

Application of OMP-2020 for the toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands vicinity to provide a TAC recommendation for the 2023 “fishing” year

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ABSTRACT

Application of OMP-2020 for toothfish in the Prince Edward Islands vicinity provides a TAC recommendation for the 2022 “fishing”¹ year of 573.2 tonnes. This is a 4.5% increase of the previous season’s TAC of 548.5 tonnes.

Keywords: OMP, Patagonian toothfish, TAC recommendation

THE 2020 OMP (Brandão and Butterworth, 2021)

The algorithm for recommending the TAC for the $y+1$ “fishing” year is specified as:

$$TAC_{y+1} = TAC_y \left[1 + \lambda \left(\frac{\mu_y^{CPUE} - t^*}{t^*} \right) \right] \left[1 - \gamma \left(\frac{s_y^{cum(recap)} - s_t^*}{s_t^*} \right) \right], \quad (1)$$

where

TAC_y is the TAC recommended for year y ,

μ_y^{CPUE} is the mean trotline CPUE for the years $y - 4, y - 3$ and $y - 2$,

$s_y^{cum(recap)}$ is the slope of a linear regression of the cumulative number of recaptured tags against time for the years $y - 6$ to $y - 2$, and

λ, γ, t^* and s_t^* are control parameters given by:

$$\lambda = 1, \quad \gamma = 1, \quad t^* = 0.760 \quad \text{and} \quad s_t^* = 44.$$

Constraints

The MP constrains TACs to a maximum inter-annual change of 10%, so that TAC_{y+1} is adjusted accordingly as:

¹ A “fishing”- year y is defined to be from 1 December of year $y-1$ to 30 November of year y .

$$TAC_{y+1} = \begin{cases} TAC_y(1 + 0.1) & \text{if } TAC_{y+1} > TAC_y(1 + 0.1) \\ TAC_y(1 - 0.1) & \text{if } TAC_{y+1} < TAC_y(1 - 0.1) \\ TAC_{y+1} & \text{otherwise} \end{cases} \quad (2)$$

A smoothing of the TAC over its first five years of implementation is also applied, so that the final TAC is given by:

$$TAC_{y+1}^{final} = \psi_{y+1} TAC_{y+1} , \quad (3)$$

where

ψ_{y+1} is the initial period smoothing factor, given by:

$$\psi_{y+1} = \begin{cases} x & \text{for } y + 1 \leq 2025 \\ z & \text{for } 2025 < y + 1 < 2030 \\ 1 & \text{for } y + 1 \geq 2030 \end{cases} \quad (4)$$

where

$1 - x$ is the percentage by which the TAC is reduced initially, with $x = 0.95$ for OMP-2020, and

z reflects a linear increase from x in 2025 to 1 in 2030.

Table 1 provides the GLMM-standardised trotline CPUE estimates (Brandão and Butterworth, 2022), and the cumulative number of tag-recaptures observed which include data up to 2021.

Figure 1 compares the recent observed CPUE index and the cumulative number of recaptured tags to the projections for the Reference Set of Operating Models under **OMP-2020**. The cumulative number of recaptured tags lies within its 90% probability envelope, but the recent CPUE index lies above its 90% probability envelope. However, given the positive result for the most recent CPUE index and the fact that the observed value is not substantially above the probability envelope, together with the resultant TAC increase indicated below, it is considered not necessary to immediately invoke Exceptional Circumstances.

The mean CPUE μ_y^{CPUE} is calculated as:

$$\mu_y^{CPUE} = \frac{1}{3} \sum_{y=2019}^{2021} CPUE_y = \frac{0.927 + 0.689 + 1.043}{3} = 0.886.$$

The slope of the linear regression of the cumulative number of recaptured tags against time $s_y^{cum(recap)}$ is calculated by fitting a linear regression to the pairwise series (2017, 107), (2018, 138), (2019, 149), (2020,171) and (2021, 188) and is given by $s_y^{cum(recap)} = 19.5$.

Thus, the preliminary TAC is given by:

$$TAC_{2022} = \left(548.5 \left[1 + 1 \left(\frac{0.886 - 0.76}{0.76} \right) \right] \left[1 - 1 \left(\frac{19.5 - 44}{44} \right) \right] \right) = 995.9.$$

However, as the MP constrains the TACs to a maximum inter-annual change of 10%, and also applies an initial smoothing of the TAC, the final TAC is given by:

$$TAC_{2022}^{final} = \psi_{y+1}(TAC_{2021}(1 + 0.1)) = 0.95(548.5(1.1)) = 573.2.$$

Therefore, the final TAC recommendation for 2022 (i.e. the 2022 “fishing” year) is 573.2 tonnes.

REFERENCES

Brandão, A. and Butterworth, D.S. 2021. The 2020 Operational Management Procedure for the toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands vicinity. DFFE Branch Fisheries document: FISHERIES/2021/JUN/SWG-DEM/09.

Brandão, A. and Butterworth, D.S. 2022. GLMM standardised trotline CPUE series for the toothfish resource in the Prince Edward Islands EEZ updated to include data up to the 2021 season. DFFE Branch Fisheries document: FISHERIES/2021/OCT/SWG-DEM/22.

Table 1. The GLMM relative abundance indices for toothfish provided by the standardised commercial trotline CPUE series for the Prince Edward Islands EEZ (Brandão and Butterworth, 2022). This series has been updated to include the 2021 “fishing”-year data that are now available. The cumulative number of all recaptured tags is also given.

“Fishing”-year	GLMM CPUE	Cumulative number of recaptured tags
2007	—	2
2008	—	2
2009	—	5
2010	1.160	7
2011	1.000	16
2012	1.102	21
2013	0.858	26
2014	0.761	38
2015	0.773	64
2016	0.528	85
2017	0.524	107
2018	0.918	138
2019	0.927	149
2020	0.689	171
2021	1.043	188

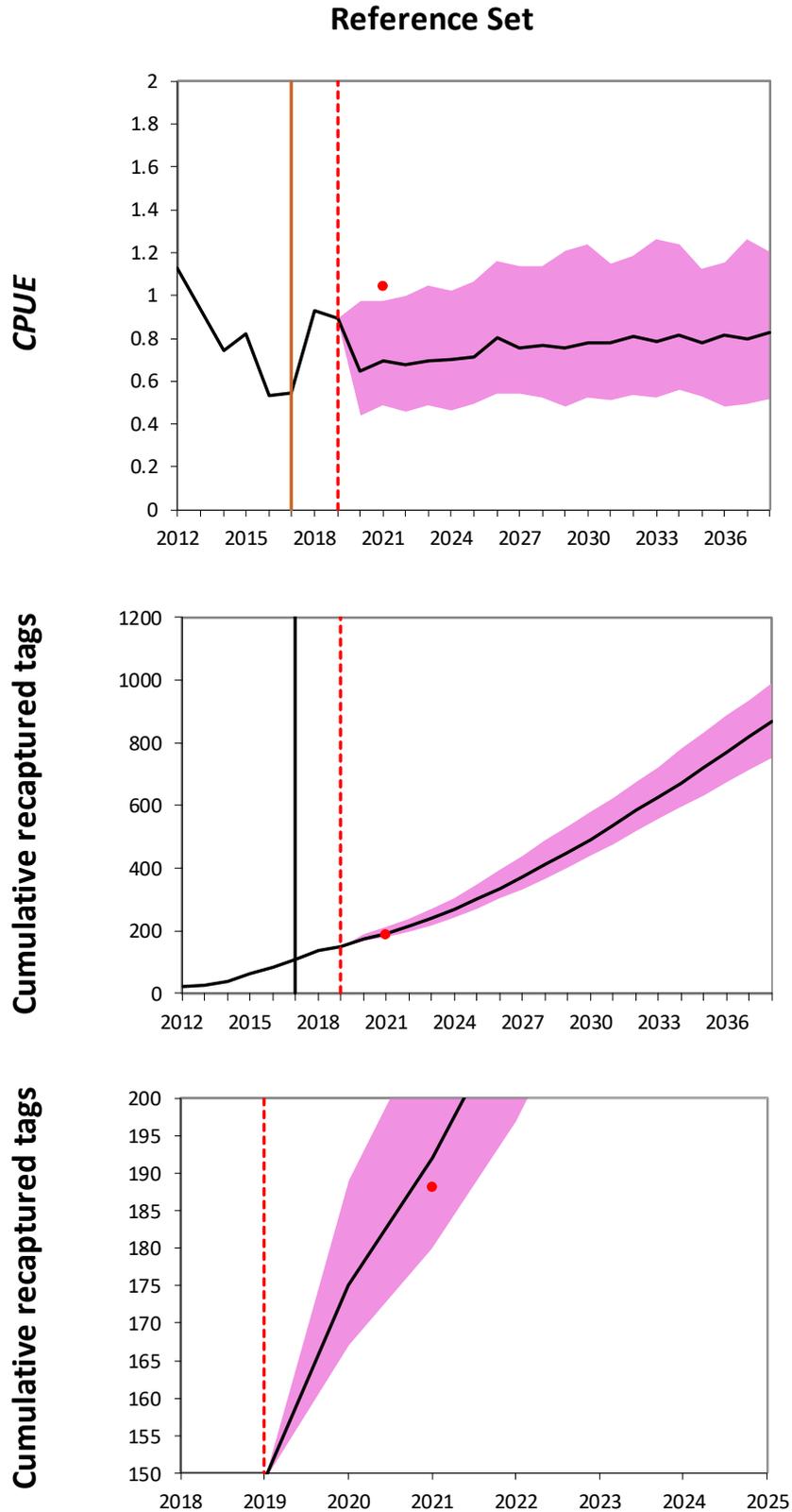


Figure 1. Median trajectories of the CPUE trend and the cumulative number of recaptured tags for the Reference Set of Operating Models under **OMP-2020** and the recent observed values (red dots). Projections commence to the right of the thick black vertical lines but with observed data until the red dashed vertical lines, and the shaded areas represent 90% probability envelopes. The bottom plot shows a magnification of the cumulative number of recaptured tags for clarity.