Northwest Atlantic  Fisheries Organization

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[Adopted]

40th ANNUAL MEETING OF NAFO - SEPTEMBER 2018

Recommendations from the WG-RBMS
to forward to the NAFO Commission and Scientific Council

The NAFO Joint Fisheries Commission-Scientific Council Working Group on Risk-Based Management Strategies (WG-RBMS) met in August of 2018 (COM-SC Doc. 18-02) and agreed on the following recommendations to forward to the NAFO Commission and Scientific Council:

The WG-RBMS **recommends** that:

- **The Commission adopt the Exceptional Circumstances Protocol for 2+3KLMNO Greenland halibut management strategy as reflected in Annex 3. The Protocol would be inserted as Annex I.G in the NAFO Conservation and Enforcement Measures.**
- **The Commission and Scientific Council consider and endorse the revised calendar for the development of the 3M Cod MSE as reflected in Annex 4 of this report (COM-SC Doc. 18-02).**
- **The Commission and the Scientific Council continue their work on the NAFO PA Framework.**
- **The Commission approve the corrections in Annex I.F of the NCEM as reflected in Annex 5 of this report (COM-SC Doc. 18-02).**

Annex 3. Draft Exceptional Circumstances Protocol for the Greenland halibut Management Procedure

(from COM-SC Doc. 18-02)

The following criteria constitute Exceptional Circumstances:

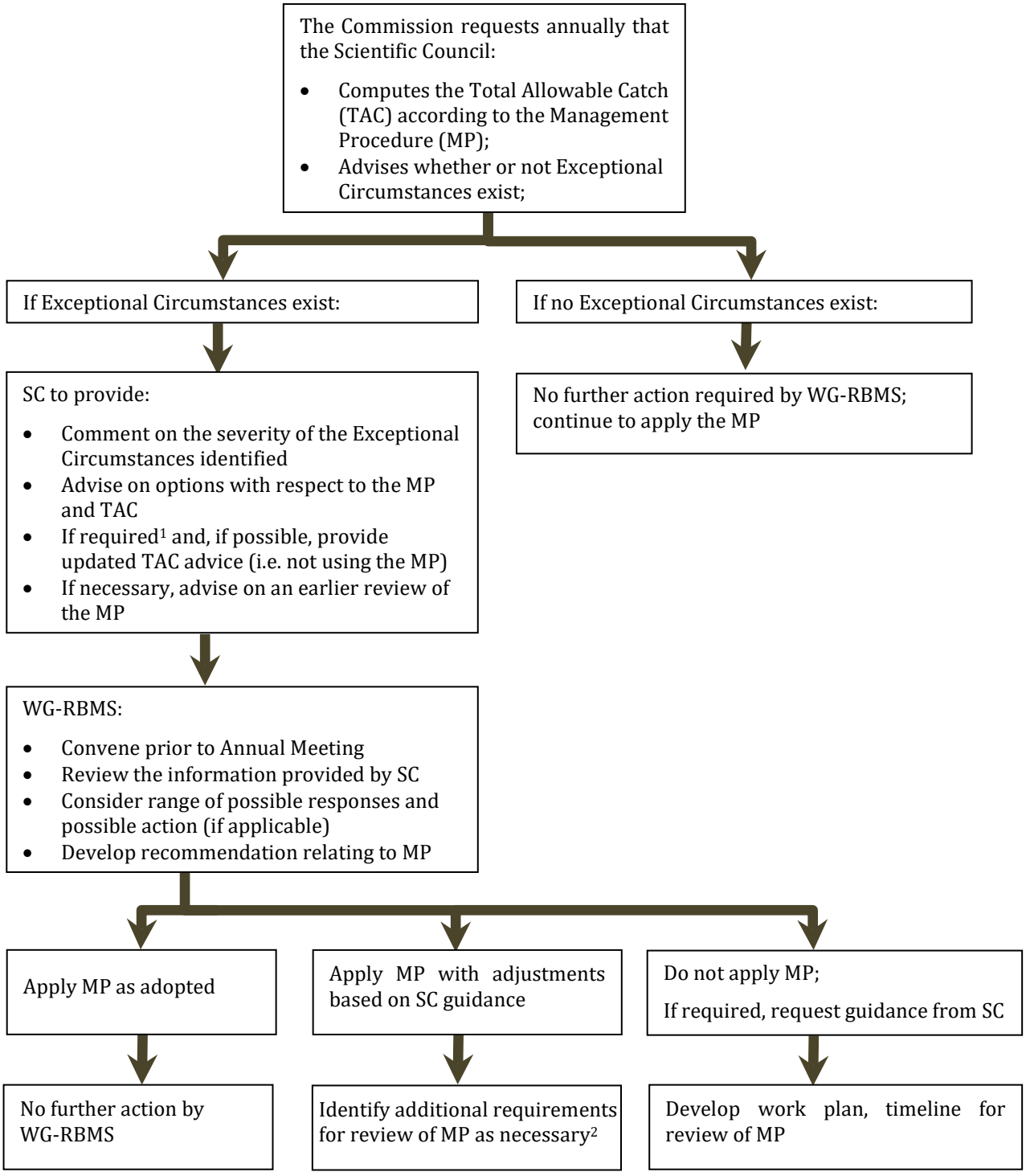
1. Missing survey data:
   - More than one value missing, in a five-year period, from a survey with relatively high weighting in the HCR (Canadian Fall 2J3K, Canadian Fall 3LNO, and EU 3M surveys);
   - More than two values missing, in a five-year period, from a survey with relatively low weighting in the HCR (Canadian Spring 3LNO and EU-Spain 3NO surveys);
2. The composite survey index used in the HCR, in a given year, is above or below the 90 percent probability envelopes projected by the base case operating models from SSM and SCAA under the MS; and
3. TACs established that are not generated from the MP

The following elements will require application of expert judgment to determine whether Exceptional Circumstances are occurring:

1. the five survey indices relative to the 80, 90, and 95 percent probability envelopes projected by the base case operating models (SSM and SCAA) for each survey;
2. survey data at age four (age before recruitment to the fishery) compared to its series mean to monitor the status of recruitment; and
3. discrepancies between catches and the TAC calculated using the MP.[1]

Figure 1 illustrates the actions to be taken in Exceptional circumstances.

[1] Noting that 10% exceedance of TAC was tested during MSE.



1 For example, where the SC determines that, in the light of identified exceptional circumstances, the application of the TAC generated by the MP may not be appropriate.

2 This review may include updated assessment, sensitivity analysis, etc.

Figure 1. Decision tree illustrating actions to be taken in the event of Exceptional Circumstances.

Annex 4. Revised calendar for the development of 3M Cod MSE

(from COM-SC Doc. 18-02)

The table below shows actions required to complete the MSE process, the parties responsible for their completion, and indicative dates that would enable the process to be completed by September 2019.

Validation of code by independent analysts was initially suggested as a separate step towards the end of the process. It is considered to be unlikely that this could be done in the time available although this will remain under consideration. An alternative option would be that external validation could be achieved through some sort of continuous external review throughout the process.

Dates	Action	Responsibility
Fall 2018	Development of OMs	Analysts
	Testing of HCRs	Analysts
	Development of Projection Specifications	Analysts
	Proposals for full set of MO/PS/Risks	Analysts
	Develop Trials Specification document (to be updated as the process continues)	Analysts
	Arrange repository for code and results	Secretariat
January 2019	Review OMs and approve initial set of OMs, including the acceptability of their conditioning, and/or suggest further refinements	SC
	Approve Projection Specifications	SC
	Comments on initial set of HCR (if required)	SC
Feb-March 2019	Test initial/refined HCRs using initial/refined set of OMs	Analysts
March 2019	Review initial MSE results	WG-RBMS
	Update and possibly finalize PS and associated risk levels	WG-RBMS
	Indicate where improvements in performance are most required to guide analysts in revising HCRs	WG-RBMS
April – May 2019	Implement HCR improvements	Analysts
	Propose plausibility weightings for OMs (if required)	Analysts
June 2019 SC Meeting	Review refined OMs and approve final set of OMs, including the acceptability of their conditioning	SC
	Review results from refined HCRs and cull those HCRs not needing further consideration	SC
	Agree plausibility weightings of OMs (though subject to endorsement by RBMS)	SC
Summer 2019. (potentially an additional day on the end of the SC June meeting or separate July meeting, possibly by Webex)	Finalize PS and associated risk levels –	WG-RBMS
	Endorse plausibility weightings of OMs	WG-RBMS
August-early September 2019	Run tests of a final set of HCRs on finalized OMs and prepare consolidated results –	Analysts
preceding NAFO AM 2019	Review results of MSE for revised HCRs & recommendation to Commission –	WG-RBMS

Annex 5. Changes in Greenland halibut Harvest Control Rule in Annex I.F of the NCEM

(from COM-SC Doc. 18-02)

Revision of NCEM Annex I.F
Greenland halibut Management ~~Strategy~~Procedure

Proposed changes to Annex I.F to reflect the original intention in the Greenland halibut management strategy adopted by the Commission in 2017.

Annex I.F
Greenland halibut Management ~~Strategy~~Procedure

The harvest control rule (HCR) will adjust the total allowable catch (TAC) from year (y) to year (y+1), according to:

a combination of a "target based" and a "slope based" rule detailed below.

*Target based (***t***)*

The basic harvest control rule (HCR) is:

$$TAC_{y+1} = TAC_y\left(1 + \gamma\left(J_y - 1\right)\right) \quad (1)$$

where

TAC_y is the TAC recommended for year y,

γ is the "response strength" tuning parameter,

J_y is a composite measure of the immediate past level in the mean weight per tow from surveys (I^i_y) ~~abundance indices~~ that are available to use for calculations for year y; ~~for this base case CMP~~ five series ~~have been~~ are used, with i = 1, 2, 3, 4 and 5 corresponding respectively to Canada Fall 2J3K, EU 3M 0-1400m, Canada Spring 3LNO, EU 3NO and Canada Fall 3LNO:

$$J_y = \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} \frac{J^i_{current~~curr~~,y}}{J^i_{target}} \Big/ \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} \quad (2)$$

with

$(\sigma^i)^2$ being the estimated variance for index i (estimated in the SCAA model fitting procedure, see Table 1)

$$J^i_{current~~curr~~,y} = \frac{1}{q}\sum_{y'=y-q}^{y-1} I^i_{y'} \quad (3)$$

$$J^i_{target} = \alpha\frac{1}{5}\sum_{y'=2011}^{2015} I^i_{y'} \quad \text{(where α is a control/tuning parameter for the ~~CMP~~MP)} \quad (4)$$

Note the assumption that when a TAC is set in year y for year y+1, indices will not at that time yet be available for the current year y.

*Slope based (***s***)*

The basic harvest control rule (HCR) is:

$$TAC_{y+1} = TAC_y\left[1 + \lambda_{up/down}\left(s_y - X\right)\right] \quad (5)$$

where

$\lambda_{up/down}$ and X are tuning parameters,

s_y is a measure of the immediate past trend in the survey-based abundance indices, computed by linearly regressing $lnI^i_{y'}$ vs year y' for $y' = y - 5$ to $y' = y - 1$, for each of the five surveys considered, with

$$s_y = \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} s_y^i / \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} \quad (6)$$

with the standard error of the residuals of the observed compared to model-predicted logarithm of survey index i (σ^i) estimated in the SCAA base case operating model.

*Combination Target and Slope based (**s+t**)*

For the target and slope-based combination:

1) TAC_{y+1}^{target} is computed from equation (1),
2) TAC_{y+1}^{slope} is computed from equation (5), and
3) $TAC_{y+1} = \left(TAC_{y+1}^{target} + TAC_{y+1}^{slope}\right)/2$

Finally, constraints on the maximum allowable annual change in TAC are applied, viz.:

$$\text{if } TAC_{y+1} > TAC_y(1+\Delta_{up}) \text{ then } TAC_{y+1} = TAC_y(1+\Delta_{up}) \quad (7)$$

and

$$\text{if } TAC_{y+1} < TAC_y(1-\Delta_{down}) \text{ then } TAC_{y+1} = TAC_y(1-\Delta_{down}) \quad (8)$$

The control parameters for the ~~recommended~~ adopted MP ~~MP: CMP16.5_s+t~~are shown in Table 2 with a starting TAC of 16 500 t in 2018. Missing survey values are treated as missing in the calculation of the rule as in the MSE.

Table 1. The weights given to each survey in obtaining composite indices of abundance are proportional to the inverse squared values of the survey error standard deviations σ^i listed below.

Survey	σ^i
Canada Fall 2J3K	0.22
EU 3M 0-1400m	0.21
Canada Spring 3LNO	0.49
EU 3NO	0.38
Canada Fall 3LNO	0.26

Table 2. Control parameter values for the MPs recommended. The parameters α and X were adjusted to achieve a median biomass equal to B_{msy} for the exploitable component of the resource biomass in 2037.

TAC_{2018}	16 500 tonnes
γ	0.15
q	3
α	0.972
λ_{up}	1.00
λ_{down}	2.00
X	-0.0056
Δ_{up}	0.10
Δ_{down}	0.10