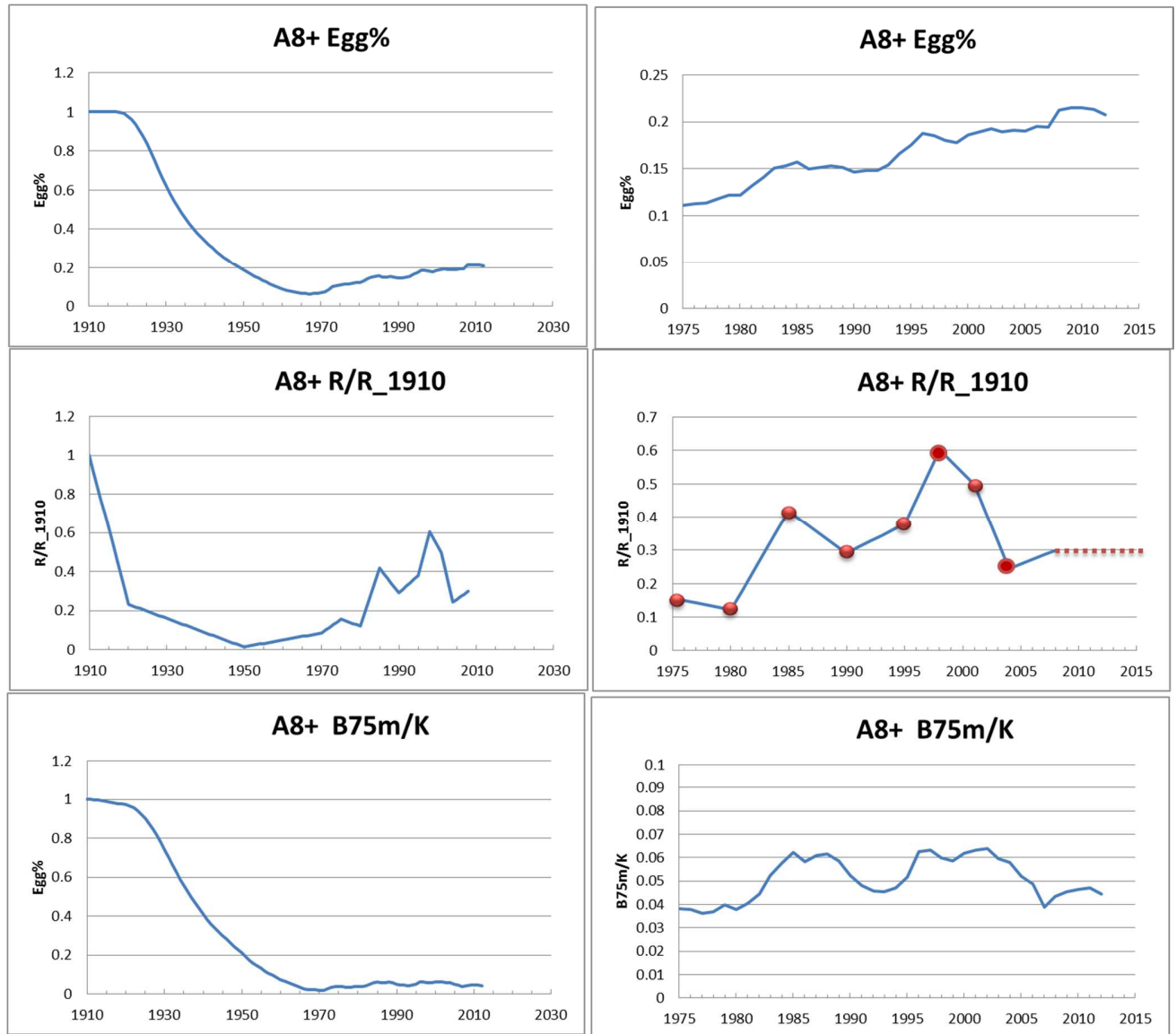


Figure 6a: Comparison of male exploitable biomass trends for each super-area between the 2011 assessments and the updated 2013 assessments.

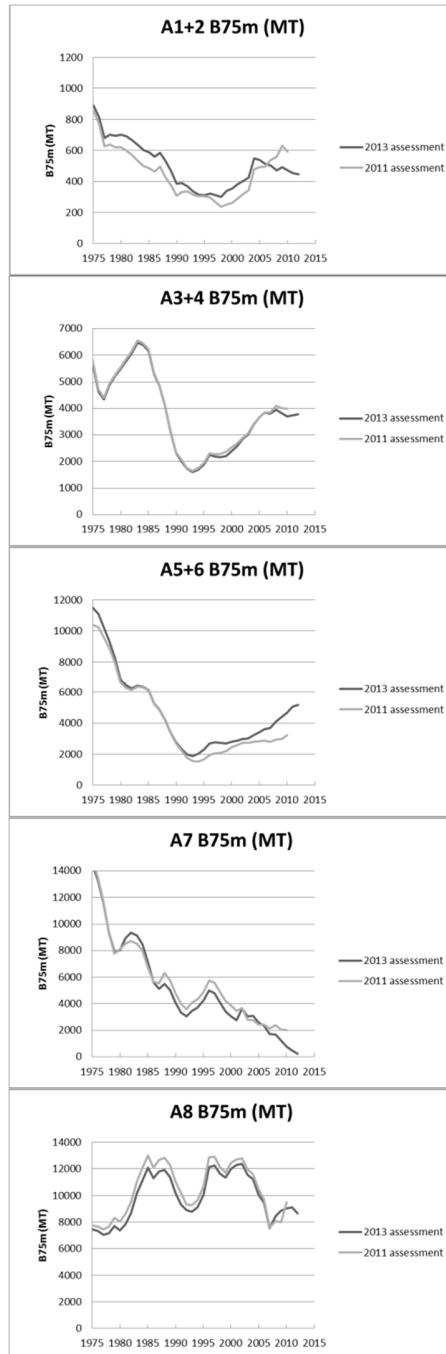


Figure 6b: Comparison of total male exploitable biomass trends for the resource as a whole between the 2011 assessments and the updated 2013 assessments. The top plot shows absolute tonnage, and the bottom plot shows the biomass relative to pristine.

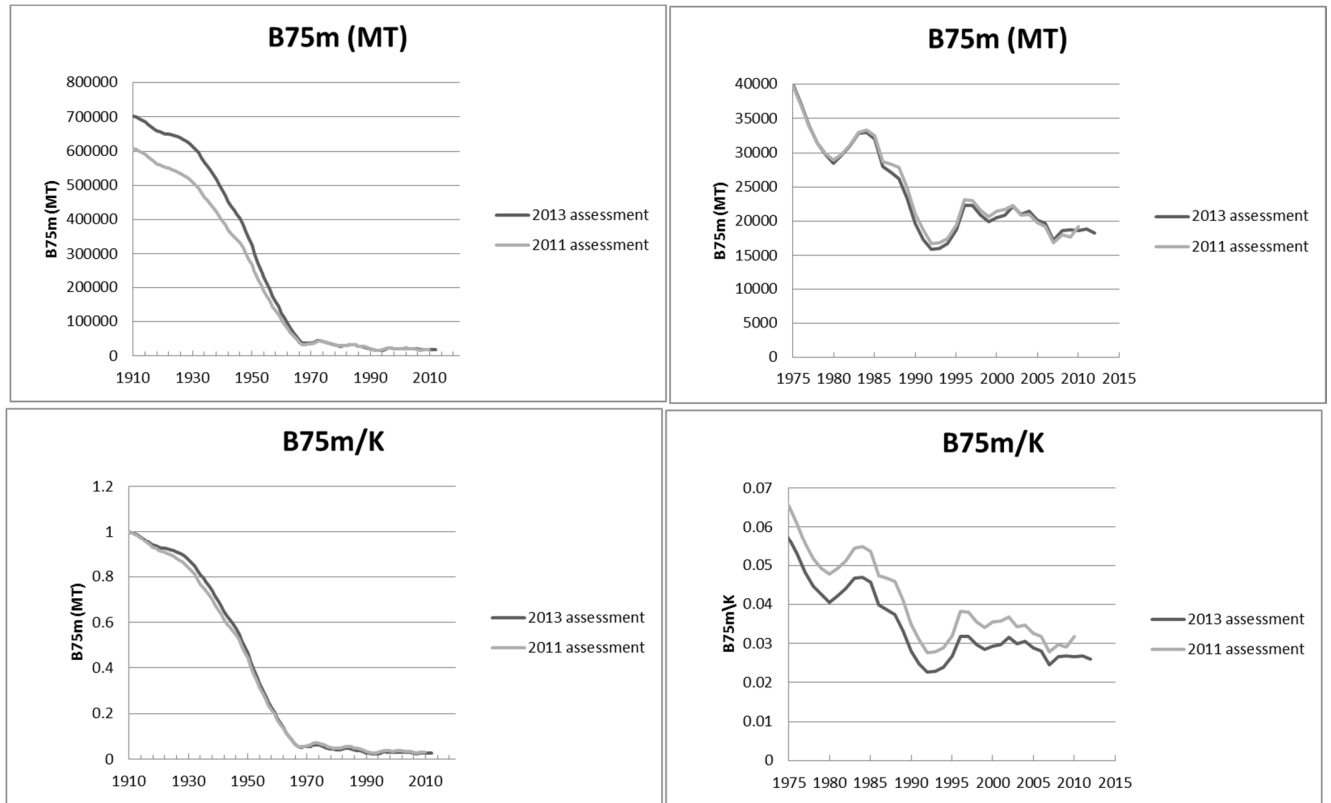


Figure 6c: Comparison of each super-area B75m contribution to overall resource biomass.

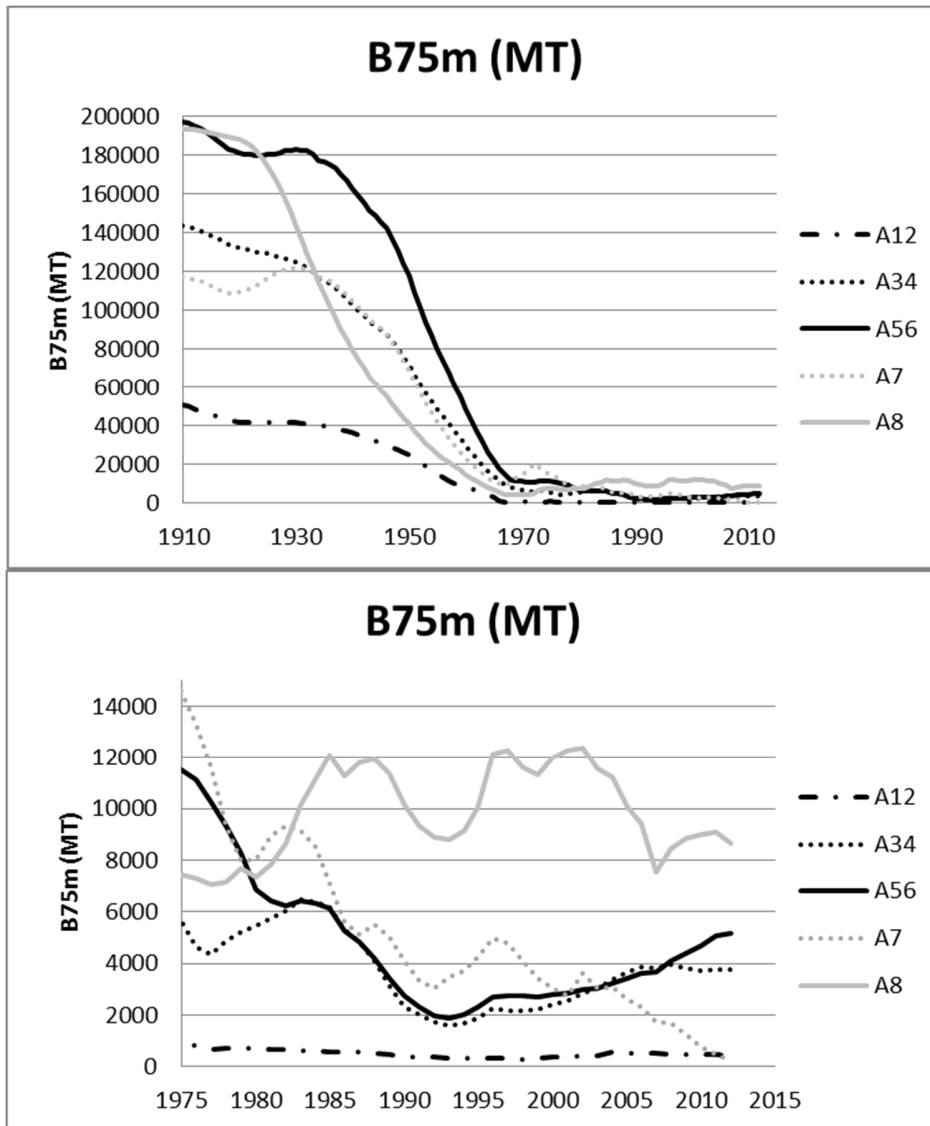


Figure 7: Comparison between the 2013 and 2011 estimated biomass trends (B75m) and the biomass recovery target. The OMP predicted trend is as calculated earlier in 2013 following retuning of the OMP to take account of the 2012 decision not to reduce the TAC as per the recommendation from the OMP at that time.

