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Results for Greenland halibut survey in NAFO Divisions 1C-1D for the period 1997-2017, and 2019.

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**Abstract**

Greenland initiated a survey series in 1997 covering NAFO Divisions 1CD at depths between 400 and 1500 m. No survey has been conducted in 2018. In 2019, the annual trawl survey was conducted with a chartered vessel, the Icelandic trawler Helga Maria. All the standard gear from the research vessel Paamiut were used, in order to make the 2019 survey as identical as possible to the previous years' surveys. The survey was designed as a Stratified Random Bottom Trawl Survey aimed primarily at Greenland halibut (*Reinhardtius hippoglossoides*) and roundnose grenadier (*Coryphaenoides rupestris*). The paper gives biomass and abundance estimates and length frequencies for Greenland halibut, roundnose grenadier, roughhead grenadier (*Macrourus berglax*), and deep-sea redfish (*Sebastes mentella*) together with a list of recorded fish species. In 2019, 70 valid hauls were conducted. Greenland halibut biomass index shows a slightly increased from 2016 to 2019. Roundnose and roughhead grenadier increased from 2017 to 2019, and deep-sea redfish index slightly decreased.

**Introduction**

During 1987-1995 the Japan Marine Fishery Resources Research Center (JAMARC) and the Greenland Institute of Natural Resources (GINR), jointly conducted 12 bottom trawl surveys at depths down to 1500 m (Jørgensen, 1998a) and four pelagic surveys (Jørgensen, 1997) at West Greenland, in 1BCD, as part of a joint venture agreement on fisheries development and fisheries research in Greenland waters. The bottom trawl surveys were aimed primarily at Greenland halibut (*Reinhardtius hippoglossoides*) in NAFO Div. 1B-1D. In 1997, the GINR continued the bottom trawl surveys series with the Institute's own vessel, the R/V Paamiut, that had been rigged for deep sea trawling. Unfortunately, no calibration experiments between the Japanese research vessel Shinkai Maru and Paamiut were performed, making comparisons between both vessels impossible. The Paamiut survey traditionally covered NAFO Div.1CD (Table 1), but in 2001 the survey area was expanded to include Div. 1A (to 74°N) and Div. 1B, and in 2004 the northernmost part of the Baffin Bay (73°N-77°N) (Div. 1A) was also surveyed. In 2010, Div.1A was surveyed to 75.30°N (SCR 11/010). In 2013, the survey only covered Div. 1D. In 2018 no survey was undertaken due to the retirement of the R/V Paamiut and the survey



in 2019 was conducted with the chartered RV Helga Maria. All the standard gear from the R/V Paamiut (such as the Alfredo III trawl along its doors, bridles, ect; and the Marport sensors used on doors and headlines) were used, in order to make the 2019 survey as identical as possible to the previous years' surveys (Appendix 3).

### **Material and Methods:**

#### **Stratification**

The survey covered NAFO Divisions 1CD between the 3-nm and the midline to Canada at depths between 400 and 1500 m. The survey area was stratified within NAFO divisions in 6 depth strata 401-600, 601-800, 801-1000, 1001-1200, 1201-1400, and 1401-1500 m. The depth stratification was based on Greenland Geological Survey's 10 m depth contour maps, Canadian maps and depth soundings made during previous surveys. The area of each stratum was measured using "MapInfo Version 4.0". A list of numbers of valid hauls per strata and area is given in Table 2.

The survey was planned as a Stratified Random Bottom Trawl Survey with a total of 70 hauls. A minimum of two randomly placed trawls were conducted per stratum (Bishop, 1994). The remaining hauls were allocated to strata based on the stratum area and on predictions, from past surveys, of the variability in catch. This allocation minimizes the standard error of the total survey biomass estimate of Greenland halibut, given the predicted stratum variances. Hence, strata with high variation in the catches of Greenland halibut in previous surveys have got relatively more hauls than strata with little variation in the catches. In 2004, the placing of stations independently and randomly was replaced by buffered random sampling. This method combines the use of a minimum between-stations distance rule (buffer zone) with a random allocation scheme (Kingsley *et al.*, 2004). Because the seabed in Division 1D stratum 601-800 m is muddy and soft, and generally not suitable for trawling, stations are fixed in that stratum.

#### **Vessel and gear**

From 1997 to 2017, the survey was conducted by the 1084 GT trawler Paamiut. However, in the beginning of 2018, it was decided that the old research vessel Paamiut had to be scrapped owing to increasing expenses to maintenance. No survey has been conducted in 2018. In 2019, the survey was carried out with the chartered commercial vessel Helga Maria. All the standard gear has been maintained (Appendix 3). The survey uses an Alfredo III trawl with a mesh size on 140 mm and a 30-mm mesh-liner in the cod-end. The ground gear is of the rockhopper type. The trawl doors are Greenland Injector weighing 2700 kg. The Injector otter doors replaced the Greenland Perfect doors that have been used until 2003. The average net height was, in 2014, 20 cm higher with the new doors compared to the old, but the difference was not statistically significant (95% level), and it was concluded that the net performance has not changed by the introduction of the new doors. Further information about trawl and gear is given in Jørgensen (1998b). The effect of the vessel change on the 2019 survey was examined by looking at gear performance variables (e.g. net height and door distance) (Nogueira and Treble 2020). Data reviewed for the 1CD survey suggests the change in vessel in 2019 had an effect on the

performance of the Alfredo III trawl gear at depths > 701 m, where Greenland halibut are known to be abundant, **then indices must be compare with caution.**

A MarPort net sonda mounted on the head rope measured net height. MarPort sensors measured the distance between the trawl doors. Wingspread, taken as the distance between the outer bobbins, was calculated as:

$$\text{Distance between outer bobbins} = 10.122 + \text{distance between trawl doors} * 0.142$$

This relationship was estimated based on flume tank measurements of the trawl and rigging used in the survey (Jørgensen, 1998b).

Near-bottom temperature was measured, by 0.1°C, by a Seastar sensor mounted on one of the otter doors.

### **Trawling procedure**

Trawls were towed for 30-min at a speed of 3.0 knots; however, tows down to 15 minutes were considered acceptable. Trawl distance was estimated from the start and the end positions of the haul.

### **Handling of the catch**

The catch of each haul was sorted, weighted, and reordered by species. All fish species were measured as total length (TL) to 1.0 cm below. Grenadiers were measured as pre anal fin length (AFL) to 0.5 cm below from 1997 to 2008, and in 2019, and 1.0 cm below from 2009 to 2017. In case of large catches, subsamples of the catch were measured.

### **Biomass and abundance**

Biomass and abundance estimates were obtained by applying the swept area method (trawled distance \* estimated bobbin spread), taking the catchability coefficient as 1.0. All catches were standardized to 1 km<sup>2</sup> swept prior to further calculations.

In strata with one haul, SD was estimated as:

$$SD = \frac{\text{Meancatch}}{\text{MeanCV}} * 100$$

## **Results and discussion**

A total of 70 valid hauls were made (Figure 1). Haul by haul information on catches of Greenland halibut, roundnose grenadier, roughhead grenadier, and deep-sea redfish is given in Appendix 1. The distribution of hauls by strata is given in Table 2.

A total of 80 fish species were recorded (Appendix 2).

### **Greenland halibut (*Reinhardtius hippoglossoides*):**

The Greenland halibut stock in Subareas 0 and 1 is considered to be part of a biological stock complex, which included Subarea 2 and Div. 3KLMNO. Abundance and biomass indices were available from research vessel surveys by Canada in Subarea 0A South (1999, 2001, 2004, 2006, 2008, 2010, 2012, and 2014-2019); Canada in OB (2000, 2001, 2011, 2013, 2014, 2015, 2016), Greenland in Divisions 1CD from 400 to 1500 m (1987-1995 and 1997-2017 and 2018), and **Greenland in Divisions 1A-1F offshore, from 100 to 600 m (1988-2019).**

From 1979 to 1994, the assessment included SA 0+1, including Div. 1A inshore. In 1994, it was decided to make a separate assessment for the inshore in Div. 1A and for SA 0-1 Div1 offshore + Div. 1B-F. based on tagging experiments. The TAC has been increasing since then (Treble and Nogueira, 2018). In 2020, based on historical catches and taggings experiments, it was also decided to separate, the stocks inshore Div.1B-F, in 3 other different management units 1BC, 1D and 1EF (Nygaard and Nogueira, 2020).

The current assessment is based on survey indices. The ICES guidance on data-limited stocks (DLS) method 3.3 (ICES 2012a and 2012b, ICES 2014) is applied as approach for the advice on SA0+1 Greenland halibut.

Greenland halibut was caught in all hauls except one (Figure 2 and Appendix 1). **The biomass in 1CD** has been almost constant for the whole time series with few fluctuations. A gradual decrease in biomass was observed from 2011 (87223 t) to 2014 (58666 t), but then increased in 2015. From 2017 (78896 t) to 2019 (82938 t) the biomass slightly increased (Tables 3 and Figure 3).

The survey in 2013 only covered Division 1D. Total biomass and **abundance in Division 1C has been estimated by a GLM** (model:  $\ln \text{biomass} = \text{year} * \text{division}$ ) using data from 2010-2014 where the distribution of the biomass has been rather stable with 63-69% of the biomass found in division 1D. The 1CD biomass and abundance in 2013 were estimated to 64049 tons and  $51160 * 10^3$  indiv., respectively.

In 2019, the highest densities (in weight) were found at 1001-1200 m in 1D (2167.78 kg/km<sup>2</sup>) and at 801-1000 m in 1C (3144.92 kg/km<sup>2</sup>) (Table 4).

Estimated abundance by age, for 1997 to 2009, is given in Table 6. **There has been no updating since 2009 because the age reading has been under revision.** GINR plans to restart the readings in the near future.

The abundance in 2019 was estimated in  $65498 * 10^3$  indiv. which is in minor increase compare to 2017 ( $60110 * 10^3$  indiv.) (Table 7, Figure 4). The highest abundance was found between 1001-2000 m in 1D ( $2168 * 10^3$  indiv.) and between 601-800 m in 1C ( $15410 * 10^3$  indiv.).

Estimated abundance by length, for 1997-2019, is given in Table 7. The effect of the vessel change on the 2019 survey was examined by looking at the survey length frequency of fish 35-70 cm and >70 cm. The stability in the length frequency distribution for the 1CD survey suggests the gear catchability at deeper depths may not be affecting overall selectivity for Greenland halibut (Nogueira and Treble 2020). The length ranged from 6 cm to 111 cm. The overall length distribution (weighted by stratum area) was dominated by a mode at 53 cm (Table 7, Figure 5). Since 2000, the mode has been slightly increasing (Figure 6).

### **Roundnose grenadier (*Coryphaenoides rupestris*):**

There is not directed fishery for roundnose grenadier. Most of the catches are taken as bycatch in the Greenland halibut fishery subareas 0 and 1 south. Since catches and biomass have been very low for almost two decades, the assessment has not been updated since 2016.

Roundnose grenadier has been caught in 58 hauls out of 70 valid hauls (Figure 7, Appendix 1), but catches were very low. The biomass has been very low since 2001 (Tables 8 and 9, Figure 8), and far below the level found in the late 80s. The highest biomass was found from 1997 to 2001, then it sharply decreased by five orders of magnitude, from 7781 t (in 2001) to 1594 (in 2000). Since then, it has maintained low values. The biomass has increased slightly from 2017 (677 t) to 2019 (717t; Table 8). The higher density was found between 601-800 m in 1D (29.71 kg/km<sup>2</sup>), and 1001-1200 in 1C (21.36 kg/km<sup>2</sup>; Table 9.).

The abundance, in 2019, was estimated at 5090\*10<sup>3</sup> indiv. (Table 10) which supposes an increase relative to 2017 (2887\*10<sup>3</sup> indiv.). (Figure 9, Table 11).

Table 11 and Figure 10 show the length distribution from 1997 to 2019 weighted to the stratum area. Pre anal fin length ranged from 2 to 22 cm. The mode was found at 4 cm.

### **Roughhead grenadier (*Macrourus berglax*):**

There is not directed fishery for roughhead grenadier. Most of the catches are taken as bycatch both in the trawl fishery for Greenland halibut.

Roughhead grenadier was caught in all hauls (Figure 11, Appendix 1). The biomass shows an increased trend, from 1997 (1239 t) to 2000 (7369 t), then decreased in 2001, and in 2002 it reached the highest value level of the time series (8101 t). Since 2003, it has been decreasing with some fluctuations until 2015. From 2015 to 2019, the biomass decreased (from 3271 t in 2015 to 1544 t in 2017) and has increased back in 2019 (3580 t; Table 12, Table 13, Figure 12). The highest density in 2019 was found between 1001-1200 m in 1C (69.54 kg/km<sup>2</sup>), and between 1401-1500 in 1D (109.86 kg/km<sup>2</sup>).

The abundance followed a similar trend as the biomass. It increased from 1997 (5013 \*10<sup>3</sup> indiv.) to 2000 (21012 \*10<sup>3</sup> indiv.). Since then, it has been decreasing with fluctuations from 2001 to 2015. In 2019, the abundance has increased back (8155\*10<sup>3</sup>) but is still below the value observed in 2015 (9345\*10<sup>3</sup> indiv.) (Table 14, 15 and Figure 13).

Pre anal fin length ranged from 1 to 45 cm , and the overall length distribution showed minor modes at 7, 9, 12, and 18 cm . In 2019, the mode was of 13 cm (Figure 14 and Table 15).

### **Deep-sea redfish (*Sebastes mentella*):**

There is not directed fishery to the deep-sea redfish stock in West Greenland Divisions 1A-F. Abundance and biomass indices were available from surveys carried out by the Greenland Institute of Natural Resources in Divisions 1CD from 400 to 1500 m (1987-1995 and 1997-2019 ) and in Divisions 1A offshore and 1B-F from 100 to 600 m (1988-2019).

Deep-sea redfish was caught in 24 of the 70 valid hauls (Figure 15, Appendix 1).

The biomass was very low from 1997 to 2007 (426 t), then it peaked 2008 (13256 t). Since then, the biomass has fluctuated at a higher level than before 2008. The biomass decreased slightly from 2016 (11336 t) to 2019 (8249 t) (Table 16, 17, and figure 16).

The highest density in 2019 was found between 401 to 600 m in both divisions (1102 kg/km<sup>2</sup> in 1C and 1685 kg/km<sup>2</sup> in 1D).

The abundance followed a similar trend as the biomass. Until 2017 the abundance was very low, then it increased from 1892\*10<sup>3</sup> indiv. in 2007, to 5306\*10<sup>3</sup> indiv. in 2008. Since 2009, the abundance has been fluctuating, reaching the highest value of the time series in 2014. It decreased by 10 from 2014 (65975\*10<sup>3</sup>) to 2017 (16422\*10<sup>3</sup>) (Table 18, 19 and Figure 17). In 2019, there has been a decrease (17084\*10<sup>3</sup>)

The length distribution ranged from 2 to 52 cm, with a mode at 35 cm (Table 19; Figure 18).

### Temperature:

The bottom temperature ranged from 1.04 to 5.06 °C (Appendix 1). The mean temperature decreased in 1D with depth as in previous years. Mean temperature decreased from 2017 to 2019, from 600 m in both divisions (Figure 19 and 20; Appendix 2).

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**Table 1.** Greenland halibut survey bottom trawls in NAFO Divisions 1C-D, 1997-2019.

Year	Vessel	Valid tows 1C	Valid tows 1D	Total Valid tows 1CD	Depth strata covered (m)	Dates
1997	R/V Paamiut	24	39	63	427-1469	September 24-October 08
1998	R/V Paamiut	28	28	56	500-1494	September 23-October 07
1999	R/V Paamiut	15	23	38	576-1457	September 23-October 01
2000	R/V Paamiut	9	22	31	667-1464	September 27-October 04
2001	R/V Paamiut	17	29	46	468-1458	November 05-November 15
2002	R/V Paamiut	9	26	35	637-1490	September 17-September 23
2003	R/V Paamiut	12	23	35	564-1449	September 17-September 24
2004	R/V Paamiut	18	33	51	574-1468	October 28-November 05
2005	R/V Paamiut	23	38	61	412-1485	August 31-September 11
2006	R/V Paamiut	19	42	61	402-1486	October 11-October 22
2007	R/V Paamiut	17	33	50	426-1468	September 19-September 30
2008	R/V Paamiut	21	49	70	417-1458	September 19-October 01
2009	R/V Paamiut	22	46	68	422-1468	September 19-September 30
2010	R/V Paamiut	20	46	66	417-1482	September 07-September 20
2011	R/V Paamiut	22	45	67	484-1472	September 01-September 17
2012	R/V Paamiut	18	32	50	466-1473	September 12-September 22
2013	R/V Paamiut	0	27	27	406-1492	September 12-September 17
2014	R/V Paamiut	20	38	58	404-1464	August 31-September 16
2015	R/V Paamiut	23	44	67	409-1458	August 26-September 05
2016	R/V Paamiut	26	44	70	422-1462	August 31-September 12
2017	R/V Paamiut	15	38	53	450-1476	October 10-October 21
2019	C/V Helga Maria	27	43	70	418-1451	July 31-August 12

**Table 2.** Number of valid hauls per strata from 1997 to 2019.

Division	Stratum (m)	Area (km <sup>2</sup> )	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
1C	401-600	3366	3	4	2	0	4	0	2	1	2	2	1	3	2	2	1	2	0	1	2	2	0	2
1C	601-800	16120	11	14	7	3	8	4	4	5	8	6	4	5	5	4	5	3	0	5	6	9	6	10
1C	801-1000	6066	8	8	6	4	3	4	4	10	11	9	10	11	13	12	14	11	0	12	13	13	7	13
1C	1001-1200	611	2	2	0	2	2	1	2	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2
1D	401-600	903	2	1	0	0	0	0	0	0	2	3	2	2	2	2	2	2	1	1	2	2	2	2
1D	601-800	1940	2	2	1	0	0	0	0	2	1	2	0	2	2	2	2	1	1	2	2	3	2	2
1D	801-1000	3874	4	4	2	2	3	4	2	3	3	4	5	4	4	5	5	3	4	3	4	4	4	4
1D	1001-1200	10140	18	11	11	11	13	12	10	12	14	13	12	18	18	19	17	14	11	15	20	19	16	19
1D	1201-1400	6195	8	8	7	7	10	7	7	12	12	14	9	16	15	13	14	9	7	13	11	12	10	12
1D	1401-1500	3091	5	2	2	2	3	3	4	4	6	6	5	7	5	5	5	3	3	4	5	4	4	4
<b>TOTAL</b>			52306	63	56	38	31	46	35	51	61	61	50	70	68	66	67	50	27	58	67	70	53	70



**Table 3.** Greenland halibut biomass per strata, total biomass (t) with SE, and stratified mean catch per tow (kg) and SE in NAFO divisions 1CD for the period 1997-2019. n.s= not surveyed.

Division	Stratum(m)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1C	401-600	467	256	117	n.s	710	n.s	419	194	57	323	0
1C	601-800	5477	6160	6030	5827	7203	4066	7040	8743	5861	8970	4435
1C	801-1000	4727	8721	5661	5152	10275	6028	11253	13070	9894	11602	9893
1C	1001-1200	1366	2278	n.s	1519	1350	1734	1308	2789	2615	1542	1784
1D	401-600	330	39	n.s	n.s	n.s	n.s	n.s	n.s	335	252	244
1D	601-800	721	747	455	n.s	n.s	n.s	n.s	435	1855	1551	n.s
1D	801-1000	3189	5854	6819	3793	11192	5667	3939	6058	5378	6619	7113
1D	1001-1200	23948	24475	20987	18101	20280	29136	22033	24275	25893	25363	29806
1D	1201-1400	11310	18538	17774	16597	14621	20627	18489	13509	23035	15029	15560
1D	1401-1500	6252	3579	7548	9436	5802	5798	4235	5134	6396	6308	6117
<b>Biomass</b>		57788	70647	65391	60426	71434	73056	68717	74207	81318	77559	74952
<b>S.E</b>		4754	8349	6460	6056	10776	5979	6412	5191	8600	6160	9415
<b>TOTAL</b>	<b>MeanCatch</b>	1104.8	1350.64	1287.44	1310.84	1444.19	1584.82	1389.27	1443.63	1554.66	1482.8	1488.14
<b>S.E.</b>		91	160	127	131	218	130	130	101	164	118	187

Division	Stratum(m)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
1C	401-600	587	83	167	85	101	n.s	845	449	163	n.s	604
1C	601-800	8160	6179	8357	9290	9010	n.s	9587	14270	13732	17101	22816
1C	801-1000	12707	9890	13003	15199	11476	n.s	9806	19194	13760	14118	19077
1C	1001-1200	2381	1571	3227	1845	2428	n.s	1553	1456	1557	1730	1807
1D	401-600	52	157	27	95	102	38	17	424	374	127	284
1D	601-800	884	1356	1429	995	5382	1023	1557	1136	1366	1847	545
1D	801-1000	8658	7878	9593	5469	6634	6543	7732	8192	6065	5417	7608
1D	1001-1200	32358	18664	21060	32492	17661	22192	15745	21562	20920	24629	21981
1D	1201-1400	12800	17089	12257	16602	9768	7941	7231	10446	12804	9996	6436
1D	1401-1500	5654	6541	6352	5151	2894	3508	4592	2404	5888	3933	1780
<b>Biomass</b>		84242	69409	75471	87223	65455	41245	58666	79532	76630	78896	82938
<b>S.E</b>		5611	4735	5396	5188	10450	4621	4336	6844	4811	6072	6337
<b>TOTAL</b>	<b>MeanCatch</b>	1610.55	1326.97	1442.88	1667.55	1251.39	1577.69	1121.59	1520.52	1465.03	1612.11	1585.63
<b>S.E.</b>		107	91	103	99	200	177	83	131	92	124	121

**Table 4.** Mean catch (kg/km<sup>2</sup>), biomass (tons) with S.E. of Greenland halibut in Division 1 CD by depth stratum in 2019..

Division	Stratum (m)	Area (sq.km)	Tow number	Mean Catch	Biomass	SE
1C	401-600	3366	2	179.46	604	339
1C	601-800	16120	10	1415.38	22816	3313
1C	801-1000	6066	13	3144.92	19077	3345
1C	1001-1200	611	2	2958.04	1807	634
1D	401-600	903	2	314.28	284	284
1D	601-800	1940	2	281.15	545	429
1D	801-1000	3874	4	1963.77	7608	1923
1D	1001-1200	10140	19	2167.78	21981	3491
1D	1201-1400	6195	12	1038.82	6436	962
1D	1401-1500	3091	4	575.81	1780	638
<b>TOTAL</b>		52306	70	1585.63	82938	6337

**Table 5.** Mean number (num/km<sup>2</sup>), abundance ('000s) with S.E. of Greenland halibut in Division 1 CD by depth stratum in 2019.

Division	Stratum (m)	Area (sq.km)	Tow number	Mean Number	Abundance	SE
1C	401-600	3366	2	166.02	559	166
1C	601-800	16120	10	1382.96	22293	2129
1C	801-1000	6066	13	2375.73	14411	2527
1C	1001-1200	611	2	1991.44	1217	461
1D	401-600	903	2	412.15	372	372
1D	601-800	1940	2	204.49	397	340
1D	801-1000	3874	4	1376.86	5334	1321
1D	1001-1200	10140	19	1503.85	15249	2380
1D	1201-1400	6195	12	734.99	4553	697
1D	1401-1500	3091	4	360.33	1114	443
<b>TOTAL</b>		52306	70	1252.23	65499	4416

**Table 6.** Number by age and year for Greenland halibut, weighted by survey area. No data from 2008, and 2010-2009.

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0	0	0	78826	15585	71512	833452	314358	200672	132147	0	-	
2	536130	609093	184098	109496	281013	214536	3187890	255511	201882	641030	99520	-	613665
3	1704893	3722237	920490	479059	511722	285367	1468105	274564	569831	524114	268062	-	773577
4	3023773	4662948	4172888	3074341	4835796	2361529	2417001	4465950	1749900	2959669	802718	-	704747
5	9961295	14760362	11291344	15090231	20601616	11779876	12348567	14877198	12218823	13324592	12509462	-	7823793
6	15370847	19057854	15893794	16838191	26595603	26697300	21816458	30067732	19867351	20210890	18237159	-	12339572
7	13558728	14083592	19759852	14711646	17922784	18561065	18499540	14298142	21303055	15509156	19469186	-	22722253
8	5436358	5766084	4786548	5026106	4674899	6201987	6534966	6252194	12674030	13224793	11815872	-	9358562
9	1200931	1515966	859124	3214208	2550178	1857799	2403542	1724259	385774	731747	360855	-	3065130
10	948950	1211419	920490	1040152	780082	1340261	1244102	944766	1881136	1342871	1960085	-	2058523
11	584382	764751	613660	717770	705656	905723	581491	392534	158664	362986	0	-	1095209
12	466433	527881	675026	350292	369836	166242	224915	230820	1044342	958082	1030110	-	741972
13	187646	351921	429562	318336	345397	257412	264203	158687	36861	122337	26403	-	558339
14	96503	155657	429562	122157	195607	143024	207745	163836	410090	459693	502253	-	346258
15	262704	236870	184098	230208	225277	263139	67270	218713	85460	114617	27483	-	199826
16	187646	115051	61366	128242	91540	178780	206590	71775	13547	102977	182091	-	50494
17	64336	128586	61366	95352	80275	107268	72546	96352	118365	28973	49422	-	26348
18	16084	0	61366	57045	22628	35756	41219	6650	35465	0	26001	-	
19	0	0	0	27474	32325	83431	58531	37874	45452	0	0	-	
20	0	0	0	0	8081	0	22258	0			46549	-	
21	0	0	0	0	0	0	7419	0				-	
TOTAL	53607639	67670272	61304634	61709132	80845900	71512007	72507812	74851915	73000702	70750676	67413231	-	62478267

**Table 7.** Length distribution (3cm groups) and total abundance estimated number (000's) with SE (weighted by survey area), and stratified mean number with SE, for Greenland halibut, in Division 1CD, for the period 1997-2019.

Lenght Class(3cm)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
6	0	0	46	0	0	0	0	0	0	0	0	0	0	7	13	9	0	0	16	6	0	6
9	0	55	97	0	0	0	59	0	87	62	4	21	29	98	0	163	0	204	0	8	20	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0
15	20	34	0	90	0	0	458	166	50	34	0	39	0	0	195	0	0	0	42	98	30	40
18	158	43	0	0	0	80	187	0	0	36	5	0	0	0	5	7	0	0	0	74	0	60
21	211	97	141	121	84	61	1097	215	165	314	48	0	75	49	74	73	0	0	0	399	0	547
24	613	620	390	66	209	103	1053	7	67	469	47	300	465	0	7	5	0	0	104	286	30	400
27	750	938	596	256	138	74	1690	95	244	133	90	202	514	0	127	8	0	52	98	276	103	269
30	659	865	554	255	302	99	1068	89	176	109	93	233	329	8	57	232	0	9	163	470	31	402
33	1053	723	934	557	374	270	755	78	280	299	85	139	96	64	188	112	42	110	117	267	95	143
36	1679	1892	1871	1505	1307	1156	901	486	453	612	619	235	326	249	303	287	94	28	281	520	120	686
39	3162	3667	3938	3395	4165	2165	1565	1725	1361	1980	1004	1049	776	588	1121	655	362	529	364	650	458	1515
42	5417	6928	5813	7840	10929	6415	5425	5534	4103	4920	3765	3214	2753	2729	2993	2734	938	953	1303	1507	1144	2106
45	6889	10351	9058	12834	17076	13181	12338	13027	9731	9603	8815	8086	6754	7680	10415	5619	2947	3499	3895	3977	3597	3713
48	9591	11602	10449	12057	16826	17999	15929	19015	16001	15253	14732	16115	12861	13571	15296	10887	5763	7972	9751	7855	8338	7927
51	9754	11020	9903	10155	10664	13858	13880	16536	17047	15516	15135	17619	15464	15831	17362	11079	8093	11020	15291	13001	14119	13206
54	6760	8413	7780	5810	5598	7736	7886	8901	11602	10454	10861	12200	10606	11589	12150	10016	6265	9389	14288	13122	13757	14469
57	3707	4118	4221	3027	2431	3434	3436	3660	5735	5364	6108	6570	5487	6052	6655	5385	3704	4706	8202	7855	9442	9774
60	1477	2227	1545	1973	1417	1930	1819	1536	2053	2585	2818	2734	2600	2558	3305	2900	1714	2709	3220	4117	4116	4372
63	1069	1294	1230	792	825	956	901	821	1212	1056	1109	1805	1182	1398	1573	1209	734	984	1491	1727	1700	2138
66	631	836	887	646	489	804	663	481	814	659	532	738	633	667	976	959	554	641	865	1177	936	1339
69	486	536	383	472	389	461	367	262	511	463	433	568	422	435	575	632	435	558	514	707	628	741
72	267	320	253	174	321	251	252	246	342	309	352	412	241	206	473	403	169	283	465	401	448	496
75	98	291	281	159	218	131	201	106	254	241	151	292	226	255	316	233	157	309	292	258	303	216
78	114	191	222	108	55	93	144	143	174	143	120	146	162	103	116	111	89	291	176	219	110	190
81	81	97	101	153	131	113	94	103	100	113	108	126	124	171	184	135	142	201	153	120	150	152
84	122	176	163	102	100	100	120	63	70	126	53	140	96	120	109	118	114	124	118	140	120	130
87	159	96	185	81	88	175	48	33	108	156	55	58	66	72	75	54	18	45	62	94	58	128
90	54	43	226	137	36	112	51	65	103	63	68	69	53	83	119	64	55	113	152	154	35	87
93	69	32	36	12	80	56	51	24	30	32	41	65	29	47	63	64	25	107	47	63	20	94
96	44	73	60	54	28	39	40	3	77	22	121	53	40	103	34	38	14	55	95	20	28	52
99	38	0	25	18	22	12	46	0	26	45	0	20	33	44	57	41	37	9	36	31	54	51
102	8	47	11	0	26	10	33	11	36	11	47	0	18	65	35	21	12	25	31	22	54	14
105	8	46	0	0	10	8	0	18	9	0	10	18	5	16	0	63	24	16	15	15	52	14
108	0	0	0	0	0	0	0	0	15	0	0	13	0	12	7	0	0	0	3	7	0	21
111	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	13	14	0
<b>Abundance</b>	55148	67671	61399	62849	74338	71882	72557	73449	73036	71182	67429	73284	62465	64870	74978	54316	32501	44941	61650	59679	60110	65498
<b>S.E</b>	4566	7639	6016	6230	12193	6153	7765	5448	7534	5550	8492	5144	4422	5389	4724	10123	0	3388	6069	3729	5032	4416
<b>MeanNumber</b>	1054.36	1293.71	1208.84	1363.34	1502.89	1559.34	1466.88	1428.89	1396.3	1360.87	1338.75	1401.04	1194.22	1240.17	1433.44	1038.45	0	859.17	1178.76	1140.92	1228.23	1252.23
<b>S.E.</b>	87	146	118	135	247	133	157	106	144	106	169	98	85	103	90	194	0	65	116	71	103	84

**Table 8.** Roundnose grenadier. Biomass per strata, total biomass (t) with SE, and stratified mean catch per tow (kg) and SE in NAFO divisions 1CD, for roundnose grenadier, for the period 1997-2019.

Division	Stratum (m)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1C	401-600	0	1	2	n.s	1	n.s	1	0	0	0	0
1C	601-800	85	305	262	459	42	42	18	40	145	52	6
1C	801-1000	28	958	538	4931	290	433	92	166	108	282	400
1C	1001-1200	32	54	n.s	31	5	37	13	7	14	7	6
1D	401-600	2	155	n.s	n.s	n.s	n.s	n.s	n.s	1	4	3
1D	601-800	240	16	12	n.s	n.s	n.s	n.s	2	12	15	n.s
1D	801-1000	125	50	17	53	26	15	11	27	21	23	126
1D	1001-1200	2007	1239	476	331	201	247	88	102	96	111	106
1D	1201-1400	1443	3399	867	889	570	210	349	124	148	121	83
1D	1401-1500	1901	1013	645	1087	473	661	222	161	194	48	148
<b>TOTAL</b>	Biomass	5863	7190	2819	7781	1608	1645	794	629	739	663	878
	S.E	971	2518	456	2820	515	467	142	97	115	182	209
	MeanCatch	112.09	137.48	55.49	168.8	32.53	35.67	16.04	12.23	14.14	12.66	17.45
	S.E.	19	48	9	61	10	10	3	2	2	3	4

Division	Stratum (m)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
1C	401-600	0	2	2	116	0	n.s	14	0	5	n.s	9
1C	601-800	26	31	74	141	86	n.s	58	100	102	19	69
1C	801-1000	31	58	32	106	61	n.s	29	36	95	27	69
1C	1001-1200	7	4	9	6	8	n.s	5	5	9	2	13
1D	401-600	3	10	4	12	4	0	0	2	251	337	8
1D	601-800	30	9	3	18	838	125	235	128	26	64	58
1D	801-1000	24	598	79	229	436	166	34	85	35	16	19
1D	1001-1200	73	198	169	120	77	95	73	217	153	101	228
1D	1201-1400	166	152	154	198	106	82	119	219	139	85	177
1D	1401-1500	195	94	78	76	26	19	50	23	47	26	67
<b>TOTAL</b>	Biomass	555	1156	604	1022	1642	487	617	815	862	677	717
	S.E	81	516	93	260	867	212	230	168	275	337	90
	MeanCatch	10.61	22.07	11.54	19.52	31.38	18.65	11.76	15.57	16.45	13.83	13.69
	S.E.	2	10	2	5	17	8	4	3	5	7	2

**Table 9.** Mean catch (kg/km<sup>2</sup>), biomass (tons) with S.E. of roundnose grenadier, in Division 1 CD, by depth stratum in 2019.

Division	Stratum (m)	Area (sq.km)	Tow number	Mean Catch	Biomass	SE
1C	401-600	3366	2	2.6	9	9
1C	601-800	16120	10	4.31	69	31
1C	801-1000	6066	13	11.29	69	22
1C	1001-1200	611	2	21.36	13	1
1D	401-600	903	2	9.36	8	4
1D	601-800	1940	2	29.79	58	30
1D	801-1000	3874	4	4.81	19	10
1D	1001-1200	10140	19	22.44	228	48
1D	1201-1400	6195	12	28.56	177	48
1D	1401-1500	3091	4	21.73	67	31
<b>TOTAL</b>		52306	70	13.69	717	90

**Table 10.** Mean number (num/km<sup>2</sup>), abundance ('000s) with S.E. of roundnose grenadier in Division 1 CD by depth stratum in 2019.

Division	Stratum (m)	Area (sq.km)	Tow number	Mean Catch	Abundance	SE
1C	401-600	3366	2	2.6	128	128
1C	601-800	16120	10	4.31	1248	751
1C	801-1000	6066	13	11.29	932	518
1C	1001-1200	611	2	21.36	93	25
1D	401-600	903	2	9.36	18	6
1D	601-800	1940	2	29.79	296	13
1D	801-1000	3874	4	4.81	157	40
1D	1001-1200	10140	19	22.44	1287	283
1D	1201-1400	6195	12	28.56	660	125
1D	1401-1500	3091	4	21.73	271	92
<b>TOTAL</b>		52306	70	97.3	5090	978

**Table 11.** Length distribution (pre anal fin length, 1 cm groups) and total abundance estimated number (000's) with SE (weighted by survey area), and stratified mean number with SE for roundnose grenadier in Division 1CD for the period 1997-2019.

Length class (1 cm)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
1	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	135	503	41	271	156	54	49	0	175	20	29	33	11	0	102	0	0	22	37	17	11	11
3	480	4854	1022	6232	1493	628	647	535	1354	316	485	234	904	134	535	135	0	238	412	187	34	206
4	2041	8262	5378	21591	3406	2188	978	2726	2962	1183	1637	352	1829	1118	1545	613	174	436	962	659	174	789
5	4459	9904	7969	44302	6184	3699	1205	3017	3497	3053	3053	614	3800	1346	2629	3344	539	458	1084	1200	216	628
6	5578	12195	4812	39265	6526	4758	1058	2239	1944	3627	4408	959	3708	1668	2585	8816	738	646	1045	924	284	664
7	4617	17779	3127	14398	4088	3385	972	896	747	1253	2288	942	3584	937	1753	7763	816	985	1174	558	234	676
8	5002	10713	1959	5042	1169	1488	412	380	451	462	427	609	1472	617	931	2469	529	908	863	622	223	465
9	4510	4277	1098	1833	659	910	270	222	215	200	178	341	539	274	518	395	465	812	794	726	289	463
10	2403	2218	1032	878	241	343	262	131	245	158	120	159	143	205	423	412	292	264	407	536	285	294
11	1860	1246	756	711	289	383	298	211	234	176	122	174	120	145	169	212	149	218	196	508	240	309
12	1639	857	759	620	152	360	309	83	115	80	82	105	94	153	97	66	88	90	94	124	467	207
13	894	619	511	595	189	258	204	87	129	47	27	85	83	65	106	79	100	57	76	176	159	217
14	634	458	478	590	106	101	121	44	51	27	66	62	49	53	49	36	24	28	99	80	171	50
15	360	505	268	386	30	105	69	0	0	7	25	39	68	29	0	24	0	26	68	28	61	79
16	254	106	81	117	54	80	22	0	42	17	47	23	20	20	12	0	12	15	14	29	16	8
17	118	86	86	22	27	38	0	24	11	7	0	11	38	0	62	0	0	0	0	0	0	13
18	25	10	34	0	14	13	23	6	0	6	7	17	10	18	6	0	0	6	19	0	0	7
19	0	11	19	0	0	0	0	0	0	0	0	0	0	0	51	0	0	6	0	6	23	0
20	8	9	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	7	9	0	0
21	0	0	0	0	15	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Abundance</b>	35017	74624	29430	136853	24806	18791	6899	10601	12172	10639	13001	4765	16472	6782	11573	24364	3926	5215	7351	6389	2887	5086
<b>S.E.</b>	7964	26529	9097	60292	8765	8845	1272	2529	3747	4016	4502	698	10006	1797	4645	14246	0	2248	2282	1802	1028	978
<b>Mean Number</b>	669.52	1426.19	578.02	2968.91	501.63	407.68	139.51	206.34	232.84	203.34	261.34	91.19	316.91	129.7	221.24	465.33	0	99.73	140.49	122.13	59	97.3
<b>S.E.</b>	152	507	179	1308	177	192	26	49	72	77	89	13	191	34	89	272	0	43	44	34	21	19

**Table 12.** Roughhead grenadier. Biomass per strata, total biomass (t) with SE, and stratified mean catch per tow (kg) and SE in NAFO divisions 1CD, for roughhead grenadier, for the period 1997-2019.  
n.s. = stratum not surveyed

Division	Stratum (m)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1C	401-600	3	21	25	n.s	25	n.s	246	43	89	110	32
1C	601-800	70	540	677	874	437	2308	1681	803	1912	1375	966
1C	801-1000	145	625	919	2688	231	624	643	661	596	516	297
1C	1001-1200	31	84	n.s	92	85	166	110	40	116	38	27
1D	401-600	0	7	n.s	n.s	n.s	n.s	n.s	n.s	23	0	19
1D	601-800	63	244	279	n.s	n.s	n.s	n.s	154	96	393	n.s
1D	801-1000	79	575	423	255	584	462	257	139	340	230	359
1D	1001-1200	1228	1130	1379	1713	1361	1808	1288	934	1297	1291	892
1D	1201-1400	574	735	688	1174	1094	1515	1017	757	593	777	584
1D	1401-1500	283	323	740	574	771	1150	416	686	540	395	337
<b>TOTAL</b>	<b>Biomass</b>	2477	4284	5130	7369	4588	8033	5658	4218	5603	5125	3514
	<b>S.E.</b>	450	374	847	1603	500	888	701	429	431	622	378
	<b>Mean Catch</b>	47.35	81.9	100.99	159.87	92.75	174.26	114.38	82.06	107.12	97.98	69.77
	<b>S.E.</b>	9	7	17	35	10	19	14	8	8	12	8

Division	Stratum(m)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
1C	401-600	66	92	72	0	81	n.s	50	86	106	n.s	121
1C	601-800	1691	1206	1054	580	931	n.s	427	1270	603	508	626
1C	801-1000	734	240	299	284	255	n.s	302	379	332	77	328
1C	1001-1200	26	10	43	26	40	n.s	53	18	16	33	42
1D	401-600	73	65	34	24	24	38	37	4	42	37	51
1D	601-800	216	141	93	187	652	393	182	60	191	73	194
1D	801-1000	171	293	193	148	359	323	226	136	173	50	260
1D	1001-1200	657	587	1081	931	954	570	786	670	528	412	975
1D	1201-1400	624	650	695	565	731	590	540	419	660	235	643
1D	1401-1500	518	504	421	306	169	340	317	230	222	115	340
<b>TOTAL</b>	<b>Biomass</b>	4775	3787	3986	3050	4195	2255	2921	3271	2872	1540	3580
	<b>S.E.</b>	1167	297	565	264	1174	578	266	226	282	276	260
	<b>MeanCatch</b>	91.29	72.4	76.21	58.31	80.2	86.26	55.84	62.54	54.9	31.46	68.45
	<b>S.E.</b>	22	6	11	5	22	22	5	4	5	6	5

**Table 13.** Mean catch (kg/km<sup>2</sup>), biomass (tons) with S.E. of roughhead grenadier in Division 1 CD by depth stratum in 2019. n.s = stratum not surveyed

Division	Stratum (m)	Area (sq.km)	Tow number	Mean Catch	Biomass	SE
1C	401-600	3366	2	35.98	121	71
1C	601-800	16120	10	38.83	626	126
1C	801-1000	6066	13	54.12	328	78
1C	1001-1200	611	2	69.54	42	26
1D	401-600	903	2	56.9	51	36
1D	601-800	1940	2	99.99	194	73
1D	801-1000	3874	4	67.05	260	58
1D	1001-1200	10140	19	96.12	975	133
1D	1201-1400	6195	12	103.8	643	88
1D	1401-1500	3091	4	109.86	340	68
<b>TOTAL</b>		52306	70	68.45	3580	260



**Table 14.** Mean number (num/km<sup>2</sup>), abundance ('000s) with S.E. of roughhead grenadier in Division 1 CD by depth stratum in 2019.

Division	Stratum (m)	Area (sq.km)	Tow number	Mean Catch	Abundance	SE
1C	401-600	3366	2	35.98	365	103
1C	601-800	16120	10	38.83	2045	274
1C	801-1000	6066	13	54.12	996	208
1C	1001-1200	611	2	69.54	137	69
1D	401-600	903	2	56.9	107	60
1D	601-800	1940	2	99.99	398	29
1D	801-1000	3874	4	67.05	554	142
1D	1001-1200	10140	19	96.12	2157	321
1D	1201-1400	6195	12	103.8	1074	211
1D	1401-1500	3091	4	109.86	322	92
<b>TOTAL</b>		52306	70	561	8155	155.92

**Table 15.** Length distribution (pre anal fin length, 1 cm groups) and total abundance estimated number (000's) with SE (weighted by survey area), and stratified mean number with SE, for roughhead grenadier, in Division 1CD, for the period 1997-2019.

Length Class (1 cm)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
1	0	0	12	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	6
2	0	11	0	0	61	0	0	34	0	0	0	0	7	0	0	0	0	0	8	20	0	0
3	14	20	0	0	15	24	0	0	11	0	0	7	0	6	0	0	0	43	12	26	0	8
4	8	56	12	103	69	115	0	12	94	96	78	12	13	21	98	20	13	103	75	34	14	14
5	30	58	40	0	85	75	83	102	53	96	51	20	17	20	36	10	96	32	82	47	8	6
6	29	51	12	144	168	57	259	83	18	7	147	52	0	20	27	28	17	74	211	178	78	104
7	25	319	213	409	370	329	658	224	157	141	57	153	158	57	185	120	76	389	424	172	165	80
8	34	427	231	212	681	396	215	142	92	90	154	229	130	131	168	259	61	449	368	295	67	226
9	81	440	724	587	340	1138	353	384	464	259	339	501	255	118	202	148	138	528	766	541	217	314
10	201	566	1313	954	724	1005	541	609	582	571	338	504	235	210	158	304	127	532	629	283	121	374
11	253	1074	1303	1540	940	746	1060	665	1320	471	124	474	538	393	303	577	120	597	807	457	195	554
12	331	1071	1164	2707	1088	1446	1606	877	1027	1202	591	517	782	397	458	328	157	752	945	498	327	679
13	384	1129	1429	3491	1262	1686	1210	1291	1236	1137	545	811	636	652	567	539	175	472	933	531	190	861
14	453	1196	1513	2724	1127	2151	1308	1204	1886	1269	497	867	297	499	660	458	175	499	604	410	260	809
15	429	911	1305	2398	1271	1856	1731	1096	1763	1481	873	814	811	1117	614	714	226	287	505	381	278	798
16	584	752	968	1532	1419	2519	1727	1275	1372	1280	822	840	836	816	1008	645	403	620	470	565	160	474
17	508	909	1081	1412	1272	1807	1475	1228	1101	1120	1055	1082	897	968	1009	798	364	537	553	411	281	732
18	458	580	737	843	815	1735	1065	691	991	952	1085	1006	752	918	787	775	647	630	455	506	331	717
19	358	559	410	441	650	810	687	428	510	397	478	699	525	702	475	1237	567	502	327	344	184	321
20	253	418	513	351	290	457	540	254	279	428	316	415	370	220	243	422	194	210	270	302	132	245
21	38	349	250	249	265	395	309	225	371	158	111	265	278	235	119	31	117	107	268	97	51	140
22	153	78	134	187	221	219	138	114	149	87	18	134	114	86	82	182	43	87	101	132	24	91
23	113	194	309	181	122	208	81	59	121	74	29	176	90	139	19	255	107	52	94	109	81	80
24	49	110	122	88	25	115	58	17	62	82	163	210	85	142	19	62	0	32	134	62	22	88
25	52	94	67	131	71	119	86	58	40	103	47	97	122	57	52	90	70	43	74	79	15	13
26	0	63	59	64	31	125	39	44	72	80	40	95	8	35	8	74	103	78	67	56	75	81
27	45	24	11	140	74	109	37	44	79	37	10	17	28	13	14	46	73	45	19	43	67	61
28	0	13	14	45	0	80	15	21	49	38	17	114	68	70	5	115	0	42	25	68	15	60
29	28	38	0	0	29	56	14	17	15	70	67	13	25	27	12	49	12	22	28	40	16	22
30	21	20	0	26	16	23	10	6	12	50	9	28	30	41	6	15	25	0	39	13	0	80
31	18	0	0	0	0	0	25	6	40	83	10	5	6	18	0	5	13	22	6	19	0	37
32	0	11	0	12	14	0	0	22	24	8	4	5	23	0	13	88	0	0	13	19	13	28
33	9	0	11	0	15	55	11	17	0	18	0	7	10	30	5	15	0	16	0	39	0	17
34	0	11	12	13	9	12	0	0	8	11	0	7	0	13	13	8	0	0	10	21	0	0
35	0	0	0	21	19	13	0	0	7	23	10	5	8	0	0	0	24	0	7	0	0	10
36	0	13	0	0	0	24	0	0	7	5	7	12	0	14	0	0	0	15	14	0	29	7
37	0	0	0	0	0	44	0	7	0	0	0	16	9	19	0	0	0	0	0	0	4	6
38	0	0	34	0	0	0	21	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	5	9	0	6	0	13	6	0	0	0	8
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	13	0	0	7	0	7	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
<b>Abundance</b>	5013	11571	14003	21012	12773	19952	15366	11248	14020	11927	8185	10224	8200	8205	7386	8417	0	7826	9345	6814	3425	8156
<b>S.E.</b>	723	1004	2040	5114	1291	1956	2573	1389	1384	1088	1085	1601	671	1101	650	2707	0	691	688	604	351	561
<b>Mean Number</b>	95.84	221.21	275.69	455.83	258.23	432.84	310.66	218.81	268.04	228.02	162.51	195.46	156.77	156.87	141.2	160.92	0	149.63	178.66	130.28	69.98	155.92
<b>S.E.</b>	14	19	40	111	26	42	52	27	26	21	22	31	13	21	12	52	0	13	13	12	7	11

**Table 16.** Deep sea redfish biomass per strata, total biomass (t) with SE, and stratified mean catch per tow (kg) and SE in NAFO divisions 1CD, for deep-sea redfish, for the period 1997-2019. n.s. = stratum not surveyed

Division	Stratum (m)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1C	401-600	686	911	970	n.s	1032	n.s	1137	1983	173	1576	0
1C	601-800	1158	726	1329	733	778	295	323	331	2144	159	200
1C	801-1000	8	6	20	25	0	11	11	8	53	14	28
1C	1001-1200	1	0	n.s	2	0	0	0	0	1	1	0
1D	401-600	102	489	n.s	n.s	n.s	n.s	n.s	n.s	130	35	109
1D	601-800	441	100	197	n.s	n.s	n.s	n.s	4	30	177	n.s
1D	801-1000	20	0	0	5	0	5	22	0	4	0	80
1D	1001-1200	10	5	2	6	10	0	0	4	3	8	2
1D	1201-1400	10	0	3	0	0	4	0	0	6	8	8
1D	1401-1500	0	2	0	0	7	3	0	0	1	3	0
<b>TOTAL</b>	<b>Biomass</b>	2436	2240	2522	771	1826	317	1493	2330	2546	1982	426
	<b>S.E.</b>	780	513	969	259	649	40	684	1259	1683	720	181
	<b>Mean Catch</b>	46.58	42.82	49.66	16.72	36.92	6.89	30.19	45.33	48.68	37.88	8.47
	<b>S.E.</b>	15	10	19	6	13	1	14	24	32	14	4

Division	Stratum(m)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
1C	401-600	2273	2379	2538	4062	6420	n.s	13669	5827	2133	n.s	3712
1C	601-800	8219	3432	440	3309	607	n.s	5072	3804	3753	345	1184
1C	801-1000	16	9	14	74	14	n.s	61	35	79	20	82
1C	1001-1200	0	1	3	1	0	n.s	0	1	0	0	0
1D	401-600	1142	1824	1035	1179	344	4830	1402	117	4164	2661	1522
1D	601-800	1583	37	5	975	6322	20649	1811	161	1152	5898	1729
1D	801-1000	5	90	10	0	43	0	13	18	0	0	9
1D	1001-1200	6	10	2	13	6	3	13	21	40	68	5
1D	1201-1400	8	8	5	9	15	5	10	30	2	9	6
1D	1401-1500	4	7	18	2	3	5	9	1	11	0	0
<b>TOTAL</b>	<b>Biomass</b>	13256	7796	4069	9624	13774	46565	22058	10016	11333	9001	8249
	<b>S.E.</b>	6468	3917	1329	3623	4450	13196	10284	4457	4829	6425	4004
	<b>Mean Catch</b>	253.43	149.05	77.8	183.99	263.33	1781.18	421.72	191.48	216.66	183.91	157.7
	<b>S.E.</b>	124	75	25	69	85	505	197	85	92	131	77

**Table 17.** Mean catch (kg/km<sup>2</sup>), biomass (tons) with S.E. of deep-sea redfish in Division 1 CD by depth stratum in 2019.

Division	Stratum (m)	Area (sq.km)	Tow number	Mean Catch	Biomass	SE
1C	401-600	3366	2	1102.76	3712	3269
1C	601-800	16120	10	73.44	1184	500
1C	801-1000	6066	13	13.58	82	44
1C	1001-1200	611	2	0	0	0
1D	401-600	903	2	1685.2	1522	1506
1D	601-800	1940	2	891.18	1729	1681
1D	801-1000	3874	4	2.24	9	9
1D	1001-1200	10140	19	0.51	5	4
1D	1201-1400	6195	12	0.95	6	4
1D	1401-1500	3091	4	0	0	0
<b>TOTAL</b>		<b>52306</b>	<b>70</b>	<b>157.7</b>	<b>8249</b>	<b>4004</b>

**Table 18.** Mean number (num/km<sup>2</sup>), abundance ('000s) with S.E. of deep-sea redfish in Division 1 CD by depth stratum in 2019.

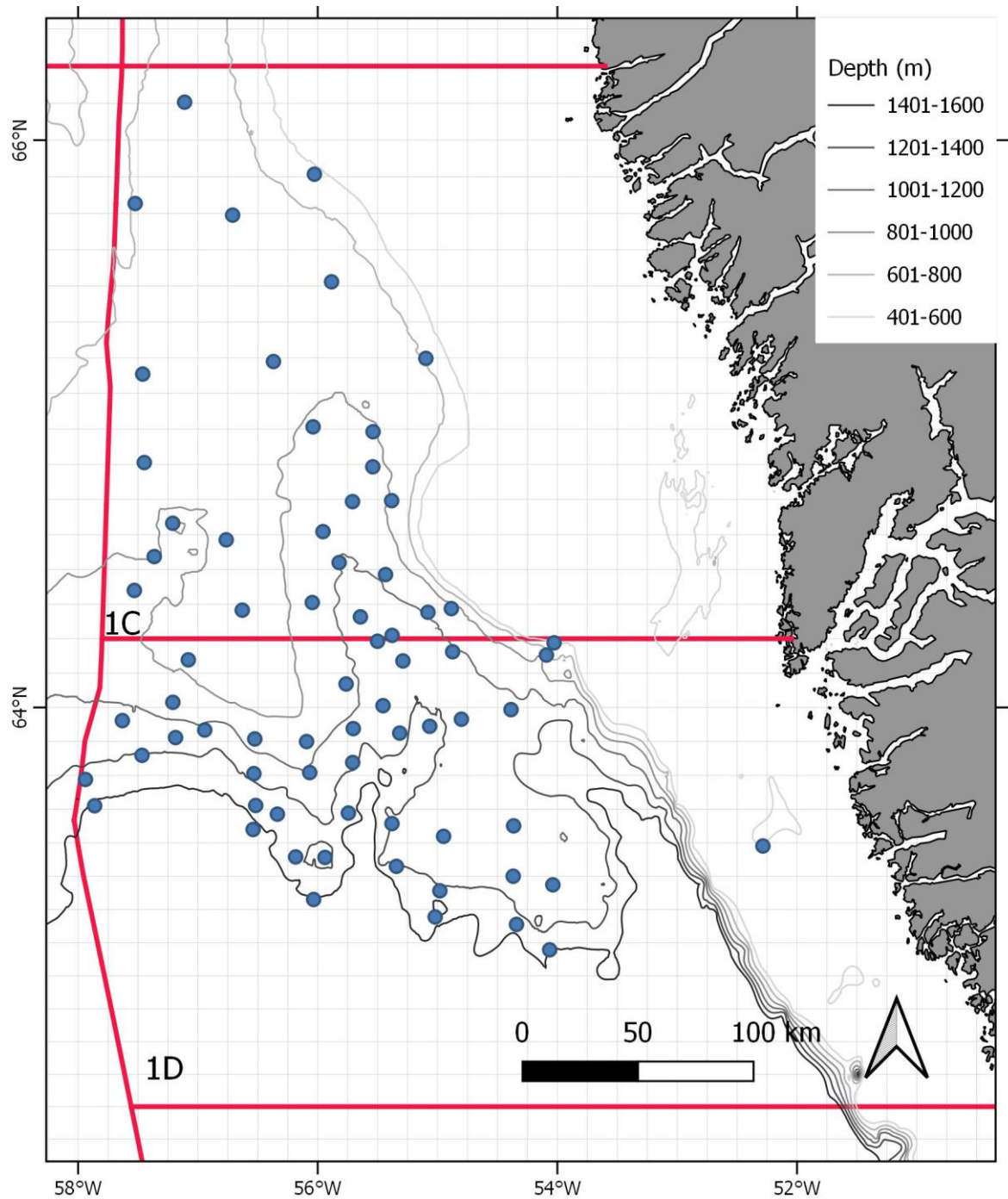
<b>Division</b>	<b>Stratum (m)</b>	<b>Area (sq.km)</b>	<b>Tow number</b>	<b>Mean Catch</b>	<b>Abundance</b>	<b>SE</b>
1C	401-600	3366	2	1102.76	6953	5381
1C	601-800	16120	10	73.44	2209	814
1C	801-1000	6066	13	13.58	158	93
1C	1001-1200	611	2	0	0	0
1D	401-600	903	2	1685.2	3417	3358
1D	601-800	1940	2	891.18	4297	4178
1D	801-1000	3874	4	2.24	23	23
1D	1001-1200	10140	19	0.51	13	9
1D	1201-1400	6195	12	0.95	14	9
1D	1401-1500	3091	4	326.63	0	0
<b>TOTAL</b>		52306	70	326.63	17084	7639

**Table 19.** Length distribution (1 cm groups) and total abundance estimated number (000's) with SE (weighted by survey area), and stratified mean number with SE for deep-sea redfish, in Division 1CD, for the period 1997-2019.

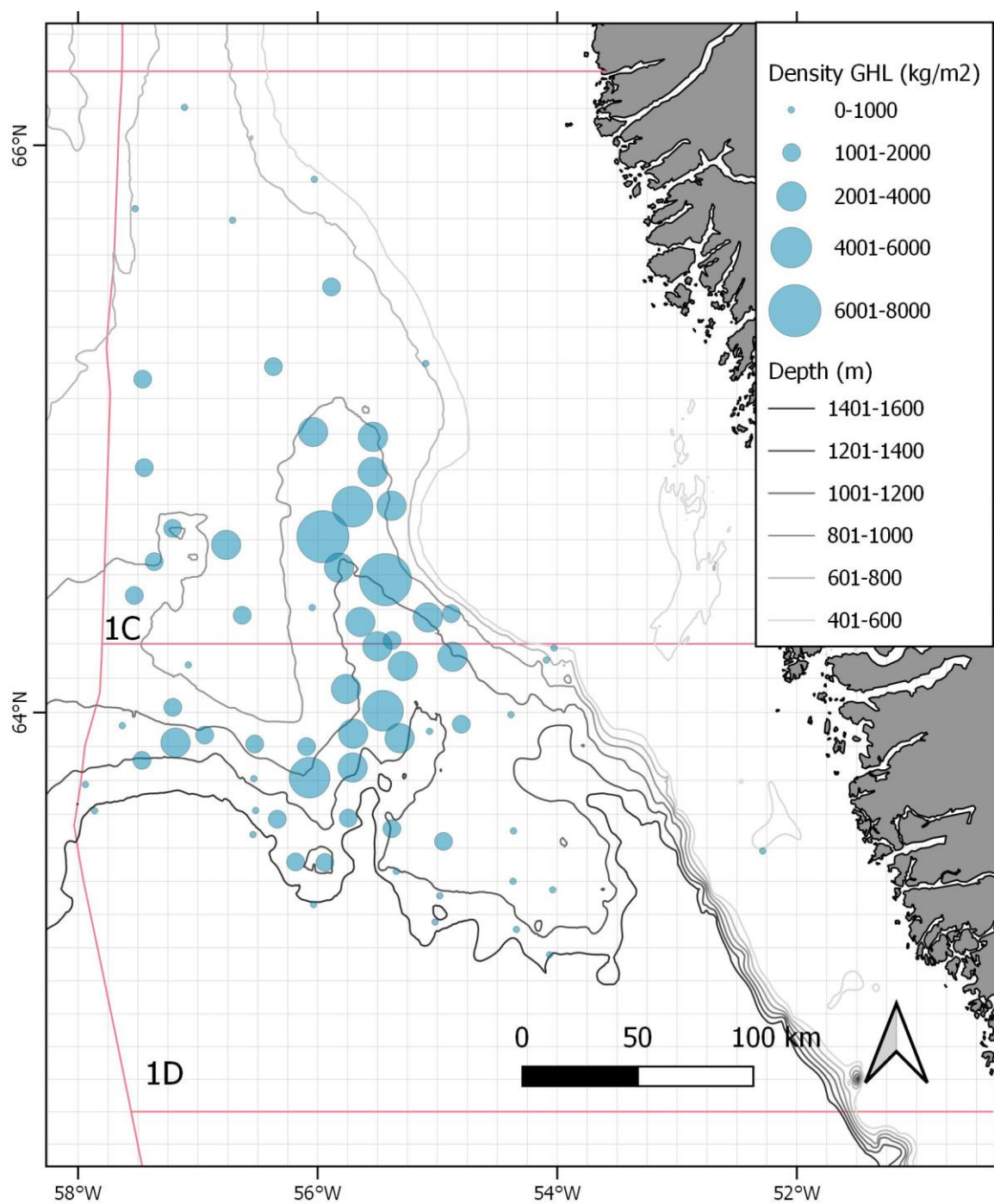
Lenght Class (2 cm)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019
2	0	0	0	0	136	0	0	0	0	11	5	0	0	0	0	0	0	0	0	0	0	0
4	5	0	0	0	435	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0
6	36	0	0	0	0	0	44	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
8	16	0	0	0	0	0	0	0	16	0	11	0	18	0	0	0	0	0	0	0	0	0
10	36	263	0	0	50	0	21	0	129	0	69	28	84	0	0	0	0	0	0	0	0	0
12	722	1160	274	0	778	0	44	37	226	146	58	1142	266	77	39	0	0	0	0	0	0	0
14	2727	2253	851	121	4280	53	163	251	646	1472	145	9537	1565	1126	117	0	0	0	22	0	0	0
16	3046	2932	1432	358	2235	112	832	1929	725	3928	78	6447	7489	1155	432	73	0	0	237	23	0	22
18	2495	2835	2483	289	2488	340	2209	3575	307	6142	278	5149	6564	3038	2012	588	240	1778	1143	37	0	32
20	1932	1934	2220	307	2034	71	1801	2958	329	2331	292	5782	3786	3925	5623	3752	1560	5040	2902	454	46	128
22	1355	1609	2045	835	1262	223	896	2652	1048	668	175	5369	4484	3068	7204	8186	4560	9005	5924	1829	180	74
24	514	703	1234	1201	565	298	708	862	655	220	218	5483	3858	2293	5877	9703	6735	16562	6504	3705	1080	588
26	419	309	1091	242	201	0	173	556	516	318	76	4030	2598	1367	5459	5947	7083	14085	5595	4291	1806	2104
28	617	157	742	0	127	134	99	282	464	160	402	2480	1718	935	2308	3982	5009	10408	3687	4008	2413	2589
30	307	284	343	90	52	165	49	128	510	82	27	2716	931	307	1267	3081	3182	4980	2944	3350	2871	3162
32	205	177	231	0	14	0	0	123	714	32	16	2117	777	348	955	505	1942	1924	916	2569	2938	3190
34	47	89	63	0	28	0	65	0	459	26	9	1570	536	79	561	1153	3763	520	474	2292	2259	2929
36	21	18	32	0	11	0	25	0	375	0	19	789	311	99	321	1222	4164	686	338	1136	1321	1525
38	13	0	0	18	0	0	0	0	72	27	0	231	18	14	170	743	6506	472	269	641	1132	640
40	0	22	22	0	0	0	0	0	30	0	0	178	0	0	79	294	1561	229	92	272	253	11
42	0	0	0	0	0	0	0	0	47	0	0	13	18	0	0	147	260	194	73	67	77	90
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	46	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0
<b>Abundance</b>	14513	14745	13063	3461	14696	1396	7129	13353	7268	15568	1892	53061	35039	17831	32424	39376	46565	65975	31120	24697	16422	17084
<b>S.E</b>	5435	3852	4082	937	4670	332	3079	7173	3159	8569	762	17663	17720	3171	12978	12774	0	33357	12674	9945	11439	7639
<b>Mean Number</b>	277.48	281.9	257.18	75.07	297.14	30.27	144.16	259.74	138.94	297.64	37.57	1014.44	669.89	340.96	619.87	752.8	0	1261.33	601.71	472.17	335.56	326.63
<b>S.E.</b>	104	74	80	20	94	7	62	140	60	164	15	338	339	61	248	244	0	638	242	190	234	146

**Table 20.** Mean temperature, S.E. and number of observations by NAFO Division and depth stratum in 1CD.

<b>Division</b>	<b>Depth stratum (m)</b>	<b>n</b>	<b>Mean °C</b>	<b>S.E.</b>
1C	401-600	-	-	-
1C	601-800	6	3.6	0.1
1C	801-1000	7	3.7	0.05
1C	1001-1200	2	3.6	0.03
1D	401-600	2	4.7	0
1D	601-800	2	4.1	0.37
1D	801-1000	4	3.6	0.03
1D	1001-1200	16	3.5	0.01
1D	1201-1400	10	3.5	0.02
1D	1401-1500	4	3.4	0.01

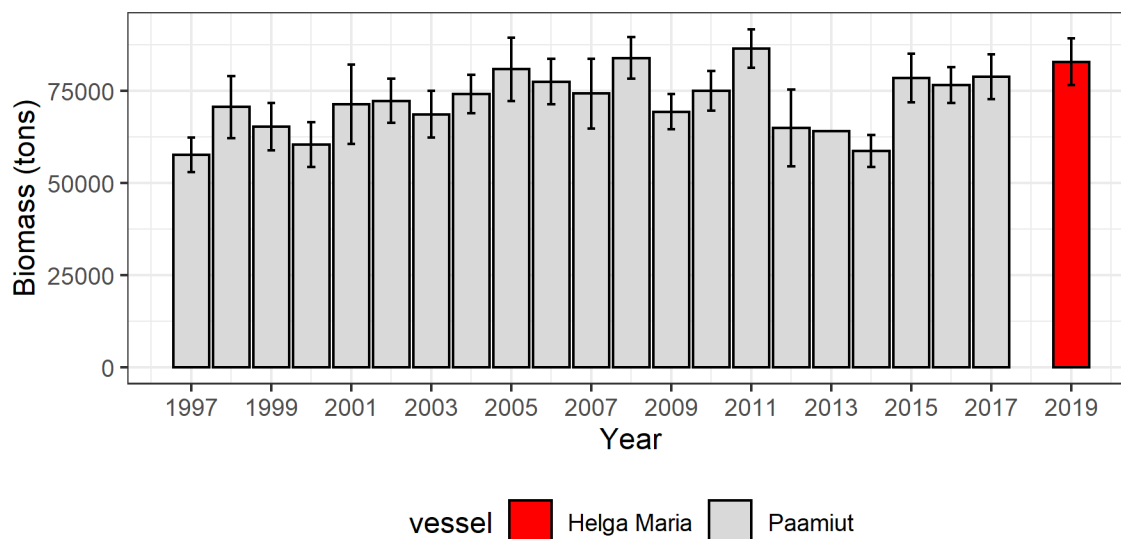


**Figure 1.** Hauls positions for the West Greenland halibut 2019 survey. Coordinate system is WGS84/Pseudo Mercator EPSG: 3857- Grid in latitude /longitude.

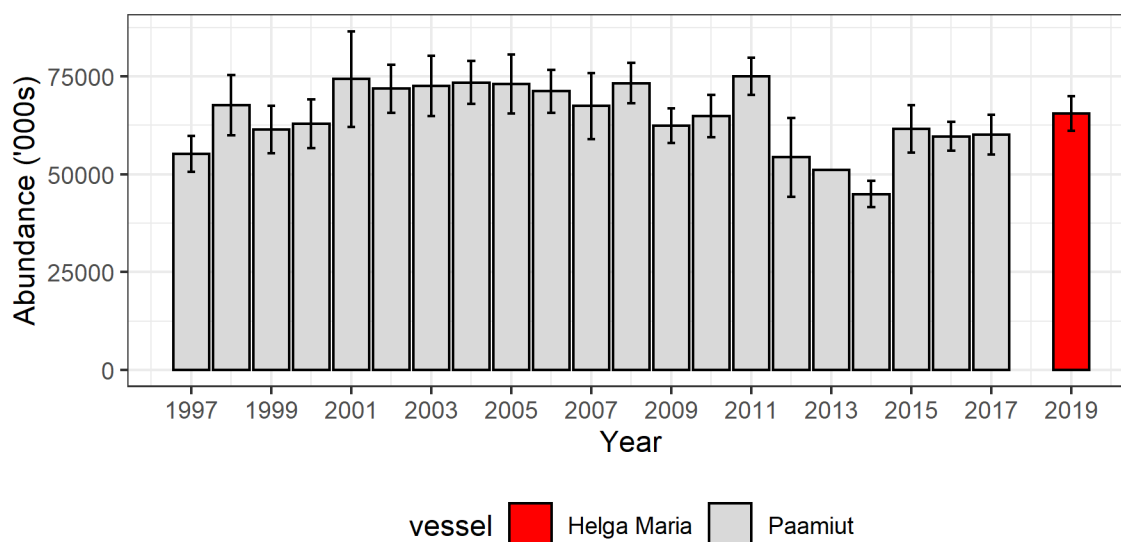


**Figure 2.** Distribution of catches (kg/km<sup>2</sup>) of Greenland halibut in 2019.

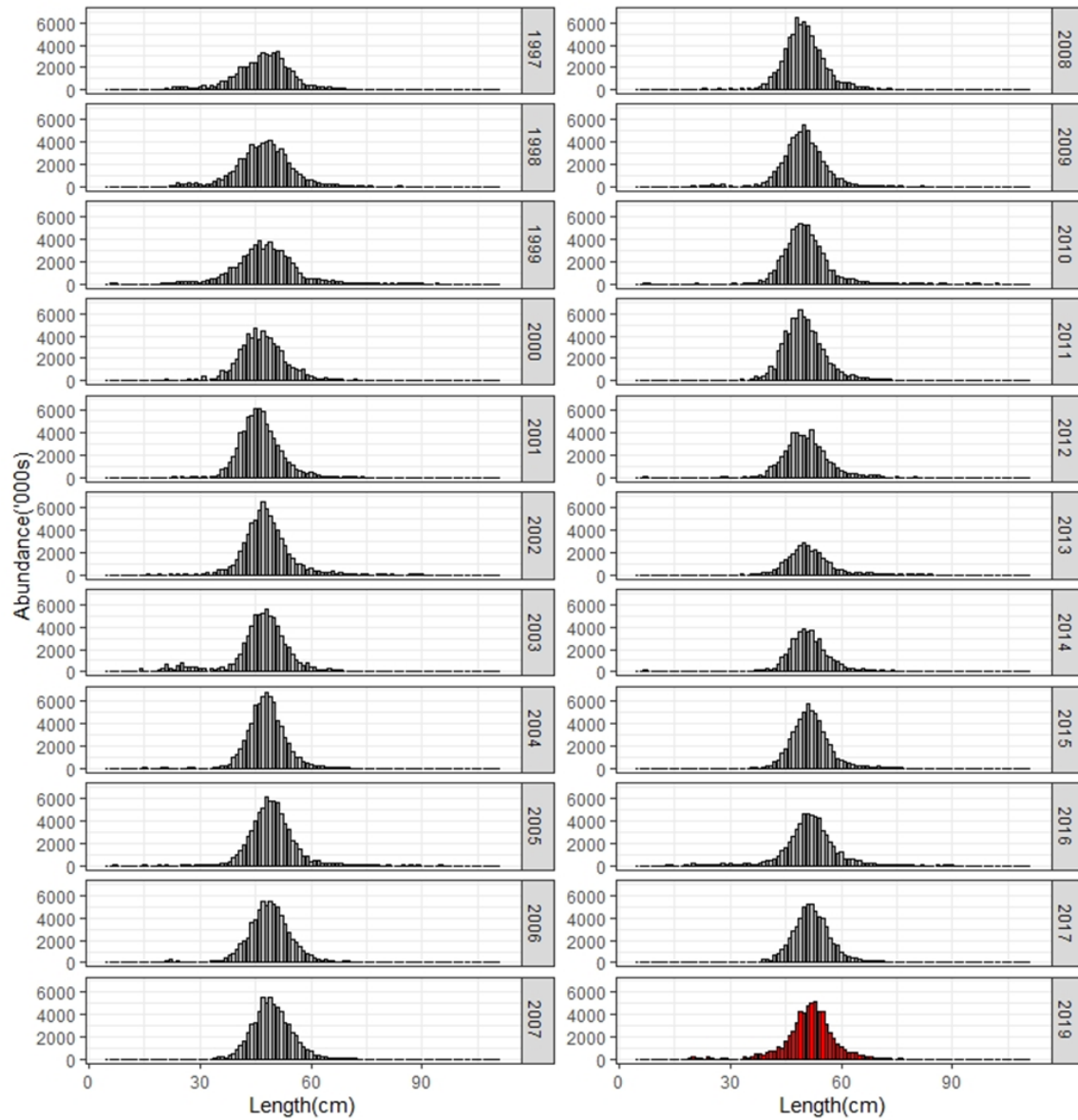




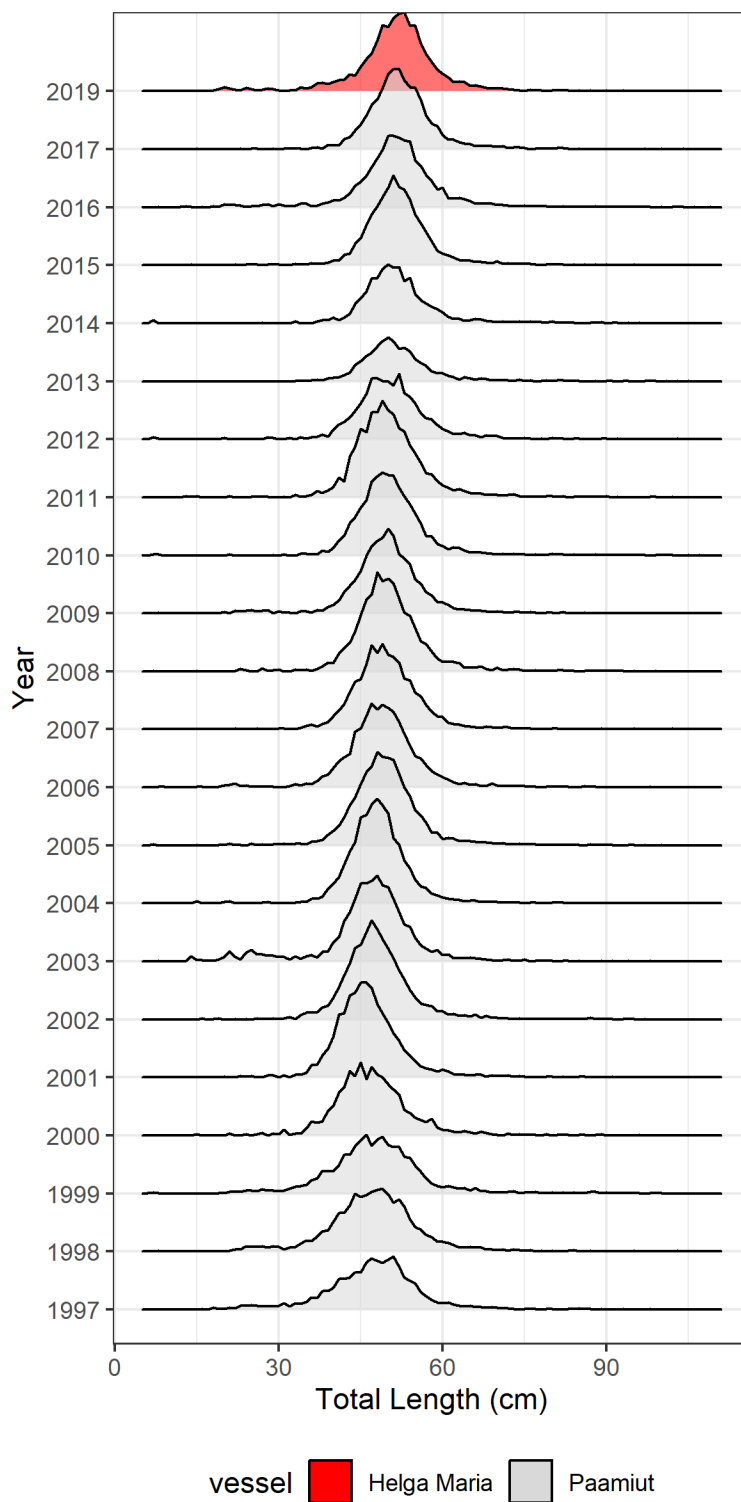
**Figure 3.** Greenland halibut biomass calculated by swept area method in tons and +/- S.E. by year for the period 1997-2019. The biomass in Division 1C, in 2013, has been estimates by a GLM including data from 2010-2014. (Biomass 2013 = 64049 t).



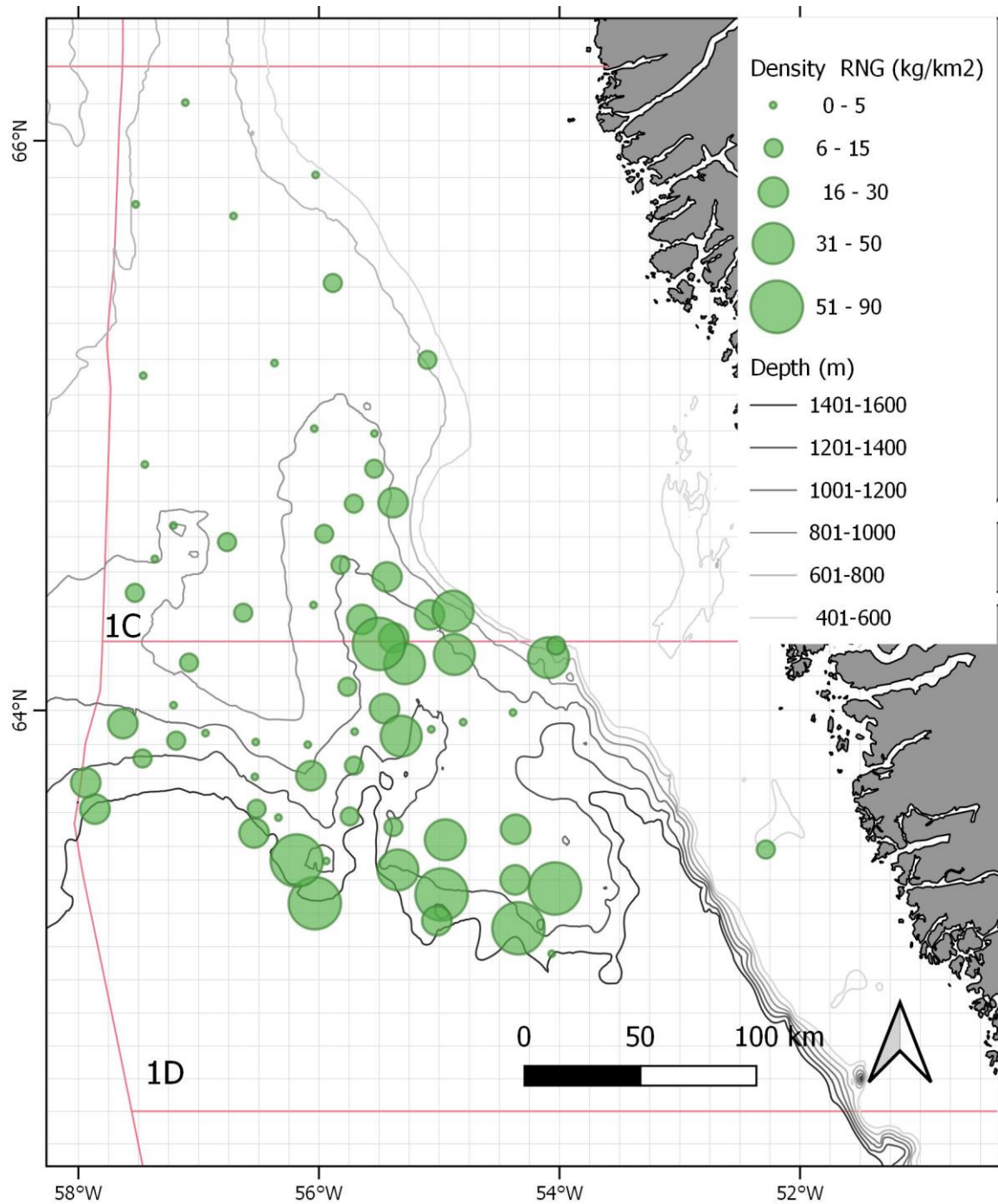
**Figure 4.** Greenland halibut abundance calculated by swept area method in ('000s) and +/- S.E. by year for the period 1997-2019. The biomass in Division 1C, in 2013, has been estimated by a GLM including data from 2010-2014. (Abundance 2013 = 51160 \*10<sup>3</sup> indiv.).



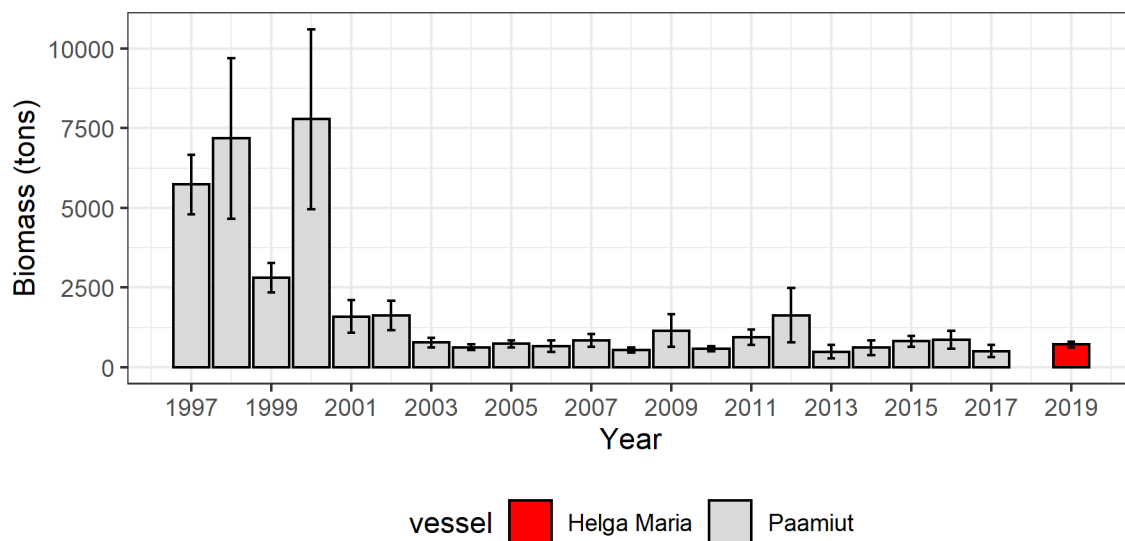
**Figure 5.** Greenland halibut length distribution (cm), in numbers ('000s) per swept area, on NAFO 1CD: 1997-2019. In 2013, only the Division 1D was surveyed. 1997-2017 onboard R/V Paamiut (grey) and 2019 onboard Helga Maria (red).



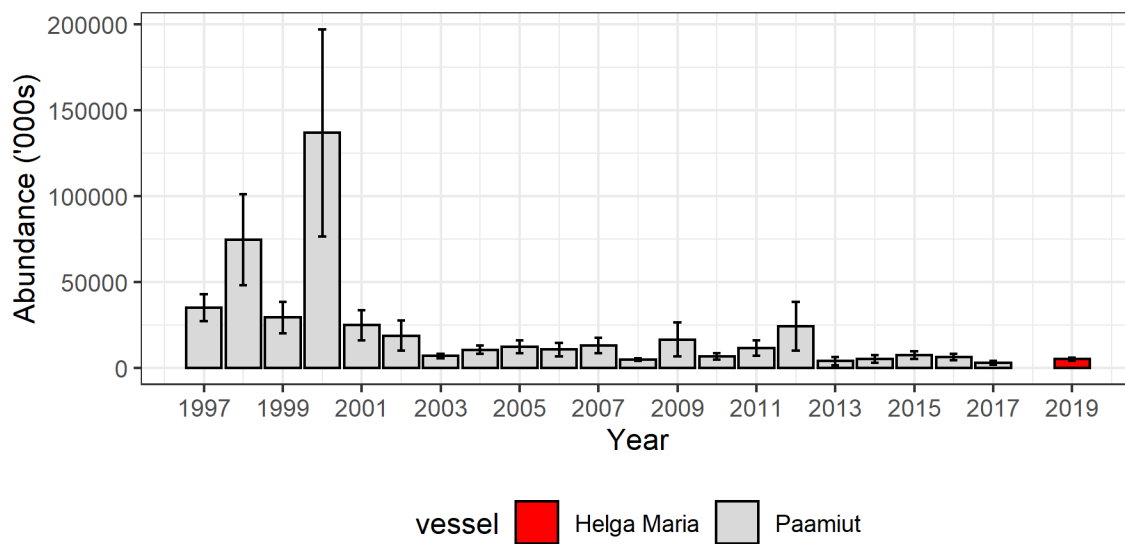
**Figure 6.** Greenland halibut length distribution (weighted to stratum area), NAFO Div. 1CD, for the period 1997-2019.



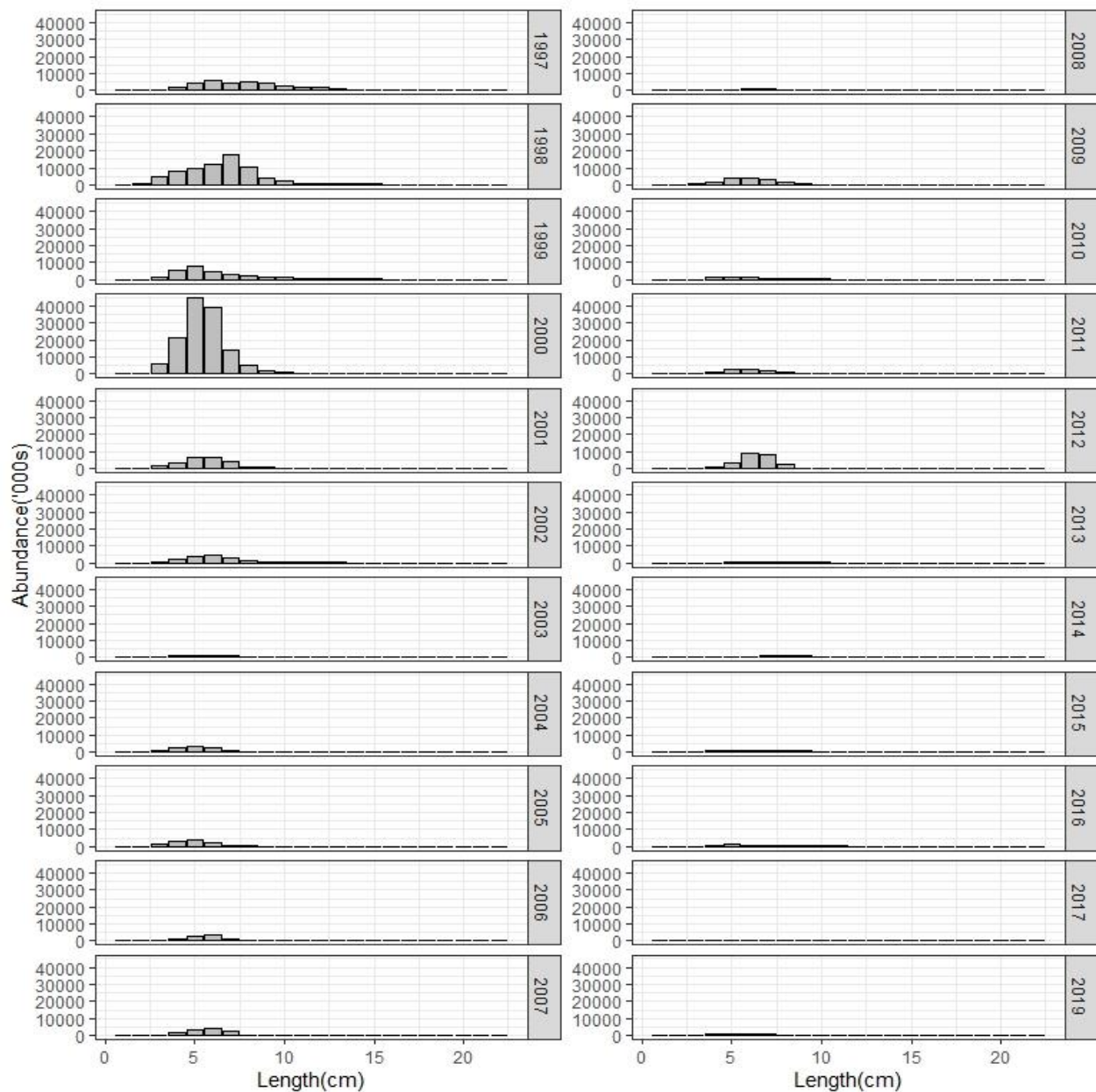
**Figure 7.** Distribution of catches (kg/km<sup>2</sup>) of roundnose grenadier in 2019.



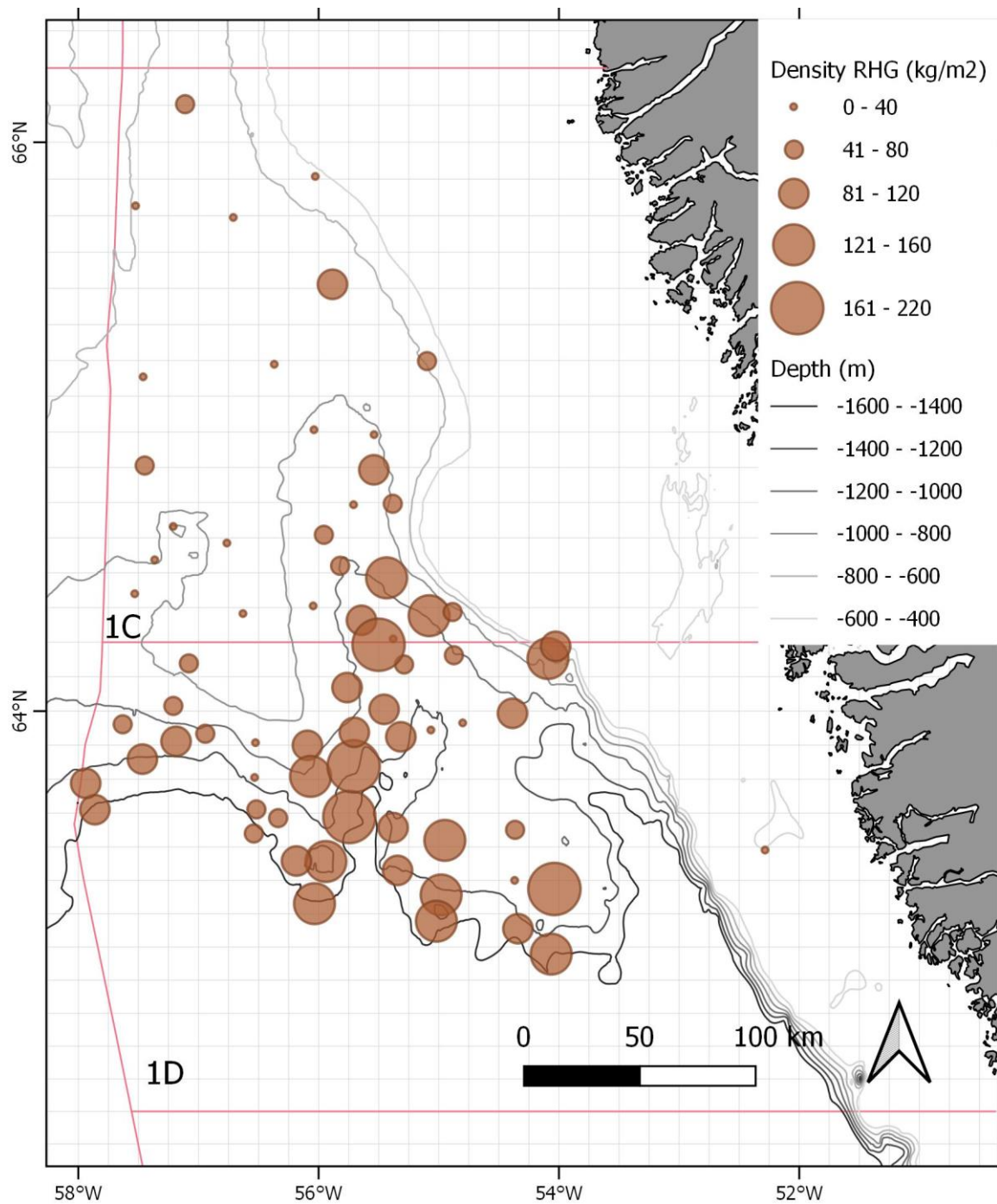
**Figure 8.** Roundnose grenadier biomass calculated by swept area method in tons and +/- S.E. by year for the period 1997-2019. In 2013, only the Division 1C was surveyed.



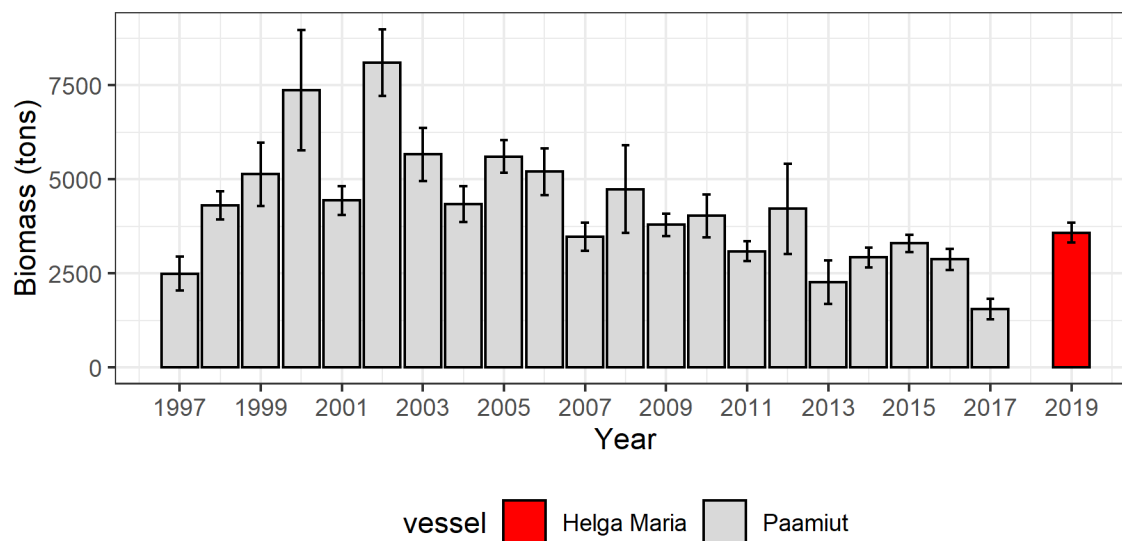
**Figure 9.** Roundnose grenadier abundance calculated by swept area method in ('000s) and +/- S.E. by year for the period 1997-2019. In 2013, only the Division 1D was surveyed.



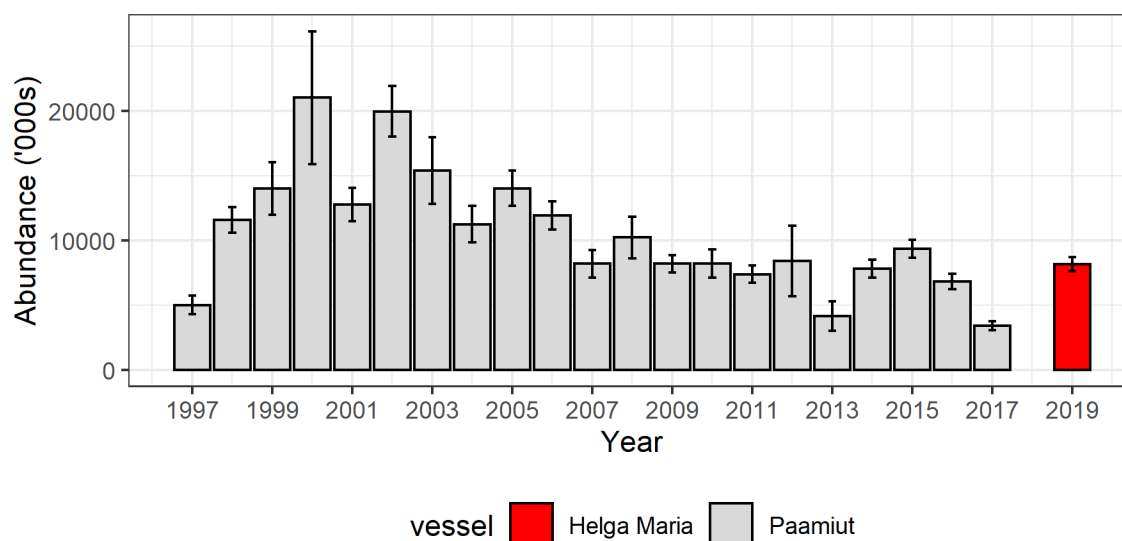
**Figure 10.** Roundnose grenadier length distribution (cm) in numbers ('000s) per swept area, on NAFO 1CD: 1997-2019. In 2013, only the Division 1D was surveyed. 1997-2017 onboard R/V Paamiut and 2019 onboard Helga Maria.



**Figure 11.** Distribution of catches (kg/km<sup>2</sup>) of roughhead grenadier in 2019.

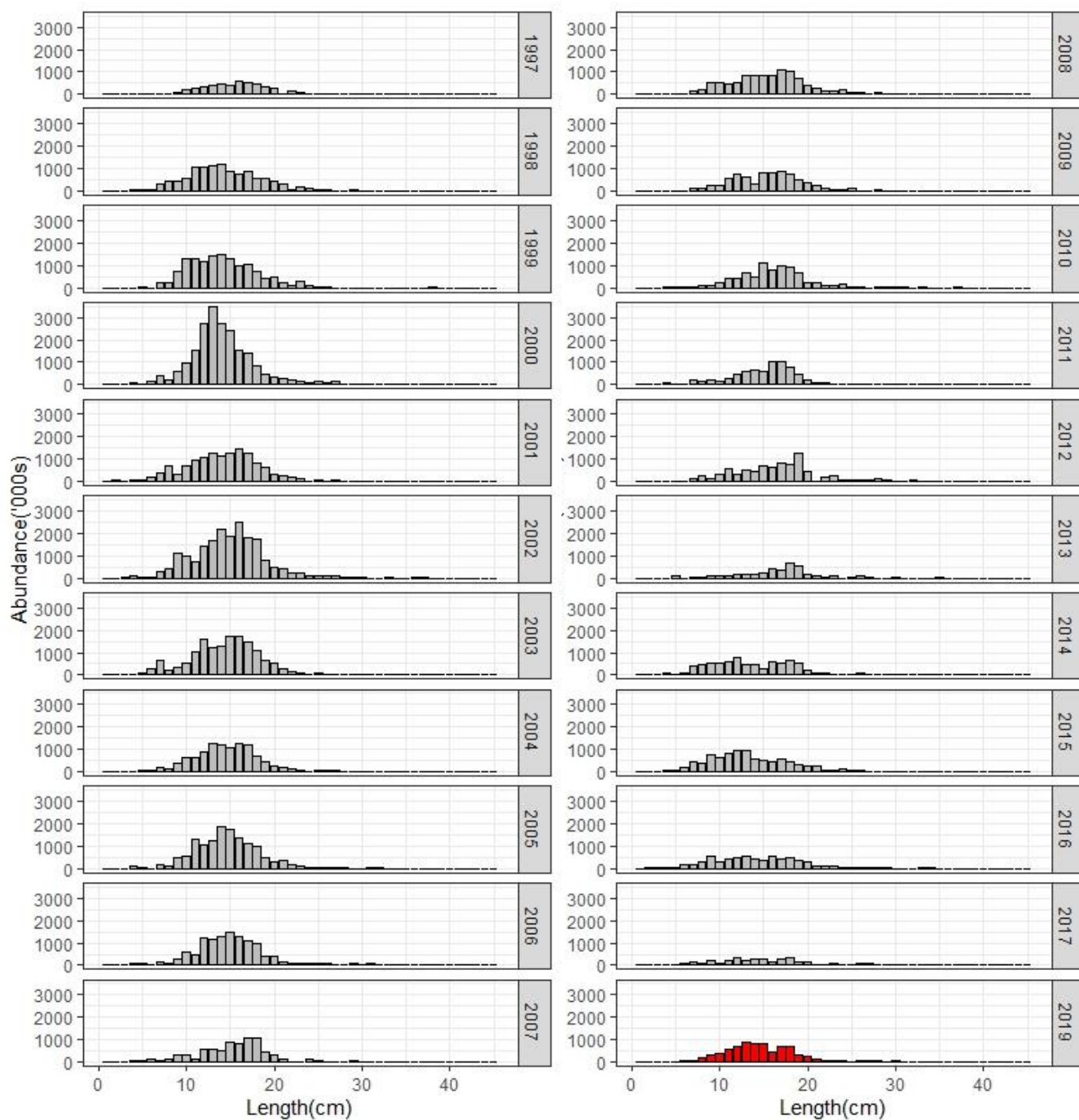


**Figure 12.** Roughhead grenadier biomass (tons) calculated by swept area method in tons and +/- S.E. by year for the period 1997-2019. In 2013, only the Division 1D was surveyed

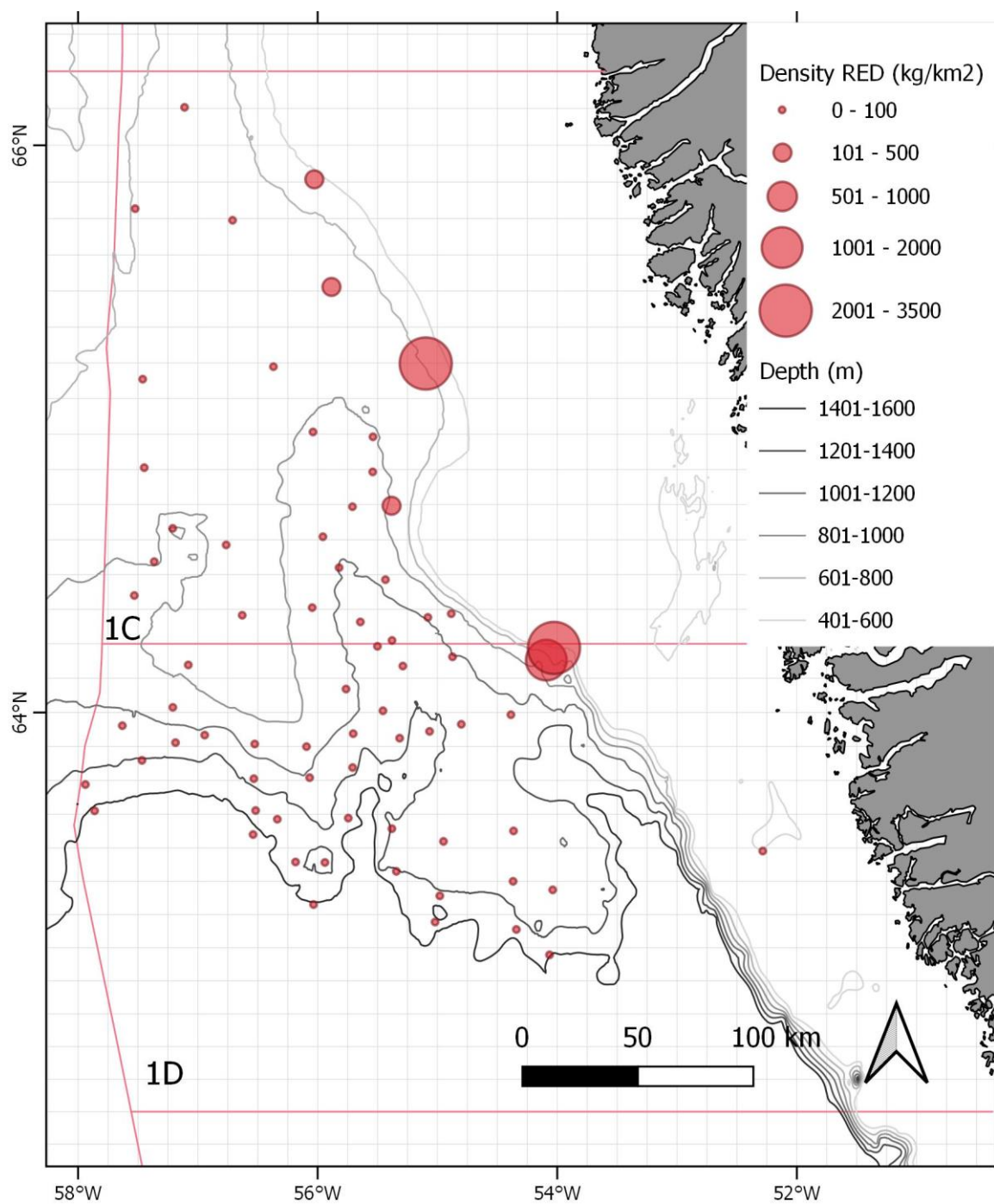


**Figure 13.** Roughhead grenadier abundance calculated by swept area method in ('000s) and +/- S.E. by year for the period 1997-2019. In 2013, only the Division 1C was surveyed.

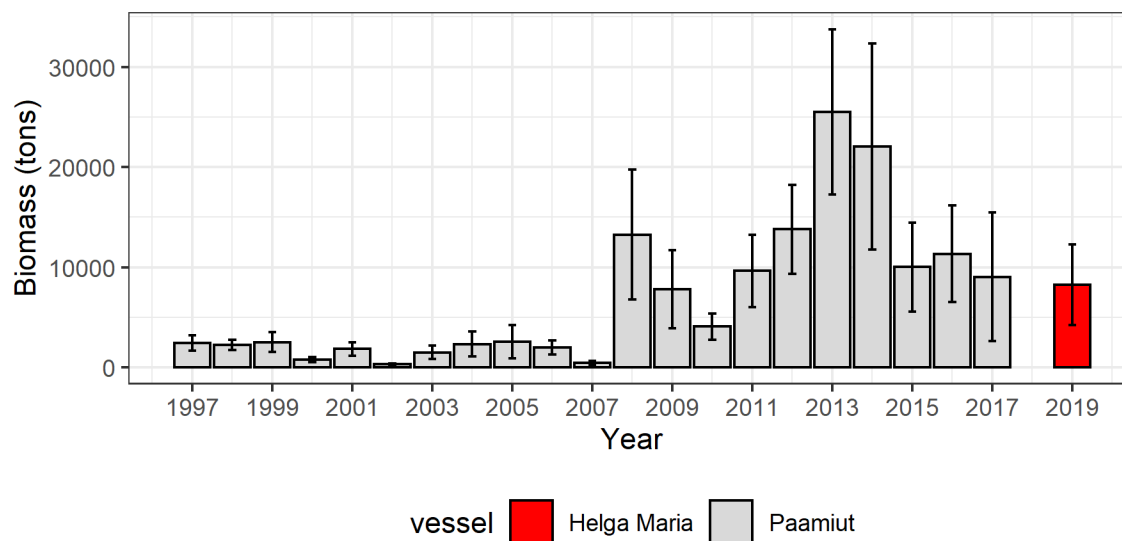




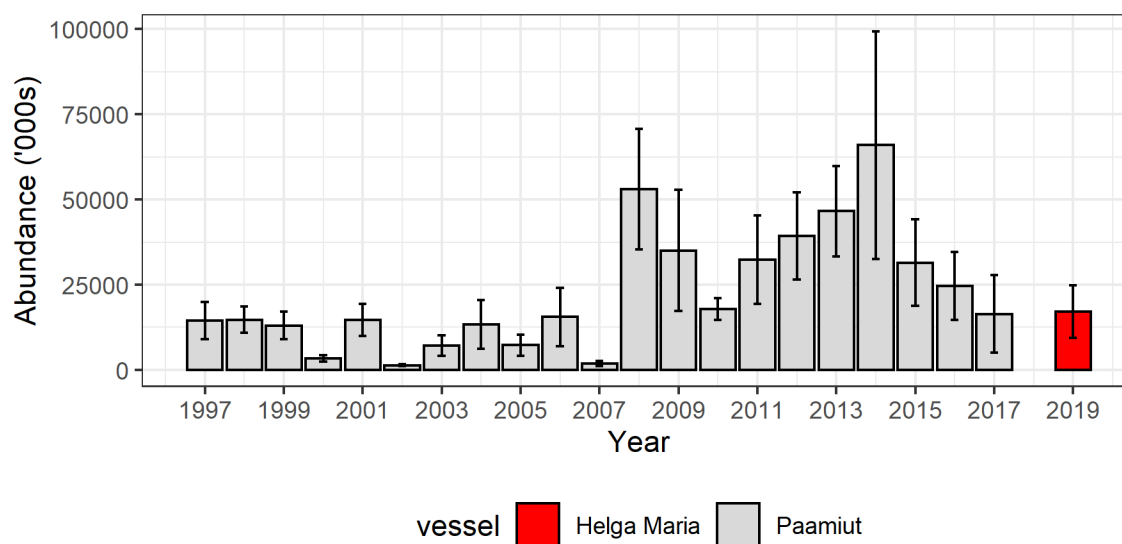
**Figure 14.** Roughhead grenadier length distribution (cm) in numbers ('000s) per swept area, on NAFO 1CD: 1997-2019. In 2013, only the Division 1C was surveyed. 1997-2017 onboard R/V Paamiut (grey) and 2019 onboard Helga Maria (red).



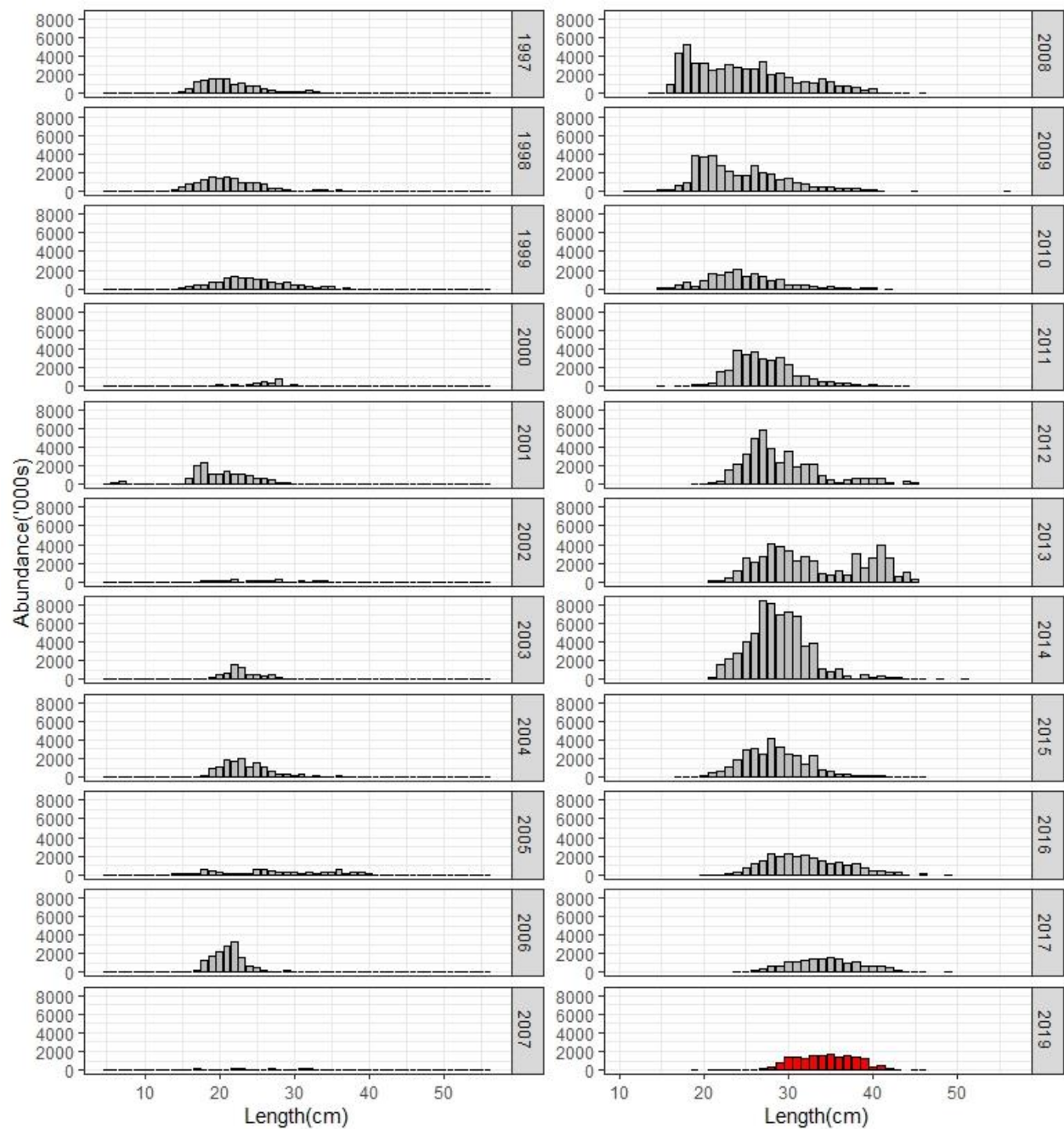
**Figure 15.** Distribution of catches (kg/km<sup>2</sup>) of deep-sea redfish in 2019.



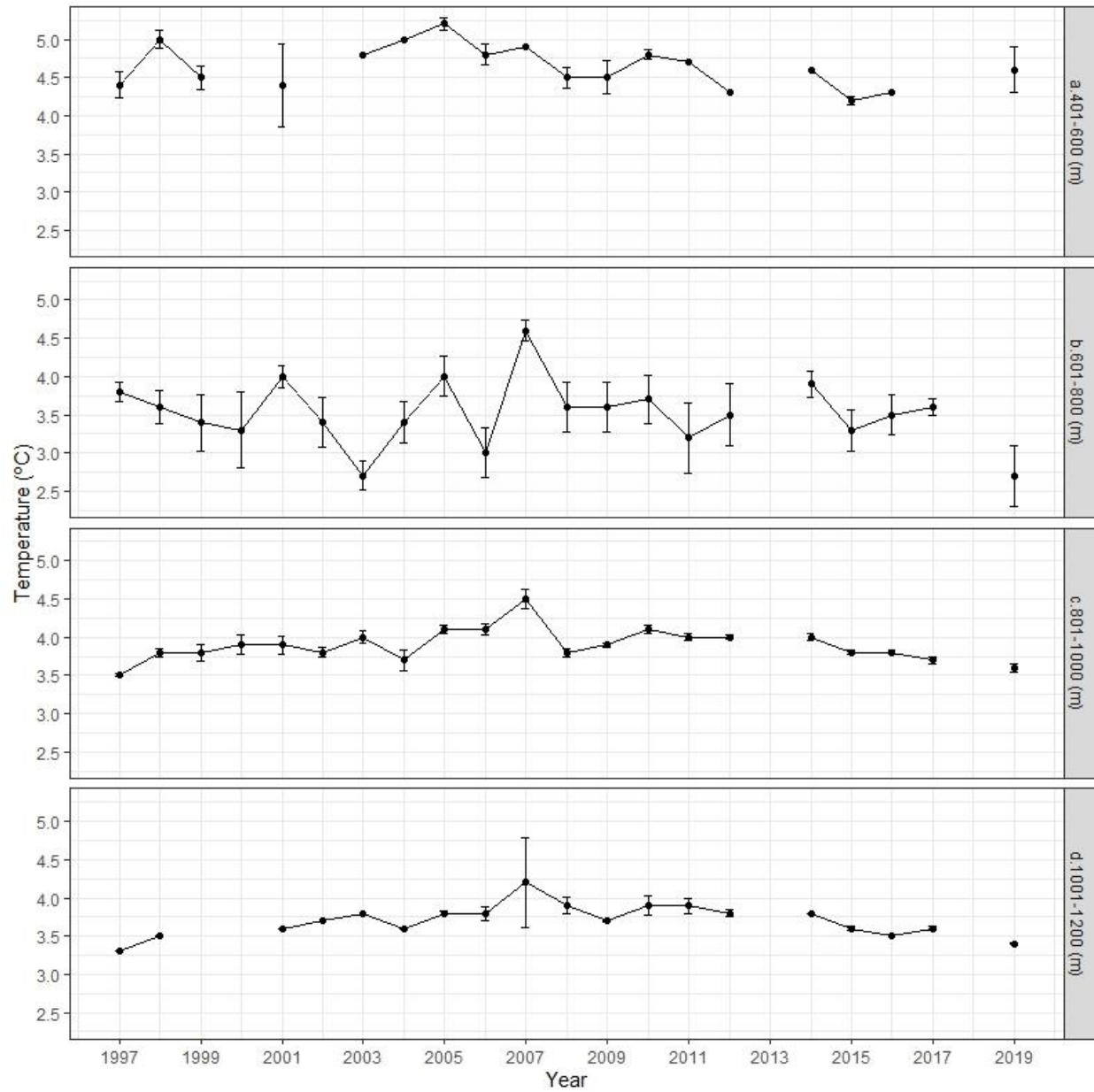
**Figure 16.** Deep-sea redfish biomass (tons) calculated by swept area method in tons and +/- S.E. by year for the period 1997-2019. In 2013, only the Division 1D was surveyed.



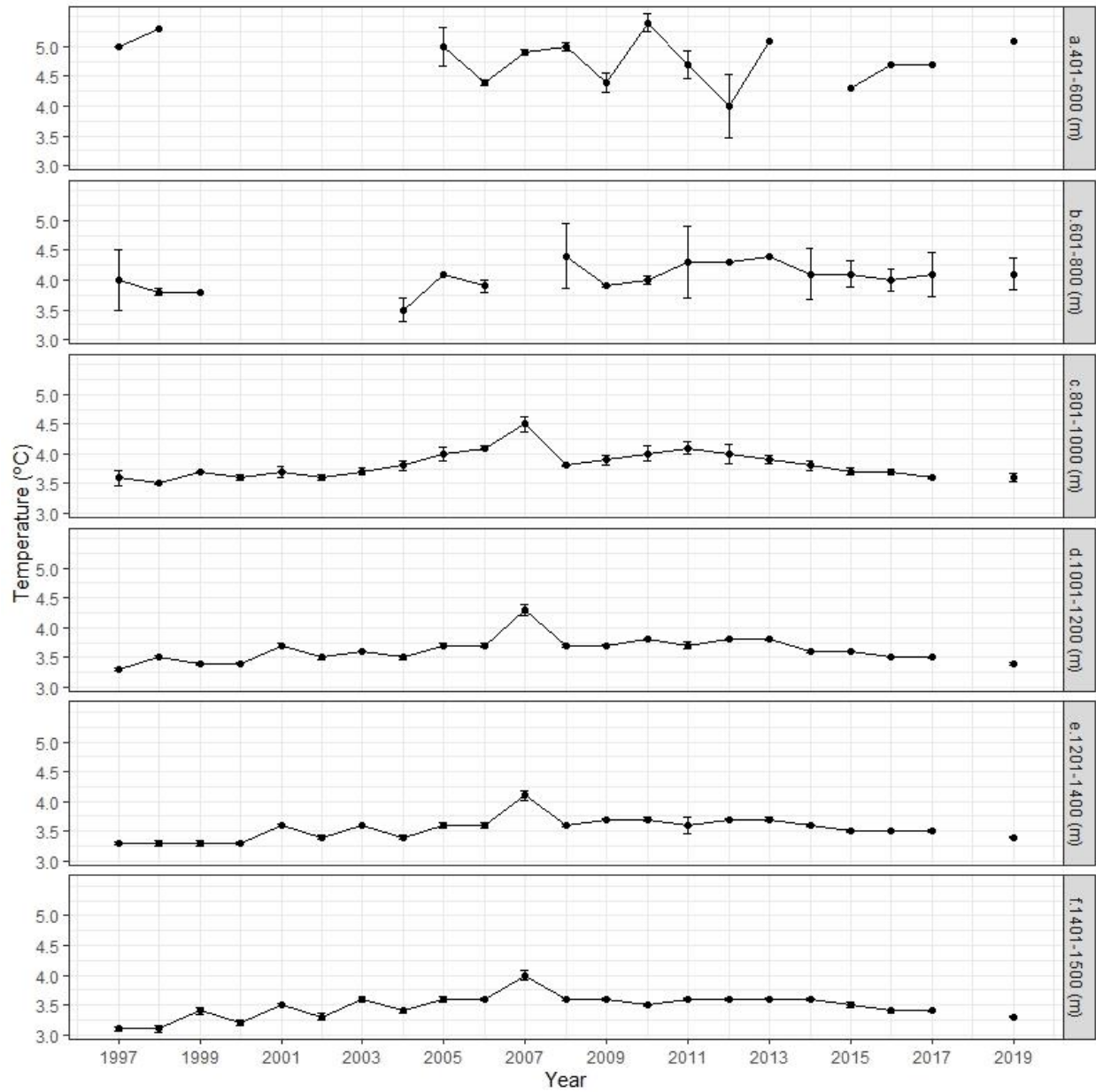
**Figure 17.** Deep-sea redfish abundance calculated by swept area method in ('000s) and +/- S.E. by year for the period 1997-2019. In 2013, only the Division 1D was surveyed.



**Figure 18.** Deep-sea redfish length distribution (cm) in numbers ('000s) per swept area, on NAFO 1CD: 1997-2019. In 2013, only the Division 1D was surveyed. 1997-2017 onboard R/V Paamiut (grey) and 2019 onboard Helga Maria (red).



**Figure 19.** Mean temperatures with S.E. in NAFO division 1C by depth and stratum for the period 1997-2017.



**Figure 20.** Mean temperatures with S.E. in NAFO division 1D by depth and stratum for the period 1997-2019.

**Appendix 1.** Catch weight and numbers (not standardized to kg/km<sup>2</sup>) of Greenland halibut, roundnose and roughhead grenadier and deep-sea redfish, by haul, in 2019. Depth in meters, swept area in km<sup>2</sup> and bottom temperature in °C.

St. No	Swept Area	Division	Depth	Bottom Temp.	Greenland halibut ( <i>Reinhardtius</i> )		Roundnose grenadier ( <i>Coryphaenoides</i> )		Roughhead grenadier ( <i>Macrourus berglax</i> )		Deepwater redfish ( <i>Sebastes mentella</i> )	
					Weight (kg)	Number	Weight (kg)	Number	Weight (kg)	Number	Weight (kg)	Number
1	0.0764	ID	464.5	-	48	63	1	2	1.3	4	1.4	5
2	0.0782	ID	1413.5	3.33	1.9	2	0.3	1	10.9	8	0	0
4	0.0811	ID	1284.5	3.35	41.5	22	4.9	16	7.9	18	0	0
6	0.0638	ID	1080	3.35	19.7	16	4.4	34	13	27	0	0
7	0.0735	ID	1141.5	3.39	18.6	15	1.6	6	0.7	2	0	0
8	0.071	ID	1088	3.36	67	37	1.7	8	4.3	6	0	0
9	0.0792	ID	1110	3.39	137.7	103	2.8	17	9.9	25	0	0
10	0.0711	ID	1223.5	3.34	65.5	46	3.9	12	8.7	17	0	0
11	0.0394	ID	1341.5	3.35	24.7	19	1	3	6.2	11	0	0
13	0.0742	ID	1220.5	3.34	43.5	27	3.2	10	8	15	0	0
14	0.077	ID	1201.5	3.41	122.9	81	0.8	8	7.3	6	0	0
16	0.0719	ID	1299.5	3.33	137.8	97	0.9	5	15.6	33	0.5	1
17	0.0767	ID	1167	3.4	104.1	65	0.3	3	11.5	16	0	0
18	0.0708	ID	1431	3.35	37.4	16.3	3.6	11	10.4	13	0	0
19	0.078	ID	1261.5	3.36	125.7	82	6.7	19	7.7	13	0	0
21	0.0769	ID	1451	3.33	75.9	51	1.2	6	3.9	3	0	0
23	0.0755	ID	1314	3.43	99.1	75	0.3	3	5.2	8	0	0
24	0.0711	ID	1342	3.4	24.4	18	0.8	4	2.8	9	0	0
25	0.0931	ID	1187	3.5	55.1	39	0	1	0.1	1	0	0
26	0.0757	ID	967	3.52	140	117	0.1	2	2.8	5	0	0
27	0.0763	ID	1027.5	3.46	139.3	95	0.2	2	5.4	11	0.4	1
29	0.0749	ID	1100.5	3.47	201.9	150	0.6	3	7.5	15	0	0
31	0.0802	ID	1210.5	3.44	126.2	99	0.6	4	8.7	9	0.4	1
33	0.0766	ID	1447	3.36	58.6	40	1.3	8	7.8	7	0	0
34	0.0795	ID	1269.5	3.39	73.5	58	2.3	10	7.8	3	0	0
36	0.0826	ID	1064	3.45	60.2	50	1.5	11	6.3	13	0	0
37	0.0795	ID	916.5	3.68	81.4	67	0.3	3	3.6	8	0	0
38	0.0816	ID	743.5	3.85	41	31	1.2	13	5.1	18	2	5
40	0.0833	IC	726.5	3.63	128.7	115	0.7	3	1.8	10	4.3	11
41	0.076	IC	780.5	3.74	179.6	171	0.6	5	2.5	6	3.2	8
43	0.0811	IC	844.5	3.62	126.2	109	0.9	3	2.1	5	0	0
44	0.0801	IC	823	3.63	117.8	107	0	0	2.2	11	0	0
45	0.0797	IC	812.5	3.48	105.7	87	0.2	2	0.7	5	0	0
46	0.0817	IC	755.5	3.3	125	109	0	0	5.6	12	0	0
48	0.0794	IC	659.5	1.31	101.9	87	0	0	2.8	16	2.1	5
50	0.0814	IC	605.5	1.28	71.1	99	0	0	0.9	3	1.2	3
52	0.0831	IC	667	1.29	47.9	67	0	0	4.3	15	2.5	6
53	0.0797	IC	668	1.04	58.1	89	0	0	2.5	14	0.8	2
54	0.077	IC	487	4.87	6.1	9	0	0	1.1	6	10.1	36
56	0.0791	IC	727	3.61	113.6	113	0.8	18	6.9	11	22.2	39
57	0.079	IC	598	4.27	22.1	17	0.4	6	4.5	11	163.8	289.4
58	0.0802	IC	718	3.81	99.7	103	0	0	0.7	5	3.9	7
60	0.0805	IC	831.5	3.68	267.9	231	0	0	1.9	9	7.5	16
61	0.0772	IC	831	3.76	216.1	168	0	0	0.9	6	1.4	2
62	0.0771	IC	867.5	3.66	185.7	136	0.8	6	6.4	12	0	0
63	0.0787	IC	750.5	3.83	202.8	151	1.4	35	3.2	10	18.1	28
65	0.0773	IC	903.5	3.5	335.7	254.2	1.1	5	2.2	8	0	0
66	0.0821	IC	929.5	3.5	599.2	504	1.2	6	4.8	15	0	0
68	0.078	IC	984.5	3.47	301.8	224	0.9	7	6.2	16	0	0
70	0.0823	IC	921.5	3.65	64.7	55	0	1	0.6	2	0	0
71	0.075	IC	970.5	3.65	481.5	308.9	1.2	26	10.4	32	1	2
73	0.083	IC	1059.5	3.37	331.8	228	2	16	9.3	28	0	0
74	0.0808	IC	1099	3.39	155.2	100	1.5	9	2.2	9	0	0
75	0.0718	IC	969	3.39	263.1	140.3	1.2	10	10.2	29	1.2	2
76	0.0831	IC	863	4.03	134.3	105	4	94	5.8	15	3	5
78	0.0781	ID	1019.5	3.67	299.9	196	2.7	19	3.7	9	0	0
79	0.0819	ID	1142.5	3.41	276.6	177	3.1	9	4.2	8	0	0
80	0.0786	ID	1109.5	3.38	282.5	173	5	19	13.9	36	0	0
82	0.085	ID	964	3.38	285.4	193	1.1	6	8.5	15	0.8	2
83	0.0743	ID	889	3.64	120.7	63	0.1	2	6.3	17	0	0
84	0.0828	ID	1017.5	3.47	347.9	249.8	2.2	11	12.5	38	0.4	1
85	0.0828	ID	1158	3.4	255.8	202	0.9	6	13.5	26	0	0
87	0.081	ID	1045.5	3.47	267	189	0.2	6	9.2	18	0	0
88	0.0806	ID	1090.5	3.38	429.2	291	1.4	9	9	27	0	0
90	0.0416	ID	1185	3.41	96.7	69	1.9	7	3.8	7	0	0
91	0.0766	ID	1215.5	3.39	41.5	30	0	1	2.6	4	0	0
92	0.0761	ID	1149.5	3.37	80.4	59	0.2	2	1.5	6	0	0
94	0.0764	ID	1066.5	3.36	48.8	36	0.2	3	7.8	17	0	0
95	0.0684	ID	672.5	4.39	4.1	2	3.1	10	9.4	13	120.2	298.7
96	0.0759	ID	417.5	5.06	0	0	0.4	1	7.4	14	254.6	569.8



**Appendix 2.** List of species and groups of species recorded in NAFO Division 1CD in 2019 with observed maximum catch weight (kg), maximum per tow, minimum and maximum depth (m), minimum and maximum bottom temperature (°C) and most northern observation, respectively.

Obs	Code	Species	max. Weight(kg)	max. Number	min. Depth(m)	max. Depth(m)	min. Bottom temp.	max. Bottom temp.	max. NorthPosition
1	ALA	Alepocephalus agassizii	110.9	0	1066	1451	3.4	3.3	64.1692
2	ALB	Alepocephalus bairdii	0.4	0	418	1224	5.1	3.3	65.5143
3	RJJ	Amblyraja jenseni	11.6	0	1431	1431	3.3	3.3	63.2879
4	RRD	Amblyraja radiata	0.4	0	487	487	4.9	4.9	65.8840
5	CAD	Anarhichas denticulatus	25.5	0	418	1451	5.1	0	65.2480
6	CAA	Anarhichas lupus	17.8	0	1064	1064	3.5	3.5	63.9514
7	CAS	Anarhichas minor	0.7	0	667	667	1.3	1.3	66.1284
8	ANC	Anoplogaster cornuta	0.1	0	930	1216	3.5	3.4	64.6356
9	ANT	Antimora rostrata	27	0	756	1451	3.7	3.3	64.8815
10	APL	Apristurus laurussonii	2.7	0	1284	1284	3.3	3.3	63.1941
11	ARZ	Arctozenus risso	0.3	0	464	1088	4.4	0	65.7838
12	ARS	Argentina silus	7.5	0	418	598	5.1	4.3	65.8840
13	BAM	Bajacalifornia megalops	0.3	0	922	1342	3.7	3.3	64.3809
14	BAT	Bathylagus euryops	10.5	0	718	1451	4	3.3	65.5143
15	BSP	Bathyraxia spinicauda	11.8	0	598	831	4.3	3.8	65.2480
16	BHF	Bathysaurus ferox	0.9	0	1262	1262	3.4	3.4	63.4471
17	BEG	Benthosema glaciale	0.1	0	464	1451	4.4	0	66.1284
18	POC	Boreogadus saida	0	0	660	660	1.3	1.3	65.1932
19	BOA	Borostomias antarcticus	0.5	0	726	1342	3.8	3.3	64.9905
20	USK	Brosme brosme	3.7	0	418	672	5.1	4.4	64.2350
21	CFB	Centroscyllium fabricii	42.7	0	487	1300	4.9	1	65.8840
22	CHO	Ceratias holboellii	0.6	0	1414	1414	3.3	3.3	63.0985
23	CHA	Chauliodus sloani	0.2	0	744	1451	3.8	3.3	64.9905
24	CHH	Chiasmodon harteli	0	0	418	1431	5.1	3.3	64.7461
25	CHN	Chiasmodon niger	0	0	660	1447	3.7	1.3	65.1932
26	CGR	Coryphaenoides guentheri	2.8	0	1060	1451	3.5	3.3	64.3290
27	RNG	Coryphaenoides rupestris	6.7	0	418	1451	5.1	0	65.5143
28	COM	Cottunculus microps	0.3	0	726	1142	3.6	3.3	65.5143
29	COT	Cottunculus thomsonii	1.6	0	969	1167	3.4	3.3	64.3456
30	CYB	Cyclothone braueri	0	0	1066	1216	3.4	3.4	63.9916
31	CLM	Cyclothone microdon	0	0	672	1414	4.4	3.3	64.6356
32	DPK	Dolopichthys longicornis	0.1	0	964	964	3.4	3.4	64.0854
33	EUR	Eurypharynx pelecanoides	0.1	0	1060	1447	3.4	3.3	64.3290
34	COD	Gadus morhua	6.8	0	418	487	5.1	0	65.8840
35	ONA	Gaidropsarus argentatus	0.4	0	930	1451	3.5	3.3	64.6356
36	ONN	Gaidropsarus ensis	2.1	0	606	1447	3.6	1	66.1284
37	GOF	Gonatus fabricii	0	0	464	464	0	0	63.4880
38	GST	Gonatus steenstrupi	0	0	464	464	0	0	63.4880
39	GOS	Gonostoma sp.	0.1	0	1300	1300	3.3	3.3	63.6105
40	PLA	Hippoglossoides platessoides	4.8	0	464	970	4.9	0	65.8840
41	HOA	Holbyrnia anomala	0.3	0	718	1447	3.8	3.3	65.2370
42	HAF	Hydrolagus affinis	23	0	1220	1451	3.4	3.3	63.6063
43	LMC	Lampanyctus macdonaldi	7.8	0	464	1451	4.4	0	66.1284
44	LEP	Lepidion eque	0.5	0	672	1066	4.4	3.4	64.7461
45	LIK	Liparis fabricii	0	0	606	667	1.3	1.3	66.1284
46	LOA	Lophodolos acanthognathus	0	0	930	930	3.5	3.5	64.6356
47	LYN	Lycodes eudipleurostictus	0	0	606	606	1.3	1.3	65.7838
48	ELZ	Lycodes sp.	0.4	0	1110	1110	3.4	3.4	64.2407
49	RHG	Macrourus berglax	15.6	0	418	1451	5.1	0	66.1284
50	MAL	Malacosteus niger	0.1	0	780	1099	3.7	3.4	64.6655
51	MAM	Maulisia maui	0.1	0	1224	1224	3.3	3.3	63.3205
52	MWM	Melamphaes microps	0	0	1060	1142	3.4	3.4	64.3290
53	WHB	Micromesistius poutassou	0.2	0	418	418	5.1	5.1	64.2350
54	BLI	Molva dypterygia	1.6	0	487	598	4.9	4.3	65.8840
55	NAT	Nannobrachium atrum	0	0	868	1064	3.7	3.5	64.8664
56	NY1	New Species No 1	0	0	1060	1088	3.4	3.4	64.3290
57	NOT	Notacanthus chemnitzii	6	0	598	1451	4.4	1.3	65.2480
58	NOK	Notoscopeus kroyeri	4.8	0	418	1142	5.1	1	66.1284
59	ONE	Oneirodes eschrichtii	0.6	0	1451	1451	3.3	3.3	63.5493
60	OND	Oneirodes sp.	0.1	0	984	984	3.5	3.5	64.5248
61	PAC	Paraliparis copei	0.1	0	1431	1431	3.3	3.3	63.2879
62	PAG	Paraliparis garmani	0	0	464	823	3.6	0	65.5143
63	AFI	Pisces	0	0	1210	1210	3.4	3.4	63.8238
64	POL	Polyacanthonotus rissoanus	0.5	0	916	1431	3.7	3.3	64.0184
65	PSN	Pseudosn. sp.	0	0	756	756	3.3	3.3	64.8815
66	RBI	Raja bigelowi	0.8	0	1080	1167	3.4	3.3	63.4453
67	SKA	Raja sp.	0.3	0	916	916	3.7	3.7	64.0184
68	RBT	Rajella bathyphila	23.6	0	1224	1431	3.3	3.3	63.3205
69	RFL	Rajella fyllae	0.5	0	606	1080	3.8	1	65.7838
70	GHL	Reinhardtius hippoglossoides	599.2	0	464	1451	4.9	0	66.1284
71	SCO	Scopelosaurus lepidus	4.2	0	744	1447	4	3.3	65.0077
72	REB	Sebastes mentella	254.6	0	418	1300	5.1	0	66.1284
73	REG	Sebastes norvegicus	2.3	0	464	756	3.3	0	64.8815
74	SER	Serrivomer beanii	0.5	0	726	1451	3.8	3.3	64.8815
75	REJ	Shrimp	3	0	464	1414	3.3	0	66.1284
76	GOB	Sigmops bathyphilus	0	0	823	1431	3.6	3.3	64.5463
77	STO	Stomias boa	0.1	0	726	1224	3.7	3.3	64.7428
78	SYN	Synaphobranchus kaupii	1.5	0	844	1447	4	3.3	64.8664
79	TRA	Trachyrincus murrayi	1.4	0	744	1110	3.8	3.3	64.6356
80	XEC	Xenodermichthys copei	0	0	1210	1210	3.4	3.4	63.8238



**Appendix 3:****Grønlands Naturinstitut**

Greenland Institute of Natural Resources

R/V Paamiut

OYZC – GR6-251 MMSI 331 102 00 engine.paamiut@gmail.com

**Statement regarding using M/Tr Helga Maria to carry out the same surveys as R/V Paamiut for 2019**

In November 2017 R/V Paamiut failed to comply with DNVGL standards for working in Arctic waters. The management of Greenland Institute of Natural Resources (GN) decided not to spend more money on the vessel, but to go for building a new ship.

For the 2019-season, GN decided to charter Helga Maria, a Islandic trawler of almost same dimensions as Paamiut, doing the normal surveys on the Greenland west coast and Canada east coast.

To make the surveys as identical as possible this equipment was used from R/V Paamiut:

Alfredo trawls with 96 mtr bridles, as with R/V Paamiut

Cosmos trawls with 48 mtr bridles, as with R/V Paamiut

- All other equipment, such as bridles ,gear etc.

- Doors

- Marport sensors on doors and headline

Other steps taken ensuring the validity of received data:

- The wires/warps on Helga Maria were same dimension (26mm) as used on Paamiut

- The distance between the hanging blocks was the same

- The Marport equipment on the bridge was set up and calibrated as on Paamiut

- All data from the tows were logged as normal procedure on Paamiut

- Skipper on Paamiut (Jakup G.Mikkelsen) and Chief Engineer Kari Hansen was on Island ,used 14 days onboard Helga Maria, before departure to Greenland, to prepare and make the right arrangement on deck and factory for trawl equipment, and what else the Scientifics need, to make the surveys as simular as possible compare with R/V Paamiut. Skipper Jakup G.Mikkelsen also was onboard for one month, working on the bridge and deck as supervisor, taking care of that all of the trawling and equipment was carried out as on Paamiut

- Crew from Paamiut worked together with the rest of the crew, ensuring that all maintenance of trawls etc. were carried out exactly as normal

To our best conviction regarding comparison, the surveys were executed in the best possible way, and we have absolutely no thoughts that this could be done otherwise or better.

Best regards

Jakup G Mikkelsen

Captajn

Kari Hansen

Chief Engineer I

*Jakup G. Mikkelsen*