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The Canadian fishery for Greenland halibut in SA 2 + Div. 3KLMNO, with emphasis on 2006.

by

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Abstract

The Canadian catch of Greenland halibut in 2006 in NAFO Subarea 2 and Divisions 3KLMNO was reported to be 6379 tons, about 250 t lower than in 2005. There was a small increase in otter trawl catches, which were taken primarily in Div. 3K. Catches in the shallow water gillnet sector were higher in 2006, but lower in the deep-water gillnet component. As in previous years, much (61%) of the catch in 2006 came from Division 3K, and about 63% of the catch was taken in May, June, and August. The catch at age in 2006 was dominated by the 1998-99 year classes, which accounted for 71% of the catch numbers and 67% of the catch weight in the Canadian fishery. Catches in the deepwater gillnet sector have trended toward younger fish since 2001, particularly with the permitted use of smaller mesh deeper zones in recent years. Mean weights at age in 2006 were similar to previous years. CPUE analysed from logbooks of Canadian trawlers increased by about 50% in 2006, and data collected by observers also indicated sharp increases in both otter trawl and gillnet CPUE.

Review of the Canadian fishery

As reported in several previous documents, 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. In 2000, the Canadian catch in NAFO Subarea 2 and Divisions 3KLMNO increased to about 10,600 tons, more than two and a half times the catches in 1998 and 1999. However, catches declined by more than 2000 tons from 2000 to 2001, then declined by a similar amount to about 6300 tons in 2002. Since then, catches have mainly been around 6500 tons per year, with the exception of about 4900 t in 2004. Reasons for fluctuations in catch and effort include a switch of some effort by fishers in Divs. 3KL between snow crab and G.halibut due to changes in quotas and product prices, combined with variable catch rates for Greenland halibut in some of the traditional fishing areas (Brodie and Power, 2000).

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) was regulated to be no less than 191 mm, with the exception of Div. 2J. Other restrictions on numbers of nets also exist,

as indicated in the table below, which show the 2006 conservation harvesting plan (CHP) regulations in the Canadian gillnet fishery for Greenland halibut. In 2005 and 2006, but not reflected in the table, fishers in Div. 3K were permitted to use some 152 mm mesh gillnets in waters deeper than 732 m, but these fishers were then not permitted to fish for G. halibut in depths less than 732 m.

Area	Depth	# of Nets	Min. Mesh
2GH + 3L	293 – 549 m	125	152 mm
2GH + 3KL	549 – 732 m	200	152 mm
2GH + 3KL	> 732 m	500	191 mm
2J	> 732 m	500	152 mm
3NO	> 732 m	500	191 mm

Gillnet catches during the 1990's ranged from 2400 to 6700 tons, averaging about 4200 tons. Catches in 2000 from this sector then increased to 9300 tons, similar to the levels seen in the late 1980's, but since then have declined to 6400 tons in 2001, and between 2600 and 3900 tons since. Since early-2002, an area in the Funk Island Deep region of Div. 3K (see Fig. 1) was closed to gillnetting in order to reduce by-catch of snow crab, and was partly responsible for the decline in gillnet catch. An area of Hawke Channel has also been closed to fishing for some years, due to crab – shrimp fishing interactions. Both these areas have undergone modifications over time.

Canadian otter trawl catches peaked at about 8,000 tons in 1982, but from 1993 to 1999, catches by this fleet were less than 1050 tons annually. Otter trawl catches increased sharply from less than 90 tons in 1998 and 1999, to around 1800 tons in 2001-02 and 2004, but were double this level at just over 3700 tons in 2003, which is the highest level since 1985 (Table 1). OT catch in 2005 was about 2200 tons. Much of the otter trawl catch in the recent period occurred in the slope area around the boundary between Divs. 3K and 3L, although the increase in 2003 was due to an increase in effort in Div. 2H (Brodie and Power 2004). The 2005 OT catch was split mainly between 2J and 3KL (Table 3d) This fishery is conducted mostly 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 1970's, then increased to a peak around 9000 tons in 1982 (Table 2). From 1991 to 2001, catches from Subarea 2 have been in the range of 1000 to 2500 tons per year, and were stable around 1300 tons during 1999-2001. The catch in SA 2 increased to almost 3000 tons in 2003, due to higher catches in Div. 2GH, but has since declined. Most of the catch from Subarea 2 has come from Div. 2J, although catches in 1993-96 and 2003-04 were higher in Div. 2GH combined compared to Div. 2J. This was not the case in 2005, when the catch in 2J increased and was over 4 times higher than the 2GH catch. The catch of about 1700 t in 2J in 2005 was the highest from this Division since 1991. The catch in Divs. 2GH declined from the mid-1990's to about 125 tons in 2000, before increasing to near 2200 tons in 2003, which is the highest catch from 2GH since 1983. Catches have since declined again. In most years, Div. 3K has produced the largest Canadian catches, peaking around 18,000 tons in 1979-80. Catches in recent years from Div. 3K have fluctuated between 750 tons (1995) and 5800 tons (2000), with the 2005 value at 3000 tons. Peak catches of around 13,000 tons in Div 3L occurred in 1966-67 and 1980, and averaged about 1700 tons from 2000 to 2005. Catches in Div. 3M , 3N, and 3O combined have generally been in the range of 100 to 600 tons per year, mainly from Div. 3O (Table 2).

The Canadian fishery in 2006

There were some differences in the spatial and temporal patterns in the Canadian fishery for G.halibut in 2006 compared to those observed in 2002-05. The total reported catch was just under 6400 tons, about 250 t lower than in 2005, and similar to catches in 2002 and 2003 (Table 3). Catches by gillnet in 2006 were almost 500 t lower than in 2005, with the decrease occurring in the deep-water fleets (Tables 3e and 4). Catches in the shallow water gillnet fleet, and in the otter trawl fleet, both increased in 2006.

Breakdowns of the catch by gear, Division, depth range and month are shown in Tables 3 and 4. As in most years, gillnet was the dominant gear in 2006. In 2004 to 2006 the gillnet catches in the shallow zone (<400 fm) were lower than in the deep zone, contrasting to 2002 and 2003. These gillnet catches are referred to in Tables 3 and 4 as GN<400 and GN>400. Longline catches, which had not exceeded 130 tons per year since the early 1970's, were higher in 2002-2004, but have since declined. Catches in Div. 3K increased to 3900 t in 2006, about 30% higher than in 2005,

and similar to 2001. Catches in Div. 3L in 2006 were similar to 2005, above those of 2003-04. Most of the catches in 2006 occurred in August (mainly gillnet), and March (all otter trawl). The temporal pattern of catch in 2006 was unusual compared to 2005, with only a small amount of catch occurring in July. This was due to creation of a split season in management of the gillnet fishery in 2006, with a substantial portion of the quota not available to be fished until August 1, 2006. Much of the quota in the first season was taken by the end of June, resulting in very low catches in July.

Figs. 1-3 show the location of most of the Canadian catch of Greenland halibut in 2002, 2004, and 2006. These data were aggregated by 10-minute squares from logbook records. In all three years, the plotted data account for over 91% of the total Canadian catch. The spatial distributions of the 3 years were fairly similar (Figs 1-3), with the major difference being the gillnet catches in the north-central part of Div. 3L in 2006, which was also fished in 2005, but to a lesser extent in 2004, and not at all in 2002-03. A major difference from 2002 onward was the reduction in catch from the central 3K (Funk Island Deep) area, due to the area closed to gillnetting (Brodie and Power, 2002). This was noted in previous sections, and is shown in Fig. 1 in Power and Brodie (2006), where the closed area, which was not in the regulations in 2001, was overlaid on the 2001 catch. Fig. 4 shows the location of the 2005 catch by the 4 major gear types (2 gillnet categories, otter trawl, and longline). Most of the otter trawl fishery in 2006 (Figs 4, 7) was located in one main area: around the slope edge at from the border between Divs. 3K and 3L north to about 51 N, similar to the fishery in recent years.. The spatial distribution of the deepwater gillnet fishery in 2006 was similar to recent years, ie. widely distributed along the slope edge, with relatively more effort in Div. 3K. With the closure of the Funk Island Deep area, the shallow water gillnet catches were more concentrated towards the slope area in 3K in 2002-05 compared to 2001 and earlier (eg. Brodie and Power 2006, and earlier docs). In 2006, much of the shallow water GN catches came from north-central 3L. As noted above, some smaller mesh gillnets have been allowed in Div. 2J and 3K in recent years. In 2006, about 35% of the catch occurred in May-June, although August was the peak month (28%). As noted above, the temporal pattern in 2006 was much different than in recent years, due to a split in the gillnet quotas before and after August 1. Almost no catch was taken in July, which contrasts totally with 2005 when peak catches occurred in July. Also, almost all of the otter trawl catch was taken in February to April in 2006, compared to May to July for the bulk of this fishery in 2005. The reasons for this may have been favorable ice conditions and lower by-catch of species under moratorium in the winter months of 2006.

As in previous years, by-catches were taken in the 2006 Greenland halibut fisheries within Canadian waters. These include rough-head grenadier (94 t), American plaice (68 t), witch flounder (52 t), redfish (49 t), and cod (20 t). Some by-catches of snow crab were also reported, but are not quantified here. By-catches of Greenland halibut in the Canadian shrimp fishery have been described previously (eg. Orr et al. 2002), but have not been updated for this paper. Of the 2886 tons of catch of Greenland halibut documented by fishery observers in 2006, 43 tons were discarded. – both are similar figures to those observed in 2005. A caveat with the set-by-set discard estimates of G. halibut recorded in the shrimp fishery is that any discards < 1 kg are recorded as 1 kg in the database.

Catch at age

Details on the Canadian catch at age for previous years can be found in Bowering and Brodie (2000), and Brodie and Power (2006; and earlier docs by same authors). Ages 6-8 dominated the Canadian catch in most years, both in the otter trawl and shallow water gillnet fisheries. The catch in the GN>400 fleet has been tending towards smaller fish, as smaller mesh is permitted in deeper areas.

Sampling data collected in 2006 by observers at sea and by port samplers, were available from Divs. 2GJ, 3KL. The following table shows the number of length measurements by Division and gear, and the number of otoliths (in italics).

2006	2GHJ		3K		3L	
Gill net < 400	-	*350*	300	*735*	4070	*313*
Gill net > 400	2060		4525		450	
Longline	363		-		-	
Otter/Twin trawl	0/482	*181*	22565/1548	*621*	-	
Totals	2905	*531*	28938	*1356*	4520	*313*

The otolith samples from the fixed gear sectors have been combined, as there is a mixture of mesh sizes in the deepwater fisheries in 2J and 3K. The high 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. The total number of length measurements in 2006 was 36,363, a decrease of almost 50% from 2005 levels. However all major fleet sectors appeared to be adequately sampled in 2006, and part of the reduction was due to the more concentrated spatial and temporal nature of the fishery in 2006 (eg fewer month/gear/Division cells with large catches). The number of otoliths (2200) was 19% lower than in 2005.

Age compositions are presented for both gillnet components (GN<400 and GN>400) as well as for otter trawl (Table 5). The predominant age in the otter trawl in all areas, and GN <400 sectors was 7 (1999 year class), while age 8 (1998 year class) was most abundant in the catches of deepwater gillnets. Ages 7 and 8 were also dominant in these fisheries in recent years. Overall, the catch at age in 2006 was dominated by the 1998 and 1999 year classes, which accounted for 71% of the catch numbers and 67% of the catch weight. In recent years, the catch at age is becoming dominated more by these 2 ages (7+8). As was the case in 2000 - 2005, age 8 was second highest in the catch numbers, followed by age 6. The catch in the GN>400 fleet has been tending towards smaller fish, as smaller mesh is permitted in deeper areas. For example, only 14% of the catch in numbers by this fleet in 2006 was estimated to be age 10 or older, compared to 80% in 2001 and 72% in 2002. Mean weights at age for all areas were calculated using the same length-weight relationship used for Greenland halibut catch at age in 1998-2005, which was the Divisions-combined, year = 1997 (from Gundersen and Brodie 1999). Weights at age in 2006 were slightly higher, but similar to those from 2005 (Brodie and Power 2006), and the sum of products was about 4.2% 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 2002 were obtained from the NAFO STATLANT 21B database and were combined with data from 2003-2006 from Canada (N) 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 model. 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. In recent years, there was sufficient data available from the tonnage class 4 trawlers and the tonnage class 7 trawlers utilizing twin trawls for inclusion in the standardization. The twin trawls were introduced in 2003 but have accounted for less than 11% of the otter trawl catch with the exception of 2005 when they took 32%. 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.

Residual plots did not indicate model misspecification. The model resulted in a significant regression ($P < 0.05$) explaining 59% of the variation in catch rates (Table 6). Based on the regression coefficients, over the entire time series, catch rates were better in late summer and higher in Div. 2H. The fishing power of the large trawlers is also much higher. The standardized catch rate index (Table 7, Fig. 8) shows much between-year variability. Initial CPUE increased rapidly to 1978, probably as a result of captains learning a relatively new fishery, then showed period of stability from 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, remained stable to 2005 at a level which is marginally higher than the lowest CPUE observed over the 30 year series. CPUE then increased by over 50% in 2006, albeit with very wide confidence limits (Fig. 8). This increase is consistent with that observed in the Spanish fishery in the NRA. 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 82% since 1995.

CPUE data was also collected by observers on Canadian vessels, independent of the logbook/ZIFF data described above. Otter trawl and gillnet catch rates (unstandardized, all fleets and areas combined) increased sharply in 2006. The data recorded by observers (almost 100% of OT catch of G. halibut) showed that otter trawl CPUE increased by more than double from 2005 to 2006, while gillnet CPUE (catch per net per day) increased by about 50%. It should be noted that there were substantial changes in the gillnet fishery regulations in 2006, which lead to a substantial change in the fishing pattern, and that possible effects on gillnet CPUE in 2006 are unknown.

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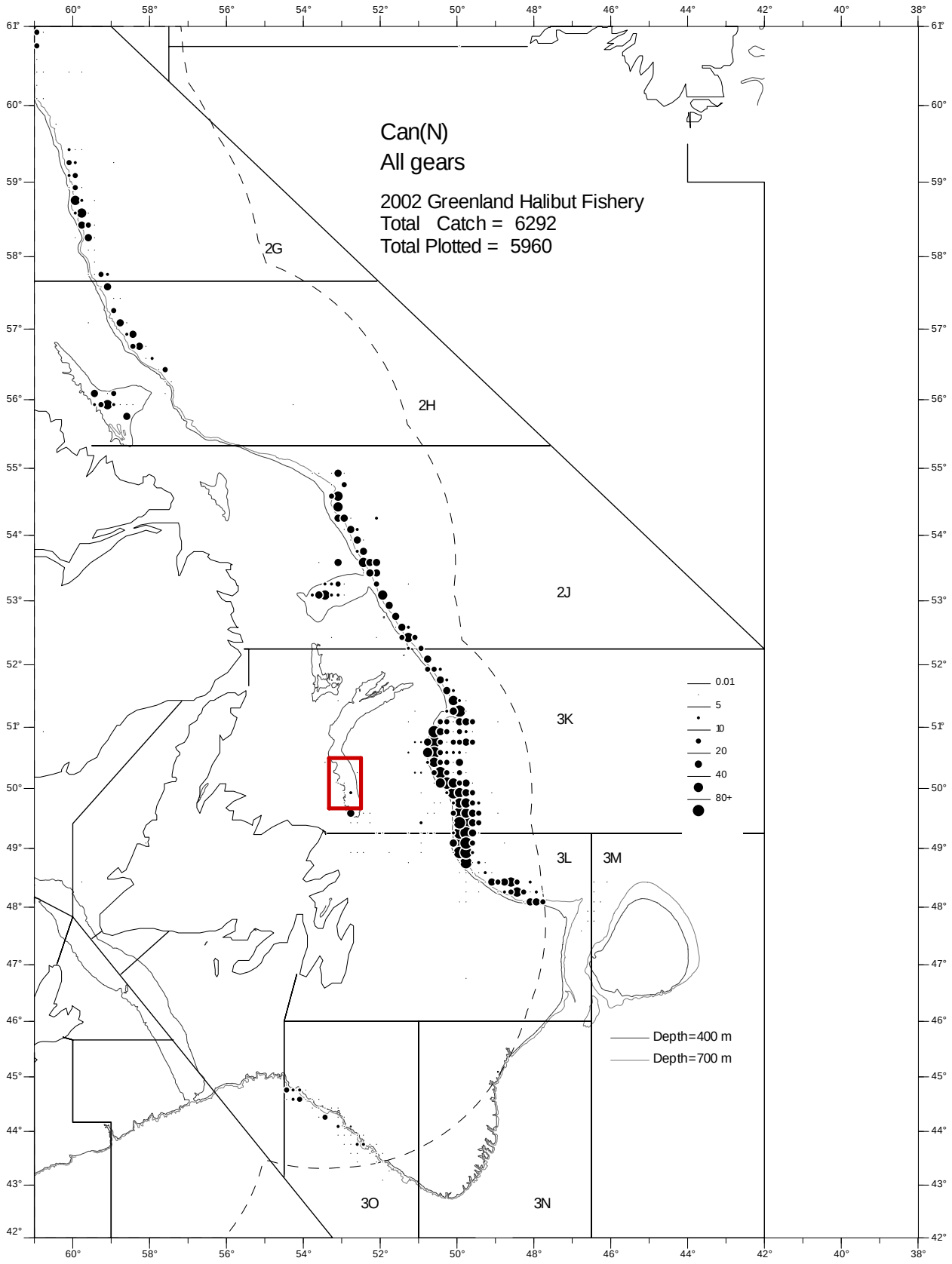

Fig. 1. Distribution of Can(N) Greenland halibut catch (tons) from the 2002 commercial fishery. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10-minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook. Also shown is the area in Div. 3K closed to GILLNETs since early 2002 due to snow crab bycatch

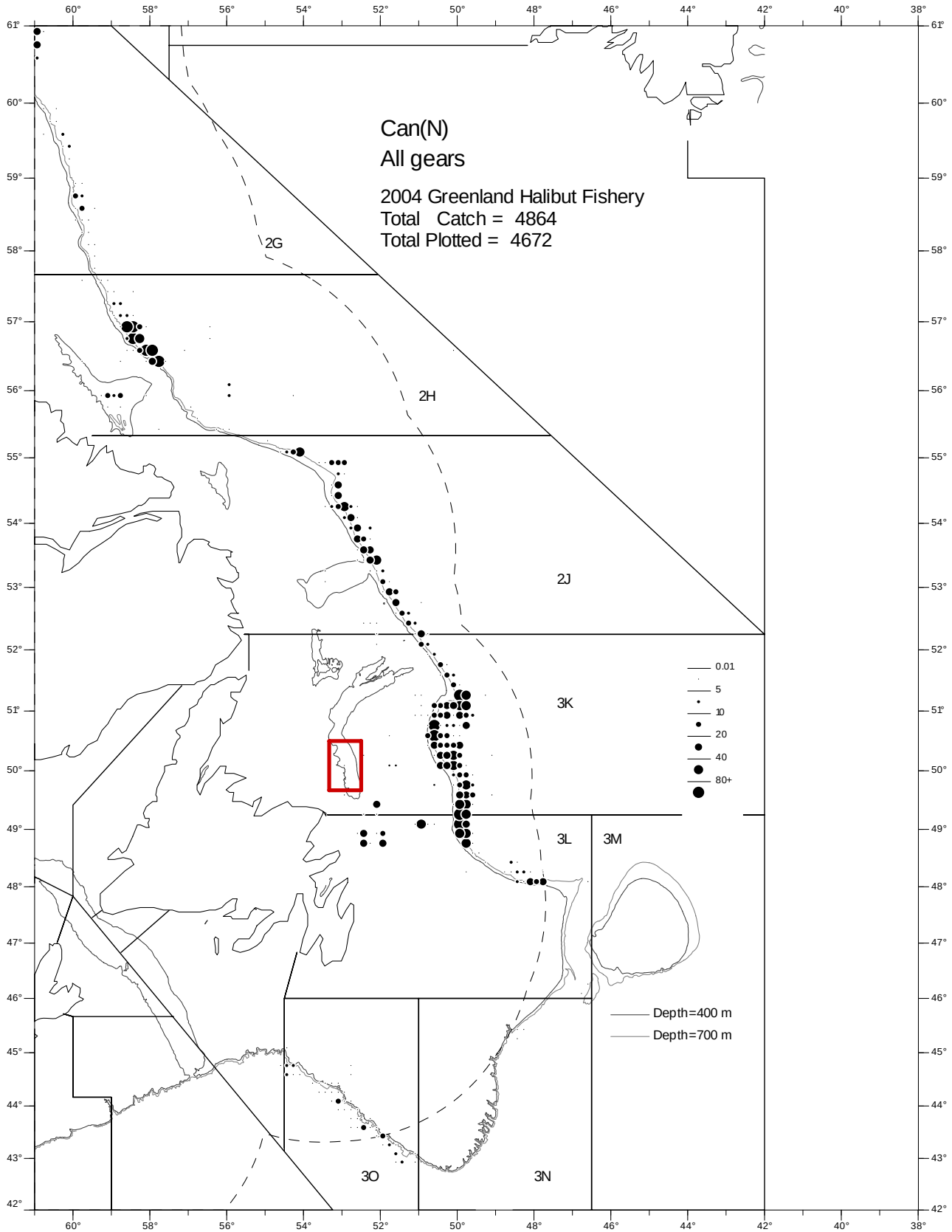

Fig. 2. Distribution of Can(N) Greenland halibut catch (tons) from the 2004 commercial fishery. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10-minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook. Also shown is the area in Div. 3K closed to GILLNETs since early 2002 due to snow crab bycatch

ghl2004 zf cat 2q3o.ACN

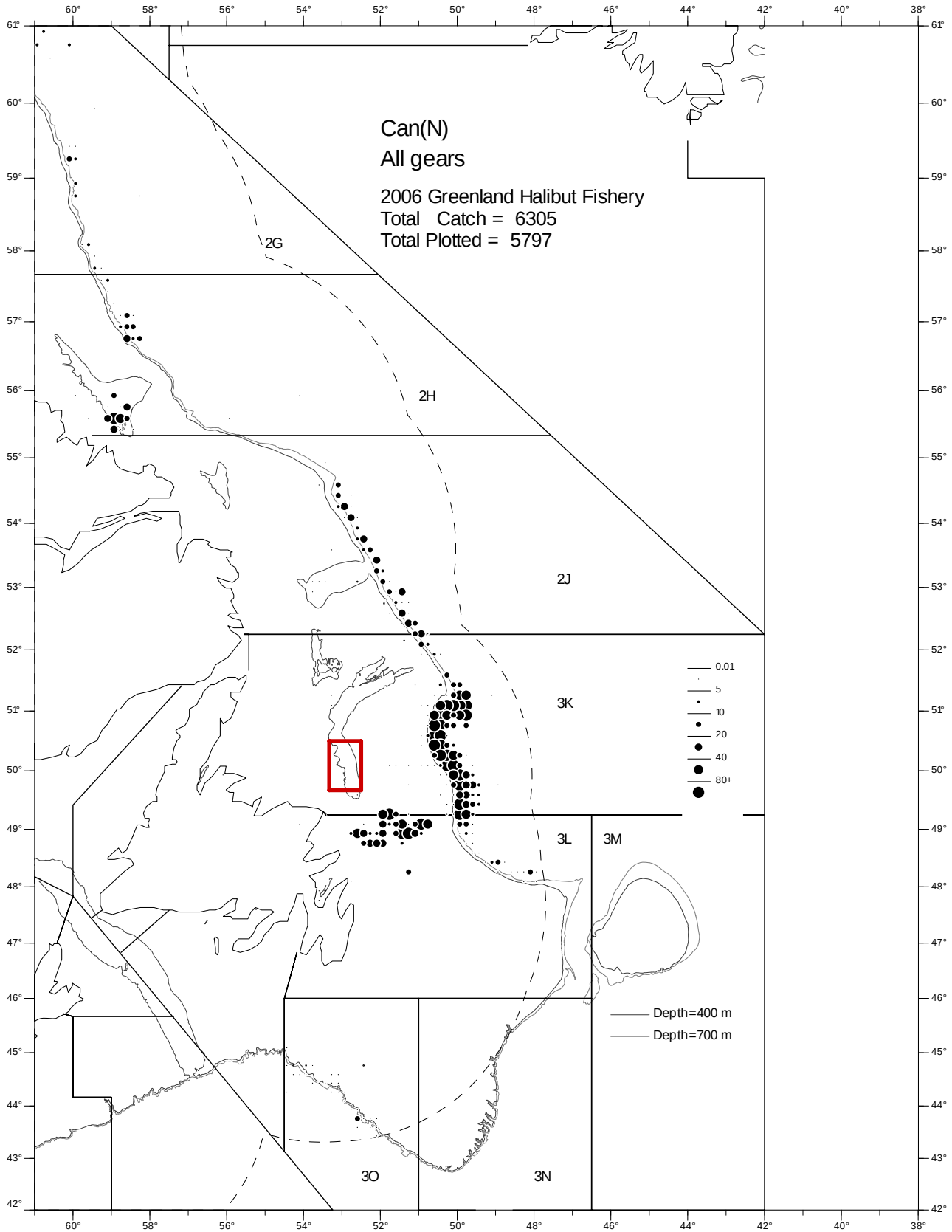

Fig. 3. Distribution of Can(N) Greenland halibut catch (tons) from the 2006 commercial fishery. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10-minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook. Also shown is the area in Div. 3K closed to GILLNETs since early 2002 due to snow crab bycatch

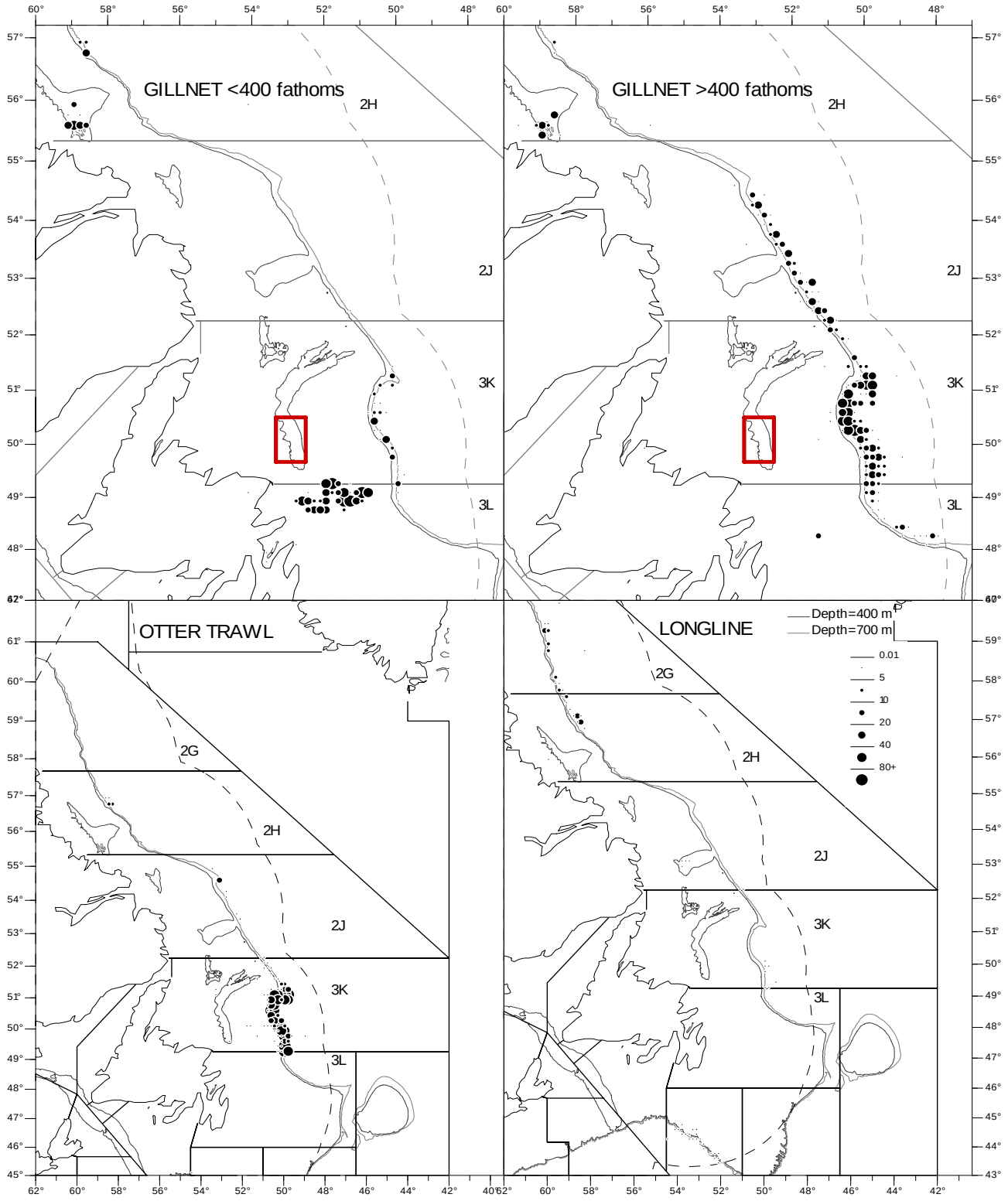

Fig. 4. Distribution of Can(N) Greenland halibut catch (tons) from the 2006 commercial fishery. Represented is LONGLINE, GILLNET (<400 fathoms and >400 fathoms) and OTTER TRAWL from both directed and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

oh2006 zf cat bvgear .ACN

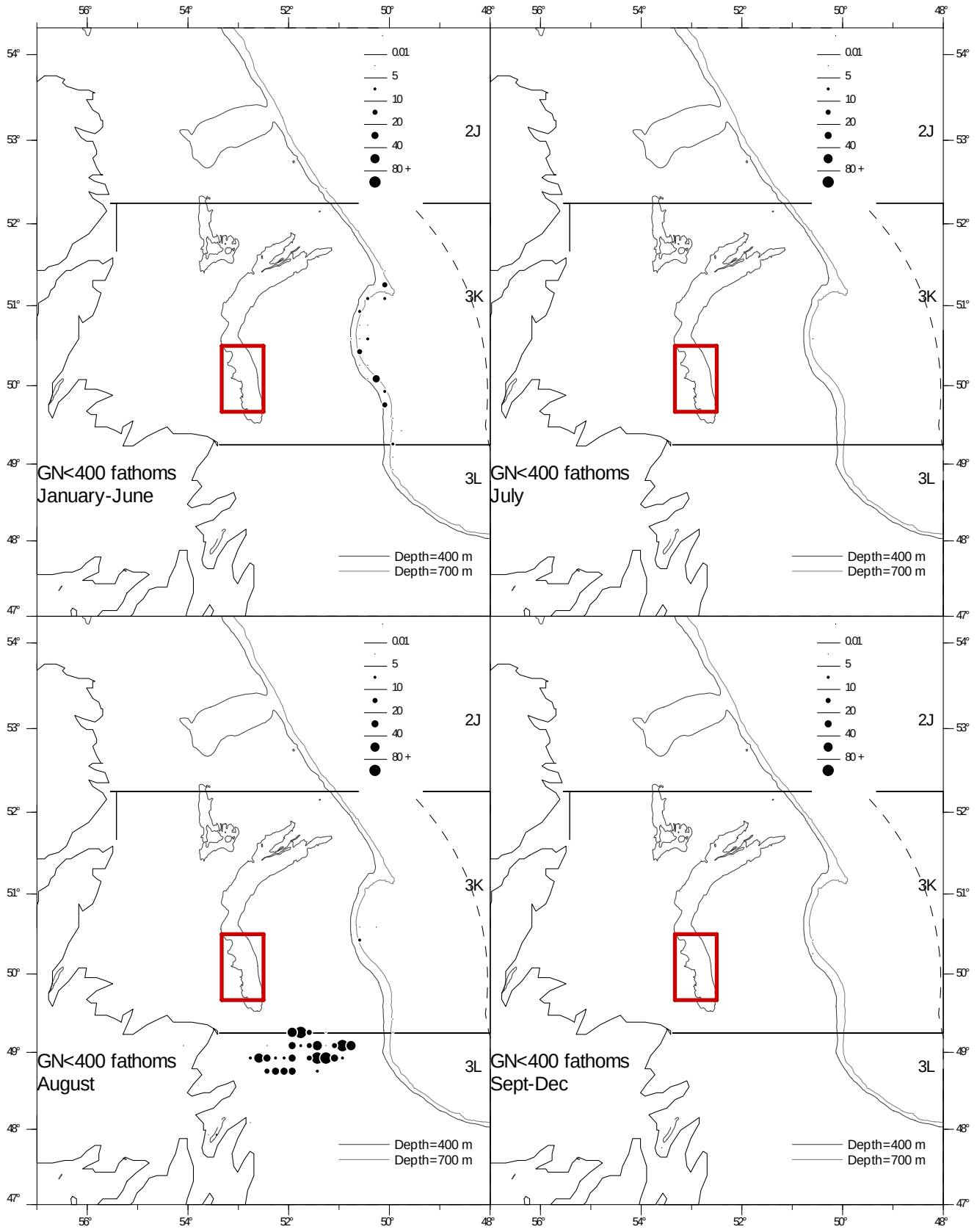

Fig. 5. Distribution of Can(N) Greenland halibut catch (tons) from the 2006 commercial fishery. Represented is GILLNET (<400 fathoms) for various months from both directed fisheries and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

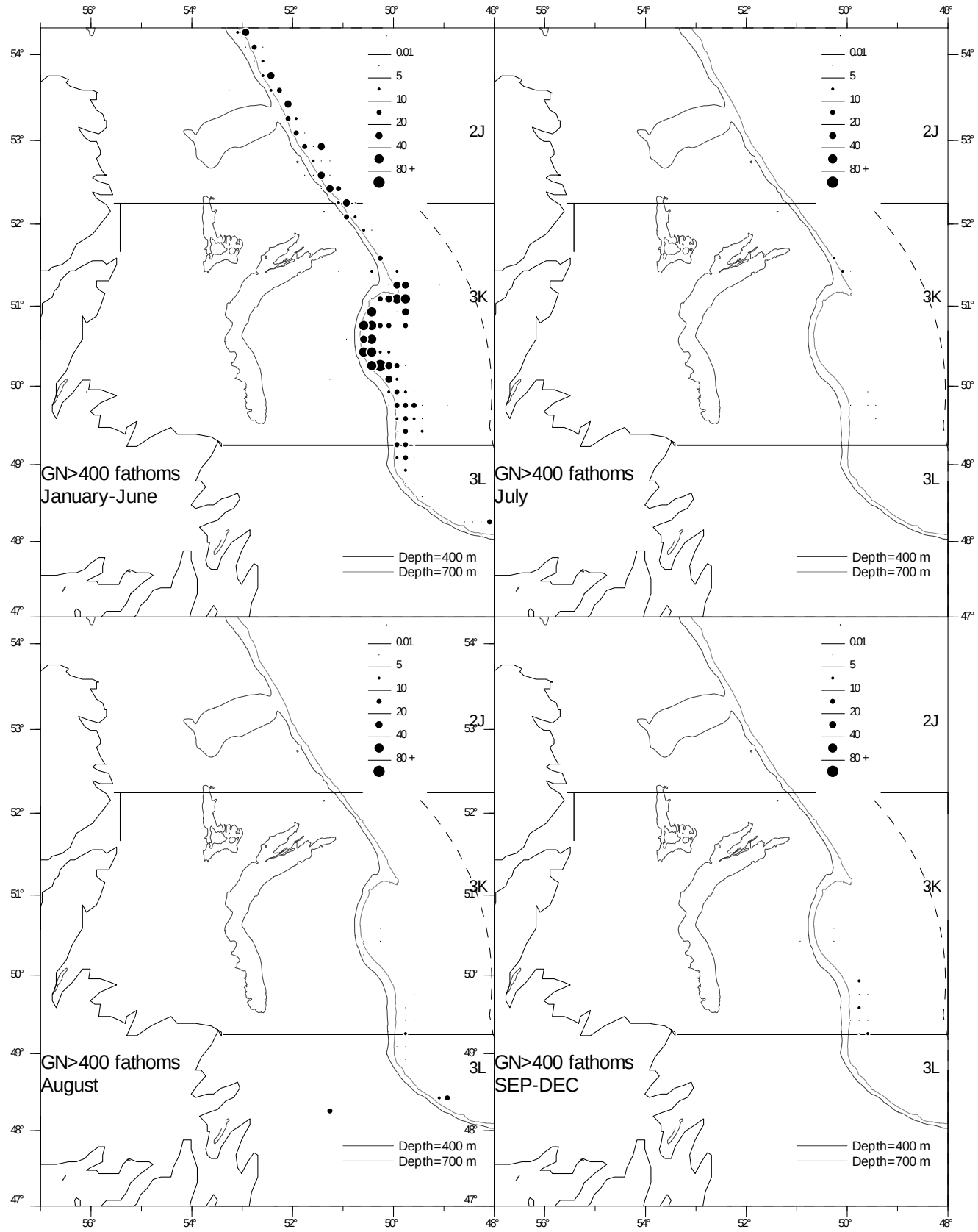

Fig. 6. Distribution of Can(N) Greenland halibut catch (tons) from the 2006 commercial fishery. Represented is GILLNET (>400 fathoms) for various months from both directed fisheries and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

ohl2006 zif cat GNGT400.ACN

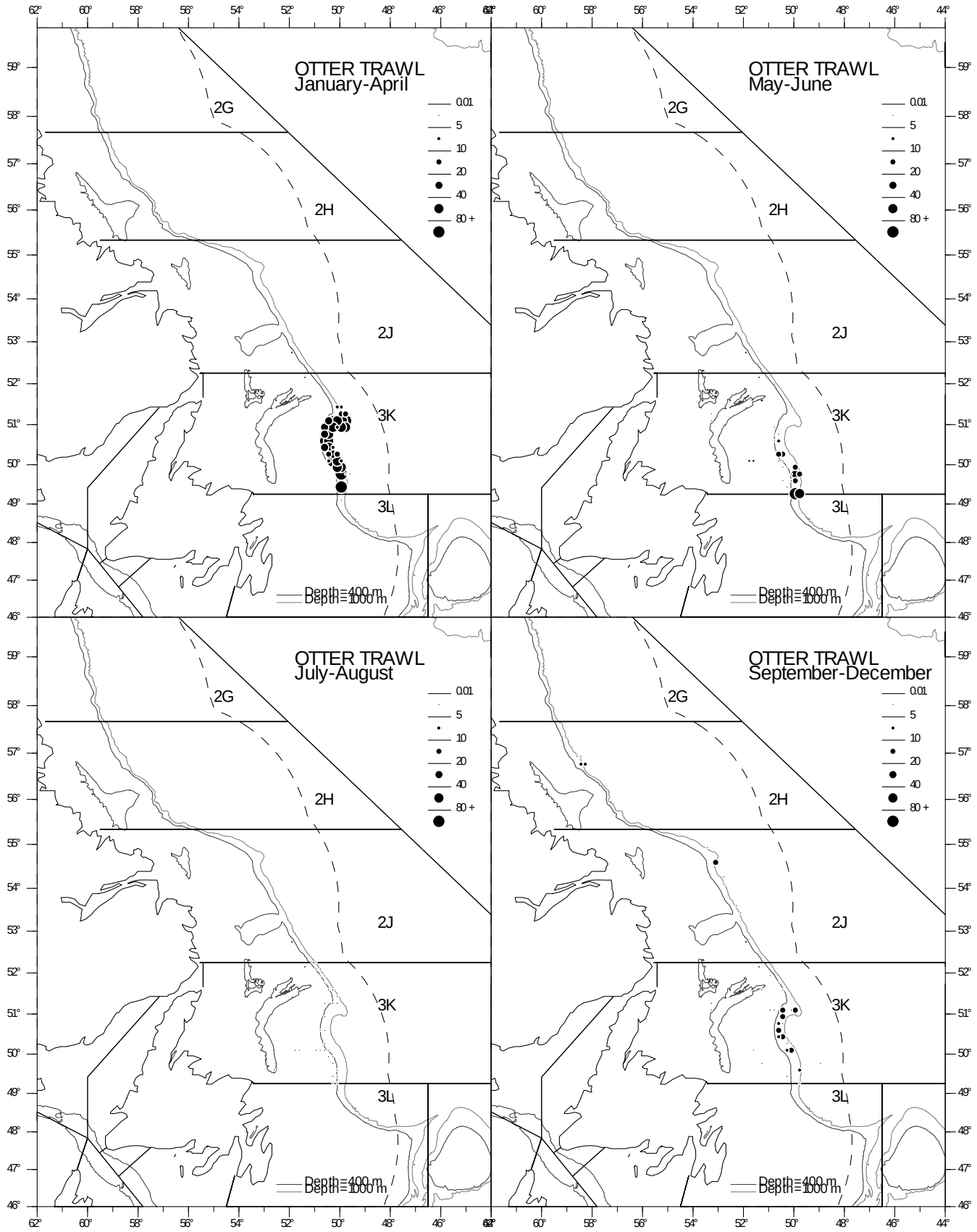

Fig. 7. Distribution of Can(N) Greenland halibut catch (tons) from the 2006 commercial fishery. Represented is OTTER TRAWL catch for various months from directed fisheries and by-catch from other fisheries. The data are aggregated by 10-minute square for Div. 2J3KL where position was recorded on the logbook.

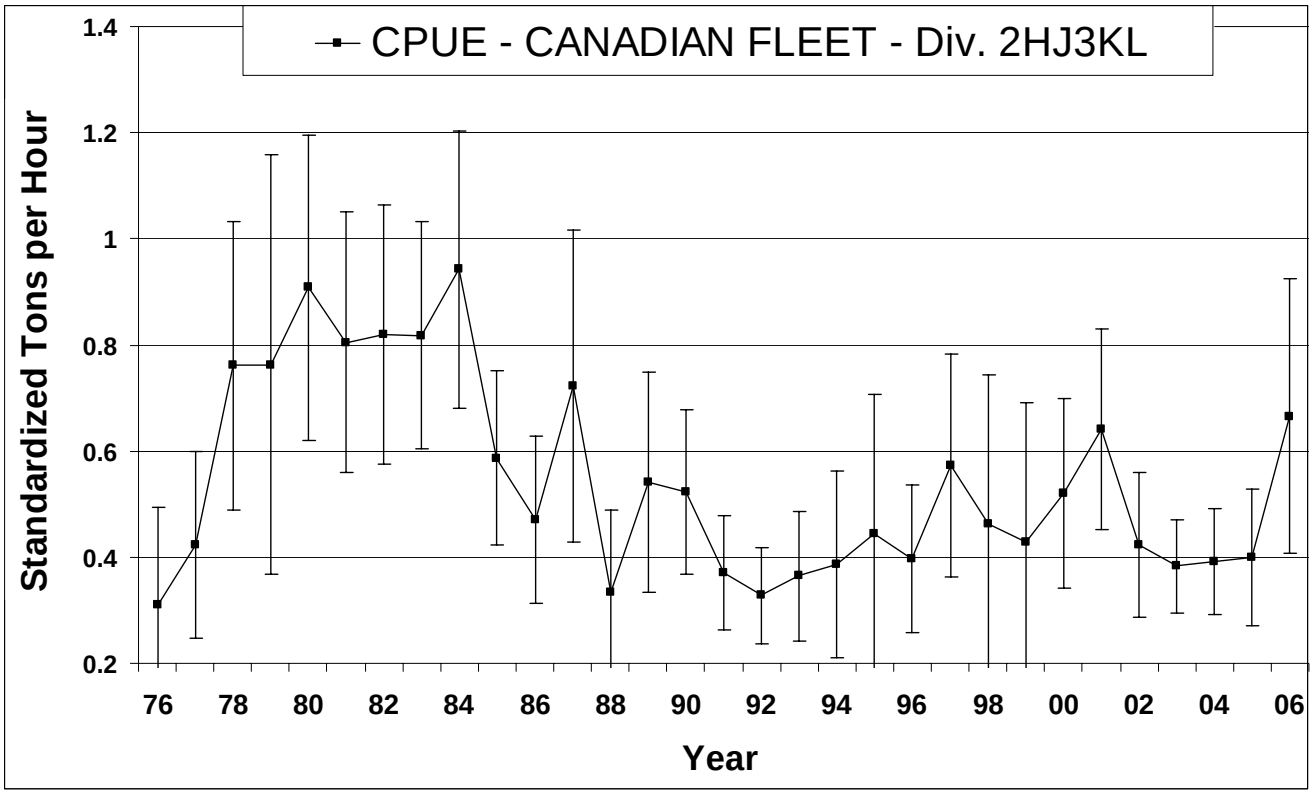

Fig. 8. Standardized Mean CPUE ± 2 standard errors for Greenland Halibut in Div. 2HJ3KL utilizing effort in HOURS fished from the CANADIAN OTTERTRAWL FLEET.

Table 1. Canadian catch of G.halibut, by gear type, from 1960-2006.

	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
2005	4317	101	1		2218	6637
2006	3848	175			2356	6379

Table 2. Canadian catch of G.halibut, by Division, from 1960-2006.

	DIVISION									**Canada**
YEAR	2G	2H	2J	*SA 2*	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	*7*	2892	13705		1	3	16608
1968			53	*53*	3672	9597		31		13353
1969				*0*	7140	4413		1	2	11556
1970				*0*	5937	4769		5		10711
1971				*0*	4160	5248		2		9410
1972				*0*	4736	4216				8952
1973			5	*5*	3602	3233		1	7	6848
1974			19	*19*	2817	2909		9	3	5757
1975			22	*22*	3245	4540		7		7814
1976	62	168	153	*383*	4779	4144	1	7		9314
1977		72	419	*491*	10751	6725	1	2	3	17973
1978		14	1255	*1269*	15875	7548	1	5	4	24702
1979		34	3163	*3197*	18165	8578	2	17	6	29965
1980		217	1157	*1374*	17658	12742	14	43	3	31834
1981	10	41	862	*913*	14379	8833		49	6	24180
1982	15	5155	3942	*9112*	6031	4105		55	6	19309
1983		2578	2238	*4816*	7679	4618		12	2	17127
1984		1913	2796	*4709*	7496	5078		12	2	17297
1985		1758	3101	*4859*	4395	3023		35	1	12313
1986		82	2476	*2558*	2886	2769		2	1	8216
1987		6	4143	*4149*	4740	4561		1		13451
1988	45	27	1867	*1939*	4591	1921	2	12	2	8467
1989		190	2635	*2825*	6342	2809	6	10	3	11995
1990	57	171	2798	*3026*	4075	2020	38	4	4	9167
1991		50	3008	*3058*	2215	1291	157	11	7	6739
1992	428	230	476	*1134*	3882	1951	4	10	22	7003
1993	557	403	214	*1174*	2398	880		19	435	4906
1994	1045	210	203	*1458*	1032	258		1	204	2953
1995	1006	453	709	*2168*	754	197			116	3235
1996	688	639	1058	*2385*	2567	888			339	6179
1997	370	619	1513	*2502*	2659	935			184	6280
1998	358	418	1234	*2010*	1374	633		1	103	4121
1999	65	103	1094	*1262*	1940	683			131	4016
2000	45	81	1152	*1278*	5845	2901	1	1	567	10593
2001	63	251	1030	*1344*	3999	2666		9	347	8365
2002	374	360	1030	*1764*	2933	1466	15		112	6290
2003	258	1897	730	*2885*	2873	964			252	6974
2004	147	1050	891	*2088*	1844	794		1	142	4869
2005	39	378	1717	*2134*	3006	1379		3	115	6637
2006	102	402	499	*1003*	3904	1438			34	6379

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 3d. Summary of Canadian catches of G.halibut in 2005 by area and gear.

	GN <400	GN >400	Longline	Otter trawl	Total Can
2G			39		39
2H	50	286	41	1	378
2J	10	767		940	1717
3K	446	1441		1119	3006
3L	1002	220	2	155	1379
3N		3			3
3O		93	19	3	115
Total	1508	2810	101	2218	**6637**

Table 3e. Summary of Canadian catches of G.halibut in 2006 by area and gear.

	GN <400	GN >400	Longline	Otter trawl	Total Can
2G			102		102
2H	200	134	51	17	402
2J	52	370	5	72	499
3K	292	1373	5	2234	3904
3L	1299	133	2	4	1438
3O		24	10		34
Total	1843	2034	175	2327	**6379**

Table 4. Breakdown of Canadian catches of G.halibut in SA 2 + Div 3KLMNO in 2006 by area, gear, and month.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	GN<400 fm							15	141	44				200
	GN>400 fm							5	107	22				134
2GH	Otter trawl									17				17
	Longline							8	105	40				153
	Total							28	353	123				504
	GN<400 fm						14		38					52
2J	GN>400 fm					236	134							370
	Otter Trawl				45					27				72
	Longline						5							5
	Total				45	236	153		38	27				499
	GN<400 fm					95	135	8	52	2				292
3K	GN>400 fm				29	640	597	28	28	51				1373
	Otter Trawl		156	1360	323	175	83	14	4	10			109	2234
	Longline						5							5
	Total		156	1360	352	910	820	50	84	63			109	3904
	GN<400 fm						32		1266	1				1299
	GN>400 fm					13	80		40					133
3L	Otter Trawl		4											4
	Longline					1	1							2
	Total		4			14	113		1306	1				1438
	Gillnet	1					16		7					24
3NO	Longline	6	3					1						10
	Total	7	3				16	1	7					34
	TOTAL	7	163	1360	397	1160	1102	79	1788	214			109	**6379**

Table 5. Catch at age for the Canadian catch of G.halibut in SA 2 + Div. 3KLMNO in 2006.
Catch at age in thousands of fish. See text for definition of GN gear types.
Asterisk represents catch of less than 500 fish. SOP is catch number x mean wgt

	Gear						Mean		
Age	OT trawl	Longline	GN<400	GN>400	Total	Pct	Len (cm)	Wgt (kg)	S.O.P(t)
3	*				**0.3**	**0.005%**	25.4	0.125	0.0
4	23				**23**	**0.37%**	32.4	0.269	6.2
5	243		3	1	**246**	**3.92%**	37.0	0.414	101.8
6	802	*	129	22	**954**	**15.20%**	42.0	0.613	584.8
7	1397	2	1013	489	**2901**	**46.24%**	46.6	0.853	2474.6
8	326	8	668	577	**1578**	**25.15%**	50.8	1.120	1767.4
9	63	11	54	179	**307**	**4.89%**	56.2	1.540	472.8
10	15	11	8	93	**127**	**2.02%**	60.7	1.959	248.8
11	5	8		49	**62**	**0.99%**	65.9	2.534	157.1
12	2	4		23	**29**	**0.46%**	70.7	3.170	91.9
13	1	5		14	**20**	**0.32%**	75.0	3.825	76.5
14	1	3		14	**18**	**0.29%**	78.1	4.341	78.1
15		1		3	**5**	**0.08%**	83.1	5.266	26.3
16		1		2	**3**	**0.05%**	87.7	6.242	18.7
17		*		1	**1**	**0.02%**	89.6	6.712	6.7
18		*			**0.1**	**0.002%**	91.0	6.977	0.7
19									
	2878	54	1875	1467	6274.4	**100.00%**			**6112**
								Catch	6379

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 ottertrawl fleet (2006 based on preliminary data).

REGRESSION OF MULTIPLICATIVE MODEL
MULTIPLE R..... 0.771
MULTIPLE R SQUARED..... 0.594

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARE	F-VALUE
INTERCEPT	1	2.70E2	2.70E2	
REGRESSION	50	6.70E1	1.34E0	8.091
Cntry|Gear|TC	6	7.86E0	1.31E0	7.906
Month	11	3.01E0	2.73E-1	1.651
Division	3	2.69E0	8.98E-1	5.422
Year	30	2.91E1	9.68E-1	5.848
RESIDUALS	276	4.57E1	1.66E-1	
TOTAL	327	3.83E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VAR #	REG. COEF	STD. ERR	NO. OBS
Cntry|Gear|TC	3125	INT	-1.209	0.305	327
Month	9				
Division	22				
Year	76				
1	3123	1	-0.233	0.140	11
	3124	2	-0.158	0.198	5
	3126	3	0.016	0.134	13
	3127	4	0.722	0.130	23
	3857	5	0.748	0.158	11
	27125	6	0.138	0.099	25
2	1	7	-0.072	0.150	11
	2	8	0.040	0.146	13
	3	9	-0.240	0.129	19
	4	10	-0.144	0.115	29
	5	11	0.064	0.113	28
	6	12	0.063	0.104	36
	7	13	-0.026	0.092	50
	8	14	0.134	0.088	47
	10	15	-0.143	0.119	20
	11	16	-0.210	0.137	14
	12	17	-0.032	0.130	16
3	23	18	-0.133	0.085	85
	31	19	-0.324	0.089	136
	32	20	-0.329	0.100	61
4	77	21	0.284	0.345	5
	78	22	0.869	0.332	8
	79	23	0.891	0.378	3
	80	24	1.042	0.318	13
	81	25	0.921	0.320	14
	82	26	0.939	0.325	10
	83	27	0.933	0.312	18
	84	28	1.076	0.318	12
	85	29	0.603	0.318	13
	86	30	0.386	0.334	8
4	87	31	0.822	0.347	5
	88	32	0.060	0.361	4
	89	33	0.529	0.339	6
	90	34	0.488	0.318	12
	91	35	0.143	0.313	16
	92	36	0.021	0.312	20
	93	37	0.131	0.322	15
	94	38	0.203	0.361	4
	95	39	0.359	0.414	2
	96	40	0.217	0.330	8
	97	41	0.585	0.334	7
	98	42	0.404	0.415	2
	99	43	0.326	0.419	2
	100	44	0.486	0.328	9
	101	45	0.692	0.315	17
	102	46	0.278	0.322	11
	103	47	0.173	0.307	28
	104	48	0.195	0.310	20
	105	49	0.220	0.317	23
	106	50	0.738	0.339	10

LEGEND FOR ANOVA RESULTS:

CGT CODES: All are Stern Trawlers

3123 = Can(NFLD) Otter Trawl TC 3

3124 = " " TC 4

3125 = " " TC 5

3126 = " " TC 6

3127 = " " TC 7

3857 = " Twin Otter Trawl TC 7

27125 = Can(M) Otter Trawl 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 (2006 based on preliminary data).

	LN TRANSFORM		RETRANSFORMED				% OF CATCH IN
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT	THIS ANALYSIS
1976	-1.2089	0.0931	0.310	0.092	767	2478	9.5
1977	-0.9244	0.0441	0.422	0.088	2866	6796	20.9
1978	-0.3401	0.0326	0.761	0.136	3951	5193	30.0
1979	-0.3183	0.0696	0.763	0.198	5183	6791	35.4
1980	-0.1672	0.0253	0.908	0.144	3946	4347	42.9
1981	-0.2882	0.0237	0.805	0.123	6155	7647	59.2
1982	-0.2702	0.0224	0.820	0.122	8143	9929	73.4
1983	-0.2755	0.0172	0.818	0.107	7085	8663	87.4
1984	-0.1328	0.0193	0.942	0.131	6070	6442	90.4
1985	-0.6058	0.0195	0.587	0.082	4847	8255	91.2
1986	-0.8232	0.0288	0.470	0.079	1896	4032	74.6
1987	-0.3866	0.0420	0.723	0.147	2465	3410	85.6
1988	-1.1488	0.0533	0.335	0.077	629	1875	38.8
1989	-0.6796	0.0373	0.541	0.104	988	1828	21.2
1990	-0.7205	0.0224	0.523	0.078	2402	4595	75.9
1991	-1.0659	0.0217	0.370	0.054	3254	8789	70.0
1992	-1.1881	0.0187	0.328	0.045	2502	7625	50.2
1993	-1.0783	0.0279	0.365	0.061	1034	2837	87.7
1994	-1.0055	0.0529	0.387	0.088	575	1485	96.5
1995	-0.8499	0.0928	0.443	0.132	632	1425	56.2
1996	-0.9924	0.0306	0.397	0.069	1043	2629	81.0
1997	-0.6236	0.0344	0.572	0.105	1017	1776	94.7
1998	-0.8051	0.0948	0.463	0.140	46	99	63.0
1999	-0.8831	0.0978	0.428	0.131	81	189	81.5
2000	-0.7225	0.0297	0.520	0.089	1285	2472	99.3
2001	-0.5172	0.0220	0.641	0.095	1833	2861	99.2
2002	-0.9313	0.0261	0.423	0.068	1784	4221	98.7
2003	-1.0363	0.0134	0.383	0.044	3710	9689	89.9
2004	-1.0140	0.0166	0.391	0.050	1832	4686	98.5
2005	-0.9885	0.0257	0.399	0.064	2225	5574	97.8
2006	-0.4708	0.0381	0.666	0.129	2282	3428	97.9

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.186