Addendum 2 to WG/08/08/WCRL11

S.J. Johnston and D.S. Butterworth

Table 3a has been updated with $B_{\mathrm{m}}(16)/\ K_m^{curr}$ values for the "2401" tuning.

Results for different future somatic growth scenarios

The results presented in WG/08/07/WCRL11 document are for the full stochastic reference set, which includes scenarios which assume there is a 50% probability of the future somatic growth remaining low, and a 50% probability that it will increase to its historic average level either over a 3 year period (10% probability – termed "high" somatic growth scenario) or a 10 year period (40% probability – termed "medium" somatic growth option). Table 3c reports results of the "2245" MT OMP for the full stochastic reference set (i.e. assumes a 50% probability future somatic growth remains low), as well as for the "SGLOW" scenario which assumes 100% future somatic growth remaining low, and "SGHI" which excludes the low future somatic growth scenarios, and thus assumes an 80% probability of a "medium" future somatic growth, and a 20% probability of a "high" future somatic growth. Table 3d compares results for the "2401" tuning between the full stochastic reference set, and that for the "SGLOW" scenario.

Table 3a: Median and 5th and 95th percentile values for four candidate OMPs tuned so that median 10-year average commercial TAC =2030 MT, 2245 MT, 2401 MT and 2596 MT, as well as for a CC=Zero scenario (zero commercial+recreational+poaching). Results are for the full stochastic integration over the Reference Set.

		CC=Zero	**OMP Tuning 2030 MT**	**OMP Tuning 2245 MT**	**OMP Tuning 2401 MT**	**OMP Tuning 2596 MT**
10-yr Ave commercial TAC	A1-2	0 [0; 0]	30 [30; 30]	30 [30; 30]	30 [30; 30]	30 [30; 30]
	A3-4	0 [0; 0]	166 [130; 209]	186 [145; 234]	203 [158; 252]	222 [174; 267]
	A5-6	0 [0; 0]	40 [40; 40]	40 [40; 40]	40 [40; 40]	40 [40; 40]
	A7	0 [0; 0]	573 [460; 710]	633 [490; 774]	677 [523; 832]	728 [570; 866]
	A8	0 [0; 0]	1216 [1013; 1451]	1340 [1092; 1578]	1438 [1162; 1666]	1540 [1253; 1738]
	T	0 [0; 0]	2030 [1679; 2393]	2245 [1830; 2587]	2401 [1954; 2744]	2596 [2115; 2838]
2007-2009 Ave commercial TAC	T	0 [0; 0]	2043 [2021; 2144]	2100 [2021; 2229]	2151 [2021; 2229]	2223 [2048; 2229]
10-yr Ave offshore TAC	A1-2	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]
	A3-4	0 [0; 0]	75 [40; 120]	96 [55; 144]	113 [68; 162]	132 [84; 177]
	A5-6	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]
	A7	0 [0; 0]	573 [460; 710]	633 [490; 774]	677 [523; 832]	728 [570; 866]
	A8	0 [0; 0]	817 [613; 1051]	940 [692; 1178]	1038 [762; 1266]	1140 [853; 1138]
	T	0 [0; 0]	1438 [1080; 1812]	1655 [1241; 1997]	1811 [1364; 2165]	2005 [1526; 2248]
Ave Total Recreational Take	T	0 [0; 0]	228 [188; 279]	262 [202; 294]	281 [214; 308]	298 [232; 320]
Ave V commercial	A1-2	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]
	A3-4	0 [0; 0]	12 [9; 16]	13 [10; 18]	14 [11; 19]	16 [12; 20]
	A5-6	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]	0 [0; 0]
	A7	0 [0; 0]	17 [13; 22]	17 [14; 22]	18 [14; 22]	19 [15; 22]
	A8	0 [0; 0]	7 [5; 10]	7 [5; 9]	6 [4; 9]	6 [4; 9]
	T	0 [0; 0]	9 [7; 11]	9 [6; 11]	9 [6; 11]	9 [7; 10]
B_m**(16/06)**	A1-2	1.41 [0.12; 1.96]	0.80 [0.51; 1.33]	0.79 [0.50; 1.32]	0.78 [0.50; 1.31]	0.77 [0.49; 1.31]
	A3-4	1.45 [0.97; 3.03]	1.11 [0.66; 2.62]	1.06 [0.62; 2.58]	1.02 [0.58; 2.56]	0.99 [0.54; 2.53]
	A5-6	2.11 [0.90; 11.68]	1.79 [0.62; 11.31]	1.77 [0.61; 11.30]	1.77 [0.60; 11.28]	1.75 [0.59; 11.27]
	A7	2.65 [1.75; 4.80]	1.39 [0.49; 4.47]	1.26 [0.36; 3.26]	1.16 [0.26; 3.12]	1.07 [0.18; 2.99]
	A8	2.73 [1.88; 4.78]	1.18 [0.54; 2.98]	1.01 [0.39; 2.83]	0.90 [0.25; 2.69]	0.77 [0.13; 2.55]
	T	2.42 [1.69; 4.25]	1.36 [0.73; 3.10]	1.26 [0.62; 3.00]	1.16 [0.52; 2.92]	1.07 [0.43; 2.81]
B_m**(16/80)**	A1-2	0.44 [0.34; 0.62]	0.25 [0.16; 0.42]	0.25 [0.16; 0.42]	0.25 [0.15; 0.42]	0.24 [0.15; 0.42]
	A3-4	0.99 [0.66; 2.11]	0.76 [0.45; 1.82]	0.72 [0.42; 1.79]	0.70 [0.39; 1.78]	0.68 [0.37; 1.76]
	A5-6	0.46 [0.19; 2.53]	0.39 [0.13; 2.45]	0.39 [0.13; 2.45]	0.39 [0.13; 2.45]	0.38 [0.12; 2.44]
	A7	1.12 [0.72; 2.06]	0.61 [0.21; 1.48]	0.54 [0.15; 1.40]	0.51 [0.11; 1.34]	0.45 [0.07; 1.27]
	A8	3.09 [2.12; 5.51]	1.34 [0.61; 3.40]	1.14 [0.44; 3.24]	1.03 [0.28; 3.09]	0.88 [0.15; 2.94]
	T	1.41 [0.96; 2.48]	0.78 [0.41; 1.82]	0.72 [0.35; 1.76]	0.68 [0.30; 1.70]	0.61 [0.24; 1.64]

B_m(16/1910)	A1-2	0.02 [0.02; 0.03]	0.01 [0.01; 0.02]	0.01 [0.01; 0.02]	0.01 [0.01; 0.02]	0.01 [0.001; 0.02]
	A3-4	0.05 [0.03; 0.11]	0.04 [0.02; 0.09]	0.04 [0.02; 0.09]	0.03 [0.02; 0.09]	0.03 [0.002; 0.01]
	A5-6	0.03 [0.01; 0.16]	0.02 [0.01; 0.15]	0.02 [0.01; 0.15]	0.02 [0.01; 0.15]	0.02 [0.01; 0.15]
	A7	0.05 [0.03; 0.09]	0.03 [0.01; 0.07]	0.02 [0.01; 0.06]	0.02 [0.004; 0.06]	0.02 [0.003; 0.06]
	A8	0.16 [0.11; 0.28]	0.07 [0.03; 0.17]	0.06 [0.02; 0.17]	0.05 [0.01; 0.16]	0.04 [0.01; 0.15]
	T	0.07 [0.05; 0.13]	0.04 [0.02; 0.09]	0.04 [0.02; 0.09]	0.03 [0.02; 0.09]	0.03 [0.01; 0.08]
B_m(16)/ K_m^{curr}	A1-2	0.61 [0.28; 0.91]	-	0.32 [0.15; 0.50]	0.32 [0.15; 0.50]	0.31 [0.15; 0.49]
	A3-4	0.38 [0.22; 1.00]	-	0.29 [0.14; 0.93]	0.28 [0.74; 0.88]	0.27 [0.13; 0.83]
	A5-6	0.15 [0.07; 1.00]	-	0.13 [0.05; 1.13]	0.12 [0.05; 1.12]	0.12 [0.05; 1.00]
	A7	0.48 [0.32; 0.82]	-	0.23 [0.08; 0.50]	0.21 [0.05; 0.48]	0.19 [0.04; 0.46]
	A8	0.47 [0.29; 0.83]	-	0.18 [0.09; 0.36]	0.16 [0.06; 0.33]	0.13 [0.03; 0.31]
	T	0.40 [0.26; 0.86]	-	0.21 [0.12; 0.41]	0.19 [0.10; 0.39]	0.18 [0.09; 0.36]
Effort(15/06)	T		0.55 [0.25; 1.12]	0.72 [0.33; 1.72]	0.90 [0.37; 2.42]	1.16 [0.46; 3.76]

Table 3c: Median and 5th and 95th percentile values for the "2245" tuned OMP for the full stochastic integration over the Reference Set, as well as for the SGLOW and SGHI scenarios.

		Tuning 2245 MT Full stochastic	**Tuning 2245 MT SGLOW**	**Tuning 2245 MT SGHI**
10-yr Ave commercial TAC	A1-2	30 [30; 30]	30 [30; 30]	30 [30; 30]
	A3-4	186 [145; 234]	173 [139; 208]	198 [164; 239]
	A5-6	40 [40; 40]	40 [40; 40]	40 [40; 40]
	A7	633 [490; 774]	605 [480; 719]	659 [524; 809]
	A8	1340 [1092; 1578]	1257 [1064; 1438]	1410 [1213; 1626]
	T	2245 [1830; 2587]	2118 [1788; 2385]	2347 [2019; 2677]
B_m**(16/06)**	A1-2	0.79 [0.50; 1.32]	0.79 [0.51; 1.33]	0.78 [0.50; 1.30]
	A3-4	1.06 [0.62; 2.58]	0.95 [0.56; 2.01]	1.27 [0.73; 3.22]
	A5-6	1.77 [0.61; 11.30]	1.55 [0.55; 8.48]	2.12 [0.77; 13.56]
	A7	1.26 [0.36; 3.26]	1.25 [0.41; 3.10]	1.32 [0.33; 3.41]
	A8	1.01 [0.39; 2.83]	0.77 [0.33; 1.53]	1.54 [0.66; 3.20]
	T	1.26 [0.62; 3.00]	1.07 [0.54; 2.21]	1.54 [0.80; 3.48]
B_m**(16)/** K_m^{curr}	A1-2	0.32 [0.15; 0.50]	0.32 [0.15; 0.50]	0.31 [0.15; 0.50]
	A3-4	0.29 [0.14; 0.93]	0.33 [0.18; 1.07]	0.24 [0.13; 0.73]
	A5-6	0.13 [0.05; 1.13]	0.13 [0.05; 1.27]	0.12 [0.05; 0.86]
	A7	0.23 [0.08; 0.50]	0.25 [0.10; 0.51]	0.21 [0.07; 0.46]
	A8	0.18 [0.09; 0.36]	0.19 [0.09; 0.37]	0.17 [0.08; 0.36]
	T	0.21 [0.12; 0.41]	0.23 [0.14; 0.46]	0.19 [0.12; 0.37]

Table 3d: Median and 5th and 95th percentile values for the "2401" tuned OMP for the full stochastic integration over the Reference Set, as well as for the SGLOW scenario.

		Tuning 2401 MT Full stochastic	**Tuning 2401 MT SGLOW**
10-yr Ave commercial TAC	A1-2	30 [30; 30]	30 [30; 30]
	A3-4	203 [158; 252]	190 [151; 227]
	A5-6	40 [40; 40]	40 [40; 40]
	A7	677 [523; 832]	648 [514; 777]
	A8	1438 [1162; 1666]	1344 [1129; 1544]
	T	2401 [1954; 2744]	2277 [1918; 2551]
B_m**(16/06)**	A1-2	0.78 [0.50; 1.31]	0.79 [0.50; 1.32]
	A3-4	1.02 [0.58; 2.56]	0.91 [0.52; 1.97]
	A5-6	1.77 [0.60; 11.28]	1.54 [0.54; 8.46]
	A7	1.16 [0.26; 3.12]	1.13 [0.30; 2.96]
	A8	0.90 [0.25; 2.69]	0.65 [0.19; 1.41]
	T	1.16 [0.52; 2.92]	1.00 [0.45; 2.11]
B_m**(16)/** K_m^{curr}	A1-2	0.32 [0.15; 0.50]	
	A3-4	0.28 [0.74; 0.88]	
	A5-6	0.12 [0.05; 1.12]	
	A7	0.21 [0.05; 0.48]	
	A8	0.16 [0.06; 0.33]	
	T	0.19 [0.10; 0.39]	

Table 4: Robustness test results using the "2245 MT" tuned OMP. Median values are presented with values in parenthesis being the 5th and 95th %iles. These results refer to the resource as a whole. Tests marked * involve refitting the assessment model; other tests use the Reference Set of operating models, changing only some assumptions regarding the future.

TEST		***B*(16/06)**	TAC_{comm}^{ave}	**Effort(16/06)**
Reference Set		**1.26 [0.62; 3.00]**	**2245 [1831; 2587]**	**0.72 [0.33; 1.72]**
CC fixed (2210 MT)		**1.24 [0.53; 2.98]**	**2245 [2245; 2245]**	**0.91 [0.34; 3.11]**
CC flexible (2210 MT)		**1.23 [0.52; 2.98]**	**2245 [2245; 2245]**	**0.70 [0.28; 2.26]**
Priority I tests				
NS1*	Male natural survivorship = 0.88	1.22 [0.52; 3.29]	2230 [1835; 2580]	1.01 [0.49; 2.22]
NS2*	Male natural survivorship = 0.92	1.27 [0.60; 3.66]	1954 [1632; 2458]	0.57 [0.25; 1.31]
D2*	Discard mortality = 0.20	1.24 [0.56; 3.89]	2145 [1755; 2524]	0.64 [0.29; 1.55]
SG2*	1910-1967 growth = 68-88 average	1.28 [0.60; 3.54]	2054 [1696; 2491]	0.56 [0.25; 1.42]
W1 future*	Future walkouts continue at 1990s rate	1.19 [0.51; 3.17]	2203 [1807; 2585]	0.66 [0.32; 1.48]
W1 future* With Zero future commercial catch	Future walkouts continue at 1990s rate	2.27 [1.48; 4.30]	0 [0; 0]	0 [0; 0]
Priority II tests				
SG low	Future somatic growth remains low for all simulations	1.07 [0.54; 2.21]	2118 [1788; 2385]	0.73 [0.31; 1.66]
SG1	Adult growth is 0.5mm more than thought	1.06 [0.40; 3.61]	2266 [1940; 2838]	0.97 [0.38; 3.48]
SG3	Pre-1990 growth shifted down to 1990+ average level	1.55 [0.70; 4.13]	2284 [1900; 2709]	0.72 [0.32; 1.78]
D3	Discard mortality increases 5 yrs prior to min size change	1.17 [0.56; 3.24]	2192 [1797; 2587]	0.68 [0.32; 1.57]
B1	CPUE 2007+ stays constant	1.25 [0.60; 2.99]	2252 [1835; 2594]	0.89 [0.49; 1.55]
B3	Future adult somatic growth 0.5mm less than reported	0.84 [0.41; 2.09]	2113 [1728; 2518]	1.03 [0.45; 2.53]
E1	R drops 50% for 3 years, once in 1998-2006	1.03 [0.49; 2.54]	2203 [1805; 2568]	0.85 [0.35; 2.10]
E3	25% all lobsters die once during 2006-2015	0.81 [0.35; 2.31]	2125 [1699; 2540]	1.02 [0.38; 2.88]
P1	Poaching reduced next 5 years to 200 MT	1.32 [0.68; 3.07]	2245 [1840; 2587]	0.67 [0.31; 1.46]

Table 5: Robustness test results using the "2245 MT" tuned OMP. Median values are presented with values in parenthesis being the 5th and 95th %iles. These results refer to the individual super-areas *B*(16/06) values.

	A12	A34	A56	A7	A8
Reference Set	0.79 [0.50; 1.32]	1.06 [0.62; 2.58]	1.78 [0.61; 11.29]	1.26 [0.36; 3.26]	1.06 [0.39; 2.83]
CC fixed (2210 MT)	0.77 [0.48; 1.30]	1.22 [0.77; 2.80]	1.75 [0.56; 11.26]	1.05 [0.20; 3.19]	0.93 [0.18; 2.82]
CC flexible (2210 MT)	0.77 [0.48; 1.30]	1.05 [0.58; 2.60]	1.75 [0.58; 11.26]	1.23 [0.36; 3.31]	0.95 [0.19; 2.86]
NS1*	0.81 [0.51; 1.33]	1.00 [0.50; 3.67]	1.30 [0.22; 19.32]	2.06 [0.88; 4.70]	0.79 [0.21; 2.42]
NS2*	0.77 [0.54; 1.23]	0.98 [0.54; 4.54]	1.08 [0.47; 11.56]	1.51 [0.39; 3.85]	1.01 [0.31; 3.13]
D2*	0.78 [0.50; 1.33]	0.88 [0.42; 5.17]	1.10 [0.34; 18.29]	1.49 [0.42; 3.93]	0.99 [0.37; 2.78]
SG2*	0.66 [0.53; 0.85]	0.94 [0.44; 4.19]	1.26 [0.29; 20.56]	1.42 [0.30; 3.96]	1.11 [0.46; 2.97]
W1 future*	0.79 [0.51; 1.32]	0.78 [0.30; 3.53]	0.86 [0.02; 17.77]	1.36 [0.55; 3.33]	1.02 [0.41; 2.82]
W1 future* with zero future commercial catch	1.34 [1.05; 1.89]	1.20 [0.68; 4.06]	1.32 [0.16; 18.42]	2.54 [1.64; 4.70]	2.43 [1.60; 4.45]
SG low	0.79 [0.51; 1.33]	0.95 [0.56; 2.01]	1.55 [0.55; 8.48]	1.25 [0.41; 3.10]	0.77 [0.33; 1.53]
SG1	1.95 [0.99; 3.52]	1.00 [0.56; 3.42]	1.13 [0.37; 16.70]	1.12 [0.15; 3.54]	0.50 [0.18; 2.58]
SG3	0.87 [0.53; 1.49]	1.55 [0.82; 4.35]	2.30 [0.53; 24.07]	1.29 [0.32; 3.30]	1.12 [0.40; 2.59]
D3	0.79 [0.51; 1.34]	0.88 [0.44; 3.62]	1.04 [0.34; 15.37]	1.36 [0.41; 3.42]	0.99 [0.44; 2.60]
B1	0.79 [0.50; 1.32]	1.05 [0.61; 2.58]	1.71 [0.61; 11.30]	1.31 [0.34; 3.31]	1.00 [0.36; 2.28]
B3	0.58 [0.36; 0.99]	0.85 [0.52; 1.97]	1.46 [0.51; 8.29]	0.93 [0.23; 2.47]	0.56 [0.15; 1.81]
E1	0.66 [0.42; 1.12]	0.94 [0.57; 2.21]	1.55 [0.56; 9.88]	1.09 [0.27; 3.01]	0.77 [0.30; 2.19]
E3	0.52 [0.29; 0.96]	0.78 [0.43; 2.01]	1.33 [0.43; 0.78]	0.89 [0.17; 2.69]	0.58 [0.16; 1.94]
P1	0.82 [0.54; 1.35]	1.07 [0.62; 2.59]	1.79 [0.62; 11.31]	1.31 [0.40; 3.33]	1.13 [0.50; 2.98-