On Specifications for OMP-2011 and Associated Trials

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This document reports further initial specifications for OMP 2011 and associated simulation trials where the underlying OMP has not been altered to any great extent compared to OMP 2007 re-cast. It extends the details provided in Fisheries/2011/MAR/SWG-WCRL/01.

Intentions are first to report on the results for the application of OMP 2007 recast to the revised set of trials, without changing control parameter values, as a "sighter" of what to expect. This will be followed both by refinements of the OMP and retuning to a realistic range of recovery targets.

Note that for the moment, allocations by sector are assumed to be as for the 2010/2011 season. This will be revised as calculations progress in the light of any information relayed by DAFF Management.

The split of the global (combined) TAC generated from the OMP split amongst the super-areas and sectors

The final OMP TAC setting rule produces a recommended global TAC each season - TAC_y^G . [The GLOBAL TAC needs to be split into commercial, recreational and subsistence and amongst super-areas]

For the recreational take component, the following algorithm is applied:

$C_y^{rec} = C_{y-1}^{rec}$ initially (i.e. for the 2010 season a value of 107 MT)

If $C_y^{rec} / TAC_y^G > 0.06$ then $C_y^{rec} = 0.05\ TAC_y^G$

If $C_y^{rec} / TAC_y^G < 0.03$ then $C_y^{rec} = 0.05\ TAC_y^G$

If $C_y^{rec} > 250$ MT then $C_y^{rec} = 250$ MT

where C_y^{rec} is the overall recreational take for season *y*, and TAC_y^G is the "global" (commercial plus recreational plus subsistence) TAC for season *y* as output by the OMP. (Note that recreational take limits are not imposed directly. Rather if a change in this take is indicated, recommendations for changes to the extent of the recreational season will be made which are chosen with the intent of achieving the change in take sought.)

Note that the following proportional breakdown of the overall recreational take (C_y^{rec}) by super-area is assumed for the purposes of OMP trials; these proportions are taken in the trials to remain unchanged over time (note these proportions may change when 2011 telephone survey report becomes available):

Area 1-2	=	2%
Area 3-4	=	12.5%
Area 5-6	=	12.5%
Area 7	=	4%
Area 8	=	69%

For the subsistence take component, the following algorithm is applied:

$C_y^{SUB} = C_{y-1}^{SUB}$ initially (i.e. for the 2010 season this value is 250 MT, being the most recent estimate for the likely catch)

If $C_y^{SUB} / TAC_y^G > 0.11$ then $C_y^{rec} = 0.088\ TAC_y^G$

If $C_y^{SUB} / TAC_y^G < 0.07$ then $C_y^{rec} = 0.088\ TAC_y^G$

If $C_y^{SUB} > 500$ MT then $C_y^{IRc} = 500\,\text{MT}$

where C_y^{SUB} is the overall subsistence take for season *y*, and TAC_y^G is the “global” (commercial plus recreational plus subsistence) TAC for season *y* as output by the OMP. (Note that subsistence take limits are not imposed directly. Rather if a change in this take is indicated, recommendations for changes to the extent of the subsistence season will be made which are chosen with the intent of achieving the change in take sought.)

Note that the following proportional breakdown of the overall subsistence take (C_y^{SUB}) by super-area is assumed for the purposes of OMP trials; these proportions are taken in the trials to remain unchanged over time. (These values have been taken as averaged subsistence take over the last four seasons):

Area 1-2	=	3.3%
Area 3-4	=	20.7%
Area 5-6	=	24.6%
Area 7	=	0.0%
Area 8	=	51.3%

The remaining (commercial) TAC ($TAC_y^{comm} = TAC_y^G - C_y^{rec} - C_y^{SUB}$) (adjusted if necessary at this stage to conform to inter-annual TAC change constraints) must then be split into super-area allocations. First the nearshore allocations are calculated, and then subtracted as indicated below.

The total nearshore allocation may vary up and down over time in a similar manner to the recreational take. Thus, first the total nearshore TAC each season, NSQ_y, is calculated as follows:

$NSQ_y = NSQ_{y-1}$ initially (i.e. for the 2010 season this value is 451 MT)

If $NSQ_y / TAC_y^G > 0.24$ then $NSQ_y = 0.197\ TAC_y^G$

If $NSQ_y / TAC_y^G < 0.16$ then $NSQ_y = 0.197\ TAC_y^G$

If $NSQ_y > 800$ MT then $NSQ_y = 800$ MT.

The proportional inter-super-area split of the NSQ_y remains the same as for 2006-2010, i.e.:

Area 1-2 NSQ_y^{A1-2} = 5.36% of NSQ_y

Area 3-4 NSQ_y^{A3-4} = 16.07% of NSQ_y

Area 5-6 NSQ_y^{A5-6} = 7.14% of NSQ_y

Area 7 NSQ_y^{A7} = 0% of NSQ_y

Area 8 NSQ_y^{A8} = 71.43% of NSQ_y

Finally the TAC allocation to offshore rights holders in each super-area A, $TAC_y^{off} = TAC_y^{comm} - NSQ_y$, is divided between super-areas 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:

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

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}) for the super-areas concerned. If the allocations do not total to that offshore commercial TAC, simply scale them all by the same proportion so that they do total to match that offshore commercial TAC.

STEP 5: Transfer of 5% of the offshore commercial TAC (TAC_y^{off}) from A8 to A3-4 and A7 in the ratio 1:4.

The commercial rights holders TAC allocations by super-area are then simply calculated as:

$$TAC_y^{comm,A} = TAC_y^{off,A} + NSQ_y^A .$$

Summary of the order of the TAC calculations

1. The OMP generates the global (all super-areas combined) commercial (offshore+nearshore rights holders)+recreational TAC + subsistence= TAC_y^G recommendation.
2. Check for inter-annual TAC constraint violations (at a global level) and adjust TAC_y^G if necessary.
3. Remove the total recreational take component (which would then be split into super-areas as per the specified proportions for subsequent computations in any simulation testing).
4. Remove the total subsistence take component (which would then be split into super-areas as per the specified proportions for subsequent computations in any simulation testing):
$$TAC_y^{comm} = TAC_y^G - C_y^{rec} - C_y^{SUB} \quad .$$
5. Re-check that the remaining commercial (offshore+nearshore rights holders) TAC_y^{comm} does not violate inter-annual TAC constraints; if it does, adjust it to the bound concerned.
6. Calculate the total nearshore TAC, NSQ_y .
7. Split the total nearshore TAC component into super-areas according to fixed proportions – note no nearshore TAC allocation for super-area A7. This gives:
$NSQ_y^{A1-2}, NSQ_y^{A3-4}, NSQ_y^{A5-6}, NSQ_y^{A8}$. Note NSQ_y^{A7}=0.
8. Remove the total nearshore TAC component from the total commercial TAC to give the amount to be split into offshore TAC for super-areas A3-4, A7 and A8 (note no offshore TAC allocations for A1-2 and A5-6), i.e.:
$$TAC_y^{off} = TAC_y^{comm} - NSQ_y \; .$$
9. Split the offshore TAC into A3-4, A7 and A8 (using the slopes method above– this gives initial $TAC_y^{off,A3-4}, TAC_y^{off,A7}, TAC_y^{off,A8}$). Note that $TAC_y^{off,A1-2}$ and $TAC_y^{off,A5-6}$ are both equal to zero.
10. Transfer 5% of offshore TAC from A8 into A3-4 (20%) and A7 (80%):
$$TAC_y^{off,A3-4} = TAC_y^{off,A3-4} + (0.2)(0.05)TAC_y^{off,A8}$$
$$TAC_y^{off,A7} = TAC_y^{off,A7} + (0.8)(0.05)TAC_y^{off,A8}$$
$$TAC_y^{off,A8} = 0.95TAC_y^{off,A8} .$$

11. The final commercial TAC allocations are then:

$$TAC_y^{comm,A1-2} = TAC_y^{off,A1-2} + NSQ_y^{A1-2}$$
$$TAC_y^{comm,A3-4} = TAC_y^{off,A3-4} + NSQ_y^{A3-4}$$
$$TAC_y^{comm,A5-6} = TAC_y^{off,A5-6} + NSQ_y^{A5-6}$$
$$TAC_y^{comm,A7} = TAC_y^{off,A7} + NSQ_y^{A7}$$
$$TAC_y^{comm,A8} = TAC_y^{off,A8} + NSQ_y^{A8}$$

Future Scenarios

In 2007 the reference set of operating models used for basic OMP testing comprised of 27 possible scenarios, which resulted as combinations of uncertainties regarding future recruitment, future somatic growth and current abundance. The working group have recently revised this set of future scenarios, and for calculations presented here the following specifications apply.

1.1 Median Future recruitment	**WT**
• FRM: Geometric Mean of $R_{75}, R_{80}, R_{85}, R_{90}, R_{95}, R_{00}$	0.60
• FRH: Maximum of $R_{75}, R_{80}, R_{85}, R_{90}, R_{95}, R_{00}$	0.30
• FRL: Minimum of $R_{75}, R_{80}, R_{85}, R_{90}, R_{95}, R_{00}$	0.10

Future recruitment (for FRM)

Future R_y: where y = 2003, 2007, 2010, 2015, 2020, 2025 and 2030; linearity between each of these years (and between 2000 and 2003).

Stochastic: R_y randomly selected from $\bar{R}\, e^{\varepsilon_y}$, where,

$$\ln \bar{R} = \frac{1}{6}\left(\ln R_{75} ... \ln R_{00}\right)$$

$$\sigma = \text{SD of } \left(\ln R_{75}, ... \ln R_{00}\right)$$

$$\varepsilon_y \sim N(0, \sigma^2)$$

For FRH and FRL, the $\bar{R}$ was replaced by either the maximum or minimum R between $R_{75}, R_{80}, R_{85}, R_{90}, R_{95}, R_{00}$. If any of these values are less than 0.01 however, they are excluded from the above $\bar{R}$ and σ calculation.

1.2 Future Somatic growth (2005+) **WT**

- FSGL: = FSGM for 3 years (2010, 2011, 2012) then will equal the 1989-2009 average — 0.80
- FSGM: ↑ linearly to 1968-2009 ave over 10 yrs — 0.20

[The above applied to the growth rates for Areas 3+4, 5+6, 7 and 8+. The somatic growth rate for Area 1-2 is assumed to remain constant in the future at the 1989-2009 average level for all scenarios.]

1.3 Current Abundance levels

- The two alternate models (Alt1 and Alt2) are virtually identical to the RC model, except with regards to the R_{2003} value. For the RC model R_{2003} is an estimable parameter, although it is found to be estimated with very low precision. Alt1 and Alt2 models correspond almost exactly to the RC best fit parameter values except for R_{2003} which is fixed at the (approximate) upper and lower 25%iles of this distribution as follows:

$$\ln R_{2003}^{alt1} = \ln \hat{R}_{2003}^{RC} + \sigma\alpha \quad (1)$$

and

$$\ln R_{2003}^{alt2} = \ln \hat{R}_{2003}^{RC} - \sigma\alpha \quad (2)$$

where σ is from equation (4) below, and the α value (0.741) corresponds to the 25%iles of a *t*-distribution with the appropriate number of degrees of freedom.

$$\ln \overline{R} = \frac{1}{6}\sum_{y=1975}^{2000} \ln R_y \quad (3)$$

$$\sigma^2 = \frac{1}{5}\sum_{y=1975}^{2000} \left(\ln \overline{R} - \ln R_y\right)^2 \quad (4)$$

	WT
• RC: Best Estimate of R_{2003}	0.50
• ALTL: Estimated lower 12.5%ile for R_{2003}	0.25
• ALTH: Estimated upper 12.5%ile for R_{2003}	0.25

1.4 Future poaching levels (these values are the total poaching levels)

		WT
• **PRC**	2008=500 MT 2009=500 MT 2010+=500 MT	0.50
• **PRL**	2008=500 MT 2009=750 MT 2010+=1000 MT	0.25
• **PRH**	2008=500 MT 2009=1000 MT 2010+=1500 MT	0.25

Note: The super-areal breakdowns of future poaching levels are assumed to be those reported in Fisheries/2011/May/SWG-WCRL/23 and are:

Super-area 1+2 = 0.15%
Super-area 3+4 = 24.97 %
Super-area 5+6 = 40.13%
Super-area 7 = 0.0%
Super-area 8+ = 34.75%

The various scenarios (54 in total) and their weights are shown in Table 1.

Table 1: The 2011 OMP combinations of the uncertainties resulting in 54 scenarios.

Scenario	Recruitment	Somatic growth	rent Abunda	Poaching	R WT	G WT	A WT	P WT	Total WT	CUM WT
1	FRM	FSGL	RC	PRC	0.6	0.8	0.5	0.5	0.12	0.12
2	FRM	FSGL	RC	PL	0.6	0.8	0.5	0.25	0.06	0.18
3	FRM	FSGL	RC	PH	0.6	0.8	0.5	0.25	0.06	0.24
4	FRM	FSGL	ALTL	PRC	0.6	0.8	0.25	0.5	0.06	0.3
5	FRM	FSGL	ALTL	PL	0.6	0.8	0.25	0.25	0.03	0.33
6	FRM	FSGL	ALTL	PH	0.6	0.8	0.25	0.25	0.03	0.36
7	FRM	FSGL	ALTH	PRC	0.6	0.8	0.25	0.5	0.06	0.42
8	FRM	FSGL	ALTH	PL	0.6	0.8	0.25	0.25	0.03	0.45
9	FRM	FSGL	ALTH	PH	0.6	0.8	0.25	0.25	0.03	0.48
10	FRM	FSGM	RC	PRC	0.6	0.2	0.5	0.5	0.03	0.51
11	FRM	FSGM	RC	PL	0.6	0.2	0.5	0.25	0.015	0.525
12	FRM	FSGM	RC	PH	0.6	0.2	0.5	0.25	0.015	0.54
13	FRM	FSGM	ALTL	PRC	0.6	0.2	0.25	0.5	0.015	0.555
14	FRM	FSGM	ALTL	PL	0.6	0.2	0.25	0.25	0.0075	0.5625
15	FRM	FSGM	ALTL	PH	0.6	0.2	0.25	0.25	0.0075	0.57
16	FRM	FSGM	ALTH	PRC	0.6	0.2	0.25	0.5	0.015	0.585
17	FRM	FSGM	ALTH	PL	0.6	0.2	0.25	0.25	0.0075	0.5925
18	FRM	FSGM	ALTH	PH	0.6	0.2	0.25	0.25	0.0075	0.6
19	FRH	FSGL	RC	PRC	0.3	0.8	0.5	0.5	0.06	0.66
20	FRH	FSGL	RC	PL	0.3	0.8	0.5	0.25	0.03	0.69
21	FRH	FSGL	RC	PH	0.3	0.8	0.5	0.25	0.03	0.72
22	FRH	FSGL	ALTL	PRC	0.3	0.8	0.25	0.5	0.03	0.75
23	FRH	FSGL	ALTL	PL	0.3	0.8	0.25	0.25	0.015	0.765
24	FRH	FSGL	ALTL	PH	0.3	0.8	0.25	0.25	0.015	0.78
25	FRH	FSGL	ALTH	PRC	0.3	0.8	0.25	0.5	0.03	0.81
26	FRH	FSGL	ALTH	PL	0.3	0.8	0.25	0.25	0.015	0.825
27	FRH	FSGL	ALTH	PH	0.3	0.8	0.25	0.25	0.015	0.84
28	FRH	FSGM	RC	PRC	0.3	0.2	0.5	0.5	0.015	0.855
29	FRH	FSGM	RC	PL	0.3	0.2	0.5	0.25	0.0075	0.8625
30	FRH	FSGM	RC	PH	0.3	0.2	0.5	0.25	0.0075	0.87
31	FRH	FSGM	ALTL	PRC	0.3	0.2	0.25	0.5	0.0075	0.8775
32	FRH	FSGM	ALTL	PL	0.3	0.2	0.25	0.25	0.00375	0.88125
33	FRH	FSGM	ALTL	PH	0.3	0.2	0.25	0.25	0.00375	0.885
34	FRH	FSGM	ALTH	PRC	0.3	0.2	0.25	0.5	0.0075	0.8925
35	FRH	FSGM	ALTH	PL	0.3	0.2	0.25	0.25	0.00375	0.89625
36	FRH	FSGM	ALTH	PH	0.3	0.2	0.25	0.25	0.00375	0.9
37	FRL	FSGL	RC	PRC	0.1	0.8	0.5	0.5	0.02	0.92
38	FRL	FSGL	RC	PL	0.1	0.8	0.5	0.25	0.01	0.93
39	FRL	FSGL	RC	PH	0.1	0.8	0.5	0.25	0.01	0.94
40	FRL	FSGL	ALTL	PRC	0.1	0.8	0.25	0.5	0.01	0.95
41	FRL	FSGL	ALTL	PL	0.1	0.8	0.25	0.25	0.005	0.955
42	FRL	FSGL	ALTL	PH	0.1	0.8	0.25	0.25	0.005	0.96
43	FRL	FSGL	ALTH	PRC	0.1	0.8	0.25	0.5	0.01	0.97
44	FRL	FSGL	ALTH	PL	0.1	0.8	0.25	0.25	0.005	0.975
45	FRL	FSGL	ALTH	PH	0.1	0.8	0.25	0.25	0.005	0.98
46	FRL	FSGM	RC	PRC	0.1	0.2	0.5	0.5	0.005	0.985
47	FRL	FSGM	RC	PL	0.1	0.2	0.5	0.25	0.0025	0.9875
48	FRL	FSGM	RC	PH	0.1	0.2	0.5	0.25	0.0025	0.99
49	FRL	FSGM	ALTL	PRC	0.1	0.2	0.25	0.5	0.0025	0.9925
50	FRL	FSGM	ALTL	PL	0.1	0.2	0.25	0.25	0.00125	0.99375
51	FRL	FSGM	ALTL	PH	0.1	0.2	0.25	0.25	0.00125	0.995
52	FRL	FSGM	ALTH	PRC	0.1	0.2	0.25	0.5	0.0025	0.9975
53	FRL	FSGM	ALTH	PL	0.1	0.2	0.25	0.25	0.00125	0.99875
54	FRL	FSGM	ALTH	PH	0.1	0.2	0.25	0.25	0.00125	1

Table 2: Comparison between OMP 2007 re-cast OMP results and an initial 2011-realted OMP with the same tuning parameter values as OMP 2007 re-cast. Values in parenthesis are the 5th and 95th percentile values.

		OMP 2007 Re-cast	**Initial OMP 2011**
10-yr (2006-2015) Ave commercial TAC	A1-2	28 [25; 33]	29 [25; 29]
	A3-4	178 [144; 222]	126 [102; 158]
	A5-6	37 [33; 43]	38 [34; 39]
	A7	713 [598; 876]	749 [607; 978]
	A8	1363 [1196; 1611]	1381 [1205; 1577]
	T	2312 [2048; 2763]	2297 [1985; 2429]
10-yr (2006-2015) Ave near shore TAC	A1-2	28 [25; 33]	27 [24; 28]
	A3-4	83 [74; 98]	81 [71; 83]
	A5-6	37 [33; 43]	36 [32; 37]
	A7	0 [0; 0]	0 [0; 0]
	A8	369 [328; 435]	358 [316; 369]
	T	517[460; 609]	502 [443; 517]
10-yr (2006-2015) Ave offshore TAC	A1-2	0 [0; 0]	0 [0; 0]
	A3-4	95 [67; 130]	45 [24; 76]
	A5-6	0 [0; 0]	2 [2; 2]
	A7	713 [598; 876]	749 [607; 978]
	A8	994 [865; 1195]	1025 [863; 1212]
	T	1796 [1586; 2160]	1795 [1534; 1912]
10-yr (2006-2015) Ave subsistence TAC	A1-2	-	7 [6;7]
	A3-4	-	45 [38; 47]
	A5-6	-	54 [45; 55]
	A7	-	2 [2; 2]
	A8	-	112 [94; 116]
	T	-	219 [184; 226]
10 yr (2006-2015) Ave Total Recreational Take	T	268 [227; 309]	173 [173; 181]
B_m(16/06)	A1-2	0.85 [0.54; 1.37]	1.22 [0.76; 2.27]
	A3-4	1.09 [0.62; 2.58]	1.17 [0.67; 2.85]
	A5-6	1.76 [0.62; 11.31]	1.38 [1.14; 1.90]
	A7	1.12 [0.34; 3.06]	0.67 [0.01; 5.34]
	A8	0.93 [0.28; 2.76]	0.53 [0.11; 0.91]
	T	1.20 [0.55; 2.96]	0.89 [0.45; 1.72]
B_m(16/1910)	A1-2	0.01 [0.01; 0.02]	0.01; [0.01;0.02]
	A3-4	0.04 [0.02; 0.09]	0.03 [0.02; 0.08]
	A5-6	0.02 [0.01; 0.15]	0.02 [0.02; 0.03]
	A7	0.02 [0.01; 0.06]	0.02 [0.00; 0.14]
	A8	0.05 [0.02; 0.16]	0.04 [0.01; 0.06]
	T	0.04 [0.02; 0.09]	0.03 [0.01; 0.05]

Figure 1: Comparison between OMP 2007 re-cast and initial OMP 2011 plots of median expected TACs.

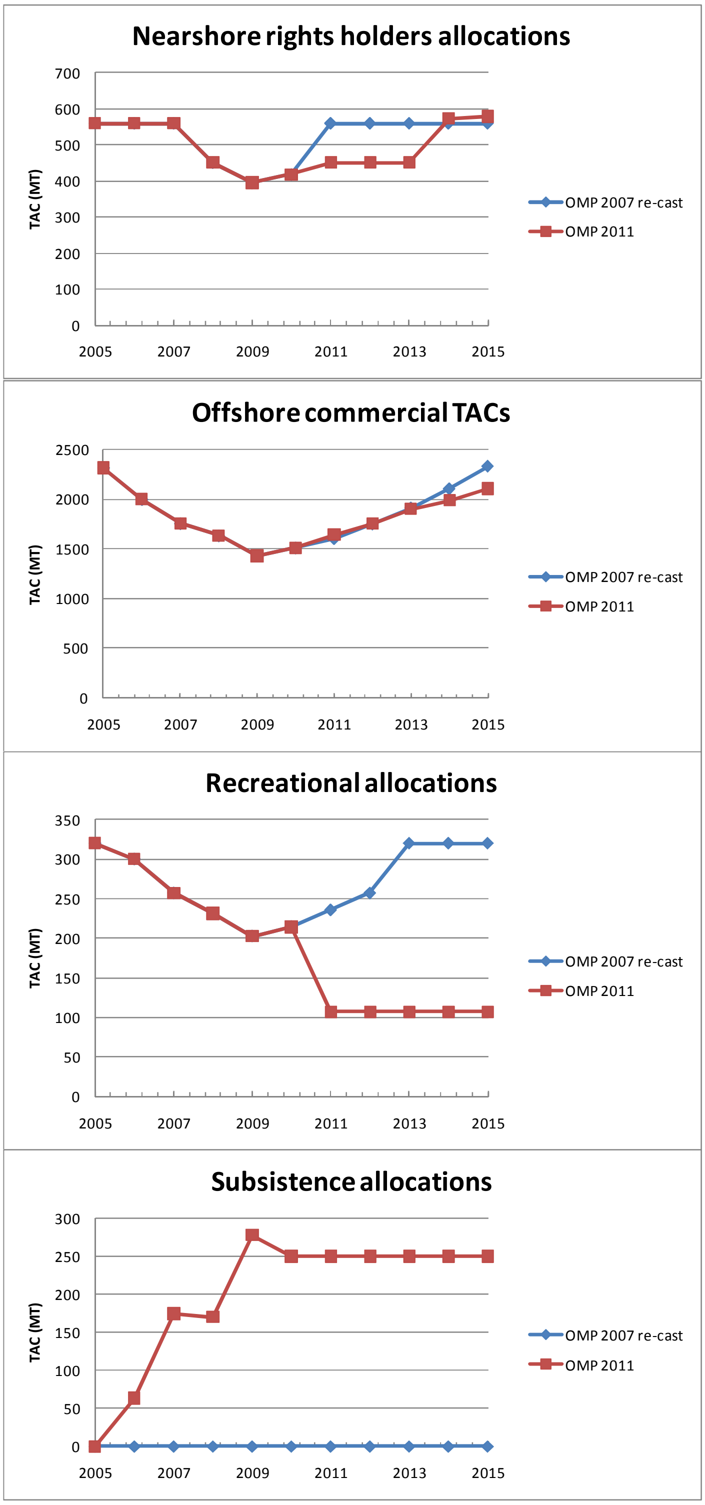

Figure 2: OMP 2007 re-cast median *B*75m trajectories compared to those for the new inital OMP 2011. Values are divided by the *B*75m(2006) value. The target for OMP-2007 re-cast was *B*75m(16)/*B*75m(06)=1.20.

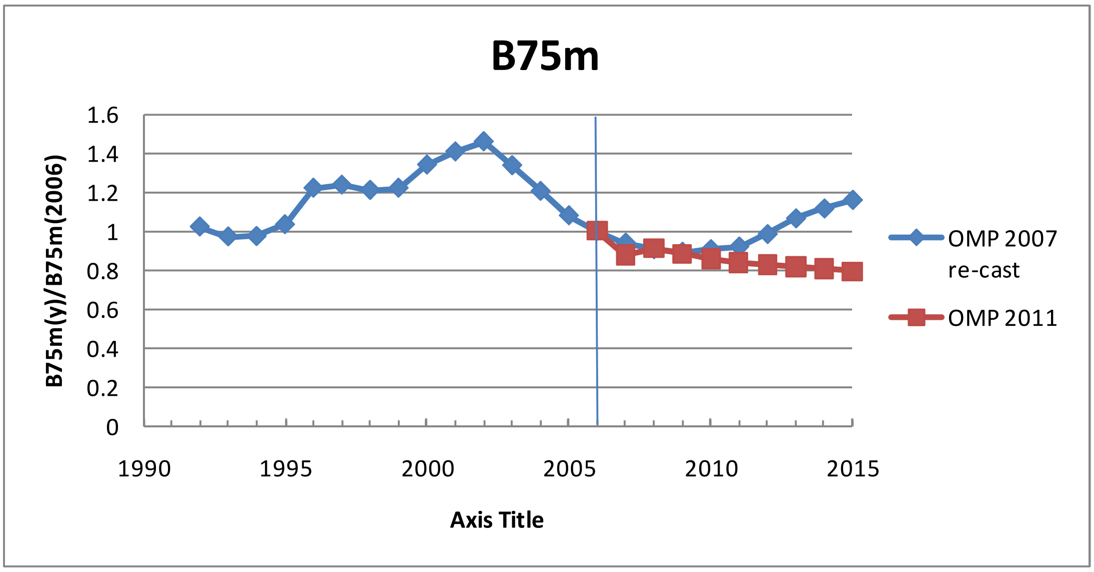

Figure 3: Initial OMP 2011 median *B*75(m+f) [note not B75 male only] trajectories of B75 in absolute terms.

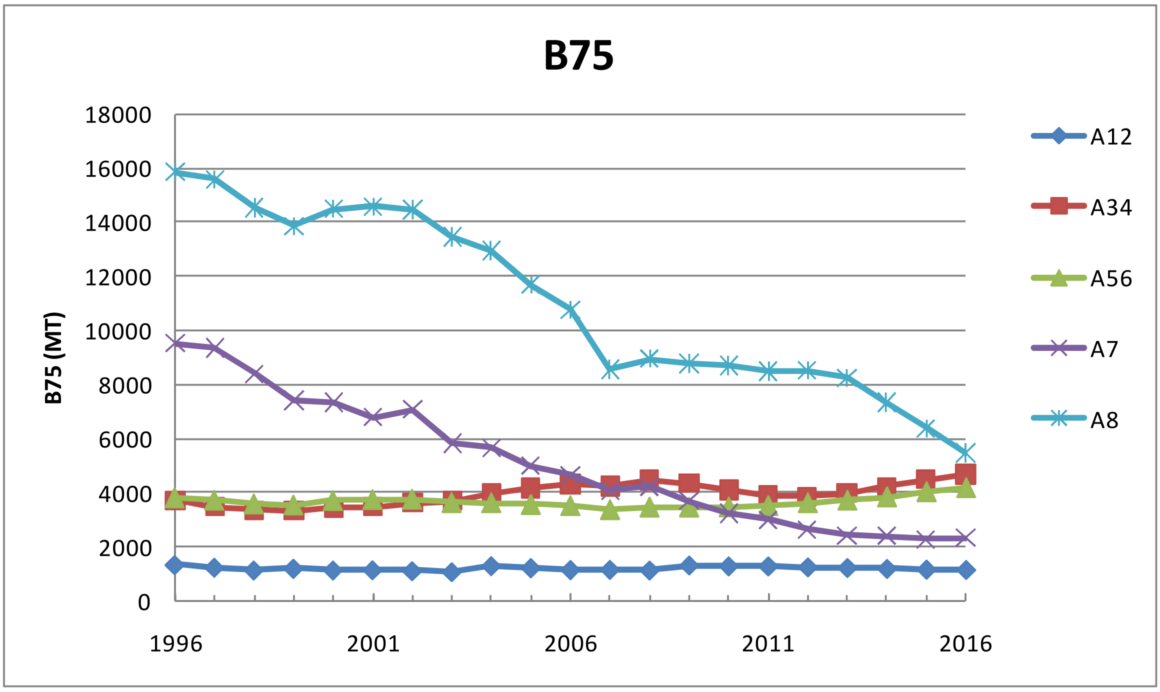

Figure 4: Initial OMP 2011 median *B*75(m+f) [note not B75 male only] trajectories of *B*75(y)/*B*75(2006) (LHS) and B75 in absolute terms (RHS).