

GREENLAND HALIBUT – GRÁLÚÐA

Reinhardtius hippoglossoides

GENERAL INFORMATION

Greenland halibut in ICES Subareas 5a, 5b, 6a, 6b, 12 and 14, 14a, 14b (East-Greenland, Iceland, Faroe-islands) are assessed as one stock. In Icelandic waters, it is found on the continental shelf around Iceland with the highest abundance west, north and east off the coast in deeper and colder waters. It is mainly found on a muddy substrate at depths ranging from 200-1500 m. The main spawning grounds are located west off the coast at around 1000 m depth and eggs and larvae drift between Iceland and the east coast of Greenland until juveniles seek bottom post metamorphosis. After spawning, Greenland halibut migrates further north and east to their main feeding grounds.

THE FISHERY

Spatial distribution of the 2018 fishery and historic catch and effort in 2018 in the trawl fishery in Subareas 5, 6, 12 and 14 is provided in Figures 1-3. Fishery in the entire area did in the past occur in a seemingly continuous belt on the continental slope from the slope of the Faroe plateau to southeast of Iceland extending north and west of Iceland and further south to southeast Greenland. Fishing depth ranges from 350-500 m southeast, east and north of Iceland to about 1500 m at East Greenland. In 2018 the distribution of the fishery covered all areas but was discontinuous in its distribution (Figure 1).

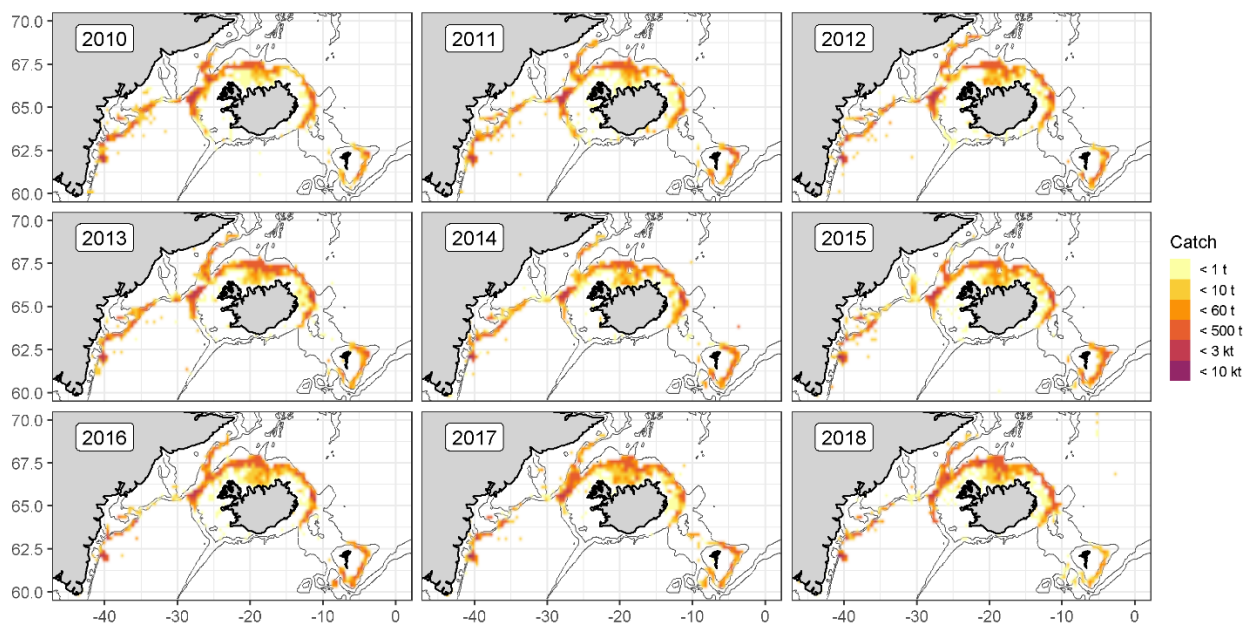


Figure 1. Greenland halibut. Geographical distribution of the fishery in division 5, 6, 12 and 14 since 2010. The 500 m and 1000 m depth contours are shown. Reported catch from logbooks.

Mynd 1. Grálúða. Útbreiðsla veiða á svæðum 5, 6, 12 og 14 frá 2010 samkvæmt afladagbókum. Sýndar eru 500 m og 1000 m dýptarlínur.

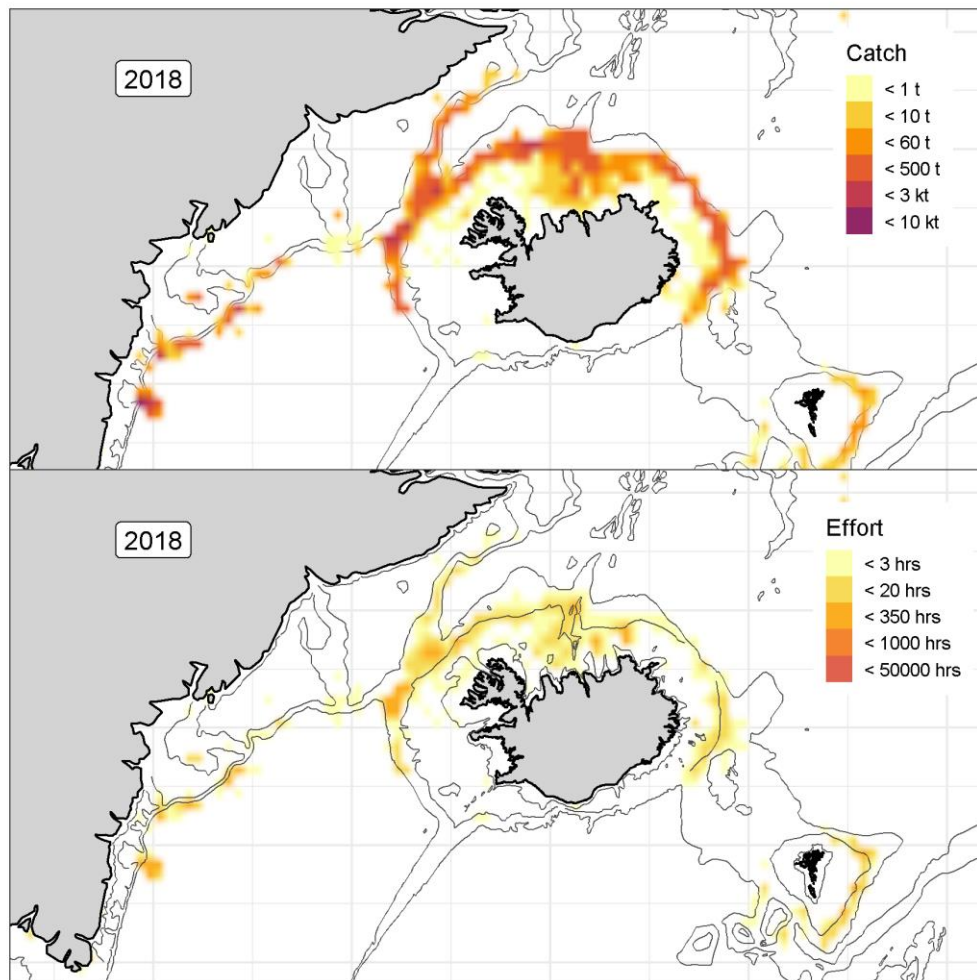


Figure 3. Spatial distribution of catch and effort in Geographical distribution of the fishery in division 5, 6, 12 and 14 in 2017. 500m and 1000 m depth contours are shown. Reported catch from logbooks.

Mynd 2. Grálúða. Útbreiðsla veiða á svæðum 5, 6, 12 og 14 árið 2017 samkvæmt afladagbókum. Sýndar eru 500 m og 1000 m dýptarlínur.

In 1980–1990, about 75–90% of catches were caught by Iceland. Since 1990, the Icelandic proportion has decreased, and has in recent years been 50–60%. Highest catches were recorded in 1986, about 60 thous. tonnes. (Figure 3).

Landings in Icelandic waters (usually allocated to Division 5a) have historically been predominated by the total landings in areas 5+14 (Icelandic waters), but since the mid-1990s fisheries in Subarea 14 and Division 5b have developed. Landings have since 1997 been between 20-31 thous. tonnes (Figure 4).

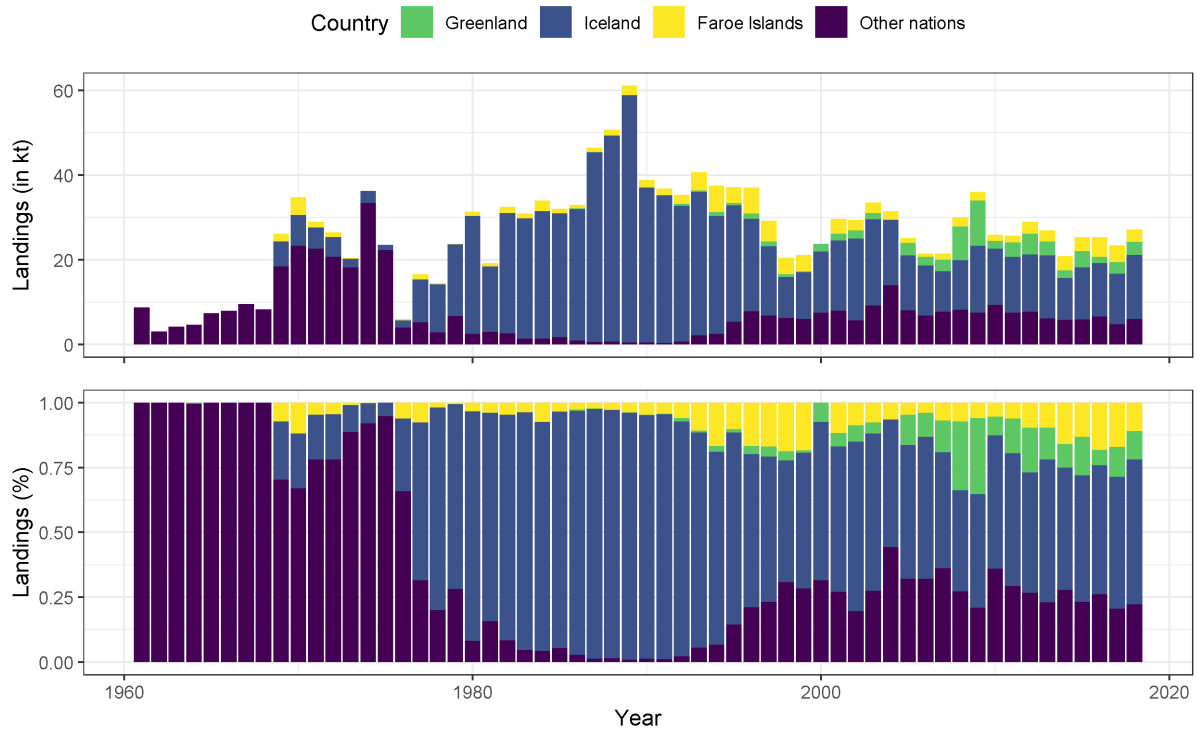


Figure 3. Greenland halibut. Spatial distribution of the fishery in ICES Subareas 5,6,12 and 14 (Greenland, Iceland and Faroe Islands) from 1961-2018. All gears combined.

Mynd 3. Grálúða. Útbreiðsla veiða á ICES svæðum 5, 6, 12 og 14 frá 1961-2018. Öll veiðarfæri samanlagt.

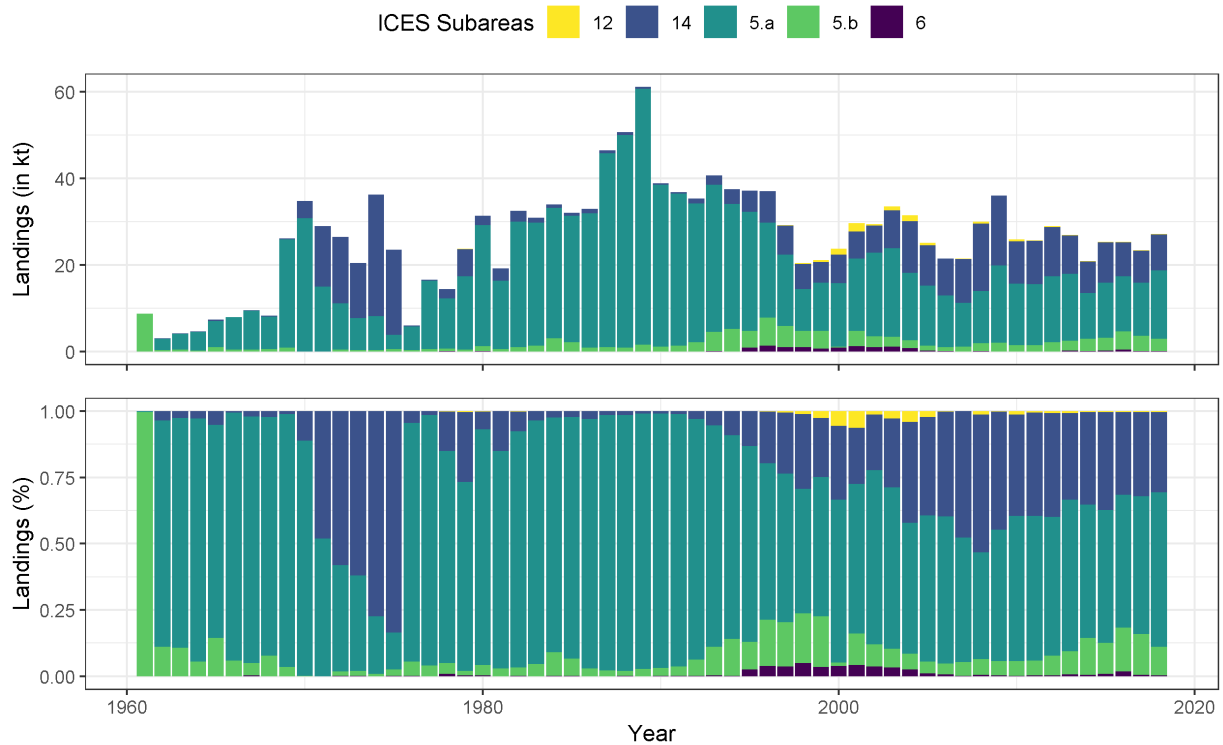


Figure 4. Greenland halibut. Spatial distribution of catch between ICES subareas 5.a, 5.b, 6, 12 and 14 from 1961-2018. All gears combined.

Mynd 4. Grálúða. Útbreiðsla afla á ICES undirsvæðum 5.a, 5.b, 6, 12 og 14 árin 1961-2018. Öll veiðarfæri.

Demersal trawl is the main fishing gear for Greenland halibut in Icelandic waters, followed by gillnets while a small proportion of the catch is taken in longlines and shrimp trawls. Since 2015, landings by gillnets have increased, reaching 45% of total catch in 2018 (Figure 5). The Greenland halibut trawl fishery is considered clean with respect to by-catches. The mandatory use of sorting grids in the shrimp fishery in Icelandic and Greenland waters since 2002 is observed to have reduced by-catches of Greenland halibut considerably.

Greenland halibut is caught in relatively deep waters, with most of the catch (70%) taken between 400-800 meters depth. In 2003, most of Greenland halibut was caught at 800 meters or deeper (73%), but since then, catch has increased steadily in more shallow waters (Figure 6).

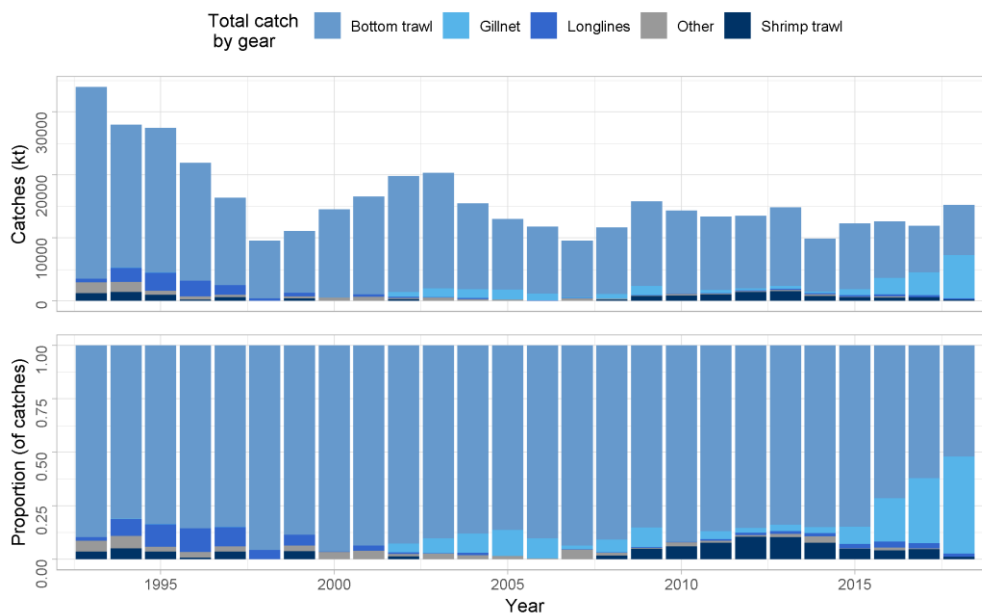


Figure 5. Greenland halibut. Total catch (landings) by fishing gear since 1994, according to statistics from the Directorate of Fisheries.

Mynd 5. Grálúða. Landaður afli eftir veiðarfærum frá 1994, samkvæmt aflskráningarkerfi Fiskistofu.

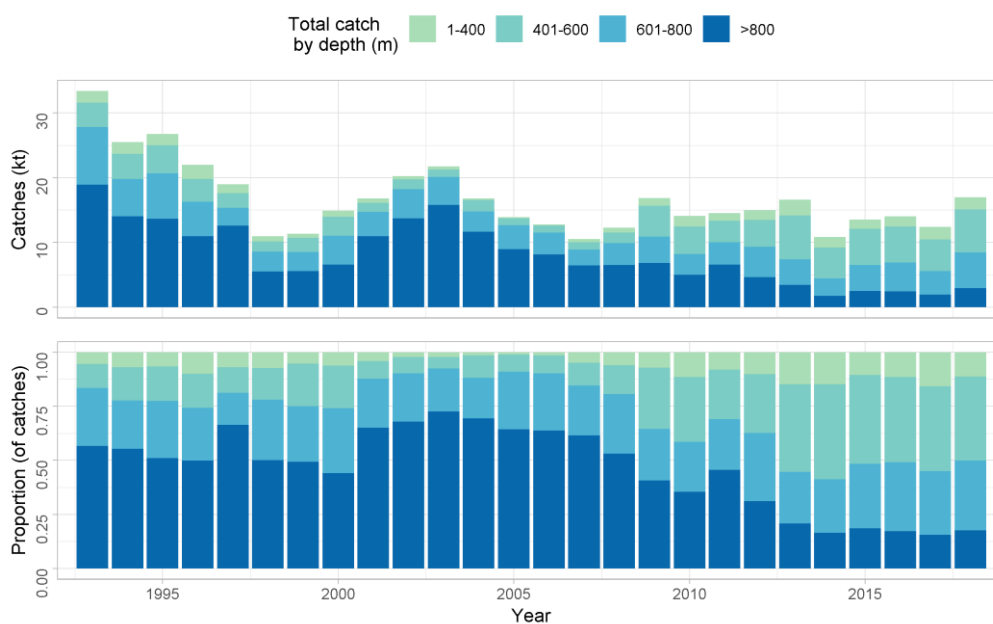


Figure 6. Greenland halibut. Depth distribution of catches according to Icelandic logbooks.

Mynd 6. Grálúða. Afli samkvæmt afladagbókum íslenskra skipa, skipt eftir dýpi.

Since 2000, the number of Icelandic demersal trawlers reporting catches over 1000 kg of Greenland halibut has decreased, where the number has dropped from 60 vessels in 2000, to 33 in 2018. The catch from trawlers has decreased as well, from approximately 14 thousand tonnes in 2000 to 8000 tonnes in 2018. The Icelandic longline fleet has expanded and in 2018 a total of 24 longliners reported catches over 1000 kg. Since 2000, total annual catches have fluctuated from around 9000 to 20000 tonnes and in 2018 the c was just over 15000 tonnes (Table 1).

Table 1. Greenland halibut. Number of Icelandic vessels landing catch of 1000 kg or more of Greenland halibut, and all landed catch divided by gear type according to logbooks

Tafla 1. Grálúða. Fjöldi íslenskra skipa sem landað hafa yfir 1000 kg af grálúðu og allur landaður afli eftir veiðarfærum samkvæmt afladagbókum.

YEAR	NUMBER OF VESSELS			CATCHES (TONNES)				
	<i>Trawlers</i>	<i>Longliners</i>	<i>Gillnetters</i>	<i>Demersal trawl</i>	<i>Long-line</i>	<i>Gillnet</i>	<i>Other</i>	<i>Sum</i>
2000	60	7	2	13988	26	5	499	14518
2001	47	6	1	15541	393	2	660	16597
2002	46	4	1	18378	159	793	481	19812
2003	48	4	1	18378	65	1383	527	20353
2004	40	5	2	13618	170	1392	298	15478
2005	39	3	3	11239	11	1576	190	13016
2006	41	2	4	10638	11	1115	35	11799
2007	41	7	1	8970	20	166	424	9580
2008	37	5	1	10593	22	715	340	11671
2009	37	13	3	13487	84	1441	818	15831
2010	37	12	1	13202	33	0	1125	14360
2011	44	18	1	11625	91	500	1156	13372
2012	47	27	1	11535	154	304	1515	13507
2013	42	31	1	12460	206	450	1743	14859
2014	40	36	1	8393	149	273	1064	9880
2015	35	38	1	10444	247	986	633	12309
2016	40	41	4	9035	346	2576	696	12653
2017	33	36	5	7411	273	1436	2807	11926
2018	33	24	0	7926	208	0	7080	15214

The number of vessels accounting for 95% of the catch of Greenland halibut in Icelandic waters changed from about 75 to about 30 vessels in 1994-1998 (Figure 7). This change coincided with reduced catches. Since 1998, the number of vessels accounting for 95% of the catch has been relatively constant despite variable annual catches, with the lowest number of vessels observed in 2018.

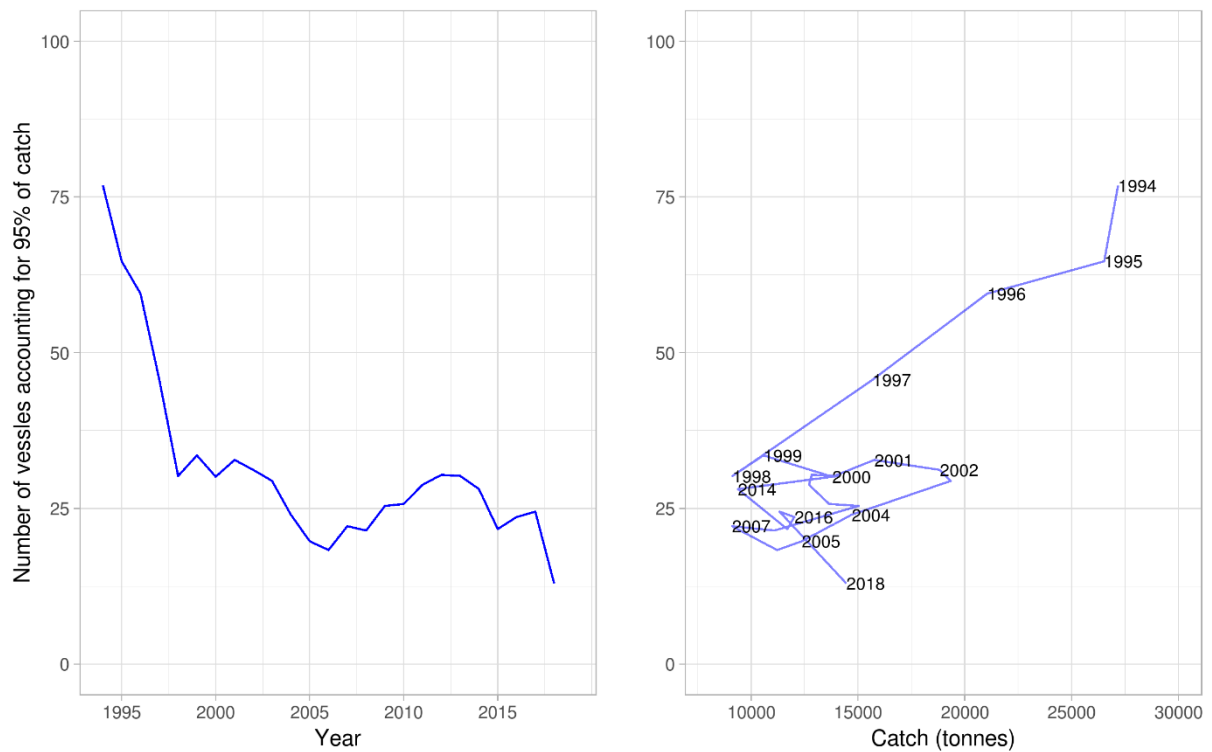


Figure 7. Greenland halibut. Number of vessels (all gear types) accounting for 95% of the total catch annually since 1994. Left: Plotted against year. Right: Plotted against total catch. Data from the Directorate of Fisheries.

Mynd 7. Grálúða. Fjöldi skipa (öll veiðarfæri) sem veiddu 95% heildaraflans hvert ár frá 1994. Vinstri: Sýnt eftir árum. Hægri: Sýnt í samanburði við heildarafla. Gögn frá aflaskráningarkerfi Fiskistofu.

CATCH PER UNIT EFFORT (CPUE) AND EFFORT.

Indices of CPUE for the Icelandic trawl fleet directed at Greenland halibut for the period 1985–2018 is provided in Figure 8. The overall CPUE index for the Icelandic fishery are compiled as the average of the standardised indices from the whole area. Catch rates of Icelandic bottom trawlers decreased for all fishing grounds during 1990–1996 but peaked again in 2001. Since 2003, CPUE has been relatively stable. The Icelandic CPUE series has for many years been used as one of the biomass indicators in the assessment of the stock. The CPUE of the Greenlandic trawlers and the biomass indices from the Faroese waters have not been used in the assessment, as the stock production model is not able to accommodate the contrasting indices (Icelandic CPUE and Greenlandic/Icelandic autumn surveys) and these CPUE series do not .

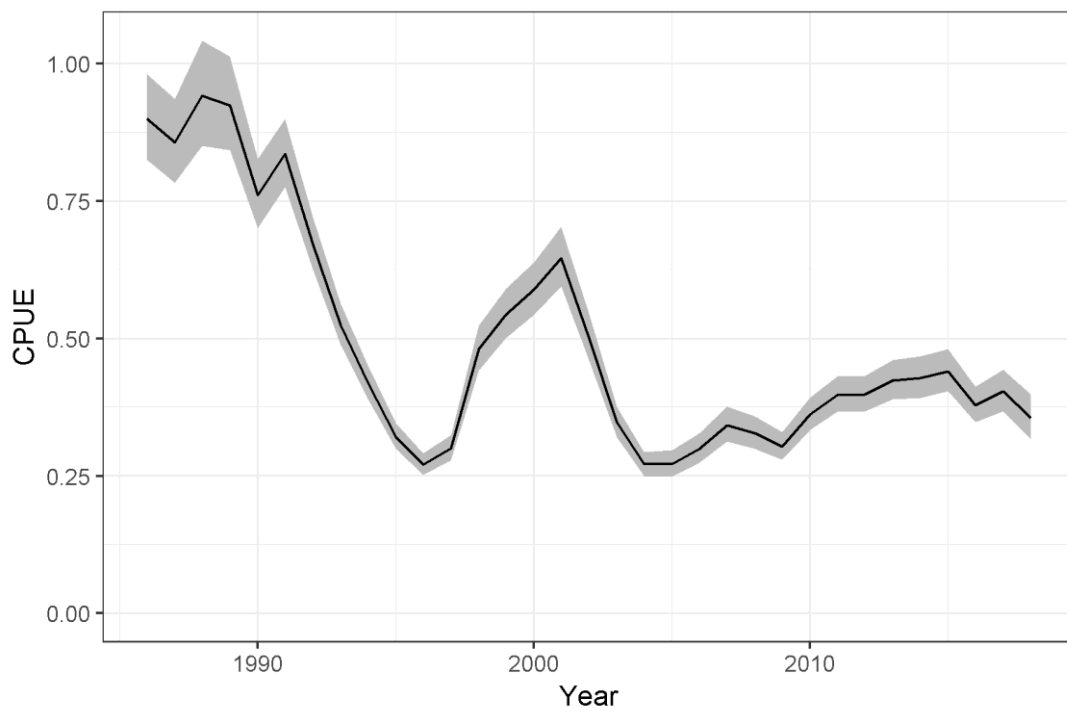


Figure 8. Greenland halibut. Catch per unit effort (CPUE) (log) from the Icelandic trawler fleet in 5a. 95% CI indicated

Mynd 8. Grálúða. Afli á sóknareiningu (kg/togtímar)

SAMPLING OF LANDED GREENLAND HALIBUT

Since 2010, 11-28 thous. individuals of Greenland halibut have been length measured from landed catch. 61-149 samples have been collected yearly by the MFRI and most samples come from demersal trawlers (Table 2, Figure 9). Otoliths are not sampled from landed catch. In 2017, 61 samples were taken, and 11074 individuals measured, which is the lowest since 2010.

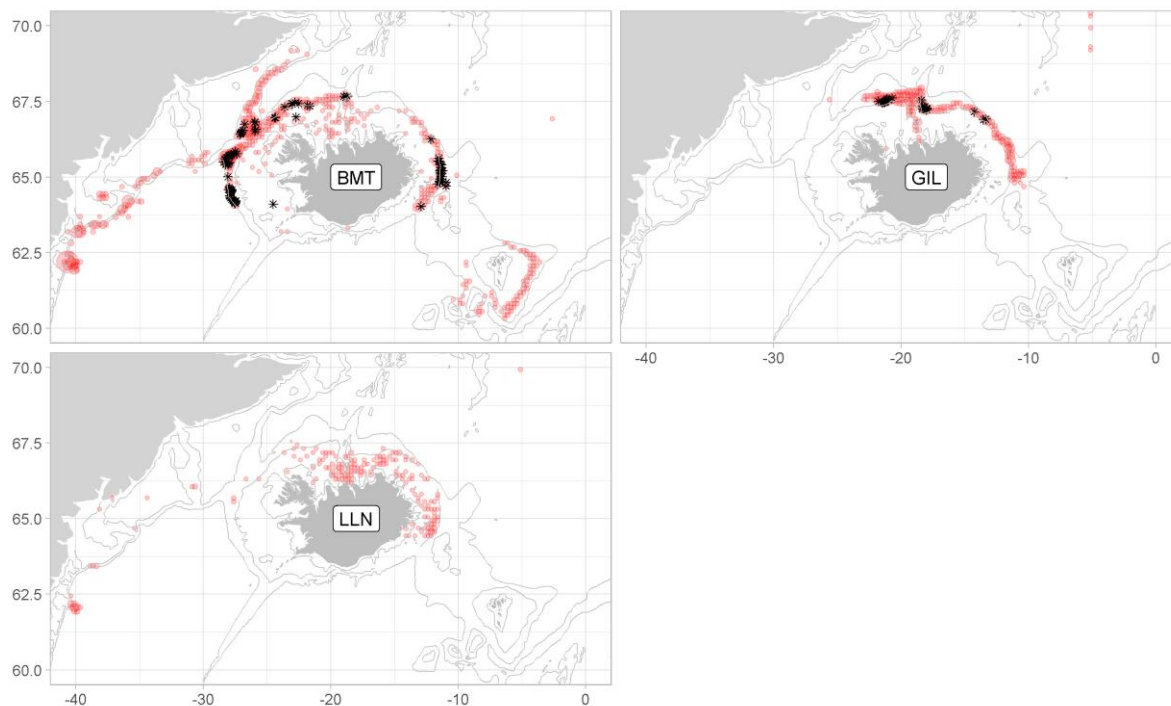


Figure 9. Greenland halibut. Fishing grounds in 2018 as reported in logbooks (red) and positions of samples taken from landings (asterisks). Note that sampling locations are only available from Icelandic sources.

Mynd 9. Grálúða. Veiðisvæði við Ísland árið 2018 samkvæmt afladagbókum (rautt) og staðsetningar sýna úr lönduðum afla (stjörnur). Einungis er um gögn landaðs afla frá Íslandi að ræða.

Table 2. Greenland halibut. Number of samples and length measured individuals from landed catch.

Tafla 2. Grálúða. Fjöldi sýna og lengdamældra fiska úr lönduðum afla.

Year	Demersal trawl		Other gear	
	Samples	Individuals	Samples	Individuals
2010	69	12360	47	9662
2011	133	22707	9	1600
2012	130	23938	19	4218
2013	88	13410	3	499
2014	98	17327	22	2784
2015	39	5863	29	4557
2016	92	14591	25	5532
2017	41	7117	20	3957
2018	93	18617	31	6555

LENGTH DISTRIBUTION OF LANDED GREENLAND HALIBUT

There has been a shift towards larger fish in the length distribution of landed catch (Figure 10). As a result, the average length in the samples taken from commercial catch has increased from 62.7 cm in 2002 to 65.7 cm in 2017.

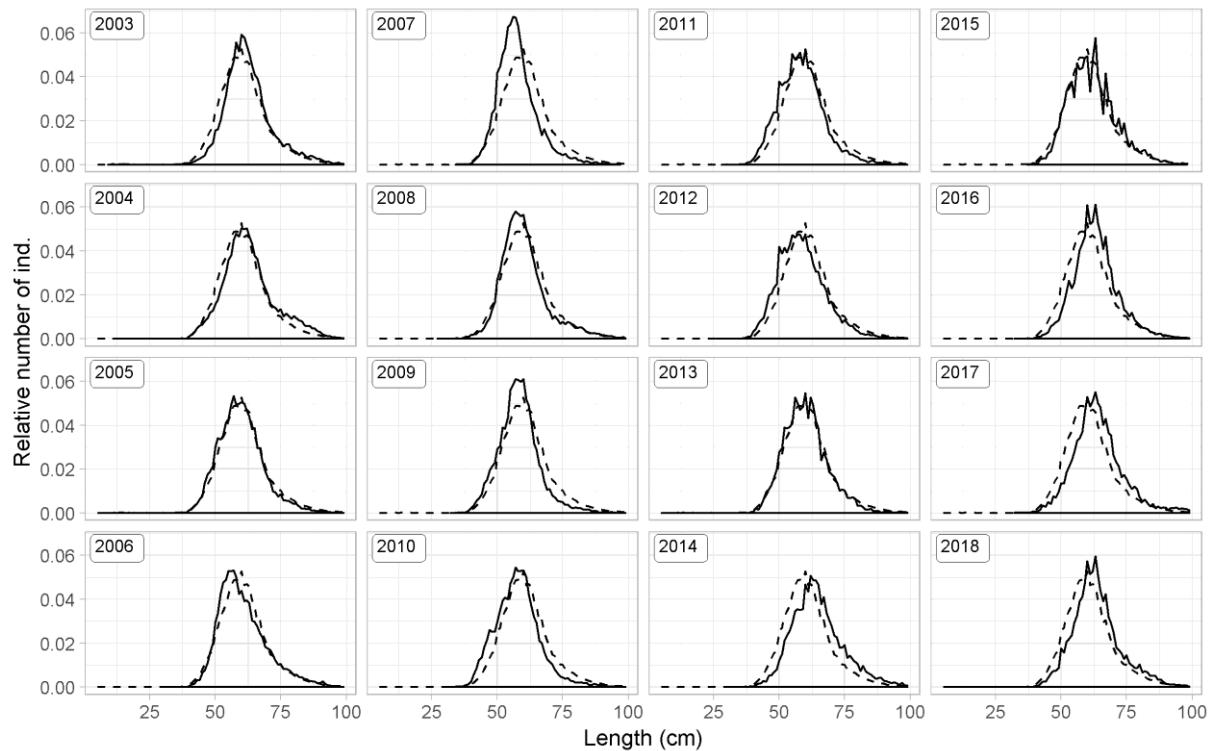


Figure 10. Greenland halibut. Length distribution from landed catch. The dotted line represents the mean length distribution for all years.

Mynd 10. Grálúða. Lengdardreifing aflasýna frá árinu 2003 með meðal lengdardreifingu fyrir öll árin (punktalína).

Males measured from landed catch have the tendency to be smaller than females, with the mean length ranging from 51.0 - 60.8 cm since 2002. The mean length of females ranged from 54.5 - 71.8 cm, but in recent years, the means seem to be narrowing and in 2017, the mean length of females were 65.9 compared to 60.0 cm in males (Figure 10).

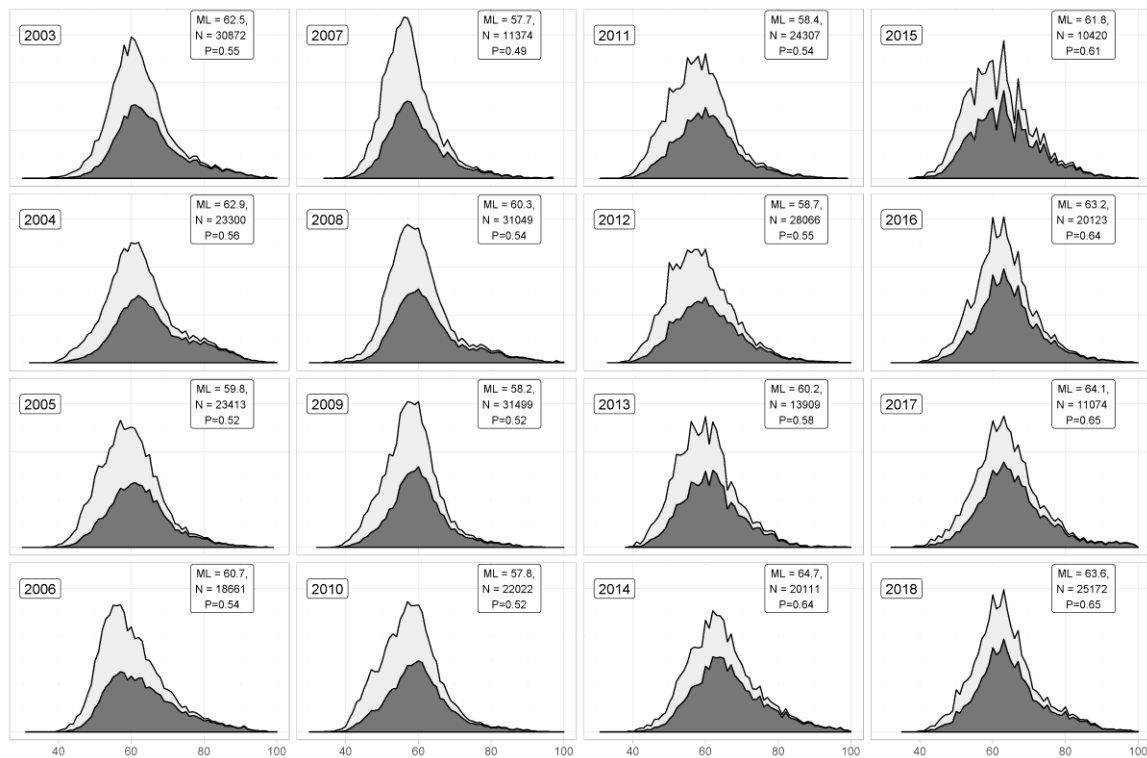


Figure 11. Greenland halibut. Length distribution of males (light-grey) and females (dark-grey) from landed catch from 2003-2018. ML is mean length, N is number of individuals and P is the proportion of females in the catch.

Mynd 11. Grálúða. Lengdardreifing hænga (ljósgrár) og hrygna (dökkgrár) úr aflasýnum frá árinu 2003-2018. ML er meðallengd, N er fjöldi í sýni og P er hlutfall hrygna í afla.

SURVEY DATA

The Icelandic autumn groundfish survey (hereafter autumn survey) was commenced in 1996. However, a full autumn survey was not conducted in 2011 due to a labour dispute. Figure 13 shows both a recruitment index based on abundance of Greenland halibut ≤ 40 cm, and trends in various biomass indices. Survey length distributions are shown in Figure 15, abundance and changes in spatial distribution in Figure 12-13.

In the 2018 survey, Greenland halibut were mainly caught on the continental slope south east, north and northwest of the country (Figure 12).

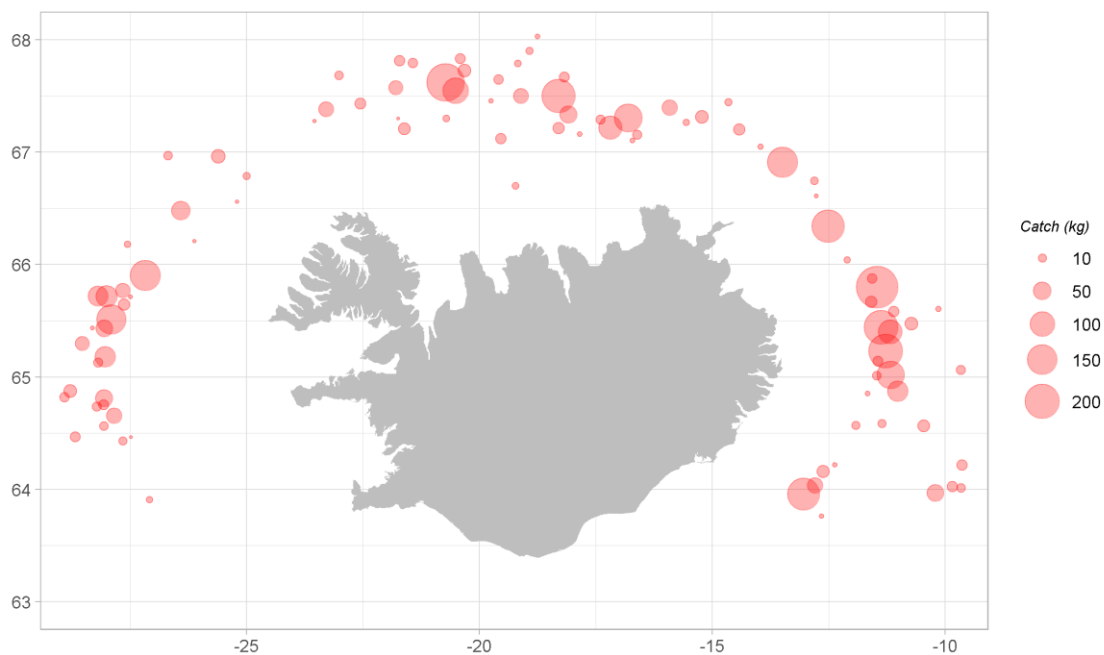


Figure 12. Greenland halibut. Spatial distribution of Greenland halibut in 2018 in the autumn survey.

Mynd 12. Grálúða. Útbreiðsla í stofnmælingu botnfiska að hausti árið 2018.

Since the survey was commenced in 1996, the distributional pattern has remained quite stable, with the greatest biomass index in the northeast and northwest. Since 1996, biomass index in the west has been decreasing steadily, while increasing in the southeast (Figure 13)

Biomass indices for the total stock of Greenland halibut and Greenland halibut larger than 40 cm (harvestable part of the stock), showed an increase from 1996-2001. After peaking in 2001, indices dropped but have been steadily increasing since 2004 (Figure 14). The same holds for the index of Greenland halibut larger than 60 cm. The index of juvenile abundance (< 40 cm) has fluctuated between years, peaking in 2002 but remained low in the past four years (Figure 14).

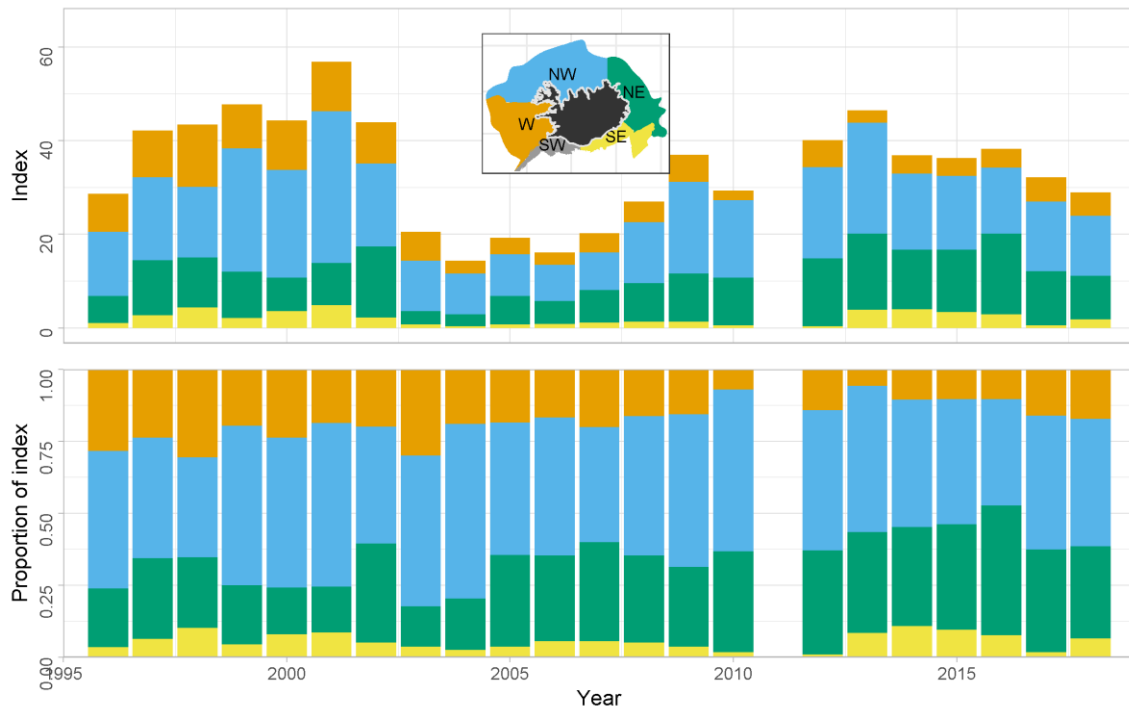


Figure 13. Greenland halibut. Spatial distribution of biomass index from the autumn survey.

Mynd 13. Grálúða. Dreifing lífmassavísitölu í stofnmælingu botnfiska að hausti árin.

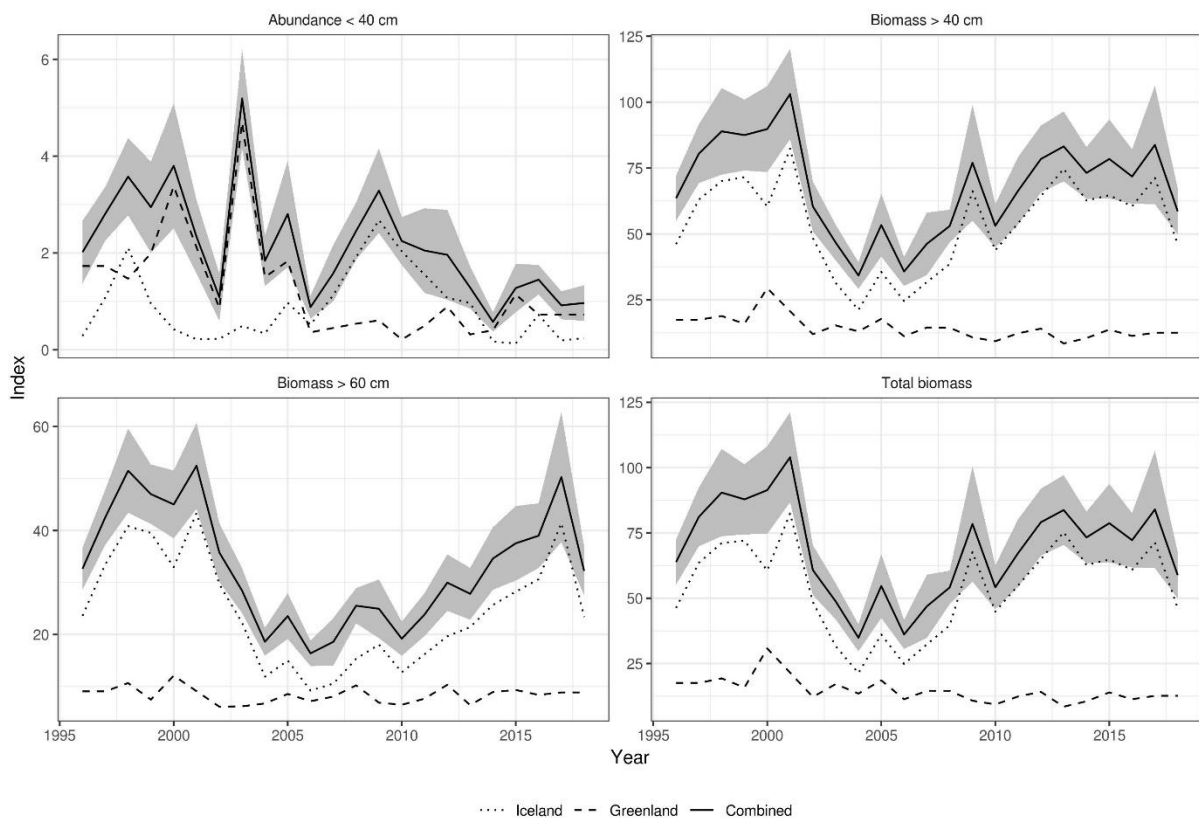


Figure 14. Greenland halibut. Indices from Iceland (smaller dots) Greenland (larger dots) and combined (straight line) with 95% CI indicated. Harvestable biomass indices (>40 cm) (upper left), juvenile abundance indices (<40 cm) (upper right), biomass indices of larger ind. (>60cm) (lower left) and total biomass indices (lower right)

Mynd 14. Grálúða. Vísitölur frá Íslandi (lítillir punktar), Grænlandi (stórir punktar) og samanlagt (lína) með 95% öryggismörkum. Nýliðunarvísitala (>40 cm) (efri til vinstri), vísitala veiðistofns (40 cm og stærr, efri til hægri), vísitala stærr einstaklinga (<60 cm) (neðri til vinstri) og stofnvísitala grálúðu (neðri til hægri).

Length distributions from the survey show a similar trend as in landed catch. Females tend to be larger than males and in greater abundance. The average length for females fluctuates from 61-68 cm throughout the years when males fluctuate from 54-63 cm. The length distribution of males has gradually increased since 1996, and in 2018, the mean length of males was 62.6 cm.

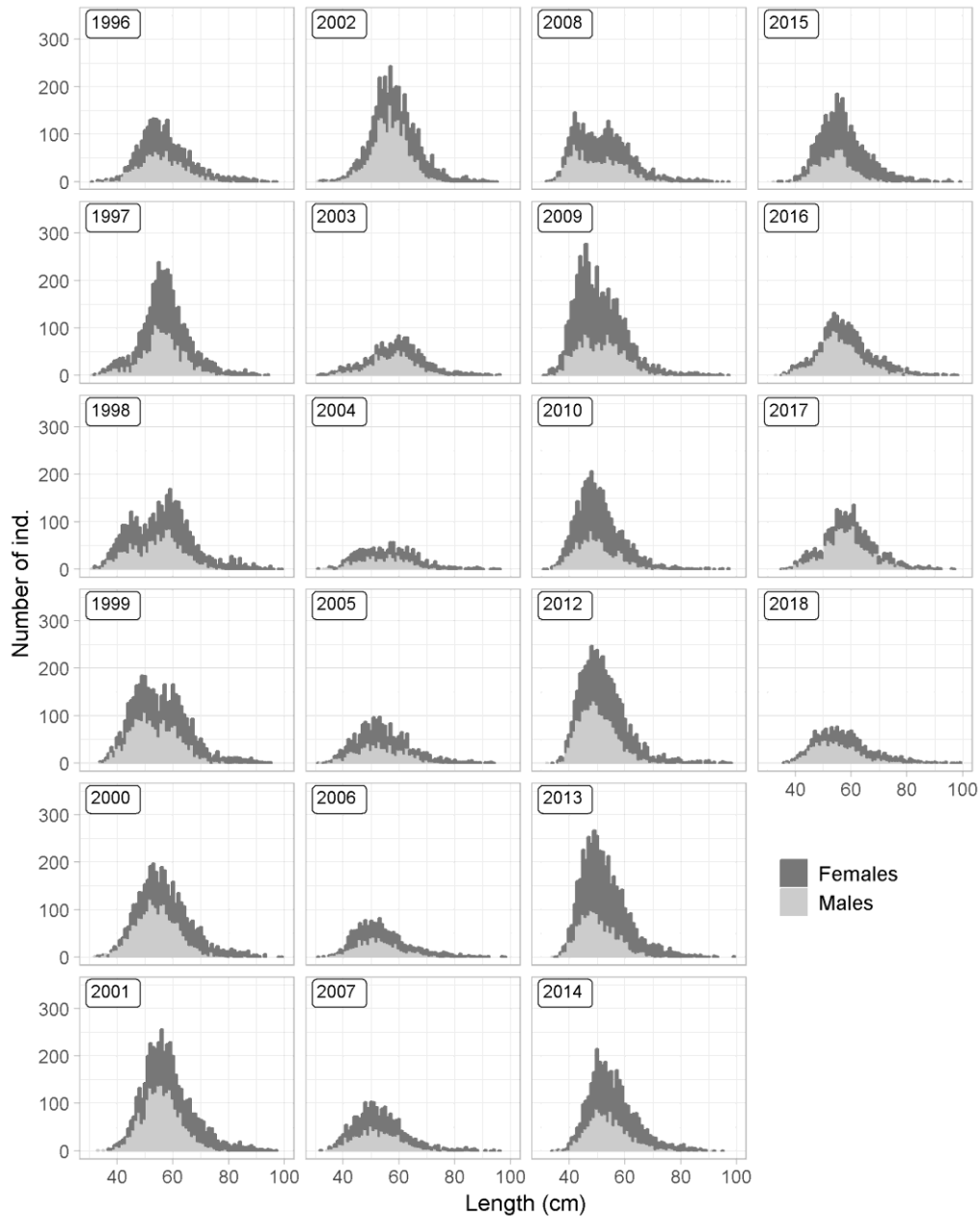


Figure 15. Greenland halibut. Length distribution of females and males from the autumn survey since 1996.

Mynd 15. Grálúða. Lengdardreifing eftir kyni úr stofnmælingu botnfiska að hausti frá 1996.

Age distribution between sexes of Greenland halibut from 2015 from the survey show that the greatest proportion caught are between 9 and 10 years old and range between 4-16 years. The greatest proportion of females caught are 11-13 years old and range from 3 to 21 years.

It is worth noting that aging recently resumed after a long period where otoliths were sampled but not read. Recent advances in age reading techniques suggested that older age reading methods used previously were biased and thus older age-readings are not considered representative of the age structure in the population. Further, otoliths sampled prior to 2015 were not stored in a manner compatible with the newer age-reading method. It is therefore uncertain whether data on the age structure will ever be available.

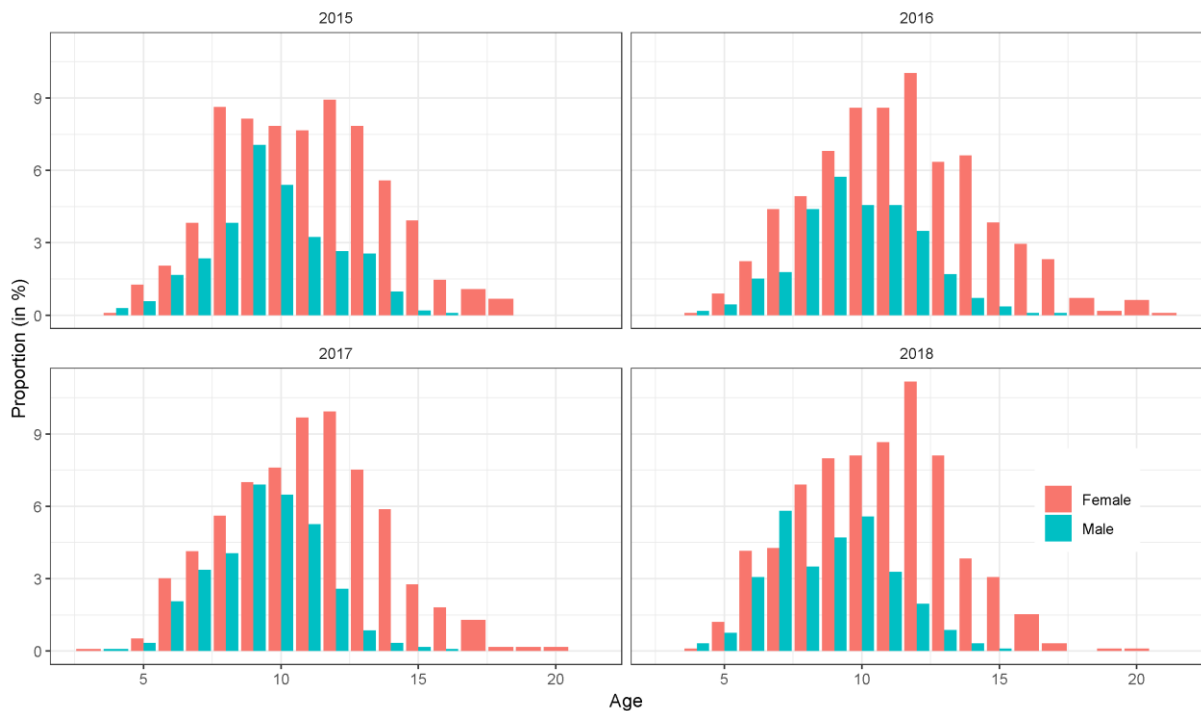


Figure 16. Greenland halibut. Proportion by age from the autumn survey from 2015.

Mynd 16. Grálúða. Hlutfall eftir aldri úr haustralli frá 2015.

According to the length distribution by age of Greenland halibut, it reaches 60 cm at the roughly the age of 12 on average. The growth of Greenland halibut appears to be similar between the sexes, while females exhibit larger variability in size. It is noteworthy that males tend to be on average smaller in the catches than females, even though both sexes seem to have similar mean length at age. This may suggest differences in behaviour of the sexes, such as catchability with respect to gear and/or natural mortality.

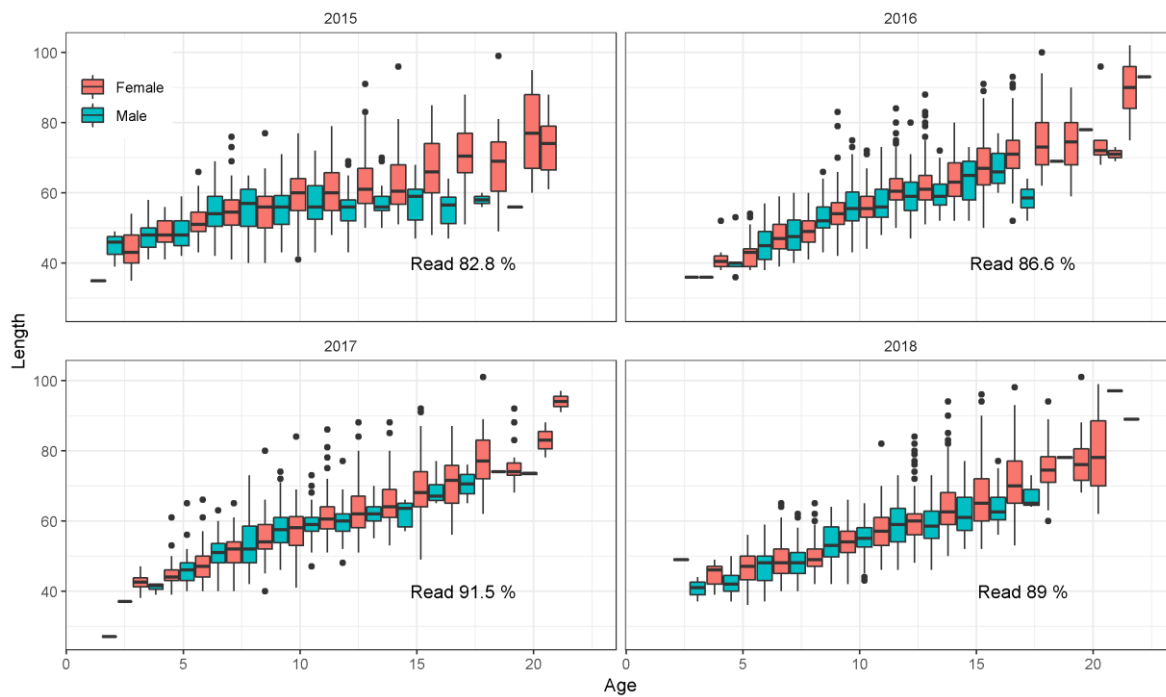


Figure 17. Greenland halibut. Distribution of length at age by sex from the autumn survey. Percentage of age-read otoliths is shown by year.

Mynd 17. Grálúða. Lengdardreifing sem fall af aldri skipt eftir kyni úr hautstralli. Hlutfall lesinna kvarna er sýnd eftir árum.

MANAGEMENT

Table 6 shows the recommended TAC to the East-Greenland/Iceland/Faroes, national TAC, and catches (thous. tonnes) since 1984. In 2014, the MRI and ICES made a five-year agreement to apply a precautionary approach for the Greenland halibut stock in East-Greenland and Iceland. According to the agreement 56.4% of the TAC is allocated to Iceland and 37.6% to Greenland. The Faroe Islands are excluded from the agreement. In 2017, the MFRI and ICES advised catches in 2017/2018 would be no more than 24 thous. tonnes. The Ministry of Industries and Innovation (MII) gave a TAC of 13.5 thousand tonnes in Icelandic waters for the ongoing fishing year 2017/2018. The MFRI and ICES advise that when the MSY approach is applied, catches in 2018/2019 should be no more than 24150 tonnes in East-Greenland/Iceland/Faroes and 56.4% of the TAC is allocated in Iceland.

Table 6. Greenland halibut. Recommended TAC to East Greenland/Iceland/Faroes, national TAC, and catches (thous. tonnes).

Tafla 6. Grálúða. Tillögur Hafrannsóknastofnunar um hámarksafla fyrir Austur-Grænland/Ísland/Færeyjar, ákvörðun stjórnvalda um heildarafla og afli (tonn).

FISHING YEAR	REC. TAC	NATIONAL TAC ICELAND	LANDINGS ICELAND	LANDINGS OTHER AREAS	TOTAL LANDINGS
1991/92	25.0	25.0	30.3	3.5	33.8
1992/93	30.0	30.0	34.5	6.7	41.3
1993/94	25.0	30.0	29.5	8.4	37.6
1994/95	30.0	30.0	26.4	8.9	35.3
1995/96	20.0	20.0	22.3	13.8	36.1
1996/97	15.0	15.0	17.7	13.3	31.0
1997/98	10.0	10.0	11.0	9.8	20.8
1998/99	10.0	10.0	11.2	9.3	20.5
1999/00	10.0	10.0	11.5	12.0	23.5
2000/01	20.0	20.0	20.0	11.3	31.3
2001/02	20.0	20.0	19.2	9.9	29.1
2002/03	23.0	23.0	20.3	10.2	30.5
2003/04	20.0	23.0	26.9	11.3	32.1
2004/05	15.0	15.0	13.0	11.0	24.0
2005/06	15.0	15.0	12.7	9.5	22.2
2006/07	15.0	15.0	9.6	11.3	20.9
2007/08	15.0	15.0	9.7	11.1	20.8
2008/09	5.0	15.0	15.6	11.6	27.2
2009/10	5.0	12.0	14.1	11.6	25.7
2010/11	5.0	13.0	12.2	13.0	26.4
2011/12	12.0	13.0	13.2	15.6	29.4
2012/13	20.0	14.7	14.1	12.0	26.9
2013/14	20.0	12.5	11.5	11.2	21.0
2014/15	25.0	14.1	11.9	13.3	25.7
2015/16	22.0	12.4	13.4	12.7	25.4
2016/17	24.0	13.5	12.2	11.3	23.5
2017/18	24.0	13.5	14.9	11.3	27.1
2018/19	24.15	13.3			
2019/20	21.36				

In recent fishing years, landings have been similar to the advised TAC (Table 6). Figure 18 shows the net transfers in the Icelandic ITQ-system since 1991. In this period, transfers to Greenland halibut from other species (positive values) and transfers from Greenland halibut to other species (negative values) have fluctuated (Figure 18). Since 2002/03, transfers have been negative, apart from 2009/10 and the past two fishing years, when a small amount was transferred to Greenland halibut quota.

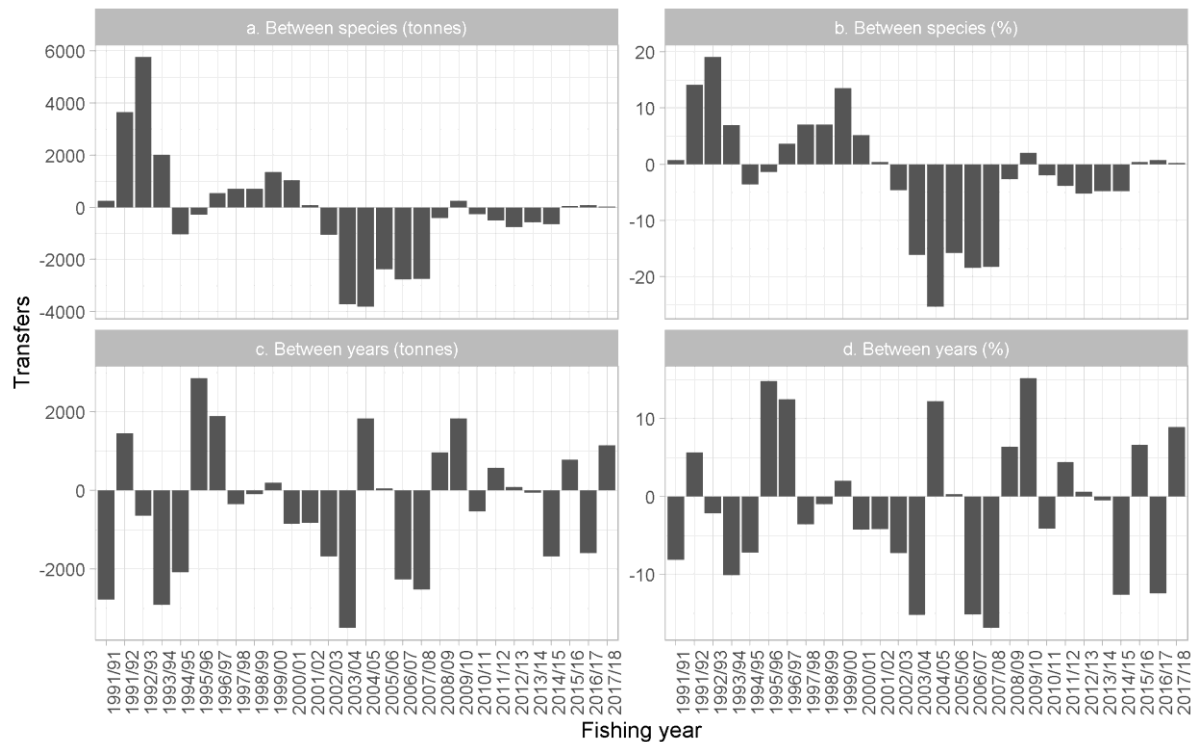


Figure 18. Greenland halibut. Net transfers of quota to and from Greenland halibut in the Icelandic ITQ system by fishing year. Between species (upper): Positive values indicate a transfer of other species to Greenland halibut, but negative values indicate a transfer of Greenland halibut quota to other species. **Between years (lower):** Net transfer of quota for a given fishing year.

Mynd 18. Grálúða. Nettó tilfærsla á kvóta eftir fiskveiðiárum. Tilfærsla milli tegunda (efri myndir): Jákvæð gildi tákna tilfærslu á kvóta annarra tegunda yfir á grálúðu en neikvæð gildi tilfærslu grálúðukvóta á aðrar tegundir. Tilfærsla milli ára (neðri myndir): Nettó tilfærsla kvóta á viðkomandi fiskveiðiári.