ECOREGION Barents Sea and Norwegian Sea
STOCK Saithe in Subareas I and II (Northeast Arctic)

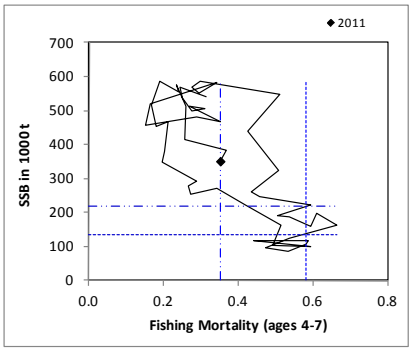
Advice for 2013

ICES advises on the basis of the management plan implemented by the Norwegian Ministry of Fisheries and Coastal Affairs that catches in 2013 should be no more than 164 000 t. Bycatches of coastal cod and *Sebastes marinus* should be kept as low as possible.

Stock status

F (Fishing Mortality)	2009	2010	2011	
MSY (F_{MSY})	?	?	?	Undefined
Precautionary approach (F_{pa},F_{lim})	✓	✓	✓	Harvested sustainably
Management plan (F_{MP})	✓	✓	✓	At target

SSB (Spawning-Stock Biomass)	2010	2011	2012	
MSY ($B_{trigger}$)	?	?	?	Undefined
Precautionary approach (B_{pa},B_{lim})	✓	✓	✓	Full reproductive capacity
Management plan (SSB_{MP})	✓	✓	✓	Above trigger



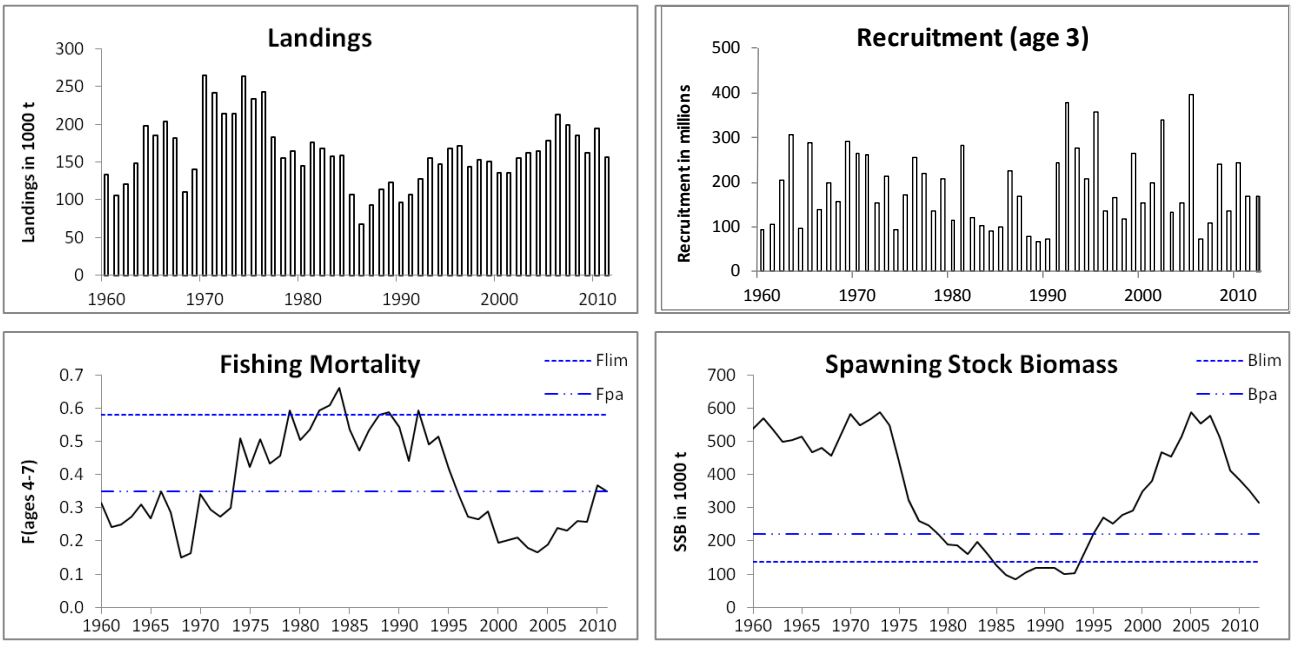


Figure 3.4.4.1 Saithe in Subareas I and II (Northeast Arctic). Summary of stock assessment (weights in thousand tonnes, recruitment estimates are shown in grey). Top right: SSB/F for the time-series used in the assessment.

Since 1995, SSB has been well above B_{pa} and has decreased in recent years. Fishing mortality was well below F_{pa} for a number of years after 1996, but has increased since 2005 to F_{pa} in 2010 and 2011. The 2005 and 2007 year classes are above average, while the 2006 and 2008 year classes seem to be below average strength.

Management plans

The Norwegian Ministry of Fisheries and Coastal Affairs implemented a harvest control rule (HCR) in autumn 2007 (see Annex 3.4.4). ICES evaluated the HCR in 2007 and concluded that it is consistent with the precautionary approach, providing the assessment uncertainty and error are not greater than those calculated from historical data. This also holds true for implementation error (difference between TAC and catch).

Biology

Saithe in Subareas I and II is an important predator on other species in the ecosystem, notably young herring, haddock, and Norway pout. Saithe is a typical migrating fish and makes both feeding and spawning migrations. There are examples of extensive migration of young saithe from the western part of the Norwegian coast to the North Sea and of older saithe migrating from more northern areas to Iceland and the Faroe Islands, and a few examples of migration to the Norwegian coast.

Environmental influence on the stock

There have been variations in distribution and migration patterns over the years, but the link with environmental parameters remains unclear.

The fisheries

Norway accounts for more than 90% of the landings. The gillnet fishery is most intense during winter, purse seine in the summer months, while the trawl fishery takes place more evenly year-round. Coastal cod and *S. marinus* are caught as bycatch in some of the saithe fisheries (ICES, 2011b, 2011c).

Catch distribution	Total landings (2011) are 157 kt (43% trawl, 29% purse-seine, 20% gillnet, and 8% other gear types). Discards are considered to be low.

Quality considerations

Norwegian sampling of commercial catches is believed to be less precise because of the termination of a Norwegian port sampling programme in mid-2009. The poor sampling caused problems in estimating Norwegian catches for the oldest ages in 2010. A small Norwegian port sampling programme from 2011 and onwards and an expansion of the high seas reference fleet has improved the situation somewhat. But there is still a lack of samples from certain gears and areas and the working group recommends an increase in port sampling effort.

After the 2010 benchmark the retrospective pattern of the assessment has been less severe.

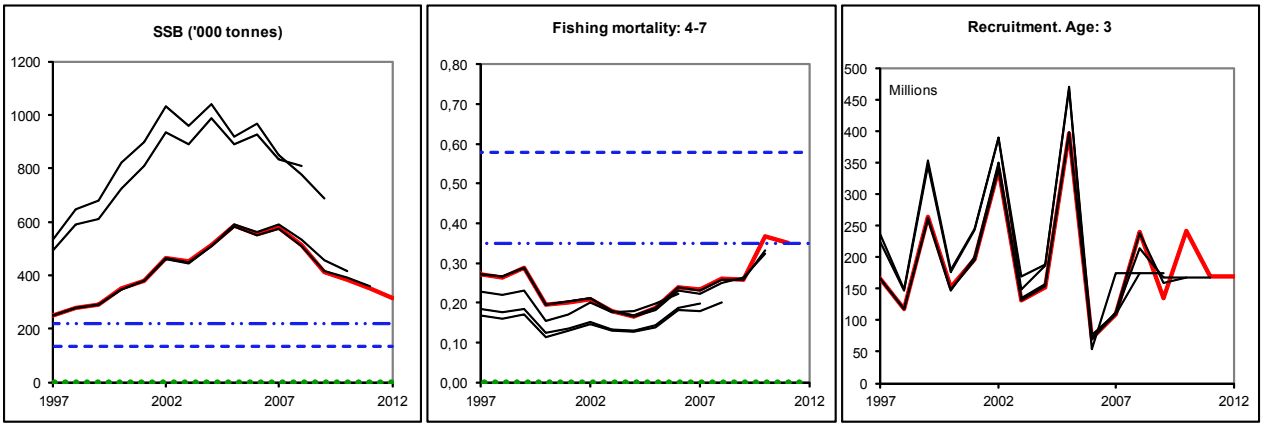


Figure 3.4.4.2 Saithe in Subareas I and II (Northeast Arctic). Historical assessment results (final-year recruitment estimates included).

Scientific basis

Assessment type	XSA with a 3–15+ catch matrix, two tuning time-series split in 2002, shrinkage (S.E. of the mean to which estimates are shrunk = 1.5), and no tapered time weighting.
Input data	Two tuning fleets (NOcoast-Aco-4Q), cpue data from the Norwegian trawl fisheries, and indices from the Norwegian acoustic survey, both split in 2002.
Discards and bycatch	Discarding is considered to be minor.
Indicators	None.
Other information	The latest benchmark was performed in 2010 (WKROUND, 2010).
Working group report	AFWG

ECOREGION Barents Sea and Norwegian Sea
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Reference points

	Type	*Value*	*Technical basis*
Management Plan	SSB_{MP}	220 000 t	B_{pa}, TAC is linearly reduced from F_{pa} at SSB = B_{pa} to 0 at SSB equal to zero.
	F_{MP}	0.35	Average TAC for the coming 3 years based on F_{pa}.
MSY Approach	MSY $B_{trigger}$	not defined	
	F_{MSY}	not defined	
Precautionary	B_{lim}	136 000 t	Change point regression.
	B_{pa}	220 000 t	B_{lim} * exp(1.645*σ), where σ = 0.3.
	F_{lim}	0.58	F corresponding to an equilibrium stock = B_{lim}.
	F_{pa}	0.35	F_{lim} * exp(−1.645*σ), where σ = 0.3. This value is considered to have a 95% probability of avoiding the F_{lim}.

(unchanged since: 2005)

Yield and spawning biomass per Recruit F-reference points (2012):

	Fish Mort Ages 4–7	Yield/R	SSB/R
Average last 3 years	0.33	0.82	1.41
F_{max} [*]	-	-	-
$F_{0.1}$	0.14	0.74	3.76
F_{med}	0.27	0.82	1.83
$F_{35\%SPR}$	0.14	0.74	3.76

[*] F_{max} is not well-defined.

Outlook for 2013

Basis: F_{2012} = TAC constraint = 0.31[1)]; Landings (2012) = 164; SSB (2013) = 302; R (2012 onwards) = geometric mean (1960–2009) = 169 millions.

Rationale	Landings (2013)	Basis	F (2013)	SSB (2014)	%SSB change [2)]	%TAC change [3)]
Management plan [4)]	164	F_{MP}	0.32	292	-3	0
Precautionary approach	176	F_{pa}	0.35	284	-6	+7
Zero catch	0	F=0	0	406	+34	-100
Status quo	89	F_{sq} * 0.5	0.16	344	+11	-46
	165	F_{sq} * 1.0	0.33	292	-3	+1
	199	F_{sq} * 1.25	0.41	269	-11	+21

Weights in '000 t.
[1)] It is assumed that the TAC will be implemented and that the landings in 2012 will correspond to the TAC.
[2)] SSB 2014 relative to SSB 2013.
[3)] TAC 2013 relative to TAC 2012.
[4)] Average TAC for the coming 3 years based on F_{pa}.

Management plan

Following the agreed management plan implies a TAC of 164 000 t in 2013. The SSB is expected to remain above B_{pa} at the beginning of 2014.

Precautionary approach

The fishing mortality in 2013 should be no more than F_{pa}, corresponding to landings of less than 176 000 t in 2013. This is expected to keep SSB above B_{pa} in 2014.

Additional considerations

The ICES advice is based on a harvest control rule adopted by the Norwegian authorities. The stock is exploited by fleets from a number of nations that acquire fishing rights by quota swaps with Norway. In addition, Russia sets a small quota for the Russian zone. ICES advice applies to all catches of Northeast Arctic saithe.

Preliminary stochastic simulations show that the highest long-term yield is obtained at F values lower than the F = 0.35 currently used in the management plan. More work on this is needed to determine an F_{MSY} value that may be considered as a basis for changing the harvest control rule.

Regulations and their effects

TAC regulations are in place for this stock. Norway and Russia have each set national measures applicable to their EEZ. Since 2007 the catch has been less than the TAC. However, in 2010–2011 this difference was less than in previous years.

In the Norwegian fishery, quotas may be transferred between fleets if it becomes clear that the quota allocated to one of the fleets will not be taken. In addition to quotas, the fisheries are managed by minimum mesh size, minimum fish size, bycatch regulations, area closures, and other area and seasonal restrictions. Furthermore, sorting grids are used in the trawl fishery.

Since the early 1960s, purse-seiners and trawlers have dominated the fishery, with a traditional gillnet fishery for spawning saithe as the third major component. The purse-seine fishery is conducted in coastal areas and fjords. Historically, purse-seiners and trawlers have taken, approximately, equal shares of the catches. Regulation changes led to a reduction in the amounts taken by purse-seiners after 1990.

Discarding is illegal, but may occur when trawlers targeting cod catch saithe without having a quota for saithe. In the purse-seine fishery, slipping has been reported, mainly related to minimum size of fish in the catch. There is no quantitative information on discards, but they are considered minor.

On 1 March 1999, the minimum fish size was increased to 45 cm for trawl and conventional gears, and to 42 cm (north of Lofoten) and 40 cm (between 62°N and Lofoten) for purse-seine, with an exception for the first 3000 t purse-seine catch between 62°N and 66°33′N, where the minimum fish size remains at 35 cm.

A real-time closure system has been in force along the Norwegian coast and in the Barents Sea since 1984, aimed at protecting juvenile fish. Based on scientific research data and mapping of areas by hired fishing vessels, fishing is prohibited in areas where the proportion by number of undersized cod, haddock, and saithe combined has been observed by inspectors to exceed 15% (the size limits vary by species). The time of notice before a closure of an area comes into force is 2–4 hours for national vessels and 7 days for foreign vessels. Before or parallel to a closure, the Coast Guard requests vessels not to fish in an area where too many small fish have been observed during their inspections. A closed area is not opened until a low percentage of juvenile fish is documented by trial fishing within the area by the Surveillance Service.

Uncertainties in assessment and forecast

The assessment is based on two tuning series which, in recent years, show divergent signals.

Lack of reliable recruitment estimates is still a major problem. Prediction of catches will, to a large extent, be dependent on assumptions of average recruitment, since fish from age four to seven constitute major parts of the catches. Since the saithe HCR is a three-year-rule, the estimation of average F_{pa} catch in the HCR will affect stock numbers up to age seven, and thereby heavily affect the total prognosis of the fishable stock and the quotas derived from it.

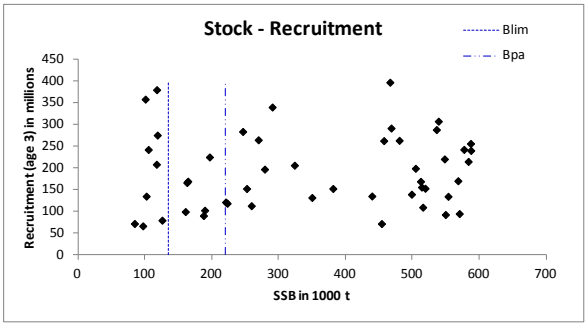
Comparison with previous assessment and advice

The current estimate of SSB for 2011 is consistent with the previous assessment.

The basis for the advice is the same as last year.

Sources

ICES. 2010. Report of the Benchmark Workshop on Roundfish (WKROUND), 9–16 February 2010, Copenhagen, Denmark. ICES CM 2010/ACOM: 36. 183 pp.
ICES. 2011a. Report of the Arctic Fisheries Working Group, 28 April–4 May 2011. ICES CM 2011/ACOM:05.
ICES. 2011b. Cod in Subareas I and II (Norwegian coastal waters cod). Report of the ICES Advisory Committee, 2010. ICES Advice, 2010. Book 3, Section 3.4.2.
ICES. 2011c. Golden Redfish (*Sebastes marinus*) in Subareas I and II. Report of the ICES Advisory Committee, 2010. ICES Advice, 2010. Book 3, Section 3.4.6.
ICES. 2012. Report of the Arctic Fisheries Working Group, 20 April–26 April 2012. ICES CM 2011/ACOM:05.



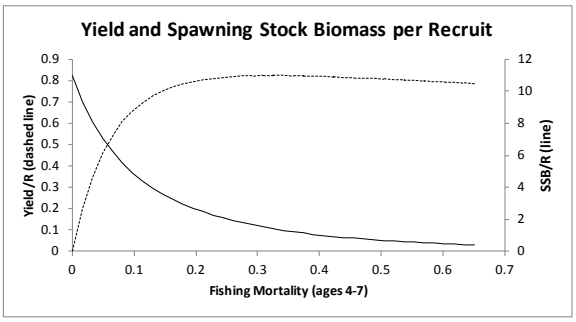


Figure 3.4.4.3 Saithe in Subareas I and II (Northeast Arctic). Stock–recruitment plot and yield-per-recruit analysis.

Table 3.4.4.1 Saithe in Subareas I and II (Northeast Arctic). ICES advice, management, and landings.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[2]	Official landings	ICES landings
1987	No increase in F; TAC; protect juveniles	90	-	92	92
1988	No increase in F	< 83	-	114	114
1989	*Status quo* F; TAC	120	120	123	123
1990	$F \leq F_{med}$; TAC	93	103	96	96
1991	F at F_{low}; TAC	90	100	107	107
1992	Within safe biological limits	115	115	128	128
1993	Within safe biological limits	132[1]	132	155	155
1994	No increase in F	158[1]	145	147	147
1995	No increase in F	221[1]	165	168	168
1996	No increase in F	158[1]	163	171	171
1997	Reduction of F to F_{med} or below	107	125	144	144
1998	Reduction of F to F_{med} or below	117	145[3]	153	153
1999	Reduce F below F_{pa}	87	144[4]	150	150
2000	Reduce F below F_{pa}	89	125[5]	136	136
2001	Reduce F below F_{pa}	<115	135	136	136
2002	Maintain F below F_{pa}	< 152	162[6]	155	155
2003	Maintain F below F_{pa}	< 168	164	162	162
2004	Maintain F below F_{pa}	< 186	169	165	165
2005	Take account of *Sebastes marinus* bycatch. Maintain F below F_{pa}	< 215	215	179	179
2006	Take account of *Sebastes marinus* bycatch. Maintain F below F_{pa}	< 202	193.5	213	213
2007	Take account of *Sebastes marinus* bycatch. Maintain F below F_{pa}	< 247	222.525	199	199
2008	Take account of *Sebastes marinus* bycatch. Maintain F below F_{hcr}	< 247	< 247	185	185
2009	Take account of *Sebastes marinus* bycatch. Apply management plan	< 225	225	162	162
2010	Take account of *Sebastes marinus* bycatch. Apply management plan	< 204	204	195	195
2011	Take account of *Sebastes marinus* bycatch. Apply management plan	< 173	173	157	157
2012	Take account of coastal cod and *Sebastes marinus* bycatch. Apply management plan.	< 164	164		
2013	Take account of coastal cod and *Sebastes marinus* bycatch. Apply management plan.	< 164			

Weights in thousand tonnes.
[1] Predicted catch at *status quo* F.
[2] Set by Norwegian authorities. TAC for Russian EEZ is not included.
[3] TAC first set at 125 000 t, then increased in May 1998 after an intersessional assessment.
[4] TAC set after an intersessional assessment in December 1998.
[5] TAC set after an intersessional assessment in December 1999.
[6] TAC first set at 152 000 t, then increased in June 2003 after the spring 2002 assessment.

Table 3.4.4.2 Saithe in Subareas I and II (Northeast Arctic). Nominal catch (t) by countries as officially reported to ICES.

Nominal catch (t) by countries as officially reported to ICES.

Year	Faroe Islands	France	Germany Dem.Rep	Fed.Rep. Germany	Iceland	Norway	Poland	Portugal	Russia[3]	Spain	UK	Others[5]	Total all countries
1960	23	1 700		25 948		96 050					9 780	14	133 515
1961	61	3 625		19 757		77 875					4 595	18	105 951
1962	2	544		12 651		101 895			912		4 699	4	120 707
1963		1 110		8 108		135 297					4 112		148 627
1964		1 525		4 420		184 700			84		6 511	186	197 426
1965		1 618		11 387		165 531			137		6 741	181	185 600
1966		2 987	813	11 269		175 037			563		13 078	41	203 788
1967		9 472	304	11 822		150 860			441		8 379	48	181 326
1968			70	4 753		96 641					8 781		110 247
1969	20	193	6 744	4 355		115 140					13 585	23	140 060
1970	1 097		29 362	23 466		151 759			43 550		15 469		264 924
1971	215	14 536	16 840	12 204		128 499	6 017		39 397	13 097	10 361		241 272
1972	109	14 519	7 474	24 595		143 775	1 111		1 278	13 125	8 223		214 334
1973	7	11320	12 015	30 338		148 789	23		2 411	2 115	6 841		213 859
1974	46	7119	29 466	33 155		152 699	2521		28 931	7 075	3 104	5	264 121
1975	28	3156	28 517	41 260		122 598	3860	6430	13 389	11 397	2 763	55	233 453
1976	20	5609	10 266	49 056		131 675	3164	7233	9 013	21 661	4 724	65	242 486
1977	270	5658	7 164	19 985		139 705	1	783	989	1 327	6 935		182 817
1978	809	4345	6 484	19 190		121 069	35	203	381	121	2 827		155 464
1979	1117	2601	2 435	15 323		141 346			3	685	1 170		164 680
1980	532	1016		12 511		128 878			43	780	794		144 554
1981	236	218		8 431		166 139			121		395		175 540
1982	339	82		7 224		159 643			14		732		168 034
1983	539	418		4 933		149 556			206	33	1 251		156 936
1984	503	431	6	4 532		152 818			161		335		158 786
1985	490	657	11	1 873		103 899			51		202		107 183
1986	426	308		3 470		63 090			27		75		67 396
1987	712	576		4 909		85 710			426		57	1	92 391
1988	441	411		4 574		108 244			130		442		114 242
1989	388	460 [2]		606		119 625			506	506	726		122 817
1990	1207	340 [2]		1 143		92 397			52		709		95 848
1991	963	77 [2]	**Greenland**	2 003		103 283			504 [4]		492	5	107 327
1992	165	1980	734	3 451		119 763			964	6	541		127 604
1993	31	566	78	3 687	3	140 604		1	9 509	4 [2]	415	5 [2]	154 903
1994	67 [2]	557	15	1 863	4 [2]	141 589		1 [2]	1 640 [2]	655 [2]	557	2	146 950
1995	172 [2]	358	53	935		165 001		5	1 148		688	18	168 378
1996	248 [2]	346	165	2 615		166 045		24	1 159	6	707	33	171 348
1997	193 [2]	560	363 [2]	2 915		136 927		12	1 774	41	799	45	143 629
1998	366	932	437 [2]	2 936		144 103		47	3 836	275	355	40	153 327
1999	181	638 [2]	655 [2]	2 473	146	141 941		17	3 929	24	339	32	150 375
2000	224 [2]	1438	651 [2]	2 573	33	125 932		46	4 452	117	454	8 [2]	135 928
2001	537	1279	701 [2]	2 690	57	124 928		75	4 951	119	514	2	135 853
2002	788	1048	1393	2 642	78	142 941		118	5 402	37	420	3	154 870
2003	2056	1022	929 [2]	2 763	80 [2]	150 400		147	3 894	18	265	18 [2]	161 592
2004	3071	255	891 [2]	2 161	319	147 975		127	9 192	87	544	14	164 636
2005	3152	447	817 [2]	2 048	395	162 338		354	8 362	25	630		178 568
2006	1795	899	786 [2]	2 779	255	195 462	89	339 [2]	9 823	21 [2]	532	42	212 822
2007	2048	966	810 [2]	3 019	219	178 644	99	412	12 168	53 [2]	558	12	199 008
2008	2314	1009	503 [2]	2 263	113	165 998	66	348	11 577	33	506	10	184 740
2009	1611 [2]	326	697	2 021	69	144 570	30	204 [2]	11 899	2 [2]	379	45 [2]	161 853
2010	1632	677	954	1 592	109 [2]	174 544	279	93	14 664	8	283	2 [2]	194 837
2011 [1]	112	357	445	1 371	110	143 252		43	10 007	2 [2]	972	15	156 686

1 Provisional figures.

2 As reported to Norwegian authorities.

3 USSR prior to 1991.

4 Includes Estonia.

5 Includes Denmark,Netherlands, Ireland and Sweden

6 As reported by Working Group members

Table 3.4.4.3 Saithe in Subareas I and II (Northeast Arctic). Assessment summary.

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4–7
1960	92382	539004	133515	0.315
1961	104182	570302	105951	0.242
1962	203732	536072	120707	0.250
1963	307190	498806	148627	0.274
1964	95252	504704	197426	0.310
1965	287982	513878	185600	0.268
1966	139613	468328	203788	0.351
1967	199107	480490	181326	0.288
1968	156042	457349	110247	0.150
1969	291446	519126	140060	0.164
1970	263215	583641	264924	0.341
1971	262608	549539	241272	0.295
1972	153304	568220	214334	0.275
1973	214898	587140	213859	0.300
1974	93077	548068	264121	0.510
1975	170518	439590	233453	0.424
1976	256069	323825	242486	0.506
1977	220593	259383	182817	0.433
1978	135546	246457	155464	0.456
1979	206194	221057	164680	0.593
1980	113271	189652	144554	0.505
1981	283643	187844	175540	0.537
1982	121615	160760	168034	0.595
1983	102847	196833	156936	0.610
1984	90673	164444	158786	0.662
1985	99780	125880	107183	0.535
1986	225093	97133	67396	0.473
1987	169531	84694	92391	0.532
1988	80036	105373	114242	0.580
1989	67032	117873	122817	0.587
1990	72454	118864	95848	0.543
1991	242239	117525	107327	0.441
1992	379449	100832	127604	0.593
1993	275340	102283	154903	0.492
1994	208334	163026	146950	0.515
1995	357793	223290	168378	0.419
1996	135206	269802	171348	0.343
1997	166453	252383	143629	0.273
1998	118881	279192	153327	0.265
1999	264486	290589	150375	0.289
2000	152720	349961	135928	0.195
2001	197163	381287	135853	0.202
2002	339679	466516	154870	0.210
2003	132172	454004	161592	0.179
2004	152800	515685	164636	0.167
2005	396629	587497	178568	0.188
2006	72303	553524	212822	0.240
2007	109848	577136	199008	0.233
2008	240154	512341	184740	0.260
2009	134796	413820	161853	0.257
2010	242458	383279	194837	0.368
2011	169149	351241	156686	0.351
2012	169149	314684		
Average	187474	351400	162954	0.373

Annex 3.4.4 Implemented management strategy for saithe in Subareas I and II

The harvest control rule as 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_{pa}. 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_{pa} 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.*