

## Blue ling (*Molva dypterygia*) in subareas 6–7 and Division 5.b (Celtic Seas and Faroes grounds)

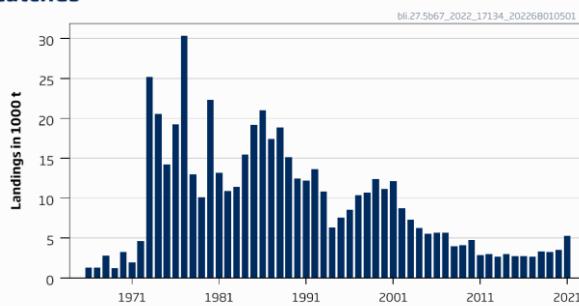
### ICES stock advice

ICES advises that when the MSY approach is applied, catches should be no more than 10 952 tonnes in 2023 and no more than 10 972 tonnes in 2024.

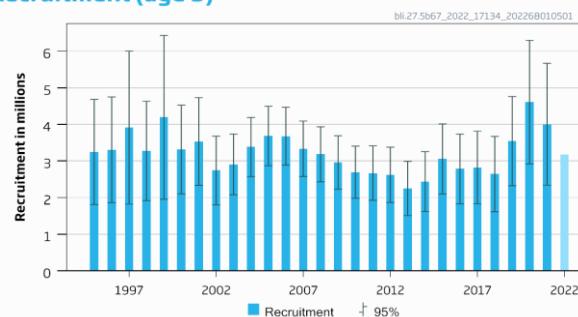
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and spawning-stock size is above MSY  $B_{trigger}$ .

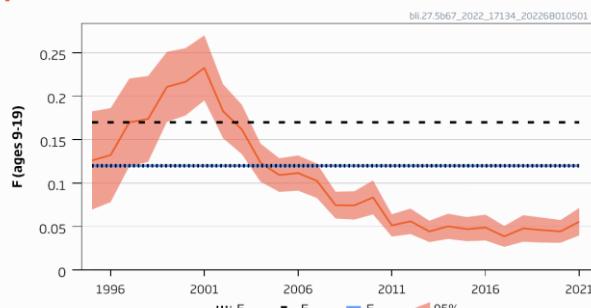
#### Catches



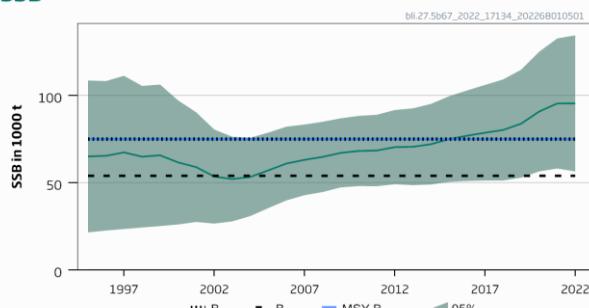
#### Recruitment (age 9)



#### F



#### SSB



**Figure 1** Blue ling in subareas 6–7 and Division 5.b. Summary of the stock assessment (weights in thousand tonnes and recruitment in millions). The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Blue ling in subareas 6–7 and Division 5.b. Assumptions made for the interim year and in the first forecast year.

Variable	Value	Notes
$F_{ages\ 9-19}\ (2022)$	0.056	$F = F_{sq} = F_{2021}$
$F_{ages\ 9-19}\ (2023)$	0.056	$F_{sq}$ , applied to 2023 for forecasting 2024
$R_{age\ 9}\ (2022\ and\ 2023)$	3 168 000	Geometric mean of model estimates 1995–2021; in numbers
SSB (2023)	95 770	SSB when fishing at $F_{sq}$ in 2022; in tonnes
Total catch (2022)	5 224	Catches corresponding to $F_{sq}$ in tonnes
Discards (2023 and 2024)	0	Negligible discards in 2009–2021

**Table 2a** Blue ling in subareas 6–7 and Division 5.b. Annual catch scenarios for 2023. All weights are in tonnes.

Rationale	Catch (2023)	F (2023)	SSB (2024)	% SSB change*	% advice change^
ICES advice basis					
MSY approach ( $F = F_{MSY}$ )	10 952	0.12	90 298	-5.7	1
Other scenarios					
$F_{pa}$	10 952	0.12	90 298	-5.7	1
$F_{2021} = 0$	0	0	106 655	5.6	-100
$F_{2021} = F_{lim}$	15 161	0.17	86 136	-10.1	40
$SSB(2024) = B_{pa} = MSY B_{trigger}$	26 411	0.32	75 037	-21.6	144
$SSB(2024) = B_{lim}$	48 895	0.67	54 000	-43.6	351
$F_{2023} = F_{sq} = F_{2021}$	5 237	0.056	95 958	0.2	-52

\* SSB in 2024 (1 January) in relation to SSB in 2023.

^ Advice value for 2023 relative to the advice value for 2022 (10 831 t).

**Table 2b** Blue ling in subareas 6–7 and Division 5.b. Annual catch scenarios for 2024 with  $F_{2023} = F_{sq} = F_{2021}$ . All weights are in tonnes.

Rationale	Catch (2024)	F (2024)	SSB (2025)	% SSB change*	% advice change^
ICES advice basis					
MSY approach ( $F_{2024} = F_{MSY}$ )	10 972	0.12	90 530	-5.7	0.2
Other scenarios					
$F_{pa}$	10 972	0.12	90 530	-5.7	0.2
$F_{2024} = 0$	0	0	101 413	5.7	-100
$F_{2024} = F_{lim}$	15 189	0.17	86 357	-10	39
$SSB(2025) = B_{pa} = MSY B_{trigger}$	26 675	0.32	75 037	-22	144
$SSB(2025) = B_{lim}$	48 137	0.67	54 000	-44	340
$F_{2024} = F_{sq} = F_{2021}$	5 246	0.056	96 206	0.3	-52

\* SSB in 2025 (1 January) in relation to SSB in 2024 (95 958 tonnes assuming  $F_{sq}$  in 2023).

^ Advice value for 2024 relative to advice value for 2023 (10 952 t).

The advice for 2023 and 2024 is similar to the advice for 2021 and 2022.

### Basis of the advice

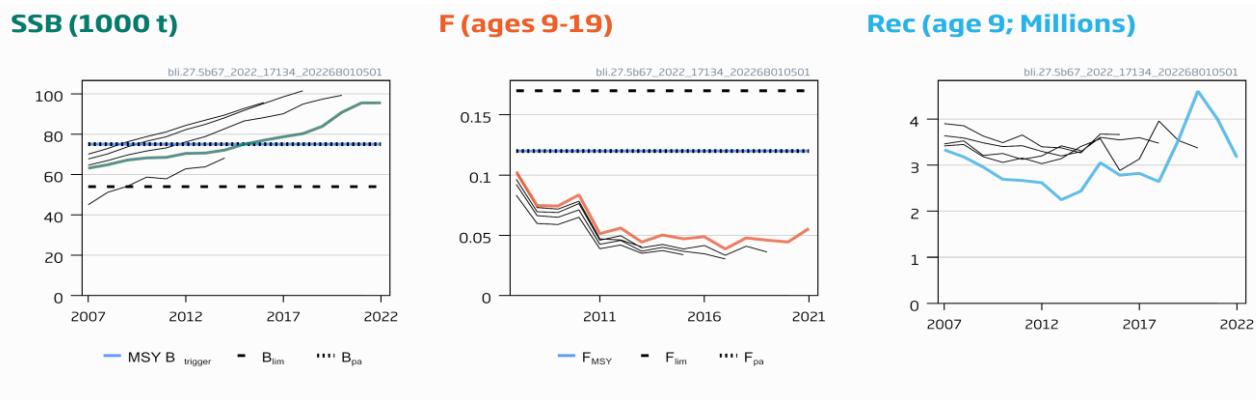
**Table 3** Blue ling in subareas 6–7 and Division 5.b. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for blue ling in this area

### Quality of the assessment

Estimated fishing mortality and biomass are more uncertain compared to previous assessments because of less sampling in recent years. If high longline landings continue, they should be sampled to avoid bias.

There has been a tendency of the assessment to overestimate SSB and underestimate fishing mortality.



**Figure 2** Blue ling in subareas 6–7 and Division 5.b. Historical assessment results.

### Issues relevant for the advice

In EU waters, catches lower than the TACs in 2015–2021 are considered to reflect a low level of fishing activity. Protection of spawning areas restricts catch opportunities at times when blue ling has a higher catchability. Higher catches in 2021 likely resulted from increased recruitment and increased activities of longline fisheries, which landed about three times as much blue ling as in 2020 (Table 7). This stock is classified as Category 4 in the NEAFC categorization of deep-sea species/stocks (NEAFC, 2016), which implies that fisheries are primarily restricted to coastal state exclusive economic zones (EEZs). Therefore, management measures are not taken by NEAFC unless complementary to coastal state conservation and management measures.

### Reference points

**Table 4** Blue ling in subareas 6–7 and Division 5.b. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	F <sub>MSY</sub>	0.12	F <sub>MSY</sub> and F intervals estimated without the advice rule (AR)	ICES (2014)
	MSY B <sub>trigger</sub>	75 037 t	Set equal to B <sub>pa</sub>	
Precautionary approach	B <sub>lim</sub>	54 000 t	Set as B <sub>loss</sub>	ICES (2014)
	B <sub>pa</sub>	75 037 t	B <sub>lim</sub> × e <sup>1.645σ</sup> , σ = 0.20	
	F <sub>lim</sub>	0.17	Based on simulated SSB to B <sub>lim</sub>	
	F <sub>pa</sub>	0.12	F <sub>lim</sub> × exp(-1.645 × σ); σ = 0.2	
Management plan	SSB <sub>mgt</sub>	Not defined		
	F <sub>mgt</sub>	Not defined		

### Basis of the assessment

**Table 5** Blue ling in subareas 6–7 and Division 5.b. The basis of the assessment.

ICES stock data category	1 (ICES, 2022a).
Assessment type	Multi-Year Catch Curves (MYCC), a model fitted to age composition and total catch in order to estimate annual total mortality ([Z] ICES, 2022b)
Input data	International landings 1995–2021; age-at-length from French sampling (2009–2021)
Discards and bycatch	Not included; discarding is considered negligible
Indicators	None
Other information	Last benchmarked in 2014 (ICES, 2014)
Working group	Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP)

## History of the advice, catch, and management

**Table 6** Blue ling in subareas 6–7 and Division 5.b. History of TACs and quotas, and ICES advice and landings. Weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	EU quota in 5.b (Faroese waters)*	EU TAC in subareas 6 and 7**	Faroese quota in subareas 6 and 7	Norwegian quota in 2.a, 4, 5.b, 6, and 7	ICES landings in 5.b, 6, and 7
2003	No direct fisheries^	-	3240	3678	940	-	7275
2004	Biennial^	-	3240	3678	900	-	6222
2005	No direct fisheries^	-	3240	3137	900	200	5481
2006	Biennial^	-	3065	3137	400	200	5650
2007	No direct fisheries	-	3065	2510	200	160	5648
2008	Biennial	-	3065	2009	200	150	3940
2009	No direct fisheries	-	3065	2009	150	150	4121
2010	Biennial	-	2700	1732	150	150	4759
2011	No direct fishery and effort to limit bycatch. A reduction in catches should be considered.	-	0	1717	0	150	2861
2012	No new advice, same as 2011		0	1882	0	150	3016
2013	Average catch 2008 to 2011	3900	0	2540	0	150	2675
2014	No new advice, same as 2013	3900	1500	2540	***	***	2963
2015	MSY approach	< 5046	1500	5046	***	***	2748
2016	No new advice, same as 2015	< 5046	2100	5046	***	***	2734
2017	MSY approach	≤ 11314	2000	11314	***	***	2673
2018	MSY approach	≤ 10763	2000	10763	***	***	3310
2019	MSY approach	≤ 11778	1885	11778	***	***	3268
2020	MSY approach	≤ 11150	1885	11150	***	***	3478
2021	MSY approach	≤ 11470	0	11522	***	***	5285
2022	MSY approach	≤ 10831	0	10859	***	***	
2023	MSY approach	≤ 10952					
2024	MSY approach	≤ 10362					

\* Quota of ling and blue ling combined.

\*\* From 2011, TAC in EU waters and international waters of Division 5.b and subareas 6 and 7.

\*\*\* Included in EU TAC.

^ Advice for blue ling in the Northeast Atlantic (not split by different assessment units).

## History of catch and landings

**Table 7** Blue ling in subareas 6–7 and Division 5.b. Official catch distribution by fleet in 2021.

Total catch (2021)	Landings		Discards
	20% longline	80% bottom trawl	
5285 t		5285 t	Negligible

**Table 8** Blue ling in subareas 6–7 and Division 5.b. History of commercial catch as estimated by ICES.  
All weights are in tonnes.

Year	Faroe Islands	France	Germany	Norway	UK (E & W)	UK (Scot)	Ireland	Russia	Lithuania	Poland	Iceland	Estonia	Spain	Total	
1966	0	839	0	450	0	0	0	0	0					1289	
1967	0	0	1043	273	0	0	0	0	0					1316	
1968	0	0	1838	949	0	0	0	0	0					2787	
1969	0	0	309	910	0	0	0	0	0					1219	
1970	0	0	348	2894	0	0	0	0	0					3242	
1971	0	0	1367	572	0	0	0	0	0					1939	
1972	0	696	2730	1217	0	0	0	0	0					4643	
1973	51	18080	3009	4028	4	0	0	0	0					25172	
1974	76	15390	3026	1916	167	0	0	0	0					20575	
1975	19	7147	4469	2549	9	0	0	0	0	0	0	0		14193	
1976	61	15937	1714	1535	1	0	0	0	0	0	0	0		19248	
1977	29	14953	1340	967	560	0	0	12500	0	0	0	0		30349	
1978	433	8922	3242	347	56	0	0	0	0	0	0	0		13000	
1979	1090	6399	1871	448	279	0	0	0	0	0	0	0		10087	
1980	1223	8378	12204	481	0	1	0	0	0	0	0	0		22287	
1981	1529	4243	7146	276	0	1	0	0	0	0	0	0		13195	
1982	2889	4536	3171	216	99	1	0	0	0	0	0	0		10912	
1983	4396	6144	271	606	13	2	0	0	0	0	0	0		11432	
1984	7343	7449	397	243	5	0	0	0	0	0	0	0		15437	
1985	4501	14126	253	323	2	0	0	0	0	0	0	0		19205	
1986	6756	13760	243	248	9	2	0	0	0	0	0	0		21018	
1987	3920	12645	553	298	4	10	0	0	0	0	0	0		17430	
1988	8289	10201	89	237	11	15	0	0	0	0	0	0		18842	
1989	4388	9952	75	685	0	16	0	0	0	0	0	0		15116	
1990	1374	10113	115	822	0	3	0	0	0	0	0	0		12427	
1991	1763	9871	60	412	7	72	0	0	0	0	0	0		12185	
1992	3858	8895	27	828	6	45	0	0	0	0	0	0		13659	
1993	2321	7631	181	319	114	220	3	0	0	0	0	0		10789	
1994	1309	3897	131	313	13	143	74	0	0	0	0	0	437	6317	
1995	1769	4121	191	182	92	796	14	0	0	0	0	0	405	7570	
1996	1142	4693	99	202	103	1590	0	0	0	0	0	0	702	8531	
1997	1145	6219	8	150	1035	1609	10	0	0	0	0	1	0	190	10367
1998	1166	6867	6	88	485	1762	22	0	0	0	0	122	0	164	10682
1999	1949	5567	6	152	345	3558	41	0	0	0	0	610		178	12406
2000	1677	5724	97	491	588	2320	89	1	0	0			0	173	11160
2001	1643	3601	13	577	493	4019	819	0	16	0		85	861	12127	
2002	1082	3140	4	629	242	2719	579	3	28	0	0	0	327	8753	
2003	2472	3680	1	304	26	677	30	2	29	4	0	5	45	7275	
2004	1475	3933	1	52	15	647	20	18	38	1	0	3	19	6222	
2005	1655	3072	0	122	11	538	13	15	1	0	0	0	113	5540	
2006	1939	2976	0	106	10	478	5	16	2	0	0	0	118	5650	
2007	1880	3213	0	253	17	160	2	37	1	0	0	0	85	5648	
2008	975	2501	0	110	2	212	0	122	2	0	0	0	16	3940	
2009	978	2547	0	83	0	346	0	1	0	0	0	0	166	4121	
2010	1539	2453	0	160	0	360	0	0	0	0	0	0	247	4759	

Year	Faroe Islands	France	Germany	Norway	UK (E & W)	UK (Scot)	Ireland	Russia	Lithuania	Poland	Iceland	Estonia	Spain	Total
2011	1167	1480	0	104	0	74	0	0	0	0	0	0	36	2861
2012	1015	1609	0	102	0	47	0	5	0	0	0	0	238	3016
2013	575	1715	0	132	0	205	0	3	0	0	0	0	45	2675
2014	880	1741	0	53	3	285	0	0	0	0	0	0	1	2963
2015	703	1119	0	366	11	372	0	0	0	0	0	0	177	2748
2016	1113	1086	0	111	0	281	1	0	0	0	0	0	142	2734
2017	854	1044	1	60	1	644	0	0	0	0	0	0	65	2673
2018	969	1290	0	237	0	736	0	0	0	0	0	0	78	3310
2019	638	1624	0	155	0	719	0	0	0	0	0	0	132	3268
2020	799	1569	0	121	0	715	0	0	0	0	0	0	274	3478
2021	848	1955	0	300	0	1807	0	0	0	0	0	0	375	5285

**Table 9** Blue ling in subareas 6–7 and Division 5.b. Landings inside and outside the NEAFC Regulatory Area (RA) as estimated by ICES as well as official landings. Weights are in tonnes.

Year	Inside the NEAFC RA		Outside the NEAFC RA		Total landings		Proportion inside the NEAFC RA (%)	
	1	2962	2963	0.03				
2014	1	2962	2963	0.03				
2015	33	2715	2748	1.20				
2016	18	2716	2734	0.66				
2017	20	2653	2673	0.75				
2018	6	3304	3310	0.18				
2019	5	3263	3268	0.15				
2020	0	3478	3478	0				
2021	0	5285	5285	0				

### Summary of the assessment

**Table 10** Blue ling in subareas 6–7 and Division 5.b. Assessment summary. Weights are in tonnes, recruitment in thousands. ‘High’ and ‘Low’ indicate 95% confidence intervals.

Year	Recruitment			Stock size: SSB			Landings	Fishing pressure: F		
	Age 9	High	Low	SSB	High	Low		Ages 9–18	High	Low
		thousands	tonnes		tonnes	tonnes				
1995	3247	4683	1811	65099	108649	21549	7570	0.126	0.183	0.069
1996	3305	4749	1861	65466	108320	22613	8531	0.132	0.19	0.078
1997	3914	6003	1824	67431	111369	23492	10367	0.170	0.22	0.120
1998	3276	4635	1918	64960	105565	24355	10682	0.174	0.22	0.124
1999	4192	6430	1953	65763	106341	25185	12406	0.21	0.25	0.170
2000	3314	4525	2103	61685	97264	26107	11160	0.22	0.26	0.178
2001	3533	4731	2336	58983	90439	27527	12127	0.23	0.27	0.20
2002	2742	3680	1803	53590	80573	26608	8753	0.183	0.21	0.152
2003	2908	3738	2078	52134	76398	27869	7275	0.162	0.190	0.133
2004	3381	4189	2574	53377	75819	30935	6222	0.124	0.146	0.101
2005	3683	4493	2873	57156	78817	35494	5540	0.109	0.129	0.090
2006	3677	4468	2887	61041	82187	39895	5650	0.112	0.132	0.091
2007	3334	4090	2578	63150	83416	42883	5648	0.103	0.123	0.083
2008	3182	3932	2431	64838	85000	44677	3940	0.075	0.090	0.059
2009	2961	3690	2231	67147	86972	47321	4121	0.074	0.091	0.058
2010	2694	3405	1983	68237	88378	48097	4759	0.084	0.103	0.064
2011	2669	3413	1925	68501	88996	48006	2861	0.051	0.064	0.038
2012	2621	3377	1865	70444	91737	49151	3016	0.056	0.071	0.041
2013	2251	2990	1512	70649	92693	48605	2675	0.044	0.057	0.032
2014	2438	3256	1619	72117	95232	49002	2963	0.050	0.065	0.036
2015	3056	4013	2099	75028	99593	50462	2748	0.047	0.061	0.033
2016	2783	3735	1831	76983	102957	51009	2734	0.049	0.064	0.034
2017	2824	3816	1831	78684	106120	51249	2673	0.039	0.051	0.027
2018	2644	3673	1614	80265	109248	51283	3310	0.048	0.063	0.033

Year	Recruitment			Stock size: SSB			Landings	Fishing pressure: F		
	Age 9	High	Low	SSB	High	Low		Ages	High	Low
2019	3543	4762	2325	83902	114871	52933	3268	0.046	0.060	0.032
2020	4609	6296	2922	90852	125170	56533	3478	0.044	0.058	0.031
2021	4004	5668	2340	95478	132781	58174	5285	0.056	0.072	0.040
2022	3168*			95515	134560	56470				

\*Geometric mean from 1995 to 2021.

## Sources and references

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[Download the stock assessment data and figures.](#)

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## Sea bass (*Dicentrarchus labrax*) in divisions 4.b–c, 7.a, and 7.d–h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea)

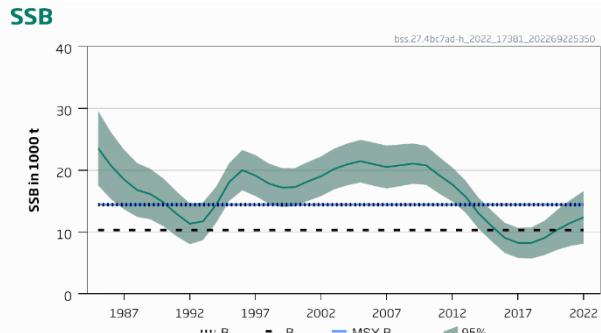
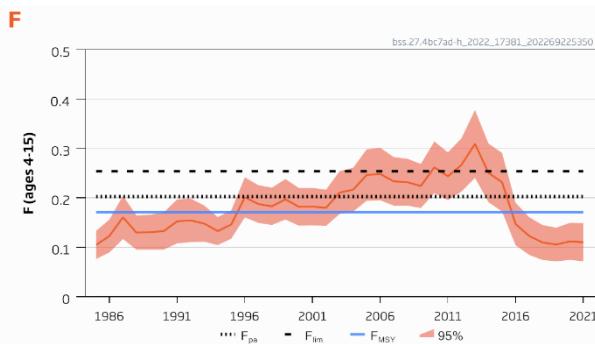
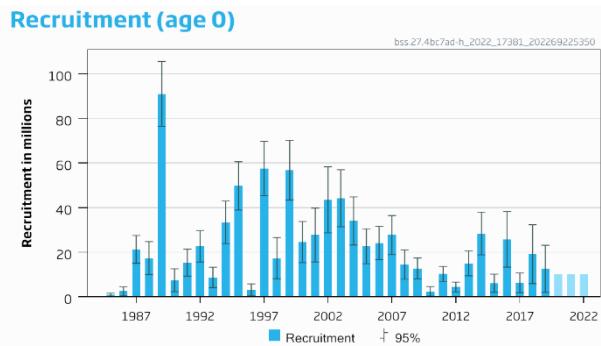
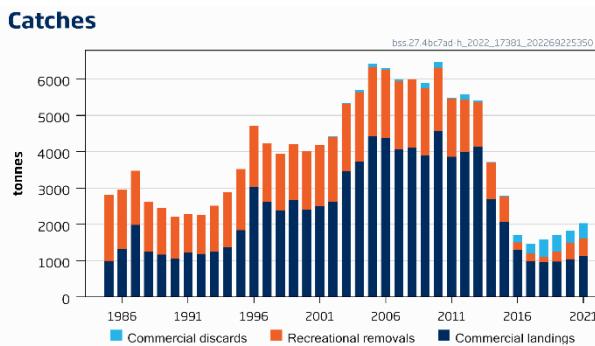
### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, total removals<sup>†</sup> in 2023 should be no more than 2542 tonnes.

ICES notes the existence of a precautionary management plan, developed and adopted by one of the relevant management authorities for this stock.

### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ , and spawning-stock size is below MSY  $B_{trigger}$  and between  $B_{pa}$  and  $B_{lim}$ .



**Figure 1**

Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Summary of the stock assessment. Recreational removals are model estimates based on a survey in 2012 and implemented management measures. Discard estimates are available since 2002. Fishing mortality ( $F$ ) is shown for the combined commercial and recreational fisheries. The assumed recruitment values for 2020–2022 are shaded in a lighter colour.

<sup>†</sup>Total removals include both commercial and recreational catches, taking mortality of released fish into account (estimated at approximately 5%).

## Catch scenarios

**Table 1** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{\text{ages } 4-15} \text{ (2022)}$	0.113	Total $F$ , $F_{\text{sq}} = F_{\text{average (2019-2021)}} (0.081)$ for commercial fishery, plus $F_{\text{rec}} = 0.031^*$ , assuming full compliance of recreational fisheries in 2022
SSB (2023)	12899	Short-term forecast; in tonnes
$R_{\text{age } 0} \text{ (2020-2023)}$	10105	Geometric mean (2010–2019); in thousands
Total removals (2022)	1870	Short-term forecast fishing at $F = 0.113$ ; in tonnes
Total landings (2022)	1211**	Short-term forecast; in tonnes
Discards (2022)	148**	Short-term forecast; in tonnes
Recreational removals (2022)	511	Short-term forecast assuming an $F = 0.031$ ; in tonnes

\* Recreational  $F$  as estimated in 2012 (0.068, reduced [by 54%]) to account for management measures since 2012.

\*\* The split of total commercial  $F$  into commercial landings and commercial discards in the interim year is estimated by the model.

**Table 2** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Annual catch scenarios for 2023. All weights are in tonnes.

Basis	Total removals* (2023)	$F_{\text{total}}$ (2023)	SSB (2024)	% SSB change**	% advice change ***
ICES advice basis					
MSY approach: $F = F_{\text{MSY}} \times \text{SSB}_{2023}/\text{MSY } B_{\text{trigger}}$	2542	0.153	12631	-2.1	14.7
Other scenarios					
EU MAP <sup>^</sup> : $F_{\text{MSY}} \times \text{SSB}_{2023}/\text{MSY } B_{\text{trigger}}$	2542	0.153	12631	-2.1	14.7
EU MAP <sup>^</sup> : $F_{\text{MSY upper}} \times \text{SSB}_{2023}/\text{MSY } B_{\text{trigger}}$	2542	0.153	12631	-2.1	14.7
EU MAP <sup>^</sup> : $F_{\text{MSY lower}} \times \text{SSB}_{2023}/\text{MSY } B_{\text{trigger}}$	2133	0.127	12964	0.50	-3.7
$F = F_{\text{MSY}}$	2821	0.171	12405	-3.8	27
$F = 0$	0	0	14716	14.1	-100
$F_{\text{pa}}$	3294	0.20	12021	-6.8	49
$F_{\text{lim}}$	4096	0.25	11430	-11.4	85
$\text{SSB}_{2024} = B_{\text{lim}}$	5422	0.36	10313	-20	145
$\text{SSB}_{2024} = B_{\text{pa}}$	336	0.0190	14439	11.9	-85
$\text{SSB}_{2024} = \text{MSY } B_{\text{trigger}}$	336	0.0190	14439	11.9	-85
$F = F_{2022}$	1906	0.113	13149	1.94	-14.0
$\text{SSB}_{2024} = \text{SSB}_{2023}$	2213	0.132	12899	0.00	-0.135

\* Includes commercial catch and recreational removals (taking mortality of released fish into account, estimated at approximately 5%).

\*\* SSB 2024 relative to SSB 2023.

\*\*\* Advice value for 2023 relative to the MSY value for 2022 (2216 tonnes).

<sup>^</sup> MAP multiannual plan (EU, 2019).

The increase in advice for 2023 is due to an increase in stock size, with the larger spawning-stock biomass also allowing a higher target fishing mortality.

## Basis of the advice

**Table 3** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is aware of the multiannual management plan (MAP) which has been adopted by the EU for this stock (EU, 2019) and which ICES considers to be precautionary. There is no agreed shared management plan with UK for this stock, and ICES provides advice according to ICES MSY approach. Catch scenarios consistent with the MAP $F_{\text{MSY}}$ ranges are provided.

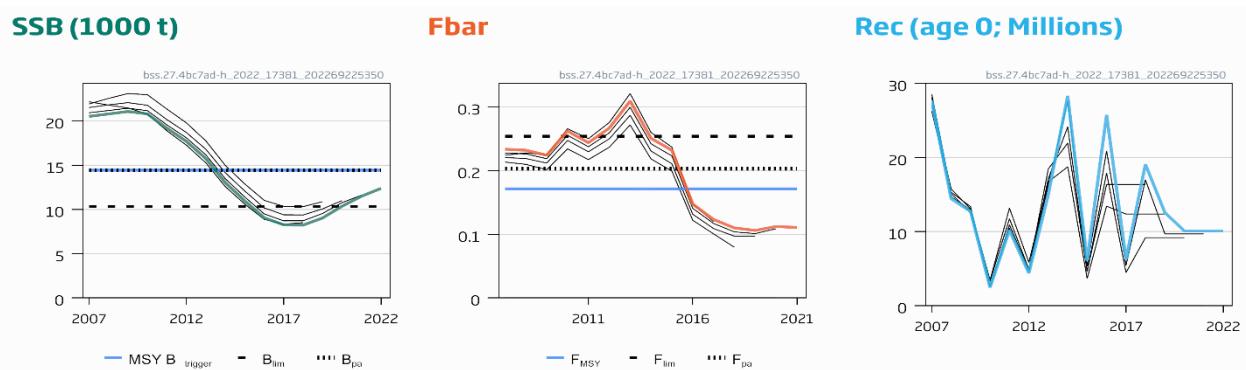
## Quality of the assessment

Limited sampling of the discards and recreational removals, leads to uncertainty in catch data and increases the uncertainty in the assessment. The discard values are estimated from sampling programmes and more recently from a combination of sampling programmes and logbooks, where sampling is variable across fleets and years. Estimates of discards are available only from the early 2000s, but do not cover all fisheries, are imprecise, and are only included for some fleets in the assessment. For the forecast, the discard ratio assumed is the estimate provided by the assessment model. However, this assumed rate is much lower than the recently observed discards.

The estimate of 1440 tonnes of recreational removals (including post-release mortality, estimated 5%) in 2012 is based on multiple surveys covering a range of years. As in previous years, the mortality rate from recreational removals for 1985–2014 (excluding 2012) was assumed to be the same as estimated for 2012. In the assessment, the mortality rate from recreational removals for 2015–2021 was derived by scaling down the F from 2012 to account for the management measures in these years, assuming full compliance.

Fishery sampling rates have been variable over time for all countries. Additional information on recreational removals from all countries is needed in order to improve these estimates and the stock assessment model.

Stock identity is still under investigation.



**Figure 2** Sea bass in divisions 4.b-c, 7.a, and 7.d-h. Historical assessment results (final-year SSB estimates and final three years of recruitment assumptions are included).

### Issues relevant to the advice

Following the prohibition of the directed sea bass fishery in 2015, discarding has increased. Sea bass is still being caught as bycatch.

ICES notes that under the ICES MSY approach scenario, the SSB in 2024 is expected to decrease slightly, remaining below MSY  $B_{trigger}$ .

ICES does not provide any split in the catch scenarios table this year as the recreational fishing pressure cannot be allocated in the absence of known management measures in 2023 (e.g. bag limit) and the limited data on recreational removals.

## Reference points

**Table 4** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	14439	$B_{pa}$ ; in tonnes	ICES (2019)
	$F_{MSY}$	0.1713	Stochastic simulations (EqSim)	ICES (2019)
Precautionary approach	$B_{lim}$	10313	$B_{loss}$ (lowest value in the time-series, SSB in 2018 as estimated by the WGCSE 2019 assessment); in tonnes	ICES (2019)
	$B_{pa}$	14439	$B_{lim} \times 1.4$ ; in tonnes	ICES (2019)
	$F_{lim}$	0.254	Stochastic simulations (EqSim)	ICES (2019)
	$F_{pa}$	0.203	$F_{P05}$ ; the F that leads to $SSB \geq B_{lim}$ with 95% probability	ICES (2019, 2021)
Management plan*	MAP MSY $B_{trigger}$	14439	MSY $B_{trigger}$ ; in tonnes	EU (2019)
	MAP $B_{lim}$	10313	$B_{lim}$ ; in tonnes	EU (2019)
	MAP $F_{MSY}$	0.1713	$F_{MSY}$	EU (2019)
	MAP range $F_{lower}$	0.142	Consistent with ranges provided by ICES (2019), resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2019) and EU (2019)
	MAP range $F_{upper}$	0.1713	Consistent with ranges provided by ICES (2019), resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2019) and EU (2019)

\* EU multiannual plan (MAP) for the Western Waters and adjacent waters (EU, 2019).

## Basis of the assessment

**Table 5** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Basis of the assessment and advice.

ICES stock data category	<a href="#">1 (ICES, 2022b)</a>
Assessment type	Age- and length-based analytical assessment (Stock Synthesis 3; NOAA Toolbox)
Input data	Commercial landings (international landings, ages and length frequencies from catch sampling); commercial discards (UK bottom otter trawl and nets and combined French fleet, length frequencies from catch sampling); one recruit survey (UK Solent autumn survey [G9863], 1986 to present, excluding 2010 and 2012); one bottom trawl survey (Channel Groundfish Survey [G3425], 1988–2014); one commercial tuning fleet (2001 to present); growth and maturity data from sampling of commercial catches and surveys; natural mortality (inferred from life-history parameters and maximum observed ages)
Discards and bycatch	Discards included in the model and forecast for some of the fleets
Recreational	Used in the model and in the forecast
Indicators	None
Other information	Benchmarked in 2018 (ICES, 2018)
Working group	Working Group for the Celtic Seas Ecoregion ( <a href="#">WGCSE</a> )

## History of the advice, catch, and management

**Table 6** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. History of ICES advice, and ICES estimates of landings, discards, and official landings. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice*	Official commercial landings	ICES commercial landings	ICES commercial discards^	ICES recreational removals
2000	-	-	2100	2407		
2001	-	-	2200	2500		
2002	No increase in effort or F	-	2400	2622	17	
2003	No increase in effort or F	-	2900	3459	16	
2004	No increase in effort or F	-	3000	3731	59	
2005	-	-	3200	4430	96	
2006	-	-	3396	4377	53	
2007	-	-	3521	4064	50	
2008	-	-	3027	4107	8	
2009	-	-	4288	3889	151	
2010	-	-	4952	4562	148	
2011	-	-	4183	3858	22	
2012	No increase in catch	-	3982	3987	157	1440
2013	20% reduction in catches (average of the last three years)	< 6000**	4243	4137	53	
2014	36% reduction in commercial landings (20% reduction, followed by 20% precautionary reduction)	< 2707**	2816	2682	25	
2015	MSY approach	< 115***	2081	2066	40	
2016	MSY approach	≤ 541***	1300	1295	199	
2017	Precautionary approach	0	1027	984	271	
2018	MSY approach	≤ 880^^^	931	948	482	
2019	MSY approach	≤ 1806^^^	970	972	464	
2020	Management plan	1634–1946^^^	1150^^	1042	325	
2021	Management plan	2000 (range 1680–2000) ^^^	1275^^	1126	412	
2022	MSY approach	≤ 2216^^^				
2023	MSY approach	≤ 2542^^^				

\* Advice prior to 2014 was provided for sea bass in the Northeast Atlantic.

\*\* Commercial landings.

\*\*\* Total landings (commercial and recreational landings).

^ Incomplete for some fleets 2002–2008.

^^ Preliminary.

^^^^ Includes commercial catch and recreational removals (taking mortality of released fish into account, estimated at approximately 5%).

## History of the catch and landings

**Table 7** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Catch distribution by fleet in 2021 as estimated by ICES.

Total catch	Commercial landings						Commercial discards	Recreational removals
	Lines 46%	Bottom trawlers 21%	Other gears 2.9%	Fixed/drift nets 24%	Danish seine 5.4%	Pelagic trawlers < 1%		
2027 tonnes	1126 tonnes						412 tonnes	489 tonnes

**Table 8** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. History of commercial landings by country and ICES estimates of landings.  
All weights are in tonnes.

Year	Belgium	Denmark	Germany	France	UK	Netherlands	Channel Is.	Total	Total ICES
1985	0	0	0	620	105	0	18	743	994
1986	0	0	0	841	124	0	15	980	1319
1987	0	0	0	1226	123	0	14	1363	1980
1988	0	18	0	714	173	8	12	925	1239
1989	0	2	0	675	192	2	48	919	1161
1990	0	0	0	609	189	0	25	824	1063
1991	0	0	0	726	239	0	16	982	1227
1992	0	0	0	721	148	0	36	906	1186
1993	0	1	0	718	230	0	45	994	1255
1994	0	1	0	593	535	0	49	1178	1371
1995	0	1	0	801	708	0	69	1579	1835
1996	0	1	0	1703	563	8	56	2331	3022
1997	0	1	0	1429	561	1	74	2066	2620
1998	0	2	0	1363	488	48	79	1980	2390
1999	0	1	0	na	685	32	108	826	2670
2000	0	5	0	1522	407	60	130	2124	2407
2001	0	2	0	1619	458	77	80	2236	2500
2002	0	1	0	1580	627	96	73	2377	2622
2003	154	1	0	1903	586	163	84	2891	3459
2004	159	1	0	1883	617	191	159	3010	3731
2005	206	1	0	1937	512	327	220	3203	4430
2006	211	2	0	2116	736	308	23	3396	4377
2007	178	1	0	2075	873	376	18	3521	4064
2008	187	0	0	1506	934	380	20	3027	4107
2009	174	0	0	2904	801	395	15	4288	3889
2010	216	4	0	3441	879	399	14	4952	4562
2011	152	2	0	2688	928	395	17	4183	3858
2012	154	3	0	2492	946	376	12	3982	3987
2013	146	4	2	2868	841	370	12	4243	4137
2014	148	1	1	1322	1080	253	11	2816	2682
2015	40	0	0	1113	701	218	9	2081	2066
2016	23	0	1	545	551	156	24	1300	1295
2017	22	0	0	423	438	132	12	1027	984
2018	18	0	0	297	432	172	11	931	948
2019	19	0	0	309	411	209	22	970	972
2020*	24	0	0	387	521	218	0	1150	1042
2021*	45	0	0	385	613	231	1	1275	1126

\* Preliminary official landings.

**Summary of the assessment**

**Table 9** Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Assessment summary. Weights are in tonnes and recruitment in thousands. ‘High’ and ‘Low’ refer to 95% confidence intervals.

Year	Recruitment age 0			SSB			Total $F_{\text{ages } 4-15}$			$F_{\bar{\text{bar}}}$ commercial catch	$F_{\bar{\text{bar}}}$ recreational removals	Commercial landings	Commercial discards*	Recreational removals**
	Low	Value	High	Low	Value	High	Low	Value	High					
1985	74	855	1635	17572	23629	29686	0.076	0.105	0.133	0.037	0.068	994		1820
1986	442	2490	4538	15315	20735	26155	0.09	0.123	0.157	0.056	0.068	1318		1638
1987	15045	21289	27534	13658	18496	23333	0.117	0.161	0.20	0.093	0.068	1979		1493
1988	9976	17384	24793	12431	16800	21168	0.095	0.130	0.165	0.062	0.068	1239		1384
1989	76439	90994	105549	12061	16146	20231	0.096	0.131	0.166	0.063	0.067	1161		1279
1990	2289	7431	12574	10912	14789	18665	0.095	0.133	0.17	0.066	0.068	1064		1150
1991	9230	15313	21397	9323	12945	16566	0.108	0.153	0.197	0.085	0.068	1226		1056
1992	15613	22686	29758	8027	11350	14673	0.111	0.155	0.199	0.087	0.068	1186		1080
1993	4094	8674	13254	8663	11735	14807	0.111	0.148	0.185	0.08	0.068	1256		1258
1994	23880	33431	42982	11432	14377	17322	0.105	0.133	0.161	0.066	0.067	1370		1508
1995	38898	49741	60583	15017	18087	21156	0.118	0.146	0.175	0.079	0.067	1835		1689
1996	455	3124	5793	16747	20021	23296	0.161	0.20	0.24	0.133	0.068	3022		1696
1997	45330	57526	69722	15828	19147	22467	0.150	0.188	0.23	0.120	0.068	2620		1605
1998	8068	17317	26565	14607	17868	21128	0.145	0.183	0.22	0.115	0.068	2390		1548
1999	43395	56771	70148	14047	17205	20362	0.156	0.197	0.24	0.129	0.068	2670		1548
2000	15298	24547	33797	14165	17255	20346	0.144	0.182	0.22	0.114	0.068	2407		1601
2001	15645	27708	39770	15049	18200	21351	0.145	0.182	0.22	0.114	0.068	2500		1685
2002	28707	43508	58309	15800	19024	22247	0.143	0.18	0.22	0.112	0.068	2622	17	1782
2003	31439	44224	57010	16902	20213	23524	0.168	0.21	0.25	0.143	0.068	3459	16	1863
2004	23245	34018	44791	17568	20953	24337	0.172	0.22	0.26	0.149	0.068	3731	59	1908
2005	14857	22668	30479	18014	21470	24925	0.194	0.25	0.30	0.178	0.068	4430	96	1905
2006	16681	24147	31614	17485	20993	24501	0.195	0.25	0.30	0.180	0.068	4377	53	1874
2007	18925	27697	36469	17050	20524	23998	0.185	0.23	0.28	0.165	0.068	4064	50	1871
2008	7871	14458	21046	17419	20797	24175	0.184	0.23	0.28	0.164	0.068	4107	8	1878
2009	8033	12729	17424	17793	21070	24347	0.180	0.22	0.27	0.156	0.068	3889	151.2	1852
2010	339	2456	4572	17643	20805	23967	0.21	0.26	0.31	0.194	0.068	4562	147.9	1751
2011	6762	10188	13613	16213	19192	22171	0.196	0.24	0.29	0.176	0.068	3858	22	1605

Year	Recruitment age 0			SSB			Total F <sub>ages 4–15</sub>			F <sub>bar</sub> commercial catch	F <sub>bar</sub> recreational removals	Commercial landings	Commercial discards*	Recreational removals**
	Low	Value	High	Low	Value	High	Low	Value	High					
2012	2163	4378	6593	14932	17702	20471	0.21	0.27	0.32	0.199	0.068	3987	156.6	1440
2013	9443	15034	20624	13144	15749	18355	0.24	0.31	0.38	0.24	0.068	4137	53.4	1222
2014	18802	28374	37947	10524	13040	15557	0.191	0.25	0.31	0.184	0.067	2682	24.7	1008
2015	2030	6095	10161	8483	10967	13451	0.172	0.23	0.29	0.177	0.055	2066	39.5	689
2016	13317	25790	38263	6603	9058	11514	0.104	0.147	0.191	0.128	0.019	1295	198.6	209
2017	1860	6281	10702	5810	8254	10699	0.085	0.123	0.161	0.104	0.0189	984	271.102	206
2018	5906	19116	32326	5706	8231	10756	0.074	0.11	0.145	0.097	0.0131	948	482.4	150
2019	2009	12589	23169	6251	9033	11816	0.072	0.106	0.140	0.085	0.021	972	463.9	274
2020		10105^		7130	10369	13609	0.075	0.112	0.150	0.081	0.032	1042	325	453
2021		10105^		7754	11491	15227	0.072	0.111	0.149	0.079	0.032	1126	411.8	489
2022		10105^		8128	12384	16640								

\* Incomplete for some fleets 2002–2008.

\*\* All values were derived from the 2012 survey estimate (1440 tonnes).

^ Geometric mean recruitment (2010–2019).

## Sources and references

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[Download the stock assessment data and figures.](#)

*Recommended citation:* ICES. 2022. Seabass (*Dicentrarchus labrax*) in Divisions 4.b-c, 7.a, and 7.d-h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, bss.27.4bc7ad-h. <https://doi.org/10.17895/ices.advice19447796>.

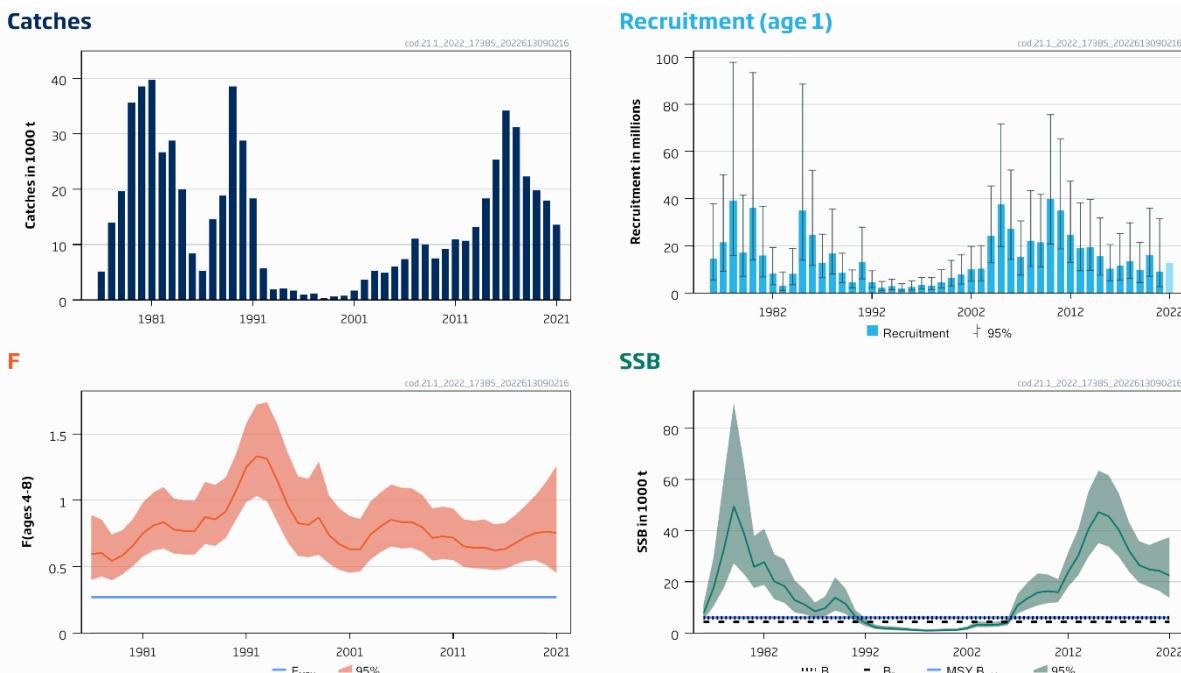
## Cod (*Gadus morhua*) in NAFO Subarea 1, inshore (West Greenland cod)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 4590 tonnes.

### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$ , and the spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Cod in NAFO Subarea 1, inshore. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Cod in NAFO Subarea 1, inshore. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 4-8}\ (2022)$	0.755	$F_{sq} = F_{2021}$
SSB (2023)	20388	Short-term forecast; tonnes
$R_{age\ 1}\ (2022)$	12732	Sample from the time-series 1976–2021*; thousands
Catch (2022)	11310	Based on $F_{ages\ 4-8}\ (2022) = 0.755$ ; tonnes

\* Recruitment is randomly resampled from the assessment estimates of 1976–2021.

**Table 2** Cod in NAFO Subarea 1, inshore. Annual catch scenarios. All weights are in tonnes.

Rationale	Catch (2023)	F (2023)	SSB (2024)	% SSB change*	% advice change**	% TAC change***
ICES advice basis						
MSY approach: $F_{MSY}$	4590	0.27	24549	+20	-4	-78
Other scenarios						
$F = 0$	0	0	30348	+49	-100	-100
$F = F_{2022}$	9913	0.755	18549	-9	+107	-53

\* SSB<sub>2024</sub> relative to SSB<sub>2023</sub>.

\*\* Advice value for 2023 relative to the advice value for 2022 (4780 tonnes).

\*\*\* Advice value for 2023 relative to TAC for 2022 (21 000 tonnes)

## Basis of the advice

**Table 3** Cod in NAFO Subarea 1, inshore. The basis of the advice.

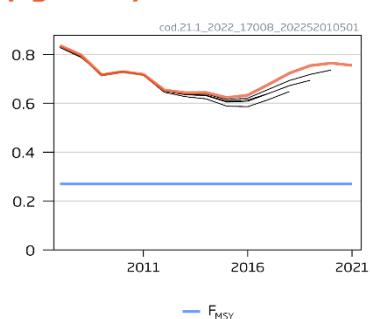
Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for cod in this area

## Quality of the assessment

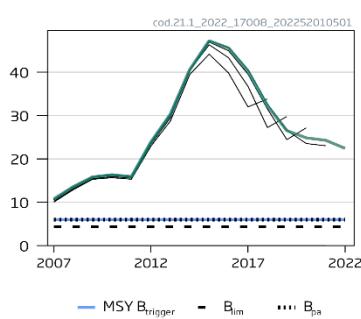
The assessment is considered uncertain because of known stock mixing that affects both surveys and commercial catches.

Genetics have shown that the reported landings include catches of other cod stocks in addition to the West Greenland inshore stock. This may cause a considerable overestimation of stock size of the inshore cod stock.

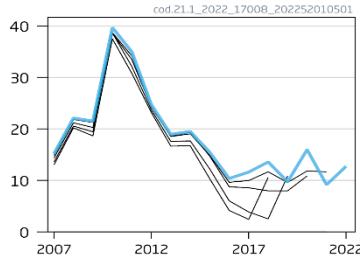
**F (ages 4-8)**



**SSB (1000 t)**



**Rec (age 1; Millions)**



**Figure 2** Cod in NAFO Subarea 1, inshore. Historical assessment results. Final-year recruitment assumption included for each line.

## Issues relevant for the advice

The TAC area covers NAFO Subarea 1 inshore. The current stock boundaries do not reflect the complexity of the different genetic components that are caught in the area (ICES, 2022a). This will be the core issue dealt with in the 2023 benchmark.

A considerable proportion of catches in the inshore area are considered to originate from the West Greenland offshore stock, which is in a depleted condition; current ICES advice for that stock is zero (ICES, 2021) catch, so the mixed catch will prolong the stock recovery time.

TACs have not been taken in the last four years, and based on information from the fishing industry it is unlikely that the TAC of 21 000 tonnes in 2022 will be taken. ICES assumes that fishing will continue at current effort levels in 2022, resulting in estimated catches equal to 11 310 tonnes in 2022. The agreed TAC has never followed the catch advice.

## Reference points

**Table 4** Cod in NAFO Subarea 1, inshore. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	5983 tonnes	Assumed at $B_{pa}$	ICES (2018)
	$F_{MSY}$	0.27	Stochastic simulations with segmented regression and a Beverton–Holt stock-recruitment curve from 1976 to 2017	ICES (2018)
Precautionary approach	$B_{lim}$	4346 tonnes	Breakpoint in segmented regression	ICES (2018)
	$B_{pa}$	5983 tonnes	$B_{lim} \times e^{1.645\sigma}, \sigma = 0.194$	ICES (2018)
	$F_{lim}$	-	Not defined	
	$F_{pa}$	-	Not defined	
Management plan	$SSB_{mgt}$	-	-	
	$F_{mgt}$	-	-	

## Basis of the assessment

**Table 5** Cod in NAFO Subarea 1, inshore. The basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022b</a> )
Assessment type	Age-based analytical assessment (SAM; ICES, 2022a) that uses catches in the model and in the forecast
Input data	Catch-at-age and age-disaggregated survey indices (WGRL-Gill [N6619] since 1987)
Discards and bycatch	Discarding is considered negligible
Indicators	None
Other information	Benchmarked in 2018 (ICES, 2018)
Working group	Northwestern Working Group ( <a href="#">NWWG</a> )

## History of the advice, catch, and management

**Table 6** Cod in NAFO Subarea 1, inshore. ICES advice, TACs, and catch. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
2012	-	-	15000	10672
2013	Mean catch in recent ten years	8000	13500	13202
2014	20% increase in catch (relative to three-year average)	< 12379	18500	18331
2015	Same basis as 2014	< 12379	27500	25272
2016	Same advice as in 2014	< 12379	35400	34204
2017	Precautionary approach (same advice value as for 2014–2016)	< 12379	36500	31220
2018	MSY approach	< 8858	36500	22290
2019	MSY approach	≤ 6806	27800	19753
2020	MSY approach	≤ 5537	29800	17926
2021	MSY approach	≤ 5283	21000	13580
2022	MSY approach	≤ 4780	21000	
2023	MSY approach	≤ 4590		

## History of the catch and landings

**Table 7** Cod in NAFO Subarea 1, inshore. Catch distribution by fleet in 2021 as estimated by ICES. All weights are in tonnes.

Catch (2021)	Catches				Discards
	Poundnet 62%	Longline 18%	Gillnet 7%	Jigs 13%	
13580	13580				Discarding is considered negligible

**Table 8** Historical catches of cod in NAFO Subarea 1, inshore. All weights are in tonnes.

Year	NAFO divisions						Total West Greenland	ICES Division 14.b
	1A	1B	1C	1D	1E	1F		
1911				19			19	
1912				5			5	
1913				66			66	
1914				60			60	
1915		47	6	45			98	
1916		66	24	103			193	
1917		67	28	59			154	
1918		106	26	140		169	441	
1919		39	37	140	148	137	501	
1920		117	32	187	23	95	454	
1921		116	92	97	7	196	508	
1922		82	178	144	40	158	602	
1923		120	116	147	-	307	690	
1924		131	223	221	1	267	843	
1925		122	371	318	45	168	1024	
1926		97	785	673	170	499	2224	
1927		282	974	982	305	1027	3570	
1928		426	888	1153	497	1199	4163	
1929		1479	1572	1335	642	2052	7080	
1930	137	2208	2326	1681	994	2312	9658	
1931	315	1905	2026	1520	835	2453	9054	
1932	358	1713	2130	1042	731	3258	9232	
1933	304	1799	1743	1148	948	2296	8238	
1934	451	2080	1473	652	921	3591	9168	
1935	524	1870	1277	769	670	2466	7576	
1936	329	2039	1199	705	717	2185	7174	
1937	135	1982	1433	854	496	2061	6961	
1938	258	1743	1406	703	347	1035	5492	
1939	416	2256	1732	896	431	1430	7161	
1940	482	2478	1600	1061	646	1759	8026	
1941	636	3229	1473	823	593	1868	8622	
1942	879	3831	2249	1332	1003	2733	12027	
1943	1507	5056	2016	1240	1134	2073	13026	
1944	1795	4322	2355	1547	1198	2168	13385	
1945	1585	4987	2844	1207	1474	2192	14289	
1946	1889	5210	2871	1438	1139	2715	15262	
1947	1573	5261	3323	2096	1658	4118	18029	
1948	1130	5660	3756	1657	1652	4820	18675	
1949	1403	4580	3666	2110	2151	3140	17050	
1950	1657	6358	4140	2357	2278	4383	21173	
1951	1277	5322	3324	2571	2101	3605	18200	
1952	646	4443	2906	2437	2216	4078	16726	
1953	1092	5030	3662	5513	3093	4261	22651	
1954	950	6164	3118	3275	1773	3418	18698	
1955	591	5523	3225	4061	2773	3614	19787	
1956	475	5373	3175	5127	3292	3586	21028	
1957	277	6146	3282	5257	4380	5251	24593	
1958	19	6178	3724	5456	3975	6450	25802	
1959	237	6404	5590	5009	3767	6570	27577	
1960	188	6741	6230	3614	3626	6610	27009	
1961	601	6569	6726	4178	6182	9709	33965	
1962	315	7809	6269	3824	5638	11525	35380	
1963	295	4877	3178	2804	3078	9037	23269	
1964	275	3311	2447	8766	2206	4981	21986	
1965	325	5209	4818	6046	2477	5447	24322	

Year	NAFO divisions							Total West Greenland	ICES Division 14.b
	1A	1B	1C	1D	1E	1F	Unknown NAFO division		
1966	483	8738	5669	7022	2335	4799		29046	
1967	310	5658	6248	6747	2429	6132		27524	
1968	142	1669	2738	6123	2837	7207		20716	
1969	57	1767	4287	7540	2017	5568		21236	
1970	136	1469	2219	3661	2424	5654		15563	
1971	255	1807	2011	3802	1698	3933		13506	
1972	263	1855	3328	3973	1533	3696		14648	
1973	158	1362	1225	3682	1614	1581		9622	
1974	454	926	1449	2588	1628	1593		8638	
1975	216	1038	1930	1269	964	1140		6557	
1976	204	644	1224	904	1367	831		5174	
1977	216	580	2505	2946	3521	4231		13999	
1978	348	1587	3244	2614	4642	7244		19679	
1979	433	1768	2201	6378	9609	15201		35590	
1980	719	2303	2269	7781	10647	14852		38571	
1981	281	2810	3599	6119	7711	11505	7678	39703	
1982	206	2448	3176	7186	4536	3621	5491	26664	
1983	148	2803	3640	7430	5016	2500	7205	28742	
1984	175	3908	1889	5414	1149	1333	6090	19958	
1985	149	2936	957	1976	1178	1245		8441	
1986	76	1038	255	1209	1456	1268		5302	
1987	77	2366	423	6407	3602	1326	403	14604	
1988	333	6294	1342	2992	3346	4484		18791	
1989	634	8491	5671	8212	10845	4676		38529	
1990	476	9857	1482	9826	1917	5241		28799	
1991	876	8641	917	2782	1089	4007		18312	
1992	695	2710	563	1070	239	450		5727	
1993	333	327	168	970	19	109		1926	
1994	209	332	589	914	11	62		2117	
1995	53	521	710	332	4	81		1701	
1996	41	211	471	164	11	46		944	
1997	18	446	198	99	13	130	282	1186	
1998	9	118	79	78	-	38		322	
1999	68	142	55	336	8	4		613	
2000	154	266	-	332	-	12		764	
2001	117	1183	245	54	-	81		1680	
2002	263	1803	505	214	24	813		3622	
2003	1109	1522	334	274	3	479	1494	5215	
2004	535	1316	242	116	47	84	2608	4948	
2005	650	2351	1137	1162	278	382	83	6043	
2006	922	1682	577	943	630	1461	1173	7388	
2007	416	2547	1195	1842	659	4391		11050	42
2008	870	3066	1539	3172	225	1133		10005	6
2009	325	1288	1189	2009	1142	1581		7534	2
2010	559	2990	1607	1795	1458	859		9268	2
2011	567	2364	2850	2905	1274	1047		11007	-
2012	546	1376	2061	4375	1989	325		10672	0
2013	1506	2552	2784	4711	1450	198		13202	35
2014	3084	6142	3710	4629	684	82		18331	38
2015	4088	7912	6426	6613	117	115		25272	50
2016	5929	11466	11270	5279	87	173		34204	39
2017	5797	11110	10060	4066	56	131		31220	82
2018	2213	6422	6190	7043	31	390		22290	51
2019	1987	2925	4214	8673	131	1823		19753	143
2020	1382	2324	4482	7412	222	2104		17926	223
2021	1133	2910	4144	4671	93	629		13580	286

## Summary of the assessment

**Table 9** Cod in NAFO Subarea 1, inshore. Assessment summary. ‘High’ and ‘Low’ correspond to 95% confidence intervals. Weights are in tonnes, recruitment in thousands.

Year	Recruitment			Spawning-stock biomass			Landings	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 4–8	High	Low
1976	14554	37795	5605	7491	11142	5037	5174	0.60	0.89	0.40
1977	21442	50154	9167	17605	29707	10433	13999	0.60	0.86	0.43
1978	39305	97839	15790	32425	60337	17425	19679	0.54	0.74	0.40
1979	17135	41473	7080	49521	90156	27201	35590	0.58	0.78	0.44
1980	36164	93486	13989	38972	66125	22969	38571	0.66	0.86	0.50
1981	15837	36757	6823	25823	37955	17570	39703	0.75	0.99	0.57
1982	8185	19321	3467	27684	40742	18811	26664	0.81	1.06	0.62
1983	3044	8897	1041	20119	30760	13159	28742	0.84	1.10	0.64
1984	8117	18873	3491	18362	28757	11725	19958	0.78	1.01	0.60
1985	35014	88575	13841	12861	20626	8019	8441	0.77	1.00	0.59
1986	24564	52016	11600	11068	16879	7258	5302	0.77	1.00	0.59
1987	12732	24922	6504	8480	11938	6024	14604	0.87	1.14	0.67
1988	16954	35540	8087	9646	14273	6518	18791	0.86	1.12	0.66
1989	8581	16846	4370	13803	21780	8747	38529	0.92	1.17	0.72
1990	4462	9743	2043	11483	17542	7517	28799	1.07	1.35	0.85
1991	12937	27932	5992	6373	9000	4513	18312	1.25	1.58	0.99
1992	4620	9434	2262	3855	5592	2657	5727	1.33	1.72	1.03
1993	2209	4879	1000	2176	3168	1494	1926	1.31	1.74	0.99
1994	2782	5745	1347	1794	2688	1198	2117	1.15	1.58	0.83
1995	1859	3855	896	1613	2534	1026	1701	0.96	1.36	0.68
1996	2488	5128	1208	1376	2111	897	944	0.83	1.18	0.58
1997	3304	6632	1646	1100	1694	714	1186	0.82	1.16	0.57
1998	3101	6594	1458	907	1538	535	322	0.87	1.29	0.59
1999	4477	9858	2034	967	1616	579	613	0.74	1.04	0.52
2000	6382	13804	2951	1102	1720	706	764	0.67	0.94	0.47
2001	7812	16169	3774	1192	1813	784	1680	0.63	0.88	0.45
2002	9932	19777	4988	1765	2565	1214	3622	0.63	0.86	0.46
2003	10254	20054	5243	3259	4660	2280	5215	0.74	0.99	0.55
2004	24124	45395	12820	3106	4284	2252	4948	0.80	1.06	0.61
2005	37563	71727	19672	3248	4452	2369	6043	0.85	1.12	0.65
2006	27236	52157	14222	3934	5256	2945	7388	0.84	1.10	0.64
2007	15189	30569	7547	10758	15288	7570	11050	0.84	1.09	0.64
2008	22106	43435	11251	13584	19808	9315	10005	0.80	1.04	0.61
2009	21517	41788	11079	15838	23308	10762	7534	0.72	0.94	0.55
2010	39687	75604	20833	16339	22824	11697	9268	0.73	0.95	0.56
2011	34967	65401	18695	15911	21075	12013	11007	0.72	0.94	0.55
2012	24730	47469	12883	23876	31612	18033	10672	0.65	0.86	0.50
2013	18950	38212	9398	30279	40599	22582	13202	0.64	0.85	0.49
2014	19494	39614	9593	40568	55312	29754	18331	0.64	0.86	0.48
2015	15474	31791	7532	47229	63509	35123	25272	0.62	0.82	0.47
2016	10375	20560	5236	45565	61618	33694	34204	0.63	0.83	0.48
2017	11606	25182	5349	40253	54578	29688	31220	0.68	0.89	0.52
2018	13572	29792	6183	32233	43314	23987	22288	0.72	0.96	0.54
2019	9732	21451	4415	26526	35904	19598	19753	0.75	1.04	0.55
2020	15978	36037	7084	24840	34427	17923	17926	0.76	1.14	0.51
2021	9146	31587	2648	24281	35993	16380	13580	0.76	1.26	0.45
2022*	12732			22418	37457	13677				

\* Recruitment is randomly resampled from the assessment estimates of 1976–2021.

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## Cod (*Gadus morhua*) in Division 6.a (West of Scotland)

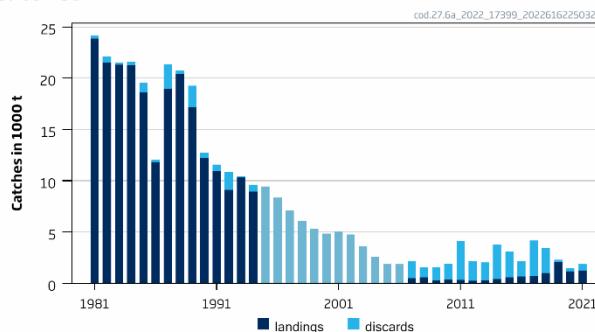
### ICES advice on fishing opportunities

ICES advises that when the MSY approach and precautionary considerations are applied, there should be zero catch in each of the years 2023 and 2024.

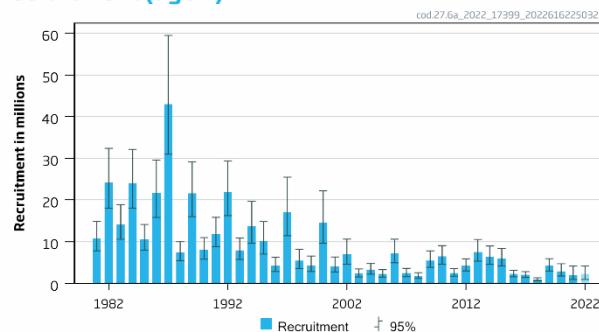
### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$ ,  $F_{pa}$  and  $F_{lim}$ ; spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

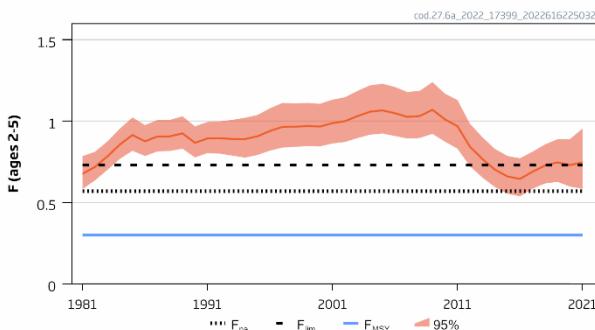
#### Catches



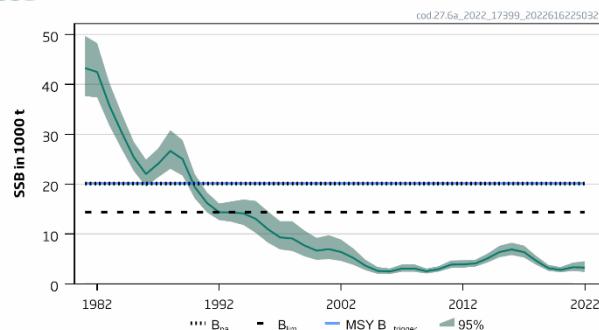
#### Recruitment (age 1)



#### F



#### SSB



**Figure 1**

Cod in Division 6.a. Summary of the stock assessment. . . Reported landings and estimated discards shown in the upper left panel (catches from 1995–2005 (pale blue) are excluded from the assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Cod in Division 6.a. Assumptions made for the interim year and forecast.

Variable	Value	Notes
$F_{ages\ 2-5}\ (2022)$	0.74	$F_{sq} = F_{average}\ (2019-2021)$
SSB (2023)	2 923	Short-term forecast; in tonnes
$R_{age\ 1}\ (2022,\ 2023\ and\ 2024)$	2 226	Median recruitment resampled from the years 2016–2021; in thousands
Total catch (2022)	1 873	Short-term forecast; in tonnes
Projected landings (2022)	1 333	Short-term forecast assuming average landing pattern (2019–2021) <sup>^</sup> ; in tonnes
Projected discards (2022)	540	Short-term forecast assuming average discard pattern (2019–2021) <sup>^</sup> ; in tonnes

<sup>^</sup> Because of inadequate discard sampling coverage of the fishery in 2021, average landings and discards proportions from 2019–2020 are used for ages 1 and 2.

**Table 2** Cod in Division 6.a. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	Projected landings (2023)	Projected discards (2023)	F <sub>total</sub> (2023)	F <sub>projected</sub> landings (2023)	F <sub>projected</sub> discards (2023)	SSB (2024)	% SSB change*	% TAC change^
ICES advice basis									
MSY approach: F = 0	0	0	0	0	0	0	4728	62	-100
Other scenarios									
F <sub>MSY</sub> × SSB (2023)/MSY B <sub>trigger</sub>	133	99	34	0.043	0.033	0.01	4569	56	-90
F <sub>MSY lower</sub> × SSB (2023)/MSY B <sub>trigger</sub>	80	60	20	0.026	0.02	0.006	4632	58	-94
F <sub>MSY upper</sub> × SSB (2023)/MSY B <sub>trigger</sub>	214	159	55	0.071	0.055	0.016	4472	53	-83
F = F <sub>MSY lower</sub>	514	380	134	0.18	0.139	0.041	4113	41	-60
F = F <sub>MSY</sub>	809	594	215	0.3	0.23	0.069	3757	29	-37
F = F <sub>pa</sub>	1359	985	374	0.57	0.44	0.13	3099	6.0	6.3
F = F <sub>MSY upper</sub>	1210	881	329	0.49	0.38	0.112	3278	12.1	-5.4
F = F <sub>2022</sub>	1642	1181	461	0.74	0.57	0.17	2760	-5.6	28
F = F <sub>lim</sub>	1625	1169	456	0.73	0.56	0.167	2781	-4.9	27
TAC(2022)	1279	929	350	0.53	0.41	0.12	3196	9.3	0.0
TAC(2022) – 25%	959	703	256	0.37	0.28	0.084	3577	22	-25
SSB(2024) = SSB(2023)	1507	1088	419	0.66	0.51	0.15	2923	0.0	17.8
SSB(2024) = 1.2 × SSB(2023)	1017	744	273	0.39	0.3	0.09	3510	20	-20
SSB (2024) = B <sub>lim</sub> **									
SSB(2024) = B <sub>pa</sub> = MSY B <sub>trigger</sub> **									

\* SSB 2024 relative to SSB 2023.

\*\* The B<sub>lim</sub>, B<sub>pa</sub>, and MSY B<sub>trigger</sub> options were left blank because none of the three can be achieved in 2024, even with zero catches.

^ Total catch in 2023 relative to the TAC in 2022 (1279 tonnes).

The stock is estimated to be below B<sub>lim</sub>. There are no catch scenarios that will rebuild the stock above B<sub>lim</sub> in the short term. ICES continues to advise zero catch.

### Basis of the advice

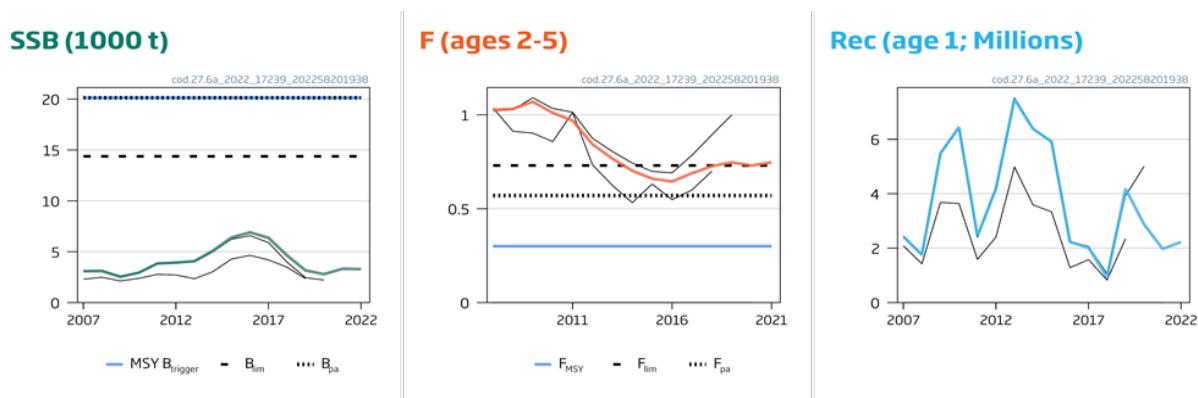
**Table 3** Cod in Division 6.a. The basis of the advice.

Advice basis	MSY approach
Management plan	The EU multiannual plan (MAP) for stocks in the Western Waters and adjacent waters (EU, 2019) takes bycatch of this species into account. There is no agreed shared management plan with UK for this stock, and ICES provides advice according to ICES MSY approach and precautionary considerations.

### Quality of the assessment

As a result of vessel breakdown, the UK-SCOGFS-Q1 survey was not carried out in 2022. In addition, a lack of discard sampling from the Nephrops trawl fleet (due to COVID-19 disruption) means that total discards were not adequately sampled for ages 1 and 2 in 2021, therefore catch numbers for ages 1 and 2 for 2021 were estimated by the model. Sensitivity analyses indicate that these issues are likely to have minimal impact on the assessment.

Stock structure remains an issue for cod in Division 6.a. The issues of multiple stocks in Division 6.a and connectivity with the North Sea stock remain sources of uncertainty.



**Figure 2** Cod in Division 6.a. Historical assessment results. Final-year recruitment and SSB estimates are included. The assessment was benchmarked in 2020.

### Issues relevant for the advice

Management measures taken so far have not resulted in a recovery of the stock. Even though fishing mortality declined between 2009 and 2016, it has remained stable at above  $F_{lim}$  since then.

Cod are known to form aggregations; hence, it is still possible to find areas of high cod density at low stock abundance. This can lead to high catches in localized areas, generating high fishing mortality even with low fishing effort. The impact of this could be reduced by temporary spatial measures (e.g. real-time closures).

From 2019, cod is fully under the EU landing obligation in Division 6.a. The below minimum size (BMS) landings of cod reported to ICES are currently negligible, and they are much lower than ICES estimates of catches below the minimum conservation reference size (MCRS).

Cod to the west of Scotland (Division 6.a) are believed to comprise at least two subpopulations and potentially linked to cod in the North Sea (Division 4.a). The current assessment and management does not capture this dynamic as they are treated independently.

Estimated area-misreported landings (catches taken in Division 6.a, but reported elsewhere) have declined from 40% (average percentage 2017–2019) to around 20% (2019–2021) of the total landings.

Grey seal abundance is significant to the west of Scotland, and grey seals are known to feed on cod among other species. Cook *et al.* (2015) suggest that seal predation may be impairing the recovery of this stock.

## Reference points

**Table 4** Cod in Division 6.a. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	20 126	$B_{pa}$ ; in tonnes	ICES (2020)
	$F_{MSY}$	0.30	Based on simulation using a segmented regression stock–recruitment relationship (EqSim).	ICES (2020)
	$F_{MSY\ lower}$	0.18	$F$ at 95% MSY (below $F_{MSY}$ ), based on simulation using a segmented regression stock–recruitment relationship (EqSim)	ICES (2020)
	$F_{MSY\ upper}$	0.49	$F$ at 95 % MSY (above $F_{MSY}$ ), based on simulation using a segmented regression stock–recruitment relationship (EqSim)	ICES (2020)
Precautionary approach	$B_{lim}$	14 376	SSB consistent with high probability of above-average recruitment (SSB in 1992 as estimated by WKDEM); in tonnes	ICES (2020)
	$B_{pa}$	20 126	$B_{lim} \times 1.4$ ; in tonnes	ICES (2020)
	$F_{lim}$	0.73	The $F$ with 50% probability of $SSB < B_{lim}$	ICES (2020)
	$F_{pa}$	0.57	$F_{P95}$ ; the $F$ that leads to $SSB \geq B_{lim}$ with 95% probability	ICES (2020)
Management plan	$SSB_{mgt}$	Not applicable		
	$F_{mgt}$	Not applicable		

## Basis of the assessment

**Table 5** Cod in Division 6.a. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Analytical age-based assessment (SAM) that uses catches in the model and in the forecast (ICES, 2022b)
Input data	Commercial catches (international landings, ages compositions from catch sampling); five survey indexes (ScoGFS-WIBTS-Q1 [G1179]; UK-SCOWCGFS-Q1 [G4748]; ScoGFS-WIBTS-Q4 [G4299]; UK-SCOWCGFS-Q4 [G4815]; IGFS-WIBTS-Q4 [G7212]); maturity data from surveys; time-varying natural mortalities (M) based on a mean weight model (Lorenzen, 1996), using mean weight data from market sampling and discard observations
Discards and bycatch	Because of a lack of discard sampling from the <i>Nephrops</i> fleet in 2021 (due to COVID-19 disruption), total discards were underestimated for 2021. Catch numbers at age 1 and 2 for 2021 were estimated by the assessment model.
Indicators	-
Other information	The stock was last benchmarked in 2020 (WKDEM; ICES, 2020)
Working group	Working Group for the Celtic Seas Ecoregion ( <a href="#">WGCSE</a> )

## History of the advice, catch, and management

**Table 6** Cod in Division 6.a. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC*	Agreed TAC**	Official landings	ICES estimates of reported landings	Misreporting adjustment	ICES discards^^^	ICES catch
1987	Reduce F towards $F_{max}$	18000	22000		19199	18970		2388	21358
1988	No increase in F; TAC	16000	18430		19182	20413		368	20781
1989	80% of F (87); TAC	16000	18430		15426	17170		2076	19246
1990	80% of F (88); TAC	15000	16000		11777	12175		571	12746
1991	70% of effort (89)	-	16000		10634	10927		622	11549
1992	70% of effort (89)	-	13500		9017	9086 ^		1779	10865
1993	70% of effort (89)	-	14000		10475	10314 ^		139	10453
1994	30% reduction in effort	-	13000		9131	8927 ^		661	9588
1995	Significant reduction in effort	-	13000		9660	9439 ^		141	9580
1996	Significant reduction in effort	-	13000		9580	9426		63	9489
1997	Significant reduction in effort	-	14000		6992	7034		499	7533
1998	20% reduction in F	9500^^	11000		5671	5714		538	6252
1999	F reduced to below $F_{pa}$	< 9700^^	11800		4289	4201		69	4270
2000	Recovery plan, 60% reduction in F	< 4200	7480		3064	2977		821	3798
2001	Lowest possible F, recovery plan	-	3700		2439	2347		92	2439
2002	Recovery plan or lowest possible F	-	4600		2231	2242		480	2722
2003	Closure	-	1808		1298	1292		60	1353
2004	Zero catch +	0	848		596	573		78	651
2005	Zero catch +	0	721		420	516		54	570
2006	Zero catch +	0	613		484	470	34	461	965
2007	Zero catch +	0	490		487	485	30	1651	2166
2008	Zero catch +	0	402		445	460	102	1037	1598
2009	Zero catch +	0	302	240	234	231	54	1287	1572
2010	Zero catch +	0		240	249	239	119	1575	1933
2011	Zero catch +	0		182	206	211	130	3867	4208
2012	Zero catch +	0		0 <sup>++</sup>	216	162	65	1914	2141
2013	No directed fisheries, minimize bycatch and discards	0		0 <sup>++</sup>	172	172	93	1870	2136
2014	No directed fisheries, minimize bycatch and discards	0		0 <sup>++</sup>	161	161	234	3369	3764
2015	No directed fisheries, minimize bycatch and discards	0		0 <sup>++</sup>	256	258	270	2498	3026

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC*	Agreed TAC**	Official landings	ICES estimates of reported landings	Misreporting adjustment	ICES discards^^^	ICES catch
2016	MSY approach (minimize all catches)	0		0 <sup>++</sup>	346	336	272	1499	2108
2017	MSY approach (same advised catch value as provided for 2016)	0		0 <sup>++</sup>	351	355	320	3519	4195
2018	MSY approach	0		0 <sup>++</sup>	367	378	613	2429	3419
2019	MSY approach (same advised catch value as provided for 2018)	0		1735 <sup>+++</sup>	1443##	1489	571	204	2264
2020	MSY approach	0		1279 <sup>+++</sup>	983***	941	332	309	1583
2021	MSY approach	0		1279 <sup>+++</sup>	1209***	1215	49	642#	1906#
2022	MSY approach (same advised catch value as provided for 2021)	0		1279 <sup>+++</sup>					
2023	MSY approach	0							
2024	MSY approach (same advised catch value as provided for 2023)	0							

\* TAC is for the whole of Subdivision 5.b1 and subareas 6, 12, and 14.

\*\* TAC is for Subdivision 5.b1 and Division 6.a.

\*\*\* Preliminary.

^ Including ICES estimates of misreporting.

^^ For Division 6.a only.

^^^ Including BMS landings from 2018 onwards.

+ Single-stock boundaries and the exploitation of this stock should be conducted in the context of mixed fisheries, protecting stocks outside safe biological limits.

++ Bycatch of cod in the area covered by this TAC may be landed, provided this bycatch does not exceed 1.5% of the live weight of the total catch retained on board per fishing trip.

+++ Bycatch TAC.

# Underestimate due to lack of discard samples from the *Nephrops* fleet.

## Incomplete/missing, as part of the data is unavailable under data confidentiality clauses .

## History of the catch and landings

**Table 7** Cod in Division 6.a. Catch distribution by fleet in 2021 as estimated by ICES.

Catch	Landings			Discards		
	Demersal finfish trawl 96%	<i>Nephrops</i> fleet < 1%	Other 4%	Demersal finfish trawl 99%	<i>Nephrops</i> fleet# < 1%	Other < 1%
1906# tonnes	1264 tonnes			642# tonnes		

# Underestimate because of lack of discard samples from *Nephrops* fleet which accounted for 45% of the discards in 2021.

**Table 8** Cod in Division 6.a. History of commercial landings; official values are presented by country. All weights are in tonnes.

Year	Belgium	Denmark	Faroe Islands	France	Germany	Greenland	Ireland	Netherlands	Norway	Spain	UK (E, W, N.I.)	UK (Scotland)	UK	Official BMS landings	Total
1985	48	-	-	7411	66	-	2564	-	204	28	260	8032	-	-	18613
1986	88	-	-	5096	53	-	1704	-	174	-	160	4251	-	-	11526
1987	33	4	-	5044	12	-	2442	-	77	-	444	11143	-	-	19199
1988	44	1	11	7669	25	-	2551	-	186	-	230	8465	-	-	19182
1989	28	3	26	3640	281	-	1642	-	207	85	278	9236	-	-	15426
1990	-	2	-	2220	586	-	1200	-	150	-	230	7389	-	-	11777
1991	6	2	-	2503	60	-	761	-	40	-	511	6751	-	-	10634
1992	-	3	-	1957	5	-	761	-	171	-	577	5543	-	-	9017
1993	22	2	-	3047	94	-	645	-	72	-	524	6069	-	-	10475
1994	1	+	-	2488	100	-	825	-	51	-	419	5247	-	-	9131
1995	2	4	-	2533	18	-	1054	-	61	16	450	5522	-	-	9660
1996	+	2	-	2253	63	-	1286	-	137	+	457	5382	-	-	9580
1997	11	-	-	956	5	-	708	2	36	6	779	4489	-	-	6992
1998	1	-	-	714	6	-	478	1	36	42	474	3919	-	-	5671
1999	+	+	-	842	8	-	223	-	79	45	381	2711	-	-	4289
2000	+	-	-	236	6	-	357	-	114	14	280	2057	-	-	3064
2001	2	-	-	391	4	-	319	-	39	3	138	1544	-	-	2440
2002	+	-	-	208	+	-	210	-	88	11	195	1519	-	-	2231
2003	-	-	-	172	+	-	120	-	45	3	79	879	-	-	1298
2004	-	-	2	91	-	-	34	-	10	-	46	413	-	-	596
2005	-	-	-	107	-	-	28	-	17	-	25	243	-	-	420
2006	-	-	1	108	2	-	18	-	30	-	14	318	-	-	491
2007	-	-	12	92	2	-	70	-	30	-	21	260	-	-	487
2008	-	-	1	82	1	-	58	-	65	-	6	232	-	-	445
2009	-	-	-	74	-	-	24	-	18	-	14	104	-	-	234
2010	-	-	-	60	-	-	49	-	21	-	4	115	-	-	249
2011	-	-	-	49	-	-	41	-	8	-	3	107	-	-	208
2012	-	-	-	4	-	-	18	-	2	-	2	135	-	-	161
2013	-	-	-	3	-	-	14	-	24	-	1	130	-	-	172
2014	-	-	-	5	-	-	12	-	13	-	9	121	-	-	160
2015	-	-	-	11	-	-	17	-	59	-	-	-	168	-	256
2016	-	11	-	86	-	1	28	-	39	-	-	-	183	-	348
2017	-	1	-	119	-	-	19	-	14	-	-	-	200	-	352
2018	-	+	+	101	-	-	12	-	37	-	-	-	217	-	367
2019	-	-	-	142	-	-	^	-	47	31	-	-	1224	+	1443^
2020	-	-	-	139	-	3	65	-	4	32	-	-	738	2	983
2021	-	-	-	162	-	-	98	-	-	27	-	-	923	+	1209

\* Preliminary.

+ Landings < 0.5 tonnes.

^Incomplete/missing part of the data being unavailable under data confidentiality clauses.

### Summary of the assessment

**Table 9** Cod in Division 6.a. Assessment summary. Weights are in tonnes and recruitment in thousands. ‘High’ and ‘Low’ refer to 95% confidence intervals. Total landings and discards from 1995–2006 are not included as input to the assessment.

Year	Recruitment age 1			SSB			Catches ^^	Landings^	Discards ^,*	Fishing mortality ages 2–5		
	Value	High	Low	Value	High	Low				Value	High	Low
1981	10776	14874	7807	43252	49703	37639		23865	303	0.68	0.79	0.58
1982	24158	32385	18021	42471	48273	37367		21511	571	0.72	0.81	0.64
1983	14133	18900	10568	35762	40320	31720		21305	197	0.78	0.88	0.70
1984	24070	32119	18038	30414	34196	27051		21272	329	0.86	0.96	0.77
1985	10610	14131	7966	25388	28505	22611		18607	963	0.92	1.02	0.82
1986	21633	29608	15806	22021	24899	19475		11820	263	0.88	0.98	0.79
1987	42929	59470	30989	24089	27161	21365		18971	2388	0.91	1.01	0.81
1988	7360	9974	5432	26656	30811	23062		20413	368	0.91	1.01	0.82
1989	21585	29143	15987	25011	28826	21701		17169	2076	0.93	1.03	0.83
1990	7974	10959	5803	19427	22020	17139		12175	571	0.87	0.97	0.78
1991	11762	15821	8745	16219	18356	14331		10927	622	0.89	1.00	0.80
1992	21848	29386	16244	14351	16120	12777		9086	1779	0.89	1.00	0.80
1993	7886	10879	5717	14335	16522	12438		10314	139	0.89	1.01	0.79
1994	13771	19640	9656	14118	16916	11784		8928	661	0.89	1.02	0.78
1995	10200	14828	7016	13032	16629	10213	9419		141	0.91	1.04	0.79
1996	4222	6265	2845	10962	14540	8264	8359		63	0.94	1.08	0.82
1997	17062	25460	11434	9311	12567	6899	7087		499	0.97	1.11	0.84
1998	5413	8172	3586	9098	12560	6591	6095		538	0.97	1.11	0.84
1999	4314	6539	2846	7685	10687	5527	5285		69	0.97	1.11	0.85
2000	14621	22205	9627	6650	9228	4792	4822		821	0.97	1.11	0.85
2001	4137	6313	2711	6966	9763	4971	5057		92	0.99	1.13	0.86
2002	6975	10613	4583	6387	8885	4591	4756		480	1.00	1.15	0.87
2003	2303	3466	1531	5208	7115	3811	3649		57	1.03	1.19	0.90
2004	3243	4777	2202	3632	4839	2726	2570		75	1.06	1.22	0.92
2005	2204	3284	1480	2609	3382	2012	1870		41	1.07	1.23	0.92
2006	7212	10572	4920	2476	3095	1981	1856		456	1.05	1.21	0.91
2007	2419	3617	1617	3083	3909	2431		515	1648	1.03	1.18	0.89
2008	1751	2573	1192	3091	3946	2422		561	1037	1.03	1.19	0.90
2009	5474	7799	3843	2534	3080	2084		293	1285	1.07	1.24	0.92
2010	6453	9064	4594	2940	3549	2435		353	1558	1.01	1.17	0.87
2011	2450	3515	1708	3838	4664	3159		344	3805	0.97	1.13	0.83
2012	4188	5873	2986	3931	4759	3248		238	1916	0.84	0.98	0.72
2013	7473	10512	5312	4074	4824	3441		270	1784	0.77	0.90	0.65
2014	6372	8932	4546	5094	6061	4281		397	3367	0.70	0.83	0.60
2015	5925	8356	4201	6395	7652	5343		565	2501	0.66	0.79	0.55
2016	2226	3117	1590	6902	8255	5770		650	1499	0.65	0.77	0.54
2017	2012	2817	1437	6366	7671	5284		687	3500	0.69	0.81	0.59
2018	924	1338	638	4634	5613	3825		994	2426	0.73	0.86	0.62
2019	4183	5902	2964	3158	3820	2611		2077	203	0.75	0.89	0.63
2020	2876	4705	1758	2795	3378	2313		1176	309	0.73	0.89	0.60
2021	1974	4198	928	3326	4255	2600		1241	642 <sup>#</sup>	0.75	0.95	0.58
2022	2226**	4183	924	3288	4558	2376						

\* BMS landings are included with discards from 2018 onwards.

\*\* Median resampled recruitment (2016–2020).

^ Calculated using sum of products from the landings and discards numbers-at-age and mean weights-at-age.

^^ Catches estimated by the model.

# Underestimate because of lack of discard samples from the *Nephrops* fleet.

## Sources and references

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[Download the stock assessment data and figures](#).

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## Cod (*Gadus morhua*) in Division 7.a (Irish Sea)

### ICES advice on fishing opportunities

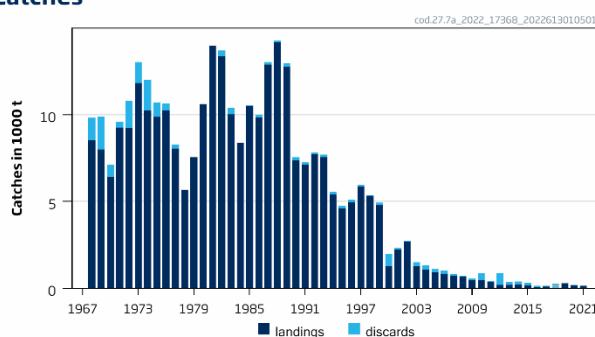
ICES advises that when the MSY approach and precautionary considerations are applied, there should be zero catch in 2023.

ICES notes the existence of a precautionary management plan, developed and adopted by one of the relevant management authorities for this stock.

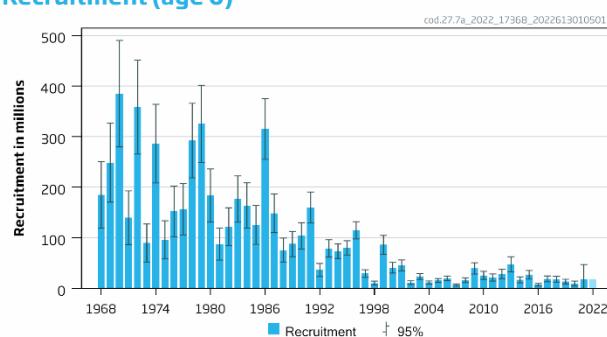
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ , and spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

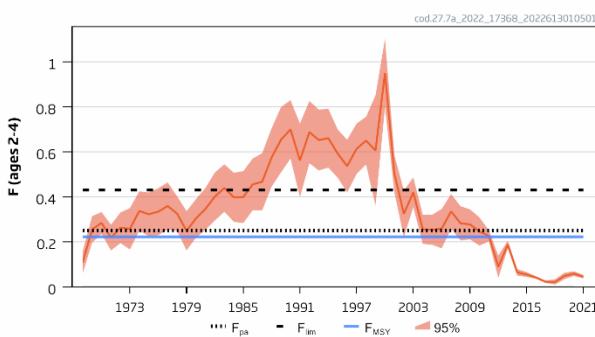
#### Catches



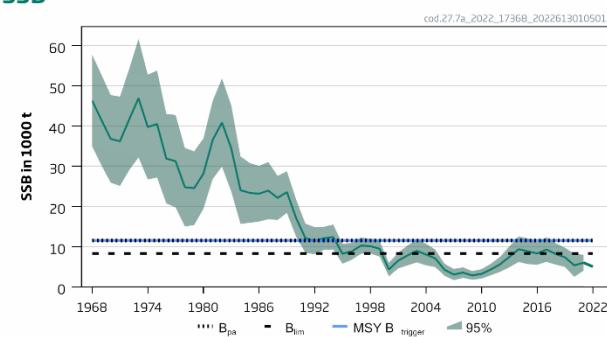
#### Recruitment (age 0)



#### F



#### SSB



**Figure 1** Cod in Division 7.a. Summary of the stock. The assumed recruitment value for 2022 is shaded in a lighter colour. The SSB in 2022 is forecasted.

### Catch scenarios

**Table 1** Cod in Division 7.a. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 2-4}\ (2022)$	0.038	$F_{sq} = F_{average}(2018, 2019, 2021)^*$
SSB (2023)	4 842	Short-term forecast fishing at $F_{sq}$ ; in tonnes
$R_{age\ 0}\ (2022\ and\ 2023)$	17 989	Geometric mean (2002–2019); in thousands
Total catch (2022)	165	Fishing at $F_{sq}$ ; in tonnes
Projected landings (2022)	159	Short-term forecast assuming average landing pattern (2019–2021); in tonnes
Projected discards (2022)	6	Short-term forecast assuming average discard pattern (2019–2021); in tonnes

\*  $F$  in 2020 was assumed to be unrepresentative because of the COVID-19 disruption and hence  $F_{sq}$  was calculated as  $F_{average}\ (2018, 2019, 2021)$ .

**Table 2<sup>†</sup>** Cod in Division 7.a. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	Projected landings (2023)	Projected discards (2023)	F <sub>total</sub> (2023)	F <sub>projected</sub> landings (2023)	F <sub>projected</sub> discards (2023)	SSB (2024)	% SSB change*	% TAC change^	% advice change^^
ICES advice basis										
MSY approach: F = 0	0	0	0	0	0	0	5930	9.8	-100	-100
Other scenarios										
F = 0	0	0	0	0	0	0	5930	9.8	-100	-100
F <sub>MSY</sub> × SSB (2023)/MSY B <sub>trigger</sub>	448	424	23	0.104	0.099	0.0040	5410	0.19	117	510
EU MAP**: F <sub>MSY</sub> lower × SSB (2023)/MSY B <sub>trigger</sub>	343	325	18	0.079	0.076	0.0030	5532	2.44	66	364
EU MAP**: F <sub>MSY</sub> lower	704	667	37	0.168	0.162	0.0065	5116	-5.3	242	850
F = F <sub>MSY</sub>	908	861	48	0.22	0.21	0.0086	4882	-9.6	340	1130
F = F <sub>pa</sub>	1011	958	53	0.25	0.24	0.0097	4766	-11.7	390	1270
F = F <sub>MSY</sub> upper	1093	1035	58	0.27	0.26	0.0106	4673	-13.5	430	1380
F = F <sub>2022</sub>	170	161	9	0.038	0.037	0.00148	5732	6.1	-17.5	130
F = F <sub>lim</sub>	1612	1526	86	0.43	0.41	0.0166	4092	-24	680	2100
F=F <sub>eco</sub>	788	747	41	0.19	0.183	0.0074	5019	-7.1	280	960
F <sub>eco</sub> × SSB (2023)/MSY B <sub>trigger</sub>	386	366	20	0.089	0.085	0.0034	5482	1.52	87	423
SSB (2024) = SSB (2023)	457	433	24	0.106	0.102	0.0041	5400	0	122	520
SSB (2024) = B <sub>lim</sub> ***										
SSB(2024)=B <sub>pa</sub> = MSY B <sub>trigger</sub> ***										

\* SSB 2024 relative to SSB 2023.

\*\* EU multiannual plan (MAP) for the Western Waters (EU, 2019).

\*\*\* The B<sub>lim</sub>, B<sub>pa</sub>, and MSY B<sub>trigger</sub> options were left blank because none of them can be achieved in 2024, even with zero catches.

^ Total TAC in 2023 relative to the TAC in 2022 (206 tonnes).

^^ Total advice in 2023 relative to advice in 2022 (74 tonnes).

The stock is estimated to be below B<sub>lim</sub>. There are no catch scenarios that will rebuild the stock above B<sub>lim</sub> by 2024 and therefore ICES advises zero catch.

### Basis of the advice

**Table 3** Cod in Division 7.a. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is aware of the multiannual management plan (MAP) which has been adopted by the EU for this stock (EU, 2019) and which ICES considers to be precautionary. There is no agreed shared management plan with UK for this stock, and ICES provides advice according to ICES MSY approach. Catch scenarios consistent with the MAP F <sub>MSY</sub> ranges are provided.

### Quality of the assessment

The assessment was benchmarked in 2022 and changed from category 3 to category 1 (ICES, 2022a); therefore, historical assessments are not comparable.

Recreational removals were not included in the 2022 assessment owing to uncertainty around their calculations and selectivity patterns. This exclusion makes minor changes to the perception of the stock.

### Issues relevant for the advice

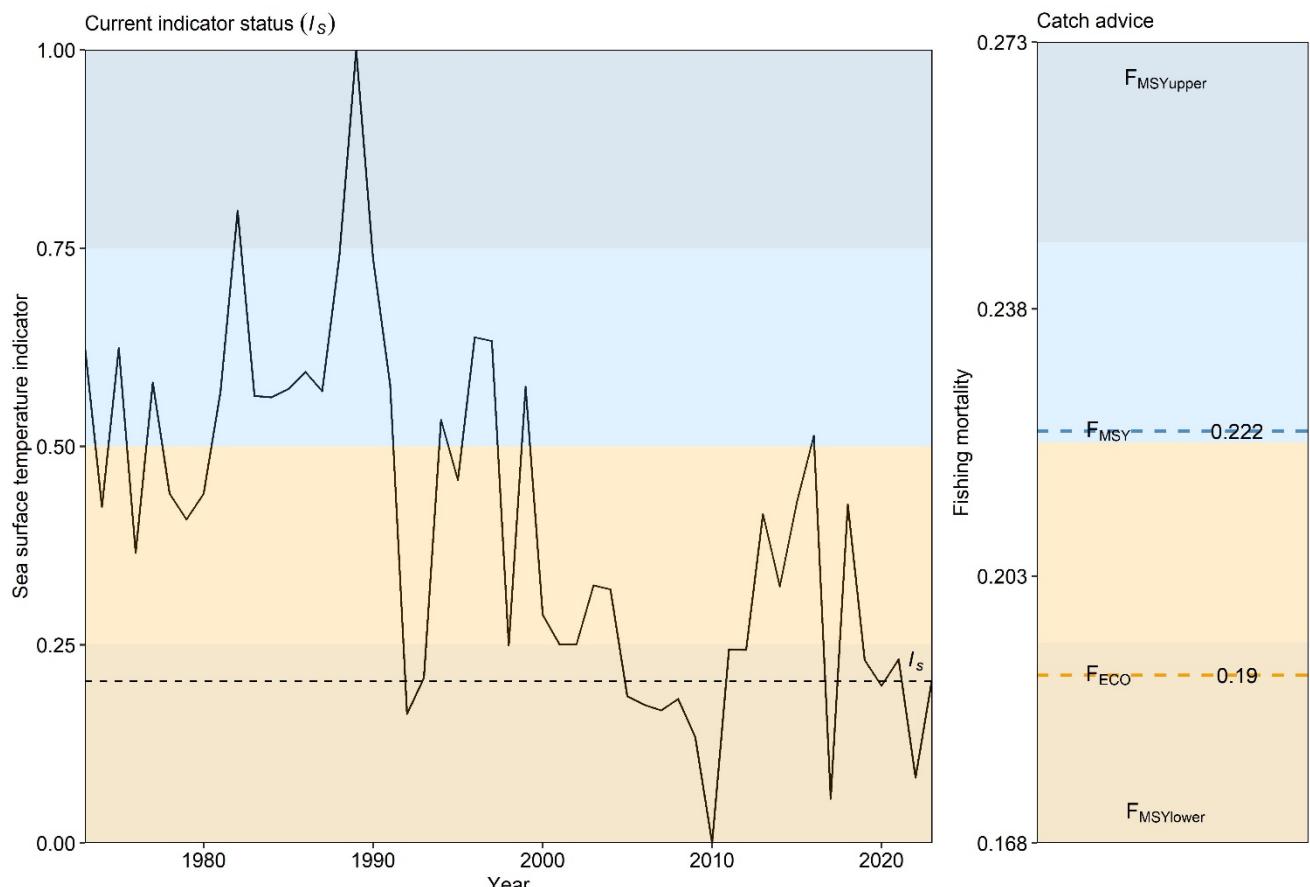
The advice is for Division 7.a, excluding the rectangles 33E2 and 33E3 in the Irish Sea.

<sup>†</sup> Version 2: Correction to the + group weights which affects slightly the values in table 2 but does not affect the advice.

Landings have been adjusted since 2003 to exclude those taken from the southern rectangles (33E2 and 33E3) in the Irish Sea; these landings are not believed to be part of this stock (Table 8) but rather of the stock in divisions 7.e-k (western English Channel and southern Celtic Seas). The advice thus excludes these two southern rectangles for cod in Division 7.a but includes them in the assessment and advice for cod in divisions 7.e-k. This should be considered when setting TACs for the two management areas for cod in both 7.a and 7.e-k. In total, 38.8% of total Irish Sea ICES landings are reallocated, accounting for 8.2% of ICES landings in divisions 7.e-k.

During the benchmark the existence of recreational fishery for cod was noted. The relative contribution of the recreational fishery to the total catch may have increased.

A new reference point,  $F_{eco}$ , was introduced during the benchmark (ICES, 2022a).  $F_{eco}$  falls in the pre-defined  $F_{MSY}$  range and it should provide in the long-term better yield and lower risk. For Irish Sea cod,  $F_{eco}$  was derived from the inverse of sea surface temperature. This indicator is updated annually (ICES, 2019, 2020).



**Figure 2** Derivation of  $F_{eco}$  for Irish Sea cod. Left: time-series of inverted SST (three-year lag) / rescaled between zero and one which informs the status of the indicator ( $I_s$ ) in 2023 compared with previous years. Right: the status of the indicator determines the placement of the  $F_{eco}$  reference point within  $F_{MSY}$  ranges (ICES, 2019,2020).

## Reference points

**Table 4** Cod in Division 7.a. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	11 538	$B_{pa}$	ICES (2022a)
	$F_{MSY}$	0.222	Based on a simulation using model averaged combined stock-recruitment relationship (EqSim)	ICES (2022a)
	$F_{eco}$	0.19	Ecosystem indicator ( $I_s$ ); $F_{eco} = F_{MSY\ lower} + ([F_{MSY\ upper} - F_{MSY\ lower}] * I_s)$	ICES (2022a)
Precautionary approach	$B_{lim}$	8 303	Lowest SSB with above-average recruitment	ICES (2022a)
	$B_{pa}$	11 538	$B_{lim} \times \exp(1.645 \times \sigma)$ , $\sigma = 0.20$ ; in tonnes	ICES (2022a)
	$F_{lim}$	0.43	$F$ with 50% probability of SSB > $B_{lim}$	ICES (2022a)
	$F_{pa}$	0.25	$F_{P05}$ ; the $F$ that leads to SSB > $B_{lim}$ with 95% probability	ICES (2022a)
EU Management Plan (MAP)*	MAP MSY $B_{trigger}$	11 538	MSY $B_{trigger}$ ; in tonnes	ICES (2022a)
	MAP $B_{lim}$	8 303	$B_{lim}$ ; in tonnes	ICES (2022a)
	MAP $F_{MSY}$	0.222	$F_{MSY}$	ICES (2022a)
	MAP range $F_{lower}$	0.168	$F$ at 95% MSY (below $F_{MSY}$ ), based on simulation using a model average combined stock-recruitment relationship (EqSim)	ICES (2022a)
	MAP range $F_{upper}$	0.273	$F$ at 95 % MSY (above $F_{MSY}$ ), based on simulation using model averaged combined stock-recruitment relationship (EqSim)	ICES (2022a)

\* EU multiannual plan (MAP) for the Western Waters (EU, 2019).

## Basis of the assessment

**Table 5** Cod in Division 7.a. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2022b)
Assessment type	Age-based stochastic analytical assessment (SS3; ICES, 2022a, 2022c)
Input data	Northern Ireland Groundfish Survey quarter 1 (G7144; 1995–2021) ages 1–4, and quarter 4 (G7655; 1995–2021) age 0 recruitment index, Fishery science partnership survey UKFSP (B7897; ages 2–6, 2004–2021, excluding 2014), commercial catches (age composition of landings and discards), annual maturity from the G7144 survey and commercial landings, natural mortality estimated from tagging data (ICES, 2022a)
Discards and bycatch	Discards available since 2007, prior to 2007 are reconstructed (ICES, 2017)
Indicators	Sea surface temperature (Rayner, 2003)
Other information	This stock was benchmarked in 2022 (ICES, 2022a)
Working group	Working Group for the Celtic Seas Ecoregion

## History of the advice, catch, and management

**Table 6** Cod in Division 7.a. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice, with single-stock exploitation boundaries since 2004	Catch corresponding to advice	Agreed TAC	Official landings	ICES landings ***	ICES discards
1987	No increase in $F$ ; interaction with <i>Nephrops</i>	10300	15000	13200	12900	
1988	No increase in $F$ ; interaction with <i>Nephrops</i>	10100	15000	15800	14200	
1989	No increase in $F$	13400	15000	11300	12800	
1990	$F$ at $F_{med}$ ; TAC	15300	15300	9900	7400	
1991	Stop SSB decline; TAC	6000	10000	7000	7100**	
1992	20% of $F(90) \sim 10 000$ tonnes	10000	10000	7400	7700**	
1993	$F_{med} \sim 10 200$ tonnes	10200	11000	5900	7600**	
1994	60% reduction in $F$	3700	6200	4500	5400**	
1995	50% reduction in $F$	3900	5800	4500	4600**	
1996	30% reduction in $F$	5400	6200	5303	4964**	
1997	30% reduction in $F$	5900	6200	4441	5859**	
1998	No increase in $F$	6200	7100	4962	5318**	
1999	Reduce $F$ below $F_{pa}$	4900	5500	2875	4784**	

Year	ICES advice, with single-stock exploitation boundaries since 2004	Catch corresponding to advice	Agreed TAC	Official landings	ICES landings ***	ICES discards
2000	Lowest possible F	0	2100	1417	1274	
2001	Lowest possible F	0	2100	2026	2252	
2002	Establish recovery plan	-	3200	2715	2695	
2003	Closure of all fisheries for cod	-	1950	1477	1285	
2004	Zero catch	0	2150	1179	1072	
2005	Zero catch	0	2150	967	910	
2006	Zero catch	0	1828	948	840	
2007	Zero catch	0	1462	1117	702	148
2008	Zero catch	0	1199	1224	661	62
2009	Zero catch	0	899	765	468	60
2010	Zero catch	0	674	594	464	377
2011	Zero catch	0	506	485	368	43
2012	Zero catch	0	380	326	198	658
2013	No directed fisheries, minimize bycatch and discards	0	285	281	206	118
2014	No directed fisheries, minimize bycatch and discards	0	228	236	213	149
2015	No directed fisheries, minimize bycatch and discards	0	182	199	161	224
2016	No directed fisheries, minimize bycatch and discards	0	146	122	82	60
2017	MSY approach	0	146	103	84	59
2018	MSY approach	≤ 1073	695	235	215	42
2019	MSY approach	≤ 807	807	205†	295	7
2020	Precautionary approach	≤ 116	257	252*	181	25
2021	Precautionary approach	≤ 93	206	184*	133	4
2022	Precautionary approach	≤ 74	206			
2023	MSY approach and precautionary considerations	0				

\* Preliminary.

\*\* Includes sample-based estimates of landings into three ports.

\*\*\* Excludes landings reported from rectangles 33E2 and 33E3 since 2004.

† Incomplete/missing as a result of part of the data being unavailable under data confidentiality clauses.

## History of the catch and landings

**Table 7** Cod in Division 7.a. Catch distribution by fleet in 2021 as estimated by ICES.

Catch	Landings				
	Otter trawls		Midwater trawl	Beam trawls	Other gear types
137 tonnes	Nephrops directed 33%	Demersal fish directed 37%	18.7%	9.4%	1%
	133 tonnes				
	Discards				
	Otter trawls		Midwater trawl	Beam trawls	Other gear types
	Nephrops directed 77%	Demersal fish directed < 1%	< 1%	22%	1%
	4 tonnes				

**Table 8** Cod in Division 7.a. History of commercial catches; official landings by country and ICES estimates of total landings and discards. All weights are in tonnes, minor differences in total value are due to rounding.

Year	Belgium	France	Ireland	Netherlands	Spain	UK (England & Wales, & NI)	UK (Isle of Man)	UK (Scotland)	Total	Landings in rectangles 33E2 & 33E3***	ICES Landings	ICES discards
1996	142	148	2476	25	-	2359	27	126	5303		4964**	
1997	183	268	1492	29	-	2370	19	80	4441		5859**	
1998	316	269	1739	20	-	2517	34	67	4962		5318**	
1999	150	n/a	966	5	-	1665	9	80	2875		4784**	
2000	60	53	455	1	-	799	11	38	1417		1274	
2001	283	74	751	-	-	885	1	32	2026		2252	
2002	318	116	1111	-	-	1134	7	29	2715		2695	
2003	183	151	594	-	14	505	7	23	1477		1285	
2004	104	29	380	-	-	646	5	15	1179	108	1072	
2005	115	35	220	-	-	594	n/a	3	967	54	910	
2006	60	18**	275	-	-	589	n/a	6	948	103	840	
2007	67	17**	608	-	-	423	n/a	2	1117	527	702	148
2008	26	3	618**	-	-	543	22	12	1224	558	661	62
2009	19	12	323**	-	-	387	12	12	765	193	468	60
2010	21	1	289	-	-	282	1	-	594	143	464	377
2011	36	3	275	-	-	169	1	-	485	147	368	43
2012	23	1	193	-	-	109	< 1	-	326	85	198	658
2013	13	< 1	160			107	< 1	-	281	76	206	118
2014	9	< 1	148	-	-	79	< 1	-	236	24	213	149
2015	12	< 1	137	-	-	50	< 1	-	199	39	161	224
2016	3	< 1	84	-	-	35	< 1	-	122	40	82	60
2017	5	< 1	57	-	-	41	< 1	< 1	103	19	84	59
2018	2	< 1	105	-	-	128	< 1	< 1	235	20	215	42
2019	10	< 1	+	-	-	195	< 1	< 1	205+	37	295	7
2020*	10	0	76	-	-	95	< 1	< 1	252	71	181	25
2021*	3	0	93	-	-	89	< 1	< 1	184	52	133	4

\* Preliminary official landings.

\*\* Includes sample-based estimates of landings into ports.

\*\*\* Landings in the southern part of Division 7.a (rectangles 33E2 and 33E3) are not included in the assessment and are considered to be part of the cod stock in divisions 7.e–k.

† Incomplete/missing as a result of part of the data being unavailable under data confidentiality clauses.

### Summary of the assessment

**Table 9** Cod in Division 7.a. Assessment summary. All weights are in tonnes, recruitment (age 0) in thousands. ‘Low’ and ‘High’ refer to 95% confidence intervals.

Year	Recruitment age 0			SSB			Landings	Discards	Fishing mortality ages 2–4		
	Low	Value	High	Low	Value	High			Low	Value	High
1968	146962	212818	278674	34934	46341	57748	8541	1285	0.059	0.108	0.156
1969	134614	212818	291022	30242	41512	52782	7991	1898	0.196	0.26	0.31
1970	79297	184549	289801	25921	36819	47717	6426	708	0.24	0.28	0.33
1971	195211	248327	301443	25101	36214	47328	9246	363	0.162	0.22	0.28
1972	292036	384744	477452	29061	41664	54267	9234	1546	0.194	0.26	0.33
1973	102005	139637	177269	32188	46927	61667	11819	1222	0.166	0.26	0.35
1974	280484	358296	436108	26715	39749	52783	10251	1749	0.25	0.34	0.42
1975	51901	89533	127165	27201	40510	53818	9863	857	0.23	0.32	0.42
1976	235851	286027	336203	20762	31895	43028	10247	381	0.23	0.33	0.44
1977	45127	95891	146655	19752	31257	42762	8054	201	0.25	0.36	0.46
1978	78345	152041	225737	15019	24799	34579	5662	0	0.25	0.33	0.4
1979	80263	156311	232359	15368	24541	33713	7548	0	0.162	0.25	0.34

Year	Recruitment age 0			SSB			Landings	Discards	Fishing mortality ages 2–4		
	Low	Value	High	Low	Value	High			Low	Value	High
1980	239567	292095	344623	19393	28154	36916	10599	0	0.22	0.3	0.39
1981	293444	325000	356556	26816	36538	46259	13958	0	0.25	0.35	0.44
1982	146139	183575	221011	29889	40865	51841	13381	313	0.29	0.4	0.51
1983	41580	87444	133308	23719	34460	45201	10015	372	0.33	0.44	0.54
1984	77218	121906	166594	15660	24049	32437	8383	2	0.29	0.4	0.51
1985	138125	176541	214957	15943	23371	30800	10483	61	0.28	0.4	0.51
1986	103594	163766	223938	16236	23174	30112	9852	154	0.34	0.45	0.57
1987	87022	125242	163462	16830	23944	31059	12894	128	0.34	0.47	0.59
1988	291263	314979	338695	16638	22126	27614	14168	109	0.45	0.57	0.7
1989	123188	148276	173364	18403	23577	28751	12751	202	0.51	0.65	0.8
1990	49786	75658	101530	12468	17093	21719	7379	159	0.57	0.7	0.83
1991	57023	87599	118175	8473	12099	15725	7095	163	0.4	0.56	0.73
1992	90849	103824	116799	8115	11486	14857	7735	98	0.55	0.69	0.83
1993	142592	159860	177128	9225	12087	14948	7555	155	0.52	0.65	0.79
1994	21708	36349	50990	9303	12400	15497	5402	142	0.53	0.66	0.79
1995	64909	79041	93172	5765	8234	10704	4587	166	0.48	0.59	0.7
1996	56511	73406	90302	6747	8845	10942	4964	140	0.42	0.54	0.65
1997	72462	79988	87515	8237	10256	12274	5859	120	0.5	0.61	0.73
1998	110742	114682	118622	8309	10136	11963	5318	29	0.54	0.65	0.76
1999	10399	29215	48031	7531	9471	11412	4784	159	0.36	0.61	0.85
2000	0	10300	20943	2628	4321	6015	1274	699	0.8	0.95	1.1
2001	75200	85980	96760	4576	6527	8477	2252	64	0.42	0.5	0.58
2002	36988	40830	44672	5337	7807	10276	2695	46	0.22	0.32	0.43
2003	39805	45489	51173	6084	8965	11846	1285	215	0.35	0.42	0.49
2004	8044	11180	14316	5367	8052	10737	1072	254	0.191	0.26	0.32
2005	19426	23209	26992	4919	7094	9270	910	204	0.187	0.25	0.32
2006	6928	11475	16022	2764	4255	5747	840	185	0.171	0.26	0.35
2007	13523	15620	17718	1671	3072	4473	702	145	0.26	0.34	0.41
2008	15086	19634	24181	2236	3544	4851	662	61	0.21	0.28	0.36
2009	0	6406	17461	1764	2840	3916	466	88	0.21	0.28	0.34
2010	8238	16137	24036	2064	3242	4420	464	386	0.183	0.25	0.31
2011	32304	39400	46495	2888	4322	5757	365	48	0.2	0.23	0.25
2012	16258	25608	34957	3736	5617	7499	198	678	0.039	0.089	0.139
2013	6289	21342	36395	4879	7466	10053	206	152	0.171	0.188	0.21
2014	22163	28200	34236	6188	9363	12538	213	184	0.05	0.064	0.079
2015	38890	47279	55668	5646	8841	12036	161	147	0.044	0.055	0.066
2016	13938	16662	19387	5511	8313	11116	82	60	0.036	0.041	0.047
2017	20971	26831	32692	6213	9270	12328	84	59	0.0175	0.023	0.028
2018	1441	7164	12887	5531	8196	10862	215	42	0.01	0.022	0.033
2019	14158	18842	23527	4945	7336	9727	295	7	0.035	0.049	0.063
2020	12947	17867	22787	2483	5345	8206	181	25	0.048	0.059	0.07
2021	0	13315	42715	4034	6014	7994	133	4	0.037	0.045	0.053
2022		17989*			5029						

\*Geometric mean 2002–2019.

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[Download the stock assessment data and figures](#).

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## Cod (*Gadus morhua*) in divisions 7.e–k (western English Channel and southern Celtic Seas)

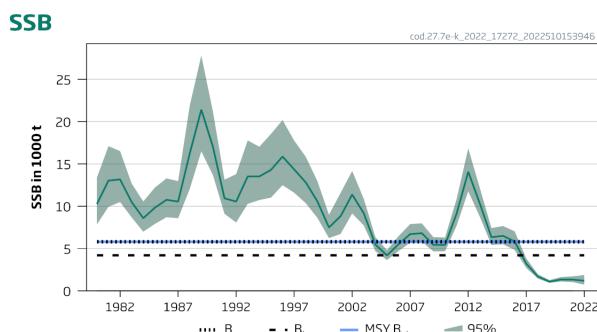
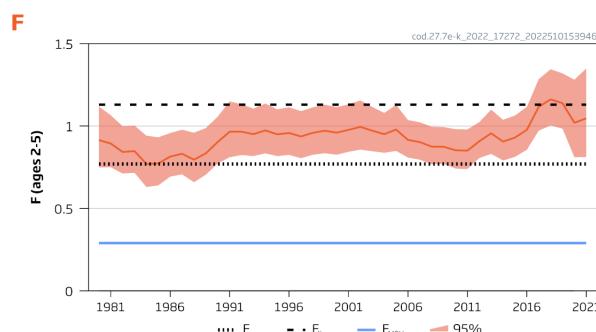
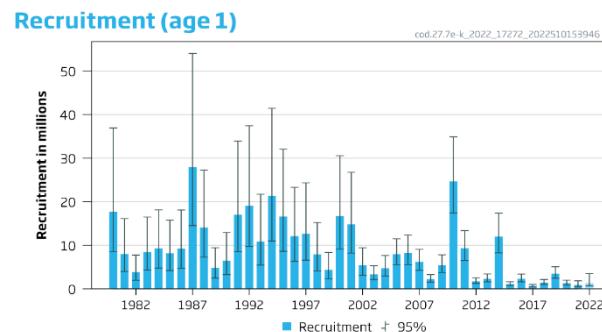
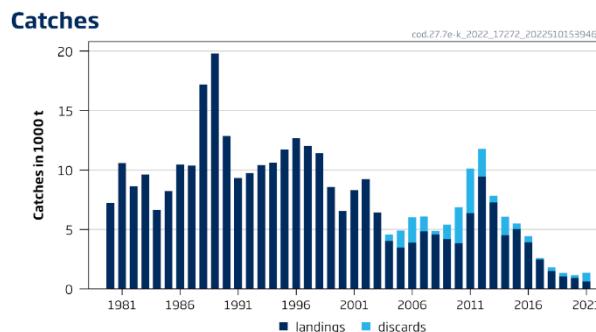
### ICES advice on fishing opportunities

ICES advises that when the MSY approach and precautionary considerations are applied, there should be zero catch in 2023.

ICES notes the existence of a precautionary management plan, developed and adopted by one of the relevant management authorities for this stock.

### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$  and between  $F_{pa}$  and  $F_{lim}$ , and spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Cod in divisions 7.e–k. Summary of the stock assessment. Discard estimates are available from 2004. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Cod in divisions 7.e–k. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages\ 2-5}\ (2022)$	1.069	$F_{sq} = F_{average}\ (2019-2021)$ .
SSB (2023)	1053	Short-term forecast; in tonnes
Recruitment age 1 (2022–2023)	1305	Median from resampled (2015–2021); in thousands
Total catch (2022)	1174	Short-term forecast, in tonnes

**Table 2<sup>†</sup>** Cod in divisions 7.e–k. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F <sub>total</sub> (2023)	SSB (2024)	% SSB change*
ICES advice basis				
MSY approach: F = 0	0	0	2754	162
Other scenarios				
F <sub>MSY</sub> × SSB <sub>2023</sub> /MSY B <sub>trigger</sub>	80	0.050	2632	150
EU MAP**: F <sub>MSY lower</sub> × SSB <sub>2023</sub> /MSY B <sub>trigger</sub>	48	0.029	2682	155
EU MAP**: F <sub>MSY upper</sub> × SSB <sub>2023</sub> /MSY B <sub>trigger</sub>	113	0.070	2583	145
F=F <sub>MSY</sub>	424	0.29	2120	101
F = 0	0	0	2754	162
F=F <sub>lim</sub>	1194	1.13	1014	-3.7
F = F <sub>pa</sub>	928	0.77	1385	32
SSB <sub>2024</sub> = B <sub>lim</sub> ***				
SSB <sub>2024</sub> = B <sub>pa</sub> = MSY B <sub>trigger</sub> ***				
F = F <sub>2022</sub>	1154	1.069	1069	1.5
SSB <sub>2024</sub> =SSB <sub>2023</sub>	1210	1.156	992	-5.7
F=F <sub>MSY upper</sub>	933	0.410	1904	81
F=F <sub>MSY lower</sub>	262	0.170	2360	124

\* SSB<sub>2024</sub> relative to SSB<sub>2023</sub>.

\*\* EU multiannual plan (MAP) for the Western Waters (EU, 2019).

\*\*\*The B<sub>lim</sub>, B<sub>pa</sub>, and MSY B<sub>trigger</sub> options were left blank because none of them can be achieved in 2024, even with zero catch in 2023.

The advice for 2023 is the same as the previous advice because there is no change in the perception of the stock.

### Basis of the advice

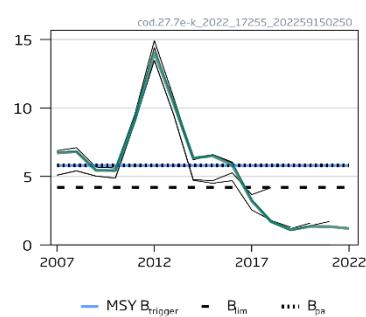
**Table 3** Cod in divisions 7.e–k. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is aware of the multiannual management plan (MAP) which has been adopted by the EU for this stock (EU, 2019) and which ICES considers to be precautionary. There is no agreed shared management plan with UK for this stock, and ICES provides advice according to ICES MSY approach. Catch scenarios consistent with the MAP F <sub>MSY</sub> ranges are provided.

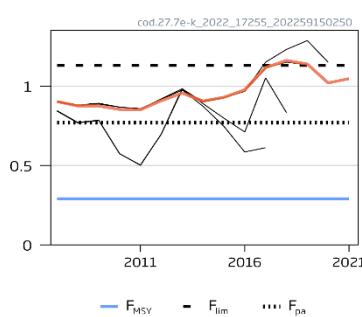
### Quality of the assessment

The estimate of fishing mortality is highly sensitive to the additional annual data; this is due to the low stock size.

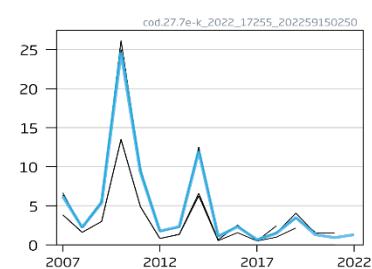
**SSB (1000 t)**



**F (ages 2–5)**



**Rec (age 1; Millions)**



**Figure 2**

Cod in divisions 7.e–k. Historical assessment results (final-year SSB estimate and recruitment assumption included). The assessment was benchmarked in 2020 (ICES, 2020). The reference points were revised in 2020 (following a benchmark), and only assessment results from the last three years should be compared to the reference points indicated.

<sup>†</sup> Version 2: F<sub>MSY lower</sub> and F<sub>MSY upper</sub> options added to table 2.

## Issues relevant for the advice

ICES provides zero-catch advice for this stock in 2023 because the median SSB remains below  $B_{lim}$  by 2024 under all catch scenarios.

The assumed recruitment in 2022 and 2023 used in the forecast constitutes a significant part (70%) of the projected SSB in 2024 (45% and 25%, respectively).

There was an observed change in fishing behaviour in 2021 with increased levels of discarding of fish above MCRS which may be due to restrictive TACs and delay in total TAC attribution. The discard rate in 2021 was 54% compared to an average of 20% for the previous 3 years. As a result of this large change, recent discard ratio is not considered a plausible assumption to split the catch forecast. Therefore, ICES does not provide separate landings and discards estimates for 2023.

Landings are adjusted to include those reported from rectangles 33E2 and 33E3 in Division 7.a because they are considered part of this stock. The 2021 reallocation (52 tonnes) accounts for 8.3% of ICES estimated division 7.b–k landings and 28% of the Irish Sea (Division 7.a) landings. This should be taken into consideration when setting TACs for the two management areas (divisions 7.a and 7.e–k) as a portion of the catch taken under the Division 7.a TAC is considered to be part of the divisions 7.e–k stock.

## Mixed-fisheries considerations

Cod in divisions 7.e–k is caught as part of a mixed fishery and almost all fisheries operating with demersal gears catch cod ([ICES, 2021](#)).

## Reference points

**Table 4** Cod in divisions 7.e–k. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	5800	$B_{pa}$ ; in tonnes	ICES (2020)
	$F_{MSY}$	0.29	Segmented regression with $B_{lim}$ (EqSim).	ICES (2020)
Precautionary approach	$B_{lim}$	4200	$B_{loss}$ , lowest observed SSB from which there has been some recovery (2005) rounded value; in tonnes	ICES (2020)
	$B_{pa}$	5800	$B_{lim} \times 1.4$ ; in tonnes	ICES (2020)
	$F_{lim}$	1.13	Segmented regression with $B_{lim}$ (EqSim)	ICES (2020)
	$F_{pa}$	0.77	$F_{P95}$ ; the F that leads to $SSB \geq B_{lim}$ with 95% probability	ICES (2020)
	MAP MSY $B_{trigger}$	5800	MSY $B_{trigger}$ ; in tonnes	EU (2019), ICES (2020)
Management plan (MAP)*	MAP $B_{lim}$	4200	$B_{lim}$ ; in tonnes	EU (2019), ICES (2020)
	MAP $F_{MSY}$	0.29	$F_{MSY}$	EU (2019), ICES (2020)
	MAP range $F_{lower}$	0.17	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY	EU (2019), ICES (2020)
	MAP range $F_{upper}$	0.41	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY	EU (2019), ICES (2020)

\* EU multiannual plan (MAP) for the Western Waters (EU, 2019).

## Basis of the assessment

**Table 5** Cod in divisions 7.e–k. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based stochastic analytical assessment (SAM; ICES, 2022b)
Input data	Commercial landings, ages, and length frequencies from sampling by métier; one combined VAST-modelled survey index (combined IGFS-WIBTS-Q4 [G7212] and EVHOE-WIBTS-Q4 [G9527]); one commercial index (FR-OTDEF Q2+3+4 trawlers in divisions 7.e–k); fixed maturity ogive derived from UK-WCGFS survey Q1 data; age-dependent natural mortalities (Lorenzen, 1996)
Discards and bycatch	Included in the assessment. Observer-based estimates from 2004; discards and bycatch prior to that (between 1980 and 2003) are model estimated. No discards proportion was provide in the 2022 advice.
Indicators	None
Other information	Benchmarked at WKCELTIC 2020 (ICES, 2020)
Working group	Working Group for the Celtic Seas Ecoregion ( <a href="#">WGCSE</a> )

## History of the advice, catch, and management

**Table 6** Cod in divisions 7.e–k. ICES advice and official landings and ICES catch estimates. All weights are in tonnes.

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC*	ICES landings ^^^	ICES discards
1987	Reduce F	< 6400**			10390	
1988	No increase in F; TAC	7000**			17196	
1989	No increase in F; TAC	8600**			19804	
1990	No increase in F; TAC	9200**			12878	
1991	TAC; SSB mean	4500**			9336	
1992	Appropriate to reduce F	-			9747	
1993	20% reduction in F	6500**		17500	10416	
1994	20% reduction in F	5600**		17000	10620	
1995	20% reduction in F	4700***		17000	11710	
1996	20% reduction in F	4700***		20000	12681	
1997	20% reduction in F	7400***		20000	12028	
1998	10% reduction in F	8800^		20000	11418	
1999	Reduce F below $F_{pa}$	9200^		19000	8580	
2000	Reduce F below $F_{pa}$	< 7600^^		16000	6539	
2001	40% reduction in F	< 4300^^		10500	8316	
2002	45% reduction in F	< 5300^^		8700	9239	
2003	60% reduction in F	< 3800^^		n/a	6425	
2004	90% reduction in F or management plan	< 700		n/a	4027	543
2005	17% reduction in F	< 5200		6200	3478	1426
2006	No increase in effort (should have been "reduce effort")	Cannot be estimated		5580	3902	2118
2007	Zero catch	0		4743	4842	1248
2008	Zero catch	0		4316	4577	306
2009	50% reduction in F	< 2600		4023	4187	1229
2010	Substantial catch reduction	-		4023	3831	3040
2011	Catch and effort reduction	-		5379	6376	3749
2012	MSY framework	< 10000		10059	9443	2341
2013	MSY framework	< 10200		10200	7273	562
2014	MSY approach	< 6848		6848	4512	1569
2015	MSY approach	< 4024		5072	5028	483
2016	MSY approach	≤ 3569		4565	3924	525
2017	MSY approach	≤ 1447		2830	2471	134
2018	MSY approach	≤ 3076	≤ 3428	3076	1496	316
2019	MSY approach		0	1610	1051	300
2020	MSY approach		0	805	922	231
2021	MSY approach and precautionary considerations		0	805	627	733
2022	MSY approach and precautionary considerations		0	644		

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC*	ICES landings ^^^	ICES discards
2023	MSY approach and precautionary considerations		0			

\* TAC covers subareas 7 (except Division 7.a) and 8. From 2009 onwards, the TAC covers divisions 7.b–c and 7.e–k, subareas 8–10, and EU waters of CECAF Division 34.1.1 (with a separate TAC established for Division 7.d).

\*\* For the division 7.f–g stock component.

\*\*\* For the division 7.f–h stock component.

^ For the division 7.e–h stock component.

^^ For the division 7.e–k stock component.

^^^ Landings have been adjusted to include those taken or reported in rectangles 33E2 and 33E3 since 2004.

## History of the catch and landings

**Table 7** Cod in divisions 7.e–k. Catch distribution by fleet in 2021, as estimated by ICES.

Catch 1360 tonnes	Landings				Discards			
	Otter trawls	Seine nets	Beam trawls	Other gears	Otter trawls	Seine nets	Beam trawls	Other gears
	70%	8%	11%	11%	90%	1%	2%	7%
627 tonnes				733 tonnes				

**Table 8** Cod in divisions 7.e–k. History of official commercial landings, presented by country and discard estimates. All weights are in tonnes.

Year	Belgium	France	Ireland	UK	Others	Total	Discard estimates	Landings taken or reported in rectangles 33E2 and 33E3*
1971	n/a	n/a	n/a	n/a	n/a	5782	n/a	n/a
1972	n/a	n/a	n/a	n/a	n/a	4737	n/a	n/a
1973	n/a	n/a	n/a	n/a	n/a	4015	n/a	n/a
1974	n/a	n/a	n/a	n/a	n/a	2898	n/a	n/a
1975	n/a	n/a	n/a	n/a	n/a	3993	n/a	n/a
1976	n/a	n/a	n/a	n/a	n/a	4818	n/a	n/a
1977	n/a	n/a	n/a	n/a	n/a	3059	n/a	n/a
1978	n/a	n/a	n/a	n/a	n/a	3647	n/a	n/a
1979	n/a	n/a	n/a	n/a	n/a	4650	n/a	n/a
1980	n/a	n/a	n/a	n/a	n/a	7243	n/a	n/a
1981	n/a	n/a	n/a	n/a	n/a	10597	n/a	n/a
1982	n/a	n/a	n/a	n/a	n/a	8766	n/a	n/a
1983	n/a	n/a	n/a	n/a	n/a	9641	n/a	n/a
1984	n/a	n/a	n/a	n/a	n/a	6631	n/a	n/a
1985	n/a	n/a	n/a	n/a	n/a	8317	n/a	n/a
1986	n/a	n/a	n/a	n/a	n/a	10475	n/a	n/a
1987	n/a	n/a	n/a	n/a	n/a	10228	n/a	n/a
1988	554	13863	1480	1292	2	17191	n/a	n/a
1989	910	15801	1860	1223	15	19809	n/a	n/a
1990	621	9383	1241	1346	158	12749	n/a	n/a
1991	303	6260	1659	1094	20	9336	n/a	n/a
1992	195	7120	1212	1207	13	9747	n/a	n/a
1993	391	8317	766	945	6	10425	n/a	n/a
1994	398	7692	1616	906	8	10620	n/a	n/a
1995	400	8321	1946	1034	8	11709	n/a	n/a
1996	552	8981	1982	1166	0	12681	n/a	n/a
1997	694	8662	1513	1166	0	12035	n/a	n/a
1998	528	8096	1718	1089	0	11431	n/a	n/a
1999	326	5488	1883	897	0	8594	n/a	n/a
2000	208	4281	1302	744	0	6535	n/a	n/a
2001	347	6033	1091	838	0	8309	n/a	n/a
2002	555	7368	694	618	0	9235	n/a	n/a

Year	Belgium	France	Ireland	UK	Others	Total	Discard estimates	Landings taken or reported in rectangles 33E2 and 33E3*
2003	136	5222	517	346	0	6221	n/a	n/a
2004	153	2934	657	281	1	4027	543	108
2005	186	2127	855	309	1	3478	1426	54
2006	101	2431	995	371	3	3902	2118	103
2007	107	3113	1208	411	3	4842	1248	527
2008	65	2994	1222	295	1	4577	306	558
2009	48	3020	847	267	5	4187	1229	193
2010	52	2449	1030	296	3	3831	3040	143
2011	123	4808	1010	427	7	6376	3749	147
2012	290	6900	1539	706	8	9443	2341	85
2013	202	5051	1470	548	3	7273	562	76
2014	141	2715	1189	466	0	4512	1569	24
2015	121	3373	1109	422	3	5028	483	39
2016	97	2579	881	365	1	3924	525	40
2017	82	1578	623	188	0	2471	134	19
2018	49	611	706 †	130	0	1496†	316	20
2019	43	369	554 †	84	n/a	1051†	300	37
2020**	18	371	487	44	2	922	231	71
2021**	11	261	309	46	0	627	733	52

\* Included in Ireland landings estimates. Landings in the southern part of Division 7.a (rectangles 33E2 and 33E3) are included in the assessment and are considered to be part of the stock.

\*\* Preliminary official landings.

n/a = not available.

† Incomplete/missing as a result of part of the data being unavailable under data confidentiality clauses.

### Summary of the assessment

**Table 9** Cod in divisions 7.e–k. Assessment summary. Recruitments are in thousands, weights in tonnes.

Year	Recruitment age 1			SSB			Landings	Discards	F ages 2–5		
	Low	Value	High	Low	Value	High			Low	Value	High
1980	8502	17720	36932	7843	10247	13387	7241		0.75	0.92	1.12
1981	3988	8019	16127	9933	13034	17105	10595		0.75	0.89	1.07
1982	1949	3889	7760	10494	13167	16521	8639		0.71	0.84	1.00
1983	4312	8433	16495	8677	10489	12681	9635		0.72	0.85	1.00
1984	4767	9296	18131	6982	8588	10565	6642		0.63	0.77	0.94
1985	4205	8141	15762	7912	9830	12213	8241		0.64	0.77	0.93
1986	4695	9219	18101	8700	10758	13301	10475		0.69	0.82	0.96
1987	14496	27983	54019	8582	10551	12972	10390		0.71	0.83	0.98
1988	7264	14070	27253	12026	16219	21873	17196		0.66	0.80	0.96
1989	2454	4807	9419	16488	21417	27820	19804		0.71	0.84	0.99
1990	3257	6490	12932	13673	17023	21193	12878		0.77	0.90	1.06
1991	8528	17005	33908	9097	10934	13143	9336		0.81	0.97	1.15
1992	9725	19077	37422	8075	10555	13797	9747		0.82	0.97	1.13
1993	5449	10876	21710	10277	13519	17783	10416		0.82	0.95	1.11
1994	10979	21331	41447	10730	13521	17038	10620		0.83	0.97	1.14
1995	8616	16618	32050	11018	14295	18546	11710		0.82	0.95	1.10
1996	6327	12144	23307	12485	15874	20184	12681		0.83	0.96	1.11
1997	6588	12659	24326	11592	14352	17770	12028		0.81	0.94	1.09
1998	4120	7921	15232	10363	12818	15855	11418		0.83	0.96	1.11
1999	2287	4374	8365	8628	10582	12978	8580		0.84	0.97	1.13
2000	9099	16676	30560	6228	7486	8999	6539		0.83	0.96	1.12
2001	8194	14810	26768	6725	8824	11577	8316		0.84	0.98	1.13
2002	3108	5412	9426	9147	11384	14167	9239		0.86	1.00	1.16
2003	2123	3354	5296	7727	9163	10867	6425		0.85	0.97	1.12
2004	2937	4741	7653	4694	5463	6358	4027	543	0.84	0.95	1.08
2005	5530	7966	11477	3640	4190	4823	3478	1426	0.85	0.98	1.13
2006	5536	8275	12371	4708	5522	6477	3902	2118	0.81	0.92	1.04
2007	4238	6203	9079	5695	6708	7900	4842	1248	0.80	0.90	1.02
2008	1541	2242	3262	5818	6814	7981	4577	306	0.77	0.88	1.00
2009	3739	5403	7808	4656	5438	6350	4187	1229	0.77	0.88	0.99
2010	17401	24640	34892	4675	5431	6310	3831	3040	0.74	0.85	0.98
2011	6505	9323	13361	7692	9140	10861	6376	3749	0.74	0.85	0.98
2012	1229	1771	2551	11764	14076	16842	9443	2341	0.81	0.91	1.02
2013	1599	2337	3414	8747	10315	12165	7273	562	0.83	0.96	1.10
2014	8271	11992	17387	5420	6343	7423	4512	1569	0.79	0.91	1.04
2015	759	1111	1627	5510	6499	7666	5028	483	0.81	0.93	1.06
2016	1586	2320	3394	4832	5834	7043	3924	525	0.86	0.98	1.12
2017	447	666	992	2705	3224	3843	2471	134	0.97	1.12	1.28
2018	1000	1472	2168	1450	1689	1966	1496	316	1.00	1.16	1.35
2019	2423	3502	5062	940	1097	1279	1051	300	0.98	1.14	1.32
2020	856	1305	1990	1105	1346	1640	922	231	0.81	1.02	1.28
2021	464	923	1837	1036	1334	1716	627	733	0.81	1.05	1.35
2022	666	1305*	3502	732	1196	1879					

\*Median resampled (2015–2021).

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[Download the stock assessment data and figures.](#)

*Recommended citation:* ICES. 2022. Cod (*Gadus morhua*) in divisions 7.e–k (eastern English Channel and southern Celtic Seas). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, cod.27.7e–k.  
<https://doi.org/10.17895/ices.advice.19447898>.

## Cod (*Gadus morhua*) in subdivisions 22–24, western Baltic stock (western Baltic Sea)

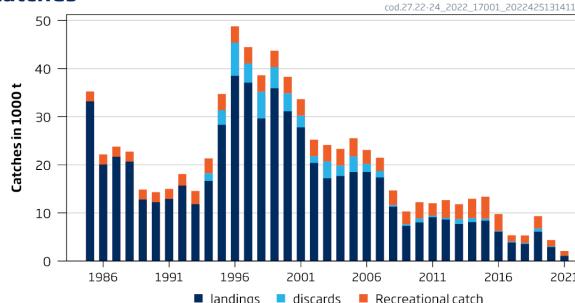
### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches should be no more than 943 tonnes in 2023. This applies to the sum of commercial and recreational catches.

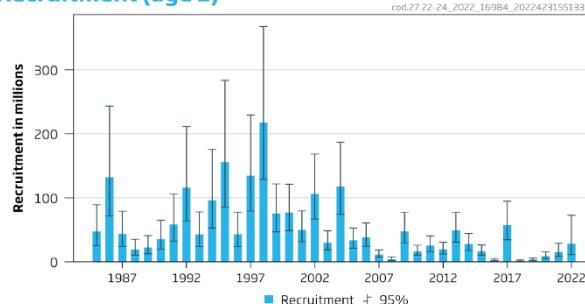
### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$  and between  $F_{pa}$  and  $F_{lim}$ ; spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

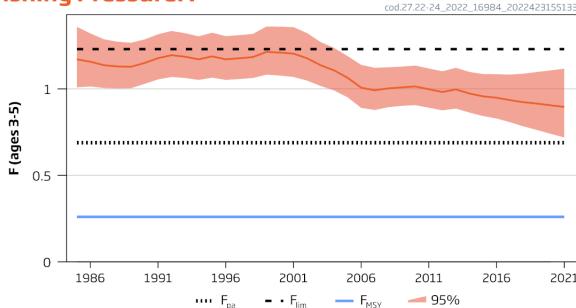
#### Catches



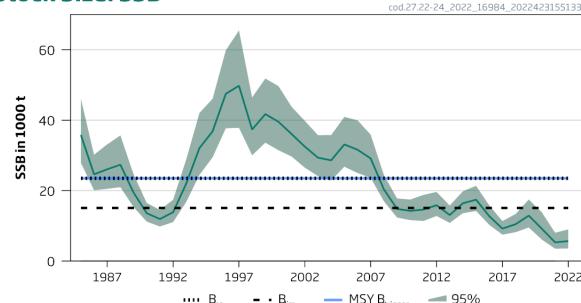
#### Recruitment (age 1)



#### Fishing Pressure: F



#### Stock Size: SSB



**Figure 1** Cod in subdivisions 22–24, western Baltic stock. Summary of the stock assessment. Landings since 2017 include landings below minimum conservation reference size (MBS).

### Catch scenarios

**Table 1** Cod in subdivisions 22–24, western Baltic stock. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 3-5}\ (2022)$	0.90	Equal to $F$ in 2021 ( $F_{sq}$ )
SSB (2023)	9 299	Short-term forecast; tonnes
$R_{age\ 1}\ (2022)$	28 966	From the assessment; thousands
$R_{age\ 1}\ (2023)$	17 015	Sampled from the last ten years (2013–2022); thousands*
$R_{age\ 1}\ (2024)$	17 187	Sampled from the last ten years (2013–2022); thousands*
Total catch (2022)	4 295	Based on $F$ in 2021

\* Recruitment is randomly resampled from the assessment estimates of the last ten years, and the median of these random draws is used. This will vary slightly every time this is carried out.

**Table 2** Cod in subdivisions 22–24, western Baltic stock. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch* (2023)	F <sub>total</sub> (2023)	SSB (2024)	% SSB change***	% advice change^	% probability of SSB being below B <sub>lim</sub> in 2024##
ICES advice basis						
MSY approach: F <sub>MSY</sub> × SSB (2023) /MSY B <sub>trigger</sub>	943	0.103	17 918	93	35	31
Other scenarios						
EU MAP**: F <sub>MSY</sub> × SSB (2023) /MSY B <sub>trigger</sub>	943	0.103	17 918	93	35	31
EU MAP**: MAP range F <sub>lower SSB</sub> (2023)/ MSY B <sub>trigger</sub>	621	0.067	18 240	96	34	29
Zero catch	0	0	18 859	103	-100	25
F = F <sub>pa</sub>	5 277	0.69	13 581	46	656	60
F = F <sub>lim</sub>	8 175	1.23	10 698	15	1071	76
SSB (2024) = B <sub>lim</sub>	3 753	0.46	15 067	62	438	50
SSB (2024) = B <sub>pa</sub> #	-	-	-	-	-	-
SSB (2024) = MSY B <sub>trigger</sub> #	-	-	-	-	-	-
F <sub>sq</sub> (F = 2021)	6 485	0.90	12 361	33	829	66
TAC <sub>2022</sub> (489 t)+ estimated recreational catch 2022 (494 t)	983	0.108	17 872	92	41	32

\* Includes commercial and recreational catch.

\*\* EU Multiannual Plan for the Baltic Sea (EU, 2016, 2019).

\*\*\* SSB 2024 relative to SSB 2023.

^ Total catch in 2023 relative to total catch corresponding to the MAP F<sub>MSY</sub> advice for 2022 (698 tonnes), including commercial and recreational catch.

# The B<sub>pa</sub>, and MSY B<sub>trigger</sub> options were left blank because neither can be achieved in 2024 even with zero catch in 2023.

## This probability relates to the short-term probability of SSB < B<sub>lim</sub> and is not comparable to the long-term probability of SSB < B<sub>lim</sub> tested in simulations when estimating fishing mortality reference points.

Recruitment in 2022 has been estimated to be slightly higher than in the previous year; this results in higher catch advice for 2023.

### Basis of the advice

**Table 3** Cod in subdivisions 22–24, western Baltic stock. The basis of the advice.

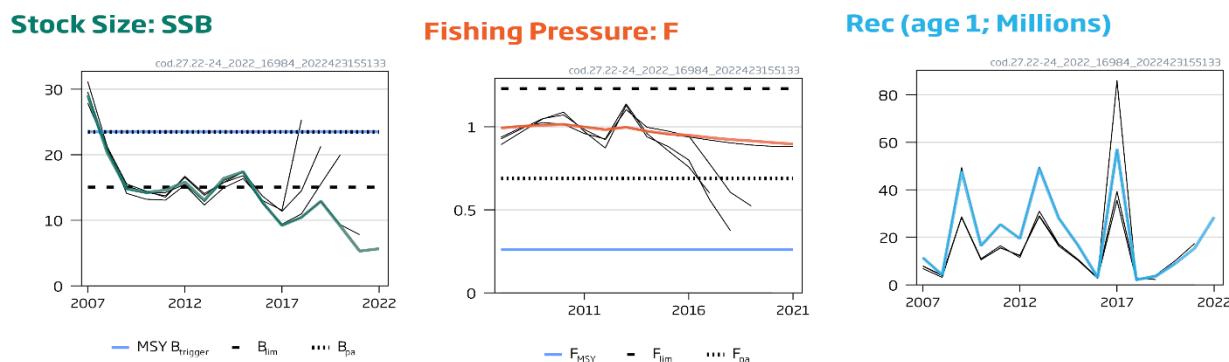
Advice basis	The EU Baltic multiannual plan could not be used because this plan does not provide guidance on catch scenarios for the present state of the stock. Therefore, the MSY approach was used as basis for the advice.
Management plan	The EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes cod (EU, 2016, 2019). The advice, based on F <sub>MSY</sub> ranges, is considered precautionary.

### Quality of the assessment

In previous years' forecasts, the expected catch in the interim year predicted a substantial reduction in fishing mortality and a corresponding increase in SSB. However, although the assumptions made on catches in the interim year have turned out to be reasonable, the fishing mortality estimated from the assessment has remained high, with SSB subsequently considerably lower than was predicted. Such a pattern suggests that processes other than those captured by catch and assumed natural mortality data are influencing the SSB of the western Baltic cod stock. The sources for the presumably additional mortality are presently unclear but could involve e.g. increased natural mortality (due to increased predation, hypoxia, decreased condition, increased water temperatures) and unreported catches. However, the effects associated

with these drivers are presently not possible to identify and quantify and are therefore difficult to account for in the forecast. For this reason  $F_{sq}$  was used for the intermediate year, which produces a considerably higher assumed catch (total removal) than the present quota for 2022. It is not possible to account for this additional mortality in the advice year such that the estimated SSB in 2024 may be an overestimate. The probability of SSB being below  $B_{lim}$  in 2024 is likely to be higher than the 31% estimated in Table 2.

The SSB development from stock assessment is considered well estimated, but the trend in fishing mortality may represent a combination of other sources of mortality with those related to fishing.



**Figure 2** Cod in subdivisions 22–24, western Baltic stock. Historical assessment results (final-year recruitment estimates included). The stock was interbenchmarked in 2021, and only assessment results from the last two years should be compared to the reference points indicated.

### Issues relevant to the advice

Cod is exploited by a mixed commercial–recreational fishery. In 2021, the recreational catches included in the stock assessment constituted 46% of the total catches. The current management includes trade-offs between commercial and recreational fisheries, but ICES is not in a position to provide catch options separately for commercial and recreational fisheries because the catch advice for the stock is so low that it is not possible to partition the catches. Catch and release in the recreational fishery is one potential measure to reduce the exploitation rate on western Baltic cod. The assessment uses estimates of post-release mortality in the sea-based recreational fishery of 11.2%, while it is considered to be 100% in the land-based recreational fishery (ICES, 2020). The commercial fishery has changed from being a directed cod fishery towards a bycatch fishery. There are gears available that successfully reduce cod bycatches in the flatfish fisheries (Stepputtis *et al.*, 2020); however, these gears are not in use at present. Reducing the bycatch of cod in flatfish fisheries is necessary to enhance the recovery of the cod stocks.

There is high uncertainty in the short term forecast of this stock. The sum of fishing mortality and unaccounted natural mortality will probably be close to  $F_{sq}$  value in 2023, which would result in a probability of SSB being below  $B_{lim}$  of around 66% in 2024. Thus, the risk associated to the MSY advice is high.

## Reference points

**Table 5** Cod in subdivisions 22–24, western Baltic stock. Reference points, values, and their technical basis. Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	23 492	$B_{pa}$	ICES (2021)
	$F_{MSY}$	0.26	Stochastic simulations with segmented regression stock–recruitment relationship	ICES (2021)
Precautionary approach	$B_{lim}$	15 067	Average of lowest SSB in years with above average recruitment (1990, 1991, 1993, 2016)	ICES (2021)
	$B_{pa}$	23 492	$B_{lim} \cdot \exp(1.645 \cdot 0.27)$	ICES (2021)
	$F_{lim}$	1.23	Equilibrium scenarios with stochastic recruitment: F value corresponding to 50% probability of ( $SSB < B_{lim}$ )	ICES (2021)
	$F_{pa}$	0.689	$F_{pos}$ ; the F that leads to $SSB \geq B_{lim}$ with 95% probability	ICES (2021)
Management plan	MSY $B_{trigger}$	23 492	MSY $B_{trigger}$	ICES (2021)
	$B_{lim}$	15 067	$B_{lim}$	ICES (2021)
	MAP $F_{MSY}$	0.26	$F_{MSY}$	ICES (2021)
	MAP target range $F_{upper}$	0.26–0.44	Consistent with the ranges resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2021)
	MAP target range $F_{lower}$	0.17–0.26	Consistent with the ranges resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2021)

## Basis of the assessment

**Table 6** Cod in subdivisions 22–24, western Baltic stock. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2022a)
Assessment type	Age-based analytical assessment SAM (ICES, 2022b) that uses catches (landings, discards, and recreational catch) in the model and the forecast
Input data	Commercial catches (landings, age distributions from catch sampling) and recreational catch (Germany, Sweden, and Denmark). Annual stock separation key (from commercial catches) to split catches in Subdivision 24 into eastern and western Baltic cod, derived from otolith shape analyses combined with genetics (this key is available for 20 of the 35 years in the present time-series). The allocation of catches to stock for the remaining years was performed by interpolation. Three survey indices: FEJUCS, ([N2828], age 0), BITS-Q1 ([G2916] ages 1–4+), and BITS-Q4 ([G8863]; ages 0–4+); constant maturity data as an average from BITS-Q1 surveys for the whole time period. Natural mortalities estimated from life history parameters, constant for the whole time period.
Discards and bycatch	Included in the assessment since 1994, data series from the main fleets
Indicators	None
Other information	Interbenchmarked in 2021 (ICES, 2021)
Working group	Baltic Fisheries Assessment Working Group ( <a href="#">WGBFAS</a> )

## History of the advice, catch, and management

**Table 7** Cod in subdivisions 22–24, western Baltic stock. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Total catch from the stock corresponding to the advice	Commercial catch corresponding to the advice*	Agreed TAC**	ICES estimated total commercial landings subdivisions 22–24 (eastern and western Baltic cod stocks)
1987	TAC		9 000		28 566
1988	TAC		16 000		29 159
1989	TAC		14 000	220 000	18 516
1990	TAC		8 000	210 000	17 780
1991	TAC		11 000	171 000	16 693
1992	Substantial reduction in F		-	100 000	17 996

Year	ICES advice	Total catch from the stock corresponding to the advice	Commercial catch corresponding to the advice*	Agreed TAC**	ICES estimated total commercial landings subdivisions 22–24 (eastern and western Baltic cod stocks)
1993	F at lowest possible level		-	40 000	21 228
1994	TAC		22 000	60 000	30 695
1995	30% reduction in fishing effort from 1994 level		-	120 000	33 895
1996	30% reduction in fishing effort from 1994 level		-	165 000	50 845
1997	Fishing effort should not be allowed to increase above the level of recent years		-	180 000	43 624
1998	20% reduction in F from 1996		35 000	136 950	34 216
1999	At or below $F_{sq}$ with 50% probability		38 000	126 000	42 155
2000	Reduce F by 20%		44 600	105 000	38 347
2001	Reduce F by 20%		48 600	105 000	34 244
2002	Reduce F to below 1.0		36 300	76 000	24 158
2003	Reduce F to below 1.0		***22 600 or 28 800	75 000	24 624
2004	Reduce F to below 1.0		< 29 600	29 600	20 854
2005	Reduce F to below 0.92		< 23 400	24 700	22 045
2006	Management plan		< 28 400	28 400	22 751
2007	Keep SSB at $B_{pa}$		< 20 500	26 700	23 736
2008	Rebuild SSB to $B_{pa}$		< 13 500	19 200	20 082
2009	Rebuild SSB to $B_{pa}$		< 13 700	16 300	15 549
2010	Management plan		< 17 700	17 700	14 120
2011	See scenarios		-	18 800	16 332
2012	Management plan		21 300	21 300	17 072
2013	Management plan		20 800	20 000	12 968
2014	Management plan		17 037	17 000	13 538
2015	MSY approach		8 793	15 900	13 418
2016	MSY approach ( $F = 0.23$ )	$\leq 7 797$		12 720	10 629
2017	MSY approach ( $F = 0.15$ )	$\leq 3 475$	$\leq 917$	5 597	5 865 <sup>▲</sup>
2018	MAP F ranges: $F_{lower}$ to $F_{MSY}$ adjusted by SSB <sub>2018</sub> /MSY $B_{trigger}$ ( $F = 0.11$ – $0.188$ )	3 130–5 295	1 376–3 541	5 597	5 850 <sup>▲</sup>
2019	MAP range: $F_{MSY}$ $F_{lower}$ to $F_{upper}$ ( $F = 0.15$ – $0.45$ )	9 094–23 992	5 867–22 238	9 515	7 701 <sup>▲</sup>
2020	MAP range: $F_{MSY}$ $F_{lower}$ to $F_{upper}$ ( $F = 0.18$ – $0.43$ )	5 205–11 006	3 065–8 866	3 806	3 329 <sup>▲</sup>

Year	ICES advice	Total catch from the stock corresponding to the advice	Commercial catch corresponding to the advice*	Agreed TAC**	ICES estimated total commercial landings subdivisions 22–24 (eastern and western Baltic cod stocks)
2021	Management plan	5 950 (range 4 275–9 039)	4 635 (range 2 960–7 724)	4 000	1 329 <sup>▲</sup>
2022	MSY approach	≤ 698		489	
2023	MSY approach	≤ 943			

\* Values since 2016 are for the western Baltic cod stock only, whereas in earlier years they are for the area of subdivisions 22–24 and include a fraction of the eastern Baltic cod stock.

\*\* Included in TAC for total Baltic until and including 2003.

\*\*\* Two options based on implementation of the adopted mesh regulation.

<sup>▲</sup> Including BMS.

### History of the catch and landings

**Table 8** Cod in subdivisions 22–24, western Baltic stock. Catch distribution in 2021 as estimated by ICES.

Catch (2021)	Commercial landings		Commercial discards	Recreational catch		
	Active gears 45% Passive gears 55%					
	1 065 tonnes					
2 084 tonnes			51 tonnes	968 tonnes		

**Table 9** Cod in subdivisions 22–24, western Baltic management area. History of commercial catch; both the official and ICES estimated values are presented by area. The table includes landings of the western Baltic cod stock as well as of the eastern Baltic cod stock in Subdivision 24. All weights are in tonnes.

Year	Total for management area							
	Human consumption (HC) landings				BMS	Discards	Unalloc.	Total catch
	22	23	24	HC (SDs 22–24)				
1992	9 887	2 739	5 370	17 996				17 996
1993	7 296	1 275	7 129	15 700			5 528	21 228
1994	8 229	1 628	13 336	23 193		2 235	7 502	32 930
1995	16 936	3 158	13 801	33 895		3 684		37 579
1996	21 417	4 031	23 097	48 545		7 984	2 300	58 829
1997	21 966	2 663	18 995	43 624		4 623		48 247
1998	15 093	3 074	16 049	34 216		6 207		40 423
1999	20 409	3 521	18 225	42 155		4 978		47 133
2000	18 934	3 149	16 264	38 347		4 947		43 294
2001	14 976	2 817	16 451	34 244		2 839		37 083
2002	11 968	2 409	9 781	24 158		1 958		26 116
2003	9 573	1 925	13 127	24 624		4 336		28 960
2004	9 091	2 320	9 430	20 841		2 377	13	23 231
2005	8 729	2 621	10 686	22 036		4 994	9	27 039
2006	9 979	1 914	10 858	22 751		1 831		24 582
2007	7 840	2 713	13 183	23 736		2 199		25 935
2008	5 687	2 139	12 256	20 082		1 123		21 205
2009	3 451	839	11 259	15 549		815		16 364
2010	3 925	1 179	9 016	14 120		1 371		15 491
2011	5 493	1 198	9 641	16 332		780		17 112
2012	4 896	1 123	11 053	17 072		905		17 977
2013	4 675	960	7 333	12 968		2 250		15 218
2014	4 316	1 361	7 862	13 538		2 135		15 673
2015	4 994	1 232	7 193	13 419		1 361		14 780
2016	3 193	1 123	6 313	10 629	34	449		11 112
2017	2 195	941	2 697	5 833	32	421		6 286
2018	2 014	870	2 942	5 826	24	476		6 326
2019	3 728	1 167	2 783	7 679	22	1 292		8 993
2020	2 147	508	671	3 326	3	205		3 534
2021	624	345	357	1 326	3	80		1 409

## Summary of the assessment

**Table 10** Cod in subdivisions 22–24, western Baltic stock. Assessment summary. Weights are in tonnes. Recruitment in thousands. High and low refer to 95% confidence intervals.

Year	Recruitment			Stock size			Landings	Discards	Recreational catch	Fishing pressure		
	R (age 1)	High	Low	SSB	High	Low				F (ages 3–5)	High	Low
1985	47 412	89 065	25 239	35 840	46 095	27 866	33 188		2 075	1.17	1.36	1.01
1986	132 126	243 310	71 749	24 626	30 201	20 081	20 088		2 078	1.16	1.32	1.01
1987	43 683	79 116	24 119	26 063	33 142	20 497	21 692		2 081	1.14	1.29	1.00
1988	19 280	35 262	10 541	27 355	35 686	20 969	20 672		2 082	1.13	1.27	1.00
1989	22 649	41 039	12 500	19 435	24 642	15 328	12 795		2 083	1.13	1.27	1.00
1990	35 804	64 945	19 739	13 578	16 483	11 185	12 237		2 085	1.15	1.29	1.03
1991	58 495	105 900	32 310	11 928	14 533	9 790	12 931		2 087	1.18	1.32	1.05
1992	116 204	211 479	63 852	13 860	17 395	11 043	15 672		2 420	1.20	1.34	1.07
1993	42 902	77 999	23 597	22 016	28 876	16 786	11 815		2 752	1.19	1.32	1.06
1994	96 480	175 560	53 021	32 068	42 050	24 455	16 642	1 614	3 088	1.17	1.30	1.05
1995	155 746	283 426	85 585	36 840	46 099	29 441	28 310	3 016	3 417	1.19	1.32	1.06
1996	43 083	77 496	23 952	47 491	59 842	37 689	38 505	6 868	3 419	1.17	1.30	1.05
1997	134 857	229 263	79 325	49 784	65 511	37 833	37 077	3 981	3 420	1.18	1.31	1.06
1998	217 458	367 691	128 608	37 351	46 460	30 027	29 634	5 575	3 410	1.18	1.32	1.06
1999	75 488	121 670	46 835	41 734	51 841	33 598	35 934	4 378	3 416	1.21	1.36	1.08
2000	77 002	121 346	48 863	39 541	49 689	31 466	31 132	3 738	3 432	1.21	1.36	1.08
2001	50 016	79 549	31 447	36 051	43 801	29 672	27 781	2 449	3 427	1.20	1.36	1.07
2002	106 148	168 324	66 938	32 491	39 821	26 510	20 410	1 395	3 437	1.18	1.32	1.05
2003	30 176	48 500	18 775	29 344	35 742	24 092	17 205	3 473	3 448	1.14	1.27	1.02
2004	117 717	186 923	74 134	28 603	35 783	22 864	17 686	2 189	3 445	1.11	1.24	0.99
2005	33 530	52 857	21 270	33 112	40 928	26 789	18 493	3 265	3 771	1.06	1.19	0.95
2006	38 355	60 729	24 224	31 613	39 982	24 995	18 503	1 686	2 923	1.01	1.14	0.89
2007	11 458	18 428	7 124	29 126	35 899	23 631	17 384	1 325	2 782	0.99	1.12	0.88
2008	4 236	7 807	2 298	20 356	24 453	16 946	11 302	336	3 039	1.00	1.13	0.89
2009	47 789	77 487	29 473	14 812	17 783	12 337	7 313	351	2 648	1.01	1.13	0.90
2010	16 452	26 003	10 410	14 243	17 459	11 619	8 007	838	3 367	1.01	1.14	0.91
2011	25 450	40 587	15 958	14 612	18 773	11 373	9 107	299	2 595	1.00	1.12	0.89
2012	19 437	30 584	12 353	15 849	19 634	12 793	8 622	370	3 661	0.98	1.10	0.88
2013	48 989	77 547	30 947	13 060	15 764	10 821	7 697	1 007	3 106	1.00	1.12	0.89
2014	28 030	44 285	17 742	16 397	19 824	13 561	8 083	837	4 044	0.97	1.10	0.86
2015	16 605	26 239	10 508	17 420	21 361	14 206	8 390	432	4 568	0.96	1.09	0.84
2016	3 191	5 248	1 941	12 742	15 815	10 266	6 122	143	3 505	0.95	1.08	0.83
2017	57 165	94 684	34 513	9 209	11 347	7 474	3 861*	180	1 315	0.94	1.08	0.81
2018	2 182	3 551	1 341	10 456	13 358	8 185	3 555*	157	1 600	0.92	1.09	0.78
2019	3 590	5 984	2 154	12 896	17 478	9 515	6 103*	655	2 573	0.92	1.10	0.76
2020	8 972	15 571	5 170	9 133	13 799	6 045	2 900*	152	1 311	0.91	1.11	0.74
2021	15 456	29 242	8 169	5 303	8 038	3 498	1 065*	51	968	0.90	1.12	0.72
2022	28 524	72 770	11 180	5 661	8 986	3 566						

\*Includes BMS.

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[Download the stock assessment data and figures.](#)

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## Cod (*Gadus morhua*) in Subarea 4, Division 7.d, and Subdivision 20 (North Sea, eastern English Channel, Skagerrak)

### ICES advice on fishing opportunities

Please note: The present advice replaces the advice given in June 2022 for catches in 2023.

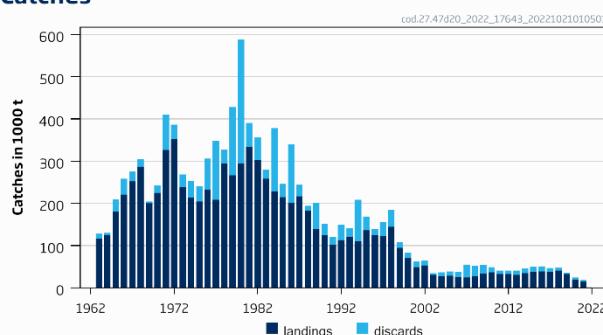
ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 26 008 tonnes.

ICES notes the existence of a precautionary management plan, developed and adopted by one of the relevant management authorities for this stock.

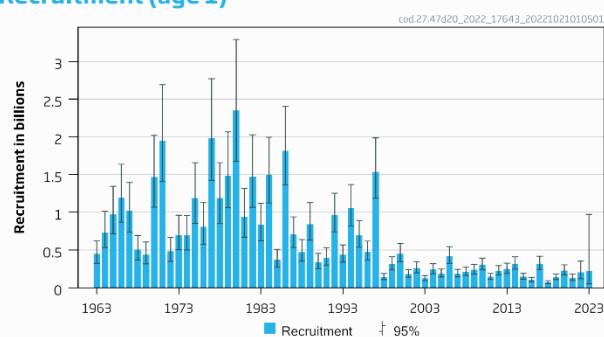
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

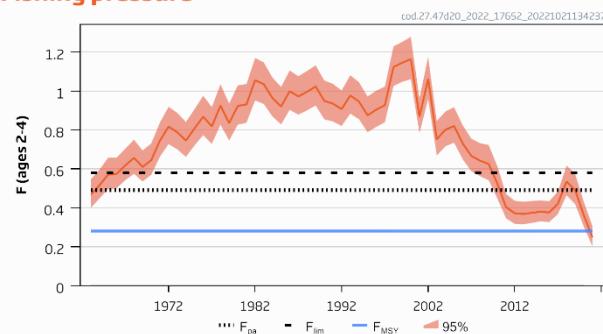
#### Catches



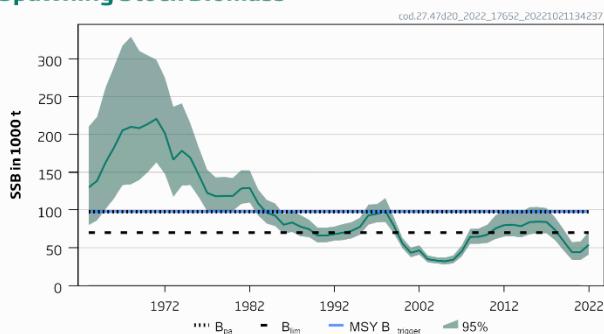
#### Recruitment (age 1)



#### Fishing pressure



#### Spawning Stock Biomass



**Figure 1** Cod in Subarea 4, Division 7.d, and Subdivision 20. Summary of the stock assessment.

### Catch scenarios

**Table 1** Cod in Subarea 4, Division 7.d, and Subdivision 20. Values in the forecast and for the interim year.

Variable	Value	Notes
F <sub>ages 2-4</sub> (2022)	0.179	Based on the assumed total catch (2022) and exploitation pattern in 2021
SSB (2023)	73 038	Short-term forecast; tonnes
R <sub>age 1</sub> (2022)	201 238	Median recruitment estimate in 2022; thousands
R <sub>age 1</sub> (2023)	233 050	Median recruitment estimate in 2023; thousands
Total catch (2022)	17 789	Sum of projected landings and projected discards; tonnes
Projected landings (2022)	15 098	Estimated from 2022 quarter 1 and 2 landings data; tonnes
Projected discards (2022)	2691	Assuming 2021 discards ratio at age; tonnes

**Table 2** Cod in Subarea 4, Division 7.d, and Subdivision 20. Annual catch scenarios. All weights are in tonnes (t).

Basis	Total catch (2023)	Projected landings (2023)	Projected discards* (2023)	F <sub>total</sub> (ages 2–4) (2023)	F <sub>projected</sub> landings (ages 2–4) (2023)	F <sub>projected</sub> discards (ages 2–4) (2023)	SSB (2024)	% SSB change **	% TAC change ***	% advice change ^	% probability of falling below B <sub>lim</sub> in 2024 ^^
ICES advice basis											
MSY approach: F <sub>MSY</sub> × SSB (2023) /MSY B <sub>trigger</sub>	26008	21785	4223	0.21	0.166	0.043	91130	25	63	82	7.5
Other scenarios											
F = F <sub>MSY</sub> lower × SSB (2023) /MSY B <sub>trigger</sub>	17863	14989	2874	0.139	0.110	0.029	97892	34	12.3	25	3.4
F = 0	0	0	0	0.00	0.00	0.00	112672	54	-100	-100	0.30
F <sub>pa</sub>	53641	44359	9282	0.49	0.39	0.100	69181	-5.3	240	280	52
F <sub>lim</sub>	61064	50279	10785	0.58	0.46	0.119	63339	-13.3	280	330	67
SSB (2024) = B <sub>lim</sub>	52784	43673	9111	0.48	0.38	0.098	69841	-4.4	230	270	50
SSB (2024) = MSY B <sub>trigger</sub> = B <sub>pa</sub>	17997	15099	2898	0.140	0.111	0.029	97777	34	13.1	26	3.6
TAC (2022) -20%	12729	10699	2030	0.097	0.077	0.020	102182	40	-20.0	-10.8	2.2
TAC (2022) -15%	13524	11368	2156	0.104	0.082	0.022	101533	39	-15.0	-5.3	2.5
TAC (2022) -10%	14320	12032	2288	0.110	0.087	0.023	100877	38	-10.0	0.31	2.7
TAC (2022) -5%	15116	12698	2418	0.116	0.093	0.023	100207	37	-5.0	5.9	2.8
TAC (2022)	15911	13370	2541	0.123	0.098	0.025	99554	36	0.00	11.5	2.8
TAC (2022) +5%	16707	14041	2666	0.129	0.103	0.026	98892	35	5.0	17.0	3.3
TAC (2022) +10%	17502	14696	2806	0.136	0.108	0.028	98200	34	10.0	23	3.4
TAC (2022) +15%	18297	15346	2951	0.143	0.113	0.030	97502	33	15.0	28	3.7
TAC (2022) +20%	19093	16011	3082	0.149	0.119	0.030	96820	33	20.0	34	4.1
F = F <sub>2022</sub>	22523	18897	3626	0.179	0.142	0.037	93985	29	42	58	5.6
F = F <sub>MSY</sub> lower	23374	19604	3770	0.186	0.148	0.038	93301	28	47	64	5.9
F = F <sub>MSY</sub>	33693	28121	5572	0.28	0.22	0.057	84708	16.0	112	136	14.9

\* Including below minimum size (BMS) landings, assuming recent discard rate.

\*\* SSB 2024 relative to SSB 2023.

\*\*\* Total catch in 2023 relative to TAC in 2022: North Sea (13 246 t) + Skagerrak (1893 t) + eastern English Channel (772 t) = 15 911 t.

^ Total catch in 2023 relative to advice value for 2022 (14 276 t).

^^ This probability relates to the short-term probability of SSB < B<sub>lim</sub> and is not comparable to the long-term probability of SSB < B<sub>lim</sub> tested in simulations when estimating fishing mortality reference points.

The change in advice (+82%), comparing to last year, is due to a larger stock size estimated for the start of the advice year which leads to a higher target fishing mortality (F = 0.21 compared to F = 0.144 used last year), according to the MSY approach.

### Basis of the advice

**Table 3** Cod in Subarea 4, Division 7.d, and Subdivision 20. The basis of the advice.

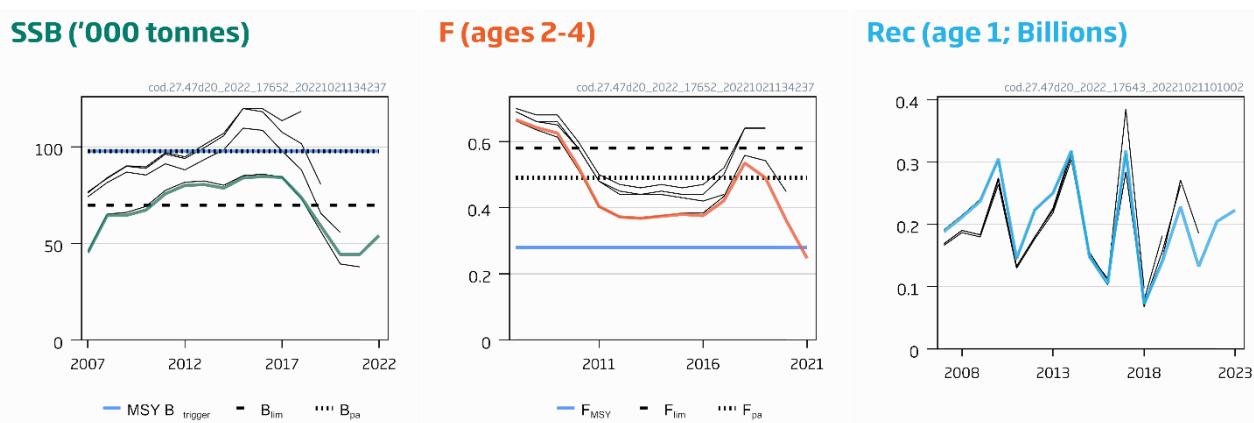
Advice basis	ICES MSY approach
Management plan	ICES is aware of the EU multiannual management plan (MAP) that has been agreed for this stock (EU, 2018) and considers it to be precautionary. There is no agreement with Norway and the UK regarding this plan, and it is not used as the basis of the advice for this shared stock. ICES provides catch scenarios consistent with the F <sub>MSY</sub> ranges in the MAP.

### Quality of the assessment

Stock identity remains an issue with this assessment, with multiple populations inhabiting the North Sea and extending to neighbouring areas (ICES, 2020a). The 2021 benchmark introduced an *ad hoc* adjustment on natural mortality of ages 3+ from 2011 to account for migration to the West of Scotland area, which is not included in the assessment area.

The proportion of landings sampled for ages was lower in 2020 (75%) and 2021 (78%) than in 2019 (89%), likely because of the COVID-19 situation. Weights-at-age in the catch and selectivity patterns, however, did not exhibit unreasonable deviations from the previous years.

A combination of several major storms and mechanical issues with some vessels resulted in a reduction in the sampling coverage in the IBTS–Q1 survey in 2022. Thus, the survey data was not fully representative of the distribution of cod due to incomplete survey coverage, especially in the central and northern North Sea. However, it was considered appropriate as an abundance index.



**Figure 2** Cod in Subarea 4, Division 7.d, and Subdivision 20. Historical assessment results. The reference points were revised in 2021 following a benchmark, and only assessment results from the last two years should be compared to the reference points indicated.

### Issues relevant for the advice

This advice is a revision of the June advice according to the reopening protocol (ICES, 2020b). The IBTS-Q3 survey shows a higher recruitment than was previously assumed which triggered the revision of the advice. The catch advice for 2023 is now based on landings data for 1 January–30 June 2022, which were used to predict annual landings and catches (assuming the same discard ratio by age as in 2021) for the intermediate year. This corresponds to a reduction in fishing mortality in the intermediate year from 0.21 in June advice to 0.179 (Table 1).

Because the SSB (2022) is currently below B<sub>lim</sub>, ICES has provided the probability of SSB being below B<sub>lim</sub> in 2024 for each of the scenarios presented in Table 2. Given the advised catch of 26 008 tonnes, the probability of SSB being below B<sub>lim</sub> in 2024 is 7.5%.

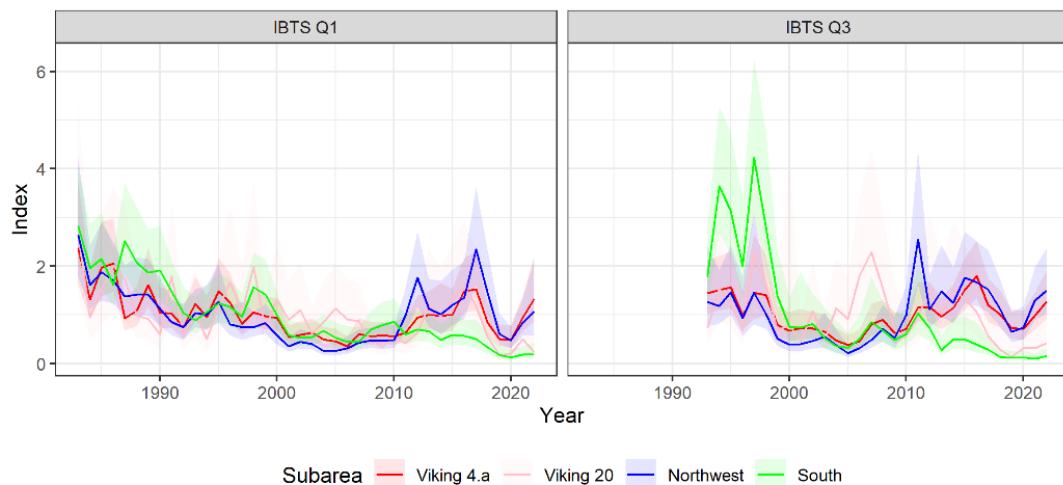
Cod in the North Sea is under the EU landing obligation, and Norway and UK national legislation regulating discards. The below minimum size (BMS) landings of cod reported to ICES are currently negligible, and are much lower than the discards estimated by observer programmes.

Although F has reduced, recent catches have not been in line with ICES advice. The SSB remains below B<sub>lim</sub>, with an ongoing high risk of impaired recruitment.

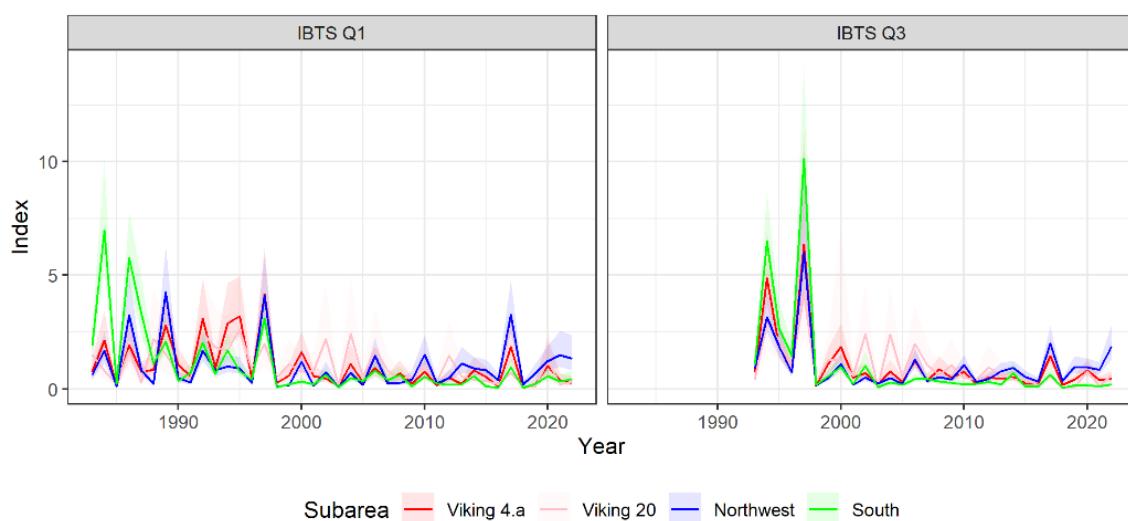
Recreational catches are estimated to account for 4.3–7.6% of total removals between 2010–2020, but values are provisional and not included in the assessment due to unknown age structure in recreational catches and high uncertainty in the estimates.

The North Sea cod stock consists of reproductively isolated populations of Viking cod and Dogger cod, with the Dogger cod population extending to Division 6a (ICES, 2020a). These genetically different groups have different rates of sexual maturity and growth.

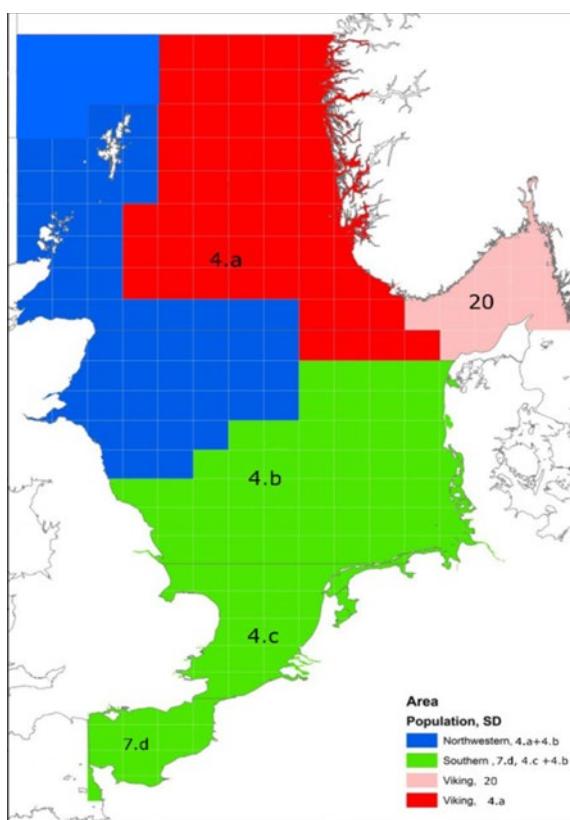
Trends in biomass and recruitment from surveys were strongly correlated among subareas of the North Sea in the past but have diverged in the last decade, with no apparent rebuilding in the south (Figures 3–5).



**Figure 3** Cod in Subarea 4, Division 7.d, and Subdivision 20. Biomass indices by subregion (see Figure 5), based on the NS-IBTS Q1 and Q3 survey data. The indices and confidence intervals are mean standardized for each subregion.



**Figure 4** Cod in Subarea 4, Division 7.d, and Subdivision 20. Recruitment indices by subregion (see Figure 5), based on NS-IBTS Q1 and Q3 survey data. The indices and confidence intervals are mean standardized for each subregion.



**Figure 5** Cod in Subarea 4, Division 7.d, and Subdivision 20. Subregions used to derive area-specific biomass indices, based on NS-IBTS Q1 and Q3 survey data. Note that these areas are used to define the different subpopulations based on ICES (2020).

#### Reference points

**Table 4** Cod in Subarea 4, Division 7.d, and Subdivision 20. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	97 777	$B_{pa}$ ; in tonnes.	ICES (2021)
	$F_{MSY}$	0.28	Stochastic simulations (EqSim) based on the recruitment period 1998–2020	ICES (2021)
Precautionary approach	$B_{lim}$	69 841	$B_{pa}/1.4$ ; in tonnes	ICES (2021)
	$B_{pa}$	97 777	Highest observed SSB (1998) based on the recruitment period 1998–2020 with 2019 as the last year of catch data; in tonnes	ICES (2021)
	$F_{lim}$	0.58	The F that on average leads to $B_{lim}$	ICES (2021)
	$F_{pa}$	0.49	The F that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P,0.05}$ with advice rule [AR])	ICES (2021)
EU Management Plan (MAP) EU (2018)	MAP MSY $B_{trigger}$	97 777	MSY $B_{trigger}$	ICES (2021)
	MAP $B_{lim}$	69 841	$B_{lim}$	ICES (2021)
	MAP $F_{MSY}$	0.28	$F_{MSY}$	ICES (2021)
	MAP range $F_{lower}$	0.186–0.28	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with $F_{MSY}$	ICES (2021)
	MAP range $F_{upper}$	0.28–0.45	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with $F_{MSY}$	ICES (2021)

## Basis of the assessment

**Table 5** Cod in Subarea 4, Division 7.d, and Subdivision 20. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based analytical assessment (SAM; ICES, 2022b) that uses catches in the model and in the forecast (Nielsen and Berg, 2014)
Input data	Commercial catches (international catches and ages from catch sampling by métier), two survey indices (IBTS Q1 [G1022] 1983–2022 and IBTS Q3 [G2829] 1992–2022) derived by a Delta–GAM approach; a third index for recruits is derived from the same IBTS Q3 Delta-GAM approach. Annually varying maturity data from IBTS Q1 ([G1022]; 1978–2022). Annually varying natural mortalities from the North Sea multispecies model. An <i>ad hoc</i> adjustment of M to mimic emigration of 3+ cod out of the assessment area has been implemented for M values from 2011 and onwards.
Discards, BMS landings, and bycatch	In 2021, 57% of the landings had associated discards reported to ICES and 34% were raised. Below minimum size (BMS) landings, where reported, are included with discards in the assessment from 2016.
Indicators	NS-IBTS (G1022 and G2829) biomass indices by subregion
Other information	Benchmarked in 2021 (ICES, 2021).
Working group	Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak ( <a href="#">WGNSSK</a> )

## History of the advice, catch, and management

**Table 6a** Cod in Subarea 4, Division 7.d, and Subdivision 20. North Sea (Subarea 4). ICES advice, TAC, official landings, and ICES estimates of landings and discards. All weights are in tonnes. Values of official landings and ICES landings for the period 1987 to 1996 are presented to the nearest thousand tonnes.

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC	Official landings*	ICES landings**	ICES discards ▲
1987	SSB recovery; TAC	100 000–125 000		175 000	167 000	182 000	
1988	70% of F (86); TAC	148 000		160 000	142 000	157 000	
1989	Halt SSB decline; protect juveniles; TAC	124 000		124 000	110 000	116 000	
1990	80% of F (88); TAC	113 000		105 000	99 000	105 000	
1991	70% of effort (89)			100 000	87 000	89 000	
1992	70% of effort (89)			100 000	98 000	97 000	
1993	70% of effort (89)			101 000	94 000	105 000	
1994	Significant effort reduction			102 000	87 000	95 000	
1995	Significant effort reduction			120 000	111 000	120 000	
1996	80% of F (94) = 0.7	141 000		130 000	107 000	107 000	
1997	80% of F (95) = 0.65	135 000		115 000	99 423	102 169	
1998	F (98) should not exceed F (96)	153 000		140 000	114 324	122 103	
1999	F = 0.60 to rebuild SSB	125 000		132 400	77 566	78 392	
2000	F less than 0.55	< 79 000		81 000	60 881	59 767	
2001	Lowest possible catch	0		48 600	41 713	40 973	
2002	Lowest possible catch	0		49 300	44 526	42 193	7235
2003	Closure	0		27 300	25 958	24 083	2643
2004	Zero catch	0		27 300	23 806	22 529	5026
2005	Zero catch	0		27 300	22 500	22 855	5236
2006	Zero catch	0		23 205	23 119	21 078	5236
2007	Zero catch	0		19 957	20 102	19 056	22 418
2008	Exploitation boundaries in relation to precautionary limits. Total removals < 22 000 t	< 22 000		22 152	22 262	21 657	20 710
2009	Zero catch	0		28 798	27 497	27 634	13 542
2010	Management plan F (65% of F <sub>2008</sub> )	< 40 300 ***		33 552	31 657	30 980	10 122
2011	See scenarios	-		26 842	27 800	26 675	6071
2012	Management plan F (45% of F <sub>2008</sub> )	< 31 800		26 475	27 640	26 627	6533
2013	Management plan (TAC –20%)	< 25 441		26 475	26 324	25 315	8421
2014	Management plan long-term phase	< 28 809		27 799	29 355	28 550	7831

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC	Official landings*	ICES landings**	ICES discards ^
2015	Management plan long-term phase	< 26 713		29 189	32 012	31 244	9601
2016	MSY approach	≤ 40 419	≤ 49 259	33 651	34 265	33 035	10 538
2017	MSY approach		≤ 47 359	39 220	34 746	33 109	7945
2018	MSY approach		≤ 53 058	43 156	35 997	34 444	6873
2019	MSY approach		≤ 28 204	29 437	28 163	28 558	3240
2020	MSY approach		≤ 13 686	14 718	17 095	17 192	2588
2021	MSY approach		≤ 14 755	13 246	12 718	12 737	3129
2022	MSY approach		≤ 14 276	13 246			
2023	MSY approach		≤ 26 008				

\* Official landings for Norway include Norwegian fjords.

\*\* Norwegian fjords not included from 2002 onwards.

\*\*\* From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (eastern English Channel), and Subdivision 20 (Skagerrak).

^ Since 2016, discards include BMS landings.

**Table 6b** Cod in Subarea 4, Division 7.d, and Subdivision 20. Skagerrak (Subdivision 20). ICES advice, TAC, official landings, and ICES estimates of landings and discards. All weights are in tonnes. Values of official landings and ICES landings for the period 1987 to 1996 are presented to the nearest hundred tonnes.

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC*	Official landings	ICES landings*	ICES discards^
1987	$F = F_{max}$	< 21 000		22 500	19 900	20 900	
1988	Reduce F			21 500	17 000	16 900	
1989	$F$ at $F_{med}$	< 23 000		20 500	18 700	19 600	
1990	$F$ at $F_{med}$ ; TAC	21 000		21 000	17 800	18 600	
1991	TAC	15 000		15 000	12 100	12 400	
1992	70% of F (90)			15 000	14 000	14 800	
1993	Precautionary TAC			15 000	14 700	15 300	
1994	No long-term gain in increased F + precautionary TAC			15 500	15 100	13 900	
1995	If required precautionary TAC; link to North Sea			20 000	19 800	12 100	
1996	If required precautionary TAC; link to North Sea			23 000	17 900	16 400	
1997	If required precautionary TAC; link to North Sea			16 100	15 736	14 946	
1998	If required precautionary TAC; link to North Sea	21 900		20 000	15 586	15 331	
1999	$F = 0.60$ to rebuild SSB	17 900		19 000	11 790	10 974	
2000	F less than 0.55	< 11 300		11 600	9957	9277	
2001	Lowest possible catch	0		7000	7729	7086	
2002	Lowest possible catch	0		7100	7170	6854	4168
2003	Closure	0		3900	4483	3979	1225
2004	Zero catch	0		3900	4516	3914	3552
2005	Zero catch	0		3900	4375	3998	4573
2006	Zero catch	0		3315	3972	3258	6398
2007	Zero catch	0		2851	3751	3020	5946
2008	Exploitation boundaries in relation to precautionary limits. Total removals less than 22 000 t	< 22 000		3165	3769	3393	2697
2009	Zero catch	0		4114	3982	3794	2910
2010	Management plan F (65% of $F_{2008}$ )	< 40 300**		4793	4211	4057	2023
2011	See scenarios	-		3835	4117	3956	2050
2012	Management plan F (45% of $F_{2008}$ )	< 31 800		3783	4391	4327	2054
2013	Management plan (TAC -20%)	< 25 441		3783	4240	4154	1780
2014	Management plan long-term phase	< 28 809		3972	4650	4687	2210

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC*	Official landings	ICES landings*	ICES discards^
2015	Management plan long-term phase	< 26 713		4171	4533	4563	2942
2016	MSY approach	≤ 40 419	≤ 49 259	4807	5006	4774	1704
2017	MSY approach		≤ 47 359	5744	4852	4715	777
2018	MSY approach		≤ 53 058	7995	5332	5484	951
2019	MSY approach		≤ 28 204	4205	3339	3478	367
2020	MSY approach		≤ 13 686	2103	2239	2299	2113
2021	MSY approach		≤ 14 755	1893	1940	2017	663
2022	MSY approach		≤ 14 276	1893			
2023	MSY approach		≤ 26 008				

\* Norwegian fjords not included.

\*\* From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (eastern English Channel), and Subdivision 20 (Skagerrak).

^ Since 2016 discards include BMS landings.

**Table 6c** Cod in Subarea 4, Division 7.d, and Subdivision 20. **Eastern English Channel (Division 7.d)**. ICES advice, TAC, official landings, and ICES estimates of landings and discards. All weights are in tonnes. Values of official landings and ICES landings for the period 1987 to 1996 are presented to the nearest hundred tonnes.

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC*	Official landings	ICES landings	ICES discards^
1987	Not assessed	-		-	9400	14200	
1988	Precautionary TAC	-		-	10100	10700	
1989	No increase in F; TAC	10000**		-	n/a	5500	
1990	No increase in F; TAC	9000**		-	n/a	2800	
1991	Precautionary TAC	3000**		-	n/a	1900	
1992	If required, precautionary TAC	5500**		-	2700	2700	
1993	If TAC required, consider SSB decline	-		-	2500	2400	
1994	Reduce F + precautionary TAC			-	2900	2900	
1995	Significant effort reduction; link to North Sea			-	4000	4000	
1996	Reference made to North Sea advice			-	3500	3500	
1997	No advice			-	7178	7043	
1998	Link to North Sea	4900		-	8665	8580	
1999	F = 0.60 to rebuild SSB	4000		-	629	6858	
2000	F less than 0.55	< 2500		-	3583	2325	
2001	Lowest possible catch	0		-	2036	1573	
2002	Lowest possible catch	0		-	1563	3139	507
2003	Closure	0		-	1941	2131	213
2004	Zero catch	0		-	974	1014	225
2005	Zero catch	0		-	1230	1259	278
2006	Zero catch	0		-	1480	1479	377
2007	Zero catch	0		-	2073	2147	2086
2008	Exploitation boundaries in relation to precautionary limits; total removals less than 22 000 t	< 22000		-	1662	1629	1674
2009	Zero catch	0		1678	2023	1887	4513
2010	Management plan F (65% of $F_{2008}$ )	< 40300***		1955	1836	1708	343
2011	See scenarios	-		1564	1311	1319	623
2012	Management plan F (45% of $F_{2008}$ )	< 31800		1543	1064	1120	102
2013	Management plan (TAC -20%)	< 25441		1543	959	916	123
2014	Management plan long-term phase	< 28809		1620	1548	1436	624
2015	Management plan long-term phase	< 26713		1701	1434	1398	19
2016	MSY approach	≤ 40419	≤ 49259	1961	459	421	72
2017	MSY approach		≤ 47359	2059	180	170	9
2018	MSY approach		≤ 53058	1733	92	84	0
2019	MSY approach		≤ 28204	1715	38	36	0
2020	MSY approach		≤ 13686	858	40	32	0

Year	ICES advice	Landings corresponding to advice	Catch corresponding to advice	Agreed TAC*	Official landings	ICES landings	ICES discards^
2021	MSY approach		≤ 14755	772	28	37	1
2022	MSY approach		≤ 14276	772			
2023	MSY approach		≤ 26008				

\* Until 2008, this area was included in the TAC for Subarea 7 (except Division 7.a). From 2009, a separate TAC was set.

\*\* Including Division 7.e.

\*\*\* From 2010 onwards, the advice is for Subarea 4 (North Sea), Division 7.d (eastern English Channel), and Subdivision 20 (Skagerrak).

^ Since 2016, discards include BMS landings.

## History of the catch and landings

**Table 7** Cod in Subarea 4, Division 7.d, and Subdivision 20. Catch distribution by fleet in 2021 as estimated by ICES.

Catch	Landings					Discards*
18 583 tonnes	Demersal trawls and seines >100 mm 73%	Gillnets 10%	Demersal trawls 70–99 mm 8%	Beam trawls 5%	Other gears 4%	3792 tonnes
	14 791 tonnes					

\* Discards include BMS landings.

**Table 8** Cod in Subarea 4, Division 7.d, and Subdivision 20. History of commercial landings; both the official and ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

Country	Subarea 4																		
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020***	2021***	
Belgium	1627	1722	1309	1008	894	946	666	653	862	1075	1258	1223	1103	695	817	727	666	553	
Denmark	5889	6291	5105	3430	3831	4402	5686	4863	4803	4536	5457	6026	6713	6119	5493	4967	3064	2021	
Faroe Islands	37	34	3	-	16	45	32	-	-	-	-	-	-	-	-	< 0.5	1	-	
France	294	664	354	659	573	950	782	619	369	287	637	517	391	401	583	450	265	284	
Germany	2213	2648	2537	1899	1736	2374	2844	2211	2385	1921	2257	2133	2083	2300	1510	824	755	767	
Greenland	.	35	23	17	17	11	-	-	-	-	-	-	2	1	-	-	-	-	
Netherlands	1726	1660	1585	1523	1896	2649	2657	1928	1955	1344	1242	1403	1365	653	515	719	590	618	
Norway	3223	2900	2749	3057	4128	4234	4495	4898	4601	4080	4600	5404	5627	5521	5539	4509	2330	1659	
Poland	-	-	-	1	2	3	-	2	-	-	-	-	-	-	-	-	-	-	
Sweden	240	319	309	386	439	378	362	316	471	332	401	415	373	387	274	344	354	396	
UK (E/W/NI)	1890	1270	1491	1587	1546	2383	2553	2169	1629	2129	2962	.	.	.	.	.	.	.	
UK (Scotland)	6650	4936	6857	6511	7185	9052	11 567	10 141	10 565	10 619	10 517	.	.	.	.	.	.	.	
UK (combined)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	14 889	16 603	18 523	21 265	15 621	9061	6416	
Others	-	-	786	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.5	
Danish industrial bycatch	17	21	11	23	1	72	12	< 0.5	< 0.5	2	24	< 0.5	5	147	< 0.5	2	11	5	
Norwegian industrial bycatch*	.	.	48	101	22	4	201	1	.	.	.	.	.	.	.	.	.	.	
Total nominal catch	23 806	22 500	23 119	20 102	22 262	27 497	31 657	27 800	27 640	26 324	29 355	32 012	34 265	34 746	35 997	28 163	17 095	12 718	
Unallocated landings	-1277	356	-2041	-1046	-605	136	-677	-1125	-1013	-1009	-805	-768	-1230	-1637	-1553	395	97	19	
BMS landings	-	-	-	-	-	-	-	-	-	-	-	-	-	1	8	41	32	8	
ICES estimate of total landings	22 529	22 855	21 078	19 056	21 657	27 634	30 980	26 675	26 627	25 315	28 550	31 244	33 035	33 109	34 444	28 558	17 192	12 737	
Agreed TAC	27 300	27 300	23 205	19 957	22 152	28 798	33 552	26 842	26 475	26 475	27 799	29 189	33 651	39 220	43 156	29 437	14 718	13 246	

Country	Division 7.d																		
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020***	2021***	
Belgium	47	51	80	84	154	73	57	56	40	53	72	78	39	18	8	3	8	12	
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
France	810	986	1124	1743	1326	1779	1606	1078	885	768	1270	1142	279	92	35	16	10	5	
Netherlands	14	9	9	59	30	35	45	51	40	38	50	52	40	22	10	3	2	1	
UK (E/W/NI)	103	184	267	174	144	133	127	125	99	100	156	.	.	.	.	.	.	.	
UK (Scotland)	-	-	1	12	7	3	1	1	-	-	-	.	.	.	.	.	.	.	
UK (combined)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	162	102	48	39	17	20	11	
Others	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.5	-	< 0.5	-	-	
Total nominal catch	974	1230	1480	2073	1662	2023	1836	1311	1064	959	1548	1434	459	180	92	38	40	28	
Unallocated landings	40	29	-2	74	-33	-135	-128	8	56	-43	-112	-36	-38	-10	-8	-3	-8	9	
BMS landings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.5	< 0.5	< 0.5	
ICES estimate of total landings	1014	1259	1479	2147	1629	1887	1708	1319	1120	916	1436	1398	421	170	84	36	32	37	
Agreed TAC	n/a	n/a	n/a	n/a	n/a	1678	1955	1564	1543	1543	1620	1701	1961	2059	1733	1715	858	772	

Subdivision 20 **																		
Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020***	2021***
Denmark	3038	3019	2513	2246	2553	3024	3286	3118	3178	3033	3430	3344	3696	3665	4222	2740	1857	1597
Germany	99	86	84	67	52	55	56	60	78	69	84	87	94	67	86	52	35	25
Norway	856	759	628	681	779	440	375	421	615	575	533	500	551	486	288	151	94	68
Sweden	495	488	372	370	365	459	458	518	520	529	570	571	641	557	670	355	223	238
Others	24	21	373	385	13	2	26	-	-	33	29	26	25	38	58	40	18	11
Danish industrial by-catch	4	2	3	2	7	2	10	< 0.5	1	1	5	5	< 0.5	40	7	1	13	1
Total nominal catch	4516	4375	3972	3751	3769	3982	4211	4117	4391	4240	4650	4533	5006	4852	5332	3339	2239	1940
Unallocated landings	-602	-376	-715	-731	-376	-188	-154	-161	-64	-86	37	31	-232	-137	152	139	61	77
BMS landings	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	3	4	5
ICES estimate of total landings	3914	3998	3258	3020	3393	3794	4057	3956	4327	4154	4687	4563	4774	4715	5484	3478	2299	2017
Agreed TAC	3900	3900	3315	2851	3165	4114	4793	3835	3783	3783	3972	4171	4807	5744	7995	4205	2103	1893

Subarea 4, Division 7.d, and Subdivision 20 combined																		
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020***	2021***
Total nominal catch	29 296	28 104	28 572	25 926	27 693	33 502	37 704	33 228	33 095	31 523	35 554	37 978	39 730	39 778	41 421	31 540	19 373	14 686
Unallocated landings	-1839	9	-2757	-1703	-1014	-187	-958	-1277	-1022	-1138	-881	-773	-1500	-1784	-1409	532	150	105
BMS landings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	12	44	36
ICES estimate of total landings	27 457	28 113	25 815	24 223	26 679	33 315	36 746	31 950	32 074	30 386	34 673	37 205	38 230	37 994	40 012	32 072	19 523	14 791
Sum of agreed TACs	31 200	31 200	26 520	22 808	25 317	34 590	40 300	32 241	31 801	31 801	33 391	35 061	40 419	47 023	52 884	35 357	17 679	15 911

#### Subarea 4 and Subdivision 20 landings not included in the assessment

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Norwegian industrial bycatch *	.	.	48	101	22	4	201	1	.	.	.	.	.	.	.	.	.	
Total	.	.	48	101	22	4	201	1	.	.	.	.	.	.	.	.	.	

\* The Norwegian industrial bycatch is not included in the (working group estimate of) total landings.

\*\* Skagerrak/Kattegat split derived from national statistics prior to 2016.

\*\*\* Official landings are preliminary.

^ No agreed TAC in division 7d prior to 2009

. = Magnitude not available.

- = Magnitude known to be nil.

< 0.5 = Magnitude less than half the unit used in the table.

n/a = Not applicable.

### Summary of the assessment

**Table 9** Cod in Subarea 4, Division 7.d, and Subdivision 20. Assessment summary. Highs and lows refer to 95% confidence intervals. Catches (landings and discards) are assessment inputs.

Year	Recruitment (Age 1)			Spawning Stock Biomass			Landings**	Discards**	Fishing pressure (Ages 2–4)		
	R	High	Low	SSB	High	Low			F	High	Low
	thousands			tonnes			tonnes				
1963	448879	620375	324792	129744	210245	80067	115893	12199	0.47	0.55	0.40
1964	735304	1014232	533085	138581	223177	86052	125393	4656	0.52	0.60	0.45
1965	979441	1344669	713413	162757	262001	101106	180120	28973	0.57	0.66	0.50
1966	1193002	1637204	869320	182574	289529	115129	220197	37862	0.57	0.66	0.50
1967	1015848	1395321	739578	205322	317573	132748	251687	23285	0.62	0.70	0.54
1968	505145	694954	367177	209979	329277	133903	286948	17468	0.66	0.75	0.57
1969	438697	607138	316988	208284	310334	139792	199746	4757	0.61	0.70	0.54
1970	1469677	2022564	1067927	213929	304482	150307	224993	17663	0.65	0.73	0.57
1971	1949023	2692632	1410772	220614	298732	162924	326492	84007	0.75	0.84	0.66
1972	482251	666750	348806	201619	275331	147641	352161	33603	0.82	0.92	0.73
1973	696940	962380	504713	166614	236677	117292	237874	29966	0.79	0.89	0.70
1974	691259	956185	499735	178411	241121	132011	213215	39533	0.75	0.84	0.66
1975	1189072	1657764	852892	169146	214920	133122	204249	36841	0.81	0.91	0.72
1976	806197	1130803	574772	146131	182698	116883	233007	72397	0.87	0.98	0.77
1977	1985757	2769946	1423576	122529	153155	98027	208318	139027	0.82	0.92	0.73
1978	1188124	1658601	851102	118197	143164	97585	294640	32434	0.93	1.03	0.83
1979	1481562	2067952	1061449	118543	143849	97689	266019	162278	0.84	0.94	0.75
1980	2348608	3290782	1676185	118543	142443	98654	293753	294208	0.92	1.03	0.83
1981	940544	1315525	672449	128378	152613	107991	333616	57076	0.93	1.04	0.84
1982	1470717	2027785	1066685	129400	152447	109838	302365	54008	1.05	1.17	0.95
1983	834323	1120493	621240	108670	127355	92726	257634	21430	1.03	1.15	0.93
1984	1497219	1994591	1123872	96563	113545	82121	227070	151004	0.96	1.07	0.87
1985	371613	508210	271730	92500	108713	78705	214354	31298	0.92	1.02	0.83
1986	1811547	2405169	1364437	80540	94673	68518	201279	138604	1.00	1.11	0.90
1987	708292	940420	533461	83513	98409	70871	216041	27706	0.97	1.08	0.88
1988	473589	639310	350826	78012	93443	65129	183202	10504	1.00	1.10	0.90
1989	844008	1130051	630369	74712	87090	64093	139578	61656	1.02	1.13	0.93
1990	339517	455209	253228	66205	76940	56968	124835	26747	0.95	1.05	0.85
1991	398867	529576	300420	66219	76704	57167	101442	18199	0.94	1.04	0.84
1992	964171	1254474	741048	68143	78201	59378	112740	36193	0.91	1.00	0.82
1993	439577	568694	339775	69976	81499	60083	119947	21412	0.98	1.08	0.88
1994	1057585	1367359	817990	72382	83891	62451	109915	98208	0.95	1.05	0.86
1995	692028	890702	537669	77700	89888	67164	136397	31707	0.88	0.97	0.79
1996	477477	618701	368489	92943	107263	80535	124721	14030	0.90	1.00	0.82

Year	Recruitment (Age 1)			Spawning Stock Biomass			Landings**	Discards**	Fishing pressure (Ages 2–4)		
	R	High	Low	SSB	High	Low			F	High	Low
	thousands			tonnes			tonnes				
1997	1535829	1985258	1188143	94962	107719	83716	122434	33184	0.93	1.02	0.84
1998	142751	190042	107228	98574	115824	83892	144637	40102	1.12	1.23	1.02
1999	312322	411390	237112	79182	90767	69075	94108	13642	1.15	1.25	1.05
2000	451128	587169	346605	56004	63449	49433	69567	13360	1.16	1.28	1.06
2001	183102	239937	139729	43384	50309	37413	48440	13519	0.87	0.96	0.78
2002	261754	344485	198891	46653	53399	40760	53152	11901	1.06	1.18	0.96
2003	121914	160599	92547	34911	40030	30446	30426	4007	0.75	0.85	0.67
2004	241882	317924	184028	33269	37742	29327	27748	8721	0.80	0.90	0.72
2005	189014	249036	143459	32081	37038	27786	28165	9932	0.82	0.92	0.73
2006	420206	543831	324684	34227	39994	29291	25665	11923	0.73	0.82	0.65
2007	187994	244872	144327	45174	53087	38441	24215	30422	0.67	0.76	0.59
2008	211252	274338	162672	64486	75183	55312	26814	24984	0.64	0.73	0.56
2009	236841	310798	180483	64626	75613	55236	33177	20846	0.63	0.72	0.54
2010	305331	393809	236731	67293	80470	56274	36762	12341	0.52	0.61	0.45
2011	145183	191241	110218	75754	93151	61607	31979	8711	0.40	0.47	0.35
2012	223399	294019	169740	80025	98807	64813	32124	8638	0.37	0.44	0.32
2013	250024	326315	191570	80507	99452	65171	30474	10289	0.37	0.43	0.32
2014	317889	409986	246480	78644	97090	63702	34651	10538	0.37	0.44	0.32
2015	148615	193276	114275	83922	103942	67758	37373	12537	0.38	0.44	0.33
2016	104716	136879	80111	84688	104019	68950	38104	12203	0.38	0.43	0.33
2017	318508	417095	243223	84181	102658	69030	37668	8702	0.42	0.48	0.37
2018	71823	93817	54985	73762	90579	60068	40153	7744	0.54	0.62	0.46
2019	140015	182281	107549	58998	74816	46524	32361	3555	0.49	0.57	0.42
2020	228230	304585	171016	44289	57644	34029	19373	4700	0.36	0.43	0.30
2021	132322	181993	96208	44335	58383	33667	14660	3744	0.25	0.31	0.20
2022*	204530	351748	118927	54148	71276	41137					
2023*	222820	974261	50960								

\* Recruitment in 2022–2023 are the assessment estimates. The values provided in Table 1 are the medians from a normal distribution of the assessment estimates required for stochastic projections.

\*\* Any differences in landings and discards values between Table 9 and others in the advice are due to SOP correction.

## Sources and references

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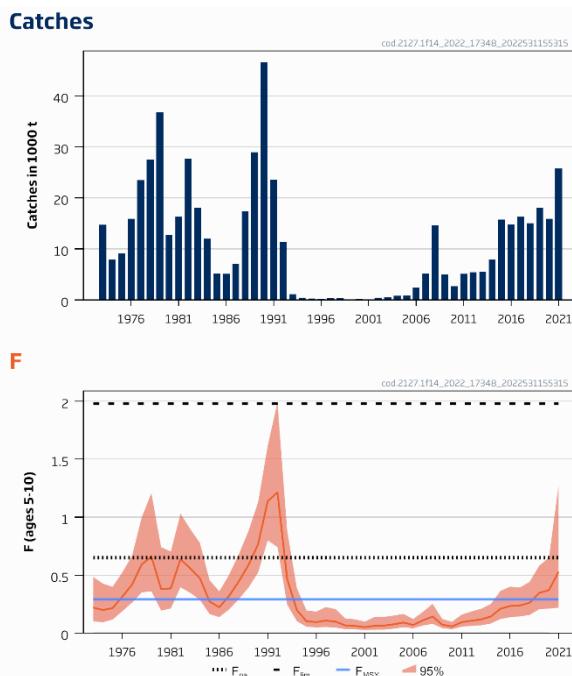
## Cod (*Gadus morhua*) in ICES Subarea 14 and NAFO Division 1F (East Greenland, Southwest Greenland)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 8460 tonnes.

### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$  but below  $F_{pa}$  and  $F_{lim}$ ; spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Cod in ICES Subarea 14 and NAFO Division 1F. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Cod in ICES Subarea 14 and NAFO Division 1F. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 5-10}\ (2022)$	0.995	Based on catch constraint
SSB (2023)	48317	Short-term forecast; tonnes
$R_{age\ 1}\ (2022)$	7781	Median of resamples from the time-series 1973–2020. thousands
Catch (2022)	27430	TAC 2022; tonnes

**Table 2** Cod in ICES Subarea 14 and NAFO Division 1F. Annual catch scenarios. All weights are in tonnes.

Rationale	Catch (2023)	F (2023)	SSB (2024)	% SSB change*	% advice change**	% TAC change***
<b>ICES advice basis</b>						
MSY approach: $F_{MSY}$	8460	0.290	60722	+26	-4	-69
<b>Other scenarios</b>						
$F = 0$	0	0	76675	+59	-100	-100
$F = F_{2022}$	19782	0.995	45552	-6	+126	-28

\* SSB<sub>2024</sub> relative to SSB<sub>2023</sub> (48 317 tonnes).

\*\* Advice value for 2023 relative to the advice value for 2022 (8768 tonnes).

\*\*\* Advice value for 2023 relative to the TAC value for 2022 (27 430 tonnes).

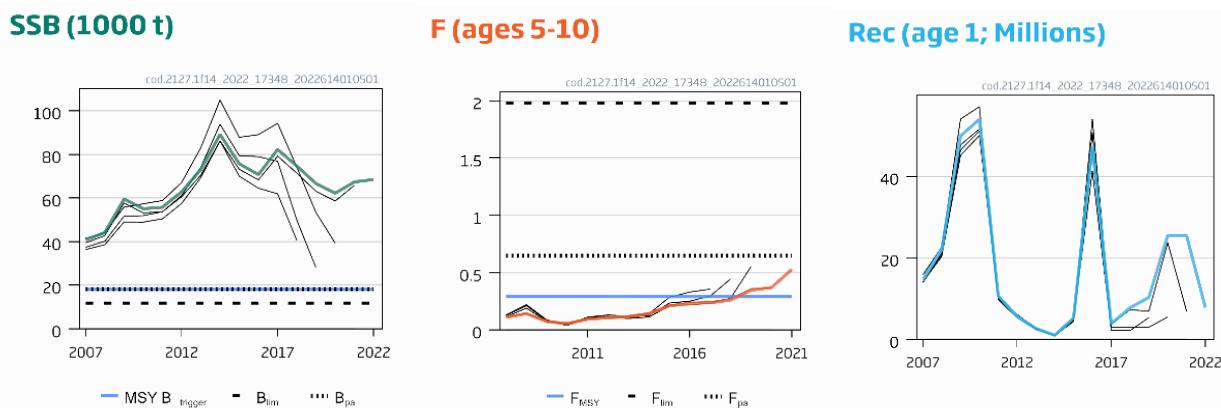
## Basis of the advice

**Table 3** Cod in ICES Subarea 14 and NAFO Division 1F. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for cod in this area

## Quality of the assessment

The assessment is considered uncertain because of unknown levels of stock mixing that affects both surveys and commercial catches. There were no surveys in this area in 2021. In recent years, fishing effort on the slope south of the Dohrn Bank (northeastern part of Division 14b), where large old cod are caught, has been increasing. These factors all contribute to the uncertainty of the assessment.



**Figure 2** Cod in ICES Subarea 14 and NAFO Division 1F. Historical assessment results. Final-year recruitment values are assumed. The reference points were revised in 2021 following an interbenchmark, and only assessment results from the last two years should be compared to the reference points indicated.

## Issues relevant for the advice

Population structure in the assessment area is poorly understood. Spawning is known to occur on Kleine Bank while juvenile migrations from west Greenland contribute substantially to the recruitment of the stock. Migration of spawning cod to Iceland has been observed. Population structure in the assessment area will be further investigated in the 2023 benchmark.

In 2021 East Greenland was split into two management areas by Greenland authorities: the Dohrn Bank area (east of 35°15'W) and the remaining part. ICES advice is for the East Greenland stock (ICES Subarea 14 and NAFO Division 1F).

The agreed TAC has never followed the catch advice.

## Reference points

**Table 4** Cod in ICES Subarea 14 and NAFO Division 1F. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{trigger}}$	18146	$B_{\text{pa}}$	ICES (2021)
	$F_{\text{MSY}}$	0.29	Stochastic simulations with a segmented regression through $B_{\text{lim}}$	ICES (2021)
Precautionary approach	$B_{\text{lim}}$	11738	Based on the lowest SSB which still gave a large recruitment (mean SSB of 2003–2005)	ICES (2021)
	$B_{\text{pa}}$	18146	$B_{\text{lim}} \times e^{1.645\sigma}, \sigma = 0.265$	ICES (2021)
	$F_{\text{lim}}$	1.98	Equilibrium F, which will maintain SSB above $B_{\text{lim}}$ with a 50% probability and with stochastic recruitment	ICES (2021)
	$F_{\text{pa}}$	0.65	The F that provides a 95% probability for SSB to be above $B_{\text{lim}}$ ( $F_{\text{P95}}$ with advice rule [AR])	ICES (2021)
Management plan	SSB <sub>mgt</sub>	-	-	
	$F_{\text{mgt}}$	-	-	

## Basis of the assessment

**Table 5** Cod in ICES Subarea 14 and NAFO Division 1F. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based analytical assessment (SAM; ICES, 2022b) that uses catches in the model and in the forecast
Input data	Catch-at-age and age-disaggregated survey indices: Greenland August bottom trawl (G2064) since 2008 and German DTS (GFS) October bottom trawl (G3244) since 1982; age-specific natural mortality incorporating emigration to Icelandic waters (from age 5 onwards) until 2015
Discards and bycatch	Discarding is considered negligible
Indicators	None
Other information	Interbenchmarked in 2021 (ICES, 2021)
Working group	Northwestern Working Group ( <a href="#">NWWG</a> )

## History of the advice, catch, and management

**Table 6** Cod in ICES Subarea 14 and NAFO Division 1F. ICES advice, TACs, and catch. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
2004	Precautionary approach*	0	5000	775
2005	Precautionary approach*	0	5000	890
2006	Precautionary approach*	0	5000	2456
2007	Precautionary approach*	0	5000	5205
2008	Precautionary approach*	0	15000	14628
2009	Precautionary approach*	0	10000	4965
2010	Precautionary approach*	0	5000	2669
2011	Precautionary approach*	0	5000	5113
2012	Precautionary approach**	0	5500	5411
2013	Precautionary approach**	0	6500	5509
2014	Precautionary approach**	0	10000	7893
2015	Precautionary approach**	0	18104	15755
2016	Precautionary approach	7577	16000	14818
2017	Precautionary approach	≤ 7930	16000	16300
2018	MSY approach	≤ 12151	16500	15068
2019	MSY approach	≤ 5363	20000	18074
2020	MSY approach	≤ 3409	18824	15933
2021	MSY approach	≤ 6091	26091	25829
2022	MSY approach	≤ 8768	27430	
2023	MSY approach	≤ 8460		

\*The advice until 2011 was included in the advice for inshore cod in NAFO Subarea 1 and offshore cod in NAFO divisions 1A–1E.

\*\* The advice for 2012–2015 was combined advice with offshore cod in NAFO divisions 1A–1E.

## History of the catch and landings

**Table 7** Cod in ICES Subarea 14 and NAFO Division 1F. Catch distribution by fleet in 2021 as estimated by ICES. All weights are in tonnes.

Catch (2021)	Landings		Discards
	Trawl 77%	Longline 23%	
25829		25829	Discarding is considered negligible

## Summary of the assessment

**Table 8** Cod in ICES Subarea 14 and NAFO Division 1F. All weights are in tonnes, recruitment in thousands. ‘High’ and ‘Low’ correspond to 95% confidence intervals.

Year	Recruitment			Spawning-stock biomass			Catches tonnes	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 5–10	High	Low
	thousands	tonnes								
1973	52079	180110	15059	85635	159933	45853	14725	0.22	0.48	0.100
1974	193807	637364	58932	64904	111517	37775	7950	0.198	0.43	0.092
1975	30891	99948	9548	60527	95444	38384	9091	0.22	0.40	0.116
1976	13778	44538	4262	63346	92181	43531	15922	0.31	0.52	0.188
1977	13006	42052	4022	75551	112203	50872	23455	0.42	0.67	0.26
1978	21256	68327	6613	104305	168318	64637	27561	0.59	1.00	0.35
1979	7639	24791	2354	120625	200308	72640	36775	0.66	1.21	0.36
1980	15784	46827	5320	100998	168063	60695	12724	0.38	0.74	0.193
1981	5361	14561	1974	80977	126363	51892	16255	0.39	0.70	0.21
1982	5621	13791	2291	60960	86686	42870	27720	0.64	1.03	0.39
1983	2342	6185	887	44439	63001	31346	18054	0.56	0.90	0.35
1984	4301	10082	1835	34908	50041	24351	11997	0.47	0.78	0.29
1985	155111	363695	66153	28035	40263	19520	5187	0.27	0.46	0.162
1986	119280	285331	49864	28106	40164	19668	5074	0.22	0.36	0.137
1987	3091	7237	1320	31702	44195	22740	7093	0.32	0.50	0.20

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Age 1	High	Low	SSB	High	Low		Ages 5–10	High	Low
	thousands			tonnes				tonnes		
1988	2638	6070	1146	40527	57252	28688	17388	0.44	0.68	0.29
1989	756	1754	326	67127	102889	43796	28917	0.59	0.88	0.39
1990	1503	3633	622	81409	128525	51566	46519	0.77	1.13	0.52
1991	2455	5993	1006	50738	82493	31207	23538	1.14	1.62	0.80
1992	854	2003	364	16077	27129	9528	11349	1.22	1.99	0.74
1993	753	1790	316	3325	5350	2067	1135	0.47	0.89	0.24
1994	3492	8648	1410	2227	3968	1250	437	0.198	0.39	0.101
1995	244	637	94	2289	3825	1370	284	0.101	0.195	0.053
1996	321	911	113	2268	3687	1395	192	0.094	0.185	0.048
1997	1577	4384	567	2583	4110	1623	355	0.107	0.22	0.051
1998	5223	12593	2166	2561	4034	1626	345	0.098	0.21	0.046
1999	10150	24869	4143	2479	3934	1562	116	0.065	0.126	0.033
2000	13984	33577	5824	2584	4018	1662	152	0.061	0.118	0.031
2001	8561	20456	3582	3290	4901	2209	125	0.050	0.099	0.025
2002	1605	4159	619	5388	7909	3671	401	0.062	0.138	0.028
2003	37736	89628	15888	8271	12113	5648	485	0.064	0.139	0.029
2004	329291	841875	128799	11581	16939	7918	775	0.075	0.151	0.037
2005	64328	155702	26577	16607	24194	11400	890	0.090	0.165	0.049
2006	35350	81507	15331	25800	37691	17661	2456	0.069	0.121	0.040
2007	14656	32538	6601	40761	60031	27676	5205	0.109	0.183	0.064
2008	22127	45342	10798	44131	63869	30493	14628	0.142	0.25	0.079
2009	49915	103774	24009	59545	89065	39810	4965	0.072	0.122	0.042
2010	54005	110743	26336	55071	80737	37564	2669	0.056	0.097	0.032
2011	10715	22266	5157	55750	81015	38364	5113	0.093	0.159	0.054
2012	5636	11613	2735	62882	89385	44237	5411	0.106	0.186	0.061
2013	2720	5596	1322	73048	103247	51681	5509	0.117	0.21	0.066
2014	1033	2214	482	89203	125502	63403	7893	0.142	0.25	0.081
2015	5298	11095	2530	75723	106997	53590	15755	0.21	0.36	0.120
2016	47421	101069	22250	70739	101537	49283	14818	0.23	0.40	0.136
2017	3874	8845	1697	82296	121270	55848	16300	0.24	0.39	0.143
2018	7781	24014	2521	74666	116000	48060	15068	0.26	0.44	0.155
2019	10314	29825	3567	66588	107218	41355	18074	0.35	0.58	0.21
2020	25521	70590	9226	62209	98747	39191	15933	0.37	0.65	0.21
2021	25521	651399	1000	67384	117926	38503	25829	0.53	1.28	0.22
2022*	7781			68494	139406	30495				

\* Recruitment is randomly resampled from the assessment estimates of 1973–2020.

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*Recommended citation:* ICES. 2022. Cod (*Gadus morhua*) in ICES Subarea 14 and NAFO Division 1.F (East Greenland, South Greenland). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, cod.2127.1f14, <https://doi.org/10.17895/ices.advice.19447838>.

## Haddock (*Melanogrammus aeglefinus*) in Division 7.a (Irish Sea)

### ICES advice on fishing opportunities

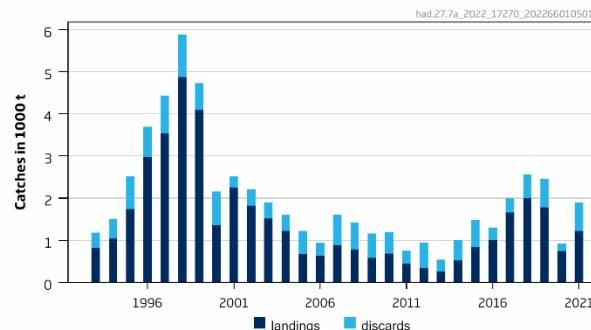
ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 2648 tonnes.

ICES notes the existence of a precautionary management plan, developed and adopted by one of the relevant management authorities for this stock.

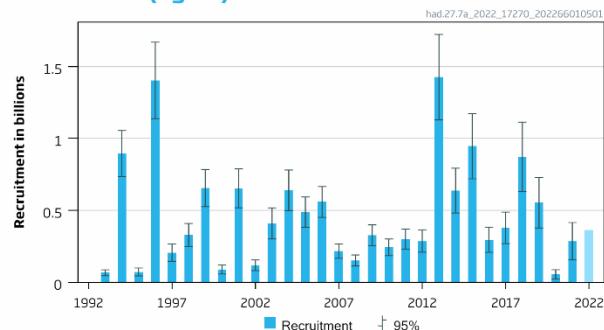
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ , and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

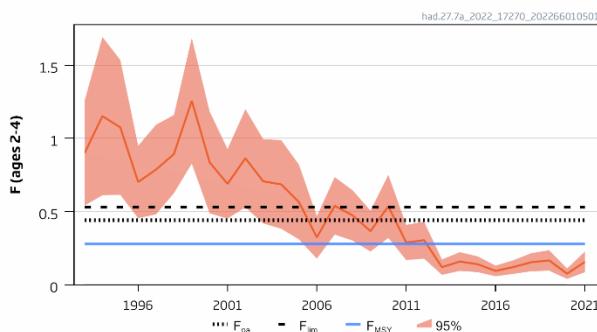
#### Catches



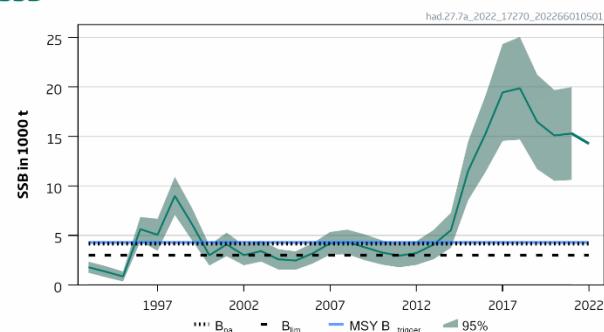
#### Recruitment (age 0)



#### F



#### SSB



**Figure 1** Haddock in Division 7.a. Summary of stock assessment. The assumed 2022 recruitment value is shaded in a light colour. The SSB in 2022 is forecasted.

### Catch scenarios

**Table 1** Haddock in Division 7.a. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages\ 2-4}\ (2022)$	0.159	$F_{sq} = F_{average(2018-2021)} *$
SSB (2023)	11 817	Short-term forecast; fishing at $F_{sq}$ , in tonnes
$R_{age\ 0}\ (2022-2023)$	364 084	Geometric Mean (1993–2019), in thousands
Catch (2022)	1 846	Fishing at $F_{sq}$ ; in tonnes
Projected landings (2022)	1 545	Short-term forecast assuming average landing pattern (2019–2021); in tonnes
Projected discards (2022)	301	Short-term forecast assuming average discard pattern (2019–2021); in tonnes

\* F in 2020 was assumed to be unrepresentatively low for the fishery due to the COVID-19 disruption and hence  $F_{sq}$  was assumed as  $F_{average(2018-2021)}$  excluding 2020.

**Table 2** Haddock in Division 7.a. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	Projected landings (2023)	Projected discards (2023)	F <sub>total</sub> (2023)	F <sub>projected landings</sub> (2023)	F <sub>projected discards</sub> (2023)	SSB (2024)	% SSB change*	% advice change**
ICES advice basis									
MSY approach: F <sub>MSY</sub>	2648	2107	541	0.28	0.171	0.109	9321	-21	-12.8
Other scenarios									
EU MAP***: F <sub>MSY</sub>	2648	2107	541	0.28	0.171	0.109	9321	-21	-12.8
EU MAP*** F <sub>MSY lower</sub>	1956	1560	396	0.2	0.122	0.078	10044	-15	-36
EU MAP*** F <sub>MSY upper</sub>	3216	2554	661	0.35	0.21	0.137	8732	-26	5.9
F = 0	0	0	0	0	0	0	12115	2.5	-100
F = F <sub>pa</sub>	3676	2915	761	0.41	0.25	0.160	8258	-30	21
F = F <sub>lim</sub>	4323	3421	903	0.5	0.3	0.195	7597	-36	42
SSB <sub>2024</sub> = B <sub>lim</sub>	9125	7029	2095	1.526	0.93	0.6	2994	-75	200
SSB <sub>2024</sub> = B <sub>pa</sub>	7834	6092	1742	1.158	0.71	0.45	4160	-65	158
SSB <sub>2024</sub> = SSB <sub>2023</sub>	280	224	56	0.027	0.0162	0.0104	11817	0	-91
SSB <sub>2024</sub> = MSY B <sub>trigger</sub>	7704	5997	1708	1.13	0.69	0.44	4281	-64	154
F = F <sub>2022</sub>	1587	1267	320	0.159	0.097	0.062	10432	-11.7	-48

\* SSB 2024 relative to SSB 2023.

\*\* Advice value for 2023 relative to the F<sub>MSY</sub> advice value for 2022 (3038 tonnes).

\*\*\* EU multiannual plan (MAP) for the Western Waters (EU, 2019).

The advice for 2023 is reduced from 2022 because of poor recruitment in 2020 leading to a reduction in the forecast stock size and a downward revision of the spawning stock size.

## Basis of the advice

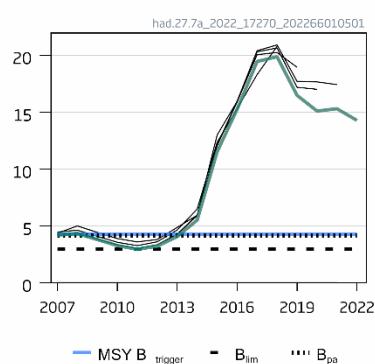
**Table 3** Haddock in Division 7.a. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is aware of the multiannual management plan (MAP) which has been adopted by the EU for this stock (EU, 2019) and which ICES considers to be precautionary. There is no agreed shared management plan with UK for this stock, and ICES provides advice according to ICES MSY approach. Catch scenarios consistent with the MAP F <sub>MSY</sub> ranges are provided.

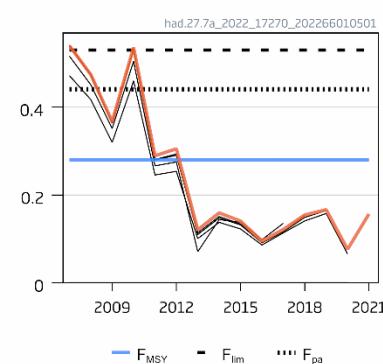
## Quality of the assessment

Catch sampling in 2021 has increased compared to 2020 but has not returned to pre-covid levels, however it is considered sufficient to describe the current stock.

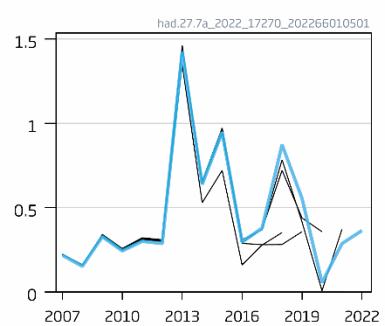
**SSB (1000 t)**



**F (ages 2-4)**



**Rec (age 0; Billions)**



**Figure 2**

Haddock in Division 7.a. Historical assessment results (final-year SSB estimate and recruitment assumption included).

## Issues relevant for the advice

The assessment and the advice are for Division 7.a, excluding the rectangles 33E2 and 33E3 in the Irish Sea. Landings are adjusted to exclude those reported from rectangles 33E2 and 33E3 in the Irish Sea, as they are not considered to be part of this stock (Table 8). The annual reallocation has increased since 2006, peaking in 2017. In 2021 the reallocation accounted for 68% of ICES landings in Division 7.a and contributed 9% of the estimated landings in divisions 7. b–k . This should be considered when setting TACs for the two management areas for haddock in divisions 7.a and 7.b–k. Changes in the TAC for the haddock stock in Division 7.a may have implications for the fishing pressure on haddock in divisions 7.b–k.

## Mixed Fisheries considerations

Haddock in division 7.a is caught as part of a mixed fishery with cod and whiting.

## Reference points

**Table 4** Haddock in Division 7.a. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	4 281	The 5th percentile of $B_{MSY}$ ; Division 7.a haddock has been fished at or below $F_{MSY}$ for more than five years; in tonne	ICES (2018)
	$F_{MSY}$	0.28	Median point estimates of EqSim with a model averaged stock–recruitment relationship	ICES (2018)
Precautionary approach	$B_{lim}$	2 994	Tonnes; lowest observed SSB with > 75th percentile recruitment; in tonnes	ICES (2018)
	$B_{pa}$	4 160	$B_{lim}$ combined with the assessment error; $B_{lim} \times \exp(1.645 \times \sigma)$ ; $\sigma = 0.20$ ; in tonnes	ICES (2018)
	$F_{lim}$	0.50	$F$ with 50% probability of SSB < $B_{lim}$	ICES (2018)
	$F_{pa}$	0.41	$F_{P05}$ ; the $F$ that leads to SSB > $B_{lim}$ with 95% probability	ICES (2018, 2021a)
Management plan	MAP MSY $B_{trigger}$	4 281	Tonnes; MSY $B_{trigger}$	ICES (2018), EU (2019)
	MAP $B_{lim}$	2 994	$B_{lim}$ ; in tonnes	ICES (2018), EU (2019)
	MAP $F_{MSY}$	0.28	$F_{MSY}$	ICES (2018), EU (2019)
	MAP range $F_{lower}$	0.20	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2018), EU (2019)
	MAP range $F_{upper}$	0.35	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2018), EU (2019)

## Basis of the assessment

**Table 5** Haddock in Division 7.a. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022</a> )
Assessment type	ASAP (Age-Structured Assessment Programme; NOAA toolbox) that uses catches in the model and in the forecast (ICES, 2021a)
Input data	Four survey indices (NIGFS-WIBTS-Q1 [G7144], NIGFS-WIBTS-Q4 [G7655], NIMIK [I9826], UKFSPW [B7897]); annual maturity and growth data from the NIGFS-WIBTS-Q1 (G7144) survey and from commercial landings in quarter 1. Commercial catch-at-age.
Discards and bycatch	Included in the assessment for the full time-series
Indicators	None
Other information	This stock was benchmarked in 2017 (ICES, 2017); revision in reference points in 2018 (ICES, 2018)
Working group	Working Group for the Celtic Seas Ecoregion

## History of the advice, catch, and management

**Table 6** Haddock in Division 7.a. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Landings corresponding to advice	Agreed TAC*	Official landings	ICES landings	ICES discards	ICES catches
1987	Not dealt with			6000	1287	1287		
1988	Not dealt with			6000	747	747		
1989	Not dealt with			6000	560	560		
1990	Not dealt with			6000	582	582		
1991	Not dealt with			6000	616	616		
1992	Not dealt with			6000	703	656		
1993	Not dealt with			6000	730	813		
1994	Not dealt with			6000	681	1042		
1995	Not dealt with			6000	841	1736	780	2516
1996	No advice			10000	1453	2981	709	3690
1997	Means of setting catch limits required			14000	1925	3547	895	4442
1998	Catch limit for Division 7.a		3000	20000	3015	4874	1015	5889
1999	No increase in F; catch limit for Division 7.a		7000	4990	2370	4095	634	4729
2000	Reduce F below $F_{pa}$		< 2800	3400	2447	1357	802	2159
2001	Reduce F below $F_{pa}$		< 1710	2700	2229	2246	269	2515
2002	Reduce F below $F_{pa}$		< 1200	1300	1115	1817	387	2204
2003	No cod catches		-	585	674	659**	-	-
2004	$F < F_{pa}$		< 1500	1500	761	1217	392	1609
2005	$F < F_{pa}$		< 1370	1500	547	666	551	1217
2006	Substantial reduction in fishing mortality	-		1275	655	633	306	939
2007	Substantial reduction in fishing mortality	-		1179	1078	886	722	1608
2008	No increase in effort	-		1238	879	786	643	1429
2009	No increase in effort	-		1424	846	581	579	1160
2010	No increase in effort	-		1424	939	679	508	1187
2011	See scenarios	-		1317	813	446	307	753
2012	Reduce catch and improved selectivity	-		1215	813	343	599	942
2013	Decrease catch by 18%	-	< 710	1189	656	254	283	537
2014	Increase catch by 17%	1120	< 572	1181	974	518	488	1006
2015	Increase catch by 20%	< 893	< 425	1181	1154	833	652	1485
2016	Precautionary approach (increase catch by 20%)	≤ 1072	≤ 481	1654	1477	1008	298	1306
2017	MSY approach	≤ 3061	≤ 2348	2615 <sup>#</sup>	2379	1662	333	1995
2018	MSY approach	≤ 3444	≤ 2796	3207	2523	1993	568	2561
2019	MSY approach	≤ 3739	≤ 3334	3739	2553	1778	672	2450
2020	Management plan	3156 (range 2333–3830)		3156	1535 <sup>^</sup>	742	234	976
2021	Management plan	3371 (range 2491–4092)		3371	2048 <sup>^</sup>	1219	672	1891
2022	MSY approach	≤ 3038		3038				
2023	MSY approach	≤ 2648						

\* Precautionary TAC for subareas 7–10 and CECAF Division 34.1.1 up to 1998. Since 1999, a special condition or separate TAC has been set for Division 7.a.

\*\* Underestimate because of inadequate sampling.

<sup>#</sup> Revised TAC in March 2017.

<sup>^</sup> Preliminary.

## History of the catch and landings

**Table 7** Haddock in Division 7.a. Catch distribution by fleet in 2021 as estimated by ICES.

Catch	Landings									
	Otter trawls		Scottish seines	Mid-water trawl	Beam trawl	Other gear types				
1891 tonnes	<i>Nephrops</i> directed fishery	Demersal fish directed fishery	3.6%	22%	< 1%	< 1%				
		8.0%								
		66%								
	1219 tonnes									
	Discards									
	<i>Nephrops</i> directed fishery	Demersal fish directed fishery	< 1%	< 1%	3.9%	1%				
		85%								
		8.8%								
	672 tonnes									

**Table 8** Haddock in Division 7.a. History of official landings and ICES estimates of landings (tonnes).

Year	Belgium	France	Ireland	Netherlands	UK (England & Wales)*	UK (Isle of Man)	UK (N. Ireland)*	UK (Scotland)* *	United Kingdom**	Total	ICES landings^	ICES discards	Reallocation ^^^
1984	3	38	199	-	29	2	38	78		387	387		
1985	4	31	341	-	28	5	215	104		728	728		
1986	5	39	275	-	22	4	358	23		726	726		
1987	10	50	797	-	41	3	230	156		1287	1287		
1988	12	47	363	-	74	3	196	52		747	747		
1989	4	n/a	215	-	252	3		86		560	560		
1990	4	n/a	80	-	177	5		316		582	582		
1991	1	n/a	254	-	204	14		143		616	616		
1992	8	73	251	-	244	13		114		703	656		
1993	18	41	252	-	260	19		140		730	813		
1994	22	22	246	-	301	24		66		681	1042		
1995	32	58	320	-	294	27		110		841	1736	780	16
1996	34	105	798	1	463	38		14		1453	2981	709	33
1997	55	74	1005	14	717	9		51		1925	3547	895	36
1998	104	86	1699	10	1023	13		80		3015	4874	1015	28
1999	53	n/a	759	5	1479	7		67		2370	4095	634	34
2000	22	49	1238	2	1061	19		56		2447	1357	802	11
2001	68	184	652	-	1238	1		86		2229	2246	269	74
2002	44	72	401	-	551	-		47		1115	1817	387	82
2003^**	20	146	229	-	248	-		31		674	n/a	-	64
2004	15	20	296	-	421	-		9		761	1217	392	53
2005	22	36	139	-	344	-		6		547	666	551	35
2006	23	20	184		419	-		9		655	633	306	26
2007	30	11	477	-	559	-		1		1078	886	722	222
2008	15	6	319	-	521	1		17		879	786	643	194
2009	7	3	388	-	446	1		1		846	581	579	285
2010	9	2	333	-	593	-		2		939	679	508	267
2011	16	8	434	-	355	-		-		813	446	307	374
2012	13	3	561	-		-			236	813	343	599	473
2013	6	1	492	-		< 1			155	656	254	283	410
2014	7	0	541	-		< 1			426	974	518	488	470
2015	7	7	507	-		< 1			634	1154	833	652	322
2016	5	1	646	-					825	1463	1008	298	455
2017	5	5	1114	-					1240	2363	1662	333	715
2018	4	0	949	-					1580	2532	1993	568	532
2019	9	0	1347	-					1197	2553	2537	672	764
2020***	3	0	759	-					539	1301	742	234	559
2021***	3	0	1162	-					884	2048	1219	674	827

\* From 1989 to 2011, Northern Ireland is included with England and Wales.

\*\* Since 2012, Northern Ireland, Scotland, England, and Wales have been combined to UK.

\*\*\* Preliminary official landings.

^ Landings in the southern part of Division 7.a (rectangles 33E2 and 33E3) are excluded.

^ ^ Landings taken or reported in rectangles 33E2 and 33E3(belonging to the 7.b–k stock)

^ ^ ^ Underestimate or low confidence due to inadequate sampling.

## Summary of the assessment

**Table 9** Haddock in Division 7.a. Assessment summary. All weights are in tonnes, recruitment (age 0) in thousands. Low and high refer to 95% confidence intervals.

Year	Recruitment			SSB			Landings	Discards *	F 2–4		
	Low	Value	High	Low	Value	High			Low	Value	High
1993	46607	66913	87219	1222	1782	2341	813	365	0.54	0.9	1.26
1994	735823	895924	1056025	766	1329	1891	1042	468	0.61	1.15	1.69
1995	45113	72493	99872	349	851	1353	1736	780	0.61	1.08	1.54
1996	1137229	1403632	1670035	4384	5624	6864	2981	709	0.46	0.7	0.95
1997	146594	206402	266209	3449	5064	6679	3547	895	0.48	0.79	1.09
1998	250080	329828	409576	7059	8987	10915	4874	1015	0.63	0.89	1.16
1999	526038	655112	784186	4492	6124	7756	4095	634	0.83	1.26	1.69
2000	58144	89531	120919	1957	2990	4022	1357	802	0.49	0.84	1.18
2001	517912	653512	789113	2897	4087	5276	2246	269	0.45	0.69	0.93
2002	81567	118762	155957	1984	3008	4031	1817	387	0.53	0.86	1.2
2003	301882	409766	517650	2353	3414	4475	1517	390	0.42	0.71	0.99
2004	497901	639366	780831	1554	2582	3610	1217	392	0.38	0.69	0.99
2005	381616	487460	593304	1527	2457	3387	666	551	0.31	0.57	0.82
2006	450949	558777	666604	2162	3193	4225	633	306	0.179	0.32	0.47
2007	166827	217242	267657	3053	4200	5348	886	722	0.34	0.54	0.74
2008	112833	151657	190481	3098	4341	5584	786	643	0.3	0.47	0.65
2009	255179	327164	399149	2494	3801	5107	581	579	0.23	0.37	0.51
2010	185913	243502	301091	2048	3276	4504	679	508	0.32	0.54	0.75
2011	230292	299962	369632	1778	2948	4119	446	307	0.169	0.29	0.41
2012	209462	286859	364255	2016	3216	4416	343	599	0.179	0.31	0.43
2013	1129076	1426173	1723270	2593	4070	5548	254	282	0.068	0.121	0.173
2014	481853	637664	793474	3747	5517	7286	518	488	0.095	0.159	0.22
2015	719551	946813	1174075	8547	11519	14491	833	652	0.087	0.141	0.195
2016	208578	295735	382892	11393	15252	19111	1008	298	0.059	0.095	0.132
2017	269515	378760	488004	14557	19453	24349	1662	333	0.075	0.122	0.169
2018	631559	872521	1113484	14684	19871	25058	1993	568	0.093	0.155	0.22
2019	378313	554048	729784	11698	16477	21255	1778	672	0.097	0.167	0.24
2020	22732	55311	87890	10509	15099	19689	742	177	0.041	0.076	0.112
2021	157020	286347	415674	10609	15301	19993	1219	672	0.086	0.157	0.23
2022		364 084**			14274					0.159	

\* Discard estimates available from 2007; prior to 2007, discard estimates are based on limited sampling.

\*\* Geometric mean (1993–2019).

## Sources and references

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*Recommended citation:* ICES. 2022. Haddock (*Melanogrammus aeglefinus*) in Division 7.a (Irish Sea). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, had.27.7a. <https://doi.org/10.17895/ices.advice.19447958>.

## Haddock (*Melanogrammus aeglefinus*) in divisions 7.b–k (southern Celtic Seas and English Channel)

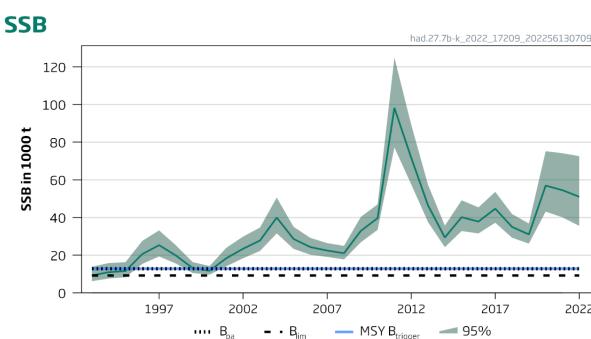
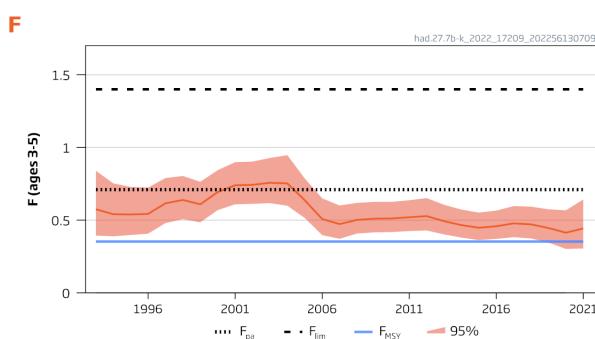
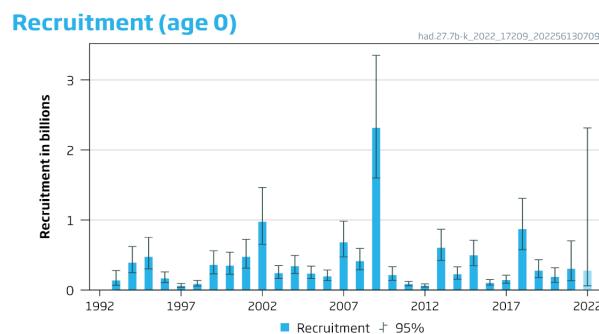
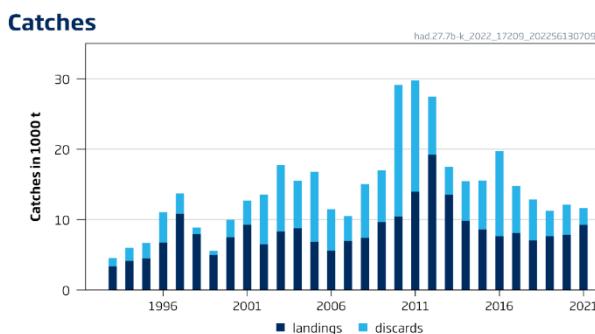
### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 11 901 tonnes.

ICES notes the existence of a precautionary management plan, developed and adopted by one of the relevant management authorities for this stock.

### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$  and below  $F_{pa}$  and  $F_{lim}$ , and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Haddock in divisions 7.b–k. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Haddock in divisions 7.b–k. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 3-5}\ (2022)$	0.443	$F = F_{Average}\ (2019-2021)$ rescaled to $F_{2021}$
SSB (2023)	47 157	Short-term forecast; in tonnes
$R_{age\ 0}\ (2022,\ 2023)$	275 943	Median resampled (1993–2021); in thousands
Total catch (2022)	15 320	Short-term forecast; in tonnes
Projected landings (2022)	12 308	Short-term forecast, assuming average 2018–2021 landing pattern; in tonnes
Projected discards (2022)	3 012	Short-term forecast, assuming average 2018–2021 discard pattern; in tonnes

**Table 2** Haddock in divisions 7.b–k. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	Projected landings (2023)	Projected discards (2023)	F <sub>total</sub> (2023)	F <sub>projected</sub> landings (2023)	F <sub>projected</sub> discards (2023)	SSB (2024)	% SSB change*	% advice change^
ICES advice basis									
MSY approach: F <sub>MSY</sub>	11901	9064	2837	0.353	0.31	0.044	48157	2.1	-25
Other scenarios									
EU MAP ^: F <sub>MSY</sub>	11901	9064	2837	0.353	0.31	0.044	48157	2.1	-25
EU MAP^ F <sub>MSY</sub> lower	7862	6030	1832	0.22	0.194	0.027	52430	11.2	-26
EU MAP^ F <sub>MSY</sub> upper	16424	12419	4005	0.52	0.46	0.064	43270	-8.2	-25
F = 0	0	0	0	0	0	0	61031	29.4	-100
F <sub>pa</sub>	20787	15604	5183	0.71	0.62	0.088	38652	-18.0	30
F <sub>lim</sub>	32583	23767	8816	1.400	1.23	0.170	26386	-44	104
SSB <sub>2024</sub> = B <sub>lim</sub>	50807	34676	16131	4.05	3.55	0.50	9227	-80	219
SSB <sub>2024</sub> = B <sub>pa</sub> = MSY B <sub>trigger</sub>	46662	32469	14193	3.08	2.70	0.38	12822	-72.8	193
F = F <sub>2022</sub>	14401	10923	3478	0.44	0.39	0.06	45431	-3.7	-9.7
SSB <sub>2024</sub> = SSB <sub>2023</sub>	12788	9731	3057	0.384	0.337	0.047	47157	0.00	-19.8

\* SSB<sub>2024</sub> forecast relative to SSB<sub>2023</sub>.

^ Advice values for 2023 relative to the MSY value for 2022 (15 946 tonnes).

^^ EU multiannual plan (MAP) for the Western Waters (EU, 2019).

The reduction in catch advice is caused by a downward revision in estimated stock size and low recruitments.

### Basis of the advice

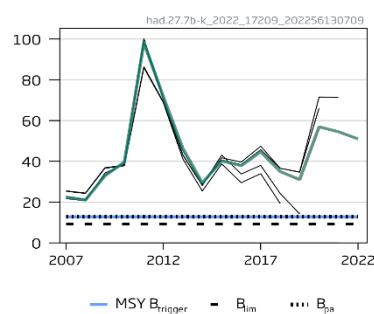
**Table 3** Haddock in divisions 7.b–k. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is aware of the multiannual management plan (MAP) which has been adopted by the EU for this stock (EU, 2019) and which ICES considers to be precautionary. There is no agreed shared management plan with UK for this stock, and ICES provides advice according to ICES MSY approach. Catch scenarios consistent with the MAP F <sub>MSY</sub> ranges are provided.

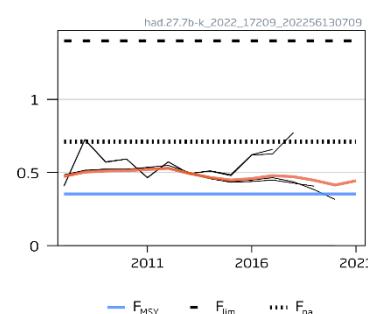
### Quality of the assessment

Catch sampling in 2021 increased compared to 2020 when it was impacted owing to the COVID 19 pandemic and is considered sufficient to describe the stock.

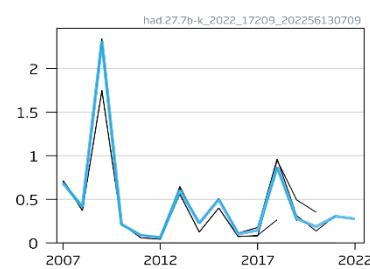
**SSB (1000 t)**



**F (ages 3-5)**



**Rec (age 0; Billions)**



**Figure 2**

Haddock in divisions 7.b–k. Historical assessment results (final-year recruitment assumption and SSB estimate included). The assessment was benchmarked in 2020, prior to which a different method was applied. The reference points were revised in 2020 [following the benchmark], and only assessment results from the last three years should be compared to the reference points indicated.

## Issues relevant for the advice

The assessment and advice are for divisions 7.b–k, including rectangles 33E2 and 33E3 in Division 7.a, as they are considered part of this stock. The 2021 reallocation (827 tonnes) from Division 7a accounts for 9% of ICES estimated division 7.b–k landings and 68% of the Irish Sea (Division 7.a) landings. This should be considered when setting TACs, as a portion of the catch taken under the Division 7.a TAC is considered to be part of the division 7.b–k stock.

The assumed recruitment in 2022 and 2023 used in the forecast would constitute a minor part of the projected catches in 2023 (8%) and approximately 31% of the SSB in 2024.

## Mixed-fisheries considerations

Haddock in divisions 7.b–k is caught as part of a mixed fishery with cod and whiting.

## Reference points

**Table 4** Haddock in divisions 7.b–k. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{trigger}}$	12822	$B_{\text{pa}}$ ; in tonnes	ICES (2020)
	$F_{\text{MSY}}$	0.353	Based on simulation using a segmented regression stock–recruitment relationship (EqSim)	ICES (2020)
Precautionary approach	$B_{\text{lim}}$	9227	Lowest observed SSB; in tonnes	ICES (2020)
	$B_{\text{pa}}$	12822	$B_{\text{lim}}$ combined with the assessment error; $B_{\text{lim}} \times \exp(1.645 \times \sigma)$ ; $\sigma = 0.20$ (default setting); in tonnes	ICES (2020)
	$F_{\text{lim}}$	1.40	$F$ with 50% probability of $\text{SSB} < B_{\text{lim}}$	ICES (2020)
	$F_{\text{pa}}$	0.71	$F_{\text{P95}}$ ; the $F$ that leads to $\text{SSB} \geq B_{\text{lim}}$ with 95% probability	ICES (2020)
	MAP MSY $B_{\text{trigger}}$	12822	MSY $B_{\text{pa}}$ ; in tonnes	EU (2019), ICES (2020)
EU MAP	MAP $B_{\text{lim}}$	9227	Lowest observed SSB; in tonnes	EU (2019), ICES (2020)
	MAP $F_{\text{MSY}}$	0.353	$F_{\text{MSY}}$	EU (2019), ICES (2020)
	MAP range $F_{\text{lower}}$	0.221	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY	EU (2019), ICES (2020)
	MAP range $F_{\text{upper}}$	0.521	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY	EU (2019), ICES (2020)

## Basis of the assessment

**Table 5** Haddock in divisions 7.b–k. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based stochastic analytical assessment (SAM; ICES, 2022b)
Input data	Commercial catches (age composition of landings and discards); vector autoregressive spatio-temporal (VAST) standardized survey index (combined IGFS-WIBTS-Q4 [G7212] and EVHOE-WIBTS-Q4 [G9527]); maturity data (surveys and observer data; constant for all years); age-dependent natural mortality (Lorenzen, 1996)
Discards and bycatch	Included in the assessment for the full time-series. Full observer-based estimates from 2005, partial observer-based estimates from 1993 to 2004.
Indicators	None
Other information	This stock was benchmarked in 2020 (ICES, 2020)
Working groups	Working Group for the Celtic Seas Ecoregion ( <a href="#">WGCSE</a> )

## History of the advice, catch, and management

**Table 6** Haddock in divisions 7.b–k. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Landings corresponding to advice	Agreed TAC	Official landings	ICES landings <sup>##</sup>	ICES discards <sup>^^</sup>	ICES catch
1987	Not dealt with				3000 <sup>^^</sup>	2600 <sup>^^</sup>	n/a	2600 <sup>^^</sup>
1988	Not dealt with				4000 <sup>^^</sup>	3600 <sup>^^</sup>	n/a	3600 <sup>^^</sup>
1989	Not dealt with				4200 <sup>^^</sup>	3200 <sup>^^</sup>	n/a	3200 <sup>^^</sup>
1990	Not dealt with				2900 <sup>^^</sup>	2000 <sup>^^</sup>	n/a	2000 <sup>^^</sup>
1991	Not dealt with				2900 <sup>^^</sup>	2300 <sup>^^</sup>	n/a	2300 <sup>^^</sup>
1992	Not dealt with				2900 <sup>^^</sup>	2700 <sup>^^</sup>	n/a	2700 <sup>^^</sup>
1993	Not dealt with				3400 <sup>^^</sup>	3348	1208	4556
1994	Not dealt with				4076	4131	1886	6017
1995	Not dealt with			6000*	4468	4470	2218	6688
1996	Not dealt with			7000**	6653	6756	4309	11 065
1997	Not dealt with			14 000	10270	10827	2883	13 710
1998	Not dealt with			20 000	7361	7928	934	8862
1999	Not dealt with			22 000***	5247	4970	586	5556
2000	No expansion of catches			16 600***	6656	7499	2503	10 002
2001	No expansion of catches			12 000***	9702	9278	3418	12 696
2002	No expansion of catches		8000	9300***	7089	6488	7073	13 561
2003	No expansion of catches		7200	8185***	8241	8292	9456	17 748
2004	No increase in F			9600***	8453	8777	6750	15 527
2005	No increase in effort			11 520***	6859	6839	9953	16 792
2006	No increase in effort			11 520***	5647	5592	5899	11 491
2007	No increase in effort			11 520***	6629	6961	3552	10 513
2008	Same advice as last year			11 579***	6234	7392	7660	15 052
2009	Same advice as last year			11 579 <sup>^</sup>	9307	9664	7322	16 986
2010	Same advice as last year			11 579 <sup>^</sup>	9998	10 429	18 701	29 130
2011	See scenarios			13 316 <sup>^</sup>	13 709	13 957	15 807	29 764
2012	No increase in catch and technical measures to reduce discard rates			16 645 <sup>^</sup>	18 221	19 196	8285	27 481
2013	MSY transition		< 9500	14 148 <sup>^</sup>	13099	13 538	3962	17 501
2014	MSY transition	< 5281	< 3602	9479 <sup>^</sup>	9371	9846	5619	15 464
2015	MSY approach	< 10 434	< 5605	8342 <sup>^</sup>	8229	8608	6941	15 549
2016	MSY approach	≤ 8590	≤ 6078	7258 <sup>^</sup>	7024	7648	12 065	19 713
2017	MSY approach	≤ 12 444	≤ 7751	7751 <sup>^</sup>	7374	8099	6691	14 789
2018	MSY approach	≤ 8358	≤ 5911	6910 <sup>^</sup>	6595	7046	5798	12 844
2019	MSY approach	≤ 6317		8329 <sup>^</sup>	8342	7656	3603	11 259
2020	Management plan	16 671 (range 11 418–23 262)		10 859 <sup>^</sup>	6476 <sup>#</sup>	7859	4260	12 119
2021	Management plan	18 382 (range 12 128–25 454)		15 000	8447 <sup>#</sup>	9260	2385	11645
2022	MSY approach	≤ 15 946		15 000				
2023	MSY approach	≤ 11 901						

\* Applies to subareas 7–10.

\*\* Increased in-year to 14 000 tonnes.

\*\*\* Includes separate Division 7.a allocation.

^ Applies to divisions 7.b–k and subareas 8–10.

^^ Values presented to the nearest 100.

^^^ Discard estimates are available from 2005; prior to 2005, discard estimates are based on limited sampling.

# Preliminary.

## Including landings from rectangles 33E2 and 33E3 since 2003.

## History of the catch and landings

**Table 7** Haddock in divisions 7.b–k. Catch distribution by fleet in 2021, as estimated by ICES.

Catch 11 645 tonnes	Landings				Discards			
	Otter trawls	Beam trawls	Gillnets	Other	Otter trawls	Beam trawls	Gillnets	Other
	73%	6%	3%	18%	57%	22%	3%	18%
	9260 tonnes				2385 tonnes			

**Table 8** Haddock in divisions 7.b–k. History of commercial catch and landings and ICES estimates. All weights are in tonnes.

Year	Official landings						ICES estimates			
	Belgium	France	Ireland	UK	Others	Total	Landings taken or reported in rectangles 33E2 and 33E3**	Landings	Discards ***	Catch
1993	51	1839	1262	256	0	3408		3348	1208	4556
1994	123	2788	908	240	17	4076		4131	1886	6017
1995	189	2964	966	266	83	4468		4470	2218	6688
1996	133	4527	1468	439	86	6653		6756	4309	11065
1997	246	6581	2789	569	85	10270		10827	2883	13710
1998	142	3674	2788	444	312	7360		7928	934	8862
1999	51	2725	2034	278	159	5247		4970	586	5556
2000	90	3088	3066	289	123	6656		7499	2503	10002
2001	165	4842	3608	422	665	9702		9278	3418	12696
2002	132	4348	2188	315	106	7089		6488	7073	13561
2003	118	5781	1867	393	82	8241	64	8292	9456	17748
2004	136	6130	1715	313	159	8453	53	8777	6750	15527
2005	167	4174	2037	292	197	6867	35	6839	9953	16792
2006	99	3191	1874	274	183	5621	26	5592	5899	11491
2007	119	4143	1931	385	50	6627	222	6961	3552	10513
2008	109	3638	1800	566	121	6234	194	7392	7660	15052
2009	131	5430	2983	716	48	9307	285	9664	7322	16986
2010	170	6240	2609	852	128	9998	267	10429	18701	29130
2011	211	8389	3323	1657	129	13709	374	13957	15807	29764
2012	232	11793	4129	1901	166	18221	473	19196	8285	27481
2013	174	8747	2699	1455	23	13099	410	13538	3962	17501
2014	99	6375	2092	785	21	9371	444	9846	5619	15464
2015	118	5679	1657	769	6	8229	322	8608	6941	15549
2016	88	4487	1730	692	27	7024	468	7648	12065	19713
2017	110	4885	1677	690	12	7374	715	8099	6691	14789
2018	89	4470	1444	583	9	6595	532	7046	5798	12844
2019	90	4259	1323	516	74	6262	760	7656	3603	11259
2020*	106	3522	2203	543	102	6475	554	7859	4260	12119
2021*	156	4249	3379	515	149	8447	827	9260	2385	11645

\* Preliminary official landings.

\*\* Landings in the southern part of Division 7.a (rectangles 33E2 and 33E3) are included in the assessment and are considered part of the stock.

\*\*\* Prior to 2005, discard estimates are based on limited sampling.

### Summary of the assessment

**Table 9** Haddock in divisions 7.b–k. Assessment summary. ‘High’ and ‘Low’ refer to 95% confidence intervals. All weights are in tonnes and recruitment in thousands.

Year	Recruitment (age 0)			SSB			Landings	Discards**	Fishing mortality ages 3–5		
	Low	Value	High	Low	Value	High			Low	Value	High
1993	67900	137524	278540	6188	9267	13880	3348	1208	0.39	0.57	0.84
1994	247144	392005	621773	7617	10974	15810	4131	1886	0.39	0.54	0.75
1995	300708	475242	751076	8259	11602	16297	4470	2218	0.40	0.54	0.73
1996	106170	165752	258771	15368	20604	27625	6756	4309	0.41	0.54	0.72
1997	38128	59509	92881	19321	25319	33177	10827	2883	0.48	0.62	0.79
1998	56018	87806	137632	15556	19822	25258	7928	934	0.51	0.64	0.80
1999	231157	359811	560067	10534	13115	16328	4970	586	0.49	0.61	0.76
2000	225057	348755	540440	9688	11742	14231	7499	2503	0.57	0.69	0.84
2001	312325	475463	723813	14106	18392	23980	9278	3418	0.61	0.74	0.90
2002	650852	976184	1464136	18383	23438	29883	6488	7073	0.61	0.74	0.90
2003	166214	241122	349789	22230	27763	34672	8292	9456	0.62	0.76	0.93
2004	235849	341271	493815	31562	39966	50608	8777	6750	0.60	0.75	0.95
2005	162874	236237	342644	23356	28620	35071	6839	9953	0.52	0.64	0.79
2006	133225	195043	285545	20233	24306	29198	5592	5899	0.40	0.51	0.65
2007	472854	681770	982989	19091	22460	26424	6961	3552	0.37	0.47	0.60
2008	288369	414184	594892	17755	21044	24942	7392	7660	0.41	0.50	0.62
2009	1600195	2316405	3353174	26829	32887	40312	9664	7322	0.42	0.51	0.63
2010	138162	214532	333116	33456	39668	47033	10429	18701	0.42	0.51	0.63
2011	60654	86560	123532	77185	98217	124979	13957	15807	0.43	0.52	0.64
2012	41822	60869	88590	57593	71729	89335	19196	8285	0.43	0.53	0.65
2013	421428	604932	868340	37571	46457	57445	13538	3962	0.40	0.49	0.61
2014	154582	225966	330313	24229	29415	35711	9846	5619	0.38	0.47	0.57
2015	346622	496568	711378	32827	40176	49170	8608	6941	0.36	0.45	0.55
2016	70213	102096	148455	31556	37846	45390	7648	12065	0.37	0.46	0.57
2017	97262	143397	211414	37221	44690	53657	8099	6691	0.38	0.48	0.60
2018	576472	869056	1310138	29269	35005	41866	7046	5798	0.37	0.47	0.59
2019	176134	275943	432310	26143	31040	36854	7656	3603	0.35	0.45	0.57
2020	108999	186296	318408	43126	56954	75217	7859	4260	0.30	0.41	0.57
2021	132001	304566	702725	40077	54513	74148	9260	2385	0.31	0.44	0.64
2022	59509	275943*	2316405	35556	50999	72567					

\* Median resampled (1993–2021), as estimated by stochastic projection.

\*\* Discard estimates are available from 2005; prior to 2005, discard estimates are based on limited sampling.

## Sources and references

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*Recommended citation:* ICES. 2022. Haddock (*Melanogrammus aeglefinus*) in Divisions 7.b-k (southern Celtic Seas and English Channel). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, had.27.7b-k.  
<https://doi.org/10.17895/ices.advice.19447961>.

## Haddock (*Melanogrammus aeglefinus*) in Subarea 4, Division 6.a, and Subdivision 20 (North Sea, West of Scotland, Skagerrak)

### ICES advice on fishing opportunities

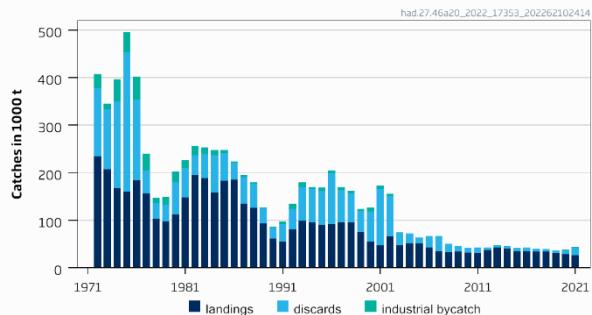
ICES advises that when the MSY approach is applied, total catches in 2023 should be no more than 137 058 tonnes.

ICES notes the existence of a precautionary management plan, developed and adopted by one of the relevant management authorities for this stock.

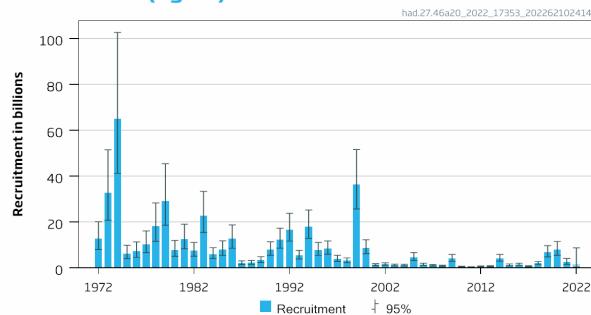
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

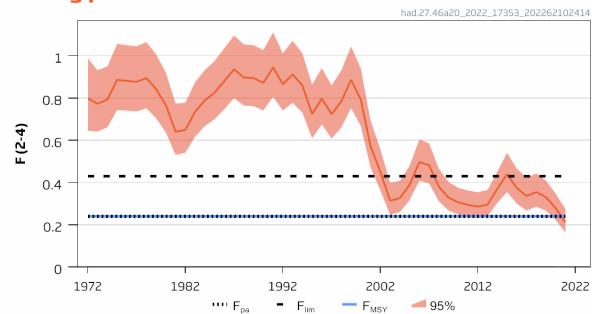
#### Catches



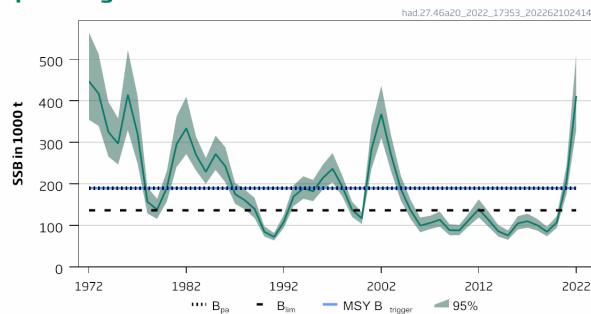
#### Recruitment (age 0)



#### Fishing pressure



#### Spawning Stock Biomass



**Figure 1** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour. Discards include BMS landings.

### Catch scenarios

**Table 1** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 2-4}\ (2022)$	0.111	Based on a catch constraint for 2022. Average exploitation pattern (2019–2021)
SSB (2023)	494 778	Short-term forecast (STF); tonnes
$R_{age\ 0}\ (2022,\ 2023)$	1 623 040	Geometric mean of recruitment resampled from the years 2000–2021; thousands
Total catch (2022)	52 692	TAC for 2022; tonnes
Projected landings (2022)	40 425	STF; assuming average landings ratio by age 2019–2021; tonnes
Projected discards and IBC (2022)	12 267	STF; assuming average discards (including IBC) ratio by age 2019–2021; tonnes

**Table 2** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Annual catch scenarios. All weights are in tonnes (t).

Basis	Total catch (2023)	Projected landings (2023)	Projected discards and IBC* (2023)	F <sub>total</sub> (ages 2–4) (2023)	F <sub>projected landings</sub> (ages 2–4) (2023)	F <sub>projected discards and IBC</sub> (ages 2–4) (2023)	SSB (2024)	% SSB change ^	% TAC change ^^	% advice change ^^^
ICES advice basis										
MSY approach: F <sub>MSY</sub>	137 058	118 373	18 685	0.24	0.19	0.05	438 042	-11.50	160	6.50
Other scenarios										
F = F <sub>MSY</sub> lower	109 157	94 391	14 766	0.19	0.15	0.04	461 609	-6.70	107	-15.20
F = F <sub>MSY</sub> upper #	137 058	118 373	18 685	0.24	0.19	0.05	438 042	-11.50	160	6.50
F = 0	0	0	0	0	0	0	556 373	12.40	-100	-100
F <sub>pa</sub>	137 058	118 373	18 685	0.24	0.19	0.05	438 042	-11.50	160	6.50
F <sub>lim</sub>	223 464	192 501	30 963	0.43	0.35	0.09	363 491	-27	324	74
SSB (2024) = B <sub>lim</sub>	496 564	419 677	76 887	1.54	1.24	0.31	136 540	-72	842	286
SSB (2024) = B <sub>pa</sub> = MSY B <sub>trigger</sub>	429 169	363 631	65 538	1.13	0.91	0.22	189 733	-62	715	233
F = F <sub>2022</sub>	67 653	58 557	9096	0.11	0.09	0.02	498 369	0.73	28	-47
Rollover TAC	52 690	45 652	7038	0.09	0.07	0.02	511 261	3.30	0	-59

\* Including below minimum size (BMS) landings, assuming recent discard rate.

^ SSB 2024 relative to SSB 2023.

^^ Human consumption fishery (HCF) catch in 2023 relative to TAC in 2022: Subdivision 20 (2761 t) + Subarea 4 (44 924 t) + Division 6.a (5006 t) = 52 691 t.

^^^ Total catch 2023 relative to the advice value 2022 (128 708 t).

# For this stock, F<sub>MSY</sub> upper = F<sub>MSY</sub>.

## Basis of the advice

**Table 3** Haddock in Subarea 4, Division 6.a, and Subdivision 20. The basis of the advice.

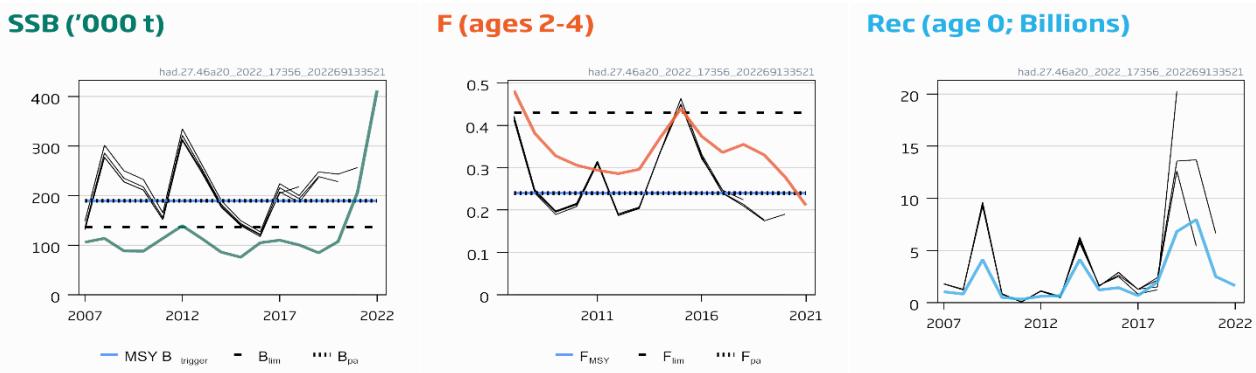
Advice basis	MSY approach
Management plan	An EU multiannual management plan (MAP) has been agreed by the EU for this stock (EU, 2018). There is no agreement with Norway and UK regarding this plan, and it is not used as the basis of the advice for this shared stock. ICES was requested by the EC and UK to provide advice based on the MSY approach, and to include $F_{MSY}$ ranges in the catch scenarios.

## Quality of the assessment

A benchmark was conducted for Northern Shelf haddock in 2022 (WKNSCS; ICES, 2022a). The primary changes consist of a change to a new assessment model (SAM) and the re-estimation of the reference points. Several input datasets were also updated, the most significant being changes to the maturity ogives and survey indices. These changes does not affect the perception of the stock but largely revised the estimates.

Scottish observer sampling was not possible during Q1 of 2021 because of the COVID-19 disruption. Sampling proceeded at a reduced level for the rest of 2021, but this reduced coverage is not thought to have had a significant impact on the quality of catch data for Scotland, which has the main fleets catching haddock.

A combination of several major storms and mechanical issues with some vessels resulted in a reduction in the sampling coverage across the NS-IBTS and SCOWCGFS Q1 surveys in 2022. This increased the uncertainty on the Q1 survey indices, which is now accounted for in the assessment model.



**Figure 2** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Historical assessment results (final-year SSB and recruitment included for each line, corresponding respectively to the estimated survivors at the start of the interim year, and the forecast recruitment in the interim year). The reference points were revised in 2022 following a benchmark, and only assessment results from the final year should be compared to the reference points indicated.

## Issues relevant to the advice

The new benchmark assessment has resulted in substantial revisions to the absolute levels of historic stock development, fishing mortality and recruitment as well as the reference points. However, all the differences together lead to a catch advice that is only 6.4% different to that given last year for 2022.

More abundant year classes were produced prior to 2000; recruitment since then has tended to be consistently lower. However, the 2019 and 2020 year classes are estimated to be the largest since 2000, which produced a sharp increase in SSB and continues to impact the catch advice.

Haddock on the Northern Shelf is under EU landing obligation and Norway and UK national legislation regulating discards. Landings of fish below the minimum size (BMS) reported to ICES are very low and discarding still takes place. The estimated discards in 2021 were 37% of the total catch by weight, based on observer data.

## Reference points

**Table 4** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	189 734	$B_{pa}$ ; in tonnes.	ICES (2022a)
	$F_{MSY}$	0.24	Stochastic simulations (EqSim) based on the recruitment period 2000–2020 with segmented regression fixed at $B_{lim}$ .	ICES (2022a)
Precautionary approach	$B_{lim}$	136 541	Lowest estimated SSB that resulted in high recruitment (1999); in tonnes.	ICES (2022a)
	$B_{pa}$	189 734	$B_{lim} \times \exp(1.645 \times \sigma)$ , $\sigma = 0.20$ ; in tonnes.	ICES (2022a)
	$F_{lim}$	0.43	The F that on average leads to $B_{lim}$ from EqSim.	ICES (2022a)
	$F_{pa}$	0.24	$F_{P.05}$ ; the F that leads to $SSB \geq B_{lim}$ with 95% probability.	ICES (2022a)
EU Management Plan (MAP)*	MAP MSY $B_{trigger}$	189 734	MSY $B_{trigger}$ ; in tonnes.	ICES (2022a)
	MAP $B_{lim}$	136 541	$B_{lim}$ ; in tonnes.	ICES (2022a)
	MAP $F_{MSY}$	0.24	$F_{MSY}$	ICES (2022a)
	MAP range $F_{lower}$	0.186–0.24	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2022a)
	MAP range $F_{upper}^{**}$	0.24–0.24	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2022a)

\* EU multiannual plan (MAP) for the North Sea (EU, 2018).

\*\* For this stock,  $F_{MSY\ upper} = F_{MSY}$ .

## Basis of the assessment

**Table 5** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022b</a> )
Assessment type	Age-based analytical assessment (SAM; Nielsen and Berg, 2014; ICES, 2022c) that uses catches and surveys in the model and in the forecast
Input data	Commercial catches (international catches, ages from catch sampling), two survey indices derived through a delta-GAM approach: "Q1" (combining NS-IBTS [G1022], SWC-IBTS [G1179], SCOWCGFS [G4748]), "Q3+Q4" (combining NS-IBTS Q3 [G2829], Q4 SWC-IBTS [G4299], Q4 SCOWCGFS [G4815], and Q4 IGFS [G7212]). Annually varying maturity data from Q1 NS-IBTS [G1022], Q1 SWC-IBTS [G1179], and Q1 SCOWCGFS [G4748] (1991–2022). Annually varying natural mortalities from the North Sea multispecies model (1974–2020)(ICES, 2021b).
Discards, BMS landings and bycatch	Included in the assessment, data from the main fleets (covering around 86% of the landings in 2021). BMS landings, where reported, are included with discards and industrial bycatch in the assessment from 2016 onwards.
Indicators	None
Other information	Last benchmarked in 2022 during ICES Benchmark Meeting on North Sea and Celtic Sea Stocks (WKNSCS; ICES, 2022a), where several updates were made to biological parameters and a new assessment model was selected.
Working group	Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak ( <a href="#">WGNSSK</a> )

## History of the advice, catch, and management

**Table 6a** Haddock in Subarea 4, Division 6.a, and Subdivision 20. **North Sea (Subarea 4)**. ICES advice, TAC, official landings, and ICES catch estimates. All weights are in tonnes. Values of landings, discards, and catches for the period 1987 to 2014 are presented to the nearest thousand tonnes.

Year	ICES advice	Landings corresp. to advice	Total catch corresp. to advice^	Agreed TAC	Official landings	ICES landings	ICES discards^^	ICES industrial bycatch	ICES total
1987	80% of F(85)	105 000		140 000	109 000	108 000	59 000	4000	172 000
1988	77% of F(86); TAC	185 000		185 000	105 000	105 000	62 000	4000	171 000
1989	Reduce decline in SSB; TAC; protect juveniles	68 000		68 000	64 000	76 000	26 000	2000	104 000
1990	80% of F (88); TAC	50 000		50 000	43 000	51 000	33 000	3000	87 000
1991	70% of effort (89)			50 000	45 000	45 000	40 000	5000	90 000
1992	70% of effort (89)			60 000	51 000	70 000	48 000	11 000	129 000
1993	70% of effort (89)			133 000	80 000	80 000	80 000	11 000	170 000
1994	Significant reduction in effort; mixed fishery			160 000	87 000	81 000	65 000	4000	150 000
1995	Significant reduction in effort; mixed fishery			120 000	75 000	75 000	57 000	8000	140 000
1996	Mixed fishery to be taken into account			120 000	75 000	76 000	73 000	5000	154 000
1997	Mixed fishery to be taken into account			114 000	73 000	79 000	52 000	7000	138 000
1998	No increase in F	100 300		115 000	72 000	77 000	45 000	5000	128 000
1999	Reduction of 10% F (95–97)	72 000		88 600	64 000	64 000	43 000	4000	111 000
2000	F less than $F_{pa}$	< 51 700		73 000	47 000	45 000	47 000	8000	100 000
2001	F less than $F_{pa}$	< 58 000		61 000	40 000	39 000	118 000	8000	165 000
2002	F less than $F_{pa}$	< 94 000		104 000	54 000	53 000	45 000	4000	101 000
2003	No cod catches	-		52 000	42 000	42 000	23 000	1000	76 000
2004	Mixed-fisheries considerations; F should be below $F_{pa}$	No forecast*		85 000	48 000	47 000	17 000	1000	65 000
2005	Mixed-fisheries considerations/F should be below $F_{pa}$	92 000*		66 000	31 000	48 000	10 000	0	57 000
2006	Mixed-fisheries considerations/F < 0.3	39 000*		52 000	36 000	36 000	17 000	0	55 000
2007	Mixed-fisheries considerations/F < 0.3	55 400*		55 000	31 000	31 000	30 000	0	61 000
2008	Mixed-fisheries considerations/15% TAC reduction	49 300*,**		46 000	30 000	29 000	15 000	0	45 000
2009	Mixed-fisheries considerations/apply management plan	44 700*,**		42 000	31 000	30 000	10 000	0	40 000
2010	Mixed-fisheries considerations/apply management plan	38 000*,**		36 000	28 000	28 000	7000	0	35 000
2011	See scenarios	-		34 000	26 000	27 000	10 000	0	37 000
2012	Apply management plan	41 575*,**		39 000	30 000	30 000	4000	0	34 000
2013	Apply management plan	47 811*,**		45 041	37 000***	39 000***	2000***	0	39 000***
2014	Apply management plan	38 201*		38 284	35 000	35 000	4000	65	39 000
2015	(November update) MSY approach		68 690	40 711	30 276	30 013	4676	18	34 707

Year	ICES advice	Landings corresp. to advice	Total catch corresp. to advice^	Agreed TAC	Official landings	ICES landings	ICES discards^^	ICES industrial bycatch	ICES total
2016	MSY approach		≤ 59 945	61 933	30 162	29 713	6106	29	35 848
2017	MSY approach		≤ 39 461	33 643	30 051	29 318	5322	8	34 648
2018	MSY approach		≤ 48 990	41 767	29 417	29 333	3767	30	33 130
2019	MSY approach		≤ 33 956	28 950	25 542	26 697	3570	184	30 451
2020	MSY approach		≤ 41 818	35 653	26 243	26 023	8106	930	35 060
2021	MSY approach		≤ 69 280	42 785	22 402	21 019	11 450	1266	33 735
2022	MSY approach		≤ 128 708	44 924					
2023	MSY approach		≤ 137 058						

\* The exploitation of this stock should be conducted in the context of mixed fisheries, protecting stocks outside safe biological limits.

\*\* Including industrial bycatch.

\*\*\* Subarea 4 and Subdivision 20 combined.

^ Catch advice since 2015 is provided for Subarea 4, Division 6.a, and Subdivision 20.

^^ Since 2016 discards estimated by ICES include BMS landings.

^^^ Due to an InterCatch issue when generating area-specific catch estimates, these values do not sum to the catch-component totals in tables 7, 8, and 9 when added across areas. The latter are used in the assessment.

**Table 6b** Haddock in Subarea 4, Division 6.a, and Subdivision 20. **Skagerrak (Subdivision 20)**. ICES advice, TAC, official landings, and ICES catch estimates. All weights are in tonnes. Values of landings, discards, and catches for the period 1987 to 2014 are presented to the nearest hundred tonnes.

Year	ICES advice	Landings corresp. to advice	Catch corresp. to advice**	Agreed TAC	Official landings	ICES landings	ICES discards^	ICES industrial bycatch	ICES total catch
1987	Precautionary TAC	-		11 500		3800		1400	5300
1988	Precautionary TAC	-		10 000		2900		1500	4300
1989	Precautionary TAC	-		10 000		4100		400	4500
1990	Precautionary TAC	-		10 000		4100		2000	6100
1991	Precautionary TAC	4600		4600		4100		2600	6700
1992	TAC	4600		4600		4400		4600	9000
1993	Precautionary TAC	-		4600		2000		2400	4400
1994	Precautionary TAC	-		10 000		1800		2200	4000
1995	If required, precautionary TAC; link to North Sea	-		10 000		2200		2200	4400
1996	If required, precautionary TAC; link to North Sea	-		10 000		3100		2900	6100
1997	Combined advice with North Sea	-		7000		3400		600	4000
1998	Combined advice with North Sea	4700		7000		3800		300	4000
1999	Combined advice with North Sea	3400		5400		1400		300	1700
2000	Combined advice with North Sea	< 1800		4500		1500		600	2100
2001	Combined advice with North Sea	< 2000		4000		1900		200	2100
2002	Combined advice with North Sea	< 3000		6300		4100		60	4100
2003	Combined advice with North Sea	-		3200		1800	200	n/a	1800
2004	Combined advice with North Sea/ F should be below $F_{pa}$	No forecast		4900		1400	100	n/a	1400
2005	Combined advice with North Sea/F should be below $F_{pa}$	-		4000		800	200	0	800
2006	Combined advice with North Sea/F < 0.3	-		3200		1500	1000	0	1500
2007	Combined advice with North Sea/F < 0.3	-		3400		1600	800	0	2500
2008	Combined advice with North Sea/15% TAC reduction	2900		2900		1300	400	0	1800
2009	Combined advice with North Sea/apply management plan	-		2600		1500	400	0	1900
2010	Combined advice with North Sea/apply management plan	-		2200		1400	600	0	2000
2011	See scenarios	-		2100		2100	1300	0	3400

Year	ICES advice	Landings corresp. to advice	Catch corresp. to advice**	Agreed TAC	Official landings	ICES landings	ICES discards^	ICES industrial bycatch	ICES total catch
2012	Apply North Sea management plan	-		2095	2500	2600	800	0	3400
2013	Apply North Sea management plan	-		2770	2000	*	*	*	*
2014	Apply North Sea management plan	2438		2355	2200	2300	200	0	2400
2015	(November update) MSY approach		68 690	2504	1432	1421	163	3	1586
2016	MSY approach		≤ 59 945	3926	1215	1221	93	7	1321
2017	MSY approach		≤ 39 461	2069	1032	1111	134	0	1245
2018	(November update) MSY approach		≤ 48 990	2569	717	797	68	0	865
2019	MSY approach		≤ 33 956	1780	584	628	75	3	706
2020	MSY approach		≤ 41 818	2193	532	402	247	147	796
2021	MSY approach		≤ 69 280	2630	2005	1988	614	93	2695
2022	MSY approach		≤ 128 708	2761					
2023	MSY approach		≤ 137 058						

\* Subarea 4 and Subdivision 20 combined (see Table 4a).

\*\* Catch advice since 2015 is given for Subarea 4, Division 6.a, and Subdivision 20.

^ Since 2016, discards estimated by ICES include BMS landings.

^^ Due to an InterCatch issue when generating area-specific catch estimates, these values do not sum to the catch-component totals in Tables 7, 8, and 9 when added across areas. The latter are used in the assessment.

**Table 6c** Haddock in Subarea 4, Division 6.a, and Subdivision 20. **West of Scotland (Division 6.a.)**. ICES advice, TAC, official landings, and ICES catch estimates. All weights are in tonnes. Values for the period from 1987 to 2014 are presented to the nearest thousand (official landings) or nearest hundred (ICES landings, discards, and total) tonnes.

Year	ICES advice/Single-stock exploitation boundaries from 2004 onwards *	Landings corresp. to advice	Catch corresp. to advice^^	Agreed TAC	Official landings	ICES landings	ICES discards#	ICES industrial bycatch	ICES total catch
1987	Reduce F towards $F_{max}$	20 000		32 000	27 000	27 000	16 200		43 200
1988	No increase in F; TAC	25 000		35 000	21 000	21 200	9500		30 700
1989	80% of F (87); TAC	15 000		35 000	24 000	16 700	3000		19 700
1990	80% of F (88); TAC	14 000		24 000	13 000	10 100	5400		15 500
1991	70% of effort (89)	-		15 200	10 000	10 600	8700		19 200
1992	70% of effort (89)	-		12 500	7000	11 400**	9300**		20 500**
1993	70% of effort (89)	-		17 600	13 000	19 100**	16 800**		35 900**
1994	30% reduction in effort	-		16 000	9000	14 200**	11 100**		25 000**
1995	Significant reduction in effort	-		21 000	13 000	12 400	8600		20 900
1996	Significant reduction in effort	-		22 900	13 000	13 500	11 400		24 800
1997	Significant reduction in effort	-		20 000	13 000	12 900	6500		19 300
1998	No increase in F	20 800***		25 700	14 000	14 400	5500		19 900
1999	F reduced to $F_{pa}$	14 300***		19 000	11 000	10 500	4900		15 300
2000	Maintain F below $F_{pa}$	< 14 900***		19 000	7000	7000	7900		14 900
2001	Reduce F below $F_{pa}$	< 11 200***		13 900	7000	6870	6600		13 400
2002	Reduce F below $F_{pa}$	< 14 100***		14 100	7000	7100	8900		16 000
2003	No cod catches	-		8700	4900	5300	4100		9400
2004	$F_{pa}$ *	12 200		6500	3000	3900	3700		7600
2005	$0.75 \times F_{pa}$ *	7600		7600	3200	3800	2900		6700
2006	$0.7 \times F_{pa}$ *	8000		7810	5700	6300	4600		10 900
2007	$0.87 \times F_{pa}$ *	7200		7200	3700	3800	4000		7700
2008	$SSB > B_{pa}$ *	4200		6120	2800	2800	1600		4400
2009	No fishing and recovery plan*	0		3520	2800	2800	1800		4600
2010	No fishing and recovery plan	0		2670	2900	2900	1600		4500
2011	See scenarios	0		2005	1700	1800	1300		3100
2012	MSY framework	5600		6015	5000	5100	500		5600
2013	MSY framework	3100		4211	4700	4800	1000		5800

Year	ICES advice/Single-stock exploitation boundaries from 2004 onwards *	Landings corresp. to advice	Catch corresp. to advice <sup>^^</sup>	Agreed TAC	Official landings	ICES landings	ICES discards <sup>#</sup>	ICES industrial bycatch	ICES total catch
2014	MSY approach	6432 <sup>^</sup>		3988	4000	4100	800		4900
2015	(November update) MSY approach		68 690	4536	3889	39 625	1425		5387
2016	MSY approach		≤ 59 945	6462	4265	4346	1626		5972
2017	MSY approach		≤ 39 461	3697	3251	34 564	1615		5071
2018	(November update) MSY approach		≤ 48 990	4654	4318	4380	1391		5771
2019	MSY approach		≤ 33 956	3226	3511	3588	2090		5679
2020	MSY approach		≤ 41 818	3973	2653	2695	619		3314
2021	MSY approach		≤ 69 280	4767	3559	3660	4370		8030
2022	MSY approach		≤ 128 708	5006					
2023	MSY approach		≤ 137 058						

\* Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries, protecting stocks outside safe biological limits.

\*\* Adjusted for misreporting.

\*\*\* For Division 6.a only.

<sup>^</sup> This value (6432 t) refers to total catch, including discards. Therefore, it is not directly comparable to the value advised for 2013 (3100 t), which referred only to landings.

<sup>^^</sup> Catch advice since 2015 is given for Subarea 4, Division 6.a, and Subdivision 20.

<sup>##</sup> Due to an InterCatch issue when generating area-specific catch estimates, these values do not sum to the catch-component totals in tables 7, 8, and 9 when added across areas. The latter are used in the assessment.

# Since 2016, discards estimated by ICES include BMS landings.

## History of the catch and landings

**Table 7** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Catch distribution by fleet in 2021 as used in the assessment model.

Catch	Landings*			Discards**	IBC
44 122 tonnes	Demersal trawl and seine > 100 mm 92%	Trawl 70–99 mm 1.38%	Others 6.8%	16 308 tonnes	1357 tonnes
	26 457 tonnes				

\*Landings include the Norwegian component of BMS landings.

\*\*Discards include BMS landings from EU and UK fleets.

**Table 8** Haddock in Subarea 4, Division 6.a, and Subdivision 20. History of official commercial landings, along with ICES estimates for individual areas. All weights are in tonnes.

Country	Subdivision 20													
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*	2021*
Germany	87	105	65	102	120	90	114	103	125	56	31	30	12	21
Denmark	1052	1263	1139	1661	1916	1456	1764	1059	908	852	542	457	448	1841
Netherlands	0	0	1	0	0	5	6	4	2	20	4	4	1	11
Norway	170	121	81	125	303	223	86	63	70	0	0	0	0	8
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	15	0
Sweden	276	166	126	198	210	217	219	203	110	104	140	93	56	124
UK	0	0	0	0	0	3	0	0	0	0	0	0	0	0
BMS landings										< 1	< 1	0	1	74
Subarea 4														
Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*	2021*
Belgium	112	108	78	106	78	78	98	47	53	30	29	29	40	150
Germany	393	657	634	575	548	677	677	599	554	609	348	313	331	369
Denmark	501	552	725	697	947	1283	1079	1442	1244	1185	1117	1174	1683	1892
Spain	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faroes	3	32	5	0	0	0	0	0	0	0	0	1	2	0
France	448	135	276	320	175	177	209	100	121	140	201	188	144	219
Greenland	0	4	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	130	0
Netherlands	29	24	41	71	191	172	99	44	146	75	102	166	175	291
Norway	1482	1278	1126	1195	1006	1662	2743	2003	1499	2164	1428	1516	3171	2215
Poland	16	0	0	0	0	0	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sweden	83	141	90	128	103	113	154	136	118	181	100	111	114	142
UK	27 365	28 393	24 983	23 343	27 378	33 013	29 851	25 905	26 427	25 667	26 091	22 044	20 452	17 123
BMS landings										< 1	15	160	287	208

Division 6.a														
Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*	2021*
Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	2	2	1	9	4	18
Spain	10	21	28	36	15	14	19	9	33	28	28	64	26	24
Faroes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	151	136	89	73	32	51	67	41	62	68	66	57	86	92
Ireland	879	297	396	290	845	746	667	768	1034	641	758	562	441	587
Netherlands	0	0	0	0	0	0	0	11	28	31	17	54	13	0
Norway	28	18	9	4	0	6	2	7	5	1	7	10	2	0
UK	1776	2380	2415	1364	4123	3878	3261	3052	3101	2480	3441	2755	2081	2838
BMS landings										0	2	15	26	30
Subarea 4, Division 6.a, and Subdivision 20														
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*	2021*
Official landings	34 862	35 831	32 308	30 288	37 990	43 864	41 115	35 596	35 642	34 334	34 451	29 637	29 427	27 965
ICES landings	32 692	34 361	31 926	30 273	37 839	43 230	40 589	35 215	35 111	33 799	34 441	30 747	28 942	26 457
ICES discards and IBC^	17 235	12 159	9417	12 609	5073	3473	5336	6262	7819	7061	5245	5702	9987	17 665
ICES total catch	49 927	46 519	41 344	42 882	42 912	46 703	45 926	41 477	42 930	40 860	39 687	36 449	38 928	44 122
TAC 4	46 444	42 110	35 794	34 057	39 000	45 041	38 284	40 711	61 933	33 643	41 767	28 950	35 653	44 924
TAC 3.a 20	2856	2590	2201	2100	2095	2770	2355	2504	3926	2069	2569	1780	2193	2630
TAC 6.a	6120	3520	2670	2005	6015	4211	3988	4536	6462	3697	4654	3226	3973	4767
Total TAC	55 420	48 220	40 665	38 162	47 110	52 022	44 627	47 751	72 321	39 409	48 990	33 956	41 819	50 182

\* Preliminary.

^ ICES discards included since 2016 BMS landings from EU and UK fleets.

### Summary of the assessment

**Table 9** Haddock in Subarea 4, Division 6.a, and Subdivision 20. Assessment summary. Recruitment is in thousands, weights are in tonnes. High and low refers to 95% confidence intervals.

Year	Recruitment (Age 0)			Spawning stock biomass			Landings*	Discards ***	IBC	Fishing pressure (Ages 2–4)		
	R	High	Low	SSB	High	Low				F	High	Low
	thousands			tonnes								
1972	12 649 827	20 113 092	7 955 919	447 664	565 255	354 535	234 019	144 366	29 585	0.80	0.99	0.65
1973	32 687 783	51 475 117	20 757 431	417 535	513 277	339 652	207 489	126 105	11 267	0.77	0.93	0.64
1974	64 979 645	102 606 259	41 151 040	325 315	398 085	265 847	167 528	181 802	47 505	0.79	0.95	0.66
1975	6 249 833	9 833 292	3 972 261	297 219	358 137	246 663	160 271	293 321	41 487	0.89	1.06	0.74
1976	7 216 914	11 340 999	4 592 527	415 182	523 568	329 234	184 421	169 776	48 163	0.88	1.05	0.74
1977	10 302 559	16 105 854	6 590 319	320 170	412 156	248 714	156 639	48 732	35 022	0.88	1.04	0.74
1978	18 077 321	28 282 709	11 554 393	157 491	192 402	128 915	102 970	32 860	10 903	0.89	1.06	0.75
1979	29 049 767	45 377 445	18 597 102	138 197	164 641	116 000	97 896	35 054	16 240	0.84	1.01	0.70
1980	7 730 850	11 952 788	5 000 176	190 866	231 481	157 376	111 371	68 831	22 472	0.77	0.92	0.64
1981	12 568 912	19 030 232	8 301 399	295 790	363 448	240 726	147 806	61 683	17 041	0.64	0.77	0.53
1982	7 520 588	11 110 874	5 090 440	334 187	410 793	271 866	195 456	41 297	19 383	0.65	0.78	0.54
1983	22 651 401	33 335 912	15 391 389	269 887	314 169	231 847	188 754	51 584	12 898	0.74	0.88	0.62
1984	5 967 728	8 788 517	4 052 308	229 279	262 782	200 048	158 205	79 012	10 080	0.79	0.93	0.67
1985	7 974 824	11 756 222	5 409 715	272 109	316 718	233 784	182 946	58 373	5998	0.83	0.98	0.70
1986	12 651 223	18 691 287	8 562 998	242 521	288 707	203 724	185 137	36 063	2643	0.88	1.04	0.75
1987	2 068 253	3 046 503	1 404 125	175 563	202 834	151 959	135 022	55 674	4410	0.94	1.10	0.80
1988	2 182 966	3 209 442	1 484 788	160 702	186 494	138 476	126 227	49 833	4002	0.90	1.05	0.76
1989	3 331 710	4 876 122	2 276 460	140 052	166 724	117 647	92 840	32 453	2410	0.89	1.05	0.76
1990	7 883 152	11 353 356	5 473 632	84 855	98 167	73 348	61 605	22 548	2589	0.87	1.03	0.74
1991	12 172 282	17 287 476	8 570 623	72 369	82 189	63 722	55 208	36 610	5386	0.95	1.11	0.81
1992	16 645 721	23 823 591	11 630 490	108 819	125 922	94 038	81 566	42 477	10 927	0.87	1.01	0.74
1993	5 458 651	7 632 031	3 904 186	169 965	196 921	146 699	98 631	70 748	10 766	0.91	1.07	0.78
1994	18 014 805	25 226 697	12 864 673	189 463	218 673	164 156	95 141	70 668	3576	0.86	1.01	0.73
1995	7 732 879	11 098 636	5 387 816	182 341	209 790	158 483	89 859	71 262	7695	0.73	0.86	0.61
1996	8 352 530	11 729 542	5 947 782	214 411	246 633	186 398	92 615	107 207	5000	0.80	0.94	0.67
1997	3 918 301	5 474 646	2 804 398	236 707	274 753	203 930	95 391	67 879	6684	0.72	0.86	0.61
1998	3 125 460	4 363 147	2 238 865	193 454	220 720	169 556	95 472	61 399	5101	0.78	0.93	0.66
1999	36 390 173	51 550 735	25 688 182	137 730	157 492	120 449	76 009	43 562	3835	0.89	1.04	0.75
2000	8 706 721	12 203 038	6 212 142	117 042	132 124	103 682	54 504	64 185	8134	0.79	0.94	0.67
2001	1 297 496	1 831 910	918 984	284 289	341 924	236 369	47 592	117 882	7879	0.57	0.69	0.47
2002	1 559 523	2 182 575	1 114 332	368 458	437 244	310 493	65 405	86 051	3717	0.45	0.56	0.36
2003	1 136 921	1 597 872	808 945	270 109	317 446	229 831	47 282	25 975	1150	0.31	0.40	0.25

Year	Recruitment (Age 0)			Spawning stock biomass			Landings*	Discards ***	IBC	Fishing pressure (Ages 2–4)		
	R	High	Low	SSB	High	Low				F	High	Low
	thousands			tonnes			tonnes					
2004	1 113 678	1 556 649	796 762	188 026	220 738	160 161	51 896	20 020	554	0.33	0.41	0.26
2005	4 611 225	6 667 834	3 188 951	136 860	161 868	115 716	51 528	12 389	168	0.39	0.48	0.32
2006	1 424 468	1 995 510	1 016 837	99 835	119 359	83 504	43 334	23 094	535	0.50	0.60	0.41
2007	1 038 390	1 458 304	739 388	106 115	123 465	91 202	34 672	32 651	48	0.48	0.59	0.40
2008	822 127	1 164 693	580 319	113 882	133 503	97 145	32 692	17 234	1	0.38	0.47	0.31
2009	4 116 082	5 888 324	2 877 242	88 656	103 020	76 294	34 361	12 159	-	0.33	0.40	0.27
2010	499 120	707 224	352 251	88 234	101 620	76 611	31 926	9417	-	0.31	0.38	0.25
2011	329 439	461 757	235 037	113 933	130 890	99 173	30 273	12 609	-	0.29	0.36	0.24
2012	600 032	843 918	426 627	139 435	163 163	119 157	37 839	5054	19	0.29	0.35	0.23
2013	657 116	918 034	470 354	113 522	133 414	96 595	43 230	3305	168	0.30	0.37	0.24
2014	4 126 647	5 877 875	2 897 172	86 111	101 084	73 355	40 589	5271	65	0.37	0.45	0.30
2015	1 214 108	1 696 366	868 951	75 981	88 345	65 347	35 215	6241	21	0.44	0.54	0.36
2016	1 426 828	1 997 470	1 019 209	105 109	122 449	90 223	35 111	7782	37	0.37	0.47	0.30
2017	662 496	926 763	473 585	110 232	128 495	94 565	33 799	7053	8	0.34	0.42	0.27
2018	1 980 231	2 777 843	1 411 641	100 671	115 781	87 532	34 441	5215	30	0.36	0.44	0.28
2019	6 810 487	9 689 090	4 787 109	84 858	97 448	73 895	30 747	5516	186	0.33	0.41	0.27
2020	7 955 652	11 520 390	5 493 946	107 457	122 494	94 265	28 942	8910	1077	0.28	0.35	0.22
2021	2 499 031	4 117 484	1 516 741	207 210	245 324	175 018	26 457	16 308	1357	0.21	0.27	0.162
2022	1 623 040	8 706 721	329 439	412 059	513 977	330 351						

\* ICES estimates, presented as the sum of product (SOP) values from the catch and weight-at-age used in the assessment model.

\*\* Discards include since 2016, BMS landings from EU and UK fleets.

\*\*\* Recruitment in 2022 is the geometric mean of resampled assessment recruitment estimates from 2000 to 2021.

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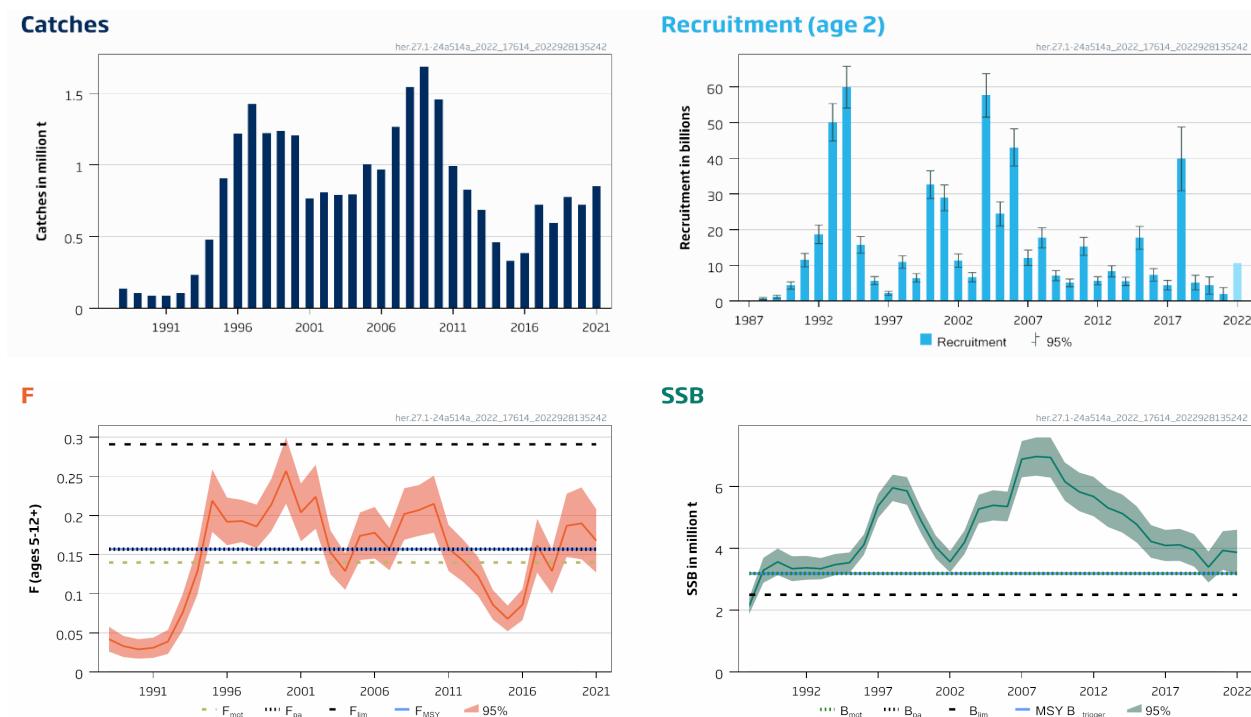
## Herring (*Clupea harengus*) in subareas 1, 2, and 5, and in divisions 4.a and 14.a, Norwegian spring-spawning herring (Northeast Atlantic and Arctic Ocean)

### ICES advice on fishing opportunities

ICES advises that when the long-term management strategy agreed by the European Union, the Faroe Islands, Iceland, Norway, and the Russian Federation is applied, catches in 2023 should be no more than 511 171 tonnes.

### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$  and between  $F_{pa}$  and  $F_{lim}$ ; spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 5-12+}\ (2022)$	0.192	Based on assumed catches in 2022
SSB (2023)	3 531 608	From the assessment model; in tonnes
$R_{age\ 2}\ (2022)$	10.671	Median stochastic recruitment based on the years 1988–2021; in billions
$R_{age\ 2}\ (2023)$	10.671	Median stochastic recruitment based on the years 1988–2021; in billions
Catch (2022)	827 963	Sum of declared unilateral quotas from the individual parties; in tonnes

**Table 2** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F (2023)	SSB (2024)	% SSB change*	% catch change**	% advice change***
ICES advice basis						
Agreed management strategy <sup>^</sup>	511171	0.14	3147970	-11	-38	-15
Other scenarios						
MSY approach: $F_{MSY}$	568410	0.157	3098334	-12	-31	-5
$F = 0$	0	0	3592990	2	-100	-100
$F_{pa}$	568410	0.157	3098334	-12	-31	-5
$F_{lim}$	986742	0.291	2736980	-23	19	65
$SSB_{2024} = B_{lim}^{++}$	1262850	0.390	2500025	-29	53	111
$SSB_{2024} = B_{pa} = MSY B_{trigger}^{++}$	469646	0.128	3184005	-10	-43	-22
$F = F_{2022}$	684536	0.192	2997770	-15	-17	14

\* SSB<sub>2024</sub> relative to SSB<sub>2023</sub>.

\*\* Catch in 2023 relative to ICES estimated catch in 2022 (827 963 tonnes).

\*\*\* Advice value 2023 relative to advice value 2022 (598 588 tonnes).

<sup>^</sup> According to the harvest control rule in the management strategy  $F$  (2023) =  $F_{mgt}$  = 0.14, since the SSB is forecasted to be above  $B_{trigger}$  on 1 January 2023.

<sup>++</sup> SSB<sub>2024</sub> values are the closest available approximation to  $B_{lim}$  and  $B_{trigger}$ .

The advice for 2023 is 15% lower than for 2022 because the stock size is declining as a result of low recruitment since the large 2016 year class.

### Basis of the advice

**Table 3** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). The basis of the advice.

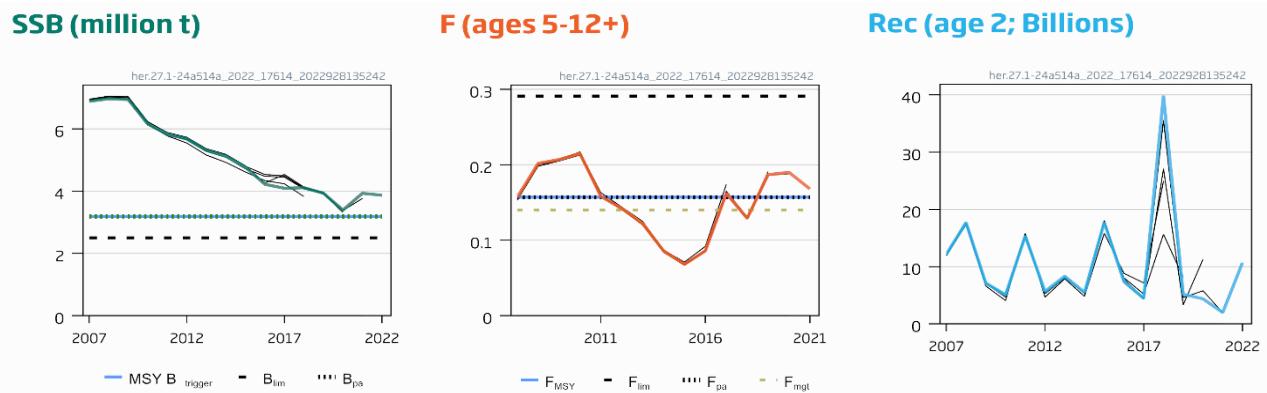
Advice basis	Management strategy
Management strategy	A long-term management strategy was agreed by the European Union, the Faroe Islands, Iceland, Norway, and Russian Federation in 2018 (Anon, 2018). ICES has evaluated the long-term management strategy and found it to be precautionary (ICES, 2018a).

### Quality of the assessment

The estimated SSB and fishing mortality are generally in line with the estimates from last year's assessment.

The only available catch data from Russian Federation for 2021 was total catch by ICES division from ICES preliminary catch database, and no Russian catch samples were available. Historically, preliminary catches are comparable to ICES final estimated catch. There were adequate samples from other fishing nations operating in the same areas, which were used to estimate catch-at-age and weight-at-age.

The Barents Sea survey (IESNS; A3675) was not conducted in 2022. There was no survey information on age 2, and therefore median stochastic recruitment based on the years 1988–2021 was used instead in the forecast. However, this has negligible impact on the advised catches.



**Figure 2** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Historical assessment results.

### Issues relevant for the advice

The 2016 year class is expected to dominate the catches in 2023, and the subsequent year classes recruiting to the fishery are estimated to be weak.

SSB is predicted to be below  $SSB_{mgt}$  in 2024 if  $F_{mgt}$  is applied in 2023.

There has been an overshoot of the catches in relation to the advised TAC since 2013. The advice is based on the target fishing mortality in the long-term management strategy agreed by the European Union, the Faroe Islands, Iceland, Norway, and the Russian Federation; it does not consider the deviations from the long-term management strategy as evident from the sum of declared unilateral quotas. During the evaluation of the long-term management strategy (ICES, 2018a), the implementation error in the form of a consistent overshoot of the TAC was not included. Therefore, failing to adhere to the advised catches as derived from the application of the long-term management strategy may not be precautionary. Specifically, this may result in an increased risk for the stock to fall below  $B_{lim}$ , loss of catch in the long term, and unsustainable utilization of the resource.

### Reference points

**Table 4** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Reference points, values, and their technical basis. F values corresponded to fishing mortality weighted by the population numbers, for ages 5–12+.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	3.184	$B_{pa}$ ; in million tonnes.	ICES (2018b)
	$F_{MSY}$	0.157	Stochastic simulations with Beverton–Holt, segmented regression, and Ricker stock–recruitment relationships, capped to $F_{P05}$	ICES (2018a)
Precautionary approach	$B_{lim}$	2.5	MBAL (accepted in 1998); in million tonnes	ICES (2018b)
	$B_{pa}$	3.184	Based on $B_{lim}$ and assessment uncertainties. $B_{lim} \times \exp(1.645 \times \sigma)$ , with $\sigma = 0.147$ ; in million tonnes	ICES (2018b)
	$F_{lim}$	0.291	Equilibrium scenarios with stochastic recruitment: F value corresponding to 50% probability of ( $SSB < B_{lim}$ )	ICES (2018a)
	$F_{pa}$	0.157	$F_{P05}$ ; the F that leads to $SSB \geq B_{lim}$ with 95% probability	ICES (2018a, 2021)
EU–Faroes–Iceland–Norway–Russian Federation long-term management strategy	$SSB_{mgt\_lower}$	2.5	Precautionary HCR evaluated by MSE. SSB values in million tonnes.	ICES (2018a)
	$SSB_{mgt}$	3.184		
	$F_{mgt\_lower}$	0.05		
	$F_{mgt}$	0.14		

## Basis of the assessment

**Table 5** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Statistical assessment model (XSAM; ICES, 2016) that uses catches in the model and in the forecast and also includes uncertainty in catches and abundance indices
Input data	Assessment period 1988–2022: commercial catches-at-age (stock weight-at-age from surveys and, since 2009, from catch sampling). Three survey indices: Norwegian acoustic survey on spawning grounds in February/March (NASF [A7918]; 1988–1989, 1994–1996, 1998–2000, 2005–2008, 2015–2022); International Ecosystem Survey in the Nordic Seas (IESNS; A3675) covering the adult stock in the Nordic seas (1996–2022), and the juvenile stock in the Barents Sea (1991–2002, 2005–2007, 2009–2019, 2021). Maturity ogive variable by year-class strength. Natural mortalities are fixed values from historical analyses (age 2 = 0.9; ages greater than 2 = 0.15).
Discards and bycatch	Not included, considered negligible
Indicators	None
Other information	This stock was benchmarked in 2016 (ICES, 2016). A re-evaluation of reference points and the current management plan took place in 2018 (ICES, 2018a, 2019b).
Working group	Working Group on Widely Distributed Stocks ( <a href="#">WGWD</a> ; ICES 2022b).

## History of the advice, catch, and management

**Table 6** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). ICES advice and landings. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Sum of agreed quotas	ICES catch
1987	TAC	150000	115000	127306
1988	TAC	120000–150000	120000	135301
1989	TAC	100000	100000	103830
1990	TAC	80000	80000	86411
1991	No fishing from a biological point of view	0	76000	84683
1992	No fishing from a biological point of view	0	98000	104448
1993	No increase in F	119000	200000	232457
1994	Gradual increase in F towards $F_{0.1}$ ; TAC suggested	334000	450000	479228
1995	No increase in F	513000	900000*	905501
1996	Keep SSB above 2.5 million tonnes	-	1425000*	1220283
1997	Keep SSB above 2.5 million tonnes	-	1500000	1426507
1998	Do not exceed the harvest control rule	-	1300000	1223131
1999	Do not exceed the harvest control rule	1263000	1300000	1235433
2000	Do not exceed the harvest control rule	$\leq 1500000$	1250000	1207201
2001	Do not exceed the harvest control rule	753000	850000	766136
2002	Do not exceed the harvest control rule	853000	850000	807795
2003	Do not exceed the harvest control rule	710000	711000*	789510
2004	Do not exceed the harvest control rule	825000	825000*	794066
2005	Do not exceed the harvest control rule	890000	1000000*	1003243
2006	Do not exceed the harvest control rule	732000	967000*	968958
2007	Do not exceed the harvest control rule	1280000	1280000	1266993
2008	Do not exceed the harvest control rule	1518000	1518000	1545656
2009	Do not exceed the harvest control rule	1643000	1643000	1687371
2010	Do not exceed the harvest control rule	1483000	1483000	1457015
2011	See scenarios in the 2010 advice	988000–1170000	988000	992997
2012	Follow the management plan	833000	833000	826000
2013	Follow the management plan	619000	692000*	684743
2014	Follow the management plan	418487	436893*	461306
2015	Follow the management plan	283013	328206*	328740
2016	Follow the management plan	$\leq 316876$	376612*	383174
2017	Follow the management plan	$\leq 437364^{**}$	805142*	721566
2018	Follow the management plan	$\leq 384197$	546448*	592899

Year	ICES advice	Catch corresponding to advice	Sum of agreed quotas	ICES catch
2019	Follow the management strategy, $F_{mgt} = 0.14$ and $B_{mgt} = 3.184$ million tonnes	$\leq 588562$	773750*	777165
2020	Follow the management strategy, $F_{mgt} = 0.14$ and $B_{mgt} = 3.184$ million tonnes	$\leq 525594$	693915*	720937
2021	Follow the management strategy, $F_{mgt} = 0.14$ and $B_{mgt} = 3.184$ million tonnes	$\leq 651033$	881097*	851813
2022	Follow the management strategy, $F_{mgt} = 0.14$ and $B_{mgt} = 3.184$ million tonnes	$\leq 598588$	827963*	
2023	Follow the management strategy, $F_{mgt} = 0.14$ and $B_{mgt} = 3.184$ million tonnes	$\leq 511171$		

\* There was no agreement on the TAC; the number is the sum of the declared unilateral quotas from the individual parties.

\*\* Value corrected in October 2017 (previously 646 075 tonnes).

**Table 7** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Catches inside and outside the NEAFC Regulatory Area (RA), as estimated by ICES, as well as total landings. Weights are in tonnes.

Year	Inside the NEAFC RA	Outside the NEAFC RA	Total catches	Percentage inside the NEAFC RA
2019	281092	496073	777165	36
2020	95322	625615	720937	13
2021*	20347	738626	758972	2

\* Without catches from the Russian Federation which did not report catches inside/outside the NEAFC RA for 2021. In the past, around 50% of Russian catches were taken inside the NEAFC RA.

## History of the catch and landings

**Table 8** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Catch distribution by fleet in 2021 as estimated by ICES.

Catch (2021)	Landings		Discards	
	48% purse seine			
	851813 tonnes	52% pelagic trawl		
		851813 tonnes		

**Table 9** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). History of commercial landings; ICES estimated values are presented for each country participating in the fishery. All weights are in tonnes.

Year	Norway	Russian Federation*	Denmark	Faroës	Iceland	Ireland	Netherlands	Greenland	UK	Germany	France	Poland	Sweden	Total
1986	199256	26000	-	-	-	-	-	-	-	-	-	-	-	225256
1987	108417	18889	-	-	-	-	-	-	-	-	-	-	-	127306
1988	115076	20225	-	-	-	-	-	-	-	-	-	-	-	135301
1989	88707	15123	-	-	-	-	-	-	-	-	-	-	-	103830
1990	74604	11807	-	-	-	-	-	-	-	-	-	-	-	86411
1991	73683	11000	-	-	-	-	-	-	-	-	-	-	-	84683
1992	91111	13337	-	-	-	-	-	-	-	-	-	-	-	104448
1993	199771	32645	-	-	-	-	-	-	-	-	-	-	-	232457
1994	380771	74400	-	2911	21146	-	-	-	-	-	-	-	-	479228
1995	529838	101987	30577	57084	174109	-	7969	2500	881	556	-	-	-	905501
1996	699161	119290	60681	52788	164957	19541	19664	-	46131	11978	-	-	22424	1220283
1997	860963	168900	44292	59987	220154	11179	8694	-	25149	6190	1500	-	19499	1426507
1998	743925	124049	35519	68136	197789	2437	12827	-	15971	7003	605	-	14863	1223131
1999	740640	157328	37010	55527	203381	2412	5871	-	19207	-	-	-	14057	1235433
2000	713500	163261	34968	68625	186035	8939	-	-	14096	3298	-	-	14749	1207201
2001	495036	109054	24038	34170	77693	6070	6439	-	12230	1588	-	-	9818	766136
2002	487233	113763	18998	32302	127197	1699	9392	-	3482	3017	-	1226	9486	807795
2003	477573	122846	14144	27943	117910	1400	8678	-	9214	3371	-	-	6431	789510
2004	477076	115876	23111	42771	102787	11	17369	-	1869	4810	400	-	7986	794066
2005	580804	132099	28368	65071	156467	-	21517	-	-	17676	0	561	680	1003243
2006	567237	120836	18449	63137	157474	4693	11625	-	12523	9958	80	-	2946	968958
2007	779089	162434	22911	64251	173621	6411	29764	4897	13244	6038	0	4333	0	1266993
2008	961603	193119	31128	74261	217602	7903	28155	3810	19737	8338	0	0	0	1545656
2009	1016675	210105	32320	85098	265479	10014	24021	3730	25477	14452	0	0	0	1687371
2010	871113	199472	26792	80281	205864	8061	26695	3453	24151	11133	0	0	0	1457015
2011	572641	144428	26740	53271	151074	5727	8348	3426	14045	13296	0	0	0	992997
2012	491005	118595	21754	36190	120956	4813	6237	1490	12310	11945	0	0	705	826000
2013	359458	78521	17160	105038	90729	3815	5626	11788	8342	4244	0	0	23	684743
2014	263253	60292	12513	38529	58828	706	9175	13108	4233	669	0	0	0	461306
2015	176321	45853	9105	33031	42625	1400	5255	12434	55	2660	0	0	0	328740
2016	197501	50455	10384	44727	50418	2048	3519	17508	4031	2582	0	0	0	383174
2017	389383	91118	19037	98170	90400	3495	6679	12569	4358	5201	0	1	1155	721566
2018	332028	64185	17052	82062	83393	2428	4290	2465	2582	1989	0	0	425	592899
2019	430507	84364	21207	113945	108045	2775	5111	3190	1801	4188	0	1327	705	777165
2020	409436	74936	16523	103029	98173	2704	5060	3546	143	2969	0	1352	3065	720937
2021	489632	92841^	15854	114291	114299	1793	10939	6456	0	3365	0	1242	1101	851813

\* USSR before 1992

^ From ICES preliminary catch database

### Summary of the assessment

**Table 10** Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Assessment summary. All weights are in tonnes and recruitment in thousands. F is the fishing mortality weighted by population numbers.

Year	Recruitment (age 2)			SSB			Total catch	F (ages 5–12+)		
	Low	Value	High	Low	Value	High		Low	Value	High
1988	349000	672000	996000	1863000	2126000	2389000	135301	0.026	0.042	0.058
1989	693000	1173000	1653000	2881000	3287000	3694000	103830	0.0190	0.033	0.046
1990	3320000	4339000	5358000	3131000	3562000	3993000	86411	0.0170	0.029	0.042
1991	9592000	11466000	13340000	2937000	3340000	3743000	84683	0.0180	0.031	0.044
1992	16058000	18683000	21308000	2982000	3368000	3753000	104448	0.023	0.039	0.054
1993	44859000	50101000	55342000	2993000	3340000	3687000	232457	0.053	0.076	0.100
1994	54096000	59953000	65811000	3125000	3471000	3817000	479228	0.099	0.129	0.160
1995	13419000	15751000	18082000	3205000	3536000	3868000	905501	0.179	0.22	0.26
1996	4601000	5722000	6843000	3787000	4118000	4450000	1220283	0.162	0.192	0.22
1997	1587000	2152000	2716000	4984000	5374000	5765000	1426507	0.166	0.193	0.22
1998	9163000	10941000	12719000	5526000	5954000	6383000	1223131	0.158	0.186	0.21
1999	5246000	6461000	7677000	5403000	5854000	6304000	1235433	0.180	0.21	0.25
2000	28751000	32626000	36501000	4458000	4873000	5287000	1207201	0.22	0.26	0.30
2001	25328000	28927000	32527000	3669000	4043000	4416000	766136	0.167	0.20	0.24
2002	9465000	11339000	13212000	3218000	3565000	3913000	807795	0.183	0.22	0.27
2003	5399000	6678000	7956000	3806000	4189000	4571000	789510	0.125	0.153	0.181
2004	51584000	57658000	63732000	4805000	5269000	5734000	794066	0.105	0.129	0.152
2005	21072000	24428000	27784000	4898000	5389000	5880000	1003243	0.143	0.174	0.20
2006	37840000	43044000	48247000	4868000	5350000	5832000	968958	0.145	0.178	0.21
2007	9976000	12127000	14277000	6294000	6882000	7471000	1266993	0.130	0.157	0.184
2008	14863000	17706000	20549000	6346000	6965000	7584000	1545656	0.169	0.20	0.24
2009	5681000	7109000	8536000	6285000	6937000	7588000	1687373	0.174	0.21	0.24
2010	3977000	5074000	6171000	5533000	6154000	6775000	1457014	0.178	0.22	0.25
2011	12785000	15315000	17846000	5198000	5824000	6450000	992998	0.129	0.158	0.188
2012	4504000	5658000	6812000	5034000	5673000	6312000	825999	0.115	0.142	0.169
2013	6760000	8319000	9879000	4687000	5307000	5926000	684743	0.097	0.122	0.147
2014	4300000	5491000	6681000	4506000	5123000	5741000	461306	0.067	0.086	0.105
2015	14504000	17709000	20913000	4183000	4772000	5360000	328740	0.052	0.068	0.085
2016	5588000	7341000	9094000	3690000	4220000	4750000	383174	0.066	0.086	0.106
2017	3113000	4432000	5752000	3585000	4091000	4596000	721566	0.127	0.162	0.196
2018	30907000	39850000	48793000	3590000	4110000	4630000	592899	0.100	0.129	0.157
2019	3066000	5149000	7231000	3406000	3934000	4463000	777165	0.147	0.187	0.23
2020	1958000	4358000	6757000	2891000	3393000	3895000	720937	0.144	0.190	0.24
2021	148000	1958000	3768000	3304000	3930000	4555000	851813	0.127	0.168	0.21
2022		10671000		3134000	3867000	4600000				

## Sources and references

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[Download the stock assessment data and figures.](#)

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## Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)

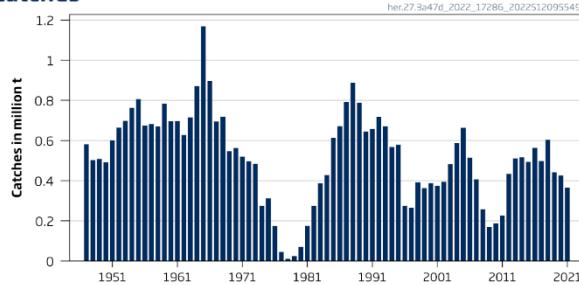
### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 414 886 tonnes.

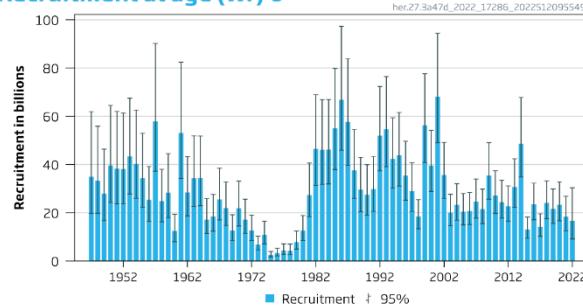
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and the spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$  and  $B_{lim}$ .

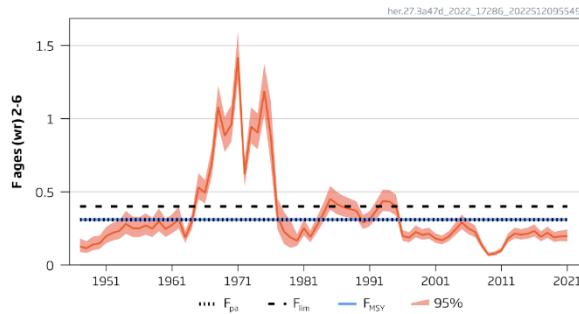
#### Catches



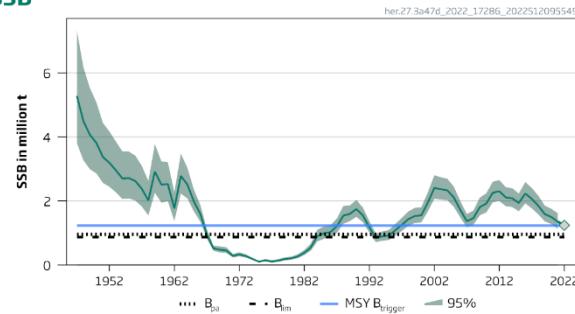
#### Recruitment at age (wr) 0



#### F



#### SSB



**Figure 1** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Summary of the stock assessment. The grey diamond in the SSB plot is a predicted number for 2022 at spawning time. wr is winter ring.

## Catch scenarios

**Table 1** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis for the catch scenarios. All weights are in tonnes and recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 2-6\ (wr)}\ (2022)$	0.27	Based on 2022 total assumed catches
SSB (2022)	1 240 164	Calculated based on catch constraint
$R_{age\ 0\ (wr)}\ (2022)$	16 619 677	Estimated by assessment model
$R_{age\ 0\ (wr)}\ (2023)$	22 556 738	Weighted mean by standard deviation over 2012–2021
Total catch (2022)	454 747	<ul style="list-style-type: none"> <li>• A-fleet: Total catch: 445 371 t. Fleet TAC (427 628 t) + NSAS catches from the C-fleet transfer to the North Sea (23 885 t)</li> <li>• B-fleet: Total catch: 8 973 t. Fleet TAC (8174 t) + NSAS catches from the D-fleet transfer to the North Sea (3330 t)</li> <li>• C-fleet: Total catch: 403 t catch in 3.a (NSAS proportion of 167 t Norwegian catch and 969 t EU catch in 3a)</li> <li>• D-fleet: Total catch set at 0 t because considered negligible</li> </ul>

**Table 2** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The intermediate year (2022) assumptions. Weights are in tonnes.

F by fleet and total						NSAS catches by fleet				SSB 2022
$F_{ages\ (wr)\ 2-6\ A-fleet}$	$F_{ages\ (wr)\ 0-1\ B-fleet}$	$F_{ages\ (wr)\ 1-3\ C-fleet}$	$F_{ages\ (wr)\ 0-1\ D-fleet}$	$F_{ages\ (wr)\ 2-6}$	$F_{ages\ (wr)\ 0-1}$	Catches A-fleet*	Catches B-fleet	Catches C-fleet	Catches D-fleet	
0.269	0.048	0	0	0.27	0.051	445 371	8973	403	0	1 240 164

**Table 3** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Annual catch scenarios. All weights are in tonnes.

Basis	F values by fleet and total						NSAS catches by fleet				Total stock catch	Biomass*				% Advice change ^
	A-fleet $F_{ages\ (wr)\ 2-6}$	B-fleet $F_{ages\ (wr)\ 0-1}##$	C-fleet $F_{ages\ (wr)\ 1-3}$	D-fleet $F_{ages\ (wr)\ 0-1}$	Total $F_{ages\ (wr)\ 2-6}$	Total $F_{ages\ (wr)\ 0-1}$	A-fleet	B-fleet	C-fleet#	D-fleet#		SSB 2023	SSB 2024**	%SSB change ***	A-fleet **** %TAC change	
<b>ICES advice basis</b>																
MSY approach ( $F_{MSY}^*$ * $SSB_{2023}/MSY\ B_{trigger}$ )	0.28	0.05	0	0	0.28	0.05	403 813	11 073	0	0	414 886	1 117 094	1 005 280	-9.9	-5.6	-22
<b>Other scenarios</b>																
$F = F_{MSY}$	0.31	0.06	0	0	0.31	0.06	438 848	12 175	0	0	451 023	1 094 001	964 099	-12	2.60	-15
$F = 0$	0	0	0	0	0	0	0	0	0	0	0	1 372 327	1 548 998	11	-100	-100
No change in TAC^^	0.30	0.05	0.01	0.00	0.31	0.07	427 628	11 821	8 885	330	448 664	1 096 000	962 258	-12	0	-16
$F = F_{2022}$	0.27	0.05	0	0	0.27	0.05	391 016	10 677	0	0	401 693	1 125 489	1 020 557	-9.2	-8.6	-25
$F_{pa}$	0.31	0.06	0	0	0.31	0.06	438 848	12 175	0	0	451 023	1 094 001	964 099	-12	2.60	-15
$F_{lim}$	0.40	0.07	0	0	0.40	0.08	540 487	15 533	0	0	556 020	1 026 066	849 918	-17	26	4.50
$SSB_{2023} = B_{pa}$	0.50	0.09	0	0	0.50	0.09	642 407	19 170	0	0	661 577	956 483	743 240	-23	50	24
$SSB_{2023} = B_{lim}$	0.63	0.11	0	0	0.63	0.12	760 120	23 763	0	0	783 883	874 198	629 634	-30	78	47
$SSB_{2023} = MSY\ B_{trigger}$	0.15	0.03	0	0	0.15	0.03	224 496	5 817	0	0	230 313	1 232 828	1 230 894	-0.6	-48	-57
MSY approach^^ with $F_{ages\ 0-1} = 0.05$ target ##	0.28	0.05	0	0	0.28	0.05	403 880	10 443	0	0	414 323	1 117 093	1 005 463	-9.9	-5.6	-22
MSY approach with C-fleet catches and C- and D-fleet TAC transfer	0.29	0.07	0.00	0	0.29	0.07	419 564 ^^^	14 160	403	0	434 127	1 106 309	984 896	-11	-1.9	-18
MSY approach with C- and D-fleet catches and no C- and D-fleet TAC transfer	0.27	0.05	0.01	0.00	0.28	0.06	395 645	10 821	8 885	330	415 681	1 117 074	999 916	-9.9	-7.5	-22

\* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1 January and spawning.

\*\* Assuming same catch scenario in 2024 as in 2023.

\*\*\* SSB (2023) relative to SSB (2022).

\*\*\*\* A-fleet catches (2023) relative to TAC 2022 for the A-fleet (427 628 tonnes).

^ Advice value 2023 relative to advice value 2022, using catches for all fleets (532 183 tonnes).

^^ Based on the agreed TACs for A-, C-, and D-fleets in 2022, the average proportion in 2019–2021 of NSAS herring in the catch (for A-, C-, and D-fleets), no C- and D-fleet TAC transfer to the North Sea, and the average uptake in 2019–2021 of the bycatch quota (for B- and D-fleets).

^^^ Includes a C-fleet transfer of 23 885 t

# The catch for C- and D-fleets are set to zero because of the zero catch advice given for 2023 for the western Baltic spring-spawning herring stock.

## B-fleet fishing pressure set independently on change in the A-fleet fishing pressure (ICES, 2022)

### Fishing pressure inclusive of catches induced by D-fleet transfer.

The basis for the 22% decrease in catch advice is mainly due to the decline in stock biomass. Additionally, the spawning stock biomass in the forecast year (2023) is forecast to be below MSY  $B_{trigger}$  which implies that the fishing pressure is scaled down from the  $F_{MSY}$  reference point.

## Basis of the advice

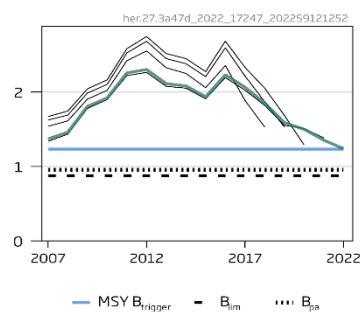
**Table 4** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for herring in this area

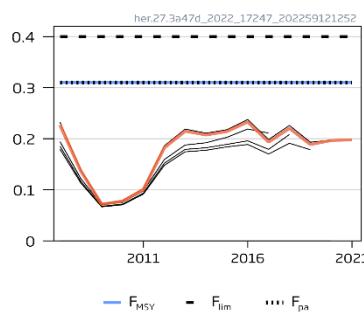
## Quality of the assessment

The estimates of SSB and fishing mortality are consistent with last year while recruitment in 2021 has been scaled down in the update assessment.

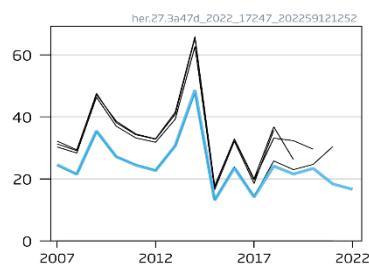
### SSB (million t)



### F (ages 2-6)



### Rec at age (wr) O(Billions)



**Figure 2** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Historical assessment results. Final-year recruitment included for each line. The reference points were revised in 2021 following an inter-benchmark, and only assessment results from the last 2 years should be compared to the reference points indicated.

## Issues relevant for the advice

**Low recruitment for the stock in recent years.** The stock level has been decreasing in recent years because of ongoing low recruitment. The application of the MSY advice rule with these reference points in combination with low recruitment may keep the stock below MSY  $B_{trigger}$  in the short to medium term.

**Several spawning components of herring where protection measures should be continued.** North Sea Autumn spawners (NSAS) have several spawning components, including the Downs herring that spawns in divisions 4.c and 7.d. These components are fished on individual spawning grounds and in a mixed-component fishery in the central and northern North Sea. To help protect the Downs component, sub-TACs have been set for divisions 4.c and 7.d. A long-term management plan should be developed to ensure the maximum productivity of the stock and protect all components.

**Fleet definition as used in the advice.** When addressing NSAS catch options, catch by the A-, B-, C-, and D-fleets in Subarea 4 and divisions 3.a and 7.d have to be considered all at once. The input catch data are disaggregated in these different fleets based on assumptions which deviate from the definition of those fleets for management purposes (based on TAC settings). In the context of this advice, the fleets are currently described as follows:

**Fleet A:** Directed fishery for herring for human consumption in the North Sea and division 7.d, but includes herring bycatches in the Norwegian industrial fishery. The catch of herring is almost exclusively NSAS herring, with some bycatch of WBSS herring in the eastern part of the Division 4.

**Fleet B:** Bycatch industrial fleet of EU nations targeting sprat, Norway pout and sandeel operating in the North Sea. The catch of herring is assumed to be exclusively NSAS herring.

**Fleet C:** Directed fishery for herring for human consumption in Kattegat and Skagerrak (Division 3.a). This fleet also includes catches from the small meshed Swedish fishery. The catch of herring consists of a mixture of NSAS and WBSS herring.

**Fleet D:** Bycatch of herring in Kattegat and Skagerrak (Division 3.a) in the Danish small-meshed industrial fleet for sprat and Norway pout and sandeel. The catch of herring consists of a mixture of NSAS and WBSS herring.

**Inter area flexibility.** Inter area transfers from Division 3.a to the North Sea results in an increase in catches of NSAS and a decline in catches in WBSS. These transfers are not accounted for in the ICES MSY advice for 2023.

**Bycatch of WBSS herring in eastern part of 4a could require new management measures.** The catch of WBSS in the North Sea in recent years has been substantial but variable. The expected catches of WBSS in 2022 will be larger in the North Sea than in subdivisions 20–24. Without additional area and seasonal restrictions on the herring fishery in the North Sea in 2023, the catch of WBSS in the North Sea could be of a similar magnitude to previous years (estimated at 5688 t based on the average over the 2019–2021 period). ICES assumes in the forecast that fishery in the eastern part of the North Sea will continue even though there is likely to be a considerable catch of WBSS for which a zero catch is advised by ICES.

**No activities should be allowed that have negative impact on spawning habitats.** Activities that might have a negative impact on the spawning habitat of herring should not occur unless the effects of these activities have been assessed and shown not to be detrimental (ICES, 2003; 2015).

## Reference points

**Table 5** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Reference points, values, and their technical basis. Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	1 232 828	50th percentile of biomass at $F_{MSY}$	ICES, 2021a
	$F_{MSY}$	0.31	Stochastic simulations (EqSim) with a segmented regression stock–recruitment curve fitted to data from the low productivity period (2002–2020) assuming a break-point at $B_{lim}$	ICES, 2021a
Precautionary approach	$B_{lim}$	874 198	Breakpoint in the segmented regression of the stock–recruitment time-series (1947–2016, excluding the recovery period 1979–1990)	ICES, 2021a
	$B_{pa}$	956 483	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ with $\sigma \approx 0.06$ , based on the $\sigma$ from the terminal assessment year	ICES, 2021a
	$F_{lim}$	0.40	The $F$ that on average leads to $B_{lim}$	ICES, 2021a
	$F_{pa}$	0.31	The maximum $F$ that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P05}$ with advice rule [AR])	ICES, 2021a

## Basis of the assessment

**Table 6** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based analytical assessment, SAM (ICES, 2022b) that uses catches in the model and in the forecast
Input data	Commercial catches disaggregated by fleets and split for NSAS/WBSS. Five survey indices IBTS Q1 1-ringer (G1022), IBTSO (I8304), LAI as SSB index (I2359, I9086, I2687), HERAS 1–8 ringers (includes split for NSAS/WBSS, A5092), IBTS Q3 0–5-ringlers (G2829); annual maturity data from HERAS survey, natural mortalities from SMS North Sea multispecies model (ICES, 2021b)
Discards	Discarding is considered to be negligible
Indicators	None
Other information	This stock was inter-benchmarked and reference points were updated in 2021 (ICES, 2021a)
Working group	Herring Assessment Working Group for the Area South of 62°N ( <a href="#">HAWG</a> )

## History of the advice, catch, and management

**Table 7** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. ICES advice, TACs, official landings, and ICES catch estimates. All weights are in tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC *	B-fleet ***	ICES landings in 4, 7.d #	ICES catch in 4, 7.d ##	ICES catch of autumn spawners in 3.a, 4, 7.d
1987	TAC	610 000	600 000		625 000	625 000	792 000
1988	TAC	515 000	530 000		710 000	710 000	888 000
1989	TAC	514 000	514 000		669 000	717 000	787 000
1990	TAC	403 000	415 000		523 000	578 000	646 000
1991	TAC	423 000	420 000		537 000	588 000	657 000
1992	TAC	406 000	430 000		518 000	572 000	716 000
1993	No increase in yield at $F > 0.3$	340 000	430 000		495 000	540 000	671 000
1994	No increase in yield at $F > 0.3$	346 000	440 000		463 000	498 000	571 000
1995	Long-term gains expected at lower F	429 000	440 000		510 000	516 000	579 000
1996	50% reduction of agreed TAC **	156 000	156 000 ***	44 000	207 000	233 000	275 000
1997	$F = 0.2$	159 000	159 000	24 000	175 000	238 000	264 000
1998	$F(\text{adult}) = 0.2$ , $F(\text{juv}) < 0.1$	254 000	254 000	22 000	268 000	338 000	392 000
1999	$F(\text{adult}) = 0.2$ , $F(\text{juv}) < 0.1$	265 000	265 000	30 000	290 000	333 000	363 000
2000	$F(\text{adult}) = 0.2$ , $F(\text{juv}) < 0.1$	265 000	265 000	36 000	284 000	346 000	388 000
2001	$F(\text{adult}) = 0.2$ , $F(\text{juv}) < 0.1$	See scenarios	265 000	36 000	296 000	323 000	363 000
2002	$F(\text{adult}) = 0.2$ , $F(\text{juv}) < 0.1$	See scenarios	265 000	36 000	304 000	353 000	372 000
2003	$F(\text{adult}) = 0.25$ , $F(\text{juv}) = 0.12$	See scenarios	400 000	52 000	414 000	450 000	48 0000
2004	$F(\text{adult}) = 0.25$ , $F(\text{juv}) = 0.1$	See scenarios	460 000	38 000	484 000	550 000	567 000
2005	$F(\text{adult}) = 0.25$ , $F(\text{juv}) = 0.1$	See scenarios	535 000	50 000	568 000	639 000	664 000
2006	$F(\text{adult}) = 0.25$ , $F(\text{juv}) = 0.12$	See scenarios	455 000	43 000	490 000	511 000	515 000
2007	Bring SSB above $B_{pa}$ by 2008	See scenarios	341 000	32 000	361 000	388 000	407 000
2008	$F(\text{adult}) = 0.17$ , $F(\text{juv}) = 0.08$ (management plan [MP])	See scenarios	201 000	19 000	228 000	245 000	258 000
2009	Adopt one of the new proposed HCRs	See scenarios	171 000	16 000	167 000	166 000	168 000
2010	$F(\text{adult}) = 0.15$ , $F(\text{juv}) = 0.05$ (MP)	See scenarios	164 000	14 000	175 000	175 000	188 000
2011	See scenarios	See scenarios	200 000	16 000	218 000	218 000	226 000
2012	2008 management plan	See scenarios	405 000	18 000	425 000	425 000	435 000
2013	2008 management plan	See scenarios	478 000	14 000	498 000	498 000	511 000
2014	2008 management plan	See scenarios	470 000	13 000	504 000	508 000	517 000

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC *	B-fleet ***	ICES landings in 4, 7.d #	ICES catch in 4, 7.d ##	ICES catch of autumn spawners in 3.a, 4, 7.d
2015	2008 management plan	See scenarios	445 000	16 000	480 000	482 000	494 000
2016	2014 management strategy	555 086	518 000	13 000	559 700	559 900	563 600
2017	2014 management strategy	458 926	481 608	11 375	491 693	491 693	498 662
2018	2014 management strategy	517 891	600 588	9669	602 328	602 328	603 536
2019	ICES MSY approach	311 572	385 008	13 190	444 001	445 631	442 886
2020	ICES MSY approach	431 062	385 008	8954	424 799	427 321	426 928
2021	ICES MSY approach	365 792	356 357	7750	364 453	364 616	365 351
2022	ICES MSY approach	532 183	427 628	8174			
2023	ICES MSY approach	414 886					

\* Catch in directed fishery in Subarea 4 and Division 7.d (A-fleet).

\*\* Revision of advice given in 1995.

\*\*\* Revised in June 1996, down from 263 000 tonnes.

# Landings are provided by ICES and do not in all cases correspond to official statistics.

## ICES catch includes unallocated and misreported landings, discards, and slipping. Includes catches for WBSS in the North Sea.

### Bycatch ceiling up to 2012 and TAC from 2013.

## History of the catch and landings

**Table 8** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution by fleet and area in 2021 as estimated by ICES.

Area where NSAS are caught	Fleet	Fishery	NSAS 2021 catches (tonnes)
North Sea fisheries (Subarea 4, Division 7.d)	A	Directed herring fisheries	352 320
	B	Bycatches of herring	8788
Division 3.a	C	Directed herring fisheries	4140
	D	Bycatches of herring	103

**Table 9** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution in 2021 as estimated by ICES.

Catch (2021)	Landings		Discards
	Directed fishery 97.6%	Bycatch 2.4%	
	365 188 tonnes		

**Table 10** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in the North Sea; official or ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2005	2006	2007	2008	2009	2010	2011
Belgium	6	3	1	-	-	-	4
Denmark *	128 380	102 322	84 697	62 864	46 238	45 869	58 726
Faroe Islands	738	1785	2891	2014	1803	3 014	-
France	38 829	49 475	24 909	30 347	18 114	17 745	16 693
Germany	46 555	40 414	14 893	8095	5368	7 670	9 427
Netherlands	81 531	76 315	66 393	23 122	24 552	23 872	34 708
Norway	156 802	135 361	100 050	59 321	50 445	46 816	60 705
Poland	458	-	-	-	-	90	-
Sweden	13 464	10 529	15 448	13 840	5299	4 395	8 086
USSR/Russia	99	-	-	-	-	-	-
UK (England)	25 311	22 198	15 993	11 717	652	10 770	11 468
UK (Scotland)	73 227	48 428	35 115	16 021	14 006	14 373	18 564
UK (N. Ireland)	2912	3531	638	331	-	-	17
Unallocated landings	57 788	18 764	26 641	17 151	-726	-	-
Total landings	626 101	509 125	387 669	244 823	165 751	174 614	218 398
Discards	12 824	1492	93	224	91	13	-
Total catch	638 925	510 617	387 762	245 047	165 842	174 627	218 398
Parts of the catches that have been allocated to spring-spawning stocks							
WBSS	7039	10 954	1070	124	3 941	774	308
Thames Estuary **	74	65	2	7	48	85	2
Norw. spring spawners ***	417	626	685	2 721	44 560	56 900	12 178

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Belgium	3	14	27	18	26	13	32	60	119	47
Denmark *	105 707	117 367	124 423	113 481	133 962	110 318	132 231	91 680	95 615	62 943
Faroe Islands	-	-	118	981	833	442	497	614	804	0
France	23 819	30 122	29 679	30 269	35 177	28 801	31 505	25 288	19 768	25 070
Germany	24 515	46 922	36 767	44 377	44 231	43 707	51 636	37 699	29 439	25 741
Netherlands	72 344	80 462	74 647	70 076	98 859	84 914	111 302	79 465	75 036	66 402
Norway	119 253	143 718	142 002	134 349	150 183	134 132	162 594	128 614	115 879	95 061
Lithuania	-	-	9 830	-	-	-	-	-	-	466
Sweden *	14 092	15 615	15 583	13 184	16 625	18 518	19 408	13 184	13 149	18 765
Ireland	-	221	68	183	127	868	515	3	235	414
UK (England)	25 346	19 079	19 287	18 897	20 485	16 997	19 591	12 685	16 241	13 174
UK (Scotland)	34 414	39 243	45 119	48 332	59 240	49 514	66 005	50 771	49 692	51 194
UK (N. Ireland)	4794	5738	6612	5948	-	3469	6916	3938	2681	5 176

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Unallocated landings	321	-	3292	1516	8	0	0	0	0	0
Total landings	424 608	498 501	507 454	481 611	559 756	491 693	602 232	444 001	424 800	364 453
Discards/BMS	-	-	31	-	170	-	96	1630	2522	162
Total catch	424 608	498 501	507 485	481 611	559 926	491 693	602 328	445 631	427 321	364 615
Parts of the catches that have been allocated to spring-spawning stocks										
WBSS	2095	452	2953	2205	1839	632	2164	8832	6802	3 505
Thames Estuary **	63	20	10	10	1	0	10	-	-	2
Norw. spring spawners ***	9619	3150	2307	2191	216	83	310	5	88	0

\* Including any bycatches in the industrial fishery.

\*\* Landings from the Thames Estuary area are included in the North Sea catch figure for UK (England).

\*\*\* These catches (including some local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure for this area.

**Table 11** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The “Wonderful Table”, which shows herring TACs and catches by different fleets, areas, and stocks. Weights are in thousand tonnes.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Subarea 4 and Division 7.d: TAC</b>															
Agreed divisions 4.a–b	303.5	174.6	147.4	149	173.5	360.4	427.7	418.3	396.3	461.2	428.7	534.5	342.7	342.7	321.6
Agreed divisions 4.c, 7.d	37.5	26.7	23.6	15.3	26.5	44.6	50.3	51.7	49	57	53	66	42.4	42.4	34.8
Bycatch ceiling in the small-mesh fishery *	31.9	18.8	16	13.6	16.5	17.9	14.4	13.1	15.7	13.4	11.4	9.7	13.2	9.0	7.8
<b>CATCH (Subarea 4 and Division 7.d)</b>															
National catch divisions 4.a–b **	326.8	201.2	145	148.1	191.7	387.2	453.8	465.9	439	514	456.5	556.9	405.1	389.3	328.5
Unallocated catch divisions 4.a–b	21.9	14	-1.1	0	0	-3.0	0	3.3	1.5	0	0	0	0.0	0.0	0.0
Discard/slipping divisions 4.a–b ***	0.1	0.2	0.1	0	-	-	-	0	-	0.1	-	0	0.8	0.3	0.1
Total catch divisions 4.a–b#	348.8	215.4	143.9	148.1	191.7	384.2	453.9	469.2	440.5	514.1	456.5	556.9	405.9	389.6	328.5
National catch divisions 4.c, 7.d **	34.3	26.5	21.5	26.5	26.7	37.1	44.7	38.2	41.1	45.8	35.2	45.4	38.9	35.5	36.0
Unallocated catch divisions 4.c, 7.d	4.7	3.1	0.4	0	0	3.3	0	0	0	0	0	0	0.0	0.0	0.0
Discard/slipping divisions 4.c, 7.d ***	-	-	-	-	-	-	-	-	-	0.1	-	0.1	0.8	2.2	0.1
Total catch divisions 4.c, 7.d	39	29.6	21.9	26.5	26.7	40.4	44.7	38.2	41.1	45.8	35.2	45.5	39.8	37.7	36.1
Total catch Subarea 4 and Division 7.d as used by ICES #	387.8	245	165.8	174.6	218.4	424.6	498.5	507.5	481.6	559.9	491.7	602.3	445.6	427.3	364.6
<b>CATCH BY FLEET/STOCK (Subarea 4 and Division 7.d) ##</b>															
North Sea autumn spawners directed fisheries (A-fleet)	379.6	236.3	152.1	164.8	209.2	411.8	489.9	490.5	471.5	543.6	484.1	591.7	440.5	417.5	352.3
North Sea autumn spawners industrial (B-fleet)	7.1	8.6	9.8	9.1	8.9	10.6	8.1	14	7.9	14.5	7	8.5	5.2	9.9	8.8
North Sea autumn spawners in Subarea 4 and Division 7.d total	386.7	244.9	161.9	173.9	218.1	422.5	498.1	504.5	479.4	558.1	491.1	600.2	436.8	420.5	361.1
Baltic-20–24-type spring spawners in Subarea 4	1.1	0.1	3.9	0.8	0.3	2.1	0.5	3	2.2	1.8	0.6	2.2	8.8	6.8	3.5
Coastal-type spring spawners	0	0	0	0.1	0	0.1	0	0	0	0	0	0	0.0	0.0	0.0
Norw. spring spawners caught under a separate quota in Subarea 4 ###	0.7	2.7	44.6	56.9	12.2	9.6	3.2	2.3	2.2		0.1	0.3	0.0	0.1	0.0
<b>Division 3.a: TAC</b>															
Agreed herring TAC	69.4	51.7	37.7	33.9	30	45	55	46.8	43.6	51.1	50.7	48.4	29.3	24.5	21.6
Bycatch ceiling in the small-mesh fishery	15.4	11.5	8.4	7.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
<b>CATCH (Division 3.a)</b>															
National catch	47.3	38.2	38.8	37.3	20	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	13.3
Catch as used by ICES	47.4	38.2	38.8	37.3	20	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	13.3
<b>CATCH BY FLEET/STOCK (Division 3.a) ##</b>															
Autumn spawners human consumption (C-fleet)	16.4	9.2	5.1	12	6.6	7.8	11.8	9.5	10.2	4.1	7.4	3.2	5.8	6.0	4.1
Autumn spawners mixed clupeoid (D-fleet)	3.4	3.7	1.5	1.8	1.8	4.4	1.6	3.3	4.4	1.4	0.2	0.2	0.3	0.4	0.1
Autumn spawners in Division 3.a total	19.8	12.9	6.5	13.8	8.4	12.2	13.4	12.8	14.7	5.5	7.6	3.4	6.1	6.4	4.2
Spring spawners human consumption (C-fleet)	25.3	23	29.4	23	10.8	14.5	16.6	15.4	11.3	23.3	19	19.7	8.8	10.9	9.0
Spring spawners mixed clupeoid (D-fleet)	2.3	2.2	2.9	0.5	0.8	1	1.3	0.6	1.8	1.1	0.2	0.2	0.0	0.5	0.0
Spring spawners in Division 3.a total	27.6	25.2	32.3	23.5	11.6	15.5	17.9	16.1	13.1	24.4	19.2	19.9	8.8	11.4	9.1
North Sea autumn spawners: Total as used by ICES	406.5	257.9	168.4	187.6	226.5	434.6	511.4	517.3	494.1	563.6	498.7	603.5	442.9	426.9	365.4

\* Divisions 4.a–b and EC zone of Division 2.a. \*\* ICES estimates. \*\*\* Incomplete, only some countries providing discard information. # Includes spring spawners not included in assessment. ## Based on sum-of-products (number × mean weight-at-age). ### These catches (including local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure.

## Summary of the assessment

**Table 12** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Assessment summary. Weights are in tonnes and numbers in thousands. High and low refer to the 95% confidence intervals.

Year	Recruitment			SSB			Total Catch	F		
	Recruitment at age (wr) 0	High	Low	SSB *	High	Low		Ages 2-6	High	Low
		thousands		tonnes		tonnes				
1947	34 933 554	61 900 650	19 714 707	5 285 579	7 331 788	3 810 441	581 760	0.127	0.182	0.089
1948	33 243 309	55 852 320	19 786 422	4 498 149	6 182 684	3 272 582	502 100	0.115	0.162	0.082
1949	27 876 772	46 353 471	16 764 967	4 068 639	5 529 503	2 993 728	508 500	0.140	0.195	0.101
1950	39 549 436	64 485 983	24 255 781	3 813 584	5 082 848	2 861 275	491 700	0.148	0.201	0.109
1951	38 332 357	62 000 780	23 699 211	3 376 462	4 443 804	2 565 481	600 400	0.198	0.261	0.150
1952	38 183 068	61 317 735	23 776 916	3 193 191	4 170 729	2 444 769	664 400	0.220	0.289	0.167
1953	43 326 920	67 488 027	27 815 630	2 960 946	3 859 977	2 271 310	698 500	0.234	0.306	0.178
1954	40 294 149	62 546 474	25 958 593	2 705 410	3 548 400	2 062 689	762 900	0.281	0.370	0.213
1955	34 319 467	52 948 552	22 244 721	2 715 493	3 544 188	2 080 562	806 400	0.252	0.332	0.192
1956	25 365 753	39 161 412	16 429 985	2 622 714	3 415 790	2 013 775	675 200	0.250	0.327	0.191
1957	57 941 798	90 208 427	37 216 611	2 376 734	3 095 960	1 824 592	682 900	0.270	0.354	0.207
1958	24 823 836	38 003 385	16 214 946	2 017 862	2 626 096	1 550 502	670 500	0.248	0.322	0.192
1959	28 315 691	44 529 385	18 005 602	2 920 802	3 777 042	2 258 668	784 500	0.299	0.387	0.231
1960	12 460 158	19 398 450	8 003 503	2 513 467	3 240 432	1 949 591	696 200	0.246	0.316	0.192
1961	53 119 421	82 421 861	34 234 520	2 527 008	3 211 914	1 988 151	696 700	0.274	0.346	0.217
1962	28 426 460	43 252 649	18 682 408	1 768 353	2 275 770	1 374 072	627 800	0.315	0.399	0.248
1963	34 277 972	51 875 033	22 650 190	2 784 064	3 476 064	2 229 825	716 000	0.188	0.233	0.152
1964	34 446 126	51 797 295	22 907 288	2 515 254	3 039 959	2 081 115	871 200	0.294	0.353	0.244
1965	17 177 153	25 850 024	11 414 094	1 989 648	2 362 351	1 675 745	1 168 800	0.530	0.627	0.448
1966	18 451 668	27 592 908	12 338 825	1 592 304	1 875 794	1 351 658	895 500	0.495	0.581	0.422
1967	25 572 686	38 437 171	17 013 798	957 998	1 116 038	822 337	695 500	0.690	0.798	0.597
1968	21 982 231	32 764 882	14 748 061	523 533	611 548	448 185	717 800	1.079	1.225	0.950
1969	12 706 227	19 199 824	8 408 837	478 525	583 327	392 552	546 700	0.885	1.014	0.772
1970	21 921 266	33 113 043	14 512 163	455 974	556 266	373 764	563 100	0.960	1.093	0.843
1971	17 176 447	25 653 692	11 500 502	286 537	346 916	236 667	520 100	1.419	1.604	1.256
1972	12 632 049	19 004 624	8 396 307	328 789	398 579	271 220	497 500	0.620	0.717	0.536
1973	6 847 350	10 270 819	4 564 992	279 135	334 422	232 988	484 000	0.946	1.078	0.831
1974	10 823 529	16 498 915	7 100 393	191 486	228 064	160 775	275 100	0.904	1.034	0.791
1975	2 561 527	3 935 192	1 667 370	105 622	127 779	87 307	312 800	1.189	1.379	1.025
1976	3 325 786	5 273 397	2 097 481	143 885	189 611	109 186	174 800	0.874	1.116	0.684
1977	4 383 451	7 116 001	2 700 203	109 516	150 442	79 724	46 000	0.332	0.455	0.242
1978	4 276 395	7 015 316	2 606 804	136 468	185 870	100 197	11 000	0.228	0.363	0.143
1979	7 834 683	12 397 706	4 951 098	186 008	242 387	142 742	25 100	0.188	0.302	0.117
1980	12 618 730	18 829 852	8 456 379	209 548	262 285	167 415	70 764	0.166	0.210	0.132
1981	27 336 674	40 624 103	18 395 329	269 982	336 903	216 354	174 879	0.252	0.316	0.201
1982	46 487 835	68 937 891	31 348 781	383 091	471 984	310 940	275 079	0.192	0.237	0.156
1983	46 119 251	66 899 860	31 793 569	547 774	669 888	447 921	387 202	0.271	0.329	0.223
1984	46 255 876	66 940 414	31 962 845	901 656	1 103 562	736 690	428 631	0.354	0.425	0.295
1985	55 006 798	79 797 942	37 917 617	989 672	1 198 233	817 413	613 780	0.452	0.541	0.377
1986	66 844 177	97 297 692	45 922 405	1 029 021	1 238 263	855 136	671 488	0.417	0.500	0.348
1987	57 661 607	83 805 981	39 673 313	1 207 748	1 451 771	1 004 741	792 058	0.396	0.473	0.332
1988	37 652 038	54 579 076	25 974 716	1 541 445	1 846 136	1 287 040	887 686	0.382	0.454	0.322
1989	29 611 643	42 906 861	20 436 111	1 598 124	1 863 053	1 370 868	787 899	0.371	0.435	0.316
1990	27 465 205	39 923 881	18 894 393	1 748 337	2 033 109	1 503 453	645 229	0.289	0.341	0.245
1991	29 856 193	43 329 721	20 572 305	1 551 746	1 797 306	1 339 736	658 008	0.313	0.368	0.266
1992	52 002 128	72 383 331	37 359 725	1 180 619	1 371 624	1 016 213	716 799	0.373	0.439	0.316
1993	54 689 598	76 466 515	39 114 535	839 871	985 770	715 566	671 397	0.437	0.516	0.369
1994	42 327 104	59 398 980	30 161 861	892 915	1 049 783	759 487	568 234	0.433	0.513	0.366
1995	43 745 924	61 573 383	31 080 084	924 912	1 095 922	780 587	579 371	0.403	0.481	0.337
1996	35 378 362	49 657 868	25 205 039	1 085 584	1 284 639	917 372	275 098	0.198	0.239	0.165
1997	28 927 930	40 713 625	20 553 933	1 252 705	1 475 489	1 063 560	264 313	0.187	0.225	0.156
1998	18 436 245	25 420 760	13 370 771	1 432 476	1 672 079	1 227 208	391 628	0.226	0.271	0.189
1999	56 283 952	77 614 606	40 815 555	1 530 535	1 785 656	1 311 863	363 163	0.206	0.245	0.173
2000	39 546 582	54 189 309	28 860 529	1 552 473	1 809 602	1 331 880	388 157	0.214	0.255	0.179
2001	68 068 660	94 432 143	49 065 310	1 947 136	2 267 896	1 671 744	374 065	0.181	0.216	0.151
2002	35 673 589	49 162 478	25 885 695	2 406 200	2 803 571	2 065 151	394 709	0.169	0.202	0.141
2003	20 127 944	27 623 474	14 666 299	2 368 340	2 742 078	2 045 541	482 281	0.194	0.231	0.163
2004	23 308 892	32 063 390	16 944 697	2 334 587	2 696 790	2 021 031	587 698	0.242	0.289	0.203
2005	20 454 449	27 938 463	14 975 215	2 108 713	2 449 957	1 814 999	663 813	0.290	0.345	0.244
2006	20 763 428	28 460 316	15 148 108	1 722 082	1 997 668	1 484 514	514 597	0.249	0.297	0.209
2007	24 591 328	33 976 587	17 798 533	1 369 887	1 594 364	1 177 015	406 482	0.227	0.271	0.190

Year	Recruitment			SSB			Total Catch	F		
	Recruitment at age (wr) 0	High	Low	SSB *	High	Low		Ages 2-6	High	Low
	thousands			tonnes				tonnes		
2008	21 498 765	29 779 223	15 520 784	1 461 007	1 697 803	1 257 237	257 870	0.137	0.163	0.114
2009	35 475 263	49 063 180	25 650 484	1 808 626	2 105 767	1 553 415	168 443	0.072	0.086	0.060
2010	27 173 952	37 416 926	19 735 017	1 920 666	2 242 352	1 645 128	187 611	0.078	0.093	0.065
2011	24 406 725	33 473 982	17 795 559	2 257 511	2 602 471	1 958 276	226 478	0.101	0.120	0.085
2012	22 665 108	31 114 543	16 510 193	2 303 866	2 654 129	1 999 827	434 710	0.182	0.216	0.153
2013	30 689 037	42 402 328	22 211 446	2 112 765	2 430 494	1 836 572	511 416	0.215	0.255	0.181
2014	48 616 427	67 786 939	34 867 440	2 083 311	2 398 999	1 809 165	517 356	0.207	0.246	0.175
2015	13 098 673	18 207 517	9 423 319	1 936 797	2 234 804	1 678 528	494 099	0.214	0.255	0.179
2016	23 503 414	32 294 052	17 105 641	2 232 275	2 590 560	1 923 541	563 610	0.233	0.278	0.195
2017	14 150 971	19 564 080	10 235 594	2 064 512	2 407 617	1 770 303	498 437	0.193	0.230	0.162
2018	24 124 008	33 227 453	17 514 666	1 852 687	2 166 513	1 584 320	603 536	0.220	0.262	0.185
2019	21 552 500	29 866 735	15 552 764	1 589 952	1 856 230	1 361 873	442 138	0.189	0.226	0.157
2020	23 368 085	32 824 021	16 636 212	1 499 912	1 757 567	1 280 028	426 900	0.196	0.236	0.164
2021	18 346 146	26 835 940	12 542 176	1 352 809	1 620 970	1 129 011	365 356	0.198	0.244	0.161
2022	16 619 677	30 369 274	9 095 169	1 240 164^						

\* At spawning time (September).

^ The predicted 2022 SSB from the intermediate forecast, applying an exact biomass removed by each fleet (see tables 2 and 3).

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

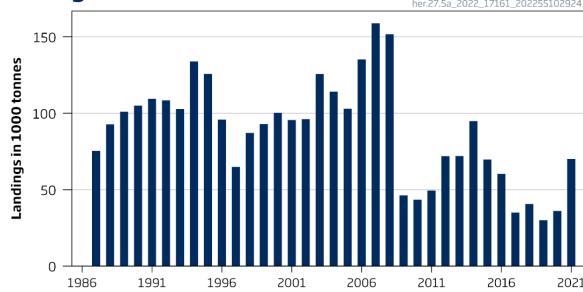
### ICES advice on fishing opportunities

ICES advises that when the Icelandic management plan is applied, catches in the fishing year 2022/2023 should be no more than 66 195 tonnes.

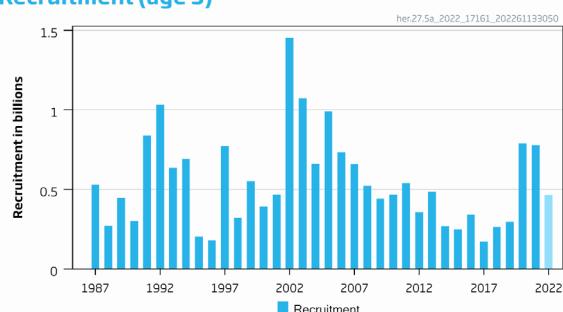
### Stock development over time

Fishing pressure on the stock is above HR<sub>mgt</sub>. Spawning-stock size is above MSY B<sub>trigger</sub>, B<sub>pa</sub>, and B<sub>lim</sub>.

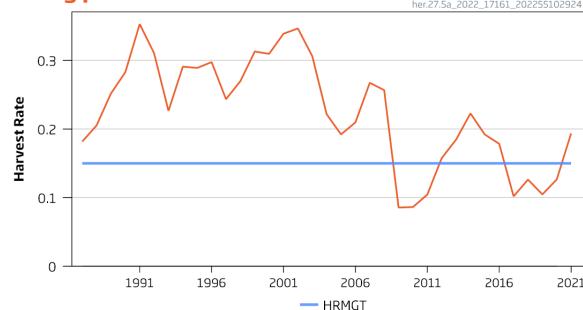
#### Landings



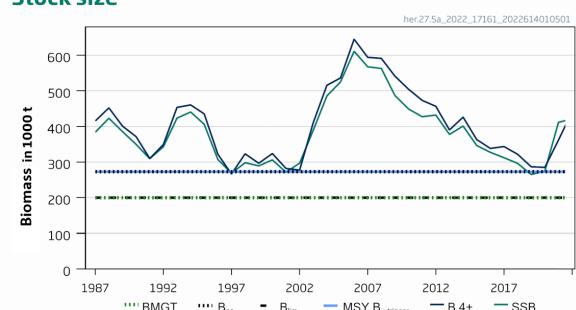
#### Recruitment (age 3)



#### Fishing pressure



#### Stock size



**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. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Herring in Division 5.a, summer-spawning herring. Values in the forecast and for the interim year.

Variable	Value	Notes
HR (2021/2022)	0.19	Harvest rate based on catch constraint
SSB (2022)	421 132	Predicted (1 July 2022) after accounting for <i>Ichthyophonus</i> infection in 2022; tonnes
B <sub>age 4+</sub> (2022)	441 299	Estimated by the assessment (1 January 2022); tonnes
R <sub>age 3</sub> (2022)	464 740	Based on geometric mean for 1987–2019; thousands
R <sub>age 3</sub> (2023)	464 740	Based on geometric mean for 1987–2019; thousands
Total catch (2021/2022)	70 084	Reported catch from June 2021 to the end of April 2022; tonnes

**Table 2** Herring in Division 5.a, summer-spawning herring. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2022/2023)	HR (2022/2023)	Biomass of age 4+ (2023)	SSB (2023)	% SSB change*	% advice change**
ICES advice basis						
Management plan	66 195	0.15	422 801	403 999	-4	-8

\* SSB 2023 relative to SSB 2022.

\*\* Advised catches for 2022/2023 relative to advised catch for 2021/2022 (72 239 tonnes).

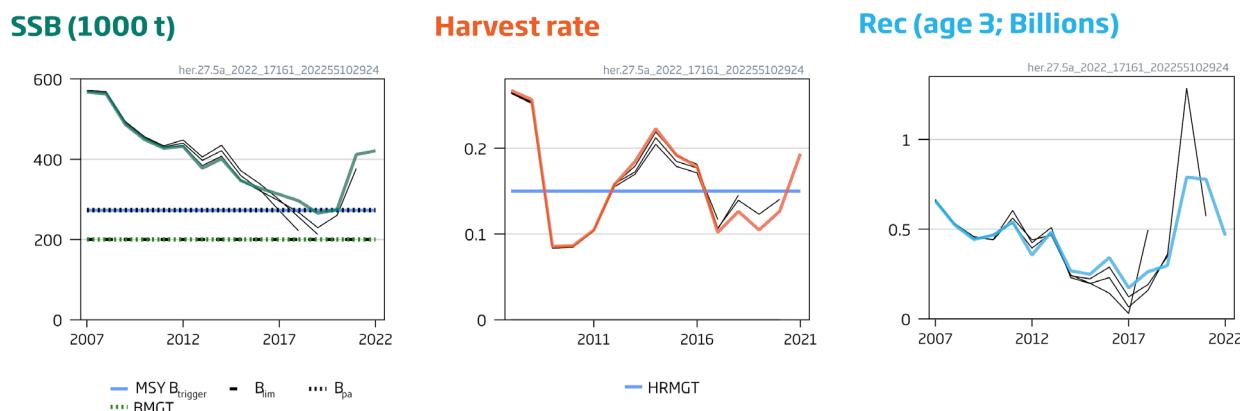
## Basis of the advice

**Table 3** Herring in Division 5.a, summer-spawning herring. The basis of the advice.

Advice basis	Iceland management plan <a href="#">Rule 5</a> (ICES, 2017a; 2017b)
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 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><i>When SSB<sub>Y</sub> is equal to or above MGT B<sub>trigger</sub>: TAC<sub>Y/Y+1</sub> = HR<sub>mgt</sub> × B<sub>ref,Y</sub></i></p> <p><i>When SSB<sub>Y</sub> is below MGT B<sub>trigger</sub>: TAC<sub>Y/Y+1</sub> = HR<sub>mgt</sub> × (<math>\frac{SSB_Y}{MGT B_{trigger}}</math>) × B<sub>ref,Y</sub></i></p> <p>The spawning-stock biomass trigger (MGT B<sub>trigger</sub>) 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<sub>mgt</sub>) is set to 0.15.</p>

## Quality of the assessment

The assessment shows consistency with previous years.



**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. There was no ICES assessment in 2020.

## Issues relevant for the advice

Infection rates of *Ichthyophonus* remain high, and this is taken into account in both the assessment and management plan.

## Reference points

**Table 4** 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 <sub>trigger</sub>	273 000	B <sub>pa</sub>	ICES (2016, 2017a)
	F <sub>MSY</sub>	0.22	Stochastic simulations	ICES (2016, 2017a)
Precautionary approach	B <sub>lim</sub>	200 000	SSB with a high probability of impaired recruitment	ICES (2016)
	B <sub>pa</sub>	273 000	B <sub>pa</sub> = B <sub>lim</sub> × exp(1.645 × σ), where σ = 0.19	ICES (2016)
	F <sub>lim</sub>	0.61	The F that leads to SSB = B <sub>lim</sub>	ICES (2016)
	F <sub>pa</sub>	0.45	F <sub>pa</sub> = F <sub>lim</sub> × exp(-1.645 × σ), where σ = 0.18	ICES (2016)
Management plan	MGT B <sub>trigger</sub>	200 000	Stochastic simulations	ICES (2017a)
	HR <sub>mgt</sub>	0.15	Management plan	ICES (2017a)

## Basis of the assessment

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

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based analytical (NFT-ADAPT) that uses catches in the model and in the forecast (ICES, 2022b)
Input data	The data used in the assessment are catch-at-age and one age-structured acoustic survey index (Icelandic herring acoustic survey - Juveniles [A5718]). Natural mortality is assumed to be 0.1, except for 2009–2011 and 2017–2021, 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	Northwestern Working Group ( <a href="#">NWWG</a> )

## History of the advice, catch, and management

**Table 6** 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		50 000	-	50 304	-
1985		50 000	-	49 368	-
1986		65 000	-	65 500	-
1987	F <sub>0.1</sub>	70 000	72 900	75 439	-
1988	F <sub>0.1</sub>	~ 100 000	90 000	92 828	-
1989	F <sub>0.1</sub>	95 000	90 000	97 270	3700
1990/1991**	<i>Status quo F</i>	90 000	100 000	101 632	3500
1991/1992**	F <sub>0.1</sub>	79 000	110 000	98 538	11 000
1992/1993**	F <sub>0.1</sub>	86 000	110 000	106 653	1800
1993/1994**	No gain in yield by fishing higher than F <sub>0.1</sub>	110 000*	110 000	101 496	1200
1994/1995**	No gain in yield by fishing higher than F <sub>0.1</sub>	83 000*	130 000	131 994	2000
1995/1996**	No gain in yield by fishing higher than F <sub>0.1</sub>	120 000*	110 000	124 963	900
1996/1997**	No gain in yield by fishing higher than F <sub>0.1</sub>	97 000*	110 000	95 882	-
1997/1998	No gain in yield by fishing higher than F <sub>0.1</sub>	90 000*	100 000	64 931	-
1998/1999	No gain in yield by fishing higher than F <sub>0.1</sub>	90 000*	90 000	87 238	-
1999/2000	Current F is sustainable	100 000*	100 000	92 896	-
2000/2001	Current F is sustainable	110 000*	110 000	100 332	-
2001/2002	Current F is sustainable	125 000*	125 000	95 675	-
2002/2003	Current F is sustainable	113 000*	105 000	96 208	-
2003/2004	Current F is sustainable	113 000*	110 000	125 717	-
2004/2005	F = 0.22	106 000	110 000	114 237	-
2005/2006	<i>Status quo catch</i>	110 000	110 000	103 043	-
2006/2007	<i>Status quo catch</i>	110 000	130 000	135 303	-
2007/2008	Average of the last three years' catch	117 000	150 000	158 917	-
2008/2009	F <sub>pa</sub> = 0.22	131 000	130 000	151 780	-
2009/2010	F <sub>pa</sub> = 0.22	75 000	40 000	46 332	-
2010/2011 ***	Domestic advice autumn 2010	40 000	40 000	43 533	-
2011/2012 ***	Domestic advice autumn 2011, no fishery until then	40 000	45 000	49 446	-
2012/2013	F <sub>MSY</sub> = 0.22	67 000	68 500	71 976	-
2013/2014	F <sub>MSY</sub> = 0.22	87 000	87 000	72 058	-
2014/2015	F <sub>MSY</sub> = 0.22	83 000	83 000	94 975	-
2015/2016	F <sub>MSY</sub> = 0.22	71 000	71 000	69 729	-
2016/2017	F <sub>MSY</sub> = 0.22	63 000	63 000	60 403	-
2017/2018	HR <sub>mgt</sub> = 0.15	38 712	39 000	35 034	-
2018/2019	Management plan	35 186	35 186	40 683	-

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES landings	ICES discards
2019/2020	Management plan	≤ 34 572	34 572	30 038	-
2020/2021	No advice requested <sup>^</sup>	-	35 490	36 100	-
2021/2022	Management plan	≤ 72 239	72 239	70 084	-
2022/2023	Management plan	≤ 66 195			

\* 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.

<sup>^</sup> Advice for 2020/2021 was issued by MFRI based on the same method agreed by ICES (35 490 tonnes).

## History of the catch and landings

**Table 7** Herring in Division 5.a, summer-spawning herring. Catch distribution by fleet in 2021 as estimated by ICES. All weights are in tonnes.

Catch (2021)	Landings	Discards
70 084	Pelagic trawl 100% 70 084	Discarding is considered negligible

## Summary of the assessment

**Table 8** 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.

Year	Recruitment (age 3)	SSB†	Biomass age 4+	F (ages 5–10)	Harvest rate	Total catch
1987	529825	383813	415358	0.347	0.182	75439
1988	270993	423298	452286	0.266	0.205	92828
1989	447320	385511	401083	0.322	0.252	101000
1990	300814	349850	371472	0.400	0.283	105097
1991	840512	309707	310169	0.436	0.353	109489
1992	1033058	343166	349456	0.415	0.310	108504
1993	635381	423555	453578	0.248	0.227	102741
1994	691671	440681	460605	0.312	0.291	134003
1995	202671	406112	435339	0.343	0.289	125851
1996	181359	307399	322236	0.361	0.298	95882
1997	772436	268791	266602	0.250	0.244	64931
1998	320393	298255	323322	0.280	0.270	87238
1999	552379	289535	296796	0.377	0.313	92896
2000	391053	306206	323997	0.335	0.310	100332
2001	468220	271730	282257	0.415	0.339	95675
2002	1454523	297001	277532	0.418	0.347	96208
2003	1074133	389080	410650	0.280	0.306	125717
2004	662188	485787	515601	0.245	0.222	114237
2005	989930	524868	536229	0.253	0.192	103043
2006	734927	611136	645260	0.144	0.210	135303
2007	657500	567531	594216	0.322	0.267	158917
2008	523716	562979	591228	0.311	0.257	151780
2009	442152	486770	541289	0.089	0.086	46332
2010	466510	449113	504467	0.101	0.086	43533
2011	541370	427443	473266	0.127	0.104	49446
2012*	355611	432102	456683	0.209	0.158	71976
2013	484745	377760	390368	0.175	0.185	72058
2014	267525	401277	426353	0.307	0.223	94975
2015	249091	346662	363238	0.247	0.192	69729
2016	341300	327485	338460	0.215	0.178	60403
2017	173248	312435	343762	0.112	0.102	35034

Year	Recruitment (age 3)	SSB†	Biomass age 4+	F (ages 5–10)	Harvest rate	Total catch
2018	263290	296468	322136	0.154	0.126	40683
2019	296860	265396	286885	0.125	0.105	30038
2020	789257	274733	285242	0.165	0.127	36100
2021	778097	411769	361768	0.288	0.194	70084
2022	464740‡	421132	441299			

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

† SSB calculated at spawning time (1 July) after accounting for infection mortality.

‡ Predicted from a survey index of numbers at age 1 in 2020.

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*Recommended citation:* ICES. 2022. Herring (*Clupea harengus*) in Division 5.a, summer-spawning herring (Iceland grounds). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, her.27.5a, <https://doi.org/10.17895/ices.advice.19447988>

## Herring (*Clupea harengus*) in subdivisions 20–24, spring spawners (Skagerrak, Kattegat, and western Baltic)

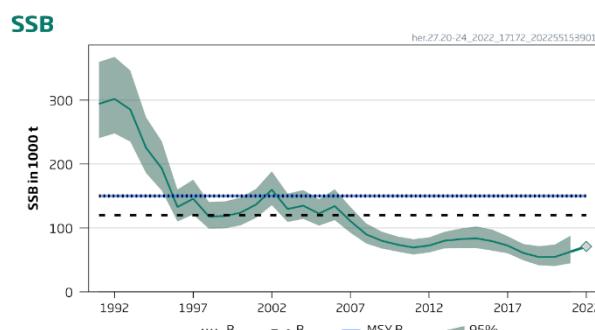
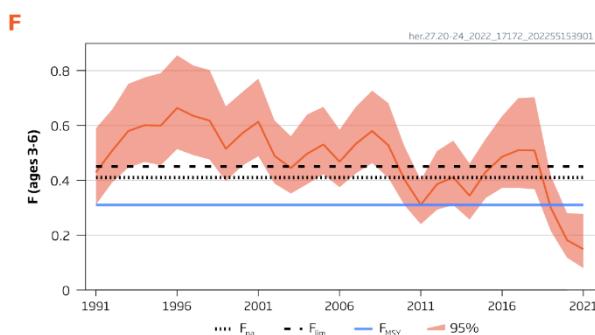
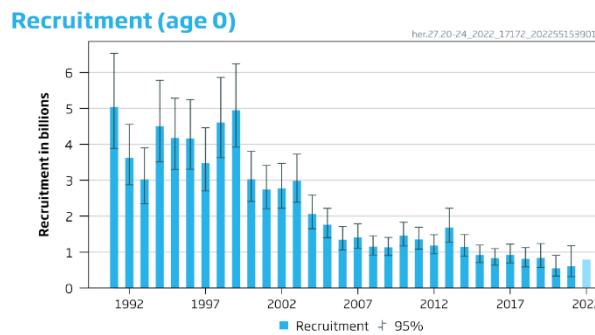
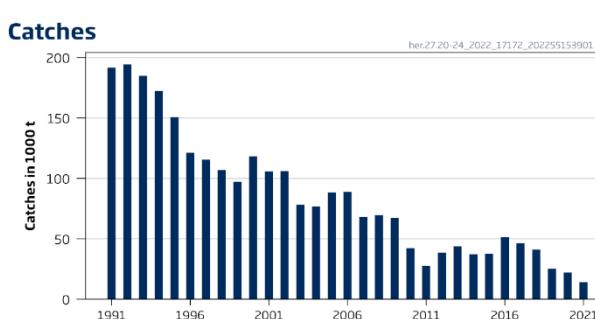
### ICES advice on fishing opportunities

ICES advises that when the MSY approach and precautionary considerations are applied, there should be zero catch in 2023.

This advice applies to the catch of western Baltic spring-spawning herring (WBSS) in subdivisions 20–24 and the eastern part of Subarea 4.

### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ ; spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Herring in subdivisions 20–24, spring spawners. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour and the grey diamond in the SSB plot is a predicted number for 2022 at spawning time.

### Catch scenarios

**Table 1** Herring in subdivisions 20–24, spring spawners. Values in the forecast and for the interim year. All weights are in tonnes and recruitment (R) is in thousands.

Variable	Value	Notes
$F_{ages\ 3-6}\ (2022)$	0.064	Based on catch constraint in 2022
SSB (2022)	71 011	Short term forecast
$R_{age\ 0}\ (2022\ and\ 2023)$	792 293	Average 2016–2020
Total catch (2022)	7662	<p>See Table 8 and issues relevant to the advice for the fleet descriptions.</p> <ul style="list-style-type: none"> <li>• A-fleet: 6 142 t corresponding to the A-fleet TAC (427 628 t) plus what is transferred from the C-fleet in Division 3.a to the North Sea (23 885 t) scaled by the 3-year average proportion of WBSS in A-fleet catch (1.36%, 2019–2021)</li> <li>• C-fleet: 733 t corresponding to 1136 t catch in Division 3.a (based on 167 t agreed maximum Norwegian catch and 969 t agreed maximum EU catch) scaled by the 3-year average proportion of WBSS in the C-fleet catch (64.5%, 2019–2021)</li> <li>• D-fleet: 0 t because considered negligible compared to the other fleets</li> <li>• F-fleet: 788 t (TAC*)</li> </ul>

\* Council Regulation (EU) 2021/1888

**Table 2** Herring in subdivisions 20–24, spring spawners. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F <sub>3–6</sub> (2023)	SSB* (2023)	SSB* (2024)	% SSB change **	% advice change ***
ICES advice basis						
MSY approach: zero catch	0	0	80 978	95 882	18	0
Other scenarios						
EU Baltic Sea multiannual plan (MAP) <sup>†</sup> : F = F <sub>MSY</sub> × SSB <sub>2022</sub> /MSY B <sub>trigger</sub>	19 391	0.147	79 256	79 224	0	
MAP <sup>†</sup> : F = F <sub>MSY lower</sub> × (SSB <sub>2022</sub> /MSY B <sub>trigger</sub> )	14 025	0.102	79 772	83 745	5	
F = F <sub>MSY</sub>	36 088	0.310	77 401	65 861	-15	
F = F <sub>pa</sub>	44 481	0.410	76 296	59 278	-22	
F = F <sub>lim</sub>	47 526	0.450	75 860	56 930	-25	
SSB (2024) = B <sub>lim</sub> ^^						
SSB (2024) = B <sub>pa</sub> ^^						
SSB (2024) = MSY B <sub>trigger</sub> ^^						
F = F <sub>2022</sub>	9073	0.064	80 221	88 093	10	
Catch for bycatch fleets only ^^^	6142	0.039	80 475	90 852	13	

\* For spring-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1 January and spawning time (April).

\*\* SSB (2024) relative to SSB (2023).

\*\*\* The advised catch in 2021 was 0 tonnes.

† Because SSB<sub>2022</sub> is below MSY B<sub>trigger</sub>, the F<sub>MSY</sub> and F<sub>MSY lower</sub> values in the MAP are adjusted by the SSB<sub>2022</sub>/MSY B<sub>trigger</sub> ratio.

^^ B<sub>lim</sub> and B<sub>pa</sub> cannot be achieved in 2024, even with zero catch.

^^^ Only the A-fleet that targets North Sea autumn-spawning (NSAS) herring and therefore catches WBSS herring as bycatch in the eastern part of the North Sea, assuming the same catch as in the intermediate year 2022. The D-fleet that is bycatch fleet has zero catch because of the intermediate year assumption (C- and F-fleets are directed WBSS fisheries so have zero catch in this scenario).

**Table 3** Herring in subdivisions 20–24, spring spawners. Medium-term catch scenarios. Different low F scenarios are provided, where F<sub>2024</sub> = F<sub>2023</sub>. All weights are in tonnes.

Basis	Total catch (2023)	Total catch (2024)	F <sub>3–6</sub> (2023)	SSB* (2023)	SSB* (2024)	SSB* (2025)	% SSB change (2023–2024)	% SSB change (2024–2025)
Medium-term catch scenarios								
F = 0	0	0	0	80 978	95 882	111 989	18	17
F = 0.01	1488	1856	0.010	80 859	94 594	109 348	17	16
F = 0.025	3670	4466	0.025	80 681	92 713	105 581	15	14
F = 0.05	7177	8395	0.050	80 385	89 708	99 777	12	11
F = 0.1	13 742	14 913	0.100	79 799	84 145	89 698	5	7
F = 0.15	19 767	20 008	0.150	79 218	79 114	81 275	0	3
Constant catch 2022–2024 **	7662	7662	0.054	80 345	89 405	100 170	11	12

\* For spring-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1 January and spawning time (April).

\*\* It is assumed that the fleets' 2022 catches (as defined in Table 1) are kept constant for 2023–2024.

The stock is estimated to be below B<sub>lim</sub>. There are no catch scenarios that will rebuild the stock above B<sub>lim</sub> by 2025. ICES continues to advise zero catch.

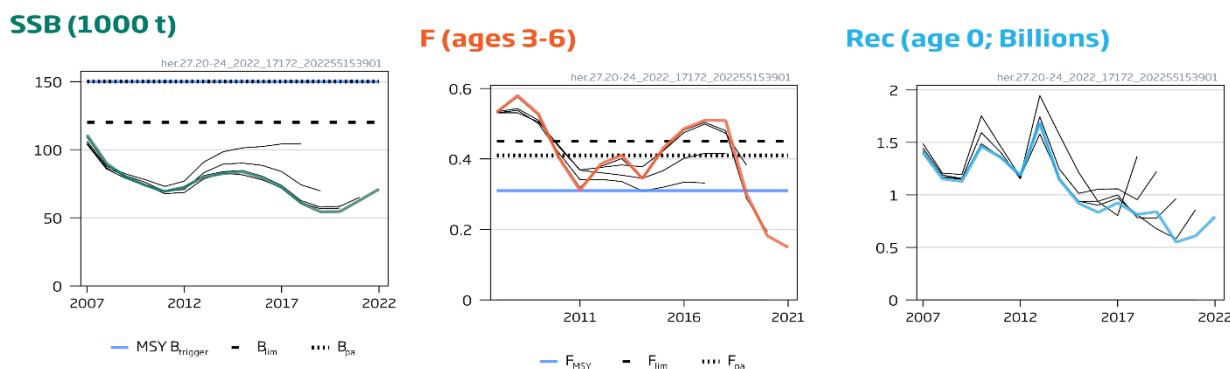
## Basis of the advice

**Table 4** Herring in subdivisions 20–24, spring spawners. The basis of the advice.

Advice basis	MSY approach
Management plan	An EU Baltic Sea multiannual plan (MAP; EU, 2016) was established in 2016 and updated in 2019 (MAP; EU, 2019). It applies to herring in subdivisions 22–24, which is part of the distribution area of the WBSS stock. This plan is not adopted by Norway and thus not used as basis of the advice for this shared stock.

## Quality of the assessment

The 2022 assessment gives consistent estimates of SSB and fishing mortality compared to the 2021 assessment. The final (intermediate) year assumption for recruitment is consistently higher than the estimated recruitment the following year. If this pattern continues the SSB predicted for 2025 (Table 3) will be lower.



**Figure 2** Herring in subdivisions 20–24, spring spawners. Historical assessment results (final-year recruitment included for each line, corresponding to the recruitment assumption in the intermediate year. Final-year SSB prediction is included for each line).

## Issues relevant for the advice

ICES MSY approach stipulates that  $F$  is reduced proportionally to SSB when the spawning-stock size falls below MSY  $B_{trigger}$ . When SSB is below  $B_{lim}$ , measures should be taken so that it can be brought above  $B_{lim}$  in the short term. All catch scenarios, including zero catch, result in SSB remaining below  $B_{lim}$  in 2024 (Table 2), therefore zero catch is advised for 2023.

The input catch data are disaggregated in these different fleets based on assumptions which deviate from the definition of those fleets for management purposes (based on TAC settings). In the context of this advice, the fleets are currently described as follows:

**Fleet A:** Directed fishery for herring for human consumption in the North Sea and division 7.d, but includes herring bycatches in the Norwegian industrial fishery. The catch of herring is almost exclusively NSAS herring, with some bycatch of WBSS herring in the eastern part of the Division 4.

**Fleet C:** Directed fishery for herring for human consumption in Kattegat and Skagerrak (Division 3.a). This fleet also includes catches from the small meshed Swedish fishery. The catch of herring consists of a mixture of NSAS and WBSS herring.

**Fleet D:** Bycatch of herring in Kattegat and Skagerrak (Division 3.a) in the Danish small-meshed industrial fleet for sprat and Norway pout and sandeel. The catch of herring consists of a mixture of NSAS and WBSS herring.

**Fleet F:** Catches from subdivisions 22–24. Most of the catches are taken in a directed fishery for herring and some as bycatch in a directed sprat fishery. The catch of herring consists exclusively of WBSS herring.

This stock is caught across three different management areas, and recovery will be impaired if catches of this stock are not minimized in all areas. Based on agreed catches for 2022 and assumptions on stock mixing, it is predicted that around 80%

of the total WBSS catches will be taken in Division 4.a in 2022. For the other two areas, catch shares in 2022 are predicted to be around 10% for subdivisions 20–21 and 10% for subdivisions 22–24.

The catch of WBSS in the North Sea in recent years has been substantial but variable. The expected catches of WBSS in 2022 will be larger in the North Sea than in subdivisions 20–24. Without additional area and seasonal restrictions on the herring fishery in the North Sea in 2023, the catch of WBSS in the North Sea could be of a similar magnitude to previous years (estimated at 5688 t based on the average over the 2019–2021 period). ICES assumes in the forecast that fishery in the eastern part of the North Sea will continue even though there is likely to be a considerable catch of WBSS for which a zero catch is advised by ICES.

### Reference points

**Table 5** Herring in subdivisions 20–24, spring spawners. Reference points, values, and their technical basis. Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	150 000	$B_{pa}$	ICES (2018)
	$F_{MSY}$	0.31	Stochastic simulations (EqSim) with Beverton-Holt, Ricker, and segmented regression stock-recruitment curve from the full time-series (1991–2016)	ICES (2018)
Precautionary approach	$B_{lim}$	120 000	Chosen as the mean of the two lowest SSB (1998, 1999) values with above average recruitment	ICES (2018)
	$B_{pa}$	150 000	Upper 95% confidence limit of $B_{lim}$ with $\sigma \approx 0.136$ , using the CV from the final-year SSB estimate in the assessment	ICES (2018)
	$F_{lim}$	0.45	$F_{P50\%}$ leading to 50% probability of SSB > $B_{lim}$ under stochastic simulations with Beverton-Holt, Ricker, and segmented stock-recruitment from the full time-series (1991–2016)	ICES (2018)
	$F_{pa}$	0.41	The maximum F that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P,05}$ with advice rule)	ICES (2018)
Management plan (2018) *	MAP (2018) MSY $B_{trigger}$	150 000	$B_{pa}$ equal to the upper 95% confidence limit of $B_{lim}$	ICES (2018)
	MAP (2018) $B_{lim}$	120 000	Chosen as the mean of the two lowest SSB (1998, 1999) values with above average recruitment	ICES (2018)
	MAP (2018) $F_{MSY}$	0.31	Stochastic simulations (EqSim) with Beverton-Holt, Ricker, and segmented regression stock-recruitment curve from the full time-series (1991–2016)	ICES (2018)
	MAP (2018) target range $F_{lower}$	0.216–0.310	Consistent with the ranges, resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2018)
	MAP (2018) target range $F_{upper}$	0.310–0.379	Consistent with the ranges, resulting in no more than 5% reduction in long-term yield compared with MSY	ICES (2018)

\*Revised Baltic MAP (EU, 2016, 2019) which refers to most recent reference points (ICES, 2018).

### Basis of the assessment

**Table 6** Herring in subdivisions 20–24, spring spawners. Basis of assessment and advice.

ICES stock data category	1( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based analytical assessment, multi-fleet SAM (ICES, 2022b) that uses catches by fleet in the model and in the forecast
Input data	Two acoustic, two trawl, and indices from one larval survey (HERAS [A5092], GerAS/BIAS [A1588], IBTS/BITS Q1 [G1022/G2916], IBTS/BITS Q3–4 [G2829/G8863], and N20 [I2308, I7165]); catch statistics and corrections for historical area misreporting; including split for North Sea herring (NSAS)/WBSS in catches, HERAS, and IBTS, and split for Central Baltic Herring (CBH)/WBSS in GerAS
Discards and bycatch	Discarding is considered to be negligible. The amount of slippage in Division 3.a is unknown.
Indicators	None
Other information	Last benchmarked in 2018 (ICES, 2018)
Working group	Herring Assessment Working Group for the Area South of 62°N ( <a href="#">HAWG</a> )

## History of the advice, catch, and management

**Table 7** Herring in subdivisions 20–24, spring spawners. ICES advice, TACs, and ICES estimated catch. All weights are in tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC Division 3.a ***	Agreed TAC subdivisions 22–24	ICES estimated catch ^			
					Subdiv. 22–24	Division 3.a	Subarea 4	Total
1987	Reduction in F	224 000	218 000		102 000	59 000	14 000	175 000
1988	No increase in F	196 000	218 000		99 000	129 000	23 000	251 000
1989	TAC	174 000	218 000		95 000	71 000	20 000	186 000
1990	TAC	131 000	185 000		78 000	118 000	8000	204 000
1991	TAC	180 000	155 000		70 000	112 000	10 000	192 000
1992	TAC	180 000	174 000		85 000	101 000	9000	195 000
1993	Increased yield from reduction in F; reduction in juvenile catches	188 000	210 000		81 000	95 000	10 000	186 000
1994	TAC	130 000–180 000	191 000		66 000	92 000	14 000	172 000
1995	If required, TAC not exceeding recent catches	168 000–192 000	183 000		74 000	80 000	10 000	164 000
1996	If required, TAC not exceeding recent catches	164 000–171 000	163 000		58 000	71 000	1000	130 000
1997	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	66 000–85 000*	100 000		68 000	55 000	1000	124 000
1998	Should be managed in accordance with NSAS	-	97 000		51 000	53 000	8000	112 000
1999	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-	99 000		50 000	43 000	5000	98 000
2000	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60 000 for SDs 22–24	101000		54000	57000	7000	118000
2001	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 000 for SDs 22–24	101000		64000	42000	6000	112000
2002	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 000 for SDs 22–24	101000		53000	47000	7000	107000
2003	Reduce F	< 80 000	101 000		40 000	36 000	2000	78 000
2004	Separate management regime; reduce F	< 92 000	91 000		42 000	28 000	7000	77 000
2005	Separate management regime; <i>status quo</i> F	95 000	120 000		44 000	38 000	7000	89 000
2006	Separate management regime; <i>status quo</i> F	95 000	102 000	47 500	42 000	36 000	11 000	89 000
2007	Separate management regime; <i>status quo</i> F	99 000	69 000	49 500	40 000	28 000	1000	69 000
2008	Separate management regime; reduce F 20% towards $F_{0.1}$	71 000	51 700	45 000	44 000	25 000	0	69 000
2009	Separate management regime. Reduce F to $F = 0.25$	< 32 800	37 700	27 200	31 000	32 000	4000	67 000
2010	Separate management regime; reduce F to $F = 0.25$	< 39 800	33 900	22 700	18 000	24 000	1000	42 000

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC Division 3.a ***	Agreed TAC subdivisions 22–24	ICES estimated catch ^			
					Subdiv. 22–24	Division 3.a	Subarea 4	Total
2011	MSY transition in 1–5 years and no increase in catches of WBSS herring in the North Sea	26 500–53 600	30 000	15 800	16 000	12 000	300	28 000
2012	$F_{MSY} = 0.25$ and no increase in catches of WBSS herring in the North Sea	< 42 700	45 000	20 900	21 000	15 000	2000	39 000
2013	$F_{MSY} = 0.25$ and no optional transfer of catch scenarios to the North Sea	< 51 900	55 000	25 800	26 000	17 000	500	44 000
2014	Transition to MSY approach	< 41 602	46 800	19 800	18 000	16 000	3000	37 000
2015	MSY approach ( $F_{MSY} = 0.28$ )**	< 44 439	43 600	22 200	22 000	13 000	2000	37 000
2016	MSY approach ( $F_{MSY} = 0.32$ )	< 52 547	51 048	26 274	25 000	24 000	2000	51 000
2017	MSY approach ( $F_{MSY} = 0.32$ )	< 56 802	50 740	28 401	26 513	19 195	632	46 340
2018	MSY approach ( $F = 0.295$ )	< 34 618	48 427	17 309	18 992	19 902	2164	41 058
2019	MSY approach	0	29 326	9 001	9831	8832	6757	25 420
2020	MSY approach	0	24 528	3 150	3966	11 361	6802	22 130
2021	MSY approach	0	21 604	1 575	1601	9074	3505	14 180
2022	MSY approach	0	25 021#	788				
2023	MSY approach	0						

\* Catch in subdivisions 22–24.

\*\* Advice for 2015 was for wanted catch.

\*\*\* Including mixed clupeid TAC and a bycatch ceiling in the small-meshed fisheries until 2005 and for 2007. For 2006, and from 2008, human consumption only, not including industrial bycatch or mixed clupeids but including North Sea autumn-spawners catch in fleet C, with an optional 50% transfer from Division 3.a to Subarea 4 since 2011 and 100% in 2022.

# Agreed to be limited to 1136 t.

^ WBSS only.

## History of the catch and landings

**Table 8** Herring in subdivisions 20–24, spring spawners. Catch distribution, by stock and by fleet, of WBSS and NSAS herring in 2021 as estimated by ICES.

WBSS catch area	Fleet	Fisheries	WBSS 2021 catch (t)	NSAS 2021 catch (t)
Division 3.a	C	Directed herring fisheries with purse-seiners and trawlers	9039	4140
	D	Bycatches of herring caught in the small-meshed fisheries	35	103
Subdivisions 22–24	F	All herring fisheries in subdivisions 22–24.	1601	0
Subarea 4	A	Directed herring fisheries with purse-seiners and trawlers	3505	-
Total area	C,D,F,A	All	14 180	4244

**Table 9** Herring in subdivisions 20–24, spring spawners. Catch distribution of WBSS in 2021 as estimated by ICES.

Total catch (2021)	Landings		Discards
	75% directed fishery	25% bycatch*	
14 180 tonnes	14 180 tonnes		Negligible

\* of WBSS by the A-fleet and bycatch by the D-fleet

**Table 10** Herring in subdivisions 20–24. History of commercial catch by area and country as estimated by ICES for all herring stocks caught within the management area for subdivisions 20–24. Values prior to 2002 are rounded. Weights are in tonnes.

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
<b>Skagerrak</b>														
Denmark	47 400	62 300	58 700	64 700	87 800	44 900	43 700	28 700	14 300	10 300	10 100	16 000	16 200	25 968
Norway	1600	5600	8100	13 900	24 200	17 700	16 700	9400	8800	8000	7400	9 700	0	0
Sweden	47 900	56 500	54 700	88 000	56 400	66 400	48 500	32 700	32 900	46 900	36 400	45 800	30 800	26 354
Total	96 900	124 400	121 500	166 600	168 400	129 000	108 900	70 800	56 000	65 200	53 900	71 500	47 000	52 322
<b>Kattegat</b>														
Denmark	57 100	32 200	29 700	33 500	28 700	23 600	16 900	17 200	8800	23 700	17 900	18 900	18 800	18 609
Sweden	37 900	45 200	36 700	26 400	16 700	15 400	30 800	27 000	18 000	29 900	14 600	17 300	16 200	7 246
Total	95 000	77 400	66 400	59 900	45 400	39 000	47 700	44 200	26 800	53 600	32 500	36 200	35 000	25 855
<b>Subdivisions 22 and 24</b>														
Denmark	21 700	13 600	25 200	26 900	38 000	39 500	36 800	34 400	30 500	30 100	32 500	32 600	28 300	13 066
Germany	56 400	45 500	15 800	15 600	11 100	11 400	13 400	7300	12 800	9000	9800	9 300	11 400	22 400
Poland	8500	9700	5600	15 500	11 800	6300	7300	6000	6900	6500	5300	6 600	9 300	0
Sweden	6300	8100	19 300	22 300	16 200	7400	15 800	9000	14 500	4300	2600	4 800	13 900	10 717
Total	92 900	76 900	65 900	80 300	77 100	64 600	73 300	56 700	64 700	49 900	50 200	53 300	62 900	46 184
<b>Subdivision 23</b>														
Denmark	1500	1100	1700	2900	3300	1500	900	700	2200	400	500	900	600	4 572
Sweden	100	100	2300	1700	700	300	200	300	100	300	100	100	200	0
Total	1600	1200	4000	4600	4000	1800	1100	1000	2300	700	600	1 000	800	4 572
Grand total	286 400	279 900	257 800	311 400	294 900	234 400	231 000	172 700	149 800	169 400	137 200	162 000	145 700	128 932
Year	2003	2004	2005	2006**	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<b>Skagerrak</b>														
Denmark	15 477	11 782	14 768	5156	3595	3867	12 720	5309	3577	3244	4886	6 449	4 137	3 554
Faroe Islands	0	0	440	0	0	0	552	447	0	0	0	0	480	318
Netherlands	725	484	751	600	454	1566	255	145	54	629	194	84	128	125
Germany	0	0	0	0	0	0	0	395	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	30	0
Norway	0	0	0	0	3466	4024	3295	3281	116	446	3019	2 048	2 475	3 924
Sweden	25 830	21 806	32 545	26 000	19 422	16 501	12 869	17 445	9458	16 210	16 677	12 594	12 857	13 321
Total	42 032	34 073	48 504	31 756	26 937	25 958	29 691	27 023	13 205	20 530	24 776	21 175	20 107	21 242
<b>Kattegat</b>														
Denmark	15 952	7563	11 109	8617	9181	7020	4896	7567	5155	6 26	3877	4 266	3 976	2 448
Sweden	10 236	9626	9986	10 800	11 153	5213	3612	2693	1661	800	2586	3 412	3 752	6 206
Germany	0	0	0	0	0	0	631	0	0	0	0	0	0	0
Total	26 188	17 189	21 095	19 417	20 334	12 234	9140	10 260	6800	7126	6464	7 678	7 728	8 653
<b>Subdivisions 22 and 24</b>														
Denmark	6143	7305	5311	1405	2839	3073	2146	762	3089	4105	5060	4 283	4 487	5 714
Germany	18 776	18 493	21 040	22 870	24 583	22 823	15 981	12 239	8187	11 170	14 591	10 241	13 289	14 427
Poland	4398	5512	6292	5504	2945	5535	5232	1799	1803	2394	3110	2 381	2 648	2 918
Sweden	9379	9865	9171	9604	7220	7024	4050	2034	2179	2706	2067	1 078	1 497	1 659
Total	38 696	41 175	41 814	39 383	37 587	38 456	27 409	16 833	15 258	20 400	24 800	17 983	21 922	24 718
<b>Subdivision 23</b>														
Denmark	2315	94	1779	1827	2871	5324	2817	1***	26	38	44	47	30	26
Sweden	243	317	384	652	0	327	807	934	544	681	632	319	192	332
Total	2558	411	2163	2479	2871	5651	3623	1000	600	700	366	222	359	
Grand total	109 473	92 848	113 576	93 035	87 729	82 298	69 863	55 200	35 863	48 755	56 740	47 202	49 978	54 972

Year	2017	2018	2019	2020	2021*
<b>Skagerrak</b>					
Denmark	2699	858	593	3189	2865
Faroe Islands	400	149			
Netherlands					
Germany	85	205	121	155	143
Lithuania					
Norway	3337	3411	2472	2119	1122
Sweden	11 936	11 332	8509	9073	6133
Total	18 458	15 956	11 695	14 537	10 263
<b>Kattegat</b>					
Denmark	912	1258	1499	672	210
Sweden	7426	6044	1725	2570	2845
Germany					
Total	8338	7302	3224	3242	3055
<b>Subdivisions 22 and 24</b>					
Denmark	5586	4487	2041	586	147
Finland		1			
Germany	14 694	11 304	5571	2069	843
Poland	3330	1773	1130	596	249
Sweden	2287	943	729	233	75
Total	25 898	18 507	9470	3484	1315
<b>Subdivision 23</b>					
Denmark	260	69	9	1	5
Sweden	356	416	351	481	281
Total	616	485	360	482	286
Grand total	53 309	42 250	24 750	21 745	14 918

\* Preliminary data.

\*\* 2000 t of Danish catches are missing (ICES, 2007).

\*\*\* 3103 t officially reported catches (ICES, 2011).

## Summary of the assessment

**Table 11** Herring in subdivisions 20–24, spring spawners. Assessment summary. High and low refer to the 95% confidence intervals.

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Recruitment (age 0)	High	Low	SSB*	High	Low		F (ages 3–6)	High	Low
	thousands	tonnes			tonnes					
1991	5 037 767	6 534 448	3 883 893	294 145	359 778	240 485	191 573	0.43	0.59	0.31
1992	3 616 981	4 557 363	2 870 641	301 866	367 698	247 819	194 408	0.51	0.66	0.39
1993	3 024 804	3 903 383	2 343 977	285 247	346 314	234 948	185 010	0.58	0.75	0.45
1994	4 505 757	5 780 695	3 512 008	225 394	273 322	185 870	172 439	0.60	0.78	0.47
1995	4 177 252	5 281 963	3 303 589	193 228	235 693	158 414	150 820	0.60	0.79	0.46
1996	4 163 472	5 242 679	3 306 420	132 731	160 086	110 050	121 260	0.66	0.86	0.51
1997	3 473 011	4 462 194	2 703 111	145 701	175 493	120 967	115 585	0.64	0.82	0.49
1998	4 610 783	5 862 794	3 626 141	117 839	140 632	98 741	107 033	0.62	0.80	0.48
1999	4 948 162	6 242 272	3 922 340	118 531	141 503	99 288	97 234	0.52	0.67	0.40
2000	3 027 959	3 806 967	2 408 357	123 786	147 458	103 914	118 277	0.57	0.72	0.45
2001	2 746 047	3 414 180	2 208 664	136 674	161 213	115 870	105 803	0.61	0.77	0.49
2002	2 775 373	3 470 312	2 219 597	159 829	188 518	135 505	106 189	0.49	0.62	0.39
2003	2 983 774	3 730 129	2 386 756	129 623	153 743	109 287	78 310	0.45	0.56	0.35
2004	2 064 899	2 585 285	1 649 260	134 779	159 255	114 065	76 814	0.50	0.64	0.39
2005	1 762 657	2 217 260	1 401 261	122 478	144 795	103 601	88 404	0.53	0.67	0.42
2006	1 345 815	1 712 435	1 057 685	134 187	160 501	112 186	88 931	0.47	0.59	0.38
2007	1 404 787	1 790 437	1 102 204	110 775	132 817	92 390	68 180	0.53	0.67	0.43
2008	1 152 732	1 453 199	914 390	89 997	107 095	75 629	69 576	0.58	0.73	0.46
2009	1 129 287	1 409 059	905 064	79 847	94 129	67 731	67 261	0.53	0.68	0.41
2010	1 462 341	1 828 742	1 169 351	73 802	86 589	62 903	42 214	0.40	0.52	0.31
2011	1 354 293	1 692 610	1 083 599	69 344	82 333	58 404	27 771	0.31	0.40	0.24
2012	1 187 034	1 482 334	950 561	72 453	85 242	61 583	38 648	0.39	0.51	0.29
2013	1 683 600	2 220 223	1 276 677	80 066	94 057	68 156	43 829	0.41	0.55	0.31
2014	1 146 962	1 488 703	883 669	82 432	99 011	68 629	37 358	0.34	0.46	0.26
2015	919 966	1 196 150	707 551	83 726	102 309	68 518	37 491	0.43	0.55	0.34
2016	832 966	1 097 055	632 450	79 359	97 558	64 556	51 298	0.49	0.63	0.37
2017	924 380	1 220 799	699 933	72 396	86 973	60 263	46 340	0.51	0.70	0.37
2018	813 549	1 124 615	588 524	60 775	74 869	49 335	41 058	0.51	0.70	0.37
2019	839 747	1 236 763	570 178	54 388	71 476	41 386	25 420	0.30	0.42	0.22
2020	550 822	912 136	332 631	54 606	73 964	40 314	22 130	0.182	0.28	0.118
2021	609 230	1 178 016	315 073	62 765	88 002	44 766	14 180	0.149	0.28	0.080
2022	792 293**			71 011***						

\* SSB at spawning time (April).

\*\* Recruitment is the average of 2016–2020.

\*\*\* SSB is predicted.

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### Download the stock assessment data and figures

*Recommended citation:* ICES. 2022. Herring (*Clupea harengus*) in subdivisions 20-24, spring spawners (Skagerrak, Kattegat, and western Baltic). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, her.27.20-24, <https://doi.org/10.17895/ices.advice.19447964>.

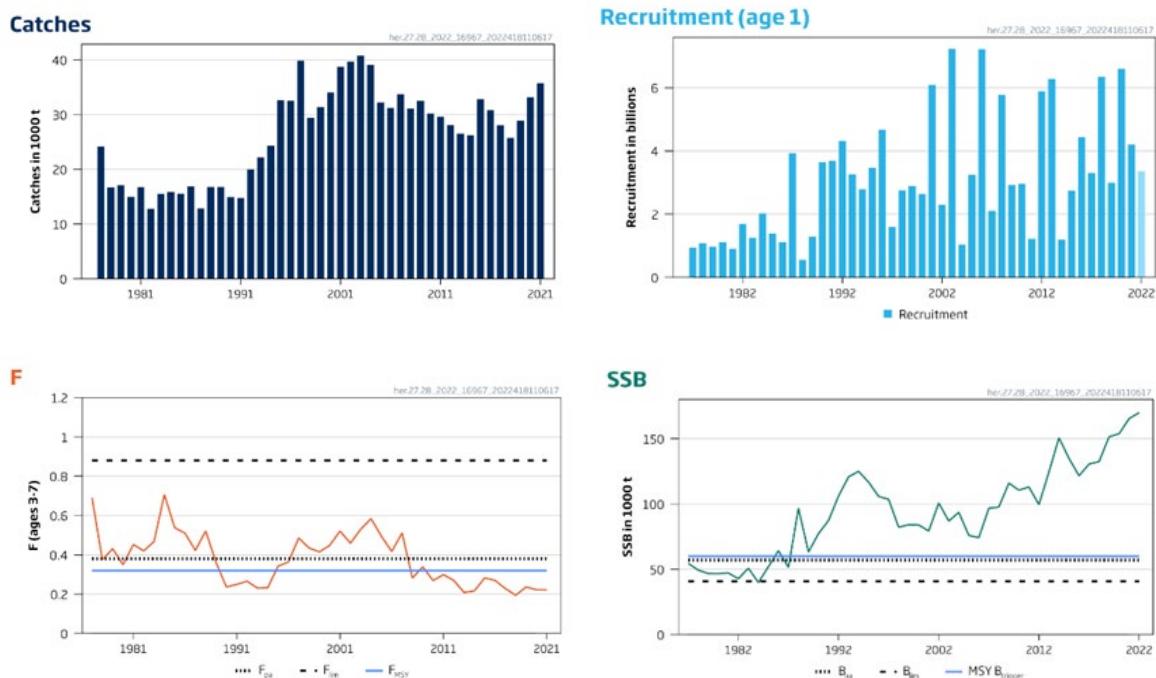
## Herring (*Clupea harengus*) in Subdivision 28.1 (Gulf of Riga)

### ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Baltic Sea is applied, the catches in 2023 that correspond to the F ranges in the plan are between 33 519 tonnes and 50 079 tonnes. According to the MAP, catches higher than those corresponding to  $F_{MSY}$  (43 226 tonnes) can only be taken under conditions specified in the plan, whilst the entire range is considered precautionary when applying ICES advice rule. This advice applies to all catches from the stock in subdivisions 28.1 and 28.2.

### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Herring in Subdivision 28.1. Summary of the stock assessment. The assumed recruitment for 2022 is shaded in a lighter colour. SSB at spawning time in 2022 is predicted.

### Catch scenarios

**Table 1** Herring in Subdivision 28.1. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 3-7}\ (2022)$	0.3028	F based on catch constraint
SSB (2022)	169 866	Projected SSB at spawning time; tonnes
$R_{age\ 1}\ (2022-2024)$	3 358 136	Geometric mean of year classes 1989–2019; thousands
Total catch (2022)	44 945	Catch constraint; tonnes*

\* Catch constraint in 2022: TAC for Gulf of Riga management area in 2022 (47 697 tonnes) + assumed Gulf of Riga herring caught in the central Baltic (696 tonnes [mean 2016–2020]) – assumed central Baltic herring caught in the Gulf of Riga in 2022 (3 448 tonnes [mean 2016–2020]) = 44 945 tonnes.

**Table 2** Herring in Subdivision 28.1. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F (2023)	SSB (2023)	SSB (2024)	% SSB change **	% Advice change ***
ICES advice basis						
EU MAP *: $F_{MSY}$	43 226	0.32	150 026	133 034	-11%	-3.8%
EU MAP *: MAP range $F_{lower}$	33 519	0.24	152 258	143 856	-5.5%	-3.7% <sup>^</sup>
EU MAP *: MAP range $F_{upper}$	50 079	0.38	148 373	125 496	-15%	-3.9% <sup>^^</sup>
Other scenarios						
$F_{MSY}$	43 226	0.32	150 026	133 034	-11%	-3.8%
$F = 0$	0	0	159 163	182 424	15%	-100%
$F = F_{pa}$	50 079	0.38	148 373	125 496	-15%	11%
$F = F_{lim}$	95 373	0.88	135 331	78 079	-42%	112%
SSB (2024) = SSB (2023)	24 318	0.17	154 267	154 267	0%	-46%
SSB (2024) = $B_{lim}$	135 147	1.60	118 582	40 800	-66%	201%
SSB (2024) = $B_{pa}$	117 106	1.22	127 103	57 100	-55%	161%
SSB (2024) = MSY $B_{trigger}$	114 006	1.17	128 390	60 000	-53%	154%
$F = F_{2022}$	41 195	0.30	150 503	135 285	-10%	-8.3%

\* MAP multiannual plan (EU, 2016).

\*\* SSB 2024 relative to SSB 2023.

\*\*\* Total catch in 2023 relative to ICES advice for 2022 (44 945 tonnes for the Gulf of Riga herring stock).

<sup>^</sup> ICES advice for  $F_{lower}$  for 2023 relative to ICES advice for EU MAP range  $F_{lower}$  for 2022 (34 797 tonnes).

<sup>^^</sup> ICES advice for  $F_{upper}$  for 2023 relative to ICES advice for EU MAP range  $F_{upper}$  for 2022 (52 132 tonnes).

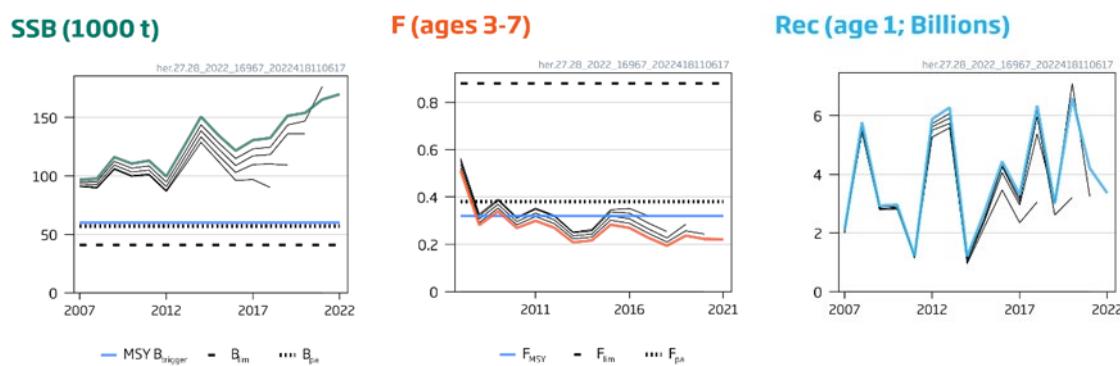
## Basis of the advice

**Table 3** 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, 2019). The advice based on the $F_{MSY}$ ranges used in the management plan is considered precautionary.

## Quality of the assessment

Historical assessments have generally shown an overall upward revision in SSB and a downward revision in fishing mortality. The reasons for both these trends are not fully understood.



**Figure 2** Herring in Subdivision 28.1. Historical assessment results. Final-year recruitment assumptions included for each line.

## Issues relevant for the advice

The assessment and the advice take account of all of the Gulf of Riga herring stock, both that harvested in the Gulf of Riga and that harvested outside of it. A mixture of central Baltic herring (subdivisions 25–27, 28.2, 29, and 32) and Gulf of Riga herring (Subdivision 28.1) is caught in the Gulf of Riga. An example of how TAC setting could address the stock mixing issues is presented based on the ICES MSY approach advice catch for the Gulf of Riga herring stock (43 226 tonnes), plus the assumed catch of central Baltic herring harvested in the Gulf of Riga, minus the assumed catch of 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.

- Central Baltic herring assumed to be taken in the Gulf of Riga in 2023 (Subdivision 28.1) is 3211 tonnes (average 2017–2021).
- Gulf of Riga herring assumed to be taken in Subdivision 28.2 in 2023 is 794 tonnes (average 2017–2021).

As an example, following ICES MSY approach (here identical to the MAP  $F_{MSY}$ ), catches from the Gulf of Riga herring stock in 2023 should be no more than 43 226 tonnes. The corresponding TAC in the Gulf of Riga management area for 2023 would be calculated as: 43 226 tonnes – 794 tonnes + 3211 tonnes = 45 643 tonnes.

## Reference points

**Table 4** 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, 2016)
	$F_{MSY}$	0.32	Stochastic simulations with Beverton, Ricker, and segmented regression stock-recruitment model from the full time-series (1977–2013)	ICES (2015)
Precautionary approach	$B_{lim}$	40 800	$B_{lim} = B_{loss}$	ICES (2016)
	$B_{pa}$	57 100	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$ with the default value $\sigma = 0.2$ .	ICES (2016)
	$F_{lim}$	0.88	$F_{lim}$ derived from the curve of SSB/R against F	ICES (2015)
	$F_{pa}$	0.38	$F_{pos}$ . The F that leads to $SSB \geq B_{lim}$ with 95% probability	ICES (2021)
Management plan	MAP MSY $B_{trigger}$	60 000	MSY $B_{trigger}$	ICES (2016)
	MAP $B_{lim}$	40 800	$B_{lim}$	ICES (2016)
	MAP $F_{MSY}$	0.32	$F_{MSY}$	ICES (2015)
	MAP target range $F_{lower}$	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)
	MAP target range $F_{upper}$	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)

## Basis of the assessment

**Table 5** Herring in Subdivision 28.1. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2022a)
Assessment type	Age-based analytical assessment XSA (ICES, 2022b) that uses catches in the model and in the forecast
Input data	Commercial catches; one acoustic survey index (GRAHS, A2217); 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 ( <a href="#">WGBFAS</a> )

## History of the advice, catch, and management

**Table 6** Herring in Subdivision 28.1. ICES advice, TAC for the Gulf of Riga, and catches of Gulf of Riga herring stock from the Gulf of Riga. All weights are in tonnes.

Year	ICES advice	Catch from stock corresp. to advice	Agreed TAC for Gulf of Riga	Catches of Gulf of Riga herring stock
1987	Reduce F towards $F_{0.1}$	8 000	-	12 884
1988	Reduce F towards $F_{0.1}$	6 000	-	16 791
1989	F should not exceed present level	20 000	-	16 783
1990	F should not exceed present level	20 000	-	14 931
1991	No separate advice for this stock	-	-	14 791
1992	No separate advice for this stock	-	-	20 000
1993	No separate advice for this stock	-	-	22 200
1994	No separate advice for this stock	-	-	24 300
1995	No separate advice for this stock	-	-	32 656
1996	No separate advice for this stock	-	-	32 584
1997	Current exploitation rate within safe biological limits	35 000	-	39 843
1998	Current exploitation rate within safe biological limits	35 000	-	29 443
1999	Current exploitation rate within safe biological limits	34 000	-	31 403
2000	Current exploitation rate within safe biological limits	37 000	-	34 069
2001	Current exploitation rate within safe biological limits	34 100	-	38 785
2002	Current exploitation rate within safe biological limits	33 200	-	39 701
2003	$F < F_{pa}$	< 41 000	41 000	40 803
2004	$F = F_{sq}$	39 000	39 300	39 115
2005	$F = F_{sq}$	35 300	38 000	32 225
2006	$F = F_{pa}$	39 900	40 000	31 232
2007	$F = F_{pa}$	33 900	37 500	33 742
2008	$F < F_{pa}$	< 30 100	36 100	31 137
2009	$F < F_{pa}$	< 31 500	34 900	32 554
2010	$F < F_{pa}$	< 33 400	36 400	30 174
2011	$F < F_{pa}$	< 33 000	32 700	29 639
2012	MSY transition	< 25 500	30 600	28 115
2013	MSY framework	< 23 200	30 600	26 511
2014	MSY	< 25 800	30 700	26 253
2015	MSY ( $F_{MSY} = 0.35$ )	< 34 300	38 800	32 851
2016	MSY approach ( $F_{MSY} = 0.32$ )	$\leq 26 200$	34 900	30 865
2017	MSY approach ( $F_{MSY} = 0.32$ )	$\leq 23 100$	31 100	28 058

Year	ICES advice	Catch from stock corresp. to advice	Agreed TAC for Gulf of Riga	Catches of Gulf of Riga herring stock
2018	MAP target F ranges: $F_{lower}$ to $F_{upper}$ (0.24– 0.38), but F higher than $F_{MSY} = 0.32$ only under conditions specified in the MAP	19 396–29 195, but catch higher than 24 919 only under conditions specified in the MAP	28 999	25 747
2019	MAP target F ranges: $F_{lower}$ to $F_{upper}$ (0.24– 0.38), but F higher than $F_{MSY} = 0.32$ only under conditions specified in the MAP	20 664–31 237, but catch higher than 26 932 only under conditions specified in the MAP	31 044	28 922
2020	MAP target F ranges: $F_{lower}$ to $F_{upper}$ (0.24– 0.38), but F higher than $F_{MSY} = 0.32$ only under conditions specified in the MAP	23 395–35 094, but catch higher than 30 382 only under conditions specified in the MAP	34 445	33 215
2021	Management Plan	35 771 (ranges 27 702– 41 423)	39 446	35 758
2022	Management Plan	44 945 (range 34 797– 52 132)	47 697	
2023	Management Plan	43 226 (range 33 519– 50 079)		

### History of the catch and landings

**Table 7** Herring in Subdivision 28.1. Catch distribution by fleet in 2021 as estimated by ICES.

Total herring catch in the Gulf of Riga management area (2021)	Total catch of stock (2021)	Landings		Discards
		Trawls 80 %	Trapnets 20 %	
38 110 tonnes	35 758 tonnes	35 758 tonnes		Discarding is considered to be negligible

**Table 8** 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	7 410	13 481	-	20 891
1992	9 742	14 204	-	23 946
1993	9 537	13 554	2 209	25 300
1994	9 636	14 050	3 514	27 200
1995	16 008	17 016	3 332	36 356
1996	11 788	17 362	3 534	32 684
1997	15 819	21 116	4 308	41 243
1998	11 313	16 125	3 305	30 743
1999	10 245	20 511	3 077	33 803
2000	12 514	21 624	2 631	36 769
2001	14 311	22 775	3 399	40 485
2002	16 962	22 441	3 398	42 801
2003	19 647	21 780	3 276	44 703
2004	18 218	20 903	3 094	42 215
2005	11 213	19 741	3 071	34 025
2006	11 924	19 186	2 922	34 032
2007	12 764	19 425	2 953	35 142
2008	15 877	19 290	1 970	37 137
2009	17 167	18 323	1 864	37 354
2010	15 422	17 751	1 791	34 974
2011	14 721	20 218	-	35 039

Year	Estonia	Latvia	Unallocated landings	Total
2012	13 789	17 926	-	31 715
2013	11 898	18 413	-	30 311
2014	10 541	20 012	-	30 553
2015	16 509	21 010	-	37 519
2016	15 814	19 066	-	34 880
2017	13 772	17 948	-	31 720
2018	12 521	16 904	-	29 424
2019	13 320	17 961	-	31 281
2020	12 231	21 019	-	33 249
2021	16 099	22 011	-	38 110

**Table 9** Herring in Subdivision 28.1. Total catches (in tonnes) in the Gulf of Riga by stock and of the Gulf of Riga herring stock by area.

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	24 186	2 400	26 586	-	24 186
1978	16 728	6 300	23 028	-	16 728
1979	17 142	4 700	21 842	-	17 142
1980	14 998	5 700	20 698	-	14 998
1981	16 769	5 900	22 669	-	16 769
1982	12 777	4 700	17 477	-	12 777
1983	15 541	4 800	20 341	-	15 541
1984	15 843	3 800	19 643	-	15 843
1985	15 575	4 600	20 175	-	15 575
1986	16 927	1 300	18 227	-	16 927
1987	12 884	4 800	17 684	-	12 884
1988	16 791	3 000	19 791	-	16 791
1989	16 783	5 900	22 683	-	16 783
1990	14 931	6 000	20 931	-	14 931
1991	14 791	6 100	20 891	-	14 791
1992	18 700	3 500	23 946	1 300	20 000
1993	21 000	4 300	25 300	1 200	22 200
1994	22 200	5 000	27 200	2 100	24 300
1995	30 256	6 100	36 356	2 400	32 656
1996	28 284	4 400	32 684	4 300	32 584
1997	36 943	4 300	41 243	2 900	39 843
1998	26 643	4 100	30 743	2 800	29 443
1999	29 503	4 300	33 803	1 900	31 403
2000	32 169	4 600	36 769	1 900	34 069
2001	37 585	2 900	40 485	1 200	38 785
2002	39 301	3 500	42 801	400	39 701
2003	40 403	4 300	44 703	400	40 803
2004	38 915	3 300	42 215	200	39 115
2005	31 725	2 300	34 025	500	32 225
2006	30 832	3 200	34 032	400	31 232
2007	33 642	1 500	35 142	100	33 742
2008	31 037	6 100	37 137	100	31 137
2009	32 454	4 900	37 354	100	32 554
2010	29 774	5 200	34 974	400	30 174
2011	29 539	5 500	35 039	100	29 639
2012	27 915	3 800	31 715	200	28 115
2013	26 211	4 100	30 311	300	26 511
2014	26 053	4 500	30 553	200	26 253
2015	32 551	4 968	37 519	316	32 851
2016	30 565	4 315	34 880	289	30 865
2017	27 824	3 896	31 720	234	28 058

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
2018	25 217	4 208	29 424	530	25 747
2019	27 721	3 560	31 281	1 200	28 922
2020	31 986	1 264	33 249	1 229	33 215
2021	34 984	3 126	38 110	775	35 758

### Summary of the assessment

**Table 10** Herring in Subdivision 28.1. Assessment summary. Weights are in tonnes; recruitment in thousands.

Year	Recruitment (age 1)	SSB *	Catches	F (ages 3–7)
1977	943 222	54 522	24 186	0.69
1978	1 076 482	49 356	16 728	0.38
1979	976 944	46 739	17 142	0.43
1980	1 110 341	46 712	14 998	0.35
1981	908 421	47 221	16 769	0.45
1982	1 689 001	42 758	12 777	0.42
1983	1 253 654	50 858	15 541	0.47
1984	2 027 216	39 914	15 843	0.71
1985	1 388 061	51 937	15 575	0.54
1986	1 120 348	64 284	16 927	0.51
1987	3 928 655	51 523	12 884	0.42
1988	560 972	96 702	16 791	0.52
1989	1 292 403	63 293	16 783	0.36
1990	3 645 558	77 333	14 931	0.24
1991	3 690 000	87 278	14 791	0.25
1992	4 319 409	106 143	20 000	0.27
1993	3 257 358	120 790	22 200	0.23
1994	2 788 656	124 969	24 300	0.23
1995	3 469 309	116 715	32 656	0.34
1996	4 668 324	105 798	32 584	0.36
1997	1 601 060	103 579	39 843	0.49
1998	2 757 920	82 165	29 443	0.43
1999	2 894 438	84 164	31 403	0.42
2000	2 640 146	83 954	34 069	0.45
2001	6 085 443	79 299	38 785	0.52
2002	2 299 182	100 850	39 701	0.46
2003	7 226 977	86 879	40 803	0.53
2004	1 039 278	93 605	39 115	0.58
2005	3 247 198	75 943	32 225	0.49
2006	7 219 180	74 243	31 232	0.42
2007	2 101 655	96 751	33 742	0.51
2008	5 774 650	97 697	31 137	0.28
2009	2 926 691	116 044	32 554	0.34
2010	2 967 051	110 515	30 174	0.27
2011	1 219 882	113 059	29 639	0.30
2012	5 880 709	99 487	28 115	0.27
2013	6 274 168	124 628	26 511	0.21
2014	1 199 120	150 673	26 253	0.22
2015	2 740 812	134 894	32 851	0.28
2016	4 436 513	121 596	30 865	0.27
2017	3 305 446	130 577	28 058	0.23
2018	6 344 144	132 469	25 747	0.19
2019	2 997 768	151 441	28 922	0.24
2020	6 594 147	153 857	33 215	0.22
2021	4 206 171	165 395	35 758	0.22

Year	Recruitment (age 1)	SSB *	Catches	F (ages 3–7)
2022	3 358 136**	169 866***		

\* At spawning time.

\*\* Geometric mean of year classes 1989–2019.

\*\*\* Predicted.

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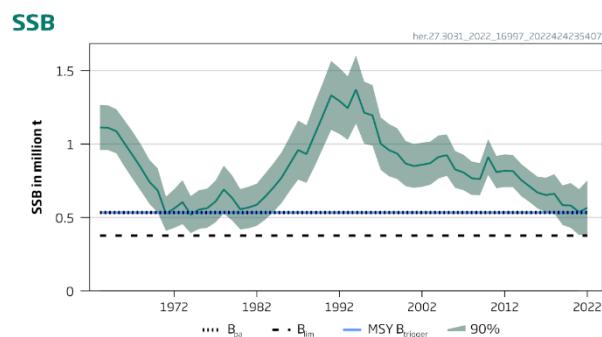
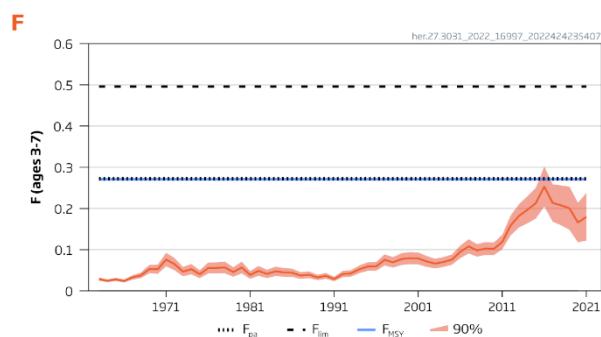
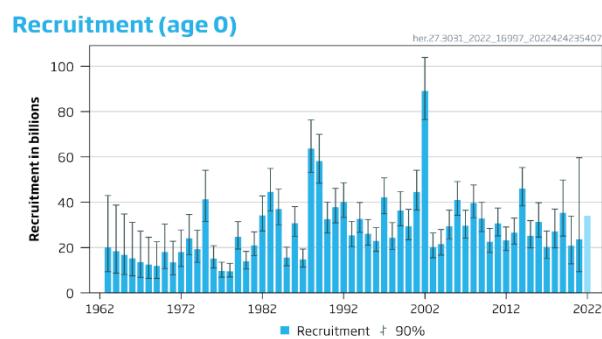
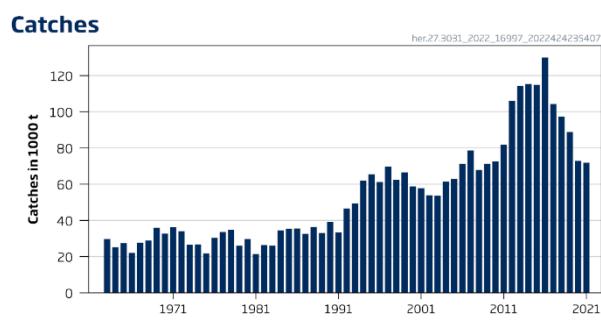
## Herring (*Clupea harengus*) in subdivisions 30 and 31 (Gulf of Bothnia)

### ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Baltic Sea is applied, catches in 2023 that correspond to the F ranges in the plan are between 80 047 tonnes and 103 059 tonnes. According to the MAP, catches higher than those corresponding to  $F_{MSY}$  (102 719 tonnes) can only be taken under conditions specified in the plan, whilst the entire range is considered precautionary when applying ICES advice rule.

### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Herring in subdivisions 30 and 31. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

### Catch scenarios

**Table 1** Herring in subdivisions 30 and 31. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 3-7}\ (2022)$	0.18	$F_{2021}$
SSB (2023)	538 857	Short term forecast; tonnes
$R_{age\ 0}\ (2022-2024)$	34 097 000	Average of recruitment (2012–2021); thousands
Total catch (2022)	72 033	Based on $F=F_{2021}$ ; tonnes

**Table 2** Herring in subdivisions 30 and 31. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F (2023)	SSB (2024)	% SSB change *	% TAC change**	% Advice change ***
ICES advice basis						
EU MAP <sup>^^^</sup> : $F_{MSY}$	102 719	0.271	511 754	-5.0	-7.7	-7.7
EU MAP <sup>^^^</sup> : MAP range $F_{lower}$	80 047	0.206	533 549	-1.0	-28	-7.2 <sup>^</sup>
EU MAP <sup>^^^</sup> : MAP range $F_{upper}$	103 059	0.272	511 427	-5.1	-7.4	-7.7 <sup>^</sup>
Other scenarios						
$F_{MSY}$	102 719	0.271	511 754	-5.0	-7.7	-7.7
$F = 0$	0	0.000	610 774	13	-100	-100
$F = F_{pa}$	103 059	0.272	511 427	-5.1	-7.4	-7.4
$F = F_{lim}$	172 890	0.496	444 558	-18	55	55
SSB (2024) = $B_{lim}$	254 409	0.818	367 116 <sup>#</sup>	-32	128	128
SSB (2024) = $B_{pa}$	80 047	0.206	533 549 <sup>#</sup>	-1.0	-28	-28
SSB (2024) = MSY B <sub>trigger</sub>	80 047	0.206	533 549 <sup>#</sup>	-1.0	-28	-28
SSB (2024) = SSB (2023)	75 011	0.192	538 396 <sup>#</sup>	-0.09	-33	-33
$F = F_{2022}$	70 649	0.180	542 595	0.7	-37	-37

\* SSB 2024 relative to SSB 2023.

\*\* Catch in 2023 relative to the quota in 2022 (111 345 tonnes).

\*\*\* Advice value in 2023 relative to advice value for EU MAP:  $F_{MSY}$  2022 (111 345 tonnes).

<sup>^</sup> Advice value for 2023 relative to advice value for EU MAP range  $F_{lower}$  2022 (86 279 tonnes).

<sup>^</sup><sup>^</sup> Advice value for 2023 relative to advice value for EU MAP range  $F_{upper}$  2022 (111 714 tonnes).

<sup>^^^</sup> MAP multiannual plan (EU, 2016, 2019).

# Based on stochastic forecasts, using the F with three decimals to get close to the biomass target.

The decreased catch advice is due to the continued decrease in SSB, likely to be the result of a combination of a downward revision of recruitment in 2021 and decreased condition and weight-at-age of larger herring.

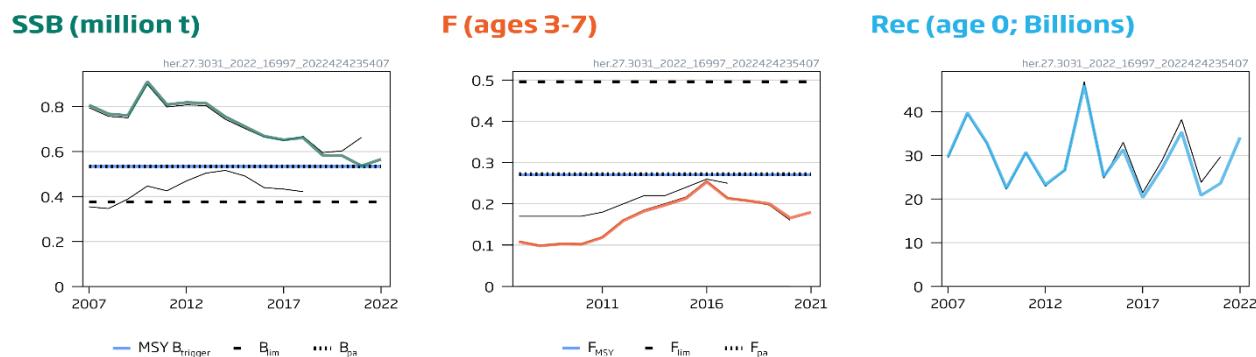
### Basis of the advice

**Table 3** Herring in subdivisions 30 and 31. The basis of the advice.

Advice basis	EU Baltic multiannual plan
Management plan	An EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes herring (EU, 2016, 2019). The advice, based on the $F_{MSY}$ ranges used in the management plan, is considered precautionary.

### Quality of the assessment

The updated assessment has revised down SSB in recent years. It is likely that this decrease in SSB is related to the decreased weight-at-age of the larger herring in particular. The reasons for the decline in weight-at-age are not fully understood and is partially taken into account in the forecast.



**Figure 2** Herring in subdivisions 30 and 31. Historical assessment results (final-year recruitment estimates included). The reference points were revised in 2021 following a benchmark, and only assessment results from the last two years should be compared to the reference points indicated. Series shown in the panels are from assessment years 2018, 2021 and 2022, when the stock was category 1.

### Issues relevant for the advice

Spawning stock biomass has a decreasing trend since 2010 and in 2022 is estimated to be close to MSY B<sub>trigger</sub>. Out of the EU MAP scenarios, only F<sub>MSY</sub> lower will keep the stock above MSY B<sub>trigger</sub> in 2024.

Mean weight-at-age has been at low levels for 15 years, and decreased even further in 2021. The present low state of the body condition of larger herring has not previously been observed in the time series.

### Reference points

**Table 4** Herring in subdivisions 30 and 31. Reference points, values, and their technical basis. Weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY B <sub>trigger</sub>	533 515	B <sub>pa</sub>	ICES (2021a)
	F <sub>MSY</sub>	0.271	Stochastic simulations (EqSim) with segmented regression fixed at B <sub>pa</sub>	ICES (2021b)
Precautionary approach	B <sub>lim</sub>	376 571	B <sub>lim</sub> = B <sub>pa</sub> /exp(1.645 * σ), σ = 0.212 (variance in SSB 2020)	ICES (2021a)
	B <sub>pa</sub>	533 515	B <sub>pa</sub> = B <sub>loss</sub> (lowest observed SSB during 1980–2019)	ICES (2021a)
	F <sub>lim</sub>	0.496	The F that on average leads to B <sub>lim</sub> from EqSim	ICES (2021b)
	F <sub>pa</sub>	0.272	F <sub>P05</sub> . The F that leads to SSB ≥ B <sub>lim</sub> with 95% probability	ICES (2021b)
Management plan	MAP MSY B <sub>trigger</sub>	533 515	MSY B <sub>trigger</sub>	ICES (2021a)
	MAP B <sub>lim</sub>	376 571	B <sub>lim</sub>	ICES (2021a)
	MAP F <sub>MSY</sub>	0.271	F <sub>MSY</sub>	ICES (2021b)
	MAP target range F <sub>lower</sub>	0.206–0.271	Consistent with the ranges which result in no more than a 5% reduction in long-term yield compared to MSY	ICES (2021b)
	MAP target range F <sub>MSY</sub>	0.271–0.272	Consistent with the ranges which result in no more than a 5% reduction in long-term yield compared to MSY	ICES (2021b)

## Basis of the assessment

**Table 5** Herring in subdivisions 30 and 31. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2022a)
Assessment type	Age-based analytical assessment, Stock Synthesis (ICES, 2022b)
Input data	Commercial catches (since 1963); two tuning fleets: one acoustic survey, since 2007 (BIAS, A1588) and one commercial survey, 1990–2006 (trapnet). Annual maturity data from Finnish commercial trawl catches before spawning; age-specific natural mortalities, constant through time.
Discards and bycatch	Discards are included but considered negligible.
Indicators	None
Other information	Last benchmarked in 2021 (ICES, 2021b)
Working group	Baltic Fisheries Assessment Working Group ( <a href="#">WGBFAS</a> )

## History of the advice, catch, and management

**Table 6a** Herring in subdivisions 30 and 31. ICES advice, TAC, and catches. All weights are in tonnes.

Year	ICES advice for Subdivision 30	ICES advice for Subdivision 31	Catch corresponding to advice	Agreed TAC*	ICES catch
1987	Not available	Not available			32 628
1988	Not available	Not available			36 418
1989	Not available	Not available			33 086
1990	Not available	Not available			39 180
1991	TAC for the eastern part of the subdivision, allowance for the western part	TAC for the eastern part of the subdivision, allowance for the western part	41 000	84 000	33 419
1992	<i>Status quo F</i>	<i>Status quo F</i>	47 000	84 000	46 610
1993	<i>Status quo F</i>	Increase in yield by increasing F	39 000	90 000	49 314
1994	No specific advice	Increase in yield by increasing F	41 000	90 000	61 986
1995	TAC	Increase in yield by increasing F	91 400	110 000	65 547
1996	TAC	Increase in yield by increasing F	91 400	110 000	61 303
1997	$F(97) = 1.4 \times F(95)$	Increase in yield by increasing F	78 000	110 000	69 808
1998	<i>Status quo F</i>	Increase in yield by increasing F	50 000	110 000	62 474
1999	Reduce catches	Increase in yield by increasing F	-	94 000	66 502
2000	Reduce catches	Increase in yield by increasing F	-	85 000	58 852
2001	$F_{pa} = 0.21$	Exploitation rate should not be increased	36 000	72 000	57 806
2002	$F$ below $F_{pa}$	Exploitation rate should be decreased	53 000	64 000	53 969
2003	$F$ below $F_{pa}$	No increase in catches	53 000	60 000	53 644
2004	$F$ below $F_{pa}$	No increase in catches	53 000	61 200	61 423
2005	$F$ below $F_{pa}$	No increase in catches	63 700	64 000	62 911
2006	$F$ below $F_{pa}$	Less than average catches (2002–2004)	92 600/97 600	91 600	71 318
2007	$F$ below $F_{pa}$	Less than average catches (2002–2005)	88 100	82 800	78 678
2008	$F$ below $F_{pa}$	No increase in catches	70 300	87 000	67 914
2009	Same advice as last year	Same advice as last year	70 300	82 700	71 248
2010	$F$ below $F_{pa}$	Same advice as last year	112 600	103 300	72 590
2011	$F$ below $F_{pa}$	No basis for advice	118 000	104 400	81 850
2012	MSY framework	No increase in catches	107 000	106 000	106 007

Year	ICES advice for Subdivision 30	ICES advice for Subdivision 31	Catch corresponding to advice	Agreed TAC*	ICES catch
2013	MSY framework ( $F_{MSY}$ )	Reduce catches by more than 20%	99 100	106 000	114 396
2014	MSY approach ( $F_{MSY}$ )	Increase catches by no more than 20%	142 300	138 000	115 366
2015	MSY approach ( $F_{MSY}$ )	Increase catches by no more than 20%	186 434	158 470	114 942
2016	MSY approach ( $F_{MSY} = 0.15$ )	Precautionary approach ( $\leq 20\%$ increase in catch)	103 254	103 254	130 029
2017	MSY approach ( $F_{MSY} = 0.15$ )	Precautionary approach	140 998	140 998	104 358

\* TAC for subdivisions 29N, 30, and 31 (IBSFC Management Unit 3), and from 2005 for subdivisions 30 and 31.

**Table 6b** Herring in subdivisions 30 and 31. ICES advice, TAC, and catches. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
2018	MSY approach ( $F_{MSY} = 0.21$ )	$\leq 95\ 566$	84 599	97 366
2019	MSY approach ( $F_{MSY} = 0.21$ )	$\leq 88\ 703$	88 703	88 907
2020	Precautionary approach	$\leq 65\ 018$	65 018	72 956
2021	Management plan	117 485 (range 91 494–117 875)	117 485	71 924
2022	Management plan	111 345 (range 86 729 – 111 714)	111 345	
2023	Management plan	102 719 (range 80 047–103 059)		

### History of the catch and landings

**Table 7** Herring in subdivisions 30 and 31. Catch distribution by fleet in 2021, as estimated by ICES.

Catch (2021)	Landings			Discards
	95.8 % trawls	3.7 % trapnets	0.5 % gillnets	
71 924 tonnes	71 924 tonnes		Discarding is negligible	

**Table 8** Herring in subdivisions 30 and 31. History of ICES commercial catches by subdivision (SD) for each country participating in the fishery. All weights are in tonnes.

Year	Finland		Sweden		Total		Grand total
	SD 30	SD 31	SD 30	SD 31	SD 30	SD 31	
1980	18 758	8 899	1 392	760	20 150	9 659	29 809
1981	12 410	7 206	1 290	620	13 700	7 826	21 526
1982	16 117	7 982	1 730	670	17 847	8 652	26 499
1983	16 104	7 011	2 397	696	18 501	7 707	26 208
1984	23 228	8 322	2 401	594	25 629	8 916	34 545
1985	24 235	8 595	1 885	717	26 120	9 312	35 432
1986	23 988	8 754	2 501	336	26 489	9 090	35 579
1987	22 615	7 788	1 905	320	24 520	8 108	32 628
1988	24 478	8 501	3 172	267	27 650	8 768	36 418
1989	25 453	4 005	3 205	423	28 658	4 428	33 086
1990	28 815	7 603	2 467	295	31 282	7 898	39 180
1991	23 219	6 800	3 000	400	26 219	7 200	33 419
1992	35 610	6 900	3 700	400	39 310	7 300	46 610
1993	36 600	8 752	3 579	383	40 179	9 135	49 314
1994	53 860	5 195	2 520	411	56 380	5 606	61 986
1995	58 806	3 898	2 280	563	61 086	4 461	65 547
1996	54 372	5 080	1 737	114	56 109	5 194	61 303
1997	63 532	4 195	1 995	86	65 527	4 281	69 808
1998	54 115	5 358	2 777	224	56 892	5 582	62 474
1999	60 483	3 909	1 862	248	62 345	4 157	66 502
2000	54 886	2 479	1 374	113	56 260	2 592	58 852
2001	52 987	2 755	1 997	67	54 984	2 822	57 806

Year	Finland		Sweden		Total		Grand total
	SD 30	SD 31	SD 30	SD 31	SD 30	SD 31	
2002	46 315	3 532	3 903	219	50 218	3 751	53 969
2003	45 932	3 855	3 707	150	49 639	4 005	53 644
2004	50 236	5 831	5 214	142	55 450	5 973	61 423
2005	55 422	4 800	2 520	169	57 942	4 969	62 911
2006	66 962	2 684	1 403	269	68 365	2 953	71 318
2007	72 116	2 992	3 317	253	75 433	3 245	78 678
2008	61 756	2 309	3 674	175	65 430	2 484	67 914
2009	64 881	2 166	3 992	209	68 873	2 375	71 248
2010	68 760	1 898	1 755	177	70 515	2 075	72 590
2011	75 130	3 218	3 370	132	78 500	3 350	81 850
2012	94 248	5 206	6 392	161	100 640	5 367	106 007
2013	98 935	4 486	10 849	126	109 784	4 612	114 396
2014	97 779	4 637	12 755	195	110 534	4 832	115 366
2015	96 414	4 370	14 001	157	110 415	4 527	114 942
2016	103 432	4 371	22 067	159	125 499	4 530	130 029
2017	90 490	3 068	10 672	127	101 162	3 195	104 358
2018	78 770	2 100	16 210	286	94 980	2 386	97 366
2019	71 113	2 130	15 473	190	86 586	2 320	88 907
2020	59 357	1 187	12 082	330	71 439	1 517	72 956
2021	55 985	939	14 797	202	70 782	1 141	71 924

### Summary of the assessment

**Table 9** Herring in subdivisions 30 and 31. Assessment summary. Weights are in tonnes. Recruitment in thousands.

Year	Recruitment			SSB*			Total Catch	F		
	Age 0	90%	10%	SSB	90%	10%		Ages 3–7	90%	10%
	thousands			Tonnes			tonnes			
1963	20 040 600	42 945 588	9 351 965	1 112 470	1 265 594	959 346	29 739	0.029	0.033	0.025
1964	18 358 400	38 677 790	8 713 808	1 110 570	1 262 766	958 374	25 204	0.024	0.028	0.021
1965	16 780 500	34 774 311	8 097 506	1 086 830	1 236 831	936 829	27 541	0.028	0.032	0.024
1966	15 243 400	31 092 146	7 473 310	1 002 390	1 160 188	844 592	22 164	0.024	0.028	0.020
1967	13 607 400	27 278 677	6 787 768	920 385	1 080 915	759 855	27 772	0.033	0.038	0.027
1968	12 546 600	24 524 586	6 418 749	835 102	993 317	676 887	28 966	0.038	0.044	0.031
1969	11 946 400	22 566 198	6 324 347	742 591	892 628	592 554	35 996	0.053	0.063	0.043
1970	18 015 100	30 352 224	10 692 588	683 686	833 834	533 538	32 790	0.052	0.063	0.041
1971	13 472 600	22 770 458	7 971 335	524 871	640 974	408 768	36 347	0.076	0.092	0.060
1972	17 960 200	27 747 331	11 625 219	561 023	692 903	429 143	34 092	0.065	0.080	0.050
1973	24 079 800	34 565 398	16 775 064	604 175	753 924	454 426	26 507	0.047	0.058	0.035
1974	19 294 600	27 605 959	13 485 552	519 516	645 811	393 221	26 776	0.053	0.065	0.040
1975	41 294 600	54 094 621	31 523 356	553 410	685 123	421 697	21 811	0.040	0.050	0.031
1976	15 111 100	20 815 696	10 969 863	563 442	696 927	429 957	30 520	0.055	0.069	0.042
1977	9 686 550	13 521 900	6 939 058	608 444	750 846	466 042	33 634	0.056	0.069	0.042
1978	9 501 910	12 989 688	6 950 613	690 201	852 967	527 435	34 873	0.057	0.071	0.043
1979	24 668 500	31 467 425	19 338 567	633 178	787 041	479 315	26 109	0.046	0.057	0.034
1980	13 880 300	18 304 844	10 525 232	555 661	693 215	418 107	29 809	0.057	0.071	0.043
1981	20 968 800	26 929 793	16 327 291	567 556	709 357	425 755	21 526	0.039	0.048	0.029
1982	34 167 900	42 756 473	27 304 530	586 751	730 236	443 266	26 499	0.048	0.060	0.037
1983	44 536 900	54 922 439	36 115 211	641 418	798 347	484 489	26 208	0.041	0.051	0.031
1984	37 009 900	45 763 653	29 930 581	702 712	867 529	537 895	34 545	0.047	0.059	0.036
1985	15 556 400	20 189 495	11 986 510	771 238	943 979	598 497	35 432	0.045	0.056	0.035
1986	30 756 900	38 036 362	24 870 594	865 664	1 049 983	681 345	35 579	0.044	0.054	0.034
1987	14 803 100	19 323 795	11 339 997	958 958	1 160 115	757 801	32 628	0.037	0.045	0.029
1988	63 695 000	76 290 162	53 179 243	931 468	1 127 746	735 190	36 418	0.039	0.048	0.031
1989	58 146 200	69 950 995	48 333 560	1 063 290	1 277 930	848 650	33 086	0.033	0.039	0.026
1990	32 521 500	40 083 080	26 386 395	1 195 250	1 418 639	971 861	39 180	0.036	0.044	0.029
1991	37 733 700	46 081 111	30 898 389	1 331 360	1 566 039	1 096 681	33 419	0.029	0.034	0.023
1992	40 179 300	48 586 111	33 227 112	1 293 280	1 517 990	1 068 570	46 610	0.041	0.048	0.033
1993	25 347 000	31 576 426	20 346 521	1 244 590	1 461 107	1 028 073	49 314	0.042	0.050	0.035

Year	Recruitment			SSB*			Total Catch	F		
	Age 0	90%	10%	SSB	90%	10%		Ages 3–7	90%	10%
	thousands			Tonnes				tonnes		
1994	32 616 000	39 827 734	26 710 117	1 370 970	1 603 080	1 138 861	61 986	0.052	0.062	0.043
1995	26 093 800	32 351 314	21 046 638	1 213 120	1 424 838	1 001 402	65 547	0.059	0.069	0.049
1996	22 926 900	28 742 907	18 287 738	1 195 050	1 401 583	988 517	61 303	0.059	0.070	0.049
1997	42 102 700	50 781 976	34 906 821	1 002 100	1 180 652	823 548	69 808	0.075	0.089	0.062
1998	24 387 100	30 993 305	19 189 004	958 338	1 136 432	780 244	62 474	0.069	0.082	0.057
1999	36 377 300	44 706 189	29 600 106	934 555	1 107 423	761 687	66 502	0.077	0.091	0.063
2000	29 410 400	36 851 494	23 471 820	867 516	1 021 720	713 312	58 852	0.080	0.094	0.065
2001	44 486 400	54 109 251	36 574 888	850 179	999 315	701 043	57 806	0.079	0.093	0.064
2002	89 118 900	104 000 000	76 459 420	858 746	1 009 070	708 422	53 969	0.071	0.085	0.058
2003	20 231 900	26 474 450	15 461 314	869 988	1 017 359	722 617	53 644	0.066	0.078	0.055
2004	21 558 600	27 928 897	16 641 303	912 214	1 059 009	765 419	61 423	0.070	0.082	0.058
2005	29 426 100	36 495 321	23 726 202	923 961	1 064 366	783 556	62 911	0.076	0.088	0.063
2006	40 984 000	49 113 115	34 200 402	827 024	952 690	701 358	71 318	0.095	0.110	0.079
2007	29 672 400	36 440 984	24 161 020	806 697	927 863	685 531	78 678	0.108	0.125	0.091
2008	39 729 300	47 611 327	33 152 138	767 511	881 711	653 311	67 914	0.098	0.113	0.083
2009	32 851 900	39 932 063	27 027 087	760 341	869 926	650 756	71 248	0.103	0.118	0.087
2010	22 516 700	28 438 110	17 828 251	910 410	1 032 437	788 383	72 590	0.102	0.117	0.087
2011	30 676 700	37 438 184	25 136 367	808 856	918 850	698 862	81 850	0.119	0.136	0.101
2012	23 279 400	29 049 188	18 655 615	818 278	929 735	706 821	106 007	0.159	0.183	0.135
2013	26 625 200	32 977 509	21 496 508	815 673	925 389	705 957	114 396	0.182	0.211	0.154
2014	46 048 800	55 303 570	38 342 769	755 009	864 769	645 249	115 366	0.197	0.230	0.164
2015	25 170 100	31 878 492	19 873 397	711 913	818 824	605 002	114 942	0.213	0.250	0.176
2016	31 302 900	39 805 827	24 616 284	668 702	776 949	560 455	130 029	0.253	0.302	0.205
2017	20 301 600	27 285 325	15 105 371	652 292	770 967	533 617	104 358	0.213	0.259	0.168
2018	27 090 000	36 961 886	19 854 726	661 535	794 483	528 587	97 366	0.208	0.256	0.159
2019	35 332 400	49 771 083	25 082 406	583 644	718 126	449 162	88 907	0.200	0.253	0.148
2020	20 821 500	33 893 336	12 791 153	581 614	734 127	429 101	72 956	0.166	0.214	0.118
2021	23 595 100	59 636 184	9 335 419	536 457	692 642	380 272	71 924	0.180	0.237	0.122
2022	34 097 000 **			565 634	751 690	379 578				

\* 1 January.

\*\* Arithmetic mean of years 2012–2021.

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[Download the stock assessment data and figures.](#)

*Recommended citation:* ICES. 2022. Herring (*Clupea harengus*) in Subdivisions 30 and 31 (Gulf of Bothnia). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, her.27.3031.  
<https://doi.org/10.17895/ices.advice.19447979>.

## Herring (*Clupea harengus*) in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k (Irish Sea, Celtic Sea, and southwest of Ireland)

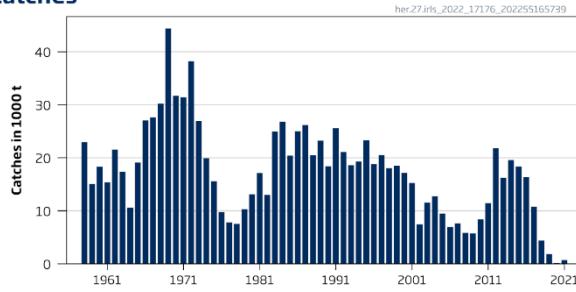
### ICES advice on fishing opportunities

ICES advises that when the MSY approach and precautionary considerations are applied, there should be zero catch in 2023.

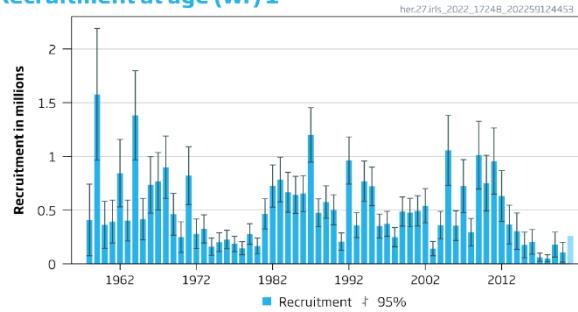
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ , and spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

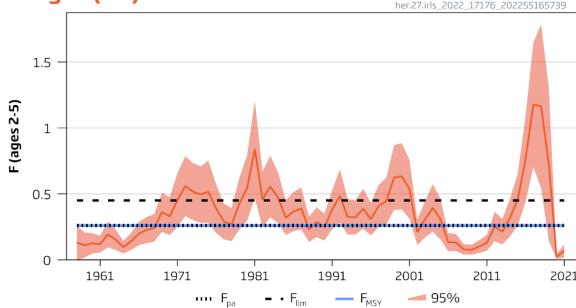
#### Catches



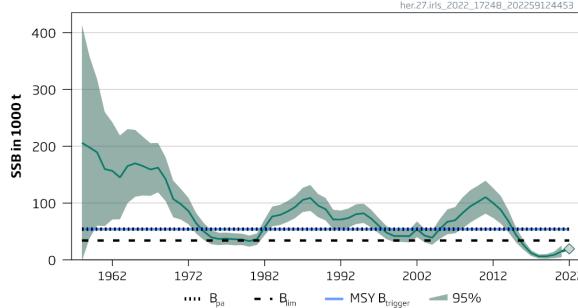
#### Recruitment at age (wr) 1



#### F at ages (wr) 2-5



#### SSB



**Figure 1** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Summary of the stock assessment. The assumed recruitment is in a lighter shade, and the forecast spawning-stock biomass (SSB) value is indicated with a grey diamond. (WR is winter ring).

### Catch scenarios

**Table 1** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages (wr) 2-5} (2022)$	0.058	The $F$ that corresponds to the monitoring TAC
$R_{age (wr) 1} (2022-2023)$	197 044	Stock-recruitment relationship based on the $SSB_{2020}$ from the assessment output; in thousands
$SSB (2022)$	19 349	Short-term forecast; in tonnes
Total catch (2022)	869	Monitoring TAC; in tonnes

**Table 2** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F <sub>2–5</sub> (2023)	SSB* (2023)	% SSB change**	SSB* (2024) <sup>#</sup>	% TAC change***	% advice change <sup>^</sup>
ICES advice basis							
MSY approach: zero catch	0	0	22746	17.6	25875	-100	
Other scenarios							
F <sub>MSY</sub>	4475	0.26	20454	5.7	20049	415	-
F <sub>MSY</sub> × SSB <sub>2022</sub> /MSY B <sub>trigger</sub>	1725	0.093	21891	13.1	23546	98.5	-
F = 0	0	0	22746	17.6	25875	-100	-
F <sub>pa</sub>	4475	0.26	20454	5.7	20049	415	-
F <sub>lim</sub>	7150	0.45	18953	-2	16914	722.8	-
SSB <sub>2023</sub> = B <sub>lim</sub> <sup>^^</sup>	-	-	-	-	-	-	-
SSB <sub>2023</sub> = B <sub>pa</sub> <sup>^^</sup>	-	-	-	-	-	-	-
SSB <sub>2023</sub> = MSY B <sub>trigger</sub> <sup>^^</sup>	-	-	-	-	-	-	-
F = F <sub>2022</sub>	1091	0.058	22209	14.8	24390	25.5	-
TAC = monitoring TAC	869	0.046	22319	15.3	24746	0	-

\* For this autumn- and winter-spawning stock, the SSB is determined at spawning time and is influenced by fisheries between 1 April and spawning (October).

\*\* SSB 2023 relative to SSB 2022.

\*\*\* Total catch in 2023 relative to the advised monitoring TAC in 2022 (869 tonnes).

<sup>^</sup> Advice value for 2023 relative to the advice value for 2022 (0 tonnes).

<sup>^^</sup> These catch scenarios are left blank because the stated SSB cannot be achieved, even with F = 0.

<sup>#</sup> Assuming the same catch scenario in 2024 as in 2023.

There are no catch scenarios that will rebuild the stock above B<sub>lim</sub> by 2024, and the ICES advice for zero catch is the same as last year.

## Basis of the advice

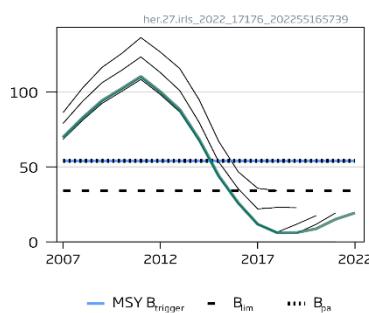
**Table 3** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for herring in this area

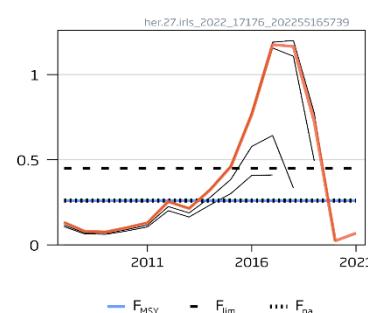
## Quality of the assessment

SSB is consistently overestimated and fishing mortality is consistently underestimated; however, this bias does not impact the outcome of the advice.

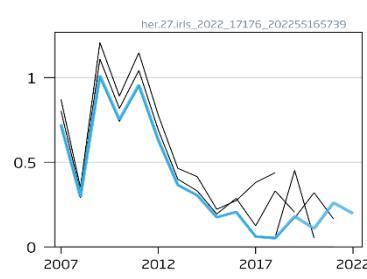
### SSB (1000 t)



### F at ages (wr) 2–5



### Rec at age (wr) 1 (Millions)



**Figure 2**

Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Historical assessment results. Final-year recruitment and SSB estimates included. The reference points were revised in 2018 (following an interbenchmark), and only assessment results from the last four years should be compared to the reference points indicated.

## Issues relevant for the advice

There has been an increase in marine anthropogenic activity. Activities that have a negative impact on the spawning habitat of herring – such as the dumping of dredge spoil, the extraction of marine aggregates (e.g. gravel and sand), and the erection of structures such as wind turbines in the vicinity of spawning grounds – are a cause for concern (see for example de Groot, 1979, 1996; ICES, 2003, 2015a). This is because a gravel substratum is an essential habitat for herring spawning. Activities that have a negative impact on the spawning of herring should not occur unless the effects of these activities have been assessed and shown not to be detrimental to the productivity of the stock (ICES, 2003, 2015a).

Recruitment estimates are uncertain because of a lack of recruitment indices. It is known that juvenile Celtic Sea herring mix with the Irish Sea stock, but the level of mixing is unknown. The consequence of this needs to be further evaluated for management and advice.

## Reference points

**Table 4** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	54000	$B_{pa}$	ICES (2018b)
	$F_{MSY}$	0.26	Stochastic simulations using a segmented regression stock–recruitment relationship from 1970–2014	ICES (2018b)
Precautionary approach	$B_{lim}$	34000	$B_{loss}$ = the lowest observed SSB (1980)	ICES (2018b)
	$B_{pa}$	54000	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma_B)$ , with $\sigma_B = 0.29$ from assessment uncertainty in the terminal year	ICES (2018b)
	$F_{lim}$	0.45	Equilibrium F maintaining SSB > $B_{lim}$ with 50% probability	ICES (2018b)
	$F_{pa}$	0.26	The F that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P05}$ with advice rule [AR])	ICES (2018b)
Management Plan	SSB <sub>mgt</sub>	Not defined		
	$F_{mgt}$	Not defined		

## Basis of the assessment

**Table 5** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based analytical assessment (ASAP; ICES, 2022b) that uses catches in the model and in the forecast
Input data	Commercial catches (weights, ages, and length frequencies from catch sampling); Acoustic survey index (CSHAS [A4057], excluding 2017); annual weights in the stock; fixed maturity ogive; natural mortality assumed constant
Discards and bycatch	Included in the assessment
Indicators	None
Other information	Benchmarked in WKWEST (ICES, 2015b) and interbenchmarked in 2018 (ICES, 2018b). Assessed on a seasonal basis, 1 April–31 March, to allow for the inclusion of the spawning cycle in the assessment period. This is an autumn-/winter-spawning stock. Age is given in winter rings (wr), so for example: a 2-year-old fish is termed “1-winter ring” as fish do not lay down a ring in their first winter.
Working group	Herring Assessment Working Group for the Area South of 62°N ( <a href="#">HAWG</a> )

## History of the advice, catch, and management

**Table 6** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. ICES advice, official landings, and ICES estimated catch. All weights are in tonnes.

Year <sup>a</sup>	ICES advice	Catch corresponding to advice	Agreed TAC	ICES landings	Discards	ICES estimated catch
1988	TAC	13000	18000	16800	2400	19200
1989	TAC	20000	20000	19200	3500	22700
1990	TAC	15000	17500	17700	2500	20200
1991	TAC (TAC excluding discards)	15000 (12500)	21000	21700	1900	23600

Year^	ICES advice	Catch corresponding to advice	Agreed TAC	ICES landings	Discards	ICES estimated catch
1992	TAC	27000	21000	20900	2100	23000
1993	Precautionary TAC (including discards)	20000–24000	21000	19200	1900	21100
1994	Precautionary TAC (including discards)	20000–24000	21000	17400	1700	19100
1995	No specific advice		21000	18300	700	19000
1996	TAC	9800	16500–21000**	18800	3000	21800
1997	If required, precautionary TAC	< 25000	22000	18100	700	18800
1998	Catches below 25	< 25000	22000	20300	0	20300
1999	F = 0.4	19000	21000	18100	0	18100
2000	F < 0.3	20000	21000	18267	0	18267
2001	F < 0.34	17900	20000	17729	0	17729
2002	F < 0.35	11000	11000	10550	0	10550
2003	Substantially less than recent catches	-	13000	10875	0	10875
2004	60% of average catch 1997–2000	11000	13000	11065	0	11065
2005	60% of average catch 1997–2000	11000	13000	8452	0	8452
2006	Further reduction 60% average catch 2002–2004	6700	11000	8530	0	8530
2007	No fishing without rebuilding plan		9400	8268	0	8268
2008	No targeted fishing without rebuilding plan		7900	6853	0	6853
2009	No targeted fishing without rebuilding plan		5900	5760	0	5760
2010	F <sub>mgt</sub> = 0.19	10150	10150	8406	0	8406
2011	See scenarios		13200	11503	0	11503
2012	MSY approach	< 26900	21100	21604	161	21765
2013	MSY approach	< 18500	17200	16067	118	16185
2014	MSY approach	< 35942	22300	18930	644	19574
2015	MSY approach	< 15140	15700*	17579	247	17826
2016	MSY approach	< 23164	15400*	16659	182	16841
2017	MSY approach	< 16145	14500*	11194	130	11324
2018	MSY approach	≤ 5445	10100*	4589	0	4589
2019	MSY approach	≤ 4742	4742	1841	0	1841
2020	MSY approach	0	869^^	132	0	132
2021	MSY approach	0	869^^	609	0	609
2022	MSY approach and precautionary considerations	0	869^^			
2023	MSY approach and precautionary considerations	0				

\* Initial TAC before carry-over of unused quota from previous year.

\*\* Revised in 1996 after the ACFM May meeting.

^ By calendar year.

^^ Monitoring TAC.

## History of the catch and landings

**Table 7** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Catch distribution by fleet in 2021/2022 as estimated by ICES. All weights are in tonnes.

Catch	Landings	Discards
745	Pelagic trawlers 100% 745	Negligible

**Table 8** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. ICES estimates of landings by country and ICES estimates of total annual unallocated/misreported, discards, and catch by assessment year. All weights are in tonnes.

Year	Denmark	France	Germany	Ireland	Netherlands	UK	Unallocated/misreported	Discards	Total
1988/1989	-	-	-	17000	-	-	-	3400	20400
1989/1990	-	+	-	15000	1900	-	2600	3600	23100
1990/1991	-	+	-	15000	1000	200	700	1700	18600
1991/1992	-	500	100	21400	1600	-	-100	2100	25600
1992/1993	-	-	-	18000	1300	-	-100	2000	21200
1993/1994	-	-	-	16600	1300	+	-1100	1800	18600
1994/1995	-	+	200	17400	1300	+	-1500	1900	19300
1995/1996	-	200	200	20000	100	+	-200	3000	23300
1996/1997	-	1000	-	17900	1000	-	-1800	750	18850
1997/1998	-	1300	-	19900	1400	-	-2100	-	20500
1998/1999	-	+	-	17700	1200	-	-700	-	18200
1999/2000	-		200	18300	1300	+	-1300	-	18500
2000/2001	-	573	228	16962	44	1	-617	-	17191
2001/2002	-	-	-	15236	-	-	-	-	15236
2002/2003	-	734	-	7465	257	-	-991	-	7465
2003/2004	-	800	-	11536	610	14	-1424	-	11536
2004/2005	-	801	41	12702	-	-	-801	-	12743
2005/2006	-	821	150	9494	799	-	-1770	-	9494
2006/2007	-	-	-	6944	518	5	-523	-	6944
2007/2008	-	379	248	7636	327	-	-954	-	7636
2008/2009	-	503	191	5872	150	-	-844	-	5872
2009/2010	-	364	135	5745	-	-	-499	-	5745
2010/2011	-	636	278	8370	325	-	-1239	n/a	8370
2011/2012	-	241	-	11470	7	-	-248	n/a	11470
2012/2013	-	3	230	16132	3135	-	2104	161	21765
2013/2014	-	-	450	14785	832	-	-	118	16185
2014/2015	-	244	578	17287	821	-	-	644	19574
2015/2016	-	-	477	16320	1304	+	-	254	18355
2016/2017	-	-	419	14585	1025	559	-451	182	16319
2017/2018	-	-	298	9627	648	64	-	130	10767
2018/2019	-	-	-	4227	436	-	-245	-	4418
2019/2020	-	-	-	1803	38	-	-	-	1841
2020/2021	1	-	-	132	+	-	-	-	133
2021/2022	-	-	-	745	-	-	-	-	745

+ Designates catch of less than 0.5 tonnes.

### Summary of the assessment

**Table 9** Herring in divisions 7.a South of 52°30'N, 7.g–h, and 7.j–k. Assessment summary. All weights are in tonnes and recruitment is in thousands. ‘High’ and ‘Low’ refer to 95% confidence intervals.

Year <sup>^</sup>	Recruitment at age (wr) 1	High	Low	SSB**	High	Low	Total catch <sup>^</sup>	F at ages (wr) 2–5	High	Low
1958	408556	742916	74204	206015	414368	0	22978	0.130	0.26	0
1959	1577690	2191396	964004	197957	358131	37789	15086	0.112	0.21	0.0168
1960	362961	581990	143930	189253	318267	60233	18283	0.126	0.20	0.048
1961	393717	592934	194506	159919	260499	59341	15372	0.119	0.183	0.056
1962	843980	1157913	530047	156601	242158	71042	21552	0.192	0.29	0.094
1963	402905	593224	212576	145174	219042	71298	17349	0.153	0.23	0.075
1964	1381900	1798028	965772	165103	230311	99889	10599	0.096	0.145	0.048
1965	416515	609615	223425	169927	228787	111073	19126	0.139	0.20	0.075
1966	735267	998655	471885	165194	217065	113315	27030	0.199	0.29	0.110
1967	768497	1035648	501352	159041	205484	112596	27658	0.23	0.32	0.126
1968	899711	1190064	609356	162296	205751	118849	30236	0.24	0.35	0.138
1969	461941	656468	267412	141929	180495	103365	44389	0.36	0.51	0.21
1970	248671	391417	105923	107098	139385	74815	31727	0.33	0.47	0.186

Year^	Recruitment at age (wr) 1	High	Low	SSB**	High	Low	Total catch^	F at ages (wr) 2–5	High	Low
1971	821309	1090281	552339	97962	124988	70936	31396	0.45	0.66	0.25
1972	279417	417622	141218	85877	109150	62604	38203	0.56	0.79	0.33
1973	325406	456671	194149	64565	82708	46422	26936	0.52	0.73	0.30
1974	160325	240937	79723	50062	64974	35148	19940	0.49	0.71	0.28
1975	202064	289678	114442	39631	51968	27294	15588	0.52	0.75	0.28
1976	226223	312599	139841	36804	47643	25965	9771	0.39	0.57	0.20
1977	184803	256273	113327	37415	48045	26785	7833	0.29	0.43	0.155
1978	145587	206656	84524	36168	46742	25594	7559	0.27	0.39	0.142
1979	278555	374323	182777	36022	46144	25900	10321	0.43	0.62	0.23
1980	166477	240942	92018	33006	42833	23179	13130	0.54	0.79	0.30
1981	464972	605982	323958	36517	46658	26376	17103	0.84	1.21	0.47
1982	724433	920802	528058	57440	71500	43380	13000	0.46	0.67	0.25
1983	784556	993182	575938	76388	93818	58958	24981	0.56	0.79	0.32
1984	666197	851616	480784	78994	96722	61266	26779	0.47	0.66	0.28
1985	642488	815309	469671	85081	103564	66598	20426	0.32	0.45	0.188
1986	654169	821436	486904	93073	112716	73430	25024	0.37	0.51	0.22
1987	1200230	1453961	946439	105472	126789	84151	26200	0.39	0.55	0.23
1988	475514	605932	345088	108978	131881	86079	20447	0.23	0.33	0.135
1989	575732	726301	425159	95704	116137	75271	23254	0.29	0.40	0.172
1990	503380	643048	363712	89224	109110	69338	18404	0.25	0.35	0.146
1991	207415	287852	126968	71049	88243	53855	25562	0.38	0.53	0.23
1992	962480	1182039	742921	70955	86887	55023	21127	0.48	0.69	0.28
1993	359813	475826	243794	73640	90500	56780	18618	0.33	0.46	0.190
1994	768796	957052	580548	80405	97815	62995	19300	0.32	0.45	0.192
1995	722078	901324	542836	81907	98932	64882	23305	0.39	0.54	0.24
1996	352309	463509	241111	72428	88163	56693	18816	0.31	0.43	0.185
1997	372858	489112	256608	59884	73358	46408	20496	0.41	0.57	0.25
1998	248780	338266	159294	47984	59675	36293	18041	0.45	0.62	0.27
1999	486666	622145	351195	41994	52244	31744	18485	0.62	0.87	0.38
2000	477218	610357	344083	42058	52569	31548	17191	0.63	0.88	0.38
2001	493295	634271	352309	41690	52703	30677	15269	0.53	0.76	0.31
2002	541125	699792	382448	53818	67673	39963	7465	0.21	0.31	0.113
2003	141584	209043	74117	42833	54876	30790	11536	0.31	0.44	0.169
2004	361343	488689	233991	39041	51556	26526	12743	0.39	0.57	0.21
2005	1057130	1384361	729839	54401	71860	36942	9494	0.31	0.46	0.153
2006	355901	494188	217612	67024	89012	45034	6944	0.133	0.20	0.065
2007	723893	970811	476969	69764	92931	46597	7636	0.132	0.198	0.066
2008	294385	423058	165722	82687	110119	55255	5872	0.079	0.120	0.039
2009	1011860	1327930	695870	94170	122710	65630	5745	0.076	0.114	0.038
2010	751592	1010271	492909	102117	130562	73678	8370	0.101	0.149	0.053
2011	956829	1265060	648600	110331	139318	81342	11470	0.130	0.190	0.070
2012	631242	868184	394296	100126	126514	73746	21820	0.25	0.37	0.141
2013	365882	546329	185431	88219	112611	63827	16247	0.21	0.31	0.116
2014	304081	473332	134828	68225	87622	48828	19574	0.32	0.47	0.179
2015	175780	295246	56314	44041	57385	30697	18355	0.46	0.66	0.26
2016	204642	319259	90021	26000	34530	17470	16318	0.77	1.09	0.44
2017	60833	99404	22262	11791	16914	6668	10767	1.18	1.65	0.70
2018	51314	84054	18574	6082	9788	2375	4418	1.16	1.78	0.55
2019	180019	296905	63135	6168	10309	2027	1841	0.73	1.31	0.143
2020	108106	200395	15825	8741	14453	3028	132	0.023	0.042	0.0053
2021	260375	627850	0	15084	25474	4694	745	0.069	0.120	0.0178
2022	197044***			19349*						

\* From the short-term forecast.

\*\* SSB estimated at spawning time (1 October).

\*\*\* Stock-recruitment relationship based on SSB<sub>2020</sub> from the assessment output.

^ Assessment year (1 April–31 March).

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## Herring (*Clupea harengus*) in Division 7.a North of 52°30'N (Irish Sea)

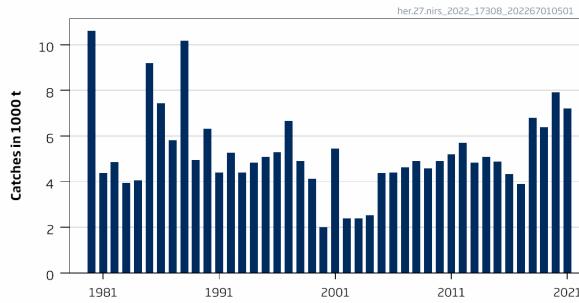
### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 7309 tonnes.

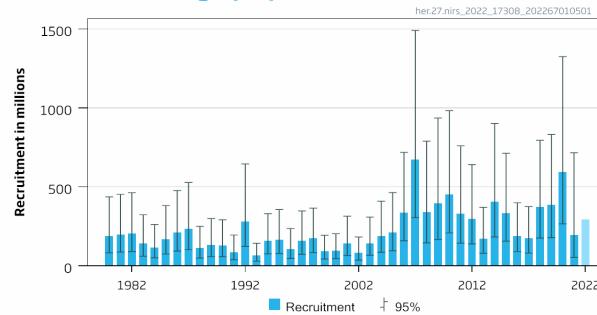
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ , and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .

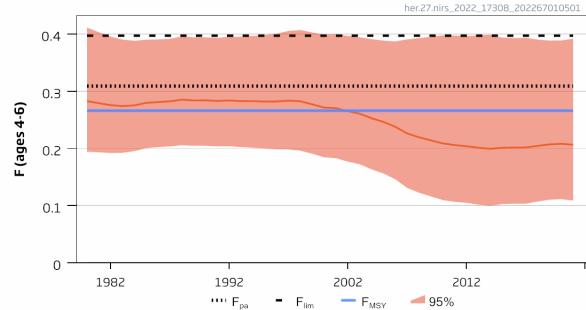
#### Catches



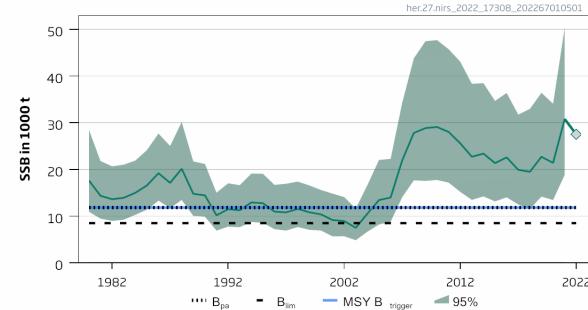
#### Recruitment at age (wr) 1



#### F at ages (wr) 4-6



#### SSB



**Figure 1** Herring in Division 7.a North of 52°30'N. Summary of the stock assessment. The assumed final-year recruitment value is in a lighter shade, and the predicted SSB is shown with a grey diamond. (WR is winter ring).

### Catch scenarios

**Table 1** Herring in Division 7.a North of 52°30'N. Basis for the catch scenarios. Assumptions made for the interim year and the forecast.

Variable	Value	Notes
$F_{ages\ (wr)\ 4-6}\ (2022)$	0.284	$F$ based on the assumed catch for 2022
SSB (2022)*	24 716	Short-term forecast; in tonnes
$R_{age\ (wr)\ 1}\ (2022-2023)$	294 667	Geometric mean over 2010–2019; in thousands
Total catch (2022)	8455	TAC in 2022; in tonnes

\* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries between 1 January and spawning (set for September).

**Table 2** Herring in Division 7.a North of 52°30'N. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F <sub>4-6</sub> (2023)	SSB* (2023)	SSB*,^ (2024)	% SSB change**	% advice change^^
ICES advice basis						
MSY approach: F <sub>MSY</sub>	7309	0.266	23076	22204	-7	-14
Other scenarios						
F = 0	0	0.000	28552	32681	16	-100
F <sub>pa</sub>	10359	0.397	20797	18480	-16	23
F <sub>lim</sub>	8346	0.309	22301	20895	-10	-1
F = F <sub>sq</sub>	7748	0.284	22748	21952	-8	-8
SSB (2023) = B <sub>lim</sub>	27238	1.567	8500	11655	-66	222
SSB (2023) = B <sub>pa</sub>	22529	1.124	11831	14294	-52	166
SSB (2023) = MSY B <sub>trigger</sub>	22529	1.124	11831	14294	-52	166

\* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries between 1 January and spawning (set for September).

\*\* SSB 2023 relative to SSB 2022.

^ Assuming same catch scenario in 2024 as in 2023.

^^ Advice value for 2023 relative to the advice/TAC value for 2022 (8455 tonnes).

The decrease in catch advice for 2023 is the result of a reduction in the estimated stock size at the start of the TAC year .

### Basis of the advice

**Table 3** Herring in Division 7.a North of 52°30'N. The basis of the advice.

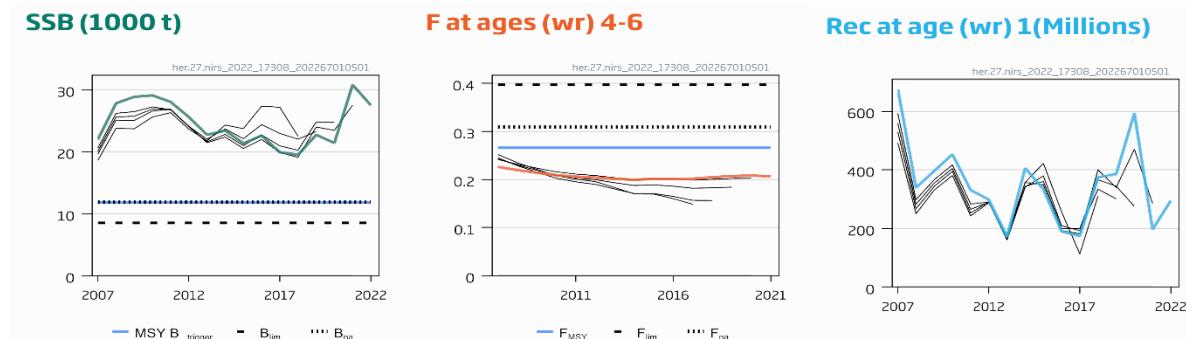
Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for herring in this area

### Quality of the assessment

The herring assessment for Division 7.a North of 52°30'N is performed on a mixed stock (including juveniles from the Celtic Sea), which affects the estimates of the younger ages. Both the catches and acoustic survey indices contain an unknown amount of fish from other stocks. Due to the presence of herring from other stocks, the assessment may overestimate the Irish Sea stock. There is interannual variation in the proportion of juvenile Celtic Sea herring present in the Irish Sea, as well as variation in the distribution patterns.

The interannual variation in herring migration patterns affects the quality of the assessment. The timing of the acoustic survey is occasionally mismatched with the assumed migration pattern of the spawning stock into the Irish Sea from the Malin Shelf.

While the trend in fishing mortality is estimated to be stable, a historical comparison of the current assessment with previous assessments shows annual upward revision of fishing mortality and wide confidence intervals. The assessed historic SSB appears to be sensitive to addition of a new year of data resulting in revision during the recent time period.



**Figure 2** Herring in Division 7.a North of 52°30'N. Historical assessment results. Final-year recruitment estimates and forecast SSB are included.

## Issues relevant for the advice

There has been an increase in marine anthropogenic activity. Activities that have a negative impact on the spawning habitat of herring – such as the dumping of dredge spoil, the extraction of marine aggregates (e.g. gravel and sand), and the erection of structures such as wind turbines in the vicinity of spawning grounds – are a cause for concern (see for example de Groot, 1979, 1996; ICES, 2003, 2015). This is because a gravel substratum is an essential habitat for herring spawning. Activities that have a negative impact on the spawning of herring should not occur unless the effects of these activities have been assessed and shown not to be detrimental to the productivity of the stock (ICES, 2003, 2015).

It is known that juvenile Celtic Sea herring mix with the Irish Sea stock, and the consequence of this needs to be further evaluated for management and advice. This stock should be considered as part of a metapopulation.

## Reference points

**Table 4** Herring in Division 7.a North of 52°30'N. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	11831	$MSY B_{trigger} = B_{pa}$ .	ICES (2017a)
	$F_{MSY}$	0.266	Based on simulation using a combined stock–recruitment relationship (EqSim)	ICES (2017a)
Precautionary approach	$B_{lim}$	8500	Lowest SSB producing above-average recruitment	ICES (2017a)
	$B_{pa}$	11831	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ , with $\sigma = 0.201$ , based on the estimated CV from the terminal assessment year	ICES (2017a)
	$F_{lim}$	0.397	Equilibrium F maintaining SSB > $B_{lim}$ with 50% probability	ICES (2017a)
	$F_{pa}$	0.309	The F that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P05}$ with advice rule)	ICES (2017a, 2021)
Management plan	SSB <sub>mgt</sub>	Not defined		
	$F_{mgt}$	Not defined		

## Basis of the assessment

**Table 5** Herring in Division 7.a North of 52°30'N. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Age-based analytical assessment (FLSAM; ICES, 2022b) that uses catches in the model and in the forecast
Input data	Two survey indices (Northern Ireland Acoustic Surveys: AC [Division 7.a North; A2002] and SSB acoustic survey included as an absolute index [A4705]); commercial catch-at-age data and annual maturity ogives; annual stock weights from AC (Division 7.a North)
Discards and bycatch	Discarding is considered to be negligible
Indicators	None
Other information	Benchmarked in WKIRISH3 and HAWG (ICES, 2017a, 2017b). Age is given in winter rings (wr), so for example: a 2-year-old fish is termed “1-winter ring”, as fish do not lay down a ring in their first winter.
Working group	Herring Assessment Working Group for the Area South of 62°N ( <a href="#">HAWG</a> )

## History of the advice, catch, and management

**Table 6** Herring in Division 7.a North of 52°30'N. ICES advice, ICES estimates of catch. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES estimated catch
1987	TAC	4300	4500	5823
1988	TAC (Revised advice in 1988)	10500 (5600)	10500	10172
1989	TAC	5500	6000	4962
1990	Precautionary TAC	5700	7000	6312
1991	TAC	5600	6000	4398
1992	TAC	6600	7000	5270
1993	TAC	4900–7400	7000	4408
1994	Precautionary TAC	5300	7000	4828
1995	Precautionary TAC	5100	7000	5076
1996	If required, precautionary TAC	5000	7000	5302

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES estimated catch
1997	No advice given	-	9000	6651
1998	<i>Status quo F</i>	6500	9000	4905
1999	$F = \text{proposed } F_{pa} = 0.36$	4900	6600	4127
2000	$F = 90\% F(98) = 0.31$	3900	5400	2002
2001	<i>Status quo F = 0.26</i>	5100	6900	5461
2002	Average catch of 1996–2000	4800	4800	2393
2003	2002 TAC	4800	4800	2399
2004	Advice 2003 catch	4800	4800	2531
2005	<i>Status quo TAC</i>	4800	4800	4387
2006	<i>Status quo TAC</i>	4800	4800	4402
2007	<i>Status quo TAC</i>	4800	4800	4629
2008	Recent catches	4400	4800	4895
2009	Same advice as last year	4400	4800	4594
2010	Recent TAC	4800	4800	4894
2011	No increase in catch	< 4800	5200	5202
2012	No increase in catch	-	5280	5693
2013	MSY approach	< 5100	4993	4828
2014	MSY approach	< 5251	5251	5208
2015	MSY approach	< 4854	4854	4891
2016	MSY approach	≤ 4575	4575	4327
2017	MSY approach	≤ 4127	4127	3896
2018	MSY approach	≤ 7016	7016	6804
2019	MSY approach	≤ 6896	6896	6377
2020	MSY approach	≤ 8064	8064	7927
2021	MSY approach	≤ 7341	7341	7208
2022	MSY approach	≤ 8455	8455	
2023	MSY approach	≤ 7309		

### History of the catch and landings

**Table 7** Herring in Division 7.a North of 52°30'N. Catch by fleet in 2021 as estimated by ICES. All weights are in tonnes.

Catch	Landings		Discards	
	Pelagic trawlers			
	> 99%	< 1%		
7208	7208		Negligible	

**Table 8** Herring in Division 7.a North of 52°30'N. History of landings; ICES estimated values presented for each country. All weights are in tonnes.

Year	Country		Total
	Ireland	UK	
1987	1200	3290	5823
1988	2579	7593	10172
1989	1430	3532	4962
1990	1699	4613	6312
1991	80	4318	4398
1992	406	4864	5270
1993	0	4408	4408
1994	0	4828	4828
1995	0	5076	5076
1996	100	5180	5324
1997	0	6651	6651
1998	0	4905	4905
1999	0	4127	4127
2000	0	2002	2002
2001	862	4599	5461
2002	286	2107	2393

Year	Country		Total
	Ireland	UK	
2003	0	2399	2399
2004	749	1782	2531
2005	1153	3234	4387
2006	581	3821	4402
2007	0	4629	4629
2008	0	4895	4895
2009	0	4594	4594
2010	0	4894	4894
2011	0	5202	5202
2012	18	5675	5693
2013	0	4828	4828
2014	119	5089	5208
2015	0	4868	4891
2016	82	4245	4327
2017	200	3696	3896
2018	1299	5504	6804
2019	1317	5061	6378
2020	1957	5969	7927
2021	753	6455	7208

### Summary of the assessment

**Table 9** Herring in Division 7.a North of 52°30'N. Assessment summary. Weights are in tonnes, recruitment in thousands. 'High' and 'Low' refer to 95% confidence intervals.

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Age (wr) 1	High	Low	SSB*	High	Low		F (ages 4–6)	High	Low
1980	189662	436733	82366	17659	28517	10935	10613	0.28	0.41	0.194
1981	198988	452664	87474	14364	21821	9456	4377	0.28	0.40	0.193
1982	204434	463433	90182	13623	20672	8977	4855	0.28	0.40	0.192
1983	140505	323991	60933	13929	21033	9224	3933	0.27	0.39	0.192
1984	115382	261498	50910	14995	21904	10266	4066	0.28	0.39	0.195
1985	169058	381696	74878	16574	24150	11375	9187	0.28	0.39	0.20
1986	211293	476865	93621	19199	27689	13312	7440	0.28	0.39	0.20
1987	233281	528455	102980	17123	25033	11713	5823	0.28	0.39	0.20
1988	110968	250066	49243	20149	30167	13458	10172	0.29	0.40	0.21
1989	132455	299999	58481	14778	21729	10051	4949	0.28	0.39	0.20
1990	129832	291705	57786	14459	21178	9872	6312	0.28	0.39	0.20
1991	86422	195298	38243	10182	15035	6896	4398	0.28	0.39	0.20
1992	281813	645238	123084	11490	17041	7747	5270	0.28	0.40	0.20
1993	65121	143310	29591	11261	16631	7625	4409	0.28	0.40	0.20
1994	158261	330497	75784	12940	19129	8754	4828	0.28	0.40	0.20
1995	166708	356758	77900	12769	19079	8546	5076	0.28	0.40	0.200
1996	105240	236623	46806	10969	16700	7204	5301	0.28	0.40	0.199
1997	159213	347558	72934	10813	16945	6900	6651	0.28	0.41	0.198
1998	175255	365650	84000	11545	17406	7658	4905	0.28	0.41	0.196
1999	91675	193861	43352	10825	16581	7067	4127	0.28	0.40	0.191
2000	95416	203604	44715	10389	15610	6914	2002	0.27	0.40	0.185
2001	143487	314724	65418	9165	14842	5660	5461	0.27	0.40	0.183
2002	81552	182292	36484	8945	14085	5680	2393	0.27	0.40	0.177
2003	143631	308991	66765	7512	11651	4844	2399	0.26	0.39	0.172
2004	187775	409563	86091	10534	16670	6657	2531	0.25	0.39	0.163
2005	210449	464029	95444	13448	22041	8205	4387	0.25	0.39	0.156
2006	337729	718438	158763	13986	22267	8784	4402	0.24	0.39	0.146
2007	674684	1490620	305376	21954	34314	14046	4629	0.23	0.39	0.131
2008	339083	789204	145688	27806	43796	17654	4895	0.22	0.39	0.123

Year	Recruitment			Spawning-stock biomass			Catches	Fishing mortality		
	Age (wr) 1	High	Low	SSB*	High	Low		F (ages 4–6)	High	Low
2009	395537	936542	167050	28854	47450	17546	4594	0.21	0.40	0.116
2010	452707	982607	208571	29086	47699	17736	4894	0.21	0.40	0.110
2011	330711	760287	143853	28029	45747	17173	5202	0.21	0.40	0.107
2012	298343	641231	138809	25591	43094	15197	5693	0.20	0.40	0.105
2013	171957	370531	79802	22720	38336	13465	4828	0.20	0.40	0.102
2014	405550	902050	182330	23389	38478	14217	5083	0.199	0.40	0.100
2015	333367	713146	155836	21354	34679	13149	4891	0.20	0.39	0.103
2016	189473	399847	89784	22584	36390	14016	4327	0.20	0.39	0.103
2017	174033	375365	80688	19922	31761	12497	3896	0.20	0.39	0.103
2018	373996	795291	175876	19489	32965	11522	6804	0.20	0.39	0.107
2019	385386	832201	178469	22720	36414	14176	6377	0.21	0.39	0.110
2020	593030	1324780	265466	21401	34088	13436	7927	0.21	0.39	0.111
2021	196418	716188	53869	30792	50397	18813	7208	0.21	0.39	0.109
2022	294667**			24716***						

\*For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries between 1 January and spawning (September).

\*\* Geometric mean recruitment 2010–2019 and SSB from assessment model.

\*\*\* From the short-term forecast.

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## Hake (*Merluccius merluccius*) in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock (Greater North Sea, Celtic Seas, and the northern Bay of Biscay)

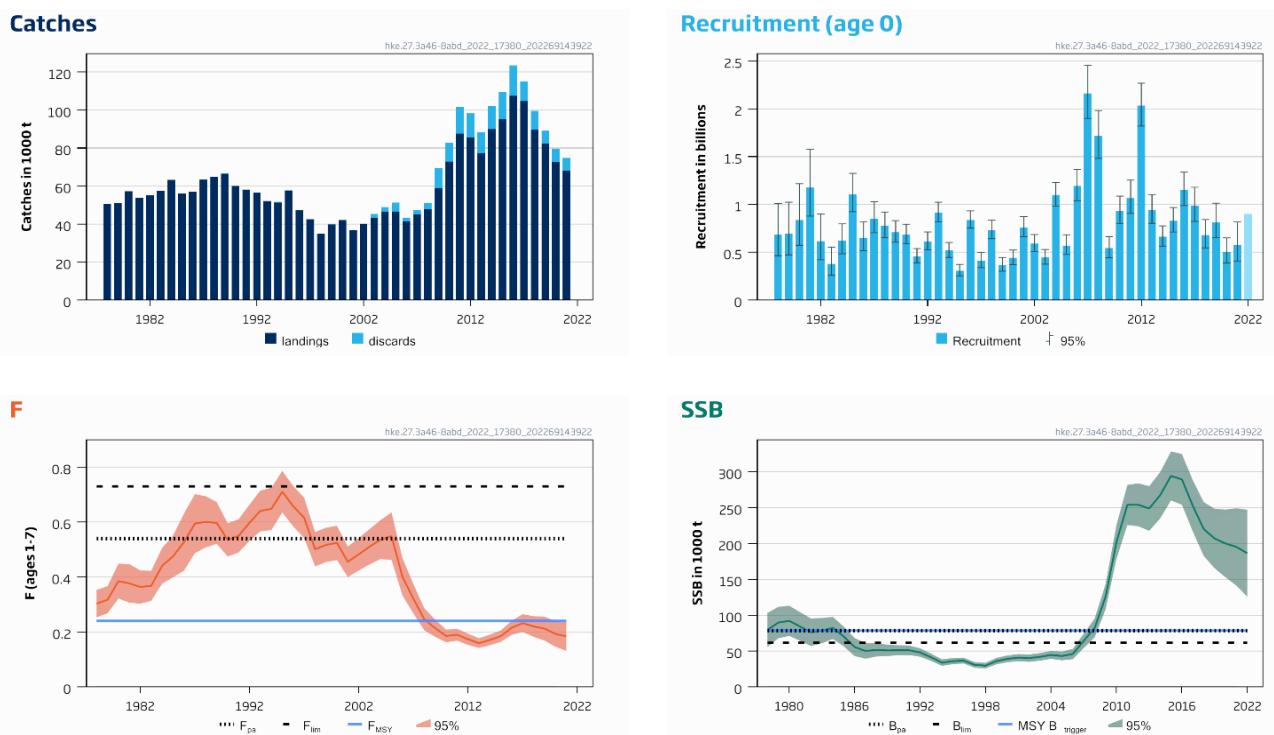
### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 83 130 tonnes.

ICES notes the existence of a precautionary management plan developed and adopted by one of the relevant management authorities for this stock.

### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ , and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Summary of the stock assessment. Discard estimates prior to 2003 are model estimates. Assumed recruitment values for 2022 are shaded in a lighter colour. Estimates for SSB are for females only and the 2022 value is a forecast.

### Catch scenarios

**Table 1** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. The basis of the catch scenarios.

Variable	Value	Notes
$F_{ages\ 1-7}$ (2022)	0.198	$F_{sq}$ = average $F$ (2019–2021); in tonnes.
SSB (2023)	168765	Short-term forecast (STF); females only, in tonnes.
$R_{age\ 0}$ (2022)	898602	Estimated by the model based on the stock–recruitment relationship; in thousands.
$R_{age\ 0}$ (2023)	891837	Estimated by the model based on the stock–recruitment relationship; in thousands.
Total catch (2022)	74935	STF; in tonnes.
Projected landings (2022)	69563	STF; assuming average landings ratio by length (2019–2021); in tonnes.
Projected discards (2022)	5371	STF; assuming average discards ratio by length (2019–2021); in tonnes.

**Table 2** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Annual catch scenarios. All weights are in tonnes. Note: the % change in TAC is not presented because the stock area does not correspond to the area for the TAC.

Basis	Total catch (2023)	Projected landings (2023)	Projected discards (2023)	F <sub>ages 1–7</sub> total (2023)	F <sub>ages 1–7</sub> projected landings (2023)	F <sub>ages 1–7</sub> projected discards (2023)	SSB (2024)	% SSB change*	% advice change**
ICES advice basis									
MSY approach = F <sub>MSY</sub>	83130	76360	6770	0.24	0.223	0.020	148841	-11.8	10.8
Other scenarios									
EU MAP***: F <sub>MSY</sub>	83130	76360	6770	0.24	0.22	0	148841	-11.8	10.8
F = MAP***F <sub>MSY</sub> lower	53284	49067	4218	0.147	0.135	0.0120	168127	-0.38	-29
F = MAP***F <sub>MSY</sub> upper	117526	107599	9927	0.37	0.34	0.031	126984	-25	57
F = 0	0	0	0	0	0	0	203180	20	-100
F = F <sub>pa</sub>	155336	141603	13733	0.54	0.49	0.047	103497	-39	107
SSB (2024) = B <sub>lim</sub>	226111	203813	22298	0.98	0.89	0.097	61563	-64	201
SSB (2024) = B <sub>pa</sub>	197045	178555	18491	0.77	0.70	0.072	78405	-54	163
SSB (2024) = MSY B <sub>trigger</sub>	197045	178555	18491	0.71	0.70	0.072	78405	-54	163
SSB (2024) = SSB(2023)	52303	48167	4136	0.14	0.133	0.0110	168765	0.0	-30
F = F <sub>2022</sub>	69596	64003	5593	0.198	0.182	0.0160	157552	-6.6	-7.3

\* SSB 2024 relative to SSB 2023.

\*\* Total catch advice in 2023 relative to the catch advice for 2022 (75 052 tonnes).

\*\*\*The EU multiannual plan (MAP; EU, 2019).

The advice for 2023 is 10.8% higher than the advice for 2022 following the benchmark.

### Basis of the advice

**Table 3** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. The basis for the advice.

Advice basis	MSY approach
Management plan	The EU multiannual plan (MAP) for stocks in the Western Waters and adjacent has been agreed by the EU for this stock (EU, 2019). This plan is not adopted by Norway and UK; thus, it was not used as the basis of the advice for this shared stock. ICES was requested to provide advice based on the MSY approach and to include the MAP as a catch option.

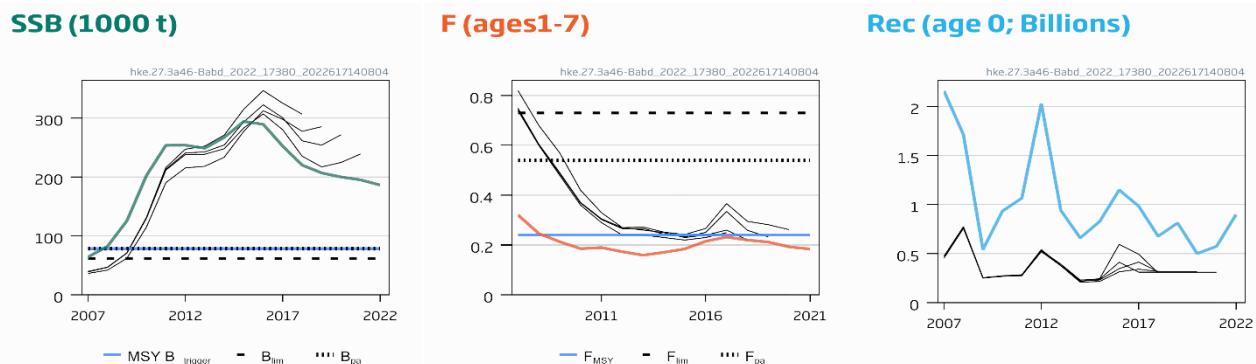
### Quality of the assessment

The stock was benchmarked in 2022 (ICES, 2022a). An update of the Stock Synthesis framework was applied with the addition of commercial and survey data. The stock is now sex-separated with sex-dependent growth and natural mortality.

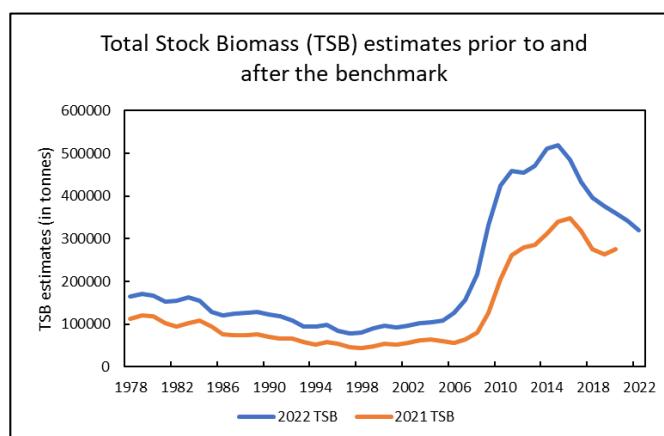
There is no full survey coverage of the entire stock distribution area, and changes in the spatial distribution of the stock are known to increase the uncertainty in the assessment.

On average the new assessment estimates a 71% larger stock size over time (ICES, 2022c). The SSB estimates made prior to 2022 include males and females while estimates in this assessment are female only. The perception of the stock status in relation to reference points is similar. SSB remains above the MSY B<sub>trigger</sub>, while recent fishing mortalities are now estimated below F<sub>MSY</sub> (Figure 2). On average the new assessment estimates a 70% larger stock size over time (Figure 3).

Analyses show that the new assessment tends to revise historical SSB downwards and F upwards when a new year's data is added. If this pattern continues, this may result in an inflated advised catch.



**Figure 2** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Historical assessment results. The reference points and assessment results were revised following a benchmark in 2022. Thus the 2022 estimates are not comparable to the previous assessments. The final-year recruitment values are assumptions.



**Figure 3** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Comparison of Total Stock Biomass from before the last benchmark (2021 assessment) and after the benchmark (current assessment).

### Issues relevant for the advice

Analyses show that the new assessment tends to revise historical SSB downwards and F upwards when a new year of data is added. If this pattern continues, this may result in an inflated advised catch.

### Reference points

**Table 4** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	78405	$B_{pa}$ ; females only, in tonnes.	ICES (2022a)
	$F_{MSY}$	0.24	Stock Synthesis simulations.	ICES (2022a)
Precautionary approach	$B_{lim}$	61563	The breakpoint of the segmented regression stock-recruitment relationship; females only, in tonnes.	ICES (2022a)
	$B_{pa}$	78405	$\exp(1.654 \times \sigma) \times B_{lim}$ , with $\sigma = 0.147$ ; females only, in tonnes.	ICES (2022a)
	$F_{lim}$	0.73	The F that provides a 50% probability for SSB to be above $B_{lim}$ .	ICES (2022a)
	$F_{pa}$	0.54	$F_{pos}$ with advice rule (AR): the F that provides a 95% probability for SSB to be above $B_{lim}$ .	ICES(2022a)
	$F_{mgt}$	Not defined		

Framework	Reference point	Value	Technical basis	Source
Management plan	SSB <sub>mgt</sub>	Not defined		
	MAP MSY B <sub>trigger</sub>	78405	MSY B <sub>trigger</sub> ; females only, in tonnes.	ICES (2022a), EU (2019)
	MAP B <sub>lim</sub>	61563	B <sub>lim</sub> ; females only, in tonnes.	ICES (2022a), EU (2019)
	MAP F <sub>MSY</sub>	0.24	F <sub>MSY</sub>	ICES (2022a), EU (2019)
	MAP range F <sub>lower</sub>	0.147	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2022a), EU (2019)
	MAP range F <sub>upper</sub>	0.37	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2022a), EU (2019)

## Basis of the assessment

**Table 5** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022b</a> ).
Assessment type	Length-based and sex-disaggregated model (Stock Synthesis; ICES, 2022a, 2022c) that uses landings and discards in the assessment and forecast.
Input data	Commercial landings; four survey indices including the French Southern Atlantic Bottom trawl survey (EVHOE-WIBTS-Q4 [G9527]), the Spanish Porcupine Bottom Trawl Survey (SpPGFS-WIBTS-Q3 [G5768]), the Irish Groundfish Survey (IGFS-WIBTS-Q4 [G7212]), the Irish Anglerfish and Megrin Survey (IE-IAMS [G3098]), and French surveys in the Bay of Biscay (FR-RESSGACQ [G2537]); constant maturity, and sex- and age-dependent natural mortality.
Discards and bycatch	Discard estimates from most fleets are available and included in the assessment.
Indicators	None.
Other information	Last benchmarked in 2022 (ICES, 2022a).
Working group	Working Group for the Bay of Biscay and the Iberian Waters Ecoregion ( <a href="#">WGBIE</a> ).

## History of the advice, catch, and management

**Table 6** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. ICES advice and catch. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Landings corresponding to advice	Agreed TAC*	ICES landings	ICES discards	ICES catch
1987	Precautionary TAC; juvenile protection			63500	63369		
1988	Precautionary TAC; juvenile protection		54000	66200	64823	**	
1989	Precautionary TAC; juvenile protection		54000	59700	66473	**	
1990	Precautionary TAC; juvenile protection		59000	65100	59954		
1991	Precautionary TAC; juvenile protection		59000	67000	58129		
1992	If required, precautionary TAC		61500	69000	56617		
1993	Enforce juvenile protection legislation		-	71500	52144		
1994	F significantly reduced		-	60000	51259	**	
1995	30% reduction in F		31000	55100	57621		
1996	30% reduction in F		39000	51100	47210		
1997	20% reduction in F		54000	60100	42465		
1998	20% reduction in F		45000	59100	35060		
1999	Reduce F below F <sub>pa</sub>		-	55100	39814	**	
2000	50% reduction in F		-	42100	42026	**	
2001	Lowest possible catch, recovery plan		-	22600	36675		

Year	ICES advice	Catch corresponding to advice	Landings corresponding to advice	Agreed TAC*	ICES landings	ICES discards	ICES catch
2002	Lowest possible catch/recovery plan		-	27000	40105		
2003	Lowest possible catch/recovery plan		-	30000	43162	1393	44555
2004	70% reduction in F or recovery plan		-	39100	46416	2614	49029
2005	F = 0.19		33000	42600	46550	4583	51133
2006	F = 0.25		44000	43900	41469	1222	42691
2007	Recovery plan limits		50500	52700	45093	2165	47258
2008	Recovery plan limits		54000	54000	47822	3368	51190
2009	F = 0.25 = F <sub>pa</sub>		51500	51500	58781	11033	69814
2010	F = 0.25 = F <sub>pa</sub>		55200	55105	72760	12118	84878
2011	See scenarios		50600	55105	87540	13903	101443
2012	MSY transition		51900	55105	85677	14870	100547
2013	MSY transition		45400	69440	86148	15450	101598
2014	MSY approach		81846	81846	89940	9832	99772
2015	MSY approach		78457	90849	95041	10921	105962
2016	MSY approach	≤ 109592	≤ 96651	108764	107546	11115	118662
2017	MSY approach	≤ 123777		119765	104671	7100	111771
2018	MSY approach	≤ 115335		111785	89695	7038	96733
2019	MSY approach	≤ 142240		141160	82291	4940	87238
2020	MSY approach	≤ 104763		112903	72579	3955	76534
2021	MSY approach (value revised in June 2021)	≤ 102888		98658	68058	3085	71142
2022	MSY approach	≤ 75052		78926			
2023	MSY approach	≤ 83130					

\* Sum of area TACs, corresponding to Northern stock (subareas 4, 6, and 7 and in divisions 3.a, 8.a–b, and 8.d), Division 2.a (EU zone only; from 2021 onwards UK only) and divisions 3.b–d (except for 2019 onwards). There is no agreed TAC for Norwegian waters of Subarea 4.

\*\* Partial discard estimates are available and used in the assessment. For remaining years where values are not presented, there are no valid discard estimates available for the assessment.

## History of the catch and landings

**Table 7** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Catch distribution by fleet in 2021 as estimated by ICES. All weights are in tonnes.

Catch	Landings				Discards
	74799	9.53% unspecified gear	28.8% longline	32% gillnet	
		68061			

**Table 8** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. History of commercial catch and landings; ICES estimated values (i.e. landings by area and total landings minus unallocated) are presented by area for each country participating in the fishery. All weights are in tonnes.

Year	ICES estimated landings*							ICES estimated discards							Total catches **
	3	4	6	7	8abd	Unallocated	Total	3	4	6	7	8abd	Total		
1961			-	-	-	95600	95600						-		95600
1962			-	-	-	86300	86300						-		86300
1963			-	-	-	86200	86200						-		86200
1964			-	-	-	76800	76800						-		76800
1965			-	-	-	64700	64700						-		64700
1966			-	-	-	60900	60900						-		60900
1967			-	-	-	62100	62100						-		62100
1968			-	-	-	62000	62000						-		62000

Year	ICES estimated landings*							ICES estimated discards							Total catches **
	3	4	6	7	8abd	Unallocated	Total	3	4	6	7	8abd	Total		
1969			-	-	-	54900	54900						-	54900	
1970			-	-	-	64900	64900						-	64900	
1971	8500		19400	23400	0	0	51300						-	51300	
1972	9400		14900	41200	0	0	65500						-	65500	
1973	9500		31200	37600	0	0	78300						-	78300	
1974	9700		28900	34500	0	0	73100						-	73100	
1975	11000		29200	32500	0	0	72700						-	72700	
1976	12900		26700	28500	0	0	68100						-	68100	
1977	8500		21000	24700	0	0	54200						-	54200	
1978	8000		20300	24500	0	-2249	50551						-	50551	
1979	8700		17600	27200	0	-2404	51096						-	51096	
1980	9700		22000	28400	0	-2835	57265						-	57265	
1981	8800		25600	22300	0	-2782	53918						-	53918	
1982	5900		25200	26200	0	-2306	54994						-	54994	
1983	6200		26300	27100	0	-2093	57507						-	57507	
1984	9500		33000	22900	0	-2114	63286						-	63286	
1985	9224		27459	21044		-1628	56099						-	56099	
1986	7320		27408	23903		-1539	57092						-	57092	
1987	7800		32900	24700	0	-2031	63369						-	63369	
1988	8800		30900	26600	0	-1477	64823						-	64823	
1989	7375		26938	31957		203	66473						-	66473	
1990	6680		23011	34424		-4161	59954						-	59954	
1991	8328		21546	31635		-3380	58129						-	58129	
1992	8561		22475	23465		2116	56617						-	56617	
1993	8484		20465	19849		3346	52144						-	52144	
1994	5421		21080	24727		31	51259						+	51259	
1995	5335		24056	28144		86	57621						-	57621	
1996	4445		24738	18036		-9	47210						-	47210	
1997	3312		18949	20339		-135	42465						-	42465	
1998	3208		18705	13147		0	35060						-	35060	
1999	4256		23955	11604		-1	39814						+	39814	
2000	4033		25991	11998		4	42026						+	42026	
2001	4367		23065	9244		0	36675						-	36675	

Year	ICES estimated landings*							ICES estimated discards							Total catches **
	3	4	6	7	8abd	Unallocated	Total	3	4	6	7	8abd	Total		
2002		2944	2122 6	1593 5		0	40105						-	40105	
2003		3284	2543 8	1444 0		0	43162						1393	44555	
2004		4438	2748 3	1449 4		0	46416						2614	49029	
2005		5461	2662 3	1446 7		0	46550						4583	51133	
2006		6127	2470 9	1063 3		0	41469						1222	42691	
2007		7017	2745 6	1062 0		0	45093						2165	47258	
2008		10654	2283 4	1433 4		0	47822						3368	51190	
2009		13057	2530 0	2042 4		0	58781						1103 3	69814	
2010		14187	3350 0	2507 3		0	72760						1211 8	84878	
2011		18789	1857 4	1660 4		32000^	87540						1390 3	101443	
2012		22415	2216 6	1671 6		19300^	85677						1487 0	100547	
2013	292	1068 4	5232	5005 4	1988 5		0	86148	31 4	294 5	1545	658 4	406 1	1545 0	101598
2014	350	1208 2	11415	4053 8	2555 4		0 ^	89940	28 8	310 4	952	402 6	146 2	9832	99772
2015	450	1461 5	7079^A	4440 0	2849 8		0 ^	95041	93	344 4	72	421 2	310 0	1092 1	105962
2016	698	1959 1	11379 ^A	4938 8	2649 0		0	107546	14 4	418 7	348^ A	228 5	415 1	1111 5	118662
2017	775	1969 0	9615^A	4573 7	2885 4		0	104671	14 9	177 7	314	116 8	369 2	7100	111771
2018	698	1891 5	7281^A	3690 6	2589 4		0	89695	28 7	125 6	266	212 4	310 5	7038	96733
2019	152 2	1556 9	6835^A	3687 3	2149 2		8	82291	23 5	926	297	142 3	205 9	4940	87238
2020	605	1308 0	4113^A	3510 0	1967 4		7	72579	28 0	336	296	106 3	197 9	3955	76534
2021	791	9300	3823^A	3339 3	2075 0		0	68058	11 0	340	619	926	109 0	3085	71142

\* Data for Subarea 8 for 1973–1978 include those for divisions 8.a and 8.b only. Divisions 3.a and 4.b–c are included in the column "3, 4, and 6" only after 1976. There are some unallocated landings.

\*\* The working group used total catches from 1978.

^ Unallocated landings for the years 2011–2014 were revised in 2015.

^A Landings and discards data from Subarea 5 are included.

**Table 9** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. History of commercial catches by country as estimated by ICES. All weights are in tonnes.

Year	Belgium	Denmark	France	Germany	Ireland	Netherlands	Norway	Spain	Sweden	UK (England)	UK (Northern Ireland)	UK (Scotland)
2014	218	3407	41290	835	4919	221	3031	30747	106	2310	29	12659
2015	144	4242	46034	786	3873	693	4181	33471	103	3148	134	9154
2016	155	4617	49103	845	4168	883	5781	34503	94	2722	116	15675
2017	451	5125	47557	737	3477	188	3974	33317	90	2329	222	14303
2018	212	4529	41804	1212	4440	519	3960	26078	119	2689	130	11039
2019	362	3427	35341	760	4700	503	4144	25538	148	2763	127	9425
2020	190	4225	31635	409	4399	318	2968	23540	94	1879	96	6737
2021	141	3598	29208	696	4721	305	1995	23171	100	1779	155	5273

### Summary of the assessment

**Table 10** Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Assessment summary. ‘High’ and ‘Low’ refer to 95% confidence intervals. SSB is for females only, all weights are in tonnes, and recruitment is in thousands.

Year	Recruitment age 0			Stock size				Landings	Discards **	Fishing pressure (15–80 cm)			
	R	High	Low	SSB	High	Low	TSB^			tonnes	F	High	Low
	thousands			tonnes						tonnes			
1978	683793	1009868	463004	79409	103239	55579	165452	50551			0.30	0.35	0.25
1979	694155	1022100	471433	89683	111632	67734	170824	51096			0.32	0.37	0.27
1980	834917	1216139	573196	92068	113116	71021	166150	57265			0.39	0.45	0.32
1981	1175640	1575799	877097	84112	104211	64014	152225	53918			0.38	0.45	0.31
1982	614691	899366	420124	76137	95392	56883	154363	54994			0.36	0.42	0.30
1983	377577	551118	258682	78414	96056	60773	162353	57507			0.37	0.42	0.31
1984	620641	796870	483385	82226	97655	66796	155018	63286			0.44	0.51	0.38
1985	1106470	1325017	923970	70174	83943	56405	128792	56099			0.48	0.55	0.40
1986	647799	816081	514218	55524	68159	42888	120085	57092			0.53	0.63	0.42
1987	850153	1027361	703511	50084	60954	39214	124434	63369			0.59	0.70	0.49
1988	774160	920602	651013	51547	60782	42312	127307	64823			0.60	0.69	0.51
1989	708777	829472	605644	50868	58858	42878	129460	66473	68		0.60	0.67	0.52
1990	681849	791933	587067	51134	58166	44101	123406	59954			0.54	0.60	0.47
1991	455911	537741	386534	51017	57649	44385	118811	58129			0.55	0.61	0.49
1992	609905	711541	522786	47917	53873	41960	108362	56617			0.60	0.66	0.53
1993	912648	1021946	815039	41246	46392	36101	93438	52144			0.64	0.72	0.57
1994	517928	601140	446235	33808	38426	29190	93348	51259	356		0.65	0.73	0.57
1995	305821	371666	251641	35902	40119	31684	97616	57621			0.71	0.79	0.63
1996	836512	932012	750797	36507	40527	32487	84926	47210			0.66	0.73	0.58
1997	410473	498368	338080	30644	34689	26600	79002	42465			0.62	0.69	0.54
1998	731414	835575	640237	29633	33642	25624	80969	35060			0.50	0.56	0.44
1999	366120	445304	301017	35976	40499	31453	90711	39814	349		0.52	0.58	0.45
2000	439243	521290	370110	39052	43844	34260	95484	42026	77		0.52	0.59	0.46
2001	759622	871031	662463	40741	45746	35736	91736	36675			0.46	0.51	0.40
2002	589414	684584	507475	40092	45344	34839	97172	40107			0.48	0.54	0.42
2003	445111	528048	375200	41880	47195	36565	102175	43162	2110		0.51	0.57	0.45
2004	1099150	1227784	983993	44536	50074	38998	103502	46417	2548		0.54	0.61	0.47
2005	569922	681568	476564	43042	49145	36939	107877	46550	4676		0.55	0.64	0.46
2006	1192020	1366735	1039639	45885	53199	38571	126169	41467	1816		0.40	0.47	0.33
2007	2159010	2454608	1899009	64178	74307	54048	156177	45028	2191		0.32	0.37	0.27
2008	1712400	1980798	1480370	82270	95552	68989	216267	47739	3248		0.25	0.29	0.21
2009	540533	662387	441096	125660	143465	107855	332726	58818	10590		0.21	0.24	0.182
2010	932764	1086960	800442	202255	226085	178425	423769	72799	9978		0.185	0.21	0.162
2011	1065940	1254941	905404	253759	281786	225732	458471	87540	14156		0.190	0.21	0.168
2012	2031050	2267092	1819584	253980	284062	223898	454241	85677	12680		0.173	0.194	0.153
2013	940460	1102399	802309	248863	280080	217646	470863	77343	11098		0.159	0.177	0.141
2014	659779	775330	561449	267180	299560	234800	511899	89940	12131		0.171	0.190	0.151
2015	828652	965837	710952	294240	328413	260067	518740	95043	14446		0.185	0.21	0.164

Year	Recruitment age 0			Stock size				Landings	Discards **	Fishing pressure (15–80 cm)		
	R	High	Low	SSB	High	Low	TSB^			F	High	Low
	thousands			tonnes				tonnes				
2016	1149080	1337644	987097	289381	324867	253895	484606	107547	16041	0.22	0.24	0.189
2017	983549	1178767	820661	252412	288453	216371	433388	104670	10488	0.23	0.26	0.20
2018	676762	841934	543994	220187	257774	182600	395442	89695	9934	0.22	0.26	0.182
2019	812397	1011782	652303	206897	248472	165322	375357	82298	6966	0.21	0.26	0.168
2020	500739	649526	386035	199969	247338	152600	359331	72579	6946	0.193	0.24	0.146
2021	573606	815318	403553	195117	249154	141080	342088	68061	6738	0.184	0.24	0.131
2022	898602*			186358	247139	125577	320420					

\* Recruitment estimated by the model; to carry out the short-term forecast.

\*\* Model estimates.

^ Total stock size.

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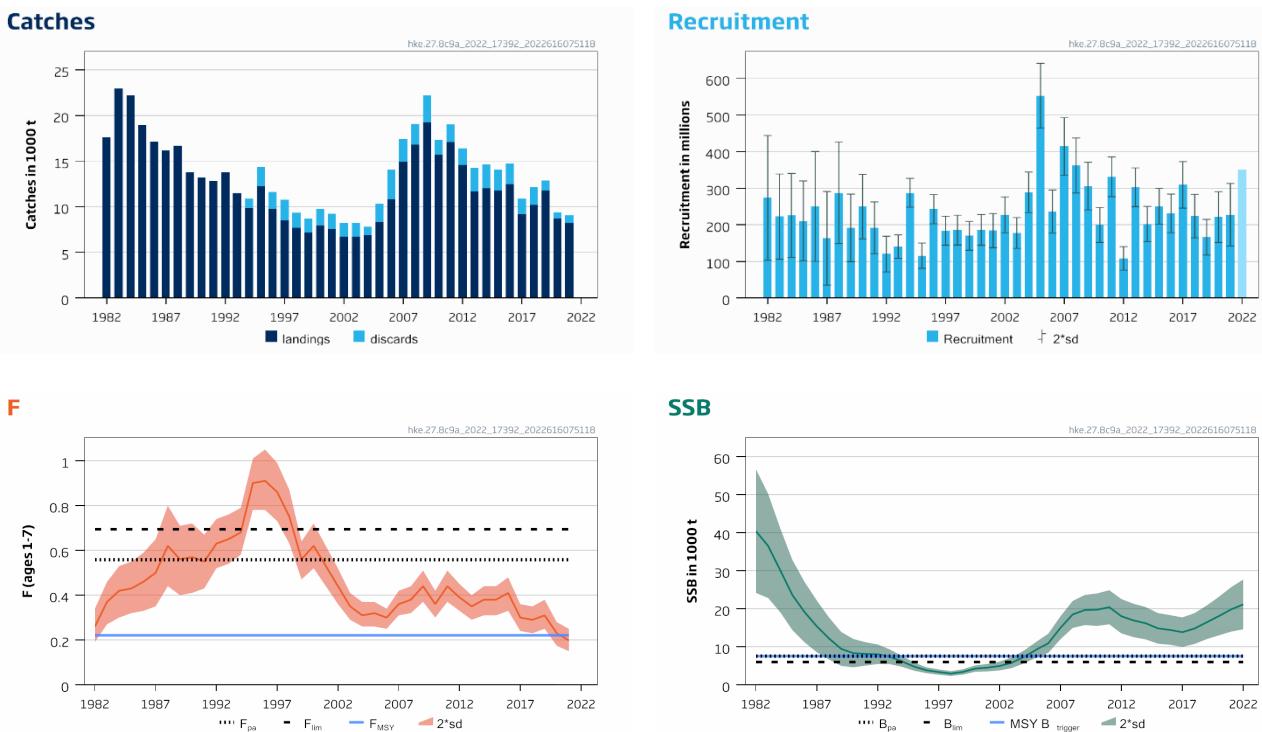
## Hake (*Merluccius merluccius*) in divisions 8.c and 9.a, Southern stock (Cantabrian Sea and Atlantic Iberian waters)

### ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Western Waters and adjacent waters is applied, catches in 2023 that correspond to the F ranges in the plan are between 8322 tonnes and 15 925 tonnes. According to the MAP, catches higher than those corresponding to  $F_{MSY}$  (11 791 tonnes) can only be taken under conditions specified in the MAP, while the entire range is considered precautionary when applying ICES advice rule.

### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$ , and spawning-stock size is above MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$



**Figure 1** Hake in divisions 8.c and 9.a, Southern stock. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour. Discards are included since 1994. Estimates for SSB are for females only and the 2022 SSB estimate is a model forecast.

### Catch scenarios

**Table 1** Hake in divisions 8.c and 9.a, Southern stock. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages\ 1-7}$ (2022)	0.25	$F_{sg}$ = Average F (2019–2021).
SSB (2023)	21850	Short-term forecast (STF); for females in tonnes.
$R_{age\ 0}$ (2022)	350934	Estimated by the model based on the stock–recruitment relationship; in thousands.
$R_{age\ 0}$ (2023)	354110	Estimated by the model based on the stock–recruitment relationship; in thousands.
Total catch (2022)	11738	STF; in tonnes.
Projected landings (2022)	10703	STF; assuming average landings ratio by length (2019–2021); in tonnes.
Projected discards (2022)	1035	STF; assuming average discards ratio by length (2019–2021); in tonnes.

**Table 2** Hake in divisions 8.c and 9.a, Southern stock. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	Projected landings (2023)	Projected discards (2023)	F <sub>ages 1–7</sub> total (2023)	F <sub>ages 1–7</sub> projected landings <sup>^^</sup> (2023)	F <sub>ages 1–7</sub> projected discards <sup>^^</sup> (2023)	SSB (2024)	% SSB change*	% advice change**
<b>ICES advice basis</b>									
EU MAP F = F <sub>MSY</sub> <sup>^</sup>	11791	10599	1192	0.22	0.199	0.022	23936	10	70
EU MAP F = F <sub>MSY</sub> lower	8322	7491	830	0.15	0.136	0.0150	25747	18	20
EU MAP F = F <sub>MSY</sub> upper	15925	14288	1637	0.31	0.28	0.032	21794	0	129
<b>Other scenarios</b>									
F = 0	0	0	0	0	0	0	30141	38	-100
F = F <sub>lim</sub>	30055	26752	3303	0.69	0.62	0.076	14641	-33	333
F = F <sub>pa</sub>	25611	22861	2750	0.56	0.50	0.060	16859	-23	269
SSB (2024) = B <sub>lim</sub>	48198	42169	6030	1.56	1.37	0.196	6011	-72	594
SSB (2024) = B <sub>pa</sub>	44814	39373	5441	1.34	1.18	0.163	7556	-65	545
SSB (2024) = MSY B <sub>trigger</sub>	44814	39373	5441	1.34	1.18	0.163	7556	-65	545
SSB (2024) = SSB(2023)	15816	14191	1625	0.31	0.28	0.032	21850	0	128
F = F <sub>2022</sub>	12950	11635	1315	0.25	0.22	0.025	23334	7	86

\* SSB 2024 relative to SSB 2023.

\*\* Advice values for 2023 relative to the corresponding 2022 values (category 3 advice; ICES, 2021).

<sup>^</sup> The EU multiannual plan (MAP; EU, 2019).

<sup>^^</sup> F<sub>landings</sub> and F<sub>discards</sub> were calculated using the ratios of the projected landings and discards (F<sub>landings</sub> = F<sub>total</sub>\*landings/catch; F<sub>discards</sub> = F<sub>total</sub>\*discards/catch).

The advice increases by 70% due to a change in assessment and advice basis from PA (category 3) to MSY (category 1) and a change in the perception of the stock with an increase in SSB in recent years with the new assessment (ICES, 2022a).

### Basis of the advice

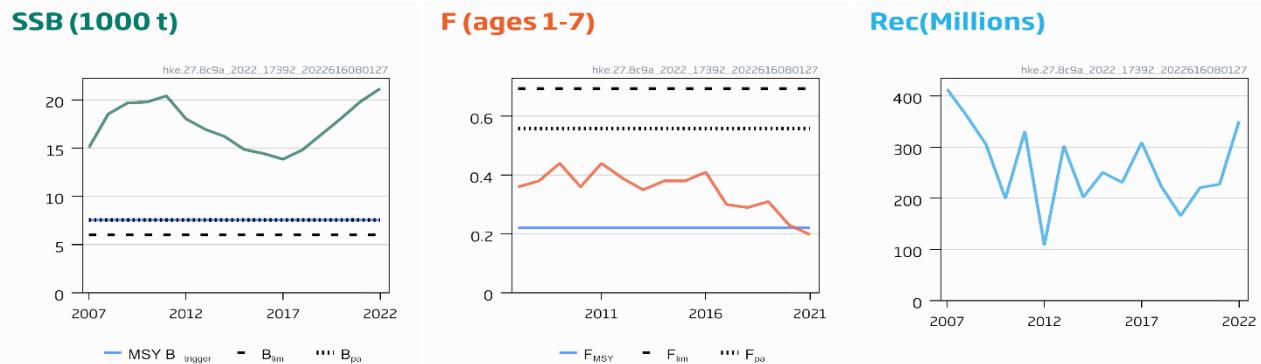
**Table 3** Hake in divisions 8.c and 9.a, Southern stock. The basis of the advice.

Advice basis	Management plan approach
Management plan	<p>The EU multiannual plan (MAP) for stocks in the Western Waters and adjacent waters applies to this stock. The plan specifies conditions for setting fishing opportunities depending on stock status and making use of the F<sub>MSY</sub> range for the stock.</p> <p>In accordance with the MAP, “provided that the stock is above MSY B<sub>trigger</sub>:</p> <ul style="list-style-type: none"> <li>(a) if, on the basis of scientific advice or evidence, it is necessary for the achievement of the objectives laid down in Article 3 in the case of mixed fisheries;</li> <li>(b) if, on the basis of scientific advice or evidence, it is necessary to avoid serious harm to a stock caused by intra- or inter-species stock dynamics; or</li> <li>(c) in order to limit variations in fishing opportunities between consecutive years to not more than 20 %.”</li> </ul> <p>ICES considers that the F<sub>MSY</sub> range for this stock used in the MAP is precautionary.</p> <p>Full details of the plan are described in Regulation 2019/472 (EU, 2019).</p>

### Quality of the assessment

The stock was benchmarked in 2022 and is now in category 1. A new model was developed in Stock Synthesis framework with sex-separated growth and natural mortality (ICES, 2022a).

Discards are estimated by the model, which shows a tendency to underestimate them. If this pattern continues, there is a risk that the catch advice will be overestimated.



**Figure 2** Hake in divisions 8.c and 9.a, Southern stock. Historical assessment results. The basis for the advice has changed from a trends-based analysis (category 3) to an analytical assessment (category 1) in 2022 and there are no previous estimates of SSB, F, or R.

### Issues relevant for the advice

There is no information to present for this stock.

### Reference points

**Table 4** Hake in divisions 8.c and 9.a, Southern stock. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	7556	$B_{pa}$ ; females only, in tonnes.	ICES (2022a)
	$F_{msy}$	0.221	Stock Synthesis simulations.	ICES (2022a)
Precautionary approach	$B_{lim}$	6011	The breakpoint of the segmented regression stock-recruitment relationship; females only, in tonnes.	ICES (2022a)
	$B_{pa}$	7556	$\exp(1.654 \times \sigma) \times B_{lim}$ , $\sigma = 0.139$ ; females only, in tonnes.	ICES (2022a)
	$F_{lim}$	0.694	The F that provides a 50% probability for SSB to be above $B_{lim}$ .	ICES (2022a)
	$F_{pa}$	0.558	$F_{P05}$ with advice rule (AR): the F that provides a 95% probability for SSB to be above $B_{lim}$ .	ICES (2022a)
Management plan	$F_{MGT}$	Not defined		
	$SSB_{MGT}$	Not defined		
	MAP MSY $B_{trigger}$	7556	MSY $B_{trigger}$ ; females only, in tonnes.	ICES (2022a)
	MAP $B_{lim}$	6011	$B_{lim}$ ; females only, in tonnes.	ICES (2022a)
	MAP $F_{msy}$	0.221	$F_{MSY}$	ICES (2022a)
	MAP range $F_{lower}$	0.151	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared to MSY.	ICES (2022a)
	MAP range $F_{upper}$	0.311	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared to MSY.	ICES (2022a)

## Basis of the assessment

**Table 5** Hake in divisions 8.c and 9.a, Southern stock. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022b</a> ).
Assessment type	Length-based and sex-disaggregated model (Stock Synthesis; ICES, 2022c) that uses landings and discards in the assessment and forecast.
Input data	Commercial catches (international landings, discards, and length frequencies from catch sampling); three survey indices: SP-NSGFS-WIBTS-Q4 (1983 to 2021; G2784), SPGCGFS-WIBTS-Q4 (1997 to 2020; G4309), and Pt-PGFS-Q4 (1989–2021; G8899); two commercial indices (SP-TRAWL [2004 to 2021] and SP-VOLPAL [2009 to 2021]; constant maturity, and sex and age dependent natural mortality.
Discards and bycatch	Included in the assessment since 1994.
Indicators	None.
Other information	Benchmarked in 2022 (ICES, 2022a).
Working group	Working Group for the Bay of Biscay and the Iberian Waters Ecoregion ( <a href="#">WGBIE</a> ).

## History of the advice, catch, and management

**Table 6** Hake in divisions 8.c and 9.a, Southern stock. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Catch/landings corresponding to advice**	Agreed TAC***	ICES estimated landings	ICES estimated discards	ICES estimated catch
1987	Precautionary TAC; juvenile protection	15000	25000	16185	-	-
1988	TAC; juvenile protection	15000	25000	16653	-	-
1989	TAC; juvenile protection	15000	20000	13786	-	-
1990	TAC; juvenile protection	15000	20000	13190	-	-
1991	Precautionary TAC	10000	18000	12827	-	-
1992	Precautionary TAC	10300	16000	13798	473	14271
1993	F = 10% of F <sub>91</sub>	1000	12000	11489	683	12172
1994	F lowest possible, at least reduced by 80%	2000	11500	9865	994	10859
1995	F lowest possible	-	8500	12239	2102	14341
1996	F lowest possible	-	9000	9730	1910	11640
1997	F lowest possible	-	9000	8499	2270	10769
1998	60% reduction in F	4000	8200	7683	1681	9364
1999	Reduce F below F <sub>pa</sub>	9500	9000	7171	1519	8690
2000	20% reduction from 1994–1998 average landings	< 7700	8500	7902	1835	9737
2001	Reduce F below F <sub>pa</sub> ; no increase in landings	8500	8900	7581	1662	9243
2002	F below F <sub>pa</sub>	< 8000	8000	6697	1492	8189
2003	Lowest possible catch/rebuilding plan	0	7000	6745	1461	8206
2004	Zero catch	0	5950	6940	913	7854
2005	Zero catch	0	5968	8302	1978	10280
2006	Zero catch	0	6661	10799	3262	14061
2007	Zero catch	0	6128	14934	2504	17438
2008	Zero catch	0	7047	16773	2311	19084
2009	Zero catch	0	8104	19242	2935	22177
2010	Reach B <sub>pa</sub> in 2011	4900	9300	15736	1580	17316
2011	See scenarios	< 9900	10695	17072	1948	19020
2012	MSY transition	< 14323	12299	14573	1822	16395
2013	MSY transition	< 10552	14144	11661	2549	14209
2014	MSY transition	< 13123*	16266	12011	2602	14614

Year	ICES advice	Catch/landings corresponding to advice**	Agreed TAC***	ICES estimated landings	ICES estimated discards	ICES estimated catch
2015	MSY approach	< 8417*	13826	11786	2292	14077
2016	MSY approach	≤ 6078	10674	12443	2313	14756
2017	MSY approach	≤ 8049	10520	9171	1676	10847
2018	MSY approach	≤ 8561	9258	10183	1942	12125
2019	MSY approach	≤ 8281	9258	11800	1061	12861
2020	Management plan	6615 (range 4694–8991) <sup>#</sup>	8752	8732	438 <sup>^</sup>	9171
2021	Precautionary approach	≤ 7825	8517	8214	851	9065
2022	Precautionary approach	≤ 6947	7836			
2023	Management plan	11791 (range 8322–15925) <sup>#</sup>				

\*This value refers to total catch, including discards.

\*\* From 2016 this refers to total catch, including unwanted catch.

\*\*\* Applies to ICES Division 8.c and subareas 9 and 10; EU waters of CECAF 34.1.1.

<sup>#</sup> Catches corresponding to  $F_{MSY}$ , EU MAP range in brackets (EU, 2019).

<sup>^</sup> 2020 discards were not used because of poor sampling and were estimated by the model as 650 t.

## History of catch and landings

**Table 7** Hake in divisions 8.c and 9.a, Southern stock. Catch distribution by fleet in 2021 as estimated by ICES. All weights are in tonnes.

Catch	Landings			Discards
	43% trawlers		57% other fleets	
9065			8214	851

**Table 8** Hake in divisions 8.c and 9.a, Southern stock. History of commercial catch and landings by country. All weights are in tonnes.

Year	Spain		Portugal		France	Unallocated	Total		
	Discards	Landings	Discards	Landings	Landings		Discards	Landings	Catch
1960								16073	16073
1961								17655	17655
1962								17553	17553
1963								19139	19139
1964								24658	24658
1965								28516	28516
1966								23074	23074
1967								20771	20771
1968								19769	19769
1969								18254	18254
1970								11707	11707
1971								11267	11267
1972	17300		8800	0				26100	26100
1973	20800		13800	200				34800	34800
1974	14100		8600	100				22800	22800
1975	19000		10400	100				29500	29500
1976	16900		9100	100				26100	26100
1977	9200		6100	200				15500	15500
1978	8500		4800	100				13400	13400
1979	11200		5800					17000	17000
1980	12700		6800					19500	19500
1981	10500		6000					16500	16500
1982	10098		7494					17592	17592
1983	14906		8044					22950	22950
1984	16664		5515					22179	22179
1985	13121		5820					18941	18941

Year	Spain		Portugal		France	Unallocated	Total		
	Discards	Landings	Discards	Landings	Landings		Discards	Landings	Catch
1986		12207		4947	7			17161	17161
1987		11362		4798	25			16185	16185
1988		10612		6017	24			16653	16653
1989		9187		4583	16			13786	13786
1990		9765		3399	26			13190	13190
1991		8866		3955	6			12827	12827
1992	143	8700	329	5098			473	13798	14271
1993	242	7577	441	3912			683	11489	12172
1994	286	6778	709	3087			994	9865	10859
1995	927	8648	1175	3591			2102	12239	14341
1996	915	6966	995	2765			1910	9730	11640
1997	1070	6084	1199	2415			2270	8499	10769
1998	571	5045	1110	2638			1681	7683	9364
1999	353	3961	1166	3210			1519	7171	8690
2000	622	4651	1213	3251			1835	7902	9737
2001	370	4359	1292	3222			1662	7581	9243
2002	379	3923	1112	2774			1492	6697	8189
2003	411	4653	1050	2092			1461	6745	8206
2004	222	4845	691	2065			913	6910	7824
2005	379	6240	1599	2061			1978	8301	10279
2006	2654	8673	608	2126			3262	10799	14061
2007	1192	12802	1312	2132			2504	14934	17438
2008	1455	14563	856	2210			2311	16773	19084
2009	976	16887	1959	2353			2935	19240	22175
2010	1004	13026	575	2341	362		1580	15729	17309
2011	1209	6452	739	2214			8396	1948	17062
2012	1353	5831	470	2607			6136	1823	14573
2013	2223	7154	330	2744	308		1455	2553	11661
2014	2020	7256	582	2374	136		2246	2602	12011
2015	2061	6758	231	2000	238		2789	2292	11786
2016	2149	8063	164	1973	233		2174	2313	12443
2017	1432	6857	244	1484	67		763	1676	9171
2018	1765	6441	177	1489	60		2193	1942	10183
2019	754	7267	307	1915	5		2612	1061	11800
2020	211	6570	227	1904	52		206	438	8732
2021	573	6161	277	1963	90		0	851	8214
									9065

### Summary of the assessment

**Table 9** Hake in divisions 8.c and 9.a, Southern stock. Assessment summary. Weights are in tonnes and recruitment is in thousands. ‘High’ and ‘Low’ refer to two standard deviations (sd) confidence intervals. The SSB is for females only.

Year	Recruitment			Stock size			Landings (tonnes)	Discards (tonnes)	Fishing pressure		
	R <sub>age 0</sub>	High	Low	SSB	High	Low			F <sub>ages 1–7</sub>	High	Low
1982	273723	444260	103186	40456	56742	24169	17592	0	0.26	0.34	0.19
1983	222433	338956	105910	36570	50305	22834	22950	0	0.37	0.46	0.27
1984	225682	340510	110854	30139	41198	19080	22179	0	0.42	0.53	0.3
1985	210797	319908	101686	23612	32850	14373	18941	0	0.43	0.55	0.32
1986	250260	400464	100056	19117	27071	11163	17161	0	0.46	0.59	0.33
1987	163263	291151	35375	15389	22215	8564	16185	0	0.5	0.65	0.35
1988	287486	425979	148993	12201	17743	6658	16653	0	0.62	0.8	0.44
1989	191758	283988	99528	9460	13942	4979	13786	0	0.56	0.71	0.4
1990	249786	338116	161456	8339	12077	4601	13190	0	0.57	0.72	0.41
1991	192034	262797	121271	8147	11237	5057	12827	0	0.55	0.67	0.43
1992	120216	169140	71292	8056	10629	5482	13798	0	0.63	0.74	0.52

Year	Recruitment			Stock size			Landings (tonnes)	Discards (tonnes)	Fishing pressure		
	R <sub>age 0</sub>	High	Low	SSB	High	Low			F <sub>ages 1–7</sub>	High	Low
1993	140437	172587	108287	7389	9332	5446	11489	0	0.65	0.76	0.54
1994	287587	327050	248124	6151	7588	4714	9865	994	0.68	0.79	0.58
1995	115690	150351	81029	4785	5871	3699	12239	2102	0.9	1.01	0.78
1996	242718	282721	202715	3838	4623	3053	9730	1910	0.91	1.05	0.78
1997	183817	223348	144286	3367	4071	2663	8499	2270	0.86	0.99	0.73
1998	185626	226412	144840	2973	3616	2329	7683	1681	0.75	0.87	0.63
1999	170205	209715	130695	3402	4107	2696	7171	1519	0.56	0.64	0.47
2000	186244	228224	144264	4273	5129	3417	7902	1835	0.62	0.72	0.52
2001	184247	230878	137616	4517	5519	3515	7581	1662	0.53	0.62	0.44
2002	226857	276259	177455	4960	6136	3784	6697	1492	0.44	0.52	0.36
2003	177771	219741	135801	5815	7229	4401	6745	1461	0.35	0.41	0.29
2004	288913	344448	233378	7331	9024	5638	6910	913	0.31	0.37	0.26
2005	553089	641602	464576	9226	11301	7152	8301	1978	0.32	0.37	0.26
2006	236310	295282	177338	10944	13474	8414	10799	3262	0.3	0.34	0.25
2007	414119	493008	335230	15020	18061	11978	14934	2504	0.36	0.42	0.31
2008	362243	437451	287035	18521	22080	14963	16773	2311	0.38	0.44	0.32
2009	305965	371015	240915	19681	23649	15712	19240	2935	0.44	0.51	0.37
2010	199719	247468	151970	19770	24053	15488	15730	1580	0.36	0.42	0.3
2011	331296	385700	276892	20411	24911	15910	17062	1948	0.44	0.51	0.37
2012	108251	140543	75959	18040	22569	13510	14573	1823	0.39	0.45	0.33
2013	302658	355653	249663	16936	21339	12534	11661	2553	0.35	0.4	0.29
2014	202335	250529	154141	16196	20456	11937	12011	2602	0.38	0.44	0.31
2015	250613	299663	201563	14854	18890	10818	11786	2292	0.38	0.44	0.31
2016	231301	284106	178496	14435	18344	10526	12443	2313	0.41	0.48	0.33
2017	309336	372883	245789	13847	17747	9947	9171	1676	0.3	0.36	0.24
2018	223962	283546	164378	14813	18880	10746	10183	1942	0.29	0.35	0.23
2019	166006	214762	117250	16452	20880	12024	11800	1061	0.31	0.38	0.25
2020	220969	290358	151580	18095	23173	13018	8732	650*	0.23	0.28	0.17
2021	227692	313250	142134	19836	25685	13987	8214	851	0.198	0.25	0.15
2022	350934			21167	27716	14618					

\*Discards estimated by the model.

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[Download the stock assessment data and figures.](#)

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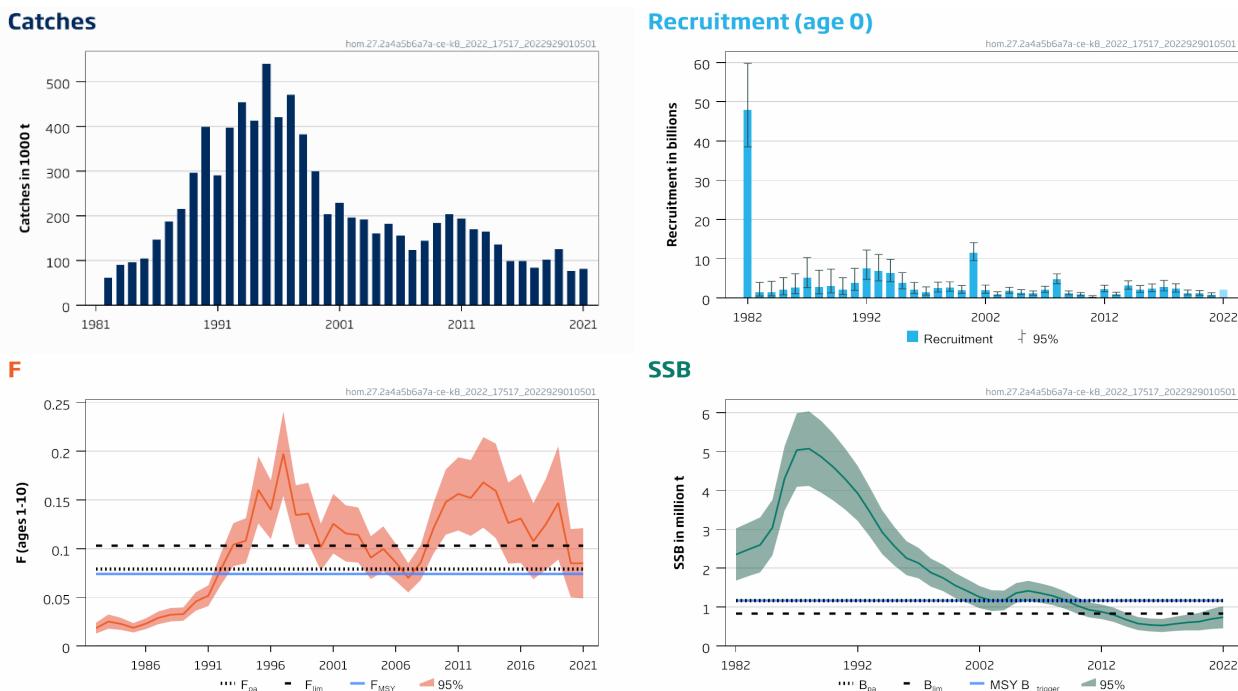
## Horse mackerel (*Trachurus trachurus*) in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k (Northeast Atlantic)

### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied there should be zero catch in 2023.

### Stock development over time

Fishing pressure on the stock is above  $F_{MSY}$  and between  $F_{pa}$  and  $F_{lim}$ ; spawning-stock size is below MSY  $B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a paler colour.

### Catch scenarios

**Table 1** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Values in the forecast and for the interim year

Variable	Value	Notes
$F_{ages\ 1-10}\ (2022)$	0.072	Based on assumed catches in 2022
SSB (2023)	754 163	Short-term forecast; in tonnes
$R_{age\ 0}\ (2022-2023)$	2 174 351	Geometric mean (1983–2021); in thousands
Catch (2022)	71 138	TAC for 2022; in tonnes

**Table 2** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F (2023)	SSB (2024)	% SSB change*	% advice change**
ICES advice basis					
MSY approach: F = 0	0	0	805 946	6.9	-100
Other scenarios					
F = F <sub>MSY</sub>	73 950	0.074	737 593	-2.2	3.95
F = F <sub>P05</sub> = F <sub>pa</sub>	78 719	0.079	733 196	-2.8	10.7
F = F <sub>lim</sub>	101 225	0.103	712 460	-5.5	42.3
SSB <sub>2024</sub> = MSY B <sub>trigger</sub> or B <sub>pa</sub> or B <sub>lim</sub> ***					
SSB <sub>2024</sub> = SSB <sub>2023</sub> ^	56 059	0.055	754 102	0.0	-21.2
F = F <sub>2022</sub>	71 813	0.072	739 564	-1.94	0.95
PelAC proposed HCR^^	15 513	0.015	791 583	4.96	-78

\* SSB 2024 relative to SSB 2023 (754 163 t).

\*\* Advice value for 2023 relative to advice value for 2022 (71 138 tonnes).

\*\*\* The B<sub>pa</sub>, B<sub>lim</sub>, and MSY B<sub>trigger</sub> options were left blank because none of them can be achieved in 2024, even with a zero catch in 2023.

^ Closest available approximation to SSB<sub>2023</sub>.

^^ HCR proposed by PelAC 2020 and reviewed by ICES (ICES, 2021a). The recovery time frame will differ from that indicated during the evaluation in 2020 as the perception of the stock has changed.

The catch advice for 2023 is 100% lower compared to that provided in 2022. The stock has been revised down in the latest assessment such that SSB is below B<sub>lim</sub> and is forecast to remain below B<sub>lim</sub> in 2024 even under a scenario of zero catch in 2023.

## Basis of the advice

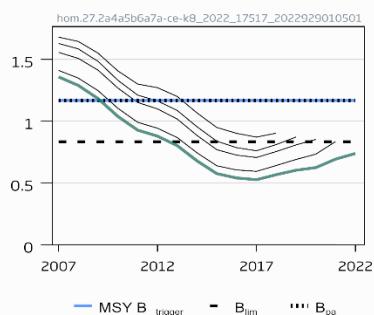
**Table 3** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for horse mackerel in this area

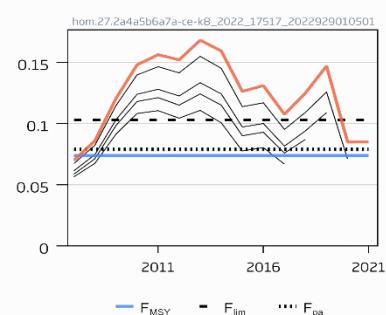
## Quality of the assessment

Recent assessments show a strong retrospective pattern with a consistent downward revision in absolute level of SSB and an upward revision in F. However, this does not affect the zero catch advice for 2023.

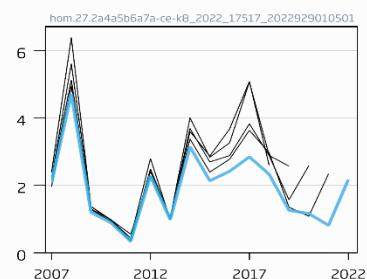
### SSB (million t)



### F (ages 1-10)



### Rec (age 0; Billions)



**Figure 2**

Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Historical assessment results. The reference points were revised in 2019 following an interbenchmark (ICES, 2019), and only the last four assessment results should be compared to the reference points.

## Issues relevant for the advice

ICES provides zero-catch advice for this stock in 2023 because the SSB remains below  $B_{lim}$  by 2024 under all catch scenarios.

## Reference points

**Table 4** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	1 168 272	$B_{pa}$ ; in tonnes	ICES (2019)
	$F_{MSY}$	0.074	Stochastic simulations (EqSim)	ICES (2019)
Precautionary approach	$B_{lim}$	834 480	$B_{pa}/1.4$ ; in tonnes	ICES (2019)
	$B_{pa}$	1 168 272	SSB <sub>2003</sub> ; in tonnes	ICES (2019)
	$F_{lim}$	0.103	Stochastic simulations (EqSim)	ICES (2019)
	$F_{pa}$	0.079	The F that provides a 95% probability for SSB to be above $B_{lim}$ ( $F_{P95}$ )	ICES (2019, 2021b)
	$F_{P95}$	0.079	Stochastic simulations (EqSim)	ICES (2019)
Management plan	SSB <sub>mgt</sub>			
	$F_{mgt}$			

## Basis of the assessment

**Table 5** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Length- and age-based analytical assessment (Stock Synthesis 3; NOAA Toolbox)
Input data	Commercial catches: international catches, length and age data from catch sampling. Three survey indices: triennial egg survey index (I4189, 1992–2019); a combined recruitment index (2003–2021) derived from EVHOE (G9527), IGFS (G7212), SCOWCGFS (G4748 and G4815), and SWC-IBTS (G1179 and G4299); PELACUS acoustic biomass index ([A2548], 1992–2019, 2021). Length frequency distribution from the PELACUS survey. Time variant maturity-at-age. Natural mortality constant at 0.15 for all ages and years.
Discards and bycatch	Partial (prior to 2014) and full (since 2014) discards are included in the assessment.
Indicators	None
Other information	The stock was benchmarked in 2017 (ICES, 2017). The reference points were updated in 2019 (ICES, 2019) and 2021 (ICES, 2021b)
Working group	Working Group on Widely Distributed Stocks ( <a href="#">WGWD</a> ; ICES 2022b)

## History of the advice, catch, and management

**Table 6** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. ICES advice, TACs, and catches. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice**	Agreed TAC*	ICES estimated landings***	ICES estimated discards***	ICES estimated catch***
1987	Not assessed	-	155000	187338	-	187338
1988	No increase in catches	102000	169000	210989	3740	214729
1989	If sustained catches required; TAC	100000	153000	294887	1150	296037
1990	TAC	~200000	203000	388721	9930	398651
1991	Within safe biological limits	-	230000	284623	5440	290063
1992	Within safe biological limits	-	250000	395559	1820	397379
1993	Within safe biological limits	-	250000	445484	8600	454084
1994	Prudent not to increase F	-	300000	408968	3935	412903
1995	Reduction in catch	-	300000	538611	2046	540657
1996	Reduction in catch	-	300000	403869	16870	420739
1997	Reduction in F	173000	300000	470252	158	470410
1998	Reduction in F to 0.15	150000	320000	381411	913	382324
1999	Effectively limit catches to 200 000 t	< 200000	265000	299431	0	299431

Year	ICES advice	Catch corresponding to advice**	Agreed TAC*	ICES estimated landings***	ICES estimated discards***	ICES estimated catch***
2000	Effectively limit catches to 200 000 t	< 200000	240000	202350	382	202732
2001	Effectively limit catches to 224 000 t	< 224000	233000	228827	254	229081
2002	Effectively limit catches to 98 000 t	< 98000	150000	195813	307	196120
2003	Effectively limit catches to 113 000 t	< 113000	137000	191014	842	191856
2004	Limit catches to less than 130 000 t	< 130000	137000	157386	2356	159742
2005	Limit catches to less than 150 000 t	< 150000	137000	180199	1802	182001
2006	Limit catches to less than 150 000 t	< 150000	137000	154474	1353	155827
2007	Limit catches to less than 150 000 t	< 150000	137000	122985	370	123356
2008	Follow proposed management plan	180000	170000	142875	474	143349
2009	Follow proposed management plan	180000	170000	183335	447	183782
2010	Follow proposed management plan	180000	183191	202680	432	203112
2011	See scenarios	181000–229000	195130	193268	430	193698
2012	MSY framework	≤ 211000	183000	166579	3279	169858
2013	MSY framework	≤ 126000	181000	160676	4582	165258
2014	MSY approach	≤ 110546	133220	134463	1896	136360
2015	MSY approach	≤ 99304	97603	94192	4228	98419
2016	MSY approach	≤ 126103	124403	94394	4417	98811
2017	MSY approach	≤ 69186	95500	79033	3928	82961
2018	MSY approach	≤ 117070	115470	99072	2609	101682
2019	MSY approach	≤ 145237	136376	121806	3141	124947
2020	MSY approach	≤ 83954	81796	73682	2740	76422
2021	MSY approach	≤ 81376	81375	79916	1641	81557
2022	MSY approach	≤ 71138	71138			
2023	MSY approach	0				

\* EU and UK TAC.

\*\* Division 8.c is not included prior to 2005.

\*\*\* Division 8.c is not included prior to 2003.

## History of the catch and landings

**Table 7** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Landings distribution by fleet in 2021 as estimated by ICES.

Catch (2021)	Landings				Discards
	Pelagic trawl 45%	Otter trawl 3%	Purse seine 18%	Unspecified and other gears* 33%	
81 557	79 916 tonnes				1641 tonnes

\* Most of those catches are taken by pelagic trawls.

**Table 8** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. History of commercial catch and landings; official landing values presented by area and ICES estimated discards. All weights are in tonnes.

Year	ICES divisions						Discards	Total western stock
	2.a and 5.b	3.a***	4.a	6.a–b	7.a–c and 7.e–k	8.a–e		
1982	-		-	6283	32231	22683	-	61197
1983	412		-	24881	36926	28223	-	90442
1984	23		94	31716	38782	25629	500	96744
1985	79		203	33025	35296	27740	7500	103843
1986	214		776	20343	72761	43405	8500	145999
1987	3311		11185	35197	99942	37703	-	187338
1988	6818		42174	45842	81978	34177	3740	214729
1989	4809		85304*	34870	131218	38686	1150	296037
1990	11414	14878	112753*	20794	182580	46302	9930	398645
1991	3200	2725	56157*	29726	149975	42840	5440	290063
1992	13457	2374	103725	39061	182770	54172	1820	397379
1993		850	141220	65397	193291	44726	8600	454084
1994	759	2492	106911	69616	193689	35501	3935	412903
1995	13151	128	92728	83568	320329	28707	2046	540657

Year	ICES divisions						Discards	Total western stock
	2.a and 5.b	3.a***	4.a	6.a–b	7.a–c and 7.e–k	8.a–e		
1996	3366	0	16783	81311	254049	48360	16870	420739
1997	2601	2037	63646	40145	321017	40806	158	470410
1998	2544**	3693	17001	35073	284529	38571	913	382324
1999	2557^	2095	47315	40381	158733	48350		299431
2000	919^^	1014	4314	20735	121171	54197	382	202732
2001	310	134	11438	24839	117038	75067	254	229081
2002	1324	174	36221	14843	87354	55897	307	196120
2003	36	1843	21272	23772	102379	41711	842	191856
2004	42	48	11708	22177	99284	24126	2356	159746
2005	176	284	24983	22053	91211	41491	1802	182001
2006	27	58	27156	15722	77394	34121	1353	155827
2007	366	110	4940	25949	63224	28396	370	123356
2008	572^^^	2.98	12107	25867	70570	33756	474	143349
2009	1847	17	58738	17775	71378	33580	447	183782
2010	1667	88	11442	23199	126624	39659	432	203112
2011	648	0.23	14723	39496	103156	35245	430	193698
2012	66	8.9	3311	44971	101012	17209	3279	169858
2013	30	10.0	6702	43266	83684	26983	4582	165258
2014	424	4096	10573	32444	56081	30844	1896	136360
2015	10	65	9078	24153	41063	19822	4228	98419
2016	45	0	8960	32186	35692	17511	4417	98811
2017	5	697	9332	28170	22510	18307	3939	82961
2018	718	380	8547	38896	27140	23393	2609	101682
2019	867	490	8314	47351	35144	29640	3141	124947
2020	290	96	10387	19037	24232	19639	2740	76422
2021	12	12	3751	13726	42813	19602	1641	81557

\* Norwegian catches from Division 4.b included.

\*\* Includes 1937 t from Division 5.b.

\*\*\* Catches in the western part of Division 3.a are allocated to horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k.

^ Includes 132 t from Division 5.b.

^^ Includes 250 t from Division 5.b.

^^^ All from Division 5.b.

## Summary of the assessment

**Table 9** Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. Assessment summary. High and low refer to 95% confidence intervals. All weights are in tonnes and recruitment in thousands. F is the fishing mortality weighted by population numbers.

Year	Recruitment			SSB			Total Catch	F		
	Low	Value at age 0	High	Low	Value	High		Low	Mean ages 1–10	High
1982	38491699	47973500	59790988	1680611	2351030	3021449	61197	0.0127	0.0183	0.0239
1983	498387	1409080	3983863	1791394	2477960	3164526	90442	0.0177	0.0251	0.0324
1984	5520183	1529300	4236742	1892698	2600980	3309262	96744	0.0165	0.0227	0.0290
1985	814160	2061350	5219076	2327714	3044610	3761506	103843	0.0139	0.0187	0.0236
1986	1098775	2605390	6177841	3477237	4307560	5137883	145999	0.0174	0.0230	0.0285
1987	2634346	5209590	10302300	4091365	5036810	5982255	187338	0.0224	0.0289	0.0355
1988	1057169	2733740	7069193	4113947	5073630	6033313	214729	0.0252	0.0322	0.0391
1989	1311134	3106180	7358786	3940293	4865000	5789707	296037	0.0259	0.0329	0.0398
1990	873850	2128810	5186053	3737157	4599300	5461443	398645	0.0363	0.0458	0.0553
1991	1963772	3848570	7542369	3497870	4282640	5067410	290063	0.0410	0.0517	0.0624
1992	4749191	7613940	12206729	3214272	3922920	4631568	397379	0.0625	0.0789	0.0952
1993	4361982	6952140	11080343	2808567	3443150	4077733	454084	0.0820	0.104	0.126
1994	4154507	6397130	9850332	2364242	2930260	3496278	412903	0.0849	0.108	0.131
1995	2333578	3888900	6480839	2069738	2568610	3067481	540657	0.126	0.160	0.195
1996	1145261	2130800	3964433	1822011	2258940	2695869	420739	0.110	0.140	0.170
1997	748259	1455050	2829462	1737772	2130370	2522968	470410	0.154	0.198	0.241
1998	1532223	2488060	4040171	1526143	1887400	2248657	382324	0.104	0.135	0.165
1999	1703261	2653150	4132782	1410359	1751820	2093281	299431	0.104	0.136	0.168
2000	1192835	1952630	3196389	1233816	1556520	1879224	202732	0.0774	0.102	0.126
2001	9488813	11569200	14105704	1108372	1411810	1715248	229081	0.0950	0.126	0.156
2002	1190639	1982640	3301472	973007	1257880	1542753	196120	0.0867	0.116	0.145
2003	614023	988367	1590932	898410	1167000	1435590	191856	0.0856	0.114	0.142
2004	1197612	1801970	2711309	917128	1171620	1426112	159746	0.0688	0.0908	0.113
2005	878020	1366060	2125374	1106949	1362250	1617551	182001	0.0766	0.0998	0.123
2006	720700	1137640	1795789	1160114	1418690	1677266	155827	0.0667	0.0859	0.105
2007	1432072	2071850	2997450	1108107	1359080	1610053	123356	0.0550	0.070	0.0850
2008	3614561	4713810	6147360	1051919	1290160	1528401	143349	0.0678	0.0859	0.104
2009	798308	1196590	1793578	959598	1183320	1407042	183782	0.0945	0.121	0.147
2010	567831	893847	1407042	830953	1039260	1247567	203112	0.114	0.148	0.182
2011	189719	338534	604077	733910	928577	1123245	193698	0.119	0.156	0.194
2012	1594164	2277900	3254889	691985	880027	1068069	169858	0.113	0.152	0.191
2013	655327	982006	1471534	618889	803142	987395	165258	0.122	0.168	0.215
2014	2252754	3140900	4379197	502560	679877	857194	136360	0.111	0.159	0.208
2015	1438809	2138820	3179400	406998	576525	746052	98419	0.0846	0.126	0.168
2016	1626934	2419130	3597066	374504	541909	709314	98811	0.0853	0.131	0.177
2017	1814679	2846550	4465169	357558	527801	698044	82961	0.0686	0.108	0.147
2018	1498203	2329200	3621119	385126	568172	751218	101682	0.0782	0.125	0.172
2019	779457	1260210	2037482	402220	604308	806396	124947	0.0889	0.147	0.205
2020	712122	1165290	1906838	399516	625449	851382	76422	0.0498	0.0850	0.120
2021	501332	816224	1328904	436761	693991	951221	81557	0.0489	0.0851	0.121
2022		2174351*		454253	739665	1025077				

\* R (age 0) is the geometric mean of the time-series from 1983 to 2021.

## Sources and references

- ICES. 2017. Report of the Benchmark Workshop on Widely Distributed Stocks (WKWIDE), 30 January–3 February 2017, ICES HQ, Copenhagen, Denmark. ICES CM 2017/ACOM:36. 196 pp.
- ICES. 2019. Report of the Inter-Benchmark Protocol on reference points for Western horse mackerel (*Trachurus trachurus*) in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k (the Northeast Atlantic) (IBPWHM). ICES Scientific Reports, 2:95. 75 pp. <https://doi.org/10.17895/ices.pub.7509>
- ICES. 2021. EU request to ICES on the assessment of a new rebuilding plan for western horse mackerel (*Trachurus trachurus*) in ICES Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k. In Report of the ICES Advisory Committee, 2021. ICES Advice 2021, sr.2021.04. <https://doi.org/10.17895/ices.advice.8039>
- ICES. 2022a. Advice on fishing opportunities. In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, Section 1.1.1. <https://doi.org/10.17895/ices.advice.19928060>
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[Download the stock assessment data and figures.](#)

*Recommended citation:* ICES. 2022. Horse mackerel (*Trachurus trachurus*) in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c,e–k (the Northeast Atlantic). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, hom.27.2a4a5b6a7a-ce-k8. <https://doi.org/10.17895/ices.advice.19772383>

## Horse mackerel (*Trachurus trachurus*) in Division 9.a (Atlantic Iberian waters)

### ICES advice on fishing opportunities

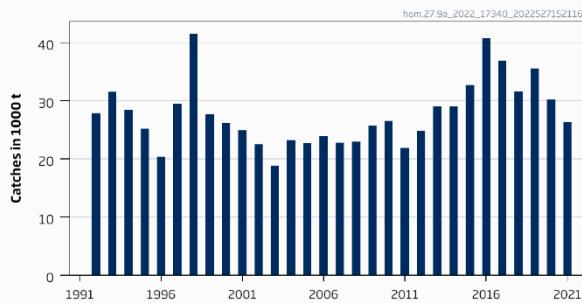
ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 165 173 tonnes.

Management of southern horse mackerel, blue jack mackerel, and Mediterranean horse mackerel under a combined TAC prevents effective control of the single-species exploitation rates and could lead to overexploitation of any of these species.

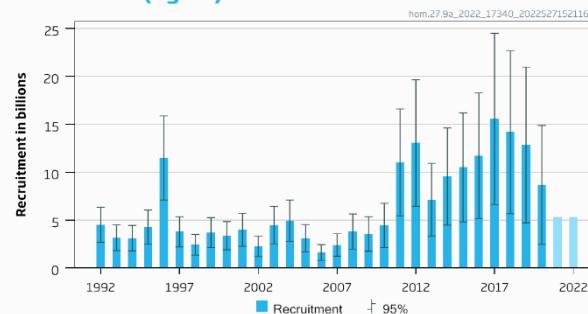
### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and spawning-stock size is above MSY B<sub>trigger</sub>, B<sub>pa</sub>, and B<sub>lim</sub>.

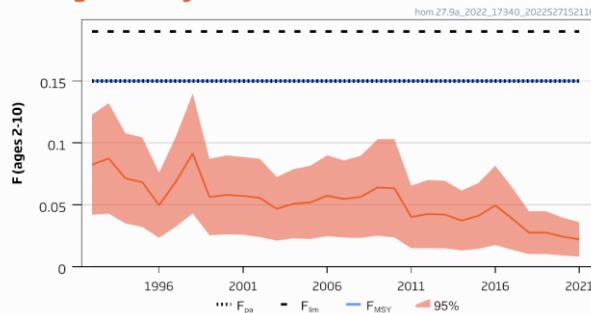
#### Catches



#### Recruitment (age 0)



#### Fishing Mortality



#### Spawning Stock Biomass

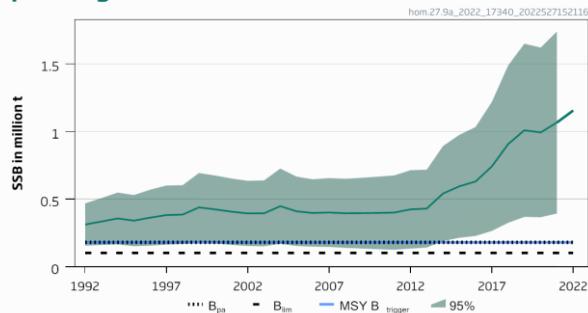


Figure 1

Horse mackerel (*Trachurus trachurus*) in Division 9.a. Summary of the stock assessment. The assumed recruitment values for 2021 and 2022 are shaded in a lighter colour.

### Catch scenarios

Table 1 Horse mackerel (*Trachurus trachurus*) in Division 9.a. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
F <sub>ages 2-10</sub> (2022)	0.022	F <sub>ages 2-10</sub> (2021)
SSB (2022)	1 155 488	Short-term forecast; tonnes
R <sub>age 0</sub> (2021-2023)	5310	Geometric mean (1992–2020); millions
Total catch (2022)	26 254	Short-term forecast using an F <sub>2022</sub> = F <sub>2021</sub> ; tonnes
Landings (2022)	26 254	Short-term forecast using an F <sub>2022</sub> = F <sub>2021</sub> ; tonnes
Discards (2022)	0	Negligible

**Table 2** Horse mackerel (*Trachurus trachurus*) in Division 9.a. Annual catch scenarios. All weights are in tonnes.

Basis	Catches (2023)	F (2023)	SSB*(2023)	SSB*,#(2024)	% SSB change**	% catch change***	% advice change ^
ICES advice basis							
MSY approach: $F_{MSY}$	165173	0.150	1195440	1069137	-10.6	528	15.1
Other scenarios							
$F = 0$	0	0	1202540	1241548	3.2	-100	-100
$F = F_{2021}$	25956	0.022	1201486	1214321	1.07	-1.38	-82
Management plan <sup>^^</sup>	123365	0.110	1197330	1112580	-7.1	369	-14.0
$F = F_{2021} \times 1.2$	31083	0.027	1201275	1208949	0.64	18	-78
$F = F_{2021} \times 1.6$	41273	0.035	1200854	1198277	-0.21	57	-71
$F = F_{2021} \times 2.0$	51378	0.044	1200432	1187701	-1.06	95	-64
$F_{pa}$	165173	0.150	1195440	1069137	-10.6	528	15.1
$F_{lim}$	205452	0.190	1193554	1027417	-13.9	681	43
SSB (2024) = $B_{lim}$	1169479	2.5	1087697	103002	-91	4343	715
SSB (2024) = $B_{pa}$	1074965	1.96	1113050	181005	-84	3984	649
SSB (2024) = MSY $B_{trigger}$	1074965	1.96	1113050	181005	-84	3984	649

\* For this stock, the SSB is determined at spawning time (assumed to be mid-January) and is influenced by fisheries before spawning.

\*\* SSB 2024 relative to SSB 2023.

\*\*\* Catches in 2023 relative to ICES estimates of catches in 2021 (26 320 tonnes).

^ Advised catches for 2023 relative to the advised catches for 2022 (143 505 tonnes).

^^ Management plan with  $F_{target} = 0.11$  ( $F_{MSY}$  at the time of the management plan establishment).

# Assuming same catch scenario in 2024 as in 2023.

The advice for 2023 has increased compared to the advice provided for 2022 owing to the increasing biomass estimate.

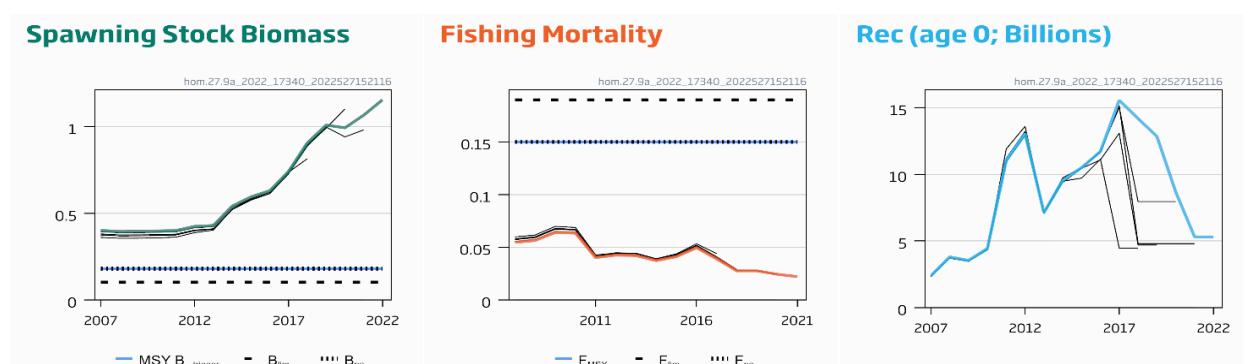
### Basis of the advice

**Table 3** Horse mackerel (*Trachurus trachurus*) in Division 9.a. The basis of the advice.

Advice basis	MSY approach
Management plan	A management plan (MP) was proposed for this stock and has been evaluated as precautionary by ICES (ICES, 2018). The MP was modified in 2021 by setting the $F_{target}$ to be achieved by 2022 and is considered precautionary. ICES was requested by the EU to base its advice for 2023 on ICES MSY approach and include the MP as a catch scenario.

### Quality of the assessment

In 2019 and 2020 the survey was not carried out in the Portuguese area of Division 9.a. As this part of the survey covers 87% of the total stock area, the combined survey index could not be estimated. Because of this, the stock assessment was performed without the 2019 and 2020 survey index values. In 2021, the Portuguese Bottom Trawl Survey was carried out and the combined survey index estimate was used in the assessment. The assessment continues to show high variability, reflected in the large confidence intervals for SSB and recruitment.



**Figure 2** Horse mackerel (*Trachurus trachurus*) in Division 9.a. Historical assessment results. The differences observed in the recruitment plot are due to the different range of years used for the geometric mean recruitment assumptions.

## Issues relevant to the advice

The advice pertains to *T. trachurus*, while the total allowable catch (TAC) is set for several *Trachurus* species, including *T. picturatus* (blue jack mackerel) and *T. mediterraneus* (Mediterranean horse mackerel). Part of the catches consist of other *Trachurus* species, and the percentage composition can vary from year to year. Estimates indicate that in 2021, 23% of the catch consisted of *Trachurus* spp. other than *T. trachurus* (6712 tonnes). ICES considers that management of several species under a combined TAC prevents effective control of the single-species exploitation rates and could lead to overexploitation of any of these species.

## Reference points

**Table 4** Horse mackerel (*Trachurus trachurus*) in Division 9.a. Reference points, values, and their technical basis.  
Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{trigger}}$	181000	Lower bound (average) of 90% confidence intervals of the SSB time-series in a stock being exploited well below $F_{\text{MSY}}$	ICES (2016, 2017)
	$F_{\text{MSY}}$	0.15	Stochastic long-term simulations using a segmented regression with breakpoint at MSY $B_{\text{trigger}}$	ICES (2016, 2021)
Precautionary approach	$B_{\text{lim}}$	103000	Derived from $B_{\text{pa}}$ and assessment uncertainty ( $B_{\text{lim}} = B_{\text{pa}} \times \exp(-1.645\sigma)$ ; $\sigma = 0.34$ )	ICES (2016, 2017)
	$B_{\text{pa}}$	181000	MSY $B_{\text{trigger}}$	ICES (2016, 2017)
	$F_{\text{lim}}$	0.19	Equilibrium scenarios with stochastic recruitment: F corresponding to 50% probability of ( $\text{SSB} < B_{\text{lim}}$ )	ICES (2016, 2017)
	$F_{\text{pa}}$	0.15	F that leads to $\text{SSB} \geq B_{\text{lim}}$ with 95% probability	ICES (2016, 2021)
Management plan	MP MSY $B_{\text{trigger}}$	181000	MSY $B_{\text{trigger}}$	ICES (2018)
	MP $B_{\text{lim}}$	103000	$B_{\text{lim}}$	ICES (2018)
	MP $F_{\text{target}}$	0.11	Previous defined $F_{\text{MSY}}^*$	ICES (2018)
	MP $F_{\text{bycatch}}$	0.01	F to be applied when $\text{SSB} \leq B_{\text{lim}}$ to allow for bycatches	ICES (2018)

\*  $F_{\text{MSY}}$  recalculated in 2021 following redefinition of  $F_{\text{pa}}$  to  $F_{\text{POS}}$  (ICES, 2021).

## Basis of the assessment

**Table 5** Horse mackerel (*Trachurus trachurus*) in Division 9.a. Basis of assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2022a</a> )
Assessment type	Analytical assessment (AMISH model) that uses catches in the model and in the forecast (ICES, 2022b)
Input data	Commercial catches (international landings, ages, and length frequencies from catch sampling). One combined index, using two IBTS surveys (Spanish North Coast Bottom Trawl Survey [G2784] and Portuguese International Bottom Trawl Survey [G8899]); maturity data from Daily Egg Production Method surveys [I4189])
Discards and bycatch	Not included and considered negligible
Indicators	None
Other information	This stock was benchmarked in 2017 (WKPELA; ICES, 2017)
Working group	Working Group Southern Horse Mackerel, Anchovy and Sardine ( <a href="#">WGHSANSA</a> )

## History of the advice, catch, and management

**Table 6** Horse mackerel (*Trachurus trachurus*) in Division 9.a. ICES advice, agreed TAC, and official landings. All weights are in tonnes.

Year	ICES advice*	Catch corresponding to advice ( <i>T. trachurus</i> )	Agreed TAC ( <i>Trachurus</i> spp.)**	ICES catches ( <i>T. trachurus</i> ) ***
1987	Not assessed	-	72500	55000^
1988	Mesh size increase	-	82000	56000^
1989	No increase in F; TAC	72500	73000	56000^
1990	F at $F_{0.1}$ ; TAC	38000	55000	49000^
1991	Precautionary TAC	61000	73000	22000
1992	If required, precautionary TAC	61000	73000	27858
1993	No advice	-	73000	31521
1994	<i>Status quo</i> prediction (Catch at <i>status quo</i> F)	55000	73000	28441
1995	No long-term gains in increasing F (Catch at <i>status quo</i> F)	63000	73000	25147
1996	No long-term gains in increasing F (Catch at <i>status quo</i> F)	60000	73000	20400
1997	No advice	-	73000	29491
1998	F should not exceed the F (94–96)	59000	73000	41564
1999	No increase in F	58000	73000	27733
2000	$F < F_{pa}$	< 59000	68000	26160
2001	$F < F_{pa}$	< 54000	68000	24910
2002	$F < 0.113$	< 34000	57500	22506
2003	Average of last three years	< 49000	55200	18887
2004	Should not exceed the recent average (2000–2002)	< 47000	55000	23252
2005	Should not exceed the recent average (2000–2002)	< 25000	55000	22695
2006	Should not exceed the recent average (2000–2004, excluding 2003)	< 25000	55000	23902
2007	Same advice as last year	< 25000	55000	22790
2008	Same advice as last year	< 25000	57800	22993
2009	Same advice as last year	< 25000	57800	25737
2010	Same advice as last year	< 25000	31100	26556
2011	Same advice as last year	< 25000	29585	21875
2012	No increase in F	< 30800	30800	24868
2013	No increase in F	< 26000	30000	28993
2014	MSY approach	< 35000	35000	29017

Year	ICES advice*	Catch corresponding to advice ( <i>T. trachurus</i> )	Agreed TAC ( <i>Trachurus spp.</i> )**	ICES catches ( <i>T. trachurus</i> ) ***
2015	MSY approach	< 71824	59500	32723
2016	MSY approach	≤ 68583	68583	40730
2017	MSY approach	≤ 73349	73349	36946
2018	MSY approach	≤ 55555	55555	31661
2019	MSY approach	≤ 94017	94017	35520
2020	MSY approach	≤ 116871	116871	30177
2021	MSY approach	≤ 128627	128627	26320
2022	MSY approach	≤ 143505	143505	
2023	MSY approach	≤ 165173		

\* Advice referred to divisions 8.c and 9.a until 2004 and refers to Division 9.a since then as a result of a change in the stock definition.

\*\* From 1987–1989 the TAC applied to Division 8.c, subareas 9 and 10, and Division 34.1.1 of the Fishery Committee for the Eastern Central Atlantic (CECAF [EU waters only]), and from 1990–2009 the TAC applied to Division 8.c and Subarea 9. From 2010 onwards, the TAC applies only to Subarea 9.

\*\*\* Not including Spanish catches in 9.a South-Cadiz, considered to be less than 2% of the total catches in recent years.

### History of the catch and landings

**Table 7** Horse mackerel (*Trachurus trachurus*) in Division 9.a. Catch distribution by fleet in 2021 as estimated by ICES. (Note: Spanish catches in 9.a South-Cadiz are not included).

Catch (2021)	Landings			Discards
	bottom trawl 31%	purse-seine 64%	other gears 5%	
26320 tonnes			26320 tonnes	Negligible

**Table 8** Horse mackerel (*Trachurus trachurus*) in Division 9.a. History of ICES estimated catch (in tonnes). Spanish catches from 9.a South-Cadiz are included from 2002 onwards. Catches from 2002–2012 are uncertain; these catches are small and therefore not included in the assessment.

Year	Catch used in the assessment (excluding Spanish catches in 9.a South-Cadiz)	Spanish catches in 9.a South-Cadiz	Total catch in 9.a
1992	27858		
1993	31521		
1994	28441		
1995	25147		
1996	20400		
1997	29491		
1998	41564		
1999	27733		
2000	26160		
2001	24910		
2002	22506	1157	23663
2003	18887	679	19566
2004	23252	325	23577
2005	22695	416	23111
2006	23902	656	24558
2007	22790	634	23424
2008	22993	600	23593
2009	25737	760	26497
2010	26556	660	27216
2011	21875	700	22575
2012	24868	448	25316
2013	28993	389	29382
2014	29017	188	29205
2015	32723	455	33178
2016	40730	351	41081
2017	36946	143	37089
2018	31661	259	31920

Year	Catch used in the assessment (excluding Spanish catches in 9.a South-Cadiz)	Spanish catches in 9.a South-Cadiz	Total catch in 9.a
2019	35520	1016	36536
2020	30177	1167	31344
2021	26320	425	26745

### Summary of the assessment

**Table 9** Horse mackerel (*Trachurus trachurus*) in Division 9.a. Assessment summary.

Year	Recruitment			Spawning-stock biomass (SSB)**			Total catch tonnes	Fishing mortality		
	Age 0	97.5%	2.5%	SSB	97.5%	2.5%		Ages 2–10	97.5%	2.5%
	thousands			tonnes						
1992	4511750	6343219	2680281	312644	469568	155720	27858	0.082	0.123	0.042
1993	3157140	4503194	1811086	334915	507772	162059	31521	0.088	0.132	0.043
1994	3116640	4457094	1776186	357692	549568	165815	28441	0.071	0.108	0.035
1995	4262840	6046591	2479089	341582	530801	152364	25147	0.068	0.105	0.032
1996	11485300	15877758	7092842	363614	570636	156593	20400	0.050	0.076	0.023
1997	3776370	5348521	2204219	382830	601181	164479	29491	0.069	0.105	0.032
1998	2422560	3498186	1346934	386496	603998	168994	41564	0.092	0.140	0.043
1999	3698310	5268088	2128532	439734	693938	185531	27733	0.056	0.087	0.025
2000	3376760	4845508	1908012	424627	675185	174069	26160	0.058	0.090	0.026
2001	3990810	5717301	2264319	407941	653336	162546	24910	0.057	0.089	0.026
2002	2255730	3311010	1200450	395041	636004	154079	22506	0.056	0.087	0.024
2003	4477560	6435522	2519598	395506	639269	151743	18887	0.047	0.073	0.021
2004	4941720	7100542	2782898	448590	726787	170394	23252	0.051	0.079	0.023
2005	3106400	4531688	1681112	410485	666978	153993	22695	0.052	0.082	0.022
2006	1619040	2439741	798339	398318	647454	149182	23902	0.057	0.090	0.025
2007	2400310	3576771	1223849	401867	656355	147380	22790	0.055	0.086	0.024
2008	3804480	5644273	1964687	396024	651472	140575	22993	0.057	0.090	0.023
2009	3549020	5347869	1750171	396981	658457	135505	25737	0.064	0.103	0.025
2010	4443340	6756552	2130128	398639	666737	130541	26556	0.063	0.103	0.024
2011	11032300	16608167	5456433	401282	675939	126624	21875	0.040	0.066	0.0150
2012	13050500	19657229	6443771	425006	714813	135199	24868	0.043	0.070	0.0151
2013	7131340	10935230	3327450	430724	718701	142747	28993	0.042	0.069	0.0149
2014	9551120	14617583	4484657	541959	893490	190427	29017	0.037	0.062	0.0132
2015	10503000	16188490	4817510	595386	975881	214890	32723	0.041	0.068	0.0145
2016	11724300	18280480	5168120	630963	1033777	228149	40730	0.050	0.082	0.0175
2017	15568400	24506862	6629938	742574	1219718	265429	36946	0.039	0.064	0.0138
2018	14186700	22702959	5670441	907062	1488802	325323	31661	0.028	0.045	0.0103
2019	12849300	20973578	4725022	1009547	1649839	369256	35520	0.028	0.045	0.0103
2020	8679670	14883521	2475819	993801	1620903	366700	30177	0.024	0.040	0.0091
2021	5309945*			1066959	1739882	394037	26320	0.022	0.036	0.0083
2022	5309945*			1155488						

\* Geometric mean (1992–2020).

\*\* SSB is estimated at spawning time (mid-January).

### Sources and references

- ICES. 2016. Working Group on Southern Horse Mackerel, Anchovy and Sardine (WGHANSA), 24–29 June 2016, Lorient, France. ICES CM 2016/ACOM:17.
- ICES. 2017. Report of the Benchmark Workshop on Pelagic Stocks (WKPELA), 6–10 February 2017, Lisbon, Portugal. ICES CM 2017/ACOM:35. 294 pp.