9 Barents Sea Capelin

As decided by the Arctic Fisheries Working Group at its 2019 meeting, the assessment of Barents Sea capelin was left to the parties responsible for the autumn survey, i.e. IMR in Bergen and PINRO in Murmansk. In accordance with this, the assessment was made during a meeting in Murmansk, Russia on 3–4 October 2019. The assessment was an update assessment, without changes in the methodology.

Therefore, the information in this annex overrides section 9 of the initial AFWG 2019 report.

Participants:

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9.1 Regulation of the Barents Sea Capelin Fishery

Since 1979, the Barents Sea capelin fishery has been regulated by a bilateral fishery management agreement between Russia (former USSR) and Norway. A TAC has been set separately for the winter fishery and for the autumn fishery. From 1999, no autumn fishery has taken place, except for a small Russian experimental fishery in some years. A minimum landing size of 11 cm has been in force since 1979. AFWG strongly recommends capelin fishery only on mature fish during the period from January to April.

9.2 TAC and Catch Statistics (Table 9.1)

The Joint Russian-Norwegian Fishery Commission set a quota of 205 000 tonnes for 2018, while the TAC for 2019 was set to zero. Both the quotas were in accordance with the ICES advice. The international historical catch by country and season in the years 1965–2019 is given in Table 9.1. There were no landing in 2019, except very small catches during scientific research by Norway and Russia.

9.3 Sampling

The capelin sampling from the Barents Sea ecosystem survey used in the 2019 capelin assessment is summarized below:

Investigation	No. of trawl hauls	Length measurements	Aged individuals
Ecosystem survey in autumn 2019 (Norway)	105	9782	2734
Ecosystem survey in autumn 2019 (Russia)	142	8749	529

9.4 Stock assessment

9.4.1 Acoustic stock size estimates in 2019 (Table 9.2, Figure 9.1)

The geographical survey coverage of the Barents Sea capelin stock during the BESS in 2019 was considered to be complete (Figure 9.1). The northeastern part of the standard survey area was not covered, but based on the rest of the distribution data, no capelin was expected here. The catches in the survey were 5 t.

The stock estimate from the area covered by the 2019 survey was 0.41 million tonnes (Table 9.2). About 73% (0.30 million tonnes) of the estimated stock biomass consisted of maturing fish (>14.0 cm). The mean weight at age in the 2019 survey was similar to 2018 for all age groups (Figure 9.2).

As decided during the 2016 assessment meeting, the capelin abundance was estimated using the software StoX (Johnsen *et al.*, 2019), applying agreed settings.

A fixed sampling variance expressed as Coefficient of Variance (CV) of 0.2 per age group has been applied as input for CapTool in the capelin assessment and was also used this year (Tjelmeland 2002; Gjøsæter *et al.*, 2002). The survey design and estimation software now allows for estimation of a direct CV by age group, and for the 2019 survey this was estimated:

for age group 1 -0.13; for age group 2 - 0.33, and for age group 3 - 0.36.

These values are higher than previous years for age groups 2 and 3, and lower for age group 1. This can be due to the very patchy distribution of adult capelin this year. Relative sampling error based only on acoustic recordings (Nautical Area Scattering Coefficient (NASC; m^2nmi^{-2}) by nau-tical mile) was estimated to 25.37%, which was very similar to last year. These values are higher than in 2017. Detailed information about previous CV estimates can be found in AFWG WD5, 2018. Future implementation of direct survey CV in the assessment is discussed under future work (9.4.7).

9.4.2 Recruitment estimation in 2018 (Table 9.3)

The survey coverage of 0-group in 2019 was considered complete. Swept volume 0-index (Dingsør, 2005; Eriksen *et al.*, 2009) was calculated both: without correction and with correction for catching efficiency (Table 9.3). The capelin 0-group index for 2019 was above the long-term average. The mean length of 0-group capelin in the areas covered was the lowest since 1993, and well below the long-term average. Table 9.3 also shows the number of fish in the various year classes at age 0-2, and their "survey mortality" from age one to age two.

9.4.3 Forecast

Probabilistic projections of the maturing stock to the time of spawning at 1 April 2020 were made using the spreadsheet model CapTool (implemented in the @RISK add-on for EXCEL, 50 000

simulations were used). The settings were the same as last year. The projection was based on a maturation and predation model with parameters estimated by the model Bifrost and data on cod abundance and size at age in 2020 from the 2019 Arctic Fisheries Working Group.

The methodology is described in the 2009 WKSHORT report (ICES, 2009) and the WKARCT 2015 report (ICES, 2015). The natural mortality M for the months October to December is drawn among a set of M-values estimated for different years based on historical data. The same set of M-values was used in 2019 as in 2018 (ICES 2011, Annex 12).

With no catch, the estimated median spawning stock size on 1 April 2020 is 85 100 tonnes (Figure 9.3), and the probability for the spawning stock to be below B_{lim} (200 000 t) is 97.8%.

Estimates of stock in number by age group and total biomass for the historical period are shown in Table 9.4. Other data, which describe the stock development, are shown in Table 9.5. Summary plots are given in Figure 9.4.

9.4.4 Recruitment

The 1-group abundance in 2019 was 17.5 billion which is far below the long-term average and the lowest since 1995 (Figure 9.5). The most recent evaluation of the spawning stock and recruitment time-series was made by Gjøsæter *et al.* (2016).

Future recruitment conditions: High abundance of young herring (mainly age groups 1 and 2) has been suggested to be a necessary but not a single factor causing recruitment failure in the capelin stock (Hjermann *et al.*, 2010; Gjøsæter *et al.*, 2016). Based on survey data from the Barents Sea Ecosystem Survey in 2019, a significant proportion of the young herring is 3-year-olds, which are expected to leave the Barents Sea in the year to come, and the abundance of young herring in the Barents Sea in 2020 is expected to be below average.

9.4.5 Comments to the assessment

The survey estimate of abundance at age in 2019 is in correspondence with the 2018 estimate, but the "survey mortality" from age 1 to 2 is very high (Figure 9.6, Table 9.3). This is one of the highest values in the historical period.

Ecological considerations

The number of young herring in the Barents Sea can be an important factor that affects the capelin recruitment. It is not currently taken into account in the assessment model. The benchmark for capelin stocks in the Barents Sea (ICES, 2015) noted the need for further study of this effect as well as better monitoring of the young herring abundance.

The amount of other food than capelin for cod and other predators may also have changed in recent years. This may also indirectly have affected the predation pressure on capelin. A more detailed discussion of interactions between capelin and other species is given in the 2016–2019 WGIBAR reports (ICES 2016, 2017, 2018c, 2019).

9.4.6 Further work on survey and assessment methodology

Survey

Since the only source of information about the capelin stock abundance and composition comes from the BESS, it is crucial to the assessment that the survey results are reliable. While the survey results of 2016 and 2017 revealed inconsistencies related to monitoring issues (Skaret *et al.*, 2018), the results from 2017 and 2018 were consistent, and also from 2018 and 2019.

On 3–17 March 2019, IMR tested out acoustic monitoring and stock estimation of spawning capelin. The initiative and funding comes from the industry, and the idea in the long term is that monitoring closer to when fishery and spawning happens, can reduce uncertainty in stock advice. Monitoring during spawning has been attempted before, last time in 2007–2009, and has proven to be methodologically difficult due to unpredictable timing and location of the spawning migration. This time the survey was done using the fishing vessel 'Vendla' in collaboration with a scouting vessel, the fishing vessel 'Rødholmen'. A stratified design with zigzag transects with randomized starting points were used and the effort was allocated based on historical and recent information about capelin distribution. The fishery sonar was used actively during the whole survey to estimate size distribution of capelin schools, and migration speed and direction. The coverage of the capelin spawning migration was successful and the estimate was within the expected range from the autumn predictions (Table 9.6). The survey report (Peña *et al.*, 2019) is available here: https://www.hi.no/resources/Toktrapport-loddetokt-mars-2019.pdf.

Nevertheless, methodological issues due to timing and patchy distribution of capelin were still very apparent, and this must be looked further into before such monitoring can be potentially implemented in an advisory process. A similar survey will be carried out again in the winter of 2020 with increased effort.

With the aim of improving survey methodology, the Deep vision camera system was tested this year on board 'Johan Hjort' during BESS for the second time. It was mounted on a frame in the trawl opening and towed after the vessel to obtain image samples of fish. The results can help to validate the classification of acoustic data to species groups which was an issue in particular during the 2016 survey, and can potentially provide size distribution of capelin in different depths. The test was promising, but unfortunately, leakage into the camera housing limited the testing to only a few trawl hauls.

Assessment model

In the present capelin assessment model, the only species interaction in the Barents Sea taken explicitly into account is predation by cod on mature capelin. The model does not take into account possible changes in capelin stock dynamics (e.g. maturation), the current state of the environment and stock status of other fish species and mammals in the Barents Sea. The ICES Working Group of Integrated Assessment of the Barents Sea (WGIBAR) has addressed some of these issues.

Consumption of prespawning capelin by mature cod in winter-spring season and autumn season is still not included in the assessment model. It may have a significant impact on capelin SSB calculations.

Gjøsæter *et al*. (2015) calculated what the quota advice and spawning stock would have been in the period 1991–2013, given the present assessment model and knowledge of the cod stock. By exchanging that cod forecast with the actual amount of cod from the cod assessment model run later in time and rerunning the model, they showed that considerably smaller annual quotas would have been advised if the amount of cod had been known and the present assessment

model had been used when the capelin quota was set. Following this work, a retrospective analysis of the capelin assessment as well as of the assessment performance should be included annually. This is a feature, which so far has been missing from the capelin assessment.

The further research should include improvement of the Bifrost model for calculation and inclusion interactions between capelin and other species for calculation new target reference point for capelin B_{target}.

A joint benchmark for IGJM capelin and BS capelin is planned for 2020. A few points, which are planned to be raised, are briefly discussed in the following:

Implementation of survey CV in the stock prediction. The StoX software allows for a rapid calculation of survey CV as part of the capelin biomass estimation process. Potentially this can be included in the stock prediction instead of the fixed CV of 0.2, which is used currently. A more detailed description of the CV estimation and discussion about its implementation is presented in WD5, 2018. The capelin stock projection as currently formulated implements uncertainty in a range of parameters, also related to the cod predation on capelin. A validation of the sensitivity of these uncertainties and their relative contribution to the output of the projection model is needed. At present and from a more practical point of view, the capelin projection model interface in use cannot efficiently run such evaluations and sensitivity tests, but potentially these can be available for the benchmark meeting.

Estimating the maturing part of the capelin stock. Currently a cut-off length of 14 cm is used and the proportion of the stock, which is above this length, is assumed to represent the maturing stock. There has been work investigating whether the cut-off is appropriate, and this will be presented at the benchmark.

Estimation of capelin mortality from cod predation during autumn. At present, the cod predation from 1 January to 1 April is explicitly modelled in the stock prediction model Bifrost. The cod predation during autumn is implemented as a monthly mortality rate based on a subset of historical estimates of capelin survey mortality. This implementation should be improved.

The parameterization for all processes in Bifrost and CapTool should be updated to include recent data.

9.5 Reference points

A B_{lim} (SSB_{lim}) management approach has been suggested for this stock (Gjøsæter *et al.*, 2002). In 2002, the JRNFC agreed to adopt a management strategy based on the rule that, with 95% probability, at least 200 000 tonnes of capelin should be allowed to spawn. Consequently, 200 000 tonnes was used as a B_{lim}. Alternative harvest control rules of 80, 85, and 90% probability of $SSB > B_{lim}$ were suggested by JNRFC and evaluated by ICES (ICES, 2016). ICES considers these rules not to be precautionary. At its 2016 meeting, JNRFC decided not to change the adopted management strategy.

Table 9.1. Barents Sea CAPELIN. International catch ('000 t) as used by the Working Group.

Year	Winter-Spring				Summer-Autumn			Total
	Norway	Russia	Others	Total	Norway	Russia	Total	
1965	217	7	0	224	0	0	0	224
1966	380	9	0	389	0	0	0	389
1967	403	6	0	409	0	0	0	409
1968	460	15	0	475	62	0	62	537
1969	436	1	0	437	243	0	243	680
1970	955	8	0	963	346	5	351	1314
1971	1300	14	0	1314	71	7	78	1392
1972	1208	24	0	1232	347	13	360	1591
1973	1078	34	0	1112	213	12	225	1337
1974	749	63	0	812	237	99	336	1148
1975	559	301	43	903	407	131	538	1441
1976	1252	228	0	1480	739	368	1107	2587
1977	1441	317	2	1760	722	504	1226	2986
1978	784	429	25	1238	360	318	678	1916
1979	539	342	5	886	570	326	896	1782
1980	539	253	9	801	459	388	847	1648
1981	784	429	28	1241	454	292	746	1986
1982	568	260	5	833	591	336	927	1760
1983	751	373	36	1160	758	439	1197	2357
1984	330	257	42	629	481	368	849	1477
1985	340	234	17	591	113	164	277	868
1986	72	51	0	123	0	0	0	123
1987-1990	0	0	0	0	0	0	0	0
1991	528	159	20	707	31	195	226	933
1992	620	247	24	891	73	159	232	1123
1993	402	170	14	586	0	0	0	586
1994-1996	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	1	1	1

Year	Winter-Spring				Summer-Autumn			Total
	Norway	Russia	Others	Total	Norway	Russia	Total	
1998	0	2	0	2	0	1	1	3
1999	50	33	0	83	0	22	22	105
2000	279	94	8	381	0	29	29	410
2001	376	180	8	564	0	14	14	578
2002	398	228	17	643	0	16	16	659
2003	180	93	9	282	0	0	0	282
2004	0	0	0	0	0	0	0	0
2005	1	0	0	1	0	0	0	1
2006	0	0	0	0	0	0	0	0
2007	2	2	0	4	0	0	0	4
2008	5	5	0	10	0	2	0	12
2009	233	73	0	306	0	1	1	307
2010	246	77	0	323	0	0	0	323
2011	273	87	0	360	0	0	0	360
2012	228	68	0	296	0	0	0	296
2013	116	60	0	177	0	0	0	177
2014	40	26	0	66	0	0	0	66
2015	71	44	0	115	0	0	0	115
2016-2017	0	0	0	0	0	0	0	0
2018	129	66	0	195	0	0	0	195
2019	5*	0	0	0	0	0	0	0

*** Research catch**

Table 9.2. Barents Sea CAPELIN. Stock size estimation table. Estimated stock size (10^9) by age and length, and biomass (10^3 tonnes) from the acoustic survey in August-September 2019. TSN: Total stock number. TSB: Total-stock biomass. MSN: Maturing stock number. MSB: Maturing stock biomass.

Length (cm)	Age/year class				Sum (10^9)	Biomass (10^3t)	Mean weight (g)
	1 2018	2 2017	3 2016	4 2015			
7-7.5	1.121	0	0	0	1.121	1.46	1.3
7.5-8	1.756	0	0	0	1.756	2.509	1.43
8-8.5	0.985	0	0	0	0.985	2.004	2.03
8.5-9	1.874	0.0088	0	0	1.883	4.649	2.47
9-9.5	1.387	0.042	0	0	1.429	4.137	2.9
9.5-10	1.452	0.006	0	0	1.459	5.141	3.52
10-10.5	1.522	0	0	0	1.522	6.405	4.21
10.5-11	1.598	0.016	0	0	1.615	7.914	4.9
11-11.5	0.875	0.015	0.053	0	1.077	6.054	5.62
11.5-12	1.112	0.122	0	0	1.234	7.785	6.31
12-12.5	0.95	0.271	0	0	1.221	9.28	7.6
12.5-13	0.512	0.4185	0.018	0	0.949	8.375	8.83
13-13.5	0.747	0.865	0.027	0	1.638	16.516	10.08
13.5-14	0.554	1.534	0.278	0	2.369	27.303	11.53
14-14.5	0.515	1.094	0.043	0	1.651	21.559	13.06
14.5-15	0.317	1.395	0.124	0.059	1.895	27.993	14.77
15-15.5	0.146	1.045	0.267	0.002	1.461	24.488	16.77
15.5-16	0.01	1.002	1.391	0.041	2.444	46.278	18.94
16-16.5	0.0194	0.736	1.195	0.116	2.066	43.827	21.21
16.5-17	0.003	0.388	1.537	0.343	2.271	52.693	23.21
17-17.5	0	0.049	0.801	0.244	1.095	28.896	26.39
17.5-18	0	0.101	0.665	0.179	0.945	28.35	29.99
18-18.5	0	0.014	0.551	0.149	0.714	23.057	32.31
18.5-19	0	0.003	0.06	0.015	0.008	2.752	35.08
19-19.5	0	0	0.024	0.008	0.032	1.213	37.9
19.5-20	0	0	0	0.006	0.006	0.244	38

Length (cm)	Age/year class 1 2018	2 2017	3 2016	4 2015	Sum (10^9)	Biomass (10^3t)	Mean weight (g)
20-20.5				0.006	0.006	0.264	41
20.5-21				0	0	0.002	44
TSN(10^9)	17.455	9.26	7.036	1.169	34.92		
TSB(10^3t)	86.015	134.535	160.425	30.171		411.147	
Mean length (cm)	10.03	14.26	16.22	16.83			
Mean weight (g)	4.93	14.53	22.8	25.71			11.77
MSN (10^9)	1.01	5.828	6.658	1.169	14 593	105.593	
MSB (10^3t)	14.51	100.915	156.141	30.055			301.615

Table 9.3. Barents Sea CAPELIN. Recruitment and natural mortality table. Larval abundance estimate in June, 0-group indices and acoustic estimate in August-September, total mortality from age 1+ to age 2+.

Year class	Larval abundance	0-group Index (10^9 ind.)		Acoustic estimate (10^9ind.)		Mortality survey(1—2)
	(10^{12})	Without Keff	With Keff	1(Y+1)	2(Y+2)	%
1980	-	197.3	740	402.6	147.6	63
1981	9.7	123.9	477	528.3	200.2	62
1982	9.9	168.1	600	514.9	186.5	64
1983	9.9	100.0	340	154.8	48.3	69
1984	8.2	68.1	275	38.7	4.7	88
1985	8.6	21.3	64	6.0	1.7	72
1986	0.0	11.4	42	37.6	28.7	24
1987	0.3	1.2	4	21.0	17.7	16
1988	0.3	19.6	65	189.2	177.6	6
1989	7.3	251.5	862	700.4	580.2	17
1990	13.0	36.5	116	402.1	196.3	51
1991	3.0	57.4	169	351.3	53.4	85
1992	7.3	1.0	2	2.2	3.4	--
1993	3.3	0.3	1	19.8	8.1	59
1994	0.1	5.4	14	7.1	11.5	--
1995	0.0	0.9	3	81.9	39.1	52
1996	2.4	44.3	137	98.9	72.6	27
1997	6.9	54.8	189	179.0	101.5	43
1998	14.1	33.8	113	156.0	110.6	29
1999	36.5	85.3	288	449.2	218.7	51
2000	19.1	39.8	141	113.6	90.8	20
2001	10.7	33.6	90	59.7	9.6	84
2002	22.4	19.4	67	82.4	24.8	70
2003	11.9	94.9	341	51.2	13.0	75
2004	2.5	16.7	54	26.9	21.7	19
2005	8.8	41.8	148	60.1	54.7	9

Year class	Larval abundance (10^{12})	0-group Index (10^9 ind.)		Acoustic estimate (10^9ind.)		Mortality survey(1—2)
		Without Keff	With Keff	1(Y+1)	2(Y+2)	%
2006	17.1	166.4	516	221.7	231.4	--
2007	-	157.9	480	313.0	166.4	46
2008	-	288.8	995	124.0	127.6	--
2009	-	189.8	673	248.2	181.1	27
2010	-	91.7	319	209.6	156.4	25
2011	-	175.8	594	145.9	216.2	-
2012	-	310.5	989	324.5	106.6	67
2013	-	94.7	316	105.1	40.5	62
2014	-	49.0	164	39.5	8.1	79
2015	-	148.0	456	31.6	123.7	-
2016	-	274.0	779	86.4	59.6	31
2017	-	104.2	694	58.6	7.0	88
2018	-	-	-	17.5		
2019	-	156	538			
Average	9.0	95.8	338	175.3	104	

Table 9.4. Barents Sea CAPELIN. Stock size in numbers by age, total-stock biomass, biomass of the maturing component (MSB) on 1 October.

Year	Stock in numbers (10^9)						Biomass (10^3 tonnes)	
	Age 1	Age 2	Age 3	Age 4	Age 5	Total	Total	MSB
1973	528	375	40	17	0	961	5144	1350
1974	305	547	173	3	0	1029	5733	907
1975	190	348	296	86	0	921	7806	2916
1976	211	233	163	77	12	696	6417	3200
1977	360	175	99	40	7	681	4796	2676
1978	84	392	76	9	1	561	4247	1402
1979	12	333	114	5	0	464	4162	1227
1980	270	196	155	33	0	654	6715	3913
1981	403	195	48	14	0	660	3895	1551
1982	528	148	57	2	0	735	3779	1591
1983	515	200	38	0	0	754	4230	1329
1984	155	187	48	3	0	393	2964	1208
1985	39	48	21	1	0	109	860	285
1986	6	5	3	0	0	14	120	65
1987	38	2	0	0	0	39	101	17
1988	21	29	0	0	0	50	428	200
1989	189	18	3	0	0	209	864	175
1990	700	178	16	0	0	894	5831	2617
1991	402	580	33	1	0	1016	7287	2248
1992	351	196	129	1	0	678	5150	2228
1993	2	53	17	2	2	75	796	330
1994	20	3	4	0	0	28	200	94
1995	7	8	2	0	0	17	193	118
1996	82	12	2	0	0	96	503	248
1997	99	39	2	0	0	140	911	312
1998	179	73	11	1	0	263	2056	931
1999	156	101	27	1	0	285	2776	1718

Year	Stock in numbers (10^9)						Biomass (10^3 tonnes)	
	Age 1	Age 2	Age 3	Age 4	Age 5	Total	Total	MSB
2000	449	111	34	1	0	595	4273	2099
2001	114	219	31	1	0	364	3630	2019
2002	60	91	50	1	0	201	2210	1290
2003	82	10	11	1	0	104	533	280
2004	51	25	6	1	0	82	628	294
2005	27	13	2	0	0	42	324	174
2006	60	22	6	0	0	88	787	437
2007	222	55	4	0	0	280	1882	844
2008	313	231	25	2	0	571	4427	2468
2009	124	166	61	0	0	352	3756	2323
2010	248	128	61	1	0	438	3500	2051
2011	209	181	55	8	0	454	3707	2115
2012	146	156	88	2	0	392	3586	1997
2013	324	216	59	7	0	610	3956	1471
2014	105	107	39	2	0	253	1949	873
2015	40	40	13	1	0	94	842	375
2016	32	8	3	0	0	43	328	181
2017	86	124	17	0	0	227	2506	1723
2018	59	60	21	0	0	140	1597	1056
2019	17	9	7	1	0	35	411	302

Table 9.5. Barents Sea CAPELIN. Summary stock and data for prognoses table. Recruitment and total biomass (TSB) are survey estimates back-calculated to 1 August (before the autumn fishing season) for 1985 and earlier; for 1986 and later it is the survey estimate. Maturing biomass (MSB) is the survey estimate of fish above length of maturity (14.0 cm). SSB is the median value of the modelled stochastic spawning-stock biomass (after the winter/spring fishery). *-indicates a very small spawning stock.

Year	Estimated stock by autumn acoustic survey (10^3 t) 1 October		SSB, assessment model, April 1 year+1 (10^3 t)	SSB, by winter acoustic survey (10^3 t)	Recruitment Age 1, survey assessment 1 October 10^9 sp.	Young herring biomass age 1+2 (10^6 t) source: WGIBAR	Herring 0-group index (10^9 sp) corr. for catching efficiency	Capelin Landing (10^3 t)
	TSB	MSB						
1972	6600	2727			152	0.002		1591
1973	5144	1350	33		529	0.002		1337
1974	5733	907	*		305	0.048		1148
1975	7806	2916	*		190	0.074		1441
1976	6417	3200	253		211	0.039		2587
1977	4796	2676	22		360	0.046		2986
1978	4247	1402	*		84	0.052		1916
1979	4162	1227	*		12	0.039		1782
1980	6715	3913	*		270	0.066	0.08	1648
1981	3895	1551	316		403	0.047	0.04	1986
1982	3779	1591	106		528	0.009	2.52	1760
1983	4230	1329	100		515	0.012	195.45	2357
1984	2964	1208	109		155	1.467	27.35	1477
1985	860	285	*		39	2.638	20.08	868
1986	120	65	*		6	0.191	0.09	123
1987	101	17	34	4	38	0.287	0.05	0
1988	428	200	*	10	21	0.056	60.78	0
1989	864	175	84	378	189	0.156	17.96	0
1990	5831	2617	92	94	700	0.467	15.17	0
1991	7287	2248	643	1769	402	0.955	267.64	933
1992	5150	2228	302	1735	351	2.037	83.91	1123
1993	796	330	293	1498	2	3.649	291.47	586
1994	200	94	139	187	20	3.000	103.89	0
1995	193	118	60	29	7	0.821	11.02	0

Year	Estimated stock by autumn acoustic survey (10^3 t) 1 October		SSB, assessment model, April 1 year+1 (10^3 t)	SSB, by winter acoustic survey (10^3 t)	Recruitment Age 1, survey assessment 1 October 10^9 sp.	Young herring biomass age 1+2 (10^6 t) source: WGIBAR	Herring 0-group index (10^9 sp) corr. for catching efficiency	Capelin Landing (10^3 t)
	TSB	MSB						
1996	503	248	60		82	0.300	549.61	0
1997	909	312	85		99	0.349	463.24	1
1998	2056	932	94	414	179	0.620	476.07	3
1999	2775	1718	382		156	1.080	35.93	105
2000	4273	2098	599	700	449	2.136	469.63	410
2001	3630	2019	626		114	1.543	10.01	578
2002	2210	1291	496	1417	60	0.664	151.51	659
2003	533	280	427		82	1.695	177.68	282
2004	628	294	94	105	51	3.108	773.89	0
2005	324	174	122		27	2.105	125.93	1
2006	787	437	72		60	2.153	294.65	0
2007	2119	844	189		222	0.916	144	4
2008	4428	2468	330	469	313	0.865	201.05	12
2009	3765	2323	517	180	124	0.375	104.23	307
2010	3500	2051	504	452	248	0.579	117.09	323
2011	3707	2115	487	160	209	0.843	83.05	360
2012	3586	1997	504		146	0.394	177.19	296
2013	3956	1471	479		324	0.468	289.39	177
2014	1949	873	504		105	0.553	136.31	66
2015	842	375	82		40	0.698	82.75	115
2016	328	181	37		32	0.452	79.44	0
2017	2506	1723	462		124	0.703	153.76	0
2018	1597	1056	317		59		-	195
2019	411	302	85	295	17			0

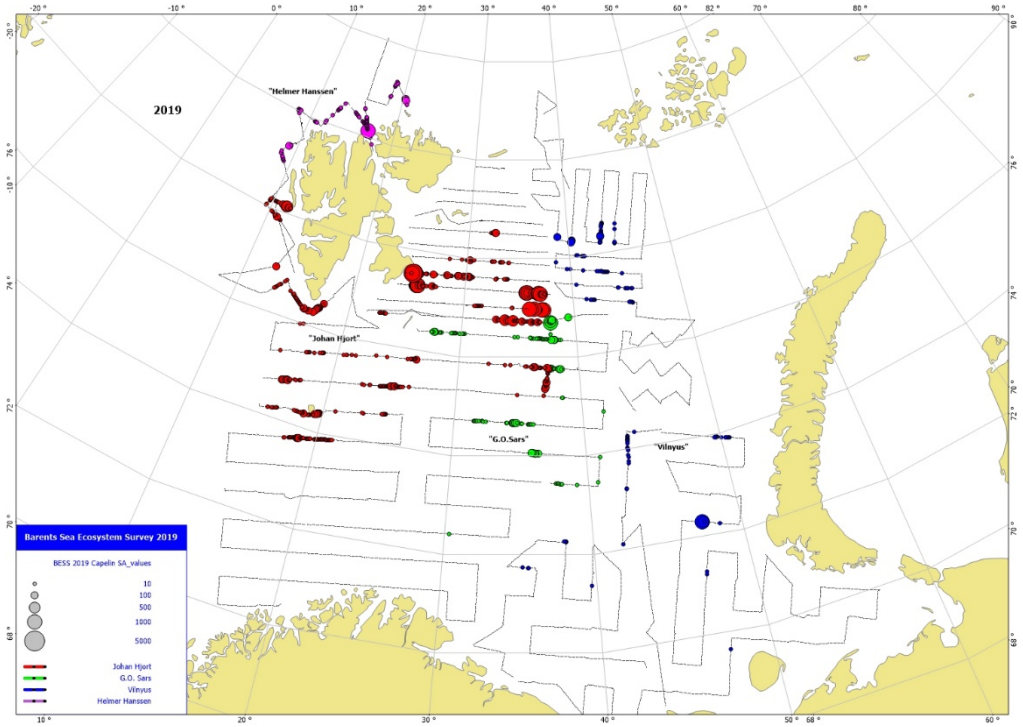

Figure 9.1. Geographical distribution of capelin in autumn 2019.

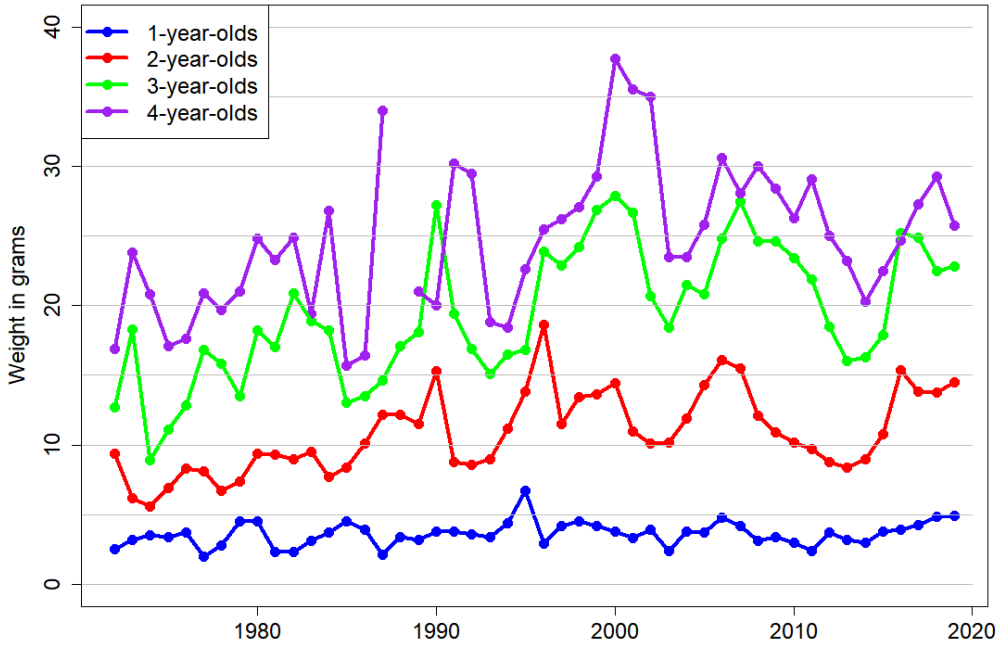

Figure 9.2. Weight-at-age (grammes) for capelin from the autumn survey.

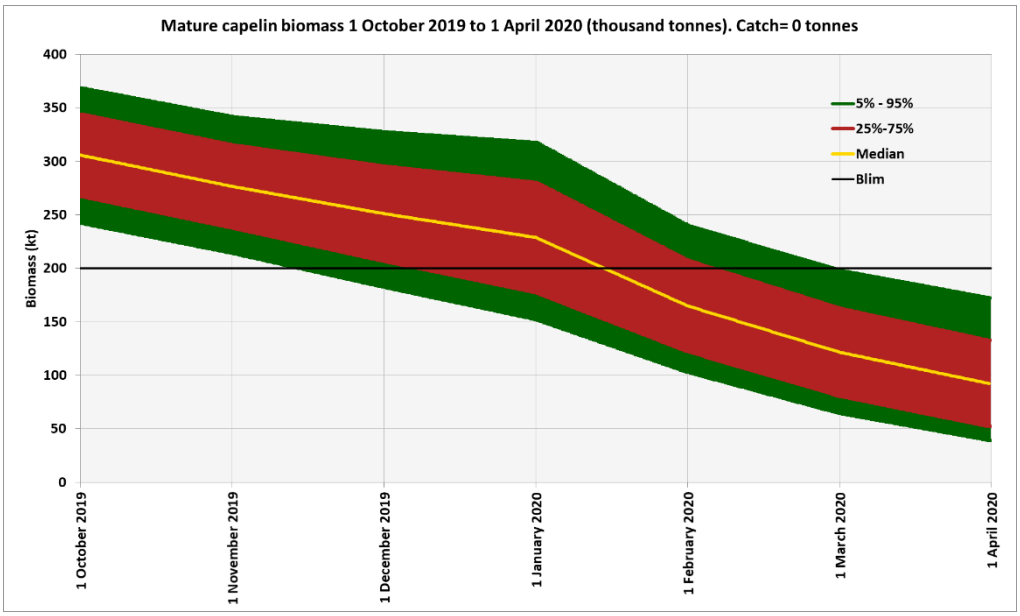

Figure 9.3. Probabilistic prognosis 1 October 2019–1 April 2020 for Barents Sea capelin maturing stock, with no catch (model CapTool, 50 000 simulations).

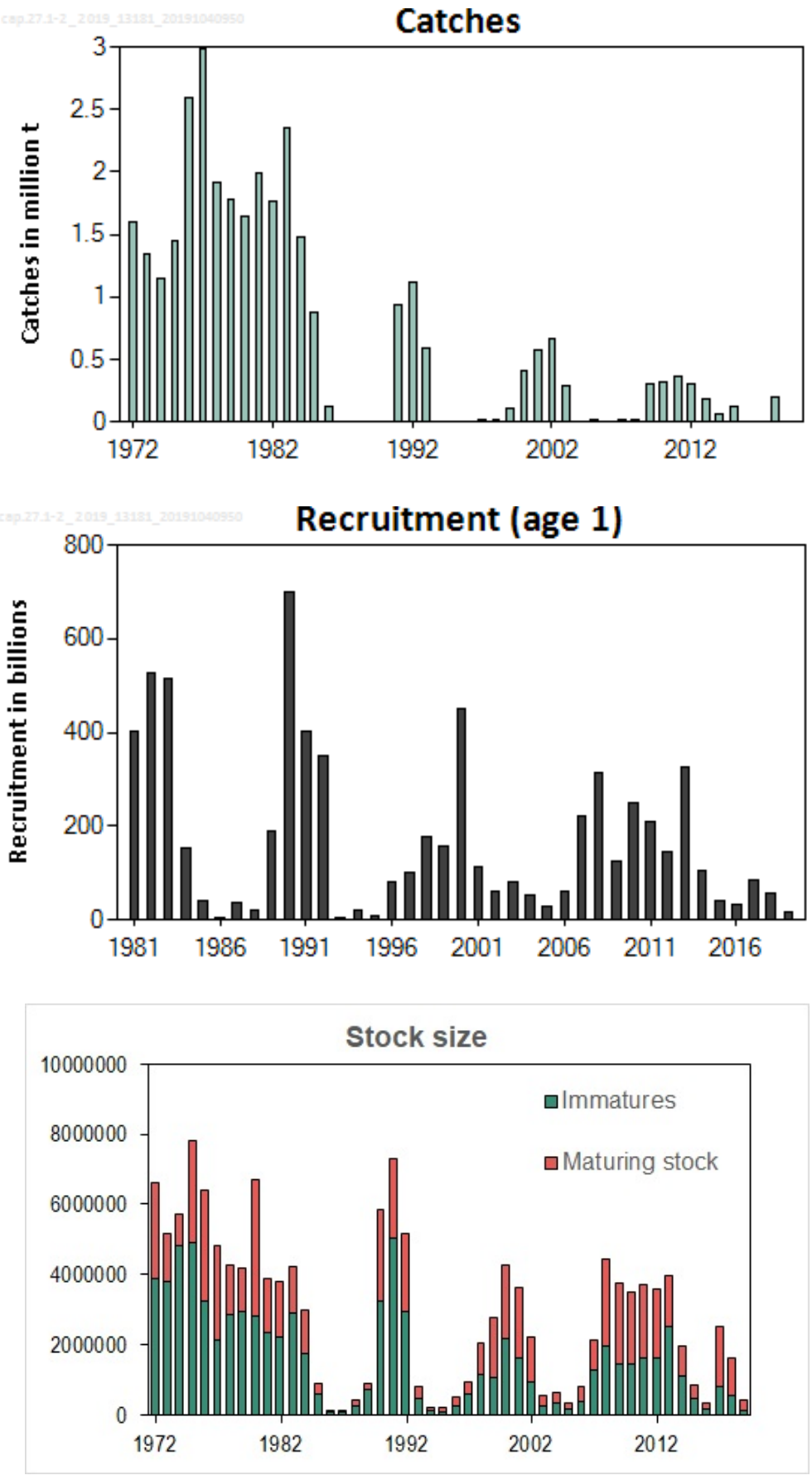

Figure 9.4. Capelin in subareas 1 and 2, excluding Division 2.a west of 5°W (Barents Sea capelin). Landing and summary of stock assessment (mature and immature stock biomass).

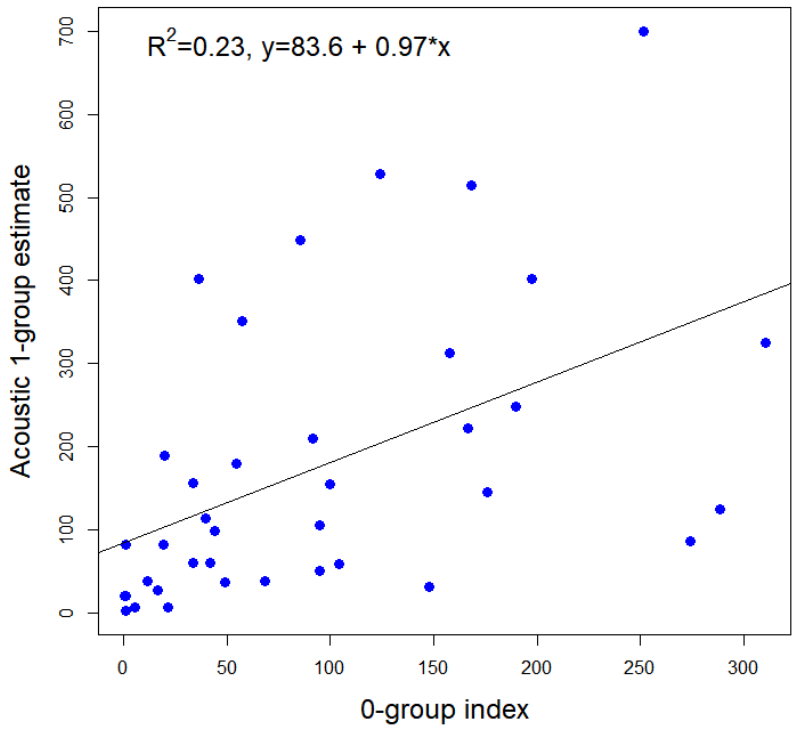

Figure 9.5. Regression of abundance of capelin at age 0 (0-group index without K_{eff}) and age 1 for cohorts 1980–2017. No 0-group estimate was made for the 2018 cohort.

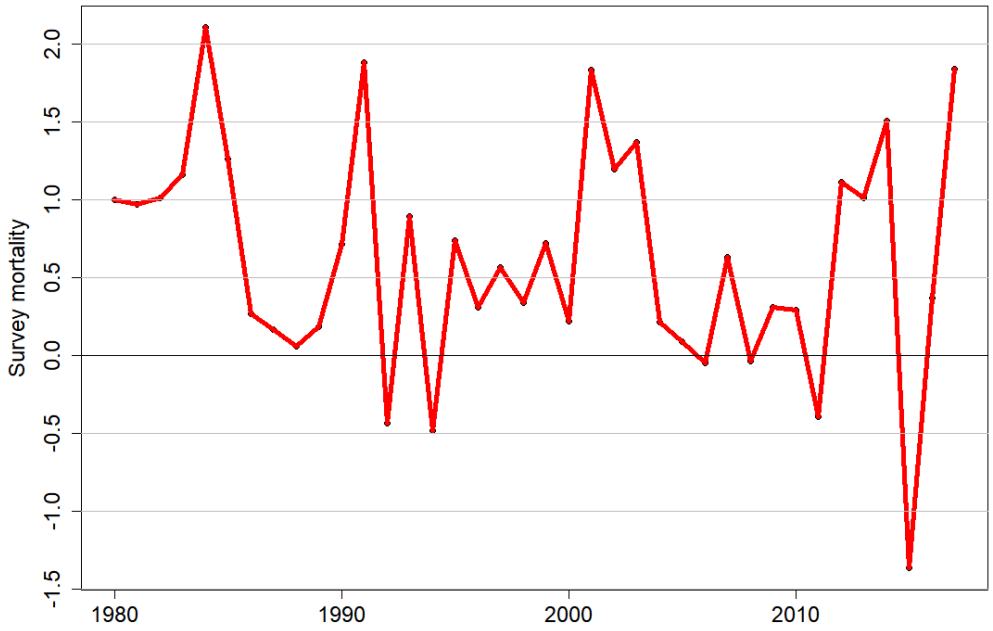

Figure 9.6. Capelin survey mortality from age 1–2.