Extracted from Report of the Scientific Council, June 2014, SCS Doc. 14/17

(http://archive.nafo.int/open/sc/2014/scs14-17.pdf)

viii) Development of MSE for redfish in Div. 3LN (Item 11)

The Fisheries Commission requests the Scientific Council to explore models that could be used to conduct a Management Strategy Evaluation for Div. 3LN redfish and report back through the Working Group on Risk-Based Management Strategies during their next meeting.

Further to this the FC/SC WG on Risk Based Management Strategies (FC-SC 14/02) made the following recommendation:

*The WG **recommends** SC discuss selection of operating models and evaluate the Div. 3LN Redfish management strategy relative to the performance statistics prior to the 2014 Annual Meeting (Annex 7).*

Scientific Council responded

Models to conduct a Management Strategy Evaluation for Div. 3LN redfish were developed. The management strategy proposed by the FC-SC WG on Risk Based Management Strategies was tested and found to meet the specified management objectives and performance statistics.

Scientific Council considered a range of operating models (OM) all based on versions of the Schaeffer surplus production model. The following set of OMs was chosen for the MSE:

i. old stock assessment model updated to 2014 (ASPIC 2012)

ii new stock assessment model (ASPIC 2014)

iii. "ASPIC2012-like" surplus production model in a Bayesian framework (same constraints on parameters)

iv. "ASPIC-like" new stock assessment in a Bayesian framework (ASPIC 2014 fixed MSY)

v. Surplus production model in a Bayesian framework with all data sets, minimum constraints

vi. A spatially disaggregated surplus production model in a Bayesian framework (treating carrying capacity in Div. 3L and 3N separately)

The MSE considered the harvest control rule (HCR) proposed by the WGRBM as well as three other HCRs.

HCR1 stepwise: (from WGRBM)
Increase the TAC in constant increments starting in 2015 – i.e. TAC $_{y+1}$ = TAC $_{y}$ + 1 900t to a maximum of 20 000t. This would provide the following annual TACs:

2015: 8 900
2016: 10 800
2017: 12 700
2018: 14 600
2019: 16 500
2020: 18 400
2021: 20 000

HCR2 stepwise slow: this HCR is designed to reach 18 100 t of annual catch by 2019-2020 through a stepwise biannual catch increase, with the same amount of increase every two years between 2015 and 2020. 18 100 t is the equilibrium yield in 2014 assessment under the assumption of an MSY of 21 000 t.

2015: 10 400
2016: 10 400
2017: 14 200
2018: 14 200
2019: 18 100
2020: 18 100

HCR3: Constant catch (20 000 t)

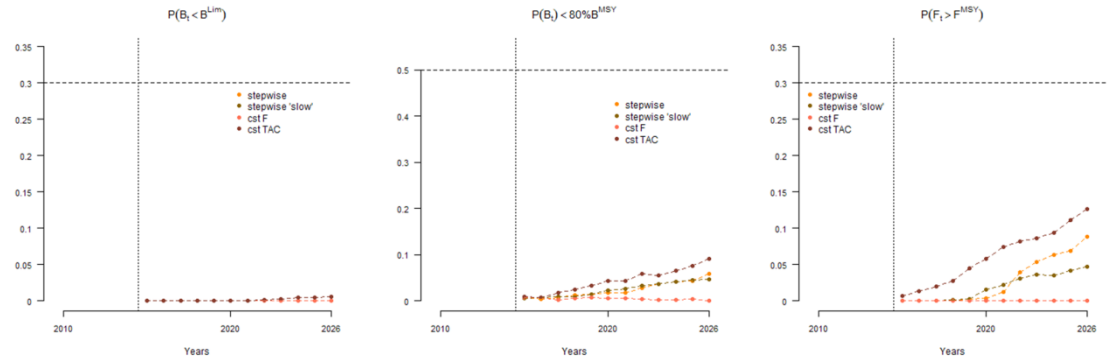
HCR4: Constant F (2/3 of FMSY)

The performance statistics used to evaluate the performance of the HCRs were as in FC-SC 14/02:

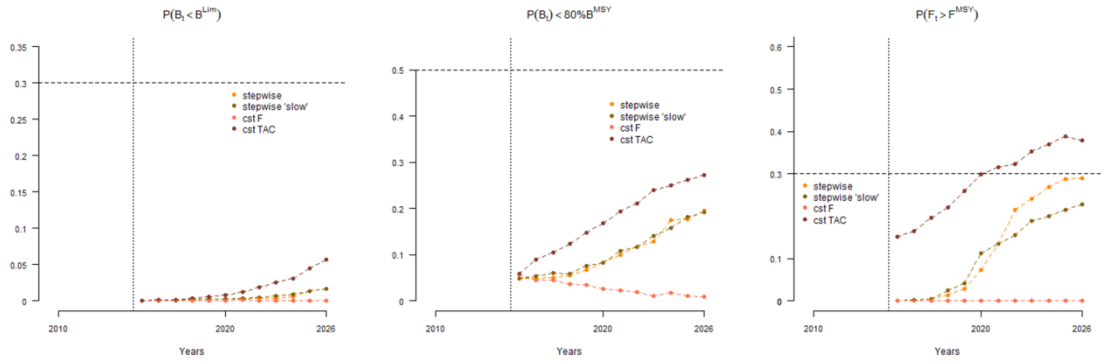
i. Low (30%) probability of exceeding F_{msy} in any year
ii. Very low (10%) probability of declining below B_{lim} in the next 7 years
iii. Less than 50% probability of declining below 80% B_{msy} in the next 7 years

Projections of population size were conducted for each OM using each HCR and the probability of transgressing the performance statistics calculated. In the figures below the probabilities of transgressing each performance statistic are given for each operating model and HCR. In the plots 'stepwise' is the HCR proposed by the FC/SC WGRBMS, 'stepwise slow' is HCR2 which has an increase in TAC every two years to a maximum of 18 100 t, 'cst TAC' is a constant catch of 20 000 t, and 'cst F' is a constant F of 2/3 FMSY.

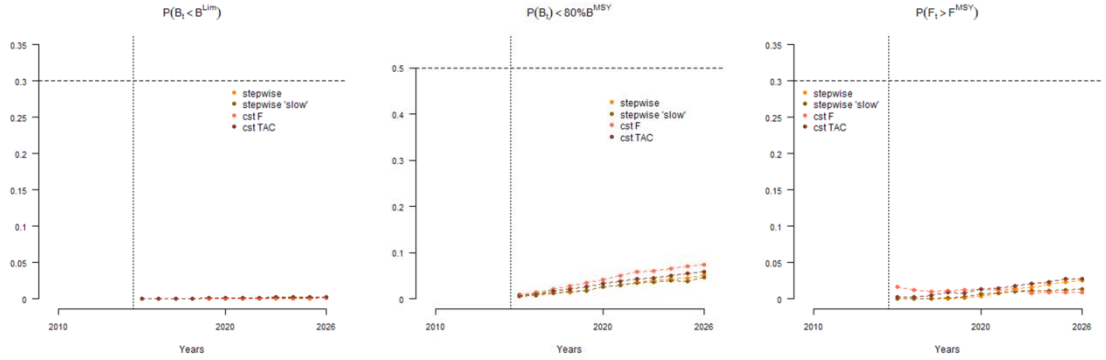
OM1 ASPIC 2012



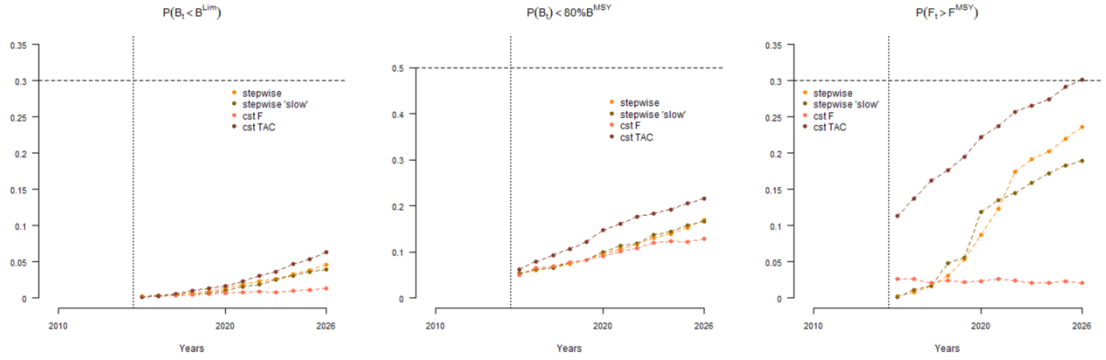
OM2 ASPIC 2014



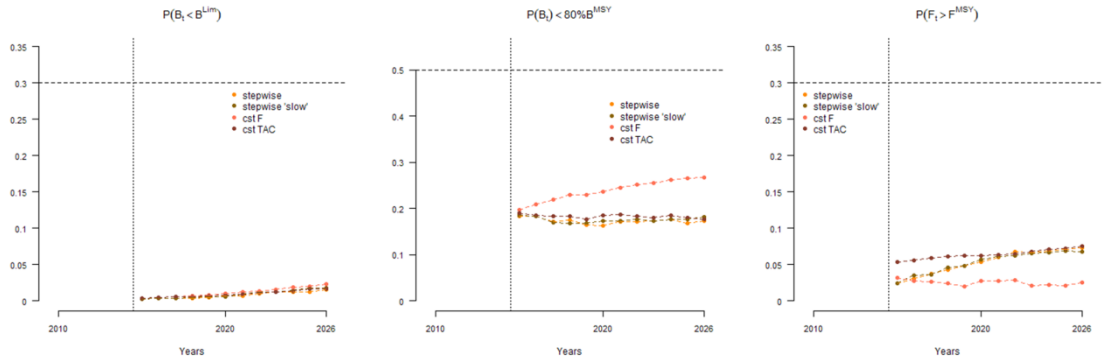
OM3 Bayesian ASPIC 2012 like



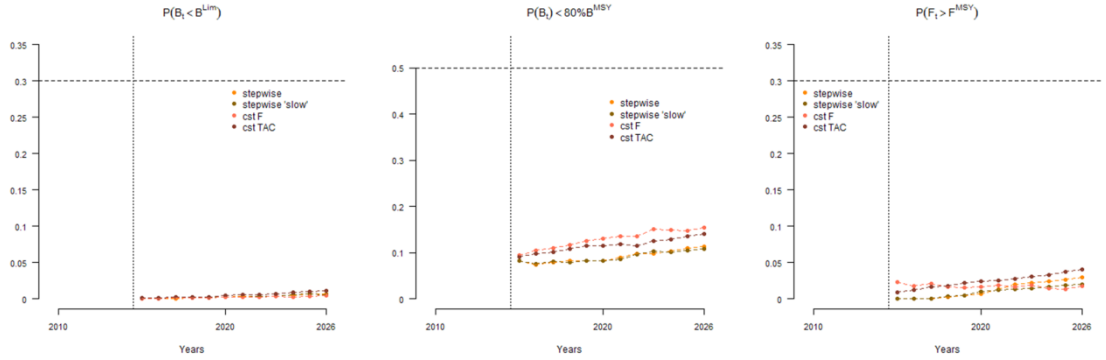
OM4 Bayesian ASPIC 2014 like



OM5 Bayesian surplus production model minimum constraints



OM6



Of the HCRs tested, only the constant catch of 20 000 t rule failed to meet the performance statistics on all OM. This HCR had greater than 30% probability of exceeding F_{msy} by the end of the projection period for OM 2 and OM 4, the two operating models based on an MSY of 21 000 t. The HCR proposed by the FC-SC WGRBMS meets all performance statistics on all OM.

Scientific Council notes the uncertainty in performing long term projections. If a long term management strategy is implemented for this stock, Scientific Council will continue to monitor its performance through trends in the survey indices and every two years, by conducting a full assessment. If the assessment results indicate deterioration in stock status such that the probability of transgressing the performance statistics exceeds the probabilities outlined in the MSE, or if catches exceed the TACs defined in the harvest control rule, then exceptional circumstance will be considered to be occurring. Scientific Council will provide advice on other exceptional circumstances at a later date.