

10 Barents Sea capelin¹

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 winter fishery and for 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 10.1)

The Joint Russian-Norwegian Fishery Commission set a zero TAC for 2021 and a TAC of 70 000 tonnes for 2022. For both years, the quotas were in accordance with the ICES advice. The international historical catch by country and season in the years 1965–2022 is given in Table 10.1. The Norwegian catch in 2022 was 42 346 tonnes which was 396 tonnes above the national TAC. Russian catches were 22 646 tonnes which was 5404 tonnes below the national TAC.

The age–length distribution of Russian catches in 2022 is summarized in the text table below (age distribution (%) for each length group and catch at length in numbers).

Norwegian age–length composition of 2022 catches were not ready at the time of AFWG.

The capelin sampling from the Barents Sea in 2021–2022 is summarized below:

Investigation	No. of trawl hauls	Length measurements	Aged individuals
Winter capelin survey 2022 (Norway)	25	2383	978
Joint Winter survey 2022 (Norway)	292	10859	1059
Joint Winter survey 2022 (Russia)	97	5759	200
IESNS 2021 (Russia)	12	362	156
BESS 2021 (Norway)	339	22261	6221
BESS 2021 (Russia)	195	15255	1103

¹ Capelin (*Mallotus villosus*) in subareas 1 and 2 (Northeast Arctic), excluding Division 2.a west of 5°W (Barents Sea capelin); cap.27.1-2.

10.3 Stock assessment

10.3.1 Acoustic stock size estimates in 2021 (Table 10.2, Figure 10.1, 10.2 and 10.3)

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 is 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 group 1 and 2 and similar for age group 3. Relative sampling error based only on acoustic recordings (Nautical Area Scattering Coefficient (NASC; $\text{m}^2\text{nmi}^{-2}$)) was estimated to 9.27% which is much lower than in the two previous years. 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 (10.4.6).

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

Probabilistic projections of the maturing stock to the time of spawning on 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. 2.52). The revised cod assessment made in September 2021 was used.

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 479 000 tonnes (90% confidence interval: 259 000–916 000 tonnes), 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: 200 000–833 000 tonnes), 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} was calculated to the nearest 5000 tonnes.

Estimates of stock in number 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 are given in Gjørseter and Prozorkevitch (WD05, 2020). Summary plots are given in Figure 10.6.

10.3.3 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. The 0-group series was recalculated by WGIBAR in 2022. 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 Gjørseter *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; Gjørseter *et al.* 2016). In 2021, very little herring at age 1–4 were recorded in the Barents Sea during the ecosystem survey.

10.3.4 Comments to the assessment

10.3.4.1 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 (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 2016–2022 ICES WGIBAR reports.

The abundance of 2-year-olds observed is the highest in 30 years and the high abundance is corresponded by 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-yearclass 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 of 2023.

10.3.5 Further work on survey and assessment methodology

10.3.5.1 Survey

On 27 February–13 March 2022, IMR carried out a trawl-acoustic monitoring and stock estimation of spawning capelin (Skaret *et al.* 2022). The survey is the fourth in a series to evaluate whether such a monitoring can be used in the assessment to improve the advice. The initiative and funding come from the Norwegian 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 challenging 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 using submersible TS-probes on both vessels. The coverage of the capelin spawning migration was successful and the estimate of ca. 427 000 tonnes with a CV of 0.42 was within the expected range from the predictions made in autumn 2021.

Despite the methodological challenges due to timing and distribution of capelin as well as acoustic target strength, the survey results from all four test years have fallen within the uncertainty range of the autumn prediction. This consistency is promising for the use of the survey in an advisory process. An evaluation of the four-year series will be carried out as part of the benchmark for this stock which is planned to be held in 2022.

10.3.5.2 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 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.

There is ongoing work to address specific points related to modelling for the benchmark meeting in 2022. 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 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.

10.3.6 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

Year	Winter-Spring				Summer-Autumn			Total
	Norway	Russia	Others	Total	Norway	Russia	Total	
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
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

Year	Winter-Spring				Summer-Autumn			Total
	Norway	Russia	Others	Total	Norway	Russia	Total	
2019–2021	0	0	0	0	0	0	0	0
2022	42	23	0	65				

Table 10.2. Barents Sea CAPELIN. Stock size estimation table. Estimated stock size (10^9) 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 10^9	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5			
	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

Length (cm)	Age/year class					Sum 10 ⁹	Biomass (10 ³ t)	Mean weight (g)
	1	2	3	4	5			
	2020	2019	2018	2017	2016			
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
20.5–21.0				0.0002		0.0002	0.01	47.88
TSN (10 ⁹)	220.85	330.0204	6.996	0.0316		557.89		
TSB (10 ⁹)	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 ⁹)	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 ⁹ ind.)	Mortality survey(1–2)	
				0 (Y)	0+(Y)
				1(Y+1)	2(Y+2)
					%
1980	-	740	402.6	147.6	63
1981	9.7	477	528.3	200.2	62
1982	9.9	600	514.9	186.5	64
1983	9.9	340	154.8	48.3	69
1984	8.2	275	38.7	4.7	88
1985	8.6	64	6.0	1.7	72
1986	0.0	42	37.6	28.7	24
1987	0.3	4	21.0	17.7	16
1988	0.3	65	189.2	177.6	6
1989	7.3	862	700.4	580.2	17

Year class	Larval abundance (10 ¹²)		0-group swept-area numbers (10 ⁹ ind.)	Acoustic estimate (10 ⁹ ind.)	Mortality survey(1—2)
1990	13.0	116	402.1	196.3	51
1991	3.0	169	351.3	53.4	85
1992	7.3	2	2.2	3.4	--
1993	3.3	1	19.8	8.1	59
1994	0.1	14	7.1	11.5	--
1995	0.0	3	81.9	39.1	52
1996	2.4	137	98.9	72.6	27
1997	6.9	189	179.0	101.5	43
1998	14.1	113	156.0	110.6	29
1999	36.5	288	449.2	218.7	51
2000	19.1	141	113.6	90.8	20
2001	10.7	90	59.7	9.6	84
2002	22.4	67	82.4	24.8	70
2003	11.9	341	51.2	13.0	75
2004	2.5	54	26.9	21.7	19
2005	8.8	148	60.1	54.7	9
2006	17.1	516	221.7	231.4	--
2007	-	480	313.0	166.4	46
2008	-	995	124.0	127.6	--
2009	-	673	248.2	181.1	27
2010	-	319	209.6	156.4	25
2011	-	594	145.9	216.2	-
2012	-	989	324.5	106.6	67
2013	-	316	105.1	40.5	62
2014	-	164	39.5	8.1	79
2015	-	457	31.6	123.7	-
2016	-	779	86.4	59.6	31
2017	-	214	58.6	7.0	88

Year class	Larval abundance (10 ¹²)		0-group swept-area numbers (10 ⁹ ind.)	Acoustic estimate (10 ⁹ ind.)	Mortality survey(1—2)
2018	-	680	17.5	31.1	-
2019	-	1465	366.4	330.0	10
2020	-	1077	220.9		
2021	-	325			
Average	9.0	372	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

Year	Stock in numbers (10 ⁹)					Biomass (10 ³ tonnes)		
	Age 1	Age 2	Age 3	Age 4	Age 5	Total	Total	MSB
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
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

Year	Stock in numbers (10 ⁹)						Biomass (10 ³ tonnes)	
	Age 1	Age 2	Age 3	Age 4	Age 5	Total	Total	MSB
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 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 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 tons) source: WGIBAR 2022	Herring 0-group swept-area index (10 ⁹ ind.p) source: WGIBAR 2022	Capelin land- ing (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	0	1648
1981	3895	1551	316	403	47	0	1986
1982	3779	1591	106	528	9	3	1760
1983	4230	1329	100	515	12	195	2357
1984	2964	1208	109	155	1467	27	1477
1985	860	285	*	39	2638	20	868
1986	120	65	*	6	191	0	123
1987	101	17	34	38	288	0	0
1988	428	200	*	21	77	61	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 tons) source: WGIBAR 2022	Herring 0-group swept-area index (10 ⁹ ind.p) source: WGIBAR 2022	Capelin landing (10 ³ t)	
1989	864	175	84	189	277	18	0
1990	5831	2617	92	700	434	15	0
1991	7287	2248	643	402	929	268	933
1992	5150	2228	302	351	1329	84	1123
1993	796	330	293	2	2432	291	586
1994	200	94	139	20	1887	104	0
1995	193	118	60	7	647	11	0
1996	503	248	60	82	238	550	0
1997	909	312	85	99	537	463	1
1998	2056	932	94	179	560	476	3
1999	2775	1718	382	156	1616	36	105
2000	4273	2098	599	449	2109	470	410
2001	3630	2019	626	114	1233	10	578
2002	2210	1291	496	60	428	152	659
2003	533	280	427	82	1794	178	282
2004	628	294	94	51	3790	774	0
2005	324	174	122	27	2191	126	1
2006	787	437	72	60	2115	295	0
2007	2119	844	189	222	876	144	4
2008	4428	2468	330	313	958	201	12
2009	3765	2323	517	124	440	104	307
2010	3500	2051	504	248	605	117	323
2011	3707	2115	487	209	816	83	360
2012	3586	1997	504	146	445	177	296
2013	3956	1471	479	324	492	289	177
2014	1949	873	504	105	673	136	66

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 tons) source: WGIBAR 2022	Herring 0-group swept-area index (10 ⁹ ind.p) source: WGIBAR 2022	Capelin landing (10 ³ t)	
2015	842	375	82	40	963	83	115
2016	328	181	37	32	498	79	0
2017	2506	1723	462	124	1106	154	0
2018	1597	1056	317	59	2034	55	195
2019	411	302	85	17	389	50	0
2020	1884	533	154	366	359	12	0
2021	3998	1438	420	221	152	209	0
2022						65	

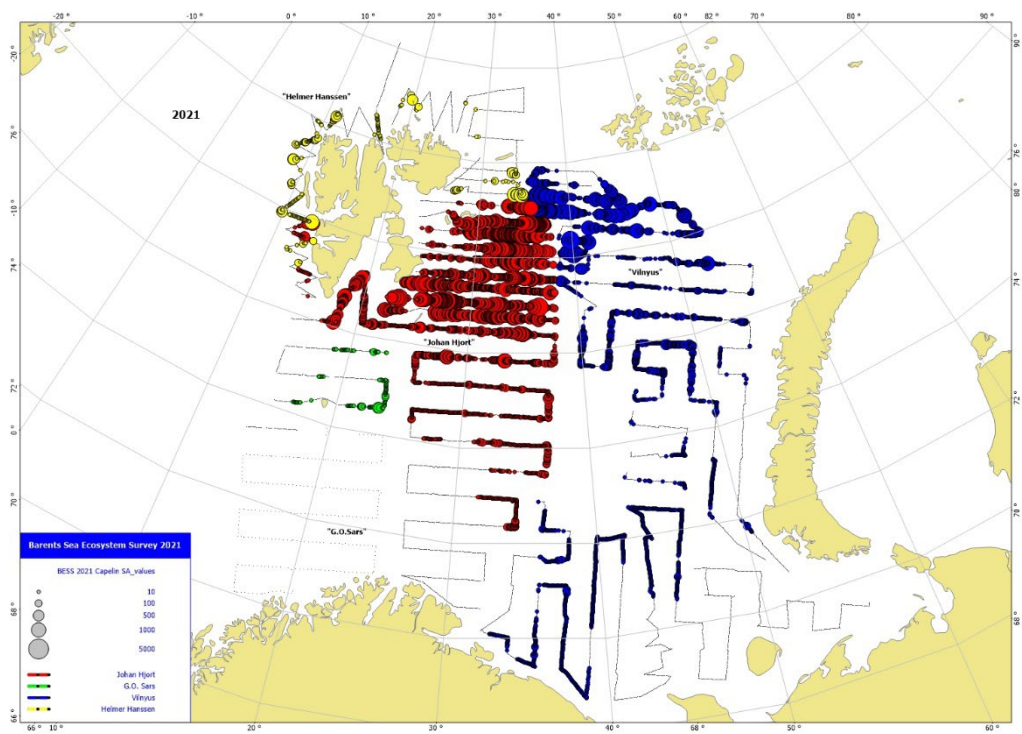


Figure 10.1. Geographical distribution of capelin in August-September 2021.

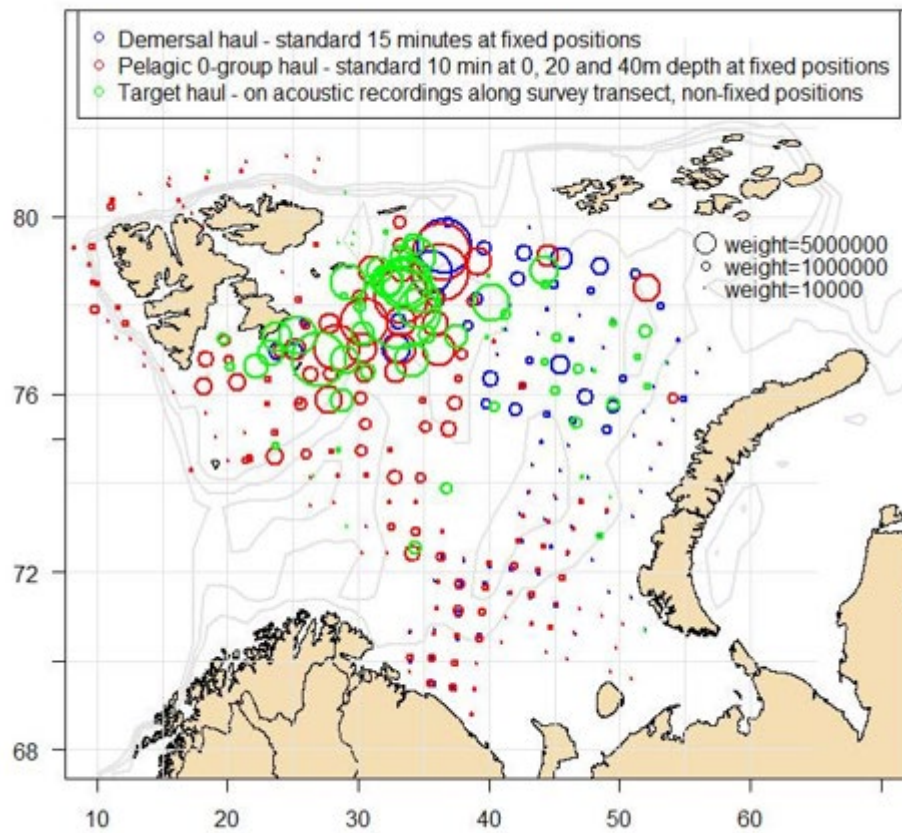


Figure 10.2. Position of trawl hauls and weighting of the corresponding capelin length distributions applied in the acoustic estimate in 2021. The weighting is proportional to NASC within a 10 nm radius.

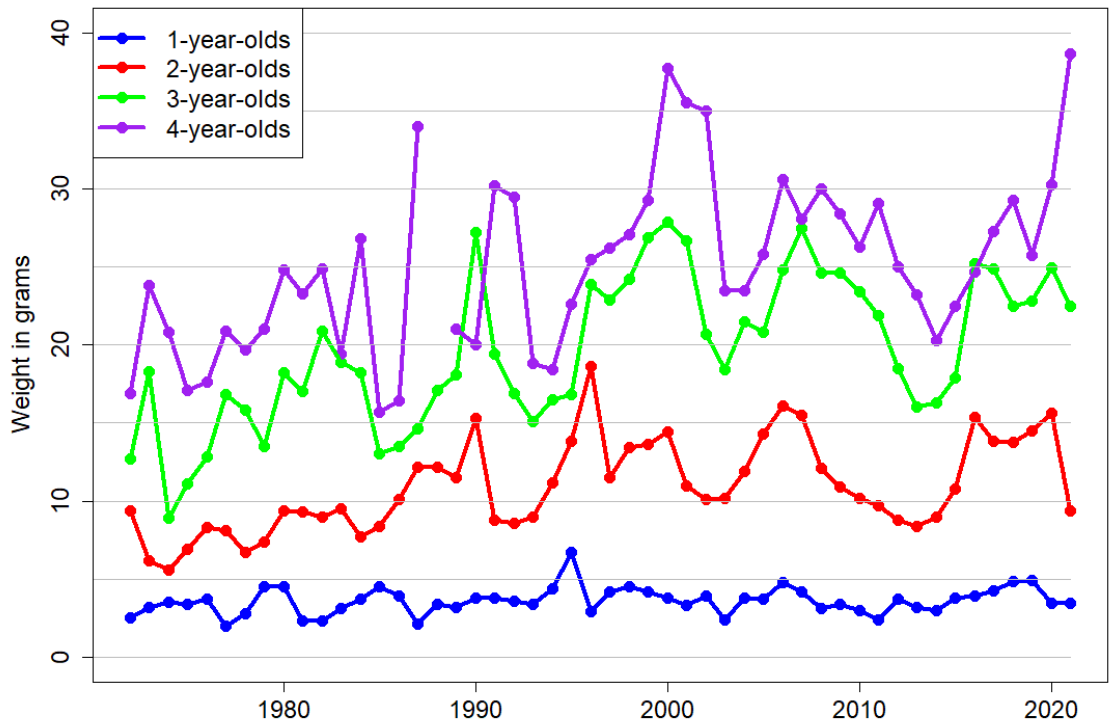


Figure 10.3 Weight-at-age (grammes) for capelin from the autumn survey.

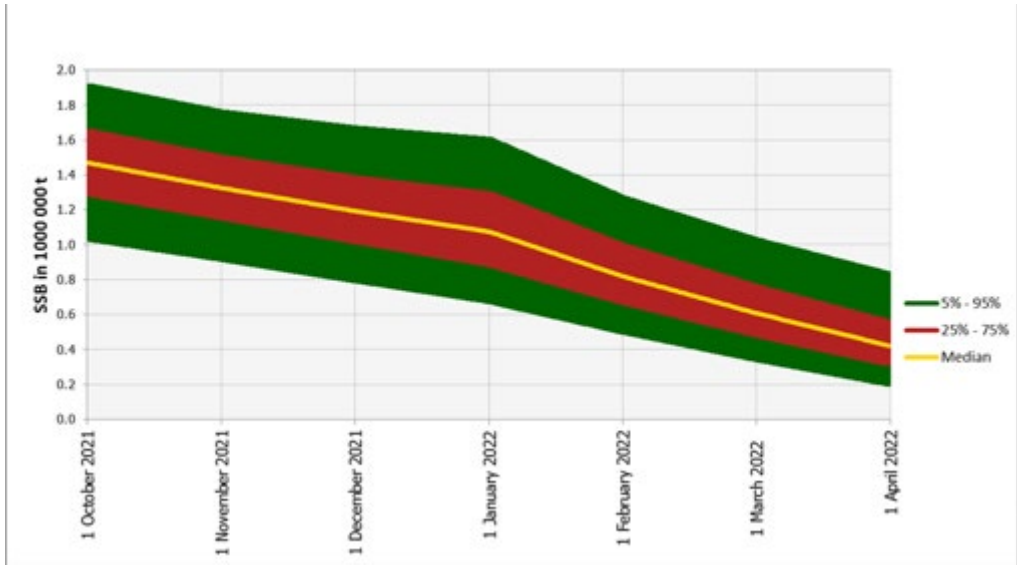


Figure 10.4. Probabilistic prognosis 1 October 2021—1 April 2022 for Barents Sea capelin maturing stock, with a catch of 70 000 tonnes (model CapTool, 50 000 simulations).

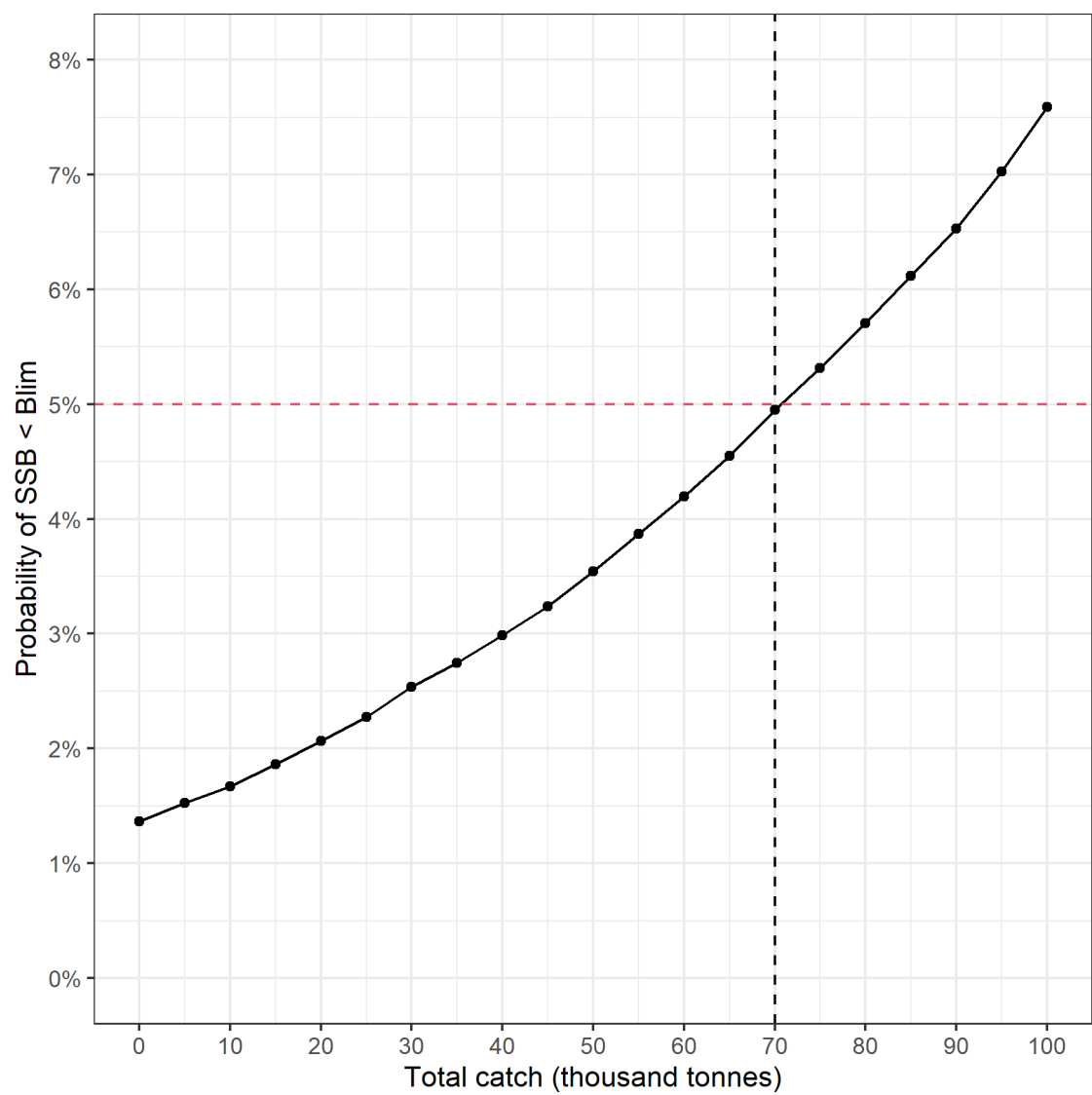
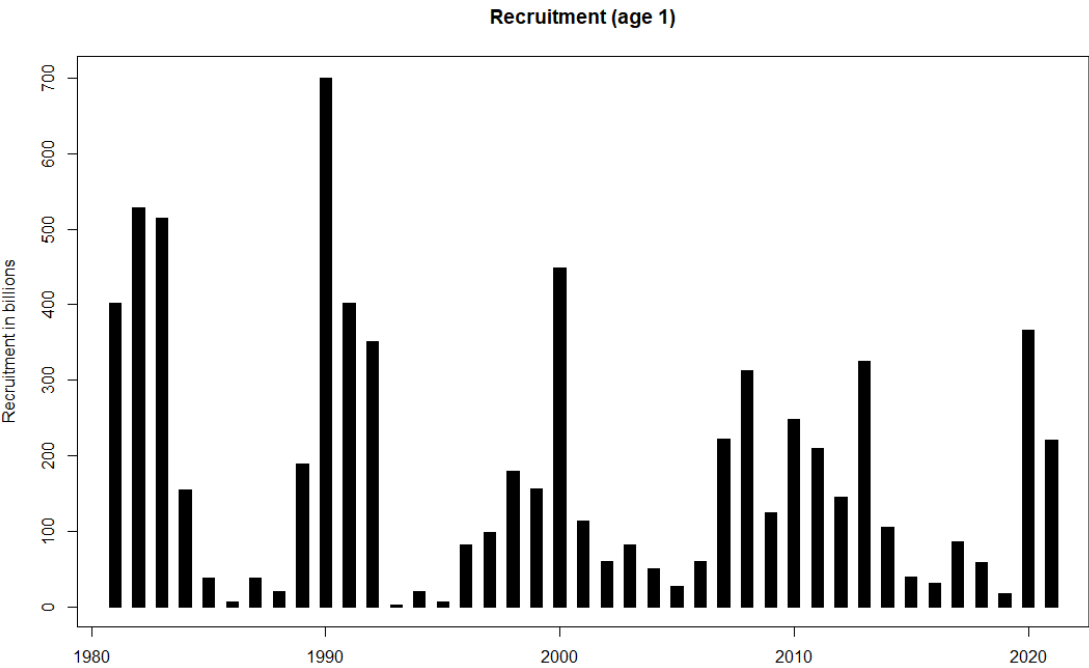
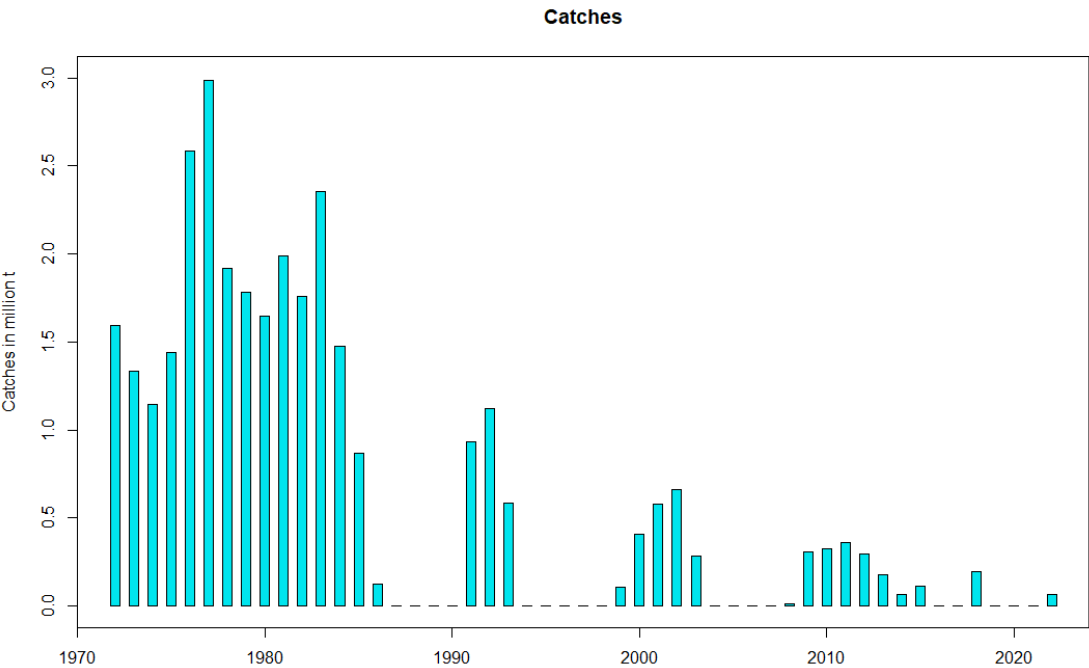


Figure 10.5. Probability of SSB 2022 < B_{lim} as a function of the catch



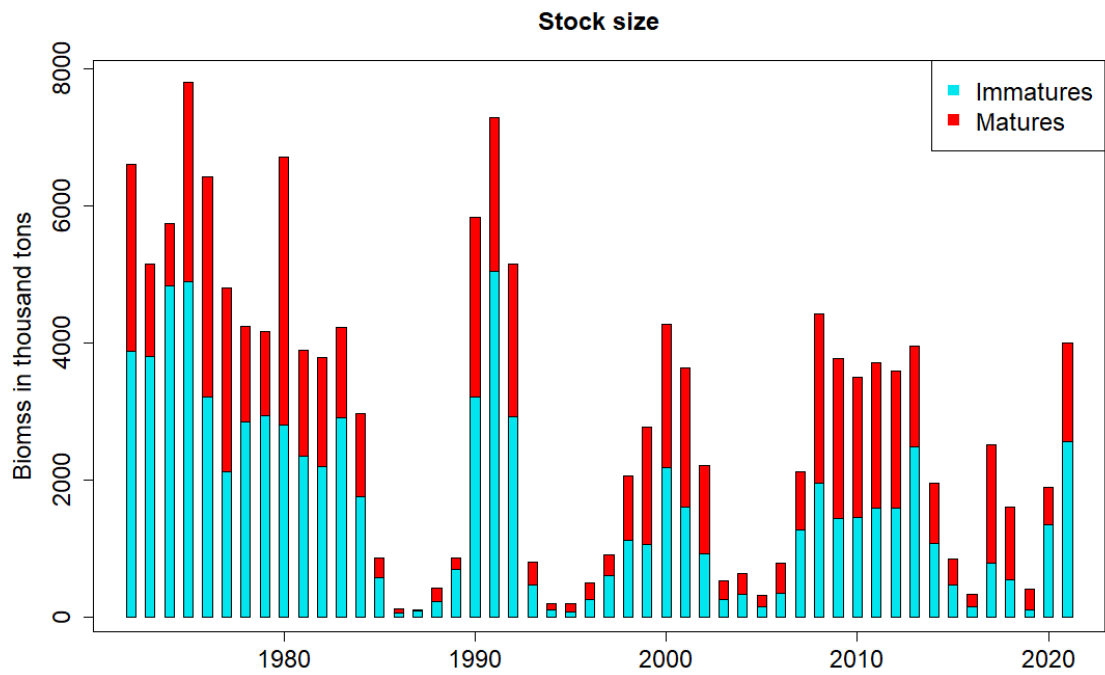


Figure 10.6. Capelin in subareas 1 and 2, excluding Division 2a west of 5°W (Barents Sea capelin). Landings, recruitment, and summary of stock assessment (mature and immature stock biomass in tonnes).

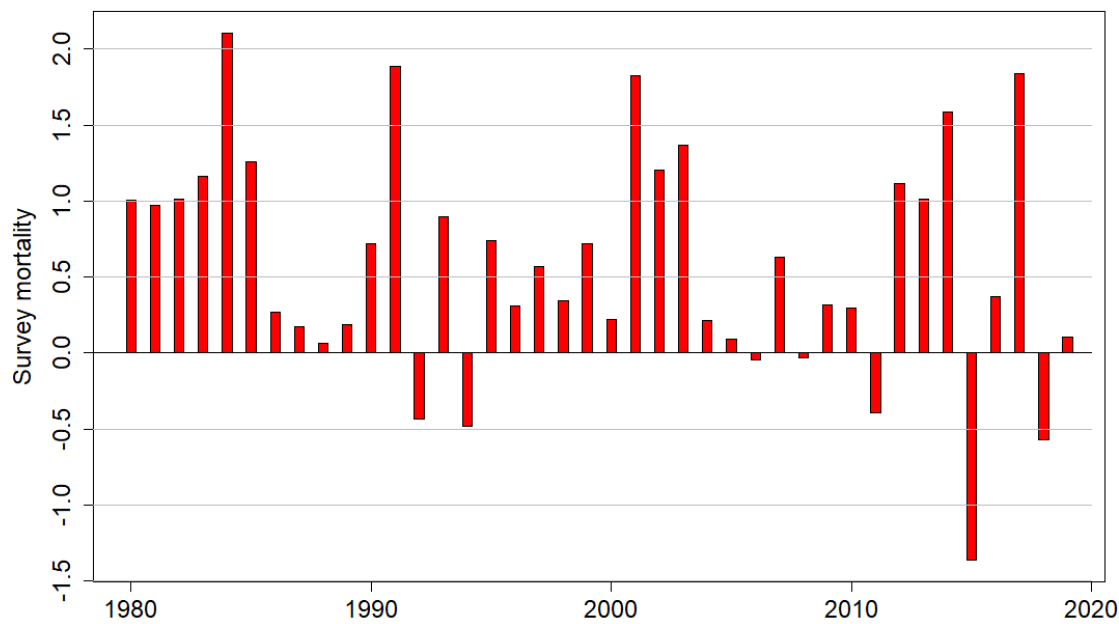


Figure 10.7. Capelin survey mortality per year class from age 1–2 (survey data).

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