ECOREGION North Sea
SUBJECT Joint EU–Norway request on interim advice on the North Sea herring management plan

Advice for 2012

Based on the assumption that the current low productivity regime for North Sea herring (observed since 2002 onward) will continue, ICES concludes that the current Harvest Control Rule (HCR)—as well as each of the four tested alternative HCRs— is compatible with the precautionary approach as the risk of SSB falling below B_{lim} is low. The current HCR, with the 15% constraint, allows a slow increase in TAC and gives similar or better stability in annual TACs than any of the other HCR options. However, this result is attained at the expense of lower average yields, even in the medium term. The other HCR options provide similar average yields in the medium term, but differ with respect to TAC stability. Although the management plan options evaluated by ICES are appropriate given the uncertainty in the current population size, the analyses conducted do not provide a full Management Strategy Evaluation (MSE). In case the management plan is revisited to do a full MSE, ICES favours a collaborative iterative process between scientists, managers, and stakeholders.

Request

Joint EU–Norway additional request on North Sea herring advice for 2012

In view of exceptional increase in the estimated SSB in 2010, the EU and Norway requested ICES to comment on whether an in-year revision of the TAC in similar circumstances is consistent with the objectives of the long term management plan for herring in the North Sea. In its response, ICES stated that rather than within-year revisions of the TAC, it is better to have a management plan that can respond to large changes in the biology of the stock or assessment uncertainty. In order to address this issue, ICES indicated that it would favor a collaborative iterative process between scientists, managers, and stakeholders if the management plan is revisited in 2011.

The stakeholders agree that the plan is effective in ensuring the long term sustainability of the stock, but are concerned that the inter-annual TAC constraints are preventing the stock from being exploited at the maximum sustainable yield.

In view of this, ICES is requested by the EU and Norway to evaluate, by 31 October 2011, the impact the following options would have on the performance of the plan in relation to the objectives of providing sustainable fisheries with stable yield in conformity with the precautionary approach:

1. *Remove the TAC constraints when they would lead to a fishing mortality that is outside a predefined range, for example 0.2 to 0.3.*

2. *Introducing a different mechanism to attenuate inter-annual TAC variations, such as setting the TAC as the average of that corresponding to the target fishing mortality and the previous year's TAC.*

ICES is also asked by the EU and Norway to evaluate the implications for the long term objectives of the plan if a TAC increase of more than 15% were to be allowed for 2012, taking into account the continuing low recruitment to the stock.

Elaboration on the Advice

To meet this request, ICES evaluated whether the management plan with the following options is precautionary[*], based on the assumption that the current low productivity regime (2002–2010) will continue. The term 'the preliminary TAC' is used in the rest of the document for the TAC derived from the fishing mortality defined in the current HCR without any TAC constraining measures.

1. Current HCR: This option is included as a baseline for general comparison. If the preliminary TAC deviates less than 15% from the TAC in the year before, the preliminary TAC is kept. If not, a constrained TAC is set

[*] based on the precautionary approach validation as laid down between ICES and STECF at WKOMSE (the ICES–STECF Workshop on Fishery Management Plan Development and Evaluation; ICES, 2009).

that deviates 15% from the TAC the year before. If the constrained TAC leads to an SSB< 800 kt (B_{lim}), the preliminary TAC is kept.

2. Current HCR without constraint: this option is included as a baseline in relation to performance indicators for stability in the TAC. Without exception, the TAC is set based on the F resulting from the currently agreed HCR without applying the TAC constraint.
3. 0.2–0.3 HCR: this option is the ICES interpretation of ToR-1. If the preliminary TAC deviates less than 15% from the TAC in the year before, the preliminary TAC is kept. If it deviates more than 15%, the TAC change is constrained to a maximum of 15%, unless the constrained TAC implies that the consequent F_{2-6} falls outside the range of 0.2–0.3, in which case the preliminary TAC is maintained.
4. 50–50 HCR: this option is the ICES interpretation of ToR-2. The TAC is set at the average of the preliminary TAC and the agreed TAC the previous year using equal weights (50–50%) for both years.
5. Current HCR without constraint in 2012: the TAC for 2012 is set according to the current HCR without applying the 15% TAC constraint in 2012. From 2013 onwards the constraint is applied according to the current HCR.

The above five options were tested and evaluated in light of a range of performance indicators. Four indicators have been selected to inform decisions on the stock sustainability (indicator 1 and 2), yield (indicator 3), and stability of the TAC (indicator 4).

Indicator 1) Risk: percentage of simulations in which SSB falls below B_{lim} at least once during the simulation period
Indicator 2) Stock performance: SSB in 2020 (median of all simulations)
Indicator 3) Yield: Mean catch of A-fleet over the simulation period
Indicator 4) Stability in TAC: Mean % absolute TAC change between consecutive years over the simulation period: [abs(TAC year2–TAC year1)]/TAC year2 * 100. The lower the value, the more stable is the TAC.

Results

The main results of the evaluation are presented in the Table below. Figure 6.3.3.4.1 show the results from the simulations performed for each HCR option.

HCR option	**Risk < B_{lim}**	**Stock performance (SSB 2020, '000 t)**	**Yield ('000 t)**	**Stability in TAC (mean TAC change)**
1. Current HCR	0%	1 500	350	11.8%
2. Current HCR without constraint	0%	1 420	370	22.8%
3. 0.2–0.3 HCR	0%	1 400	370	18.1%
4. 50–50 HCR	0%	1 380	360	12.5%
5. Current HCR without constraint in 2012	1%	1 410	370	16.8%

1. Current HCR.
   This option was evaluated to be in conformity with the precautionary approach. It showed a slightly higher SSB in 2020 and the lowest mean yield compared to the other HCRs. The option showed a high stability in TAC.

2. Current HCR without constraint.
   This option was evaluated to be in conformity with the precautionary approach. It resulted in an average SSB in 2020 as well as a similar mean yield compared to the other HCRs (options 2–5). Of all five options the TAC stability in this one was the poorest.

3. 0.2–0.3 HCR.
   This option was evaluated to be in conformity with the precautionary approach. It resulted in an average SSB in 2020 as well as a similar mean yield compared to the other HCRs (options 2–5). The stability in TAC was intermediate.

4. 50–50 HCR.
   This option was evaluated to be in conformity with the precautionary approach. It resulted in an average SSB in 2020 as well as a similar mean yield compared to the other HCRs (options 2–5). The option showed a high stability in TAC.

5. Current HCR without constraint in 2012.
   This option was evaluated to be in conformity with the precautionary approach. It resulted in an average SSB in 2020 as well as a similar mean yield compared to the other HCRs (options 2–5). The stability in TAC was intermediate.

Conclusions

ICES considers that all options are compatible with the precautionary approach, as the risk of SSB falling below B_{lim} is always low under the assumed conditions.

The current HCR (option 1), with the 15% constraint, allows a slow increase in TAC from the low in 2011. It provides a similar or better TAC stability than the other options, but it does so at the expense of a lower average yield, even in the medium term (average F is 0.18).

The remaining four options are similar in respect to average yields in the medium term and they lead to an average F that is close to 0.25 (see Figure 6.3.3.4.1), which is regarded as F_{MSY} (ICES, 2011c). They do differ with respect to stability in TAC: the current HCR without TAC constraint (option 2) is the least stable, while the 50–50 option 4 gives most stability.

The stochastic simulation model has been designed to explicitly incorporate the natural and stock assessment variability as observed over the recent years, which has led to considerable revisions in recruitment and spawning-stock biomass. The evaluation presented here shows that the evaluated HCRs are all robust against this variability. However, the different options have not been evaluated against exceptional variations in biology which are beyond the variation observed in history, nor have the options been tested for robustness under varying starting conditions in population size. These analyses, therefore, can be viewed as appropriate given the assumed starting conditions and uncertainty in the current population size and they answer the request fully. However, they do not provide a full Management Strategy Evaluation.

Basis of advice

The evaluation of the harvest rules was conducted using simulations of the projected population from 2011 to 2020. The approach used here is similar to previous evaluations of the long-term management plan (ICES, 2008), but performed with updated data-series and software. The model simulates the biological North Sea herring population and the behaviour of the fishing fleets and surveys, while the stock assessment is mimicked to estimate the stock status. Finally, the management advice and implementation are based on the adjusted management plan scenarios. In turn, management feeds back into the biological population and the fishery the year after. The simulations were run with 100 Monte Carlo realisations which were considered a sufficient number to represent a broad range of possible outcomes given the variability in the input data (Figure 6.3.3.4.2). Stochasticity (randomness) was added to variables and parameters to ensure that they reflect biological variation, and the uncertainty in the historical perception of the stock was thus reflected. The analysis was conducted using R (R Development Core Team, 2011) and FLR libraries (Kell *et al.*, 2007).

Sources

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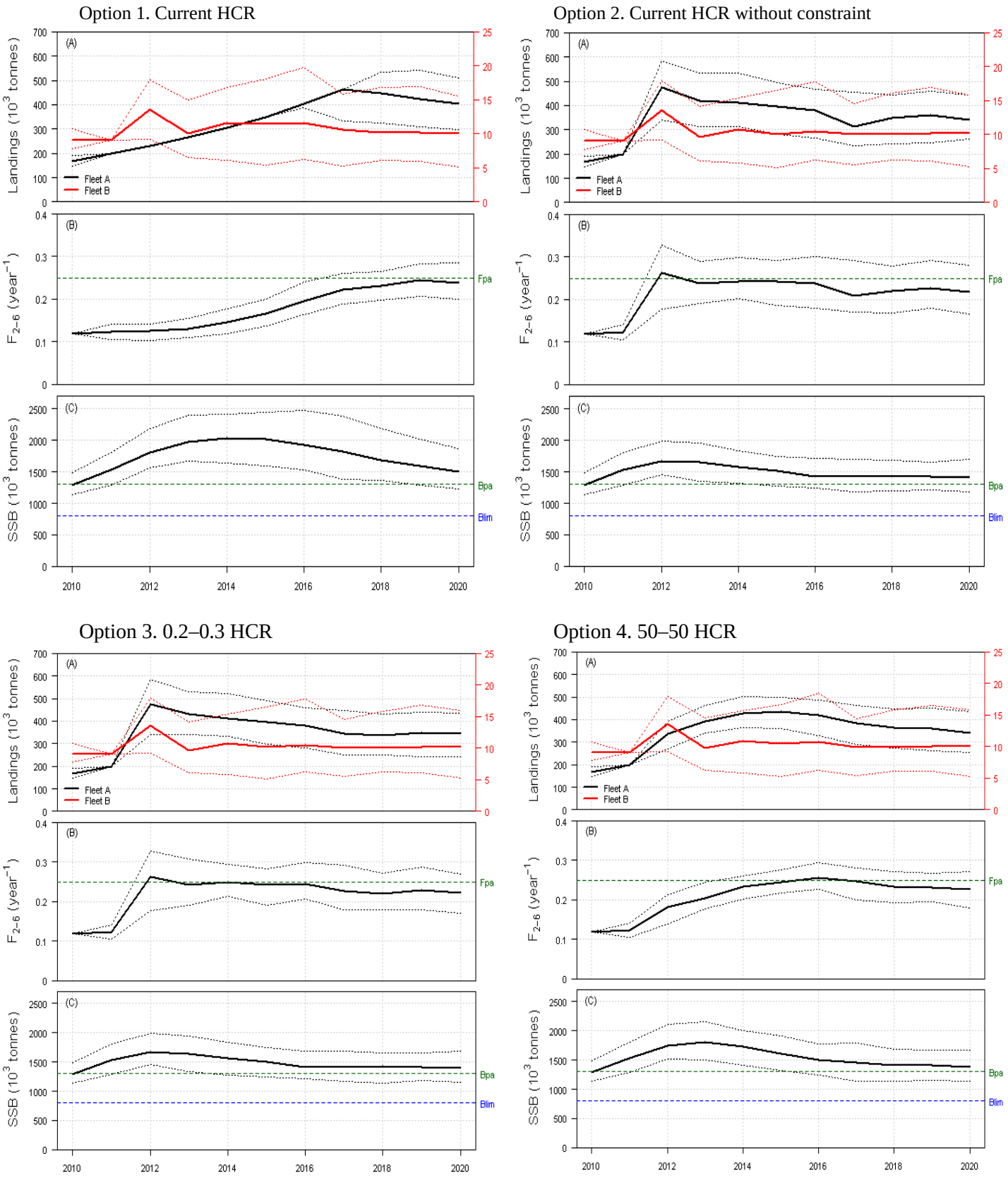

Figure 6.3.3.4.1 North Sea herring management plan interim options, with the trajectory from 2010–2020 per option. Top: Landings (by fleets A and B, in '000 tonnes), Middle: Fishing mortality (ages 2–6), and Bottom: SSB (in '000 t). Solid lines represent the median of the 100 Monte Carlo simulations and dashed lines the 5th and 95th percentiles.

Option 5. Current HCR without constraint in 2012

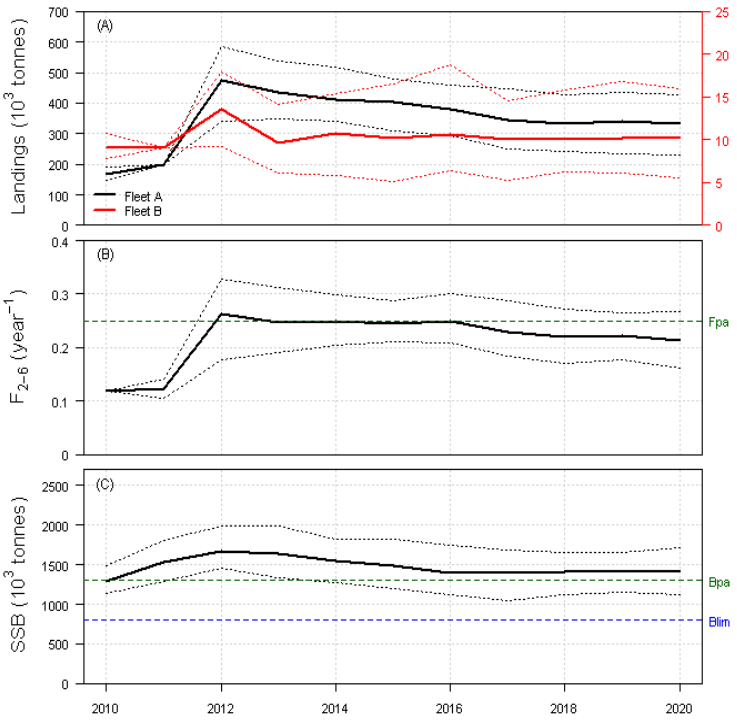

Figure 6.3.3.4.1 **Continued:** North Sea herring management plan interim options, with the trajectory from 2010–2020 per option. Top: Landings (by fleets A and B, in '000 tonnes), Middle: Fishing mortality (ages 2–6), and Bottom: SSB (in '000 t). Solid lines represent the median of the 100 Monte Carlo simulations and dashed lines the 5th and 95th percentiles.

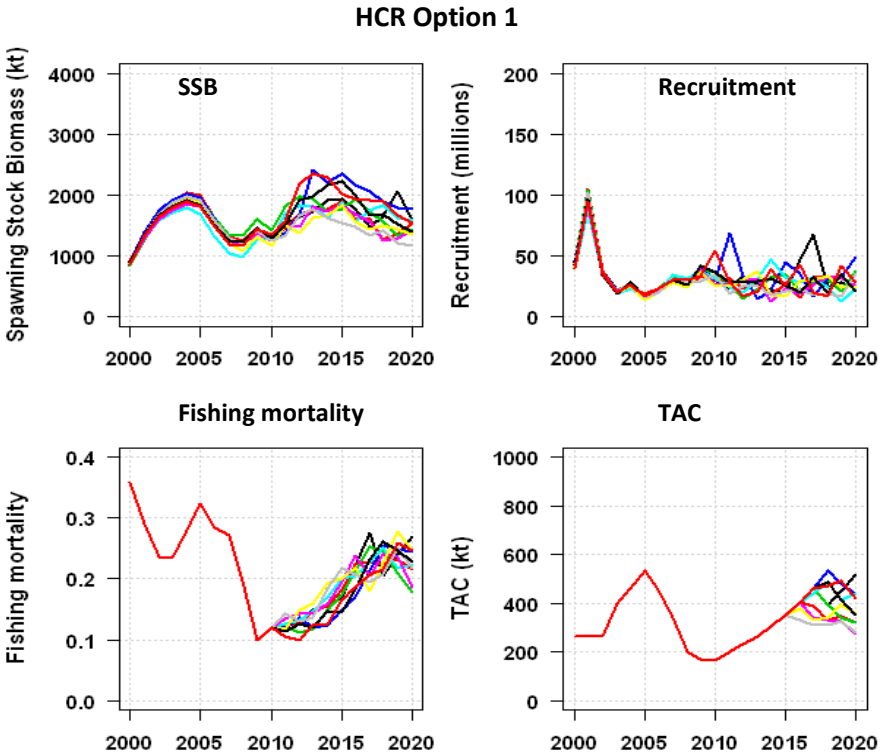

Figure 6.3.3.4.2 North Sea herring management plan interim options: For illustrative purposes, the first 10 (out of 100) Monte Carlo simulations for Harvest Control Rule (Option 1), between 2000 and 2020. Lines represent the trajectories of SSB, recruitment, fishing mortality, or TAC as they occurred within one simulation. The combination of these 10 simulations shows that dynamics are erratic and not smooth as given in the median + CI plots.