Further OMP simulation results for OMP 2015 for west coast rock lobster

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Summary

Three aspects of OMP 2015 are examined further. An alternative prescription for movement of allocation away from A8+ is preferred. The trade-offs between alternative interannual TAC change constraints are presented. Two methods of allowing "tolerance" are considered, and indicate no biological objection to this.

Introduction

Following the presentation of initial OMP 2015 simulation results at a previous SWG meeting (see FISHERIES/2015/MAYSWG_WCRL/14) a number of further modification in the development of the new OMP were suggested. This document reports back on further OMP variants which take these suggestions into consideration. The specific suggestions or tasks that were requested were as follows:

1) Re-examine the offshore TAC "redistribution" (as part of OMP) between super-areas, as (for VAR1 in FISHERIES/2015/MAY/SWG_WCRL/14) the A34 B75m(21/06) lower 5th percentile was rather low (0.59).
2) Look at options for which the maximum inter-annual TAC increase is either 10% or 12% (with 5% and 15% being explored as well).
3) Explore the option of allowing "tolerance" in the offshore allocations mid-season, such that the offshore allocations in the "best" performing super-area would increase by 10% (only once the full allocation has been caught in that super-area). This extra allocation would be removed from the super-area with the "worst" performance.

Further OMP simulation outputs were requested to be included. These include the allocations expected each year for each sector. Furthermore, average TACs for each sector and super-area are now reported for the 2015-2020 period (previously the average of 2011-2010 period was used).

It was also requested that the probability of Exceptional Circumstances being invoked in each super-area be checked, and compared to values calcualted for OMP 2011 (see Tables 6a and 6b).

Methodology

Task 1: The following offshore TAC redistributions (as part of OMP rule) are reported for OMP variants for which a 10% maximum interannual TAC constraint applies:

i) VAR1a • This is VAR1 of FISHERIES/2015/MAY/SWG_WCRL/14.
• 20% of A8+ offshore TAC is shifted 50:50 into A34 and A56.
ii) VAR1b • VAR1a but 20% of A8+ offshore TAC is shifted into A56 only.
iii) VAR1c •VAR1b but only 10% of A8+ offshore TAC is shifted into A56 only.

Task 2: Using VAR1c as the baseline, the maximum inter-annual TAC increase constraint was altered from 10% to:

i. VAR2 – maximum TAC increase constraint changed to 12%
ii. VAR3 – maximum TAC increase constraint changed to 5%
iii. VAR4 – maximum TAC increase constraint changed to 15%

Task 3 (Offshore TAC tolerance)

The simulation of the offshore tolerance here should be seen as the most extreme implementation of tolerance, noting that in reality:

i) The offshore TAC shift due to "tolerance" would not be requested each year, and
ii) the full amount of requested offshore TAC shift may be less than the "10%" requested, if the poorly performing super-area from which the offshore TAC is to be shifted, has already had sufficient offshore TAC caught by the time of the request, that there is simply not enough remaining TAC from that super-area to fulfil the request.

The possible impact of allowing each year a 10% increase in offshore TAC in the "best performing" super-area, with that amount taken from the "worst performing" super-area was examined via two methods of simulation. Note that in reality, this extra offshore allocation would only be considered once the total offshore allocation for the "best performing" area had been fully taken. See Table 4 and Figures 1a-c for results.

<u>VARTOL1: Method 1 (uses ratio of future trap CPUE relative to current to determine best and worst performing super-areas).</u>

For super-areas A34, A56, A7 and A8 generate future trap CPUE values (as normal):

$$CPUE_{Y,A}^{model}$$

where *Y* is from 2014 onwards (actual data are available up to 2013), and *A* is the super-area.

Calculate a recent average of the trap CPUE in each area, where the average is over the previous three years (2012, 2013 and 2014), i.e.

$$\overline{CPUE}_{A}^{model} = \sum_{y=2012}^{y=2014} CPUE_{y,A}^{model} \quad (1)$$

For each year in the future for which the OMP generates a TAC (2015 onwards), calculate a ratio of the CPUE at the start of that season relative to the average in equation (2) as follows:

$$X_{Y,A} = \frac{CPUE_{Y,A}^{model}}{\overline{CPUE}_{A}^{model}} \quad (2)$$

The offshore allocation of the super-area with the highest "*X*" value is then increased by 10% with the extra allocation being removed from the offshore quota of the super-area with the lowest "*X*" value.

VARTOL2: Method 2 (scales the CPUE to absolute/real values to determine the best and worst super-areas)

For super-areas A34, A56, A7 and A8 generate future trap CPUE values (as normal):

$$CPUE_{Y,A}^{model}$$

where *Y* is from 2014 onwards (actual data are available up to 2013), and *A* is the super-area.

Scale these values such that the average standardised CPUE values over the 2011-2013 period produced by Jean Glazer multiplied by the "scaling" results in the average nominal 2011-2013 CPUE values reported by Danie in FISHERIES/2014/JUL/SWG/WCRL/12. Note the average over the A3 and A4 values were used for A34, and A8 is used for A8+. The scaling values for each super-area are as follows:

A34 = 5.396

A56 = 3.532

A7 = 9.736

A8 = 8.900

Results

TAC shifts within OMP formula

See Table 1 for results where different rules apply to shifting offshore TAC as part of the OMP formula. VAR1c appears to manage a reasonable balance on the lower 5th percentiles for B75m(21/06). Table 3 and Figure 2 show further details for VAR1c.

Maximum interannual TAC increase constraint

See Tables 2 and 5 for results where different values (5%, 10%, 12% and 15%) of maximum interannual TAC increase constraint are explored. The 15% maximum increase constraint results in some very low

B75(21/06) lower 5th percentile values (for A3+4 in particular from Table 5) and the size of future possible TAC decreases can be quite high.

Offshore allocation "tolerance"

Implementing the tolerance using assuming either simulation method 1 or 2 makes virtually no difference to results (see Table 4, and Figures 1a-d). The lower 5th percentile on the average annual catch drops somewhat, but there is a reduction in the probability of an EC rule being invoked (Table 6a). Thus there is no biological reason not to allow this 10% tolerance. The issue therefore is more of an operational one.

References

Johnston, S.J. and Butterworth, D.S. 2011. Results for final set of candidate OMPs for the new OMP 2011 for West Coast Rock Lobster. FISHERIES/2011/OCT/SWG-WCRL/58.

Table 1: VAR1a-VAR1b OMP 2015 simulation results of offshore TAC and B75m(21/06) Medians with 5th and 95th percentile values shown in parentheses.

		OMP 2011 retuned **(Max TAC incr. constraint 10%)**	**OMP 2015 VAR1a** **Max TAC incr. constraint 10%.** **20% A8+ offshore TAC shifted 50:50 into A34 and A56**	**OMP 2015 VAR1b** **Max TAC incr. constraint 10%** **20% A8+ offshore TAC shifted into A56 only**	**OMP 2015 VAR1c** **Max TAC incr. constraint 10%** **10% A8+ offshore TAC shifted into A56 only**
10-yr (2011-2020) Ave offshore TAC	A1-2	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]
	A3-4	224 [101; 379]	312 [138; 347]	154 [87; 182]	151 [87; 180]
	A5-6	60 [60; 60]	282 [254; 321]	434 [357; 476]	306 [280; 341]
	A7	452 [60; 737]	193 [177; 204]	195 [179; 208]	211 [196; 223]
	A8	602 [518; 754]	649 [628; 671]	651 [627; 673]	752 [722; 781]
***B75*$_m$(21/06)**	A1-2	1.26 [0.66; 3.05]	0.77 [0.41; 2.02]	0.77 [0.40, 1.98]	0.77 [0.40; 1.98]
	A3-4	1.28 [0.50; 3.77]	1.29 [**0.59**; 2.41]	1.72 [0.91; 2.93]	1.72 [0.91; 2.93]
	A5-6	1.62 [1.14; 3.30]	1.93 [0.82; 4.35]	0.99 [**0.09**; 3.35]	1.80 [0.70; 4.15]
	A7	1.93 [0.48; 8.63]	1.90 [1.24; 2.89]	1.89 [1.25; 2.88]	1.86 [1.21; 2.85]
	A8	0.98 [0.44; 2.41]	1.39 [0.82; 2.70]	1.38 [1.00; 2.54]	1.29 [0.74; 2.60]
	T	1.35 [0.72; 3.11]	1.57 [0.99; 2.55]	1.56 [1.00; 2.54]	1.57 [1.00; 2.56]

Table 2: VAR1a-VAR1b OMP 2015 simulation results of average offshore TAC for 2015-2020 and B75m(21/06) Medians with 5th and 95th percentile values shown in parentheses.

		OMP 2015 VAR3 Max TAC incr. constraint **5%** 10% A8+ offshore TAC shifted into A56 only	**OMP 2015 VAR1c** Max TAC incr. constraint **10%** 10% A8+ offshore TAC shifted into A56 only	**OMP 2015 VAR2** Max TAC incr. constraint **12%** 10% A8+ offshore TAC shifted into A56 only	**OMP 2015 VAR4** Max TAC incr. constraint **15%** 10% A8+ offshore TAC shifted into A56 only
6-yr (2015-2020) Ave offshore TAC	A1-2	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]
	A3-4	153 [56; 197]	178 [61; 229]	191 [63; 246]	391 [137; 461]
	A5-6	380 [338; 436]	446 [393; 515]	478 [419; 556]	537 [440; 628]
	A7	202 [177; 220]	223 [202; 256]	250 [215; 275]	279 [234; 308]
	A8	511 [469; 554]	581 [528; 635]	616 [543; 674]	678 [570; 744]
	T	1256 [1132; 1262]	1453 [1270; 1463]	1555 [1355; 1562]	1732 [1398; 1751]
***B75*$_m$(21/06)**	A1-2	0.81 [0.44; 2.02]	0.77 [0.40; 1.98]	0.75 [0.38; 1.96]	0.71 [0.36; 1.93]
	A3-4	1.80 [0.96; 3.01]	1.72 [0.91; 2.93]	1.68 [0.88; 2.88]	1.60 [0.84; 2.79]
	A5-6	2.07 [0.96; 4.52]	1.80 [0.70; 4.15]	1.67 [0.57; 3.96]	1.37 [0.33; 3.67]
	A7	1.90 [1.25; 2.90]	1.86 [1.21; 2.85]	1.83 [1.17; 2.81]	1.78 [1.13; 2.76]
	A8	1.36 [0.81; 2.68]	1.29 [0.74; 2.60]	1.25 [0.70; 2.55]	1.17 [0.65; 2.47]
	T	1.66 [1.07; 2.65]	1.57 [1.00; 2.56]	1.53 [0.97; 2.51]	1.44 [0.89; 2.41]

Table 3: OMP VAR1c 2015 simulation results. Medians with 5th and 95th percentile values shown in parentheses. (Results for 100 simulations are reported.)

		OMP 2015 VAR1c **Max TAC incr. constraint 10%**
Tuning parameter	α	**5000**
6-yr (2011-2020) Ave Global TAC	A1-2	48 [39; 48]
	A3-4	319 [121; 372]
	A5-6	546 [486; 616]
	A7	260 [229; 282]
	A8	1093 [968; 1146]
	T	2229 [1915; 2236]
6-yr (2011-2020) Ave offshore TAC	A1-2	0 [0; 0]
	A3-4	178 [61; 229]
	A5-6	446 [393; 515]
	A7	223 [202; 256]
	A8	581 [528; 635]
	T	1453 [1270; 1463]
6-yr (2011-2020) Ave near shore TAC	A1-2	30 [24; 30]
	A3-4	81 [35; 82]
	A5-6	36 [30; 36]
	A7	15 [13; 15]
	A8	304 [255; 306]
	T	430 [361; 430]
6-yr (2011-2020) Ave subsistence TAC	A1-2	16 [13; 16]
	A3-4	50 [20; 50]
	A5-6	54 [45; 54]
	A7	9 [8; 9]
	A8	152 [125; 153]
	T	266 [221; 266]
6 yr (2011-2020) Ave Total Recreational Take	T	77 [67; 81]
***B75*$_m$ (21/06)**	A1-2	0.77 [0.40; 1.98]
	A3-4	1.72 [0.91; 2.93]
	A5-6	1.80 [0.70; 4.15]
	A7	1.86 [1.21; 2.85]
	A8	1.29 [0.74; 2.60]
	T	1.57 [1.00; 2.56]

Table 4: OMP 2015 simulation results of offshore TAC and B75m(21/06) Medians with 5th and 95th percentile values shown in parentheses. Note the offshore TAC values reported here are those set by the OMP prior to any tolerances allowed.

		OMP 2015 VAR1c **Max TAC incr. constraint 10%** **10% A8+ offshore TAC shifted into A56 only** **No tolerance**	**OMP 2015 VARTOL1** **Max TAC incr. constraint 10%** **10% A8+ offshore TAC shifted into A56 only** **Tolerance allowed (Method 1)**	**OMP 2015 VARTOL2** **Max TAC incr. constraint 10%** **10% A8+ offshore TAC shifted into A56 only** **Tolerance allowed (Method 2)**
6-yr (2011-2020) Ave offshore TAC	A1-2	0 [0; 0]	0 [0; 0]	0 [0; 0]
	A3-4	178 [61; 229]	170 [45; 229]	177 [51; 240]
	A5-6	446 [393; 515]	429 [345; 512]	428 [346; 510]
	A7	223 [202; 256]	248 [203; 279]	240 [186; 275]
	A8	581 [528; 635]	584 [520; 668]	584 [518; 673]
	T	1453 [1270; 1463]	1453 [1219; 1463]	1453 [1214; 1463]
***B75*$_m$(21/06)**	A1-2	0.77 [0.40; 1.98]	0.77 [0.40; 2.01]	0.77 [0.40; 2.01]
	A3-4	1.72 [0.91; 2.93]	1.74 [0.94; 2.97]	1.73 [0.91; 2.95]
	A5-6	1.80 [0.70; 4.15]	1.87 [0.73; 4.32]	1.88 [0.72; 4.33]
	A7	1.86 [1.21; 2.85]	1.82 [1.19; 2.83]	1.83 [1.21; 2.85]
	A8	1.29 [0.74; 2.60]	1.29 [0.76; 2.59]	1.29 [0.76; 2.58]
	T	1.57 [1.00; 2.56]	1.57 [1.01; 2.56]	1.57 [1.01; 2.56]

Table 5: Global TAC % inter-annual changes (median, 5th and 95th percentiles).

	% Global TAC change			
season	VAR3 **5%** maximum inter-annual TAC increase constraint	VAR1c **10%** maximum inter-annual TAC increase constraint	VAR2 **12%** maximum inter-annual TAC increase constraint	VAR4 **15%** maximum inter-annual TAC increase constraint
2011	6.10	6.10	6.10	6.10
2012	0.00	0.00	0.00	0.00
2013	-11.08	-11.08	-11.08	-11.08
2014	-16.50	-16.50	-16.50	-16.50
2015	3.12 [3.12; 3.12]	6.23 [6.23; 6.23]	7.48 [7.48; 7.48]	9.34 [9.34; 9.34]
2016	1.32[1.25; 1.40]	4.47 [4.35; 4.55]	5.75 [5.63; 5.84]	12.61 [7.48; 12.70]
2017	1.65 [1.48; 1.75]	4.91 [4.55; 5.02]	10.30 [5.42; 10.41]	13.28 [6.32; 13.39]
2018	1.91 [-3.99; 2.05]	8.60 [0.86; 8.76]	10.59 [-3.79; 10.75]	13.31 [-2.02; 13.53]
2019	2.15 [-5.98; 2.31]	8.84 [-3.68; 9.02]	6.47 [-6.92; 6.70]	9.27 [-6.66; 9.57]
2020	2.32[-3.50; 2.53]	5.36 [-7.01; 6.64]	10.94 [-7.28; 11.21]	13.89 [-12.15; 14.21]

Table 6a: The chance (expressed as a %) that the EC rule is invoked at least once in any one super-area **over the six year period** 2015-2020. Results shown for OMP 2011[1], and for OMP 2015 (10% max TAC increase constraint).

	OMP 2011 re-tuned	**OMP 2015 VAR1c**	**OMP 2015 VAR1c+ tolerance method1 (VARTOL1)**	**OMP 2015 VAR1c+ tolerance method2 (VARTOL2)**
A1+2	1.08%	1.00%	1.00%	1.00%
A3+4	1.35%	2.50%	2.50%	2.50%
A5+6	0.38%	1.00%	1.00%	1.00%
A7	3.79%	0.00%	0.00%	0.00%
A8+	3.33%	2.17%	0.00%	0.00%
T	9.33%	6.67%	4.50%	4.50%

Table 6b: The chance (expressed as a %) that the EC rule is invoked at least once in any one super-area **in the first four years.** Results shown for OMP 2011, and for OMP 2015 (10% max TAC increase constraint).

	OMP 2011 re-tuned	**OMP 2015 VAR1c**	**OMP 2015 VAR1c+ tolerance method1 (VARTOL1)**	**OMP 2015 VAR1c+ tolerance method2 (VARTOL2)**
A1+2	0.00%	0.00%	0.00%	0.00%
A3+4	0.25%	1.50%	1.50%	1.50%
A5+6	0.18%	0.25%	0.25%	0.25%
A7	5.23%	0.00%	0.00%	0.00%
A8+	1.00%	0.00%	0.00%	0.00%
T	5.68%	1.75%	1.75%	1.75%

[1] Johnston and Butterworth (2011)

Figure 1a: Top plot showing the annual probability (reported as percentage chance) of offshore TAC transfers taking place between different super-areas in the simulation study using Method 1 (**VARTOL1**). Note A34_A56 refers to offshore TAC transfer FROM A34 into A56. Middle plot shows the probability (reported as percentage change) of offshore TAC transfer **INTO** each super-area and the bottom plot shows the probability of offshore TAC transfer **FROM** each super-area.

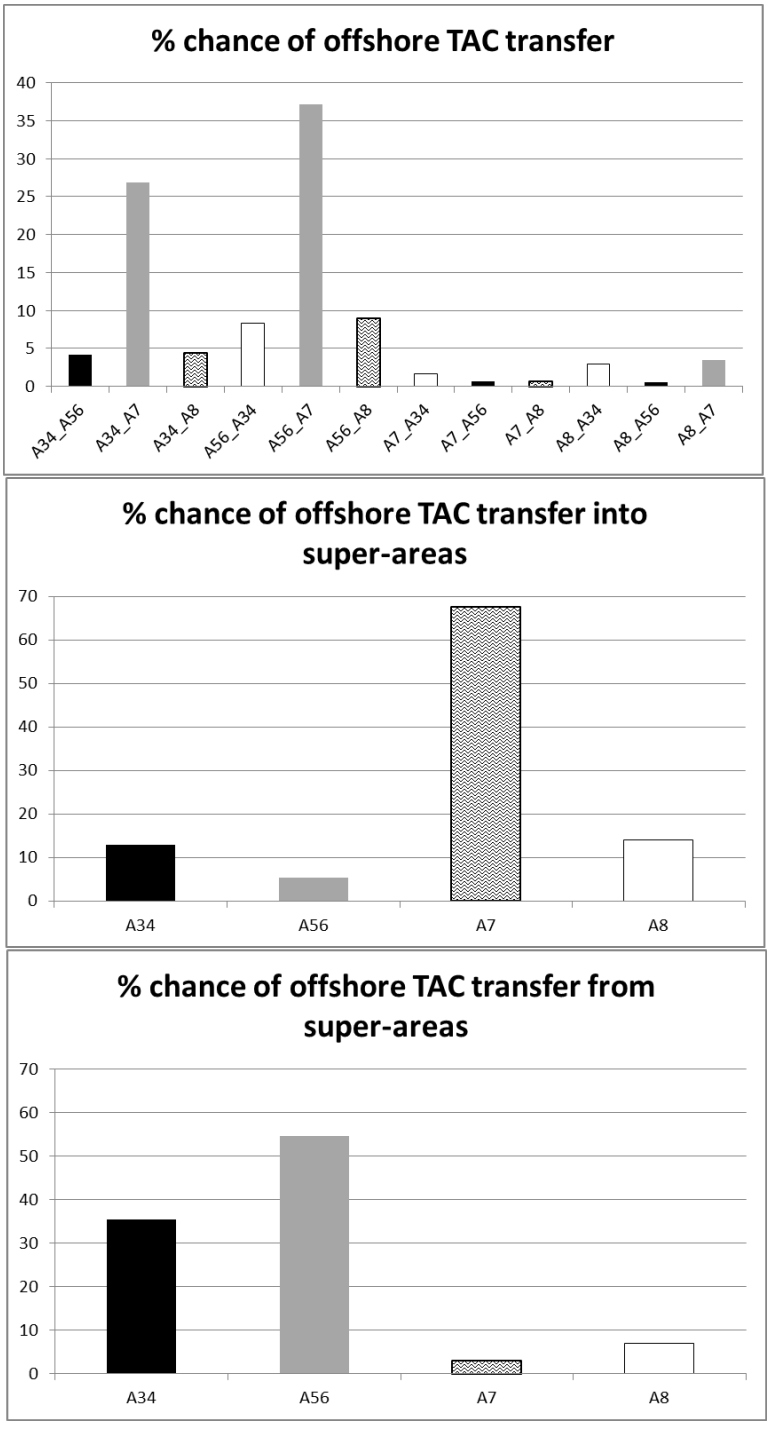

Figure 1b: Top plot showing the annual probability (reported as percentage chance) of offshore TAC transfers taking place between different super-areas in the simulation study using Method 2 (**VARTOL2**). Bottom plots shows the probability (reported as percentage change) of offshore TAC transfer into each super-area. Note A34_A56 refers to offshore TAC transfer FROM A34 into A56.

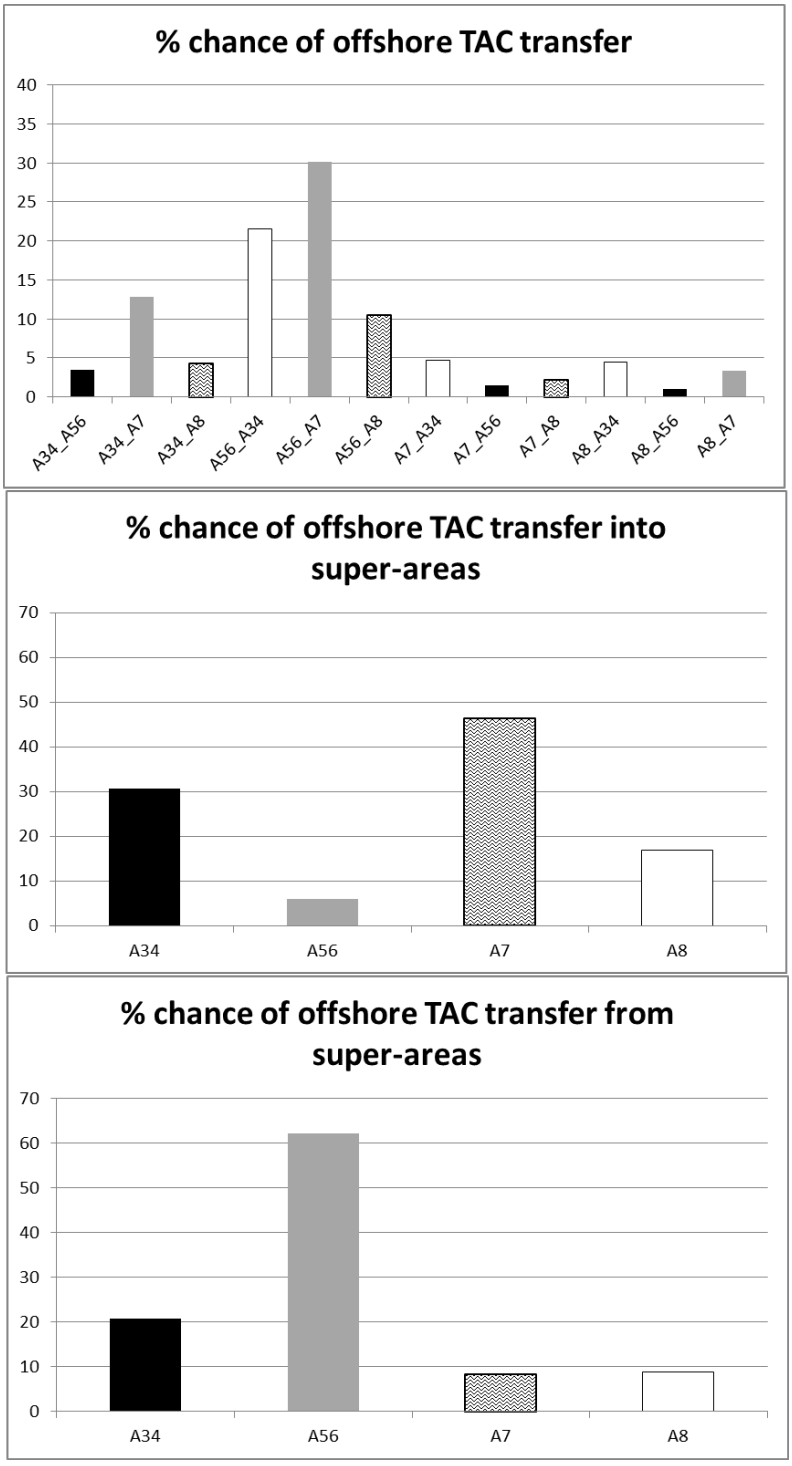

Figure 1c: Comparative plots of B75m(21/06) medians (with the 5th and 95th percentiles indicated) between VAR1c (no tolerance) and **VARTOL1** (tolerance method 1).

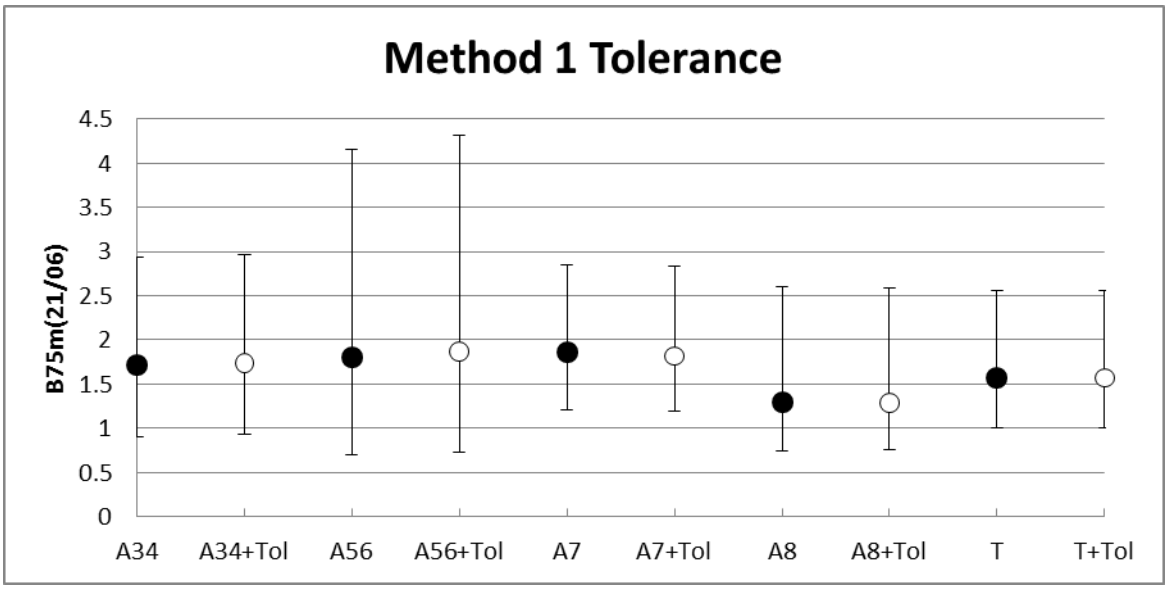

Figure 1d: Comparative plots of B75m(21/06) medians (with the 5th and 95th percentiles indicated) between VAR1c (no tolerance) and **VARTOL2** (tolerance method 2).

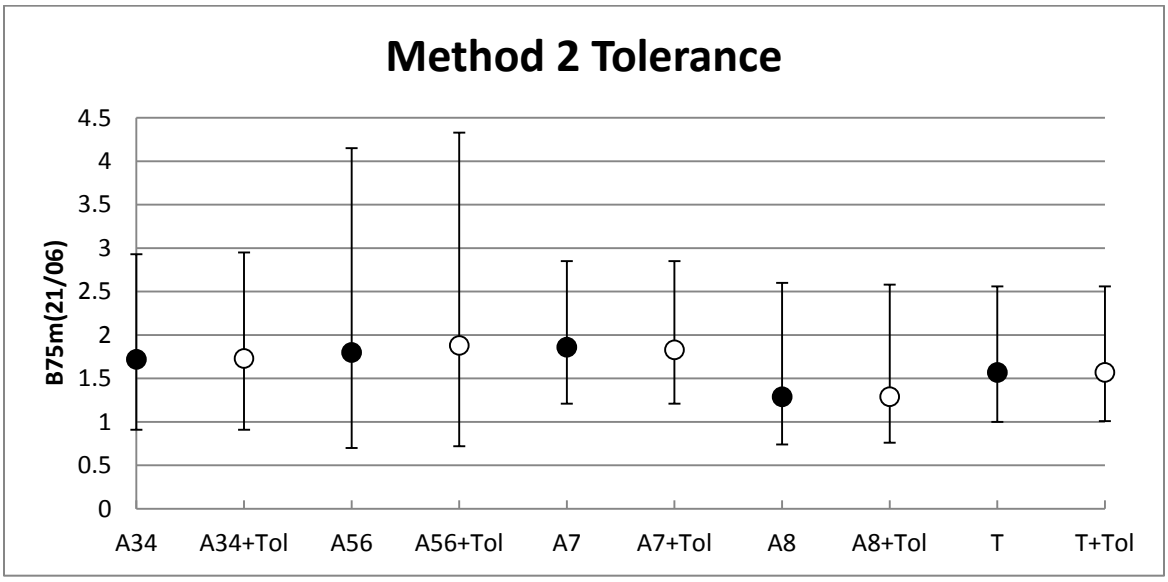

Figure 2: OMP 2015 - VAR1c simulated results. Medians (black circles) and 5th and 95th percentiles (dotted lines) are shown.