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Summary of Results for Greenland Halibut from Trawl Surveys Conducted in NAFO Subareas 0 and 1 from 61°N to 74°N in 2001

by

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Abstract

In 2001 surveys were conducted in Subarea 0 by Canada and in Subarea 1 by Greenland. This is the first time that surveys have been conducted so extensively in a single season within Davis Strait and Baffin Bay (up to 74°N). Results are presented for each of these areas in separate NAFO Scientific Council Research Documents (SCR Doc. 02/30, 02/47). This paper presents a summary of the data over the entire Greenland halibut stock area Subareas 0+1. The densities and abundances km^{-2} were almost alike at comparable depths and areas and the total biomass and abundance was almost identical in the two areas. The length distribution in Div. 1CD and 0B was almost totally overlapping with modes at 45 cm. A single mode at 43 cm was seen in Div. 0A, while several modes were seen in the length distribution from Div. 1AB including modes at 8, 15 and 25 cm primarily constituted of fish coming from shallow waters <400 m not covered in the other areas.

Introduction

Greenland has conducted surveys for Greenland halibut annually in Div. 1CD since 1997. In 1999 Canada conducted a survey in Div. 0A and in 2000 Canada surveyed Div. 0B. In 2001 Canada surveyed Div. 0AB and the Greenland survey was expanded to cover Div. 1AB. The surveys were done one after the other and conducted with the same vessel, gear and skipper hence giving an unique opportunity to get an overview of the distribution and stock structure for Greenland halibut in the southern part of the Baffin Bay and northern part of the Davis Strait.

Materials and Methods

The Greenland research vessel *Paamiut* conducted the surveys using an *Alfredo III* bottom trawl with rock hopper gear. Mesh size was 140 mm with a 30 mm liner in the codend. The surveys were done one after the other, beginning with the Div. 0A survey September 16 and ending with the Div. 1CD survey 15 November 2001. For more detailed information on methods see papers by Treble (2002) and Jorgensen (2002).

There were differences in the stratification schemes used in Subarea 0 and Subarea 1. For the purposes of this paper and in order to make comparisons easier between the Divisions the existing strata have been pooled. Instead of 5 depth strata in Div. 0A and 0B there are 3 (401-500 m, 501-1000 m, and 1001-1500 m). In Div. 1A (North) there are 3 instead of 4 (1-500 m, 501-1000 m, and 1001-1500 m). In Div. 1A (South) and 1B there are 4 instead of 7 (201-400 m,

401-600 m, 601-1000 m, and 1001-1500 m). In Div.1C and D there are 3 instead of 4 (401-600 m, 601-1000 m, and 1001-1500 m). The areas (sq. km.) and hauls planned and conducted for these revised depth strata are provided in Table 1.

Results and Discussion

The distribution of bottom temperature is shown in Fig. 1. Mean temperatures varied from a high of 4.4 ^{o}C in Div. 1C (401-600 m) to a low of 0.3 ^{o}C in 1A North (1001-1500 m) (Jorgensen, 2002; Treble, 2002). A majority of sets in Div. 0A had temperatures below 1.0 ^{o}C. The influence of the warm West Greenland current is seen on the banks of West Greenland as far as 72^{o}N. A part of the current flexes towards the west following the depth contour lines and also influences the south-eastern part of Div. 0B. The cold Baffin current flows south along the east coast of Baffin Island and likely contributes to the cold bottom temperatures observed in Div. 0A during the 2001 survey and the survey in 1999 (Treble *et al*., 2000).

The stratified area for depths 401-1500 m is 136,230 sq km for Subarea 0 and 101,799 for SA1 (Table 1). However, there is considerable area (89,939 sq km) within SA1 below 400 m that was also included in the 2001 survey.

Greenland halibut were caught in almost all tows throughout the entire survey area (Fig. 2 and 3). The largest catches in terms of biomass were taken in Div. 0A and Div. 1D while the largest catches in terms of numbers were made in Div. 0A and in Div 1AB. The highest density was found in Div. 0B at depths between 1000-1500 m, where the mean density was 2.394 t km^{-2} close to the estimate from Div. 1CD (2.187 km^{-2}) and the estimates from depth stratum 500 (600) –1000 m in Div. 0A (2.290 t km^{-2}) and in Div. 1ASB (2.304 km^{-2}) (Table 2). The densities were also very similar at 500 (600) – 1000 m in Div 0B and Div. 1CD and in Div. 0A and 1AB. The total Biomass (400-1500 m) was estimated at 159039 tons and 138074.9 tons in SA 0 and 1, respectively. (The estimates are based on a more crude stratification than in Treble, 2000 and Jørgensen, 2000 and probably not as precise).

The highest abundance was found in Div. 0A and 1ASB (app. 3950 km^{-2}) at 500 (600)-1000 m. and as with the biomass, abundance was very much alike in comparable areas and depths in the two Subareas. The total abundance (400-1500 m) was estimated at 222.8*10^{6} and 240.4*10^{6} in SA 0 and 1, respectively (Table 3). Further 50.0*10^{6} individuals were found at 1-500 m in Div. 1AN and 200-400 m in Div. 1ASB.

The overall length distributions (1cm grps) for Div. 0A, 0B, 1AB, 1CD are shown in Fig. 4. The length distribution in Div. 0B and 1CD was almost totally overlapping with a mode around 45 cm. There were, however, slightly more fish at length 20-35 cm in Div. 0B compared to Div. 1CD. In Div. 0A the length distribution was dominated by a mode at 43 cm. In the length distribution from Div. 1AB several modes were seen, at 8 cm (newly settled fish), 15 cm, 25, 30, 36 and 42 cm, respectively. The small fish <25 mainly come from shallow water <600 m).

The percentage of fish < than 45 and <= 35 cm in the different Divisions is given in Tabel 4. Small fish were mainly found in Div. 1AB, the only Divisions in the survey area that included shallow areas <400 m, where small fish are dominant. Division 0A also contained a large percentage of these small fish compared to Div. 0B and 1CD.

References

JORGENSEN, O. A. 2002. Survey for Greenland halibut in NAFO Divisions 1A-1D, 2001. NAFO SCR Doc. 02/30, Ser. No. N4637, 40 pp.

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TREBLE, M.A., BRODIE, W. B., BOWERING, W. R. and O. A. JORGENSEN. 2000. Analysis of data from a trawl survey in NAFO Division 0A, 1999. NAFO SCR Doc. 00/31, Ser. No. N4260, 19 pp.

Table 1. Area of depth strata for NAFO Subarea 0 and 1 with the number of hauls planned ( ) and conducted.

NAFO Division	Depth Stratum (m)	1-500	201-400	401-500	501-1000	1001-1500	Total
0A	Area (sq. km)			5889	29601	26257	61747
	Hauls			(12) 2	(44) 25	(36) 21	(92) 48
0B	Area (sq. km)			19314	41589	13580	74483
	Hauls			(19) 9	(42) 16	(15) 11	(76) 36
Overall (SA0)	Area (sq. km)			25203	71190	39837	136230
	Hauls			(31) 11	(86) 41	(51) 32	(168) 84
1AN	Area (sq. km)	57325			27334	6167	90826
	Hauls	(41) 13			(30) 20	(20) 8	(91) 41
	Depth Stratum (m)		201-400	401-600	601-1000	1001-1500	Total
1ASB	Area (sq. km)		32614	6746	6134	3112	48606
	Hauls		(15) 10	(9) 8	(17) 13	(8) 7	(49) 38
1CD	Area (sq. km)			4269	28000	20037	52306
	Hauls			(6) 3	(28) 12	(36) 27	(70) 42
Overall (SA1)	Area (sq. km)	57325	32614	11015	61468	29316	191738
	Hauls	(41) 13	(15) 10	(15) 11	(75) 45	(64) 42	(210) 121

Table 2. Biomass estimates (tons) of Greenland halibut by depth stratum for NAFO Subarea 0, 2001.

Division	Stratum	Survey Area	No.	Mean Biomass	Biomass	SE
0A	(m)	(sq. km)	Sets	(t/sq. km)	(tons)	
	401-500	686	2	0.362	248.4	245.4
	501-1000	24442	25	2.290	55961.8	10292.2
	1001-1500	23753	21	1.147	27248.3	7653.3
	Overall	48881	48	1.707	83458.5	12828.2
0B	401-500	14344	9	0.215	3088.4	630.0
	501-1000	34283	16	1.166	39981.6	6635.2
	1001-1500	13580	11	2.394	32511.0	3694.2
	Overall	62207	36	1.215	75580.9	7620.4
1AN	1-500	57325	13	0.118	6771.0	3103.5
	501-1000	27334	20	1.026	28054.5	4647.8
	1001-1500	6167	8	0.895	5521.5	690.1
	Overall	90826	41	0.444	40346.9	5631.2
1ASB	201-400	32614	10	0.054	1752.7	515.2
	401-600	6746	8	0.561	3785.5	946.9
	601-1000	6134	13	2.304	14131.5	2183.2
	1001-1500	3049	7	1.103	3361.5	877.8
	Overall	48543	38	0.474	23031.2	2588.22
1CD	401-600	4269	3	0.156	665.0	509.3
	601-1000	28000	12	1.383	38728.5	15954.3
	1001-1500	20037	27	2.187	43827.0	3136.6
	Overall	52306	42	1.682	83220.5	16267.7

Table 3. Abundance estimates (000's) of Greenland halibut by depth stratum for NAFO Subarea 0, 2001.

Division 0A	Stratum (m)	Survey Area (sq. km)	No. Sets	Mean Abundance (No./sq. km)	Abundance	SE
	401-500	686	2	553.6	3.80E+05	3.72E+05
	501-1000	24442	25	3913.1	9.56E+07	1.79E+07
	1001-1500	23753	21	1445.3	3.43E+07	1.12E+07
	Overall	48881	48	2666.7	1.30E+08	2.11E+07
0B	401-500	14344	9	485.2	6.96E+06	1.21E+06
	501-1000	34283	16	1494.9	5.12E+07	7.99E+06
	1001-1500	13580	11	2545.8	3.46E+07	4.24E+06
	Overall	62207	36	1491.5	9.28E+07	9.13E+06
1AN	1-500	57325	13	674.9	3.87E+07	1.38E+07
	501-1000	27334	20	2148.9	5.87E+07	1.24E+07
	1001-1500	6167	8	877.1	5.41E+06	6.90E+05
	Overall	90826	41	1132.2	1.03E+08	1.86E+07
1ASB	201-400	32614	10	346.4	1.13E+07	2.18E+06
	401-600	6746	8	1510.2	1.02E+07	2.52E+06
	601-1000	6134	13	3990.2	2.45E+07	3.84E+06
	1001-1500	3049	7	1322.8	4.03E+06	1.42E+06
	Overall		38	1029.9	5.00E+07	5.28E+06
1CD	401-600	4269	3	257.5	1.10E+06	7.75E+05
	601-1000	28000	12	1664.3	4.66E+07	1.74E+07
	1001-1500	20037	27	1981.4	3.97E+07	3.35E+06
	Overall	52306	42	1767.0	8.74E+07	1.77E+07

Table 4. Percentage of Greenland halibut less than 45 cm and less than or equal to 35 cm for the surveys in SA0 and 1, 2001.

	0A	0B	1AB	1CD
Percent =<35	15.694	9.936	53.879	2.039
Percent <45	68.063	46.768	84.506	37.951

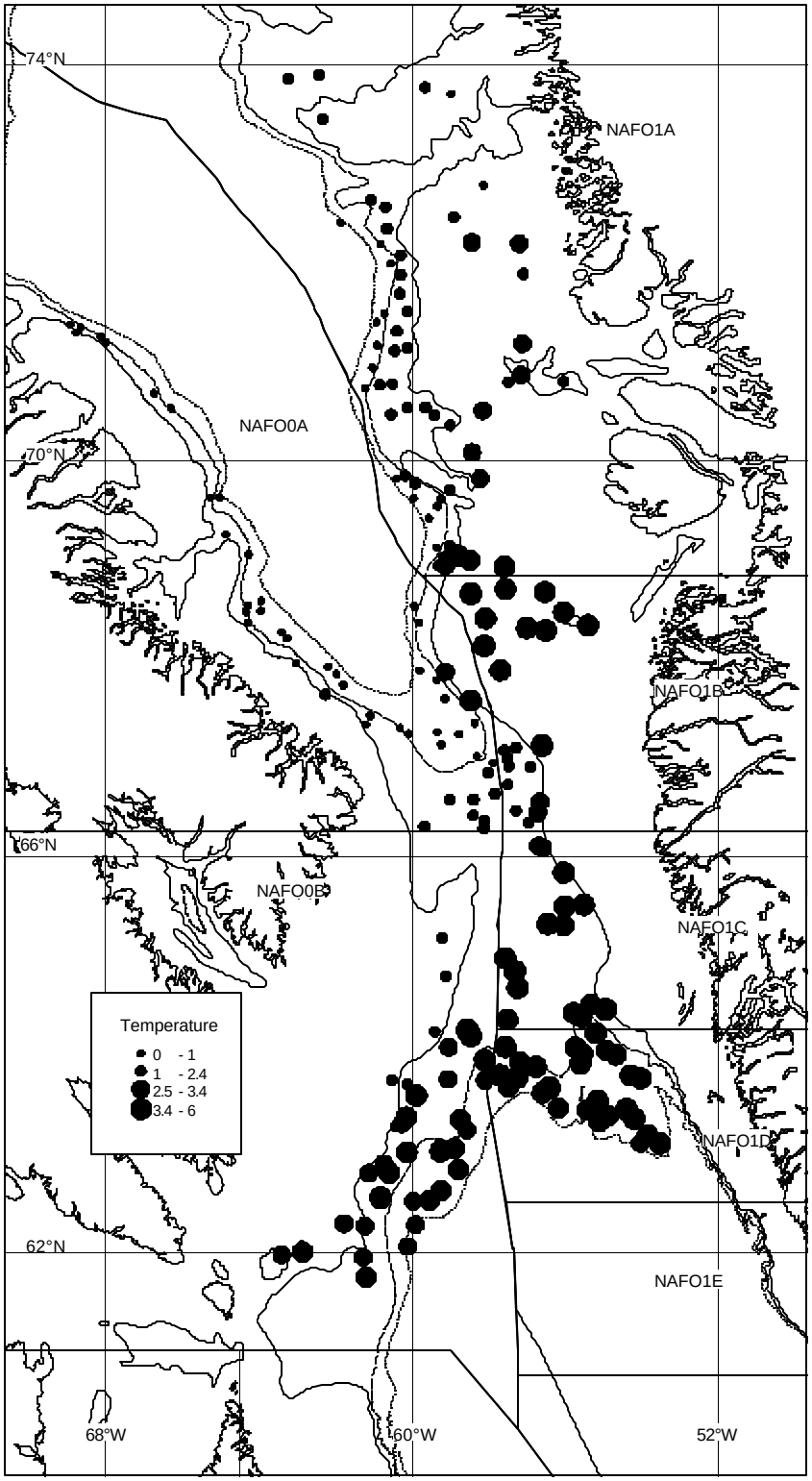

Fig. 1. Bottom temperature (°C) for NAFO Subareas 0 and 1 sampled between 16 September and 15 November 2001.

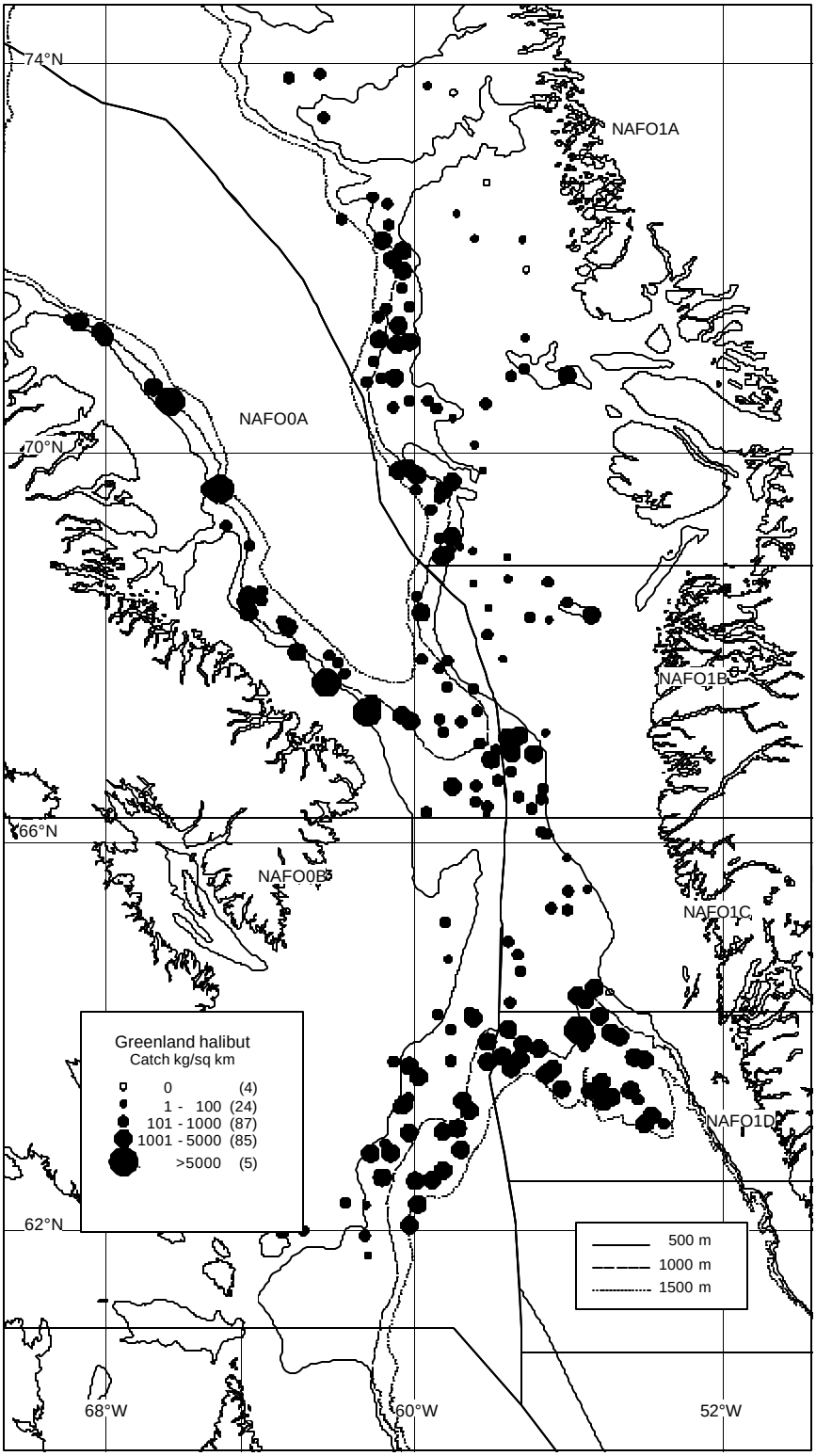

Fig. 2. Greenland halibut catch distribution (kg/sq km) for NAFO Subareas 0 and 1 surveys, 2001.

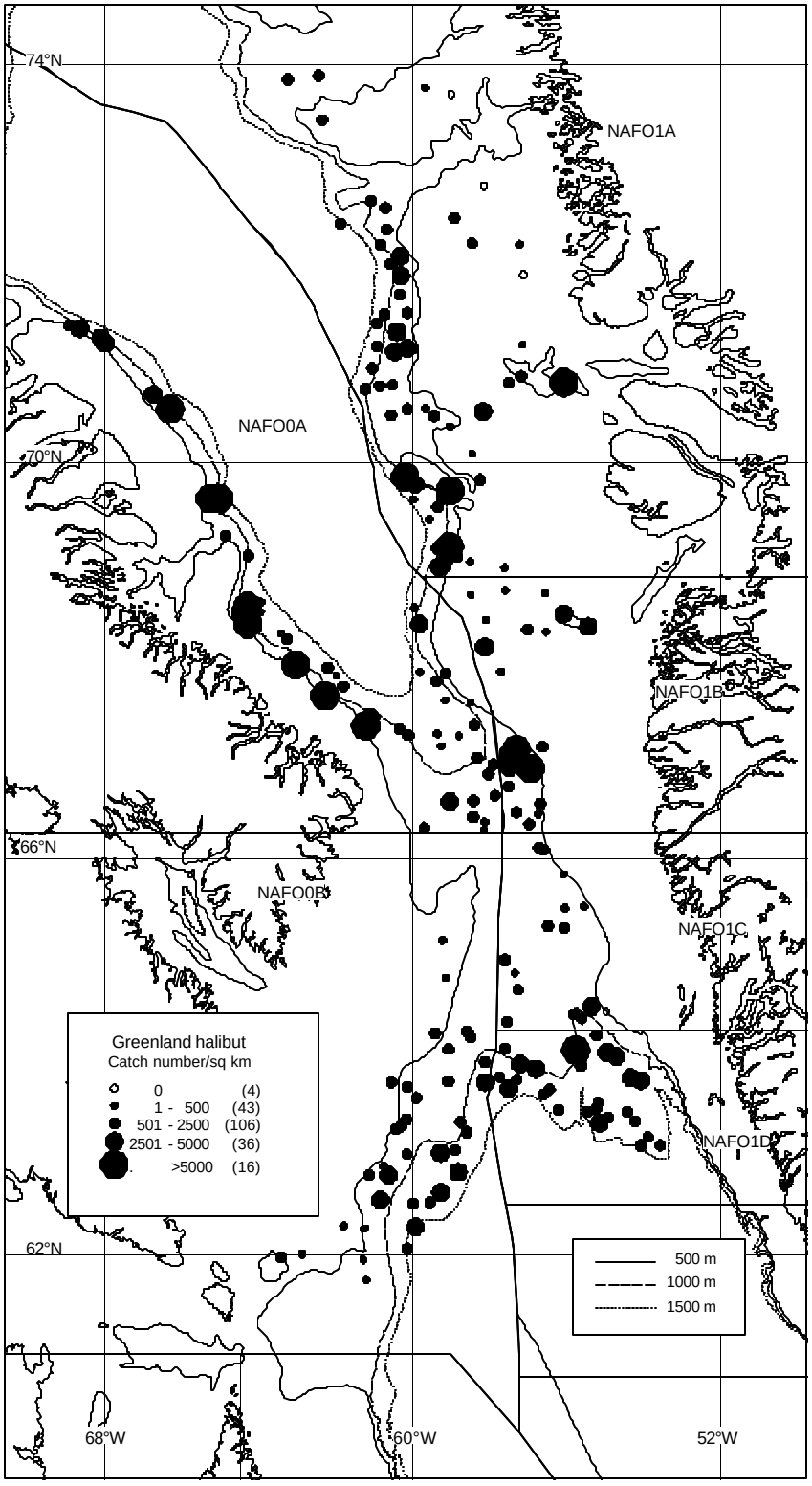

Fig. 3. Greenland halibut catch distribution (number/sq km) for NAFO Subareas 0 and 1 surveys, 2001.

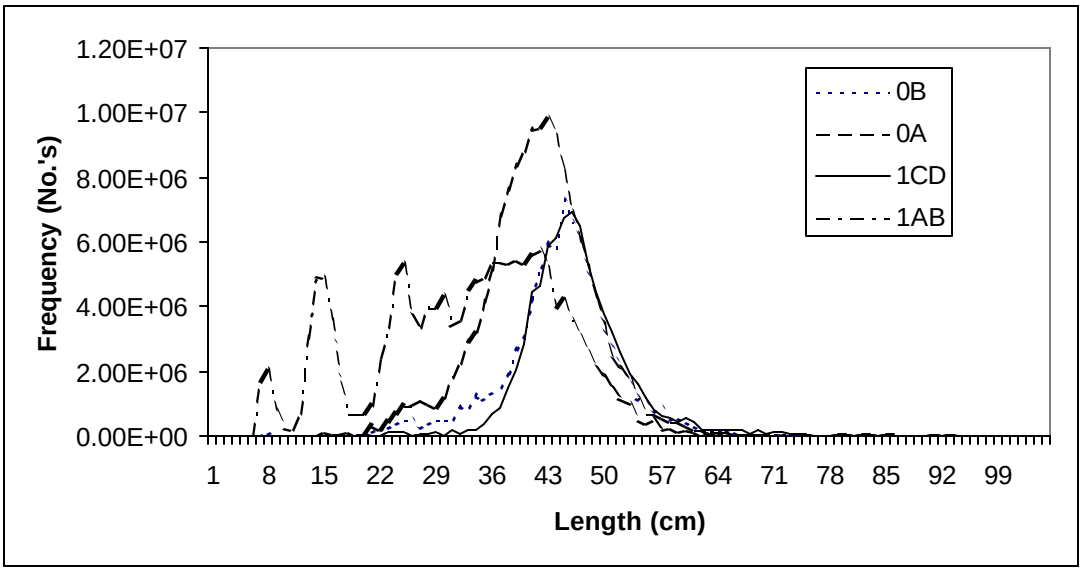

Fig. 4. Estimated abundance at length for the Greenland halibut population in NAFO Div. 0A, 0B, 1AB and 1CD, 2001.