Final updated 2019 assessments and projections of west coast rock lobster for different poaching scenarios

S.J. Johnston and D.S. Butterworth

MARAM, University of Cape Town

Summary

The 2018 assessments and projections for the five super-areas for the west coast rock lobster resource are updated to 2019, using basically the same approach as in 2018. The update takes account of a further year's catch and resource monitoring data, uses improved recruitment and projection methodologies, and incorporates major revisions of estimates of past poaching levels following extensive further examination of the associated data. There is clear evidence that quantity of lobsters poached has dropped from the 2017/18 to the 2018/19 season. Projections are developed on an identical basis to that used in 2018, with the results for three options shown for two different assumptions about the historical poaching trend. These are that future legal catches are set to zero, that they are set so that the abundance of the whole resource is equal (in median terms) to that in the 2006 benchmark year by the time the 2025 target year is reached, and hallway between these two options (in 2018 the WCRL SWG's TAC recommendations were based on the third of these three options), The key projection results are listed in Table 1, with graphical representations provided in Figure 1. These reflect an improvement compared to the situation a year previously, with very little difference for the two historical poaching scenarios considered.

Background

Updated assessment results for each super-area, using the new 2019 assessment methodology, are reported for two different poaching scenarios. These scenarios are described more fully in FISHERIES/2019/AUG/SWG/WCRL/19. The scenario which implies an estimate of illegal local sales of 400 MT in 2018 is termed here "**LS 400**" with the scenario which implies one of illegal local sales of 700 MT that year is termed "**LS 700**". (The 2018 poaching trend along with the LS 400 and LS 700 trends are shown in Figure 1.)

For each assessment a value for σ_R = 1.0 is assumed. For A7 the 2009-2018 TRAP CPUE data are up weighted by a factor of 10 in the likelihood to provide better fits to these data.

Projections

The "Variant 1" method as described in FISHERIES/2019/AUG/SWG/WCRL16 is followed, i.e. the most recent recruitment values are not down weighted in the projections.

Projections are reported for constant future annual legal catches (CC) by all sectors of either:

1) Future (2019+) CC = as per the current 2-step recommendation (i.e. a total future annual TAC of 244 MT)
2) Future (2019+) CC = zero, which gives the maximum recovery possible under current poaching levels.
3) Future (2019+) CC such that the median B75m(2025)/B75m(2006)=1.00 (corresponds to a CC of 1275 MT and 1280 MT for the LS 400 and LS 700 poaching trends respectively), i.e. no recovery by 2025 above the benchmark 2006 abundance.

4) Future (2019+) CC such that the B75m(2025)/B75m(2006) recovery is halfway between that for 2) and 3) above.

Results and Discussion

Detailed updated assessment results are reported in the Appendix.

Table 1 reports biomass recovery statistics for both poaching scenarios for the resource as a whole. Figures 2a and b compare median biomass recovery trajectories for a number of future CC and the two poaching scenarios, whilst Figures 3a and b show the medians, 50% and 90% probability envelopes for a future CC of 638 MT or 640 MT for the LS 400 and LS 700 poaching scenarios respectively.

It is evident that results are not very sensitive to which of the two poaching scenarios is assumed. In the Appendix, for example Figures A3a and b, it is evident that the recent very low somatic growth rates in 2018 impact the corresponding 2018 biomass estimates negatively. Should these very low somatic growth rates continue, the impact on the assessment of current biomass will continue to be negatively impacted.

Table 1: Total resource biomass projections estimates. For example, the 1.071 value for the 2018 2-step scenario reflects a 7.1% increase of biomass by the 2025 target year above the benchmark 2006 level.

2018	**LS 400**	**LS 700**
Deterministic B75m(2025)/B75m(2006) CC=2-step	1.071	
Deterministic B75m(2025)/B75m(2006) CC=0	1.132	
2019		
Median B75m(2025)/B75m(2006) CC=0 MT	1.297	1.303
Median B75m(2025)/B75m(2006) CC=244 MT	1.241	1.251
Median B75m(2025)/B75m(2006) CC=638 MT and 640 MT for LS 400 and LS 700 respectively	1.150	1.150
Median B75m(2025)/B75m(2006) CC=1275 and 1280 MT for LS 400 and LS 700 respectively	1.000	1.000

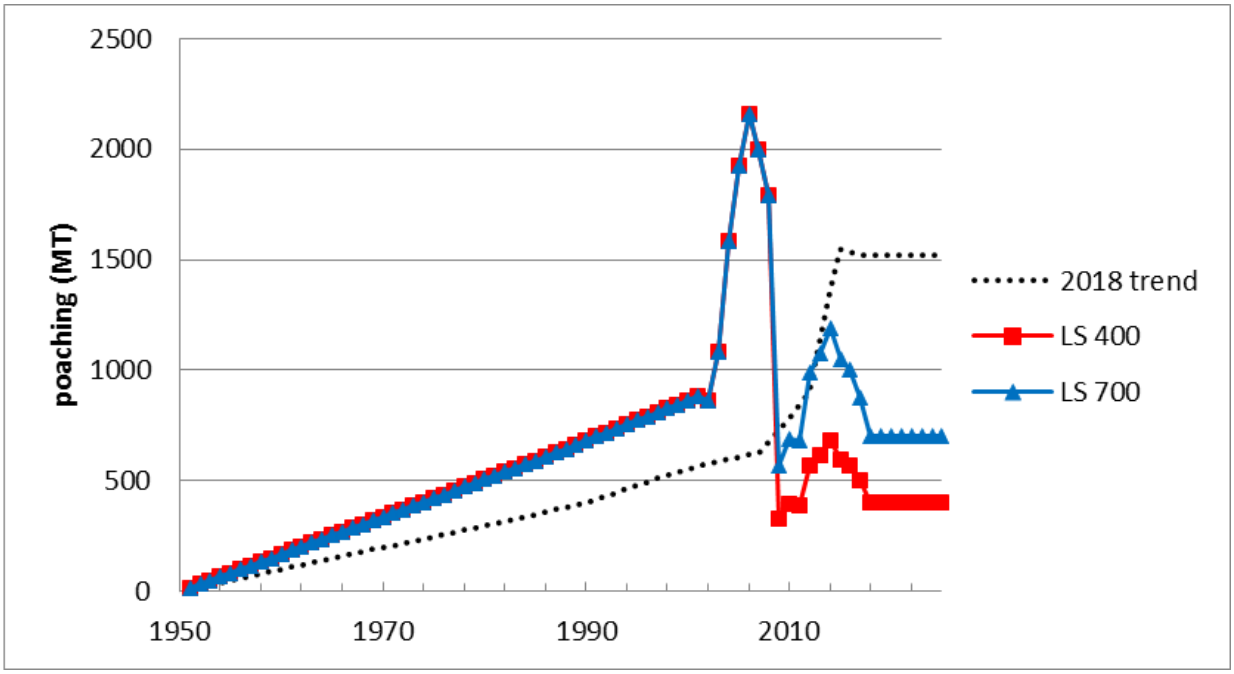


Figure 1: Poaching trends assumed for the 2018 assessments and for the two new 2019 scenarios (LS 400 and LS 700).

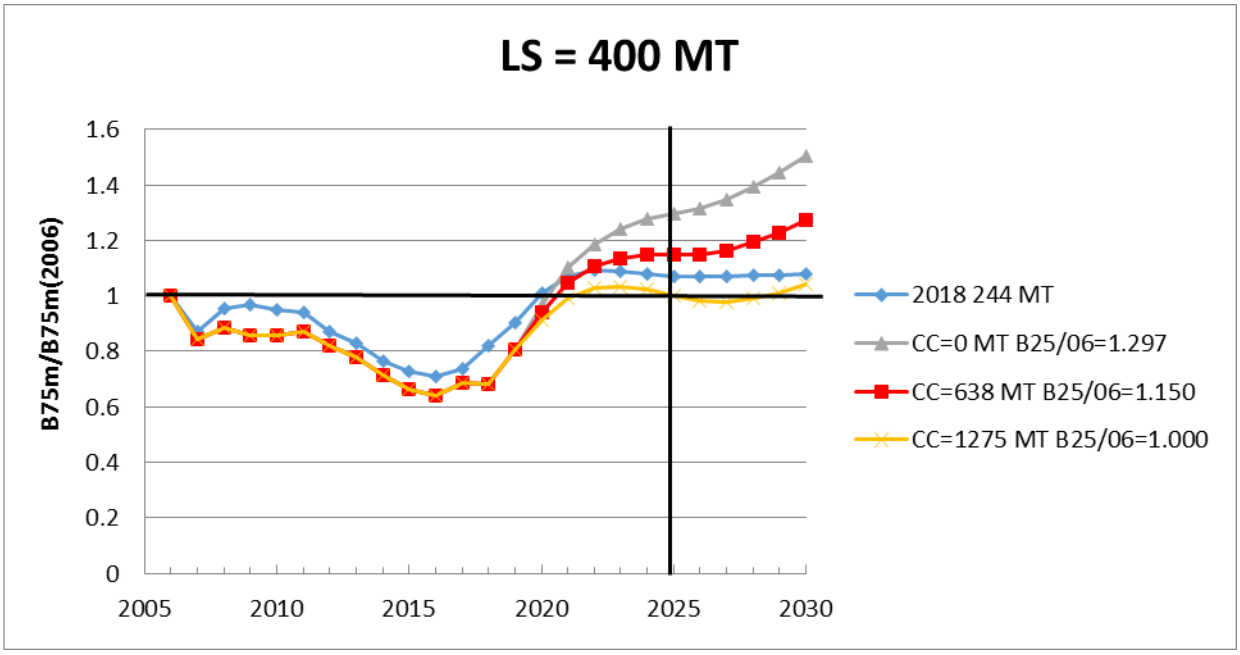


Figure 2a: Total median biomass (B75m) trajectories for B75m/B75m(2006) for a poaching scenario which implies local illegal sales of **400** MT in 2018.

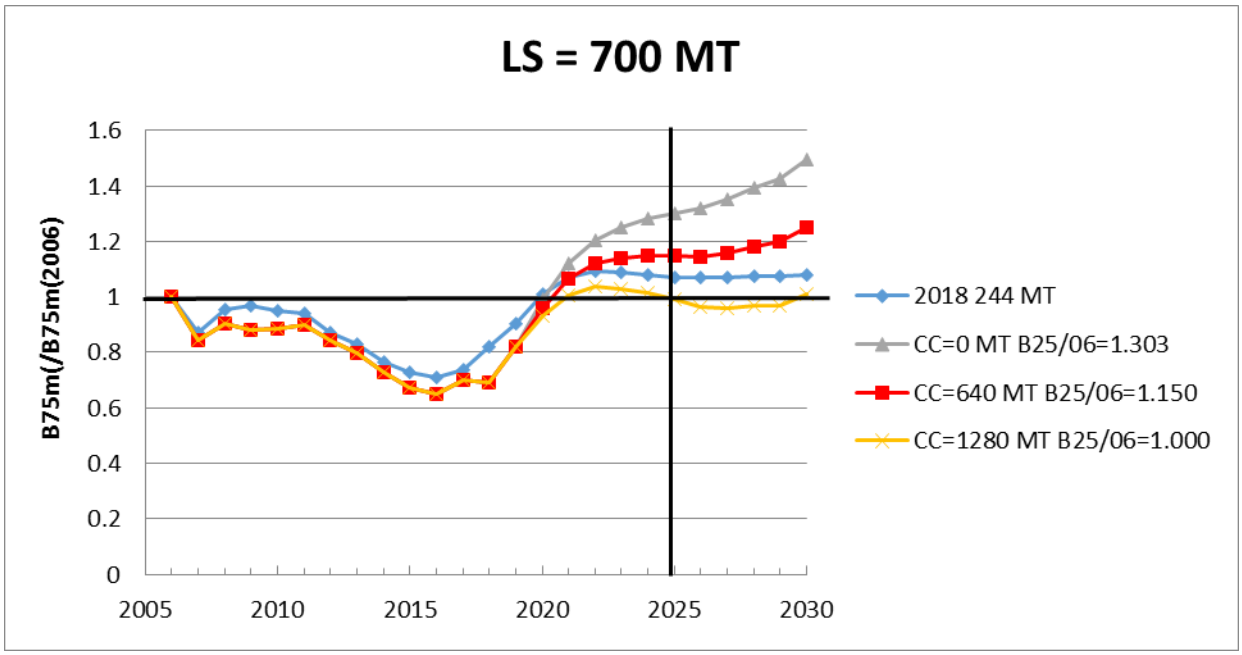


Figure 2b: Total median biomass (B75m) trajectories for B75m/B75m(2006) for a poaching scenario which implies local illegal sales of **700** MT in 2018.

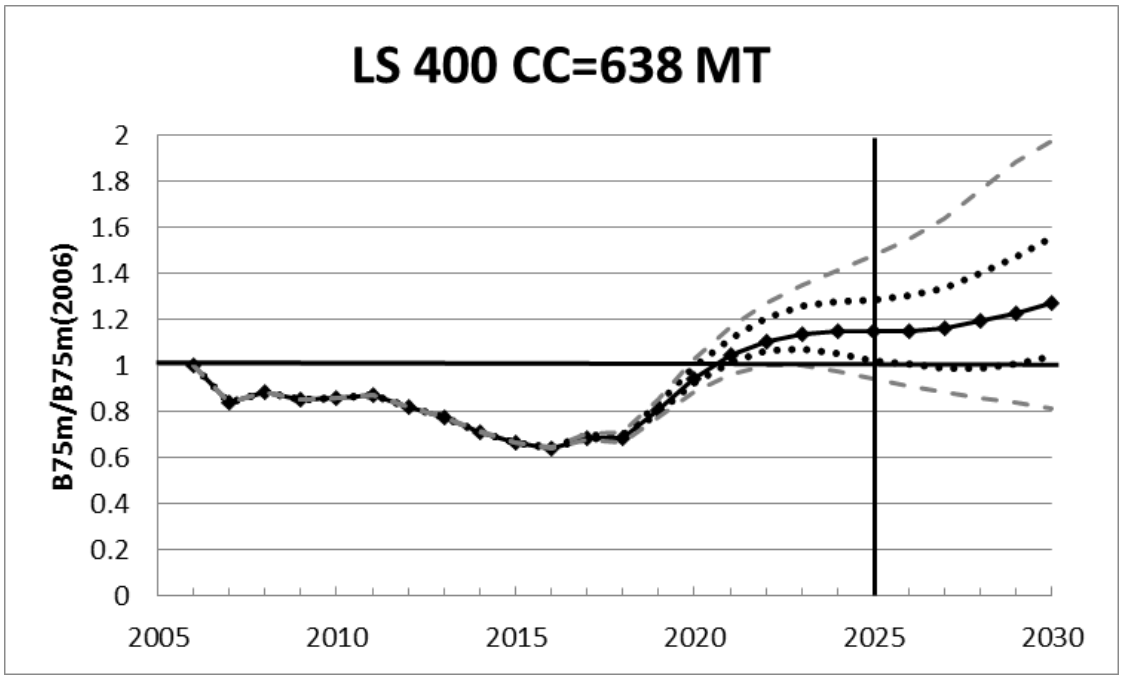


Figure 3a: Median and 50% (black dots) and 90% (grey dashed) probability envelopes for the LS 400 CC=638 MT scenario.

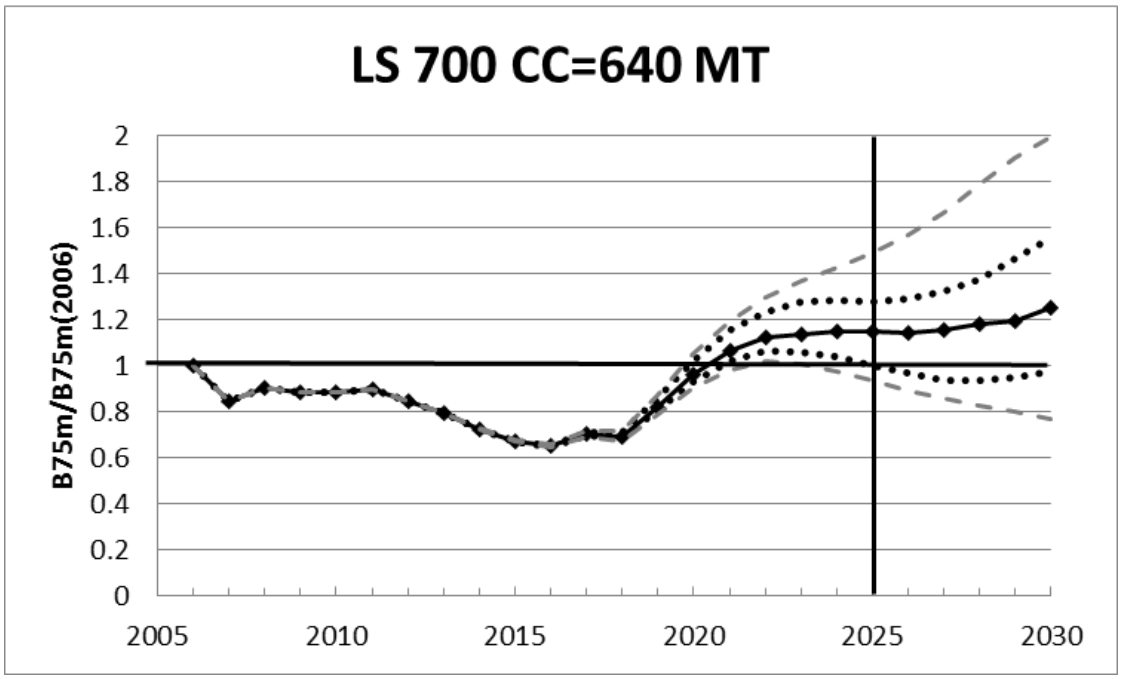


Figure 3b: Median and 50% (black dots) and 90% (grey dashed) probability envelopes for the LS 700 CC=640 MT scenario.

Appendix

Tables A1a-e report updated assessment results assuming either the LS 400 or LS 700 poaching scenario for each of the five super-areas.

Figure A1-5 show recruitment estimates, model fits to data and model estimates of biomass for each of the five super-areas.

Table A1a: A8+ results for two different poaching scenarios. The values in parentheses next to the –lnL values are the associated σ values for that parameter.

	LS 400	**LS 700**
-lnL total (T=D+R)	-55.017	-58.958
-lnL from data (D)	-58.576	-62.289
R penalties (R)	3.559	3.331
Trap CPUE –lnL (σ)	-37.640 (0.194)	-38.528 (0.189)
Hoop CPUE –lnL (σ)	-38.357 (0.183)	-39.525 (0.176)
FIMS CPUE –lnL (σ)	-11.998 (0.382)	-13.273 (0.364)
R_2004	0.339	0.447
R_2007	0.651	0.685
R_2010	0.351	0.386
$\bar{x}$	0.520	0.542
B75m(2006) (B75m(2006)/K)	9586 (0.041)	9275 (0.041)
B75m(2018) (B75m(2018)/K)	4995 (0.021)	4822 (0.021)
Median B75m(2025)/B75m(2006) CC=2-step	1.236	1.148
Median B75m(2025)/B75m(2006) CC=0	1.324	1.110
	nn.for 8v1.res	nn.for 8v2.res

Table A1b: A7 results for two different poaching scenarios. The values in parentheses next to the –lnL values are the associated σ values for that parameter.

	LS 400	**LS 700**
-lnL total (T=D+R)	120.817	121.623
-lnL from data (D)	117.023	117.632
R penalties (R)	3.794	3.992
Trap CPUE –lnL (σ)	15.548 (0.670)	16.015 (0.689)
Hoop CPUE –lnL (σ)	-	-
FIMS CPUE –lnL (σ)	5.351 (0.752)	5.782 (0.764)
R_2004	0.021	0.017
R_2007	0.012	0.013
R_2010	0.024	0.025
$\bar{x}$	0.043	0.045
B75m(2006) (B75m(2006)/K)	5278 (0.017)	5147 (0.017)
B75m(2018) (B75m(2018)/K)	3274 (0.011)	3110 (0.011)
Median B75m(2025)/B75m(2006) CC=2-step	1.344	1.347
Median B75m(2025)/B75m(2006) CC=0	1.373	1.403
	N7.for n7v1.res	N7.for n7v2.res

Table A1c: A56 results for two different poaching scenarios. The values in parentheses next to the –lnL values are the associated σ values for that parameter.

	LS 400	**LS 700**
-lnL total (T=D+R)	106.027	105.533
-lnL from data (D)	104.363	103.868
R penalties (R)	1.663	1.665
Trap CPUE –lnL (σ)	-	-
Hoop CPUE –lnL (σ)	-16.081 (0.334)	-17.066 (0.332)
FIMS CPUE –lnL (σ)	14.656 (1.090)	14.896 (1.101)
R_2004	0.047	0.046
R_2007	0.043	0.048
R_2010	0.066	0.069
$\bar{x}$	0.054	0.055
B75m(2006) (B75m(2006)/K)	1875 (0.007)	1913 (0.007)
B75m(2018) (B75m(2018)/K)	2928 (0.012)	2803 (0.011)
Median B75m(2025)/B75m(2006) CC=2 step	2.167	2.074
Median B75m(2025)/B75m(2006) CC=0	2.220	2.126
	nn.for 56v1.res	nn.for 56v2.res

Table A1d: A34 results for two different poaching scenarios. The values in parentheses next to the –lnL values are the associated σ values for that parameter.

	LS 400	**LS 700**
-lnL total (T=D+R)	145.120	140.556
-lnL from data (D)	141.643	137.376
R penalties (R)	3.477	3.180
Trap CPUE –lnL (σ)	-6.109 (0.480)	-5.533 (0.490)
Hoop CPUE –lnL (σ)	-2.736 (0.558)	-4.181 (0.534)
FIMS CPUE –lnL (σ)	22.817 (1.511)	22.699 (1.504)
R_2004	0.066	0.077
R_2007	0.081	0.086
R_2010	0.094	0.111
$\bar{x}$	0.071	0.073
B75m(2006) (B75m(2006)/K)	5330 (0.029)	4711 (0.026)
B75m(2018) (B75m(2018)/K)	3344 (0.018)	3324 (0.018)
Median B75m(2025)/B75m(2006) CC=2-step	0.786	0.915
Median B75m(2025)/B75m(2006) CC=0	0.814	0.947
	nn.for 34v1.res	nn.for 34v2.res

Table A1e: A12 results. The values in parentheses next to the –lnL values are the associated σ values for that parameter. Note that the assumption is that poaching in A12 is zero for all poaching scenarios.

	No poaching
-lnL total (T=D+R)	-35.117
-lnL from data (D)	-37.806
R penalties (R)	2.689
Trap CPUE –lnL (σ)	-
Hoop CPUE –lnL (σ)	-48.983 (0.194)
FIMS CPUE –lnL (σ)	-
R_2004	0.005
R_2007	0.011
R_2010	0.020
$\bar{x}$	0.014
B75m(2006) (B75m(2006)/K)	598 (0.006)
B75m(2018) (B75m(2018)/K)	737 (0.008)
Median B75m(2025)/B75m(2006) CC=2-step	1.556
Median B75m(2025)/B75m(2006) CC=0	1.608
	N12.for 12v1.res

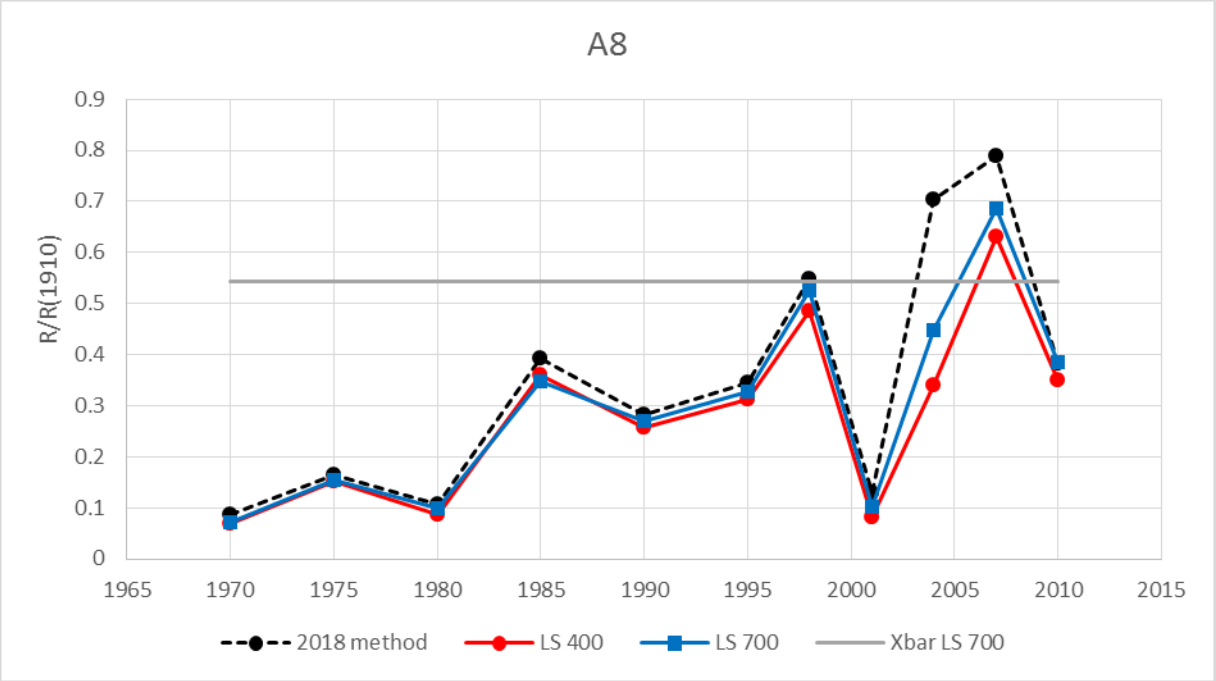


Figure A1a: R estimates (relative to that in 1910) for A8+ for two different poaching scenarios.

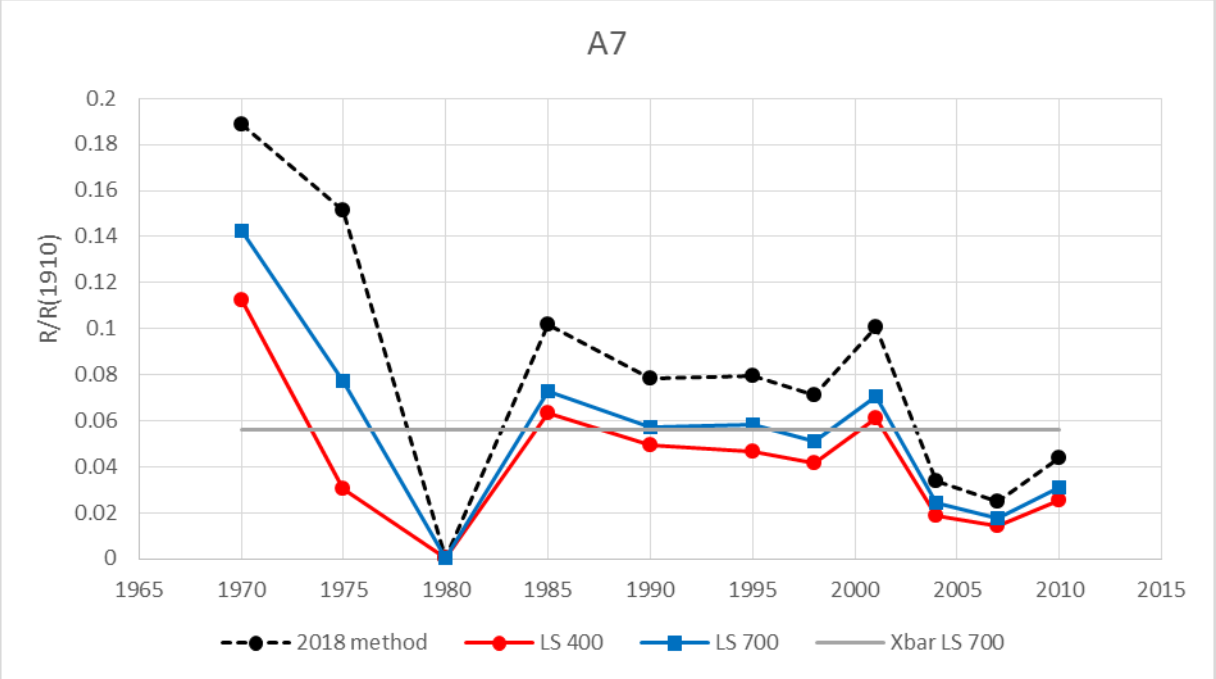


Figure A1b: R estimates (relative to that in 1910) for A7 for two different poaching scenarios.

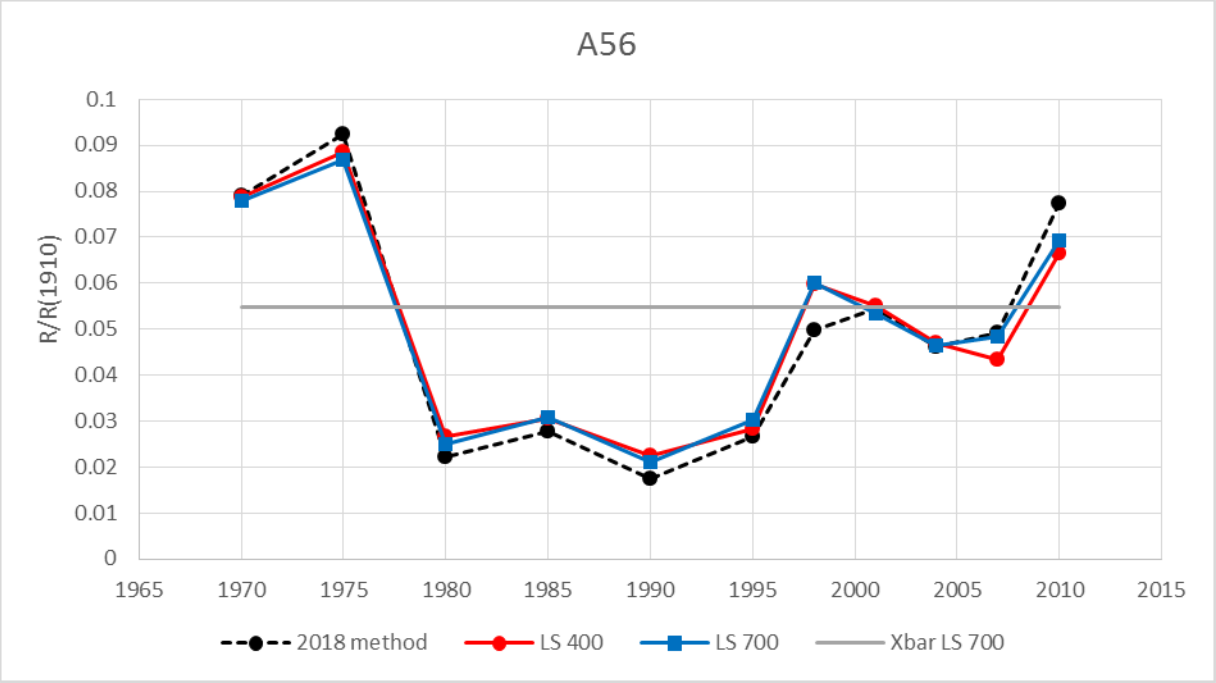


Figure A1c: R estimates (relative to that in 1910) for A56 for two different poaching scenarios.

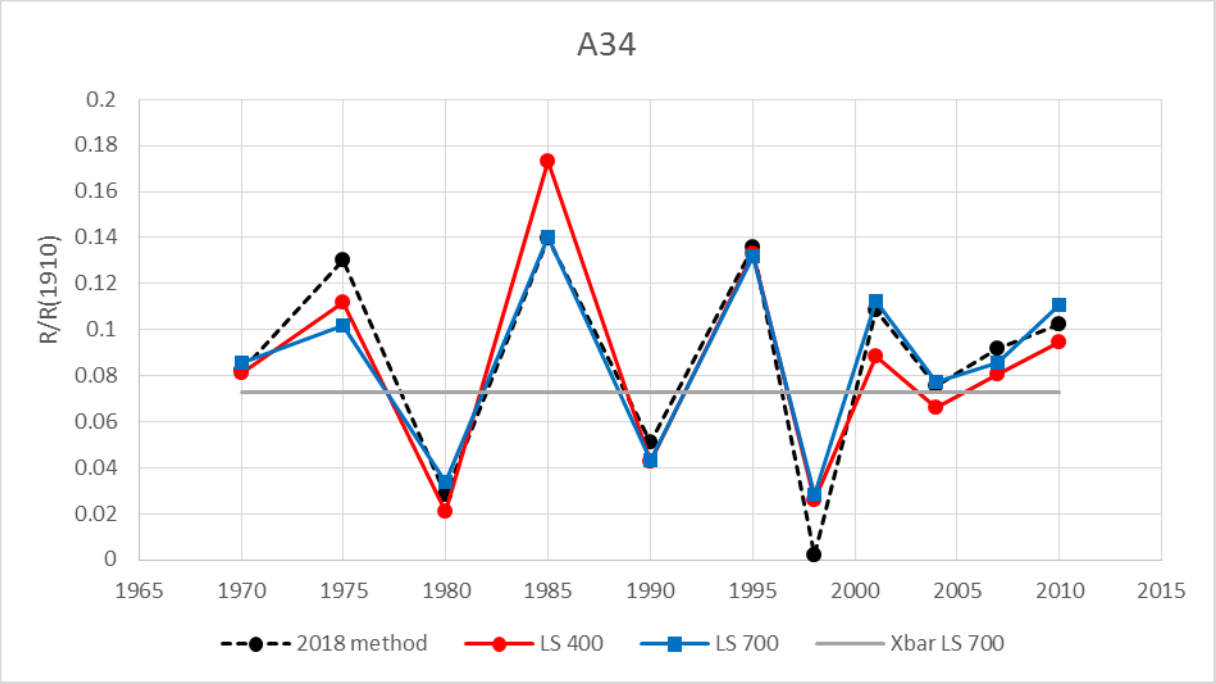


Figure A1d: R estimates (relative to that in 1910) for A34 for two different poaching scenarios.

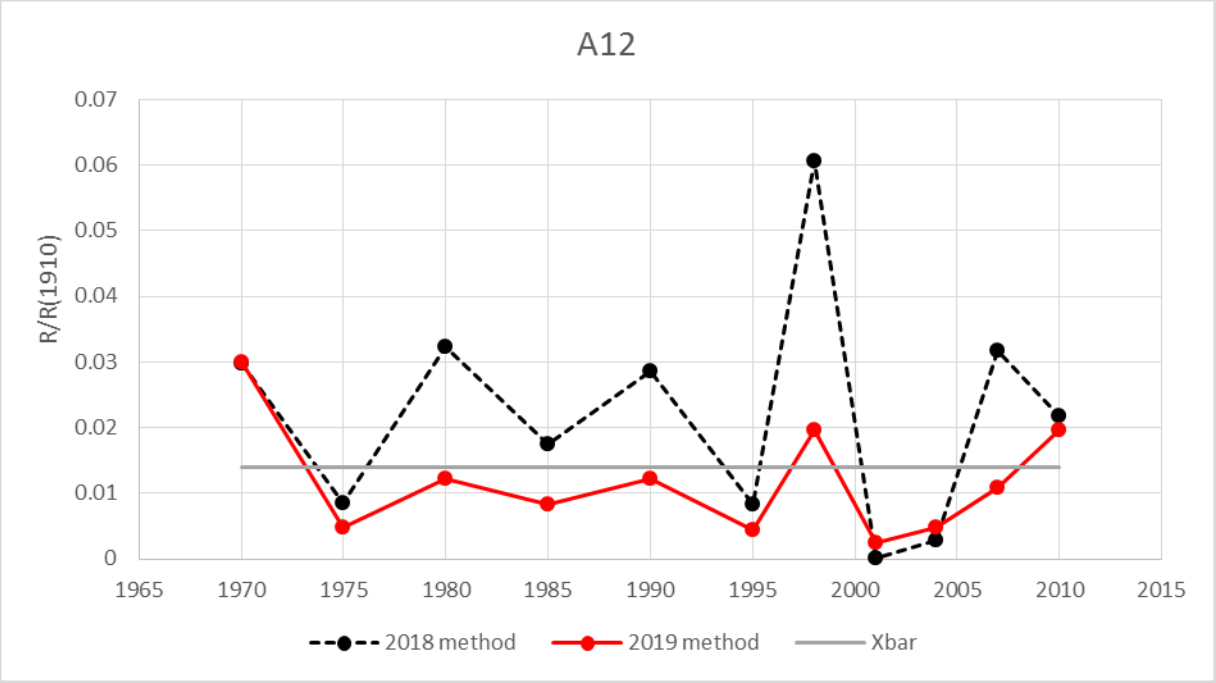


Figure A1e: R estimates (relative to that in 1910) for A12. Note it is assumed poaching in A12 is zero hence the LS 400 and LS 700 scenarios are identical.

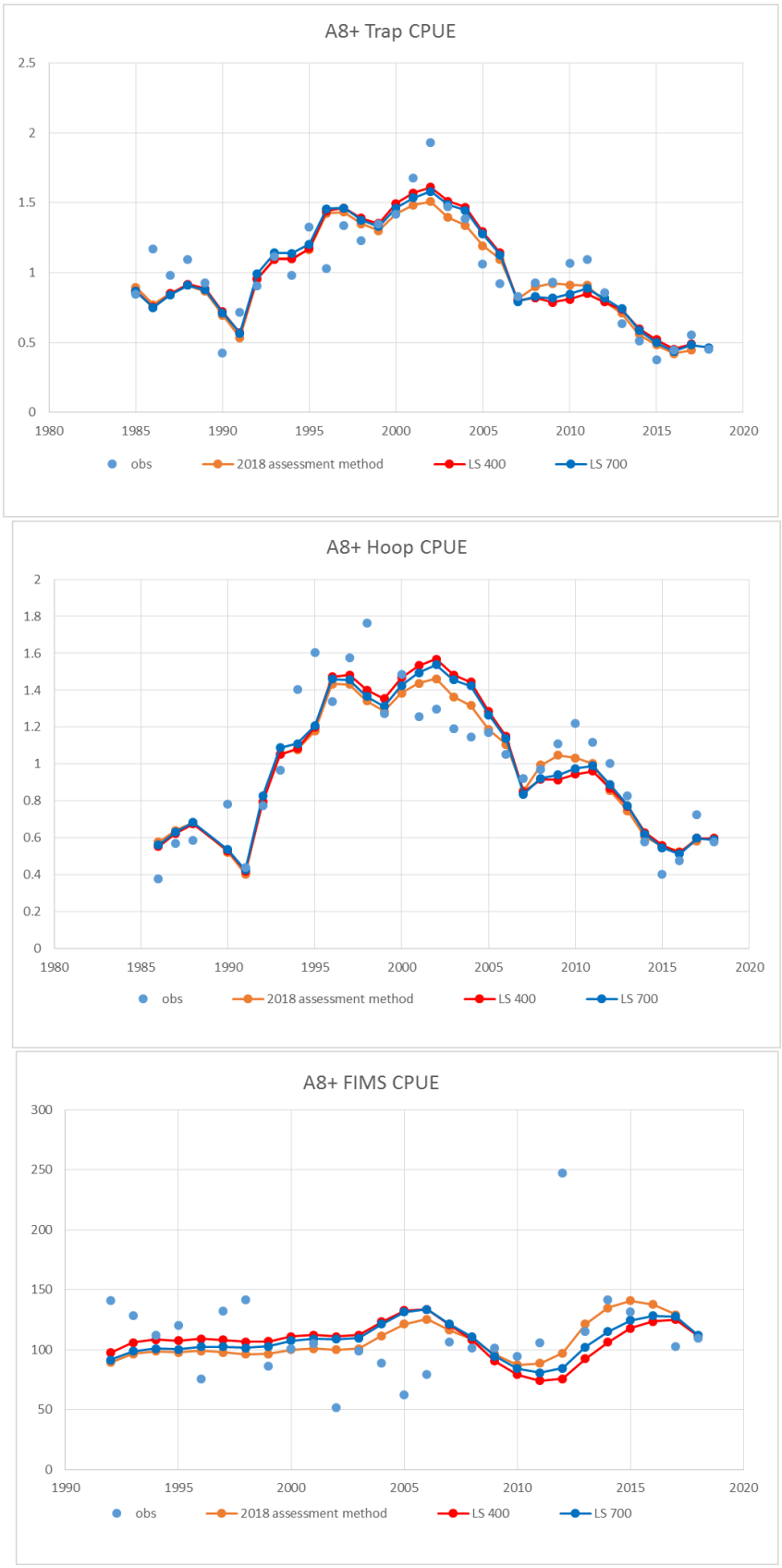


Figure A2a: Comparison of fits to A8+ CPUE for the different assessments.

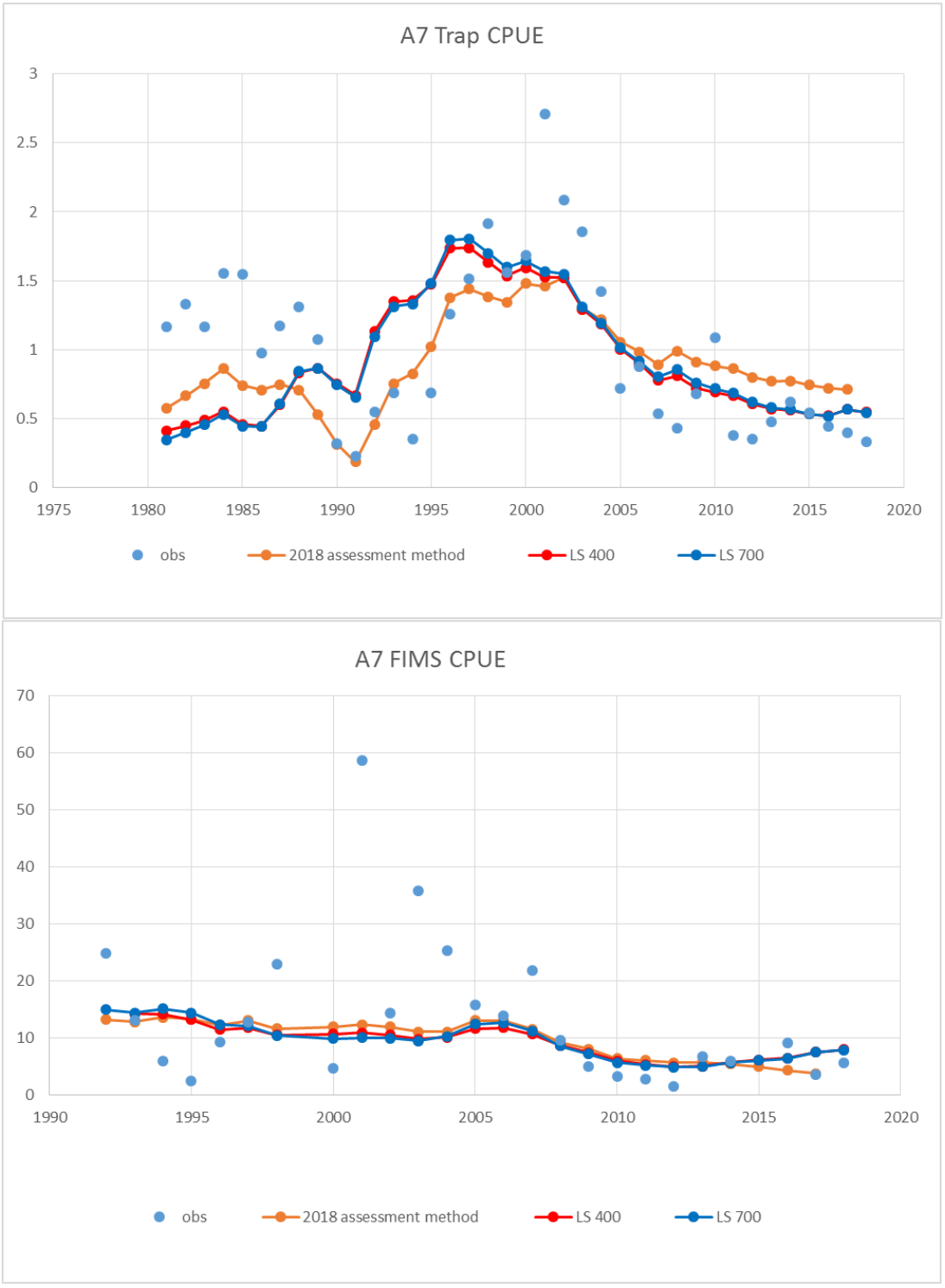
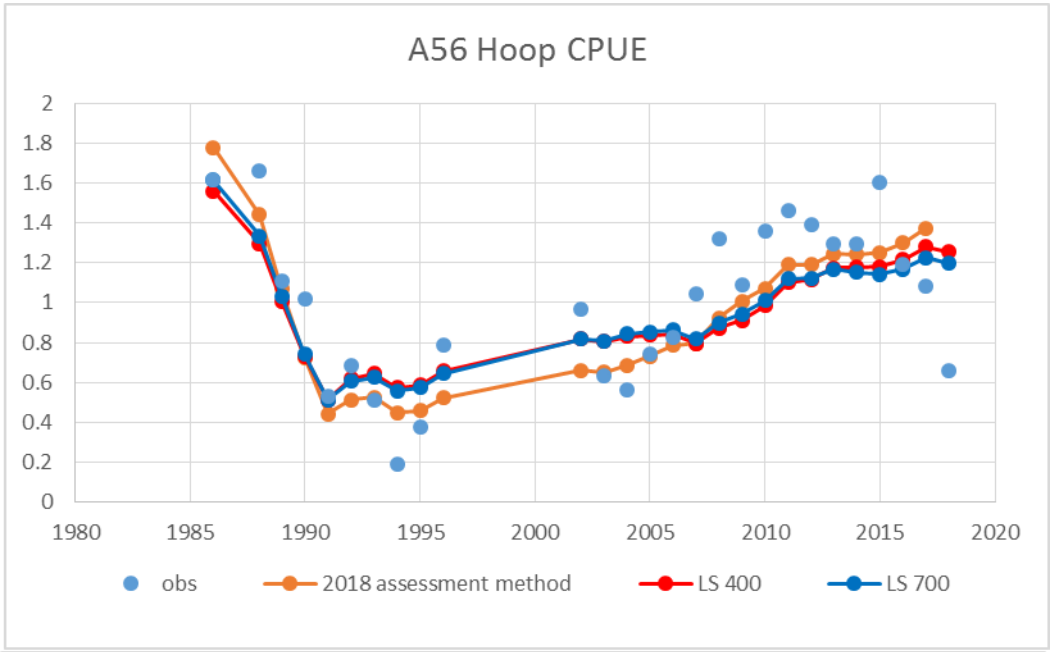


Figure A2b: Comparison of fits to A7 CPUE for the different assessments.



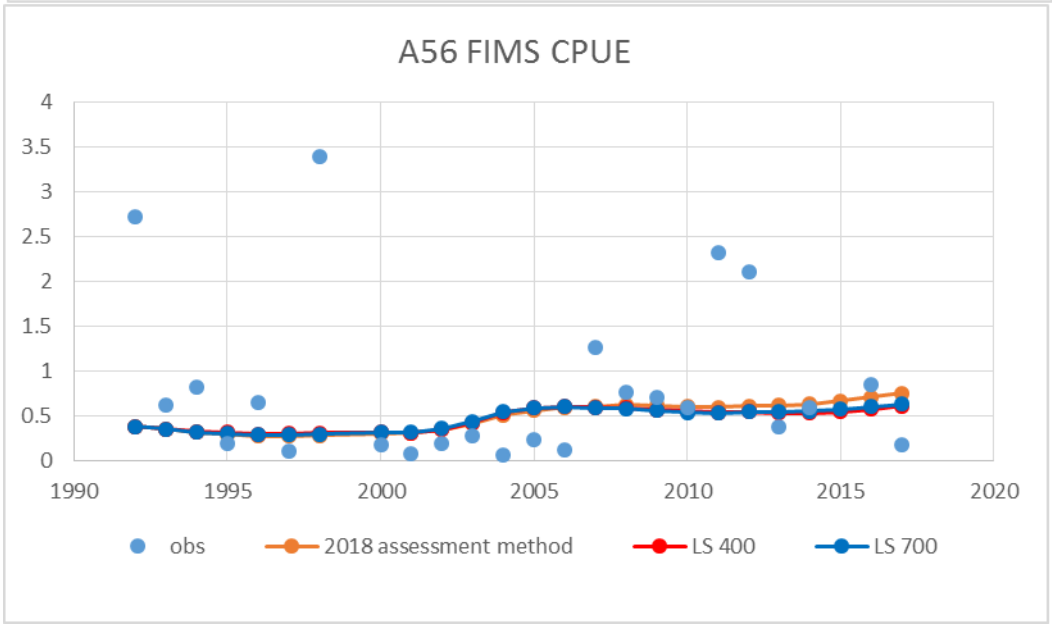


Figure A2c: Comparison of fits to A56 CPUE for the different assessments.

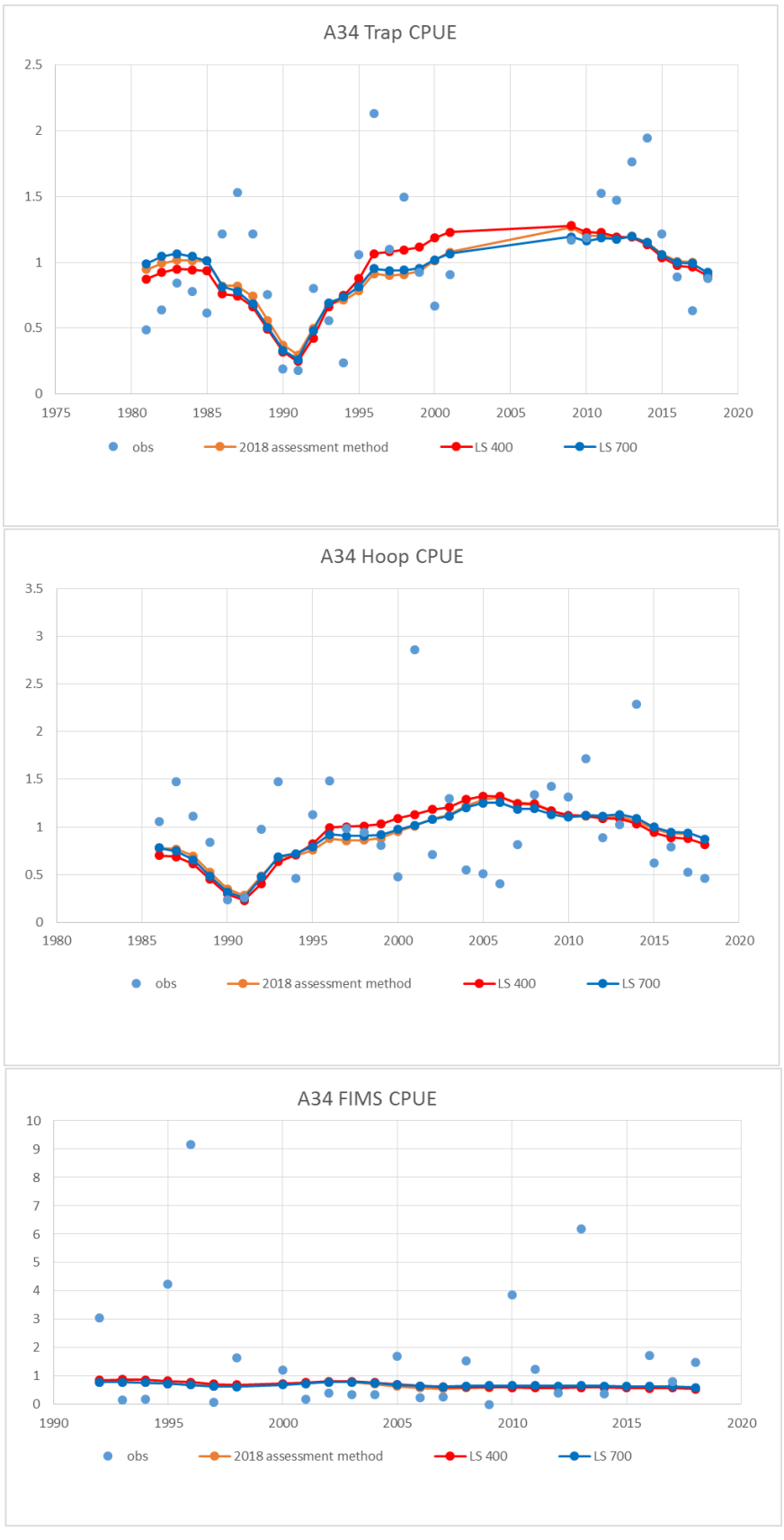


Figure A2d: Comparison of fits to A34 CPUE for the different assessments.

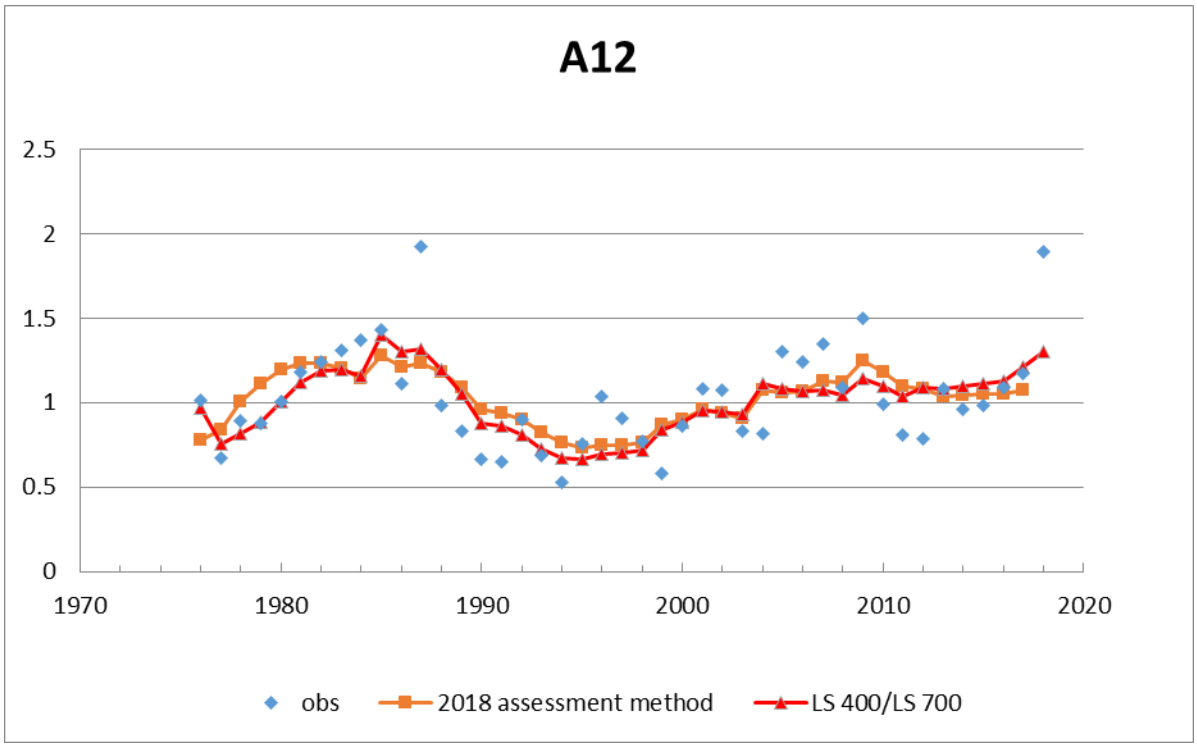


Figure A2e: Comparison of fits to A12 CPUE for the different assessments.

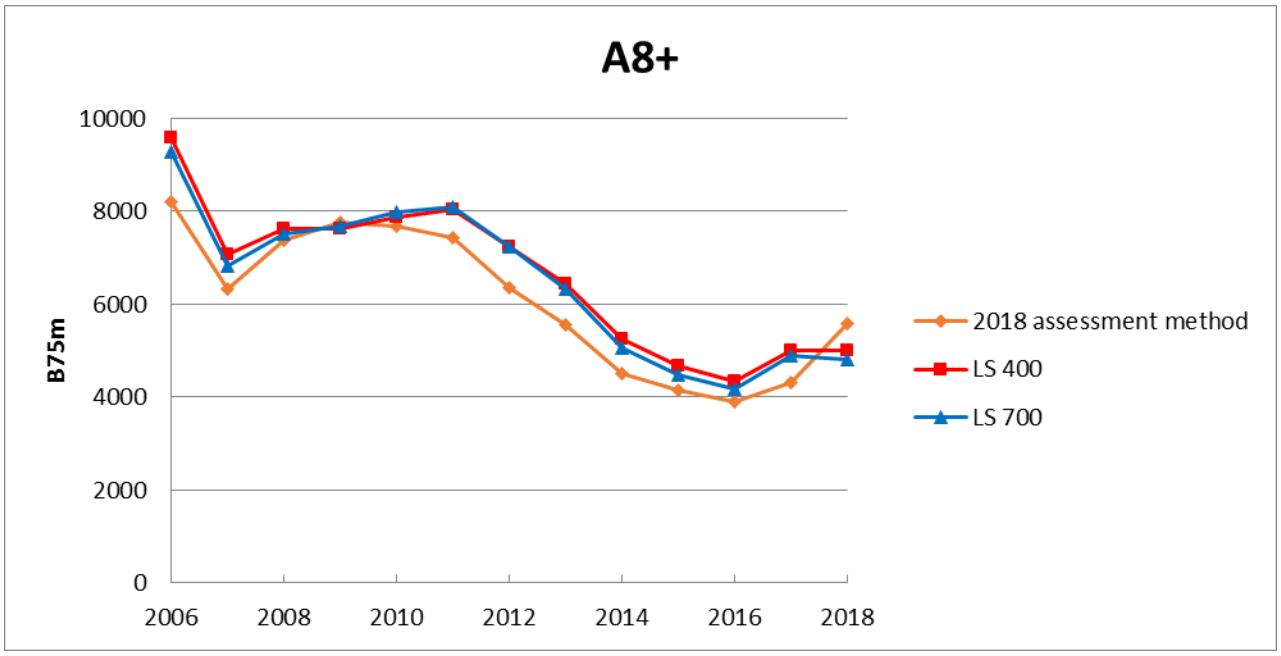


Figure A3a: Comparison between the A8+ B75m trajectories (for 2006-2030) for the different assessments and projections.

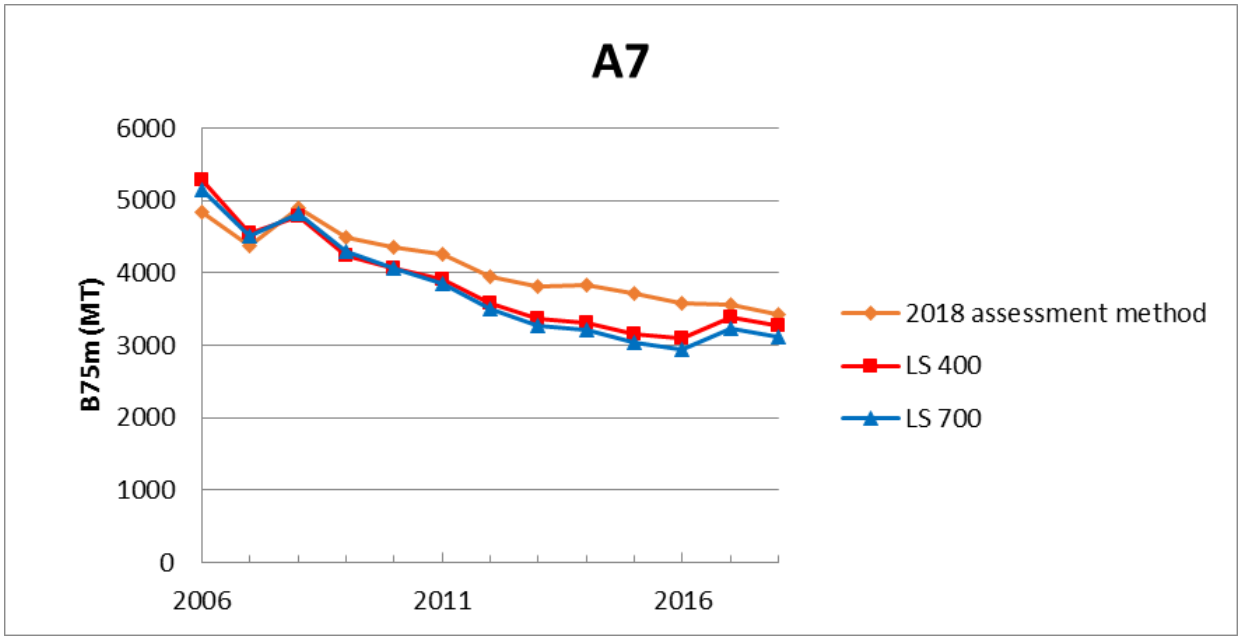


Figure A3b: Comparison between the A7 B75m trajectories (for 2006-2030) for the different assessments and projections.

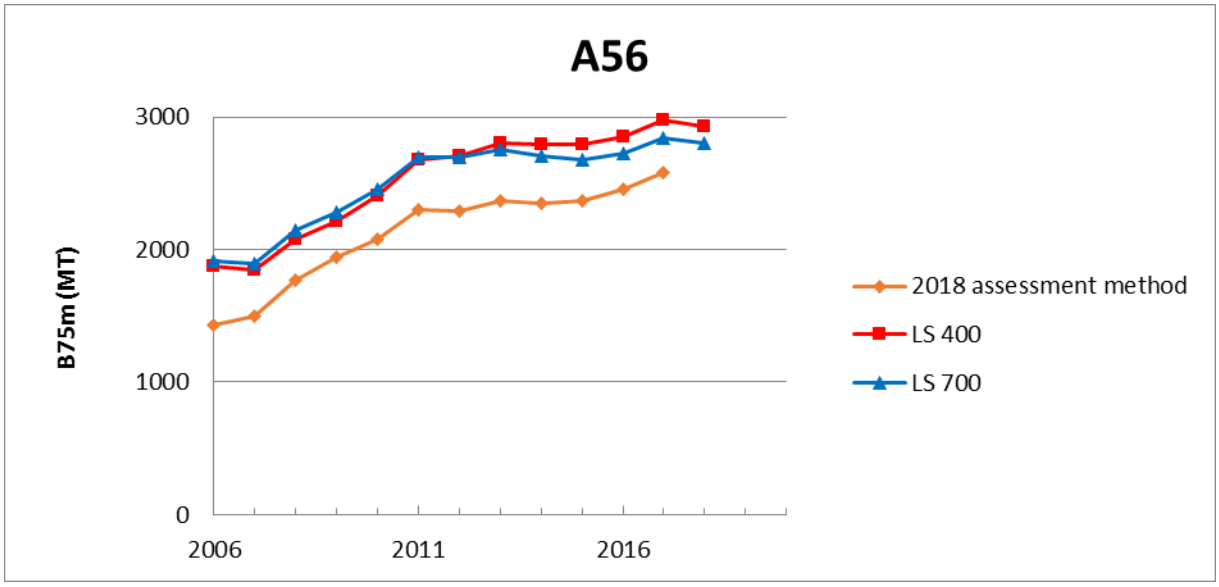


Figure A3c: Comparison between the A56 B75m trajectories (for 2006-2030) for the different assessments and projections.

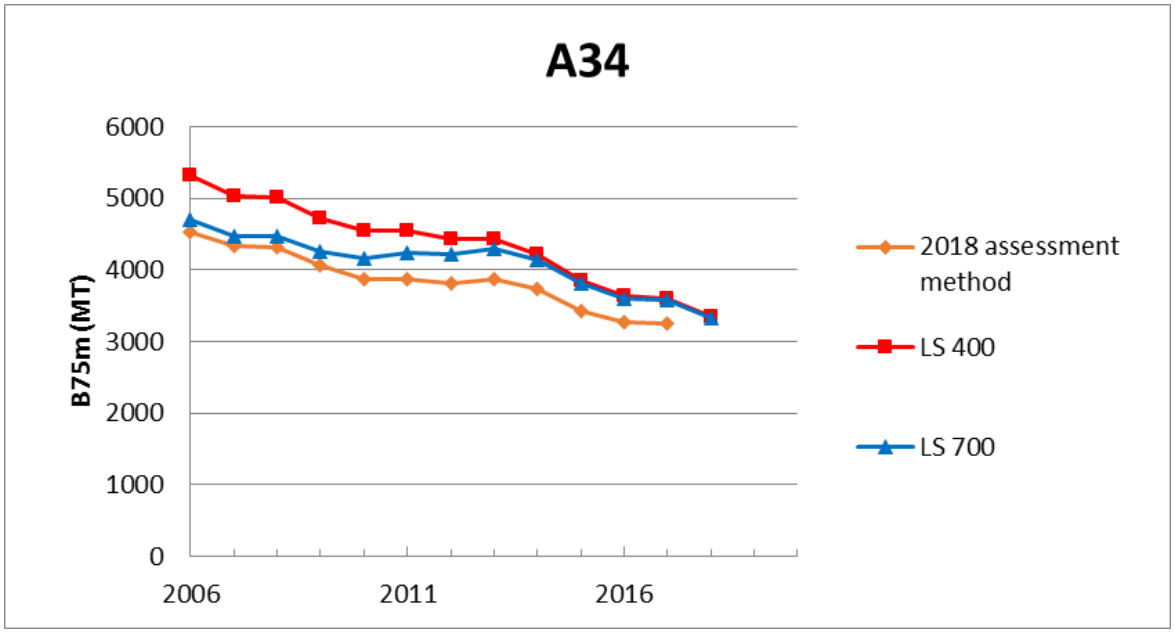


Figure A3d: Comparison between the A34 B75m trajectories (for 2006-2030) for the different assessments and projections.

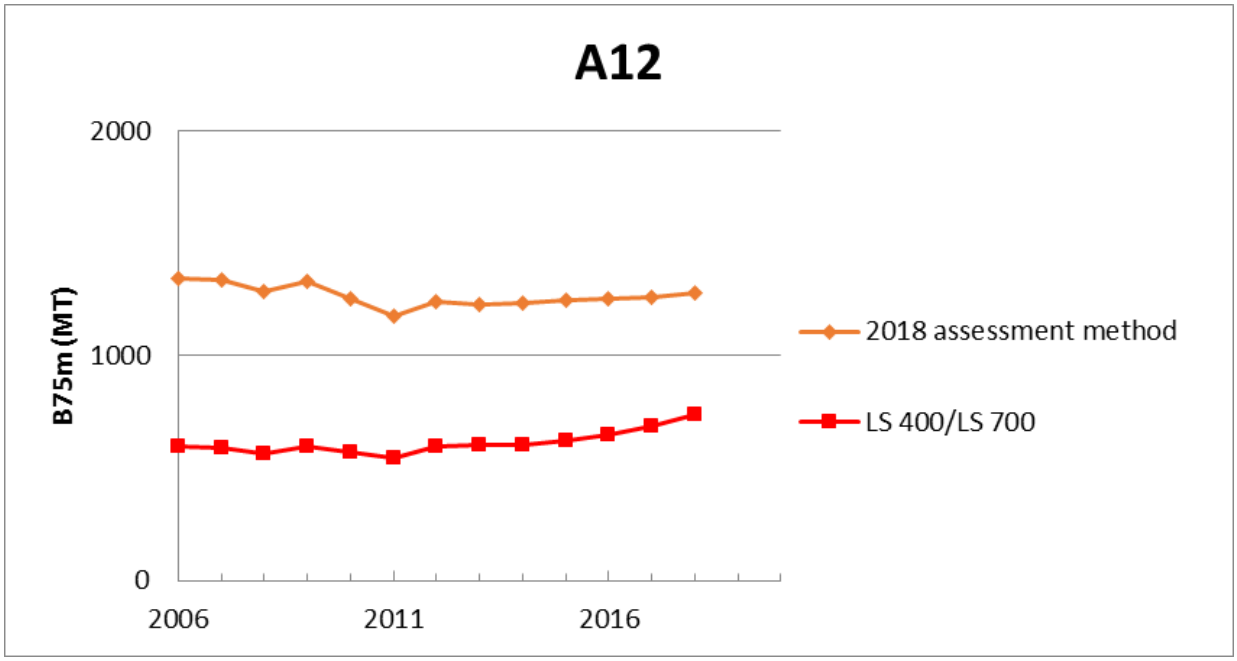


Figure A3e: Comparison between the A12 B75m trajectories (for 2006-2030) for the different assessments and projections.

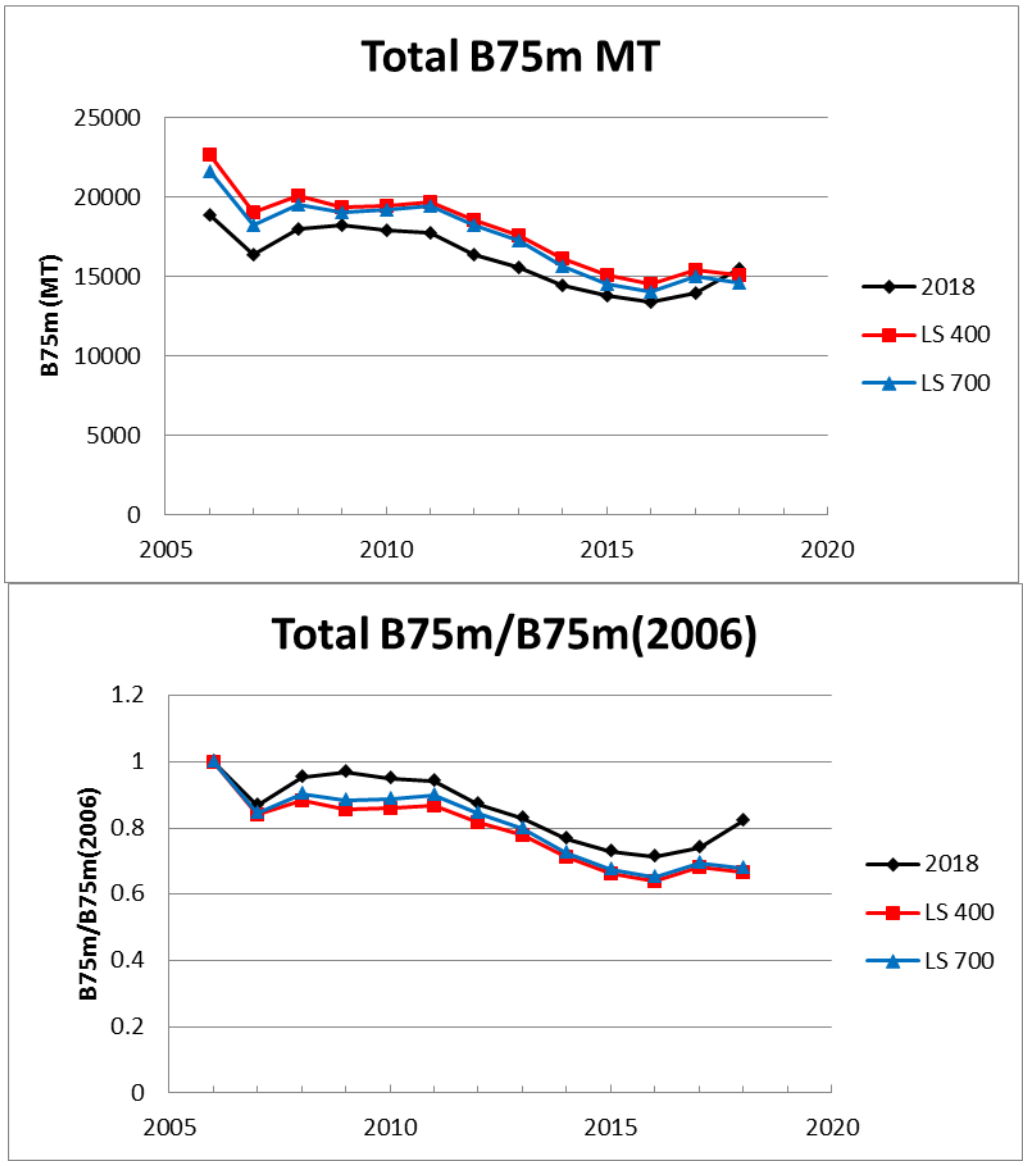


Figure A5: Comparison of the total estimated resource biomass in absolute terms (top plot) and relative to 2006 (bottom plot) for the 2018 assessment and the two 2019 assessments.