

Testing an alternative CMP approach where the 2019 and 2020 TACs are fixed at 10% above the 2018 value

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Summary

Results for an Alternative CMP where the 2019 and 2020 TACs are fixed at the 2018 value plus 10% are compared to the Base CMPs. Simulations based on the Reference Set OMs suggest that the Alternative CMPs are likely to result in higher short-term TACs at the cost of a slightly more depleted *M. paradoxus* resource, but that in the long term both the catch and resource status are projected to be fairly similar for each Alternative and Base CMP option.

Introduction

A request has been received to evaluate the likely performance of a CMP where the 2019 and 2020 TACs are fixed at the 2018 value plus 10% (i.e. fixed at 146 431t). This document presents results for this Alternative CMP by comparing to those for the current Base CMP, for four different CMP options (cap of 150 000t, cap of 150 000t with the tuning parameter b increased by 10%, cap of 160 000t and cap of 160 000t with b increased by 10%). The current Base CMPs incorporate a rule that the 2019 TAC cannot be less than the 2018 TAC.

Results

Table 1 lists the performance statistics, with a graphic representation given in Figure 1. Figure 2 plots the median estimates and 90% probability intervals for the projected catch for each of the next four years. Figure 3 plots the approximate effort (taken here to be the *M. paradoxus* West Coast offshore fishing mortality rate) and CPUE projections, comparing the alternative and Base for each of the four cap/ b options. Table 2 lists the catch, effort and CPUE values after 4, 10, 15 and 15 years of projection.

Discussion

Simulations suggest that the Alternative CMPs will likely result in a slightly more depleted *M. paradoxus* in the short term, but that it will make very little difference to the projected resource status at the end of the 25-year projection period. Similarly, higher TAC can (naturally) be expected over the next four years with the Alternative CMPs, but TAC projections for the long term are very similar (Table 1 and Figure 1).

In future, median CPUE values are projected to increase, while median effort values decrease over time, for all these CMPs. CPUE projections are very similar for the Alternative compared to the Base CMPs (Figure 3), as are approximate effort projections. However, with a cap of 150 000t the projected effort for the Alternative CMPs are a little higher in 2019 and 2020 than for the Base CMPs, although the level is still projected to be lower than at present (2017). Table 2 shows that, as might be expected, CMPs that yield higher TACs require relatively higher effort levels and lead to relatively lower CPUE values.

These Alternative vs Base comparisons will also need to be conducted for robustness tests.

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Table 1: Performance statistics for the Base ($TAC_{2019} \geq TAC_{2018}$) and the Alternative CMP (2019 and 2020 TACs are fixed at $TAC_{2018} + 10\%$). All statistics are reported as medians of the equally weighted simulations from the nine RS models (i.e. medians of 9x100 values) with their 90% probability intervals, except for the second columns under TAC_{av} (25 yrs) and TAC_{av} (4 yrs) where the means and standard deviations are also listed.

			<i>M. paradoxus</i>						<i>M. capensis</i>						
Cap	b	Row	B_{2042}/B_{MSY}		B_{2022}/B_{MSY}		B_{low}/B_{MSY}		B_{2042}/B_{MSY}		B_{2022}/B_{MSY}		B_{low}/B_{MSY}		
Base	150	+0%	1	2.94	(1.54,5.16)	2.21	(1.17,3.53)	1.58	(1.03,2.20)	3.06	(1.09,6.76)	2.96	(0.40,5.20)	2.44	(0.32,4.52)
		+10%	2	2.87	(1.48,5.15)	2.14	(1.09,3.45)	1.54	(0.96,2.19)	3.04	(1.05,6.76)	2.96	(0.39,5.19)	2.44	(0.32,4.52)
	160	+0%	3	2.72	(1.42,4.83)	2.20	(1.17,3.49)	1.52	(0.99,2.15)	3.01	(0.96,6.71)	2.96	(0.40,5.20)	2.41	(0.32,4.52)
		+10%	4	2.63	(1.30,4.80)	2.12	(1.07,3.37)	1.45	(0.89,2.13)	2.98	(0.90,6.67)	2.95	(0.39,5.19)	2.39	(0.32,4.52)
Alt.	150	+0%	5	2.93	(1.55,5.15)	2.12	(1.01,3.46)	1.57	(0.96,2.19)	3.06	(1.07,6.76)	2.95	(0.39,5.18)	2.44	(0.32,4.52)
		+10%	6	2.87	(1.48,5.15)	2.12	(1.01,3.46)	1.53	(0.90,2.18)	3.04	(1.03,6.76)	2.94	(0.39,5.18)	2.44	(0.32,4.52)
	160	+0%	7	2.71	(1.42,4.82)	2.11	(1.01,3.43)	1.50	(0.92,2.15)	3.01	(0.94,6.71)	2.95	(0.39,5.18)	2.41	(0.32,4.52)
		+10%	8	2.63	(1.31,4.81)	2.10	(1.01,3.43)	1.45	(0.86,2.14)	3.00	(0.89,6.67)	2.94	(0.38,5.18)	2.39	(0.32,4.52)
Species combined															
Cap	b	Row	TAC_{av} (25 yrs)				TAC_{av} (4 yrs)				AAV(25 years)		AAV(4 years)		
			Median	(90% P.I)	Mean	(sd)	Median	(90% P.I)	Mean	(sd)					
Base	150	+0%	1	145.79	(135.14,149.57)	144.30	(4.95)	138.15	(124.08,149.00)	137.230	(8.30)	0.019	(0.005,0.041)	0.035	(0.024,0.056)
		+10%	2	147.89	(137.75,150.12)	146.56	(4.12)	145.79	(125.62,149.44)	142.640	(7.71)	0.013	(0.005,0.037)	0.031	(0.030,0.056)
	160	+0%	3	151.73	(138.04,158.45)	150.28	(6.71)	138.61	(124.08,155.13)	138.990	(10.24)	0.027	(0.008,0.049)	0.048	(0.024,0.063)
		+10%	4	154.94	(142.41,159.60)	153.43	(5.79)	148.49	(125.62,156.94)	145.940	(10.19)	0.022	(0.008,0.044)	0.048	(0.031,0.068)
Alt.	150	+0%	5	146.81	(135.69,149.96)	145.35	(4.89)	145.81	(140.47,148.48)	144.850	(3.66)	0.02	(0.005,0.043)	0.043	(0.031,0.056)
		+10%	6	148.56	(139.26,149.96)	147.03	(3.99)	148.48	(141.47,148.48)	146.130	(3.39)	0.014	(0.005,0.038)	0.031	(0.031,0.056)
	160	+0%	7	152.54	(138.73,159.13)	151.21	(6.70)	146.12	(140.47,153.48)	146.630	(5.50)	0.029	(0.008,0.050)	0.048	(0.038,0.062)
		+10%	8	155.46	(142.81,159.13)	153.73	(5.66)	151.13	(141.47,153.48)	148.800	(5.29)	0.021	(0.008,0.045)	0.048	(0.038,0.062)

Table 2: Print out of the catch, effort (*M. paradoxus* West Coast fishing mortality rate) and CPUE values after 4, 10, 15 and 25 years of projections. The values are the medians and 90% probability intervals of the equally weighted 9x100 values across the nine RS OMs. Note that the catch output here (as well as in the rest of this document) include an extra 260t that account for the midwater hake by-catch from the horse mackerel fishery, which is added to the catch in the projection code after the TAC allocations have been made. In future this by-catch amount will be removed before calculating statistics, but given the small size it was not considered worthwhile to immediately recalculate all the figures and tables in this document. Both effort and CPUE are reported relative to their 2017 values.

Cap	b	CMP	Catch in 2022 (4 years)	Catch in 2028 (10 years)	Catch in 2033 (15 years)	Catch in 2042
150	+0%	Base	145.47 (115.10, 150.26)	150.26 (127.33, 150.26)	150.26 (123.35, 150.26)	150.26 (126.82, 150.26)
		Alt	146.96 (132.90, 150.26)	150.26 (123.33, 150.26)	150.26 (123.35, 150.26)	150.26 (126.30, 150.26)
	+10%	Base	150.26 (118.38, 150.26)	150.26 (132.43, 150.26)	150.26 (129.76, 150.26)	150.26 (133.06, 150.26)
		Alt	150.26 (132.90, 150.26)	150.26 (130.17, 150.26)	150.26 (129.57, 150.26)	150.26 (132.95, 150.26)
160	+0%	Base	146.75 (115.10, 160.26)	160.26 (127.61, 160.26)	160.26 (124.74, 160.26)	160.26 (126.82, 160.26)
		Alt	147.68 (132.90, 160.26)	160.26 (123.60, 160.26)	160.26 (124.76, 160.26)	160.26 (125.80, 160.26)
	+10%	Base	158.51 (118.38, 160.26)	160.26 (132.50, 160.26)	160.26 (130.97, 160.26)	160.26 (131.78, 160.26)
		Alt	158.83 (132.90, 160.26)	160.26 (131.22, 160.26)	160.26 (129.66, 160.26)	160.26 (131.59, 160.26)
			Effort in 2022 (4 years)	Effort in 2028 (10 years)	Effort in 2033 (15 years)	Effort in 2042
150	+0%	Base	0.64 (0.43, 1.01)	0.63 (0.38, 1.11)	0.58 (0.36, 1.09)	0.56 (0.33, 1.05)
		Alt	0.67 (0.44, 1.10)	0.63 (0.38, 1.10)	0.59 (0.36, 1.10)	0.56 (0.33, 1.05)
	+10%	Base	0.68 (0.44, 1.08)	0.65 (0.39, 1.11)	0.60 (0.36, 1.12)	0.57 (0.33, 1.07)
		Alt	0.69 (0.44, 1.14)	0.65 (0.38, 1.11)	0.60 (0.36, 1.12)	0.57 (0.33, 1.07)
160	+0%	Base	0.65 (0.45, 1.05)	0.67 (0.40, 1.19)	0.63 (0.39, 1.12)	0.62 (0.37, 1.11)
		Alt	0.69 (0.46, 1.10)	0.68 (0.40, 1.20)	0.63 (0.40, 1.11)	0.62 (0.37, 1.12)
	+10%	Base	0.70 (0.47, 1.13)	0.71 (0.42, 1.21)	0.66 (0.40, 1.17)	0.64 (0.37, 1.15)
		Alt	0.72 (0.47, 1.15)	0.71 (0.42, 1.21)	0.66 (0.40, 1.18)	0.64 (0.38, 1.15)
			CPUE in 2022 (4 years)	CPUE in 2028 (10 years)	CPUE in 2033 (15 years)	CPUE in 2041
150	+0%	Base	1.18 (0.71, 2.20)	1.27 (0.71, 2.32)	1.42 (0.80, 2.29)	1.45 (0.78, 2.62)
		Alt	1.13 (0.67, 2.16)	1.25 (0.71, 2.31)	1.42 (0.80, 2.28)	1.45 (0.77, 2.61)
	+10%	Base	1.14 (0.69, 2.15)	1.25 (0.70, 2.31)	1.39 (0.79, 2.28)	1.43 (0.77, 2.61)
		Alt	1.13 (0.67, 2.15)	1.24 (0.70, 2.29)	1.39 (0.78, 2.28)	1.43 (0.77, 2.61)
160	+0%	Base	1.17 (0.70, 2.17)	1.24 (0.70, 2.29)	1.37 (0.78, 2.26)	1.38 (0.75, 2.47)
		Alt	1.13 (0.67, 2.16)	1.23 (0.70, 2.27)	1.37 (0.78, 2.24)	1.37 (0.76, 2.45)
	+10%	Base	1.14 (0.68, 2.15)	1.21 (0.68, 2.25)	1.34 (0.76, 2.20)	1.35 (0.74, 2.46)
		Alt	1.12 (0.67, 2.15)	1.20 (0.68, 2.22)	1.34 (0.76, 2.19)	1.35 (0.74, 2.44)

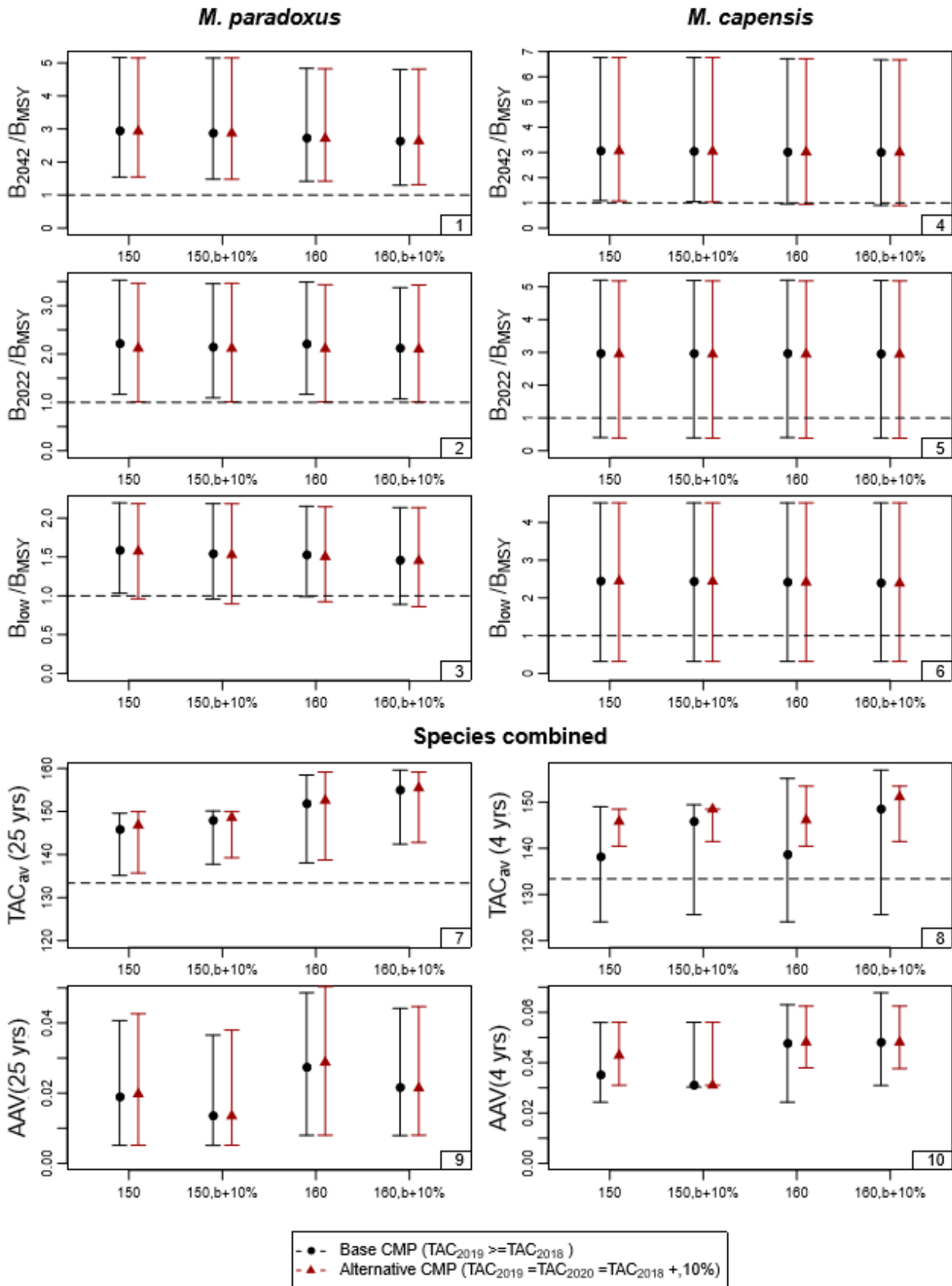


Figure 1: Zeh plots of the performance statistics from Table 1. The statistics are B^{SP}/B_{MSY} for 2042 and 2022 (i.e. at the planned end of OMP2018 application), $B^{SP}(low)/B_{MSY}$ (the lowest value of this statistic in the projection period to 2042), TAC_{av} (the average catch over the projection period (25 years) and over the next four years) and AAV (the average inter-annual proportional change in catch over the projection period (25 years) and over the next four years). Medians and 90% probability intervals are shown.

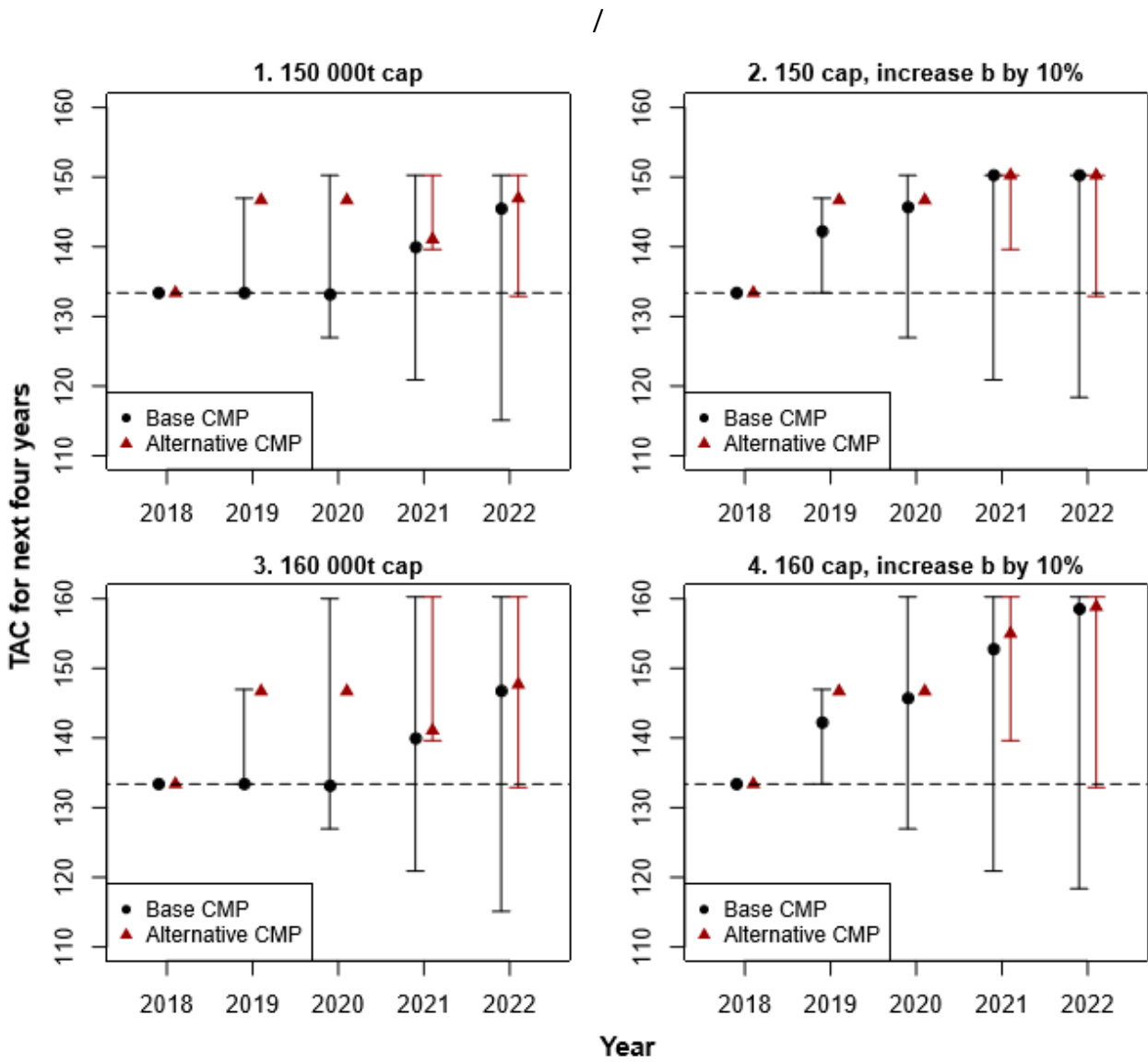


Figure 2: Median estimates and 90% probability intervals for the projected catch for each of the next four years (i.e. the planned life span of OMP2018) for the Base CMP and the alternative CMP.

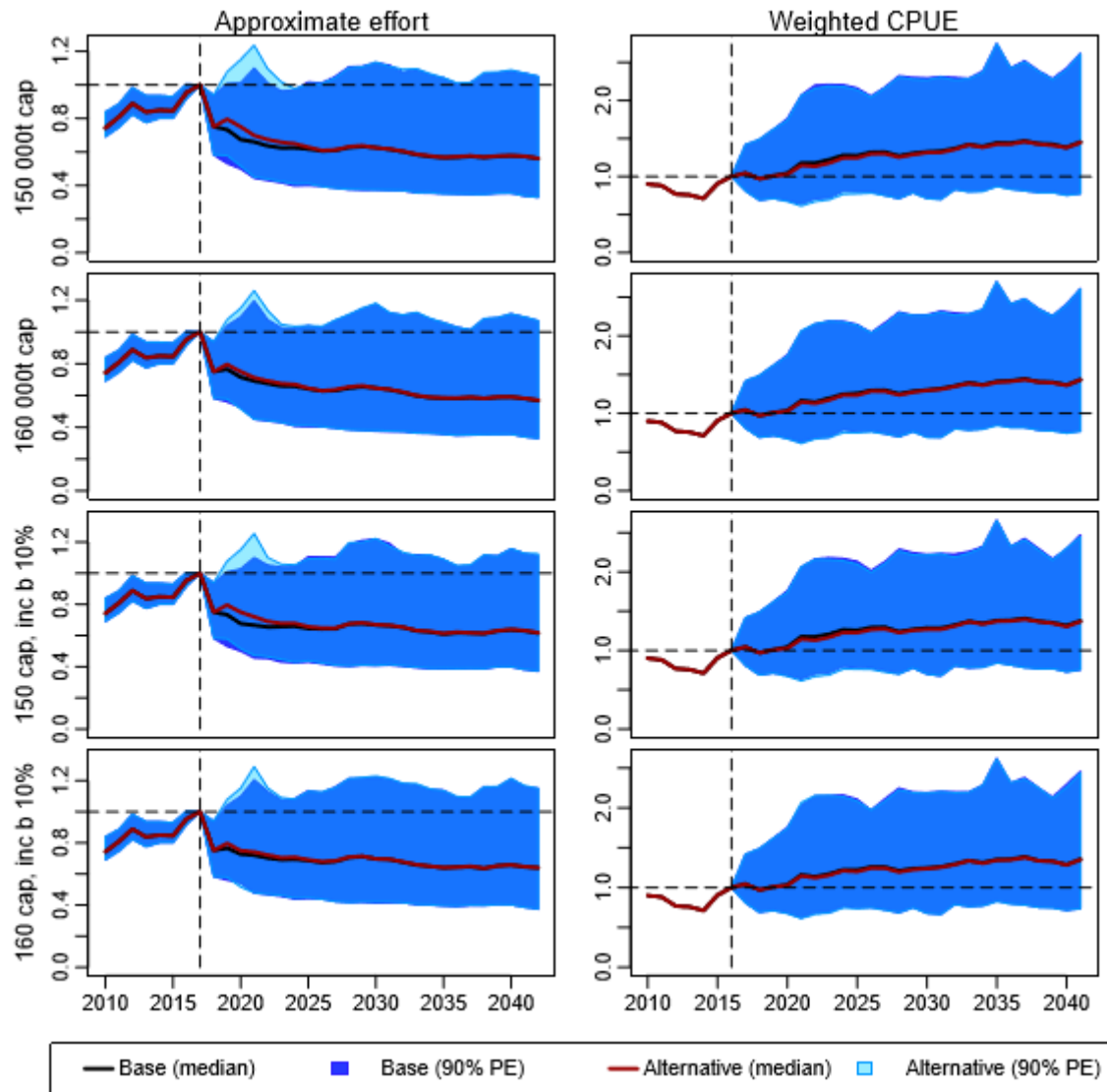


Figure 3: Projected trajectories for effort (left column) and CPUE (right column). In each plot, the black line and dark blue shaded area show the median trajectory and 90% probability envelop (PE) for the Base CMP and the red line with light blue shading the median trajectory and 90% PE for the alternative CMP. The area of overlap is shown by an intermediate blue. The measure of effort is taken to be the *M. paradoxus* West Coast offshore fishing mortality rate. The effort series are normalised to be one in 2017 (last year in the OM) and the CPUE series normalised to be one in 2016 (last year of data currently available).