HADDOCK – ÝSA
Melanogrammus aeglefinus

GENERAL INFORMATION

Icelandic haddock (*Melanogrammus aeglefinus*) is 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 tons in 2016). The nearest area to the Icelandic where haddock is 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 nonexistent, 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, but it is unlikely to be as diverse as observed for cod.

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 (50-200 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.

THE FISHERY

The fishery for haddock in division 5.a has not changed substantially in recent years. Around 250 longliners annually report catches of haddock, around 60 trawlers and 40 demersal seine boats. Most of haddock in division 5.a is caught by trawlers and the proportion caught by that gear has decreased since 1995 from around 70% and is currently around 45%. At the same time the proportion caught by longlines has increased from around 15% in 1995 - 2000 to 40 % in 2011–2018. Catches in demersal seine have varied less and have been at around 15% of Icelandic catches of haddock in division 5.a. Currently less than 2% of catches are taken by other vessel types, but historically up to 10 % of total catches were by gillnetters, but since 2000 these catches have been low. (Table 2 and Figure 3). Most of the haddock caught in 5.a by Icelandic vessels is caught at depths less than 200 m (Figure 2). The main fishing grounds for haddock in division 5.a, as observed from logbooks, are in the south, southwestern and western part of the Icelandic shelf (Figure 2 and Figure 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.

LANDING TRENDS

Landings of Icelandic haddock in 2018 are estimated to have been 49.91 thousand tonnes, see Figure 1 and Table 1. 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 2209 tonnes, while Norwegian vessels land considerably less haddock.

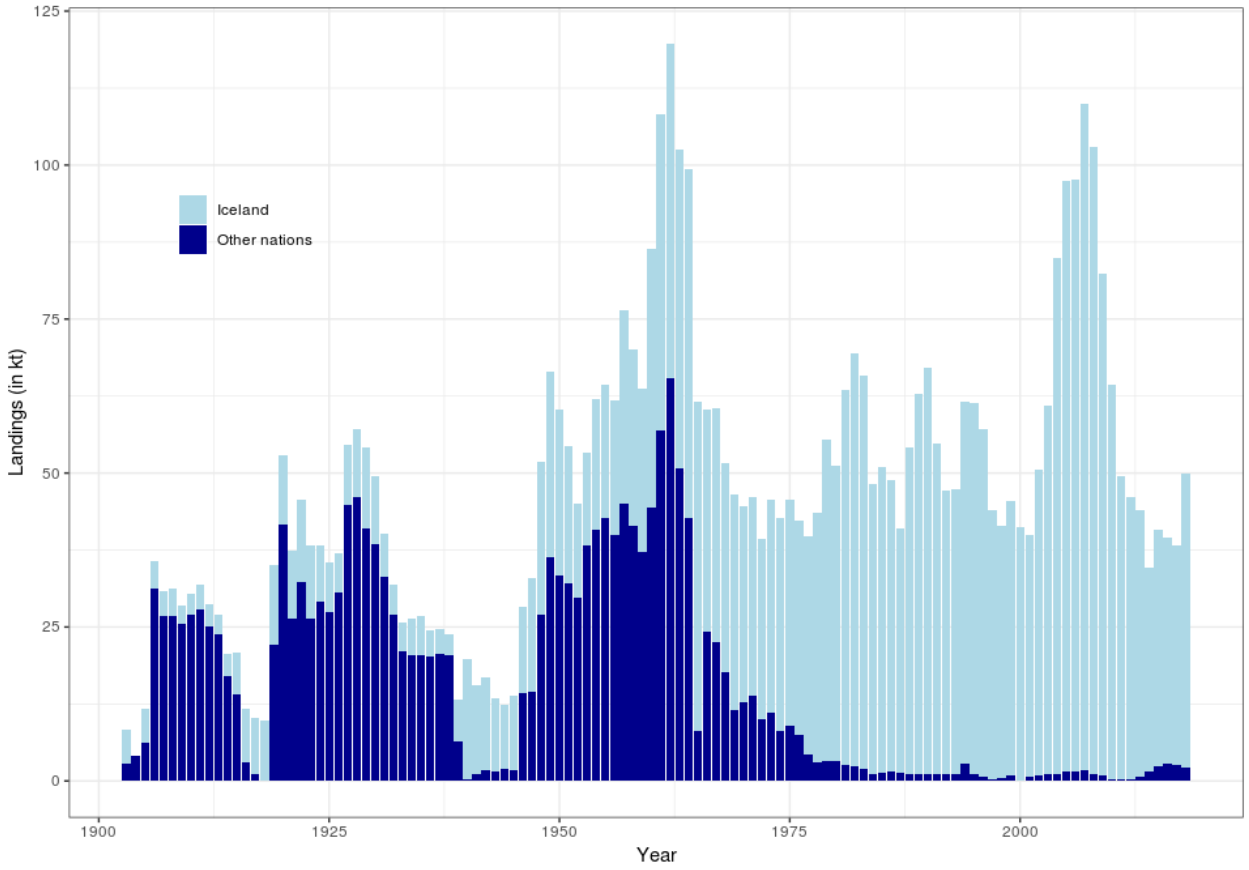

Figure 1. Haddock in division 5.a. (Iceland). Recorded landings 1905–2018

Mynd 1. Ýsa á Íslandsmiðum. Skráður afli árin 1905–2018.

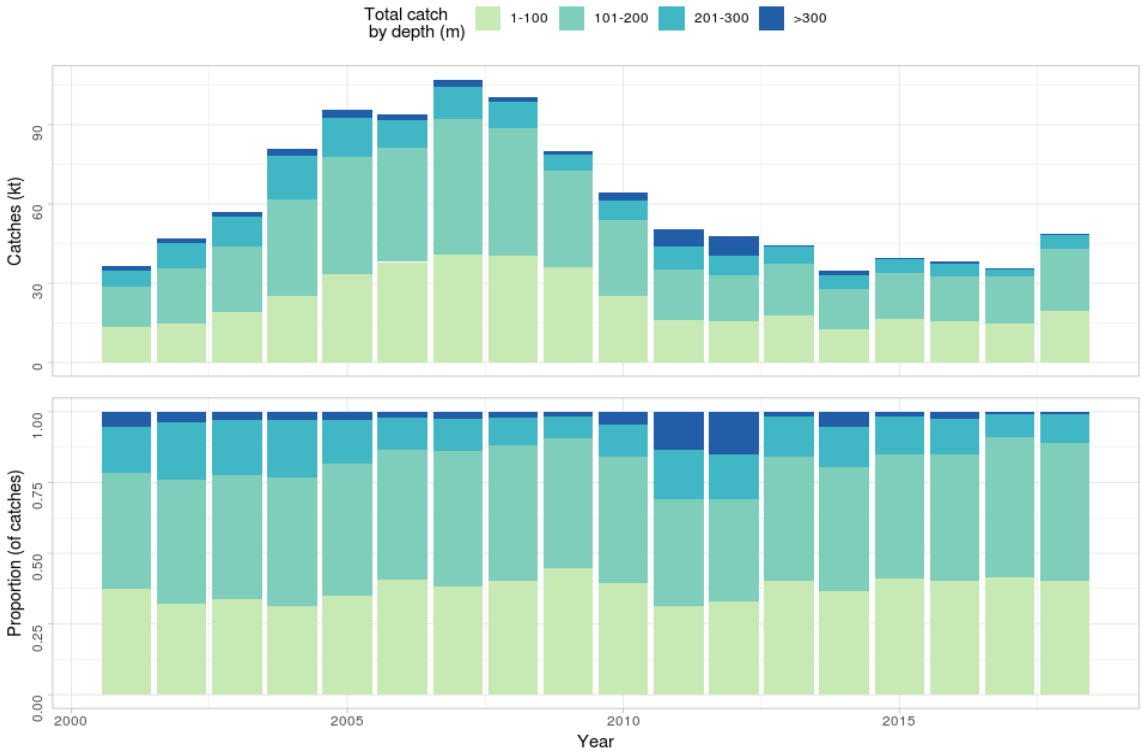

Figure 2. Haddock in division 5.a. Depth distribution of catches from bottom trawls, longlines, trawls and demersal seine according to Icelandic logbooks.

Mynd 2. Ýsa á Íslandsmiðum. Afli eftir dýpi samkvæmt afladagbókum.

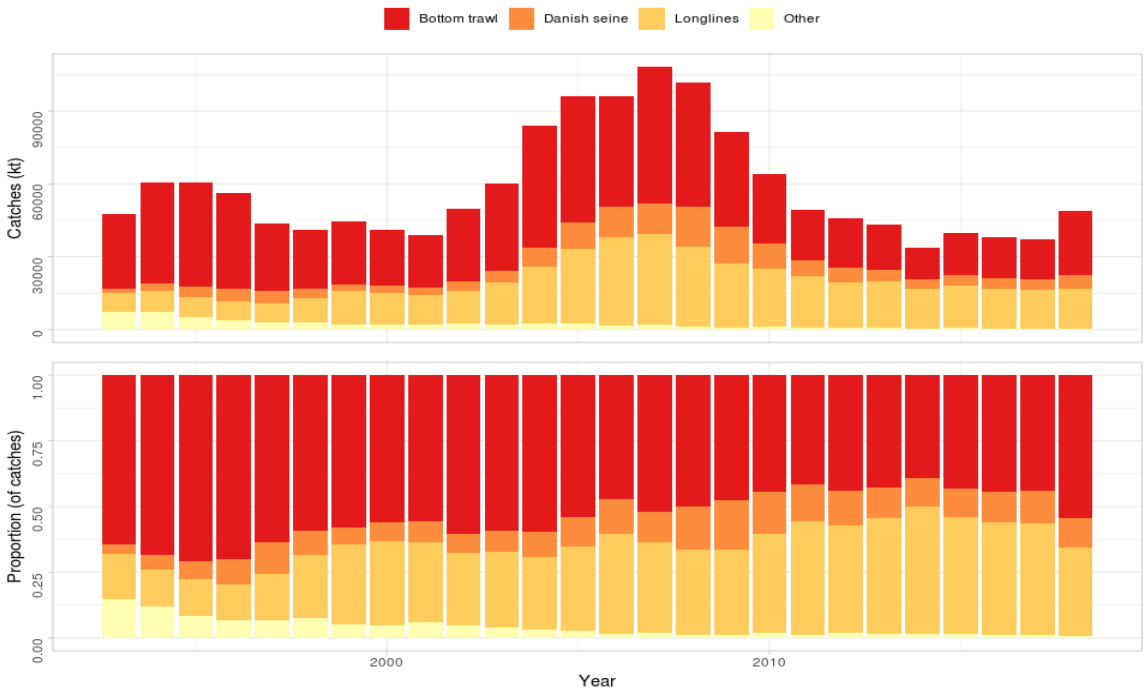

Figure 3. Haddock in division 5.a. Total catch (landings) by fishing gear since 1994, according to statistics from the Directorate of Fisheries.

Mynd 3. Ýsa á Íslandsmiðum. Landaður afli eftir veiðarfærum frá 1994, samkvæmt aflaskráningarkerfi Fiskistofu.

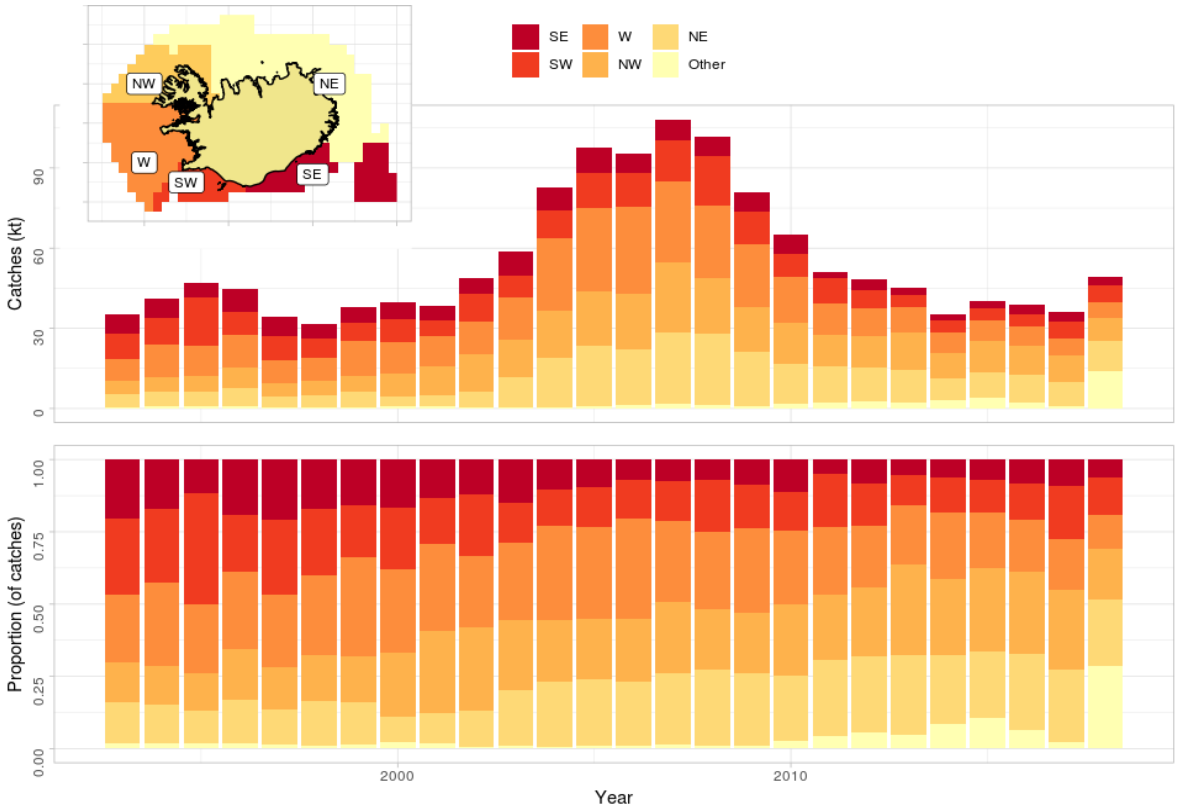

Figure 4. Haddock in division 5.a. Spatial distribution of the Icelandic fishery by fishing area since 1993 according to logbooks. All gears combined.

Mynd 4. Ýsa á Íslandsmiðum. **Útbreiðsla veiða á íslensku veiðisvæði frá árinu 1993 samkvæmt aflaskýrslum. Öll veiðarfæri samanlagt.**

Figure 5: Haddock in division 5.a. Geographical distribution of the Icelandic haddock fisheries from all gears since 1999. Reported catch from logbooks.

Mynd 5. Ýsa á Íslandsmiðum. Útbreiðsla veiða frá öllum veiðarfærum síðan 1999, samkvæmt afladagbókum.

MANAGAMENT

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 division 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 11). 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 division 5.a. There are agreements between Iceland, Norway and the Faroe Islands relating to a fishery of vessels in restricted areas within the Icelandic EEZ. Faroese vessels are allowed to fish 5600 t of demersal fish species in Icelandic waters which includes maximum 1200 tonnes of cod and 40 t of Atlantic halibut.

The effect of these species transformations and quota transfers is illustrated in Figure 6. 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 because haddock is easy to catch, as demonstrated by high CPUE in 2018. 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 7 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 fishing year the government of Iceland increased TAC mid-season.

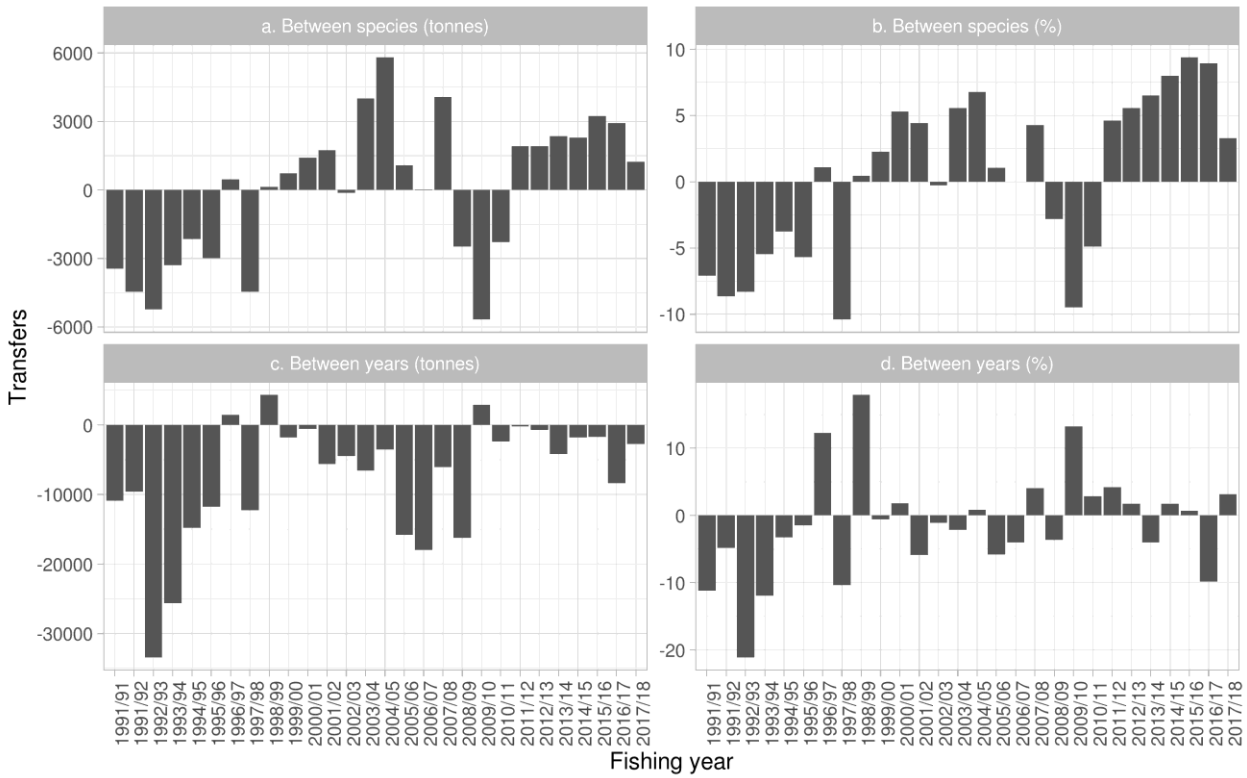

Figure 6. Haddock in division 5.a. Net transfers of quota to and from haddock in the Icelandic ITQ system by quota year. Between species (upper): Positive values indicate a transfer of other species to haddock, but negative values indicate a transfer of haddock quota to other species. Between years (lower): Net transfer of quota for a given fishing year.

Mynd 6. Ýsa á Íslandsmiðum. Nettó tilfærsla á kvóta eftir fiskveiðiárum. Tilfærsla milli tegunda (efri myndir): Jákvæð gildi tákna tilfærslu á kvóta annarra tegunda yfir á ýsu en neikvæð gildi tilfærslu ýsukvóta á aðrar tegundir. Tilfærsla milli ára (neðri myndir): Nettó tilfærsla kvóta á viðkomandi fiskveiðiári

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 distribution of catches. Similarly, sampling does seem to follow the temporal distribution of catches (see MRI 2012). The sampling coverage by gear in 2018 is shown in Figure 8.

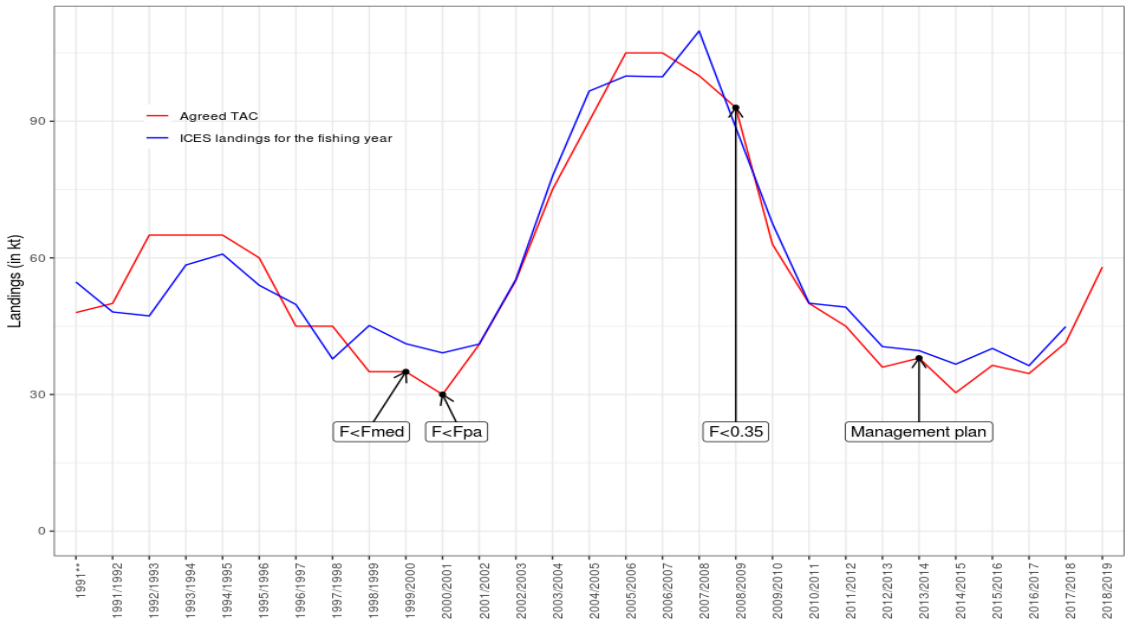

Figure 7. Haddock in 5a. Comparison of the realized catches and the set TAC for the fishing operations in Icelandic waters.

Mynd 7. Ýsa á Íslandsmiðum. Samanburður á heildarafla og aflamarks í íslenskri lögsögu.

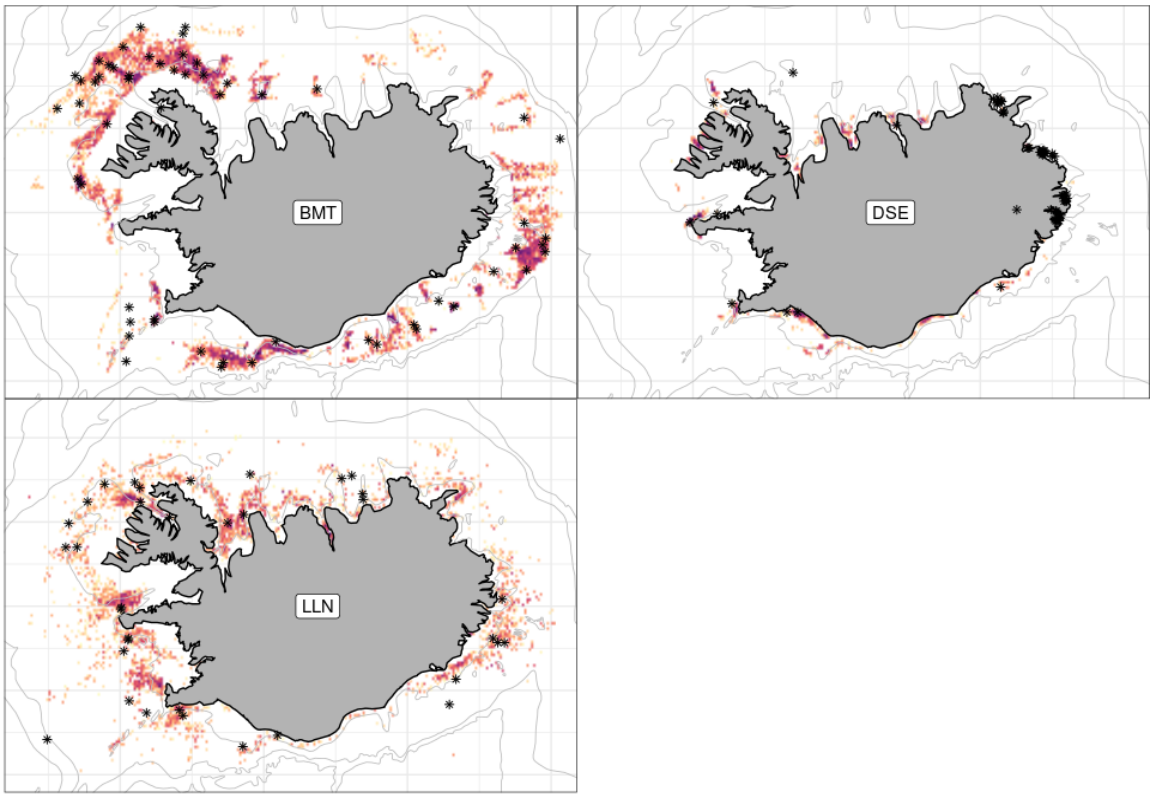

Figure 8. Haddock in division 5.a. Fishing grounds in 2018 as reported in logbooks (tiles) and positions of samples taken from landings (asterisks) by main gear types (Bottom trawl, demersal seine and longlines).

Mynd 8. Ýsa á Íslandsmiðum. Veiðislóð árið 2018 samkvæmt afladagbókum (reitir) og staðsetning sýna (stjörnur) skipt eftir helstu veiðarfærum (Botnvarpu, dragnót og línu).

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 are estimated very low in recent years (<3% in either numbers or weight, see @MFRIdiscards2016 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/.

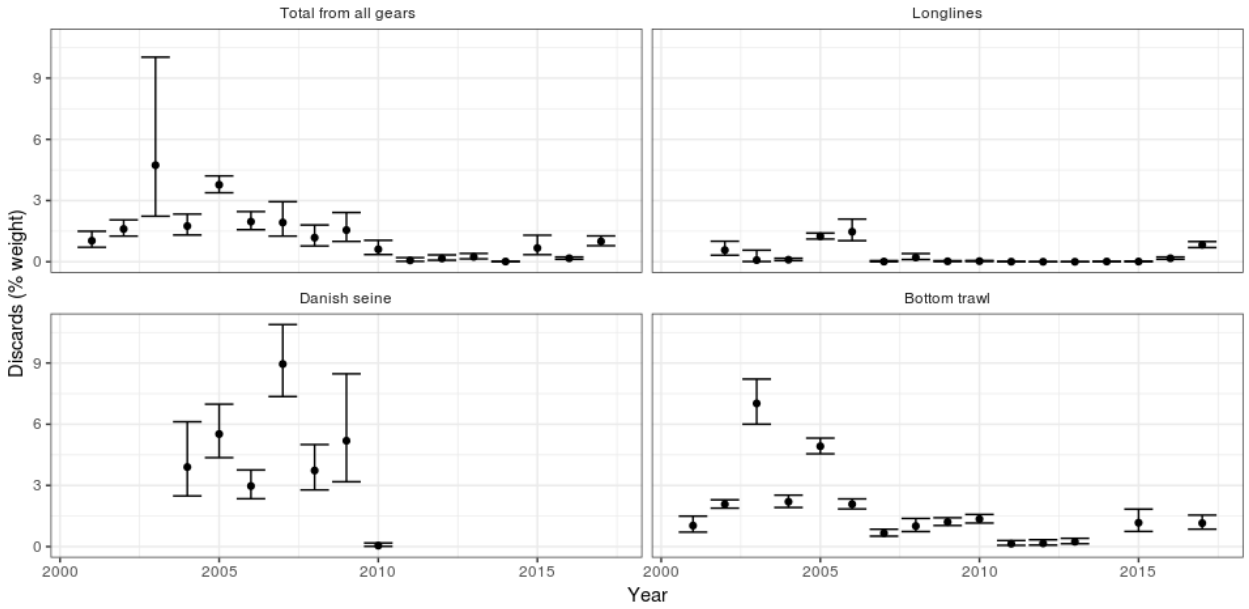

Figure 9. Haddock in 5a. Estimates of annual discards by gear. Vertical lines indicate the 95 % confidence interval while dots the point estimates.

Mynd 9. Ýsa á Íslandsmiðum. Mat á brottkasti eftir veiðarfærum. Lóðréttar línur gefa til kynna 95 % öryggisbil og punktar punktmat.

LENGTH COMPOSITIONS

An overview of available length measurements from 5.a is given in Table 3. The bulk of the 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. The sizes caught by the main gear types (bottom trawl and long lines) 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.

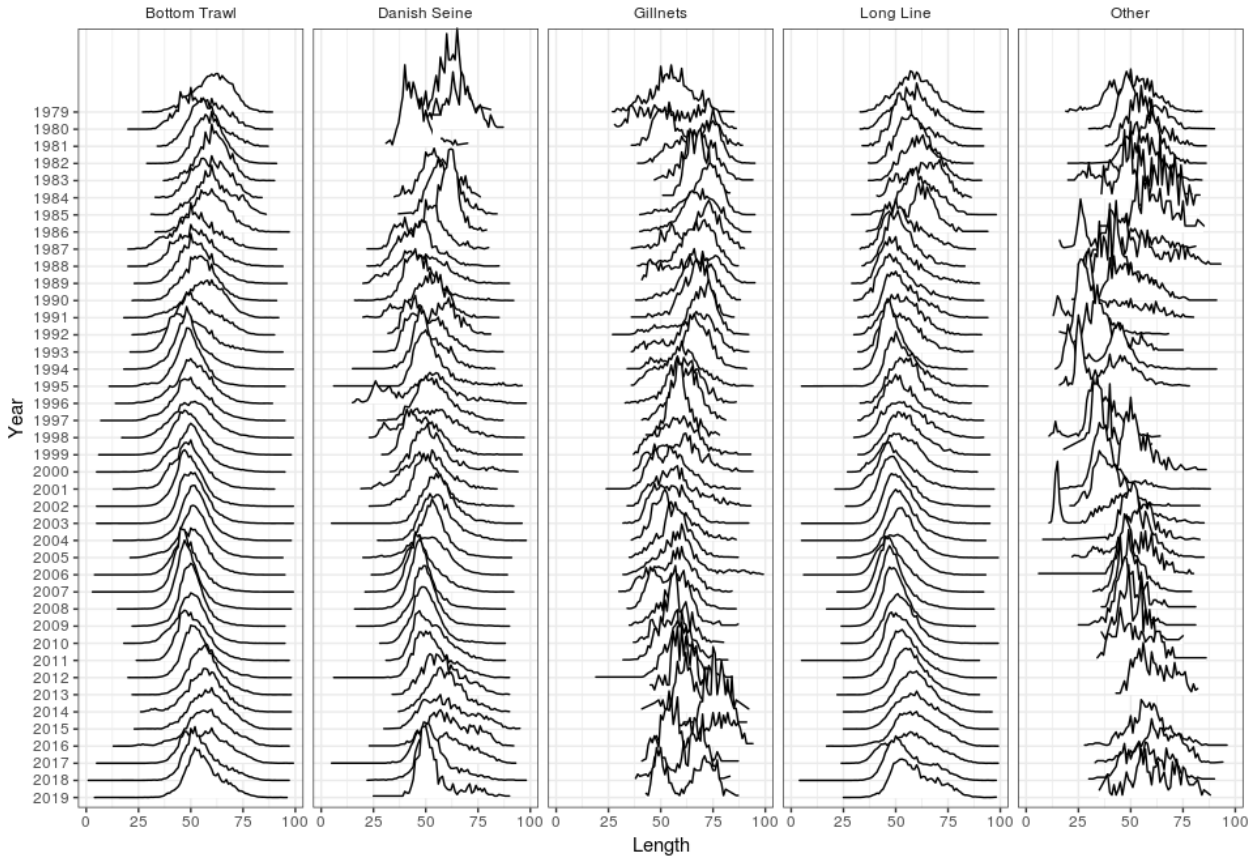

Figure 10. Haddock in 5a. Commercial length distributions by gear and year.

Mynd 10. Ýsa á Íslandsmiðum. Lengdardreifing úr afla eftir helstu veiðarfærum og árum.

AGE COMPOSITIONS

Table 4 gives an overview of otolith sampling intensity by gear types in 5.a. Catch in numbers-at-age is shown in Table 5 and Figure 11. The catches in 2018 mainly composed of relatively small year classes as the last above average year class, the 2008 year class, accounted for roughly 3 % of the total catches. Older year classes contributed around 4% of total catches. So roughly 90 % of the catch is from the small year classes 2008–2015, with the 2014 year class being the largest component (appr. 36.4 %). The number of year classes contributing to the catches is unusually many; the result of low fishing mortality in recent years and the last large year class is 10 years old.

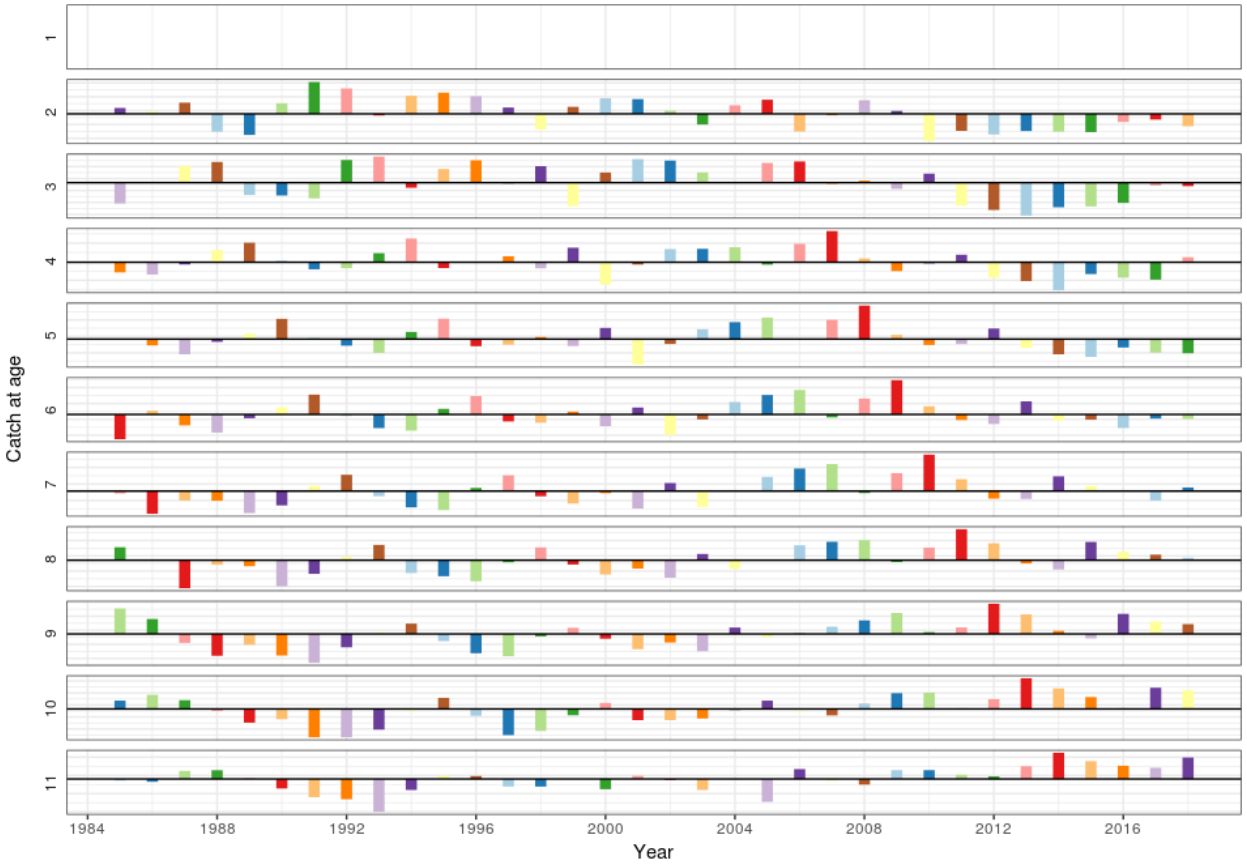

Figure 11. Haddock in division 5.a. Catch at age from the commercial fishery in Iceland waters. Bar size is indicative of the deviations from the mean catch in numbers and bars are colored by cohort.

Mynd 11. Ýsa á Íslandsmiðum. Aldurskiptur afli. Súlur gefa til kynna frávik frá meðalafla eftir aldri og eru litaðar eftir árgangi.

WEIGHT AT AGE

Mean weight at age in the catch is shown in Table 6 and Figure 12. Mean weight at age in the stock is given in Table 7 and Figure 12. Those data 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 have been increasing in recent years, after being very low when the stock was large between 2005 and 2009. Higher mean weight at age is most apparent for the younger haddock from the small cohorts (2008–2013), but mean weight of the old fish is now also average. Mean weight of the 2014 cohort was more lower than that of recent small year classes but above average for a large cohorts.

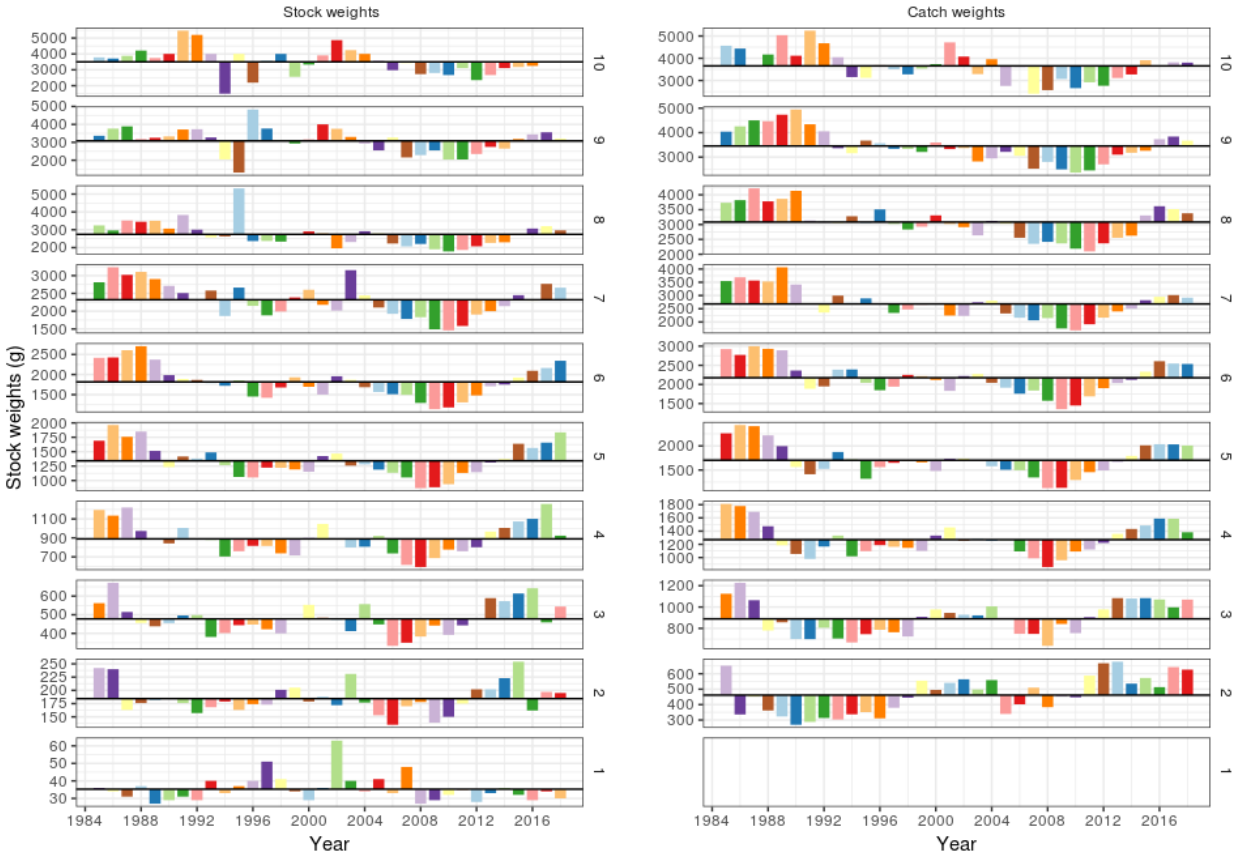

Figure 12: Haddock in division 5.a. Catch weights from the commercial fishery and stock weights from the March survey in Icelandic waters. Bar size is indicative of the deviations from the mean and bars are colored by cohort.

Mynd 12. Ýsa á Íslandsmiðum. Afla- og stofnþyngdir (úr vorralli) eftir aldri. Súlur gefa til kynna frávik frá meðalþyngd eftir aldri og eru litaðar eftir árgangi.

MATURITY AT AGE

Maturity-at-age data are given in Table 8 and Figure 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. The numbers for age 10 only apply to the spawning stock. 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 14.

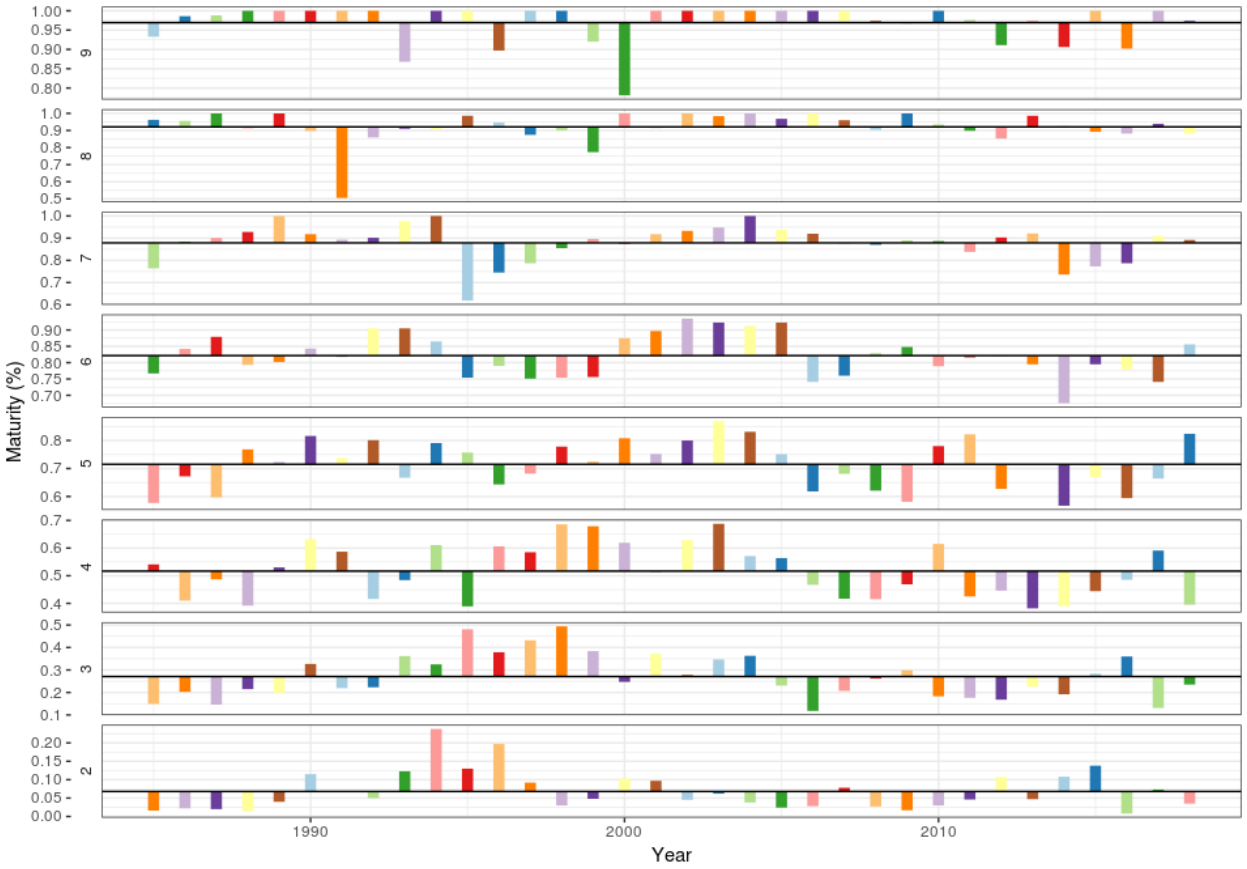

Figure 13. Haddock in division 5.a. Maturity-at-age in the survey. The values are used to calculate the spawning stock.

Mynd 13. Ýsa á Íslandsmiðum. Kynþroski (úr vorralli) eftir aldri. Súlur gefa til kynna frávik frá meðalþyngd eftir aldri og litaðar eftir árgangi. Gögnin eru notuð til þess að reikna stærð hrygningarstofns.

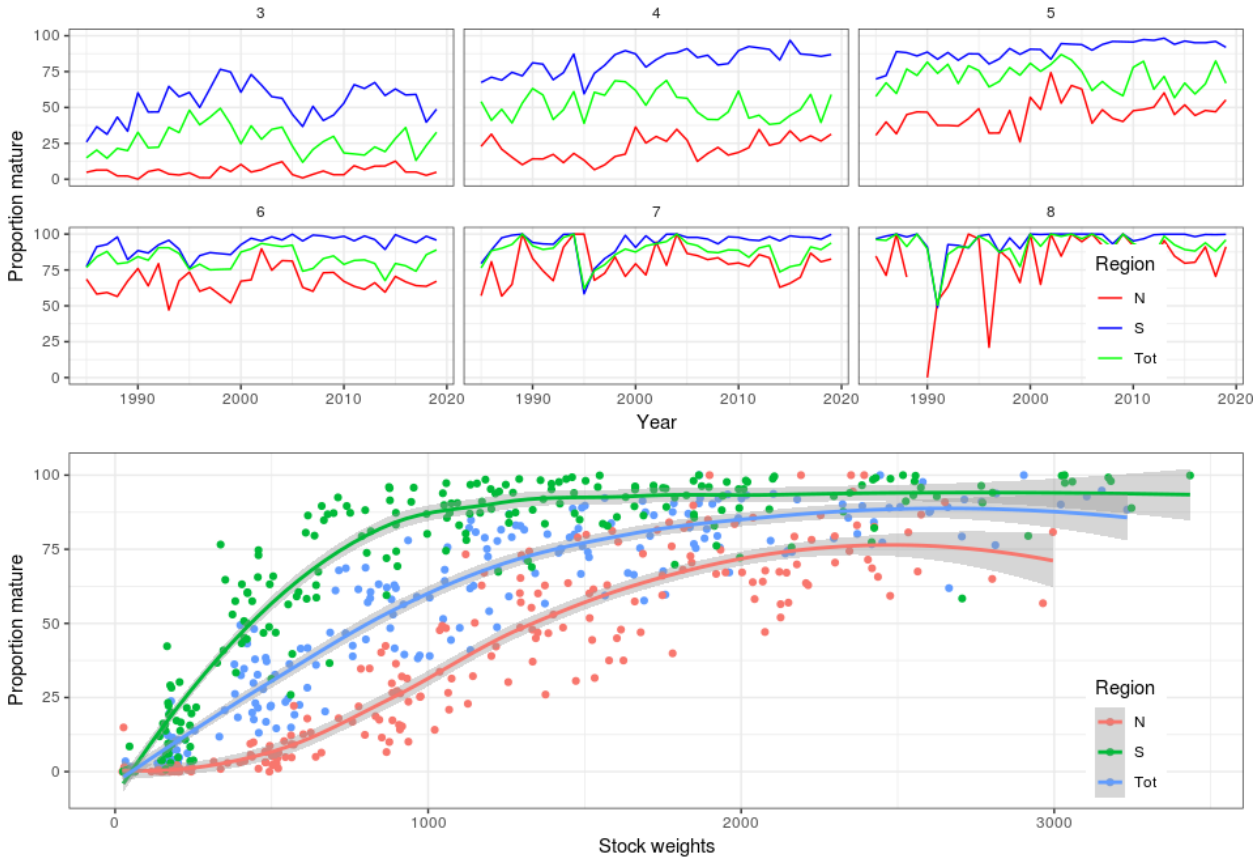

Figure 14. Haddock in 5a. Geographical differences in proportion mature by year and age (top), and stock weights (below).

Mynd 14.Ýsa á Íslandsmiðum. Kynþroskahlutfall eftir svæði (norður/suður), árum og aldri (efri mynd)/stofnþyngd (neðri mynd).

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.

CATCH, EFFORT AND RESEARCH VESSEL DATA

CATCH PER UNIT OF EFFORT AND EFFORT DATA FROM COMMERCIAL FISHERIES

Catch per unit of effort data (Figure 15) give somewhat 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 fisher's 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. Area inhabited by the stock increased so the density in the traditional fishing area did not increase in relation to the stock size. First when the stock was large slower growth lead to larger proportion of the stock below "fishable size" 45cm limiting the areas where large haddock could be caught without too much bycatch of small haddock. The opposite has happened in recent years, faster growth and poor recruitment lead to the fisheries not

limited by small haddock. Bycatch issues, but haddock is often caught as bycatch or one of the species in mixed fisheries where the goal is certain mixture of species.

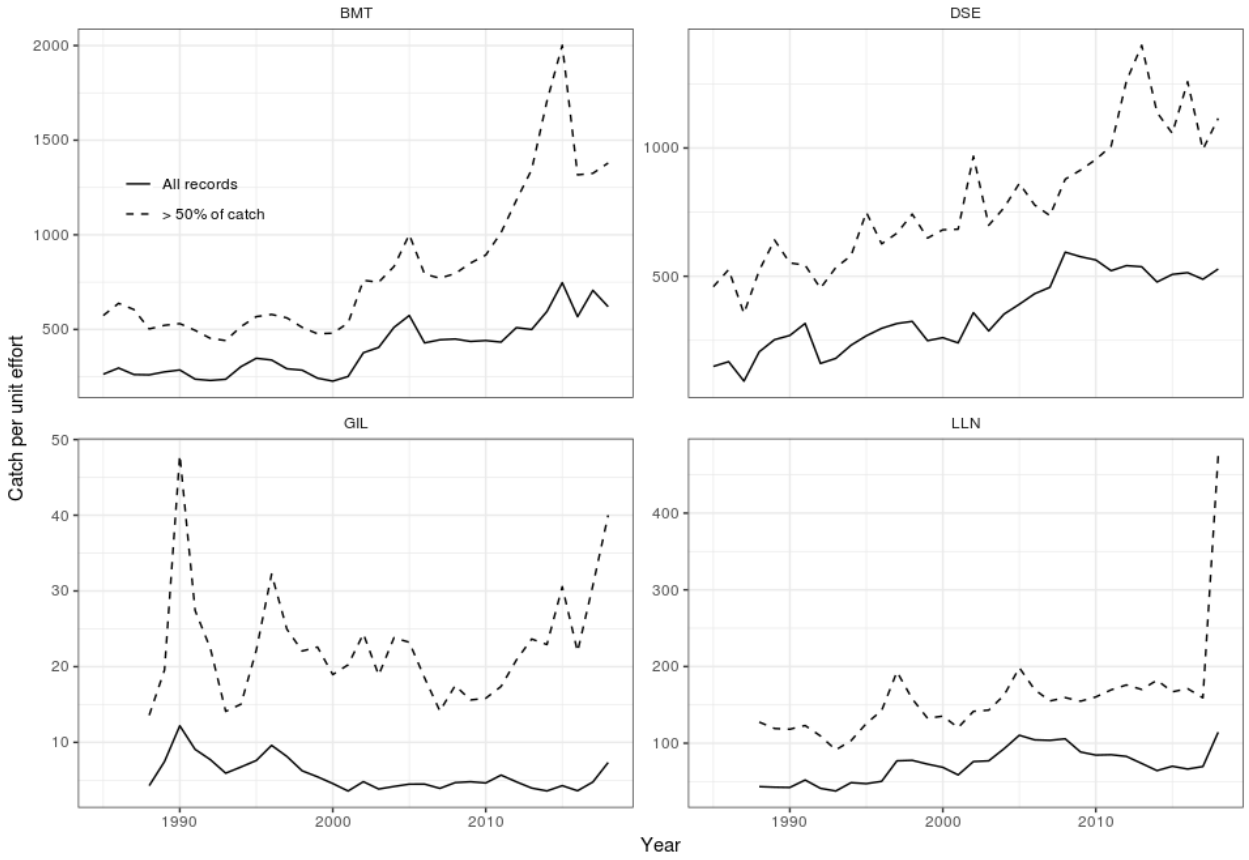

Figure 15. Haddock in division 5.a. Catch per unit of effort in the most important gear types. The dashed lines are based on locations where more than 50% of the catch is haddock and solid lines on all records where haddock is caught. A change occurred in the longline fleet starting September 1999. Earlier only vessels larger than 10 BRT were required to return logbooks but later all vessels were required to return logbooks.

Mynd 15. Ýsa á Íslandsmiðum. Afli á sóknareiningu brotinn niður eftir helstu veiðarfæraflokkum. Brotalínur gefa til kynna afla á sóknareiningu þar sem meir en 50% aflans var ýsa en heilar línur allar færslur þar sem ýsa veiddist. Athugið að breyting átti sér stað í September 1999 þar sem öll skip voru skyldug til að skila inn afladagbók en fyrir þann tíma voru skip minni en 10 brúttólestir undanskilin þeirri skyldu.

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 except for 2011 when a full autumn survey could not be conducted due to a 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 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 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 17 (abundance) and changes in spatial distribution in Figure 18 and Figure 19.

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. The autumn survey index shows at downwards trend while the spring survey and upwards trend.

Age disaggregated indices from the March survey are given in Table 9 and indices from the autumn survey in Table 10. Abundance of age groups 3–7 in the 2016 March survey is low while age 9 is among the highest indices observed. The index of age 12 and 13 (2003 cohort) is much higher than seen before (large part of 11+ in the March survey), but that cohort will though not contribute much to the landings. Year classes 2008 and 2009 (age 8 and 7) are now close to average, mostly due to reduced fishing mortality in recent years but those year classes were originally small.

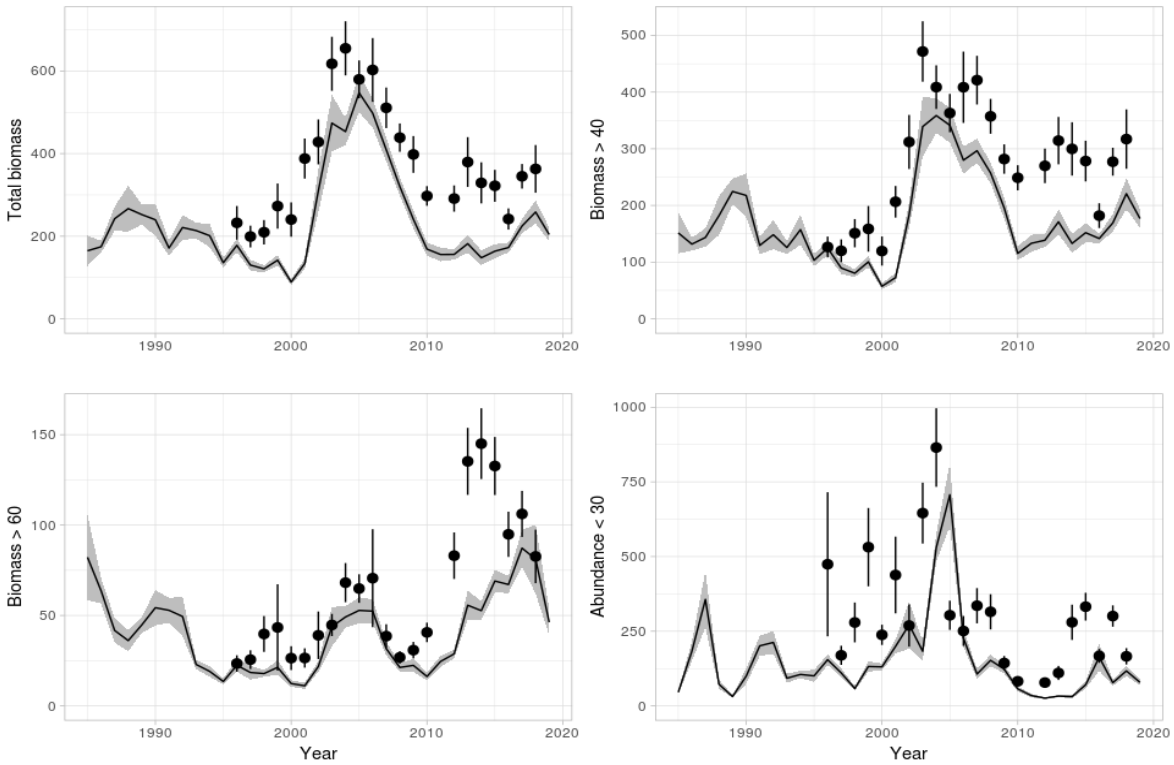

Figure 16. Haddock in division 5.a. Indices in the Spring Survey (March) 1985 and onwards (line shaded area) and the autumn survey (point ranges).

Mynd 16. Ýsa á Íslandsmiðum. Vísitölur úr stofnmælingum Hafrannsóknastofnunar. Vísitala úr vorralli er táknuð með heilli línu, þar sem skyggð svæði gefa til kynna óvissu í mælingum (staðalfrávik), og haustrallsvísitalan er táknuð með punktum, þar sem lóðréttar línur tákna óvissu.

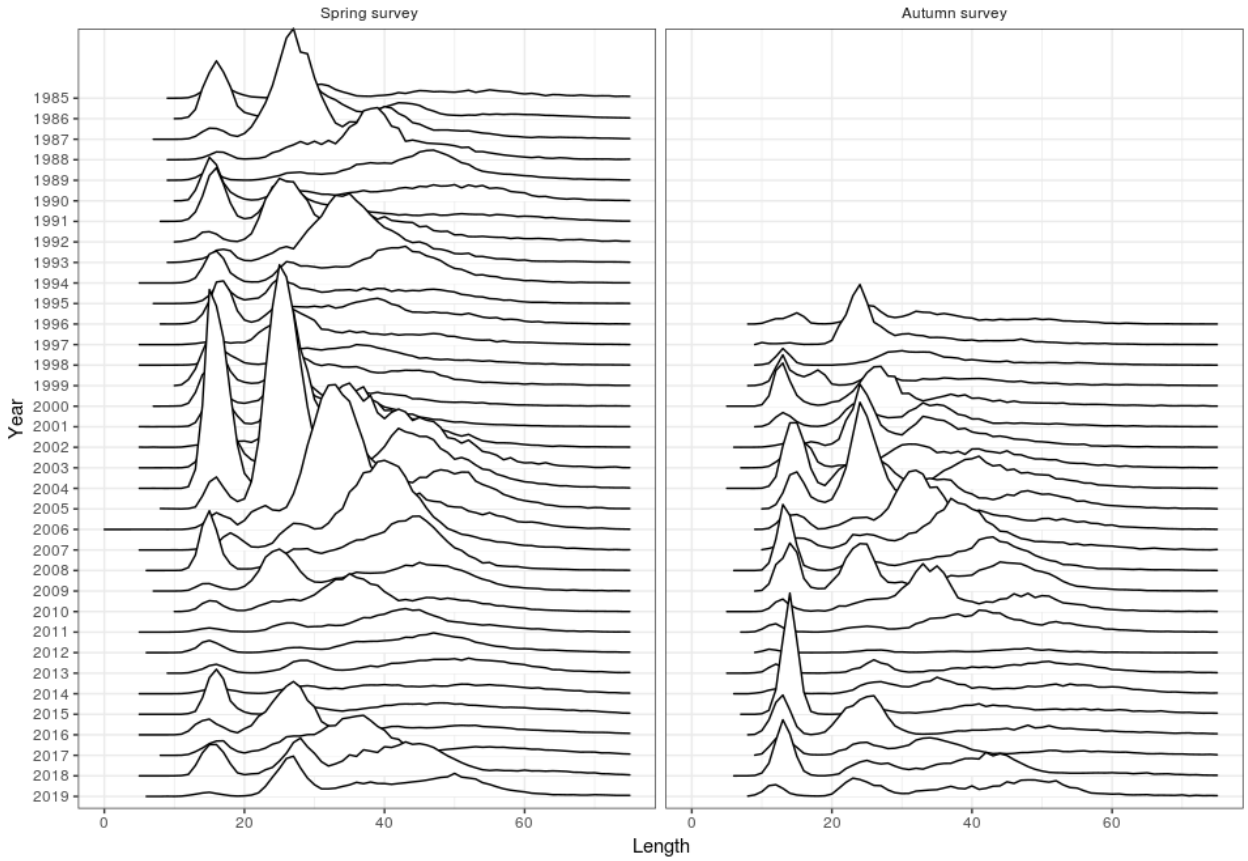

Figure 17. Haddock in division 5.a. Length disaggregated abundance indices from the spring survey (March) 1985 and onwards, and the Autumn survey from 1996 onwards (except for 2011).

Mynd 17. Ýsa á Íslandsmiðum. Lengdardreifingar úr árlegum stofnmælingum Hafrannsóknastofnunar. Heil lína sýnir mælingar úr vorralli, sem hófst 1985, en brotalínan sýnir mælingar úr haustralli, sem hófst 1996. Árið 2011 féll haustrallið niður.

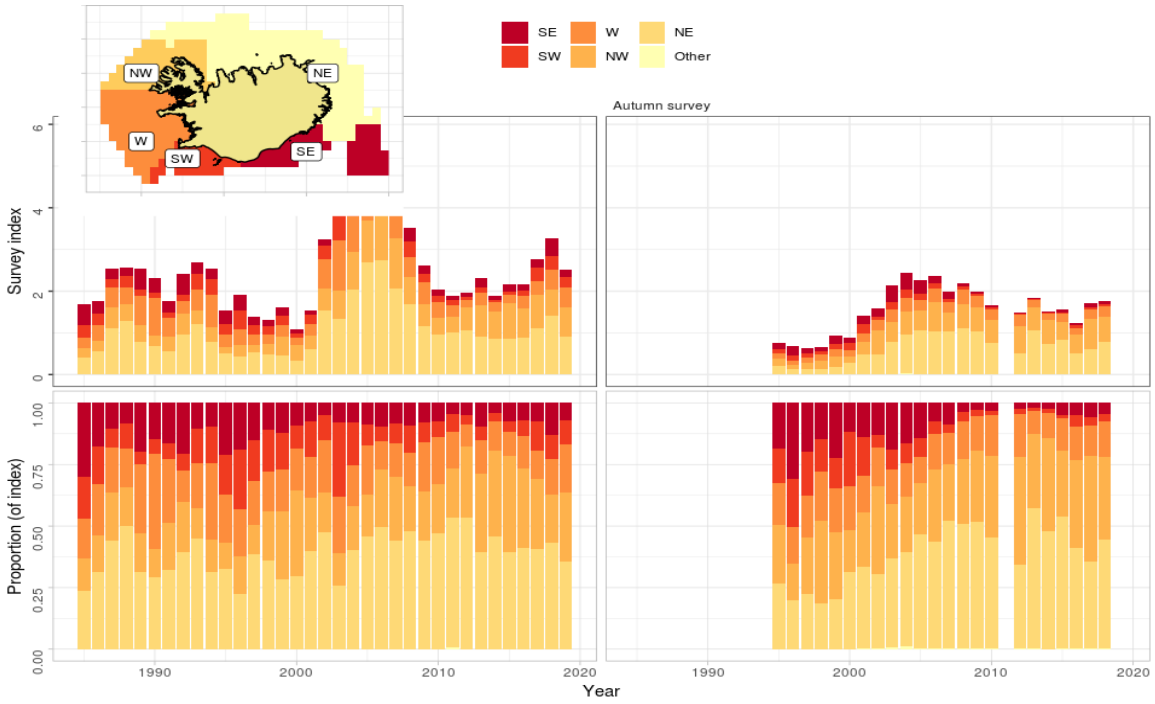

Figure 18. Haddock in division 5.a. Changes in geographical distribution of the survey biomass.

Mynd 18. Ýsa á Íslandsmiðum. Breytingar á dreifingu ýsu í vorralli Hafrannsóknastofnunar.

Figure 19. Haddock in division 5.a. Location of haddock in the March survey, bubble sizes are relative to catch sizes.

Mynd 19. Ýsa á Íslandsmiðum. Staðsetning ýsu í vorralli Hafrannsóknastofnunar. Punktastærð er í hlutfalli við afla í togi.

DATA ANALYSES

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 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 20. 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 25.

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.

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. The input data is shown in Table 6 to Table 7. A full description of the preparation of the data used for tuning and as input is given in the stock annex (see ICES (2019)). The assessment model with all settings can be obtained at https://github.com/ices-taf/2019_had.27.5a.

DIAGNOSTICS

The fit to data is illustrated in Figure 20 where no concerning residual patterns are observed. When looking at the combined fit (Figure 22) 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.

Figure 25 shows the estimated "catchability" and CV as a function of age for the surveys. The estimated CV is generally lower for ages 2–6, whereas the CV increases faster by age for the autumn survey compared with the spring survey. Residuals from the assessment model are positive for the most recent October survey, but close to zero for the most recent March survey. The March surveys 2011-2015 are, on the other hand, below predictions. A similar appears in the fishery during 2012-2013 (Figure 15), so there is indication that the stock might have been underestimated or availability of haddock was unusually high in that period.

Assessment in recent years has shown some difference between model runs where either of the two different tuning series, i.e. March and the October surveys, are omitted from the estimation. As shown in Figure 1.26 the differences are mainly in last few years before the assessment, and mostly contained within the estimated ranges of uncertainty.

Plot of observed vs. predicted biomass from the surveys (Figure 22) indicates that historically the autumn survey biomass has been closer to prediction than corresponding values from the March survey where the contrast in observed biomass is more than predicted from the assessment. When the stock was small in 2000 and 2001, the March survey indicated considerably smaller stock while the autumn survey values were reasonably correct and from 2003-2007 the March survey overestimated the stock. 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 @ref(fig:qsigmaplot) 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.

Residuals from the assessment model are positive for the most recent October survey but close to zero for the most recent March survey (Figure 20 and Figure 22). The March surveys 2011-2015 are on the other hand below predictions. Similar thing seems to be happening in the fishery in 2012-2013 (Figure 15) so there are indications that the stock might be underestimated, or availability of haddock is unusually high.

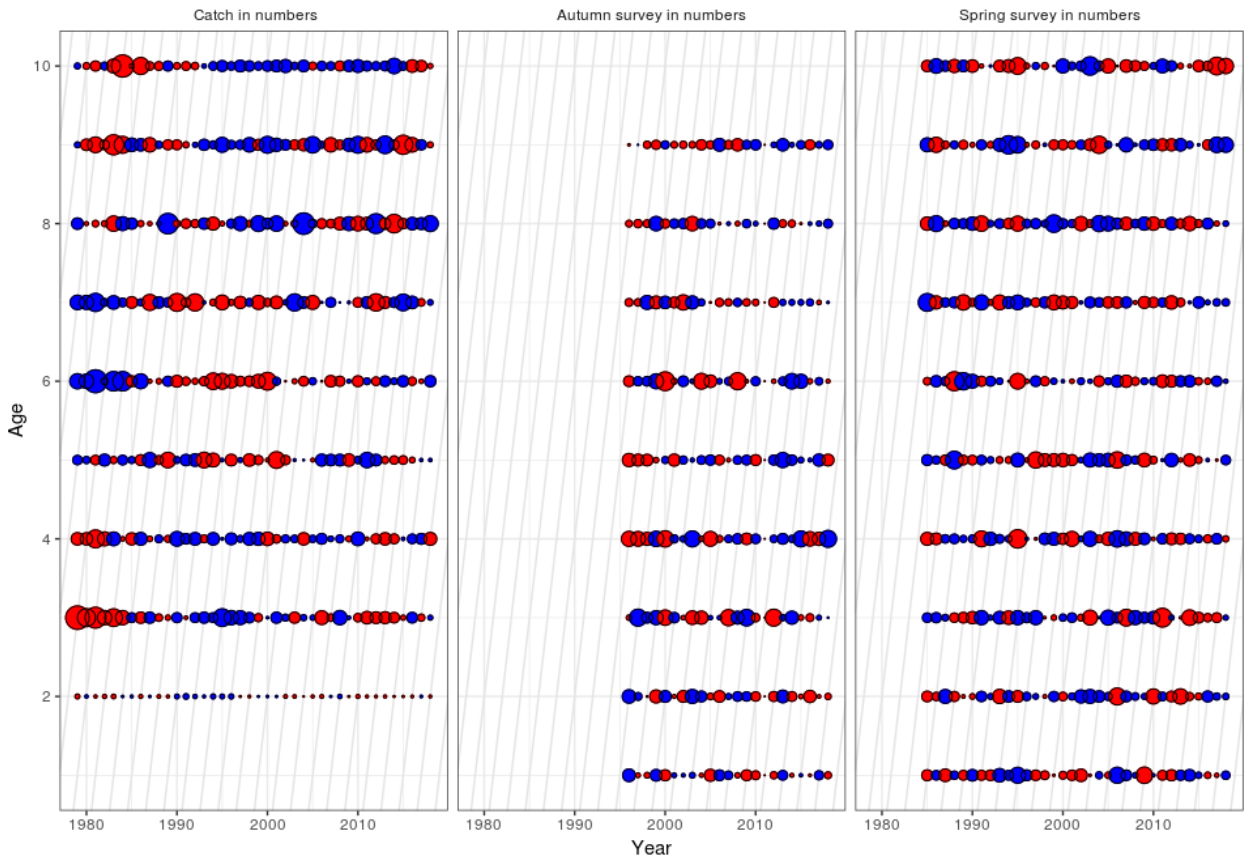

Figure 20. Haddock in division 5.a. Residuals from the model fit to survey and catch data based on the both the surveys. Red circles indicate negative residuals (observed < modelled), while blue positive. Residuals are proportional to the area of the circles.

Mynd 20. Ýsa á Íslandsmiðum. Leifar stofnmatslíkansins þegar úttak líkansins er borið saman við aldurskiptar vísitölur úr vor- og haustralli Hafrannsóknastofnunar. Rauðir hringir tákna neikvæðar leifar (mæligögn < spá líkans), en bláir jákvæðar leifar. Stærð hringja er í hlutfalli við stærð leifa.

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 21). 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 newly benchmarked assessment indicates a marginally larger stock than the assessment presented at NWWG 2018 (Figure 21) and the analytical retrospective (Figure 23) indicates a slight 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 or -0.092 for estimated recruitment, 0.07 for SSB and -0.065 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 24) but that has not always been the case.

Estimated selection is illustrated in Figure 25, 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 26.

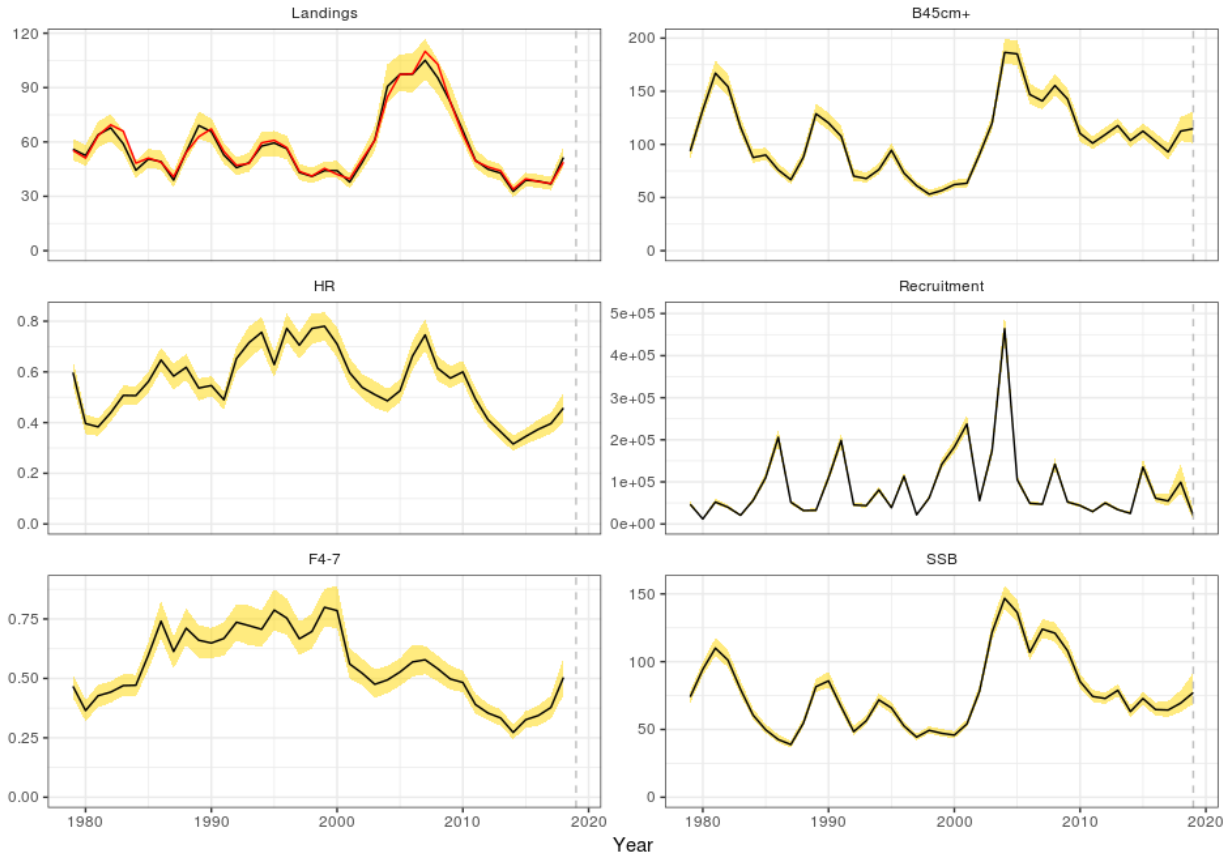

Figure 21. Haddock in division 5.a. Summary from assessment. Dashed vertical line indicates the assessment year and yellow shaded region the uncertainty as estimated by the model.

Mynd 21. Ýsa á Íslandsmiðum. Samantekt stofnmats. Lóðrétt brotalína gefur til kynna úttektarár á meðan skyggð svæði 95 % óvissumörk.

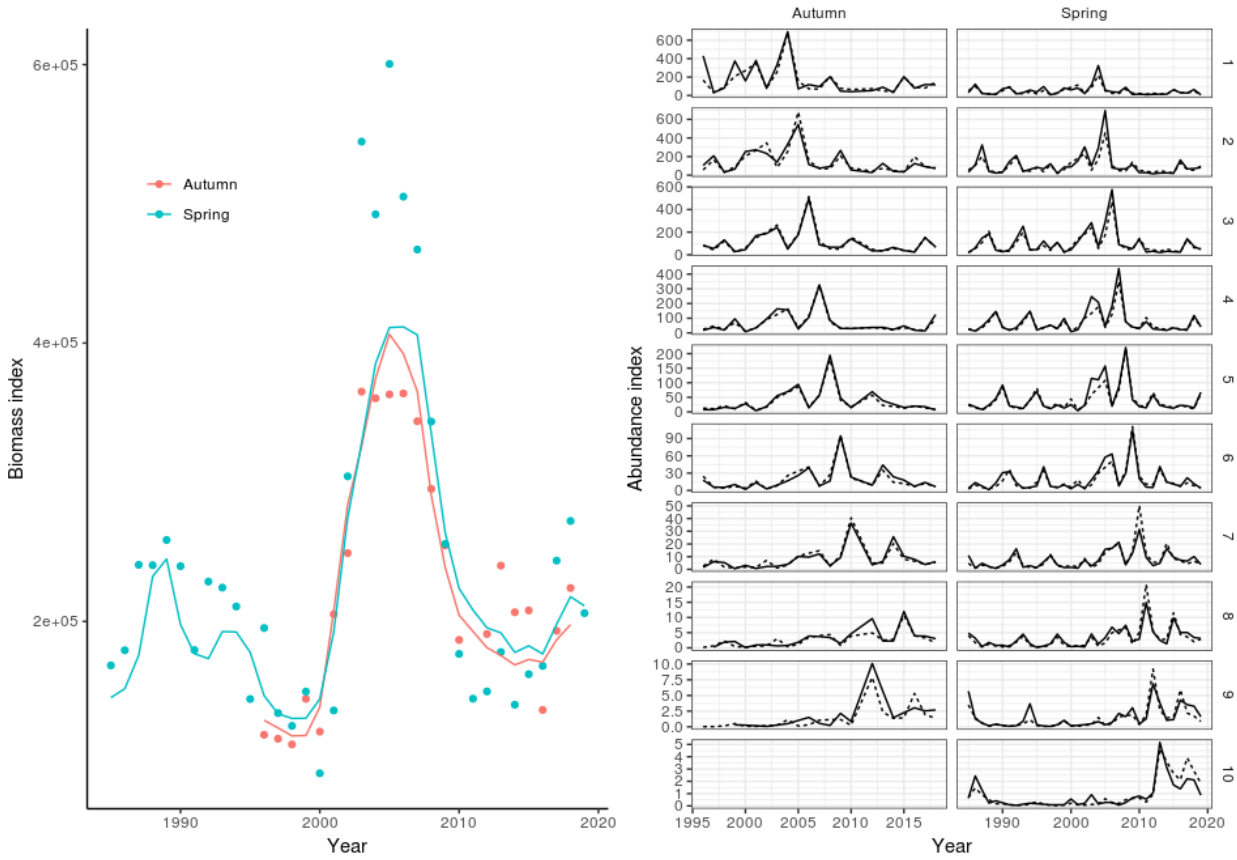

Figure 22. Haddock in division 5.a. Aggregated model fit to the total biomass indices.

Mynd 22. Ýsa á Íslandsmiðum. Samanburður á spáðri heildarvísitölu (vinstri) og vísitölu skipt eftir aldri (hægri) úr stofnmatslíkani.

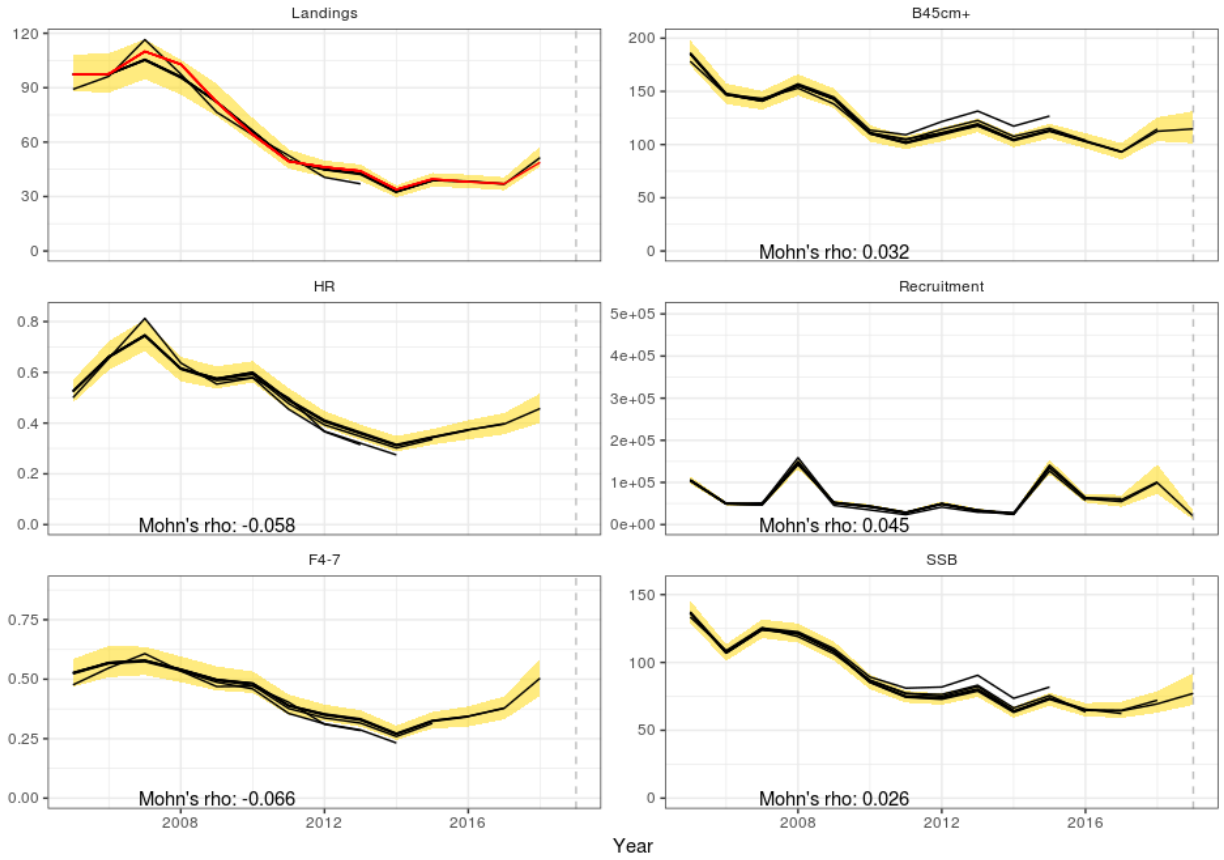

Figure 23. Haddock in division 5.a. Analytical retrospective analysis of the assessment of haddock with a 5-year peel.

Mynd 23. Ýsa á Íslandsmiðum. 5 ára endurlitsgreining á stofnmati ýsu.

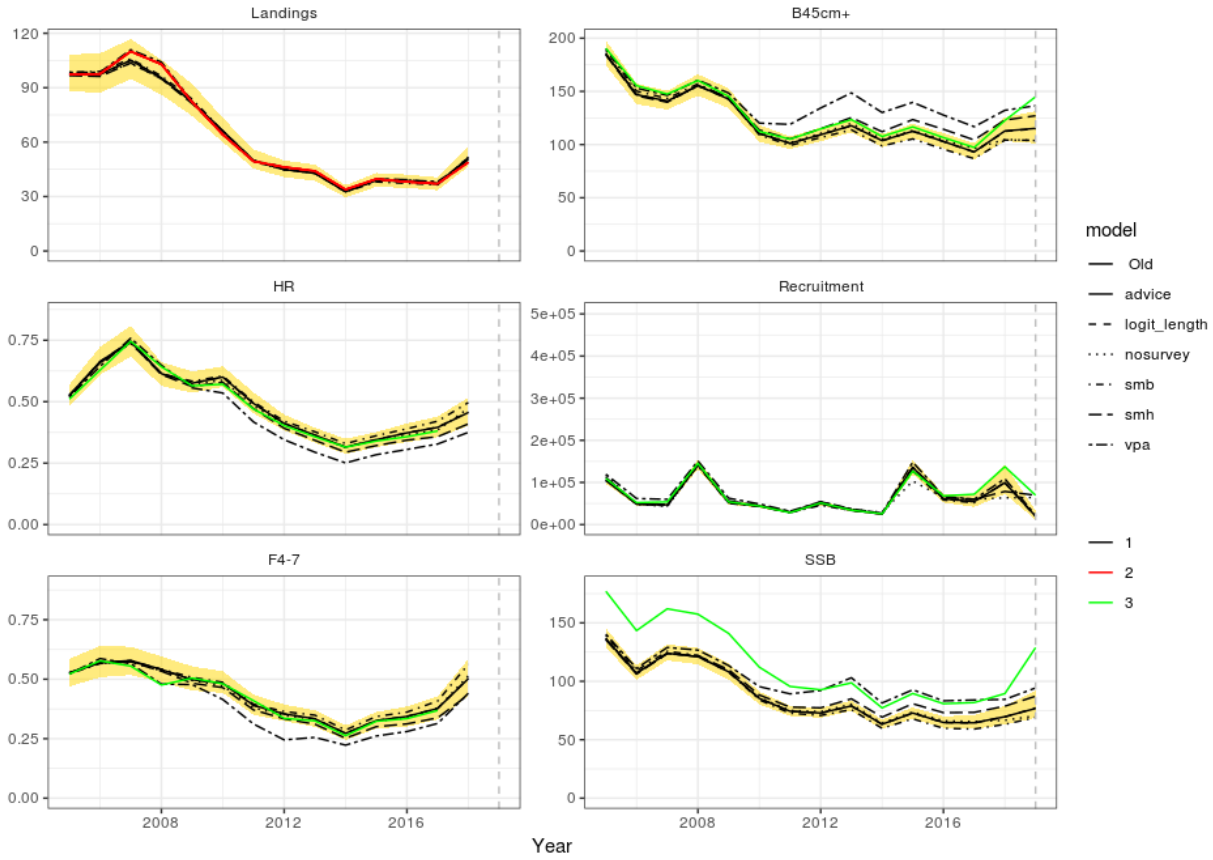

Figure 24. Haddock in division 5a. Comparison of assessment results where either the spring survey or the autumn survey is omitted from the estimation.

Mynd 24. Ýsa á Íslandsmiðum. Samanburður á stofnmatsniðurstöðum þar sem annaðhvort haustralli eða vorralli er sleppt.

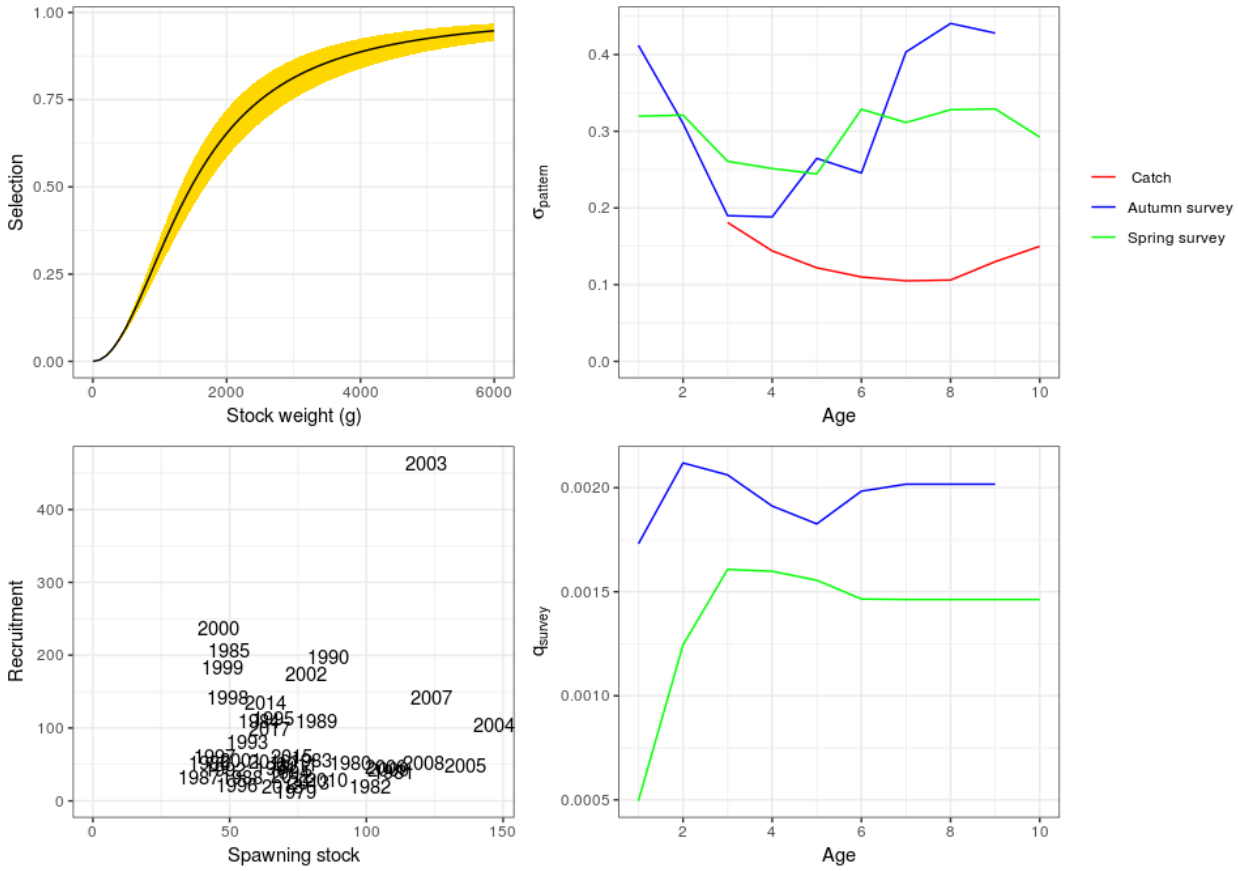

Figure 25. Haddock in division 5a. Estimated selection by weight, CV pattern, stock recruitment relationship and survey catchability.

Mynd 25. Ýsa á Íslandsmiðum. Metið þyngdarháð veiðimynstur, vigtun aldurvísitalna, nýliðunarsamband og veiðanleiki úr stofnmælingum.

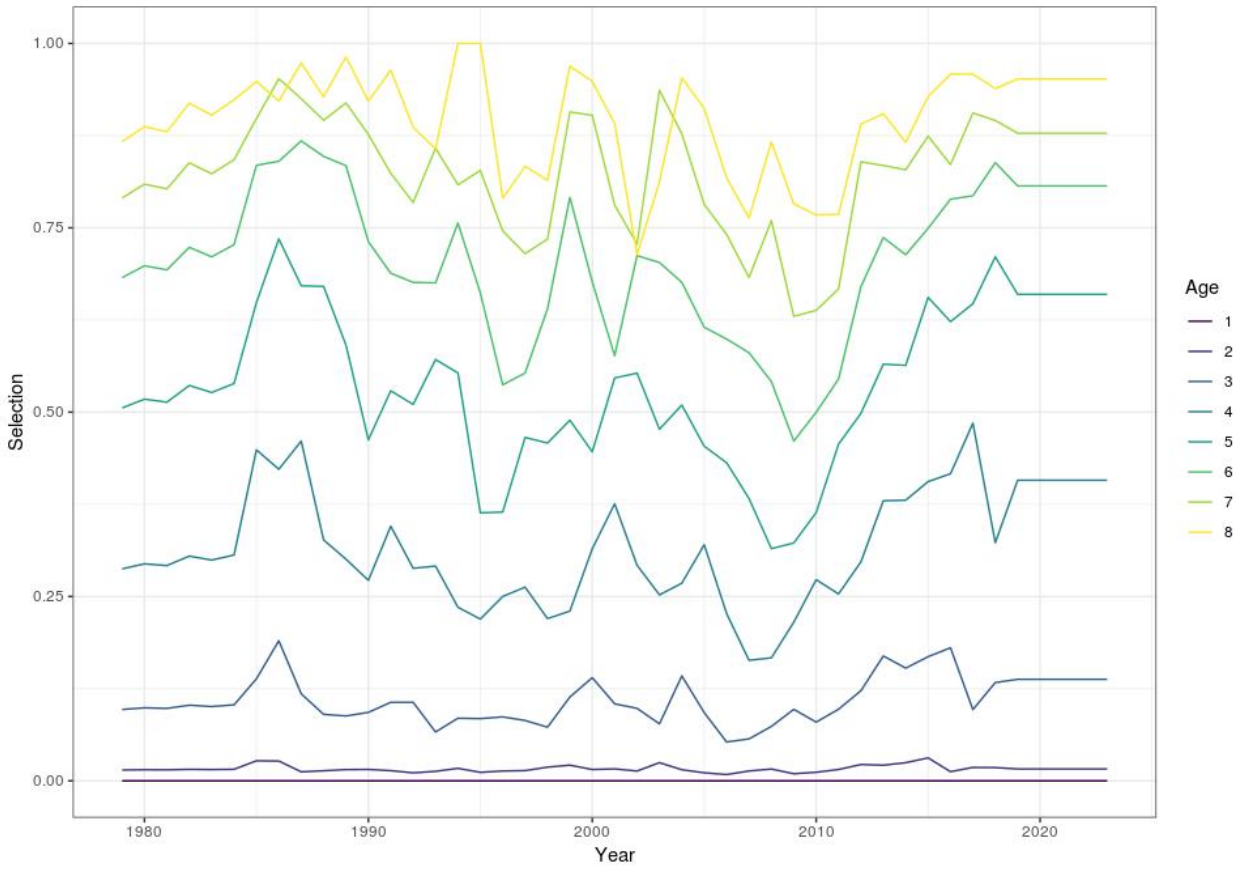

Figure 26. Haddock in division 5a. Estimated selection at age.

Mynd 26. Ýsa á Íslandsmiðum. Veiðimynstur eftir aldri.

SHORT TERM PROJECTIONS

Prediction of weight at age in the stock, weight at age in the catches, maturity-at-age and selection has been similar since 2006 (WD #19 in 2006). The procedure is described in the advice part of the report of ADGISHA (Björnsson 2013) and in the stock annex. The procedure was changed in 2016 in such a way that instead of taking only last year's value, average of last 3 values is used, and was evaluated at WKICEMSE 2019. Prediction of growth is a source of uncertainty for this stock as the predicted value of the reference biomass in the advisory year is used to determine next fishing years catch. In recent year's growth has shown interannual variability without any pattern, indicating that basing the short-term prediction on average growth of last 2-3 years is appropriate.

Mean weight and maturity-at-age in 2017 are available and are used to predict catch weights and selection at age (Figure 30). Growth in 2020 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 29) 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 2019. When those values have been estimated the prediction is done by the same model as used in the assessment. The resulting projections of maturity and weight at age are shown in relevant figures, indicated with red. The model works iteratively as the estimated TAC for the fishing year 2019/2020 has some effect of the biomass at the beginning of 2020, which the TAC is based on.

MANAGEMENT CONSIDERATIONS

All the signs from commercial catch data and surveys indicate that haddock in division 5.a is at present in a good state. This is confirmed in the assessment. Although the retrospective pattern the model predictions for the harvestable biomass for the coming fishing year (2019/2020) has increased by more than 10% from that which was predicted last year. There are differences in the perception of the state of stock in assessment based on either the spring or autumn survey with autumn survey indicating a larger stock. This difference has been apparent since 2009. The assessment this year projects a large increase in the reference biomass (B_{45cm^+}) for 2019 compared with last year projections. This is due to an update in expected weight at age.

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.

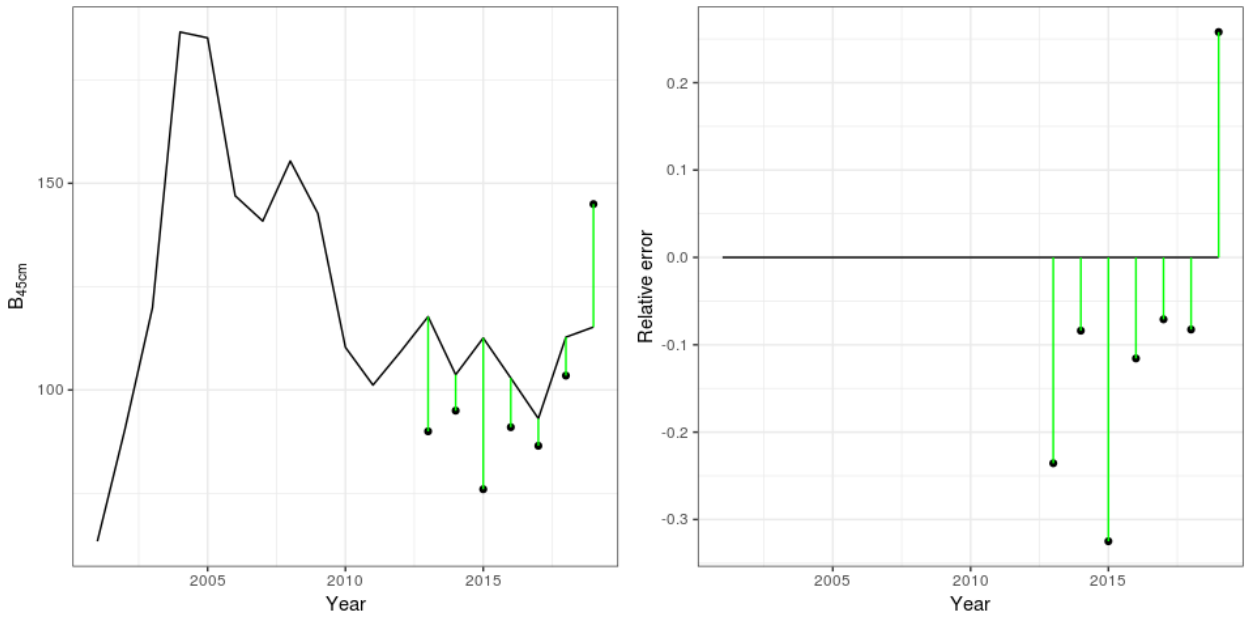

Figure 27. Haddock in 5a. Comparison of the short-term prediction of reference biomass to the realized value a year later.

Mynd 27. Ýsa á Íslandsmiðum. Samanburður á niðurstöðum stofnmatsins ár og spá stofnmatsins í fyrra fyrir árið í ár.

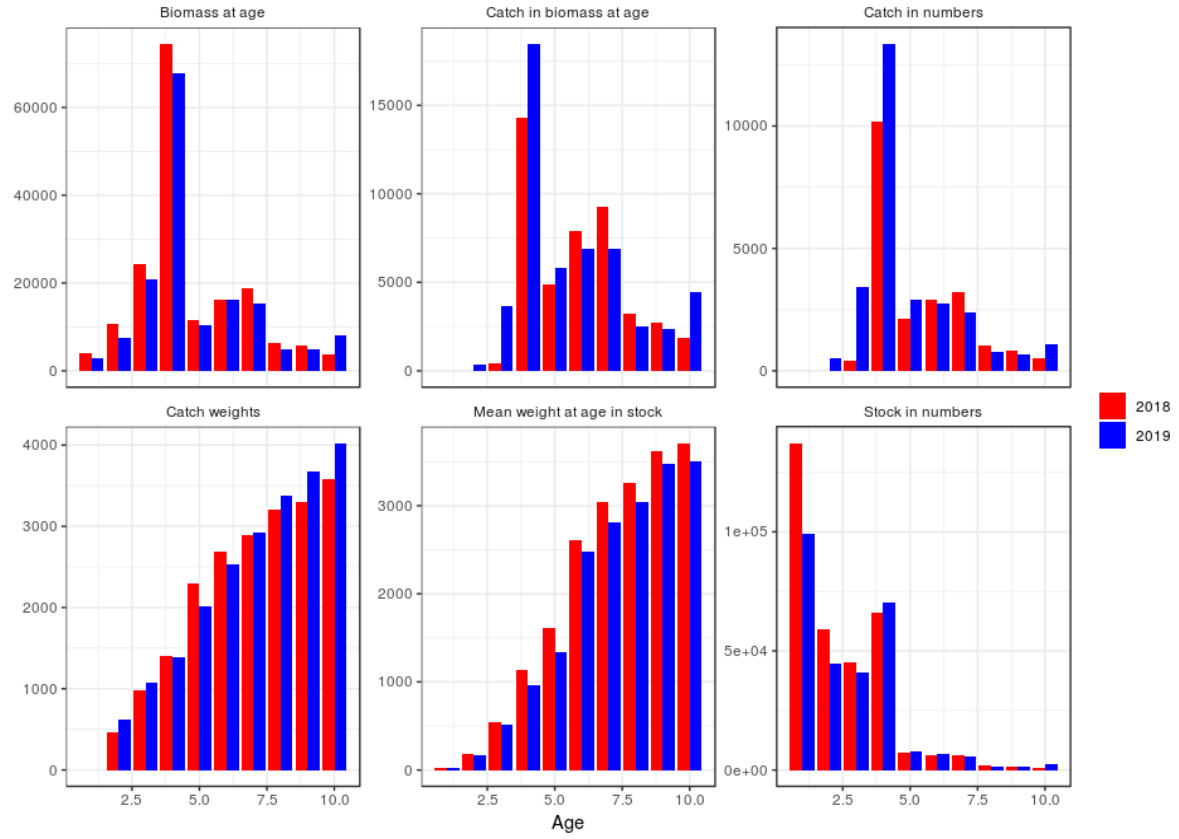

Figure 28. Haddock in division 5a. Comparison of some of the results of 2019 assessment based on different tuning data and 2017 assessment tuned with both the surveys.

Mynd 28. Ýsa á Íslandsmiðum. Samanburður niðurstaðna úr stofnmatslíkani 2019 byggðum á ólíkum stillingum og stofnmati 2017 stillt með vor- og haustleiðangri.

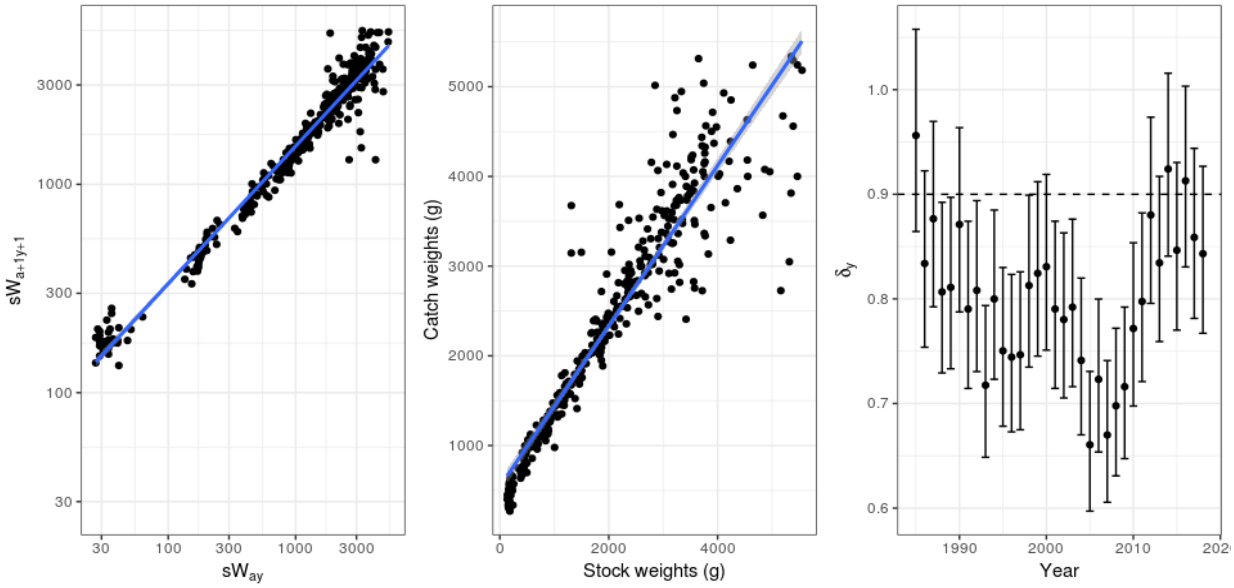

Figure 29. Haddock in 5a. Input data to prediction model, where the exponent of the year factor (growth multiplier) is estimated to derive the reference biomass in the advisory year, as described in the text. *7.*

Mynd 29. Ýsa á Íslandsmiðum. Inntaksgögn fyrir vaxtarspá fyrir komandi fiskveiðiár. Nánar lýsing er í texta.

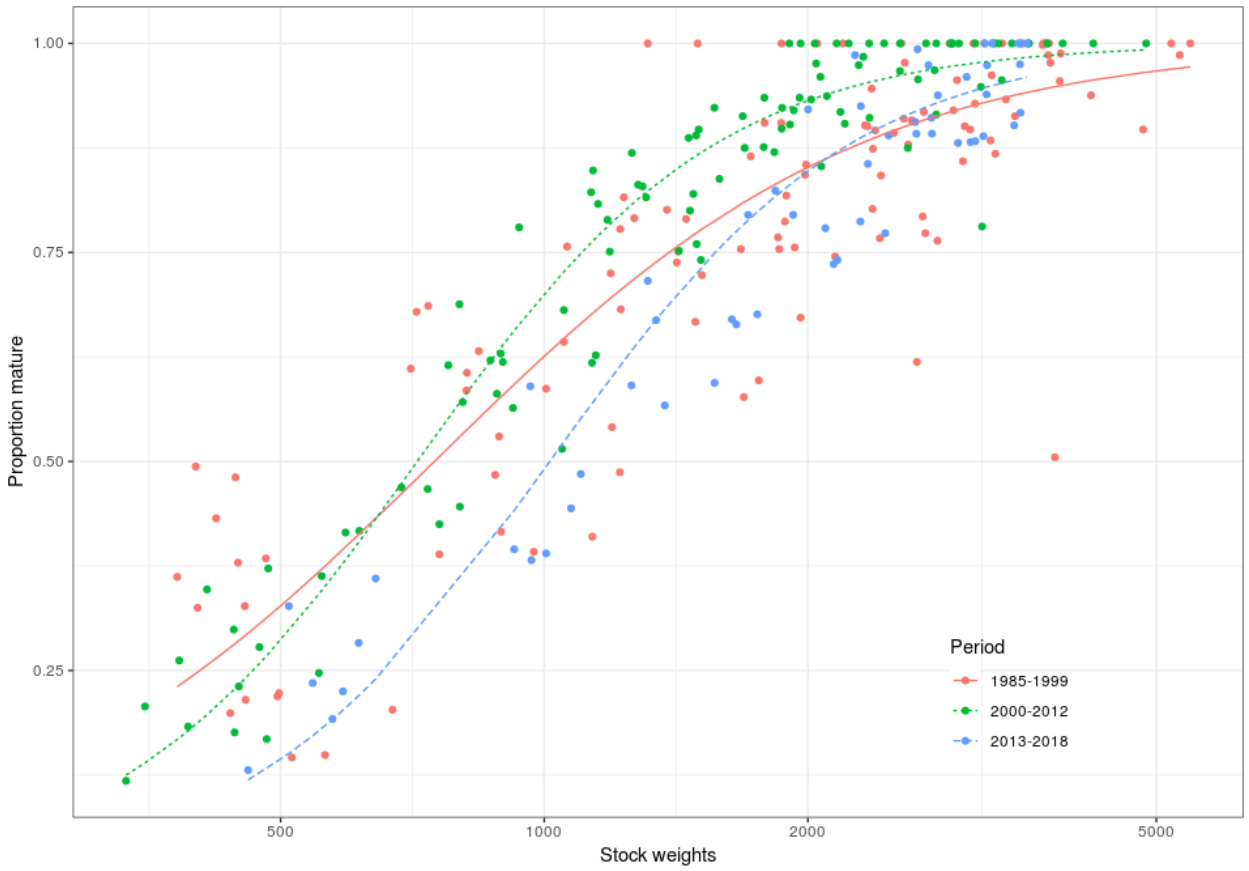

Figure 30. Haddock in 5a. Maturity at weight as used in the projections.

Mynd 30. Ýsa á Íslandsmiðum. Kynþroskahlutfall sem fall af stofnþyngd, notað til í framreikningum.

Table 1. Haddock in division 5a. Landings by nation.

Tafla 1. Ýsa á Íslandsmiðum. Afli eftir þjóðum.

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	-	2502	-	-	35695	22	-	**-**
2018	-	2209	-	-	47676	30	-	**-**

Table 2. Haddock in 5a. Number of Icelandic boats and catches by fleet segment participating in the haddock fishery in 5a.

Tafla 2. ***Ýsa á Íslandsmiðum. Fjöldi báta og afli eftir veiðarfærum.***

	NUMBER OF VESSELS			CATCHES (TONNES)				
YEAR	*Bottom trawl*	*Danish seine*	*Longlines*	*Bottom trawl*	*Danish seine*	*Longlines*	*Other*	***SUM***
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**	**12635**	**179**	**44090**

Table 3. Haddock in division 5.a. Number of available length measurements and samples from Icelandic commercial catches.
Tafla 3. Ýsa á Íslandsmiðum. Fjöldi lengdarmælinga og sýna úr afla.

	DEMERSAL		DEMERSAL SEINE		GILLNET		LONGLINE		OTHER	
YEAR	*Sample*	*Otoliths*	*Sample*	*Otoliths*	*Sample*	*Otoliths*	*Sample*	*Otoliths*	*Sample*	*Otoliths*
2010	330	59118	116	19504	10	827	344	56743	4	229
2011	278	53239	53	8304	9	1350	237	43198	2	325
2012	223	41074	59	10084	10	1508	302	60838	1	3
2013	198	34131	23	2498	1	176	237	43132	4	560
2014	79	13529	22	3128	6	289	217	37035	-	-
2015	154	25969	18	2742	1	125	221	41593	-	-
2016	129	21303	17	2425	3	333	202	37490	6	849
2017	144	23123	39	6305	2	375	232	42356	7	1367
2018	134	21782	94	5611	29	414	231	35621	3	558

Table 4. Haddock in division 5.a. Number of available age measurements and samples from Icelandic commercial catches.
Tafla 4. ***Ýsa á Íslandsmiðum. Fjöldi aldurslesinna fiska og fjöldi sýna úr afla.***

	DEMERSAL		DEMERSAL SEINE		GILLNET		LONGLINE		OTHER	
YEAR	*Sample*	*Otoliths*	*Sample*	*Otoliths*	*Sample*	*Otoliths*	*Sample*	*Otoliths*	*Sample*	*Otoliths*
2010	330	59118	116	19504	10	827	344	56743	4	229
2011	278	53239	53	8304	9	1350	237	43198	2	325
2012	223	41074	59	10084	10	1508	302	60838	1	3
2013	198	34131	23	2498	1	176	237	43132	4	560
2014	79	13529	22	3128	6	289	217	37035	-	-
2015	154	25969	18	2742	1	125	221	41593	-	-
2016	129	21303	17	2425	3	333	202	37490	6	849
2017	144	23123	39	6305	2	375	232	42356	7	1367
2018	134	21782	94	5611	29	414	231	35621	3	558

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

Tafla 5. ***Ýsa á Íslandsmiðum. Aldursskiptur afli.***

YEAR	2	3	4	5	6	7	8	9	10
1979	0.149	1.908	3.762	6.057	9.022	1.743	0.438	0.056	0.112
1980	0.595	1.385	11.481	4.298	3.798	3.732	0.544	0.091	0.037
1981	0.010	0.514	4.911	16.900	5.999	2.825	1.803	0.168	0.057
1982	0.107	0.245	3.149	10.851	14.049	2.068	1.000	0.725	0.201
1983	0.034	1.010	1.589	4.596	9.850	8.839	0.766	0.207	0.280
1984	0.241	1.069	4.946	1.341	4.772	3.742	4.076	0.238	0.080
1985	1.320	1.728	4.562	6.796	0.855	1.682	1.914	1.903	0.296
1986	1.012	4.223	4.068	4.686	5.139	0.494	0.796	0.897	0.400
1987	1.939	8.308	6.965	2.728	2.042	1.094	0.132	0.165	0.339
1988	0.237	9.831	15.164	5.824	1.304	1.084	0.609	0.066	0.213
1989	0.188	2.474	22.560	9.571	3.196	0.513	0.556	0.144	0.141
1990	1.857	2.415	8.628	23.611	6.331	0.816	0.150	0.067	0.074
1991	8.617	2.145	5.397	7.342	14.103	2.648	0.338	0.040	0.027
1992	5.405	10.693	5.721	4.610	3.691	5.209	0.999	0.120	0.016
1993	0.769	12.333	12.815	2.968	1.722	1.425	2.239	0.343	0.038
1994	3.198	3.343	28.258	10.682	1.469	0.726	0.358	0.647	0.108
1995	4.015	7.323	5.744	23.927	5.769	0.615	0.290	0.187	0.331
1996	3.090	10.552	7.639	4.468	12.896	2.346	0.208	0.079	0.125
1997	1.364	3.939	10.915	4.895	2.610	5.035	0.719	0.064	0.069
1998	0.279	8.257	5.667	7.856	2.418	1.422	1.897	0.261	0.045
1999	1.434	1.550	17.243	4.516	4.837	0.915	0.620	0.481	0.064
2000	2.659	6.317	2.352	13.615	1.945	1.706	0.324	0.222	0.192
2001	2.515	11.098	6.954	1.446	6.262	0.675	0.478	0.105	0.094
2002	1.082	10.434	15.998	5.099	1.131	3.149	0.262	0.169	0.100
2003	0.401	6.352	16.265	12.548	2.968	0.748	1.236	0.091	0.070
2004	1.597	4.063	17.652	19.358	8.871	1.940	0.471	0.489	0.155
2005	2.405	9.450	6.929	25.421	13.778	4.584	0.809	0.251	0.237
2006	0.241	10.038	21.246	6.646	18.840	7.600	2.180	0.323	0.202
2007	0.782	3.884	42.224	22.239	3.354	9.952	2.740	0.519	0.181
2008	2.316	4.508	9.706	53.022	11.014	1.717	3.033	0.815	0.192
2009	1.066	3.185	4.886	8.892	35.011	5.733	0.726	1.381	0.509
2010	0.121	6.032	7.061	4.806	6.766	17.503	1.874	0.354	0.528
2011	0.253	1.584	11.797	5.080	2.853	3.983	6.220	0.494	0.183
2012	0.196	1.322	3.421	13.107	2.223	1.231	2.480	2.662	0.370

2013	0.250	1.042	2.865	4.008	9.222	1.206	0.668	1.248	1.599
2014	0.238	1.478	1.751	2.725	2.737	4.742	0.447	0.387	1.403
2015	0.232	1.532	4.155	2.317	2.916	2.623	2.715	0.226	0.823
2016	0.481	1.773	3.437	4.130	1.727	1.953	1.420	1.293	0.455
2017	0.573	3.680	3.079	3.013	3.135	1.097	1.182	0.751	0.940
2018	0.353	3.570	10.356	2.908	3.063	2.419	0.964	0.622	1.066

Table 6. Haddock in 5a. Catch weights from the commercial fishery in Icelandic waters.

Tafla 6. Ýsa á Íslandsmiðum. Aflaþyngdir.

YEAR	2	3	4	5	6	7	8	9	10
1979	620	960	1410	2030	2910	3800	4560	4720	5956.00
1980	837	831	1306	2207	2738	3188	3843	4506	4982.84
1981	584	693	1081	1656	2283	3214	3409	4046	5261.02
1982	289	959	1455	1674	2351	3031	3481	3874	4122.51
1983	320	1006	1496	1921	2371	2873	3678	4265	4501.74
1984	691	1007	1544	2120	2514	3027	2940	3906	4033.31
1985	652	1125	1811	2260	2924	3547	3733	4039	4658.72
1986	336	1227	1780	2431	2771	3689	3820	4258	4455.68
1987	452	1064	1692	2408	3000	3565	4215	4502	4024.82
1988	362	780	1474	2217	2931	3529	3781	4467	4418.39
1989	323	857	1185	1996	2893	4066	3866	4734	4989.60
1990	269	700	1054	1562	2364	3414	4134	4946	4451.01
1991	288	699	979	1412	1887	2674	3135	4341	4956.93
1992	313	806	1167	1524	1950	2357	3075	4053	4703.25
1993	303	705	1333	1875	2386	2996	3059	3363	4408.79
1994	337	668	1019	1717	2391	2717	3280	3156	3277.94
1995	351	746	1096	1318	2044	2893	3049	3675	3136.79
1996	311	787	1187	1560	1849	2670	3510	3567	3731.34
1997	379	764	1163	1649	1943	2342	3020	3337	3235.90
1998	445	724	1147	1683	2250	2475	2834	3333	3596.42
1999	555	908	1101	1658	2216	2659	2928	3209	3512.52
2000	495	978	1333	1481	2119	2696	3307	3597	3756.94
2001	541	945	1456	1731	1832	2243	3020	3328	4235.94
2002	564	928	1253	1737	2219	2230	2911	3365	4387.08
2003	498	922	1283	1704	2274	2744	2635	2819	3741.91
2004	559	1006	1258	1579	2044	2809	3123	2945	3759.31
2005	339	886	1265	1506	1916	2323	3028	3211	2890.52
2006	402	749	1093	1495	1758	2163	2555	3054	3589.48
2007	510	748	988	1346	1840	2062	2350	2525	3142.71
2008	383	636	857	1125	1575	2149	2417	2802	2600.47
2009	452	841	960	1131	1352	1757	2364	2497	3073.67
2010	447	756	1092	1294	1448	1685	2188	2366	2645.85
2011	588	905	1122	1455	1688	1914	2094	2455	2985.68
2012	668	978	1222	1492	1903	2164	2366	2704	2939.96

2013	678	1084	1358	1675	2036	2400	2554	3097	3097.31
2014	536	1080	1433	1793	2121	2504	2624	3178	3349.39
2015	573	1084	1486	2011	2332	2823	3306	3258	3768.15
2016	513	1071	1590	2035	2607	2952	3616	3734	4096.66
2017	643	997	1587	2032	2546	3016	3518	3839	3915.67
2018	627	1070	1383	2007	2536	2919	3377	3671	4026.36

Table 7. Haddock in 5a. Stock weights from the March survey in Icelandic waters.

Tafla 7. Ýsa. Stofnþyngdir úr vorleiðangri Hafrannsóknastofnunnar.

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	36	242	562	1195	1690	2417	2812	3243	3367	3897.85
1986	34	240	671	1135	1962	2424	3233	2961	3764	3821.01
1987	31	163	515	1220	1758	2604	3021	3517	3888	3764.51
1988	37	176	456	973	1849	2705	3104	3448	3179	4787.85
1989	27	181	438	888	1514	2371	2903	3506	3253	3746.75
1990	29	184	455	842	1233	1985	2713	3065	3334	4041.92
1991	31	176	496	1005	1417	1890	2508	3830	3715	4542.96
1992	29	157	498	893	1381	1865	2324	3007	3729	4750.00
1993	40	168	381	879	1488	1785	2580	2574	3274	4000.00
1994	33	179	402	704	1267	1721	1866	2628	2050	1844.64
1995	37	163	444	759	1062	1855	2664	5318	1313	4000.00
1996	40	174	447	816	1053	1452	2149	2365	4829	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	2580.53
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	3755	4356.88
2003	40	231	412	800	1259	1869	3152	2314	3302	3945.74
2004	34	177	557	807	1280	1685	2444	2920	2927	3333.11
2005	41	153	448	921	1188	1564	2103	2791	2548	3633.75
2006	33	135	333	736	1134	1510	1927	2227	3269	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
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	3675.05
2018	30	195	544	924	1836	2342	2660	2968	3204	3585.57

Table 8. Haddock in division 5.a. Sexual maturity-at-age in the stock (from the March survey). The numbers for age 10 only apply to the spawning stock.

Tafla 8. Ýsa á Íslandsmiðum. Kynþroskahlutfall eftir aldri.,

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	0.901	1.000	0.988	0.967909
1988	0.000	0.013	0.215	0.392	0.768	0.793	0.928	0.913	1.000	0.970376
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
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

Table 9. Haddock in division 5.a. Age disaggregated survey indices from the groundfish survey in March.
Tafla 9. Ýsa á Íslandsmiðum. Aldurskiptar stofnvísitölur úr vorralli.

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	13.38	16.84	13.56	1.00	3.17	1.27	2.43
1987	21.49	324.64	148.07	44.68	7.77	7.53	4.77	0.40	0.62	1.28
1988	15.72	40.01	184.62	90.05	23.12	1.36	2.20	1.77	0.16	0.23
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
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	7.07	82.63	45.52	40.69	67.44	4.15	3.82	3.09	1.61	0.87

Table 10. Haddock in division 5.a. Age disaggregated survey indices from the groundfish survey in October.

Tafla 10. Ýsa á Íslandsmiðum.. Aldurskiptar stofnvísitölur úr haustralli.

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	13.38	16.84	13.56	1.00	3.17	1.27	2.43
1987	21.49	324.64	148.07	44.68	7.77	7.53	4.77	0.40	0.62	1.28
1988	15.72	40.01	184.62	90.05	23.12	1.36	2.20	1.77	0.16	0.23
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
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	7.07	82.63	45.52	40.69	67.44	4.15	3.82	3.09	1.61	0.87

Table 11. Haddock in division 5.a. ICES advice and official landings. All weights are in tonnes. * Calendar year. ** January to August.

Tafla 11. Ýsa á Íslandsmiðum. Ráðgjafarsaga og opinber afli. Allar þyngdir eru í tonnum.

Fishing year	*ICES advice*	*Predicted catch corresp. to advice*	*Agreed TAC*	*Fishing year catches*	*Calendar year catches*
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
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		

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