

Saithe (*Pollachius virens*) in Division 5.a (Iceland grounds)

ICES advice on fishing opportunities

ICES advises that when the Iceland management plan is applied, catches in the fishing year 2018/2019 should be no more than 79 092 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been above $MSY B_{trigger}$ since 1998 and is currently at the time-series maximum. The harvest rate (HR) has declined from 2009 and is presently below HR_{MSY} . Recruitment (R) has been fluctuating and is estimated to be well above the average in every year of the last decade, except 2018. The reference biomass (B_{4+}) has increased since 2015 due to the 2013 year class, which is estimated to be strong.

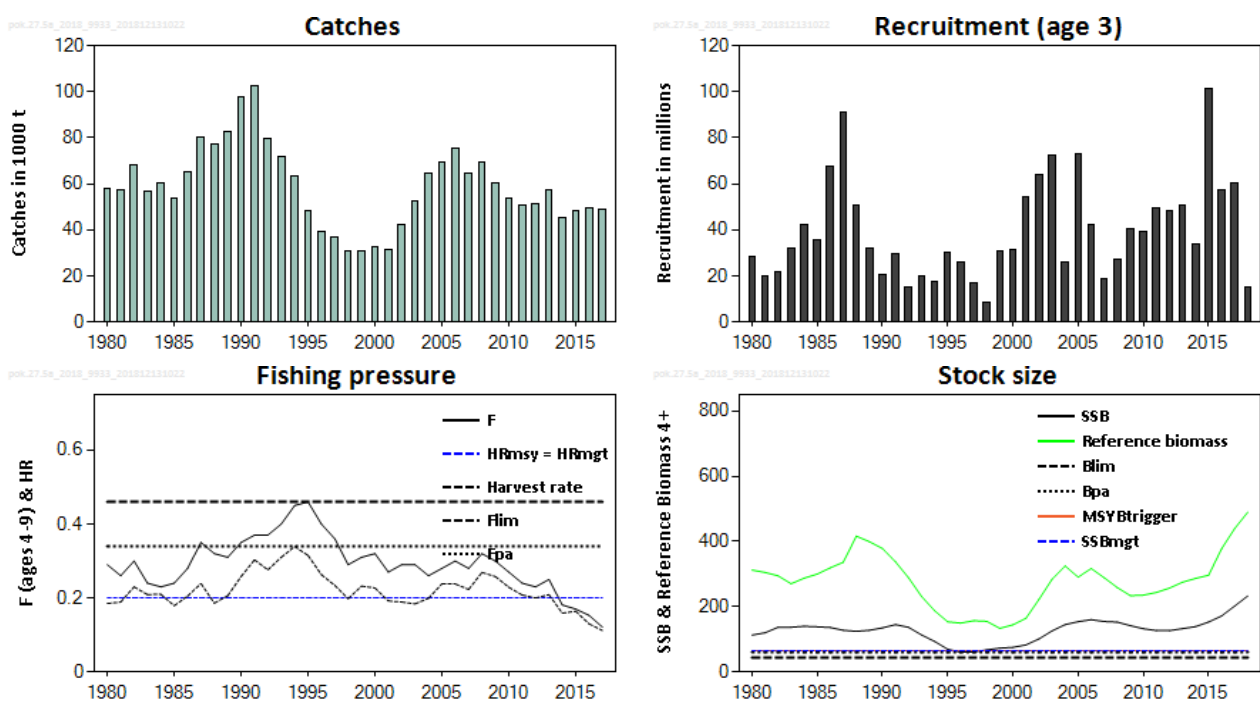


Figure 1[§] Saithe in Division 5.a. Summary of the stock assessment. Harvest rates are calculated based on biomass age 4+. All biomass reference points refer to SSB levels (SSB is shown as black line on the plot). For this stock, $HR_{MGT} = HR_{MSY}$ and $MGT B_{trigger} = MSY B_{trigger}$.

Stock and exploitation status

ICES assesses that fishing pressure on this stock is below HR_{MSY} , HR_{MGT} , F_{pa} , F_{lim} , and spawning stock size is above $MSY B_{trigger}$, $MGT B_{trigger}$, B_{pa} , and B_{lim} .

[§] Version 2: Fishing pressure plot corrected (harvest rate and F legends were previously swapped).

Table 1 Saithe in Division 5.a. State of the stock and fishery relative to reference points. The expected range of realized HR following the management plan (HR_{MGT}) can be found in the management plan evaluation advice (ICES, 2013).

	Fishing pressure			Stock size						
	2015	2016	2017	2016	2017	2018				
Maximum Sustainable Yield	HR _{MSY}	✓	✓	✓	Appropriate	MSY B _{Trigger}	✓	✓	✓	Above trigger
Precautionary Approach	F _{pa'} F _{lim}	✓	✓	✓	Harvested sustainably	B _{pa'} B _{lim}	✓	✓	✓	Full reproductive capacity
Management plan	HR _{MGT}	✓	✓	✓	Within expected range	MGT B _{trigger}	✓	✓	✓	Above

Catch scenarios

Table 2 Saithe in Division 5.a. Assumptions made for the interim year and in the forecast. All weights are in tonnes.

Variable	Value	Notes
F _{ages 4-9} (2018)	0.165	TAC constraint
SSB (2019)	259195	Assessment model
R _{age 3} (2019)	32457	Assessment model
Total catch (2018)	70325	Remaining TAC 2017/18 at start of 2018 + 1/3 of TAC 2018/19
Landings (2018)	70325	
Discards (2018)	-	Considered negligible

Table 3 Saithe in Division 5.a. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2018/2019)	F _{ages 4-9} (2019)	SSB (2020)	% SSB change *	% TAC change **	% Advice change***
ICES advice basis						
Management plan	79092	0.20	263320	1.59	31	31

* SSB 2020 relative to SSB 2019.

** Catch in 2018/2019 relative to TAC_{2017/18} (60 232 t).

*** Advice value for 2018/2019 relative to advice value for 2017/2018.

The advised catch (in tonnes) is 31% greater than the advice for 2018. The reason for this is the large incoming recruitment that was not predicted last year and the increased stock size estimate.

Basis of the advice

Table 4 Saithe in Division 5.a. The basis of the advice.

Advice basis	Management plan (Icelandic MII, 2013)
Management plan	<p>The Icelandic Ministry of Industries and Innovation's fisheries has a management plan for Icelandic saithe (Icelandic MII, 2013). The plan aims at providing long term maximum sustainable yield and has been evaluated by ICES (ICES, 2013). The plan is considered to be precautionary. According to the management plan, the TAC for the fishing year Y/Y+1 (September 1 of year Y to August 31 of year Y+1) is calculated as follows:</p> <p>If $SSB_Y \geq MGT B_{trigger}$:</p> $TAC_{Y/Y+1} = 0.5 \times 0.2 B_{4+,Y} + 0.5 \times TAC_{Y-1/Y}$ <p>If $SSB_Y < MGT B_{trigger}$:</p> $TAC_{Y/Y+1} = \frac{SSB_Y}{MGT B_{trigger}} \left\{ \left(1 - 0.5 \frac{SSB_Y}{MGT B_{trigger}} \right) 0.2 B_{4+,Y} + 0.5 TAC_{Y-1/Y} \right\}$ <p>where $B_{4+,Y}$ is the biomass of saithe aged 4 and older in year Y, and $MGT B_{trigger} = 65\ 000$ tonnes.</p>

Quality of the assessment

The combination of uncertain survey indices, particularly for recruitment, and time-varying fleet selectivity leads to high uncertainty in the estimates of current SSB and fishing mortality. The management plan has been designed to take these uncertainties into account.

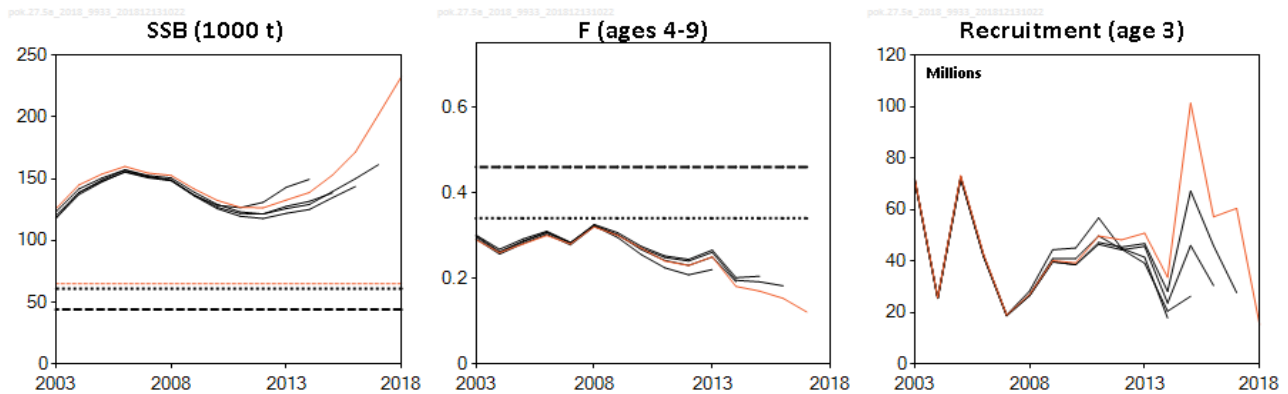


Figure 2** Saithe in Division 5.a. Historical assessment results.

Issues relevant for the advice

There is no information to present for this stock.

Reference points

Table 5 Saithe in Division 5.a. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	65000	Stochastic evaluations. Lower 5 th percentile of SSB when fishing at HR_{MSY} .	Hjörleifsson and Björnsson (2013), Icelandic MII (2013)
	HR_{MSY}	20%	Stochastic HCR evaluation (SSB 95% of the time over B_{lim})	Hjörleifsson and Björnsson (2013), Icelandic MII (2013)
Precautionary approach	B_{lim}	44000	$B_{pa} / 1.4$	ICES (2016a)
	B_{pa}	61000	B_{loss} is used as B_{pa} as fishing pressure has never been high for this stock, the spawning stock is not depleted much, and no relationship is seen between the spawning stock and recruitment.	ICES (2016a)
	F_{lim}	0.46	Equilibrium F that will maintain the stock above B_{lim} with a 50% probability.	ICES (2016a)
	F_{pa}	0.34	$F_{pa} = F_{lim} \times \exp(-1.645\sigma_F)$, with $\sigma_F = 0.19$	ICES (2016a)
Management plan	SSB_{mgt}	65000	Stochastic HCR evaluation	Hjörleifsson and Björnsson (2013)
	HR_{mgt}	20%	Stochastic HCR evaluation (SSB 95% of the time over B_{pa})	Hjörleifsson and Björnsson (2013)

** Version 2: 2018 assessment line in the F (ages 4-9) plot corrected (harvest rate was previously plotted).

Basis of the assessment

Table 6 Saithe in Division 5.a. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016b)
Assessment type	Separable statistical catch-at-age model, with changes in selectivity for three different time periods, using catches in the model and in the forecast (ICES, 2018)
Input data	Catch-at-age and age-disaggregated abundance indices from the spring groundfish survey
Discards and bycatch	Discards are considered negligible.
Indicators	None
Other information	Benchmark performed in 2010 (ICES, 2010); management plan adopted in 2013 (Icelandic MII, 2013).
Working group	North-Western Working Group (NWWG)

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 7 Saithe in Division 5.a. ICES advice, TACs and catches. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
1987*	TAC	64000	70000	80531
1988*	TAC	64000	80000	77247
1989*	TAC	80000	80000	82411
1990*	TAC	80000	90000	98127
1991*	TAC	87000	65000	71000
1991/1992	TAC	70000	75000	88000
1992/1993	Marginal gains from increase in F	75000	95000	78000
1993/1994	No measurable gains from increase in F	84000	85000	69000
1994/1995	No measurable gains from increase in F	72000	75000	61000
1995/1996	No measurable gains from increase in F	65000	70000	41000
1996/1997	No measurable gains from increase in F	52000	50000	38000
1997/1998	F below $F_{med} = 0.23$	30000	30000	33000
1998/1999	F below 60% of F(97)	28000	30000	30816
1999/2000	F below 60% of F(98)	24000	30000	29646
2000/2001	F = 70% of F(99)	25000	30000	31337
2001/2002	No directed fishing	-	37000	36230
2002/2003	2/3 F_{pa} to rebuild stock	24000	45000	47471
2003/2004	No advice	-	50000	55953
2004/2005	F_{pa}	69000	70000	70609
2005/2006	F_{pa}	78000	80000	77882
2006/2007	F_{pa}	81000	80000	66467
2007/2008	No advice	-	75000	66719
2008/2009	MaintainSSB $>B_{pa}$	<22000	65000	61981
2009/2010	F reduced below 0.22	< 34000	50000	57404
2010/2011	F_{MSY}	< 40000	50000	51592
2011/2012	F_{MSY}	≤ 45000	52000	49664
2012/2013	MSY framework [B-rule]	≤ 49000	50000	51275
2013/2014	Management plan [20% HCR]	57000	57000	54335
2014/2015	Management plan [20% HCR]	58000	58000	52033
2015/2016	Management plan [20% HCR]	55000	55000	49253
2016/2017	Management plan [20% HCR]	< 55000	55000	44980
2017/2018	Management plan [20% HCR]	60237	60237	
2018/2019	Management plan	79092		

* Calendar year.

History of the catch and landings

Table 8 Saithe in Division 5.a. Catch distribution by fleet in 2017 as estimated by ICES. All weights are in tonnes.

Catch (2017)	Landings			Discards
	Bottom trawl 90.2%	Gillnets 2.7%	Other 7.1 %	
49057	49057			Negligible

Summary of the assessment

Table 9** Saithe in Division 5.a. Assessment summary. Weights are in tonnes.

Year	Recruitment	Stock size		Fishing pressure		Total catch
	Age 3 thousands	SSB	Reference biomass ages 4+	Harvest rate	F ages 4–9	
1980	28292	112946	312009	0.185	0.29	57659
1981	20196	119805	304804	0.189	0.26	57548
1982	21640	136907	294617	0.23	0.30	67865
1983	32094	136961	270221	0.209	0.24	56504
1984	42030	139824	287428	0.21	0.23	60405
1985	35323	138220	299929	0.179	0.24	53728
1986	67354	136158	319017	0.205	0.28	65230
1987	91337	127591	336234	0.239	0.35	80237
1988	50784	124254	416215	0.186	0.32	77244
1989	31798	127666	399023	0.206	0.31	82339
1990	20793	134965	378206	0.258	0.35	97537
1991	29460	144863	337171	0.303	0.37	102201
1992	14847	136753	288599	0.276	0.37	79568
1993	19868	113162	230933	0.31	0.40	71539
1994	17721	93546	187522	0.339	0.45	63559
1995	29975	69503	153372	0.315	0.46	48296
1996	25701	60385	149635	0.263	0.40	39352
1997	16980	61208	156953	0.234	0.36	36671
1998	8683	67545	154947	0.198	0.29	30657
1999	30666	72785	133357	0.232	0.31	30898
2000	31453	75340	144357	0.227	0.32	32751
2001	54576	82780	164432	0.192	0.27	31570
2002	64002	101220	222502	0.189	0.29	41969
2003	72195	125600	283833	0.184	0.29	52306
2004	25830	145028	324731	0.199	0.26	64668
2005	73180	153854	290577	0.238	0.28	69054
2006	42452	160023	316821	0.238	0.30	75462
2007	19015	154632	288564	0.223	0.28	64261
2008	27038	152783	258420	0.269	0.32	69426
2009	40162	141753	233720	0.258	0.30	60266
2010	39284	132482	235326	0.229	0.27	53853
2011	49751	126913	243641	0.208	0.24	50769
2012	48271	126484	256907	0.2	0.23	51252
2013	50881	132782	275147	0.209	0.25	57522
2014	33722	138898	286506	0.159	0.181	45538
2015	101406	152937	296351	0.164	0.170	48476
2016	57199	171628	377812	0.13	0.153	49223
2017	60517	202117	439505	0.112	0.121	49057
2018	15293	232883	489739			

** Version 2: Table column headers corrected (harvest rate and F column headers were previously swapped)

Sources and references

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