

Capelin (*Mallotus villosus*) in subareas 1 and 2 (Northeast Arctic), excluding Division 2.a west of 5°W (Barents Sea capelin)

ICES advice on fishing opportunities

ICES advises that when the management plan of the Joint Norwegian–Russian Fisheries Commission (JNRFC) is applied, there should be zero catch in 2021.

Note: This advice sheet is abbreviated due to the COVID-19 disruption. The previous advice issued for 2020 is attached as Annex 1.

Stock development over time

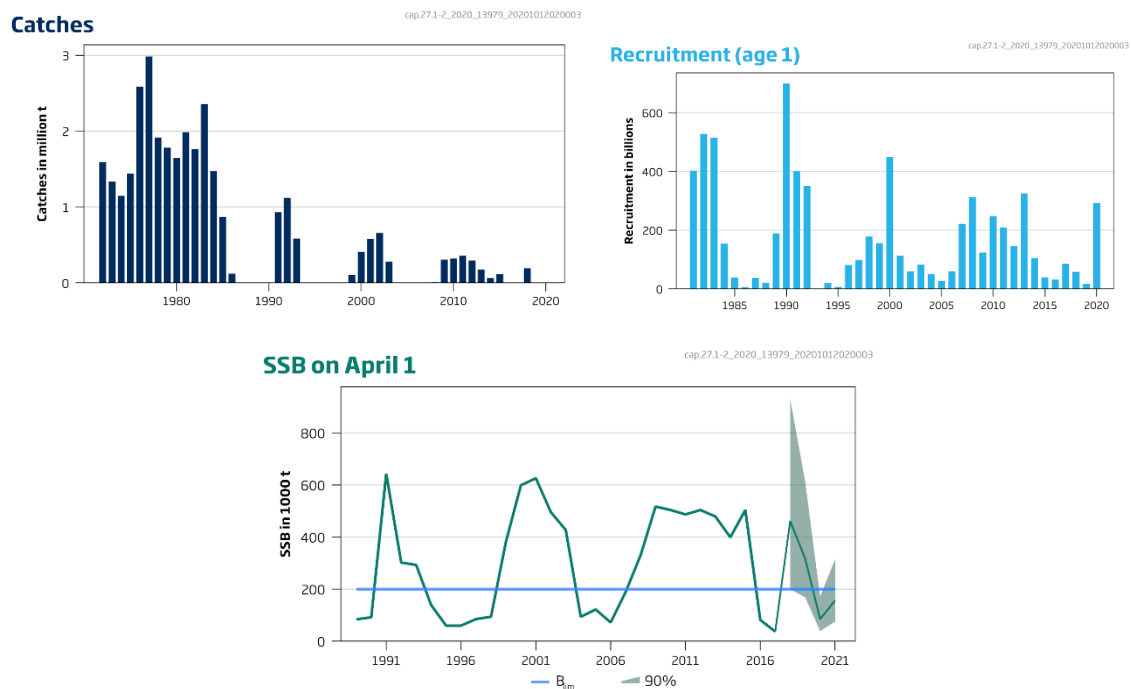


Figure 1 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Summary of the stock assessment. Catch in million tonnes, recruitment abundance in billions of fish, and spawning-stock biomass (SSB) in thousand tonnes. Recruitment values are estimates from the acoustic survey in September. The recruitment plot is shown only from 1981 onwards, since earlier estimates of age 1 capelin are based on incomplete survey-area coverage. Stock-size estimates (SSB; vertical shading in the last four years is the 90% confidence interval) are shown only from 1989 onwards, because a different model was used previously.

Stock and exploitation status

Table 1 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. State of the stock and the fishery relative to reference points. Stock-size status is based on population size calculated for 1 April.

		Fishing pressure				Stock size		
		2018	2019	2020		2019	2020	2021
Maximum sustainable yield	F_{MSY}	?	?	?	Undefined	$MSY B_{trigger}$?	✗ Below possible reference points
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	✓	✗ Below
Management plan	F_{MGT}	?	?	?	Undefined	B_{MGT}^*	✗	✗ Not above with 95% probability

* The B_{mgt} used in the harvest control rule corresponds to 95% probability of the spawning stock being above B_{lim} on 1 April.

Catch scenarios

Calculations of catch scenarios are based on a forward projection from the autumn acoustic survey. An SSB estimate for April 2021 is calculated by taking into account predation by immature cod and other natural mortality, while assuming zero fishing mortality between 1 October 2020 and 1 April 2021.

Table 2 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Assumptions made for the interim year and in the forecast. Biomass values are in tonnes.

Variable	Value	Notes
Maturing stock biomass 2020	545 106	Biomass of fish above the length-at-maturity (14.0 cm), estimated based on the autumn acoustic survey 1 October 2020. These fish will be spawning in April 2021.
Predation by immature cod in January–March 2021 – from the predation model	241 010	Based on the prediction of cod abundance in 2021 (ICES, 2020) from the 2020 cod stock assessment. The predation model is based on cod stomach content data.

Table 3 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Annual catch scenarios. P = probability. All weights are in tonnes.

Basis	Total catch (2021)	SSB (2021)	P (SSB ₂₀₂₁ > 200 000 t) in %	% TAC change *	% advice change **
ICES advice basis					
MP harvest control rule, P (SSB > 200 000 t) = 95%	0	156 376	27	0	0

* TAC (2021) vs. TAC (2020).

** Advice value 2021 relative to the advice value 2020.

The maturing stock has increased from 2019 to 2020; however, it remains below the limit of the harvest control rule (HCR) that would allow a fishery. Therefore, there is no change in the advice compared to 2020.

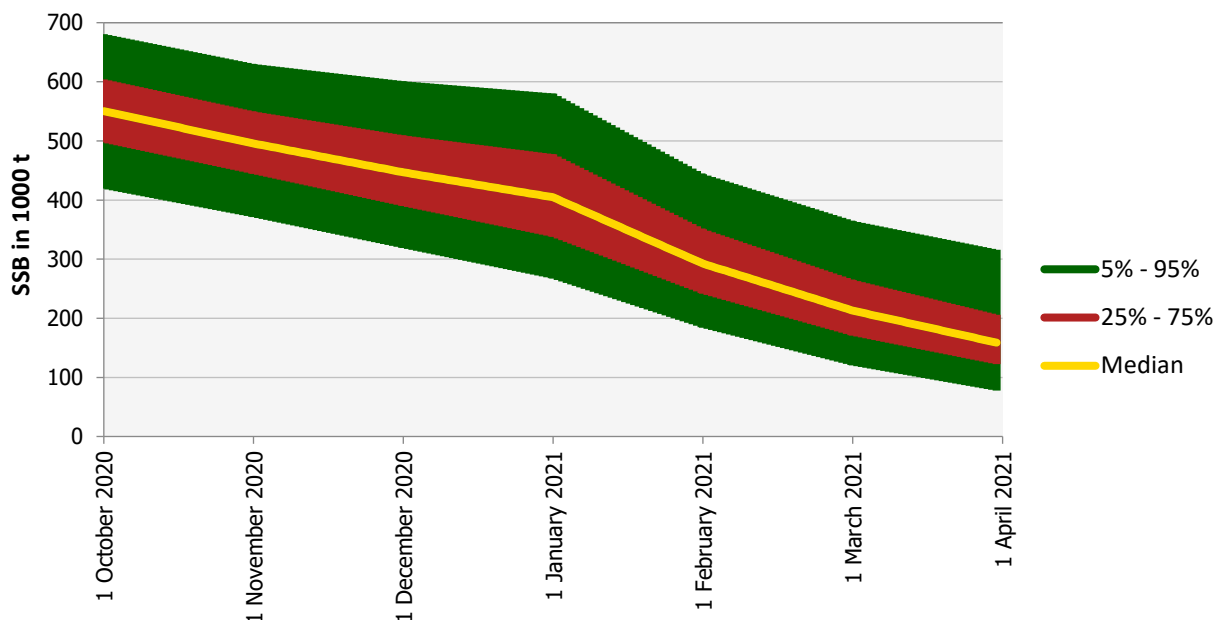


Figure 2 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Probabilistic prognosis of SSB for the Barents Sea capelin maturing stock from 1 October 2020 to 1 April 2021, based on the acoustic survey estimates from autumn 2020, and assuming zero catch. Biomass in thousand tonnes. The median and the 5th, 25th, 75th, and 95th percentiles of the distribution are shown.

Quality of the assessment

The survey coverage in autumn 2020 was incomplete and it is considered likely that the SSB is underestimated. However, though the coverage of the immature stock was incomplete, this does not affect the advice because the immature stock does not contribute to the fishable biomass in 2021. Based on the distribution of the maturing stock in previous years (Figure 3), the acoustic estimates were nevertheless considered adequate to provide the basis for the advice.

Acoustic recordings of capelin

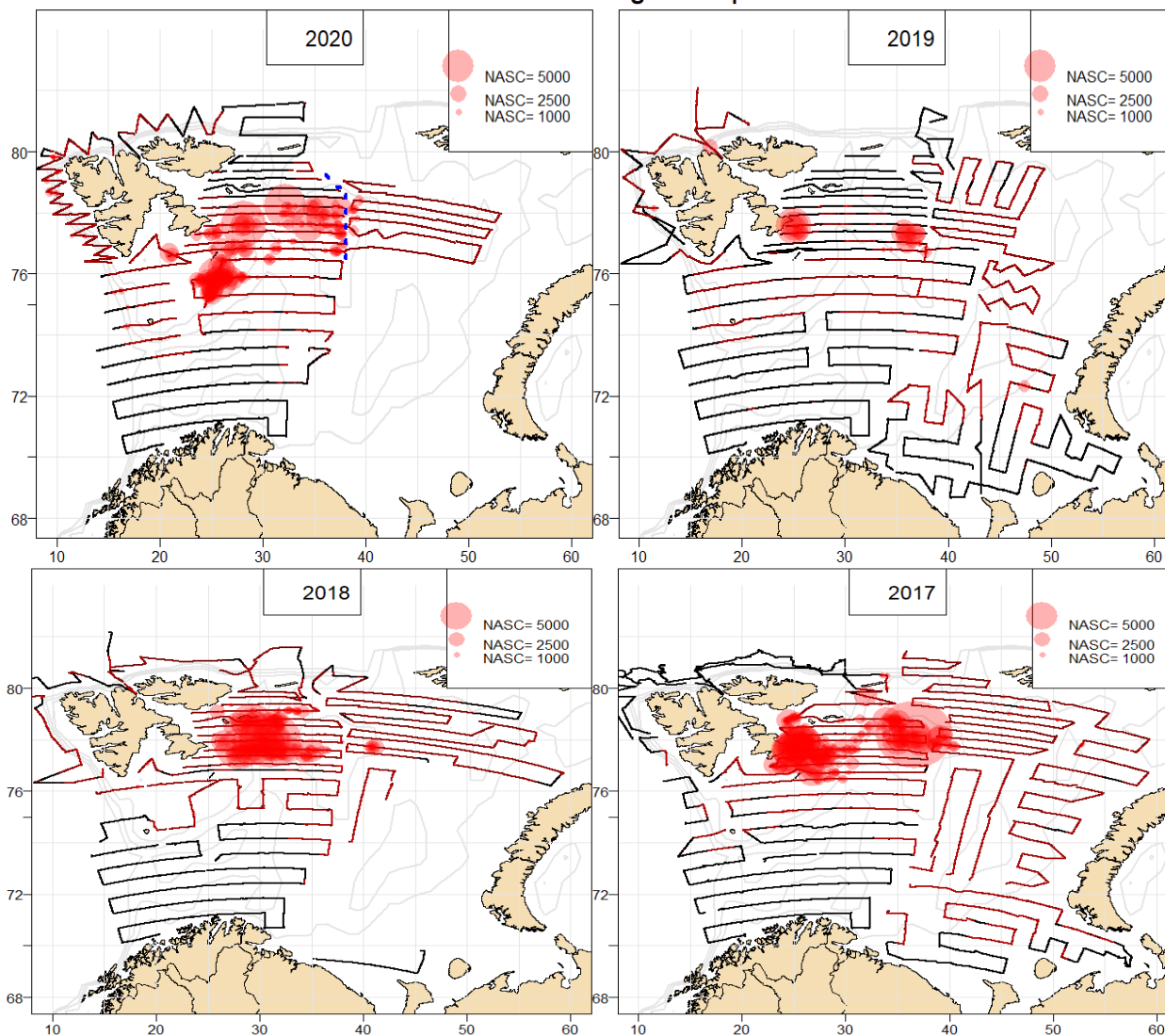


Figure 3 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Geographical distribution of capelin from autumn 2017 to 2020, as observed in the acoustic survey. An approximate border between the Russian and Norwegian coverage areas for 2020 is shown as a blue dashed line.

Issues relevant for the advice

The survey coverage was incomplete and the biomass of the maturing stock from the acoustic survey is therefore likely to be underestimated. The areas missed in the 2020 survey accounted for no more than 20% of the survey biomass estimates in 2017 to 2019. Even assuming that the 2020 survey biomass is 20% higher than the estimated biomass from the partial coverage, this would result in 44% probability that the SSB is above 200 000 tonnes. According to the JNRF management plan, this would still lead to a zero catch advice.

History of the advice, catch, and management

Table 4 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. ICES advice, agreed TAC, and catch. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
1987	Catches at the lowest practical level	0	0	0
1988	No catch	0	0	0
1989	No catch	0	0	0
1990	No catch	0	0	0
1991	TAC	1000000	900000	933000
1992	SSB > 400 000–500 000 t	834000	1100000	1123000
1993	A cautious approach, SSB > 400 000–500 000 t	600000	630000	586000
1994	No fishing	0	0	0
1995	No fishing	0	0	0
1996	No fishing	0	0	0
1997	No fishing	0	0	1000
1998	No fishing	0	0	3000
1999	SSB > 500 000 t	79000	80000	101000
2000	5% probability of SSB < 200 000 t	435000	435000	414000
2001	5% probability of SSB < 200 000 t	630000	630000	568000
2002	5% probability of SSB < 200 000 t	650000	650000	651000
2003	5% probability of SSB < 200 000 t	310000	310000	282000
2004	No fishing	0	0	0
2005	No fishing	0	0	1000 *
2006	No fishing	0	0	0
2007	No fishing	0	0	4000 *
2008	No fishing	0	0	12000 *
2009	5% probability of SSB < 200 000 t	390000	390000	307000
2010	5% probability of SSB < 200 000 t	360000	360000	323000
2011	5% probability of SSB < 200 000 t	380000	380000	360000
2012	5% probability of SSB < 200 000 t	320000	320000	296000
2013	5% probability of SSB < 200 000 t	200000	200000	177000
2014	5% probability of SSB < 200 000 t	65000	65000	66000
2015	5% probability of SSB < 200 000 t	6000	120000	115000
2016	Zero catch	0	0	0
2017	Zero catch	0	0	0
2018	5% probability of SSB < 200 000 t	205000	205000	194520
2019	Zero catch	0	0 †	53*
2020	Management plan	0	0 †	31*
2021	Management plan	0		

* Research catch and bycatches in other fisheries; values are preliminary.

† Up to 500 tonnes was allowed for research survey catches.

Summary of the assessment

Table 5 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Assessment summary. Weights are in tonnes, recruitment in thousands. Recruitment and stock biomass in 1985 and earlier are survey estimates, back-calculated to 1 August (before the autumn fishing season); from 1986 and later, these values are based on the survey estimates with no back-calculation. Maturing biomass is the survey estimate of fish above the length-at-maturity (14.0 cm). Predicted SSB is the modelled stochastic spawning-stock biomass (after the winter fishery).

Year	Predicted SSB assuming catch = ICES advised catch, 1 April			Recruitment from autumn acoustic survey, 1 October	Stock biomass from autumn acoustic survey, 1 October		Catch
	Median	5th percentile	95th percentile		Immatures	Maturing biomass	
	tonnes			Age 1, thousands	tonnes		
1972					3873000	2727000	1591000
1973					3794000	1350000	1337000
1974					4826000	907000	1148000
1975					4890000	2916000	1441000
1976					3217000	3200000	2587000
1977					2120000	2676000	2986000
1978					2845000	1402000	1916000
1979					2935000	1227000	1782000
1980					2802000	3913000	1648000
1981				402600000	2344000	1551000	1986000
1982				528300000	2188000	1591000	1760000
1983				514900000	2901000	1329000	2357000
1984				154800000	1756000	1208000	1477000
1985				38700000	575000	285000	868000
1986				6000000	55000	65000	123000
1987				37600000	84000	17000	0
1988				21000000	228000	200000	0
1989	84000			189200000	689000	175000	0
1990	92000			700400000	3214000	2617000	0
1991	643000			402100000	5039000	2248000	933000
1992	302000			351300000	2922000	2228000	1123000
1993	293000			2200000	466000	330000	586000
1994	139000			19800000	106000	94000	0
1995	60000			7100000	75000	118000	0
1996	60000			81900000	255000	248000	0
1997	85000			98900000	597000	312000	1000
1998	94000			179000000	1124000	932000	3000
1999	382000			156000000	1057000	1718000	105000
2000	599000			449200000	2175000	2098000	410000
2001	626000			113600000	1611000	2019000	578000
2002	496000			59700000	919000	1291000	659000
2003	427000			82400000	253000	280000	282000
2004	94000			51200000	334000	294000	0
2005	122000			26900000	150000	174000	1000
2006	72000			60100000	350000	437000	0
2007	189000			221700000	1275000	844000	4000
2008	330000			313000000	1960000	2468000	12000
2009	517000			124000000	1442000	2323000	307000
2010	504000			248200000	1449000	2051000	323000

Year	Predicted SSB assuming catch = ICES advised catch, 1 April			Recruitment from autumn acoustic survey, 1 October	Stock biomass from autumn acoustic survey, 1 October		Catch
	Median	5th percentile	95th percentile		Immatures	Maturing biomass	
	tonnes			Age 1, thousands	tonnes		
2011	487000			209600000	1592000	2115000	360000
2012	504000			145900000	1589000	1997000	296000
2013	479000			324500000	2485000	1471000	177000
2014	399000			105100000	1076000	873000	66000
2015	504000			39500000	467000	375000	115000
2016	82000			31600000	147000	181000	0
2017	37000			86400000	783000	1723000	0
2018	462000	200000	930000	58600000	541000	1056000	194520
2019	317000	168282	613733	17455060	109533	301615	53
2020	85110	38830	171850	292262000	1174676	545106	31
2021	156376	75197	314559				

Sources and references

ICES. 2020. Arctic Fisheries Working Group (AFWG). ICES Scientific Reports, 2:52. 577 pp. <http://doi.org/10.17895/ices.pub.6050>.

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