9 Icelandic cod in 5.a

9.1 Overview

A formal HCR to set the TAC has been in place for this stock since 1994. 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 $SSB_{trigger}$ (220 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 (2020/2021) based on last year's assessment was 256.593 kt.

The results of this year's assessment show that the spawning stock in 2021 is estimated to be 361.348 kt. The values estimated in recent years are higher than have been observed during the last five decades. The reference biomass B_{4+} in 2021 is estimated to be 940.767 kt. Fishing mortality is 0.43 in 2020 having declined significantly in recent decades due to management action. Year classes since the mid-1980s are estimated to be relatively stable but with the mean around 34% lower than observed in the period 1955 to 1985.

Given the above HCR rule and the estimated reference biomass in the beginning of 2021 the catch for the coming fishing year (2021/2021) is 222.373 kt based on the following:

$$TAC_{2021/2022} = (0.20 * 940.767_{2021} + 256.593_{2020/2021})/2 = 222.373kt$$

Following the benchmark 2021 the assessment upon which the advice is based is approximately 20% lower than based on setting prior to the benchmark. This in part is reflected in somewhat higher harvest rate than intended although it is still within the range expected in the HCR simulation.

The input in the analytical age-based assessment are catch at age 1955–2020 (age 3 to 14) and ages 1 to 14 (from the 1985–2021 spring (often referred to as SMB in this report) and ages 1 to 13 from the 1996–2020 fall groundfish surveys (often referred to as SMH in this report).

9.2 Some elaborations

9.2.1 Data

The data used for assessing Icelandic cod are landings and catch-at-age composition since 1955 and indices from two standardized bottom trawl surveys. The spring survey (SMB) was instigated in 1985, the fall survey (SMH) in 1996.

The sampling programs i.e log books, surveys, sampling from landings etc. have been described in previous reports.

9.2.1.1 Landings

Landings of Icelandic cod in 2020 are estimated to have been 270.303 kt, the bulk taken by the Icelandic fleet.

The share of the catch by different gears in 2020 is according to the following in-text table:

gear	p
Long line	0.26
Gill net	0.07
Jiggers	0.06
Scottish seine	0.06
Bottom trawl	0.55

The estimates of landings for the current calendar year of 247 kt is based on the remainder of the quota from the current fishing year (2020/21, 257 kt) on 1 January 2021 (170 kt), the catch that is expected to be taken from 1. September to 31. December 2021 (74 kt, 1/3rd of the advised TAC of 222 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.

9.2.1.2 Catch in numbers and weight at age

Catch in numbers by age: The method for deriving the catch at age (Table 3.1) 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).

In recent decades, the composition of the catch in weights has shifted towards older ages, e.g. age 8 and older where generally less than 25% of the catch prior to 2007 while in the last 4 years it has been above 40% of the catch. The increase in ages 11 to 14 have increased even more, being less than 2.5% of the caches prior to 2010 to above 10% of the catches in the last two years.

Mean weight at age in the landings: The mean weight age in the catch (Table 3.2 and Figure 3.2) 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 in 2020 just under the average weights observed over the period from 1985 and close to the long term mean (1955–2020) 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 spring survey (Table 3.3 and Figure 3.3).

Prediction of catch weights in 2021: The reference biomass (B_{4+}) upon which the TAC in the fishing year is set is derived from population numbers and catch weights in the beginning of the assessment year. 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 ($y - 1$}. The same approach was used this year for predicting weight at age in the catches for 2021 (Figure 9.3). I.e. the α and β were estimated from:

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

and the catch weights for 2021 then from:

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

Based on this the mean weights at age in the catches in 2021 are predicted to be around average (Figure 9.1.b. and Table 3.2). For ages 10 and older, the weights from the previous year are used.

Weight and maturity at age used in the calculation of SSB are presented in Tables 3.4 and 3.5.

9.2.1.3   Surveys

Length based indices: The total spring (SMB) and fall survey (SMH) measurements decreased significantly from the highest value observed in 2017 to the 2020 measurement (Figure 3.5). The 2021 spring survey measurement was however more optimistic, being on par with that observed in 2018 and 2019.

The 2020 spring survey measurement indicate that the abundance in 2020 is below the average of the last 6 years for length classes 35 to 90 cm (Figure 3.6). Although the 2016 year-class (approximately 50 cm mean length in year 2020) was expected to be low and although year effects in survey measurements are known, the 2020 survey measurements are substantially below for size classes that constitute the bulk of the fish-able biomass. The 2021 measurements were more in line with the expectations indicating that the spring survey in 2020 may have been a large negative anomaly.

Age based indices: Abundance indices by age from the spring and the fall surveys (Tables 3.6 and 3.7). Indices of older fish are all relatively high in recent decade despite the indices of these year classes when younger are low or moderate in size (Figure 3.7). 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). In the 2021 survey these year classes are however more on par with the 2019 measurement.

The log ratio of spring survey indices principal age groups (Figure 3.8) over time illustrate the anomaly in the measurements in 2019 through 2021 for some selected age groups. Although noisy, the overall pattern over time show a decline in the log-ratio (consistent with long term reduction in mortality), but the between years 2019 and 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.

9.2.2   The 2020 assessment and the 2021 benchmark

The 2020 domestic assessment: Only domestic advice was provided for this stock in 2020. The advice was bases on an assessment that deviated from the ICES 2015 benchmark by including survey age groups older than 10 in the tuning. This resulted in lower stock estimates and hence advice than the 2015 benchmark setup, largely because the inclusion of the older indices shifted the fisheries selection pattern from being dome shaped to a more logistic type. This interim change however lead to larger retrospective patterns (although within the ICES 0.2 Mohn's rho criterion).

The 2021 benchmark: In conjunction with a 5-year re-evaluation of the HCR the stock was benchmarked in the beginning of 2021 based on data available in 2020 (ICES, 2021).

All the changes had to do with treatment of survey indices in the model:

1.   With lower fishing effort the abundance of old age groups increased. For some of those age groups (10+) the number caught had been so low that sampling error related to few otoliths had been the most important uncertainty. Ages 11 and older in the surveys were earlier not used in the tuning as they were minor part of the stock (1-2%). Not including them in the survey lead to "ghostfish" i.e dome shaped selection pattern of the fleet, not an impossible pattern but not acceptable without some proofs, especially when the older fish becomes larger part of the stock. Inclusion of survey indices age 11 and above was already done in the 2020 domestic assessment.

2. For ages 6–9 abundance increased, and nonlinear relationships started to show up, that was not apparent when range of values was smaller. This resulted in ~95 kt (~8%) reduction in biomass in 2020.

3. The relationship between abundance indices of ages 1–3 and older fish changed. The change can either be related to increased mortality or changed behaviour or less coastal spatial distribution. Inclusion of ages 1 and 2 in the survey correlation model (were treated separately before. This resulted in ~50kt (4.1%) reduction in biomass in 2020.

4. The VPA version of Muppet was run and CV in the survey estimated for each age group using a VPA model. That pattern was then used in the separable model with one estimated multiplier. Updated estimates of the survey CV-profile by age. This resulted in ~35 kt (2.8%) reduction in biomass in 2020.

5. An improvement in retrospective pattern was observed when dropping ages 1 and 2 from the fall survey. This resulted in ~30 kt (2.5%) reduction in biomass in 2020.

The sum of the changes itemized in 2.–5. resulted in a change in biomass estimates from 1205 kt to 996 kt in 2020, a reduction of 209 kt or 17%.

Additional information are found in the benchmark report (ICES, 2021)

9.2.3   The 2021 assessment

The framework: 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. The same framework is used to carry the stock dynamics forward to evaluate reference points and HCR.

Diagnostics: The diagnostic (see Tables 3.8, 3.9 and 3.9 and Figure 3.9) manifest the large negative residuals in the spring survey 2020 for the most important age groups (ages 4 to 8) as observed in the 2020 assessment, while residuals in these age groups in the 2021 are much closer to that observed historically. The spring survey residuals are however anomalously high for age groups 10 years and older in the last two years. As in the spring survey the fall survey residuals in 2020 are generally negative. A summarised diagnostic of the observed vs predicted survey biomass (Figure 3.10) illustrate deviation between the model estimates and the point estimates. There are indication that interannual variability in survey measurements in both surveys has increased in recent years compared with that observed in the past.

Results: The detailed result by age of the assessment are provided in Tables 3.11 and 3.12 and the stock summary in Table 3.13 and Figure 3.11. The reference biomass is estimated to be 940.767 kt in 2021 and the fishing mortality 0.43 in 2020. The first estimates of the 2019 and 2020 year classes indicate that they may be above the average since 2000 although this may not be manifested with future measurements.

Mohn's rho: One of the ToR for this year was to evaluate the retrospective pattern of the assessment (Figure 3.12) and calculate the Mohn's rho values. The default 5-year peels resulted in the following values:

variable	value
fbar	0.035
bio	0.018
ssb	-0.021
rec	0.074

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	value
fbar	0.020
bio	0.018
ssb	0.010
rec	0.018

Comparison with last year (Figure 3.13)

The reference stock (B_{4+}) in 2020 is now estimated to be 982 kt compared to 1205 kt last year. The SSB in 2020 is now estimated to be 385 kt compared to 486 kt estimated last year. Fishing mortality in 2019 is now estimated 0.39 compared to 0.33 estimated last year. Year classes 2017–2019 were estimated to be 162, 142 and 192 million in last year's assessment and are now estimated to be 143, 131 and 190 million.

9.2.3.1   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 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 was 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 an 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 a 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 $B_{trigger}$ (which was hence conveniently left undefined). 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. The simulation showed that the median realized value of fishing pressure given the trigger was ~0.30.

9.2.3.2   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

that normally because the advice is not for a calendar year but fishing year. It was decided to use the following metric in the summary (3.13) 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.

9.3   Reference

ICES 2021. 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.

Table 3.1: Icelandic cod in Division 5.a. Estimated catch in numbers (millions) by year and age in millions of fish in 1955–2020.

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
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

year	3	4	5	6	7	8	9	10	11	12	13	14
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

Table 3.2: Icelandic cod in Division 5.a. Estimated mean weight at age in the catch (kg) in period the 1955–2020. The weights for age groups 3 to 9 in 2021 are based on predictions from the 2021 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
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

year	3	4	5	6	7	8	9	10	11	12	13	14
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
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	1.001	1.742	2.566	3.322	4.075	5.405	6.969	7.838	8.484	9.631	9.601	11.945

Table 3.3: 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
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

Table 3.4: Icelandic cod in Division 5.a. Estimated weight at age in the spawning stock (kg) in period the 1955–2021. 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
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

year	3	4	5	6	7	8	9	10	11	12	13	14
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
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	1.348	2.943	3.817	4.523	6.061	7.879	7.838	8.484	9.631	9.601	11.945

Table 3.5: Icelandic cod in Division 5.a. Estimated maturity at age in period the 1955–2021.

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
1956	0.019	0.025	0.033	0.111	0.577	0.782	0.818	0.980	0.980	1.000	1.000	1
1957	0.019	0.026	0.043	0.100	0.549	0.801	0.842	0.990	1.000	1.000	1.000	1
1958	0.019	0.028	0.086	0.520	0.682	0.801	0.834	1.000	1.000	1.000	1.000	1
1959	0.019	0.029	0.070	0.535	0.772	0.818	0.834	0.990	1.000	1.000	1.000	1
1960	0.019	0.026	0.066	0.577	0.782	0.826	0.834	0.990	1.000	1.000	1.000	1
1961	0.019	0.025	0.053	0.450	0.772	0.818	0.834	0.990	0.990	1.000	1.000	1
1962	0.019	0.025	0.048	0.281	0.791	0.834	0.834	0.990	0.990	1.000	1.000	1
1963	0.019	0.025	0.048	0.237	0.706	0.834	0.849	1.000	1.000	1.000	1.000	1
1964	0.019	0.026	0.048	0.329	0.762	0.826	0.849	1.000	1.000	1.000	1.000	1
1965	0.019	0.025	0.045	0.354	0.751	0.826	0.842	1.000	1.000	1.000	1.000	1
1966	0.019	0.026	0.045	0.394	0.791	0.849	0.849	1.000	1.000	1.000	1.000	1
1967	0.019	0.028	0.051	0.341	0.772	0.842	0.849	1.000	1.000	1.000	1.000	1
1968	0.019	0.025	0.051	0.292	0.682	0.801	0.842	1.000	1.000	1.000	1.000	1
1969	0.019	0.028	0.043	0.227	0.682	0.801	0.842	1.000	1.000	1.000	1.000	1
1970	0.019	0.023	0.041	0.227	0.644	0.772	0.818	1.000	1.000	1.000	1.000	1
1971	0.019	0.025	0.037	0.074	0.657	0.706	0.772	0.979	0.994	0.982	0.993	1
1972	0.019	0.023	0.035	0.106	0.450	0.772	0.809	0.979	0.994	0.982	0.993	1
1973	0.022	0.028	0.163	0.382	0.697	0.801	0.834	0.996	0.996	1.000	1.000	1
1974	0.020	0.031	0.085	0.346	0.636	0.790	0.818	0.989	1.000	1.000	1.000	1
1975	0.020	0.035	0.118	0.287	0.715	0.809	0.839	1.000	1.000	1.000	1.000	1
1976	0.025	0.026	0.086	0.253	0.406	0.797	0.841	1.000	1.000	1.000	1.000	1
1977	0.019	0.024	0.060	0.382	0.742	0.817	0.842	1.000	1.000	1.000	1.000	1
1978	0.025	0.025	0.052	0.192	0.737	0.820	0.836	1.000	1.000	1.000	1.000	1
1979	0.019	0.021	0.053	0.282	0.635	0.790	0.836	0.919	1.000	1.000	1.000	1
1980	0.026	0.021	0.047	0.225	0.653	0.777	0.834	0.977	1.000	0.964	1.000	1
1981	0.019	0.022	0.030	0.090	0.448	0.751	0.811	0.962	0.988	1.000	1.000	1
1982	0.021	0.025	0.038	0.065	0.297	0.705	0.815	0.967	1.000	1.000	1.000	1
1983	0.019	0.030	0.047	0.116	0.264	0.530	0.715	0.979	0.985	1.000	1.000	1
1984	0.019	0.024	0.053	0.169	0.444	0.620	0.716	0.949	0.969	0.948	1.000	1
1985	0.000	0.021	0.186	0.414	0.495	0.730	0.580	0.746	1.000	1.000	1.000	1
1986	0.001	0.023	0.154	0.398	0.681	0.727	0.936	0.667	1.000	1.000	1.000	1
1987	0.001	0.033	0.094	0.359	0.487	0.879	0.777	0.805	1.000	1.000	1.000	1
1988	0.006	0.029	0.220	0.498	0.446	0.677	0.932	0.890	1.000	1.000	1.000	1
1989	0.008	0.026	0.141	0.363	0.621	0.639	0.619	1.000	1.000	1.000	1.000	1
1990	0.006	0.012	0.154	0.428	0.576	0.781	0.774	0.714	1.000	1.000	1.000	1
1991	0.000	0.055	0.149	0.368	0.629	0.787	0.654	0.901	1.000	1.000	1.000	1
1992	0.002	0.062	0.265	0.407	0.813	0.916	0.880	1.000	1.000	1.000	1.000	1
1993	0.006	0.085	0.267	0.462	0.684	0.795	0.843	0.834	1.000	1.000	1.000	1

year	3	4	5	6	7	8	9	10	11	12	13	14
1994	0.008	0.109	0.338	0.590	0.706	0.921	0.694	0.830	1.000	1.000	1.000	1
1995	0.005	0.109	0.383	0.527	0.747	0.790	0.859	1.000	1.000	1.000	1.000	1
1996	0.002	0.032	0.186	0.501	0.653	0.733	0.810	0.774	1.000	1.000	1.000	1
1997	0.006	0.037	0.247	0.427	0.686	0.786	0.804	0.539	1.000	1.000	1.000	1
1998	0.000	0.061	0.208	0.486	0.782	0.807	0.809	0.852	1.000	1.000	1.000	1
1999	0.012	0.044	0.239	0.517	0.650	0.836	0.691	0.974	1.000	1.000	1.000	1
2000	0.001	0.065	0.248	0.512	0.611	0.867	0.998	0.999	1.000	1.000	1.000	1
2001	0.003	0.046	0.286	0.599	0.761	0.766	0.883	1.000	1.000	1.000	1.000	1
2002	0.006	0.086	0.321	0.656	0.759	0.920	0.559	0.724	1.000	1.000	1.000	1
2003	0.005	0.048	0.222	0.532	0.873	0.798	0.879	0.833	1.000	1.000	1.000	1
2004	0.000	0.040	0.249	0.549	0.631	0.833	0.807	0.854	1.000	1.000	1.000	1
2005	0.003	0.108	0.281	0.494	0.795	0.808	0.949	0.904	1.000	1.000	1.000	1
2006	0.002	0.023	0.298	0.446	0.749	0.874	0.739	0.741	1.000	1.000	1.000	1
2007	0.012	0.031	0.156	0.504	0.696	0.797	0.836	0.926	1.000	1.000	1.000	1
2008	0.001	0.042	0.275	0.546	0.728	0.833	0.850	0.958	1.000	1.000	1.000	1
2009	0.002	0.015	0.134	0.451	0.684	0.884	0.752	0.631	1.000	1.000	1.000	1
2010	0.000	0.015	0.057	0.380	0.821	0.868	0.927	0.813	1.000	1.000	1.000	1
2011	0.002	0.012	0.136	0.427	0.732	0.923	0.941	0.961	1.000	1.000	1.000	1
2012	0.004	0.031	0.127	0.414	0.730	0.884	0.963	0.850	1.000	1.000	1.000	1
2013	0.003	0.008	0.062	0.344	0.738	0.922	0.965	1.000	1.000	1.000	1.000	1
2014	0.000	0.026	0.069	0.238	0.615	0.893	0.967	0.956	1.000	1.000	1.000	1
2015	0.003	0.007	0.110	0.353	0.636	0.907	0.978	0.988	1.000	1.000	1.000	1
2016	0.001	0.009	0.025	0.289	0.543	0.731	0.941	0.986	1.000	1.000	1.000	1
2017	0.005	0.008	0.089	0.262	0.765	0.906	0.979	0.987	1.000	1.000	1.000	1
2018	0.002	0.013	0.147	0.434	0.605	0.935	0.953	1.000	1.000	1.000	1.000	1
2019	0.004	0.004	0.062	0.452	0.707	0.898	0.987	0.993	1.000	1.000	1.000	1
2020	0.001	0.037	0.065	0.298	0.763	0.878	0.976	1.000	1.000	1.000	1.000	1
2021	0.002	0.005	0.111	0.432	0.612	0.873	1.000	1.000	1.000	1.000	1.000	1

Table 3.6: 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	17.18	111.13	35.39	48.27	64.86	23.21	15.46	5.21	3.56	1.94	0.31	0.32	0.09	0.08
1986	15.61	61.09	96.43	22.57	21.74	27.73	7.36	2.85	0.97	0.85	0.31	0.08	0.06	0.04
1987	3.66	28.17	104.43	82.67	21.47	12.83	13.01	2.81	0.99	0.41	0.45	0.23	0.13	0.13
1988	3.45	7.08	73.15	103.77	69.57	8.47	6.57	7.28	0.70	0.29	0.12	0.27	0.06	0.05
1989	4.02	16.39	21.28	75.16	71.44	38.41	4.82	1.71	1.41	0.27	0.19	0.06	0.01	0.01
1990	5.47	11.74	26.44	14.30	27.98	35.30	16.78	1.76	0.58	0.47	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	16.96	33.51	18.78	16.44	6.80	6.33	5.75	1.48	0.23	0.04	0.04	0.04	NA
1993	3.55	4.66	30.75	36.67	13.49	10.59	2.42	2.02	1.39	0.41	0.13	0.03	0.03	0.01
1994	14.22	14.72	9.02	26.93	22.47	6.08	3.95	0.79	0.53	0.50	0.18	0.02	0.03	0.01
1995	1.08	29.27	24.77	9.07	24.56	18.47	4.04	1.92	0.39	0.20	0.24	0.14	0.03	NA
1996	3.70	5.42	42.50	29.69	13.25	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	33.15	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	27.69	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	40.59	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	36.90	29.21	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
2015	21.06	10.98	28.05	42.23	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	24.95	33.72	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	36.88	16.11	28.81	26.66	15.32	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	29.45	13.21	19.32	10.07	18.48	15.32	7.49	10.27	7.34	4.13	3.56	2.04	0.48	0.02
2021	19.23	40.30	26.90	34.21	18.08	33.56	21.40	6.79	6.01	5.30	3.19	2.48	1.17	0.38

Table 3.7: 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	7.45	10.04	4.08	0.59	0.34	0.37	0.03	NA	0.06
2000	15.24	3.76	11.55	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	5.53	4.86	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	4.00	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	17.95	18.81	5.89	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	6.01	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	2.46	1.68	0.74	0.26	0.16
2020	14.99	8.78	12.79	11.51	4.01	4.04	2.34	1.49	0.90	0.36	0.17

Table 3.8: Icelandic cod in Division 5.a. Catch at age residuals from the ADCAM model 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	-0.05
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	0.11	-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	0.36	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	0.18	0.27	-0.13	0.23	-0.15	-0.21	-0.34	-0.11	-0.08	-0.02
1972	-0.46	-0.22	0.17	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	-0.33	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	0.11	-0.10	0.06	-0.15	0.14	-0.17	-0.15	0.03	0.07	-0.03	0.02
1977	-0.54	-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	0.16	-0.09	0.08	-0.12	-0.06	-0.08	-0.02	0.03
1979	0.13	0.26	-0.16	0.01	0.06	0.08	-0.25	-0.03	-0.02	-0.06	-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	0.18	0.07	0.30	0.08	0.15	-0.02	0.06
1982	-0.50	-0.04	0.07	-0.08	-0.26	0.18	0.22	0.03	-0.10	-0.22	-0.02	-0.04
1983	-0.86	-0.56	0.12	0.19	0.09	0.09	0.00	-0.08	-0.05	0.07	-0.07	0.03
1984	0.26	0.04	-0.01	0.01	-0.04	0.06	0.02	-0.18	-0.36	-0.07	0.04	-0.01
1985	0.12	0.18	-0.03	0.11	-0.10	-0.03	-0.19	-0.01	-0.08	-0.30	-0.02	0.01
1986	0.31	-0.16	0.05	0.01	0.11	-0.07	0.03	-0.20	-0.01	-0.05	-0.21	-0.02
1987	-0.17	0.13	0.09	-0.13	0.04	0.04	0.01	0.06	-0.07	-0.02	-0.01	-0.04
1988	-0.30	-0.15	0.04	0.15	-0.21	0.07	0.14	0.05	0.19	0.05	0.08	0.01
1989	-0.41	0.04	0.28	0.07	-0.05	-0.20	-0.24	-0.04	0.02	0.06	0.01	-0.02
1990	-0.01	-0.20	-0.03	0.12	0.10	-0.03	-0.16	-0.11	0.06	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	-0.02	0.00	-0.02	-0.07	-0.05	-0.01	0.00
1993	1.00	0.01	-0.29	-0.09	-0.29	-0.15	0.26	0.56	0.20	0.02	-0.01	0.02

year	3	4	5	6	7	8	9	10	11	12	13	14
1994	0.61	0.32	-0.13	-0.27	-0.07	0.01	-0.04	0.16	0.39	0.09	0.04	0.01
1995	0.81	0.20	0.11	-0.07	-0.09	-0.13	-0.16	-0.09	0.01	0.26	0.07	0.02
1996	0.09	0.16	-0.33	0.01	0.08	-0.02	0.02	0.09	-0.02	0.04	0.13	0.01
1997	-0.47	0.14	-0.10	-0.28	-0.09	0.24	0.07	0.20	0.15	-0.01	0.05	0.05
1998	-0.50	-0.25	0.03	0.07	-0.13	-0.20	0.18	0.00	0.08	0.07	0.05	0.01
1999	-0.25	0.01	-0.06	0.11	0.05	-0.17	-0.29	-0.17	-0.08	-0.02	0.00	0.00
2000	0.36	-0.34	0.09	-0.06	-0.03	0.13	-0.06	-0.09	0.06	0.05	0.02	0.01
2001	0.75	0.33	-0.26	0.11	-0.01	-0.15	0.18	0.20	0.04	0.13	0.00	0.06
2002	0.12	0.21	0.10	-0.08	0.07	0.09	0.06	0.28	0.12	0.03	0.06	0.00
2003	-0.05	0.09	0.07	-0.05	0.02	0.15	0.18	-0.06	0.07	0.04	0.03	0.07
2004	-0.48	0.03	0.06	0.01	-0.12	0.15	0.03	0.14	-0.09	0.05	0.02	0.01
2005	0.04	-0.45	0.08	-0.05	-0.19	-0.07	0.20	0.08	0.16	0.06	0.04	0.00
2006	-0.18	-0.05	-0.28	0.15	0.00	-0.04	-0.01	0.13	-0.01	-0.01	-0.02	0.01
2007	-0.31	0.04	-0.16	-0.07	-0.14	0.12	0.08	0.23	0.38	0.01	0.16	-0.01
2008	-0.24	-0.36	0.06	-0.09	0.09	-0.05	0.14	0.18	0.05	0.07	0.05	-0.01
2009	-0.11	-0.26	-0.02	0.20	0.09	0.15	-0.13	-0.25	-0.06	-0.17	0.00	-0.01
2010	-0.03	-0.03	-0.13	-0.01	0.22	0.01	0.08	-0.22	-0.20	-0.08	0.01	0.03
2011	-0.11	-0.05	0.12	0.01	0.07	0.09	-0.11	-0.08	-0.21	-0.25	-0.12	-0.04
2012	-0.17	0.01	0.02	-0.05	0.10	0.16	0.01	-0.27	-0.16	-0.25	-0.11	-0.04
2013	0.40	-0.04	0.02	-0.04	-0.04	-0.05	0.05	-0.04	-0.20	-0.09	-0.09	-0.07
2014	0.03	0.01	0.03	-0.07	0.07	-0.02	-0.03	0.10	0.08	-0.15	0.04	0.07
2015	0.33	0.23	0.03	-0.06	-0.08	0.03	-0.08	-0.04	0.31	-0.16	-0.21	-0.05
2016	0.05	0.19	-0.14	-0.01	0.11	-0.03	0.04	0.00	-0.03	0.16	-0.17	-0.15
2017	0.25	0.25	0.15	-0.08	-0.08	-0.09	-0.06	0.09	-0.06	-0.05	0.09	0.02
2018	0.11	0.20	-0.01	0.06	-0.03	0.11	-0.08	-0.21	-0.12	-0.07	-0.21	0.00
2019	-0.18	-0.30	-0.05	-0.05	-0.15	-0.12	0.13	0.29	0.32	0.09	0.11	0.07
2020	-0.38	0.11	0.13	0.15	-0.01	-0.22	-0.11	0.13	-0.01	0.01	0.18	0.23

Table 3.9: Icelandic cod in Division 5.a. Spring survey (SMB) at age residuals from the ADCAM model, 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	-0.02	0.25	0.49	0.08	0.34	0.47	0.22	0.19	0.40	-0.05	-0.32	-0.10	0.09
1986	0.35	-0.18	-0.47	-0.21	-0.05	-0.11	-0.11	-0.27	-0.26	-0.13	-0.16	-0.12	-0.33	-0.04
1987	0.61	-0.11	0.02	-0.53	0.06	-0.02	-0.01	-0.01	-0.06	-0.05	0.15	0.12	0.17	0.09
1988	-0.24	-0.09	0.46	0.10	-0.11	-0.30	0.16	0.53	-0.07	-0.08	-0.04	0.26	0.02	0.08
1989	0.29	0.03	0.55	0.51	0.23	0.12	-0.04	-0.10	0.18	0.01	0.15	0.02	-0.07	-0.02
1990	-0.55	0.03	0.10	0.09	-0.15	-0.36	0.04	-0.13	-0.08	0.05	0.07	-0.10	0.05	0.06
1991	-0.02	-0.59	0.05	0.22	0.33	0.03	0.00	-0.14	0.22	0.08	0.13	-0.09	0.14	0.16
1992	-0.29	0.15	-0.23	0.08	-0.03	-0.01	-0.13	-0.11	0.04	0.02	-0.08	-0.02	0.07	-0.01
1993	-0.50	-0.10	0.34	-0.08	0.10	0.14	-0.08	-0.02	-0.01	0.03	0.14	0.02	0.04	0.02
1994	0.54	-0.31	0.08	0.18	-0.17	-0.22	0.03	-0.10	-0.03	0.09	0.12	0.00	0.05	0.01
1995	-0.33	0.14	-0.19	-0.05	0.22	0.02	-0.09	0.02	0.01	-0.08	0.13	0.19	0.05	-0.01
1996	-0.70	-0.28	0.12	-0.11	0.20	-0.01	0.29	0.49	0.23	0.03	-0.05	0.30	0.18	0.11
1997	0.21	-0.09	0.17	0.33	-0.05	0.00	-0.06	0.21	-0.38	-0.20	0.22	0.01	0.26	0.21
1998	-0.05	0.18	-0.19	0.20	0.55	0.30	0.10	0.13	0.31	0.28	0.09	-0.07	0.02	-0.02
1999	0.09	0.24	-0.03	0.10	0.02	0.09	0.02	-0.06	-0.13	0.02	0.07	0.05	-0.02	-0.01
2000	0.87	0.24	0.36	-0.14	0.00	-0.07	-0.20	0.03	-0.31	-0.24	-0.26	-0.03	0.06	0.02
2001	0.15	-0.02	0.12	-0.04	-0.47	-0.17	-0.27	-0.58	-0.31	0.05	-0.06	0.06	0.09	0.04
2002	-0.27	0.22	0.15	0.16	0.10	0.04	-0.10	-0.21	-0.42	-0.18	-0.05	-0.09	-0.05	-0.01
2003	-0.11	-0.38	0.03	-0.04	-0.07	-0.26	-0.08	-0.01	0.16	-0.45	-0.08	-0.06	0.16	-0.02
2004	-0.12	0.24	-0.18	0.33	0.18	0.34	0.25	0.30	0.55	0.21	0.17	-0.12	-0.03	0.01
2005	-0.23	0.12	0.25	-0.14	0.12	0.08	-0.04	0.03	0.05	0.23	0.23	0.30	0.02	-0.01
2006	0.15	-0.07	0.05	0.14	-0.05	0.15	-0.15	-0.36	-0.33	-0.17	-0.17	-0.06	-0.06	-0.02
2007	-0.01	0.24	-0.31	-0.15	-0.09	-0.08	-0.37	-0.10	0.00	-0.10	0.24	0.06	-0.02	-0.02
2008	-0.09	0.05	0.02	-0.38	-0.18	-0.07	0.21	-0.09	0.01	-0.24	0.04	0.06	0.02	-0.02
2009	0.24	-0.12	-0.09	-0.12	-0.06	-0.04	-0.09	-0.03	-0.27	-0.21	-0.32	-0.16	0.10	0.03
2010	-0.12	-0.26	-0.15	-0.12	-0.06	-0.10	-0.06	-0.10	0.24	-0.05	-0.14	0.01	-0.08	0.02
2011	-0.74	-0.34	-0.40	-0.22	0.02	0.12	0.16	0.07	-0.08	-0.22	-0.04	-0.24	-0.10	-0.05
2012	0.11	-0.30	-0.19	0.21	0.43	0.38	0.41	0.24	0.10	0.11	0.20	-0.09	0.26	0.14
2013	-0.02	0.15	-0.22	-0.16	0.05	0.07	0.03	0.17	0.46	0.08	0.10	0.36	-0.18	0.29
2014	-0.03	0.20	-0.09	-0.09	-0.04	0.07	-0.04	-0.23	-0.29	0.00	-0.49	-0.23	-0.10	-0.01
2015	0.48	0.33	-0.06	-0.11	-0.28	0.06	0.05	0.31	-0.08	0.03	0.16	-0.24	-0.30	0.03
2016	0.84	0.35	0.21	0.11	0.16	0.10	0.21	0.05	0.08	-0.20	-0.23	0.18	-0.23	-0.12
2017	-0.36	0.08	0.02	0.22	0.04	0.06	0.15	0.12	0.27	0.40	0.23	-0.01	0.27	-0.23
2018	0.05	0.21	-0.13	0.00	-0.05	-0.04	-0.10	0.13	-0.20	-0.16	-0.28	-0.22	-0.25	-0.11
2019	-0.04	0.12	-0.20	-0.20	-0.16	-0.16	-0.11	-0.04	0.36	0.25	0.10	0.04	-0.01	-0.32
2020	0.14	-0.17	-0.41	-0.69	-0.68	-0.65	-0.49	-0.27	-0.10	0.27	0.40	0.48	0.10	-0.31
2021	0.16	0.07	0.12	0.07	-0.17	0.15	0.03	-0.10	0.00	0.36	0.68	0.69	0.60	0.32

Table 3.10: Icelandic cod in Division 5.a. Fall survey (SMH) at age residuals from the ADCAM model, assessment tuned with both the spring and the fall survey.

year	3	4	5	6	7	8	9	10	11	12	13
1996	-0.17	-0.32	-0.13	-0.11	0.21	0.26	-0.11	0.00	-0.05	0.06	0.01
1997	-0.14	0.19	0.04	-0.07	-0.21	-0.16	-0.24	-0.04	-0.04	0.03	0.08
1998	-0.37	-0.05	-0.05	0.40	0.52	0.08	0.23	0.03	-0.01	0.03	0.01
1999	0.11	0.09	0.11	-0.02	-0.10	-0.43	-0.34	0.12	-0.04	-0.04	0.14
2000	-0.41	-0.20	-0.18	-0.26	-0.40	-0.30	0.00	0.15	0.06	0.01	0.02
2001	-0.03	-0.04	-0.29	-0.25	-0.25	-0.54	-0.49	-0.18	0.10	-0.02	-0.01
2002	-0.32	0.15	-0.01	0.24	0.08	0.08	0.01	-0.23	0.26	0.00	0.07
2003	-0.05	-0.25	-0.14	-0.24	-0.17	0.18	-0.04	-0.24	0.03	0.01	0.02
2004	0.02	0.10	0.16	0.10	0.27	0.46	0.56	0.13	0.05	0.11	-0.01
2005	-0.01	-0.02	0.29	-0.02	-0.28	-0.24	-0.14	0.03	-0.05	0.07	0.04
2006	0.04	0.10	0.09	0.07	0.05	-0.17	0.01	-0.01	0.01	-0.05	0.01
2007	-0.51	-0.27	-0.02	0.02	-0.16	0.07	-0.21	0.12	-0.06	0.09	-0.02
2008	0.04	-0.12	0.16	0.31	0.32	0.29	-0.04	0.20	0.12	0.14	0.00
2009	0.16	0.14	0.25	0.15	0.22	0.28	0.26	0.16	0.07	0.14	0.00
2010	0.15	0.22	0.18	0.03	0.19	0.27	0.46	0.13	0.21	-0.11	0.14
2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2012	-0.15	-0.26	-0.19	-0.11	0.05	0.25	0.03	0.00	0.21	-0.18	0.04
2013	-0.04	-0.18	-0.10	-0.08	-0.03	0.08	0.29	0.13	0.19	0.40	0.15
2014	0.15	-0.02	-0.08	0.02	-0.07	0.10	0.18	0.48	0.35	0.35	0.38
2015	0.61	0.40	0.15	0.25	0.22	-0.08	0.07	-0.29	-0.05	0.04	0.01
2016	0.04	-0.15	-0.12	-0.28	-0.15	-0.19	-0.17	0.00	-0.09	0.18	-0.07
2017	0.44	0.58	0.46	0.44	0.20	0.09	-0.02	-0.09	0.11	0.03	0.29
2018	0.02	-0.08	-0.21	-0.20	-0.02	0.19	0.06	0.02	-0.04	-0.01	-0.11
2019	0.49	0.15	-0.10	-0.08	-0.18	-0.36	-0.21	-0.25	-0.30	-0.21	-0.05
2020	-0.19	-0.33	-0.41	-0.30	-0.40	-0.34	-0.41	0.02	-0.13	-0.16	-0.02

Table 3.11: Icelandic cod in Division 5.a. Estimates of fishing mortality 1955–2020 based on ACAM 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
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	0.97	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	0.53	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	0.85	0.81	0.68	0.71	0.71	0.71
1977	0.04	0.19	0.33	0.48	0.60	0.70	0.69	0.66	0.55	0.58	0.58	0.58
1978	0.03	0.15	0.27	0.38	0.49	0.57	0.56	0.53	0.44	0.46	0.46	0.46
1979	0.03	0.14	0.25	0.36	0.46	0.54	0.53	0.50	0.42	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	0.76	0.74	0.71	0.59	0.62	0.62	0.62
1982	0.05	0.23	0.41	0.58	0.74	0.86	0.84	0.80	0.67	0.71	0.71	0.71
1983	0.04	0.22	0.38	0.55	0.69	0.81	0.79	0.75	0.63	0.66	0.66	0.66
1984	0.04	0.20	0.36	0.51	0.64	0.75	0.74	0.70	0.59	0.62	0.62	0.62
1985	0.05	0.23	0.40	0.57	0.72	0.84	0.82	0.79	0.66	0.69	0.69	0.69
1986	0.06	0.28	0.49	0.69	0.88	1.02	1.00	0.96	0.80	0.84	0.84	0.84
1987	0.06	0.29	0.51	0.74	0.93	1.09	1.06	1.01	0.85	0.89	0.89	0.89
1988	0.06	0.30	0.52	0.75	0.95	1.11	1.08	1.03	0.87	0.91	0.91	0.91
1989	0.05	0.25	0.43	0.62	0.78	0.91	0.89	0.85	0.71	0.75	0.75	0.75
1990	0.05	0.25	0.44	0.63	0.79	0.92	0.90	0.86	0.72	0.76	0.76	0.76
1991	0.06	0.30	0.52	0.75	0.94	1.10	1.08	1.03	0.86	0.90	0.90	0.90
1992	0.07	0.33	0.58	0.83	1.05	1.23	1.20	1.15	0.96	1.00	1.00	1.00
1993	0.07	0.32	0.57	0.81	1.03	1.20	1.18	1.12	0.94	0.98	0.98	0.98

year	3	4	5	6	7	8	9	10	11	12	13	14
1994	0.04	0.22	0.39	0.55	0.70	0.82	0.80	0.76	0.64	0.67	0.67	0.67
1995	0.04	0.14	0.30	0.45	0.58	0.66	0.73	0.78	0.79	0.78	0.78	0.78
1996	0.03	0.13	0.29	0.42	0.55	0.63	0.70	0.74	0.75	0.74	0.74	0.74
1997	0.03	0.13	0.29	0.43	0.56	0.64	0.71	0.75	0.77	0.75	0.75	0.75
1998	0.04	0.16	0.35	0.53	0.68	0.78	0.86	0.91	0.93	0.91	0.91	0.91
1999	0.05	0.19	0.42	0.62	0.80	0.92	1.01	1.07	1.10	1.07	1.07	1.07
2000	0.05	0.19	0.42	0.63	0.81	0.93	1.03	1.09	1.11	1.09	1.09	1.09
2001	0.05	0.18	0.39	0.58	0.75	0.86	0.95	1.01	1.03	1.00	1.00	1.00
2002	0.04	0.15	0.32	0.48	0.62	0.71	0.78	0.83	0.85	0.83	0.83	0.83
2003	0.04	0.14	0.32	0.47	0.61	0.69	0.76	0.81	0.83	0.81	0.81	0.81
2004	0.04	0.15	0.33	0.50	0.64	0.74	0.81	0.86	0.88	0.86	0.86	0.86
2005	0.04	0.14	0.32	0.48	0.62	0.71	0.78	0.83	0.85	0.83	0.83	0.83
2006	0.04	0.14	0.30	0.45	0.58	0.67	0.74	0.78	0.80	0.78	0.78	0.78
2007	0.03	0.13	0.28	0.42	0.54	0.62	0.68	0.72	0.74	0.72	0.72	0.72
2008	0.04	0.11	0.20	0.31	0.38	0.48	0.48	0.51	0.49	0.61	0.61	0.61
2009	0.04	0.12	0.21	0.34	0.41	0.51	0.51	0.55	0.53	0.65	0.65	0.65
2010	0.03	0.10	0.18	0.29	0.35	0.44	0.44	0.47	0.45	0.55	0.55	0.55
2011	0.03	0.10	0.17	0.27	0.33	0.41	0.41	0.44	0.42	0.52	0.52	0.52
2012	0.03	0.10	0.17	0.27	0.33	0.42	0.41	0.44	0.43	0.53	0.53	0.53
2013	0.03	0.10	0.18	0.29	0.36	0.45	0.45	0.48	0.46	0.57	0.57	0.57
2014	0.03	0.09	0.16	0.26	0.32	0.40	0.40	0.43	0.42	0.51	0.51	0.51
2015	0.03	0.09	0.16	0.25	0.31	0.39	0.39	0.41	0.40	0.49	0.49	0.49
2016	0.03	0.09	0.16	0.26	0.32	0.40	0.40	0.42	0.41	0.50	0.50	0.50
2017	0.03	0.09	0.16	0.26	0.32	0.40	0.40	0.43	0.41	0.50	0.50	0.50
2018	0.03	0.10	0.18	0.28	0.34	0.43	0.43	0.46	0.45	0.55	0.55	0.55
2019	0.03	0.11	0.19	0.31	0.38	0.47	0.47	0.50	0.49	0.60	0.60	0.60
2020	0.04	0.12	0.22	0.35	0.42	0.53	0.53	0.57	0.55	0.67	0.67	0.67

Table 3.12: Icelandic cod in Division 5.a. Estimates of numbers at age in the stock 1955–2021 (in millions) based on ACAM 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	161.466	143.753	151.013	211.538	199.648	110.944	31.895	20.439	9.572	77.118	6.371	4.706	5.491	1.819
1956	215.103	161.466	143.752	116.169	145.111	128.588	70.707	19.157	11.537	5.181	38.311	2.975	2.276	2.655
1957	304.213	215.103	161.466	110.614	79.752	93.561	82.043	42.526	10.831	6.256	2.580	17.937	1.442	1.103
1958	153.622	304.213	215.103	123.337	74.375	49.990	57.962	47.578	34.749	5.594	2.937	1.131	8.173	0.657
1959	195.931	153.623	304.213	162.880	80.900	45.079	29.901	32.185	39.722	16.937	2.449	1.190	0.479	3.459
1960	125.111	195.930	153.622	232.505	109.691	50.818	27.989	17.388	17.477	31.618	7.987	1.079	0.545	0.219
1961	173.200	125.111	195.930	116.474	153.060	66.811	30.553	15.641	9.001	8.591	13.983	3.273	0.461	0.233
1962	197.565	173.200	125.111	149.273	77.737	94.981	40.958	17.490	25.151	4.569	3.950	5.986	1.459	0.206
1963	219.616	197.565	173.200	95.289	99.542	48.184	58.157	23.411	9.302	12.742	2.096	1.686	2.661	0.649
1964	233.050	219.616	197.565	130.583	61.737	59.333	28.323	31.605	11.719	4.408	5.387	0.817	0.688	1.086
1965	320.419	233.050	219.616	147.332	82.017	35.281	33.376	14.577	14.821	5.161	1.707	1.902	0.304	0.256
1966	171.116	320.419	233.050	162.545	90.576	45.528	19.253	16.545	6.535	6.208	1.881	0.563	0.664	0.106
1967	239.593	171.116	320.419	173.839	102.168	51.813	25.637	9.922	7.771	2.883	2.409	0.666	0.210	0.247
1968	179.438	239.593	171.116	240.565	111.296	59.922	29.947	13.645	4.844	3.579	1.178	0.904	0.262	0.083
1969	192.968	179.438	239.593	126.604	147.748	61.699	32.655	44.935	6.104	2.024	1.301	0.388	0.315	0.091
1970	141.824	192.968	179.438	180.708	82.116	88.196	36.323	31.391	22.546	2.898	0.858	0.509	0.159	0.129
1971	277.781	141.824	192.968	132.759	110.979	45.518	48.059	17.973	14.042	9.421	1.053	0.282	0.177	0.055
1972	186.988	277.781	141.824	139.982	77.093	57.020	22.913	21.560	23.525	5.147	2.923	0.290	0.083	0.052
1973	259.329	186.988	277.781	102.947	81.435	39.707	28.777	10.312	8.606	8.660	1.605	0.809	0.086	0.025
1974	370.981	259.329	186.988	200.362	58.822	40.933	19.536	12.549	3.964	3.038	2.567	0.420	0.227	0.024
1975	143.961	370.982	259.329	134.338	113.198	29.117	19.819	8.352	4.710	1.363	0.872	0.648	0.114	0.062
1976	225.108	143.962	370.982	186.526	76.148	56.285	14.165	8.523	3.157	1.632	0.395	0.222	0.178	0.031
1977	239.218	225.108	143.962	289.738	120.856	41.327	25.616	5.514	2.931	1.106	0.594	0.164	0.089	0.071
1978	140.994	239.218	225.107	113.444	196.241	70.907	21.022	11.480	2.235	1.206	0.470	0.281	0.076	0.041
1979	145.929	140.994	239.218	178.701	79.698	122.778	39.536	10.582	5.328	1.050	0.581	0.247	0.144	0.039
1980	139.250	145.930	140.994	190.213	126.564	50.578	75.326	20.421	5.062	2.578	0.520	0.313	0.130	0.076
1981	230.639	139.250	145.930	111.769	132.695	78.212	27.708	45.416	9.234	2.319	1.212	0.268	0.157	0.065
1982	140.599	230.639	139.250	114.670	74.648	75.958	38.409	11.876	17.474	3.612	0.938	0.550	0.118	0.069
1983	139.345	140.599	230.639	108.791	74.421	40.631	34.713	15.030	4.109	6.159	1.322	0.391	0.222	0.048
1984	303.152	139.346	140.599	180.729	71.660	41.577	19.272	14.238	5.494	1.528	2.374	0.576	0.166	0.094
1985	251.883	303.151	139.345	110.497	120.789	41.071	20.454	8.279	5.493	2.154	0.619	1.079	0.255	0.073
1986	176.012	251.883	303.152	108.974	72.067	66.318	19.003	8.130	2.917	1.971	0.802	0.262	0.443	0.105
1987	96.786	176.012	251.884	234.746	67.674	36.303	27.133	6.464	2.389	0.876	0.619	0.295	0.093	0.157
1988	131.121	96.786	176.012	194.398	143.394	33.115	14.250	8.758	1.786	0.676	0.260	0.217	0.099	0.031
1989	113.564	131.121	96.786	135.689	118.089	69.484	12.818	4.519	2.371	0.495	0.197	0.090	0.072	0.033
1990	170.010	113.564	131.121	75.410	86.881	92.665	30.696	4.805	1.487	0.796	0.173	0.079	0.035	0.028
1991	126.349	170.010	113.564	102.087	48.112	45.891	40.570	11.377	1.560	0.493	0.275	0.069	0.030	0.013
1992	81.465	126.349	170.010	87.568	62.084	23.360	17.814	12.912	3.093	0.434	0.144	0.095	0.023	0.010
1993	145.063	81.465	126.349	130.205	51.490	28.411	8.333	5.094	3.098	0.762	0.113	0.045	0.028	0.007
1994	159.988	145.063	81.465	96.895	77.068	23.838	10.304	2.433	1.252	0.782	0.203	0.036	0.014	0.009

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1995	94.018	159.987	145.062	63.805	63.669	42.872	11.238	4.194	0.881	0.462	0.299	0.088	0.015	0.006
1996	158.086	94.019	159.988	114.594	45.594	38.565	22.454	5.154	1.771	0.347	0.174	0.111	0.033	0.006
1997	76.603	158.085	94.019	126.606	82.435	28.028	20.646	10.595	2.248	0.723	0.136	0.067	0.043	0.013
1998	162.111	76.603	158.086	74.347	90.821	50.361	14.867	9.626	4.558	0.905	0.278	0.051	0.026	0.017
1999	150.099	162.110	76.603	124.097	51.869	52.167	24.380	6.157	3.617	1.579	0.297	0.090	0.017	0.008
2000	156.510	150.099	162.111	59.691	84.180	27.996	23.029	8.958	2.018	1.078	0.442	0.081	0.025	0.005
2001	174.114	156.510	150.099	126.223	40.372	45.142	12.240	8.356	2.894	0.592	0.296	0.119	0.022	0.007
2002	88.497	174.115	156.510	117.331	86.659	22.379	20.731	4.734	2.904	0.920	0.177	0.087	0.036	0.007
2003	149.780	88.497	174.115	123.337	83.072	51.427	11.371	9.141	1.911	1.089	0.329	0.062	0.031	0.013
2004	130.720	149.780	88.497	137.321	87.592	49.634	26.393	5.079	3.745	0.729	0.396	0.117	0.023	0.011
2005	97.891	130.720	149.780	69.633	96.660	51.314	24.740	11.352	1.993	1.361	0.252	0.134	0.041	0.008
2006	127.510	97.891	130.720	118.046	49.321	57.414	26.107	10.927	4.592	0.749	0.487	0.089	0.048	0.015
2007	115.199	127.510	97.891	103.237	84.271	29.809	29.972	11.923	4.592	1.800	0.281	0.179	0.033	0.018
2008	125.757	115.200	127.510	77.527	74.487	52.146	16.115	14.323	5.276	1.906	0.716	0.110	0.071	0.013
2009	166.957	125.757	115.199	100.781	56.758	55.618	31.177	9.004	7.263	2.678	0.935	0.358	0.049	0.032
2010	177.841	166.957	125.757	90.813	73.174	37.647	32.485	16.933	4.407	3.558	1.265	0.450	0.153	0.021
2011	128.170	177.841	166.957	99.699	67.131	50.088	23.128	18.761	8.950	2.331	1.825	0.660	0.212	0.072
2012	169.553	128.170	177.841	132.645	74.201	46.501	31.363	13.670	10.208	4.874	1.234	0.980	0.322	0.103
2013	143.996	169.553	128.170	141.221	98.564	51.254	28.986	18.436	7.387	5.521	2.560	0.658	0.474	0.156
2014	96.821	143.996	169.554	101.529	104.126	67.164	31.260	16.594	9.637	3.865	2.799	1.319	0.305	0.220
2015	151.035	96.821	143.996	134.765	75.664	72.296	42.213	18.561	9.081	5.279	2.058	1.512	0.648	0.150
2016	153.302	151.035	96.821	114.579	100.790	52.863	45.895	25.371	10.313	5.050	2.856	1.129	0.758	0.325
2017	115.027	153.302	151.034	76.987	85.500	70.138	33.346	27.371	13.960	5.680	2.704	1.552	0.559	0.375
2018	143.158	115.027	153.302	120.085	57.434	59.473	44.213	19.871	15.046	7.681	3.038	1.468	0.767	0.276
2019	130.767	143.158	115.027	121.588	88.888	39.407	36.674	25.651	10.563	8.006	3.964	1.593	0.695	0.363
2020	189.564	130.766	143.159	90.964	89.170	60.004	23.674	20.613	13.104	5.402	3.960	1.995	0.717	0.313
2021	163.431	189.565	130.766	112.735	65.826	58.801	34.720	12.713	9.945	6.329	2.513	1.879	0.836	0.300

Table 3.13: 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 the calendar year yield divided by the reference biomass in the start of the year, 'Harvest rate2' 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	Recruits	SSB	Yield	F5-10	Reference biomass	Harvest rate
1955	151.013	726.241	545.250	0.35	2090.320	0.24
1956	143.752	583.804	486.909	0.35	1818.140	0.26
1957	161.466	574.563	455.182	0.39	1639.740	0.30
1958	215.103	689.959	517.359	0.44	1650.370	0.29
1959	304.213	639.226	459.081	0.38	1580.310	0.30
1960	153.622	583.530	470.121	0.43	1657.860	0.25
1961	195.930	399.302	377.291	0.40	1430.560	0.27
1962	125.111	505.480	388.985	0.40	1464.330	0.27
1963	173.200	460.469	408.800	0.46	1298.680	0.33
1964	197.565	420.076	437.012	0.52	1210.650	0.33
1965	219.616	322.911	387.106	0.56	1052.680	0.35
1966	233.050	295.681	353.357	0.52	1063.260	0.32
1967	320.419	280.570	335.721	0.48	1139.610	0.32
1968	171.116	248.410	381.770	0.56	1242.860	0.32
1969	239.593	354.183	403.205	0.46	1335.750	0.34
1970	179.438	354.785	475.077	0.56	1332.670	0.34
1971	192.968	252.991	444.248	0.67	1083.340	0.38
1972	141.824	225.430	395.166	0.67	978.206	0.39
1973	277.781	244.838	369.205	0.71	829.801	0.44
1974	186.988	188.285	368.133	0.73	908.077	0.40
1975	259.329	174.257	364.754	0.72	889.039	0.40
1976	370.982	144.821	346.253	0.71	945.577	0.36
1977	143.962	197.742	340.086	0.58	1297.470	0.26
1978	225.107	211.015	329.602	0.47	1306.800	0.27
1979	239.218	306.679	366.462	0.44	1409.580	0.29
1980	140.994	368.922	432.237	0.49	1512.890	0.30
1981	145.930	268.023	465.032	0.62	1244.300	0.33
1982	139.250	177.331	380.068	0.71	980.697	0.33
1983	230.639	139.019	298.049	0.66	794.045	0.36
1984	140.599	148.271	282.022	0.62	908.082	0.34
1985	139.345	164.568	323.428	0.69	929.609	0.38
1986	303.152	191.453	364.797	0.84	855.173	0.45
1987	251.884	144.474	389.915	0.89	989.609	0.39
1988	176.012	159.873	377.554	0.91	985.283	0.37
1989	96.786	161.381	363.125	0.75	950.420	0.36
1990	131.121	197.404	335.316	0.76	815.683	0.39
1991	113.564	155.780	307.759	0.90	696.868	0.40

Year	Recruits	SSB	Yield	F5-10	Reference biomass	Harvest rate
1992	170.010	141.908	264.834	1.01	563.578	0.45
1993	126.349	114.550	250.704	0.99	599.228	0.34
1994	81.465	152.348	178.138	0.67	572.173	0.30
1995	145.062	174.084	168.592	0.58	567.699	0.31
1996	159.988	157.872	180.701	0.55	685.535	0.29
1997	94.019	191.678	203.112	0.57	792.512	0.29
1998	158.086	200.239	243.987	0.69	733.200	0.35
1999	76.603	175.092	260.147	0.81	724.660	0.34
2000	162.111	160.381	235.092	0.82	585.873	0.40
2001	150.099	157.143	236.707	0.75	649.756	0.34
2002	156.510	189.278	209.535	0.62	694.293	0.30
2003	174.115	185.748	207.241	0.61	725.876	0.30
2004	88.497	192.443	228.330	0.65	791.616	0.28
2005	149.780	220.740	213.863	0.62	717.393	0.28
2006	130.720	211.858	197.200	0.59	675.921	0.27
2007	97.891	195.743	171.641	0.54	651.464	0.24
2008	127.510	245.586	147.663	0.39	659.452	0.26
2009	115.199	225.779	183.315	0.42	726.787	0.24
2010	125.757	254.755	170.018	0.36	773.335	0.22
2011	166.957	311.443	172.197	0.34	819.615	0.23
2012	177.841	344.400	196.188	0.34	940.442	0.23
2013	128.170	364.574	223.593	0.37	1065.260	0.21
2014	169.554	333.010	222.013	0.33	1074.200	0.21
2015	143.996	439.073	230.168	0.32	1149.060	0.21
2016	96.821	382.258	251.238	0.33	1193.030	0.21
2017	151.034	506.895	243.922	0.33	1116.430	0.23
2018	153.302	493.086	267.222	0.35	1154.570	0.23
2019	115.027	436.468	263.015	0.39	1086.780	0.25
2020	143.159	384.961	270.303	0.43	982.186	0.26
2021	130.766	361.348	247.078	0.44	940.767	0.24
2022	189.565	338.572	NA	0.40	898.237	0.23
2023	163.431	349.326	NA	NA	976.021	NA
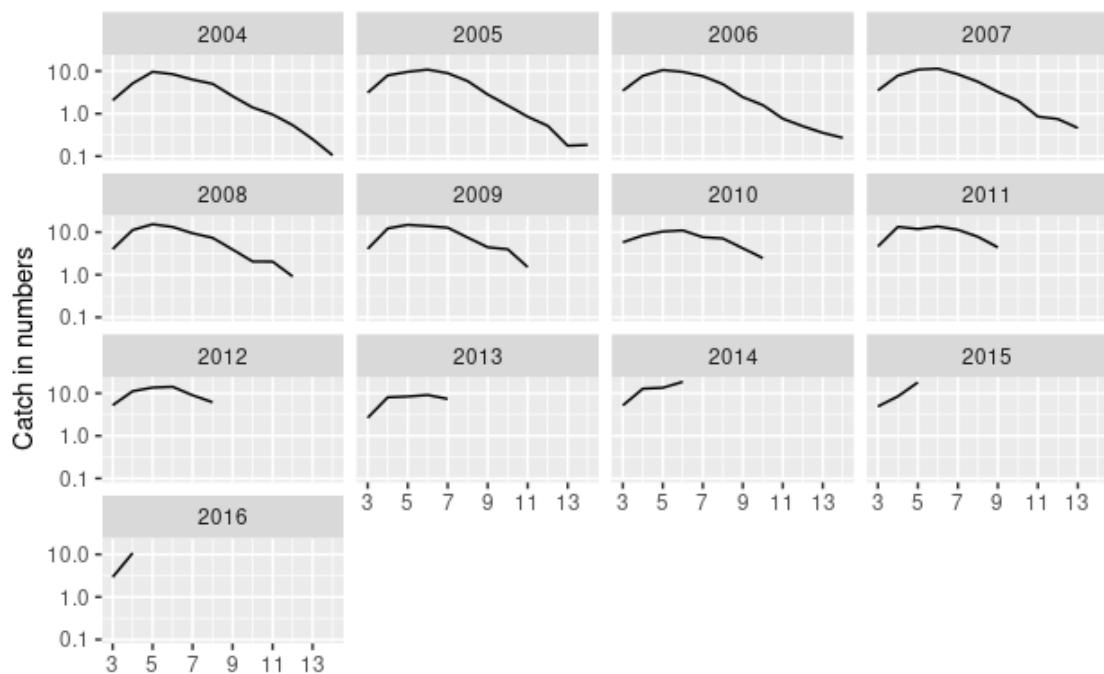
Figure 3.1: Icelandic cod division 5.a. Catch curve of recent year classes.
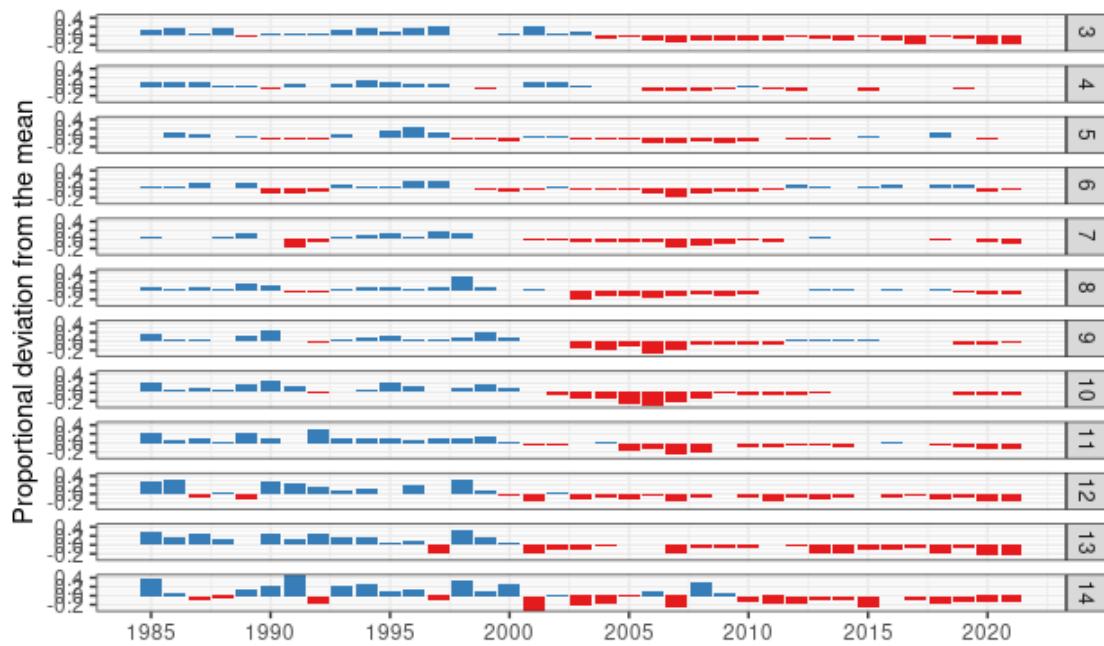
Figure 3.2: Icelandic cod division 5.a. Weight at age (numbers in panel indicate age classes) in the catches expressed as proportional deviations from the mean. Weight at age in the assessment year are estimates. Note that values that are equal to the mean are not visible in this type of a plot.
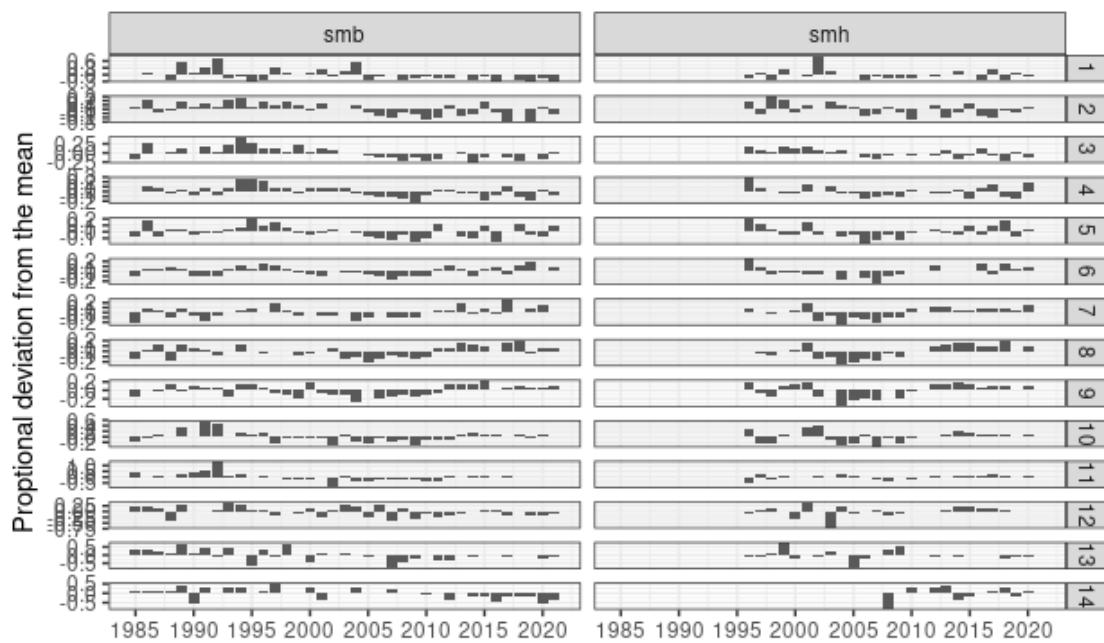
Figure 3.3: Icelandic cod division 5.a. Weight at age (numbers in panel indicate age classes) in the spring survey (SMB) and fall survey (SMH) expressed as proportional deviations from the mean. No fall survey was conducted in 2011. Note that values that are equal to the mean are not visible in this type of a plot.
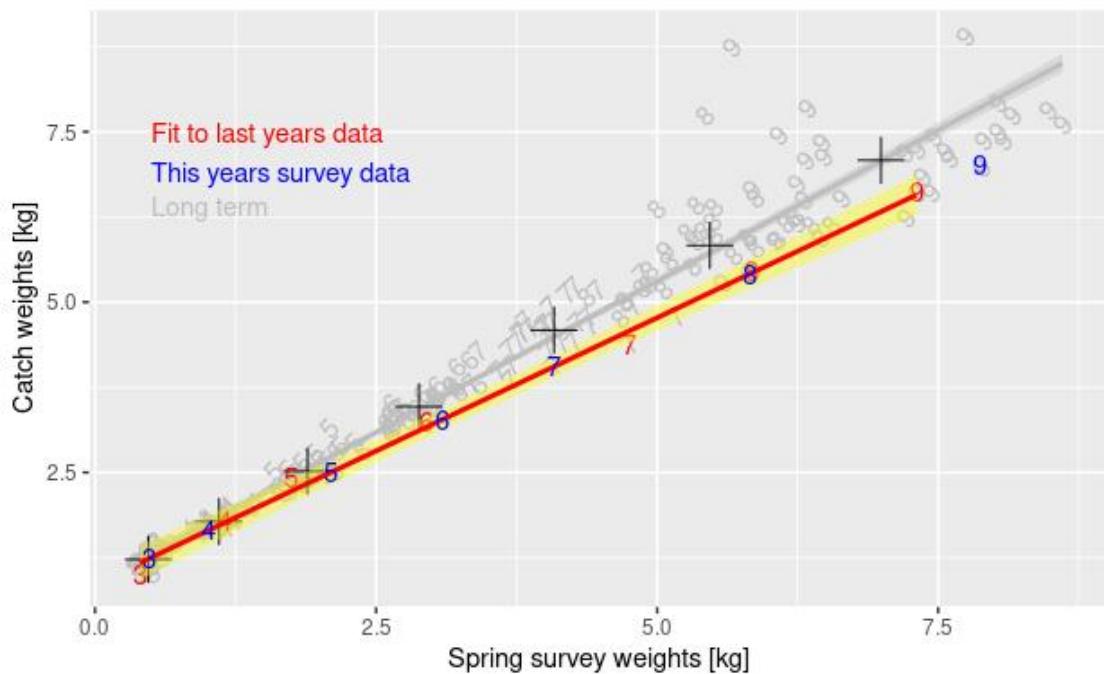
Figure 3.4: Icelandic cod division 5.a. Prediction of catch weights age 3 to 9 in the assessment year. The 'crossed' points are the mean from 1990 to the present.
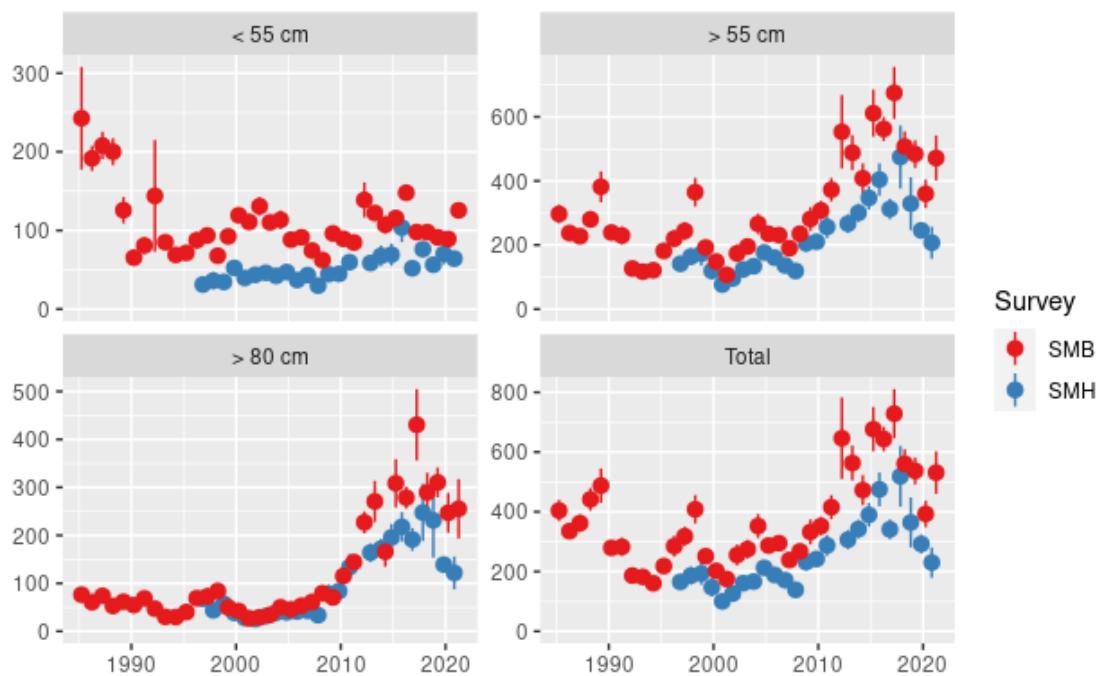
Figure 3.5: Icelandic cod division 5.a. Indices of cod in the spring (SMB, red) and fall (SMH, blue) groundfish surveys. Abundance index of fish less than 55 cm, (< 55 cm, top left) and biomass indices of 55 cm and larger (>55 cm, top right), biomass index 80 cm and larger (bottom left) and total biomass (Total, bottom right). The vertical bar show 1 standard error of the estimate.
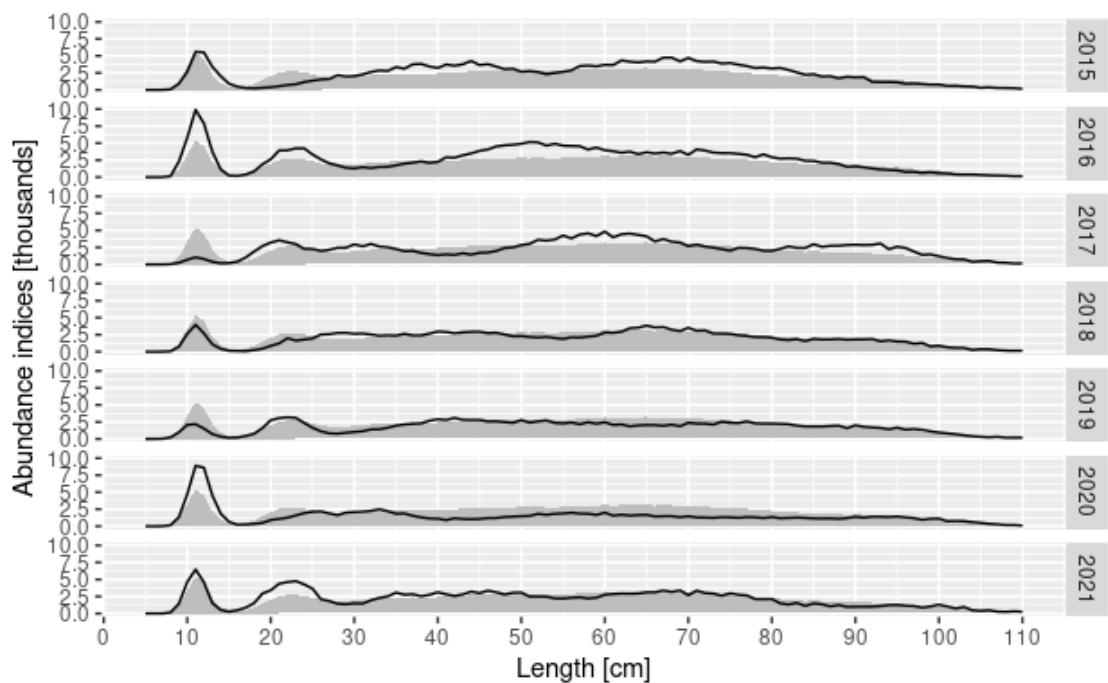
Figure 3.6: Icelandic cod division 5.a. Abundance indices of cod in the spring (SMB, red) by length in 2015 to 2021. The grey line is the average indices over the 6 years while the black line is yearly measurement.
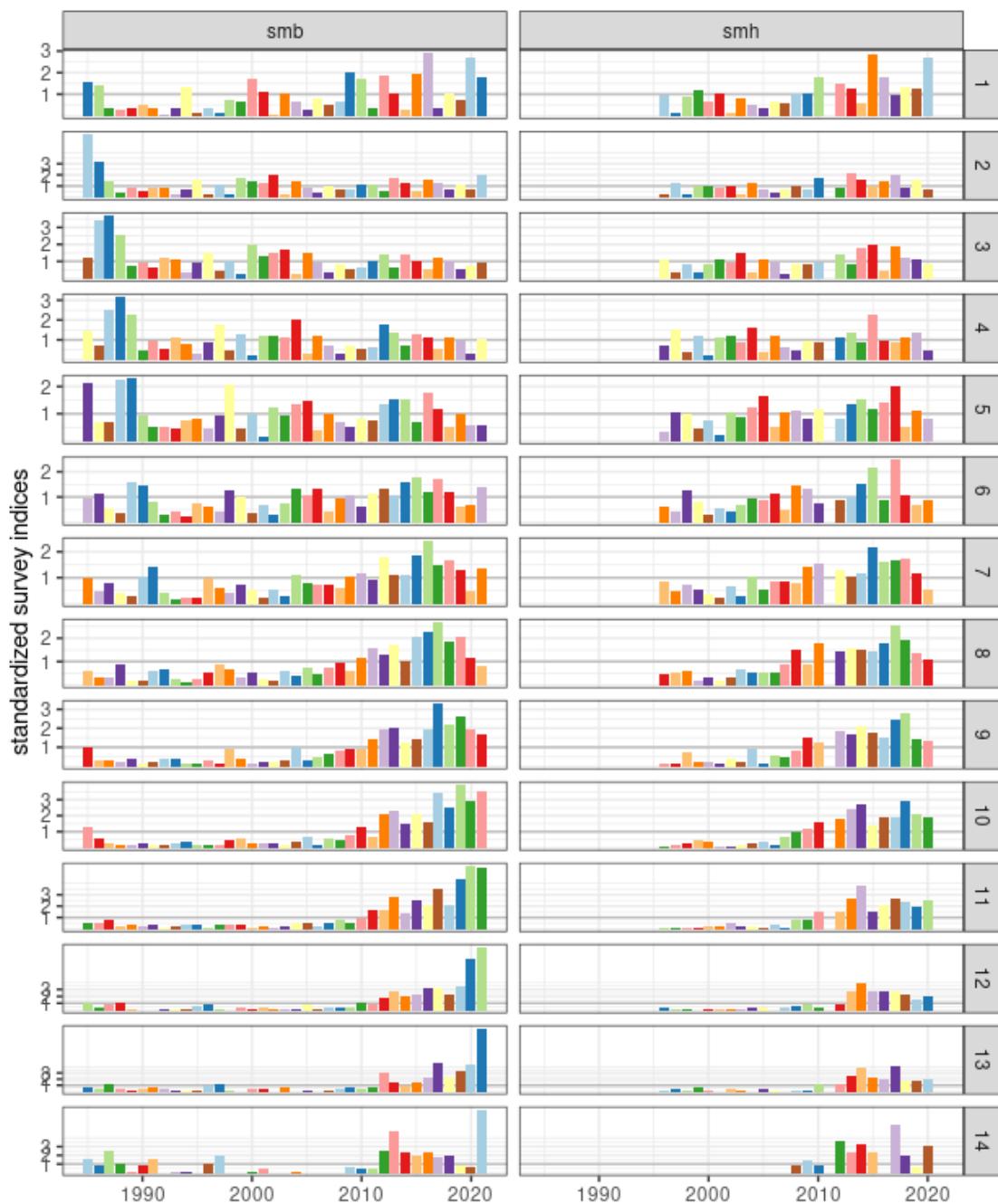
Figure 3.7: Icelandic cod division 5.a. Age based abundance indices of cod in the groundfish survey in spring (SMB) and fall (SMH). The indices are standardized within each age group and within each survey. Indices for age 11 to 14 are not used in the SPALY assessment but used in an alternative assessment.
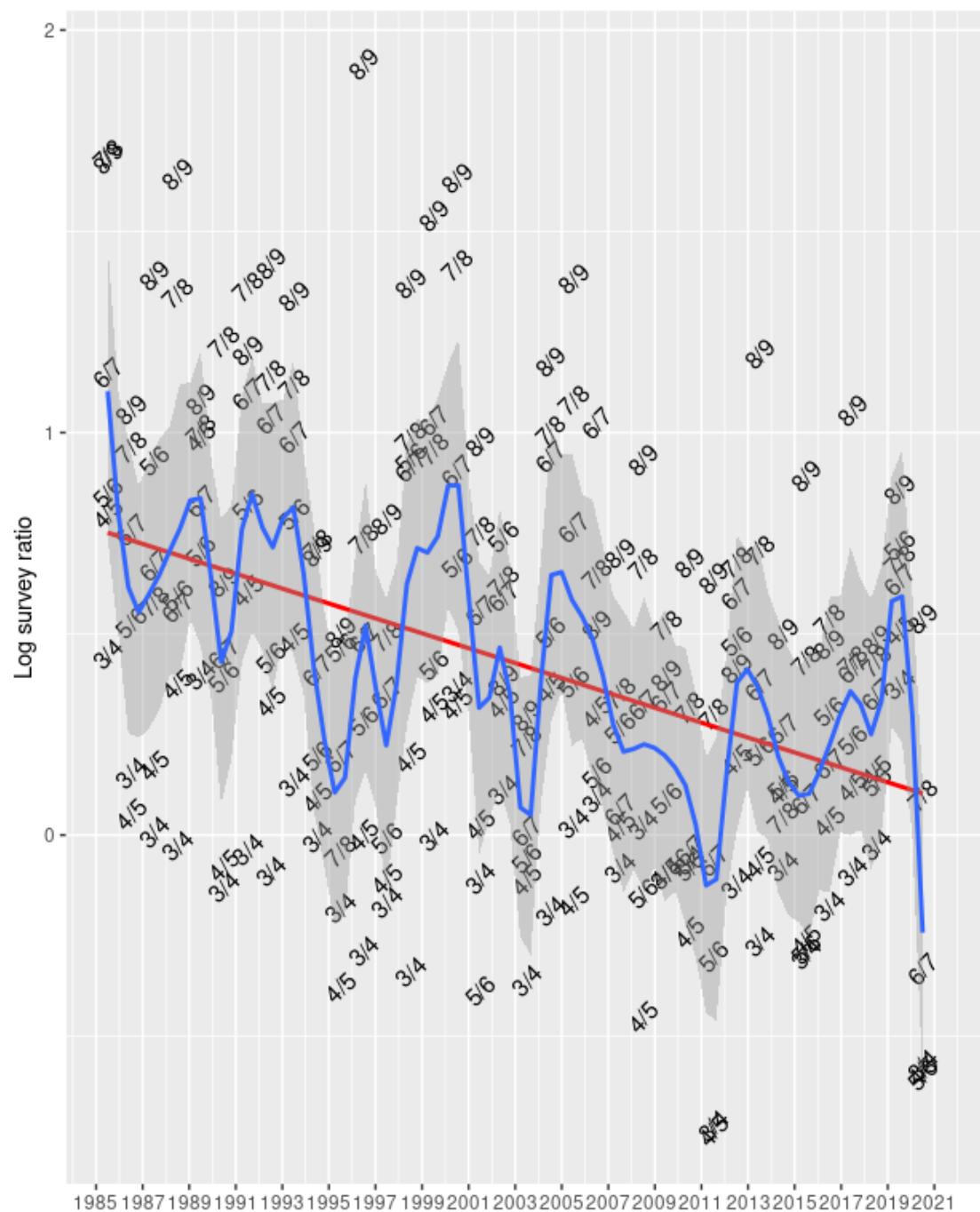
Figure 3.8: Icelandic cod division 5.a. Log ratio of the spring survey indices by age classes 3 to 9.
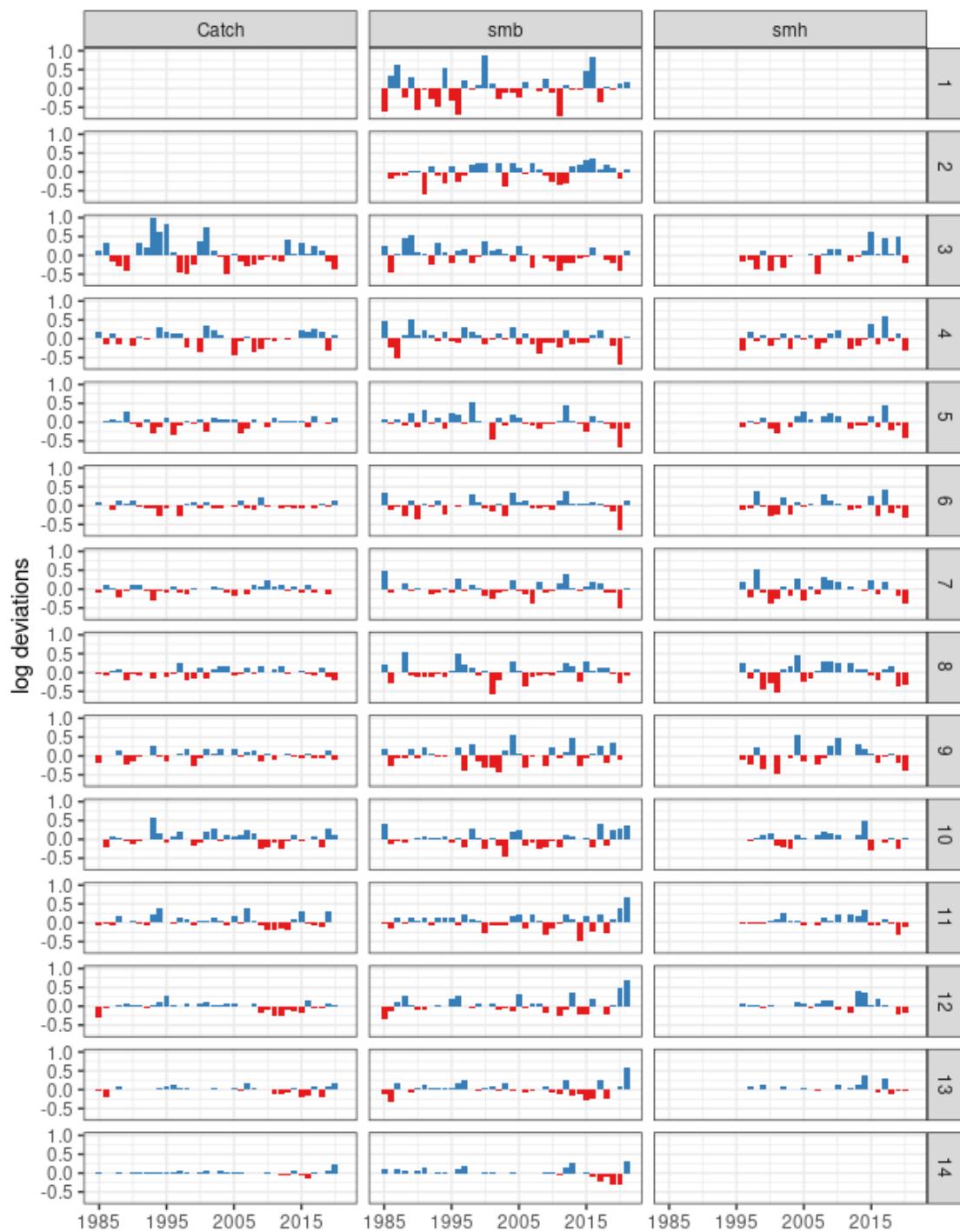
Figure 3.9: Catch residuals (left), spring survey residuals (SMB, middle) and fall survey residuals (SMH, right) by year and age. Note that values that are equal to zero are not visible in this type of a plot and that no survey was carried out in the fall 2011.
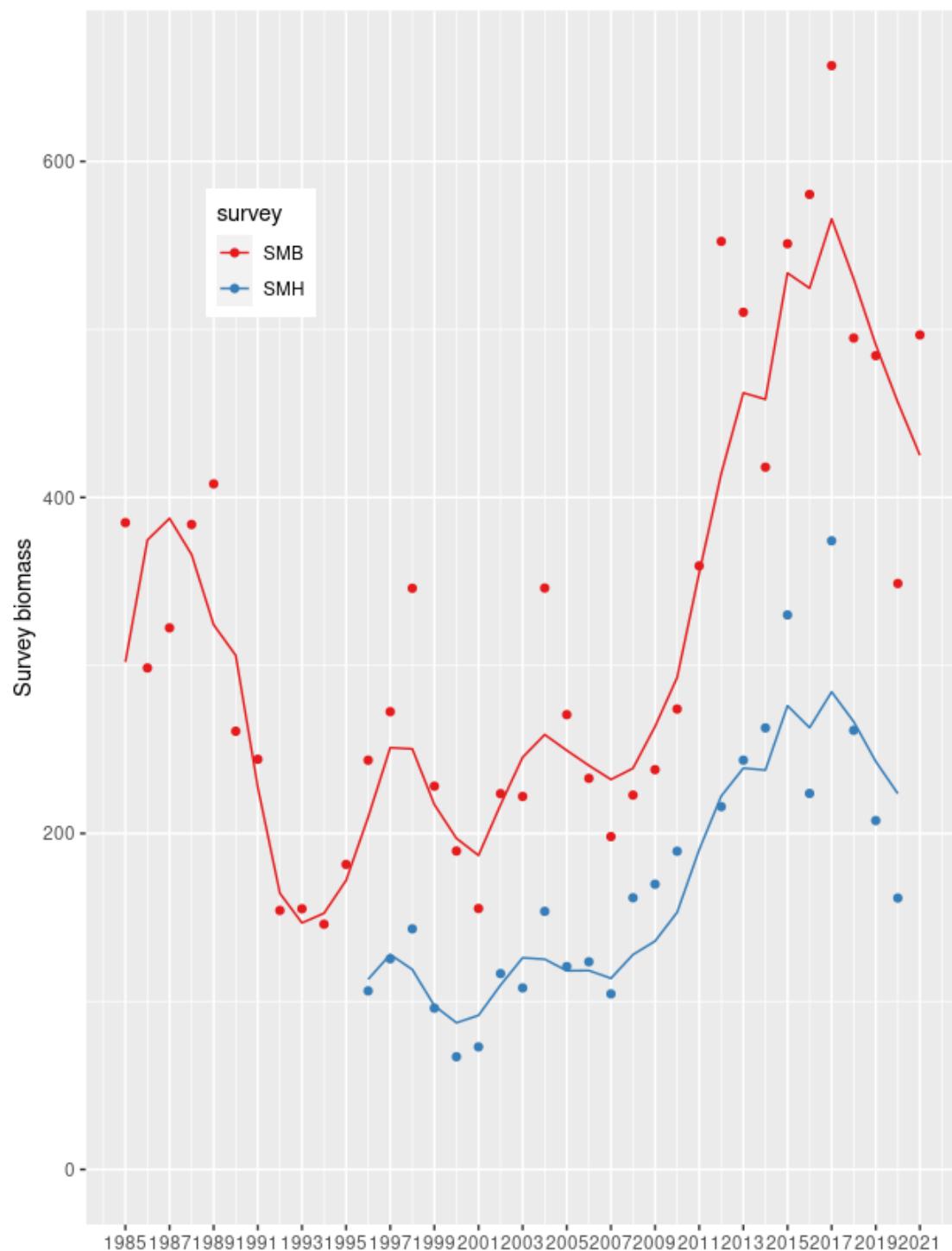
**Figure 3.10: Summary plot of observed vs predicted survey biomass.**
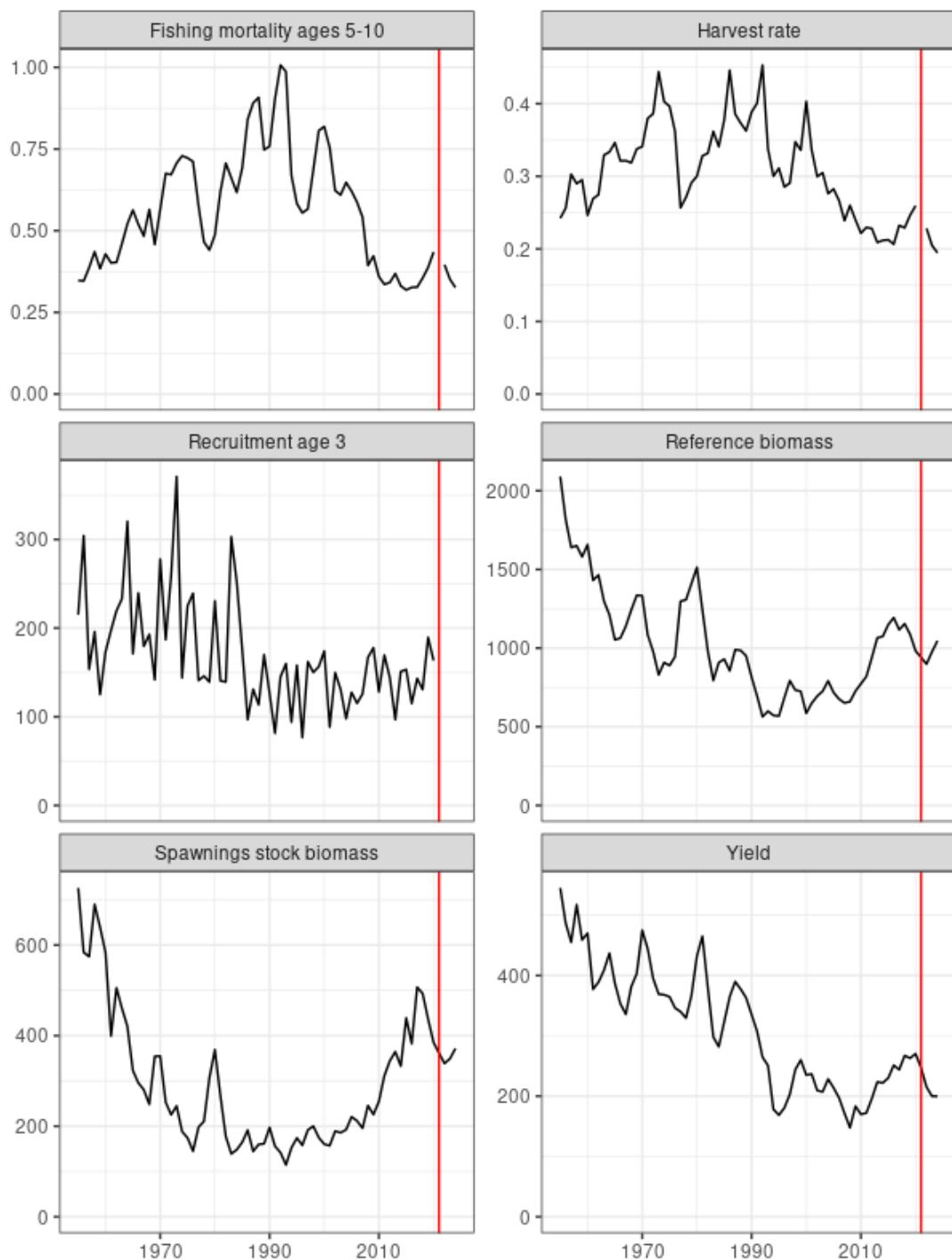
**Figure 3.11: Icelandic cod in division 5.a. Assessment summary. The x-axis for the recruitment refer to the year class.**
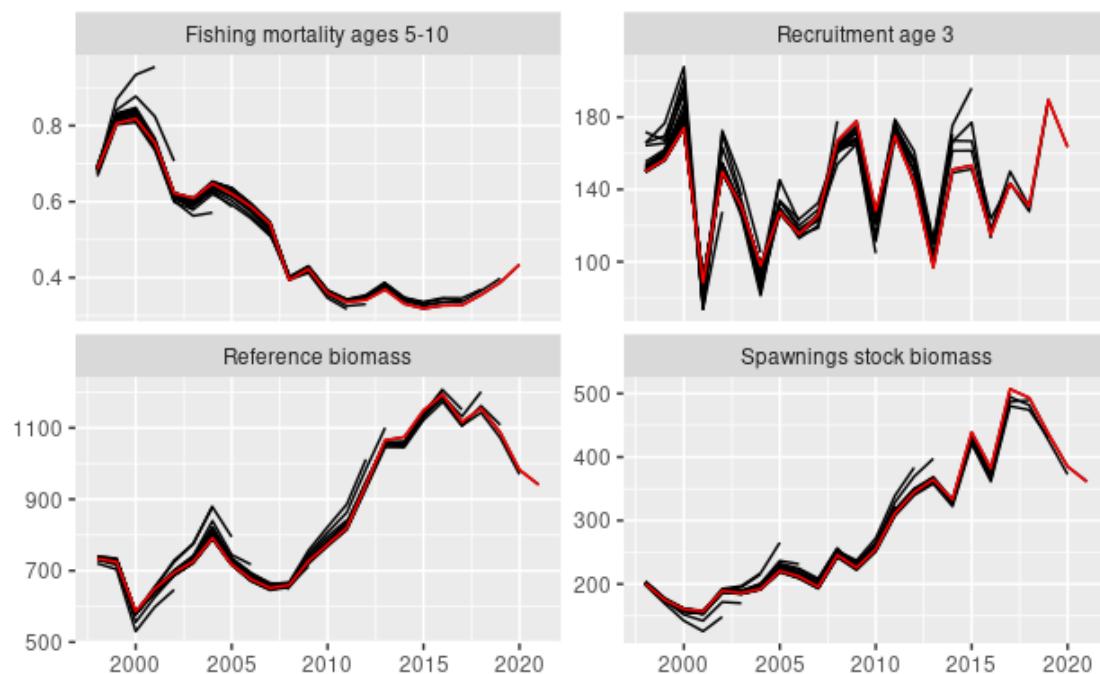
Figure 3.12: Icelandic cod in division 5.a. Analytical retrospective pattern of key metrics in the last eight years and the current estimates.
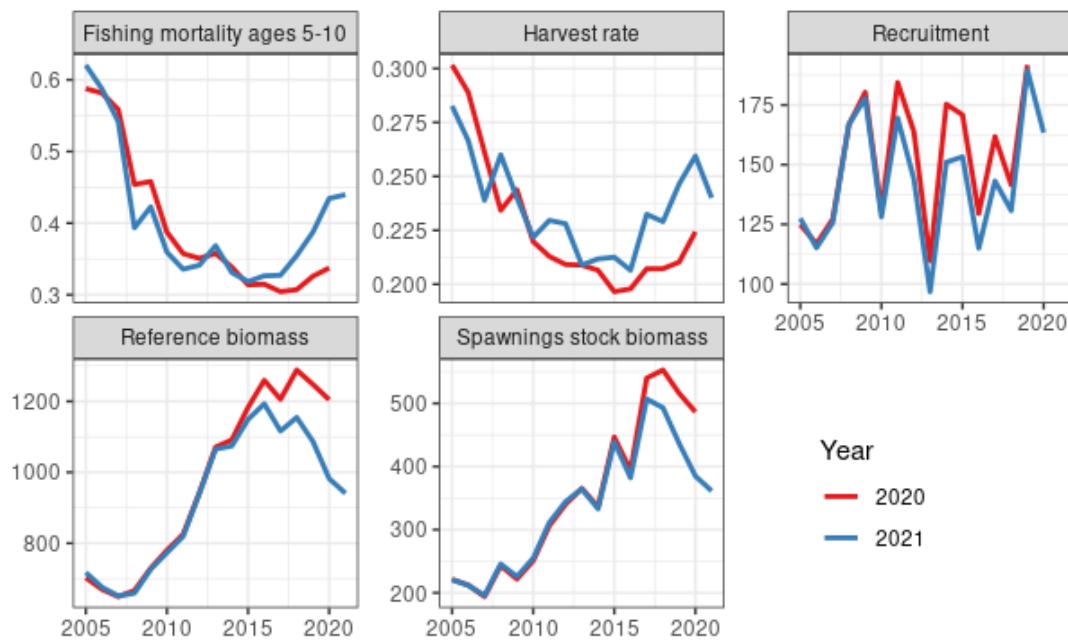

Figure 3.13: Icelandic cod in division 5.a. Comparison with last year's assessment