The Effect of a Cap on the TAC and restricting the 3-yr Maximum Decline in the TAC in Candidate Management Procedure Testing for the South African Hake Resource

RA Rademeyer and DS Butterworth

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Abstract

Two possible variants suggested at the last DWG meeting to the Base Case hake CMP structure are examined. The results obtained suggest no need to modify this baseline structure.

Introduction

At the last DWG meeting, four tuning options for a Base Case CMP structure (CMPf) were agreed for examination as final candidates. However industry also requested consideration of two variations of that Base Case structure:

i) inclusion of a 160 000t cap (upper bound) on the hake TAC; and

ii) inclusion of a constraint that limited the extent of TAC reduction over any three successive years to 20%.

This document reports the results of the consequent investigation, which was conducted based on the CMPf1a tuning (a median average catch over 2011-2020 of 137 000t, and a 5% maximum downward constraint on the TAC change over successive years unless a penalty provision comes into play).

Results and Discussion

For ease of reference, the full set of CMPs considered in this document are listed in Table 1a, with their control parameter values given in Table 1b.

Cap of 160 000t on future TACs

Results for two variants of the Base Case CMP (CMPf1a) which include a cap of 160 000t on future TACs are reported in Table 2. All three CMPs are tuned to a median average TAC over the next decade of 137 000 t. In CMPf6a, the value for the parameter *p* (equation 1, Rademeyer and Butterworth, 2010) is decreased from 0.75 to 0.65.

Capping the TAC to 160 000t has very little effect of the median average TAC over the next decade or on the risk of *M. paradoxus* falling below its 2007 level for both the RS and Rob13 (a reduction in carrying capacity in the past). It does however bring the lowest TAC up by about 3 000t for the RS.

Results for CMPf6a show again that decreasing the parameter *p* below 0.75 increases the risk substantially under Rob13, even when the cap of 160 000t is included.

Constraint on the maximum allowed TAC decline over any three successive years of 20%

Fig. 1 plots the distribution of three-year TAC change under the RS and Rob13 for CMPf1a and for CMPf7a which includes a 20% constraint on the three-year TAC change. Table 3 compares results for these two CMPs under the RS and Rob13.

Three new statistics are included in the standard results table:

1) the probability of a decline in the TAC greater than 20% over the 2011-2013 period;
2) the probability of a decline in the TAC greater than 20% over the 2012-2014 period; and
3) the median and 97.5% PI probability of a decline in the TAC greater than 20% over any consecutive three years for such periods commencing 2011-2028.

In the absence of the constraint, there is little chance of a three-year TAC decline exceeding 20% over the next decade under the RS, though under Rob13 there is a sizable chance that this could occur. Imposing a constraint of 20% on this change hardly affects results for the RS, but unacceptable levels of further decline of *M. paradoxus* could occur under this scenario.

Conclusions

Given that these variations to the Base Case CMP made little difference to performance under the RS, and that the second led to poor performance under robustness test Rob13, following discussions with senior DAFF scientists, it has been decided to complete other robustness tests using the original CMPf structure without making either of the variations suggested.

Reference

Rademeyer RA and Butterworth DS. 2010. And yet Further Candidate Management Procedure testing for the South African hake resource. Unpublished report, Marine and Coastal Management, South Africa. FISHERIES/2010/AUGUST/SWG-DEM/43.

Table 1a: Summary of the CMPs tested.

CMP	Description
CMPf1a	**Base Case f**, tuned to average catch of **137 000t** over 2011-2020
CMPf5a	As **Base Case f1**, with 160 000t cap on TAC
CMPf6a	As **Base Case f1**, with 160 000t cap on TAC and p =0.65 for both spp
CMPf7a	As **Base Case f1**, with 20% constraint on 3-yr TAC decline

Table 1b: Tuning parameter values for each CMP presented. T^{para} applies up to the year 2015 and then declines linearly to zero in year 2018.

CMP	$\forall_{up}$	$\forall_{down}$	T^{para}	T^{cap}	w	a^{para}	a^{cap}	b^{para}	b^{cap}	c^{para}	c^{cap}	p^{para}	p^{cap}	Q_{min}	cap	Annual change constraints		constraint on 3-yr decline
CMPf1a	1.25	1.50	0.50%	0	1-0.5	114.3	40.0	60.0	20.0	180	20	0.75	0.75	0.75	-	+10%	-5%*	-
CMPf5a	1.25	1.50	0.50%	0	1-0.5	114.7	40.0	60.0	20.0	180	20	0.75	0.75	0.75	160	+10%	-5%*	-
CMPf6a	1.25	1.50	0.50%	0	1-0.5	112.3	40.0	60.0	20.0	180	20	0.65	0.65	0.75	160	+10%	-5%*	-
CMPf7a	1.25	1.50	0.50%	0	1-0.5	114.3	40.0	60.0	20.0	180	20	0.65	0.65	0.75	160	+10%	-5%*	20%

* can change up to -25% following equation (4) (Rademeyer and Butterworth, 2010)

Table 2: Projections results (either median or lower 2.5%ile) for a series of performance statistics for different CMPs under the RS and Rob13. This Table focuses in particular on the new Reference Case (CMPf1) and two variants including a 160 000t cap on future TACs (CMPf5a, cap of 160 000t; and CMPf6a, cap of 160 000t and p=0.65).

			RS	RS	RS	Rob13	Rob13	Rob13
		RSa	CMPf1a	CMPf5a	CMPf6a	CMPf1a	CMPf5a	CMPf6a
median	BS	avC: 2011-2020	137.0	137.0	137.0	87.9	88.0	91.0
low	para	$B^{sp}_{low}/B^{sp}_{2010}$	0.71	0.71	0.71	0.26	0.26	0.16
low	cap	$B^{sp}_{low}/B^{sp}_{2010}$	0.75	0.76	0.77	1.02	1.03	1.03
median	para	B^{sp}_{2020}/B_{MSY}	1.11	1.10	1.11	0.72	0.72	0.62
median	cap	B^{sp}_{2020}/B_{MSY}	2.87	2.89	2.89	2.11	2.11	2.04
median	BS	AAV	3.6	3.2	3.3	7.6	7.6	6.6
low	BS	lowest TAC (2011-2030)	94.5	97.3	95.2	31.4	31.5	41.1
		RSb						
median	BS	avC: 2011-2015	130.5	130.6	130.7			
low	para	$B^{sp}_{low}/B^{sp}_{2010}$	0.93	0.93	0.93			
low	cap	$B^{sp}_{low}/B^{sp}_{2010}$	0.80	0.80	0.80			
median	para	B^{sp}_{2020}/B_{MSY}	0.89	0.88	0.89			
median	cap	B^{sp}_{2020}/B_{MSY}	0.55	0.54	0.55			
median	BS	AAV	3.5	3.0	3.2			
low	BS	lowest TAC (2011-2030)	86.1	89.9	86.2			

Table 3: Projections results (either median or lower 2.5%ile) for a series of performance statistics for two CMPs under the RS and Rob13. This Table focuses in particular on the new Reference Case (CMPf1) and a variant (CMPf7a) which include a constraint on the maximum 3-year decline in TAC.

			RS CMPf1a	RS CMPf7a	Rob13 CMPf1a	Rob13 CMPf7a
		RSa				
median	BS	avC: 2011-2020	137.0	137.0	87.9	102.5
low	para	$B^{sp}_{low}/B^{sp}_{2010}$	0.71	0.70	0.26	0.00
low	cap	$B^{sp}_{low}/B^{sp}_{2010}$	0.75	0.75	1.02	0.00
median	para	B^{sp}_{2020}/B_{MSY}	1.11	1.10	0.72	0.42
median	cap	B^{sp}_{2020}/B_{MSY}	2.87	2.87	2.11	1.82
median	BS	AAV	3.6	3.6	7.6	3.7
low	BS	lowest TAC (2011-2030)	94.5	101.4	31.4	53.0
	BS	Prob decl >20% (2011-2014)	2.1	0.0	8.0	0.0
	BS	Prob decl >20% (2012-2015)	1.8	0.0	6.8	0.0
median	BS	Pdecl>20% (2011-2027)	0.0	0.0	16.7	0.0
high	BS	Pdecl>20% (2011-2027)	11.1	0.0	27.8	0.0
		RSb				
median	BS	avC: 2011-2015	130.5	130.7		
low	para	$B^{sp}_{low}/B^{sp}_{2010}$	0.93	0.93		
low	cap	$B^{sp}_{low}/B^{sp}_{2010}$	0.80	0.80		
median	para	B^{sp}_{2020}/B_{MSY}	0.89	0.88		
median	cap	B^{sp}_{2020}/B_{MSY}	0.55	0.55		
median	BS	AAV	3.5	3.3		
low	BS	lowest TAC (2011-2030)	86.1	98.8		
	BS	Prob decl >20% (2011-2014)	5.0	0.0		
	BS	Prob decl >20% (2012-2015)	10.0	0.0		
median	BS	Pdecl>20% (2011-2027)	0.0	0.0		
high	BS	Pdecl>20% (2011-2027)	11.1	0.0		

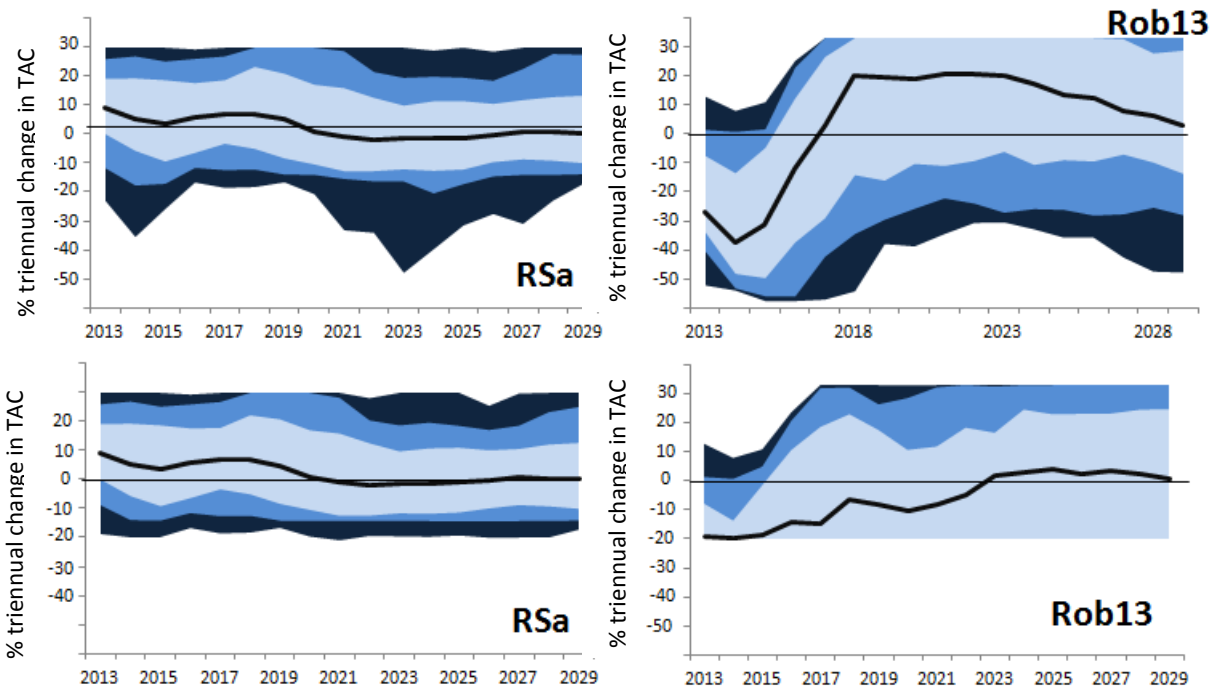

Fig. 1: **Full range**, 95, 75% PI and median of the 3-year TAC change under RSa and Rob13 for **CMPf1a** (top row) and **CMPf7a** which constrains any downward change in the TAC over three consecutive years to a maximum of 20% (bottom row).Note that the three lower percentiles coincide for **CMPf7a** under Rob13.