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10 Icelandic haddock

A formal HCR has been in place for haddock in 5.a since 2013. According to the adopted Harvest Control Rule the advice for the fishing year 2017/2018 (September 1st 2017–August 31st 2018) is 41 390 tonnes. The advice for the following fishing year is predicted to be approximately 47 600 tonnes and remain at that level, as the catches will mainly be from a large year class.

The 2014 year class is estimated to be large, after 6 consecutive small year class from 2008–2013. The 2015 and 2016 year classes are, however, expected to be close to the geometric mean recruitment. The current assessment shows similar stock status compared to last year's assessment. The main features are though the same that the fisheries are currently mostly based on relatively small year classes. It is expected that 2014 year class will be substantially present in the fishery in 2018.

Growth in 2016 was above average since 1985 and the mean weight of young fish is above average while old fish are close to average. The assessment procedure was the same as last year (SPALY), an Adapt type model tuned with both the surveys.

There are differences in the perception of the state of stock in assessment based on either the spring or autumn survey with autumn survey indicating a larger stock. This difference has been apparent since 2009, although now this difference is now decreasing. Sensitivity analysis based on different models, using the same tuning series, exhibit similar properties.

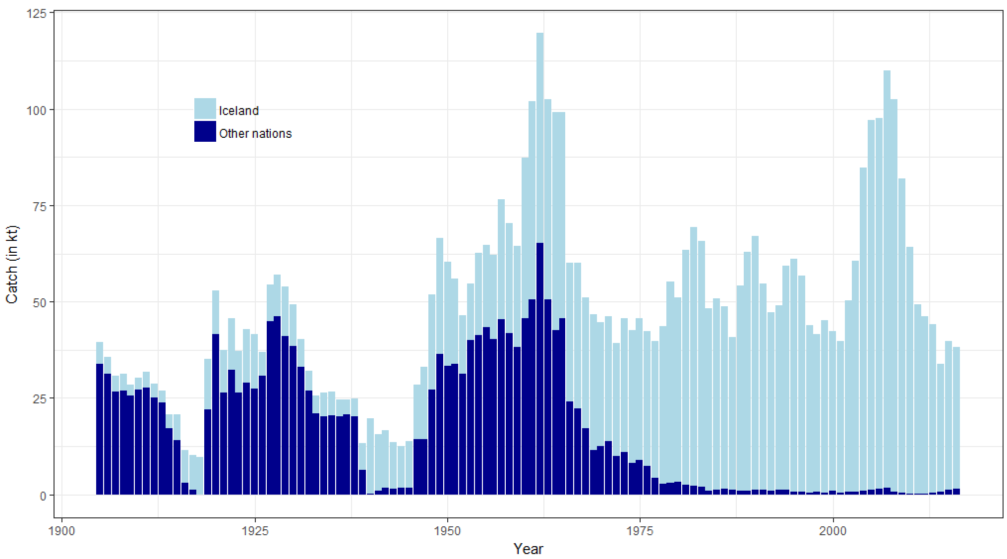


Figure 10.1.1 Haddock in division Va. Landings 1905 – 2016

10.1 Fishery

Landings of Icelandic haddock in 2016 are estimated to have been 38 100 tonnes, see Figure 10.1.1 and Table 10.1.1. Of the landings, 36 660 tonnes are caught by Iceland and 1440 tonnes by the Faeroese. The landings have decreased from 100 thous. tonnes between 2005–2008. The fishery for haddock in 5.a has not changed substantially in recent years. Around 250 longliners annually report catches of haddock, around 60 trawlers and 40 Danish seine boats. Most of haddock in 5.a is caught by trawlers and the proportion caught by that gear has decreased since 1995 from around 70% and is currently around 45%. At the same time the proportion caught by longlines has increased from around 15% in 1995 - 2000 to 40 % in 2011–2016. Catches in Danish seine have varied less and have been at around 15% of Icelandic catches of haddock in 5.a. Currently less than 2% of catches are taken by other vessel types, but historically up to 10 % of total catches were by gillnetters, but since 2000 these catches have been low.

(Table 10.1.2 and figure 10.1.2). Most of the haddock caught in 5.a by Icelandic longliners is caught at depths less than 200 m, by trawlers less than 300 m and Danish seine at depths (Figure 10.1.3). The main fishing grounds for haddock in 5.a, as observed from logbooks, are in the south, southwestern and western part of the Icelandic shelf (Figure 10.1.4). The main trend in the spatial distribution of haddock catches in 5.a according to logbook entries is the increased proportion of catches caught in the north and northeast. Table 10.1.1 Haddock in Division Va Landings by nation.

Country	1979	1980	1981	1982	1983	1984	1985	1986
Belgium	1010	1144	673	377	268	359	391	257
Faroe Islands	2161	2029	1839	1982	1783	707	987	1289
Iceland	52152	47916	61033	67038	63889	47216	49553	47317
Norway	11	23	15	28	3	3	+	
UK								
Total	55334	51112	63560	69425	65943	48285	50933	48863

HADDOCK Va

Country	1987	1988	1989	1990	1991	1992	1993	1994
Belgium	238	352	483	595	485	361	458	248
Faroe Islands	1043	797	606	603	773	757	754	911
Iceland	39479	53085	61792	66004	53516	46098	46932	58408
Norway	1	+						1
Total	40761	54234	62881	67202	53774	47216	48144	59567

HADDOCK Va

Country	1995	1996	1997	1998	1999	2000	2001	2002
Belgium								
Faroe Islands	758	664	340	639	624	968	609	878
Iceland	60061	56223	43245	40795	44557	41199	39038	49591
Norway	+	4						
Total	60819	56891	43585	41434	45481	42167	39647	50469

Country	2003	2004	2005	2006	2007	2008	2009	2010	2011
Belgium									
Faroe Islands	833	1035	1372	1499	1780	828	625	311	207
Iceland	59970	83791	95859	96115	108175	101651	81418	63868	49231
Norway	30	9			11	11			
Total	60884	84835	97231	97614	109966	102490	82043	64179	49437

Country	2012	2013	2014	2015	2016
Belgium					
Faroe Islands	303	600	800	1259	1441
Iceland	45888	43500	33100	38391	36648
Norway					
Total	46191	44100	33900	39650	38100

Table 10.1.2. Haddock in 5.a. Number of Icelandic boats and catches by fleet segment participating in the haddock fishery in 5.a.

Year	Number of boats			Catches in tons				
	Bottom trawl	Danish seine	Longliners	Bottom trawl	Danish seine	Longliners	Other	Total catch
1992	186	73	739	5969	282	5061	1858	13170
1993	283	142	809	30656	1787	8125	7110	47678
1994	226	152	843	41220	3430	8600	7179	60429
1995	196	137	753	42865	4317	8324	5188	60694
1996	180	146	631	39423	5550	7716	3746	56435
1997	170	151	475	27766	5330	7595	3026	43717
1998	170	136	473	24242	3687	9937	3039	40905
1999	161	128	491	25880	2772	13576	2304	44532
2000	142	117	480	23015	3101	13094	2024	41234
2001	119	91	449	21770	3036	11997	2321	39124
2002	111	90	418	29903	3596	13644	2469	49612
2003	104	96	436	35618	4804	17302	2285	60009
2004	109	95	449	49922	8095	23198	2586	83801
2005	107	89	449	51899	10493	30767	2719	95878
2006	97	89	437	45489	12708	36245	1696	96138
2007	97	81	408	56060	12862	37199	2060	108181
2008	88	78	363	50923	16456	33051	1250	101680
2009	85	71	335	38844	15157	26571	867	81439
2010	81	63	279	28458	10138	23916	1357	63869
2011	73	52	278	20509	6866	21175	682	49232
2012	76	54	289	20045	6048	18722	896	45711
2013	76	52	284	18587	4950	19229	645	43411
2014	66	45	295	13235	3776	16392	532	33935
2015	67	47	270	17082	4323	17641	619	39665
2016	68	44	250	16914	4452	16279	456	38101

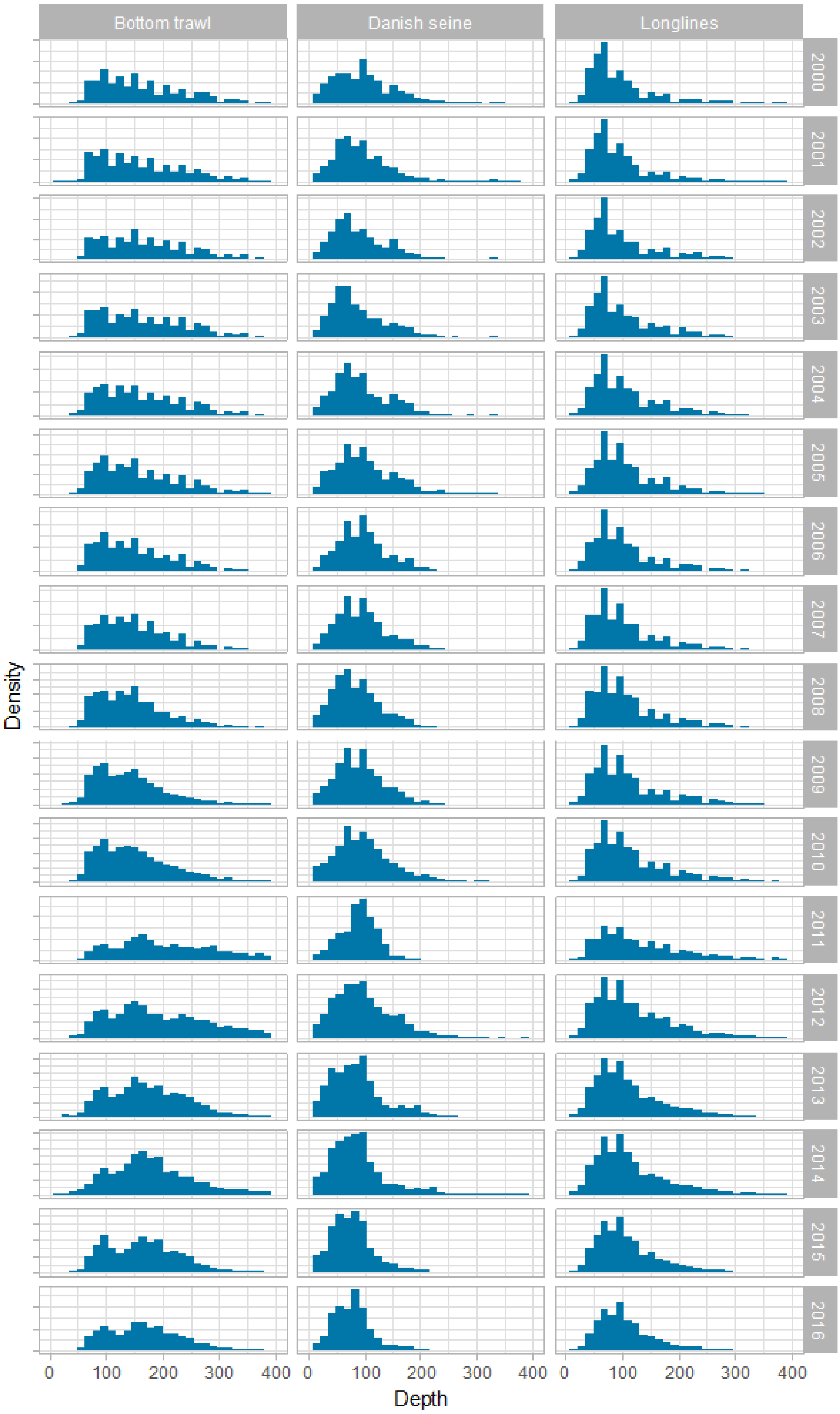


Figure 10.1.3. Haddock in 5.a. Depth distribution of haddock catches from bottom trawls, longlines, trawls and Danish seine from Icelandic logbooks

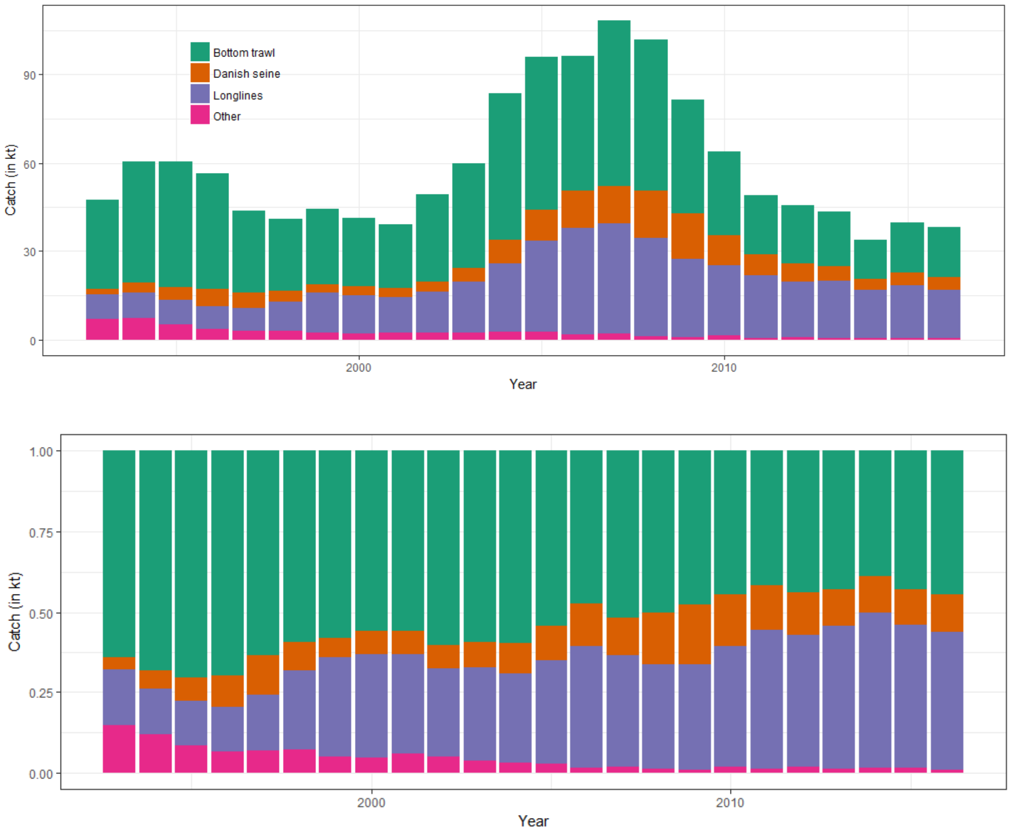


Figure 10.1.2 Haddock Division VA. Landings in tons and percent of total by gear and year.

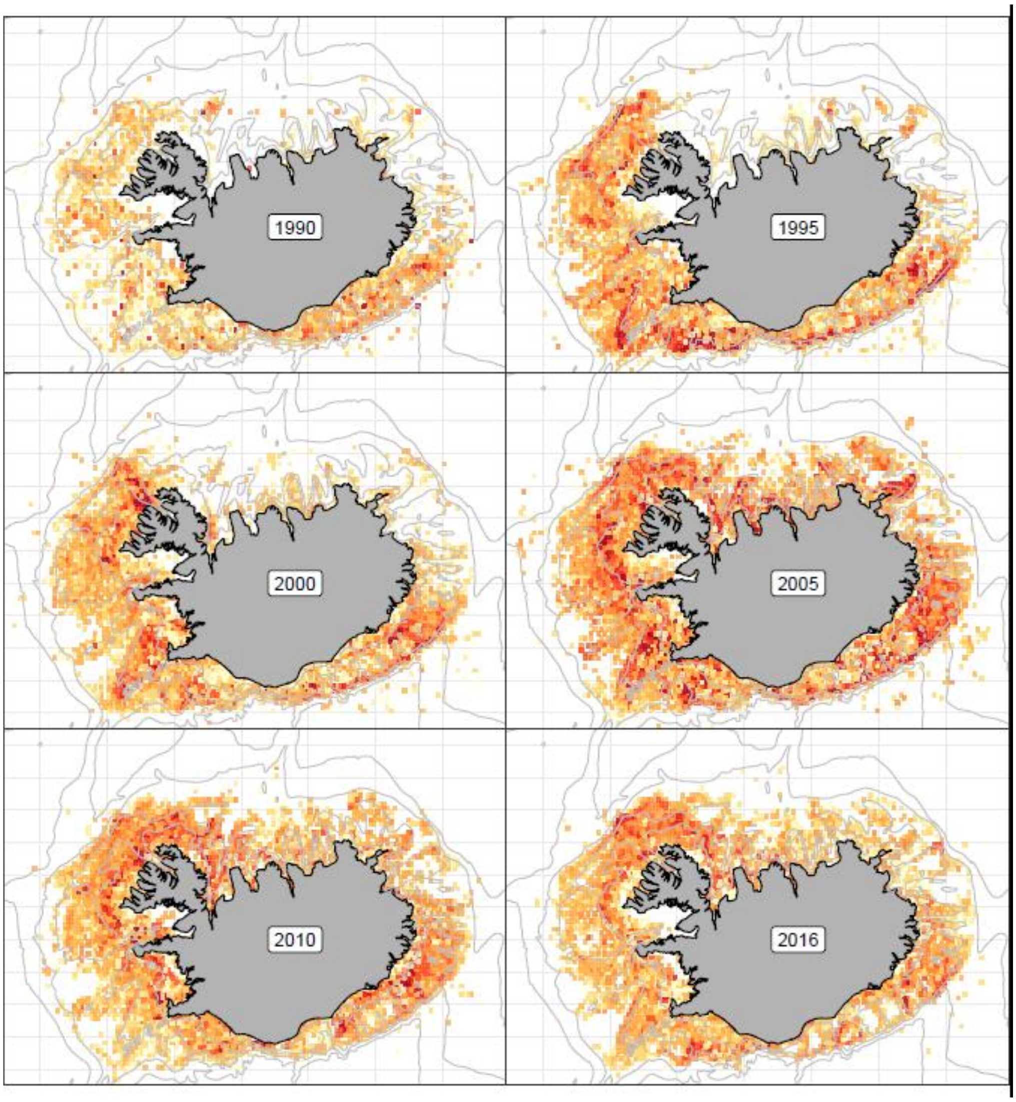


Figure 10.1.4 Haddock in 5.a. Spatial distribution of catches of haddock by all gears.

10.2 Data

10.2.1 Catch at age

Catch in numbers-at-age is shown in Table 10.2.1 and Figure 10.2.1. The catches in 2016 mainly composed of relatively small year classes as the last above average year class, the 2008 year class, accounted for roughly 12 % of the total catches. Older year classes contributed around 5% of total catches. So roughly 80 % of the catch is from the small year classes 2008–2013. The number of year classes contributing to the catches is unusually many; the result of low fishing mortality in recent years and the last large year class is 9 years old.

Table 10.2.1 Haddock in division Va. Catch in number by year and age.

Year/ Age	2	3	4	5	6	7	8	9	10+
1979	149	1908	3762	6057	9022	1743	438	56	112
1980	595	1385	11481	4298	3798	3732	544	91	37
1981	10	514	4911	16900	5999	2825	1803	168	57
1982	107	245	3149	10851	14049	2068	1000	725	201
1983	34	1010	1589	4596	9850	8839	766	207	280
1984	241	1069	4946	1341	4772	3742	4076	238	80
1985	1320	1728	4562	6796	855	1682	1914	1903	296
1986	1012	4223	4068	4686	5139	494	796	897	400
1987	1939	8308	6965	2728	2042	1094	132	165	339
1988	237	9831	15164	5824	1304	1084	609	66	213
1989	188	2474	22560	9571	3196	513	556	144	141
1990	1857	2415	8628	23611	6331	816	150	67	74
1991	8617	2145	5397	7342	14103	2648	338	40	27
1992	5405	10693	5721	4610	3691	5209	999	120	16
1993	769	12333	12815	2968	1722	1425	2239	343	38
1994	3198	3343	28258	10682	1469	726	358	647	108
1995	4015	7323	5744	23927	5769	615	290	187	331
1996	3090	10552	7639	4468	12896	2346	208	79	125
1997	1364	3939	10915	4895	2610	5035	719	64	69
1998	279	8257	5667	7856	2418	1422	1897	261	45
1999	1434	1550	17243	4516	4837	915	620	481	64
2000	2659	6317	2352	13615	1945	1706	324	222	192
2001	2515	11098	6954	1446	6262	675	478	105	94
2002	1082	10434	15998	5099	1131	3149	262	169	100
2003	401	6352	16265	12548	2968	748	1236	91	70
2004	1597	4063	17652	19358	8871	1940	471	489	155
2005	2405	9450	6929	25421	13778	4584	809	251	237
2006	241	10038	21246	6646	18840	7600	2180	323	202
2007	782	3884	42224	22239	3354	9952	2740	519	181
2008	2316	4508	9706	53022	11014	1717	3033	815	192
2009	1066	3185	4886	8892	35011	5733	726	1381	509
2010	121	6032	7061	4806	6766	17503	1874	354	528
2011	253	1584	11797	5080	2853	3983	6220	494	183
2012	196	1322	3421	13107	2223	1231	2480	2662	370
2013	250	1042	2865	4008	9222	1206	668	1248	1599
2014	238	1478	1751	2725	2737	4742	447	387	1403
2015	232	1532	4155	2317	2926	2623	2715	226	823
2016	482	1773	3437	4130	1727	1953	1420	1293	455

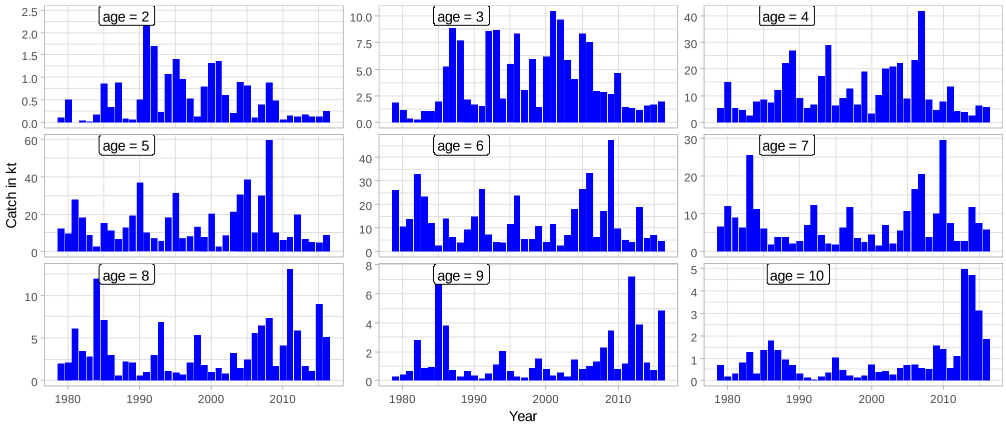


Figure 10.2.1 Haddock in division Va. Age disaggregated catch in tons.

10.2.2 Catch, effort and research vessel data

The index of total biomass from the groundfish surveys in March and October is shown in Figure 10.1.8. Both surveys show much increase between 2002 and 2005 but considerable decrease from 2007–2010. The difference in perception of the stock between the surveys is that the autumn survey shows less contrast between periods of large and small stock. In 2016, however, a substantial decrease in the autumn survey was observed while the 2017 spring survey index was increased.

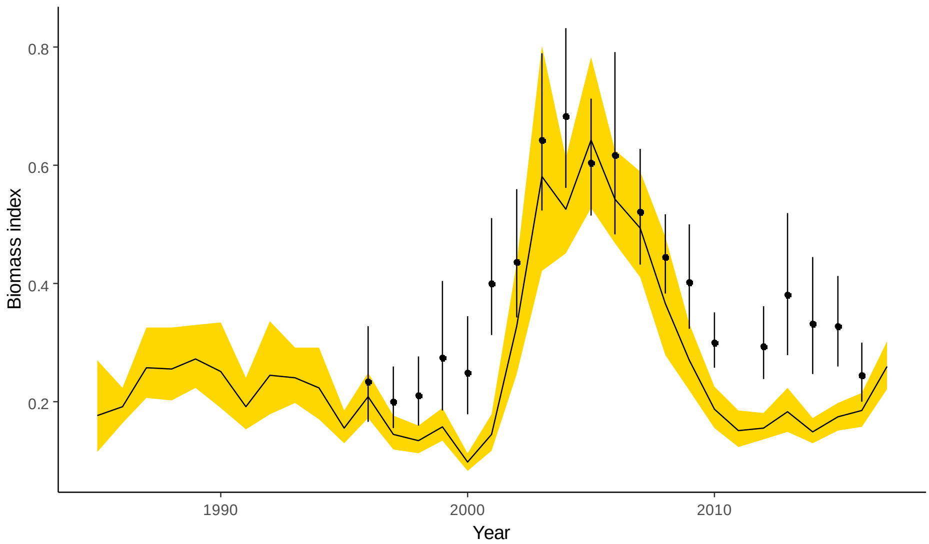


Figure 10.2.2 Icelandic haddock. Total biomass indices from the groundfish surveys in March (lines and shading) and the groundfish survey in October vertical segments. The standard error in the estimate of the indices is shown in the figure. Due to a strike the autumn survey was not conducted in October 2011.

Age disaggregated indices from the March survey are given in Table 10.2.2 and indices from the autumn survey in Table 10.2.3. Abundance of age groups 3–7 in the 2016 March survey is low while age 9 is among the highest indices observed (Table 10.2.2). The index of age 12 and 13 (2003 cohort) is much higher than seen before (large part of 11+ in the March survey), but that cohort will though not contribute much to the landings. Year classes 2008 and 2009 (age 8 and 7) are now close to average, mostly due to reduced fishing mortality in recent years but those year classes were originally small.

Table 10.2.2 Haddock in 5.a. Age disaggregated survey indices from the groundfish survey in March.

YEAR/ AGE	1	2	3	4	5	6	7	8	9	10	11+
1985	28.14	32.68	18.33	23.58	26.39	3.7	10.86	4.8	5.54	0.49	0.19
1986	123.87	108.48	58.97	12.79	16.31	13.12	0.97	2.71	1.22	2.25	0.19
1987	21.82	338.29	147.5	44.15	7.68	7.47	4.72	0.39	0.61	0.44	0.86
1988	15.77	40.73	184.79	88.87	22.86	1.34	2.18	1.76	0.16	0.22	0.31
1989	10.58	23.33	41.16	146.61	45.09	12.88	0.79	0.81	0.41	0.28	0.23
1990	70.48	31.8	26.73	38.84	92.82	30.89	3.44	0.88	0.23	0	0.02
1991	89.73	145.95	41.43	17.73	20.19	32.85	7.63	0.3	0.1	0.08	0.08
1992	18.15	211.43	137.77	35.38	16.91	13.77	16.32	2.22	0.18	0.07	0
1993	29.99	37.8	244.96	87.19	11.23	3.85	1.66	4.46	0.88	0	0
1994	58.54	61.34	39.83	142.35	42.18	6.9	2.87	1.42	4.44	0.17	0
1995	35.89	82.47	47.03	19.75	69.52	7.66	1.31	0.11	0.34	0	0
1996	95.25	66.21	119.86	36.78	19.58	40.63	5.78	0.59	0.13	0.12	0.15
1997	8.6	119.35	50.81	53.33	10.88	7.37	10.9	1.35	0.07	0.03	0.13
1998	23.08	18	107.93	28.23	23.49	4.9	3.54	4.56	0.33	0	0
1999	80.73	85.46	25.53	98.73	12.99	9.85	1.42	1.77	1.03	0.09	0
2000	60.58	90.07	44.63	8.45	25.22	3.14	1.59	0.4	0.15	0.52	0.04
2001	81.27	147.71	115.4	22.15	4.09	10.63	0.93	0.57	0	0.1	0
2002	20.75	298.67	200.74	112.49	23.24	3.51	7.49	0.31	0.3	0.08	0.15
2003	111.59	97.54	282.28	244.81	113.45	18	2.55	4.48	0.48	0.82	0.15
2004	325.9	291.65	70.75	208.74	109.33	33.96	6.79	1.24	0.82	0	0.31
2005	57.96	698.48	289.43	44.58	157.2	57.52	15.72	3.35	0.32	0.25	0.02
2006	39.29	88.69	575.93	179.11	19.13	62.94	16.43	6.74	0.7	0.29	0
2007	34	65.6	88.63	436.41	85.68	7.9	21.6	4.74	2.15	0.07	0
2008	88.53	68.05	71.7	75.57	222.79	29.99	3.53	7.47	1.64	0.27	0.03
2009	10.46	111.21	53.82	41.48	41.91	105.64	12.94	2.23	3.11	0.44	0.23
2010	15.15	27.71	138.2	29.95	18.28	20.59	31.59	2.92	0.46	0.69	0.2
2011	8.79	27.65	24.75	77.43	14.03	5.9	9.4	14.89	1.22	0.31	0.3
2012	12.47	14.9	31.27	27.22	58.3	5.23	2.92	5.3	6.87	0.8	0.49
2013	13.91	23.32	19.72	22.9	22.51	41.93	4.78	2.52	3.83	4.52	1.02
2014	14.01	24.78	30.27	17.74	16.44	14.79	16.44	1.33	1.05	1.68	1.63
2015	62.58	19.59	26.56	34.23	12.58	11.18	9.63	9.96	1.14	0.56	2.29
2016	30.02	163.8	4.08	22.2	22.26	7.17	7.27	5.05	4.2	0.93	1.79
2017	26.67	66.65	140.89	23.02	20.29	22.02	6.41	5.06	3.54	1.92	0.26

Table 10.2.3 Haddock in 5.a. Age disaggregated survey indices from the groundfish survey in October

YEAR/AGE	0	1	2	3	4	5	6	7	8	9	10	11	12
1996	16	458	108	83.9	18	7.6	17.6	1.5	0	0	0	0	0
1997	52	32	210	53.5	37.6	6.8	5.6	5.8	0.3	0	0	0	0
1998	208	81	32	131.1	19.3	15.2	5	5.2	1.8	0	0	0.07	0
1999	174	396	66	28.3	95.7	11.6	10.1	0.5	2.1	0.29	0	0	0
2000	54	161	259	45.8	8.1	28.3	1.9	3.2	0.1	0.27	0.58	0	0
2001	46	382	277	172.1	34.9	3.9	13.9	0.7	0.9	0	0.21	0	0
2002	148	80	239	189.7	94.1	18.4	2.8	2.1	1	0.04	0	0	0
2003	315	344	145	247.6	164.9	54.5	8.9	2.4	0.6	0	0.04	0	0
2004	187	709	344	50	156.1	68.1	16.2	3.9	0.8	0.49	0	0	0
2005	90	73	552	178.9	26.4	93.6	25.5	9.7	1.8	0	0.12	0	0
2006	84	124	116	500.6	105.7	13.4	39.4	9.4	3.9	1.5	0	0	0
2007	233	97	78	89.2	328	56.8	7.9	12	3.6	0.54	0.19	0	0.09
2008	95	201	93	67.1	85.7	193.6	16.3	2.8	3.3	0.21	0.07	0	0
2009	51	47	268	67.2	30.4	47.5	94.2	9.2	1.4	2.09	0.05	0.36	0
2010	36	42	56	141.6	30	14.1	23.2	36.3	4.6	0.85	0.95	0.15	0
2012	26	53	29	33.7	37.1	69.2	9.1	3.5	9.6	10.09	0.97	0.18	0.5
2013	27	90	127	36.5	37.8	38.7	44.2	6.2	2.3	5.69	4.14	0.69	0
2014	248	34	41	65.5	23.4	26.4	23.8	25.8	2.2	1.46	2.94	1.44	0.54
2015	132	204	36	38.7	47.7	15.1	18	10.3	12	2.26	1.36	0.54	1.35
2016		78.9	125.27	23.15	18.18	19.41	7.15	7.88	3.92	3.04	0	0	0

The survey results indicate that in recent decade higher and larger proportion of the haddock stock has gradually been inhabiting the waters north of Iceland (Figures 10.2.2 and 10.2.3.).

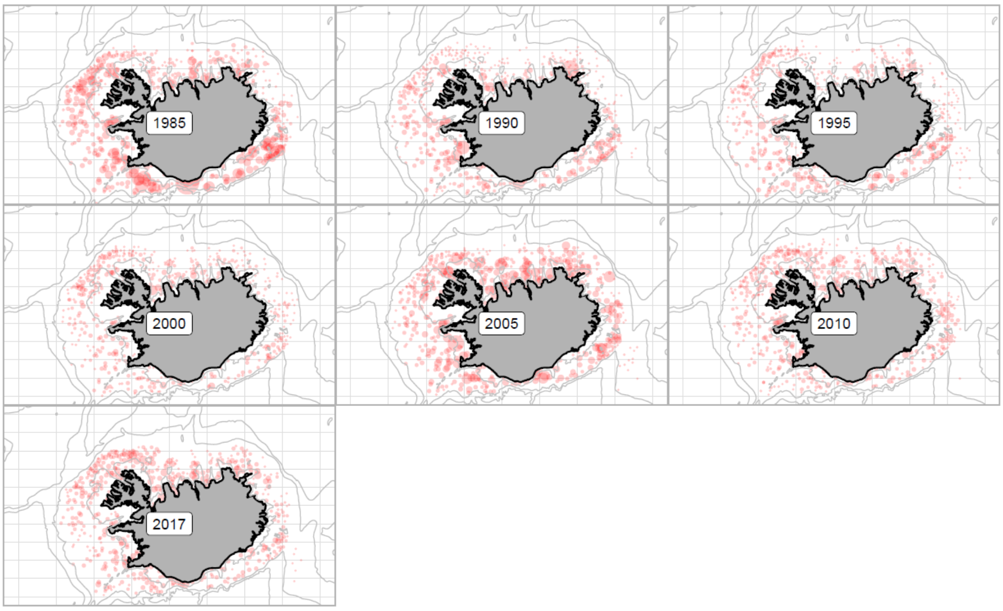


***Figure 10.2.2. Spatial distribution of haddock in the groundfish survey in March. The circles are indicative of tow size.**

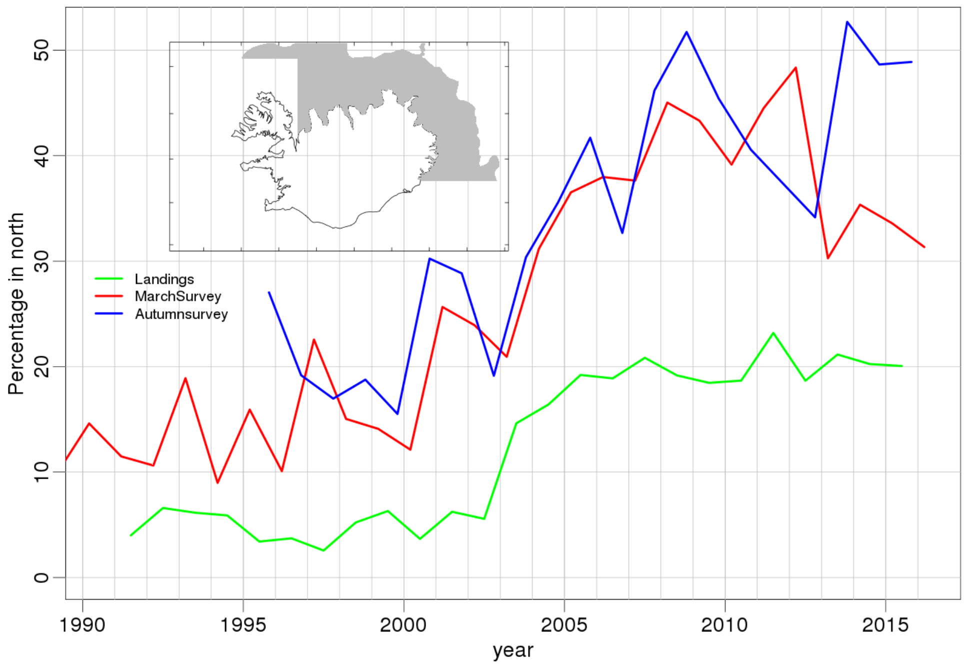


Figure 10.2.3. Proportion of the landings and the biomass of 42cm and larger haddock that is in the north area. The small figure shows the northern area.

10.2.3 Weight at age

Mean weight at age in the catch is shown in Table 10.2.4 and Figure 10.2.4. Mean weight at age in the stock is given in Table 10.1.5 and Figure 10.1.9. Those data are obtained from the groundfish survey in March and are also used as mean weight at age in the spawning stock.

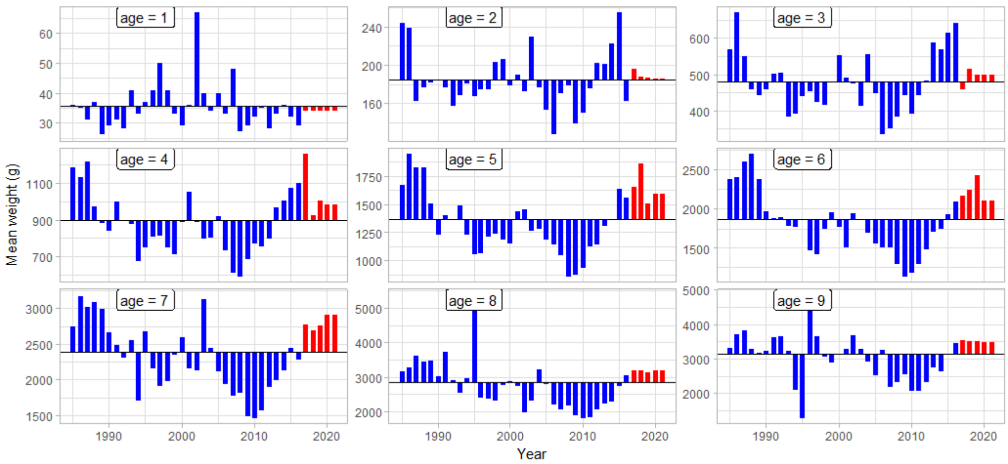


Figure 10.2.4 Haddock in division Va. Mean weight at age in the survey. Predictions are shown as red. The values shown are used as weight at age in the stock and spawning stock.

Table 10.2.4 Haddock in division Va Weight at age in the stock. Predicted values are shaded

Year/age	1	2	3	4	5	6	7	8	9	10
1979	37	185	481	910	1409	1968	2496	3077	3300	4000
1980	37	185	481	910	1409	1968	2496	3077	3300	4615
1981	37	185	481	910	1409	1968	2496	3077	3300	4898
1982	37	185	481	910	1409	1968	2496	3077	3300	3952
1983	37	185	481	910	1409	1968	2496	3077	3300	4463
1984	37	185	481	910	1409	1968	2496	3077	3300	3941
1985	36	244	568	1187	1673	2371	2766	3197	3331	4564
1986	35	239	671	1134	1943	2399	3190	3293	3728	4436
1987	31	162	550	1216	1825	2605	3030	3642	3837	3653
1988	37	176	457	974	1830	2695	3102	3481	3318	4169
1989	26	182	441	887	1510	2380	3009	3499	3195	5039
1990	29	184	457	840	1234	1965	2675	3052	3267	4115
1991	31	176	501	1003	1406	1884	2496	3755	3653	5243
1992	28	157	503	894	1365	1891	2325	2936	3682	4674
1993	41	168	384	878	1492	1785	2562	2573	3266	4047
1994	33	181	392	680	1235	1766	1717	2977	2131	3154
1995	37	167	440	755	1065	1857	2689	5377	1306	3119
1996	41	174	453	813	1076	1477	2171	2426	4847	3686
1997	50	174	424	817	1221	1425	1915	2390	3692	3508
1998	41	203	415	753	1241	1747	1996	2342	3076	3275
1999	33	206	480	715	1189	1956	2366	2782	2922	3534
2000	29	179	552	889	1159	1767	2612	2917	3132	3734
2001	36	190	490	1056	1437	1509	2169	2765	3300	4715
2002	67	172	475	889	1460	1949	2137	1990	3709	4078
2003	40	230	412	801	1268	1873	3139	2343	3301	3289
2004	34	176	556	807	1282	1690	2454	3236	2942	3957
2005	40	153	448	920	1188	1564	2128	2808	2550	2755
2006	33	127	333	736	1145	1512	1944	2232	3272	3617
2007	48	170	350	615	1053	1514	1786	2073	2198	2408
2008	27	179	382	595	868	1295	1828	2201	2340	2568
2009	29	139	442	687	882	1141	1495	1920	2574	3070
2010	32	150	392	773	942	1190	1468	1829	2086	2730
2011	35	175	442	757	1129	1304	1583	1865	2107	3094
2012	28	202	482	801	1145	1480	1909	2072	2353	2350
2013	33	201	589	967	1312	1710	1999	2265	2764	2709
2014	36	222	570	1005	1372	1751	2141	2298	2653	3104
2015	32	255	614	1073	1637	1926	2452	2774	3170	3173
2016	29	162	642	1099	1564	2094	2296	3068	3481	3248
2017	34	196	459	1258	1657	2168	2780	3205	3564	3462
2018	34	188	516	927	1858	2247	2704	3210	3541	3810
2019	34	187	500	1004	1505	2431	2772	3150	3545	3793

Both stock and catch weights have been increasing in recent years, after being very low when the stock was large between 2005 and 2009. Higher mean weight at age is most apparent for the younger haddock from the small cohorts (2008–2013), but mean weight of the old fish is now also average. Mean weight of the 2014 cohort is more than 20% lower than of recent small year classes but close to average for a large cohorts.

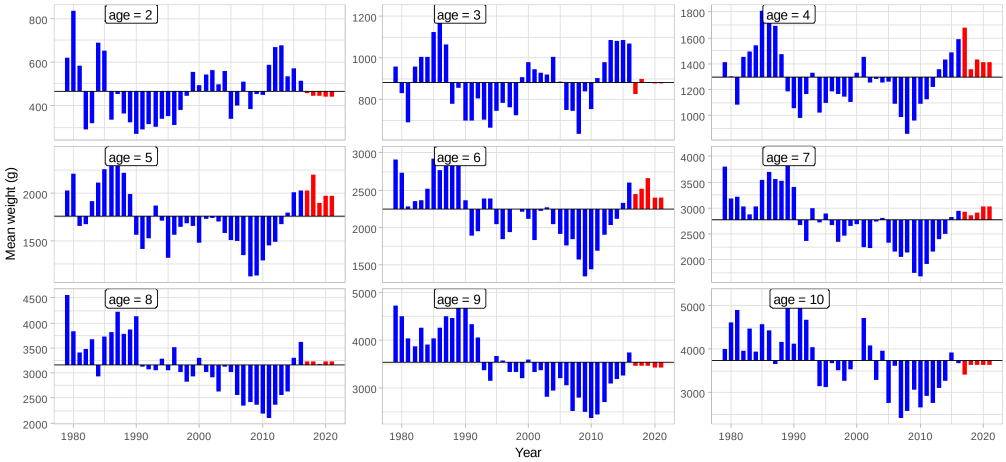


Figure 10.2.5 Haddock in division Va. Mean weight at age in the catches. Predictions are shown as red.

Table 10.2.5 Haddock in division Va Weight at age in the catches. Predicted values are shaded.

Year/Age	2	3	4	5	6	7	8	9	10+
1979	620	960	1410	2030	2910	3800	4560	4720	5956
1980	837	831	1306	2207	2738	3188	3843	4506	4983
1981	584	693	1081	1656	2283	3214	3409	4046	5261
1982	289	959	1455	1674	2351	3031	3481	3874	4123
1983	320	1006	1496	1921	2371	2873	3678	4265	4502
1984	691	1007	1544	2120	2514	3027	2940	3906	4033
1985	652	1125	1811	2260	2924	3547	3733	4039	4659
1986	336	1227	1780	2431	2771	3689	3820	4258	4456
1987	452	1064	1692	2408	3000	3565	4215	4502	4025
1988	362	780	1474	2217	2931	3529	3781	4467	4418
1989	323	857	1185	1996	2893	4066	3866	4734	4990
1990	269	700	1054	1562	2364	3414	4134	4946	4451
1991	288	699	979	1412	1887	2674	3135	4341	4957
1992	313	806	1167	1524	1950	2357	3075	4053	4703
1993	303	705	1333	1875	2386	2996	3059	3363	4409
1994	337	668	1019	1717	2391	2717	3280	3156	3278
1995	351	746	1096	1318	2044	2893	3049	3675	3137
1996	311	787	1187	1560	1849	2670	3510	3567	3731
1997	379	764	1163	1649	1943	2342	3020	3337	3236
1998	445	724	1147	1683	2250	2475	2834	3333	3596
1999	555	908	1101	1658	2216	2659	2928	3209	3513
2000	495	978	1333	1481	2119	2696	3307	3597	3757
2001	541	945	1456	1731	1832	2243	3020	3328	4236
2002	564	928	1253	1737	2219	2230	2911	3365	4387
2003	498	922	1283	1704	2274	2744	2635	2819	3742
2004	559	1006	1258	1579	2044	2809	3123	2945	3759
2005	339	886	1265	1506	1916	2323	3028	3211	2891
2006	402	749	1093	1495	1758	2163	2555	3054	3589
2007	510	748	988	1346	1840	2062	2350	2525	3143
2008	383	636	857	1125	1575	2149	2417	2802	2600
2009	452	841	960	1131	1352	1757	2364	2497	3074
2010	447	756	1092	1294	1448	1685	2188	2366	2646
2011	588	905	1122	1455	1688	1914	2094	2455	2986
2012	668	978	1222	1492	1903	2164	2366	2704	2940
2013	678	1084	1358	1675	2036	2400	2554	3097	3097
2014	536	1080	1433	1793	2121	2504	2624	3178	3349
2015	573	1084	1486	2011	2332	2823	3306	3258	3768
2016	513	1071	1590	2035	2607	2952	3616	3734	3679
2017	458	829	1678	2034	2454	2920	3225	3473	3404
2018	444	900	1355	2203	2516	2864	3229	3458	3639

10.2.4 Maturity at age

Maturity-at-age data are given in Table 10.2.6 and Figure 10.2.6. Those data are obtained from the groundfish survey in March. Maturity-at-age of the youngest age groups has been decreasing in recent years while mean weight at age has been increasing so maturity by size has been decreasing. The most likely explanation is large proportion of those age groups north of Iceland where proportion mature has always been low.

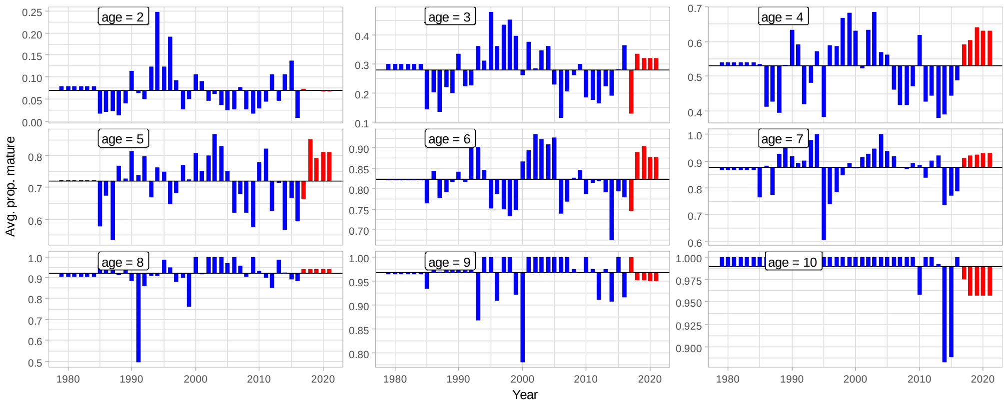


Figure 10.2.6 Haddock in division Va. Maturity-at-age in the survey. The red bars indicates predictions. The values are used to calculate the spawning stock.

Table 10.2.6 Haddock in division Va Sexual maturity-at-age in the stock. (from the March survey). Predicted values are shaded. The numbers for age 10 only apply to the spawning stock.

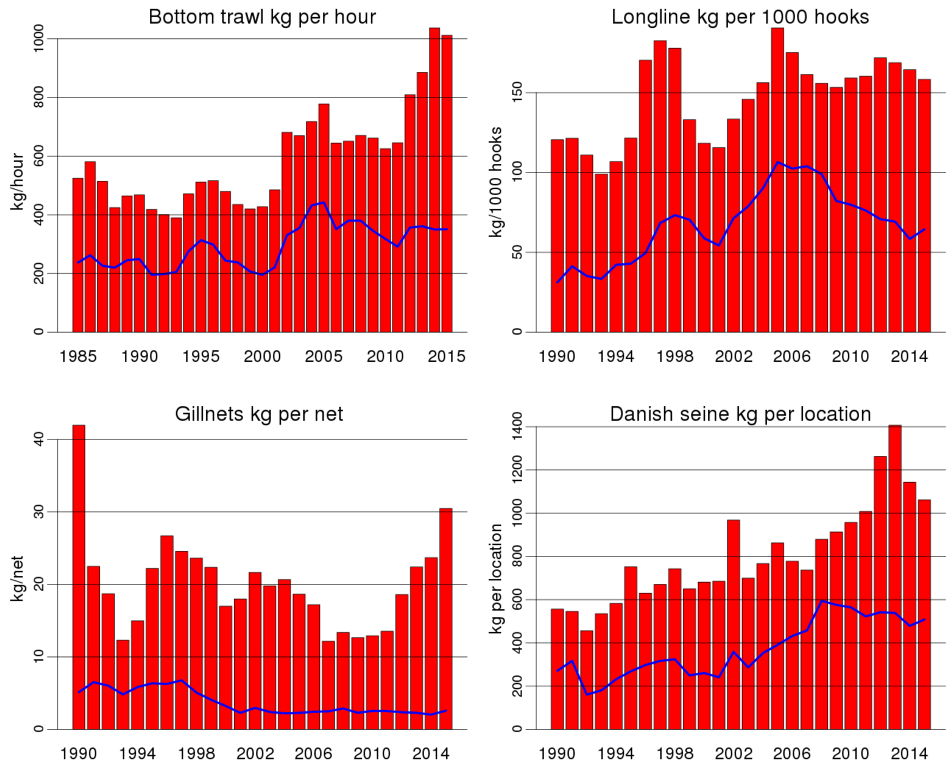
Year/Age	2	3	4	5	6	7	8	9	10
1979	0.08	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1
1980	0.08	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1
1981	0.08	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1
1982	0.08	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1
1983	0.08	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1
1984	0.08	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1
1985	0.016	0.144	0.536	0.577	0.765	0.766	0.961	0.934	1
1986	0.021	0.205	0.413	0.673	0.845	0.884	0.952	0.986	1
1987	0.022	0.137	0.426	0.535	0.778	0.776	1	0.969	1
1988	0.013	0.221	0.394	0.767	0.793	0.928	0.914	1	1
1989	0.041	0.202	0.532	0.727	0.818	0.998	1	1	1
1990	0.114	0.334	0.634	0.814	0.843	0.918	0.882	1	1
1991	0.063	0.224	0.592	0.739	0.817	0.894	0.495	1	1
1992	0.05	0.227	0.419	0.799	0.901	0.901	0.858	1	1
1993	0.124	0.362	0.481	0.67	0.904	0.977	0.908	0.867	1
1994	0.248	0.312	0.573	0.762	0.846	1	0.907	1	1
1995	0.124	0.479	0.382	0.75	0.753	0.606	0.985	1	1
1996	0.191	0.362	0.59	0.648	0.787	0.739	0.949	0.908	1
1997	0.093	0.436	0.587	0.683	0.75	0.783	0.88	1	1
1998	0.026	0.454	0.668	0.77	0.733	0.849	0.899	1	1
1999	0.05	0.397	0.683	0.724	0.749	0.892	0.761	0.92	1
2000	0.107	0.261	0.632	0.808	0.868	0.873	1	0.78	1
2001	0.091	0.377	0.522	0.753	0.895	0.916	0.918	1	1

2002	0.047	0.286	0.633	0.8	0.934	0.928	1	1	1
2003	0.062	0.347	0.685	0.867	0.922	0.946	1	1	1
2004	0.037	0.361	0.57	0.831	0.91	1	1	1	1
2005	0.024	0.23	0.562	0.753	0.927	0.936	0.968	1	1
2006	0.027	0.117	0.462	0.621	0.739	0.918	1	1	1
2007	0.078	0.208	0.418	0.68	0.77	0.875	0.959	1	1
2008	0.027	0.263	0.418	0.621	0.828	0.87	0.904	0.975	1
2009	0.017	0.301	0.47	0.576	0.847	0.891	1	0.968	1
2010	0.029	0.187	0.618	0.778	0.787	0.887	0.934	1	0.958
2011	0.045	0.176	0.426	0.823	0.816	0.838	0.899	0.974	1
2012	0.106	0.167	0.445	0.627	0.819	0.903	0.852	0.911	1
2013	0.046	0.223	0.381	0.714	0.793	0.92	0.986	0.974	0.992
2014	0.107	0.192	0.391	0.567	0.675	0.735	0.925	0.906	0.883
2015	0.138	0.283	0.445	0.667	0.795	0.772	0.892	1	0.889
2016	0.008	0.366	0.487	0.594	0.779	0.787	0.883	0.915	1
2017	0.073	0.131	0.591	0.664	0.745	0.91	0.939	1	0.975
2018	0.069	0.335	0.605	0.851	0.891	0.921	0.942	0.951	0.957

10.2.5 Catch per unit effort from the commercial fishery

Catch per unit of effort data (figure 10.2.7) give somewhat different picture of the development of the stock than the surveys and assessment, much less increase after 2000 but much less decrease in recent years. The interesting thing for the current assessment is the relatively high CPUE, in recent years, confirming fishers's view that is now easier to catch haddock. The discrepancy observed between CPUE and stock size has not been explained, but a number of plausible reasons mentioned.

- Area inhabited by the stock increased so the density in the traditional fishing area did not increase in relation to the stock size.
- When the stock was large slower growth lead to larger proportion of the stock below "fishable size" 45cm limiting the areas where large haddock could be caught without too much bycatch of small haddock.
- The opposite is happening in recent years, faster growth and poor recruitment lead to the fisheries not limited by small haddock.
- Bycatch issues, but haddock is often caught as bycatch or one of the species in mixed fisheries where the goal is certain mixture of species.



- **Figure 10.2.7. Catch per unit of effort in the most important gear types. The bars are based on locations where more than 50% of the catch is haddock and the lines on all records where haddock is caught. A change occurred in the longline fleet starting September 1999. Earlier only vessels larger than 10 BRT were required to return logbooks but later all vessels were required to return logbooks. Not updated this year.**

10.3 Management

The Icelandic Ministry of Industries and Innovation (MII) is responsible for management of the Icelandic fisheries and implementation of legislation. The Ministry issues regulations for commercial fishing for each fishing year (1 September–31 August), including an allocation of the TAC for each stock subject to such limitations. Haddock in 5.a has been managed by TAC since the 1987. Landings have roughly followed the advice given by MRI and the set TAC in all fishing years (Table xxx.3). Since the 2001/2002 the catches have exceeded more that 5% the set TAC in five fishing years. The largest overshoot in landings in relation to advice/TAC was observed in the fishing year 2007/2008 when the landings of haddock exceeded the advice by 11%. The reasons for the implementation errors are related to the management system that allow for transfers of quota share between fishing years and conversion of TAC from one species to another. In addition these attributes of the TAC system catches are also taken by Norway and the Faroe Islands by bilateral agreement.

The level of those catches is known in advance but has until recently not been taken into consideration by the Ministry when allocating TAC to Icelandic vessels. There is no minimum landing size for haddock in 5.a. There are agreements between Iceland, Norway and the Faroe Islands relating to a fishery of vessels in restricted areas within the Icelandic EEZ. Faroese vessels are allowed to fish 5600 t of demersal fish species in Icelandic waters which includes maximum 1200 tonnes of cod and 40 t of Atlantic halibut. In 2016 total catches of Faroese vessels were 1 441 t.

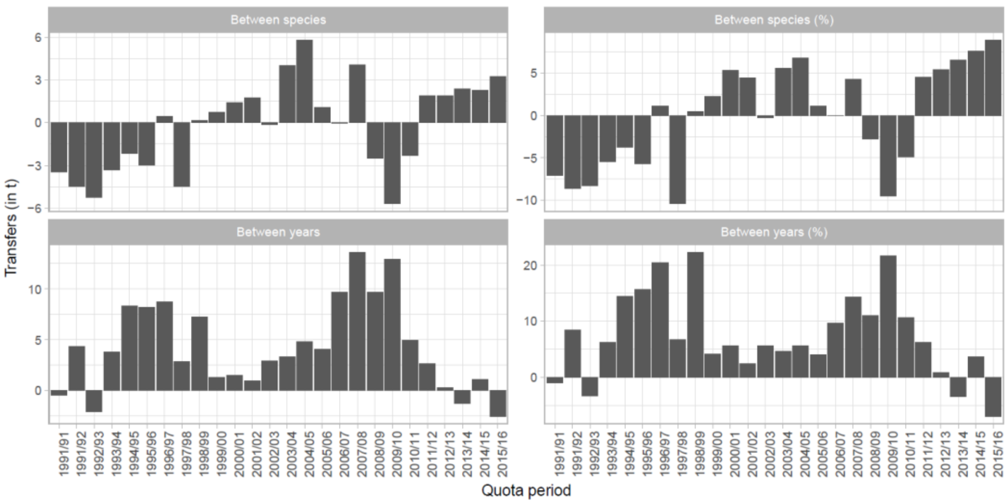


Figure 10.3.1 . Haddock in 5.a. Transfer between species and quota years both in tons and percentages.

The effect of these species conversions and quota transfers is illustrated in figure 10.3.1. The figure illustrates that when the biomass of haddock was high in the years between 2002 to 2007 the net transfers to haddock from other species increased. This may in part be explained by shifts in distribution of haddock, as illustrated in fig. 10., as the fisheries that traditionally target the northern area had lower amounts of haddock in their quota portfolio. However looking over longer period quota transfer towards/from haddock has on the average been close to zero. With the establishment a management plan in 2013 the transfers between quota years have decreased substantially, while at the same time transfers from other species have increased. This is likely due to the fact that haddock is easy to catch, as demonstrated by high CPUE in 2016. The haddock quota may also be limiting in some mixed fisheries and that haddock may have been underestimated in last years could also contribute to transfer towards haddock.

Table 10.3.1. Haddock in Division 5.a. History of ICES advice, the agreed TAC, and ICES estimates of landings by national fishing year. All weights are in thousand tonnes. * Calendar year ** Jan to August

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	ICES landings for the fishing year	ICES landings for the calendar year
1987*	National advice	< 50	60		41
1988*	National advice	< 60	65		54
1989*	National advice	< 60	65		63
1990*	National advice	< 60	65		67
1991**	National advice	< 38	48		54
1991/1992	National advice	< 50	50	48	47
1992/1993	National advice	< 60	65	48	49
1993/1994	National advice	< 65	65	57	59
1994/1995	National advice	< 65	65	61	61
1995/1996	National advice	< 55	60	54	57
1996/1997	National advice	< 40	45	51	44
1997/1998	National advice	< 40	45	38	41
1998/1999	National advice	< 35	35	46	45
1999/2000	F reduced below Fmed	< 35	35	42	42
2000/2001	F reduced below provisional Fpa	< 31	30	40	40

2001/2002	F reduced below provisional Fpa	< 30	41	45	50
2002/2003	F reduced below provisional Fpa	< 55	55	56	61
2003/2004	F reduced below provisional Fpa	< 75	75	79	84
2004/2005	F reduced below provisional Fpa	< 97	90	98	97
2006/2007	F reduced below provisional Fpa	< 112	105	110	110
2007/2008	F reduced below provisional Fpa	120	100	102	102
2008/2009	F reduced below 0.35	< 83	93	82	82
2009/2010	F reduced below 0.35	< 57	63	73	64
2010/2011	F reduced below 0.35	< 51	50	53	49
2011/2012	F reduced below 0.35	< 42	45	49	46
2013/2014	TAC 0.4 × B45+cm,2014	< 38	38	39.6	34
2014/2015	TAC 0.4 × B45+cm,2015	< 30.4	30.4	36.6	39.6
2015/2016	TAC 0.4 × B45+cm,2016	< 36.4	36.4	36.8	38.1
2016/2017	TAC 0.4 × B45+cm,2017	< 34.6	34.6		
2017/2018	TAC 0.4 × B45+cm,2018	<41.4			

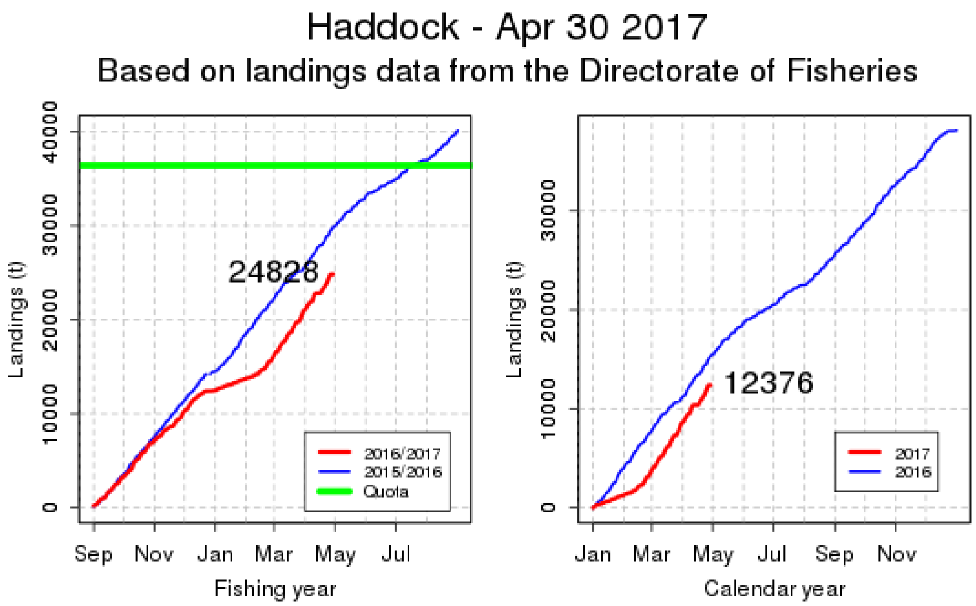


Figure 10.3.2 Haddock in division 5.a. Development of the landings during the fishing year 2016/17 (left side) and calendar year (2016) on the right. Fishing year 2015/2016 and calendar year 2016 shown for comparison. TAC for the fishing year shown in the left figure.

10.3.1 ICES advice

The ICES advice for the 2016/2017 fishing year states: ICES advises that when the Icelandic management plan is applied, catches in the fishing year 2016/2017 should be no more than 34 600 tonnes.

10.4 Assessment.

From 2007–2017 the final assessment was based on an Adapt type model calibrated with indices from both the groundfish surveys in March and October. The stock was benchmarked in February 2013, (WKROUND 2013) and this model setup was recommended for the use in the assessment. Prior to 2007 a statistical catch-at-age model calibrated with indices from the March survey was used.

Assessment in recent years has shown some difference between different models, but more difference between different data sources i.e. the March and the October surveys. From 2004–2008 models calibrated with the October survey indicated smaller stock. In the last five years things have changed and models calibrated with the October survey indicate a better state of the stock, while this did decrease with addition of the most recent data points i.e. October 2016 and March 2017. This behaviour is in line with what is seen in the surveys where the contrast in biomass is higher in the March survey (Figure 10.1.8).

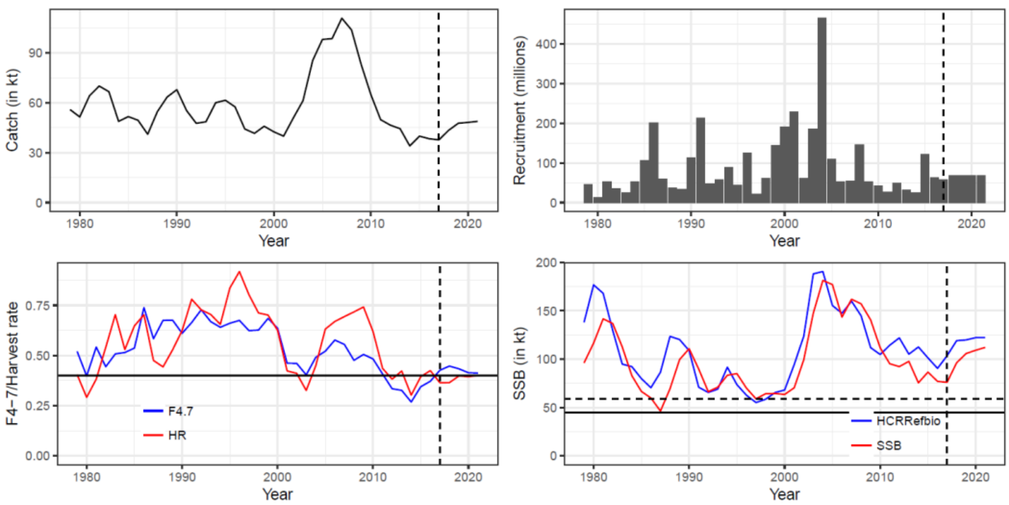


Figure 10.4.1 Haddock in division 5a. Summary from assessment. Dashed vertical line indicates the prediction period.

The results of the assessment indicate that the stock decreased from 2008–2011 when large year classes disappeared from the stock and were replaced by smaller year classes (Figure 10.4.1). Since 2011 the rate of reduction has slowed down as fishing mortality has been low. In spite of this the spawning stock has decreased more than the reference biomass as proportion mature by age/size has been decreasing. Fishing mortality is now estimated to be low and is inline with the overall goal of the HCR. The current assessment does indicate the bottom has been reached and the stock size will increase in next years.

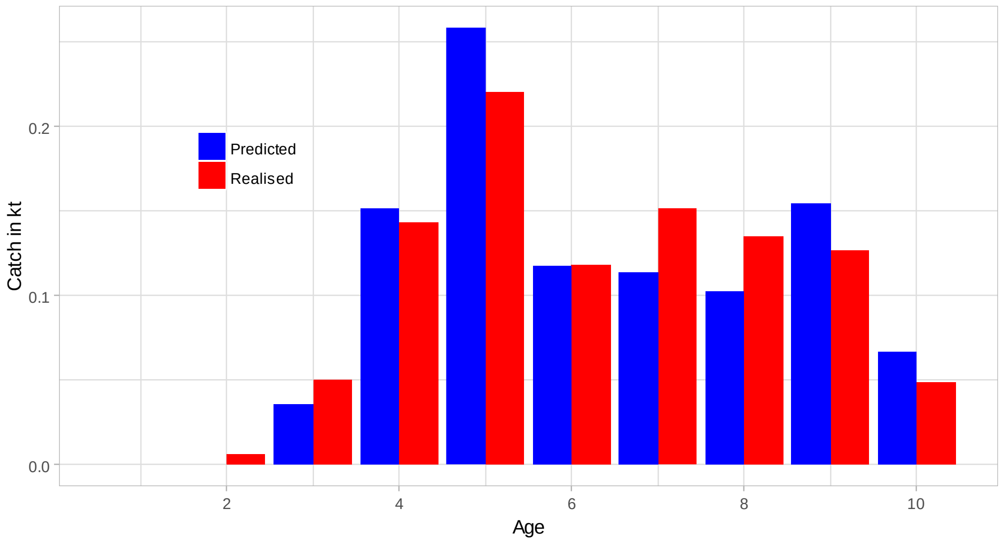


Figure 10.4.2 Haddock in division Va. Percent of catch in tonnes 201165 (red) compared to last year's predictions.

The main features of the current assessment are the same as in the assessments 2011 to 2016. The current assessment indicates similar stock as predicted by the 2016 assessment (Figure 10.4.2 and 10.4.3). Most of the difference is explained by lower than predicted catches from the 2012 year class (Figure 10.4.2). The tendency has been to underestimate recruitment and stock size in recent years.

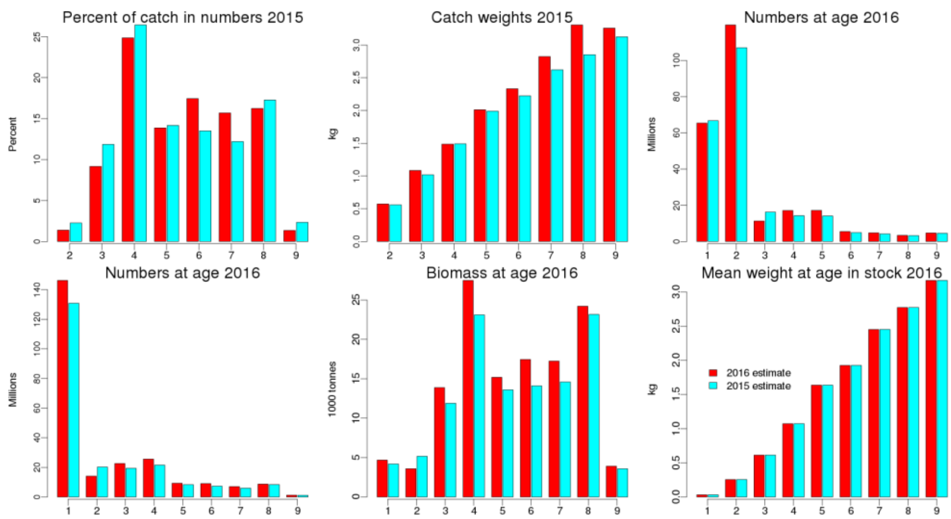
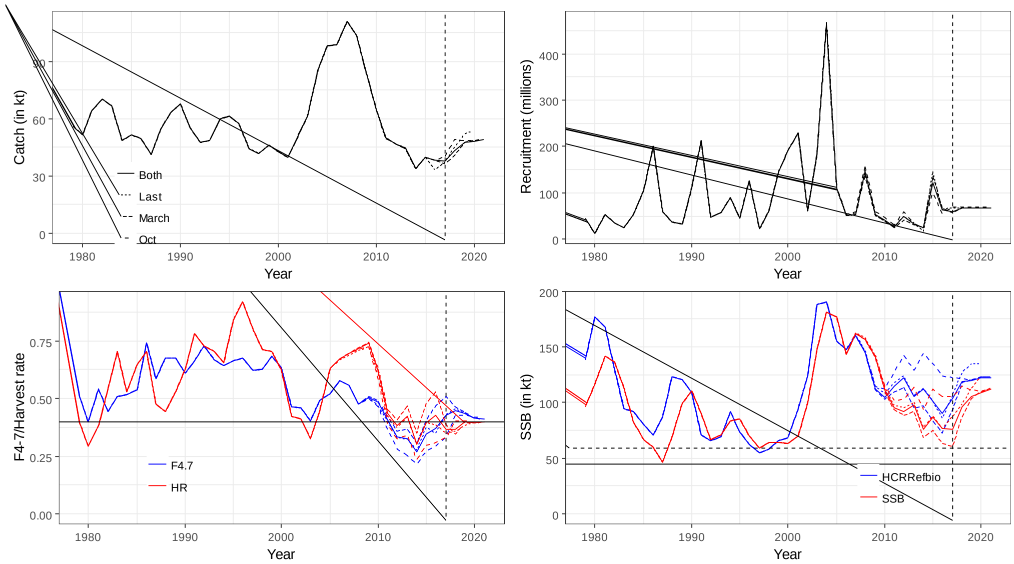


Figure 10.4.3. Comparison of 2016 and 2017 assessment



10.4.4 Haddock in division 5a. Comparison of some of the results of 2017 assessment based on different tuning data and 2016 assessment tuned with both the surveys.

Residuals from the assessment model are positive for the most recent October survey but close to zero for the most recent March survey. (Figures 10.2.2 and 10.2.3). The March surveys 2011-2015 are on the other hand below predictions. Similar thing seem to be happening in the fishery in 2012-2013 (Figure 10.1.15) so there are indication that the stock might be underestimated or availability of haddock is unusually high.

Figure 10.2.2. Haddock in division Va. Residuals from the fit to survey data from Adapt run based on the both the surveys. Red circles indicate positive residuals (observed > modelled), while blue negative. Residuals are proportional to the area of the circles.

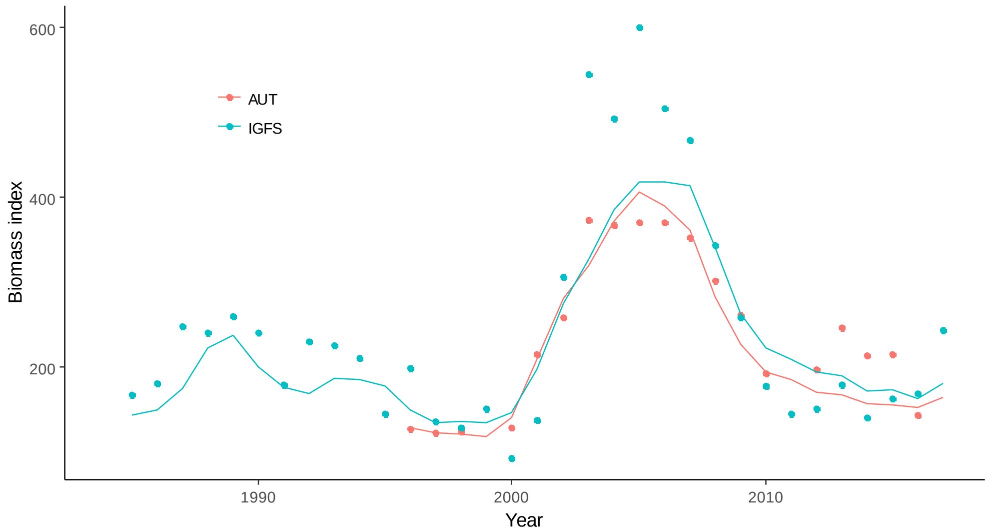


Figure 10.2.3. Haddock in division 5a. Observed and predicted biomass from the surveys according to the SPALY run.

Standard errors in estimates of SSB in 2016 from the Adapt model are 9 thous. tons for the March survey and 16 thous. for the autumn survey. The difference between the stock biomass is 67 thous. tonnes (124 vs. 57 thous. tonnes) that does not fit within the confidence intervals (less than 1% probability of 65 thous tonnes or more difference between autumn survey and March survey results). This is an indication that the estimated confidence intervals are too narrow. The same observation has been made last 5 years. The spawning stock according to the model tuned with both the surveys is 77 thous. tonnes.

Plot of observed vs. predicted biomass from the surveys (figure 10.2.3) indicates that historically the autumn survey biomass has been closer to prediction than corresponding values from the March survey where the contrast in observed biomass is more than predicted from the assessment. When the stock was small in 2000 and 2001, the March survey indicated considerably smaller stock while the autumn survey values were reasonably correct and from 2003-2007 the March survey overestimated the stock.

10.4.1 Short-term forecast

Prediction of weight at age in the stock, weight at age in the catches, maturity-at-age and selection has been similar since 2006 (WD #19 in 2006). The procedure is described in the advice part of the report of ADGISHA (Björnsson 2013) and also in the stock annex. The procedure was changed last year so instead of taking only last year's value, average of last 2 values is used.

Prediction of growth is a source of uncertainty for this stock. (Figures 10.2.8, and 10.4.2). In recent year's growth has shown interannual variability without any pattern, indicating that short-term prediction should rather been based on average growth of last 2-3 years instead of only last year's growth. This approach might though have to be changed if stock size increases much so care should be exercised in carving any approach in stone.

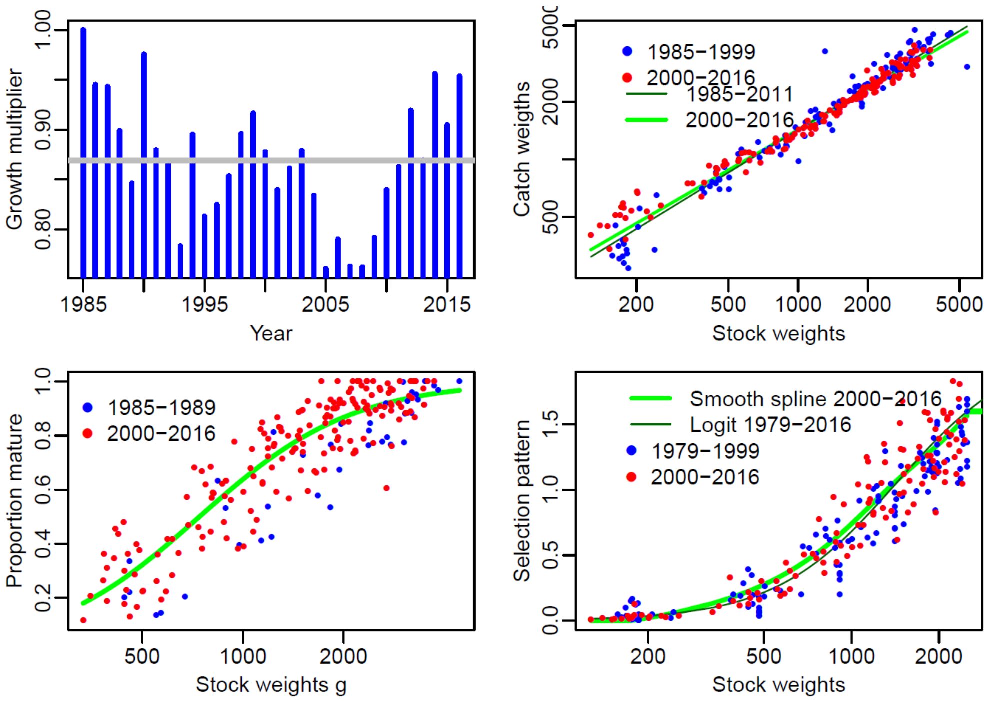


Figure 10.4.2 Haddock in division 5a. Input data to prediction. Predictions are based on the period since 2000. . Exponential of the yearfactor (growth multiplier) in the equation

$$\log \frac{W_{a+1,t+1}}{W_{a,t}} = \alpha + \beta \log W_{a,t} + \delta_{year}$$

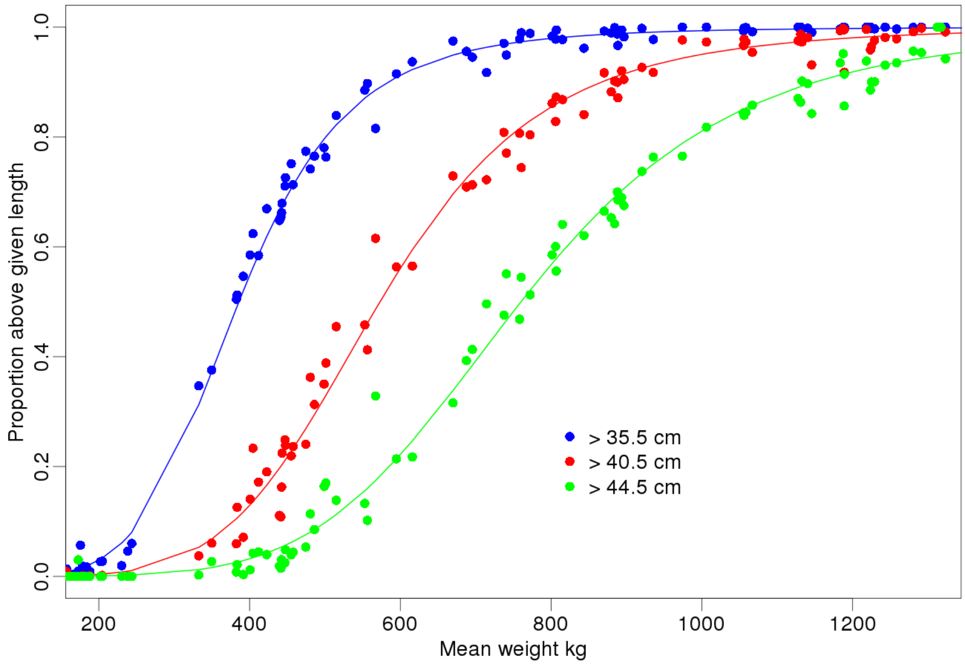


Figure 10.4.3 Haddock in division 5a. Proportion of the biomass of a yearclass above certain size. The points show data, compiled from the March survey and the lines a curve fitted to the data and used in simulations.

Mean weight and maturity-at-age in 2017 are available and are used to predict catch weights and selection at age (Figure 10.4.2). Growth in 2017 is predicted by the equation

$$\log \frac{W_{a+1,t+1}}{W_{a,t}} = \alpha + \beta \log W_{a,t} + \delta_{year}$$

Where according to the stock annex the factor δ_{year} for the assessment year (figure 10.4.2) is the average of δ_{year} of the growth in the 2 preceding years. Growth has been high but somewhat variable in recent years but was much less in when the stock was larger (figure 10.4.2).

Maturity, selection, catch weights at age and proportion of the biomass above 45cm are then predicted from stock weights 2018. When those values have been estimated the prediction is done by the same model as used in the assessment.

The model works iteratively as the estimated TAC for the fishing year 2017/2018 has some effect of the biomass at the beginning of 2018, which the TAC is based on. Advice for the following fishing year (2018/2019) is predicted to be approximately 48 000 tonnes and is projected to remain at that level as the 2014 year class will be fully recruited.

Results of the short-term prediction are shown in figure 10.2.1 assuming that the harvest control rule is followed. Summary of the assessment are in tables 10.4.1, 10.4.2 and 10.4.3. The TAC for the fishing year 2017/2018 will be 41 370 tons.

Table 10.4.1 Haddock in division Va. Summary table from the SPALY run using the surveys in March and October for tuning.

Year	Recruitment thousand at age 2	Biomass 3+ tons	SSB tons	Landings tons	Yield/SSB	F4-7
1979	80923,3	162,177	96,0722	55,3303	0,575924	0,52088
1980	37389,6	192,244	116,521	51,1104	0,438637	0,397891
1981	10426,4	206,988	141,628	63,5585	0,448771	0,542203
1982	42787,7	180,38	136,817	69,4278	0,50745	0,444141
1983	29305,6	148,112	112,589	65,9425	0,585692	0,508177
1984	20573,7	112,797	82,9611	48,2821	0,581985	0,515023
1985	42787,7	102,394	66,652	51,1016	0,766693	0,537229
1986	86501,1	96,4798	59,8372	48,8593	0,816537	0,738889
1987	164036	105,395	46,2981	40,7597	0,880375	0,583643
1988	48741,8	153,708	69,3913	54,2035	0,781128	0,675359
1989	29777,9	168,184	99,5369	62,8849	0,631775	0,676371
1990	27093,7	145,507	110,745	67,1975	0,606777	0,610767
1991	92280,5	122,708	89,8252	54,6918	0,608869	0,664292
1992	175094	106,31	66,3787	47,121	0,709881	0,728033
1993	38436,9	130,461	71,0004	48,1233	0,677789	0,668831
1994	46842	127,836	83,2949	59,5019	0,714352	0,640774
1995	72857	124,042	85,0535	60,8842	0,715834	0,660904
1996	36341,2	108,036	70,0083	56,8898	0,812615	0,675114
1997	102509	87,1523	58,9926	43,7638	0,741852	0,624108
1998	17975,8	97,1206	64,2033	41,1917	0,641582	0,626716
1999	50160,5	91,0235	64,4395	45,4108	0,704704	0,68486
2000	117423	90,6737	63,5091	42,1054	0,662982	0,636291

2001	156535	115,046	70,3664	39,6535	0,563529	0,461692
2002	187267	168,427	99,344	50,4975	0,50831	0,460974
2003	50393,9	219,757	147,523	60,8831	0,412702	0,403617
2004	151499	252,826	181,306	84,8281	0,467873	0,491146
2005	380385	259,044	177,009	97,2252	0,549267	0,521616
2006	89949,7	297,783	143,351	97,6139	0,680943	0,577149
2007	42734,5	295,572	161,863	109,966	0,679377	0,555256
2008	44106,5	247,505	157,129	102,872	0,654698	0,47605
2009	119577	190,27	140,53	82,0447	0,583823	0,505519
2010	43519,3	165,446	111,675	64,1685	0,5746	0,482894
2011	33990,5	150,825	95,2236	49,4331	0,519127	0,407959
2012	22236,9	142,401	92,2356	46,2077	0,500975	0,334525
2013	40644,3	136,966	97,7045	44,0972	0,451332	0,326602
2014	26208,8	124,409	75,5111	33,9001	0,448942	0,268533
2015	20388,3	126,688	86,5573	39,6456	0,458027	0,344764
2016	100236	111,606	77,0097	38,1093	0,494864	0,371789
Average 1979-2016	75787.79	154.3237	99.21296	58.40756	0.6094893	0.5355416

Table 10.4.2 Haddock in division Va. Number in stock from the SPALY run using both the surveys. Shaded cells are input to prediction. . Predictions shown are based on HCR.

Year/Age	1	2	3	4	5	6	7	8	9	10
1979	46	81	117.3	27.7	19.6	20.44	3.41	0.77	0.15	0.05
1980	13	37	66.1	94.3	19.3	10.54	8.57	1.21	0.23	0.07
1981	52	10	30.1	52.9	66.8	11.91	5.19	3.64	0.5	0.11
1982	36	43	8.5	24.2	38.9	39.42	4.33	1.69	1.35	0.26
1983	25	29	34.9	6.8	16.9	21.99	19.56	1.67	0.48	0.45
1984	52	21	24	27.7	4.1	9.7	9.09	8.02	0.68	0.21
1985	106	43	16.6	18.6	18.2	2.14	3.63	4.06	2.88	0.34
1986	200	86	33.8	12.1	11.1	8.75	0.98	1.45	1.59	0.63
1987	60	164	69.9	23.9	6.2	4.88	2.51	0.35	0.46	0.49
1988	36	49	132.6	49.7	13.2	2.59	2.15	1.07	0.17	0.23
1989	33	30	39.7	99.6	27	5.58	0.94	0.78	0.32	0.08
1990	113	27	24.2	30.3	61.1	13.43	1.68	0.31	0.14	0.13
1991	214	92	20.5	17.6	17	28.7	5.27	0.63	0.12	0.05
1992	47	175	67.8	14.8	9.6	7.25	10.74	1.92	0.21	0.06
1993	57	38	138.5	45.8	7	3.65	2.59	4.08	0.67	0.07
1994	89	47	30.8	102.2	25.9	3.03	1.43	0.83	1.31	0.23
1995	44	73	35.5	22.2	58.1	11.54	1.15	0.52	0.36	0.49
1996	125	36	56	22.4	12.9	25.93	4.23	0.38	0.16	0.13
1997	22	102	27	36.3	11.4	6.56	9.56	1.34	0.13	0.06
1998	61	18	82.7	18.5	19.9	4.93	3.01	3.27	0.45	0.05
1999	143	50	14.5	60.2	10	9.15	1.85	1.18	0.96	0.13
2000	191	117	39.8	10.4	33.7	4.12	3.11	0.69	0.4	0.35
2001	229	156	93.7	26.9	6.4	15.28	1.61	1.01	0.27	0.13
2002	62	187	125.9	66.7	15.7	3.95	6.85	0.71	0.39	0.12
2003	185	50	152.3	93.6	40.1	8.23	2.21	2.76	0.34	0.17
2004	470	151	40.9	119	61.9	21.5	4.05	1.13	1.14	0.2
2005	111	385	122.3	29.8	81.4	33.19	9.58	1.56	0.5	0.49
2006	52	91	312.8	91.6	18.1	43.68	14.71	3.7	0.55	0.18
2007	54	43	74	247.1	55.8	8.83	18.71	5.17	1.05	0.16
2008	148	44	34.3	57	164.1	25.52	4.2	6.31	1.75	0.39
2009	51	121	34.3	24	37.9	86.35	10.93	1.88	2.43	0.7
2010	40	42	98.2	25.2	15.2	23.01	39.02	3.76	0.88	0.74
2011	26	32	34.1	74.9	14.2	8.13	12.71	16.11	1.38	0.4
2012	49	21	26.3	26.5	50.6	7.07	4.08	6.8	7.56	0.69
2013	34	40	17.4	20.4	18.6	29.61	3.78	2.22	3.33	3.78
2014	17	28	32.9	13.3	14.1	11.62	15.9	2	1.22	1.59
2015	146	14	22.6	25.6	9.3	9.06	7.03	8.73	1.23	0.65
2016	66	120	11.3	17.1	17.2	5.5	4.78	3.39	4.69	0.81
2017	58,68	52,25	81,63	11,89	9,99	10,43	3,24	2,61	1,9	2,37
2018	67,54	48,04	42,51	61,72	7,09	5,5	5,32	1,58	1,27	0,93
2019	67,54	55,29	39,18	31,36	39,7	3,66	2,67	2,48	0,74	0,59

Table 10.4.3 Haddock in division Va. Fishing mortality from the SPALY run using the March and October surveys for tuning. Predictions based on F4-7 = 0.3 are highlighted.

YEAR/AGE	2	3	4	5	6	7	8	9	10
1979	0.002	0.018	0.162	0.419	0.669	0.833	0.99	0.553	0
1980	0.018	0.023	0.144	0.282	0.508	0.657	0.685	0.561	0.724
1981	0.001	0.019	0.108	0.328	0.813	0.92	0.793	0.463	0.569
1982	0.003	0.032	0.156	0.369	0.501	0.751	1.056	0.903	1.288
1983	0.001	0.032	0.301	0.357	0.683	0.692	0.706	0.643	1.051
1984	0.013	0.051	0.22	0.449	0.784	0.607	0.825	0.493	0.369
1985	0.035	0.122	0.315	0.532	0.582	0.719	0.737	1.314	1.184
1986	0.013	0.148	0.467	0.625	1.048	0.816	0.937	0.976	0.918
1987	0.013	0.141	0.389	0.669	0.62	0.657	0.53	0.5	0.685
1988	0.005	0.086	0.411	0.665	0.811	0.815	0.998	0.557	0.557
1989	0.007	0.071	0.288	0.498	1.003	0.917	1.552	0.682	0.632
1990	0.079	0.117	0.379	0.556	0.736	0.772	0.769	0.794	0.467
1991	0.109	0.123	0.413	0.651	0.783	0.811	0.89	0.473	0.25
1992	0.035	0.192	0.555	0.762	0.827	0.768	0.858	0.973	0.204
1993	0.022	0.104	0.37	0.635	0.736	0.934	0.933	0.842	0.383
1994	0.078	0.128	0.365	0.608	0.769	0.821	0.643	0.786	0.575
1995	0.063	0.259	0.337	0.607	0.804	0.895	0.971	0.856	0.926
1996	0.099	0.233	0.473	0.48	0.798	0.95	0.912	0.79	0.756
1997	0.015	0.176	0.404	0.641	0.579	0.873	0.9	0.819	0.253
1998	0.017	0.117	0.413	0.575	0.781	0.738	1.025	1.041	0.53
1999	0.032	0.126	0.38	0.689	0.878	0.792	0.87	0.806	0.776
2000	0.025	0.193	0.286	0.591	0.737	0.93	0.74	0.933	0.807
2001	0.018	0.14	0.337	0.286	0.603	0.62	0.745	0.568	0.44
2002	0.006	0.096	0.308	0.445	0.381	0.71	0.523	0.65	0.468
2003	0.009	0.047	0.213	0.424	0.508	0.469	0.685	0.345	0.383
2004	0.012	0.116	0.179	0.424	0.609	0.753	0.616	0.645	0.71
2005	0.007	0.089	0.297	0.423	0.614	0.753	0.849	0.809	0.653
2006	0.003	0.036	0.296	0.519	0.648	0.846	1.056	1.057	0.829
2007	0.02	0.06	0.209	0.581	0.544	0.886	0.882	0.787	0.58
2008	0.059	0.157	0.208	0.442	0.648	0.602	0.757	0.723	0.636
2009	0.01	0.108	0.255	0.3	0.594	0.867	0.555	0.992	0.987

2010	0.003	0.07	0.37	0.428	0.393	0.685	0.8	0.584	0.963
2011	0.009	0.053	0.191	0.501	0.491	0.425	0.557	0.501	0.366
2012	0.01	0.057	0.154	0.337	0.427	0.406	0.515	0.493	0.491
2013	0.007	0.069	0.169	0.272	0.422	0.435	0.403	0.535	0.51
2014	0.009	0.051	0.158	0.241	0.302	0.4	0.283	0.433	0.521
2015	0.018	0.078	0.198	0.323	0.44	0.531	0.421	0.226	0.672
2016	0,01	0,23	0,27	0,31	0,39	0,52	0,52	0,4	0,19
2017	0,01	0,08	0,32	0,4	0,47	0,52	0,52	0,52	0,52
2018	0	0,1	0,24	0,46	0,52	0,56	0,56	0,56	0,56
2019	0	0,1	0,26	0,39	0,54	0,55	0,55	0,55	0,55