

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

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

ii) *Reference points for cod in Div. 3M (Item 5)*

*The Fisheries Commission requests the Scientific Council to continue the work on reference points and provide  $B_{msy}$  and  $F_{msy}$  for cod in Div. 3M.*

The Scientific Council responded:

Scientific Council decided that  $F_{30\%}$  (the fishing mortality which reduces Spawner Per Recruit (SPR) to 30% of its value at  $F=0$ ) is the best  $F_{msy}$  proxy at this moment.

In 2013, Scientific Council discussed the Div. 3M cod reference points based on the stock recruitment (S/R) data for 3M cod from the most recent assessment. Three different S/R models were fit to these data. Results show that none of these fitted appropriately. Scientific Council (NAFO, 2013) noted that the level of  $B_{msy}$  estimated from Yield Per Recruit (YPR) and Spawning Per Recruit (SPR) depends on assumptions about the level of recruitment. So, more research about the possibility of changes in productivity and the level of recruitment that should be used to estimate the MSY is needed.

In 2014, Scientific Council analyzed the YPR and SPR inputs (mean weights, partial recruitment and maturity ogive) to study the possibility of changes in productivity in the past and its impact in the estimated values of reference points. The  $F_{msy}$  proxy was estimated using data from 1972 to 2013 because trends in biological parameters (weights, maturity, partial recruitment) have been observed in the most recent years (2009-2013).

In Div. 3M cod there is clear evidence of recruitment dependence on biomass at low SSB levels. Low recruitment have been observed at SSB less than 14 000 t. The recruitment dependence on biomass is less clear at medium and high SSB levels although a certain decrease of the recruitment at high SSB levels. Scientific Council decided not use  $F_{max}$  in the Div. 3M cod case as the best  $F_{msy}$  proxy due to the recruitment decline at low spawning stock sizes and probably  $F_{max}$  overestimate  $F_{msy}$ .

The NAFO Study Group on Limit Reference considered that when a SR relationship or a production relationship cannot be determined from the available data, consideration should be given to SPR analysis as a means of determining  $F_{msy}$ . The determination of the appropriate %SPR for use as  $F_{msy}$  depends on the biology of the population. %SPR of 35% should be used as a default  $F_{lim}$  for such stocks in the absence of meta-analysis considerations or other considerations to suggest it should be higher or lower. Examination of the data for Div. 3M cod determined that a 30% SPR was the most appropriate proxy for  $F_{msy}$ .