Final set of OMP results for the South Coast Rock Lobster Resource OMP

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Introduction

Results are presented here for a range of OMP tunings which assume/attain either
  i)   inter-annual TAC constraint of 5%, 7.5% or 10%
  ii)   median recovery levels B^{sp} (2025/2006) of either 1.10, 1.175 or 1.25.

The five OMP candidates presented are:

OMP1   10% inter-annual TAC constraint + median 1.10 B^{sp} (2025/2006)
OMP2   10% inter-annual TAC constraint + median 1.24 B^{sp} (2025/2006)
OMP3   7.5% inter-annual TAC constraint + median 1.18 B^{sp} (2025/2006)
OMP4   5% inter-annual TAC constraint + median 1.10 B^{sp} (2025/2006)
OMP5   5% inter-annual TAC constraint + median 1.25 B^{sp} (2025/2006)

For all results the α control parameter is set to 3.

Results for all five OMPs are presented for both Model 3 (MARAM TVS) and Model 4 (OLRAC TVS).

Results assuming Model 3 in conjunction with OMP 3 (7.5% inter-annual TAC constraint with a B^{sp} (2025/2006) of 1.175), for the following robustness tests are also reported:

  [R1: Model 3 with $h = \hat{h} - 0.1$ - not completed yet]
  R2: Model 3 with $h = \hat{h} + 0.1$

  R3: Model 3 with $M = 0.07$
  R4: Model 3 with $M = 0.15$.

  R5: Model 3 with $B^{sp}_{2006} = \hat{B}^{sp}_{2006} * 1.1$
  R6: Model 3 with $B^{sp}_{2006} = \hat{B}^{sp}_{2006} * 0.95$

  R7: Model 3 with recruitment R_y being halved for a 10 year period from 2002-2011.

Results and Discussion

Tables 1a and b show performance statistics for the five candidate OMPs together with the TAC kept at its current level for Model 3 (MARAM TVS) and Model 4 (OLRAC TVS) respectively while Figure 1 compares these results graphically.

Similarly Table 2 shows results across the robustness test under the "central" OMP3 candidate, which are compared in Figure 2.

Figures 3a and b show time plots of TAC, B_{sp} and annual TAC % change (V) to compare these amongst different OMP candidates and operating models 3 and 4, while Figure 4 compares results for robustness test R7 (10 years of poor recruitment) under constant catch and OMP3 scenarios.

Results for the different OMP candidates show the qualitative trade-offs anticipated. Most noticeable in Figure 1 is the improvement in current biomass achieved under the OMP candidates under Model 3, compared to the constant catch approach.

Figure 2 shows that R6 (lower current biomass) and R7 (10 year period of poor recruitment) are the most demanding of the robustness tests. Figure 4 indicates that the OMP achieves some correction in the latter case compared to a constant catch approach.

Table 1a: Model 3 (MARAM TVS) summary performance statistics for a future constant catch scenario of 382 MT, and five OMP candidates. Medians with 5th and 95th percentiles are reported. The value of the δ control parameter was varied to achieve the median recovery targets shown in bold.

	CC=382	**OMP 1**	**OMP 2**	**OMP 3**	**OMP 4**	**OMP 5**
	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)	Model 3 (MARAM TVS)
δ	-	-0.024	0.005	-0.008	-0.03	0.021
TAC constraint (%)	-	10	10	7.5	5	5
C_{ave}^{7} (2006-2012)	382 [382; 382]	330 [312; 370]	317 [310; 341]	333 [327; 362]	351 [343; 383]	345 [343; 354]
C_{ave}^{10} (2006-2015)	382 [382; 382]	333 [298; 400]	321 [289; 363]	337 [306; 374]	351 [328; 393]	338 [323; 363]
C_{ave}^{20} (2006-2025)	382 [382; 382]	377 [300; 472]	327 [270; 410]	356 [289; 427]	384 [320; 446]	332 [296; 381]
C(2008)	382 [382; 382]	344 [344; 384]	344 [344; 351]	353 [353; 365]	363 [363; 391]	363 [363; 363]
C(2009)	382 [382; 382]	309 [309; 378]	309 [309; 328]	327 [327; 351]	345 [345; 380]	345 [345; 345]
C(2010)	382 [382; 382]	283 [278; 363]	278 [278; 320]	302 [302; 351]	328 [328; 385]	328 [328; 328]
V^{7} (2006-2012)	0 [0; 0]	7 [5; 8]	7 [5; 8]	5 [4; 6]	4 [3; 4]	4 [3; 4]
V^{10} (2006-2015)	0 [0; 0]	7 [6; 8]	8 [6; 8]	6 [4; 6]	4 [4; 4]	4 [4; 4]
V^{20} (2006-2025)	0 [0; 0]	8 [7; 9]	8 [6; 9]	6 [5; 7]	4 [4; 5]	4 [4; 5]
B^{sp} (2015/2006) 90% range	1.15 [0.84; 1.58] 0.74	1.23 [0.98; 1.72] 74	1.28 [1.03; 1.73] 70	1.24 [0.98; 1.69] 71	1.19 [0.94; 1.65] 71	1.25 [0.97; 1.67] 70
B^{sp} (2025/2006) 90% range	0.80 [0.48; 1.19] 0.71	**1.10** [0.81; 1.51] 70	**1.24** [0.93; 1.74] 81	**1.18** [0.87; 1.66] 79	**1.10** [0.81; 1.58] 77	**1.25** [0.88; 1.77] 89
B^{sp} (2006/K)	0.34	0.34	0.34	0.34	0.34	0.34
B^{sp} (2015/K)	0.39 [0.29; 0.53]	0.42 [0.33; 0.58]	0.44 [0.35; 0.59]	0.42 [0.33; 0.57]	0.40 [0.32; 0.56]	0.42 [0.33; 0.57]
B^{sp} (2025/K)	0.27 [0.16; 0.40]	0.37 [0.28; 0.51]	0.42 [0.32; 0.59]	0.40 [0.29; 0.56]	0.38 [0.27; 0.54]	0.41 [0.30; 0.60]
		Re6.res T6.res	Res7.res T7.res	Res8.res T8.res	Res3.res T3.res	Res5.res T5.res

Table 1b: Model 4 (OLRAC TVS) summary performance statistics for a future constant catch scenario of 382 MT, and five OMP candidates. Medians with 5th and 95th percentiles are reported. Note that the δ values here are as determined or Table 1a. Median B^{sp} (2025/2006) values differ from those in Table 1a because of the different operating model used.

	CC=382	OMP 1	OMP 2	OMP 3	OMP 4	OMP 5
	Model 4 (OLRAC TVS)	Model 4 (OLRAC TVS)	Model 4 (OLRAC TVS)	Model 4 (OLRAC TVS)	Model 4 (OLRAC TVS)	Model 4 (OLRAC TVS)
δ	-	**-0.024**	**0.005**	**-0.008**	**-0.03**	**0.021**
TAC constraint (%)	-	10	10	7.5	5	5
C^{7}_{ave} (2006-2012)	382 [382; 382]	346 [317; 412]	322 [310; 360]	340 [326; 381]	364 [344; 405]	344 [343; 361]
C^{10}_{ave} (2006-2015)	382 [382; 382]	361 [315; 438]	324 [291; 379]	344 [310; 397]	371 [338; 427]	337 [322; 366]
C^{20}_{ave} (2006-2025)	382 [382; 382]	416 [298; 548]	329 [263; 439]	368 [289; 459]	416 [329; 489]	325 [286; 378]
C(2008)	382 [382; 382]	351 [344; 393[	344 [344; 361]	353 [353; 375]	363 [363; 401]	363 [363; 363]
C(2009)	382 [382; 382]	327 [309; 415]	309 [309; 357]	326 [326; 380]	351 [344; 410]	345 [345; 345]
C(2010)	382 [382; 382]	319 [278; 443]	280 [278; 356]	309 [302; 395]	355 [327; 427]	327 [327; 346]
V^{7} (2006-2012)	0 [0; 0]	5 [3; 7]	6 [5; 7]	5 [3; 5]	3 [2; 4]	4 [3; 4]
V^{10} (2006-2015)	0 [0; 0]	7 [4; 7]	7 [5; 8]	5 [5; 6]	4 [3; 4]	4 [3; 4]
V^{20} (2006-2025)	0 [0; 0]	7 [6; 8]	7 [6; 8]	6 [5; 6]	4 [4; 4]	4 [4; 5]
B^{sp} (2015/2006) 90% range	1.14 [0.92; 1.52]	1.17 [0.96; 1.54] 58	1.21 [1.00; 1.57] 57	1.19 [0.97; 1.54]	1.16 [0.94; 1.54]	1.20 [0.96; 1.55]
B^{sp} (2025/2006) 90% range	1.18 [0.79; 1.70]	1.14 [0.89; 1.61] 72	1.25 [0.97; 1.77] 80	1.20 [0.93; 1.70]	1.15 [0.85; 1.61]	1.27 [0.91; 1.77]
B^{sp} (2006/K)	0.47	0.47	0.47	0.47	0.47	0.47
B^{sp} (2015/K)	0.54 [0.43; 0.71]	0.55 [0.45; 0.72]	0.57 [0.46; 0.74]	0.56 [0.45; 0.72]	0.54 [0.44; 0.72]	0.56 [0.45; 0.73]
B^{sp} (2025/K)	0.55 [0.37; 0.80]	0.54 [0.42; 0.76]	0.59 [0.46; 0.83]	0.56 [0.44; 0.80]	0.54 [0.40; 0.75]	0.59 [0.42; 0.83]
	Olcc.res Occt.res	Ol1.res Ot1.res	Ol2.res Ot2.res	ol5.res ot5.res	Ol3.res Ot3.res	Ol4.res Ot4.res

Table 2: Robustness test summary performance statistics assuming Model 3 (MARAM TVS) and OMP3 (5% inter-annual TAC constraint and B^{sp} (2025/2006) of 1.175). Medians with 5th and 95th percentiles are reported.

	RC Model 3	R2 $h = \hat{h} + 0.1$	R3 $M = 0.07$	R4 $M = 0.15$	R5 $B^{sp}_{2006} = \hat{B}^{sp}_{2006} * 1.1$	R6 $B^{sp}_{2006} = \hat{B}^{sp}_{2006} * 0.95$	R7 Recruitment halves for 10 years	R7 Recruitment halves for 10 years
	OMP 3	OMP 3	OMP 3	OMP 3	OMP 3	OMP 3	OMP 3	CC=382
δ	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-
TAC constraint (%)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	-
C^{7}_{ave} (2006-2012)	333 [327; 362]	338 [325; 375]	332 [326; 363]	340 [326; 367]	333 [326; 367]	348 [329; 393]	332 [326; 354]	382 [382; 382]
C^{10}_{ave} (2006-2015)	337 [306; 374]	338 [309; 393]	324 [302; 363]	349 [317; 397]	337 [306; 379]	358 [314; 411]	318 [295; 358]	382 [382; 382]
C^{20}_{ave} (2006-2025)	356 [289; 427]	366 [301; 435][	339 [280; 421]	367 [301; 443]	357 [296; 426]	378 [297; 451]	273 [223; 332]	382 [382; 382]
C(2008)	353 [353; 365]	353 [353; 374]	353 [353; 371]	353 [353; 353]	353 [353; 369]	353 [353; 365]	353 [353; 365]	382 [382; 382]
C(2009)	327 [327; 351]	327 [327; 371]	327 [327; 358]	327 [327; 353]	327 [327; 356]	327 [327; 382]	327 [327; 351]	382 [382; 382]
C(2010)	302 [302; 351]	302 [302; 377]	302 [302; 352]	302 [302; 351]	302 [302; 355]	323 [302; 410]	302 [302; 346]	382 [382; 382]
V^{7} (2006-2012)	5 [4; 6]	5 [4; 6]	6 [4; 6]	6 [4; 6]	5 [4; 6]	5 [4; 6]	6 [4; 6]	0 [0; 0]
V^{10} (2006-2015)	6 [4; 6]	6 [4; 6]	6 [5; 6]	6 [5; 6]	6 [4; 6]	6 [5; 6]	6 [5; 6]	0 [0; 0]
V^{20} (2006-2025)	6 [5; 7]	6 [5; 7]	6 [5; 7]	6 [5; 7]	6 [5; 7]	6 [5; 7]	6 [6; 7]	0 [0; 0]
B^{sp} (2015/2006) 90% range	1.24 [0.98; 1.69] 71	1.24 [1.00; 1.69]	1.15 [0.94; 1.54]	1.35 [1.04; 1.90] 86	1.21 [0.97; 1.64] 67	1.15 [0.90; 1.55] 65	0.89 [0.72; 1.18] 46	0.75 [0.57; 1.08] 51
B^{sp} (2025/2006) 90% range	1.18 [0.87; 1.66] 79	1.19 [0.86; 1.68] 82	1.15 [0.86; 1.58] 72	1.22 [0.83; 1.80] 97	1.14 [0.84; 1.62] 78	1.10 [0.82; 1.52] 68	0.86 [0.61; 1.28] 67	0.60 [0.40; 0.97] 53
B^{sp} (2006/K)	0.34	0.38	0.32	0.36	0.37	0.33	0.34	0.34
B^{sp} (2015/K)	0.42 [0.33; 0.57]	0.47 [0.37; 0.64]	0.37 [0.30; 0.50]	0.49 [0.38; 0.69]	0.44 [0.35; 0.60]	0.37 [0.29; 0.51]	0.30 [0.25; 0.40]	0.26 [0.19; 0.37]
B^{sp} (2025/K)	0.40 [0.29; 0.56]	0.45 [0.32; 0.63]	0.37 [0.28; 0.51]	0.45 [0.30; 0.69]	0.42 [0.31; 0.59]	0.36 [0.27; 0.50]	0.29 [0.21; 0.43]	0.20 [0.13; 0.33]
		Rob2.res Robt2.res	rob3.res robt3.res	Rob4.res Robt4.res	Rob5.res Robt5.res	Rob6.res Robt7.res	Lowr.res Lowt.res	Lowrcc.res Lowtcc.res

Figure 1: Six comparative plots of median (and 5th and 95 percentiles) values of various summary statistics for the CC=382 MT as well as for five OMP candidates, for two alternate underlying operating models: a) Model 3 (MARAM TVS) and b) Model 4 (OLRAC TVS).
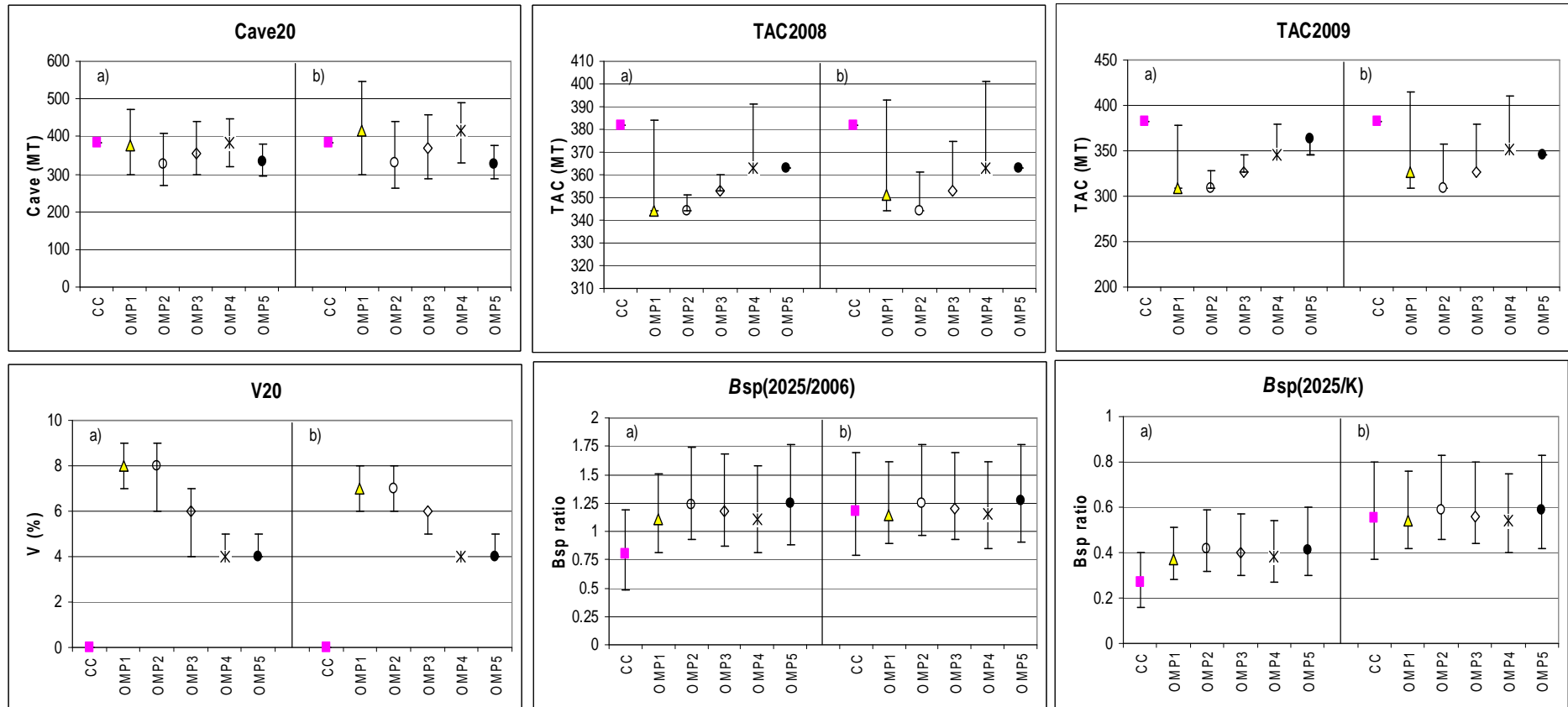
Figure 2: Six comparative plots of median (and 5th and 95 percentiles) values of various summary statistics for the Model 3 (MARAM TVS) and 6 robustness tests for candidate OMP3.
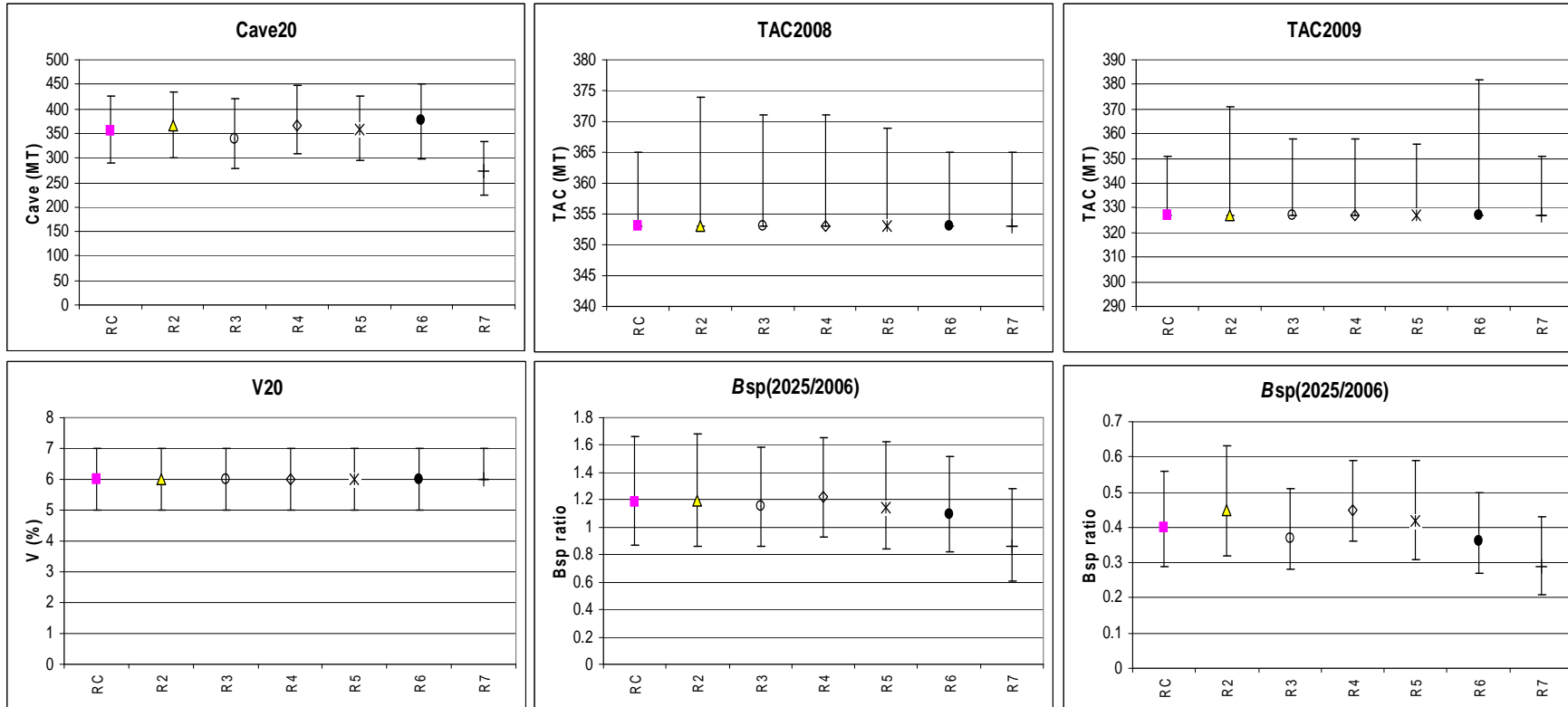
Figure 3a: Median annual TAC, B_{sp} and V (inter-annual TAC change as a %) trajectories with the 5th and 95th percentiles for the Reference Case Model 3 (left panel) and Model 4 (right panel) for OMP3 (7.5% inter-annual TAC constraint + median 1.18 B^{sp} (2015/2006)). Note that 95th percentiles and median co-inside for V.
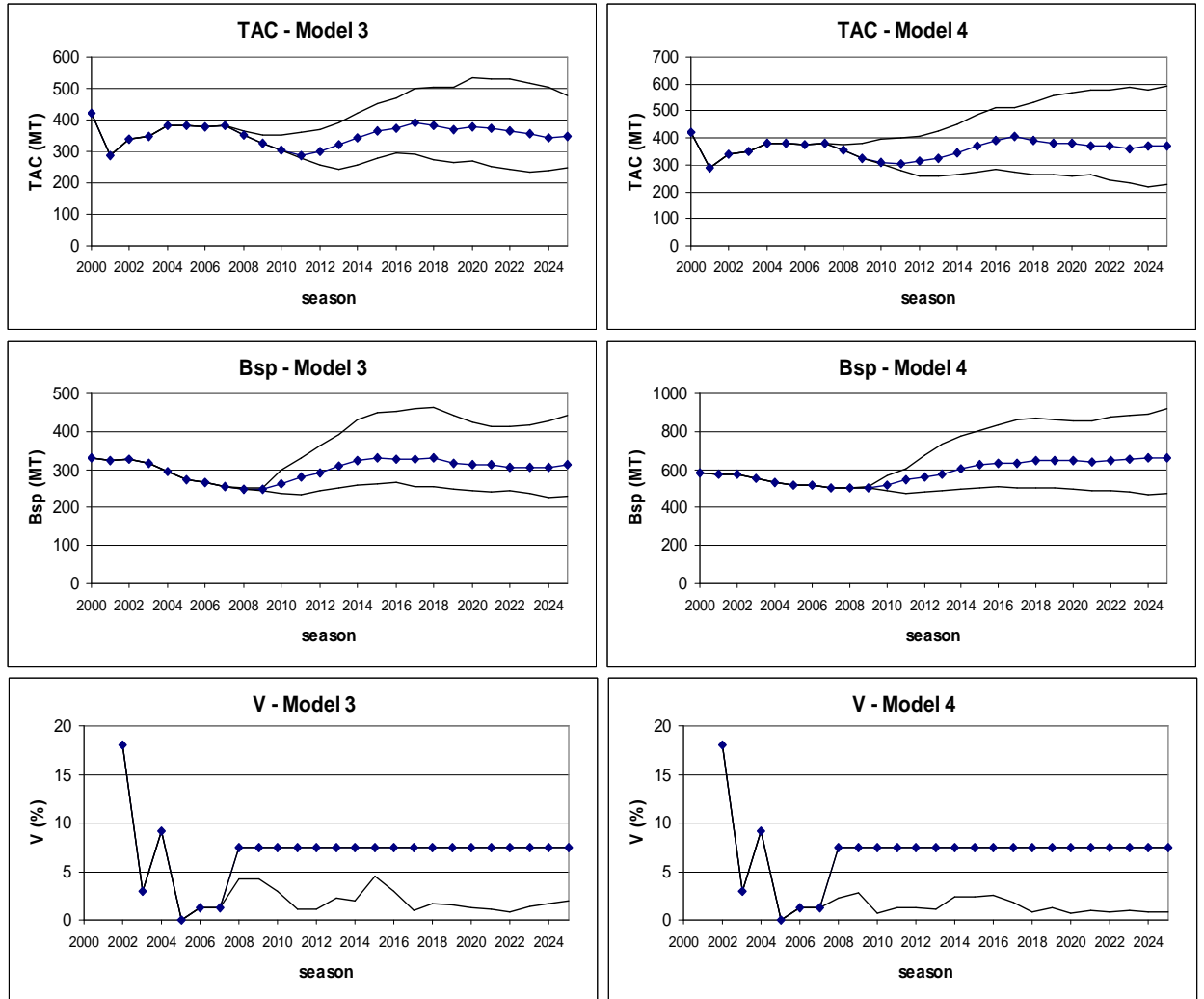
Figure 3b: Comparison of the median TAC and B_{sp} trajectories for five different candidate OMPs for Model 3 (left panel) and Model 4 (right panel).
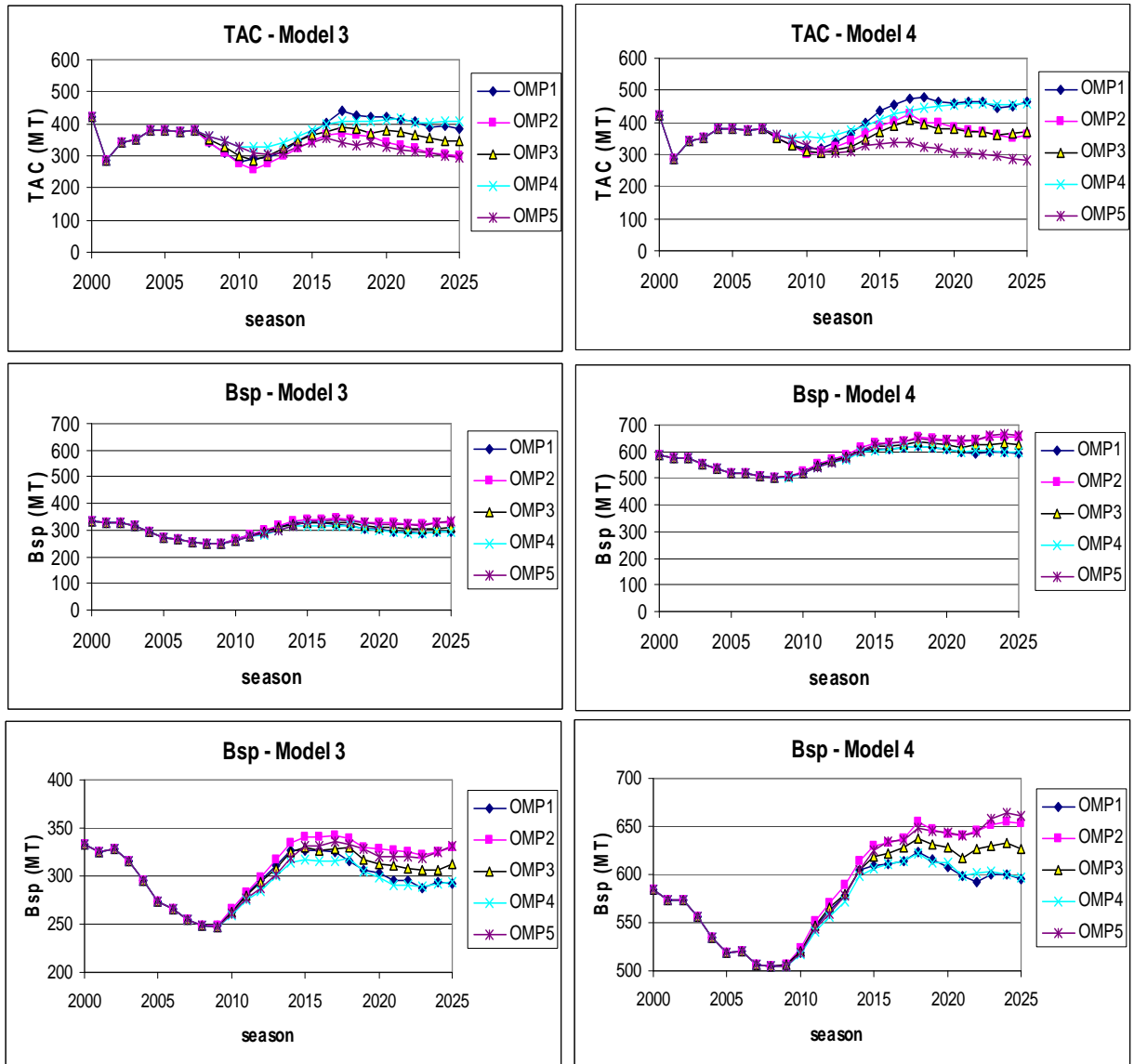
Figure 4: Comparison of the median and lower 5th percentiles of TAC and B_{sp} trajectories for CC=382 vs OMP3 for R7 (poor recruitment) for Model 3.