

ECOREGION Iceland and East Greenland
STOCK Cod in Division Va (Icelandic cod)

Advice for 2014/2015

ICES advises on the basis of the Icelandic 2009 management plan that the TAC in the fishing year 2014/2015 should be set at 218 000 t.

Stock status

Fishing pressure			
	2011	2012	2013
MSY (F_{MSY})	✓	✓	✓ Below possible candidate
Precautionary approach (F_{pa}, F_{lim})	✓	✓	✓ Below possible candidate F_{pa} and F_{lim}
Management plan (F_{MGT})	✓	✓	✓ Within expected range
Stock size			
	2012	2013	2014
MSY ($B_{trigger}$)	✓	✓	✓ Above trigger
Precautionary approach (B_{pa}, B_{lim})	✓	✓	✓ Full reproductive capacity
Management plan (SSB_{MGT})	✓	✓	✓ Above trigger

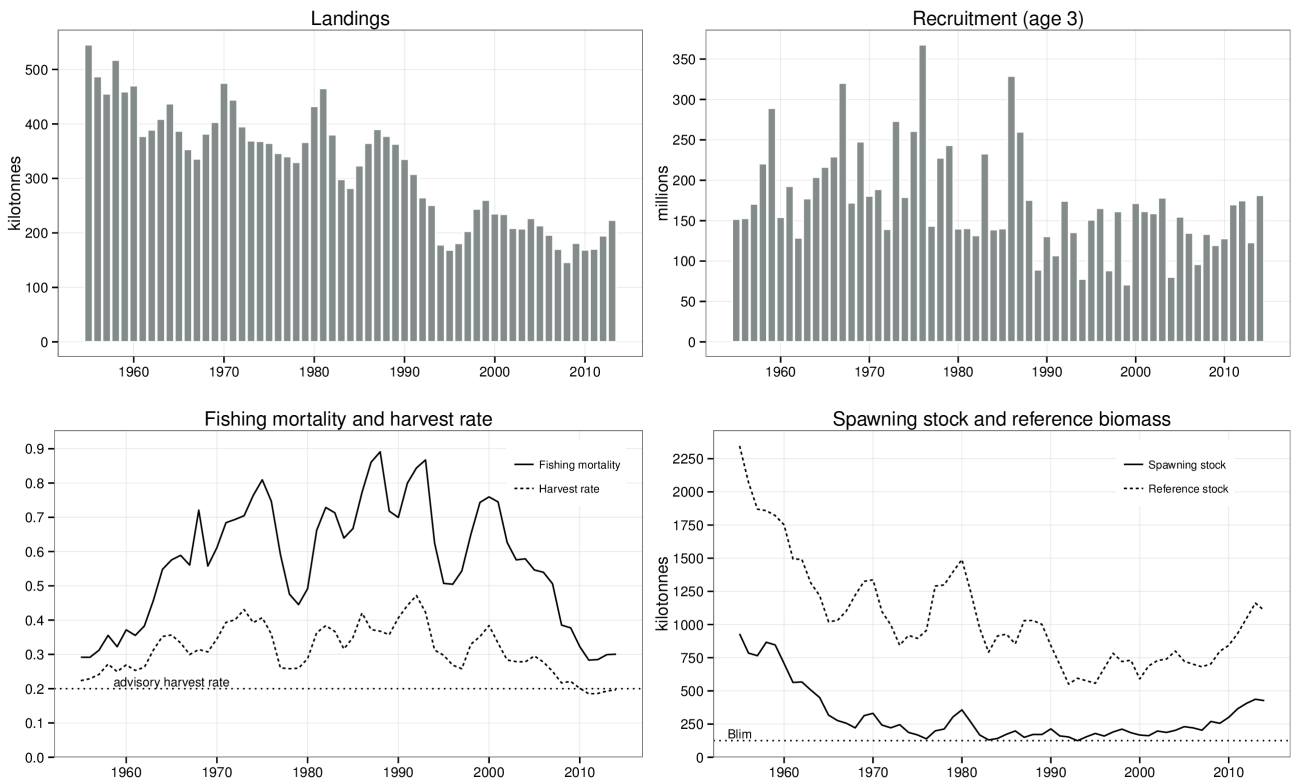
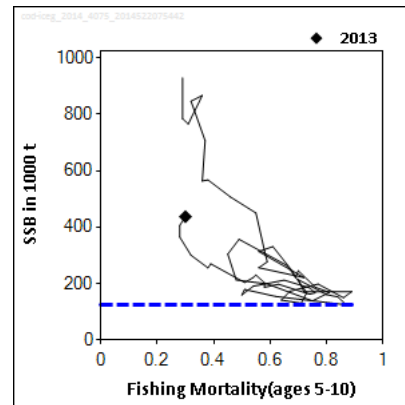


Figure 2.3.4.1 Cod in Division Va (Icelandic cod). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

The spawning stock of Icelandic cod is increasing and is higher than has been observed over the last four decades. Fishing mortality has declined significantly in the last decade and is presently at a historical low, below likely candidates for F_{pa} and F_{lim} . Year classes are estimated to have been relatively stable since 1988 but with the mean around the lower values observed in the period 1955 to 1985.

Management plan

In spring 2009 the Icelandic Government adopted a management plan for the Icelandic cod (Annex 2.3.4). ICES has evaluated the plan and concludes that it is in accordance with the precautionary approach and the ICES MSY approach.

Biology

The Icelandic cod is distributed all around Iceland. Spawning takes place in late winter mainly off the southwestern coast, but smaller and variable regional spawning components have also been observed all around Iceland. The pelagic eggs and larvae drift clockwise around the island to the main nursery ground off the north coast. A larval drift to Greenland waters has been recorded in some years and substantial immigrations of mature cod from Greenland, which are considered to be of Icelandic origin, have been observed in some years.

Environmental influence on the stock

An increased inflow of Atlantic water has been observed in Icelandic waters since 1997, resulting in higher temperature and higher salinity. A northward shift in distribution of immature capelin may be linked to these hydrographical changes, resulting in lower availability of capelin for cod. In the past low weights-at-age of cod have been related to a low biomass of capelin. Because of low productivity in capelin in recent years, the observed current increase in weight-at-age is likely driven by other factors.

The fisheries

Cod has traditionally been targeted in the trawl fisheries, with other species being bycaught. With the recent constraints in TAC the fleet has reduced effort in areas where cod is in relatively high abundance, manifested in a higher proportion of the annual catches being taken in tows where the species composition is more mixed in nature. For vessels that can target cod the catch rates are very high.

Catch distribution Total catch (2013): 212 kt, where 212 kt were estimated landings (45% bottom trawl, 35% longline, 10% gillnet, 5% Danish seine, and 5% hooks). Discards are known to take place (in the order of 1.4–4.3%) but cannot be fully quantified.

Quality considerations

This assessment is considered very consistent.

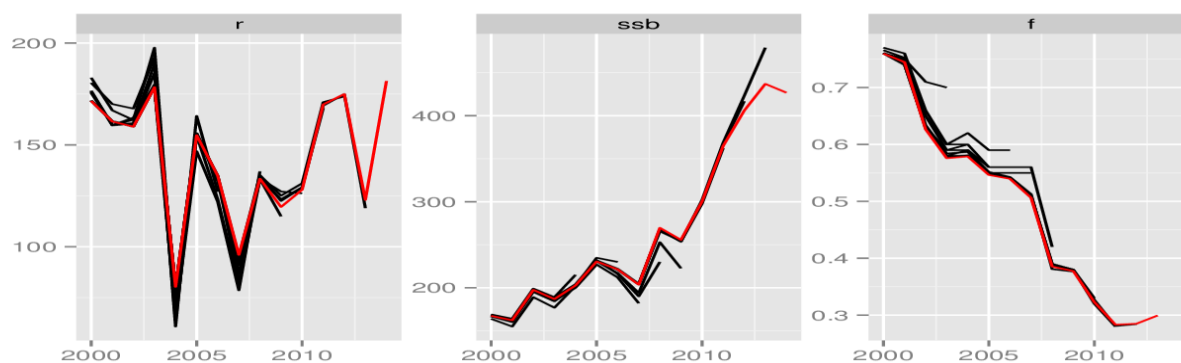


Figure 2.3.4.2 Cod in Division Va (Icelandic cod). Historical assessment results (final-year recruitment estimates included). SSB plot: green line MSY $B_{trigger}$, blue line B_{lim} . F plot: green line Harvest rate_{MP}.

Scientific basis

Stock data category	1 (ICES, 2014a).
Assessment type	A forward-based statistical catch-at-age model, implemented in the AD model builder.
Input data	Landings-at-age and age-structured spring and autumn survey indices.
Discards and bycatch	Not included, considered negligible.
Indicators	None.
Other information	Immigration has been taken into account.
Working group	North-Western Working Group (NWWG).

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Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
Management plan	MP _{Btrigger}	220 000 t.	Set by managers, consistent with ICES MSY framework.
	Harvest rate _{MP}	0.2	Set by managers, consistent with ICES MSY framework.
MSY framework	MSY B _{trigger}	220 000t.	Trigger point in HCR considered consistent with ICES MSY framework.
	F _{MSY}	Not relevant.	
Precautionary approach	B _{lim}	125 000 t.	B _{loss}
	B _{pa}	Not defined.	
	F _{lim}	Not defined.	
	F _{pa}	Not defined.	

(Last changed in:2011)

Outlook for 2015

Basis: F (2014) = TAC constraint: F = 0.30; landings (2014)³ = 227; SSB (2015) = 547; B₄₊ (2014) = 1106; B₄₊ (2015) = 1172; R age 3 (2014) = 181 million.

Rationale	Landings (2014/15)	Basis	F (2015)	SSB (2016)	%SSB change ¹⁾	% TAC change ²⁾
Management plan	218	Harvest control rule	0.3	579	+6%	+4%

Weights in thousand tonnes.

¹⁾ SSB 2016 relative to SSB 2015.

²⁾ Landings 2015 relative to TAC 2014.

³⁾ Estimated from recorded landings/TAC until 31 August; predicted catch for the remainder of the calendar year.

Management plan

The TAC value, which is given for the calendar year (i.e. 2015), is applied in the fishery for the fishing year (September 2014 to August 2015).

Following the agreed management plan (Annex 2.3.4) implies a TAC of 218 000 t in the fishing year 2014/2015. The management plan has been evaluated to be in conformity with ICES MSY approach.

Additional considerations*Management considerations*

Prior to allocating the individual transferable quota (ITQ) catches to the Icelandic fishing fleet, managers should ensure that all expected catches from other sources are subtracted. The amount of these is not known in advance, but they are likely to be of a similar magnitude as in recent years and estimated at 12 kt in the fishing year 2013/2014.

Stock size is at present relatively high in spite of slightly reduced recruitment because of a decreasing harvest rate in recent years.

The immigration of adult cod from Greenlandic to Icelandic waters has occurred in some years, based on results from tagging returns and catch-at-age anomalies. The high abundance of larvae in East Greenland waters in years with high recruitments in Iceland indicate that some of these year classes originate from spawning in Iceland. Based on catch-at-age data anomalies attempts have been made to estimate some of these migrations in the historical part of the assessment. Tag returns, survey estimates in Greenlandic waters, as well as anomalies in the catch-at-age matrix in Iceland indicate that a portion of the moderate 2003 year class observed in Greenlandic waters in recent years may have migrated to Icelandic waters in 2009. This has been taken into account in the assessment, resulting in an additional 5% increase (40 kt) in the estimates of the reference biomass in 2009.

Regulations and their effects

The TAC restrictions on catches have resulted in 60% reduction in fishing mortality and 50% in harvest rate since 2000.

Rather than setting a minimum landing size and allowing discarding, a real-time closure system aimed at protecting juvenile fish has been in force since 1976. Fishing is prohibited, for at least two weeks, in areas where the proportion by number of small cod (< 55 cm) in the catches is observed by inspectors to exceed 25%. A preliminary evaluation of the effectiveness of the system indicates that the relatively small areas closed for a short time most likely do not contribute significantly to the protection of juveniles. On the other hand, several consecutive quick closures often lead to closures of larger areas for a longer time and force the fleet to operate in other areas. The effect of these longer closures has not been evaluated.

Since 1995, spawning areas have been closed for 2–3 weeks during the spawning season for all fisheries. This measure was aimed at protecting spawning fish. In 2005, the maximum mesh size allowed in gillnets was decreased to 20.3 cm (8 inches) in order to protect the largest spawners, but this mesh size ban was lifted in 2012. The effect of these measures has not been evaluated.

The mesh size in the codend in the trawling fishery was increased from 120 mm to 155 mm in 1977. Since 1998 the minimum codend mesh size allowed is 135 mm, provided that a so-called “Polish cover” is not used. Numerous areas are closed temporarily or permanently for all fisheries or specific gears to protect juveniles and habitat, or for socio-political reasons. The effects of these measures have not been evaluated.

Data and methods

The data used in the assessment are landings-at-age and indices-at-age from the spring and the autumn surveys. The analytical assessment is based on landings and survey data using a statistical catch-at-age model, implemented in the AD model builder. Landings-at-age data as well as survey indices are considered reliable. The modelling setup is the same as last year, using both the spring and the autumn survey indices in the final assessment.

Comparison of the basis of previous assessment and advice

The basis for the assessment has not changed from last year.

The basis for the advice this year is the same as last year: the Icelandic management plan.

Sources

- ICES. 2010. Icelandic request on evaluation of Icelandic cod management plan. *In* Report of the ICES Advisory Committee, 2010. ICES Advice 2010, Book 2, Section 2.3.3.1, pp. 4–8.
- ICES. 2013. Report of the North-Western Working Group (NWWG), 25 April–02 May 2013, ICES Headquarters, Copenhagen. ICES CM 2013/ACOM:07. 1538 pp.
- ICES. 2014a. Advice basis. *In* Report of the ICES Advisory Committee, 2014. ICES Advice 2014, Book 1, Section 1.2.
- ICES. 2014b. Report of the North-Western Working Group (NWWG), 24 April–1 May 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:07. 902 pp.

Table 2.3.4.1

Cod in Division Va (Icelandic cod). ICES advice, management, and landings.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ICES landings for the fishing year	ICES landings for the calendar year
1988 ^a	National advice	300	350		378
1989 ^a	National advice	300	325		356
1990 ^a	National advice	250	300		335
1991 ^a	National advice	240	245		309
1991/1992 ^b	National advice	250	265	274	274
1992/1993 ^b	Reduce F by 40%	154	205	241	241
1993/1994 ^b	Reduce F by 40%	150	165	197	197
1994/1995 ^b	Reduce F by 50%	130	155	165	169
1995/1996 ^b	Apply catch rule	155	155	170	182
1996/1997 ^b	Apply catch rule	186	186	202	203
1997/1998 ^b	Apply catch rule	218	218	227	243
1998/1999 ^b	Apply catch rule	250	250	254	260
1999/2000 ^b	Apply catch rule	247	250	257	236
2000/2001 ^b	Apply catch rule	203	220 ^c	221	235
2001/2002 ^b	Apply catch rule	164	190 ^c	217	209
2002/2003 ^b	Apply catch rule	183	179 ^c	198	206
2003/2004 ^b	Apply catch rule	210	209	225	226
2004/2005 ^b	Apply catch rule	205	205	214	214
2005/2006	Apply catch rule	198	198	209	196
2006/2007	Apply catch rule	187	193 ^d	187	170
2007/2008	Apply catch rule	152	130	140	147
2008/2009	Apply F_{\max}	< 124	160 ^e	168	181
2009/2010	Apply F_{\max}	< 135	150 ^f	168	169
2010/2011	Apply catch rule	160	160	165	165
2011/2012	Apply catch rule	177	177	185	196
2012/2013	Apply catch rule	196	196	212	220
2013/2014	Apply catch rule	215	215		
2014/2015	Apply catch rule	218			

Weights in thousand tonnes.

^a Calendar year.^b National fishing year ending 31 August.^c Amended catch rule.^d Catch rule 2006.^e Initial TAC set to 130 according to the catch rule, raised to 160 in January 2009.^f Set according to the catch rule.

Table 2.3.4.2 Cod in Division Va (Icelandic cod). Summary of the assessment. Landings (thousand tonnes), average fishing mortality of age groups 5 to 10, recruitment to the fisheries at age 3 (millions), reference fishing biomass (B4+, thousand tonnes), spawning-stock biomass (thousand tonnes) at spawning time, and harvest ratio.

Year	Yield	F5-10	SSB	Reference biomass	Recruits	Harvest rate
1955	545.250	0.292	929.240	2345.610	151.983	0.224
1956	486.909	0.291	784.523	2071.560	152.843	0.229
1957	455.182	0.312	765.435	1869.680	170.678	0.242
1958	517.359	0.355	866.698	1858.030	220.633	0.272
1959	459.081	0.322	846.183	1821.250	289.163	0.250
1960	470.121	0.372	706.461	1751.370	154.243	0.269
1961	377.291	0.355	563.558	1494.600	192.691	0.253
1962	388.985	0.383	567.393	1490.760	128.705	0.262
1963	408.800	0.458	506.564	1313.920	177.373	0.313
1964	437.012	0.548	449.951	1217.420	203.851	0.352
1965	387.106	0.576	317.131	1021.500	216.397	0.357
1966	353.357	0.589	276.815	1030.550	229.206	0.333
1967	335.721	0.561	256.066	1102.040	320.360	0.300
1968	381.770	0.721	221.301	1222.320	172.068	0.314
1969	403.205	0.558	313.518	1325.590	247.662	0.307
1970	475.077	0.612	330.937	1337.100	180.622	0.345
1971	444.248	0.684	242.406	1098.130	188.751	0.393
1972	395.166	0.694	221.720	997.097	139.351	0.401
1973	369.205	0.705	245.402	844.008	273.170	0.431
1974	368.133	0.764	187.018	918.426	179.072	0.393
1975	364.754	0.809	168.329	895.540	260.874	0.407
1976	346.253	0.747	138.573	955.641	367.679	0.359
1977	340.086	0.592	198.754	1289.930	143.363	0.261
1978	329.602	0.476	212.456	1298.230	227.704	0.258
1979	366.462	0.445	304.328	1397.760	243.297	0.260
1980	432.237	0.492	356.840	1489.750	140.043	0.288
1981	465.032	0.662	264.258	1242.230	140.431	0.363
1982	380.068	0.729	167.467	970.826	131.666	0.384
1983	298.049	0.713	130.362	791.371	232.955	0.367
1984	282.022	0.639	141.377	913.749	139.002	0.316
1985	323.428	0.667	172.745	927.554	140.185	0.349
1986	364.797	0.773	198.193	854.359	329.034	0.421
1987	389.915	0.861	149.764	1029.420	259.904	0.372
1988	377.554	0.891	171.701	1030.480	175.482	0.368
1989	363.125	0.718	171.217	1000.960	89.219	0.357
1990	335.316	0.700	213.699	841.205	130.512	0.406
1991	307.759	0.800	160.661	698.373	106.860	0.443
1992	264.834	0.844	152.811	550.873	174.344	0.472
1993	250.704	0.867	124.522	595.258	135.496	0.423

Year	Yield	F5-10	SSB	Reference biomass	Recruits	Harvest rate
1994	178.138	0.625	154.228	576.272	77.749	0.313
1995	168.592	0.507	179.242	557.247	150.966	0.297
1996	180.701	0.505	159.681	670.672	165.428	0.269
1997	203.112	0.543	190.400	783.058	88.251	0.258
1998	243.987	0.650	211.859	720.766	161.359	0.330
1999	260.147	0.743	184.832	731.141	70.839	0.352
2000	235.092	0.760	167.299	590.388	171.560	0.384
2001	234.229	0.745	162.204	688.013	161.472	0.333
2002	208.487	0.626	197.490	729.016	158.935	0.284
2003	207.543	0.576	186.877	739.773	178.337	0.279
2004	226.762	0.579	202.696	799.959	80.291	0.278
2005	213.403	0.546	230.506	723.544	154.767	0.295
2006	196.077	0.540	221.317	700.792	134.777	0.278
2007	170.300	0.506	203.576	681.227	95.993	0.250
2008	146.104	0.385	269.650	704.125	133.395	0.217
2009	181.151	0.377	255.681	798.614	119.541	0.221
2010	168.880	0.323	300.175	842.711	127.987	0.201
2011	170.425	0.283	364.764	932.087	169.860	0.185
2012	194.795	0.285	405.910	1046.710	174.925	0.186
2013	223.548	0.299	436.995	1161.350	122.997	0.193
2014			426.805	1106.360	181.370	
2015					160.033	
2016					109.447	

Annex 2.3.4 Icelandic management plan

The Icelandic Government has adopted a management plan for the Icelandic cod stock for the next five fishing years, starting with the 2009/2010 fishing season. The main objective of the management plan is to ensure that the spawning-stock biomass (SSB) will, with high probability (>95%), be above the present size of 220 thousand tonnes by the year 2015. This will be achieved by applying the following harvest control rule (HCR) to calculate the total allowable catch (TAC):

$TAC_{y+1} = (\alpha B_{4^+} + TAC_y)/2$, where y refers to the assessment year, B_{4^+} to the biomass of 4-year and older cod, and α to the harvest rate. α is set to 0.2 when SSB_y is higher than 220 thousand tonnes (SSB_{MP}^*), but set to $\alpha = 0.2 SSB_y / SSB_{MP}$ when SSB_y is lower.

*ICES interprets SSB_{MP} as $B_{trigger}$.