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Section contents

10 Barents Sea capelin

Mallotus villosus in subareas 1 and 2 (Northeast Arctic), excluding Division 2.a west of 5°W – cap.27.1–2

As decided at the Arctic Fisheries Working Group at its 2021 meeting, the assessment of Barents Sea capelin was left to the parties responsible for the autumn survey, i.e. IMR in Bergen and VNIRO PolarBranch in Murmansk. In accordance with this, the assessment was done during a virtual meeting 4–5 October 2021. The assessment is an update assessment, without changes to the methodology. Participants:

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10.1 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.

10.2 TAC and catch statistics (Table 9.1)

The Joint Russian-Norwegian Fishery Commission set a zero TAC both for 2019, 2020 and 2021. For all three years, the quotas were in accordance with the ICES advice. The international historical catch by country and season in the years 1965–2021 is given in Table 10.1. There was no commercial fishery in 2021, but some minor catches were taken – 2.3 tonnes in the capelin spawning survey by Norway and 7.3 tonnes in scientific surveys and as bycatch in the northern shrimp trawl fishery by Russia.

10.3 Sampling

The capelin sampling from the Barents Sea in 2021 is summarized below:

Investigation	No. of trawl hauls	Length measurements	Aged individuals
Winter capelin survey 2021 (Norway)	27	1775	675
Winter bottom survey 2021 (Norway)	211	9983	1134
Winter bottom survey 2021 (Russia)	90	5339	175
IESNS 2021 (Russia)	12	362	156
BESS 2021 (Norway)	339	22261	6221
BESS 2021 (Russia)	195	15255	1103

10.4 Stock assessment

10.4.1 Acoustic stock size estimates in 2021 (Table 10.2, Figure 10.1 and 10.2)

The geographical survey coverage of the Barents Sea capelin stock during the BESS in 2021 was almost complete (Figure 10.1). However, as last year, an area in the central part of the Barents Sea ("Loophole") was not covered.

The geographical distribution of capelin in 2021 is shown in Figure 10.1, and the position and weighting of the trawl stations are shown in Figure 10.2.

The stock estimate from the area covered by the 2021 survey was 3.998 million tonnes (Table 10.2). About 36% (1.438 million tonnes) of the estimated stock biomass consisted of maturing fish (> 14.0 cm). The mean weight at age in the 2021 survey was the lowest since 2014 for age 2 (Figure 10.3).

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 allow for estimation of a direct CV by age group, and for the 2021 survey this was estimated:

- for age group 1: 0.17;
- for age group 2: 0.10;
- and for age group 3: 0.29.

These values are lower than previous years for age groups 1 and 2 and similar for age group 3. Relative sampling error based only on acoustic recordings (Nautical Area Scattering Coefficient (NASC; m^2nmi^{-2})) was estimated to be 9.27% which is much lower than in the two previous years. Detailed information about previous CV estimates can be found in AFWG WD05, 2018. Future implementation of direct survey CV in the assessment is discussed under future work (10.4.6).

10.4.2 Stock assessment in 2021 (Table 10.3–10.5, Figure 10.4)

Probabilistic projections of the maturing stock to the time of spawning at 1 April 2022 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 2022 from the 2021 Arctic Fisheries Working Group (ICES Scientific Reports. 3:58). The revised cod assessment made in September 2021 was used[1].

The methodology is described in the 2009 WKSHORT report (ICES C.M. 2009/ACOM:34) and the WKARCT 2015 report (ICES C.M. 2015/ACOM:31). 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 2021 as in 2020 (ICES 2011/ACOM:05, Annex 12).

The CapTool forecast methodology has been implemented in the R package Bifrost and was run alongside the standard procedure. The results were similar, and it produced the same advice.

With no catch, the estimated median spawning stock size on 1 April, 2022 is 479 kt (90% confidence interval: 259–916 kt; Figure 10.4), and the probability for the spawning stock to be above B_{lim} (200 000 t) is 99%.

With a catch of 70 000 tonnes, the probability for the spawning stock in 2022 to be below 200 000 t, the B_{lim} value used by ACFM in recent years, is 5% (Figure 10.4). The median spawning stock size in 2022 will then be 420 000 tonnes (90% confidence interval: 200–833 kt), and the corresponding median modelled consumption by immature cod in the period January–March 2022 will then be 570 000 tonnes. Figure 10.4 shows the probabilistic forecast from 1 October 2021 to 1 April 2022 conditional on a quota of 70 000 tonnes, while Figure 10.5 shows the probability of $SSB < B_{lim}$ as a function of the catch.

As in previous years, the catch corresponding to 95% probability of being above B_{lim} is calculated to the nearest 5000 tonnes.

Estimates of stock by age group and total biomass for the historical period are shown in Table 10.4. Other data which describe the stock development are shown in Table 10.5. Information about spawning surveys going back to the 1980s is given in Gjøsæter and Prozorkevitch (WD05, 2020). Summary plots are given in Figure 10.6.

10.4.3 Recruitment

The coverage of the 0-group survey in 2018 and 2020 was incomplete, and an estimate of the 0-group numbers was made for only half of the survey area. In 2021, the coverage was complete, but results were not available at the time of the working group. Table 10.3 shows the number of fish in the various year classes from surveys at age 0–2, and their "survey mortality" from age one to age two is also shown in Figure 10.7.

The 1-group abundance in 2021 was 220.8 billion which is higher than the long-term average (Figure 10.6). 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

[1] ICES. 2021. Cod (*Gadus morhua*) in subareas 1 and 2 (Northeast Arctic). In Report of the ICES Advisory Committee, 2021. ICES Advice 2021, cod.27.1-2, https://doi.org/10.17895/ices.advice.7741.

capelin stock (Hjermann *et al.*, 2010; Gjøsæter *et al.*, 2016). In 2021, very little herring at age 1–4 were recorded in the Barents Sea.

10.4.4 Comments to the assessment

10.4.4.1 Ecological considerations

The number of young herring in the Barents Sea can be an important factor that affects capelin recruitment. It is not currently taken into account in the assessment model. The benchmark for capelin stocks in the Barents Sea (WKARCT, ICES C.M. 2015/ACOM:31) 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 2016–2021 ICES WGIBAR reports.

The abundance of 2-year-olds observed is the highest in 30 years and the high abundance corresponds to low length-at-age. This is likely a result of high internal competition for food and reduced growth. This tendency is likely enhanced by a strong 2020-year class at least partly competing for the same food. The implication is that the majority of this year class had not reached a length of 14 cm and is not expected to migrate to the coast and spawn before winter 2023.

10.4.5 Further work on survey and assessment methodology

10.4.5.1 Survey

On 26 February–12 March 2021, IMR carried out trawl-acoustic monitoring and stock estimation of spawning capelin (Skaret *et al.*, 2021). The survey is the third survey in a series to evaluate whether such monitoring can be used in the assessment to improve the advice. The initiative and funding come 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. The survey was carried out using two fishing vessels 'Vendla' and 'Eros'. A stratified design using zig-zag transects with randomized starting points was 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, migration speed and direction. In addition, target-strength measurements were carried out and an autonomous sail buoy was tried for monitoring through remote control. The coverage of the capelin spawning migration was successful and the estimate of ca. 86 000 tonnes with a CV of 0.49 was within the expected range from the predictions made in autumn 2020.

Nevertheless, methodological issues due to timing and patchy distribution of capelin were still very apparent, and this must be handled in an adequate manner before such monitoring can be potentially implemented in an advisory process. A similar survey will be carried out again in winter 2022, and then an evaluation of the four-year series will be carried out. This will be a part of the benchmark for this stock which will be held in 2022.

10.4.5.2 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 the winter-spring season and autumn season is still not included in the assessment model. It may have a significant affect 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 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 that so far has been missing from the capelin assessment.

There is ongoing work to address specific points related to modelling for the benchmark meeting in 2021/22. These include implementation of survey CV in the capelin assessment model, incorporating the assessment model in Template Model Builder (R-package), validating both the cod consumption part of the model and the capelin maturation part and updating consumption parameters to reflect the recent state in the Barents Sea. As mentioned above, the CapTool methodology for half-year predictions has already been implemented in R. Historic CVs of SSB estimates will be calculated back to 2004.

10.4.6 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 (WKNEAMP-2, ICES C. M. 2016/ACOM:47). ICES considers these rules not to be precautionary. At its 2016 meeting, JNRFC decided not to change the adopted management strategy.

Table 10.1 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**
2019–2021	0	0	0	0	0	0	0	**0**

Table 10.2. Barents Sea capelin. Stock size estimation table. Estimated stock size (10^6) by age and length, and biomass (1000 tonnes) from the acoustic survey in August-October 2021. TSN: Total stock number. TSB: Total-stock biomass. MSN: Maturing stock number. MSB: Maturing stock biomass.

Length (cm)	Age/year class					Sum	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	10^9		
	2020	2019	2018	2017	2016			
7.0-7.5	1.92					1.92	2.53	1.32
7.5-8.0	4.82					4.82	9.07	1.88
8.0-8.5	15.46					15.46	34.93	2.26
8.5-9.0	26.72	1.07				27.79	73.09	2.63
9.0-9.5	53.27	2.98				56.25	170.44	3.03
9.5-10.0	60.28	6.18				66.46	227.95	3.43
10.0-10.5	32.24	14.56				46.8	187.67	4.01
10.5-11.0	15.64	44.08				59.72	284.86	4.77
11.0-11.5	4.68	39.57				44.25	241.61	5.46
11.5-12.0	2.93	40.58	0.02			43.53	278.59	6.4
12.0-12.5	1.41	34.22				35.63	265.09	7.44
12.5-13.0	0.93	31.6	0.17			32.7	285.18	8.72
13.0-13.5	0.35	26.38	0.24			26.97	273.76	10.15
13.5-14.0	0.13	18.48	0.44			19.04	224.8	11.81
14.0-14.5	0.07	15.84	0.34			16.25	215.82	13.28
14.5-15.0		13.36	0.53			13.89	215.3	15.5
15.0-15.5		14.24	0.23			14.47	251.54	17.38
15.5-16.0		9.74	1.51			11.25	223.36	19.85
16.0-16.5		6.27	0.68			6.95	154.24	22.18
16.5-17.0		6.74	0.32			7.06	177.3	25.1
17.0-17.5		2.774	1.03	0.01		3.814	105.26	27.6
17.5-18.0		1.043	0.454			1.497	48.24	32.23
18.0-18.5		0.164	0.924			1.089	36.55	33.58
18.5-19.0		0.115				0.115	4.3	37.39
19.0-19.5		0.0344	0.1013	0.0006		0.1362	5.38	39.46
19.5-20.0				0.0208		0.0208	0.91	43.87
20.5-20.5				0.0002		0.0002	0.01	47.88
TSN (10^9)	220.85	330.0204	6.996	0.0316		557.89		
TSB (10^3 t)	757.71	3081.46	157.23	1.22			3997.62	
Mean length (cm)	9.58	12.57	16.11	18.95		11.43		
Mean weight (g)	3.43	9.34	22.47	38.66				7.17
SSN (10^9)	0.07	70.3204	6.12	0.0316		76.54		
SSB (10^3 t)	0.93	1287.85	147.96	1.22			1437.96	

Table 10.3 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(10^{12})	0-group swept-area numbers (10^9 ind.)	Acoustic estimate (10^9ind.)		Mortality survey (1–2)
	0 (Y)	0+(Y)	1(Y+1)	2(Y+2)	%
1980	-	760	402.6	147.6	63
1981	9.7	536	528.3	200.2	62
1982	9.9	655	514.9	186.5	64
1983	9.9	421	154.8	48.3	69
1984	8.2	295	38.7	4.7	88
1985	8.6	112	6.0	1.7	72
1986	0.0	59	37.6	28.7	24
1987	0.3	4	21.0	17.7	16
1988	0.3	79	189.2	177.6	6
1989	7.3	963	700.4	580.2	17
1990	13.0	130	402.1	196.3	51
1991	3.0	234	351.3	53.4	85
1992	7.3	5	2.2	3.4	--
1993	3.3	2	19.8	8.1	59
1994	0.1	20	7.1	11.5	--
1995	0.0	17	81.9	39.1	52
1996	2.4	172	98.9	72.6	27
1997	6.9	282	179.0	101.5	43
1998	14.1	147	156.0	110.6	29
1999	36.5	428	449.2	218.7	51
2000	19.1	188	113.6	90.8	20
2001	10.7	139	59.7	9.6	84
2002	22.4	100	82.4	24.8	70
2003	11.9	550	51.2	13.0	75
2004	2.5	67	26.9	21.7	19
2005	8.8	231	60.1	54.7	9

Year class	Larval abundance(10^{12})	0-group swept-area numbers (10^9 ind.)	Acoustic estimate (10^9ind.)		Mortality survey (1–2)
	0 (Y)	0+(Y)	1(Y+1)	2(Y+2)	%
2006	17.1	819	221.7	231.4	--
2007	-	760	313.0	166.4	46
2008	-	1251	124.0	127.6	--
2009	-	865	248.2	181.1	27
2010	-	416	209.6	156.4	25
2011	-	767	145.9	216.2	-
2012	-	1141	324.5	106.6	67
2013	-	398	105.1	40.5	62
2014	-	268	39.5	8.1	79
2015	-	592	31.6	123.7	-
2016	-	980	86.4	59.6	31
2017	-	273	58.6	7.0	88
2018	-	592 (804)*	17.5	31.1	-
2019	-	2165	366.4	330.0	10
2020	-	753 (1265)*	220.9		
2021	-				
Average	9.0	451	176.8	105.2	

***In the brackets – the correction numbers, taking into account not surveyed area.**

Table 10.4 Barents Sea capelin. Stock size in numbers by age, total-stock biomass, biomass of the maturing component (MSB) at 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
2020	366	31	4	1	0	403	1884	533
2021	221	330	7	0	0	558	3998	1438

Table 10.5 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. "SSB by winter" is acoustic assessment in the winter-spring survey in next year. For most of the years, the survey area was covered partly. Estimates from spawning surveys going back to the 1980s are given in Gjøsæter and Prozorkevitch (WD05, AFWG 2021) and not included here.

Year	Estimated stock by autumn acoustic survey (10^3 t) 1 October		SSB, assessment model, April 1 year+1 (10^3 t)	Recruitment Age 1, survey assessment 1 October 10^9 sp.	Young herring biomass age 1+2 (10^3 tonnes) source: WGIBAR	Herring 0-group swept-area index (10^9 ind.p)	Capelin landing (10^3 t)
	TSB	MSB					
1972	6600	2727		152	2		1591
1973	5144	1350	33	529	2		1337
1974	5733	907	*	305	48		1148
1975	7806	2916	*	190	74		1441
1976	6417	3200	253	211	39		2587
1977	4796	2676	22	360	46		2986
1978	4247	1402	*	84	52		1916
1979	4162	1227	*	12	39		1782
1980	6715	3913	*	270	66	2	1648
1981	3895	1551	316	403	47	7	1986
1982	3779	1591	106	528	9	1	1760
1983	4230	1329	100	515	12	220	2357
1984	2964	1208	109	155	1467	33	1477
1985	860	285	*	39	2638	12	868
1986	120	65	*	6	191	0	123
1987	101	17	34	38	288	6	0
1988	428	200	*	21	76	71	0
1989	864	175	84	189	276	19	0
1990	5831	2617	92	700	431	19	0
1991	7287	2248	643	402	926	263	933
1992	5150	2228	302	351	1326	110	1123
1993	796	330	293	2	2426	233	586
1994	200	94	139	20	1882	187	0
1995	193	118	60	7	646	14	0

Year	Estimated stock by autumn acoustic survey (10^3 t) 1 October		SSB, assessment model, April 1 year+1 (10^3 t)	Recruitment Age 1, survey assessment 1 October 10^9 sp.	Young herring biomass age 1+2 (10^3 tonnes) source: WGIBAR	Herring 0-group swept-area index (10^9 ind.p)	Capelin landing (10^3 t)
	TSB	MSB					
1996	503	248	60	82	238	650	0
1997	909	312	85	99	534	609	1
1998	2056	932	94	179	556	675	3
1999	2775	1718	382	156	1613	50	105
2000	4273	2098	599	449	2102	572	410
2001	3630	2019	626	114	1229	17	578
2002	2210	1291	496	60	426	194	659
2003	533	280	427	82	1788	173	282
2004	628	294	94	51	3777	941	0
2005	324	174	122	27	2176	170	1
2006	787	437	72	60	2100	289	0
2007	2119	844	189	222	866	184	4
2008	4428	2468	330	313	946	276	12
2009	3765	2323	517	124	433	109	307
2010	3500	2051	504	248	593	166	323
2011	3707	2115	487	209	799	100	360
2012	3586	1997	504	146	433	177	296
2013	3956	1471	479	324	485	361	177
2014	1949	873	504	105	677	155	66
2015	842	375	82	40	986	95	115
2016	328	181	37	32	531	123	0
2017	2506	1723	462	124	911	232	0
2018	1597	1056	317	59	1544	97	195
2019	411	302	85	17	455	101	0
2020	1884	533	154	366	885	22	0
2021	3998	1438	420	221			0

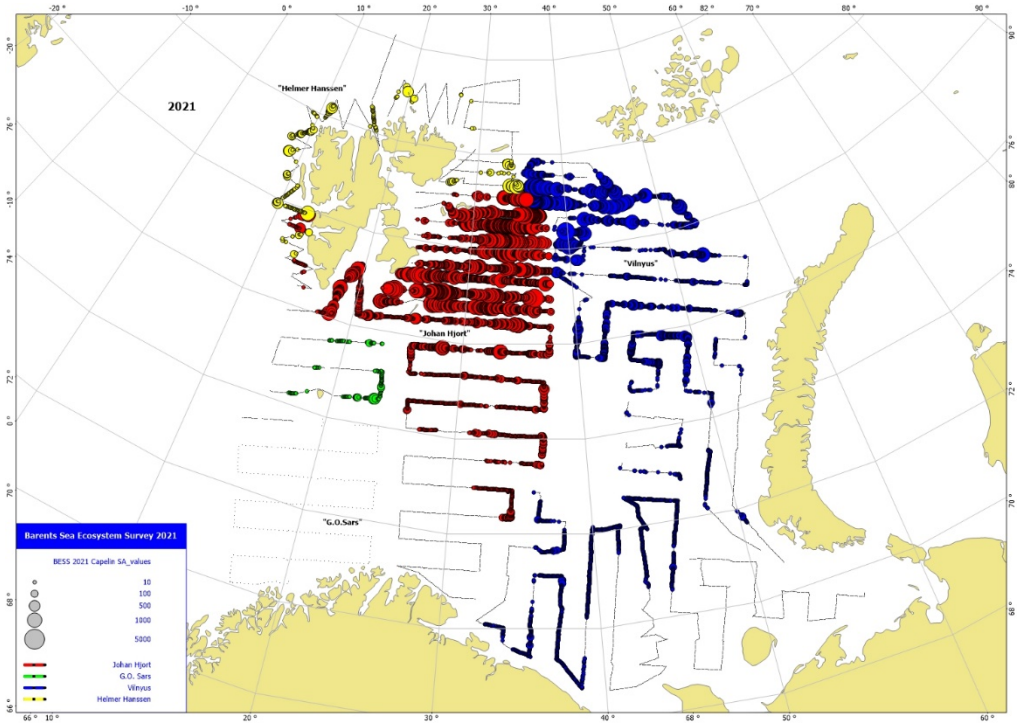


Figure 10.1. Geographical distribution of capelin in autumn 2021.

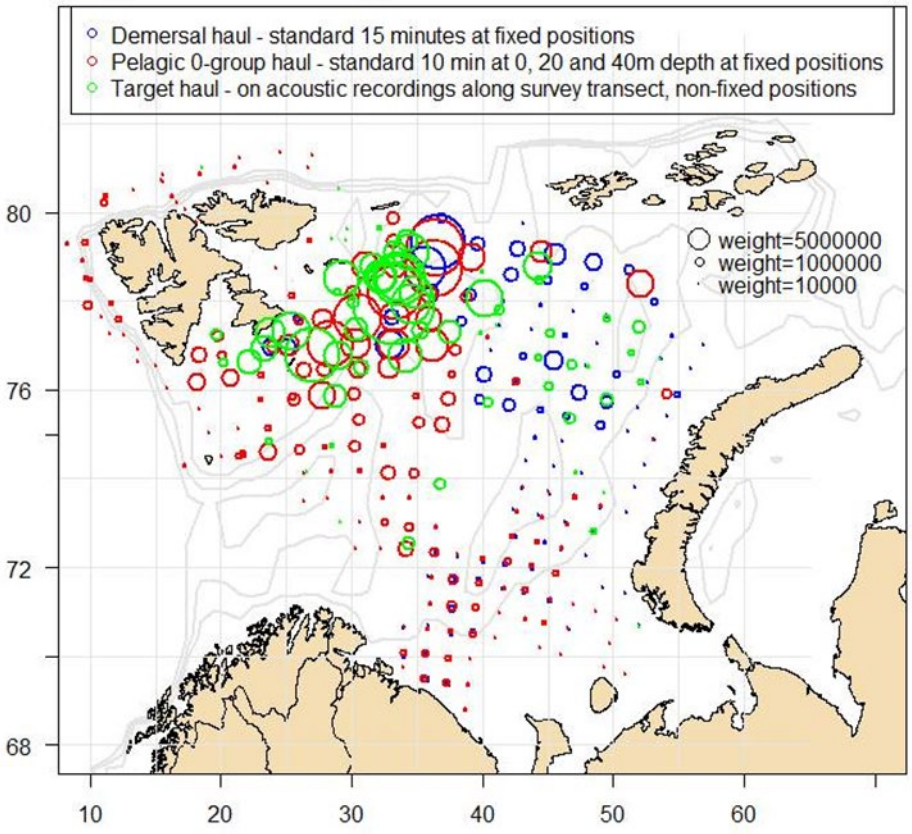


Figure 10.2. Position of trawl hauls and weighting of the corresponding capelin length distributions applied in the acoustic estimate. The weighting is proportional to NASC within a 10 nm radius.

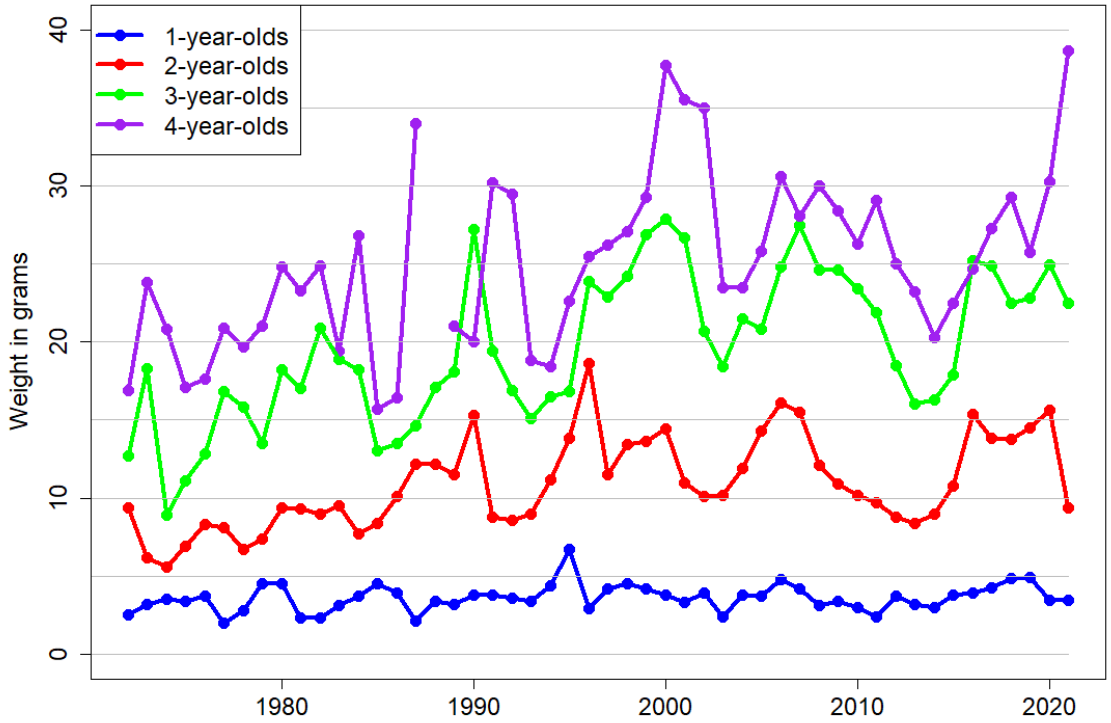


Figure 10.3 Weight-at-age (grammes) for capelin from the autumn survey.

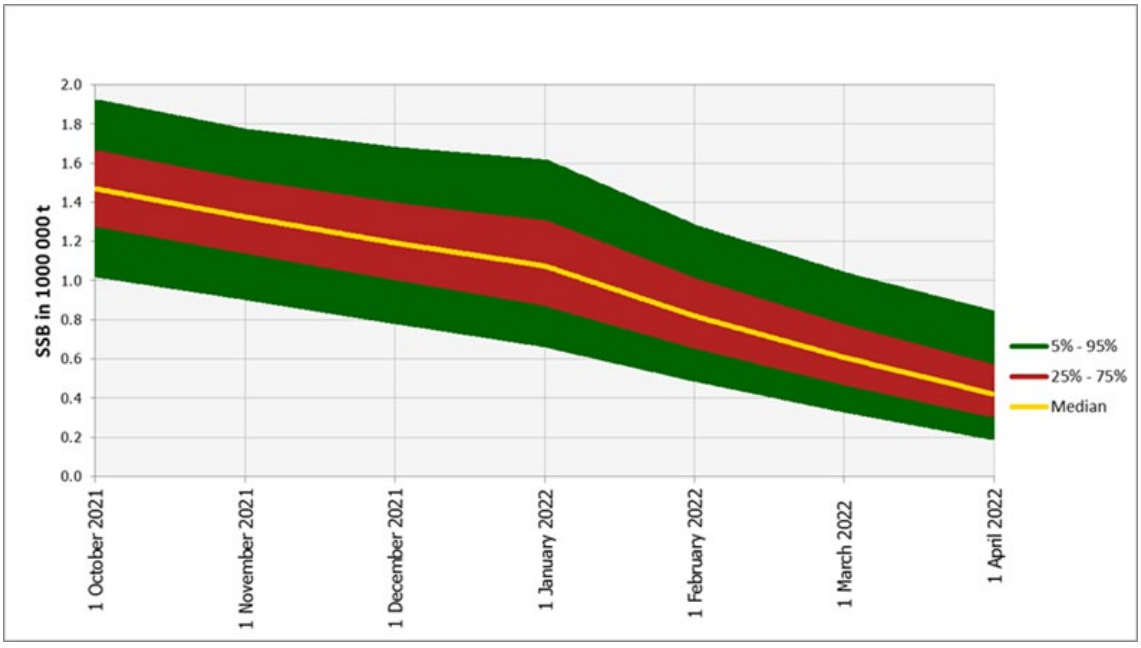


Figure 10.4. Probabilistic prognosis 1 October 2021–1 April 2022 for Barents Sea capelin maturing stock, with a catch of 70 000 tonnes (model CapTool, 50 000 simulations).

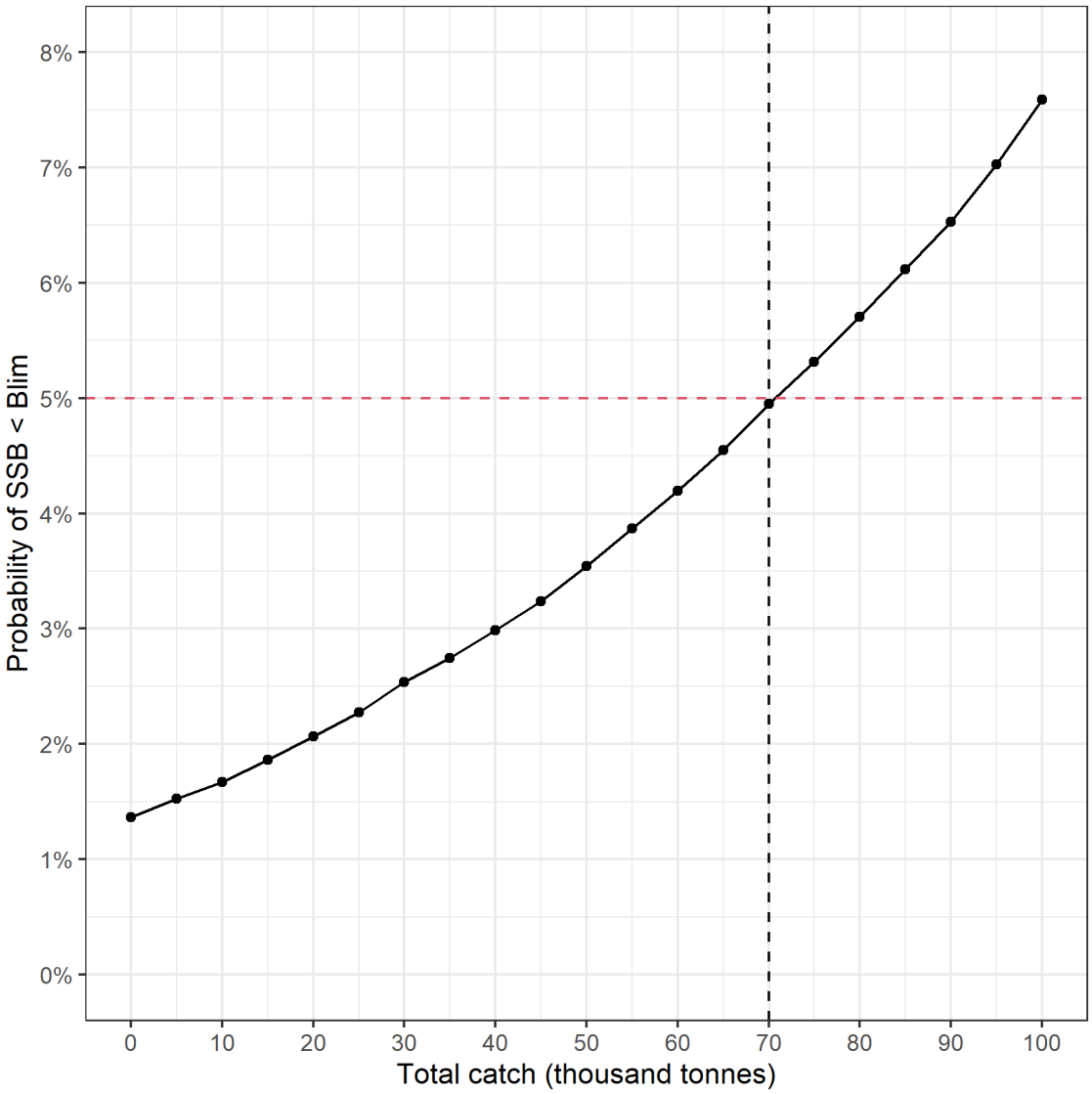
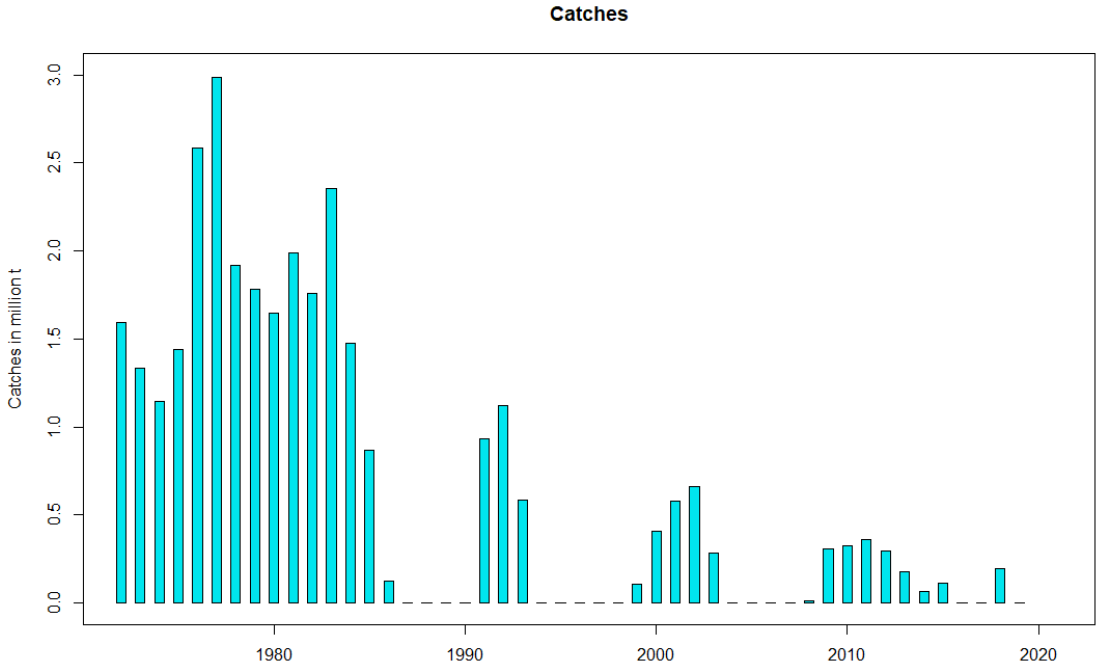
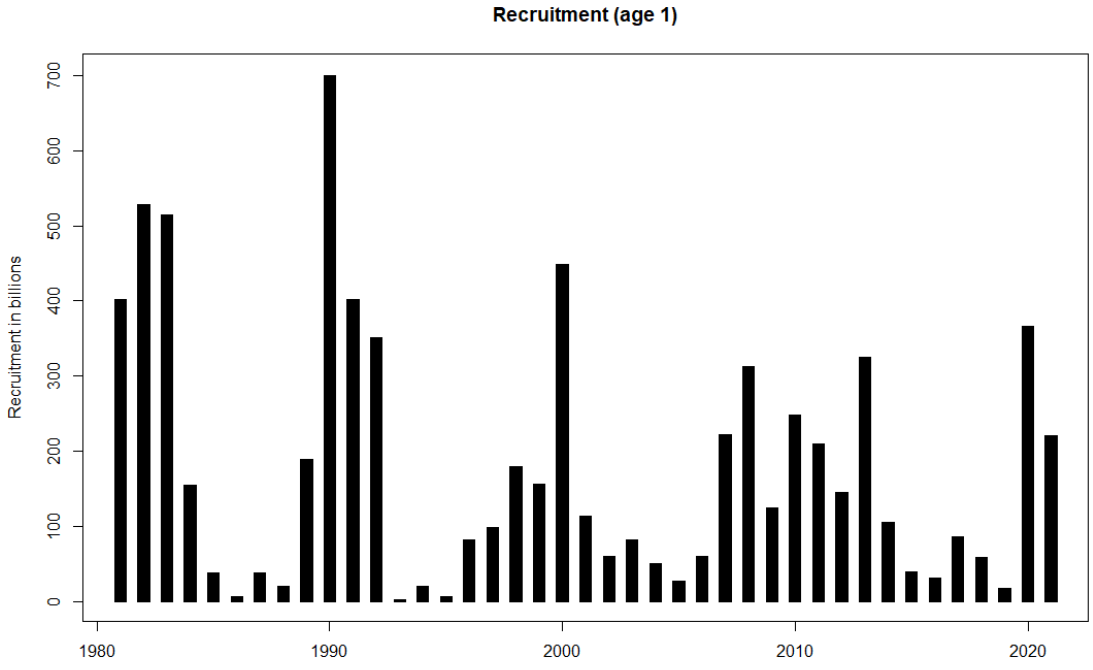


Figure 10.5. Probability of SSB < B_{lim} as a function of the catch.


Catches
Catches in million t
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1980
1990
2000
2010
2020


Recruitment (age 1)
Recruitment in billions
0
100
200
300
400
500
600
700
1980
1990
2000
2010
2020

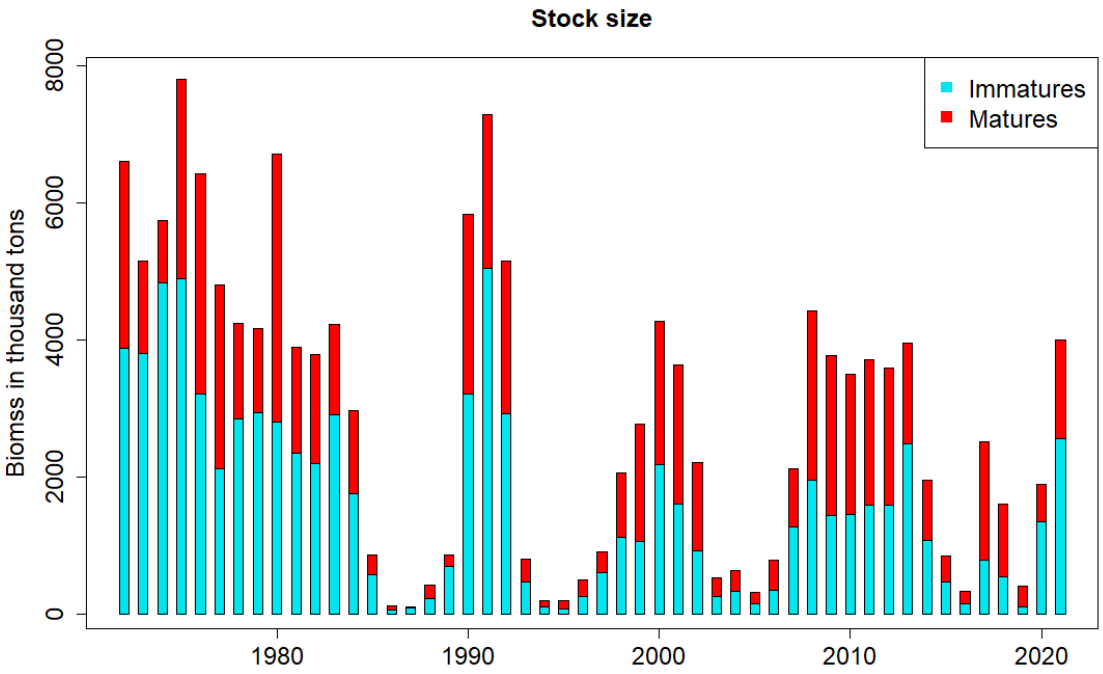


Figure 10.6. Capelin in subareas 1 and 2, excluding Division 2a west of 5°W (Barents Sea capelin). Landing and summary of stock assessment (mature and immature stock biomass in tonnes.

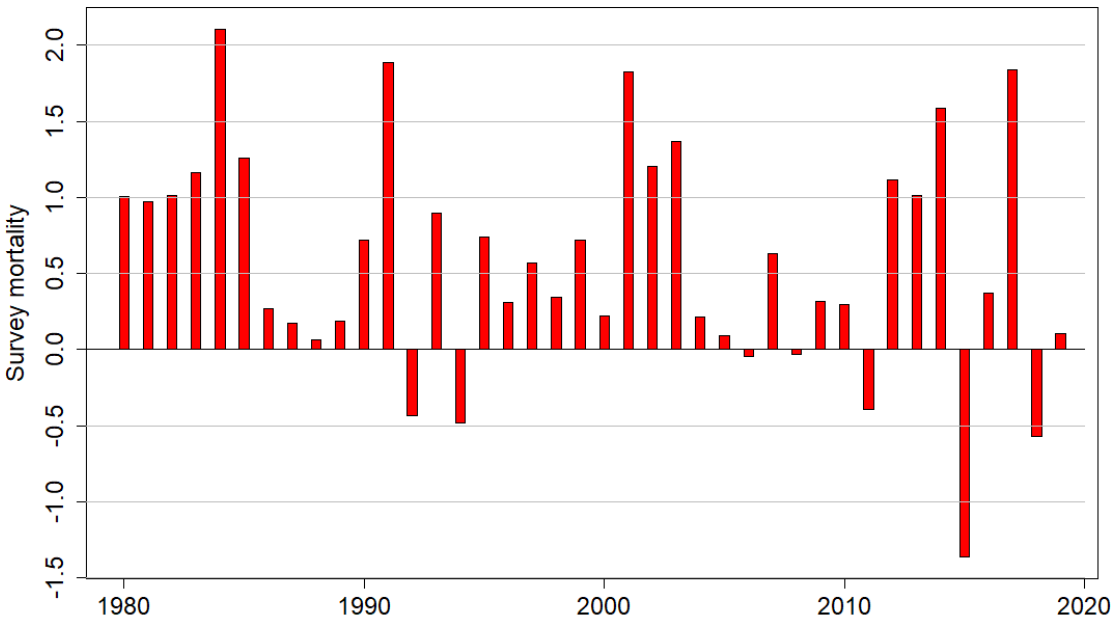


Figure 10.7. Capelin survey mortality per year class from age 1–2 (survey data).