Initial Updated 2015 assessments for West Coast rock lobster

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This document reports initial updated assessments for the five super-areas which are considered as separate populations of the west coast rock lobster resource. The previous assessment was conducted in 2014 (see Johnston 2014). The only "new" data available since the 2014 assessment are the FIMS catch-at-length and F% data for 2010-2013 (i.e. 4 more years of these data). The input data overall are thus:

- Commercial catches – see FISHERIES/2014/JUL/SWG-WCRL/12.
- Estimates of recreational takes – see FISHERIES/2014/JUN/SWG-WCRL/01.
- Updated poaching scenarios – see FISHERIES/2014/JUN/SWG-WCRL/08.
- Interim relief catch estimates – see FISHERIES/2014/JUL.SWG-WCRL/17.
- Commercial CPUE – see FISHERIES/2014/JUN/SWG-WCRL/4, 5, 6 and 9.[1]
- Commercial trap and hoopnet catch-at-length and F% data see FISHERIES/2011/MAR/SWG-WCRL/12.
- FIMS CPUE, catch-at-length and F% – see FISHERIES/2014/JUL/SWG-WCRL/11.
- Somatic growth rate – see FISHERIES/2014/JUN/SWG-WCRL/02.

Estimation and projection of recruitment

The recruitment trend is modeled as for the 2013 and 2014 assessments: recruitment is assumed to change linearly 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 –*ln*L based on the geometric mean as follows:

$$pen = \frac{1}{2}\frac{(lnR_{2004} - ln\bar{R})^2}{\sigma_R^2} \qquad \text{where}$$

$$\sigma_R^2 = \frac{\sum_{y=1975}^{y=2004}(lnR_y - ln\bar{R})^2}{7}$$

- All recruitments are constrained to be less than R1910.

[1] Note that the A7 2013/14 experimental CPUE data is included here.

Note that values assumed for recruitment after 2008 do not affect the assessment results shown, but would impact future projections.

Results

Tables 1-5 report the updated 2015 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 2014 assessment results for comparison. Table 6 gives summary statistics of the B75m(2014)/K and B75m(2014)/B75m(2006) for each super-area (with RC1 having 65% weight and RC2 having 0.35% weight), and also gives comparative values for the 2014 assessment (Johnston 2014). Statistics for the resource as a whole are also given, and also for the resource as a whole excluding super-area A7.

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 across the 2011, 2013, 2014 and 2015 assessments. Figure 6b shows the total male biomass trends for the resource as a whole across the 2011, 2013, 2014 and 2015 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, 2013, 2014 and 2015 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.

Super-area A7 is currently open to experimental fishing only as a result of a low combined Trap CPUE and FIMS index. The updated assessment suggests a much improved (in relative terms) abundance compared to that estimated in Johnston (2014) (Table 4 and Figure 4a). However what is evident from this Figure is that this difference reflects an incompatibility between recent trends in CPUE and FIMS, with the 2014 assessment focusing more on fitting the FIMS, and the 2015 one more on fitting the Trap CPUE. (Note that it is only for A7 that there is as an obvious a conflict amongst different indices of abundance). This is being pursued further by developing likelihood profiles as functions of the current extent of resource depletion to provide a basis to decide how best to proceed for this super-area.

Reference

Johnston, 2014. Updated 2014 assessments for West Coast rock lobster. DAFF document, FISHEREIS/2013/JUL/SWG_WCRL14.

Table 1: No updated 2015 assessment results for super-area A1+2 have been produced as no new data are available for that region.

	2014 Historic Poaching= 500 MT	**2014 Historic Poaching= 250 MT**
B_{75}^{m}(1910) MT	49 841	49 650
B_{75}^{m}(2010) MT	314	311
B_{75}^{m}(2012) MT	289	287
B_{75}^{m}(2014) MT	274	273
B_{75}^{m}(2010)/ B_{75}^{m} (1910)	0.006	0.006
B_{75}^{m}(2012)/ B_{75}^{m} (1910)	0.006	0.006
B_{75}^{m}(2014)/ B_{75}^{m} (1910)	0.006	0.005
B_{75}^{m}(2010)/ B_{75}^{m}(1996)	1.233	1.274
B_{75}^{m}(2012)/ B_{75}^{m}(1996)	1.137	1.177
B_{75}^{m}(2014)/ B_{75}^{m}(1996)	1.077	1.117
B_{75}^{m}(2010)/ B_{75}^{m}(2006)	0.883	0.885
B_{75}^{m}(2012)/ B_{75}^{m}(2006)	0.814	0.817
B_{75}^{m}(2014)/ B_{75}^{m}(2006)	0.772	0.775
Egg (2010)/Egg (1910)	0.016	0.015
Egg (2012)/Egg (1910)	0.014	0.014
Egg (2014)/Egg (1910)	0.014	0.014

Table 2: Updated 2015 assessment results for super-area A3+4.

	2014 Historic Poaching= 500 MT	**2014 Historic Poaching= 250 MT**	**2015 Historic Poaching= 500 MT**	**2015 Historic Poaching= 250 MT**
B_{75}^{m}(1910) MT	145 413	145 466	145 600	147 370
B_{75}^{m}(2010) MT	3 831	3 943	3 679	3 721
B_{75}^{m}(2012) MT	4279	4398	3 988	4 075
B_{75}^{m}(2014) MT	4754	4888	5 051	5 066
B_{75}^{m}(2010)/ B_{75}^{m} (1910)	0.026	0.027	0.025	0.025
B_{75}^{m}(2012)/ B_{75}^{m} (1910)	0.029	0.030	0.028	0.028
B_{75}^{m}(2014)/ B_{75}^{m} (1910)	0.033	0.034	0.035	0.034
B_{75}^{m}(2010)/ B_{75}^{m}(1996)	1.637	1.666	1.625	1.670
B_{75}^{m}(2012)/ B_{75}^{m}(1996)	1.829	1.857	1.922	1.990
B_{75}^{m}(2014)/ B_{75}^{m}(1996)	2.032	2.964	2.231	2.274
B_{75}^{m}(2010)/ B_{75}^{m}(2006)	0.967	0.969	0.929	0.948
B_{75}^{m}(2012)/ B_{75}^{m}(2006)	1.081	1.081	1.098	1.129
B_{75}^{m}(2014)/ B_{75}^{m}(2006)	1.201	1.201	1.275	1.291
Egg (2010)/Egg (1910)	0.061	0.061	0.061	0.060
Egg (2012)/Egg (1910)	0.061	0.062	0.063	0.066
Egg (2014)/Egg (1910)	0.062	0.063	0.071	0.067

Table 3: Updated 2015 assessment results for super-area A5+6.

	2014 Historic Poaching= 500 MT	**2014 Historic Poaching= 250 MT**	**2015 Historic Poaching= 500 MT**	**2015 Historic Poaching= 250 MT**
B_{75}^{m}(1910) MT	196 491	191 931	217 129	208 950
B_{75}^{m}(2010) MT	3 252	2 987	2 499	2 569
B_{75}^{m}(2012) MT	3 766	3303	2 821	2 933
B_{75}^{m}(2014) MT	4 194	3701	3 564	3 721
B_{75}^{m}(2010)/ B_{75}^{m} (1910)	0.017	0.016	0.012	0.012
B_{75}^{m}(2012)/ B_{75}^{m} (1910)	0.019	0.017	0.013	0.014
B_{75}^{m}(2014)/ B_{75}^{m} (1910)	0.021	0.019	0.016	0.018
B_{75}^{m}(2010)/ B_{75}^{m}(1996)	1.708	1.600	1.829	1.803
B_{75}^{m}(2014)/ B_{75}^{m}(1996)	2.203	1.984	2.608	2.611
B_{75}^{m}(2010)/ B_{75}^{m}(2006)	1.166	1.104	1.302	1.289
B_{75}^{m}(2014)/ B_{75}^{m}(2006)	1.504	1.369	1.856	1.867
Egg (2010)/Egg (1910)	0.040	0.037	0.032	0.034
Egg (2012)/Egg (1910)	0.041	0.038	0.036	0.038
Egg (2014)/Egg (1910)	0.043	0.040	0.038	0.040

Table 4: Updated 2015 assessment results for super-area A7.

	2014 Historic Poaching= 500 MT	**2014 Historic Poaching= 250 MT**	**2015 Historic Poaching= 500 MT**	**2015 Historic Poaching= 250 MT**
B^m_{75}(1910) MT	120 042	121 319	140 592	136 818
B^m_{75}(2010) MT	835	1401	1 910	2 837
B^m_{75}(2012) MT	197	948	2 175	3 110
B^m_{75}(2014) MT	249	1020	2 903	3 809
B^m_{75}(2010)/ B^m_{75} (1910)	0.006	0.015	0.014	0.021
B^m_{75}(2012)/ B^m_{75} (1910)	0.002	0.008	0.015	0.023
B^m_{75}(2014)/ B^m_{75} (1910)	0.002	0.008	0.021	0.028
B^m_{75}(2012)/ B^m_{75}(1996)	0.040	0.091	0.420	0.478
B^m_{75}(2014)/ B^m_{75}(1996)	0.051	0.206	0.597	0.530
B^m_{75}(2010)/ B^m_{75}(2006)	0.400	0.624	0.743	0.775
B^m_{75}(2014)/ B^m_{75}(2006)	0.120	0.455	1.132	1.040
Egg (2010)/Egg (1910)	0.078	0.084	0.087	0.094
Egg (2012)/Egg (1910)	0.059	0.065	0.084	0.092
Egg (2014)/Egg (1910)	0.054	0.060	0.085	0.091

Table 5: Updated 2015 assessment results for super-area A8+.

	2014 Historic Poaching= 500 MT	**2014 Historic Poaching= 250 MT**	**2015 Historic Poaching= 500 MT**	**2015 Historic Poaching= 250 MT**
B^m_{75}(1910) MT	190 368	176 789	192 267	180 528
B^m_{75}(2010) MT	9 113	8 580	8 582	8 214
B^m_{75}(2012) MT	8 062	7 850	8 117	7 860
B^m_{75}(2014) MT	9 189	9 223	9 933	9 825
B^m_{75}(2010)/ B^m_{75} (1910)	0.048	0.048	0.045	0.046
B^m_{75}(2012)/ B^m_{75} (1910)	0.042	0.044	0.042	0.044
B^m_{75}(2014)/ B^m_{75} (1910)	0.048	0.052	0.052	0.054
B^m_{75}(2010)/ B^m_{75}(1996)	0.702	0.690	0.707	0.705
B^m_{75}(2014)/ B^m_{75}(1996)	0.708	0.741	0.818	0.842
B^m_{75}(2010)/ B^m_{75}(2006)	0.898	0.874	0.890	0.879
B^m_{75}(2014)/ B^m_{75}(2006)	0.906	0.940	1.030	1.051
Egg (2010)/Egg (1910)	0.206	0.201	0.201	0.195
Egg (2014)/Egg (1910)	0.188	0.185	0.213	0.207

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 (with and without A7) for the initial updated 2015 assessments. The values from the 2014 assessment are also reported in the unshaded columns.

	B75m(2014)/K	B75m(2014)/K	B75m(2014)/B75m(2006)	B75m(2014)/B75m(2006)
A1+2	0.005	0.005	0.773	0.773
A3+4	0.033	0.035	1.201	1.280
A5+6	0.021	0.017	1.457	1.860
A7	0.004	0.023	0.243	1.092
A8	0.050	0.053	0.917	1.037
Total excl A7	**0.032**	**0.032**	**1.067**	**1.194**
Total resource	**0.027**	**0.030**	**0.976**	**1.118**

Figure 1a: Fits to A1+2 CPUE data (from 2014 assessment as there are no further data available here to update).

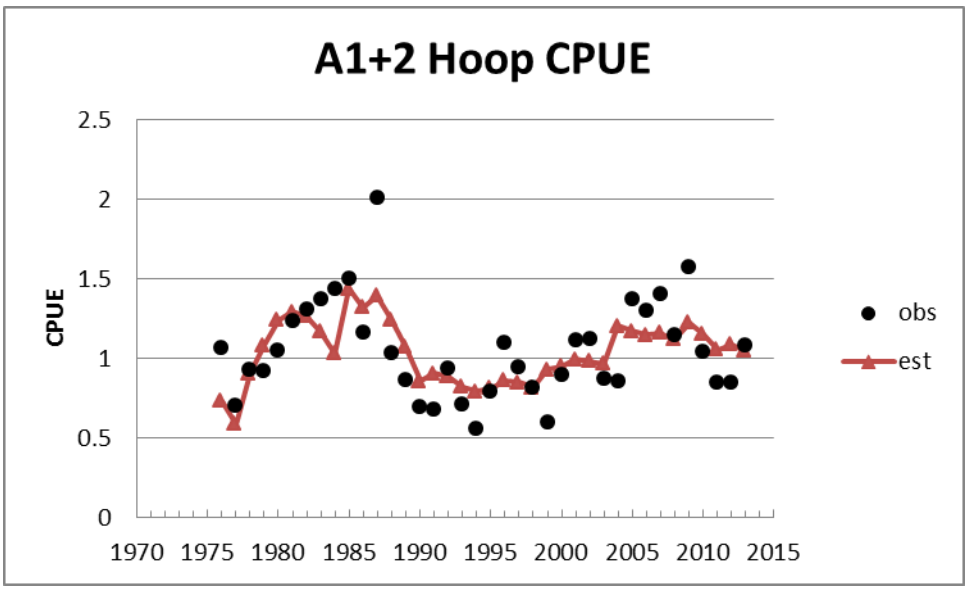


Figure 1b: A1+2 B75m and Bsp **2014** estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate the geometric mean value (R2008+ - see main text) to be used in projections, which is shown as a dashed line.

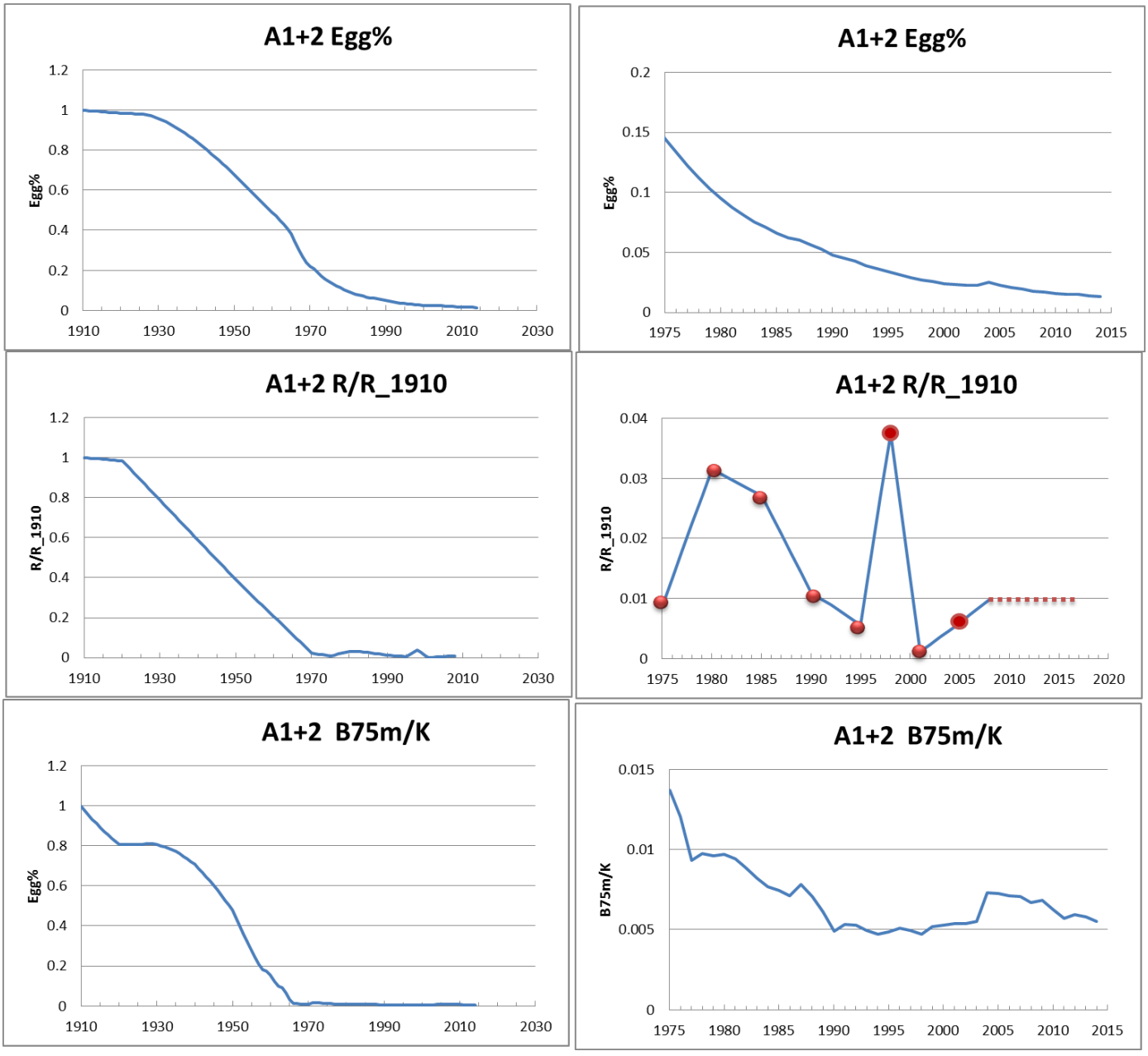


Figure 2a: Fits to A3+4 CPUE data.

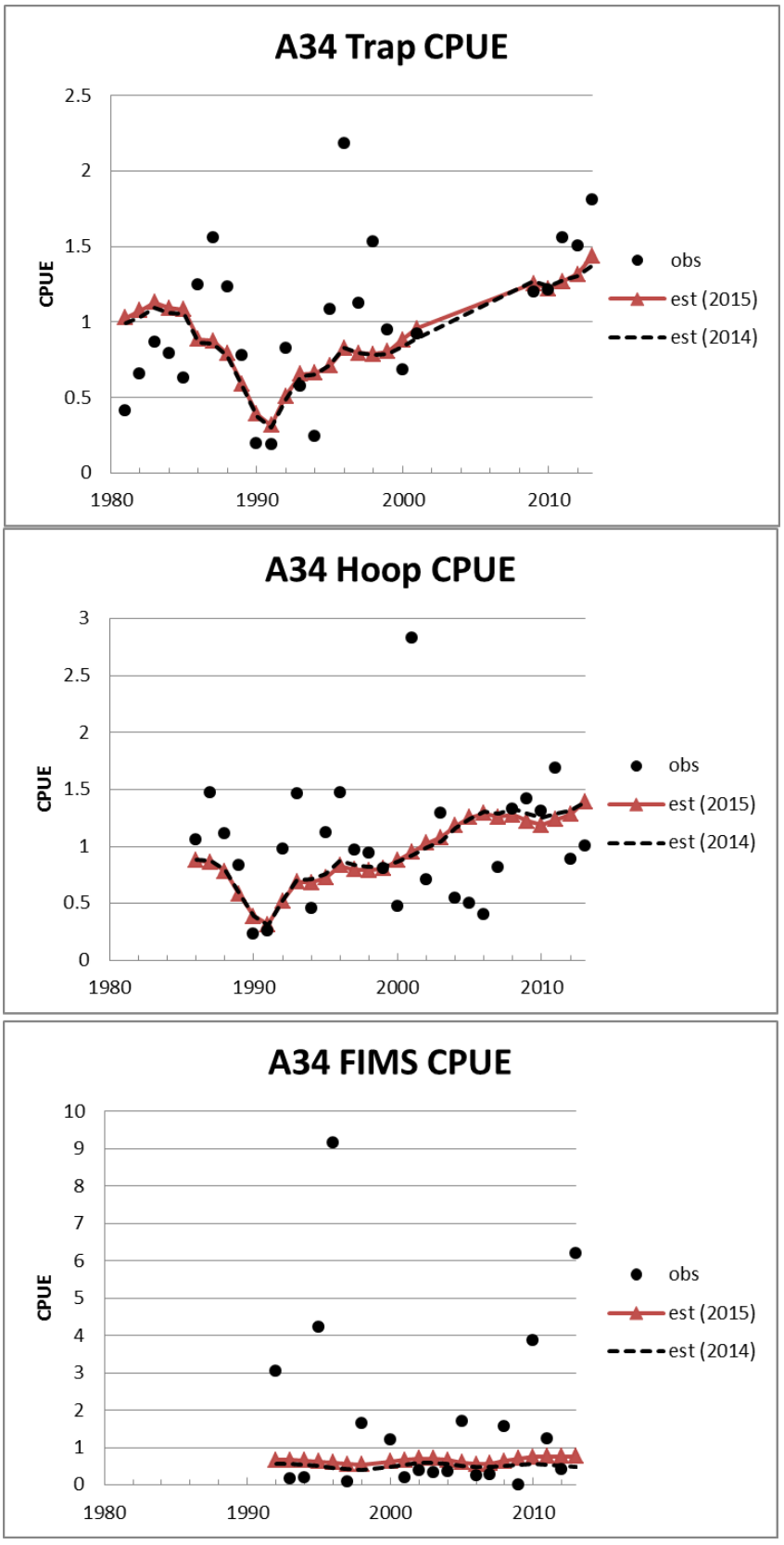


Figure 2b: A3+4 B75m and Bsp estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate the geometric mean value (R2008+ - see main text) to be used in projections, which is shown as a dashed line.

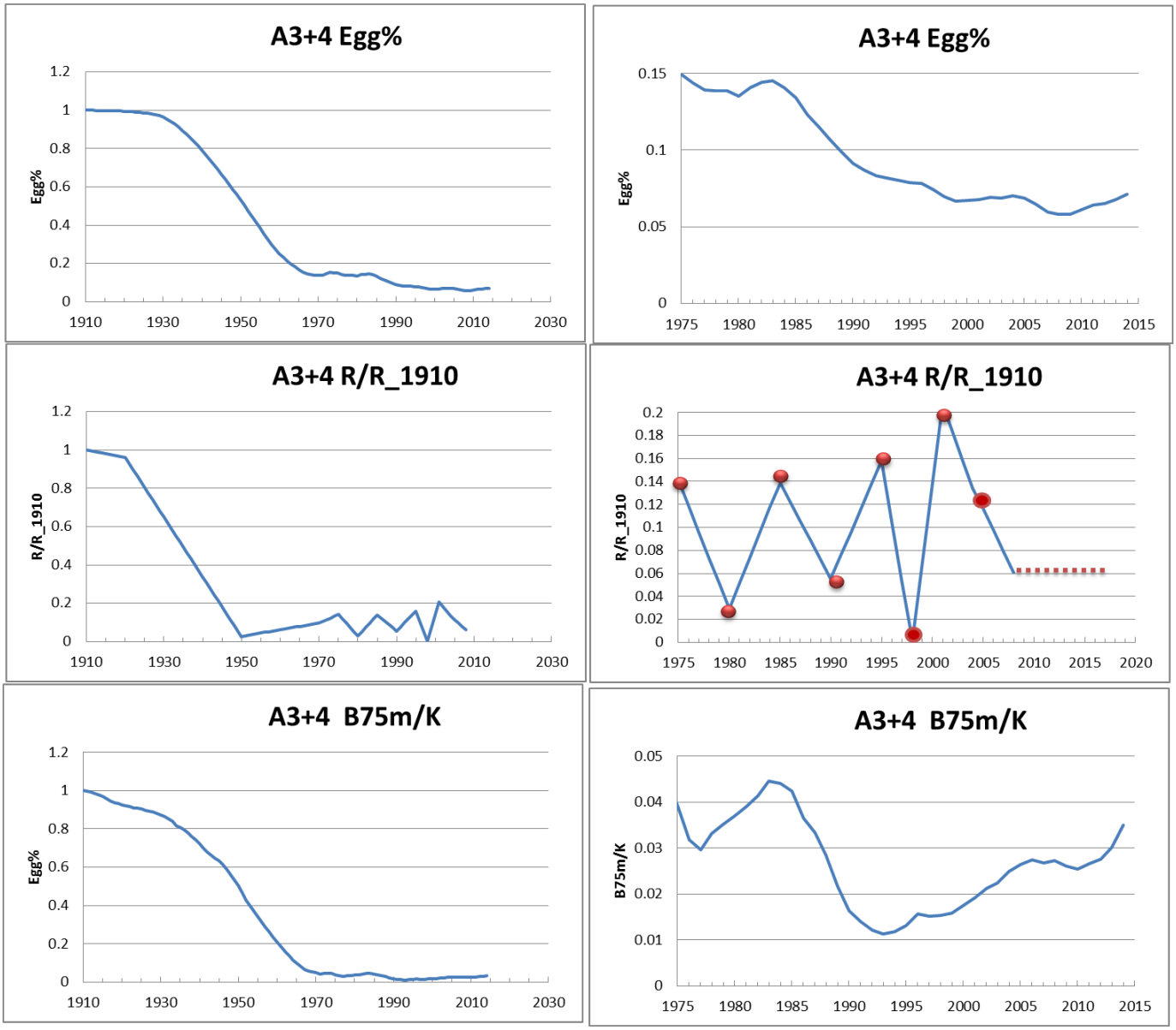
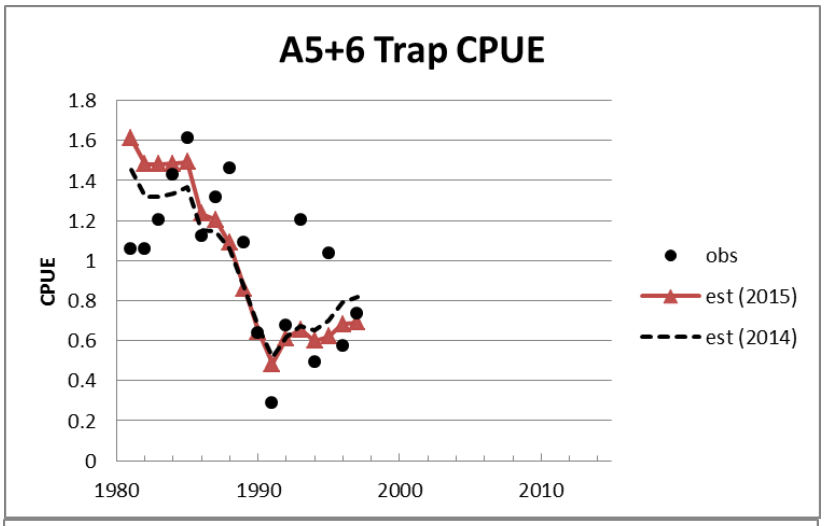
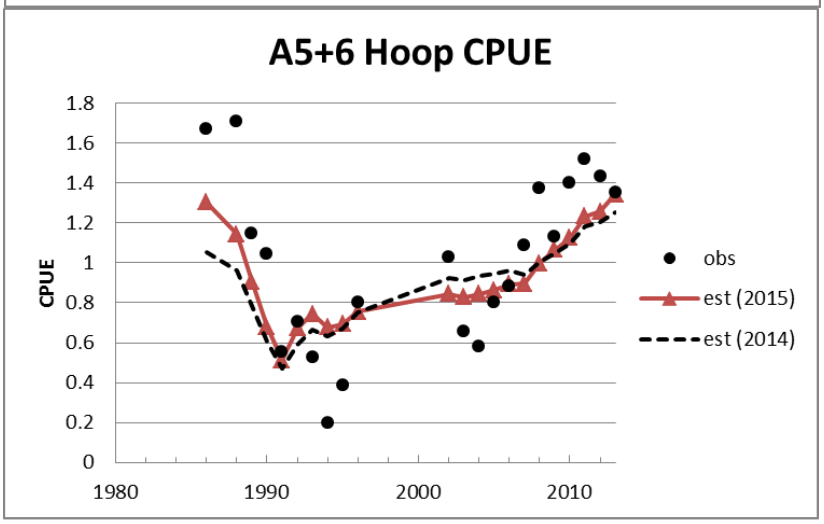


Figure 3a: Fits to A5+6 CPUE data.





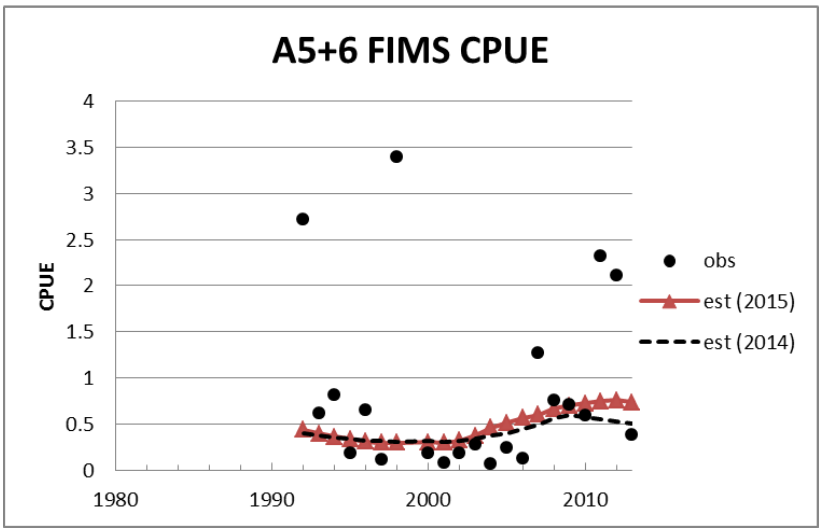


Figure 3b: A5+6 B75m and Bsp estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate the geometric mean value (R2008+ - see main text) to be used in projections, which is shown as a dashed line.

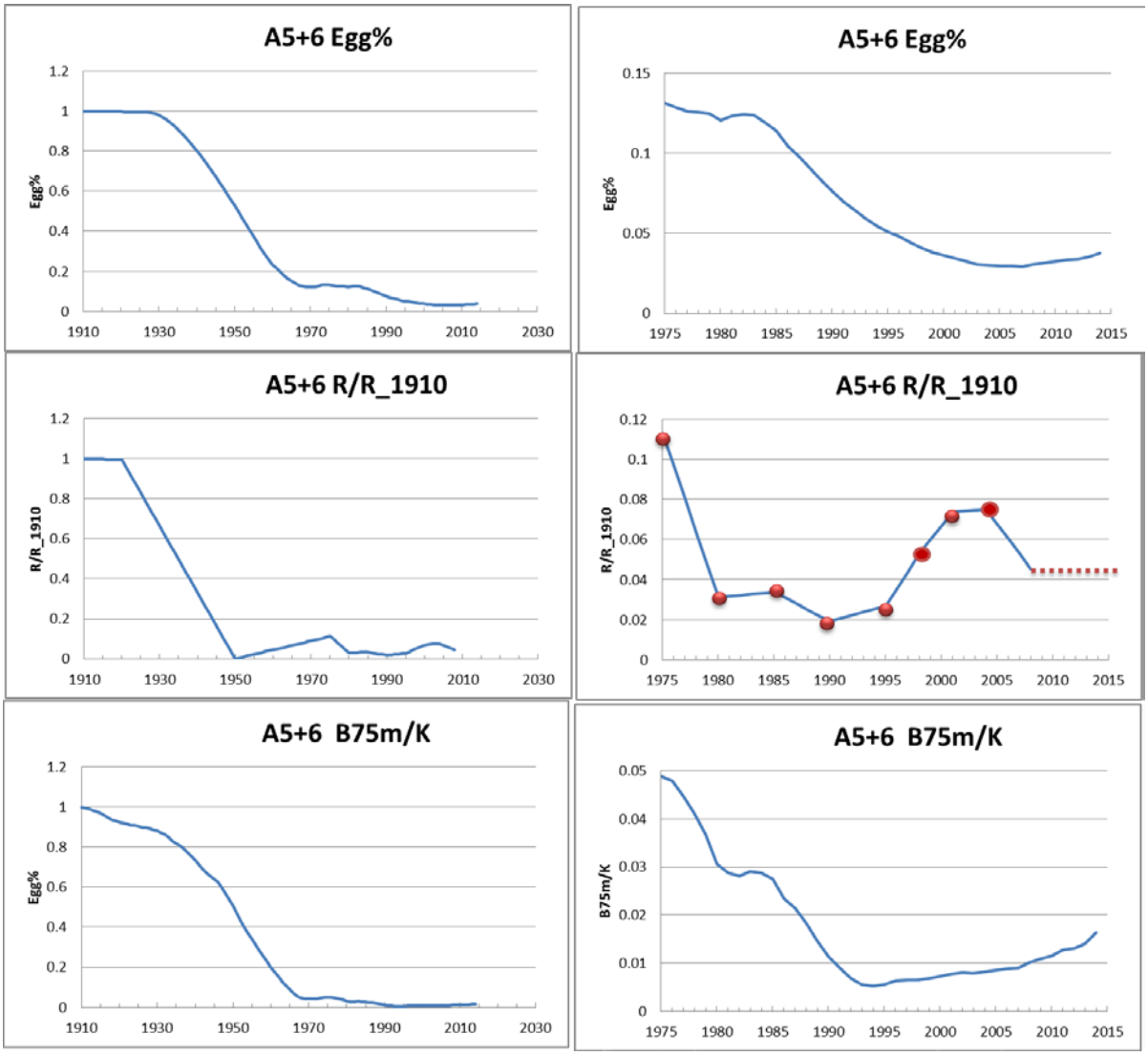
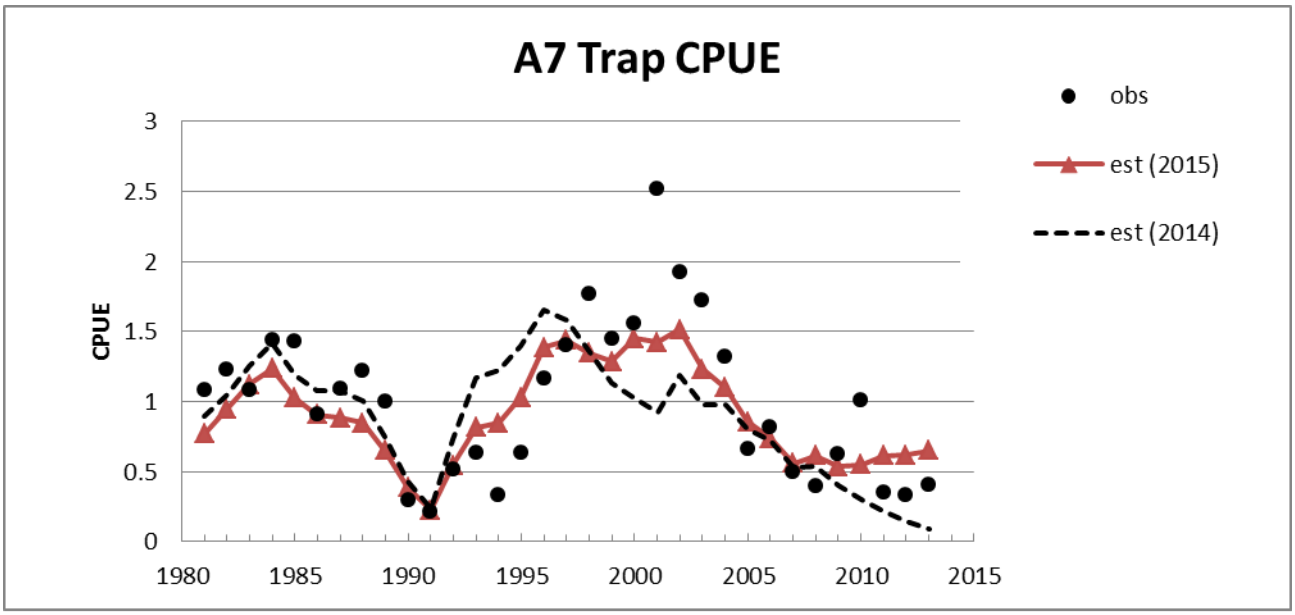


Figure 4a: Fits to A7 CPUE data.



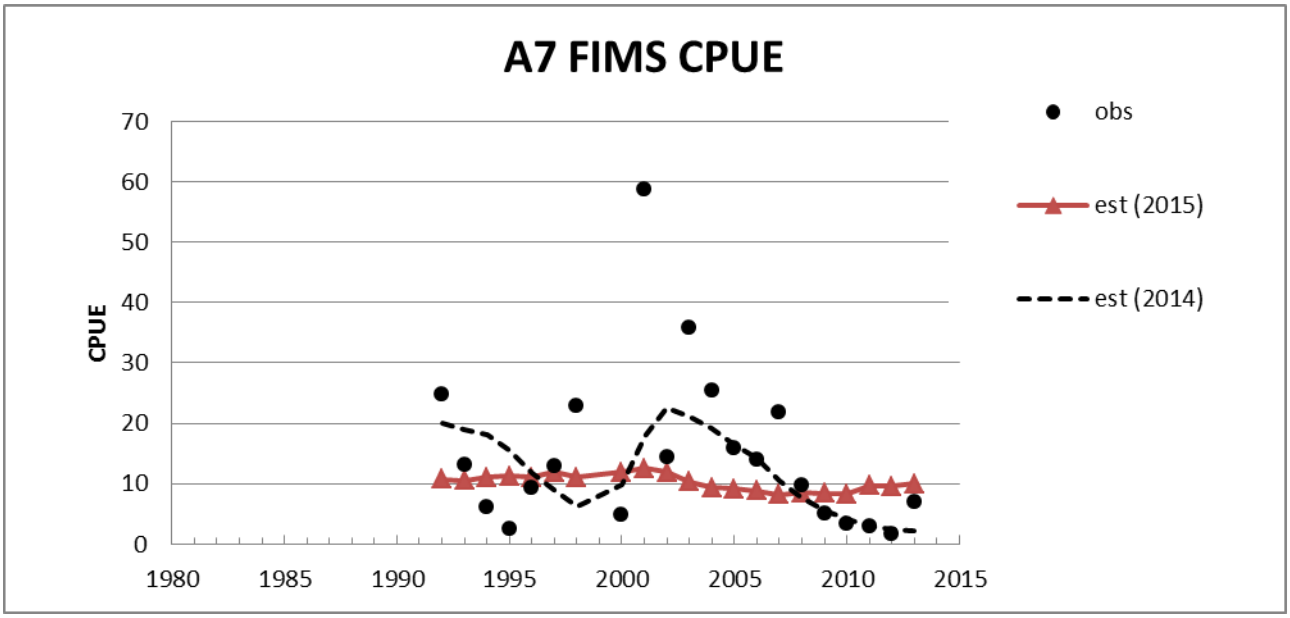


Figure 4b: A7 B75m and Bsp estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate the geometric mean value for 2008+, which is shown as a dashed line).

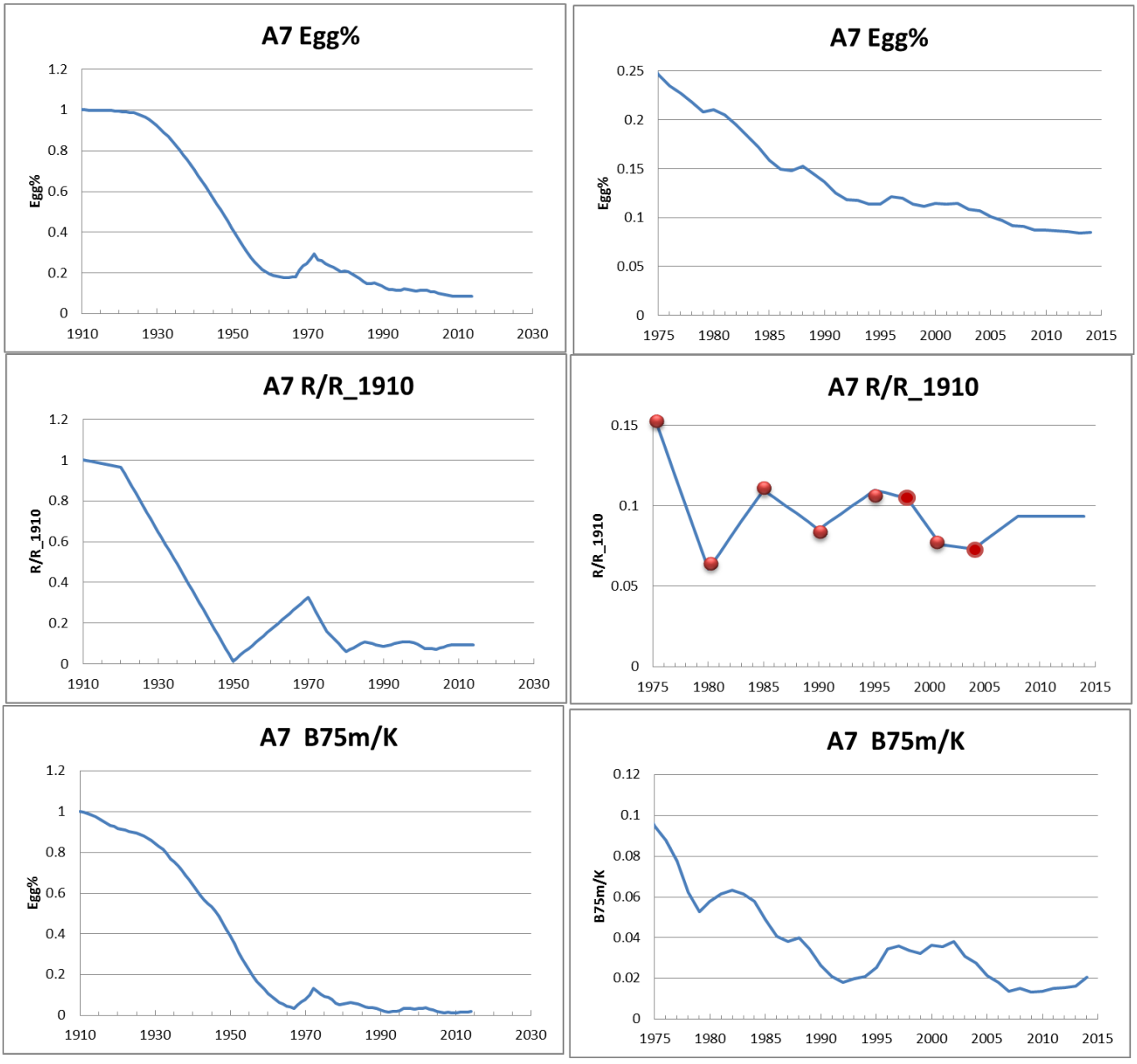


Figure 5a: Fits to A8+ CPUE data.

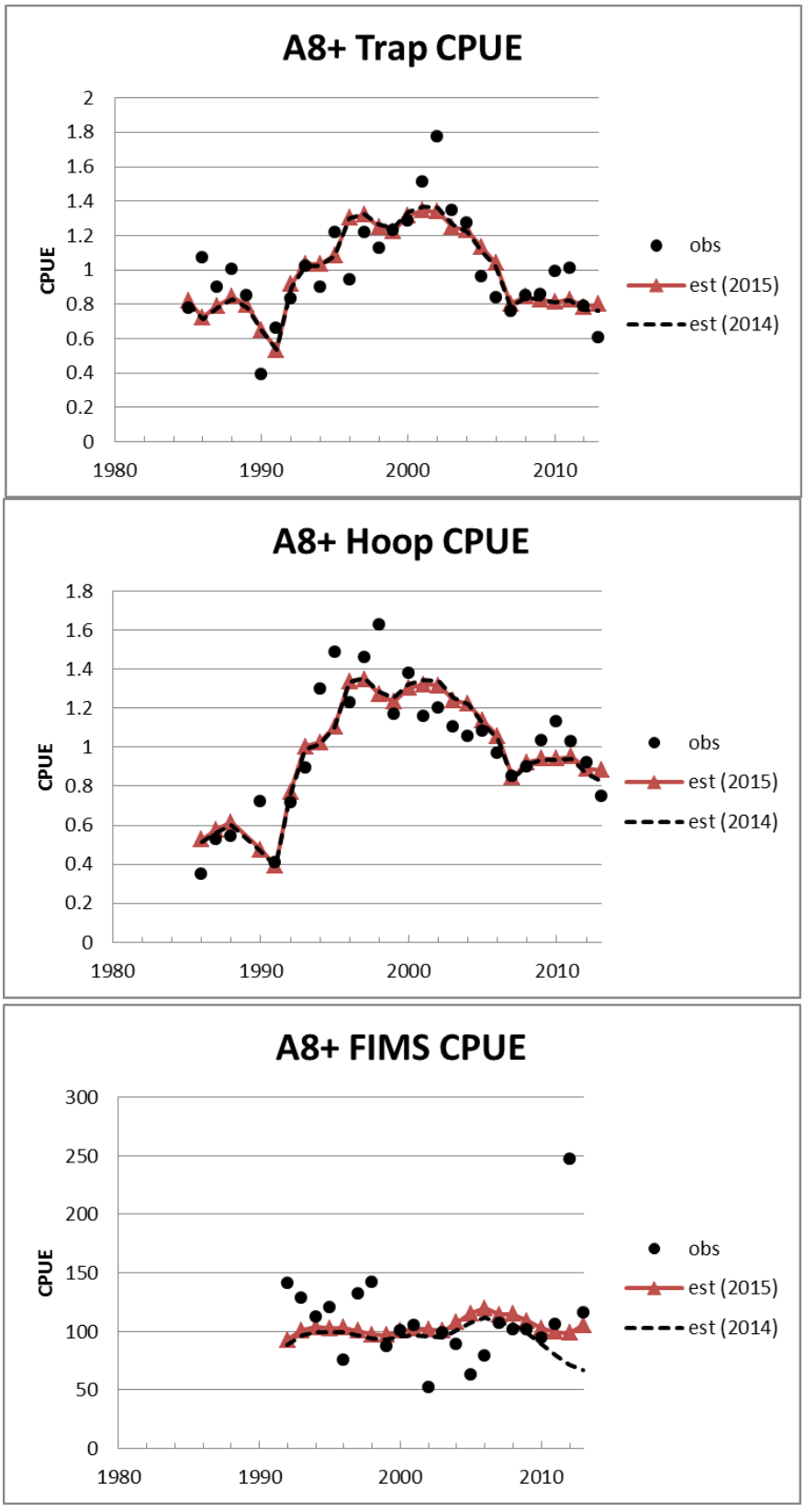


Figure 5b: A8+ Egg%, recruitment and B75m estimated trends. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate the geometric mean value (R2008+ - see main text) to be used in projections, which is shown as a dashed line.

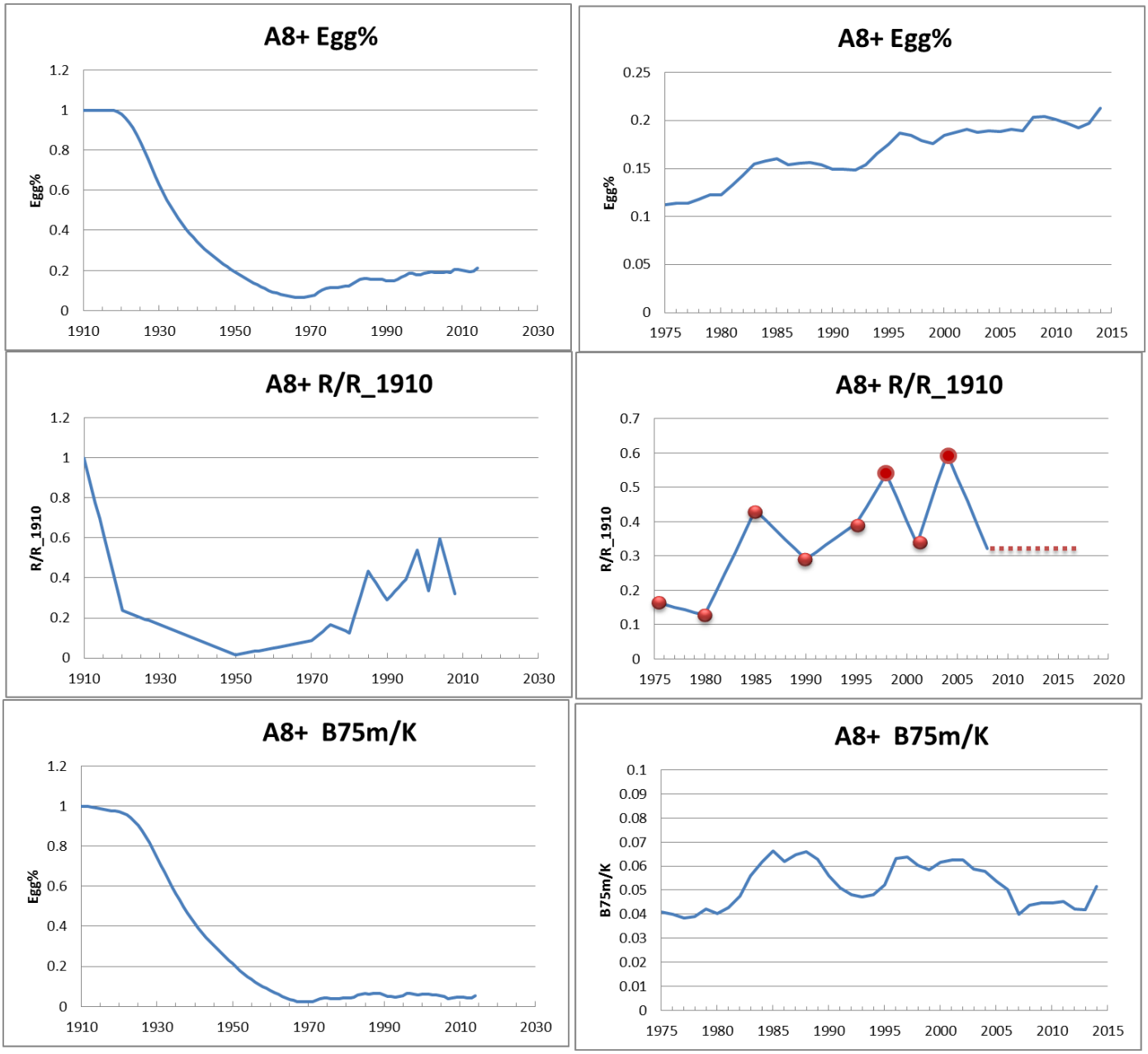


Figure 6a: Comparison of male exploitable biomass trends for each super-area between the 2011, 2013, 2014 and the updated 2015 assessments.

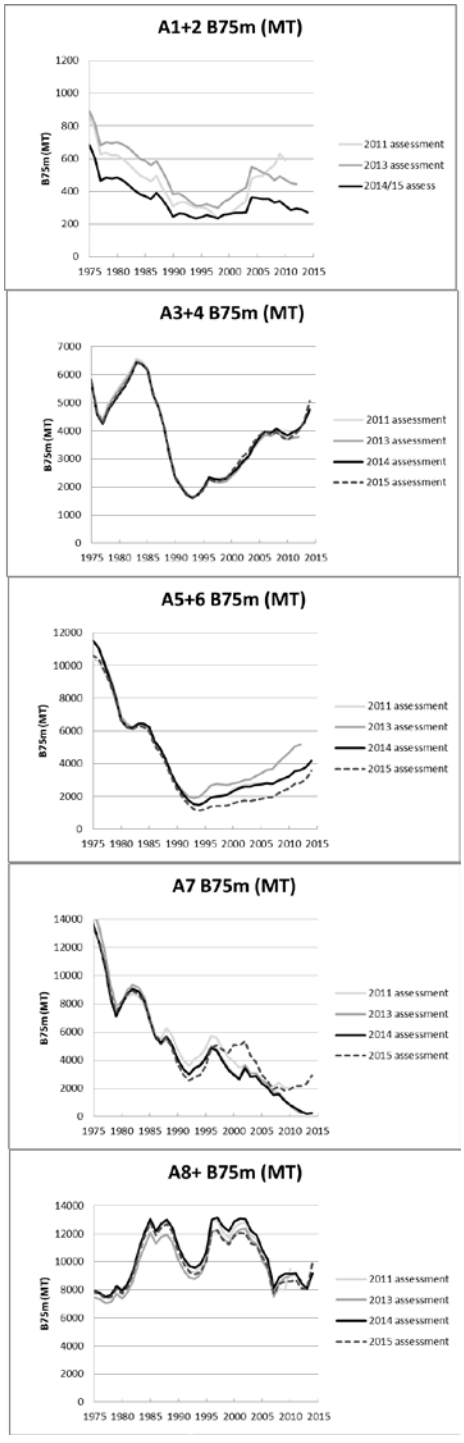


Figure 6b: Comparison of total male exploitable biomass trends for the resource as a whole between the 2011, 2013, 2014 and the updated 2015 assessments. The top plots show absolute tonnages, whereas the bottom plots show the biomass relative to pristine.

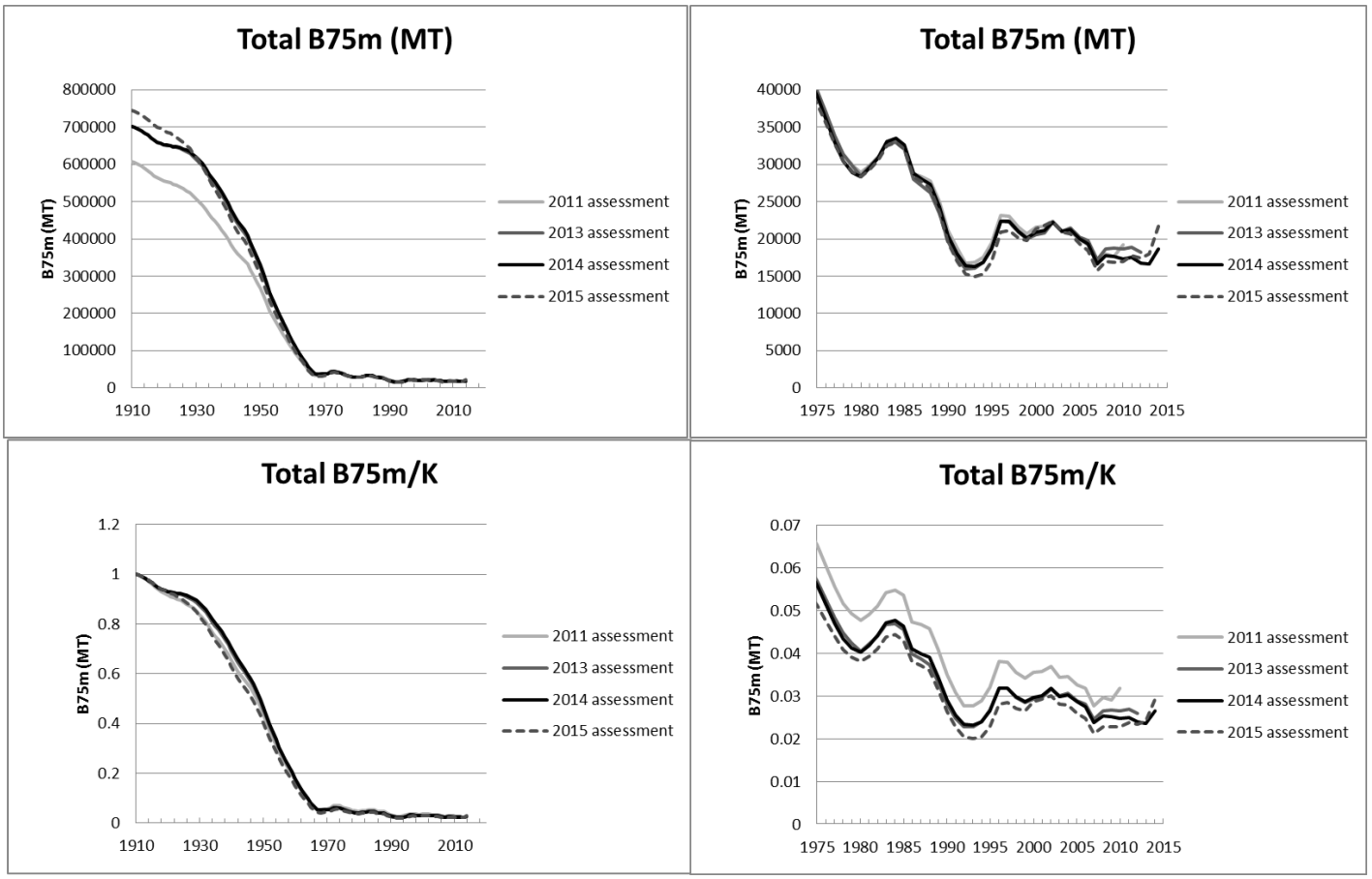


Figure 6c: Comparison of total male exploitable biomass trends for the resource but EXCLUDING Area 7 (Dassen Island) between the 2011, 2013, 2014 assessments and the updated 2015 assessments. The top plots show absolute tonnages, whereas the bottom plots show the biomass relative to pristine

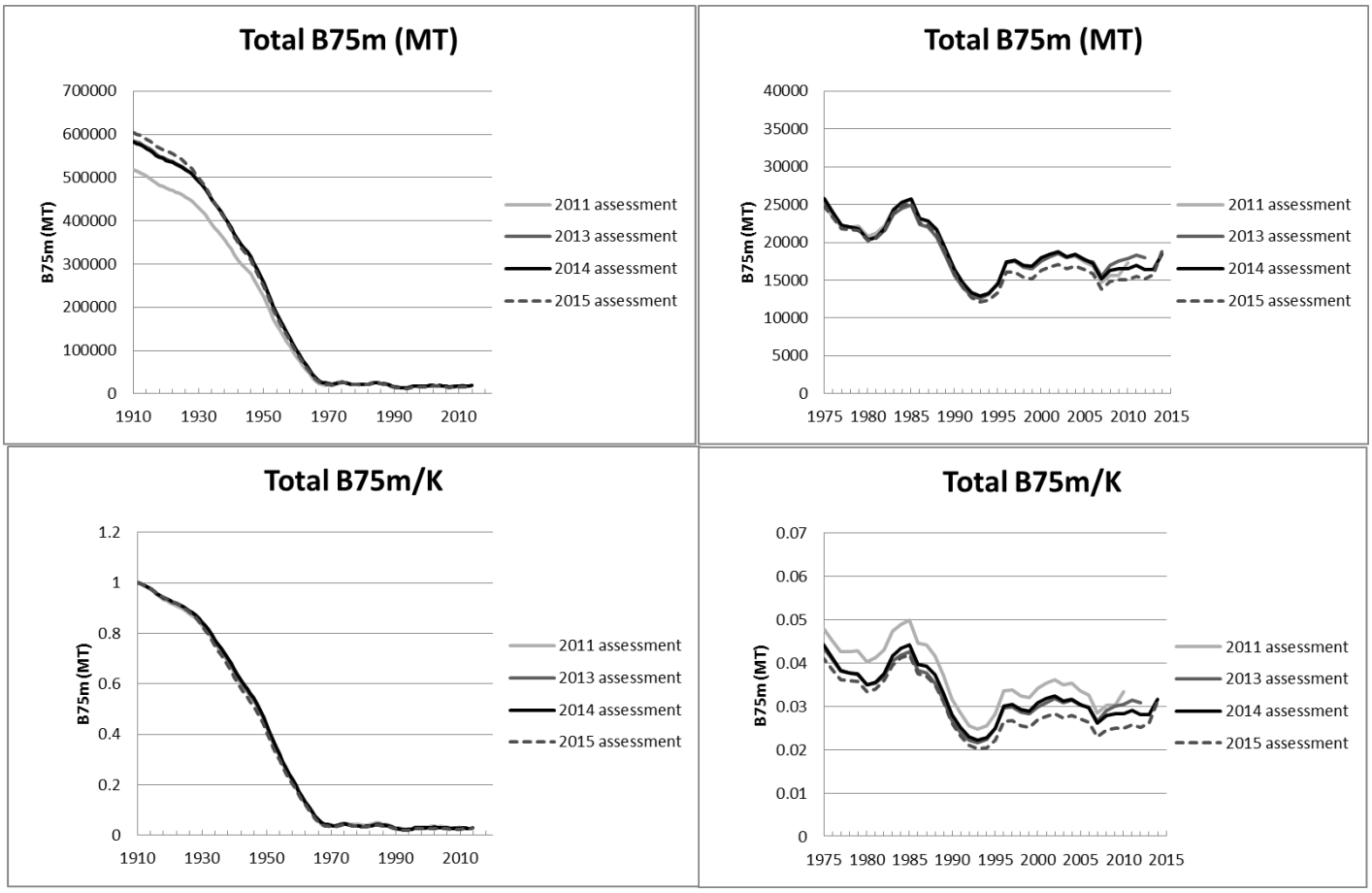


Figure 6d: Comparison of each super-area B75m contribution to overall resource biomass for the 2015 assessments.

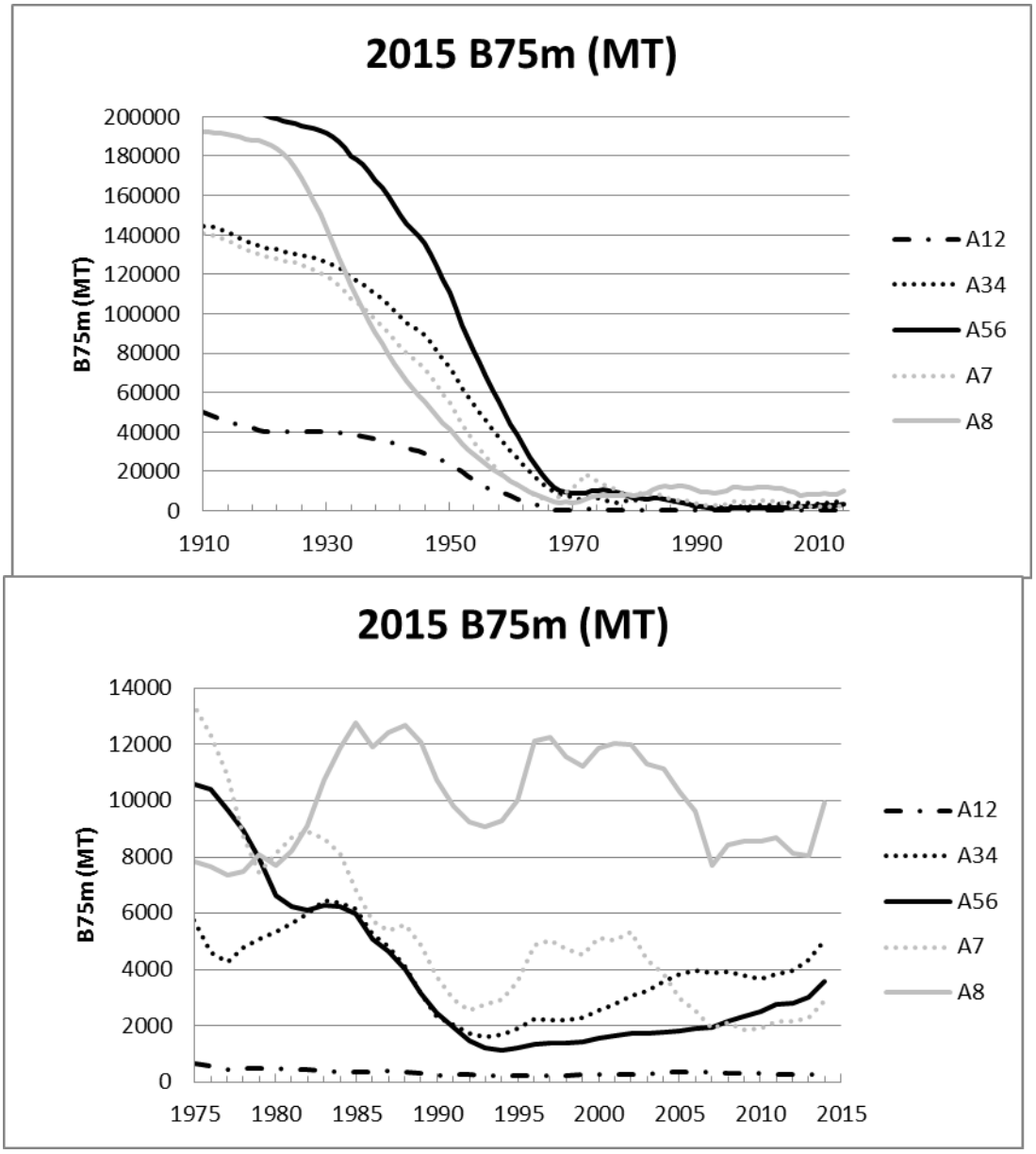


Figure 7a: Comparison between the 2011, 2013, 2014 and 2015 estimated biomass trends (B75m) and the biomass recovery target. The OMP predicted trend is as calculated earlier in 2013 following retuning of the OMP to take account of the 2012 decision not to reduce the TAC as per the recommendation from the OMP at that time.

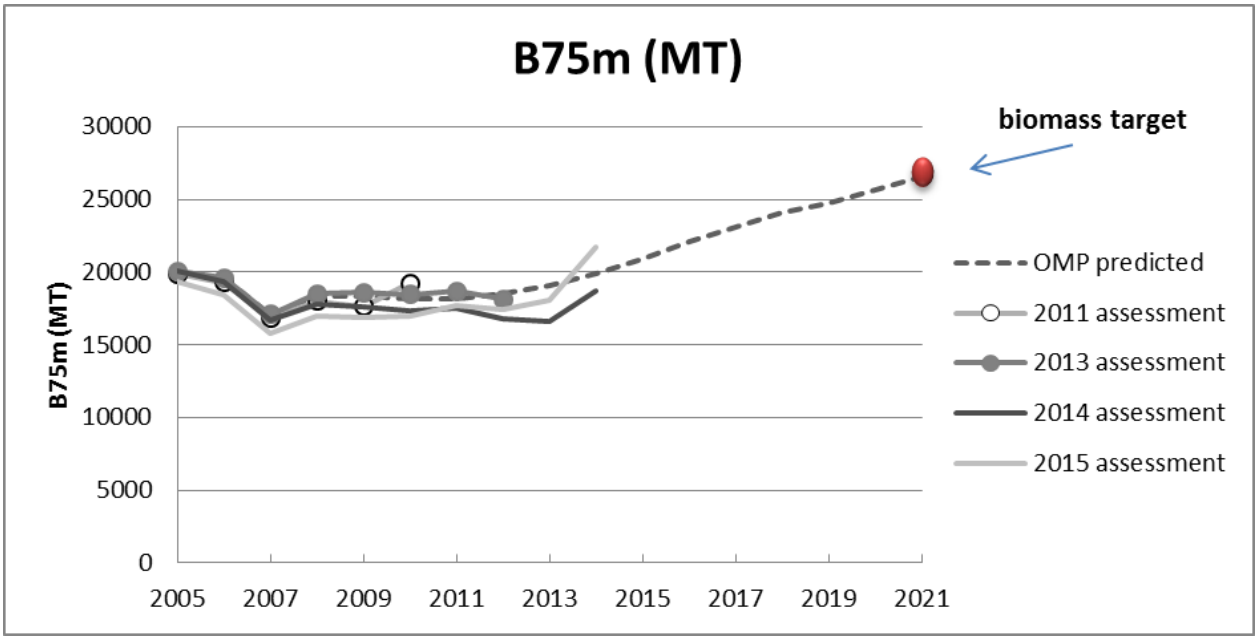


Figure 7b: As above but the 2011-2015 assessment projections exclude A7 (Dassen Island). The OMP predicted biomass target remains unchanged though (i.e. includes all five super-areas).