

EU request for ICES to evaluate the long-term management plan for Celtic Sea herring

Advice summary

ICES advises that the harvest control rule in the long-term management plan for Celtic Sea herring is no longer consistent with the precautionary approach. The management plan results in a greater than 5% probability of the stock falling below B_{lim} in several years throughout the simulated period.

The simulations indicate the management plan cannot ensure that the stock is fished and maintained at levels which can produce maximum sustainable yield as soon as or by 2020. However, simulations indicate that median SSB reaches $MSY B_{trigger}$ in 2020.

ICES considers that the stability clause in the management plan that constrains TAC changes from year to year to $\pm 30\%$ can imply fishing mortalities greater than F_{MSY} , which in turn may result in a greater than 5% probability of the stock falling below B_{lim} . This may also prevent the stock being fished and maintained at levels which can produce maximum sustainable yield, in any given year.

ICES notes that paragraphs 5 and 7 of the management plan were not quantitatively evaluated.

Request

The EU has requested ICES to assess the long-term management strategy (plan) for Celtic Sea herring¹ as follows:

"ICES is requested to assess whether the plan is still precautionary. ICES is furthermore asked, in analysing the elements of the plan, as to ensure that the stock is fished and maintained at levels which can produce maximum sustainable yield, as soon as possible and at the latest in 2020.

Should the proposed plan include elements that are in contradiction with ensuring that the stock is fished and maintained, also in the future, at levels which can produce maximum sustainable yield, ICES is requested to comment specifically on such elements, and their consequences for ensuring MSY."

Elaboration on the advice

Precautionary considerations

The long-term management plan for Celtic Sea herring (LTMP) aims to maintain the biomass above 33 000 t, as mentioned in the harvest control rule (HCR, paragraph 1), and furthermore stipulates actions that should be taken if the assessed biomass falls below this level (HCR, paragraphs 5, 6, and 7). In assessing the precautionarity of the management plan, considerations are based on the probability of SSB falling below B_{lim} , the SSB level below which recruitment may become impaired. This reference point was revised to 34 000 t (previously 33 000 t) during the recent benchmark exercise (ICES, 2018), and the probability of SSB falling below B_{lim} has been calculated on the basis of the revised value.

Simulations over a 20-year period indicate that the harvest control rule of the management plan (simulated, excluding HCR paragraphs 5 and 7) result in a greater than 5% probability of SSB falling below B_{lim} throughout almost the entire period; the management plan can thus no longer be considered precautionary. Risk is particularly high in the early years of the simulation, as a consequence of the current low stock levels. An alternative risk calculation based on the previous B_{lim} value (33 000 t) leads to the same conclusion.

¹ See Annex 1.

Two further provisions are made for rebuilding the stock in the event of $SSB < B_{lim}$; an area closure (HCR, paragraph 5) and a clause allowing for TAC setting lower than the HCR (paragraph 7). Paragraph 5 was not included in the current evaluation. A full evaluation of the effects of the closure of Division 7.a South in terms of effort (F), recruitment (R), and spawning-stock biomass (SSB) is not achievable given the current assessment and simulation models. In order to accurately accommodate paragraph 5 in the management plan evaluation (MSE), a different assessment model (i.e. a multi-area, multifleet assessment model) would need to be developed to better inform a spatial simulation model.

Paragraph 7 was not quantitatively defined in the management plan and therefore could not be evaluated. The use of paragraph 7 for reducing TACs when the stock falls below B_{lim} could be evaluated if the managers provide ICES with a clear quantification of the rule(s).

It is possible that either or both of these measures could to some extent reduce the probability of $SSB < B_{lim}$, but this could not be evaluated.

MSY considerations

The management plan is constructed around a target fishing mortality (0.23) and a biomass trigger (61 000 t) below which the target fishing mortality is reduced (Figure 1). In this respect, the management plan follows an approach somewhat similar to the ICES MSY advice rule. The target fishing mortality of the HCR is lower than the estimated F_{MSY} (0.26; ICES, 2018) and the biomass trigger is higher than the estimated MSY $B_{trigger}$ (54 000 t; ICES, 2018), implying that these elements of the management plan are more precautionary than the ICES MSY advice rule. However, the requirement for stability in yield in the management plan limits TAC changes to $\pm 30\%$. The effect of this rule is to limit interannual changes in yield at the expense of maximizing yield in any given year (Clarke and Egan, 2012), resulting in fishing mortalities that exceed F_{MSY} in some years, and likely increasing the probability of $SSB < B_{lim}$.

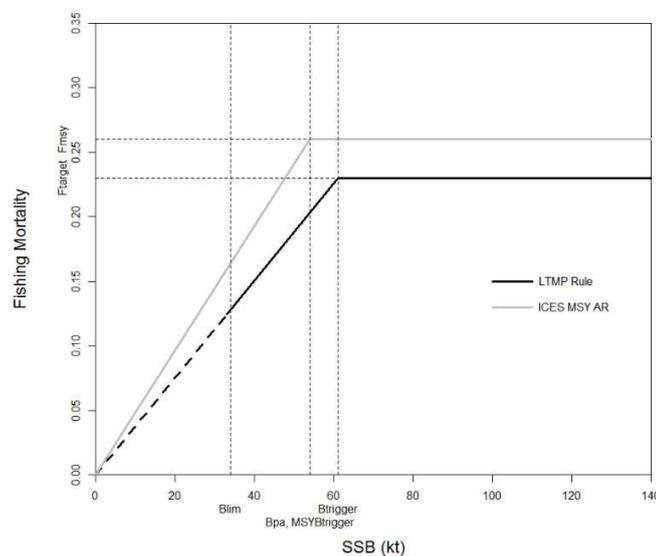


Figure 1 The Celtic Sea herring long-term management plan harvest control rule (black line). The simulation assumes proportional reduction in fishing mortality below B_{lim} (dashed line) because paragraph 7 is not specific about the additional management measures to reduce TAC at those biomass levels. The ICES MSY advice rule is shown in grey. Light dashed lines correspond to various biomass and exploitation reference points as labelled. Note: The LTMP rule also includes a $\pm 30\%$ constraint on TAC changes not represented in the figure.

Simulations indicate that the current management plan can lead to median biomass levels slightly above MSY B_{trigger} by 2020.

ICES considers that the stability clause in the management plan that constrains TAC changes from year to year to $\pm 30\%$ can imply fishing mortalities greater than F_{MSY} , which in turn may result in a greater than 5% probability of the stock falling below B_{lim} .

Suggestions

ICES suggests that for the formulation of future management strategies the following issues should be considered:

1. A clause such as the one in paragraph 7 is not specific enough to be evaluated. Future management strategies should quantitatively specify the amount by which the TAC should be set lower.
2. Although spatial measures, such as that in paragraph 5, may be very useful, it should be noted that it may be impossible to evaluate the consequences of these measures with the current models and the current level of spatially resolved data. An elaboration on the objectives of the spatial measures might assist an evaluation.

Basis of the advice

Background

In 2008 a rebuilding plan was developed for Celtic Sea herring and used as a basis for setting the TAC in 2010–2012. This plan was subsequently replaced by a long-term management plan when the stock had met the conditions for recovery, as specified in the rebuilding plan. ICES evaluated the long-term management plan in 2012 (Clarke and Egan, 2012) and deemed the HCR consistent with the precautionary approach. It was found to deliver long-term sustainable yield, at the expense of maximizing yield in any given year.

Following benchmark assessments (ICES, 2014a, 2015a), re-evaluations were undertaken of the 2012 long-term management plan with respect to the precautionary approach (ICES, 2014b, 2015b). New reference points were defined in 2015 and the plan was updated to reflect this change in B_{lim} to 33 000 t, the level below which recruitment becomes impaired. The plan has been used as the basis for setting the TAC from 2012 to 2018.

In November 2017, ICES received a request from the European Commission to re-evaluate the current management plan with regard to adherence to the precautionary approach and to comment specifically on elements of the plan in relation to achieving MSY by 2020.

The request was addressed by the ICES Working Group for the Area South of 62°N (HAWG) through simulations that included the most recent information on the perception of the stock and the stock productivity, following the inter-benchmark assessment in February 2018.

Results

The results of the 20-year simulation for the management plan HCR ($F_{\text{target}} = 0.23$, $B_{\text{trigger}} = 61\ 000$ t) are shown in Table 1 and Figure 2.

Table 1 Simulation annual results 2018–2037, showing the median realised fishing mortality, SSB (t), and yield (t). Probabilities are calculated as the proportion of the 1000 simulations where SSB falls below B_{lim} (34 000 t) and $SSB > MSY B_{trigger}$. Shaded years correspond to greater than 5% probability of the SSB falling below B_{lim} .

Year	Median realised F	Median SSB (t)	Probability SSB < B_{lim} (%)	Probability SSB > $MSY B_{trigger}$	Median yield (t)
2018	0.27	49332	18	42	7992
2019	0.23	53220	13	48	9680
2020	0.22	54346	10	51	9625
2021	0.22	56003	7	54	8808
2022	0.22	57297	7	57	10220
2023	0.21	57731	6	59	9639
2024	0.21	57793	6	59	10315
2025	0.21	56802	7	57	10206
2026	0.22	57783	6	60	9901
2027	0.22	57658	6	60	10253
2028	0.22	58572	5	61	10319
2029	0.23	58029	4	60	10720
2030	0.23	57716	6	58	10490
2031	0.23	57781	6	60	10515
2032	0.23	58109	5	59	10468
2033	0.22	57678	5	59	10555
2034	0.23	57873	5	61	10602
2035	0.23	57468	7	58	10426
2036	0.23	56682	7	58	10615
2037	0.23	56394	6	57	10672

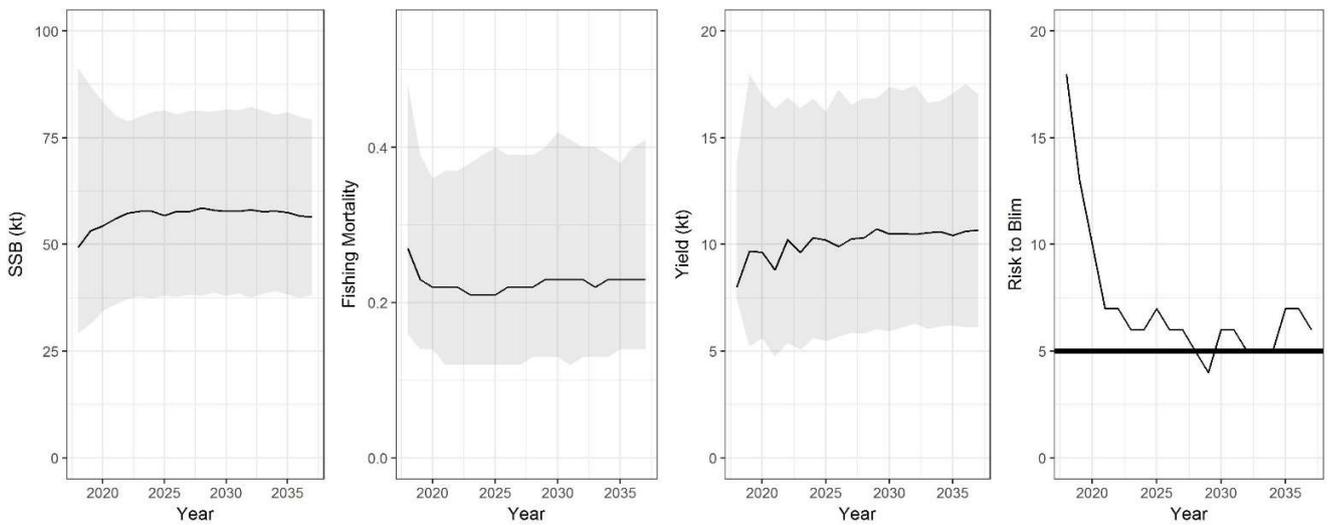


Figure 2 SSB (kt), fishing mortality, yield (kt), and probability of the stock falling below B_{lim} , 2017–2037. The limits of the shaded areas show the 10th and 90th percentiles. The horizontal black line on the risk plot indicates the 5% probability of the stock falling below B_{lim} .

Methods

The procedure for evaluation of the management plan follows that of previous evaluations (Clarke and Egan, 2012; ICES, 2014b, 2015a, 2015b). Simulations were performed using the HCS 10_3 simulation software package (Skagen, 2010). The HCS platform is a stochastic projection programme designed specifically for the testing of harvest rules. The programme consists of a population model (tracking the true population), an observation model which adds noise to the true population and represents the observed stock, a decision rule (through which the TAC is derived), and an implementation model which translates the TAC into actual stock removals.

The most recent stock assessment (ICES, 2018) indicates that there is no well-defined stock–recruitment relationship for this stock. The evaluation of the management plan is based on a hockey-stick (i.e. segmented regression) stock–recruitment form fit to assessment data between 1970 and 2014, with the most recent recruitment estimates excluded since they are less certain. Recruitment is assumed to be log-normally distributed and capped to prevent predicted recruitments outside of the observed historical range (Clarke and Egan, 2012).

Initial stock numbers are derived from the terminal year of the most recent assessment and a short-term forecast. Preliminary catch estimates for 2017 were used as the catch in the first year of the simulation. Natural mortality was derived from a recent SMS key run. Stock and catch weights are the average of the last three years. 50% of the one-ringers are assumed to be mature, while all older ages are 100% mature. Selection-at-age is based on the assessment output.

The CV on the observation model was set at 30%, based on an estimate of uncertainty in the assessment. Following the rationale of previous evaluations, a positive 10% implementation bias is assumed. The stock is projected forward for 20 years and 1000 iterations are performed for each scenario considered.

Paragraph 7 was not quantitatively defined. In the simulations it was assumed that when the stock is below B_{lim} the harvest control rules are applied, as stipulated in paragraphs 3 and 4. The use of other simulation frameworks could have allowed the testing of lower values of F when the stock is below B_{lim} .

Sources and references

- Clarke, M., and Egan, A. 2012. Evaluation of proposed long term management plan for Celtic Sea Herring. ICES CM 2012/ACOM:75. 48 pp.
- ICES, 2014a. Report of the Benchmark Workshop on Pelagic Stocks (WKPELA), 17–21 February 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:43. 343 pp.
- ICES. 2014b. Report of the Herring Assessment Working Group for the Area South of 62°N (HAWG), 11–20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1406 pp.
- ICES. 2015a. Report of the Benchmark Workshop on West of Scotland Herring (WKWEST), 2–6 February 2015, Dublin, Ireland. ICES CM 2015/ACOM:34. 297 pp.
- ICES. 2015b. Report of the Herring Assessment Working Group for the Area South of 62°N (HAWG), 10–19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 864 pp.
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- Skagen, D. W. 2010. HCS10-3. A Stochastic Simulation Package. Skagen Fisheries Consultant, Bergen. Unpublished report. 44 pp.
- ICES. 2018. Report on Celtic Sea Herring Management Plan Evaluation. Coming as Annex 8 in the report of the Herring Assessment Working Group for the Area South of 62°N (HAWG), scheduled to meet 12–20 March 2018 at ICES HQ, Denmark. Annex 8 is currently available separately at <http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2018/HAWG/24%20HAWG%20Report%202018%20Annex%208%20Report%20on%20Celtic%20Sea%20Herring%20Management%20Plan%20Evaluation.pdf>

Annex I Long-term management plan for herring in the Celtic Sea and Division 7.j

ICES received the following harvest control rules as part of the long-term management plan for Celtic Sea herring.

1. *Every effort shall be made to maintain a minimum level of Spawning Stock Biomass (SSB) greater than 33,000 t, the level below which recruitment becomes impaired.*
2. *Where the SSB, in the year for which the TAC is to be fixed, is estimated to be above 61,000 t (Btrigger) the TAC will be set consistent with a fishing mortality, for appropriate age groups, of 0.23 (Ftarget).*
3. *Where the SSB is estimated to be below 61,000 tonnes, the TAC will be set consistent with a fishing mortality of:
 $SSB * 0.23 / 61,000$*
4. *Where the rules in paragraphs 2 and 3 would lead to a TAC which deviates by more than 30 % from the TAC of the preceding year, the TAC will be fixed such that it is not more than 30 % greater or 30 % less than the TAC of the preceding year.*
5. *Where the SSB is estimated to be below 33,000 tonnes, Sub-Division VIIaS will be closed until the SSB has recovered to above 33,000 tonnes.*
6. *Where the SSB is estimated to be below 33,000 tonnes, and Sub-Division VIIaS is closed, a small-scale sentinel fishery will be permitted in the closed area. This fishery will be confined to vessels, of no more than 50 feet in registered length. A maximum catch limitation of 8% of the Irish quota will be exclusively allocated to this sentinel fishery.*
7. *Notwithstanding paragraphs 2, 3 and 4, if the SSB is estimated to be at or below the level consistent with recruitment impairment (33,000 t), then the TAC will be set at a lower level than that provided for in those paragraphs.*
8. *No vessels participating in the fishery, if requested, will refuse to take on-board any observer for the purposes of improving the knowledge on the state of the stock. All vessels will, upon request, provide samples of catches for scientific analyses.*
9. *Every three years from the date of entry into force of this Regulation, the Commission will request ICES and STECF to review and evaluate the plan.*
10. *This arrangement enters into force on 1st January, 2016.*