

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

Advice for 2013/2014

ICES advises on the basis of the Icelandic 2009 management plan that the TAC in the fishing year 2013/2014 should be set at 215 000 t.

Stock status

		F (Fishing Mortality)		
		2010	2011	2012
MSY (F_{MSY})		✓	✓	✓ Below possible candidate
Precautionary approach (F_{pa}, F_{lim})		✓	✓	✓ Below possible candidate F_{pa} and F_{lim}
Management plan (HR_{MP})		✓	✓	✓ Within expected range
		SSB (Spawning-stock Biomass)		
		2011	2012	2013
MSY ($B_{trigger}$)		✓	✓	✓ Above trigger
Precautionary approach (B_{lim})		✓	✓	✓ Full reproductive capacity
Management plan ($MP_{Btrigger}$)		✓	✓	✓ Above trigger

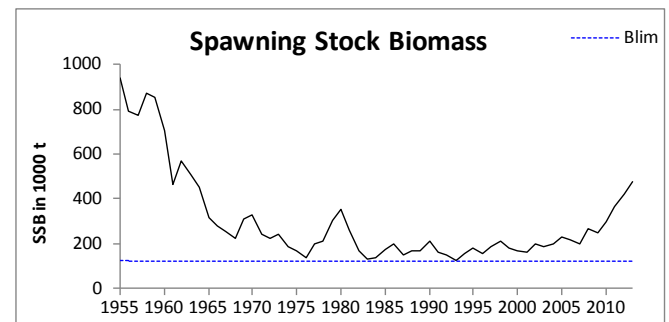
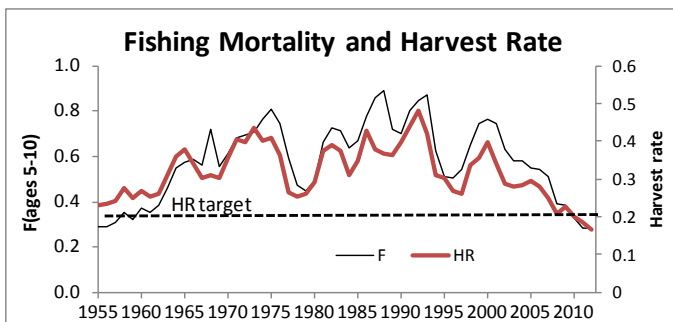
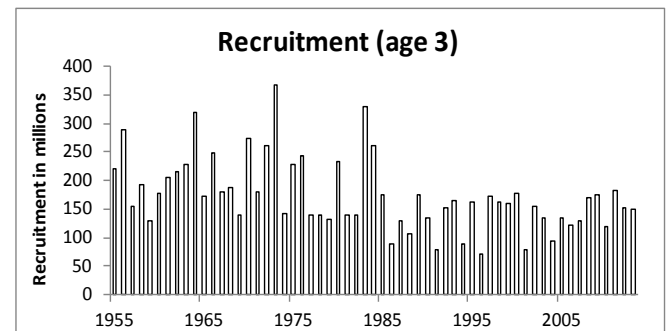
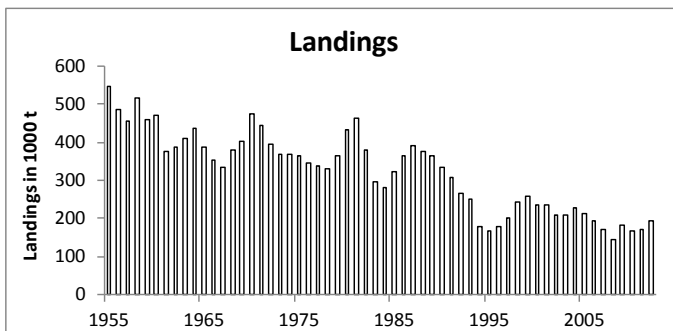
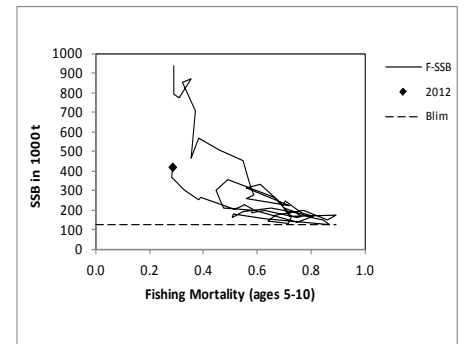


Figure 2.4.4.1 Cod in Division Va (Icelandic cod). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

The spawning stock of Icelandic cod is increasing and is higher than has been observed over the last five decades. Fishing mortality has declined significantly in the last decade and is presently at a historical low and below likely

candidates for F_{pa} and F_{lim} . Year classes since the mid-1980s are estimated to be relatively stable 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. 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. The increase in mean weight-at-age in cod in recent years may, however, have more to do with reduction in fishing mortality than with increased availability of capelin.

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 landings (2012) are 194 kt (45% bottom trawl, 35% longline, 10% gillnet, 5% Danish seine, and 5% hooks). Discards are in the range of 1.4–4.3%.

Quality considerations

This assessment is considered very consistent.

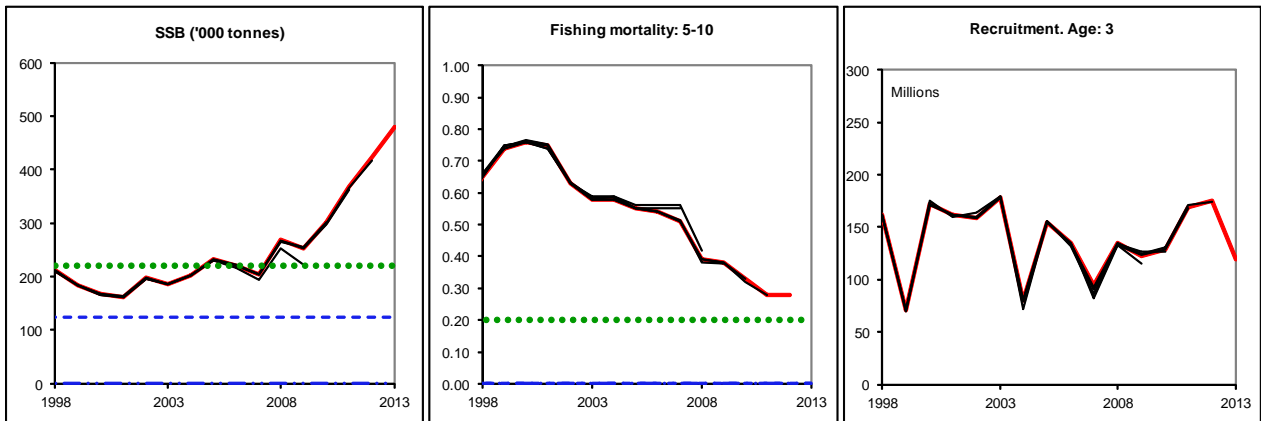


Figure 2.4.4.2 Cod in Division Va (Icelandic cod). Historical assessment results (final-year recruitment estimates included). SSB plot: green line $MSYB_{trigger}$, blue line B_{lim} . F plot: green line $HarvestRate_{MP}$.

Scientific basis

Assessment type	A forward-based statistical catch-at-age model, implemented in the AD model builder. Category 1.
Stock data category	Category 1.
Input data	Landings-at-age and age-structured spring and autumn survey indices.
Discards and bycatch	Not included in the assessment and considered negligible.
Indicators	None.
Other information	Immigration has been taken into account.
Working group report	NWWG (ICES, 2013).

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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	MSY B _{trigger}	220 000t.	Trigger point in HCR considered consistent with ICES MSY framework.
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.	

(unchanged since 2011)

Outlook for 2014

Basis: F (2013) = TAC constraint: F = 0.26; landings (2013) = 197; SSB (2014) = 535; B₄₊ (2014) = 1211; R (2013) = 119 million.

Rationale	Landings (2014)	Basis	F (2014)	SSB (2015)	%SSB change¹⁾	% TAC change²⁾
Management plan	215	Harvest Control Rule	0.26	600	+12%	9%

Weights in thousand tonnes.

¹⁾ SSB 2015 relative to SSB 2014.

²⁾ Landings 2014 relative to TAC 2013.

Management plan

The TAC value is given for the calendar year (i.e. 2014) while it is applied in the fishery for the fishing year (September 2013 to August 2014).

Following the agreed management plan (Annex 2.4.4) implies a TAC of 215 000 t in the fishing year 2013/2014. The management plan has been evaluated to be in conformity with ICES MSY approach.

Additional considerations

Management considerations

Discards are estimated to be between 1 and 4% and this is considered to be negligible.

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 is not known in advance, but is likely to be of a similar magnitude as in recent years and estimated to be 7 kt in the 2013/2014 fishing year.

Stock size is at present high in spite of low productivity 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.

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%. This is the measure taken rather than setting a minimum landing size and allowing discarding. 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. The intent of this measure was to protect 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 two age-structured survey indices. The analytical assessment is based on landings and survey data using a forward-based 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 with previous assessment and advice

The SSB, F, and recruitment estimates are consistent with last year’s estimates (Figure 2.4.4.2).

The basis of the advice this year is the same as last year.

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, 25 April–2 May 2013. ICES CM 2013/ACOM:07.

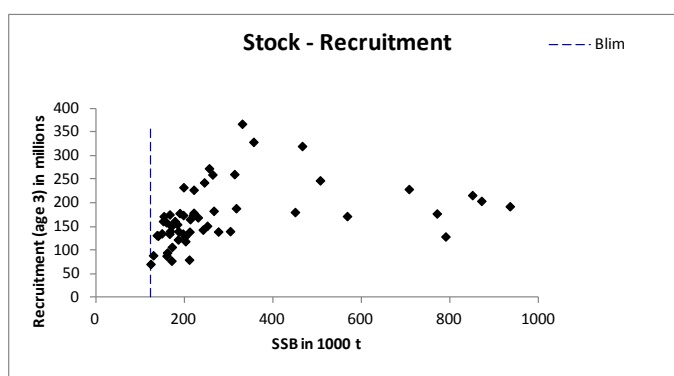


Figure 2.4.4.3 Cod in Division Va (Icelandic cod). Stock–recruitment plot.

Table 2.4.4.1 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 ¹	National advice	300	350		378
1989 ¹	National advice	300	325		356
1990 ¹	National advice	250	300		335
1991 ¹	National advice	240	245		309
1991/1992 ²	National advice	250	265	274	274
1992/1993 ²	Reduce F by 40%	154	205	241	241
1993/1994 ²	Reduce F by 40%	150	165	197	197
1994/1995 ²	Reduce F by 50%	130	155	165	169
1995/1996 ²	Apply catch rule	155	155	170	182
1996/1997 ²	Apply catch rule	186	186	202	203
1997/1998 ²	Apply catch rule	218	218	227	243
1998/1999 ²	Apply catch rule	250	250	254	260
1999/2000 ²	Apply catch rule	247	250	257	236
2000/2001 ²	Apply catch rule	203	220 ³	221	235
2001/2002 ²	Apply catch rule	164	190 ³	217	209
2002/2003 ²	Apply catch rule	183	179 ³	198	206
2003/2004 ²	Apply catch rule	210	209	225	226
2004/2005 ²	Apply catch rule	205	205	214	214
2005/2006	Apply catch rule	198	198	209	196
2006/2007	Apply catch rule	187	193 ⁴	187	170
2007/2008	Apply catch rule	152	130	140	147
2008/2009	Apply F_{max}	< 124	160 ⁵	168	181
2009/2010	Apply F_{max}	< 135	150 ⁶	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		
2013/2014	Apply catch rule	215			

Weights in thousand tonnes.

¹ Calendar year.

² National fishing year ending 31 August.

³ Amended catch rule.

⁴ Catch rule 2006.

⁵ Initial TAC set to 130 according to the catch rule, raised to 160 in January 2009.

⁶ Set according to the catch rule.

Table 2.4.4.2

Cod in Division Va (Icelandic cod). Summary of the assessment.

Year	Recruitment	SSB	Landings	Mean F	Harvest
	Age 3 thousands	tonnes	tonnes	Ages 5–10	rate
1955	220616	935897	545250	0.291	0.23
1956	288997	790537	486909	0.290	0.23
1957	154375	770993	455182	0.311	0.24
1958	192800	871609	517359	0.355	0.28
1959	128905	851043	459081	0.322	0.25
1960	177523	707801	470121	0.371	0.27
1961	204220	466631	377291	0.355	0.25
1962	216433	568167	388985	0.383	0.26
1963	229190	507163	408800	0.458	0.31
1964	320150	450511	437012	0.548	0.36
1965	172024	317411	387106	0.576	0.38
1966	247565	277067	353357	0.589	0.34
1967	180566	256363	335721	0.560	0.30
1968	188692	221554	381770	0.721	0.31
1969	139347	313592	403205	0.558	0.30
1970	273099	330994	475077	0.612	0.36
1971	179026	242388	444248	0.684	0.40
1972	260791	221651	395166	0.694	0.40
1973	367230	245350	369205	0.705	0.44
1974	143324	186982	368133	0.764	0.40
1975	227714	168289	364754	0.810	0.41
1976	243208	138513	346253	0.747	0.36
1977	139960	198645	340086	0.592	0.26
1978	140374	212292	329602	0.476	0.25
1979	131726	303992	366462	0.446	0.26
1980	233057	356699	432237	0.492	0.29
1981	139062	264037	465032	0.663	0.37
1982	140177	167245	380068	0.729	0.39
1983	328947	130126	298049	0.714	0.38
1984	259979	141074	282022	0.640	0.31
1985	175501	172450	323428	0.668	0.35
1986	89221	197938	364797	0.774	0.43
1987	130523	149540	389915	0.862	0.38
1988	106829	171522	377554	0.892	0.37
1989	174214	171056	363125	0.719	0.36
1990	135519	213495	335316	0.701	0.40
1991	77698	160429	307759	0.801	0.44
1992	150971	152514	264834	0.846	0.48
1993	165515	124255	250704	0.869	0.42
1994	88244	153940	178138	0.626	0.31
1995	161450	178900	168592	0.509	0.30
1996	70821	159297	180701	0.506	0.27
1997	171782	189953	203112	0.545	0.26
1998	161406	211372	243987	0.652	0.34
1999	159148	184432	260147	0.745	0.36
2000	178335	166865	235092	0.762	0.40
2001	79915	161767	234229	0.747	0.34
2002	154731	196998	208487	0.629	0.29
2003	134620	186284	207543	0.579	0.28

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 5–10	Harvest rate
2004	94983	201903	226762	0.583	0.28
2005	135057	231051	213403	0.551	0.30
2006	122483	220512	196077	0.545	0.28
2007	129000	202901	170300	0.514	0.25
2008	169240	266827	146104	0.391	0.21
2009	174864	252106	181151	0.383	0.23
2010	118915	300208	168880	0.329	0.20
2011	183177	366812	170425	0.282	0.18
2012	151476	421703	194477	0.284	0.17*
2013	148685	478095			
Average	173956	302707	324631	0.582	0.31**

*Ver 2. Typing error corrected from 0.23 to 0.17.

**Ver 2. Typing error corrected from 0.17 to 0.31.

Annex 2.4.4 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):

$TAC_{y+1} = (\alpha B4^+_y + TAC_y)/2$, where y refers to the assessment year, $B4^+$ 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 $B_{trigger}$.