10 Haddock in 5.a

Icelandic haddock (*Melanogrammus aeglefinus*) is fairly abundant in the coastal waters around Iceland and is mostly limited to the Icelandic continental shelf, while 0-group and juveniles from the stock are occasionally found in East Greenland waters (ICES area 14). Apart from this, larval drifts links with other areas have not been found. In addition, minimal catches have been reported in area 14 (less than 10 tonnes in 2016). The nearest area to the Icelandic were haddock are found in reasonable abundance are in shallow Faroese waters, an area that constitutes as a separate stock. The two grounds are separated by a wide and relatively deep ridge, an area where reporting of haddock catches is non-existent, both commercially and scientifically. Tagging studies (Jónsson 1996) conducted between 1953 and 1965 showed no migrations of juvenile and mature fish outside of Icelandic waters, with most recaptures taking place in the area of tagging (or adjacent areas) and on the spawning grounds south of Iceland. Information about stock structure (metapopulation) of haddock in Icelandic waters is limited.

The species is found all around the Icelandic coast, principally in the relatively warm waters off the west and south coast, in fairly shallow waters (10–200 m depth). Spawning has historically been limited to the southern waters. Haddock is also found off the north coast and in warm periods a large part of the immature fish have been found north of Iceland. In recent years a larger part of the fishable stock has been found off the north coast of Iceland than the last two decades of the 20th century.

10.1 Fishery

The fishery for haddock in 5.a has not changed substantially in recent years, but the total number of boats that account for 95% of fishery have been declining steadily (Figure 10.1.1). Around 250 longliners annually report catches of haddock, around 60 trawlers and 40 demersal 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% to 45% in 2017. However, for the last two years this proportion has increased slightly and was around 60% in 2019. At the same time the proportion caught by longlines has increased from around 15% in 1995–2000 to 40 % in 2011–2020. Catches in demersal 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 (Figure 10.1.2). Most of the haddock caught in 5.a by Icelandic vessels is caught at depths less than 200 m (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) and Figure 10.1.5). 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.

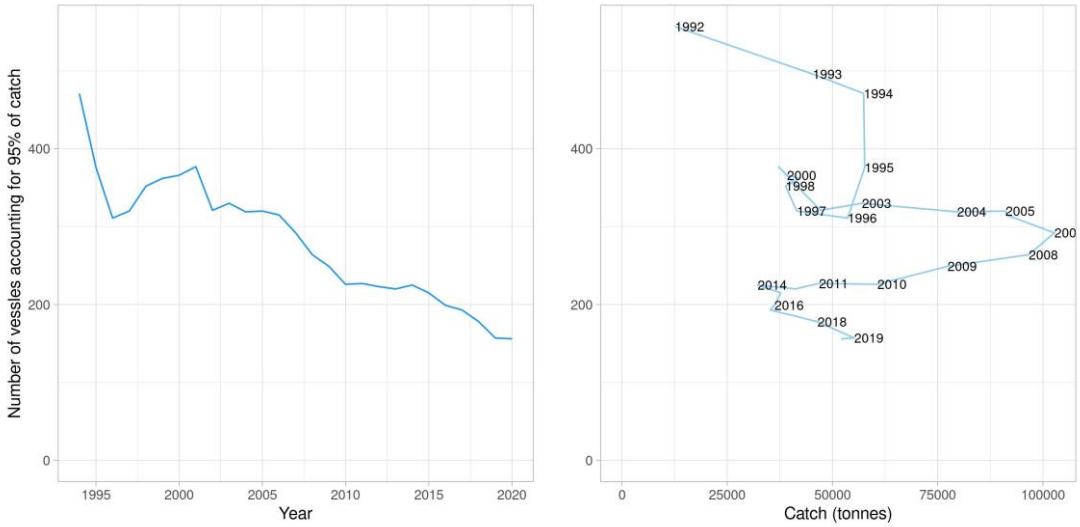

Figure 10.1.1: Haddock in 5.a. Number of vessels (all gear types) accounting for 95% of the total catch annually since 1994. Left: Plotted against year. Right: Plotted against total catch. Data from the Directorate of Fisheries.

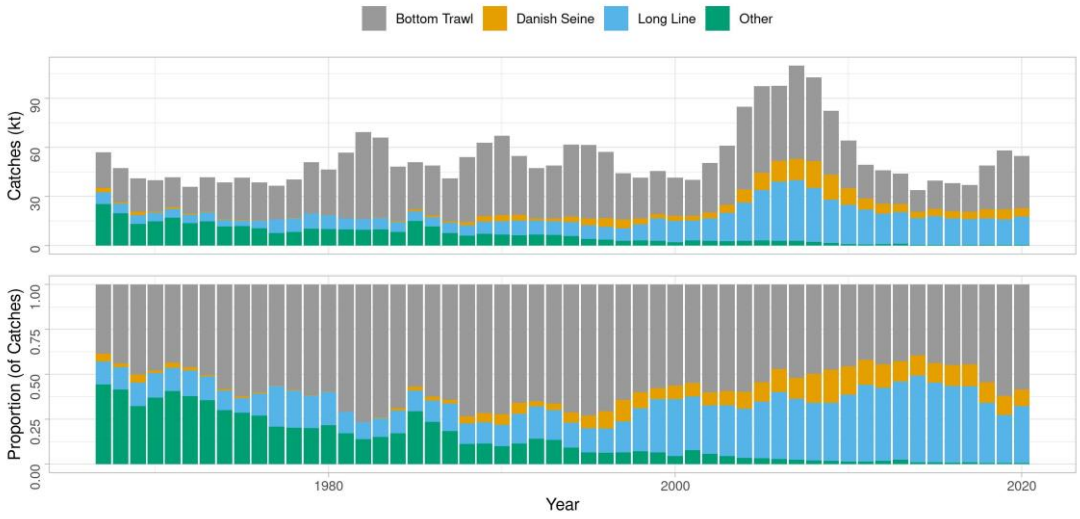

Figure 10.1.2: Haddock in 5.a. Landings in tonnes and percent of total by gear and year.

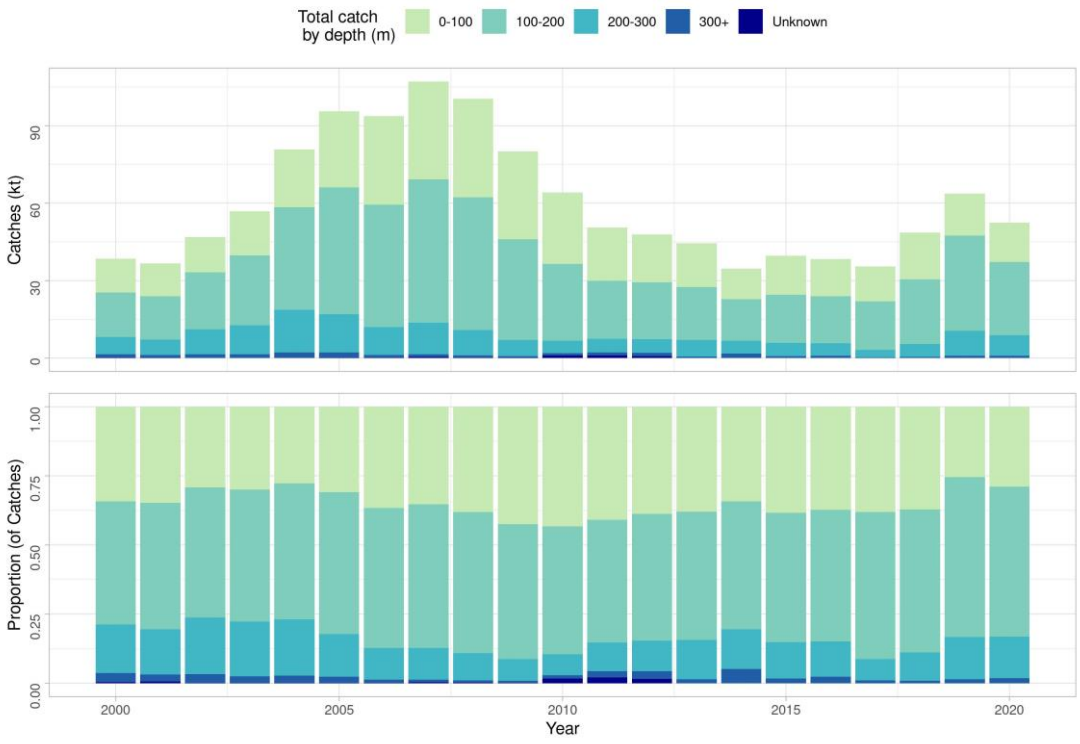

Figure 10.1.3: Haddock in 5.a. Depth distribution of haddock catches from bottom trawls, longlines, trawls and demersal seine from Icelandic logbooks.

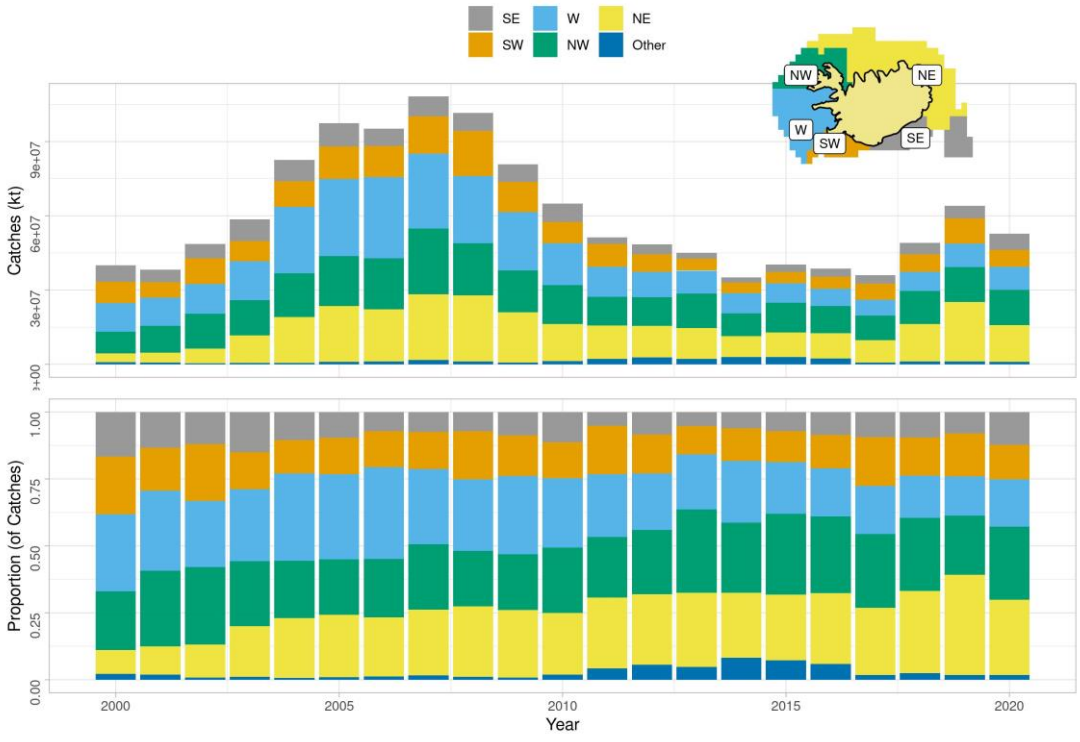

Figure 10.1.4: Haddock in 5.a. Changes in spatial distribution of haddock catches as recorded in Icelandic logbooks.

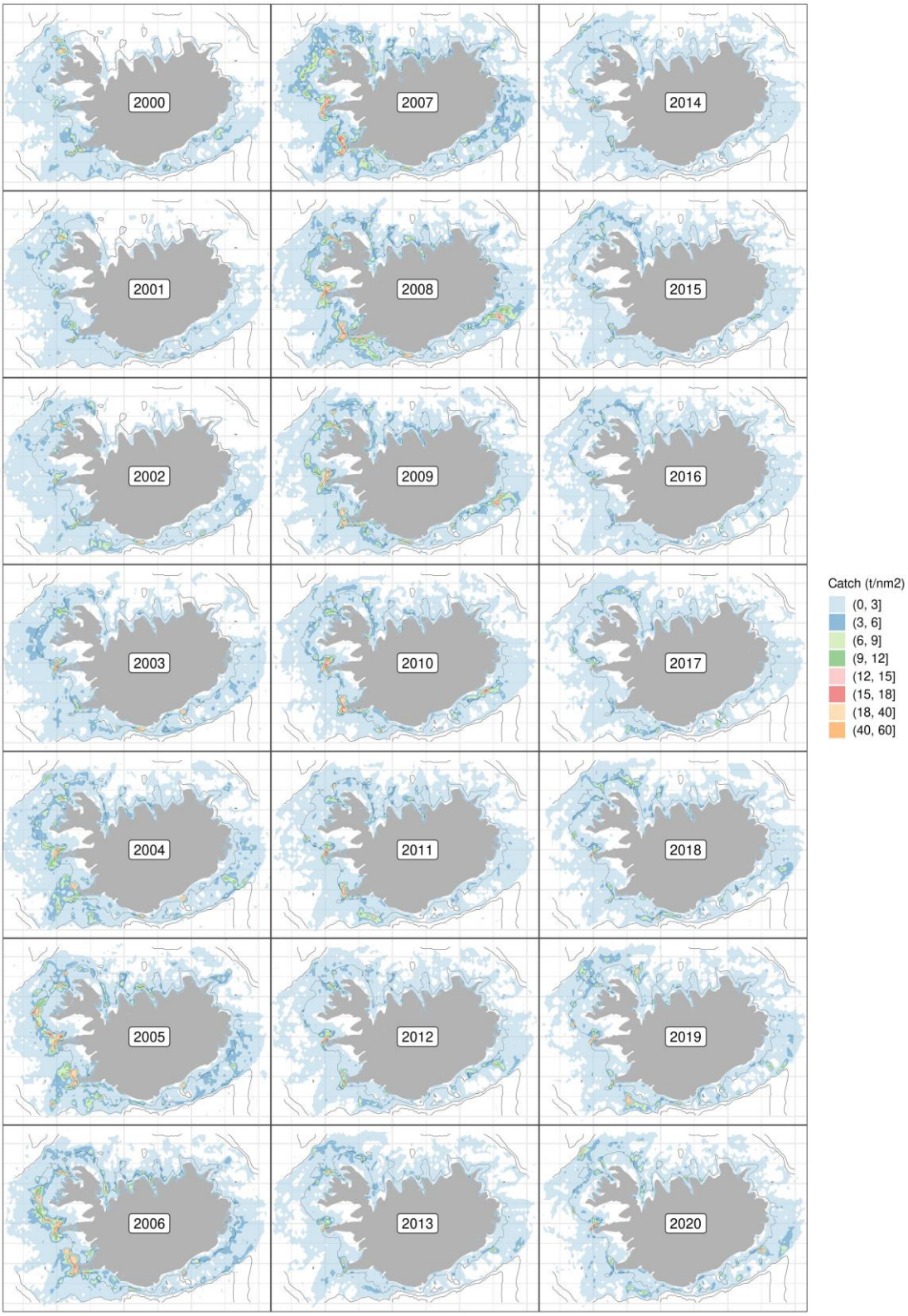

Figure 10.1.5: Haddock in 5.a. Spatial distribution of catches by all gears.

10.1.1 Landing trends

Landings of Icelandic haddock in 2020 are estimated to have been 5.478074^{4} thousand tonnes, see Figure 10.1.6. The landings in Division 5.a. have decreased from 100 thous. tonnes between 2005–2008, which historically was very near the maximum levels observed in the 1960's, to the current level which is slightly lower than observed between 1975 to early 2000's.

Foreign vessel landings were a considerable proportion of the landings, but since the expansion of the EEZ landings of foreign vessels are negligible. Currently most of the foreign catch is caught by Faeroese vessels, which in last year was 1.248329^{6} tonnes, while Norwegian vessels land considerably less haddock.

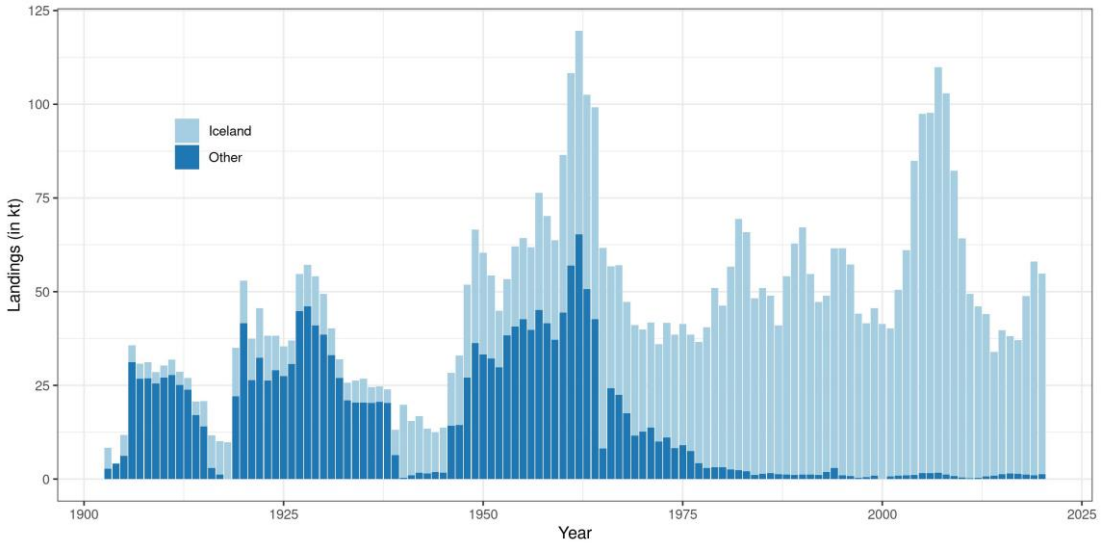

Figure 10.1.6: Haddock in 5.a. Recorded landings since 1905.

10.2 Data available

In general sampling is considered good from commercial catches from the main gears (demersal seines, longlines and trawls). The sampling does seem to cover the spatial and seasonal distribution of catches (see Figure 10.1.7and Figure 10.1.8. In 2020 sampling effort was reduced substantially, on-board sampling in particular, due to the COVID-19 pandemic. This reduction in sampling is, however, considered to be sufficiently representative of the fishing operations and thus not considered to substantially affect the assessment of the stock.

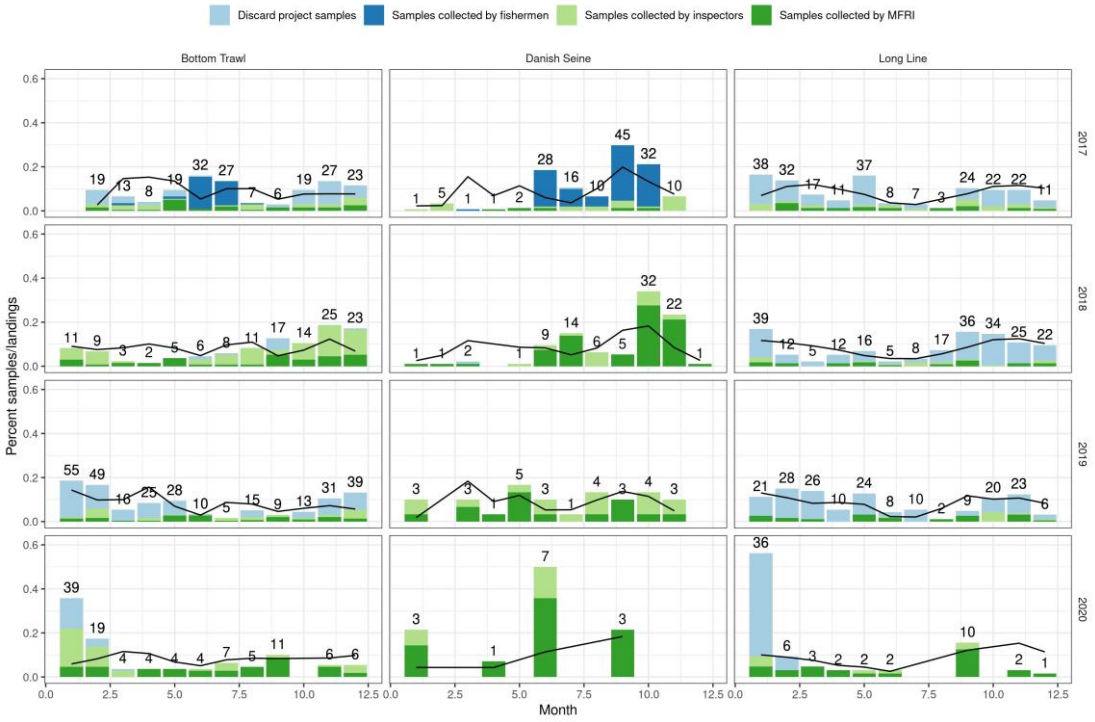

Figure 10.2.1: Haddock in 5.a. Ratio of samples by month (blue bars) compared with landings by month (solid black line) split by year and main gear types. Numbers of above the bars indicate number of samples by year, month and gear.

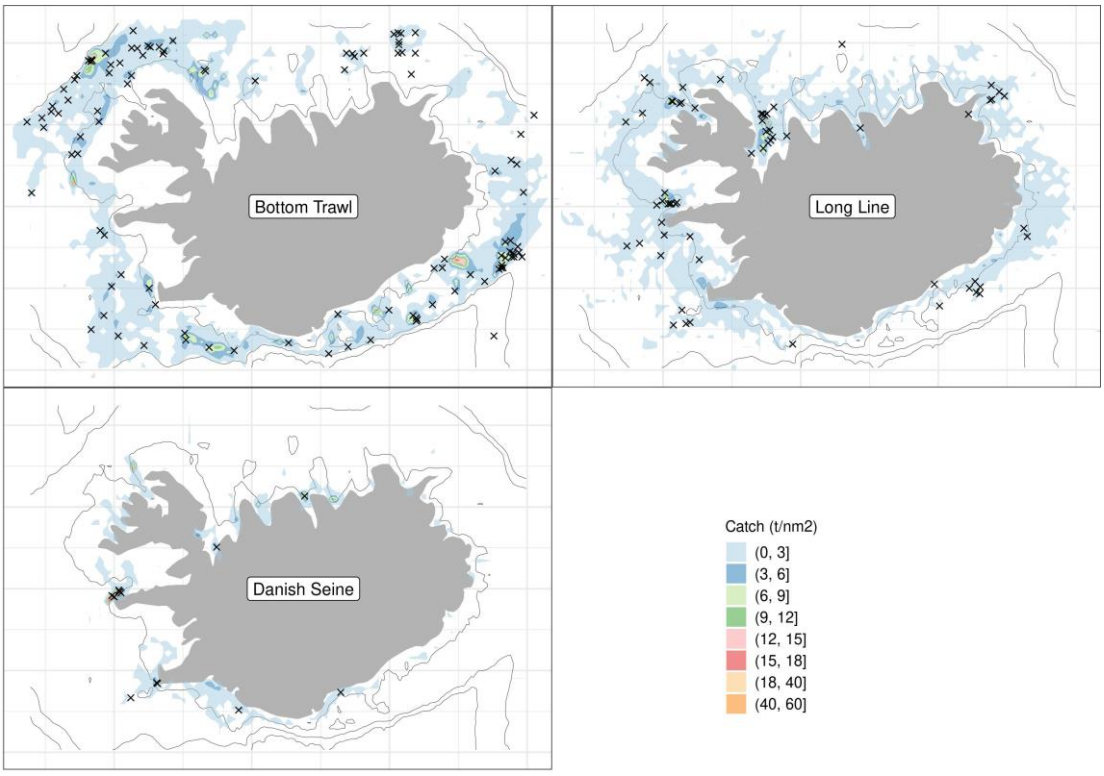

Figure 10.2.2: Haddock in 5.a. Fishing grounds in 2019 as reported in logbooks (tiles) and positions of samples taken from landings (asterisks) by main gear types.

10.2.1 Landings and discards

All landings in 5.a before 1982 are derived from the STATLANT database, and also all foreign landings in 5.a to 2005. The years between 1982 and 1993 landings by Icelandic vessels were collected by the Fisheries Association of Iceland (Fiskifélagið). Landings after 1994 by Icelandic vessels are given by the Icelandic Directorate of Fisheries. Landings of foreign vessels (mainly Norwegian and Faroese vessels) are given by the Icelandic Coast Guard prior to 2014 but after 2014 this are also recorded by the Directorate. Discarding is banned by law in the Icelandic demersal fishery. Based on annual discards estimates since 2001, discard rates in the Icelandic fishery for haddock are estimated very low in recent years (<3% in either numbers or weight, see MRI (2016) for further details) while historically discards may have been substantial in the early 1990s. Measures in the management system such as converting quota share from one species to another are used by the fleet to a large extent and this is thought to discourage discarding in mixed fisheries. In addition to prevent high grading and quota mismatch the fisheries are allowed to land fish that will not be accounted for in the allotted quota, provided that the proceedings when the landed catch is sold will go to the Fisheries Project Fund (*Verkefnasjóður sjávarútvegsins*). A more detailed description of the management system can be found on https://www.responsiblefisheries.is/seafood-industry/management-and-control-system/.

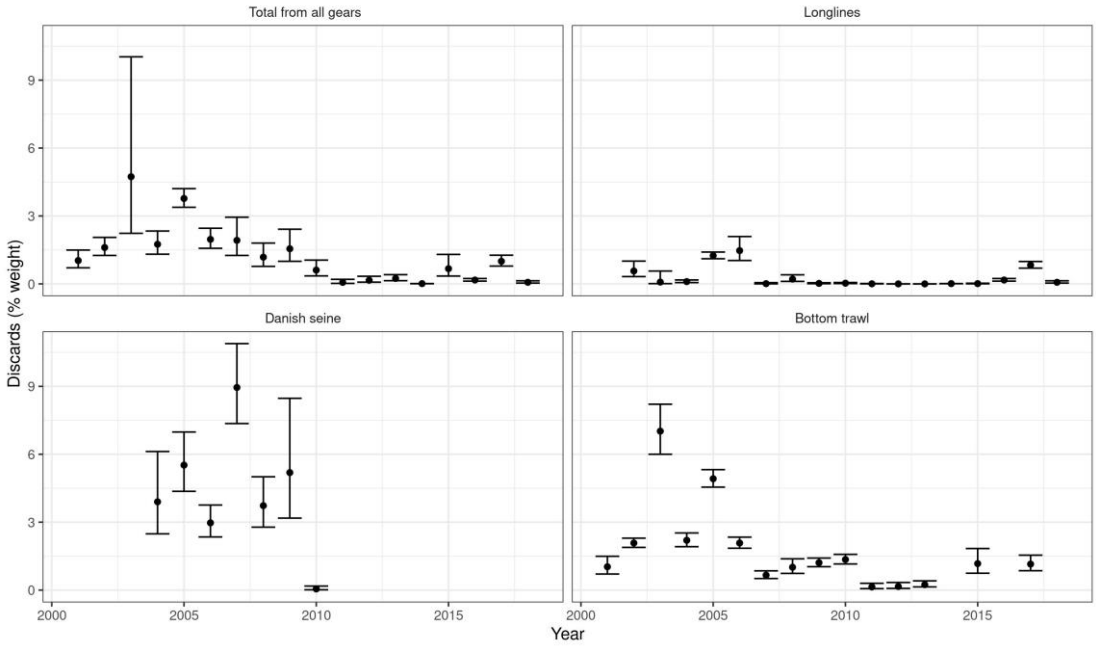

Figure 10.2.3: Haddock in 5.a. Estimates of annual discards by gear. Vertical lines indicate the 95 % confidence interval while dots the point estimates. No estimates are available for 2019 and 2020 at this time.

10.2.2 Length compositions

The bulk of the length measurements are from the three main fleet segments, i.e. trawls, longlines and demersal seine. The number of available length measurements by gear has fluctuated in recent years in relation to the changes in the fleet composition.

Length distributions from the main fleet segments are shown in Figure 10.1.9. The sizes caught by the main gear types (bottom trawl and longlines) appear to be fairly stable, primarily catching

haddock in the size range between 40 and 70 cm. Gillnets tend to catch slightly larger fish and modes of the length distribution varies more depending on the availability of large haddock.

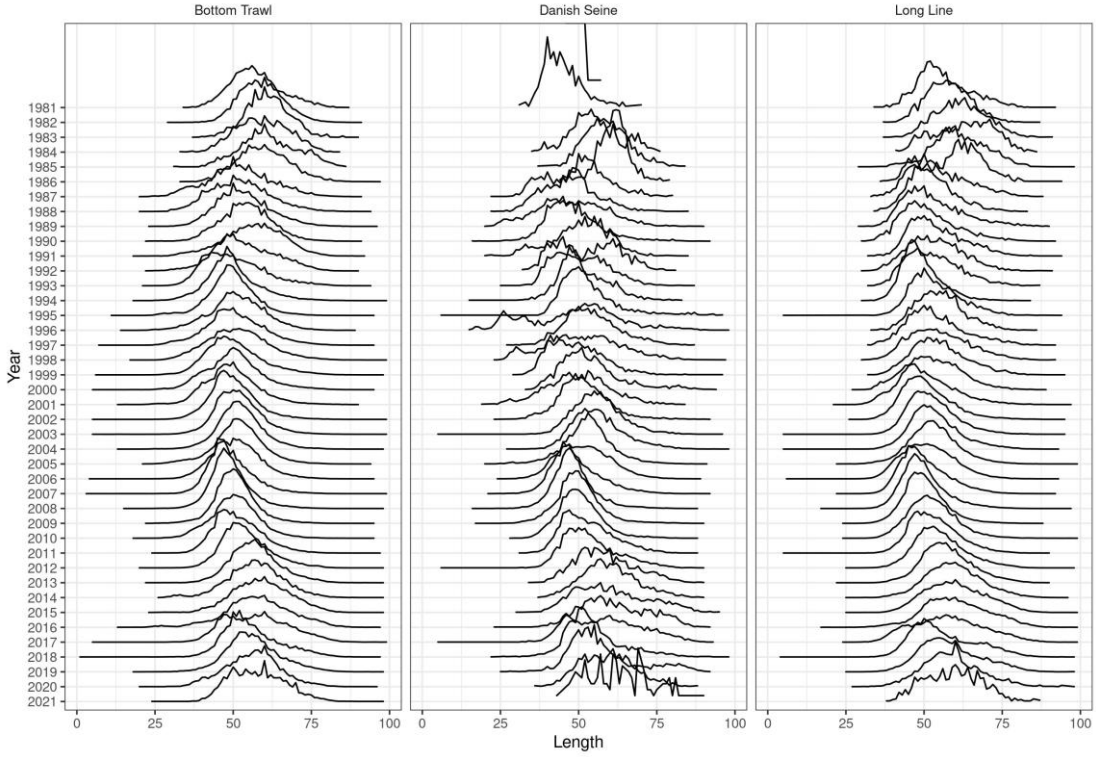

Figure 10.2.4: Haddock in 5.a. Commercial length distributions by gear and year

10.2.3 Age compositions

Catch in numbers-at-age is shown in Figure 10.1.10. The catches in 2020 are mainly composed of the 2014-year class largest component (approx. 35 %) with remainder spread across a number of relatively small year classes. The number of year classes contributing to the catches is unusually many; the result of low fishing mortality in recent years and the last year class contributing with more that 1% of total is 11 years old Figure 10.1.11.

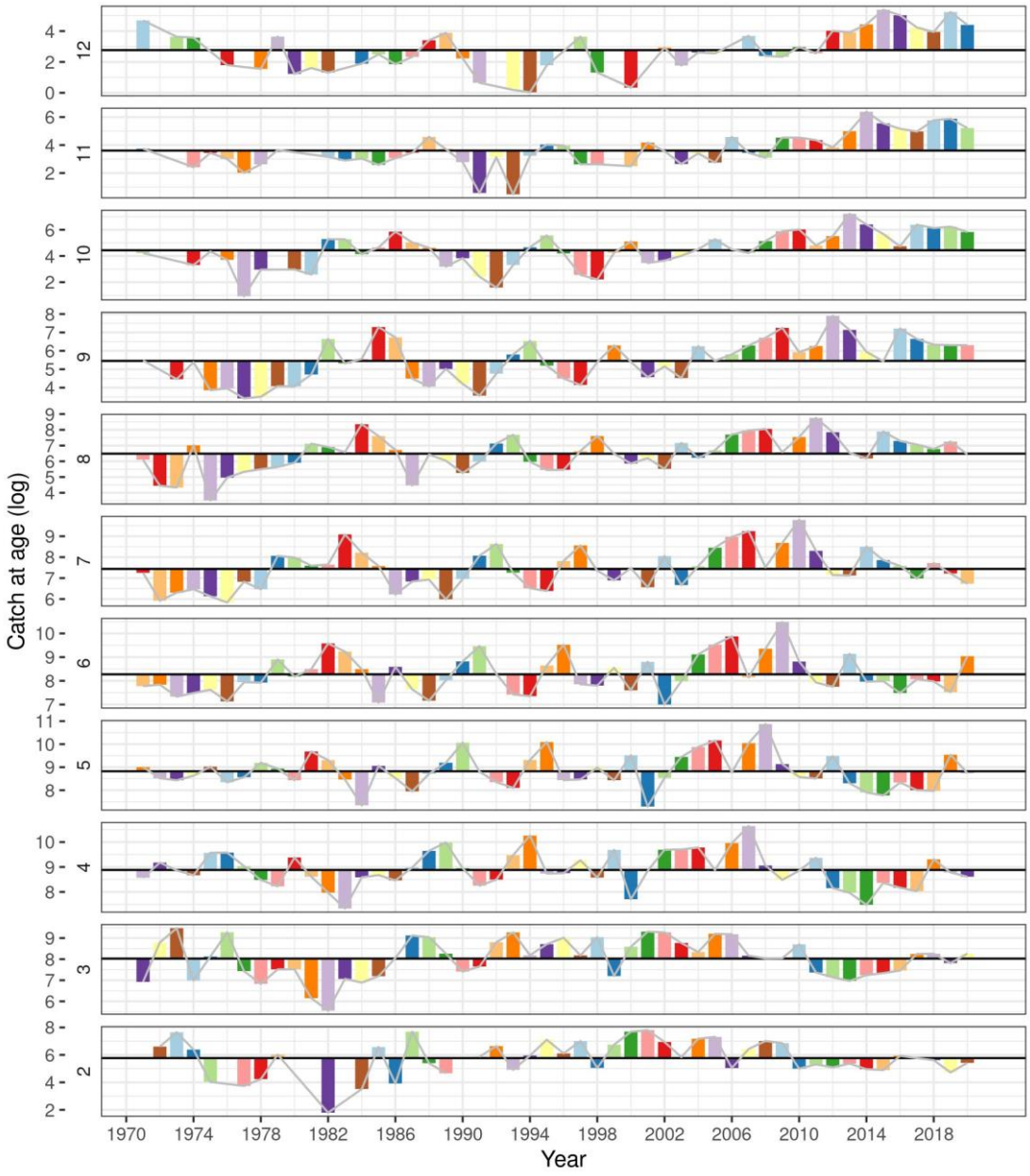

Figure 10.2.7: Haddock in 5.a. Catch at age from the commercial fishery in Iceland waters. Bar size is indicative of the catch in numbers and bars are coloured by cohort.

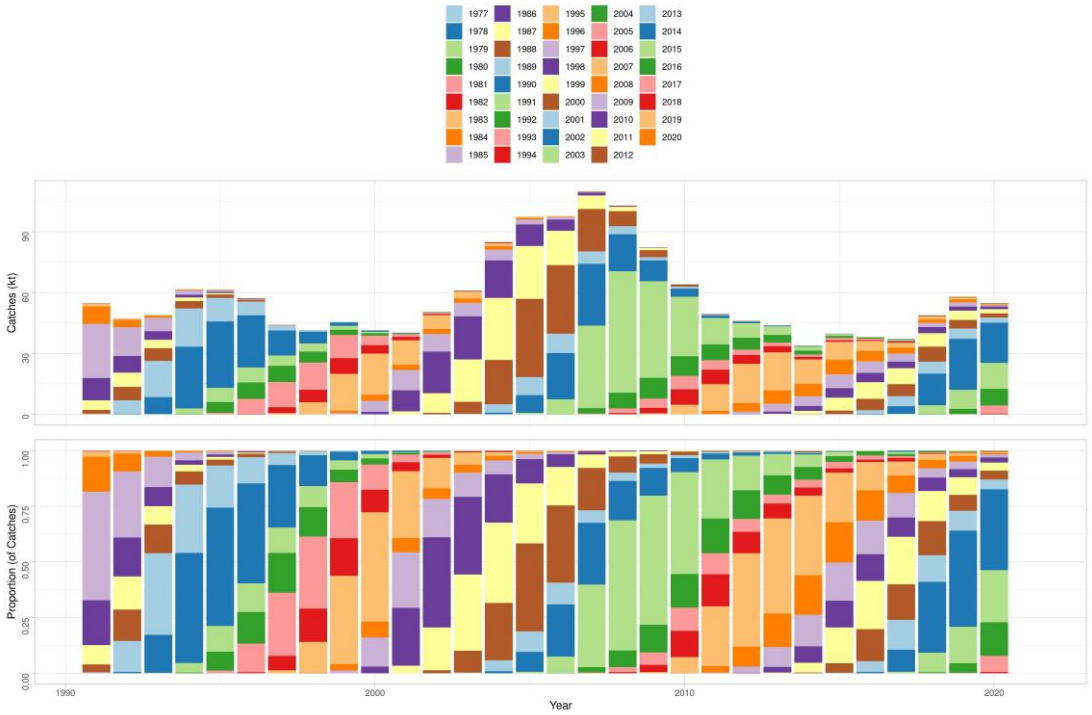

Figure 10.2.6: Haddock in 5.a. Catch at age from the commercial fishery in Iceland waters. Biomass caught by year and age, bars are coloured by cohort.

10.2.4 Weight at age

Mean weight at age in the stock and catch is shown in Figure 10.1.12. Stock weights are obtained from the groundfish survey in March and are also used as mean weight at age in the spawning stock. Both stock and catch weights of the older year classes 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), which has resulted in a mean weight of the old fish above average. Mean weight of younger year classes has decreased but is still above average.

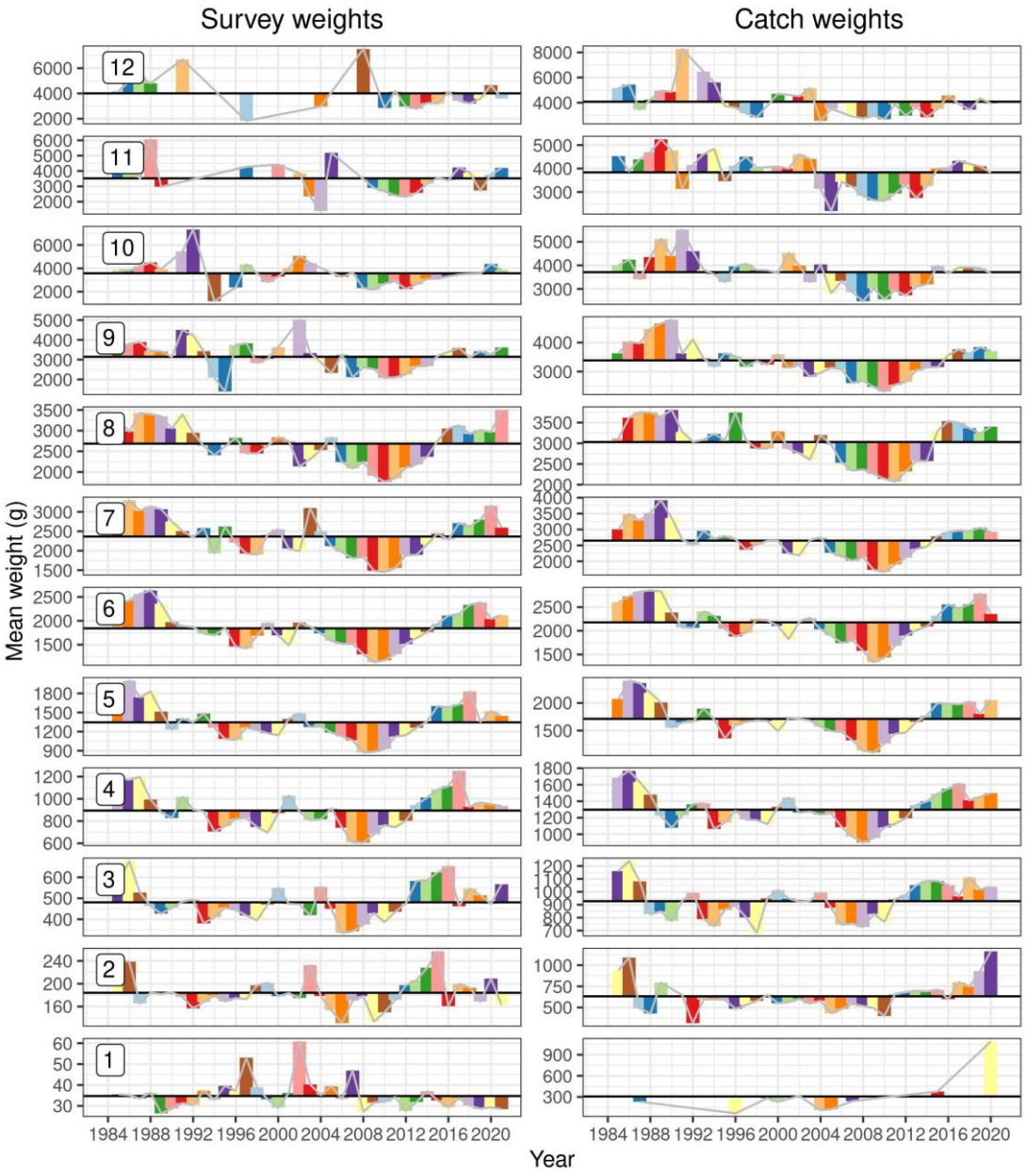

Figure 10.2.8: Haddock in 5.a. Catch weights from the commercial fishery and stock weights from the March survey in Icelandic waters. Bars are coloured by cohort.

10.2.5 Maturity at age

Maturity-at-age data are shown Figure 10.1.13. Those data are obtained from the groundfish survey in March. Maturity-at-age of the youngest age groups has been decreasing in recent years which is likely to be related to the distributional shift towards the north. Maturity by size has been decreasing and the most likely explanation is large proportion of those age groups north of Iceland where proportion mature has always been low, as illustrated in Figure 10.1.14.

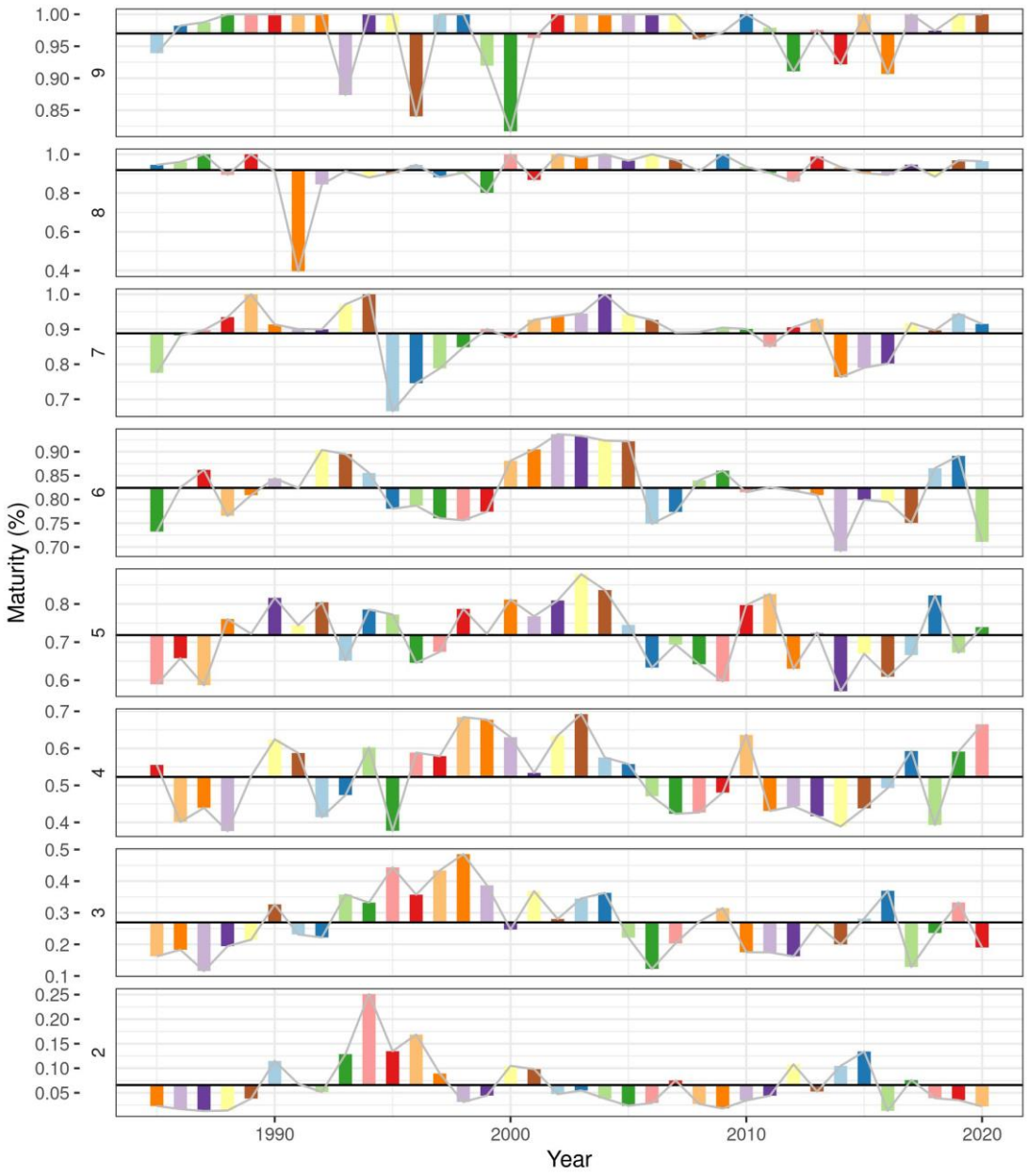

Figure 10.2.9: Haddock in Division 5.a. Maturity-at-age in the survey. The red bars indicates predictions. The values are used to calculate the spawning stock.

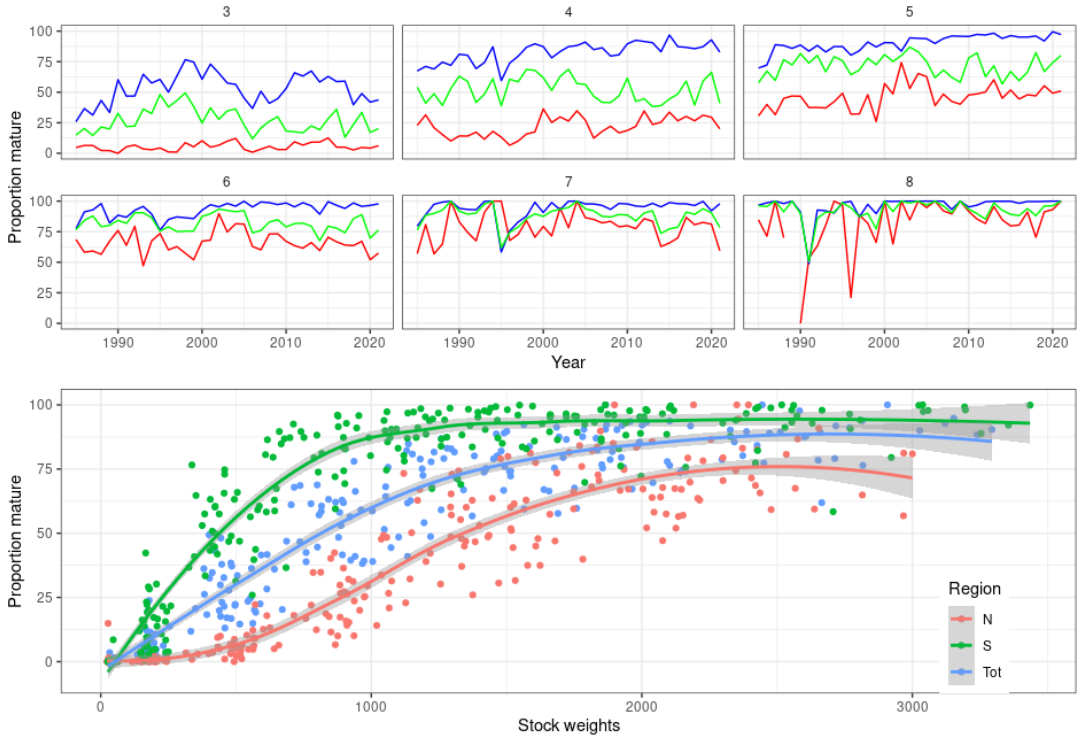

Figure 10.1.14: Haddock in 5.a. Geographical differences in proportion mature by year and age (top), and stock weights (below).

10.2.6 Natural mortality

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

10.2.7 Catch, effort and research vessel data

10.2.7.1 Catch per unit of effort from commercial fisheries

Catch per unit of effort data (Figure 10.1.15) gives different picture of the development of the stock than the surveys and assessment, much less increase after 2000 and much less decrease in recent years. The current assessment coupled with the relatively high CPUE, in recent years, confirms fishers' view that is now easier to catch haddock. The discrepancy observed between CPUE and stock size has not been explained, but a plausible explanation might be related to a couple reasons, and relate to the development of the stock, its spatial distribution and the evolution of the fisheries and management. As is evident, both from the survey data and commercial catch data, the spatial distribution of the stock started to shift northwards in the early 2000s. This shift in distribution is believed be the result of a surge in recruitment that occurred around that time. These shifts caused issues in the fisheries (as described in the management section below) and bycatch of juvenile haddock (<45 cm) which was exacerbated with slower growth of the stock due to higher densities. The opposite has happened in recent years, faster growth and poor recruitment lead to the fisheries not limited by small haddock. There is also a considerable change in the size composition of the stock, where the biomass of 60 cm and above is at the highest observed in the time series, while the total biomass is close to it average value.

There are also considerable differences in the CPUE by area, where the area north of Iceland has seen a continuous increase while the southern regions are more consistent with the total biomass index from the spring survey. Bycatch is of little concern as the haddock is commonly targeted in specific catch mixtures.

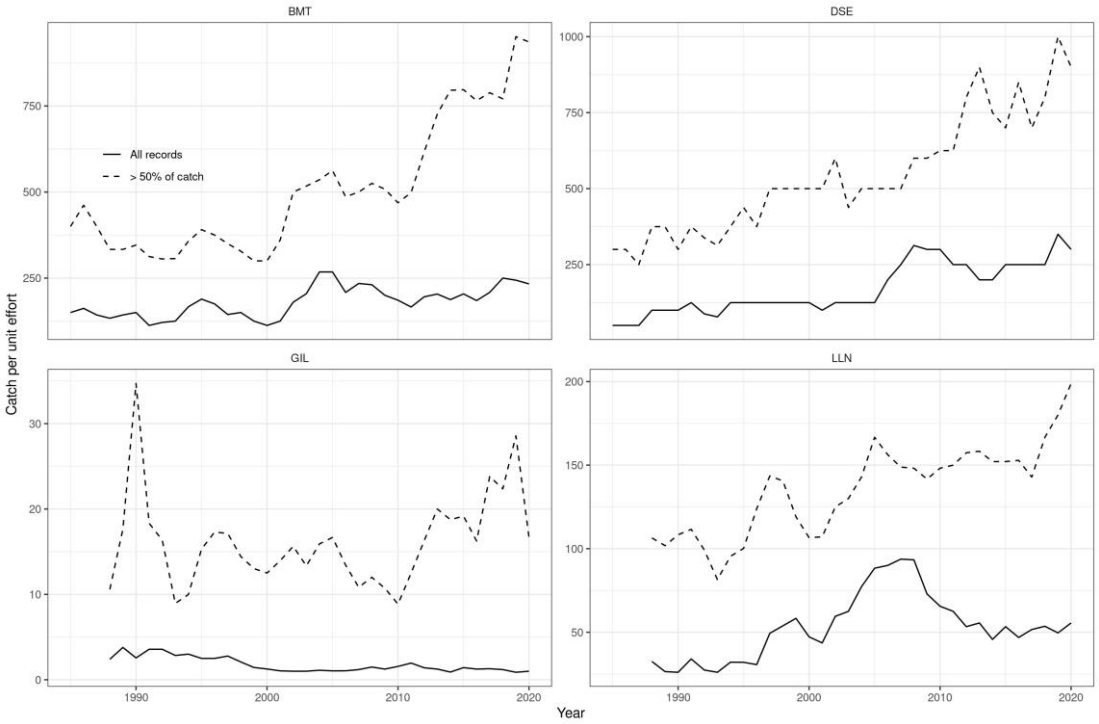

Figure 10.2.11: Catch per unit of effort in the most important gear types. The dashed lines are based on locations where more than 50% of the catch is haddock and solid lines on all records where haddock is caught. A change occurred in the longline fleet starting September 1999. Earlier only vessels larger than 10 BRT were required to return logbooks but later all vessels were required to return logbooks.

10.2.7.2 Icelandic survey data

Information on abundance and biological parameters from haddock in 5.a is available from two surveys, the Icelandic groundfish survey in the spring and the Icelandic autumn survey.

The Icelandic groundfish survey in the spring, which has been conducted annually since 1985, covers the most important distribution area of the haddock fishery. The autumn survey commenced in 1996 and expanded in 2000 to include deep water stations. It provides additional information on the development of the stock. The autumn survey has been conducted annually with the exception of 2011 when a full autumn survey could not be conducted due to a fisherman strike. Although both surveys were originally designed to monitor the Icelandic cod stock, the surveys are considered to give a fairly good indication of the haddock stock, both the juvenile population and the fishable biomass. A detailed description of the Icelandic spring and autumn groundfish surveys is given in the Stock Annex. Figure 10.1.16 shows both a recruitment index and the trends in various biomass indices. Changes in spatial distribution observed in the spring survey are shown in Figure 10.1.17 and Figure 10.1.18. The figure shows that a larger proportion of the observed biomass now resides in the north (areas NW and NE). Survey length distributions are shown in Figure 10.1.19 and Figure 10.1.20 (abundance) and changes in spatial distribution in Figure 10.1.21.

Both surveys show much increase total biomass 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. The 2015 estimate from the autumn survey exhibited substantially lower biomass compared to adjacent years. The contrast between the surveys appears to be starker when looking at the biomass of 60 cm and larger, but both surveys show that the 60 cm^+ is at its maximum in recent years.

Age disaggregated indices from the March survey are shown in Figure 10.1.22. Similar to the biomass of 60cm^+ the index of age 11^+ higher than seen before in March survey. This is assumed to be related to lower fishing mortality after the establishment of a management plan for haddock in 5.a. After a period of low recruitment, the biomass for other age groups is near the geometric mean in both surveys.

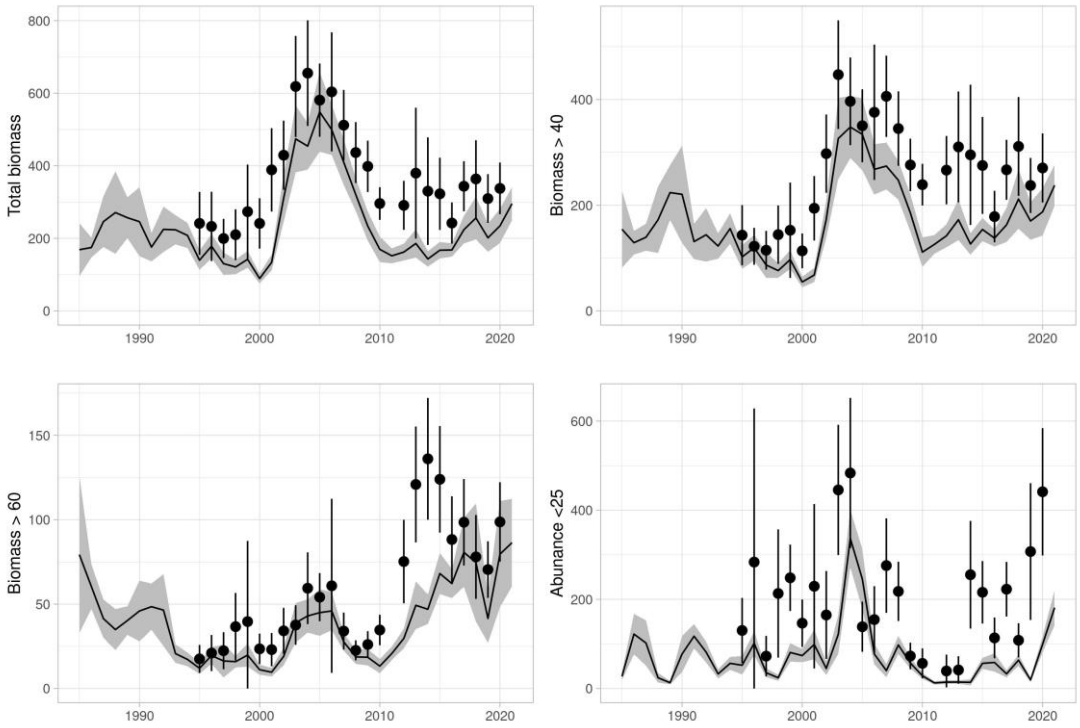

Figure 10.2.12: Haddock in 5.a. Indices in the Spring Survey (March) 1985 and onwards (line shaded area) and the autumn survey (point ranges).

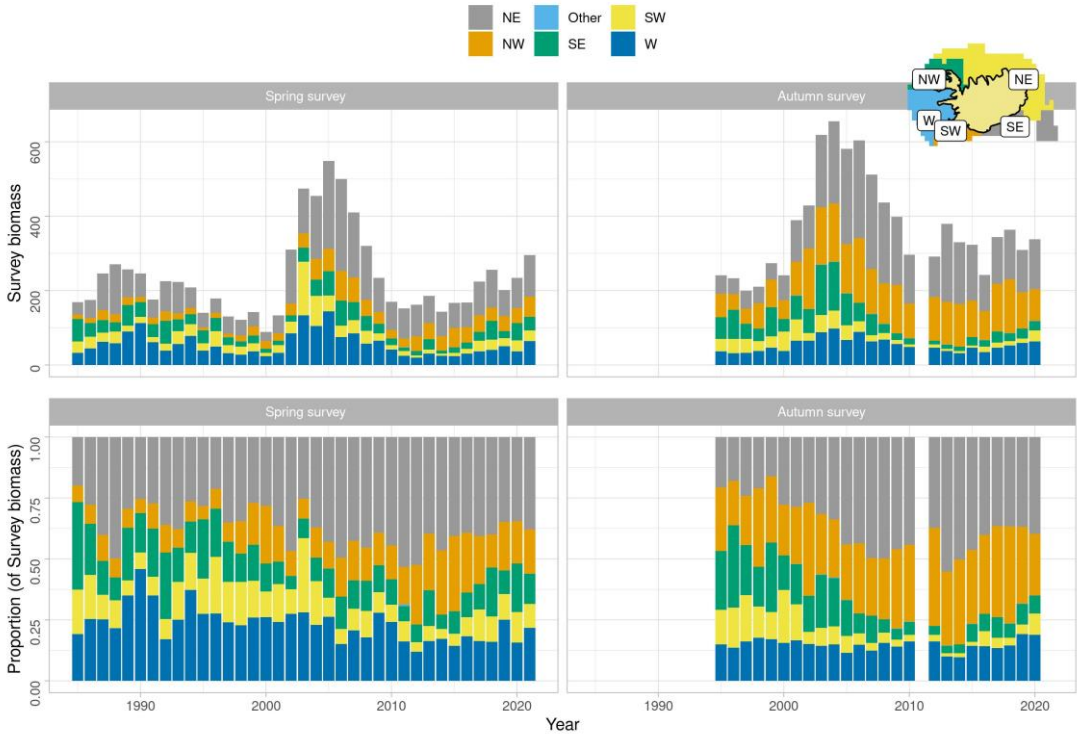

Figure 10.2.13: Haddock in 5.a. Changes in geographical distribution of the survey biomass.

Figure 10.2.17: Haddock in 5.a. Location of haddock in the March (SMB) and the Autumn (SMH) survey, bubble sizes are relative to catch sizes.

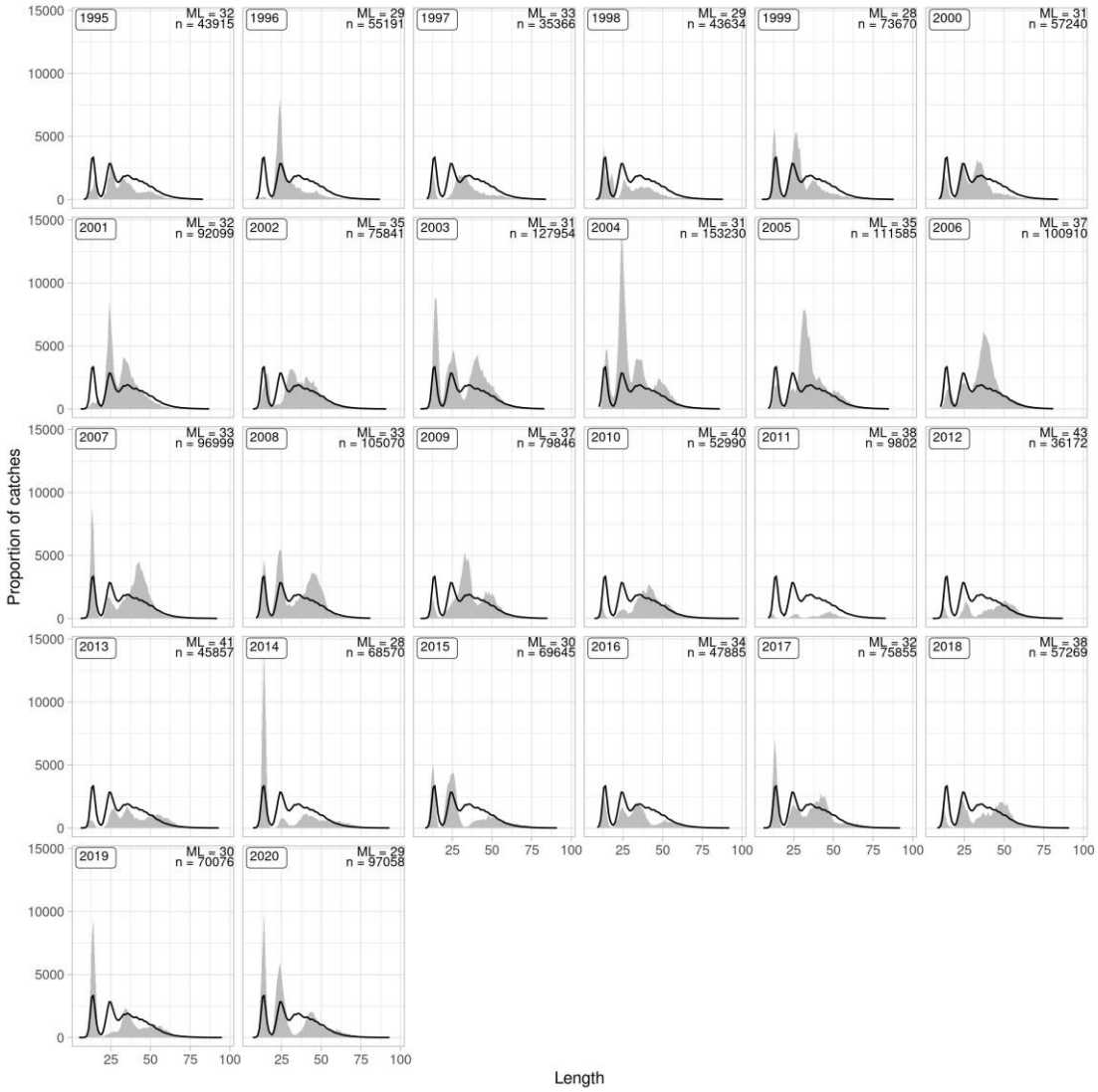

Figure 10.2.15: Haddock in 5.a. Length disaggregated abundance indices from the March survey 1985 and onwards.

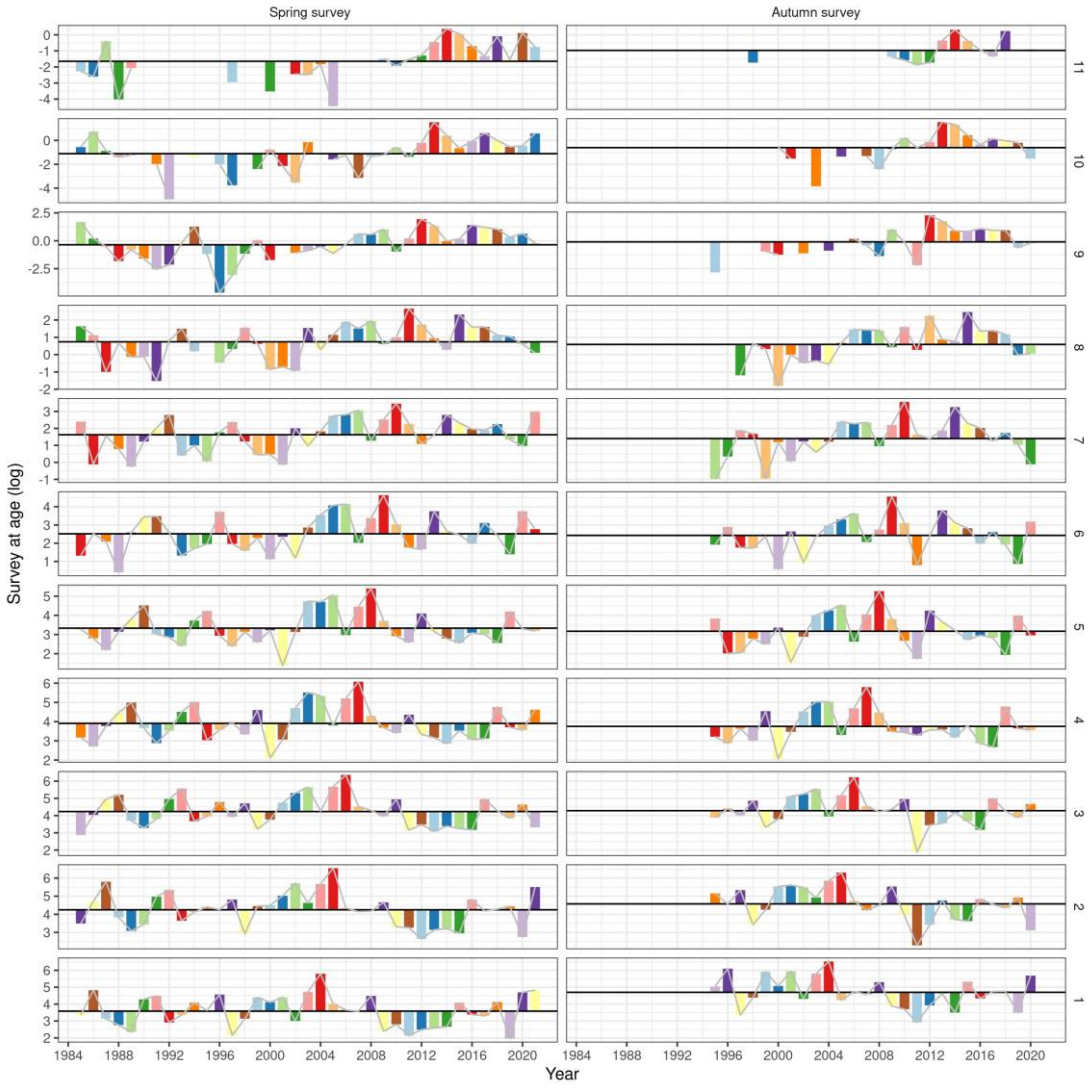

Figure 10.2.18: Haddock in 5.a. Age disaggregated indices in the Spring Survey (left) and the autumn survey (rights). Bars indicated the deviation from the log mean index, fill colours indicate cohorts.

10.3 Data analyses

10.3.1 Analytical assessment

This stock was last benchmarked in 2019 (WKICEMSE 2019), but the model had been used in parallel to the previous assessment since 2013. A management plan for haddock in 5.a based on this assessment was tested at the same meeting and subsequently implemented by the government of Iceland in the same year.

The assessment model used is a statistical catch–at-age model described in Bjornsson, Hjorleifsson, and Elvarsson (2019). The model runs from 1979 onwards and ages 1 to 10 are tracked by the model, where the age of 10 is a plus group. Natural mortality is set to 0.2 for all age groups. Selection pattern of the commercial fleet is defined in terms of mean stock weights at age, rather than age, based on a logit selection function:

$$S_{a,y} = \frac{1}{1 + e^{-\alpha(\log(sW_{a,y}) - \log(W_{50}))}}$$

The rationale for this choice, compared to a more traditional age-based selection, is to account for observed changes in growth between year classes. Larger year classes tend to have lower mean weight compared to smaller year classes, as observed in Figure 10.1.12. As fishery selection is mainly size based, the assessment model using a size-based selection only requires two parameters to estimate the selection pattern. In contrast an age-based selection pattern would require parameter based on multiple selection time periods.

The weights to the survey data are based on a common multiplier to the variance estimates of each age group and survey obtained from a backwards calculation model (described in Bjornsson, Hjorleifsson, and Elvarsson 2019), shown in Figure 10.1.23.

The ratio of fishing and natural mortality before spawning was set at 0.4 and 0.3 respectively as haddock is known to spawn in the period between April till the end of May.

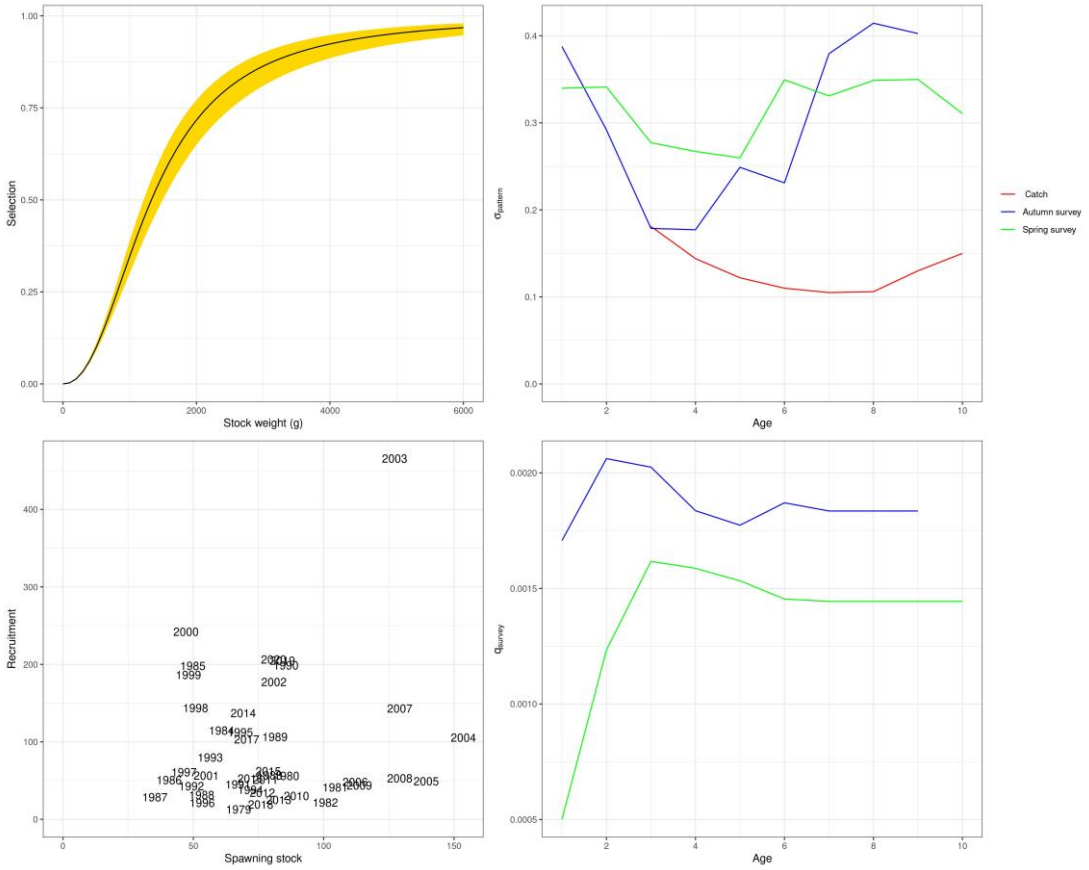

Figure 10.2.19: Haddock in 5.a. Estimated selection by weight, CV pattern, stock recruitment relationship and survey catchability.

10.3.2 Data used by the assessment

The assessment relies on four sources of data, that are described above. These are the two surveys, commercial samples and landings. The commercial data is used to compile catch at age data that enter the likelihood along with the survey at age from both surveys. Stock weights and catch weights at age are derived from the spring survey and catches respectively. The maturity data is similarly collected in the spring survey. Prior to 1985, when the spring survey started, stock weights and maturity at age were assumed constant at the 1985 values. A full description

of the preparation of the data used for tuning and as input is given in the stock annex (see ICES, 2019).

10.3.3 Diagnostics

The fit to data is illustrated in Figure 10.1.24 where no concerning residual patterns are observed. When looking at the combined fit (Figure 10.1.25) the figure shows the observed vs. predicted biomass from the surveys and it indicates that historically the autumn survey biomass has been closer to the prediction than corresponding values from the March survey, where the contrast in observed biomass is more than predicted from the assessment. The model accounts for this by estimating a stronger residual correlation for the spring survey (0.527) compared with the autumn survey (0.193). When contrasting the biomass levels before and after the mid-2000s peak the autumn survey suggests that the biomass level after the peak biomass is higher while the spring survey is at similar levels. Thus, the model appears to fall in a region between the two surveys. The discrepancy appears to be in the largest age groups where the age indices autumn survey are overpredicted in recent years, suggesting that older age groups observed in the March survey are not observed to the same degree in the October survey. Related to this Figure 10.1.23 shows the estimated "catchability" and CV as a function of age for the surveys, showing that estimated CV is lower is generally lower for ages 2–6, whereas the CV increases faster by age for the autumn survey compared with the spring survey.

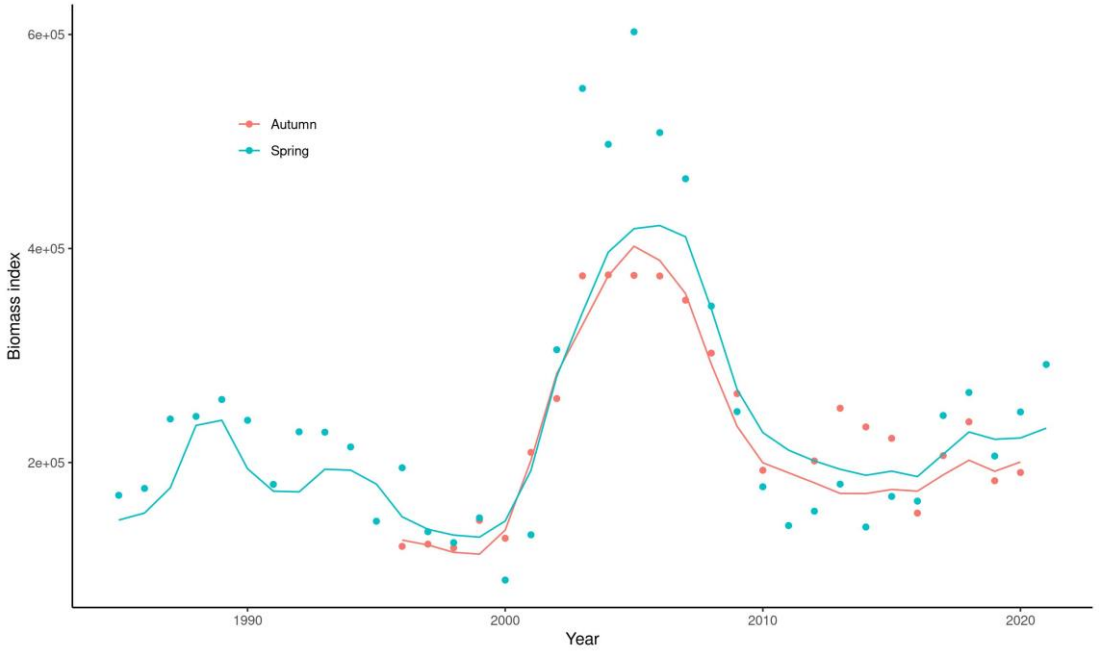

Figure 10.2.21: Haddock in Division 5.a. Aggregated model fit to the total biomass indices.

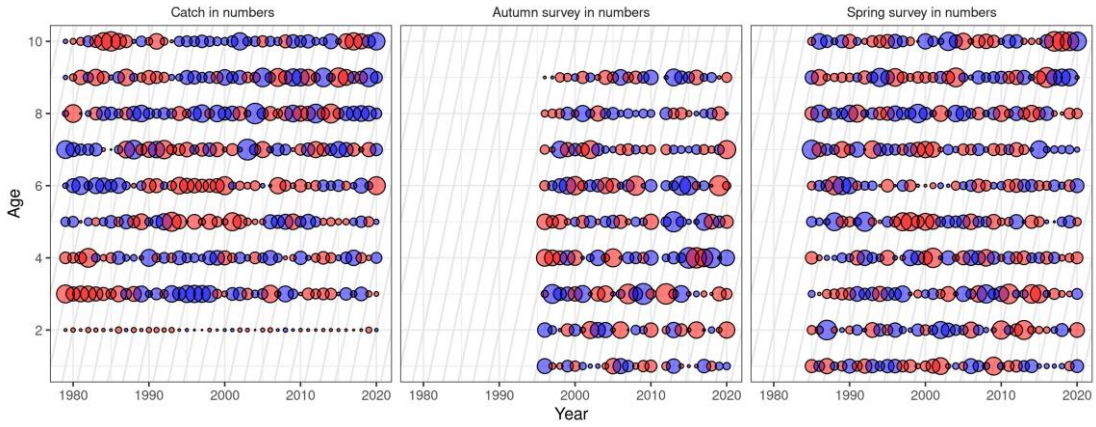

Figure 10.2.22: Haddock in Division 5.a. Residuals from the model fit to survey and catch data based on the both the surveys. Red circles indicate negative residuals (observed < modelled), while blue positive. Residuals are proportional to the area of the circles.

10.3.4 Model results

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 10.1.26). Since 2011 the rate of reduction has slowed down as fishing mortality has been low. The spawning stock has, however, decreased more than the reference biomass as the proportion mature by age/size has been decreasing. Fishing mortality is now estimated to be low and is in line with the overall goal of the currently implemented HCR. The baseline assessment does indicate that a bottom has been reached and the stock size will increase in the coming years. The main features of the baseline assessment are the same as in the assessments used between 2011 to 2018. The analytical retrospective (Figure 10.1.27) indicates a slight upwards revision in the most recent years. The assessment can however be considered fairly stable and the estimated 5-year Mohn's ρ are within acceptable range or 0.035 for estimated recruitment, –0.065 for SSB and 0.064 for harvest rate.

Assessment in recent years has shown some difference between model runs where either or both of the two different tuning series, i.e. March and the October surveys, are omitted from the estimation, but currently this difference is mostly within the estimated uncertainty (Figure 10.1.28) but that has not always been the case.

Estimated selection is illustrated in Figure 10.1.29, where substantial variations in selection at age is estimated by the model. Haddock in Icelandic waters has exhibited substantial density dependence in growth, as illustrated in Figure 10.1.30.

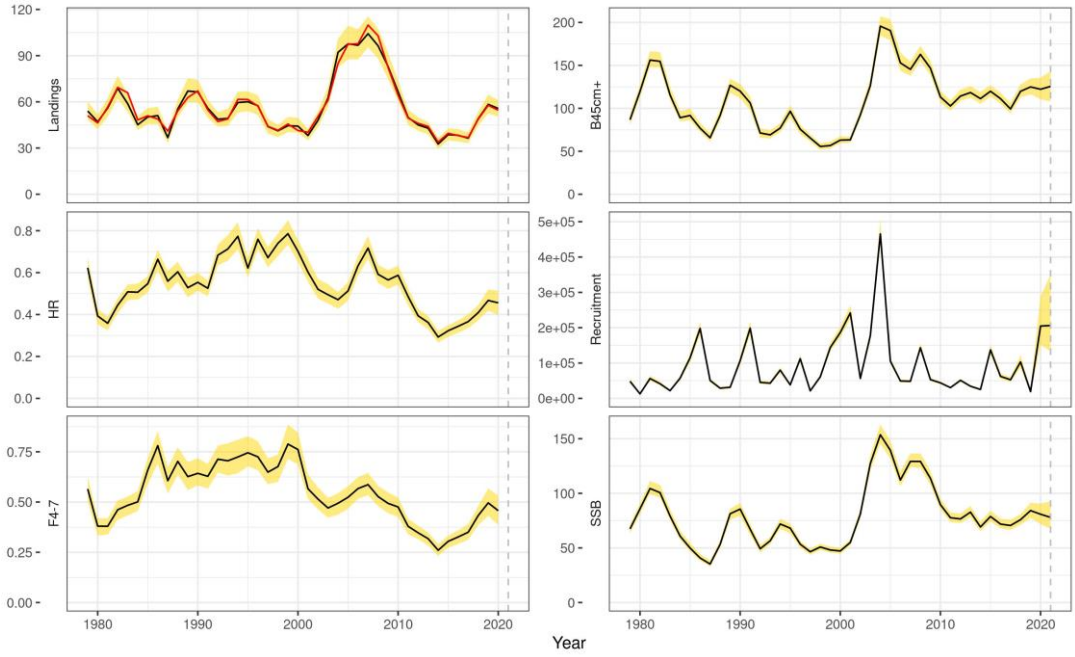

Figure 10.2.23: Haddock in Division 5.a. Summary from assessment. Dashed vertical line indicates the assessment year and yellow shaded region the uncertainty as estimated by the model.

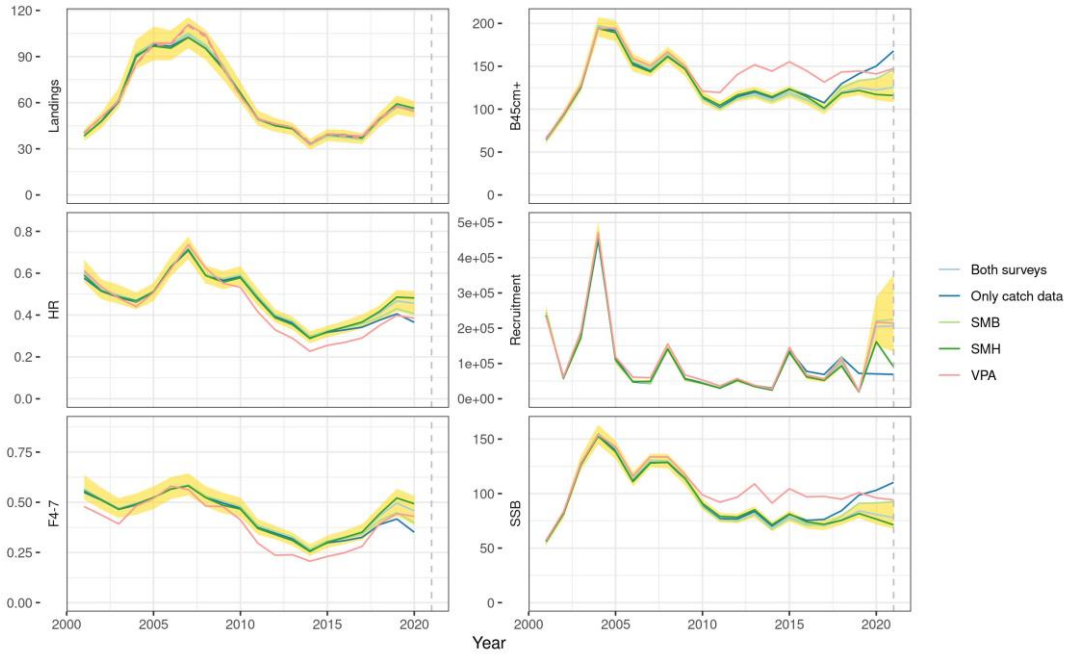

Figure 10.2.28: Haddock in 5.a. Comparison of assessment results where either the spring survey or the autumn survey is omitted from the estimation.

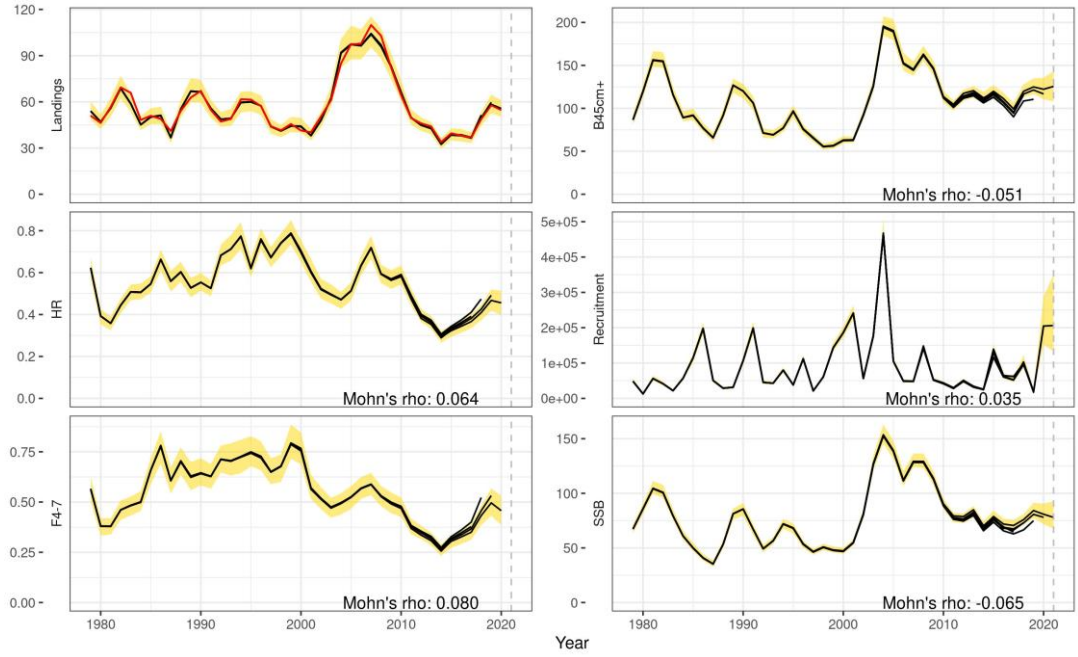

Figure 10.2.29: Haddock in Division 5.a. Analytical retrospective analysis of the assessment of haddock with a 5-year peel.

Figure 10.2.30: Haddock in 5.a. Estimated selection at age.

10.3.5 Short term projections

Following the management plan the advice for the coming fishing year (2021/2022) is based in the biomass of 45 cm^+ at the beginning the next calendar year (2022). To arrive at this prediction a deterministic projection of the growth in weight and changes in maturity in the coming calendar year is needed. Growth in 2022 is predicted by the equation:

$$log(\frac{W_{a+1,y+1}}{W_{a,y}}) = \alpha + \beta log(W_{a,y0}) + \delta_y$$

where according to the stock annex the factor δ_y for the assessment year (Figure 10.1.30) is the average of the points estimates of the growth factor in the two preceding years. Growth has been high but somewhat variable in recent years but was much less in when the stock was larger. Maturity, selection, catch weights at age and proportion of the biomass above 45cm^+ are then predicted from stock weights in 2021. 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 2021/2022 has some effect of the biomass at the beginning of 2022, which the TAC is based on. This procedure is described in the detail in the stock annex.

10.3.6 Updated management reference points

This year, in line with recent ICES guidelines, the definition of F_{pa} was set to $F_{p.05}$ as estimated by WKICEMSE 2019.

10.4 Management considerations

All the signs from commercial catch data and surveys indicate that haddock in 5.a is at present in a good state. This is confirmed in the assessment. At WKICEMSE 2019 the harvest rate target applied by the HCR in the period between 2013 and 2018 was estimated to be no longer precautionary while a rate of 0.35 was in-line with both the precautionary and ICES MSY approach. As the 2018-year class is fairly small the stock expected to remain at the current levels next year but it is, however projected to increase in coming years due to strong incoming recruitment from the 2019 and 2020 year classes.

Due to this good state of the stock, and CPUE are at its highest value, the landings are expected to substantially exceed the TAC advice for the 2020/2021. To prevent a possible quota choke, the Government of Iceland increased the TAC by 8000 tonnes while stating that the TAC for 2021/2022 will be reduced by 8000 tonnes. The advice for 2021/2020 is therefore based on catch constraint based on the remainder TAC advice.

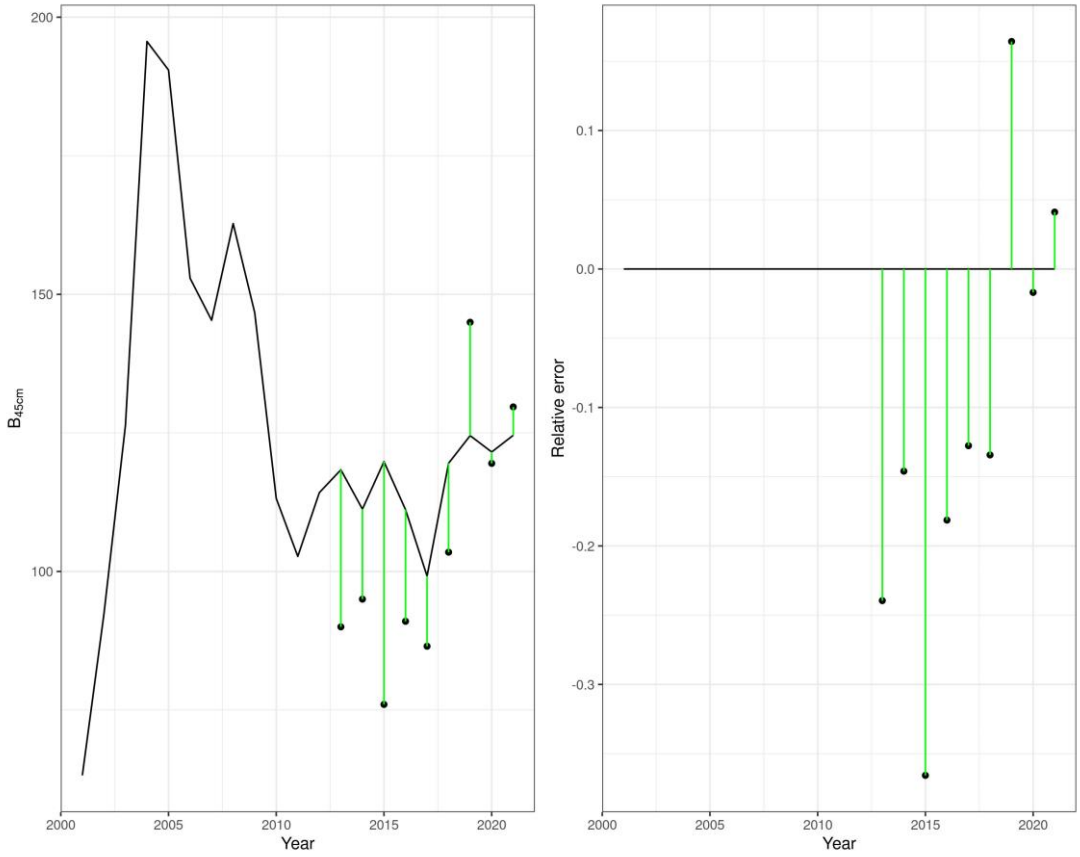

Figure 10.2.31: Haddock in 5.a. Comparison of the short-term prediction of reference biomass to the realised value a year later.

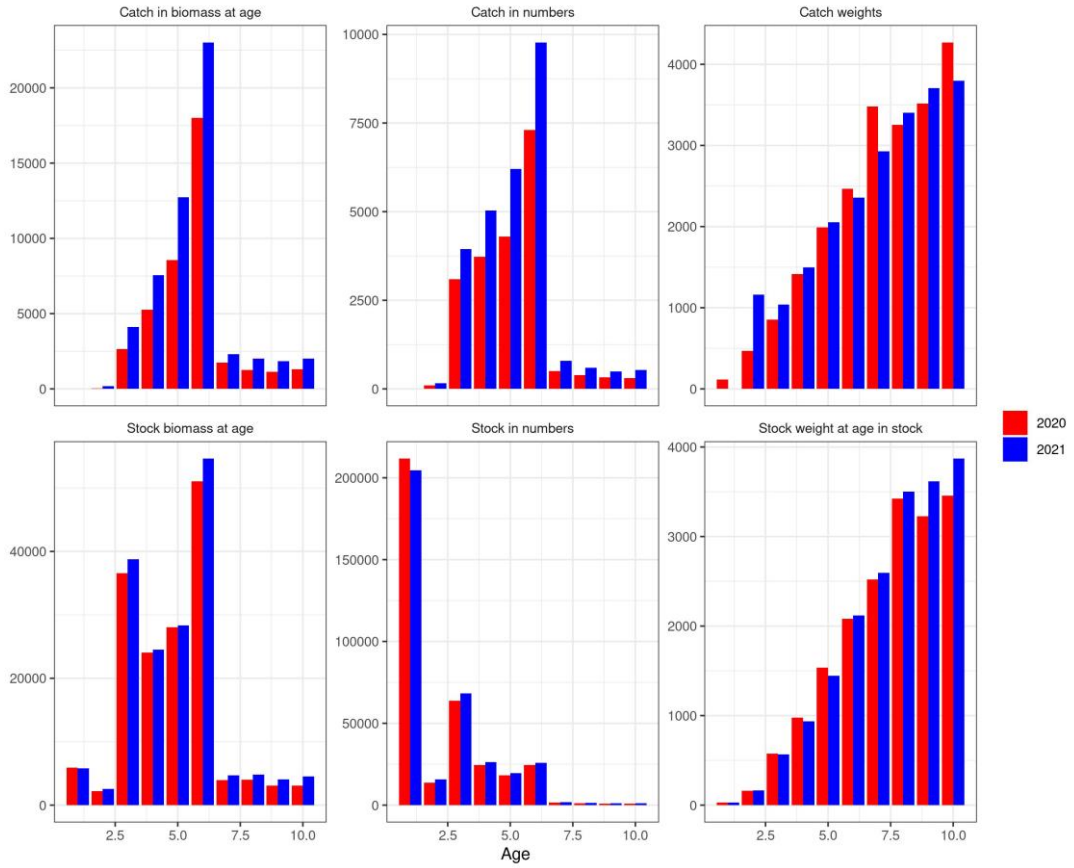

Figure 10.2.32: Haddock in 5.a. Comparison of some of the results of 2019 assessment based on different tuning data and 2017 assessment tuned with both the surveys.

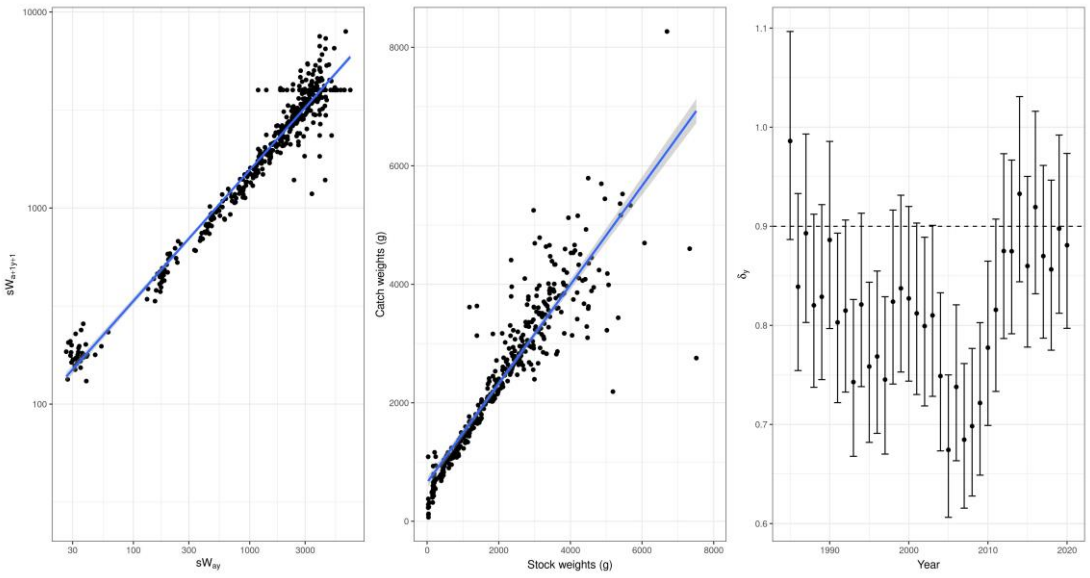

Figure 10.2.27: Haddock in 5.a. Input data to prediction model, where the exponent of the yearfactor (growth multiplier) is estimated to derive the reference biomass in the advisory year, as described in the text.

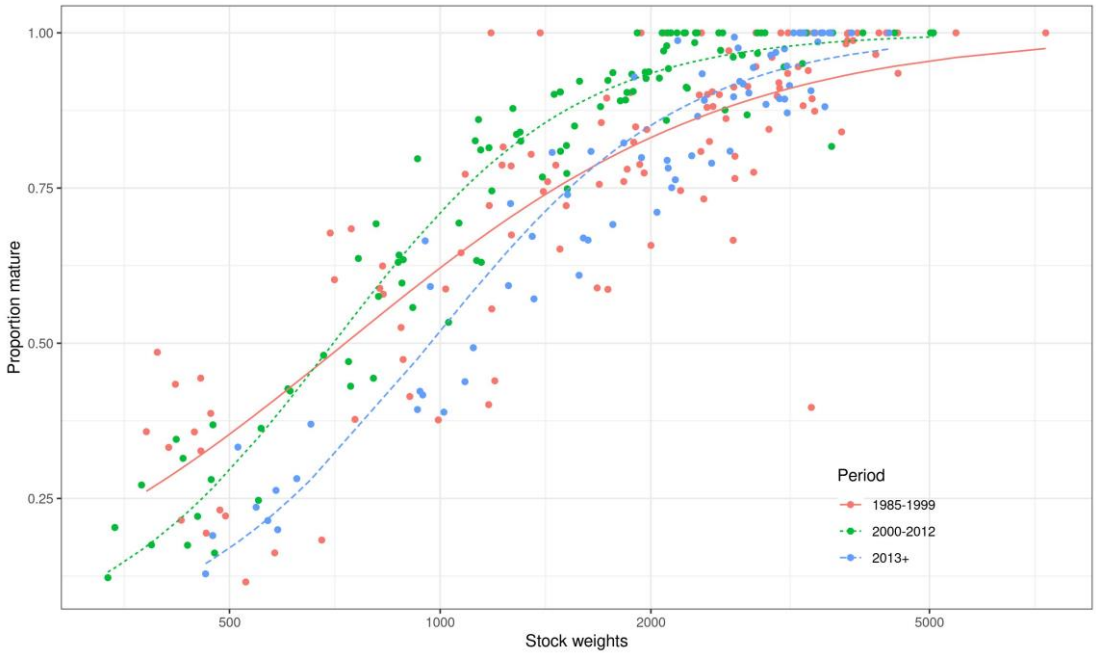

Figure 10.2.33: Haddock in 5.a. Maturity at weight as used in the projections.

10.5 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 10.1.1 and Figure 10.1.31). 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 (species transformation).

The TAC system does not include catches 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 tonnes of demersal fish species in Icelandic waters which includes maximum 1200 tonnes of cod and 40 tonnes of Atlantic halibut.

The effect of these species transformations and quota transfers is illustrated in Figure 10.1.32. 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 Figure 10.1.5, 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 recent years. 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.

Figure 10.1.31 illustrates the difference between national TAC and landed catch in 5.a. The difference can be attributed to species transformation (in both directions), while for the 1999/2000 fishing year the government of Iceland increased TAC mid-season.

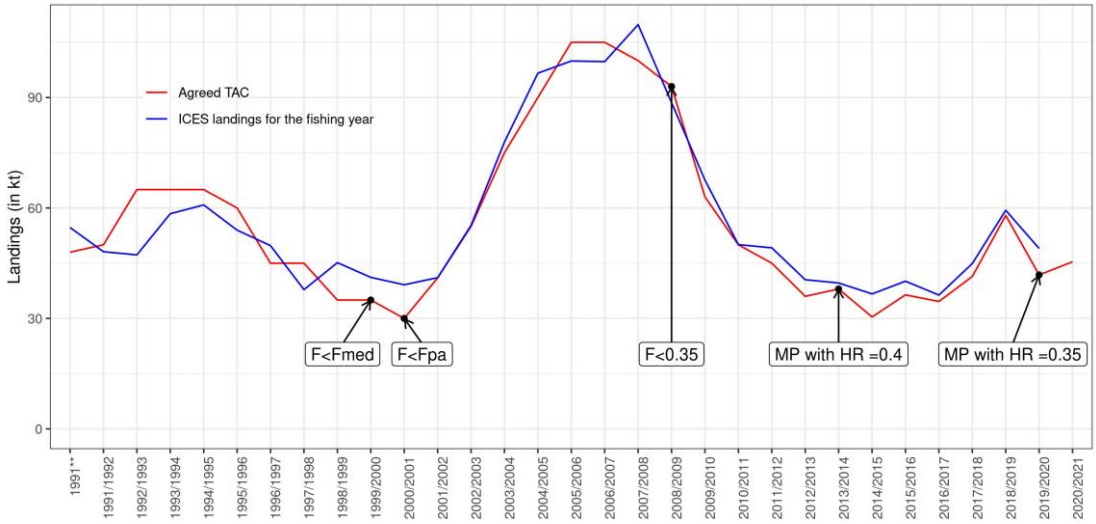

Figure 10.2.34: Haddock in 5.a. Comparison of the realised catches and the set TAC for the fishing operations in Icelandic waters. Note that in the 1999/2000 fishing year the government of Iceland increased TAC mid-season.

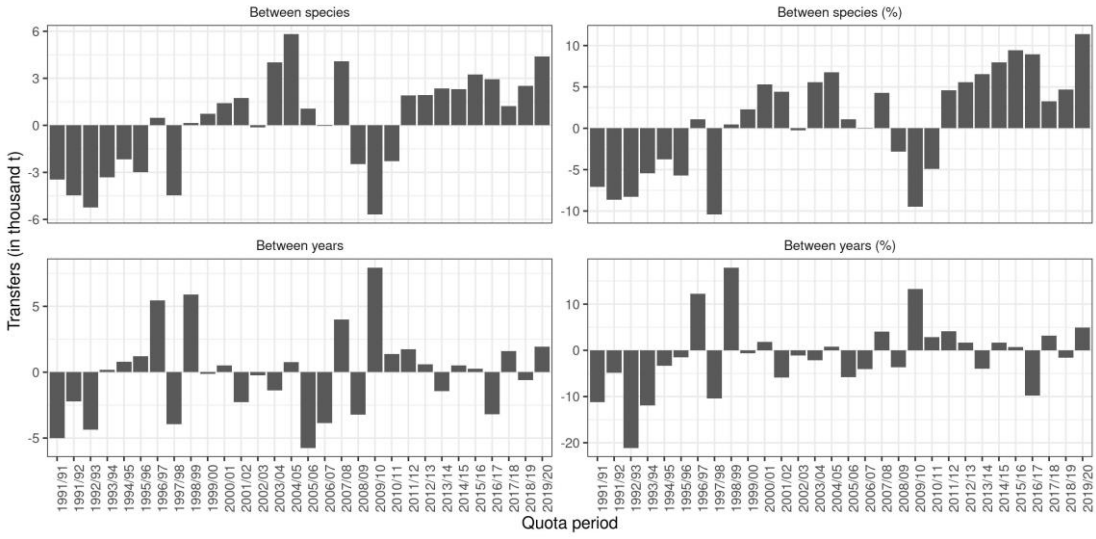

Figure 10.2.35: Haddock in 5.a. An overview of the net transfers of quota between years and species transformations in the fishery in 5.a.

10.6 References

Bjornsson, Hoskur, Einar Hjorleifsson, and Bjarki or Elvarsson. 2019. "Muppet: Program for Simulating Harvest Control Rules." Reykjavik: Marine; Freshwater Research Institute. http://www.github.com/hoski/Muppet-HCR.

ICES. 2019. "Stock Annex: Haddock (*Melanogrammus aeglefinus*) in Division 5.a (Iceland grounds)." International Council for the Exploration of the Seas; ICES publishing.

Jónsson, Jón. 1996. *Tagging of Cod (Gadus Morhua) in Icelandic Waters 1948-1986;: Tagging of Haddock (Gadus Aeglefinus) in Icelandic Waters 1953-1965*. Hafrannsóknastofnunin.

MRI. 2016. "Mælingar á brottkasti þorsks og ýsu (e. Measurments of discards of Cod and Haddock), 2014–2016, Reykjavik, Iceland." Vol. 3. Marine; Freshwater Research Institute, Iceland; Marine Research Institute, Iceland. https://www.hafogvatn.is/static/research/files/fjolrit-183pdf.

Table 1.1: Haddock in Division 5.a. Landings by nation.

Year	Belgium	Faroe Islands	Germany	Greenland	Iceland	Norway	Russia	UK
1979	1010	2161			52152	11		
1980	1144	2029			47916	23		
1981	673	1839			61033	15		
1982	377	1982			66998	28		
1983	268	1783			63815	3		
1984	359	707			47167	3		
1985	391	987			49573	0		2
1986	257	1289			47335			
1987	238	1043			39751	1		
1988	352	797			52999	0		
1989	483	606			61715			
1990	595	603			65897			
1991	485	733			53491			
1992	361	757			46067			
1993	458	754			46231			
1994	271	915	1046	2	58677	13	492	173
1995		968	0		60424		2	57
1996		764			56317	4	17	0
1997		340			43717			
1998		513			40882			
1999		885			44523	18		0
2000		5			41229	4		1
2001		690			39101	56		
2002		847			49602	8		
2003		968			59991	1		51
2004		1125			83801	1		
2005		1515			95878	3		44
2006		1588			96130	4		
2007		1686		2	108181	11		
2008		1197			101680	11		
2009		824			81439	5		
2010		360			63869	8		
2011		214			49232	3		
2012		325			45711	13		
2013		654			43370	23		
2014		1626			33048	22		
2015		2337			38393	26		
2016		2858			36648	14		
2017		2515			35695	22		

Year	Belgium	Faroe Islands	Germany	Greenland	Iceland	Norway	Russia	UK
2018		2209			47677	30		
2019		1774			57075	1		

Table 1.2: Haddock in 5.a. Number of Icelandic boats and catches by fleet segment participating in the haddock fishery in 5.a.

Year	Bottom trawl	Danish seine	Longlines	Bottom trawl	Danish seine	Longlines	Other	Total catch
1993	223	79	130	31192	1308	3832	4068	40400
1994	186	90	163	42057	2861	3833	4743	53494
1995	159	97	140	43851	3766	3965	3543	55125
1996	145	107	146	41049	4887	4767	2410	53113
1997	139	93	157	28545	4706	4848	1770	39869
1998	133	77	200	24820	3162	6451	1595	36028
1999	130	68	222	26314	2213	9130	1041	38698
2000	118	63	223	23000	2533	7576	866	33975
2001	109	63	222	21858	2473	7031	921	32283
2002	101	63	238	29820	3026	9157	1295	43298
2003	101	77	259	36005	4002	12421	1142	53570
2004	104	74	290	50940	7167	16880	1274	76261
2005	103	72	307	52927	9821	23567	1561	87876
2006	91	77	308	46716	11904	28512	760	87892
2007	94	66	283	57009	11875	29814	1204	99902
2008	83	65	266	50572	15554	26064	551	92741
2009	79	65	228	38476	14418	20160	300	73354
2010	68	56	206	28551	9582	17528	872	56533
2011	64	52	203	20443	6337	15365	250	42395
2012	68	48	195	19988	5583	13227	459	39257
2013	69	47	198	18454	4440	13501	201	36596
2014	62	44	207	13043	3304	11489	202	28038
2015	62	41	199	16926	3851	12680	243	33700
2016	62	40	182	16735	3961	11754	87	32537
2017	63	41	164	16081	3982	11536	169	31768
2018	64	39	157	26316	4960	12639	175	44090
2019	61	41	142	35583	5829	12337	267	54016

Table 1.3: Haddock in 5.a. Number of available length measurements and samples from Icelandic commercial catches.

Year	Bottom Trawl	Danish Seine	Gillnets	Long Line	Other
2000	62409/326	3114/21	1353/11	12854/77	356/2
2001	69392/346	3900/24	3023/18	26610/151	3864/19
2002	83052/453	7644/47	2063/17	29578/196	1392/12
2003	70828/419	7066/47	2965/26	30259/203	1713/20
2004	82474/503	10201/74	1705/16	35405/252	785/12
2005	94529/514	14880/102	2426/25	53472/375	1778/18
2006	74451/416	29743/172	3395/35	75069/480	685/5
2007	101635/599	34293/196	3721/30	87705/499	1572/11
2008	82671/524	29062/177	3542/30	88912/570	378/4
2009	55862/347	34904/202	831/7	63816/406	658/6
2010	59118/330	19504/116	827/10	56533/343	229/4
2011	53239/278	8304/53	1350/9	43198/237	325/2
2012	41074/223	10084/59	1508/10	60838/302	3/1
2013	34131/198	2498/23	176/1	43132/237	560/4
2014	13529/79	3128/22	289/6	37035/217	
2015	25969/154	2742/18	125/1	41593/221	
2016	21303/129	2425/17	333/3	37490/202	849/6
2017	23123/144	6305/39	375/2	42360/232	1367/7
2018	21780/134	5611/94	414/29	35621/231	558/3
2019	50698/295	3254/30	431/4	25692/187	567/3

Table 1.4: Haddock in 5.a. Number of available age measurements and samples from Icelandic commercial catches.

year	Bottom Trawl	Danish Seine	Gillnets	Long Line	Other
2000	62409/326	3114/21	1353/11	12854/77	356/2
2001	69392/346	3900/24	3023/18	26610/151	3864/19
2002	83052/453	7644/47	2063/17	29578/196	1392/12
2003	70828/419	7066/47	2965/26	30259/203	1713/20
2004	82474/503	10201/74	1705/16	35405/252	785/12
2005	94529/514	14880/102	2426/25	53472/375	1778/18
2006	74451/416	29743/172	3395/35	75069/480	685/5
2007	101635/599	34293/196	3721/30	87705/499	1572/11
2008	82671/524	29062/177	3542/30	88912/570	378/4
2009	55862/347	34904/202	831/7	63816/406	658/6
2010	59118/330	19504/116	827/10	56533/343	229/4
2011	53239/278	8304/53	1350/9	43198/237	325/2
2012	41074/223	10084/59	1508/10	60838/302	3/1
2013	34131/198	2498/23	176/1	43132/237	560/4
2014	13529/79	3128/22	289/6	37035/217	
2015	25969/154	2742/18	125/1	41593/221	
2016	21303/129	2425/17	333/3	37490/202	849/6
2017	23123/144	6305/39	375/2	42360/232	1367/7
2018	21780/134	5611/94	414/29	35621/231	558/3
2019	50698/295	3254/30	431/4	25692/187	567/3

Table 1.5: Haddock in 5.a. Catch at age from the commercial fishery in Icelandic waters

Year	2	3	4	5	6	7	8	9	10
1979	0.149000	1.90800	3.76200	6.0570	9.02200	1.74300	0.43800	0.056000	0.11200
1980	0.595000	1.38500	11.48100	4.2980	3.79800	3.73200	0.54400	0.091000	0.03700
1981	0.010000	0.51400	4.91100	16.9000	5.99900	2.82500	1.80300	0.168000	0.05700
1982	0.107000	0.24500	3.14900	10.8510	14.04900	2.06800	1.00000	0.725000	0.20100
1983	0.034000	1.01000	1.58900	4.5960	9.85000	8.83900	0.76600	0.207000	0.28000
1984	0.241000	1.06900	4.94600	1.3410	4.77200	3.74200	4.07600	0.238000	0.08000
1985	1.320000	1.72800	4.56200	6.7960	0.85500	1.68200	1.91400	1.903000	0.29600
1986	1.012000	4.22300	4.06800	4.6860	5.13900	0.49400	0.79600	0.897000	0.40000
1987	1.939000	8.30800	6.96500	2.7280	2.04200	1.09400	0.13200	0.165000	0.33900
1988	0.237000	9.83100	15.16400	5.8240	1.30400	1.08400	0.60900	0.066000	0.21300
1989	0.188000	2.47400	22.56000	9.5710	3.19600	0.51300	0.55600	0.144000	0.14100
1990	1.857000	2.41500	8.62800	23.6110	6.33100	0.81600	0.15000	0.067000	0.07400
1991	8.617000	2.14500	5.39700	7.3420	14.10300	2.64800	0.33800	0.040000	0.02700
1992	5.405000	10.69300	5.72100	4.6100	3.69100	5.20900	0.99900	0.120000	0.01600
1993	0.769000	12.33300	12.81500	2.9680	1.72200	1.42500	2.23900	0.343000	0.03800
1994	3.198000	3.34300	28.25800	10.6820	1.46900	0.72600	0.35800	0.647000	0.10800
1995	4.015000	7.32300	5.74400	23.9270	5.76900	0.61500	0.29000	0.187000	0.33100
1996	3.090000	10.55200	7.63900	4.4680	12.89600	2.34600	0.20800	0.079000	0.12500
1997	1.364000	3.93900	10.91500	4.8950	2.61000	5.03500	0.71900	0.064000	0.06900
1998	0.279000	8.25700	5.66700	7.8560	2.41800	1.42200	1.89700	0.261000	0.04500
1999	1.434000	1.55000	17.24300	4.5160	4.83700	0.91500	0.62000	0.481000	0.06400
2000	2.659000	6.31700	2.35200	13.6150	1.94500	1.70600	0.32400	0.222000	0.19200
2001	2.515000	11.09800	6.95400	1.4460	6.26200	0.67500	0.47800	0.105000	0.09400
2002	1.082000	10.43400	15.99800	5.0990	1.13100	3.14900	0.26200	0.169000	0.10000
2003	0.401000	6.35200	16.26500	12.5480	2.96800	0.74800	1.23600	0.091000	0.07000
2004	1.597000	4.06300	17.65200	19.3580	8.87100	1.94000	0.47100	0.489000	0.15500
2005	2.405000	9.45000	6.92900	25.4210	13.77800	4.58400	0.80900	0.251000	0.23700
2006	0.241000	10.03800	21.24600	6.6460	18.84000	7.60000	2.18000	0.323000	0.20200
2007	0.782000	3.88400	42.22400	22.2390	3.35400	9.95200	2.74000	0.519000	0.18100
2008	2.316000	4.50800	9.70600	53.0220	11.01400	1.71700	3.03300	0.815000	0.19200
2009	1.066000	3.18500	4.88600	8.8920	35.01100	5.73300	0.72600	1.381000	0.50900
2010	0.121000	6.03200	7.06100	4.8060	6.76600	17.50300	1.87400	0.354000	0.52800
2011	0.253000	1.58400	11.79700	5.0800	2.85300	3.98300	6.22000	0.494000	0.18300
2012	0.196000	1.32200	3.42100	13.1070	2.22300	1.23100	2.48000	2.662000	0.37000
2013	0.250000	1.04200	2.86500	4.0080	9.22200	1.20600	0.66800	1.248000	1.59900
2014	0.238000	1.47800	1.75100	2.7250	2.73700	4.74200	0.44700	0.387000	1.40300
2015	0.232000	1.53200	4.15500	2.3170	2.91600	2.62300	2.71500	0.226000	0.82300
2016	0.481000	1.77300	3.43700	4.1300	1.72700	1.95300	1.42000	1.293000	0.45500
2017	0.573000	3.68000	3.07900	3.0130	3.13500	1.09700	1.18200	0.751000	0.94000

Year	2	3	4	5	6	7	8	9	10
2018	0.353000	3.57000	10.35600	2.9080	3.06300	2.41900	0.96400	0.622000	1.06600
2019	0.386757	2.42112	6.43663	13.9091	1.87026	1.36609	1.46909	0.552468	1.10759

Table 1.6: Haddock in 5.a. Catch weights from the commercial fishery in Icelandic waters.

Year	2	3	4	5	6	7	8	9	10
1979	620.000	960.00	1410.00	2030.00	2910.00	3800.00	4560.00	4720.00	5956.00
1980	837.000	831.00	1306.00	2207.00	2738.00	3188.00	3843.00	4506.00	4982.84
1981	584.000	693.00	1081.00	1656.00	2283.00	3214.00	3409.00	4046.00	5261.02
1982	289.000	959.00	1455.00	1674.00	2351.00	3031.00	3481.00	3874.00	4122.51
1983	320.000	1006.00	1496.00	1921.00	2371.00	2873.00	3678.00	4265.00	4501.74
1984	691.000	1007.00	1544.00	2120.00	2514.00	3027.00	2940.00	3906.00	4033.31
1985	652.000	1125.00	1811.00	2260.00	2924.00	3547.00	3733.00	4039.00	4658.72
1986	336.000	1227.00	1780.00	2431.00	2771.00	3689.00	3820.00	4258.00	4455.68
1987	452.000	1064.00	1692.00	2408.00	3000.00	3565.00	4215.00	4502.00	4024.82
1988	362.000	780.00	1474.00	2217.00	2931.00	3529.00	3781.00	4467.00	4418.39
1989	323.000	857.00	1185.00	1996.00	2893.00	4066.00	3866.00	4734.00	4989.60
1990	269.000	700.00	1054.00	1562.00	2364.00	3414.00	4134.00	4946.00	4451.01
1991	288.000	699.00	979.00	1412.00	1887.00	2674.00	3135.00	4341.00	4956.93
1992	313.000	806.00	1167.00	1524.00	1950.00	2357.00	3075.00	4053.00	4703.25
1993	303.000	705.00	1333.00	1875.00	2386.00	2996.00	3059.00	3363.00	4408.79
1994	337.000	668.00	1019.00	1717.00	2391.00	2717.00	3280.00	3156.00	3277.94
1995	351.000	746.00	1096.00	1318.00	2044.00	2893.00	3049.00	3675.00	3136.79
1996	311.000	787.00	1187.00	1560.00	1849.00	2670.00	3510.00	3567.00	3731.34
1997	379.000	764.00	1163.00	1649.00	1943.00	2342.00	3020.00	3337.00	3235.90
1998	445.000	724.00	1147.00	1683.00	2250.00	2475.00	2834.00	3333.00	3596.42
1999	555.000	908.00	1101.00	1658.00	2216.00	2659.00	2928.00	3209.00	3512.52
2000	495.000	978.00	1333.00	1481.00	2119.00	2696.00	3307.00	3597.00	3756.94
2001	541.000	945.00	1456.00	1731.00	1832.00	2243.00	3020.00	3328.00	4235.94
2002	564.000	928.00	1253.00	1737.00	2219.00	2230.00	2911.00	3365.00	4387.08
2003	498.000	922.00	1283.00	1704.00	2274.00	2744.00	2635.00	2819.00	3741.91
2004	559.000	1006.00	1258.00	1579.00	2044.00	2809.00	3123.00	2945.00	3759.31
2005	339.000	886.00	1265.00	1506.00	1916.00	2323.00	3028.00	3211.00	2890.52
2006	402.000	749.00	1093.00	1495.00	1758.00	2163.00	2555.00	3054.00	3589.48
2007	510.000	748.00	988.00	1346.00	1840.00	2062.00	2350.00	2525.00	3142.71
2008	383.000	636.00	857.00	1125.00	1575.00	2149.00	2417.00	2802.00	2600.47
2009	452.000	841.00	960.00	1131.00	1352.00	1757.00	2364.00	2497.00	3073.67
2010	447.000	756.00	1092.00	1294.00	1448.00	1685.00	2188.00	2366.00	2645.85
2011	588.000	905.00	1122.00	1455.00	1688.00	1914.00	2094.00	2455.00	2985.68
2012	668.000	978.00	1222.00	1492.00	1903.00	2164.00	2366.00	2704.00	2939.96
2013	678.000	1084.00	1358.00	1675.00	2036.00	2400.00	2554.00	3097.00	3097.31

Year	2	3	4	5	6	7	8	9	10
2014	536.000	1080.00	1433.00	1793.00	2121.00	2504.00	2624.00	3178.00	3349.39
2015	573.000	1084.00	1486.00	2011.00	2332.00	2823.00	3306.00	3258.00	3768.15
2016	513.000	1071.00	1590.00	2035.00	2607.00	2952.00	3616.00	3734.00	4096.66
2017	643.000	997.00	1587.00	2032.00	2546.00	3016.00	3518.00	3839.00	3915.67
2018	627.000	1070.00	1383.00	2007.00	2536.00	2919.00	3377.00	3671.00	4026.36
2019	541.285	1005.15	1457.86	1820.85	2702.88	3091.86	3352.01	3694.17	4015.07

Table 1.7: Haddock in 5.a. Stock weights from the March survey in Icelandic waters.

Year	1	2	3	4	5	6	7	8	9	10
1979	37	185	481	910	1409	1968	2496	3077	3300	5956.00
1980	37	185	481	910	1409	1968	2496	3077	3300	4982.84
1981	37	185	481	910	1409	1968	2496	3077	3300	5261.02
1982	37	185	481	910	1409	1968	2496	3077	3300	4122.51
1983	37	185	481	910	1409	1968	2496	3077	3300	4501.74
1984	37	185	481	910	1409	1968	2496	3077	3300	4033.31
1985	35	241	562	1195	1690	2418	2814	3245	3369	3901.80
1986	34	240	671	1134	1963	2425	3236	2964	3767	3824.29
1987	31	163	514	1219	1758	2605	3024	3524	3896	3773.70
1988	37	176	456	973	1851	2711	3118	3485	3277	4986.42
1989	27	181	438	888	1514	2372	2905	3509	3255	3748.60
1990	29	183	454	842	1232	1985	2714	3067	3337	4042.05
1991	31	176	496	1004	1417	1890	2510	3833	3719	4545.56
1992	29	157	497	893	1381	1866	2325	3009	3732	4753.75
1993	40	167	381	878	1488	1786	2581	2576	3277	4000.00
1994	33	179	402	704	1267	1721	1866	2628	2050	1844.64
1995	37	163	444	759	1062	1855	2664	5319	1313	4000.00
1996	40	174	447	816	1053	1452	2149	2365	4830	3133.12
1997	51	173	422	815	1223	1422	1883	2373	3771	2877.68
1998	41	201	400	737	1221	1677	1991	2338	3091	4000.00
1999	34	205	481	715	1191	1932	2387	2724	2933	2581.52
2000	29	179	553	897	1152	1694	2601	2910	3162	3370.46
2001	36	188	484	1048	1425	1501	2179	2803	4000	3958.89
2002	63	172	473	892	1467	1957	2017	1962	3756	4357.30
2003	40	231	412	800	1259	1869	3153	2314	3303	3945.97
2004	34	177	557	807	1280	1685	2444	2920	2927	3333.11
2005	41	153	448	921	1188	1564	2103	2792	2548	3633.75
2006	33	135	333	736	1134	1510	1927	2227	3270	3528.55
2007	48	170	350	615	1053	1493	1781	2067	2157	3801.33
2008	27	178	383	593	868	1295	1831	2204	2286	2924.73
2009	29	139	442	687	883	1137	1491	1905	2548	2937.31

Year	1	2	3	4	5	6	7	8	9	10
2010	32	150	392	777	936	1181	1462	1784	2037	2719.15
2011	35	175	443	759	1131	1307	1585	1867	2044	2956.30
2012	28	202	482	801	1145	1480	1908	2072	2352	2520.06
2013	33	202	589	967	1313	1709	2001	2264	2746	2658.79
2014	36	223	573	1005	1373	1751	2141	2299	2653	3134.85
2015	32	254	614	1073	1638	1924	2451	2772	3186	3388.15
2016	29	162	642	1101	1565	2094	2296	3067	3441	3486.42
2017	34	197	459	1258	1657	2162	2768	3200	3558	3675.10
2018	30	195	544	924	1836	2342	2660	2968	3204	3585.57
2019	29	166	505	962	1341	2472	2814	3035	3477	3532.69

Table 1.8: Haddock in 5.a. Sexual maturity-at-age in the stock (from the March survey). The numbers for age 10 only apply to the spawning stock.

Year	1	2	3	4	5	6	7	8	9	10
1979	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000000
1980	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000000
1981	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000000
1982	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000000
1983	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000000
1984	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000000
1985	0.000	0.016	0.149	0.541	0.577	0.767	0.764	0.962	0.933	0.983527
1986	0.000	0.022	0.203	0.410	0.672	0.842	0.884	0.956	0.986	0.991175
1987	0.000	0.020	0.146	0.487	0.597	0.879	0.900	1.000	0.988	0.967909
1988	0.000	0.013	0.215	0.392	0.767	0.791	0.927	0.913	1.000	0.970986
1989	0.000	0.040	0.199	0.530	0.723	0.802	1.000	1.000	1.000	1.000000
1990	0.000	0.115	0.327	0.632	0.816	0.843	0.918	0.897	1.000	1.000000
1991	0.000	0.066	0.219	0.587	0.738	0.818	0.893	0.505	1.000	1.000000
1992	0.000	0.050	0.223	0.416	0.801	0.905	0.902	0.859	1.000	1.000000
1993	0.005	0.123	0.362	0.484	0.667	0.905	0.977	0.910	0.868	1.000000
1994	0.035	0.238	0.325	0.611	0.791	0.865	1.000	0.908	1.000	1.000000
1995	0.000	0.130	0.481	0.389	0.757	0.754	0.619	0.986	1.000	1.000000
1996	0.000	0.197	0.379	0.606	0.643	0.790	0.745	0.946	0.897	1.000000
1997	0.016	0.092	0.432	0.585	0.682	0.751	0.787	0.874	1.000	1.000000
1998	0.000	0.030	0.494	0.686	0.778	0.754	0.855	0.901	1.000	1.000000
1999	0.000	0.048	0.384	0.679	0.725	0.756	0.896	0.773	0.920	1.000000
2000	0.000	0.103	0.247	0.619	0.808	0.875	0.875	1.000	0.781	0.959667
2001	0.002	0.097	0.372	0.515	0.752	0.897	0.918	0.915	1.000	1.000000
2002	0.000	0.045	0.278	0.629	0.800	0.935	0.933	1.000	1.000	1.000000
2003	0.005	0.062	0.347	0.688	0.869	0.923	0.948	0.984	1.000	1.000000
2004	0.000	0.038	0.363	0.571	0.831	0.913	1.000	1.000	1.000	1.000000

Year	1	2	3	4	5	6	7	8	9	10
2005	0.000	0.024	0.231	0.564	0.751	0.923	0.937	0.968	1.000	1.000000
2006	0.000	0.028	0.118	0.467	0.618	0.741	0.920	1.000	1.000	1.000000
2007	0.000	0.078	0.207	0.417	0.681	0.760	0.876	0.960	1.000	1.000000
2008	0.000	0.027	0.262	0.415	0.621	0.829	0.870	0.904	0.974	1.000000
2009	0.000	0.017	0.299	0.469	0.581	0.848	0.890	1.000	0.967	1.000000
2010	0.010	0.030	0.183	0.615	0.780	0.789	0.887	0.935	1.000	0.966447
2011	0.000	0.046	0.176	0.425	0.822	0.816	0.838	0.898	0.976	1.000000
2012	0.000	0.107	0.168	0.446	0.627	0.820	0.903	0.853	0.911	0.973381
2013	0.000	0.047	0.225	0.382	0.716	0.795	0.921	0.986	0.974	0.988984
2014	0.000	0.108	0.192	0.390	0.567	0.676	0.736	0.925	0.906	0.951132
2015	0.000	0.138	0.283	0.444	0.670	0.795	0.773	0.892	1.000	0.961426
2016	0.000	0.008	0.360	0.485	0.594	0.779	0.787	0.882	0.902	0.971048
2017	0.000	0.073	0.131	0.591	0.664	0.741	0.911	0.939	1.000	0.970437
2018	0.000	0.035	0.235	0.395	0.824	0.856	0.892	0.881	0.974	1.000000
2019	0.009	0.036	0.335	0.591	0.669	0.890	0.938	0.960	1.000	0.964376

Table 1.9: Haddock in Division 5.a. Age disaggregated survey indices from the groundfish survey in March

Year	1	2	3	4	5	6	7	8	9	10
1985	29.91	32.25	17.67	23.26	26.30	3.73	11.01	4.87	5.68	0.63
1986	122.05	109.77	61.10	13.39	16.84	13.57	1.00	3.17	1.27	2.43
1987	21.50	324.64	148.07	44.69	7.77	7.53	4.77	0.40	0.62	1.28
1988	15.71	39.99	184.56	90.07	23.12	1.37	2.23	1.81	0.17	0.26
1989	10.45	23.09	40.59	145.63	45.09	12.92	0.79	0.81	0.42	0.41
1990	72.10	31.55	26.67	38.57	92.00	30.73	3.43	0.88	0.23	0.00
1991	88.43	147.01	42.92	17.86	20.17	32.71	7.64	0.31	0.10	0.09
1992	17.21	211.29	139.98	35.42	16.63	13.63	16.15	2.25	0.18	0.05
1993	30.58	38.93	252.31	88.40	11.35	3.89	1.68	4.51	0.89	0.00
1994	58.68	61.57	40.90	147.33	40.55	5.47	2.82	1.37	3.67	0.22
1995	37.07	84.74	47.12	19.82	69.91	7.71	1.31	0.12	0.34	0.00
1996	96.53	67.19	121.31	36.89	19.78	41.00	5.84	0.60	0.13	0.13
1997	8.41	122.61	51.08	53.11	10.80	7.28	10.85	1.34	0.07	0.09
1998	23.17	18.73	110.23	28.45	23.27	4.89	3.48	4.52	0.34	0.00
1999	80.92	86.14	25.79	98.86	12.99	9.88	1.43	1.78	1.04	0.09
2000	60.41	88.73	43.92	8.33	24.82	3.12	1.58	0.40	0.15	0.56
2001	81.03	153.29	116.21	21.70	4.03	10.45	0.89	0.55	0.00	0.10
2002	20.68	304.47	198.83	110.43	22.88	3.45	7.39	0.30	0.34	0.21
2003	112.29	97.95	283.72	247.05	115.11	18.26	2.60	4.57	0.49	0.91
2004	325.12	291.10	70.86	208.82	110.08	34.24	6.82	1.26	0.83	0.16
2005	57.55	693.57	288.64	44.58	157.39	57.69	15.78	3.36	0.32	0.28
2006	39.87	78.50	575.82	181.71	19.34	63.24	16.54	6.80	0.70	0.29

Year	1	2	3	4	5	6	7	8	9	10
2007	34.23	65.13	89.00	437.40	85.58	7.84	21.32	4.67	2.13	0.07
2008	88.07	67.69	71.12	75.02	220.74	29.75	3.51	7.42	1.63	0.27
2009	10.87	112.24	53.00	40.53	41.31	104.80	12.76	2.19	3.04	0.65
2010	15.25	27.69	137.03	29.60	18.10	20.48	31.38	2.90	0.46	0.80
2011	8.76	27.46	24.33	76.71	13.95	5.88	9.40	14.89	1.28	0.54
2012	12.33	14.76	31.18	27.15	58.16	5.22	2.92	5.28	6.85	1.05
2013	13.93	23.05	19.56	22.61	22.25	41.48	4.76	2.49	3.82	5.16
2014	14.15	24.53	30.15	17.69	16.40	14.76	16.39	1.33	1.04	3.14
2015	62.08	19.53	26.50	34.10	12.62	11.11	9.57	9.85	1.16	1.70
2016	29.85	162.26	23.51	22.09	22.24	7.17	7.27	5.05	4.25	1.39
2017	26.66	66.57	140.89	23.02	20.29	22.05	6.47	5.05	3.53	2.21
2018	64.07	70.39	73.53	118.35	13.70	11.54	10.06	3.41	3.29	2.11
2019	7.14	85.21	47.89	40.85	67.31	4.13	3.80	3.08	1.61	0.86
2020	111.97	13.95	97.24	35.18	27.72	42.48	2.86	1.87	2.17	1.79

Table 1.10: Haddock in 5.a. Age disaggregated survey indices from the groundfish survey in October.

Year	1	2	3	4	5	6	7	8	9	10
1985	29.91	32.25	17.67	23.26	26.30	3.73	11.01	4.87	5.68	0.63
1986	122.05	109.77	61.10	13.39	16.84	13.57	1.00	3.17	1.27	2.43
1987	21.50	324.64	148.07	44.69	7.77	7.53	4.77	0.40	0.62	1.28
1988	15.71	39.99	184.56	90.07	23.12	1.37	2.23	1.81	0.17	0.26
1989	10.45	23.09	40.59	145.63	45.09	12.92	0.79	0.81	0.42	0.41
1990	72.10	31.55	26.67	38.57	92.00	30.73	3.43	0.88	0.23	0.00
1991	88.43	147.01	42.92	17.86	20.17	32.71	7.64	0.31	0.10	0.09
1992	17.21	211.29	139.98	35.42	16.63	13.63	16.15	2.25	0.18	0.05
1993	30.58	38.93	252.31	88.40	11.35	3.89	1.68	4.51	0.89	0.00
1994	58.68	61.57	40.90	147.33	40.55	5.47	2.82	1.37	3.67	0.22
1995	37.07	84.74	47.12	19.82	69.91	7.71	1.31	0.12	0.34	0.00
1996	96.53	67.19	121.31	36.89	19.78	41.00	5.84	0.60	0.13	0.13
1997	8.41	122.61	51.08	53.11	10.80	7.28	10.85	1.34	0.07	0.09
1998	23.17	18.73	110.23	28.45	23.27	4.89	3.48	4.52	0.34	0.00
1999	80.92	86.14	25.79	98.86	12.99	9.88	1.43	1.78	1.04	0.09
2000	60.41	88.73	43.92	8.33	24.82	3.12	1.58	0.40	0.15	0.56
2001	81.03	153.29	116.21	21.70	4.03	10.45	0.89	0.55	0.00	0.10
2002	20.68	304.47	198.83	110.43	22.88	3.45	7.39	0.30	0.34	0.21
2003	112.29	97.95	283.72	247.05	115.11	18.26	2.60	4.57	0.49	0.91
2004	325.12	291.10	70.86	208.82	110.08	34.24	6.82	1.26	0.83	0.16
2005	57.55	693.57	288.64	44.58	157.39	57.69	15.78	3.36	0.32	0.28
2006	39.87	78.50	575.82	181.71	19.34	63.24	16.54	6.80	0.70	0.29
2007	34.23	65.13	89.00	437.40	85.58	7.84	21.32	4.67	2.13	0.07

Year	1	2	3	4	5	6	7	8	9	10
2008	88.07	67.69	71.12	75.02	220.74	29.75	3.51	7.42	1.63	0.27
2009	10.87	112.24	53.00	40.53	41.31	104.80	12.76	2.19	3.04	0.65
2010	15.25	27.69	137.03	29.60	18.10	20.48	31.38	2.90	0.46	0.80
2011	8.76	27.46	24.33	76.71	13.95	5.88	9.40	14.89	1.28	0.54
2012	12.33	14.76	31.18	27.15	58.16	5.22	2.92	5.28	6.85	1.05
2013	13.93	23.05	19.56	22.61	22.25	41.48	4.76	2.49	3.82	5.16
2014	14.15	24.53	30.15	17.69	16.40	14.76	16.39	1.33	1.04	3.14
2015	62.08	19.53	26.50	34.10	12.62	11.11	9.57	9.85	1.16	1.70
2016	29.85	162.26	23.51	22.09	22.24	7.17	7.27	5.05	4.25	1.39
2017	26.66	66.57	140.89	23.02	20.29	22.05	6.47	5.05	3.53	2.21
2018	64.07	70.39	73.53	118.35	13.70	11.54	10.06	3.41	3.29	2.11
2019	7.14	85.21	47.89	40.85	67.31	4.13	3.80	3.08	1.61	0.86
2020	111.97	13.95	97.24	35.18	27.72	42.48	2.86	1.87	2.17	1.79

Table 1.11: Haddock in 5.a. ICES advice and official landings. All weights are in tonnes. * Calendar year. ** January 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	< 50000	60000		40760
1988*	National advice	< 60000	65000		54204
1989*	National advice	< 60000	65000		62885
1990*	National advice	< 60000	65000		67198
1991**	National advice	< 38000	48000		54692
1991/1992	National advice	< 50000	50000	48123	47121
1992/1993	National advice	< 60000	65000	47255	48123
1993/1994	National advice	< 65000	65000	58443	59502
1994/1995	National advice	< 65000	65000	60829	60884
1995/1996	National advice	< 55000	60000	53972	56890
1996/1997	National advice	< 40000	45000	49764	43764
1997/1998	National advice	< 40000	45000	37811	41192
1998/1999	National advice	< 35000	35000	45146	45411
1999/2000	F reduced below F_{med}	< 35000	35000	41150	42105
2000/2001	F reduced below provisional F_{pa}	< 31000	30000	39143	39654
2001/2002	F reduced below provisional F_{pa}	< 30000	41000	41069	50498
2002/2003	F reduced below provisional F_{pa}	< 55000	55000	55269	60883
2003/2004	F reduced below provisional F_{pa}	< 75000	75000	77916	84828
2004/2005	F reduced below provisional F_{pa}	< 97000	90000	96617	97225

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	ICES landings for the fishing year	ICES landings for the calendar year
2005/2006	F reduced below provisional F_{pa}	< 110000	105000	99926	97614
2006/2007	F reduced below provisional F_{pa}	< 112000	105000	99763	109966
2007/2008	F reduced below provisional F_{pa}	< 120000	100000	109810	102872
2008/2009	F reduced below 0.35	< 83000	93000	88617	82045
2009/2010	F reduced below 0.35	< 57000	63000	67579	64169
2010/2011	F reduced below 0.35	< 51000	50000	50042	49433
2011/2012	F reduced below 0.35	< 42000	45000	49179	46208
2012/2013	F reduced below 0.35	< 32000	36000	40512	44097
2013/2014	TAC 0.4 × B45+cm,2014	< 38000	38000	39628	33900
2014/2015	TAC 0.4 × B45+cm,2015	< 30400	30400	36656	39646
2015/2016	TAC 0.4 × B45+cm,2016	< 36400	36400	40117	38109
2016/2017	TAC 0.4 × B45+cm,2017	< 34600	34600	36340	37062
2017/2018	TAC 0.4 × B45+cm,2018	< 41390	41390	44905	49993
2018/2019	TAC 0.4 × B45+cm,2019	< 57982	57982	59382	58850
2019/2020	TAC 0.35 x B45+cm,2020	< 41823	41823		