

ICES NWWG REPORT 2018

ICES ADVISORY COMMITTEE

ICES CM 2018 / ACOM:09

Report of the North Western Working Group (NWWG)

26 April - 3 May 2018

ICES HQ, Copenhagen, Denmark

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International Council for
the Exploration of the Sea

Conseil International pour
l'Exploration de la Mer

ICELANDIC COD IN VA

2018-05-06 13:13:25

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 (2017/2018) based on last years assessment was 257.572 kt.

The results of this years assessment show that the spawning stock in 2018 is estimated to be 651.6 kt. The values estimated in recent years are higher than have been observed during the last five decades. The reference biomass B_{4+} in 2018 is estimated to be 1356.509 kt. Fishing mortality is 0.26 in 2017 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 32% lower than observed in the period 1955 to 1985. Poor year-classes, below 120 millions, have however become less frequent in the most recent decade.

Given the above HCR rule the catch for the coming fishing year (2018/2018) is 264.437 kt.

This years assessment is an update. The input in the analytical age based assessment are catch at age 1955-2017 (age 3 to 14) and spring groundfish survey (often referred to as SMB in this report) indices at age from 1985-2018 and fall survey groundfish survey (often referred to as SMH in this report) indices at age from 1996-2017 (ages 1 to 10). The model framework has been the same since 2002, spring survey only used as input up to the 2009 assessment, both surveys since then.

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 2017 are estimated to have been 243.99 kt, the bulk taken by the Icelandic fleet.

The share of the catch by different gears in 2017 is according to the following in-text table:

gear	p
Long line	0.32
Gill net	0.07
Jiggers	0.06
Scottish seine	0.06
Bottom trawl	0.49

The trend in landings in last two decades is largely a reflection of the TAC that is set for the fishing year (starting 1. September and ending 31. August). According to the HCR the catch for the fishing year 2017/2018 was supposed to be capped to 244 kt. Landings of the Icelandic fleet was 234.649 kt. Including additional landings of some 2.995 kt of the foreign fleet the total was 237.644 kt.

The estimates of landings for the current calendar year of 254 kt is based on the remainder of the quota from the current fishing year (2017/18) on 1. January 2018 (163 kt), the catch that is expected to be taken from 1. September to 31. December 2018 (88 kt, 1/3rd of the advised TAC) 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). The method used for deriving these estimates assumes that discarding only occurs as high grading.

9.2.1.2 Catch in numbers and weight by age

Catch in numbers by age: The method for deriving the catch at age 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 catch at age matrix is reasonably consistent (Table 9.1), with CV estimated to be approximately 0.2 for age groups 4-10 based on a Shepherd-Nicholson model.

Mean weight at age in the landings: The mean weight age in the landings (Table 9.2 and Figure 9.1) 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 2017 around the average weights observed over the period from 1985 and close to the long term mean (1955-2017) in most 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 9.3 and Figure 9.2).

Prediction of catch weights in 2018: 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 landings 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 2018 (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 2018 then from:

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

Based on this the mean weights at age in the catches in 2018 are predicted to be around average (Figure 9.1 and Table 9.2) except for age class 4 and 7. For ages 10 and older the mean weights from the previous year are used.

9.2.1.3 Surveys

Length based indices: The total biomass indices from the spring (SMB) and the fall (SMH) surveys (Figure 9.4) indicate that the stock biomass has been increasing substantially in recent years and is in the last 5 years among highest since the start of the spring survey in 1985. The increase in biomass is most pronounced in larger fish.

Age based indices: Abundance indices by age from the spring and the fall surveys (Tables 9.6 and 9.7). Indices of older fish are all relatively high in recent years despite the indices of these year classes when younger are low or moderate in size (Figure 9.5). Any age based assessment model will interpret this pattern as being a decline in total mortality. The spring survey indices used as input in the assessment were not of the right base, this being corrected this year. The effect of this on the advice last year was less than 3%.

9.2.2 Assessment

The framework: The results from a statistical catch at age model (sometimes refer to as ADCAM) tuned with the spring and the fall survey have been used as the final point estimator upon which annual advice is based since 2002. In the framework catch at age are modeled and the fishing mortality can change gradually over time, constrained by a random walk. The survey residuals are modeled as multivariate normal distribution to account for potential survey “year effects” - this being a feature in place since 2002.

Diagnostics: The tuning with both the spring and the fall survey show similar diagnostics as that observed in previous years (see Tables 9.8, 9.9 and 9.10 and Figure 9.6 for the residuals). A negative residual block for spring survey indices age groups 2 to 5 in recent years may indicate that there may have been some change in catchability.

Results: The detailed result from the assessment are provided in Tables 9.11, 9.12 and the stock summary in Table 9.13} and Figure 9.7. The reference biomass is estimated to be 1356.509 kt in 2018 and the fishing mortality 0.26 in 2017.

Alternatives: Assessment based on tuning with the spring and the fall survey separately have in recent years shown that the fall survey gives a higher estimate than the spring survey (Figure 9.8). Tuning with spring survey only this year resulted in a reference biomass of 1162 kt in 2018 and a fishing mortality of 0.3 in 2017. An assessment based on the fall survey only gave reference biomass of 1428 kt in 2018 and fishing mortality of 0.25 in 2017.

Mohn's rho: One of the ToR for this year was to evaluate the retrospective pattern of the assessment (Figure 9.9) by calculating the Mohn's rho values. The default 5 year peels resulted in the following values:

variable	value
fbar	-0.007
bio	0.003
ssb	0.015
rec	0.010

Comparison with last year(Figure 9.10): The reference stock (B_{4+}) in 2017 is now estimated to be 1344 kt compared to 1349 kt last year. The SSB in 2017 is now estimated to be 633 kt compared to 617 kt estimated last year. Fishing mortality in 2016 is now estimated 0.27 compared to 0.28 estimated last year. Year classes 2014-2016 were estimated to be 191, 188 and 117 million in last years assessment and are now estimated to be 194, 192 and 135 millions.

9.2.3 HCR and reference points

The HCR upon which the TAC is set when the SSB in the assessment year is estimated to be above $SSB_{trigger}$ (220 kt) is as follows:

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

In case the SSB is estimated to be below $SSB_{trigger} = 220kt$ the 0.20 multiplier is reduced linearly. The $B_{4+,y}$ refers to the reference biomass (4 years and older) in the beginning of the assessment year (y). The notation $y/y + 1$ refers to the next fishing year (starting 1. September of the assessment year) and $y - 1/y$ to the current fishing year (ending 31. August of the assessment year). The advice for the 2017/2018 fishing season is:

$$TAC_{y/y+1} = (0.20 * 1354.028 + 257.572)/2 = 264.189kt$$

Although no prediction (besides catch weights in the assessment year) are needed to derive the advice, the basis as well as the calculation are provided (Table 9.14 and 9.15).

The 20% HCR rule was formally evaluated by ICES in 2009, but had been in place since the 2007/2008 fishing season. The evaluation showed that using the 0.20 multiplier would result in yield that was close to maximum (maximum yield when no catch stabilizer is used was estimated when applying a multiplier of around 0.22), while at the same time have a low probability that the stock would go below the $SSB_{trigger}$. The results were robust to numerous stock-recruitment scenarios tested, including assumption that future maximum mean recruitment would be around the mean observed since 1985 (Figure 9.8). All scenarios tested showed that there was very low probability that the stock would go below $B_{trigger} = 220kt$ and $B_{lim} = B_{loss} = 125kt$ (latter formally set in 2010) if the

above rule is followed. ICES concluded that the HCR was in conformity both the ICES PA and MSY approach.

Assessment errors ($CV = 0.15$, $\rho = 0.45$ (auto-correlation)) were included in the HCR evaluations. These errors were estimated from empirical retrospective pattern in the estimates of the reference biomass since the earliest available assessment in the 1970's. The distribution of the realized harvest rate when the HCR is followed showed that the 90% expected range are within a harvest rate of 0.15-0.27. The recent realized harvest rates are within the above range.

The F_{pa} is defined as 0.58 and is based on the current ICES derivation methodology. It is not a precautionary **advisory** reference point.

Table 9.1. Icelandic cod in Division Va. Estimated catch in numbers (millions) by year and age in millions of fish in 1955-2017.

year	3	4	5	6	7	8	9	10	11	12	13	14
1955	4.79 0	25.1 64	46.5 66	28.2 87	10.5 41	5.22 4	2.46 7	25.1 82	2.10 1	1.20 2	1.66 8	0.66 5
1956	6.70 9	17.2 65	31.0 30	27.7 93	14.3 89	4.26 1	3.42 9	2.12 8	16.8 20	1.55 2	1.52 2	1.54 5
1957	13.2 40	21.2 78	17.5 15	24.5 69	17.6 34	12.2 96	3.56 8	2.16 9	1.17 1	6.82 2	0.51 2	1.08 9
1958	25.2 37	30.7 42	14.2 98	10.8 59	15.9 97	15.8 22	12.0 21	2.00 3	2.12 5	0.77 1	3.50 8	0.72 3
1959	18.3 94	37.6 50	23.9 01	7.68 2	5.88 3	8.79 1	13.0 03	7.68 3	0.91 4	0.99 0	0.21 8	1.28 7
1960	14.8 30	28.6 42	27.9 68	14.1 20	8.38 7	6.08 9	6.39 3	11.6 00	3.52 6	0.69 2	0.18 3	0.51 0
1961	16.5 07	21.8 08	19.4 88	15.0 34	7.90 0	6.92 5	3.96 9	3.21 1	6.75 6	1.20 2	0.08 9	0.42 5
1962	13.5 14	28.5 26	18.9 24	14.6 50	12.0 45	4.27 6	8.80 9	2.66 4	1.88 3	2.98 8	0.40 5	0.32 4
1963	18.5 07	28.4 66	19.6 64	11.3 14	15.6 82	7.70 4	2.72 4	6.50 8	1.65 7	1.03 0	1.37 2	0.24 6
1964	19.2 87	28.8 45	18.7 12	11.6 20	7.93 6	18.0 32	5.04 0	1.43 7	2.67 0	0.65 5	0.37 0	1.02 5
1965	21.6 58	29.5 86	24.7 83	11.7 06	9.33 4	6.39 4	11.1 22	1.47 7	0.82 3	0.48 9	0.11 8	0.48 9
1966	17.9 10	30.6 49	20.0 06	13.8 72	5.94 2	7.58 6	2.32 0	5.58 3	0.40 7	0.36 3	0.29 9	0.31 1
1967	25.9 45	27.9 41	24.3 22	11.3 20	8.75 1	2.59 5	5.49 0	1.39 2	1.99 8	0.10 9	0.03 0	0.10 6
1968	11.9 33	47.3 11	22.3 44	16.2 77	15.5 90	7.05 9	1.57 1	2.50 6	0.51 2	0.65 9	0.04 7	0.09 8

196	11.1	23.9	45.4	17.3	12.5	14.8	1.59	0.47	0.34	0.06	0.02	0.02
9	49	25	45	97	59	11	0	5	0	4	4	1
197	9.87	47.2	23.6	25.4	15.1	12.2	14.4	0.56	0.20	0.14	0.03	0.05
0	6	10	07	51	96	61	69	7	7	7	5	0
197	13.0	35.8	45.5	21.1	17.3	10.9	6.00	4.21	0.23	0.06	0.03	0.02
1	60	56	77	35	40	24	1	0	7	9	8	0
197	8.97	29.5	30.9	22.8	11.0	9.78	10.5	3.93	1.24	0.11	0.03	0.00
2	3	74	18	55	97	4	38	8	2	9	1	1
197	36.5	25.5	27.3	17.0	12.7	3.68	4.71	5.80	1.13	0.28	0.00	0.00
3	38	42	91	45	21	5	8	9	4	2	7	1
197	14.8	61.8	21.8	14.4	8.97	6.21	1.64	2.53	1.76	0.33	0.06	0.02
4	46	26	24	13	4	6	7	0	5	4	2	8
197	29.3	29.4	44.1	12.0	9.62	3.69	2.05	0.75	0.89	0.41	0.06	0.04
5	01	89	38	88	8	1	1	2	1	6	0	6
197	23.5	39.7	21.0	24.3	5.80	5.34	1.29	0.63	0.20	0.15	0.06	0.02
6	78	90	92	95	3	3	7	3	5	5	5	9
197	2.61	42.6	32.4	12.1	13.0	2.80	1.77	0.42	0.08	0.02	0.00	0.00
7	4	59	65	62	17	9	3	1	6	4	6	2
197	5.99	16.2	43.9	17.6	8.72	4.11	0.97	0.34	0.11	0.04	0.01	0.02
8	9	87	31	26	9	9	8	8	9	8	5	7
197	7.18	28.4	13.7	34.4	14.1	4.42	1.43	0.35	0.16	0.04	0.02	0.00
9	6	27	72	43	30	6	2	0	8	3	4	4
198	4.34	28.5	32.5	15.1	27.0	7.84	2.22	0.64	0.24	0.09	0.02	0.00
0	8	30	00	19	90	7	8	6	6	9	5	4
198	2.11	13.2	39.1	23.2	12.7	26.4	4.80	1.67	0.58	0.22	0.05	0.06
1	8	97	95	47	10	55	4	7	2	8	3	8
198	3.28	20.8	24.4	28.3	14.0	7.66	11.5	1.91	0.32	0.09	0.04	0.01
2	5	12	62	51	12	6	17	2	7	4	3	1
198	3.55	10.9	24.3	18.9	17.3	8.38	2.05	2.73	0.51	0.21	0.06	0.03
3	4	10	05	44	82	1	4	3	4	5	4	7
198	6.75	31.5	19.4	15.3	8.08	7.33	2.68	0.51	0.53	0.19	0.09	0.03
4	0	53	20	26	2	6	0	2	8	5	0	6
198	6.45	24.5	35.3	18.2	8.71	4.20	2.26	1.06	0.21	0.23	0.10	0.03
5	7	52	92	67	1	1	4	3	7	3	2	8
198	20.6	20.3	26.6	30.8	11.4	4.44	1.77	0.80	0.39	0.10	0.07	0.04
6	42	30	44	39	13	1	1	5	2	3	6	4
198	11.0	62.1	27.1	15.1	15.6	4.15	1.46	0.59	0.25	0.14	0.04	0.05
7	02	30	92	27	95	9	3	2	3	2	6	8
198	6.71	39.3	55.8	18.6	6.39	5.87	1.34	0.45	0.30	0.15	0.11	0.02
8	3	23	95	63	9	7	5	5	5	7	4	5
198	2.60	27.9	50.0	31.4	6.01	1.91	0.88	0.22	0.10	0.08	0.03	0.00
9	5	83	59	55	0	5	1	5	7	6	8	5

199	5.78	12.3	27.1	44.5	17.0	2.57	0.60	0.32	0.11	0.05	0.01	0.02
0	5	13	79	34	37	3	9	2	8	0	5	0
199	8.55	25.1	15.4	21.5	25.0	6.36	0.90	0.24	0.12	0.06	0.01	0.01
1	4	31	91	14	38	4	3	3	5	3	1	2
199	12.2	21.7	26.5	11.4	10.0	8.30	2.00	0.25	0.04	0.03	0.00	0.00
2	17	08	24	13	73	4	6	7	6	2	9	8
199	20.5	33.0	15.1	13.2	3.58	2.78	2.70	1.18	0.18	0.03	0.01	0.01
3	00	78	95	81	3	5	7	1	0	4	1	3
199	6.16	24.1	19.6	6.96	4.39	1.25	0.59	0.50	0.28	0.04	0.01	0.00
4	0	42	66	8	3	7	9	8	3	9	8	6
199	10.7	9.10	16.8	13.0	4.11	1.59	0.31	0.18	0.15	0.14	0.02	0.00
5	70	3	29	66	5	6	3	4	6	1	9	8
199	5.35	14.8	7.37	12.3	9.42	2.15	0.83	0.20	0.07	0.06	0.05	0.00
6	6	86	2	07	9	7	7	8	6	5	5	5
199	1.72	16.4	17.2	6.71	7.37	5.95	1.14	0.49	0.12	0.02	0.03	0.02
7	2	42	98	1	9	8	7	3	6	8	7	1
199	3.45	7.70	25.3	20.1	5.89	3.85	2.95	0.50	0.19	0.05	0.03	0.01
8	8	7	94	67	3	6	1	0	6	5	3	3
199	2.52	19.5	15.2	24.6	12.9	2.79	1.48	0.74	0.14	0.04	0.01	0.00
9	5	54	26	22	66	5	9	8	0	6	0	5
200	10.4	6.58	29.0	11.2	11.3	5.71	1.10	0.56	0.31	0.07	0.02	0.00
0	93	1	80	27	90	4	4	7	4	4	2	6
200	13.5	26.0	9.11	20.2	5.85	3.76	2.02	0.50	0.19	0.13	0.01	0.03
1	53	00	1	13	0	0	8	8	9	7	3	1
200	6.00	17.7	24.0	7.16	9.42	2.45	1.55	0.73	0.15	0.05	0.04	0.00
2	9	85	31	0	4	1	5	8	0	8	1	4
200	5.49	16.3	22.0	16.6	4.84	4.93	1.20	0.50	0.21	0.04	0.02	0.03
3	0	13	45	28	0	3	1	7	1	6	6	3
200	1.78	17.9	24.0	17.9	10.1	2.88	1.97	0.49	0.16	0.08	0.01	0.00
4	4	60	43	01	66	0	8	9	2	7	9	8
200	5.27	5.30	26.1	16.9	8.54	4.89	1.29	0.79	0.21	0.09	0.03	0.00
5	1	2	83	22	3	0	2	0	6	6	7	5
200	3.44	13.1	8.83	22.0	10.5	4.68	2.16	0.47	0.24	0.04	0.01	0.01
6	7	12	6	70	43	4	5	1	0	0	6	0
200	2.05	11.6	15.9	8.59	9.89	5.68	2.28	1.13	0.33	0.08	0.06	0.00
7	4	40	38	9	5	1	1	9	2	8	7	6
200	3.10	5.12	12.8	11.6	5.15	4.70	2.13	0.88	0.28	0.06	0.04	0.00
8	4	5	49	41	3	8	9	0	0	7	3	4
200	3.45	7.92	9.62	17.8	10.5	3.88	2.29	0.74	0.31	0.08	0.02	0.01
9	8	6	7	95	03	8	5	2	5	9	2	2
201	3.50	7.72	9.58	8.44	10.9	5.54	1.56	0.92	0.29	0.14	0.06	0.01
0	8	4	7	9	28	7	6	3	8	4	3	7

201	4.00	7.84	10.5	10.8	6.28	6.29	2.42	0.68	0.41	0.13	0.04	0.01
1	2	6	77	20	7	1	9	0	9	4	0	6
201	4.05	11.2	10.8	9.56	8.91	5.00	3.21	1.15	0.29	0.22	0.08	0.02
2	7	49	15	0	9	9	3	2	2	7	1	6
201	5.77	12.2	15.3	11.4	7.59	5.79	2.57	1.83	0.65	0.20	0.14	0.03
3	6	24	47	13	4	2	1	3	3	9	6	6
201	4.61	8.36	14.8	13.2	8.43	4.93	2.81	1.39	0.96	0.37	0.12	0.10
4	8	8	84	77	0	1	6	5	4	6	7	7
201	5.23	13.3	10.3	13.8	9.40	5.61	2.44	1.56	0.95	0.40	0.12	0.03
5	0	45	71	86	6	2	1	1	0	7	5	7
201	2.86	10.8	12.1	10.4	13.0	7.34	3.22	1.62	0.86	0.54	0.18	0.05
6	9	88	14	11	91	9	8	4	4	2	8	7
201	5.35	7.98	13.4	13.6	7.62	7.52	3.89	2.03	0.75	0.50	0.26	0.14
7	2	1	03	35	7	5	4	4	1	4	5	6

Table 9.2. Icelandic cod in Division Va. Estimated mean weight at age in the landings (kg) in period the 1955-2017. The weights for age groups 3 to 9 in 2018 are based on predictions from the 2018 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	0.82	1.30	2.15	3.61	4.63	5.65	6.63	6.168	8.746	8.829	10.08	14.58
	7	7	7	7	8	7	5				6	4
1956	1.08	1.60	2.19	3.28	4.65	5.63	6.18	6.970	6.830	9.290	10.96	12.95
	0	0	0	0	0	0	0				5	4
1957	1.14	1.71	2.52	3.20	4.56	5.96	7.17	7.260	8.300	8.290	10.35	13.17
	0	0	0	0	0	0	0				0	4
1958	1.21	1.81	3.12	4.51	5.00	5.94	6.64	8.290	8.510	8.840	9.360	13.09
	0	0	0	0	0	0	0					7
1959	1.11	1.95	2.93	4.52	5.52	6.17	6.61	7.130	8.510	8.670	9.980	11.27
	0	0	0	0	0	0	0					6
1960	1.06	1.72	2.92	4.64	5.66	6.55	6.91	7.140	7.970	10.24	10.10	12.87
	0	0	0	0	0	0	0			0	0	1
1961	1.02	1.67	2.70	4.33	5.53	6.31	6.93	7.310	7.500	8.510	9.840	14.55
	0	0	0	0	0	0	0					0
1962	0.99	1.61	2.61	3.90	5.72	6.66	6.75	7.060	7.540	8.280	10.90	12.82
	0	0	0	0	0	0	0				0	6
1963	1.25	1.65	2.64	3.80	5.11	6.92	7.84	7.610	8.230	9.100	9.920	11.55
	0	0	0	0	0	0	0					3
1964	1.21	1.75	2.64	4.02	5.45	6.46	8.00	9.940	9.210	10.94	12.67	15.90
	0	0	0	0	0	0	0			0	0	0
1965	1.02	1.53	2.57	4.09	5.41	6.40	7.12	8.600	12.31	10.46	10.19	17.22
	0	0	0	0	0	0	0		0	0	0	0

196	1.17	1.68	2.59	4.18	5.73	6.90	7.83	8.580	9.090	14.23	14.09	17.92
6	0	0	0	0	0	0	0			0	0	4
196	1.12	1.82	2.66	4.06	5.56	7.79	7.84	8.430	9.090	10.09	14.24	16.41
7	0	0	0	7	0	0	0			0	0	2
196	1.17	1.59	2.68	3.93	5.04	5.91	7.51	8.480	10.75	11.58	14.64	16.01
8	0	0	0	0	0	0	0		0	0	0	1
196	1.10	1.81	2.48	3.77	5.04	5.86	7.00	8.350	8.720	10.08	11.43	13.14
9	0	0	0	0	0	0	0			0	0	4
197	0.99	1.45	2.44	3.77	4.86	5.59	6.26	8.370	10.49	12.31	14.59	21.77
0	0	0	0	0	0	0	0		0	0	0	7
197	1.09	1.57	2.31	2.98	4.93	5.15	5.58	6.300	8.530	11.24	14.74	17.13
1	0	0	0	0	0	0	0			0	0	0
197	0.98	1.46	2.21	3.25	4.33	5.61	6.04	6.100	6.870	8.950	11.72	16.00
2	0	0	0	0	0	0	0				0	0
197	1.03	1.42	2.47	3.60	4.90	6.11	6.67	6.750	7.430	7.950	10.17	17.00
3	0	0	0	0	0	0	0				0	0
197	1.05	1.71	2.43	3.82	5.24	6.66	7.15	7.760	8.190	9.780	12.38	14.70
4	0	0	0	0	0	0	0				0	0
197	1.10	1.77	2.78	3.76	5.45	6.69	7.57	8.580	8.810	9.780	10.09	11.00
5	0	0	0	0	0	0	0				0	0
197	1.35	1.78	2.65	4.10	5.07	6.73	8.25	9.610	11.54	11.43	14.06	16.18
6	0	0	0	0	0	0	0		0	0	0	0
197	1.25	1.91	2.85	4.06	5.77	6.63	7.68	9.730	11.70	14.39	17.45	24.11
7	9	1	6	9	7	6	5		3	4	6	6
197	1.28	1.83	2.92	3.95	5.72	6.80	9.04	10.86	13.06	11.98	19.06	21.28
8	9	3	9	5	6	6	1	5	8	2	2	4
197	1.40	1.95	2.64	3.99	5.54	6.75	8.29	9.312	13.13	13.41	13.54	20.07
9	8	6	2	9	8	4	9		0	8	0	2
198	1.39	1.86	2.73	3.76	5.25	6.98	8.03	10.73	12.30	17.28	14.89	19.06
0	2	2	3	8	9	1	7	1	1	1	3	9
198	1.18	1.65	2.26	3.29	4.48	5.82	7.73	9.422	11.37	12.78	12.51	19.06
1	0	1	0	3	3	1	9		4	4	4	9
198	1.00	1.55	2.24	3.10	4.25	5.38	6.68	9.141	11.96	14.22	17.28	16.59
2	6	0	6	4	8	6	2		3	6	7	0
198	1.09	1.59	2.27	3.02	4.09	5.48	7.04	8.128	11.00	13.97	15.88	18.49
3	5	9	5	1	6	1	9		9	2	2	8
198	1.28	1.72	2.59	3.58	4.37	5.79	7.45	9.851	11.05	14.33	15.27	16.66
4	8	5	6	1	1	8	6		2	8	3	0
198	1.40	1.97	2.57	3.65	4.97	6.37	8.20	10.32	12.19	14.68	16.17	19.05
5	7	1	6	0	6	2	7	0	7	3	5	0
198	1.45	1.96	2.84	3.59	4.63	6.15	7.50	9.084	10.35	15.28	14.54	15.01
6	9	1	4	3	5	5	3		6	3	0	7

198	1.31	1.95	2.68	3.89	4.71	6.25	7.36	9.243	10.69	10.62	15.89	12.59
7	6	6	6	4	6	7	8		7	2	4	2
198	1.43	1.80	2.57	3.51	4.93	6.00	7.14	8.822	9.977	11.73	14.15	13.04
8	8	5	6	9	0	1	4			2	6	2
198	1.18	1.81	2.59	3.91	5.21	6.89	8.03	9.831	11.98	10.00	12.61	16.04
9	6	3	0	5	0	2	5		6	3	1	5
199	1.29	1.70	2.38	3.03	4.62	6.52	8.88	10.59	10.99	14.57	15.73	17.29
0	0	4	3	4	4	1	8	2	3	0	2	0
199	1.30	1.89	2.47	3.15	3.79	5.68	7.24	9.804	9.754	14.34	14.17	20.20
1	9	9	5	9	2	0	2			4	2	0
199	1.28	1.76	2.46	3.29	4.39	5.58	6.83	8.127	12.67	13.41	15.71	11.26
2	9	8	9	2	4	2	0		9	0	5	7
199	1.39	1.88	2.77	3.76	4.93	6.05	7.45	8.641	10.90	12.51	14.74	16.87
3	2	7	2	2	0	4	0		1	7	2	4
199	1.44	2.06	2.56	3.65	5.11	6.26	7.71	8.896	10.84	12.87	14.74	17.47
4	3	3	2	9	7	2	9		7	4	2	0
199	1.34	1.95	2.92	3.62	5.17	6.41	7.91	10.27	11.02	11.40	13.09	15.18
5	8	9	0	5	6	6	6	3	2	7	8	2
199	1.45	1.93	3.13	4.14	4.92	6.00	7.40	9.772	10.53	13.50	13.68	16.19
6	7	0	2	1	2	9	6		9	3	9	4
199	1.48	1.87	2.87	4.02	5.40	6.38	7.34	8.537	10.79	11.53	10.42	12.78
7	4	7	8	8	2	6	4		7	3	8	8
199	1.23	1.75	2.45	3.55	5.21	7.73	7.83	9.304	10.75	14.90	16.65	18.66
8	0	0	8	9	3	7	7		9	3	1	6
199	1.24	1.71	2.42	3.44	4.72	6.35	8.73	9.946	11.08	12.53	14.99	15.15
9	1	6	6	3	0	2	0		8	5	5	1
200	1.30	1.78	2.33	3.25	4.69	5.89	7.80	9.203	10.24	11.17	13.17	17.44
0	8	2	0	2	0	4	9		0	2	2	2
200	1.48	2.01	2.62	3.36	4.55	6.18	7.12	8.445	9.311	9.566	10.24	9.503
1	4	7	9	2	5	7	4				2	
200	1.30	1.94	2.66	3.63	4.55	5.92	7.08	8.100	9.276	11.66	11.22	14.02
2	9	7	4	8	1	7	3			0	1	9
200	1.35	1.86	2.45	3.39	4.38	4.75	6.14	7.138	9.580	10.26	11.47	10.72
3	0	6	9	1	0	6	1			0	9	0
200	1.13	1.75	2.41	3.37	4.28	5.18	5.74	7.376	10.03	10.32	12.42	11.45
4	9	4	3	3	8	5	1		8	2	8	2
200	1.19	1.73	2.42	3.39	4.29	5.05	6.23	6.124	7.964	10.07	12.77	13.71
5	6	5	1	5	2	9	3			5	6	9
200	1.08	1.62	2.20	3.05	4.26	4.97	5.28	6.028	8.455	11.15	12.60	15.38
6	8	2	5	2	5	8	7			4	8	1
200	1.06	1.59	2.17	2.79	3.86	5.15	5.87	6.405	7.182	9.506	10.40	10.53
7	3	5	9	1	1	9	1				6	2

200	1.09	1.59	2.36	3.14	3.99	5.26	6.48	7.367	7.784	10.50	11.62	18.09
8	8	8	4	0	0	4	2			5	1	2
200	1.09	1.66	2.20	3.18	4.05	5.02	6.64	8.354	9.529	11.19	11.76	14.91
9	6	6	6	7	9	4	9			3	1	8
201	1.10	1.82	2.35	3.21	4.48	5.46	6.73	8.024	8.968	10.41	11.64	12.20
0	0	4	5	4	1	3	8			9	7	8
201	1.10	1.66	2.51	3.44	4.40	5.78	6.52	7.828	8.805	9.662	12.94	11.64
1	9	0	1	3	4	3	7				1	9
201	1.18	1.62	2.44	3.74	4.70	5.92	7.36	7.988	9.111	10.72	12.04	11.60
2	0	5	2	4	7	5	9			0	2	8
201	1.13	1.74	2.45	3.61	4.93	6.12	7.36	8.137	9.173	10.12	10.42	12.70
3	2	3	1	2	6	6	8			1	1	2
201	1.11	1.74	2.52	3.51	4.67	6.15	7.48	8.586	8.967	10.51	10.28	12.35
4	8	0	1	7	6	8	6			8	6	4
201	1.19	1.64	2.66	3.60	4.64	5.92	7.58	8.600	9.687	11.20	11.33	10.36
5	6	5	6	0	3	0	3			5	0	0
201	1.09	1.78	2.51	3.80	4.61	5.94	7.16	8.486	10.11	10.70	11.36	13.89
6	8	9	0	3	9	5	1		1	1	2	9
201	1.01	1.77	2.51	3.42	4.79	5.96	7.12	8.486	9.509	11.09	11.57	12.80
7	4	0	6	1	0	3	6			5	5	0
201	1.15	1.63	2.58	3.41	4.07	6.15	7.01	8.486	9.509	11.09	11.57	12.80
8	2	2	1	5	5	8	4			5	5	0

Table 9.3. Icelandic cod in Division Va. Estimated survey weight (g) 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

Table 9.4. Icelandic cod in Division Va. Estimated weight at age in the spawning stock (kg) in period the 1955-2018. 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	0.64	1.01	1.83	3.18	4.12	5.65	6.63	6.168	8.746	8.829	10.08	14.58
	5	9	3	3	8	7	5				6	4
1956	0.64	1.24	1.86	2.88	4.13	5.63	6.18	6.970	6.830	9.290	10.96	12.95
	5	8	2	6	8	0	0				5	4
1957	0.64	1.33	2.14	2.81	4.05	5.96	7.17	7.260	8.300	8.290	10.35	13.17
	5	4	2	6	8	0	0				0	4
1958	0.64	1.41	2.65	3.96	4.45	5.94	6.64	8.290	8.510	8.840	9.360	13.09
	5	2	2	9	0	0	0					7
1959	0.64	1.52	2.49	3.97	4.91	6.17	6.61	7.130	8.510	8.670	9.980	11.27
	5	1	0	8	3	0	0					6
1960	0.64	1.34	2.48	4.08	5.03	6.55	6.91	7.140	7.970	10.24	10.10	12.87
	5	2	2	3	7	0	0			0	0	1
1961	0.64	1.30	2.29	3.81	4.92	6.31	6.93	7.310	0.750	8.510	9.840	14.55
	5	3	5	0	2	0	0					0
1962	0.64	1.25	2.21	3.43	5.09	6.66	6.75	7.060	7.540	8.280	10.90	12.82
	5	6	8	2	1	0	0				0	6

196	0.64	1.28	2.24	3.34	4.54	6.92	7.84	7.610	8.230	9.100	9.920	11.55
3	5	7	4	4	8	0	0					3
196	0.64	1.36	2.24	3.53	4.85	6.46	8.00	9.940	9.210	10.94	12.67	15.90
4	5	5	4	8	0	0	0			0	0	0
196	0.64	1.19	2.18	3.59	4.81	6.40	7.12	8.600	12.31	10.46	10.19	17.22
5	5	3	4	9	5	0	0		0	0	0	0
196	0.64	1.31	2.20	3.67	5.10	6.90	7.83	8.580	9.090	14.23	14.09	17.92
6	5	0	2	8	0	0	0			0	0	4
196	0.64	1.42	2.26	3.57	4.94	7.79	7.84	8.430	9.090	10.09	14.24	16.41
7	5	0	1	9	8	0	0			0	0	2
196	0.64	1.24	2.27	3.45	4.48	5.91	7.51	8.480	10.75	11.58	14.64	16.01
8	5	0	8	8	6	0	0		0	0	0	1
196	0.64	1.41	2.10	3.31	4.48	5.86	7.00	8.350	8.720	10.08	11.43	13.14
9	5	2	8	8	6	0	0			0	0	4
197	0.64	1.13	2.07	3.31	4.32	5.59	6.26	8.370	10.49	12.31	14.59	21.77
0	5	1	4	8	5	0	0		0	0	0	7
197	0.64	1.22	1.96	2.62	4.38	5.15	5.58	6.300	8.530	11.24	14.74	17.13
1	5	5	4	2	8	0	0			0	0	0
197	0.64	1.13	1.87	2.86	3.85	5.61	6.04	6.100	6.870	8.950	11.72	16.00
2	5	9	8	0	4	0	0				0	0
197	0.64	1.10	2.10	3.16	4.36	6.11	6.67	6.750	7.430	7.950	10.17	17.00
3	5	8	0	8	1	0	0				0	0
197	0.64	1.33	2.06	3.36	4.66	6.66	7.15	7.760	8.190	9.780	12.38	14.70
4	5	4	6	2	4	0	0				0	0
197	0.64	1.38	2.36	3.30	4.85	6.69	7.57	8.580	8.810	9.780	10.09	11.00
5	5	1	3	9	0	0	0				0	0
197	0.64	1.38	2.25	3.60	4.51	6.73	8.25	9.610	11.54	11.43	14.06	16.18
6	5	8	2	8	2	0	0		0	0	0	0
197	0.64	1.49	2.42	3.58	5.14	6.63	7.68	9.730	11.70	14.39	17.45	24.11
7	5	1	8	1	2	6	5		3	4	6	6
197	0.64	1.43	2.49	3.48	5.09	6.80	9.04	10.86	13.06	11.98	19.06	21.28
8	5	0	0	0	6	6	1	5	8	2	2	4
197	0.64	1.52	2.24	3.51	4.93	6.75	8.29	9.312	13.13	13.41	13.54	20.07
9	5	6	6	9	8	4	9		0	8	0	2
198	0.64	1.45	2.32	3.31	4.68	6.98	8.03	10.73	12.30	17.28	14.89	19.06
0	5	2	3	6	1	1	7	1	1	1	3	9
198	0.64	1.28	1.92	2.89	3.99	5.82	7.73	9.422	11.37	12.78	12.51	19.06
1	5	8	1	8	0	1	9		4	4	4	9
198	0.64	1.20	1.90	2.73	3.79	5.38	6.68	9.141	11.96	14.22	17.28	16.59
2	5	9	9	2	0	6	2		3	6	7	0
198	0.64	1.24	1.93	2.65	3.64	5.48	7.04	8.128	11.00	13.97	15.88	18.49
3	5	7	4	8	5	1	9		9	2	2	8

198	0.64	1.34	2.20	3.15	3.89	5.79	7.45	9.851	11.05	14.33	15.27	16.66
4	5	6	7	1	0	8	6		2	8	3	0
198	1.31	1.39	1.76	2.73	3.48	4.76	7.30	10.32	12.19	14.68	16.17	19.05
5	2	9	6	8	3	2	1	0	7	3	5	0
198	1.31	1.61	2.91	3.27	4.59	5.80	7.19	9.084	10.35	15.28	14.54	15.01
6	2	2	5	9	1	3	9		6	3	0	7
198	1.71	1.59	2.43	3.53	4.88	6.40	7.49	9.243	10.69	10.62	15.89	12.59
7	8	8	9	2	6	8	9		7	2	4	2
198	0.93	1.48	2.28	3.28	4.42	4.67	8.14	8.822	9.977	11.73	14.15	13.04
8	1	6	1	7	3	8	7			2	6	2
198	0.82	1.52	2.36	3.42	4.70	7.27	8.43	9.831	11.98	10.00	12.61	16.04
9	3	6	4	6	2	3	6		6	3	1	5
199	0.73	1.04	2.19	2.84	4.36	6.17	8.91	10.59	10.99	14.57	15.73	17.29
0	3	4	9	1	7	7	9	2	3	0	2	0
199	0.11	1.28	2.06	2.79	3.47	6.00	8.82	9.804	9.754	14.34	14.17	20.20
1	4	8	9	9	7	7	3			4	2	0
199	0.44	1.34	2.11	3.08	3.86	5.19	7.42	8.127	12.67	13.41	15.71	11.26
2	9	9	7	6	1	6	9		9	0	5	7
199	0.77	1.37	2.31	3.27	4.17	5.72	6.44	8.641	10.90	12.51	14.74	16.87
3	3	4	6	6	9	9	1		1	7	2	4
199	1.61	1.73	2.25	3.38	4.56	6.47	9.80	8.896	10.84	12.87	14.74	17.47
4	8	3	9	4	3	1	3		7	4	2	0
199	0.51	1.63	2.35	3.19	4.49	5.54	8.57	10.27	11.02	11.40	13.09	15.18
5	4	9	3	7	3	4	9	3	2	7	8	2
199	0.54	1.75	2.49	3.53	4.25	5.62	8.26	9.772	10.53	13.50	13.68	16.19
6	2	6	0	0	1	1	3		9	3	9	4
199	1.11	1.34	2.26	3.72	5.41	5.96	6.96	8.537	10.79	11.53	10.42	12.78
7	1	6	7	3	5	3	4		7	3	8	8
199	1.11	1.60	2.26	3.26	4.46	5.75	6.79	9.304	10.75	14.90	16.65	18.66
8	1	5	2	2	1	9	3		9	3	1	6
199	1.31	1.47	1.93	2.99	3.96	5.13	6.52	9.946	11.08	12.53	14.99	15.15
9	1	1	6	9	8	2	2		8	5	5	1
200	0.49	1.35	1.91	2.88	4.31	5.57	8.46	9.203	10.24	11.17	13.17	17.44
0	7	5	6	1	8	3	4		0	2	2	2
200	0.81	1.58	2.08	2.67	4.11	6.23	6.92	8.445	9.311	9.566	10.24	9.503
1	6	3	0	6	2	6	6				2	
200	0.78	1.59	2.26	3.12	3.99	5.99	9.22	8.100	9.276	11.66	11.22	14.02
2	2	1	0	0	1	1	5			0	1	9
200	1.15	1.32	2.24	3.04	4.22	5.05	6.82	7.138	9.580	10.26	11.47	10.72
3	0	6	1	9	6	1	3			0	9	0
200	1.15	1.45	2.09	3.01	3.67	5.19	5.40	7.376	10.03	10.32	12.42	11.45
4	0	6	5	1	8	2	0		8	2	8	2

200	0.64	1.12	1.90	2.97	3.90	4.78	7.23	6.124	7.964	10.07	12.77	13.71
5	8	3	8	9	1	9	8			5	6	9
200	0.90	1.40	2.01	2.91	4.35	5.05	6.47	6.028	8.455	11.15	12.60	15.38
6	7	7	6	3	1	7	2			4	8	1
200	1.43	1.26	2.02	2.64	4.11	5.69	6.63	6.405	7.182	9.506	10.40	10.53
7	9	1	3	0	6	7	2				6	2
200	0.91	1.84	2.23	2.91	3.89	5.40	6.92	7.367	7.784	10.50	11.62	18.09
8	2	5	2	1	7	0	7			5	1	2
200	0.64	1.46	2.04	2.88	3.94	4.92	7.04	8.354	9.529	11.19	11.76	14.91
9	4	5	1	7	3	3	4			3	1	8
201	0.64	1.59	2.15	3.14	4.20	5.20	6.46	8.024	8.968	10.41	11.64	12.20
0	4	0	4	9	7	7	0			9	7	8
201	0.79	2.46	2.66	3.21	4.54	5.98	6.85	7.828	8.805	9.662	12.94	11.64
1	4	7	6	6	6	9	1				1	9
201	1.40	1.70	2.60	3.71	4.51	6.01	8.03	7.988	9.111	10.72	12.04	11.60
2	4	2	6	7	6	6	8			0	2	8
201	0.94	2.32	2.99	3.83	5.20	6.53	8.26	8.137	9.173	10.12	10.42	12.70
3	4	3	1	4	7	2	0			1	1	2
201	0.94	1.33	2.54	3.31	4.45	6.39	8.17	8.586	8.967	10.51	10.28	12.35
4	4	2	9	6	9	0	8			8	6	4
201	0.70	1.04	3.32	3.83	4.89	6.21	8.67	8.600	9.687	11.20	11.33	10.36
5	4	3	0	6	5	8	7			5	0	0
201	0.97	2.24	3.04	4.21	4.61	6.00	7.35	8.486	10.11	10.70	11.36	13.89
6	2	7	2	3	4	0	1		1	1	2	9
201	1.77	2.58	3.51	3.93	5.69	6.71	7.63	8.486	9.509	11.09	11.57	12.80
7	3	2	3	6	8	6	6			5	5	0
201	1.02	2.37	3.23	3.86	4.57	6.67	7.71	8.486	9.509	11.09	11.57	12.80
8	9	2	0	2	4	1	1			5	5	0

Table 9.5 Icelandic cod in Division Va. Estimated maturity at age in period the 1955-2018.

year	3	4	5	6	7	8	9	10	11	12	13	1
195	0.01	0.02	0.03	0.18	0.57	0.78	0.83	0.96	1.00	1.00	1.00	1
5	9	2	3	1	7	2	4	0	0	0	0	
195	0.01	0.02	0.03	0.11	0.57	0.78	0.81	0.98	0.98	1.00	1.00	1
6	9	5	3	1	7	2	8	0	0	0	0	
195	0.01	0.02	0.04	0.10	0.54	0.80	0.84	0.99	1.00	1.00	1.00	1
7	9	6	3	0	9	1	2	0	0	0	0	
195	0.01	0.02	0.08	0.52	0.68	0.80	0.83	1.00	1.00	1.00	1.00	1
8	9	8	6	0	2	1	4	0	0	0	0	
195	0.01	0.02	0.07	0.53	0.77	0.81	0.83	0.99	1.00	1.00	1.00	1
9	9	9	0	5	2	8	4	0	0	0	0	

196	0.01	0.02	0.06	0.57	0.78	0.82	0.83	0.99	1.00	1.00	1.00	1
0	9	6	6	7	2	6	4	0	0	0	0	
196	0.01	0.02	0.05	0.45	0.77	0.81	0.83	0.99	0.99	1.00	1.00	1
1	9	5	3	0	2	8	4	0	0	0	0	
196	0.01	0.02	0.04	0.28	0.79	0.83	0.83	0.99	0.99	1.00	1.00	1
2	9	5	8	1	1	4	4	0	0	0	0	
196	0.01	0.02	0.04	0.23	0.70	0.83	0.84	1.00	1.00	1.00	1.00	1
3	9	5	8	7	6	4	9	0	0	0	0	
196	0.01	0.02	0.04	0.32	0.76	0.82	0.84	1.00	1.00	1.00	1.00	1
4	9	6	8	9	2	6	9	0	0	0	0	
196	0.01	0.02	0.04	0.35	0.75	0.82	0.84	1.00	1.00	1.00	1.00	1
5	9	5	5	4	1	6	2	0	0	0	0	
196	0.01	0.02	0.04	0.39	0.79	0.84	0.84	1.00	1.00	1.00	1.00	1
6	9	6	5	4	1	9	9	0	0	0	0	
196	0.01	0.02	0.05	0.34	0.77	0.84	0.84	1.00	1.00	1.00	1.00	1
7	9	8	1	1	2	2	9	0	0	0	0	
196	0.01	0.02	0.05	0.29	0.68	0.80	0.84	1.00	1.00	1.00	1.00	1
8	9	5	1	2	2	1	2	0	0	0	0	
196	0.01	0.02	0.04	0.22	0.68	0.80	0.84	1.00	1.00	1.00	1.00	1
9	9	8	3	7	2	1	2	0	0	0	0	
197	0.01	0.02	0.04	0.22	0.64	0.77	0.81	1.00	1.00	1.00	1.00	1
0	9	3	1	7	4	2	8	0	0	0	0	
197	0.01	0.02	0.03	0.07	0.65	0.70	0.77	0.97	0.99	0.98	0.99	1
1	9	5	7	4	7	6	2	9	4	2	3	
197	0.01	0.02	0.03	0.10	0.45	0.77	0.80	0.97	0.99	0.98	0.99	1
2	9	3	5	6	0	2	9	9	4	2	3	
197	0.02	0.02	0.16	0.38	0.69	0.80	0.83	0.99	0.99	1.00	1.00	1
3	2	8	3	2	7	1	4	6	6	0	0	
197	0.02	0.03	0.08	0.34	0.63	0.79	0.81	0.98	1.00	1.00	1.00	1
4	0	1	5	6	6	0	8	9	0	0	0	
197	0.02	0.03	0.11	0.28	0.71	0.80	0.83	1.00	1.00	1.00	1.00	1
5	0	5	8	7	5	9	9	0	0	0	0	
197	0.02	0.02	0.08	0.25	0.40	0.79	0.84	1.00	1.00	1.00	1.00	1
6	5	6	6	3	6	7	1	0	0	0	0	
197	0.01	0.02	0.06	0.38	0.74	0.81	0.84	1.00	1.00	1.00	1.00	1
7	9	4	0	2	2	7	2	0	0	0	0	
197	0.02	0.02	0.05	0.19	0.73	0.82	0.83	1.00	1.00	1.00	1.00	1
8	5	5	2	2	7	0	6	0	0	0	0	
197	0.01	0.02	0.05	0.28	0.63	0.79	0.83	0.91	1.00	1.00	1.00	1
9	9	1	3	2	5	0	6	9	0	0	0	
198	0.02	0.02	0.04	0.22	0.65	0.77	0.83	0.97	1.00	0.96	1.00	1
0	6	1	7	5	3	7	4	7	0	4	0	

198	0.01	0.02	0.03	0.09	0.44	0.75	0.81	0.96	0.98	1.00	1.00	1
1	9	2	0	0	8	1	1	2	8	0	0	
198	0.02	0.02	0.03	0.06	0.29	0.70	0.81	0.96	1.00	1.00	1.00	1
2	1	5	8	5	7	5	5	7	0	0	0	
198	0.01	0.03	0.04	0.11	0.26	0.53	0.71	0.97	0.98	1.00	1.00	1
3	9	0	7	6	4	0	5	9	5	0	0	
198	0.01	0.02	0.05	0.16	0.44	0.62	0.71	0.94	0.96	0.94	1.00	1
4	9	4	3	9	4	0	6	9	9	8	0	
198	NA	0.02	0.18	0.41	0.49	0.73	0.58	0.74	1.00	1.00	1.00	1
5		1	6	4	5	0	0	6	0	0	0	
198	0.00	0.02	0.15	0.39	0.68	0.72	0.93	0.66	1.00	1.00	1.00	1
6	1	3	4	8	1	7	6	7	0	0	0	
198	0.00	0.03	0.09	0.35	0.48	0.87	0.77	0.80	1.00	1.00	1.00	1
7	1	3	4	9	7	9	7	5	0	0	0	
198	0.00	0.02	0.22	0.49	0.44	0.67	0.93	0.89	1.00	1.00	1.00	1
8	6	9	0	8	6	7	2	0	0	0	0	
198	0.00	0.02	0.14	0.36	0.62	0.63	0.61	1.00	1.00	1.00	1.00	1
9	8	6	1	3	1	9	9	0	0	0	0	
199	0.00	0.01	0.15	0.42	0.57	0.78	0.77	0.71	1.00	1.00	1.00	1
0	6	2	4	8	6	1	4	4	0	0	0	
199	NA	0.05	0.14	0.36	0.62	0.78	0.65	0.90	1.00	1.00	1.00	1
1		5	9	8	9	7	4	1	0	0	0	
199	0.00	0.06	0.26	0.40	0.81	0.91	0.88	1.00	1.00	1.00	1.00	1
2	2	2	5	7	3	6	0	0	0	0	0	
199	0.00	0.08	0.26	0.46	0.68	0.79	0.84	0.83	1.00	1.00	1.00	1
3	6	5	7	2	4	5	3	4	0	0	0	
199	0.00	0.10	0.33	0.59	0.70	0.92	0.69	0.83	1.00	1.00	1.00	1
4	8	9	8	0	6	1	4	0	0	0	0	
199	0.00	0.10	0.38	0.52	0.74	0.79	0.85	1.00	1.00	1.00	1.00	1
5	5	9	3	7	7	0	9	0	0	0	0	
199	0.00	0.03	0.18	0.50	0.65	0.73	0.81	0.77	1.00	1.00	1.00	1
6	2	2	6	1	3	3	0	4	0	0	0	
199	0.00	0.03	0.24	0.42	0.68	0.78	0.80	0.53	1.00	1.00	1.00	1
7	6	7	7	7	6	6	4	9	0	0	0	
199	NA	0.06	0.20	0.48	0.78	0.80	0.80	0.85	1.00	1.00	1.00	1
8		1	8	6	2	7	9	2	0	0	0	
199	0.01	0.04	0.23	0.51	0.65	0.83	0.69	0.97	1.00	1.00	1.00	1
9	2	4	9	7	0	6	1	4	0	0	0	
200	0.00	0.06	0.24	0.51	0.61	0.86	0.99	0.99	1.00	1.00	1.00	1
0	1	5	8	2	1	7	8	9	0	0	0	
200	0.00	0.04	0.28	0.59	0.76	0.76	0.88	1.00	1.00	1.00	1.00	1
1	3	6	6	9	1	6	3	0	0	0	0	

200	0.00	0.08	0.32	0.65	0.75	0.92	0.55	0.72	1.00	1.00	1.00	1
2	6	6	1	6	9	0	9	4	0	0	0	
200	0.00	0.04	0.22	0.53	0.87	0.79	0.87	0.83	1.00	1.00	1.00	1
3	5	8	2	2	3	8	9	3	0	0	0	
200	NA	0.04	0.24	0.54	0.63	0.83	0.80	0.85	1.00	1.00	1.00	1
4		0	9	9	1	3	7	4	0	0	0	
200	0.00	0.10	0.28	0.49	0.79	0.80	0.94	0.90	1.00	1.00	1.00	1
5	3	8	1	4	5	8	9	4	0	0	0	
200	0.00	0.02	0.29	0.44	0.74	0.87	0.73	0.74	1.00	1.00	1.00	1
6	2	3	8	6	9	4	9	1	0	0	0	
200	0.01	0.03	0.15	0.50	0.69	0.79	0.83	0.92	1.00	1.00	1.00	1
7	2	1	6	4	6	7	6	6	0	0	0	
200	0.00	0.04	0.27	0.54	0.72	0.83	0.85	0.95	1.00	1.00	1.00	1
8	1	2	5	6	8	3	0	8	0	0	0	
200	0.00	0.01	0.13	0.45	0.68	0.88	0.75	0.63	1.00	1.00	1.00	1
9	2	5	4	1	4	4	2	1	0	0	0	
201	NA	0.01	0.05	0.38	0.82	0.86	0.92	0.81	1.00	1.00	1.00	1
0		5	7	0	1	8	7	3	0	0	0	
201	0.00	0.01	0.13	0.42	0.73	0.92	0.94	0.96	1.00	1.00	1.00	1
1	2	2	6	7	2	3	1	1	0	0	0	
201	0.00	0.03	0.12	0.41	0.73	0.88	0.96	0.85	1.00	1.00	1.00	1
2	4	1	7	4	0	4	3	0	0	0	0	
201	0.00	0.00	0.06	0.34	0.73	0.92	0.96	1.00	1.00	1.00	1.00	1
3	3	8	2	4	8	2	5	0	0	0	0	
201	NA	0.02	0.06	0.23	0.61	0.89	0.96	0.95	1.00	1.00	1.00	1
4		6	9	8	5	3	7	6	0	0	0	
201	0.00	0.00	0.11	0.35	0.63	0.90	0.97	0.98	1.00	1.00	1.00	1
5	3	7	0	3	6	7	8	8	0	0	0	
201	0.00	0.00	0.02	0.28	0.54	0.73	0.94	0.98	1.00	1.00	1.00	1
6	1	9	5	9	3	1	1	6	0	0	0	
201	0.00	0.00	0.08	0.26	0.76	0.90	0.97	0.98	1.00	1.00	1.00	1
7	5	8	9	2	5	6	9	7	0	0	0	
201	0.00	0.01	0.14	0.43	0.60	0.93	0.95	1.00	1.00	1.00	1.00	1
8	2	3	7	4	5	5	3	0	0	0	0	

Table 9.6. Icelandic cod in Division Va. Survey indices of the spring bottom trawl survey (SMB).

year	1	2	3	4	5	6	7	8	9	10
1985	17.18	111.13	35.38	48.27	64.85	23.21	15.46	5.21	3.56	1.94
1986	15.60	61.07	96.42	22.59	21.74	27.72	7.34	2.84	0.95	0.83
1987	3.66	28.16	104.43	82.68	21.47	12.83	13.00	2.80	0.99	0.42
1988	3.45	7.07	73.22	103.89	69.60	8.41	6.45	7.08	0.67	0.27

1989	4.02	16.41	21.28	75.12	71.48	38.40	4.81	1.70	1.41	0.27
1990	5.55	11.75	26.36	14.30	27.98	35.30	16.76	1.75	0.58	0.47
1991	3.95	15.98	18.11	30.13	15.44	18.89	22.43	4.92	0.94	0.31
1992	0.71	16.95	33.54	18.77	16.44	6.80	6.32	5.74	1.48	0.23
1993	3.56	4.73	30.73	36.63	13.49	10.57	2.42	2.02	1.39	0.41
1994	14.23	14.83	9.01	26.87	22.41	6.08	3.95	0.79	0.53	0.50
1995	1.08	29.27	24.77	9.07	24.56	18.47	4.04	1.92	0.39	0.20
1996	3.70	5.42	42.50	29.69	13.25	15.43	15.22	4.21	1.16	0.21
1997	1.20	22.39	13.61	56.71	29.75	9.98	9.47	7.29	0.62	0.25
1998	8.04	5.46	30.11	16.08	63.24	29.99	7.01	5.78	3.33	0.76
1999	7.38	33.15	6.99	42.29	13.27	24.77	12.00	2.61	1.47	0.83
2000	18.89	27.69	55.05	7.01	30.86	8.71	8.85	4.60	0.56	0.35
2001	12.24	23.59	36.46	38.18	5.07	15.70	3.53	2.15	0.90	0.34
2002	0.96	38.56	41.31	40.59	37.26	7.47	8.99	1.66	0.81	0.35
2003	11.16	4.20	46.55	36.90	29.22	17.76	4.13	4.79	1.13	0.23
2004	7.34	27.62	8.24	66.84	41.29	30.95	17.60	3.27	3.57	0.57
2005	2.69	17.79	41.72	9.95	46.31	24.99	12.10	6.45	1.01	1.03
2006	9.09	7.43	25.06	40.53	11.73	31.64	11.66	4.11	1.62	0.28
2007	5.65	19.04	9.07	22.77	29.88	10.06	11.37	6.10	2.44	0.86
2008	6.75	12.41	23.00	9.84	22.36	22.94	9.44	8.00	3.03	0.77
2009	22.14	12.74	16.46	22.41	15.49	25.86	16.60	4.81	3.15	1.16
2010	18.62	21.51	18.89	18.10	24.64	14.13	18.36	9.87	3.24	1.93
2011	3.55	22.96	27.54	20.10	23.07	26.66	14.70	13.37	5.02	1.01
2012	20.36	11.03	39.37	56.70	41.90	31.19	28.43	10.88	7.06	3.21
2013	10.89	33.70	18.22	44.39	47.10	25.89	17.15	14.44	7.19	3.47
2014	3.29	24.25	39.05	23.75	47.55	38.29	17.83	8.45	4.37	2.24
2015	21.06	10.98	28.05	42.23	21.22	41.98	29.41	17.09	5.13	3.18
2016	31.71	31.65	15.21	37.62	54.80	28.19	38.46	19.05	7.00	2.33
2017	3.83	24.95	33.72	18.16	36.47	40.37	23.60	22.54	11.85	5.15
2018	11.72	14.07	29.74	37.19	14.77	29.02	26.88	15.94	7.98	3.88

Table 9.7. Icelandic cod in Division Va. Survey indices of the fall bottom trawl survey (SMH).

year	1	2	3	4	5	6	7	8	9	10
1996	6.323	3.433	19.594	14.191	5.568	7.699	6.489	1.652	0.310	0.083
1997	0.634	16.657	6.651	29.249	16.338	5.401	3.737	2.134	0.306	0.145
1998	5.713	2.588	15.335	7.293	16.104	16.161	5.241	2.251	1.272	0.204
1999	7.996	13.794	5.581	23.159	7.449	10.045	4.085	0.587	0.341	0.367
2000	4.520	12.736	15.236	3.757	11.543	3.642	2.705	1.142	0.344	0.284

2001	6.888	11.288	19.321	21.271	3.398	6.932	1.651	0.792	0.176	0.029
2002	0.934	13.189	15.838	23.389	16.207	5.534	4.865	1.132	0.627	0.078
2003	5.198	2.731	26.026	17.313	13.477	9.119	1.930	2.591	0.368	0.104
2004	3.568	15.824	6.893	30.302	19.394	12.080	7.612	1.923	1.685	0.232
2005	2.128	8.866	19.967	6.772	26.102	11.297	4.004	1.962	0.312	0.316
2006	4.407	4.409	15.857	22.847	7.784	14.469	6.311	2.119	1.053	0.165
2007	3.668	9.571	4.901	12.101	16.261	6.526	6.105	3.210	0.802	0.533
2008	6.680	12.659	15.131	8.073	17.955	18.820	5.887	5.582	1.408	0.737
2009	6.776	9.260	13.726	17.697	12.749	16.903	10.576	3.291	2.762	0.923
2010	11.902	22.213	16.448	15.980	18.080	9.886	11.301	6.762	2.264	1.239
2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2012	9.707	10.794	24.846	21.550	12.811	11.131	9.587	5.406	3.248	1.434
2013	8.099	28.822	14.067	26.047	21.293	12.619	7.876	6.014	3.061	1.872
2014	3.967	20.395	30.559	15.919	24.264	19.850	8.463	5.719	3.676	2.112
2015	18.852	12.839	34.955	43.590	18.982	27.606	16.135	5.387	3.099	1.097
2016	12.001	18.443	8.685	17.909	22.236	10.988	11.949	6.710	2.673	1.527
2017	6.070	25.994	32.340	16.847	31.310	32.001	12.143	9.762	4.378	1.531

Table 9.8. Icelandic cod in Division Va. 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	-	-	0.08	0.12	0.21	-	-	0.13	-	-	-	0.00
	0.12	0.21				0.12	0.16		0.10	0.45	0.21	
1956	-	-	0.03	0.00	-	-	-	0.01	0.17	0.09	0.23	0.22
	0.03	0.05			0.13	0.20	0.01					
1957	0.09	0.02	-	0.17	-	0.09	0.06	-	-	-	-	0.52
			0.01		0.13			0.15	0.10	0.12	0.38	
1958	0.15	0.18	-	-	0.06	0.08	0.13	-	0.23	0.00	-	0.39
			0.26	0.07				0.23			0.23	
1959	-	0.21	0.26	-	-	-	-	0.28	-	0.38	-	-
	0.21			0.24	0.22	0.06	0.07		0.26		0.23	0.41
1960	0.10	-	0.14	0.19	0.06	0.07	-	-	-	0.03	-	0.90
		0.36					0.03	0.11	0.04		0.64	
1961	0.05	0.04	-	0.12	-	0.27	0.20	-	0.09	-	-	0.82
			0.40		0.02			0.14		0.19	0.97	
1962	0.09	-	0.12	-	0.12	-	0.09	0.26	-	0.03	-	0.69
		0.01		0.24		0.30			0.07		0.40	
1963	-	0.29	-	0.01	-	-	-	0.21	0.35	0.06	0.08	-
	0.06		0.18		0.03	0.07	0.38					0.62
1964	-	-	0.12	-	-	0.38	-	-	-	0.27	-	0.00

	0.13	0.02		0.25	0.12		0.10	0.45	0.01		0.16	
1965	-	-	0.08	0.16	-	0.05	0.48	-	-	-	-	0.63
	0.03	0.11			0.13			0.48	0.06	0.51	0.36	
1966	-	-	-	0.10	-	0.12	-	0.59	-	0.28	0.01	1.05
	0.04	0.04	0.18		0.07		0.35		0.83			
1967	0.19	-	0.02	-	0.02	-	0.49	0.05	0.67	-	-	-
		0.13		0.20		0.37				0.72	0.83	0.19
1968	0.03	-	-	-	0.23	0.16	-	0.37	-	0.60	-	0.65
		0.02	0.27	0.12			0.42		0.13		0.66	
1969	-	-	0.15	-	0.05	-	-	-	-	-	-	-
	0.09	0.03		0.01		0.15	0.33	0.25	0.04	0.26	0.81	0.16
1970	-	0.14	-	-	0.05	-	0.48	-	-	0.25	0.30	0.44
	0.10		0.05	0.13		0.16		0.58	0.12			
1971	-	0.07	0.09	0.18	-	0.28	-	0.06	-	-	0.13	0.35
	0.10				0.18		0.17		0.45	0.02		
1972	-	-	0.07	-	0.12	-	-	0.29	-	0.17	0.53	-
	0.17	0.13		0.03		0.05	0.10		0.07			2.78
1973	0.28	-	-	0.03	0.00	-	0.09	0.17	0.16	-	-	-
		0.02	0.10			0.24				0.19	1.25	2.11
1974	-	0.21	-	-	-	0.00	-	0.29	0.01	0.19	-	0.78
	0.16		0.02	0.18	0.01		0.22				0.43	
1975	0.19	-	0.04	-	0.03	-	-	0.00	0.41	-	-	0.07
		0.07		0.05		0.15	0.21			0.01	0.12	
1976	0.10	0.00	-	0.08	-	0.25	-	-	0.06	0.27	-	0.21
			0.17		0.09		0.16	0.15			0.23	
1977	-	-	0.05	-	0.13	0.05	0.31	0.03	-	-	-	-
	0.40	0.06		0.09					0.70	0.48	1.22	2.52
1978	0.08	-	0.04	-	0.04	-	0.12	-	0.01	-	0.54	1.18
		0.01		0.10		0.21		0.19		0.05		
1979	0.16	0.10	-	0.10	-	0.03	-	-	0.04	-	0.42	-
			0.22		0.05		0.31	0.08		0.14		0.21
1980	0.21	0.01	0.08	0.06	-	-	0.12	-	0.29	0.10	0.17	-
					0.01	0.09		0.49				1.09
1981	-	-	0.08	-	0.07	0.09	0.02	0.33	-	0.60	0.00	1.16
	0.30	0.21		0.13					0.08			
1982	0.01	0.15	0.07	-	-	0.19	0.18	0.14	-	-	0.06	-
				0.06	0.22				0.23	0.87		0.88
1983	-	-	0.11	0.14	0.04	0.01	-	-	0.00	0.37	-	0.56
	0.32	0.36					0.04	0.03			0.19	
1984	0.35	0.03	-	-	-	0.00	0.06	-	-	0.17	0.73	0.07
			0.06	0.04	0.10			0.14	0.35			
1985	0.04	0.18	-	0.12	-	-	-	0.14	0.03	-	0.49	0.45

			0.10		0.09	0.02	0.14			0.34		
1986	0.14	-	0.01	-	0.18	-	0.12	-	0.08	0.06	-	0.16
		0.12		0.01		0.04		0.21			0.57	
1987	-	0.11	0.01	-	0.07	0.04	-	0.11	-	-	0.14	-
	0.16			0.17			0.02		0.38	0.11		0.33
1988	-	-	-	0.13	-	0.08	0.16	0.03	0.47	0.02	0.55	0.06
	0.08	0.07	0.07		0.08							
1989	-	0.05	0.13	-	0.00	-	-	-	-	0.52	-	-
	0.20			0.09		0.15	0.31	0.09	0.02		0.01	1.49
1990	0.00	-	-	0.00	0.03	0.09	-	-	0.29	0.13	-	0.01
		0.13	0.11				0.08	0.22			0.19	
1991	0.07	0.04	-	-	0.10	-	0.12	-	-	0.42	-	0.06
			0.13	0.07		0.08		0.07	0.30		0.54	
1992	-	0.08	0.04	0.03	0.10	0.00	-	-	-	-	-	-
	0.24						0.05	0.07	0.74	0.75	0.55	0.23
1993	0.25	0.04	-	-	-	-	0.07	0.48	0.50	-	-	0.32
			0.21	0.06	0.07	0.12				0.20	0.97	
1994	0.02	0.24	-	-	-	0.07	-	-	0.42	0.52	0.53	-
			0.14	0.20	0.04		0.19	0.13				0.52
1995	0.27	-	0.08	-	-	-	-	-	-	0.74	1.15	0.52
		0.04		0.04	0.04	0.12	0.12	0.29	0.20			
1996	0.01	-	-	0.07	0.04	0.02	0.13	0.18	-	-	0.65	-
		0.06	0.18						0.37	0.37		0.13
1997	-	0.03	-	-	-	0.21	0.18	0.26	0.43	-	-	0.10
	0.16		0.03	0.13	0.10					0.70	0.17	
1998	-	-	0.07	0.07	0.01	-	0.25	0.06	0.10	0.31	0.19	-
	0.18	0.17				0.16						0.82
1999	-	0.04	0.04	0.04	0.09	-	-	-	-	-	-	-
	0.11					0.04	0.23	0.18	0.25	0.40	0.47	1.07
2000	0.15	-	0.12	-	0.01	0.11	0.03	-	-	0.12	-	-
		0.23		0.03				0.13	0.01		0.18	0.32
2001	0.25	0.23	-	0.02	0.04	-	0.06	0.32	-	0.18	-	0.82
			0.19			0.25			0.14		0.68	
2002	-	0.06	0.04	-	0.01	0.03	-	0.23	0.30	-	0.11	-
	0.09			0.05			0.09			0.15		0.97
2003	-	0.04	0.01	-	0.12	0.07	0.20	-	0.08	0.22	0.08	0.68
	0.06			0.11				0.19				
2004	-	0.07	0.09	-	-	0.25	-	0.22	-	0.18	0.27	-
	0.27			0.04	0.04		0.04		0.35			0.41
2005	0.18	-	0.13	-	-	-	0.31	-	0.40	0.17	0.31	-
		0.26		0.05	0.11	0.07		0.01				0.32
2006	-	0.04	-	0.07	0.06	-	-	0.20	-	-	-	-

	0.06		0.10			0.07	0.08		0.22	0.26	0.63	0.25
2007	-	0.15	-	0.02	-	0.08	0.01	0.17	0.78	-	1.17	-
	0.15		0.04		0.12					0.25		0.96
2008	0.12	-	0.07	-	0.05	-	0.04	0.13	-	0.39	0.25	-
		0.19		0.15		0.18			0.07			0.68
2009	0.08	-	0.05	0.15	-	0.23	-	-	-	-	0.21	-
		0.10			0.01		0.20	0.25	0.02	0.35		0.41
2010	0.08	0.03	-	0.02	0.04	-	0.19	-	-	0.14	0.36	0.67
			0.13			0.06		0.21	0.16			
2011	-	-	0.08	0.01	-	-	-	0.10	-	-	-	-
	0.02	0.04			0.03	0.01	0.11		0.12	0.18	0.16	0.42
2012	-	0.02	-	-	0.01	0.17	0.01	-	-	-	0.13	-
	0.14		0.01	0.04				0.25	0.02	0.13		0.22
2013	0.28	-	0.04	0.02	-	-	0.14	-	-	0.16	0.14	-
		0.03			0.07	0.03		0.02	0.18			0.42
2014	-	0.01	0.03	0.00	0.00	-	-	0.11	0.03	-	0.47	0.20
	0.14					0.05	0.05			0.13		
2015	0.07	0.06	0.06	0.03	-	0.02	-	-	0.46	-	-	-
					0.12		0.06	0.07		0.17	0.30	0.28
2016	-	-	-	0.09	0.10	-	0.05	-	-	0.41	-	-
	0.06	0.01	0.16			0.02		0.03	0.05		0.14	0.79
2017	0.01	0.03	0.06	-	-	-	-	0.09	-	-	0.50	-
				0.02	0.05	0.05	0.02		0.12	0.03		0.13

Table 9.9. Icelandic cod in Division Va. 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
1985	-0.50	0.09	0.27	0.49	0.18	0.27	0.40	0.19	0.34	0.72
1986	0.46	-0.01	-0.29	-0.18	-0.04	0.01	-0.16	-0.28	-0.25	-0.03
1987	0.68	0.05	0.21	-0.41	0.00	-0.07	0.04	-0.11	-0.10	-0.01
1988	-0.19	0.05	0.58	0.20	-0.09	-0.34	0.08	0.45	-0.13	-0.12
1989	0.38	0.09	0.53	0.55	0.23	0.16	-0.14	-0.13	0.20	0.11
1990	-0.49	0.14	0.12	0.10	-0.11	-0.15	0.05	-0.17	-0.05	0.14
1991	-0.16	-0.42	0.13	0.19	0.28	0.03	0.12	-0.18	0.21	0.19
1992	-0.23	0.06	-0.13	0.15	-0.07	-0.14	-0.16	-0.17	-0.14	-0.01
1993	-0.53	-0.03	0.23	-0.01	0.08	-0.05	-0.22	-0.19	-0.25	-0.23
1994	0.52	-0.23	0.02	0.15	-0.16	-0.32	-0.18	-0.24	-0.20	-0.10
1995	-0.22	0.18	-0.18	-0.03	0.20	-0.02	-0.23	-0.11	-0.07	-0.22
1996	-0.64	-0.10	0.16	-0.09	0.22	-0.04	0.24	0.37	0.20	0.04
1997	0.21	-0.01	0.15	0.33	-0.01	-0.05	-0.05	0.22	-0.36	-0.28

1998	-0.10	0.14	-0.11	0.15	0.54	0.29	0.06	0.17	0.41	0.49
1999	-0.03	0.23	-0.04	0.09	-0.03	0.07	-0.01	-0.06	-0.06	0.11
2000	0.90	0.17	0.36	-0.14	-0.05	-0.22	-0.23	-0.06	-0.30	-0.28
2001	0.20	0.07	0.07	-0.04	-0.44	-0.24	-0.43	-0.63	-0.41	0.13
2002	-0.11	0.30	0.21	0.12	0.09	-0.15	-0.21	-0.34	-0.49	-0.23
2003	0.09	-0.12	0.13	0.02	-0.07	-0.20	-0.21	-0.10	0.13	-0.59
2004	0.02	0.26	-0.09	0.37	0.22	0.32	0.27	0.18	0.52	0.36
2005	-0.11	0.10	0.27	-0.08	0.13	0.10	-0.02	0.02	0.04	0.29
2006	0.27	-0.06	0.02	0.12	-0.06	0.16	-0.12	-0.34	-0.33	-0.18
2007	0.05	0.19	-0.32	-0.20	-0.12	-0.18	-0.32	-0.08	0.03	-0.07
2008	-0.01	0.00	-0.03	-0.41	-0.24	-0.10	0.11	-0.06	0.09	-0.18
2009	0.44	-0.12	-0.16	-0.19	-0.17	-0.09	-0.08	0.01	-0.18	-0.08
2010	0.10	-0.16	-0.19	-0.23	-0.16	-0.21	-0.09	-0.05	0.36	0.05
2011	-0.52	-0.22	-0.31	-0.28	-0.10	0.07	0.09	0.08	-0.01	-0.10
2012	0.04	-0.19	-0.10	0.22	0.33	0.28	0.40	0.25	0.13	0.14
2013	-0.25	0.00	-0.19	-0.12	0.07	0.04	0.01	0.21	0.50	0.03
2014	-0.37	-0.07	-0.21	-0.09	-0.01	0.16	-0.04	-0.21	-0.28	-0.02
2015	0.10	-0.06	-0.30	-0.25	-0.26	0.17	0.17	0.35	-0.06	-0.02
2016	0.53	-0.03	-0.20	-0.16	0.04	0.13	0.35	0.18	0.12	-0.26
2017	-0.54	-0.22	-0.32	-0.20	-0.18	0.07	0.21	0.26	0.36	0.40
2018	0.07	-0.07	-0.42	-0.35	-0.46	-0.12	-0.07	0.25	-0.12	-0.16

Table 9.10. Icelandic cod in Division Va. Fall survey (SMH) 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
1996	-0.09	-0.10	-0.06	-0.19	-0.02	-0.08	0.18	0.22	-0.17	-0.05
1997	-0.15	0.06	0.00	0.24	0.05	-0.03	-0.13	-0.10	-0.24	-0.10
1998	-0.31	-0.01	-0.24	0.00	-0.05	0.32	0.49	0.12	0.27	0.08
1999	0.12	-0.18	0.16	0.10	0.05	-0.04	-0.14	-0.31	-0.36	0.13
2000	-0.34	-0.14	-0.29	-0.10	-0.23	-0.25	-0.40	-0.33	-0.01	0.19
2001	-0.24	-0.19	0.01	0.00	-0.23	-0.27	-0.26	-0.51	-0.59	-0.37
2002	-0.13	-0.27	-0.16	0.16	0.00	0.10	-0.02	0.01	-0.02	-0.43
2003	-0.15	-0.09	0.07	-0.12	-0.11	-0.17	-0.14	0.09	-0.07	-0.41
2004	-0.18	0.10	0.15	0.16	0.18	0.09	0.23	0.35	0.52	0.24
2005	0.05	-0.11	0.07	0.05	0.25	-0.01	-0.26	-0.25	-0.16	-0.01
2006	0.04	-0.11	0.07	0.10	0.07	0.05	0.04	-0.18	-0.02	0.00
2007	0.08	-0.04	-0.32	-0.25	-0.08	-0.03	-0.17	0.06	-0.21	0.18
2008	0.41	0.29	0.05	-0.13	0.09	0.21	0.29	0.26	0.03	0.34

2009	-0.19	-0.06	0.12	0.06	0.13	0.04	0.16	0.29	0.31	0.30
2010	0.17	0.18	0.13	0.11	0.08	-0.05	0.09	0.23	0.55	0.19
2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2012	-0.16	0.07	-0.06	-0.18	-0.22	-0.15	0.00	0.20	-0.05	-0.07
2013	-0.04	0.18	0.04	-0.11	-0.08	-0.12	-0.09	0.01	0.24	0.00
2014	0.18	0.10	0.04	0.02	-0.05	0.03	-0.11	0.04	0.11	0.46
2015	0.50	0.32	0.36	0.26	0.15	0.25	0.21	-0.12	0.00	-0.46
2016	0.09	-0.16	-0.21	-0.34	-0.22	-0.23	-0.14	-0.18	-0.22	-0.10
2017	0.28	0.13	0.11	0.18	0.24	0.32	0.18	0.07	-0.05	-0.19

Table 9.11. Icelandic cod in Division Va. Estimates of fishing mortality 1955-2017 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	0.04	0.17	0.25	0.27	0.30	0.30	0.28	0.32	0.32	0.31	0.32	0.32
1956	0.05	0.18	0.25	0.26	0.29	0.30	0.29	0.34	0.35	0.33	0.33	0.33
1957	0.08	0.21	0.27	0.27	0.30	0.33	0.33	0.36	0.36	0.33	0.29	0.29
1958	0.11	0.25	0.30	0.29	0.32	0.37	0.40	0.44	0.44	0.38	0.32	0.32
1959	0.09	0.23	0.28	0.26	0.30	0.34	0.35	0.40	0.38	0.32	0.22	0.22
1960	0.10	0.23	0.29	0.29	0.34	0.40	0.43	0.47	0.47	0.38	0.27	0.27
1961	0.09	0.23	0.26	0.26	0.33	0.40	0.42	0.46	0.44	0.35	0.22	0.22
1962	0.11	0.25	0.28	0.26	0.35	0.42	0.47	0.51	0.48	0.37	0.23	0.23
1963	0.13	0.28	0.33	0.31	0.38	0.49	0.59	0.64	0.62	0.46	0.28	0.28
1964	0.13	0.29	0.37	0.36	0.43	0.57	0.74	0.81	0.83	0.60	0.38	0.38
1965	0.12	0.28	0.38	0.40	0.47	0.60	0.74	0.85	0.87	0.65	0.42	0.42
1966	0.09	0.25	0.34	0.38	0.49	0.62	0.78	0.91	1.00	0.78	0.52	0.52
1967	0.08	0.23	0.30	0.34	0.48	0.61	0.75	0.88	0.92	0.71	0.45	0.45
1968	0.08	0.25	0.34	0.41	0.58	0.76	1.04	1.20	1.35	1.07	0.72	0.72
1969	0.06	0.23	0.32	0.35	0.50	0.61	0.72	0.84	0.87	0.70	0.43	0.43
1970	0.07	0.27	0.39	0.43	0.55	0.65	0.76	0.89	0.94	0.79	0.50	0.50
1971	0.09	0.31	0.48	0.53	0.62	0.72	0.80	0.95	1.03	0.86	0.56	0.56
1972	0.09	0.30	0.48	0.55	0.65	0.73	0.79	0.96	1.05	0.89	0.58	0.58
1973	0.12	0.32	0.49	0.56	0.67	0.75	0.80	0.95	1.03	0.88	0.56	0.56
1974	0.11	0.32	0.50	0.57	0.70	0.83	0.92	1.05	1.17	1.00	0.66	0.66
1975	0.11	0.31	0.50	0.60	0.72	0.88	1.02	1.12	1.23	1.07	0.73	0.73
1976	0.07	0.26	0.43	0.55	0.69	0.85	0.94	1.00	1.04	0.91	0.61	0.61
1977	0.03	0.20	0.33	0.43	0.61	0.72	0.72	0.73	0.68	0.60	0.38	0.38
1978	0.03	0.17	0.28	0.35	0.52	0.60	0.54	0.54	0.47	0.43	0.26	0.26
1979	0.03	0.17	0.27	0.34	0.50	0.56	0.49	0.48	0.41	0.37	0.23	0.23

1980	0.03	0.17	0.31	0.39	0.54	0.62	0.55	0.54	0.46	0.42	0.27	0.27
1981	0.02	0.18	0.35	0.49	0.65	0.82	0.84	0.81	0.73	0.66	0.47	0.47
1982	0.03	0.19	0.39	0.56	0.70	0.89	0.95	0.86	0.73	0.64	0.46	0.46
1983	0.02	0.18	0.38	0.55	0.70	0.88	0.91	0.84	0.71	0.63	0.47	0.47
1984	0.04	0.20	0.38	0.53	0.67	0.80	0.75	0.69	0.58	0.53	0.38	0.38
1985	0.05	0.23	0.42	0.58	0.71	0.83	0.76	0.68	0.57	0.52	0.38	0.38
1986	0.06	0.26	0.52	0.72	0.82	0.95	0.86	0.75	0.63	0.57	0.42	0.42
1987	0.06	0.27	0.55	0.82	0.91	1.05	0.98	0.83	0.71	0.64	0.49	0.49
1988	0.05	0.26	0.52	0.80	0.92	1.10	1.06	0.92	0.83	0.75	0.60	0.60
1989	0.04	0.24	0.46	0.65	0.79	0.89	0.78	0.69	0.60	0.56	0.42	0.42
1990	0.05	0.25	0.47	0.66	0.79	0.85	0.73	0.66	0.58	0.53	0.39	0.39
1991	0.09	0.30	0.56	0.81	0.88	0.94	0.82	0.74	0.66	0.59	0.45	0.45
1992	0.10	0.32	0.60	0.87	0.92	0.99	0.87	0.77	0.68	0.61	0.47	0.47
1993	0.14	0.31	0.55	0.80	0.88	1.02	0.99	0.88	0.82	0.72	0.58	0.58
1994	0.09	0.24	0.38	0.53	0.67	0.75	0.69	0.65	0.58	0.53	0.40	0.40
1995	0.06	0.19	0.32	0.42	0.57	0.61	0.54	0.53	0.47	0.43	0.32	0.32
1996	0.04	0.16	0.28	0.41	0.55	0.61	0.56	0.56	0.49	0.44	0.33	0.33
1997	0.03	0.14	0.27	0.42	0.58	0.66	0.63	0.63	0.56	0.50	0.38	0.38
1998	0.03	0.15	0.33	0.52	0.66	0.76	0.77	0.75	0.69	0.60	0.48	0.48
1999	0.04	0.17	0.39	0.64	0.73	0.83	0.86	0.81	0.73	0.63	0.51	0.51
2000	0.06	0.18	0.38	0.61	0.72	0.84	0.87	0.84	0.77	0.66	0.54	0.54
2001	0.07	0.19	0.38	0.57	0.68	0.82	0.90	0.89	0.84	0.72	0.60	0.60
2002	0.05	0.16	0.33	0.48	0.59	0.70	0.78	0.80	0.75	0.64	0.53	0.53
2003	0.04	0.15	0.33	0.49	0.57	0.67	0.72	0.74	0.69	0.60	0.50	0.50
2004	0.03	0.14	0.32	0.52	0.58	0.67	0.73	0.74	0.70	0.61	0.51	0.51
2005	0.03	0.13	0.29	0.47	0.55	0.64	0.69	0.70	0.67	0.58	0.48	0.48
2006	0.03	0.12	0.27	0.46	0.53	0.63	0.67	0.67	0.63	0.54	0.44	0.44
2007	0.03	0.11	0.23	0.38	0.49	0.60	0.66	0.66	0.62	0.52	0.43	0.43
2008	0.02	0.09	0.18	0.30	0.41	0.49	0.50	0.49	0.44	0.38	0.29	0.29
2009	0.03	0.10	0.19	0.31	0.40	0.48	0.48	0.46	0.39	0.34	0.25	0.25
2010	0.03	0.09	0.16	0.26	0.35	0.41	0.39	0.37	0.30	0.26	0.19	0.19
2011	0.03	0.09	0.16	0.24	0.32	0.38	0.34	0.32	0.26	0.22	0.15	0.15
2012	0.03	0.09	0.16	0.24	0.32	0.37	0.33	0.31	0.25	0.22	0.14	0.14
2013	0.04	0.10	0.17	0.25	0.32	0.37	0.34	0.33	0.27	0.24	0.16	0.16
2014	0.03	0.09	0.16	0.23	0.30	0.35	0.32	0.32	0.27	0.23	0.16	0.16
2015	0.03	0.09	0.15	0.22	0.29	0.33	0.30	0.30	0.25	0.22	0.14	0.14
2016	0.03	0.09	0.15	0.22	0.30	0.34	0.32	0.32	0.27	0.23	0.14	0.14
2017	0.03	0.09	0.14	0.21	0.28	0.33	0.31	0.32	0.27	0.24	0.15	0.15

Table 9.12. Icelandic cod in Division Va. Estimates of numbers at age in the stock 1955-2018 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	254.	186.	152.	217.	212.	115.	36.	24.	13.	88.	9.2	7.8	8.1	2.6
56	553	664	038	703	095	584	108	638	002	082	58	63	87	60
1956	329.	208.	152.	119.	150.	134.	71.	21.	14.	8.0	52.	5.4	4.7	4.8
57	201	411	828	596	363	923	979	869	904	35	301	97	42	61
1957	430.	269.	170.	118.	81.6	95.9	85.	44.	13.	9.1	4.6	30.	3.2	2.7
58	844	527	632	911	20	65	348	136	232	03	85	119	31	95
1958	230.	352.	220.	128.	78.5	50.8	59.	51.	35.	7.8	5.1	2.6	17.	1.9
59	471	745	670	812	43	41	910	770	279	24	97	75	774	72
1959	287.	188.	288.	161.	82.2	47.5	31.	35.	51.	19.	4.1	2.7	1.4	10.
60	861	693	804	154	71	63	139	510	810	450	44	44	97	588
1960	192.	235.	154.	215.	104.	50.7	30.	18.	20.	37.	10.	2.3	1.6	0.9
61	616	681	489	933	507	98	139	919	682	635	716	24	38	79
1961	264.	157.	192.	114.	140.	63.7	31.	17.	10.	11.	19.	5.4	1.3	1.0
62	952	701	959	363	024	16	069	604	414	046	180	77	00	29
1962	304.	216.	129.	143.	74.7	88.4	40.	18.	23.	5.6	5.7	10.	3.1	0.8
63	316	925	114	820	58	47	155	224	620	15	25	145	76	52
1963	322.	249.	177.	94.5	91.8	46.1	55.	23.	9.7	12.	2.7	2.8	5.7	2.0
64	781	153	603	37	69	74	626	249	67	129	57	86	14	56
1964	341.	264.	203.	127.	58.3	54.1	27.	31.	11.	4.4	5.2	1.2	1.4	3.5
65	819	270	989	707	15	68	750	047	636	48	12	11	96	34
1965	477.	279.	216.	147.	78.2	32.9	30.	14.	14.	4.5	1.6	1.8	0.5	0.8
66	200	858	366	279	09	08	924	711	373	47	23	59	43	36
1966	256.	390.	229.	157.	90.7	43.5	18.	15.	6.6	5.5	1.5	0.5	0.7	0.2
67	340	699	128	021	85	99	010	812	02	98	98	54	97	93
1967	368.	209.	319.	170.	99.7	52.8	24.	9.0	6.9	2.4	1.8	0.4	0.2	0.3
68	997	873	877	762	90	56	380	29	54	79	39	81	09	88
1968	269.	302.	171.	242.	111.	60.3	30.	12.	4.0	2.6	0.8	0.5	0.1	0.1
69	167	109	830	580	206	43	871	309	20	93	45	98	93	09
1969	281.	220.	247.	130.	155.	64.6	32.	41.	4.6	1.1	0.6	0.1	0.1	0.0
70	336	376	346	286	195	91	942	220	90	69	66	79	68	77
1970	207.	230.	180.	191.	84.5	92.0	37.	32.	18.	1.8	0.4	0.2	0.0	0.0
71	789	338	428	505	54	40	172	919	370	72	15	29	72	90
1971	407.	170.	188.	137.	119.	46.9	49.	17.	14.	7.0	0.6	0.1	0.0	0.0
72	340	123	585	922	750	13	234	544	075	38	30	32	86	36
1972	266.	333.	139.	141.	82.9	60.7	22.	21.	23.	5.1	2.2	0.1	0.0	0.0
73	993	502	285	351	22	81	562	686	274	84	20	85	46	40
1973	389.	218.	273.	104.	85.5	42.0	28.	9.6	8.5	8.6	1.6	0.6	0.0	0.0
74	092	596	048	474	91	39	622	51	64	41	31	35	62	21

19	547.	318.	178.	198.	62.0	43.0	19.	12.	3.7	3.1	2.7	0.4	0.2	0.0
74	908	562	971	551	89	16	585	025	19	57	37	75	15	29
19	213.	448.	260.	130.	117.	30.8	19.	7.9	4.2	1.2	0.9	0.6	0.1	0.0
75	785	589	816	843	532	80	829	74	91	15	04	97	43	91
19	339.	175.	367.	191.	78.6	58.2	13.	7.8	2.7	1.2	0.3	0.2	0.1	0.0
76	253	032	274	650	18	71	878	94	02	71	25	15	96	57
19	363.	277.	143.	281.	121.	41.9	27.	5.6	2.7	0.8	0.3	0.0	0.0	0.0
77	296	757	304	406	216	85	508	79	66	64	85	94	71	87
19	208.	297.	227.	113.	189.	71.3	22.	12.	2.2	1.1	0.3	0.1	0.0	0.0
78	974	442	408	809	537	99	418	264	69	02	42	60	42	40
19	209.	171.	243.	181.	78.3	117.	41.	10.	5.5	1.0	0.5	0.1	0.0	0.0
79	023	094	525	179	03	132	027	867	11	81	26	75	85	27
19	196.	171.	140.	193.	125.	48.7	71.	20.	5.0	2.7	0.5	0.2	0.0	0.0
80	783	134	080	831	058	26	927	336	58	59	46	86	98	56
19	346.	161.	140.	111.	133.	75.4	27.	47.	8.9	2.3	1.3	0.2	0.1	0.0
81	307	113	113	506	239	00	124	158	73	81	19	83	54	62
19	207.	283.	131.	112.	76.5	76.6	37.	11.	17.	3.1	0.8	0.5	0.1	0.0
82	594	533	908	135	65	54	896	628	068	57	70	19	20	78
19	210.	169.	232.	105.	75.7	42.2	35.	15.	3.8	5.3	1.0	0.3	0.2	0.0
83	291	964	137	054	54	43	947	440	92	99	99	45	25	62
19	498.	172.	139.	185.	71.9	42.5	19.	14.	5.2	1.2	1.9	0.4	0.1	0.1
84	257	172	155	647	53	34	865	555	59	87	14	42	50	15
19	393.	407.	140.	109.	124.	40.3	20.	8.2	5.3	2.0	0.5	0.8	0.2	0.0
85	969	938	962	617	391	53	473	94	46	42	29	81	14	83
19	262.	322.	333.	109.	71.3	66.7	18.	8.2	2.9	2.0	0.8	0.2	0.4	0.1
86	128	555	991	791	22	01	524	13	68	54	43	45	28	19
19	132.	214.	264.	257.	69.2	34.8	26.	6.6	2.6	1.0	0.7	0.3	0.1	0.2
87	612	612	086	193	27	11	690	57	04	24	93	66	13	30
19	195.	108.	175.	204.	160.	32.5	12.	8.8	1.9	0.8	0.3	0.3	0.1	0.0
88	563	573	709	593	558	49	579	37	02	01	67	19	59	57
19	159.	160.	88.8	137.	129.	77.8	12.	4.1	2.4	0.5	0.2	0.1	0.1	0.0
89	991	113	92	266	499	49	018	01	16	37	62	31	24	71
19	262.	130.	131.	69.8	88.3	100.	33.	4.4	1.3	0.9	0.2	0.1	0.0	0.0
90	083	990	090	94	48	047	126	56	83	05	20	17	62	67
19	203.	214.	107.	102.	44.5	45.1	42.	12.	1.5	0.5	0.3	0.1	0.0	0.0
91	159	576	245	081	81	84	200	346	59	44	82	01	57	34
19	117.	166.	175.	80.5	61.8	20.7	16.	14.	3.9	0.5	0.2	0.1	0.0	0.0
92	342	333	680	95	49	57	426	315	59	60	13	62	46	29
19	227.	96.0	136.	129.	47.9	27.8	7.1	5.3	4.3	1.3	0.2	0.0	0.0	0.0
93	747	72	182	838	34	43	30	60	50	60	13	88	72	23
19	247.	186.	78.6	97.0	77.7	22.5	10.	2.4	1.5	1.3	0.4	0.0	0.0	0.0
94	585	463	57	85	33	45	213	13	90	21	60	77	35	33

19	133.	202.	152.	58.9	62.4	43.3	10.	4.2	0.9	0.6	0.5	0.2	0.0	0.0
95	070	706	663	72	57	41	854	69	31	53	62	10	37	19
19	241.	108.	165.	117.	39.7	37.1	23.	5.0	1.8	0.4	0.3	0.2	0.1	0.0
96	671	949	961	575	40	94	263	47	91	46	14	89	12	22
19	106.	197.	89.2	131.	82.0	24.5	20.	10.	2.2	0.8	0.2	0.1	0.1	0.0
97	419	864	00	071	62	67	198	938	38	88	09	58	52	66
19	255.	87.1	161.	71.1	92.9	51.0	13.	9.2	4.6	0.9	0.3	0.0	0.0	0.0
98	676	28	997	98	14	90	223	71	42	75	87	98	79	85
19	241.	209.	71.3	128.	50.0	54.8	24.	5.6	3.5	1.7	0.3	0.1	0.0	0.0
99	722	330	35	887	55	74	978	22	51	56	76	59	44	40
20	236.	197.	171.	55.8	88.6	27.8	23.	9.8	1.9	1.2	0.6	0.1	0.0	0.0
00	886	905	385	54	30	73	758	51	98	35	43	48	69	22
20	265.	193.	162.	132.	38.2	49.5	12.	9.4	3.4	0.6	0.4	0.2	0.0	0.0
01	563	946	031	198	40	14	432	27	82	83	38	44	62	33
20	120.	217.	158.	123.	89.5	21.4	22.	5.1	3.4	1.1	0.2	0.1	0.0	0.0
02	216	425	790	156	79	47	870	53	09	56	30	55	97	28
20	229.	98.4	178.	124.	85.6	52.5	10.	10.	2.0	1.2	0.4	0.0	0.0	0.0
03	768	24	012	075	92	10	833	350	88	75	26	89	67	47
20	202.	188.	80.5	140.	87.4	50.5	26.	5.0	4.3	0.8	0.4	0.1	0.0	0.0
04	217	118	83	466	44	89	383	09	56	34	97	74	40	33
20	148.	165.	154.	63.8	99.8	51.8	24.	12.	2.0	1.7	0.3	0.2	0.0	0.0
05	236	562	018	71	78	14	732	106	88	23	25	02	78	20
20	198.	121.	135.	122.	46.0	61.1	26.	11.	5.2	0.8	0.6	0.1	0.0	0.0
06	356	365	550	129	83	96	426	721	16	59	97	36	93	40
20	181.	162.	99.3	107.	88.6	28.9	31.	12.	5.1	2.1	0.3	0.3	0.0	0.0
07	275	400	65	671	55	22	725	711	01	76	59	04	65	49
20	198.	148.	132.	79.1	79.0	57.5	16.	15.	5.7	2.1	0.9	0.1	0.1	0.0
08	414	415	962	88	86	97	115	960	17	65	24	58	47	35
20	258.	162.	121.	106.	59.2	64.0	34.	8.7	8.0	2.8	1.0	0.4	0.0	0.0
09	615	448	512	379	36	82	974	96	21	40	82	88	89	90
20	277.	211.	133.	96.6	79.2	40.2	38.	19.	4.4	4.0	1.4	0.5	0.2	0.0
10	250	736	001	00	01	51	632	107	39	54	72	97	85	57
20	194.	226.	173.	105.	72.3	55.0	25.	22.	10.	2.4	2.3	0.8	0.3	0.1
11	550	993	355	965	15	12	535	239	341	70	01	91	76	94
20	292.	159.	185.	138.	79.3	50.4	35.	15.	12.	6.0	1.4	1.4	0.5	0.2
12	787	284	846	252	98	13	413	114	510	41	68	59	85	66
20	260.	239.	130.	147.	103.	55.2	32.	21.	8.5	7.3	3.6	0.9	0.9	0.4
13	476	714	411	929	292	11	359	030	76	83	20	35	62	15
20	178.	213.	196.	102.	109.	71.2	35.	19.	11.	5.0	4.3	2.2	0.6	0.6
14	144	260	261	823	721	63	175	175	866	20	60	59	05	73
20	289.	145.	174.	155.	76.6	76.8	46.	21.	11.	7.0	2.9	2.7	1.4	0.4
15	333	852	602	872	97	12	392	230	031	52	90	27	62	24

20	286.	236.	119.	138.	116.	54.0	50.	28.	12.	6.6	4.2	1.9	1.7	1.0
16	766	886	414	544	251	23	714	415	449	98	74	06	99	46
20	201.	234.	193.	95.0	103.	82.3	35.	30.	16.	7.4	3.9	2.6	1.2	1.2
17	700	784	946	15	504	26	633	895	520	33	80	82	38	79
20	235.	165.	192.	154.	70.8	73.3	54.	21.	18.	9.9	4.4	2.4	1.7	0.8
18	966	138	225	014	26	17	825	988	222	64	20	94	27	68

Table 9.13. Icelandic cod in Division Va. Landings (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.

Year	Yield	F5-10	SSB	Reference biomass	Recruits	Harvest rate
1955	545.250	0.29	947.569	2368.250	152.038	0.23
1956	486.909	0.29	801.431	2092.380	152.828	0.23
1957	455.182	0.31	781.071	1888.140	170.632	0.24
1958	517.359	0.35	880.754	1873.750	220.670	0.28
1959	459.081	0.32	859.254	1835.810	288.804	0.25
1960	470.121	0.37	711.838	1756.750	154.489	0.27
1961	377.291	0.35	468.893	1498.960	192.959	0.25
1962	388.985	0.38	570.804	1494.470	129.114	0.26
1963	408.800	0.46	509.293	1317.380	177.603	0.31
1964	437.012	0.55	452.463	1220.700	203.989	0.36
1965	387.106	0.57	318.269	1023.180	216.366	0.38
1966	353.357	0.59	277.840	1032.090	229.128	0.34
1967	335.721	0.56	256.987	1103.400	319.877	0.30
1968	381.770	0.72	221.930	1222.830	171.830	0.31
1969	403.205	0.56	313.863	1325.290	247.346	0.30
1970	475.077	0.61	331.270	1336.510	180.428	0.36
1971	444.248	0.68	242.637	1097.660	188.585	0.40
1972	395.166	0.69	221.872	996.800	139.285	0.40
1973	369.205	0.70	245.649	843.908	273.048	0.44
1974	368.133	0.76	187.466	918.677	178.971	0.40
1975	364.754	0.81	168.857	895.993	260.816	0.41
1976	346.253	0.74	139.174	956.278	367.274	0.36
1977	340.086	0.59	199.545	1290.270	143.304	0.26
1978	329.602	0.47	213.191	1298.510	227.408	0.25
1979	366.462	0.44	304.915	1397.430	243.525	0.26
1980	432.237	0.49	357.963	1490.960	140.080	0.29
1981	465.032	0.66	265.292	1243.200	140.113	0.37
1982	380.068	0.73	168.661	971.772	131.908	0.39

1983	298.049	0.71	131.592	792.757	232.137	0.38
1984	282.022	0.64	142.651	914.145	139.155	0.31
1985	323.428	0.66	163.327	927.882	140.962	0.35
1986	364.797	0.77	195.839	855.615	333.991	0.43
1987	389.915	0.86	150.055	1037.820	264.086	0.38
1988	377.554	0.89	168.477	1043.520	175.709	0.36
1989	363.125	0.71	172.157	1011.780	88.892	0.36
1990	335.316	0.69	210.378	843.534	131.090	0.40
1991	307.759	0.79	166.021	700.367	107.245	0.44
1992	264.834	0.84	153.853	553.127	175.680	0.48
1993	250.704	0.86	122.552	599.269	136.182	0.42
1994	178.138	0.61	159.021	580.401	78.657	0.31
1995	168.592	0.50	179.555	562.038	152.663	0.30
1996	180.701	0.50	161.580	677.690	165.961	0.27
1997	203.112	0.53	190.715	790.641	89.200	0.26
1998	243.987	0.63	202.525	729.444	161.997	0.33
1999	260.147	0.71	184.373	741.042	71.335	0.35
2000	235.092	0.71	174.563	602.656	171.385	0.39
2001	236.707	0.71	172.779	686.535	162.031	0.34
2002	209.535	0.62	201.473	730.009	158.790	0.29
2003	207.241	0.59	193.944	745.161	178.012	0.28
2004	228.330	0.59	199.556	805.951	80.583	0.28
2005	213.863	0.56	231.336	725.377	154.018	0.29
2006	197.257	0.54	225.363	699.481	135.550	0.28
2007	171.652	0.50	210.909	684.245	99.365	0.25
2008	147.663	0.39	267.640	706.869	132.962	0.21
2009	183.315	0.39	254.019	793.493	121.512	0.23
2010	170.018	0.32	294.766	855.455	133.001	0.20
2011	172.197	0.29	364.649	910.781	173.355	0.19
2012	196.192	0.29	409.972	1043.130	185.846	0.19
2013	223.593	0.30	445.218	1180.210	130.411	0.19
2014	222.016	0.28	417.899	1198.030	196.261	0.19
2015	230.231	0.26	537.283	1303.270	174.602	0.18
2016	251.132	0.27	480.458	1392.850	119.414	0.18
2017	243.990	0.26	633.123	1344.220	193.946	0.18
2018	NA	NA	651.600	1356.509	192.225	NA
2019	NA	NA	NA	NA	135.203	NA
2020	NA	NA	NA	NA	158.173	NA

Table 9.14. Icelandic cod in Division Va. Inputs in the deterministic predictions.

Age	2018	2019	2020	2021	Variable
3	1.0140000	1.1520000	1.1520000	1.1520000	Catch weights
4	1.7700000	1.6320000	1.6320000	1.6320000	Catch weights
5	2.5160000	2.5810000	2.5810000	2.5810000	Catch weights
6	3.4210000	3.4150000	3.4150000	3.4150000	Catch weights
7	4.7900000	4.0750000	4.0750000	4.0750000	Catch weights
8	5.9630000	6.1580000	6.1580000	6.1580000	Catch weights
9	7.1260000	7.0140000	7.0140000	7.0140000	Catch weights
10	8.4860000	8.4860000	8.4860000	8.4860000	Catch weights
11	9.5090000	9.5090000	9.5090000	9.5090000	Catch weights
12	11.0950000	11.0950000	11.0950000	11.0950000	Catch weights
13	11.5750000	11.5750000	11.5750000	11.5750000	Catch weights
14	12.8000000	12.8000000	12.8000000	12.8000000	Catch weights
3	1.0290000	1.0290000	1.0290000	1.0290000	SSB weights
4	2.3720000	2.3720000	2.3720000	2.3720000	SSB weights
5	3.2300000	3.2300000	3.2300000	3.2300000	SSB weights
6	3.8620000	3.8620000	3.8620000	3.8620000	SSB weights
7	4.5740000	4.5740000	4.5740000	4.5740000	SSB weights
8	6.6710000	6.6710000	6.6710000	6.6710000	SSB weights
9	7.7110000	7.7110000	7.7110000	7.7110000	SSB weights
10	8.4860000	8.4860000	8.4860000	8.4860000	SSB weights
11	9.5090000	9.5090000	9.5090000	9.5090000	SSB weights
12	11.0950000	11.0950000	11.0950000	11.0950000	SSB weights
13	11.5750000	11.5750000	11.5750000	11.5750000	SSB weights
14	12.8000000	12.8000000	12.8000000	12.8000000	SSB weights
3	0.0020000	0.0020000	0.0020000	0.0020000	Maturity
4	0.0130000	0.0130000	0.0130000	0.0130000	Maturity
5	0.1470000	0.1470000	0.1470000	0.1470000	Maturity
6	0.4340000	0.4340000	0.4340000	0.4340000	Maturity
7	0.6050000	0.6050000	0.6050000	0.6050000	Maturity
8	0.9350000	0.9350000	0.9350000	0.9350000	Maturity
9	0.9530000	0.9530000	0.9530000	0.9530000	Maturity
10	1.0000000	1.0000000	1.0000000	1.0000000	Maturity
11	1.0000000	1.0000000	1.0000000	1.0000000	Maturity
12	1.0000000	1.0000000	1.0000000	1.0000000	Maturity
13	1.0000000	1.0000000	1.0000000	1.0000000	Maturity

14	1.0000000	1.0000000	1.0000000	1.0000000	Maturity
3	0.1125814	0.1125814	0.1125814	0.1125814	Selection
4	0.3470357	0.3470357	0.3470357	0.3470357	Selection
5	0.5483701	0.5483701	0.5483701	0.5483701	Selection
6	0.7944374	0.7944374	0.7944374	0.7944374	Selection
7	1.0821168	1.0821168	1.0821168	1.0821168	Selection
8	1.2517154	1.2517154	1.2517154	1.2517154	Selection
9	1.1478425	1.1478425	1.1478425	1.1478425	Selection
10	1.1755179	1.1755179	1.1755179	1.1755179	Selection
11	0.7339628	0.7339628	0.7339628	0.7339628	Selection
12	0.7339628	0.7339628	0.7339628	0.7339628	Selection
13	0.7339628	0.7339628	0.7339628	0.7339628	Selection
14	0.7339628	0.7339628	0.7339628	0.7339628	Selection
3	192.0960000	135.1060000	158.1150000	0.0000000	Stock numbers
4	153.8920000	NA	NA	NA	Stock numbers
5	70.7496000	NA	NA	NA	Stock numbers
6	73.2321000	NA	NA	NA	Stock numbers
7	54.7483000	NA	NA	NA	Stock numbers
8	21.9497000	NA	NA	NA	Stock numbers
9	18.1796000	NA	NA	NA	Stock numbers
10	9.9330700	NA	NA	NA	Stock numbers
11	4.4001600	NA	NA	NA	Stock numbers
12	2.4775200	NA	NA	NA	Stock numbers
13	1.7113300	NA	NA	NA	Stock numbers
14	0.8575710	NA	NA	NA	Stock numbers

Table 9.15. Icelandic cod in Division Va. Output of the deterministic predictions.

Year	B4+	Fmult	Fbar	SSB	Landings	2020 B4+	2020 SSB	SSB change	TAC change
2018	1354.028	NA	NA	NA	NA	NA	NA	NA	NA
2019	1417.812	0.000000	0.00	751.8766	0.000000	1692.955	998.1417	0.3275339	-1.0000000
NA	NA	0.2164538	0.06	732.6866	61.88467	1622.114	919.8356	0.2554284	-0.7563596
NA	NA	0.2525294	0.07	729.5411	71.87943	1610.679	907.4514	0.2438659	-0.71701

NA	NA	0.79366 39	0.2 2	684.10 58	211.628 68	1450.9 93	742.09 47	0.08476 61	- 0.16681 62
NA	NA	0.82973 95	0.2 3	681.18 99	220.304 79	1441.0 93	732.31 62	0.07505 44	- 0.13265 83
NA	NA	0.86581 52	0.2 4	678.28 79	228.905 30	1431.2 80	722.68 00	0.06544 74	- 0.09879 80
NA	NA	0.90189 08	0.2 5	675.39 95	237.430 99	1421.5 54	713.18 39	0.05594 38	- 0.06523 23
NA	NA	0.93796 64	0.2 6	672.52 47	245.882 59	1411.9 14	703.82 57	0.04654 25	- 0.03195 83
NA	NA	0.97404 21	0.2 7	669.66 35	254.260 83	1402.3 60	694.60 33	0.03724 23	0.00102 69
NA	NA	1.01011 77	0.2 8	666.81 58	262.566 46	1392.8 90	685.51 46	0.02804 20	0.03372 62
NA	NA	1.04619 33	0.2 9	663.98 14	270.800 19	1383.5 03	676.55 76	0.01894 05	0.06614 25
NA	NA	1.08226 89	0.3 0	661.16 05	278.962 73	1374.1 99	667.73 02	0.00993 67	0.09827 84
NA	NA	1.11834 46	0.3 1	658.35 28	287.054 78	1364.9 77	659.03 04	0.00102 93	0.13013 69
NA	NA	1.15442 02	0.3 2	655.55 83	295.077 06	1355.8 36	650.45 63	- 0.00778 26	0.16172 07
NA	NA	1.19049 58	0.3 3	652.77 70	303.030 24	1346.7 75	642.00 60	- 0.01650 02	0.19303 25
NA	NA	1.22657 15	0.3 4	650.00 87	310.915 02	1337.7 94	633.67 75	- 0.02512 46	0.22407 49
NA	NA	1.26264 71	0.3 5	647.25 35	318.732 06	1328.8 91	625.46 90	- 0.03365 68	0.25485 06
NA	NA	1.29872 27	0.3 6	644.51 12	326.482 05	1320.0 67	617.37 86	- 0.04209 79	0.28536 24
NA	NA	1.33479 84	0.3 7	641.78 18	334.165 63	1311.3 19	609.40 46	- 0.05044 90	0.31561 27

NA	NA	1.37087 40	0.3 8	639.06 53	341.783 46	1302.6 48	601.54 51	- 0.05871 10	0.34560 42
NA	NA	1.40694 96	0.3 9	636.36 15	349.336 20	1294.0 52	593.79 84	- 0.06688 50	0.37533 94
NA	NA	1.44302 53	0.4 0	633.67 04	356.824 48	1285.5 31	586.16 28	- 0.07497 20	0.40482 08
NA	NA	1.47910 09	0.4 1	630.99 19	364.248 94	1277.0 84	578.63 66	- 0.08297 30	0.43405 09
NA	NA	1.51517 65	0.4 2	628.32 60	371.610 20	1268.7 10	571.21 81	- 0.09088 90	0.46303 23
NA	NA	1.55125 22	0.4 3	625.67 26	378.908 89	1260.4 09	563.90 57	- 0.09872 09	0.49176 73
NA	NA	1.58732 78	0.4 4	623.03 17	386.145 62	1252.1 80	556.69 77	- 0.10646 98	0.52025 83
NA	NA	1.62340 34	0.4 5	620.40 32	393.321 00	1244.0 22	549.59 25	- 0.11413 65	0.54850 79
NA	NA	1.65947 91	0.4 6	617.78 69	400.435 62	1235.9 35	542.58 87	- 0.12172 20	0.57651 82

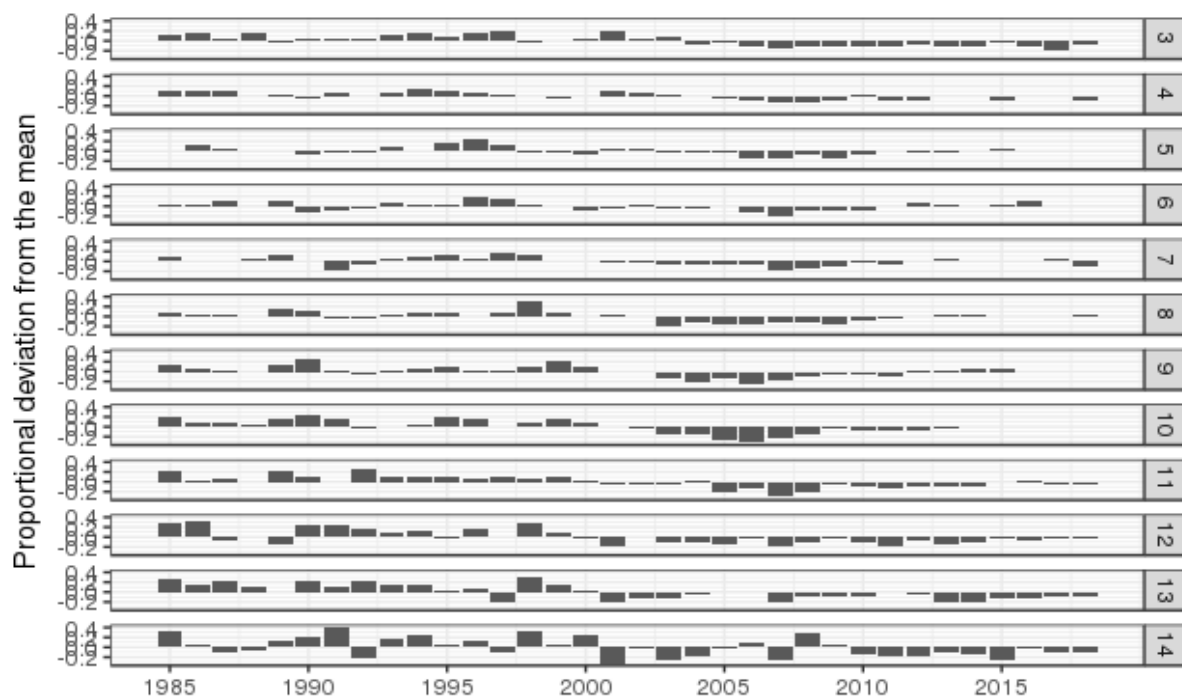


Figure 9.1. Icelandic cod division Va. Estimated weight at age (numbers in panel indicate age classes) in the catches expressed as proportional deviations from the mean. Weight at age in the assessment year are estimates. Note that values that are equal to the mean are not visible in this type of a plot.

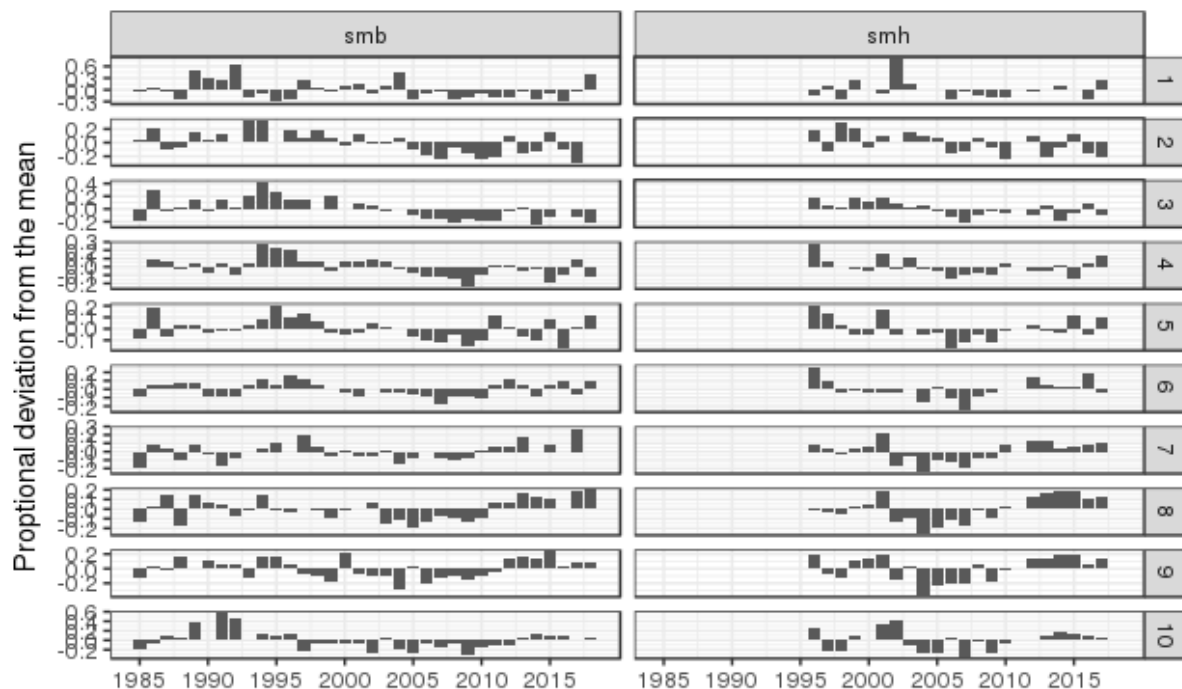


Figure 9.2. Icelandic cod division Va. Estimated weight at age (numbers in panel indicate age classes) in the spring survey (SMB) and fall survey (SMH) expressed as proportional deviations from the mean. No fall survey was conducted in 2011. Note that values that are equal to the mean are not visible in this type of a plot.

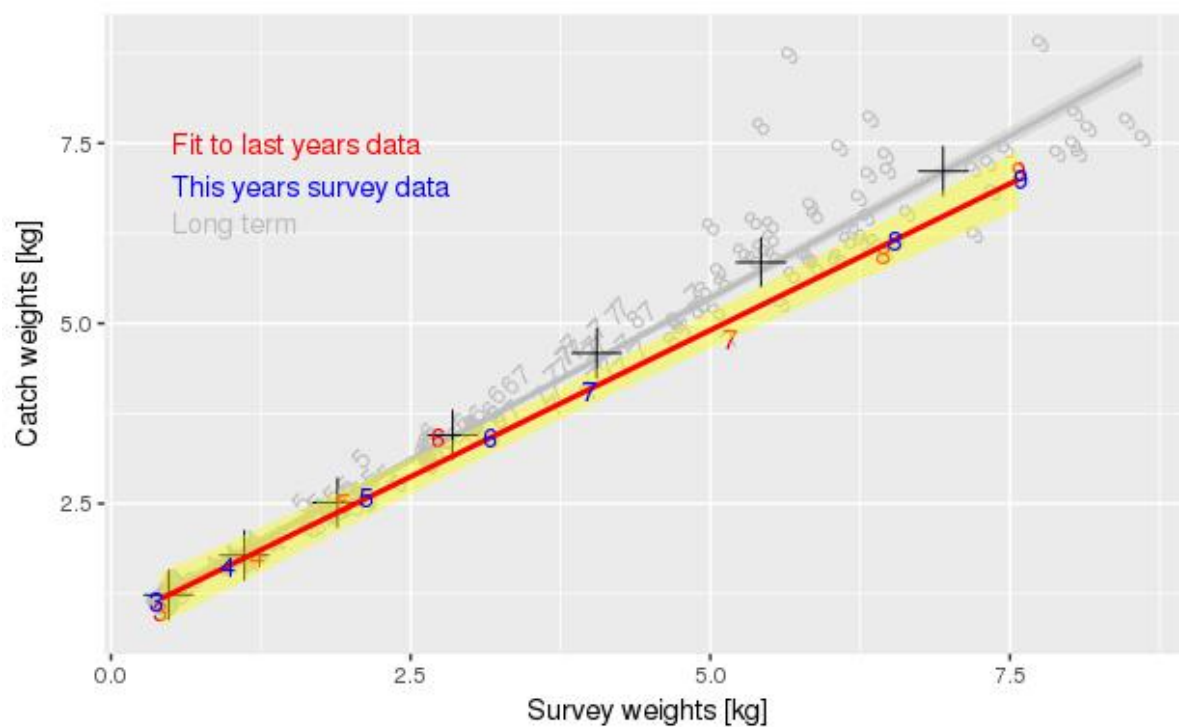


Figure 9.3. Icelandic cod division Va. Prediction of catch weights age 3 to 9 in the assessment year. The 'crossed' points are the mean from 1990 to the present.

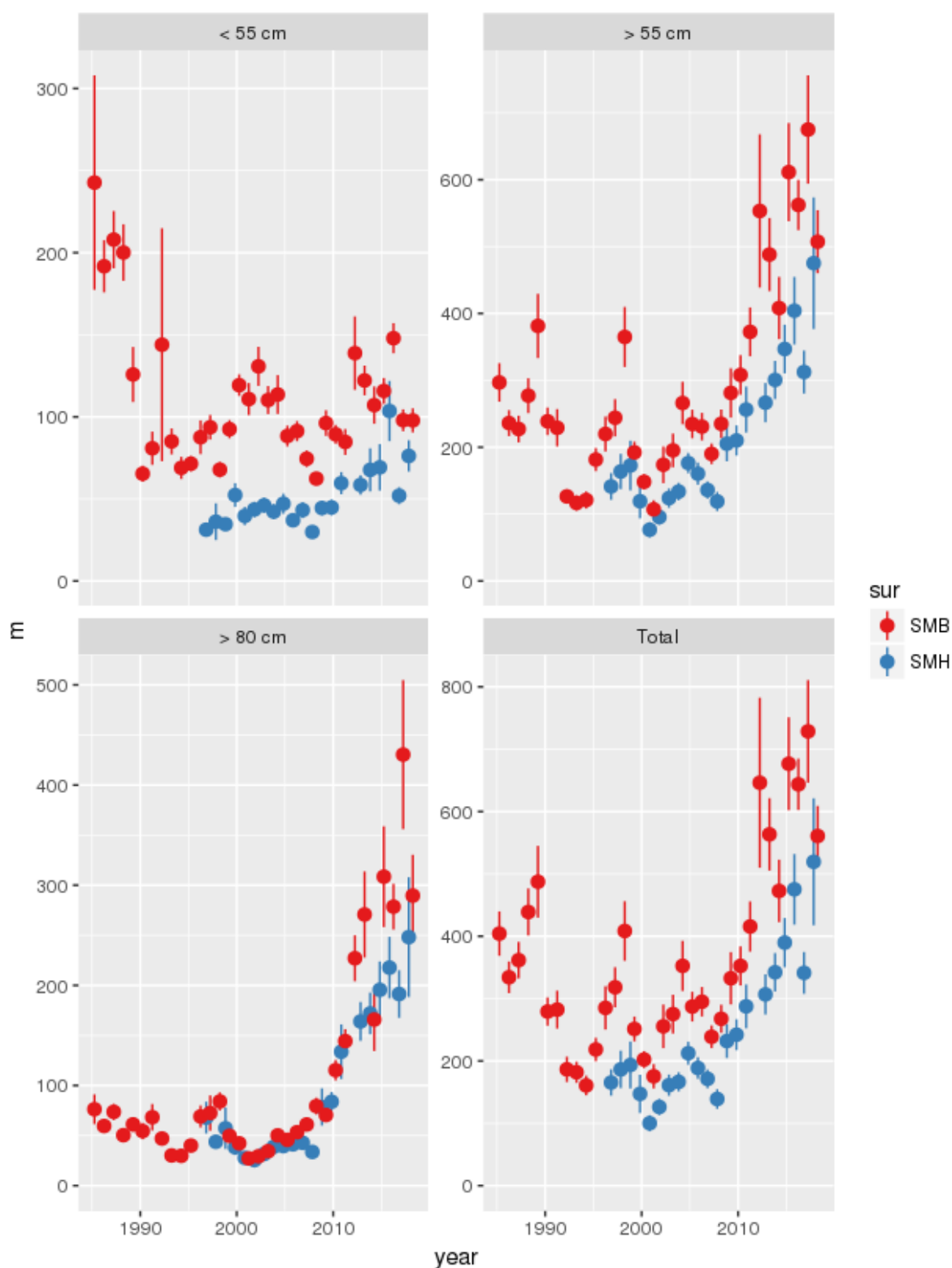


Figure 9.4. Icelandic cod division Va. Indices of cod in the spring (SMB, red) and fall (SMH, blue) groundfish surveys. Total biomass index (top right), biomass index of 55 cm and larger (bottom right), biomass index 80 cm and larger (bottom right) and abundance index of < 55 cm, (top left). The shaded area and the vertical bar show 1 standard error of the estimate.

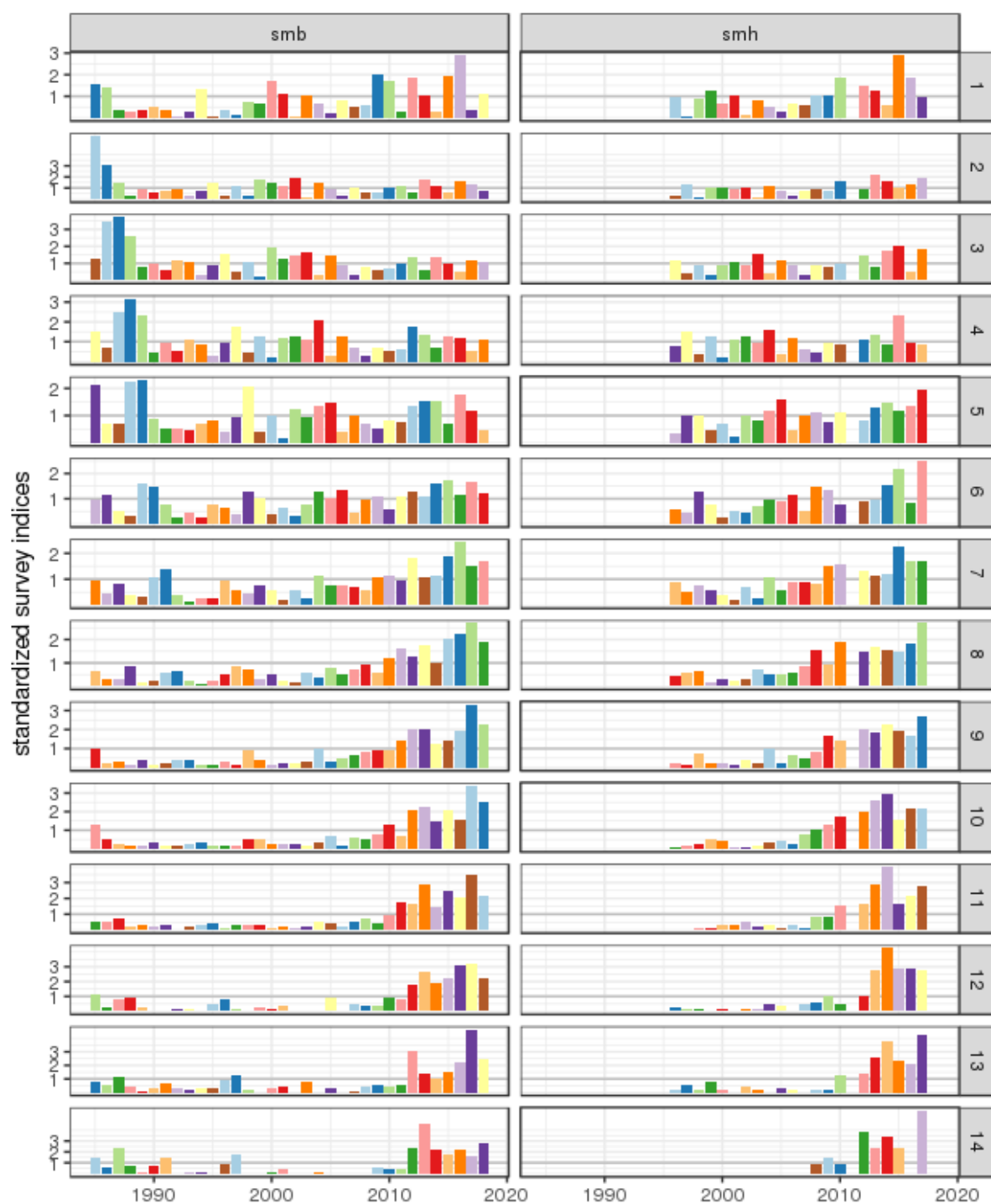


Figure 9.5. Icelandic cod division Va. Age based abundance indices of cod in the groundfish survey in spring (SMB) and fall (SMH). The indices are standardized within each age group and within each survey.

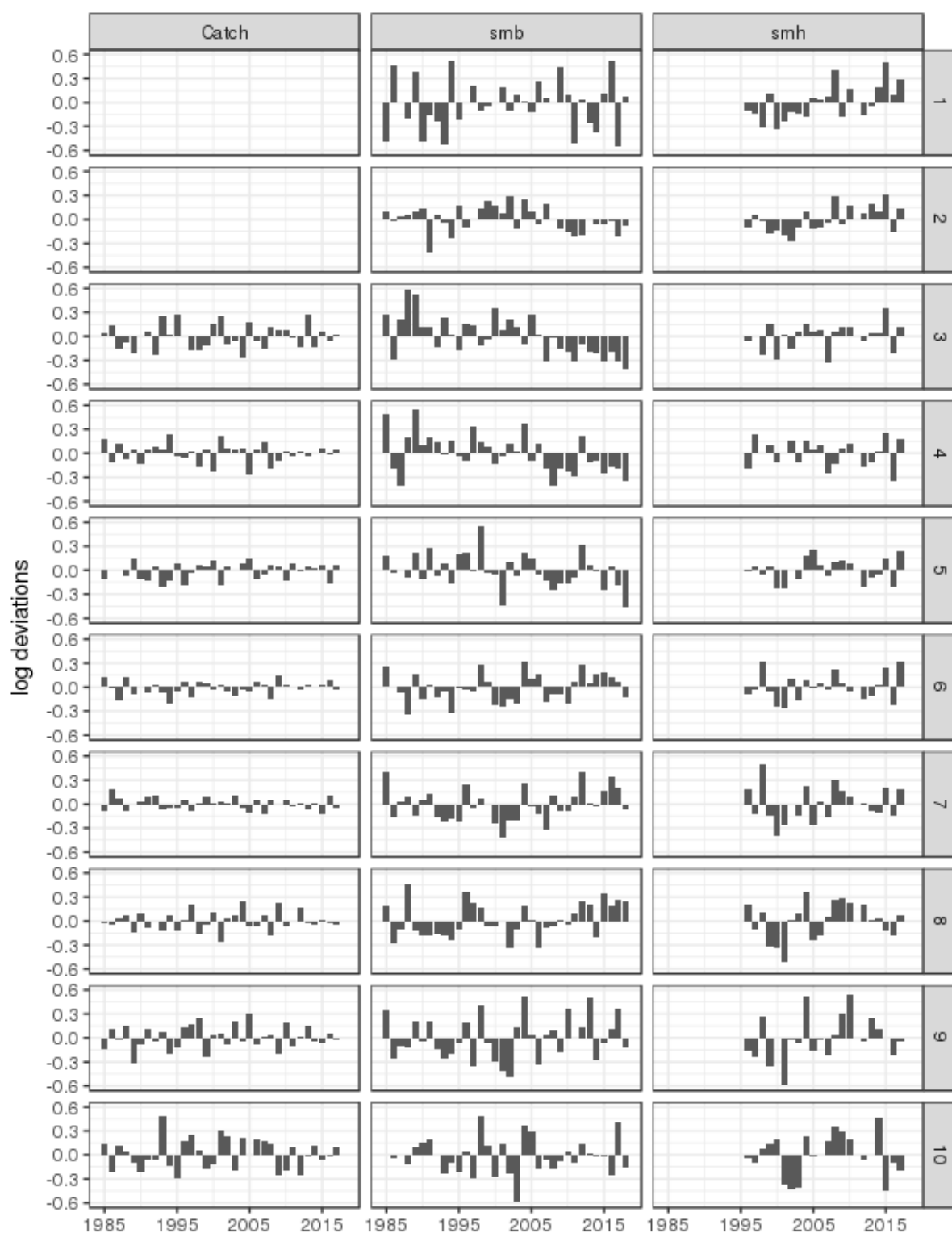


Figure 9.6. Catch residuals (left), spring survey residuals (SMB, middle) and fall survey residuals (SMH, right) by year and age from the spaly ADCAM run. Note that values that are equal to the mean are not visible in this type of a plot and that no survey was carried out in the fall 2011.

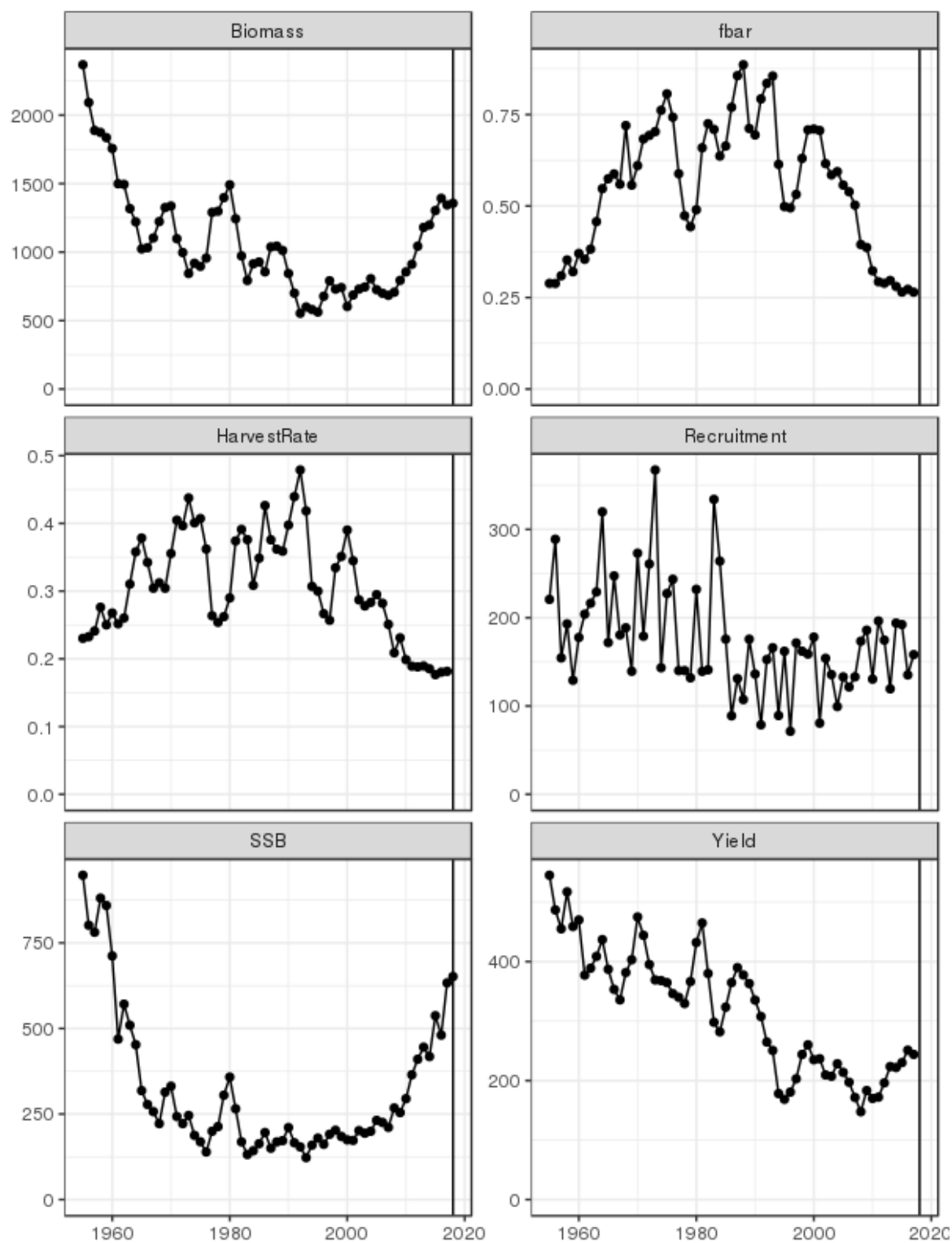


Figure 9.7. Icelandic cod in division Va. Assessment summary based ADCAM tuned with the spring and the fall survey. The x-axis for the recruitment refer to the year class

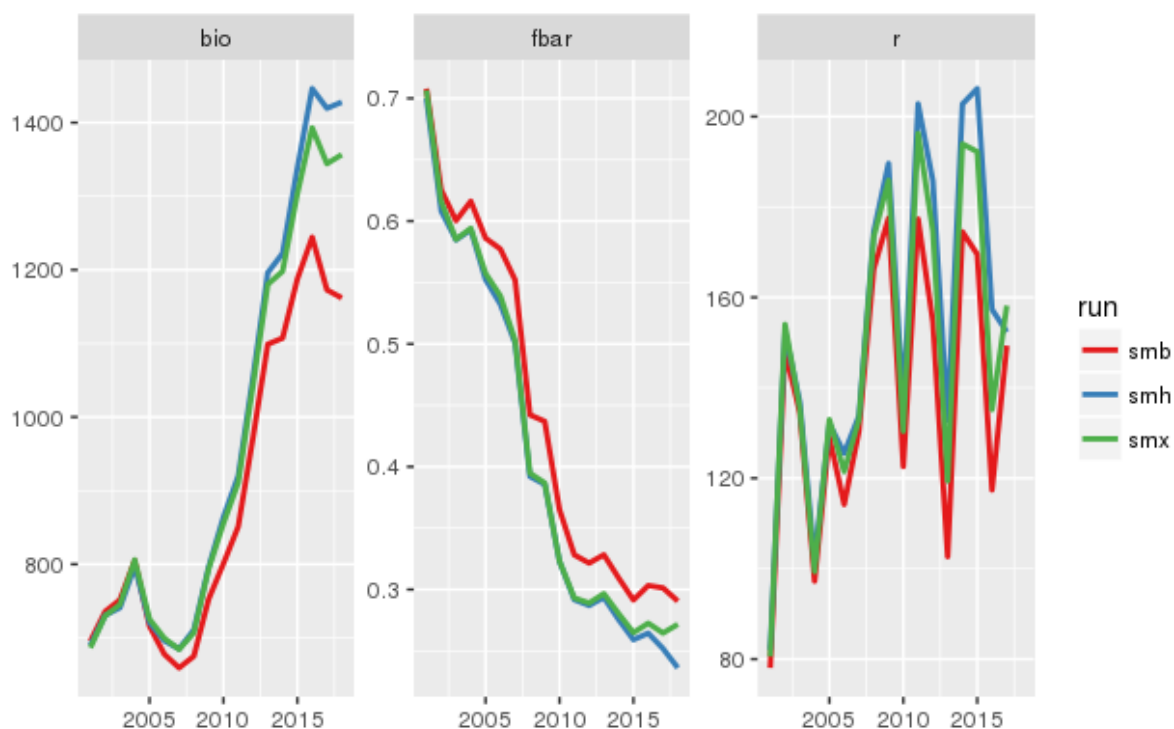


Figure 9.8. Icelandic cod in division Va. Comparison of key assessment variables when tuning with the spring survey (SMB), the fall survey (SMH) and both surveys (SMX).

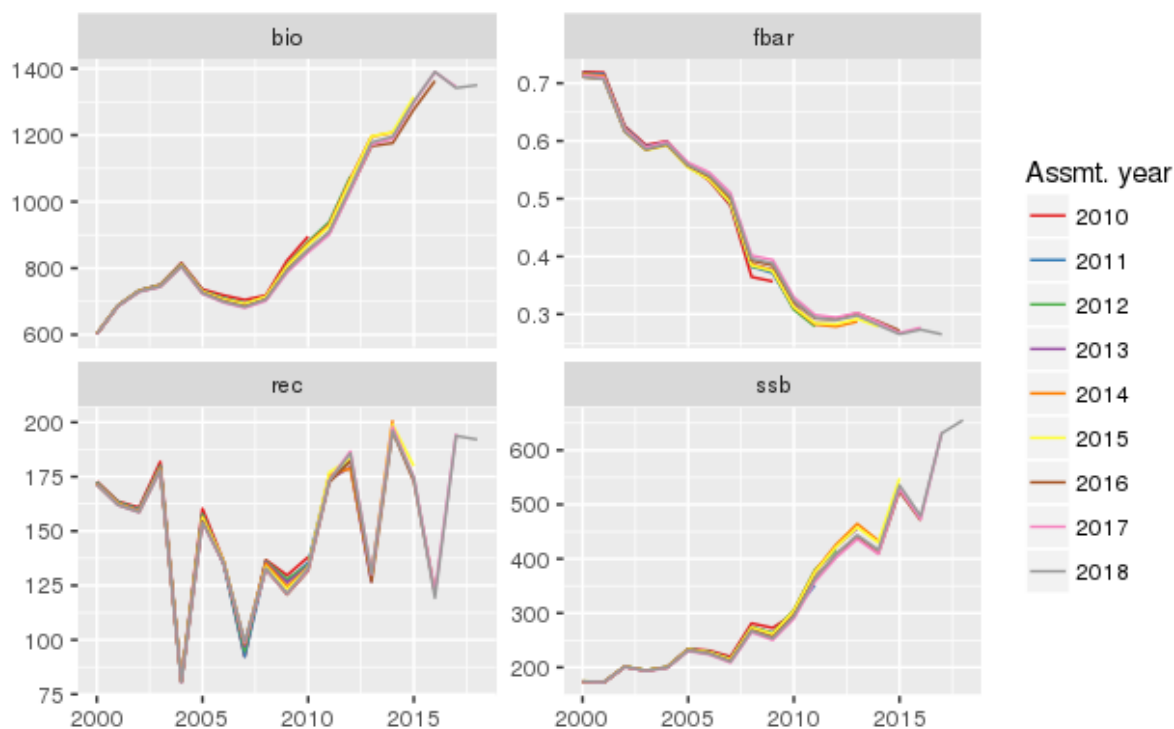


Figure 9.9. Icelandic cod in division Va. Analytical retrospective pattern of key metrics in the last seven years and the current estimates.

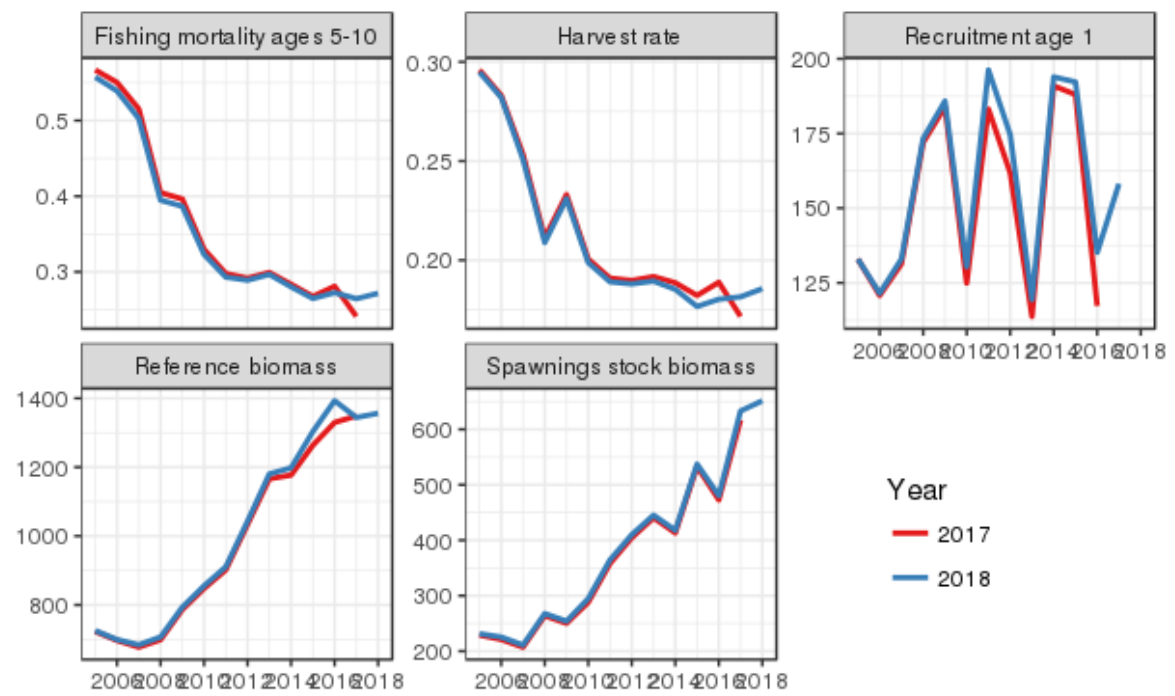


Figure 9.10. Icelandic cod in division Va. Comparison with last years assessment