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Section contents

8 Greenland halibut in subareas 1 and 2 (Northeast Arctic)

Reinhardtius hippoglossoides – ghl.27.1–2

8.1 Status of the fisheries

8.1.1 Landings prior to 2021 (Tables 8.1–8.8, Figures 8.1–8.3)

Nominal landings by country for subareas 1 and 2 combined are presented in Table 8.1. Tables 8.2 to 8.4 give the landings for Subarea 1 and divisions 2a and 2b separately, and landings separated by gear type are presented in Table 8.5. For most countries, the landings listed in the tables are similar to those officially reported to ICES. Some of the values in the tables vary slightly from the official statistics and represent those presented to the Working Group by the members. Catch per unit effort is presented in Table 8.6 and total catch from 1935 to now in Table 8.7 and Figure 8.1.

The preliminary estimate of the total landings for 2020 is 28 713 t. This is 118 t less than the landings in 2019 and about 5713 t more than the ICES advised maximum catch for 2020 (23 000 t). The catches from most countries remained fairly stable, compared to 2019. Combined landings exceeded the quotas set by the Joint Russian-Norwegian Fisheries Commission for 2019 by 1713 t (total TAC 27 000 t). One explanation is the difficulties in bycatch regulation. Also, catches in the report include all landings in ICES 1 and 2, and thus include catches in EU waters in the southern part of ICES 2.

Some fishing for Greenland halibut has taken place in the northern part of Division 4a during the past 20–30 years, varying between a few tonnes and up to 1670 t in 1995 and 2 577 in 1999. From 2005 to 2011 this catch was mostly below 200 t, taken mostly by Norway, France, and the UK. Preliminary numbers show 719 t in 2020, mainly due to the Norwegian trawl fleets (Table 8.8, Figures 8.2 and 8.3). Although there is a continuous distribution of this species from the southern part of Division 2a along the continental slope towards the Shetland area, the stock structure is unclear in this area and these landings have therefore not been added to the total from subareas 1 and 2. Recent mark-recapture and genetic investigations indicate that the stock might have a more south and westward distribution than the current ICES definition of the stock boundaries (Albert and Vollen, 2015, Westgaard *et al.*, 2016).

8.1.2 ICES advice applicable to 2021

The roll over advice from ICES for 2021 was as follows:

ICES advises that when the precautionary approach is applied, catches in 2020 should be no more than 23 000 tonnes. This corresponds to a harvest rate of ≈0.036. All catches are assumed to be landed.

8.1.2.1 Additional considerations

A benchmark and data workshop process led to an agreed analytic assessment in 2015.

A benchmark meeting (WKBUT; ICES 2013/ACOM:44) was held for the Northeast Arctic (NEA) Greenland halibut in 2013, but the benchmark process was prolonged due to problems with data. A data workshop was conducted in November 2014 (DCWKNGHD ICES CM 2014/ACOM:65), followed by a benchmark by correspondence that ended in 2015. The assessment is reported in the benchmark by correspondence (IBPHALI; ICES CM 2015/ACOM:54) and in the stock annex.

8.1.3 Management

The 38th JRNFC's session in 2009 decided to cancel the ban against targeted Greenland halibut fishery and established the TAC at 15 000 t for the next three years (2010–2012). The 40th JRNFC Session in 2011 decided to increase the TAC for 2012 up to 18 000 t, and at the 42nd JRNFC Session in 2012, the TAC for 2013 was increased to 19 000 t. The 43rd and 44th sessions kept the same TAC for 2014 and 2015. For 2016 and 2017 TAC was set to 22 and 24 thousand tonnes, respectively. The TAC for 2018 was 27 thousand tonnes and the same for 2019, 2020 and 2021.

The TAC for Greenland halibut set by JNRFC applies to catches in ICES areas 1, 2a and 2b, except the Jan Mayen EEZ and the part of the EU EEZ which is north of 62°N.

In 2020 catches of 48 tonnes were taken in the Jan Mayen area (within ICES Subarea 2), where Greenland halibut fisheries are not regulated by TAC.

Norway has a quota for Greenland halibut in the EU EEZ which in 2019 and 2020 was set to 1250 t each year and can be fished in ICES areas 2a and 6. Thus this TAC is given partly within and partly outside the stock boundary. In 2019 total of 844 t of this TAC was caught, assumingly mainly in ICES area 2a, but information was not available for catches in 2020. There is no ICES separate advice for the fishery in this area.

The TAC sat by EU for 2020 applied to "Union waters of 2a and 4; Union and international waters of 5b and 6" with a total quota of 2500 t, of which 1250 t were allocated to Norway with the footnote "To be taken in Union waters of 2a and 6. In 6, this quantity may only be fished with longlines (GHL/*2A6-C)." Additionally EU has sat another TAC of 1800 t in "International waters of 1 and 2(GHL/1/2INT)" (this possibly includes the Svalbard zone in EU lingo) and 50 t in "Norwegian waters of 1 and 2(GHL/1N2AB.)", both with the footnote "Exclusively for by-catches[1].

EU has set a TAC of 629 t for 2021 to be taken in Union waters of 2a and 6. In 6, this quantity may only be fished with longlines. EU has sat 1800 t TAC in international waters of ICES 1 and 2, exclusively for bycatches. No directed fisheries are permitted under this[2].

As the UK has left the EU and unilateral agreements between Norway, the UK and the EU are not reached yet the final TAC in this area is not available.

Further information on regulations is found in the Stock Annex.

8.1.4 Expected landings in 2021

Catches in 2020 exceeded the TAC sat by JRNFC and were 28 713 t. The total Greenland halibut landings in the Barents Sea and adjacent waters (ICES Subarea 1 and divisions 2a and 2b) in 2021 may thus be higher than the TAC of 27 000 t. Discards at present are not regarded as a problem.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0123&from=EN

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32021R0092&from=EN

8.2 Status of research

8.2.1 Survey results (Tables 8.9–8.13, Figures 8.4–8.14)

Survey indices from the Russian autumn survey (Figures 8.4–8.6), the Norwegian slope survey (Figures 8.4–8.5 and 8.7–8.8), the Joint Norwegian-Russian Ecosystem survey (A5216), Eco-juv and Eco-south indices; Figures 8.9–8.10) and the Joint Norwegian-Russian Winter Survey (Figure 8.11) are given. Length distributions from these surveys are presented in Tables 8.9–8.12 and Figure 8.12. Results from Spanish surveys are presented in Table 8.13 and Figure 8.13. Results from a Polish spring survey is presented in Figure 8.14.

The Russian bottom-trawl surveys in October-December (ICES acronym: *RU-BTr-Q4*) are important since they usually cover large parts of the total known distribution area of the Greenland halibut within 100–900 m depth. However, it has been considered imprudent to use 2002, 2003 and 2013 data from this survey series. During the 2002 survey, no observations were available from the Exclusive Economic Zone of Norway (NEEZ). In 2003, observations on the main spawning grounds were conducted three weeks later than usual because access to NEEZ was obtained too late. The number of trawl stations was also insufficient due to the same reason. Due to technical problems indices in 2013 were not obtained. Technical and practical changes were made in 2003. In 2017 and 2019 the coverage was insufficient. The assessment was run without 2019 in the index and the effect on biomass estimates were minor. It was decided to keep the 2019 estimate in the current assessment. The 2020 estimate was not considered appropriate to use due to gear-related problems during the survey. A working document with a revision of the Russian index was provided to the 2021 meeting (Russkikh WD12). Revised and recalculated length distributions were not implemented in the 2021 assessment but will be subject to the upcoming benchmark. Length distributions by year for this survey are given in Table 8.9. The biomass indices for this survey increased steeply from 2005 to 2011, but have mainly showed a downward trend since then (Figures 8.4 and 8.5).

Total biomass indices from the Norwegian autumn slope survey (*NO-GH-Btr-Q3*) showed an upward trend in biomass estimates between 1994 and 2003, then a downward trend until 2008 until it increased again in 2009 but levelled out again in 2011, 2013, and 2015 (Figures 8.4–8.5, and 8.7–8.8). Since then there is a downward trend and the index for 2020 is the lowest since the start of the survey. The length distributions from this survey (Figure 8.12, Tables 8.10 and 8.11) show modes that can be followed through the years and indicate new recruitment to the adult stock in 2007. Since then no such large recruit events are apparent in the length distributions, and since 2009 abundance of fish in adult lengths has been declining s as well. This survey was conducted every year during 1994–2009 but is now run biennially.

The Joint Ecosystem Survey in autumn (A5216; *Eco-NoRu-Q3 (Btr)*) covers a large part of the Barents Sea down to 500 m and concerning Greenland halibut it can be regarded to be in the areas where mainly juveniles and immature fish are found. Two indices for Greenland halibut are based on the Joint Ecosystem Survey in the Barents Sea and previous juvenile survey, one for juvenile areas (Figure 8.9) denoted Eco-juv index in the northernmost survey area, and another denoted Eco-south index defined by the survey area south from 76.5°N and west of Spitsbergen (Figure 8.10). The juvenile index, covering the juvenile area (see section 8.3), indicates a highly variable recruitment success with years between good year classes. The trend has mainly been downward since around 2007 and the 2015 estimates are the lowest registered so far, followed by a minor peak in 2017. The Eco-south index for both females and males showed an increasing trend until 2012, followed by a decrease since then. The 2018 estimate in the Eco-south index was excluded from this year's assessment. The abundance estimate in 2018 peaked to extend that can be considered unrealistic for a slow-growing species. Additionally, there are concerns about the quality of the estimate due to the lack of survey coverage in 2018, especially in the area south of 76.5°N as defined for the Eco-south index (Figure 8.19). The male index shows a similar trend except the increase started a year later, in 2016 - 2018, but is also down in 2019. Length distributions by year for this survey are given in Table 8.11.

The joint winter survey in the Barents Sea (*Eco-NoRu-Q3 (Btr)*) has been run from 1986 to the present (jointly with Russia since 2000, except 2006 and 2007). The survey mainly covers depths of 100–500 m and does not cover the deeper slope areas. Spatially, the survey focuses on the central Barents Sea, and west of Svalbard for some years. The northward coverage is limited by sea ice in some years. It is conducted in February and can thus give information on the stock at a different time of the year, as the other surveys are run in autumn. The biomass index has shown an increasing trend since 2004 with large variations in recent years. This survey is not currently used in the assessment.

The Spanish bottom-trawl survey, (Table 8.13, Figure 8.13) was carried out on a new hired commercial vessel and some changes have been done in the initial standard protocol. The indices for Greenland halibut from earlier Spanish surveys (1997–2005) cannot be standardized with more recent ones (2008 to present, Basterretxea *et al.*, WD13 2013). This means that biomass estimates from the survey are only available for years 2008 and onwards. The Spanish survey has since 2015 only been run in autumn. This survey is not conducted every year. The biomass index from the Spanish survey shows a downward trend since around 2012. This survey is not currently used in the assessment.

Polish bottom-trawl surveys on Greenland halibut were carried out in the Svalbard-Bear Island area (ICES 2b) in October 2006, April 2007, April 2008, June 2009, and March 2011. The main objectives of the survey were to determine the biological structure, distribution, density and standing biomass of Greenland halibut in the survey area (Trella and Janusz, WD6 ICES AFWG 2012). The survey has not been conducted since then. Polish survey index is shown in Figure 8.14, no new data were presented to the meeting. This survey is not currently used in the assessment.

8.2.2 Commercial catch-per-unit-effort (Table 8.6, Figure 8.15)

The CPUE series for the stock was subject to the last benchmark and following data workshops (see reports from WKBUT 2013, DCWKNGHD 2014 and IBPHALI 2015, and working documents by Bakanev (WD14 WKBUT 2013) and Nedreaas (WD 2 DCWKNGHD 2014); Figure 8.15). An alternative CPUE series for the Russian fisheries for the years 2004–2015 was presented at the 2016 meeting (Mikhaylov, WD14 ICES AFWG 2016). It shows some discrepancies compared to the previous CPUE series used for the Russian fisheries for the same years. See the Stock Annex for further comments. The CPUE series are not currently used in the assessment.

8.2.3 Age readings

Based on the scientific understanding that the species is slower growing and vulnerable than the previous age readings suggest, the Norwegian age reading methods were changed in 2006. The new Norwegian age readings are not comparable with older data or the Russian age readings.

The report from Workshop on Age Reading of Greenland Halibut (WKARGH) 14–17 February 2011 (ICES CM 2011/ACOM:41) described and evaluated several age reading methods for Greenland halibut.

The different methods can be classified into two groups: A) Those that produce age–length relationships that broadly compare with the traditional methods described by the joint NAFO-ICES workshop in 1996 (ICES CM 1997/G:1); and B) Several recently developed techniques that show much higher longevity and approximately half the growth rate from 40–50 cm onwards compared to the traditional method.

A second workshop on age reading of Greenland halibut (WKARGH 2) was conducted in August 2016 and worked on further validation on new age reading methods. The workshop recommended that two of the new methods can be used to provide age estimations for stock assessments. Further, recognizing some bias and low precision in methods, the WKARGH2 suggested that an aging error matrix or growth curve with error be provided for use in future stock assessments (WKARGH2 report 2016, ICES CM 2016/SSGIEOM:16).

WKARGH2 recommends regular inter-lab calibration exercises to improve precision (i.e. exchange of digital images between readers for each method and between methods).

AFWG suggests that Russian and Norwegian scientists and age readers meet to work out issues of disagreements on Greenland halibut aging.

8.3 Data used in the assessment

In the assessment, the catch data are split into four aggregated fleets by gear and countries. Longline/gillnet fleets include landings from gillnet, longline, and handline. Trawl fleets include landings from bottom trawl, purse-seine (very minor catches, can be bycatch or misreporting) and Danish seine. Catch in tonnes and length distributions per quarter per fleet per sex from 1992–2020 are used in the assessment. Fleets are split between Norwegian (including 3rd countries) and Russian catches, and selectivities are allowed to vary by sex (logistic for gill fleets, asymmetric dome-shaped for trawl fleets), to account for sexual dimorphism influencing vulnerability to fishing. For each fleet listed below, length distributions and reported catch in tonnes are split by quarter and sex (although length distributions are not available for all quarters for some fleets).

- Russian, trawl and minor gears (split by sex)
- Russian, gillnet and longline (split by sex)
- Norwegian and 3rd countries, trawl and minor gears (split by sex)
- Norwegian and 3rd countries, gillnet and longline (split by sex)

In addition, the model has four surveys, all modelled with asymmetric dome-shaped selectivities (note that in a model context "selectivity" encompasses all aspects of vulnerability to the fishery, including gear effects, vessel effects, area effects etc.). In each case, data are used as length distribution and biomass index. The biomass index was not available to split by sex for all years, so a combined sex index is used. The four survey indices that go into the current assessment are:

- Norway slope (*NO-GH-Btr-Q3*)– based on the Norwegian Greenland halibut slope survey (yearly 1996–2009, biennially since then). Split by sex.
- EcoJuv - a juvenile index based on data from the northern/northeastern areas of the Joint Ecosystem survey (A5216; *Eco-NoRu-Q3 (Btr)*; 2003–present) and the precursory Norwegian juvenile Greenland halibut survey north and east of Svalbard (1996–2002; Hallfredsson and Vollen, WD 1 ICES IBPhali 2015). Split by sex.
- EcoSouth - an index for the Barents Sea south of 76.5°N, based on data from the Joint Ecosystem survey (A5216; *Eco-NoRu-Q3 (Btr)*; 2003–present; Hallfredsson and Vollen, ICES AFWG, WD 20, April 2015). Split by sex.
- Russian - Russian bottom-trawl survey in the Barents Sea (1992–2015 and 2017; *RU-BTr-Q4*). Sex aggregated (can be split by sex in future work).

No age data or CPUE indices are used in the tuning.

8.4 Methods used in the assessment

A new assessment method with a length-based GADGET model was benchmarked in 2015 (IPHALI 2015) and accepted by ACOM the same year. The model is further described in the IPHALI report and the Stock Annex.

8.4.1 Model settings

Model used: Gadget (see ICES, 2015).

Period: 1992–2020, monthly time-steps

Model structure:

- 1 cm length classes (1–114+ cm) and 1-year age classes (1–30+)
- Two sexes, split into mature and immature
- Logistic maturity estimated for each sex
- Von Bertanlanffy growth estimated separately for males and females
- L-W relationship fixed based on data from the Norwegian slope (Females: a = 1.4E-6 and b = 3.47. Males: a = 5.7E-6 and b = 3.12)
- Natural mortality set to 0.1 for all fish
- Initial size of recruits fixed at 8.5 cm (necessary to fix this in the absence of age data)
- Recruitment modelled as annual numbers, no relationship with SSB
- Four aggregated fleets (as described above), each with sex-specific selectivity (logistic for gillnet and longline fleets, asymmetric dome-shaped for trawl)
- Four surveys (as described above), all with asymmetric dome-shaped selectivity

Note that to avoid the problem of modelled fish not covered by any fleet (and therefore not tuned to any data) the gillnet and longline fleets have been assumed to have logistic (flat-topped) selectivity.

8.4.1.1 Estimated parameters:

Estimated parameters are L_{50} and slope for the maturation (male and female separately), two growth parameters per sex, two maturation parameters per sex, one annual recruitment parameter per year, two parameters for s.d. of the length of recruits, parameters governing commercial selectivity (two per sex per gillfleet and three per sex per trawlfleet), one effort parameter per year for each fleet, three parameters per survey per sex governing selectivity, initial population numbers for male and female fish by age, initial population s.d. of lengths by sex and age.

Data used for tuning are:

- Quarterly length distribution of the landings from commercial fishing fleets (by sex)
- Quarterly catch in tonnes for each fleet (by sex)
- Length disaggregated survey indices from the four surveys (by sex except for the Russian survey)
- Overall survey index (by biomass) for the four surveys (by sex except for the Russian survey)
- Estimated maturity ogives (maturity at length in the population) for 1992–2020 (by sex)

Note that no age data are used in tuning the model. Although age readings are available for some years there is not a full agreement on which age-reading methodology should be used, and these data are thus not suitable for inclusion in an assessment model yet.

Concerning the recruitment, it should be noted that age 1 is the age for recruitment to the stock, NOT the age for recruitment to the fishery, which is the quantity normally used to describe recruitment. But since age 1 recruitment is the quantity estimated by the model and the age of recruitment to the fishery can't be defined due to lack of age data, we use age 1 as the recruitment age for this stock. Even if adequate age data were available, the strong sexual dimorphism in growth would make it very difficult to define an appropriate recruitment age to the fishery.

8.5 Results of the assessment

The assessment is conducted every two years and advice was given in 2019 for catches in 2020 and 2021. Model results are shown in Figures 8.16 and 8.17, and Table 8.14. The stock abundance and biomass are presented for fish larger than 45 cm, this corresponds to the minimum legal size and is slightly larger than L_{50} maturity for males. Both 45 cm+ abundance and biomass peaks around 2013–2014 and show a clear downward trend since then. The harvest rate has been steadily increasing since 2009 and has reached levels higher than the HR_{pa} that is recommended by the meeting. There is a retrospective trend to reduce the stock estimate over time (Figure 8.18). AFWG 2021 decided to exclude the ecosystem survey data from 2018 (in line with their exclusion for cod and haddock). This removal has resulted in a downwards revision of the stock biomass since the AFWG 2019 assessment. However, the last 5 years of the retrospective for the 45cm+ biomass are very consistent (Figure 8.18). The modelled recruitment is spiky (Figure 8.17), and this is likely exaggerated due to the lack of age data. However, although the real recruitment is likely more spread out, the modelled peaks show reasonably good agreement to the data from the juvenile survey. This stock is dominated by sporadic recruitment events, and the model does a reasonable job of capturing this. The model estimates a large recruitment event of one-year-old in 2002, which corresponds to recruitment to the adult stock in 2007 as can be seen in length distributions in surveys at the continental slope (Figure 8.12). Since then no such large recruitments events have been estimated by the model, but the model has been consistently estimating reasonably good recruitment in 2009–2010 and 2014, which should be entering the fishery in the coming years.

8.5.1 Biological reference points

The last benchmark (ICES 2015), given the sporadic nature of recruitment and the relatively short period of the model, concluded that constructing a SSB-recruitment relationship had not been possible. It was therefore decided to take the "Bloss" route to arriving at a reference point. In the assessment at the benchmark, there was evidence of good recruitment in 1995, when the biomass was around 500 000 tonnes. This could be taken as a reference point, "Bloss with good recruitment". It was noted that this is likely to be precautionary, and a "real" B_{lim} is likely to be rather lower. It was therefore recommended to use the 1995 biomass (c. 500 000 tonnes 45+ cm biomass) as a precautionary reference point. It should be noted that because of lack of age data the exact year for modelled good recruitment can vary slightly between assessments. In the current assessment there is relatively good recruitment of 1-year-olds in 1994 (Figure 8.17) and the 45+ biomass in 1993, the year before, is around 500 000 tonnes (figure 8.16).

There is evidence (in the estimated initial population for the assessment model) that an earlier good recruitment event occurred in the 1980s from lower biomass, but the exact biomass level is unknown as this is before the model period. Using 45+ cm biomass (rather than total or female SSB) avoids uncertainty around maturation sizes and the different distributions of males and females, and relates directly to the fishable stock, but does not directly relate to the most vulnerable or critical female SSB. The biomass reference point was used until the last assessment accepted by ACOM in 2019. This year a new approach is implemented for the draft advice. Two options are given for ADG/ACOM to decide on with HR_{pa} = 0.035 and HR_{pa} = 0.025 as a reference value (see 8.6 Comments to the assessment).

8.5.2 NEA Greenland halibut surplus production models

Results of the assessment of the Barents Sea Greenland halibut stock based on a Bayesian surplus production model was provided by Bakanev in 2013, (WKBUT WD 14). Different sets of abundance indices were used for tuning the model. The analysis of model run results has shown that K is estimated within the range of 810 to 1139 kilotonnes, B_{MSY} of 405 to 570 kilotonnes and MSY of 23 to 47 kilotonnes. However, the model was sensitive to the choice of prior on K. Taking into consideration a high probability of the stock size being at the level which was quite a bit above B_{MSY}, the risk of the biomass being below this optimal one was very small in 2002–2012 (<1%). The risk analysis of the stock size in the prediction years (2013–2020) under the catch of 0 to 30 kilotonnes indicated that the probability of the stock size being under the threshold levels (B_{MSY}, B_{lim}) was also minor (less than 1%). It was concluded that further work was needed on the historical CPUE series. Based on scrutiny of the CPUE series it was recommended to examine runs with the surplus production model for the period 1964 –1991 and 1964 –2005, in addition to runs for the whole 1964–2013 period. Fisheries CPUE series were considered less reliable to reflect stock dynamics than survey indices in the period after regulations of the fishery were introduced in 1992. The Bayesian surplus model was not updated for presentation at the current meeting.

A production model was presented at the 2016 meeting (Mikhaylov, 2016, WD 14), although this model has not been reviewed at a benchmark, nor were biomass trends presented at this meeting. The model has been proposed as a possible method for the estimation of long-term reference points. An update was presented at the 2019 meeting (Mikhaylov 2019, AFWG 2019 WD21). In the current version, the MSY would be around 34 ktonnes, the B_{MSY} around 500 ktonnes and F_{MSY} on the level 0.069. It should be noted that these values are not directly transferable to a different model with different biomass levels and in any case a long-term average. The WD concluded that, in general, the stock can withstand the fishing load in 2016 and the fishing regime was approaching optimum, indicating that the results of the exploratory surplus production model were in general alignment with the assessment.

F_{MSY} is not appropriate to this stock given the recent extended run of poor recruitment, and such values have not been evaluated for precautionarity. In a plenary, it was concluded that it would be useful for further development of the production model to conduct separate exploratory runs for CPUE split into before and after 1992 and run with CPUE only before 1992 and survey data after 1992. This production model was not updated for presentation at the current meeting.

At the 2018 meeting, AFWG results from SPiCT production model were presented (AFWG report 2018). In the run that is presented in this report, all available data up to 2016 were used. For run with default, priors applied K = 995 421 t and deterministic reference points were B_{MSY} = 419 955 t, F = 0.07 and MSY = 29 742 t. Stochastic reference points for this run were in a similar range. Run with default priors deactivated gives similar MSY estimates but otherwise, rather different estimates; K = 2 504 006 t, B_{MSY} = 609 410 t, F = 0.05 and MSY = 28 097 t. Further utilization of this approach demands closer scrutiny of model settings in relation to diagnostics. The SPiCT model can be a flexible tool to examine the production model approach to Greenland halibut, however, concerns highlighted below still apply.

In principle, a production model could be used in conjunction with the GADGET assessment model in order to extend the simulations back in time and provide better estimates for B_{lim}. However, the inability of production models to follow variable recruitment, and especially runs of above or below average recruitment, limits their ability to advise on this stock.

In the benchmark report (IBPHALI 2015) Table 3.3 gives CPUE series and survey estimates that can be helpful for this task (Figure 8.15).

8.6 Comments to the assessment

The draft advice sheet in 2019 was rejected by ADGANW and roll-over advice was used for advice in 2020. ADGANW issued a request to repeat the advice process in 2020 with HR_{pa} reference points for use in the 2021 advice (ICES 2017). Due to the need for a simplified approach related to the 2020 corona virus outbreak, ACOM decided, in agreement with Advice Requestors, that roll-over advice should be used in 2020 to provide advice on fishing opportunities in 2021.

ADGANW 2019 requested that a simple F_{MSY} proxy is developed as well as $B_{trigger}$, or failing that a Fpa to provide precautionary advice. The approach implemented for the current draft advice is documented by Howell (2020, WD 15 and 2021, WD 08) that proposed an interim HR_{pa} (harvest rate pa) until such time as the stock next undergoes a full benchmark followed by an HCR evaluation to come with a full management plan for this stock. Such a benchmark is planned for 2022.

The HR_{pa} is based on the method proposed in the 2017 ICES fisheries management reference points for category 1 and 2 stocks (ICES 2017). This method involved projecting the stock forward under average recruitment to identify the fishing level Flim that drives the stock to B_{lim} under equilibrium. This method was chosen because the lack of age tuning data makes the variability of recruitment unreliable, and using averages is a more robust approach. There is a modification to allow for the fact that in light of the lack of contrast in the data this stock has Bpa set equal to Bl_{im}, and hence the method gives HR_{pa} directly, and there may be no need to first compute an HR_{lim} and then adjust this for an HR_{pa}. In using this approach it is necessary to select the recruitment average to use, and the method chosen was to use the full time-series of recruitment, but excluding the extra-high peak in 2003, with the justification that this recruitment peak is already recruited to the fishery and that such a recruitment peak has not been repeated since and therefore this level of recruitment cannot be expected to enter the fishery in the coming years.

Two alternatives are proposed as HR_{pa} for Greenland halibut in areas 1 and 2 for ADG/ACOM to decide, 0.035 or 0.025, both with the provision that if a large recruitment event is observed in the surveys then the HR_{pa} should be revised before the incoming good recruitment entering the fishery.

This solution for HR_{pa}, if accepted by ACOM, would apply until the planned benchmark, i.e. for one two-year advice cycle.

HR_{pa} is set at 0.035 (following ICES reviews that were arranged afterwards, in conjunction with the AFWG meeting.

The ongoing reduction in sex-split length samples in two survey indices, EcoJuv and EcoSouth required a change in methodology for computing the tuning indices used in the assessment. The change was implemented in the 2019 assessment.

We stress once again that the absolute biomass levels for this model are rather uncertain. Without age data in the model tuning there is little information on total mortality (Z) at age (number-at-age x in year y minus number-at-age x-1 in year y-1 gives information on Z). Without this, there is little information for the model to translate catch information into F and hence inform biomass levels. Furthermore, the conflicting survey signals translate into an uncertainty range of several hundred thousand tonnes (IBPHALI 2015). All the exploratory work suggests that the overall trends are robust, but that care should be taken in interpreting the absolute abundance estimates (and hence absolute estimates of harvest rate).

Although there are few retrospective pattern differences over the last four years, the model exhibits a retrospective pattern in earlier years associated with the biomass peak around 2014 (Figure 8.18). The two coastal shelf surveys (the ecosystem survey (A5216) and the Russian survey) showed a more rapid rise than the other surveys, and then a more rapid reduction. The Russian survey had a very rapid rise and then a rapid decline. The model, therefore, had a series of downward revisions as the peak was passed, where the model now estimates that it had previously been over-optimistic about the size of the peak. It should be noted (ICES IBPHALI REPORT 2015; ICES CM 2015\ACOM:54) that there is an issue with this stock where different surveys give different signals and choosing one survey over the others could affect the biomass level by several hundred thousand tonnes. Given this, a retrospective pattern is probably to be expected as the different surveys evolve. Note also that one of the surveys is run every two years (in odd-numbered years), this accounts for the grouping of lines in the retrospective pattern into pairs.

8.6.1 Future work

Further development of the assessment is needed and, in consistency with conclusions of the IBPHALI benchmark and report of the external benchmark reviewer.

A new benchmark on the stock is planned for 2022, and intersessional work will commence on a issues list. Such a benchmark, especially if it can extend the model back in time to a period of lower stock biomass and includes age data, would allow a more accurate determination of precautionary biomass reference points. It would, therefore, be a precursor to a potential MSE to generate an HCR for this stock and move away from precautionary advice.

8.7 Tables and figures

Table 8.1. Greenland halibut in subareas 1 and 2. Nominal Catch (t) by countries (Subarea 1, divisions 2a, and 2b combined) as officially reported to ICES.

Year	Denmark	Estonia	Faroe Islands	France	Fed. Rep. Germany	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[3]	Spain	GB	UK (Engl. & Wales)	UK (Scot land)	Total
1984	0	0	0	138	2 165	0	0	0	0	0	4 376	0	0	15 181	0	0	23	0	21 883
1985	0	0	0	239	4 000	0	0	0	0	0	5 464	0	0	10 237	0	0	5	0	19 945
1986	0	0	42	13	2 718	0	0	0	0	0	7 890	0	0	12 200	0	0	10	2	22 875
1987	0	0	0	13	2 024	0	0	0	0	0	7 261	0	0	9 733	0	0	61	20	19 112
1988	0	0	186	67	744	0	0	0	0	0	9 076	0	0	9 430	0	0	82	2	19 587
1989	0	0	67	31	600	0	0	0	0	0	10 622	0	0	8 812	0	0	6	0	20 138
1990	0	0	163	49	954	0	0	0	0	0	17 243	0	0	4 764	0	0	10	0	23 183
1991	11	2 564	314	119	101	0	0	0	0	0	27 587	0	0	2 490	132	0	0	2	33 320
1992	0	0	16	111	13	13	0	0	0	0	7 667	0	31	718	23	0	10	0	8 602
1993	2	0	61	80	22	8	56	0	0	30	10 380	0	43	1 235	0	0	16	0	11 933
1994	4	0	18	55	296	3	15	5	0	4	8 428	0	36	283	1	0	76	2	9 226
1995	0	0	12	174	35	12	25	2	0	0	9 368	0	84	794	1106	0	115	7	11 734
1996	0	0	2	219	81	123	70	0	0	0	11 623	0	79	1 576	200	0	317	57	14 347

Year	Denmark	Estonia	Faroe Islands	France	Fed. Rep. Germany	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[3]	Spain	GB	UK (Engl. & Wales)	UK (Scot land)	Total
1997	0	0	27	253	56	0	62	2	0	0	7 661	12	50	1 038	157	0	67	25	9 410
1998	0	0	57	67	34	0	23	2	0	0	8 435	31	99	2 659	259	0	182	45	11 893
1999	0	0	94	0	34	38	7	2	0	0	15 004	8	49	3 823	319	0	94	45	19 517
2000	0	0	0	45	15	0	16	1	0	0	9 083	3	37	4 568	375	0	111	43	14 297
2001	0	0	0	122	58	0	9	1	0	0	10 896	2	35	4 694	418	0	100	30	16 365
2002	0	219	0	7	42	22	4	6	0	0	7 143	5	14	5 584	178	0	41	28	13 293
2003	0	0	459	2	18	14	0	1	0	0	8 216	5	19	4 384	230	0	41	58	13 447
2004	0	0	0	0	9	0	9	0	0	0	13 939	1	50	4 662	186	0	43	0	18 899
2005	0	170	0	32	8	0	0	0	0	0	13 011	0	23	4 883	660	0	29	18	18 834
2006	0	0	204	46	8	0	8	0	0	196	11 119	201	26	6055	29	0	10	2	17 904
2007	0	0	203	41	8	198	15	0	0	0	8230	200	47	6484	8	0	11	8	15 453
2008	0	0	663	42	5	0	28	0	0	0	7393	201	46	5294	94	0	16	10	13 792
2009	0	0	422	16	19	16	15	2	0	0	8 446	204	237	3 335	210	0	9	60	12 990
2010	0	0	272	102	14	15	16	0	0	0	7 700	3	11	6 888	182	0	4	22	15 229
2011	0	0	538	46	80	4	7	0	0	234	8 270	169	21	7 053	144	0	36	4	16 606
2012	0	0	564	40	40	12	13	0	0	0	9 331	22	1	10 041	190	0	21	14	20 288

Year	Denmark	Estonia	Faroe Islands	France	Fed. Rep. Germany	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[3]	Spain	GB	UK (Engl. & Wales)	UK (Scot land)	Total
2013	0	0	783	168	49	22	106	1	0	0	10 403	30	7	10 310	196	0	17	75	22 167
2014	0	0	887	269	33	20	86	0	0	0	11 232	19	0	10 061	206	0	28	184	23 025
2015	0	0	312	227	33	14	53	0	0	5	10 874	13	1	12 953	159	0	25	79	24 748
2016	0	359	483	229	9	17	79	0	0	0	12 932	8	19	10 576	198	0	20	19	24 948
2017	0	523	917	177	21	26	10	0	1	72	13 741	27	13	10 714	56	0	83	0	26 380
2018	2	574	401	150	50	20	24	0	0	206	14 712	27	6	12 072	60	134	0	0	28 438
2019*	0	588	350	105	44	23	9	0	32	377	14 813	122	8	12 198	87	75	0	0	28 832
2020*	1	578	514	49	72	41	19	0	149	226	14 532	97	28	12 266	96	45	0	0	28 713

* **Provisional figures.**

Table 8.2. Greenland halibut in subareas 1 and 2. Nominal catch (t) by countries in Subarea 1 as officially reported to ICES.

Year	Estonia	Faroe Islands	Fed. Rep. Germany	France	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[3]	Spain	GB	UK (England & Wales)	UK (Scot land)	Total
1984	0	0	0	0	0	0	0	0	0	593	0	0	81	0	0	17	0	691
1985	0	0	0	0	0	0	0	0	0	602	0	0	122	0	0	1	0	725

Year	Estonia	Faroe Islands	Fed. Rep. Germany	France	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[3]	Spain	GB	UK (England & Wales)	UK (Scot land)	Total
1986	0	0	1	0	0	0	0	0	0	557	0	0	615	0	0	5	1	1 179
1987	0	0	2	0	0	0	0	0	0	984	0	0	259	0	0	10	0	1 255
1988	0	9	4	0	0	0	0	0	0	978	0	0	420	0	0	7	0	1 418
1989	0	0	0	0	0	0	0	0	0	2 039	0	0	482	0	0	0	0	2 521
1990	0	7	0	0	0	0	0	0	0	1 304	0	0	321	0	0	0	0	1 632
1991	164	0	0	0	0	0	0	0	0	2 029	0	0	522	0	0	0	0	2 715
1992	0	0	0	0	0	0	0	0	0	2 349	0	0	467	0	0	0	0	2 816
1993	0	32	0	0	0	56	0	0	0	1 754	0	0	867	0	0	0	0	2 709
1994	0	17	217	0	0	15	0	0	0	1 165	0	0	175	0	0	0	0	1 589
1995	0	12	0	0	0	25	0	0	0	1 352	0	0	270	84	0	0	0	1 743
1996	0	2	0	0	0	70	0	0	0	911	0	0	198	0	0	0	0	1 181
1997	0	15	0	0	0	62	0	0	0	610	0	0	170	0	0	0	0	857
1998	0	47	0	0	0	23	0	0	0	859	0	0	491	0	0	2	0	1 422
1999	0	91	0	0	13	7	0	0	0	1 101	0	0	1 203	0	0	0	0	2 415
2000	0	0	0	0	0	16	0	0	0	1 021	0	0	1 169	0	0	0	0	2 206
2001	0	0	0	0	0	9	0	0	0	925	0	0	951	0	0	2	0	1 887

Year	Estonia	Faroe Islands	Fed. Rep. Germany	France	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[3]	Spain	GB	UK (England & Wales)	UK (Scot land)	Total
2002	0	0	3	0	0	0	0	0	0	834	0	0	1 167	0	0	0	0	2 004
2003	0	48	0	0	2	0	1	0	0	962	1	0	735	0	0	0.3	0	1 749
2004	0	0	0	0	0	0.3	0	0	0	866	0	0	633	0	0	3	0	1 503
2005	0	0	0	1	0	0	0	0	0	572	0	0	595	0	0	3	0	1 171
2006	0	17	1	0	0	1	0	0	0	575	0	0	626	2	0	2	0	1 224
2007	0	18	0	1	198	3	0	0	0	514	0	3	438	0	0	4	0	1 179
2008	0	13	0	1	0	5	0	0	0	599	0	0	390	0	0	0	0	1 008
2009	0	33	0	0	16	5	0	0	0	734	0	0	483	0	0	1	0	1 272
2010	0	15	0	0	0	16	0	0	0	659	0	0	708	2	0	0	0	1 399
2011	0	63	0	0	0	6	0	0	0	867	0	0	782	0	0	0	0	1 718
2012	0	8	5	0	0	7	0	0	0	921	0	0	1 368	1	0	7	0	2 318
2013	0	39	1	8	0	100	0	0	0	1 055	4	0	1 442	4	0	8	0	2 661
2014	0	143	8	11	19	38	0	0	0	1 271	7	0	1 261	10	0	14	0	2 782
2015	0	96	14	3	12	47	0	0	5	1 424	5	0	1 681	8	0	4	0	3 299
2016	353	84	2	3	3	38	0	0	0	1 265	7	0	1 172	7	0	20	0	2 954
2017	519	125	4	4	2	8	0	1	72	1 389	9	1	1 124	13	0	21	0	3 293

Year	Estonia	Faroe Islands	Fed. Rep. Germany	France	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[3]	Spain	GB	UK (England & Wales)	UK (Scot land)	Total
2018	574	104	9	16	2	20	0	0	199	1 008	4	1	894	2	97	0	0	2 930
2019*	588	116	27	9	6	6	0	32	377	939	119	0	932	16	49	0	0	3 216
2020*	578	123	37	7	11	18	0	142	223	1388	96	17	787	36	1	0	0	3 464

* **Provisional figures.**

Table 8.3. Greenland halibut in subareas 1 and 2. Nominal catch (t) by countries in Division 2a as officially reported to ICES.

Year	Estonia	Faroe Islands	Fed. Rep. Germ.	France	Greenland	Ireland	Iceland	Lithuania	Norway	Poland	Portugal	Russia[5]	Spain	GB	UK (Engl. & Wales)	UK (Scot-land)	Total
1984	0	0	265	138	0	0	0	0	3 703	0	0	5 459	0	0	1	0	9 566
1985	0	0	254	239	0	0	0	0	4 791	0	0	6 894	0	0	2	0	12 180
1986	0	6	97	13	0	0	0	0	6 389	0	0	5 553	0	0	5	1	12 064
1987	0	0	75	13	0	0	0	0	5 705	0	0	4 739	0	0	44	10	10 586
1988	0	177	150	67	0	0	0	0	7 859	0	0	4 002	0	0	56	2	12 313
1989	0	67	104	31	0	0	0	0	8 050	0	0	4 964	0	0	6	0	13 222
1990	0	133	12	49	0	0	0	0	8 233	0	0	1 246	0	0	1	0	9 674
1991	1 400	314	21	119	0	0	0	0	11 189	0	0	305	0	0	0	1	13 349

Year	Estonia	Faroe Islands	Fed. Rep. Germ.	France	Greenland	Ireland	Iceland	Lithuania	Norway	Poland	Portugal	Russia[5]	Spain	GB	UK (Engl. & Wales)	UK (Scot-land)	Total
1992	0	16	1	108	13	0	0	0	3 586	0	15	58	0	0	1	0	3 798
1993	0	29	14	78	8	0	0	0	7 977	0	17	210	0	0	2	0	8 335
1994	0	0	33	47	3	4	0	0	6 382	0	26	67	0	0	14	0	6 576
1995	0	0	30	174	12	2	0	0	6 354	0	60	227	0	0	83	2	6 944
1996	0	0	34	219	123	0	0	0	9 508	0	55	466	4	0	278	57	10 744
1997	0	0	23	253	0	0	0	0	5 702	0	41	334	1	0	21	25	6 400
1998	0	0	16	67	0	1	0	0	6 661	0	80	530	5	0	74	41	7 475
1999	0	0	20	0	25	2	0	0	13 064	0	33	734	1	0	63	45	13 987
2000	0	0	10	43	0	0	0	0	7 536	0	18	690	1	0	65	43	8 406
2001	0	0	49	122	0	1	9	0	8 740	0	13	726	5	0	56	30	9 751
2002	0	0	9	7	22	0	4	0	5 877	0	3	849	0	0	12	28	6 811
2003	0	390	5	2	12	0	0	0	6 713	0	10	1 762	14	0	5	58	8 971
2004	0	0	4	0	0	0	9	0	11 704	0	24	810	4	0	1	0	12 556
2005	0	0	3	31	0	0	0	0	11 216	0	11	1 406	0	0	5	18	12 690
2006	0	175	0	38	0	0	7	0	8 897	0	6	950	0	0	6	2	10 081
2007	0	162	2	37	0	0	12	0	6 761	0	2	489	1	0	2	8	7 475
2008	0	646	4	38	0	0	23	0	5 566	1	1	1 170	0	0	6	10	7 465

Year	Estonia	Faroe Islands	Fed. Rep. Germ.	France	Greenland	Ireland	Iceland	Lithuania	Norway	Poland	Portugal	Russia[5]	Spain	GB	UK (Engl. & Wales)	UK (Scot-land)	Total
2009	0	379	0	13	0	0	10	0	6 456	0	9	1 531	0	0	0	60	8 459
2010	0	255	0	102	15	0	0	0	6 426	0	0	4 757	0	0	0	22	11 577
2011	0	467	0	45	4	0	1	0	6 637	0	0	3 643	2	0	0	4	10 803
2012	0	553	0	37	12	0	6	0	7 934	0	0	3 878	0	0	0	14	12 434
2013	0	739	0	150	22	0	6	0	8 215	0	2	4 143	0	0	0	75	13 352
2014	0	741	0	255	1	0	48	0	8 640	0	0	4 800	0	0	0	184	14 669
2015	0	215	2	221	2	0	6	0	8 166	0	1	3 691	0	0	0	79	12 383
2016	6	380	6	216	14	0	41	0	10 073	0	6	1 797	7	0	0	19	12 566
2017	0	773	0	161	20	0	2	0	10 122	0	7	1 852	1	0	16	0	12 955
2018	0	297	1	104	9	0	4	1	11 226	2	5	695	0	6	0	0	12 350
2019*	0	232	15	95	16	0	4	0	12 121	3	7	2 755	3	12	0	0	15 263
2020*	0	385	21	34	28	0	1	0	11 437	0	8	2 691	0	3	0	0	14 608

* **Provisional figures.**

Table 8.4. Greenland halibut in subareas 1 and 2. Nominal catch (t) by countries in Division 2b as officially reported to ICES.

Year	Denmark	Estonia	Faroe Islands	Fed. rep. Germ.	France	Greenland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[4]	Spain	GB	UK (Engl. & Wales)	UK (Scot land)	Total
1984	0	0	0	1 900	0	0	0	0	0	80	0	0	9 641	0	0	5	0	11 626
1985	0	0	0	3 746	0	0	0	0	0	71	0	0	3 221	0	0	2	0	7 040
1986	0	0	36	2 620	0	0	0	0	0	944	0	0	6 032	0	0	0	0	9 632
1987	0	0	0	1 947	0	0	0	0	0	572	0	0	4 735	0	0	7	10	7 271
1988	0	0	0	590	0	0	0	0	0	239	0	0	5 008	0	0	19	0	5 856
1989	0	0	0	496	0	0	0	0	0	533	0	0	3 366	0	0	0	0	4 395
1990	0	0	23	942	0	0	0	0	0	7 706	0	0	3 197	0	0	9	0	11 877
1991	11	1 000	0	80	0	0	0	0	0	14 369	0	0	1 663	132	0	0	1	17 256
1992	0	0	0	12	3	0	0	0	0	1 732	0	16	193	23	0	9	0	1 988
1993	2	0	0	8	2	0	0	0	30	649	0	26	158	0	0	14	0	889
1994	4	0	1	46	8	0	1	0	4	881	0	10	41	1	0	62	2	1 061
1995	0	0	0	5	0	0	0	0	0	1 662	0	24	297	1022	0	32	5	3 047
1996	0	0	0	47	0	0	0	0	0	1 204	0	24	912	196	0	39	0	2 422
1997	0	0	12	33	0	0	2	0	0	1 349	12	9	534	156	0	46	0	2 153
1998	0	0	10	18	0	0	1	0	0	915	31	19	1 638	254	0	106	4	2 996
1999	0	0	3	14	0	0	0	0	0	839	8	16	1 886	318	0	31	0	3 115

Year	Denmark	Estonia	Faroe Islands	Fed. rep. Germ.	France	Greenland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[4]	Spain	GB	UK (Engl. & Wales)	UK (Scot land)	Total
2000	0	0	0	5	2	0	1	0	0	526	3	19	2 709	374	0	46	0	3 685
2001	0	0	0	9	0	0	0	0	0	1 231	2	22	3 017	413	0	42	0	4 736
2002	0	219	0	30	0	0	6	0	0	432	5	11	3 568	178	0	29	0	4 478
2003	0	0	21	13	0	0	0	0	0	541	4	9	1 887	216	0	35	0	2 726
2004	0	0	0	5	0	0	0	0	0	1 369	1	26	3 219	182	0	39	0	4 840
2005	0	170	0	5	0	0	0	0	0	1 223	0	12	2 882	660	0	21	0	4 973
2006	0	0	12	7	8	0	0	0	196	1 647	201	20	4 479	27	0	2	0	6 600
2007	0	0	23	6	3	0	0	0	0	955	200	45	5 557	7	0	5	0	6 801
2008	0	0	4	1	3	0	0	0	0	1 228	200	45	3 734	94	0	10	0	5 319
2009	0	0	10	19	3	0	2	0	0	1 256	204	228	1 321	210	0	8	0	3 260
2010	0	0	2	14	0	0	0	0	0	615	3	11	1 423	180	0	4	0	2 252
2011	0	0	8	80	1	0	0	0	234	766	169	21	2 628	142	0	36	0	4 085
2012	0	0	2	35	3	0	0	0	0	476	22	1	4 795	189	0	14	0	5 537
2013	0	0	5	48	10	0	1	0	0	1 133	26	5	4 725	192	0	9	0	6 154
2014	0	0	3	25	3	0	0	0	0	1 321	12	0	4 000	196	0	14	0	5 574
2015	0	0	1	17	3	0	0	0	0	1 284	8	0	7 581	151	0	21	0	9 066
2016	2	0	19	1	10	0	0	0	0	1 594	1	13	7 608	183	0	0	0	9 431

Year	Denmark	Estonia	Faroe Islands	Fed. rep. Germ.	France	Greenland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia[4]	Spain	GB	UK (Engl. & Wales)	UK (Scot land)	Total
2017	0	4	19	17	12	3	0	0	0	2 230	17	5	7 737	42	0	46	0	10 132
2018	2	0	1	40	30	9	0	6	0	2 477	21	0	10 483	58	31	0	0	13 159
2019*	0	0	2	2	1	1	0	0	0	1 753	0	1	8 511	68	14	0	0	10 353
2020*	1	0	6	15	8	2	0	6	3	1 708	1	3	8 788	60	40	0	0	10 641

* Provisional figures.

Table 8.5. Greenland halibut in subareas 1 and 2. Landings by gear (tonnes). Approximate figures, the total may differ slightly from Table 8.1.

Year	Gillnet	Longline	Trawl	Danish seine	Other
1980	1 189	336	11 759	-	-
1981	730	459	13 829	-	-
1982	748	679	15 362	-	-
1983	1 648	1 388	19 111	-	-
1984	1 200	1 453	19 230	-	-
1985	1 668	750	17 527	-	-
1986	1 677	497	20 701	-	-
1987	2 239	588	16 285	-	-
1988	2 815	838	15 934	-	-
1989	1 342	197	18 599	-	-

Year	Gillnet	Longline	Trawl	Danish seine	Other
1990	1 372	1 491	20 325	-	-
1991	1 904	4 552	26 864	-	-
1992	1 679	1 787	5 787	-	-
1993	1 497	2 493	7 889	-	-
1994	1 403	2 392	5 353	-	-
1995	1 500	4 034	5 494	-	-
1996	1 480	4 616	7 977	-	-
1997	998	3 378	5 198	-	-
1998	1 327	7 395	6 664	-	-
1999	2 565	6 804	10 177	-	-
2000	1 707	5 029	7 700	-	-
2001	2 041	6 303	7 968	-	-
2002	1 737	5 309	6 115	-	-
2003	2 046	5 483	6 049	-	-
2004	2 290	7 135	8 778	599	-
2005	1 842	7 539	9 420	447	-
2006	1 503	6 146	10 042	205	-
2007	997	4 503	9 618	119	-

Year	Gillnet	Longline	Trawl	Danish seine	Other
2008	901	3 575	9 285	9	8
2009	1 409	4 952	6 583	34	18
2010	1 449	5 427	8 165	170	10
2011	1 583	5 039	9 351	239	15
2012	1 929	5 602	12 130	413	5
2013	2 398	5 805	13 791	176	0
2014	2 647	6 166	13 673	183	0
2015	2 508	6 287	15 445	489	18
2016	2 646	7 290	14 333	650	304
2017	2 677	7 221	15 774	679	29
2018	3 021	6 542	17 367	842	20
2019	3 323	7 028	17 046	1 119	0
2020*	2 976	6 989	17 675	1 044	28

*** Provisional figures.**

Table 8.6. Greenland halibut in subareas 1 and 2. Catch per unit effort and total effort.

Year	USSR catch/hour trawling (t)		Norway[10] catch/hour trawling (t)		Average CPUE		Total effort (in '000 hrs trawling)[5]	CPUE 7+[6]	GDR[7] (catch/day tonnage (kg)
	RT[1]	PST[2]	A[8]	B[9]	A[3]	B[4]			
1965	0.80	-	-	-	0.80	-	-	-	-

Year	USSR catch/hour trawling (t)		Norway[10] catch/hour trawling (t)		Average CPUE		Total effort (in '000 hrs trawling)[5]	CPUE 7+[6]	GDR[7] (catch/day tonnage (kg)
	RT[1]	PST[2]	A[8]	B[9]	A[3]	B[4]			
1966	0.77	-	-	-	0.77	-	-	-	-
1967	0.70	-	-	-	0.70	-	-	-	-
1968	0.65	-	-	-	0.65	-	-	-	-
1969	0.53	-	-	-	0.53	-	-	-	-
1970	0.53	-	-	-	0.53	-	169	0.50	-
1971	0.46	-	-	-	0.46	-	172	0.43	-
1972	0.37	-	-	-	0.37	-	116	0.33	-
1973	0.37	-	0.34	-	0.36	-	83	0.36	-
1974	0.40	-	0.36	-	0.38	-	100	0.36	-
1975	0.39	0.51	0.38	-	0.39	0.45	99	0.37	-
1976	0.40	0.56	0.33	-	0.37	0.45	100	0.34	-
1977	0.27	0.41	0.33	-	0.30	0.37	96	0.26	-
1978	0.21	0.32	0.21	-	0.21	0.27	123	0.17	-
1979	0.23	0.35	0.28	-	0.26	0.32	67	0.19	-
1980	0.24	0.33	0.32	-	0.28	0.33	47	0.25	-
1981	0.30	0.36	0.36	-	0.33	0.36	42	0.28	-
1982	0.26	0.45	0.41	-	0.34	0.43	39	0.37	-

Year	USSR catch/hour trawling (t)		Norway[10] catch/hour trawling (t)		Average CPUE		Total effort (in '000 hrs trawling)[5]	CPUE 7+[6]	GDR[7] (catch/day tonnage (kg)
	RT[1]	PST[2]	A[8]	B[9]	A[3]	B[4]			
1983	0.26	0.40	0.35	-	0.31	0.38	58	0.32	-
1984	0.27	0.41	0.32	-	0.30	0.37	59	0.30	-
1985	0.28	0.52	0.37	-	0.33	0.45	44	0.37	-
1986	0.23	0.42	0.37	-	0.30	0.40	57	0.32	-
1987	0.25	0.50	0.35	-	0.30	0.43	44	0.35	-
1988	0.20	0.30	0.31	-	0.26	0.31	63	0.26	4.26
1989	0.20	0.30	0.26	-	0.23	0.28	73	0.19	2.95
1990	-	0.20	0.27	-	-	0.24	95	0.16	1.66
1991	-	-	0.24	-	-	-	134	0.18	-
1992	-	-	0.46	0.72	-	-	20	0.29	-
1993	-	-	0.79	1.22	-	-	15	0.65	-
1994	-	-	0.77	1.27	-	-	11	0.70	-
1995	-	-	1.03	1.48	-	-	-	-	-
1996	-	-	1.45	1.82	-	-	-	-	-
1997	0.71	-	1.23	1.60	-	-	-	-	-
1998	0.71	-	0.98	1.35	-	-	-	-	-
1999	0.84	-	0.82	1.77	-	-	-	-	-

Year	USSR catch/hour trawling (t)				Norway[10] catch/hour trawling (t)		Average CPUE		Total effort (in '000 hrs trawling)[5]	CPUE 7+[6]	GDR[7] (catch/day tonnage (kg)
	RT[1]		PST[2]		A[8]	B[9]	A[3]	B[4]			
2000	0.94		-		1.38	1.92	-	-	-	-	-
2001	0.82	[11]	-		1.18	1.57	-	-	-	-	-
2002	0.85		-		1.07	1.82	-	-	-	-	-
2003	0.97	[12]	-		0.86	2.45	-	-	-	-	-
2004	0.63	[13]	-		1.16	1.79	-	-	-	-	-
2005	0.61	[12]	-		1.30	2.29	-	-	-	-	-
2006	0.57	[12]	-		0.96	2.09	-	-	-	-	-
2007	0.64	[12]	-		-	-	-	-	-	-	-
2008	0.48	[12]	-		-	-	-	-	-	-	-
2009	0.77	[13]	-		-	-	-	-	-	-	-
2010			1.57	[12]	-	-	-	-	-	-	-
2011			2.32	[12]							
2012			2.06	[12]							
2013			2.25	[12]							
2014			2.52	[12]							

[1] Side trawlers, 800–1000 hp. From 1983 onwards, stern trawlers (SRTM), 1000 hp. From 1997 based on research fishing.

[2] Stern trawlers, up to 2000 HP.

[3] Arithmetic average of CPUE from USSR RT (or SRTM trawlers) and Norwegian trawlers.

[4] Arithmetic average of CPUE from USSR PST and Norwegian trawlers.

[5] For the years 1981–1990, based on average CPUE type B. For 1991–1993, based on the Norwegian CPUE, type A.

[6] Total catch (t) of seven years and older fish divided by total effort.

[7] For the years 1988–1989, frost-trawlers 995 BRT (FAO Code 095). For 1990, factory trawlers S IV, 1943 BRT (FAO Code 090).

[8] Norwegian trawlers, ISSC-code 07, 250–499.9 GRT.

[9] Norwegian factory trawlers, ISSCFV-code 09, 1000-1999.9 GRT

[10] From 1992 based on research fishing. 1992–1993: two weeks in May/June and October; 1994–1995: 10 days in May/June

[11] Based on fishery from April-October only, a period with relatively low CPUE. In previous years fishery was carried out throughout the whole year.

[12] Based on fishery from October-December only, a period with relatively high CPUE.

[13] Based on fishery from October-November only.

Table 8.7. Greenland halibut in subareas 1 and 2. Catch history back to 1935. Note two year columns.

Year	Norway	Russia	Others	Total	Year	Norway	Russia	Others	Total
1935	1 534	n/a	-	1 534	1979	2 843	10 311	4 088	17 312
1936	830	n/a	-	830	1980	3 157	7 670	2 457	13 284
1937	616	n/a	-	616	1981	4 201	9 276	1 541	15 018
1938	329	n/a	-	329	1982	3 206	12 394	1 189	16 789
1939	459	n/a	-	459	1983	4 883	15 152	2 112	22 147
1940	846	n/a	-	846	1984	4 376	15 181	2 326	21 883
1941	1 663	n/a	-	1 663	1985	5 464	10 237	4 244	19 945
1942	955	n/a	-	955	1986	7 890	12 200	2 785	22 875

Year	Norway	Russia	Others	Total	Year	Norway	Russia	Others	Total
1943	824	n/a	-	824	1987	7 261	9 733	2 118	19 112
1944	678	n/a	-	678	1988	9 076	9 430	1 081	19 587
1945	1 148	n/a	-	1 148	1989	10 622	8 812	704	20 138
1946	1 337	25	-	1 362	1990	17 243	4 764	1 176	23 183
1947	1 409	28	-	1 437	1991	27 587	2 490	3 243	33 320
1948	1 877	110	-	1 987	1992	7 667	718	217	8 602
1949	198	177	-	375	1993	10 380	1235	318	11 933
1950	1 853	221	-	2 074	1994	8 428	283	515	9 226
1951	2 438	423	-	2 861	1995	9 368	794	1 572	11 734
1952	2 576	377	-	2 953	1996	11 623	1 576	1 148	14 347
1953	2 208	393	-	2 601	1997	7 661	1 038	711	9 410
1954	3 674	416	-	4 090	1998	8 435	2 659	799	11 893
1955	3 010	290	-	3 300	1999	15 004	3 823	690	19 517
1956	3 493	446	-	3 939	2000	9 083	4 568	646	14 297
1957	4 130	505	-	4 635	2001	10 896	4 694	775	16 365
1958	2 931	1 261	-	4 192	2002	7 143	5 584	566	13 293
1959	4 307	3 632	-	7 939	2003	8 216	4 384	847	13 447
1960	6 662	4 299	-	10 961	2004	13 939	4 662	298	18 899

Year	Norway	Russia	Others	Total	Year	Norway	Russia	Others	Total
1961	7 977	3 836	-	11 813	2005	13 011	4 883	940	18 834
1962	11 600	1 760	-	13 360	2006	11 119	6 055	730	17 904
1963	11 300	3 240	-	14 540	2007	8 230	6 484	739	15 453
1964	14 200	26 191	-	40 391	2008	7 393	5 294	1 105	13 792
1965	18 000	16 682	-	34 751	2009	8 446	3 335	1 210	12 990
1966	16 434	9 768	119	26 321	2010	7 700	6 888	641	15 229
1967	17 528	5 737	1 002	24 267	2011	8 270	7 053	1 283	16 606
1968	22 514	3 397	257	26 168	2012	9 331	10 041	916	20 288
1969	14 856	19 760	9 173	43 789	2013	10 403	10 310	1 454	22 167
1970	15 871	35 578	38 035	89 484	2014	11 232	10 061	1 732	23 025
1971	9 466	54 339	15 229	79 034	2015	10 874	12 953	921	24 748
1972	15 983	16 193	10 872	43 055	2016	12 932	10 576	1 440	24 948
1973	13 989	8 561	7 349	29 938	2017	13 741	10 714	1 925	26 380
1974	8 791	16 958	11 972	37 763	2018	14 874	12 072	1 598	28 544
1975	4 858	20 372	12 914	38 172	2019	14 813	12 198	1 471	28 482
1976	6 005	16 580	13 469	36 074	2020*	14 532	12 266	1 915	28 713
1977	4 217	15 045	9 613	28 827					
1978	4082	14 651	5884	24 617					

* **Provisional figures.**

Table 8.8. Greenland halibut in ICES Division 4a (North Sea). Nominal catch (t) by countries as officially reported to ICES. Not included in the assessment.

Year	Denmark	Faroe Islands	France	Germany	Greenland	Ireland	Norway	Russia	GB	UK England & Wales	UK Scotland	Netherlands	Total
1973	0	0	0	4	0	0	9	8	0	28	0	0	49
1974	0	0	0	2	0	0	2	0	0	30	0	0	34
1975	0	0	0	1	0	0	4	0	0	12	0	0	17
1976	0	0	0	1	0	0	2	0	0	18	0	0	21
1977	0	0	0	2	0	0	2	0	0	8	0	0	12
1978	0	0	2	30	0	0	0	0	0	1	0	0	33
1979	0	0	2	16	0	0	2	0	0	1	0	0	21
1980	0	177	0	34	0	0	5	0	0	0	0	0	216
1981	0	0	0	0	0	0	7	0	0	0	0	0	7
1982	0	0	2	26	0	0	17	0	0	0	0	0	45
1983	0	0	1	64	0	0	89	0	0	0	0	0	154
1984	0	0	3	50	0	0	32	0	0	0	0	0	85
1985	0	1	2	49	0	0	12	0	0	0	0	0	64
1986	0	0	30	2	0	0	34	0	0	0	0	0	66
1987	0	28	16	1	0	0	35	0	0	0	0	0	80
1988	0	71	62	3	0	0	19	0	0	1	0	0	156

Year	Denmark	Faroe Islands	France	Germany	Greenland	Ireland	Norway	Russia	GB	UK England & Wales	UK Scotland	Netherlands	Total
1989	0	21	14	1	0	0	197	0	0	5	0	0	238
1990	0	10	30	3	0	0	29	0	0	4	0	0	76
1991	0	48	291	1	0	0	216	0	0	2	0	0	558
1992	1	15	416	3	0	0	626	0	0	+	1	0	1 062
1993	1	0	78	1	0	0	858	0	0	10	+	0	948
1994	+	103	84	4	0	0	724	0	0	6	0	0	921
1995	+	706	165	2	0	0	460	0	0	52	283	0	1 668
1996	+	0	249	1	0	0	1 496	0	0	105	159	0	514
1997	+	0	316	3	0	0	873	0	0	1	162	0	1 355
1998	+	0	71	10	0	10	804	0	0	35	435	0	1 365
1999	+	0		1	0	18	2 157	0	0	43	358	0	2 577
2000	+		41	10	0	19	498	0	0	67	192	0	827
2001	+		43	0	0	10	470	0	0	122	202	0	847
2002	+		8	+	0	2	200	0	0	10	246	0	466
2003	0	0	1	+	+	+	453	0	0	+	122	0	576
2004	0	0	0	0	0	0	413	0	0	90	0	0	503
2005	0	0	2	0	0	0	58	0	0	4	0	0	64

Year	Denmark	Faroe Islands	France	Germany	Greenland	Ireland	Norway	Russia	GB	UK England & Wales	UK Scotland	Netherlands	Total
2006	0	0	3	0	0	0	90	0	0	0	7	0	100
2007	0	1	0	0	0	0	133	0	0	1	6	0	141
2008	0	0	0	0	0	0	14	0	0	0	22	0	36
2009	0	9	22	0	0	0	5	0	0	0	129	0	165
2010	+	1	38	0	0	0	10	0	0	0	49	0	98
2011	0	1	39	0	0	0	94	0	0	0	44	0	178
2012	0	0	14	0	0	0	788	0	0	0	43	0	845
2013	0	0	25	0	0	0	122	0	0	0	174	0	321
2014	0	2	27	0	0	0	723	0	0		104	0	856
2015	0	0	34	1	0	0	1 151	0	0	0	127	0	1 313
2016	0	0	31	0	0	0	983	0	0	0	120	0	1 134
2017	0	0	20	0	0	0	753	0	0	0	73	0	846
2018	0	0	15	0	0	0	472	0	42	0	0	0	532
2019	0	0	21	0	0	0	241	0	14	0	0	1	277
2020*	0	0	10	0	0	0	663	0	45	0	0	1	719

Table 8.9. Abundance indices of different length groups in 1984–2020 (in thousands), Russian autumn survey.

Year/Length (cm)	≤30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	66–70	71–75	76–80	>80	Total
1984	4 837	5 078	11 690	21 171	15 167	10 886	7 370	6 549	3 751	1 786	1 128	483	89 896
1985	4 003	6 748	16 858	24 897	23 244	15 702	8 376	5 704	3 776	2 054	1 028	698	113 088
1986	3 482	6 062	13 765	18 945	15 997	10 369	4 839	3 022	2 534	1 325	440	205	80 985
1987	2 010	4 828	7 228	10 490	8 831	5 513	2 123	1 784	1 437	645	481	421	45 791
1988	3 374	5 111	9 022	10 147	10 128	5 828	2 265	1 862	1 218	511	361	341	50 168
1989	2 030	7 055	13 962	17 252	16 790	10 028	3 789	1 916	1 279	415	200	388	75 104
1990	2 762	6 056	12 802	13 061	9 527	9 829	4 967	2 094	589	312	115	119	62 233
1991	1 036	5 012	16 237	20 998	17 418	11 728	8 012	4 562	814	181	122	174	86 294
1992	184	2 153	17 185	32 399	22 481	12 977	6 229	3 473	1 869	502	182	106	99 740
1993	-	290	3 593	14 782	21 080	16 013	6 743	3 341	2 031	859	269	164	69 165
1994	49	17	1 651	12 582	16 203	12 566	5 391	3 320	2 019	819	188	106	54 911
1995	-	38	1 245	13 193	20 571	12 445	5 432	2 717	1 587	579	187	82	58 076
1996*	-	11	786	13 012	30 573	18 294	5 730	1 795	773	534	169	12	71 689
1997	140	152	1 318	7 744	18 504	17 221	6 932	3 079	1 952	465	195	142	57 844
1998	2 449	2 238	2 949	10 847	24 266	19 640	11 112	5 946	2 158	440	172	90	82 307
1999	1 070	2 815	4 632	7 886	17 734	18 489	10 158	4 827	2 043	529	196	74	70 453
2000	1 274	1 698	5 184	14 996	24 170	20 721	12 805	5 675	3 100	1 228	240	143	91 234
2001	1 399	2 887	7 496	18 136	34 752	29 886	13 463	6 759	3 772	1 511	593	369	121 024

Year/Length (cm)	≤30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	66–70	71–75	76–80	>80	Total
2002**	662	2 033	6 395	13 329	19 810	13 135	7 180	3 406	1 311	381	129	58	67 828
2003***	955	2 396	7 420	13 006	17 160	11 630	7 978	5 332	3 541	985	485	238	71 126
2004	1 431	2 705	11 945	16 937	20 155	18 274	12 594	6 948	4 783	2 087	813	536	99 209
2005	830	3 970	10 726	17 850	17 547	15 164	9 726	5 859	3 343	1 150	453	545	87 163
2006****	293	1 981	18 471	35 224	36 563	26 335	14 138	7 248	4 943	1 669	668	488	148 021
2007	376	1 431	6 937	24 330	26 780	26 086	22 157	15 586	7 480	3 786	932	628	136 510
2008	463	4 626	19 991	28 799	30 062	32 159	23 175	11 326	8 368	4 198	1 872	1 089	166 129
2009	152	4 919	29 389	48 321	45 833	33 915	24 484	10 227	6 568	3 032	881	616	208 338
2010	146	5 097	37 901	66 086	57 863	46 321	25 428	10 058	8 612	3 983	1 587	1 610	264 692
2011	456	1 285	22 470	61 115	78 247	64 186	49 620	19 412	11 607	7 226	3 529	874	320 025
2012	213	798	12 051	49 062	56 704	52 393	36 362	13 622	7 533	4 213	1 944	1 611	236 506
2013*****													
2014	17	1697	10 296	34 074	45 287	35 861	22 621	8613	5505	2227	929	427	167 553
2015	318	2 099	13 542	35 864	43 551	36 082	21 114	10 924	4 472	1 342	850	339	170 497
2016*****													
2017	158	2 198	10 687	32 464	61 577	71 590	40 700	16 830	7 449	3 483	1 206	1 245	249 585
2018*****													
2019	144	2 186	13 500	27 129	28 572	22 536	13 943	5 825	3 080	1 654	707	406	119 742

Year/Length (cm)	≤30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	66–70	71–75	76–80	>80	Total
2020*****													

*** Only half of the standard area was investigated**

**** No observations in NEEZ**

***** Observations in the NEEZ on the main spawning grounds were conducted considerably later than usual**

****** Survey was conducted by one vessel with a reduced number of trawls at depths less than 500 m**

*******No indices for 2013, 2016, 2018 and 2020**

Table 8.10. Abundance indices of different length groups in 1994–2019 (in thousands), Norwegian autumn slope survey.

Year	<30	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1994	0	0	0	0	1	15	23	80	197	335	645	1 225	1 611	2 432	3 431	3 511	3 830	3 519	3 940	3 724	2 896	3 020
1995	0	0	1	3	6	15	29	86	141	242	472	931	1 210	2 294	3 092	3 840	4 475	4 540	4 633	4 321	3 836	3 856
1996	0	2	1	6	6	2	18	49	54	166	321	772	957	1 787	2 912	3 769	4 728	5 199	5 944	5 644	5 224	5 132
1997	7	5	11	4	33	27	49	186	250	297	443	862	1 009	1 814	2 888	3 578	5 451	5 402	6 132	5 206	4 125	5 455
1998	7	2	6	15	17	22	51	103	174	219	372	504	727	1 061	1 491	2 103	2 941	3 092	3 609	3 735	3 851	4 850
1999	10	4	18	15	20	40	61	75	110	174	202	377	476	862	1 175	1 655	2 397	2 543	3 485	4 214	3 694	5 274
2000	2	7	11	30	34	46	128	122	163	264	383	677	739	932	1 183	1 439	2 038	2 030	2 268	2 644	2 846	3 888
2001	21	20	35	37	77	147	274	270	440	462	724	986	1 176	1 373	1 630	1 720	2 724	2 655	3 349	3 128	3 973	3 999
2002	97	75	107	122	180	267	399	404	723	669	869	1 026	1 097	1 360	1 883	1 870	2 560	2 185	3 322	3 450	3 597	4 032
2003	38	27	65	97	172	270	383	692	783	894	1 214	1 100	1 481	1 561	2 082	1 792	2 468	2 104	3 193	3 360	3 506	3 117
2004	27	15	47	125	191	402	636	639	951	1 042	1 092	1 206	1 337	1 319	1 398	1 546	2 013	1 967	2 638	2 646	3 337	3 373

Year	<30	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2005	66	104	285	317	517	765	861	1 220	1 492	1 540	2 053	2 295	2 293	2 588	2 262	2 677	3 041	2 446	2 854	2 095	3 056	2 336
2006	12	50	80	158	258	456	849	1 022	1 429	1 579	1 603	1 900	1 823	1 824	2 015	1 974	2 529	2 359	2 350	2 137	2 338	2 175
2007	157	96	161	359	766	1 423	2 508	3 142	4 411	5 679	5 346	5 639	5 502	5 038	4 600	3 632	3 667	3 628	3 278	2 571	2 882	2 597
2008	378	384	723	1 323	1 763	1 793	2 441	2 911	3 249	3 685	4 229	4 300	4 257	3 568	3 911	3 534	3 020	3 066	2 769	2 582	2 639	2 284
2009	31	36	93	349	505	934	1 663	2 660	3 050	3 680	4 138	4 885	5 567	4 148	5 327	4 639	3 688	3 752	3 682	3 410	3 553	3 215
2011	0	0	20	36	57	124	288	563	646	1 414	1 454	2 228	2 680	3 174	3 649	3 750	3 532	3 031	3 299	3 991	3 251	2 454
2013	17	5	3	1	13	64	103	122	324	582	1 022	1 266	2 138	2 207	3 553	3 748	3 476	4 124	3 717	3 045	3 718	3 052
2015	3	24	24	36	131	318	439	721	757	1 043	1 253	1 473	2 602	2 444	3 776	4 459	4 602	4 598	4 371	3 962	4 156	3 694
2017	6	20	45	54	63	144	184	328	593	365	928	955	1 267	1 457	1 764	1 983	2 367	2 465	2 651	2 569	2 816	3 011
2019	0	0	28	43	128	362	372	569	874	1 322	1 290	1 424	1 667	2 285	2 210	2 168	2 208	2 229	2 434	2 119	2 305	2 405

Year	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
1994	2 545	2 729	2 398	2 092	1 975	1 547	1 488	1 103	920	788	565	702	576	523	577	370	367	386
1995	3 165	3 152	2 963	2 647	2 272	1 756	1 586	1 153	970	880	764	690	680	592	525	461	387	334
1996	4 106	3 638	3 571	2 752	2 177	1 568	1 443	1 017	867	782	512	449	538	404	391	356	281	248
1997	3 644	3 427	3 018	2 302	2 111	1 502	1 131	1 042	617	849	585	576	537	403	446	481	294	230
1998	4 211	3 824	3 166	2 988	2 857	1 974	1 714	1 515	981	1 172	783	613	598	668	641	569	479	364
1999	4 092	5 196	4 136	3 909	4 122	2 631	2 299	1 787	1 374	1 388	895	1 037	865	886	923	791	807	594
2000	3 692	3 681	3 512	3 016	3 197	2 388	2 007	1 545	1 227	1 327	915	1 028	734	630	732	517	509	505

Year	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
2001	3 649	4 512	4 106	3 005	3 358	2 552	2 589	2 147	1 293	1 350	1 099	939	1 187	684	787	612	751	603
2002	4 241	3 516	3 966	3 602	3 855	2 837	2 511	2 248	1 672	1 787	1 239	1 237	1 139	808	882	604	679	474
2003	4 400	3 465	3 808	3 512	3 907	3 368	3 035	2 319	1 896	1 705	1 612	1 384	1 542	1 130	1 350	972	994	675
2004	3 535	4 405	3 614	3 801	3 249	2 751	2 252	1 911	1 493	1 455	1 372	1 360	1 284	1 162	962	763	891	590
2005	2 400	2 734	2 413	2 084	2 295	1 882	1 681	1 492	1 458	1 168	1 241	1 057	1 065	984	903	782	865	479
2006	2 493	2 125	2 290	2 025	2 189	1 790	1 668	1 542	1 337	1 159	1 188	1 009	925	1 036	807	798	647	678
2007	2 109	2 249	2 123	2 142	1 758	1 609	1 581	1 070	1 008	1 044	625	938	672	558	537	526	394	469
2008	2 288	2 248	2 229	1 815	1 751	1 514	1 150	1 019	861	668	652	657	508	582	629	523	484	361
2009	2 668	2 944	2 850	2 441	2 372	2 233	1 837	1 698	1 503	1 135	845	962	647	858	715	607	653	609
2011	2 905	2 746	2 602	2 713	2 387	1 709	1 704	1 529	978	1 179	577	649	554	440	466	315	440	550
2013	2 498	2 035	1 905	1 631	1 710	1 573	1 424	1 009	790	671	503	506	400	456	234	266	227	176
2015	3 469	2 384	2 546	2 084	2 142	1 734	1 336	1 108	1 020	899	713	621	605	495	274	289	341	291
2017	2 890	2 547	2 501	2 091	1 792	1 786	1 532	1 274	1 269	1 029	765	579	481	446	294	299	247	245
2019	1 653	1 799	1 617	1 490	1 057	1 185	846	840	670	568	461	313	304	312	231	242	179	130

Year	69	70	71	72	73	74	75	76	77	78	79	>80	SUM
1994	256	253	151	136	122	74	113	47	39	40	30	97	57 444
1995	339	244	181	179	97	100	137	56	53	53	34	101	64 574
1996	232	168	118	123	93	97	61	28	40	39	21	74	68 887

Year	69	70	71	72	73	74	75	76	77	78	79	>80	SUM
1997	171	207	216	119	109	111	104	61	32	35	40	185	67 819
1998	308	320	235	222	229	144	102	64	65	61	43	192	59 786
1999	478	406	385	319	182	205	223	125	109	145	51	328	67 569
2000	341	376	232	210	168	153	141	77	96	77	47	233	55 187
2001	490	375	279	170	207	178	157	85	133	69	49	306	66 941
2002	469	383	297	251	183	163	134	104	130	48	65	251	70 069
2003	563	632	464	249	244	170	242	201	128	125	114	356	74 961
2004	654	420	373	325	521	248	181	135	121	100	109	431	68 415
2005	523	508	400	262	196	159	156	162	109	82	61	426	67 190
2006	474	508	397	285	185	276	185	140	136	81	96	497	59 886
2007	289	254	261	101	140	130	75	52	80	59	47	278	90 260
2008	313	258	226	201	138	107	59	62	89	66	76	508	80 851
2009	574	541	271	386	219	171	191	112	121	89	100	407	93 764
2011	415	409	200	285	235	193	225	204	175	51	87	503	67 066
2013	162	173	124	114	109	112	66	72	79	34	43	260	55 662
2015	252	265	176	195	186	205	89	78	73	141	53	286	69 236
2017	178	185	88	98	77	51	61	50	35	40	46	184	49 195
2019	144	117	71	81	50	44	32	31	9	13	12	113	43 056

***Biennial surveys since 2009**

Table 8.11. Abundance indices of females of different length groups in 1994–2019 (in thousands), Norwegian autumn slope survey.

Year	<30	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1994	0	0	0	0	1	15	23	80	196	335	643	1 223	1 611	2 429	3 426	3 503	3 824	3 510	3 934	3 716	2 886	3 018
1995	0	0	1	3	6	15	29	86	141	242	472	930	1 210	2 291	3 088	3 837	4 470	4 537	4 629	4 317	3 835	3 855
1996	0	0	0	4	0	1	10	26	28	64	123	228	233	424	415	773	937	1020	1 185	1 151	1 037	1 374
1997	6	5	7	4	17	14	36	134	139	146	187	337	331	419	569	685	899	852	1 169	1 058	828	1 226
1998	5	0	0	11	4	7	26	41	78	77	156	170	190	274	290	364	413	526	605	665	743	970
1999	2	0	1	0	7	14	19	12	41	68	93	137	117	227	285	300	336	313	496	574	533	1 049
2000	1	5	6	14	16	16	44	44	65	121	155	201	229	245	268	278	374	311	303	411	410	517
2001	13	6	14	15	38	61	118	123	177	167	293	411	462	355	425	376	544	477	493	379	558	673
2002	51	48	58	60	77	109	178	182	290	275	326	319	306	407	500	378	515	331	483	461	501	575
2003	25	25	27	43	100	124	182	276	413	429	532	504	512	545	610	450	552	394	539	487	523	406
2004	15	3	13	61	83	160	305	278	436	358	434	404	440	384	381	454	413	362	382	309	427	472
2005	30	24	110	99	182	258	322	464	565	537	723	758	619	630	452	633	723	467	593	293	500	329
2006	4	19	48	81	148	187	327	442	595	674	713	686	648	568	649	482	619	501	503	512	468	452
2007	85	67	104	178	371	731	1 321	1 539	2 259	2 654	2 515	2 403	2 454	2 145	1 580	1 242	1 132	988	851	727	640	554
2008	216	210	432	698	829	958	1 190	1 372	1 529	1 597	1 720	1 516	1 625	1 069	1 180	9 28	889	948	834	677	773	615
2009	13	19	33	146	210	343	662	1 001	1 263	1 470	1 491	1 814	1 979	1 441	1 752	1 533	1 044	1 195	1 037	988	922	878
2011	0	0	8	22	24	31	103	175	195	469	311	538	642	722	623	645	686	664	528	665	751	298

Year	<30	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2013	0	0	0	0	3	11	49	30	50	186	261	246	521	286	650	509	621	693	626	664	745	576
2015	0	7	7	19	67	149	183	304	380	358	391	377	491	387	549	490	682	904	632	689	761	766
2017	4	17	16	43	44	79	83	120	267	117	395	312	365	373	288	411	524	444	6 277	453	439	579
2019	0	0	16	25	92	119	183	300	360	500	527	498	604	609	512	517	426	558	489	503	541	479

***Biennial surveys since 2009.**

Year	51	52	53	54	55	56	57	58	69	60	61	62	63	64	65	66	67	68	69	70	71	72	73
1994	####	####	2 384	2 088	1 969	1 545	1 482	1 098	917	785	560	700	571	522	573	368	364	385	254	253	151	136	122
1995	####	####	2 958	2 646	2 271	1 752	1 586	1 152	968	875	761	689	680	592	525	461	387	333	339	244	181	179	97
1996	####	886	895	771	527	547	639	548	508	602	410	401	481	383	387	344	281	230	232	167	118	123	93
1997	911	985	824	650	669	590	523	562	346	633	484	501	506	364	433	437	289	225	171	207	216	119	109
1998	995	####	999	1 056	903	758	754	831	667	907	615	543	569	639	638	567	453	362	308	307	235	222	225
1999	830	####	928	1 042	1 287	1 019	1 002	955	845	1 106	754	927	816	814	890	780	798	582	478	403	384	317	182
2000	590	591	593	663	756	816	704	649	670	839	699	829	620	588	665	487	491	495	328	376	230	210	167
2001	479	632	761	643	680	698	962	877	743	936	928	714	1 062	594	772	577	746	598	488	370	279	170	207
2002	610	438	638	694	823	672	824	779	780	989	780	1 024	813	705	827	598	656	443	458	383	295	251	183
2003	604	582	662	611	968	854	1 111	964	1 057	1 126	1 260	1 165	1 314	1 085	1 278	938	962	670	555	625	462	249	242
2004	461	638	570	693	760	937	876	839	966	998	1 202	1 186	1 227	1 116	932	749	885	585	639	420	373	325	461
2005	378	411	427	451	597	638	775	718	800	871	935	938	965	904	860	740	860	449	523	465	390	262	192
2006	490	458	461	392	537	523	545	678	805	796	893	865	820	927	775	768	637	633	468	499	376	285	178

Year	51	52	53	54	55	56	57	58	69	60	61	62	63	64	65	66	67	68	69	70	71	72	73
2007	476	499	471	491	469	533	607	549	566	776	494	790	587	534	517	515	394	469	278	254	261	101	133
2008	509	481	515	495	443	547	441	543	466	490	530	572	482	539	610	514	483	361	309	252	226	201	138
2009	640	665	738	639	733	724	698	783	814	605	653	765	534	776	701	525	616	587	561	526	263	378	219
2011	557	468	480	472	466	369	329	469	324	378	341	523	477	348	450	300	415	550	393	409	192	285	235
2013	518	381	477	308	375	529	526	304	296	334	324	377	329	390	218	260	227	174	159	173	120	114	109
2015	826	770	744	579	811	649	471	494	553	537	470	462	420	450	270	283	339	283	251	265	176	195	186
2017	530	438	516	448	392	555	578	498	563	530	473	330	378	371	271	286	243	245	178	185	88	98	77
2019	401	481	431	494	351	391	324	458	402	367	277	254	260	257	210	218	174	123	143	114	71	81	50

***Biennial surveys since 2009**

Year	74	75	76	77	78	79	>80	SUM
1994	74	113	47	39	40	30	95	51 911
1995	100	137	56	53	53	34	99	58 202
1996	92	61	28	40	39	21	74	18 961
1997	111	104	61	29	35	40	185	20 387
1998	144	102	64	65	61	43	192	19 839
1999	205	223	125	109	140	47	328	22 940
2000	153	141	77	96	77	47	233	17 914
2001	178	157	85	131	69	49	306	22 069
2002	163	131	104	130	48	65	251	21 985

Year	74	75	76	77	78	79	>80	SUM
2003	170	242	201	128	125	114	356	28 378
2004	241	181	135	119	100	109	431	25 728
2005	149	156	152	109	82	61	426	24 995
2006	259	185	138	136	81	96	491	24 521
2007	124	75	52	80	59	47	275	38 016
2008	107	59	62	89	66	76	506	32 917
2009	171	191	104	121	80	100	385	36 529
2011	193	225	204	175	51	87	503	18 768
2013	112	66	72	79	34	43	260	14 415
2015	205	89	78	73	141	53	286	20 002
2017	51	61	50	35	40	46	184	20 388
2019	44	32	31	9	13	12	113	14 444

***Biennial surveys since 2009**

Table 8.12. Abundance indices (numbers in thousands) from bottom-trawl surveys in the Barents Sea standard area winter 1994–2021 (Mehl *et al.*, WD4 AFWG 2019).

	Length group (cm)															Biomass
Year	≤14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	≥80	Total	(tonnes)
1994	0	0	21	76	148	1 117	3 139	4 740	3 615	1 941	889	541	21	0	0	16 248	19 228
1995	298	0	0	0	90	129	2 877	7 182	5 739	2 027	1 622	839	489	86	0	21 378	27 459
1996	4 121	0	0	0	62	124	1 214	4 086	4 634	1 871	1 112	638	337	74	12	18 285	20 256

	Length group (cm)															Biomass
Year	**≤14**	**15–19**	**20–24**	**25–29**	**30–34**	**35–39**	**40–44**	**45–49**	**50–54**	**55–59**	**60–64**	**65–69**	**70–74**	**75–79**	**≥80**	**Total**	**(tonnes)**
1997[1]	0	68	0	0	55	163	949	4 313	5 629	2 912	1 609	643	300	65	21	16 728	24 214
1998[1]	68	220	945	578	481	487	1 088	4 016	6 591	3 076	1 798	707	326	93	44	20 518	27 248
1999	43	84	241	436	566	269	784	1 701	3 097	1 669	1 094	491	89	75	0	10 640	14 681
2000	140	184	344	836	1 722	3 857	2 253	1 560	2 144	1 714	1 191	615	249	76	0	16 883	17 246
2001	68	49	147	179	737	1 525	3 716	3 271	2 302	2 010	1 088	529	160	50	39	15 871	18 224
2002	271	0	70	34	382	1 015	1 916	3 803	3 250	2 279	1 138	976	242	159	114	15 648	21 198
2003	51	0	74	19	304	715	1 842	3 008	4 765	2 235	714	561	245	146	0	14 678	19 635
2004	106	104	15	0	319	1 253	1 229	1 717	2 277	1 227	798	298	148	94	26	9615	11 872
2005	263	70	159	1 139	2 235	2 621	4 206	3 782	3 847	2 037	917	585	336	118	0	22 314	22 293
2006[2]	0	72	94	414	1 968	5 149	4 613	5 743	4 283	2 132	891	449	258	34	18	26 118	25 579
2007[1]	0	18	146	1 869	1 418	3 114	5 710	5 947	4 287	2 205	963	658	391	80	89	26 896	28 006
2008	0	0	0	243	1 708	5 974	4 654	6 136	5 198	3 403	827	638	174	82	50	29 088	30 153
2009	55	0	0	26	1 044	4 327	8 133	4 551	4 084	2 266	996	627	442	253	154	26 960	28 919
2010	0	0	0	99	678	3 648	5 729	6 560	4 897	2 467	1 064	552	229	128	41	26 092	25 979
2011	51	0	0	0	216	4 396	5 864	5 498	5 237	3 698	699	936	327	252	97	27 271	31 552
2012[3]	77	0	0	0	51	1 145	4 524	5 366	4 517	2 774	1 147	195	73	0	48	19 917	22 656
2013	0	0	0	0	0	511	5 368	4 868	5 374	3 687	1 944	939	348	131	154	23 504	31 748

	Length group (cm)																Biomass
Year	≤14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	≥80	Total	(tonnes)
2014	0	0	46	92	156	368	2 271	5 587	5 903	3 555	2 251	1 369	154	260	79	22 090	31 112
2015	367	0	61	0	284	1 612	3 187	6 452	7 249	6 752	3 350	1 936	587	334	0	32 172	46 828
2016	205	0	124	511	950	1 953	3 486	4 539	5 479	5 613	1 999	1 973	646	98	80	27 657	35 831
2017[4]	52	0	0	78	592	1 328	1 885	3 850	4 852	4 550	1 721	1 455	317	190	23	20 827	29 756
2018	0	0	62	0	383	1 333	2 049	3 445	4 258	3 573	1 904	1 366	736	196	20	19 325	28 688
2019	0	0	0	375	272	1 6 71	3 285	4 034	5 177	4 265	3 570	2 526	1 328	535	137	27 176	45 912
2020[3]	80	91	2464	442	790	2272	4391	5136	4929	4613	3278	1803	894	384	250	29 599	43 631
2021[3]	0	154	927	927	2370	2976	3869	4265	3516	2991	2378	1649	670	682	238	27 613	37090

[1] **Indices raised to also represent the Russian EEZ**

[2] **Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005**

[3] **Indices not raised to also represent uncovered parts of the Russian EEZ.**

[4] **Indices raised to also represent uncovered parts of the Russian EEZ**

Table 8.13. Greenland halibut catch in weight, numbers, and biomass (in tonnes) and abundance (in thousands) estimated from Spanish autumn and spring surveys 1997–2019. NB. Absolute biomass and abundance values must not be compared between spring and autumn surveys due to different gears. The trawl used during spring surveys is considered less efficient on benthic species as Greenland halibut and skates, and better to catch species less associated with bottom.

Autumn survey

Year	Catch (Kg)	Catch (numbers)	Biomass™	Abundance ('000)
1997	195 056	211 533	344 014	379 444
1998	180 974	187 259	351 466	373 149
1999	198 781	172 687	436 956	377 792
2000	169 389	140 355	340 619	291 265
2001	152 681	129 289	283 511	249 219
2002	144 335	115 213	256 460	207 466
2003	151 952	132 117	283 644	256 327
2004	153 859	135 631	320 485	283 965
2005	144 573	134 566	317 320	313 459
2008	91 573	101 578	129 221*	144 561*
2010	167 862	182 464	191 510*	216 731*
2012	178 607	174 670	336 543*	339 697*
2013	172 762	168 619	264 101*	267 548*
2014	175 553	160 557	321 485*	307 679*
2016	176 015	142 413	247 644*	214 778*
2019	50 880	45 631	209 439*	187 830*

No survey in 2006, 2007, 2009, 2011, 2015, 2017, 2018, and 2020.

***New swept-area estimation method**

Spring survey

Year	Catch (Kg)	Catch (numbers)	Biomass™	Abundance ('000)
2008	96 797	109 515	38 406	38 951
2009	200 299	222 018	58 273	65 464
2011	136 610	160 566	98 142	117 666
2015**	111 425	105 385	150 385	155 333

No survey in 2010, 2012, 2013 and 2014.

****Different from the one used during the 2014 Spanish "autumn" survey.**

Table 8.14. Greenland halibut in subareas 1 and 2. The catch scenarios. Weights in tonnes. Assessment 2021 as basis for advice for 2022 and 2023. NB. according to working group forecast, this may diverge slightly from final advice by ACOMTAC for 2021 from EU/UK was not sat at the time of the working group and TAC change is thus relative only to the TAC sat by JRNFC.

Table a Greenland halibut in subareas 1 and 2. Annual catch scenarios for 2022. All weights are in tonnes.

Basis	Total catch (2022)	HR_{total} (2022)	Biomass 45 cm+ (2023)	% Biomass 45 cm+ change *	% TAC change **	% Advice change ***
ICES advice basis						
HR = 0.035	19094	0.035	535	−5%	−29%	−17%
Other scenarios						
HR = 0	0	0	554	−1%	−100%	−100%
HR = 0.025	13873	0.025	540	−4%	−49%	−40%
Catch_SQ (HR=0.052/0.055)	28713	0.052/0.055	526	−6%	6%	25%

*** Biomass 45 cm+ 2023 relative to 2022 (561 tonnes).**

**** Advice in 2022 relative to TAC in 2021. Only TAC sat by JRNFC in 2021 (27 000 tonnes) was available.**

***** Advice value for 2022 relative to the advice value for 2021.**

Table b Greenland halibut in subareas 1 and 2. Annual catch scenarios for 2023. All weights are in tonnes.

Basis	Total catch (2023)	HR_{total} (2023)	Biomass 45 cm+ (2024)	% Biomass 45 cm+ change *	% Advice change **
ICES advice basis					
HR = 0.035	18494	0.035	523	−2%	−3%
Other scenarios					
HR = 0	0	0	558	1%	0%
HR = 0.025	13590	0.025	533	−1%	−2%
Catch_SQ (HR=0.052/0.055)	28713	0.052/0.055	505	−4%	0%

*** Biomass 45cm+ 2024 relative to 2023 (biomass 2023 depends on scenario).**

**** Advice value for 2023 relative to the advice value for same scenario in 2022.**

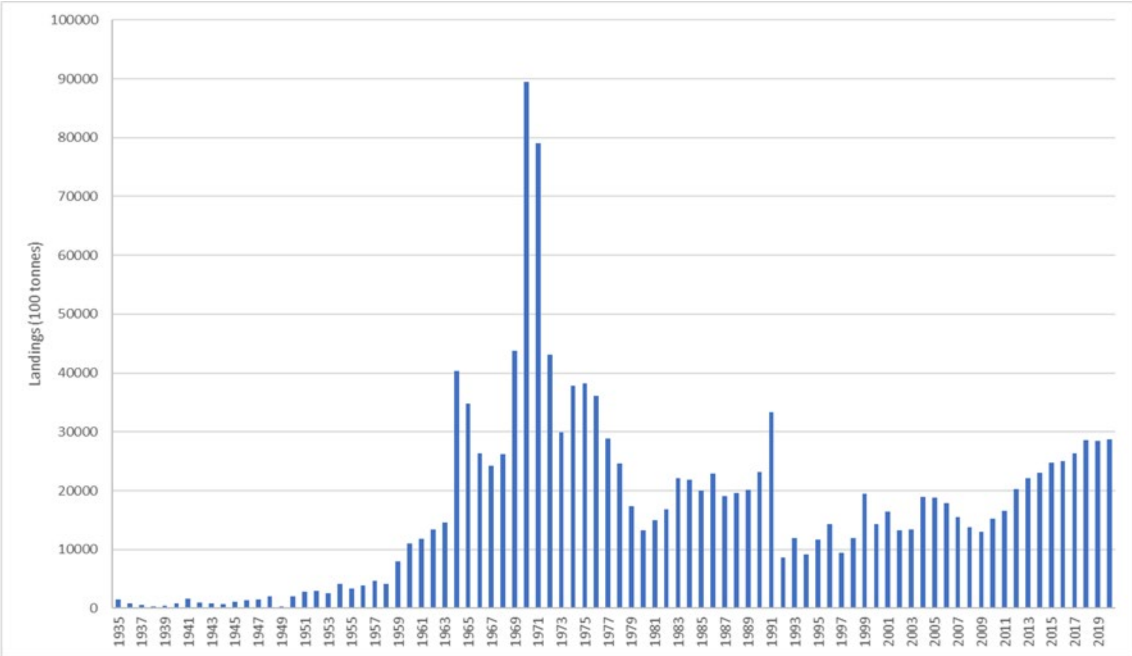


Figure 8.1. NEA Greenland halibut landings. Historical landings (Nedreaas and Smirnov 2003 and AFWG).

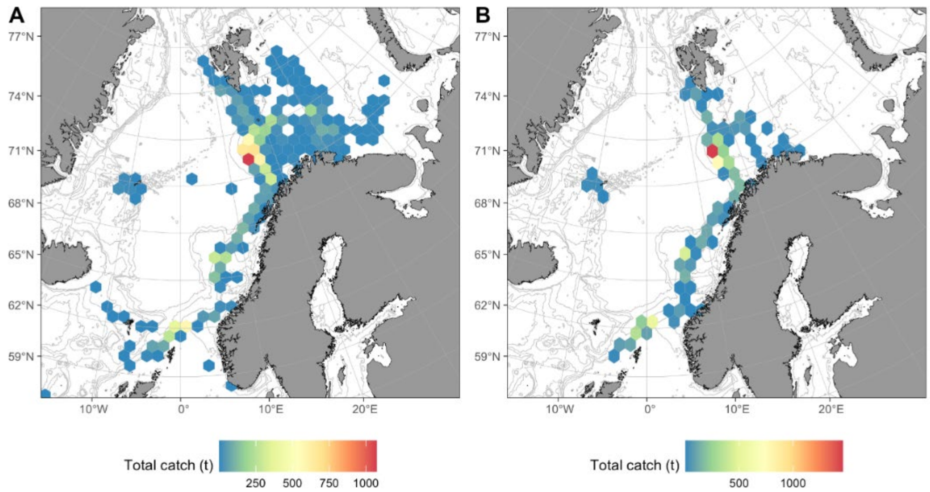


Figure 8.2. Spatial distribution of Greenland halibut catches in 2020 according to Norwegian electronic logbooks, in all registered fisheries including bycatch (A), and catches where G. halibut make more than 50% of the total catches (B).

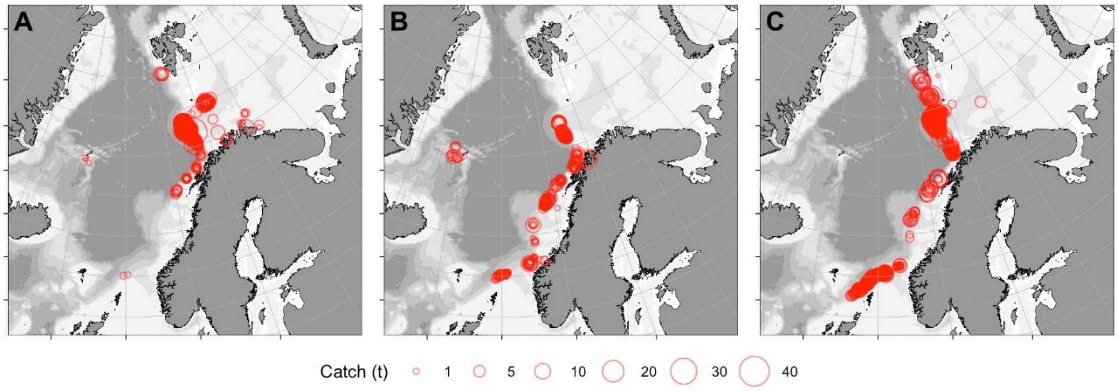


Figure 8.3. Spatial distribution of catches where Greenland halibut make more than 50% of the total catches, according to Norwegian electronic logbooks from 2020. Bubble area is proportional to the size of single catches expressed in metric tonnes. The panels show longline (A), gillnet (B) and trawl (C) catches.

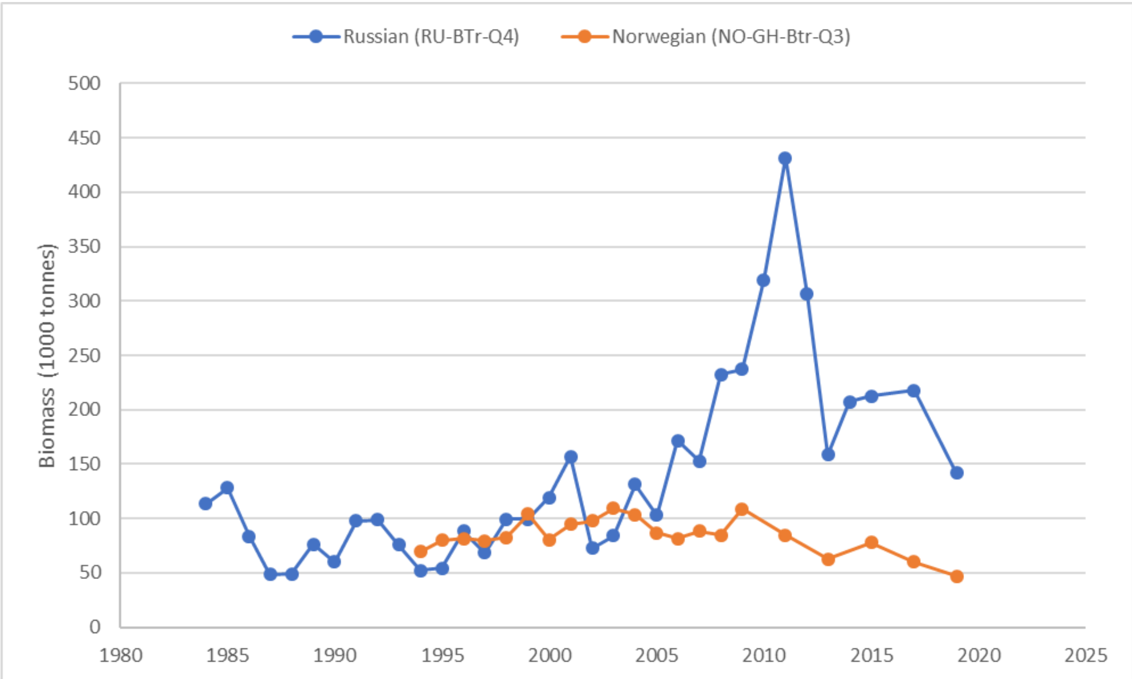


Figure 8.4. NEA Greenland halibut. Total biomass estimates from Russian autumn survey and the Norwegian slope survey. Note that the Norwegian survey is run every other year since 2009. Uncertain estimate for 2013 from the Russian survey. Russian data from 1992 and onwards are revised in 2021 (Russkikh WD12). No Russian data for 2016, 2018 and 2020.

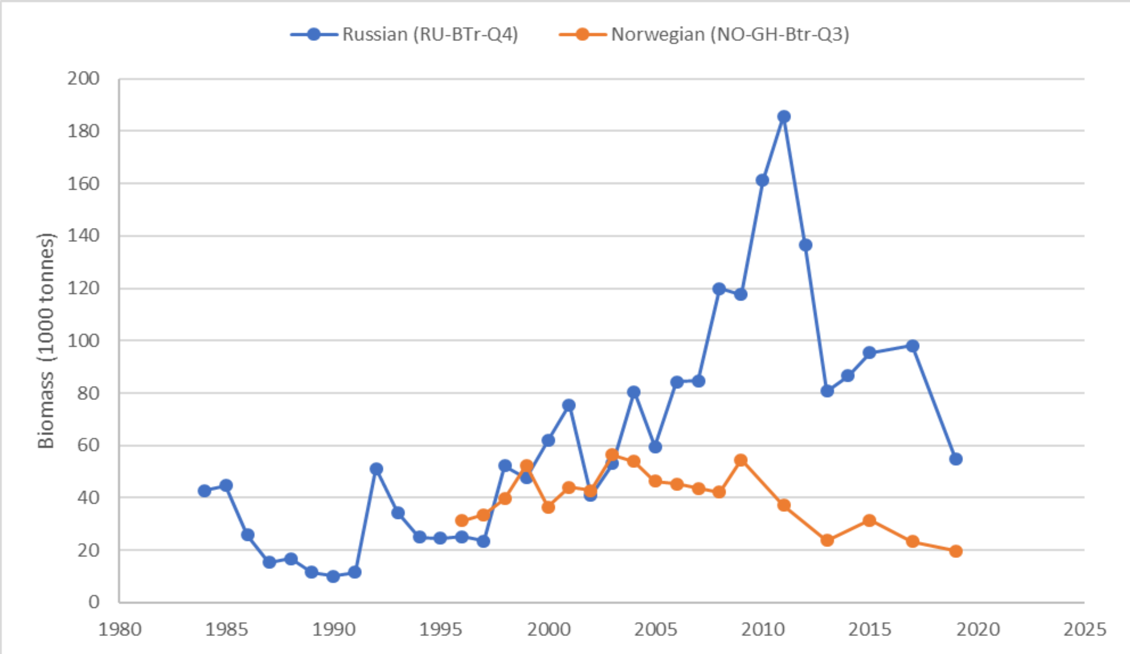


Figure 8.5. NEA Greenland halibut. Swept–area estimate of the female biomass based on the data from the Norwegian slope survey in August (every other year since 2009) and the Russian trawl survey in October–December (compared to previous reports, . Russian data from 1992 and onwards are revised in 2021 (Russkikh WD12)). Uncertain estimate for 2013 from the Russian survey.

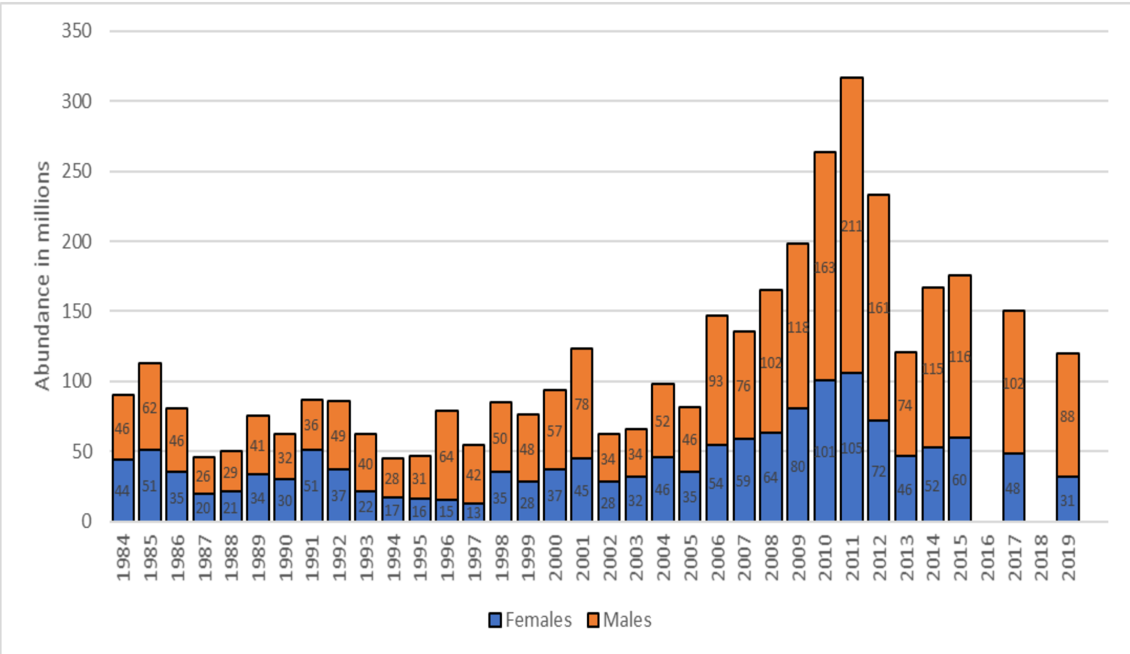


Figure 8.6. Russian autumn survey; Greenland halibut abundance by sex (Russkikh and Smirnov, WD16 AFWG 2016). Russian data from 1992 and onwards are revised in 2021 (Russkikh WD12). In this figure the 1992, 1996, 2002, 2017 and 2019 indices were not raised to also represent uncovered parts of the standard survey area.

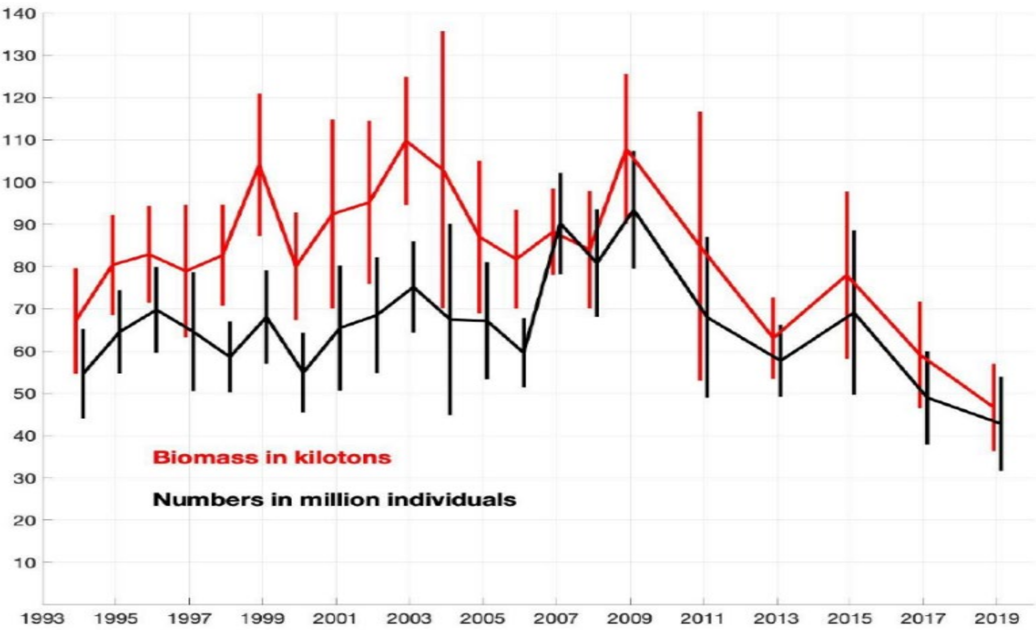


Figure 8.7. Estimated Greenland halibut total abundance in biomass and by number of individuals from the Norwegian slope surveys 1994–2019. The vertical bars show 95% confidence intervals.

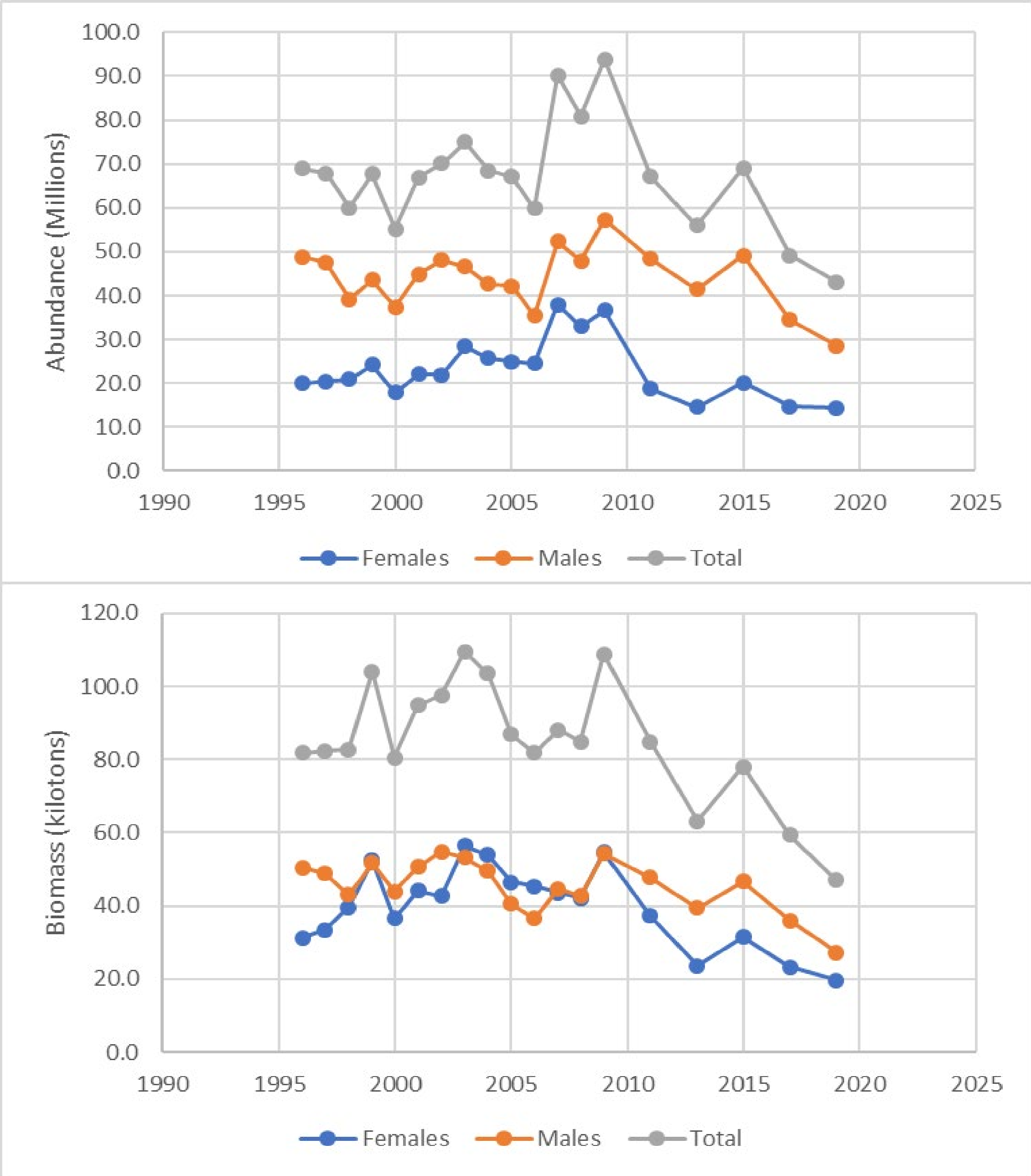


Figure 8.8. Estimated Greenland halibut abundance (upper panel) and biomass (lower panel), by sex, from the Norwegian autumn slope survey.

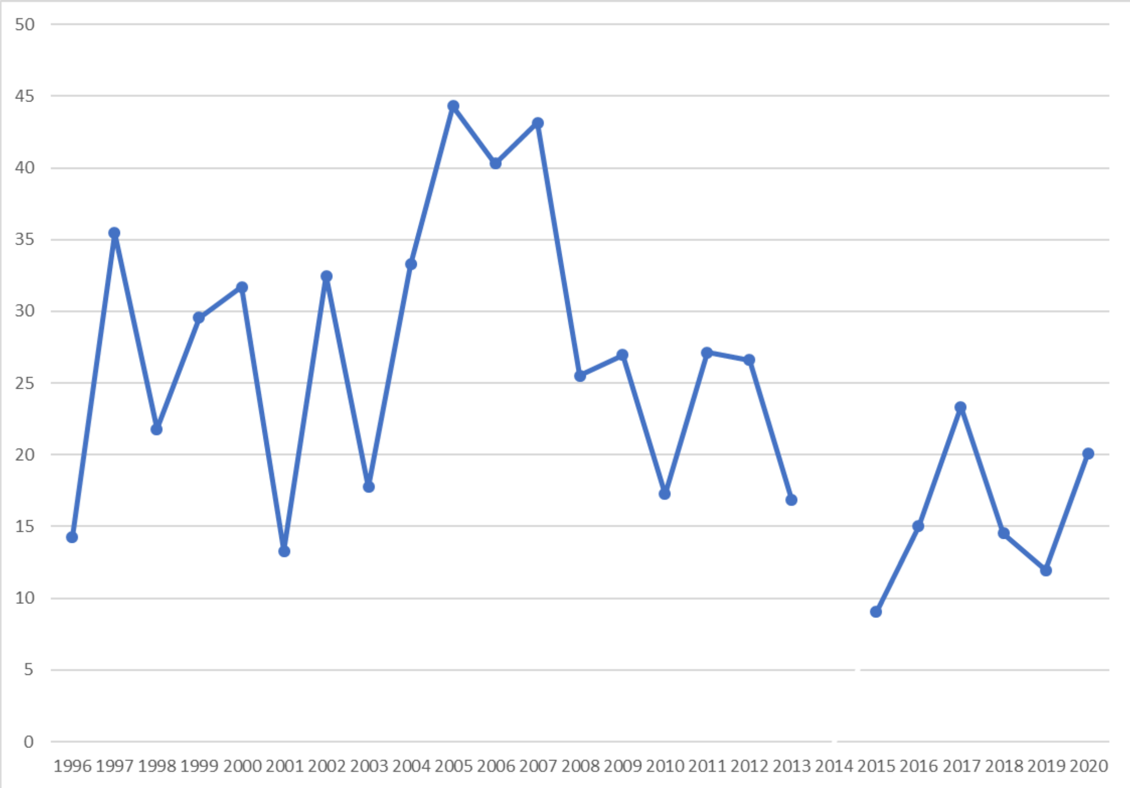


Figure 8.9. Total juvenile biomass index (EcoJuv) (female biomass = male biomass) for Greenland halibut based on the Barents Sea Ecosystem Survey (A5216) 2003 – 2020 (2014 not included due to poor survey coverage in the juvenile area) and the juvenile survey 1996–2002 (for area see Hallfredsson and Vollen, WD20 AFWG 2015).

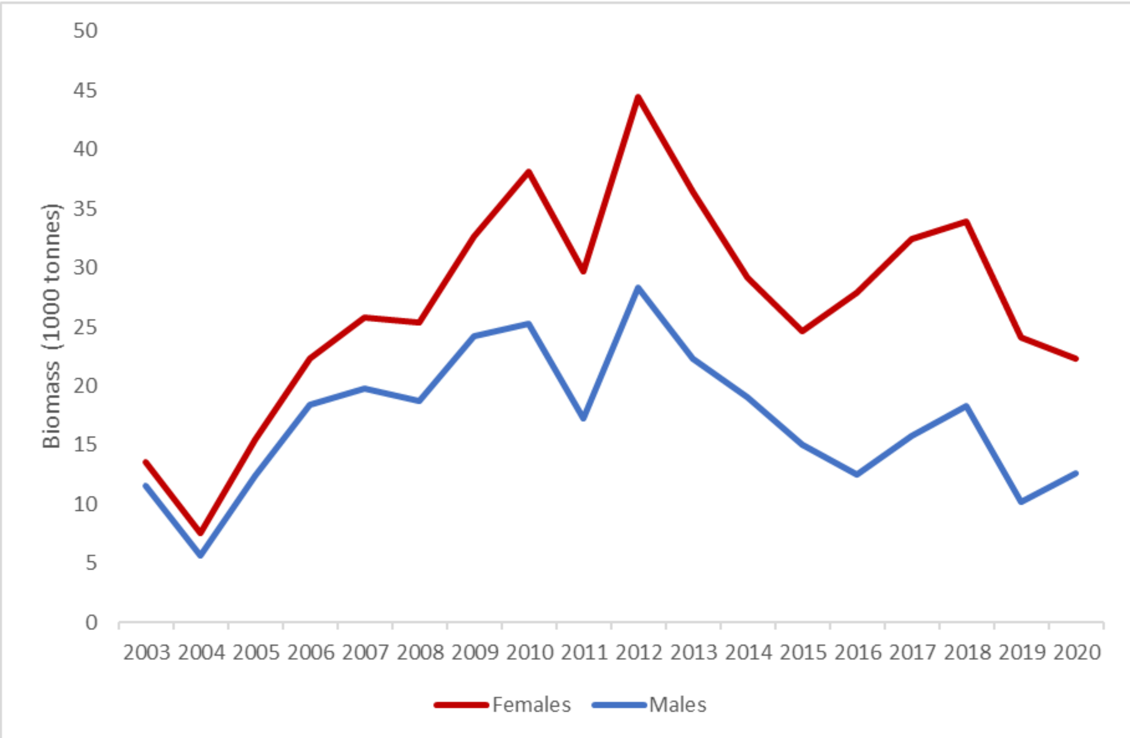


Figure 8.10. Eco–south biomass index by sex for Greenland halibut in the Barents Sea Ecosystem Survey (A5216) 2003 – 2020, outside the juvenile area (for area see Hallfredsson and Vollen, WD20 AFWG 2015). The 2018 estimate is not considered reliable mainly due to lack in survey coverage, and was excluded from the 2021 assessment.

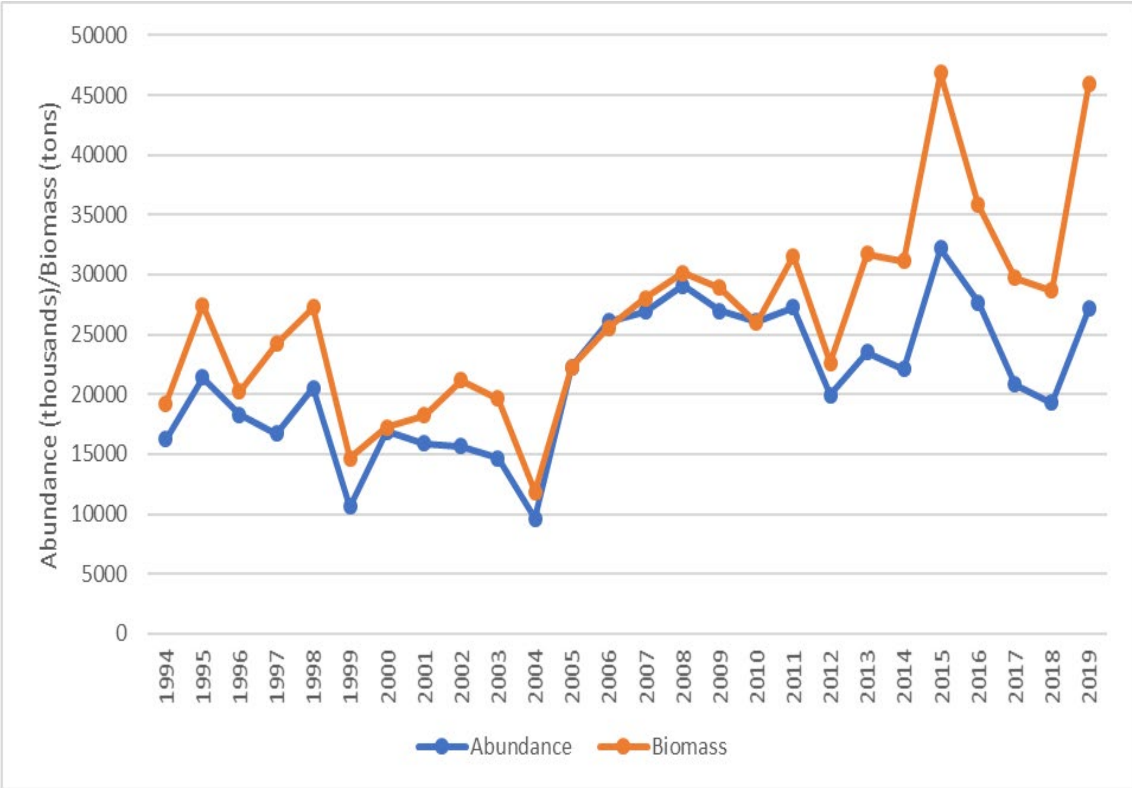


Figure 8.11. Joint Norwegian−Russian winter survey in the Barents Sea 1994−2020; Greenland halibut abundance and biomass estimates.

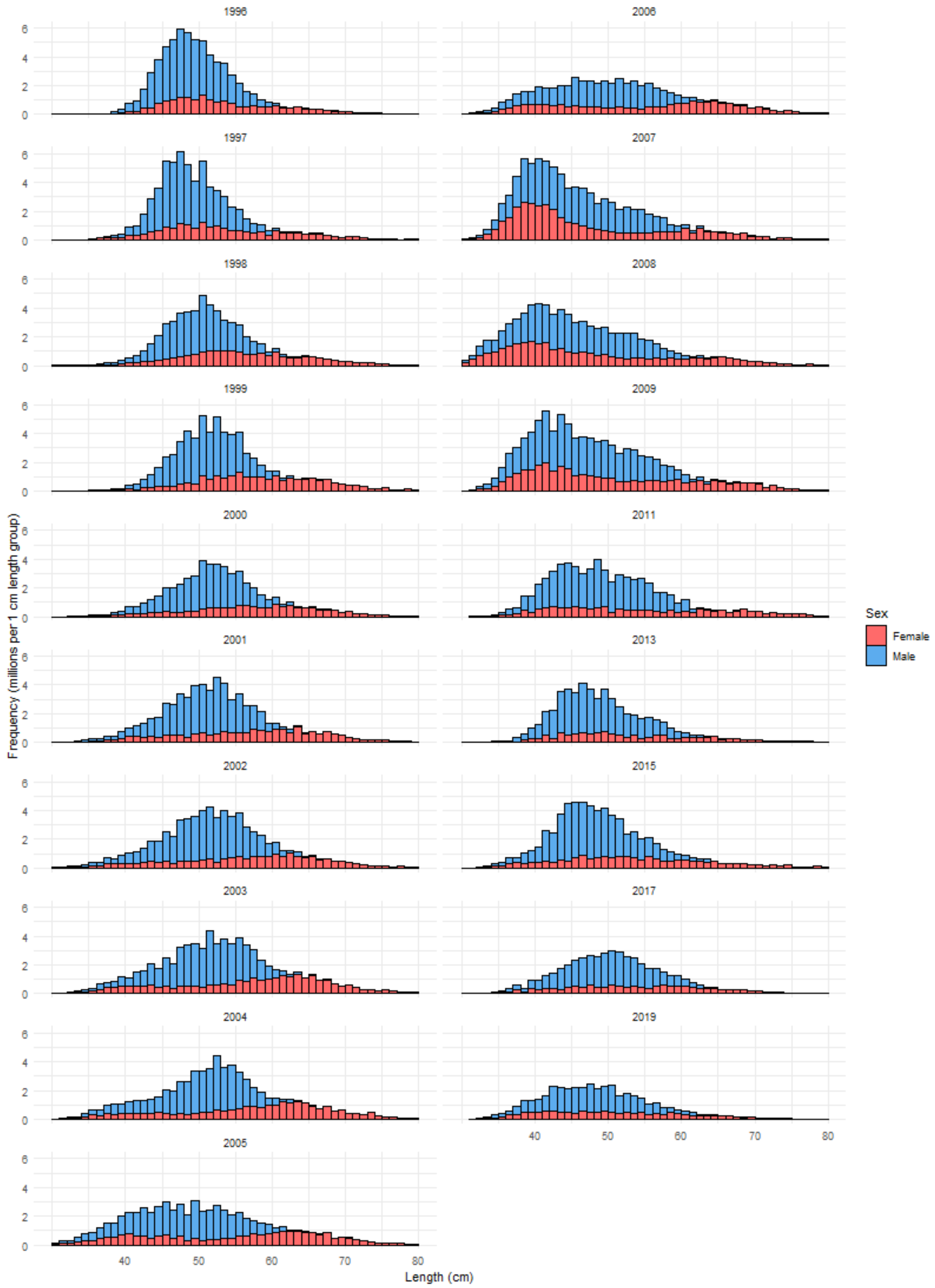


Figure 8.12. Length frequency distribution estimates for the entire area covered by the Norwegian Slope survey during autumns 1996–2019. Note biennial surveys after 2009.

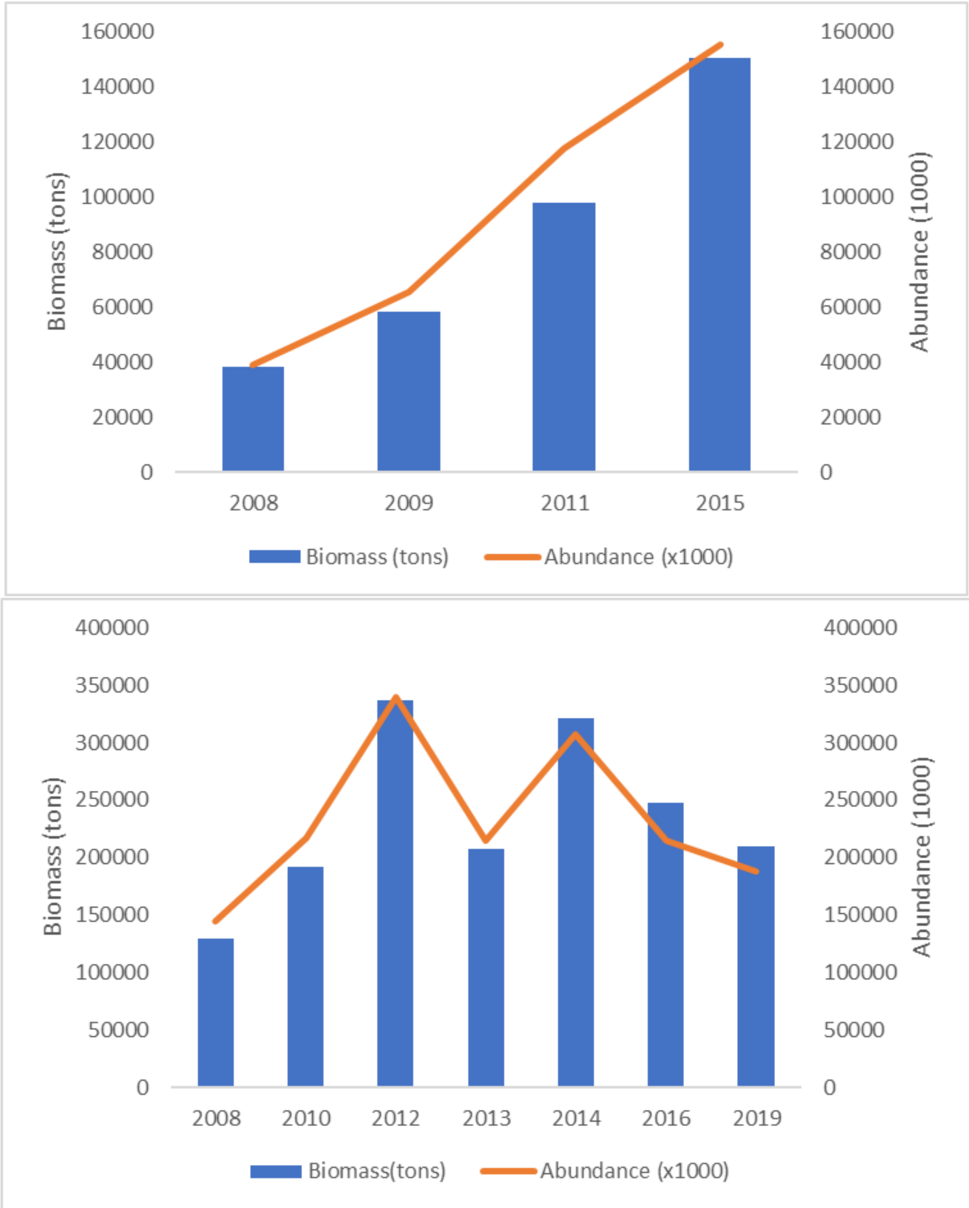


Figure 8.13. Abundance and biomass estimates from Spanish autumn surveys (lower panel) (Muñoz *et al.*, WD7 AFWG 2017), and abundance and biomass estimates from Spanish spring surveys (upper panel) (Muñoz *et al.*, WD10 AFWG 2016). Note that X–axis is not continuous.

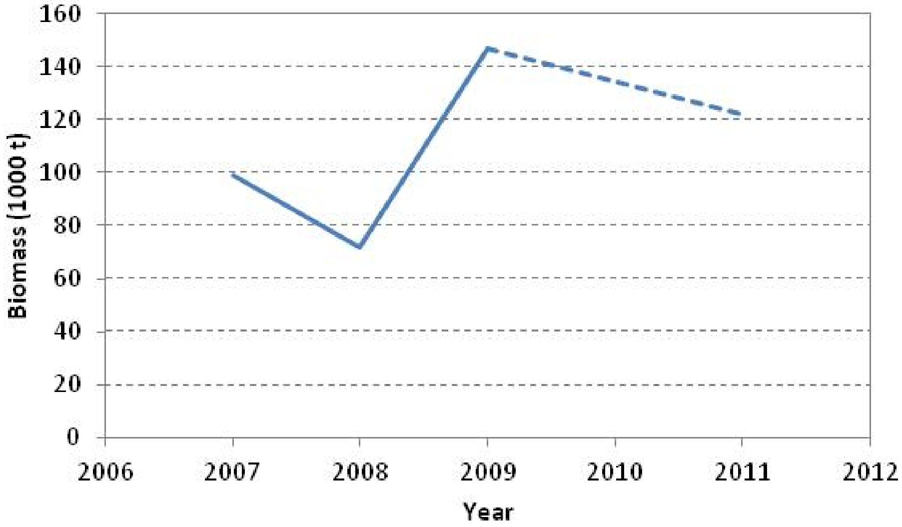


Figure 8.14. Biomass estimates from Polish spring survey (based on: Janusz *et al.*, WD8 AFWG 2008; Janusz and Trella, WD10 AFWG 2009; Trella and Janusz, WD6 AFWG 2012). No update presented to the 2020 AFWG.

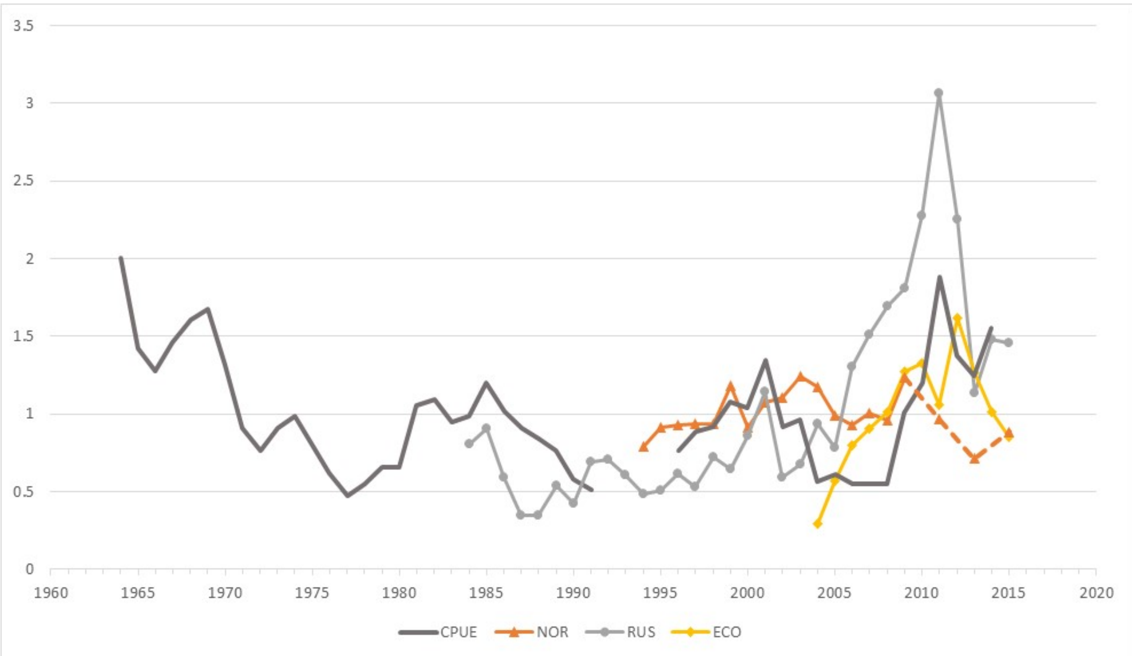
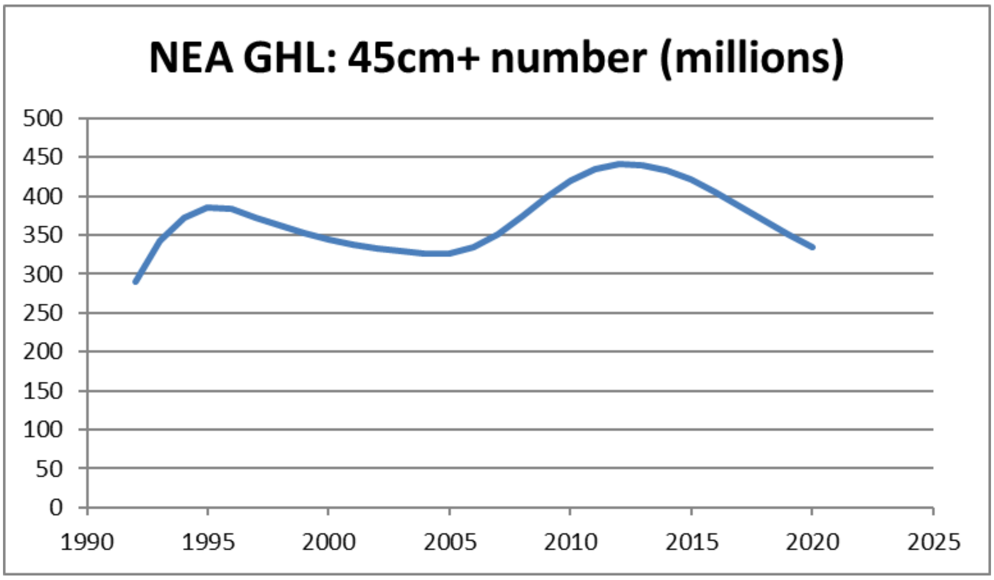
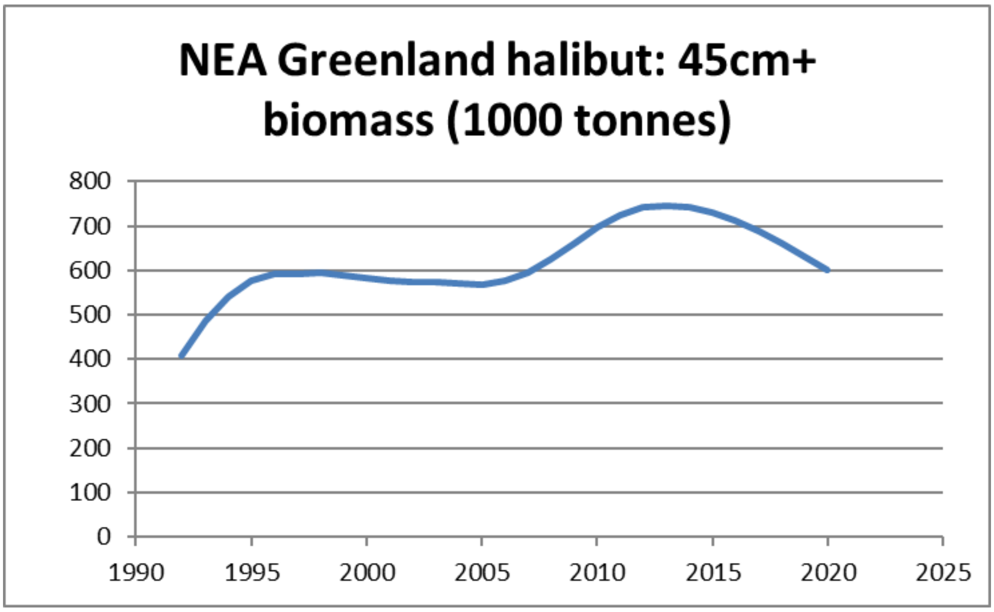


Figure 8.15. Dynamics of indices of the Barents Sea Greenland halibut stock in 1964–2015. Indices are divided by corresponding mean to put them in comparable scale. CPUE series divided in two, 1964–1991 and after 1996. In addition to the standardized CPUE three survey indices are shown; the Russian autumn survey (RUS), the Norwegian autumn survey (NOR) and the EcoSouth index (ECO).


NEA GHL: 45cm+ number (millions)
500
450
400
350
300
250
200
150
100
50
0
1990
1995
2000
2005
2010
2015
2020
2025


NEA Greenland halibut: 45cm+ biomass (1000 tonnes)
800
700
600
500
400
300
200
100
0
1990
1995
2000
2005
2010
2015
2020
2025

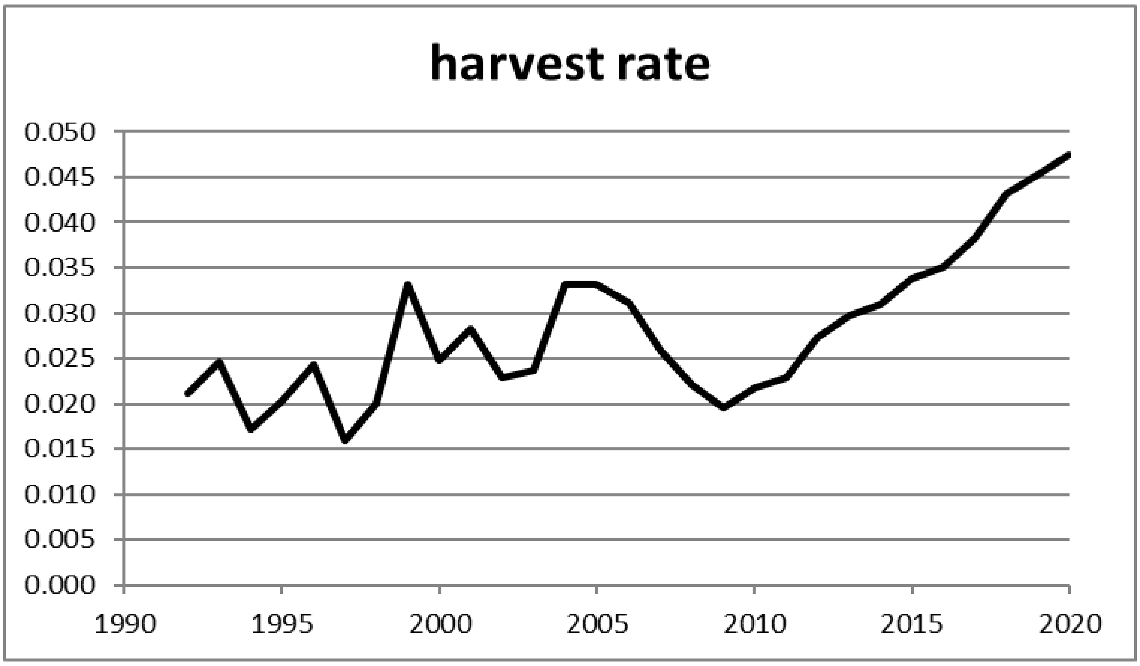


Figure 8.16. Numbers (upper) and biomass (middle)(previous page) for 45+ cm Greenland halibut as estimated by the GADGET model, and estimated exploitation rates (below).

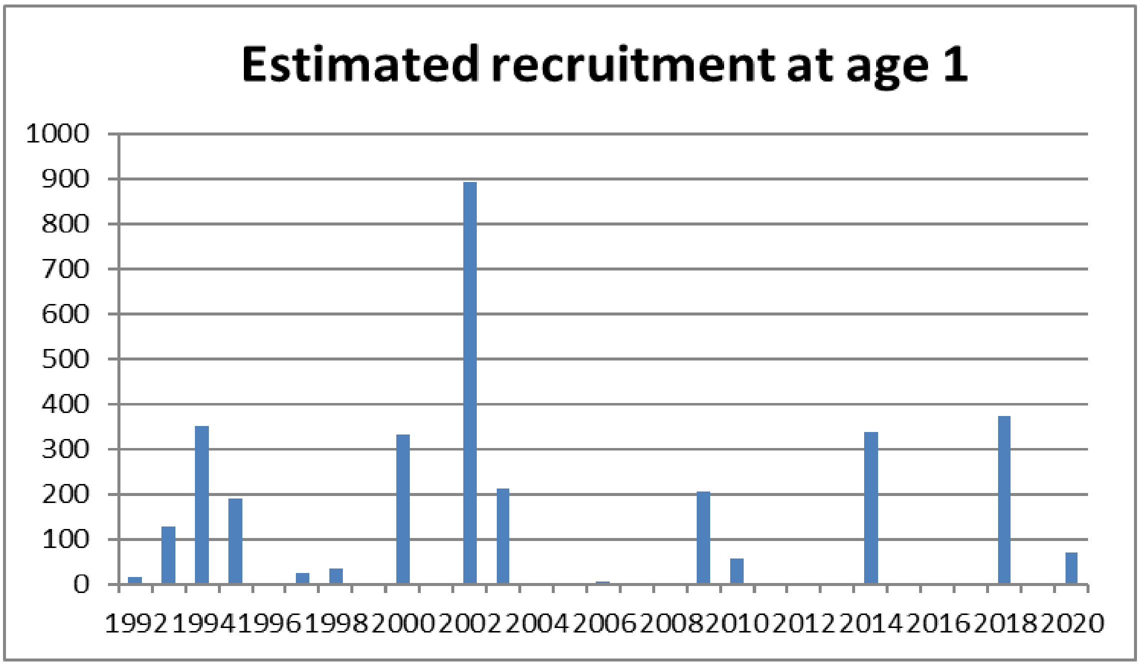


Figure 8.17. Gadget recruitment estimate (in millions) for 1 year olds in the Greenland Halibut stock at 1st January. Note that the most recent year(s) of recruitment are tuned by very few data and should be considered tentative.

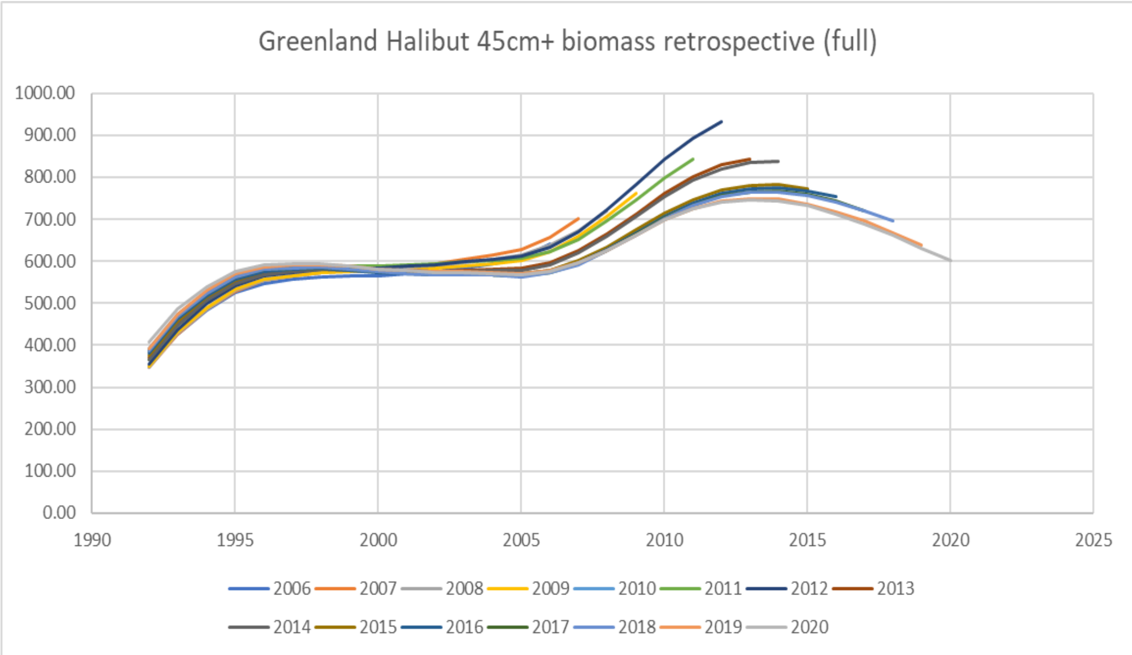


Figure 8.18. Retrospective patterns from the GADGET model run.

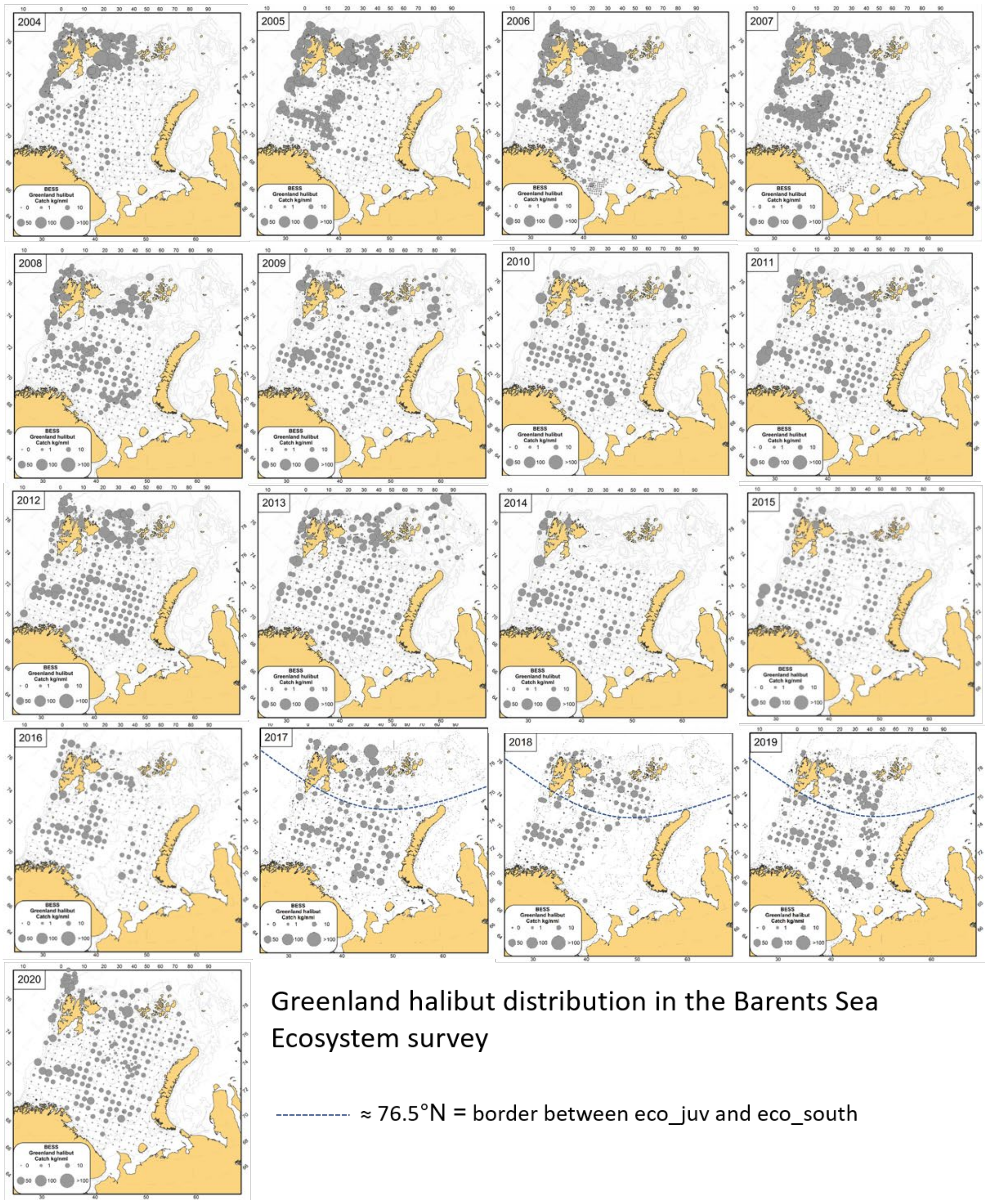


Figure 8.19. Biomass of G. halibut per station in the Barents Sea ecosystem survey (A5216).