Results for alternate candidate OMPs for the new OMP 2011 for West Coast Rock Lobster

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Results of alternate candidate OMPs are presented. Although the original intention was to produce these results for 1000 simulations, due to time constraints (and the power failure!), results presented here are mainly for 50 simulations.

The OMP variants reported here have two main new features:

1) Allowance of the inter-annual TAC downward constraint to be changed from the baseline 10% to as much as 30% if circumstances require (RULE 1)
2) Allowance for exceptional circumstances to be invoked in a super-area which results in all fishing in that super-area being suspended (EC rule).

The idea underlying the "EC rule" is not to suggest that this complete closure would occur in practice. Rather, what would need happen is an early OMP review with shifting of effort by nearshore, commercial and interim relief/subsistence to other super-areas. The reason underlying presenting calculation results in this extreme form is to demonstrate that if the situation became "so bad" in a super-area, it remains possible to achieve the same reasonable extent of recovery by appreciable reductions in future catches from that super-area.

Results all assume the "alternative" sector split method proposed, except for one model (Model 5) which shows results for the "current" sector split.

OMP 2011

Method for calculating the Global TAC

$$TAC_y^G = \alpha\left(\bar{J}_y - J_{min}\right) \tag{1}$$

where

α and J_{min} are two tuning parameters, and

$\bar{J}_y$ is the combined abundance index – combined over both super-areas and gear-type:

$$\bar{J}_y = \sum_{gear=1}^{3} W^{gear} J_y^{gear} \tag{2}$$

where

J_y^{gear} is a relative measure of the immediate past level in the abundance index “gear” (I_y^{gear})(for gear type trap, hoop or FIMS) as available for use in calculation of the global TAC for year *y:*

$$J_y^{gear} = \frac{e^{\left[\sum_{y'=y-3}^{y'=y-1} \ln\left(I_{y'}^{gear}\right)\right]/3}}{e^{\left[\sum_{y'=2005}^{y'=2009} \ln\left(I_{y'}^{gear}\right)\right]/5}}$$

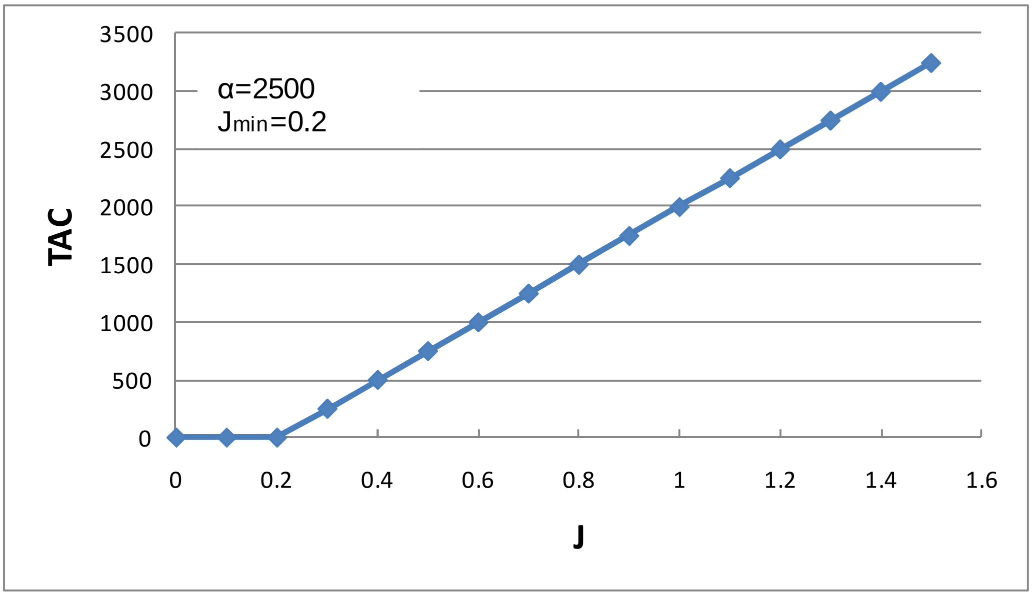
and

W^{gear} is the relative weight given to that gear type.

The W^{gear} values selected by the SWG are:

$W^{trap} = 0.45$; $W^{hoop} = 0.35$; and $W^{FIMS} = 0.20$.

Figure 1: The illustrative figure below shows the TAC as a function of “J”, where the value of α is 2500 and J_{min} is 0.2.



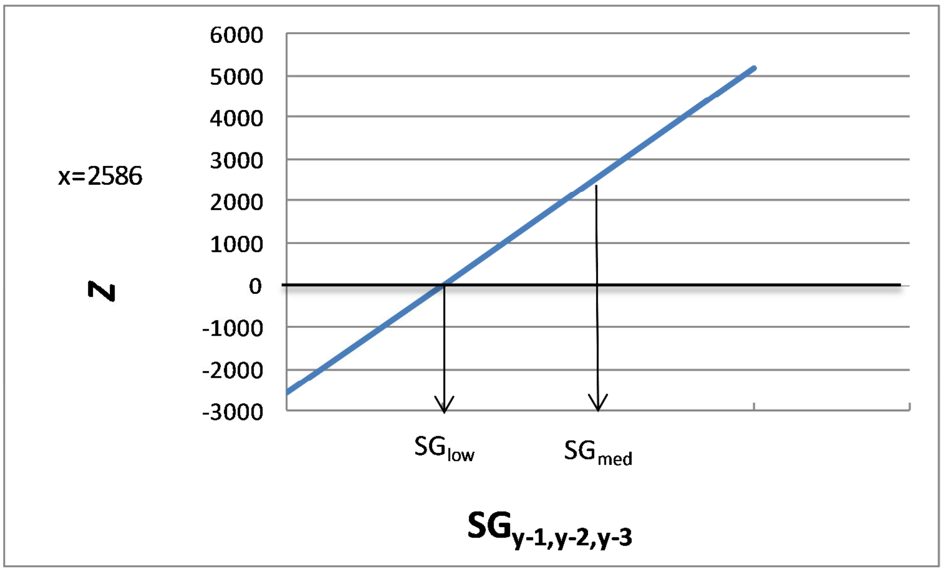
Adjusting TAC for recent somatic growth

The global TAC value is then adjusted up or down by the addition or subtraction of an amount “Z” such that:

and where

where is the geometric mean of the combined somatic growth index for the three most recent seasons. The value of , which is 2586 MT, was calculated by comparing the tonnage differentials between the low and medium somatic growth rates that would result in the same biomass level after 10 years. Figure 2 below illustrates the dependence of *Z* on .

Figure 2: The relationship between *Z* and (see Equation 5).

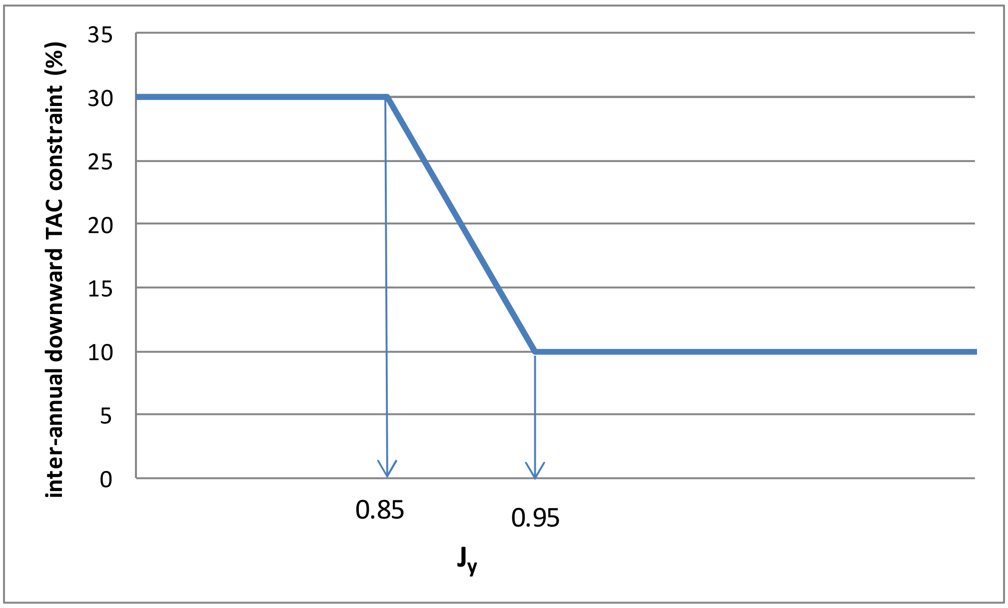


If is equal to SG_{low}, then the value of *Z* will be zero. If the value of is equal to SG_{med}, then the value of *Z* will be 2586 MT. If drops to below SG_{low}, then the value of *Z* will be negative, and the TAC will be adjusted downwards.

Inter-annual TAC constraints

Both the total Global TAC and total Offshore TAC values are constrained by the amount they can vary from the previous year's value. This amount has been set at 10%. However, a further rule, "RULE 1", allows for the TAC values to decrease by as much as 30% under certain conditions of poor resource performances, as indexed by $\bar{J}_y$. Figure 3 below shows how this TAC decrease constraint would be set. The amount of TAC decrease permitted is dependent of the $\bar{J}_y$ value and is set equal to 10% for values of $\bar{J}_y > 0.95$ and set equal to 30% for values of $\bar{J}_y < 0.85$, with linear interpolation between $\bar{J}_y$ values between 0.85 and 0.95.

Figure 3: RULE 1 - inter-annual downward TAC constraint calculation based on value of $\bar{J}_y$.



Method for calculating the sector splits: two alternate approaches

Table 1a: Sector splits of global TAC ("Current")

Sector	Baseline % of Global TAC	Range of global TAC allowed before revert to baseline	Maximum allowed
Recreational	5%	3% - 6%	250 MT
Subsistence/IR	8.8%	7% - 11%	500 MT
Nearshore commercial	19.7%	16% - 24%	800 MT
Offshore commercial	66.5%	Currently max 10% pa	-

Table 1b: Sector splits of global TAC ("Alternative")

Sector	Baseline % of Global TAC	Range of global TAC allowed before revert to baseline	Maximum allowed	2011 starting value
Recreational	8%	6% - 10%	400 MT	182.9 MT
Subsistence/IR	11%	8% - 14%	600 MT	251.48 MT
Nearshore commercial	19.7%	16% - 24%	800 MT	451 MT
Offshore commercial	61.3%	Currently max 10% pa	-	No less than 90% of 2010 value

Method for splitting the sector TACs amongst super-areas

Table 1c: Super-area splits of the Nearshore, Subsistence and Recreational TACs/allocations

	Nearshore	**Subsistence**	**Recreational**
A1+2	0.0536	0.033	0.02
A3+4	0.1607	0.207	0.125
A5+6	0.0714	0.246	0.125
A7	0.000	0.000	0.04
A8+	0.7143	0.513	0.69

<u>Splitting of offshore TAC</u>

The total Offshore TAC is split between the super-areas based on a method (the same for OMP 2007) that uses the slopes of the recent resource indices where available, e.g. trap and hoop CPUE and FIMS. The Offshore TAC is split between A3+4, A7 and A8+ as follows:

STEP 1: For each of these super-areas there are 1-3 abundance index time series. For each index, linearly regress *ln*(index) *vs* season for the last seven seasons of data, and calculate the slope.

STEP 2: If there is more than one series for a super-area, take the average of the slopes for each series, using inverse variance weighting, as follows:

$$slope^A = \frac{\left(\frac{slope^A_{trap}}{\sigma^2_{slope^A_{trap}}} + \frac{slope^A_{hoop}}{\sigma^2_{slope^A_{hoop}}} + \frac{slope^A_{FIMS}}{\sigma^2_{slope^A_{FIMS}}}\right)}{\frac{1}{\sigma^2_{slope^A_{trap}}} + \frac{1}{\sigma^2_{slope^A_{hoop}}} + \frac{1}{\sigma^2_{slope^A_{FIMS}}}} \quad \text{(assuming three series),} \qquad (6)$$

where:

$\sigma^2_{slope^A} = \frac{1}{n-2}(slope^A)^2 \frac{1-r^2}{r^2}$ from each regression, where r is the correlation coefficient and n = 7 given that seven seasons of data are used.

STEP 3: If these resultant slopes are above 0.15 or below -0.15, replace them with the corresponding bound.

STEP 4: Take the previous season's offshore commercial allocation for the super-area and multiply it by (1+$slope^A$) for that super-area, giving a new set of commercial allocations by super-area, which will not necessarily total to the new overall offshore commercial TAC (TAC_y^{off}). If the allocations do not total to the total offshore commercial TAC, simply scale them all by the same proportion so that they do total to match the required offshore commercial TAC.

STEP 5: Transfer of 20*Y% of the offshore commercial TAC (TAC_y^{off}) from A8+ to A3+4 and A7 in the ratio 0.4:0.6, where Y=0.25 for 2011, Y=0.5 for 2012, Y=0.75 for 2013, and Y=1 for 2014 and thereafter.

The intent of this approach is first to adjust the split to take account of possible different trends in abundance in the three super-areas, and also to effect a movement of commercial catch from A8+ to A3+4 and A7 because the current take in A8+ is too high. This last change is phased in over four years to cause less disruption to the offshore commercial industry operations.

Exception Circumstances (EC) rule:

$J_{area,y}$ is an index of recent resource performance for that super-area, relative to recent (2005-2009) levels, which is calculated for each area using the resource indices available for that super-area e.g. hoop and trap CPUE and FIMS. The appendix gives the equations used for calculating $J_{area,y}$.

If $J_{area,y} < X_{crit}^{area}$ then EC invoked for that area and year (y) then all catches set to zero in that area for that year and the remaining years to 2020.

The values of X_{crit}^{area} used here are:

X_{crit}^{A1+2} =0.7

X_{crit}^{A3+4} =0.85

X_{crit}^{A5+6} =0.7

X_{crit}^{A7} =0.8

X_{crit}^{A8+} =0.7

Simulation Method

For each simulation a set of random numbers is generated which are used to select between the various choices that are required for future somatic growth (2 options), future recruitment (3 options), current abundance levels (3 options), historic poaching level (2 options) and future poaching levels (6 options). The weights that each of these options receive remain the same as agreed previously by the WCRL SWG.

Results reported here are for 50 simulations. The medians and 5th , 25th and 95th percentiles are calculated from these 50 simulations. Results for 1000 simulation would be ideal but due to time constraints these were not possible. Some results for 1000 simulations have been produced and these have been shown to be fairly similar at the median level (see Table 3b for example). Note that in cases where there are only 50 simulations reported, the values given for the 5th percentile will be rather imprecisely determined.

Results

Table 2 reports the median, 5th and 25th percentile values of B75m(2021/2006) values for the following candidate MPs (CMPs):

CMP 1: Allows for 20% of Offshore TAC transfer from A8+ to A3+4 and A7. Maximum TAC downward constraint = 10%. No EC rule.

CMP 2: Allows for 20% of Offshore TAC transfer from A8+ to A3+4 and A7, phased in over the next four years, Maximum TAC downward constraint increased to 30% if extreme circumstance arise (RULE 1). No EC rule.

CMP 3: Model 2 but including also EC rule.

CMP 4: Model 3 but allow for some of the Offshore TAC transfer from A8+ to be

transferred to A5+6 instead of entirely to A3+4 and A7.

CMP 5: Model 3 but use the "current" method for sector splits.

CMP 6: Model 3 but for all simulations force recruitment to be "low".

Table 3a reports results for CMP 3 for four different tunings – median total B75m(2021/2006) values range from 1.15 to 1.41.

Table 3b compares CMP 2 results for 1000 and 50 simulations.

Table 4a reports the number of time (expressed also as percentages) one can expect the EC rule to be invoked for the four different tunings of CMP 3. Table 4b reports the number of times (and percentages) that one can expect the same rule to be invoked in the first four years (i.e. period 2011-2014).

Table 5 reports detailed output statistics for the various sector catches/takes per area as well as biomass recovery values. Medians, 5th, 25th and 95th percentiles are reported.

Figure 1a and 2a show the Total Global TAC and B75m(y/2006) trajectories for CMP 3 α=3000 ("alternative" sector split), and CMP 5 α=3000 ("current" sector split). Median, 5th, 25th and 95th percentiles are shown. Global recreational allocations are also reported. Figures 1b and 2b show the offshore, nearshore and subsistence allocations for each for the two models respectively. Figures 1c and 2c report the annual TAC change values (as % change) for the Global and Offshore TACs.

Discussion

The initial CMP, CMP 1, transfers offshore commercial TAC from A8+ to A3+4 and A7 to achieve some abundance increase in median terms in A8+. However, the problem remains of poor resource performance in lower percentile terms for A3+4 and A7 Z(see Table 2).

More conservative (lower α) tunings do ameliorate this problem but not completely resolve it (Table 3a).

Table 3b suggests that results for 50 simulations only are not qualitatively misleading compared to what would be obtained for 1000 simulations.

There does seem scope to improve risk levels for A3+4 and A7 by allowing some of the offshore commercial catches in A5+6. (Table 2) (consider the lower 25%iles – the lower 5%iles are imprecisely determined given only 50 simulations) (Table 2 CMP 4 compared to CMP 3).

In terms of resource performance, there seems little difference between the two sector split approaches (Table 2, CMP5 compared to CMP 3).

If re3cruitment is low, there are concerns about performance for A3+4 (Table 2, CMP 6).

Immediate concerns of possible Exceptional Circumstance declarations are only for A7 (see Table 4b).

In fishery terms, chief concern is the projected decrease in the Global and particularly the offshore commercial TAC in A8+ (Figure 1a and 1b).

Overall these results suggest a final choice with a high median target recovery level, commercial offshore allocations in A5+6, and reduction of offshore transfers to A3+4 at the level considered in CMP 3.

Table 2: B75m(2021/2006) median values (with 5th and 25th percentiles in parentheses).

	CMP 1	CMP 2	CMP 3	CMP 4	CMP 5: CMP 3 but "current" sector split method	CMP 6: CMP 3 but for "low future recruitment"
# simulations	1000	50	50	50	50	50
α	2250	2250	3000	3000	3000	3500
	Transfer 20% offshore TAC from A8 and split 40:60 between A34 and A7	Model 1 but also drop to 30% max TAC decrease over J 0.85-0.95 (Rule 1)	Model 2 but have EC rule for area closure (Rule1 and EC rule)	Model 3 + 20% Offshore TAC from A8 transferred to A34:A56:A7 0.30:0.20:0.50 ratio	Rule 1 and EC rule	Rule 1 and EC rule
A1+2	1.30 (0.57; 0.94)	1.35 (0.57; 0.97)	1.40 (0.67; 1.02)	1.39 (0.67; 1.01)	1.43 (0.70; 1.08)	1.03 (0.55; 0.88)
A3+4	1.11 (0.23; 0.66)	0.98 (0.36; 0.60)	0.82 (0.17; 0.46)	0.92 (0.07; 0.53)	0.76 (0.07; 0.43)	0.18 (0; 0.02)
A5+6	1.77 (1.27; 1.50)	1.77 (1.36; 1.52)	1.77 (1.35; 1.51)	1.69 (1.30; 1.45)	1.83 (1.43; 1.56)	1.45 (1.22; 1.28)
A7	1.76 (0.13; 0.75)	1.92 (0.13; 0.74)	2.12 (0.26; 1.07)	2.15 (0.26; 1.11)	2.01 (0.22; 1.03)	0.64 (0.20; 0.45)
A8+	1.05 (0.37; 0.75)	1.00 (0.52; 0.76)	0.88 (0.47; 0.68)	0.85 (0.42; 0.65)	0.91 (0.50; 0.72)	0.42 (0.17; 0.30)
T	1.34 (0.60; 1.00)	1.32 (0.70; 1.02)	1.29 (0.74; 0.98)	1.30 (0.73; 0.96)	1.30 (0.75; 0.98)	0.61 (0.41; 0.50)

Table 3a: CMP 3 with **50** simulations and 4 different tunings - B75m(2021/2006) median values (with 5th and 25th percentiles in parentheses). The total average Global TAC values are shown in the last row.

	CMP 3	CMP 3	CMP 3	CMP 3
α	2500	3000	3500	4000
A1+2	1.41 (0.70; 1.04)	1.40 (0.67; 1.02)	1.35 (0.63; 0.97)	1.34 (0.63; 0.99)
A3+4	0.91 (0.19; 0.57)	0.82 (0.17; 0.46)	0.70 (0.06; 0.33)	0.60 (0.02; 0.24)
A5+6	1.78 (1.37; 1.52)	1.77 (1.35; 1.51)	1.75 (1.36; 1.49)	1.75 (1.33; 1.49)
A7	2.11 (0.26; 1.25)	2.12 (0.26; 1.07)	2.04 (0.21; 0.97)	1.99 (0.21; 0.86)
A8+	0.97 (0.52; 0.76)	0.88 (0.47; 0.68)	0.79 (0.40; 0.63)	0.77 (0.35; 0.60)
T	1.41 (0.75; 1.02)	1.29 (0.74; 0.98)	1.22 (0.60; 0.90)	1.15 (0.53; 0.84)
10-yr Ave Global TAC	2014 (1384; 1710)	2224 (1605; 1828)	2405 (1779; 2073)	2504 (1905; 2223)

Table 3b: Comparison of results for CMP 2 between 50 and 1000 simulations.

	CMP 1	CMP 2
# simulations	**50**	**1000**
α	2250	2250
A1+2	1.35 (0.57; 0.97)	1.34 (0.61; 0.95)
A3+4	0.98 (0.36; 0.60)	1.13 (0.30; 0.72)
A5+6	1.77 (1.36; 1.52)	1.79 (1.29; 1.51)
A7	1.92 (0.13; 0.74)	1.80 (0.17; 0.78)
A8+	1.00 (0.52; 0.76)	1.07 (0.43; 0.77)
T	1.32 (0.70; 1.02)	1.37 (0.67; 1.03)

Table 4a: # times out of 500 (50 simulations and 10 years) that the EC rule is invoked in any one super-area for the different CMP 3 tunings. The % chance of the EC occurring is given in parentheses.

α	**2500**	**3000**	**3500**	**4000**
A1+2	8 *1.6%)	8 (1.6%)	8 (1.6%)	10 (2%)
A3+4	5(1.0 %)	7 (1.4%)	8 (1.6%)	10 (2%)
A5+6	0 (0%)	0 (0%)	0 (0%)	1 (0.2%)
A7	19 (3.8%)	23 (4.6%)	23 (4.6%)	23 (4.6%)
A8+	20 (4%)	27 (5.4%)	31 (6.2%)	31 (6.2%)
T	52 (10.4%)	65 (13%)	70 (14%)	75 (15%)

Table 4b: # times out of 200 (50 simulations and 4 years) that the EC rule is invoked in any one super-area **during the first four years** for the different CMP 3 tunings.

α	**2500**	**3000**	**3500**	**4000**
A1+2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
A3+4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
A5+6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
A7	11 (5.5%)	11 (5.5%)	11 (5.5%)	11 (5.5%)
A8+	1 (0.5%)	1 (0.5%)	1 (0.5%)	1 (0.5%)
T	12 (6%)	12 (6%)	12 (6%)	12 (6%)

Table 5: Comparison between CMP 3 and CMP 4 2011 OMPs. Medians with 5th, 25th and 95th percentile values shown in parentheses. [Results for 50 simulations.]

Sector split method		Alternative sector split	Current sector split
		CMP 3	**CMP 5**
	α	**3000**	**3000**
	J_{min}	**0.2**	**0.2**
10-yr (2011-2020) Ave Global TAC	A1-2	34 [18; 28; 45]	32 [17; 27; 41]
	A3-4	516 [268; 416; 777]	528 [276; 433; 809]
	A5-6	114 [82; 99; 145]	96 [69; 82; 119]
	A7	459 [0; 234; 807]	488 [0; 249; 849]
	A8	1147 [878; 1028; 1425]	1118 [828; 963; 1289]
	T	2224 [1605; 1928; 2960]	2210 [1539; 1809; 2960]
10-yr (2011-2020) Ave offshore TAC	A1-2	0 [0; 0; 0; 0]	0 [0; 0; 0]
	A3-4	383 [182; 294; 612]	409 [207; 320; 676]
	A5-6	0 [0; 0; 0]	0 [0; 0; 0]
	A7	452 [0; 231; 798]	484 [0; 246; 844]
	A8	596 [406; 533; 770]	618 [438; 567; 819]
	T	1401 [954; 1109; 1866]	1478 [991; 1182; 2033]
10-yr (2011-2020) Ave near shore TAC	A1-2	23 [12; 19; 30]	24 [12; 19; 30]
	A3-4	72 [36; 61; 89]	72 [37; 60; 89]
	A5-6	32 [23; 27; 40]	32 [23; 27; 40]
	A7	0 [0; 0; 0]	0 [0; 0; 0]
	A8	315 [227; 272; 401]	316 [228; 267; 400]
	T	437 [312; 376; 554]	442 [314; 371; 555]
10-yr (2011-2020) Ave subsistence TAC	A1-2	8 [4; 6; 10]	7 [4; 5; 9]
	A3-4	50 [26; 43; 63]	42 [23; 37; 56]
	A5-6	60 [43; 53; 74]	50 [35; 44; 66]
	A7	0 [0; 0; 0]	0 [0; 0; 0]
	A8	125 [90; 108; 155]	104 [73; 92; 138]
	T	240 [174; 214; 302]	205 [142; 178; 269]
10 yr (2011-2020) Ave Total Recreational Take	T	175 [107; 150; 235]	102 [63; 86; 123]
***B75*$_m$(21/06)**	A1-2	1.40 (0.67; 1.02; 2.89)	1.43 [0.70; 1.08; 2.94]
	A3-4	0.82 (0.17; 0.46; 1.97)	0.76 [0.07; 0.43; 1.95]
	A5-6	1.77 (1.35; 1.51; 3.65)	1.83 [1.43; 1.50; 3.70]
	A7	2.12 (0.26; 1.07; 9.77)	2.01 [0.22; 0.68; 9.54]
	A8	0.88 (0.47; 0.68; 1.98)	0.91 [0.50; 0.72; 1.98]
	T	1.29 (0.74; 0.98; 3.00)	1.30 [0.75; 0.98; 3.00]

Figure 1a: Total Global TAC and B75m(y/2006) trajectories for CMP 3 α=3000 (“alternative” sector split). Median, 5th, 25th and 95th percentiles shown. Global recreational allocations are also reported.

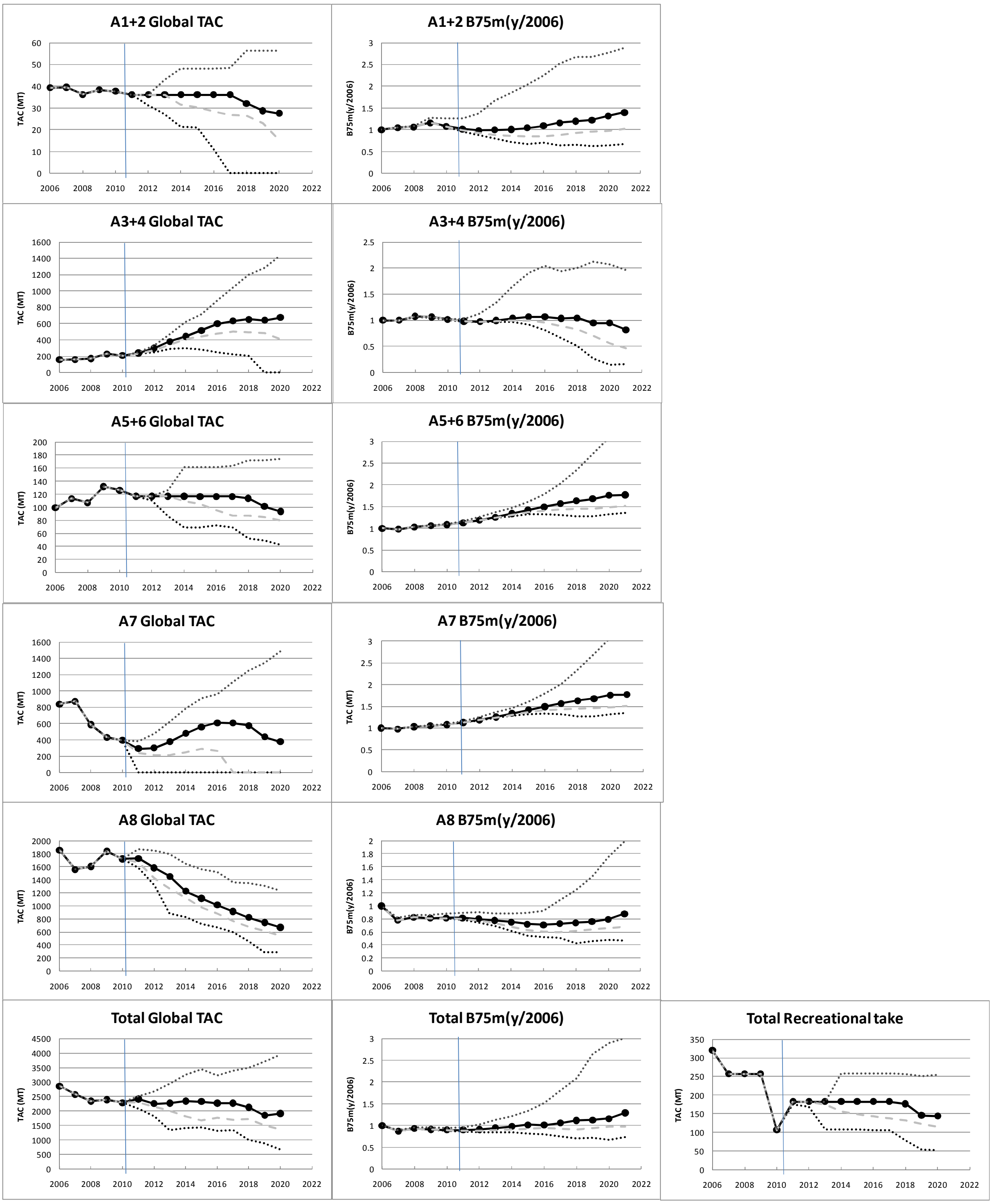


Figure 1b: Offshore, nearshore and subsistence allocation trajectories for CMP 3 α=3000 (“alternative” sector split). Median, 5th, 25th and 95th percentiles shown.

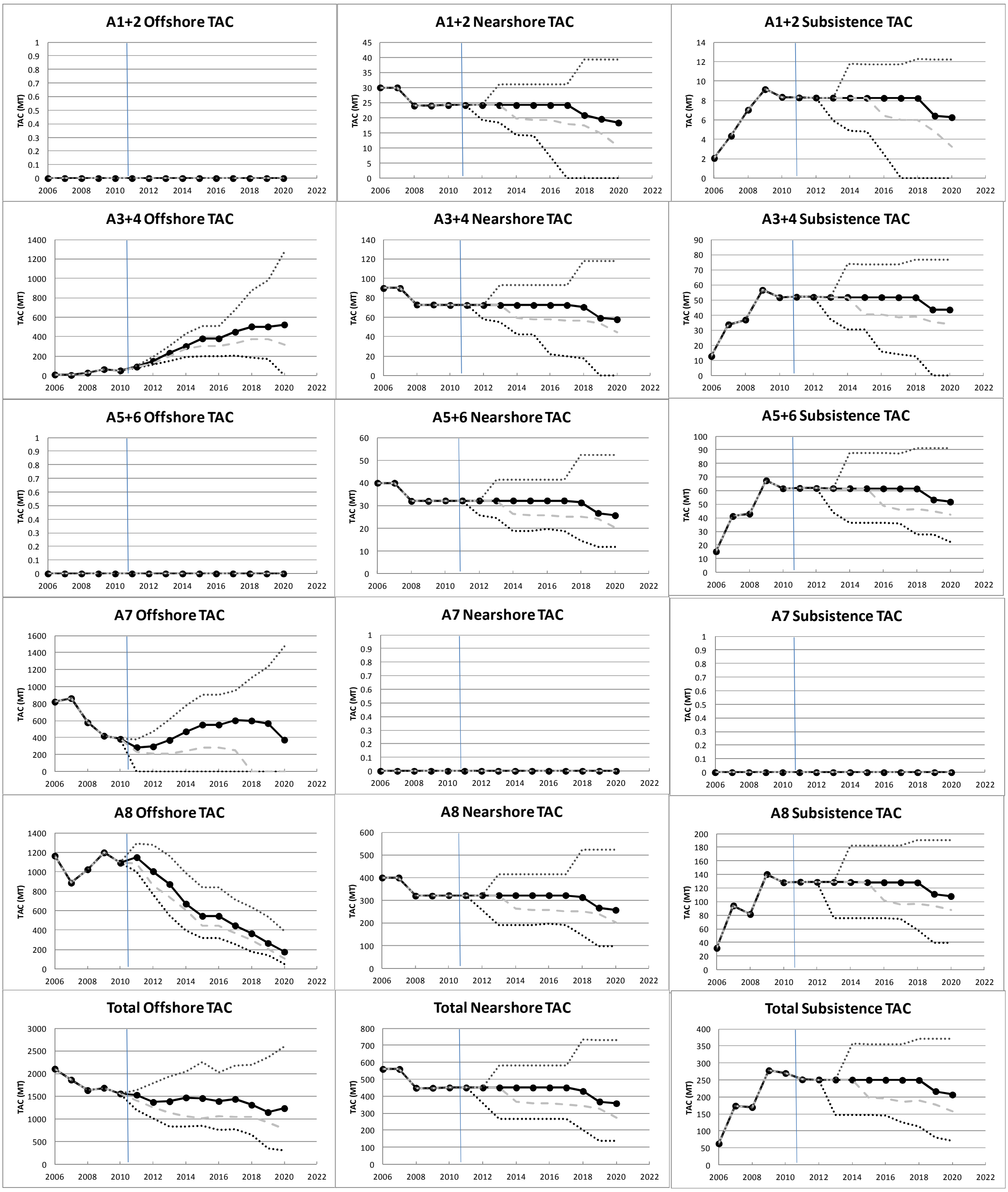


Figure 1c: Yearly inter-annual TAC change (%) for total Global TAC for CMP 3 =3000 (“alternative” sector split). Median, 5th, 25th and 95th percentiles shown.

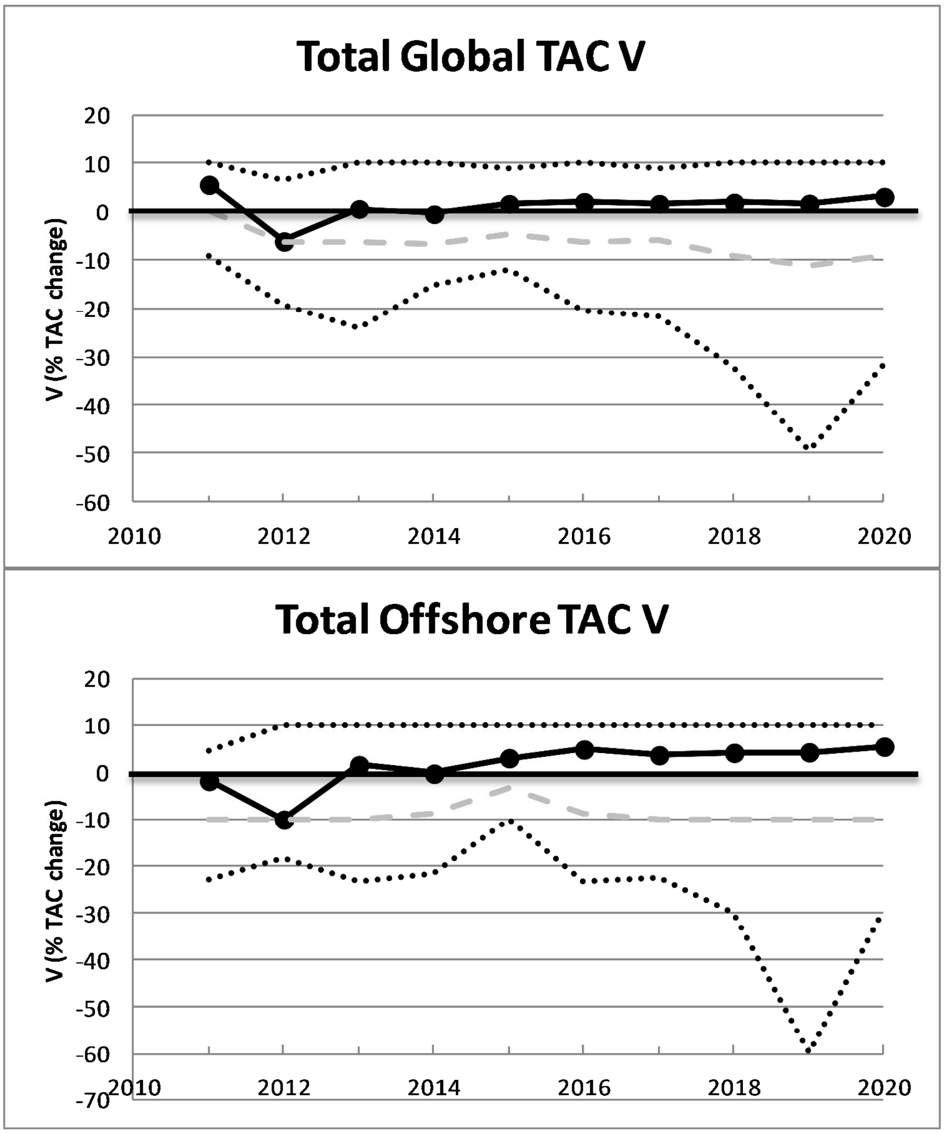


Figure 2a: Total Global TAC and B75m(y/2006) trajectories for CMP 5 α=3000 ("current" sector split). Median, 5th, 25th and 95th percentiles shown. Global recreational allocations are also reported.

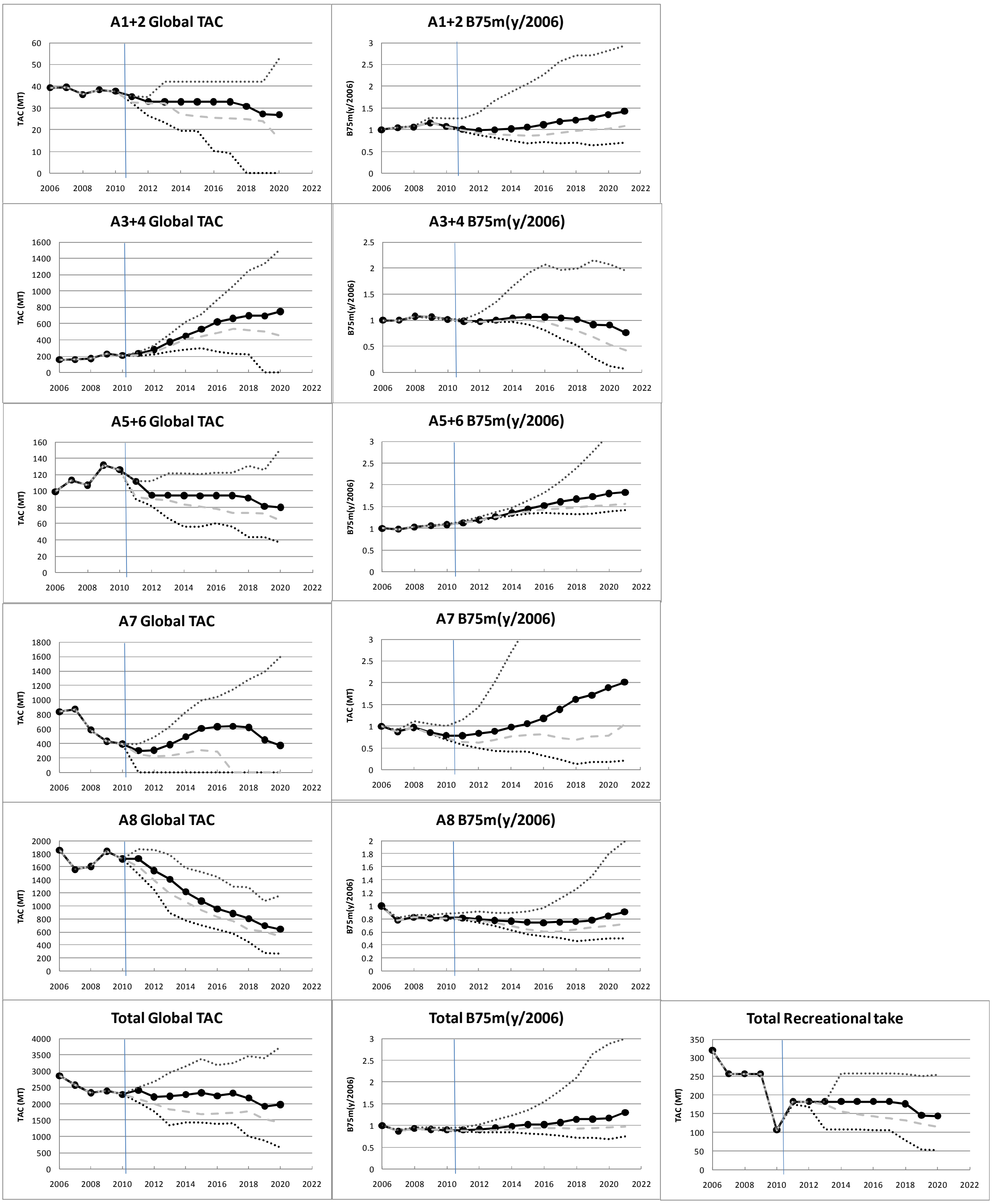


Figure 2b: Offshore, nearshore and subsistence allocation trajectories for CMP 5 α=3000 ("current" sector split). Median, 5th, 25th and 95th percentiles shown.

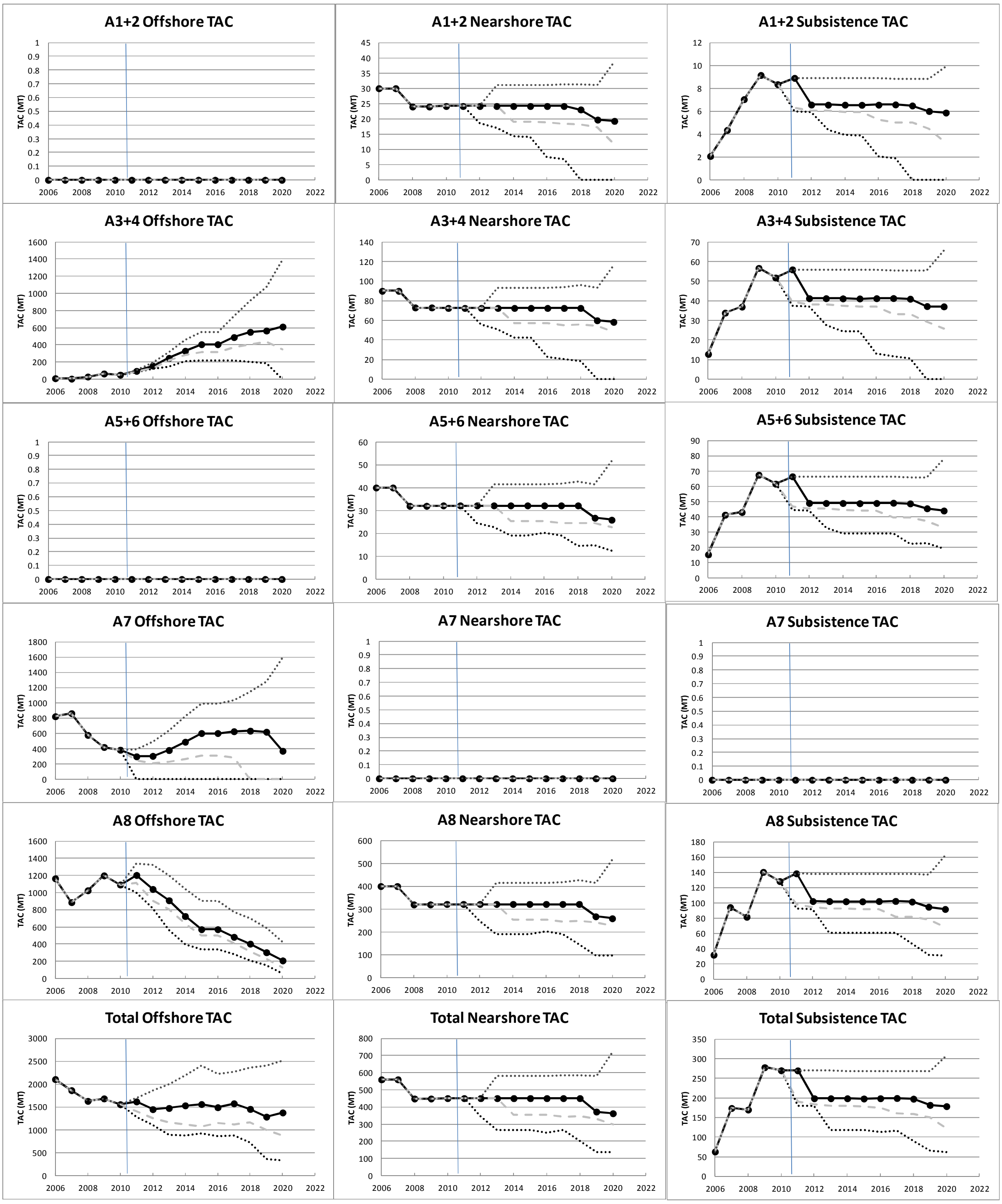
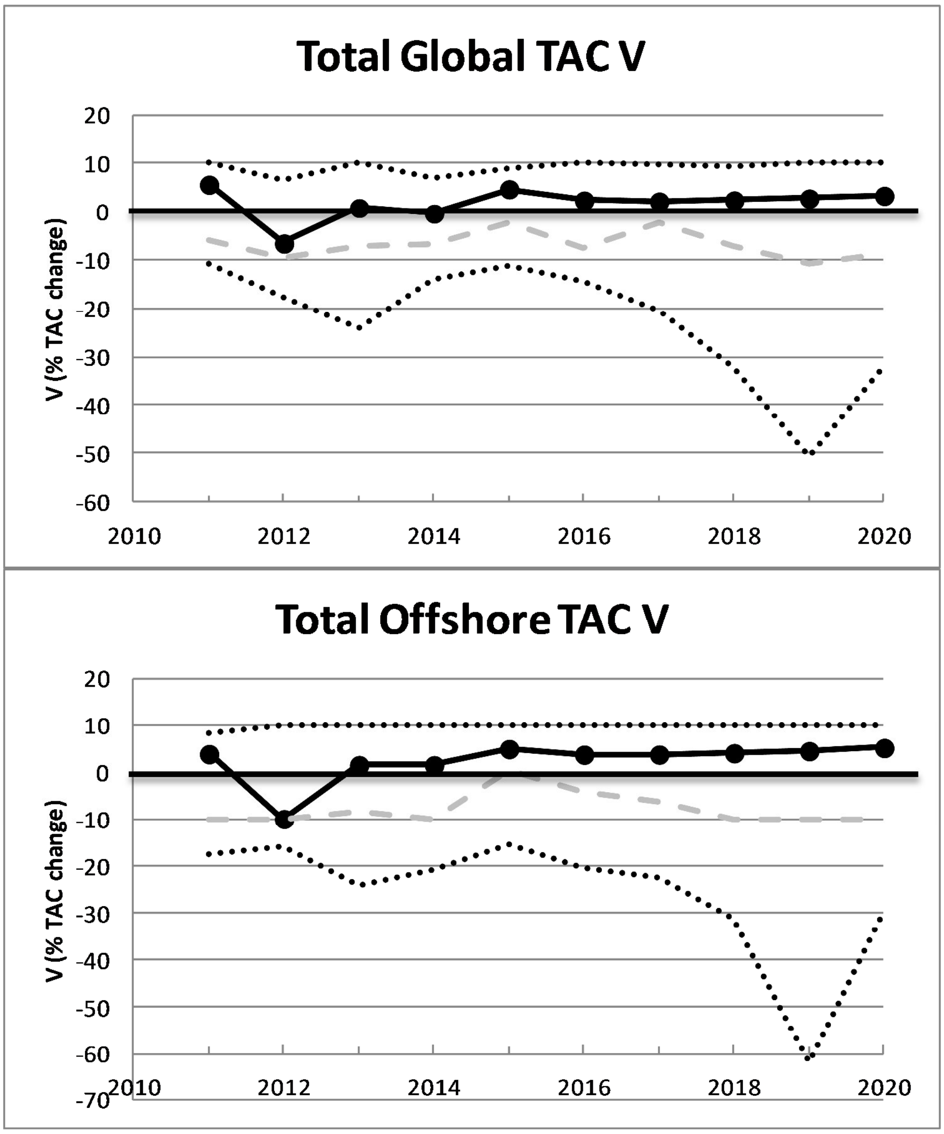


Figure 2c: Yearly inter-annual TAC change (%) for total Global TAC for CMP 5 =3000 ("current" sector split). Median, 5th, 25th and 95th percentiles shown.



Appendix: Method used for calculating $J_{area,y}$ values for use in the EC rule.

The EC rule requires a single index for each area using the available trap CPUE, hoop CPUE and FIMS for each season in the future.

STEP 1: For each super-area for which data are assumed to be available in the future, there will be for each season *Y* (here trap CPUE is used as an example):

$$CPUE_Y^{trap,A1-2}, CPUE_Y^{trap,A3-4}, CPUE_Y^{trap,A5-6}, CPUE_Y^{trap,A7}, CPUE_Y^{trap,A8}$$

STEP 2: Evaluate the geometric means of the CPUEs (and FIMS) for the super-area concerned (here we use A1-2 as an example) over the year period 2005…2009.

STEP 3: Re-normalise the CPUEs series as follows (e.g. for traps in Area A1-2):

$$CPUE_Y^{trap,A1-2} \Rightarrow X_Y^{trap,A1-2} = \frac{CPUE_Y^{trap,A1-2}}{Geometric\,mean\,(CPUE_y^{trap,A1-2}: y = 2005...2009)} \qquad (A.1)$$

STEP 5: Calculate a combined index for each area as follows:

$$J^*_{area,Y} = (w_{area}^{trap} X_Y^{trap,area} + w_{area}^{hoop} X_Y^{hoop,area} + w_{area}^{FIMS} X_Y^{FIMS,area}) / (w_{area}^{trap} + w_{area}^{hoop} + w_{area}^{FIMS}) \qquad (A.3)$$

where $w_{A1-2}^{trap} + w_{A3-4}^{trap} + ... + w_{A8}^{trap} = 1$.

The weights have been calculated in the following manner. For example, for trap and hoop CPUE, obtain $\overline{B}^{75}$, the average (male plus female) selectivity-weighted biomass above 75mm carapace length over the 2000-2009 period for each super-area:

$$\overline{B}_{A1-2}^{75}, \overline{B}_{A3-4}^{75}, \overline{B}_{A5-6}^{75}, \overline{B}_{A7}^{75}, \overline{B}_{A8}^{75};$$

then:

$$\overline{B}_{TOTAL}^{75} = \sum_{A=1..8} \overline{B}_A^{75} \text{ and} \qquad (A.4)$$

$$w_{A1-2}^{trap} = w_{A1-2}^{hoop} = \frac{\overline{B}_{A1-2}^{75}}{\overline{B}_{TOTAL}^{75}} \text{ etc.}$$

For FIMS, as above, but $\overline{B}^{60}$ is used instead of $\overline{B}^{75}$.

Since there will be a lack of certain data types for some super-areas, summations above are adjusted accordingly:

Traps A7 and A8+ only

Hoops: A1+2, A3+4, A5+6 and A8+ only

FIMS: A3+4, A5+6, A7 and A8+ only.

The table below lists the weighting *w* values. [Note that '-' indicate that data are not expected from that super-area for that gear type in the future, and hence such data are omitted from the OMP.]

	w_A^{trap}	w_A^{hoop}	w_A^{FIMS}
A1-2	-	0.034	-
A3-4	-	0.231	0.214
A5-6	-	0.187	0.173
A7	0.174	-	0.107
A8	0.826	0.548	0.507

Finally, $J_{area,Y}$ is calculated as the geometric mean of the three most recent years,

$$J_{area,Y} = [\sum_{T=Y-1}^{T=Y-3} J^*_{area,T}]/3$$