

Greenland halibut (*Reinhardtius hippoglossoides*) in subareas 5, 6, 12, and 14 (Iceland and Faroes grounds, West of Scotland, North of Azores, East of Greenland)

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2018 should be no more than 24 000 tonnes.

Stock development over time

The stock was well above MSY $B_{trigger}$ in the early part of the time-series. After dropping below the trigger in 2004 and 2005 it has steadily increased and is currently above MSY $B_{trigger}$. Recent fishing mortality (F) is estimated to be relatively close to F_{MSY}.

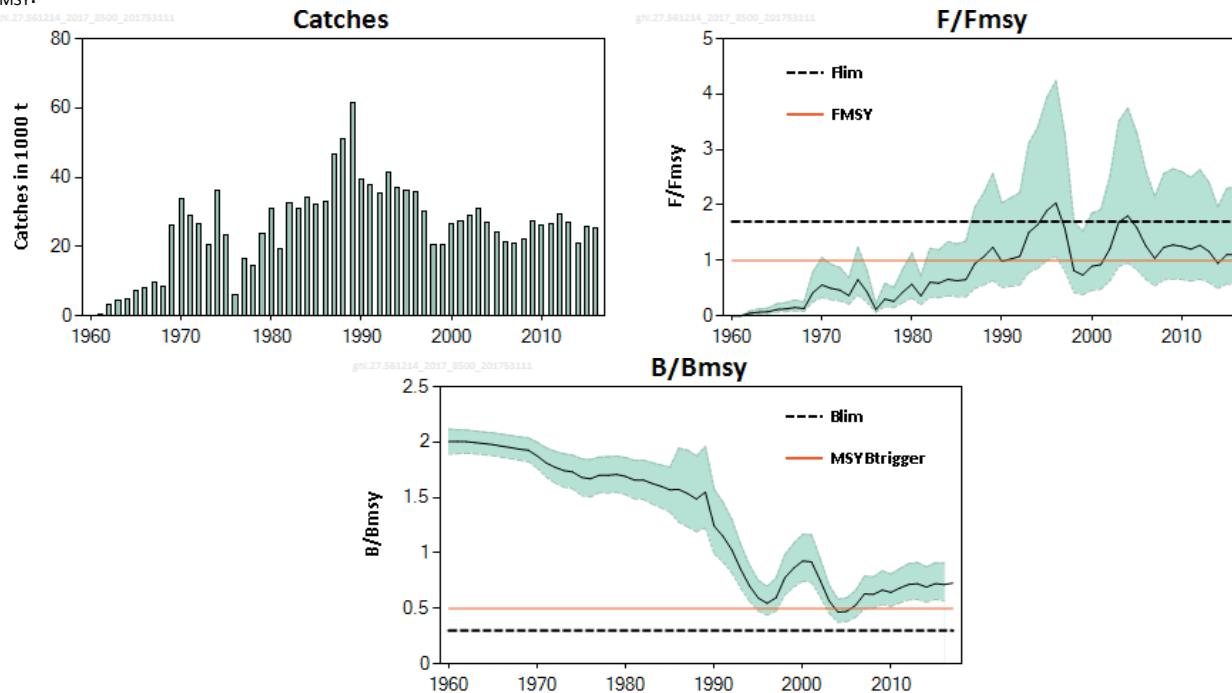


Figure 1 Greenland halibut in subareas 5, 6, 12, and 14. Summary of the stock assessment. Top: Catches. Bottom: Trends in fishing mortality (left) and biomass (right) at the end of each calendar year relative to biomass model-based MSY reference levels (medians and 90% confidence intervals).

Stock and exploitation status

Table 1 Greenland halibut in subareas 5, 6, 12, and 14. State of the stock and fishery relative to reference points.

	Fishing pressure			Stock size		
	2014	2015	2016	2015	2016	2017
Maximum sustainable yield	F _{MSY}	✓	✗	Above	MSY $B_{trigger}$	✓
Precautionary approach	F _{pa} , F _{lim}	✓	○	Increased risk	B _{pa} , B _{lim}	✓
Management plan	F _{MGT}	—	—	Not applicable	B _{MGT}	—
						— Not applicable

Catch options

Table 2 Greenland halibut in subareas 5, 6, 12, and 14. The basis for the catch options.

Variable	Value	Source	Notes
F (2017)	1.07	ICES (2017)	F/F _{MSY}
Biomass (2017)	0.73	ICES (2017)	B/B _{MSY} at the end of 2017.
Total catch (2017)	25 000 t	ICES (2017)	Based on TACs of Iceland, Greenland, and assumed catches from the Faroe Islands.

Table 3 Greenland halibut in subareas 5, 6, 12, and 14. Annual catch options.

Basis	Catch (2018) in tonnes	P(F ₂₀₁₈ > F _{MSY})	P(B ₂₀₁₈ < B _{lim})*	P(F ₂₀₁₈ > F _{lim})	B ₂₀₁₈ /B _{MSY} (median)*	F ₂₀₁₈ /F _{MSY} (median)
ICES advice basis						
MSY approach: F _{MSY}	24 000	50%	0%	15%	0.74	0.99
Other options						
Catch(2018) = 0 t	0	-	0%	-	0.81	-
Catch(2018) = 5 000 t	5 000	1%	0%	0%	0.79	0.20
Catch(2018) = 10 000 t	10 000	5%	0%	1%	0.77	0.40
Catch(2018) = 15 000 t	15 000	15%	0%	3%	0.76	0.61
Catch(2018) = 20 000 t	20 000	35%	0%	8%	0.75	0.83
Catch(2018) = 30 000 t	30 000	55%	0%	16%	0.74	1.05

* B₂₀₁₈ denotes stock biomass at the end of 2018

Basis of the advice

Table 4 Greenland halibut in subareas 5, 6, 12, and 14. The basis of the advice.

Advice basis	MSY approach.
Management plan	A formal management plan was agreed by Greenland and Iceland in 2014, aimed at being consistent with MSY. This plan has not yet been evaluated by ICES.

Quality of the assessment

The use of historical catch rates prior to the early 1990s as biomass indicators are questioned due to changes in technology, fleet behaviour, and management. That is considered to be not fully accounted for in standardization of the catch rates. Uncertainty remains as to the inclusion or exclusion of these historical commercial catch rates.

There remains uncertainty around the population dynamics within the overall distribution area, which likely contribute to the uncertainty in the advice. The stock identity for Greenland halibut remains uncertain. Tagging of Greenland halibut in the Barents Sea has demonstrated a connectivity with Greenland halibut in Iceland and the Faroe Islands. The biomass indicators presently used in the assessment only represent Division 5.a and Subarea 14. Other biomass indicators from these two areas and from Division 5.b are available and show different trends from those used in the assessment.

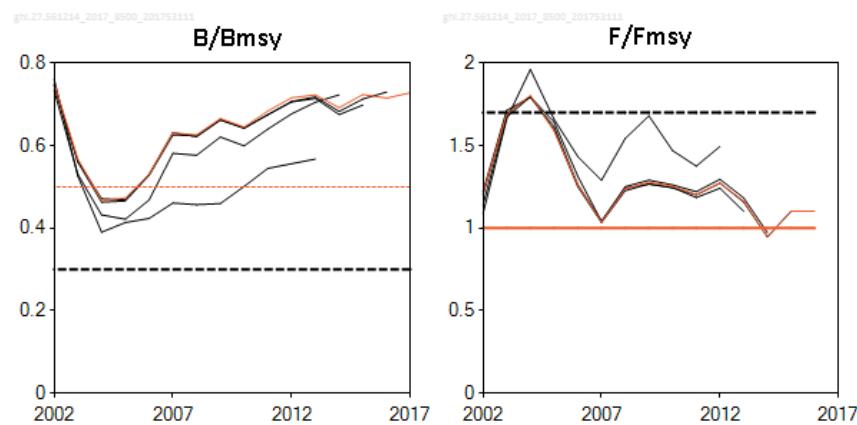


Figure 2 Greenland halibut in subareas 5, 6, 12, and 14. Historical assessment results. Recruitment is not estimated directly by the model.

Issues relevant for the advice

The fishery is conducted over an extensive area of the stock distribution (Figure 3), with the major part of the landings taken in subareas 5 and 14.

Scenarios of stock biomass development under an F_{MSY} fishery display the slow dynamics of this species and indicate that any stock increase will be slow (Figure 4).

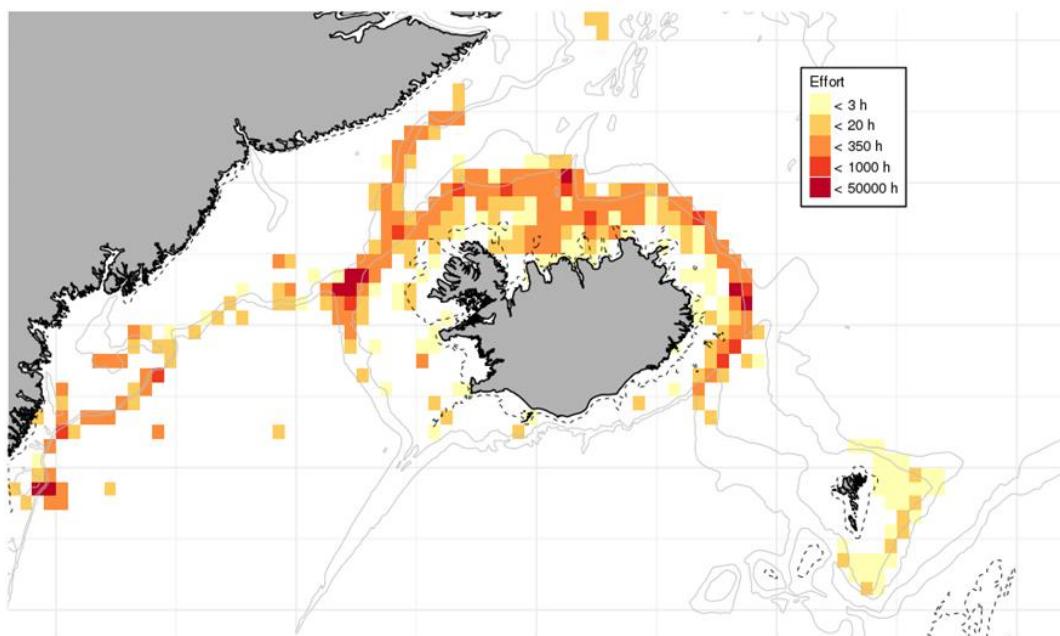


Figure 3 Greenland halibut in subareas 5, 6, 12, and 14. Distribution of total effort in the 2016 fishery with depth contours (200, 500, and 1000 m).

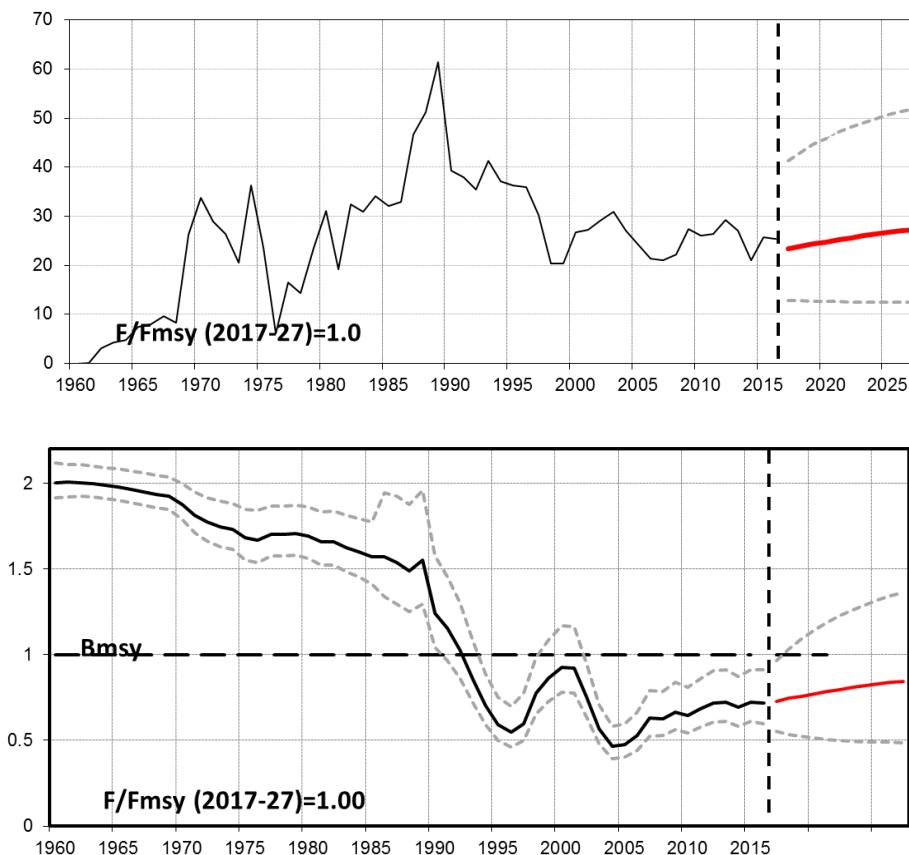


Figure 4 Greenland halibut in subareas 5, 6, 12, and 14. Top: Historical landings (thousand tonnes) and projected landings 2017–2027, assuming $F/F_{MSY} (2017–2027) = 1.0$. Bottom: Historical biomass (B/B_{MSY}) and projected biomass when fishing at F_{MSY} . Median and 90% confidence limits are indicated.

Reference points

Table 5 Greenland halibut in subareas 5, 6, 12, and 14. Reference points, values, and their technical basis. B_{pa} and F_{pa} are not needed. As the assessment provides probability distributions for B and F , it is possible to estimate the probabilities of $B < B_{lim}$ and of $F > F_{lim}$ directly.

Framework	Reference point	Value	Technical basis	Source
MSY approach	$B_{MSY} B_{trigger}$	0.5 B_{MSY}	B_{MSY} is estimated implicitly from the surplus production model.	ICES (2007)
	F_{MSY}	Relative value	F_{MSY} is estimated implicitly from the surplus production model. Fishing mortality values are expressed relative to F_{MSY} .	ICES (2007)
Precautionary approach	B_{lim}	0.3 B_{MSY}	Based on a fraction of B_{MSY} where production is reduced to 50% MSY.	ICES (2013)
	B_{pa}	Not relevant		
	F_{lim}	1.7 F_{MSY}	The F that on average gives B_{lim} .	ICES (2013)
	F_{pa}	Not relevant		
Management plan	SSB_{mgt}	Not defined		
	F_{mgt}	Not defined		

Basis of the assessment

Table 6 Greenland halibut in subareas 5, 6, 12, and 14. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016).
Assessment type	A probabilistic (Bayesian) version of a surplus production model that uses catches in the model and in the forecast.
Input data	Commercial catches (international landings); one combined survey index (GRL-deep since 1998, and IS-SMH since 1996); one commercial index (Icelandic trawlers (since 1985).
Discards and bycatch	Considered negligible.
Indicators	None.
Other information	A benchmark was conducted in 2013 (WKBUT; ICES, 2013).
Working group	North-Western Working Group (NWWG)

Information from stakeholders

There is no information available.

History of the advice, catch, and management

Table 7 Greenland halibut in subareas 5, 6, 12, and 14. ICES advice and catch. All weights are in tonnes.

Year	ICES advice	Predicted catch corresp. to advice	TAC for Iceland EEZ**	TAC for Greenland EEZ	ICES catch subareas 5, 6, 12, and 14
1987	No increase in F	28 000	30 000		46 622
1988	No increase in F	28 000	30 000		51 118
1989	TAC	33 000	30 000		61 396
1990	No advice	-	45 000		39 326
1991	TAC	40 000	30 000		37 950
1992	TAC	30 000	25 000		35 487
1993	No increase in effort	28 000	30 000		41 247
1994	No increase in effort	34 000	30 000		37 190
1995	TAC	32 000	30 000		36 288
1996	TAC	21 000	20 000		35 932
1997	60% reduction in F from 1995	13 000	15 000		30 309
1998	70% reduction in F from 1996	11 000	10 000	8100	20 382
1999	65% reduction in F from 1997	11 000	10 000	8000	20 371
2000	60% reduction in F from 1998	11 000	10 000	8000	26 644
2001	catch less than 1998–1999 catch	< 20 000	20 000	14 500	27 291
2002	F reduced below $0.67 \times F_{MSY}$	< 21 000	20 000	14 500	29 158
2003	F reduced below $0.67 \times F_{MSY}$	< 23 000	23 000	14 500	30 891
2004	F reduced below $0.67 \times F_{MSY}$	< 20 000	23 000	14 100	27 102
2005	Effort reduced to 1/3 of the 2003 level	< 15 000	15 000	12 000	24 249
2006	Effort reduced to 1/3 of the 2003 level	< 15 000	15 000	10 000	21 432
2007	Adaptive management plan, start at 15 000 t	< 15 000	15 000	11 700	20 957
2008	Adaptive management plan, start at 15 000 t	< 15 000	15 000	11 000	22 169
2009	Adaptive management plan, reduce to 5000 t	< 5000	15 000	10 000	27 349
2010	Adaptive management plan, reduce to 5000 t	< 5000	12 000	12 000	25 995
2011	Adaptive management plan, reduce F substantially below F_{MSY}	< 5000	13 000	12 000	26 424
2012	No directed fishery, multi-annual management plan to be developed and implemented	-	13 000	13 000	29 309
2013	F reduced to F_{MSY}	< 20 000	15 000	10 000	27 045

Year	ICES advice	Predicted catch corresp. to advice	TAC for Iceland EEZ**	TAC for Greenland EEZ	ICES catch subareas 5, 6, 12, and 14
2014	F reduced to F_{MSY}	< 20 000	12 500	8300	21 069
2015	F reduced to F_{MSY}	< 25 000	14 100	9500	25 677
2016	Fishing at F_{MSY}	< 22 000	12 400	8300	25 397
2017	Fishing at F_{MSY}	< 24 000	13 500	9000	
2018	Fishing at F_{MSY}	< 24 000			

* Catch at *status quo* F.

** For the fishing year ending 31 August.

History of the catch and landings

Table 8 Greenland halibut in subareas 5, 6, 12, and 14. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Landings		Discards
	Bottom trawl/shrimp trawl 82%	Gillnet/longlines 18%	
25 397 tonnes	25 397 tonnes		negligible

Table 9 Greenland halibut in subareas 5, 6, 12, and 14. History of commercial catch; both the official and ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	-	-	-	6	+	-
Faroe Islands	767	1532	1146	2502	1052	853	1096	1378	2319
France	8	27	236	489	845	52	19	25	-
Germany	3007	2581	1142	936	863	858	565	637	493
Greenland	+	1	5	15	81	177	154	37	11
Iceland	15 457	28 300	28 360	30 080	29 231	31 044	44 780	49 040	58 330
Norway	-	-	2	2	3	+	2	1	3
Total	19 239	32 441	30 891	34 024	32 075	32 984	46 622	51 118	61 156
ICES estimate	-	-	-	-	-	-	-	-	61 396
Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	-	-	-	-	-	-	1	-	-
Faroe Islands	1803	1566	2128	4405	6241	3763	6148	4971	3817
France	-	-	3	2	-	-	29	11	8
Germany	336	303	382	415	648	811	3368	3342	3056
Greenland	40	66	437	288	867	533	1162	1129	747
Iceland	36 557	34 883	31 955	33 987	27 778	27 383	22 055	18 569	10 728
Norway	50	34	221	846	1173	1810	2164	1939	1367
Russia	-	-	5	-	-	10	424	37	52
Spain									89
UK (Engl. and Wales)	27	38	109	811	513	1436	386	218	190
UK (Scotland)	-	-	19	26	84	232	25	26	43
Total	38 813	36 890	35 259	40 780	37 305	36 006	35 762	30 242	20 360
ICES estimate	39 326	37 950	35 423	40 817	36 958	36 300	35 825	30 309	20 382

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007
Estonia		0	0	8	0	0	5	3	0
Faroe Islands	3884	0	121	334	458	338	1150	855	1141
France	0	2	32	290	177	157	0	62	17
Germany	3082	3265	2800	2050	2948	5169	5150	4299	4930
Greenland	200	1740	1553	1887	1459	0	0	0	0
Iceland	11 180	14 537	16 590	19 224	20 366	15 478	13 023	11 798	0
Ireland		0	56	0	0	0	0	0	0
Lithuania		0	0	0	2	1	0	2	3
Norway	1187	1750	2243	1998	1074	1233	1124	1097	692
Poland		0	2	16	93	207	0	0	0
Portugal		0	6	130	0	0	0	1094	0
Russia	138	183	187	44	0	262	0	552	501
Spain		779	1698	1395	3075	4721	506	33	0
UK (Engl. and Wales)	261	370	227	71	40	49	10	1	0
UK (Scotland)	69	121	130	181	367	367	391	1	0
United Kingdom	0	166	252	255	841	1304	220	93	17
Total	20 001	22 913	25 897	27 609	30 900	29 286	21 579	19 890	7301
ICES estimate	20 371	26 644	27 291	29 158	30 891.4	27 102	24 978	21 466	21 873
Country	2008	2009	2010	2008	2011	2012	2013	2014	2015
Estonia	-	-	-	-	-	-	0	429	
Faroe Islands	-	270	1408	1705	1705	2811	2788	3393	3214
France	114	0	0	0	9	67	133	0	117
Germany	4846	427	5287	5782	5782	4620	3814	3701	3808
Greenland	0	2819	0	3415	3415	5239	3251	1897	3642
Iceland	0	0	13 293	13 192	1319	13 749	14 859	9861	12 400
Lithuania	566		0	0	0	97	0	0	-
Norway	639	124	233	171	176	856	614	764	1126
Poland	1354	988	960	0	0	786	0	0	-
Russia	799	762	1070	1095	1095	1168	1369	587	600
Spain	0	0	0	0	0	0	0	67	110
United Kingdom	422	581	577	323	323	12	95	44	127
Total	9744	5974	22 901	25 693	25 618	29 405	26 923	20 743	25 145
ICES estimate	24 481	28 197	25 995	26 422	26 347			21 069	25 677
Country	2016*								
Faroe Islands	4656								
France	88								
Germany	4420								
Greenland	1511								
Iceland	12 652								
Norway	1007								
Russia	600								
Spain	94								
United Kingdom	348								
Total	25 377								
ICES estimate	25 397								

* Provisional data.

Summary of the assessment

Table 10 Greenland halibut in subareas 5, 6, 12, and 14. Assessment summary. Weights are in tonnes.

Year	B/B _{MSY} at the end of the year	B/B _{MSY} 95th percentile	B/B _{MSY} 5th percentile	Catch tonnes	F/F _{MSY}	F/F _{MSY} 95th percentile	F/F _{MSY} 5th percentile
1960	2.004	2.117	1.891	0	0	0	0
1961	2.005	2.11	1.896	29	0	0.001	0
1962	2.004	2.108	1.899	3071	0.047	0.09	0.029
1963	1.995	2.099	1.894	4275	0.066	0.125	0.04
1964	1.986	2.091	1.886	4748	0.074	0.14	0.045
1965	1.977	2.083	1.878	7421	0.116	0.219	0.071
1966	1.963	2.071	1.864	8030	0.126	0.238	0.077
1967	1.95	2.06	1.851	9597	0.152	0.287	0.092
1968	1.935	2.046	1.836	8337	0.133	0.251	0.08
1969	1.927	2.038	1.824	26 200	0.42	0.794	0.253
1970	1.875	1.998	1.765	33 823	0.558	1.051	0.334
1971	1.813	1.949	1.685	28 973	0.496	0.93	0.293
1972	1.773	1.916	1.633	26 473	0.465	0.871	0.272
1973	1.743	1.894	1.594	20 463	0.366	0.688	0.212
1974	1.731	1.883	1.581	36 280	0.653	1.235	0.377
1975	1.682	1.848	1.518	23 494	0.436	0.827	0.248
1976	1.669	1.841	1.505	6045	0.113	0.216	0.064
1977	1.7	1.865	1.543	16 578	0.303	0.589	0.173
1978	1.701	1.867	1.542	14 349	0.262	0.512	0.149
1979	1.708	1.873	1.547	23 622	0.429	0.846	0.244
1980	1.69	1.86	1.526	31 157	0.572	1.134	0.323
1981	1.657	1.835	1.488	19 239	0.361	0.717	0.202
1982	1.658	1.837	1.484	32 441	0.607	1.218	0.34
1983	1.626	1.813	1.442	30 891	0.59	1.189	0.328
1984	1.601	1.793	1.408	34 024	0.66	1.339	0.365
1985	1.57	1.772	1.369	32 075	0.635	1.296	0.348
1986	1.572	1.944	1.278	32 984	0.653	1.351	0.345
1987	1.536	1.927	1.236	46 622	0.944	1.958	0.496
1988	1.486	1.874	1.192	51 118	1.069	2.223	0.56
1989	1.549	1.96	1.229	61 396	1.237	2.566	0.639
1990	1.243	1.576	0.993	39 326	0.984	2.037	0.513
1991	1.152	1.456	0.919	37 950	1.027	2.13	0.534
1992	1.028	1.302	0.822	35 487	1.074	2.222	0.559
1993	0.853	1.077	0.684	41 247	1.505	3.114	0.785
1994	0.702	0.889	0.564	37 190	1.646	3.404	0.86
1995	0.593	0.752	0.477	36 288	1.899	3.934	0.997
1996	0.547	0.699	0.439	35 932	2.035	4.238	1.072
1997	0.597	0.775	0.477	30 309	1.574	3.275	0.817
1998	0.777	0.985	0.622	20 382	0.818	1.7	0.423
1999	0.864	1.087	0.693	20 371	0.735	1.524	0.383
2000	0.928	1.168	0.745	26 644	0.894	1.854	0.465
2001	0.921	1.164	0.737	27 291	0.924	1.914	0.478
2002	0.751	0.945	0.604	29 158	1.209	2.506	0.63
2003	0.568	0.709	0.458	30 891	1.692	3.508	0.893
2004	0.467	0.583	0.375	27 102	1.804	3.751	0.956
2005	0.473	0.596	0.382	24 249	1.59	3.293	0.837
2006	0.53	0.664	0.421	21 432	1.262	2.618	0.661
2007	0.631	0.793	0.497	20 957	1.037	2.153	0.54
2008	0.626	0.784	0.503	22 169	1.237	2.562	0.649

Year	B/B _{MSY} at the end of the year	B/B _{MSY} 95th percentile	B/B _{MSY} 5th percentile	Catch tonnes	F/F _{MSY}	F/F _{MSY} 95th percentile	F/F _{MSY} 5th percentile
2009	0.666	0.839	0.536	27 349	1.279	2.653	0.667
2010	0.645	0.81	0.519	25 995	1.254	2.599	0.657
2011	0.684	0.859	0.551	26 424	1.203	2.495	0.629
2012	0.716	0.904	0.577	29 309	1.273	2.636	0.664
2013	0.723	0.913	0.581	27 045	1.164	2.411	0.606
2014	0.692	0.874	0.557	21 069	0.946	1.964	0.494
2015	0.724	0.912	0.582	25 677	1.103	2.297	0.576
2016	0.715	0.91	0.568	25 397	1.103	2.324	0.571

Sources and references

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