40th ANNUAL MEETING OF NAFO - SEPTEMBER 2018

Recommendations from the WG-RBMS addressed to the Commission

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 addressed only to the Commission:

The WG-RBMS **recommends** that:

- **The Commission adopt the Exceptional Circumstances Protocol for 2+3KLMNO Greenland halibut management strategy as reflected in Annex 3 [of COM-SC Doc. 18-02]. The Protocol would be inserted as Annex I.G in the NAFO Conservation and Enforcement Measures.**

- **The Commission approve the corrections in Annex I.F of the NCEM as reflected in Annex 5 [of 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:

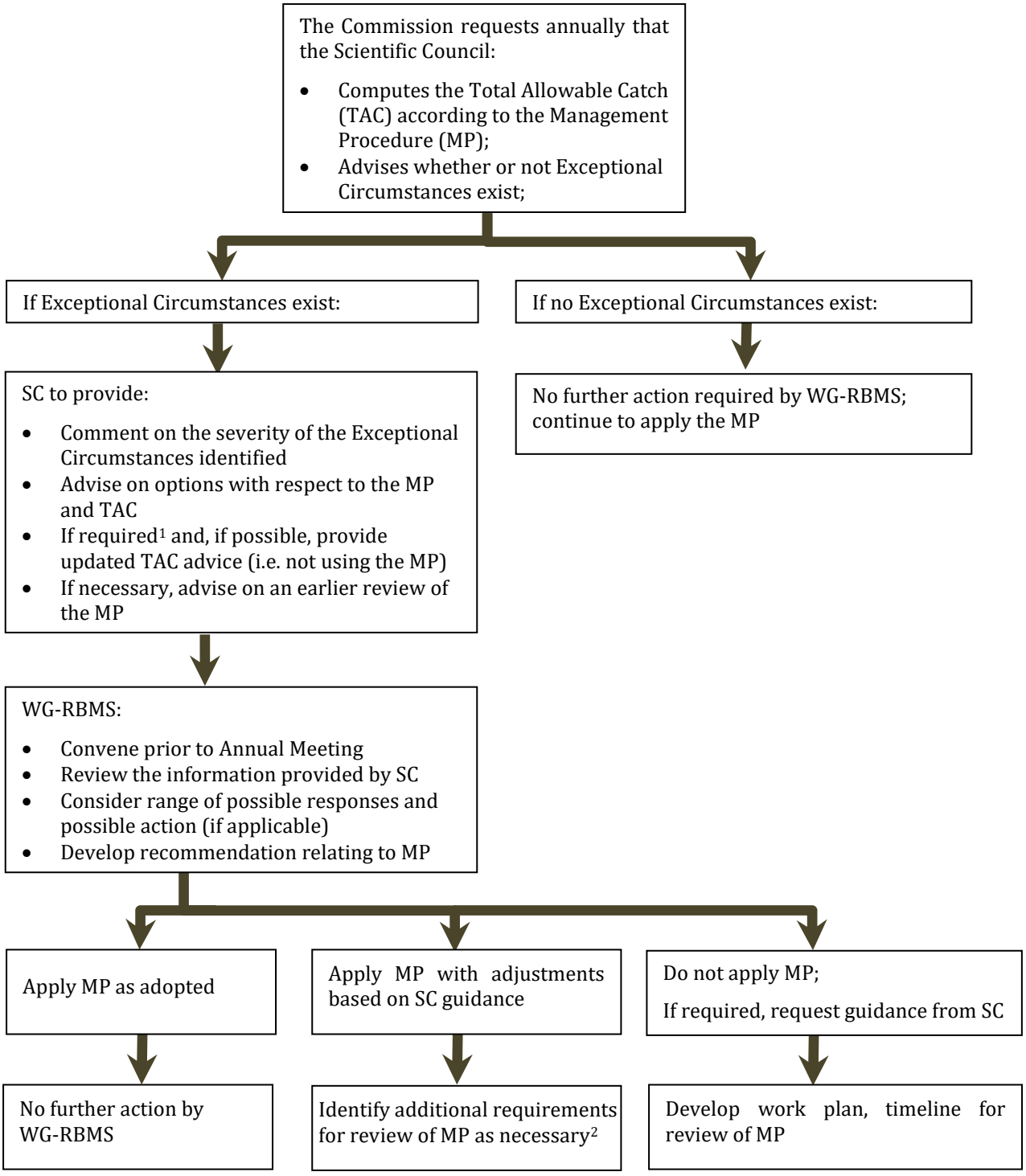
1. the five survey indices relative to the 80, 90, and 95 percent probability envelopes projected by the base case operating models (SSM and SCAA) for each survey;

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 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