

9 Iceland grounds cod

cod.27.5a – *Gadus morhua* in Division 5.a

Cod is widely dispersed in Icelandic waters, with higher abundance in the northwestern, northern, and northeastern parts of the shelf. Cod is considered demersal with moderately wide depth distribution which can vary from depths of a few meters down to 600 m, occasionally even deeper. Adult cod has not much preference regarding the bottom structure and can be found on various substrates; however, a large share of the cod juveniles prefer moderately sheltered, shallow kelp and seagrass environments. The ideal sea temperature for cod is around 4–7°C, nevertheless, the temperature limits for this species are somewhat wider, and a significant proportion of the catch is taken where the temperature is less than 2°C.

Cod spawns all around Iceland by smaller regional spawning components, however, the main spawning areas are situated in the south, southwest and west. Spawning starts early in the spring (March-April) on the main spawning grounds in the warmer waters in the south. In the past, spawning started later in the colder waters in the north, but in recent years spawning time in the north has advanced significantly. North- and eastward pelagic egg and larval drift mainly occur clockwise to the nursery grounds situated in the north and northeastern area. The adult stock takes feeding migrations to the deeper waters in the northwest and southeast, but part stays in the shallow domains to feed. Cod is the most important exploited groundfish species in Iceland.

9.1 Fishery

Due to wide spatial distribution of cod in Icelandic waters, the fishing grounds are scattered around the shelf and partially divided by gear type (Figures 9.1-9.3). Demersal trawl is the main fishing gear (Table 9.1, Figure 9.6). Main fishing grounds for demersal trawl are situated offshore in deeper relatively cold waters to the north-west, northeast, and east of the island. In recent years, the spatial distribution of demersal trawl fishery has been gradually contracting and aggregating at the previously mentioned trawl fishery hotspots (Figure 9.1). Longline accounts for the next largest portion of the catch in the cod fisheries and is widely distributed around the Icelandic shelf, with lowest reported catch in the south and southeast coast (Figure 9.2). The distribution pattern of the catches remains consistent between the years with occasional hotspots. Cod fisheries of the remaining fishing fleet, i.e. gillnets, demersal seine and jiggers, are widely distributed, but mainly take place in shallow waters (Figure 9.3).

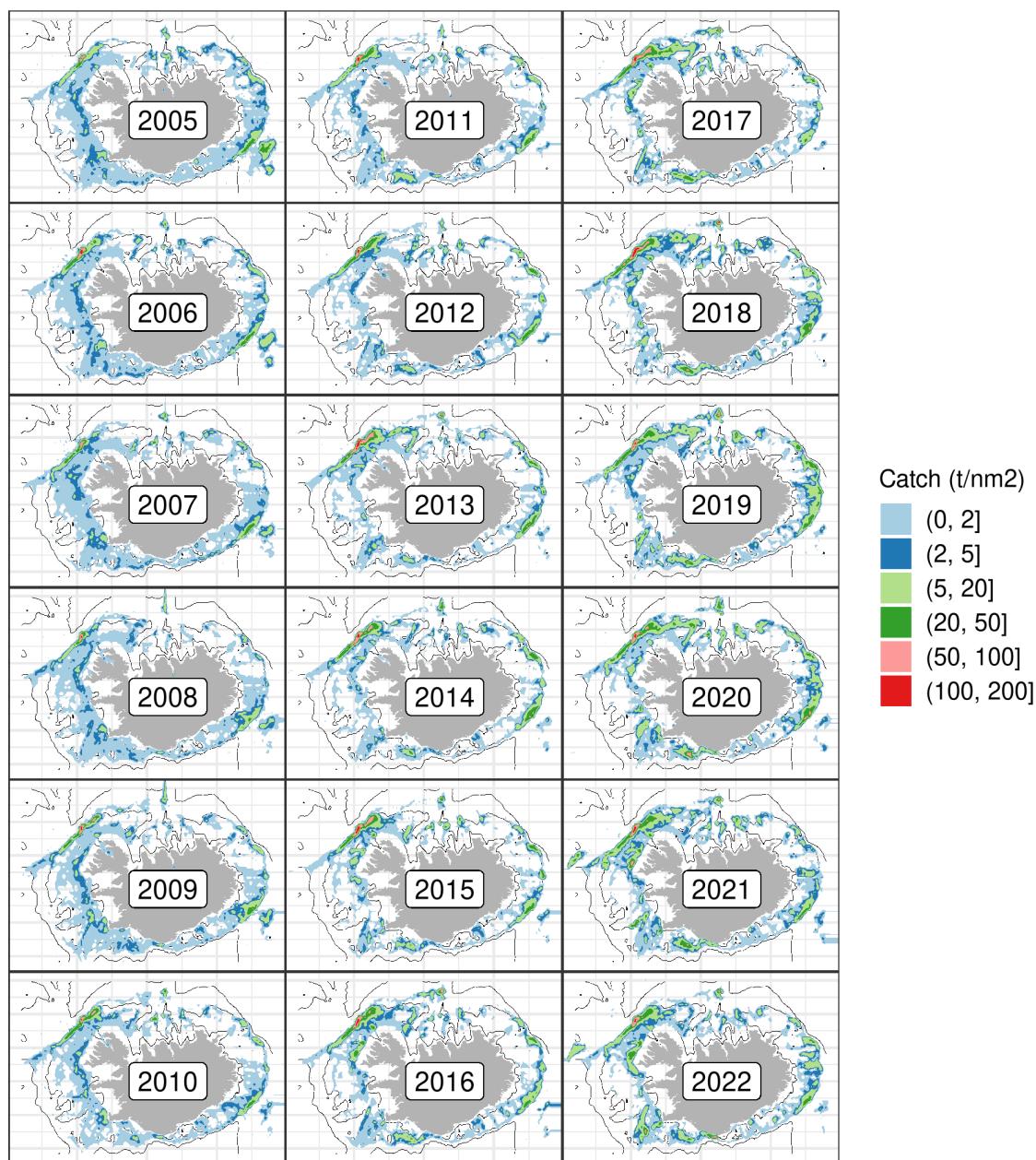


Figure 9.1. Icelandic cod Division 5.a. Geographical distribution of the Icelandic demersal trawl fishery. Reported catch from logbooks. The 100, 300, and 1000 m isobaths are shown.

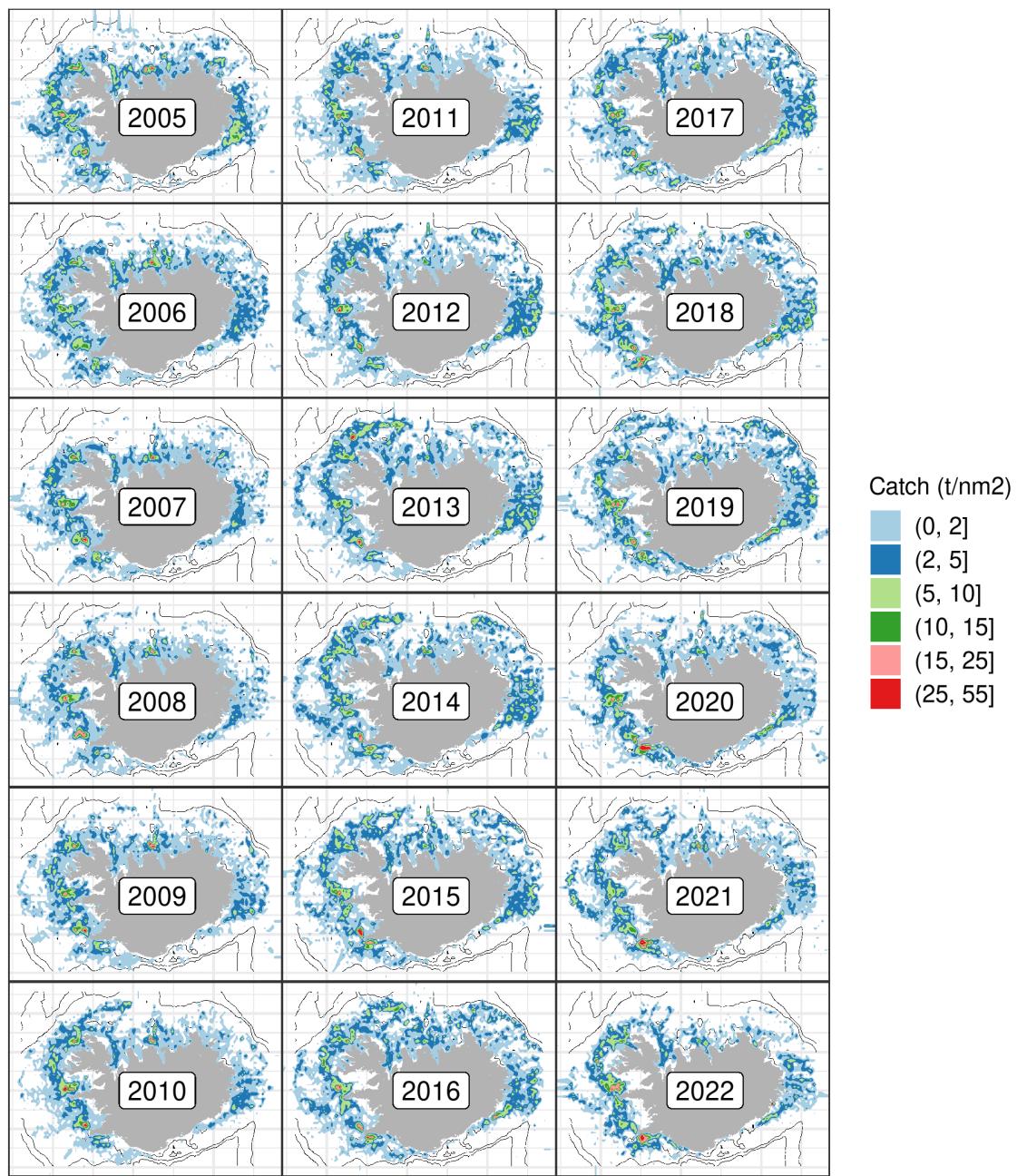


Figure 9.2. Icelandic cod Division 5.a. Geographical distribution of the Icelandic longline fisheries. Reported catch from logbooks. The 100, 300, and 1000 m isobaths are shown.

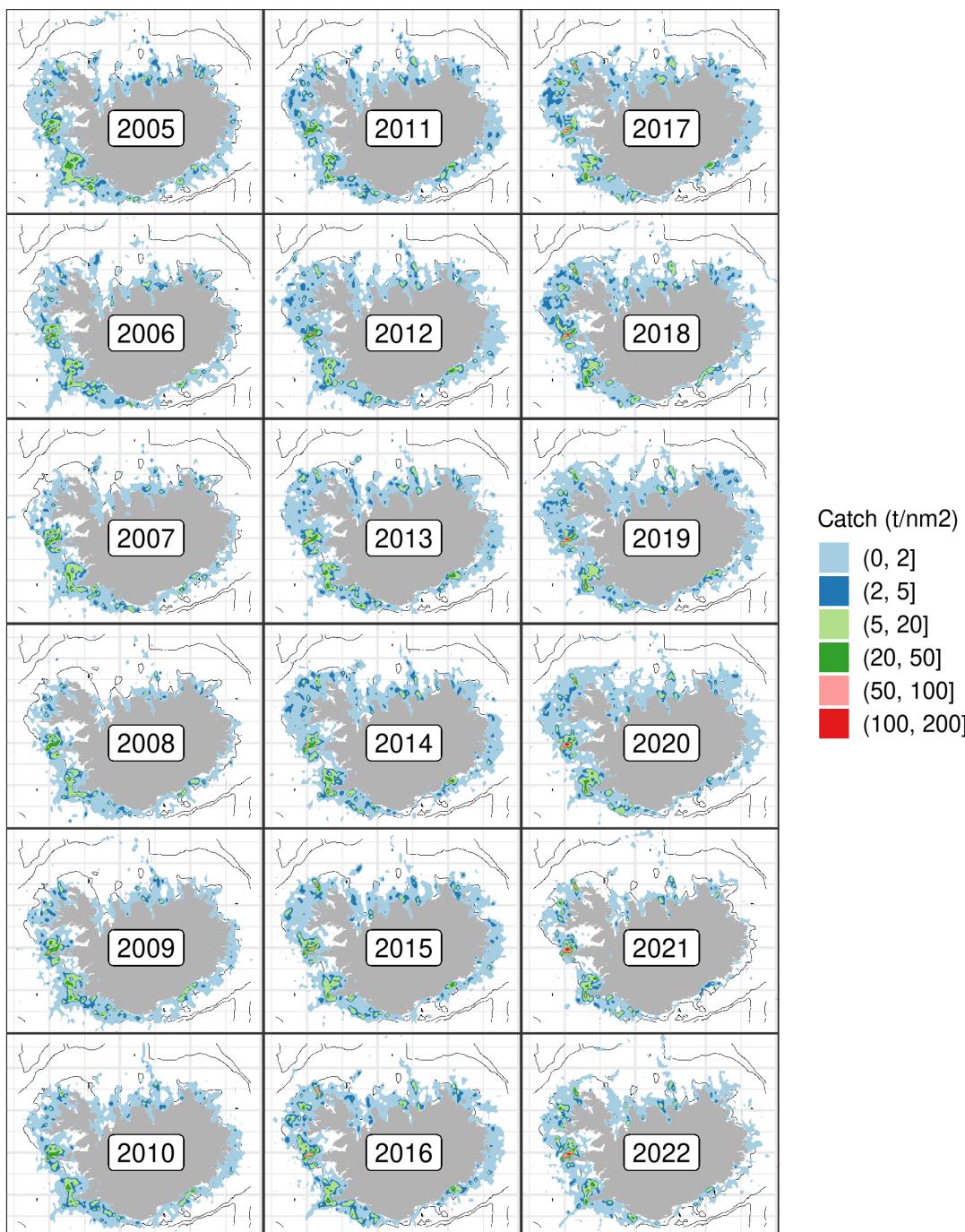


Figure 9.3. Icelandic cod Division 5.a. Geographical distribution of the Icelandic cod fisheries from gillnets, demersal seine and jiggers since 2003. Reported catch from logbooks. The 100, 300, and 1000 m isobaths are shown.

Spatial distribution of the cod fishery has been relatively stable for the past years (Figure 9.4). Changes in depth and spatial distribution (Figures 9.4 and 9.5) are partly caused by changes in gear composition (Figure 9.6). For cod, the average depth in bottom trawl is 230 m, longline 160 m, but 80 m for demersal seine and gillnets. Mixed fisheries considerations do also affect spatial distribution of the fisheries. For example, haddock TAC (Total Allowable Catch) was 50-80% of the cod TAC from 2003-2008 leading to increased fisheries in areas where haddock was abundant. For comparison, TAC for haddock has been 15-20% of the cod TAC in recent years.

The long term pattern is that gillnets and bottom trawl were the most important gear with most of the bottom trawl catches taken in the northwest, but the gillnet catches in the south and west during spawning time. The share of gillnets has declined continuously in recent decades, while

that of longlines has increased (Figure 9.6). Longline fisheries have the widest spatial distribution of the fleets targeting cod (Figure 9.2), although most of the catches come from the west and northwest. Introduction of large longliners with automatic baiting in recent decades has expanded the fishing area of longliners to deeper waters.

In some areas, especially in the northwest and southeast, cod can be found in dense schools in certain hotspots, a fact exploited by captains when they want to catch large amount of cod in short time, e.g. just before landing. Condition and size of cod in different areas is also an issue regarding fishing areas, but all those factors are weighed against proximity to landing harbour.

In 2022, more than half of the cod catch was taken in bottom trawl (52%), around 27% on longlines, 8% by gillnets, 6% by jiggers, and 7% by demersal seine. The largest proportion of the catch in recent years was taken in the western and northwestern area, followed by the northeast and southwest areas. Cod was caught at similar depth as in previous years, but perhaps slightly more shallow (Figure 9.5).

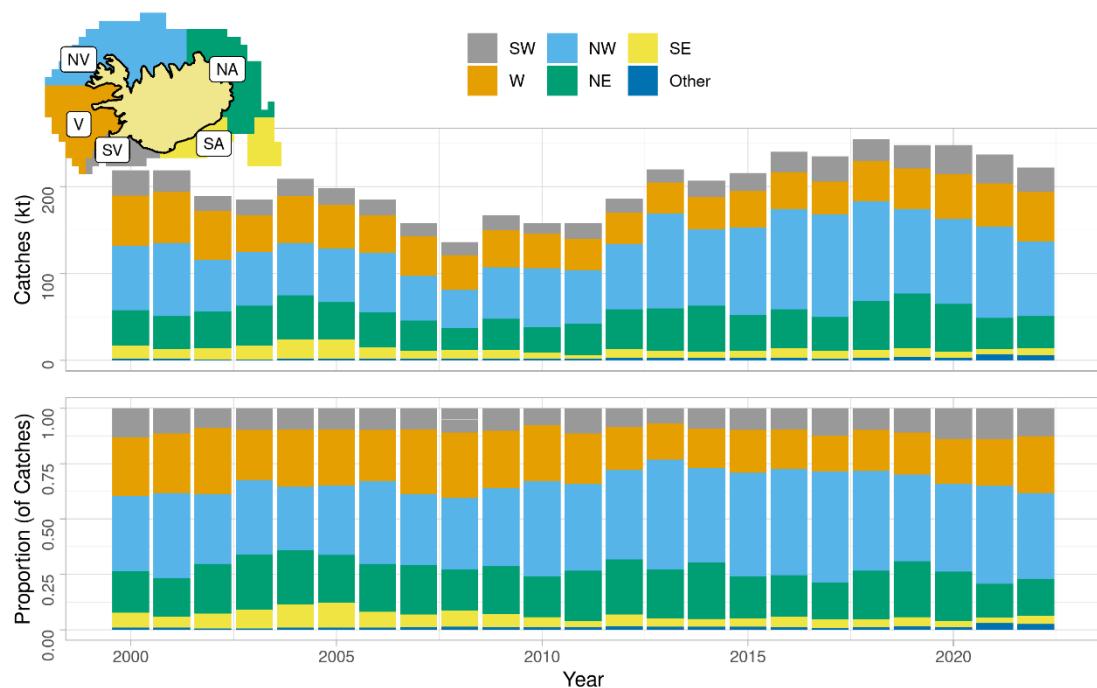


Figure 9.4. Icelandic cod Division 5.a. Spatial distribution of the Icelandic fishery by fishing area since 2000 according to logbooks. All gears combined.

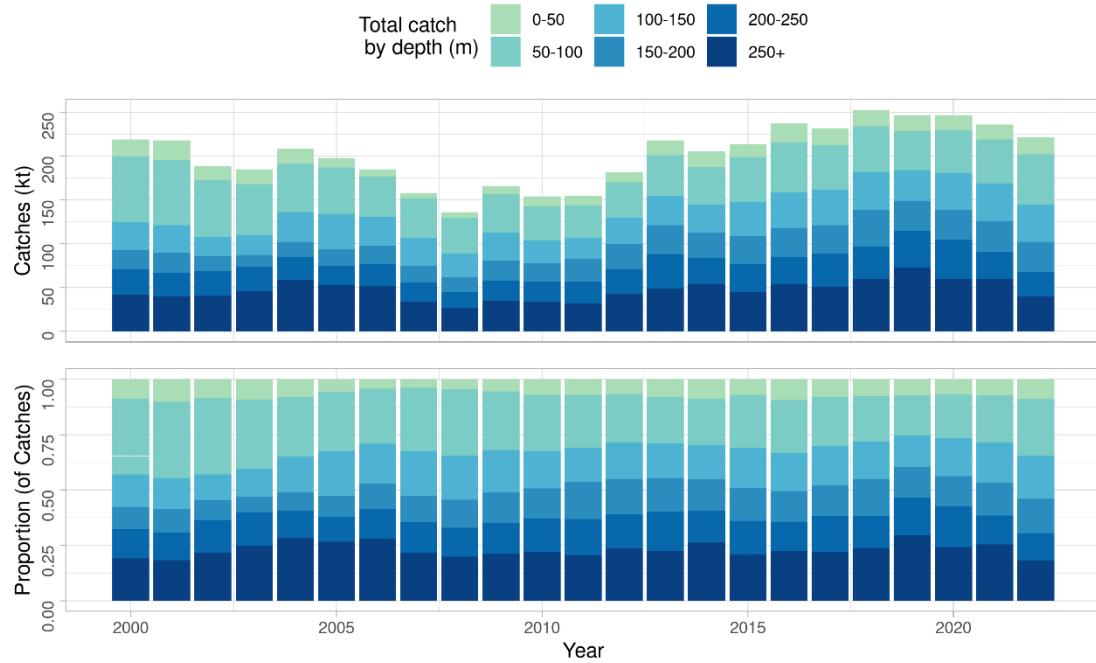


Figure 9.5. Icelandic cod Division 5.a. Depth distribution of catches since 2000 according to logbooks.

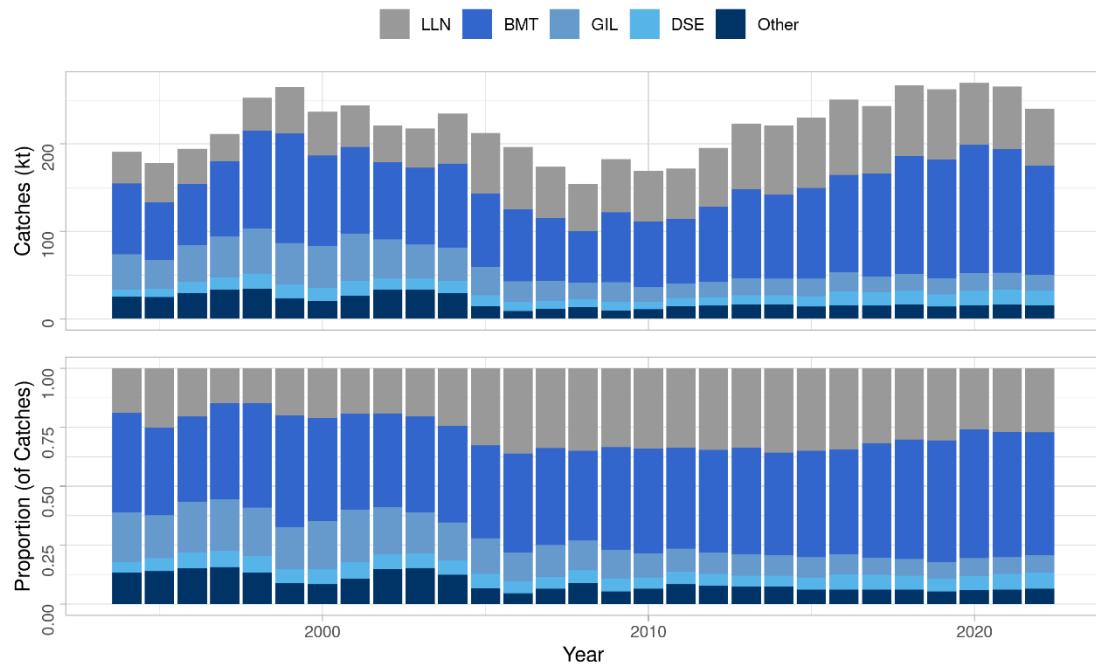


Figure 9.6. Icelandic cod Division 5.a. Total catch (landings) by fishing gear since 1994, according to statistics from the Directorate of Fisheries.

Since 1994, the number of vessels reported as having landed over 10 tonnes of cod in total annually, has decreased. This decline is noticeable in all the fleets, as the number of vessels has dropped by more than half since 1994 (Table 9.1). However, total catches have been increasing steadily in the past few years (Table 9.1).

Table 9.1. Icelandic cod Division 5.a. Number of Icelandic vessels landing catch of 10 tonnes or more of cod in the calendar year, divided by gear type. Landings data from the Directorate of Fisheries. Catch sums are for the vessels included, less than the total including all vessels for the calendar year.

Year	Number of vessels						Catches (thous. Tonnes)				
	Long-liners	Gill-netters	Trawl-ers	Seiners	Other	Line	Gillnet	Trawl	Seine	Other	Sum
1994	517	265	258	88	672	35	40	80	8	23	186
1995	495	228	193	93	673	44	32	66	10	21	173
1996	454	245	182	107	634	39	41	70	13	20	183
1997	345	223	163	110	641	31	46	86	15	26	204
1998	373	262	161	106	627	37	51	112	18	23	241
1999	401	250	156	96	559	52	47	125	16	17	257
2000	382	265	130	86	539	50	48	103	15	17	233
2001	376	333	131	87	505	47	54	99	17	16	233
2002	333	291	121	85	496	42	44	88	14	18	206
2003	342	249	117	81	445	44	37	88	13	15	197
2004	343	242	117	83	454	57	37	96	14	14	218
2005	350	193	117	77	281	69	32	84	13	7	205
2006	317	146	107	72	211	71	24	82	10	5	192
2007	273	119	102	64	152	58	23	71	9	3	164
2008	237	93	96	59	140	53	19	59	8	3	142
2009	221	94	92	63	302	61	22	80	10	6	179
2010	209	83	90	52	344	57	17	76	8	6	164
2011	202	89	87	50	521	57	16	74	9	10	166
2012	208	81	91	52	552	67	17	85	10	11	190
2013	217	79	89	51	584	75	20	101	10	13	219
2014	231	81	82	45	606	79	19	96	10	14	218
2015	218	78	73	46	573	80	19	103	12	12	226
2016	204	74	69	45	603	86	21	111	16	14	248
2017	189	71	67	46	585	77	17	118	15	14	241
2018	160	77	66	42	543	80	19	135	16	15	265
2019	150	67	62	39	522	80	18	136	14	12	260
2020	125	71	64	37	582	70	20	147	16	15	268
2021	126	62	63	34	567	72	19	141	18	15	265
2022	110	57	62	42	605	65	18	125	16	14	238

The number of vessels accounting for 95% of the annual catch of cod in Icelandic waters reduced from almost 1500 to about 900 vessels in 1994-1999 (Figure 9.7). This reduction occurred despite annual catch increasing by almost 100 thousand tonnes. In 1999-2008, the number of vessels accounting for 95% of the cod catch reduced with reduced total catches to about 400 vessels. Since 2009 the number of vessels has remained relatively constant between 250 and 500, although the

most recent years are marked by having the lowest numbers of vessels. At the same time, annual catches have increased substantially (Figure 9.7).

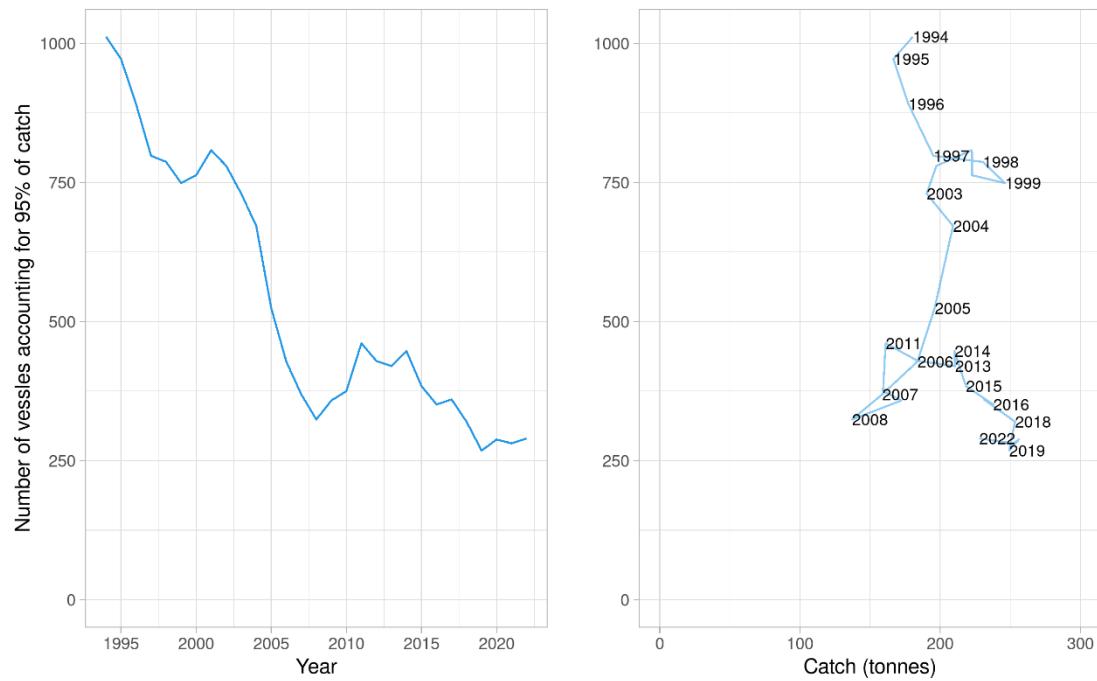


Figure 9.7. Icelandic cod Division 5.a. Number of vessels (all gear types) accounting for 95% of the total catch annually since 1994. Left: Plotted against year. Right: Plotted against total catch. Data from the Directorate of Fisheries.

9.1.1 Landings trends

Landings of cod in Icelandic waters has been historically high since industrial fishing began, although a productivity shift in the 1980s has led to relatively less recruitment and lower sustainable yield in the following decades. Landings were around 350 000 to 450 000 tonnes prior to World War II and during the 1960s, but have ranged closer to 150 000 to 250 000 both as a result of the productivity shift and management action. Sharp reductions in foreign catches are visible during World War II and the 1970s, when the Icelandic EEZ was expanded to 200 nautical miles. Landings in 2022 amounted to 242 192. Foreign landings account for a small portion of this, attributable to bilateral agreements allowing Norwegian and Faroese vessels to land a small amount of cod and other demersal species (Figure 9.8).

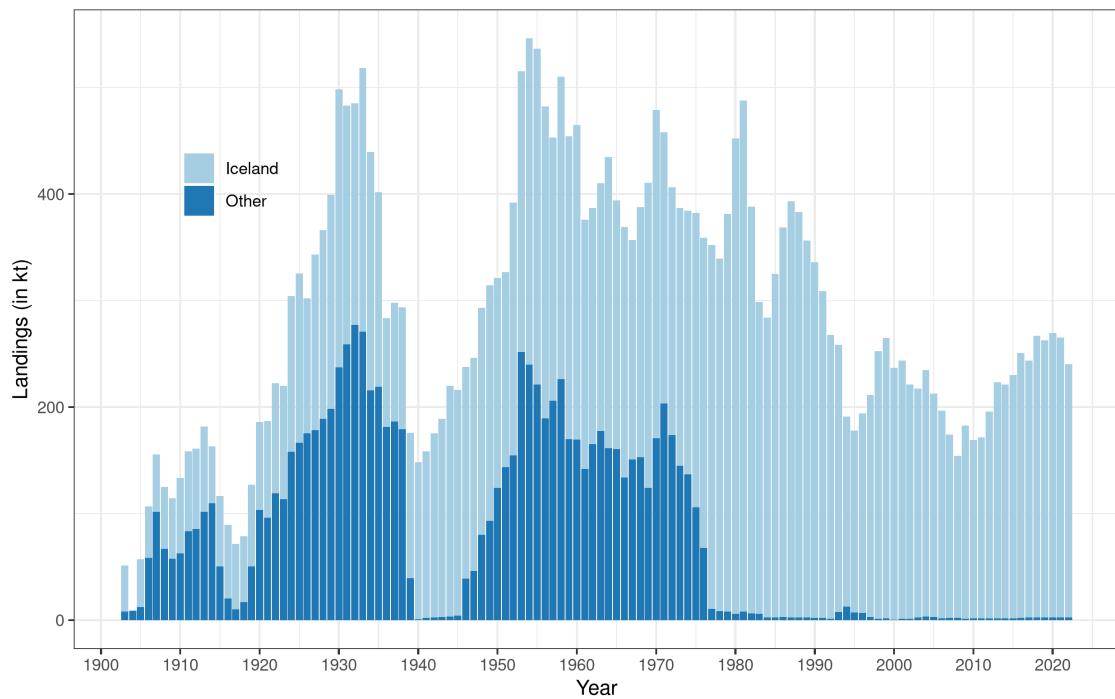


Figure 9.8. Icelandic cod Division 5.a. Landings. Data from the Directorate of Fisheries.

9.2 Data available

In general, sampling is considered good from commercial catches from the main gears (demersal seines, longlines, gillnets and trawls). The sampling does seem to cover the spatial and seasonal distribution of catches (see Figures 9.9 and 9.10). In 2020, sampling effort was reduced substantially, on-board sampling in particular, due to the COVID-19 pandemic. Although this reduction in sampling continued through 2022, sampling operations are expected to return to normal in coming years and current samples are still considered to be sufficiently representative of the fishing operations. Thus, it is not considered to substantially affect the assessment of the stock.

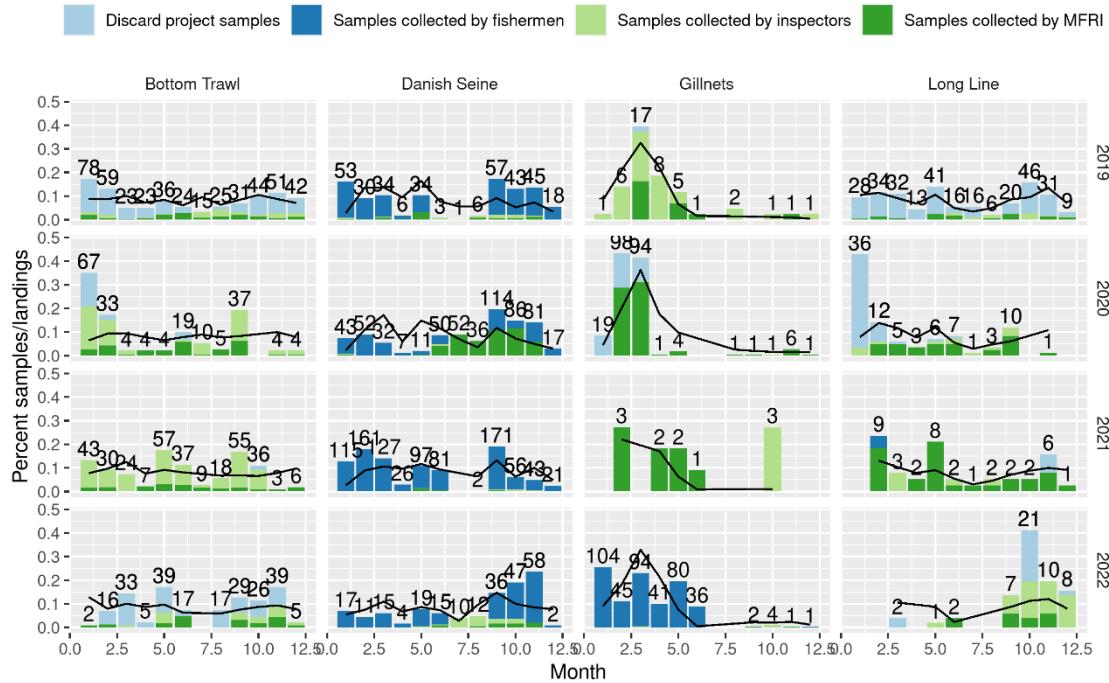


Figure 9.9. Icelandic cod Division 5.a. Ratio of samples by month (blue bars) compared with landings by month (solid black line) split by year and main gear types. Numbers of above the bars indicate number of samples by year, month and gear.

9.1.2 Age distribution

Table 9.2 shows the number of otoliths samples and number of age readings divided by gear type and Figure 9.10 shows the location of otoliths sampling.

Table 9.2. Icelandic cod Division 5.a. Number of samples, number of length measurements, and number of aged otoliths from landed catch.

Year	Demersal trawl			Longline			Gillnet			Demersal seine vessels		
	Sam-	Lengths	Otoliths	Sam-	Lengths	Otoliths	Sam-	Lengths	Otoliths	Sam-	Lengths	Otoliths
2010	806	77979	5880	757	11241	1121	849	26467	1505	986	81958	3516
2011	596	64643	5403	921	7443	1417	652	29408	1197	765	56099	2779
2012	604	54037	5757	748	8928	1334	646	22778	1557	1124	98415	3895
2013	661	73855	6194	694	2840	1041	765	4272	1790	630	83238	3302
2014	531	46615	5104	262	5340	747	453	27415	1162	691	96774	2096
2015	554	65641	4937	1018	6858	1686	767	6565	1632	1037	84003	2128
2016	493	57116	5015	1031	7182	2006	797	26568	1674	1060	97164	2183
2017	518	67512	3818	1270	8287	2189	311	7413	908	368	77691	1119
2018	264	48111	2369	1368	6545	2073	1004	16636	1290	395	74874	945
2019	451	81165	2828	330	4970	966	43	5754	300	292	56710	1237
2020	191	35494	1847	581	3915	1397	226	12606	437	84	13242	775
2021	325	53645	2171	900	6468	2304	11	1133	200	38	4333	750
2022	228	38180	1264	246	5540	524	408	1755	834	51	11228	342

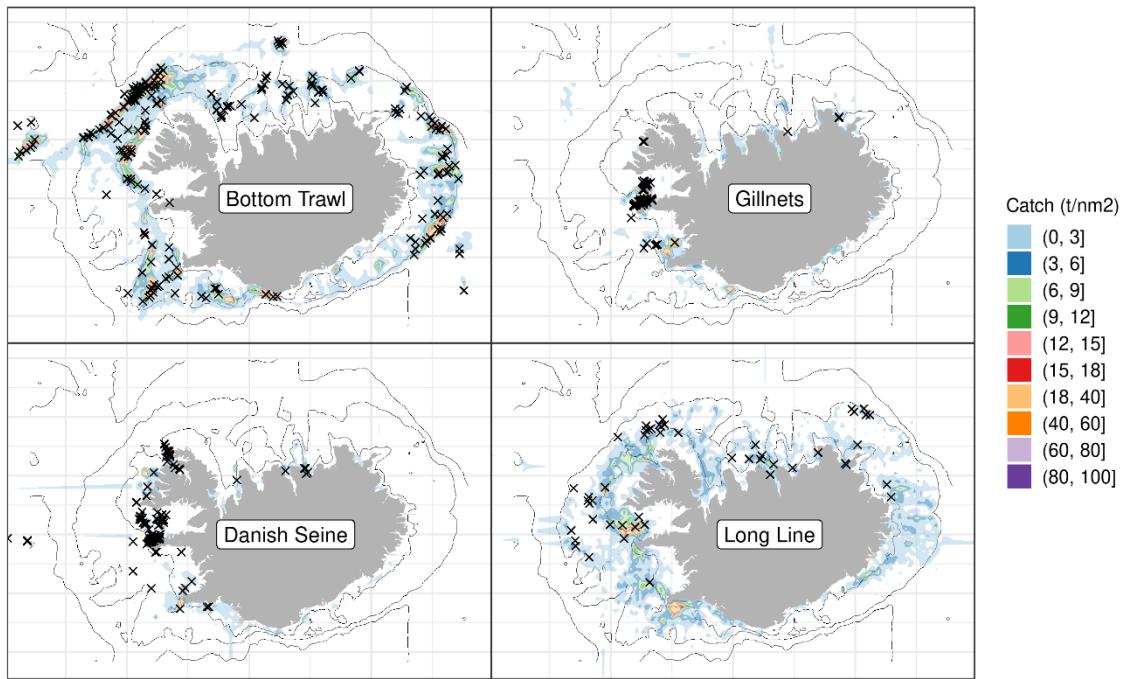


Figure 9.10. Icelandic cod Division 5.a. Fishing grounds as reported in logbooks and positions of samples taken from landings divided by gear (asterisks).

The age composition of the catch has shifted from younger to older fish in the last few decades (Figure 9.11), likely as a result of decreasing fishing pressure. Marked increases in landings of larger fish may be a result of higher variability in samples due to a reduction in sampling effort (Figure 9.9), or an unknown bias in the samples taken from the catches.

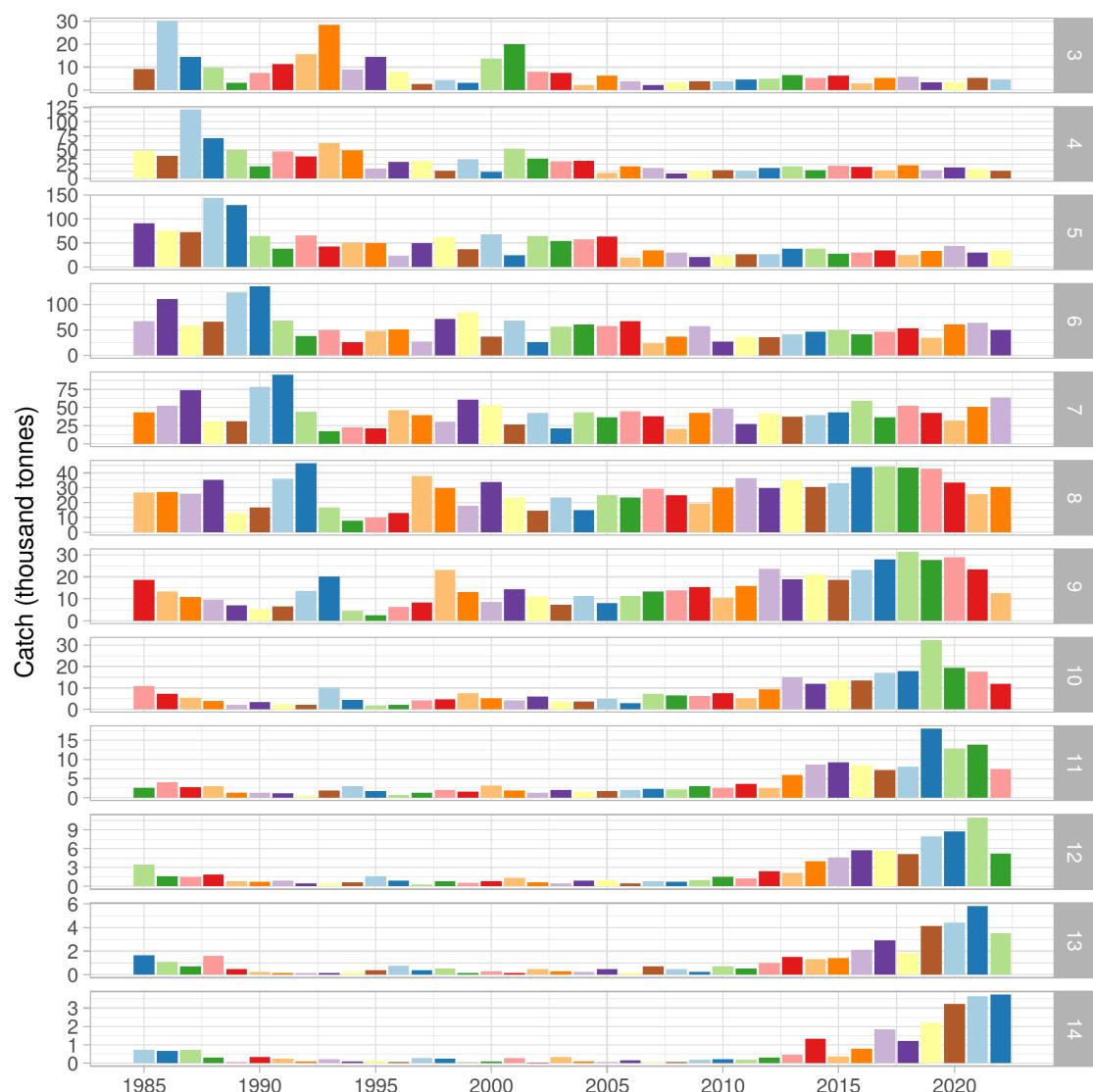


Figure 9.11. Icelandic cod Division 5.a. Estimated age distribution of landed catch based on landings and otoliths collected from landed catch (note different scales on the y-axes).

9.1.3 Length distributions

The length distribution of landed catch has shifted towards larger cod in the last ten years (Figures 9.12-9.13).

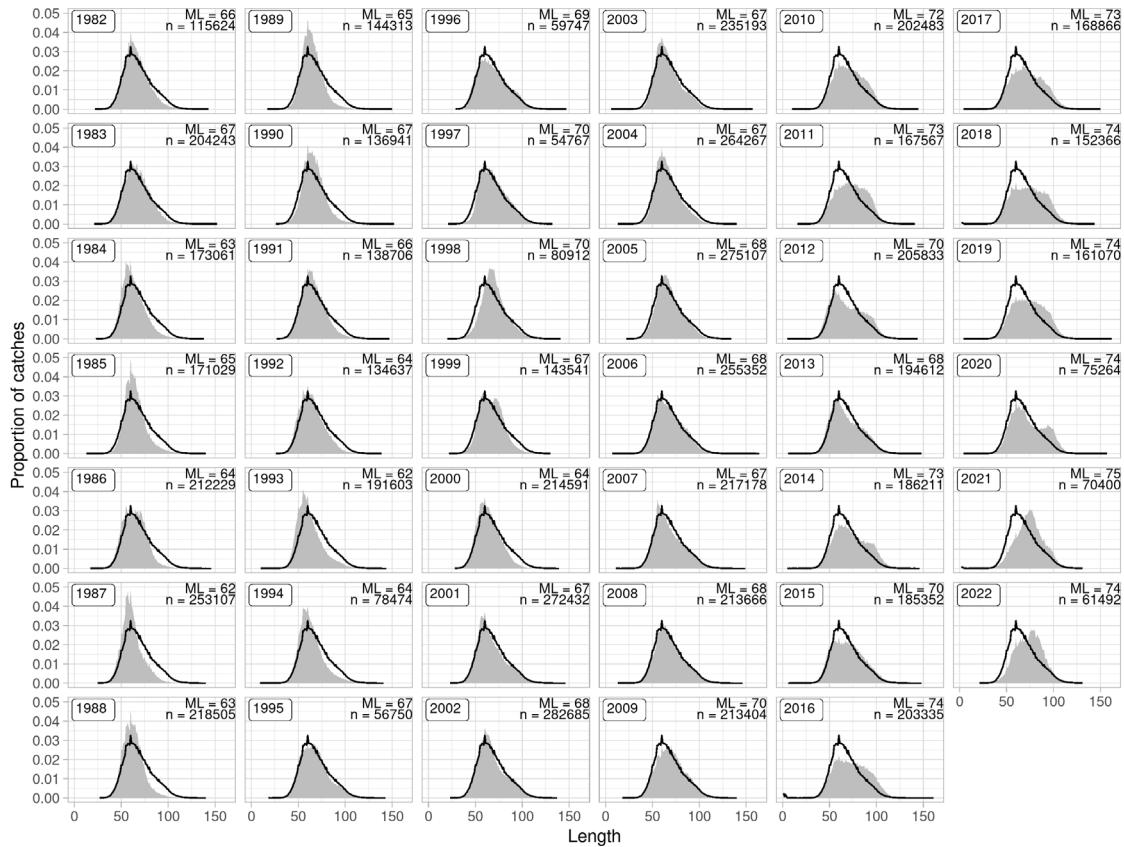


Figure 9.12. Icelandic cod Division 5.a. Length distribution from landed catch. The black line represents the mean length distribution for all years.

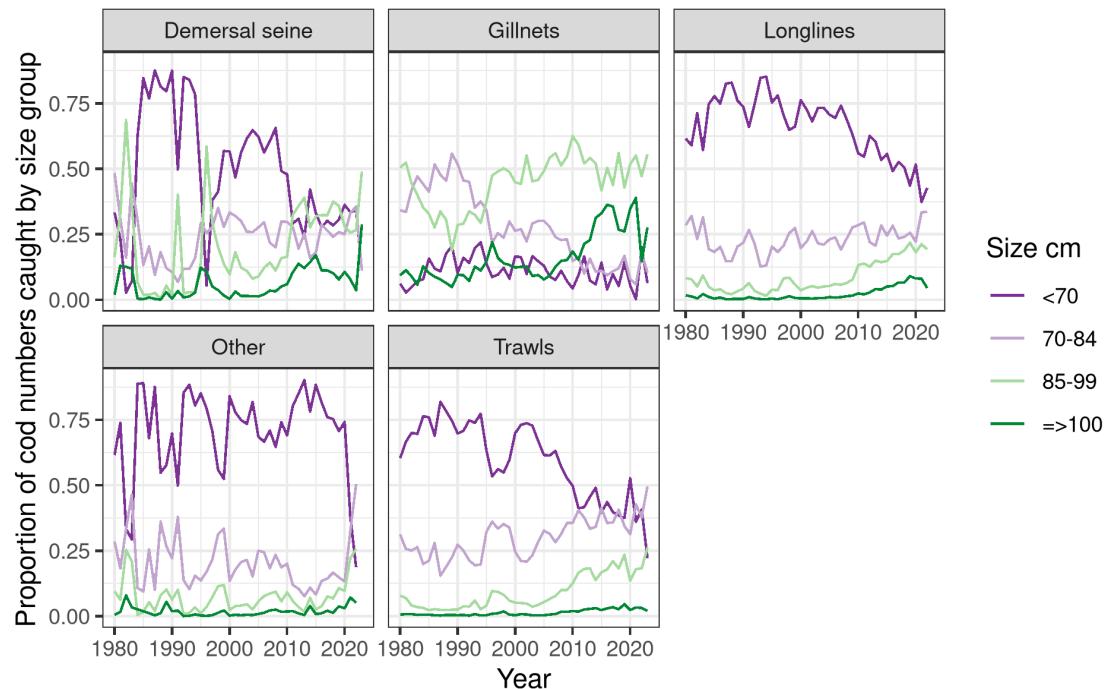


Figure 9.13. Icelandic cod Division 5.a. Proportion of the commercial catch (by numbers) from fish of a given size (cm).

9.1.4 Weight at age in the catch

The mean weight age in the catch (Figure 9.14) declined from 2001 to 2007, reaching then a historical low in many age groups. The weight at age have been increasing in recent years and are currently around the average weights observed over the period from 1985 in age groups 3 to 10, while around 10% below average in older age groups. The catch weight at age 3-10 in the final year (assessment year) is based on the relationship between spring survey and catch weights in the previous year for ages 3-9, and for older ages, the values from the previous year are used (see short-term projections).

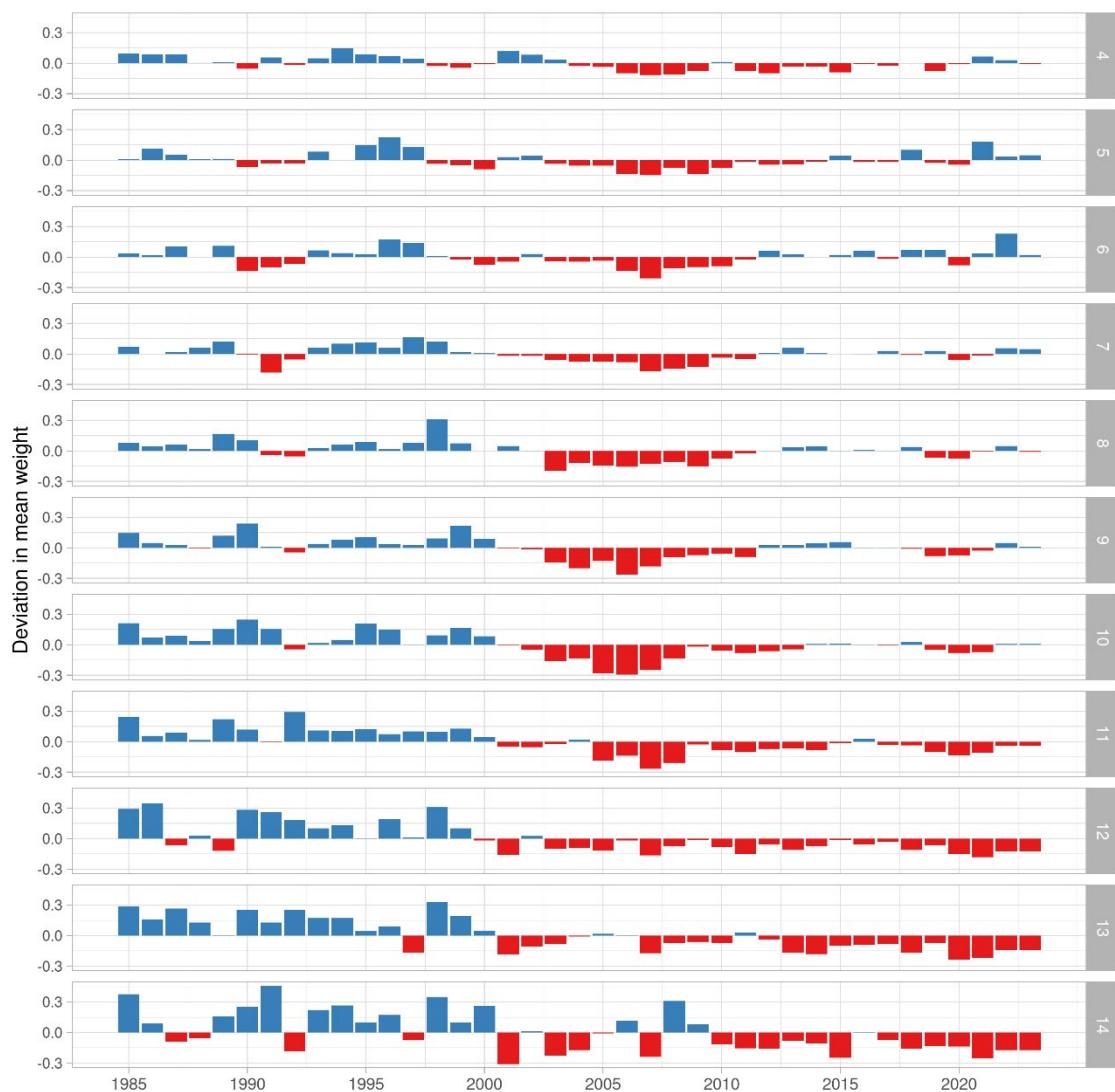


Figure 9.14. Icelandic cod Division 5.a. Weight at age (numbers in panel indicate age classes) in the catches expressed as deviations from the mean (blue: weight above the average, red: weight below average). Weight at age in the assessment year are based on predictions using the spring survey weights. Note that values that are equal to the mean are not visible in this type of a plot.

9.1.5 Natural mortality

No information is available on natural mortality. For assessment and advisory purpose, the natural mortality is set to 0.2 for all age groups.

9.3 Survey data

The Icelandic spring groundfish survey (hereafter spring survey) has been conducted annually in March since 1985. In addition, the Icelandic autumn groundfish survey (hereafter autumn survey) was commenced in 1996. However, a full autumn survey was not conducted in 2011.

Figure 9.15 shows both a recruitment index based on abundance of cod smaller than 55 cm, and trends in various biomass indices. Survey abundance by tow site and changes in spatial distribution in Figures 9.16-9.17 (spring survey) and Figures 9.18-9.19 (autumn survey).

The total biomass index in the spring survey has been high but fluctuation and with a slight decline over the last decade according to the spring survey index. The total spring (SMB) and fall survey (SMH) measurements decreased significantly from the highest value observed in 2017 to the 2020 measurement, and have since increased again slightly (Figure 9.15). While the 2021 and 2022 spring survey measurement were on par with that observed in 2018 and 2019 the fall survey measurement in 2021 continued to decline, it being the lowest observed since 2004. The 2020 survey indices were substantially below expectations for size classes that constitute the bulk of the fishable biomass, a trend which continued in 2021 in autumn survey indices but not spring survey indices. In general, the two surveys have shown similar trends through time (Figure 9.15) but the contrast through the increase and decline since the late 2000s is greater in the fall survey. The discrepancy between the last two pairs of the spring (2021 and 2022) vs the fall biomass measurements (2020 and 2021) are the highest observed in the time series. A greater decline is therefore observed in the autumn survey biomass index (Figure 9.15).

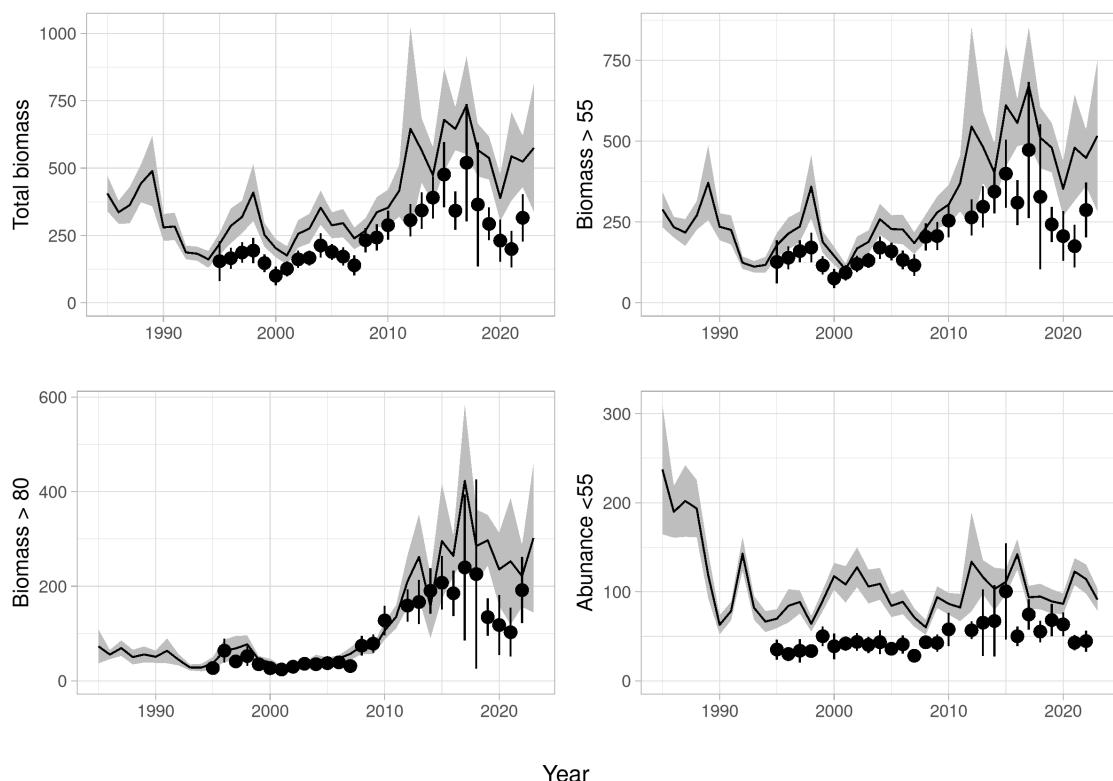


Figure 9.15. Icelandic cod Division 5.a. Total biomass indices (upper left) and harvestable biomass indices (≥ 55 cm) (upper right), biomass indices of larger ind. (≥ 80 cm) (lower left) and juvenile abundance indices (≤ 55 cm) (lower right) from the spring survey (line) from 1985 and autumn survey (black dots) from 1996, along with 95% CI.

Cod in the spring survey in 2023 was caught all around Iceland, with catch hotspots in offshore waters in the north and southwest, and in shallow waters in the south (Figure 9.16). The catch on continental slope to the west was similar to the previous year. Spatial distribution of the total biomass index of the catch in the spring survey, shows that the NW and NE areas are dominating in all years (Figure 9.17). However, some temporal changes have been occurring in recent years with the catch in the NE area decreasing and increasing in the W and SE area. In 2023 there was increase in almost all areas except for the northern areas.

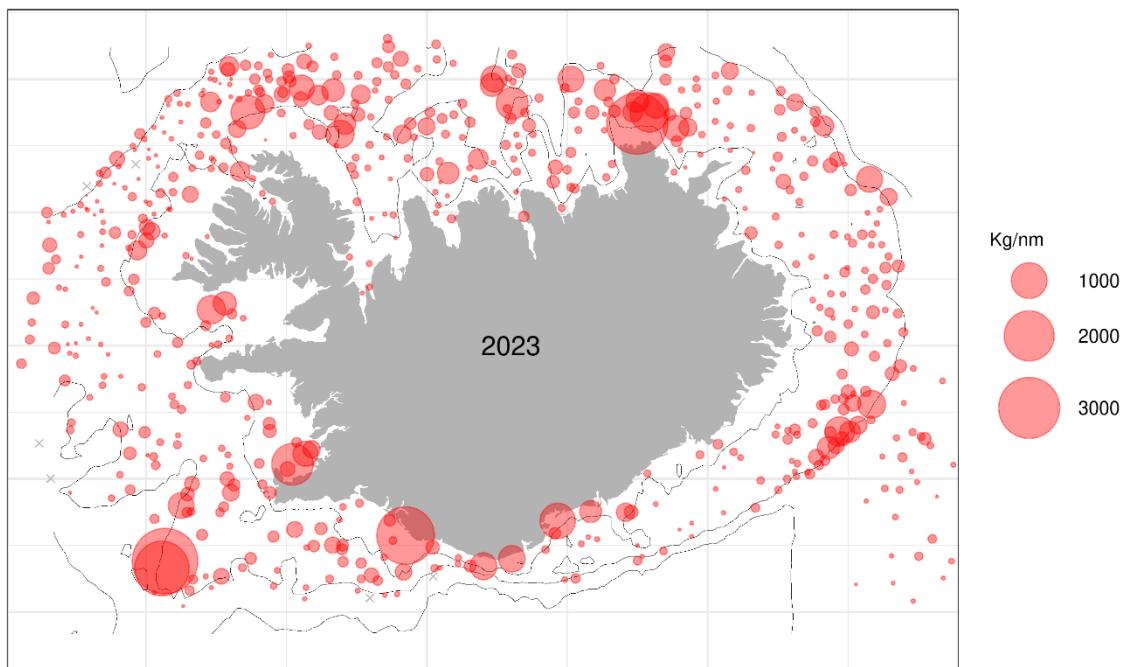


Figure 9.16. Icelandic cod Division 5.a. Spatial distribution in the spring survey. The 100, 500 and 1000 m isobaths are

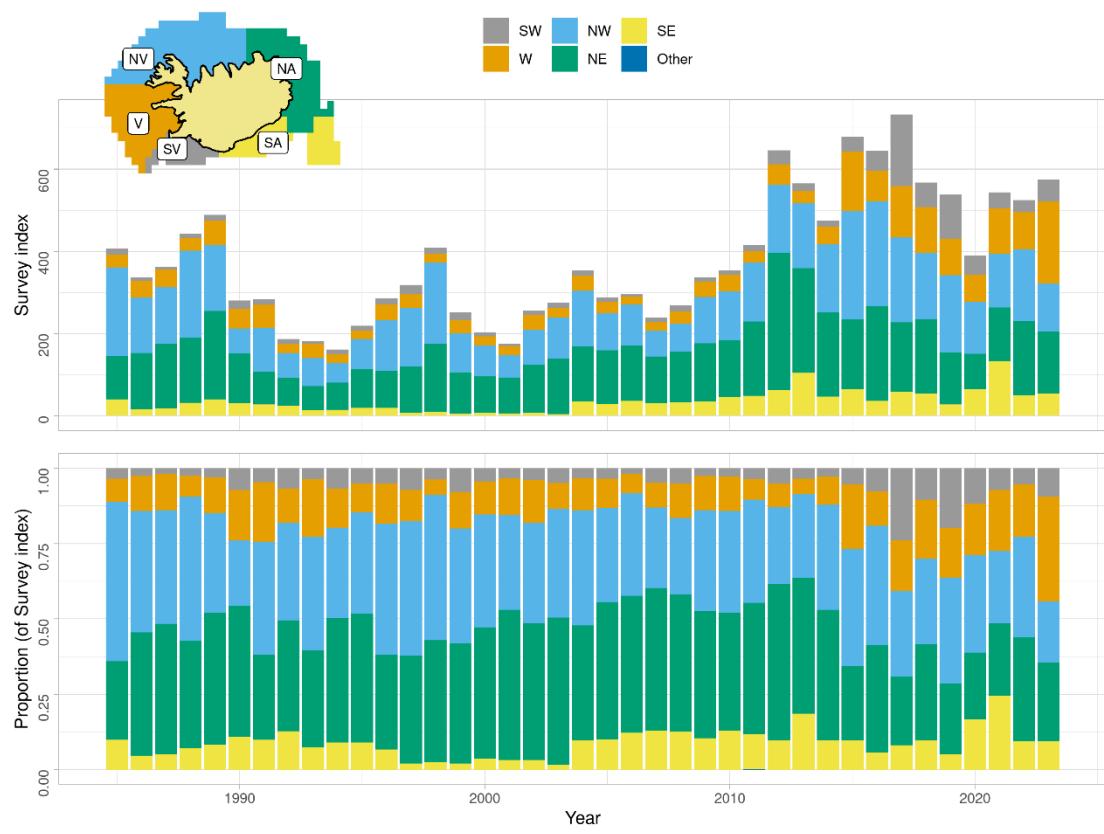


Figure 9.17. Icelandic cod Division 5.a. Spatial distribution of biomass index in the spring survey.

Spatial distribution of cod in autumn survey in 2023 was similar as in previous years (Figure 9.18). The majority of cod in the autumn survey has been caught on the traditional fishing grounds in the northwest and northeast (Figure 9.19).

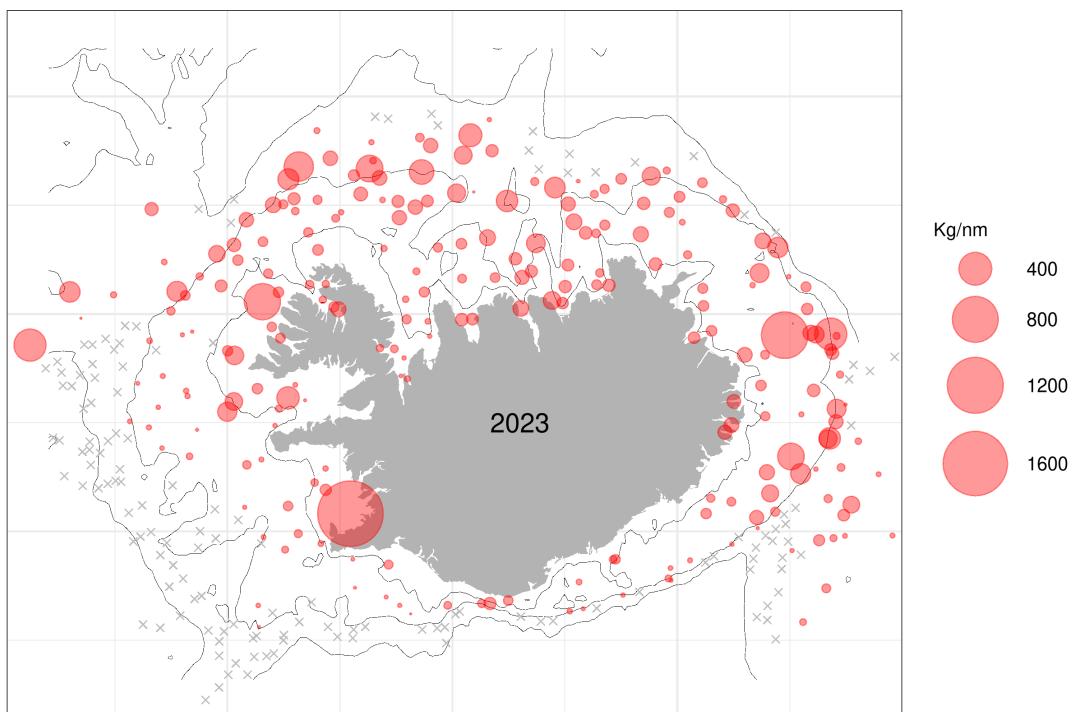


Figure 9.18. Cod. Spatial distribution of cod in the autumn survey. The 100, 300 and 1000 m isobaths are shown.

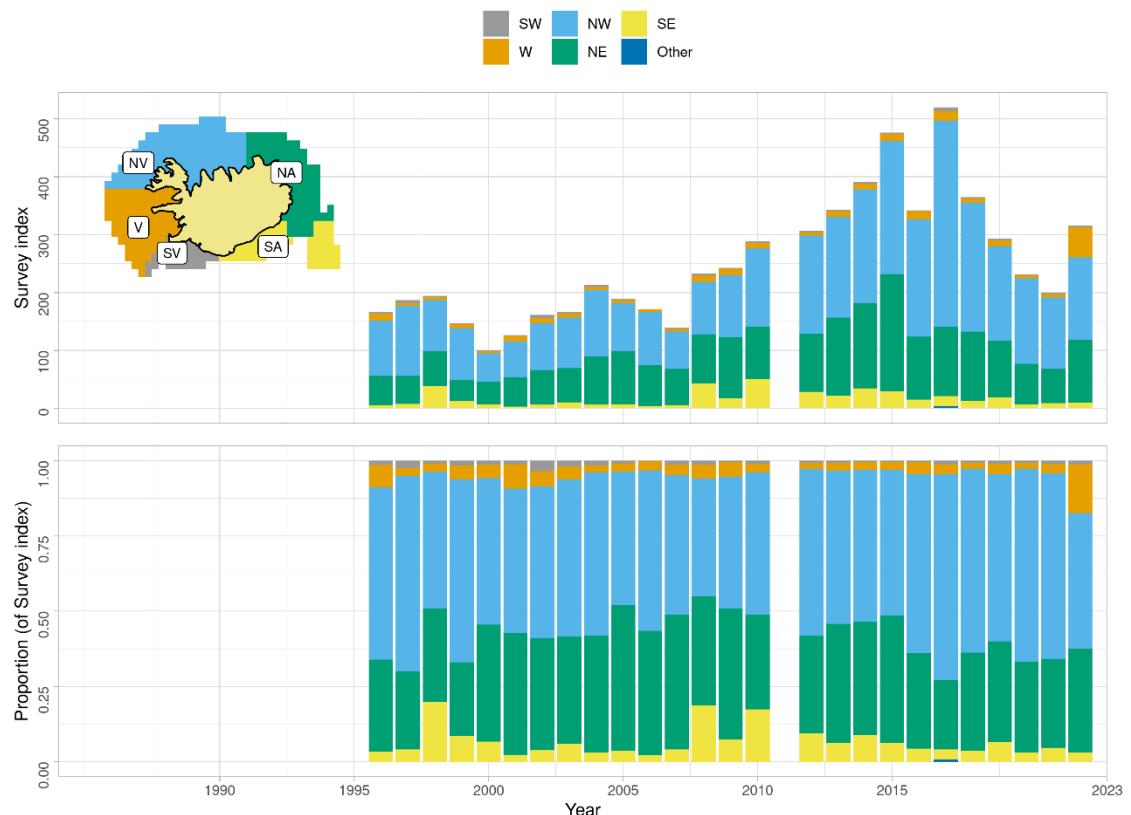


Figure 9.19. Icelandic cod Division 5.a. Spatial distribution of biomass index in the autumn survey.

Length distributions from both surveys illustrate quite clearly age groups division in the youngest age groups (Figures 9.20-9.21). Thereafter the division is not quite as clear, due to

variability in individual growth and maturity, but some multimodal length distribution can be seen. The large year classes observable in the 2020 and 2021 length distributions are now beginning to enter the fishable stock.

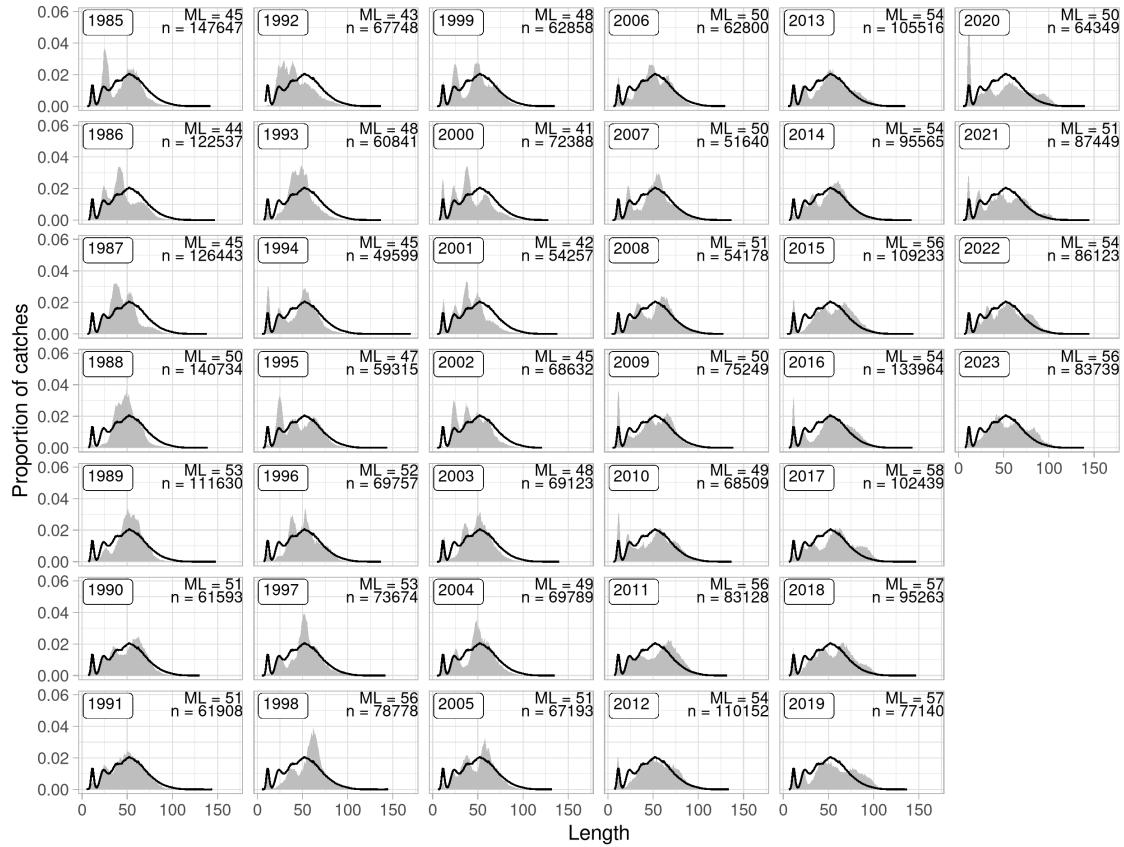


Figure 9.20. Icelandic cod Division 5.a. Length-disaggregated abundance indices from the spring survey. The black line shows the mean for all years.

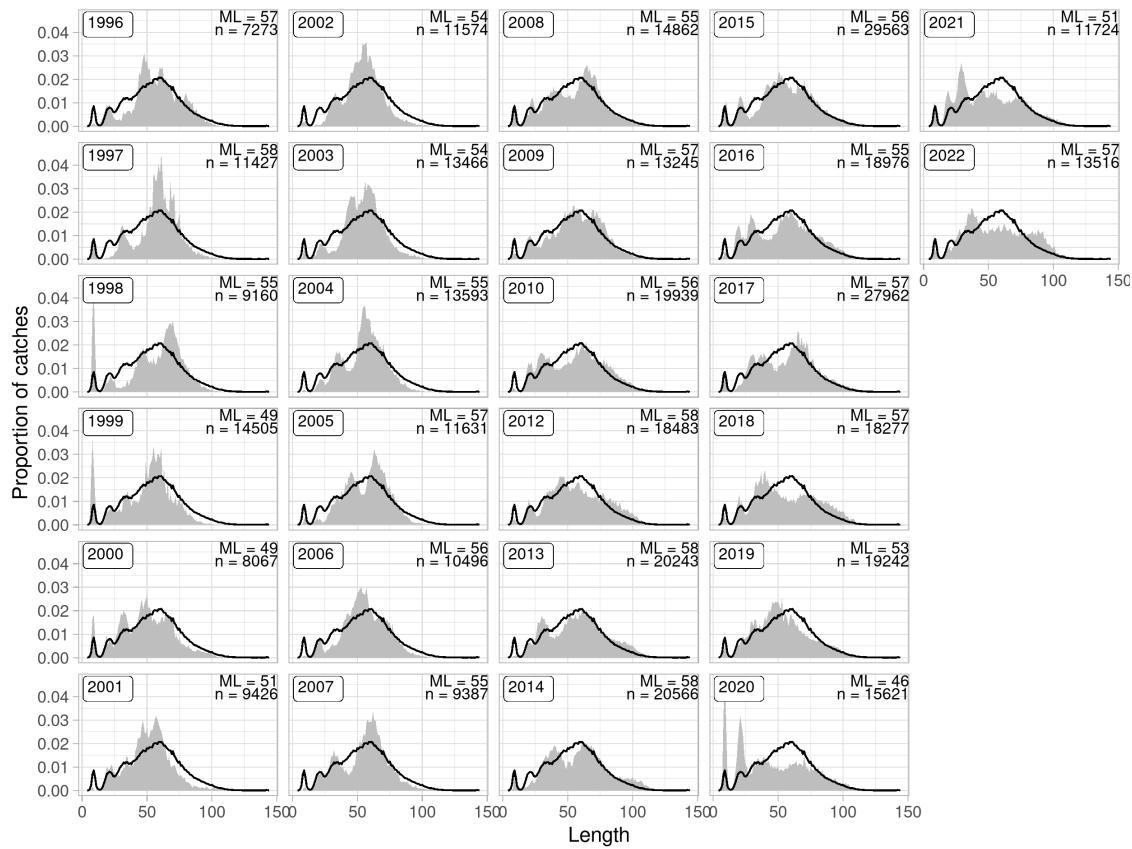


Figure 9.21. Icelandic cod Division 5.a. Length-disaggregated abundance indices from the autumn survey. The black line shows the mean for all years.

Survey age-based indices of older fish are all relatively high in recent decade despite the pattern that several of the year classes showing high indices recently were showed low - moderate indices when younger (Figure 9.22). The 2020 spring survey anomaly are clearly apparent, e.g. for year-classes 2014 and 2015 that are around the long term average in 2019 (then ages 4 and 5) but roughly half of that in 2020 (then ages 5 and 6).

The log ratio of spring survey indices (Figure 9.23) over time illustrate the anomaly in the measurements between 2019 and 2020 for some selected age groups. Although noisy, the overall pattern over time shows a decline in the log-ratio (consistent with long term reduction in mortality), but at 2020 there is an increase in the ratio, even in the younger age groups that normally are not yet fully selected in to the survey.

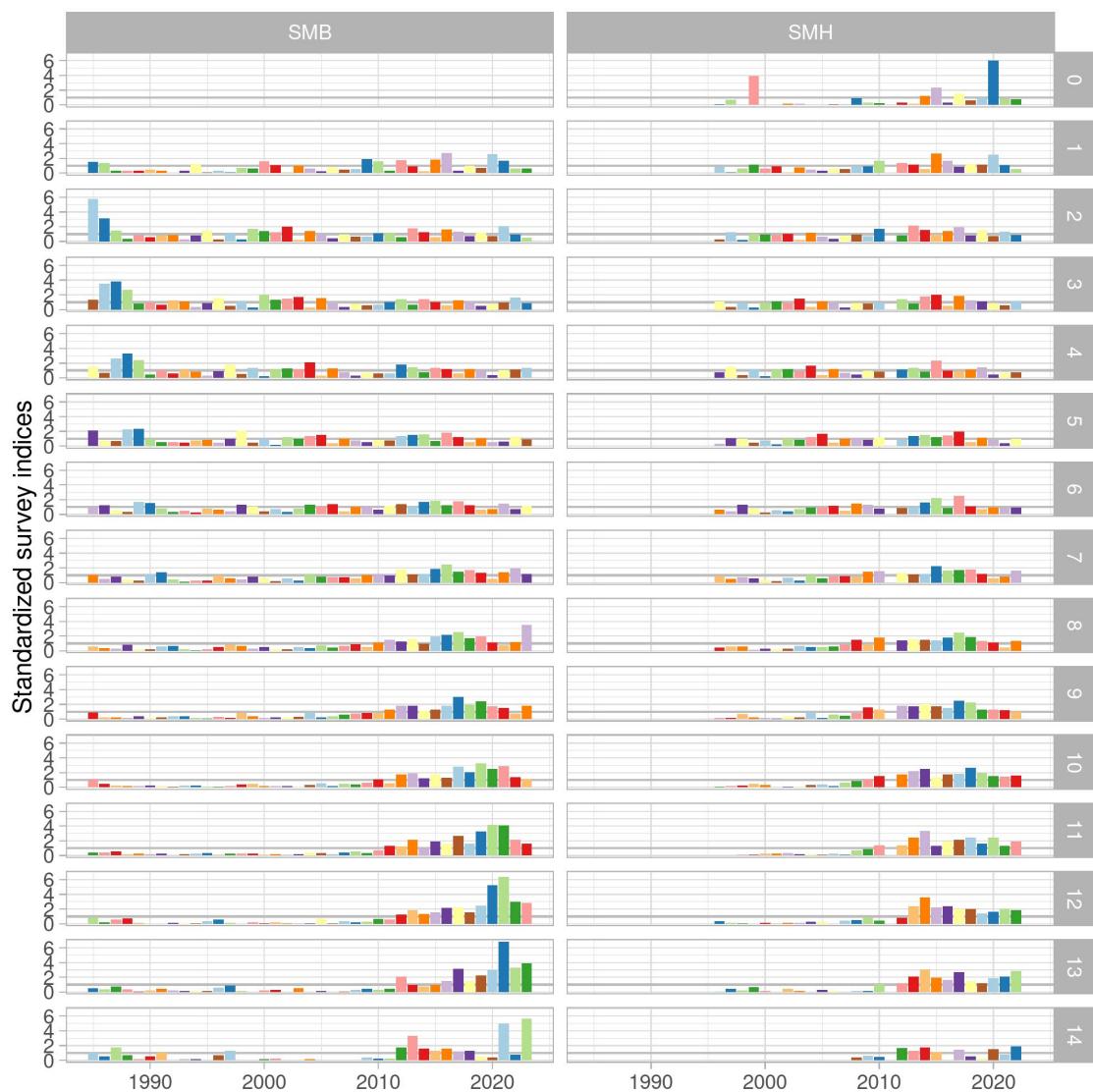


Figure 9.22. Icelandic cod Division 5.a. Age-based abundance indices of cod in the groundfish survey in spring (SMB) and autumn (SMH). The indices are standardized within each age group and within each survey.

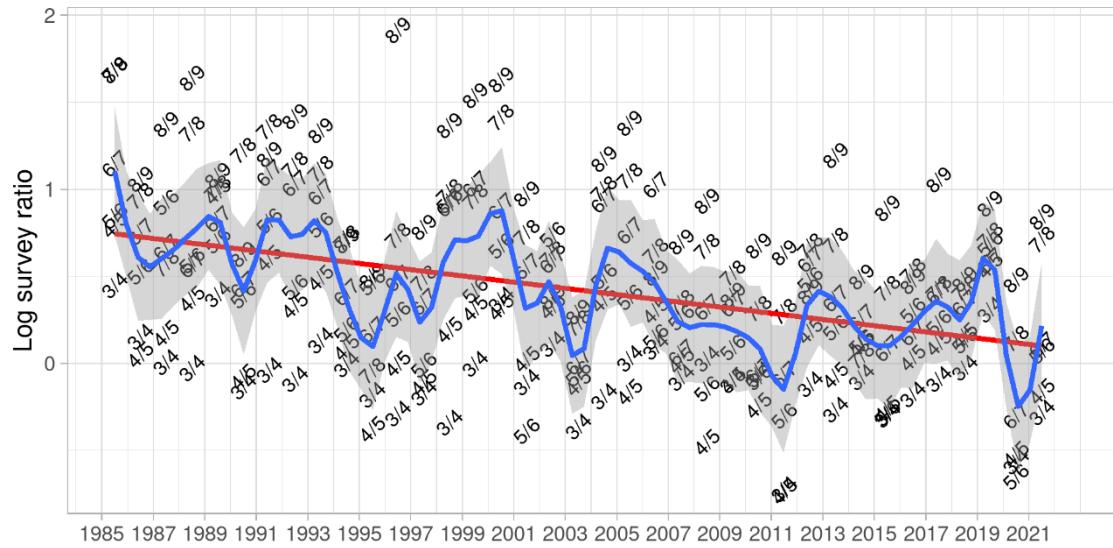


Figure 9.23. Icelandic cod Division 5.a. Log-ratio of the spring survey indices for adjacent age groups (3-9, labelled as text), with blue line showing local smoother and the red line indicating the overall trend.

Mean weights in the spring survey for all ages of cod were below average during roughly 2000 – 2010. After this period, younger ages remained older ages became mainly above average. The autumn survey shows a similar trend but only ages 3 and 4 continue to exhibit frequent below-average weights (Figure 9.24).

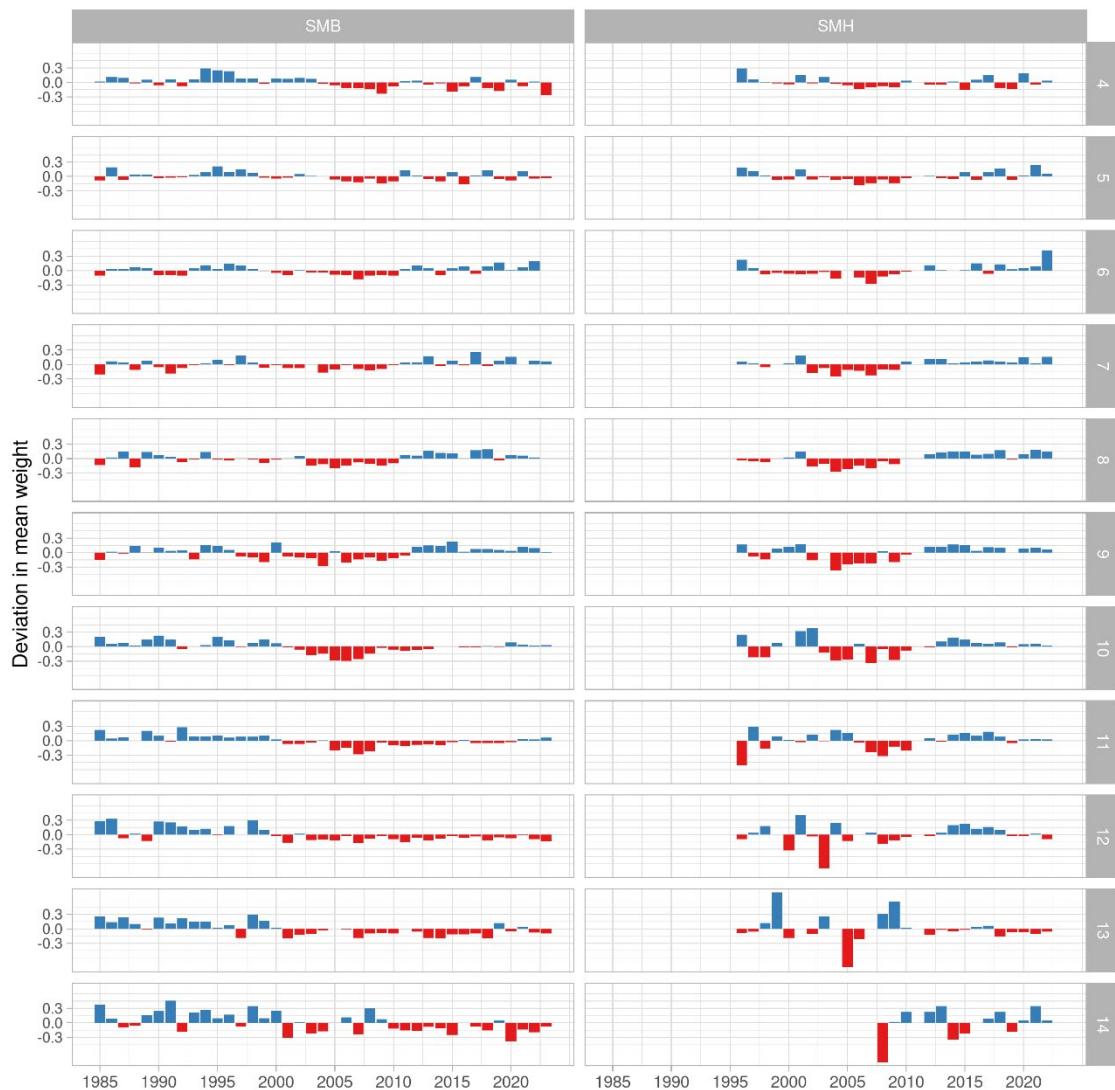


Figure 9.24. Icelandic cod Division 5.a. Weight at age (numbers in panel indicate age classes) in the spring survey (SMB) and fall survey (SMH) expressed as deviations from the mean mean (blue: weight above the average, red: weight below average). No fall survey was conducted in 2011. Note that values that are equal to the mean are not visible in this type of a plot. No age 14 cod were found in the autumn survey at the beginning of the time series.

9.4 Data analyses

9.5 Analytical assessment

A separable statistical catch at age model (sometimes referred to as MUPPET) with four periods where the selection pattern is assumed to be constant. The last separable period is from 2007 to the present. The survey residuals are modeled as multivariate normal distribution to account for potential survey “year effects” - this being a feature in place since 2002. It is a statistical cohort model where fishing mortality can change gradually over time, constrained by a random walk. The same framework is used to carry the stock dynamics forward to evaluate reference points and HCR. This framework was benchmarked in 2021. The survey residuals are modelled as multivariate normal distribution to account for potential survey “year effects” - this being a feature in place since 2002.

The input in the analytical age-based assessment are catch at age 1955–2021 (age 3 to 14) and ages 1 to 14 (from the 1985–2022 spring (often referred to as SMB in this report) and ages 3 to 13 from

the 1996–2021 fall groundfish surveys (often referred to as SMH in this report). The method for deriving the catch at age (Table 9.4) is based on 20 metiers: two areas (north and south), two seasons (January–May and June–December) and five fleets (bottom trawl, longline, hooks (jiggers), gillnet and Danish seine). The reference biomass (B_{4+}) upon which the TAC in the fishing year is set is the sumproduct of the population numbers in the beginning of the assessment year and catch weights in that year. The catch weights are not known and hence need to be predicted from stock weights measured in the spring survey, based on a relationship between catch and stock weights observed in the previous year.

The mean weight age in the catch (Table 9.5 and Figure 9.14) declined from 2001 to 2007, reaching then a historical low in many age groups. The weights at age have been increasing in recent years and are at or above the average in the most important age groups. The variation in the pattern of weight at age in the catches is in part a reflection of the variation in the weight in the stock as seen in the measurements from the surveys (Table 9.6 and Figure 9.24).

Survey indices can be found in Tables 9.9 and 9.10.

9.6 Diagnostics

The diagnostics (see Tables 9.11, 9.12 and 9.13 and Figure 9.25) shows the large negative residuals in the spring survey 2020 for the most important age groups (ages 4 to 8), as well as smaller negative residuals for the surrounding years 2019 and 2021, especially for the fall survey. The spring survey residuals are rather high for age groups 10 years and older in recent years, and especially high for age 8 in 2023. A summarised diagnostic of the observed vs predicted survey biomass (Figure 9.26) illustrates deviation between the model estimates and the point estimates. There are indications that interannual variability in survey measurements in both surveys has increased in recent years compared with that observed in the past.

One of the ToR for this year was to evaluate the retrospective pattern of the assessment (Figure 9.27) and calculate the Mohn's rho values. The default 5-year peels resulted in the following values:

Variable	Mohn's rho
Fishing mortality	0.044
Reference biomass	-0.010
Spawning stock biomass	-0.041
Recruitment	0.025

Calculation of Mohn's rho over only a 5-year period **may** not be the best indicator of potential bias in the assessment because:

- The metrics over the short period may be just a reflection of autocorrelation.
- When mortality is low the assessment converges slowly and the metrics using only the most recent years may be heavily influence by the terminal year estimates.

A longer-term metric for the Icelandic cod based on a retrospective going back to 2002 is as follows:

Variable	Mohn's rho
Fishing mortality	0.044



Figure 9.25. Icelandic cod Division 5.a. Catch residuals (left), spring survey residuals (SMB, middle) and fall survey residuals (SMH, right) by year and age (blue: measured values above the model fit, red: measured values below the model fit). Note that values that are equal to zero are not visible in this type of a plot and that no survey was carried out in the fall 2011.

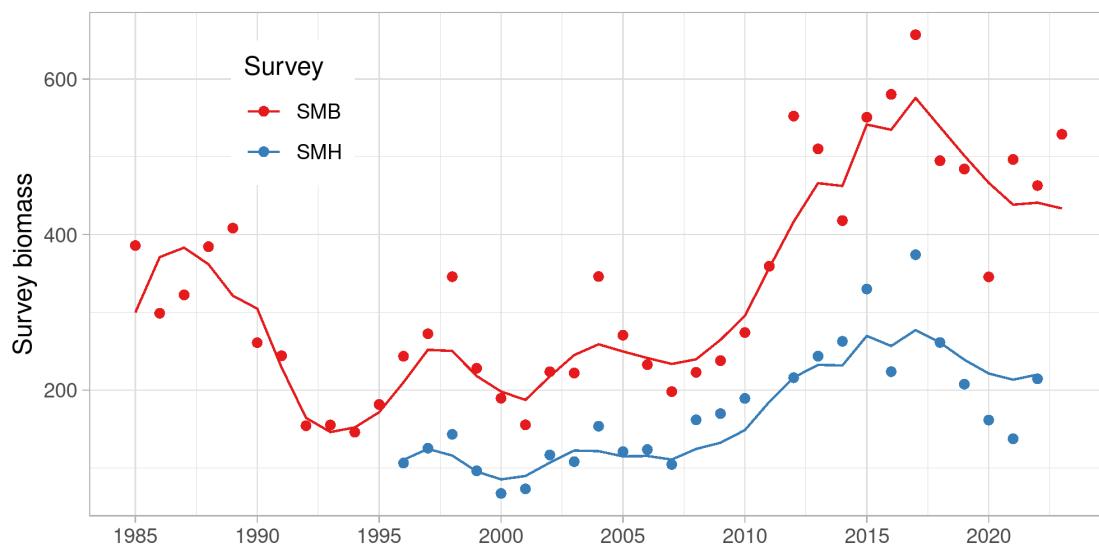


Figure 9.26. Icelandic cod Division 5.a. Observed aggregated age-based survey indices (point) and modelled indices (lines) for the spring survey (SMB) and the autumn survey (SMH).

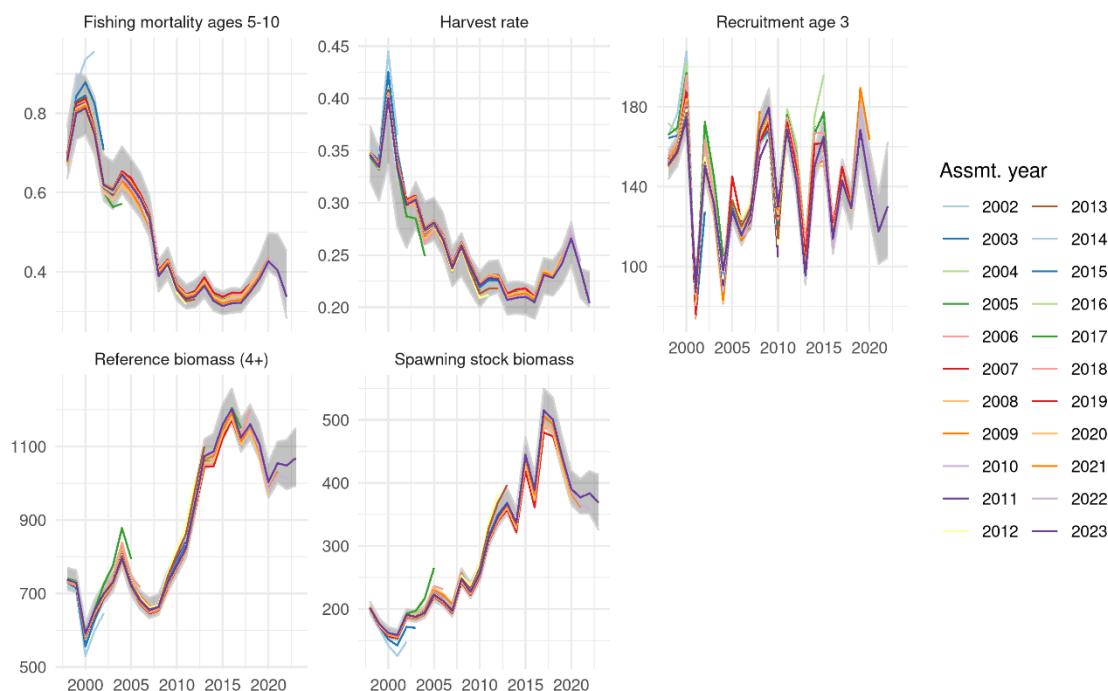


Figure 9.27: Icelandic cod Division 5.a. Analytical retrospective pattern of key metrics and the current estimates with 90% confidence intervals based on an MCMC routine (grey). The x-axis for the recruitment refers to the year class.

9.7 Model results

The results of this year's assessment show that the spawning stock in this assessment year is estimated to be 368.345 kt. Weight and maturity at age used in the calculation of SSB are presented in Tables 9.7 and 9.8. The values estimated in recent years are higher than have been observed during the last five decades. The reference biomass is estimated to be 1068.860 kt in 2023 and the fishing mortality 0.34 in 2022. Year classes since the mid-1980s are estimated to be relatively stable but with the mean around 35% lower than observed in the period 1955 to 1985.

The detailed results by age of the assessment are provided in Tables 9.14 and 9.15 and the stock summary in Table 9.16 and Figure 9.28. The reference biomass has decreased somewhat in recent years, in part driven by incoming recruitment being somewhat lower and in part driven by increase in fishing pressure. The first estimates of the 2021 and 2022 year classes indicate that they are somewhat low, but they will not begin to enter the reference biomass until 2025.

Estimated spawning stock biomass (SSB) has increased in recent years, although fluctuating, and its peak in 2017 was larger in almost 60 years. Harvest rate has declined and is at its lowest value in the assessment period. Recruitment since 1988 has been substantially lower than the average recruitment in the period 1955–1985. The increase in SSB is therefore primarily the result of lower harvest rate. It is estimated that the current fishable biomass is composed of several poor years of recruitment (e.g., 2013 and 2016), but also several good recruitment years (e.g., 2015 and 2019), indicating that variability in biomass levels can be expected to continue.

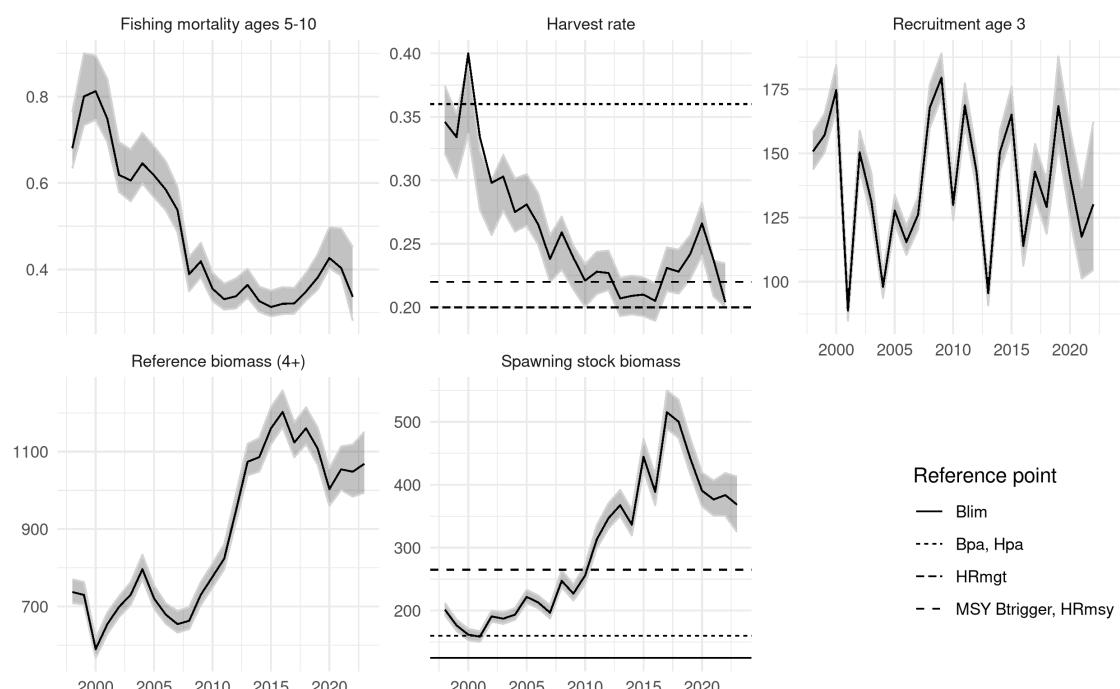


Figure 9.28. Icelandic cod Division 5.a. Stock summary plot. Catch, recruitment, fishing mortality and harvest rate, reference stock biomass (B4+) and spawning stock biomass (SSB). Grey ribbons indicate 90% confidence intervals based on an MCMC routine. The x-axis for the recruitment refers to the year class.

9.8 Short-term projections

Landings of Icelandic cod in 2022 are estimated to have been 242.313 kt, the bulk taken by the Icelandic fleet.

To perform short-term projections, estimates of catch for the current calendar year are needed. The estimates of landings for the current calendar year of 200 kt is based on the remainder of the quota from the current fishing year (2020/21, 209 kt) on 1. January 2021 (127 kt), the catch that is expected to be taken from 1. September to 31. December 2021 (70 kt, 1/3rd of the advised TAC of 211 kt) and the expected catch of the foreign fleet (3 kt).

Mean annual discard of cod over the period 2001–2012 is around 1% of landings in weight (Ólafur Pálsson et al 2013). More recent (unpublished) data indicate that discarding may have increased.

The method used for deriving these estimates assumes that discarding only occurs as high grading.

The reference biomass (B_{4+}) upon which the TAC in the fishing year is set is derived from population numbers in the beginning of the assessment year and catch weights. The catch weights are, however, not known. In recent years, the estimates of mean weights in the catch of age groups 3–9 in the assessment years (y) have been based on a prediction from the spring survey weight measurements in that year using the slope (β) and the intercept (α) from a linear relationship between survey and catch weights in preceding year ($y - 1$) (for ages 10 and older the weights from the previous year are used). The same approach was used this year for predicting weight at age in next year's catches (Figure 3.3). I.e. the α and β were estimated from:

$$cW_{a,y-1} = \alpha + \beta * sW_{a,y-1}$$

and the catch weights for 2023 then from:

$$cW_{a,y} = \alpha + \beta * sW_{a,y}$$

Based on this, the mean weights at age in the catches in 2023 are predicted to be quite high for ages 3 and 4 (Figure 9.29 and Table 9.5), even though the weights in the spring survey in those age groups are below or at the long term mean (Figure 9.14 and Table 9.6).

An alternative model based using all data from 1990 onwards to estimate α and β **within each age group 3 to 9** (labelled 'alt') was explored:

$$cW_a = \alpha + \beta * sW_a$$

The catch weight in the assessment year would then be predicted using "each age" α and β and the observed stock weights in the assessment year. This alternative model gave a much more plausible estimates of catch weights in last year's assessment (2022) although the reference biomass in the terminal year (2022) was very similar (spaly $B_{4+} = 977$ kt vs alternative 959 kt). A retrospective analysis, using the current estimates of the parameters α and β , indicated that the overall predictive power of the reference biomass was better (cv of 0.035 vs 0.050, bias -0.0020 vs -0.0049) using the alternative model (Figures 9.30 and 9.31). The alternative model was discussed within the NWWG 2022 and there was a conclusion among the more than dozen scientists that the model was an improvement over the current spaly weight prediction model. However, it was decided that before implementation, it would be beneficial for the method to be externally reviewed either as a working document appended to next year's report, or through next benchmark, that for this stock will most likely occur in 2026 or 2027.

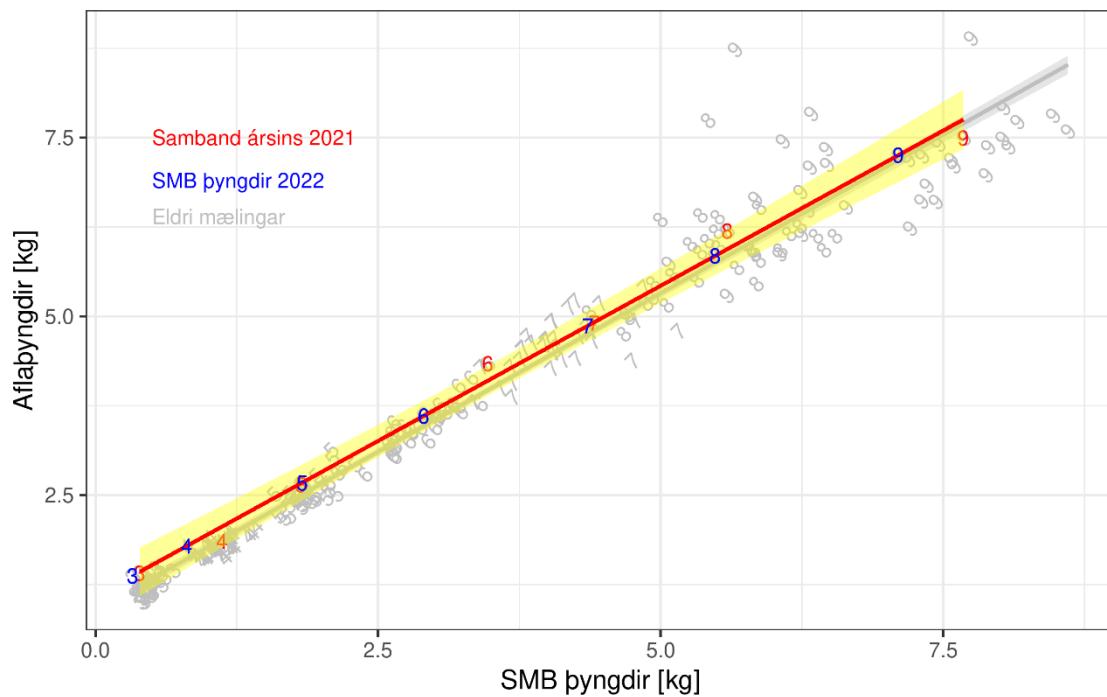


Figure 9.29: Icelandic cod Division 5.a. Prediction of catch weights age 3 to 9 in the assessment year. The ‘crossed’ points are the mean from 1990 to the present.

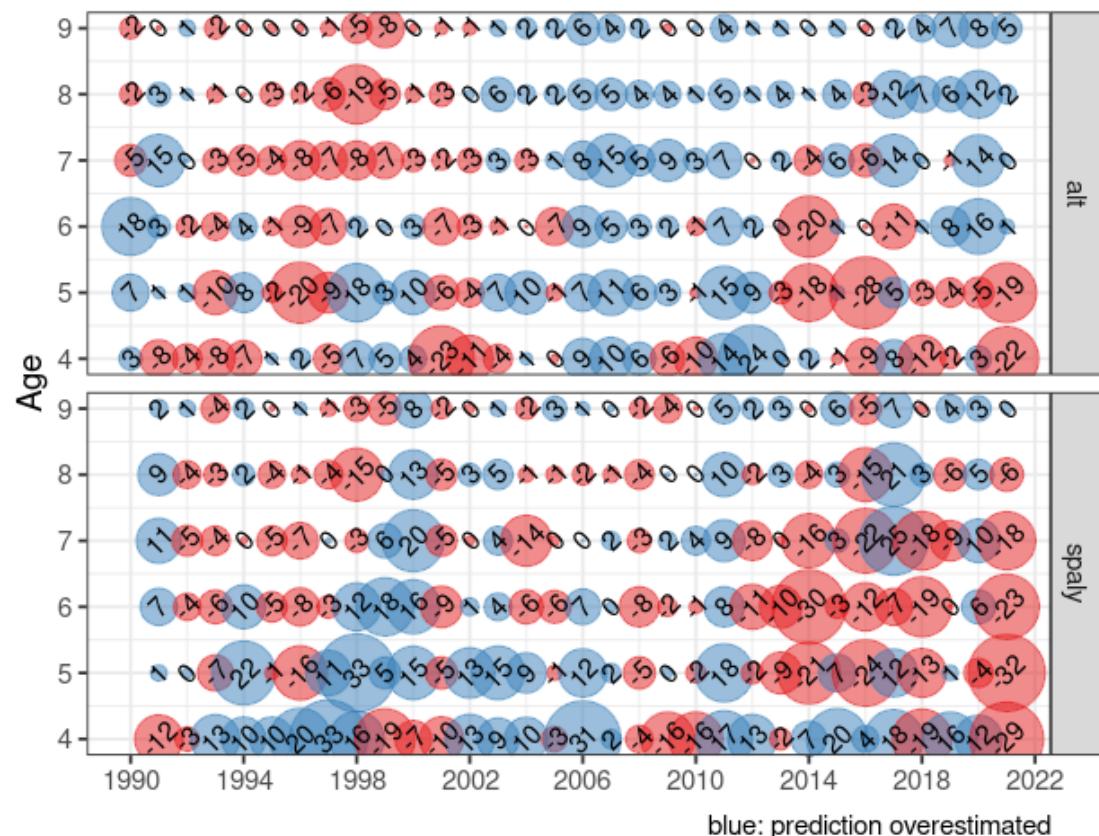


Figure 9.30: Icelandic cod Division 5.a. Residuals of the two catch prediction models, the one currently used (spaly) versus an alternative with better predictive power (alt). Numbers indicate the equivalence of biomass in kilotonnes.

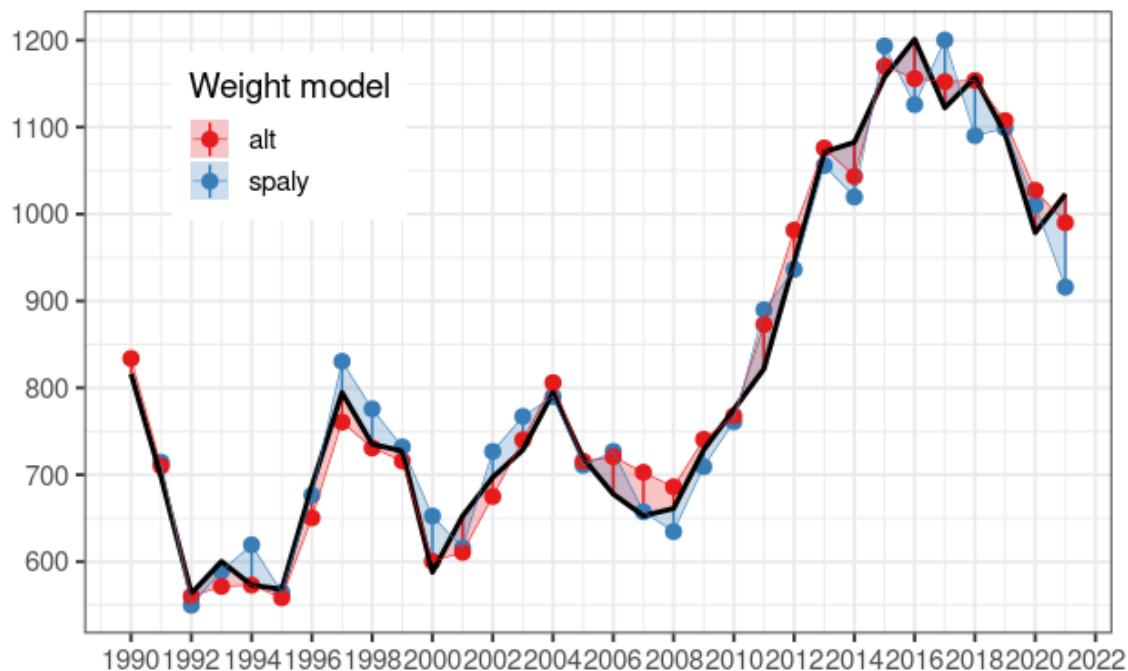


Figure 9.31: Icelandic cod Division 5.a. Comparison of the reference biomass using the two catch prediction models, the one currently used (spaly) versus an alternative with better predictive power (alt).

9.9 Management

9.1.6 History

The Ministry of Industries and Innovation is responsible for management of the Icelandic fisheries and implementation of legislation. Cod was included in the ITQ system in 1984, but effort management was also implemented during the first years of the TAC system, partly to help those that thought they got unfair share of the quota. This "additional effort" management system led to the catches exceeding TAC by 20-30% in the first years of the ITQ system.

In 1990 the law was changed, and effort management eliminated except for the smallest coastal fleet that was managed by fishing days. At the same time, many limitations of the quota transfer were released and the fishing year from 1 September to 31 August was introduced. These laws took effect on 1 September 1991. In the first years, advice by MRI (Marine Research Institute) was based on reducing F (Fishing mortality) by 40%. TAC exceeded advice during those years and catch exceeded TAC.

The cod stock reduced rapidly in the early nineties due to low recruitment and high fishing mortality. The need for more strict control of fisheries was apparent and 2-3 years of work by a group of fisheries scientist lead to an adoption of HCR (Harvest Control Rule) for the fishing year 1995/96. The HCR led to significant reduction in fishing mortality.

Since the HCR was introduced, TAC has been set according to the HCR, but catch has exceeded TAC by 7.4% on the average, however somewhat less or close to 5% in recent years. The main explanation for catch exceeding advice is that catch in the effort control system exceeded predictions, but the predicted catch is subtracted from the calculated TAC according to the HCR. The

current effort control system for the small boats that started in 2009, includes TAC constraint so catches should not exceed TAC by large amount (1-2%).

9.1.7 Harvest control rule

The primary essence of the rule is that the TAC for the next fishing year (starting 1. September in the assessment year and ending 31. August next year) is based on a multiplier on the reference biomass of four years and older in the assessment year (B_{4+}).

The rule has gone through some amendments and revisions over time. The last significant change occurred in 2007, when the harvest rate multiplier upon which the TAC for the next fishing season is based was changed from 0.25 to 0.20. The current rule has in addition a catch stabilizer. When the SSB in the assessment year is estimated to be above $SSB_{trigger}$ (265 kt) the decision rule is:

$$TAC_{y/y+1} = (0.20 * B_{4+,y} + TAC_{y-1/y})/2$$

The TAC for the current fishing year (2022/2023) based on last year's assessment was 208.846 kt.

Following the benchmark 2021 the reference biomass upon which the advice is based was approximately 20% lower in recent years than based on setting prior to the benchmark. This in part is reflected in somewhat higher recent harvest rate than intended although it is still within the range expected in the HCR simulation. During the benchmark, reference points and the definition of how harvest rate is presented were also updated.

Table 9.3. Icelandic cod Division 5.a. Advice, recommended TAC, National TAC set by the Ministry, and landings (tonnes).

Fishing year	ICES advice	Rec. TAC	National TAC	Catch
1991/92	National advice	250 000	265 000	274 000
1992/93	Reduce F by 40%	154 000	205 000	241 000
1993/94	Reduce F by 40%	150 000	165 000	197 000
1994/95	Reduce F by 50%	130 000	155 000	165 000
1995/96	25% HCR	155 000	155 000	170 000
1996/97	25% HCR	186 000	186 000	202 000
1997/98	25% HCR	218 000	218 000	228 000
1998/99	25% HCR	250 000	250 000	254 000
1999/00	25% HCR	247 000	250 000	257 000
2000/01	25% HCR	203 000 ¹⁾	220 000 ¹⁾	222 000
2001/02	25% HCR	190 000 ¹⁾	190 000 ¹⁾	217 000
2002/03	25% HCR	179 000 ¹⁾	179 000 ¹⁾	197 000
2003/04	25% HCR	209 000	209 000	227 000
2004/05	25% HCR	205 000	205 000	217 000
2005/06	Reduce harvest rate	198 000	198 000	207 000

Fishing year	ICES advice	Rec. TAC	National TAC	Catch
2006/07	Reduce harvest rate	178 000	193 000	191 000
2007/08	20% HCR	130 000	130 000	143 000
2008/09	20% HCR	124 000	160 000 ²⁾	171 000
2009/10	20% HCR	150 000	155 000 ³⁾	170 000
2010/11	20% HCR	160 000	160 000	167 000
2011/12	20% HCR	177 000	177 000	185 000
2012/13	20% HCR	196 000	195 000	213 000
2013/14	20% HCR	215 000	214 000	226 000
2014/15	20% HCR	218 000	216 000	223 000
2015/16	20% HCR	239 000	239 000	251 000
2016/17	20% HCR	244 000	244 000	237 644
2017/18	20% HCR	257 572	257 572	270 217
2018/19	20% HCR	264 437	264 437	265 385
2019/20	20% HCR	272 411	272 411	272 385
2020/21	20% HCR	256 593	256 593	272 137
2021/22	20% HCR	222 373	222 373	239 925
2022/23	20% HCR	208 846	208 846	

1) Amended harvest control rule (HCR).

2) Initial TAC set to 130 000 according to the catch rule, raised to 160 000 in January 2009.

3) Set according to the catch rule.

Figure 9.32 shows the net transfers of cod quota in the Icelandic ITQ system. Quota transfers from other species to cod are not allowed, and net transfers from cod to other species have been relatively low in recent fishing years (Figure 9.32, upper). Net transfers of unused cod quota from one fishing year to the next have usually been in the range of 0-7%.

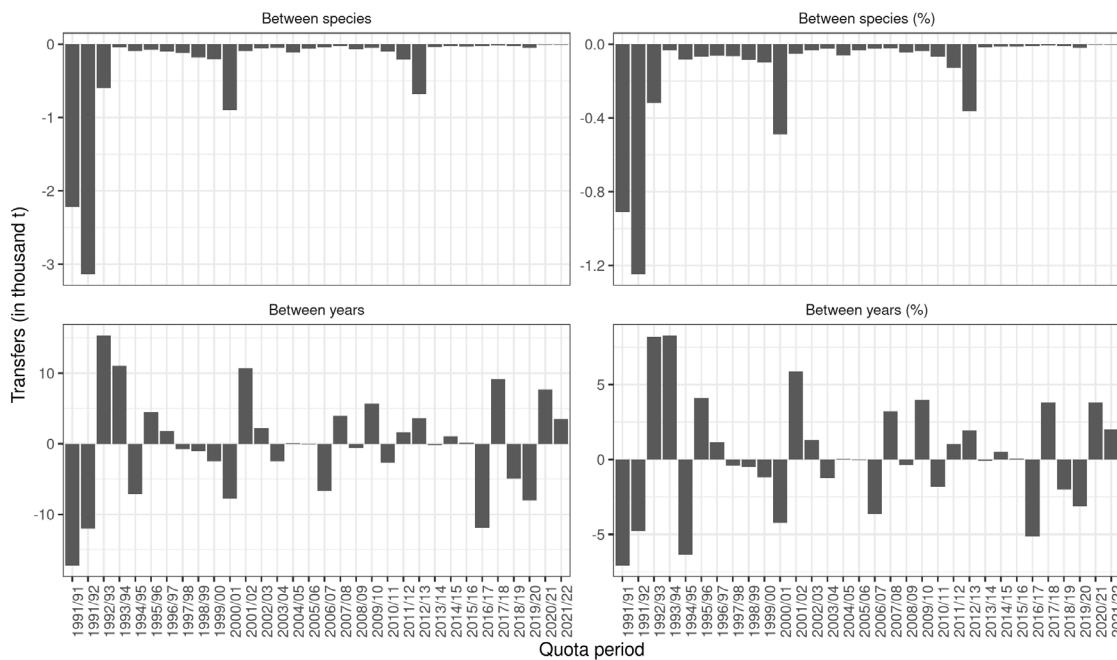


Figure 9.32. Icelandic cod Division 5.a. Net transfers of quota to and from cod in the Icelandic ITQ system by quota year.
Between species (upper): Positive values indicate a transfer of other species to cod (not allowed), but negative values indicate a transfer of cod quota to other species. Between years (lower): Net transfer of quota for a given quota year.

9.1.8 On reference points

Prior to the 2021 benchmark the ICES reference points that matter for the advice (ICES $B_{trigger}$ and HR_{msy}) were set the same as in the HCR. Other (redundant) fishing pressure reference points were set based on the conventional F (i.e. F_{lim} and F_{pa}). In the 2021 benchmark there was a requirement that ICES $B_{trigger}$ should be set in accordance with the guidelines and that fishing pressure reference points should be set in the same units as used in the HCR.

Since this stock has been fished for quite a while at a rate that is closed to that resulting in MSY the ICES $B_{trigger}$ was based on the 5% percentile of SSB with the stabilizer in the HCR being ignored. The resulting value was 265 kt. This may not be the most optimum approach because the influence of incoming age 4 weigh quite high in the B_{4+} reference biomass, something that is actually ameliorated in the HCR that uses a buffer. If advice is based on no buffer it may be better to base the reference biomass not on catch weights but stock weights, because then the influence of age four would be reduced.

More problematic is however the derivation of HR_{pa} (same would apply to any F_{pa} derivation), which according to the guidelines is defined based on using the $B_{trigger}$ (265 kt) in the simulation. The actual value became $HR_{pa} = 0.39$. This value is higher than $HR_{lim} = 0.35$, the reason being that the latter is derived in the absence of a $B_{trigger}$ implemented in simulations. On its own, a $HR_{pa} = 0.39$ is quite high, in particular if is going to be presented as a horizontal line on a summary plot. This is said because the value is conditional on the $B_{trigger} = 265kt$ and if applied will result in the stock going frequently below this value, resulting attenuated inter-annual variability in yield. That is, the simulation indicated that the trigger is effective at maintaining high spawning stock biomass. The simulation also showed that the median realized value of fishing mortality given the trigger was ~0.30.

9.1.9 On measure of fishing pressure

Given the push to define fishing pressure in the same units as used in the HCR one may need to consider how one should derive the harvest rate. For the Icelandic cod this is more cumbersome than normally because the advice is not for a calendar year but fishing year. It was decided to use the following metric in the summary (Table 9.16) as well as the table in the advice sheet:

$$HR_y = (1/3 * Y_y + 2/3 * Y_{y+1})/B_{4+,y}$$

where Y is the yield and the fractions represent the proportion of the catch of the fishing year taken in the different calendar year. This measure of fishing pressure is by no means the best one but reflects best the “intended” harvest rate as stipulated in the HCR.

9.1.10 Comparison with last year’s advice

This year’s advice increased from last year’s advice by a very small percentage because, although reference biomass is estimated higher than last year (Figure 9.33), the stabilizing clause on the Harvest Control Rule prevents a larger increase. The main reasons for reference biomass increasing is an update on the actual catch weights from last year’s predictions to form last year’s reference biomass level, and higher catch weight predicted for this year’s reference biomass compared with catch weights predicted to generate last year’s reference biomass (Figure 9.34). The numbers of cod estimated have changed less between years (Figure 9.35).

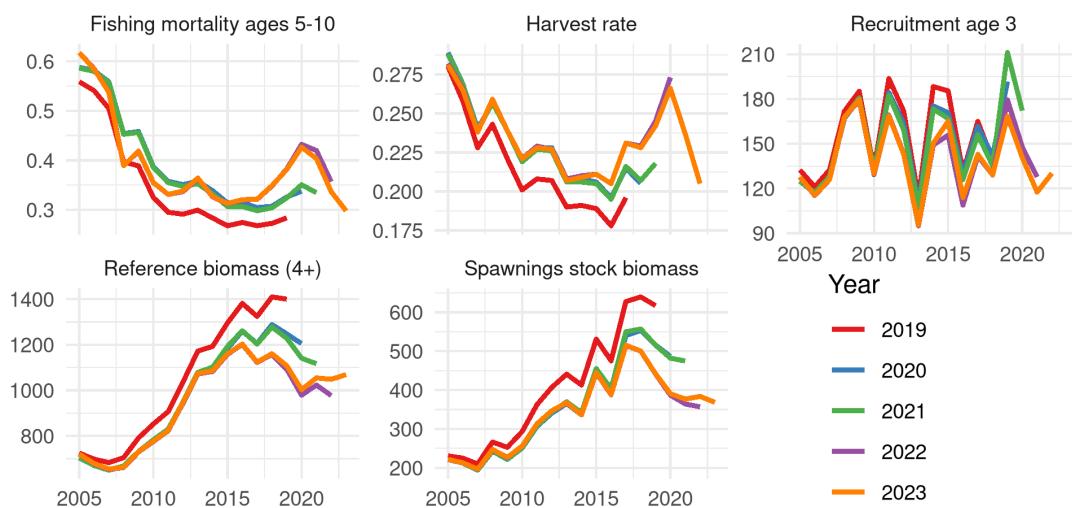


Figure 9.33. Icelandic cod Division 5.a. Historical retrospective pattern with previous year’s assessments. Note that the model was benchmarked in 2021 so only models after this point are comparable. The x-axis for the recruitment refers to the year class.

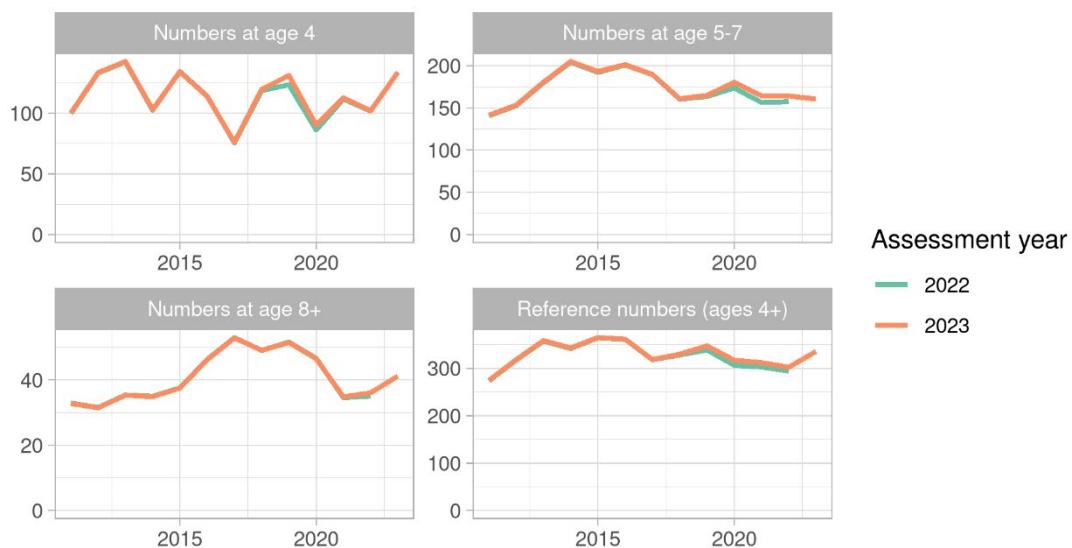


Figure 9.34. Icelandic cod Division 5.a. Historical retrospective pattern with previous year's assessments: total numbers in the reference biomass, and numbers at age 4, 5 – 7, and 8+.

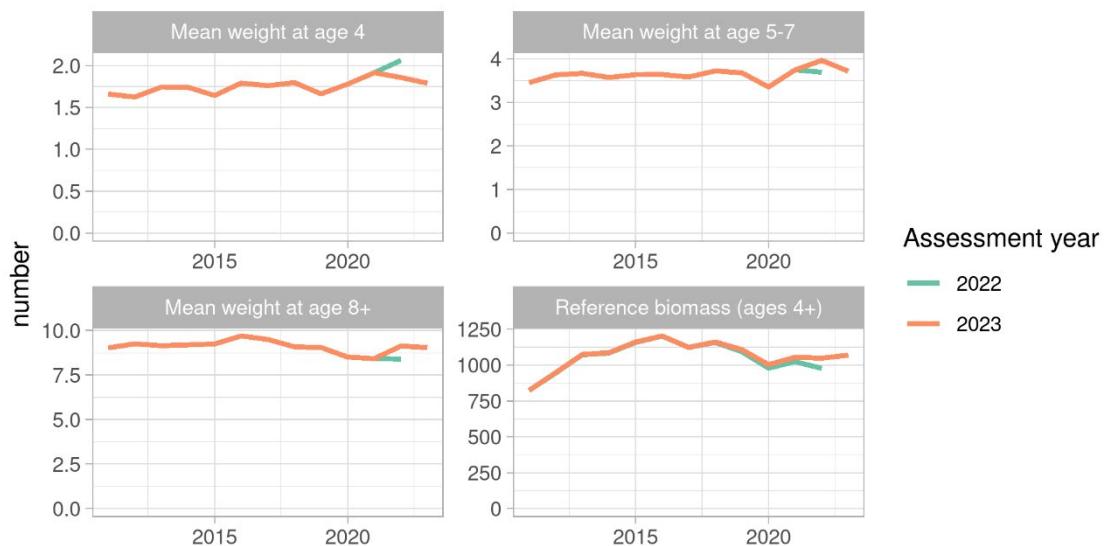


Figure 9.35. Icelandic cod Division 5.a. Comparison of reference biomass and mean catch weights for ages 4, 5 – 7, and 8+, used to determine reference biomass in the harvest control rule, from last year's and this year's assessment. The terminal year of an assessment year is a prediction made from a relationship between the previous year's stock and catch weights.

9.1.11 Management considerations

All the signs from commercial catch data and surveys indicate that cod in 5.a is at present in a good state. This is confirmed in the assessment and the recent benchmark (ICES 2021). The stock is in a high state; however, highly variable recruitment patterns in the past decade indicate that the stock size is expected to fluctuate in the future. As the harvest control rule has a built-in cap, these fluctuations will be damped in advice.

9.10 References

ICES 2021. Workshop on the re-evaluation of management plan for the Icelandic cod stock (WKICECOD). ICES Scientific Reports, 3:30. <https://doi.org/10.17895/ices.pub.7987>.

9.11 Tables

Table 9.4 Icelandic cod in Division 5.a. Estimated catch in numbers (millions) by year and age in millions of fish.

year	3	4	5	6	7	8	9	10	11	12	13	14
1955	4.790	25.164	46.566	28.287	10.541	5.224	2.467	25.182	2.101	1.202	1.668	0.665
1956	6.709	17.265	31.030	27.793	14.389	4.261	3.429	2.128	16.820	1.552	1.522	1.545
1957	13.240	21.278	17.515	24.569	17.634	12.296	3.568	2.169	1.171	6.822	0.512	1.089
1958	25.237	30.742	14.298	10.859	15.997	15.822	12.021	2.003	2.125	0.771	3.508	0.723
1959	18.394	37.650	23.901	7.682	5.883	8.791	13.003	7.683	0.914	0.990	0.218	1.287
1960	14.830	28.642	27.968	14.120	8.387	6.089	6.393	11.600	3.526	0.692	0.183	0.510
1961	16.507	21.808	19.488	15.034	7.900	6.925	3.969	3.211	6.756	1.202	0.089	0.425
1962	13.514	28.526	18.924	14.650	12.045	4.276	8.809	2.664	1.883	2.988	0.405	0.324
1963	18.507	28.466	19.664	11.314	15.682	7.704	2.724	6.508	1.657	1.030	1.372	0.246
1964	19.287	28.845	18.712	11.620	7.936	18.032	5.040	1.437	2.670	0.655	0.370	1.025
1965	21.658	29.586	24.783	11.706	9.334	6.394	11.122	1.477	0.823	0.489	0.118	0.489
1966	17.910	30.649	20.006	13.872	5.942	7.586	2.320	5.583	0.407	0.363	0.299	0.311
1967	25.945	27.941	24.322	11.320	8.751	2.595	5.490	1.392	1.998	0.109	0.030	0.106
1968	11.933	47.311	22.344	16.277	15.590	7.059	1.571	2.506	0.512	0.659	0.047	0.098
1969	11.149	23.925	45.445	17.397	12.559	14.811	1.590	0.475	0.340	0.064	0.024	0.021
1970	9.876	47.210	23.607	25.451	15.196	12.261	14.469	0.567	0.207	0.147	0.035	0.050
1971	13.060	35.856	45.577	21.135	17.340	10.924	6.001	4.210	0.237	0.069	0.038	0.020
1972	8.973	29.574	30.918	22.855	11.097	9.784	10.538	3.938	1.242	0.119	0.031	0.001
1973	36.538	25.542	27.391	17.045	12.721	3.685	4.718	5.809	1.134	0.282	0.007	0.001
1974	14.846	61.826	21.824	14.413	8.974	6.216	1.647	2.530	1.765	0.334	0.062	0.028
1975	29.301	29.489	44.138	12.088	9.628	3.691	2.051	0.752	0.891	0.416	0.060	0.046
1976	23.578	39.790	21.092	24.395	5.803	5.343	1.297	0.633	0.205	0.155	0.065	0.029
1977	2.614	42.659	32.465	12.162	13.017	2.809	1.773	0.421	0.086	0.024	0.006	0.002
1978	5.999	16.287	43.931	17.626	8.729	4.119	0.978	0.348	0.119	0.048	0.015	0.027
1979	7.186	28.427	13.772	34.443	14.130	4.426	1.432	0.350	0.168	0.043	0.024	0.004
1980	4.348	28.530	32.500	15.119	27.090	7.847	2.228	0.646	0.246	0.099	0.025	0.004
1981	2.118	13.297	39.195	23.247	12.710	26.455	4.804	1.677	0.582	0.228	0.053	0.068
1982	3.285	20.812	24.462	28.351	14.012	7.666	11.517	1.912	0.327	0.094	0.043	0.011
1983	3.554	10.910	24.305	18.944	17.382	8.381	2.054	2.733	0.514	0.215	0.064	0.037
1984	6.750	31.553	19.420	15.326	8.082	7.336	2.680	0.512	0.538	0.195	0.090	0.036
1985	6.457	24.552	35.392	18.267	8.711	4.201	2.264	1.063	0.217	0.233	0.102	0.038
1986	20.642	20.330	26.644	30.839	11.413	4.441	1.771	0.805	0.392	0.103	0.076	0.044
1987	11.002	62.130	27.192	15.127	15.695	4.159	1.463	0.592	0.253	0.142	0.046	0.058
1988	6.713	39.323	55.895	18.663	6.399	5.877	1.345	0.455	0.305	0.157	0.114	0.025
1989	2.605	27.983	50.059	31.455	6.010	1.915	0.881	0.225	0.107	0.086	0.038	0.005
1990	5.785	12.313	27.179	44.534	17.037	2.573	0.609	0.322	0.118	0.050	0.015	0.020
1991	8.554	25.131	15.491	21.514	25.038	6.364	0.903	0.243	0.125	0.063	0.011	0.012
1992	12.217	21.708	26.524	11.413	10.073	8.304	2.006	0.257	0.046	0.032	0.009	0.008

year	3	4	5	6	7	8	9	10	11	12	13	14
1993	20.500	33.078	15.195	13.281	3.583	2.785	2.707	1.181	0.180	0.034	0.011	0.013
1994	6.160	24.142	19.666	6.968	4.393	1.257	0.599	0.508	0.283	0.049	0.018	0.006
1995	10.770	9.103	16.829	13.066	4.115	1.596	0.313	0.184	0.156	0.141	0.029	0.008
1996	5.356	14.886	7.372	12.307	9.429	2.157	0.837	0.208	0.076	0.065	0.055	0.005
1997	1.722	16.442	17.298	6.711	7.379	5.958	1.147	0.493	0.126	0.028	0.037	0.021
1998	3.458	7.707	25.394	20.167	5.893	3.856	2.951	0.500	0.196	0.055	0.033	0.013
1999	2.525	19.554	15.226	24.622	12.966	2.795	1.489	0.748	0.140	0.046	0.010	0.005
2000	10.493	6.581	29.080	11.227	11.390	5.714	1.104	0.567	0.314	0.074	0.022	0.006
2001	13.553	26.000	9.111	20.213	5.850	3.760	2.028	0.508	0.199	0.137	0.013	0.031
2002	6.019	17.776	24.030	7.160	9.424	2.451	1.555	0.738	0.150	0.058	0.041	0.004
2003	5.490	16.313	22.045	16.628	4.840	4.933	1.201	0.507	0.211	0.046	0.026	0.033
2004	1.784	17.960	24.043	17.901	10.166	2.880	1.978	0.499	0.162	0.087	0.019	0.008
2005	5.271	5.302	26.183	16.922	8.543	4.890	1.292	0.790	0.216	0.096	0.037	0.005
2006	3.446	13.108	8.834	22.063	10.540	4.683	2.164	0.471	0.240	0.040	0.016	0.010
2007	2.054	11.639	15.937	8.599	9.894	5.680	2.281	1.139	0.332	0.088	0.067	0.006
2008	3.104	5.126	12.849	11.641	5.153	4.708	2.139	0.880	0.280	0.067	0.043	0.004
2009	3.458	7.926	9.626	17.895	10.503	3.888	2.295	0.742	0.315	0.089	0.022	0.012
2010	3.511	7.730	9.591	8.448	10.922	5.546	1.566	0.924	0.299	0.144	0.063	0.017
2011	4.001	7.845	10.576	10.820	6.287	6.292	2.429	0.680	0.419	0.134	0.040	0.016
2012	4.056	11.249	10.814	9.560	8.918	5.009	3.213	1.152	0.292	0.227	0.081	0.026
2013	5.778	12.224	15.347	11.414	7.594	5.792	2.571	1.832	0.653	0.209	0.146	0.036
2014	4.630	8.365	14.898	13.262	8.426	4.930	2.816	1.395	0.964	0.376	0.127	0.107
2015	5.229	13.361	10.350	13.897	9.409	5.616	2.441	1.552	0.953	0.407	0.125	0.036
2016	2.667	11.179	11.886	10.989	12.746	7.345	3.232	1.590	0.847	0.537	0.184	0.056
2017	5.174	8.033	13.630	13.590	7.632	7.459	3.904	2.005	0.761	0.517	0.251	0.143
2018	4.905	12.805	8.403	14.206	11.364	7.124	4.418	2.047	0.852	0.506	0.176	0.105
2019	2.916	8.467	13.461	9.095	8.974	7.801	4.182	3.973	2.033	0.748	0.354	0.184
2020	3.284	10.770	18.092	18.630	7.373	6.139	4.384	2.468	1.511	0.912	0.458	0.270
2021	4.071	8.397	9.783	17.340	11.149	4.337	3.344	2.217	1.589	1.180	0.593	0.352
2022	4.459	8.263	11.599	9.571	9.892	5.820	1.900	1.583	0.981	0.488	0.328	0.147

Table 9.5. Icelandic cod in Division 5.a. Estimated mean weight at age in the catch (kg). The weights for age groups 3 to 9 in the assessment year are based on predictions from the previous year's spring survey measurements. The weights in the catches are used to calculate the reference biomass (B_{4+}).

year	3	4	5	6	7	8	9	10	11	12	13	14
1955	0.827	1.307	2.157	3.617	4.638	5.657	6.635	6.168	8.746	8.829	10.086	14.584
1956	1.080	1.600	2.190	3.280	4.650	5.630	6.180	6.970	6.830	9.290	10.965	12.954
1957	1.140	1.710	2.520	3.200	4.560	5.960	7.170	7.260	8.300	8.290	10.350	13.174
1958	1.210	1.810	3.120	4.510	5.000	5.940	6.640	8.290	8.510	8.840	9.360	13.097
1959	1.110	1.950	2.930	4.520	5.520	6.170	6.610	7.130	8.510	8.670	9.980	11.276
1960	1.060	1.720	2.920	4.640	5.660	6.550	6.910	7.140	7.970	10.240	10.100	12.871

year	3	4	5	6	7	8	9	10	11	12	13	14
1961	1.020	1.670	2.700	4.330	5.530	6.310	6.930	7.310	7.500	8.510	9.840	14.550
1962	0.990	1.610	2.610	3.900	5.720	6.660	6.750	7.060	7.540	8.280	10.900	12.826
1963	1.250	1.650	2.640	3.800	5.110	6.920	7.840	7.610	8.230	9.100	9.920	11.553
1964	1.210	1.750	2.640	4.020	5.450	6.460	8.000	9.940	9.210	10.940	12.670	15.900
1965	1.020	1.530	2.570	4.090	5.410	6.400	7.120	8.600	12.310	10.460	10.190	17.220
1966	1.170	1.680	2.590	4.180	5.730	6.900	7.830	8.580	9.090	14.230	14.090	17.924
1967	1.120	1.820	2.660	4.067	5.560	7.790	7.840	8.430	9.090	10.090	14.240	16.412
1968	1.170	1.590	2.680	3.930	5.040	5.910	7.510	8.480	10.750	11.580	14.640	16.011
1969	1.100	1.810	2.480	3.770	5.040	5.860	7.000	8.350	8.720	10.080	11.430	13.144
1970	0.990	1.450	2.440	3.770	4.860	5.590	6.260	8.370	10.490	12.310	14.590	21.777
1971	1.090	1.570	2.310	2.980	4.930	5.150	5.580	6.300	8.530	11.240	14.740	17.130
1972	0.980	1.460	2.210	3.250	4.330	5.610	6.040	6.100	6.870	8.950	11.720	16.000
1973	1.030	1.420	2.470	3.600	4.900	6.110	6.670	6.750	7.430	7.950	10.170	17.000
1974	1.050	1.710	2.430	3.820	5.240	6.660	7.150	7.760	8.190	9.780	12.380	14.700
1975	1.100	1.770	2.780	3.760	5.450	6.690	7.570	8.580	8.810	9.780	10.090	11.000
1976	1.350	1.780	2.650	4.100	5.070	6.730	8.250	9.610	11.540	11.430	14.060	16.180
1977	1.259	1.911	2.856	4.069	5.777	6.636	7.685	9.730	11.703	14.394	17.456	24.116
1978	1.289	1.833	2.929	3.955	5.726	6.806	9.041	10.865	13.068	11.982	19.062	21.284
1979	1.408	1.956	2.642	3.999	5.548	6.754	8.299	9.312	13.130	13.418	13.540	20.072
1980	1.392	1.862	2.733	3.768	5.259	6.981	8.037	10.731	12.301	17.281	14.893	19.069
1981	1.180	1.651	2.260	3.293	4.483	5.821	7.739	9.422	11.374	12.784	12.514	19.069
1982	1.006	1.550	2.246	3.104	4.258	5.386	6.682	9.141	11.963	14.226	17.287	16.590
1983	1.095	1.599	2.275	3.021	4.096	5.481	7.049	8.128	11.009	13.972	15.882	18.498
1984	1.288	1.725	2.596	3.581	4.371	5.798	7.456	9.851	11.052	14.338	15.273	16.660
1985	1.407	1.971	2.576	3.650	4.976	6.372	8.207	10.320	12.197	14.683	16.175	19.050
1986	1.459	1.961	2.844	3.593	4.635	6.155	7.503	9.084	10.356	15.283	14.540	15.017
1987	1.316	1.956	2.686	3.894	4.716	6.257	7.368	9.243	10.697	10.622	15.894	12.592
1988	1.438	1.805	2.576	3.519	4.930	6.001	7.144	8.822	9.977	11.732	14.156	13.042
1989	1.186	1.813	2.590	3.915	5.210	6.892	8.035	9.831	11.986	10.003	12.611	16.045
1990	1.290	1.704	2.383	3.034	4.624	6.521	8.888	10.592	10.993	14.570	15.732	17.290
1991	1.309	1.899	2.475	3.159	3.792	5.680	7.242	9.804	9.754	14.344	14.172	20.200
1992	1.289	1.768	2.469	3.292	4.394	5.582	6.830	8.127	12.679	13.410	15.715	11.267
1993	1.392	1.887	2.772	3.762	4.930	6.054	7.450	8.641	10.901	12.517	14.742	16.874
1994	1.443	2.063	2.562	3.659	5.117	6.262	7.719	8.896	10.847	12.874	14.742	17.470
1995	1.348	1.959	2.920	3.625	5.176	6.416	7.916	10.273	11.022	11.407	13.098	15.182
1996	1.457	1.930	3.132	4.141	4.922	6.009	7.406	9.772	10.539	13.503	13.689	16.194
1997	1.484	1.877	2.878	4.028	5.402	6.386	7.344	8.537	10.797	11.533	10.428	12.788
1998	1.230	1.750	2.458	3.559	5.213	7.737	7.837	9.304	10.759	14.903	16.651	18.666
1999	1.241	1.716	2.426	3.443	4.720	6.352	8.730	9.946	11.088	12.535	14.995	15.151
2000	1.308	1.782	2.330	3.252	4.690	5.894	7.809	9.203	10.240	11.172	13.172	17.442

year	3	4	5	6	7	8	9	10	11	12	13	14
2001	1.484	2.017	2.629	3.362	4.555	6.187	7.124	8.445	9.311	9.566	10.242	9.503
2002	1.309	1.947	2.664	3.638	4.551	5.927	7.083	8.100	9.276	11.660	11.221	14.029
2003	1.350	1.866	2.459	3.391	4.380	4.756	6.141	7.138	9.580	10.260	11.479	10.720
2004	1.139	1.754	2.413	3.373	4.288	5.185	5.741	7.376	10.038	10.322	12.428	11.452
2005	1.196	1.735	2.421	3.395	4.292	5.059	6.233	6.124	7.964	10.075	12.776	13.719
2006	1.088	1.622	2.205	3.052	4.265	4.978	5.287	6.028	8.455	11.154	12.608	15.381
2007	1.063	1.595	2.179	2.791	3.861	5.159	5.871	6.405	7.182	9.506	10.406	10.532
2008	1.098	1.598	2.364	3.140	3.990	5.264	6.483	7.367	7.784	10.505	11.621	18.092
2009	1.096	1.666	2.206	3.187	4.059	5.024	6.649	8.354	9.529	11.193	11.761	14.918
2010	1.100	1.824	2.355	3.213	4.481	5.463	6.740	8.026	8.969	10.419	11.648	12.205
2011	1.109	1.660	2.512	3.443	4.404	5.783	6.526	7.828	8.806	9.662	12.941	11.649
2012	1.180	1.625	2.442	3.744	4.707	5.925	7.369	7.988	9.111	10.720	12.042	11.608
2013	1.132	1.743	2.451	3.612	4.936	6.125	7.367	8.137	9.173	10.121	10.421	12.702
2014	1.118	1.741	2.522	3.518	4.677	6.158	7.486	8.586	8.967	10.518	10.286	12.354
2015	1.196	1.643	2.663	3.599	4.643	5.919	7.589	8.600	9.686	11.208	11.328	10.392
2016	1.101	1.791	2.510	3.749	4.659	5.967	7.188	8.535	10.130	10.719	11.421	13.899
2017	1.011	1.760	2.501	3.459	4.789	5.929	7.190	8.467	9.496	11.025	11.535	12.853
2018	1.181	1.797	2.808	3.768	4.591	6.126	7.102	8.723	9.471	10.127	10.422	11.617
2019	1.155	1.662	2.480	3.773	4.783	5.504	6.604	8.095	8.842	10.596	11.687	12.003
2020	1.001	1.779	2.434	3.250	4.375	5.451	6.608	7.838	8.484	9.631	9.601	11.945
2021	1.273	1.915	3.012	3.656	4.570	5.877	6.974	7.889	8.748	9.307	9.836	10.331
2022	1.413	1.858	2.645	4.337	4.909	6.197	7.496	8.579	9.434	9.972	10.799	11.427
2023	1.372	1.789	2.674	3.605	4.869	5.846	7.254	8.579	9.434	9.972	10.799	11.427

Table 9.6. Icelandic cod in Division 5.a. Estimated survey weight (kg) at age in the spring survey (SMB).

year	1	2	3	4	5	6	7	8	9
1985	0.014	0.137	0.388	1.124	1.743	2.601	3.264	4.757	6.009
1986	0.015	0.159	0.619	1.225	2.264	3.006	4.362	5.595	7.186
1987	0.014	0.117	0.469	1.202	1.763	3.004	4.229	6.301	6.876
1988	0.011	0.122	0.496	1.082	1.977	3.119	3.622	4.482	8.046
1989	0.022	0.151	0.547	1.159	1.973	3.081	4.404	6.212	6.942
1990	0.019	0.135	0.462	1.042	1.832	2.643	3.870	5.871	7.746
1991	0.018	0.147	0.555	1.170	1.859	2.636	3.344	5.675	7.316
1992	0.024	0.134	0.500	1.017	1.863	2.619	3.766	5.101	7.355
1993	0.012	0.173	0.576	1.170	1.954	3.043	4.048	5.410	6.080
1994	0.013	0.174	0.686	1.417	2.055	3.230	4.193	6.229	8.156
1995	0.010	0.133	0.606	1.380	2.297	3.009	4.466	5.350	8.035
1996	0.011	0.155	0.551	1.352	2.084	3.322	4.044	5.257	7.460
1997	0.018	0.139	0.546	1.194	2.170	3.211	4.858	5.501	6.463
1998	0.015	0.154	0.482	1.193	2.041	3.017	4.249	5.417	6.333
1999	0.014	0.140	0.578	1.070	1.849	2.869	3.826	4.993	5.657

year	1	2	3	4	5	6	7	8	9
2000	0.016	0.124	0.486	1.195	1.817	2.771	4.068	5.345	8.472
2001	0.017	0.149	0.530	1.184	1.845	2.625	3.781	5.491	6.472
2002	0.013	0.131	0.510	1.206	1.998	2.920	3.784	5.791	6.321
2003	0.016	0.131	0.466	1.179	1.919	2.786	4.136	4.672	6.246
2004	0.021	0.142	0.480	1.073	1.896	2.791	3.413	4.866	5.069
2005	0.011	0.118	0.440	1.033	1.771	2.669	3.680	4.365	7.207
2006	0.013	0.106	0.412	0.980	1.710	2.624	4.039	4.709	5.587
2007	0.014	0.100	0.412	0.970	1.665	2.382	3.694	5.052	6.052
2008	0.011	0.121	0.376	0.943	1.811	2.612	3.586	4.919	6.301
2009	0.012	0.111	0.411	0.847	1.616	2.646	3.690	4.698	5.836
2010	0.013	0.098	0.386	1.010	1.706	2.593	4.052	4.931	6.235
2011	0.012	0.102	0.392	1.128	2.127	3.003	4.258	5.866	6.638
2012	0.012	0.143	0.467	1.144	1.936	3.210	4.281	5.812	7.897
2013	0.014	0.110	0.495	1.053	1.790	3.033	4.781	6.372	8.078
2014	0.011	0.114	0.359	1.076	1.713	2.641	3.992	6.138	8.025
2015	0.013	0.150	0.417	0.897	2.062	3.029	4.405	6.058	8.606
2016	0.010	0.119	0.478	1.007	1.583	3.164	4.000	5.510	7.192
2017	0.014	0.091	0.418	1.223	1.938	2.726	5.160	6.445	7.570
2018	0.020	0.133	0.383	0.974	2.141	3.167	3.978	6.540	7.593
2019	0.010	0.094	0.468	0.908	1.796	3.407	4.389	5.319	7.434
2020	0.012	0.137	0.398	1.159	1.741	2.941	4.752	5.846	7.305
2021	0.010	0.111	0.489	1.014	2.096	3.090	4.078	5.825	7.879
2022	0.014	0.090	0.391	1.118	1.817	3.469	4.412	5.591	7.680
2023	0.012	0.104	0.328	0.809	1.829	2.902	4.357	5.482	7.105

Table 9.7. Icelandic cod in Division 5.a. Estimated weight at age in the spawning stock (kg). These weights are used to calculate the spawning stock biomass (SSB).

year	3	4	5	6	7	8	9	10	11	12	13	14
1955	0.645	1.019	1.833	3.183	4.128	5.657	6.635	6.168	8.746	8.829	10.086	14.584
1956	0.645	1.248	1.862	2.886	4.138	5.630	6.180	6.970	6.830	9.290	10.965	12.954
1957	0.645	1.334	2.142	2.816	4.058	5.960	7.170	7.260	8.300	8.290	10.350	13.174
1958	0.645	1.412	2.652	3.969	4.450	5.940	6.640	8.290	8.510	8.840	9.360	13.097
1959	0.645	1.521	2.490	3.978	4.913	6.170	6.610	7.130	8.510	8.670	9.980	11.276
1960	0.645	1.342	2.482	4.083	5.037	6.550	6.910	7.140	7.970	10.240	10.100	12.871
1961	0.645	1.303	2.295	3.810	4.922	6.310	6.930	7.310	0.750	8.510	9.840	14.550
1962	0.645	1.256	2.218	3.432	5.091	6.660	6.750	7.060	7.540	8.280	10.900	12.826
1963	0.645	1.287	2.244	3.344	4.548	6.920	7.840	7.610	8.230	9.100	9.920	11.553
1964	0.645	1.365	2.244	3.538	4.850	6.460	8.000	9.940	9.210	10.940	12.670	15.900
1965	0.645	1.193	2.184	3.599	4.815	6.400	7.120	8.600	12.310	10.460	10.190	17.220
1966	0.645	1.310	2.202	3.678	5.100	6.900	7.830	8.580	9.090	14.230	14.090	17.924
1967	0.645	1.420	2.261	3.579	4.948	7.790	7.840	8.430	9.090	10.090	14.240	16.412

year	3	4	5	6	7	8	9	10	11	12	13	14
1968	0.645	1.240	2.278	3.458	4.486	5.910	7.510	8.480	10.750	11.580	14.640	16.011
1969	0.645	1.412	2.108	3.318	4.486	5.860	7.000	8.350	8.720	10.080	11.430	13.144
1970	0.645	1.131	2.074	3.318	4.325	5.590	6.260	8.370	10.490	12.310	14.590	21.777
1971	0.645	1.225	1.964	2.622	4.388	5.150	5.580	6.300	8.530	11.240	14.740	17.130
1972	0.645	1.139	1.878	2.860	3.854	5.610	6.040	6.100	6.870	8.950	11.720	16.000
1973	0.645	1.108	2.100	3.168	4.361	6.110	6.670	6.750	7.430	7.950	10.170	17.000
1974	0.645	1.334	2.066	3.362	4.664	6.660	7.150	7.760	8.190	9.780	12.380	14.700
1975	0.645	1.381	2.363	3.309	4.850	6.690	7.570	8.580	8.810	9.780	10.090	11.000
1976	0.645	1.388	2.252	3.608	4.512	6.730	8.250	9.610	11.540	11.430	14.060	16.180
1977	0.645	1.491	2.428	3.581	5.142	6.636	7.685	9.730	11.703	14.394	17.456	24.116
1978	0.645	1.430	2.490	3.480	5.096	6.806	9.041	10.865	13.068	11.982	19.062	21.284
1979	0.645	1.526	2.246	3.519	4.938	6.754	8.299	9.312	13.130	13.418	13.540	20.072
1980	0.645	1.452	2.323	3.316	4.681	6.981	8.037	10.731	12.301	17.281	14.893	19.069
1981	0.645	1.288	1.921	2.898	3.990	5.821	7.739	9.422	11.374	12.784	12.514	19.069
1982	0.645	1.209	1.909	2.732	3.790	5.386	6.682	9.141	11.963	14.226	17.287	16.590
1983	0.645	1.247	1.934	2.658	3.645	5.481	7.049	8.128	11.009	13.972	15.882	18.498
1984	0.645	1.346	2.207	3.151	3.890	5.798	7.456	9.851	11.052	14.338	15.273	16.660
1985	1.312	1.399	1.766	2.738	3.483	4.762	7.301	10.320	12.197	14.683	16.175	19.050
1986	1.312	1.612	2.915	3.279	4.591	5.803	7.199	9.084	10.356	15.283	14.540	15.017
1987	1.718	1.598	2.439	3.532	4.886	6.408	7.499	9.243	10.697	10.622	15.894	12.592
1988	0.931	1.486	2.281	3.287	4.423	4.678	8.147	8.822	9.977	11.732	14.156	13.042
1989	0.823	1.526	2.364	3.426	4.702	7.273	8.436	9.831	11.986	10.003	12.611	16.045
1990	0.733	1.044	2.199	2.841	4.367	6.177	8.919	10.592	10.993	14.570	15.732	17.290
1991	0.114	1.288	2.069	2.799	3.477	6.007	8.823	9.804	9.754	14.344	14.172	20.200
1992	0.449	1.349	2.117	3.086	3.861	5.196	7.429	8.127	12.679	13.410	15.715	11.267
1993	0.773	1.374	2.316	3.276	4.179	5.729	6.441	8.641	10.901	12.517	14.742	16.874
1994	1.618	1.733	2.259	3.384	4.563	6.471	9.803	8.896	10.847	12.874	14.742	17.470
1995	0.514	1.639	2.353	3.197	4.493	5.544	8.579	10.273	11.022	11.407	13.098	15.182
1996	0.542	1.756	2.490	3.530	4.251	5.621	8.263	9.772	10.539	13.503	13.689	16.194
1997	1.111	1.346	2.267	3.723	5.415	5.963	6.964	8.537	10.797	11.533	10.428	12.788
1998	1.111	1.605	2.262	3.262	4.461	5.759	6.793	9.304	10.759	14.903	16.651	18.666
1999	1.311	1.471	1.936	2.999	3.968	5.132	6.522	9.946	11.088	12.535	14.995	15.151
2000	0.497	1.355	1.916	2.881	4.318	5.573	8.464	9.203	10.240	11.172	13.172	17.442
2001	0.816	1.583	2.080	2.676	4.112	6.236	6.926	8.445	9.311	9.566	10.242	9.503
2002	0.782	1.591	2.260	3.120	3.991	5.991	9.225	8.100	9.276	11.660	11.221	14.029
2003	1.150	1.326	2.241	3.049	4.226	5.051	6.823	7.138	9.580	10.260	11.479	10.720
2004	1.150	1.456	2.095	3.011	3.678	5.192	5.400	7.376	10.038	10.322	12.428	11.452
2005	0.648	1.123	1.908	2.979	3.901	4.789	7.238	6.124	7.964	10.075	12.776	13.719
2006	0.907	1.407	2.016	2.913	4.351	5.057	6.472	6.028	8.455	11.154	12.608	15.381
2007	1.439	1.261	2.023	2.640	4.116	5.697	6.632	6.405	7.182	9.506	10.406	10.532

year	3	4	5	6	7	8	9	10	11	12	13	14
2008	0.912	1.845	2.232	2.911	3.897	5.400	6.927	7.367	7.784	10.505	11.621	18.092
2009	0.644	1.465	2.041	2.887	3.943	4.923	7.044	8.354	9.529	11.193	11.761	14.918
2010	0.644	1.590	2.154	3.149	4.207	5.207	6.460	8.024	8.968	10.419	11.647	12.208
2011	0.794	2.467	2.666	3.216	4.546	5.989	6.851	7.828	8.805	9.662	12.941	11.649
2012	1.404	1.702	2.606	3.717	4.516	6.016	8.038	7.988	9.111	10.720	12.042	11.608
2013	0.944	2.323	2.991	3.834	5.207	6.532	8.260	8.137	9.173	10.121	10.421	12.702
2014	0.944	1.332	2.549	3.316	4.459	6.390	8.178	8.586	8.967	10.518	10.286	12.354
2015	0.704	1.043	3.320	3.836	4.895	6.218	8.677	8.600	9.687	11.205	11.330	10.360
2016	0.972	2.247	3.042	4.213	4.614	6.000	7.351	8.486	10.111	10.701	11.362	13.899
2017	1.773	2.582	3.513	3.936	5.698	6.716	7.636	8.486	9.509	11.095	11.575	12.800
2018	1.029	2.372	3.230	3.862	4.574	6.671	7.711	8.699	9.445	10.072	10.269	11.638
2019	0.599	3.044	3.260	4.221	4.700	5.498	7.481	8.095	8.842	10.596	11.687	12.003
2020	0.874	1.697	3.150	3.941	5.140	5.998	7.342	7.838	8.484	9.631	9.601	11.945
2021	0.449	1.349	2.943	3.818	4.523	6.061	7.879	7.889	8.748	9.307	9.836	10.331
2022	0.965	1.622	2.531	4.285	4.589	5.779	7.752	8.579	9.434	9.972	10.799	11.427
2023	0.168	1.242	2.895	3.524	4.735	5.542	7.171	8.579	9.434	9.972	10.799	11.427

Table 9.8. Icelandic cod in Division 5.a. Estimated maturity at age.

year	3	4	5	6	7	8	9	10	11	12	13	14
1955	0.019	0.022	0.033	0.181	0.577	0.782	0.834	0.960	1.000	1.000	1.000	1.000
1956	0.019	0.025	0.033	0.111	0.577	0.782	0.818	0.980	0.980	1.000	1.000	1.000
1957	0.019	0.026	0.043	0.100	0.549	0.801	0.842	0.990	1.000	1.000	1.000	1.000
1958	0.019	0.028	0.086	0.520	0.682	0.801	0.834	1.000	1.000	1.000	1.000	1.000
1959	0.019	0.029	0.070	0.535	0.772	0.818	0.834	0.990	1.000	1.000	1.000	1.000
1960	0.019	0.026	0.066	0.577	0.782	0.826	0.834	0.990	1.000	1.000	1.000	1.000
1961	0.019	0.025	0.053	0.450	0.772	0.818	0.834	0.990	0.990	1.000	1.000	1.000
1962	0.019	0.025	0.048	0.281	0.791	0.834	0.834	0.990	0.990	1.000	1.000	1.000
1963	0.019	0.025	0.048	0.237	0.706	0.834	0.849	1.000	1.000	1.000	1.000	1.000
1964	0.019	0.026	0.048	0.329	0.762	0.826	0.849	1.000	1.000	1.000	1.000	1.000
1965	0.019	0.025	0.045	0.354	0.751	0.826	0.842	1.000	1.000	1.000	1.000	1.000
1966	0.019	0.026	0.045	0.394	0.791	0.849	0.849	1.000	1.000	1.000	1.000	1.000
1967	0.019	0.028	0.051	0.341	0.772	0.842	0.849	1.000	1.000	1.000	1.000	1.000
1968	0.019	0.025	0.051	0.292	0.682	0.801	0.842	1.000	1.000	1.000	1.000	1.000
1969	0.019	0.028	0.043	0.227	0.682	0.801	0.842	1.000	1.000	1.000	1.000	1.000
1970	0.019	0.023	0.041	0.227	0.644	0.772	0.818	1.000	1.000	1.000	1.000	1.000
1971	0.019	0.025	0.037	0.074	0.657	0.706	0.772	0.979	0.994	0.982	0.993	1.000
1972	0.019	0.023	0.035	0.106	0.450	0.772	0.809	0.979	0.994	0.982	0.993	1.000
1973	0.022	0.028	0.163	0.382	0.697	0.801	0.834	0.996	0.996	1.000	1.000	1.000
1974	0.020	0.031	0.085	0.346	0.636	0.790	0.818	0.989	1.000	1.000	1.000	1.000
1975	0.020	0.035	0.118	0.287	0.715	0.809	0.839	1.000	1.000	1.000	1.000	1.000
1976	0.025	0.026	0.086	0.253	0.406	0.797	0.841	1.000	1.000	1.000	1.000	1.000

year	3	4	5	6	7	8	9	10	11	12	13	14
1977	0.019	0.024	0.060	0.382	0.742	0.817	0.842	1.000	1.000	1.000	1.000	1.000
1978	0.025	0.025	0.052	0.192	0.737	0.820	0.836	1.000	1.000	1.000	1.000	1.000
1979	0.019	0.021	0.053	0.282	0.635	0.790	0.836	0.919	1.000	1.000	1.000	1.000
1980	0.026	0.021	0.047	0.225	0.653	0.777	0.834	0.977	1.000	0.964	1.000	1.000
1981	0.019	0.022	0.030	0.090	0.448	0.751	0.811	0.962	0.988	1.000	1.000	1.000
1982	0.021	0.025	0.038	0.065	0.297	0.705	0.815	0.967	1.000	1.000	1.000	1.000
1983	0.019	0.030	0.047	0.116	0.264	0.530	0.715	0.979	0.985	1.000	1.000	1.000
1984	0.019	0.024	0.053	0.169	0.444	0.620	0.716	0.949	0.969	0.948	1.000	1.000
1985	0.000	0.021	0.186	0.414	0.495	0.730	0.580	0.746	1.000	1.000	1.000	1.000
1986	0.001	0.023	0.154	0.398	0.681	0.727	0.936	0.667	1.000	1.000	1.000	1.000
1987	0.001	0.033	0.094	0.359	0.487	0.879	0.777	0.805	1.000	1.000	1.000	1.000
1988	0.006	0.029	0.220	0.498	0.446	0.677	0.932	0.890	1.000	1.000	1.000	1.000
1989	0.008	0.026	0.141	0.363	0.621	0.639	0.619	1.000	1.000	1.000	1.000	1.000
1990	0.006	0.012	0.154	0.428	0.576	0.781	0.774	0.714	1.000	1.000	1.000	1.000
1991	0.000	0.055	0.149	0.368	0.629	0.787	0.654	0.901	1.000	1.000	1.000	1.000
1992	0.002	0.062	0.265	0.407	0.813	0.916	0.880	1.000	1.000	1.000	1.000	1.000
1993	0.006	0.085	0.267	0.462	0.684	0.795	0.843	0.834	1.000	1.000	1.000	1.000
1994	0.008	0.109	0.338	0.590	0.706	0.921	0.694	0.830	1.000	1.000	1.000	1.000
1995	0.005	0.109	0.383	0.527	0.747	0.790	0.859	1.000	1.000	1.000	1.000	1.000
1996	0.002	0.032	0.186	0.501	0.653	0.733	0.810	0.774	1.000	1.000	1.000	1.000
1997	0.006	0.037	0.247	0.427	0.686	0.786	0.804	0.539	1.000	1.000	1.000	1.000
1998	0.000	0.061	0.208	0.486	0.782	0.807	0.809	0.852	1.000	1.000	1.000	1.000
1999	0.012	0.044	0.239	0.517	0.650	0.836	0.691	0.974	1.000	1.000	1.000	1.000
2000	0.001	0.065	0.248	0.512	0.611	0.867	0.998	0.999	1.000	1.000	1.000	1.000
2001	0.003	0.046	0.286	0.599	0.761	0.766	0.883	1.000	1.000	1.000	1.000	1.000
2002	0.006	0.086	0.321	0.656	0.759	0.920	0.559	0.724	1.000	1.000	1.000	1.000
2003	0.005	0.048	0.222	0.532	0.873	0.798	0.879	0.833	1.000	1.000	1.000	1.000
2004	0.000	0.040	0.249	0.549	0.631	0.833	0.807	0.854	1.000	1.000	1.000	1.000
2005	0.003	0.108	0.281	0.494	0.795	0.808	0.949	0.904	1.000	1.000	1.000	1.000
2006	0.002	0.023	0.298	0.446	0.749	0.874	0.739	0.741	1.000	1.000	1.000	1.000
2007	0.012	0.031	0.156	0.504	0.696	0.797	0.836	0.926	1.000	1.000	1.000	1.000
2008	0.001	0.042	0.275	0.546	0.728	0.833	0.850	0.958	1.000	1.000	1.000	1.000
2009	0.002	0.015	0.134	0.451	0.684	0.884	0.752	0.631	1.000	1.000	1.000	1.000
2010	0.000	0.015	0.057	0.380	0.821	0.868	0.927	0.813	1.000	1.000	1.000	1.000
2011	0.002	0.012	0.136	0.427	0.732	0.923	0.941	0.961	1.000	1.000	1.000	1.000
2012	0.004	0.031	0.127	0.414	0.730	0.884	0.963	0.850	1.000	1.000	1.000	1.000
2013	0.003	0.008	0.062	0.344	0.738	0.922	0.965	1.000	1.000	1.000	1.000	1.000
2014	0.000	0.026	0.069	0.238	0.615	0.893	0.967	0.956	1.000	1.000	1.000	1.000
2015	0.003	0.007	0.110	0.353	0.636	0.907	0.978	0.988	1.000	1.000	1.000	1.000
2016	0.001	0.009	0.025	0.289	0.543	0.731	0.941	0.986	1.000	1.000	1.000	1.000

year	3	4	5	6	7	8	9	10	11	12	13	14
2017	0.005	0.008	0.089	0.262	0.765	0.906	0.979	0.987	1.000	1.000	1.000	1.000
2018	0.002	0.013	0.147	0.434	0.605	0.935	0.953	1.000	1.000	1.000	1.000	1.000
2019	0.004	0.004	0.062	0.452	0.707	0.898	0.987	0.993	1.000	1.000	1.000	1.000
2020	0.001	0.037	0.065	0.298	0.763	0.878	0.976	1.000	1.000	1.000	1.000	1.000
2021	0.002	0.005	0.111	0.432	0.612	0.873	1.000	0.985	1.000	1.000	1.000	1.000
2022	0.000	0.007	0.055	0.425	0.776	0.868	0.975	1.000	1.000	1.000	1.000	1.000
2023	0.000	0.006	0.081	0.312	0.734	0.934	0.955	1.000	1.000	1.000	1.000	1.000

Table 9.9. Icelandic cod in Division 5.a. Survey indices of the spring bottom trawl survey (SMB).

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1985	17.19	111.14	35.40	48.28	64.88	23.24	15.48	5.23	3.59	1.96	0.32	0.33	0.09	0.08
1986	15.61	61.09	96.44	22.58	21.75	27.74	7.37	2.86	0.97	0.86	0.32	0.08	0.06	0.04
1987	3.66	28.17	104.43	82.68	21.47	12.84	13.02	2.81	0.99	0.42	0.45	0.23	0.13	0.13
1988	3.45	7.08	73.13	103.75	69.61	8.50	6.59	7.33	0.71	0.29	0.13	0.27	0.06	0.05
1989	4.02	16.39	21.27	75.09	71.48	38.47	4.83	1.71	1.42	0.27	0.19	0.06	0.01	0.01
1990	5.47	11.74	26.44	14.30	27.98	35.30	16.80	1.76	0.58	0.48	0.13	NA	0.04	0.04
1991	3.95	15.97	18.11	30.13	15.44	18.90	22.46	4.93	0.94	0.31	0.22	NA	0.08	0.08
1992	0.71	16.97	33.52	18.79	16.45	6.80	6.33	5.75	1.48	0.23	0.04	0.04	0.04	NA
1993	3.55	4.66	30.75	36.68	13.49	10.59	2.42	2.02	1.39	0.41	0.13	0.03	0.03	0.01
1994	14.23	14.72	9.02	26.93	22.46	6.08	3.95	0.79	0.53	0.50	0.18	0.02	0.03	0.01
1995	1.08	29.27	24.78	9.07	24.56	18.47	4.04	1.92	0.39	0.20	0.24	0.14	0.03	NA
1996	3.71	5.42	42.51	29.69	13.26	15.43	15.22	4.21	1.16	0.21	0.07	0.22	0.10	0.05
1997	1.20	22.39	13.61	56.71	29.74	9.98	9.46	7.30	0.62	0.25	0.19	0.04	0.15	0.10
1998	8.04	5.46	30.11	16.08	63.24	29.99	7.01	5.78	3.33	0.76	0.20	NA	0.02	NA
1999	7.38	33.16	6.99	42.29	13.27	24.77	12.00	2.61	1.47	0.83	0.19	0.07	NA	NA
2000	18.79	27.70	55.16	7.01	30.86	8.71	8.85	4.60	0.56	0.35	0.08	0.03	0.04	0.01
2001	12.24	23.59	36.46	38.18	5.07	15.70	3.53	2.15	0.90	0.34	0.12	0.09	0.05	0.02
2002	0.96	38.56	41.31	40.60	37.26	7.47	8.99	1.66	0.81	0.35	0.07	0.01	NA	NA
2003	11.16	4.20	46.55	36.91	29.22	17.76	4.13	4.79	1.13	0.23	0.13	0.01	0.09	NA
2004	7.34	27.62	8.24	66.84	41.29	30.95	17.60	3.27	3.56	0.57	0.32	0.01	NA	0.01
2005	2.69	17.79	41.72	9.95	46.31	24.99	12.10	6.45	1.01	1.03	0.27	0.24	0.03	NA
2006	9.09	7.43	25.05	40.53	11.74	31.64	11.66	4.11	1.62	0.28	0.16	0.02	NA	NA
2007	5.65	19.04	9.07	22.77	29.88	10.06	11.37	6.10	2.44	0.86	0.30	0.13	0.01	NA
2008	6.75	12.41	23.00	9.84	22.36	22.94	9.44	8.00	3.03	0.77	0.44	0.09	0.05	NA
2009	22.14	12.75	16.46	22.41	15.49	25.86	16.60	4.81	3.15	1.16	0.28	0.11	0.07	0.03
2010	18.62	21.51	18.89	18.10	24.64	14.14	18.35	9.87	3.24	1.93	0.58	0.26	0.05	0.02
2011	3.55	22.96	27.54	20.10	23.07	26.66	14.70	13.37	5.02	1.01	1.01	0.21	0.07	0.02
2012	20.36	11.03	39.37	56.70	41.89	31.20	28.41	10.88	7.06	3.21	0.97	0.48	0.36	0.13
2013	10.89	33.70	18.22	44.39	47.10	25.89	17.15	14.44	7.19	3.47	1.68	0.71	0.16	0.25
2014	3.29	24.25	39.05	23.75	47.55	38.29	17.83	8.45	4.37	2.24	0.84	0.52	0.12	0.12

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2015	21.06	10.98	28.05	42.24	21.22	41.98	29.41	17.09	5.13	3.18	1.48	0.60	0.17	0.10
2016	31.71	31.65	15.21	37.62	54.80	28.19	38.46	19.05	7.00	2.33	1.24	0.85	0.26	0.12
2017	3.83	25.03	33.76	18.16	36.43	40.35	23.63	22.55	11.86	5.15	2.09	0.88	0.54	0.09
2018	11.48	14.52	29.97	36.89	16.12	28.83	26.68	15.33	7.85	3.72	1.24	0.59	0.25	0.10
2019	7.99	22.09	14.63	30.72	31.46	14.13	20.34	17.31	9.43	5.98	2.56	0.95	0.38	0.04
2020	29.47	13.38	19.48	10.74	17.49	15.85	7.85	9.74	6.91	4.48	3.27	2.02	0.51	0.03
2021	19.13	40.24	26.89	34.19	18.07	33.55	21.40	6.79	6.01	5.30	3.19	2.48	1.17	0.38
2022	6.89	17.99	45.48	35.66	40.19	16.82	30.18	10.48	2.92	2.45	1.68	1.16	0.56	0.06
2023	7.49	10.32	24.76	41.81	27.65	27.33	18.58	30.85	7.07	2.02	1.28	1.10	0.66	0.43

Table 9.10. Icelandic cod in Division 5.a. Survey indices of the fall bottom trawl survey (SMH).

year	3	4	5	6	7	8	9	10	11	12	13
1996	19.59	14.19	5.57	7.70	6.49	1.65	0.31	0.08	0.02	0.05	0.01
1997	6.65	29.25	16.34	5.40	3.74	2.13	0.31	0.14	0.01	0.03	0.04
1998	15.34	7.29	16.10	16.16	5.24	2.25	1.27	0.20	0.05	0.02	0.01
1999	5.58	23.16	7.43	10.03	4.07	0.62	0.35	0.37	0.04	NA	0.06
2000	15.24	3.76	11.57	3.65	2.71	1.14	0.34	0.28	0.11	0.02	0.01
2001	19.32	21.27	3.40	6.93	1.65	0.79	0.18	0.03	0.10	0.02	NA
2002	15.84	23.39	16.21	5.54	4.87	1.13	0.63	0.08	0.17	0.02	0.04
2003	26.05	17.31	13.47	9.11	1.92	2.59	0.37	0.10	0.09	0.02	0.02
2004	6.91	30.29	19.38	12.07	7.60	1.92	1.68	0.23	0.11	0.07	NA
2005	19.96	6.77	26.10	11.30	4.01	1.96	0.31	0.32	0.03	0.06	0.02
2006	15.88	22.85	7.78	14.45	6.31	2.12	1.05	0.17	0.11	NA	0.01
2007	4.90	12.10	16.26	6.53	6.10	3.21	0.80	0.53	0.04	0.08	NA
2008	15.08	8.06	17.96	18.82	5.90	5.59	1.41	0.74	0.28	0.09	0.02
2009	13.73	17.71	12.76	16.89	10.57	3.29	2.76	0.92	0.30	0.16	0.01
2010	16.44	15.97	18.08	9.89	11.31	6.76	2.26	1.24	0.55	0.07	0.11
2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2012	24.85	21.58	12.81	11.13	9.59	5.41	3.25	1.43	0.55	0.16	0.11
2013	14.07	26.05	21.29	12.62	7.88	6.02	3.06	1.87	0.99	0.46	0.21
2014	30.52	15.92	24.26	19.85	8.46	5.72	3.68	2.11	1.38	0.69	0.31
2015	34.96	43.59	18.98	27.61	16.14	5.39	3.10	1.10	0.58	0.47	0.19
2016	8.66	17.91	22.24	11.00	11.96	6.71	2.67	1.53	0.76	0.46	0.17
2017	32.34	16.86	31.31	31.99	12.13	9.74	4.37	1.53	0.97	0.46	0.35
2018	21.84	21.00	8.40	13.43	12.87	7.42	4.99	2.31	0.85	0.40	0.14
2019	19.38	26.60	18.01	9.07	8.66	5.30	2.47	1.68	0.74	0.26	0.16
2020	15.00	8.78	12.79	11.51	4.01	4.04	2.34	1.49	0.90	0.36	0.17
2021	10.07	12.02	6.31	10.33	5.62	1.69	2.17	1.20	0.54	0.38	0.25
2022	20.08	13.90	15.31	11.70	11.60	5.10	1.80	1.37	0.76	0.35	0.29

Table 9.11. Icelandic cod in Division 5.a. Catch at age residuals from the assessment tuned with the spring (SMB) and the fall (SMH) surveys.

year	3	4	5	6	7	8	9	10	11	12	13	14
1955	-0.49	-0.21	0.18	0.23	0.28	-0.09	-0.14	-0.09	-0.13	-0.25	-0.15	-0.01
1956	-0.14	0.01	0.10	0.07	-0.17	-0.21	-0.03	0.10	0.11	0.23	0.37	0.29
1957	0.28	0.16	0.03	0.17	-0.21	-0.06	-0.02	-0.09	0.04	-0.06	-0.06	0.47
1958	0.52	0.31	-0.20	-0.12	-0.06	-0.02	-0.06	-0.13	0.32	0.21	-0.03	0.37
1959	0.00	0.35	0.32	-0.24	-0.27	-0.11	-0.02	0.14	-0.08	0.38	0.03	-0.06
1960	0.35	-0.36	0.09	0.13	0.03	0.04	0.00	-0.13	-0.03	0.18	-0.07	0.46
1961	0.28	0.10	-0.54	-0.02	-0.06	0.30	0.21	-0.06	0.09	-0.09	-0.16	0.43
1962	0.51	0.12	0.09	-0.39	0.06	-0.24	0.01	0.30	0.06	0.15	-0.20	0.32
1963	0.38	0.44	-0.22	-0.09	-0.12	-0.07	-0.23	0.13	0.34	0.17	0.08	-0.06
1964	0.18	0.04	0.09	-0.36	-0.18	0.37	0.01	-0.30	-0.04	0.22	0.03	0.36
1965	0.12	-0.12	0.03	0.08	-0.24	0.05	0.48	-0.44	-0.08	-0.39	-0.06	0.40
1966	-0.05	-0.11	-0.21	0.07	-0.09	0.15	-0.14	0.55	-0.48	0.10	-0.04	0.37
1967	0.07	-0.21	-0.08	-0.20	0.06	-0.29	0.50	0.04	0.38	-0.27	-0.11	-0.02
1968	-0.22	-0.14	-0.37	-0.11	0.35	0.20	-0.24	0.24	-0.11	0.15	-0.13	0.08
1969	-0.41	0.00	0.22	0.09	0.22	-0.07	-0.29	-0.32	-0.25	-0.15	-0.17	-0.03
1970	-0.44	0.14	-0.02	-0.05	0.14	-0.06	0.34	-0.53	-0.25	-0.13	-0.06	-0.02
1971	-0.41	0.02	0.19	0.27	-0.13	0.23	-0.15	-0.21	-0.34	-0.11	-0.08	-0.02
1972	-0.46	-0.22	0.16	0.13	0.15	-0.03	-0.11	0.25	-0.25	-0.07	-0.03	-0.04
1973	0.19	-0.10	-0.05	0.16	0.03	-0.27	0.04	0.12	0.07	-0.20	-0.06	-0.02
1974	-0.32	0.09	0.03	-0.06	0.04	0.00	-0.18	0.25	0.05	0.08	-0.10	0.02
1975	0.02	-0.24	0.08	0.11	0.10	-0.10	-0.15	-0.04	0.24	0.02	-0.01	0.01
1976	0.41	0.12	-0.10	0.06	-0.15	0.14	-0.17	-0.15	0.04	0.07	-0.03	0.02
1977	-0.55	-0.06	0.04	-0.16	0.20	0.08	0.21	-0.07	-0.21	-0.07	-0.05	-0.05
1978	-0.03	0.10	0.04	-0.15	0.15	-0.09	0.08	-0.12	-0.06	-0.09	-0.02	0.03
1979	0.13	0.25	-0.16	0.01	0.06	0.08	-0.25	-0.03	-0.02	-0.07	-0.04	-0.02
1980	0.06	0.11	0.14	-0.01	-0.01	-0.06	0.07	-0.25	0.09	-0.02	-0.03	-0.04
1981	-0.77	-0.33	0.07	-0.20	0.05	0.17	0.08	0.30	0.08	0.14	-0.02	0.06
1982	-0.50	-0.04	0.07	-0.08	-0.26	0.18	0.22	0.03	-0.10	-0.23	-0.02	-0.04
1983	-0.85	-0.56	0.12	0.19	0.09	0.09	0.00	-0.08	-0.05	0.06	-0.07	0.03
1984	0.26	0.05	-0.01	0.01	-0.04	0.06	0.02	-0.18	-0.36	-0.08	0.03	-0.01
1985	0.12	0.18	-0.02	0.10	-0.10	-0.03	-0.19	-0.01	-0.08	-0.32	-0.03	0.01
1986	0.31	-0.16	0.05	0.01	0.10	-0.07	0.03	-0.21	-0.02	-0.05	-0.22	-0.02
1987	-0.17	0.13	0.09	-0.13	0.03	0.04	0.01	0.06	-0.08	-0.03	-0.01	-0.04
1988	-0.30	-0.15	0.04	0.14	-0.21	0.07	0.13	0.05	0.18	0.04	0.08	0.01
1989	-0.41	0.04	0.27	0.06	-0.06	-0.21	-0.24	-0.05	0.02	0.06	0.00	-0.02
1990	-0.01	-0.20	-0.04	0.12	0.09	-0.03	-0.16	-0.11	0.05	0.02	0.00	0.01
1991	0.33	0.05	-0.14	-0.03	0.09	-0.09	-0.03	-0.06	-0.03	0.04	-0.01	0.01
1992	0.20	-0.03	0.06	-0.06	-0.06	-0.01	0.00	-0.02	-0.07	-0.05	-0.01	0.00
1993	1.00	0.00	-0.29	-0.09	-0.29	-0.15	0.26	0.56	0.20	0.01	-0.01	0.02

year	3	4	5	6	7	8	9	10	11	12	13	14
1994	0.61	0.33	-0.14	-0.27	-0.08	0.01	-0.04	0.16	0.39	0.09	0.03	0.01
1995	0.81	0.21	0.12	-0.08	-0.09	-0.13	-0.17	-0.10	0.01	0.26	0.07	0.02
1996	0.10	0.16	-0.32	0.00	0.07	-0.02	0.02	0.09	-0.03	0.03	0.13	0.01
1997	-0.46	0.14	-0.09	-0.30	-0.09	0.24	0.07	0.19	0.15	-0.02	0.05	0.05
1998	-0.50	-0.25	0.03	0.06	-0.13	-0.19	0.17	0.00	0.07	0.07	0.05	0.01
1999	-0.25	0.01	-0.05	0.10	0.04	-0.17	-0.29	-0.18	-0.08	-0.02	0.00	0.00
2000	0.36	-0.34	0.09	-0.07	-0.04	0.13	-0.06	-0.10	0.05	0.05	0.01	0.01
2001	0.76	0.33	-0.25	0.09	-0.01	-0.15	0.17	0.19	0.03	0.13	0.00	0.06
2002	0.12	0.20	0.10	-0.09	0.06	0.09	0.05	0.27	0.11	0.03	0.06	0.00
2003	-0.05	0.09	0.07	-0.07	0.02	0.15	0.18	-0.06	0.06	0.03	0.02	0.07
2004	-0.48	0.02	0.06	-0.01	-0.12	0.15	0.02	0.13	-0.10	0.05	0.02	0.00
2005	0.03	-0.45	0.08	-0.06	-0.20	-0.07	0.20	0.07	0.16	0.06	0.04	0.00
2006	-0.18	-0.05	-0.28	0.14	-0.01	-0.03	-0.02	0.13	-0.02	-0.02	-0.03	0.01
2007	-0.31	0.04	-0.16	-0.08	-0.14	0.12	0.08	0.22	0.38	0.00	0.15	-0.01
2008	-0.21	-0.33	0.06	-0.11	0.07	-0.05	0.15	0.19	0.05	0.07	0.05	-0.01
2009	-0.09	-0.23	-0.02	0.19	0.06	0.16	-0.13	-0.24	-0.07	-0.18	0.00	-0.01
2010	0.00	-0.01	-0.12	-0.02	0.19	0.03	0.10	-0.21	-0.21	-0.09	0.00	0.03
2011	-0.08	-0.02	0.12	0.00	0.04	0.11	-0.09	-0.05	-0.22	-0.27	-0.14	-0.04
2012	-0.15	0.03	0.02	-0.07	0.07	0.17	0.03	-0.25	-0.16	-0.27	-0.12	-0.05
2013	0.41	-0.02	0.02	-0.05	-0.07	-0.03	0.07	-0.02	-0.20	-0.10	-0.10	-0.08
2014	0.06	0.03	0.03	-0.08	0.04	0.00	-0.01	0.12	0.08	-0.16	0.03	0.05
2015	0.37	0.27	0.02	-0.08	-0.11	0.05	-0.06	-0.02	0.31	-0.18	-0.23	-0.05
2016	0.09	0.23	-0.13	-0.02	0.08	-0.02	0.06	0.02	-0.03	0.15	-0.18	-0.17
2017	0.29	0.30	0.17	-0.08	-0.12	-0.09	-0.05	0.11	-0.06	-0.07	0.08	0.00
2018	0.07	0.24	0.01	0.06	-0.05	0.11	-0.07	-0.19	-0.12	-0.09	-0.23	-0.02
2019	-0.14	-0.34	-0.04	-0.04	-0.17	-0.10	0.13	0.30	0.31	0.07	0.09	0.05
2020	-0.34	0.16	0.07	0.14	-0.02	-0.20	-0.08	0.13	-0.02	-0.01	0.16	0.21
2021	0.00	-0.25	-0.10	0.06	0.04	-0.02	-0.04	-0.05	0.40	0.25	0.26	0.38
2022	-0.30	-0.12	0.12	0.18	0.27	-0.16	-0.11	-0.12	-0.15	0.04	0.00	0.34

Table 9.12. Icelandic cod in Division 5.a. Spring survey (SMB) at age residuals from the assessment, tuned with both the spring and the fall survey.

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1985	-0.61	-0.01	0.26	0.49	0.10	0.35	0.47	0.22	0.20	0.42	-0.03	-0.31	-0.10	0.09
1986	0.36	-0.18	-0.44	-0.21	-0.05	-0.10	-0.11	-0.26	-0.25	-0.12	-0.14	-0.12	-0.33	-0.04
1987	0.62	-0.11	0.04	-0.51	0.06	-0.01	-0.02	-0.01	-0.06	-0.04	0.15	0.12	0.16	0.09
1988	-0.23	-0.09	0.48	0.11	-0.09	-0.28	0.17	0.53	-0.06	-0.08	-0.02	0.26	0.02	0.08
1989	0.30	0.03	0.55	0.52	0.24	0.13	-0.03	-0.08	0.19	0.01	0.15	0.02	-0.07	-0.02
1990	-0.55	0.04	0.11	0.08	-0.14	-0.34	0.02	-0.12	-0.08	0.07	0.07	-0.10	0.05	0.06
1991	0.00	-0.59	0.05	0.22	0.33	0.05	-0.02	-0.15	0.23	0.09	0.13	-0.09	0.14	0.16
1992	-0.28	0.16	-0.22	0.08	-0.03	0.00	-0.12	-0.12	0.05	0.02	-0.08	-0.02	0.07	-0.01

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1993	-0.50	-0.11	0.35	-0.08	0.10	0.15	-0.05	-0.01	-0.01	0.03	0.14	0.01	0.04	0.02
1994	0.53	-0.31	0.07	0.18	-0.17	-0.21	0.04	-0.08	-0.03	0.09	0.12	0.00	0.05	0.01
1995	-0.33	0.14	-0.19	-0.07	0.23	0.03	-0.08	0.03	0.01	-0.08	0.13	0.19	0.05	-0.01
1996	-0.71	-0.28	0.13	-0.11	0.19	0.00	0.28	0.50	0.22	0.04	-0.05	0.30	0.18	0.11
1997	0.21	-0.10	0.16	0.33	-0.05	0.01	-0.06	0.19	-0.38	-0.20	0.22	0.01	0.26	0.21
1998	-0.06	0.17	-0.19	0.18	0.55	0.30	0.11	0.12	0.31	0.28	0.09	-0.07	0.01	-0.02
1999	0.08	0.23	-0.04	0.09	0.01	0.09	0.00	-0.06	-0.13	0.02	0.07	0.05	-0.02	-0.01
2000	0.87	0.23	0.36	-0.17	-0.01	-0.07	-0.21	0.02	-0.31	-0.23	-0.27	-0.03	0.06	0.02
2001	0.15	-0.02	0.12	-0.04	-0.49	-0.17	-0.26	-0.59	-0.32	0.05	-0.06	0.06	0.09	0.04
2002	-0.27	0.22	0.15	0.16	0.10	0.05	-0.11	-0.20	-0.42	-0.18	-0.05	-0.09	-0.05	-0.01
2003	-0.15	-0.39	0.04	-0.04	-0.07	-0.26	-0.06	-0.02	0.16	-0.45	-0.09	-0.06	0.16	-0.02
2004	-0.16	0.23	-0.20	0.33	0.19	0.35	0.23	0.31	0.55	0.21	0.16	-0.12	-0.03	0.01
2005	-0.26	0.11	0.26	-0.16	0.12	0.09	-0.05	0.01	0.05	0.24	0.23	0.30	0.02	-0.01
2006	0.12	-0.07	0.04	0.14	-0.06	0.16	-0.17	-0.37	-0.33	-0.16	-0.17	-0.07	-0.06	-0.02
2007	-0.04	0.24	-0.32	-0.16	-0.09	-0.07	-0.39	-0.12	0.01	-0.09	0.24	0.06	-0.02	-0.02
2008	-0.13	0.05	0.02	-0.40	-0.19	-0.07	0.21	-0.12	0.02	-0.24	0.03	0.06	0.02	-0.02
2009	0.19	-0.12	-0.09	-0.13	-0.07	-0.03	-0.11	-0.02	-0.26	-0.21	-0.32	-0.17	0.09	0.03
2010	-0.18	-0.26	-0.15	-0.13	-0.07	-0.10	-0.08	-0.12	0.25	-0.05	-0.16	0.00	-0.08	0.02
2011	-0.81	-0.35	-0.40	-0.23	0.01	0.12	0.15	0.05	-0.06	-0.21	-0.05	-0.26	-0.11	-0.05
2012	0.09	-0.33	-0.19	0.21	0.43	0.38	0.39	0.23	0.12	0.12	0.20	-0.10	0.25	0.14
2013	-0.03	0.17	-0.25	-0.17	0.05	0.07	0.01	0.15	0.48	0.09	0.10	0.35	-0.19	0.28
2014	-0.02	0.22	-0.06	-0.12	-0.05	0.07	-0.07	-0.25	-0.27	0.01	-0.50	-0.24	-0.11	-0.03
2015	0.46	0.36	-0.03	-0.10	-0.30	0.05	0.01	0.28	-0.06	0.04	0.15	-0.25	-0.32	0.02
2016	0.59	0.37	0.24	0.13	0.17	0.08	0.16	0.00	0.09	-0.19	-0.24	0.16	-0.25	-0.14
2017	-0.36	-0.08	0.04	0.23	0.06	0.07	0.10	0.07	0.27	0.41	0.22	-0.03	0.25	-0.24
2018	0.02	0.24	-0.28	0.01	-0.04	-0.02	-0.13	0.09	-0.20	-0.16	-0.29	-0.24	-0.27	-0.12
2019	-0.03	0.13	-0.18	-0.35	-0.15	-0.14	-0.13	-0.07	0.35	0.24	0.08	0.02	-0.04	-0.34
2020	0.46	-0.13	-0.38	-0.61	-0.86	-0.61	-0.45	-0.35	-0.14	0.33	0.30	0.44	0.11	-0.31
2021	0.56	0.35	0.15	0.06	-0.16	0.04	-0.01	-0.10	0.01	0.36	0.64	0.65	0.56	0.30
2022	0.09	-0.03	0.09	0.30	0.22	-0.13	0.21	-0.21	-0.19	-0.13	-0.06	0.31	0.07	-0.31
2023	-0.12	-0.17	-0.12	-0.10	-0.02	-0.03	0.15	0.65	0.10	0.02	-0.15	0.09	0.32	0.25

Table 9.13. Icelandic cod in Division 5.a. Fall survey (SMH) at age residuals from the assessment, tuned with both the spring and the fall survey.

year	3	4	5	6	7	8	9	10	11	12	13
1996	-0.13	-0.29	-0.11	-0.09	0.22	0.27	-0.10	0.01	-0.04	0.06	0.01
1997	-0.14	0.23	0.07	-0.06	-0.19	-0.13	-0.23	-0.03	-0.04	0.03	0.08
1998	-0.34	-0.03	-0.01	0.41	0.54	0.10	0.24	0.04	-0.01	0.03	0.01
1999	0.11	0.12	0.13	0.00	-0.09	-0.38	-0.31	0.14	-0.03	-0.04	0.14
2000	-0.38	-0.18	-0.15	-0.25	-0.38	-0.28	0.01	0.16	0.07	0.01	0.02
2001	0.00	-0.01	-0.27	-0.23	-0.23	-0.52	-0.47	-0.17	0.10	-0.02	-0.01

year	3	4	5	6	7	8	9	10	11	12	13
2002	-0.29	0.18	0.02	0.25	0.09	0.10	0.02	-0.22	0.26	0.00	0.07
2003	-0.01	-0.22	-0.10	-0.22	-0.15	0.20	-0.03	-0.22	0.04	0.01	0.02
2004	0.02	0.13	0.20	0.12	0.29	0.48	0.58	0.14	0.06	0.11	-0.01
2005	0.03	0.00	0.33	0.00	-0.27	-0.22	-0.12	0.04	-0.05	0.07	0.04
2006	0.06	0.13	0.12	0.09	0.07	-0.14	0.03	0.01	0.02	-0.05	0.01
2007	-0.50	-0.24	0.02	0.04	-0.14	0.09	-0.20	0.14	-0.05	0.09	-0.02
2008	0.06	-0.09	0.20	0.33	0.35	0.32	-0.03	0.22	0.13	0.14	0.00
2009	0.17	0.16	0.28	0.17	0.24	0.31	0.28	0.18	0.08	0.14	0.00
2010	0.17	0.24	0.21	0.05	0.21	0.31	0.49	0.16	0.21	-0.10	0.14
2011	NA										
2012	-0.12	-0.23	-0.16	-0.09	0.07	0.29	0.05	0.03	0.23	-0.18	0.04
2013	-0.04	-0.16	-0.07	-0.06	-0.01	0.12	0.31	0.17	0.21	0.40	0.14
2014	0.20	-0.02	-0.05	0.04	-0.06	0.14	0.20	0.51	0.37	0.36	0.38
2015	0.66	0.44	0.17	0.26	0.23	-0.04	0.09	-0.26	-0.04	0.05	0.01
2016	0.08	-0.10	-0.07	-0.28	-0.15	-0.15	-0.16	0.03	-0.08	0.19	-0.07
2017	0.48	0.63	0.51	0.46	0.20	0.12	-0.01	-0.06	0.13	0.03	0.29
2018	-0.08	-0.04	-0.16	-0.17	0.00	0.21	0.06	0.05	-0.03	0.00	-0.12
2019	0.53	0.03	-0.06	-0.05	-0.15	-0.31	-0.21	-0.23	-0.29	-0.21	-0.05
2020	-0.15	-0.29	-0.48	-0.28	-0.36	-0.29	-0.40	0.03	-0.13	-0.17	-0.02
2021	-0.35	-0.43	-0.60	-0.47	-0.49	-0.59	-0.22	-0.27	-0.17	-0.13	0.05
2022	-0.20	-0.13	-0.13	0.03	0.06	-0.10	-0.02	-0.03	-0.11	0.00	0.08

Table 9.14. Icelandic cod in Division 5.a. Estimates of fishing mortality based on the assessment using catch at age and spring and fall bottom survey indices.

year	3	4	5	6	7	8	9	10	11	12	13	14
1955	0.06	0.18	0.24	0.25	0.31	0.37	0.41	0.50	0.56	0.53	0.53	0.53
1956	0.06	0.18	0.24	0.25	0.31	0.37	0.41	0.50	0.56	0.52	0.52	0.52
1957	0.07	0.20	0.27	0.28	0.34	0.41	0.46	0.56	0.62	0.59	0.59	0.59
1958	0.08	0.22	0.30	0.31	0.39	0.47	0.52	0.63	0.70	0.66	0.66	0.66
1959	0.07	0.20	0.26	0.28	0.34	0.41	0.46	0.55	0.62	0.58	0.58	0.58
1960	0.08	0.22	0.30	0.31	0.38	0.46	0.51	0.62	0.69	0.65	0.65	0.65
1961	0.07	0.20	0.28	0.29	0.36	0.43	0.48	0.58	0.65	0.61	0.61	0.61
1962	0.07	0.21	0.28	0.29	0.36	0.43	0.48	0.58	0.65	0.61	0.61	0.61
1963	0.08	0.23	0.32	0.33	0.41	0.49	0.55	0.66	0.74	0.70	0.70	0.70
1964	0.09	0.27	0.36	0.38	0.46	0.56	0.62	0.75	0.84	0.79	0.79	0.79
1965	0.10	0.29	0.39	0.41	0.50	0.60	0.67	0.81	0.91	0.85	0.85	0.85
1966	0.09	0.26	0.36	0.37	0.46	0.56	0.62	0.75	0.84	0.79	0.79	0.79
1967	0.09	0.25	0.33	0.35	0.43	0.52	0.58	0.69	0.78	0.73	0.73	0.73
1968	0.10	0.29	0.39	0.41	0.50	0.60	0.67	0.81	0.91	0.86	0.86	0.86
1969	0.08	0.23	0.32	0.33	0.41	0.49	0.54	0.66	0.74	0.69	0.69	0.69
1970	0.10	0.29	0.39	0.41	0.50	0.60	0.67	0.81	0.91	0.86	0.86	0.86

year	3	4	5	6	7	8	9	10	11	12	13	14
1971	0.12	0.34	0.47	0.49	0.60	0.72	0.80	0.97	1.09	1.02	1.02	1.02
1972	0.12	0.34	0.46	0.48	0.60	0.72	0.80	0.96	1.08	1.02	1.02	1.02
1973	0.13	0.36	0.49	0.51	0.63	0.76	0.84	1.02	1.14	1.07	1.07	1.07
1974	0.13	0.37	0.50	0.52	0.65	0.78	0.87	1.05	1.18	1.10	1.10	1.10
1975	0.13	0.37	0.50	0.52	0.64	0.77	0.86	1.04	1.17	1.09	1.09	1.09
1976	0.05	0.23	0.41	0.59	0.74	0.87	0.84	0.80	0.67	0.71	0.71	0.71
1977	0.04	0.19	0.33	0.48	0.60	0.70	0.68	0.65	0.54	0.57	0.57	0.57
1978	0.03	0.15	0.27	0.38	0.49	0.57	0.55	0.52	0.44	0.46	0.46	0.46
1979	0.03	0.15	0.25	0.36	0.46	0.54	0.52	0.50	0.41	0.44	0.44	0.44
1980	0.03	0.16	0.28	0.40	0.51	0.59	0.58	0.55	0.46	0.49	0.49	0.49
1981	0.04	0.20	0.36	0.51	0.65	0.75	0.73	0.70	0.58	0.62	0.62	0.62
1982	0.05	0.23	0.41	0.58	0.74	0.86	0.84	0.80	0.66	0.70	0.70	0.70
1983	0.04	0.22	0.38	0.55	0.69	0.80	0.78	0.74	0.62	0.66	0.66	0.66
1984	0.04	0.20	0.36	0.51	0.64	0.75	0.73	0.69	0.58	0.61	0.61	0.61
1985	0.05	0.23	0.40	0.57	0.72	0.84	0.82	0.78	0.65	0.69	0.69	0.69
1986	0.06	0.28	0.48	0.69	0.88	1.02	1.00	0.95	0.79	0.84	0.84	0.84
1987	0.06	0.29	0.51	0.73	0.93	1.08	1.05	1.00	0.83	0.89	0.89	0.89
1988	0.06	0.30	0.52	0.75	0.95	1.10	1.08	1.02	0.85	0.90	0.90	0.90
1989	0.05	0.25	0.43	0.62	0.78	0.91	0.89	0.84	0.70	0.75	0.75	0.75
1990	0.05	0.25	0.44	0.63	0.79	0.92	0.90	0.86	0.71	0.76	0.76	0.76
1991	0.06	0.30	0.52	0.75	0.94	1.10	1.07	1.02	0.85	0.90	0.90	0.90
1992	0.07	0.33	0.58	0.83	1.05	1.22	1.19	1.13	0.94	1.00	1.00	1.00
1993	0.07	0.32	0.57	0.81	1.03	1.20	1.17	1.11	0.92	0.98	0.98	0.98
1994	0.04	0.22	0.38	0.55	0.70	0.81	0.79	0.75	0.62	0.66	0.66	0.66
1995	0.04	0.13	0.30	0.45	0.58	0.65	0.72	0.76	0.78	0.77	0.77	0.77
1996	0.03	0.13	0.28	0.43	0.55	0.62	0.69	0.73	0.75	0.74	0.74	0.74
1997	0.03	0.13	0.29	0.44	0.56	0.64	0.70	0.74	0.76	0.75	0.75	0.75
1998	0.04	0.16	0.35	0.53	0.68	0.77	0.85	0.90	0.92	0.91	0.91	0.91
1999	0.05	0.19	0.41	0.62	0.80	0.91	1.00	1.06	1.09	1.07	1.07	1.07
2000	0.05	0.19	0.42	0.63	0.81	0.92	1.02	1.07	1.10	1.09	1.09	1.09
2001	0.05	0.18	0.39	0.58	0.75	0.85	0.94	0.99	1.02	1.00	1.00	1.00
2002	0.04	0.14	0.32	0.48	0.62	0.70	0.77	0.82	0.84	0.83	0.83	0.83
2003	0.04	0.14	0.31	0.47	0.61	0.69	0.76	0.80	0.82	0.81	0.81	0.81
2004	0.04	0.15	0.33	0.50	0.65	0.73	0.81	0.85	0.88	0.86	0.86	0.86
2005	0.04	0.14	0.32	0.48	0.62	0.70	0.77	0.82	0.84	0.83	0.83	0.83
2006	0.04	0.14	0.30	0.45	0.58	0.66	0.73	0.77	0.79	0.78	0.78	0.78
2007	0.03	0.13	0.28	0.42	0.54	0.61	0.67	0.71	0.73	0.72	0.72	0.72
2008	0.03	0.11	0.19	0.32	0.39	0.47	0.47	0.49	0.48	0.59	0.59	0.59
2009	0.04	0.12	0.21	0.34	0.42	0.51	0.50	0.53	0.52	0.64	0.64	0.64
2010	0.03	0.10	0.18	0.29	0.36	0.43	0.43	0.45	0.44	0.54	0.54	0.54

year	3	4	5	6	7	8	9	10	11	12	13	14
2011	0.03	0.09	0.17	0.27	0.33	0.40	0.40	0.42	0.41	0.50	0.50	0.50
2012	0.03	0.09	0.17	0.27	0.34	0.41	0.41	0.43	0.42	0.51	0.51	0.51
2013	0.03	0.10	0.18	0.30	0.37	0.44	0.44	0.46	0.45	0.55	0.55	0.55
2014	0.03	0.09	0.16	0.27	0.33	0.40	0.39	0.41	0.40	0.50	0.50	0.50
2015	0.03	0.09	0.16	0.25	0.32	0.38	0.38	0.39	0.38	0.48	0.48	0.48
2016	0.03	0.09	0.16	0.26	0.32	0.39	0.38	0.40	0.39	0.49	0.49	0.49
2017	0.03	0.09	0.16	0.26	0.32	0.39	0.39	0.40	0.40	0.49	0.49	0.49
2018	0.03	0.10	0.17	0.28	0.35	0.42	0.42	0.44	0.43	0.53	0.53	0.53
2019	0.03	0.11	0.19	0.31	0.39	0.46	0.46	0.48	0.47	0.58	0.58	0.58
2020	0.04	0.12	0.21	0.35	0.43	0.52	0.51	0.54	0.52	0.65	0.65	0.65
2021	0.04	0.11	0.20	0.33	0.41	0.49	0.48	0.51	0.50	0.61	0.61	0.61
2022	0.03	0.09	0.17	0.27	0.34	0.41	0.40	0.42	0.41	0.51	0.51	0.51

Table 9.15. Icelandic cod in Division 5.a. Estimates of numbers at age in the stock (in millions) based the assessment using catch at age and spring and fall bottom survey indices.

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1955	161.468	143.758	151.015	211.540	199.654	110.949	31.897	20.441	9.573	77.120	6.372	4.707	5.492	1.820
1956	215.097	161.468	143.758	116.170	145.111	128.591	70.710	19.158	11.538	5.182	38.314	2.976	2.277	2.656
1957	303.998	215.097	161.468	110.618	79.753	93.562	82.046	42.529	10.832	6.257	2.580	17.941	1.443	1.104
1958	153.714	303.997	215.097	123.338	74.377	49.990	57.962	47.581	34.751	5.595	2.938	1.131	8.176	0.658
1959	195.922	153.713	303.997	162.875	80.900	45.080	29.902	32.187	39.726	16.940	2.450	1.190	0.479	3.461
1960	125.229	195.921	153.714	232.341	109.688	50.819	27.990	17.389	17.479	31.622	7.989	1.079	0.545	0.219
1961	173.240	125.228	195.922	116.543	152.950	66.809	30.554	15.642	9.002	8.593	13.986	3.275	0.462	0.233
1962	197.585	173.240	125.229	149.266	77.782	94.912	40.957	17.490	25.151	4.570	3.951	5.988	1.460	0.206
1963	219.590	197.585	173.240	95.378	99.535	48.210	58.113	23.410	9.303	12.742	2.096	1.687	2.663	0.649
1964	233.023	219.590	197.585	130.611	61.793	59.326	28.337	31.580	11.719	4.408	5.387	0.817	0.688	1.087
1965	320.162	233.023	219.590	147.345	82.032	35.311	33.371	14.584	14.810	5.161	1.707	1.902	0.304	0.256
1966	171.200	320.161	233.023	162.524	90.581	45.535	19.270	16.543	6.539	6.204	1.882	0.563	0.664	0.106
1967	239.565	171.200	320.162	173.820	102.154	51.817	25.642	9.931	7.771	2.885	2.408	0.666	0.210	0.248
1968	179.539	239.566	171.200	240.373	111.284	59.915	29.950	13.648	4.849	3.579	1.179	0.904	0.262	0.083
1969	193.010	179.539	239.565	126.667	147.632	61.694	32.652	44.937	6.107	2.027	1.301	0.388	0.315	0.091
1970	141.967	193.010	179.539	180.688	82.157	88.129	36.321	31.392	22.549	2.900	0.860	0.509	0.159	0.129
1971	277.677	141.967	193.010	132.834	110.968	45.543	48.024	17.974	14.045	9.424	1.054	0.283	0.177	0.055
1972	187.047	277.677	141.967	140.014	77.140	57.019	22.928	21.547	23.526	5.150	2.925	0.290	0.083	0.052
1973	259.246	187.047	277.677	103.053	81.458	39.735	28.779	10.320	8.603	8.663	1.607	0.810	0.086	0.025
1974	370.235	259.246	187.047	200.296	58.891	40.953	19.554	12.554	3.968	3.038	2.570	0.420	0.228	0.024
1975	144.143	370.235	259.246	134.393	113.192	29.163	19.837	8.365	4.716	1.365	0.873	0.649	0.114	0.062
1976	225.021	144.143	370.235	186.495	76.211	56.316	14.195	8.538	3.165	1.636	0.396	0.223	0.178	0.031
1977	239.420	225.021	144.143	289.160	120.838	41.393	25.625	5.528	2.942	1.115	0.600	0.167	0.090	0.072
1978	141.313	239.420	225.021	113.589	195.854	70.940	21.053	11.487	2.244	1.216	0.476	0.287	0.077	0.041

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1979	145.678	141.313	239.420	178.633	79.797	122.583	39.544	10.598	5.338	1.058	0.589	0.252	0.148	0.040
1980	139.549	145.678	141.313	190.372	126.504	50.654	75.297	20.422	5.074	2.591	0.527	0.319	0.133	0.078
1981	230.590	139.549	145.678	112.020	132.790	78.197	27.737	45.567	9.244	2.331	1.225	0.273	0.161	0.067
1982	140.738	230.590	139.549	114.474	74.817	76.061	38.395	11.892	17.565	3.632	0.950	0.562	0.121	0.071
1983	139.635	140.737	230.590	109.030	74.307	40.765	34.768	15.037	4.126	6.227	1.342	0.402	0.228	0.049
1984	304.357	139.635	140.738	180.706	71.842	41.566	19.348	14.280	5.514	1.544	2.422	0.592	0.170	0.097
1985	252.709	304.357	139.635	110.617	120.828	41.232	20.467	8.325	5.528	2.175	0.631	1.114	0.263	0.076
1986	176.300	252.709	304.358	109.207	72.162	66.411	19.084	8.143	2.942	1.995	0.817	0.271	0.458	0.108
1987	96.684	176.300	252.709	235.699	67.842	36.403	27.187	6.501	2.401	0.890	0.634	0.305	0.096	0.163
1988	131.194	96.685	176.299	195.061	144.059	33.260	14.306	8.794	1.805	0.685	0.268	0.226	0.103	0.032
1989	113.530	131.194	96.684	135.909	118.473	69.850	12.866	4.536	2.386	0.503	0.202	0.094	0.075	0.034
1990	170.685	113.530	131.194	75.329	87.006	92.689	30.835	4.821	1.495	0.804	0.177	0.082	0.036	0.029
1991	126.174	170.685	113.530	102.139	48.044	45.964	40.535	11.419	1.567	0.497	0.280	0.071	0.031	0.014
1992	81.660	126.175	170.685	87.546	62.123	23.353	17.843	12.910	3.114	0.439	0.147	0.098	0.024	0.010
1993	145.778	81.661	126.175	130.753	51.532	28.511	8.350	5.121	3.119	0.776	0.116	0.047	0.030	0.007
1994	160.627	145.777	81.661	96.780	77.458	23.917	10.359	2.446	1.267	0.795	0.209	0.038	0.014	0.009
1995	94.288	160.628	145.778	63.967	63.632	43.163	11.290	4.225	0.890	0.470	0.307	0.092	0.016	0.006
1996	159.119	94.288	160.627	115.190	45.758	38.674	22.576	5.190	1.798	0.354	0.179	0.115	0.035	0.006
1997	76.761	159.118	94.288	127.138	82.931	28.207	20.663	10.666	2.278	0.740	0.140	0.070	0.045	0.014
1998	162.911	76.761	159.118	74.571	91.257	50.783	14.921	9.637	4.614	0.922	0.288	0.053	0.027	0.017
1999	150.732	162.910	76.761	124.937	52.073	52.591	24.519	6.187	3.649	1.613	0.307	0.094	0.018	0.009
2000	157.158	150.732	162.911	59.828	84.828	28.206	23.131	9.016	2.045	1.097	0.458	0.085	0.026	0.005
2001	174.679	157.158	150.732	126.878	40.506	45.659	12.289	8.403	2.939	0.606	0.307	0.125	0.023	0.007
2002	88.793	174.679	157.158	117.856	87.197	22.535	20.907	4.759	2.945	0.943	0.184	0.091	0.037	0.007
2003	150.405	88.793	174.679	123.866	83.492	51.872	11.412	9.219	1.932	1.112	0.341	0.065	0.033	0.013
2004	131.377	150.405	88.793	137.783	88.013	49.998	26.532	5.097	3.798	0.741	0.408	0.123	0.024	0.012

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2005	98.021	131.376	150.405	69.868	96.999	51.637	24.798	11.390	2.007	1.386	0.258	0.139	0.042	0.008
2006	127.740	98.021	131.376	118.552	49.511	57.740	26.176	10.949	4.631	0.759	0.501	0.092	0.050	0.015
2007	115.445	127.741	98.021	103.764	84.660	29.978	30.029	11.945	4.621	1.824	0.287	0.186	0.034	0.019
2008	126.170	115.445	127.741	77.643	74.919	52.520	16.170	14.363	5.317	1.931	0.734	0.113	0.074	0.014
2009	167.826	126.170	115.446	101.063	57.057	55.897	31.334	8.936	7.325	2.729	0.968	0.372	0.051	0.034
2010	179.497	167.826	126.170	91.096	73.655	37.893	32.551	16.803	4.395	3.628	1.318	0.474	0.161	0.022
2011	129.963	179.497	167.826	100.117	67.573	50.494	23.237	18.612	8.928	2.349	1.898	0.697	0.226	0.077
2012	168.696	129.963	179.497	133.457	74.767	46.889	31.581	13.616	10.186	4.913	1.267	1.034	0.345	0.112
2013	142.943	168.696	129.963	142.651	99.476	51.704	29.164	18.378	7.390	5.560	2.628	0.685	0.507	0.169
2014	95.503	142.943	168.696	103.047	105.558	67.896	31.480	16.528	9.661	3.909	2.877	1.375	0.322	0.238
2015	150.494	95.503	142.943	134.202	77.052	73.413	42.621	18.531	9.095	5.346	2.121	1.577	0.685	0.161
2016	165.074	150.493	95.503	113.850	100.725	53.951	46.595	25.435	10.367	5.115	2.950	1.182	0.802	0.348
2017	113.921	165.074	150.494	76.016	85.276	70.268	34.038	27.600	14.102	5.779	2.797	1.629	0.594	0.403
2018	142.871	113.921	165.074	119.775	56.920	59.458	44.293	20.140	15.282	7.851	3.156	1.542	0.818	0.298
2019	129.098	142.871	113.921	131.063	89.008	39.149	36.655	25.494	10.787	8.233	4.142	1.682	0.743	0.394
2020	168.436	129.098	142.871	90.191	96.520	60.230	23.504	20.415	13.124	5.589	4.169	2.122	0.771	0.340
2021	140.691	168.436	129.098	112.662	65.593	63.859	34.858	12.508	9.948	6.441	2.674	2.020	0.908	0.330
2022	117.524	140.692	168.436	102.008	82.461	43.899	37.656	18.986	6.268	5.019	3.172	1.333	0.895	0.402
2023	130.180	117.524	140.691	133.878	76.064	57.065	27.335	21.945	10.322	3.427	2.690	1.717	0.654	0.439

Table 9.16. Icelandic cod in Division 5.a. Catch (kt), average fishing mortality of age groups 5 to 10, recruitment to the fisheries at age 3 (millions), reference fishing biomass (B4+, kt), spawning stock biomass (kt) at spawning time and harvest ratio. 'Harvest rate' is 1/3 of the yield in the calendar year and 2/3 of the yield in the next year divided by the reference biomass at the start of the year. Predictions are based on the estimated yield in the assessment year.

Year	Recruitment Age 3		Spawning stock biomass		Total catch		Harvest rate		Biomass age 4+	Fbar Ages 5-10
	95%	5%	95%	5%	95%	5%	95%	5%		
1955	151015	167729	135458	726311	833400	626218	545250	0.24	0.26	0.21
1956	143758	161687	128648	583889	686574	510322	486909	0.26	0.28	0.23
1957	161468	180141	145560	574657	678138	513298	455182	0.30	0.33	0.26
1958	215097	238398	194427	690044	776053	623123	517359	0.29	0.31	0.25
1959	303997	334052	275084	639314	737830	566210	459081	0.30	0.32	0.26
1960	153714	170180	138850	583596	639593	525374	470121	0.25	0.27	0.23
1961	195922	215840	176066	399330	441014	367646	377291	0.27	0.30	0.25
1962	125229	139496	113234	505462	553779	461662	388985	0.28	0.30	0.25
1963	173240	191261	157555	460399	508242	419815	408800	0.33	0.35	0.29
1964	197585	225860	176414	420042	463182	381612	437012	0.33	0.35	0.29
1965	219590	255325	194605	322928	355774	295305	387106	0.35	0.37	0.31
1966	233023	262820	211327	295743	327820	270307	353357	0.32	0.35	0.29
1967	320162	352686	288003	280646	311142	256312	335721	0.32	0.36	0.30
1968	171200	192892	154097	248460	281777	225407	381770	0.32	0.34	0.29

Year	Recruitment Age 3		Spawning stock biomass			Total catch	Harvest rate		Biomass age 4+	Fbar Ages 5-10		
	95%	5%	95%	5%	95%		95%	5%				
1969	239565	263668	216237	354218	395065	323402	403205	0.34	0.35	0.30	1335600	0.458
1970	179539	201948	161638	354800	385319	326802	475077	0.34	0.36	0.31	1332540	0.565
1971	193010	213993	171901	252974	279336	231924	444248	0.38	0.41	0.34	1083400	0.675
1972	141967	159998	127841	225466	248054	205349	395166	0.39	0.41	0.35	978385	0.671
1973	277677	306868	251315	244958	267432	226374	369205	0.44	0.48	0.40	830192	0.706
1974	187047	206313	167110	188457	207167	174598	368133	0.40	0.44	0.36	908403	0.728
1975	259246	286077	235622	174495	190969	162866	364754	0.40	0.42	0.35	889563	0.722
1976	370235	436991	336806	145143	160047	135044	346253	0.36	0.39	0.33	946209	0.709
1977	144143	162128	128336	198182	219487	184538	340086	0.26	0.27	0.23	1297020	0.574
1978	225021	249598	203822	211481	235398	198558	329602	0.27	0.29	0.24	1306670	0.464
1979	239420	263396	219690	306969	345795	290417	366462	0.29	0.31	0.25	1409470	0.439
1980	141313	155574	129377	369391	423541	336292	432237	0.30	0.31	0.26	1513660	0.485
1981	145678	159650	134758	269143	291156	247251	465032	0.33	0.35	0.30	1246370	0.617
1982	139549	150613	129173	178430	196097	166273	380068	0.33	0.36	0.30	982291	0.703
1983	230590	250724	214076	140138	157045	131190	298049	0.36	0.39	0.33	795957	0.658
1984	140738	152096	129622	149546	166679	139246	282022	0.34	0.37	0.31	910211	0.613

Year	Recruitment Age 3			Spawning stock biomass			Total catch	Harvest rate		Biomass age 4+	Fbar Ages 5-10	
	95%	5%	95%	5%	95%	5%		95%	5%			
1985	139635	148361	129592	165802	180080	155022	323428	0.38	0.40	0.34	932228	0.688
1986	304358	323811	286379	192553	207648	180324	364797	0.45	0.47	0.39	857657	0.836
1987	252709	275233	233108	145405	157630	136500	389915	0.38	0.42	0.35	993410	0.886
1988	176299	187187	165461	160845	172178	154112	377554	0.37	0.39	0.33	989665	0.905
1989	96684	103808	90321	162245	173592	154195	363125	0.36	0.37	0.32	953964	0.745
1990	131194	141021	123259	197920	210462	185672	335316	0.39	0.41	0.35	816961	0.757
1991	113530	120795	106548	156117	166387	147369	307759	0.40	0.44	0.37	697346	0.9
1992	170685	181790	162099	142406	152300	134206	264834	0.45	0.49	0.42	564018	1
1993	126175	133910	119056	115170	121753	109446	250704	0.34	0.36	0.31	601357	0.98
1994	81661	86410	76650	153223	162084	146461	178138	0.30	0.32	0.27	573922	0.664
1995	145778	154399	138322	175061	184136	167035	168592	0.31	0.33	0.28	569733	0.577
1996	160627	169393	153420	158846	167299	150489	180701	0.28	0.31	0.27	688870	0.55
1997	94288	99713	89206	192841	202266	183730	203112	0.29	0.32	0.28	796676	0.563
1998	159118	168502	151939	201744	212299	193044	243987	0.35	0.37	0.32	737298	0.68
1999	76761	81333	72396	176593	185771	167748	260147	0.33	0.35	0.30	729694	0.8
2000	162911	172137	155036	161860	171367	153047	235092	0.40	0.39	0.34	589754	0.813

Year	Recruitment Age 3			Spawning stock biomass			Total catch	Harvest rate		Biomass age 4+	Fbar Ages 5-10	
	95%	5%	95%	5%	95%	5%		95%	5%			
2001	150732	158244	143677	158671	167114	150342	236702	0.33	0.32	0.28	654279	0.749
2002	157158	165530	150386	190865	200138	182351	209544	0.30	0.30	0.26	698882	0.619
2003	174679	184424	167076	187245	197088	179013	207246	0.30	0.32	0.28	730421	0.606
2004	88793	93697	84797	193716	203891	185474	228342	0.28	0.30	0.26	795952	0.646
2005	150405	158787	143722	221869	233018	211933	213867	0.28	0.31	0.26	720533	0.618
2006	131376	142505	125053	212882	224069	203685	197202	0.27	0.29	0.25	679010	0.585
2007	98021	103164	93702	196769	208292	187502	171646	0.24	0.26	0.22	654402	0.538
2008	127741	133775	122660	247304	264579	237572	147676	0.26	0.27	0.23	662927	0.389
2009	115446	121577	110450	227135	241466	216134	183320	0.24	0.25	0.21	730464	0.419
2010	126170	133156	120449	255854	272426	242584	170025	0.22	0.23	0.20	776677	0.355
2011	167826	176864	159836	313169	335779	298912	172218	0.23	0.24	0.21	823685	0.331
2012	179497	188988	171932	346901	370548	330553	196171	0.23	0.25	0.21	946720	0.338
2013	129963	137226	123922	367471	391854	350488	223582	0.21	0.22	0.193	1073870	0.364
2014	168696	177365	161177	336406	359708	319327	222021	0.21	0.23	0.194	1085890	0.327
2015	142943	149941	136374	444645	472961	423095	230165	0.21	0.22	0.193	1160110	0.313
2016	95503	99982	90744	388648	414596	367486	251219	0.21	0.22	0.189	1202560	0.32

Year	Recruitment Age 3		Spawning stock biomass			Total catch	Harvest rate		Biomass age 4+	Fbar Ages 5-10		
	95%	5%	95%	5%	95%		95%	5%				
2017	150494	158882	143227	515231	549875	488981	243945	0.23	0.25	0.21	1123640	0.322
2018	165074	176006	156859	500243	535022	474473	267221	0.23	0.25	0.21	1160340	0.349
2019	113921	120344	106266	441991	473909	417415	263025	0.24	0.26	0.22	1107650	0.381
2020	142871	153689	132813	390638	419305	365868	270302	0.27	0.28	0.24	1003040	0.426
2021	129098	139447	118686	376686	406482	351055	265740	0.24	0.24	0.21	1054320	0.403
2022	168436	187815	153261	383624	418663	350624	242192	0.20	0.23	0.20	1048100	0.337
2023	140691	159228	124492	368345	412942	324983					1068860	

Section contents

9	Iceland grounds cod	248
9.1	Fishery.....	248
9.1.1	Landings trends.....	255
9.2	Data available	256
9.1.2	Age distribution	257
9.1.3	Length distributions	259
9.1.4	Weight at age in the catch	261
9.1.5	Natural mortality	261
9.3	Survey data	262
9.4	Data analyses.....	270
9.5	Analytical assessment.....	270
9.6	Diagnostics.....	271
9.7	Model results	273
9.8	Short-term projections	274
9.9	Management.....	277
9.1.6	History.....	277
9.1.7	Harvest control rule	278
9.1.8	On reference points	280
9.1.9	On measure of fishing pressure	281
9.1.10	Comparison with last year's advice	281
9.1.11	Management considerations	282
9.10	References	282
9.11	Tables	283