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The Canadian Fishery for Greenland Halibut in SA 2 + Divisions 3KLMNO, with Emphasis on 2004

by

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Abstract

The Canadian catch of Greenland halibut in 2004 in NAFO Subarea 2 and Divisions 3KLMNO was reported to be about 4 900 tons, a decrease of 2 100 tons from 2003. There was a decrease in otter trawl catches, primarily in Div. 2H, from the high level in 2003. Catches in the gillnet sector were similar in 2003 and 2004, although there was more deepwater catch in 2004. As in previous years, much of the catch in 2004 came from Div. 3K, and almost 75% of the catch was taken in June to August. The catch at age in 2004 was dominated by the 1997-98 year-classes, which accounted for 60% of the catch numbers and 47% of the catch weight in the Canadian fishery. Mean weights at age in 2004 were similar to previous years. After a gradual increase from 1992 to 2001, CPUE from Canadian otter trawlers has declined since then.

Review of the Canadian fishery prior to 2004

The Canadian fishery for Greenland halibut in Subareas 2 and 3 began in the early 1960s, using gillnets in the deepwater bays of eastern Newfoundland, particularly Trinity Bay. As catches declined here, the effort moved progressively northward in the other bays along the east and northeast coast of Newfoundland. In later years, vessels moved further offshore to the deep channels, such as the area in the central part of Div. 3K known as Funk Island Deep, and eventually to the continental slope. Canadian catches increased from fairly low levels in the early 1960s to almost 32 000 tons in 1980 then declined steadily to between 2900 and 6300 tons in each year from 1993-99 (Table 1). This declining trend was mainly a result of low catch rates and reduced effort, as fishers pursued other species such as snow crab which were more profitable. However, in 2000, the Canadian catch in NAFO Subarea 2 and Div. 3KLMNO increased to about 10 600 tons, more than two and a half times the catches in 1998 and 1999. Reasons for this increased catch and effort include a switch of some effort by fishers in Div. 3KL from snow crab to G.halibut, combined with improved catch rates for Greenland halibut in most of the traditional fishing areas (Brodie and Power, 2000). However, catches declined by more than 2 000 tons from 2000 to 2001, then declined by a similar amount to about 6 300 tons in 2002. Catches in 2003 were just under 7 000 tons.

Canadian catches have been taken mainly by gillnet (Table 1), and most of these gillnet catches are from Div. 3K. This fishery has been conducted mainly by small vessels (<20 m) fishing in the deepwater channels near the Newfoundland and Labrador coast as well as in the deepwater bays, using an average mesh size of about 150 mm. However, Canadian gillnet catches taken during recent years also include those from a substantial fishery along the deep edge of the continental slope. In an attempt to reduce the catch of young Greenland halibut in this deepwater fishery, gillnet mesh size for Greenland halibut in the Canadian zone in depths >731 m (400 fm) is regulated to be no less than 191 mm, except in Div. 2J. Other restrictions on numbers of nets also exist, as indicated in the table below, which shows the current regulations in the Canadian gillnet fishery for Greenland halibut (J. Perry, DFO - pers. Comm.).

Area	Depth	Number of Nets	Min. Mesh Size
2GH + 3KL	293 - 549 meters	125	152 mm
2GH + 3KL	549 - 732 meters	200	152 mm
2GH + 3KL	> 732 meters	500	191 mm
2J	> 732 meters	500	152 mm
3NO	> 732 meters	500	191 mm

Gillnet catches during the 1990s ranged from 2 400 to 6 700 tons, averaging about 4 200 tons. Catches in 2000 from this sector then increased to 9 300 tons, similar to the levels seen in the late 1980s, but since then have declined steadily to 2 700 tons in 2003, which was the lowest level since 1994. Since early 2002, an area in the Funk Island Deep region of Div. 3K (see Fig. 4) was closed to gillnetting in order to reduce by-catch of snow crab, and was partly responsible for the decline in gillnet catch.

Canadian otter trawl catches peaked at about 8 000 tons in 1982, but from 1993 to 1999, catches by this fleet were less than 1 050 tons annually. Otter trawl catches increased sharply from less than 100 tons in 1998 and 1999, to around 1 800 tons in 2001-02, then doubled to just over 3 700 tons in 2003, which is the highest level since 1985 (Table 1). Much of the otter trawl catch in the recent period occurred in the slope area around the boundary between Div. 3K and 3L, although the increase in 2003 was due to an increase in effort in Div. 2H (Brodie and Power, 2004). This fishery is conducted mainly by large vessels (>30 m in length), and minimum codend mesh size has been regulated to be 145 mm for several years.

Catches from Subarea 2 were very low prior to the mid-1970s, then increased to a peak around 9 000 tons in 1982 (Table 2). From 1991 to 2001, catches from Subarea 2 have been in the range of 1 000 to 2 500 tons per year, and were stable around 1 300 tons during 1999-2001. The catch in SA 2 increased to almost 3 000 tons in 2003, due to higher catches in Div. 2GH. Most of the catch from Subarea 2 has come from Div. 2J, although catches in 1993-96 and 2003 were higher in Div. 2GH combined compared to Div. 2J. The catch in Div. 2GH declined from values around 1 400 tons in 1994-95 to less than 325 tons per year from 1999 to 2001, before increasing to a level near 2 200 tons in 2003, which is the highest catch from Div. 2GH since 1983. In most years, Div. 3K has produced the largest Canadian catches, peaking around 18 000 tons in 1979-80. Peak catches of around 13 000 tons in Div 3L occurred in 1966-67 and 1980. Catches in Div. 3M and 3N have been negligible, and catches in Div. 3O increased from similar low levels to a few hundred tons per year from 1993-2001, peaking at 567 tons in 2000.

The Canadian fishery in 2004

The total reported catch in the Canadian fishery for this stock of G. halibut in 2004 was just under 4 900 tons, which was the lowest since 1999, and represented a decrease of about 2 000 tons from 2003. Most of this decline occurred in the otter trawl fleet, mainly in Div. 2H, and the catch by this gear in 2004 was similar to the 2002 level (Table 3). Declines in quotas in 2004, under the first year of the NAFO FC rebuilding plan for this stock, were a major factor in the decline in otter trawl catches. Catches by gillnet in 2004 were similar to 2003, although the proportion caught in shallow water in 2004 was much lower (Tables 3b and 3c).

Breakdowns of the catch by gear, Division, depth range and month are shown in Tables 3 and 4. As in most years (although unlike 2003) gillnet was the dominant gear in 2004. In 2004 the gillnet catches in the shallow zone were lower than in the deep zone, contrasting to 2001 and 2003. These gillnet catches are referred to in Tables 3 and 4 as GN<400 and GN>400, with the '400' referring to depth in fathoms (731 m). Longline catches, which had not exceeded 130 tons per year since the early 1970s, increased to 650 tons in 2002, mostly in Div. 2GH, but dropped to just over 400 tons in 2004. Catches in Div. 3K dropped to 1 800 tons in 2004, about 1 000 tons less than in 2002-03. Catches in Div. 3L in 2004 were similar to levels in 1996-99.

Figures 1-3 show the location of most of the Canadian catch of Greenland halibut in 2001 and 2003-04. These data were aggregated by 10-minute squares from logbook records. In 2003, the plotted data account for almost 92% of the total Canadian catch, however in 2004, only about 60% of the catch data had positional information associated with it at this time. Most of the missing positional data are from otter trawl in Div. 2H, although a substantial portion of gillnet catches is also not available. Assuming the plotted data are representative , the spatial distributions of the 2003 and 2004 fisheries were quite similar (Fig. 2 and 3), with the major difference being the switch in the proportion of gillnet catch between shallow and deep water, as noted above. A major difference from 2002 onward was the reduction in catch from the central Div. 3K (Funk Island Deep) area, due to the area closed to gillnetting (as noted in previous sections, and shown in Fig. 4). Figure 4 also shows the location of the 2003 catch by the 4 major gear types (2 gillnet categories, otter trawl, and longline). Most of the otter trawl fishery in 2004 was located in 2 relatively small areas: one around the slope edge at the border between Div. 3K and 3L, similar to the fishery in 2000-2002; and the second on the slope edge in the central part of Div. 2H, as in 2003. The spatial distribution of the deepwater gillnet fishery in 2004 was similar to recent years. With the closure of the Funk Island Deep area, the shallow water gillnet catches were more concentrated towards the slope area in Div. 3K in 2002-04 compared to 2001 and earlier (Brodie and Power, 2002, 2003, 2004). In 2004, about 74% of the catch occurred in the summer, June to August, similar to recent years. Temporal patterns for gillnet and otter trawl fisheries in 2004 were similar to those seen in 2002 and 2003. Figures 5-6 show the temporal and spatial patterns for the deepwater gillnet and otter trawl fisheries in 2004. The major fishing areas did not change by season.

As in previous years, by-catches in the gillnet fishery include cod and snow crab, particularly in the GN<400 sector, while American plaice and witch flounder were included in by-catches in the otter trawl fishery. By-catches of Greenland halibut in the Canadian shrimp fishery have been described in separate papers (e.g. Orr *et al*., 2002).

Catch at age

Details on the catch at age for previous years can be found in Bowering and Brodie (2000), and Brodie and Power (2001, 2002, 2003, 2004). Ages 6-8 dominated the Canadian catch in most years, both in the otter trawl and shallow water gillnet fisheries. The deep water gillnet fishery was comprised mainly of larger, older individuals.

Sampling data collected in 2004 by observers at sea and by port samplers, were available from Div. 2HJ, 3KLO. The following table shows the number of length measurements by Division and gear type, and the number of otoliths (in italics).

	2GHJ		**3K**		**3L**		**3O**	
Gill net < 400	235		2387	*1350*	4909		-	
Gill net > 400	2652	*56*	7196		986	*155*	666	-
Longline	-		-		-		-	
Otter trawl	13748	*302*	9310	*1028*	3583	*233*	-	
Totals	16635	*358*	18893	*2378*	9478	*388*	666	-

The otolith samples from the fixed gear sectors have been combined. The relatively large number of measurements from the otter trawl catch is due to the requirement for these large vessels to have a high percentage of observer coverage. As in past years, the exact catch location of some port samples from the fishery operating on the boundary of Div. 3K and 3L was not known, and these samples have been assigned as Div. 3K. There were no samples collected from the longline catches in 2004, but in general, sampling of catches for length frequencies was improved in 2004 over 2003. This is reflected in the 49% increase in the total number of length measurements in 2004. Areas for improvement include otolith sampling in Subarea 2, and sampling of longline catches.

Age compositions are presented for both gillnet components (GN<400 and GN>400) as well as for otter trawl (Table 5). The longline catches were assigned the same age composition as the total combined gillnet gear catch

at age. The predominant age in the otter trawl, in all areas except Div. 2J, and GN <400 sectors was 7 (1997 year-class), while age 8 (1996 year-class) was most abundant in the catches of deepwater gillnets. Ages 7 and 8 were also dominant in fisheries in recent years. Overall, the catch at age in 2004 was dominated by the 1997 and 1998 year-classes, which accounted for 61% of the catch numbers and 47% of the catch weight. In 2003, age 7 accounted for 43% of the catch in numbers and 29% of the catch in weight. As was the case in 2000-2003, age 8 was second highest in the catch numbers, followed by age 6. Almost equal numbers of ages 6 and 8 were caught by otter trawlers in 2004, and there was no major differences in the age compositions of this gear in all areas (Table 5), although catches in Div. 2GH tended toward larger fish. Mean weights at age were calculated using the same length-weight relationship used for Greenland halibut catch at age in 1998-2003, which was the Divisions-combined, year = 1997 (from Gundersen and Brodie, 1999). Weights at age in 2004 were very similar to those from 2003 (Brodie and Power 2004), and the sum of products was about 6% lower than the catch weight.

CPUE

Catch and effort data from the Canadian otter trawl fishery directed for Greenland halibut during the period 1975 to 1999 were obtained from ICNAF/NAFO Statistical Bulletins. These data were combined with provisional 2000-2002 NAFO STATLANT 21B data and 2003-2004 data from logbook (ZIFF) records. The catch/effort data were analysed with a multiplicative model (Gavaris, 1980) to derive a standardized catch rate index based on an hours-fished measure of effort. *Ln* (CPUE) was the dependent variable in the models. Independent variables (category types) were: (1) a combination country-gear-tonnage-class category type (CGT), (2) month, (3) NAFO Division and (4) Year. Consistent with previous catch rate standardizations (e.g. Power, 2004), individual observations with catch less than 10 tons or effort less than 10 hours were eliminated prior to analysis. Subsequently, within each dependent variable, categories with arbitrarily less than five observations were also eliminated, with the exception of the variable "year", which is the purpose of the standardization. Residual plots for all runs did not indicate model misspecification. The advantage of running the Gavaris model is that the derived index is retransformed into the original units of fishing effort and can be computed for any chosen combination of the main factors.

The model resulted in a significant regression (P <0.05) explaining 56% of the variation in catch rates (Table 6). Based on the regression coefficients, over the entire time series, Canadian catch rates were better in late summer, and highest in Div. 2H. The standardized catch rate index (Table 7, Fig. 7) shows much between-year variability. Initial CPUE increased rapidly, probably as a result of captains learning a relatively new fishery. Catch rates then showed period of stability from 1978 to 1984, during which time the highest catch rates were realized. CPUE declined by about two-thirds from 1984 to 1992 although there were some sporadic increases over this period. The 1992 value was the lowest in the series (excluding the first point in 1976). Between 1992 and 2001 catch rates increased gradually, doubling over this period. Catch rate declined sharply in 2002, with slight decreases in 2003 and 2004 and again in 2003. The 2004 value is the sixth lowest in the 29-year series, and was similar to the estimates in 1993-94. The percentage of otter trawl catch with reported hours fished effort utilized in the analysis, after the selection criteria were applied, ranged from 10% in 1976 to 99% in 2000-2002, and averaged 87% since 1995.

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Table 1. Canadian catch of G.halibut, by gear type, from 1960-2004.

	GEAR					Canada
YEAR	GILLNET	LONGLINE	MISC	UNSP	OT TRAWL	**TOTAL**
1960				660		660
1961				741		741
1962				586		586
1963		5		771		776
1964				1757		1757
1965				8082		8082
1966	257	194	15	15640	120	16226
1967	93	144	95	15478	798	16608
1968		94		12766	493	13353
1969	9980	850	69	412	245	11556
1970	9818	371	119	318	85	10711
1971	8947	153	55	180	75	9410
1972	8775	34	22	50	71	8952
1973	6546	35	70	102	95	6848
1974	5500	49	16	8	184	5757
1975	7510	3	53	1	247	7814
1976	8500	6	41		767	9314
1977	15038	33	36		2866	17973
1978	20622	46	83		3951	24702
1979	24550	116	116		5183	29965
1980	27703	128	57		3946	31834
1981	17927	55	43		6155	24180
1982	11038	69	59		8143	19309
1983	9911	58	73		7085	17127
1984	11100	27	100		6070	17297
1985	7422	2	42		4847	12313
1986	6293	7	20		1896	8216
1987	10849	22	115		2465	13451
1988	7715	70	53		629	8467
1989	10956	16	35		988	11995
1990	6732	18	15		2402	9167
1991	3440	36	9		3254	6739
1992	4470	30	1		2502	7003
1993	3863	4	5		1034	4906
1994	2378				575	2953
1995	2602	1			632	3235
1996	5134	1		1	1043	6179
1997	5202	61			1017	6280
1998	3963	108	4		46	4121
1999	3870	65			81	4016
2000	9271	18	5	14	1285	10593
2001	6395	123	14		1833	8365
2002	3854	652			1784	6290
2003	2668	596			3710	6974
2004	2634	403			1832	4869

Table 2. Canadian catch of G.halibut, by Division, from 1960-2004.

	DIVISION								Canada
YEAR	2G	2H	2J	3K	3L	3M	3N	3O	**TOTAL**
1960				610	50				660
1961				613	128				741
1962				479	107				586
1963				592	184				776
1964				870	887				1757
1965				2129	5953				8082
1966				3691	12518		17		16226
1967			7	2892	13705		1	3	16608
1968			53	3672	9597		31		13353
1969				7140	4413		1	2	11556
1970				5937	4769		5		10711
1971				4160	5248		2		9410
1972				4736	4216				8952
1973			5	3602	3233		1	7	6848
1974			19	2817	2909		9	3	5757
1975			22	3245	4540		7		7814
1976	62	168	153	4779	4144	1	7		9314
1977		72	419	10751	6725	1	2	3	17973
1978		14	1255	15875	7548	1	5	4	24702
1979		34	3163	18165	8578	2	17	6	29965
1980		217	1157	17658	12742	14	43	3	31834
1981	10	41	862	14379	8833		49	6	24180
1982	15	5155	3942	6031	4105		55	6	19309
1983		2578	2238	7679	4618		12	2	17127
1984		1913	2796	7496	5078		12	2	17297
1985		1758	3101	4395	3023		35	1	12313
1986		82	2476	2886	2769		2	1	8216
1987		6	4143	4740	4561		1		13451
1988	45	27	1867	4591	1921	2	12	2	8467
1989		190	2635	6342	2809	6	10	3	11995
1990	57	171	2798	4075	2020	38	4	4	9167
1991		50	3008	2215	1291	157	11	7	6739
1992	428	230	476	3882	1951	4	10	22	7003
1993	557	403	214	2398	880		19	435	4906
1994	1045	210	203	1032	258		1	204	2953
1995	1006	453	709	754	197			116	3235
1996	688	639	1058	2567	888			339	6179
1997	370	619	1513	2659	935			184	6280
1998	358	418	1234	1374	633		1	103	4121
1999	65	103	1094	1940	683			131	4016
2000	45	81	1152	5845	2901	1	1	567	10593
2001	63	251	1030	3999	2666		9	347	8365
2002	374	360	1030	2933	1466	15		112	6290
2003	258	1897	730	2873	964			252	6974
2004	147	1050	891	1844	794		1	142	4869

Table 3a. Summary of Canadian catches of G.halibut in 2002 by area and gear.

	GN <400	GN >400	Longline	Otter trawl	Can (N)
2GH	154	7	573		734
2J	389	597	9	35	1030
3K	1304	830	28	771	2933
3L	56	424	8	978	1466
3MO	93		34		127
Total	1996	1858	652	1784	**6290**

Table 3b. Summary of Canadian catches of G.halibut in 2003 by area and gear.

	GN <400	GN >400	Longline	Otter trawl	Total Can
2G			253	5	258
2H		52	160	1685	1897
2J	263	271		196	730
3K	1462	539	2	870	2873
3L	5		5	954	964
3O		76	176		252
Total	1730	938	596	3710	**6974**

Table 3c. Summary of Canadian catches of G.halibut in 2004 by area and gear.

	GN <400	GN >400	Longline	Otter trawl	Total Can
2G			144	3	147
2H	52		131	867	1050
2J	262	533		96	891
3K	173	1231	38	402	1844
3L	208	116	6	464	794
3N			1		1
3O		59	83		142
Total	695	1939	403	1832	**4869**

Table 4. Breakdown of Canadian catches of G.halibut in SA 2 + Div 3KLMNO in 2004 by area, gear, and month.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	GN<400 fm								41	11				52
2GH	Otter trawl						106	332	385		47			870
	Longline					37	24	54	54	59	7		40	275
	Total					37	130	386	480	70	54		40	1197
	GN<400 fm					10	43	107	13				89	262
2J	GN>400 fm					19	244	245	25					533
	Otter Trawl				63	28			2		2		1	96
	Total				63	57	287	352	40		2		90	891
	GN<400 fm						11	93	61	8				173
3K	GN>400 fm					2	284	492	399	54				1231
	Otter Trawl				80	83	54	68	24	4	5		84	402
	Longline										38			38
	Total				80	85	349	653	484	66	43		84	1844
	GN<400 fm							2	34	129	37	6		208
	GN>400 fm					16			66	34				116
3L	Otter Trawl				30	99	90	114	120	7	2		2	464
	Longline					1			4			1		6
	Total				30	116	90	116	224	170	39	7	2	794
	Gillnet	1		18	36			4						59
3NO	Longline		4	16	37	27								84
	Total	1	4	34	73	27		4						143
	TOTAL	1	4	34	246	322	856	1511	1228	306	138	7	216	**4869**

Table 5. Catch at age for the Canadian catch of G.halibut in SA 2 + Div. 3KLMNO in 2004.
Catch at age in thousands of fish. See text for definition of GN gear types.

	Gear										Mean		
Age	OT 2GH	OT 2J	OT 3K	OT 3L	Total Ot trawl	GN<400	GN>400	Tot Fix Gear	Total	Pct	Len (cm)	Wgt (kg)	S.O.P(t)
3				*	*				**0.01**	**0.0003%**	28.5	0.178	0.0
4	1	1	1	5	7				**7**	**0.2%**	32.9	0.285	2.0
5	7	8	23	40	79	1	1	2	**81**	**2.4%**	36.8	0.404	32.7
6	67	53	94	118	331	22	9	36	**368**	**10.9%**	41.0	0.570	209.8
7	254	45	185	172	656	225	227	521	**1177**	**34.9%**	47.5	0.904	1064.0
8	158	9	85	94	345	113	345	528	**873**	**25.9%**	52.7	1.248	1089.5
9	85	3	28	43	159	32	120	176	**335**	**9.9%**	57.8	1.669	559.1
10	60	1	6	9	76	25	82	123	**200**	**5.9%**	63.4	2.234	446.8
11	20	*	3	6	29	23	76	113	**142**	**4.2%**	68.2	2.819	400.3
12	11	*	1	4	16	16	58	85	**102**	**3.0%**	73.8	3.621	369.3
13	5	*	*	1	6	8	30	43	**50**	**1.5%**	78.6	4.416	220.8
14	2	*	*		2	2	13	18	**20**	**0.6%**	82.5	5.135	102.7
15	1	*	*		1	1	7	9	**10**	**0.3%**	87.7	6.226	62.3
16	*	*	*		*	1	3	4	**4**	**0.1%**	91.5	7.133	28.5
17						*	1	1	**1**	**0.03%**	93.2	7.521	7.5
									3370				**4595**
													Catch=4869

* indicates catch of less than 500 fish

Table 6. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized CPUE index for Greenland halibut in NAFO Div. 2HJ3KL. Analysis is based on HOURS FISHED from the Canadian otter trawl fleet (2004 based on preliminary data).

REGRESSION OF MULTIPLICATIVE MODEL
MULTIPLE R..... 0.749
MULTIPLE R SQUARED..... 0.560

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARE	F-VALUE
INTERCEPT	1	2.68E2	2.68E2	
REGRESSION	46	5.22E1	1.13E0	6.648
Cntry|Gear|TC	4	1.29E0	3.23E-1	1.893
Month	11	3.90E0	3.55E-1	2.079
Division	3	2.03E0	6.78E-1	3.975
Year	28	2.54E1	9.07E-1	5.313
RESIDUALS	240	4.10E1	1.71E-1	
TOTAL	287	3.61E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VAR #	REG. COEF	STD. ERR	NO. OBS
Cntry|Gear|TC	3125	INT	-1.139	0.315	287
Month	9				
Division	22				
Year	76				
1	3123	1	-0.260	0.149	10
	3126	2	-0.042	0.137	13
	3127	3	0.275	0.174	7
	27125	4	0.126	0.101	25
2	1	5	-0.165	0.154	11
	2	6	-0.104	0.156	12
	3	7	-0.403	0.137	18
	4	8	-0.288	0.125	26
	5	9	-0.134	0.124	24
	6	10	-0.025	0.112	32
	7	11	-0.074	0.100	39
	8	12	0.094	0.093	44
	10	13	-0.285	0.129	17
	11	14	-0.316	0.142	14
	12	15	-0.158	0.159	10
3	23	16	-0.152	0.093	70
	31	17	-0.321	0.096	120
	32	18	-0.265	0.108	57
4	77	19	0.313	0.352	5
	78	20	0.920	0.341	8
	79	21	0.934	0.385	3
	80	22	1.078	0.327	12
	81	23	0.933	0.330	12
	82	24	0.938	0.334	10
	83	25	0.927	0.320	18
	84	26	1.059	0.327	12
	85	27	0.572	0.326	13
	86	28	0.426	0.346	7
	87	29	0.792	0.355	5
	88	30	0.051	0.370	4
	89	31	0.529	0.348	6
4	90	32	0.396	0.325	13
	91	33	0.212	0.320	16
	92	34	0.047	0.320	20
	93	35	0.184	0.331	15
	94	36	0.198	0.370	4
	95	37	0.305	0.423	2
	96	38	0.199	0.338	8
	97	39	0.587	0.342	7
	98	40	0.409	0.425	2
	99	41	0.351	0.429	2
	100	42	0.511	0.336	9
	101	43	0.737	0.324	17
	102	44	0.304	0.331	11
	103	45	0.224	0.314	26
	104	46	0.194	0.319	18

LEGEND FOR ANOVA RESULTS:

CGT CODES: All are Stern Trawlers

3123 = Can(NFLD) TC 3 |

3125 = Can(NFLD) TC 5 |

3126 = " TC 6 |

3127 = " TC 7 |

27125 = Can(M) TC 5 |

DIVISION CODES:

22 = 2H, 23 = 2J, 31 = 3K, 32 = 3L

Table 7. Standardized CPUE for Greenland halibut in NAFO 2HJ3KL based on a multiplicative model based utilizing HOURS FISHED as a measure of effort. Results are from the CANADIAN OTTERTRAWL fleet (2004 based on preliminary data).

	PREDICTED CATCH RATE						
	LN TRANSFORM		RETRANSFORMED		FLEET		% OF CATCH IN
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT	THIS ANALYSIS
1976	-1.1385	0.0990	0.332	0.102	767	2310	9.5
1977	-0.8257	0.0473	0.466	0.100	2866	6152	20.9
1978	-0.2181	0.0351	0.861	0.160	3951	4591	30.0
1979	-0.2047	0.0746	0.855	0.230	5183	6061	35.4
1980	-0.0605	0.0285	1.011	0.170	3946	3903	42.5
1981	-0.2059	0.0268	0.875	0.142	6155	7035	55.8
1982	-0.2003	0.0236	0.881	0.135	8143	9241	73.4
1983	-0.2111	0.0185	0.874	0.119	7085	8106	87.4
1984	-0.0798	0.0205	0.996	0.142	6070	6097	90.4
1985	-0.5665	0.0207	0.612	0.088	4847	7922	91.2
1986	-0.7124	0.0320	0.526	0.094	1896	3606	73.7
1987	-0.3466	0.0442	0.753	0.157	2465	3272	85.6
1988	-1.0873	0.0563	0.357	0.084	629	1762	38.8
1989	-0.6093	0.0395	0.581	0.115	988	1701	21.2
1990	-0.7426	0.0230	0.512	0.077	2402	4687	76.3
1991	-0.9267	0.0242	0.426	0.066	3254	7638	70.0
1992	-1.0918	0.0207	0.362	0.052	2502	6915	50.2
1993	-0.9540	0.0309	0.413	0.072	1034	2503	87.7
1994	-0.9406	0.0558	0.414	0.097	575	1390	96.5
1995	-0.8337	0.0968	0.451	0.137	632	1402	56.2
1996	-0.9398	0.0328	0.419	0.075	1043	2491	81.0
1997	-0.5511	0.0368	0.616	0.117	1017	1650	94.7
1998	-0.7291	0.0991	0.500	0.154	46	92	63.0
1999	-0.7875	0.1028	0.471	0.147	81	172	81.5
2000	-0.6274	0.0320	0.572	0.102	1285	2245	99.3
2001	-0.4020	0.0243	0.720	0.112	1833	2546	99.2
2002	-0.8345	0.0284	0.466	0.078	1784	3826	98.7
2003	-0.9145	0.0157	0.433	0.054	3710	8566	78.9
2004	-0.9448	0.0196	0.419	0.059	1832	4368	90.4

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.194

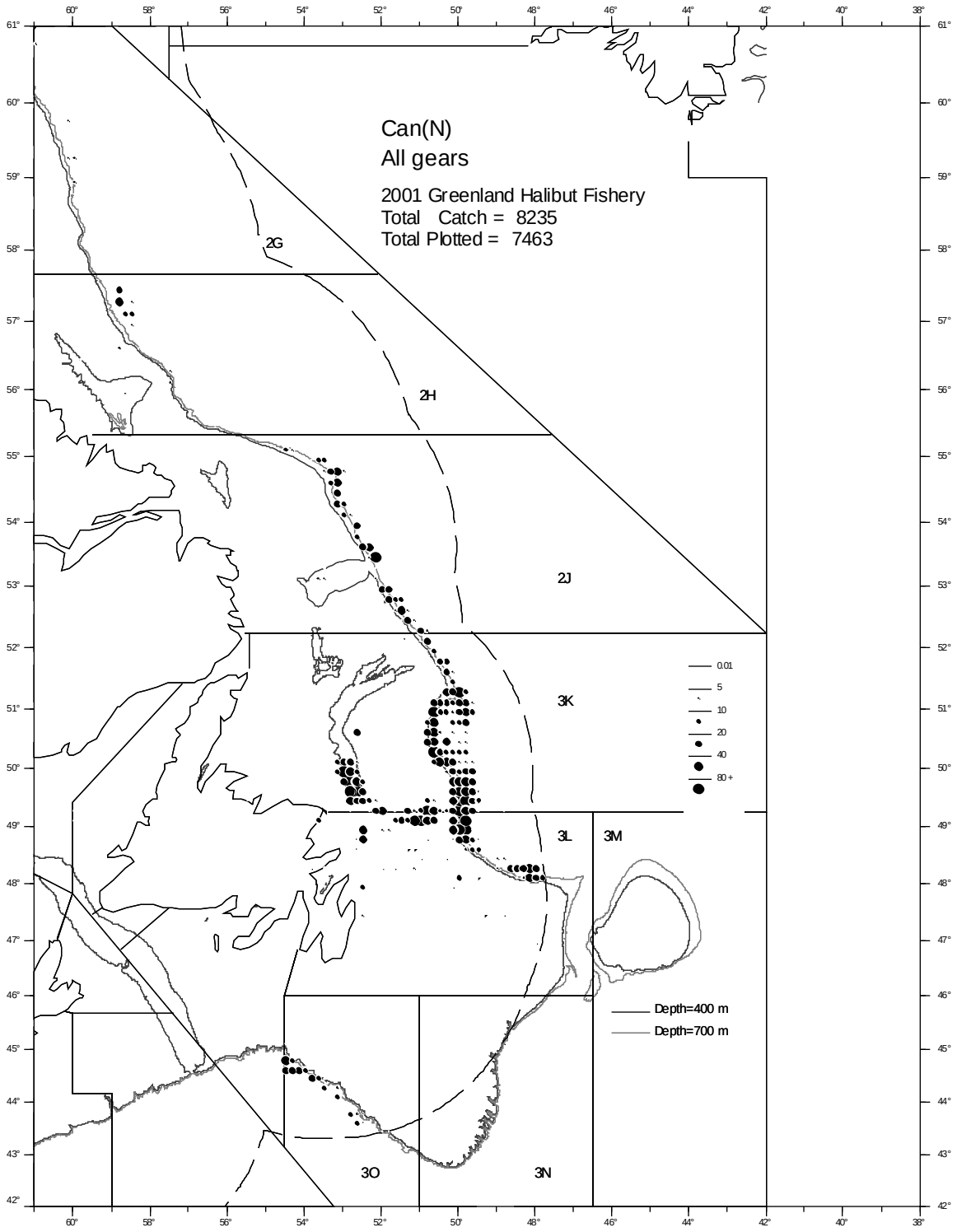

Fig. 1. Distribution of Can(N) Greenland halibut catch (tons) from the 2001 commercial fishery. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook.

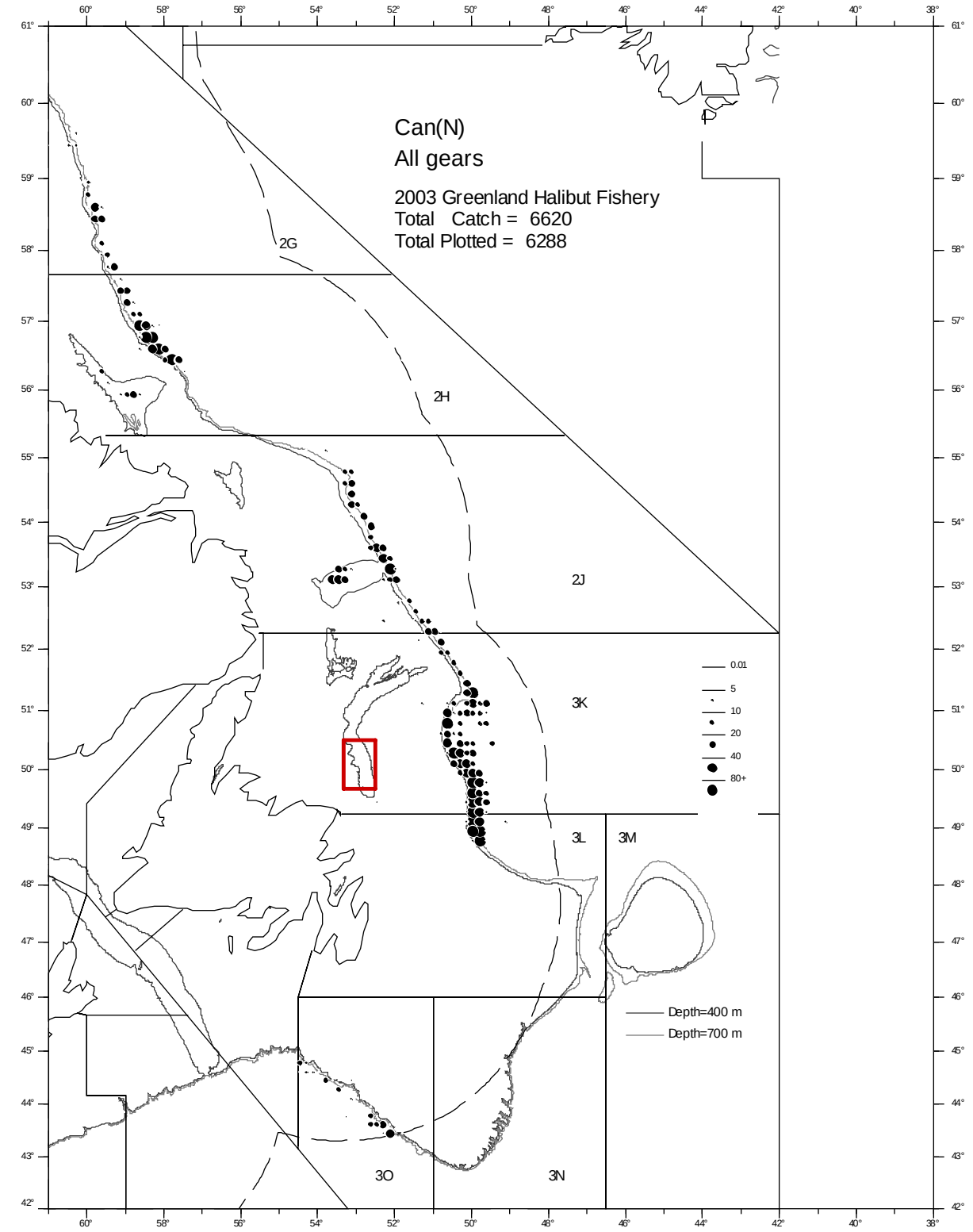

Fig. 2. Distribution of Can(N) Greenland halibut catch (tons) from the 2003 commercial fishery. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook.Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

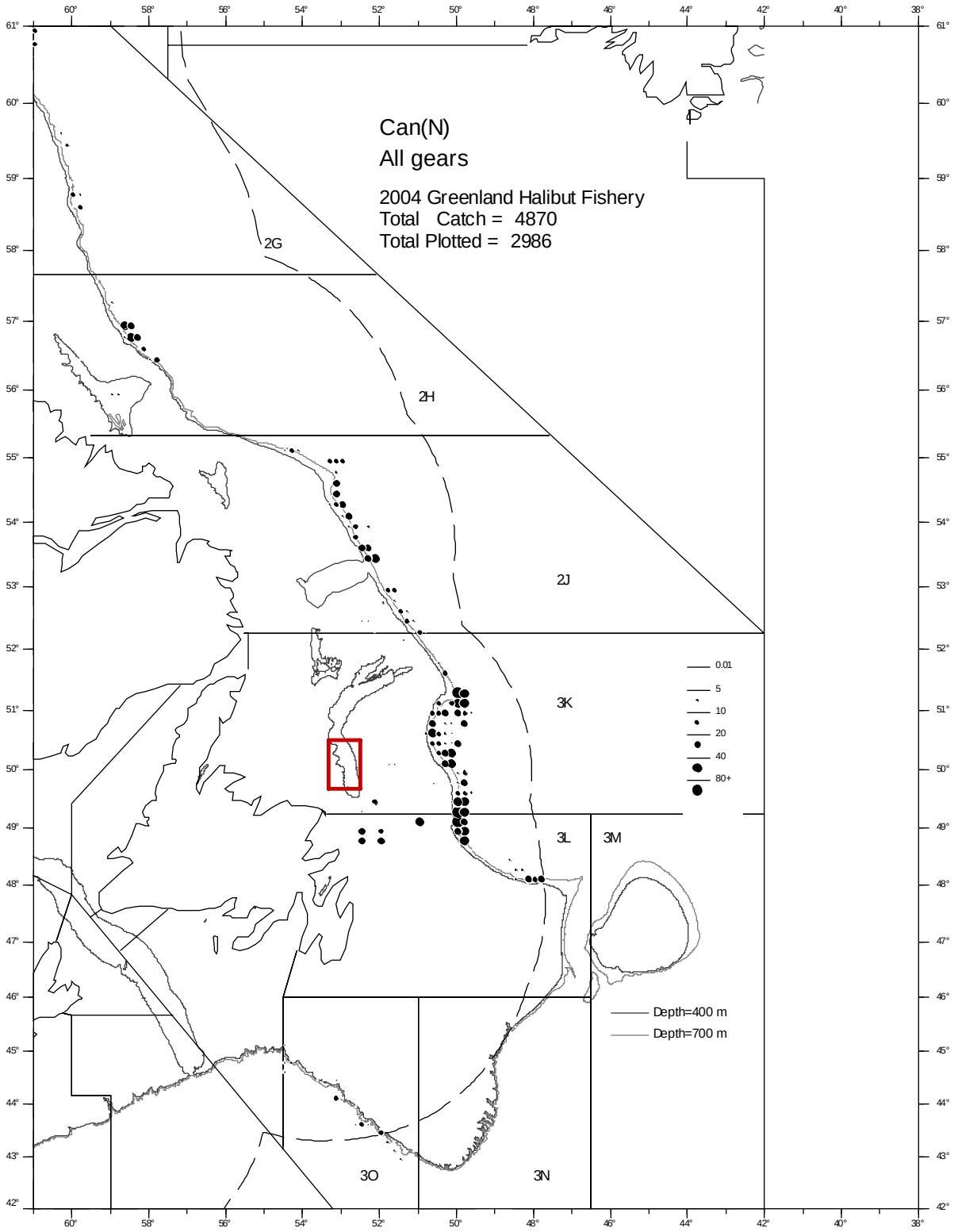

Fig. 3. Distribution of Can(N) Greenland halibut catch (tons) from the 2004 commercial fishery. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook.Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

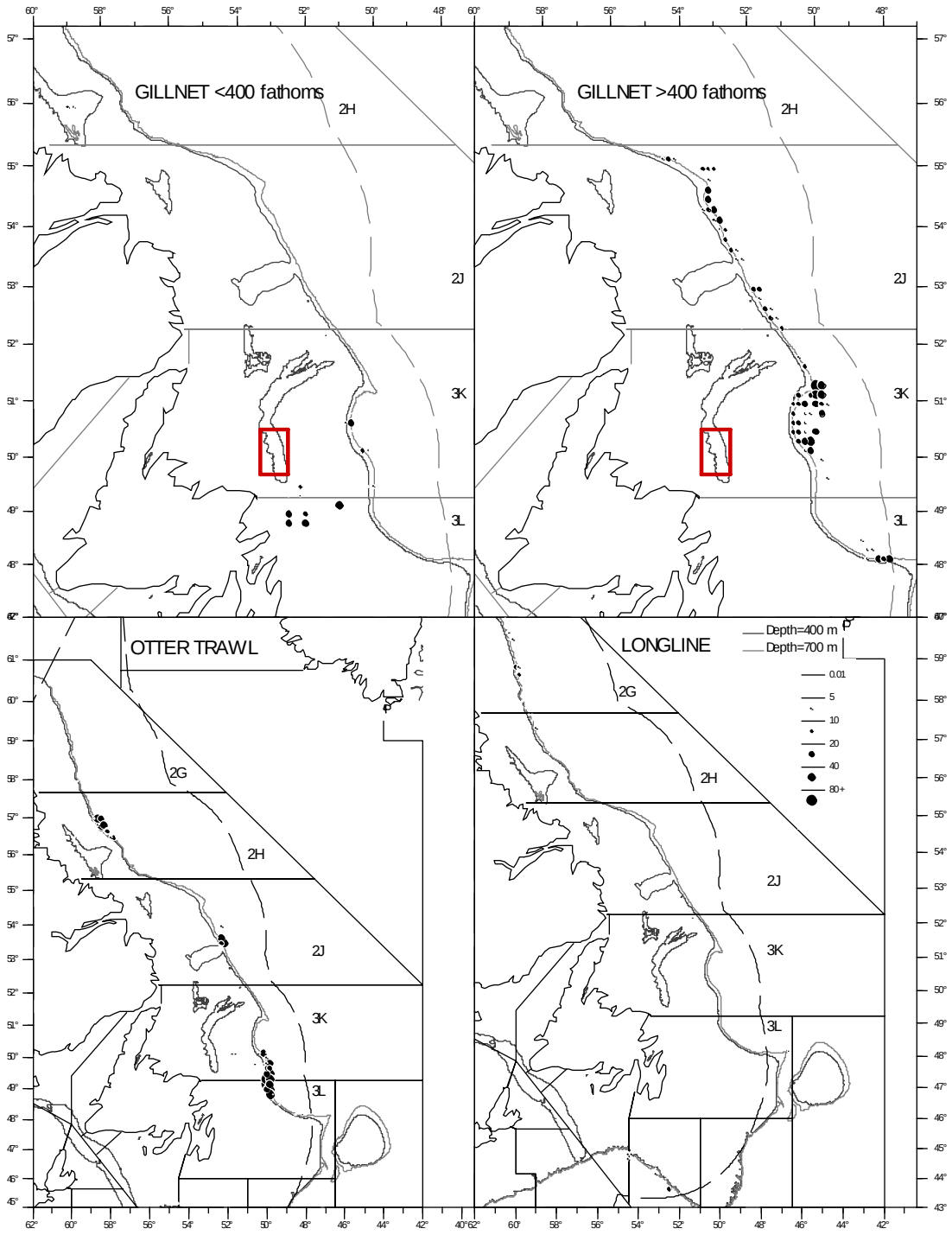

Fig. 4. Distribution of Can(N) Greenland halibut catch (tons) from the 2004 commercial fishery. Represented is LONGLINE, GILLNET (<400 fathoms and >400 fathoms) and OTTER TRAWL from both directed and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

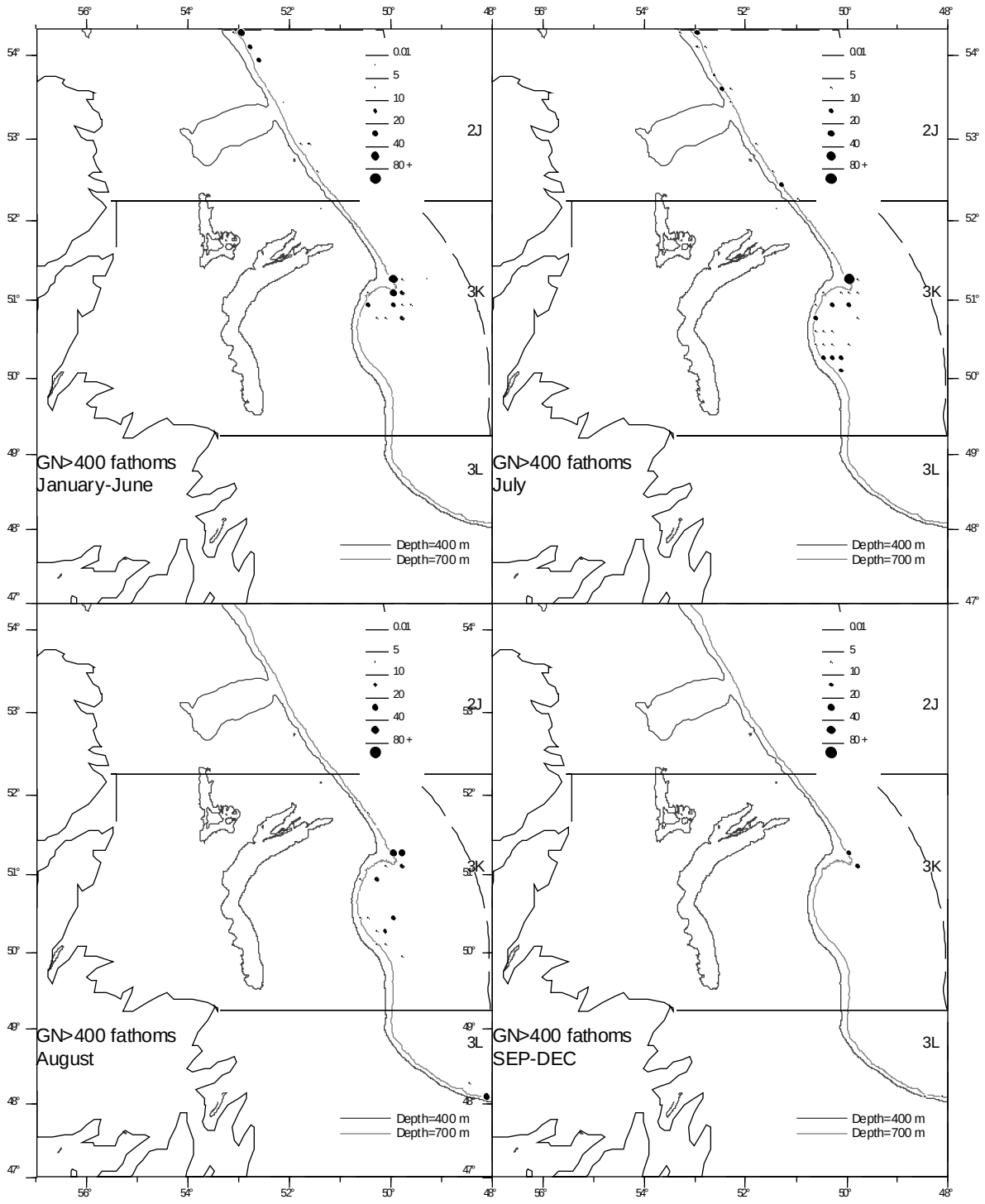

Fig. 5. Distribution of Can(N) Greenland halibut catch (tons) from the 2004 commercial fishery. Represented is GILLNET (>400 fathoms) for various months from both directed fisheries and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

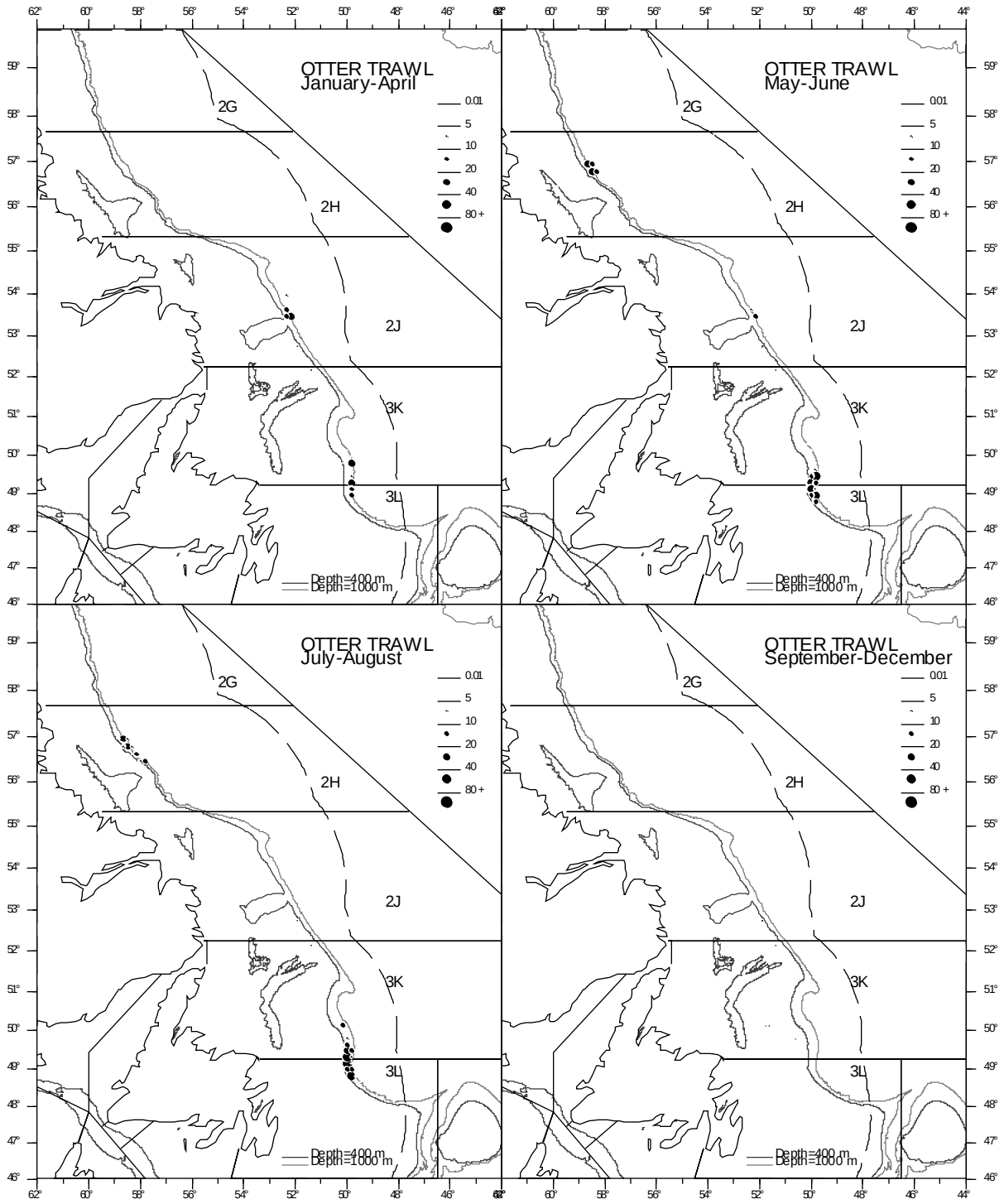

Fig. 6. Distribution of Can(N) Greenland halibut catch (tons) from the 2004 commercial fishery. Represented is OTTER TRAWL catch for various months from directed fisheries and by-catch from other fisheries. The data are aggregated by 10-minute square for Div. 2J3KL where position was recorded on the logbook.

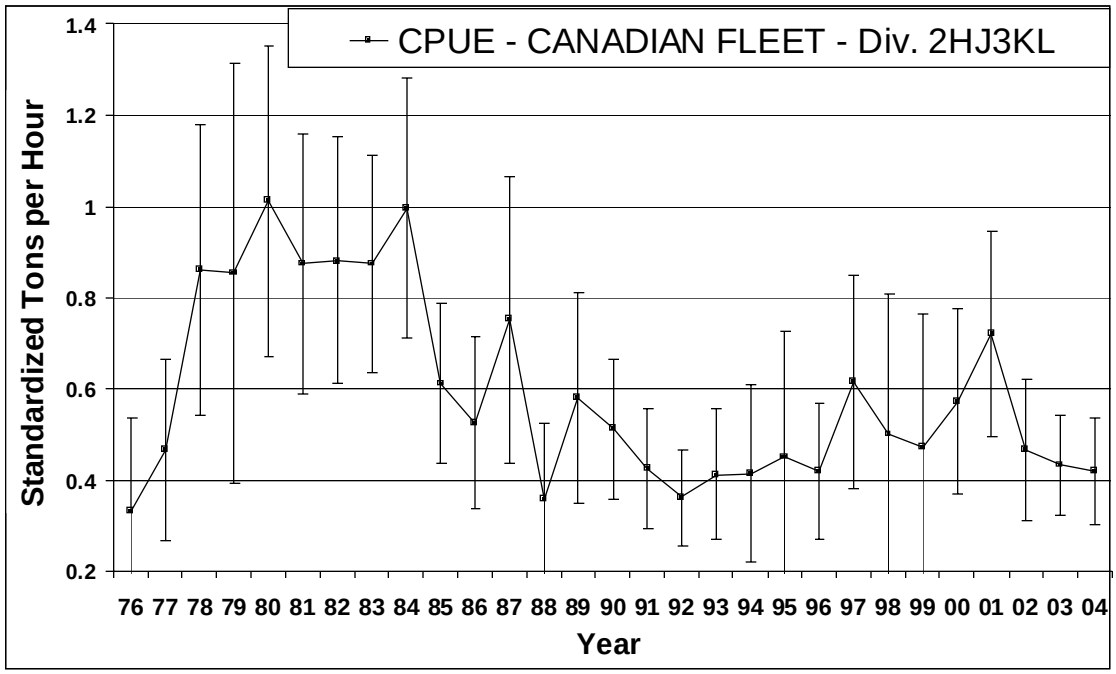

Fig. 7. Standardized Mean CPUE ± 2 standard errors for Greenland Halibut in Div. 2HJ3KL utilizing effort in HOURS fished from CANADIAN OTTERTRAWL FLEET.