

New OMPs for the rock lobster fisheries at Nightingale and Tristan islands

S J Johnston

Marine Resource Assessment and Management Group (MARAM)

Department of Mathematics and Applied Mathematics

University of Cape Town

Rondebosch 7701, South Africa

Summary

Two new OMPs have been developed for the rock lobster fisheries of Nightingale and Tristan islands. This document summarises these new OMPs.

Nightingale

OMP 2020, the selected new OMP for Nightingale, is CMP7 of Johnston and Butterworth (2020a). This is a target-based rule based on the recent commercial CPUE, viz.:

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

where

I_y^{rec} is the average of the GLM standardized CPUE over the last three years ($y-2, y-1, y$),

I^{tar} is the CPUE target value, which has a value of 5.0, and

α is a tuning parameter which is selected to have a value of 5.0.

A rule to control the inter-annual TAC variation is also applied. The baseline % TAC change relative to the previous year is restricted to a maximum of either up 5% down 5%.

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

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

Furthermore a ceiling (upper bound) applies to the TAC:

If $TAC_{y+1} > TAC_{ceiling}$ then $TAC_{y+1} = TAC_{ceiling}$.

CMP7 has a TAC ceiling of 95 MT. Note that this ceiling would be reached if, and only if, the CPUE performance at Nightingale is very positive in the future.

A precautionary metarule rule is also incorporated into the OMP, whereby the 5% TAC decrease constraint is increased by up to 20% if the standardized CPUE index drops below a threshold (Ilim) level. Here the baseline

lilim level is set at 3.0 kg/trap. The lilim is considered as the CPUE level below which “Exceptional Circumstances” would apply.

The fishing pattern at Nightingale has changed over time with recent tranches lasting a week or less. The rationale behind this change is that fishermen noted a decline in CPUE over subsequent fishing days, which would reverse if the area was left unfished for a period. Work is currently underway to investigate the effect of trip length on the GLM standardization of the CPUE data, so that this effect can be taken into account.

Tristan

OMP 2020, the selected new OMP for Tristan, is CMP1 of Johnston and Butterworth (2020b). This OMP is again a target-based rule based on the recent commercial CPUE, viz.:

$$TAC_{y+1} = TAC_y + \alpha(J_y^{rec} - J^{tar}) \quad (2)$$

where

J_y^{rec} is the average of the GLM standardized (where pertinent) CPUEs over the last three years ($y-2$, $y-1$, y), where data for three different CPUE series are incorporated (see below), where each constituent series is normalized to its average over 2010-2012,

J^{tar} is the target value for this combined index, which is set = 1.0, and

$$\alpha = 25$$

It is clearly desirable, now that further indices other than the standard powerboat CPUE index have been available for some time, to include not only the commercial CPUE as input into the TAC-setting equation, but also the Edinburgh/GS CPUE and the biomass survey index, to make use of this further information.

To do this, the following steps must be followed:

STEP 1: Normalise each series such that the 2010-2012 average equals 1.0 (for comparability purposes).

STEP 2: Calculate the I_y^{rec} value for each series ($I_y^{rec,comm}$, $I_y^{rec,Edin}$ and $I_y^{rec,survey}$) as the average of the normalized values over the last three years ($y-2$, $y-1$, y).

STEP 3: Calculate a combined J_y^{rec} from using all three of the I_y^{rec} values.

$$\text{OMP ALT3: } J_y^{rec} = \frac{w_1 I_y^{rec,comm} + w_2 I_y^{rec,Edin} + w_3 I_y^{rec,survey}}{w_1 + w_2 + w_3} \quad \text{i.e. uses all three indices.} \quad (3)$$

where the weights w_1 , w_2 and w_3 are the inverse variances from the Base case model fits to these data in the underlying assessments (Johnston and Butterworth 2020), so that:

$$w_1 = \frac{1}{\sigma_{comm}^2} = \frac{1}{0.09^2} = 123$$

$$w_2 = \frac{1}{\sigma_{Edin}^2} = \frac{1}{0.32^2} = 10$$

$$w_3 = \frac{1}{\sigma_{survey}^2} = \frac{1}{0.11^2} = 83 \quad (4)$$

A rule to control the inter-annual TAC variation is also applied. The % TAC change relative to the previous year is restricted to a maximum of either 5% up or 5% down, i.e.:

$$\text{If } TAC_{y+1} < 0.95TAC_y \quad \text{then } TAC_{y+1} = 0.95TAC_y \quad (5)$$

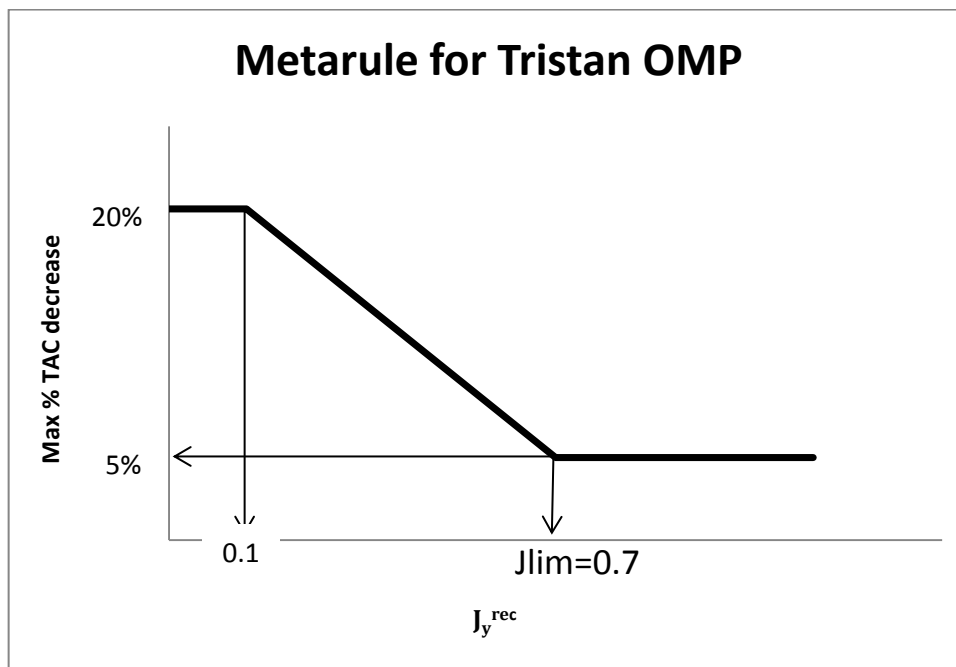
$$\text{If } TAC_{y+1} > 1.05TAC_y \quad \text{then } TAC_{y+1} = 1.05TAC_y \quad (6)$$

A further rule (used since 2016) is that:

$$\text{If } TAC_{y+1} < 120t \quad \text{then } TAC_{y+1} = 120t \quad (7)$$

Thus a “floor” TAC level of 120 tons is set, BUT this is linked to an associated lower limit for the observed recent CPUE 3-yr average, below which this 120t floor level TAC is over-ruled on the basis of Exceptional Circumstances occurring. The diagram below indicates how this further rule operates.

Exceptional Circumstances rule for Tristan



STEP4: Calculate the TAC.

$$TAC_{y+1} = TAC_y + \alpha(J_y^{rec} - J_{tar}) \quad (8)$$

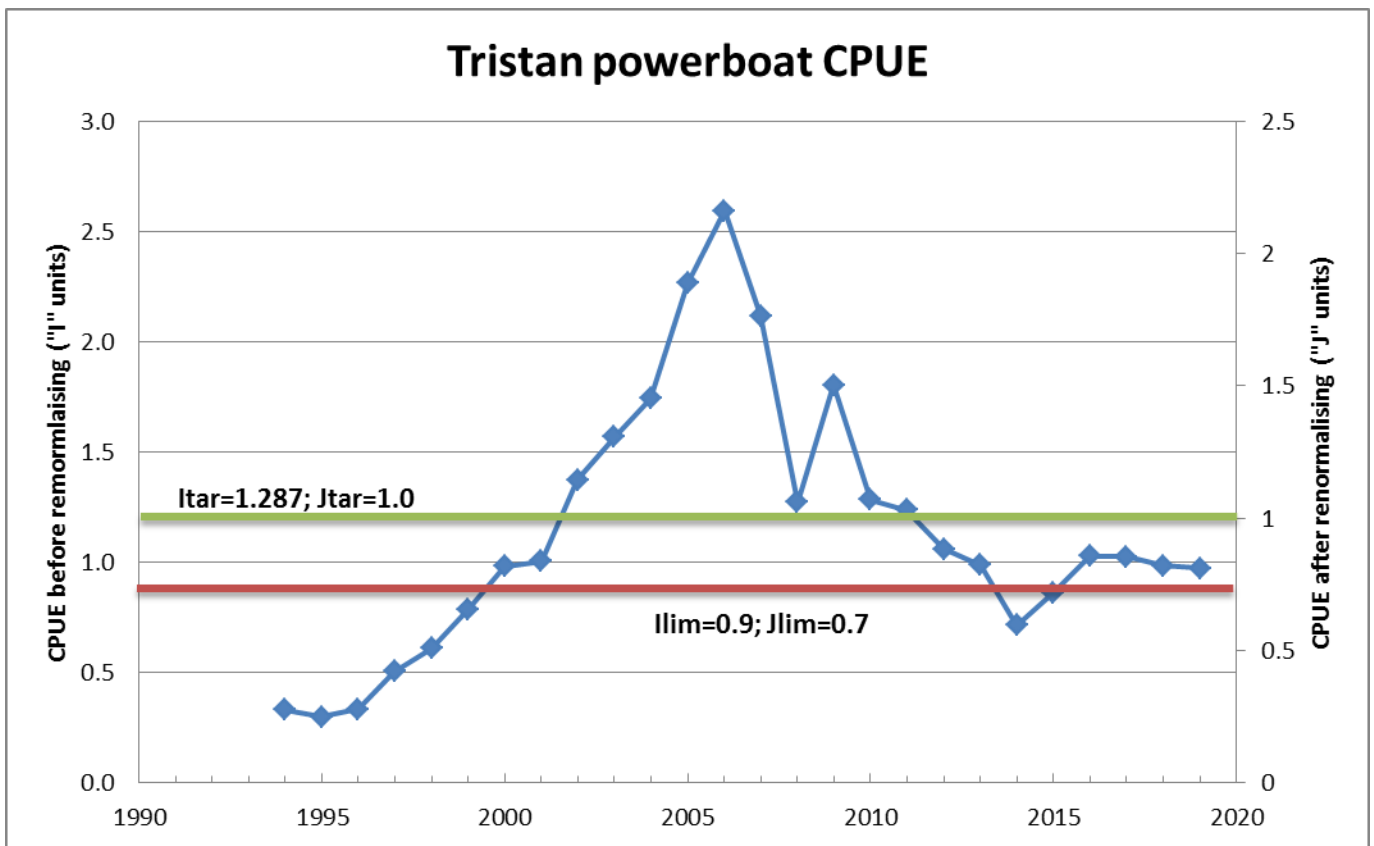
where $J_{tar} = 1.0$ and $\alpha = 25$ are the selected control parameters.

If the combined recent catch rate J_y^{rec} value drops below a threshold level (**Jlim**), the TAC may decrease by more than the usual maximum 5% decrease. The Figure above shows how the maximum % the TAC may be reduced from year to year may change from the default of 5% (at Jlim) to a value of 20% at a value of J_y^{rec} of 0.1, depending on the value of J_y^{rec} . OMP 2020 sets Jlim=0.70 (equivalent to the value of Ilim=0.90 assumed for OMP 2016).

Currently the Edinburgh/GS CPUE data is only a nominal CPUE series (simple catch per day). Further work will explore applying a GLM standardization to these data to take into account factors such as depth, soak time etc.

Note that given the rescaling of the CPUE indices so that each have an average of 1.0 over the 2010-2012 period, the new Jlim value of 0.70 is equivalent to the current Ilim=0.9 ($0.9/1.287=0.7$). Similarly, the new Jtar=1.0 is identical to Iтар=1.287 ($1.287/1.287=1.0$). Hence, the new OMP 2020 has the same CPUE target as the current OMP 2016 (although now expressed in “J” units). See Figure 1 below for a plot of the most recent GLM CPUE series for the powerboat data showing the comparability between “I” and “J” units.

Figure 1: Current powerboat GLM CPUE. The left vertical axis shows units prior to renormalising (in “I” units), whilst the right vertical axis shows units after renormalising to an average 2010-2012=1.0 (“J” units).



References

Johnston, S.J. and Butterworth, D.S. 2020a. OMP 2020 candidates for the Nightingale rock lobster fishery. MARAM document, MARAM/TRISTAN/2020/MAY/10.

Johnston, S.J. and Butterworth, D.S. 2020b. Initial results from the development of a new OMP 2020 for Tristan da Cunha island rock lobster resource. MARAM document, MARAM/TRISTAN/2020/MAY/07.