

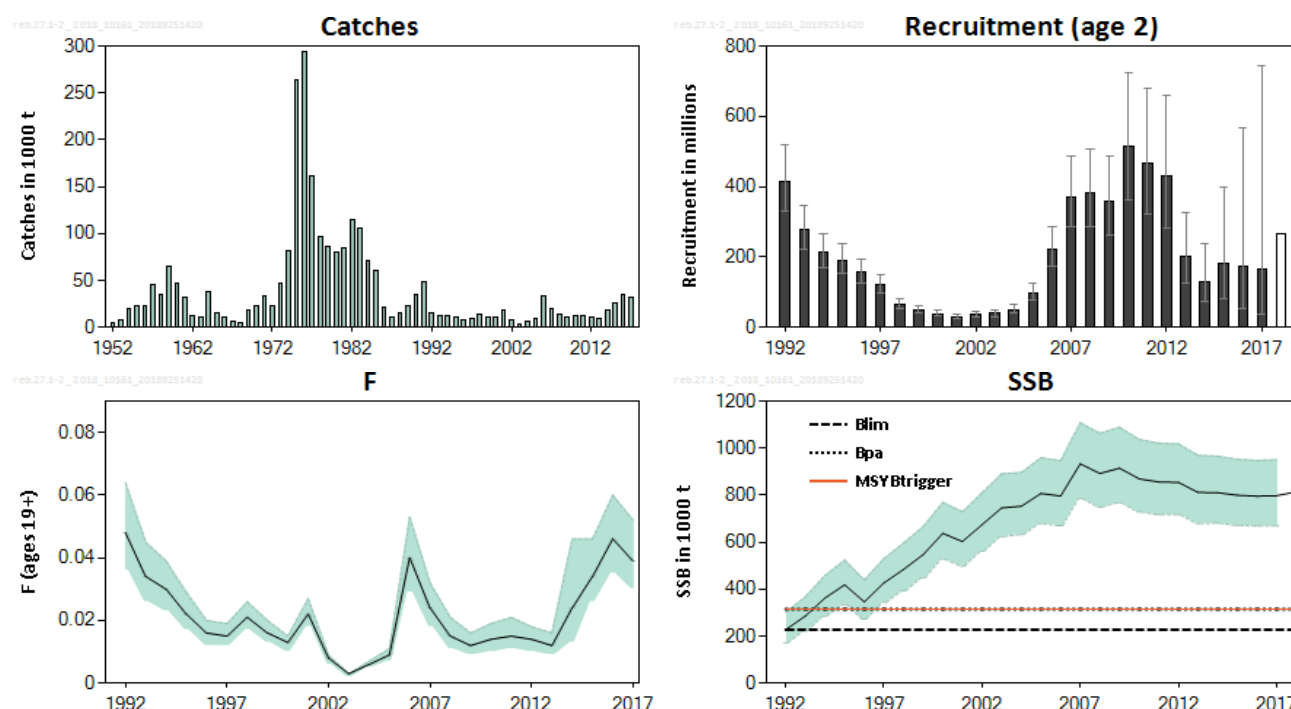
## Beaked redfish (*Sebastes mentella*) in subareas 1 and 2 (Northeast Arctic)

### ICES advice on fishing opportunities

ICES advises that when the precautionary approach is applied, catches in 2019 should be no more than 53 757 tonnes, and catches in 2020 should be no more than 55 860 tonnes.

### Stock development over time

Spawning-stock biomass (SSB) increased steadily from 1992 to 2007, followed by stabilization slightly below that peak. Whilst the year classes 1996–2003 were weak, there is evidence for strong year classes 2005 – 2010. Recent recruitments are slightly above the long-term average. Fishing mortality has been low but has increased since 2014.



**Figure 1** Beaked redfish in subareas 1 and 2. Summary of the stock assessment. Assumed recruitment value for 2018 is unshaded.

### Stock and exploitation status

ICES assesses that fishing pressure on the stock is below possible precautionary levels; and spawning stock size is above MSY  $B_{trigger}$  and above  $B_{pa}$  and  $B_{lim}$ .

**Table 1** Beaked redfish in subareas 1 and 2. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size		
		2015	2016	2017		2016	2017	2018
Maximum sustainable yield	$F_{MSY}$	?	?	?	Undefined	MSY $B_{trigger}$	✓	✓
Precautionary approach	$F_{pa}$ , $F_{lim}$	✓	✓	✓	Below possible reference points	$B_{pa}$ , $B_{lim}$	✓	✓
Management plan	$F_{MGT}$	—	—	—	Not applicable	$B_{MGT}$	—	—
								✓ Above trigger
								✓ Full reproductive capacity
								— Not applicable

## Catch scenarios

**Table 2** Beaked redfish in subareas 1 and 2. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
F <sub>ages 19+</sub> (2018)	0.039	F <sub>2017</sub>
SSB (2019)	841 973 tonnes	Short term forecast
R <sub>age 2</sub> (2018)	266 341 thousands	Regression between survey indices and recruitment time series
Catch (2018)	33 386 tonnes	Short-term forecast

**Table 3a** Beaked redfish in subareas 1 and 2. Annual catch scenarios for 2019. All weights are in tonnes.

Basis	Total catch (2019)	F <sub>total</sub> (2019)	SSB (2020)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis						
ICES Precautionary Approach: F=0.06	53 757	0.060	860 231	2.2	64.6	64.6
Other scenarios						
F = 0	0	0	905 559	7.6	-100	-100
F <sub>2019</sub> = F <sub>2018</sub>	35 264	0.039	875 810	4.0	8.0	8.0
F <sub>2019</sub> = 1.1 × F <sub>2018</sub>	38 724	0.043	872 894	3.7	18.6	18.6
F <sub>2019</sub> = 1.2 × F <sub>2018</sub>	42 173	0.047	869 988	3.3	29.1	29.1
F <sub>2019</sub> = 0.9 × F <sub>2018</sub>	31 792	0.035	878 737	4.4	-2.7	-2.7
F <sub>2019</sub> = 0.8 × F <sub>2018</sub>	28 308	0.031	881 674	4.7	-13.3	-13.3
F=0.06	53 757	0.060	860 231	2.2	64.6	64.6
F=0.08	71 056	0.080	845 672	0.4	117.6	117.6
F=0.084	74 479	0.084	842 793	0.1	128.1	128.1
F=0.10	88 053	0.100	831 381	-1.3	169.6	169.6
Suggested 50kt cap for all evaluated HCRs	50 000	0.056	863 395	2.5	53.1	53.1

\* SSB 2020 relative to SSB 2019.

\*\* Catch in 2019 relative to TAC set by Norway and Russia in 2018 (32 658 t).

\*\*\* Advice value for 2019 relative to advice value for 2018.

**Table 3b** Beaked redfish in subareas 1 and 2. Annual catch scenarios for 2020 with F<sub>2019</sub> = 0.06. All weights are in tonnes.

Scenarios	Total catch (2020)	F <sub>total</sub> (2020)	SSB (2021)	% SSB change *	% TAC change **	% Advice change ***
F = 0.06	55 860	0.060	876 101	1.8	3.9	3.9
F = 0.08	73 832	0.080	861 062	0.1	37.3	37.3
F = 0.084	77 389	0.084	858 088	-0.2	44.0	44.0
F = 0.10	91 490	0.100	846 299	-1.6	70.2	70.2
Suggested 50kt cap for all evaluated HCRs	50 000	0.054	881 007	2.4	-7.0	-7.0

\* SSB 2021 relative to SSB 2020.

\*\* Catch in 2020 relative to TAC in 2019 under the F = 0.06 scenario.

\*\*\* Advice value for 2020 relative to advice value for 2019.

This year's advice is 65% higher than last year and this is mainly due to higher fishing mortality, which was shown to be precautionary in the recent MSE evaluations (ICES, 2018b).

## Basis of the advice

**Table 4** Beaked redfish in subareas 1 and 2. The basis of the advice.

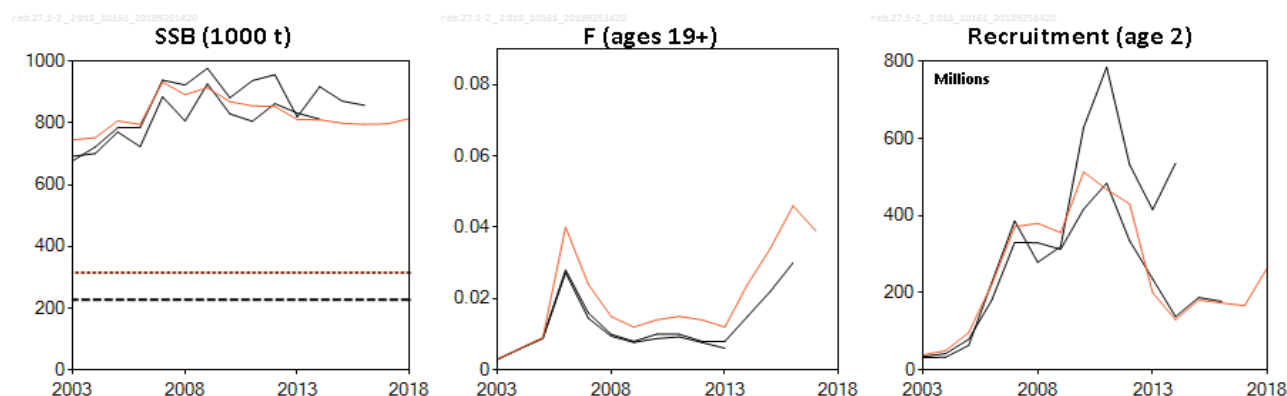
Advice basis	ICES precautionary approach
Management plan	There is no agreed management plan for this stock. Long-term management plan options have been evaluated by ICES (ICES, 2018b). The evaluated HCRs will be considered by the Norwegian-Russian fisheries commission in October 2018.

## Quality of the assessment

The stock was benchmarked in 2018. The choice of a scaling coefficient for the Norwegian–Russian ecosystem survey is a source of potential bias of up to 50%, but the advice is robust to this uncertainty.

Data from the pelagic survey in the Norwegian Sea was reviewed in the recent benchmark assessment and is now included in the assessment model. However, the survey series still does not appropriately cover the geographical distribution of the adult population, and further inclusion of the slope survey should be prioritized.

Age determination is lacking for some surveys and catches in recent years. To smooth out spurious variations in SSB, caused by biologically unfounded year-to-year variations in the weight-at-age of the 19+ group, a fixed weight-at-age function (i.e. common across years) was adopted for the assessment model during the Arctic Fisheries Working Group (AFWG) meeting. Fish over age 19 (used as plus group) constitute the majority of the fishable biomass, and age data are not currently available for this component. Expanding the age range in the assessment in the future will improve the quality of the assessment.



**Figure 2** Beaked redfish in subareas 1 and 2. Historical assessment results. Prior to 2018,  $F_{bar}$  was calculated over ages 12–18. Since the 2018 assessment, the last year of each recruitment line is the assumed value used in the forecast.

## Issues relevant for the advice

Long-term management plan options have been proposed by Norway and Russia and evaluated by ICES (ICES, 2018b). In the absence of an agreed management plan, ICES advice is based on the MSY approach. In the absence of a defined  $F_{MSY}$  the advice is based on  $F = 0.06$ . This is the highest fishing mortality of those tested during the MSE evaluations (ICES, 2018b) that was found to be precautionary. A value of  $F=0.08$  was also tested and found not to be precautionary.

There is no international agreement on the sharing of TAC among countries and between national and international waters.

## Reference points

**Table 5** Beaked redfish in subareas 1 and 2. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	315 000 t	$B_{pa}$	ICES (2018b)
	$F_{MSY}$	Not defined		
Precautionary approach	$B_{lim}$	227 000 t	$\sim B_{loss}$ (SSB in 1992)	ICES (2018b)
	$B_{pa}$	315 000 t	$\sim B_{lim} \times e^{(1.645 \times 0.2)}$	ICES (2018b)
	$F_{lim}$			
	$F_{pa}$			
Management plan	$SSB_{mgt}$			
	$F_{mgt}$			

## Basis of the assessment

**Table 5** Beaked redfish in subareas 1 and 2. Basis of the assessment and advice.

ICES stock data category	1 ( <a href="#">ICES, 2016</a> )
Assessment type	Statistical catch-at-age model
Input data	Commercial catches: international landings (tonnes), age frequencies and weight-at-age from catch sampling of the pelagic and demersal fisheries and from the survey; survey indices: numbers-at-age from BS-NoRu-Q1-Btr, Eco-NoRu-Q3-Btr, Ru-Q4-Btr; proportion-at-age from deep pelagic ecosystem survey; annual maturity data from BS-NoRu-Q1-Btr, Eco-NoRu-Q3-Btr, and commercial catch sampling; natural mortalities were fixed at 0.05.
Discards and bycatch	Discarding and bycatch are assumed negligible.
Indicators	Survey-based biomass estimate in the Norwegian Sea (Red-Nor-Q3)
Other information	Last benchmark was in January 2018 (WKREDFISH; ICES, 2018a). Proposed management plans were evaluated in 2018 (WKREBMSE; ICES, 2018b).
Working group	Arctic Fisheries Working Group ( <a href="#">AFWG</a> )

## Information from stakeholders

There is no additional available information.

## History of the advice, catch, and management

**Table 6** Beaked redfish in subareas 1 and 2. ICES advice, agreed TACs, and catches. All weights are in tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC	ICES catches
1987	Precautionary TAC	70000*	85000	35000
1988	$F=F_{0.1}$ ; TAC	11000	-	41000
1989	<i>Status quo</i> F; TAC	12000	-	47000
1990	<i>Status quo</i> F; TAC	18000	-	63000
1991	F at $F_{med}$ ; TAC	12000	-	68000
1992	If required, precautionary TAC	22000	-	32000
1993	If required, precautionary TAC	18000	18000	12814
1994	If required, precautionary TAC	-	-	12721
1995	Lowest possible F	-	-	10284
1996	Catch at lowest possible level	-	-	8075
1997	Catch at lowest possible level	-	-	8598
1998	No directed fishery, reduce bycatch	-	-	14045
1999	No directed fishery, reduce bycatch	-	-	11209
2000	No directed fishery, bycatch at lowest possible level	-	-	10075

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC	ICES catches
2001	No directed fishery, bycatch at lowest possible level	-	-	18418
2002	No directed fishery, bycatch at lowest possible level	-	-	6993
2003	No directed fishery, bycatch at lowest possible level	-	-	2520
2004	No directed trawl fishery and low bycatch limits	-	-	5493**
2005	No directed trawl fishery and low bycatch limits	-	-	8465**
2006	No directed trawl fishery and low bycatch limits	-	-	33261**
2007	No directed trawl fishery and low bycatch limits	-	15500^	20219**
2008	Protection of juveniles, no directed trawl fishery and low bycatch limits	-	14500^	13095**
2009	Protection of juveniles, no directed trawl fishery and low bycatch limits	-	10500^	10246**
2010	Protection of juveniles, no directed trawl fishery and low bycatch limits	-	8600^	11924**
2011	Protection of juveniles, no directed trawl fishery and low bycatch limits	-	7900^	12962**
2012	Protection of juveniles, no directed fishery and low bycatch limits	-	7500^	11059**
2013	F0.1	< 47000	19500^	9474**
2014	Status quo catch	< 24000	36800^^	18780**
2015	Precautionary approach	< 30000	30000#	25836
2016	Precautionary approach	< 30000	30000#	35429
2017	Precautionary approach	< 30000	30000#	31201
2018	Precautionary approach	< 32658	32658#	
2019	Precautionary approach	<53757		
2020	Precautionary approach	<55860		

\* Includes both *Sebastes mentella* and *S. norvegicus*.

\*\* Includes the pelagic catches in the Norwegian Sea outside the EEZ.

^ TAC set by the North East Atlantic Fisheries Commission (NEAFC) for an Olympic fishery in international waters.

^^ Sum of TAC set by NEAFC in international waters and by Norway in the Norwegian Economic Zone.

# TAC set by jointly by Norway and Russia.

## History of the catch and landings

**Table 7** Beaked redfish in subareas 1 and 2. Catch distribution by fleet in 2017 as estimated by ICES.

Catch (2017)	Landings		Discards
31 201 tonnes	21 % International waters (pelagic trawl)	79 % NEZ and Svalbard (predominantly demersal trawl)	Assumed to be negligible
	31 201 tonnes		

**Table 8** Beaked redfish in subareas 1 and 2. History of nominal catch for each country participating in the fishery. All weights are in tonnes.

Year		Denmark	Estonia	Faroe Islands	France	Germany	Greenland	Iceland	Ireland	Latvia	Lithuania	Netherlands	Norway	Poland	Portugal	Russia	Spain	UK		Total
																		England & Wales	Scotland **	
1993	Can.–8	4		13	50	35	1						5182		963	6260	5	293	-	12814
1994		28		4	74	18	1		3				6511		895	5021	30	124	12	12721
1995				3	16	176	2		4				2646		927	6346	67	93	4	10284
1996				4	75	119	3		2				6053		467	925	328	76	23	8075
1997				4	37	81	16		6				4657	1	474	2972	272	71	7	8598
1998				20	73	100	14		9				9733	13	125	3646	177	93	41	14045
1999				73	26	202	50		3				7884	6	65	2731	29	112	28	11209
2000				50	12	62	29	48	1				6020	2	115	3519	87		130	10075
2001				74	16	198	17	3	4				13937	5	179	3775	90		120	18418
2002			15	75	58	99	18	41	4				2152	8	242	3904	190		188	6993
2003				64	22	32	8	5	5				1210	7	44	952	47		124	2520
2004	Swe.–1			588	13	10	4	10	3				1375	42	235	2879	257		76	5493
2005			5	1147	46	33	39	4	4			7	1760		140	5023	163		95	8465
2006	Can.–433		396	3808	215	2483	63	2513	4	341	845		4710	2496	1804	11413	710		1027	33261
2007			684	2197	234	520	29	1587	17	349	785		3209	1081	1483	5660	2181		202	20219
2008				1849	187	16	25	9	9	267	117	13	2220	8	713	7117	463		83	13096
2009	EU –889			1343	15	42		33				3	2677	338	806	3843	177		80	10246
2010				979	175	21	12	2		243	457		2065		293	6414	1184		79	11924
2011				984	175	835		2		536	565		2471	11	613	5037	1678		55	12962
2012				259		517		36		447	449		2114	318	1038	4101	1780			11059
2013				697		80	21	1		280	262		1835	84	1078	3677	1459			9474
2014				743	215	446	15	-		215	167	3	13503	103	505	1704	1162			18780
2015				657	49	242	48	3		537	192	3	19720	5	678	1142	2529		52	25856
2016				491	134	436	74		8	1243	1064		19083	206	1066	8419	3138		121	35429
2017*		4		667	45	763	66	3		562	790		17281	102	1060	6583	2838		436	31200

\* Provisional figures. \*\* Includes UK (E&W) since 2000.

**Summary of the assessment**

**Table 9** Beaked redfish in subareas 1 and 2. Assessment summary. Weights are in tonnes.

Year	Recruitment age 2	High 95%	Low 95%	Recruitment age 6	High 95%	Low 95%	SSB	High 95%	Low 95%	Catches	F ages 19+	High 95%	Low 95%
Thousands tonnes per year													
1992	413106	519544	328473	133379	172929	102875	227298	301024	171629	15590	0.048	0.064	0.036
1993	275859	345079	220525	211990	273124	164540	285774	367448	222254	12814	0.034	0.045	0.026
1994	211751	264284	169660	311472	397964	243778	362252	457953	286551	12721	0.030	0.039	0.023
1995	190387	237075	152894	335140	425667	263865	418442	523650	334371	10284	0.022	0.029	0.0170
1996	155137	193250	124540	338277	425465	268956	345655	439132	272077	8075	0.0160	0.020	0.0120
1997	121120	150874	97234	225989	282702	180654	426388	530053	342997	8598	0.0150	0.0190	0.0120
1998	63476	79208	50869	173480	216523	138994	484077	596340	392948	14045	0.021	0.026	0.0170
1999	48431	60586	38715	155994	194249	125273	546747	665850	448948	11209	0.0160	0.020	0.0130
2000	38305	47872	30651	127122	158352	102050	637308	769204	528028	10075	0.0130	0.0150	0.0100
2001	29084	36679	23061	99249	123630	79676	602536	728811	498139	18418	0.022	0.027	0.0180
2002	35770	45233	28287	51992	64880	41664	674327	809781	561532	6993	0.0080	0.0090	0.0060
2003	38684	49417	30283	39685	49646	31723	745502	890553	624077	2520	0.0030	0.0030	0.0020
2004	50227	64742	38966	31386	39224	25114	752675	896740	631755	5493	0.0060	0.0070	0.0050
2005	96544	123961	75190	23829	30053	18894	807097	958747	679434	8465	0.0090	0.0110	0.0070
2006	221288	284557	172085	29307	37061	23176	796042	946533	669478	33261	0.040	0.053	0.029
2007	371053	485198	283761	31698	40493	24813	933116	1107799	785977	20219	0.024	0.032	0.0180
2008	380087	505446	285818	41157	53051	31930	892111	1062623	748960	13095	0.0150	0.021	0.0110
2009	356090	486132	260834	79110	101577	61613	914548	1088688	768262	10246	0.0120	0.0160	0.0090
2010	513031	723959	363557	181329	233173	141011	868970	1036301	728658	11924	0.0140	0.0190	0.0100
2011	467975	677768	323120	304048	397581	232519	855846	1020834	717524	12962	0.0150	0.021	0.0110
2012	430551	659362	281142	311453	414176	234207	853940	1017641	716572	11056	0.0140	0.0180	0.0100
2013	199965	324217	123331	291788	398348	213734	811463	969099	679468	9474	0.0120	0.0160	0.0090
2014	130199	238766	70997	420391	593231	297908	810552	965542	680441	18780	0.024	0.046	0.0130
2015	181131	399101	82206	383463	555371	264767	799400	951900	671331	25836	0.034	0.046	0.026
2016	173643	567049	53173	352774	540258	230352	795771	947561	668296	35429	0.046	0.060	0.035
2017	166480	742881	37308	163829	265632	101041	797447	950537	669014	31201	0.039	0.052	0.030
2018	266341*						814285						

\* Assumed value (regression between survey indices and recruitment time series)

## Sources and references

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