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Analysis of Data from the 2006 Trawl Surveys in NAFO Division 0A

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Abstract

Two stratified-random otter trawl surveys were conducted in southern Division 0A (Baffin Bay) in 2006. The first was conducted in shallow water (100 m to 800 m) from August 26 to September 5 and the second in deep water (400 m to 1500 m) from October 27 to November 7 and covered previously surveyed strata. For the shallow water survey all 75 stations were successfully completed with an additional 13 experimental stations added during the trip. In the deepwater survey 62 of 75 planned stations were successfully completed and the actual survey area was 44,915 km^2. Forty percent of the tows in the shallow water survey did not have any Greenland halibut. Greenland halibut were distributed throughout the deepwater survey area and were present in all tows. Biomass and abundance in the deepwater survey were estimated to be 52,271 t (S.E. 9,759) and 9.22×10^7 (S.E. 1.5×10^7), respectively. However, two of the four strata missed (60, 61) fell within the depth strata 1001-1500 m and accounted for 11,000-13,000 t of biomass and 1.11×10^7-1.22×10^7 fish estimated in previous surveys. Therefore, the current biomass and abundance estimates are considered to be lower than the most recent surveys but comparable to estimates from 1999. Density in t/km^2 was lower in all depth strata except 1001-1250 m compared to 2004 and 1999. Mean abundance per km^2 had increased to $5{,}103 \times 10^7$ from $3{,}319 \times 10^7$ for the 1001-1250 m depth strata but was lower for all the others compared to 2004 and 1999. The overall length distribution ranged from 6 cm to 72 cm with a lesser mode of 39 cm (similar to that seen in 1999) compared to 45 cm for the 2004 survey and 77% were less than 45 cm.

Introduction

Two stratified-random otter trawl surveys were carried out in the southern portion (below 73.5 ^{o}N) of the North West Atlantic Fisheries Organization (NAFO) Division 0A (Baffin Bay). The first survey conducted between August 26 and September 5, 2006 covered depths from 100 m to 800 m (shallow water survey). The second survey conducted between October 27 and November 7, 2006 covered depths from 400 m to 1500 m (deep water survey). The deep water survey continues a time series that has been established for this area with previous surveys conducted in 1999 (Treble et al., 2000), 2001 (Treble 2002) and 2004 (Treble 2005). These surveys were a collaborative effort between Fisheries and Oceans Canada, the Nunavut Wildlife Management Board, Baffin Fisheries Coalition, Government of Nunavut, Nunavut Tungavik Inc., and the Greenland Institute of Natural Resources. The Greenlandic research vessel Pâmiut was used to carry out the surveys. The science crew was comprised of six Canadians and one Greenlander.

The objectives were:

1. Collect the data required to establish age structure, estimate population abundance, biomass, and recruitment of Greenland halibut;

2. Collect the data required to establish age structure, estimate population abundance, biomass, and recruitment of shrimp;
3. Record numbers caught and collect length and weight data on all other commercial species caught, to allow calculation of abundance, biomass, and size structure of these species;
4. Record numbers and collect weight data on all non-commercial species caught, to allow calculation of abundance and biomass of these species;
5. Collect additional data and biological samples as desired and as time permits (e.g. lengths for by-catch, maturity information, coral samples, other special requests);
6. Collect temperature data at each fishing station;
7. Collect oceanographic data at pre-determined standard stations.

Materials and Methods

Stratification and Set Selection

The stratification for the shallow water survey was not available at the time this report was prepared. Sets were allocated proportionally to stratum size. Survey coverage was approximately 1 set per 350 nm^2 with a minimum of 2 sets per stratum. A total of 75 stations were randomly selected from numbered units within each stratum using a buffered random design (Kingsley et al. 2004). An additional 13 experimental stations were fished during the trip.

The strata for the deepwater survey covering depths 400-1500 m is given in Table 1. This stratification scheme is also shown in Figure 1. The total area between 401 m and 1500 m encompassed by the strata in southern Div. 0A (to 72^o N) is 49,834 km^2 (14,529 nm^2). A re-stratification of stratum 24-34 and correction of errors in the area measurements for stratum 40-61 was carried out in 2004. Data from 1999 and 2001 were re-calculated according to the new information. Survey coverage was intended to be approximately 1 set per 750 km^2 (220 nm^2) with a minimum of 2 sets per stratum. This coverage was similar to that used in the 1999, 2001 and 2004 surveys. A total of 75 stations were randomly selected from numbered units within each stratum, along with an additional 2 sets per stratum to be used as alternate fishing stations as necessary. The strata and stations were grouped by depth categories shown in Table 2.

Vessel and Gear

The surveys were conducted by the M/Tr Pâmiut, a 722 GRT stern trawler measuring 53 m in length. A Cosmos shrimp trawl (Wieland and Bergström 2005) was used for the shallow water survey. Trawl doors were Injector International, measuring 7.5 m^2 and weighing 2800 kg.

An Alfredo III bottom otter trawl with rock hopper ground gear was used for the deep water survey. Mesh size was 140 mm with a 30 mm mesh liner in the cod end. Trawl doors were Injector International, measuring 7.5 m^2 and weighing 2800 kg. These doors replaced the Greenland Perfect doors (9.25 m^2 and 2420 kg) in 2004. The average net height was 20 cm higher with the new doors but the overall net performance was not significantly different (95% level). Jørgensen (1998) contains more information about the trawl and gear. A Furuno based system mounted on the head rope measured net height and was used to determine bottom contact and the start/finish of each tow. Scanmar 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 (m) x 0.142. This relationship was based on flume tank measurements of the trawl and rigging (Jørgensen 1998).

Oceanographic Sampling

Star Oddi DST CTD© sensors (sensitive to within ±0.1^{o}C) mounted on one of the trawl doors provided bottom temperature data for most sets. All sensors used were inter-calibrated with a Seabird CTD (Conductivity-Temperature-Depth) system during the standard oceanographic transects. In the few cases where there was no data from the trawl door sensor temperature data from the trawl eye sensor was used.

A Seabird 19© CTD system equipped with a fluorometer was deployed at 5 to 6 stations on sections at Cape Christian and Broughton Island. Both sections were done during the shallow water survey and the Broughton Island section was repeated during the deepwater survey. Readings were taken to the bottom or within the top approx. 700 m of the water column.

Trawling Procedure

Trawl duration for the shallow water survey was 15 minutes in duration at a towing speed of 2.5 knots. Trawling took place throughout a 24 hr period in order to maximize the ships time and complete the necessary tows.

For the deepwater survey the targeted tow duration was 30 minutes, however, tows down to 15 minutes in length were considered acceptable. Average towing speed was 3.0 knots. The towing speed used in the calculations for abundance and biomass was estimated from the start and end positions of the tow, or in a few cases from GPS observations (mean of records made every 5 minutes during the tow).

Biological Data Collection and Analysis

In both surveys numbers and total weight caught were recorded on a set by set basis for each species. Detailed sampling was carried out on Greenland halibut and shrimp. For other commercial species (e.g. redfish, grenadiers, skates) sexed length measurements were collected. Lengths were measured to the lowest 1 cm total length (0.5 cm pre anal fin length for grenadiers) using a standard meter board. Large catches of either Greenland halibut or shrimp were sub-sampled. Sub-samples of Greenland halibut were comprised of at least 200 fish. Adjustments were made during analysis to estimate total number caught in each case.

Greenland halibut sampling consisted of a visual assessment of maturity for all individuals based on maturity stages described in Riget and Boje 1989. For each sampled fish the whole weight was recorded at sea using an electronic balance. Otoliths for age determination were collected, 10 per 1 cm length group per sex.

Research on age determination methods for Greenland halibut is on-going so the otolith samples were not analyzed.

Various species from the catch were collected or had tissue samples taken for use by other researchers within DFO, the University of Dalhousie, Woods Hole Oceanographic Institute (USA) and ANFACO-CECOPESCA (Spain).

Biomass and Abundance Indices

For the deepwater survey the swept area method was used in the estimation of biomass and abundance for Greenland halibut: Swept area=wingspread (m) x trawl time (min) x trawl speed (kn/hr) x 1.852/6x10^4. Abundance and biomass were calculated for each set and standardized to 1 sq km:

Abundance (no./sq. km)=catch (no.)/sweptarea (sq km)
Biomass (tons/sq km)=catch (kgs)/swept area (sq km)/1000.

Mean and standard error for abundance and biomass were calculated for each depth category. An estimate of total abundance and biomass was then calculated for each depth strata (mean x area surveyed within each depth strata (sq km)) as well as over all depths. Standard error values were also calculated for the overall total.

Abundance at length was calculated for each depth category (standardized to km^2 and weighted by tow), and a total abundance at each length (weighted by the strata area), was calculated (mean number/sq.km. x area surveyed within each depth strata (sq km)). The sum across all lengths and depth strata was calculated and compared to the overall abundance value determined above to ensure they were equal.

Results and Discussion

Mean near bottom temperatures throughout the 400 m to 1500 m depths varied from 1.5 ^{o}C to 0.4 ^{o}C in 2006 (Table 3). The majority of tows (85.5%) had temperatures less than or equal to 2.0 ^{o}C (Table 4b). Mean bottom temperatures showed a declining trend with depth. Temperatures below 750 m had increased slightly compared to previous years (Table 3). Results from the 100 m to 800 m depths survey and the oceanographic sections can be found in Treble and Siferd (2007).

For the shallow water survey all 75 stations were successfully completed with an additional 13 experimental stations added during the trip (Table 2). There was a trawl eye malfunction on one of these tows therefore sweptarea could not be calculated and only 88 tows were included in the plots of catch and length distribution.

In the deepwater survey 62 of 75 planned stations were successfully completed (Table 2) and the actual survey area was 44,915 km^2 (Table 5 and 6). This compares to 44,484 km^2, 40,475 km^2 and 44,580 km^2 in 2004, 2001 and 1999, respectively. There was better coverage in the shallow strata compared to previous years but coverage was missing or reduced in strata from depth categories 1001-1500 m. Stratum numbers that were missed in 2006 were 56 (401-500 m), 57 (501-750 m), 60 (1001-1250 m) and 61 (1251-1500 m). Three stratum had only 1 tow, 31 (1001-1250 m), 32 (1251-1500 m) and 59 (751-1000 m).

Catches of most species other than Greenland halibut were small in number and so detailed analysis of these species is not presented here. In total 86 species or groups of species were caught during the first survey in 100 m to 800 m depths and 52 were caught during the second survey in 400 m to 1500 m depths. This includes several species of shrimp and invertebrates (Appendix 1 and 2).

Greenland Halibut

Forty percent (35) of the tows in the shallow water survey did not have any Greenland halibut (Figure 2). Catch numbers varied from 1-276 and catch weight from 0.01-96.85 kg (Table 4a). No further analysis was conducted on this data.

Greenland halibut were distributed throughout the deepwater survey area and were present in all tows (Figure 3 and Table 4b). Catch numbers varied from 7-1098 and catch weight from 1.9-733 kg (Table 4b). Catch distribution for years 1999, 2001, 2004 and 2006 are shown in Figures 4 and 5.

The 2006 estimate of biomass for the deepwater survey area is 52,271 t (S.E. 9,759) (Table 5). This compares to 86,176 t in 2004, 81,002 t in 2001 and 68,760 t in 1999. However, two of the four strata missed (60, 61) fell within the depths 1001-1500 m and accounted for 11,000-13,000 t of biomass in previous surveys. Therefore, the current estimate is considered to be lower than the most recent surveys but comparable to the estimate from 1999. Biomass estimates in the 501-750 m and 751-1000 m depth strata are lower compared to previous years while estimates for 401-500 m and 1001-1250 m are similar.

In 2004 there were 5 stratum missed but they were all at depths below 750 m and likely contained little biomass. In 2001 eight strata were missed (Treble 2002) but only one was likely to contain substantial biomass (stratum 61, 1251-1500 contained 11,339 t in 1999). There were 4 stratum missed in 1999, all below 750 m.

Mean biomass or density was highest (1.2 to 3.5 t/sq km) within the 751 to 1000 m depth strata as was the case in previous surveys (Table 6). Density was lower in all depth strata except 1001-1250 m compared to 2004 and 1999. Both density and biomass for the 1251-1500 m depth strata were at levels similar to that for 2001, this likely reflects the fact that strata 61 was missed in both the 2001 and 2006 surveys.

Abundance for the 2006 survey is estimated at 9.22×10^7 (S.E. 1.5×10^7) (Table 6) a decline compared to previous years (1.11×10^8 in 2004, 1.19×10^8 t in 1999 and 2001). However, two of the four strata missed (60, 61) fell within the depths 1001-1500 m and accounted for 1.11×10^7-1.22×10^7 in previous surveys. Therefore, the current estimate is considered to be comparable to previous years.

A decline in abundance was noted in depth strata 1251-1500 m where strata 61 had been missed but there was also a decline in shallower depth strata not affected by missing tows. The 1001-1250 m depth strata was an exception where abundance increased despite a slight decrease in biomass suggesting a greater number of smaller fish at these depths compared to 2004. Mean abundance per sq km had increased to 5,103 x 10^7 from 3,319 x 10^7 for the 1001-1250 m depth strata but was lower for all the others compared to 2004 and 1999 (Table 7).

Length frequency distributions by depth strata for the deepwater survey are given in Figure 6. The number of fish at larger length classes increases with depth. The length distributions for both depth strata 401-500 m and 501-750 have modes of 21 cm and are skewed to the right. The mode increased to 36 cm for depths 751-1000 m and 39 cm for 1001-1250 m. The length distribution for the 1250-1500 m depth strata had a flat top stretching over lengths 39-54 cm.

The overall length distribution adjusted for survey area ranged from 6 cm to 72 cm with a lesser mode of 39 cm (similar to that seen in 1999) compared to 45 cm for the 2004 survey (Table 7 and Figure 7).

Note that the 1999 total abundance by length class in Table 7 does not match the overall abundance calculated for 1999 shown in Table 6 but it is reasonably close. The 1999 length frequency data were in a different format so the SAS© programs used in subsequent years for biomass, abundance and length frequency calculations could not be applied. Instead the Excel© spreadsheet program was used and so the difference observed could be due to rounding or errors in performing the Excel calculations.

The percentage of fish <45 cm was 77.0%, similar to the 1999 level and greater than the 2004 (57%) and 2001 (68%) estimates (Table 9). In contrast the percentage of fish =<35cm was lowest in 2001 at 15.7% increasing to 21.1% in 2004 and returning to 1999 levels (34%) in 2006 (Table 7). The observed trends in abundance may reflect the passing of the abundant 1995 year class through the population and increased influence of more recent good year classes (e.g. 1999 and 2000) (see Sünksen and Jørgensen 2007, Figure 4b for an offshore recruitment index).

Length frequency distributions for the shallow water survey were estimated for depth strata 301-400 m, 401-600 m and 601-800 m (Figure 8). There were no Greenland halibut caught in the 101-200 m depth strata and only a few in the 201-300 m strata. There was only a small abundance of Greenland halibut in the 301-400 m depth strata with no distinct mode. The Cosmos trawl may be more efficient at catching young Greenland halibut compared to the Alfredo trawl as frequency was greater across a wider distribution of lengths at comparable depth strata. The distribution was bi-modal (24 cm and 33 cm) for the 401-600 m depth strata and multi-modal (18-21 cm, 27 cm, 33 cm and 39 cm) for the 601-800 m depth strata (Figure 8).

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Table 1. Stratification scheme for Southern Division 0A. A conversion factor of 3.430 was used to calculate square kilometres from square nautical miles.

Stratum	Sq. N Miles	Units	Sq. Km.	Depth (m)
First roughed out by hand in 1986 and corrected in May 2004				
024	281	90	963.8	401-500
025	1527	510	5237.6	501-750
030	1004	330	3443.7	751-1000
031	832	280	2853.8	1001-1250
032	391	130	1341.1	1251-1500
033	305	100	1046.2	501-750
034	156	50	535.1	401-500
	4,496		**15,421**	
First done in March 1999 and corrected in May 2004				
040	1296	480	4445.3	1251-1500
041	546	200	1872.8	1001-1250
042	443	160	1519.5	751-1000
043	472	170	1619.0	501-750
044	289	110	991.3	401-500
045	268	100	919.2	501-750
046	281	110	963.8	751-1000
047	686	250	2353.0	1001-1250
048	653	240	2240.0	1251-1500
049	547	200	1876.2	1251-1500
050	491	190	1684.1	1001-1250
051	437	160	1499.0	751-1000
052	477	180	1636.1	501-750
053	214	80	734.0	401-500
054	649	240	2226.1	501-750
055	253	100	867.8	401-500
056	125	60	428.8	401-500
057	416	190	1426.9	501-750
058	220	100	754.6	501-750
059	377	170	1293.1	751-1000
060	422	190	1447.5	1001-1250
061	471	210	1615.5	1251-1500
	10,033		**34,413**	
TOTAL	**14,529**		**49,834**	

Table 2. Area of depth strata for 2006 Division 0A survey with the number of successful hauls and number planned in ( ).

NAFO Division	Depth Stratum (m)	401-500	501-750	751-1000	1001-1250	1251-1500	Total
0A	Area (sq. km)	4521	14866	8719	10211	11518	49835
400m-1500m	Hauls	10 (12)	20 (22)	12 (13)	8 (13)	12 (15)	62 (75)

Table 3. Mean temperature and S.E. in ( ) by depth stratum for NAFO Division 0A.

NAFO	Depth Stratum (m)				
Division 0A	401-500	501-750	751-1000	1001-1250	1251-1500
South- 1999	1.6 (0.50)	1.4 (0.16)	1.0 (0.03)	0.6 (0.05)	0.1 (0.04)
2001	0.7 (0.10)	1.5 (0.22)	0.9 (0.07)	0.7 (0.05)	0.2 (0.05)
2004	1.3 (0.21)	1.5 (0.25)	1.0 (0.05)	0.6 (0.05)	0.1 (0.04)
2006	**1.5 (0.34)**	**1.4 (0.12)**	**1.3 (0.09)**	**0.9 (0.08)**	**0.4 (0.25)**

Table 4a. Catch weight and numbers (not standardised to kg/km^2) of Greenland halibut, by haul for the 2006 survey of Division 0A depths 400 m to 1500 m. Depth in m, swept area in km2 and bottom temperature in degrees celsius. EX denotes an experimental station added during the trip.

Trip	Gear	Set No.	Month	Day	Mean Depth (m)	Sweptarea (sq. km)	Depth Stratum	Temp. (^{o}C)	Time (UTC)	Greenland halibut Number	Kg
5	Cosmos	1	8	26	637.0	0.02992	800	1.27	1:24	120	19.80
5	Cosmos	2	8	26	482.0	0.02914	600	1.29	6:21	157	27.35
5	Cosmos	3	8	26	172.5	0.02661	200	-1.5	9:43	0	0.00
5	Cosmos	4	8	26	461.0	0.03520	600	1.17	12:01	139	40.85
5	Cosmos	5	8	26	149.5	0.02818	200	-1.54	14:06	0	0.00
5	Cosmos	6	8	26	381.5	0.03501	400	0.25	15:33	10	4.53
5	Cosmos	7	8	26	553.5	0.03437	600	1.37	17:31	112	54.15
5	Cosmos	8	8	26	288.0	0.03049	300	-0.91	19:55	1	0.01
5	Cosmos	9	8	26	119.5	0.02545	200	-1.7	21:44	0	0.00
5	Cosmos	10	8	26	377.5	0.03169	400	0.03	23:43	17	8.15
5	Cosmos	12	8	27	233.5	0.02884	300	-1.5	4:16	0	0.00
5	Cosmos	13	8	27	139.0	0.02239	200	-1.68	8:10	0	0.00
5	Cosmos	14	8	27	187.0	0.02548	200	-1.58	10:37	0	0.00
5	Cosmos	15	8	27	252.0	0.02655	300	-1.37	12:45	0	0.00
5	Cosmos	16	8	27	265.0	0.02933	300	-1.16	16:26	0	0.00
5	Cosmos	17	8	27	468.5	0.03368	600	0.8	21:59	27	10.65
5	Cosmos	18	8	28	617.0	0.03490	800	1.15	0:49	71	23.20
5	Cosmos	19	8	28	641.5	0.03265	800	1.21	6:02	56	20.70
5	Cosmos	20	8	28	700.5	0.03759	800	1.2	8:49	53	32.30

5	Cosmos	21	8	28	473.5	0.03277	600	1.03	10:46	61	32.30
5	Cosmos	22	8	28	103.0	0.02158	200	-1.75	12:24	0	0.00
5	Cosmos	23	8	28	149.5	0.02664	200	-1.72	15:48	0	0.00
5	Cosmos	24	8	28	148.5	0.02772	200	-1.74	17:56	0	0.00
5	Cosmos	25	8	28	131.5	0.02733	200	-1.72	20:24	0	0.00
5	Cosmos	26	8	28	126.0	0.02513	200	-1.75	22:17	0	0.00
5	Cosmos	27	8	28	110.5	0.02700	200	-1.76	23:59	0	0.00
5	Cosmos	28	8	29	150.5	0.02540	200	-1.74	3:01	0	0.00
5	Cosmos	29	8	29	175.0	0.02546	200	-1.69	5:29	0	0.00
5	Cosmos	30	8	29	232.5	0.02993	300	-1.51	6:59	0	0.00
5	Cosmos	31	8	29	245.0	0.03009	300	-1.49	8:53	0	0.00
5	Cosmos	32	8	29	174.5	0.02929	200	-1.72	14:16	0	0.00
5	Cosmos	33	8	29	556.0	0.03347	600	1.17	16:00	17	7.45
5	Cosmos	34	8	29	142.5	0.03032	200	-1.6	17:54	0	0.00
5	Cosmos	35	8	29	215.0	0.02575	300	-1.54	19:40	0	0.00
5	Cosmos	36	8	29	188.5	0.02932	200	-1.47	21:23	0	0.00
5	Cosmos	37	8	30	549.5	0.03757	600	1	1:56	60	30.95
5	Cosmos	38	8	30	131.0	0.02683	200	-1.04	5:20	0	0.00
5	Cosmos	39	8	30	312.5	0.03393	400	-0.54	7:52	0	0.00
5	Cosmos	40	8	30	328.5	0.03154	400	-0.27	10:06	1	1.64
5	Cosmos	41	8	30	777.5	0.03992	800	1.16	12:44	38	29.15
5	Cosmos	42	8	30	725.5	0.04085	800	1.2	19:31	161	104.50
5	Cosmos	43	8	30	154.0	0.02663	200	-1.75	21:57	0	0.00
5	Cosmos	44	8	31	658.5	0.04000	800	1.11	0:07	81	44.00
5	Cosmos	45	8	31	235.5	0.03099	300	0.97	2:05	0	0.00
5	Cosmos	46	8	31	162.5	0.03178	200	-1.7	3:44	0	0.00
5	Cosmos	48	8	31	177.0	0.02899	200	-1.7	7:44	0	0.00
5	Cosmos	54	8	31	737.5	0.03845	800	0.9	15:41	37	18.40
5	Cosmos	55	8	31	414.0	0.03522	600	0.96	17:37	22	9.00
5	Cosmos	56	8	31	334.5	0.02984	400	0.24	20:00	3	0.96
5	Cosmos	57	8	31	354.0	0.03125	400	0.76	22:18	20	14.40
5	Cosmos	58	9	1	268.5	0.03278	300	-1.59	0:10	0	0.00
5	Cosmos	59	9	1	533.5	0.04135	600	1.19	2:18	104	57.20
5	Cosmos	60	9	1	280.5	0.03115	300	-0.43	4:25	1	1.28
5	Cosmos	61	9	1	672.5	0.03395	800	1.19	6:17	77	52.65
5	Cosmos	62	9	1	171.0	0.02786	200	-1.78	9:16	0	0.00
5	Cosmos	63	9	1	546.5	0.03468	600	1.24	13:19	43	28.55
5	Cosmos	64	9	1	555.5	0.03299	600	1.23	15:09	30	17.85
5	Cosmos	65	9	1	537.0	0.03492	600	1.15	19:01	38	18.70
5	Cosmos	66	9	1	254.5	0.02911	300	-1.6	21:00	0	0.00
5	Cosmos	67	9	1	473.0	0.03594	600	1.03	23:07	37	18.25
5	Cosmos	68	9	2	352.0	0.03221	400	0.1	2:11	3	1.41
5	Cosmos	69	9	2	123.0	0.02678	200	-1.76	3:42	0	0.00
5	Cosmos	70E	9	2	317.5	0.03341	400	-0.86	5:11	8	4.74
5	Cosmos	71E	9	2	409.0	.	600	-0.95	9:57	4	2.06
5	Cosmos	72	9	2	239.5	0.03184	300	-1.35	13:53	0	0.00
5	Cosmos	73	9	2	171.0	0.02853	200	-1.58	16:18	0	0.00
5	Cosmos	74E	9	2	496.5	0.03577	600	1.15	18:19	115	54.20
5	Cosmos	75	9	2	361.0	0.03250	400	0.99	21:34	7	4.30
5	Cosmos	76E	9	3	589.5	0.03444	600	0.6	0:52	89	38.25

5	Cosmos	77E	9	3	615.5	0.03501	800	0.6	3:07	67	20.25
5	Cosmos	78E	9	3	708.5	0.03651	800	0.6	5:39	190	66.35
5	Cosmos	85	9	3	483.0	0.03069	600	1.27	18:09	59	30.40
5	Cosmos	86E	9	3	349.0	0.03556	400	-1.26	21:24	0	0.00
5	Cosmos	87	9	4	505.0	0.01543	600	0.9	0:47	247	96.85
5	Cosmos	88	9	4	572.5	0.03831	600	1.37	3:52	276	81.00
5	Cosmos	89	9	4	720.0	0.04016	800	1.27	6:12	126	64.30
5	Cosmos	90E	9	4	559.0	0.03487	600	1.37	9:01	175	68.15
5	Cosmos	91E	9	4	567.5	0.03665	600	1.37	12:33	143	38.50
5	Cosmos	92	9	4	771.5	0.03953	800	1.25	15:45	66	20.90
5	Cosmos	93	9	4	763.5	0.03893	800	1.25	17:48	51	38.94
5	Cosmos	94	9	4	699.5	0.03629	800	1.22	20:15	70	18.75
5	Cosmos	95	9	4	746.5	0.03329	800	1.2	22:28	51	23.60
5	Cosmos	96	9	5	641.0	0.03312	800	2.13	1:38	134	36.27
5	Cosmos	97	9	5	649.5	0.03328	800	2.38	4:34	159	35.10
5	Cosmos	98E	9	5	583.5	0.03830	600	2.74	6:36	167	21.75
5	Cosmos	99E	9	5	580.5	0.04004	600	2.66	8:58	49	18.45
5	Cosmos	100E	9	5	575.5	0.03265	600	1.7	11:45	66	14.35
5	Cosmos	101E	9	5	482.5	0.03446	600	1.75	14:58	93	12.90
5	Cosmos	102E	9	5	540.5	0.03854	600	2.7	18:27	72	13.95

Table 4b. Catch weight and numbers (not standardised to kg/km^2) of Greenland halibut, by haul for the 2006 survey of Division 0A depths 400 m to 1500 m. Depth in m, swept area in km2 and bottom temperature in degrees Celsius.

Trip	Gear	Set No.	Stratum No.	Month	Day	Mean Depth (m)	Sweptarea (sq. km)	Depth Strata	Temp. (^{o}C)	Time (UTC)	Greenland halibut Number	Kg
8	Alfredo	2	25	10	27	554.0	0.07534	750	2.08	19:35	28	20.60
8	Alfredo	3	25	10	27	635.0	0.07297	750	0.89	21:32	46	17.70
8	Alfredo	4	25	10	28	675.0	0.06858	750	1.75	0:32	59	30.75
8	Alfredo	5	30	10	28	787.0	0.07430	1000	1.39	4:48	40	24.85
8	Alfredo	6	25	10	28	675.5	0.07480	750	1.40	7:22	77	43.85
8	Alfredo	7	25	10	28	662.5	0.07928	750	1.38	9:02	73	30.70
8	Alfredo	8	24	10	28	440.5	0.08351	500	1.07	12:19	110	25.30
8	Alfredo	9	25	10	28	540.5	0.07943	750	1.20	15:57	27	13.60
8	Alfredo	10	24	10	28	431.5	0.07394	500	1.02	18:30	139	22.00
8	Alfredo	11	43	10	28	719.0	0.07233	750	1.33	21:39	66	24.75
8	Alfredo	12	44	10	29	455.0	0.07641	500	1.28	1:05	239	38.95
8	Alfredo	13	43	10	29	588.5	0.07251	750	1.33	3:24	187	36.05
8	Alfredo	14	41	10	29	1035.5	0.07688	1250	1.00	6:54	156	127.85
8	Alfredo	15	42	10	29	769.0	0.07718	1000	1.29	9:55	493.47	152.50
8	Alfredo	16	42	10	29	925.0	0.07821	1000	1.14	12:17	367.26	187.10
8	Alfredo	17	41	10	29	1052.5	0.08138	1250	0.76	14:07	432	312.75
8	Alfredo	18	46	10	29	991.0	0.06453	1000	0.85	18:18	228	116.50
8	Alfredo	20	46	10	30	881.0	0.07934	1000	1.20	0:00	192	75.05
8	Alfredo	21	47	10	30	1055.0	0.07720	1250	1.00	2:50	299.51	181.78
8	Alfredo	22	48	10	30	1367.0	0.07307	1500	0.09	6:11	35	36.10
8	Alfredo	23	48	10	30	1378.5	0.07613	1500	-0.11	9:14	15	17.45
8	Alfredo	24	47	10	30	1017.5	0.07692	1250	1.13	17:05	194	82.65
8	Alfredo	25	48	10	30	1441.5	0.08078	1500	0.29	20:36	23	23.70

8	Alfredo	26	49	10	31	1286.5	0.07633	1500	0.11	0:04	39	44.65
8	Alfredo	27	50	10	31	1159.0	0.07220	1250	1.07	2:21	1097.94	733.10
8	Alfredo	28	51	10	31	805.5	0.07733	1000	1.15	5:14	121	42.45
8	Alfredo	29	50	10	31	1199.5	0.07548	1250	0.44	7:53	554.00	401.00
8	Alfredo	30	49	10	31	1308.0	0.06926	1500	0.32	12:53	87	86.75
8	Alfredo	31	54	10	31	509.0	0.07709	750	1.00	19:12	49	20.55
8	Alfredo	32	54	10	31	626.0	0.07564	750	1.17	21:02	178	39.70
8	Alfredo	33	53	10	31	480.5	0.06508	500	1.20	23:27	37	12.75
8	Alfredo	34	54	11	1	698.5	0.08164	750	1.09	3:30	177	49.55
8	Alfredo	35	55	11	1	415.5	0.07085	500	0.85	10:06	9	1.90
8	Alfredo	36	55	11	1	413.5	0.06230	500	0.88	13:32	24	9.35
8	Alfredo	37	52	11	1	516.0	0.07070	750	1.00	16:15	98	22.85
8	Alfredo	38	52	11	1	611.5	0.06862	750	1.04	22:23	7	2.25
8	Alfredo	39	59	11	2	914.0	0.06991	1000	1.15	4:57	56	22.55
8	Alfredo	40	58	11	2	539.5	0.07176	750	1.00	9:25	40	10.75
8	Alfredo	41	58	11	2	643.5	0.06624	750	1.10	12:35	26	7.15
8	Alfredo	44	51	11	3	759.0	0.07138	1000	1.20	9:55	145	59.50
8	Alfredo	45	53	11	3	476.0	0.07487	500	1.07	12:37	84	31.25
8	Alfredo	46	44	11	3	429.5	0.07366	500	0.83	19:17	92	24.85
8	Alfredo	47	47	11	3	1173.5	0.07598	1250	0.82	22:04	157	105.10
8	Alfredo	48	45	11	4	624.0	0.07566	750	1.29	4:27	158	40.65
8	Alfredo	49	45	11	4	685.0	0.07355	750	1.29	7:46	203	47.10
8	Alfredo	56	40	11	5	1482.5	0.07866	1500	0.04	0:28	28	34.05
8	Alfredo	57	40	11	5	1465.0	0.06988	1500	3.12	2:54	16	21.40
8	Alfredo	58	40	11	5	1444.5	0.06176	1500	0.02	5:32	22	25.15
8	Alfredo	59	40	11	5	1302.5	0.08186	1500	0.38	8:15	94	95.55
8	Alfredo	62	31	11	5	1029.0	0.07313	1250	0.92	14:36	181	135.85
8	Alfredo	64	30	11	5	827.5	0.07821	1000	1.21	17:45	279	161.05
8	Alfredo	65	33	11	5	572.5	0.07334	750	2.45	19:37	77	33.80
8	Alfredo	66	40	11	5	1441.5	0.08161	1500	0.11	23:43	20	18.80
8	Alfredo	67	40	11	6	1360.0	0.08016	1500	0.31	2:32	54	70.05
8	Alfredo	69	33	11	6	565.5	0.08005	750	2.78	6:37	81	34.70
8	Alfredo	70	34	11	6	425.5	0.23971	500	3.12	9:06	82	40.17
8	Alfredo	71	34	11	6	461.5	0.07962	500	4	13:02	90	36.85
8	Alfredo	72	30	11	6	880.5	0.07678	1000	2.1	18:51	334	176.45
8	Alfredo	73	32	11	6	1301.5	0.08016	1500	0.24	22:05	15	13.60
8	Alfredo	74	30	11	7	976.0	0.08271	1000	1.05	4:28	73	47.65
8	Alfredo	75	30	11	7	787.5	0.08203	1000	1.29	7:06	85	58.50
8	Alfredo	76	25	11	7	651.0	1.21829	750	2.06	9:53	66	37.10

Table 5. Biomass estimates (tons) of Greenland halibut by depth stratum for NAFO Division 0A.

Year/Section	Stratum (m)	Survey Area (sq. km)	No. Sets	Mean Biomass (t/sq. km)	Biomass (tons)	SE
1999	401-500	2919	8	0.3914	1142.6	431.2
0A-South	501-750	11213	18	0.8232	9230.7	2825.8
	751-1000	8719	12	1.5764	13744.3	2559.2
	1001-1250	10211	12	2.9763	30391.4	7857.9
	1251-1500	11518	15	1.2373	14251.4	4588.4
	Overall	*44580*	*65*	*1.5424*	*68760.4*	*18262.5*
2001	401-500	429	2	0.3621	155.3	153.5
0A-South	501-750	11213	18	1.8865	21153.1	5107.0
	751-1000	8719	7	3.3261	29000.3	7665.9
	1001-1250	10211	7	2.5958	26505.5	7075.2
	1251-1500	9903	14	0.4228	4187.4	869.4
	Overall	*40475*	*48*	*2.0013*	*81001.6*	*20871.1*
2004	401-500	2823	5	0.6149	1735.9	504.2
0A-South	501-750	11213	13	1.4800	16595.5	6040.8
	751-1000	8719	12	2.0645	18000.8	5948.9
	1001-1250	10211	11	3.2376	33058.8	5589.9
	1251-1500	11518	17	1.4573	16785.4	7273.9
	Overall	*44484*	*58*	*1.9372*	*86176.4*	*12501.6*
2006	401-500	4092	10	0.2868	1173.6	197.4
0A-South	501-750	13439	20	0.3531	4745.9	569.4
	751-1000	8719	12	1.2338	10757.4	2020.4
	1001-1250	8763	8	3.4553	30278.4	9470.3
	1251-1500	9902	12	0.5368	5315.4	1052.3
	Overall	*44915*	*62*	*1.1638*	*52270.8*	*9759.0*

Table 6. Abundance estimates (000's) of Greenland halibut by depth stratum for NAFO Division 0A.

Year/Section	Stratum (m)	Survey Area (sq. km)	No. Sets	Mean Abundance (sq. km)	Abundance	SE
1999	401-500	2919	8	1229.90	3.6E+06	1.3E+06
0A-South	501-750	11213	18	2327.80	2.61E+07	8.5E+06
	751-1000	8719	12	3482.70	3.04E+07	5.5E+06
	1001-1250	10211	12	4579.40	4.68E+07	1.3E+07
	1251-1500	11518	15	1045.40	1.2E+07	3.6E+06
	Overall	*44580*	*65*	*2666.22*	*1.189E+08*	*3.2E+07*
2001	401-500	429	2	553.60	2.4E+05	2.3E+05
0A-South	501-750	11213	18	3840.20	4.31E+07	1.0E+07
	751-1000	8719	7	4100.60	3.58E+07	9.9E+06
	1001-1250	10211	7	3456.60	3.53E+07	1.1E+07
	1251-1500	9903	14	439.60	4.4E+06	8.4E+05
	Overall	*40475*	*48*	*2932.65*	*1.187E+08*	*3.3E+07*
2004	401-500	2823	5	1892.90	5.34E+06	2.0E+06
0A-South	501-750	11213	13	2977.10	3.34E+07	1.1E+07
	751-1000	8719	12	3000.40	2.62E+07	9.5E+06
	1001-1250	10211	11	3319.00	3.39E+07	6.2E+06
	1251-1500	11518	17	1066.10	1.23E+07	5.1E+06
	Overall	*44484*	*58*	*2496.53*	*1.11E+08*	*1.7E+07*
2006	401-500	4092	10	1124.92	4.60E+06	1.1E+06
0A-South	501-750	13439	20	1110.16	1.49E+07	2.5E+06
	751-1000	8719	12	2651.23	2.31E+07	4.7E+06
	1001-1250	8763	8	5103.15	4.47E+07	1.4E+07
	1251-1500	9902	12	493.60	4.89E+06	1.0E+06
	Overall	*44915*	*62*	*2053.77*	*9.22E+07*	*1.5E+07*

Table 7. Length distribution (3cm groups) estimated total number (000's) for Greenland halibut from NAFO Division 0A surveys (weighted by survey area).

Length Class (3cm)	Div. 0A South 1999	2001	2004	2006
0				
3				
6	73.240			1.707
9	26.119	7.370		10.101
12	61.248	16.925	25.854	24.231
15	21.036	192.867	722.746	463.183
18	322.593	181.545	443.925	1045.423
21	639.739	766.476	1408.294	4342.790
24	2902.035	2130.242	1881.047	3895.186
27	8512.532	2464.872	5011.075	5402.579
30	12473.322	4327.508	5605.143	6754.058
33	15944.903	8561.021	8367.771	9331.157
36	16947.771	16223.824	10617.731	13128.299
39	***17014.003***	22102.681	13436.041	***14054.939***
42	14621.133	***23835.554***	15697.215	12623.585
45	10750.969	17459.631	***15979.390***	9052.162
48	6443.782	10695.541	13845.141	6147.754
51	4122.988	5219.180	9238.186	2945.622
54	2247.477	2096.945	4329.138	1826.323
57	1250.561	1189.117	2095.964	655.492
60	704.208	592.811	976.217	141.346
63	471.663	255.268	532.397	91.726
66	242.111	140.190	317.073	77.932
69	117.638	131.897	141.182	30.591
72	127.133	40.866	126.200	24.271
75	9.577	23.947	69.875	
78	18.739		45.719	
81	9.427		42.088	
84		28.336	17.519	
87			33.085	
90			14.255	
93	9.290		10.644	
96			6.874	
99		14.516		
missing				175.886
Total	116085.240	118699.128	111037.788	92246.343
Total <45 cm	89559.675	80810.884	63216.842	71077.237
percent <45 cm	77.150	68.080	56.933	77.052
percent <=35 cm	35.299	15.711	21.133	33.899

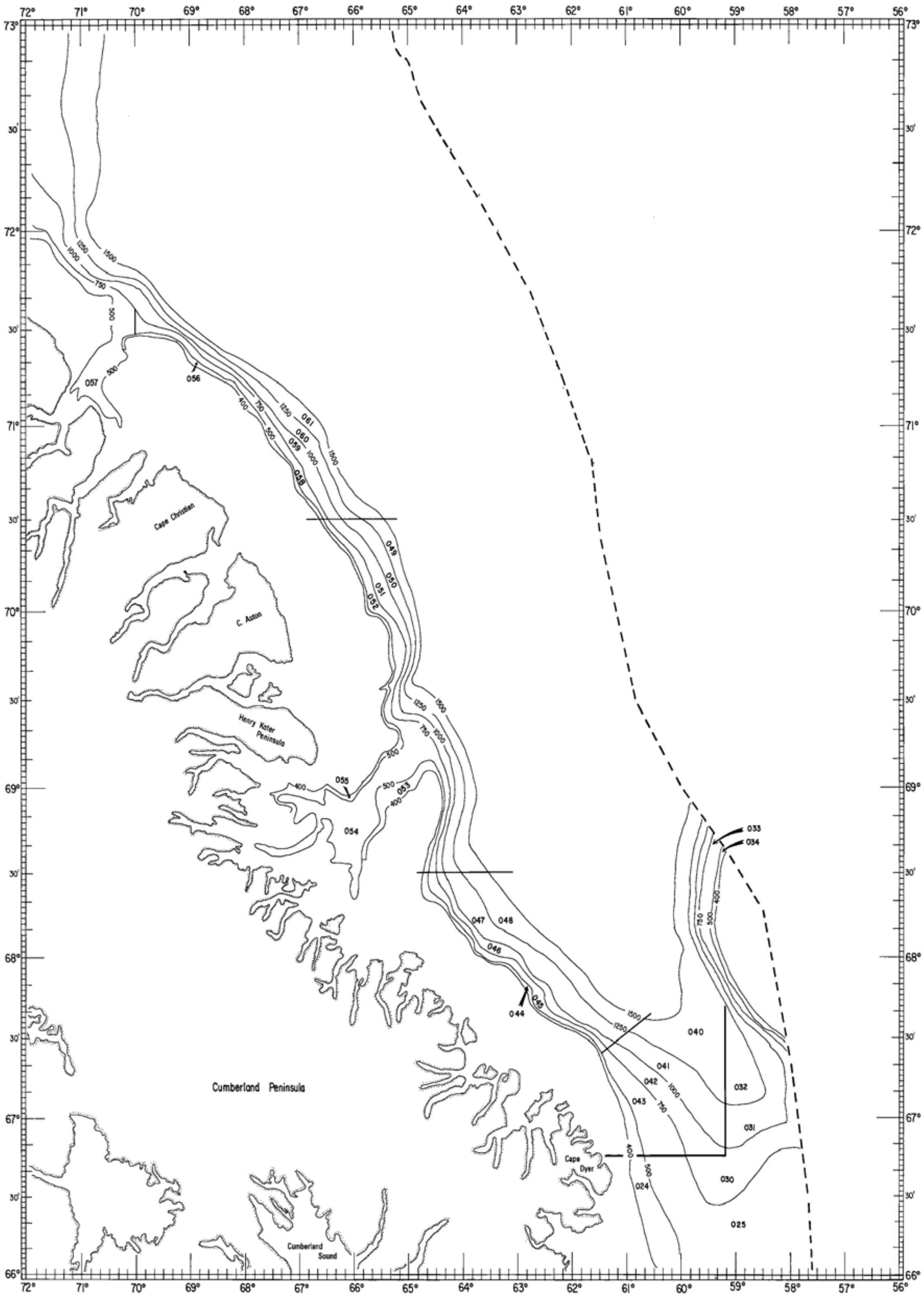

Figure 1. Stratification scheme for North Atlantic Fisheries Organization Division 0A, 66^{o} N to 72^{o} N.

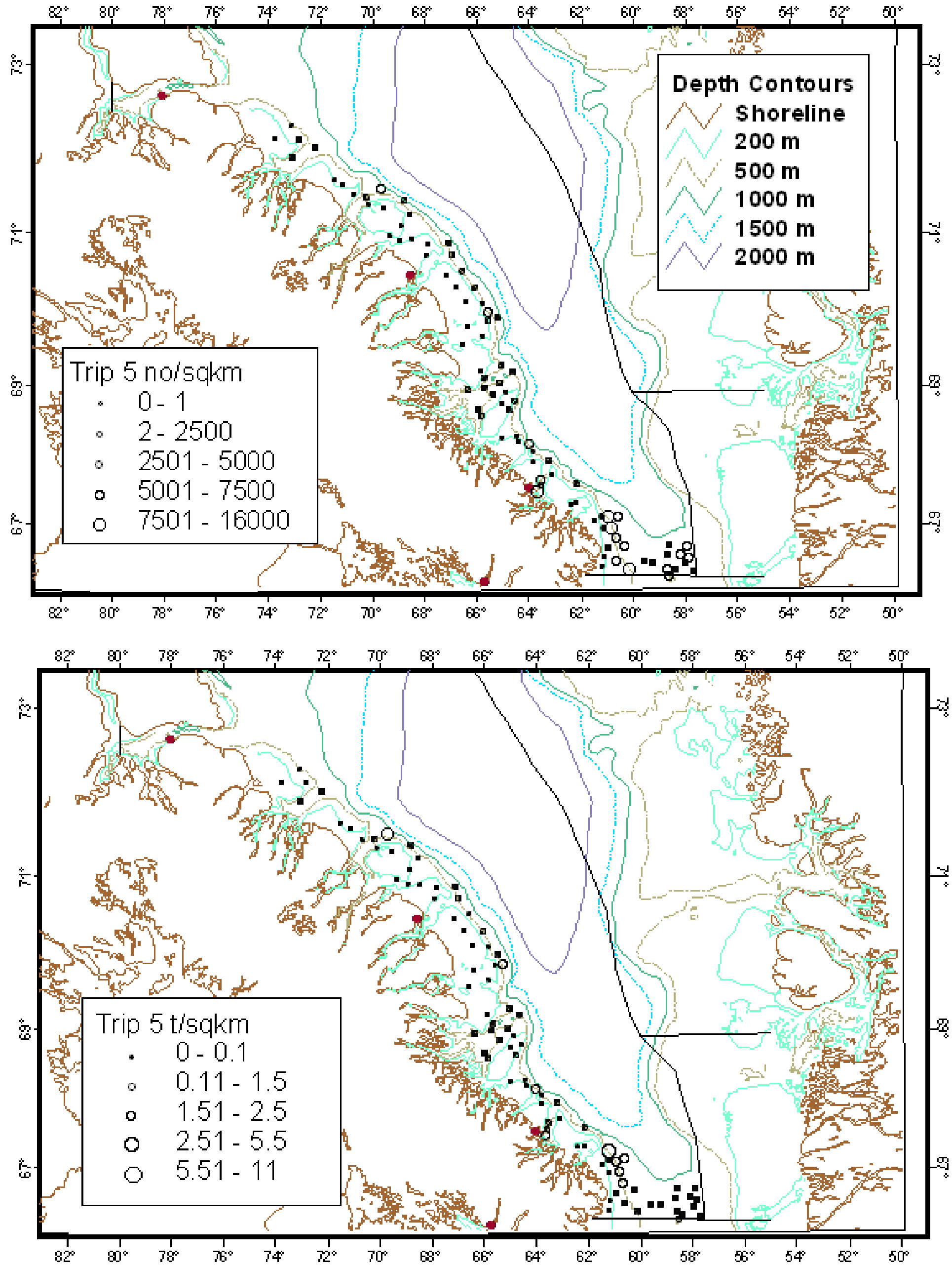

Figure 2. Distribution of catches (number/km^2 and t/ km^2 for the 2006 Division 0A shallow water survey covering depths 100 m to 800 m.

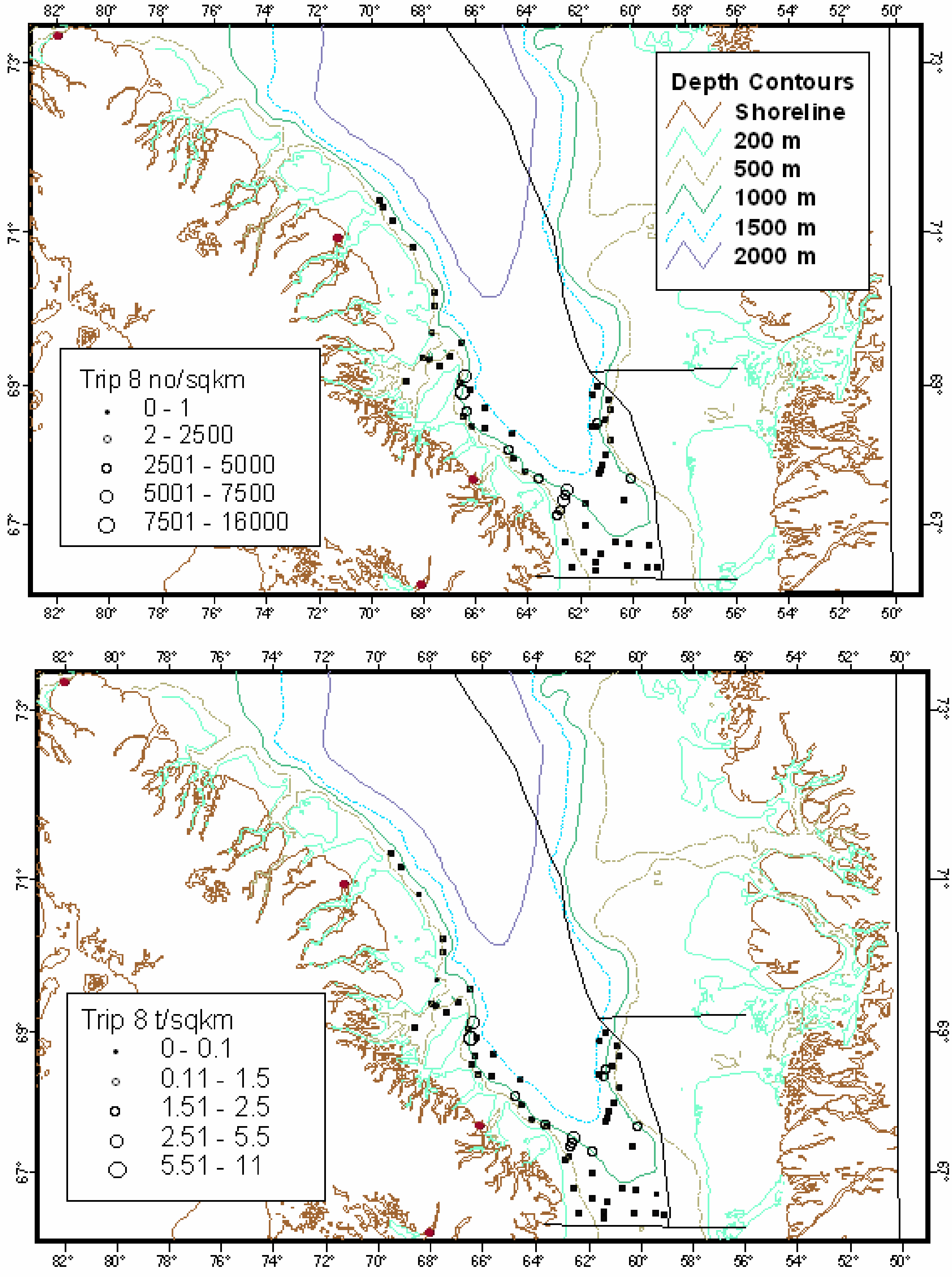

Figure 3. Distribution of catches (numbers/km^2 and t/ km^2 for the 2006 Division 0A deepwater survey covering depths 400 m to 1500.

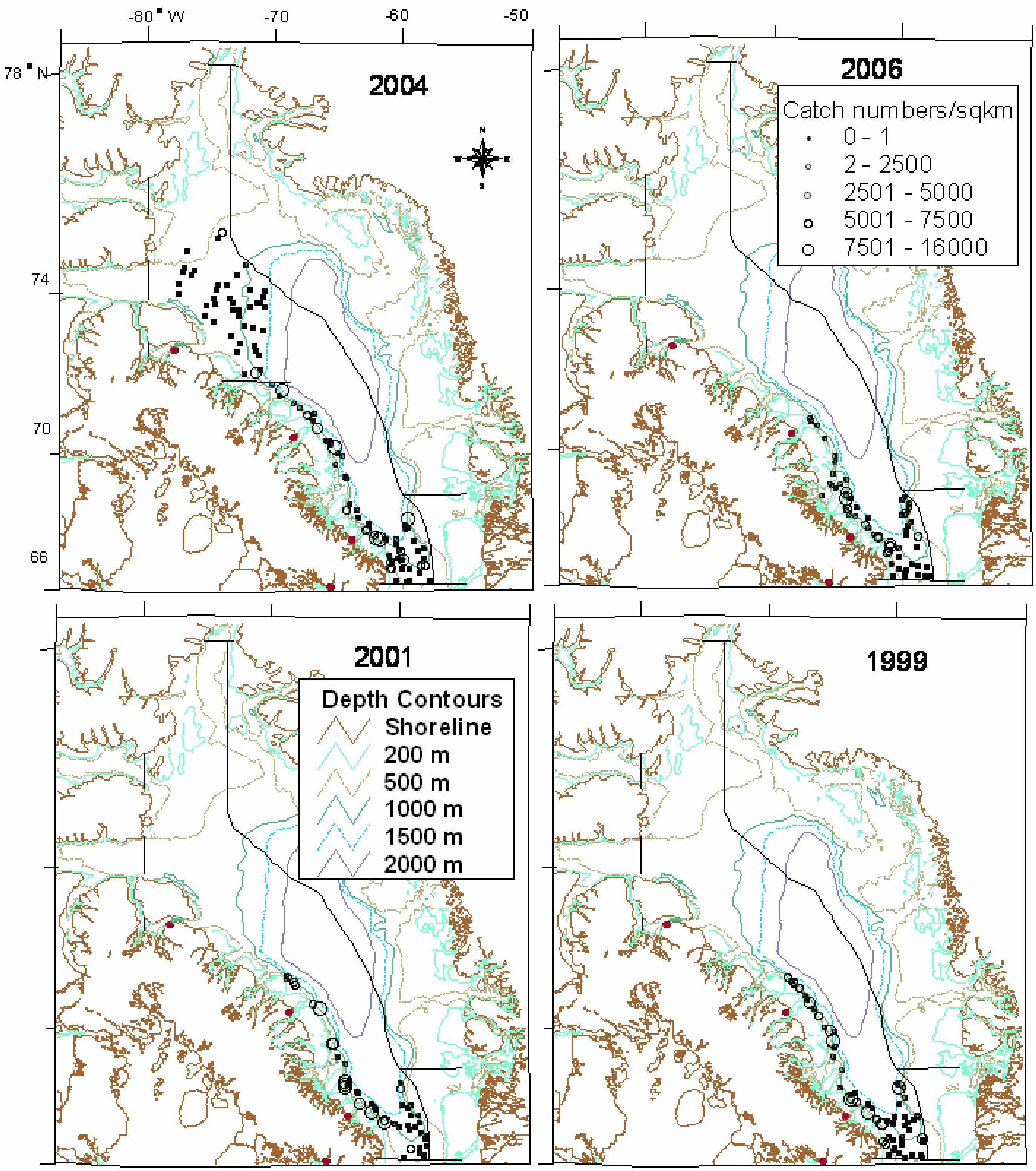

Figure 4. Distribution of catches (numbers/km^2) in Division 0A, 1999, 2001, 2004 and 2006.

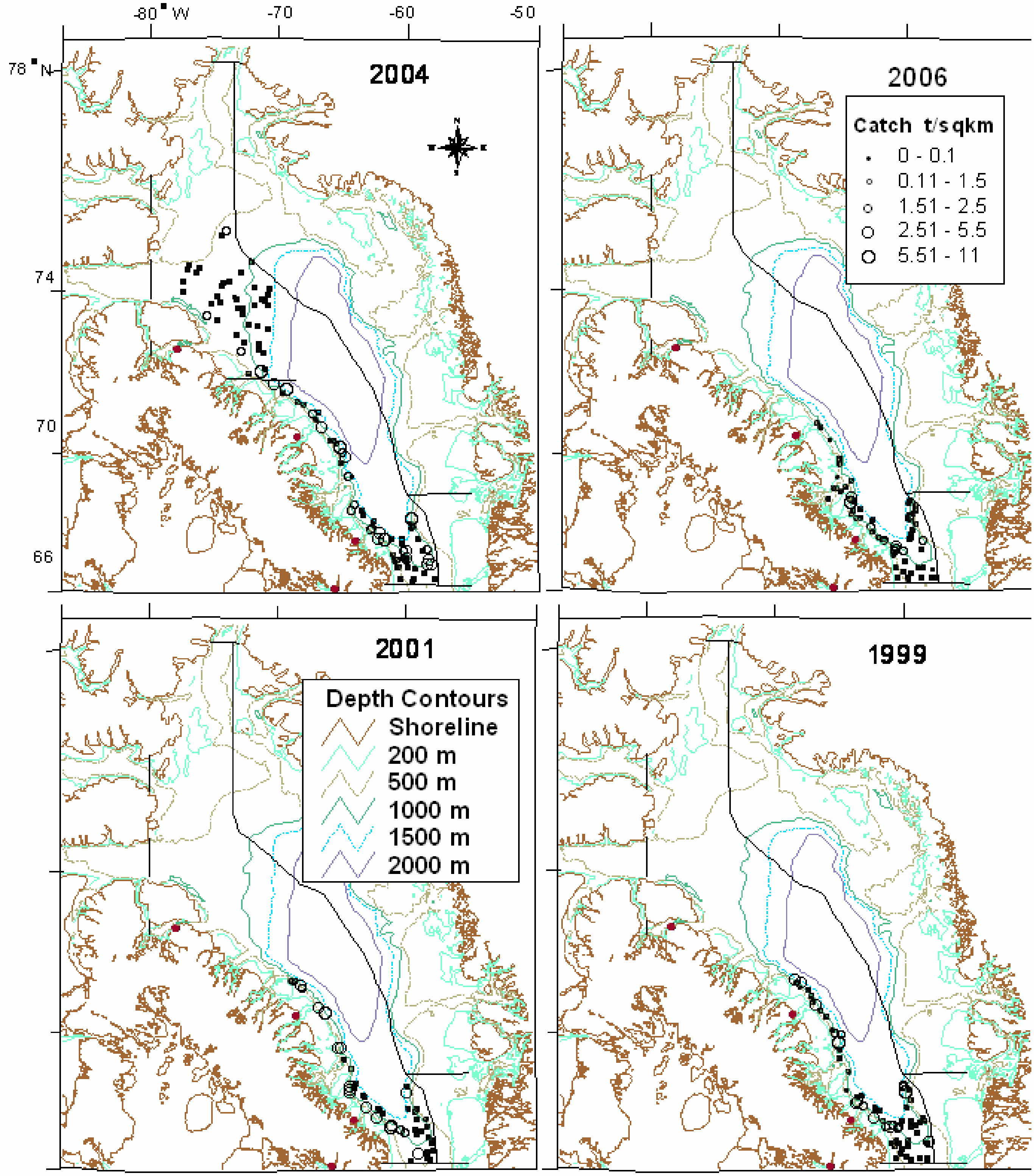

Figure 5. Distribution of catches (t/km^2) in Division 0A, 1999, 2001, 2004 and 2006.

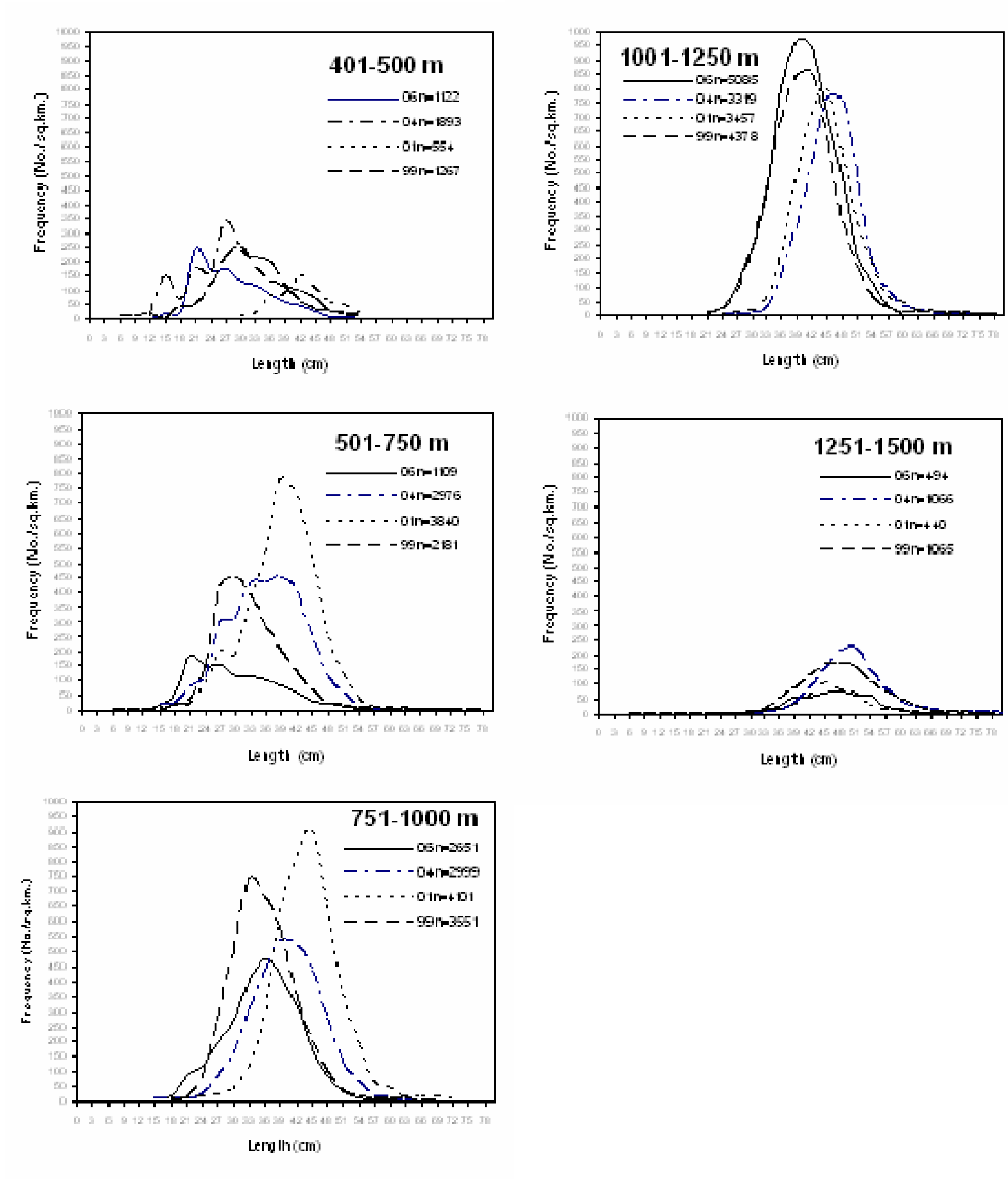

Figure 6. Greenland halibut length distribution, by depth for Division 0A-south, 2006 (standardized to numbers/km^2 and weighted by number of tows in each depth strata).

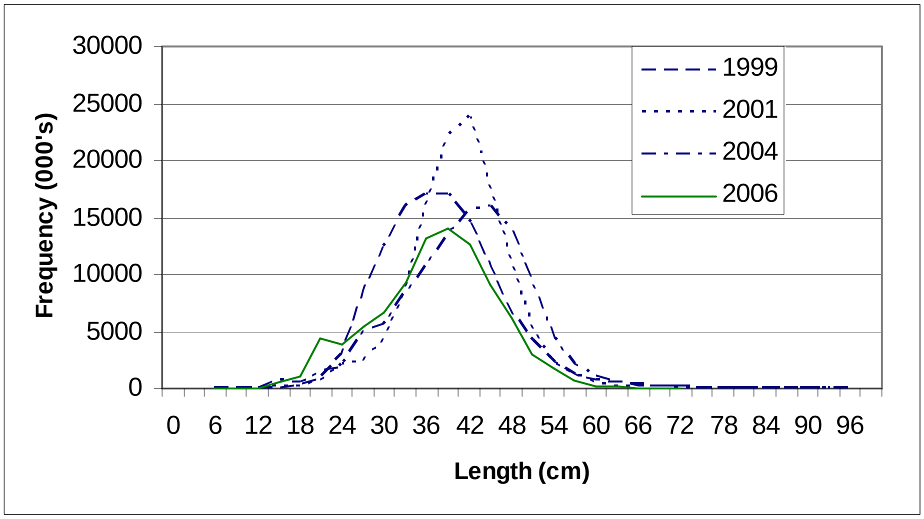

Figure 7. Estimated abundance at length for the Greenland halibut in NAFO Division 0A, 1999, 2001, 2004 and 2006 (weighted by stratum area).

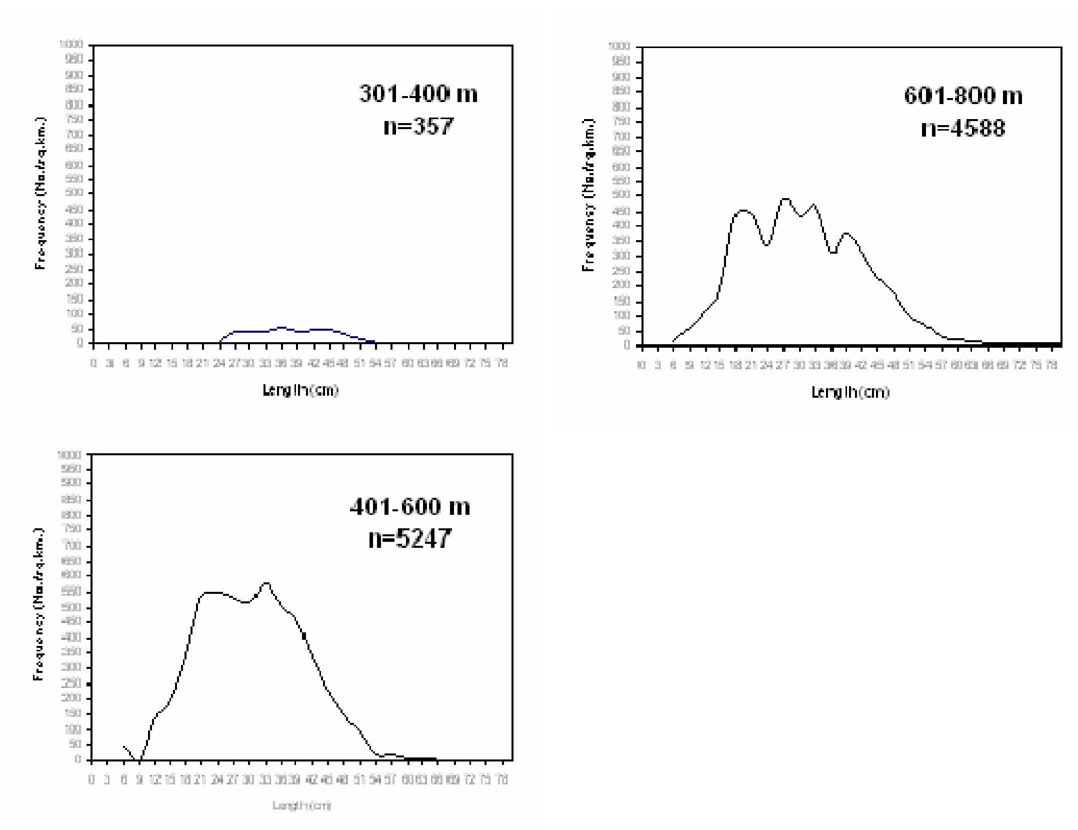

Figure 8. Length frequency distribution by depth strata for the Division 0A shallow water survey (standardized to numbers/km^2 and weighted by number of tows in each depth strata).

Appendix 1. List of species caught during the 2006 survey in southern NAFO Division 0A covering water depths 100 m to 800 m, including maximum weight, maximum numbers per tow (not standardized to km^2 swept), minimum and maximum depth, minimum and maximum temperature and maximum latitude.

Species	Code	No. Sets	Max. Wt. (Kg)	Max. No.	Min. Depth (m)	Max. Depth (m)	Min. Temp.	Max. Temp.	Max. Pos. (N Lat.)
Alepocephalus agassizzi	ALA	1	0.008	1	533.5	533.5	1.2	1.2	70
Alepocephalus bairdii	ALB	1	0.008	1	637	637	1.3	1.3	66.3
Anarhichas minor	CAS	1		1	361	361	1	1	67.9
Arctogadus glacialis	ACT	8	0.218	9	188.5	533.5	-1.5	1.2	72.3
Artediellus atlanticus	ARA	48	1.696	45	103	737.5	-1.8	1.8	72.3
Artediellus sp.	ART	1	0.256	4	119.5	119.5	-1.7	-1.7	67.1
Artediellus uncinatus	ARU	2	0.232	3	126	553.5	-1.8	1.4	70.3
Aspidophoroides monopterygius	ASP	1	0.006	1	239.5	239.5	-1.4	-1.4	68.3
Bathylagus euryops	BAT	17	0.354	26	414	777.5	0.9	2.1	72
Bathypolypus bairdii	BBA	2	0.152	1	482.5	699.5	1.2	1.8	66.5
Bathypolypus pugniger	BPU	1	0.118	4	575.5	575.5	1.7	1.7	66.3
Bathyraja spinicauda	BSP	1	1.502	1	468.5	468.5	0.8	0.8	68.6
Benthosema glaciale	BEG	18	0.53	113	461	720	0.6	2.7	70
Boreogadus saida	POC	84	132	7725	103	777.5	-1.8	2.7	72.3
Borostomias antarcticus	BOA	1	0.054	1	575.5	575.5	1.7	1.7	66.3
Careproctus micropus	CRM	8	0.012	2	162.5	737.5	-1.7	1.3	72.1
Careproctus reinhardti	CAR	38	0.374	26	175	777.5	-1.7	1.4	72
Cirroteuthis mülleri	CIM	3	0.682	2	103	672.5	-1.8	1.2	70.7
Cottunculus microps	COM	16	0.614	6	533.5	777.5	0.6	1.7	72
Cyclopteropsis macalpini	NY1	7	0.12	28	123	328.5	-1.8	1	72.1
Cyclothone microdon	CLM	4	0.006	2	103	777.5	-1.8	1.3	72
Eumicrotremus derjugini	EDR	28	0.835	24	103	737.5	-1.8	1	72.15
Eumicrotremus spinosus	EUM	41	3.992	88	103	556	-1.8	1.2	71.7
Gadidae	GAD	1	0.001	1	150.5	150.5	-1.7	-1.7	70.7
Gaidropsarus argentatus	ONA	12	0.18	37	482.5	763.5	1.2	2.7	66.7
Gaidropsarus ensis	ONN	30	3.588	22	461	777.5	0.9	2.7	72
Gonatus fabricii	GOF	19	1.534	24	483	763.5	0.6	2.7	69.9
Gonatus sp.	GON	6	4	16	482.5	771.5	1.2	1.8	69.3
Gonatus sp.	GSP	1	0.03	3	461	461	1.2	1.2	66.5
Gymnelus retrodorsalis	GYR	5	0.084	12	123	580.5	-1.8	2.7	68.7
Gymnelus sp.	GYM	4	0.018	2	139	245	-1.7	1	71.2
Gymnocanthus tricuspis	GYT	3	0.03	2	150.5	549.5	-1.7	1	72.3
Hippoglossoides platessoides	PLA	21	1.032	5	268.5	708.5	-1.6	1.8	71.9
Icelus bicornis	ICB	5	0.046	7	131	312.5	-1.8	1	72.3
Icelus spatula	ICS	31	0.262	71	103	708.5	-1.8	1	71.9
Lampanyctus macdonaldi	LMC	5	0.296	12	575.5	649.5	1.3	2.7	66.6
Leptagonus decagonus	EUD	38	0.312	37	123	737.5	-1.8	1.4	72.3
Leptoclinus maculatus	LEM	7	0.03	5	131	708.5	-1.7	1	72.3
Liparididae	LIP	11	0.6	8	239.5	771.5	-1.6	1.3	70.9
Liparis fabricii	LIF	82	5.684	427	103	777.5	-1.8	2.7	72.3
Liparis gibbus	LIG	26	0.908	44	103	549.5	-1.8	1.1	72.3
Lithodes maja	KCT	1	0.214	1	482.5	482.5	1.8	1.8	66.2

Lumpenidae	LUP	5	0.04	4	215	483	-1.5	1.3	71.6
Lumpenus fabricii	LFA	1	0.036	4	154	154	-1.8	-1.8	71.3
Lycenchelys kolthoffi	LYK	9	0.018	3	312.5	720	-0.5	1.4	72.3
Lycenchelys muraena	LMU	1	0.004	1	637	637	1.3	1.3	66.3
Lycenchelys sarsi	LYS	1	0.008	1	187	187	-1.6	-1.6	67.9
Lycenchelys sp.	LYY	17	0.566	62	268.5	763.5	-1.6	1.8	71.5
Lycodes esmarki	LYE	13	2	16	149.5	771.5	-1.7	1.7	70.7
Lycodes eudipleurostictus	LYN	28	1.094	41	162.5	720	-1.7	2.7	72.1
Lycodes frigidus	LFR	2	0.032	5	700.5	708.5	0.6	1.2	69
Lycodes luetkeni	LLU	2	0.942	1	533.5	572.5	1.2	1.4	70
Lycodes macallister	LMA	4	0.344	2	409	708.5	-0.9	1.2	69
Lycodes paamiuti	LPA	13	0.434	14	232.5	777.5	-1.5	2.7	72.1
Lycodes pallidus	LYP	1	0.046	1	317.5	317.5	-0.9	-0.9	68.6
Lycodes reticulatus	LYR	40	8	95	103	771.5	-1.8	1.3	72.3
Lycodes seminudus	LSE	3	0.376	9	641.5	777.5	1.2	1.2	72
Lycodes sp.	ELZ	24	2.636	66	126	725.5	-1.8	1.8	71.5
Lycodes terranova	LYT	7	0.62	20	482.5	771.5	0.9	2.7	70.9
Lycodes vahli	LYV	11	0.838	6	268.5	771.5	-1.6	2.7	71.4
Macrourus berglax	RHG	8	2.108	7	567.5	771.5	1.2	2.7	67.1
Mallotus villosus	CAP	4	0.032	2	149.5	349	-1.6	-1.3	67.9
Myctophidae	MYC	18	3.324	220	361	771.5	0.9	2.7	71.4
Myoxocephalus scorpius	MSC	2	0.098	1	232.5	461	-1.5	1.2	70.9
Nezumia bairdi	NZB	1	0.006	1	575.5	575.5	1.7	1.7	66.3
Notacanthus chemnitzii	NOT	1	0.77	1	641	641	2.1	2.1	66.7
Notolepis rissoi	NRI	3	0.136	3	461	580.5	1.2	2.7	66.5
Paralepididae	PAR	5	0.262	4	482.5	699.5	0.9	2.7	67.25
Paraliparis bathybius	PAB	1	0.002	1	637	637	1.3	1.3	66.3
Raja hyperborea	RHB	25	21.7	17	171	777.5	-1.8	1.4	72
Raja radiata	RRD	9	3.408	8	381.5	575.5	0.3	2.7	69.1
Reinhardtius hippoglossoides	GHL	54	104.5	276	280.5	777.5	-0.9	2.7	72.1
Rossia moelleri	RMO	2	0.036	1	139	150.5	-1.7	-1.7	70.7
Rossia palpebrosa	RPA	6	0.078	6	123	328.5	-1.8	1	72.1
Rossia sp.	ROS	4	0.082	5	154	537	-1.8	1.8	72.3
Scopelosaurus lepidus	SCO	1	0.002	1	556	556	1.2	1.2	71.4
Sebastes marinus	REG	4	3.665	4	482.5	641	1.1	2.7	68.15
Sebastes mentella	REB	34	18.55	201	103	771.5	-1.8	2.7	71.9
Shrimp	REJ	89	18.9	56	103	777.5	-1.8	2.7	72.3
Somniosus microcephalus	GSK	5	140	1	149.5	777.5	-1.5	1.2	72
Squid	SQT	1	0.01	4	637	637	1.3	1.3	66.3
Stomias boa	STO	8	0.026	3	414	763.5	1	2.7	70.7
Synapobranchus kaupi	SYN	10	0.39	10	540.5	763.5	1.2	2.7	66.7
Triglops nybelini	TRN	60	13.35	1060	103	777.5	-1.8	2.7	72.3
Triglops pingeli	TRP	35	4.084	363	103	589.5	-1.8	1.3	71.7
Triglops sp.	TRI	7	0.72	68	119.5	381.5	-1.7	0.3	70.1
Xenodermichthys copei	XEC	2	0.03	1	482.5	540.5	1.8	2.7	66.3

Appendix 2. List of species caught during the 2006 survey in southern NAFO Division 0A covering water depths 400 m to 1500 m, including maximum weight, maximum numbers per tow (not standardized to km^2 swept), minimum and maximum depth, minimum and maximum temperature and maximum latitude.

Species	Code	No. Sets	Max. Wt. (Kg)	Max. No.	Min. Depth (m)	Max. Depth (m)	Min. Temp.	Max. Temp.	Max. Pos. (N Lat.)
Anarhichas denticulatus	CAD	2	2.615	1	461.5	880.5	2.1	4	68
Anarhichas minor	CAS	1	4.45	1	425.5	425.5	3.1	3.1	68.45
Arctogadus glacialis	ACT	5	0.088	3	413.5	643.5	0.9	1.3	70.9
Arctozenius rissoi	ARZ	3	0.05	1	440.5	925	1.1	1.3	67.35
Artediellus atlanticus	ARA	25	0.56	25	413.5	1482.5	0	4	70.9
Bathylagus euryops	BAT	8	0.098	4	588.5	1444.5	0	1.4	68.85
Bathylagus sp.	BAS	1	0.042	2	662.5	662.5	1.4	1.4	66.3
Bathypolypus bairdii	BBA	1	0.05	1	827.5	827.5	1.2	1.2	68.3
Bathypolypus sp.	BSE	1	0.035	1	572.5	572.5	2.5	2.5	68.3
Benthosema glaciale	BEG	38	0.21	46	425.5	1482.5	-0.1	3.1	70.8
Boreogadus saida	POC	26	84.3	513	413.5	1302.5	0.1	4	70.9
Borostomias antarcticus	BOA	1	0.006	1	675	675	1.8	1.8	66.4
Careproctus reinhardti	CAR	13	0.178	4	413.5	976	0.8	1.8	70.35
Cirroteuthis müller i	CIM	25	13.022	42	480.5	1482.5	-0.1	3.1	69.1
Clupea harengus	HER	1	0.234	1	431.5	431.5	1	1	66.7
Cottunculus microps	COM	15	0.96	3	415.5	1199.5	0.4	2.1	70.9
Cyclothone microdon	CLM	2	0.004	1	624	976	1	1.3	67.6
Eumicrotremus spinosus	EUM	6	6.965	83	413.5	509	0.8	1.2	69.7
Gadus morhua	COD	2	7.845	10	425.5	461.5	3.1	4	68.45
Gaidropsarus argentatus	ONA	10	0.615	2	425.5	1465	0.4	4	69.8
Gaidropsarus ensis	ONN	37	9.715	39	554	1482.5	-0.1	3.1	69.2
Gonatus fabricii	GOF	32	3.968	18	425.5	1482.5	-0.1	3.1	70.65
Hippoglossoides platessoides	PLA	17	1.272	9	415.5	991	0.9	4	69.35
Lampanyctus macdonaldi	LMC	1	0.016	1	635	635	0.9	0.9	66.4
Leptagonus decagonus	EUD	4	0.066	6	415.5	588.5	0.9	1.3	69.35
Leptoclinus maculatus	LEM	1	0.005	1	425.5	425.5	3.1	3.1	68.45
Liparis fabricii	LIF	60	0.782	43	413.5	1482.5	-0.1	4	70.9
Liparis gibbus	LIG	1	0.658	1	480.5	480.5	1.2	1.2	69
Lithodes maja	KCT	1	0.26	1	461.5	461.5	4	4	68
Lycodes esmarki	LYE	1	0.354	1	461.5	461.5	4	4	68
Lycodes eudipleurostictus	LYN	14	0.644	6	425.5	991	0.9	4	70.65
Lycodes luetkeni	LLU	1	0.015	1	565.5	565.5	2.8	2.8	68.55
Lycodes macallister	LMA	3	0.462	4	626	1017.5	1.1	1.2	69.05
Lycodes paamiuti	LPA	9	0.082	2	611.5	1308	0.3	2.1	70.9
Lycodes reticulatus	LYR	8	1.752	3	413.5	698.5	0.9	1.3	70.35
Lycodes seminudus	LSE	2	0.364	1	626	1199.5	0.4	1.2	69.05
Macrourus berglax	RHG	23	4.905	13	554	1308	0.3	2.8	69.2
Myctophidae	MYC	2	0.06	16	662.5	675.5	1.4	1.4	66.4
Notacanthus chemnitzii	NOT	6	3.942	4	651	1199.5	0.4	2.1	68.85
Paraliparis bathybius	PAB	10	0.678	11	1286.5	1482.5	-0.1	3.1	68.7
Raja hyperborea	RHB	20	37.748	20	509	1482.5	-0.1	3.1	69.1
Raja radiata	RRD	15	3.594	9	415.5	880.5	0.9	3.1	69.35
Reinhardtius hippoglossoides	GHL	62	733.1	1098	413.5	1482.5	-0.1	4	70.9

Rhodichtys regina	RHO	7	0.225	4	1286.5	1465	-0.1	3.1	68.7
Rossia palpebrosa	RPA	1	0.016	1	611.5	611.5	1	1	70.35
Sebastes marinus	REG	3	3.18	8	425.5	635	0.9	4	68.45
Sebastes mentella	REB	13	16.35	406	425.5	643.5	0.9	4	70.9
Shrimp	REJ	58	57.55	2	413.5	1482.5	-0.1	4	70.9
Somniosus microcephalus	GSK	3	560	2	429.5	611.5	0.8	1	70.8
Stomias boa	STO	2	0.018	1	431.5	554	1	2.1	66.7
Triglops nybelini	TRN	16	0.514	52	413.5	805.5	0.8	1.3	70.9
Triglops pingeli	TRP	2	0.106	12	415.5	476	0.9	1.1	69.35