ECOREGION Widely distributed and migratory stocks
SUBJECT NEAFC request to ICES to evaluate possible modifications of the long-term management arrangement for the Norwegian spring-spawning herring stock

Advice summary

ICES advises that B_{lim}, B_{pa}, and F_{MSY} remain unchanged (A in the request).

Given the current status of the stock the current management plan (A in the request) has a probability >0.06 of SSB< B_{lim} in 2017.

In the short term, ICES advises against increasing target F (0.125) in the management plan (B and C in the request) as stock size is currently relatively low and decreasing. Given the current status of the stock, all of the evaluated HCRsin the request have a probability >0.05 of SSB< B_{lim} in 2017.

The stock assessment has shown bias over the last 15 years such that the stock has been overestimated on average by 26%. This overestimation means that the stock has been fished at higher Fs than intended under the plan. With the current management plan, the short-term probability of SSB< B_{lim} increases from 0.061, if no bias is assumed, to 0.77 if the historical bias is incorporated. Under the assumptions for normal recruitment used in the HCRs, the simulations show that the population is expected to increase. Currently ICES is unable to determine the source of the recent bias or predict whether it will continue or not.

Request

"In accordance with the Agreed Record of Fisheries Consultations of 14 October 2011 on the Management of the Norwegian Spring Spawning (Atlanto- Scandian) Herring Stock in the Northeast Atlantic for 2012, the Coastal States shall submit a request to ICES, which will evaluate the consistency of possible modifications of the long-term management arrangement, including notably the maximum sustainable yield for the stock. The results of this analysis shall be presented at the next consultations of the Coastal States on the management of the herring stock for 2013.

The existing management plan consists of the following elements;

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the critical level (B_{lim}) of 2 500 000 t.*
2. *For the year 2001 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of less than 0.125 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of this fishing mortality rate.*
3. *Should the SSB fall below a reference point of 5 000 000 t (B_{pa}), the fishing mortality rate referred to under paragraph 2, shall be adapted in the light of scientific estimates of the conditions to ensure a safe and rapid recovery of the SSB to a level in excess of 5 000 000 t. The basis for such an adaptation should be at least a linear reduction the fishing mortality from 0.125 at B_{pa} (5 000 000 t) to 0.05 at B_{lim} (2 500 000 t).*
4. *The Parties shall as appropriate review and revise these management measures and strategies on the basis of any new advice provided by ICES.*

ICES has already assessed the fishing mortality that generates Maximum Sustainable Yield (F_{msy}) to F=0.15. ICES has also established the reference point $B_{trigger}$ to 5 000 000 t, and we understand that these two reference points are connected as follows; When the SSB of Norwegian spring spawning herring is assessed to be above 5 000 000 t, fishing should be on the basis of a fishing mortality at F_{msy} (0.15), whereas this fishing mortality should be reduced if the SSB is assessed to be below this trigger point.

To assess whether the existing long term management plan for Norwegian Spring Spawning Herring should be amended the Parties would request ICES to assess:

A. The existing long term management plan, including the reference points.

B. *The existing long term management plan modified by substituting the fishing mortality of 0.125 referred to in paragraph 2 and 3 of the existing plan with a fishing mortality corresponding to F_{msy} (0.15), and B_{pa} with $B_{trigger}$.*
C. *The existing long term management plan modified by substituting the fishing mortality of 0.125 referred to in paragraphs 2 and 3 of the existing plan with a fishing mortality corresponding to F_{msy} (0.15) when the average recruitment for a recent period with an appropriate time lag is equal to or above the long term mean. If the average recruitment in that period is below the long term mean, the currently applied fishing mortality of 0.125 shall be used. ICES is requested to evaluate different options of recent periods, time lags, and long term mean.*

When simulating the consequences of the existing and the amended management plans (B and C), fishing mortality should be kept equal to 0.05 when SSB is below B_{lim}. Concerning the amended management plans, ICES is also requested to simulate the consequences of this with a specification stating that fishing mortality is reduced linearly from F_{msy} at $B_{trigger}$ to zero when SSB is assessed to be zero.

Each alternative should be assessed in relation to how they perform to produce maximum long term yield as well as in relation to the precautionary approach. To assess their performance in relation to these two aspects, the Parties would ask ICES to produce figures according to the following indicators;

- *Medium term yield, represented as average yield during the next 10 years*
- *Long term yield, represented as average yield during the next 50 years*
- *Probability that SSB falls below $B_{trigger}$, in a 5 and 10 year period and in a 50 year period*
- *Probability that SSB falls below B_{lim}, in a 5 and 10 year period and in a 50 year period*

ICES is also requested to assess what, if any, other measures in addition to those contained in the present Management Plan might contribute to attaining the objectives of the plan, and provide estimates of their efficiency.

Finally, ICES is requested to give advice on TAC for 2013 according to the existing management plan, but should also identify a TAC for 2013 according to an amended long term management plan recognized by ICES to be in accordance with the precautionary approach."

Elaboration on the advice

Reference points

ICES has re-evaluated the B_{lim} and concluded that it should remain unchanged at 2.5 million tonnes. B_{pa} is not to be revised as it is defined based on B_{lim}. ICES has evaluated F_{MSY} and considers it should remain unchanged at F_{MSY} = 0.15.

Evaluation of harvest control rules

ICES advises that an increase in target F (0.125) in the management plan (i.e. HCRs 2 and 5) should not be considered in the short term. The stock size is currently relatively low and decreasing. Given the current status of the stock, all of the evaluated HCRs have a probability >0.05 of SSB< B_{lim} in 2017. SSB is expected to decline until 2017, mostly due to the lack of strong year classes in the period 2005 to 2012.

Modifying the current plan by allowing for a higher F (F = 0.15) when recent recruitment (the mean over a five-year period) has been observed to be above the long-term mean recruitment (125 billions; see HCRs 3 and 6) results in marginal increases in the average catches (a maximum 3.5% increase in yield in the intermediate term compared with the current management plan). The probability of SSB falling below B_{lim} would increase only slightly.

Modifying the current plan with a higher target F (F = 0.15) results in relatively small increases in catch (see HCRs 2 and 5), and these are associated with higher probability of SSB< B_{lim}. Given the anticipated decline, an increase in F should only be considered when SSB is estimated to be above B_{pa}.

Suggestions

Applying the present HCR does not reduce the F enough if SSB drops below $B_{trigger}$ of 5 million tonnes and gives a probability of >0.05 that SSB< B_{lim}. In the short term a probability of ≤ 0.05 that SSB< B_{lim} is achievable by increasing $B_{trigger}$ to 6 million tonnes. This is equivalent to a reduction of the average F in the short term to 0.090 (HCRs 1, 3, 4, and 6; see Table 9.3.3.2.6). A similar reduction in the probability of SSB< B_{lim} could also be achieved by using a constant F≤ 0.086 (Figure 9.3.3.2.2) until 2017.

Before increases in F are advised the bias in the assessment should be taken into account, as overestimation might lead to increased probability of SSB< B_{lim}. In the last 15 years the tendency has been to overestimate the stock by 26% on average. The catches have thus been taken at a higher F than advised, which may have contributed to the decline in SSB.

Given the current situation of declining stock size, TAC stabilizers (constraint on the interannual change in TAC) should not be used. During a downward trend in the stock size a stabilizer will keep the TACs higher than advisable. There are no obvious advantages to applying TAC stabilizers in the intermediate term, either.

Basis of the advice

Background

The current harvest control rule for Norwegian spring-spawning herring (NSSH) has been used in providing advice since 2001. The previous target F (F = F_{pa} = 0.15) used from 1998 to 2000 was considered to be too high and lead to too high a risk of SSB falling below B_{lim}. Additionally, the plan had a linear reduction of F, from 0.125 at B_{pa} to 0.05 at B_{lim}, to avoid closing the fishery completely.

Taking into account ICES development of an MSY framework which suggested F_{MSY} = 0.15, the Coastal States' management organization of the Norwegian spring-spawning herring stock in the Northeast Atlantic submitted a request to ICES to re-evaluate the long-term management plan. In addition, as NSSH is characterized by occasional strong year classes, a harvest control rule that could better react to abundant year classes entering the fishery has been suggested and an evaluation has been requested.

Results and conclusions

In the NSSH stock assessment, F is calculated based on number-weighted Fs. Because of software limitations the evaluation presented is based on un-weighted mean Fs throughout (see discussion in the Methods section below).

Re-evaluation of precautionary and MSY reference points

The estimates of B_{lim} are highly dependent on the data used (assessment year and time period), and the point estimates have a wide range (2.7–4.7 million tonnes). Though most of the estimates are greater the current B_{lim} of 2.5 million tonnes lies within the confidence interval of all the estimates (lowest 2.5% confidence interval 0.3 million tonnes, highest 97.5% confidence interval 10.8 million tonnes), which may suggest that the B_{lim} could be higher. The stock–recruitment data over the time-series is a combination of spawning-stock biomass and recruitment values from individual stock assessments over the different periods of the series. The resulting estimates of B_{lim} are sensitive not only to the length of the time-series used, but also to the particular historical assessments, making it difficult to select a single preferred value. ICES therefore recommends keeping the B_{lim} at 2.5 million tonnes.

Given that B_{lim} is unchanged, ICES does not recommend a change to B_{pa}.

A long-term stochastic equilibrium evaluation, assuming normal recruitment, was used to estimate unweighted F_{MSY}. This was found to be negligibly different from the current value of F_{MSY} = 0.15, which is equal to F_{pa} and gave a probability of < 0.05 of SSB< B_{lim}. ICES does not recommend any changes in F_{MSY}.

Harvest control rule

Seven indicators were selected to evaluate the performance of HCRs implied by the request.

- Average annual catch
- Average F
- Average SSB
- Average of the interannual variability in TAC (TAC IAV) calculated as a mean (over all years in the time frame and all bootstrap replicas) of the absolute interannual variation expressed as a percentage: abs{[TAC(y)−TAC(y−1)]/[(TAC(y−1)+TAC(y)) /2]*100}.
- The maximum annual probability that the true SSB falls below B_{lim} where this is calculated over the requested time periods (WKGMSE; ICES, 2013). According to ICES standards a HCR is considered precautionary if this probability ≤ 0.05.
- The perceived probability of the SSB falling below $B_{trigger}$. This measure indicates how often the F in the advice is reduced below the target value when the perceived SSB is below $B_{trigger}$. High values are indicative of higher variability in F and consequent catches.

As a base case in the HCRs $B_{trigger} = B_{pa}$ = 5 million tonnes was used. Simulations were run over 98 years (2012–2110). All the indicators were estimated at five different time scales:

- short term (the first 5 years, 2013–2017)
- medium term (the first 10 years, 2013–2022)
- intermediate term (years 6 to 15, 2018–2027)
- long term (first 50 years, 2013–2062)
- equilibrium state (last 50 years, 2061–2110).

In the equilibrium state all tested HCRs (Table 9.3.3.2.1, Figure 9.3.3.2.1) are precautionary (Table 9.3.3.2.2). In the short term, all the HCRs have a probability of SSB falling below B_{lim} >0.05. However, all HCRs except HCR 2 and HCR 5 (where target $F = F_{MSY} = 0.15$) have a probability of SSB falling below B_{lim} >0.05 only in one year (2017, see Table 9.3.3.2.3). In the medium term, all HCRs except HCR 5 are precautionary. The medium- and long-term periods include the highest probabilities of falling below B_{lim} at and around year 2017, and hence also have a probability of SSB falling below B_{lim} >0.05.

Under normal recruitment all of the stock trajectories increase after the decline to 2017. In the absence of strong year classes entering the stock in the next decade SSB fluctuates between B_{lim} and B_{pa} but does not decline further (Figure 9.3.3.2.3). This was simulated by excluding the spasmodic good year classes from the recruitment and applying the current management plan (HCR 1). In addition, the probability of SSB< B_{lim} is >0.05 only in one year (2017; Table 9.3.3.2.4).

All the HCRs tested perform similarly in terms of the requested performance indicators (Tables 9.3.3.2.2 and 9.3.3.2.5). Excluding HCRs that apply F_{MSY} (HCRs 2 and 5), the highest intermediate term yields and lowest TAC IAV appear in the strategy where F is dependent on recent recruitment and F = 0 at SSB = 0 (HCR 6, Table 9.3.3.2.2). This highest average yield given by HCR 6 is 3.5% higher than the lowest average yield as seen in the current management plan (HCR 1). Probabilities of SSB< B_{lim} do not differ significantly between the HCRs (Table 9.3.3.2.2). HCRs 1, 3, 4, and 6 have an average intermediate term SSB >B_{pa}. In the equilibrium state the highest average yield (again excluding HCRs 2 and 5), which is produced by HCR 6, is only 2% higher than the lowest average yield, produced by the current management plan (HCR 1) and the rule of F = 0 at SSB = 0 with target F = 0.125 (HCR 4).

The short-term probabilities of SSB< B_{lim} are estimated to be higher than 0.05, even though the current management plan (HCR 1), which was considered to be precautionary, has been applied. There are a number of aspects that contribute to this. The stock size in January 2013 is estimated to be 5.1 million tonnes, well below the simulation equilibrium state median of 7.1 million tonnes. Because of the recent poor recruitment SSB is likely to continue decreasing until around 2017. The stock assessment has shown bias over the last 15 years, overestimating the stock by on average 26%. This overestimation means that the stock has been fished with higher F than intended under the plan. With the current management plan (HCR 1), the short-term probability of SSB< B_{lim} increases from 0.061 with no bias to 0.77 when 26% bias is included (Figure 9.3.3.2.4). Though there is a high probability of SSB< B_{lim} the simulations show that the populations increase again after the short-term increase in risk (not shown in the figure). Such an increase in the probability of SSB< B_{lim} with this bias illustrates the sensitivity of the plan to bias in measurement or implementation. Currently ICES is unable to determine the source of the recent bias or predict whether it will continue or not.

Methods

A stochastic simulation model was used to evaluate the HCRs. Parameterization of the model was based on the latest information of the stock from WGWIDE (ICES, 2012). The model was run for the years 2013–2110 with 1000 stochastic iterations (replicate runs), and for five different time periods. Stochasticity was implemented in weight at age in the stock and catch, initial stock numbers, recruitment, and implementation and observation parts of the model. Natural mortality, maturation and fisheries selectivity were deterministic.

Recruitment is simulated with a log-normally distributed stochastic Beverton–Holt recruitment function and additional intermittent strong year classes appearing with an average interval of 8 years (with a range interval of ±2 years). It is possible to switch off the intermittent strong year classes to study the consequences of potential lack of strong year classes in the coming decade.

In the NSSH stock assessment, F is calculated based on number-weighted Fs. Because of software limitations the evaluation presented is based on unweighted Fs. When comparing Fs with the assessment results, the long-term weighted Fs are lower than unweighted Fs by about 18%. However, at times of stock decline weighted F is more precautionary than unweighted F, reducing the exploitation relative to exploitation under unweighted F. Without

implementing weighted F it has not been possible to estimate the difference in probability of SSB< B_{lim} due to the use of unweighted F, but it will be less than the difference between a target F = 0.125 and F = 0.15.

Sources

ICES. 2012. Report of the Working Group on Widely Distributed Stocks (WGWIDE), 21–27 August 2012, Lowestoft, UK. ICES CM 2012/ACOM:15. 931 pp.

ICES. 2013. Report of the Workshop on Guidelines for Management Strategy Evaluations (WKGMSE), 21–23 January 2013, ICES HQ, Copenhagen, Denmark. ICES CM 2013/ACOM:39. 127 pp.

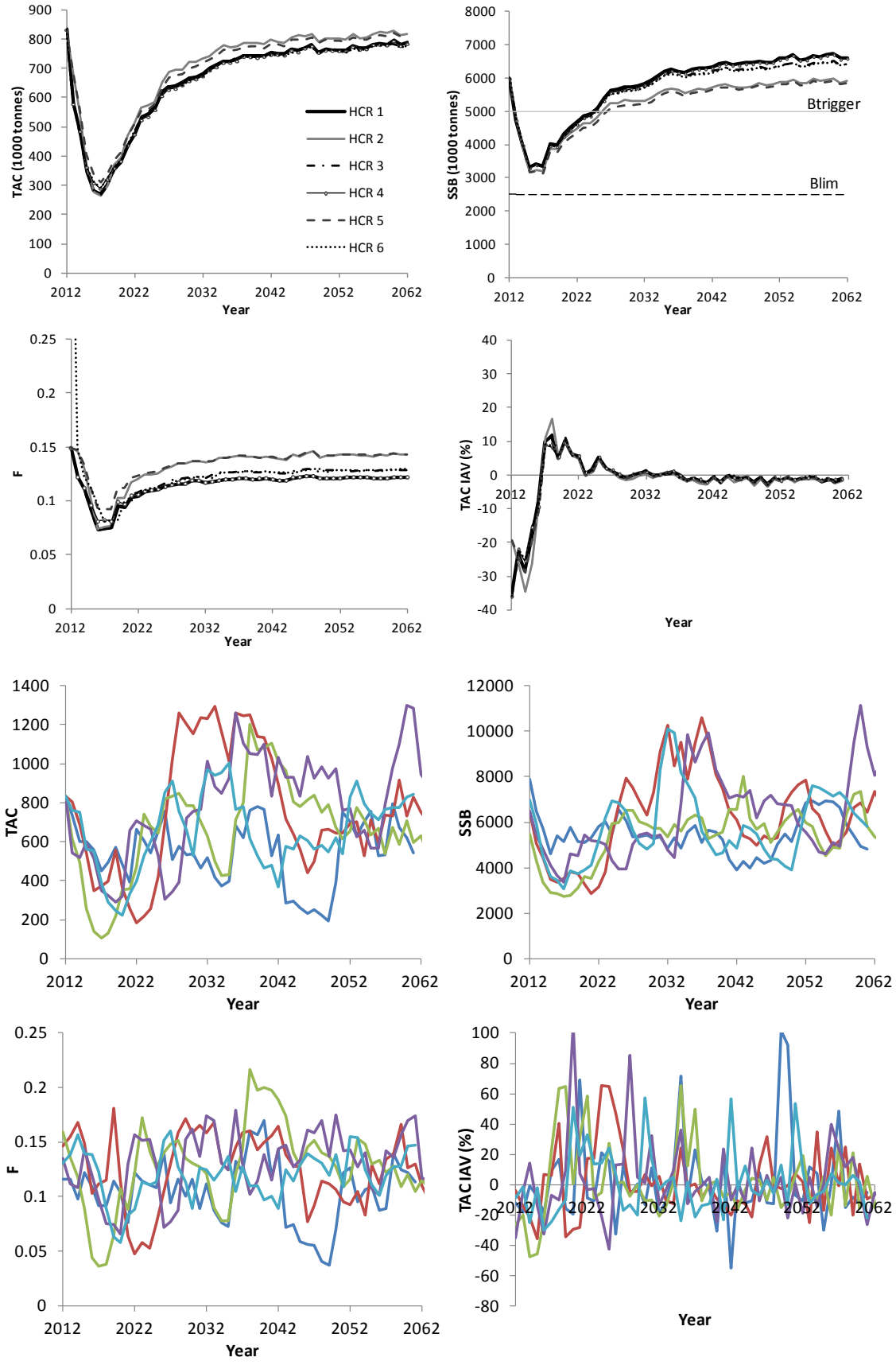

Figure 9.3.3.2.1 Comparison of the median time trajectories (2012–2062) of TAC, SSB, F, and TAC IAV of the different harvest control rules (upper set of 4 plots). Lower set of plots shows five random trajectories of the same performance indicators using the current management plan (HCR 1).

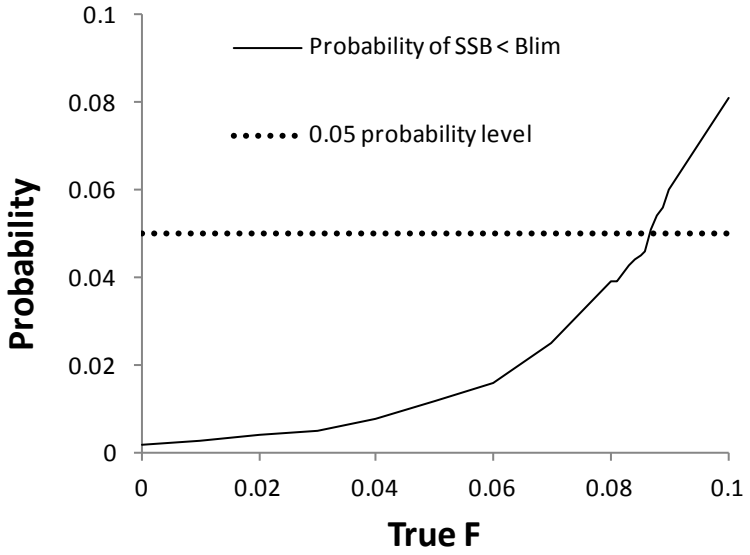

Figure 9.3.3.2.2 The effect of constant F on the probability of SSB falling below B_{lim} within the next 5 years. The same F has been applied through the five-year period. In order to achieve a probability level < 0.05, F should be ≤ 0.086.

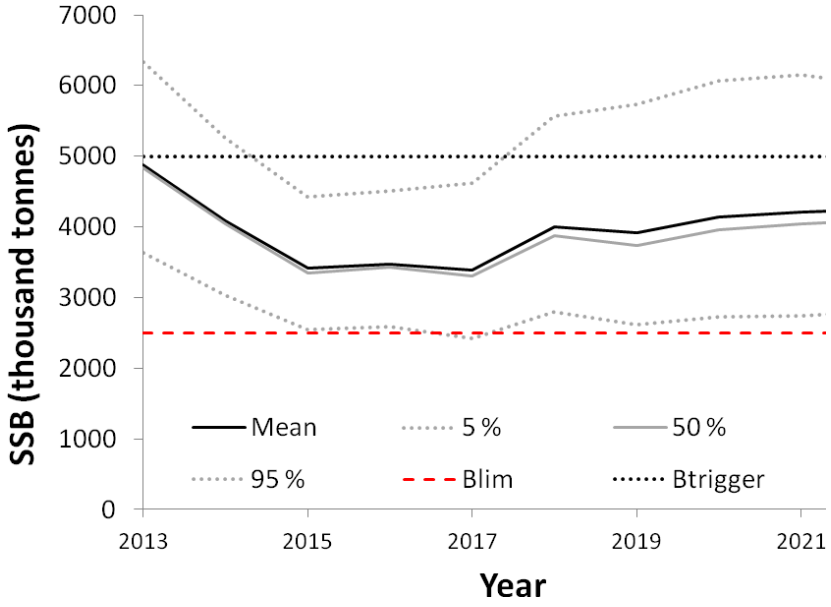

Figure 9.3.3.2.3 Medium-term probability of SSB< B_{lim} in the absence of strong year classes, applying the current long-term management plan (HCR 1).

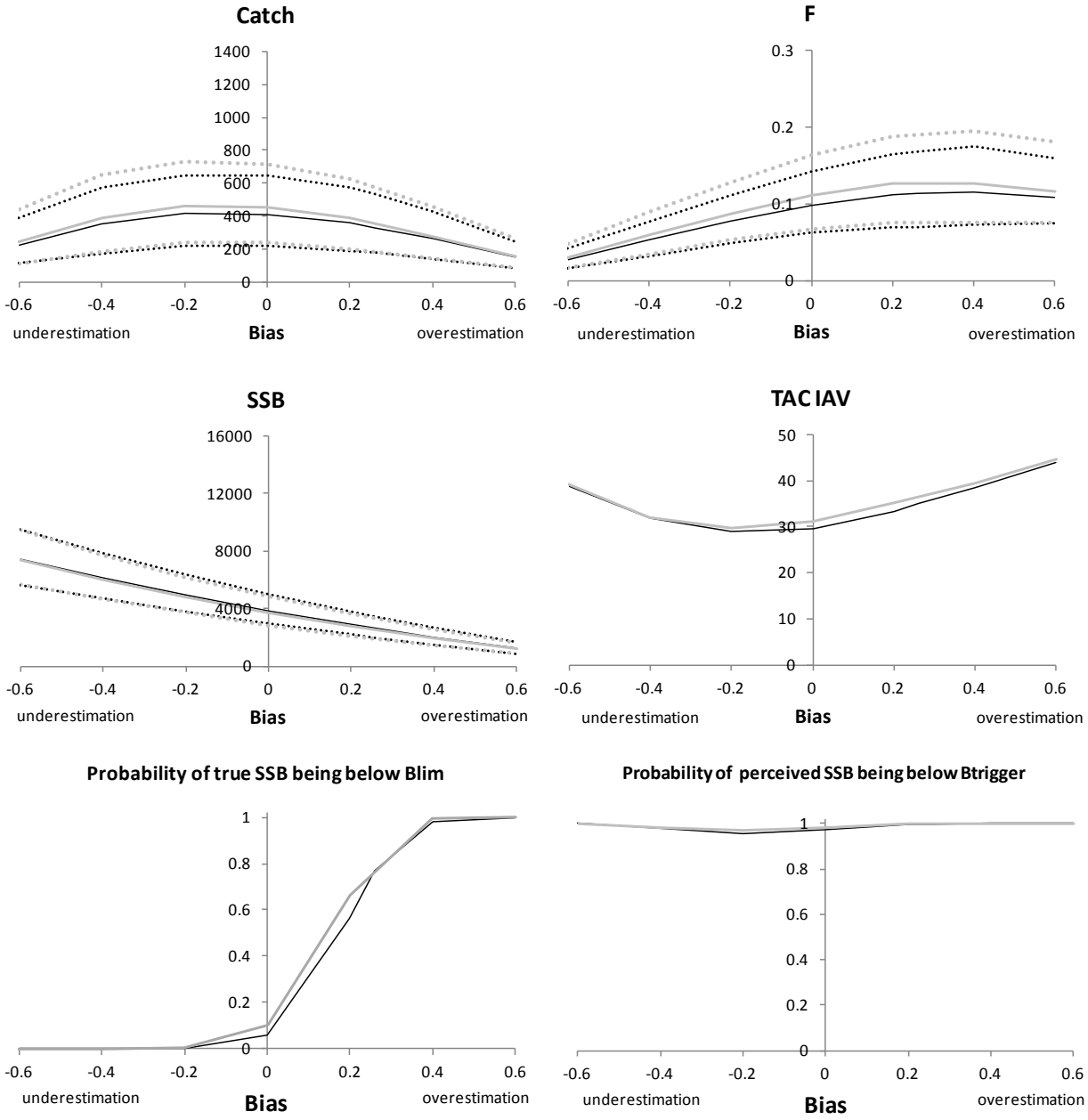

Figure 9.3.3.2.4 The effect of bias. Negative bias means underestimating the stock and positive bias means overestimating the stock. The plots show the short-term average (over the first 5 years) applying the current long-term management plan (HCR 1; black lines), and the current management plan amended with F_{MSY} = 0.15 (HCR 2; grey lines).

Table 9.3.3.2.1 Harvest control rules evaluated.

Harvest Control Rule		Ref. to request	SSB > $B_{trigger}$	$B_{trigger}$ > SSB > B_{lim}	SSB < B_{lim}
1	Current management plan	Option A	F = 0.125	Linear decrease 0.125 ≥0.05	F = 0.05
2	Current management plan modified with using F_{MSY}	Option B	F = 0.15 (F_{MSY})	Linear decrease 0.15 ≥0.05 (F_{MSY})	F = 0.05
3	F depends on recent recruitment, modified current management plan	Option C	If recent recruitment ≥ long-term average, F = 0.15 (F_{MSY}) If recent recruitment < long-term average, F = 0.125	If recent recruitment ≥ long-term average, linear decrease 0.15(F_{MSY}) ≥0.05. If recent recruitment < long-term average, linear decrease 0.125 ≥0.05	F = 0.05
			SSB >$B_{trigger}$		SSB< $B_{trigger}$
4	Zero-F-at-zero-SSB	Modified A	F = 0.125		Linear decrease from F = 0.125 at $B_{trigger}$ to F = 0 at SSB = 0
5	F_{MSY} plan with zero-F-at-zero-SSB	Modified B	F = 0.15		Linear decrease from F = 0.15 at $B_{trigger}$ to F = 0 at SSB = 0
6	Zero-F-at-zero-SSB, F depends on recent recruitment	Modified C	If recent recruitment ≥ long-term average, F = 0.15 (F_{MSY}) If recent recruitment < long-term average, F = 0.125		If recent recruitment ≥ long term average, linear decrease from F = 0.15 (F_{MSY}) at $B_{trigger}$ to F = 0 at SSB = 0 If recent recruitment < long term average, linear decrease from F = 0.125 at $B_{trigger}$ to F = 0 at SSB = 0
7	Increasing F at high stock size	Current management plan amended with $B_{trigger2}$ at high SSB where F starts linearly increasing again			

Table 9.3.3.2.2 The performance of harvest control rules 1–6 on different time scales (B_{lim} = 2.5 million tonnes and $B_{trigger}$ = 5 million tonnes). Weights in thousand tonnes.

first 5 yrs

HCR	Catch	F	SSB	TAC IAV %	Prob. SSB< B_{lim}	Prob. SSB< $B_{trigger}$
1	412	0.098	3847	30	0.061	0.97
2	453	0.111	3733	31	0.101	0.98
3	412	0.098	3847	30	0.061	0.97
4	426	0.102	3832	28	0.075	0.97
5	481	0.120	3702	27	0.141	0.98
6	426	0.102	3832	27	0.075	0.97

first 10 yrs

HCR	Catch	F	SSB	TAC IAV %	Prob. SSB< B_{lim}	Prob. SSB< $B_{trigger}$
1	422	0.098	4260	27	0.061	0.97
2	459	0.11	4117	29	0.101	0.98
3	428	0.099	4253	27	0.061	0.97
4	432	0.102	4221	24	0.075	0.97
5	479	0.118	4037	24	0.141	0.98
6	439	0.103	4213	25	0.075	0.97

yrs 6 to 15

HCR	Catch	F	SSB	TAC IAV %	Prob. SSB< B_{lim}	Prob. SSB< $B_{trigger}$
1	514	0.104	5141	22	0.022	0.95
2	552	0.118	4885	24	0.033	0.96
3	529	0.107	5099	22	0.022	0.95
4	517	0.106	5074	20	0.026	0.95
5	557	0.123	4750	21	0.054	0.96
6	532	0.11	5030	20	0.026	0.95

first 50 yrs

HCR	Catch	F	SSB	TAC IAV %	Prob. SSB< B_{lim}	Prob. SSB< $B_{trigger}$
1	688	0.115	6197	18	0.061	0.97
2	722	0.133	5671	21	0.101	0.98
3	705	0.121	6019	19	0.061	0.97
4	689	0.117	6156	17	0.075	0.97
5	723	0.136	5581	18	0.141	0.98
6	705	0.122	5977	18	0.075	0.97

last 50 yrs

HCR	Catch	F	SSB	TAC IAV %	Prob. SSB< B_{lim}	Prob. SSB< $B_{trigger}$
1	820	0.122	7157	15	0.001	0.22
2	843	0.142	6383	18	0.003	0.34
3	835	0.129	6839	16	0.001	0.24
4	820	0.123	7138	15	0.001	0.22
5	843	0.144	6326	16	0.003	0.35
6	836	0.133	6731	15	0.002	0.10

Table 9.3.3.2.3 The probability that the true SSB falls below B_{lim} (2.5 million tonnes) in any given year (2013–2110). Years when the probability of SSB<B_{lim} is >0.05 are shown in red.

Year	HCR 1	HCR 2	HCR 3	HCR 4	HCR 5	HCR 6
2013	0	0	0	0	0	0
2014	0.005	0.07	0.005	0.005	0.007	0.005
2015	0.032	**0.061**	0.032	0.035	**0.074**	0.035
2016	0.030	**0.054**	0.030	0.034	**0.078**	0.034
2017	**0.061**	**0.101**	**0.061**	**0.075**	**0.141**	**0.075**
2018	0.011	0.023	0.011	0.015	0.040	0.015
2019	0.022	0.033	0.022	0.026	**0.054**	0.026
2020-2110	≤ 0.013	≤ 0.019	≤ 0.013	≤ 0.015	≤ 0.028	≤ 0.015

Table 9.3.3.2.4 Annual probability of SSB falling below B_{lim} when no strong year classes are recruiting to the stock. The current management plan (HCR 1) is implemented (see also Figure 9.3.3.2.3).

Year	Maximum probability of SSB< B_{lim}
2013	0.002
2014	0.002
2015	0.039
2016	0.036
2017	**0.068**
2018	0.006
2019	0.035
2020	0.020
2021	0.021
2022–2110	≤ 0.016

Table 9.3.3.2.5 Median, 5, and 95 percentiles of catch, F, and SSB on HCRs 1–6, for all the time periods. Weights in thousand tonnes.

	Catch			F			SSB		
	5%	**Median**	**95%**	**5%**	**Median**	**95%**	**5%**	**Median**	**95%**
					short term				
HCR 1	222	400	648	0.062	0.096	0.142	2939	3762	4987
HCR 2	237	439	718	0.067	0.108	0.163	2861	3648	4825
HCR 3	222	400	650	0.062	0.096	0.141	2939	3762	4987
HCR 4	244	414	656	0.068	0.100	0.144	2911	3747	4982
HCR 5	279	470	732	0.080	0.117	0.170	2815	3623	4816
HCR 6	244	414	657	0.068	0.100	0.144	2911	3747	4982
					medium term				
HCR 1	231	400	677	0.067	0.097	0.131	3126	4090	5924
HCR 2	244	435	750	0.072	0.109	0.151	3028	3964	5697
HCR 3	231	403	712	0.067	0.098	0.132	3126	4090	5924
HCR 4	246	411	681	0.072	0.101	0.133	3070	4052	5901
HCR 5	275	454	761	0.084	0.117	0.156	2935	3879	5646
HCR 6	220	380	694	0.063	0.090	0.128	3174	4170	6023
					intermediate term				
HCR 1	255	483	902	0.068	0.103	0.137	3469	4813	7844
HCR 2	255	515	983	0.073	0.117	0.161	3324	4565	7440
HCR 3	255	489	958	0.068	0.106	0.137	3469	4802	7623
HCR 4	264	484	899	0.073	0.105	0.138	3384	4745	7769
HCR 5	277	517	979	0.083	0.122	0.164	3170	4440	7279
HCR 6	246	472	955	0.065	0.099	0.141	3565	4958	7756
					long term				
HCR 1	489	679	909	0.102	0.115	0.129	4688	6058	8169
HCR 2	506	710	963	0.115	0.133	0.150	4372	5532	7399
HCR 3	489	691	949	0.104	0.121	0.131	4655	5905	7720
HCR 4	491	680	910	0.104	0.117	0.130	4611	6021	8128
HCR 5	510	713	964	0.120	0.136	0.152	4243	5449	7334
HCR 6	498	696	951	0.113	0.127	0.141	4372	5727	7574
					equilibrium state				
HCR 1	589	809	1089	0.110	0.122	0.135	5385	7030	9350
HCR 2	597	829	1131	0.124	0.142	0.158	4861	6264	8270
HCR 3	593	821	1128	0.113	0.129	0.137	5309	6719	8700
HCR 4	590	809	1089	0.111	0.123	0.135	5351	7012	9349
HCR 5	598	830	1131	0.127	0.144	0.159	4763	6214	8246
HCR 6	595	822	1128	0.114	0.130	0.146	5274	6700	8675

Table 9.3.3.2.6 Precautionary HCRs in the short term when $B_{trigger}$ is increased to 6.0 million tonnes (B_{lim} = 2.5 million tonnes). For HCRs 2 and 5 $B_{trigger}$ needs to be increased to a level higher than 8 million tonnes and has not been evaluated. Weights in thousand tonnes.

Short term (first 5 years)

HCR	$B_{trigger}$	Catch	F	SSB	TAC IAV %	B_{lim} max prob	B_{lim} once prob	Prob $B_{trigger}$
1	6000	384	0.090	3901	30	0.041	0.056	1.0
2	-	-	-	-	-	-	-	-
3	6000	384	0.090	3901	30	0.041	0.056	1.0
4	6000	387	0.091	3897	30	0.041	0.056	1.0
5	-	-	-	-	-	-	-	-
6	6000	387	0.091	3897	30	0.041	0.056	1.0