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# The Canadian fishery for Greenland halibut in SA 2 + Div. 3KLMNO, with emphasis on 2007.

by

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### Abstract

The Canadian catch of Greenland halibut in 2007 in NAFO Subarea 2 and Divisions 3KLMNO was reported to be 5339 tons, about 1000 t lower than in 2006. Decreases were similar in all gear categories. Catches were highest in Div 2J, where almost all of the otter trawl catch was taken, and declined sharply in Div. 3K. About 54% of the catch was taken in June to August, although almost all the otter trawl catch was taken in January to April. The catch at age in 2007 was dominated by the 1999 and 2000 year classes, which accounted for 80% of the catch numbers and 72% of the catch weight in the Canadian fishery. Catches in the deepwater gillnet sector continued the trend toward younger fish since 2001, coincident with the permitted use of smaller mesh in deeper zones in recent years. Mean weights at age in 2007 were similar to previous years. CPUE analysed from logbooks of Canadian trawlers increased by about 45% in 2007, following a larger increase in 2006.

### Review of the Canadian fishery

As reported in several previous documents (e.g. Brodie et.al. 2007), 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 shows the 2007 conservation harvesting plan (CHP) regulations in the

Canadian gillnet fishery for Greenland halibut. In 2005 -2007, 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. The number of nets allowed in depths > 732 m in Div. 2GHJ + 3K in 2007 was reduced from 500 to 400.

| Area | Depth | # of Nets | Min. Mesh |
|---|---|---|---|
| 2GH | 293 – 549 m | 125 | 152 mm |
| 2GH + 3KL | 549 – 732 m | 200 | 152 mm |
| 2GH + 3K | > 732 m | 400 | 191 mm |
| 2J | > 732 m | 400 | 152 mm |
| 3LMNO | > 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 between 2600 and 3900 tons. 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 (OT) catches peaked at about 8,000 tons in 1982, but from 1993 to 1999, catches by this fleet were less than 1050 tons annually. OT 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 (Table 1). OT catch since then has been in the range of 1800 to 2400 tons. Much of the otter trawl catch after 2004 was in the slope area around the boundary between Divs. 3K and 3L, although almost all otter trawl catch in 2007 occurred in Div. 2J. 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, in all areas.

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 were in the range of 1000 to 2500 tons per year. 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. 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 2006 value at 3900 tons. Peak catches of around 13,000 tons in Div 3L occurred in 1966-67 and 1980, and averaged about 1400 tons in 2005 and 2006. 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 2007

There were some differences in the spatial and temporal patterns in the Canadian fishery for G.halibut in 2007 compared to those observed in 2002-06. The total reported catch was just under 5400 tons, about 1000 t lower than in 2006, reflecting declines in quotas. Catches in the both gillnet fleets, and in the otter trawl fleet, decreased in 2007.

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 2007. In 2004 to 2007 the gillnet catches in the shallow zone (<400 fm) were lower than in the deep zone, although the differences were small in 2006 and 2007. 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 declined since to practically nil in 2007. The main change in the spatial pattern of the fishery in 2007 was the shift of otter trawl catches to 2J, although there has been little consistency in the distribution of OT catches by division in the past 4 years. Most of the total catch in 2007 occurred in summer, with just under 1000 tons per month in each of June to August, almost all by gillnet. Over 93% of otter trawl catches came in January to April, mostly in March. The temporal pattern of catch in 2006 was unusual compared to 2005 and 2007, with only a small amount of catch occurring in July of 2006. In 2007, almost all GN catch in Div. 2J and 3K took place in June and July, compared to August in Div. 3L.

Figs. 1-2 show the location of most of the Canadian catch of Greenland halibut in 2002-04, and 2006-07. These data were aggregated by 10-minute squares from logbook records. In all four years, the plotted data account for over 93% of the total Canadian catch. The spatial distributions of the 4 years were fairly similar (Figs 1-2), with the major difference being the gillnet catches in the north-central part of Div. 3L in 2006 and 2007, 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, as well as in Power and Brodie (2006), where the closed area, which was not in the regulations in 2001, was overlaid on the 2001 catch. Fig. 3 shows the location of the 2007 catch by the 4 major gear types (2 gillnet categories, otter trawl, and longline, which was almost nil in 2007). Most of the otter trawl fishery in 2007 (Figs 3, 6) was located in one main area: around the slope edge between 53 and 55 degrees N latitude in Div. 2J. In many previous years, this fishery operated at from the border between Divs. 3K and 3L north to about 51 N. The spatial distribution of the deepwater gillnet fishery in 2007 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 documents). In 2007, 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 2007, gillnet catches were about the same in each of June, July, and August, generally occurring in the early summer in 2J and 3K, and later in Div. 3L (Figs. 4 and 5). This contrasts with 2006, when almost no catch was taken in July. Also, almost all of the otter trawl catch was taken in January to April in 2007, similar to the pattern in 2006, but earlier than in most years (e.g. May to July for the bulk of this fishery in 2005). As in 2006, the reasons for this in 2007 may have been favorable ice conditions in the slope areas, high CPUE, and, possibly, lower by-catch of species under moratorium in certain months.

As in previous years, by-catches were taken in the 2007 Greenland halibut fisheries within Canadian waters. These include rough-head grenadier, American plaice, witch flounder, redfish, and cod. Some by-catches of snow crab were also reported. By-catches of Greenland halibut in the Canadian shrimp fishery have been described previously (e.g. Orr et al. 2002), and are updated annually. A continuing caveat with the set-by-set discard estimates of G. halibut recorded in the shrimp fishery is that any amount of 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 et al (2007) and Brodie and Power (2006; and earlier documents 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 2007 by observers at sea and by port samplers, were available from Divs. 2J, 3KLO. The following table shows the number of length measurements by Division and gear, and the number of otoliths (in italics).

| **2007** | **2J** | | **3K** | | **3LO** | |
|---|---|---|---|---|---|---|
| Gill net < 400 | 528 | | 1197 | | 7330 | |
| Gill net > 400 | 2200 | *201* | 1758 | *273* | 1250 | *490* |
| Otter trawl | 8889 | *226* | 501 | | 381 | *43* |
| **Totals** | 11617 | *427* | 3456 | *273* | 8861 | *533* |

The otolith samples from the fixed gear sectors have been combined, as there is a mixture of mesh sizes in the deepwater fisheries. The 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. The total number of length measurements in 2007 was 24,034, which was a decrease of 33% from 2006 levels, following a decrease by about 50% from 2005. However, with the reduced quotas in 2007, and concentration of effort in relatively few gear/month cells (Table 4), all major fleet sectors appeared to be adequately sampled for lengths in 2007. The number of otoliths (1233) was 44% lower than in 2006, resulting in age-lengths keys having to be combined across some gear types, Divisions, and seasons to calculate catch at age.

Age compositions for the 2007 fishery 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 (2000 year class), while age 8 (1999 year class) was most abundant in the catches of deepwater gillnets. Ages 7 and 8 were also dominant in these fisheries in all recent years. Overall, the catch at age in 2007 was dominated by the 1999 and 2000 year classes, which accounted for 80% of the catch numbers and 72% 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 - 2006, 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 6% of the catch in numbers by this fleet in 2007 was estimated to be age 10 or older, compared to 14% in 2006, and to 72-80% in 2001 and 2002.

Mean weights at age for all areas were calculated using the same length-weight relationship used for Greenland halibut catch at age in 1998-2006, which was the Divisions-combined, year = 1997 (from Gundersen and Brodie 1999). Weights at ages 5 and 6 in 2007 were slightly higher than in 2005 and 2006, with those at other ages being very similar to the previous 2 years (Brodie et al. 2007; Brodie and Power 2006). The sum of products was about 6.2% lower than the catch weight, which is a larger difference than usual.

## 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 were combined with data from 2003-2007 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. After the selection criteria were applied, the percentage of otter trawl catch with hours fished effort utilized in the analysis ranged from 10% in 1976 to 90% or more from 2000-2007, and averaged 92% since 1995.

Residual plots did not indicate model misspecification. The model resulted in a significant regression ($P < 0.05$) explaining 62% 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 (TC 7) is also much higher, as would be expected. The standardized catch rate index (Table 7, Fig. 7) 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 marginally higher than the lowest catch rates observed over the 30 year series. The index increased by over 60% in 2006 and then by another 45% in 2007, to a level which is near the highest in the series. These most recent increases as associated with large variability within each year. In 2004, 2007 and 2008, Scientific Council rejected the use of CPUE series in general as indices of abundance for this stock, due in part to large fluctuations in the Canadian and Spanish indices, concerns about possible effects of concentration of effort on CPUE, and doubts as to what CPUE was actually measuring in each year.

**References**

Bowering, W. R., and W. B. Brodie. 2000. Calculation of catch-at-age for commercially caught Greenland halibut in NAFO Subarea 2 and Divisions 3KLMNO during 1975-99 with particular emphasis on construction of the catch-at-age matrix since 1989. NAFO SCR Doc. 00/24.

Brodie, W. B. and D. Power. 2001. The Canadian fishery for Greenland halibut in SA2 + Div. 3KLMNO, with emphasis on 2000. NAFO SCR Doc. 01/65, Ser. No. N4443, 13 p.

Brodie, W. B. and D. Power. 2002. The Canadian fishery for Greenland halibut in SA2 + Div. 3KLMNO, with emphasis on 2001. NAFO SCR Doc. 02/39, Ser. No. N4650, 12 p.

Brodie, W. B. and D. Power. 2003. The Canadian fishery for Greenland halibut in SA2 + Div. 3KLMNO, with emphasis on 2002. NAFO SCR Doc. 03/36, Ser. No. N4854, 14 p.

Brodie, W. B. and D. Power. 2004. The Canadian fishery for Greenland halibut in SA2 + Div. 3KLMNO, with emphasis on 2003. NAFO SCR Doc. 04/33, Ser. No. N4983, 14p.

Brodie, W. B. and D. Power. 2005. The Canadian fishery for Greenland halibut in SA2 + Div. 3KLMNO, with emphasis on 2004. NAFO SCR Doc. 05/62, Ser. No. N5148, 16p.

Brodie, W. B. and D. Power. 2006. The Canadian fishery for Greenland halibut in SA2 + Div. 3KLMNO, with emphasis on 2005. NAFO SCR Doc. 06/47, Ser. No. N5273, 19p.

Brodie, W. B. , D. Power and B. P.Healey. 2007. The Canadian fishery for Greenland halibut in SA2 + Div. 3KLMNO, with emphasis on 2006. NAFO SCR Doc. 07/50, Ser. No. N5402, 20p.

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Can. J. Fish. Aquat. Sci. 37:2272-2275.

Gundersen, A.C. and W.B.Brodie. 1999. Length-weight relationships of Greenland halibut in NAFO Divisions 2GHJ and 3KLMNO, 1990-97. NAFO SCR Doc. 99/31, Ser. No. N4087.

Orr, D.C., P. Veitch, and D. Sullivan. 2002. An update of information pertaining to northern shrimp (*Pandalus borealis* Kroyer) and groundfish in NAFO Divisions 3LNO. NAFO SCR Doc. 02/160, Ser. No. N4789, 55 p.

Table 1. Canadian catch of G.halibut, by gear type, from 1960-2007.

| | 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 |
| 2007 | 3202 | 3 | | 268 | 1866 | 5339 |

Table 2. Canadian catch of G.halibut, by Division, from 1960-2007.

| | DIVISION | | | | | | | | | **Canada** |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | 2G | 2H | 2J | *SA 2* | 3K | 3L | 3M | 3N | 3O | Unk | **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 |
| 2007 | 3 | 121 | 2385 | *2509* | 1456 | 1015 | | | 91 | 268 | 5339 |

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

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** |

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|---|---|---|---|---|---|
| **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 3f. Summary of Canadian catches of G.halibut in 2007 by area and gear.

| | GN <400 | GN >400 | Longline | Otter trawl | Total Can |
|---|---|---|---|---|---|
| **2G** | | 3 | | | 3 |
| **2H** | 48 | 73 | | | 121 |
| **2J** | 68 | 577 | | 1740 | 2385 |
| **3K** | 576 | 760 | | 120 | 1456 |
| **3L** | 881 | 128 | | 6 | 1015 |
| **3O** | | 88 | 3 | | 91 |
| **Total** | 1573 | 1629 | 3 | 1866 | **5339** |

Total includes 268 t for Can (SF) - Div and Gear unknown

Table 4. Breakdown of Canadian catches of G.halibut in SA 2 + Div 3KLMNO in 2007 by area, gear, and month.

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GN<400 fm | | | | | | | | 26 | 22 | | | | 48 |
| | GN>400 fm | | | | | | | | 36 | 40 | | | | 76 |
| **2GH** | Otter trawl | | | | | | | | | | | | | |
| | Longline | | | | | | | | | | | | | |
| | Total | | | | | | | | 62 | 62 | | | | 124 |
| | GN<400 fm | | | | | | | | 30 | 38 | | | | 68 |
| **2J** | GN>400 fm | | | | 62 | 28 | 201 | 265 | 21 | | | | | 577 |
| | Otter Trawl | 199 | 455 | 825 | 191 | | | | | | | 10 | 60 | 1740 |
| | Longline | | | | | | | | | | | | | |
| | Total | 199 | 455 | 825 | 253 | 28 | 201 | 265 | 51 | 38 | | 10 | 60 | 2385 |
| | GN<400 fm | | | | | | 217 | 359 | | | | | | 576 |
| **3K** | GN>400 fm | | | | | | 495 | 263 | | 2 | | | | 760 |
| | Otter Trawl | | 54 | 26 | | | | | 40 | | | | | 120 |
| | Longline | | | | | | | | | | | | | |
| | Total | | 54 | 26 | | | 712 | 622 | 40 | 2 | | | | 1456 |
| | GN<400 fm | | | | | | | 13 | 729 | 99 | 40 | | | 881 |
| | GN>400 fm | | | | | | 5 | 64 | 56 | | | 3 | | 128 |
| **3L** | Otter Trawl | | | | | | | | | | 6 | | | 6 |
| | Longline | | | | | | | | | | | | | |
| | Total | | | | | | 5 | 77 | 785 | 99 | 46 | 3 | | 1015 |
| | Gillnet | | | | | | 31 | 33 | 24 | | | | | 88 |
| **3O** | Longline | 3 | | | | | | | | | | | | 3 |
| | Total | 3 | | | | | 31 | 33 | 24 | | | | | 91 |
| | **TOTAL** | 202 | 509 | 851 | 253 | 28 | 949 | 997 | 962 | 201 | 46 | 13 | 60 | **5339** |

Table 5. Catch at age for the Canadian catch of G.halibut in SA 2 + Div. 3KLMNO in 2007.
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

| Age | OT trawl | GN<400 | GN>400 | Total | Pct | Mean Len (cm) | Mean Wgt (kg) | S.O.P(t) |
|---|---|---|---|---|---|---|---|---|
| 3 | | | | | | | | |
| 4 | * | | | **0.1** | **0.002%** | 31.9 | 0.256 | 0.03 |
| 5 | 23 | * | | **23** | **0.51%** | 38.0 | 0.444 | 10.2 |
| 6 | 218 | 36 | 12 | **266** | **5.88%** | 42.9 | 0.653 | 173.7 |
| 7 | 1063 | 762 | 318 | **2142** | **47.38%** | 47.3 | 0.895 | 1917.1 |
| 8 | 532 | 551 | 382 | **1464** | **32.38%** | 51.2 | 1.144 | 1674.8 |
| 9 | 95 | 88 | 148 | **330** | **7.30%** | 55.5 | 1.487 | 490.7 |
| 10 | 60 | 17 | 87 | **164** | **3.63%** | 61.1 | 2.013 | 330.1 |
| 11 | 15 | 6 | 50 | **71** | **1.57%** | 67.0 | 2.671 | 189.6 |
| 12 | 2 | 3 | 28 | **33** | **0.73%** | 70.3 | 3.116 | 102.8 |
| 13 | 2 | * | 16 | **19** | **0.42%** | 75.1 | 3.837 | 72.9 |
| 14 | | | 5 | **5.4** | **0.12%** | 80.3 | 4.727 | 25.5 |
| 15 | | | 1 | **1.5** | **0.03%** | 84.3 | 5.501 | 8.3 |
| 16 | | | 2 | **1.7** | **0.04%** | 85.1 | 5.686 | 9.7 |
| 17 | | | * | **0.3** | **0.01%** | 91.8 | 7.217 | 2.2 |
| 18 | | | * | **0.1** | **0.002%** | 92.9 | 7.466 | 0.7 |
| 19 | | | | | | | | |
| | 2010 | 1463 | 1049 | 4521.1 | **100.00%** | | | **5008** |
| | | | | | | | Catch | 5339 |

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 (2007 based on preliminary data).

REGRESSION OF MULTIPLICATIVE MODEL
MULTIPLE R..... 0.789
MULTIPLE R SQUARED..... 0.623

ANALYSIS OF VARIANCE

| SOURCE OF VARIATION | DF | SUMS OF SQUARES | MEAN SQUARE | F-VALUE |
|---|---|---|---|---|
| INTERCEPT | 1 | 2.61E2 | 2.61E2 | |
| REGRESSION | 51 | 7.83E1 | 1.54E0 | 9.155 |
| Cntry\|Gear\|TC(1) | 6 | 9.69E0 | 1.62E0 | 9.625 |
| Month(2) | 11 | 2.95E0 | 2.68E-1 | 1.596 |
| Division(3) | 3 | 3.11E0 | 1.04E0 | 6.179 |
| Year(4) | 31 | 3.15E1 | 1.02E0 | 6.049 |
| RESIDUALS | 283 | 4.75E1 | 1.68E-1 | |
| TOTAL | 335 | 3.87E2 | | |

REGRESSION COEFFICIENTS

| CATEGORY | CODE | VAR # | REG. COEF | STD. ERR | NO. OBS |
|---|---|---|---|---|---|
| Cntry\|Gear\|TC | 3125 | INT | -1.206 | 0.307 | 335 |
| Month | 9 | | | | |
| Division | 22 | | | | |
| Year | 76 | | | | |
| (1) | 3123 | 1 | -0.282 | 0.137 | 12 |
| | 3124 | 2 | -0.146 | 0.199 | 5 |
| | 3126 | 3 | 0.018 | 0.135 | 13 |
| | 3127 | 4 | 0.769 | 0.128 | 30 |
| | 3857 | 5 | 0.779 | 0.158 | 11 |
| | 27125 | 6 | 0.136 | 0.100 | 25 |
| (2) | 1 | 7 | -0.042 | 0.146 | 12 |
| | 2 | 8 | 0.051 | 0.146 | 13 |
| | 3 | 9 | -0.215 | 0.126 | 21 |
| | 4 | 10 | -0.093 | 0.114 | 31 |
| | 5 | 11 | 0.078 | 0.114 | 28 |
| | 6 | 12 | 0.077 | 0.105 | 36 |
| | 7 | 13 | -0.020 | 0.093 | 50 |
| | 8 | 14 | 0.120 | 0.088 | 48 |
| | 10 | 15 | -0.193 | 0.118 | 21 |
| | 11 | 16 | -0.205 | 0.138 | 14 |
| | 12 | 17 | -0.021 | 0.128 | 17 |
| (3) | 23 | 18 | -0.134 | 0.086 | 90 |
| | 31 | 19 | -0.340 | 0.090 | 139 |
| | 32 | 20 | -0.349 | 0.101 | 61 |
| (4) | 77 | 21 | 0.291 | 0.347 | 5 |
| | 78 | 22 | 0.858 | 0.334 | 8 |
| | 79 | 23 | 0.867 | 0.381 | 3 |
| | 80 | 24 | 1.033 | 0.320 | 13 |
| | 81 | 25 | 0.903 | 0.322 | 14 |
| | 82 | 26 | 0.943 | 0.327 | 10 |
| | 83 | 27 | 0.935 | 0.314 | 18 |
| | 84 | 28 | 1.079 | 0.320 | 12 |
| | 85 | 29 | 0.610 | 0.319 | 13 |
| | 86 | 30 | 0.384 | 0.335 | 8 |
| | 87 | 31 | 0.829 | 0.349 | 5 |
| | 88 | 32 | 0.065 | 0.363 | 4 |
| | 89 | 33 | 0.536 | 0.341 | 6 |
| | 90 | 34 | 0.488 | 0.320 | 12 |
| | 91 | 35 | 0.148 | 0.315 | 16 |
| | 92 | 36 | 0.031 | 0.313 | 20 |
| | 93 | 37 | 0.142 | 0.324 | 15 |
| | 94 | 38 | 0.225 | 0.363 | 4 |
| | 95 | 39 | 0.379 | 0.416 | 2 |
| | 96 | 40 | 0.237 | 0.331 | 8 |
| | 97 | 41 | 0.600 | 0.336 | 7 |
| | 98 | 42 | 0.400 | 0.418 | 2 |
| | 99 | 43 | 0.318 | 0.422 | 2 |
| | 100 | 44 | 0.492 | 0.329 | 9 |
| | 101 | 45 | 0.682 | 0.317 | 17 |
| | 102 | 46 | 0.271 | 0.324 | 11 |
| | 103 | 47 | 0.170 | 0.308 | 28 |
| | 104 | 48 | 0.198 | 0.312 | 20 |
| | 105 | 49 | 0.195 | 0.318 | 23 |
| | 106 | 50 | 0.697 | 0.341 | 10 |
| | 107 | 51 | 1.067 | 0.349 | 8 |

| CATEGORY | CODE | VAR # | REG. COEF | STD. ERR | NO. OBS |
|---|---|---|---|---|---|

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

YEARS 100-107 = 2000-2007

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 (2007 based on preliminary data).

PREDICTED CATCH RATE

| | LN TRANSFORM | | RETRANSFORMED | | | | % OF CATCH IN |
|---|---|---|---|---|---|---|---|
| YEAR | MEAN | S.E. | MEAN | S.E. | CATCH | EFFORT | THIS ANALYSIS |
| 1976 | -1.2060 | 0.0942 | 0.311 | 0.093 | 767 | 2469 | 9.5 |
| 1977 | -0.9154 | 0.0446 | 0.426 | 0.089 | 2866 | 6729 | 20.9 |
| 1978 | -0.3478 | 0.0330 | 0.756 | 0.136 | 3951 | 5228 | 30.0 |
| 1979 | -0.3387 | 0.0704 | 0.748 | 0.195 | 5183 | 6925 | 35.4 |
| 1980 | -0.1728 | 0.0256 | 0.904 | 0.144 | 3946 | 4367 | 42.9 |
| 1981 | -0.3026 | 0.0240 | 0.794 | 0.122 | 6155 | 7750 | 59.2 |
| 1982 | -0.2629 | 0.0227 | 0.827 | 0.124 | 8143 | 9848 | 73.4 |
| 1983 | -0.2706 | 0.0174 | 0.823 | 0.108 | 7085 | 8612 | 87.4 |
| 1984 | -0.1268 | 0.0196 | 0.949 | 0.132 | 6070 | 6397 | 90.4 |
| 1985 | -0.5961 | 0.0197 | 0.593 | 0.083 | 4847 | 8168 | 91.2 |
| 1986 | -0.8221 | 0.0292 | 0.471 | 0.080 | 1896 | 4024 | 74.6 |
| 1987 | -0.3768 | 0.0425 | 0.731 | 0.149 | 2465 | 3374 | 85.6 |
| 1988 | -1.1415 | 0.0539 | 0.338 | 0.078 | 629 | 1860 | 38.8 |
| 1989 | -0.6703 | 0.0377 | 0.546 | 0.105 | 988 | 1809 | 21.2 |
| 1990 | -0.7182 | 0.0227 | 0.524 | 0.079 | 2402 | 4580 | 75.9 |
| 1991 | -1.0577 | 0.0220 | 0.374 | 0.055 | 3254 | 8710 | 70.0 |
| 1992 | -1.1747 | 0.0189 | 0.333 | 0.046 | 2502 | 7517 | 50.2 |
| 1993 | -1.0636 | 0.0281 | 0.370 | 0.062 | 1034 | 2792 | 87.7 |
| 1994 | -0.9812 | 0.0535 | 0.397 | 0.091 | 575 | 1448 | 96.5 |
| 1995 | -0.8270 | 0.0939 | 0.454 | 0.136 | 632 | 1392 | 56.2 |
| 1996 | -0.9691 | 0.0309 | 0.406 | 0.071 | 1043 | 2566 | 81.0 |
| 1997 | -0.6062 | 0.0348 | 0.583 | 0.108 | 1017 | 1744 | 94.7 |
| 1998 | -0.8060 | 0.0960 | 0.463 | 0.140 | 46 | 99 | 63.0 |
| 1999 | -0.8881 | 0.0990 | 0.426 | 0.131 | 81 | 190 | 81.5 |
| 2000 | -0.7141 | 0.0301 | 0.525 | 0.090 | 1285 | 2449 | 99.3 |
| 2001 | -0.5238 | 0.0222 | 0.637 | 0.095 | 1833 | 2877 | 99.2 |
| 2002 | -0.9352 | 0.0265 | 0.421 | 0.068 | 1784 | 4234 | 98.7 |
| 2003 | -1.0363 | 0.0135 | 0.383 | 0.045 | 3710 | 9679 | 89.9 |
| 2004 | -1.0084 | 0.0168 | 0.394 | 0.051 | 1832 | 4656 | 98.5 |
| 2005 | -1.0108 | 0.0256 | 0.391 | 0.062 | 2225 | 5693 | 97.8 |
| 2006 | -0.5090 | 0.0381 | 0.642 | 0.124 | 2282 | 3557 | 97.9 |
| 2007 | -0.1387 | 0.0466 | 0.925 | 0.198 | 1865 | 2016 | 99.7 |

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.188

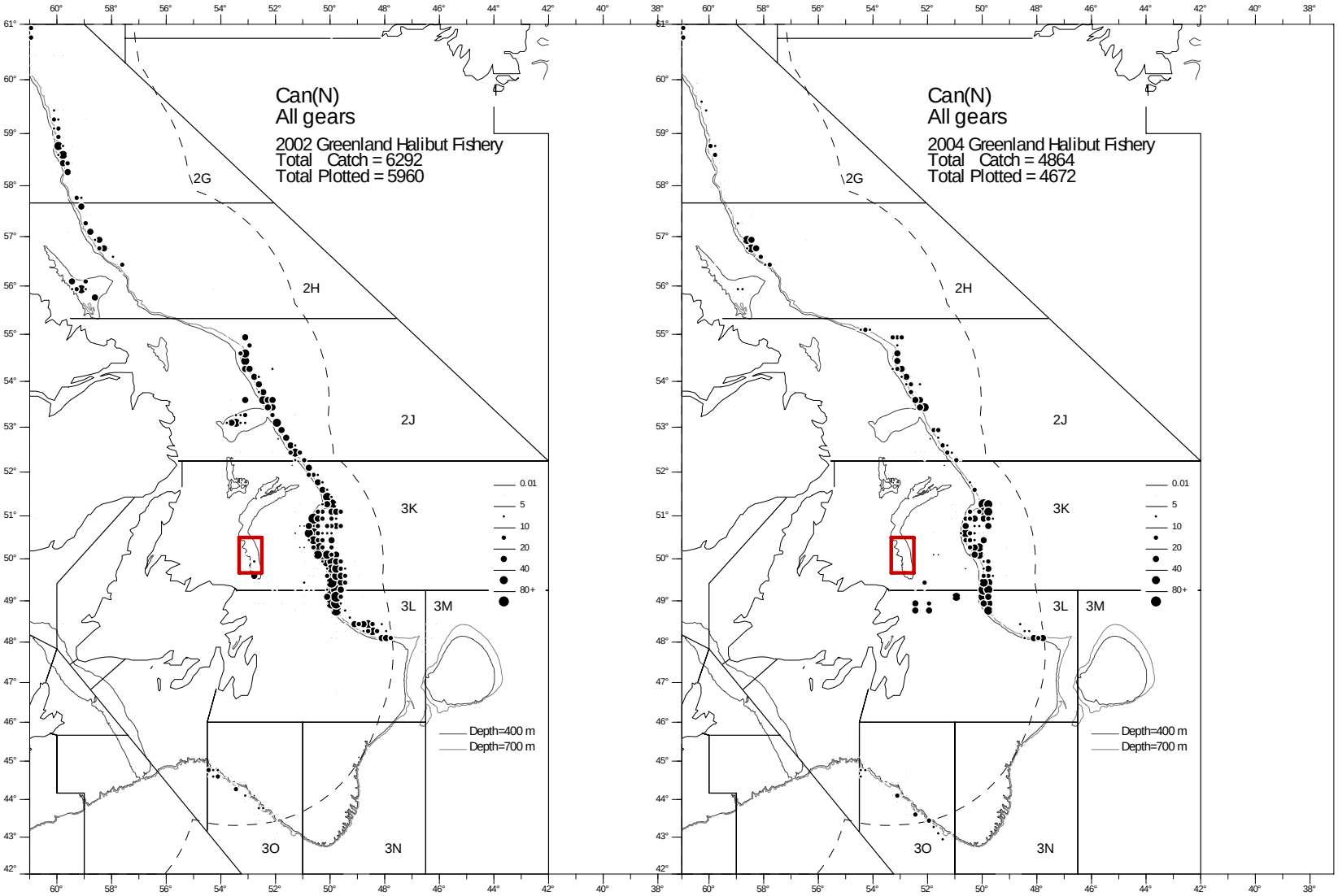


Fig. . Distribution of Can(N) Greenland halibut catch (tons) from the 2002 and 2004 fisheries. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10-minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook. Also shown is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

ghl2002+4 .rlfcat 2g3oLand.A:CN

Figure 1

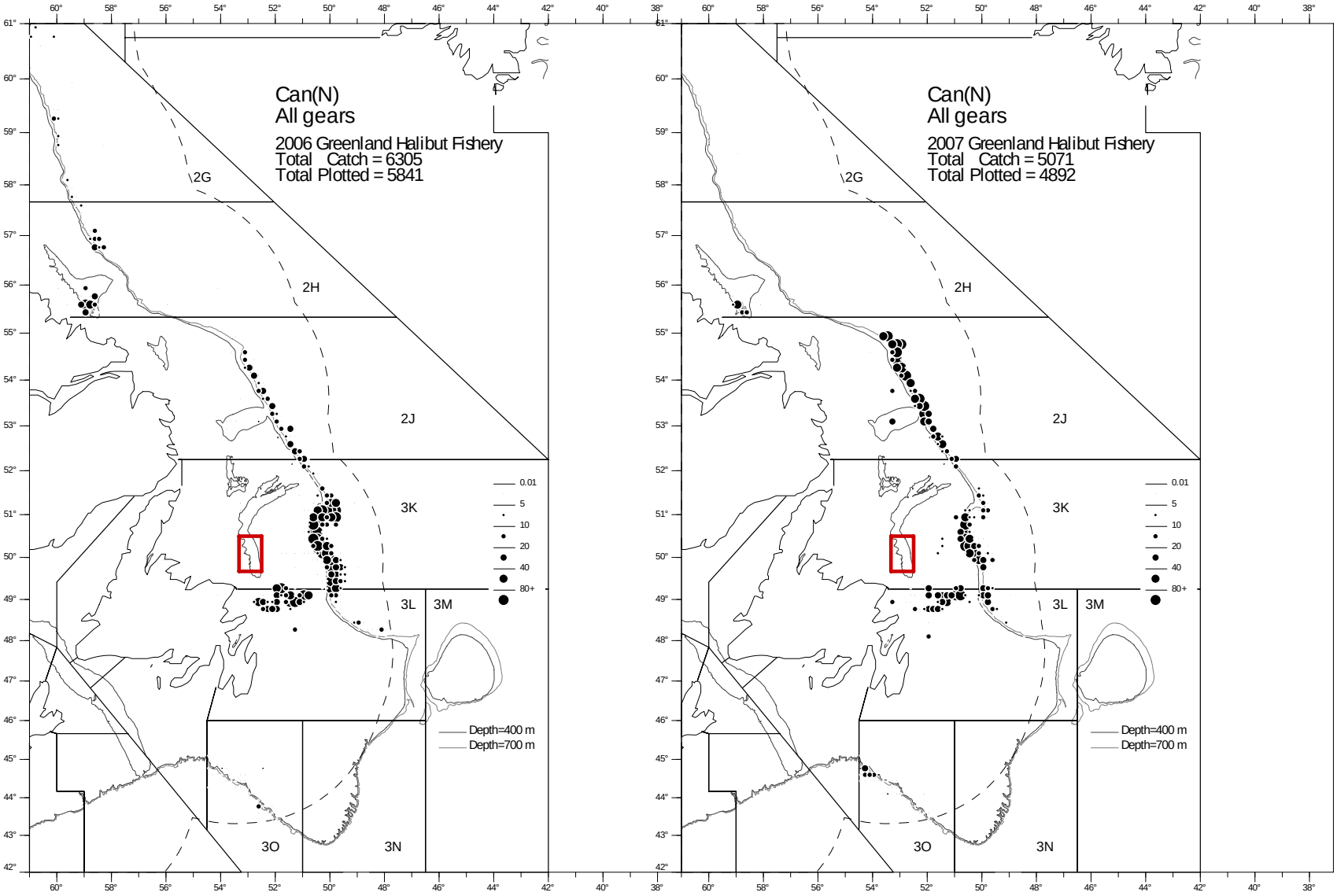


Fig. . Distribution of Can(N) Greenland halibut catch (tons) from the 2006 and 2007 fisheries. Represented is catch from directed fisheries and by-catch from other fisheries aggregated by 10-minute square for all gears from Div. 2G to Div. 3O where position was recorded on the logbook. Also shown is the area in Div. 3K closed to GILLNETs since early 2002 due to snow crab bycatch.

gNI2006+7 zrlcat 2q3oLand.ACN

Figure 2

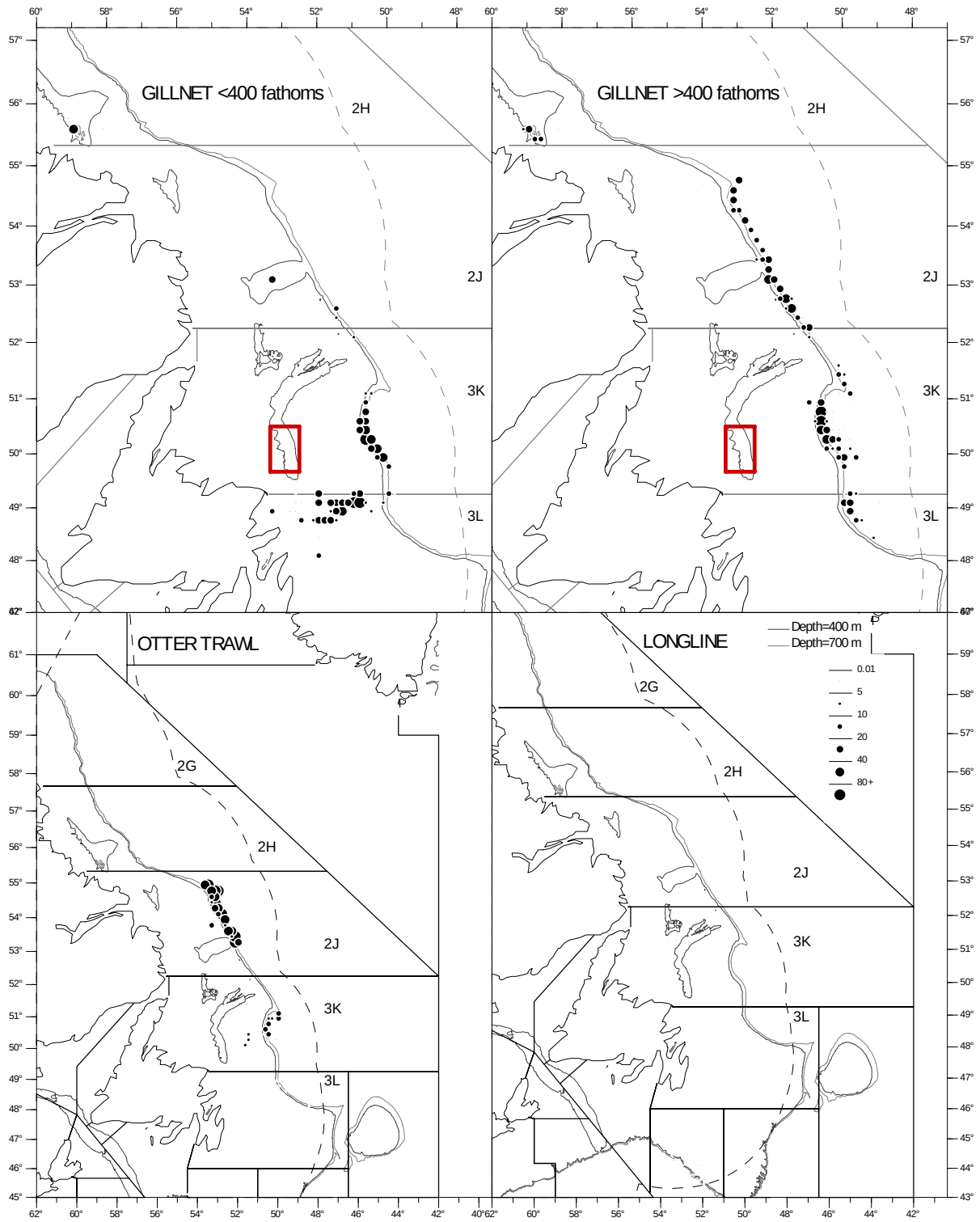


Fig. . Distribution of Can(N) Greenland halibut catch (tons) from the 2007 commercial fishery. Represented is LONGLINE, GILLNET (<400 fathoms and >400 fathoms) and OTTER TRAWL from both directed and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

Figure 3

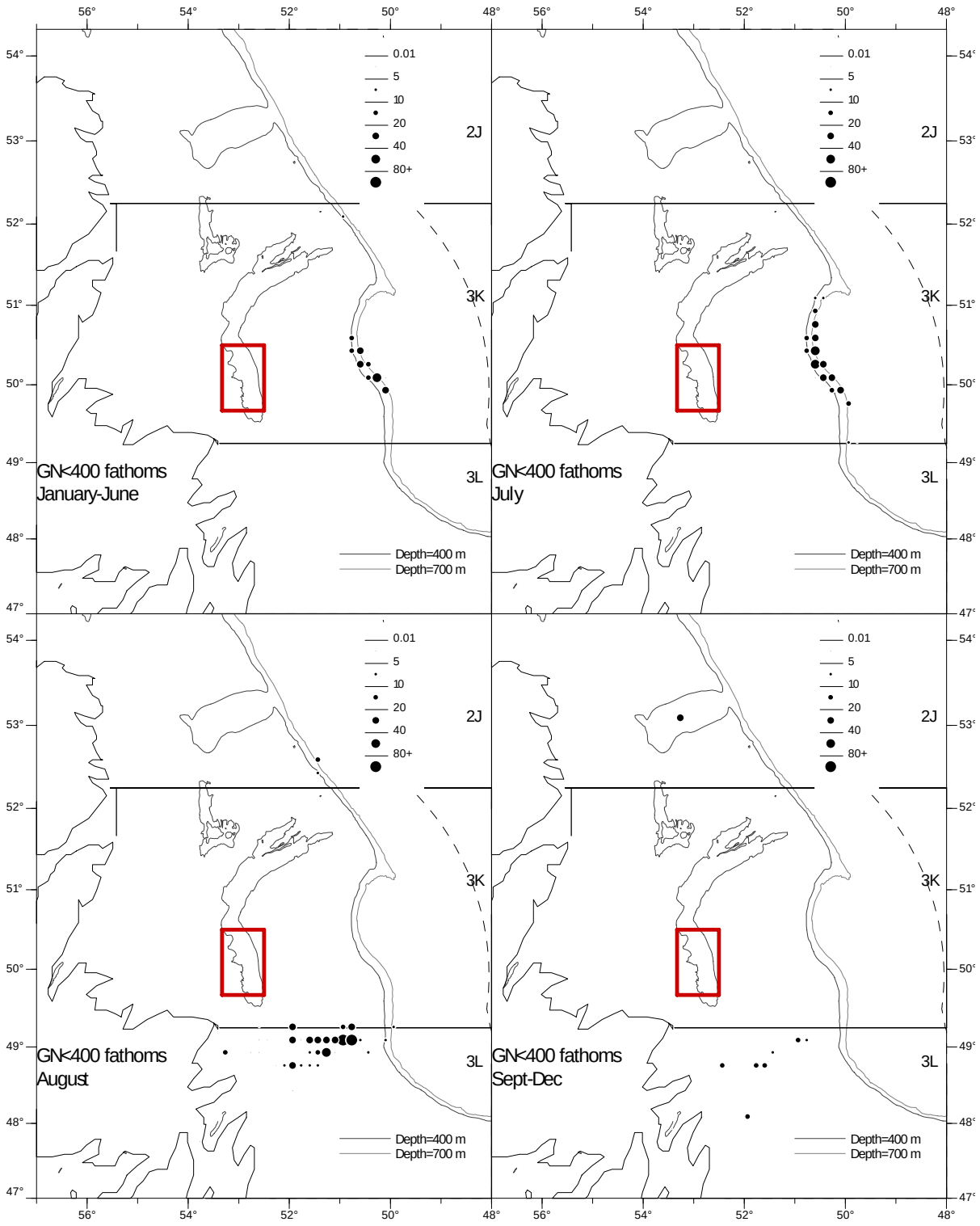


Fig. . Distribution of Can(N) Greenland halibut catch (tons) from the 2007 commercial fishery. Represented is GILLNET (<400 fathoms) for various months from both directed fisheries and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

Figure 4

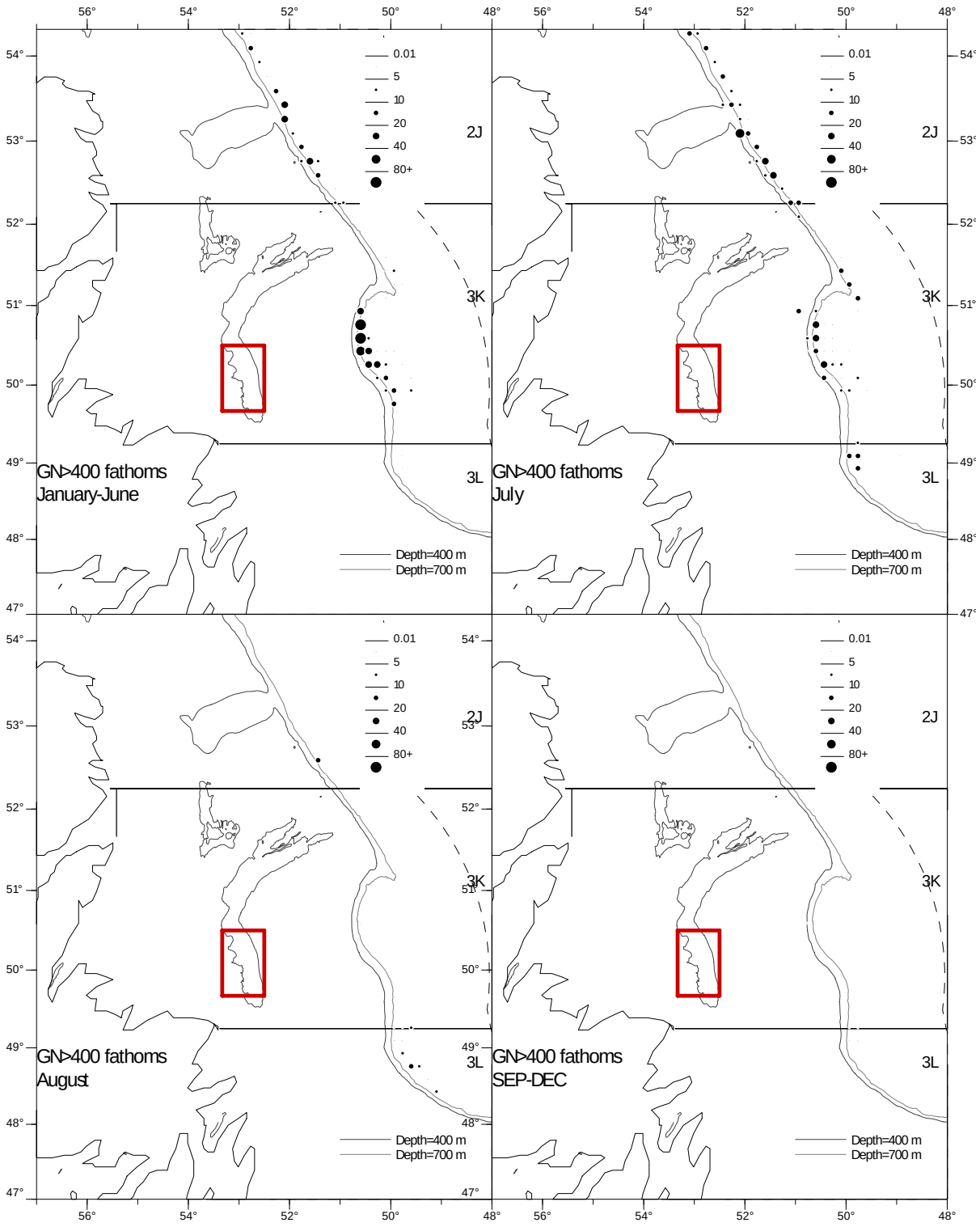


Fig. . Distribution of Can(N) Greenland halibut catch (tons) from the 2007 commercial fishery. Represented is GILLNET (>400 fathoms) for various months from both directed fisheries and by-catch fisheries. Data are aggregated by 10-minute square where position information exists. Note the closed area for GILLNETs in Div. 3K due to crab bycatch.

ghl2007 zifcat GNGT400.ACN

Figure 5

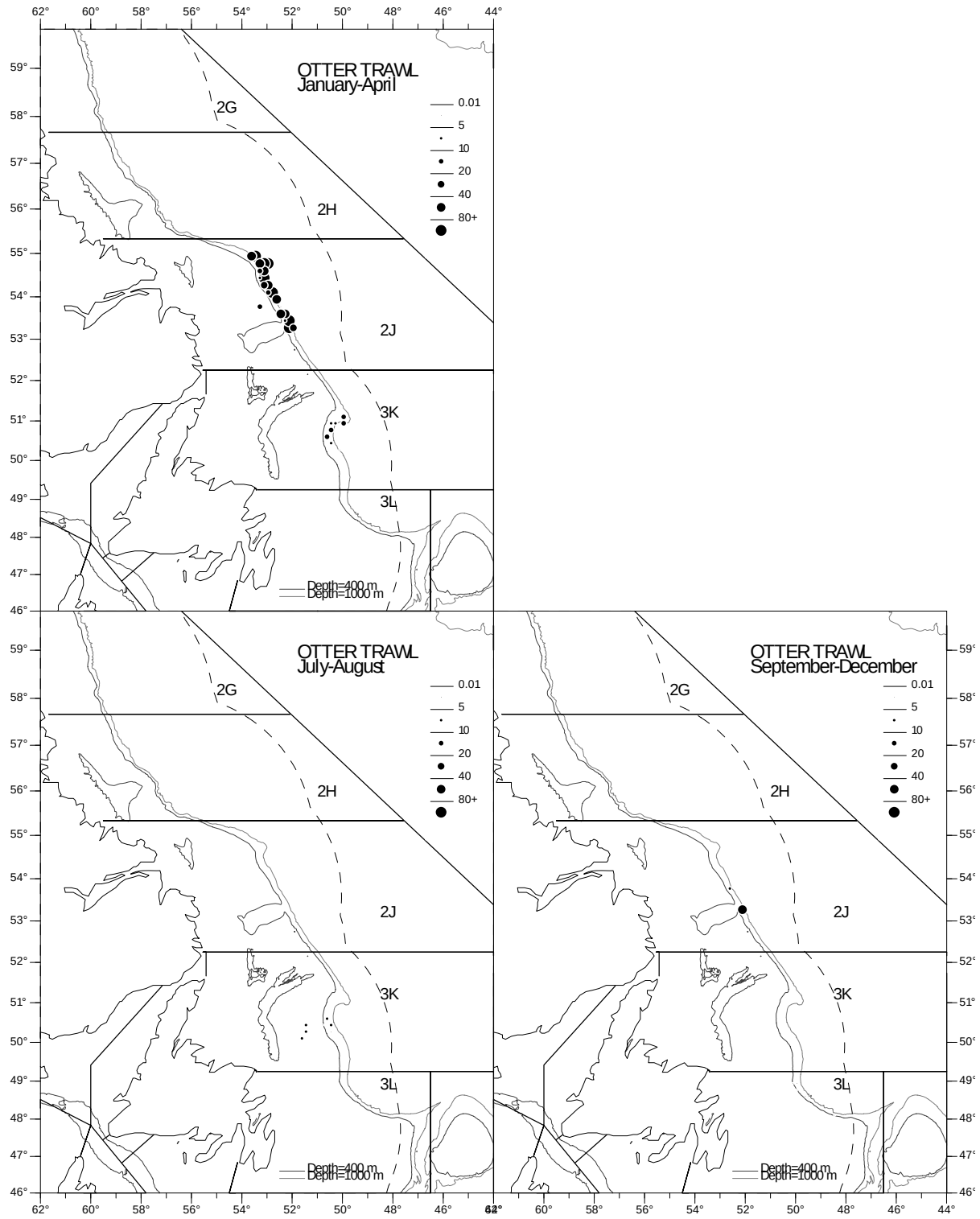


Fig. . Distribution of Can(N) Greenland halibut catch (tons) from the 2007 commercial fishery. Represented is OTTER TRAWL catch for various months from directed fisheries and by-catch from other fisheries. The data are aggregated by 10-minute square for Div. 2J3KL where position was recorded on the logbook.

ghl2007 zifcat OT.ACN

Figure 6

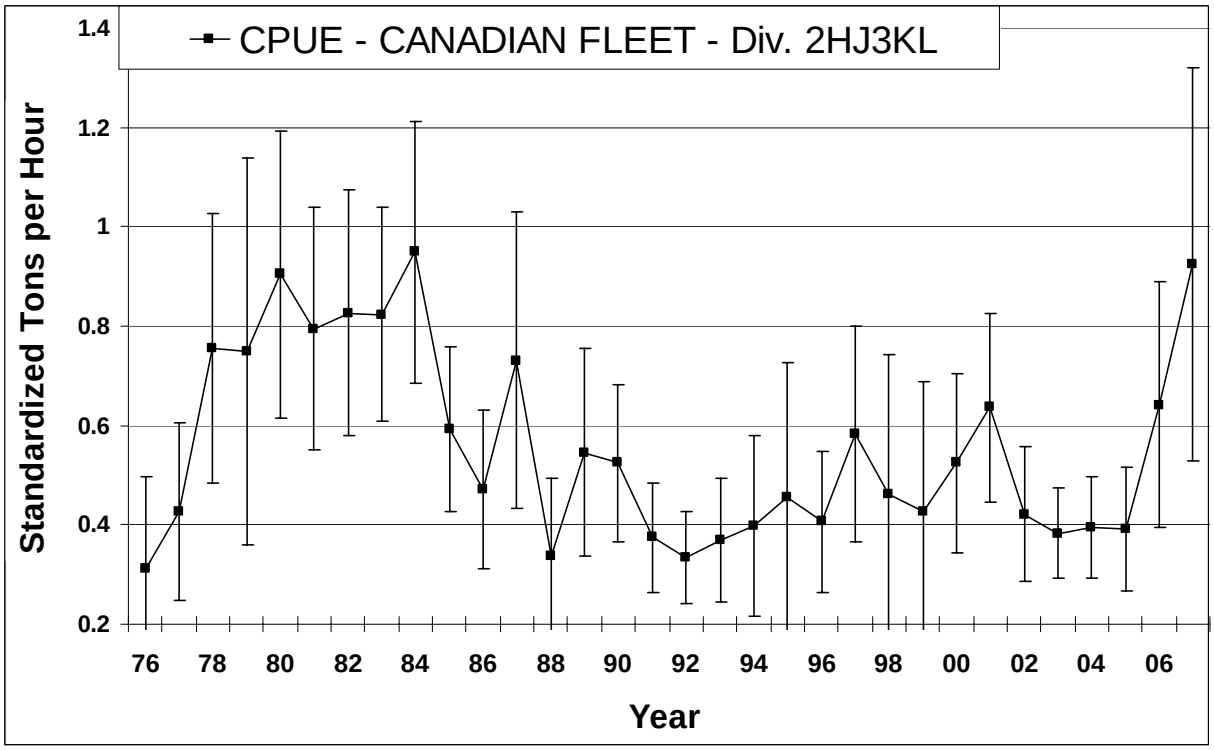


Fig. 7. Standardized Mean CPUE ± 2 standard errors for Greenland Halibut in Div. 2HJ3KL utilizing effort in HOURS fished from the CANADIAN OTTERTRAWL FLEET.