10 Iceland grounds haddock

had.27.5a – *Melanogrammus aeglefinus* in Division 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 regions have not been found. In addition, minimal catches have been reported in area 14 (maximum of less than 10 tons in 2016). The nearest area to Iceland where haddock is found in reasonable abundance are in shallow Faroese waters, which constitutes as a separate stock. The two regions 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, as most recaptures took 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 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 in the last two decades of the 20th century.

10.1 Fishery

The fishery for haddock in 5a has not changed substantially in recent years, but the total number of boats that account for 95% of the fishery has been declining steadily (Figure **1**). Around 250 longliners annually report catches of haddock, around 60 trawlers and 40 demersal seine boats. Most of Haddock in 5a 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 is now around 60%. At the same time the proportion caught by longlines has increased from around 15% in 1995 - 2000 to 40 % in 2011–2022. Catches in demersal seine have varied less and have been at around 15% of Icelandic catches of Haddock in 5a. 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 **2**). Most of the haddock caught in 5a by Icelandic vessels is caught at depths less than 200 m (Figure **3**). The main fishing grounds for Haddock in 5a, as observed from logbooks, are in the south, southwestern and western part of the Icelandic shelf (Figure **4**) and Figure **5**). The main trend in the spatial distribution of haddock catches in 5a according to logbook entries is the increased proportion of catches caught in the north and northeast.

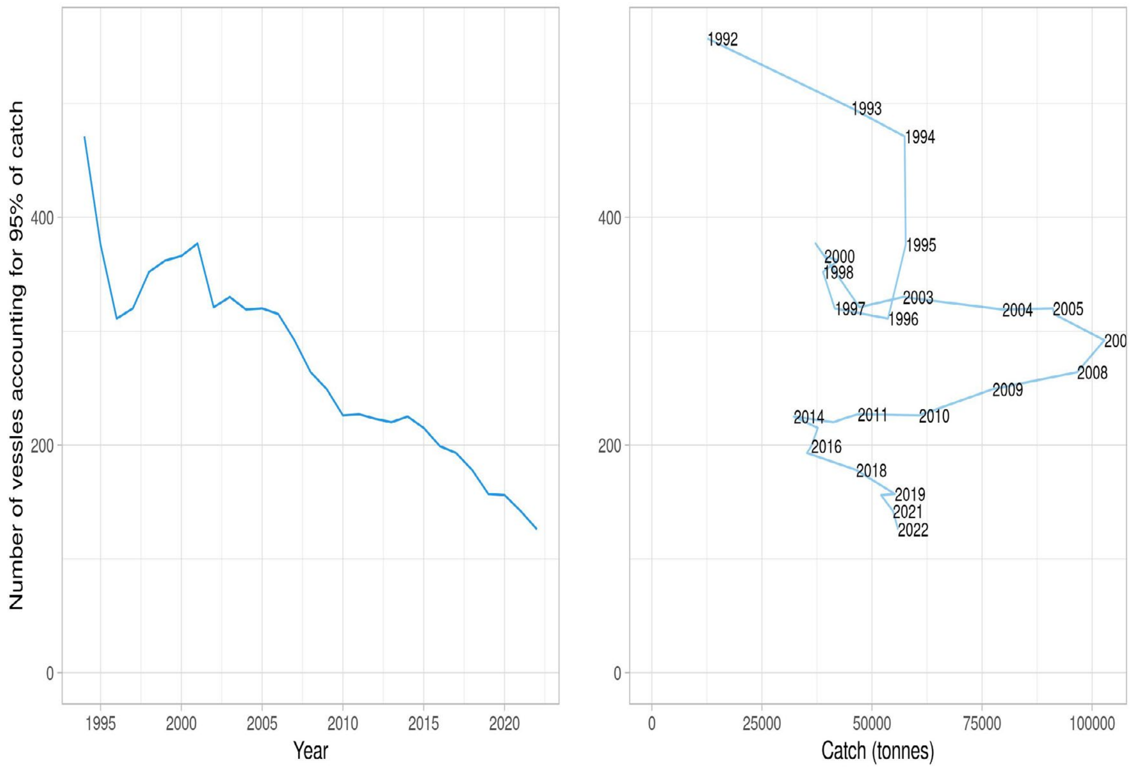

Figure 1: Haddock in 5a. Number of vessels (all gear types) accounting for 95% of the total catch annually since 1994. Left: Plotted against year. Right: Plotted against total catch. Data from the Directorate of Fisheries.

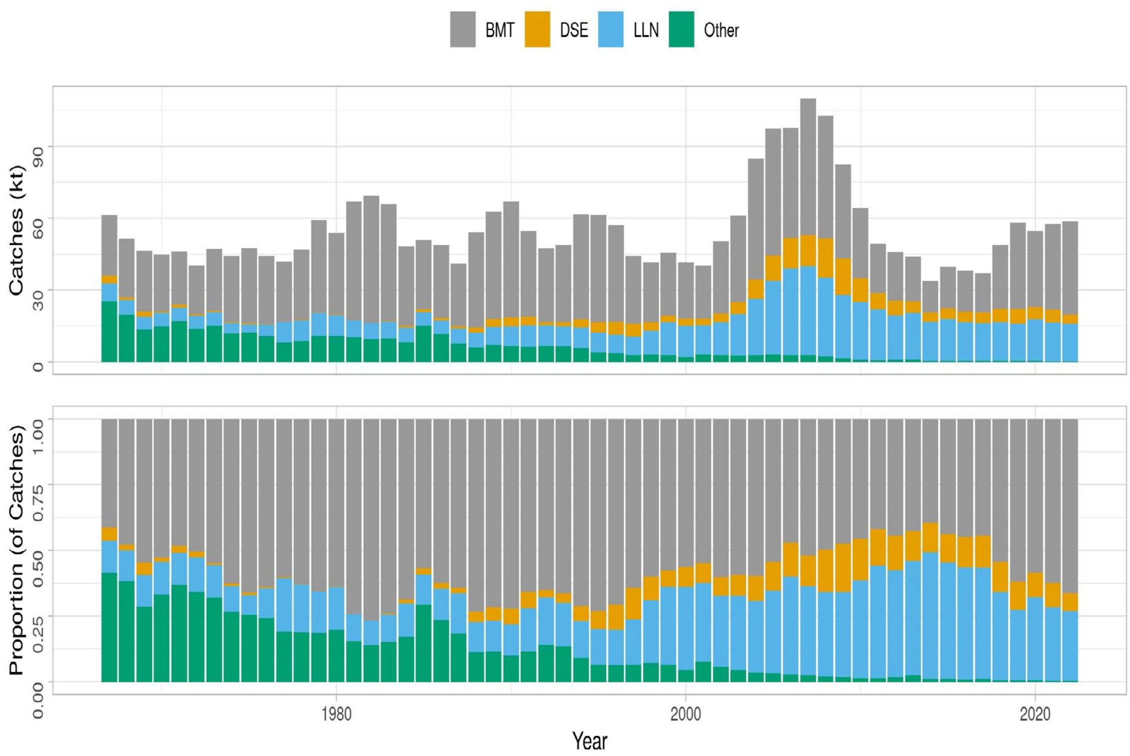

Figure 2: Haddock in 5a. Landings in tons and percent of total by gear and year

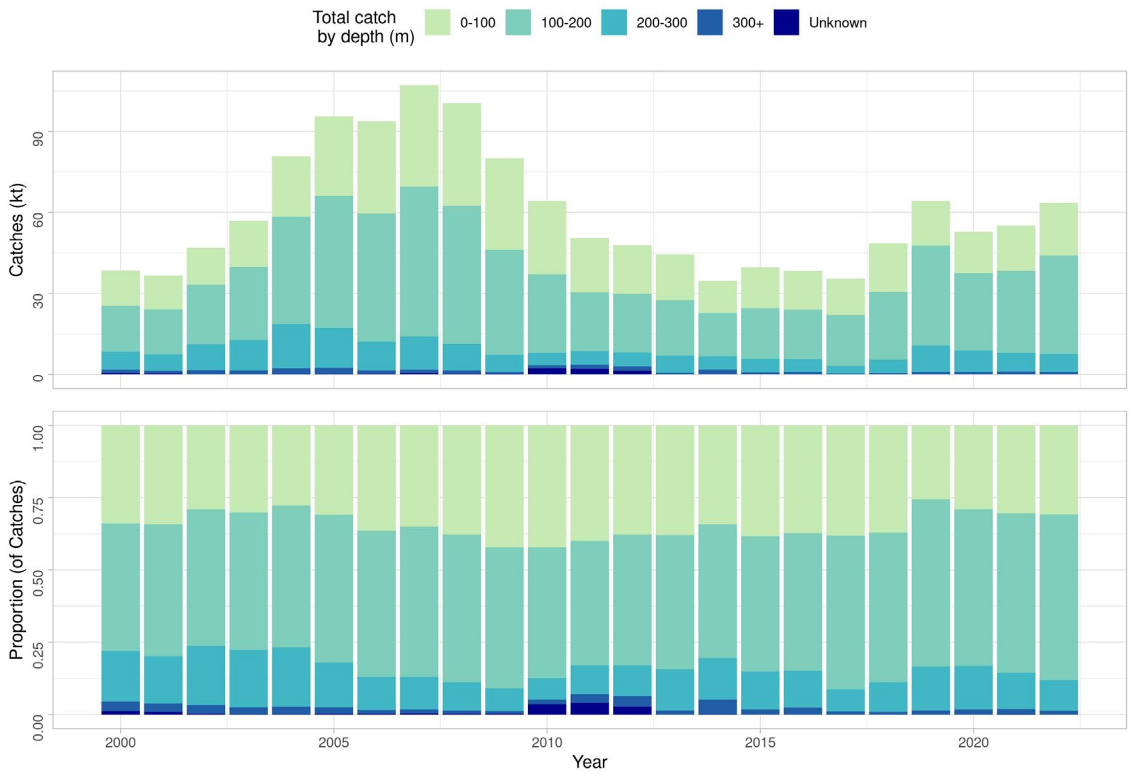

Figure 3: Haddock in 5a. Depth distribution of haddock catches from bottom trawls, longlines, trawls and demersal seine from Icelandic logbooks

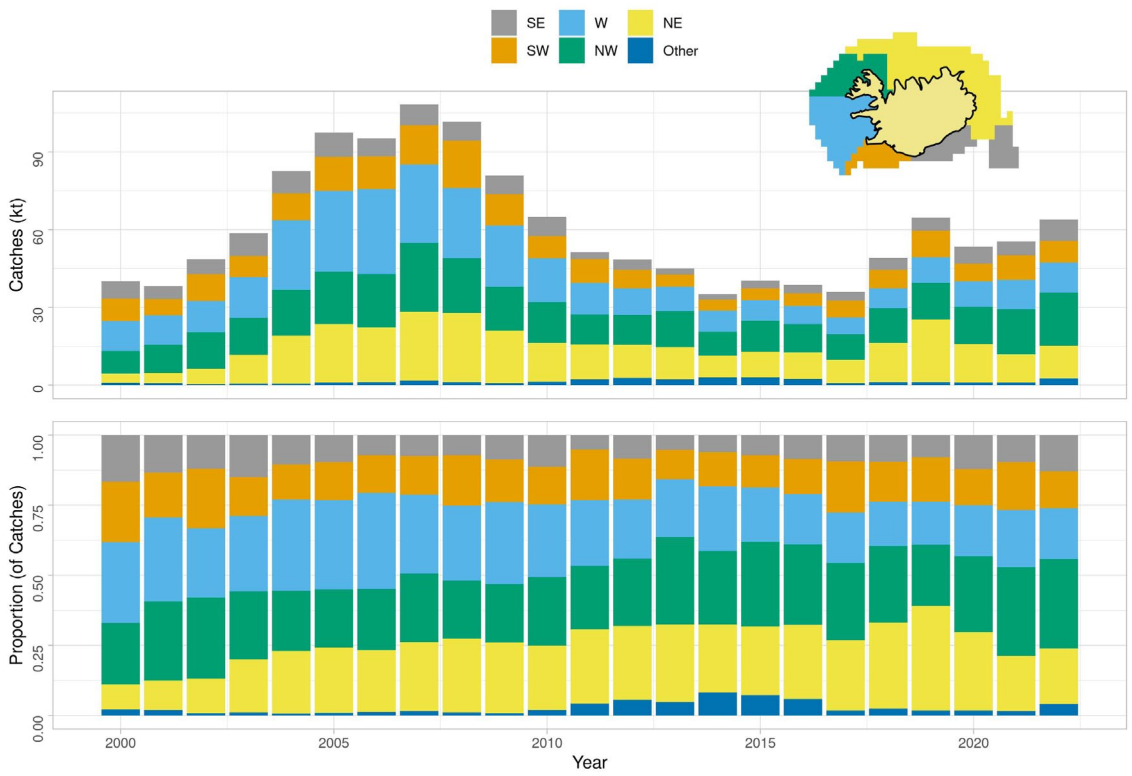

Figure 4: Haddock in 5a. Changes in spatial distribution of haddock catches as recorded in Icelandic logbooks.

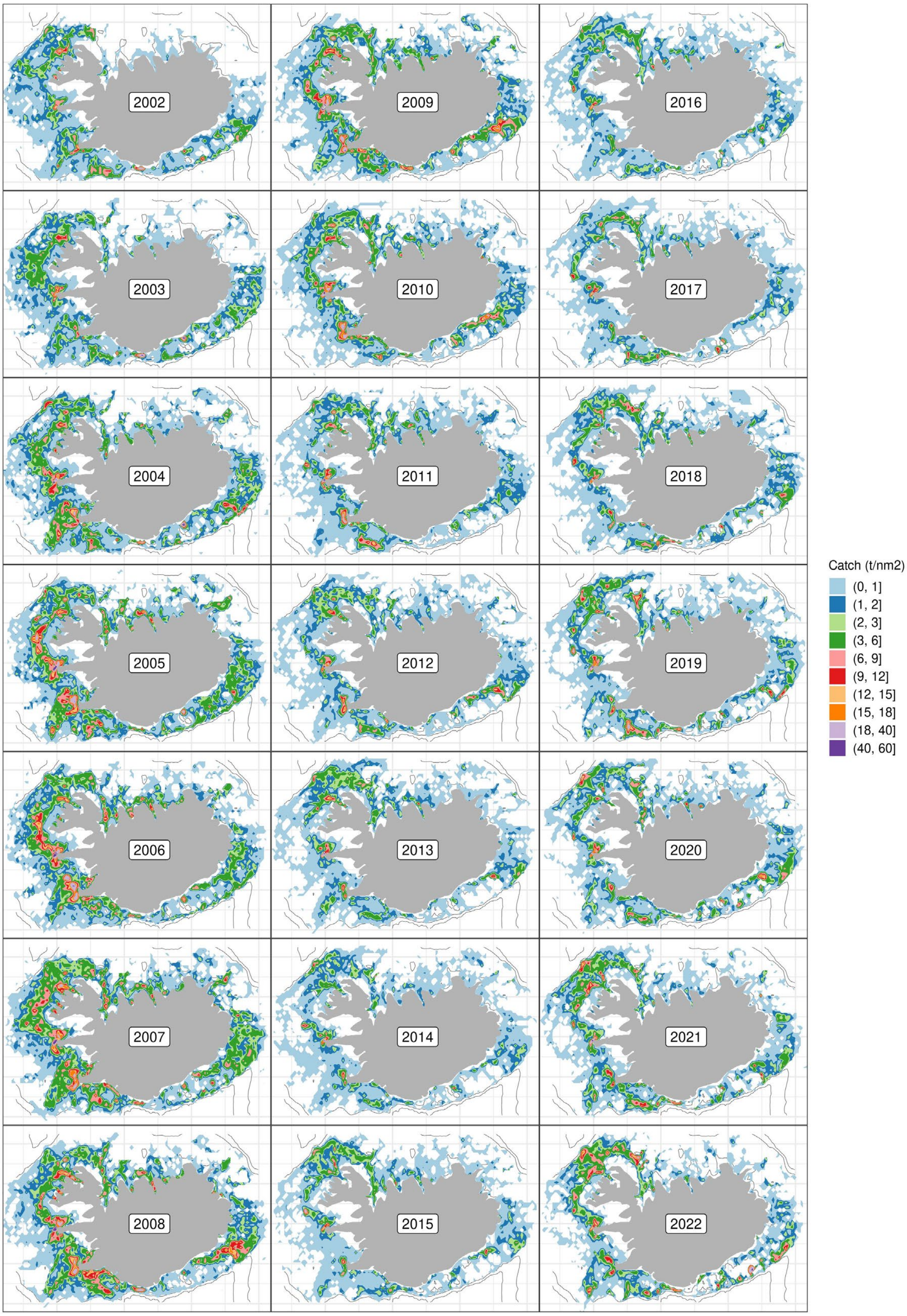

Figure 5: Haddock in 5a. Spatial distribution of catches by all gears.

10.1.1 Landing trends

Landings of Icelandic haddock in 2022 are estimated to have been 58770 tonnes, see Figure **6**. The landings in division 5a. 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 2009 tonnes, while Norwegian vessels land considerably less haddock.

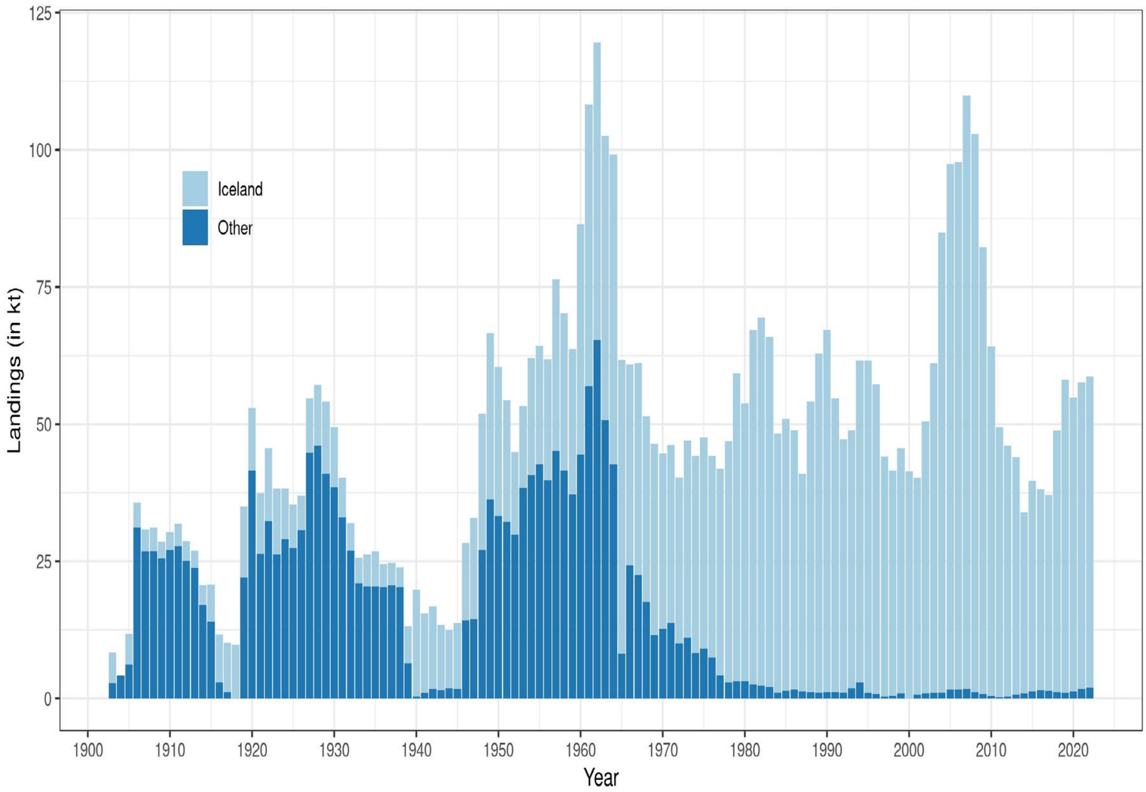

Figure 6: Haddock in 5a. Recorded landings since 1905.

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 7and Figure 8. In 2020 sampling effort was reduced substantially, onboard sampling in particular, due to the COVID-19 pandemic. However the reduced sampling is considered to be sufficiently representative of the fishing operations and thus not considered to substantially affect the stock assessment.

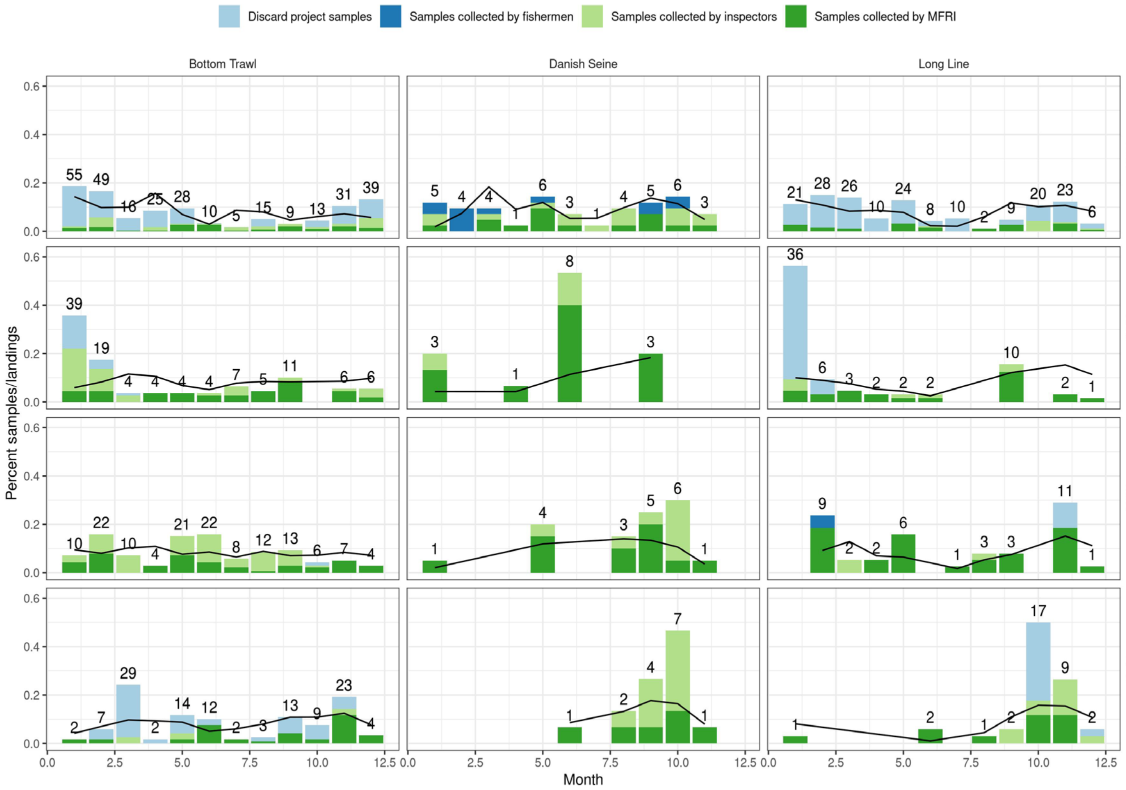

Figure 7: Haddock in 5a. Ratio of samples by month (bars) compared with proportion landings by month (solid black line) split by year and main gear types. Numbers of above the bars indicate number of samples by year, month and gear.

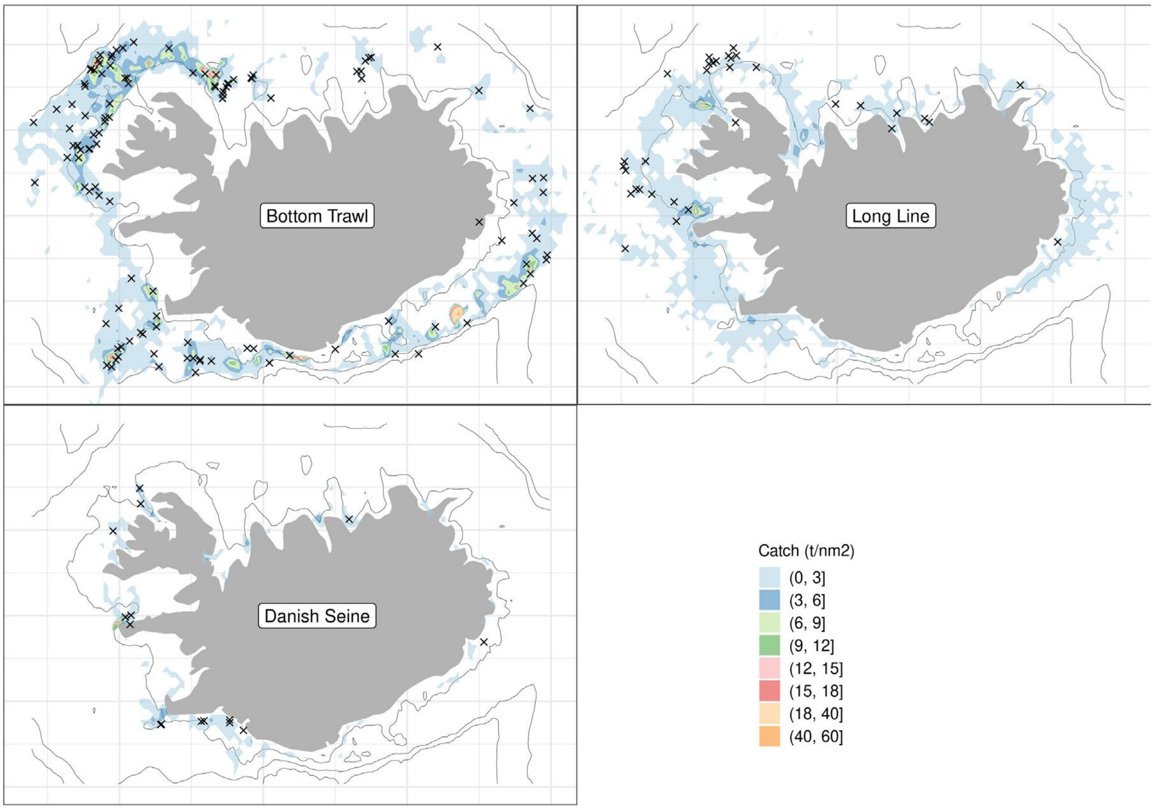

Figure 8: Haddock in 5a. Fishing grounds last year as reported in logbooks (contours) and positions of samples taken from landings (crosses) by main gear types.

Landings and discards

All landings in 5a before 1982 are derived from the STATLANT database, and also all foreign landings in 5a 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 due to highgrading 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/fisheries-management.

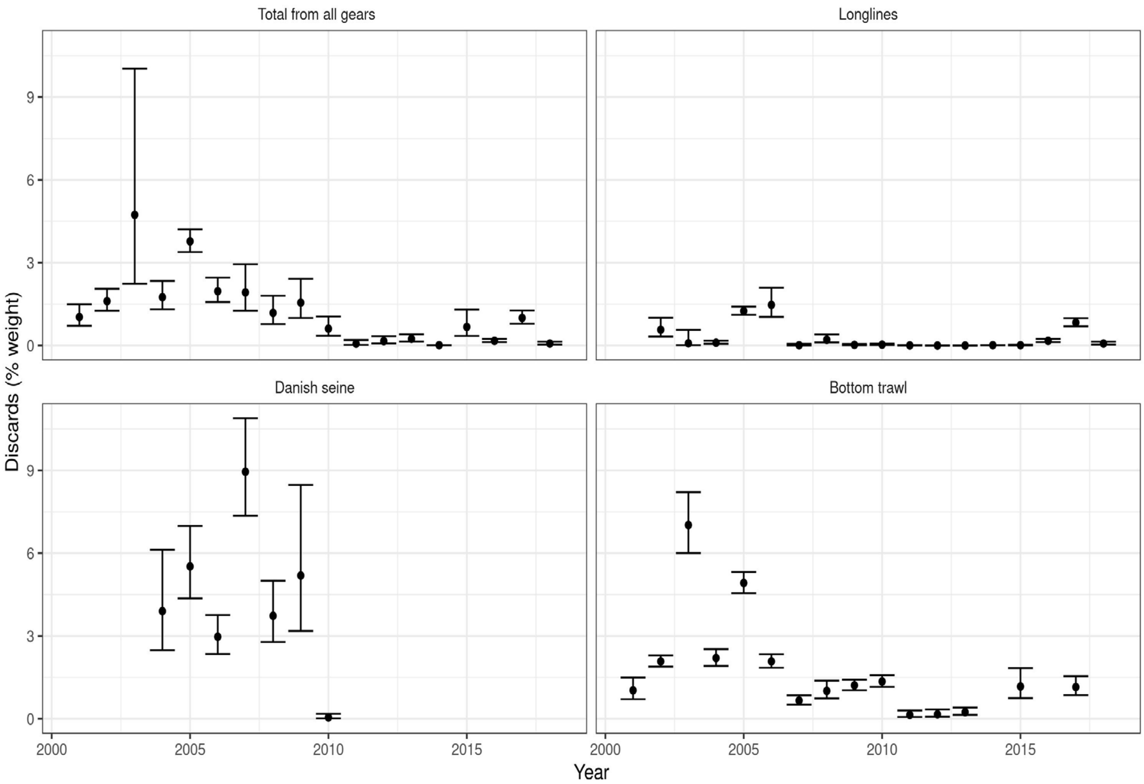

Figure 9: Haddock in 5a. Estimates of annual discards by gear. Verical lines indicate the 95 % confidence interval while dots are the point estimates. No estimates are available since 2018.

10.1.2 Length compositions

The bulk of the length measurements is 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**. 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 vary more depending on the availability of large haddock.

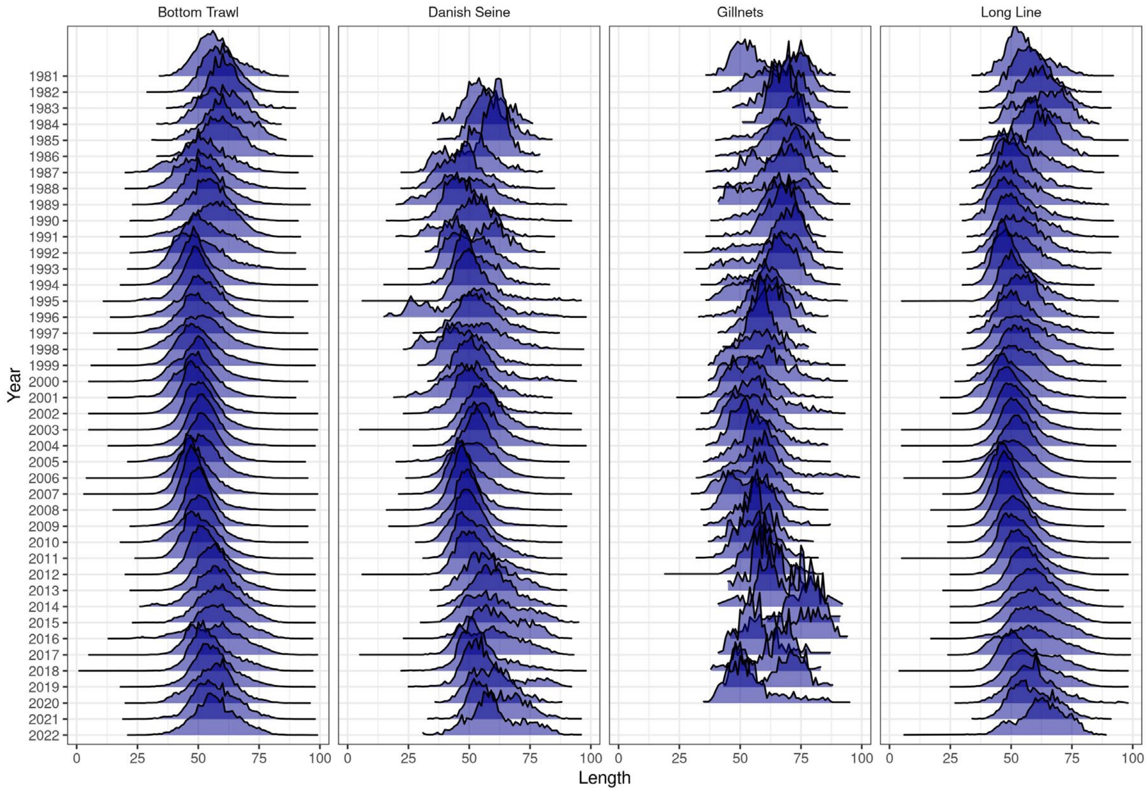

Figure 10: Haddock in 5a. Commercial length distributions by gear and year

10.1.3 Age compositions

Catch in numbers-at-age is shown in Figure **11**. The catches in 2022 are mainly of the 2014 to 2017 year classes. The number of year classes contributing to the catches has increased in recent years; the result of low fishing mortality in recent years and the last year class contributing with more than 1% of total is 11 years old (fig. **12**).

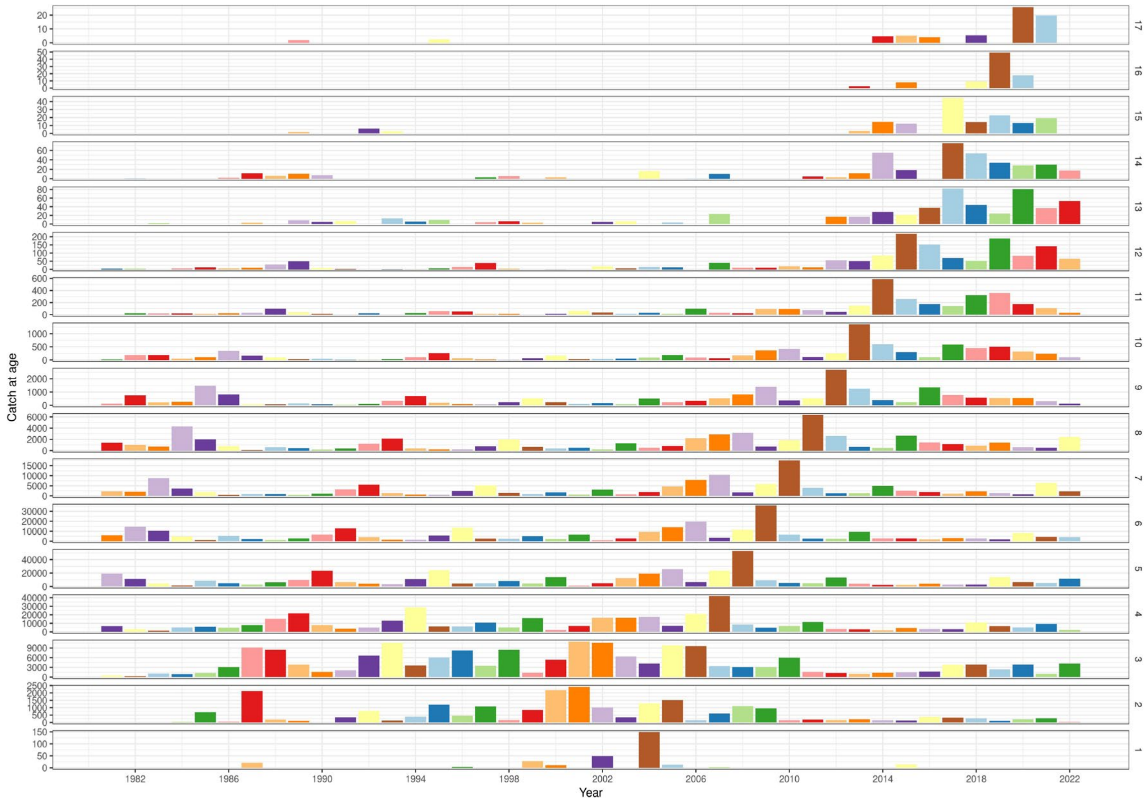

Figure 11: Haddock in 5a. Catch at age from the commercial fishery in Iceland waters. Bar size is indicative of the catch in numbers and bars are colored by cohort.

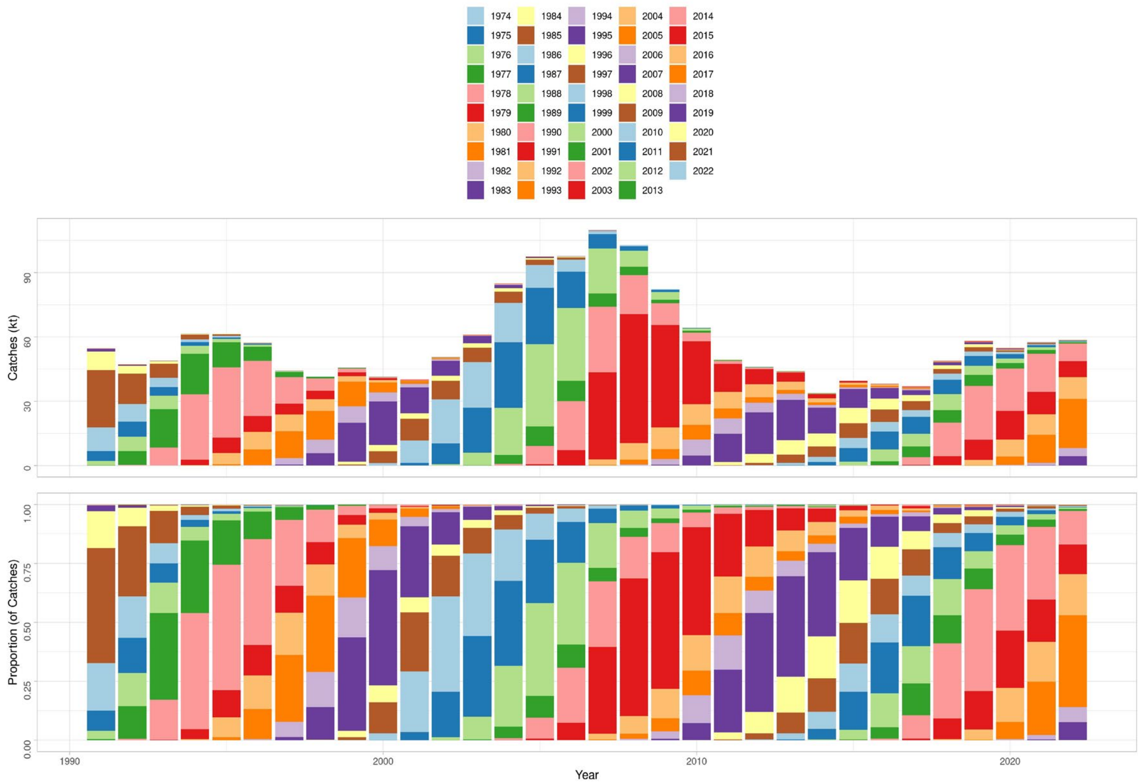

Figure 12: Haddock in 5a. Catch at age from the commercial fishery in Iceland waters. Biomass caught by year and age, bars are colored by cohort.

10.1.4 Weight at age in the catch

Mean weight at age in the catch is shown in Figure **13**. 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 in the catches has decreased but is still above average.

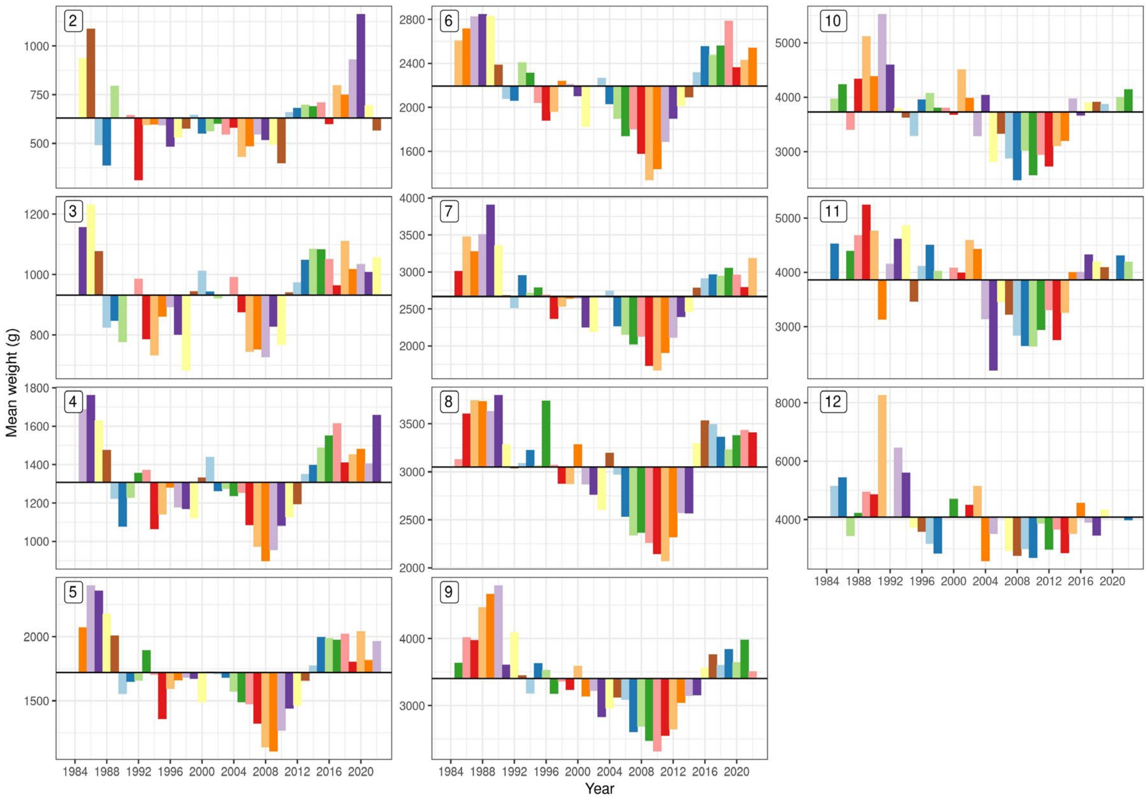

Figure 13: Haddock in 5a. Mean weight at age in the catch from the commercial fishery in Icelandic waters. Bars are coloured by cohort.

10.1.5 Natural mortality

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

10.3 Catch, effort and research vessel data

10.1.6 Catch per unit of effort from commercial fisheries

Catch per unit of effort data (Figure **14** shows that for hauls where the catch is composed of more than 50 % haddock the CPUE has been steadily increasing since 1990 for the main gear types. The CPUE from all catches from bottom trawls and demersal seine is amongst the highest recorded while for longlines it is relatively low. This is in-line with fishermen's perception that it is easy to catch haddock. This gives a different picture of the development of the stock than what is observed in surveys and assessment, much less increase after 2000 and much less decrease in recent years. However it is worth noting that 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, suggesting that the CPUE may be more representative of larger fish.

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.

The catch per unit effort could not be estimated for 2022 as the effort data from that year were not available at the time of assessment.

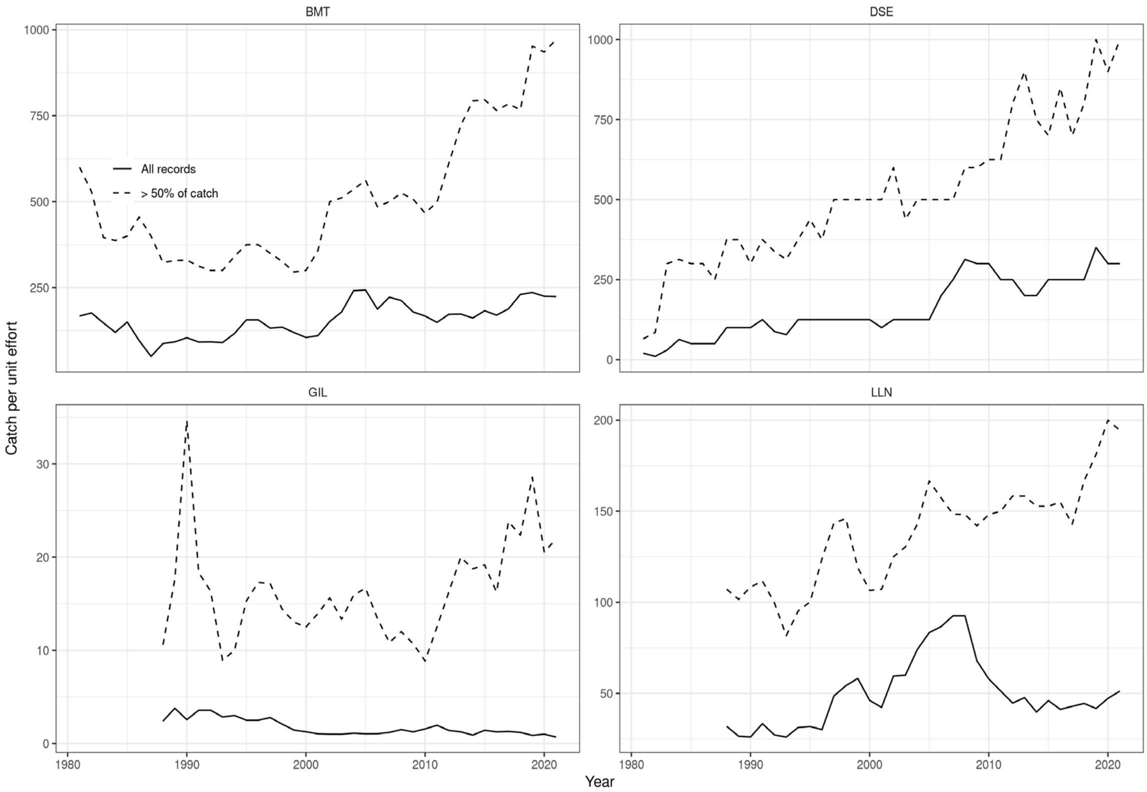

Figure 14: Haddock in 5a. Catch per unit of effort in the most important gear types. The dashed lines are based on locations where more than 50% of the catch is haddock and solid lines on all records where haddock is caught. A change occurred in the longline fleet starting September 1999. Earlier only vessels larger than 10 BRT were required to return logbooks but later all vessels were required to return logbooks. Effort data is not availble for 2022.

10.1.7 Icelandic survey data

Information on abundance and biological parameters from Haddock in 5a 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 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 **15** shows both a recruitment index (abundance < 25 cm) and the trends in various biomass indices (total biomass, biomass > 60 cm and biomass

> 45 cm). Changes in spatial distribution observed in the spring survey are shown in Figure **16**. 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 **18** (abundance) and changes in spatial distribution in Figure **17**.

Both surveys show an high 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 stronger 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. A marked increase in total survey biomass was observed in the autumn of 2022 and spring 2023.

Age disaggregated indices from the March survey are shown in Figure **19**. 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 5a. After a period of low recruitment the biomass for other age groups is near the geometric mean in both surveys.

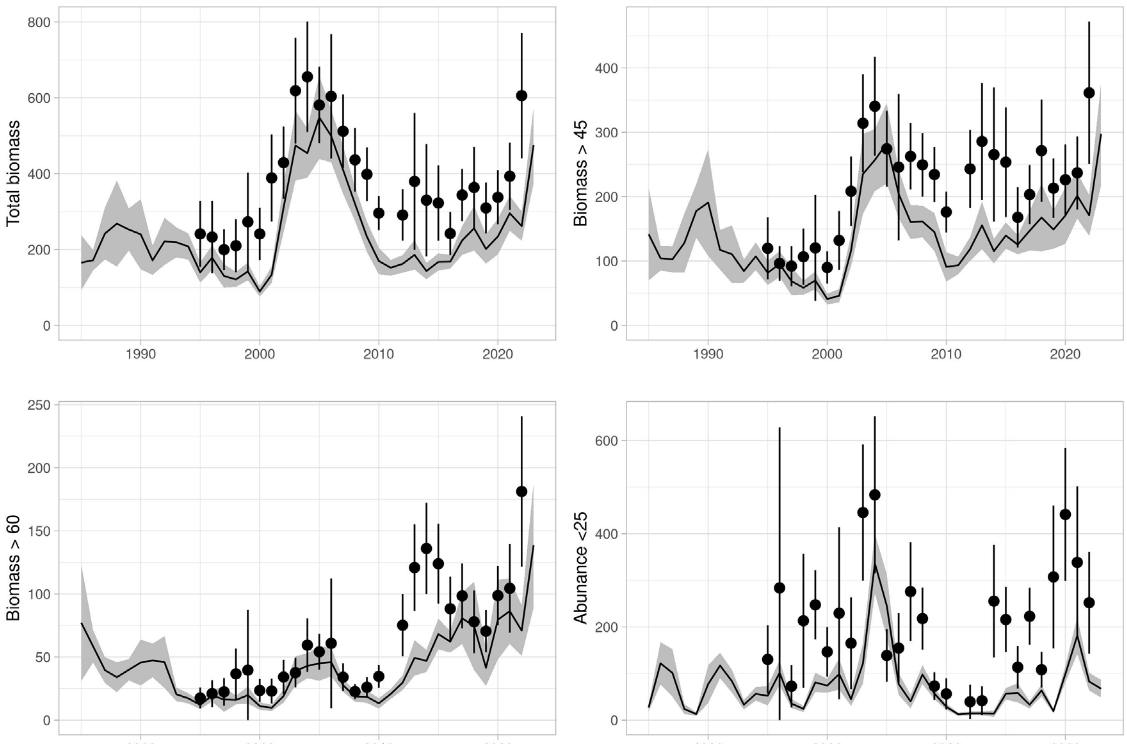

Figure 15: Haddock in 5a. Indices (total biomass, biomass> 45 cm, biomass> 60 cm and abundance <25 cm) in the Spring Survey (March) 1985 and onwards (line shaded area) and the autumn survey (point ranges).

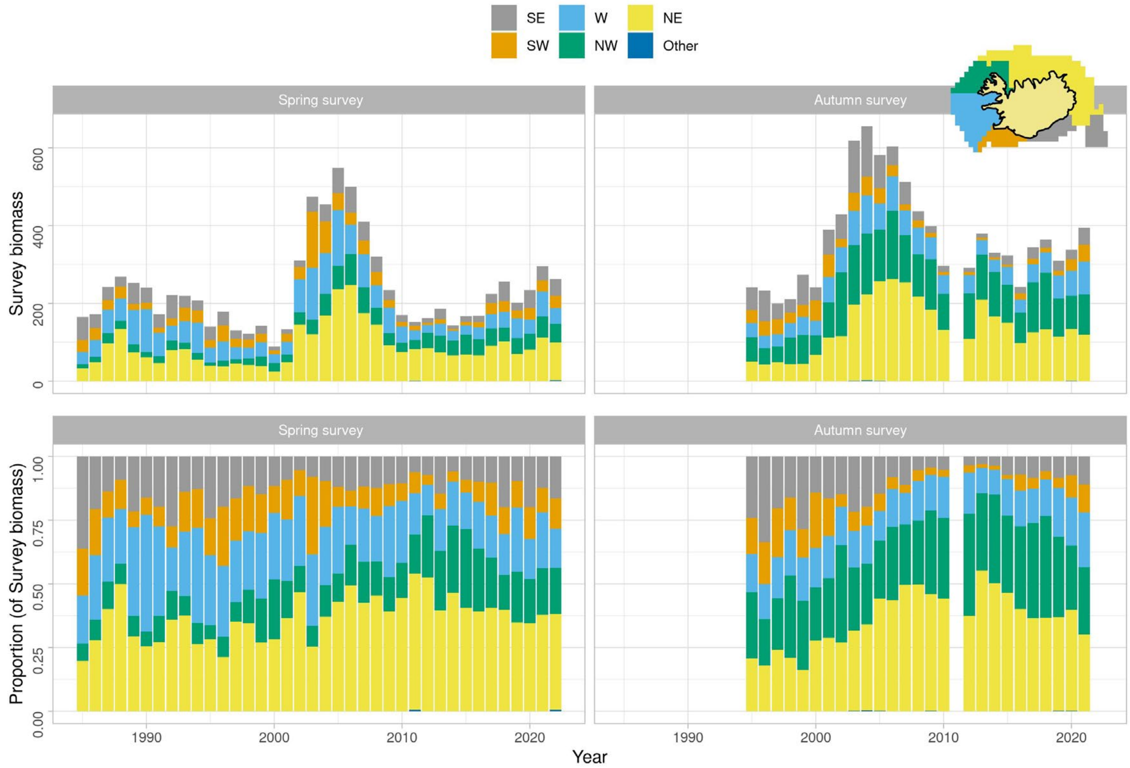

Figure 16: Haddock in 5a. Changes in geographical distribution of the survey biomass.

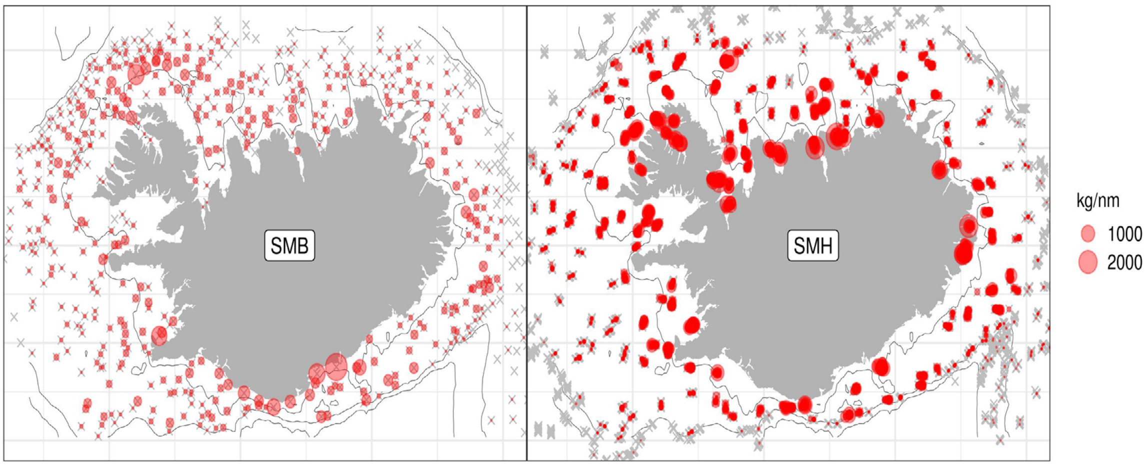

Figure 17: Haddock in 5a. Location of haddock in the most recent March (SMB) and the Autumn (SMH) surveys, bubble sizes are relative to catch sizes, and crosses indicate stations where no haddock was observed.

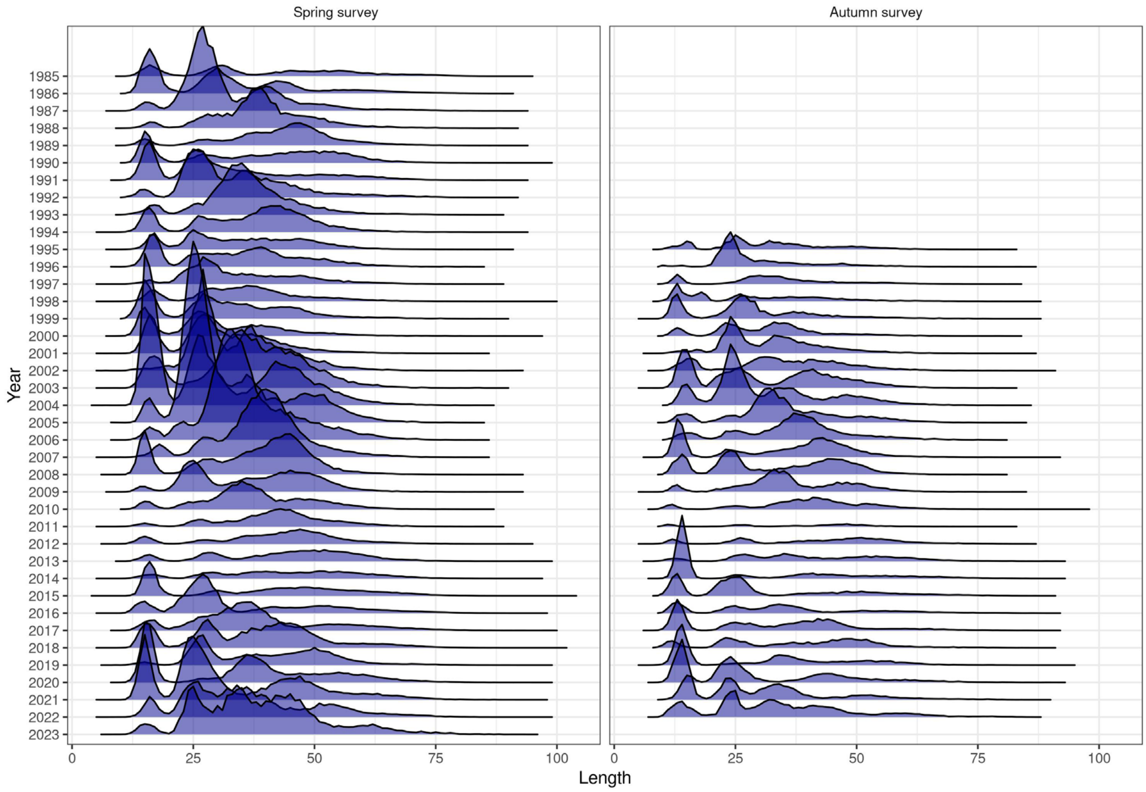

Figure 18: Haddock in 5a. Length disaggregated abundance indices from the March survey 1985 and onwards.

Figure 19: Haddock in 5a. Age disaggregated indices in the Spring Survey (left) and the autumn survey (rights). Bars indicated the deviation from the log mean index, fill colors indicate cohorts. Note different scales on y-axes.

10.1.8 Stock weight at age

Mean weight at age in the catch is shown in Figure **13**. 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.

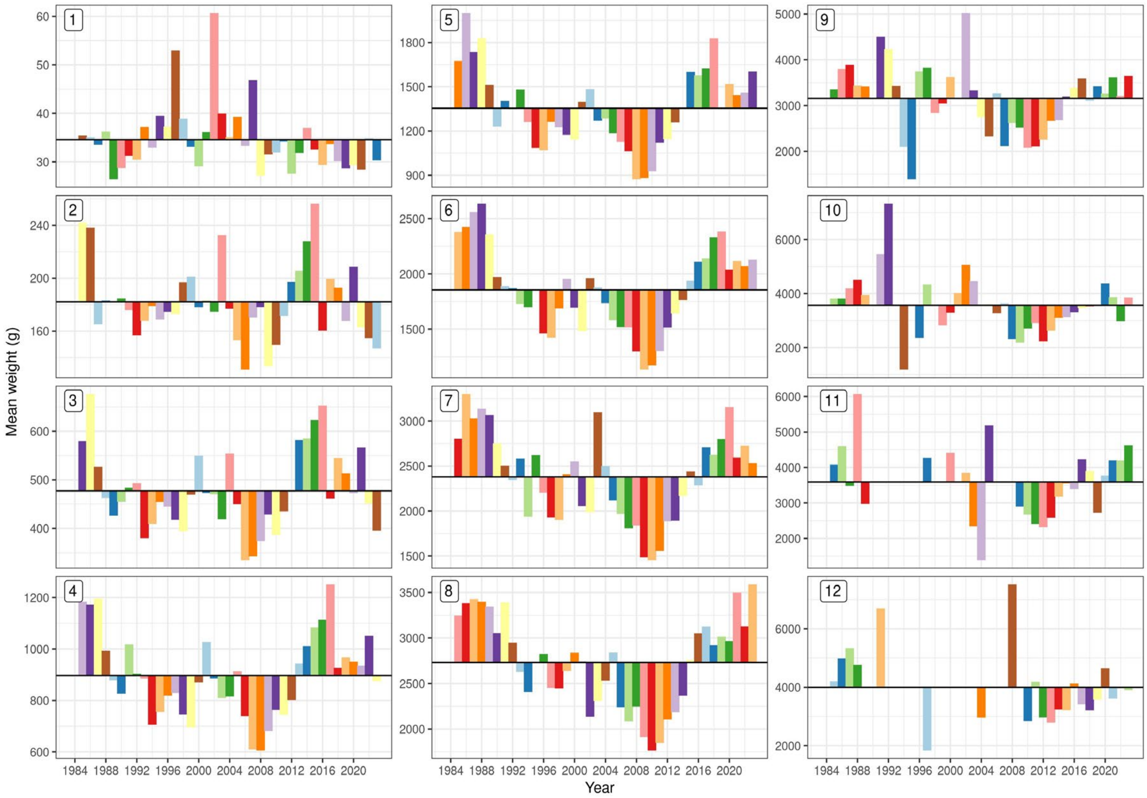

Figure 20: Haddock in 5a. Stock weights from the March survey in Icelandic waters. Bars are coloured by cohort.

10.1.9 Stock maturity at age

Maturity-at-age data are shown in Figure **21**. 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 a large proportion of those age groups north of Iceland where the proportion ofmature has always been low, as illustrated in figure **22**.

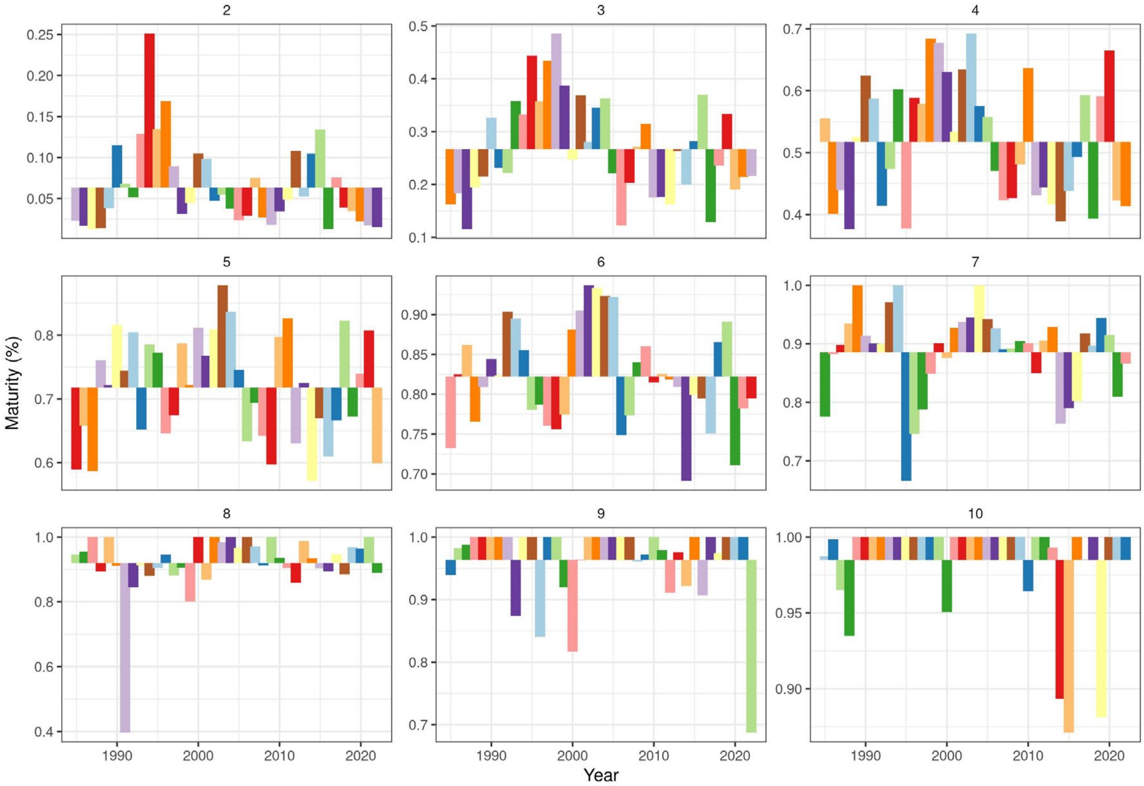

Figure 21: Haddock in division 5a. Maturity at age in the survey. Bars are coloured by cohort. The values are used to calculate the spawning stock.

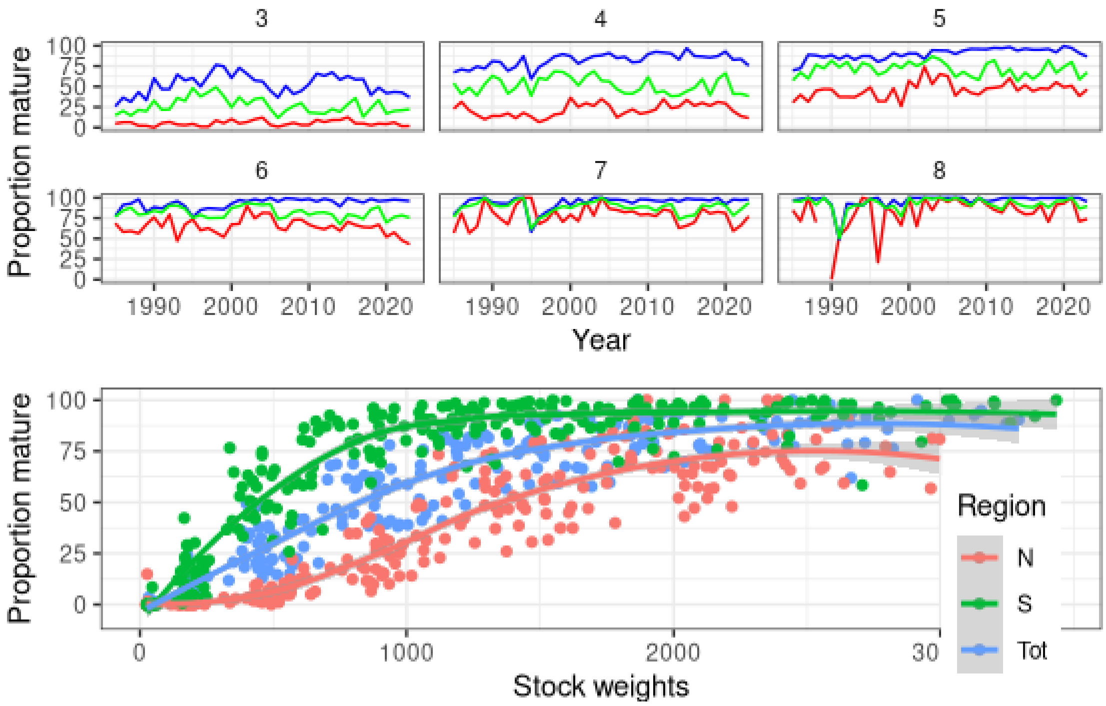

Figure 22: Haddock in 5a. Geographical differences in proportion mature by year and age (top), and stock weights (below).

10.4 Data analyses

10.1.10 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 5a 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 Björnsson, Hjörleifsson, 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:

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

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 have lower mean weight compared to smaller year classes, as observed in Figure **13**. 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 Björnsson, Hjörleifsson, and Elvarsson 2019), shown in Figure **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.

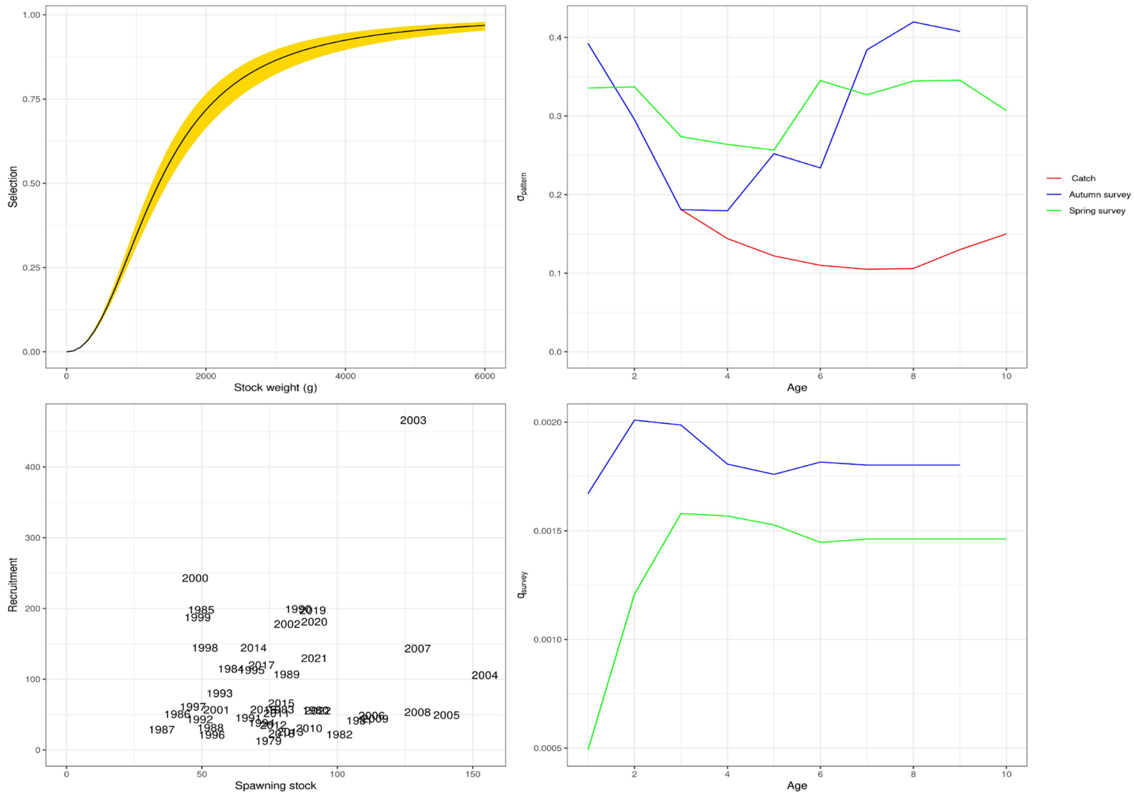

Figure 23: Haddock in 5a. Estimated selection by weight, CV pattern, stock recruitment relationship and survey catchability.

10.1.11 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)).

10.1.12 Diagnostics

The fit to data is illustrated in Figure **25** where no concerning residual patterns are observed. When looking at the combined fit (Figure **24**) 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 2000's 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 Figure **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.

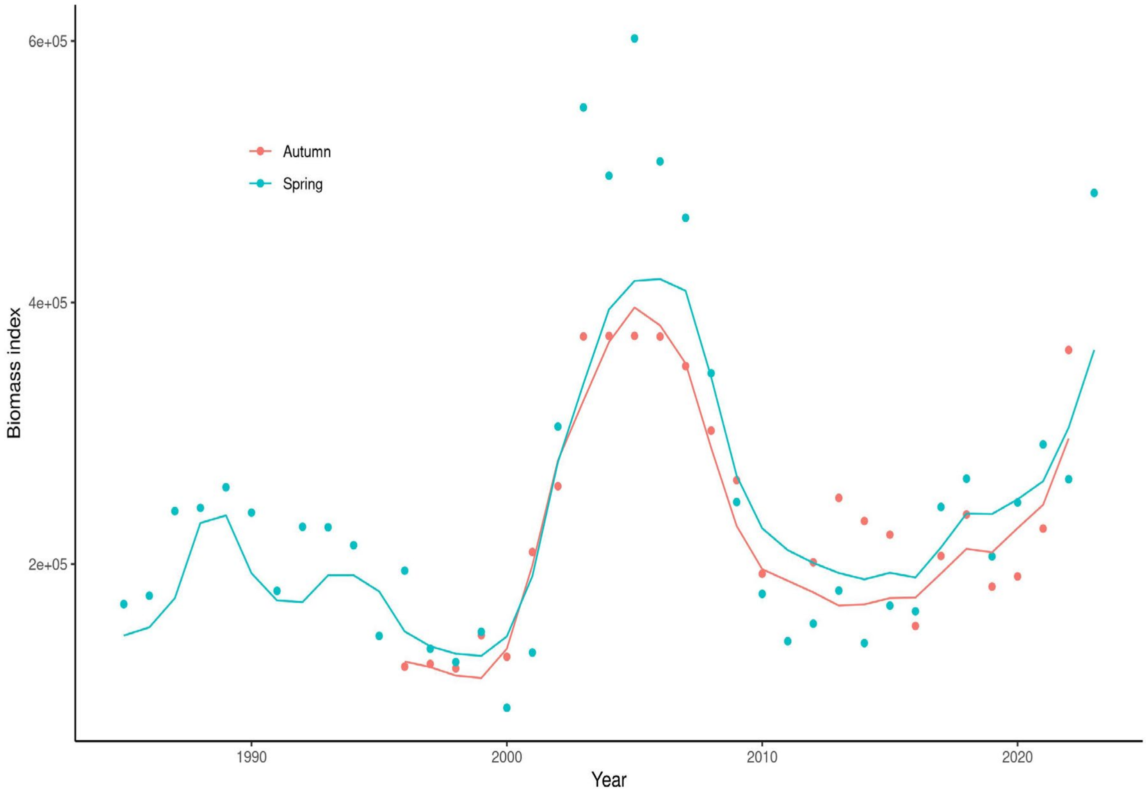

Figure 24: Haddock in division 5a. Aggregated model fit to the total biomass indices.

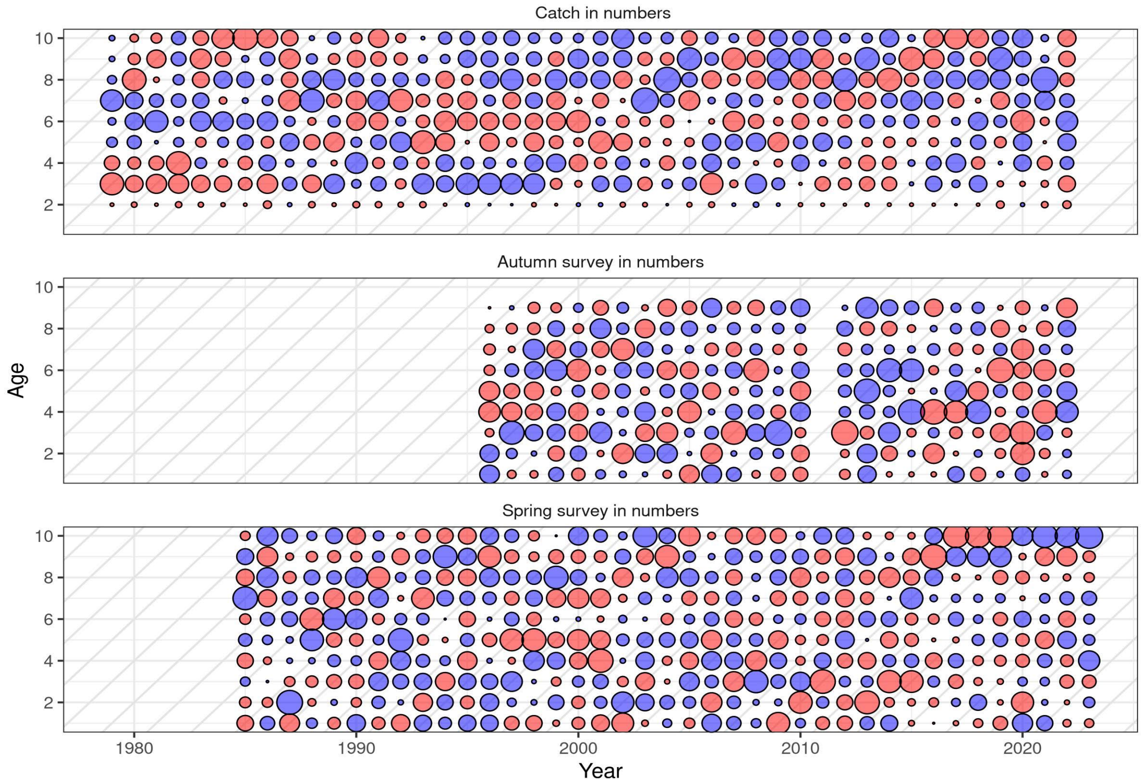

Figure 25: Haddock in division 5a. Residuals from the model fit to survey and catch data based on the both the surveys. Red circles indicate negative residuals (observed < modelled), while blue postive. Residuals are proportional to the area of the circles.

10.1.13 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 **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 the stock size is and will increase in the coming years. The analytical retrospective (Figure **28**) indicates an upwards revision in the most recent years. The assessment can however be considered fairly stable and the estimated 5 year Mohns's ρ are within acceptable range as illustrated in Figure **28**.

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 **27**) but that has not always been the case. When the model is only fitted with catch data the reference biomass shows an opposite trend from the baseline assessment which is estimated to be decreasing. Last years catch only assessment however indicated that biomass was increasing at a faster rate suggesting that the uncertainty of the estimate of the current state of the stock when the surveys are omitted increases substantially.

Estimated selection is illustrated in Figure **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 **32**.

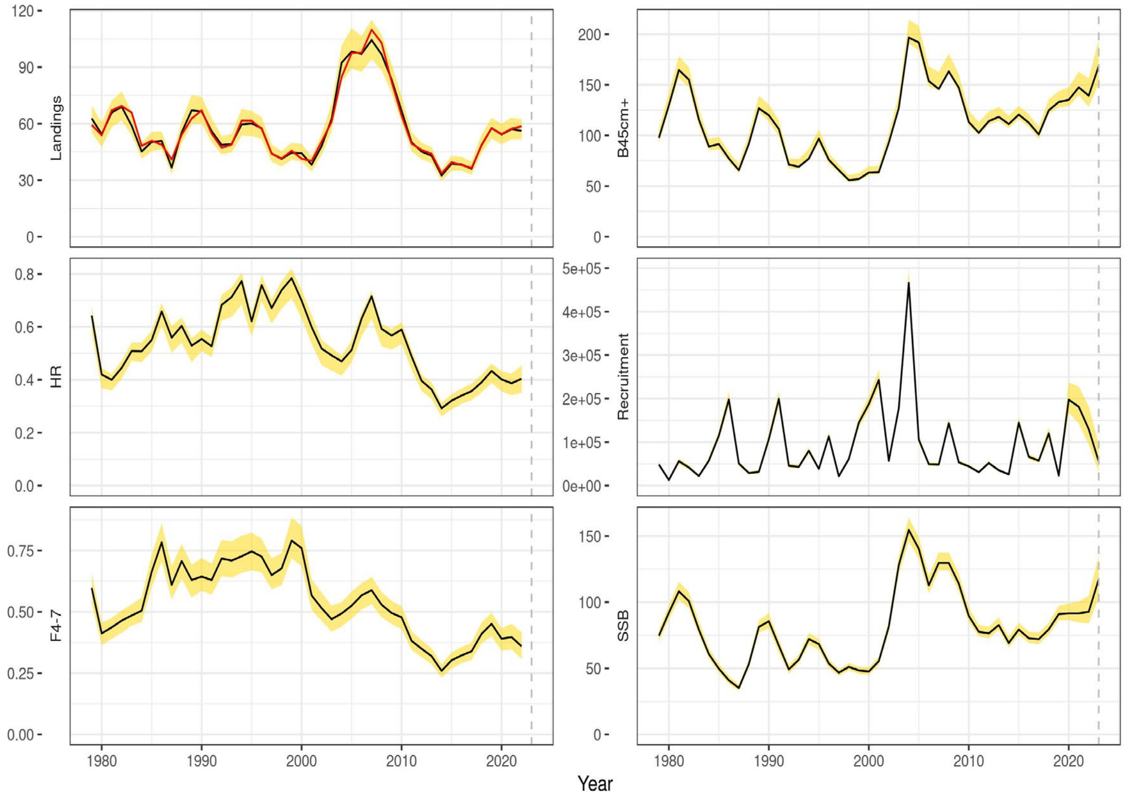

Figure 26: Haddock in division 5a. Summary from assessment. Dashed vertical line indicates the assessment year and yellow shaded region the uncertainty as estimated by the model.

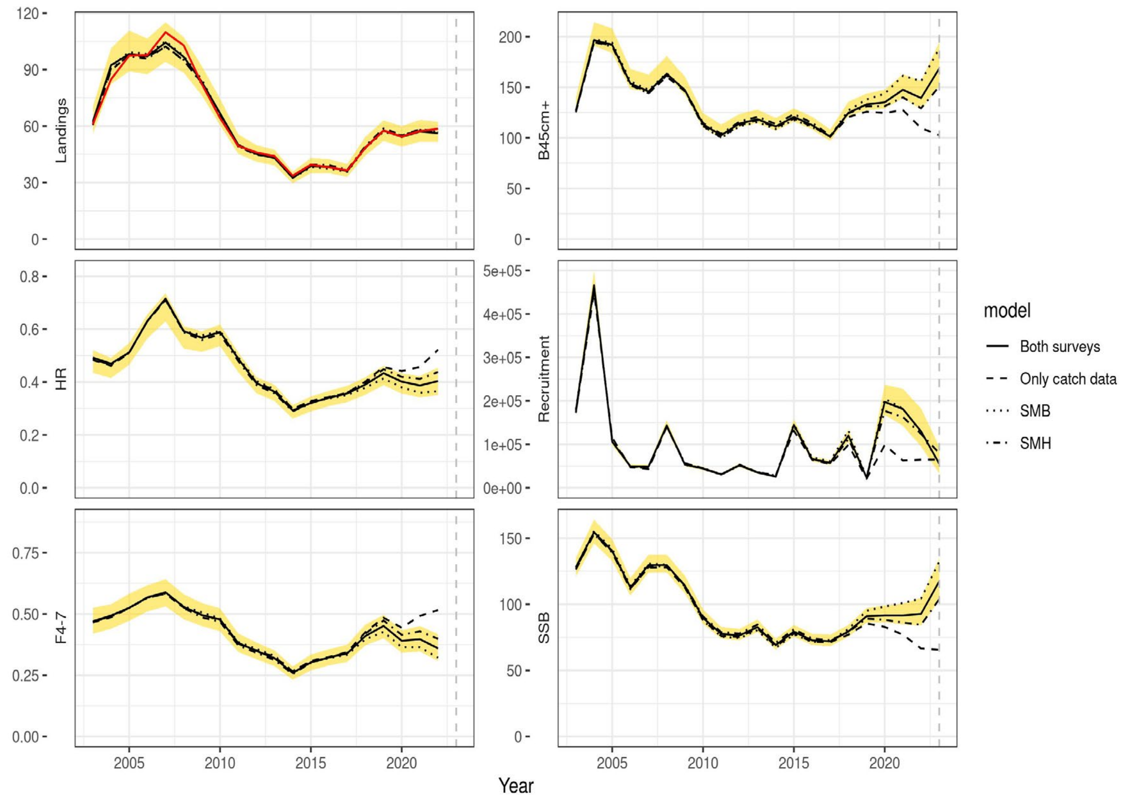

Figure 27: Haddock in 5a. Comparision of assessment results where either the spring survey or the autumn survey is omitted from the estimation.

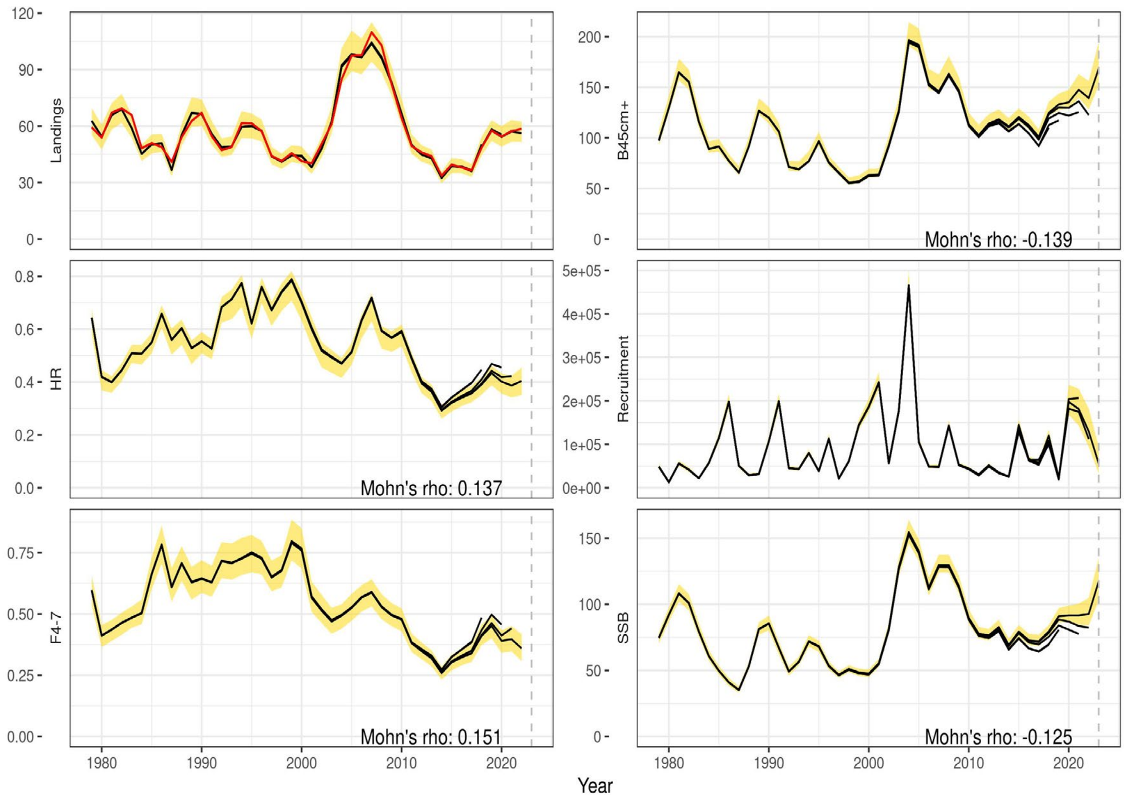

Figure 28: Haddock in division 5a. Analytical retrospective analysis of the assessment of haddock with a 5 year peel.

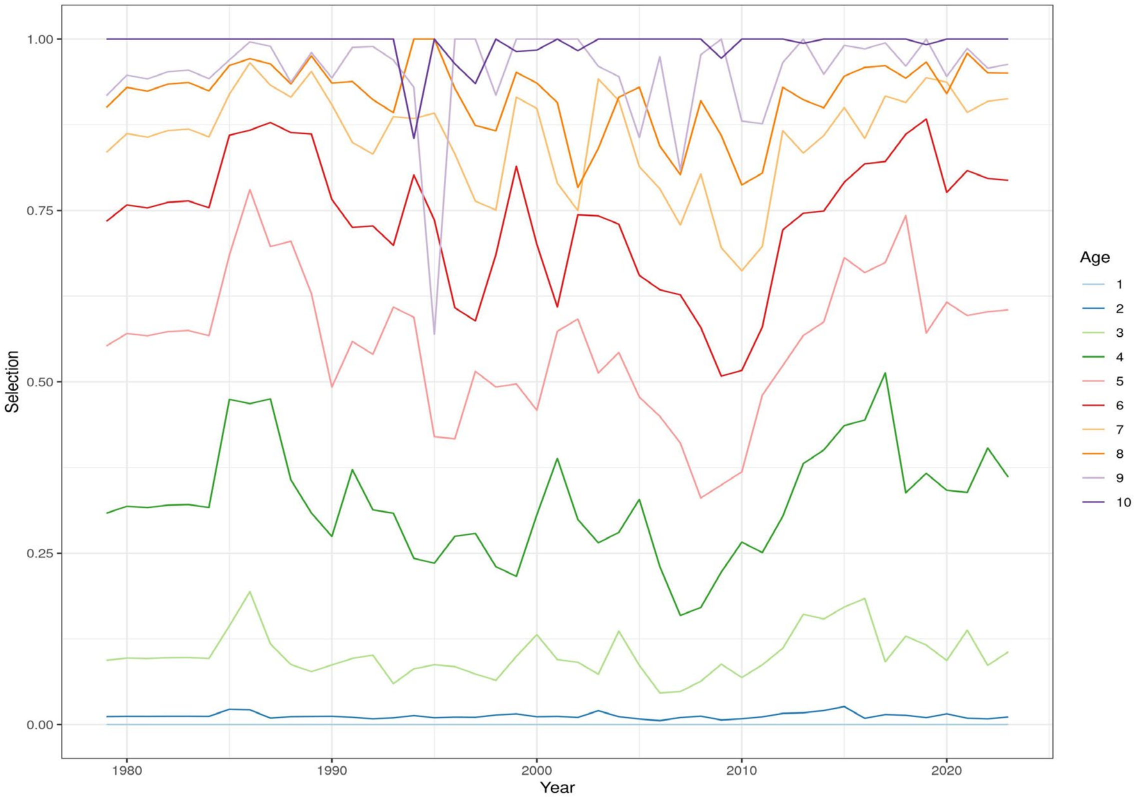

Figure 29: Haddock in 5a. Estimated selection at age.

10.1.14 Short term projections

Following the management plan the advice for the coming fishing year (2023/2024) is based in the biomass of 45 cm^{+} at the beginning the next calendar year (2024). 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 2024 is predicted by the equation:

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

where according to the stock annex the factor δ_y for the assessment year (Figure **32**) is the average of the points estimates of the growth factor in the two preceding years. Growth has been high but variable in recent years but was much less in when the stock was larger in the early 2000s. Maturity, selection, catch weights at age and proportion of the biomass above 45cm^{+} are then predicted from stock weights in 2023, see Figures **32** and **33**. 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 2023/2024 has some effect of the biomass at the beginning of 2024, which the TAC is based on. This procedure is described in detail in the stock annex. A comparison of the predicted variables and observed/esimated values are show in Figures **30** and **31**.

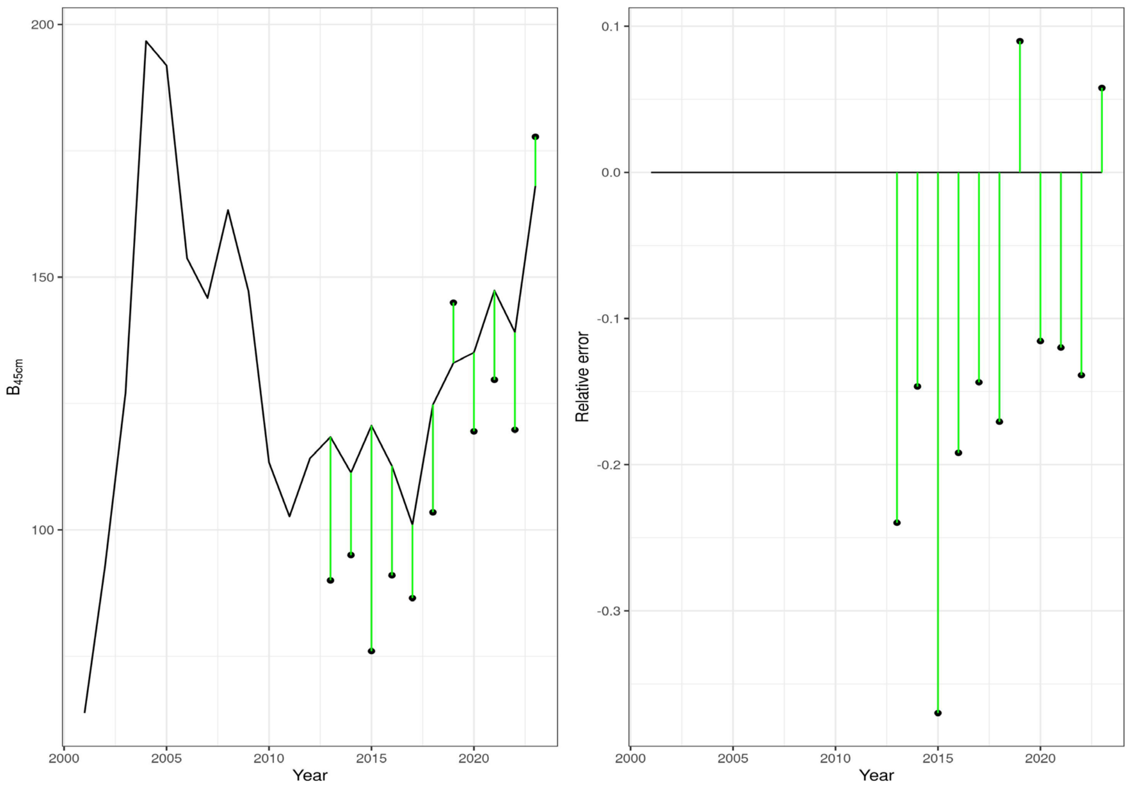

Figure 30: Haddock in 5a. Comparison of the short term prediction of reference biomass to the realised value a year later.

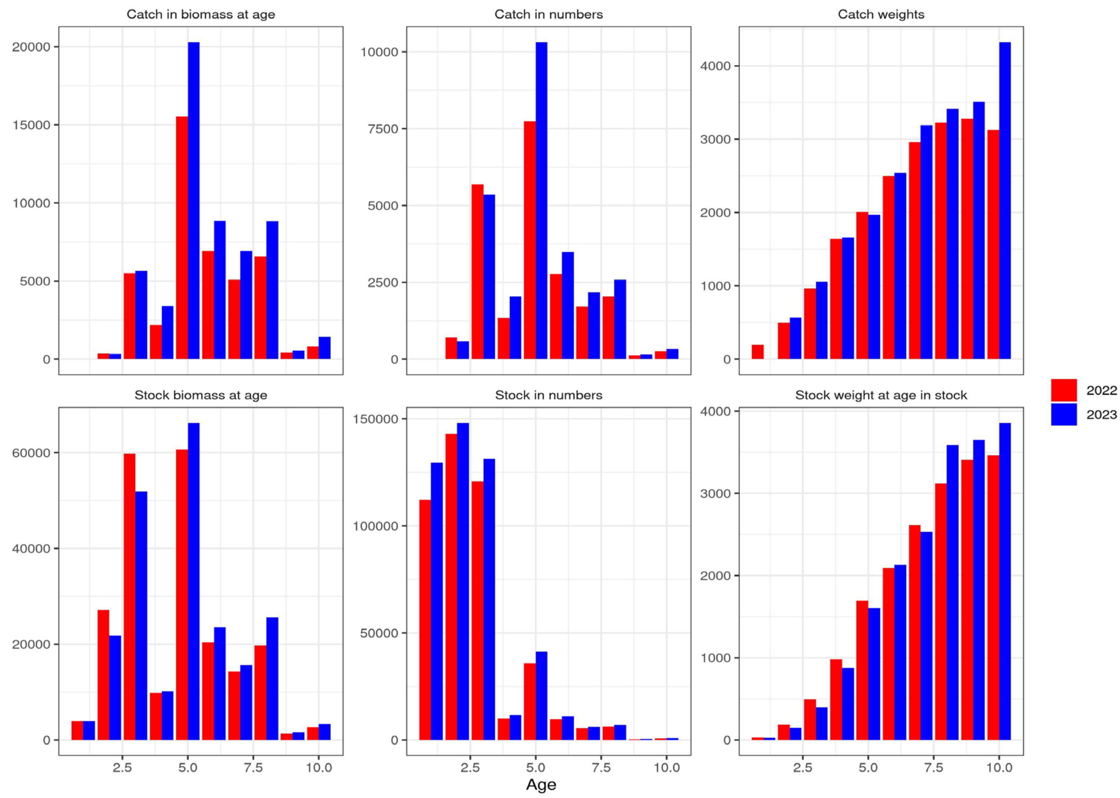

Figure 31: Haddock in 5a. Comparison of some of the results of last years assessment assessment based on different tuning data and current assessment tuned with both the surveys

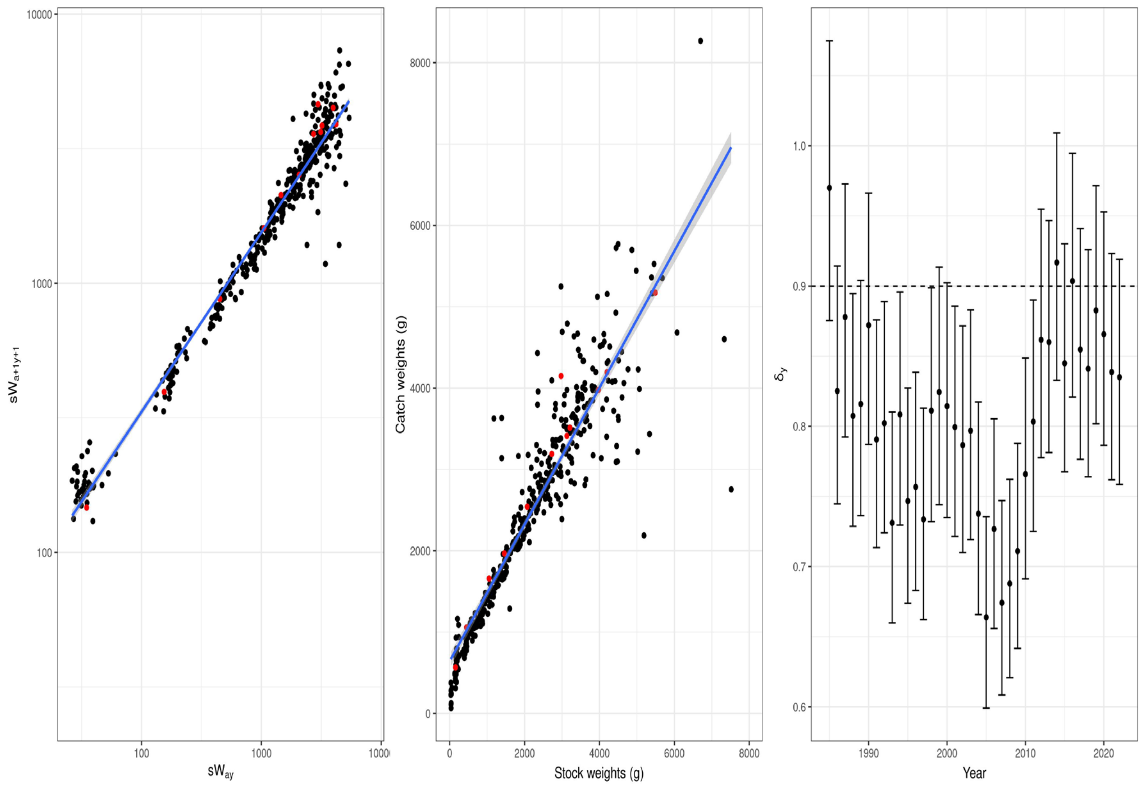

Figure 32: Haddock in 5a. Input data to the prediction model, where the exponent of the yearfactor (growth multiplier) is estimated to derive the reference biomass in the advisory year, as described in the text.

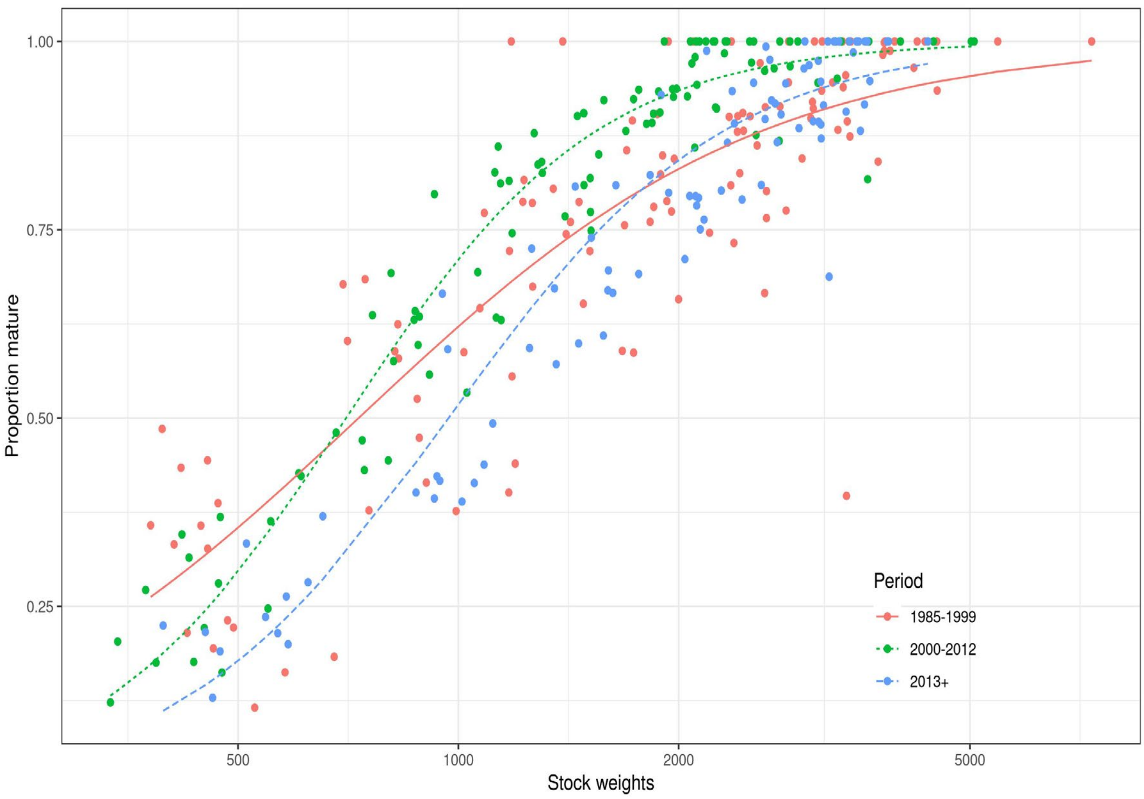

Figure 33: Haddock in 5a. Maturity at weight as used in the projections.

10.5 Management

The Icelandic Ministry of Food, Agriculture and Fisheries 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 5a has been managed by TAC since the 1987. Landings have roughly followed the advice given by MFRI and the set TAC in all fishing years (Figure **34**) . Since the 2001/2002 the catches have exceeded more that 5% the set TAC in seven fishing years. The largest overshoot in landings in relation to the 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 allows 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 5a. 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.

The effect of these species transformations and quota transfers is illustrated in Figure **35**. 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 **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. These effects were considered when the management plan was tested.

Figure **34** illustrates the difference between national TAC and landed catch in 5a. The difference can be attributed to species transformation (in both directions), while for the 1999/2000 and 2020/2021 fishing years the government of Iceland increased TAC mid-season. Similarly the TAC for the 2020/2021 fishing year was increased by 8 000 t and reduced by the same amount the following fishing year.

In 2023 the Ministry of Food, Agriculture and Fisheries initiated the process of reviewing the the management plan for haddock in Icelandic waters.

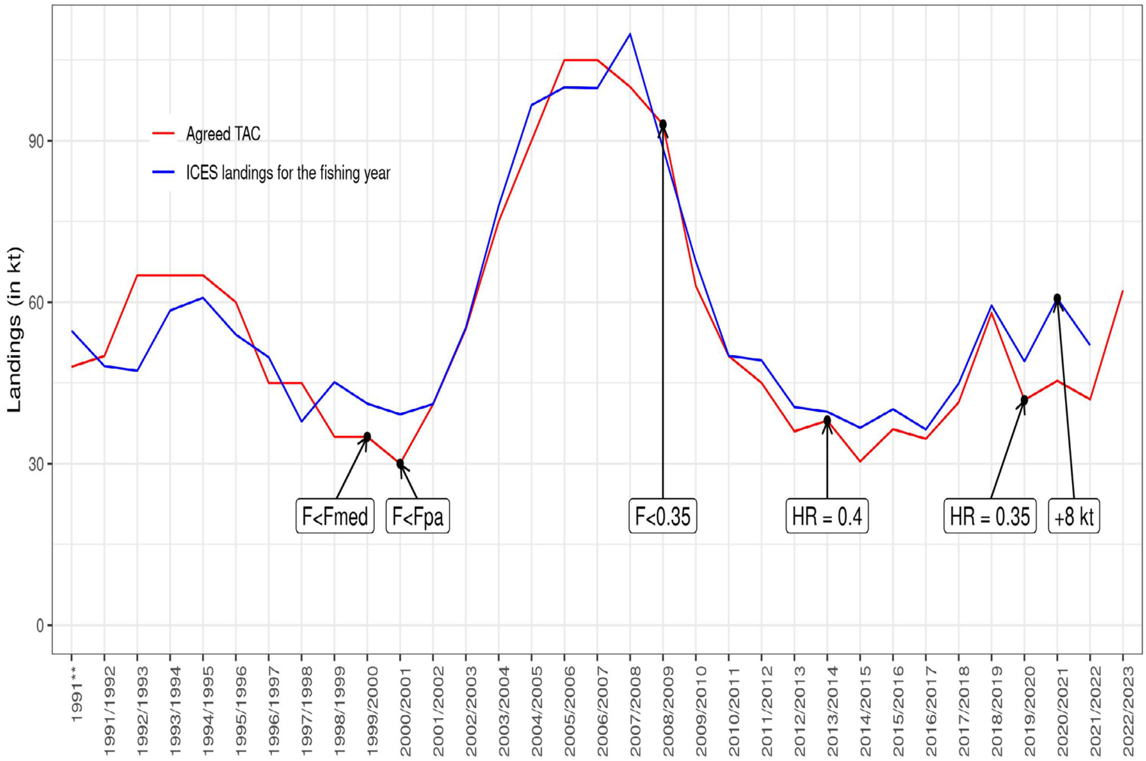

Figure 34: Haddock in 5a. Comparison of the realised catches and the set TAC for the fishing operations in Icelandic waters. Note that in the 1999/2000 fishing year the government of Iceland increased TAC mid-season

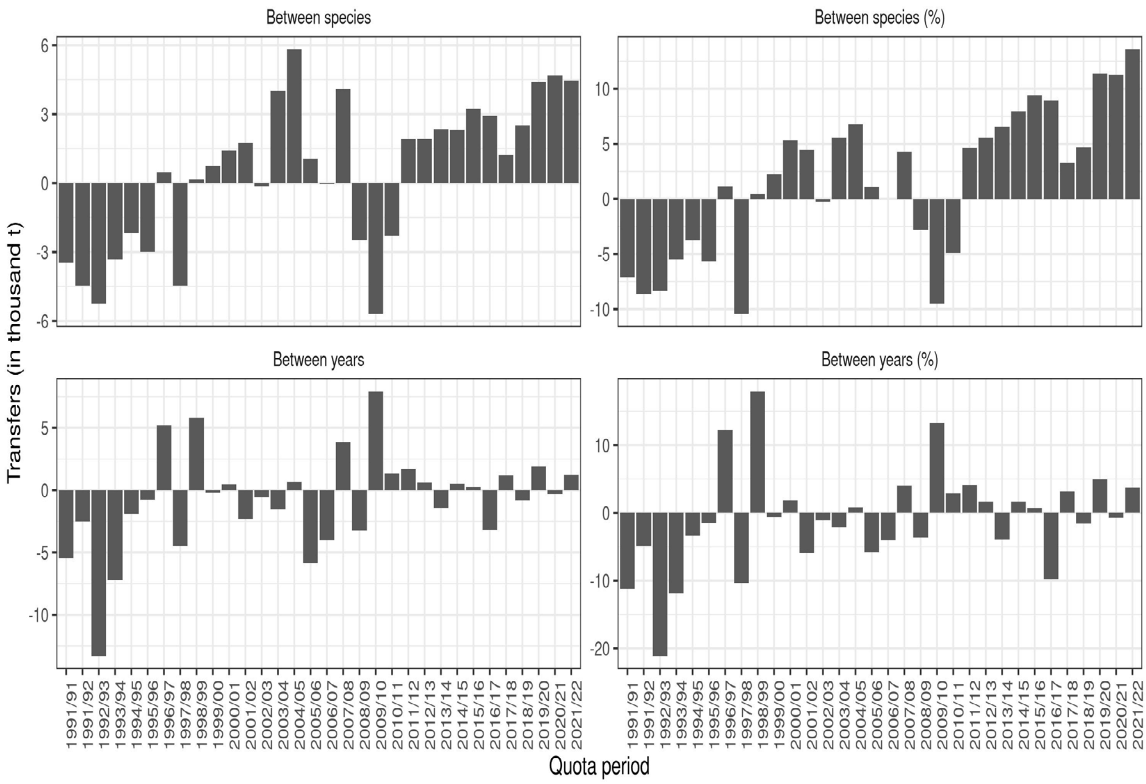

Figure 35: Haddock in 5a. An overview of the net transfers of quota between years and species transformations in the fishery in 5a.

Table 1: Haddock in 5a. ICES advice and official landings. All weights are in tonnes.

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 Fmed	< 35000	35000	41150	42105
2000/2001	F reduced below provisional Fpa	< 31000	30000	39143	39654
2001/2002	F reduced below provisional Fpa	< 30000	41000	41069	50498
2002/2003	F reduced below provisional Fpa	< 55000	55000	55269	60883
2003/2004	F reduced below provisional Fpa	< 75000	75000	77916	84828
2004/2005	F reduced below provisional Fpa	< 97000	90000	96617	97225
2005/2006	F reduced below provisional Fpa	< 110000	105000	99926	97614
2006/2007	F reduced below provisional Fpa	< 112000	105000	99763	109966
2007/2008	F reduced below provisional Fpa	< 120000	100000	109810	102872
2008/2009	F reduced below 0.35	< 83000	93000	88617	82045

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	ICES landings for the fishing year	ICES landings for the calendar year
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	48991	54781
2020/2021	TAC 0.35 x B45+cm,2021	< 45389	45389	60672	57599
2021/2022	TAC 0.35 x B45+cm,2022	< 50429	41929	51986	58770
2022/2023	TAC 0.35 x B45+cm,202	< 62219	62219	---	---

10.6 Management considerations

All the signs from commercial catch data and surveys indicate that Haddock in 5a 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's MSY approach. In 2023 the stock is estimated to have increased substantially and it is projected to increase in the coming year due to strong incoming cohorts (2019 and 2020 year classes) and the estimate of the 2021 year class is above average suggesting that the stock will remain in a good state in the near term.

10.7 References

Björnsson, Höskuldur, Einar Hjörleifsson, and Bjarki ór Elvarsson. 2019. “Muppet: Program for Simulating Harvest Control Rules.” Reykjavik: Marine; Freshwater Researh 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.

10.8 Input data

10.1.1 Spring survey at age

year	1	2	3	4	5	6	7	8	9	10
1985	28.6	32.9	17.7	23.9	26.5	3.7	11.0	5.1	5.4	0.8
1986	124.3	112.2	56.7	15.1	16.5	12.4	0.9	2.7	1.2	2.3
1987	23.1	330.0	141.9	43.3	9.0	8.0	4.7	0.4	0.6	1.1
1988	15.7	46.1	182.3	86.8	23.1	1.5	2.2	2.0	0.2	0.6
1989	10.5	21.9	40.4	147.4	44.8	13.3	0.8	0.9	0.4	0.5
1990	72.4	31.2	26.6	39.3	91.7	31.2	3.4	0.9	0.2	0.0
1991	89.4	144.5	44.7	17.9	20.5	32.7	7.6	0.2	0.1	0.2
1992	18.3	209.6	143.0	34.4	17.3	13.3	16.2	2.3	0.1	0.0
1993	29.0	38.3	260.8	90.6	11.1	3.7	1.5	4.5	0.8	0.0
1994	59.3	62.2	39.4	151.8	41.6	5.6	2.7	1.2	3.6	0.3
1995	37.7	82.0	51.5	20.8	68.5	7.1	1.1	0.0	0.3	0.0
1996	96.0	71.1	119.9	35.8	18.9	41.4	5.9	0.6	0.0	0.3
1997	8.6	123.9	50.7	52.5	11.0	7.1	10.8	1.4	0.0	0.1
1998	22.9	18.6	110.9	28.2	23.2	4.9	3.4	4.7	0.3	0.0
1999	81.0	86.2	25.0	99.6	13.4	9.8	1.6	1.9	1.0	0.1
2000	61.0	89.0	43.2	8.3	25.1	3.1	1.6	0.4	0.2	0.5
2001	81.7	152.4	115.5	21.5	4.0	10.5	0.9	0.5	0.0	0.1
2002	20.2	303.6	201.2	110.8	22.9	3.3	7.4	0.4	0.3	0.1

year	1	2	3	4	5	6	7	8	9	10
2003	112.0	102.6	281.5	248.3	113.8	17.5	2.6	4.7	0.4	1.1
2004	327.8	290.2	70.5	208.9	110.7	34.9	6.2	1.4	0.8	0.3
2005	54.8	696.3	290.9	44.7	156.7	58.7	15.5	3.1	0.3	0.2
2006	38.7	77.8	577.1	182.4	19.6	63.0	16.5	6.7	0.7	0.3
2007	35.9	63.4	91.8	435.8	86.0	7.5	21.4	4.5	1.9	0.0
2008	88.8	65.2	73.8	73.6	222.2	29.3	3.6	7.0	1.8	0.3
2009	11.0	105.7	52.4	40.0	41.1	102.9	12.5	1.9	2.8	0.5
2010	16.5	27.4	140.1	30.3	18.5	20.7	31.7	2.7	0.4	0.8
2011	8.4	26.0	23.5	78.1	13.4	5.8	9.6	14.2	1.2	0.5
2012	12.0	14.0	32.3	28.3	60.1	5.3	3.0	5.7	7.0	1.3
2013	13.4	23.1	21.9	23.7	23.5	42.6	5.1	2.5	3.8	5.7
2014	14.3	24.7	29.5	17.4	16.2	14.4	16.3	1.3	1.0	3.2
2015	59.1	19.1	25.7	34.0	13.0	11.7	10.2	10.1	1.2	2.6
2016	29.5	123.4	23.8	21.5	21.9	7.2	7.1	4.9	4.1	2.8
2017	27.2	66.0	142.1	22.7	20.3	22.3	6.6	5.0	3.4	2.7
2018	61.8	72.8	72.7	116.7	13.0	11.3	9.5	3.1	2.8	2.7
2019	7.1	85.0	47.1	40.6	66.7	4.0	3.8	2.8	1.4	1.3
2020	109.1	15.6	102.6	35.3	27.1	42.4	2.6	1.8	1.9	2.9
2021	125.0	245.3	27.6	101.3	24.2	16.0	19.9	1.1	0.8	3.0
2022	49.6	132.2	145.1	13.6	58.7	10.5	8.0	7.7	0.3	2.3

10.1.2 Autumn survey at age

year	1	2	3	4	5	6	7	9	8	10
1995	154.9	172.7	48.7	25.0	46.2	6.8	0.4	0.1	0.0	0.0
1996	444.0	96.0	81.5	17.8	7.5	18.0	1.4	0.0	0.0	0.0
1997	28.7	207.2	55.5	38.0	7.8	5.8	6.6	0.0	0.3	0.0
1998	80.0	30.9	129.2	20.3	16.3	5.6	5.3	0.0	1.9	0.2
1999	370.1	70.3	27.7	93.9	12.1	10.7	0.4	0.4	1.4	0.0
2000	160.2	254.4	44.6	7.9	28.9	1.8	3.3	0.3	0.2	0.6

year	1	2	3	4	5	6	7	9	8	10
2001	380.8	273.8	167.0	32.1	4.8	14.1	1.1	0.0	1.0	0.2
2002	74.3	239.7	190.2	93.1	17.9	2.6	3.4	0.3	0.6	0.0
2003	328.4	138.4	255.4	153.3	55.4	10.6	1.8	0.0	0.7	0.0
2004	681.1	347.9	52.1	153.4	70.1	19.6	3.4	0.4	0.6	0.0
2005	68.9	546.8	177.7	27.3	93.1	27.3	11.0	0.0	2.0	0.3
2006	115.1	113.7	504.3	109.4	13.9	37.9	9.7	1.2	4.3	0.0
2007	96.8	68.5	93.8	327.2	57.3	7.9	10.5	0.7	4.2	0.4
2008	199.8	90.5	67.8	86.8	191.9	15.6	2.6	0.3	4.1	0.1
2009	48.7	253.1	79.0	32.7	45.1	95.2	9.0	2.8	1.5	0.8
2010	40.4	52.2	142.0	31.0	14.5	22.2	35.1	0.9	4.9	1.4
2011	18.4	9.8	6.6	26.9	5.7	2.2	5.3	0.1	1.3	0.7
2012	50.5	30.5	31.3	35.7	69.7	11.1	4.1	9.7	9.4	1.8
2013	100.2	117.4	35.1	36.1	38.7	44.4	6.6	5.8	2.4	5.3
2014	32.9	41.1	65.8	24.1	25.1	22.7	25.9	2.5	2.2	5.6
2015	204.5	37.5	39.5	44.8	15.4	16.8	10.0	2.3	11.7	4.0
2016	76.5	126.9	23.9	17.8	19.2	7.2	7.6	2.9	3.9	2.7
2017	114.5	95.4	148.7	14.5	17.1	13.7	3.6	2.6	4.0	2.4
2018	116.3	77.4	71.0	118.9	7.0	6.8	5.7	2.6	3.2	2.8
2019	32.7	137.6	49.0	38.5	53.8	2.4	2.8	0.5	1.0	1.5
2020	294.6	22.4	107.1	35.3	19.2	24.1	0.9	0.8	1.0	1.4
2021	242.6	254.5	24.5	68.7	20.6	10.1	13.6	0.6	0.5	2.9
2022	213.1	282.0	227.8	19.4	67.9	12.6	8.5	0.0	11.3	1.4

10.1.3 Catch at age

year	1	2	3	4	5	6	7	8	9	10
1980	0.0	0.0	2221.9	14138.3	5355.9	4090.1	3286.6	429.6	60.3	27.1
1981	0.0	0.0	543.6	6598.8	19310.3	5869.6	2279.5	1387.3	120.8	19.3
1982	0.0	5.8	258.1	2830.6	11210.1	14438.3	2095.6	1002.9	761.3	223.4
1983	0.0	0.0	1159.4	1540.8	4752.1	10348.1	8781.6	718.4	201.2	209.6

year	1	2	3	4	5	6	7	8	9	10
1984	0.0	32.8	968.9	5342.9	1564.2	4923.3	3681.6	4281.2	262.9	90.1
1985	0.0	699.7	1321.9	5821.8	8536.7	1203.1	1954.7	2013.2	1474.2	129.3
1986	0.0	48.7	3147.2	4797.9	5075.6	5411.8	499.5	821.1	825.4	371.9
1987	20.8	2132.5	9130.4	7926.6	2881.9	2091.0	928.2	86.4	89.9	215.3
1988	0.0	205.7	8411.1	15521.6	6130.3	1293.9	1020.2	614.9	57.7	234.7
1989	0.0	104.0	3843.2	21726.2	9843.4	3060.7	397.0	419.2	150.4	137.1
1990	0.0	0.0	1634.6	7703.0	23502.6	6734.0	1052.3	191.8	67.2	84.2
1991	0.0	344.2	2074.3	3846.0	6678.4	12865.5	3189.8	396.5	35.7	22.0
1992	0.0	783.5	6651.7	4884.6	4273.3	4020.1	5602.0	1235.6	115.6	33.5
1993	0.0	133.6	10586.5	13101.4	3314.9	1672.3	1418.0	2166.0	329.4	45.7
1994	0.0	378.5	3563.4	28575.2	11121.5	1563.4	674.1	389.8	686.9	137.3
1995	0.0	1205.2	6068.4	6240.9	24121.2	5688.9	590.8	231.4	179.1	333.1
1996	4.2	450.1	8243.2	6350.0	4623.8	13698.6	2489.0	234.5	88.9	133.3
1997	0.0	1099.2	3560.3	10633.1	4769.1	2579.0	5230.4	778.8	63.5	72.5
1998	0.0	156.7	8410.9	5312.3	8009.7	2446.5	1555.9	1993.3	218.4	38.1
1999	28.1	838.6	1339.8	16168.3	4610.6	5178.2	989.4	655.4	542.6	72.8
2000	11.0	2192.9	5368.3	2221.1	13623.8	1997.7	1771.3	351.2	222.6	181.4
2001	0.0	2410.2	10971.7	7018.6	1476.7	6658.6	710.0	492.8	96.9	96.6
2002	48.7	1028.2	10563.7	16223.9	5103.8	1100.0	3152.5	250.2	173.4	96.3
2003	0.0	343.8	6377.2	16406.4	12713.7	2926.5	787.4	1294.9	91.9	80.9
2004	148.6	1297.7	4170.8	17725.1	19507.6	9091.8	1930.7	501.6	518.6	151.2
2005	13.2	1505.2	9816.3	7200.1	25743.6	13846.2	4748.5	831.3	232.2	223.9
2006	0.0	152.4	9568.3	21031.0	6510.8	19511.4	7888.7	2206.8	332.3	188.0
2007	2.6	607.5	3458.2	41721.3	23127.0	3444.5	10389.8	2852.1	539.7	174.1
2008	0.0	1102.0	3087.1	8577.2	52881.7	11568.5	1839.9	3151.8	817.0	203.1
2009	0.0	939.5	3109.4	4842.3	9266.3	35700.4	5890.8	722.3	1403.3	464.0
2010	0.0	148.5	6009.7	6999.0	5295.8	6725.1	17658.4	1876.9	374.5	524.6
2011	0.0	201.0	1582.0	11729.0	4955.6	2781.5	4043.7	6338.8	525.5	217.1
2012	0.0	161.1	1260.8	3476.3	13223.7	2323.1	1269.3	2565.4	2691.3	369.9

year	1	2	3	4	5	6	7	8	9	10
2013	0.0	210.8	1060.1	2881.7	4030.7	9339.4	1237.6	683.1	1260.6	1585.6
2014	0.0	142.5	1398.1	1779.3	2706.5	2880.8	4919.3	482.5	381.5	1378.9
2015	14.3	133.6	1537.6	4281.6	2376.0	2937.3	2591.2	2676.3	229.6	833.3
2016	0.0	377.4	1738.3	3527.0	4162.8	1783.3	1971.9	1466.1	1355.1	482.5
2017	0.0	319.8	3808.9	3071.5	2991.6	3195.5	1077.7	1166.8	770.4	1007.5
2018	0.0	275.4	3851.3	11032.3	2900.9	2906.1	2247.9	882.7	564.6	959.5
2019	0.0	112.0	2466.5	6508.9	13896.6	1847.0	1367.5	1407.6	553.5	1189.2
2020	0.0	210.7	3813.4	5369.2	6536.6	8396.4	827.8	618.8	556.8	746.5
2021	0.0	267.9	1073.0	9283.9	5325.1	4253.9	6377.7	521.0	316.9	585.6
2022	0.0	38.8	4213.1	2245.0	11624.5	4038.1	2300.5	2445.2	127.9	297.1

10.1.4 Catch weights

year	1	2	3	4	5	6	7	8	9	10
1980	0	0	807	1293	2099	2616	3008	3593	4924	4687
1981	0	0	1050	1157	1718	2298	3106	3333	3810	4119
1982	0	553	973	1465	1650	2295	2940	3329	3824	3998
1983	0	0	951	1501	1918	2358	2818	3391	4191	4307
1984	0	1102	926	1426	1931	2391	3077	2852	3843	3629
1985	0	938	1157	1688	2074	2608	3015	3134	3639	3976
1986	0	1090	1232	1763	2399	2719	3478	3608	4020	4239
1987	231	491	1078	1631	2358	2829	3281	3746	3976	3402
1988	0	387	824	1476	2179	2847	3511	3736	4471	4340
1989	0	796	847	1222	2009	2833	3911	3632	4668	5123
1990	0	0	776	1077	1552	2389	3362	3800	4793	4390
1991	0	645	931	1226	1649	2077	2686	3285	3610	5526
1992	0	311	987	1358	1657	2059	2511	3036	4090	4601
1993	0	594	786	1372	1894	2410	2956	3091	3454	3798
1994	0	597	732	1064	1704	2314	2721	3227	3178	3626
1995	0	592	860	1141	1357	2041	2791	3066	3633	3289

year	1	2	3	4	5	6	7	8	9	10
1996	66	483	892	1280	1593	1878	2694	3742	3533	3958
1997	0	530	800	1177	1659	1959	2366	3072	3173	4076
1998	0	575	682	1168	1680	2240	2531	2875	3361	3806
1999	281	646	945	1120	1670	2213	2639	2871	3234	3805
2000	229	550	1013	1333	1489	2103	2641	3285	3592	3676
2001	0	562	944	1440	1726	1822	2249	2867	3136	4515
2002	315	601	921	1261	1708	2188	2189	2761	3219	3989
2003	0	544	929	1273	1679	2269	2672	2604	2829	3287
2004	111	580	992	1236	1571	2029	2746	3199	2957	4040
2005	126	431	875	1253	1489	1896	2266	2971	3119	2808
2006	0	485	744	1084	1472	1739	2150	2531	3083	3327
2007	240	545	752	972	1322	1800	2019	2337	2603	2876
2008	0	517	726	897	1136	1577	2123	2365	2684	2474
2009	0	493	828	955	1104	1336	1731	2259	2473	3019
2010	0	399	767	1081	1267	1436	1664	2144	2314	2564
2011	0	660	941	1126	1440	1683	1905	2070	2550	2939
2012	0	682	974	1193	1463	1896	2112	2317	2645	2727
2013	0	699	1049	1352	1656	2011	2388	2572	3042	3102
2014	0	691	1085	1398	1775	2091	2462	2568	3145	3195
2015	377	711	1083	1489	1997	2319	2787	3297	3155	3978
2016	0	599	1052	1552	1989	2556	2916	3536	3565	3661
2017	0	799	965	1615	1975	2477	2967	3496	3767	3903
2018	0	750	1111	1411	2024	2561	2946	3364	3605	3913
2019	0	931	1018	1454	1805	2787	3055	3234	3844	3877
2020	0	1163	1035	1482	2042	2363	2964	3381	3649	3721
2021	0	696	1009	1406	1817	2431	2795	3435	3981	4006
2022	0	567	1057	1659	1967	2541	3190	3412	3512	4149

10.1.5 Stock weights

year	1	2	3	4	5	6	7	8	9	10
1980	37	185	481	910	1409	1968	2496	3077	3300	4000
1981	37	185	481	910	1409	1968	2496	3077	3300	4000
1982	37	185	481	910	1409	1968	2496	3077	3300	4000
1983	37	185	481	910	1409	1968	2496	3077	3300	4000
1984	37	185	481	910	1409	1968	2496	3077	3300	4000
1985	35	242	580	1184	1675	2380	2804	3247	3356	3818
1986	35	238	677	1172	1999	2424	3301	3382	3802	3818
1987	34	165	527	1196	1736	2560	3031	3427	3890	4192
1988	36	183	463	993	1828	2636	3137	3399	3436	4510
1989	26	182	426	879	1513	2357	3067	3347	3417	3945
1990	29	185	455	827	1229	1972	2751	3055	3141	4000
1991	31	176	484	1018	1404	1889	2504	3391	4506	5458
1992	30	157	493	904	1348	1870	2345	2949	4236	7333
1993	37	168	380	884	1482	1729	2584	2627	3428	4000
1994	33	179	409	706	1262	1698	1936	2406	2095	1181
1995	40	169	454	755	1085	1849	2621	4000	1389	4000
1996	37	175	445	819	1070	1462	2204	2825	3746	2361
1997	53	173	418	829	1263	1423	1927	2453	3830	4341
1998	39	197	394	746	1225	1687	1901	2447	2837	4000
1999	33	201	470	696	1174	1955	2409	2637	3047	2826
2000	29	178	549	870	1142	1694	2551	2839	3624	3293
2001	36	183	473	1027	1399	1483	2056	2744	4000	4018
2002	61	175	470	885	1485	1962	1987	2135	5020	5068
2003	40	232	419	809	1269	1878	3099	2309	3333	4458
2004	35	177	554	816	1285	1736	2500	2532	2749	4000
2005	39	153	450	913	1184	1581	2118	2840	2328	3609
2006	33	131	335	739	1127	1518	1968	2240	3264	3273
2007	47	170	342	610	1063	1516	1808	2085	2113	3638

year	1	2	3	4	5	6	7	8	9	10
2008	27	178	374	605	873	1300	1839	2246	2622	2315
2009	32	133	429	681	881	1134	1484	1912	2515	2178
2010	32	150	386	763	927	1173	1454	1764	2075	2701
2011	34	171	435	744	1122	1303	1555	1848	2106	2910
2012	28	197	475	802	1144	1514	1886	2104	2254	2230
2013	32	206	582	943	1260	1641	1893	2184	2664	2632
2014	37	228	585	1012	1361	1764	2166	2367	2679	3106
2015	33	256	623	1084	1601	1938	2442	2760	3198	3132
2016	29	160	653	1114	1578	2109	2287	3053	3387	3310
2017	34	200	462	1251	1626	2141	2709	3128	3593	3464
2018	30	193	545	927	1829	2332	2625	2920	3103	3523
2019	29	168	514	967	1353	2384	2801	3015	3421	3543
2020	29	209	473	951	1519	2040	3155	2967	3260	4380
2021	28	163	567	935	1444	2116	2594	3501	3618	3871
2022	35	155	451	1052	1460	2071	2727	3129	3211	2975

10.1.6 Maturity

year	1	2	3	4	5	6	7	8	9	10
1980	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000
1981	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000
1982	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000
1983	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000
1984	0.000	0.080	0.301	0.539	0.722	0.821	0.868	0.904	0.963	1.000
1985	0.000	0.023	0.162	0.555	0.589	0.732	0.775	0.945	0.939	0.987
1986	0.000	0.017	0.183	0.401	0.658	0.825	0.883	0.955	0.982	0.998
1987	0.000	0.013	0.115	0.439	0.587	0.862	0.898	1.000	0.988	0.965
1988	0.000	0.014	0.194	0.376	0.760	0.765	0.935	0.894	1.000	0.935
1989	0.000	0.038	0.215	0.525	0.722	0.809	1.000	1.000	1.000	1.000
1990	0.000	0.115	0.327	0.624	0.816	0.844	0.914	0.911	1.000	1.000

year	1	2	3	4	5	6	7	8	9	10
1991	0.000	0.068	0.231	0.587	0.744	0.824	0.901	0.397	1.000	1.000
1992	0.000	0.051	0.222	0.414	0.804	0.904	0.900	0.845	1.000	1.000
1993	0.000	0.129	0.358	0.474	0.652	0.895	0.971	0.913	0.874	1.000
1994	0.037	0.251	0.332	0.602	0.786	0.855	1.000	0.880	1.000	1.000
1995	0.000	0.135	0.444	0.377	0.772	0.780	0.666	0.904	1.000	1.000
1996	0.000	0.169	0.357	0.589	0.646	0.787	0.746	0.945	0.840	1.000
1997	0.132	0.089	0.434	0.579	0.674	0.760	0.788	0.881	1.000	1.000
1998	0.001	0.031	0.486	0.684	0.787	0.756	0.849	0.905	1.000	1.000
1999	0.000	0.044	0.387	0.678	0.722	0.774	0.901	0.801	0.920	1.000
2000	0.011	0.105	0.247	0.630	0.811	0.881	0.876	1.000	0.817	0.950
2001	0.003	0.098	0.369	0.534	0.768	0.905	0.927	0.868	0.963	1.000
2002	0.000	0.047	0.280	0.635	0.809	0.937	0.937	1.000	1.000	1.000
2003	0.063	0.055	0.345	0.692	0.878	0.933	0.945	0.984	1.000	1.000
2004	0.000	0.038	0.363	0.575	0.836	0.923	1.000	1.000	1.000	1.000
2005	0.000	0.023	0.221	0.558	0.745	0.922	0.942	0.967	1.000	1.000
2006	0.031	0.029	0.122	0.470	0.633	0.749	0.926	1.000	1.000	1.000
2007	0.000	0.075	0.203	0.423	0.694	0.774	0.891	0.971	1.000	1.000
2008	0.001	0.027	0.272	0.427	0.642	0.840	0.892	0.912	0.961	1.000
2009	0.001	0.018	0.315	0.481	0.597	0.860	0.905	1.000	0.972	1.000
2010	0.011	0.034	0.175	0.637	0.797	0.815	0.901	0.936	1.000	0.964
2011	0.001	0.049	0.176	0.431	0.826	0.825	0.850	0.904	0.979	1.000
2012	0.001	0.108	0.162	0.444	0.630	0.818	0.906	0.859	0.911	1.000
2013	0.001	0.053	0.263	0.417	0.725	0.809	0.929	0.988	0.976	0.993
2014	0.002	0.105	0.200	0.389	0.571	0.691	0.763	0.934	0.922	0.893
2015	0.000	0.134	0.282	0.438	0.669	0.799	0.790	0.903	1.000	0.871
2016	0.002	0.013	0.370	0.493	0.609	0.795	0.802	0.894	0.907	1.000
2017	0.001	0.076	0.129	0.593	0.666	0.751	0.918	0.947	1.000	0.985
2018	0.001	0.039	0.236	0.393	0.823	0.866	0.897	0.885	0.974	1.000
2019	0.011	0.035	0.333	0.591	0.672	0.891	0.944	0.969	1.000	0.881

year	1	2	3	4	5	6	7	8	9	10
2020	0.002	0.022	0.190	0.665	0.739	0.711	0.915	0.964	1.000	1.000
2021	0.003	0.017	0.214	0.423	0.807	0.782	0.809	1.000	1.000	1.000
2022	0.002	0.015	0.216	0.414	0.599	0.795	0.866	0.890	0.688	1.000

10.1.7 Landings

Year	Belgium	Faroe Islands	Iceland	Norway	United King-dom	Ger-many	Russia	Green-land	Den-mark	Lithua-nia
1979	1010	2161	56150	11	0	0	0	0	0	0
1980	1144	2029	50674	23	0	0	0	0	0	0
1981	673	1839	64599	15	0	0	0	0	0	0
1982	377	1982	66998	28	0	0	0	0	0	0
1983	268	1783	63815	3	0	0	0	0	0	0
1984	359	707	47167	3	0	0	0	0	0	0
1985	391	987	49573	0	2	0	0	0	0	0
1986	257	1289	47335	0	0	0	0	0	0	0
1987	238	1043	39751	1	0	0	0	0	0	0
1988	352	797	52999	0	0	0	0	0	0	0
1989	483	606	61715	0	0	0	0	0	0	0
1990	595	603	65919	0	0	0	0	0	0	0
1991	485	733	53497	0	0	0	0	0	0	0
1992	361	757	46119	0	0	0	0	0	0	0
1993	458	758	47075	0	0	6	606	0	0	0
1994	271	915	58697	13	173	1046	492	2	0	0
1995	0	968	60499	0	57	0	2	0	0	0
1996	0	764	56438	4	0	0	17	0	0	0
1997	0	340	43824	0	0	0	0	0	0	0
1998	0	513	41015	0	0	0	0	0	0	0
1999	0	885	44708	18	0	0	0	0	0	0
2000	0	5	41391	4	1	0	0	0	0	0
2001	0	690	39474	56	0	0	0	0	0	0

Year	Belgium	Faroe Islands	Iceland	Norway	United King-dom	Ger-many	Russia	Green-land	Den-mark	Lithua-nia
2002	0	847	49669	8	0	0	0	0	0	0
2003	0	968	60017	1	51	0	0	0	0	0
2004	0	1125	83809	1	0	0	0	0	0	0
2005	0	1515	95882	3	44	0	0	0	0	0
2006	0	1588	96133	4	0	0	0	0	0	0
2007	0	1686	108182	11	0	0	0	2	0	0
2008	0	1197	101680	11	0	0	0	0	0	0
2009	0	824	81439	5	0	0	0	0	0	0
2010	0	360	63869	8	0	0	0	0	0	0
2011	0	214	49232	3	0	0	0	0	0	0
2012	0	325	45711	13	0	0	0	0	0	0
2013	0	654	43370	23	0	0	0	0	0	0
2014	0	876	33048	11	0	0	0	0	0	0
2015	0	1257	38393	15	0	0	0	0	0	0
2016	0	1444	36648	8	0	0	0	0	0	0
2017	0	1355	35695	11	0	0	0	0	0	0
2018	0	1172	47677	15	0	0	0	0	0	0
2019	0	969	57075	1	0	0	0	0	0	0
2020	0	1248	53528	6	0	0	0	0	0	0
2021	0	1696	55885	20	0	0	0	0	0	0
2022	0	2009	56747	12	0	0	0	2	0	0

10.1.8 Number of boats by gear

Year	Nr. Long Line	Nr. Danish Seine	Nr. Bot-tom Trawl	Long Line	Other	Danish Seine	Bottom Trawl	Total catch
1992	844	92	308	8458	5577	1379	30705	46119
1993	808	143	374	8121	5159	1787	32008	47075
1994	842	154	322	8597	4370	3431	42299	58697
1995	743	139	269	8115	3224	4321	44839	60499

Year	Nr. Long Line	Nr. Danish Seine	Nr. Bottom Trawl	Long Line	Other	Danish Seine	Bottom Trawl	Total catch
1996	625	150	228	7601	2895	5563	40380	56439
1997	474	155	211	7596	2543	5343	28342	43824
1998	469	139	199	9918	2477	3692	24928	41015
1999	492	129	187	13569	2064	2780	26294	44707
2000	479	118	165	13091	1881	3105	23315	41392
2001	451	92	146	11987	2372	3049	22065	39473
2002	419	91	144	13639	2043	3602	30385	49669
2003	435	96	136	17285	1685	4806	36240	60016
2004	449	95	131	23198	1793	8096	50722	83809
2005	449	91	126	30767	1577	10493	53046	95883
2006	436	93	117	36237	1218	12709	45969	96133
2007	407	94	109	37199	1081	12869	57033	108182
2008	362	91	102	33051	944	16457	51228	101680
2009	335	81	98	26571	608	15182	39078	81439
2010	279	67	94	23916	475	10138	29341	63870
2011	278	54	95	21175	473	6866	20718	49232
2012	289	56	98	18722	473	6048	20469	45712
2013	281	65	95	19188	398	4955	18829	43370
2014	282	47	84	15505	329	3776	13438	33048
2015	256	50	83	16369	360	4327	17337	38393
2016	236	53	82	14826	321	4456	17045	36648
2017	209	53	80	14358	343	4539	16456	35696
2018	193	58	71	15117	336	5585	26639	47677
2019	182	43	69	14588	302	6237	35947	57074
2020	148	42	73	16165	278	5079	32005	53527
2021	140	46	82	14323	264	5338	35961	55886
2022	113	57	77	13576	243	3917	39011	56747

10.9 Assessment results

Year	Recruitment	Low Recruitment	High Recruitment	Catches	SSB	Low SSB	High SSB	HR	High HR	Low HR	B45+	Low B45+	High B45+
1979	83168	72890	92814	59326.7	74592.6	70260.08	78685.82	0.631	0.679	0.581	99531.5	92617.75	106640.05
1980	39694	35179	45426	53870.4	92031.2	87033.54	97386.80	0.408	0.445	0.368	133368.0	125180.20	141608.30
1981	10579	8950	12134	67125.9	108184.0	102035.25	115382.55	0.394	0.422	0.359	167087.0	157056.20	178344.10
1982	45963	40934	51326	69377.8	100781.0	95450.43	107770.85	0.441	0.472	0.404	156353.0	147701.95	167499.80
1983	34049	30301	38678	65869.0	79234.8	75219.15	85631.28	0.506	0.540	0.472	116397.0	109836.95	126247.70
1984	17973	15931	20312	48236.0	60729.5	57457.35	65271.71	0.501	0.540	0.466	90202.9	85380.43	96716.94
1985	46878	41852	52099	50952.9	49711.9	46903.42	53413.87	0.546	0.585	0.509	92167.6	86527.11	98887.16
1986	94001	85971	102327	48862.2	40934.8	38271.02	44169.14	0.647	0.689	0.605	78604.5	74250.99	83865.24
1987	162210	149381	176850	40983.1	35168.9	32931.22	37883.81	0.548	0.603	0.503	67014.3	62960.11	72268.18
1988	41589	37144	45718	54126.2	53206.3	50407.07	56448.53	0.589	0.636	0.541	94058.7	88513.84	100781.35
1989	23711	20972	26899	62732.3	81268.5	76891.48	86354.39	0.514	0.557	0.466	130469.0	123486.50	139084.45
1990	25775	23275	29511	67075.4	85581.0	80299.34	91450.26	0.546	0.589	0.509	121849.0	114127.45	130569.40
1991	87468	80041	97746	54715.1	67152.6	62209.89	71672.94	0.523	0.562	0.486	107129.0	99192.06	115008.50
1992	163142	149599	176989	47199.0	49219.7	45944.27	52768.07	0.672	0.721	0.624	72487.1	67114.91	77697.45
1993	37205	33870	41048	48893.5	56527.9	53904.30	60162.75	0.693	0.749	0.638	71101.7	66977.21	76744.34
1994	35361	32005	39133	61608.5	72078.3	67956.70	76774.93	0.738	0.805	0.683	80694.8	76134.48	86876.74
1995	65646	60517	71827	61510.4	68335.0	64023.66	72425.08	0.607	0.651	0.564	99113.9	92225.38	105975.50
1996	31367	28822	34425	57222.9	53650.5	50474.17	56721.18	0.743	0.795	0.698	77470.8	72205.33	82461.68

Year	Recruitment	Low Recruitment	High Recruitment	Catches	SSB	Low SSB	High SSB	HR	High HR	Low HR	B45+	Low B45+	High B45+
1997	92426	86849	100447	44141.2	46671.1	44265.38	48993.97	0.655	0.704	0.612	67405.0	63382.41	71317.56
1998	17562	16024	19525	41502.0	51065.6	48576.49	53908.69	0.724	0.773	0.669	57037.1	53549.86	60950.53
1999	50056	45702	54745	45603.1	48357.9	45759.79	51198.98	0.757	0.820	0.708	58905.8	55381.53	62915.71
2000	118309	109421	128176	41390.5	47499.3	44878.35	50685.93	0.682	0.740	0.632	64894.2	60778.58	69417.49
2001	153476	142475	167985	40220.5	55392.4	52636.44	58669.46	0.586	0.645	0.536	65198.0	61530.40	69800.24
2002	198978	184577	217331	50508.1	81469.3	77495.41	86231.41	0.500	0.551	0.455	96064.7	90892.98	102098.70
2003	46543	42205	50892	61036.2	128093.0	121072.90	135192.15	0.476	0.521	0.435	131483.0	124274.85	139696.90
2004	145677	133502	157576	84824.3	154515.0	146127.90	163998.45	0.456	0.491	0.415	202401.0	191042.75	214264.20
2005	381696	359874	408445	97442.7	140338.0	132786.45	149195.05	0.505	0.548	0.465	194797.0	183708.65	208251.30
2006	86662	79987	94499	97721.9	112691.0	106622.95	120000.45	0.616	0.655	0.565	157588.0	148225.65	168205.85
2007	40373	36970	44040	109826.0	129714.0	124091.50	137524.45	0.685	0.735	0.630	152315.0	144896.30	162499.10
2008	39760	36624	44157	102888.0	129670.0	123947.70	137660.10	0.568	0.612	0.526	170179.0	161777.80	180912.75
2009	117457	109799	127100	82268.2	114051.0	108304.45	121767.65	0.553	0.592	0.514	151001.0	142456.15	160590.70
2010	43745	40103	47365	64237.3	89646.6	85099.64	96020.60	0.579	0.618	0.535	115497.0	109455.65	124601.15
2011	36238	33574	39472	49440.0	77616.0	73989.91	82865.48	0.474	0.512	0.438	105694.0	100529.55	113125.25
2012	25162	23419	27479	46031.7	76409.4	72843.13	81330.73	0.389	0.419	0.358	116243.0	110653.65	123555.95
2013	42491	39002	46160	43986.9	82686.8	78990.77	88428.09	0.359	0.390	0.328	119803.0	114587.20	128079.90
2014	28859	26307	31238	33648.6	69158.6	65792.04	73818.64	0.289	0.313	0.261	112538.0	107179.80	119686.80
2015	21050	19526	23254	39515.2	79305.4	75459.61	84378.43	0.318	0.345	0.288	121811.0	116215.85	129166.25

Year	Recruitment	Low Recruitment	High Recruitment	Catches	SSB	Low SSB	High SSB	HR	High HR	Low HR	B45+	Low B45+	High B45+
2016	118301	109996	129040	38089.9	72720.4	69127.15	77726.45	0.338	0.367	0.309	113526.0	108300.55	121018.45
2017	54206	49661	59243	36459.0	72025.1	68259.51	77054.01	0.354	0.386	0.324	101803.0	96833.04	108426.40
2018	46866	42852	51475	48490.6	79419.9	75471.29	84308.03	0.381	0.418	0.352	127732.0	121514.65	135725.80
2019	98232	87021	109896	57580.2	90937.5	86240.08	97165.80	0.427	0.461	0.388	134893.0	127553.50	143823.85
2020	19039	16598	21970	54473.0	91542.6	86510.00	99058.00	0.397	0.432	0.356	136735.0	128889.30	147653.10
2021	161495	137448	194175	57321.8	91525.1	84699.27	100475.80	0.381	0.423	0.342	149809.0	139517.05	162964.40
2022	148090	116953	186447	58558.7	92721.9	83992.38	104918.80	0.400	0.454	0.350	140583.0	128043.55	156365.90
2023	106012	77437	149577	NA	113562.0	102879.55	134776.70	NA	NA	NA	172195.0	151371.40	194693.95

10.10 Short term projections

10.1.9 Input data for the prognosis

Age	Catch At Age	Stock Maturity	Catch Weights	Stock Weights	Numbers At Age	Selection
1	0.000	0.000	169.193	30.3078	68718.10	0.000
2	228.867	0.018	495.164	163.3710	45316.80	0.009
3	4089.270	0.154	947.366	452.0690	86279.70	0.080
4	14160.200	0.430	1423.170	855.9890	93338.30	0.270
5	16641.300	0.703	1973.820	1429.9200	69291.80	0.543
6	1371.050	0.850	2531.650	2112.9500	4543.90	0.743
7	4431.740	0.895	2844.730	2537.0500	13118.60	0.814
8	1036.130	0.916	3054.550	2836.7000	2971.83	0.849
9	541.826	0.947	3525.800	3552.7400	1537.56	0.904
10	735.095	0.949	3550.360	3591.6500	2026.03	0.906

10.1.10 Prognosis

Year	Calendar Year Catch	Fishing Year Catch	SSB	B45+	HR	Recruitment (age 2)
2023	69185	76415	113562	172195	0.402	106012.0
2024	80750	89420	140576	218287	0.370	45316.8
2025	87941	84983	164533	255447	0.344	56261.6
2026	81805	75449	164554	242826	0.337	56261.6

Section contents