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

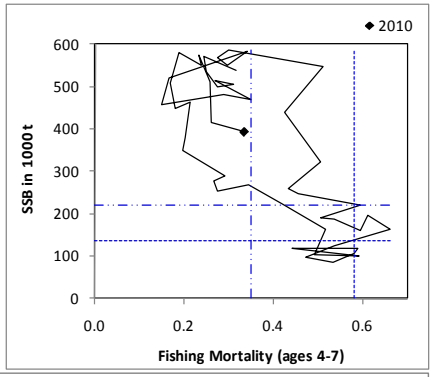
Advice for 2012

ICES advises on the basis of the management plan implemented by the Norwegian Ministry of Fisheries and Coastal Affairs that catches in 2012 should be no more than 164 000 t. Bycatches of coastal cod and *S. marinus* should be kept as low as possible.

Stock status

F (Fishing Mortality)	2008	2009	**2010**	
MSY (F_{MSY})	?	?	?	Undefined
Precautionary approach (F_{pa},F_{lim})	✓	✓	✓	Harvested sustainably
Management plan (F_{MP})	✓	✓	✓	Below target

SSB (Spawning-Stock Biomass)	2009	2010	**2011**	
MSY ($B_{trigger}$)	?	?	?	Undefined
Precautionary approach (B_{pa},B_{lim})	✓	✓	✓	Full reproductive capacity
Management plan (SSB_{MP})	✓	✓	✓	Above trigger



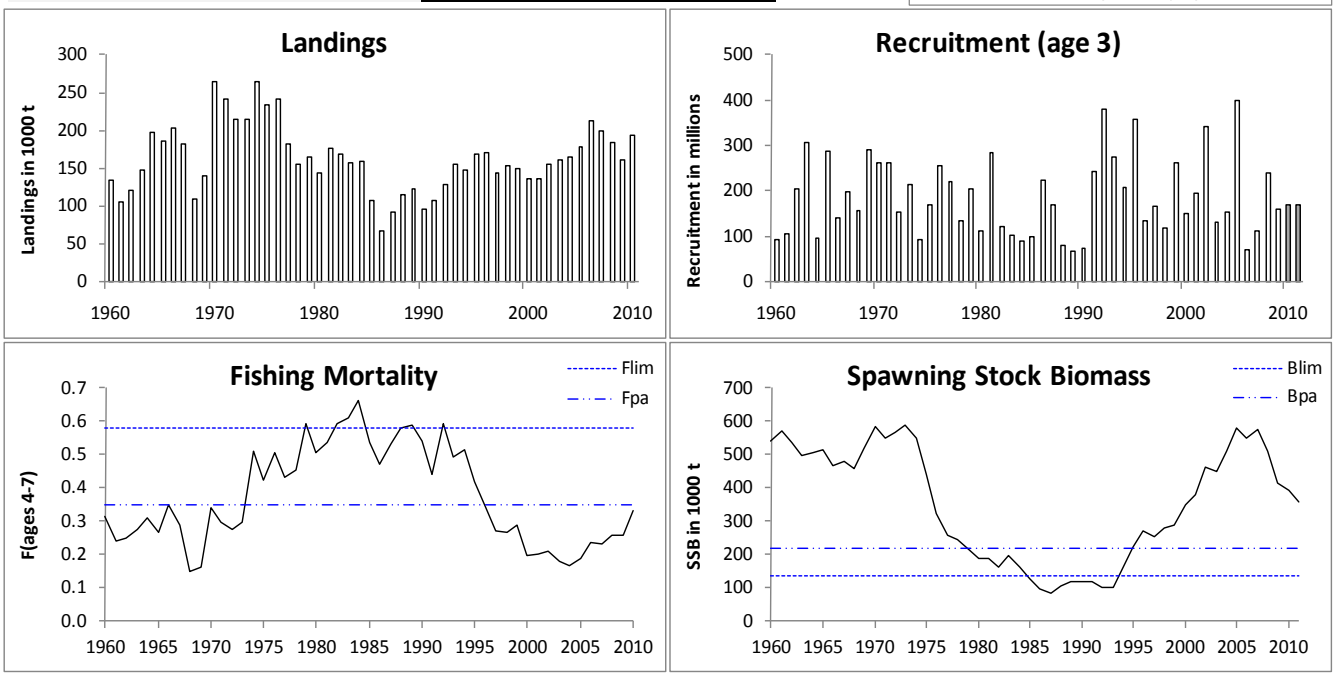


Figure 3.4.4.1 Saithe in Subareas I and II (Northeast Arctic). Summary of stock assessment (weights in '000 tonnes, recruitment estimates are shown in grey). Top right: SSB and F over the years.

Since 1995, SSB has been well above B_{pa} and has decreased in recent years. Fishing mortality has been well below F_{pa} since 1996, but has increased after 2005. The 2005 year class is above average, the 2006 year class is estimated to be below average, while the 2007 year class so far seems to be above 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 Harvest Control Rule 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 when 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 emigration of young saithe from the western part of the Norwegian coast to the North Sea and of older saithe from more northern areas to Iceland and the Faroe Islands. There are few examples of immigration to the Norwegian coast.

Environmental influence on the stock

There have been variations in distribution and migration patterns over the years, but no link with environmental parameters has been established.

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 all year around. Coastal cod and *S. marinus* are caught as bycatch in some of the saithe fisheries (ICES, 2011b,c).

Catch by fleet	Total catch (2010) = 193 kt, where 193 kt are landings (46% trawl, 28% purse-seine, 19% gillnet, and 7% other gear types).

Quality considerations

The biological sampling from some vessel groups decreased considerably and may have become critically low after the termination of the Norwegian harbour sampling program in mid-2009, e.g. for all gears in the Lofoten area and for purse seine and handline in all areas in 2010. Following the 2010 benchmark the retrospective pattern of the assessment has been less severe.

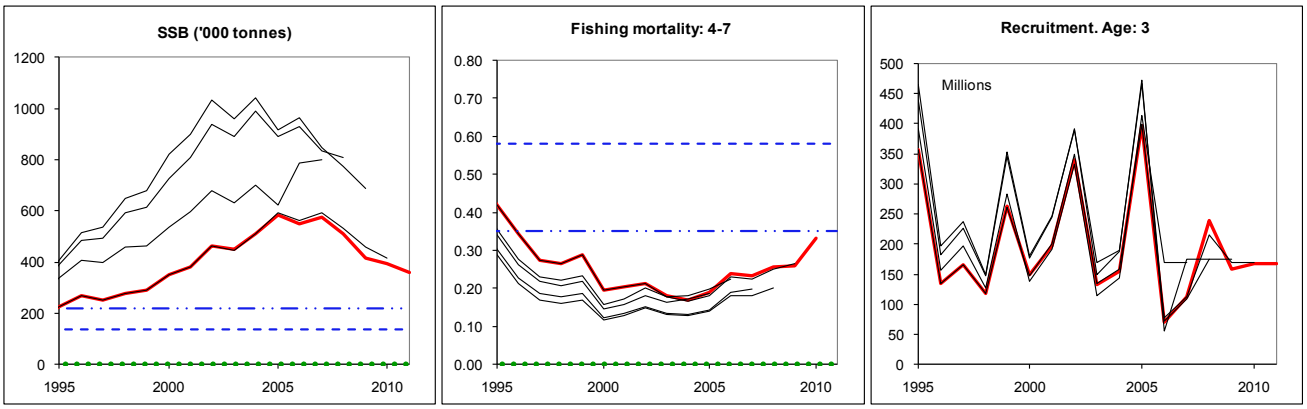


Figure 3.4.4.2 Saithe in Subareas I and II (Northeast Arctic). Historical assessment results (final year recruitment estimates included).

Scientific basis

Assessment type	XSA with a 3–15+ catch matrix, tuning time-series broken in 2002, reduced shrinkage (S.E. of the mean to which estimates are shrunk increased from 0.5 to 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.
Discards and bycatch	Discards are not accounted for.
Indicators	None.
Other information	Benchmark was done in 2010 (WKROUND, 2010).
Working group report	AFWG

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

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: 2011)

Yield and spawning biomass per Recruit F-reference points (2011):

	Fish Mort Ages 4–7	Yield/R	SSB/R
Average last 3 years	0.28	0.83	1.68
F_{max} [*]	-	-	-
$F_{0.1}$	0.10	0.71	4.55
F_{med}	0.26	0.83	1.82
$F_{35\%SPR}$	0.12	0.75	3.90

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

Outlook for 2012

Basis: F_{2011} = TAC constraint = 0.31[1)]; Landings (2011) = 173; SSB (2012) = 313; R (2011–2013) = geometric mean (1960–2009) = 168 millions.

Rationale	**Landings (2012)**	**Basis**	**F (2012)**	**SSB (2013)**	**%SSB change [2)]**	**%TAC change [3)]**
Management plan [4)]	164	F_{MP}	0.32	280	-11	-5
Precautionary approach	178	F_{pa}	0.35	270	-14	+3
Zero catch	0	F=0	0	403	+29	-100
Status quo	80	F_{sq} * 0.5	0.14	343	+10	-53
	149	F_{sq} * 1.0	0.28	291	-7	-14
	178	F_{sq} * 1.25	0.35	270	-14	+3

Weights in '000 t.
[1)]It is assumed that the TAC will be implemented and that the landings in 2011 will correspond to the TAC.
[2)] SSB 2013 relative to SSB 2012.
[3)] TAC 2012 relative to TAC 2011.
[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 2012. The SSB is expected to decrease by 11% in 2012 and to remain above B_{pa} at the beginning of 2013.

The objectives of the HCR are to maintain high long-term yield, year-to-year stability, and full utilization of all available information on the stock dynamics. The plan aims to maintain target F at F_{pa} = 0.35 and minimize between-year TAC change to ± 15%, unless SSB falls below B_{pa} in which case the fishing mortality should be reduced linearly from F_{pa} at SSB=B_{pa} to 0 at SSB=0.

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 could be considered as a basis for changing the harvest control rule.

PA approach

The fishing mortality in 2012 should be no more than F_{pa}, corresponding to landings of less than 178 000 t in 2012. This is expected to keep SSB above B_{pa} in 2013.

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 which acquire fishing rights by quota swaps with Norway. In addition, Russia sets a small quota for the Russian zone. ICES considers that its advice applies to all catches of Northeast Arctic saithe. Russian catches account for around 5%.

Preliminary long-term stochastic simulations suggest that F_{MSY} could be lower than the current F_{MP}.

Regulations and their effects

TAC regulations are in place for this stock. Norway and Russia have set national measures applicable to their EEZ. Since 2007 the catch has been less than the TAC. However, in 2010 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 being 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 discarding.

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

Discarding is illegal, but is known to occur in some fisheries. No estimates of discarding are available for assessment.

The biological sampling of some vessel groups may have become critically low after the termination of the Norwegian harbour sampling programme in mid-2009.

Comparison with previous assessment and advice

The current estimates of SSB for 2010 and the F for 2009 are 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.

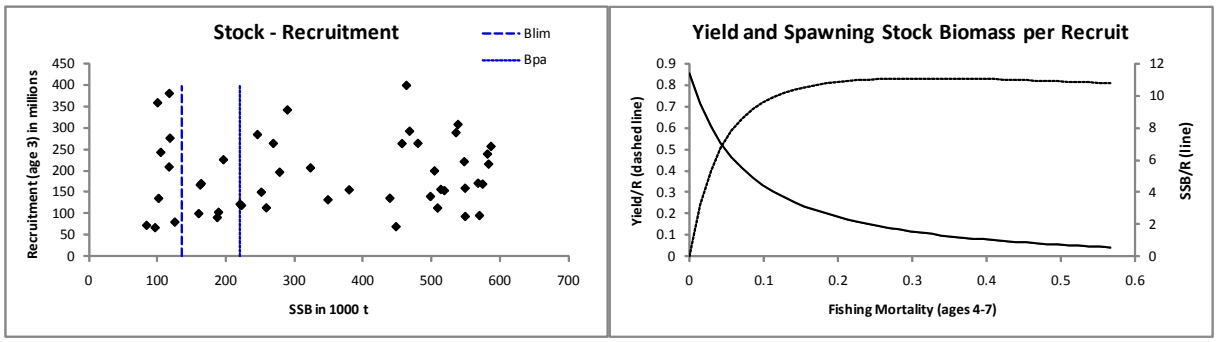


Figure 3.4.4.3 Saithe in Subareas I and II (Northeast Arctic). Stock–recruitment plot and yield-per-recruit analysis.

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	212	212
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 1
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	193	193
2011	Take account of *Sebastes marinus* bycatch. Apply management plan	< 173	173		
2012	Take account of coastal cod and *Sebastes marinus* bycatch. Apply management plan.	< 164			

Weights in '000 t.

[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.

Year	Faroe Islands	France	Germany Dem.Rep	Fed.Rep. Germany	Iceland	Norway	Pol and	Portugal	Russia[3]	Spain	UK	Other[5]	Total all countries
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	326	697	2 021	69	144 570	30	204 [2]	11 899	2 [2]	379	45 [2]	161 853
2010 [1]	817 [2]	678	956 [2]	1 559 [2]	109 [2]	173 971	251 [2]	99 [2]	14 664	8 [2]	283	4 [2]	193 399

1 Provisional figures.

2 As reported to Norwegian authorities.

3 USSR prior to 1991.

4 Includes Estonia.

5 Includes Denmark,Netherlands, Ireland and Sweden.

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	0.3148
1961	104182	570302	105951	0.2421
1962	203732	536072	120707	0.2503
1963	307190	498806	148627	0.2737
1964	95252	504704	197426	0.3101
1965	287982	513878	185600	0.2680
1966	139613	468328	203788	0.3505
1967	199107	480490	181326	0.2876
1968	156042	457349	110247	0.1500
1969	291446	519126	140060	0.1644
1970	263215	583641	264924	0.3407
1971	262608	549539	241272	0.2954
1972	153304	568220	214334	0.2747
1973	214898	587140	213859	0.2985
1974	93077	548068	264121	0.5102
1975	170518	439590	233453	0.4235
1976	256069	323825	242486	0.5062
1977	220593	259383	182817	0.4330
1978	135546	246457	155464	0.4561
1979	206194	221057	164680	0.5930
1980	113271	189652	144554	0.5049
1981	283643	187843	175540	0.5367
1982	121615	160760	168034	0.5945
1983	102847	196833	156936	0.6101
1984	90673	164444	158786	0.6617
1985	99780	125880	107183	0.5352
1986	225093	97133	67396	0.4729
1987	169531	84693	92391	0.5324
1988	80035	105371	114242	0.5793
1989	67026	117871	122817	0.5873
1990	72449	118862	95848	0.5425
1991	242213	117520	107327	0.4413
1992	379341	100820	127604	0.5927
1993	275265	102259	154903	0.4917
1994	208260	162961	146950	0.5152
1995	357604	223147	168378	0.4191
1996	135152	269576	171348	0.3429
1997	166302	252099	143629	0.2730
1998	118608	278808	153327	0.2655
1999	262946	290121	150375	0.2895
2000	149548	349261	135928	0.1957
2001	196047	380190	135853	0.2030
2002	340904	463790	154870	0.2124
2003	131912	448564	161592	0.1803
2004	155028	509233	164636	0.1690
2005	397982	581916	178568	0.1881
2006	69368	549331	212822	0.2387
2007	112763	574923	199008	0.2317
2008	238313	511528	184740	0.2574
2009	158868	415311	161853	0.2596
2010	168349	393155	193399	0.3330
2011	168349	358114		
Average	186770	351864	163049	0.3726

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.*