

FINAL Updated 2015 assessments for West Coast rock lobster

S.J. Johnston

MARAM, Department of Mathematics and Applied mathematics

University of Cape Town

This document reports the FINAL updated assessments for the five super-areas which are considered as separate populations of the west coast rock lobster resource. This follows an intensive code-checking exercise with OLRAC¹. 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 9.²
- 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 $-lnL$ based on the geometric mean as follows:

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

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

¹ This resulted in some minor corrections to the existing code. Furthermore minimisations have been carefully cross-checked.

² Note that the A7 2013/14 experimental CPUE data are included here.

- All recruitments are constrained to be less than R1910.

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). The differences arise from conflicting recent trends in Trap and FIMS CPUE data (see Figure 4a). The 2014 assessment preferred the latter, whereas the 2015 assessment prefers the former, which is more optimistic. While the results shown here do reflect the current best estimate, further runs giving relatively more weight to the FIMS series will be pursued as a sensitivity test.

Reference

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

Table 1: Updated 2015 assessment results for super-area A1+2*.

	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	49 841	49 650	56 583	56 548
$B_{75}^m(2010)$ MT	314	311	800	788
$B_{75}^m(2014)$ MT	274	273	621	618
$B_{75}^m(2010)/B_{75}^m(1910)$	0.006	0.006	0.014	0.014
$B_{75}^m(2014)/B_{75}^m(1910)$	0.006	0.005	0.011	0.011
$B_{75}^m(2010)/B_{75}^m(1996)$	1.233	1.274	1.406	1.403
$B_{75}^m(2014)/B_{75}^m(1996)$	1.077	1.117	1.093	1.101
$B_{75}^m(2010)/B_{75}^m(2006)$	0.883	0.885	0.915	0.913
$B_{75}^m(2014)/B_{75}^m(2006)$	0.772	0.775	0.711	0.716
Egg (2010)/Egg (1910)	0.016	0.015	0.021	0.021
Egg (2014)/Egg (1910)	0.014	0.014	0.015	0.015

*Note: no new data available for update. Changes arise from slight modifications to analyses noted in the text (see footnote 1) and the enforcement of the constraint that catch < exploitable biomass in each year.

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	166 501	163 390
$B_{75}^m(2010)$ MT	3 831	3 943	3 358	3 970
$B_{75}^m(2014)$ MT	4754	4888	4 864	5 035
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.026	0.027	0.020	0.024
$B_{75}^m(2014)/ B_{75}^m(1910)$	0.033	0.034	0.029	0.031
$B_{75}^m(2010)/ B_{75}^m(1996)$	1.637	1.666	1.719	1.701
$B_{75}^m(2014)/ B_{75}^m(1996)$	2.032	2.964	2.490	2.158
$B_{75}^m(2010)/ B_{75}^m(2006)$	0.967	0.969	1.197	0.955
$B_{75}^m(2014)/ B_{75}^m(2006)$	1.201	1.201	1.733	1.211
Egg (2010)/Egg (1910)	0.061	0.061	0.055	0.056
Egg (2014)/Egg (1910)	0.062	0.063	0.067	0.066

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	255 837	255 214
$B_{75}^m(2010)$ MT	3 252	2 987	2 612	2 403
$B_{75}^m(2014)$ MT	4 194	3701	3 587	3 194
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.017	0.016	0.010	0.009
$B_{75}^m(2014)/ B_{75}^m(1910)$	0.021	0.019	0.014	0.012
$B_{75}^m(2010)/ B_{75}^m(1996)$	1.708	1.600	1.553	2.224
$B_{75}^m(2014)/ B_{75}^m(1996)$	2.203	1.984	2.132	2.955
$B_{75}^m(2010)/ B_{75}^m(2006)$	1.166	1.104	1.485	1.468
$B_{75}^m(2014)/ B_{75}^m(2006)$	1.504	1.369	2.039	1.951
Egg (2010)/Egg (1910)	0.040	0.037	0.030	0.028
Egg (2014)/Egg (1910)	0.043	0.040	0.034	0.032

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
$B_{75}^m(1910)$ MT	120 042	121 319	139 888	147 279
$B_{75}^m(2010)$ MT	835	1401	2 869	2 966
$B_{75}^m(2014)$ MT	249	1020	2 861	2 712
$B_{75}^m(2010)/B_{75}^m(1910)$	0.006	0.015	0.021	0.020
$B_{75}^m(2014)/B_{75}^m(1910)$	0.002	0.008	0.021	0.018
$B_{75}^m(2014)/B_{75}^m(1996)$	0.051	0.206	0.477	0.492
$B_{75}^m(2010)/B_{75}^m(2006)$	0.400	0.624	0.818	0.912
$B_{75}^m(2014)/B_{75}^m(2006)$	0.120	0.455	0.815	0.834
Egg (2010)/Egg (1910)	0.078	0.084	0.089	0.082
Egg (2014)/Egg (1910)	0.054	0.060	0.074	0.068

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
$B_{75}^m(1910)$ MT	190 368	176 789	199 708	188 628
$B_{75}^m(2010)$ MT	9 113	8 580	9 007	8 594
$B_{75}^m(2014)$ MT	9 189	9 223	8 863	7 892
$B_{75}^m(2010)/ B_{75}^m(1910)$	0.048	0.048	0.045	0.046
$B_{75}^m(2014)/ B_{75}^m(1910)$	0.048	0.052	0.044	0.042
$B_{75}^m(2010)/ B_{75}^m(1996)$	0.702	0.690	0.709	0.701
$B_{75}^m(2014)/ B_{75}^m(1996)$	0.708	0.741	0.698	0.644
$B_{75}^m(2010)/ B_{75}^m(2006)$	0.898	0.874	0.918	0.900
$B_{75}^m(2014)/ B_{75}^m(2006)$	0.906	0.940	0.904	0.802
Egg (2010)/Egg (1910)	0.206	0.201	0.206	0.198
Egg (2014)/Egg (1910)	0.188	0.185	0.223	0.202

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 final updated 2015 assessments. The values from the 2014 assessment are also reported in the unshaded columns.

	B75m(2014)/K	Updated B75m(2014)/K	B75m(2014)/B75m(2006)	Updated B75m(2014)/B75m(2006)
A1+2	0.005	0.011	0.773	0.713
A3+4	0.033	0.030	1.201	1.502
A5+6	0.021	0.013	1.457	2.010
A7	0.004	0.020	0.243	0.822
A8	0.050	0.044	0.917	0.877
Total excl A7	0.032	0.023	1.067	1.124
Total resource	0.027	0.025	0.976	1.070

Figure 1a: Fits to A1+2 CPUE data for RC1 poaching scenario.



Figure 1b: A1+2 B75m and Bsp estimated trends for RC1 poaching scenario.. 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 for RC1 poaching scenario.

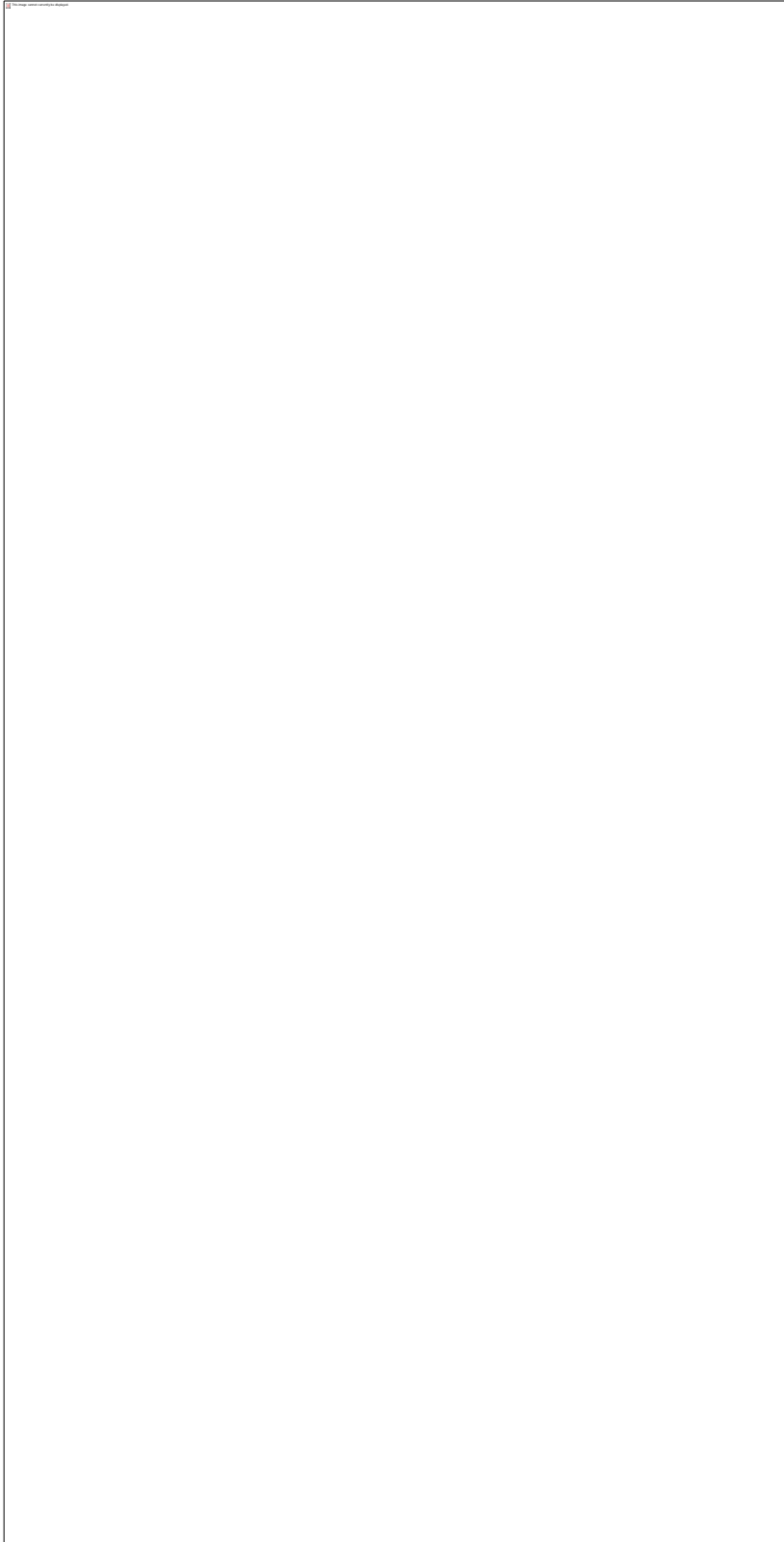


Figure 2b: A3+4 B75m and Bsp estimated trends for RC1 poaching scenario.. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate the geometric 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 for RC1 poaching scenario.

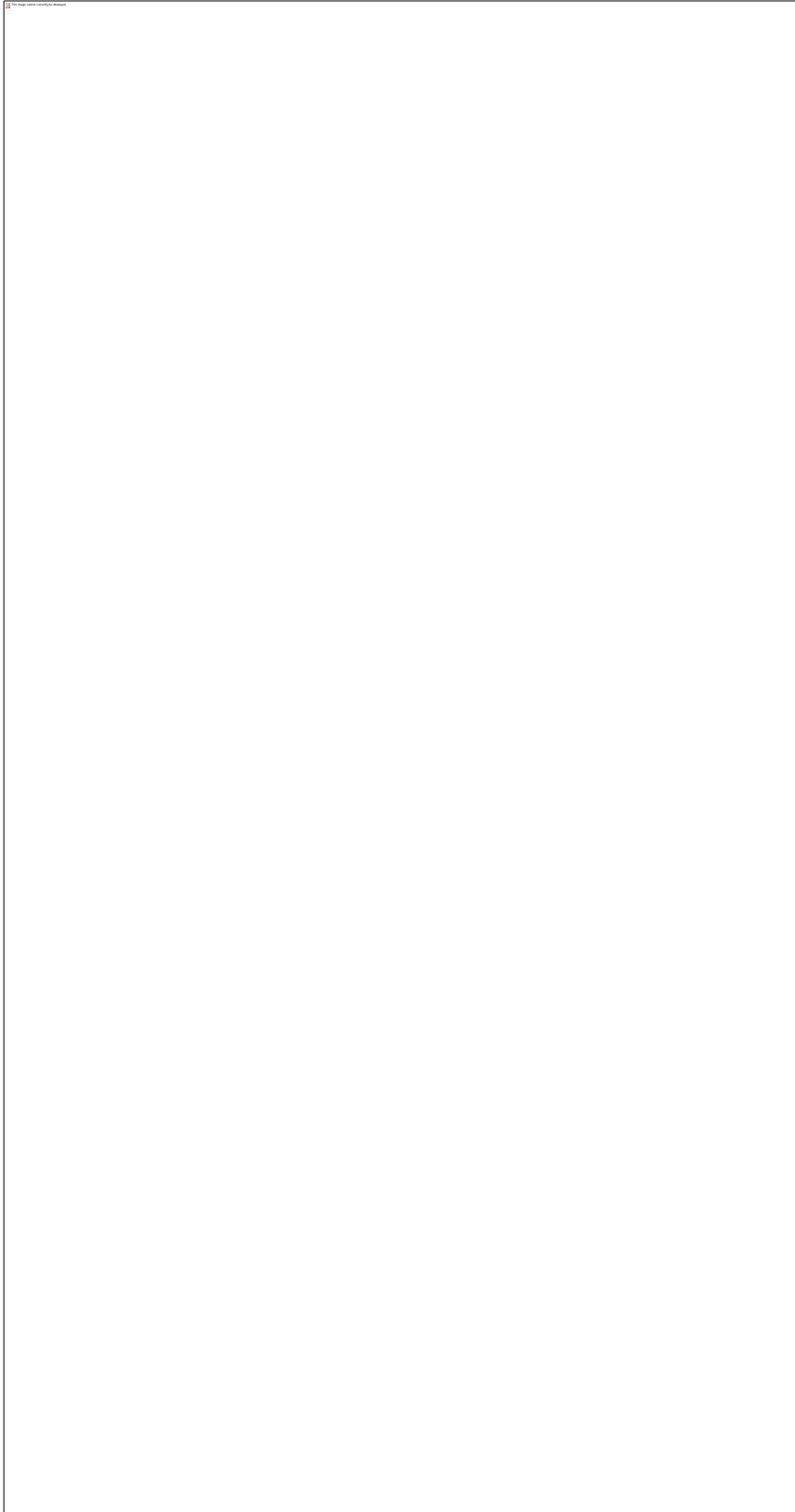


Figure 3b: A5+6 B75m and Bsp estimated trends for RC1 poaching scenario.. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate the geometric 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 for RC1 poaching scenario.



Figure 4b: A7 B75m and Bsp estimated trends for RC1 poaching scenario.. 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 for RC1 poaching scenario.

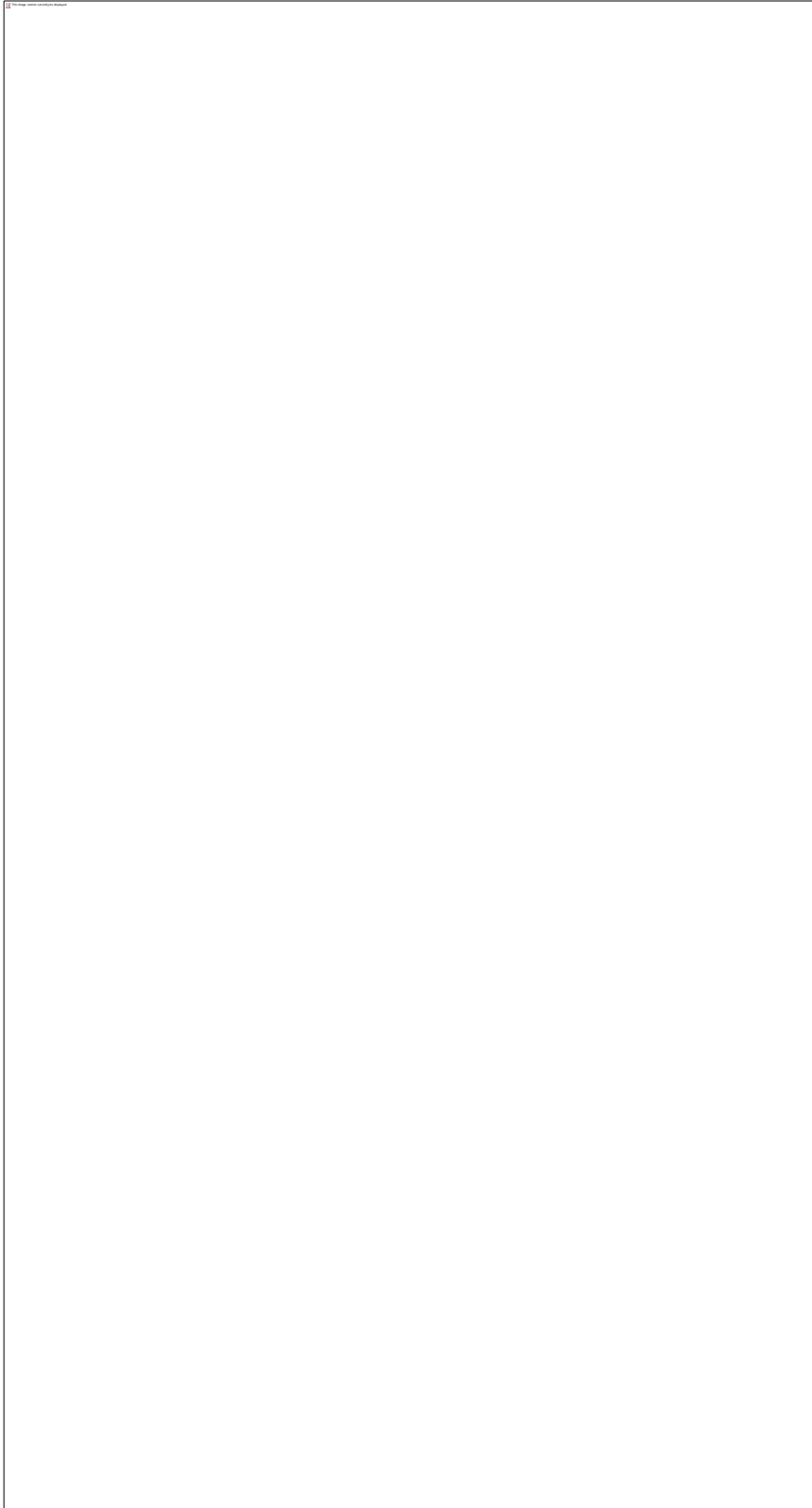


Figure 5b: A8+ Egg%, recruitment and B75m estimated trends for RC1 poaching scenario.. The plots on the left are for the period 1910+, whereas those on the right are for 1975+. In the second plot on the RHS, the circles indicate the estimated recruitment values – solid circles are those used to calculate 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 for RC1 poaching scenario.

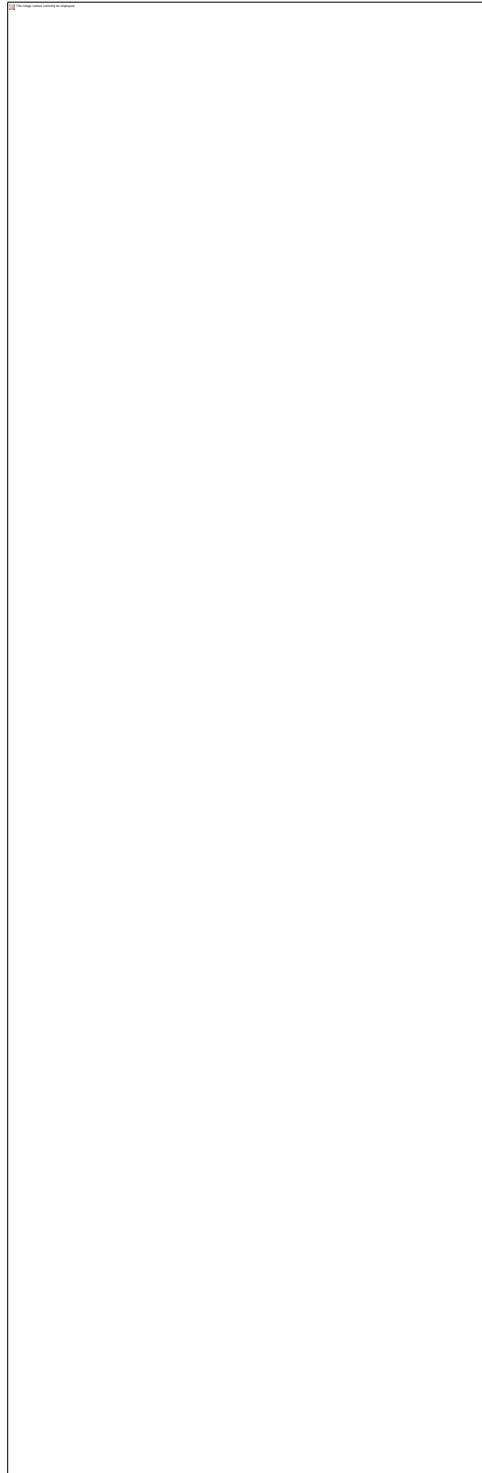


Figure 6b: Comparison of total male exploitable biomass trends for the resource as a whole between the 2011, 2013, 2014 and the updated 2015 assessments for RC1 poaching scenario. The top plots show absolute tonnages, whereas the bottom plots show the biomass relative to pristine.

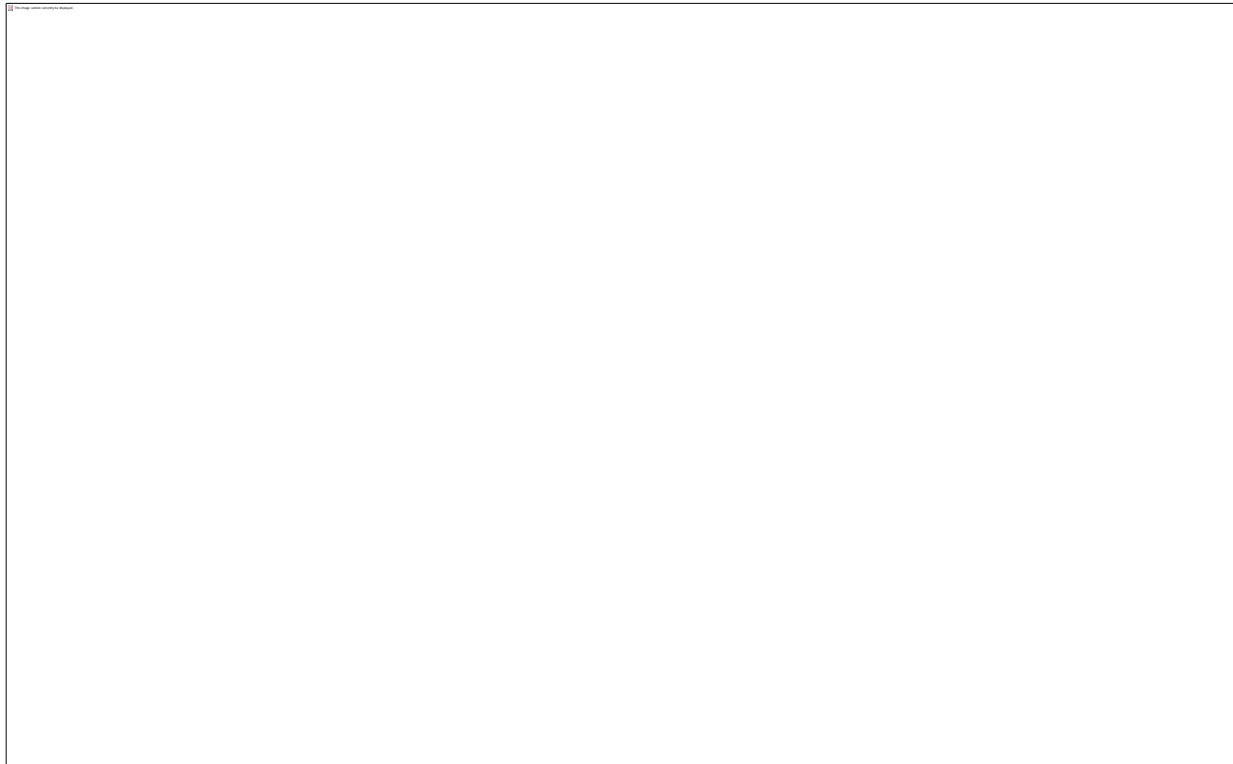


Figure 6c: Comparison of total male exploitable biomass trends for the resource but EXCLUDING Area 7 (Dassen Island) between the 2011, 2013, 2014 assessments and the updated 2015 assessments for RC1 poaching scenario. The top plots show absolute tonnages, whereas the bottom plots show the biomass relative to pristine.



Figure 6d: Comparison of each super-area B75m contribution to overall resource biomass for the 2015 assessments for RC1 poaching scenario.



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).

