

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

Advice summary for 2011

Cautiously avoid impaired recruitment and achieve other objective(s) of a **management plan** (e.g., catch stability) ICES advises that landings should be less than 173 kt. The basis for the advice is the Norwegian Management Plan (HCR).

Stock status

Spawning Stock Biomass (SSB)	2008	2009	2010
MSY $B_{trigger}$	not defined		
B_{PA}/B_{lim}	above	above	above
Fishing mortality	2007	2008	2009
F_{MSY}	not defined		
F_{PA}/F_{lim}	below	below	below

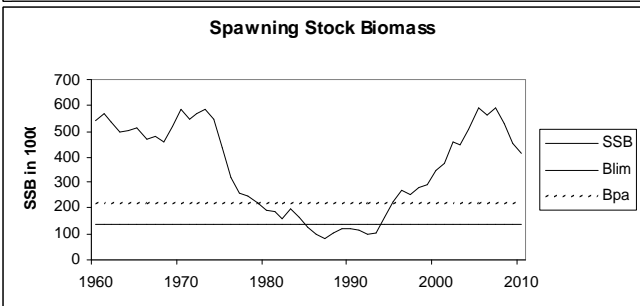
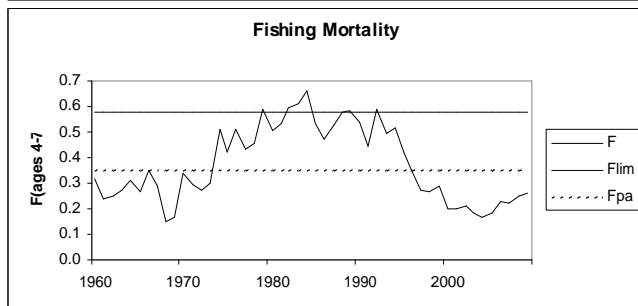
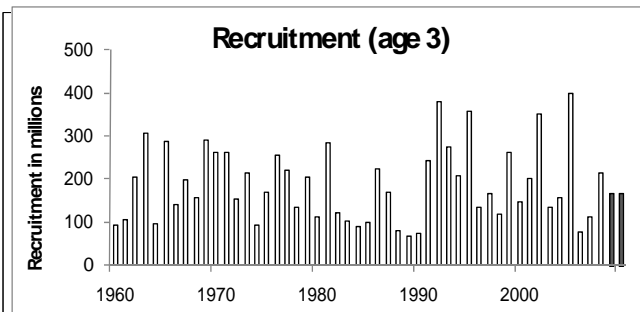
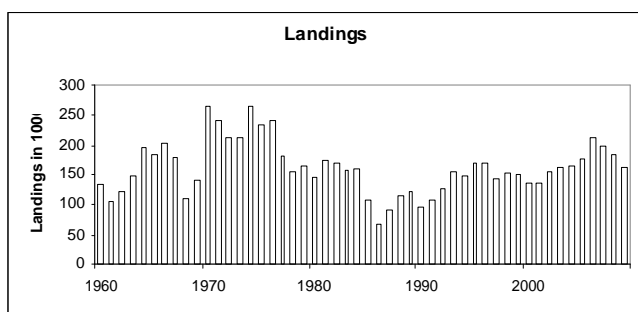
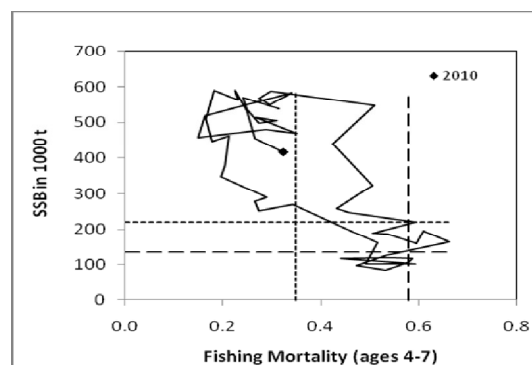


Figure 3.4.4.1 Saithe in Subareas I and II (Northeast Arctic). Summary of stock assessment (weights in '000 tonnes). Top right: SSB and F over the years.

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. The 2002 year class was the highest in the time-series, the 2003 and 2004 were among the lowest, while the 2005 year class is estimated to be around average.

Management plans

The Norwegian Ministry of Fisheries and Coastal Affairs implemented a harvest control rule (HCR) in autumn 2007 (see Annex). The HCR has the objectives of maintaining 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 $\pm 15\%$, 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 $SSB=0$.

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 an implementation error (difference between TAC and catch) equal to the historical level of 3% is included.

Biology

Saithe in Subareas I and II is an important predator on other species in the ecosystem, notably young herring and haddock and Norway pout.

Saithe is a typical migrating fish and makes both feeding and spawning migrations. Tagging experiments show migrations between the stocks. 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 recruitment of saithe may suffer in years with reduced inflow of Atlantic water.

The fisheries

Norway accounts for more than 90% of the landings. Over the last ten years about 40% of the Norwegian catch originates from bottom trawl, 25% from purse seine, 20% from gill net and 15% from other conventional gears (long line, Danish sine and hand line). The gill net fishery is most intense during winter, purse seine in the summer months while the trawl fishery takes place more evenly all year around.

Catch by fleet	Total catch (2009) 161 kt where 161 kt landings (50% trawl, 22% purse seine, 20% gill net and 7% other gear-types)
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Quality considerations

Lack of reliable recruitment estimates is a major problem.

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

Maturity estimates are not weighted by stock abundance and probably results in biased estimates of maturity ogive.

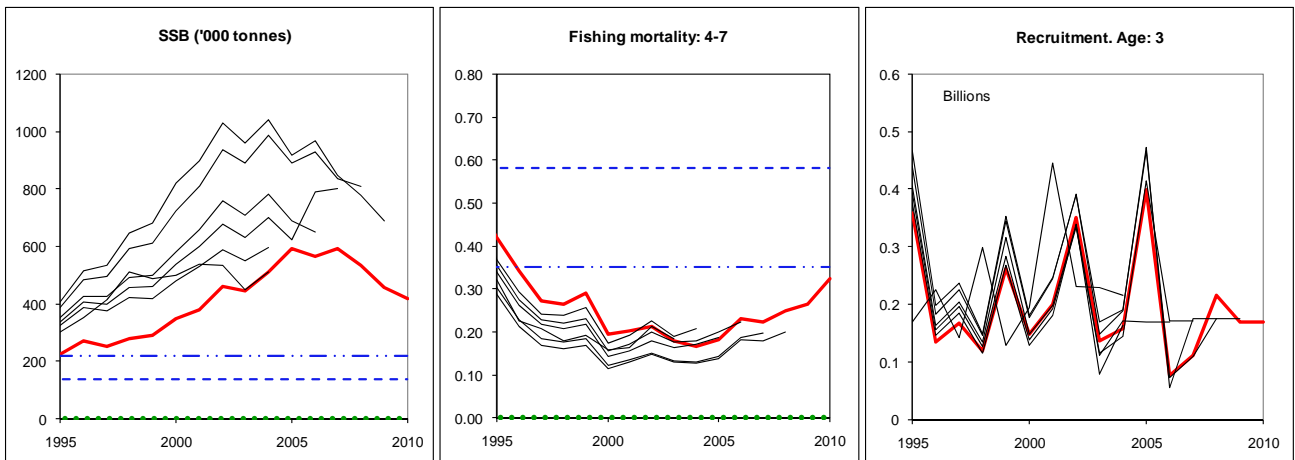


Figure 3.4.4.2 Northeast Arctic saithe (Subareas I and II). Historical assessment results (final year recruitment estimates included).

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 the estimate are shrunk increased from 0.5 to 1.5) and no tapered time weighting.
Input data	2 tuning fleets CPUE data from the Norwegian trawl fisheries Indices from the Norwegian acoustic survey
Discards and by-catch	No discards are not accounted for
Indicators	None
Other information	Benchmark was done in 2010
Working group report	AFWG

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

Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY B_{trigger}	not defined	
	F_{MSY}	not defined	
Precautionary Approach	B_{lim}	136 000 t	$B_{\text{lim}} * \exp(1.645 * \sigma)$, where $\sigma=0.3$ copy last year's report
	B_{pa}	220 000 t	F corresponding to an equilibrium stock = B_{lim}
	F_{lim}	0.58	$F_{\text{lim}} * \exp(-1.645 * \sigma)$, where $\sigma=0.3$. This value is considered to have a 95% probability of avoiding the F_{lim}
	F_{pa}	0.35	0.35 in agreed management plan

(unchanged since: 2005)

The LIM (limits) and PA reference points were re-estimated at the 2010 AFWG. The results were not very much different from the previous analyses therefore the same values (in 2005) were adopted.

No attempts were made to set MSY reference points (F_{MSY} and MSY B_{trigger}).

Yield and spawning biomass per Recruit

F-reference points (2010):

	Fish Mort Ages 4-7	Yield/R	SSB/R
Average last 3 years	0.25	0.84	2.18
Fmax[*]			
F0.1	0.08	0.71	5.27
Fmed	0.30	0.85	1.82
F35%SPR	0.11		

[*] Fmax is not well-defined.

Outlook for 2011

Basis: $F_{2010} = \text{TAC constraint} = 0.32^{1)}$; Landings (2010) = 204; SSB (2011) = 357; R (2011-2013) = geometric mean (1960-2008) = 169;

Rationale	Landings (2011)	Basis	F (2011)	SSB (2012)	%SSB change ²⁾	%TAC change ³⁾
MSY framework		Not defined				
MSY transition		Not defined				
Management plan	173	Fman plan	0.31	324	-9	-15
Precautionary approach	191	F_{pa}	0.35	310	-13	-6
Zero catch	0	F=0	0	471	+32	-100
F status quo	143	$F_{\text{sq}} * 1.0$	0.25	349	-2	-30

Weights in '000 t.

¹⁾ It is assumed that the TAC will be implemented and that the landings in 2010 therefore correspond to the TAC.

²⁾ SSB 2012 relative to SSB 2011.

³⁾ TAC 2011 relative to TAC 2010.

MSY approach

For saithe, MSY information can be derived from simulations done during the evaluation of whether the HCR for these stocks are precautionary (see AFWG 2007). The highest long-term yield was then obtained for an exploitation level of 0.32, i.e. a little below F_{pa} , and ICES then recommended using a lower value than F_{pa} in the HCR. However the basis for the simulations needs to be revised according to the revision of the time series for this stock, before any MSY reference points for advisory use are calculated. Work is in progress to evaluate the current management plan in relation to the MSY framework.

PA approach

The fishing mortality in 2011 should be no more than F_{pa} corresponding to landings of less than 191 kt in 2011. This is expected to keep SSB above B_{pa} in 2012.

Management plan

Following the agreed client management plan implies a TAC of 173 000 t in 2011. The SSB is expected to decrease by 9% in 2011 and to remain above B_{pa} at the beginning of 2012.

Additional considerations

TAC regulations are in place for this stock. Norway and Russia have set national measures applicable to their EEZ.

The ICES advice is based on a harvest control rule adopted by 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%.

Regulations and their effects

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 size of fish in the catch, 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 size of fish in the catch 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 size of fish in the catch 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 vessels 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 with too much small fish observed during their inspections. A closed area is not opened until it is documented OK by trial fishing within the area by the Surveillance Service.

A preliminary evaluation of the effectiveness of the system up to 1998 shows a clear decrease in the discarding of small cod and haddock. This work should be repeated although the historic good conditions of the stocks indirectly indicate the success of the joint Norwegian-Russian area closure system in the northeast Arctic.

Uncertainties in assessment and forecast

Lack of reliable recruitment estimates is still a major problem. Prediction of catches beyond the TAC year will, to a large extent, be dependent on assumptions of average recruitment.

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

Comparison with previous assessment and advice

The current assessment estimated SSB 34 % lower compared to the previous assessment. The F in 2008 is estimated to be 24 % higher than in the previous assessment, The main reasons for this is that following the benchmark meeting the age span was expanded from 11+ to 15+ and important XSA parameter settings were changed.

Sources

ICES 2007. Report of the Arctic Fisheries Working Group, Vigo, Spain 18-27 April 2007. ICES C.M. 2007/ACFM:16, 651 pp

ICES. 2010. Report of the Arctic Fisheries Working Group, 22-28 April 2010. ICES CM 2010/ACOM:05.

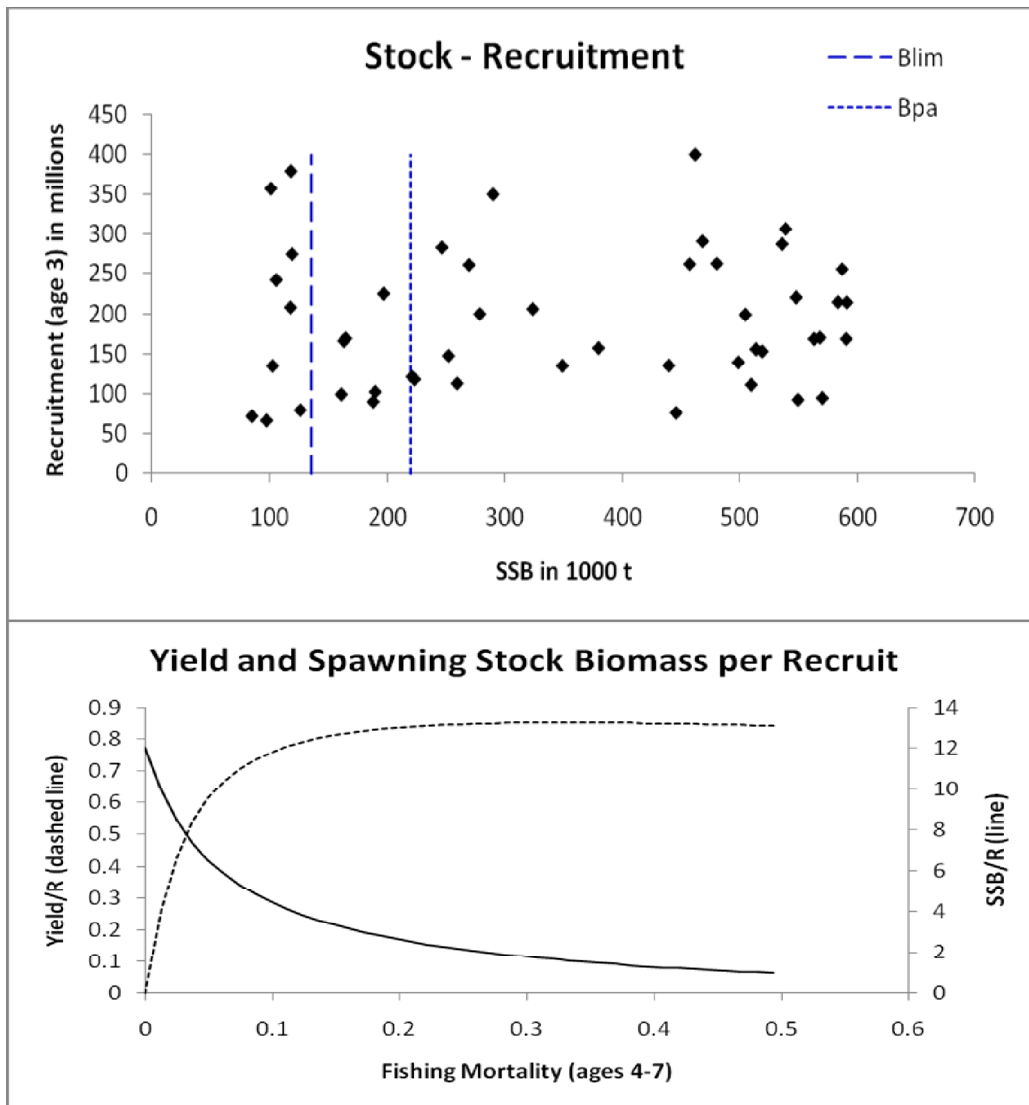


Figure 3.4.4.3 Saithe in Subareas I and II (Northeast Arctic).

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

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted Catch corresp. to single-stock exploitation boundaries	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	<i>Status quo</i> 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 <i>Sebastes marinus</i> by-catch	Maintain F below F_{pa}		< 215	215	179	179
2006	Take account of <i>Sebastes marinus</i> by-catch	Maintain F below F_{pa}		< 202	193.5	212	212
2007	Take account of <i>Sebastes marinus</i> by-catch	Maintain F below F_{pa}		< 247	222.525	199	199
2008	Take account of <i>Sebastes marinus</i> by-catch	Maintain F below F_{hcr}		< 247	< 247	185	185
2009	Take account of <i>Sebastes marinus</i> by-catch	Apply management plan		225	225	161	161
2010	Take account of <i>Sebastes marinus</i> by-catch	Apply management plan		204	204		
2011	Take account of <i>Sebastes marinus</i> by-catch	Apply management plan		173			

Weights in '000 t.

¹ Predicted catch at *status quo* F.

² Set by Norwegian authorities, TAC for Russian EEZ is not included here (11'000 t in 2009).

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 AFWG assessment.

Table 3.4.4.2 **Saithe in Sub-areas 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	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			563		13,078	41	203,788
1967		9,472		304		11,822			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		15,469		264,924
1971	215	14,536		16,840		12,204		6,017	39,397	13,097	10,361		241,272
1972	109	14,519		7,474		24,595		1,111	1,278	13,125	8,223		214,334
1973	7	11,320		12,015		30,338		23	148,789	2,411	2,115		213,859
1974	46	7,119		29,466		33,155		2,521	152,699	28,931	7,075	5	264,121
1975	28	3,156		28,517		41,260		3,860	122,598	38,600	11,397	55	233,453
1976	20	5,609		10,266		49,056		3,164	131,675	9,013	21,661	65	242,486
1977	270	5,658		7,164		19,985		1	139,705	783	989		182,817
1978	809	4,345		6,484		19,190		35	121,069	203	381		155,464
1979	1,117	2,601		2,435		15,323			141,346		3		164,680
1980	532	1,016		12,511		128,878			128,878		43		144,554
1981	236	218		8,431		166,139			166,139		121		175,540
1982	339	82		7,224		159,643			159,643		14		168,034
1983	539	418		4,933		149,556			149,556		206		156,936
1984	503	431		6		4,532			152,818		161		158,786
1985	490	657		11		1,873			103,899		51		107,183
1986	426	308				3,470			63,090		27		67,396
1987	712	576				4,909			85,710		426		92,391
1988	441	411				4,574			108,244		130		114,242
1989	388	460	²			606			119,625		506		122,817
1990	1,207	340	²			1,143			92,397		52		95,848
1991	963	77	²	Greenland		2,003			103,283		504		107,327
1992	165	1,980		734		3,451			119,763		964		127,604
1993	31	566		78		3,687			140,604		6		154,903
1994	67	² 557		15		1,863			141,589		1		146,950
1995	172	² 358		53		935			165,001		5		168,378
1996	248	² 346		165		2,615			166,045		24		171,348
1997	193	² 560		363	²	2,915			136,927		12		143,629
1998	366	932		437	²	2,936			144,103		47		153,327
1999	181	638	²	655	²	2,473			141,941		17		150,375
2000	224	² 1,438		651	²	2,573			125,932		46		135,928
2001	537	1,279		701	²	2,690			124,928		75		135,853
2002	788	1,048		1,393		2,642			142,941		118		154,870
2003	2,056	1,022		929	²	2,763			150,400		147		161,592
2004	3,071	255		891	²	2,161			147,975		127		164,636
2005	3,152	447		817	²	2,048			162,338		354		178,568
2006	1,795	899		786	²	2,779			195,462		89		212,822
2007	2,048	966		810	²	3,019			178,644		99		199,008
2008	2,314	1,009		503	²	2,263			165,998		66		184,740
2009	¹ 1,501	² 323		697	²	2,021			144,338		31		161,462

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).

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	0.268
1966	139613	468328	203788	0.3505
1967	199107	480490	181326	0.2876
1968	156042	457349	110247	0.15
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	0.433
1978	135546	246457	155464	0.4561
1979	206194	221057	164680	0.593
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	80034	105371	114242	0.5793
1989	67025	117871	122817	0.5873
1990	72448	118862	95848	0.5425
1991	242207	117519	107327	0.4413
1992	379322	100818	127604	0.5927
1993	275236	102254	154903	0.4918
1994	208224	162947	146950	0.5153
1995	357521	223117	168378	0.4191
1996	135132	269519	171348	0.343
1997	166255	252018	143629	0.2731
1998	118510	278683	153327	0.2657
1999	261608	289954	150375	0.2896
2000	147875	349011	135928	0.196
2001	200022	379708	135853	0.2038
2002	350218	462083	154870	0.2131
2003	135318	445895	161592	0.1789
2004	157551	509797	164636	0.1662
2005	399644	591192	178568	0.1814
2006	76642	563333	212822	0.2311
2007	111625	590680	199008	0.2243
2008	214493	532694	184740	0.25
2009	168751*	456509	161462	0.2651
2010	168751*	416334		
Average	200348	445125	163759	0.3565

*GM of 1960-2008 recruitment.

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 $\pm 15\%$ 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.