

ECOREGION Iceland and East Greenland
STOCK Saithe in Division Va (Icelandic saithe)

Advice for 2013/2014

ICES advises on the basis of the Icelandic 2013 management plan that the TAC in the fishing year 2013/2014 should be 57 000 t.

Stock status

HR (Harvest Rate)			
	2010	2011	2012
MSY (HR_{MSY})	✓	✓	✓ Appropriate
Precautionary approach (F_{pa}, F_{lim})	?	?	? Undefined
SSB (Spawning-Stock Biomass)			
	2011	2012	2013
MSY ($B_{trigger}$)	✓	✓	✓ Above target
Precautionary approach (B_{lim})	✓	✓	✓ Full reproductive capacity

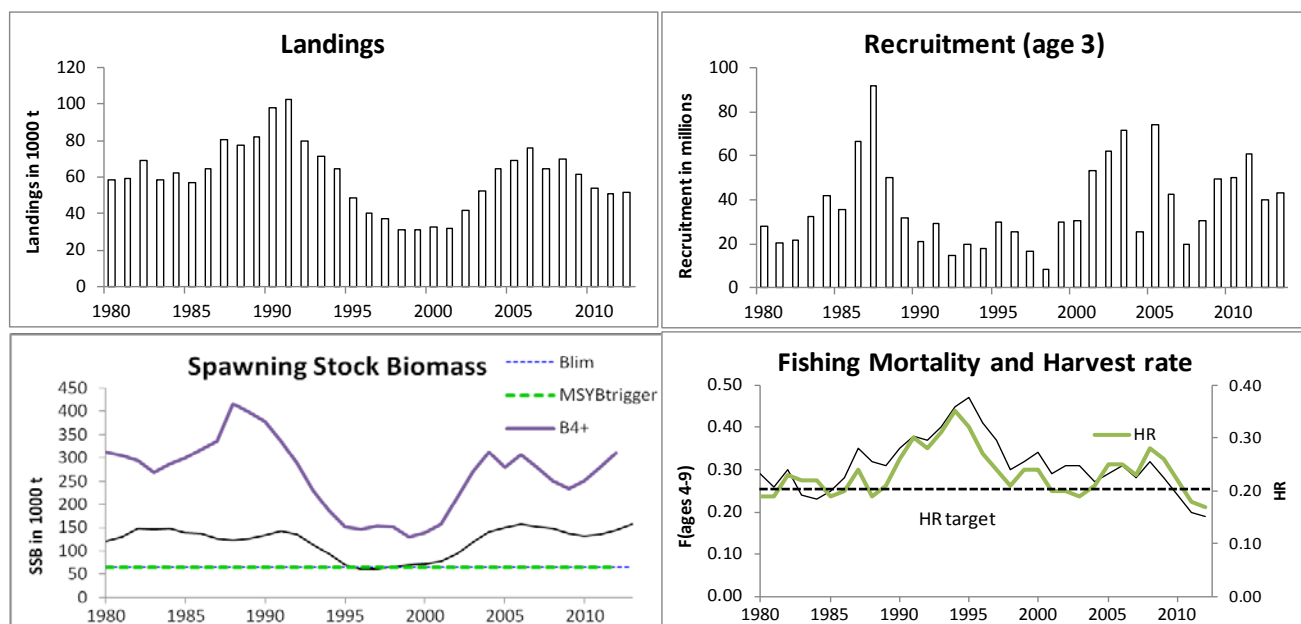
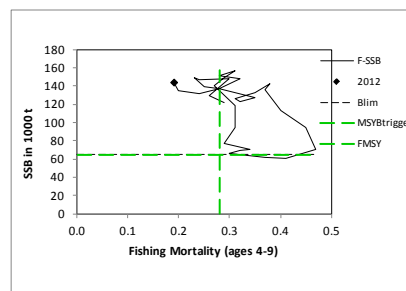


Figure 2.4.14.1 Saithe in Division Va (Icelandic saithe). Summary of stock assessment (weights in thousand tonnes). Top right: SSB/F for the time-series used in the assessment.

The spawning stock of Icelandic saithe has been relatively large in recent years, near the maximum from 1980 to the present, and the harvest rate has declined from 28% to 17% (fishing mortalities 0.32 to 0.19) from 2008 to 2012. Year classes 1998–2000 and 2002 were large, but recruitment since then has been around average.

Management plan

In spring 2013, the Icelandic government adopted a management plan for managing the Icelandic saithe fishery. ICES has evaluated this management plan and concluded that it is in accordance with the precautionary approach and the ICES MSY framework.

Biology

Saithe is a migrating species and makes both vertical and long-distance feeding and spawning migrations (Armannsson *et al.*, 2007; Armannsson and Jonsson 2012; Homrum *et al.*, in press). Evidence from tagging experiments (ICES, 2008) shows some migrations along the Faroe–Iceland Ridge, as well as onto the East Greenland shelf.

Environmental influence on the stock

Icelandic saithe is near the northern boundary of its distribution, and a relatively small part of the stock inhabits the waters off the northern and eastern coasts of Iceland, except in warm years. The fishery and the survey show a more northerly distribution in recent years, possibly because of relative warming in the northern waters. Significant changes in the length- and weight-at-age have been observed in the Icelandic saithe. It is unknown whether these changes are fisheries or environmentally driven.

The fisheries

Saithe are caught in directed saithe fisheries, as well as in mixed demersal fisheries targeting cod. The fishery is regulated by TACs and minimum mesh size in fishing gears.

Catch distribution Total landings in 2012 were 52 kt, where 76% were caught by bottom trawl and 7% by gillnet, with jiggers and Danish seine taking the majority of the rest. 1–2% discards by numbers.

Quality considerations

The assessment of Icelandic saithe is relatively uncertain, due to fluctuations in the spring survey data and irregular changes in the fleet selectivity. The vertical distribution and migrating behaviour of saithe means that the bottom trawl survey does not produce reliable measurements of the stock. There are also indications of time-varying selectivity, so changes in the commercial catch-at-age may not reflect changes in the age distribution of the population. The combination of fluctuating spring survey data and time-varying fleet selectivity leads to high uncertainty in the estimates of current SSB and fishing mortality.

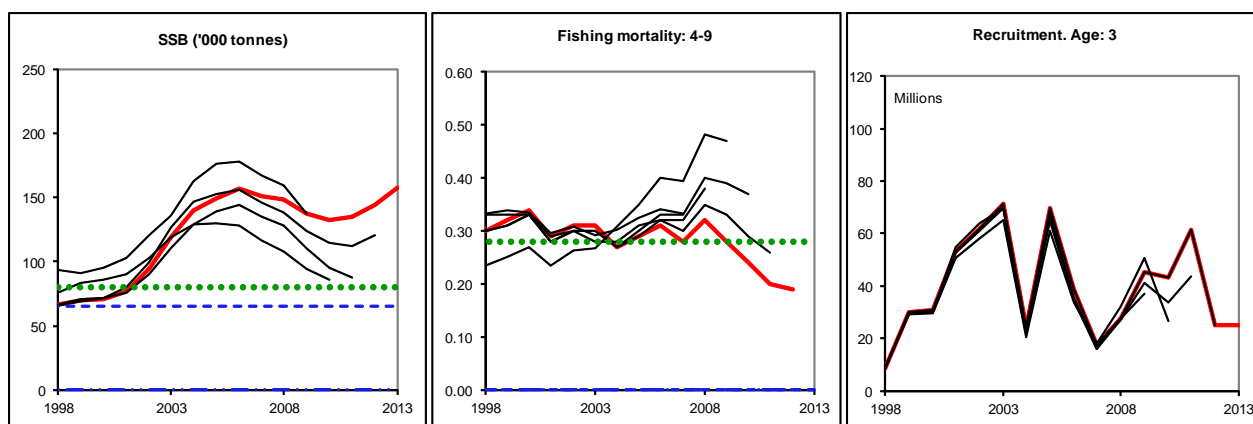


Figure 2.4.14.2 Saithe in Division Va (Icelandic saithe). Historical assessment results (final-year recruitment estimates included).

Scientific basis

Assessment type	Separable statistical catch-at-age model, with changes in selectivity for three different time periods.
Stock data category	Category 1.
Input data	Catch-at-age and spring groundfish survey.
Discards and bycatch	Not included in the assessment, estimated to be very low.
Indicators	None.
Other information	Benchmark performed in 2010, management plan adopted in 2013.
Working group report	NWWG (ICES, 2013).

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Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY $B_{trigger}$	65 000 t.	Stochastic evaluations.
	HR_{MSY}	20%	Stochastic HCR evaluation (SSB 95% of the time over B_{lim}).
Precautionary approach	B_{lim}	61 000 t.	B_{loss} as estimated in 2010.
	B_{pa} , F_{lim} , F_{pa}	Not defined.	
Management plan	HR_{MP}	20%	
	MP $B_{trigger}$	65 000 t.	

(unchanged since 2013)

Reference points from harvest control rule evaluation (Hjorleifsson and Björnsson, 2013).

Outlook for 2014

Basis: $F(2012) = 0.19$; $F(2013) = 0.21$ based on landings 2013 = 55 kt; $SSB(2014) = 173$ kt; $B_{4+}(2014) = 330$ kt; $N_3(2013) = 43$ million from assessment model.

Rationale	Landings (2014)	Basis	F (2014)	SSB (2015)	%SSB change ¹⁾	% TAC change ²⁾
Management plan	57	HCR ³⁾	0.21	181	5	4

Weights in thousand tonnes.

¹⁾ SSB 2015 relative to SSB 2014.

²⁾ Landings 2014 relative to TAC 2013.

³⁾ Average of 0.2 B_{4+} and last year's TAC.

Management plan

The TAC set in year t is valid for the upcoming fishing year, from 1 September in year t to 31 August in year $t+1$.

When $SSB \geq B_{trigger}$, the TAC set in year t equals the average of 0.20 times the current biomass and last year's TAC:

$$TAC_t = 0.5 \times 0.20 B_{t,4+} + 0.5 TAC_{t-1}$$

When SSB is below $B_{trigger}$, the harvest rate is reduced below 0.20:

$$TAC_t = SSB_t / B_{trigger} [(1 - 0.5 SSB_t / B_{trigger}) 0.20 B_{t,4+} + 0.5 TAC_{t-1}]$$

Additional considerations

Information from the fishing industry

Commercial cpue from the most important fleets targeting saithe are available for 20 years or more. However, the potential for bias in commercial cpue (for example hyperstability) is a serious concern for shoaling species such as saithe. Therefore, although these indices have been explored for inclusion in the past, they were not considered in calibrating the present assessment, as they are considered unreliable as an indicator of abundance.

Uncertainties in assessment and forecast

The Icelandic discards monitoring programme has not detected large amounts of discards in the saithe fishery. Excluding discards in the assessment is thus not considered to cause a significant bias in the assessment and the advice.

The assessment is relatively uncertain, due to high variances in survey measurements, a lack of reliable recruitment estimates, and fleet selectivity that changes between years.

The default separable assessment model estimates the reference biomass (B_{4+}) substantially larger than alternative assessment models, indicating that the current estimate is more likely to be an overestimate than an underestimate. The spring survey data indicate rapidly increasing biomass in the most recent years, but the commercial catch-at-age data do not suggest increasing biomass. Overall, the interpretation of the data depends on whether and how fleet selectivity is assumed to vary between years.

When a separable assessment model was adopted in the last benchmark (ICES, 2010), it was not chosen as the most reliable assessment model for this stock, but rather as the most practical model for evaluating the performance of potential harvest control rules (Hjorleifsson and Björnsson, 2013). A third selectivity period was added to the model in 2011, but instead of such arbitrary cutting points, a model with continuous changes in selectivity might be statistically preferable. Each year, several different models are fitted to the saithe data and their results compared, partly to evaluate the overall uncertainty, and partly to evaluate which model might perform best as the main assessment model.

Comparison with previous assessment and advice

In the current assessment, SSB in 2012 is estimated 19% higher and F in 2011 is estimated 23% lower than in last year's assessment. The assessment has become substantially more optimistic for a few years in a row.

The basis for the advice is a management plan that was approved by the Icelandic government in April 2013. Last year's advice was based on the same harvest control rule, although it had not been formally adopted at the time.

Sources

- Armannsson, H., and Jonsson, S. T. 2012. Vertical migrations of saithe (*Pollachius virens*) in Icelandic waters as observed with data storage tags. ICES Journal of Marine Science, 69: 1372–1381.
- Armannsson, H., Jonsson, S. T., Neilson, J. D., and Marteinsdottir, G. 2007. Distribution and migration of saithe (*Pollachius virens*) around Iceland inferred from mark-recapture studies. ICES Journal of Marine Science, 64: 1006–1016.
- Gudmunsson, G. 2013. Fish stock assessment by time series analysis. ICES NWWG 2013, WD 29.
- Hjorleifsson, E., and Björnsson, H. 2013. Evaluation of the Icelandic saithe management plan. ICES CM 2013/ACOM:60.
- Homrum, E. i. (in press). Migration of saithe (*Pollachius virens*) in the Northeast Atlantic. ICES Journal of Marine Science.
- ICES. 2008. Report of the North-Western Working Group (NWWG), 21–29 April 2008. ICES CM 2008/ACOM:03.
- ICES. 2010. Report of the Benchmark Workshop on Roundfish (WKROUND). ICES CM 2010/ACOM:36.
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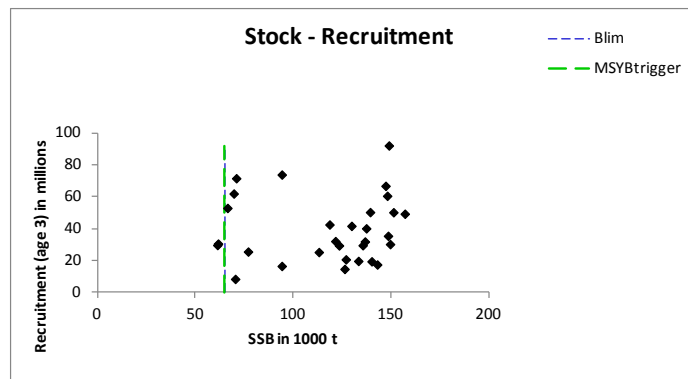


Figure 2.4.14.3 Saithe in Division Va (Icelandic saithe). Stock–recruitment plot.

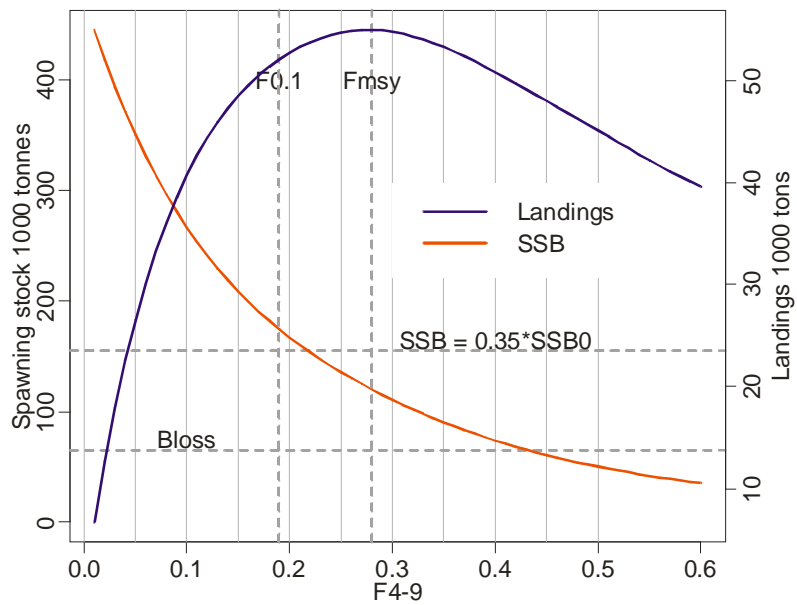


Figure 2.4.14.4 Saithe in Division Va (Icelandic saithe). Yield and SSB as a function of F_{4-9} , based on stochastic simulations from the WKROUND benchmark (ICES, 2010).

Table 2.4.14.1 Saithe in Division Va (Icelandic saithe). ICES advice, management, and catches.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Landings
1987 ¹	TAC	64	70	81
1988 ¹	TAC	64	80	77
1989 ¹	TAC	80	80	82
1990 ¹	TAC	80	90	98
1991 ¹	TAC	87	65	71
1991/92 ²	TAC	70	75 ²	88
1992/93 ²	Marginal gains from increase in F	75 ¹	95 ²	78
1993/94 ²	No measurable gains from increase in F	84 ¹	85 ²	69
1994/95 ²	No measurable gains from increase in F	72 ¹	75 ²	61
1995/96 ²	No measurable gains from increase in F	65 ¹	70 ²	41
1996/97 ²	No measurable gains from increase in F	52 ¹	50 ²	38
1997/98 ²	F below $F_{med} = 0.23$	30	30 ²	33
1998/99 ²	F below 60% of F(97)	28	30 ²	32
1999/00 ²	F below 60% of F(98)	24	30 ²	30
2000/01 ²	F = 70% of F(99)	25	30 ²	32
2001/02 ²	No directed fishing	-	37 ²	36
2002/03 ²	2/3 F_{pa} to rebuild stock	24	45	47
2003/04 ²	No advice		50	56
2004/05 ²	F_{pa}	69	70	71
2005/06 ²	F_{pa}	78	80	78
2006/07 ²	F_{pa}	81	80	66
2007/08 ²	No advice	-	75	68
2008/09 ²	Maintain $SSB > B_{pa}$	< 22	65	62
2009/10 ²	F reduced below 0.22	< 34	50	54
2010/11 ²	F_{MSY}	< 40	50	51
2011/12	F_{MSY}	≤ 45	52	51
2012/13	MSY framework [B-rule]	≤ 49	50	
2013/14	Management plan	57		

Weights in thousand tonnes.

¹Calendar year.²National fishing year ending 31 August.

Table 2.4.14.2

Saithe in Icelandic waters (Division Va). Summary of the assessment. The recruitment column is aligned so that the 2000 cohort is shown in the year 2000, but that cohort size is the estimated R at age 3 in 2003.

	B ₄₊	SSB	Cohort	HR	F ₄₋₉	Y
1980	312	122	32	19%	0.30	58
1981	304	130	42	19%	0.26	59
1982	294	148	36	23%	0.30	69
1983	269	147	67	22%	0.24	58
1984	287	149	92	22%	0.23	63
1985	299	139	50	19%	0.25	57
1986	318	137	32	20%	0.28	65
1987	335	127	21	24%	0.35	81
1988	416	123	29	19%	0.32	77
1989	398	126	15	21%	0.31	82
1990	378	133	20	26%	0.35	98
1991	336	143	18	30%	0.38	102
1992	288	135	30	28%	0.37	80
1993	230	113	25	31%	0.40	72
1994	186	94	17	35%	0.46	64
1995	152	70	9	32%	0.47	49
1996	147	61	30	27%	0.41	40
1997	154	62	31	24%	0.37	37
1998	151	66	53	21%	0.30	32
1999	130	70	62	24%	0.32	31
2000	139	71	72	24%	0.34	33
2001	158	77	26	20%	0.29	32
2002	213	94	74	20%	0.31	42
2003	271	119	43	19%	0.31	52
2004	312	140	20	21%	0.27	65
2005	279	149	30	25%	0.30	69
2006	307	157	49	25%	0.31	76
2007	279	151	50	23%	0.28	64
2008	251	148	61	28%	0.32	70
2009	234	137	40	26%	0.28	61
2010	251	132	43	22%	0.24	54
2011	280	135	32	18%	0.20	51
2012	311	144	34	17%	0.19	52
2013	321	158	34	17%	0.21	55