Further Gough OMP candidate results

Johnston, S.J.

KEY WORDS: Tristan rock lobster, Operational management Procedure, Gough island

Summary

This document provides further results for OMP candidates to be considered in the development of a revised OMP for the Tristan rock lobster fishery at Gough island.

Introduction

An OMP was first developed and agreed upon for Gough island in 2014, and used to set the TAC at this island for the first time in that season and again for the following 2015-2017 seasons. Johnston and Butterworth (2014) provides details of this OMP. The Gough OMP was updated in 2018 (Johnston and Butterworth 2018). Both these OMPs were target-based, with the TAC setting formula having the form:

$$TAC_{y+1} = TAC_y + \alpha(I_y^{rec} - I^{tar}) \quad (1)$$

where

I_y^{rec} is the average of the GLMM standardized CPUE over the last three seasons (*y*-2, *y*- 1, *y*),

I^{tar} is the CPUE target (OMP 2018 value = 6.0 kg/trap), and

α is the tuning parameter (OMP 2018 value =10).

A rule to control the inter-season TAC variation was also applied. Normally the percentage TAC change relative to the previous season is restricted to a maximum of either up 5% down 5%, i.e.:

If $TAC_{y+1} < 0.95TAC_y$ then $TAC_{y+1} = 0.95TAC_y$

If $TAC_{y+1} > 1.05TAC_y$ then $TAC_{y+1} = 1.05TAC_y$

However, in addition, an Exceptional Circumstances metarule for Gough (and Inaccessible) was to be applied under certain circumstances, where the 5% TAC decrease constraint could be widened to as much as 20% if the (catch rate) index dropped below a threshold level.

This metarule allows for the TAC to be reduced further than the usual inter-annual maximum 5% decrease. For the Gough OMP 2018 the Ilim value was set at 3.0 kg/trap.

Candidate OMP variants considered here:

Johnston (2021) provided some initial Gough CMP results. Following examination of these results, the island has initially requested the following:

- TAC(2021) not to exceed TAC(2020)=100t.
- Rollovers of 5t for each of the next three seasons (2021-2023) to be permitted (total rollover TAC of 15t).

In line with the above, three CMP variants are considered here for different Itar values:

1) VAR6: Itar=6 kg/trap).
2) VAR5.5: Itar=5.5 kg/trap
3) VAR5:Itar=5 kg/trap

It is evident that for VAR5.5 and VAR5, the future TAC trajectories show an initial increase in the expected TAC followed by a subsequent decrease. It would be preferable to try to "flatten" the TAC trajectory for improved industrial stability. To do this, one can alter the α value of equation (1) which controls how fast TACs can change from year to year in response to CPUE changes (the larger the α value, the greater the response). Variants are thus explored further by reducing the α value from 10 (the current and past value that has applied) to 4.

The CMPs reported here include only commercial CPUE as input into the OMP. These CMPs will be expanded shortly to include the biomass survey index data as well (as has been done for Tristan). As for Tristan, the biomass survey data will receive relatively less weight in the TAC generating formula.

Summary statistics

A number of summary statistics have been developed in order to compare the trade-offs and performances of alternate revised CMPs. Again, these are very similar to those used for the previous selections of OMPs.

- CR(2032) = catch rate expected in 2032 (in kg/gear/hour) in terms of the standardised GLMM.

- CR(2022) = catch rate expected in 2022 (in kg/gear/hour) in terms of the standardised GLMM.
- TAC(2021) = the TAC for the 2021 season.
- C_{ave} 5 = average annual catch (in MT) over the next 5 years (2021-2025).
- C_{ave} 10 = average annual catch (in MT) over the next 10 years (2021-2030).
- The *Bsp*(2032)/*K* = the spawning biomass at the start of 2033 relative to the pristine level (*K*). The median and lower 5%ile values are reported.

Each candidate CMP has been run for 100 simulations. The medians, and the 5th and 95th percentiles, of various management quantities of interest are reported.

Discussion

Table 2 reports comparisons of **Gough** CMP variants' expected performance results. All statistics reported below are median values unless otherwise stated. Figure 1 shows the catch, Bsp/K and catch rate (CR) trajectories for each of the VAR6, VAR5.5 and VAR5 (α-10) variants considered here. Table 3 reports the predicted median TAC values (MT) for the first 10 seasons (2021-2030) for the different variants. Some summary points:

- TAC(2021)=100t TAC plus 5t rollover = 105t expected catch.
- All the CMPs considered will result in Bsp/K(2033) median values of 0.78 and larger (the lower 5th percentile Bsp/K(2033) results in values of 0.46 and larger). For all CMP variants considered here, these values are considerable higher than the target median level of 0.66 and lower 5th percentile of 0.33 adopted for the previous OMP-2018.
- Lower Itar value (to either 5.5 or 5 kg/trap) will result in ~15-30% more catch in the next 10 years (compared with current Itar=6 kg/trap) for α = 10, and ~ 7-15% for α = 4. .
- Catch rates are expected to stabilise to between 5-6 kg/trap by the time of the 2034 season under an Itar=6 kg/trap. Catch rates will be somewhat reduced to at or slightly below 5 kg/trap for the lower Itar CMPs.
- Variants for which the α value is reduced to 4 produce more suitable "flatter" TAC trajectories, with at worst small expected TAC reductions later in the 10 year period

for Itar=5.5 kg/trap and more for Itar=5 kg/trap, as well as very little change to the Bsp and CR trajectories (Figures 2-4).

An obvious feature to notice is that the 2021 updated Gough assessment leads to far more optimistic than the assessment model used to evaluate Gough OMPs in 2018. OMP-2018 as evaluated in 2018 predicted a median Bsp(2033/K) of **0.66** (the target accepted then by the island management), whereas the exact same OMP evaluated with the new 2021 updated assessment predicts a median Bsp(2033/K) of **0.84**. If aiming for a similar level of risk when developing the new OMP-2021, then there is clearly scope for greater catches (which could be achieved by reducing the Itar value below 6 kg/trap); maintaining Itar=6kg/trap would lead to a considerable loss in catch without any consequential gain in resource safety.

References

Johnston, S.J. and Butterworth, D.S. 2014. Initial OMP candidates for the Inaccessible and Gough rock lobster fisheries. MARAM document, MARAM/Tristan/2014/FEB/03.

Johnston, S.J. and Butterworth, D.S. 2018. Initial updated 2018 OMPs for the Inaccessible and Gough islands. MARAM document, MARAM/Tristan/2018/JUL/09.

Johnston, S.J. 2021. Initial Gough OMP results. MARAM document, MARAM/Tristan/2021/JUN/08.

Table 1: Candidate OMP variants presented here.

	TAC(2021) <= 100t
Allow rollovers of 5t for the period 2021-2023 (15t rollover) Itar=**6.0** kg/trap, α=10	VAR6 (α=10) (var6.tpl)
Allow rollovers of 5t for the period 2021-2023 (15t rollover) Itar=**5.5** kg/trap, α=10	VAR5.5 (α=10) (var55.tpl)
Allow rollovers of 5t for the period 2021-2023 (15t rollover) Itar=**5.0** kg/trap, α=10	VAR5 (α=10) (var5.tpl)
VAR6 but α=4	VAR6 (α=4) (var6c.tpl)
VAR5.5 but α=4	VAR5.5 (α=4) (var55c.tpl)
VAR5 but α=4	VAR5 (α=4) (var5c.tpl)

Table 2: Comparison of **Gough** candidate OMP variants expected performance results. All statistics reported below are median values unless otherwise stated.

CMP	I^{tar} (kg/trap)	α	Inter-annual max TAC constraint	Ilim value (kg/trap)	CR(2022) (kg/trap)	CR(2032) (kg/trap)	TAC(2021)* (MT)	C_{ave} 5* (MT)	C_{ave} 10* (MT)	Lower 5%ile C_{ave} 10*	Median and Lower 5%ile *Bsp*(2033/K)
OMP-2018[#]	6.0	10	+5%,-5 to -20%	3.0	3.86	4.28	95	82	89	89	0.66 (0.33)
VAR6 (α=10) Itar=6.0 kg/trap Add 15t rollovers TAC(2021)<=100t	**6.0**	10	+5%,-5 to -20%	3.0	5.76	5.81	100+5 = 105	95+3 =98	87+1.5 =88.5	86+1.5= 87.5	0.84 (0.51)
VAR6 (α=4) Itar=6.0 kg/trap Add 15t rollovers TAC(2021)<=100t	**6.0**	4	+5%,-5 to -20%	3.0	5.74	5.54	100+5 = 105	98+3 =101	94+1.5 =95.5	91+1.5= 92.5	0.83 (0.50)
VAR5.5 (α=10) Itar=5.5 kg/trap Add 15t rollovers TAC(2021)<=100t	**5.5**	10	+5%,-5 to -20%	3.0	5.72	5.09	100+5 = 105	105+3 =108	102+1.5= 103.5	99+1.5= 100.5	0.81 (0.48)
VAR5.5 (α=4) Itar=5.5 kg/trap Add 15t rollovers TAC(2021)<=100t	**5.5**	4	+5%,-5 to -20%	3.0	5.72	5.04	100+5 =105*	102+3 =105	101+1.5 =102.5*	99+1.5 =100.5	0.81 (0.48)
VAR5 (α=10) Itar=5.0 kg/trap Add 15t rollovers TAC(2021)<=100t	**5.0**	10	+5%,-5 to -20%	3.0	5.69	4.43	100+5 = 105	110+3 =113	115+1.5= 116.5	110+1.5= 111.5	0.78 (0.46)
VAR5 (α=4) Itar=5.0 kg/trap Add 15t rollovers TAC(2021)<=100t	**5.0**	4	+5%,-5 to -20%	3.0	5.71	4.55	100+5= 105*	106+3 =111	109+1.5= 110.5	106+1.5 =107.5	0.79 (0.47)

*Here the first figure is the OMP TAC, the second is the rollover amount, the final is the combination of the two.

Table 3: Predicted median TAC values (MT) for the first 10 seasons (2021-2030) for the different CMP variants.

	2021*	2022*	2023*	2024	2025	2026	2027	2028	2029	2030
VAR6 (α=10) Itar=6.0 kg/trap Add 15t rollovers TAC(2021)<=100t	100+5= 105	97+5= 102	96+5= 101	93	89	85	81	79	74	74
VAR6 (α=4) Itar=6.0 kg/trap Add 15t rollovers TAC(2021)<=100t	100+5= 105	99+5= 104	98+5= 103	97	95	93	91	89	87	86
VAR5.5 (α=10) Itar=5.5 kg/trap Add 15t rollovers TAC(2021)<=100t	100+5= 105	102+5= 107	106+5 111	107	107	105	102	99	96	94
VAR5.5 (α=4) Itar=5.5 kg/trap Add 15t rollovers TAC(2021)<=100t	100+5= 105	101+5 =106	102+5 =107	103	103	102	102	101	100	99
VAR5 (α=10) Itar=5.0 kg/trap Add 15t rollovers TAC(2021)<=100t	100+5= 105	105+5= 110	110+5= 115	116	120	122	120	118	117	113
VAR5 (α=4) Itar=5.0 kg/trap Add 15t rollovers TAC(2021)<=100t	100+5= 105	103+5 =108	106+5 =111	109	111	112	113	113	113	113

*Here the first figure is the OMP TAC, the second is the rollover amount, the final is the combination of the two.

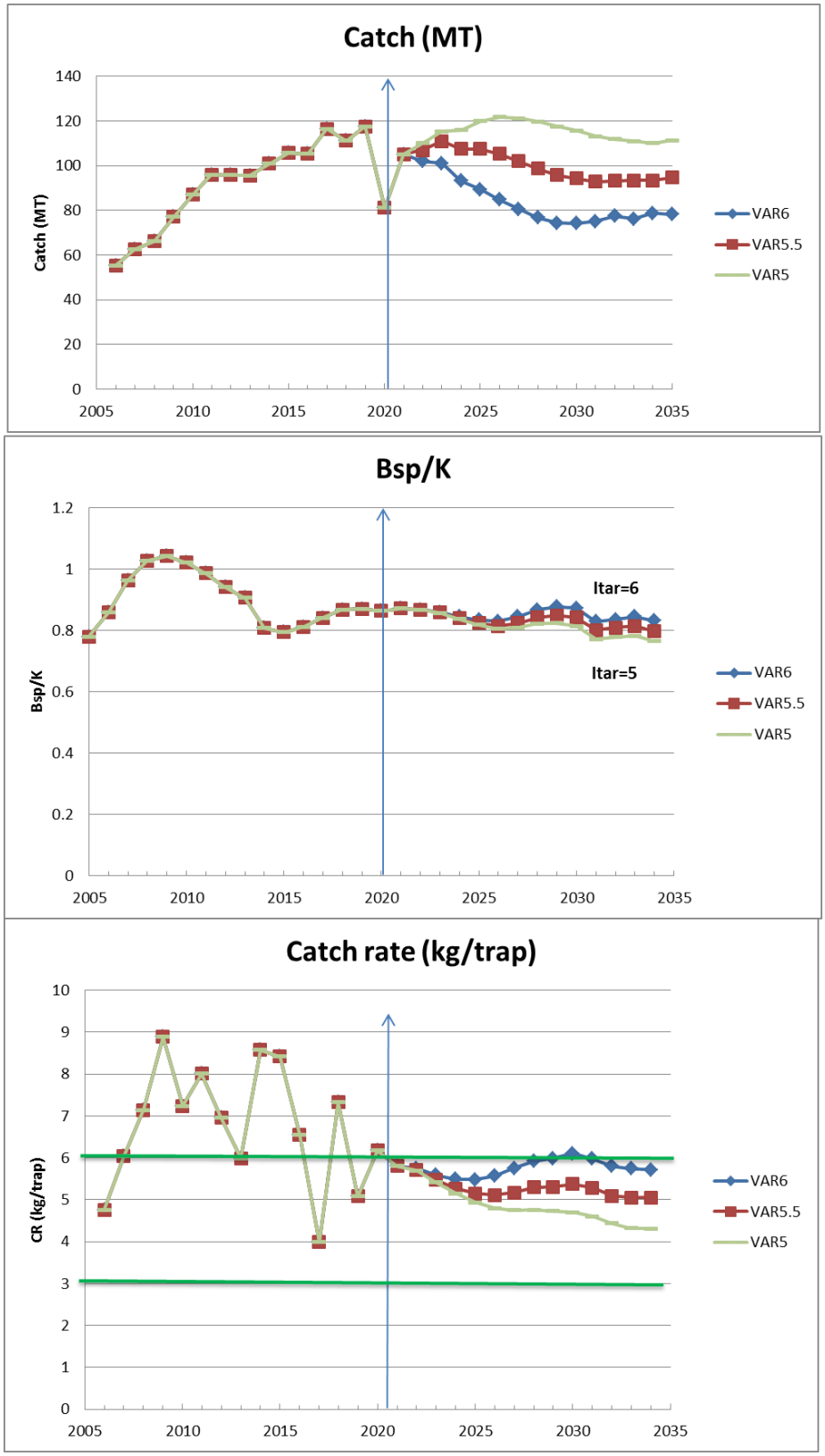

Figure 1: The Catch (MT), Bsp/K and catch rate (kg/trap) trajectories for each of the CMP variants (where α=10). (Note that the Catch of 81MT taken in 2020 is reflected in the catch plot, but the OMP algorithm uses TAC and hence an initial input value of TAC(2020)=100 MT.) The top plot of Catches also INLCUDES a 5t rollover for 2021-2023 seasons.

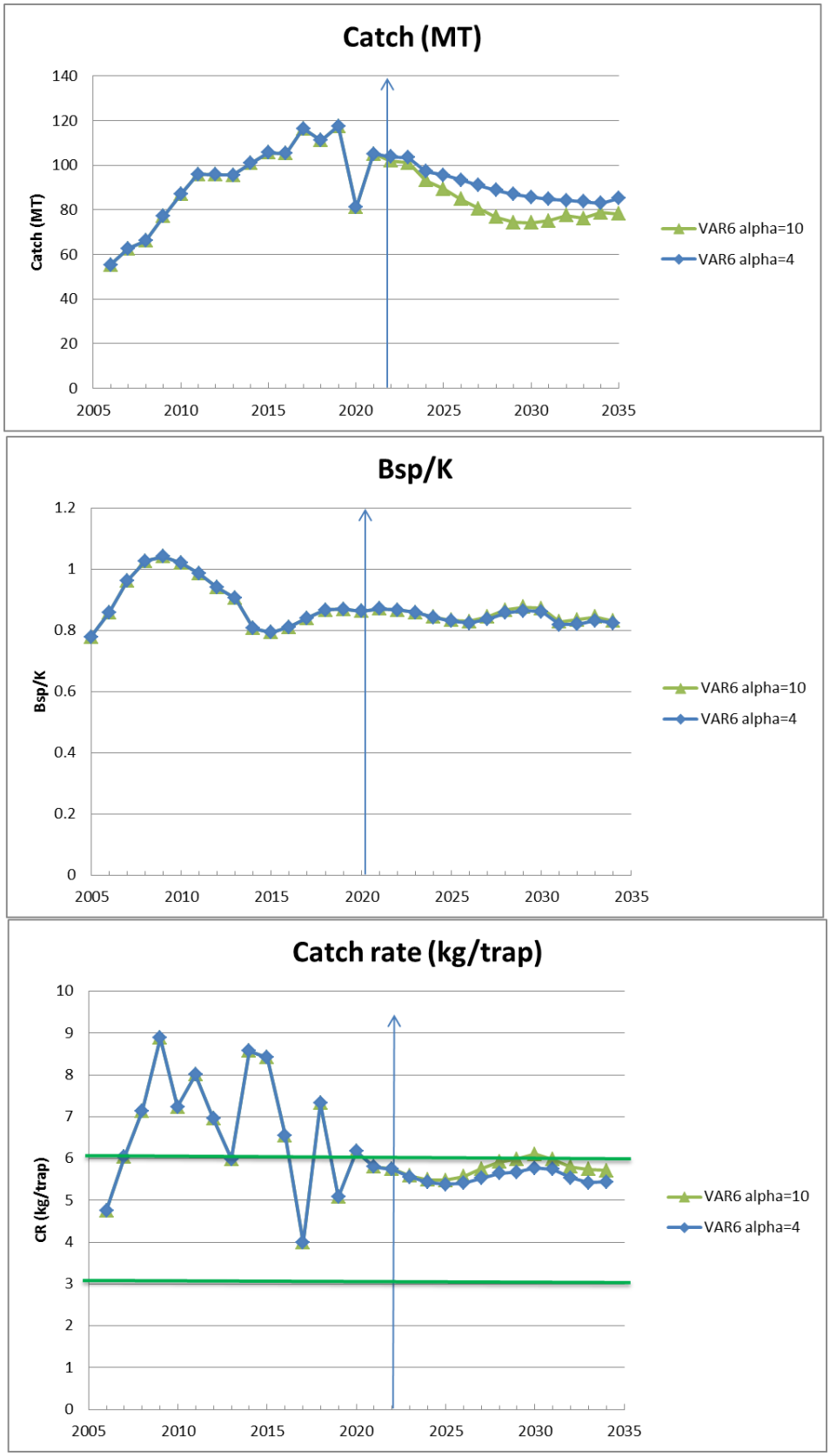

Figure 2: The Catch (MT), Bsp/K and catch rate (kg/trap) trajectories for variants of the Irar=**6.0** kg/trap CMP, for which the α value is reduced from 10 to 4. (Note that the Catch of 81MT taken in 2020 is reflected in the catch plot, but the OMP algorithm uses TAC and hence an initial input value of TAC(2020)=100 MT.) The top plot of Catches also INLCUDES a 5t rollover for 2021-2023 seasons.

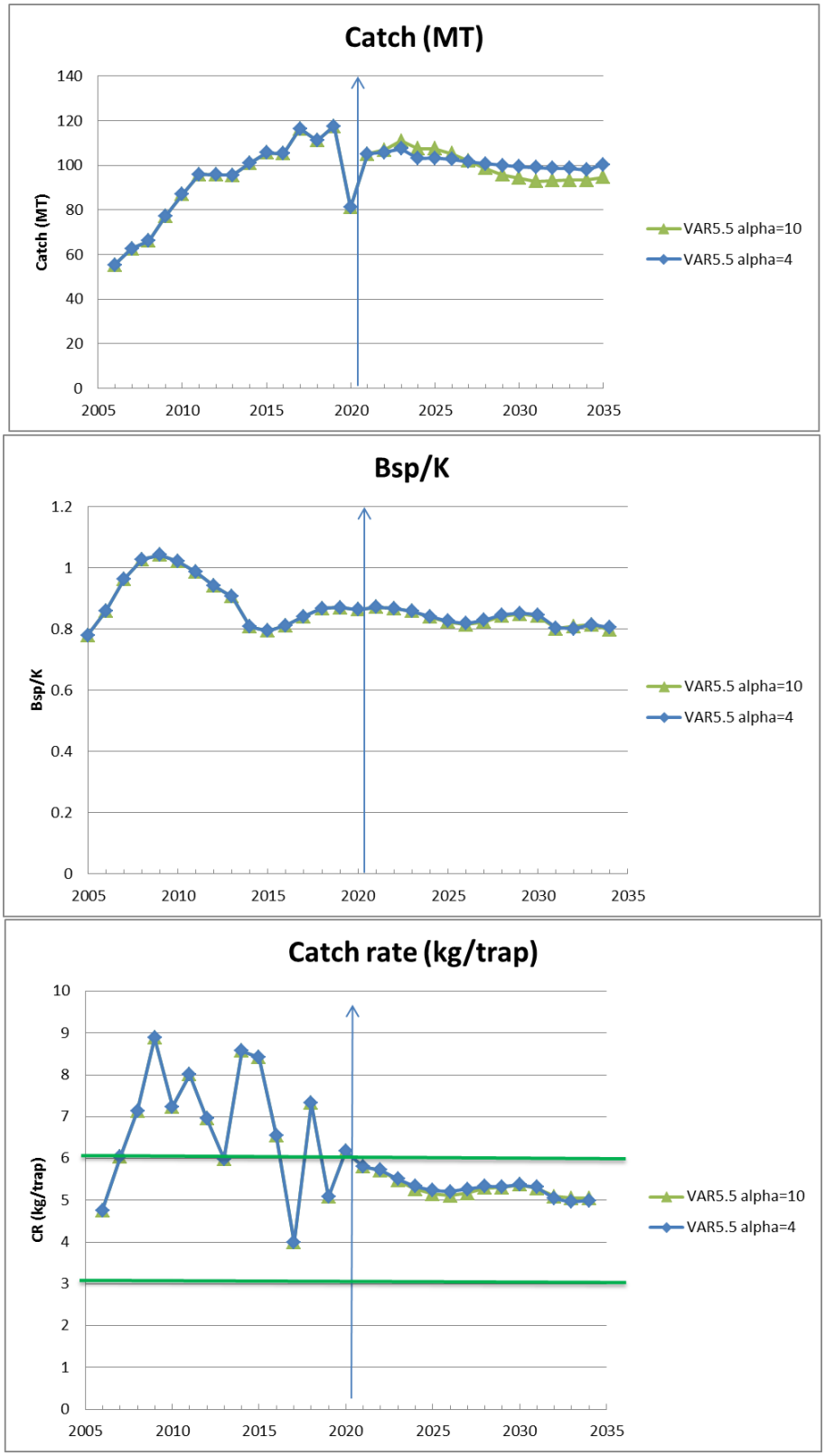

Figure 3: The Catch (MT), Bsp/K and catch rate (kg/trap) trajectories for variants of the Irar=**5.5** kg/trap CMP, for which the α value is reduced from 10 to 4. (Note that the Catch of 81MT taken in 2020 is reflected in the catch plot, but the OMP algorithm uses TAC and hence an initial input value of TAC(2020)=100 MT.) The top plot of Catches also INLCUDES a 5t rollover for 2021-2023 seasons.

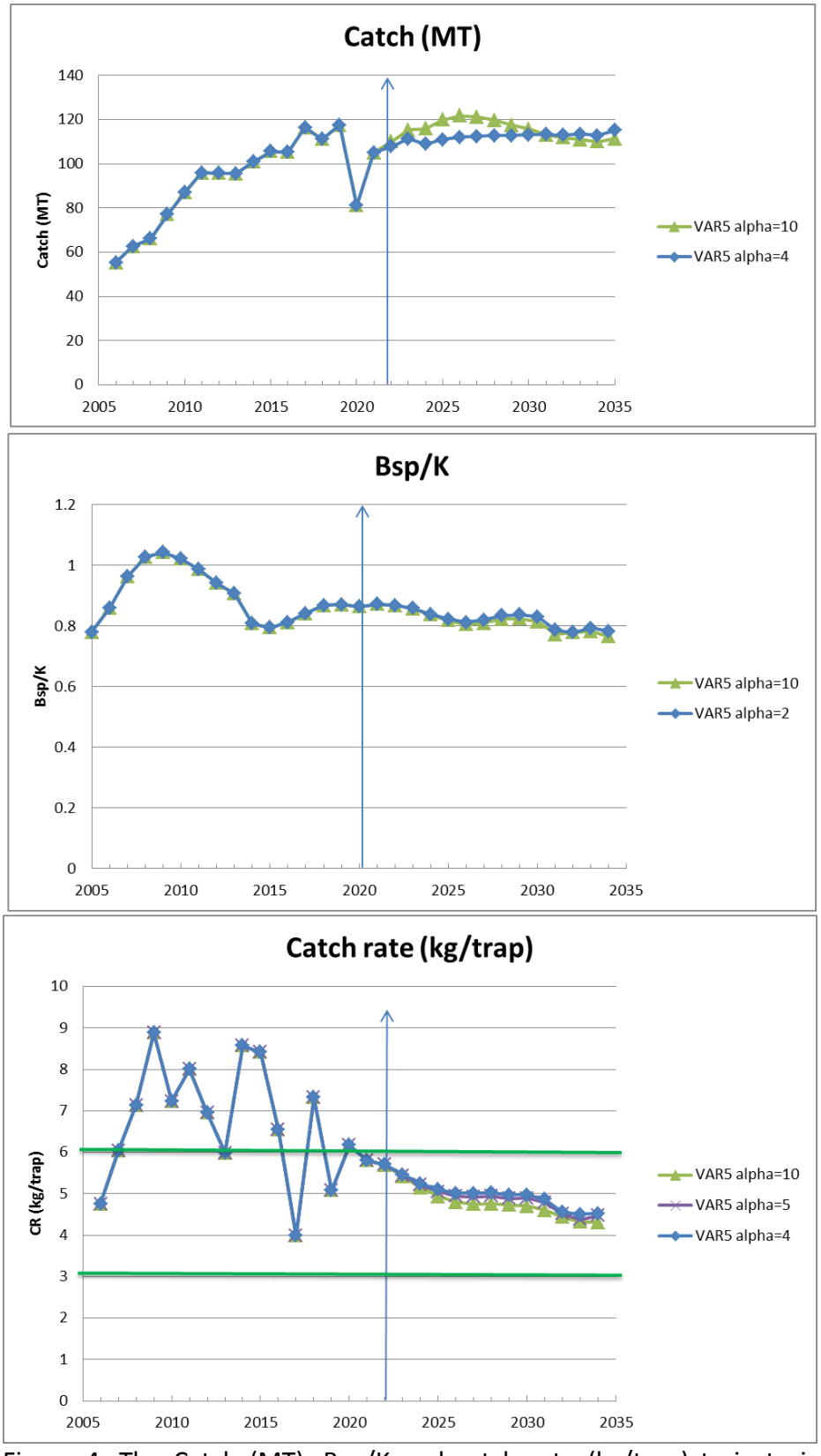

Figure 4: The Catch (MT), Bsp/K and catch rate (kg/trap) trajectories for variants of the Irar=**5.0** kg/trap CMP, for which the α value is reduced from 10 to 4. (Note that the Catch of 81MT taken in 2020 is reflected in the catch plot, but the OMP algorithm uses TAC and hence an initial input value of TAC(2020)=100 MT.) The top plot of Catches also INLCUDES a 5t rollover for 2021-2023 seasons.