Northwest Atlantic  Fisheries Organization

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Changes to the NAFO Conservation and Enforcement Measures for 2018 following the adoption of the WG-RBMS Recommendations

Based on the adoption of the NAFO Joint Fisheries Commission-Scientific Council Working Group on Risk-Based Management Strategies (WG-RBMS) recommendations (COM-SC WP 17-06), it is necessary to amend the NAFO Conservation and Enforcement Measures (CEM) for 2018.

The following text changes are proposed to implement the adoption of these WG-RBMS recommendations.

Article 10 – Greenland Halibut

Rebuilding Program

1. The current Management Strategy (MS) for Greenland halibut stock in Subarea 2 + Divisions 3KLMNO adopted by NAFO in 2017 shall be in force ~~initially~~ from 2018 to 2023 inclusive ~~until 2017~~.

~~2. The objective of this programme is an exploitable biomass of 5+ year classes of 140 000 tonnes on average, allowing a stable yield over the long term in the Greenland halibut fishery.~~

2. The total allowable catch (TAC) shall be adjusted annually according to the harvest control rule (HCR) specified in Annex I.F.
3. The Exceptional Circumstances Protocol (Annex I.G) shall be invoked in response to an event or observation by Scientific Council which is outside of the range of possibilities considered within the MSE.

Annex I.F
Greenland Halibut Management Strategy

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 abundance indices that are available to use for calculations for year *y*; for this base case CMP five series have been 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:

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

with

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

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

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

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

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

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^{target}_{y+1} 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.:

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

and

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

The control parameters for the recommended MP: CMP16.5_s+t are shown in Table 2.

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

~~TAC y+1 = TAC y (1 + λ × slope),~~
~~where slope = measure of the recent trend in survey biomass and, λ = 2.0 if slope is negative and λ = 1.0 if slope is positive.~~
~~The TAC generated by the HCR is constrained to ± 5% of the TAC in the preceding year.~~

Annex I.G
Exceptional Circumstances Protocol

The NAFO Joint Fisheries Commission-Scientific Council Working Group on Risk-Based Management Strategies (WG-RBMS) will meet in August 2018 to finalize the exceptional circumstances protocol for adoption at the Annual Meeting of NAFO in September 2018.

~~**1. Background:**~~

~~Fisheries Commission (FC) adopted in 2010 a new Management Strategy (MS) for the Greenland halibut stock in Subarea 2 + Divisions 3KLMNO. This MS is applied annually to automatically adjust the TAC based on the recent trend in the survey biomass.~~

~~*Exceptional Circumstances* provisions are intended to respond to an event or observation which is outside of the range of possibilities considered within the MSE. In such cases, Fisheries Commission may have reason to over-ride the TAC provided by the MS and/ or also require the MS to be reviewed/ revised. To this effect, Scientific Council (SC) will annually monitor the situation and provide advice to Fisheries Commission on whether or not 'exceptional circumstances' may be occurring.~~

~~**2. Exceptional Circumstances**~~

~~Some examples, identified by the Scientific Council, which could constitute exceptional circumstances in the Greenland halibut application may include catches in excess of the range tested or observed surveys outside the range simulated. The range of catches and the survey indices are the only information that allow a direct comparison of observed data with modelled results. These should therefore be considered at a primary level. Other indicators should be considered at a secondary level of importance.~~

~~**Data Gaps** - Incomplete/Missing survey data or termination of a survey time series;~~

- ~~**Biological Parameters** - Biological inputs which differ from the range of possibilities included within the MSE (e.g. natural mortality);~~
- ~~**Recruitment** - Estimated recruitments in the assessment no longer appear to be consistent with the range of recruitments considered in the MSE, where the same model is used for the estimation as used in the MSE; and /or~~
- ~~**Fishing Mortality** - Estimates of fishing mortality that are outside the range of values generated in the MSE, where the same model is used for the estimation as used in the MSE; and/or~~
- ~~**Exploitable Biomass** - Estimates of Exploitable Biomass that are outside the range of values generated in the MSE, where the same model is used for the estimation as used in the MSE.~~

~~Ongoing Scientific Council analysis related to this stock may also identify other situations which warrant consideration as exceptional circumstances.~~

~~The 90% probability intervals obtained from the projection from the MSE process should be considered as a reference.~~

~~Advice provided by Scientific Council which suggests the occurrence of exceptional circumstances should be based on compelling evidence and should include sufficient detail to allow FC to take an informed decision on implementation of the MS and possible next steps.~~

~~**3. Implementation/ Next Steps**~~

~~When SC advice indicates that exceptional circumstances may be occurring, FC will consider a range of responses/ possible courses of action taking into account the degree and type of circumstance noted. In order, those that would be considered are as follows:~~

1. ~~Review the information, but maintain the MS as the management tool; additional research/monitoring may be recommended to determine if the signal detected warrants moving to step 2;~~
2. ~~Advance the review period (currently 2017), and potentially revise the MS, but implement the MS outputs;~~
3. ~~Set a catch limit that departs from the MS, and revise the MS.~~