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Saithe (*Pollachius virens*) in subareas 1 and 2 (Northeast Arctic)

ICES stock advice

ICES advises that when the Norwegian management plan is applied, catches in 2018 should be no more than 172 500 tonnes. Bycatches of coastal cod (*Gadus morhua*) and golden redfish (*Sebastes norvegicus*) in fisheries targeting saithe in subareas 1 and 2 should be kept as low as possible.

Stock development over time

The spawning–stock biomass (SSB) has been above B_{pa} since 1996, but declined considerably from 2007 to 2011, then increased again and is presently (2017) estimated to be well above B_{pa}. The fishing pressure (F) has been below F_{pa} since 1997, with the exception of 2010 and 2011. Recruitment (R) has been close to the long-term geometric mean level since 2005.

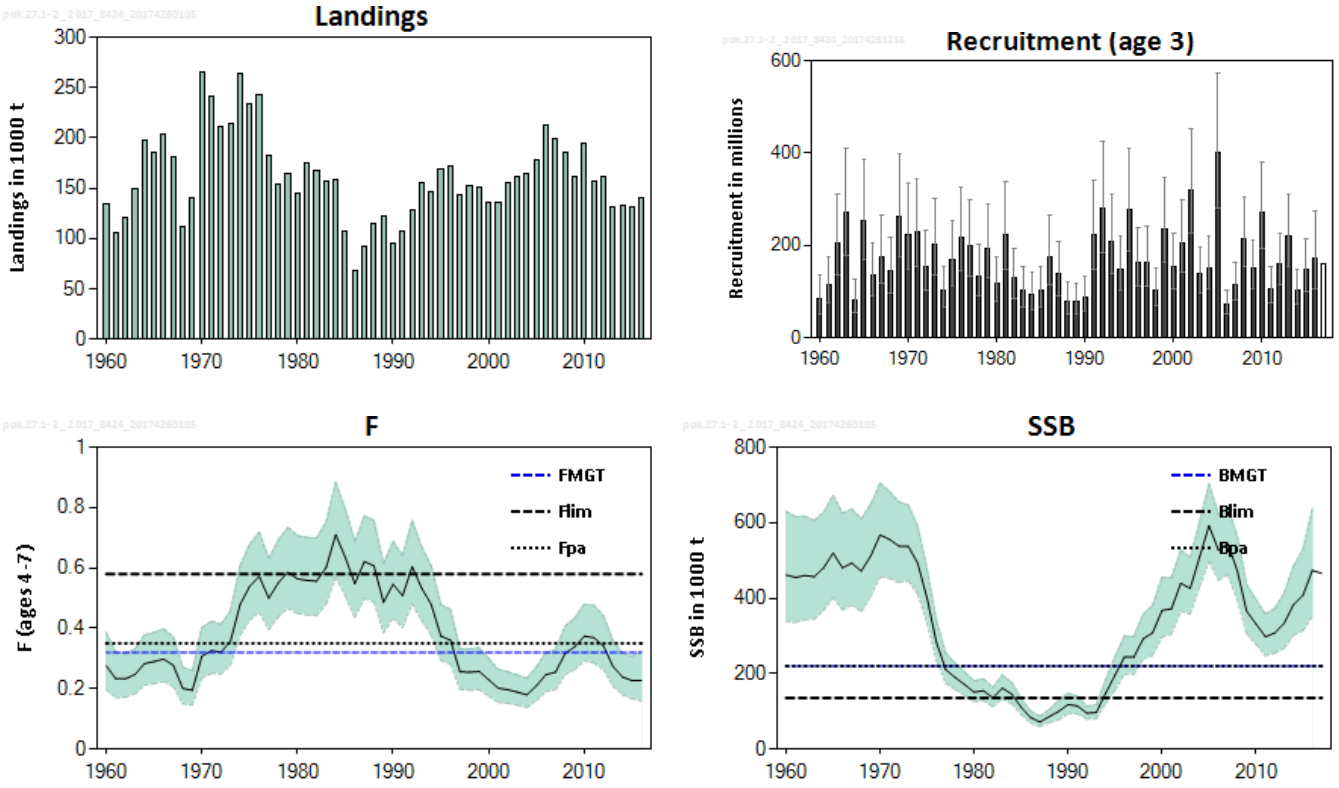

Figure 1 Saithe in subareas 1 and 2. Historical development of the stock from the summary of stock assessment (weights in thousand tonnes). Recruitment (R), fishing mortality (F), and spawning–stock biomass (SSB) have uncertainty boundaries (95%) in the plots. Predicted recruitment values are not shaded.

Stock and exploitation status

Table 1 Saithe in subareas 1 and 2. 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}	?	?	?	Undefined	MSY $B_{Trigger}$	?	?	? Undefined
Precautionary Approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa}, B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	✓	✓	✓	Below	B_{MGT}	✓	✓	✓ Above

Catch options

Table 2 Saithe in subareas 1 and 2. The basis for the catch options.

Variable	Value	Source	Notes
$F_{ages\ 4–7}$ (2017)	0.24	ICES (2017)	
SSB (2018)	454 042 t	ICES (2017)	
$R_{age\ 3}$ (2017 onwards)	158 831	ICES (2017)	Geometric mean (1960–2016), in thousands.
Total catch (2017)	150 000 t	ICES (2017)	TAC

Table 3 Saithe in subareas 1 and 2. Annual catch options. All weights are in tonnes.

Basis	Total catch (2018)	F_{total} (2018)	SSB (2019)	% SSB change *	% TAC change **
ICES advice basis					
Management Plan ***	172500	0.288	424645	−6	15
Other options					
$F = F_{MSY}$	NA	NA	NA	NA	NA
$F = 0$	0	0	587603	29	−100
F_{pa}	203000	0.35	396620	−13	35
$F = F_{sq}$	144000	0.23	458996	1	−4
$F = F_{sq} \times 0.5$	76000	0.11	522300	15	−49
$F = F_{sq} \times 1.25$	176000	0.29	430353	−5	17

* SSB 2019 relative to SSB 2018.
** Catch in 2018 relative to TAC in 2017 (150 000 t).
*** Catch decided by 15% change limit compared to TAC 2017.

Basis of the advice

Table 4 Saithe in subareas 1 and 2. The basis of the advice.

Advice basis	Norwegian management plan.
Management plan	The harvest control rule, as revised in 2013 and communicated to ICES by the Norwegian Ministry of Fisheries and Coastal Affairs, contains the following elements: • Estimate the average TAC level for the coming 3 years based on F_{MP} = 0.32. TAC for the next year will be set to this level as a starting value for the 3-year period. • The year after, the TAC calculation for the next 3 years is repeated based on the updated information about the stock development. However, the TAC should not be changed by more than +/− 15% compared with the previous year's TAC. • If the spawning–stock biomass (SSB) in the beginning of the year for which the quota is set (first year of prediction), is below B_{pa}, the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from F_{MP} at SSB = B_{pa} to 0 at SSB equal to zero. At SSB levels below B_{pa} in any of the operational years (current year and 3 years of prediction) there should be no limitations on the year-to-year variations in TAC. The harvest control rule (HCR) was last evaluated by ICES in 2011 (ICES, 2011), with F_{MP} = 0.35. The evaluation concluded that the HCR is precautionary. The F_{MP} was lowered to the current value of 0.32 by Norwegian authorities in 2013. The inter-benchmark for this stock in 2014 did not result in significantly different estimates of stock dynamics and the former HCR evaluation is still considered valid.

Quality of the assessment

The low level of biological sampling, which was an issue following the termination of the original Norwegian port-sampling programme in 2009, improved in 2016 and will thus improve the precision of the catch-, weight-, and maturity-at-age data. Predicted catches are dependent upon assumptions of average recruitment as reliable recruitment estimates are lacking.

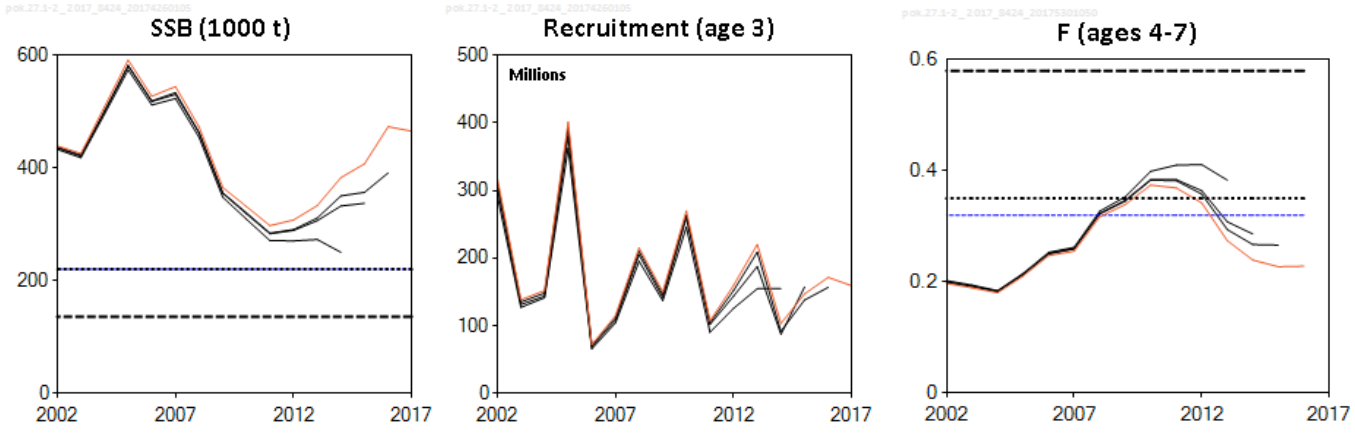

Figure 2 Saithe in Subareas 1 and 2. Historical assessment results (final-year recruitment estimates included). 2013 omitted because no assessment was accepted.

Issues relevant for the advice

Bycatch of *Sebastes norvegicus* should be kept as low as possible because of the poor status of this stock. It should be noted that *Sebastes norvegicus* is currently in a poor state, and that the stock would need to be stabilized before any safe catch limits can be defined. The current catch of *Sebastes norvegicus*, taken as bycatch in fisheries targeting Northeast Arctic (NEA) saithe, constitutes a considerable part of the total *Sebastes norvegicus* catch and is far above any sustainable catch level for this species.

Bycatch of coastal cod should be kept as low as possible in order to obtain the reductions in fishing mortality implied by the coastal cod rebuilding plan.

Reference points

Table 5 Saithe in subareas 1 and 2. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Reference
MSY approach	MSY $B_{trigger}$	Not defined		
	F_{MSY}	Not defined		
Precautionary approach	B_{lim}	136 000 t	Change point regression.	ICES (2005)
	B_{pa}	220 000 t	$B_{lim} \times \exp(1.645 \times \sigma)$, where $\sigma = 0.3$.	ICES (2005)
	F_{lim}	0.58	F corresponding to an equilibrium stock = B_{lim}.	ICES (2005)
	F_{pa}	0.35	$F_{lim} \times \exp(-1.645 \times \sigma)$, where $\sigma = 0.3$. This value is considered to have a 95% probability of avoiding the F_{lim}.	ICES (2005)
Management plan	SSB_{MGT}	220 000 t	B_{pa}; F is linearly reduced from F_{pa} at SSB = B_{pa} to zero at SSB = 0.	ICES (2011)
	F_{MP}	0.32	Average TAC for the coming three years based on F_{MP}.	ICES (2011)

Basis of the assessment

Table 6 Saithe in subareas 1 and 2. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016).
Assessment type	Age-based analytical assessment (SAM; ICES, 2017) that uses landings in the model and in the forecast.
Input data	Commercial catches (international landings, ages and length frequencies from Norwegian, German, and Russian catch sampling); one survey index (NOcoast-Aco-4Q, split in 2002); three-year running average maturity based on spawning zones from otoliths from commercial catches and surveys for 1985–2006, constant (2005–2007 average) for later years.
Discards and bycatch	Discarding is considered negligible. Bycatch is included.
Indicators	None.
Other information	An inter-benchmark was undertaken in 2014 (ICES IBP NEA SAITHE; ICES, 2014).
Working group	Arctic Fisheries Working Group (AFWG)

Information from stakeholders

No information was provided.

History of the advice, catch, and management

Table 7 Saithe in subareas 1 and 2. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC*	Official landings	ICES landings
1994	No increase in F	158000#	145000	145860	145860
1995	No increase in F	221000#	165000	168248	168248
1996	No increase in F	158000#	163000	171121	171121
1997	Reduction of F to F_{med} or below	107000	125000	143073	143073
1998	Reduction of F to F_{med} or below	117000	145000##	152890	152890
1999	Reduce F below F_{pa}	87000	144000###	150375	150375
2000	Reduce F below F_{pa}	89000	125000^	135928	135928
2001	Reduce F below F_{pa}	< 115000	135000	135853	135853
2002	Maintain F below F_{pa}	< 152000	162000^^	154870	154870
2003	Maintain F below F_{pa}	< 168000	164000	161592	161592
2004	Maintain F below F_{pa}	< 186000	169000	164636	164636
2005	Take account of *Sebastes marinus* bycatch. Maintain F below F_{pa}	< 215000	215000	178568	178568
2006	Take account of *Sebastes marinus* bycatch. Maintain F below F_{pa}	< 202000	193500	212822	212822
2007	Take account of *Sebastes marinus* bycatch. Maintain F below F_{pa}	< 247000	222525	199008	199008
2008	Take account of *Sebastes marinus* bycatch. Maintain F below F_{HCR}	< 247000	< 247000	184740	184740
2009	Take account of *Sebastes marinus* bycatch. Apply management plan	< 225000	225000	161853	161853
2010	Take account of *Sebastes marinus* bycatch. Apply management plan	< 204000	204000	194837	194837
2011	Take account of *Sebastes marinus* bycatch. Apply management plan	< 173000	173000	156716	156716
2012	Take account of coastal cod and *Sebastes marinus* bycatch. Apply management plan.	< 164000	164000	160865	160865
2013	Take account of coastal cod and *Sebastes marinus* bycatch. Apply management plan.	< 164000	140000^^^	131806	131806
2014	Take account of coastal cod and *Sebastes marinus* bycatch. Stabilize SSB.	< 140000	119000^^^	132005	132005
2015	Take account of coastal cod and *Sebastes norvegicus*** bycatch. Apply management plan.	< 122000	122000	131765	131765
2016	Take account of coastal cod and *Sebastes norvegicus*** bycatch. Apply management plan.	< 140000	140000	140392	140392
2017	Take account of coastal cod and *Sebastes norvegicus*** bycatch. Apply management plan.	≤ 150000	150000		
2018	Take account of coastal cod and *Sebastes norvegicus*** bycatch. Apply management plan.	≤ 172500			

Predicted catch at *status quo* F.
TAC first set at 125 000 t, then increased in May 1998 after an intersessional assessment.
TAC set after an intersessional assessment in December 1998.
^ TAC set after an intersessional assessment in December 1999.
^^ TAC first set at 152 000 t, then increased in June 2003 after the spring 2002 assessment.
^^^ Set by Norwegian authorities based on national advice where cpue was excluded from the assessment.
* TAC set by Norwegian authorities.
** Until 2014 this species was named *Sebastes marinus.* From 2015 it was decided to adopt the species list by WoRMS (http://www.marinespecies.org/). The name used for this species will hence hereafter be *Sebastes norvegicus*.

History of the catch and landings

Table 8 Saithe in subareas 1 and 2. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Landings				Discards	Recreational catch
140 392 t	Trawl: 45%	Purse seine: 20%	Gillnet: 15%	Other: 19%	Discarding is considered to be negligible	Imprecisely known, but negligible (< 1% of total catch)
	140 392 t					

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Table 9 Saithe in subareas 1 and 2. History of commercial landings. ICES estimated values are presented for each country participating in the fishery. Weights are in tonnes.

Year	Faroes	France	Greenland	Germany, Dem. Rep.	Fed. Rep. Germany	Iceland	Norway	Poland	Portugal	Russian Federation***	Spain	UK	Others^^	Total all countries
1960	23	1700			25948		96050					9780	14	133515
1961	61	3625			19757		77875					4595	18	105951
1962	2	544			12651		101895			912		4699	4	120707
1963		1110			8108		135297					4112		148627
1964		1525			4420		184700			84		6511	186	197426
1965		1618			11387		165531			137		6741	181	185600
1966		2987		813	11269		175037			563		13078	41	203788
1967		9472		304	11822		150860			441		8379	48	181326
1968				70	4753		96641					8781		110247
1969	20	193		6744	4355		115140					13585	23	140060
1970	1097			29362	23466		151759			43550		15469		264924
1971	215	14536		16840	12204		128499	6017		39397	13097	10361		241272
1972	109	14519		7474	24595		143775	1111		1278	13125	8223		214334
1973	7	11320		12015	30338		148789	23		2411	2115	6841		213859
1974	46	7119		29466	33155		152699	2521		28931	7075	3104	5	264121
1975	28	3156		28517	41260		122598	3860	6430	13389	11397	2763	55	233453
1976	20	5609		10266	49056		131675	3164	7233	9013	21661	4724	65	242486
1977	270	5658		7164	19985		139705	1	783	989	1327	6935		182817
1978	809	4345		6484	19190		121069	35	203	381	121	2827		155464
1979	1117	2601		2435	15323		141346			3	685	1170		164680
1980	532	1016			12511		128878			43	780	794		144554
1981	236	218			8431		166139			121		395		175540
1982	339	82			7224		159643			14		732		168034
1983	539	418			4933		149556			206	33	1251		156936
1984	503	431		6	4532		152818			161		335		158786
1985	490	657		11	1873		103899			51		202		107183
1986	426	308			3470		63090			27		75		67396
1987	712	576			4909		85710			426		57	1	92391

Year	Faroes	France	Greenland	Germany, Dem. Rep.	Fed. Rep. Germany	Iceland	Norway	Poland	Portugal	Russian Federation***	Spain	UK	Others^^	Total all countries
1988	441	411			4574		108244			130		442		114242
1989	388	460**			606		119625			506	506	726		122817
1990	1207	340**			1143		92397			52		709		95848
1991	963	77**			2003		103283			504^		492	5	107327
1992	165	1980	734		3451		119763			964	6	541		127604
1993	31	566	78		3687	3	140604		1	9509	4**	415	5	154903
1994	67**	557	15		1863	4**	141589		1**	1640**	655**	557	2	146950
1995	172**	358	53		935		165001		5	1148		688	18	168378
1996	248**	346	165		2615		166045		24	1159	6	707	33	171348
1997	193**	560	363**		2915		136927		12	1774	41	799	45	143629
1998	366	932	437**		2936		144103		47	3836	275	355	40	153327
1999	181	638**	655**		2473	146	141941		17	3929	24	339	32	150375
2000	224**	1438	651**		2573	33	125932		46	4452	117	454	8**	135928
2001	537	1279	701**		2690	57	124928		75	4951	119	514	2	135853
2002	788	1048	1393		2642	78	142941		118	5402	37	420	3	154870
2003	2056	1022	929**		2763	80**	150400		147	3894	18	265	18**	161592
2004	3071	255	891**		2161	319	147975		127	9192	87	544	14	164636
2005	3152	447	817**		2048	395	162338		354	8362	25	630		178568
2006	1795	899	786**		2779	255	195462	89	339**	9823	21**	532	42	212822
2007	2048	966	810**		3019	219	178644	99	412	12168	53**	558	12	199008
2008	2314	1009	503**		2263	113	165998	66	348	11577	33**	506	10	184740
2009	1611**	326	697		2021	69	144570	30	204**	11899	2**	379	45**	161853
2010	1632	677	954		1592	109**	174544	279	93	14664	8	283	2**	194837
2011	112	367	445		1371	65	143314		46	10007	2	972	15	156716
2012	146	781	658		1371	126	143145		23**	13607	4	1000	4**	160865
2013	80	1901	972		1326^^^	290**	111962	2	17	14796	5	433	22	131806
2014	273	1674	407		259	659	115798	1	8	12396	12	518		132005
2015	576	514	393		424	249	114830	1154	10	13181	34	400		131765
2016*	1139	526	613		952	301	120740	528	53	15203	26	301	10	140392

* Provisional figures.

** As reported to Norwegian authorities.

*** USSR prior to 1991.

^ Includes Estonia.

^^ Includes Denmark, Netherlands, Ireland, and Sweden.

^^^ As reported by Working Group members.

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Summary of the assessment

Table 10 Saithe in subareas 1 and 2. Assessment summary. Weights are in tonnes.

Year	Recruitment Age 3	High 95%	Low 95%	SSB	High 95%	Low 95%	Landings	F Ages 4–7	High 95%	Low 95%
	thousands			tonnes			tonnes			
1960	84881	136276	52868	461390	630116	337844	133515	0.276	0.387	0.196
1961	115613	176092	75905	454976	615605	336260	105951	0.233	0.319	0.17
1962	204638	309905	135128	460008	616615	343176	120707	0.233	0.316	0.172
1963	271305	410413	179347	456800	606003	344331	149437	0.247	0.332	0.183
1964	82537	125985	54072	480701	628216	367824	197506	0.283	0.378	0.212
1965	254486	384570	168404	519696	671951	401941	185600	0.29	0.386	0.217
1966	135266	203968	89705	480220	625083	368929	203788	0.298	0.398	0.224
1967	175782	265471	116394	492870	636246	381803	181315	0.278	0.372	0.208
1968	144495	217959	95793	471654	610150	364594	111424	0.201	0.271	0.15
1969	263024	398292	173696	511959	648554	404133	140060	0.195	0.26	0.146
1970	222126	334529	147491	567502	704610	457074	264762	0.308	0.403	0.236
1971	230268	345235	153587	555709	682283	452616	241272	0.326	0.423	0.251
1972	154199	230979	102942	537670	654763	441517	210456	0.321	0.414	0.249
1973	201793	302187	134753	537132	646669	446150	213769	0.358	0.458	0.279
1974	101417	152622	67392	492870	590469	411403	264121	0.479	0.607	0.378
1975	168215	252105	112241	399113	476552	334258	233453	0.539	0.679	0.427
1976	217510	326825	144758	282377	339372	234955	242486	0.572	0.719	0.454
1977	199586	299006	133223	210239	253565	174316	182817	0.5	0.631	0.396
1978	134323	201410	89581	189662	227200	158327	154464	0.551	0.693	0.439
1979	193300	289752	128955	170928	204790	142665	164180	0.586	0.734	0.467
1980	117712	176331	78581	151146	181131	126124	144554	0.564	0.707	0.449
1981	224583	338886	148833	154817	186526	128499	175522	0.559	0.701	0.445
1982	128412	192964	85455	135537	163302	112493	168034	0.556	0.699	0.442
1983	101722	153338	67481	161781	196583	133140	156936	0.602	0.753	0.481
1984	93901	142110	62047	145947	176757	120508	158786	0.71	0.883	0.57
1985	102232	154675	67570	111525	134474	92491	107147	0.635	0.795	0.507
1986	173685	263983	114275	84036	101459	69605	67396	0.548	0.688	0.436
1987	138690	209161	91963	71826	86641	59544	92391	0.621	0.772	0.5
1988	78984	120386	51820	86163	104723	70893	114242	0.607	0.757	0.487
1989	77343	117498	50910	100007	129115	77462	121851	0.486	0.614	0.385
1990	87116	133053	57040	118066	148215	94050	95508	0.546	0.688	0.434
1991	224583	339721	148467	114577	140059	93731	107250	0.508	0.641	0.402
1992	280127	423835	185146	95130	113477	79750	127603	0.604	0.757	0.482
1993	207524	311951	138054	97343	117210	80844	154895	0.533	0.669	0.425
1994	149194	219586	101367	148153	182704	120136	145860	0.479	0.606	0.378
1995	277618	409995	187982	196222	244796	157286	168248	0.374	0.478	0.293
1996	161943	237309	110512	244019	299947	198519	171121	0.361	0.463	0.282
1997	163898	240516	111687	243531	298302	198817	143073	0.256	0.332	0.198
1998	103777	151925	70888	292436	357811	239005	152890	0.255	0.332	0.196
1999	236807	346757	161720	308045	381559	248694	150375	0.257	0.336	0.197
2000	154045	225533	105217	367692	454730	297313	135928	0.23	0.3	0.176
2001	204638	297051	140975	371759	453556	304713	135853	0.202	0.264	0.155
2002	319017	452625	224848	439327	527804	365682	154870	0.197	0.256	0.152
2003	138413	196965	97267	425917	507391	357526	161592	0.189	0.245	0.146

Year	Recruitment Age 3	High 95%	Low 95%	SSB	High 95%	Low 95%	Landings	F Ages 4–7	High 95%	Low 95%
	thousands			tonnes			tonnes			
2004	151903	219507	105120	508897	601282	430706	164636	0.18	0.235	0.138
2005	401515	573275	281216	591845	702720	498464	178568	0.21	0.273	0.161
2006	71970	102394	50585	527551	621969	447465	212822	0.247	0.32	0.191
2007	114806	162905	80909	544705	641405	462584	199008	0.255	0.33	0.197
2008	215346	303568	152763	473071	564083	396743	184740	0.317	0.408	0.247
2009	149941	211500	106300	365492	436251	306210	161853	0.339	0.434	0.264
2010	269952	379011	192275	331705	396075	277795	194837	0.374	0.48	0.292
2011	107152	152509	75284	297747	358142	247537	156716	0.369	0.476	0.286
2012	159692	224960	113360	307737	372642	254136	160865	0.342	0.442	0.264
2013	220136	311732	155453	333367	414331	268225	131806	0.274	0.359	0.209
2014	103156	147993	71903	383080	485250	302422	132005	0.239	0.317	0.18
2015	146972	215544	100216	407583	528691	314217	131765	0.227	0.308	0.167
2016	171442	275213	106799	473544	637494	351758	140392	0.228	0.325	0.159
2017	158831*			465149						
Average	**171662**			**332365**			**160755**	**0.378**		

* GM 1960–2016.

Sources and references

ICES. 2005. Report of the Arctic Fisheries Working Group (AFWG), 19–28 April 2005, Murmansk, Russia. ICES CM 2005/ACFM:20. 564 pp.

ICES. 2011. Report of the Arctic Fisheries Working Group (AFWG), 28 April–4 May 2011, Hamburg, Germany. ICES CM 2011/ACOM:05. 659 pp.

ICES. 2014. Report of the Inter-Benchmark Protocol on Northeast Arctic Saithe in Subareas I and II (IBP NEAsaithe), March/April 2014, by correspondence. ICES CM 2014/ACOM:53. 94 pp.

ICES. 2016. Advice basis. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2017. Report of the Arctic Fisheries Working Group (AFWG), 19 April–25 April 2017, ICES HQ, Copenhagen. ICES CM 2017/ACOM:06. 486 pp.