

3.3.7 Greenland halibut (*Reinhardtius hippoglossoides*) in Subareas I and II (Northeast Arctic)

ICES stock advice

ICES advises that when the precautionary approach is applied, catches should be no more than 19 800 tonnes in each of the years 2016 and 2017. This corresponds to a harvest rate of ≈ 0.027 . All catches are assumed to be landed.

Stock development over time

The fishable population (length ≥ 45 cm) has increased from 1992 to 2012, and has been stable since then. The harvest rate has been relatively stable since 1992.

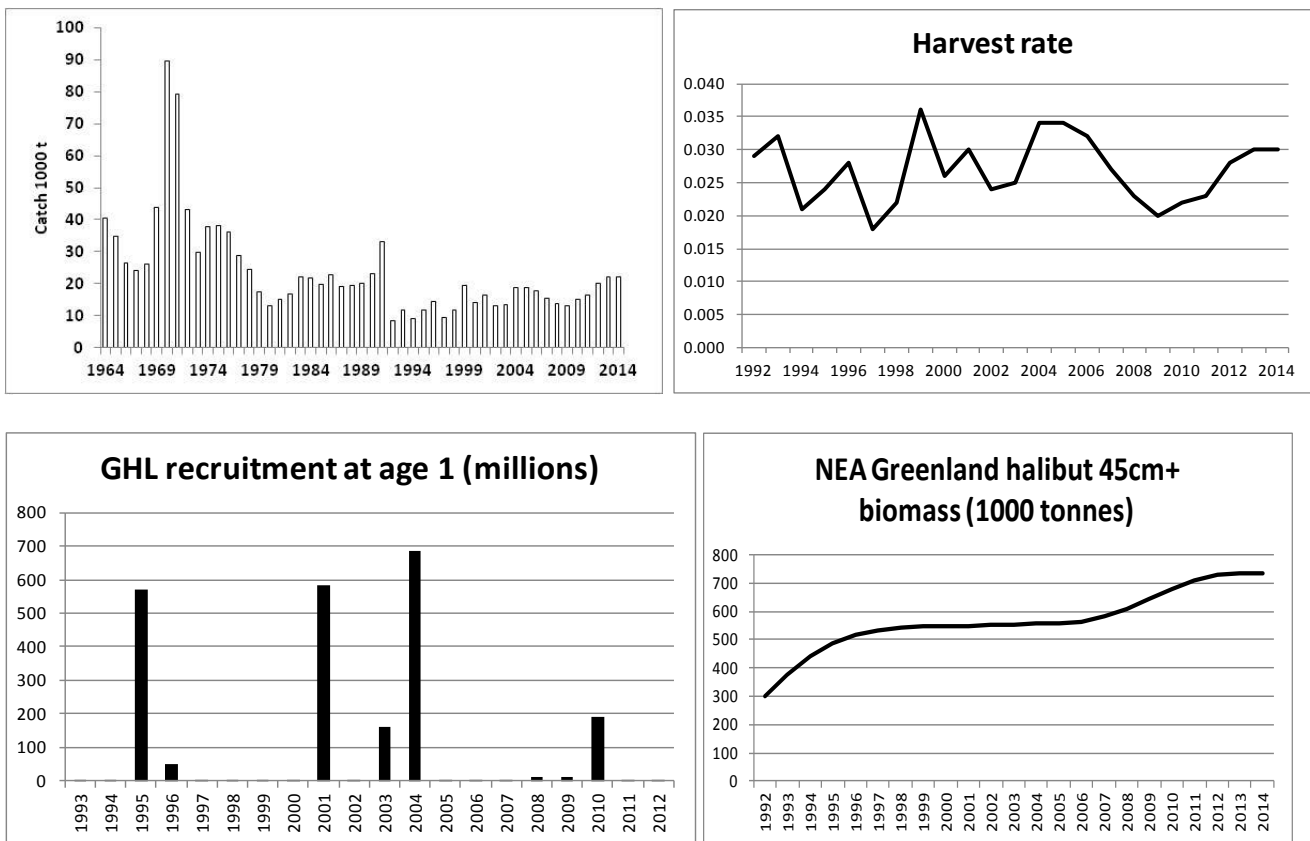


Figure 3.3.7.1 Greenland halibut in Subareas I and II. Modelled stock history: catches (thousand tonnes) and harvest rate (defined as catch in a year divided by biomass at the start of the year), recruitment at age 1 (millions), and fishable (length ≥ 45 cm) biomass (thousand tonnes). For a discussion of uncertainty in recruitment see the section Quality of the assessment.

Stock and exploitation status

Table 3.3.7.1 Greenland halibut in Subareas I and II. State of the stock and fishery, relative to reference points.

		Fishing pressure			Stock size					
		2012	2013	2014	2013	2014	2015			
Maximum Sustainable Yield	F_{MSY}	?	?	?	Undefined	$B_{trigger}$?	?	?	Undefined
Precautionary approach	F_{pa} , F_{lim}	?	?	?	Undefined	B_{pa} , B_{lim}	✓	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	?	?	?	Undefined	SSB_{MGT}	?	?	?	Undefined
Qualitative evaluation	-	→	→	→	Stable	-	→	→	→	Stable

Catch options

Table 3.3.7.2 Greenland halibut in Subareas I and II. The basis for the catch options.

Variable	Value	Source	Notes
Harvest rate (2015)	0.030	ICES (2015c)	Average of 2013–2014
Biomass ≥45 cm (2016)	725 kt	ICES (2015c)	1 January
R (2015)	N/A	ICES (2015c)	Not needed for prediction of catch and stock in advice years
Expected catch (2015)	22 kt	ICES (2015c)	Assuming recent exploitation rate

Table 3.3.7.3 Greenland halibut in Subareas I and II. The catch options. Weights in thousand tonnes.

Rationale	Catches (2016)	Basis (multiple of 2013–2014 effort)	Harvest rate 2016–2019	Mean catch 2016–2019	Biomass 45cm+ 1st January 2020	% 45cm+ Biomass change 2016–2020
Precautionary approach	19.8	*0.90	0.027	18.8	618	-15.3%
Zero catch	0	0	0	0	691	-4.7%
	11.0	*0.50	0.015	10.7	650	-10.3%
	16.5	*0.75	0.020	15.8	630	-13.1%
<i>Status quo</i>	22.0	*1.00	0.030	20.7	610	-15.9%
	33.0	*1.50	0.045	30.0	574	-20.8%
	44.0	*2.00	0.060	38.7	540	-25.5%
	66.0	*3.00	0.090	54.1	478	-34.5%

Basis of the advice

Table 3.3.7.4 Greenland halibut in Subareas I and II. The basis of the advice.

Advice basis	Precautionary approach
Management plan	None

No MSY reference points are available and ICES advice is based on the precautionary approach. Recent exploitation rates at $F = 0.027$ (average over recent 5 or 10 years) have been consistent with a rise in fishable biomass (length ≥45 cm) over the same periods. Also, medium-term projections based on known recruitment to 2010 show that although biomass will decline the current level of fishing does not drive the stock to B_{pa} rapidly. ICES therefore considers that exploitation at this rate is appropriate provided 45cm+ biomass remains above B_{pa} .

ICES proposes that a two-year advice period is suitable given the relatively slow stock development at these catch levels, balanced by the need to monitor and revise what is a new assessment methodology.

Quality of the assessment

The assessment of this stock has previously been trend-based, but following the inter-benchmark process (ICES, 2015c) a Gadget model (age–length structured, but with only length data used for tuning) has been adopted for this stock. The previous method for reading otoliths was not accurate. However, further developments are needed and until agreement on methodology is reached assessment methodology cannot be based on age data.

Biomass estimates among the surveys are not consistent. None of the current surveys cover the complete stock distribution, but most of the adult distribution area is covered. The assessment is uncertain, but is believed to give a valid perception of stock trends.

Based on ICES procedures for stocks with sporadic recruitment and low exploitation rates B_{loss} is used as B_{pa} in the current advice. Based on the estimated initial population in the model for 1992, not included in the assessment, there are strong indications of previous good recruitment from lower stock sizes than those observed since 1992. Therefore, further work extending the model back to the early 1980s to investigate behavior at lower stock sizes is required to better evaluate limit reference points.

The lack of age data in the model tuning has had the effect of adding uncertainty to the recruitment estimates. Although the survey data does show clear signals of the occasional good recruitment picked up by the model, experiments with adding the limited available age data into the model tuning indicates that the model is somewhat overestimating the size of the good year classes and underestimating the poor year classes. The overall sum of recruitment, the history of the biomass of individuals ≥ 45 cm, and the overall pattern of a few good year classes among a number of poor year classes were all robust to the introduction of age data.

Issues relevant for the advice

This is a relatively long-lived, low productivity species which requires low fishing pressure and the stock is currently in a relatively stable state. There is therefore no need for annual updates to the advice. Furthermore, one of the key surveys is only conducted every two years. Therefore ICES provides advice for two years.

Reconstruction of historical (pre-1992) stock and exploitation levels is needed to provide a better basis for reference points and evaluation of harvest control rules.

Catch reporting is believed to be accurate, but catches are higher than agreed TAC (between 10% and 20% in the years 2011–2014).

Reference points

Table 3.3.7.5 Greenland halibut in Subareas I and II. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	Not defined		
	F_{MSY}	Not defined		
Precautionary approach	B_{lim}	Not defined		
	B_{pa}	500 000 t	Fishable biomass (length ≥ 45 cm) in 1995, based on the lowest observed stock size for which good recruitment has been observed	ICES (2015c)
	F_{lim}	Not defined		
	F_{pa}	Not defined		
Management plan	SSB_{MGT}	Not defined		
	F_{MGT}	Not defined		

The current reference point is based on total biomass above a reference size. Biologically it may be better to use female spawning-stock biomass as the index level; however, this has not been evaluated fully. Therefore, fishable biomass (length ≥ 45 cm) is chosen as a robust quantity.

Basis of the assessment

Table 3.3.7.6 Greenland halibut in Subareas I and II. The basis of the assessment.

ICES stock data category	1 (ICES, 2015b).
Assessment type	Age-length structured (Gadget model), but with only length data used for tuning that uses catches in the model and forecast.
Input data	Trends in biomass and length distributions for four survey indices (the Norwegian slope survey (NO-GH-Btr-Q3), the Russian autumn survey (RU-BTr-Q4), and the newly derived EcoSouth and EcoJuv indices); catch-in-tonnes and length distributions from four aggregated commercial fleets (Norwegian trawl and seine, Russian trawl and seine, Norwegian gillnet and longline, Russian gillnet and longline); and maturity-at-length data from the Norwegian slope survey (NO-GH-Btr Q3).
Discards and bycatch	Not included, considered negligible.
Indicators	None.
Other information	Inter-benchmark process May–August 2015 (ICES, 2015c).
Working group	Arctic Fisheries Working Group (AFWG).

Information from stakeholders

No available information.

History of advice, catch, and management

Table 3.3.7.7 Greenland halibut in Subareas I and II. History of ICES advice, the agreed TAC, and official catches. Weights in thousand tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	Official catches
1987	Precautionary TAC	-	-	19
1988	No decrease in SSB	19	-	20
1989	F = F(87); TAC	21	-	20
1990	F = F(89); TAC	15	-	23
1991	F at F _{med} ; TAC; improved expl. pattern	9	-	33
1992	Rebuild SSB(1991)	6	7*	9
1993	TAC	7	7*	12
1994	F < 0.1	< 12	11*	9
1995	No fishing	0	2.5**	11
1996	No fishing	0	2.5**	14
1997	No fishing	0	2.5**	10
1998	No fishing	0	2.5**	13
1999	No fishing	0	2.5**	19
2000	No fishing	0	2.5**	14
2001	Reduce catch to rebuild stock	< 11	2.5**	16
2002	Reduce F substantially	< 11	2.5**	13
2003	Reduce catch to increase stock	< 13	2.5**	13
2004	Do not exceed recent low catches	< 13	2.5**	19
2005	Do not exceed recent low catches	< 13	2.5**	19
2006	Do not exceed recent low catches	< 13	2.5**	18
2007	Reduce catch to increase stock	< 13	2.5**	15
2008	Reduce catch to increase stock	< 13	2.5**	14
2009	Same advice as last year	< 13	2.5**	13
2010	Same advice as last year	< 13	15***	15
2011	Same advice as last year	< 13	15***	17
2012	No increase in catches	< 15	18***	20
2013	No increase in catches	< 15	19***	22
2014	No new advice, same as for 2013	< 15	19***	22
2015	Same advice as for 2014	< 15	19***	
2016	Precautionary approach	< 19.8		
2017	Precautionary approach	< 19.8		

* Set by Norwegian authorities.

** Set by Norwegian authorities for the non-trawl fishery; allowable bycatch in the trawl fishery is additional to this.

*** Set by the Joint Norwegian–Russian Fisheries Commission.

History of catch and landings

Table 3.3.7.8 Greenland halibut in Subareas I and II. Catch distribution by fleet in 2014 as estimated by ICES.

Total catch (2014)	Commercial landings				Commercial discards
	59% trawl	28% longline	12% gillnet	1% others	
22 244 t	22 244 t				Discards are negligible

Table 3.3.7.9 Greenland halibut in Subareas I and II. History of commercial catches presented by country.

Year	Denmark	Estonia	Faroe Isl.	France	Fed. Rep. Germ any	Greenland	Iceland	Ireland	Lithuania	Norway	Poland	Portugal	Russia*	Spain	UK (Engl. & Wales)	UK (Scotland)	Total
1984	0	0	0	138	2165	0	0	0	0	4376	0	0	15181	0	23	0	21883
1985	0	0	0	239	4000	0	0	0	0	5464	0	0	10237	0	5	0	19945
1986	0	0	42	13	2718	0	0	0	0	7890	0	0	12200	0	10	2	22875
1987	0	0	0	13	2024	0	0	0	0	7261	0	0	9733	0	61	20	19112
1988	0	0	186	67	744	0	0	0	0	9076	0	0	9430	0	82	2	19587
1989	0	0	67	31	600	0	0	0	0	10622	0	0	8812	0	6	0	20138
1990	0	0	163	49	954	0	0	0	0	17243	0	0	4764	0	10	0	23183
1991	11	2564	314	119	101	0	0	0	0	27587	0	0	2490	132	0	2	33320
1992	0	0	16	111	13	13	0	0	0	7667	0	31	718	23	10	0	8602
1993	2	0	61	80	22	8	56	0	30	10380	0	43	1235	0	16	0	11933
1994	4	0	18	55	296	3	15	5	4	8428	0	36	283	1	76	2	9226
1995	0	0	12	174	35	12	25	2	0	9368	0	84	794	110	115	7	11734
1996	0	0	2	219	81	123	70	0	0	11623	0	79	1576	200	317	57	14347
1997	0	0	27	253	56	0	62	2	0	7661	12	50	1038	157	67	25	9410
1998	0	0	57	67	34	0	23	2	0	8435	31	99	2659	259	182	45	11893
1999	0	0	94	0	34	38	7	2	0	15004	8	49	3823	319	94	45	19517
2000	0	0	0	45	15	0	16	1	0	9083	3	37	4568	375	111	43	14297
2001	0	0	0	122	58	0	9	1	0	10896	2	35	4694	418	100	30	16365
2002	0	219	0	7	42	22	4	6	0	7143	5	14	5584	178	41	28	13293
2003	0	0	459	2	18	14	0	1	0	8216	5	19	4384	230	41	58	13447
2004	0	0	0	0	9	0	9	0	0	13939	1	50	4662	186	43	0	18899
2005	0	170	0	32	8	0	0	0	0	13011	0	23	4883	660	29	18	18834
2006	0	0	204	46	8	0	8	0	196	11119	201	26	6055	29	10	2	17904
2007	0	0	203	41	8	198	15	0	0	8230	200	47	6484	8	11	8	15453
2008	0	0	663	42	5	0	28	0	0	7393	201	46	5294	94	16	10	13792
2009	0	0	422	16	19	16	15	2	0	8446	204	237	3335	210	9	60	12990
2010	0	0	272	102	14	15	16	0	0	7700	3	11	6888	182	4	22	15229
2011	0	0	538	46	80	4	7	0	234	8270	169	21	7053	144	36	4	16606
2012	0	0	564	40	40	12	13	0	0	9331	22	1	10041	190	21	14	20288
2013	0	0	783	168	49	22	106	1	0	10403	30	7	10310	196	17	75	22167
2014	0	0	532	269	33	1	43	0	0	10876	19	0	10061	206	204	0	22244

* USSR prior to 1991.

Summary of the assessment

Table 3.3.7.10 Greenland halibut in Subareas I and II. Assessment summary with biomass, catches, harvest rate and recruitment (age 1). Harvest rates in year y have been computed as catch in year y divided by fishable (in this case 45 cm+) stock biomass at the start of year y.

Year	Recruitment Million age 1	Biomass 45cm+ tonnes	Catch tonnes	Harvest rate
1992	-	300444	8602	0.029
1993	1	377815	11933	0.032
1994	3	439104	9226	0.021
1995	570	487292	11734	0.024
1996	51	515856	14347	0.028
1997	1	530290	9410	0.018
1998	1	542043	11893	0.022
1999	1	546636	19517	0.036
2000	1	547237	14437	0.026
2001	582	549461	16307	0.030
2002	1	550507	13161	0.024
2003	162	553607	13578	0.025
2004	685	556405	18899	0.034
2005	1	556644	18834	0.034
2006	1	564575	17904	0.032
2007	1	582071	15453	0.027
2008	10	609407	13792	0.023
2009	12	643230	12990	0.020
2010	190	678384	15229	0.022
2011	1	707166	16606	0.023
2012	1	727990	20288	0.028
2013	-	735908	22167	0.030
2014	-	733870	22244	0.030

Sources and references

ICES. 2015a. Report of the Arctic Fisheries Working Group (AFWG), 23–29 April 2015, Hamburg, Germany. ICES CM 2015/ACOM:05.

ICES. 2015b. Advice basis. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 1, Section 1.2.

ICES. 2015c. Report of the InterBenchmark Process for Greenland halibut in ICES areas I and II (IBPHALI), by correspondence. ICES CM 2015/ACOM:54.