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Survey for Greenland Halibut in NAFO Divisions 1C-1D, 2016

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Abstract

Greenland initiated a survey series in 1997covering NAFO Divisions 1CD at depths between 400 and 1 500 m. The survey is designed as a Stratified Random Bottom Trawl Survey aimed primarily at Greenland halibut and roundnose grenadier. The paper gives biomass and abundance estimates and length frequencies for Greenland halibut, roundnose and roughhead grenadier, and deep sea redfish together with information on bottom temperatures and a list over recorded fish species. In 2016 all 70 planned were conducted. The biomass and abundance of Greenland halibut has been decreasing gradually since 2011 but increased again in 2015 to a level somewhat about average and stayed at that level in 2016. The length distribution had a mode around 51 cm. The biomass of roundnose grenadier was low and is still at a very low level compared to the level seen in the 80'ies. The biomass and abundance estimates of deep sea redfish was about the half of the 2014 estimate, but still above the level seen until 2008.

Introduction

During 1987-1995 Japan Marine Fishery Resources Research Center (JAMARC) and Greenland Institute of Natural Resources jointly conducted 12 bottom trawl surveys (Jørgensen, 1998a) at depths down to 1500 m and four pelagic surveys (Jørgensen, 1997a) at West Greenland 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 Greenland Institute of Natural Resources continued the bottom trawl surveys series with the Institute's own vessel PAAMIUT that had been rigged for deep sea trawling. There has unfortunately not been any comparative trawling between the Japanese research vessel SHINKAI MARU and PAAMIUT making comparisons between the surveys difficult. The PAAMIUT survey traditionally covers NAFO Div. 1CD, but in 2001 the survey area was expanded to include Div. 1A (to 74°N) and Div. 1B and in 2004 the northern part of the Baffin Bay (73°N-77°N) (Div. 1A) was surveyed. In 2010 Div.1A was surveyed to 75.30°N (SCR 11/010). In 2013 the survey only covered Div. 1D.

Materials and Methods

The survey in 2016 covered Div. 1CD at depths between 400 and 1500 m, and took place during August 31 – September 15.

Stratification

The survey covered NAFO Div. 1CD between the 3-nm line and the midline to Canada at depths between 400 and 1500 m. The survey area was stratified in NAFO divisions and subdivided 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" (Table 2).

The survey was planned as a Stratified Random Bottom Trawl Survey with in total 70 hauls. Each stratum was allocated at least two hauls. The remaining hauls were allocated in order to minimize the variance in the estimation of the biomass of Greenland halibut. *i.e.* strata with great variation in the catches of Greenland halibut in the previous years surveys have got relatively more hauls than strata with little variation in the catches. In 2004 a new method of selecting stations was introduced. The method combines the use of a minimum between-stations-distance rule (buffer zone) with a random allocation scheme (Kingsley et al. 2004). The sea bed in Div. 1D stratum 601-800 m is muddy and soft and is generally not suitable for trawling hence trawling is done on 3 fixed stations.

Vessel and gear

The survey is conducted by the 722 GRT trawler PAAMIUT, using 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 rock hopper type. The trawl doors are Greenland Injector weighing 2 700 kg. The Injector otter doors replaced the Perfect doors that have been used until 2003. The average net height was 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 new doors. Further information about trawl and gear is given in Jørgensen, 1998b.

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

distance between outer bobbins = 10.122 + 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 temperatures were measured, by 0.1^{o}C, by a Seastar sensor mounted on one of the otter doors.

Trawling procedure

Towing time was usually 30 min, but towing time down to 15 min was accepted. Average towing speed was 3.0 kn. Towed distance was estimated from the start and end positions of the haul. Trawling took place arund the clock.

Handling of the catch

After each haul the catch was sorted by species and weighed and the number of specimens recorded. Most fish species were sexed and measured as total length (TL) to 1.0 cm below. Grenadiers were measured as pre anal fin length (AFL) to 1.0 cm below. 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^2 swept prior to further calculations.

In strata with one haul only SD was estimated as: SD= biomass or abundance.

Results and Discussion

In total 70 successful hauls were made and all depth strata were covered. Haul by haul information on catches of Greenland halibut, roundnose grenadier, roughhead grenadier, deep sea redfish, depth, temperature etc. is given in Appendix 1 and the distribution of hauls by strata is given in Table 2.

In total 71 species or groups of fish species were recorded (Appendix 2).

Greenland halibut (*Reinhardtius hippoglossoides*)

Greenland halibut was caught in all hauls except one (Fig. 1, Appendix 1) and the biomass in Div. 1CD 400-1500 m was estimated at 76 629.9 tons which is a minor decrease from 78 445.5 tons in 2015 (Table 1 and Fig. 2) and the biomass is still at a level slightly above the average of the time series (71 000 tons). The gradual decrease in biomass seen from 2011 to 2014 seems to have ended.

The survey in 2013 only covered Div. 1D and the biomass (and abundance) in Div. 1C has been estimated by an GLM (model: lnbiomass= year*division) using data from 2010-2014 where the distribution of the biomass has been rather stable with 63-69% of the biomass found in Div. 1D. The 1CD biomass and abundance in 2013 was estimated to 64 049.0 tons and $51.160*10^6$, respectively.

The highest densities (in weight) was found at 1000-1200 m and 801-1000 in Div. 1C (2.5 - 2.3 tons km^{-2}) (Table 2, Fig. 3). The weighted mean catch per tow has shown a gradual decrease from the record high 1.66 tons km^{-2} in 2011 to 1.12 km^{-2} in 2014 (Table 1. Fig. 4). The decreasing trend was reversed in 2015 where the mean catch per tow was estimated at 1.50 tons km^{-2} and the mean catch remained at that level in 2016 (1.47 tons km^{-2}) .

The abundance in 2016 was estimated at 59.677 $*10^6$ which is a minor decrease compared to 2015 $61.620*10^6$ (Table 1). The abundance estimate in 2016 was slightly below the average of the time series ($65.000*10^6$). The highest abundance was found in between 600-800 m in Div. 1C and 1000 and 1200 m in Div. 1D and the highest densities (in number) were found in Div. 1C 1000-1200 m (Table 3).

Estimated abundance by age in Div. 1CD is given in Table 4 (not updated in 2016, because the otolith reading procedure is under revision).

The length ranged from 12 cm to 109 cm, except from a few larvae < 9 cm. The overall length distribution (weighted by stratum area) was dominated by a mode at 50-52 cm (Fig. 6). The overall length distribution has throughout the years been dominated by a single distinct mode at 48-52 cm. Generally the length distributions in the different depth strata were dominated by a single mode and fish size increased with depth (Fig. 7) as seen in previous surveys (Jørgensen, 1997b).

Table 1. Biomass (tons), mean catch per tow (tons) standardized to km^2 and abundance of Greenland halibut in Div. 1CD and with S.E. The biomass and abundance in Div. 1C in 2013 is estimated by a GLM including data from 2010-2014.

Year	Biomass	S.E.	Mean	S.E.	Abundance (*10^6)	S.E.	Biomass Div. 1D
1997	56260.2	4399.6	1.07	0.08	53.613	4.118	45750.5
1998	70473.5	8391.7	1.34	0.16	67.677	7.687	53232.0
1999	64398.0	6912.1	1.27	0.14	61.366	6.265	52461.4
2000	59092.4	5543.3	1.28	0.11	61.710	5.976	47927.7
2001	77554.0	13013.6	1.57	0.26	80.814	14.221	51895.3
2002	71932.4	5613.9	1.56	0.12	71.510	6.223	60511.3
2003	68717.2	6411.9	1.39	0.13	72 556	7.764	48696.6
2004	75869.4	5186.3	1.48	0.10	74.859	5.445	51070.6
2005	80865.4	8365.7	1.54	0.16	73.001	7.317	62832.7
2006	77010.3	6259.6	1.47	0.12	70.715	5.622	54449.3
2007	74356.8	9455.4	1.48	0.19	67.427	8.492	60186.2
2008	83465.4	5456.3	1.60	0.10	72.804	5.334	60364.8
2009	70966.2	5110.3	1.36	0.10	62.507	4.419	53243.2
2010	75522.5	5382.4	1.44	0.10	64.868	5.389	50343.3
2011	86591.4	5210.4	1.66	0.10	74.978	4.723	60331.0
2012	64948.8	7379.3	1.24	0.14	54.271	6.815	42370.6
2013	64049.0		1.22		51.160		42376.7
2014	58424.6	4117.7	1.12	0.08	44,773	3.246	36634.2
2015	78445.5	6612.8	1.50	0.13	61.620	6.072	43739.3
2016	76629.9	4810.86	1.47	0.09	59.677	3.730	47417.3

Table 2. Mean catch per km^2 and biomass (tons) with Standard Error of Greenland halibut in Division 1CD by depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Biomass	SE
1C	401-600	3366	2	0.0485	163.4	163.4
	601-800	16120	9	0.8519	13732.3	2840.7
	801-1000	6066	13	2.2683	13759.8	2156.7
	1001-1200	611	2	2.5485	1557.1	301.9
1D	401-600	903	2	0.4136	373.5	292.8
	601-800	1940	3	0.7043	1366.4	425.5
	801-1000	3874	4	1.5656	6065.3	1370.8
	1001-1200	10140	19	2.0631	20919.9	2263.5
	1201-1400	6195	12	2.0668	12804.0	964.9
	1401-1500	3091	4	1.9050	5888.2	1450.6
All				1.4650	76629.9	4810.8

Table 3. Mean catch per km^2 and abundance with Standard Error of Greenland halibut in Division 1CD by depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Abundance	SE
1C	401-600	3366	2	33.0	111166.1	111166.1
	601-800	16120	9	884.3	14255052.1	2370867.7
	801-1000	6066	13	1773.7	10758982.3	1663669.2
	1001-1200	611	2	1663.0	1016067.9	389839.3
1D	401-600	903	2	517.9	467661.1	444862.3
	601-800	1940	3	456.2	884942.9	354935.9
	801-1000	3874	4	1210.7	4690357.9	1036099.0
	1001-1200	10140	19	1404.2	14239014.3	1563710.6
	1201-1400	6195	12	1478.9	9161637.2	739890.1
	1401-1500	3091	4	1323.9	4092073.0	979505.4
All				1140.9	59676954.8	3728616.9

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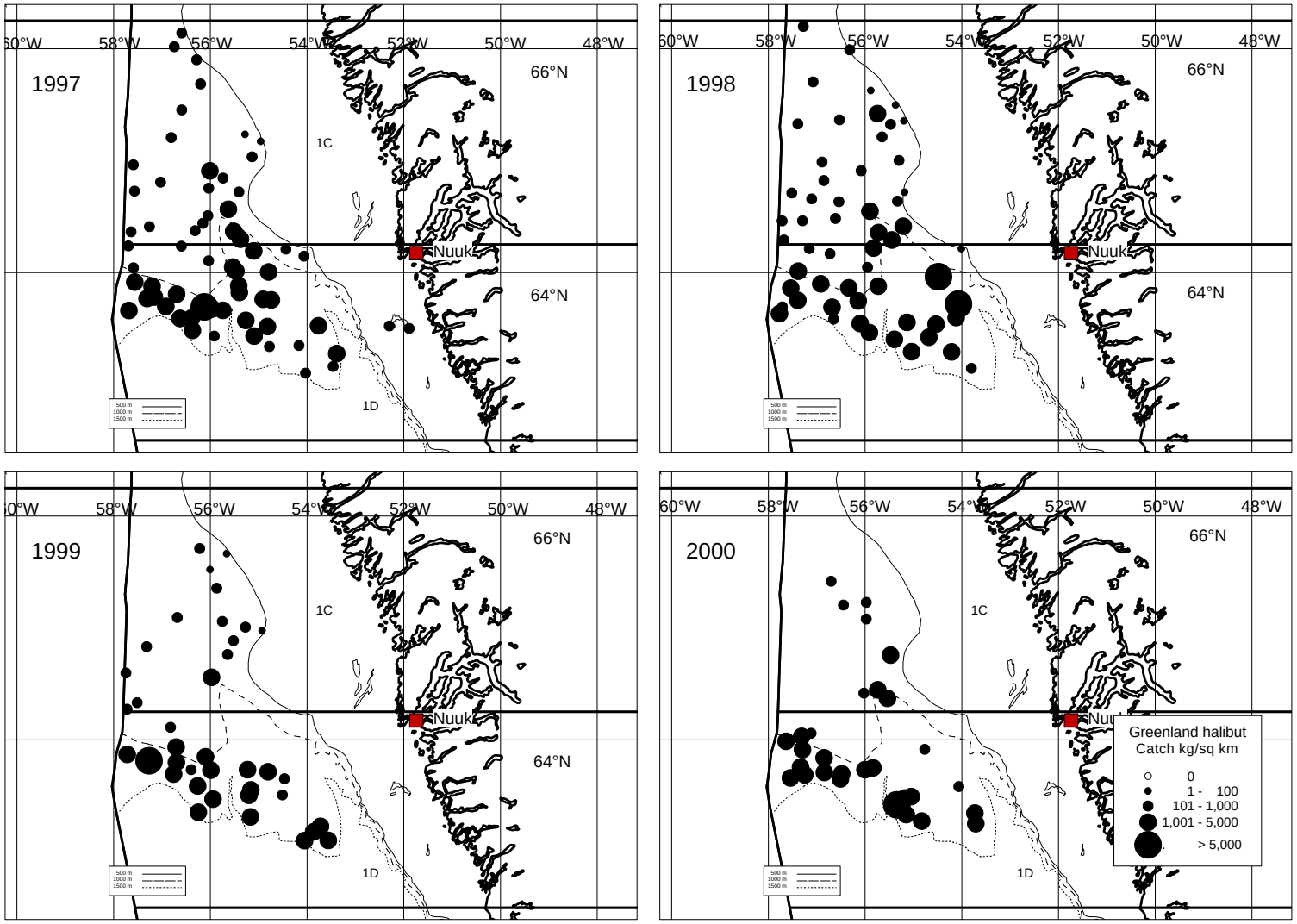

Fig. 1. Distribution of catches of Greenland halibut during 1997-2000 in kg/km^2.

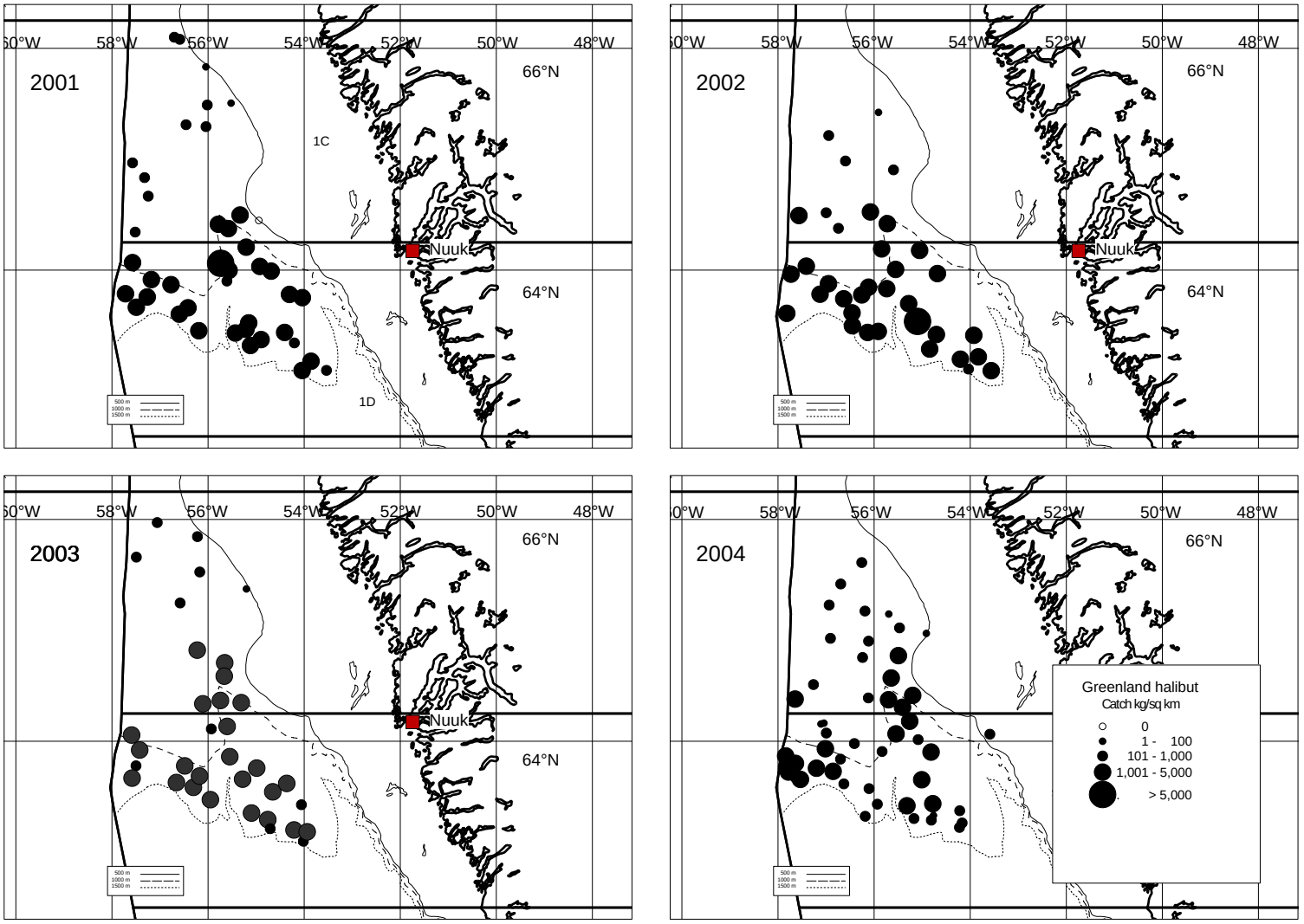

Fig. 1. (cont). Distribution of catches of Greenland halibut in 2001 - 2004 in kg/km^2

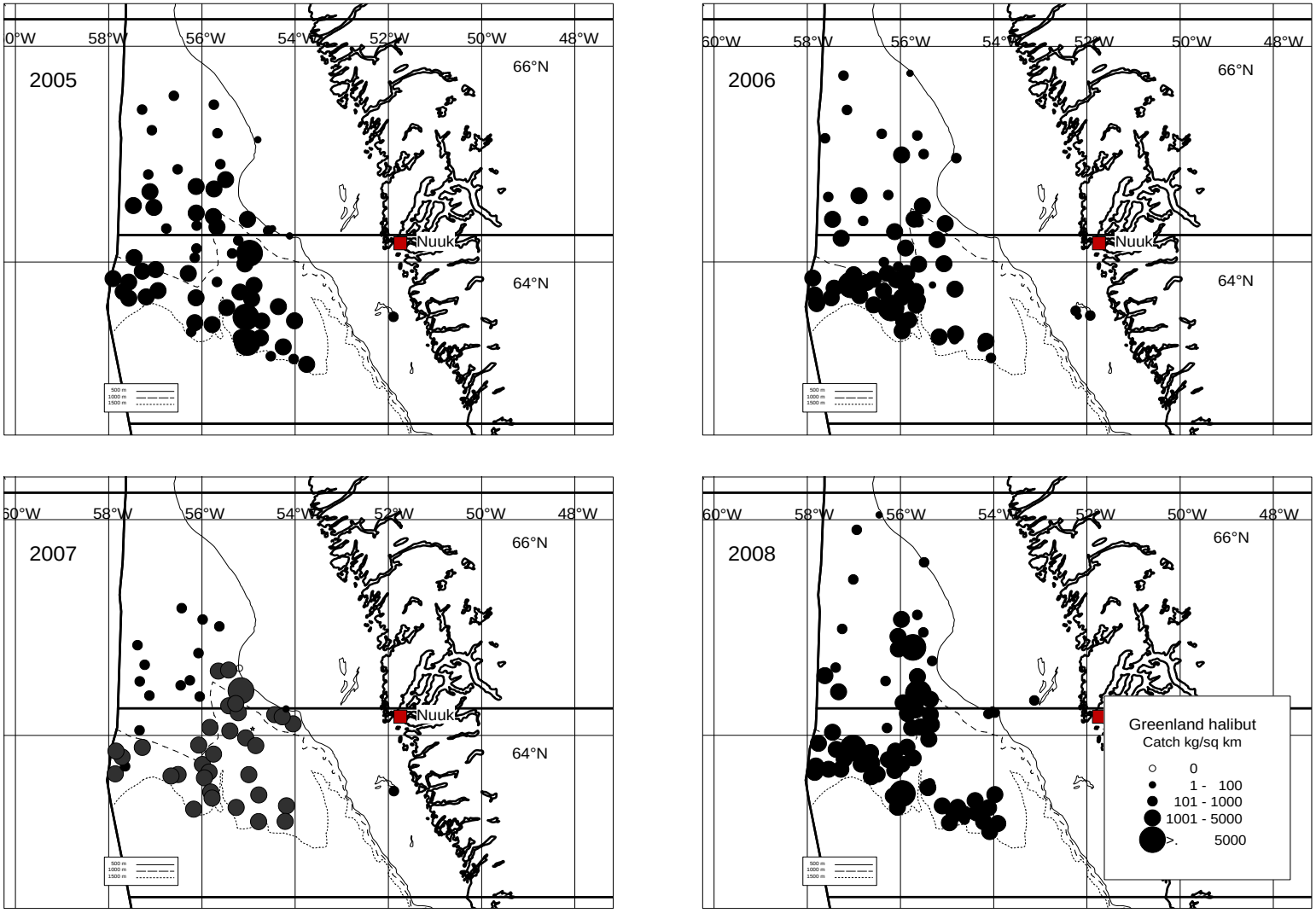

Fig. 1. (cont). Distribution of catches of Greenland halibut in 2005 - 2008 in kg/km^2

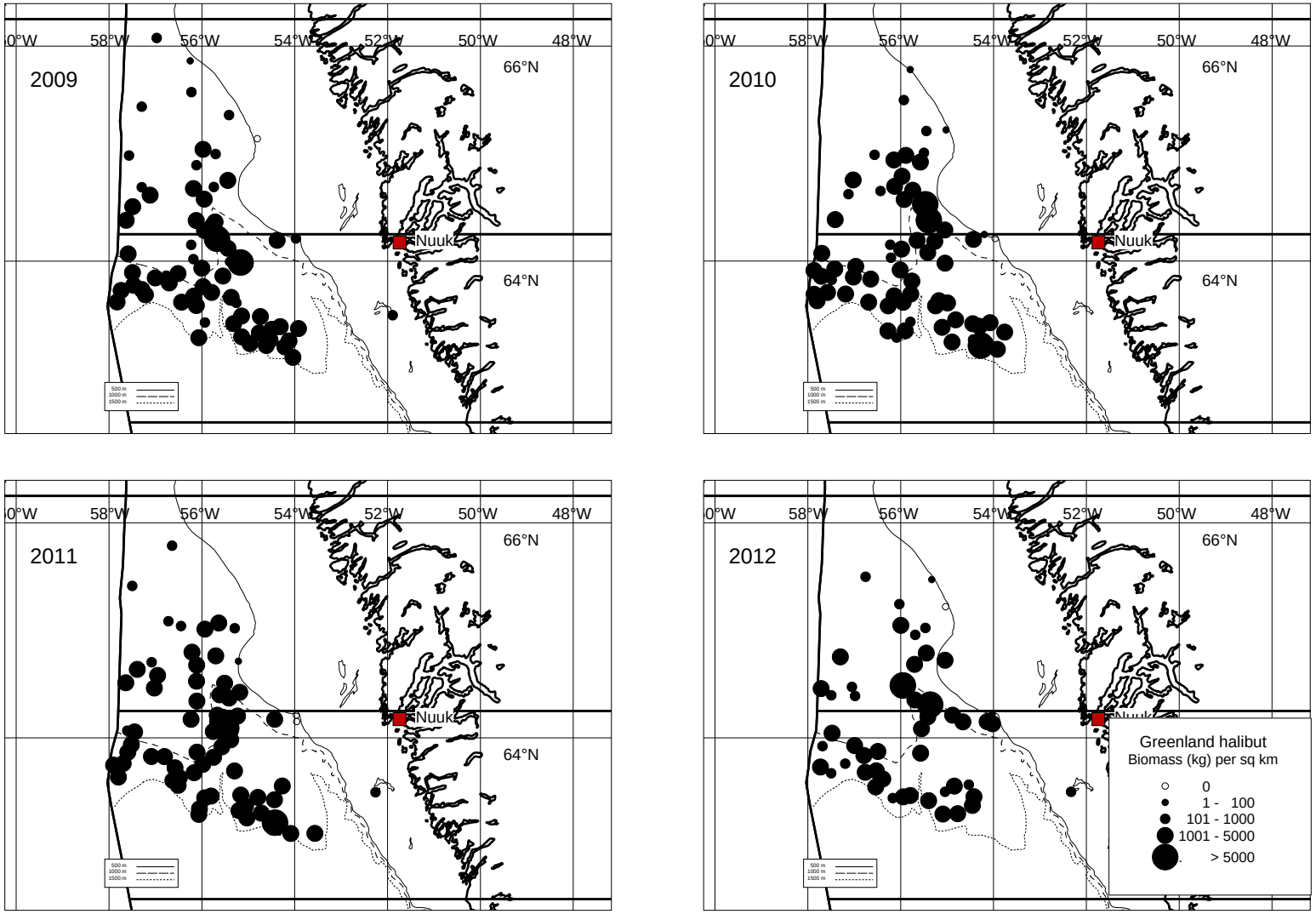

Fig. 1. (cont). Distribution of catches of Greenland halibut in 2009 - 2012 in kg/km^2

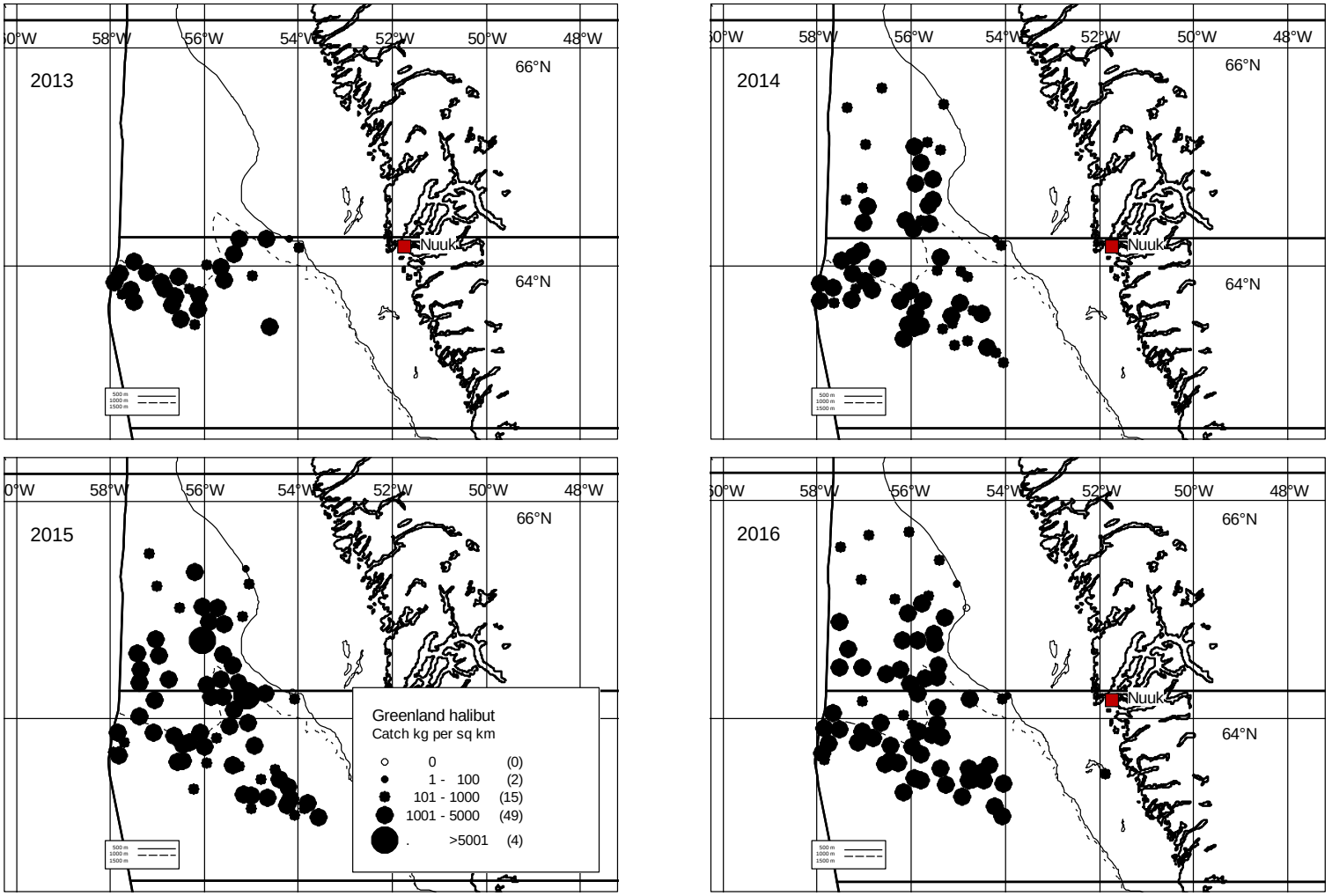

Fig. 1. (cont). Distribution of catches of Greenland halibut in 2013 - 2016 in kg/km^2

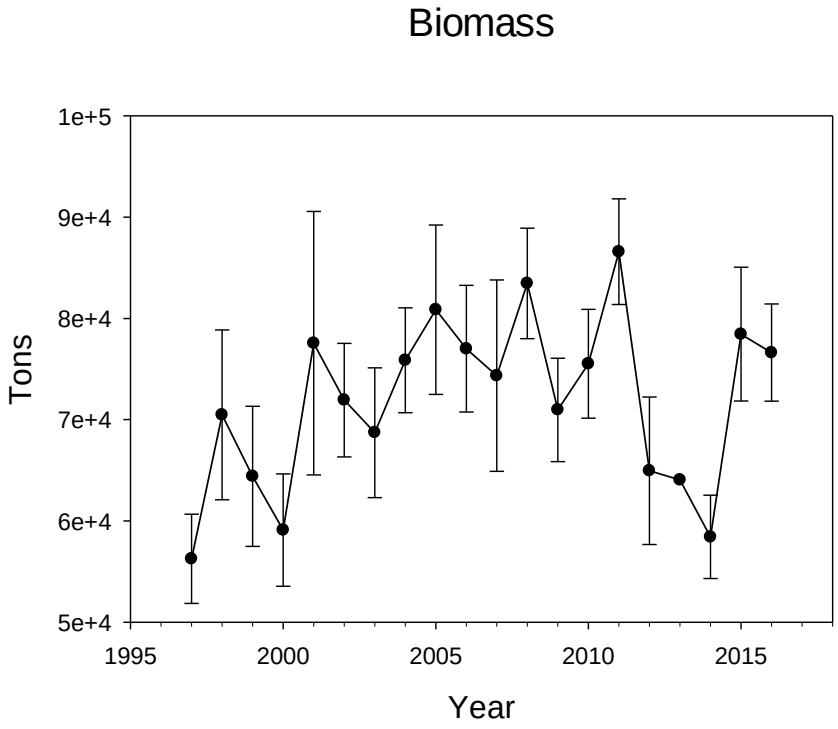

Fig. 2. Biomass (tons) of Greenland halibut in Div. 1CD by year with 1*S.E. No data from Div. 1C in 2013. The biomass in Div. 1C in 2013 is estimated by a GLM including data from 2010-2014.

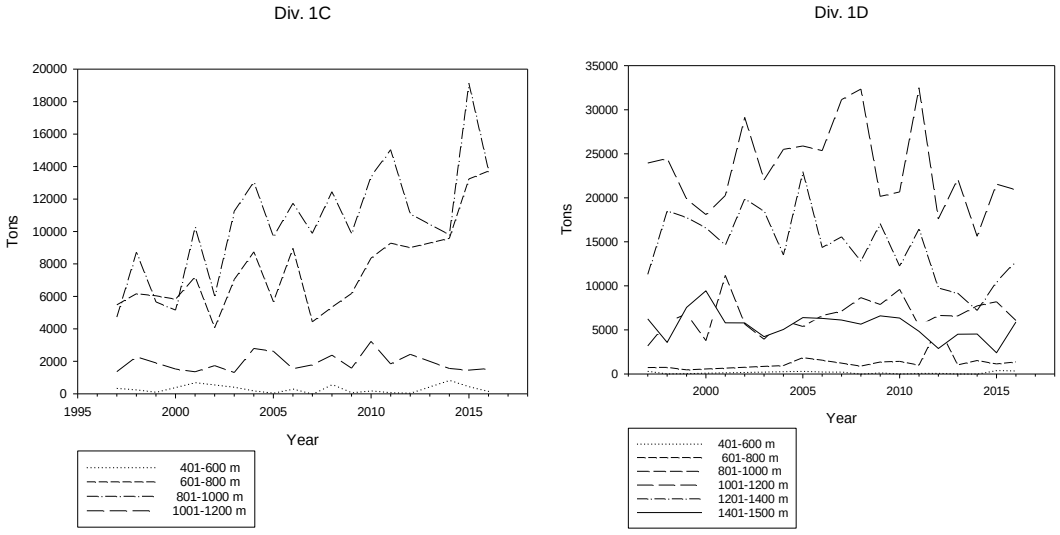

Fig.3. Biomass by Division, depth stratum and year. No data from Div. 1C in 2013

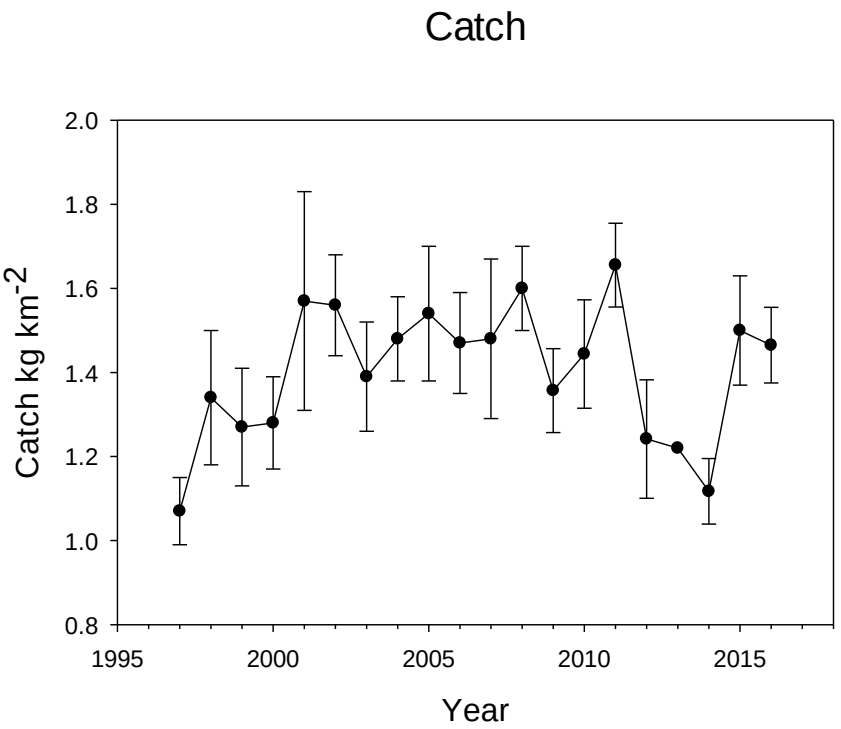

Fig. 4. Mean catch of Greenland halibut km^{-2} (tons) in Div. 1CD standardized by stratum area with 1*S.E. No data from Div. 1C in 2013. The biomass in Div. 1C in 2013 is estimated by a GLM including data from 2010-2014.

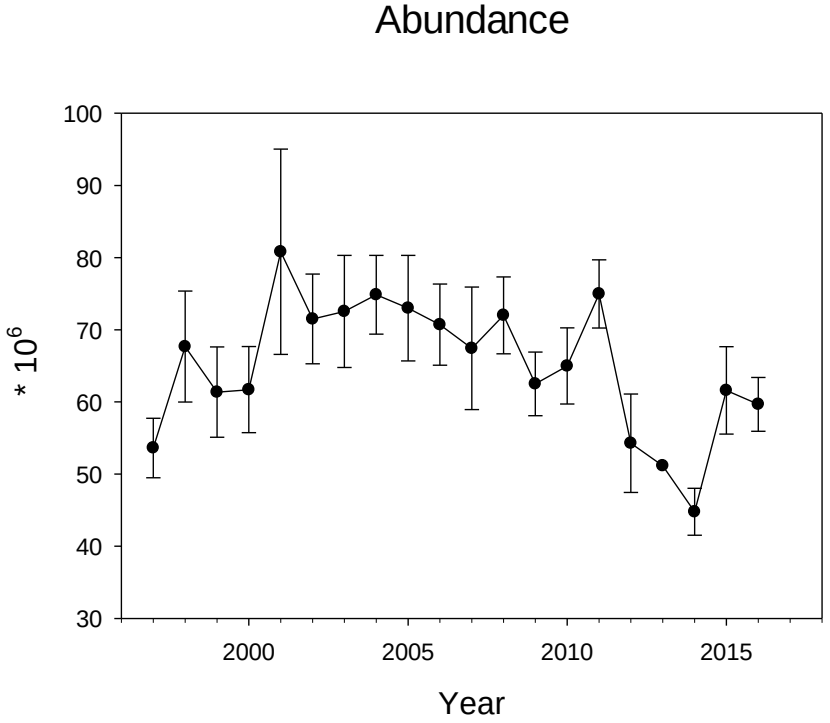

Fig. 5. Abundance (millions) of Greenland halibut in Div. 1CD by year with 1*S.E. No data from Div. 1C in 2013. The abundance in Div. 1C in 2013 is estimated by a GLM including data from 2010-2014.

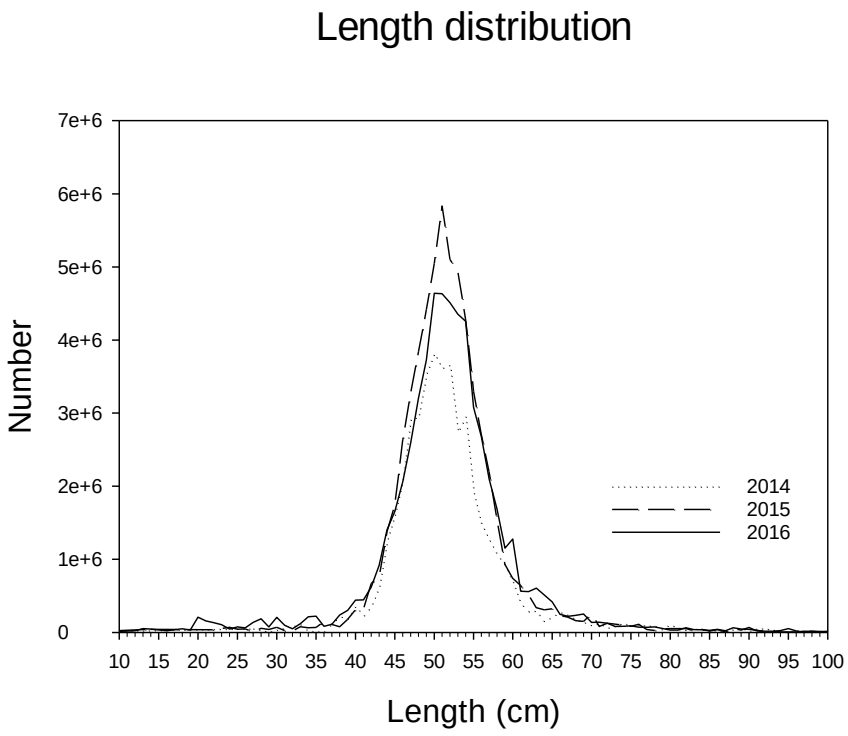

Fig. 6. Overall length distribution of Greenland halibut in numbers (weighted by stratum area) in Div. 1CD by year

Table 4. Number by age by year of Greenland halibut (excluding larvae, age 0). No data from 2008 and 2010-2016.

AGE	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	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				46549	
21						0	7419					
SUM	53607639	67670271	61304634	61709132	80845900	71512007	72507812	74851915	73000702	70750676	67413231	62478267

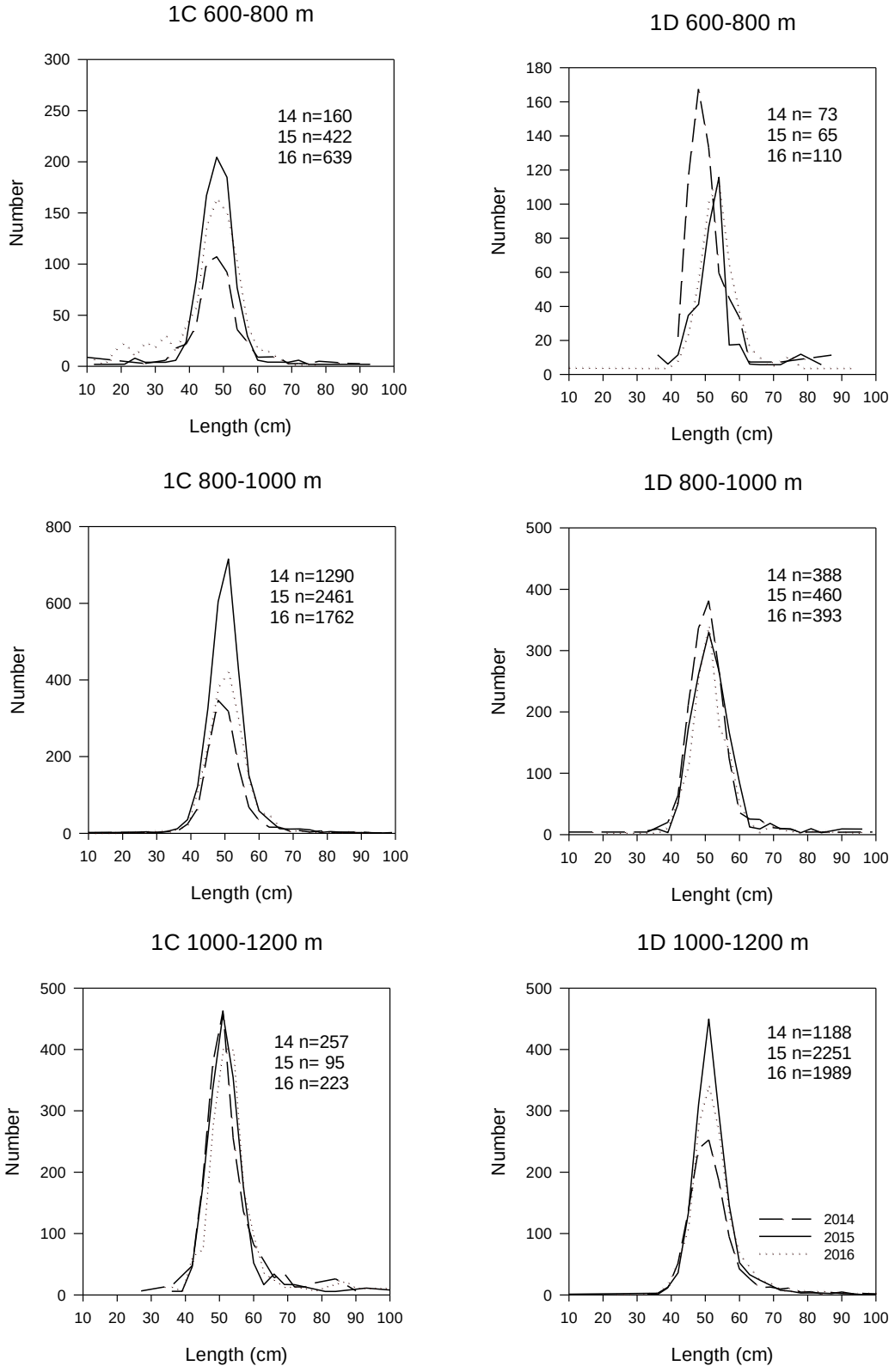

Fig. 7. Length distribution of Greenland halibut in numbers km^{-2} by year, division and depth stratum. Div 1CD 600-1200 m 2014-2016.

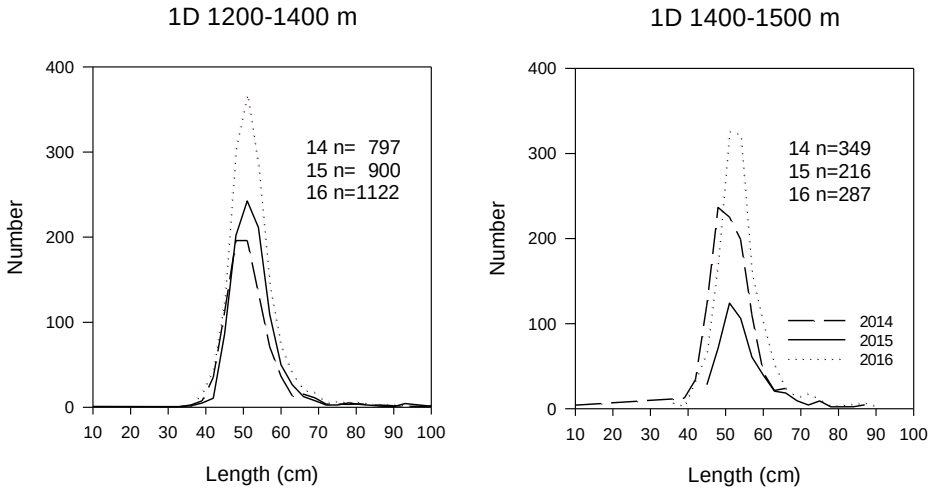

Fig. 7. cont. Length distribution of Greenland halibut in numbers km^{-2} by year, division and depth stratum. Div. 1D 1200-1500 m 2104-2016.

Table 5. Mean weight and length by year and age. No data 2008 and 2010-2016.

	1997		1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2009	
AGE	weight	length	weight	length	weight	length	weight	length	weight	length	weight	length	weight	length	weight	length	weight	length	weight	length	weight	length	weight	length
1							25	13.5	28	14.4	20	16.0							18	13.3				
2	23	15.3	38	18.7	64	21.0	75	21.0	85	21.0	60	21.7	85	23.0			69	21.5	71	21.1	70	22.0	91	23.3
3	58	19.8	176	28.5	206	27.4	146	26.3	173	26.7	200	29.6	192	29.4			169	28.5	180	28.6	181.7	28.7	162	27.1
4	137	26.1	348	35.3	342	34.4	329	33.6	366	34.2	341	35.5	355	35.7	487	39.1	382	36.6	397	36.8	352.6	35.9	377	36.6
5	272	32.8	551	40.9	571	40.3	528	39.5	574	39.7	487	39.9	522	40.2	646	42.8	550	41.3	594	41.8	565.8	41.6	544	40.7
6	444	38.0	854	46.8	793	45.6	764	44.5	849	44.9	747	45.6	763	45.4	917	47.5	831	46.7	867	47.0	859.6	47.2	771	45.4
7	737	43.9	1218	51.9	1196	51.4	1074	49.8	1159	49.9	1132	51.7	1116	51.2	1293	52.5	1137	51.6	1142	51.4	1072	51.1	1025	50.0
8	1070	49.9	1572	56.8	1665	57.9	1376	53.7	1541	54.8	1370	55.6	1419	55.9	1638	56.5	1569	56.5	1531	56.1	1541	56.6	1540	56.3
9	1454	55.6	2075	60.6	2057	61.1	1631	56.8	1844	58.0	1844	60.7	1861	59.8	1942	60.2	1754	58.8	2189	61.2	1635	57.5	1856	59.8
10	2043	61.2	2293	63.1	2441	64.1	2077	61.5	2259	61.8	2037	62.5	2115	62.6	2191	62.3	2301	63.8	2502	64.2	2123	62.4	2208	62.9
11	2815	66.7	2867	66.5	2812	66.9	2503	63.9	3316	65.0	2508	66.0	2668	66.8	2924	67.8	2878	68.0	3588	70.9			2816	67.7
12	3828	72.6	3453	69.9	4000	72.9	3014	67.5	3450	68.7	3011	69.7	3190	70.4	3237	68.2	3464	71.2	3450	70.2	3049	68.6	3492	70.9
13	4840	77.3	4538	74.7	5679	79.5	3612	70.4	3866	71.3	3558	71.6	3178	70.6	3683	72.4	4617	77.0	4951	77.5	3300	70.0	4019	73.3
14	6679	84.0	5112	77.6	7613	86.7	3893	72.8	5257	77.8	4650	78.5	3845	75.5	3889	71.1	5305	79.1	5324	79.0	4548	76.4	5586	79.8
15	7711	87.8	7141	85.1	8477	91.2	5409	78.3	6324	81.9	5149	79.0	4340	76.0	4740	74.8	6468	86.0	7029	86.1	6443	85.5	6709	83.9
16	9166	94.6	8385	88.9	9925	88.5	6873	85.5	7203	86.0	6786	84.8	5747	81.3			13320	100.0	8415	89.3	8402	90.8	9700	94.0
17	10797	97.8	10684	95.4			8492	91.8	8954	92.4	8520	90.3	6200	84.0	6498	82.0			9588	95.0	9565	92.5	9198	93.0
18					12500	99.0	8590	92.3	8760	93.0	9385	93.0			893	93.0	9570	97.0			9200	95.0		
19			12850	99.0			9645	91.5	11500	102.0	8553	90.3			10220	93.0	14150	101.0						
20									14400	105.0											12330	102.0		

Roundnose grenadier (*Coryphaenoides rupestris*)

Roundnose grenadier was caught in 65 of the 70 valid hauls but the catches were very low (Fig. 8, Appendix 1). The biomass has been very low for about two decades (Table 6) and far below the level seen in the late 80'. The biomass in in 2016 was estimated at 861.2 tons which is at the same level as in 2015 (813.4 tons). Most of the biomass and the highest densities was found in Div. 1D at 400-600 this figure is, however, based on two hauls only (Table 7 and 8).

The abundance was estimated at $6.39*10^6$ compared to $7.35*10^6$ specimens in 2015.

Table 6. Biomass (tons) and abundance of roundnose grenadier with 1*S.E. by year. NOTE! Data from 2013 only includes Div. 1D.

Year	Biomass	S.E.	Abundance ($*10^6$)	S.E. ($10*^6$)
1997	5 686.5	926.4	32.44	7.06
1998	7 263.3	2 530.2	75.24	27.36
1999	2 771.8	445.5	29.10	8.96
2000	5 593.7	2 616.8	99.52	67.31
2001	1 577.2	516.4	24.70	8.80
2002	1 593.1	462.7	18.61	8.91
2003	774.2	144.0	6.90	1.27
2004	633.0	98.2	10.56	2.53
2005	733.0	116.0	12.18	3.75
2006	658.6	192.2	10.83	4.28
2007	838.0	206.4	13.16	4.50
2008	546.1	81.3	4.75	0.70
2009	1 151.1	516.1	16.58	10.01
2010	580.7	81.1	6.78	1.80
2011	939.8	244.9	11.57	4.64
2012	1 634.1	936.3	24.36	15.63
2013	487.5	190.8	3.94	2.31
2014	596.9	215.8	5.08	2.11
2015	813.4	167.4	7.35	2.28
2016	861.2	274.6	6.39	1.80

Pre anal fin length ranged from 2 to cm 20 cm. The grenadiers were generally small and the overall length distribution (weighted by stratum area) was dominated by fish at 5 cm (Fig. 9).

Table 7. Mean catch per km^2 and biomass (tons) with Standard Error of roundnose grenadier in Division 1CD by depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Biomass	SE
1C	401-600	3366	2	0.0014	4.8	4.8
	601-800	16120	9	0.0073	117.0	83.8
	801-1000	6066	13	0.0156	94.5	45.6
	1001-1200	611	2	0.0141	8.6	0.8
1D	401-600	903	2	0.2777	250.8	250.8
	601-800	1940	3	0.0134	26.1	13.9
	801-1000	3874	4	0.0089	34.6	18.6
	1001-1200	10140	19	0.0141	143.1	36.9
	1201-1400	6195	12	0.0220	136.4	34.1
	1401-1500	3091	4	0.0147	45.3	17.2
All				0.0165	861.2	274.6

Table 8. Mean catch per km^2 and abundance with Standard Error of roundnose grenadier in Division 1CD by depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Abundance	SE
1C	401-600	3366	2	6.6	22233.2	22233.2
	601-800	16120	9	106.9	1722833.3	1296900.8
	801-1000	6066	13	252.8	1533354.0	827790.3
	1001-1200	611	2	109.6	66942.2	12487.6
1D	401-600	903	2	984.7	889150.1	889150.1
	601-800	1940	3	123.0	238534.8	85684.7
	801-1000	3874	4	88.4	342397.9	127398.7
	1001-1200	10140	19	84.9	861087.9	204508.6
	1201-1400	6195	12	94.4	584705.6	154499.6
	1401-1500	3091	4	41.0	126822.7	33340.0
All				122.1	6388061.7	1802443.9

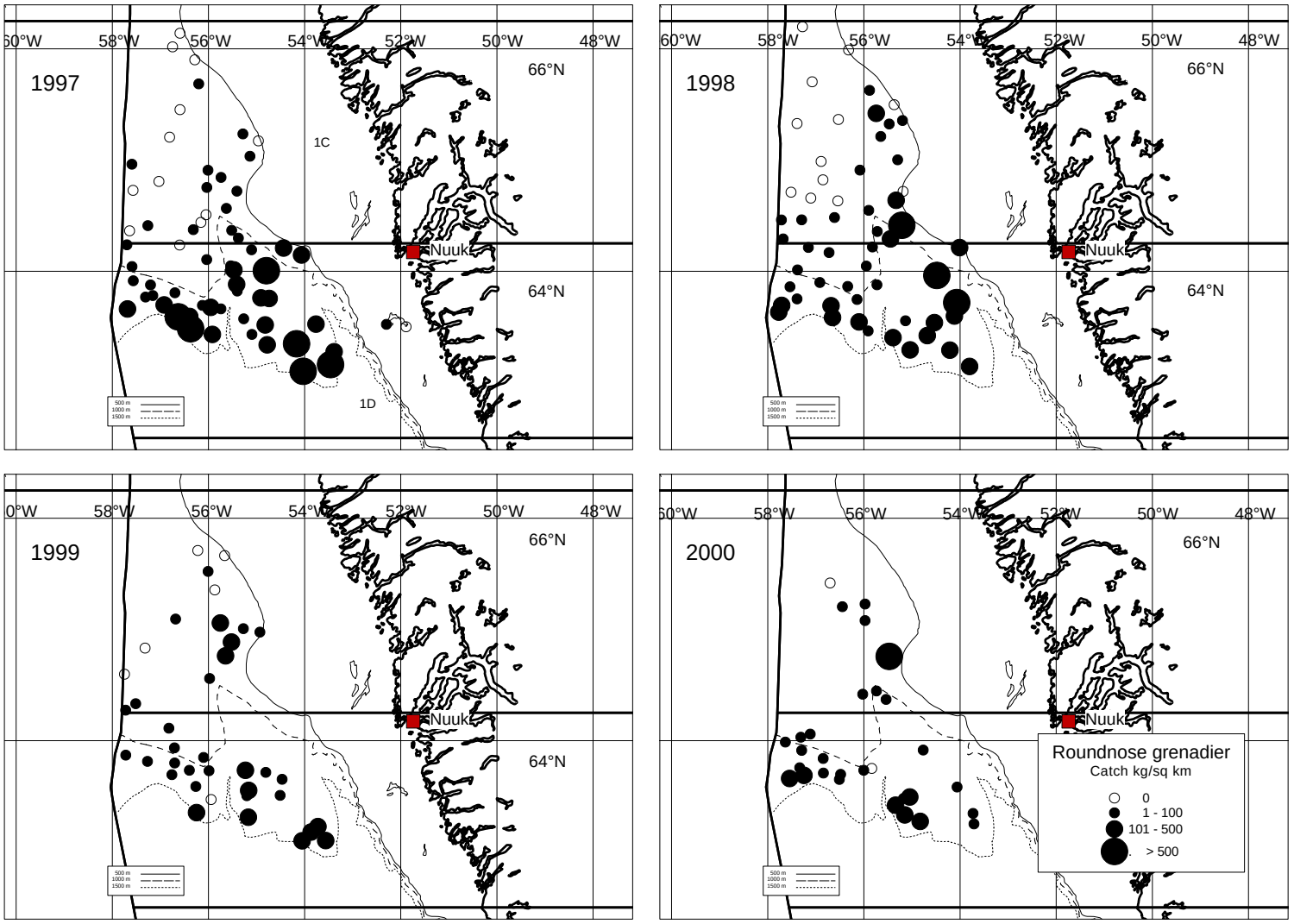

Fig. 8. Distribution of catches of roundnose grenadier in 1997-2000 in kg per km^2

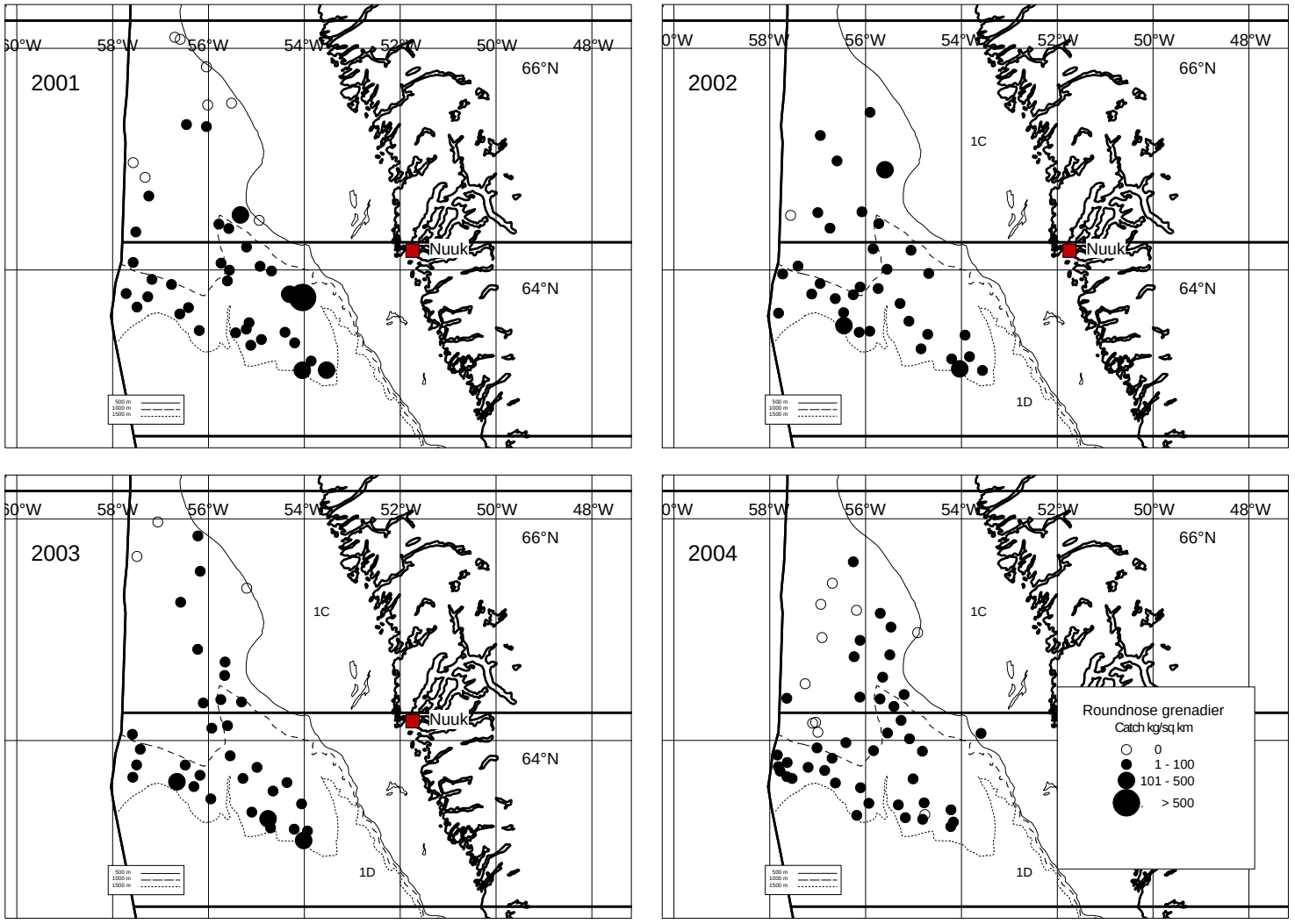

Fig. 8. cont. Distribution of catches of roundnose grenadier in 2001-2004 in kg per km².

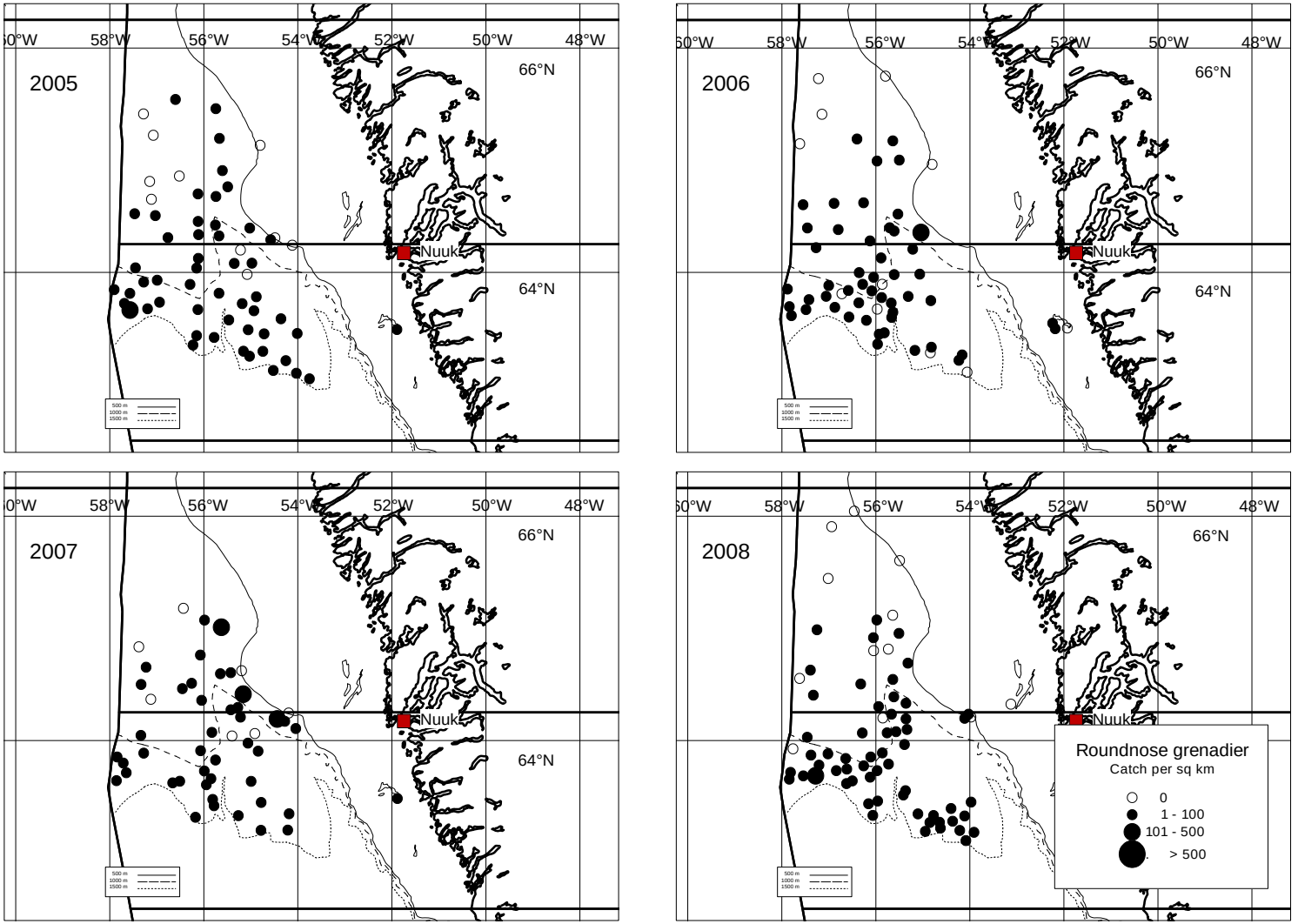

Fig. 8 cont. Distribution of catches of roundnose grenadier in 2005-2008 in kg per km^{-2}.

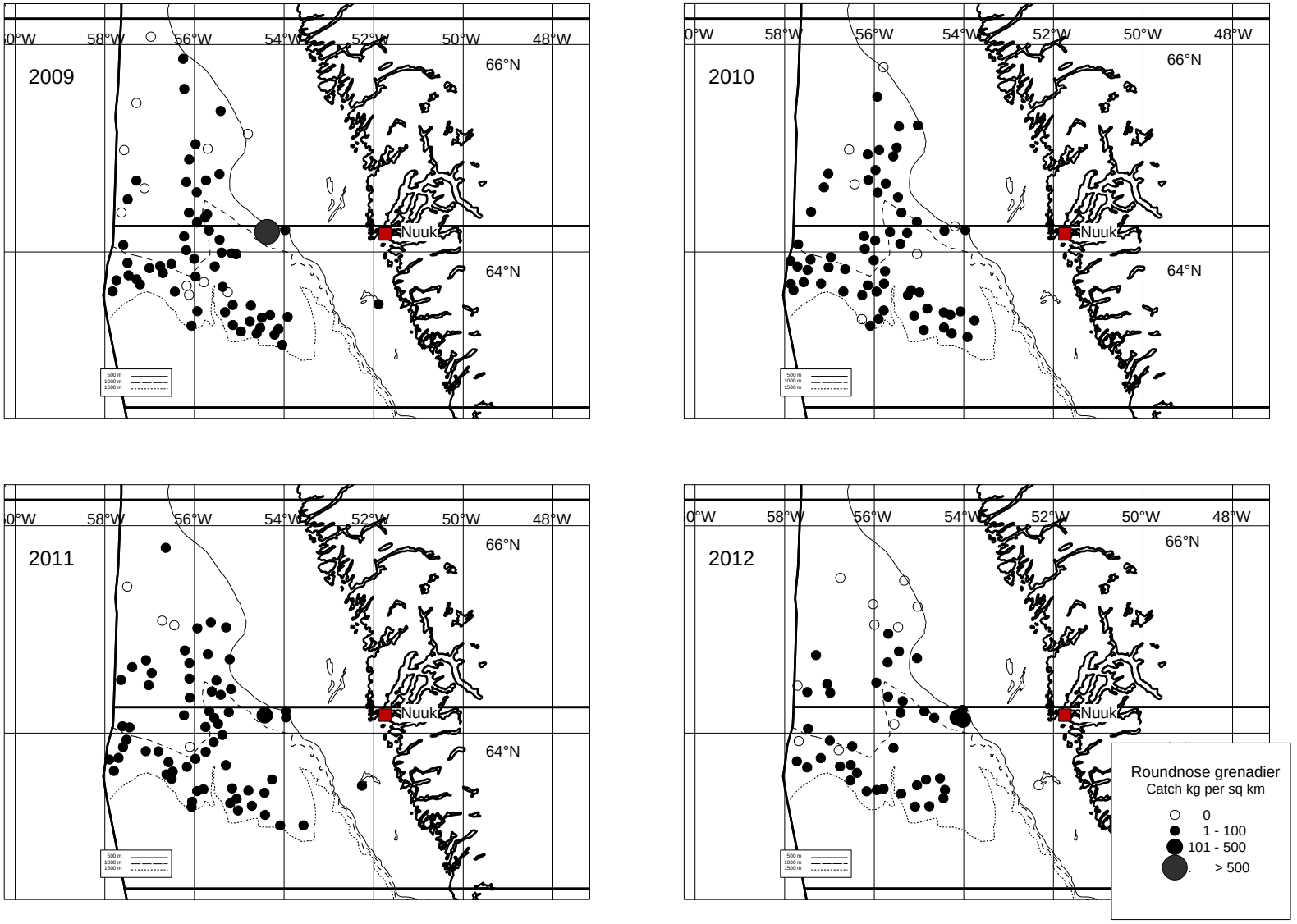

Fig. 8 cont. Distribution of catches of roundnose grenadier in 2009-2012 in kg per km^2.

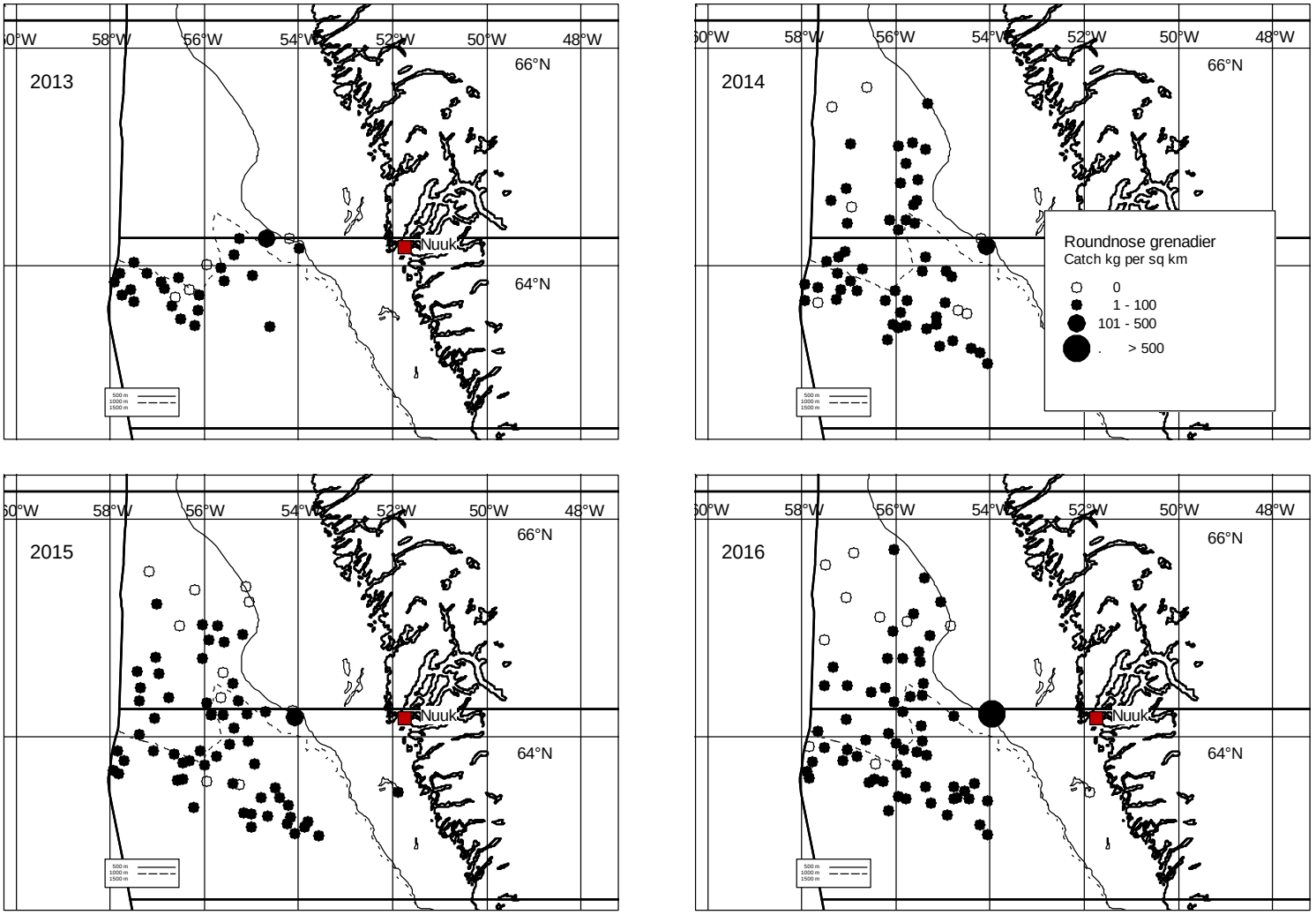

Fig. 8 cont. Distribution of catches of roundnose grenadier in 2013 -2016 in kg per km^2.

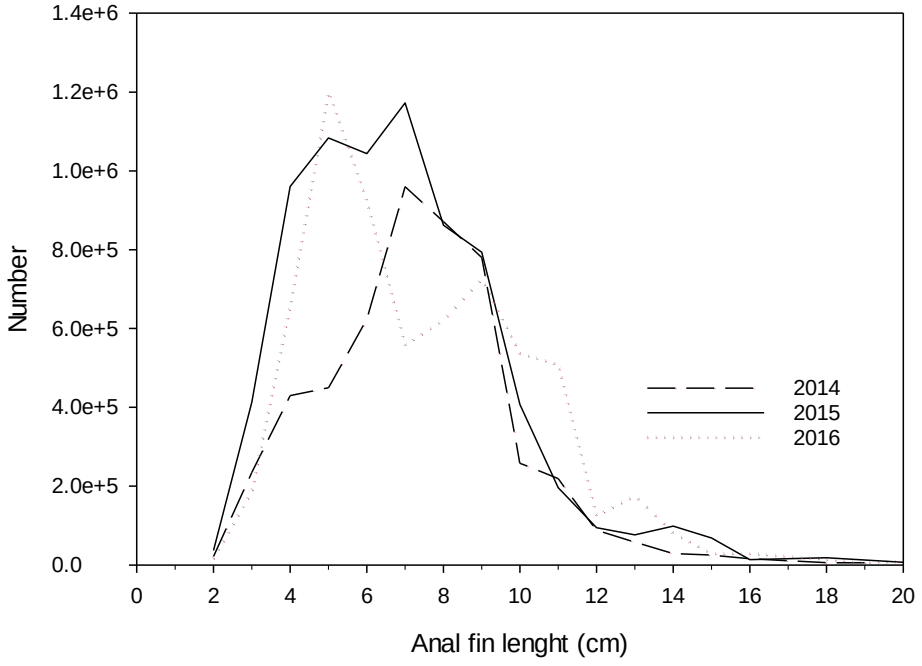

Fig. 9. Overall length distribution of roundnose grenadier (pre anal fin length) in numbers (weighted by stratum area) in 1CD in 2014-2016.

Roughhead grenadier (*Macrourus berglax*)

Roughhead grenadier was caught in 68 of 70 valid hauls. The catches were, however, generally low (Fig. 11, Appendix 1). The biomass was estimated at 2871.6 tons in 2016 compared to 3291.8 tons in 2015 which is the third lowest estimate in the time series (Table 9). The abundance was estimated at $6.81*10^6$ compared to $8.65*10^6$ in 2015. The 2016 abundance estimate is the third lowest in the time series. The densities in numbers per km^2 were fairly even distributed throughout the survey area (Table 10 and 11).

Table 9. Biomass and abundance of roughhead grenadier by year in Div. 1CD with S.E. NOTE! Data from 2013 only includes Div. 1D.

Year	Biomass	S.E.	Abundance ($*10^6$)	S.E. ($*10^6$)
1997	2258 .6	250.1	4.60	0.45
1998	4314.1	377.9	11.62	1.01
1999	5166.2	854.1	14.07	2.04
2000	7178.1	2226.5	20.28	7.18
2001	4576.6	456.3	13.87	1.55
2002	7907.6	823.6	19.62	1.76
2003	5657.5	700.8	15.37	2.57
2004	4314.3	452.6	11.16	1.32
2005	5602.6	419.5	14.00	1.31
2006	5148.2	621.2	11.84	1.09
2007	3467.6	374.6	8.18	1.08
2008	4533.7	970.2	9.94	1.35
2009	3795.7	299.2	8.21	0.67
2010	4025.8	564.5	8.21	1.10
2011	3084.5	265.3	7.39	0.65
2012	6303.4	2774.2	8.44	1.21
2013	2241.1	507.2	4.14	0.96
2014	2907.4	251.0	7.80	0.61
2015	3291.8	225.5	8.65	0.69
2016	2871.6	281.6	6.81	0.60

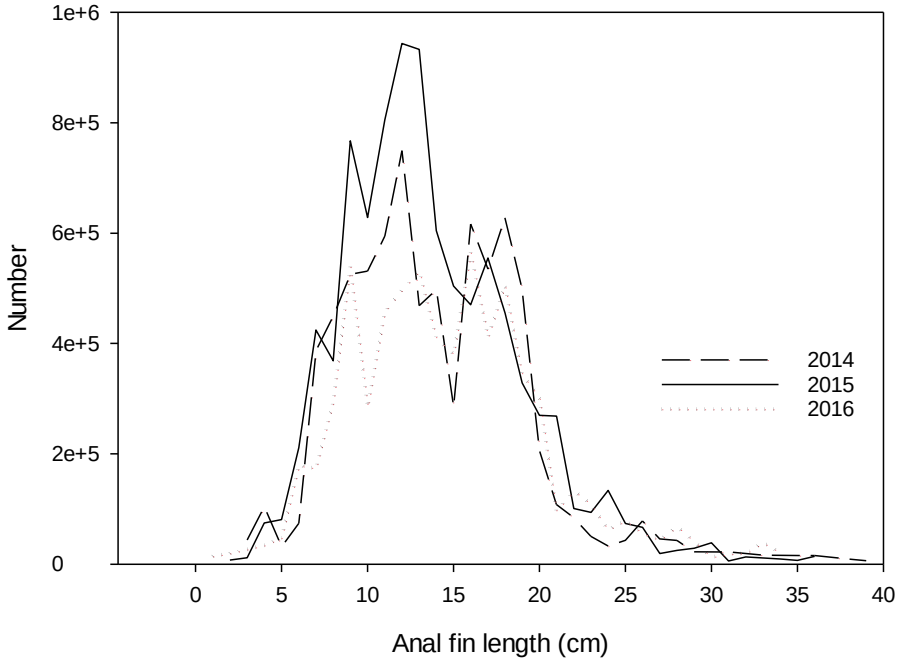

Fig. 10. Overall length distribution (pre anal fin length) of roughhead grenadier in numbers (weighted by stratum area) in 1CD in 2014-2016.

Table 10. Mean catch per km² and biomass (tons) with Standard Error of roughhead grenadier in Division 1CD by depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Biomass	SE
1C	401-600	3366	2	0.0315	106.1	1.1
	601-800	16120	9	0.0374	602.5	131.6
	801-1000	6066	13	0.0547	331.8	53.5
	1001-1200	611	2	0.0269	16.5	16.5
1D	401-600	903	2	0.0460	41.5	41.5
	601-800	1940	3	0.0985	191.0	108.8
	801-1000	3874	4	0.0446	172.7	44.9
	1001-1200	10140	19	0.0521	528.1	72.0
	1201-1400	6195	12	0.1065	659.7	155.0
	1401-1500	3091	4	0.0717	221.6	118.5
All				0.0549	2871.6	281.6

Table 11. Mean catch per km^2 and abundance and Standard Error of roughhead grenadier in Division 1CD by depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Abundance	SE
1C	401-600	3366	2	71.2	239727.5	27071.1
	601-800	16120	9	126.2	2034229.7	505720.1
	801-1000	6066	13	153.1	928630.8	135243.7
	1001-1200	611	2	97.5	59572.3	59572.3
1D	401-600	903	2	101.0	91194.9	91194.9
	601-800	1940	3	163.9	318016.5	66589.4
	801-1000	3874	4	98.8	382792.8	113319.2
	1001-1200	10140	19	137.8	1397442.7	143950.3
	1201-1400	6195	12	170.9	1058811.9	150413.8
	1401-1500	3091	4	98.4	304047.1	130217.9
All				130.3	6814466.3	603506.4

Pre anal fin length ranged from 1 to 34 cm and the overall length distribution showed minor modes at 9, 13, 16 and 18 cm, respectively. (Fig.10).

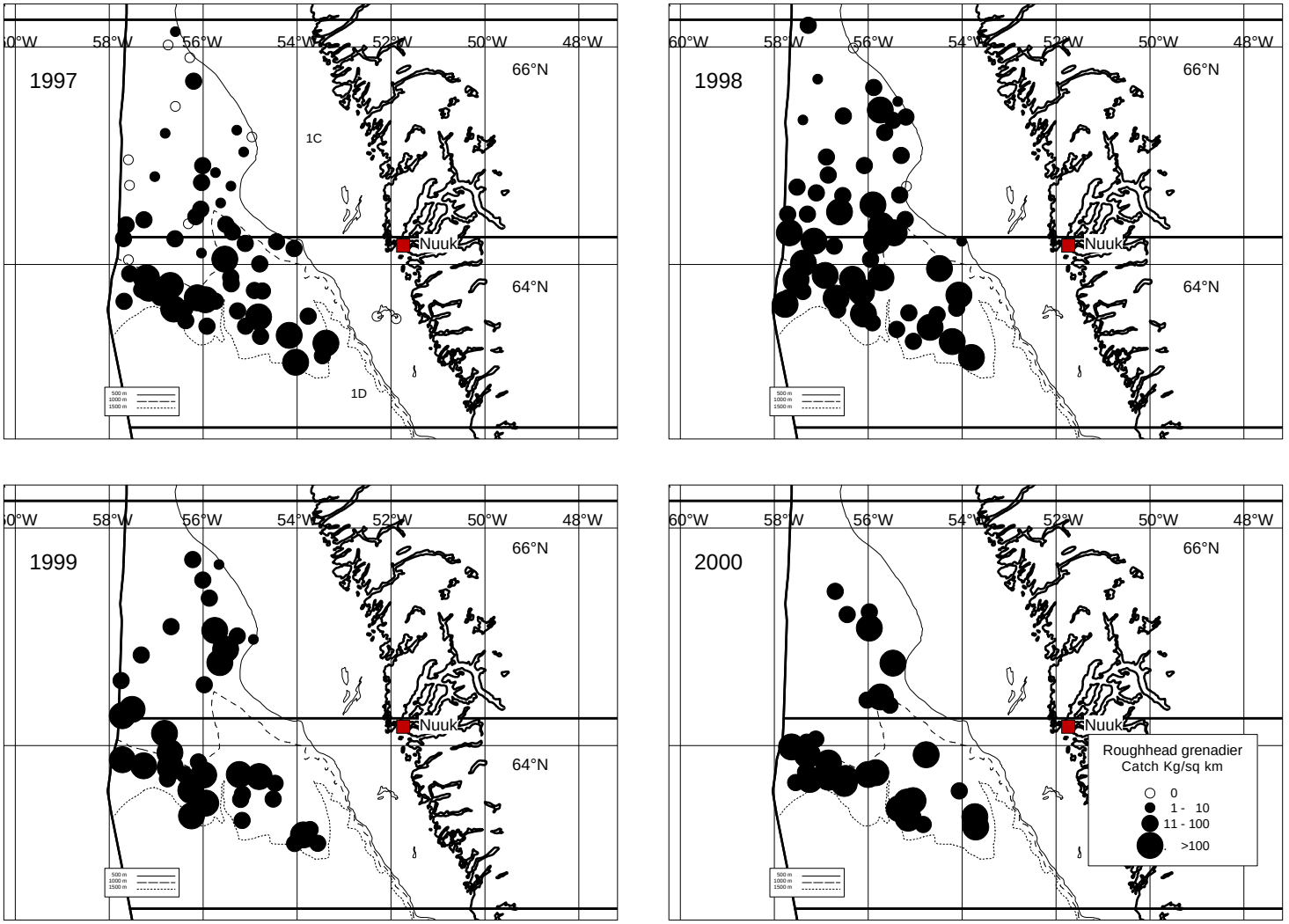

Fig.11. Distribution of catches of roughhead grenadier in 1997-2000 in kg per km^2.

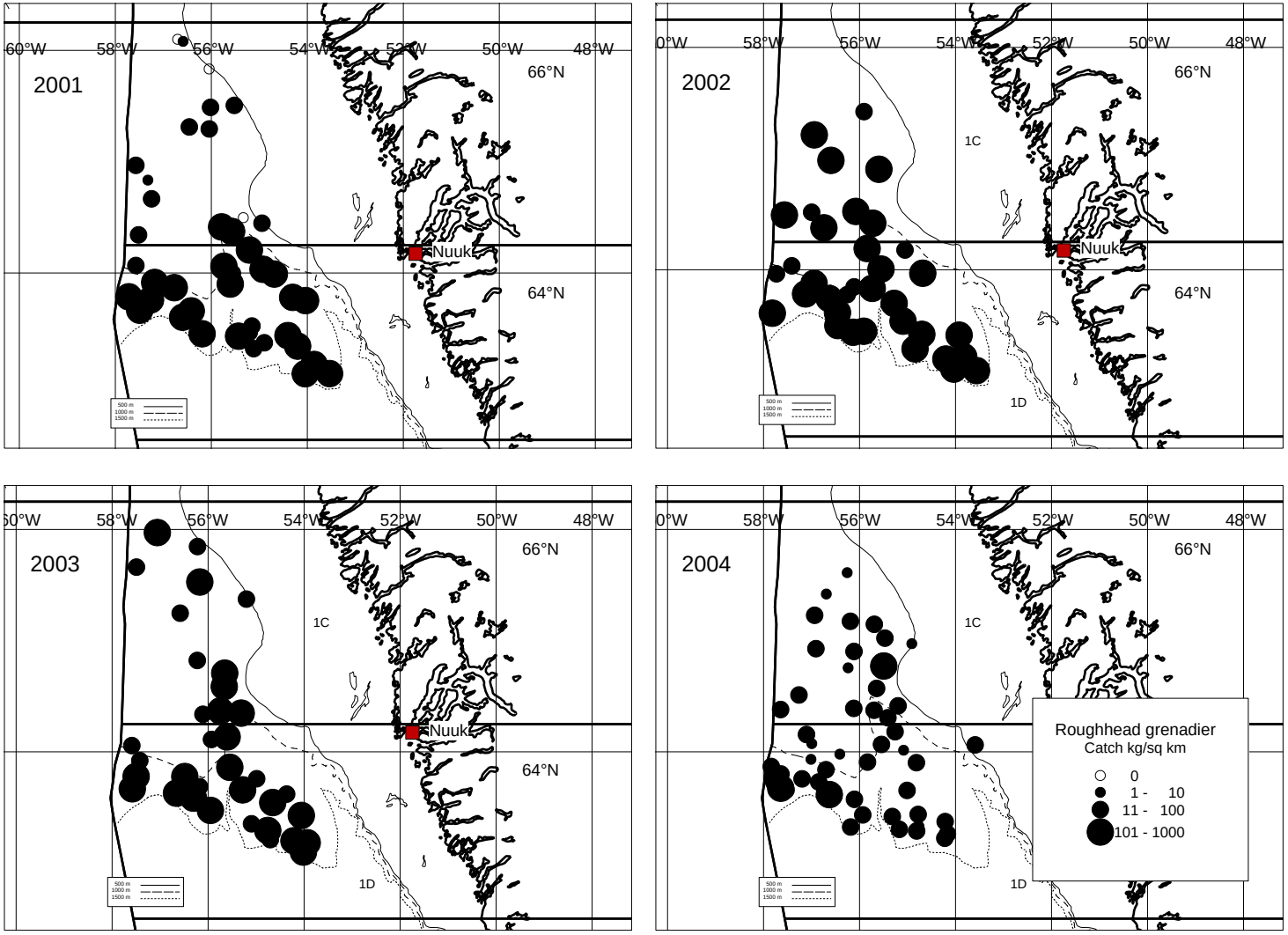

Fig. 11. cont. Distribution of catches of roughhead grenadier during 2001-2004 per km^2.

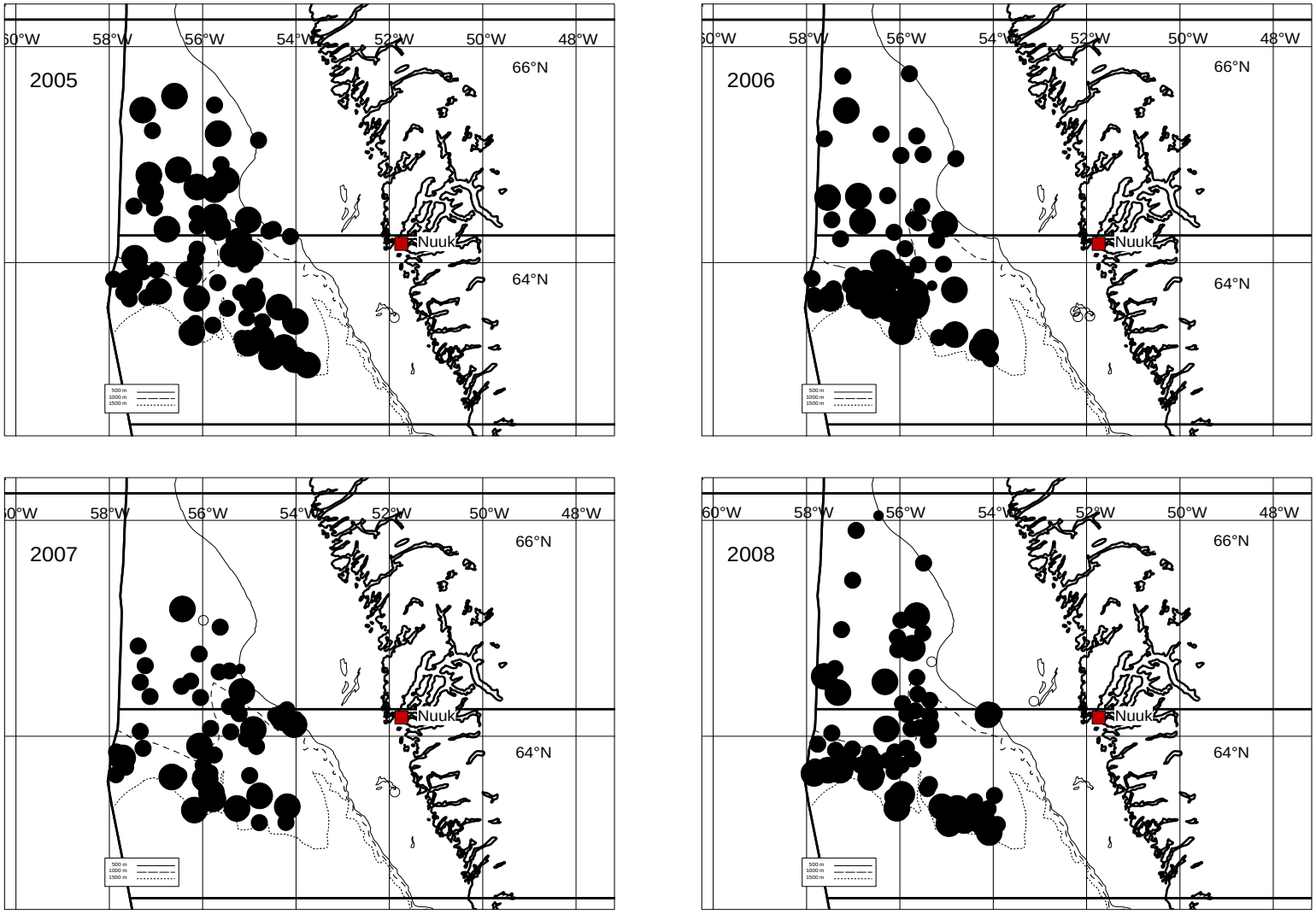

Fig.11 cont.. Distribution of catches of roughhead grenadier during 2005-2008 per km^2.

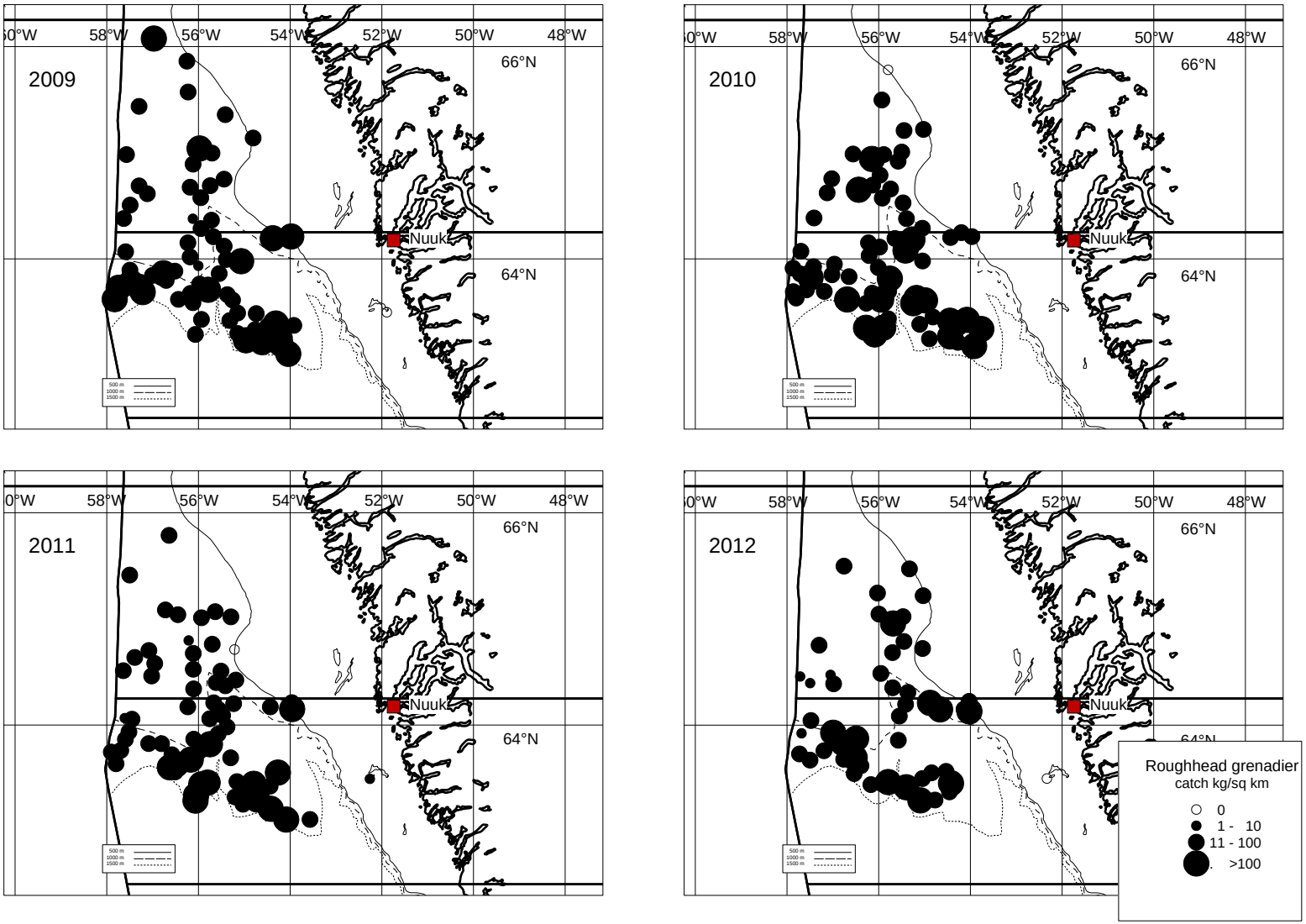

Fig. 11 cont.. Distribution of catches of roughhead grenadier during 2009-2012 in kg per km^2.

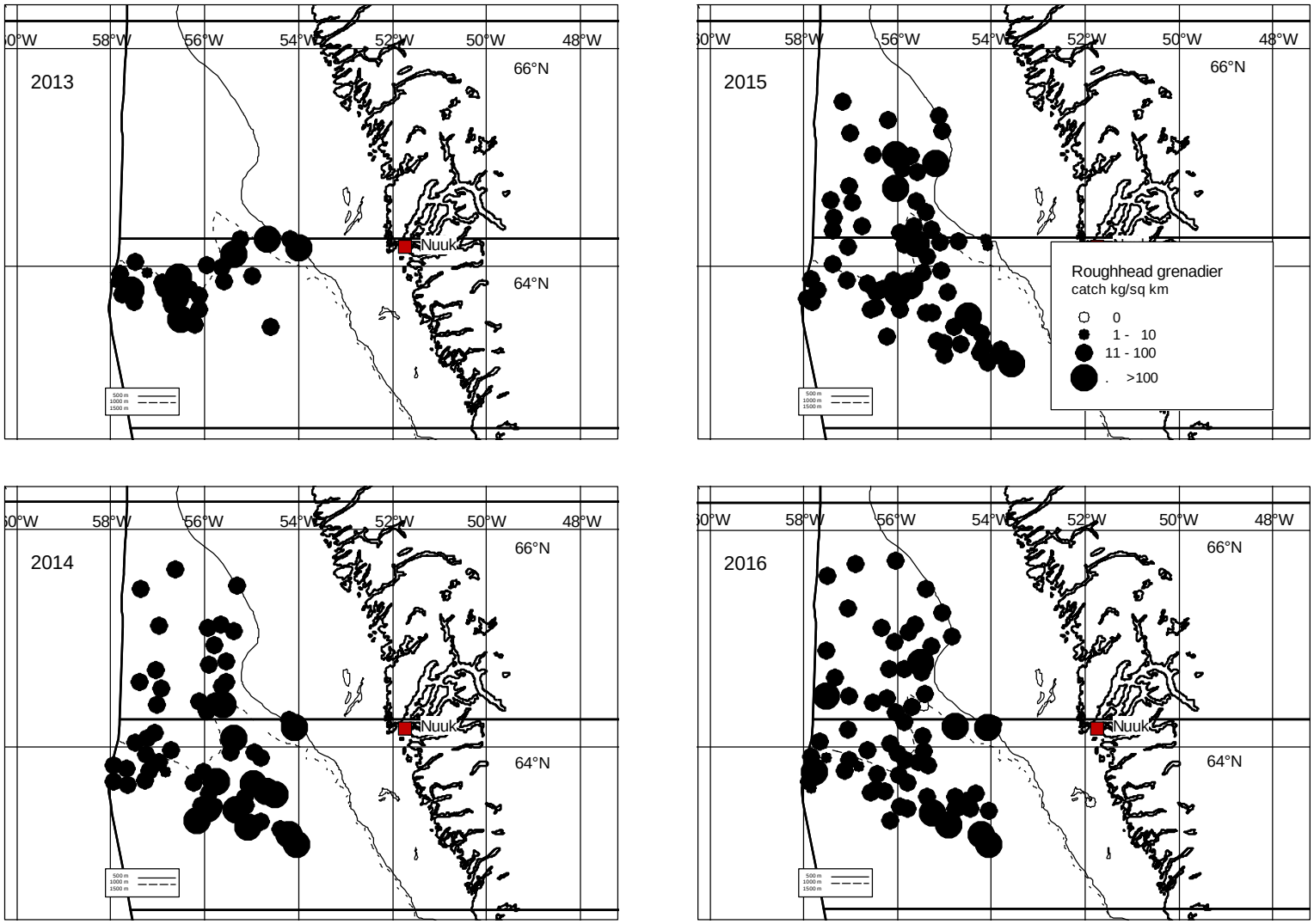

Fig. 11 cont.. Distribution of catches of roughhead grenadier in 2013 - 2016 in kg per km^2.

Deep-sea redfish (*Sebastes mentella*)

Deep-sea redfish was caught in 33 of the 70 valid hauls (Fig 13). The biomass was estimated at 11335.6 tons in 2016 which is at the same level as in 2015 (10 016.5 tons) which is about the half of the 2014 estimate, but still above the level seen until 2008 (Table 12). The survey only covers the deepest part of the distribution area and the coverage is poor (< = 4 hauls at depths between 400 and 600 m and 12 hauls at depth between 600 and 800 m and the biomass and abundance estimates are often driven by 1-3 large hauls. This was also the case in 2016 (Fig. 13, Table 13 and Appendix 1).

The abundance was estimated at 24.70 in 2016 compared to $31.46*10^6$ compared in 2015 and well below the all-time high $65.81*10^6$ estimated in 2014. Almost all the abundance was found at depths < 800 m with the highest density at 401-600 m in Div. 1D (two hauls only) (Table 14).

The length ranged from 20 to 49 cm without any clear modes (Fig. 12).

Table 12. Biomass and abundance of deep-sea redfish including a few redfish sp. by year in Div. 1CD with 1*S.E. NOTE! Data from 2013 only includes Div. 1D.

Year	Biomass	S.E.	Abundance $*10^6$	S.E.$*10^6$
1997	2464.3	787.1	14.69	5.50
1998	2408.1	503.9	18.83	4.50
1999	2484.9	1007.7	12.93	4.09
2000[1)]				
2001	2063.4	873.5	16.34	6.47
2002[1)]				
2003	1493.4	684.5	7.13	3.08
2004	2329.1	1986.8	13.34	11.31
2005	2546.2	1683.3	7.28	3.16
2006	2188.4	700.7	18.20	8.40
2007[1)]	574.2	230.0	3.00	1.31
2008	13199.0	6482.9	52.94	17.70
2009	7796.4	3916.8	35.04	17.72
2010	4065.6	1329.4	17.83	3.17
2011	9623.9	4883.7	32.42	16.19
2012	14010.6	6795.5	40.27	16.39
2013[1)]	25356.0	21231.2	45.90	33.54
2014	21945.8	14079.3	65.81	46.04
2015	10016.5	4457.3	31.46	12.67
2016	11335.6	4828.8	24.70	9.94

1) Poor coverage of relevant depths.

Table 13. Mean catch per km^2 and biomass (tons) with Standard Error of deep sea redfish in Division 1CD by depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Biomass	SE
1C	401-600	3366	2	0.6336	2132.8	766.4
	601-800	16120	9	0.2328	3753.4	2130.2
	801-1000	6066	13	0.0128	77.4	37.2
	1001-1200	611	2	0.0000	0.0	0.0
1D	401-600	903	2	4.6109	4163.7	4108.8
	601-800	1940	3	0.5939	1152.1	1143.7
	801-1000	3874	4	0.0000	0.0	0.0
	1001-1200	10140	19	0.0039	39.6	15.0
	1201-1400	6195	12	0.0009	5.8	5.8
	1401-1500	3091	4	0.0035	10.9	10.9
All				0.2167	11335.6	4828.8

Table 14. Mean catch per km^2 and abundance with Standard Error of deep sea redfish by Division and depth stratum, 2016.

Div.	Stratum(m)	Area	Hauls	Mean sq km	Abundance	SE
1C	401-600	3366	2	1382.3	4652942.7	771961.9
	601-800	16120	9	612.8	9878507.4	5660723.7
	801-1000	6066	13	26.6	161621.4	78142.7
	1001-1200	611	2	0.0	0.0	0.0
1D	401-600	903	2	8973.7	8103282.2	7951194.9
	601-800	1940	3	908.8	1763088.0	1741035.1
	801-1000	3874	4	0.0	0.0	0.0
	1001-1200	10140	19	11.2	113997.7	36040.8
	1201-1400	6195	12	2.3	14263.9	14263.9
	1401-1500	3091	4	3.2	9778.1	9778.1
All				472.2	24697481.2	9944854.3

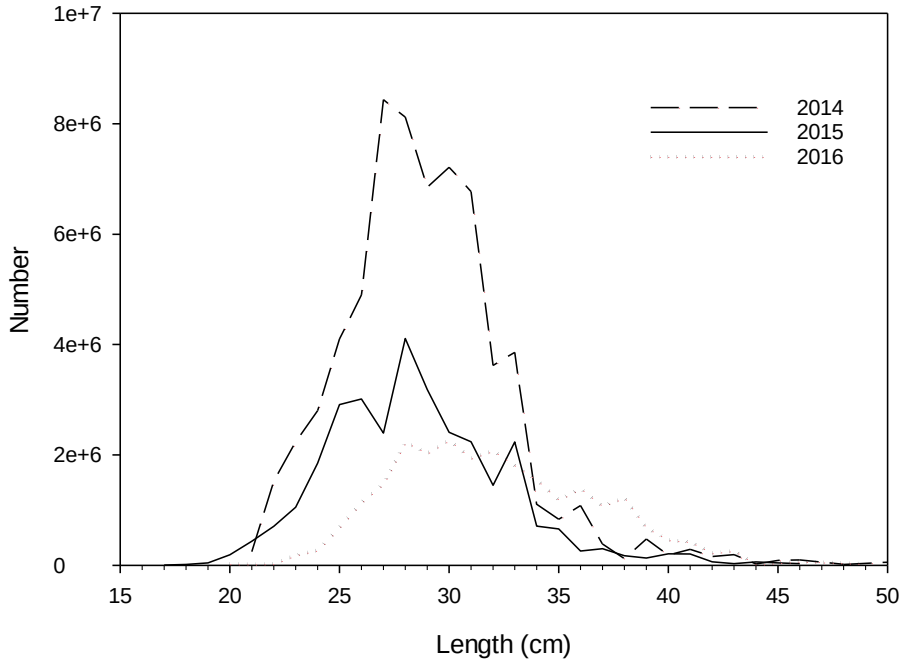

Fig. 12. Overall length distribution of deep sea redfish in numbers (weighted by stratum area) in Div. 1D in 1CD in 2014-2016.

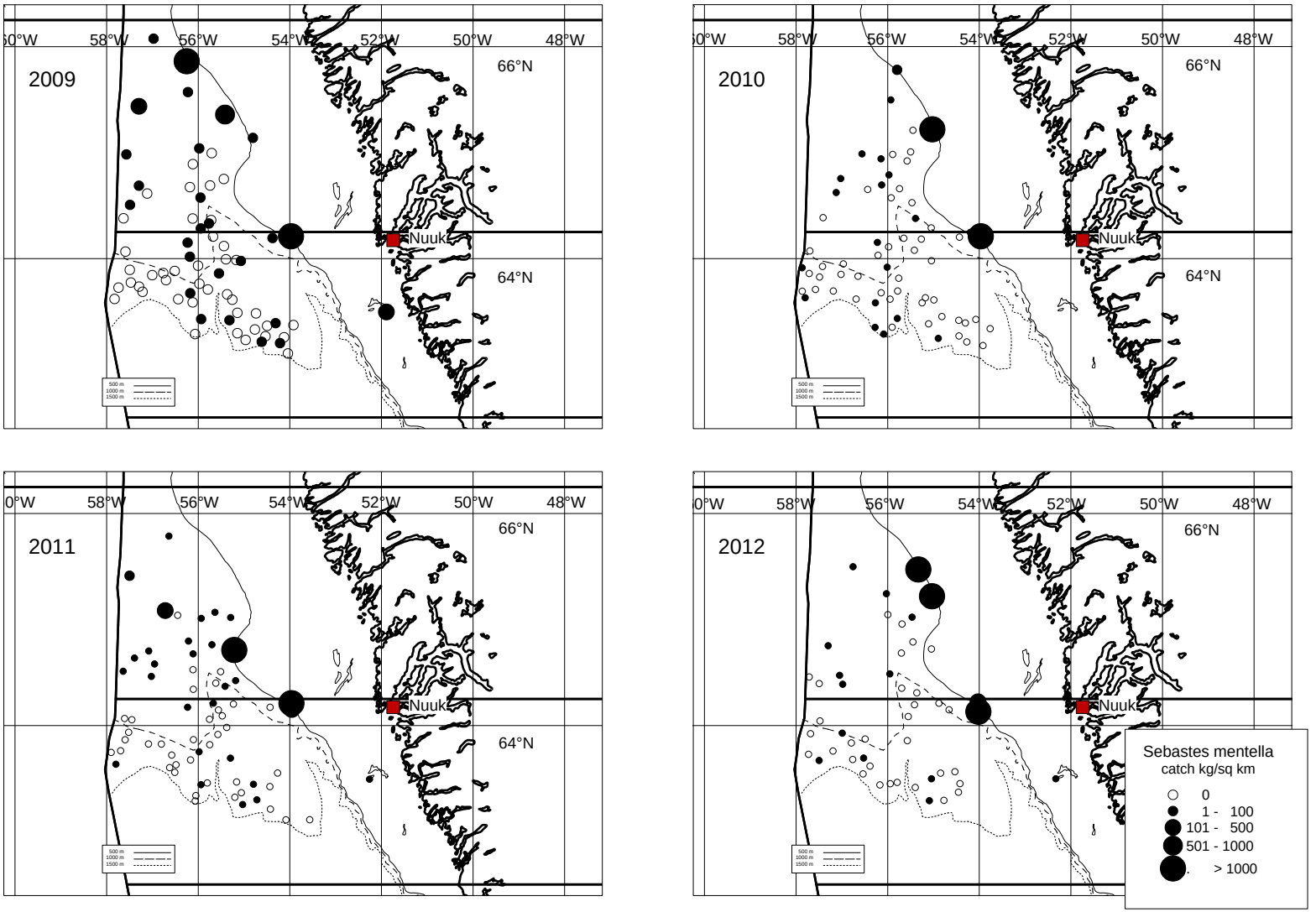

Fig. 13. Distribution of catches of deep sea redfish during 2009-2012 per km^2.

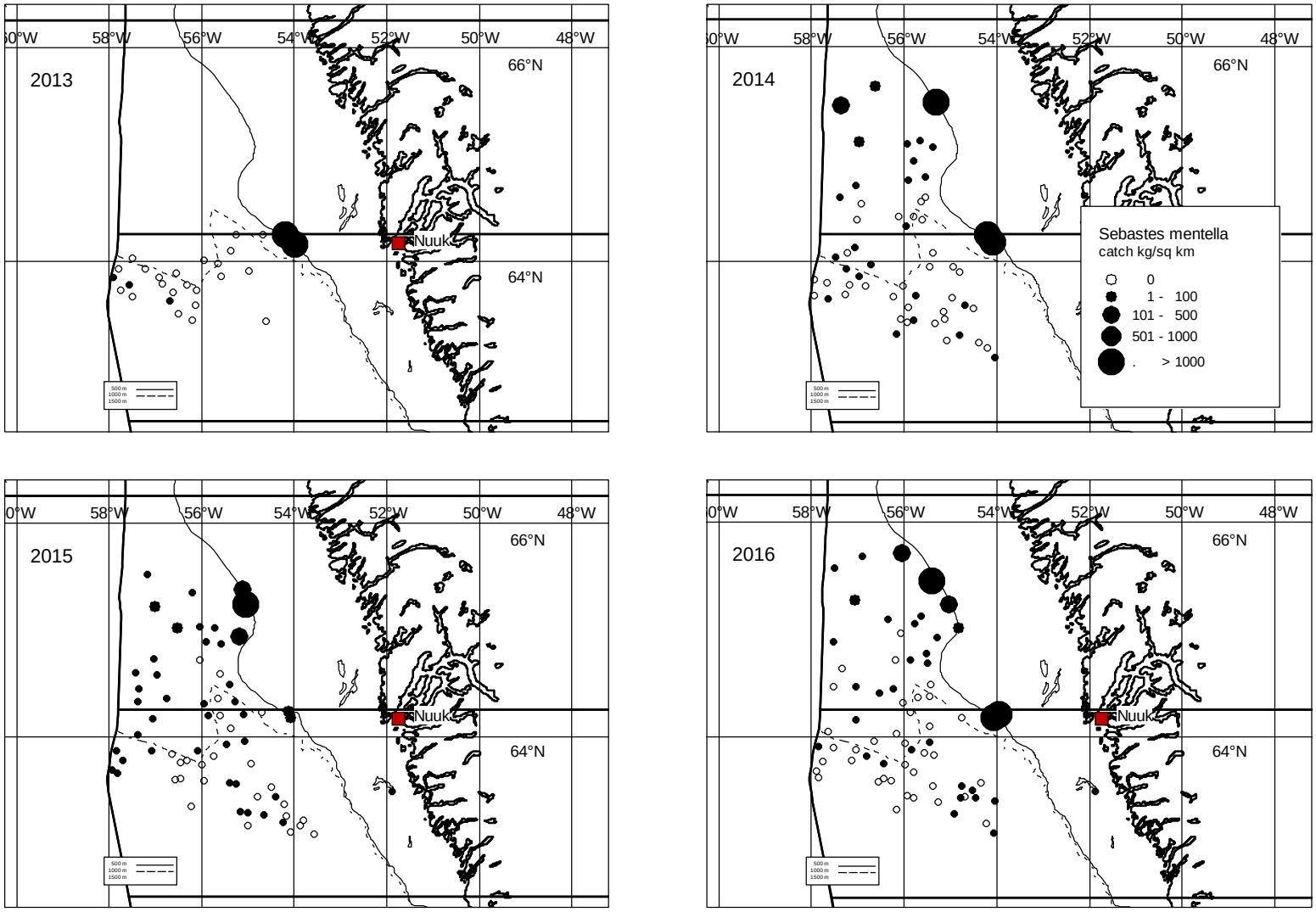

Fig. 13. Distribution of catches of deep sea redfish during 2013 - 2016 in kg per km^2

Temperature

The bottom temperature ranged from 1.88 to 4.69 °C (Appendix 1). The mean temperature was generally decreasing by depth as in previous years (Fig. 14, Table 15).

The mean temperatures have been relatively constant in recent years except at depths between 400 and 600 m and to some extend 600-800 m where the mean temperature has fluctuated somewhat during the years. The temperature data in those depth strata are, however, based on few observations(Fig. 14).

Table 15. Mean temperature, S.E and number of observations by NAFO Division and depth stratum.

Div.	Depth stratum (m)																	
	401-600			601-800			801-1000			1001-1200			1201-1400			1401-1500		
	°C	SE	n	°C	SE	n	°C	SE	n	°C	SE	n	°C	SE	n	°C	SE	n
1C	4.3	.07	2	3.5	.26	9	3.8	.03	13	3.5	.02	2						
1D	4.7	.02	2	4.0	.19	2	3.7	.05	4	3.5	.02	19	3.5	.01	12	3.4	.03	4

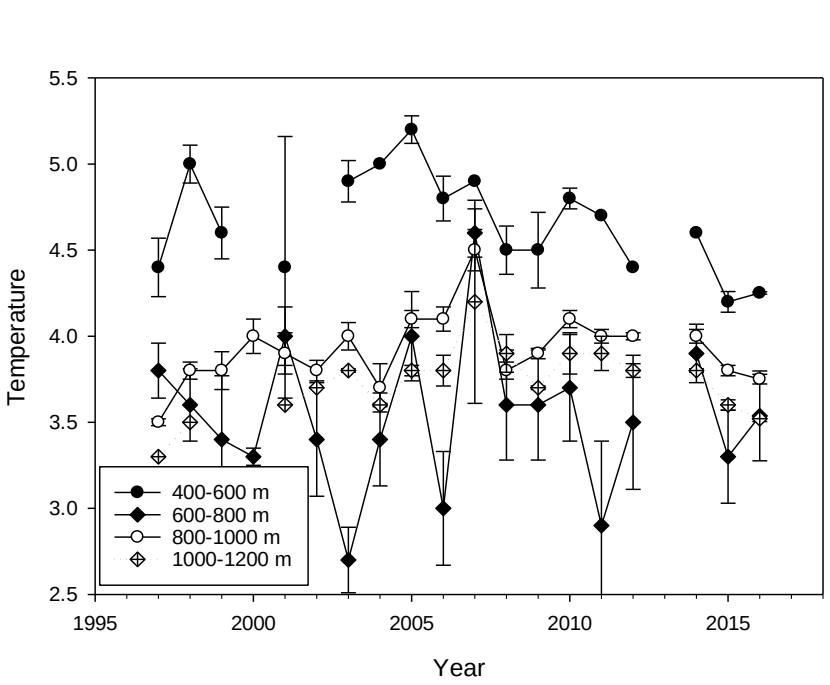

Fig 14a. Mean temperatures in Div. 1C by depth stratum and year with 1*S.E. No data from in 2013

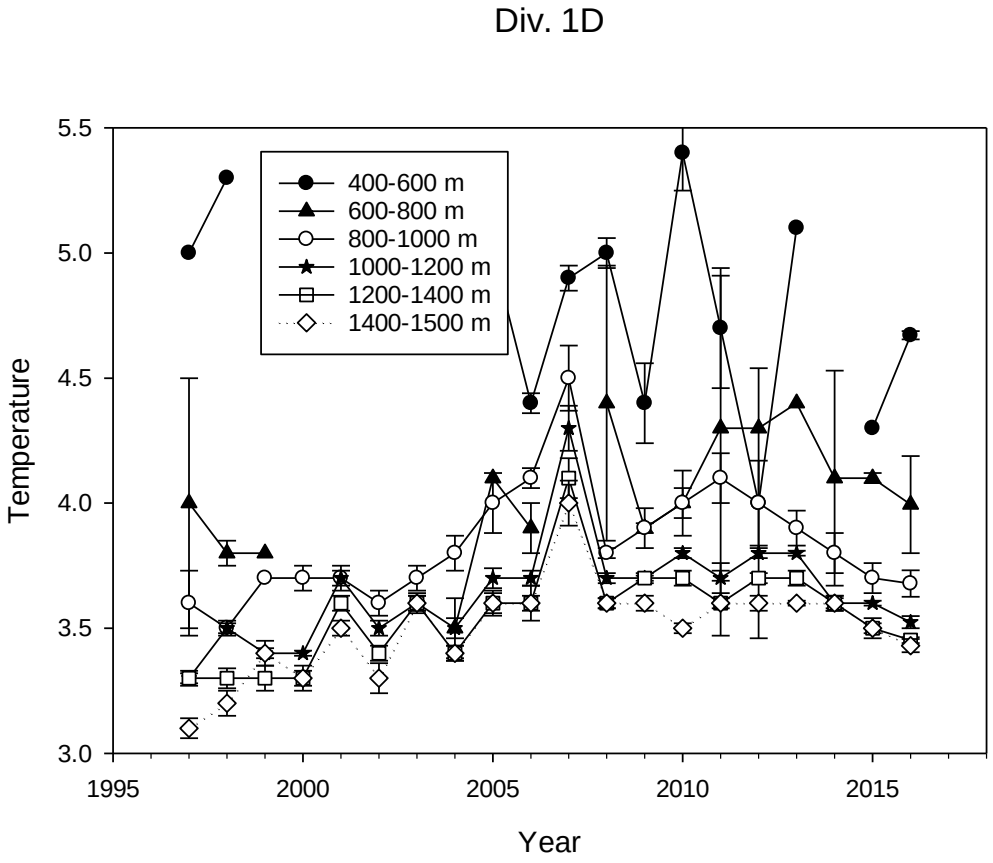

Fig 14b. Mean temperatures in Div. 1D by depth stratum and year with 1*S.E.

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Appendix 1. Catch weight and - numbers (not standardized to kg/km^2) of Greenland halibut, roundnose and roughhead grenadier and deep-sea redfish by haul, 2016. Depth in m, swept area in km^2 and bottom temperature in °C.

					Grl. halibut		Roundnose gre.		Roughhead gre.		*S. mentella*	
St. No	S. Area	Div.	Depth	Temp.	Number	Weight	Number	Weight	Number	Weight	Number	Weight
1	0.0396	1D	546.0	4.66	1.0	3.5	78	22.0	8	3.6	704.2	362.9
2	0.0435	1D	697.5	4.38	5.0	11.8	8	0.4	10	9.1	117.7	77.2
3	0.0605	1D	1028.0	3.63	164.0	238.3	18	3.0	13	6.7	0.0	0.0
4	0.0876	1D	1126.5	3.56	92.0	142.8	3	0.4	17	3.9	2.0	0.5
5	0.0781	1D	1105.5	3.55	147.0	204.8	4	0.5	17	5.7	0.0	0.0
7	0.0892	1D	979.0	3.67	143.0	193.3	5	0.4	16	6.7	0.0	0.0
8	0.0769	1C	1070.0	3.54	177.0	234.1	10	1.0	15	4.1	0.0	0.0
10	0.0449	1C	1047.0	3.50	46.0	92.2	4	0.7	0	0.0	0.0	0.0
11	0.0824	1C	955.5	3.60	276.3	341.4	29	2.4	10	6.0	0.0	0.0
13	0.0425	1C	867.5	3.65	149.0	209.6	53	2.8	9	3.4	6.0	2.0
14	0.0789	1C	877.5	3.69	136.0	181.4	113	6.4	24	8.3	9.0	5.7
15	0.0899	1C	945.0	3.72	177.0	209.3	2	0.1	14	2.1	1.0	1.0
16	0.0874	1C	872.5	3.74	189.0	227.3	1	0.1	9	1.4	0.0	0.0
17	0.0839	1C	839.0	3.74	255.0	310.5	2	0.1	7	5.4	0.0	0.0
18	0.0781	1C	757.0	3.81	69.0	75.9	1	0.0	5	1.2	3.0	1.0
19	0.0529	1C	813.5	3.96	21.0	27.0	2	0.1	14	2.7	1.0	0.6
20	0.0784	1C	839.0	3.90	116.0	132.6	0	0.0	17	3.3	3.0	1.2
21	0.0808	1C	772.5	3.90	114.0	120.0	60	3.8	8	2.2	10.0	3.6
22	0.0633	1C	512.5	4.25	0.0	0.0	0	0.0	4	2.0	73.0	25.7
24	0.0757	1C	574.5	4.26	5.0	7.4	1	0.2	6	2.4	122.0	65.2
25	0.0785	1C	617.0	4.23	14.0	15.5	9	1.0	6	2.5	251.0	93.5
26	0.0556	1C	654.5	4.07	13.0	11.7	3	0.1	3	1.4	75.0	30.6
27	0.0770	1C	668.0	3.73	64.0	38.1	0	0.0	9	2.4	15.0	4.9
28	0.0785	1C	623.5	1.88	92.0	57.7	0	0.0	12	3.1	8.0	4.0
29	0.0892	1C	626.0	2.56	82.0	60.6	0	0.0	31	3.7	32.0	9.5
30	0.0840	1C	760.0	3.80	118.0	140.6	0	0.0	4	2.1	3.0	1.1
31	0.0809	1C	810.0	3.77	67.0	83.6	2	0.2	4	1.1	0.0	0.0
32	0.0813	1C	841.5	3.76	99.0	130.7	3	0.3	17	8.6	0.0	0.0
33	0.0857	1C	823.5	3.83	93.0	128.7	4	0.7	7	1.5	1.0	0.3
34	0.0789	1C	746.0	3.87	73.0	96.3	3	0.3	14	7.9	9.0	5.0
35	0.0888	1C	839.5	3.74	93.0	128.6	1	0.1	7	4.4	1.0	0.4
37	0.0727	1C	925.5	3.65	91.0	123.5	3	0.4	8	5.1	0.0	0.0
39	0.0403	1D	922.0	3.77	18.0	22.0	6	0.3	2	1.7	0.0	0.0
40	0.0763	1D	1045.0	3.81	128.0	183.9	3	0.1	13	3.2	1.0	0.3
41	0.0810	1D	793.0	3.83	60.0	79.4	3	0.3	12	4.8	0.0	0.0
42	0.0803	1D	884.0	3.74	125.0	149.1	11	1.8	5	1.5	0.0	0.0
43	0.0878	1D	769.5	3.77	45.0	75.7	13	2.4	10	2.3	2.0	0.8
44	0.0866	1D	964.0	3.54	107.0	146.5	1	0.1	9	3.7	0.0	0.0
45	0.0789	1D	1115.0	3.50	116.0	145.2	1	0.0	5	1.1	5.0	2.2
46	0.0897	1D	1126.5	3.49	94.0	127.8	3	0.3	3	0.9	0.0	0.0
47	0.0411	1D	1269.5	3.44	52.0	78.1	3	0.2	9	6.2	0.0	0.0
48	0.0833	1D	1371.0	3.41	104.0	132.1	3	0.8	4	3.1	0.0	0.0
49	0.0806	1D	1462.0	3.47	65.0	78.3	4	1.0	1	0.7	0.0	0.0
50	0.0824	1D	1306.0	3.44	156.0	195.9	4	1.8	8	5.7	0.0	0.0
51	0.0818	1D	1121.0	3.47	231.0	343.0	3	0.8	6	3.3	0.0	0.0
52	0.0868	1D	1174.0	3.45	154.8	213.3	3	1.0	7	0.4	1.0	0.3
53	0.0863	1D	1170.5	3.56	107.0	213.6	1	0.0	15	6.9	2.0	0.8
54	0.0892	1D	1364.0	3.44	140.0	208.4	1	0.2	7	5.4	0.0	0.0
55	0.0505	1D	1341.0	3.46	72.0	99.3	2	0.5	5	2.9	0.0	0.0
56	0.0782	1D	1444.5	3.36	59.0	96.2	1	0.9	4	1.8	0.0	0.0
57	0.0628	1D	1428.5	3.48	124.0	176.6	4	1.9	8	4.8	0.0	0.0
59	0.0579	1D	1189.0	3.45	152.0	219.9	4	0.5	4	4.2	0.0	0.0
61	0.0567	1D	1312.0	3.43	140.0	190.1	17	3.5	10	4.1	0.0	0.0
62	0.0848	1D	1077.0	3.74	90.0	123.6	1	0.1	15	3.0	0.0	0.0
63	0.0897	1D	1159.0	3.59	84.0	124.4	1	0.5	21	8.1	0.0	0.0
64	0.0724	1D	1228.5	3.52	123.0	169.1	2	0.7	14	5.1	0.0	0.0
65	0.0527	1D	1252.0	3.55	66.0	91.1	2	0.4	7	1.9	0.0	0.0

66	0.0393	1D	1237.0	3.44	65.0	98.4	3	0.8	11	3.4	0.0	0.0
67	0.0785	1D	1260.0	3.44	83.0	127.2	11	2.4	16	9.7	0.0	0.0
69	0.0362	1D	1282.5	3.46	45.0	56.9	5	1.5	12	12.6	1.0	0.4
71	0.0564	1D	1125.5	3.44	46.0	79.8	13	1.6	8	5.4	1.0	0.3
72	0.0730	1D	1132.0	3.45	55.0	83.2	7	1.3	14	5.9	0.0	0.0
73	0.0443	1D	1127.0	3.47	49.0	70.5	3	0.4	7	2.9	1.0	0.3
74	0.0686	1D	1128.0	3.44	67.0	112.3	16	2.8	9	1.8	1.0	0.4
75	0.0739	1D	1105.5	3.48	61.0	76.7	3	0.5	5	1.9	0.0	0.0
76	0.0867	1D	1155.0	3.45	69.0	105.5	9	1.5	7	3.0	1.0	0.3
77	0.0753	1D	1083.5	3.44	83.0	115.9	15	3.6	11	3.3	1.0	0.4
78	0.0783	1D	1280.0	3.42	76.0	119.8	16	3.7	15	13.2	0.0	0.0
79	0.0790	1D	1434.5	3.42	139.0	205.9	3	0.3	16	14.1	1.0	1.1
80	0.0475	1D	421.5	4.69	48.0	35.1	0	0.0	0	0.0	8.0	2.9

Appendix 2. List of species and groups of species recorded in Div. 1CD in 2016 with observed maximum catch weight (kg), maximum number per tow, minimum and maximum depth (m), minimum and maximum bottom temperature (°C) and most northern observation, respectively.

Obs	art	species	maxwgt	maxno	mindepth	maxdepth	mintemp	maxtemp	maxpos
1	ALA	Alepocephalus agassizzi	21.1	32	878	1462	3.4	3.7	64.7788
2	ALB	Alepocephalus bairdii	4.0	12	698	1364	3.4	4.4	64.1800
3	RFL	Amblyraja fyllae	1.7	2	655	1128	3.4	4.1	65.7120
4	RRD	Amblyraja radiata	2.9	4	422	814	4.0	4.7	65.1285
5	CAD	Anarhichas denticulatus	17.7	4	513	1435	3.4	4.7	65.4550
6	CAS	Anarhichas minor	35.1	2	1127	1364	3.4	3.5	63.8998
7	ANC	Anopologaster cornuta	0.2	2	1106	1429	3.4	3.6	64.0993
8	ANT	Antimora rostrata	30.9	56	746	1462	3.4	4.0	65.4289
9	ARZ	Arctozenus rissoi	0.3	3	422	1229	2.6	4.7	65.2799
10	ARS	Argentina silus	8.9	22	513	546	4.2	4.7	65.0209
11	BAM	Bajacalifornia megalops	0.3	1	926	1128	3.4	3.6	64.3213
12	BAT	Bathylagus euryops	3.2	65	746	1462	3.4	3.9	65.4289
13	BSP	Bathyraja spinicauda	23.4	1	698	1229	3.4	4.4	64.4921
14	BEG	Benthosema glaciale	0.1	23	422	1462	1.9	4.7	65.7120
15	POC	Boreogadus saida	0.0	1	655	655	4.1	4.1	65.7120
16	BOA	Borostomias antarcticus	0.5	3	746	1445	3.4	3.9	65.4289
17	CFB	Centroscyllium fabricii	41.0	31	513	1364	2.6	4.4	65.7120
18	CHO	Ceratias holboelli	0.0	1	868	1260	3.4	3.7	64.6867
19	CHM	Chalinura mediterranium	1.0	4	1435	1462	3.4	3.5	63.6247
20	CHA	Chauliodus sloani	0.1	2	1127	1306	3.4	3.5	63.7829
21	CHH	Chiasmodon harteli	0.0	1	1128	1128	3.4	3.4	63.5053
22	CHN	Chiasmodon niger	0.0	1	1270	1371	3.4	3.4	63.7729
23	CGR	Coryphaenoides güntheri	5.3	31	1028	1462	3.4	3.7	65.4289
24	RNG	Coryphaenoides rupestris	22.0	113	546	1462	3.4	4.7	65.7120
25	COM	Cottunculus microps	1.1	2	760	1237	3.4	4.0	65.1285
26	COT	Cottunculus thomsonii	3.2	3	655	1171	3.4	4.1	65.7120
27	LUM	Cyclopterus lumpus	0.6	1	956	1283	3.4	3.6	64.4921
28	CLM	Cyclothone microdon	0.0	2	655	1283	3.5	4.1	65.7120
29	DPK	Dolopichthys longicornis	0.1	1	814	814	4.0	4.0	65.1285
30	EUR	Eurypharynx pelecanoides	0.3	2	1115	1371	3.4	3.5	63.9101
31	COD	Gadus morhua	32.8	18	422	624	1.9	4.7	65.5780
32	ONA	Gaidropsarus argentatus	0.3	1	668	1429	3.4	3.7	65.6871
33	ONN	Gaidropsarus ensis	2.2	5	624	1462	1.9	3.8	65.6871
34	WIT	Glyptocephalus cynoglossus	0.6	1	770	839	3.8	3.9	65.0615
35	GOB	Gonostoma bathyphilum	0.0	1	1070	1429	3.4	3.5	64.3648
36	HJI	Halargyreus johnsonii	0.2	1	956	956	3.6	3.6	64.4921
37	PLA	Hippoglossoides platessoides	18.2	114	422	868	1.9	4.7	65.7120
38	HOA	Holtbyrnia anomala	0.1	2	1047	1445	3.4	3.5	65.4289
39	HAT	Hoplostethus atlanticus	0.2	1	773	773	3.9	3.9	64.9260
40	HAF	Hydrolagus affinis	31.7	5	1252	1445	3.4	3.6	63.6752
41	LMC	Lampanyctus macdonaldi	1.1	71	422	1462	2.6	4.7	65.7120
42	LEP	Lepidion eques	1.5	7	546	1084	3.4	4.7	64.9260
43	LIF	Liparis fabricii	2.5	81	624	873	1.9	3.9	65.6871
44	LOA	Lophodoles alanthogantus	0.0	1	1174	1174	3.5	3.5	63.8250
45	LPA	Lycodes paamiuti	0.3	1	624	1237	1.9	3.8	65.5780
46	LYV	Lycodes vahli	1.0	8	422	422	4.7	4.7	63.4916
47	LYM	Lycodonus mirabilis	0.0	1	1132	1435	3.4	3.5	63.4465
48	RHG	Macrourus berglax	14.1	31	513	1462	1.9	4.7	65.7120
49	MAL	Malacosteus niger	0.1	1	1429	1462	3.5	3.5	63.6247
50	MAM	Maulisia mauli	0.1	1	626	868	2.6	3.7	65.2799
51	BLI	Molva dipterygia	1.2	1	546	546	4.7	4.7	64.2061
52	MYJ	Myxine jespersenae	0.1	1	878	878	3.7	3.7	64.7788
53	NZB	Nezumia bairdii	0.1	1	1127	1127	3.5	3.5	63.8998
54	PMO	Normichthys operosa	0.0	1	1077	1077	3.7	3.7	63.7441
55	NOT	Notacanthus chemnitzii	7.6	7	546	1462	3.4	4.7	65.1285
56	NOK	Notoscopelus kroyeri	0.0	1	624	1127	1.9	3.9	65.5780
57	PAC	Paraliparis copei	0.0	1	1128	1128	3.4	3.4	63.5053
58	PAG	Paraliparis garmani	0.0	3	626	842	2.6	4.1	65.7120
59	POL	Polyacanthonotus rissoanus	0.5	3	1084	1462	3.4	3.5	63.6247
60	RBI	Raja bigelowi	0.1	1	1128	1128	3.4	3.4	63.5053
61	SKA	Raja. sp.	0.1	1	655	655	4.1	4.1	65.7120
62	GHL	Reinhardtius hippoglossoides	343.0	276	422	1462	1.9	4.7	65.7120
63	SAS	Sagamichthys schnakenbecki	0.1	1	760	760	3.8	3.8	64.8913
64	SCO	Scopelosaurus lepidus	1.5	11	668	1462	3.4	4.0	65.6871
65	REG	Sebastes marinus	11.1	5	422	626	2.6	4.7	65.4550
66	REB	Sebastes mentella	362.9	704	422	1435	1.9	4.7	65.7120
67	RED	Sebastes sp.	0.1	1	698	698	4.4	4.4	64.1800
68	SER	Serrivomer beani	0.4	5	873	1435	3.4	3.7	64.7188

69	STO	Stomias boa	0.1	2	422	1462	3.4	4.7	64.9698
70	SYN	Synaphobranchus kaupi	1.9	13	546	1462	1.9	4.7	65.5780
71	TRA	Trachyrhynchus murrayi	0.9	3	926	1429	3.4	3.8	65.4289