Published 31 May 2018
https://doi.org/10.17895/ices.pub.4382

Herring (*Clupea harengus*) in Subdivision 28.1 (Gulf of Riga)

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) is applied, catches in 2019 that correspond to the F ranges in the plan are between 20 664 tonnes and 31 237 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (26 932 tonnes) can only be taken under conditions specified in the MAP. This advice applies to all catches from the stock in subdivisions 28.1 and 28.2.

Stock development over time

Following high recruitment, spawning-stock biomass (SSB) increased in the late 1980s and is estimated to have been above the MSY $B_{trigger}$ since then. Recruitment has been quite variable from year to year without any clear trend since the late 1980s. Fishing mortality (F) has been generally fluctuating around F_{MSY} since 2008 and was at F_{MSY} in 2017.

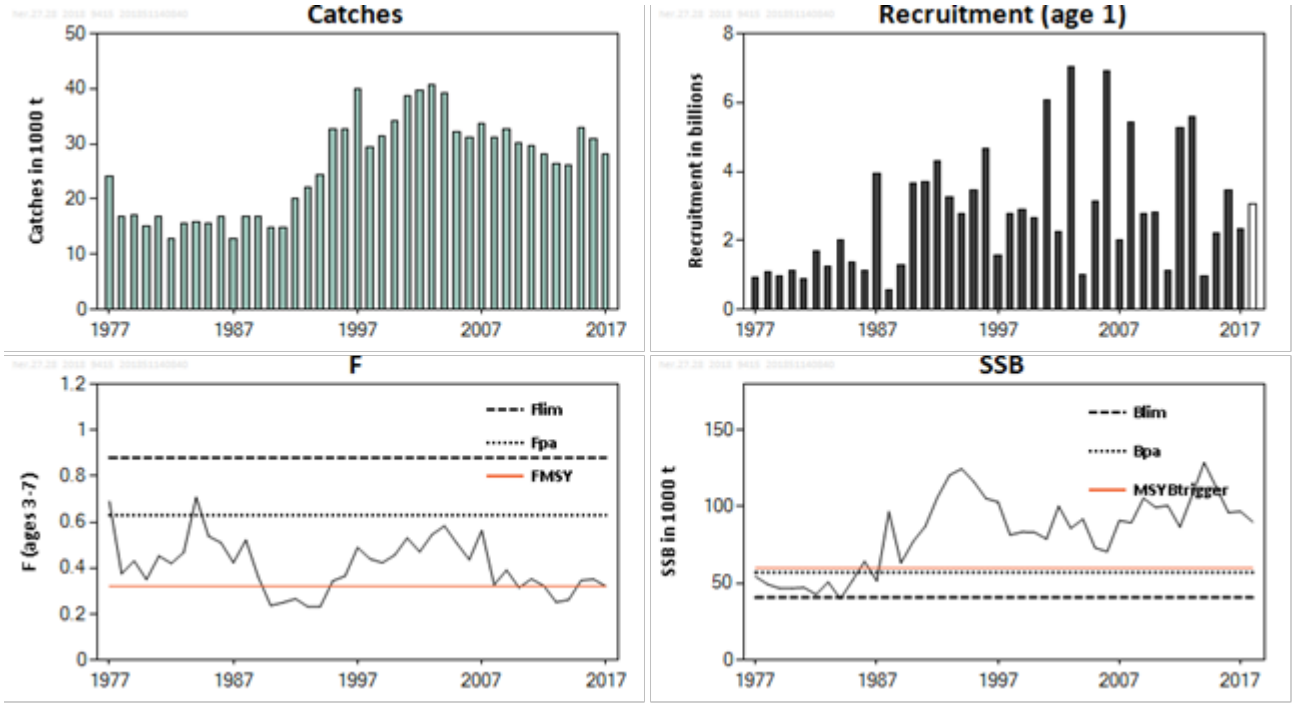

Figure 1 Herring in Subdivision 28.1. Summary of the stock assessment. Predicted recruitment values are unshaded. SSB at spawning time in 2018 is predicted.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is at F_{MSY} and below F_{pa} and F_{lim} and the spawning stock size is above $MSY_{trigger}$, B_{pa}, and B_{lim}.

Table 1 Herring in Subdivision 28.1. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2015	2016	2017		2016	2017	2018	
Maximum Sustainable Yield	F_{MSY}	✗	✗	✓	At	MSY $B_{Trigger}$	✓	✓	Above trigger
Precautionary Approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa}, B_{lim}	✓	✓	Full reproductive capacity
Management plan	F_{ranges}	✓	✓	✓	Within range	MSY $B_{trigger}$	✓	✓	Above

Catch scenarios

Table 2 Herring in Subdivision 28.1. Assumptions made for the interim year and in the forecast. Weights are in tonnes. Recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 3–7}$ (2018)	0.29	Catch constraint of 24 919 (TAC of 2018 in the Gulf of Riga minus the average catch of Central Baltic herring in the Gulf of Riga, plus the average catch of Gulf of Riga herring in the Central Baltic)
SSB (2018)	90 051	
R_{age1} (2018-2020)	3 057 539	Geometric mean of year classes 1989–2015
Total catch (2018)	24 919	
Commercial landings (2018)	24 919	

Table 3 Herring in Subdivision 28.1. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch(2019)	F_{total}(2019)	SSB (2019)	SSB(2020)	% SSBchange **	% Advice change ***
ICES advice basis						
EU MAP*: F_{MSY}	26932	0.32	91669	92404	0.8%	8.1%
EU MAP*: F_{lower}	20664	0.24	93020	99670	7.1%	6.5%^
EU MAP*: F_{upper}	31237	0.38	90698	87477	-3.6%	7.0%^^
Other scenarios						
ICES MSY approach: F_{MSY}	26932	0.32	91669	92404	0.8%	8.1%
F = 0	0	0	97030	124349	28.2%	-100.0%
F = F_{pa}	47115	0.63	86754	69785	-19.6%	89.1%
F = F_{lim}	59942	0.88	83040	56105	-32.4	140.6%
SSB (2020) = B_{lim}	75061	1.25	77788	40800	-47.5%	201.2%
SSB (2020) = B_{pa}	58989	0.86	83335	57100	-31.5%	136.7%
SSB (2020) = MSY $B_{trigger}$	56232	0.80	84172	60000	-28.7%	125.7%
F = F_{2018}	24584	0.29	92183	95113	3.2%	-1.3%

* MAP multiannual plan (EU, 2016).
** SSB 2020 relative to SSB 2019.
*** Total catch in 2019 relative to ICES advice for 2018 (24 919 tonnes for the Gulf of Riga herring stock).
^ ICES advice for F_{lower} in 2019 relative to ICES advice F_{lower} in 2018 (19 396 tonnes).
^^ ICES advice for F_{upper} in 2019 relative to ICES advice F_{upper} in 2018 (29 195 tonnes).

The advice for 2019 is similar to the advice for 2018.

Basis of the advice

Table 4 Herring in Subdivision 28.1. The basis of the advice.

Advice basis	EU Baltic multiannual plan
Management plan	The EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes herring (EU, 2016). The advice based on the F_{MSY} ranges used in the management plan are considered precautionary.

Quality of the assessment

It is considered that there have been no unallocated catches of Gulf of Riga herring since 2011.

Historical assessments have generally shown an overall upwards revision in SSB and a downwards revision in fishing mortality.

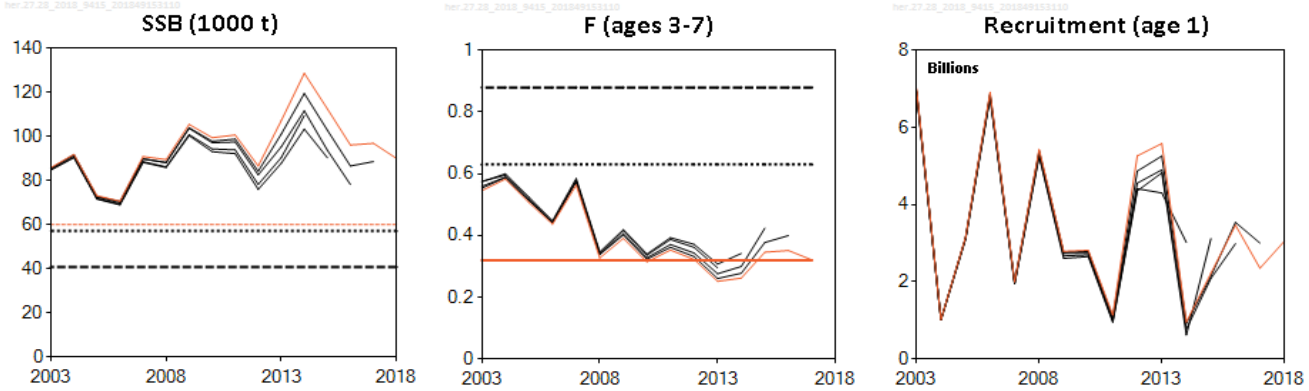

Figure 2 Herring in Subdivision 28.1. Historical assessment results (final-year recruitment estimates are included).

Issues relevant for the advice

The F_{MSY} ranges in the EU Baltic Sea Multiannual Plan (MAP) are consistent with the ranges provided by ICES (2015); these were evaluated to result in no more than 5% reduction in long-term yield compared with MSY. The ICES advice according to the MAP is based on the provisions of the plan and is considered precautionary. The ICES advice rule is used, i.e. F is adjusted by the factor SSB/MSY $B_{trigger}$ when SSB is below MSY $B_{trigger}$. For this stock, the SSB in 2018 is above MSY $B_{trigger}$. In such a situation, catch scenarios applicable under the MAP correspond to fishing mortalities between F_{lower} and F_{upper}. However, according to the MAP, catches corresponding to F higher than F_{MSY} can only be taken under conditions specified in the MAP.

The EC has requested ICES to identify if intra-specific density dependence is known to occur for Gulf of Riga herring based on existing, updated scientific evidence (EC, 2018). In the short term this stock is not expected to increase to biomasses outside the range estimated by the assessment in recent years. Mean weights in the stock have also been stable in recent years suggesting little evidence for declining growth due to intra-species interactions. The stock has been declining in recent years and the direct and indirect effects on other stocks are within the range of what would have occurred in previous years without observing significant detrimental inter-species effects. Therefore ICES does not consider that the evidence is sufficient to justify an application of the upper F_{MSY} range based on the condition; "to avoid serious harm to a stock caused by intra- or inter-species stock dynamics", set out in the MAP.

A mixture of central Baltic herring (subdivisions 25–27, 28.2, 29, and 32) and the Gulf of Riga (Subdivision 28.1) herring is caught in subdivisions 28.1 and 28.2. The assessment and the advice takes account of all of the Gulf of Riga herring stock, both that caught in and that caught outside of the Gulf of Riga. The TAC is set for herring caught in the Gulf of Riga, which also includes a certain amount of central Baltic herring caught in the Gulf of Riga, but does not include Gulf of Riga herring taken outside of the Gulf of Riga.

The TAC proposed for the Gulf of Riga area is based on the advised catch for the Gulf of Riga herring stock, plus the assumed catch of herring from the central Baltic stock taken in the Gulf of Riga, minus the assumed catch of the Gulf of Riga herring taken outside the Gulf of Riga. The values of the two latter are given by the average over the last five years.

1. Central Baltic herring assumed to be taken in the Gulf of Riga in 2019 (Subdivision 28.1) is 4 363 tonnes (average 2013–2017);
2. Gulf of Riga herring assumed to be taken in Subdivision 28.2 in 2018 is 251 tonnes (average 2013–2017).

As an example, following the ICES MSY approach (here identical to the MAP F_{MSY}), catches from the Gulf of Riga herring stock in 2019 should be no more than 26 932 tonnes. The corresponding TAC in the Gulf of Riga management area for 2019 would be calculated as 26 932 tonnes – 251 tonnes + 4 363 tonnes = 31 044 tonnes.

Reference points

Table 5 Herring in Subdivision 28.1. Reference points, values, and their technical basis. Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	60 000	From stock-recruitment relationship.	ICES (2009, 2015)
	F_{MSY}	0.32	Stochastic simulations with Beverton, Ricker, and segmented regression stock–recruitment curve from the full time-series (1977–2013)	ICES (2015)
Precautionary approach	B_{lim}	40 800	$B_{lim} = B_{loss}$	ICES (2015)
	B_{pa}	57 100	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$ with the default value $\sigma = 0.2$	ICES (2015)
	F_{lim}	0.88	F_{lim} derived from the curve of SSB/R against F	ICES (2015)
	F_{pa}	0.63	$F_{pa} = F_{lim} \times \exp(-\sigma \times 1.645)$ with the default value $\sigma = 0.2$	ICES (2015)
Management plan	MAP MSY $B_{trigger}$	60 000	MSY $B_{trigger}$	EU (2016 – Annex II column A)
	MAP B_{lim}	Not defined		EU (2016 – Annex II column B)
	MAP F_{MSY}	0.32	F_{MSY}	EU (2016 – Annex I columns A and B)
	MAP target range F_{lower} - F_{MSY}	0.24 – 0.32	Consistent with the ranges provided by ICES (2015), resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2015) and EU (2016 – Annex I column A)
	MAP target range F_{MSY} - F_{upper}	0.32 – 0.38	Consistent with the ranges provided by ICES (2015), resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2015) and EU (2016 – Annex I column B)

Basis of the assessment

Table 6 Herring in Subdivision 28.1. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016).
Assessment type	Age-based analytical assessment XSA (ICES, 2018) that uses catches in the model and in the forecast.
Input data	Commercial catches; one acoustic survey index (BIAS); one commercial cpue index (trapnets); fixed maturity ogive; natural mortality is assumed to be constant at 0.2 for all years except 1979–1983, when it was 0.25.
Discards and bycatch	Not included, considered negligible.
Indicators	None
Other information	The latest benchmark was performed in 2008 (ICES, 2008).
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

There is no additional information available.

History of the advice, catch, and management

Table 7 Herring in Subdivision 28.1. ICES advice, TACs and Gulf of Riga catches. All weights are in tonnes.

Year	ICES advice	Catch from stock corresp. to advice	Agreed TAC*	Catches of Gulf of Riga herring stock
1987	Reduce F towards $F_{0.1}$	8000	-	12884
1988	Reduce F towards $F_{0.1}$	6000	-	16791
1989	F should not exceed present level	20000	-	16783
1990	F should not exceed present level	20000	-	14931
1991	No separate advice for this stock	-	-	14791
1992	No separate advice for this stock	-	-	20000
1993	No separate advice for this stock	-	-	22200
1994	No separate advice for this stock	-	-	24300
1995	No separate advice for this stock	-	-	32656
1996	No separate advice for this stock	-	-	32584
1997	Current exploitation rate within safe biological limits	35000	-	39843
1998	Current exploitation rate within safe biological limits	35000	-	29443
1999	Current exploitation rate within safe biological limits	34000	-	31403
2000	Current exploitation rate within safe biological limits	37000	-	34069
2001	Current exploitation rate within safe biological limits	34100	-	38785
2002	Current exploitation rate within safe biological limits	33200	-	39701
2003	F below F_{pa}	< 41000	41000	40803
2004	$F = F_{sq}$	39000	39300	39115
2005	$F = F_{sq}$	35300	38000	32225
2006	$F = F_{pa}$	39900	40000	31232
2007	$F = F_{pa}$	33900	37500	33742
2008	$F < F_{pa}$	< 30100	36100	31137
2009	$F < F_{pa}$	< 31500	34900	32554
2010	$F < F_{pa}$	< 33400	36400	30174
2011	$F < F_{pa}$	< 33000	32700	29639
2012	MSY transition	< 25500	30600	28115
2013	MSY framework	< 23200	30600	26511
2014	MSY	< 25800	30700	26253
2015	MSY (F_{MSY} = 0.35)	< 34300	38800	32851
2016	MSY approach (F_{MSY} = 0.32)	≤ 26200	34900	30865
2017	MSY approach (F_{MSY} = 0.32)	≤ 23100	31100	28058
2018	MAP target F ranges: F_{lower} to F_{upper} (F = 0.24–0.38), but F higher than F_{MSY} = 0.32 only under conditions specified in the MAP	19396–29195, but catch higher than 24919 only under conditions specified in the MAP	28999	
2019	MAP target F ranges: F_{lower} to F_{upper} (F=0.24-0.38), but F higher than F_{MSY}=0.32 only under conditions specified in the MAP	20664–31237,but catch higher than 26932 only under conditions specified in the MAP		

* Total catch of herring in the Gulf of Riga area.

History of the catch and landings

Table 8 Herring in Subdivision 28.1. Catch distribution by fleet in 2017 as estimated by ICES.

Total herring catch in the Gulf of Riga management area (2017)	Total catch of stock (2017)	Landings		Discards
31 720 tonnes	28 058 tonnes	Trawls 72%	Trapnets 28%	Discarding is considered to be negligible
		28 058 tonnes		

Table 9 Herring in Subdivision 28.1. ICES estimates of total catches of herring in the Gulf of Riga by country. All weights are in tonnes.

Year	Estonia	Latvia	Unallocated landings	Total
1991	7410	13481	-	20891
1992	9742	14204	-	23946
1993	9537	13554	2209	25300
1994	9636	14050	3514	27200
1995	16008	17016	3332	36356
1996	11788	17362	3534	32684
1997	15819	21116	4308	41243
1998	11313	16125	3305	30743
1999	10245	20511	3077	33803
2000	12514	21624	2631	36769
2001	14311	22775	3399	40485
2002	16962	22441	3398	42801
2003	19647	21780	3276	44703
2004	18218	20903	3094	42215
2005	11213	19741	3071	34025
2006	11924	19186	2922	34032
2007	12764	19425	2953	35142
2008	15877	19290	1970	37137
2009	17167	18323	1864	37354
2010	15422	17751	1791	34974
2011	14721	20218	-	35039
2012	13789	17926	-	31715
2013	11898	18413	-	30311
2014	10541	20012	-	30553
2015	16509	21010	-	37519
2016	15814	19066	-	34880
2017	13772	17948	-	31720

Table 10 Herring in Subdivision 28.1. Total catches in the Gulf of Riga by stock and total catches of the Gulf of Riga herring stock by area (in tonnes).

Year	Catches in the Gulf of Riga			Gulf of Riga herring catches	
	Gulf of Riga herring	Central Baltic herring	Total	In the Central Baltic	Total
1977	24186	2400	26586	-	24186
1978	16728	6300	23028	-	16728
1979	17142	4700	21842	-	17142
1980	14998	5700	20698	-	14998
1981	16769	5900	22669	-	16769
1982	12777	4700	17477	-	12777
1983	15541	4800	20341	-	15541
1984	15843	3800	19643	-	15843
1985	15575	4600	20175	-	15575
1986	16927	1300	18227	-	16927
1987	12884	4800	17684	-	12884
1988	16791	3000	19791	-	16791
1989	16783	5900	22683	-	16783
1990	14931	6000	20931	-	14931

Year	Catches in the Gulf of Riga			Gulf of Riga herring catches	
	Gulf of Riga herring	Central Baltic herring	Total	In the Central Baltic	Total
1991	14791	6100	20891	-	14791
1992	18700	3500	23946	1300	20000
1993	21000	4300	25300	1200	22200
1994	22200	5000	27200	2100	24300
1995	30256	6100	36356	2400	32656
1996	28284	4400	32684	4300	32584
1997	36943	4300	41243	2900	39843
1998	26643	4100	30743	2800	29443
1999	29503	4300	33803	1900	31403
2000	32169	4600	36769	1900	34069
2001	37585	2900	40485	1200	38785
2002	39301	3500	42801	400	39701
2003	40403	4300	44703	400	40803
2004	38915	3300	42215	200	39115
2005	31725	2300	34025	500	32225
2006	30832	3200	34032	400	31232
2007	33642	1500	35142	100	33742
2008	31037	6100	37137	100	31137
2009	32454	4900	37354	100	32554
2010	29774	5200	34974	400	30174
2011	29539	5500	35039	100	29639
2012	27915	3800	31715	200	28115
2013	26211	4100	30311	300	26511
2014	26053	4500	30553	200	26253
2015	32551	4968	37519	316	32851
2016	30565	4315	34880	289	30865
2017	27824	3896	31720	234	28058

Summary of the assessment

Table 11 Herring in Subdivision 28.1. Assessment summary. Weights are in tonnes; recruitment in thousands.

Year	Recruitment (Age 1)	SSB*	Catch	F (ages 3-7)
1977	943220	54522	24186	0.69
1978	1076480	49356	16728	0.38
1979	976940	46738	17142	0.43
1980	1110334	46712	14998	0.35
1981	908414	47221	16769	0.45
1982	1688937	42757	12777	0.42
1983	1253616	50857	15541	0.47
1984	2027027	39913	15843	0.71
1985	1387559	51933	15575	0.54
1986	1119991	64272	16927	0.51
1987	3926396	51509	12884	0.42
1988	560628	96656	16791	0.52
1989	1291088	63255	16783	0.36
1990	3640722	77267	14931	0.24
1991	3684542	87174	14791	0.25
1992	4310588	105988	20000	0.27
1993	3248769	120558	22200	0.23
1994	2775540	124663	24300	0.23
1995	3463500	116307	32656	0.34
1996	4653443	105376	32584	0.37
1997	1582739	103082	39843	0.49
1998	2768097	81498	29443	0.44
1999	2889559	83560	31403	0.42

2000	2640118	83312	34069	0.46
2001	6076576	78901	38785	0.53
2002	2267766	100265	39701	0.47
2003	7016345	85886	40803	0.55
2004	1018996	91893	39115	0.58
2005	3155239	73152	32225	0.51
2006	6916760	70683	31232	0.44
2007	2001097	90923	33742	0.56
2008	5430831	89557	31137	0.33
2009	2790077	105530	32554	0.39
2010	2817743	99486	30174	0.31
2011	1138748	100694	29639	0.35
2012	5265180	86633	28115	0.32
2013	5585865	107259	26511	0.25
2014	956525	128714	26253	0.26
2015	2222806	112536	32851	0.35
2016	3466410	96144	30865	0.35
2017	2350759	96906	28058	0.32
2018	3057839**	90051***		
Average	2796757	83326	25876	0.41

* At spawning time.

** Geometric mean of year classes of 1989–2015.

*** Predicted.

Sources and references

EU. 2016. Regulation (EU) 2016/1139 of the European Parliament and of the council of 6 July 2016 establishing a multiannual plan for the stocks of cod, herring and sprat in the Baltic Sea and the fisheries exploiting those stocks, amending Council Regulation (EC) No 2187/2005 and repealing Council Regulation (EC) No 1098/2007. Official Journal of the European Union, L 191/1. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1139&rid=1.

ICES. 2008. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 8–17 April 2008, ICES Headquarters, Copenhagen, Denmark. ICES CM 2008\ACOM:06. 692 pp.

ICES. 2009. Workshop on Multiannual Management of Pelagic Stocks in the Baltic, 23–27 February 2009, ICES Headquarters, Copenhagen. ICES CM 2009/ACOM:38. 126 pp.

ICES. 2015. EU request to ICES to provide F_{MSY} ranges for selected North Sea and Baltic Sea stocks. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 6, Section 6.2.3.1.http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2015/Special_Requests/EU_FMSY_ranges_for_selected_NS_and_BS_stocks.pdf.

ICES. 2016. Advice basis. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2018. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 6–13 April 2018, ICES Headquarters, Copenhagen, Denmark. ICES CM 2018/ACOM:11.