South Coast Rock Lobster OMP 2014: Initial Specifications

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1. Introduction

An OMP for recommending the TAC for South Coast rock lobster resource was first developed and implemented for 2008[1] (Johnston and Butterworth 2008). A number of further OMPs have been developed for the management of this resource. These OMPs have all had similar underlying structures, with a median target spawning biomass $B^{sp}_{2025}/B^{sp}_{2006}$ of 1.20 when simulation tested. i.e. a spawning biomass increase in median terms of 20% over the 2006-2025 period. These OMPs were "slope-based" – that is the TAC-setting algorithm was based on the slope (gradient) of recent CPUE values to determine the TAC increase or decrease.

The operating model which was used to simulation test OMP-2014 is model RC1 reported in Johnston (2013). The parameters of RC1 were estimated in a Bayesian framework using MCMC. The resultant posterior distribution was used to generate 1000 vectors of parameters and current numbers at age to commence projections which were used to test candidate MPs. The median, 5th and 95th percentiles for all performance statistics were produced.

OMP-2014 as described below is to be used for setting the TACs for the South Coast rock lobster fishery for four seasons (2014-2017), and will be subject to review and possible revision in 2018.

Furthermore this document (including its Appendix) contains only the initial specifications of OMP-2014, as these will be extended in the near future, following further simulation testing, to allow for "Exceptional Circumstances", and in particular to provide a specific metarule governing the process under which the 5% maximum TAC inter-annual reduction constraint would be over-ruled if CPUE drops below a threshold level still to be determined.

2. OMP 2014

Previous OMPs for the South Coast rock lobster have all been "slope-based" OMPs, with targets of *Bsp*(2025)/*Bsp*(2006)=1.20, as described above.

With a "**target**-based" OMP such as OMP-2014, the decision whether to increase or decrease the TAC depends on whether recent CPUE values are above or below a pre-specified target CPUE value. OMP-2014 has as its target a median spawning biomass increase of 30% by 2025 relative to the 2006 value, i.e. *Bsp*(2025/2006)=1.30.

2.1 The TAC setting algorithm for OMP-2014

The algorithm used to recommend the TAC for the South Coast Rock Lobster fishery for season *y*+1 is:

[1] The convention used here is that 2008 refers to the 2008/2009 season

$$TAC_{y+1} = TAC_y[1 + \alpha \frac{\overline{CPUE}_y - CPUE_{targ}}{CPUE_{targ}}] \quad (1)$$

where $\overline{CPUE}_y$ is a measure of recent CPUE and is calculated as follows:

$$\overline{CPUE}_y = \frac{1}{3} \sum_{y'=y-3}^{y-1} \sum_{A=1}^{3} \lambda_A CPUE_{y'}^{A} \quad (2)$$

where
$CPUE_{y'}^{A}$ is the GLM standardised CPUE for area *A* in year y' and
the CPUE weighting factors, $\lambda_{A1E}, \lambda_{A1W}$ and λ_{A2+3} relate to the proportion of the overall biomass in each the three fishing areas, and were calculated using estimated values of q and B^{exp} for 2011 from the RC1 model to be:

$$\lambda_{A1E} = 0.003$$
$$\lambda_{A1W} = 0.128$$
$$\lambda_{A2+3} = 0.868.$$

$CPUE_{targ}$ = **1.22 –** this value results in the median *Bsp*(2025/2006)=1.30, the selected biomass target for OMP-2014 under the RC1 operating model.

Note that TAC_y is the TAC set (not the catch taken) in season *y*.

The tuning parameter α controls how responsive the OMP is to CPUE deviations from the CPUE target, and for OMP-2014 is set to be 1.0.

Note that the TAC for season *y*+1 is to be based upon the CPUE series that ends in season *y*-1, i.e. the TAC recommendation for the 2014/15 season would be based on a CPUE series that ended with the most recent CPUE value available at the time the TAC recommendation was required (August 2014) which would be here the 2012/13 season.

2.2 Inter-annual TAC constraint

A rule to restrict the inter-annual TAC variation to no more than 5% up or down from season to season is applied as in previous OMPs, i.e.:

$$\text{if } TAC_{y+1} > 1.05TAC_y \qquad TAC_{y+1} = 1.05TAC_y \quad (3)$$
$$\text{if } TAC_{y+1} < 0.95TAC_y \qquad TAC_{y+1} = 0.95TAC_y$$

2.3 TAC for first season (2014)

The TAC for the first season that OMP-2014 is implemented (2014) is set at a 5% increase over the TAC for the previous 2013 season. Thus TAC(2014) is fixed at 359 MT. The inter-annual rules described in the section above will come into play from the 2015 season onwards.

2.4 Maximum CAP on TAC

A maximum cap on TAC in any year in the future is set at 450 MT.

3. The Generalized Linear Model applied to the South Cost rock lobster CPUE data to obtain area-specific indices of abundance

The nominal CPUE data for South Coast rock lobster are (re-)standardized each season by means of a Generalized Linear Model (GLM) to obtain area-specific standardized indices of abundance for input to the OMP.

Certain records are excluded from the analyses; these are as follows.

- Data from companies other than the four major companies for years prior to and including 1997.
- Data pertaining to Hout Bay Fishing vessels over the period 1997–2000, since they are considered to be unreliable.
- Sets with zero effort.
- Sets with zero catch.
- One record with a CPUE value of > 9kg/trap (this was considered an outlier).

The fishing grounds have historically been separated into four areas. However, based on analyses conducted by Gaylard and Bergh (2007), these four areas were revised to three. It is these revised "new areas" upon which the analyses are based.

The GLM

The base case GLM applied to obtain area-specific indices of abundance is:

$$\ell n(CPUE) = I + \alpha_y + \beta_{seas} + \gamma_{depth} + \eta_{soak} + \kappa_{vess} + \lambda_{grid} + \varpi_{echo} + \theta_{gps} + \varsigma_{video} + \tau(traps) + (y \times area) + \varepsilon \quad (4)$$

where

I is the intercept,
α_y is the split-year fishing season effect (1977 to the season prior to the year for which the CPUE value is being calculated),
β_{seas} is the season effect
season 1 = October – December
season 2 = January – March
season 3 = April – June
season 4 = July – September,
γ_{depth} is the depth effect
d75 : depth < 100
d125 : 100 $\leq$ depth < 150
d175 : 150 $\leq$ depth < 200
d225 : 200 $\leq$ depth < 250
d275 : depth $\geq$ 250,
η_{soak} is the soak time effect
soak1 : soak $\leq$ 24 hours
soak2 : 24 < soak $\leq$ 48
soak3 : 48 < soak $\leq$ 72
soak4 : 72 < soak $\leq$ 96
soak5 : soak > 96 hours,
κ_{vess} is the vessel effect (42 vessels to 2006),
λ_{grid} is the grid effect (290 grid squares),
ϖ_{echo} is the echo-sounder effect,

θ_{gps} is the GPS effect,
ς_{video} is the video plotter effect,
traps is a measure of effort provided by the number of traps set and is treated as a continuous variable,
(*y*×*area*) is a fixed effect interaction term where *area* relates to one of the three areas), and
ε is assumed to be normally distributed.

Note that both grid and area cannot be included as main effects in the model because of confounding.

The standardized CPUE indices per area are calculated by applying the equation $CPUE_{y,a} = e^{(\alpha_y + (y \times area) + median(\lambda_{grid}))}$, where *median*($\lambda_{grid}$) is the median value amongst those for the grids specific to each area.

4. Methodology for calculating the TAE (total allowable effort)

A procedure for control of effort in the South Coast rock lobster fishery, was agreed by the Rock Lobster Working Group at its meeting on 31 July 2008. This method is reported in OLRAC(2008) and reproduced below.

4.1. Fishing day allocations

4.1.1 Effort will be controlled by the allocation to each company in the fishery of a number of ***fishing days*** for each season.

4.1.2 The number of fishing days used for any single ***trip*** is calculated as the number of ***seadays*** used less 1.5. This definition applies, both in administration of effort control for the current season and in calculation of performance in previous seasons (see section 4.2 below).

4.1.3. A day is included as a ***seaday*** for a trip if any part of that day is spent at sea. Thus the sailing day and landing day are both counted as seadays. However if a vessel spends a full day in port, e.g. for repairs, and does not spend any part of that day at sea, that day will not be counted as a seaday.

4.1.4 A ***trip*** is deemed to end when fish are offloaded and a landing report is completed.

4.1.5 The ***fishing day*** allocation $E_{c,y}$ for rights holder *r* in season *y* will be calculated as:

$$E_{r,y} = Q_{r,y} / BCR_y \quad (5)$$

where

$Q_{r,y}$ is the quota in kilograms for rights holder *r* in season *y*, and

BCR_y is the ***base catch rate*** (in kg per fishing day) for season *y* (see section 4.2 below).

4.1.6 A fishing day ***pool*** will be available from which companies may draw if needed, at the discretion of South Coast Rock Lobster Industry Association. The number of fishing days allocated to the pool will be:

$$E_{pool,y} = 0.1 \sum_r E_{r,y} \quad (6)$$

i.e. the pool is 10% of the total effort allocation to all rights holders.

4.2. Calculation of base catch rate

The base catch rate, BCR_y, for season *y* is determined by:

$$BCR_y = \tfrac{1}{3}(CR_{y-4} + CR_{y-3} + CR_{y-2}) / D \qquad (7)$$

where

CR_{y-n} is the recorded catch in kg per fishing day in season *y-n*,

calculated as $CR_{y-n} = C_{y-n} / E_{y-n}$,

E_{y-n} is the total number of fishing days used by all participants in season *y-n*,

C_{y-n} is the total catch in kg by all participants in season *y-n*, and

D = 1.555369 is a constant (see section 3.3 below).

4.3. Calculation of the divisor D in equation (7)

$$D = e^{-2\sigma} \qquad (8)$$

where

σ^2 is the expected variance in: $[\ln(CR_y) - \ln(\tfrac{1}{3}(CR_{y-4} + CR_{y-3} + CR_{y-2}))]$ which is estimated as:

$$\sigma^2 = \tfrac{1}{17} \sum_{y'=1990}^{2006} [\ln(CPUE_{y'}) - \ln(\overline{CPUE_{y'}})]^2 \qquad (9)$$

where

$CPUE_{y'}$ is the GLM standardised catch per trap in season *y'*, and

$$\overline{CPUE_{y'}} = \tfrac{1}{3}(CPUE_{y'-4} + CPUE_{y'-3} + CPUE_{y'-2}). \qquad (10)$$

4.4. Base catch rate for the 2014 season.

Using equation (7) the base catch rate for 2014 is

$$BCR_{2008} = \tfrac{1}{3}(CR_{2010} + CR_{2011} + CR_{2012}) / D$$
$$= \tfrac{1}{3}(258.523 + 170.923 + 187.70) / 1.555369$$

= 127.98 kg per fishing day

References

Gaylard, J.D. and M.O. Bergh. 2007. A clustering of South Coast rock lobster fishing grid blocks based on similarity of CPUE trend. 9pp. South Coast rock lobster task group document (May 2007).

Johnston, S.J. and D.S. Butterworth. 2008. OMP 2008 for the South Coast Rock Lobster Resource. MCM document, MCM/2008/AUG/SWG-SCRL/30. 8pp.

Johnston, S.J. 2013. Final 2013 updated South Coast rock lobster assessment results and description of OMP simulation framework. FISHERIES/2013/AUG/SWG-SCRL/06. 24pp.

OLRAC. 2008. A revised proposal for controlling effort in the South Coast rock lobster fishery. MCM document MCM/2008/JUL/SWG/SCRL/27.

Appendix

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

1. Metarule Process

Metarules can be thought of as "rules" which pre-specify what should happen in unlikely, exceptional circumstances when application of the TAC generated by the OMP is considered to be highly risky or highly inappropriate. Metarules are not a mechanism for making small adjustments, or 'tinkering' with the TAC 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 Fig. A1). The need for invoking a metarule should be evaluated by the DAFF Rock Lobster 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.

1.1 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 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 core reference set models 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 south coast rock lobster include, but are not necessarily limited to:

- CPUE trends that are appreciably outside the bounds predicted in the OMP testing.
- Catches in area A1E which are persistently high in circumstances where the biomass in that area is low, in particular relative to the other Areas.

Every two years the WG will:

- Conduct an in depth stock assessment (more intensive than the annual process above, and in particular including the conduct 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/or 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 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.

1.2 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 south coast rock lobster 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 selectivities-at-length for the major fisheries differ substantially from assumptions made to generate operating model projections.
- Whether standardised CPUE estimates are within the bounds indicated in operating model projections, where bounds here and in similar cases following shall be taken to be the 2.5%ile and 97.5%ile of projections under the Reference Set (RS) of operating models..
- [More to come]

1.3 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 that exceptional circumstances exist and provide advice on the action to take.

The Chief Director Research, DAFF 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:

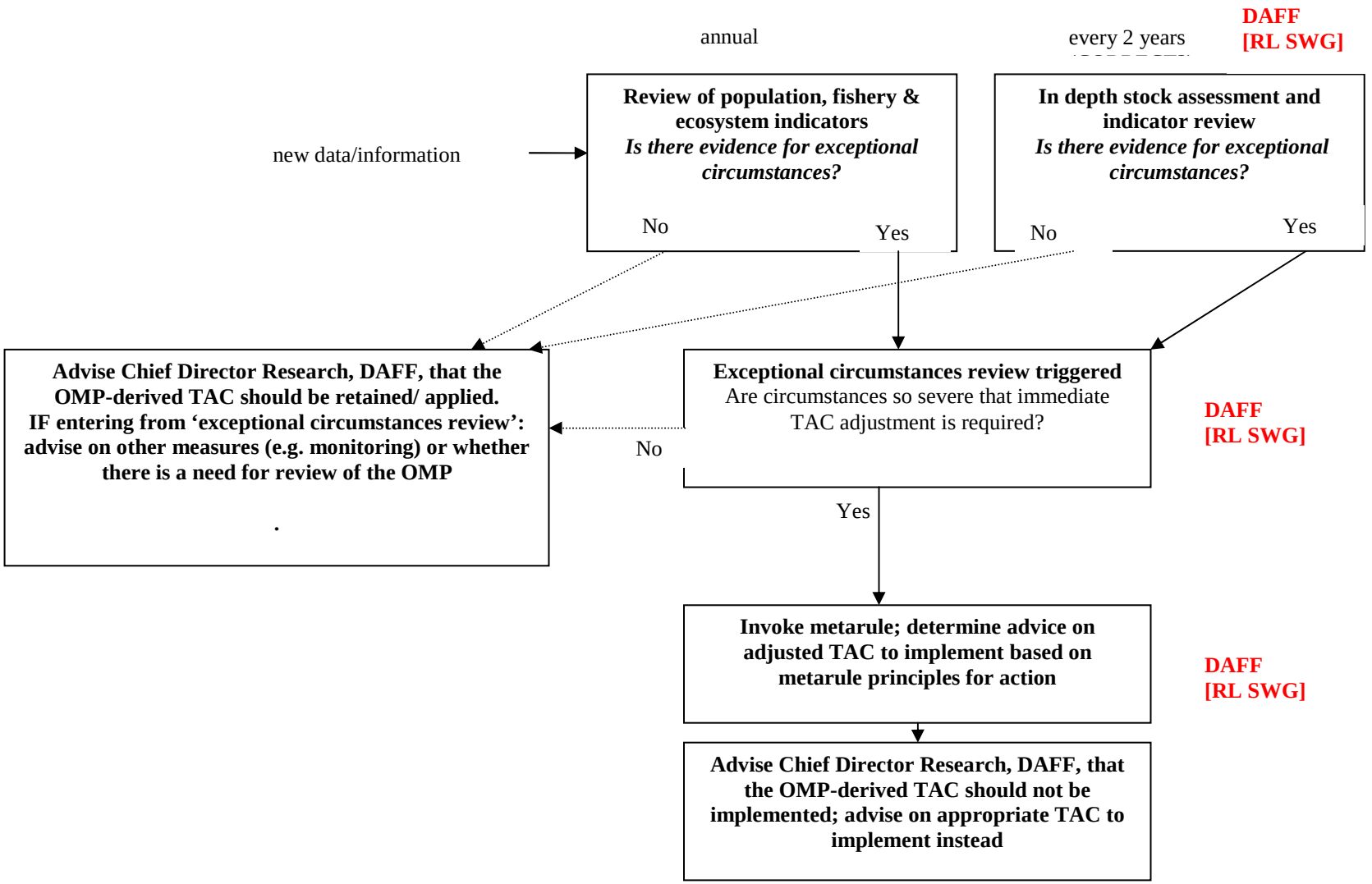
- The OMP-derived TAC should be an upper bound.
- Action should be at least an x% decrease in the TAC output by the OMP, depending on severity.

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

- The OMP-derived TAC should be a minimum.
- Action should be at least a y% increase in the TAC 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 A1: Flowchart for Metarules Process



2. 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.

2.1 Description of Process for Regular Review (see Fig.A2)

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 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 that a review/revision of the OMP is required, giving details of the proposed work plan and timeline.
- Advise the Chief Director Research, DAFF 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 that a review/revision of the OMP is not yet required.

The Chief Director Research, DAFF will:

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

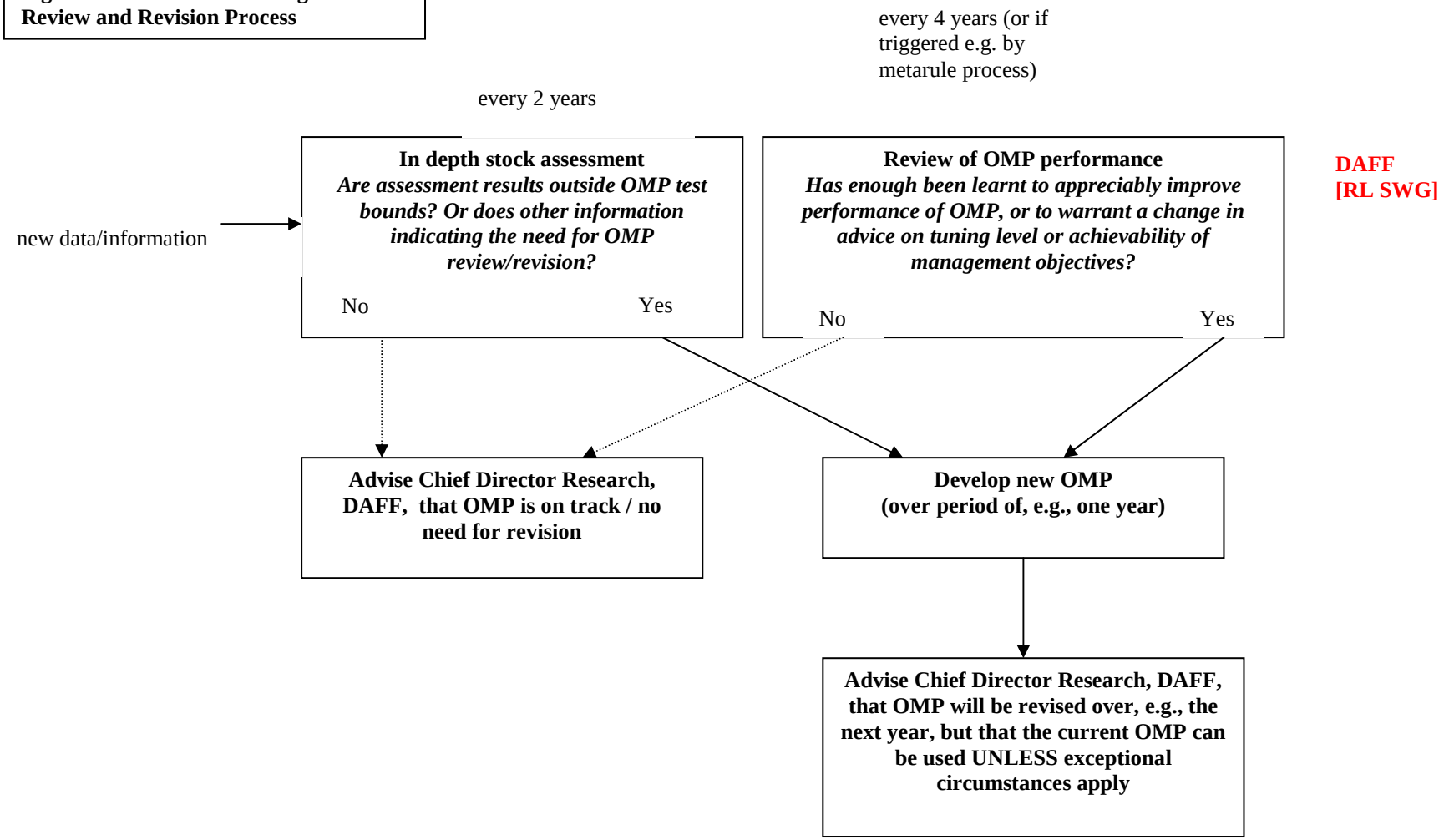



Figure A2. Flowchart for Regular Review and Revision Process