ECOREGION Celtic Sea and West of Scotland
SUBJECT NEAFC request to evaluate proposal for harvest control rules for Rockall haddock

Advice Summary

ICES examined the proposed harvest control rules (HCRs) of a long-term management plan for Rockall haddock but the analyses are preliminary and incomplete. ICES, therefore, is unable to assess if the proposed HCRs are consistent with the precautionary approach. ICES notes, however, that the proposed harvest control rules would provide an improvement over recent management approaches, but the rules need to be further evaluated.

Request

NEAFC requests ICES to evaluate the following proposal for the harvest control component of a long-term management plan for Rockall haddock and in particular to consider whether the plan is consistent with the precautionary approach and will provide for the sustainable harvesting of the stock. ICES will also suggest an alternative approach if necessary.

Draft EU-Russia proposal for harvest control component of a long-term management plan for haddock at Rockall

In the following, the TACs refer to total catches, not just landings.

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than Bpa and a minimum level of SSB greater than Blim.*
2. *For [20XX] and subsequent years the Parties agreed to set a TAC to be consistent with a fishing mortality rate of no more than [either Fpa (0.4) or Fmsy (0.3)] for appropriate age-groups, when the SSB in the end of the year in which the TAC is applied is estimated above B_{pa}.*
3. *The Parties agree that the TAC that results from the application of the fishing mortality referred to in paragraph 2 will be adjusted according to the following formula:*

    a. *TACy = TACf + 0.2 * (TACy-1 – TACf)*

    where TACy is the TAC that is to be set by the management plan, TACy-1 is the TAC that was fixed the previous year and TACf is the TAC resulting from the provisions in paragraphs 1 and 2.
4. *Where the SSB referred to in paragraph 2 is estimated to be below Bpa but above Blim the TAC shall not exceed a level, which will result in a fishing mortality rate equal to $0.3 - 0.2 \times (Bpa - SSB)/(B_{pa} - B_{lim})$. This consideration overrides paragraph 3.*
5. *Where the SSB referred to in paragraph 2 is estimated to be below Blim the TAC shall be set at a level corresponding to a total fishing mortality rate of no more than 0.1. This consideration overrides paragraph 3.*
6. *No later than 31 December [20XX], the parties shall review the arrangements in paragraphs 1 to 5 in order to ensure that they are consistent with the objective of the plan. This review shall be conducted after obtaining inter alia advice from ICES concerning the performance of the plan in relation to its objective.*

Elaboration on the Advice

ICES reviewed analyses of the proposed harvest control rules (HCRs) of a long-term management plan for Rockall haddock, but the simulations carried out were insufficient to determine whether or not the HCRs are consistent with the precautionary approach. The analyses suggested that the proposed HCR with an $F_{target} = 0.3$ had a low risk of the SSB falling below B_{lim}. In one of the analyses, the proposed HCR with an $F_{target} = 0.4$ had a greater than 10% risk of the SSB falling below B_{lim}. ICES considers that the analyses of both HCRs underestimate the risk that SSB will be less than B_{lim} because scenarios, consistent with the characteristics of the stock and fisheries, were not fully examined (see the Results and conclusions section).

Nevertheless, ICES notes that the proposed HCRs are an improvement compared to the management approaches implemented in recent years because the TAC would now account for total catches (landings and discards) from all sources, including the international fishery.

The proposed HCRs include two target fishing mortality proposals (0.3 and 0.4). When the estimated SSB value, referred to in Paragraph 2, is between B_{lim} and B_{pa}, Paragraph 4 is invoked. In this circumstance, if $F_{target} = 0.4$, there is a discontinuity in the F to be used in setting the TAC, depending on whether the SSB is just above or below B_{pa}. If the estimated SSB is below B_{pa}, an immediate drop to F = 0.3 is required, leading to large fluctuations in TAC and making

the application of this HCR very sensitive in situations where SSB is estimated to be around B_{pa}. ICES considers that the formula for determining the fishing mortality rate in Paragraph 4 should provide continuity with respect to the target F defined in Paragraph 2.

In the past, discards percentages of certain trawl fleets from the European Union have been observed to be as high as 52% to 87% by numbers. The discarding percentage is highly dependent on the abundance of incoming recruitment. The proposed HCRs specify that TACs refer to total catch, not just landings. ICES considers that controlling total catch is the only way to control fishing mortality. Closer monitoring of actual catches (instead of just landings) is required. The long-term management plan needs to specify how this will be accomplished. ICES previously advised (ICES, 2011a) *that it would be beneficial to develop and introduce fisheries practices and measures aimed at preventing discards of haddock.*

Suggestions

Because the stock-recruitment relationship for this stock is poorly defined (as is the case for many other stocks and particularly so for haddock), a more complete evaluation of the HCRs requires conducting simulations under low recruitment conditions, as have been observed in recent years. Analyses including implementation errors (for example, catch exceeding the TAC), and explorations of the impact of errors in catch data on the assessment and of variations in the fishery selection pattern (due to fleet variability) would also be useful.

The TAC adjustment foreseen in Paragraph 3 could induce large percentage changes in TAC from year to year. This could simply result from strong recruitment. The performance of this, and other TAC constraints, should be examined in subsequent analyses.

Potential benefits, both to the industry and the stock, of improving the fishery selection pattern should also be evaluated.

Basis of advice

Background

The haddock stock at Rockall is a separate stock from that on the continental shelf of the British Isles. Rockall haddock have lower growth rates and reach a lower maximum size than other haddock populations in the Atlantic. There does not appear to be a significant stock-recruitment relationship for this stock, which is typical for haddock stocks. For example, recruitment for the last four years has been very low despite a moderately large SSB.

Discussions between the European Union (EU) and the Russian Federation (RF) on possible joint management measures for the Rockall haddock fishery have taken place for over ten years. Changes in the shape of the EU Exclusive Economic Zone in 1999 led to a renewal of the RF Rockall haddock fishery, making it clear that joint management would be desirable although potentially difficult to implement. Meetings involving both scientists and fisheries managers from the EU and the RF have been held on an almost annual basis since 2001 to determine what is known about these fisheries, and how such information can best be used to develop a productive and sustainable management system.

Building on the history of Rockall fisheries and the supporting scientific work presented by Newton *et al*. (2008) and Filina *et al*. (2009), the EU-RF Working Group on Rockall haddock met several times during 2008–2010 and produced a state-of-the-art review of available data and scientific analyses pertaining to Rockall haddock [(EU-RF, 2011) documents the first three of these meetings]. At the fourth meeting in Edinburgh during September 2010, a proposal for a joint EU-RF management plan for Rockall haddock was drafted. Following further refinements, a final version was presented to the appropriate NEAFC plenary meeting towards the end of 2010. The decision was taken there to forward the HCRs proposal to ICES for evaluation.

Results and conclusions

The results of the analyses (ICES, 2011b) are preliminary, but ICES considers that the risk of the SSB falling below B_{lim} is underestimated and the simulations do not properly account for potential future conditions:

- The assumed stock-recruitment relationship makes the simulations very unlikely to reproduce a period of low recruitments under moderately high SSB, as experienced in recent years (even with the random variability assumed around the stock-recruitment relationship);
- The evaluation follows the example of the ICES stock assessment in not allowing explicitly for the presence of two fleets (EU and RF) with very different characteristics, especially in terms of fishing pattern. The relative catches of these two fleets have been highly variable in the past. Using a constant selection pattern in the simulations is unlikely to reflect future conditions;

- The analyses assumed perfect implementation, i.e. the set TAC is not exceeded.

Methods

Two different management strategy evaluation (MSE) analyses were conducted to investigate the properties of the proposed HCRs (ICES, 2011b). Both MSE analyses were based on the ICES assessment of this stock, which uses an XSA model, with catch (landings and discards) numbers-at-age data and an abundance index provided by a Scottish survey conducted annually in Division VIb. In the ICES assessment, recruitment is at age 1, and the same age at recruitment was used in the MSE analyses.

The first analysis used the R library FLR (Kell *et al*., 2007) and the XSA version provided within FLR, using the historical assessment data until 2009 with the same settings as in the ICES assessment. The assessment was rerun 500 times, assuming each time a random alteration of the original abundance index values. This produced 500 "true" population abundance values at the start of 2010 for each age older than 1. Recruitment in 2010 and subsequent years was derived from a stock-recruitment relationship, based on the fit to the historical data and incorporating random noise. The catch in 2010 was assumed equal to the EU TAC, and the proposed HCRs were used in setting the TACs in 2011-2030. This first analysis corresponds to a "standard" MSE, incorporating variability in recruitment, assessment error, and no implementation error.

The second analysis shares many methodological features with the first one; it was carried out using Excel, instead of the FLR software. This analysis used the most recent ICES assessment, leading to a single "true" population abundance value at the start of 2011 for each age older than 1. Recruitment in 2011 and subsequent years was derived from a stock-recruitment relationship, incorporating random variability based on the residuals from the fit to the historical data (100 recruitment values were simulated each year). *Status quo* F was used to calculate the catch in 2011 and the proposed HCRs were used in setting the TACs in 2012-2039. This second analysis also provides an MSE, incorporating variability in recruitment, assessment error (although following less standard procedures than in the first analysis), and no implementation error.

Both analyses used a Ricker stock-recruitment relationship, but the fits were slightly different. Both MSEs used a constant selection pattern and a constant discarding ratio at age, assumed perfect implementation, and evaluated F targets of 0.3 and 0.4. The second analysis investigated further changes in the HCRs, and also examined F targets of 0.2 and 0.5.

Sources

EU-RF. 2011. Report of The European Community - Russian Federation Scientific Expert Working Group On Rockall Haddock. Edinburgh and Moscow, 2008-2010. PINRO Press, Murmansk, 109 pp.

Filina E. A., Khlivnoy V. N., Vinnichenko V. I. 2009. The Reproductive Biology of Haddock (*Mellanogrammus aeglefinus*) at the Rockall Bank. Journal of Northwest Atlantic Fishery Science, 40: 59–73.

ICES. 2011a. Haddock in Division VIb (Rockall). Report of the ICES Advisory Committee 2011. ICES Advice, 2011. Book 5, Section 5.4.24.

ICES. 2011b. Technical Evaluation of Rockall haddock proposed harvest control rules – August 2011. ICES CM 2011/ACOM: 57.

Kell, L. T., Mosqueira, I., Grosjean, P., Fromentin, J-M., Garcia, D., Hillary, R., Jardim, E., Mardle, S., Pastoors, M. A., Poos, J.J., Scott, F., and Scott, R. D. 2007. FLR: an open-source framework for the evaluation and development of management strategies. ICES Journal of Marine Science, 64(4): 640-646.

Newton, A. W., Peach, K. J., Coull, K. A., Gault, M., and Needle, C. L. 2008. Rockall and the Scottish haddock fishery. Fisheries Research, 94(2): 133–140.