

Further OMP results for the South Coast Rock Lobster Resource OMP

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INTRODUCTION

Johnston and Butterworth (2008) reported initial OMP results for the South Coast rock lobster resource. These results were based on the following TAC rule:

$$TAC_{y+1} = TAC_y (1 + \alpha s_y^A) \quad (1)$$

where

s_y^A is the slope parameter from a regression of $\ln CPUE_y^A$ against y over the last five years (of available data) for each area A , and

$$s_y = \sum_{A=1}^3 w^A s_y^A \quad (2)$$

$$\text{where } w^A = \frac{\frac{1}{\sigma_S^{A^2}}}{\sum_{A=1}^3 \left(\frac{1}{\sigma_S^{A^2}}\right)} \quad (3)$$

and σ_S^A is the standard error of the regression estimate of s_y^A .

A rule to restrict the inter-annual TAC variation to no more than 10% up or down from year to year was applied.

The average areal split over the last five years is assumed to apply without change for each year in the future.

Note also that the TAC for year $y+1$ will be based upon the CPUE series that ends in year $y-1$, i.e. the TAC recommendation for 2008¹ would be based on a CPUE series that ended with the most recent CPUE value available at the time a recommendation was requested which would be for 2006.

OMP UPDATES

Results presented here incorporate the following.

- 1) Actual Catches taken in 2006 are taken into account, which are:
 - Area 1 = 198.59 MT
 - Area 2 = 100.40 MT
 - Area 3 = 78.01 MT
 - Total = 377 MT (5 tons less than TAC set)

¹ The convention used here is that 2008 refers to the 2008/09 season

2) The σ_s^A values in equation (3) above are now bounded below at 0.15.

3) A modified TAC rule is implemented:

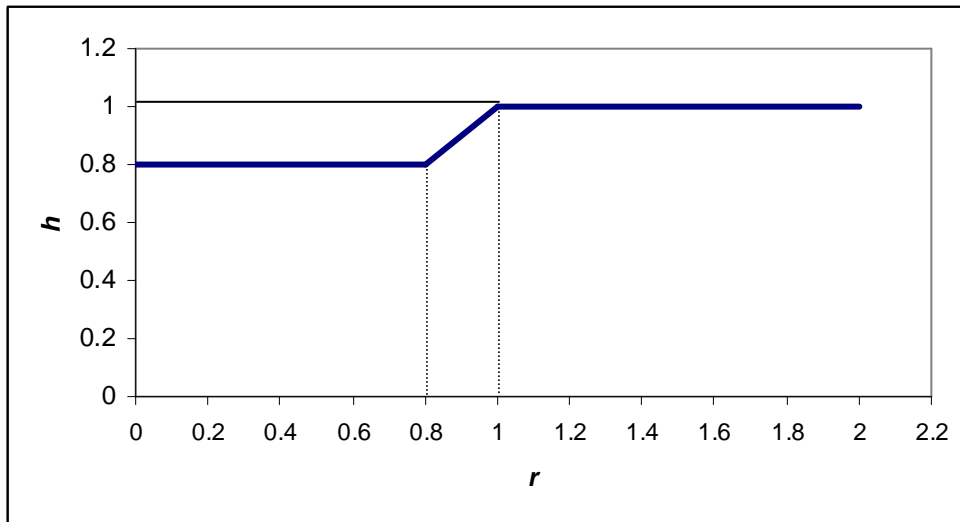
$$TAC_{y+1} = TAC_y [1 + \alpha(s_y - \delta)]h(r_y) \quad (4)$$

where

δ is a further control parameter value to α ; adjusting δ allows the extent of any resource recovery sought to be varied; and

$$\begin{aligned} h(r) &= 0.8 && \text{for } r \leq 0.8 \\ &= r && \text{for } 0.8 \leq r \leq 1.0 \\ &= 1.0 && \text{for } r \geq 1.0 \end{aligned}$$

i.e.



and r is the ratio of recent CPUE to that at the time the OMP commences:

$$\begin{aligned} \overline{CPUE}_{init} &= \frac{1}{3} \sum_{y'=2004}^{2006} \sum_{A=1}^3 w_A CPUE_{y'}^A \\ \overline{CPUE}_y &= \frac{1}{3} \sum_{y'=y-3}^{y-1} \sum_{A=1}^3 w_A CPUE_{y'}^A \\ r_y &= \frac{\overline{CPUE}_y}{\overline{CPUE}_{init}} \end{aligned}$$

where

$$w_1 = 0.28$$

$$w_2 = 0.55$$

$$w_3 = 0.17$$

The rationale is that if CPUE falls below the recent values, the TAC is reduced further to offset further resource decline and enhance recovery to earlier levels.

The CPUE weighting factors, w_1, w_2 and w_3 relate to relative biomass in each area, and are calculated as follows. Using the estimated values of q and B from the operating Model 3:

	q	B
Area 1	0.006438	177
Area 2	0.003938	211
Area 3	0.006965	115

The relative biomass weights are: Area 1 = $177/504 = 0.35$
 Area 2 = $211/504 = 0.42$
 Area 3 = $115/504 = 0.23$

In terms of CPUE we thus want:

$$\begin{aligned} & 0.35B^1 + 0.42B^2 + 0.23B^3 \\ & = 0.35 \frac{CPUE^1}{q_1} + 0.43 \frac{CPUE^2}{q_2} + 0.23 \frac{CPUE^3}{q_3} \\ & = 54.5CPUE^1 + 106.8CPUE^2 + 32.8CPUE^3 \end{aligned}$$

We need the CPUE weights to sum to 1, thus we get:

$$0.28CPUE^1 + 0.55CPUE^2 + 0.17CPUE^3$$

RESULTS

Experimentation showed that extending the period of years considered for calculating the CPUE slope s_y provided no overall performance benefits.

Initial results are presented in the form of a default choice of operating model (Model 3 – MARAM TVS) and OMP ($\delta = 0$, $\alpha = 3$, TAC variation constraint = 10%). Tables 1a)-d) show respectively the results of variation of α , the operating model, δ and the TAC variation constraint.

Figures 1a and b show the TAC and B_{sp} trajectories (median with 5th and 95th percentiles) for scenarios B (TAC constraint of 10%) and H (TAC constraint of 5%) respectively.

Figure 2 shows six comparative plots of median (and 5th and 95 percentiles) values of various summary statistics for four different comparisons: a) Model 3: $\alpha = 1, 3$ and 5; b) Model 3: $\delta = 0; -0.015$ and -0.03 ; c) Default: Model 3, 4 and 5 and d) Model 3: TAC constraint %: 10 and 5.

REFERENCES

Johnston, S.J. and D.S. Butterworth. 2008. Initial OMP results for the South Coast Rock Lobster Resource OMP. MCM document, MCM/2008/JUN/SWG-SCRL/21. 11pp.

Table 1a: Summary performance statistics for a future constant catch scenario of 382 MT, and a number of OMP candidates. These shows variations of control parameter α . Medians with 5th and 95th percentile are reported.

	CC=382	A	B	C
	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)
δ	-	0	0	0
α	-	1	3	5
# yrs in CPUE average	-	5	5	5
TAC constraint (%)	-	10	10	10
C_{ave}^7 (2006-2012)	382 [382; 382]	333 [320; 353]	319 [309; 344]	317 [309; 343]
C_{ave}^{10} (2006-2015)	382 [382; 382]	328 [295; 367]	322 [288; 360]	322 [290; 359]
C_{ave}^{20} (2006-2025)	382 [382; 382]	340 [273; 405]	335 [276; 423]	337 [274; 428]
$C(2008)$	382 [382; 382]	360 [347; 373]	344 [344; 356]	344 [344; 344]
$C(2009)$	382 [382; 382]	326 [315; 356]	309 [309; 329]	309 [309; 320]
$C(2010)$	382 [382; 382]	299 [286; 334]	278 [278; 316]	260 [250; 342]
V^7 (2006-2012)	0 [0; 0]	5 [4; 7]	7 [5; 8]	7 [6; 8]
V^{10} (2006-2015)	0 [0; 0]	6 [4; 7]	7 [6; 8]	8 [7; 8]
V^{20} (2006-2025)	0 [0; 0]	6 [4; 7]	8 [7; 8]	8 [7; 9]
B^{sp} (2015/2006) 90% range	1.16 [0.85; 1.58] 0.73	1.27 [1.00; 1.70] 0.70	1.27 [1.03; 1.76] 0.73	1.27 [1.03; 1.76] 0.73
B^{sp} (2025/2006) 90% range	1.07 [0.66; 1.60] 0.94	1.21 [0.89; 1.74] 0.85	1.22 [0.89; 1.71] 0.82	1.23 [0.90; 1.72] 0.82
B^{sp} (2006/K)	0.34	0.34	0.34	0.34
B^{sp} (2015/K)	0.39 [0.29; 0.54]	0.43 [0.34; 0.59]	0.43 [0.35; 0.60]	0.43 [0.35; 0.60]
B^{sp} (2025/K)	0.36 [0.23; 0.54]	0.41 [0.30; 0.59]	0.41 [0.30; 0.58]	0.42 [0.31; 0.58]
	xNpCC.res xNtCC.res	xNp1.res xNt1.res	xNp4.res xNt4.res	xNp2.res xNt2.res

Table 1b: Summary performance statistics for a number of OMP candidates. Medians with 5th and 95th percentile are reported.

	B	D	E
	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)
δ	0	-0.015	-0.03
α	3	3	3
# yrs in CPUE average	5	5	5
TAC constraint (%)	10	10	10
C_{ave}^7 (2006-2012)	319 [309; 344]	326 [310; 353]	335 [317; 367]
C_{ave}^{10} (2006-2015)	322 [288; 360]	331 [290; 374]	344 [301; 396]
C_{ave}^{20} (2006-2025)	335 [276; 423]	359 [290; 449]	385 [305; 485]
C (2008)	344 [344; 356]	344 [344; 374]	350 [344; 390]
C (2009)	309 [309; 329]	309 [309; 349]	316 [309; 374]
C (2010)	278 [278; 316]	280 [278; 340]	294 [278; 354]
V^7 (2006-2012)	7 [5; 8]	7 [8; 8]	7 [5; 8]
V^{10} (2006-2015)	7 [6; 8]	5 [6; 7]	7 [6; 8]
V^{20} (2006-2025)	8 [7; 8]	8 [8; 9]	8 [7; 9]
B^{sp} (2015/2006) 90% range	1.27 [1.03; 1.76] 0.73	1.25 [1.00; 1.76] 0.76	1.23 [0.96; 1.72] 0.76
B^{sp} (2025/2006) 90% range	1.22 [0.89; 1.71] 0.82	1.15 [0.84; 1.61] 0.77	1.07 [0.80; 1.55] 0.75
B^{sp} (2006/K)	0.34	0.34	0.34
B^{sp} (2015/K)	0.43 [0.35; 0.60]	0.42 [0.34; 0.60]	0.42 [0.33; 0.58]
B^{sp} (2025/K)	0.41 [0.30; 0.58]	0.39 [0.29; 0.55]	0.36 [0.27; 0.53]
	xNp4.res xNt4.res	xNp5.res xNt5.res	xNp7.res xNt7.res

Table 1c: Summary performance statistics for a number of OMP candidates. Medians with 5th and 95th percentile are reported.

	B	F	G
	Model 3 (MARAM TVS)	Model 4 (OLRAC TVS)	Model 5 (ES)
δ	0	0	0
α	3	3	3
# yrs in CPUE average	5	5	5
TAC constraint (%)	10	10	10
C_{ave}^7 (2006-2012)	319 [309; 344]	325 [309; 361]	320 [310; 343]
C_{ave}^{10} (2006-2015)	322 [288; 360]	323 [291; 381]	322 [287; 364]
C_{ave}^{20} (2006-2025)	335 [276; 423]	332 [263; 450]	331 [275; 407]
C (2008)	344 [344; 356]	344 [344; 366]	344 [344; 355]
C (2009)	309 [309; 329]	309 [309; 349]	309 [309; 329]
C (2010)	278 [278; 316]	286 [278; 342]	278 [278; 316]
V^7 (2006-2012)	7 [5; 8]	6 [5; 7]	7 [5; 7]
V^{10} (2006-2015)	7 [6; 8]	7 [5; 8]	7 [5; 8]
V^{20} (2006-2025)	8 [7; 8]	7 [6; 8]	8 [6; 8]
B^{sp} (2015/2006) 90% range	1.27 [1.03; 1.76] 0.73	1.21 [0.99; 1.57] 0.58	1.26 [1.01; 1.74] 0.73
B^{sp} (2025/2006) 90% range	1.22 [0.89; 1.71] 0.82	1.24 [0.94; 1.77] 0.83	1.22 [0.88; 1.65] 0.77
B^{sp} (2006/K)	0.34	0.47	0.35
B^{sp} (2015/K)	0.43 [0.35; 0.60]	0.57 [0.47; 0.74]	0.44 [0.35; 0.61]
B^{sp} (2025/K)	0.41 [0.30; 0.58]	0.58 [0.44; 0.83]	0.43 [0.31; 0.58]
	xNp4.res xNt4.res	xNp6.res xNt6.res	Xnp10.res Xnt10.res

Table 1d: Summary performance statistics for a number of OMP candidates. Medians with 5th and 95th percentile are reported.

	B	H
	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)
δ	0	0
α	3	3
# yrs in CPUE average	5	5
TAC constraint (%)	10	5
C_{ave}^7 (2006-2012)	319 [309; 344]	347 [344; 358]
C_{ave}^{10} (2006-2015)	322 [288; 360]	346 [324; 369]
C_{ave}^{20} (2006-2025)	335 [276; 423]	350 [308; 409]
C (2008)	344 [344; 356]	363 [363; 363]
C (2009)	309 [309; 329]	345 [345; 345]
C (2010)	278 [278; 316]	328 [328; 347]
V^7 (2006-2012)	7 [5; 8]	4 [3; 4]
V^{10} (2006-2015)	7 [6; 8]	4 [4; 4]
V^{20} (2006-2025)	8 [7; 8]	4 [4; 5]
B^{sp} (2015/2006) 90% range	1.27 [1.03; 1.76] 0.73	1.23 [0.96; 1.67] 0.71
B^{sp} (2025/2006) 90% range	1.22 [0.89; 1.71] 0.82	1.17 [0.85; 1.72] 0.87
B^{sp} (2006/K)	0.34	0.34
B^{sp} (2015/K)	0.43 [0.35; 0.60]	0.42 [0.33; 0.57]
B^{sp} (2025/K)	0.41 [0.30; 0.58]	0.40 [0.29; 0.59]
	xNp4.res xNt4.res	xNp9.res xNt9.res

Figure 1a: Median TAC (left panel) and B_{sp} (right panel) trajectories with the 5th and 95th percentile, for Scenario B (MARAM $\alpha = 3$, AAV=10%).

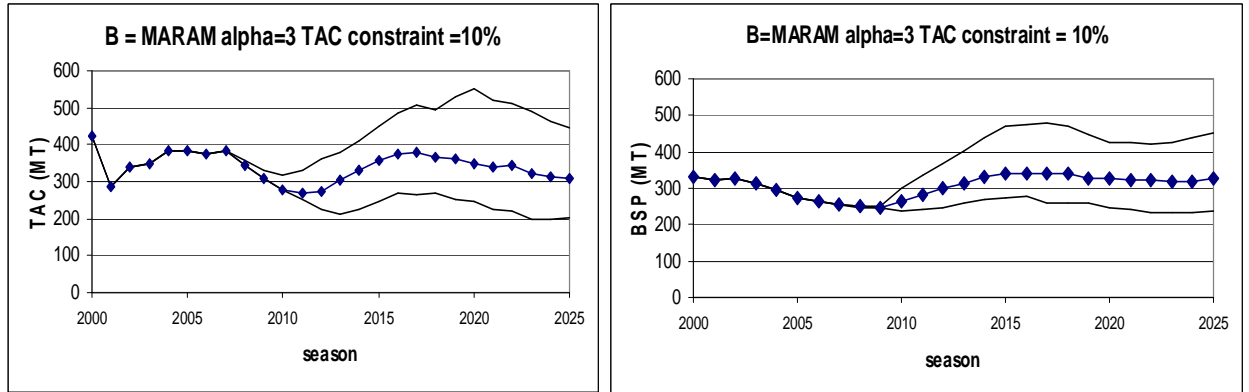
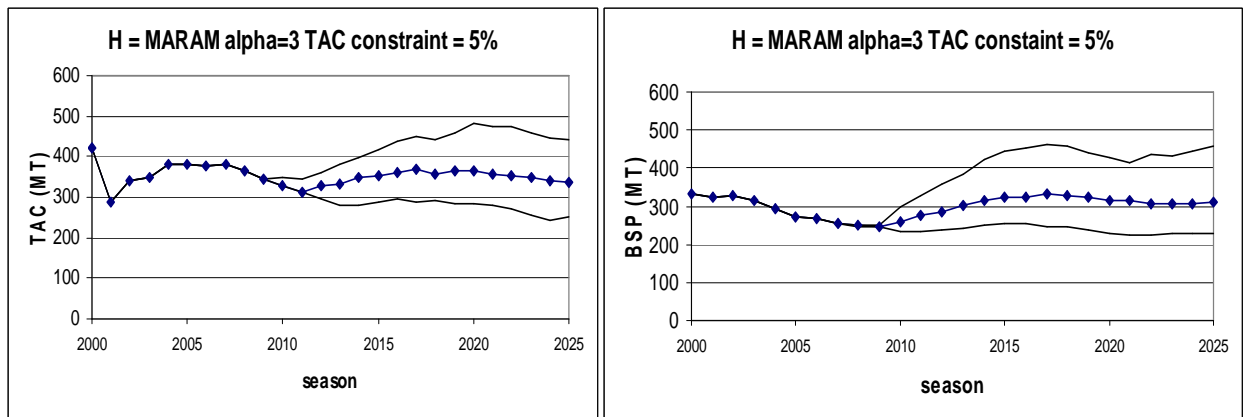


Figure 1b: Median TAC (left panel) and B_{sp} (right panel) trajectories with the 5th and 95th percentile, for Scenario H (MARAM $\alpha = 3$, AAV=5%)



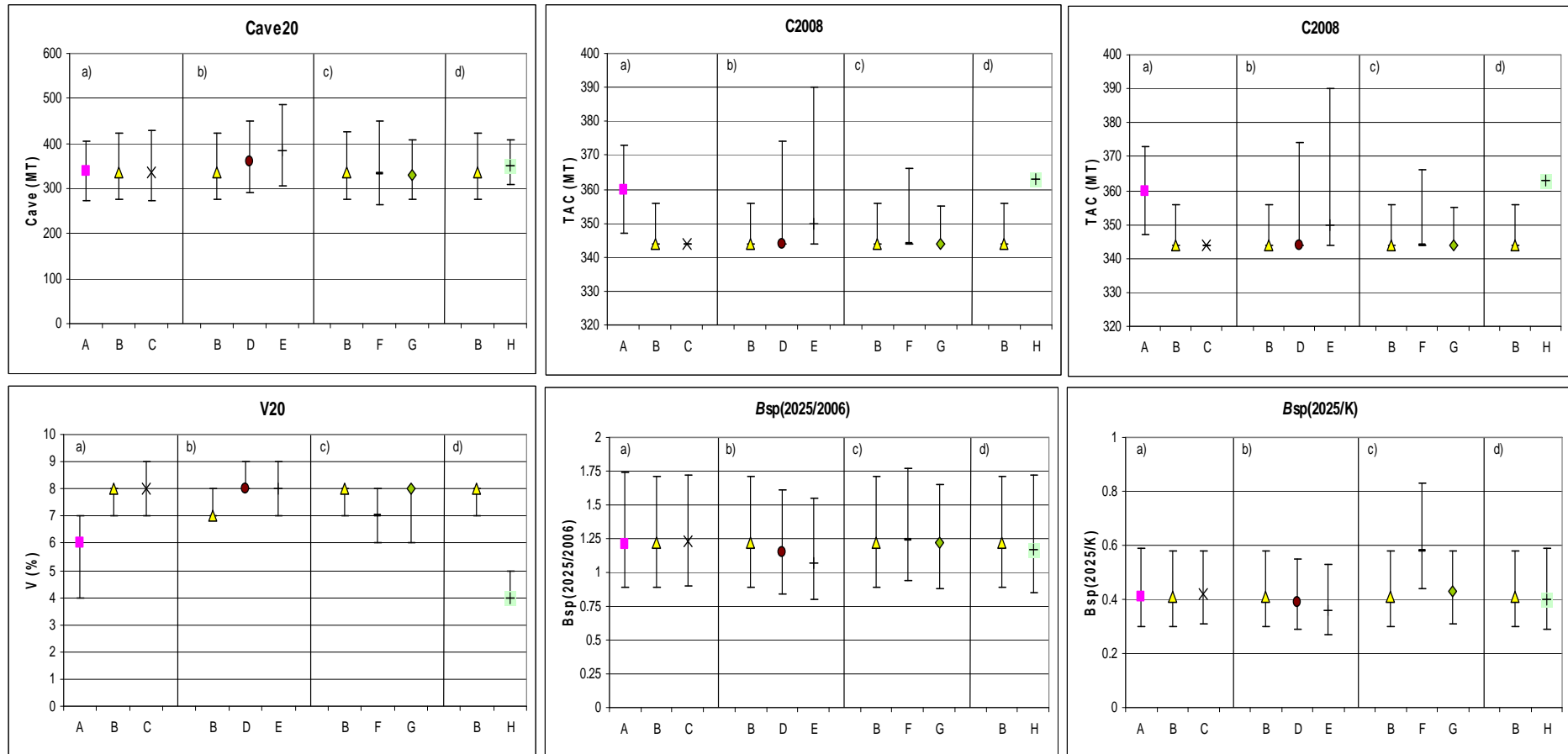


Figure 2: Six comparative plots of median (and 5th and 95 percentiles) values of various summary statistics for four different comparisons: a) Model 3: $\alpha = 1, 3$ and 5; b) Model 3: $\delta = 0, -0.015$ and -0.03 ; c) Default: Model 3, 4 and 5 and d) Model 3: TAC constraint %: 10 and 5.