

## Cod (*Gadus morhua*) in Division 5.a (Iceland grounds)

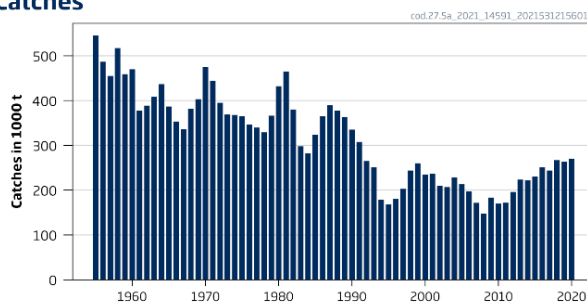
### ICES advice on fishing opportunities

ICES advises that when the Icelandic management plan is applied, catches in the fishing year 2021/2022 should be no more than 222 373 tonnes.

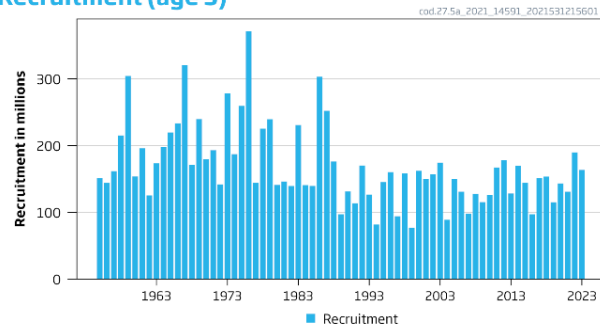
### Stock development over time

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

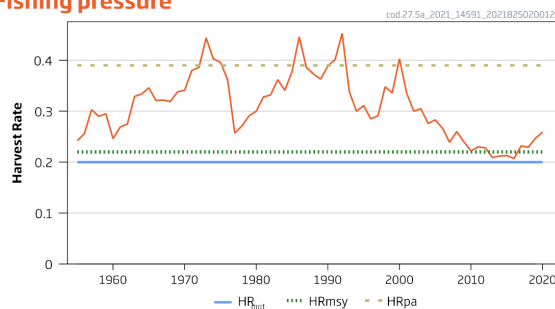
#### Catches



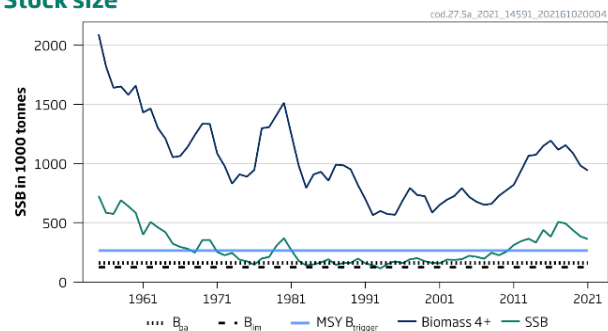
#### Recruitment (age 3)



#### Fishing pressure



#### Stock size



**Figure 1\*** Cod in Division 5.a. Summary of the stock assessment. Harvest rates are calculated based on biomass age 4+. All biomass reference points refer to SSB levels<sup>†</sup>.

### Catch scenarios

**Table 1** Cod in Division 5.a. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
HR (2021)	0.24	Catch constraint, tonnes.
SSB (2022)	338 572	Tonnes.
$B_{4+}$ (2022)	898 237	Tonnes.
$R_{age\ 3}$ (2021)	130 766	From the assessment; thousands.
$R_{age\ 3}$ (2022)	189 565	From the assessment; thousands.
$R_{age\ 3}$ (2023)	163 431	From the assessment; thousands.
Total catch (2021)	247 000	Estimated catch until the end of the fishing year (31 August 2021) and estimated catch in the first four months of the next fishing year (1 September–31 December 2021); tonnes.

\* Version 2: The reference point for  $HR_{mgt}$  was added to the fishing pressure plot.

† Version 2: caption updated.

**Table 2** Cod in Division 5.a. Annual catch scenarios. All weights are in tonnes (t).

Rationale	Catch (2021/2022)	HR (2022)	SSB (2023)	Biomass age 4+ (2023)	% SSB change *	% TAC change **	% advice change ***
Management plan	222 373	0.23	349 326	976 021	3%	-13%	-

\* SSB<sub>2023</sub> relative to SSB<sub>2022</sub>.

\*\* Catch in 2021/2022 relative to TAC<sub>2020/21</sub> (256 593 tonnes). Because SSB<sub>2021</sub> is bigger than MGT B<sub>trigger</sub>, the TAC for 2021/2022 is calculated as  $(0.2 \times B_{4+,2021} + TAC_{2020/21}) / 2$

\*\*\* No advice was requested for 2020/2021. Advice for 2020/2021 was issued by MFRI (256 593 tonnes).

The advice has decreased as a result of the downward revision in stock size estimate, based on model changes during the 2021 benchmark.

### Basis of the advice

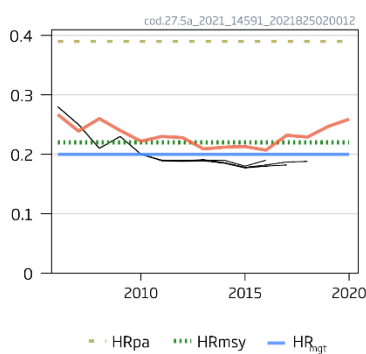
**Table 3** Cod in Division 5.a. The basis of the advice.

Advice basis	Management plan (MII, 2015)
Management plan	<p>The Icelandic Ministry of Industries and Innovation has a fisheries management plan for Icelandic cod (MII, 2015). In 2015, the plan was extended until 2020. The plan, which aims at providing maximum sustainable yield, has been evaluated by ICES and is considered to be precautionary. According to the management plan, 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> $TAC_{Y/Y+1} = \frac{\min\left(\frac{SSB_Y}{MGT B_{trigger}}, 1\right) HR_{MGT} B_{4+,Y} + TAC_{Y-1/Y}}{2}$ <p>where B<sub>4+,Y</sub> is the biomass of cod aged 4 and older in year Y and MGT B<sub>trigger</sub> = 220 000 tonnes.</p> <p>The expected range of realized harvest rate (HR) following the management plan (HR<sub>MGT</sub>) is between 0.15 and 0.27 (ICES, 2021a). ICES has evaluated the management plan and found it to be consistent with both the precautionary principle and ICES MSY approach (ICES, 2021a).</p>

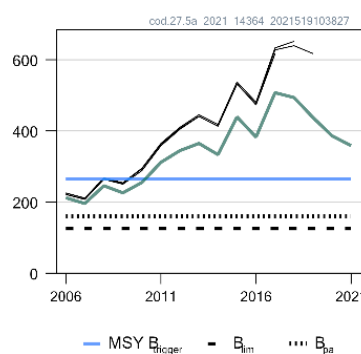
### Quality of the assessment

The stock was benchmarked in 2021 (ICES, 2021b), resulting in a downward revision of recruitment and stock size, and an upward revision in the fishing pressure.

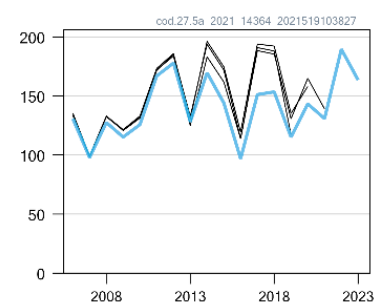
#### Harvest Rate



#### SSB (1000 t)



#### Rec (age 3; Millions)



**Figure 2<sup>‡</sup>** Cod in Division 5.a. Historical assessment results. The fishing pressure reference points and MSY B<sub>trigger</sub> were revised in 2021 following a benchmark, and only assessment results from the last year should be compared to the reference points indicated. There was no ICES assessment in 2020.

<sup>‡ ‡</sup> Version 2: The reference point for HR<sub>mgt</sub> was added to the harvest rate plot.

## Issues relevant for the advice

The stock was benchmarked in 2021, together with a management strategy evaluation which resulted in new ICES reference points being defined (ICES, 2021b). ICES concluded that the current HCR is consistent with both the precautionary approach and the ICES MSY approach.

## Reference points

**Table 4** Cod in Division 5.a. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	265 000	The trigger point is the lower 5th percentile of the SSB when fishing at $HR_{MSY}$ .	ICES (2021b)
	$HR_{MSY}$	0.22	Stochastic HCR evaluation. Percentage of age 4+ biomass.	ICES (2021b)
Precautionary approach	$B_{lim}$	125 000	$B_{loss}$	ICES (2010a)
	$B_{pa}$	160 000	$B_{pa} = B_{lim} \times \exp(1.645\sigma_B)$ ; $\sigma_B = 0.15$ .	ICES (2016)
	$HR_{lim}$		Undefined	ICES (2021b)
	$HR_{pa}$	0.39	HR leading to $P(SSB > B_{lim}) > 95\%$ with $B_{trigger} = 265\ 000$	ICES (2021b)
Management plan	MGT $B_{trigger}$	220 000	From the management plan.	ICES (2010b)
	$HR_{MGT}$	0.20	Proportion of age 4+ biomass, from the management plan, which uses a catch stabilizer.	ICES (2010b)

## Basis of the assessment

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

ICES stock data category	1 ( <a href="#">ICES, 2021c</a> ).
Assessment type	Separable catch at age model using catches in the assessment and forecast (ICES, 2021d).
Input data	Catch-at-age and age-structured Icelandic bottom trawl survey - Spring - Marsrall (G3239 [IS-SMB]), age 1–14) and Autumn - Haustrall (G4493 [IS-SMH]), age 3–13 survey indices.
Discards and bycatch	Discarding is considered negligible and is not included.
Indicators	None.
Other information	The stock was benchmarked and harvest control rules evaluated in 2021 (ICES, 2021b).
Working group	North-Western Working Group ( <a href="#">NWWG</a> ).

## History of the advice, catch, and management

**Table 6** Cod in Division 5.a. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch for the fishing year	ICES catch for the calendar year #
1988*	National advice	300 000	350 000		377 554
1989*	National advice	300 000	325 000		363 125
1990*	National advice	250 000	300 000		335 316
1991*	National advice	240 000	245 000		307 759
1991/1992	National advice	250 000	265 000	274 000	264 834
1992/1993	Reduce F by 40%	154 000	205 000	241 000	250 704
1993/1994	Reduce F by 40%	150 000	165 000	197 000	178 138
1994/1995	Reduce F by 50%	130 000	155 000	165 000	168 592
1995/1996	Apply catch rule	155 000	155 000	170 000	180 701
1996/1997	Apply catch rule	186 000	186 000	202 000	203 112
1997/1998	Apply catch rule	218 000	218 000	227 000	243 987
1998/1999	Apply catch rule	250 000	250 000	254 000	260 147
1999/2000	Apply catch rule	247 000	250 000	257 000	235 092
2000/2001	Apply catch rule	203 000	220 000 **	221 000	236 705
2001/2002	Apply catch rule	164 000	190 000 **	219 000	209 537
2002/2003	Apply catch rule	183 000	179 000 **	202 000	207 246
2003/2004	Apply catch rule	210 000	209 000	227 000	228 337
2004/2005	Apply catch rule	205 000	205 000	217 000	213 865

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch for the fishing year	ICES catch for the calendar year #
2005/2006	Apply catch rule	198 000	198 000	207 000	197 247
2006/2007	Apply catch rule	187 000	193 000	191 000	171 646
2007/2008	Apply catch rule	152 000	130 000	143 000	147 668
2008/2009	Apply $F_{max}$	< 124 000	160 000 ^	171 000	183 302
2009/2010	Apply $F_{max}$	< 135 000	150 000 ^^	170 000	170 009
2010/2011	Apply catch rule	160 000	160 000	167 000	172 207
2011/2012	Apply catch rule	177 000	177 000	185 000	196 177
2012/2013	Apply catch rule	196 000	196 000	213 000	223 594
2013/2014	Apply catch rule	215 000	215 000	226 000	221 990
2014/2015	Apply catch rule	218 000	218 000	223 000	230 229
2015/2016	Apply catch rule	239 000	239 000	249 000	251 134
2016/2017	Management plan	244 000	244 000	237 644	243 945
2017/2018	Management plan	257 572	257 572	270 217	267 221
2018/2019	Management plan	264 437	264 437	265 385	263 025
2019/2020	Management plan	≤ 272 411	274 411	272 385	270 302
2020/2021	No advice requested ***	-	256 593		
2021/2022	Management plan	≤ 222 373			

\* Calendar year.

\*\* Amended catch rule.

\*\*\* Advice for 2020/2021 was issued by MFRI (256 593 tonnes).

^ Initial TAC set to 130 000 tonnes according to the catch rule, raised to 160 000 tonnes in January 2009.

^^ Set according to the catch rule.

# The values refer to the catches in the second year within the specified fishing year.

## History of the catch and landings

**Table 7** Cod in Division 5.a. Catch distribution by fleet in 2020 as estimated by ICES. All weights are in tonnes.

Catch (2020)	Landings					Discards
	Bottom trawl	Longline	Gillnet	Demersal seine	Jigging	
270 302	55%	26%	7%	6%	6%	Discarding is considered negligible
270 302						

## Summary of the assessment

**Table 8** Cod in Division 5.a. Assessment summary. Weights are in tonnes. Recruitment in thousands.

Year	Recruitment (Age 3)	Stock size	Total catch	Fishing pressure (Age 5–10)	Biomass age 4+	Harvest rate
1955	151 013	726 241	545 250	0.35	2 090 320	0.242
1956	143 752	583 804	486 909	0.35	1 818 140	0.256
1957	161 466	574 563	455 182	0.39	1 639 740	0.303
1958	215 103	689 959	517 359	0.44	1 650 370	0.29
1959	304 213	639 226	459 081	0.38	1 580 310	0.295
1960	153 622	583 530	470 121	0.43	1 657 860	0.246
1961	195 930	399 302	377 291	0.4	1 430 560	0.269
1962	125 111	505 480	388 985	0.4	1 464 330	0.275
1963	173 200	460 469	408 800	0.46	1 298 680	0.329
1964	197 565	420 076	437 012	0.52	1 210 650	0.334
1965	219 616	322 911	387 106	0.56	1 052 680	0.346
1966	233 050	295 681	353 357	0.52	1 063 260	0.321
1967	320 419	280 570	335 721	0.48	1 139 610	0.322
1968	171 116	248 410	381 770	0.56	1 242 860	0.319
1969	239 593	354 183	403 205	0.46	1 335 750	0.338
1970	179 438	354 785	475 077	0.56	1 332 670	0.341
1971	192 968	252 991	444 248	0.68	1 083 340	0.38
1972	141 824	225 430	395 166	0.67	978 206	0.386
1973	277 781	244 838	369 205	0.71	829 801	0.444

Year	Recruitment (Age 3)	Stock size	Total catch	Fishing pressure (Age 5–10)	Biomass age 4+	Harvest rate
1974	186 988	188 285	368 133	0.73	908 077	0.403
1975	259 329	174 257	364 754	0.72	889 039	0.396
1976	370 982	144 821	346 253	0.71	945 577	0.362
1977	143 962	197 742	340 086	0.58	1 297 470	0.257
1978	225 107	211 015	329 602	0.47	1 306 800	0.271
1979	239 218	306 679	366 462	0.44	1 409 580	0.291
1980	140 994	368 922	432 237	0.49	1 512 890	0.3
1981	145 930	268 023	465 032	0.62	1 244 300	0.328
1982	139 250	177 331	380 068	0.71	980 697	0.332
1983	230 639	139 019	298 049	0.66	794 045	0.362
1984	140 599	148 271	282 022	0.62	908 082	0.341
1985	139 345	164 568	323 428	0.69	929 609	0.378
1986	303 152	191 453	364 797	0.84	855 173	0.446
1987	251 884	144 474	389 915	0.89	989 609	0.386
1988	176 012	159 873	377 554	0.91	985 283	0.373
1989	96 786	161 381	363 125	0.75	950 420	0.363
1990	131 121	197 404	335 316	0.76	815 683	0.389
1991	113 564	155 780	307 759	0.9	696 868	0.401
1992	170 010	141 908	264 834	1.01	563 578	0.453
1993	126 349	114 550	250 704	0.99	599 228	0.338
1994	81 465	152 348	178 138	0.67	572 173	0.3
1995	145 062	174 084	168 592	0.58	567 699	0.311
1996	159 988	157 872	180 701	0.55	685 535	0.285
1997	94 019	191 678	203 112	0.57	792 512	0.291
1998	158 086	200 239	243 987	0.69	733 200	0.348
1999	76 603	175 092	260 147	0.81	724 660	0.336
2000	162 111	160 381	235 092	0.82	585 873	0.403
2001	150 099	157 143	236 702	0.75	649 756	0.336
2002	156 510	189 278	209 544	0.62	694 293	0.3
2003	174 115	185 748	207 246	0.61	725 876	0.305
2004	88 497	192 443	228 342	0.65	791 616	0.276
2005	149 780	220 740	213 867	0.62	717 393	0.283
2006	130 720	211 858	197 202	0.59	675 921	0.267
2007	97 891	195 743	171 646	0.54	651 464	0.239
2008	127 510	245 586	147 676	0.39	659 452	0.26
2009	115 199	225 779	183 320	0.42	726 787	0.24
2010	125 757	254 755	170 025	0.36	773 335	0.222
2011	166 957	311 443	172 218	0.34	819 615	0.23
2012	177 841	344 400	196 171	0.34	940 442	0.228
2013	128 170	364 574	223 582	0.37	1 065 260	0.209
2014	169 554	333 010	222 021	0.33	1 074 200	0.212
2015	143 996	439 073	230 165	0.32	1 149 060	0.213
2016	96 821	382 258	251 219	0.33	1 193 030	0.207
2017	151 034	506 895	243 945	0.33	1 116 430	0.232
2018	153 302	493 086	267 221	0.35	1 154 570	0.229
2019	115 027	436 468	263 025	0.39	1 086 780	0.247
2020	143 159	384 961	270 302	0.43	982 186	0.259
2021	130 766	361 348			940 767	
2022	189 565					
2023	163 431					

## Sources and references

- ICES. 2010a. Iceland and Greenland. Report of the ICES Advisory Committee, 2010. ICES Advice 2010, Book 2. 114 pp. <https://doi.org/10.17895/ices.advice.4910>.
- ICES. 2010b. Report of the Ad hoc Group on Icelandic Cod HCR Evaluation (AGICOD), 24–26 November 2009, ICES Headquarters, Copenhagen, Denmark. ICES CM 2009\ACOM:56. 89 pp. <https://doi.org/10.17895/ices.pub.5279>.
- ICES. 2016. Report of the North-Western Working Group (NWWG), 27 April–4 May, 2016, ICES Headquarters, Copenhagen, Denmark. ICES CM 2016/ACOM:08. 703 pp. <https://doi.org/10.17895/ices.pub.5280>.
- ICES. 2019. North-Western Working Group. ICES Scientific Reports. 1:14. 620 pp. <http://doi.org/10.17895/ices.pub.5298>.
- ICES. 2021a. Cod in Division 5.a. Re-evaluation of the management plan for cod in Icelandic waters. *In* Report of the ICES Advisory Committee, 2021. ICES Advice 2021, sr.2021.03, <https://doi.org/10.17895/ices.advice.8195>.
- ICES. 2021b. Workshop on the re-evaluation of management plan for the Icelandic cod stock (WKICECOD). ICES Scientific Reports. 3:30. 85 pp. <https://doi.org/10.17895/ices.pub.7987>.
- ICES. 2021c. Advice on fishing opportunities. *In* Report of the ICES Advisory Committee, 2021. ICES Advice 2021, Section 1.1.1. <https://doi.org/10.17895/ices.advice.7720>.
- ICES. 2021d. North-Western Working Group (NWWG). ICES Scientific Reports. 3:52. <https://doi.org/10.17895/ices.pub.8186>.
- MII. 2015. Icelandic Ministry of Industries and Innovation's fisheries management plan for Icelandic cod.

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

*Recommended citation:* ICES. 2021. Cod (*Gadus morhua*) in Division 5.a (Iceland grounds). *In* Report of the ICES Advisory Committee, 2021. ICES Advice 2021, cod.27.5a, <https://doi.org/10.17895/ices.advice.7747>.