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EU-Norway request to ICES on a long-term management strategy for *Pandalus* in Skagerrak and the Norwegian Deep

Advice summary

ICES has evaluated a range of harvest control rules (HCRs), consisting of (F_{target}, $B_{trigger}$) combinations. ICES advises that the option that maximizes the median long-term yield while resulting in no more than 5% probability of the spawning–stock biomass (SSB) falling below B_{lim} in any 20-year period, was identified as (0.48, 12 000 tonnes). If an inter-annual quota flexibility of +/- 10% is allowed, with $B_{trigger}$ = 12 000 tonnes then the F_{target} should be reduced to 0.45 in order for the probability of the SSB falling below B_{lim} not to increase above 5% in any 20-year period.

Within the set of (F_{target}, $B_{trigger}$) combinations that result in no more than 5% probability of the SSB falling below B_{lim} in any 20-year period, there is a wide range of combinations that result in the median long-term yield being at least 95% of the maximum possible yield. Within the range of high-yield combinations, inter-annual yield variability is lower for HCRs with lower F_{target} and lower $B_{trigger}$ values.

ICES conducted an evaluation of the proposed HCR excluding paragraph 3 of the request. In that case, the option that maximizes the median long-term yield while resulting in no more than 5% probability of the SSB falling below B_{lim} in any 20-year period would be (0.48, 13 000 t). ICES concludes that the simulation results did not reveal a clear performance advantage of including paragraph 3, therefore ICES considers that the harvest control rule selected for management could be based only on paragraphs 1 and 2. If an inter-annual quota flexibility of +/- 10% is allowed, with $B_{trigger}$ = 13 000 t, the F_{target} should be reduced to 0.45 in order for the probability of the SSB falling below Blim not to increase above 5% in any 20-year period.

ICES advises that the advice on catch opportunities should be based on an assessment conducted in February just after the January survey with advice available in March for the current year. The performance of a TAC year from January 1 to December 31 is similar to that of a TAC year from 1 May to the 30 April. However, SSB and biomass reference points for this stock correspond to January 1. Therefore, ICES advises that the TAC year should be kept from January 1 to December 31. ICES could provide a preliminary TAC for the first six months of the following year based on a catch forecast obtained from applying the same HCR.

ICES notes that recruitment in the last decade has been lower than in earlier years. If recruitment in the next three to five years continues to be low, a lower F_{target} would be necessary in the harvest control rule in order not to exceed a 5% probability of the SSB falling below B_{lim} in any 20-year period.

Request

EU-Norway request to ICES on a long-term management strategy for Pandalus in Skagerrak and the Norwegian Deep

The assessment of this stock is based on the results of a survey carried out in January each year. Up until now, the assessment was carried out in September of the same year in order to set a TAC the following year. This meant that the TAC was based on survey and fisheries data that are more than a year old. To improve this, ICES has suggested that its advice should be delivered in March, just two months after the survey, in order to set a TAC for the same year based on that ICES advice.

The implication of the change in the advice year is that managers must decide a) to change the TAC year to reflect the advice year or b) introduce a preliminary TAC to cover the first months of the year until a definitive TAC can be set.

To this end, ICES is requested to evaluate possible management strategies with the following elements:

[Paragraph] 1. The Parties shall set a TAC for Northern shrimp within a range of fishing mortalities (F_{target}) that is consistent with fishing at maximum sustainable yield provided that the SSB at the start of the TAC year is equal to or greater than $B_{trigger}$.

[Paragraph] 2. Where the SSB at the start of the TAC year is estimated to be below $B_{trigger}$, the Parties agree that the lower and upper bounds of the fishing mortality range referred to in paragraph 1 are reduced linearly to zero.

[Paragraph] 3. Overriding the rules set out in paragraphs 1 and 2, the TAC should not exceed a level such that the probability of SSB falling below B_{lim} at the beginning of the following TAC year is greater than 5%.

ICES is asked to evaluate and estimate the combination of F_{target} and $B_{trigger}$ that maximises the long-term yield without the probability of SSB falling below B_{lim} being more than 5% for any 20 year period.

ICES is asked to tabulate the yield, SSB, inter-annual TAC variability and risk for a range of combinations of $B_{trigger}$ and F_{target} values evaluated. The tabulation should include the proportion of simulated years where rule 3 defines the TAC.

ICES is asked to perform separate evaluations under the following assumptions:

a) That the TAC year will be 1 May of the advice year to 30 April of the following year
b) That the TAC year will be from 1 January–31 December of the advice year, with a preliminary TAC fixed on 1 January as X% of the TAC of the previous year. This TAC will subsequently be revised on 1 May of the advice year. ICES should consider a range of values of X for setting the preliminary TAC that would be precautionary when implemented with the combinations of F_{target} and $B_{trigger}$ mentioned above.

ICES is further requested to evaluate whether or not the strategies would be precautionary with and without an inter-annual quota flexibility (banking and borrowing) of +/- 10% applicable if the SSB at the start of the TAC year is above $B_{trigger}$.

Elaboration on the advice

ICES has evaluated harvest control rules (HCRs) as indicated in the request. For this stock, F is presented as the average annual F of ages 1–3. The F_{target} to be used in the HCRs was defined in the same way, i.e. as the average annual F of ages 1–3.

Paragraph 3 of the request was implemented in an approximate form by requiring that the SSB from a deterministic forecast should be at or above B_{pa} at the beginning of the following TAC year. Therefore, if the HCR finally selected for management includes paragraph 3, then the definition of this paragraph in the HCR should be rewritten to require that the SSB from a deterministic forecast should be at or above B_{pa} at the beginning of the following TAC year.

HCRs that maximize long-term yield across (F_{target}, $B_{trigger}$) combinations:

The (F_{target}, $B_{trigger}$) combination that maximizes long-term yield (median value) while resulting in no more than 5% probability of the SSB falling below B_{lim} in any 20-year period was identified. This combination is (0.48, 12 000 t).
ICES also conducted an evaluation of the proposed HCR excluding paragraph 3. In that case, the option that maximizes the median long-term yield while resulting in no more than 5% probability of the SSB falling below B_{lim} in any 20-year period would be (0.48, 13 000 t). ICES concludes that the simulation results did not reveal a clear performance advantage of including paragraph 3 (Table 1), therefore ICES considers that the harvest control rule selected for management could be based only on paragraphs 1 and 2.

Table 1 Performance of the HCRs that were found to maximize median long-term yield, within the set of (F_{target}, $B_{trigger}$) combinations that result in no more than 5% probability of the SSB falling below B_{lim} in any 20-year period.

Paragraphs included in HCR	F_{target}	$B_{trigger}$, tonnes	P(SSB<B_{lim})maximum over years (ICES precautionary risk criterion)*	P(SSB<B_{lim}) maximum over 20-year periods (HCR risk criterion)**	Median long-term yield,tonnes	Median long-term SSB, tonnes	Median long-term yield inter-annual variability	% times paragraph 3 determines the TAC	F_{target} with inter-annual quota flexibility
1–3	0.48	12000	0.4%	4.7%	12511	13011	21%	7%	0.45
1–2	0.48	13000	0.6%	5.0%	12380	13250	22%	NA	0.45

*The ICES precautionary risk criterion stipulates that there should be no more than 5% probability of the SSB falling below B_{lim} in any single year.
** The HCR risk criterion in the request stipulates that there should be no more than 5% probability of the SSB falling below B_{lim} in any 20-year period.

Tables 3–13 present performance statistics for a large set of (F_{target}, $B_{trigger}$) combinations. Within the set of (F_{target}, $B_{trigger}$) combinations that result in no more than 5% probability of the SSB falling below B_{lim} in any 20-year period, there is a wide range of combinations that result in the median long-term yield being at least 95% of the maximum possible yield (identified with blue shading in the tables). Within the range of high-yield combinations, inter-annual yield variability is lower for HCRs with lower F_{target} and lower $B_{trigger}$ values.

Inter-annual quota flexibility (banking and borrowing):

Some scenarios of inter-annual quota flexibility (banking and borrowing) of +/- 10% were evaluated, and resulted in a small increase of the probability of SSB falling below B_{lim}. In this case, assuming $B_{trigger}$ is unchanged, some reduction in the F_{target} is necessary in order for the probability of the SSB falling below B_{lim} in any 20-year period to remain at no more than 5%. The highest F_{target} fulfilling the 20-year risk criterion, with unchanged $B_{trigger}$, is shown in the rightmost column of Table 1.

The real consequences of banking and borrowing are hard to predict, and strongly depend on the detail of the rules applied and the use made of them in practice. The evaluation tested several scenarios (applied when the SSB at the start of the TAC year is estimated to be above $B_{trigger}$) that may be considered as "extremes", namely, either continuously banking, continuously borrowing, or randomly choosing in each year to bank or to borrow, the largest amount possible (10% of the total TAC). The results indicate that some reduction (of the order of 5%, approximately) in the F_{target} is necessary in order not to increase the risk level from that achieved without banking and borrowing.

Choice of risk criterion:

ICES notes that the requirement in the request that there should be no more than 5% probability of the SSB falling below B_{lim} in any 20-year period is more stringent than the ICES standard criterion to consider an HCR as precautionary, which is that there should be no more than 5% probability of the SSB falling below B_{lim} in any single year[1]. As a consequence of this, all HCRs identified in Table 1 are well within the boundaries of ICES precautionary criteria, as can be seen by the fact that they result in P(SSB<B_{lim}) per year (maximum over years) values well below 5%.

The colour coding of Tables 3–13 is also designed to help understand the implications of using one or the other risk criteria. Areas that are shaded in white or blue represent (F_{target}, $B_{trigger}$) combinations that meet the HCR risk criterion of the request of having no more than 5% probability of the SSB falling below B_{lim} in any 20-year period, with the blue area showing combinations that also achieve at least 95% of the highest median long-term equilibrium yield and the HCR risk criterion. The areas shaded in white, blue, or light red represent (F_{target}, $B_{trigger}$) combinations that meet the ICES precautionary risk criterion of having no more than 5% probability of the SSB falling below B_{lim} in any single year. Finally, the areas shaded in dark red indicate (F_{target}, $B_{trigger}$) combinations that exceed both risk criteria.

[1] The difference in the risk criteria can be illustrated by assuming a case where a simulation has 100 trajectories and the results would show that within one 20-year period, SSB < B_{lim} in 3 trajectories for year A and in 4 different trajectories for year B for a total of 7 different trajectories within the 20-year period. The risk criterion of 5% in any 20-year period would be exceeded since SSB<B_{lim} would occur in more than 5 different trajectories out of 100 (7 out of 100; 7%); however the risk criterion of 5% in any year would not be exceeded since there are 3 trajectories out of 100 for year A (3%) and 4 trajectories out of 100 in year B (4%) where SSB < B_{lim}.

Recruitment scenarios

A reduction in recruitment has been observed in the last decade (Figure 1) but it is not clear whether recruitment has entered a low production phase and ICES therefore concluded that the entire time-series of recruitment was more appropriate for the evaluation. As a robustness test, the performance of HCRs which are based on the entire time-series of recruitment was examined assuming that the true future recruitment would be low (as observed in the last ten years). If the true future recruitment is low, then the HCRs no longer fulfil the criterion of there being no more than 5% probability of the SSB falling below B_{lim} in any 20-year period (Table 2). It is, however, noted that these HCRs would still be considered precautionary according to the ICES standard criterion, given that the probability of the SSB being below B_{lim} would still be less than 5% in all years.

Table 2 Performance of the HCRs in Table 1, if future recruitment is low.

Paragraphs included in HCR	F_{target}	$B_{trigger}$, tonnes	P(SSB<B_{lim}) maximum over years (ICES precautionary criterion)*	P(SSB<B_{lim}) maximum over 20-year periods (HCR risk criterion)**	Median long-term yield, tonnes	Median long-term SSB, tonnes	Median long-term yield inter-annual variability	% times paragraph 3 determines the TAC
1–3	0.48	12000	1.4%	17.8%	8587	10497	29%	19%
1–2	0.48	13000	1.6%	19.3%	8329	10678	29%	NA

*The ICES precautionary risk criterion stipulates that there should be no more than 5% probability of the SSB falling below B_{lim} in any single year.
** The HCR risk criterion in the request stipulates that there should be no more than 5% probability of the SSB falling below B_{lim} in any 20-year period.

TAC year options

The HCR selected for management is intended for application based on the results of a stock assessment conducted in February just after the January survey, with advice available in March for the current year. The catch given by the HCR would be for the same year (TAC year from January 1 to December 31). A preliminary TAC for the following year could be provided at the same time; the preliminary TAC would be updated to a final TAC at the beginning of May of the following year, i.e. four months into the corresponding TAC year. The request indicates that, alternatively, the TAC year could go from May 1 of the assessment year to April 30 of the following year.

Both TAC year options were examined in the evaluation, without detecting any significant difference in performance metrics (risk of low stock biomass, yield, interannual yield variability). For providing catch advice, a TAC year from January 1 to December 31 is more appropriate because ICES calculates the SSB and biomass reference points for this stock as corresponding to January 1. Therefore, ICES advises that the TAC year be kept from January 1 to December 31.

The request states that the preliminary TAC for the following year would be based on a fixed percentage of the TAC on the previous year, where the fixed percentage should be chosen such that the resulting HCR, including this preliminary TAC, would be precautionary. Given that this stock of *Pandalus* is relatively short-lived and that the age structure of the population can change considerably from year to year, depending on the size of the incoming year class, ICES considers that a more appropriate approach would be to base the preliminary TAC for the following year on a catch forecast, obtained applying the same HCR for the first six months of the following year. A preliminary catch advice for six months would be provided, because the update in the TAC would occur in May during the second quarter and the forecast is run using quarterly steps. This method was applied in the MSE. Managers should be aware that the advice for the preliminary TAC would be for only the first six months and would be updated for the entire year (January–December) in the next assessment after the January survey.

MSY reference points

ICES has reviewed the MSY reference points for this stock, applying the stock-specific assessment/advice error settings developed for this *Pandalus* stock as part of the management strategy evaluation work. Applying the ICES guidelines (ICES, 2017a) for the calculation of reference points, the analysis resulted in an update of the F_{MSY} value to F_{MSY}=0.60 (previously

0.62), whereas MSY $B_{trigger}$ = 9900 t remains unchanged. The lower F_{target} for the HCR compared to the F_{MSY} is due primarily to the more stringent risk criterion of the HCR.

Basis of the advice

Background

In spring 2017, ICES received a request from the EU and Norway to evaluate harvest control rules that may form the basis of a management strategy for *Pandalus* in the Skagerrak and Norwegian Deep. A group of scientists, most of which are members of the Joint NAFO/ICES *Pandalus* Assessment Working Group (NIPAG), prepared a report with the technical basis to support the ICES response to this request (Cardinale, M. *et al*., 2017). Two external scientists reviewed the work.

The value used for B_{lim} in the evaluation of HCRs is 6300 t. For HCRs including paragraph 3, B_{pa}=9900 t was used in the application of this paragraph. These are the agreed B_{lim} and B_{pa} values for this stock since the 2016 benchmark (ICES, 2016a).

MSY reference points were reviewed during the management strategy evaluation work. The results of this analysis are reported in this advice document.

Results and conclusions

ICES performed stochastic simulations for a wide range of settings to test whether the different harvest control rules would produce high long-term yield and result in no more than 5% probability of the SSB falling below B_{lim} in any 20-year period (HCR risk criterion as stated in the request). The results of the simulations should be used for comparison between scenarios and not as forecasts of absolute quantities.

MSY reference points

The MSY reference points for the stock were reviewed during the course of the management strategy evaluation (MSE) work. The analysis used long-term stochastic simulations, in accordance with ICES guidelines. The biology and fishery parameters, and the assessment/advice error settings used in these simulations were those used in the MSE.

The steps applied in the calculation of the MSY reference points follow ICES guidelines:

- The value of F maximizing the median long-term yield, without including any $B_{trigger}$ (constant F exploitation), but including assessment/advice error, was found to be F = 0.60 (Table 11); this became the initial F_{MSY} candidate value.

- The fifth percentile of the long-term distribution of SSB when fishing at F = 0.60 was lower than B_{pa}. In these circumstances, ICES sets MSY $B_{trigger}$ to B_{pa}, i.e. MSY $B_{trigger}$ = 9900 t.

- Applying the ICES MSY advice rule (where F is reduced linearly towards zero when the SSB at the start of the TAC year is below MSY $B_{trigger}$), with MSY $B_{trigger}$ = 9900 t, the largest F resulting in the long-term annual probability of SSB < B_{lim} not exceeding 5% was $F_{p.05}$ = 0.62. Therefore, the final value of F_{MSY} is F_{MSY} = 0.60.

Long-term management strategy

Multiple harvest control rules were evaluated using long-term stochastic simulations. The values of $B_{trigger}$ considered range from 0 to 15 000 t, and include MSY $B_{trigger}$=B_{pa} = 9900 t. Values of F_{target} range from 0.3 to 0.95.

As explained earlier in this document, the HCRs were evaluated including and excluding paragraph 3. When included, paragraph 3 was implemented by requiring that the SSB from a deterministic forecast should be at or above B_{pa} at the beginning of the following TAC year. A summary of main results was provided in Tables 1–2, whereas more detailed results are presented in this section.

Results are presented in tables, where the rows and columns correspond to F_{target} and $B_{trigger}$ values, respectively. The results are organized as follows:

<table>
<tr><th>Paragraphs included in the HCR</th><th>Results in tables</th><th>Performance metrics shown in tables
(Each table shows results for a performance metric.):</th></tr>
<tr><td>1–3</td><td>3–8</td><td rowspan="2">• Probability that SSB is below B_{lim} in any year (maximum overall years in the short, medium and long terms); this is ICES precautionary risk criterion.
• Probability that SSB is below B_{lim} in any 20-year period (maximum over all 20-year periods in the short, medium and long terms); this is the HCR risk criterion.
• Median long-term equilibrium yield
• Median long-term equilibrium SSB
• Median long-term equilibrium interannual yield-variability
• Percentage of times paragraph 3 determines the TAC (median in long-term equilibrium); only for HCRs including paragraphs 1–3.</td></tr>
<tr><td>1–2</td><td>9–13</td></tr>
</table>

The tables are colour-coded as follows:

- The dark red shading represents (F_{target}, $B_{trigger}$) combinations for which the ICES precautionary risk criterion exceeds 5% (i.e. HCRs that are not precautionary according to the ICES standard criterion), whereas both shades of red correspond to (F_{target}, $B_{trigger}$) combinations for which the HCR risk criterion exceeds 5% (i.e. HCRs that do not fulfil the risk criterion stated in the request).

- The (F_{target}, $B_{trigger}$) combinations shaded blue are those that achieve at least 95% of the highest median long-term equilibrium yield within the set of combinations with no more than 5% risk (HCR risk criterion).

It is clear from the tables that there are fewer (F_{target}, $B_{trigger}$) combinations fulfilling the requirement that there should be no more than 5% probability that SSB < B_{lim}, when this requirement refers to any 20-year period (HCR risk criterion as stated in the request) than when it refers to any single year (ICES standard risk criterion to consider an HCR precautionary).

The results also show that there is a wide range of (F_{target}, $B_{trigger}$) combinations for which the median long-term yield is at least 95% of the maximum possible yield (cells shaded blue). Within the range of high-yield combinations, inter-annual yield variability can be reduced by selecting an HCR with lower F_{target} and lower $B_{trigger}$ values. Regarding the application of paragraph 3, the simulations showed that this element would be used to determine the TAC in 8% or less of the cases in the HCR for (F_{target}, $B_{trigger}$) combinations that achieve at least 95% of the highest median long-term equilibrium yield (Table 8). For the option that maximizes the median long-term yield, simulations indicate that paragraph 3 would be used to determine the TAC in about 7% of the cases.

The range of variation covered by the 10 000 iterations performed in the simulations, resulting from the combination of the uncertainty in the assessment and the natural variability of the *Pandalus* stock, is very large. This implies that future values of SSB and yield in a given year as well as interannual yield variability could differ substantially from the median values reported in the tables. An illustration of uncertainty and examples of simulated future trajectories are provided in Figures 2 and 3.

Methods

A management strategy evaluation (MSE) methodology was applied for the evaluation of harvest control rules. The evaluation methodology followed the ICES guidelines for management strategy evaluation (ICES, 2013).

The results from the latest stock assessment conducted in March (i.e. those from March 2017; ICES, 2017b) were used as the basis to parametrize the underlying population dynamics model and fishery specifications (operating model, OM). The OM was set in accordance with the stock assessment model used for this stock (stock synthesis, SS3). As in the stock assessment, the OM treats biological and fishery parameters as constant over time, but their estimation uncertainty is included in the simulations. The uncertainty estimated by SS3 for the population abundance at the end of the assessment period (= beginning of the simulation period = January 2017) is also incorporated in the OM. The model runs on a quarterly time step, with the fishery selectivity-at-age increasing throughout the year, as the shrimp grow. In line with the quarterly time-step in the model, all catch forecast calculations performed in the evaluation were based on quarters. Recruitment (age 0) and SSB, with maturity starting at age 2, are both calculated on January 1. Recruitment was based on segmented-regression stock–recruitment models fitted to the recruitment time-series estimated from the stock assessment.

The stock assessment method (SS3) was not included within the simulation loop of the MSE. Instead, appropriate assessment/advice error settings were determined through a separate exploration, and the selected settings were then incorporated within the MSE loop. Assessment/advice error was quantified, applying an approach similar to that proposed by WKMSYREF3 and WKMSYREF4 for the calculation of reference points (ICES, 2015; 2016b), but extended to deal with the finer level of detail needed for this stock, such as the quarterly time step, and the potential inclusion of paragraph 3 in the HCR.

The simulations used 10 000 independent replications, each running 100 years into the future. Results were analysed per year, for the short, medium, and long terms, with full results available in the report (Cardinale, M. *et al.*, 2017). The main performance diagnostics relate to the HCR risk criterion stated in the request (that the probability of SSB < B_{lim} should not exceed 5%, in any 20-year period), long-term SSB, yield and interannual yield variability. In addition the ICES precautionary risk criterion (the requirement that the probability of SSB < B_{lim} should not exceed 5%, in any year) was examined.

Sources and references

Cardinale, M., Fernandez, C., Eigaard, O.R., and Søvik, G. 2017. Report on the Long-term Management Strategy Evaluation for Northern Shrimp (*Pandalus borealis*) in Division 4.a East and Subdivision 20, October–November 2017. ICES CM 2017/ACOM:52. 185 pp.

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ICES. 2017b. Northern shrimp (*Pandalus borealis*) in Division 4.a East and Subdivision 20 (northern North Sea, in the Norwegian Deep and Skagerrak) – advice for 2017. *In* Report of the ICES Advisory Committee, 2017. ICES Advice 2017, pra.27.4a20.

Annex

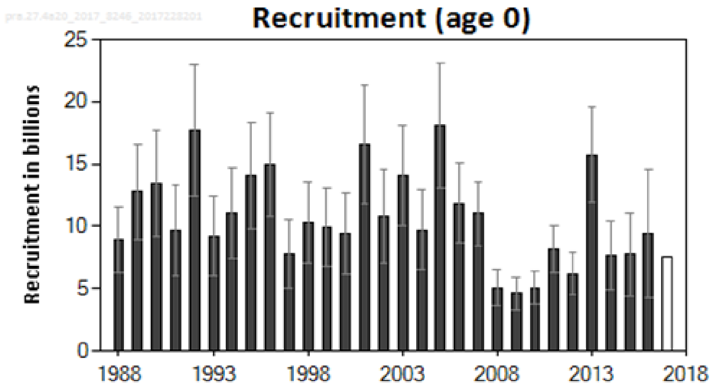

Figure 1 Recruitment (age 0 abundance), as estimated by the stock assessment from March 2017.

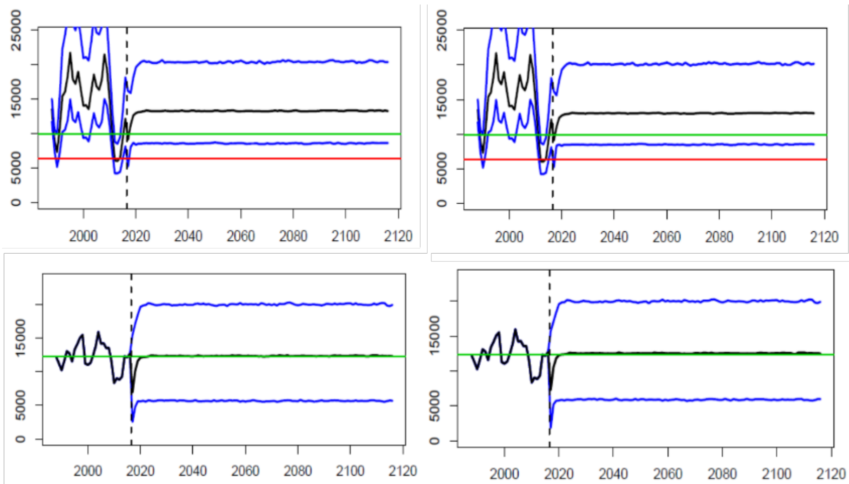

Figure 2 Simulation results. Left panels are for an HCR with F_{target} = 0.48, $B_{trigger}$ = 13 000 t and including paragraphs 1–2; Right panels are for an HCR with F_{target} = 0.48, $B_{trigger}$ = 12 000 t and including paragraphs 1–3. Top row: SSB estimated for the past, and future simulations (median, 5th, and 95th percentiles); the red and green horizontal lines correspond to B_{lim} and B_{pa}, respectively. Bottom row: Catches observed in the past and future simulations (median, 5th and 95th percentiles); the green horizontal line denotes the median of the period 1988–2016. All weights in tonnes.

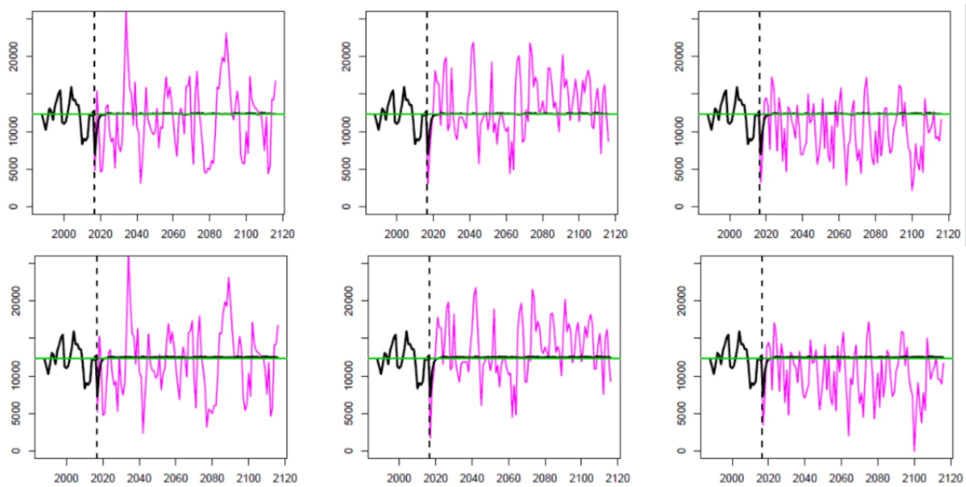

Figure 3 Simulation results. Top row is for an HCR with F_{target} = 0.48, $B_{trigger}$ = 13 000 t and including paragraphs 1–2; Bottom row is for an HCR with F_{target} = 0.48, $B_{trigger}$ = 12 000 t and including paragraphs 1–3. Catches (tonnes) observed in the past (median of the period 1988–2016 shown in green) and three future simulated trajectories.

For all the following tables (Tables 3–13), the dark red shading represents (F_{target}, $B_{trigger}$) combinations for which the ICES precautionary risk criterion exceeds 5%, whereas both shades of red correspond to (F_{target}, $B_{trigger}$) combinations for which the HCR risk criterion exceeds 5%. Blue shading identifies the (F_{target}, $B_{trigger}$) combinations that achieve at least 95% of the highest median long-term equilibrium yield within the set of combinations with no more than 5% risk (HCR risk criterion). The HCR achieving the highest median long-term yield while not exceeding 5% risk is highlighted in boldface (cell shaded blue for the HCR risk criterion, and cell shaded light red for the the ICES precautionary risk criterion).

Table 3 HCRs with paragraphs 1–3. Probability that SSB is below B_{lim} in any year (maximum over all years in the short, medium and long terms) expressed as a percentage; this is the ICES precautionary risk criterion. Rows and columns correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before this table.

	0	7000	8000	9000	9900	11000	12000	13000	14000	15000
0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.33	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.34	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
0.35	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
0.36	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0
0.37	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
0.38	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
0.39	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
0.41	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1
0.42	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1
0.43	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1
0.44	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.1
0.45	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2
0.46	0.5	0.5	0.5	0.5	0.4	0.4	0.3	0.2	0.2	0.2
0.47	0.6	0.6	0.6	0.5	0.5	0.4	0.3	0.3	0.2	0.2
0.48	0.6	0.6	0.6	0.6	0.5	0.5	**0.4**	0.3	0.2	0.2
0.49	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.3
0.5	0.8	0.8	0.8	0.8	0.7	0.6	0.5	0.4	0.3	0.3
0.51	0.9	0.9	0.9	0.8	0.8	0.6	0.6	0.5	0.4	0.3
0.52	1.1	1.1	1.0	1.0	0.9	0.7	0.6	0.5	0.4	0.3
0.53	1.2	1.2	1.1	1.1	1.0	0.8	0.7	0.6	0.5	0.4
0.54	1.3	1.3	1.2	1.2	1.1	0.9	0.7	0.6	0.5	0.4
0.55	1.4	1.4	1.4	1.2	1.2	1.0	0.8	0.7	0.6	0.5
0.56	1.6	1.5	1.5	1.4	1.3	1.1	0.9	0.8	0.6	0.5
0.57	1.7	1.7	1.6	1.5	1.4	1.2	1.0	0.8	0.7	0.5
0.58	1.9	1.9	1.8	1.7	1.5	1.3	1.1	0.9	0.8	0.6
0.59	2.0	2.0	2.0	1.8	1.6	1.4	1.1	1.0	0.8	0.6
0.6	2.2	2.1	2.1	1.9	1.8	1.5	1.2	1.0	0.9	0.7
0.61	2.3	2.3	2.2	2.1	1.9	1.6	1.3	1.1	1.0	0.7
0.62	2.5	2.5	2.4	2.3	2.1	1.7	1.4	1.2	1.0	0.8
0.63	2.8	2.8	2.6	2.4	2.2	1.9	1.6	1.3	1.1	0.9
0.64	3.0	3.0	2.8	2.6	2.3	2.0	1.7	1.4	1.1	0.9
0.65	3.3	3.2	3.1	2.8	2.5	2.1	1.8	1.5	1.2	1.0
0.66	3.5	3.5	3.3	3.1	2.7	2.3	2.0	1.6	1.3	1.1
0.67	3.8	3.8	3.6	3.4	3.0	2.5	2.1	1.8	1.4	1.2
0.68	4.0	4.0	3.8	3.6	3.3	2.7	2.3	1.9	1.5	1.2
0.69	4.2	4.1	4.0	3.7	3.4	2.9	2.5	2.0	1.6	1.3
0.7	4.4	4.3	4.2	4.0	3.5	3.1	2.6	2.2	1.8	1.4
0.71	4.7	4.6	4.5	4.2	3.8	3.4	2.9	2.4	1.9	1.5
0.72	**4.9**	4.8	4.6	4.4	4.0	3.5	3.1	2.5	2.0	1.5
0.73	5.2	5.1	5.0	4.7	4.4	3.8	3.3	2.7	2.2	1.7
0.74	5.5	5.4	5.2	4.9	4.6	4.0	3.5	3.0	2.3	1.9
0.75	5.8	5.7	5.5	5.2	4.8	4.2	3.7	3.1	2.5	2.0
0.76	6.1	6.0	5.8	5.6	5.1	4.4	3.9	3.2	2.7	2.2
0.77	6.3	6.2	6.0	5.8	5.4	4.7	4.1	3.4	2.8	2.4
0.78	6.5	6.5	6.3	6.1	5.6	5.0	4.3	3.6	2.9	2.4
0.79	6.8	6.7	6.6	6.3	5.9	5.2	4.5	3.8	3.1	2.6
0.8	7.0	7.0	6.9	6.6	6.1	5.5	4.8	4.0	3.3	2.7
0.81	7.3	7.3	7.1	6.8	6.4	5.7	5.0	4.2	3.4	2.9
0.82	7.6	7.5	7.4	7.0	6.6	5.9	5.1	4.4	3.6	3.0
0.83	7.8	7.7	7.6	7.3	6.9	6.2	5.3	4.6	3.8	3.1
0.84	8.1	8.0	7.9	7.6	7.2	6.5	5.6	4.8	4.0	3.2
0.85	8.4	8.3	8.1	7.8	7.4	6.7	5.8	5.0	4.1	3.4
0.86	8.7	8.6	8.4	8.2	7.7	6.9	6.0	5.1	4.4	3.5
0.87	8.9	8.8	8.7	8.4	7.9	7.1	6.3	5.3	4.6	3.7
0.88	9.1	9.0	9.0	8.7	8.2	7.3	6.6	5.6	4.7	3.8
0.89	9.4	9.4	9.2	9.0	8.4	7.6	6.8	5.8	4.9	4.0
0.9	9.7	9.7	9.5	9.2	8.7	7.8	7.0	5.9	5.1	4.2
0.91	9.9	9.8	9.8	9.4	8.9	8.0	7.2	6.2	5.2	4.4
0.92	10.0	10.0	9.9	9.6	9.0	8.3	7.4	6.4	5.4	4.5
0.93	10.3	10.3	10.2	9.9	9.3	8.5	7.5	6.6	5.6	4.7
0.94	10.6	10.5	10.4	10.1	9.5	8.7	7.8	6.9	5.9	4.9
0.95	10.8	10.8	10.7	10.4	9.8	8.9	8.0	7.2	6.0	5.1

Table 4 HCRs with paragraphs 1–3. Probability that SSB is below B_{lim} in any 20-year period (maximum over all 20-year periods in the short, medium, and long terms) expressed as a percentage; this is the HCR risk criterion. Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	7000	8000	9000	9900	11000	12000	13000	14000	15000
0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
0.31	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1
0.32	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.1
0.33	0.5	0.5	0.5	0.5	0.5	0.4	0.3	0.2	0.2	0.2
0.34	0.7	0.7	0.7	0.6	0.6	0.5	0.4	0.3	0.2	0.2
0.35	0.9	0.9	0.9	0.8	0.8	0.6	0.5	0.4	0.3	0.2
0.36	1.0	1.0	1.0	1.0	0.9	0.8	0.7	0.5	0.4	0.3
0.37	1.2	1.2	1.1	1.1	1.1	0.9	0.8	0.6	0.5	0.3
0.38	1.4	1.4	1.4	1.4	1.3	1.1	0.9	0.7	0.6	0.4
0.39	1.7	1.7	1.7	1.7	1.5	1.3	1.1	0.9	0.6	0.5
0.4	2.1	2.1	2.1	2.0	1.8	1.5	1.3	1.0	0.8	0.6
0.41	2.5	2.5	2.5	2.4	2.2	1.8	1.5	1.2	0.9	0.8
0.42	2.9	2.9	2.9	2.8	2.6	2.2	1.8	1.5	1.1	0.9
0.43	3.5	3.5	3.4	3.2	3.1	2.6	2.1	1.7	1.3	1.0
0.44	4.1	4.1	4.0	3.9	3.6	3.0	2.5	2.1	1.6	1.2
0.45	4.9	4.9	4.8	4.6	4.2	3.6	3.0	2.4	1.9	1.5
0.46	5.9	5.8	5.7	5.5	5.0	4.2	3.5	2.9	2.2	1.7
0.47	6.6	6.6	6.5	6.3	5.8	4.9	4.0	3.3	2.6	2.0
0.48	7.6	7.6	7.5	7.2	6.6	5.8	**4.7**	3.7	3.0	2.3
0.49	8.5	8.5	8.4	8.0	7.5	6.5	5.3	4.2	3.4	2.6
0.5	9.7	9.7	9.6	9.3	8.4	7.3	6.0	4.9	3.9	3.0
0.51	10.8	10.8	10.6	10.3	9.5	8.2	6.7	5.5	4.4	3.5
0.52	12.1	12.0	11.9	11.4	10.5	9.2	7.6	6.2	5.0	3.9
0.53	13.5	13.5	13.3	12.7	11.7	10.1	8.5	6.8	5.5	4.4
0.54	15.0	15.0	14.8	14.2	13.3	11.4	9.6	7.6	6.2	5.0
0.55	16.3	16.3	16.1	15.4	14.5	12.4	10.6	8.5	7.0	5.6
0.56	18.0	18.0	17.8	17.1	15.9	13.5	11.6	9.3	7.6	6.2
0.57	19.6	19.6	19.4	18.6	17.5	15.1	12.5	10.3	8.5	6.8
0.58	21.3	21.2	21.1	20.2	18.8	16.6	13.9	11.3	9.3	7.5
0.59	23.2	23.1	22.8	22.0	20.4	17.8	15.0	12.5	10.0	8.2
0.6	25.0	24.8	24.5	23.7	21.8	19.1	16.2	13.4	10.9	8.9
0.61	26.9	26.8	26.3	25.3	23.5	20.5	17.6	14.5	11.9	9.7
0.62	28.8	28.7	28.3	27.2	25.3	22.2	19.1	15.9	13.1	10.6
0.63	30.6	30.5	30.0	29.0	27.0	23.8	20.5	17.2	14.1	11.5
0.64	32.5	32.4	31.9	30.7	28.6	25.2	21.8	18.5	15.2	12.4
0.65	34.4	34.3	33.9	32.6	30.4	26.8	23.3	19.7	16.2	13.5
0.66	36.4	36.3	35.9	34.6	32.4	28.6	24.8	21.0	17.6	14.4
0.67	38.3	38.1	37.7	36.4	34.1	30.4	26.3	22.4	18.6	15.2
0.68	40.2	40.1	39.6	38.2	36.0	31.9	27.9	23.7	19.9	16.4
0.69	42.2	42.0	41.6	40.2	37.9	33.8	29.6	25.1	21.1	17.6
0.7	44.1	44.0	43.5	42.1	39.6	35.5	31.1	26.6	22.4	18.7
0.71	45.9	45.8	45.2	43.9	41.6	37.2	32.9	28.1	23.7	19.9
0.72	**47.8**	47.7	47.1	45.6	43.2	39.0	34.5	29.7	25.0	21.1
0.73	49.6	49.5	49.0	47.3	44.8	40.6	36.0	31.2	26.6	22.2
0.74	51.5	51.4	51.0	49.2	46.7	42.3	37.6	32.8	27.8	23.5
0.75	53.1	53.0	52.5	50.9	48.4	44.0	39.2	34.3	29.3	24.7
0.76	54.8	54.6	54.2	52.5	50.0	45.6	41.0	35.8	30.8	25.9
0.77	56.2	56.0	55.4	53.9	51.6	47.3	42.5	37.4	32.3	27.5
0.78	57.8	57.6	57.1	55.5	53.1	48.9	44.0	38.9	33.8	28.9
0.79	59.2	59.1	58.6	56.9	54.7	50.4	45.6	40.3	35.4	30.2
0.8	60.7	60.6	60.0	58.4	56.1	52.0	47.1	41.8	36.6	31.7
0.81	62.0	61.8	61.3	59.8	57.5	53.4	48.4	43.3	38.0	33.1
0.82	63.4	63.3	62.9	61.3	58.9	54.8	49.7	44.8	39.4	34.4
0.83	64.6	64.6	64.1	62.8	60.4	56.0	51.2	46.2	40.9	35.6
0.84	66.1	66.0	65.5	64.3	61.9	57.4	52.7	47.4	42.4	37.0
0.85	67.2	67.2	66.7	65.4	63.1	58.8	54.3	48.8	43.5	38.3
0.86	68.5	68.5	67.9	66.6	64.4	60.1	55.5	50.4	44.9	39.6
0.87	69.6	69.5	68.9	67.8	65.5	61.5	56.9	51.6	46.1	40.9
0.88	70.7	70.5	70.0	68.9	66.7	62.8	58.1	52.8	47.5	42.1
0.89	71.6	71.5	71.0	69.8	67.7	63.9	59.2	54.2	48.9	43.4
0.9	72.5	72.4	71.9	70.7	68.7	64.8	60.4	55.5	50.2	44.8
0.91	73.5	73.4	73.0	71.8	69.7	65.9	61.4	56.9	51.6	45.9
0.92	74.3	74.2	73.8	72.6	70.6	67.1	62.6	57.8	52.8	47.2
0.93	75.1	75.0	74.6	73.6	71.6	68.0	63.8	59.0	54.0	48.4
0.94	75.8	75.8	75.3	74.2	72.4	69.2	64.9	60.2	55.2	49.8
0.95	76.6	76.6	76.1	75.0	73.1	70.1	66.2	61.6	56.5	51.0

Table 5 HCRs with paragraphs 1–3. Median long-term equilibrium yield (tonnes). Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	**7000**	**8000**	**9000**	**9900**	**11000**	**12000**	**13000**	**14000**	**15000**
0.3	10336	10337	10338	10343	10351	10365	10381	10394	10398	10384
0.31	10498	10499	10501	10506	10516	10532	10548	10560	10561	10541
0.32	10654	10655	10658	10664	10674	10691	10709	10721	10717	10688
0.33	10803	10804	10807	10814	10826	10846	10864	10874	10865	10827
0.34	10947	10948	10951	10961	10974	10996	11013	11021	11006	10956
0.35	11086	11087	11091	11102	11117	11140	11157	11161	11140	11077
0.36	11218	11220	11226	11237	11254	11279	11296	11294	11267	11189
0.37	11347	11348	11354	11368	11387	11412	11428	11422	11383	11292
0.38	11470	11472	11479	11494	11515	11541	11554	11542	11493	11389
0.39	11588	11591	11599	11616	11638	11665	11676	11658	11595	11477
0.4	11703	11706	11714	11733	11757	11784	11791	11766	11689	11554
0.41	11812	11816	11826	11848	11872	11898	11901	11867	11778	11627
0.42	11918	11922	11934	11958	11984	12007	12005	11961	11858	11691
0.43	12020	12024	12038	12063	12091	12113	12105	12049	11931	11751
0.44	12118	12123	12138	12165	12193	12213	12198	12128	11997	11803
0.45	12212	12219	12235	12264	12292	12309	12285	12202	12055	11851
0.46	12303	12310	12328	12359	12387	12399	12365	12271	12108	11894
0.47	12391	12399	12419	12451	12478	12486	12442	12333	12156	11932
0.48	12477	12485	12507	12540	12566	12565	**12511**	12389	12199	11967
0.49	12559	12569	12591	12626	12649	12642	12575	12440	12238	11999
0.5	12640	12650	12674	12708	12729	12713	12635	12485	12272	12030
0.51	12718	12729	12753	12787	12805	12780	12688	12526	12301	12059
0.52	12794	12806	12831	12863	12878	12840	12736	12559	12329	12087
0.53	12869	12881	12906	12937	12945	12897	12781	12590	12355	12111
0.54	12942	12954	12978	13008	13009	12948	12820	12616	12377	12136
0.55	13015	13027	13050	13076	13069	12997	12855	12642	12399	12156
0.56	13085	13097	13119	13140	13125	13041	12884	12663	12418	12177
0.57	13157	13168	13187	13202	13181	13080	12910	12681	12435	12197
0.58	13226	13236	13254	13262	13232	13116	12933	12698	12450	12214
0.59	13295	13305	13319	13318	13280	13149	12952	12711	12465	12232
0.6	13362	13371	13381	13373	13324	13177	12967	12723	12479	12251
0.61	13429	13437	13443	13424	13364	13199	12980	12731	12491	12270
0.62	13496	13503	13503	13473	13399	13219	12990	12740	12504	12289
0.63	13561	13566	13561	13519	13430	13234	12997	12746	12514	12305
0.64	13625	13629	13616	13563	13458	13246	13003	12752	12526	12322
0.65	13689	13690	13669	13604	13483	13254	13005	12757	12536	12339
0.66	13752	13750	13720	13640	13502	13260	13007	12764	12546	12354
0.67	13810	13804	13767	13672	13518	13260	13007	12767	12555	12368
0.68	13867	13857	13810	13699	13528	13260	13004	12771	12566	12382
0.69	13921	13906	13848	13720	13534	13257	13002	12775	12575	12396
0.7	13970	13950	13882	13735	13534	13251	12999	12781	12586	12410
0.71	14017	13992	13909	13745	13531	13245	12998	12785	12594	12424
0.72	**14060**	14027	13932	13751	13525	13234	12997	12787	12604	12437
0.73	14094	14054	13948	13749	13517	13225	12994	12792	12612	12449
0.74	14123	14075	13954	13744	13506	13218	12989	12794	12620	12461
0.75	14145	14090	13955	13734	13494	13211	12989	12795	12629	12473
0.76	14159	14095	13952	13720	13481	13202	12986	12799	12636	12486
0.77	14167	14094	13941	13703	13465	13194	12982	12803	12641	12495
0.78	14167	14087	13924	13686	13448	13185	12979	12807	12648	12507
0.79	14161	14073	13904	13666	13433	13177	12978	12809	12655	12518
0.8	14147	14053	13880	13646	13419	13170	12977	12813	12661	12529
0.81	14125	14027	13854	13622	13402	13165	12975	12817	12670	12540
0.82	14098	13997	13824	13602	13391	13159	12974	12817	12678	12549
0.83	14067	13965	13798	13581	13378	13154	12973	12822	12686	12558
0.84	14030	13929	13771	13560	13365	13150	12973	12824	12693	12566
0.85	13991	13893	13740	13538	13353	13144	12972	12828	12700	12575
0.86	13950	13856	13710	13521	13340	13139	12974	12829	12705	12585
0.87	13908	13818	13681	13501	13328	13134	12974	12832	12710	12594
0.88	13865	13781	13653	13483	13319	13130	12974	12834	12716	12604
0.89	13822	13743	13625	13465	13309	13126	12976	12838	12721	12611
0.9	13781	13709	13599	13447	13302	13123	12976	12842	12727	12621
0.91	13742	13676	13572	13432	13290	13121	12978	12847	12731	12629
0.92	13704	13644	13548	13417	13281	13120	12978	12851	12737	12637
0.93	13666	13611	13525	13402	13271	13115	12980	12855	12744	12643
0.94	13632	13580	13501	13386	13263	13112	12981	12860	12750	12650
0.95	13597	13549	13478	13372	13255	13110	12982	12865	12756	12658

Table 6 HCRs with paragraphs 1–3. Median long-term equilibrium SSB (tonnes). Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	7000	8000	9000	9900	11000	12000	13000	14000	15000
0.3	17003	17004	17009	17020	17042	17089	17158	17254	17378	17522
0.31	16667	16668	16673	16688	16713	16770	16846	16950	17081	17236
0.32	16341	16343	16350	16367	16397	16460	16546	16658	16799	16963
0.33	16026	16029	16036	16056	16091	16161	16254	16378	16527	16700
0.34	15721	15724	15732	15756	15795	15875	15976	16108	16268	16449
0.35	15424	15427	15438	15466	15509	15597	15709	15849	16017	16210
0.36	15138	15141	15155	15185	15234	15330	15450	15602	15779	15978
0.37	14859	14864	14879	14912	14968	15072	15201	15361	15549	15756
0.38	14589	14594	14611	14649	14711	14823	14963	15133	15328	15541
0.39	14325	14331	14351	14395	14464	14584	14734	14913	15115	15337
0.4	14070	14078	14099	14148	14223	14354	14513	14700	14910	15139
0.41	13823	13831	13855	13910	13991	14134	14300	14496	14714	14949
0.42	13581	13590	13618	13679	13766	13919	14094	14299	14524	14767
0.43	13348	13358	13388	13456	13551	13714	13897	14109	14341	14591
0.44	13122	13133	13167	13240	13343	13515	13707	13925	14165	14421
0.45	12903	12916	12954	13033	13142	13324	13522	13750	13996	14257
0.46	12692	12705	12747	12831	12949	13139	13345	13580	13834	14098
0.47	12488	12503	12547	12638	12762	12961	13175	13416	13675	13945
0.48	12290	12307	12354	12451	12582	12788	**13011**	13259	13522	13797
0.49	12099	12117	12168	12271	12407	12622	12852	13107	13375	13652
0.5	11916	11936	11988	12096	12240	12463	12700	12960	13233	13512
0.51	11739	11761	11816	11929	12078	12309	12553	12817	13095	13376
0.52	11570	11592	11650	11769	11923	12160	12411	12678	12960	13245
0.53	11408	11431	11491	11615	11774	12018	12273	12545	12829	13118
0.54	11253	11276	11339	11466	11630	11879	12139	12416	12702	12995
0.55	11104	11128	11194	11324	11491	11746	12010	12290	12580	12875
0.56	10963	10988	11054	11188	11359	11618	11885	12168	12463	12757
0.57	10829	10855	10924	11058	11232	11495	11765	12052	12347	12645
0.58	10701	10728	10797	10934	11110	11376	11648	11939	12236	12534
0.59	10579	10606	10677	10814	10992	11260	11535	11828	12127	12427
0.6	10463	10490	10561	10699	10880	11150	11428	11721	12022	12324
0.61	10351	10379	10450	10591	10772	11043	11323	11617	11918	12222
0.62	10246	10273	10344	10487	10668	10941	11221	11517	11819	12124
0.63	10144	10172	10244	10388	10569	10842	11123	11419	11722	12027
0.64	10048	10077	10151	10291	10474	10747	11028	11324	11628	11932
0.65	9956	9985	10059	10200	10383	10657	10936	11233	11536	11841
0.66	9870	9898	9971	10114	10296	10568	10847	11143	11448	11752
0.67	9787	9816	9888	10030	10212	10484	10762	11057	11361	11665
0.68	9709	9738	9810	9951	10134	10402	10678	10974	11276	11581
0.69	9634	9664	9736	9875	10056	10323	10598	10892	11195	11499
0.7	9564	9593	9667	9803	9982	10249	10522	10813	11114	11418
0.71	9497	9526	9598	9735	9910	10176	10447	10738	11037	11338
0.72	**9434**	9463	9534	9670	9843	10106	10375	10663	10962	11261
0.73	9372	9401	9472	9606	9779	10038	10305	10592	10888	11187
0.74	9315	9344	9414	9546	9717	9972	10238	10522	10818	11114
0.75	9261	9289	9358	9488	9657	9910	10174	10455	10748	11043
0.76	9210	9238	9305	9434	9600	9850	10111	10390	10680	10973
0.77	9160	9188	9255	9382	9546	9792	10051	10327	10615	10905
0.78	9112	9141	9208	9333	9494	9737	9991	10267	10550	10839
0.79	9068	9096	9163	9285	9444	9684	9934	10207	10487	10775
0.8	9026	9054	9119	9240	9396	9632	9880	10149	10427	10711
0.81	8986	9014	9077	9196	9349	9583	9828	10092	10367	10650
0.82	8948	8976	9037	9155	9305	9535	9777	10038	10310	10590
0.83	8912	8939	9000	9115	9263	9489	9727	9984	10254	10533
0.84	8878	8904	8965	9077	9223	9445	9679	9933	10201	10475
0.85	8846	8872	8931	9041	9184	9402	9633	9883	10149	10420
0.86	8815	8841	8898	9007	9147	9360	9588	9834	10098	10365
0.87	8785	8811	8868	8974	9111	9319	9544	9787	10047	10313
0.88	8757	8782	8839	8943	9076	9282	9501	9742	9998	10262
0.89	8731	8756	8811	8912	9043	9245	9460	9698	9951	10211
0.9	8705	8729	8784	8883	9012	9210	9421	9655	9905	10163
0.91	8680	8705	8758	8856	8982	9176	9382	9614	9860	10115
0.92	8657	8681	8732	8829	8952	9143	9346	9574	9816	10069
0.93	8635	8658	8709	8804	8924	9111	9311	9535	9774	10024
0.94	8614	8637	8687	8780	8898	9081	9278	9498	9733	9979
0.95	8594	8617	8666	8757	8874	9052	9245	9462	9693	9935

Table 7 HCRs with paragraphs 1–3. Median long-term equilibrium interannual yield variability (percentage change in the catch between consecutive years). Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	7000	8000	9000	9900	11000	12000	13000	14000	15000
0.3	14	14	14	14	14	14	15	16	17	18
0.31	14	14	14	14	14	15	15	16	17	18
0.32	14	14	14	14	14	15	16	16	18	19
0.33	14	14	14	14	14	15	16	17	18	19
0.34	14	14	14	14	15	15	16	17	18	20
0.35	14	14	14	14	15	15	16	17	19	20
0.36	14	14	14	14	15	16	17	18	19	20
0.37	14	14	14	15	15	16	17	18	19	21
0.38	14	14	14	15	15	16	17	18	20	21
0.39	14	14	14	15	15	16	17	19	20	22
0.4	14	14	15	15	16	17	18	19	21	22
0.41	14	15	15	15	16	17	18	20	21	23
0.42	15	15	15	15	16	17	19	20	22	23
0.43	15	15	15	15	16	17	19	20	22	24
0.44	15	15	15	16	16	18	19	21	22	24
0.45	15	15	15	16	17	18	20	21	23	24
0.46	15	15	15	16	17	18	20	22	23	25
0.47	15	15	16	16	17	19	20	22	24	25
0.48	15	15	16	17	18	19	**21**	23	24	26
0.49	15	16	16	17	18	19	21	23	25	26
0.5	16	16	16	17	18	20	22	23	25	26
0.51	16	16	16	17	18	20	22	24	25	27
0.52	16	16	17	18	19	21	22	24	26	27
0.53	16	16	17	18	19	21	23	25	26	28
0.54	16	17	17	18	19	21	23	25	27	28
0.55	17	17	17	18	20	22	24	25	27	28
0.56	17	17	18	19	20	22	24	26	27	29
0.57	17	17	18	19	21	23	25	26	28	29
0.58	17	18	18	19	21	23	25	27	28	29
0.59	18	18	19	20	21	23	25	27	28	30
0.6	18	18	19	20	22	24	26	27	29	30
0.61	18	18	19	21	22	24	26	28	29	30
0.62	18	19	20	21	23	25	27	28	29	30
0.63	19	19	20	21	23	25	27	28	30	31
0.64	19	19	20	22	23	26	27	29	30	31
0.65	19	20	21	22	24	26	28	29	30	31
0.66	20	20	21	22	24	26	28	29	31	31
0.67	20	20	21	23	25	27	28	30	31	32
0.68	20	21	22	23	25	27	29	30	31	32
0.69	21	21	22	24	25	27	29	30	31	32
0.7	21	21	22	24	26	28	29	31	32	32
0.71	21	22	23	24	26	28	30	31	32	33
0.72	**22**	22	23	25	27	29	30	31	32	33
0.73	22	22	24	25	27	29	30	32	32	33
0.74	22	23	24	26	27	29	31	32	33	33
0.75	23	23	24	26	28	30	31	32	33	33
0.76	23	24	25	26	28	30	31	32	33	33
0.77	23	24	25	27	28	30	31	32	33	34
0.78	24	24	25	27	29	30	32	33	33	34
0.79	24	25	26	27	29	31	32	33	34	34
0.8	25	25	26	28	29	31	32	33	34	34
0.81	25	25	26	28	30	31	32	33	34	34
0.82	25	26	27	28	30	32	33	34	34	34
0.83	26	26	27	29	30	32	33	34	34	35
0.84	26	26	27	29	30	32	33	34	34	35
0.85	26	27	28	29	31	32	33	34	35	35
0.86	26	27	28	29	31	32	33	34	35	35
0.87	27	27	28	30	31	33	34	34	35	35
0.88	27	28	29	30	31	33	34	35	35	35
0.89	27	28	29	30	32	33	34	35	35	35
0.9	28	28	29	30	32	33	34	35	35	35
0.91	28	28	29	31	32	33	34	35	35	35
0.92	28	29	30	31	32	33	34	35	35	36
0.93	28	29	30	31	32	34	35	35	35	36
0.94	29	29	30	31	32	34	35	35	36	36
0.95	29	29	30	31	33	34	35	35	36	36

Table 8 HCRs with paragraphs 1–3. Percentage of times paragraph 3 determines the TAC (median in long-term equilibrium). Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	7000	8000	9000	9900	11000	12000	13000	14000	15000
0.3	1	1	1	1	1	0	0	0	1	1
0.31	1	1	1	1	1	1	1	1	1	1
0.32	1	1	1	1	1	1	1	1	1	1
0.33	1	1	1	1	1	1	1	1	2	2
0.34	2	2	1	1	1	1	1	2	2	2
0.35	2	2	2	1	1	1	1	1	1	2
0.36	2	2	2	2	2	2	2	2	3	3
0.37	3	2	2	2	2	2	2	3	3	3
0.38	3	3	3	2	2	2	3	3	3	4
0.39	3	3	3	3	3	3	3	3	4	4
0.4	4	4	3	3	3	2	2	2	3	3
0.41	4	4	4	4	3	3	4	4	4	5
0.42	5	5	4	4	4	4	4	4	5	5
0.43	5	5	5	5	4	4	4	5	5	6
0.44	6	6	6	5	5	4	5	5	5	6
0.45	7	7	6	6	6	6	6	7	7	8
0.46	8	7	7	6	6	5	6	6	6	7
0.47	8	8	8	7	6	6	6	6	7	7
0.48	9	9	8	8	7	7	**7**	7	7	8
0.49	10	10	9	8	8	7	7	7	8	8
0.5	11	11	10	8	6	5	3	2	2	1
0.51	12	12	10	9	7	5	4	3	2	2
0.52	13	13	11	9	8	6	4	3	2	2
0.53	14	14	12	10	8	6	5	3	3	2
0.54	16	15	13	11	9	7	5	4	3	2
0.55	17	16	15	12	10	8	6	5	4	3
0.56	18	17	16	13	11	8	6	5	3	3
0.57	19	19	17	14	12	9	7	5	4	3
0.58	21	20	18	15	13	10	7	6	4	3
0.59	22	21	19	17	14	10	8	6	5	4
0.6	24	23	21	17	14	11	8	6	5	4
0.61	25	24	22	19	16	12	9	7	6	5
0.62	27	26	23	20	17	13	10	8	6	5
0.63	28	27	25	21	18	14	11	9	7	6
0.64	30	28	26	23	19	15	12	9	7	6
0.65	31	30	28	24	20	16	13	10	8	7
0.66	33	32	29	25	22	17	14	11	9	7
0.67	34	33	31	27	23	18	15	12	10	8
0.68	36	35	32	28	24	19	15	12	10	8
0.69	38	36	33	29	25	20	16	13	11	9
0.7	39	38	35	30	26	20	16	13	10	8
0.71	41	39	36	32	28	23	18	15	12	10
0.72	**42**	41	38	34	29	24	19	16	13	11
0.73	44	42	39	35	30	25	20	17	14	12
0.74	45	44	41	36	32	26	21	18	15	12
0.75	47	46	43	39	34	29	24	20	17	15
0.76	49	47	44	39	34	28	23	20	16	14
0.77	50	48	45	41	36	30	25	21	17	15
0.78	52	50	47	42	37	31	26	22	18	16
0.79	53	51	48	43	38	32	27	23	19	16
0.8	55	53	49	44	39	32	27	22	19	16
0.81	56	54	51	46	41	35	29	25	21	18
0.82	57	56	52	48	42	36	30	26	22	19
0.83	59	57	54	49	44	37	31	27	23	20
0.84	60	58	55	50	45	38	33	28	24	20
0.85	62	60	56	51	46	39	34	29	24	21
0.86	63	61	58	53	47	41	35	30	26	22
0.87	64	62	59	54	49	42	36	31	27	23
0.88	65	64	60	55	50	43	37	31	27	23
0.89	67	65	62	57	51	44	38	33	28	25
0.9	68	66	63	58	53	46	40	35	30	26
0.91	69	67	64	59	54	47	41	35	30	27
0.92	70	68	65	60	55	48	42	36	31	27
0.93	71	69	66	61	56	49	43	37	32	28
0.94	72	70	67	62	57	50	44	38	33	29
0.95	73	72	68	63	58	51	45	40	35	30

Table 9 HCRs with paragraphs 1–2. Probability that SSB is below B_{lim} in any year (maximum over all years in the short, medium and long terms) expressed as a percentage; this is the ICES precautionary risk criterion. Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	**7000**	**9000**	**9900**	**11000**	**12000**	**13000**	**14000**	**15000**
0.3	1.2	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1
0.31	1.3	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1
0.32	1.5	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1
0.33	1.6	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1
0.34	1.8	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1
0.35	2.0	0.6	0.3	0.3	0.2	0.2	0.1	0.1	0.1
0.36	2.2	0.6	0.4	0.3	0.2	0.2	0.1	0.1	0.1
0.37	2.3	0.7	0.4	0.3	0.2	0.2	0.2	0.1	0.1
0.38	2.5	0.8	0.5	0.4	0.3	0.2	0.2	0.1	0.1
0.39	2.7	0.9	0.5	0.4	0.3	0.2	0.2	0.2	0.1
0.4	3.0	1.1	0.6	0.5	0.4	0.3	0.2	0.2	0.1
0.41	3.2	1.2	0.7	0.6	0.4	0.3	0.2	0.2	0.2
0.42	3.4	1.3	0.8	0.6	0.5	0.4	0.3	0.2	0.2
0.43	3.6	1.5	1.0	0.8	0.6	0.4	0.3	0.2	0.2
0.44	3.9	1.7	1.1	0.8	0.6	0.5	0.4	0.3	0.2
0.45	4.3	1.9	1.2	1.0	0.7	0.5	0.4	0.3	0.2
0.46	4.8	2.2	1.4	1.1	0.8	0.6	0.5	0.4	0.3
0.47	5.1	2.5	1.5	1.2	0.9	0.7	0.5	0.4	0.3
0.48	5.5	2.8	1.8	1.4	1.1	0.8	**0.6**	0.4	0.3
0.49	6.0	3.1	2.0	1.6	1.2	0.9	0.7	0.5	0.4
0.5	6.6	3.6	2.1	1.8	1.4	1.0	0.8	0.6	0.4
0.51	7.1	4.0	2.5	2.0	1.5	1.1	0.9	0.7	0.5
0.52	7.7	4.4	2.7	2.1	1.7	1.2	1.0	0.7	0.5
0.53	8.5	4.9	3.0	2.4	1.8	1.4	1.0	0.8	0.6
0.54	9.4	5.5	3.3	2.6	1.9	1.5	1.1	0.9	0.7
0.55	10.4	5.9	3.7	2.8	2.1	1.7	1.2	1.0	0.8
0.56	11.5	6.6	4.0	3.2	2.4	1.8	1.3	1.1	0.8
0.57	12.6	7.1	4.4	3.4	2.5	1.9	1.5	1.2	0.9
0.58	13.8	7.8	4.8	3.8	2.8	2.1	1.6	1.2	1.0
0.59	15.1	8.4	5.2	4.1	3.0	2.2	1.7	1.4	1.0
0.6	16.4	9.3	5.6	4.4	3.2	2.5	1.8	1.4	1.2
0.61	17.8	10.1	6.0	4.8	3.5	2.7	2.0	1.6	1.2
0.62	19.2	10.9	6.5	**5.0**	3.8	2.9	2.2	1.7	1.3
0.63	20.8	11.7	7.0	5.5	4.1	3.2	2.4	1.8	1.4
0.64	22.4	12.7	7.5	5.9	4.5	3.4	2.6	2.0	1.5
0.65	24.1	13.5	8.1	6.4	4.8	3.7	2.7	2.1	1.6
0.66	25.9	14.6	8.7	6.8	5.0	3.8	3.0	2.3	1.8
0.67	27.7	15.5	9.3	7.4	5.4	4.1	3.2	2.5	1.9
0.68	29.5	16.5	9.9	7.9	5.9	4.4	3.4	2.6	2.0
0.69	31.4	17.4	10.6	8.4	6.3	4.8	3.7	2.8	2.2
0.7	33.3	18.4	11.3	8.9	6.7	5.0	3.8	3.0	2.3
0.71	35.3	19.5	12.0	9.5	7.1	5.4	4.1	3.2	2.5
0.72	37.2	20.7	12.7	10.0	7.6	5.7	4.4	3.4	2.6
0.73	39.2	21.7	13.4	10.5	8.1	6.1	4.7	3.7	2.8
0.74	41.3	22.8	14.2	11.1	8.6	6.5	5.1	3.9	3.0
0.75	43.3	24.1	15.0	11.8	9.0	7.0	5.3	4.1	3.2
0.76	45.4	25.3	15.8	12.6	9.4	7.4	5.6	4.3	3.4
0.77	47.4	26.5	16.6	13.2	10.0	7.7	5.9	4.6	3.6
0.78	49.5	27.6	17.5	13.9	10.5	8.0	6.3	4.9	3.8
0.79	51.5	28.8	18.3	14.5	10.9	8.5	6.6	5.2	4.1
0.8	53.5	30.0	19.2	15.2	11.4	8.9	6.9	5.4	4.3
0.81	55.5	31.1	20.1	15.9	11.9	9.4	7.3	5.6	4.5
0.82	57.5	32.5	20.8	16.6	12.6	9.8	7.7	5.9	4.7
0.83	59.4	33.8	21.5	17.3	13.2	10.2	8.0	6.2	5.0
0.84	61.3	35.0	22.3	18.1	13.8	10.7	8.4	6.7	5.2
0.85	63.2	36.2	23.2	18.8	14.4	11.3	8.8	7.0	5.5

Table 10 HCRs with paragraphs 1–2. Probability that SSB is below B_{lim} in any 20-year period (maximum over all 20-year periods in the short, medium and long terms) expressed as a percentage; this is the HCR risk criterion. Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	7000	9000	9900	11000	12000	13000	14000	15000
0.3	1.9	1.1	0.8	0.7	0.5	0.3	0.2	0.2	0.1
0.31	2.2	1.3	0.9	0.8	0.6	0.4	0.3	0.2	0.2
0.32	2.6	1.4	1.1	0.9	0.7	0.5	0.4	0.3	0.2
0.33	3.0	1.8	1.2	1.1	0.9	0.6	0.5	0.3	0.3
0.34	3.5	2.1	1.6	1.2	1.0	0.8	0.6	0.4	0.3
0.35	4.1	2.5	1.8	1.5	1.2	0.9	0.7	0.5	0.4
0.36	4.7	2.9	2.2	1.8	1.5	1.2	0.9	0.7	0.4
0.37	5.3	3.4	2.5	2.1	1.7	1.4	1.0	0.8	0.6
0.38	5.9	4.0	2.8	2.4	1.9	1.6	1.2	0.9	0.7
0.39	6.5	4.5	3.3	2.8	2.2	1.8	1.5	1.0	0.8
0.4	7.6	5.3	3.9	3.3	2.6	2.0	1.6	1.2	1.0
0.41	8.6	6.2	4.7	3.9	3.1	2.3	1.8	1.4	1.1
0.42	9.8	7.3	5.4	4.7	3.6	2.8	2.1	1.7	1.3
0.43	11.2	8.7	6.1	5.3	4.2	3.3	2.5	2.0	1.4
0.44	12.6	10.0	6.9	6.0	4.8	3.8	3.0	2.2	1.7
0.45	14.3	11.6	8.1	7.1	5.5	4.5	3.4	2.5	2.0
0.46	16.2	13.3	9.4	8.0	6.4	5.1	4.0	3.0	2.3
0.47	18.1	14.9	10.9	9.2	7.3	5.7	4.5	3.5	2.6
0.48	19.9	16.5	12.4	10.5	8.4	6.5	**5.0**	4.0	3.0
0.49	21.9	18.4	13.8	11.8	9.4	7.3	5.7	4.4	3.4
0.5	24.4	20.5	15.5	13.3	10.6	8.3	6.5	5.0	3.9
0.51	27.0	22.9	17.3	14.8	11.8	9.2	7.3	5.7	4.3
0.52	29.6	25.3	19.2	16.4	13.1	10.4	8.2	6.4	4.9
0.53	32.1	27.9	21.0	18.1	14.5	11.3	9.0	7.1	5.5
0.54	35.2	30.7	23.3	20.1	16.1	12.8	9.9	7.9	6.2
0.55	37.8	33.3	25.5	21.8	17.7	14.1	11.0	8.7	6.9
0.56	40.8	36.0	27.9	23.8	19.3	15.4	12.2	9.6	7.6
0.57	43.5	38.8	30.5	26.0	21.1	16.9	13.4	10.6	8.4
0.58	46.2	41.4	32.9	28.2	23.0	18.6	14.7	11.7	9.3
0.59	49.0	44.1	35.3	30.4	24.9	20.3	16.0	12.8	10.1
0.6	51.9	47.0	37.8	32.5	26.7	21.8	17.3	13.8	10.9
0.61	54.8	49.9	40.3	34.7	28.4	23.4	18.8	15.0	12.0
0.62	57.8	52.7	42.9	**36.9**	30.6	25.1	20.4	16.2	13.1
0.63	60.8	55.5	45.3	39.3	32.6	27.1	21.9	17.4	14.3
0.64	63.5	58.3	47.8	41.6	34.6	28.8	23.5	18.9	15.4
0.65	66.3	61.2	50.5	44.2	36.8	30.6	25.2	20.2	16.4
0.66	68.9	63.7	53.1	46.9	39.1	32.5	27.0	21.8	17.5
0.67	71.3	66.3	55.8	49.4	41.3	34.6	28.6	23.2	18.5
0.68	73.7	68.7	58.0	51.8	43.7	36.6	30.3	24.9	20.1
0.69	75.9	71.2	60.4	54.1	46.1	38.8	32.0	26.4	21.4
0.7	78.2	73.8	63.1	56.3	48.3	40.8	33.9	28.0	22.8
0.71	80.4	76.0	65.4	58.6	50.6	43.1	35.7	29.8	24.3
0.72	82.1	78.0	67.7	61.0	52.9	45.2	37.6	31.3	25.9
0.73	83.9	80.0	70.2	63.4	54.9	47.3	39.6	33.1	27.6
0.74	85.6	81.8	72.3	65.6	57.1	49.2	41.5	34.8	28.9
0.75	87.2	83.6	74.3	67.9	59.1	51.2	43.4	36.4	30.6
0.76	88.5	85.1	76.1	69.8	61.2	53.4	45.4	38.2	32.1
0.77	89.6	86.6	77.8	71.7	63.3	55.4	47.5	40.0	33.8
0.78	90.8	87.8	79.5	73.7	65.2	57.3	49.3	41.7	35.4
0.79	91.9	89.0	81.1	75.4	67.3	59.3	51.5	43.6	37.0
0.8	92.8	90.2	82.7	77.3	69.3	61.2	53.2	45.4	38.5
0.81	93.9	91.1	83.9	78.8	71.0	63.1	55.1	47.1	40.3
0.82	94.7	92.2	85.1	80.3	72.7	64.7	57.1	49.0	41.9
0.83	95.4	93.0	86.2	81.7	74.0	66.7	58.8	50.9	43.4
0.84	96.0	93.8	87.5	83.1	75.8	68.5	60.4	52.6	45.2
0.85	96.4	94.5	88.6	84.3	77.4	70.2	62.3	54.3	46.7

Table 11 HCRs with paragraphs 1–2. Median long-term equilibrium yield (tonnes). Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	**7000**	**9000**	**9900**	**11000**	**12000**	**13000**	**14000**	**15000**
0.3	10330	10333	10341	10349	10364	10380	10393	10398	10384
0.31	10490	10494	10504	10514	10530	10547	10560	10561	10541
0.32	10643	10649	10661	10671	10690	10708	10720	10716	10688
0.33	10790	10797	10811	10824	10844	10863	10874	10864	10826
0.34	10931	10939	10956	10971	10994	11011	11020	11005	10955
0.35	11066	11077	11097	11113	11138	11156	11160	11139	11076
0.36	11197	11208	11231	11250	11275	11294	11293	11265	11188
0.37	11320	11334	11361	11382	11408	11426	11420	11382	11291
0.38	11439	11455	11486	11509	11537	11552	11540	11491	11387
0.39	11551	11571	11606	11631	11660	11673	11655	11593	11475
0.4	11658	11682	11722	11749	11779	11787	11763	11687	11552
0.41	11759	11788	11835	11864	11892	11896	11864	11774	11624
0.42	11856	11890	11942	11974	12001	12000	11957	11855	11688
0.43	11947	11988	12047	12080	12105	12099	12043	11927	11747
0.44	12034	12081	12147	12180	12204	12191	12122	11993	11799
0.45	12115	12169	12242	12276	12299	12277	12196	12050	11848
0.46	12190	12252	12333	12369	12388	12357	12264	12102	11889
0.47	12262	12332	12422	12458	12472	12432	12326	12150	11927
0.48	12327	12409	12505	12543	12550	12500	**12380**	12191	11961
0.49	12389	12481	12587	12623	12624	12562	12430	12230	11993
0.5	12445	12551	12664	12700	12692	12619	12473	12263	12022
0.51	12497	12615	12737	12771	12755	12670	12513	12291	12051
0.52	12544	12676	12806	12838	12813	12715	12545	12317	12079
0.53	12587	12735	12872	12900	12865	12757	12572	12343	12102
0.54	12624	12791	12933	12956	12913	12793	12597	12364	12125
0.55	12653	12842	12991	13009	12956	12826	12619	12383	12145
0.56	12679	12891	13046	13059	12994	12851	12637	12400	12164
0.57	12700	12937	13095	13103	13026	12872	12653	12415	12182
0.58	12717	12979	13140	13143	13056	12890	12667	12430	12199
0.59	12728	13016	13181	13181	13081	12904	12679	12442	12217
0.6	12732	13052	13217	13211	13101	12915	12687	12454	12235
0.61	12729	13083	13249	13235	13117	12923	12695	12464	12253
0.62	12717	13113	13279	**13259**	13126	12928	12701	12475	12269
0.63	12699	13139	13305	13275	13134	12932	12704	12485	12285
0.64	12675	13163	13326	13289	13138	12934	12709	12497	12301
0.65	12644	13184	13343	13300	13138	12933	12713	12504	12315
0.66	12606	13201	13355	13303	13135	12930	12716	12513	12329
0.67	12559	13214	13365	13302	13131	12927	12717	12520	12342
0.68	12502	13223	13368	13298	13125	12923	12717	12527	12355
0.69	12439	13229	13370	13292	13116	12915	12718	12535	12366
0.7	12364	13232	13366	13284	13103	12909	12719	12541	12380
0.71	12280	13233	13359	13273	13091	12903	12718	12546	12391
0.72	12186	13229	13347	13257	13077	12895	12717	12553	12402
0.73	12082	13222	13331	13239	13063	12884	12716	12559	12410
0.74	11964	13210	13314	13218	13046	12875	12713	12562	12420
0.75	11835	13195	13290	13195	13027	12864	12711	12566	12430
0.76	11691	13175	13265	13171	13008	12852	12707	12569	12438
0.77	11529	13154	13235	13145	12988	12840	12703	12572	12446
0.78	11348	13126	13205	13117	12968	12829	12700	12573	12452
0.79	11153	13094	13174	13088	12947	12818	12698	12575	12459
0.8	10937	13057	13140	13058	12926	12808	12693	12575	12464
0.81	10694	13018	13104	13029	12905	12794	12686	12578	12471
0.82	10421	12975	13067	12998	12885	12781	12679	12578	12476
0.83	10122	12929	13027	12968	12865	12769	12673	12579	12481
0.84	9790	12878	12986	12933	12843	12756	12665	12579	12485
0.85	9400	12825	12943	12900	12820	12741	12658	12576	12489

Table 12 HCRs with paragraphs 1–2. Median long-term equilibrium SSB (tonnes). Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	**7000**	**9000**	**9900**	**11000**	**12000**	**13000**	**14000**	**15000**
0.3	16993	16998	17017	17040	17088	17157	17253	17377	17522
0.31	16655	16661	16684	16710	16768	16845	16949	17080	17236
0.32	16326	16335	16363	16394	16458	16544	16657	16798	16963
0.33	16008	16019	16052	16088	16159	16253	16376	16527	16699
0.34	15701	15713	15750	15791	15872	15974	16106	16267	16448
0.35	15400	15414	15460	15505	15594	15706	15847	16016	16209
0.36	15110	15126	15177	15229	15326	15447	15600	15777	15977
0.37	14826	14846	14904	14962	15069	15199	15359	15548	15755
0.38	14549	14574	14639	14704	14819	14960	15130	15326	15540
0.39	14279	14308	14383	14455	14579	14730	14911	15113	15335
0.4	14016	14049	14135	14214	14348	14509	14697	14908	15138
0.41	13759	13797	13894	13980	14126	14295	14492	14712	14948
0.42	13507	13551	13662	13754	13912	14089	14296	14521	14765
0.43	13261	13312	13435	13537	13705	13891	14104	14338	14589
0.44	13022	13079	13215	13328	13505	13700	13920	14161	14419
0.45	12788	12853	13005	13124	13312	13514	13744	13992	14254
0.46	12557	12632	12798	12928	13126	13336	13574	13830	14095
0.47	12332	12416	12600	12736	12945	13165	13409	13670	13942
0.48	12110	12207	12406	12552	12770	12998	**13250**	13517	13792
0.49	11893	12001	12218	12374	12602	12839	13098	13369	13648
0.5	11678	11802	12036	12200	12439	12683	12949	13226	13507
0.51	11470	11606	11861	12033	12280	12535	12805	13087	13371
0.52	11265	11415	11690	11870	12128	12390	12666	12951	13239
0.53	11062	11230	11524	11714	11980	12250	12530	12819	13111
0.54	10862	11049	11364	11563	11839	12114	12399	12691	12988
0.55	10666	10873	11207	11414	11701	11980	12270	12568	12866
0.56	10472	10700	11056	11272	11566	11851	12146	12448	12747
0.57	10282	10533	10909	11134	11435	11727	12027	12331	12634
0.58	10093	10371	10769	11000	11308	11606	11911	12217	12522
0.59	9904	10212	10630	10869	11186	11488	11797	12106	12413
0.6	9719	10057	10496	10743	11066	11374	11686	11999	12308
0.61	9533	9905	10365	10620	10950	11262	11579	11893	12205
0.62	9349	9758	10238	**10499**	10836	11154	11474	11790	12103
0.63	9167	9613	10116	10383	10726	11049	11371	11691	12005
0.64	8983	9473	9996	10269	10619	10945	11270	11593	11908
0.65	8802	9336	9880	10160	10514	10845	11173	11497	11815
0.66	8618	9204	9766	10053	10413	10747	11078	11404	11723
0.67	8437	9074	9656	9947	10315	10651	10985	11314	11634
0.68	8254	8947	9549	9845	10217	10558	10895	11224	11546
0.69	8072	8823	9444	9746	10125	10466	10807	11137	11459
0.7	7889	8702	9342	9650	10033	10379	10720	11053	11374
0.71	7706	8585	9242	9556	9944	10292	10636	10969	11292
0.72	7520	8471	9146	9465	9858	10207	10554	10887	11212
0.73	7332	8359	9052	9374	9771	10124	10471	10807	11133
0.74	7143	8250	8959	9287	9687	10043	10391	10728	11056
0.75	6948	8143	8870	9201	9606	9964	10312	10651	10978
0.76	6754	8040	8782	9118	9526	9886	10235	10576	10903
0.77	6555	7939	8696	9036	9447	9809	10160	10501	10829
0.78	6350	7840	8611	8956	9370	9735	10087	10428	10757
0.79	6140	7744	8528	8877	9294	9662	10014	10356	10685
0.8	5928	7650	8449	8799	9221	9590	9944	10286	10616
0.81	5708	7559	8370	8725	9148	9519	9874	10216	10546
0.82	5478	7470	8293	8652	9077	9449	9805	10148	10478
0.83	5236	7383	8218	8579	9006	9380	9738	10081	10412
0.84	4984	7297	8145	8508	8937	9312	9672	10015	10347
0.85	4719	7213	8073	8438	8869	9246	9607	9950	10283

Table 13 HCRs with paragraphs 1–2. Median long-term equilibrium interannual yield-variability (percentage change in the catch between consecutive years). Rows and columns in the table correspond to F_{target} and $B_{trigger}$ values, respectively. The colour scheme and boldface are explained in the text before Table 3.

	0	7000	9000	9900	11000	12000	13000	14000	15000
0.3	14	14	14	14	14	15	16	17	18
0.31	14	14	14	14	15	15	16	17	18
0.32	14	14	14	14	15	16	16	18	19
0.33	14	14	14	14	15	16	17	18	19
0.34	14	14	14	15	15	16	17	18	20
0.35	14	14	14	15	15	16	17	19	20
0.36	14	14	14	15	16	17	18	19	20
0.37	14	14	14	15	16	17	18	19	21
0.38	14	14	15	15	16	17	18	20	21
0.39	14	14	15	15	16	17	19	20	22
0.4	14	14	15	16	17	18	19	21	22
0.41	14	14	15	16	17	18	20	21	23
0.42	14	14	15	16	17	18	20	22	23
0.43	14	14	15	16	17	19	20	22	23
0.44	14	14	16	16	18	19	21	22	24
0.45	14	15	16	17	18	20	21	23	24
0.46	14	15	16	17	18	20	22	23	25
0.47	14	15	16	17	19	20	22	24	25
0.48	14	15	16	17	19	21	**22**	24	26
0.49	14	15	17	18	19	21	23	24	26
0.5	14	15	17	18	20	21	23	25	26
0.51	14	15	17	18	20	22	24	25	27
0.52	14	15	17	19	20	22	24	26	27
0.53	14	15	17	19	21	23	24	26	27
0.54	14	16	18	19	21	23	25	26	28
0.55	14	16	18	19	22	23	25	27	28
0.56	14	16	18	20	22	24	26	27	28
0.57	14	16	19	20	22	24	26	27	29
0.58	14	16	19	21	23	25	26	28	29
0.59	14	16	19	21	23	25	27	28	29
0.6	14	17	19	21	23	25	27	28	30
0.61	14	17	20	22	24	26	27	29	30
0.62	14	17	20	**22**	24	26	28	29	30
0.63	15	17	20	22	25	26	28	29	30
0.64	15	17	21	23	25	27	28	30	31
0.65	15	18	21	23	25	27	29	30	31
0.66	15	18	21	23	26	27	29	30	31
0.67	15	18	22	24	26	28	29	30	31
0.68	15	18	22	24	26	28	29	31	31
0.69	15	18	22	24	27	28	30	31	32
0.7	15	19	23	25	27	29	30	31	32
0.71	15	19	23	25	27	29	30	31	32
0.72	15	19	23	25	28	29	30	31	32
0.73	15	20	24	26	28	29	31	32	32
0.74	15	20	24	26	28	30	31	32	32
0.75	15	20	25	26	28	30	31	32	33
0.76	15	20	25	27	29	30	31	32	33
0.77	15	21	25	27	29	30	32	32	33
0.78	15	21	26	27	29	31	32	32	33
0.79	15	21	26	28	30	31	32	33	33
0.8	15	22	26	28	30	31	32	33	33
0.81	15	22	26	28	30	31	32	33	33
0.82	15	22	27	29	30	32	32	33	33
0.83	15	23	27	29	31	32	33	33	34
0.84	15	23	27	29	31	32	33	33	34
0.85	15	23	28	29	31	32	33	33	34