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

ICES stock advice

ICES advises that when the management plan of the Joint Norwegian–Russian Fisheries Commission (JNRFC) is applied, catches in 2018 should be no more than 205 000 tonnes.

Stock development over time

The maturing component of the stock in autumn 2017 was estimated by the acoustic survey to be much larger than estimated in 2016. The estimate of the 2016 year class at age 1, using the results of the survey conducted in September 2017, is below the long-term average although higher than the 2014 and 2015 year classes. (See also "Quality of the assessment".)

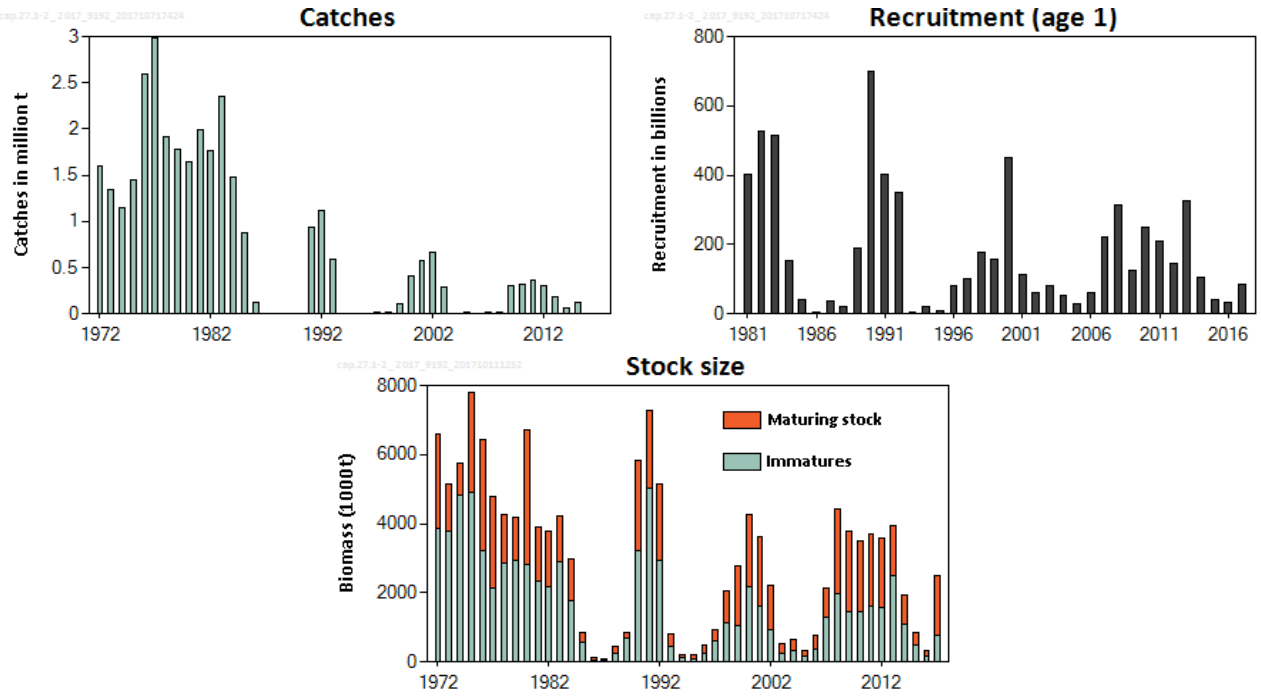

Figure 1 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Summary of the stock assessment. Catch in millions of tonnes, stock biomass in thousands of tonnes, and recruitment abundance in billions of fish. Both the total, the maturing stock, and the recruitment are estimates obtained from the acoustic survey in September; therefore, the maturing biomass does not compare directly to the reference point (B_{lim}), which relates to SSB in April. However, with a fishery of no more than 205 000 tonnes the probability that the stock will be less than B_{lim} in April 2018 is ≤ 5%. The recruitment plot is shown only from 1980 onwards, since earlier estimates of age 1 capelin are based on incomplete survey area coverage.

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 fishery relative to reference points.

	Fishing pressure					Stock size				
		2015	2016	2017			2016	2017	2018	
Maximum Sustainable Yield	F_{MSY}	?	?	?	Undefined	MSY $B_{Trigger}$	?	?	?	Undefined
Precautionary Approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{lim}	✗	✗	✓	Above
Management plan	F_{MGT}	?	?	?	Undefined	B_{MGT}	?	?	?	Undefined

Catch options

Table 2 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. The basis for the catch options. Weights are in tonnes.

Variable	Value	Source	Notes
Maturing stock biomass 2017	1723000 t	ICES (2017)	Stock estimate based on the autumn acoustic survey 1 October 2017.
Predation in tonnes by immature cod in January–March 2018 from the predation model	597000 t	ICES (2017)	Prediction of cod abundance in 2018 (ICES, 2017) from the 2017 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 options. All weights are in tonnes.

Basis	Total catch (2018)	F_{total} (2018)	SSB (2018)	P (SSB 2018 > 200000 t)	% TAC change *
ICES advice basis					
MP Harvest Control Rule, P (SSB > 200000 t) = 95%	205000	NA	462000	95%	NA
Other options					
F = 0	0	NA	636000	100%	NA

* TAC (2018) vs. TAC (2017). As TAC (2017) is zero, the percentage change cannot be calculated.
NA = not available.

Calculations of catch options are based on a forward projection from the autumn acoustic survey, taking predation by immature cod, other natural mortality, and fishery options into account to calculate an SSB estimate for April 2018.

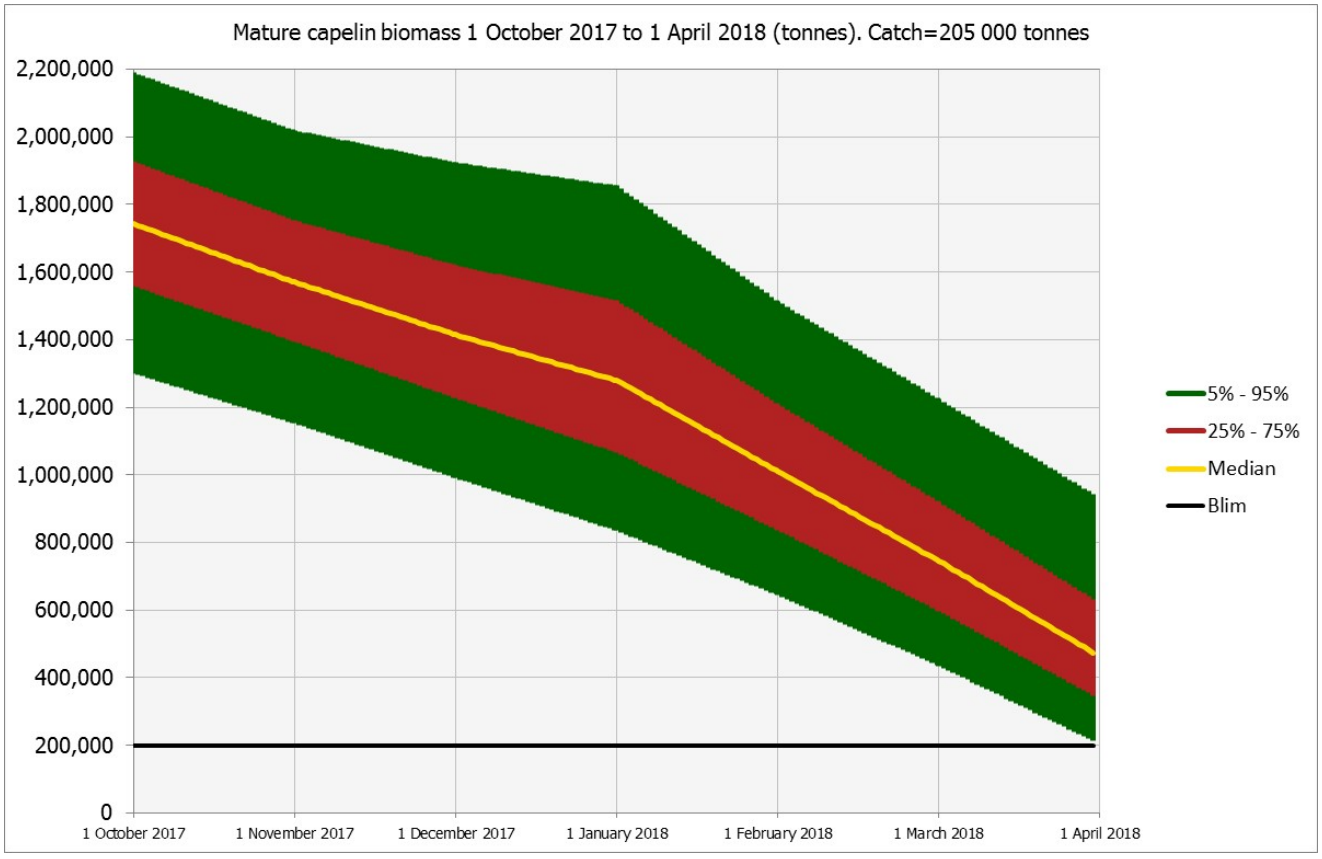

Figure 2 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Probabilistic prognosis 1 October 2017–1 April 2018 for the Barents Sea capelin maturing stock, with TAC = 205 000 tonnes. Biomass in tonnes. The median and the 5th, 25th, 75th, and 95th percentiles of the distribution are shown.

Basis of the advice

Table 4 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. The basis of the advice.

Advice basis	Management plan.
Management plan	At the 31st meeting of the Joint Norwegian–Russian Fisheries Commission (JNRFC) in November 2002, the following management plan was adopted:"For capelin, the following harvest control rule should be used: The TAC for the following year should be set so that, with 95% probability, at least 200 000 tonnes of capelin (Blim) will be allowed to spawn." At the 39th Session of the Joint Norwegian–Russian Fisheries Commission in October 2010 it was agreed that this management plan should be used "for five more years" before it is evaluated. In 2015 JNRFC suggested three alternative HCRs for this stock; setting P(SSB < 200 000 t) to 90%, 85%, and 80%, respectively. These options were evaluated by ICES in 2016 (ICES, 2016a), and only the existing HCR was found to be precautionary. Thus, the harvest control rule was not changed at the 46th Session of the Joint Norwegian–Russian Fisheries Commission in 2016 (JNRFC, 2016). It was, however, decided that the harvest control rule should be evaluated again in 2021.

Quality of the assessment

The assessment is based on an annual acoustic survey. The survey coverage in 2017 was good and is considered to include almost the entire distribution of the stock. The survey estimate in 2017 was much higher than what was expected on the basis of the 2016 survey. This either indicates that the 2016 survey provided an underestimate of the stock or that the 2017 survey provides an overestimate. Based on the available information about survey design and coverage, interpretation of acoustic recordings, cohort development, and estimated capelin consumption by cod, ICES considers it more likely that the 2016 estimate was an underestimate rather than the 2017 estimate being an overestimate.

Issues relevant for the advice

There is no information.

Reference points

Table 5 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$			
	F_{MSY}			
Precautionary approach	B_{lim}	200 000 t	Above SSB_{1989}, the lowest SSB that has produced a good year class.	ICES (2001)
	B_{pa}			
	F_{lim}			
	F_{pa}			
Management plan	SSB_{mgt}			
	F_{mgt}			

Basis of the assessment

Table 6 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016b).
Assessment type	Model based on acoustic survey and prediction six months ahead to calculate spawning biomass. The model estimates maturity, growth, and mortality (including predation by immature cod on pre-spawning capelin). Target escapement strategy used.
Input data	Norwegian–Russian acoustic survey in September (Eco-NoRu-Q3 (Aco)). • Model estimates of maturation based on survey data. • Natural mortalities from multispecies model (predation by immature cod on pre-spawning capelin) and based on historical survey estimates.
Discards and bycatch	All catches are assumed to be landed. The amount of bycaught capelin in other fisheries is very low.
Indicators	None.
Other information	Latest benchmark was in 2015 (ICES, 2015).
Working group	Arctic Fisheries Working Group (AFWG)

Information from stakeholders

No information provided.

History of the advice, catch, and management

Table 7 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Recommended TAC	Agreed TAC	ICES catch
1987	Catches at 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 > 4–500 000 t	834000	1100000	1123000
1993	A cautious approach, SSB > 4–500 000 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		

*Research catch.

History of the catch and landings

Table 8 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Catch distribution by fleet in 2017 as estimated by ICES.

Catch (2017)	Landings	Discards
0 tonnes	0 tonnes	0 tonnes

Table 9 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. History of official catches is presented for each country participating in the fishery. All weights are in tonnes.

Year	Winter				Summer–autumn			Year total
	Norway	Russia	Others	Total	Norway	Russia	Total	
1965	217000	7000	0	224000	0	0	0	224000
1966	380000	9000	0	389000	0	0	0	389000
1967	403000	6000	0	409000	0	0	0	409000
1968	460000	15000	0	475000	62000	0	62000	537000
1969	436000	1000	0	437000	243000	0	243000	680000
1970	955000	8000	0	963000	346000	5000	351000	1314000
1971	1300000	14000	0	1314000	71000	7000	78000	1392000
1972	1208000	24000	0	1232000	347000	13000	360000	1591000
1973	1078000	34000	0	1112000	213000	12000	225000	1337000
1974	749000	63000	0	812000	237000	99000	336000	1148000
1975	559000	301000	43000	903000	407000	131000	538000	1441000
1976	1252000	228000	0	1480000	739000	368000	1107000	2587000
1977	1441000	317000	2000	1760000	722000	504000	1226000	2986000
1978	784000	429000	25000	1238000	360000	318000	678000	1916000
1979	539000	342000	5000	886000	570000	326000	896000	1782000
1980	539000	253000	9000	801000	459000	388000	847000	1648000
1981	784000	429000	28000	1241000	454000	292000	746000	1986000
1982	568000	260000	5000	833000	591000	336000	927000	1760000
1983	751000	373000	36000	1160000	758000	439000	1197000	2357000
1984	330000	257000	42000	629000	481000	368000	849000	1477000
1985	340000	234000	17000	591000	113000	164000	277000	868000
1986	72000	51000	0	123000	0	0	0	123000
1987	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
1991	528000	159000	20000	707000	31000	195000	226000	933000
1992	620000	247000	24000	891000	73000	159000	232000	1123000
1993	402000	170000	14000	586000	0	0	0	586000
1994	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	1000	1000	1000
1998	0	2000	0	2000	0	1000	1000	3000
1999	50000	33000	0	83000	0	22000	22000	105000
2000	279000	94000	8000	381000	0	29000	29000	410000
2001	376000	180000	8000	564000	0	14000	14000	578000
2002	398000	228000	17000	643000	0	16000	16000	659000
2003	180000	93000	9000	282000	0	0	0	282000
2004	0	0	0	0	0	0	0	0
2005	1000	0	0	1000	0	0	0	1000
2006	0	0	0	0	0	0	0	0
2007	2000	2000	0	4000	0	0	0	4000
2008	5000	5000	0	10000	0	2000	2000	12000
2009	233000	73000	0	306000	0	1000	1000	307000
2010	246000	77000	0	323000	0	0	0	323000
2011	273000	87000	0	360000	0	0	0	360000
2012	228000	68000	0	296000	0	0	0	296000
2013	116000	60000	0	177000	0	0	0	177000
2014	40000	26000	0	66000	0	0	0	66000
2015	71000	44000	0	115000	0	0	0	115000
2016	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0

Summary of the assessment

Table 10 Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W. Assessment summary. Weights are in tonnes. Recruitment and total biomass (TSB) 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 (MSB) is the survey estimate of fish above the length of maturity (14.0 cm). SSB is the median value of the modelled stochastic spawning-stock biomass (after the winter/spring fishery).

Year	Estimated stock by autumn acoustic survey 1 October		Predicted SSB assuming catch = ICES advised catch, April 1 in year+1	Recruitment Age 1 survey assessment, 01 October	Capelin catches
	TSB	MSB		billions	
1972	6600000	2727000	33000	152	1591000
1973	5144000	1350000	*	529	1337000
1974	5733000	907000	*	305	1148000
1975	7806000	2916000	253000	190	1441000
1976	6417000	3200000	22000	211	2587000
1977	4796000	2676000	*	360	2986000
1978	4247000	1402000	*	84	1916000
1979	4162000	1227000	*	12	1782000
1980	6715000	3913000	316000	270	1648000
1981	3895000	1551000	106000	403	1986000
1982	3779000	1591000	100000	528	1760000
1983	4230000	1329000	109000	515	2357000
1984	2964000	1208000	*	155	1477000
1985	860000	285000	*	39	868000
1986	120000	65000	34000	6	123000
1987	101000	17000	*	38	0
1988	428000	200000	84000	21	0
1989	864000	175000	92000	189	0
1990	5831000	2617000	643000	700	0
1991	7287000	2248000	302000	402	933000
1992	5150000	2228000	293000	351	1123000
1993	796000	330000	139000	2	586000
1994	200000	94000	60000	20	0
1995	193000	118000	60000	7	0
1996	503000	248000	85000	82	0
1997	909000	312000	94000	99	1000
1998	2056000	932000	382000	179	3000
1999	2775000	1718000	599000	156	105000
2000	4273000	2098000	626000	449	410000
2001	3630000	2019000	496000	114	578000
2002	2210000	1291000	427000	60	659000
2003	533000	280000	94000	82	282000
2004	628000	294000	122000	51	0
2005	324000	174000	72000	27	1000
2006	787000	437000	189000	60	0
2007	2119000	844000	330000	222	4000
2008	4428000	2468000	517000	313	12000
2009	3765000	2323000	504000	124	307000
2010	3500000	2051000	487000	248	323000
2011	3707000	2115000	504000	209	360000
2012	3586000	1997000	479000	146	296000
2013	3956000	1471000	399000	324	177000
2014	1949000	873000	504000	105	66000
2015	842000	375000	82000	40	115000
2016	328000	181000	37000	32	0
2017	2506000	1723000	462000	86	0

* – indicates a very small spawning stock.

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