

Herring (*Clupea harengus*) in Division 5.a, summer-spawning herring (Iceland grounds)

ICES advice on fishing opportunities

ICES advises that when the Iceland management plan is applied, catches in the fishing year 2019/2020 should be no more than 34 572 tonnes.

Stock development over time

The spawning-stock biomass (SSB) shows a declining trend since 2006 and it is now below $MSY B_{trigger}$. The fishing mortality (F) is currently below F_{MSY} . Recruitment (R) shows a declining trend since the highest value in 2002.

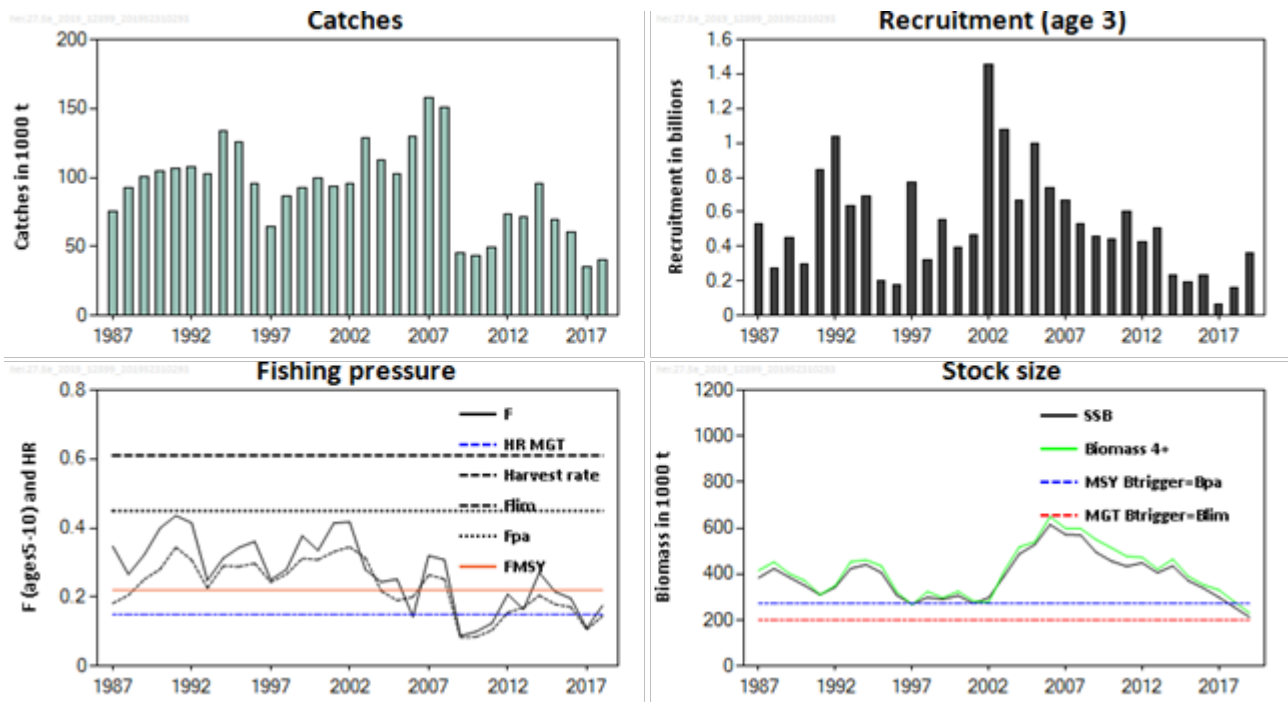


Figure 1 Herring in Division 5.a. summer-spawning herring. Summary of stock assessment. Harvest rates are calculated based on biomass age 4+. All biomass reference points refer to SSB levels.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is below F_{MSY} , F_{pa} , and F_{lim} . Spawning stock size is below $MSY B_{trigger}$ and between B_{pa} and B_{lim} .

Table 1 Herring in Division 5.a, summer-spawning herring. State of the stock and fishery relative to reference points.

		Fishing pressure			Stock size					
		2016	2017	2018	2017	2018	2019			
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Below	$MSY B_{trigger}$	✓	✗	✗	Below trigger
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa}, B_{lim}	✓	⦿	⦿	Increased risk
Management plan	HR_{MGT}	✓	✓	✓	Within expected range	$MGT B_{trigger}$	✓	✓	✓	Above trigger

Catch scenarios

Table 2 Herring in Division 5.a, summer-spawning herring. Assumptions made for the interim year and in the forecast. SSB and catch are in tonnes, recruitment in thousands.

Variable	Value	Notes
F ages 5–10 (2018/2019)	0.175	Fishing mortality based on TAC constraint.
SSB (2019)	227 841	Estimated by the assessment after accounting for <i>Ichthyophonus</i> infection in 2019 and catches.
B _{age 4+} (2019)	230 480	Estimated by the assessment (1 January 2019).
R _{age 3} (2019)	360 000	Based on prediction from a survey estimate in 2017 at age 1 (in thousands).
R _{age 3} (2020)	678 000	Based on prediction from a survey estimate in 2018 at age 1 (in thousands).
Total catch (2018/2019)	40 683	Catch from June 2018 to the end of the fishing season in 2019 (April).

Table 3 Herring in Division 5.a, summer-spawning herring. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2019/2020)	HR (2019/2020)	F _{total} (2019/2020)	Biomass of age 4+ (2020)	SSB (2020)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis								
Management plan	34 572	0.15	0.175	220 293	221 405	4.0	-1.7	-1.7

* SSB 2020 relative to SSB 2019.

** Advice value for 2019/2020 relative to TAC for 2018/2019 (35 186 tonnes).

*** Advice value for 2019/2020 relative to advice value for 2018/2019 (35 186 tonnes).

This year's advice is similar to that of last year.

Basis of the advice

Table 4 Herring in Division 5.a, summer-spawning herring. The basis of the advice.

Advice basis	Iceland management plan Rule 5 (ICES, 2017a, b)
Management plan	<p>The Icelandic Ministry of Industries and Innovation fisheries management plan has been implemented since 2017. The rule has been evaluated by ICES (ICES, 2017b) and is considered to be precautionary and conforms to the ICES MSY approach. According to the rule, the TAC for the fishing year Y/Y+1 (1 September of year Y to 31 August of year Y+1) is calculated as follows:</p> <p>When SSB_Y is equal to or above $MGT B_{trigger}$: $TAC_{Y/Y+1} = HR_{MGT} \times B_{ref,Y}$</p> <p>When SSB_Y is below $MGT B_{trigger}$: $TAC_{Y/Y+1} = HR_{MGT} \times \left(\frac{SSB_Y}{MGT B_{trigger}}\right) \times B_{ref,Y}$</p> <p>The spawning-stock biomass trigger ($MGT B_{trigger}$) is defined as 200 000 tonnes, the reference biomass is defined as the biomass of herring of ages 4 and older, and the target harvest rate (HR_{MGT}) is set to 0.15.</p>

Quality of the assessment

Survey indices were included incorrectly in last year’s assessment. This error resulted in 7% lower advice for 2018/2019. The error has now been corrected.

A downward revision of historical SSB prior to 2010 is explained by lower total *Ichthyophonus* infection mortality set for the years 2009–2011. Recruitment in the final year of the assessment is consistently overestimated but has no impact on the resulting advice.

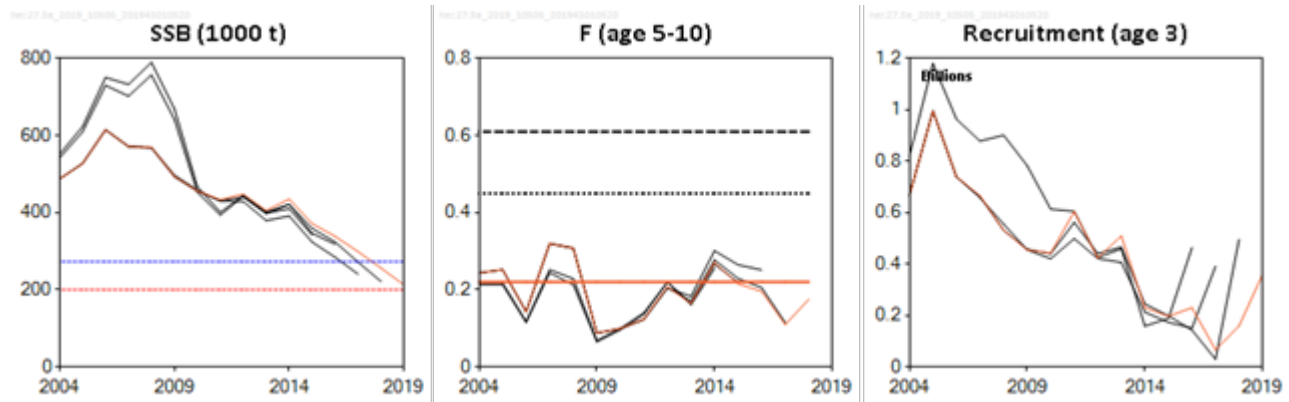


Figure 2 Herring in Division 5.a, summer-spawning herring. Historical assessment results. The final-year recruitment estimates derive from survey indices and not from model estimates.

Issues relevant for the advice

SSB has declined since 2009 because of high natural mortality caused by an *Ichthyophonus* infection (2009–2011 and 2017–2018) and decreasing recruitment. The infection rates of *Ichthyophonus* remain high, and this is taken into account in the assessment and in the management plan rule by applying a low harvest rate.

Reference points

Table 5 Herring in Division 5.a, summer-spawning herring. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	273 000	B_{pa}	ICES (2016, 2017a)
	F_{MSY}	0.22	HCS model for simulated harvest rules	ICES (2016, 2017a)
Precautionary approach	B_{lim}	200 000	SSB with a high probability of impaired recruitment	ICES (2016)
	B_{pa}	273 000	$B_{pa} = B_{lim} \times e^{1.645\sigma}$, where $\sigma = 0.19$	ICES (2016)
	F_{lim}	0.61	The F that leads to SSB = B_{lim} , given mean recruitment	ICES (2016)
	F_{pa}	0.45	$F_{pa} = F_{lim} \times \exp(-1.645 \times \sigma)$, where $\sigma = 0.18$	ICES (2016)
Management plan	MGT $B_{trigger}$	200 000	Stochastic simulations	ICES (2017a)
	HR_{MGT}	0.15	Management plan, independent of <i>Ichthyophonus</i> infection in the assessment year	ICES (2017a)

Basis of the assessment

Table 6 Herring in Division 5.a, summer-spawning herring. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2018).
Assessment type	Age-based analytical (NFT-ADAPT) that uses catches in the model and in the forecast (ICES, 2019).
Input data	The data used in the assessment are catch-at-age and one age-structured acoustic survey index (IS-Her-Aco-Q4/Q1). Natural mortality is assumed to be 0.1, with the exception of 2009–2011 and 2017–2018, for which higher values are used to reflect mortality from <i>Ichthyophonus</i> infection.
Discards and bycatch	Discarding is considered negligible and is not included. Industrial bycatch is included.
Indicators	None.
Other information	The stock was benchmarked in 2011 (ICES, 2011) and a management strategy evaluation took place in 2017 (ICES, 2017a, 2017b).
Working group	North-Western Working Group (NWWG)

Information from stakeholders

There is no additional available information for this stock.

History of the advice, catch, and management

Table 7 Herring in Division 5.a, summer-spawning herring. ICES advice, agreed TACs and ICES catches. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES landings	ICES discards
1984		50000	-	50304	0
1985		50000	-	49368	0
1986		65000	-	65500	0
1987	F _{0.1}	70000	72900	75439	0
1988	F _{0.1}	~ 100000	90000	92828	0
1989	F _{0.1}	95000	90000	97270	3700
1990/1991 **	Status quo F	90000	100000	101632	3500
1991/1992 **	F _{0.1}	79000	110000	98538	11000
1992/1993 **	F _{0.1}	86000	110000	106653	1800
1993/1994 **	No gain in yield by fishing higher than F _{0.1}	110000 *	110000	101496	1200
1994/1995 **	No gain in yield by fishing higher than F _{0.1}	83000 *	130000	131994	2000
1995/1996 **	No gain in yield by fishing higher than F _{0.1}	120000 *	110000	124963	900
1996/1997 **	No gain in yield by fishing higher than F _{0.1}	97000 *	110000	95882	0
1997/1998	No gain in yield by fishing higher than F _{0.1}	90000 *	100000	64931	0
1998/1999	No gain in yield by fishing higher than F _{0.1}	90000 *	90000	87238	0
1999/2000	Current F is sustainable	100000 *	100000	92896	0
2000/2001	Current F is sustainable	110000 *	110000	100332	0
2001/2002	Current F is sustainable	125000 *	125000	95675	0
2002/2003	Current F is sustainable	113000 *	105000	96208	0
2003/2004	Current F is sustainable	113000 *	110000	125717	0
2004/2005	F = 0.22	106000	110000	114237	0
2005/2006	Status quo catch	110000	110000	103043	0
2006/2007	Status quo catch	110000	130000	135303	0
2007/2008	Average of the last 3 years' catch	117000	150000	158917	0
2008/2009	F _{pa} = 0.22	131000	130000	151780	0
2009/2010	F _{pa} = 0.22	75000	40000	46332	0
2010/2011 ***	Domestic advice autumn 2010	40000	40000	43533	0
2011/2012 ***	Domestic advice autumn 2011, no fishery until then	40000	45000	49446	0
2012/2013	F _{MSY} = 0.22	67000	68500	71976	0
2013/2014	F _{MSY} = 0.22	87000	87000	72058	0
2014/2015	F _{MSY} = 0.22	83000	83000	94975	0
2015/2016	F _{MSY} = 0.22	71000	71000	69729	0
2016/2017	F _{MSY} = 0.22	63000	63000	60403	0

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES landings	ICES discards
2017/2018	HR _{MGT} = 0.15	38712	39000	35034	0
2018/2019	Management plan	35186	35186	40683	0
2019/2020	Management plan	≤ 34572			

* Catch at F_{0.1}.

** Season starting in October of first year.

*** No advice was given by ICES until new information on *Ichthyophonus* infection was available from survey monitoring in the following autumn.

History of the catch and landings

Table 8 Herring in Division 5.a, summer-spawning herring. Catch distribution by fleet in 2018 as estimated by ICES. All weights are in tonnes.

Catch (2018)	Landings	Discards
40 683	Pelagic trawl 100%	0
	40 683	

Summary of the assessment

Table 9 Herring in Division 5.a, summer-spawning herring. Assessment summary. Weights are in tonnes, recruitment in thousands. 'Year' refers to fishing year, starting 1 September each year; 1987 corresponds, therefore, to the fishing year 1987/1988. Catch includes only age groups used in the assessment (ages 3+).

Year	Recruitment (age 3)	SSB	Biomass age 4+	F (ages 5–10)	Harvest rate	Total catch
1987	529828	383813	415359	0.35	0.182	75439
1988	270996	423301	452288	0.27	0.205	92828
1989	447331	385514	401085	0.32	0.251	101000
1990	300826	349855	371477	0.40	0.281	105097
1991	840564	309714	310175	0.44	0.344	109489
1992	1033123	343182	349473	0.42	0.307	108504
1993	635460	423585	453608	0.25	0.226	102741
1994	691750	440724	460653	0.31	0.29	134003
1995	202724	406169	435398	0.34	0.288	125851
1996	181404	307460	322300	0.36	0.297	95882
1997	772618	268868	266677	0.25	0.243	64931
1998	320528	298355	323428	0.28	0.266	87238
1999	552736	289667	296930	0.38	0.312	92896
2000	391543	306415	324211	0.33	0.308	100332
2001	469039	272023	282558	0.41	0.331	95675
2002	1457991	297531	277998	0.42	0.345	96208
2003	1077318	390066	411674	0.28	0.313	125717
2004	666568	487511	517374	0.24	0.217	114237
2005	994341	527452	538931	0.25	0.19	103043
2006	739701	614691	648955	0.143	0.2	135303
2007	665246	571650	598444	0.32	0.264	158917
2008	532417	568872	597362	0.31	0.252	151780
2009	454849	494112	549269	0.087	0.083	46332
2010	442789	456136	513804	0.099	0.084	43533
2011	604085	433481	476911	0.124	0.104	49446
2012 *	424148	448092	472686	0.21	0.155	71976

Year	Recruitment (age 3)	SSB	Biomass age 4+	F (ages 5–10)	Harvest rate	Total catch
2013	509458	405655	421004	0.164	0.17	72058
2014	230149	434995	464179	0.27	0.205	94975
2015	197044	371452	390147	0.22	0.179	69729
2016	230172	338442	352759	0.196	0.171	60403
2017	66044	298931	330698	0.110	0.106	35034
2018	159683	256086	280124	0.175	0.145	40683
2019	360000 ‡	212481 †	230480			

* The mass mortality of 52 000 tonnes in Kolgrafafjörður in the winter 2012/2013 is not included in the landings, yield/SSB, and weighted F, but is included in the analytical assessment.

† SSB calculated at spawning time (summer) after accounting for infection mortality.

‡ Predicted from a survey index of number at age 1 in 2017.

Sources and references

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