Exceptional Circumstances rule for the Tristan OMP 2020 when one or more data inputs are unavailable.

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Summary

The Tristan OMP 2020 is extended to include Exceptional Circumstances rules in case of missing input data. Following simulation testing, the performance of OMP 2020 is not expected to be compromised if single year's data are missing from the vessel of biomass survey data series.

KEY WORDS: Tristan rock lobster, exceptional circumstances, OMP development

OMP 2020, the selected new OMP for Tristan, is CMP1 of Johnston and Butterworth (2020a). 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 2020a), so that:

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

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

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

i.e the powerboat CPUE get by far the biggest weight and the vessel CPUE the least.

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.:

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

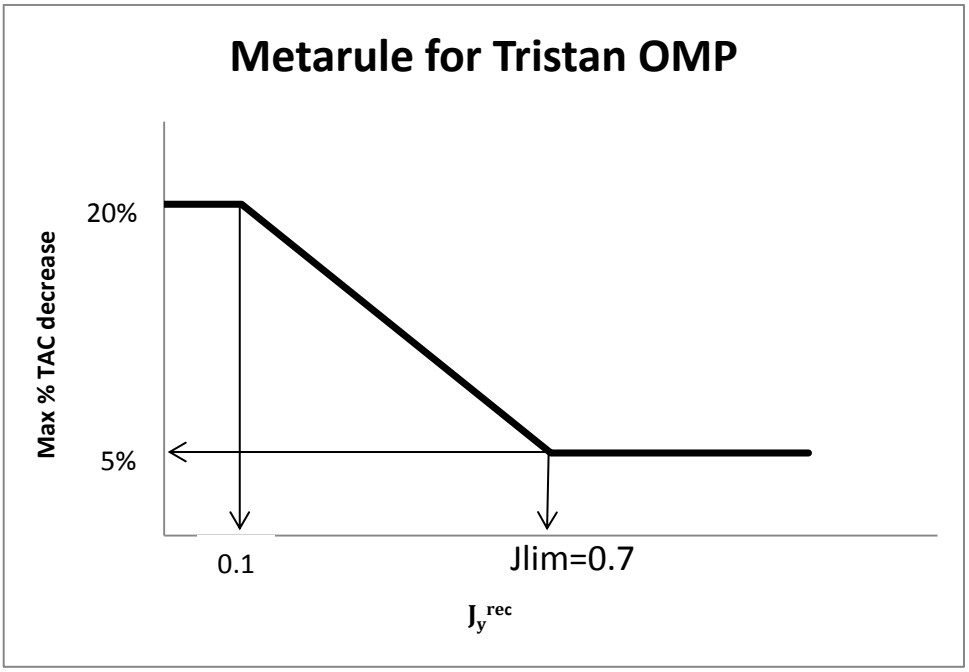
If $TAC_{y+1} > 1.05TAC_y$ then $TAC_{y+1} = 1.05TAC_y$ (6)

A further rule (used since 2016) is that:

If $TAC_{y+1} < 120t$ then $TAC_{y+1} = 120t$ (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 α =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).

Initially the Edinburgh/GS CPUE data was only a nominal CPUE series (simple catch per day). Further work however explored applying a GLM standardization to these data to take into account factors such as depth, soak time etc. (Johnston and Butterworth 2020b).

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 Itar=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).

Extension of OMP 2020 to include Exceptional Circumstances rules in case of missing input data

<u>If any of the three input data (Commercial CPUE, vessel CPUE or biomass survey index) are not available for any one year (within the last three year), STEP 2 is modified as such:</u>

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*) if all three years' data are available
- the years within the last three years (*y*-2, *y*-1, *y*) for which data are available, if only one or two years' data are available.

During the development, simulation testing of OMP 2020 was performed for OMP variants where one or more data input series were omitted in the TAC formulation. Tables 1 and 2 (taken from Johnston and Butterworth 2020c) show that near identical performance is expected if either the vessel (Edinburgh) CPUE or biomass survey input data series are entirely unavailable. The performance of OMP 2020 is thus not expected to be compromised if single year's data are missing from the vessel of biomass survey data series.

References

Johnston, S.J. and Butterworth, D.S. 2020a. 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.

Johnston, S.J. and Butterworth, D.S. 2020b. GLM-standardised lobster vessel CPUE at Tristan. MARAM document, MARAM/TRISTAN/2020/NOV/16.

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

Table 1: Details of the various 2020 OMP candidates presented in Johnston and Butterworth (2020c).

OMP	α	Jtar	Indices used		
			Commercial CPUE	Edinburgh CPUE	Survey index
RC	**25**	Jtar = 1.0	**YES**	NO	NO
ALT1	**25**	Jtar = 1.0	**YES**	**YES**	NO
ALT2	**25**	Jtar = 1.0	**YES**	NO	**YES**
ALT3	**25**	Jtar = 1.0	**YES**	**YES**	**YES**

Table 2: Simulation results for a number of candidate 2020 OMPs. All statistics reported below are median values unless otherwise indicated.

OMP	α	Jtar	CR(2022) (kg/gear/hour) (re-normalised CR)	CR(2025) (kg/gear/hour) (re-normalised CR)	CR(2032) (kg/gear/hour) (re-normalised CR)	C_{ave} 5 (20-24) (MT)	C_{ave} 10 (20-29) (MT)	AAV(10) %	Lower 5%ile $B_{sp}(2033)/K$
RC	25	Jtar = 1.0	0.88	1.03	1.08	120	120	0.71	0.58
ALT1	25	Jtar = 1.0	0.86	1.03	1.04	120	121	1.24	0.58
ALT2	25	Jtar = 1.0	0.88	1.03	1.06	120	120	0.88	0.58
ALT3	25	Jtar = 1.0	0.88	1.03	1.05	120	121	0.97	0.58