

The 2014 Operational Management Procedure for the South African horse mackerel resource

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Introduction

This document specifies the 2014 Operational Management Procedure (OMP) to provide Precautionary Upper Catch Limit (PUCL) recommendations for horse mackerel bycatches in the South African pelagic fishery and Total Allowable Catch (TAC) recommendations for targeted horse mackerel catches in the South African midwater trawl fishery. The basis for the associated computations for each fishery are set out in separate sections below. Appendix A gives the details for the GLM procedure used to produce a horse mackerel CPUE series for the midwater fishery, and Appendix B describes Exceptional Circumstances (ECs) that could lead to deviations from OMP recommendations.

The 2014 OMP for the pelagic PUCL

$$PUCL_{y+1} = PUCL_3 - bycatch_y - bycatch_{y-1} \quad (1)$$

where

$PUCL_{y+1}$ is the new PUCL recommendation for year $y+1$ in tonnes;

$PUCL_3$ is a tuning parameter that reflects the total amount that may be caught over a three year period (see Table 1); and

$bycatch_y$ is the observed horse mackerel bycatch that was taken by the pelagic fishery in year y in tonnes.

Note: Given that a recommendation for year $y+1$ is required by mid-December of year y , by which time the final value for $bycatch_y$ will not be available, the value used in computations will be the bycatch made until the end of November of year y .

The 2014 OMP for the midwater TAC

$$TAC_{y+1} = \Delta_y TAC_y \quad (2)$$

where

TAC_y is the recommended TAC for the midwater fishery for year y ; and

Δ_y is an output of the OMP that reflects the proportional change in TAC from year y to year $y+1$.

Δ_y is given by the piecewise linear function:

$$\Delta_y = \begin{cases} 1 - X_{decr} & \text{if } I_y < I_{decr} \\ 1 - X_{decr} + \frac{X_{incr} + X_{decr}}{I_{incr} - I_{decr}} (I_y - I_{decr}) & \text{if } I_{decr} \leq I_y < I_{incr} \\ 1 + X_{incr} & \text{if } I_y \geq I_{incr} \end{cases} \quad (3)$$

where

X_{decr} , X_{incr} , I_{decr} and I_{incr} are tuning parameters (see Table 1); and

I_y is an index of recent horse mackerel abundance.

I_y is given by:

$$I_y = w I_y^{cpue} + (1 - w) I_y^{aut} \quad (4)$$

where

I_y^{cpue} is the recent CPUE values in year y relative to the series' average over the period 2003–2009;

I_y^{aut} is the recent autumn demersal swept-area survey abundance estimates in year y relative to the series average over the period 2003–2009; and

w is a tuning parameter (see Table 1).

The terms in Equation 4 are given by:

$$I_y^{cpue} = \frac{7 \sum_{j=y-3}^{y-1} CPUE_j}{3 \sum_{j=2003}^{2009} CPUE_j} \quad \text{and} \quad I_y^{aut} = \frac{7 \sum_{j=y-2}^y aut_j}{3 \sum_{j=2003}^{2009} aut_j} \quad (5)$$

where

$CPUE_j$ is the CPUE estimate for year j ; and

aut_j is the autumn demersal swept-area survey based horse mackerel biomass estimate for year j .

Procedure in the event of missing survey data

It is foreseeable that autumn demersal swept-area survey based biomass estimates for horse mackerel will not be available for some years (as was the case for 2012 and 2013). In the event any biomass estimates required in the calculation of the numerator of I_y^{aut} in Equation 5 are not available, the value of the tuning parameter w in Equation 4 should be changed from 0.85 to 1. In other words, the weighting of the two terms in Equation 4 should be modified so that I_y depends on the CPUE series, which should always be available.

Table 1: Tuning parameters for the 2014 OMP.

Parameter	Value
$PUCL_3$	15589 tonnes
X_{decr}	15%
X_{incr}	10%
I_{decr}	0.84
I_{incr}	1.01
w	0.85

Appendix A

The General Linear Modelling approach applied to standardise the CPUE data for the midwater trawl fishery for Cape horse mackerel for input into the OMP

Introduction

The model applied to standardize the CPUE data of Cape horse mackerel caught as directed catch in the midwater trawl fishery off the coast of South Africa is summarised here. Only data from the *Desert Diamond* are used to produce a CPUE series, as this is currently the only vessel with directed horse mackerel fishing rights – it accounts for approximately 81% of horse mackerel caught (by mass) in the midwater. The data used in the analysis are obtained from a database of the Fisheries Branch of the Department of Agriculture, Forestry and Fisheries (DAFF).

The General Linear Model

The following model is applied to the horse mackerel CPUE data:

$$\ln(C/E + \delta) = \mu + \alpha_{year} + \beta_{month} + \gamma_{time} + \epsilon \quad (A1)$$

where for each trawl:

C	is the mass of horse mackerel caught in kg;
E	is the fishing effort expended and is the product of <i>trawl duration</i> , <i>trawl speed</i> and <i>net height</i> in metres squared;
δ	is a constant equal to 0.129262 kg/m ² (this being 10% of the mean nominal C/E value for the period 2003-2013), and is added to allow for the occurrence of zero CPUE values when taking logarithms;
μ	is the intercept;
α_{year}	is the contribution from covariate <i>year</i> , a categorical covariate reflecting the year in which the trawl took place;
β_{month}	is the contribution from covariate <i>month</i> , a categorical covariate reflecting the month in which the trawl took place: grouped by pairs of months from January to December (i.e. Jan-Feb, Mar-Apr, etc.);
γ_{time}	is the contribution from covariate <i>time</i> , a categorical covariate associated with the time of day of the trawl: grouped by three hour periods from 00:00 to 24:00 (i.e. 00:00-03:00, 03:00-06:00, etc.); and
ϵ	is the error term, which is assumed to follow a normal distribution.

The standardised CPUE value input to Equation 5 of the main text for year j is then $\exp(\alpha_j)$.

Appendix B

Procedures for deviating from OMP output for the recommendation, and for initiating an OMP review

Metarule Process

Metarules can be thought of as “rules” which pre-specify what should happen in unlikely, exceptional circumstances when application of the TAC/PUCL generated by the OMP is considered to be highly risky or inappropriate. Metarules are not a mechanism for making small adjustments, or ‘tinkering’ with the TAC/PUCL from the OMP. It is difficult to provide firm definitions of, and to be sure of including all possible, exceptional circumstances. Instead, a process for determining whether exceptional circumstances exist is described below (see Figure B1). The need for invoking a metarule should be evaluated by the DAFF BRANCH FISHERIES [Demersal or Pelagic (as appropriate)] Scientific Working Group (hereafter indicated by WG), but only provided that appropriate supporting information is presented so that it can be reviewed at a WG meeting.

Description of Process to Determine Whether Exceptional Circumstances Exist

While the broad circumstances that may invoke the metarule process can be identified, it is not always possible to pre-specify the data that may trigger a metarule. If a WG Member or Observer, or DAFF BRANCH FISHERIES Management, is to propose an exceptional circumstances review, then such person(s) must outline in writing the reasons why they consider that exceptional circumstances exist, and must either indicate where the data or analyses are to be found supporting the review, or must supply those data or analyses in advance of the WG meeting at which their proposal is to be considered.

Every year the WG will:

- Review population and fishery indicators, and any other relevant data or information on the population, fishery and ecosystem, and conduct a simple routine updated assessment (likely no more than the core Reference Case model used in the OMP testing refitted taking a further year’s data into account).
- On the basis of this, determine whether there is evidence for exceptional circumstances.

Examples of what might constitute an exceptional circumstance in the case of [horse mackerel] include, but are not necessarily limited to:

- [Survey estimates of abundance that are appreciably outside the bounds predicted in the OMP testing.
- CPUE trends that are appreciably outside the bounds predicted in the OMP testing.]

Every two years the WG will:

- Conduct an in depth stock assessment (more intensive than the annual process above, and in particular including the full Reference Set of assessment models and conducting of a range of sensitivity tests).
- On the basis of the assessment, indicators and any other relevant information, determine whether there is evidence for exceptional circumstances.

The primary focus for concluding that exceptional circumstances exist is if the population assessment/indicator review process provides results appreciably outside the range of simulated population and/other other indicator trajectories considered in OMP evaluations. This includes the core (Reference case

or set of) operating models used for these evaluations, and likely also (though subject to discussion) the operating models for the robustness tests for which the OMP was considered to have shown adequate performance. Similarly, if the review process noted regulatory changes likely to effect appreciable modifications to outcomes predicted in terms of the assumptions used for projections in the OMP evaluations (e.g. as a result, perhaps, of size limit changes or closure of areas), or changes to the nature of the data collected for input to the OMP beyond those for which allowance may have been made in those evaluations, this would constitute grounds for concluding that exceptional circumstances exist in the context of continued application of the current OMP.

(Every year) IF the WG concludes that there is no or insufficient evidence for exceptional circumstances, the WG will:

- Report to the Chief Director Research, DAFF BRANCH FISHERIES that exceptional circumstances do not exist.

IF the WG has agreed that exceptional circumstances exist, the WG will:

- Determine the severity of the exceptional circumstances.
- Follow the “Process for Action” described below.

Specific issues that will be considered annually (regarding Underlying Assumptions of the Operating Models (OMs) for the OMP Testing Process)

The following critical aspects of assumptions underlying the OMs for [horse mackerel] need to be monitored after OMP implementation. Any appreciable deviation from these underlying assumptions may constitute an exceptional circumstance (i.e. potential metarule invocation) and will require a review, and possible revision, of the OMP:

- [Whether survey or CPUE estimates of abundance are appreciable outside the bounds predicted in the OMP testing.
- Whether selectivities-at-length for the major fisheries differ substantially from assumptions made to generate operating model projections.
- Whether future recruitment levels are within the bounds projected by the RS operating models.
- Whether updates of major data sets indicate substantial differences from what were used to condition the operating models for the OMP testing.
- Whether there have been a series of substantial differences between TACs allocated and the catches subsequently made.
- Whether fishing regulations and/or strategies have changed substantially, and in a manner such that continuing use of the agreed GLM-standardisation procedures would likely introduce substantial bias in resource abundance trend estimates based on CPUE indices.]

Description of Process for Action

If making a determination that there is evidence of exceptional circumstances, the WG will with due promptness:

- Consider the severity of the exceptional circumstances (for example, how severely “out of bounds” are the recent CPUEs and survey abundance estimates or recruitment estimates).
- Follow the principles for action (see examples below).

- Formulate advice on the action required (this could include an immediate change in TAC, a review of the OMP, the relatively urgent collection of ancillary data, or conduct of analyses to be reviewed at a further WG meeting in the near future).
- Report to the Director Research, DAFF BRANCH FISHERIES that exceptional circumstances exist and provide advice on the action to take.

The Chief Director Research, DAFF BRANCH FISHERIES will:

- Consider the advice from the WG.
- Decide on the action to take, or recommendations to make to his/her principals.

Examples of 'Principles for Action'

If the risk is to the resource, or to dependent or related components of the ecosystem, principles may be:

- The OMP-derived TAC/PUCL should be an upper bound.
- Action should be at least an x% decrease in the TAC/PUCL output by the OMP, depending on severity.

If the risk is to socio-economic opportunities within the fishery, principles may be:

- The OMP-derived TAC/PUCL should be a minimum.
- Action should be at least a y% increase in the TAC/PUCL output by the OMP, depending on severity.

For certain categories of exceptional circumstances, specific metarules may be developed and pre-agreed for implementation should the associated circumstances arise (for example, as has been the case for OMP's for the sardine-anchovy fishery where specific modified TAC algorithms come into play if abundance estimates from surveys fall below pre-specified thresholds). Where such development is possible, it is preferable that it be pursued.

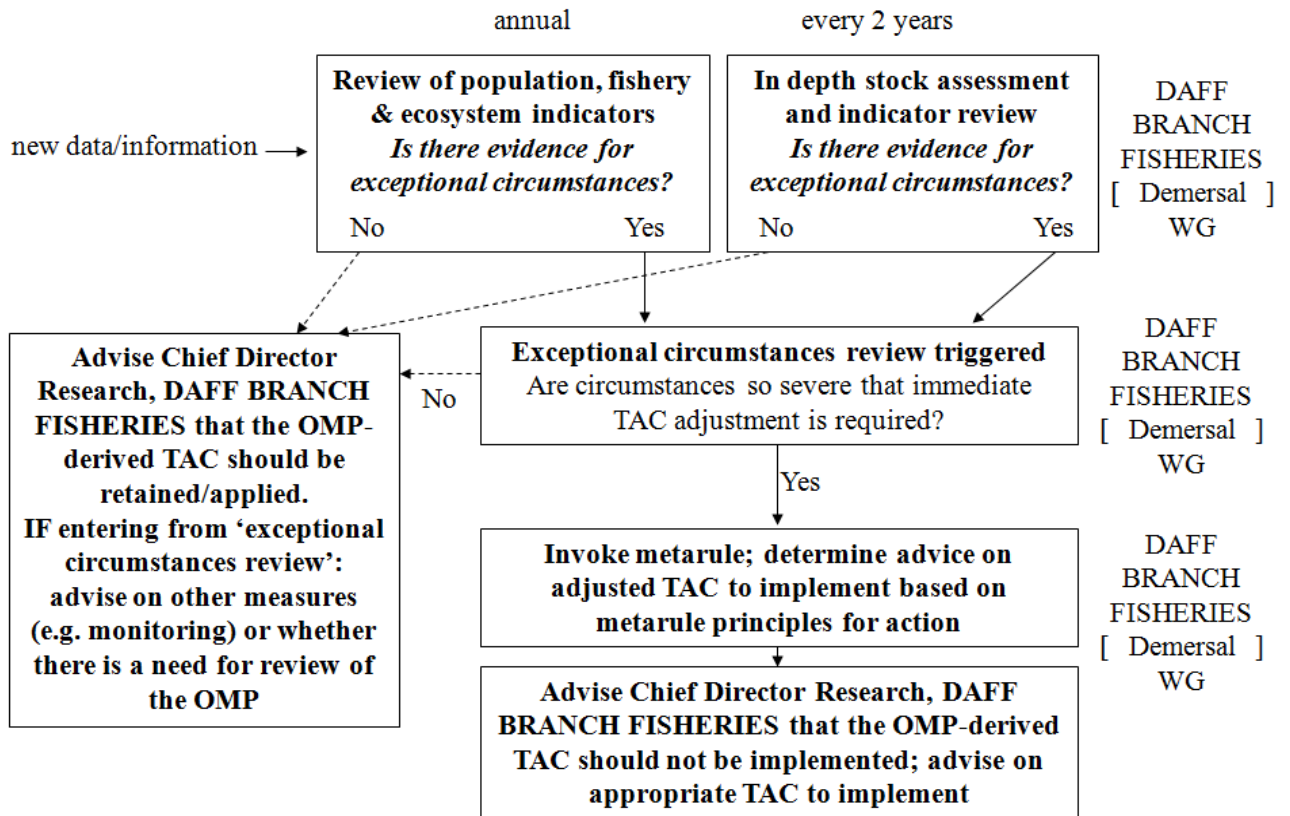


Figure B1: Flowchart for Metarules Process

Regular OMP Review and Revision Process

The procedure for regular review and potential revision of the OMP is the process for updating and incorporating new data, new information and knowledge into the management procedure, including the operating models (OMs) used for testing the procedure. This process should happen on a relatively long time-scale to avoid jeopardising the performance of the OMP, but can be initiated at any time if the WG consider that there is sufficient reason for this, and that the effect of the revision would be substantial. During the revision process the OMP should still be used to generate TAC recommendations unless a metarule is invoked.

Description of Process for Regular Review (see Fig.D2)

Every year the WG will:

- Consider whether the procedure for Metarule Process has triggered a review/revision of the OMP. Note that if proposals by a WG Member or Observer, or DAFF BRANCH FISHERIES Management, for an exceptional circumstances review include suggestions for an OMP review and possible revision, they must outline in writing the reasons why they consider this necessary, and must either indicate where the data or analyses are to be found supporting their proposed review, or must supply those data or analyses in advance of the WG meeting at which their proposal is to be considered. This includes the possibility of a suggested improvement in the manner in which the OMP calculates catch limitation recommendations; this would need to be motivated by reporting

results for this amended OMP when subjected to the same set of trials as were used in the selection of the existing OMP, and arguing that improvements in anticipated performance were evident.

Every two years the WG will:

- Conduct an in depth stock assessment and review population, fishery and related ecosystem indicators, and any other relevant data or information on the population, fishery and ecosystem.
- On the basis of this, determine whether the assessment (or other) results are outside the ranges for which the OMP was tested (note that evaluation for exceptional circumstances would be carried out in parallel with this process; see procedures for the Metarule Process), and whether this is sufficient to trigger a review/revision of the OMP.
- Consider whether the procedure for the Metarule Process triggered a review / revision of the OMP.

Every four years since the last revision of the OMP the WG will:

- Review whether enough has been learnt to appreciably improve/change the operating models (OMs), or to improve the performance of the OMP, or to provide new advice on tuning level (chosen to aim to achieve management objectives).
- On the basis of this, determine whether the new information is sufficient to trigger a review/revision of the OMP.

In any year, IF the WG concludes that there is sufficient new information to trigger a review/revision of the OMP, the WG will:

- Outline the work plan and timeline (e.g. over a period of one year) envisaged for conducting a review.
- Report to the Chief Director Research, DAFF BRANCH FISHERIES that a review/revision of the OMP is required, giving details of the proposed work plan and timeline.
- Advise the Chief Director Research, DAFF BRANCH FISHERIES that the OMP can still be applied while the revision process is being completed (unless exceptional circumstances have been determined to apply and a metarule invoked).

In any year, IF the WG concludes that there is no need to commence a review/revision of the OMP, the WG will:

- Report to the Chief Director Research, DAFF BRANCH FISHERIES that a review/revision of the OMP is not yet required.

The Chief Director Research, DAFF BRANCH FISHERIES will:

- Review the report from the WG.
- Decide whether to initiate the review/revision process.

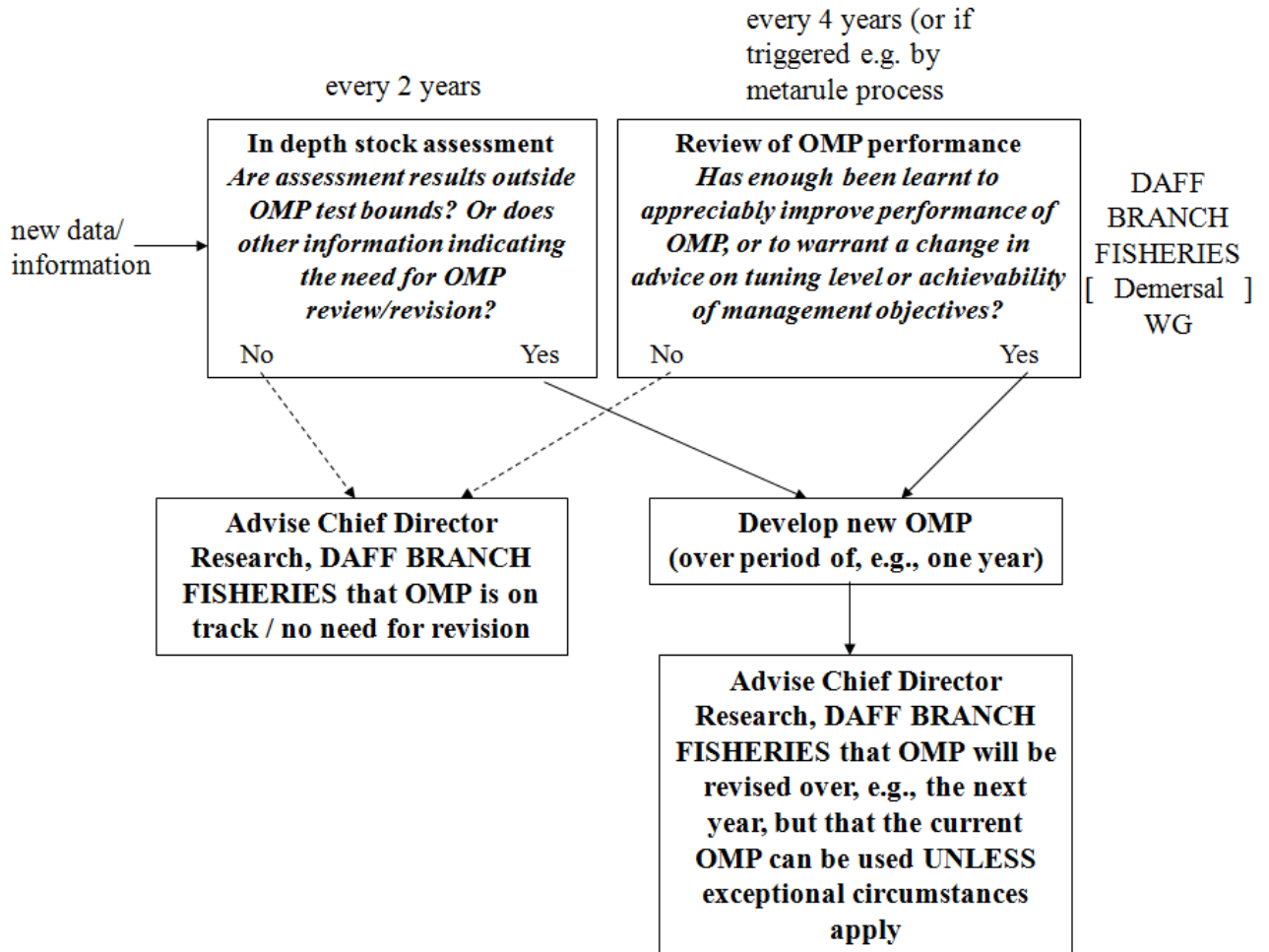


Figure B2: Flowchart for Regular Review and Revision Process