Management Strategy Evaluation - Harvest Control Rules

2003 - NAFO agreed to a fifteen-year Rebuilding Plan for the Greenland halibut stock in Subarea 2 and Divisions 3KLMNO. The objective of the plan was to attain a level of exploitable biomass 5+ year classes of 140,000 t on average, allowing for a stable yield over the long term in the Greenland halibut fishery.

2008 - NAFO began the process of developing a management strategy approach to the Greenland halibut stock. This concept describes a novel approach in the understanding and evaluating the interactions among various management strategies against a background of uncertainty and trade-offs. The strong point of the MSE approach is to properly address concerns about scientific uncertainty through simulation testing. In this way feedback secures reasonably robust performance across a range of plausible alternative resource dynamics. Indeed MSE is based on Operating Model (OM) structure, which represents a particular version of "reality" (Details of MSE, including the mechanism, are contained in NAFO SCS Doc. 08/13).

Under MSE, Management Strategy (MS) is applied based on the simulated perceived state of the stock and the impact is evaluated with respect to the simulated true stock. A strategy is acceptable if it performs well across a range of possible realities regarding the true OM and the level of processor error, estimation error and model error. In the MSE context, performance measures (PM) were proposed to evaluate how well a particular MS is performing. It was concluded that two additional PMs were considered to be important: a CPUE predictor and an optimum fish size.

The work examined represented a first step in the process, although it wasn't the stage where advice to Fisheries Commission (FC) could be provided on the management of Greenland halibut.

2009 - MS incorporating feedback harvest control rule (HCR) either based on survey data directly (model-free approach) or the annual XSA (eXtended Survivors Analysis) assessment of the stock size and the TAC in the previous year, appeared to show the most promise (NAFO/FC Doc. 09/18). But there is still continued uncertainty on the stock assessment.

2010 - The MSE approach was adopted, and was initially in force until 2014 (NAFO/FC Doc. 10/12).

The core of an MS is typically a feedback HCR. It was agreed by the Working Group-MSE that the model-free (survey-based) HCR, described in NAFO SCR Doc. 09/37, would be applied. The HCR will adjust the total allowable catch (TAC) from year (y) to year (y+1) according to:

$$TAC_{y+1} = TAC_y \ (1 + \lambda \times slope)$$

where:

slope = is based on the average trend in biomass from three survey indices (the Canadian Autumn Div. 2J3K index ("F2J3K"), the Canadian Spring Div. 3LNO index ("S3LNO"), and the EU Flemish Cap index covering depths from 0-1400m ("EU1400")) over the previous five years.

λ = is an adjustment variable for the relative change in TAC to the perceived change in stock size. The value of λ is 2 if the average slope is negative, and 1 when the slope is positive.

2011 - Slopes were estimated from linear regression of log-scale biomass indices (mean weight per tow) over 2006 -2010. Averaging the individual survey slopes yield slope= -0.1130. Therefore, 17185*[1+2*(-0.1130)] = 13 301 t. However, as this change exceeds 5%, the HCR constraint is activated and TAC2012 = 0.95*17185=16 326 t.

NAFO

Northwest Atlantic Fisheries Organization • 2 Morris Drive, Dartmouth, Nova Scotia, Canada
+1-902-468-5590 • info@nafo.int • www.nafo.int

Commission requested Scientific Council to provide guidance on what constitutes "exceptional circumstances" and to provide advice on whether or not the "exceptional circumstances" provision should be applied.

2012 - It was determined that "exceptional circumstances" occur when a resource moves outside the range of parameters compatible with the various scenarios considered in the MSE simulation testing, on which selection of the management strategy for that resource was founded. If "exceptional circumstances" are occurring, a review and possible revision of the HCR,(as outlined by the FC Working Group on MSE (FC Doc. 11/08), may be necessary.

2013 - MSE was reviewed (FC Doc. 13/23) and it was agreed to use the current MS for three additional years (2015-2017). The Working Group on Risk-based Management Strategies (WG-RBMS) will provide an approach and a workplan to review MS in 2017.

2014 - The survey slopes used in the calculation of the TAC for 2015 are shown below:
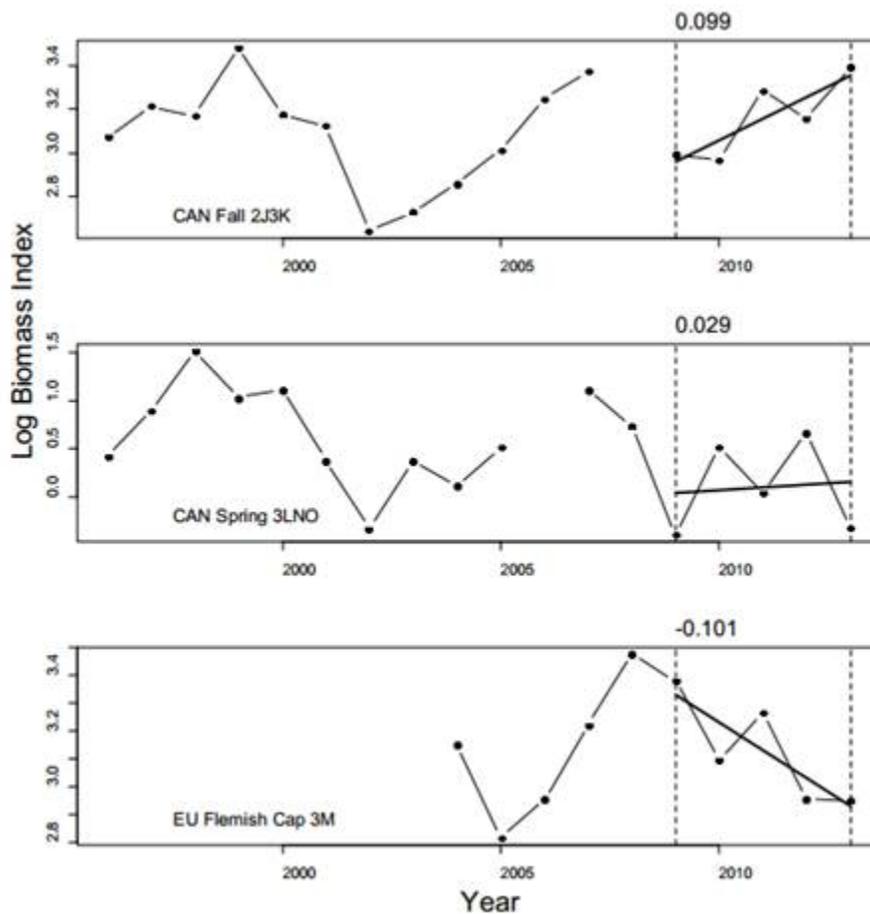
As per the HCR, survey slopes were computed using the most recent five years of survey data (2009-2013) for Greenland Halibut in Subarea 2 + Divisions. Averaging the individual survey slopes yields slope= 0.0089. Therefore, the computed TAC is: 15 441*[1+1*(0.0089)] = 15 578 t. This change from the 2014 TAC is within the ± 5% constraint on TAC change that is part of the HCR.

According to the indicator based on surveys, exceptional circumstances are presently occurring, with one survey observation below the 5th percentile of the simulated distributions. Due to the unavailability of catch estimates in 2011, 2012, and 2013, it is unable to be determined whether recent catches also constitute an exceptional

circumstance and does not allow evaluation for some of the secondary indicators. Although the application of the HCR results in an increase in TAC, the fact that one of the 2013 surveys is below the simulated distributions constitutes an exceptional circumstance and is a conservation concern.