



MARAM/OLRAC averaged Final area-disaggregated Assessment results for west coast rock lobster

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Female survivorship constraint

At the previous working group meeting, following the presentation of MARAM and OLRAC'S most recent area-disaggregated assessments results (see WG/06/06/WCRL25), it was decided that an upper limit of 0.89 should be imposed on the female survivorship estimable parameter for the final area-disaggregated model assessments. It was noted that for Area 5-6 and Area 7 the estimated female survivorship values (~0.94) were biologically unrealistic, also given that the male survivorship is fixed at 0.90.

MARAM/OLRAC averaged results

MARAM and OLRAC both individually fitted their models to the data to obtain best fit parameter values for each of the super-areas (and for the area-aggregated model). For the final models to be used for OMP testing purposes, the average of the MARAM and OLRAC best fit parameter values are to be used. In most cases the MARAM and OLRAC estimates were found to be very similar. Table 1 compares the $-\ln L$, the B75(2005) and the replacement yields (assuming FRM and FSGL – see below) for the MARAM, OLRAC, and the “averaged” parameter models (as calculated by MARAM).

Alternate assessment models and future recruitment and somatic growth rate scenarios

OMP developers will shortly be testing a new range of OMPs for the resource, this time based on super-area models as the underlying operating models for the OMP testing procedure. A range of uncertainties (as used for the previous OMP testing procedure) has been defined (see WG/03/06/WCRL21). Following recommendations made recently by the International Rock Lobster Workshop (December 2005), it is propose that the core uncertainties listed below be considered as components of the Reference Set (RS). A weight has been set for each, following discussions in a task group meeting as well as in the Working Group.

1. Current Abundance	WT
• RC: Best Estimate (from RC1-like model)	0.50
• AltL: Estimated lower 25%ile for R_{2000}	0.25
• AltH: Estimated upper 25%ile for R_{2000}	0.25

The two alternate models (AltL and AltH) are virtually identical to the RC model, except with regards to the R_{2000} value. For the RC model R_{2000} is an estimable parameter, although it was found to be estimated with very low precision. For this reason, AltL and AltH models correspond almost exactly to the RC best fit parameter values except for R_{2000} which is fixed at the (approximate) upper and lower 25%iles of this distribution as described in WG/06/06/WCRL25.

2. Future Somatic growth (2005+)	WT
• FSGL: 1989-2004 average	0.50
• FSGM: ↑ to 1968-2004 ave over 10 yrs	0.40
• FSGH: ↑ to 1968-2004 ave over 3 yrs	0.10

The above apply to the growth rates for Areas 3-4, 5-6, 7 and 8. It is suggested that the future somatic growth rate for Area 1-2 be assumed to remain constant (at the 1989-2004 average level) in the future.

3. Median Future Recruitment	WT
• FRM: Median of $R_{75}, R_{80}, R_{85}, R_{90}$ and R_{95}	0.60
• FRM: Maximum of $R_{75}, R_{80}, R_{85}, R_{90}$ and R_{95}	0.30
• FRL: Minimum of $R_{75}, R_{80}, R_{85}, R_{90}$ and R_{95}	0.10

The combination of the above uncertainties will produce a total of 27 scenarios. Each OMP candidate will effectively be run for all 27 scenarios, with the results of each scenario being weighted by a value reflective of that scenario's total weight. Table 2 reports the total weights for each of the 27 model scenarios.

Replacement yields

For each super-area and for each of the 27 "future scenarios", a replacement yield (RY) can be calculated. This RY reflects the combined commercial and recreational TAC in MT. Tables 3a-g report the RYs for the MARAM/OLRAC averaged parameter values (as calculated by MARAM).

Table 4 reports the weighted (as per Table 2) averages of the RY estimates (in MT) for each of the Table 3 options.

Table 1: MARAM, OLRAC and the “averaged” parameter model results for the $-\ln L$, $B75(2005)$ and replacement yield (RY).

		MARAM	OLRAC	Averaged parameters
A1-2	$-\ln L$	-20.13	-21.08	510
	$B75(2005)$	434	644	686
	RY	22	12	9
A3-4	$-\ln L$	25.93	26.85	31.95
	$B75(2005)$	3161	3920	3785
	RY	220	300	229
A5-6	$-\ln L$	38.53	36.39	161.27
	$B75(2005)$	566	1277	372
	RY	132	237	167
A7	$-\ln L$	9.05	-2.06	21.27
	$B75(2005)$	3192	5258	4594
	RY	619	607	600
A8	$-\ln L$	-55.00	-54.93	-53.60
	$B75(2005)$	9421	9190	9962
	RY	969	1057	1005
Area-aggregated	$-\ln L$	-50.13	-91.96	-50.04
	$B75(2005)$	17001	18204	17783
	RY	2454	2402	2404

Table 2: Weights given to each of the 27 possible model scenarios.

	Future Recruitment for ≥ 2005	Future Somatic Growth for ≥ 2005	Recruitment for 2000		
			01 Alt L	02 RC	03 Alt H
01	FRL	FSGL	0.0125	0.0250	0.0125
02	FRL	FSGM	0.0100	0.0200	0.0100
03	FRL	FSGH	0.0025	0.0050	0.0025
04	FRM	FSGL	0.0750	0.1500	0.0750
05	FRM	FSGM	0.0600	0.1200	0.0600
06	FRM	FSGH	0.0150	0.0300	0.0150
07	FRH	FSGL	0.0375	0.0750	0.0375
08	FRH	FSGM	0.0300	0.0600	0.0300
09	FRH	FSGH	0.0075	0.0150	0.0075

Table 3a: A1-2 replacement yields calculated using the averaged MARAM and OLRAC best fit parameter values. Results are reported for 27 combinations of R_{2000} , future recruitment and future somatic growth rate. Note that the future somatic growth is assumed to remain constant at the 1989-2004 average level for all three future somatic growth options.

Area 1-2 Replacement Yields (Commercial + Recreational) / MT

	<u>Future Recruitment for ≥ 2005</u>	<u>Future Somatic Growth for ≥ 2005</u>	<u>Recruitment for 2000</u>		
			<u>01 Alt L</u>	<u>02 RC</u>	<u>03 Alt H</u>
01	FRL	FSGL	0	0	0
02	FRL	FSGM	0	0	0
03	FRL	FSGH	0	0	0
04	FRM	FSGL	4	9	17
05	FRM	FSGM	4	9	17
06	FRM	FSGH	4	9	17
07	FRH	FSGL	36	41	48
08	FRH	FSGM	36	41	48
09	FRH	FSGH	36	41	48

Table 3b: A3-4 replacement yields calculated using the averaged MARAM and OLRAC best fit parameter values. Results are reported for 27 combinations of R_{2000} , future recruitment and future somatic growth rate.

Area 3-4 Replacement Yields (Commercial + Recreational) / MT

	<u>Future Recruitment for ≥ 2005</u>	<u>Future Somatic Growth for ≥ 2005</u>	<u>Recruitment for 2000</u>		
			<u>01 Alt L</u>	<u>02 RC</u>	<u>03 Alt H</u>
01	FRL	FSGL	0	54	198
02	FRL	FSGM	106	194	346
03	FRL	FSGH	209	323	519
04	FRM	FSGL	152	229	363
05	FRM	FSGM	355	432	570
06	FRM	FSGH	548	648	826
07	FRH	FSGL	424	491	611
08	FRH	FSGM	664	737	865
09	FRH	FSGH	988	1083	1254

Table 3c: A5-6 replacement yields calculated using the averaged MARAM and OLRAC best fit parameter values. Results are reported for 27 combinations of R_{2000} , future recruitment and future somatic growth rate.

Area 5-6 Replacement Yields (Commercial + Recreational) / MT

	Future Recruitment for \geq 2005	Future Somatic Growth for \geq 2005	Recruitment for 2000		
			01 Alt L	02 RC	03 Alt H
01	FRL	FSGL	54	98	208
02	FRL	FSGM	75	122	238
03	FRL	FSGH	107	161	329
04	FRM	FSGL	112	167	276
05	FRM	FSGM	128	191	335
06	FRM	FSGH	226	312	475
07	FRH	FSGL	147	204	352
08	FRH	FSGM	160	242	403
09	FRH	FSGH	338	467	826

Table 3d: A7 replacement yields calculated using the averaged MARAM and OLRAC best fit parameter values. Results are reported for 27 combinations of R_{2000} , future recruitment and future somatic growth rate.

Area 7 Replacement Yields (Commercial + Recreational) / MT

	<u>Future Recruitment for ≥ 2005</u>	<u>Future Somatic Growth for ≥ 2005</u>	<u>Recruitment for 2000</u>		
			<u>01 Alt L</u>	<u>02 RC</u>	<u>03 Alt H</u>
01	FRL	FSGL	271	297	335
02	FRL	FSGM	347	385	441
03	FRL	FSGH	495	536	599
04	FRM	FSGL	575	600	639
05	FRM	FSGM	647	685	741
06	FRM	FSGH	893	936	1001
07	FRH	FSGL	1142	1175	1219
08	FRH	FSGM	1195	1227	1299
09	FRH	FSGH	1638	1690	1764

Table 3e: A8 replacement yields calculated using the averaged MARAM and OLRAC best fit parameter values. Results are reported for 27 combinations of R_{2000} , future recruitment and future somatic growth rate.

Area 8 Replacement Yields (Commercial + Recreational) / MT

	Future Recruitment for \geq 2005	Future Somatic Growth for \geq 2005	Recruitment for 2000		
			01 Alt L	02 RC	03 Alt H
01	FRL	FSGL	490	716	1021
02	FRL	FSGM	1161	1395	1711
03	FRL	FSGH	1953	2281	2727
04	FRM	FSGL	788	1005	1298
05	FRM	FSGM	1609	1828	2123
06	FRM	FSGH	2611	2925	3354
07	FRH	FSGL	1241	1442	1713
08	FRH	FSGM	2139	2343	2616
09	FRH	FSGH	3445	3757	4180

Table 3f: Area-aggregated replacement yields calculated using the averaged MARAM and OLRAC best fit parameter values. Results are reported for 27 combinations of R_{2000} , future recruitment and future somatic growth rate.

Area
Aggregated

Replacement Yields (Commercial + Recreational) / MT

	<u>F</u> uture <u>R</u> ecruitment for \geq 2005	<u>F</u> uture <u>S</u> omatic <u>G</u> rowth for \geq 2005	Recruitment for 2000		
			01 Alt L	02 RC	03 Alt H
01	FRL	FSGL	1023	1501	2169
02	FRL	FSGM	2002	2509	3220
03	FRL	FSGH	3155	3822	4761
04	FRM	FSGL	1948	2404	3047
05	FRM	FSGM	3237	3716	4395
06	FRM	FSGH	4836	5474	6379
07	FRH	FSGL	2509	2953	3581
08	FRH	FSGM	3928	4401	5071
09	FRH	FSGH	5804	6435	7333

Table 3g: A1+2+3+4+5+6+7+8 replacement yields calculated using the averaged MARAM and OLRAC best fit parameter values. Results are reported for 27 combinations of R_{2000} , future recruitment and future somatic growth rate. The shaded blocks indicated RY which are smaller than the corresponding area-aggregated RYs.

A1+2+3+4+5+6+7+8 Replacement Yields (Commercial + Recreational) / MT

	Future Recruitment for \geq 2005	Future Somatic Growth for \geq 2005	Recruitment for 2000		
			01 Alt L	02 RC	03 Alt H
01	FRL	FSGL	815	1165	1762
02	FRL	FSGM	1689	2096	2736
03	FRL	FSGH	2764	3301	4174
04	FRM	FSGL	1631	2010	2593
05	FRM	FSGM	2743	3145	3786
06	FRM	FSGH	4282	4830	5673
07	FRH	FSGL	2990	3353	3943
08	FRH	FSGM	4194	4590	5231
09	FRH	FSGH	6445	7038	8072

Table 4: The weighted (as per Table 2) averages of the RY estimates (in MT) for each of the Table 3 options.

Area	Weighted averaged RY
A1-2	18
A3-4	435
A5-6	219
A7	815
A8	1660
Area-aggregated	3369
Sum A1-2+3-4+5-6+7+8	3147

