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Update of Data from the Offshore Canadian Commercial Fishery for Greenland Halibut in Division 0B

by

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Abstract

This document updates information from the commercial fishery for Greenland halibut in Division 0B, with a focus on the Canadian commercial fishery in 2001. Catch at age showed a slight shift toward younger fish after 1993, with a peak at age 7 in each year since then. As in previous years, catch at age from 2001 indicates larger fish in the fixed gear catches compared to the mobile gears. There were no major trends in weight at age during the period 1990 to 2001. Due to the frequency of fleet changes in this fishery, and the lack of continuity among vessels within fleets, a standardized index of CPUE for Subarea 0 alone is not considered to be a reliable indicator of overall stock abundance. Unstandardized CPUE from the Canadian fishery showed a slight increase from 1998 to 1999, but has been relatively stable since 1996. CPUE data for 2000 and 2001 are incomplete and not updated here. Twin trawls were present in the Greenland halibut fishery in Div. 0B in 2000 and 2001 but complete data were not available form this fleet component.

Catch trends

Catches of Greenland halibut in Subarea 0 increased from less than 1,000 tons annually in the late-1980s to an average of about 10,000 tons per year in 1990-92 (Jorgensen, 2000). A new management unit was introduced in 1995, which excluded the inshore waters of Division 1A in Greenland from the TAC for Subareas 0+1. As a result, the TAC for Subarea 0+1 offshore was decreased from 25,000 tons to 11,000 tons, split equally between SA 0 and SA 1. Following this, catches in Subarea 0 were reduced to between 5,300 and 6,700 tons per year in 1995 to 1997. A further reduction to about 4,400 tons occurred in 1998. In 1999 catches in Div 0B totaled about 4,050 tons, with 517 tons being taken in Div. 0A, for a total of 4,567 tons from Subarea 0. With the exception of a relatively small inshore fishery in Cumberland Sound, and some exploratory fishing in Subarea 0, virtually all the catch in Subarea 0 prior to 1999 occurred offshore in Div. 0B. In 1999, there was no exploratory fishing in Div. 0A and catches in this Division were part of the regular commercial fishery. In 2000, Canadian catches in Subarea 0 totaled 5,393 tons (Table 1). A complete breakdown by Division was not available, although at least 300 tons was reported from Div. 0A, 22 tons of which was caught under an experimental/exploratory license (Brodie and Power, 2001).

In 2001, a new quota of 4,000 tons was introduced for Div. 0A and 1A offshore, separate from the 11,000 tons in 0B + 1B-F offshore. Data from that fishery are presented in Treble and Bowering (2002). The fishery in 2001 in Div. 0B took almost 4,900 tons, similar to the catch in Div. 0B in 2000.

Catches have been taken mainly by otter trawl, although catches by gillnet are becoming more important (over 1,900 tons in both 1999 and 2000, 2,100 tons in 2001). Longline catches have also increased in recent years, from 400 tons in 1999, to 521 tons in 2000, to almost 800 tons in 2001. In 1997, about 70% of the catch of 5,740 tons was taken

by otter trawl, but this percentage declined to about 40% in 1999 (Brodie, 2000). In 2000, just over 50% of the catch came from otter trawls, about half of which was taken by twin trawls. In 2001, the percentage of otter trawl catch was again 40%, although no breakdown of twin vs. single trawl was available (Table 1). Vessels from Canada, Japan, Faroes, Russia, and Norway were the main participants in the fishery since the late-1980s, although there have been many changes to fleet compositions over time. During the 1990s, much of the Canadian quota in this fishery was caught under charter agreements with vessels from most of the nations listed above, although there were no such arrangements with non-Canadian vessels from 1999 to 2001 in Div. 0B.

Description of Data

Brodie and Power (2001) presented catch at age and mean weight at age data from 1988-2000, including data from previous documents by Atkinson *et al*. (1994), and Brodie and Bowering (1998). These data have been incorporated in the assessments of the G. halibut stock in Subareas 0+1 (e.g. Jorgensen, 2000). Most of the sampling data used in these analyses were collected at sea by observers, although some port sampling information was also included. From the fishery in 2001, samples were available from the otter trawl and gillnet catches, and were used to generate the catch at age and weights at age for 2001. Similar procedures were used as in previous years, although in the 1999-2001 data, some samples contained data in which the sex of each fish could not be recorded, because of processing at sea. In these cases, the sex was assigned as female, given the large percentage of females, which occurred in comparable sexed samples. There are no data on by-catch from the shrimp fishery in Subarea 0 included in this paper, or from catches in the inshore fixed-gear fishery (primarily in Cumberland Sound). Catches from these fisheries are relatively small and have generally been dealt with elsewhere.

It should be noted that there are considerable uncertainties with the Canadian catch data for Greenland halibut in Subarea 0. In the data for the early-1990s, the use of charter vessels from non-Canadian countries to fish Canadian quotas resulted in some double counting of catch data, although this problem has been resolved for some time. Logbook data for catches in 2000 by some Newfoundland-based vessels were not available and these catches were summarized from quota reports, resulting in incomplete data for month fished. As well, it is likely that some data for vessels fishing with licenses issued for Nunavut-based companies may not have been tabulated for the years 1997-1999, although the full extent of this is not known at present. This may explain some of the apparent shortfall of reported catches by Canada of about 1,000 tons against the 5,500-ton quotas in 1998 and 1999.

The introduction of twin trawls to the fishery in 2000-01 has resulted in a new gear type, and there is some question as to whether this has been coded differently from single trawls in data from some vessels or fleets (e.g. Can-M). Further examination of logbooks and observer data will be required to see the extent of this problem and whether or not it can be resolved. In the meantime, it is not possible to fully update the CPUE series until this has been clarified.

Catch-at-age

Table 2 shows the catch-at-age calculations for the 2001 fishery. A limited number of length frequencies were collected from the gillnet fishery, consisting of 1263 measurements from catches in June and July. No data were available from the longline catch. The otter trawl component contained many samples from April, May and December, consisting of over 17,000 measurements. About 27% of these measurements were taken from the twin trawl fishery. As was the case with the sampling data from 1997-2000, the discrepancy in sampling intensity can be explained by the deployment of observers on most of the vessels fishing otter trawls in 2000. Sampling of the fixed gear segment was not adequate in 2001, underlining the difficulty in obtaining samples from some of the Canadian fixed gear fleets operating in Subarea 0.

Age length keys, consisting of 720 otoliths taken in conjunction with various length frequency samples, were used to derive the age composition of Greenland halibut caught in 2001. The number of otoliths available, at this time, from the 2001 fishery was somewhat reduced compared to 1999 and 2000 (when 1,421 and 1,115 otoliths were collected), requiring age-length keys to be combined by gear type. Additional otoliths were collected in 2001, but have not been aged in time for inclusion here. Catch at age for 2001 will be updated when these otoliths have been aged, and presented in the 2003 evaluation of this stock. It is expected that these changes will not be substantial.

Examination of the length frequencies from single and twin trawls revealed very little difference, so these were therefore combined to produce an otter trawl age frequency. Age composition in the otter trawl fishery in 2001 was very similar to previous years, with ages 7 and 8 dominating (Table 2). Fixed gear catches were dominated by ages 10 and 11. Table 2 also shows a comparison of the catch at age totals from fixed gear and mobile gear. Although the trawl catch was about 1,000 tons lower than the fixed gear catch in 2001, the numbers of fish were about double in the trawl component. Ages 7 and 8 were dominant by number in the combined catch-at-age, which is adjusted to reflect the catch of 4,895 tons. Ages 10 and 11 were the peak ages in the catch by weight, although ages 7-12 all contributed significantly to the catch weight in 2001.

Table 3 (a and b) shows the catch-at-age and mean weights-at-age for 1988-2001 along with a sum-of-products (S.O.P.) check (Table 3c). The nominal catches used to derive the total catch-at-age values for 1988-99, were taken from Jorgensen (2000). For 2001, as in 1998-2000, mean weights-at-age were calculated from mean lengths at age using the length-weight relationship for NAFO Div. 2G, calculated from survey data obtained in 1997 (Gundersen and Brodie, 1999). As noted by Atkinson *et al*. (1994), there was a shift in the catch at age to younger fish with the increased otter trawl fishery in 1990 onward. In 1988-89, catches were taken mainly by longlines in deep water, and contained proportionally more old fish. From 1990-93, age 8 was predominant in catches, but from 1994-2001, the modal age in each year was 7. This may be due in part to the fishery occurring slightly later in the year in the latter period. Few fish older than 13 years appeared in the catch-at-age after 1990, although a few individuals as old as 16 were taken in the fishery every year.

Mean weights at most ages in 2001 were similar to those of recent years, and the weights showed little in the way of trends over time (Table 3b). The S.O.P. check (Table 3c) indicated a slight bias toward underestimating the catch weight in most years, although this bias was substantial in 2001. Table 2 shows that this discrepancy occurred in the fixed gear component, and may be caused by the lack of sampling of the longline catch. In any case, the catch at age and mean weights at age for fixed gear in 2001 contains considerable uncertainty.

CPUE

In previous papers (Brodie, 1999; Brodie and Bowering, 1998), a standardized CPUE was calculated from available data using a multiplicative model. However, it was thought that the lack of overlap of fleets throughout the time series likely caused some problems in the CPUE standardization in Subarea 0. It was noted that there is not a single fleet, which is present in all years of the time series, and that there was only one fleet involved in the 1999-2001 fisheries for which complete data were available. As well, the presence of twin trawls in 2000-01 has added a new gear type and has raised a question on how this gear code and effort data for twin trawls have been recorded. An update of CPUE will be presented if/when this issue can be resolved.

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Table 1. Canadian catch of G. halibut in Div. 0B (offshore) in 2001.

	Can (N)				Can (M)	Can (C&A)	
	OT	Gillnet	Longline	Sub-Total	OT	OT	TOTAL
April					33	59	**92**
May		194	44	238	431	565	**1234**
June		530	104	634	72		**706**
July		455	189	644			**644**
August		290	146	436			**436**
September		452	201	653			**653**
October		97	50	147			**147**
November	63	120	53	236			**236**
December	193			193		389	**582**
Unspecified1					165		**165**
Total	***256***	***2138***	***787***	***3181***	***701***	***1013***	**4895**

Footnotes:

1) Based on quota reports

2) OT includes some twin trawl catches,
Based on observer data.

Gear Totals	
LL	787
OT	1970
GN	2138

Table 2. Catch at age (000 of fish) and mean lengths (cm) and weights at age (kg), for G.halibut in the fishery in Div. 0B in 2001.

	Fixed gear (GN + LL)			Mobile gear (OT {single + twin})				Mean		
Age	*Catch*	*Wgt*	*SOP*	*Catch*	*Wgt*	*SOP*	**Total**	Len (cm)	Wgt (kg)	SOP (t)
5				*13*	*0.477*	*6.2*	**13**	38.8	0.477	6.2
6	*1*	*0.747*	*0.7*	*200*	*0.683*	*136.6*	**202**	43.3	0.684	138.2
7	*20*	*1.045*	*20.9*	*676*	*0.912*	*616.5*	**695**	47.4	0.916	636.6
8	*40*	*1.429*	*57.2*	*357*	*1.308*	*467.0*	**398**	53.1	1.320	525.4
9	*90*	*1.908*	*171.7*	*201*	*1.783*	*358.4*	**291**	58.7	1.821	529.9
10	*216*	*2.467*	*532.9*	*87*	*2.290*	*199.2*	**303**	64.0	2.416	732.0
11	*191*	*3.083*	*588.9*	*37*	*2.903*	*107.4*	**228**	68.8	3.053	696.1
12	*128*	*3.662*	*468.7*	*10*	*3.563*	*35.6*	**138**	72.7	3.654	504.3
13	*43*	*4.761*	*204.7*	*3*	*3.987*	*12.0*	**45**	78.5	4.715	212.2
14	*20*	*6.015*	*120.3*	*1*	*5.702*	*5.7*	**20**	84.6	6.005	120.1
15	*4*	*6.413*	*25.7*				**4**	86.5	6.413	25.7
16				*	*10.448*	0.4	**0.04**	100.5	10.448	0.4
	753		*2192*	*1585*		*1945*	4530			4127
			catch=2925 t			catch=1970 t				Catch=4895 t

* indicates less than 500 fish

Table 3. A) Catch-at-age, B) mean weight-at-age and C) sum of products, for Greenland Halibut in Subarea O (mainly Div. OB)

A) Catch-at-age (000's)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	1	0	0	
4	0	0	0	0	9	1	2	0	2	6	6	1	1	
5	0	0	2	14	45	30	45	18	34	58	42	25	61	13
6	0	0	53	208	524	332	181	189	296	355	225	145	389	202
7	1	2	398	1191	2078	1668	1033	1254	1726	1273	579	610	752	695
8	5	9	1387	1888	2738	1933	735	641	1193	1050	416	523	669	398
9	9	11	1186	1059	1688	891	483	388	596	478	307	346	404	291
10	18	13	663	447	657	474	140	245	309	216	253	199	296	303
11	24	14	335	175	217	156	85	168	134	173	224	119	264	228
12	31	30	184	122	147	89	82	168	84	90	97	104	185	138
13	39	32	183	96	120	50	57	62	34	67	75	104	91	45
14	30	34	111	50	60	22	25	29	17	15	49	57	42	20
15	24	20	63	30	24	13	17	16	10	9	6	33	32	4
16	8	8	14	4	6	4	11	5	2	7	1	18	6	0.04
17	1	0	2	0	1	0	2	1	1	1	0	9	1	
18	0	0	0	0	0	0	1	0	0	0	0	1	1	
19	0	0	0	0	0	0	0	0	0	0	0	1	0	
Total	190	173	4580	5285	8313	5663	2899	3184	4439	3798	2281	2295	3194	2337
Catch(t)	1024	907	9498	8606	12358	7489	4274	5299	6721	5740	4370	4567	5393	4895

B) Weight- at Age (kg)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1														
2														
3											0.173			
4					0.196	0.175	0.228		0.269	0.241	0.337	0.367	0.387	
5			0.376	0.356	0.333	0.302	0.406	0.358	0.351	0.359	0.450	0.466	0.504	0.477
6			0.562	0.554	0.572	0.526	0.559	0.568	0.537	0.547	0.630	0.599	0.634	0.684
7	0.818	0.785	0.813	0.820	0.829	0.810	0.857	0.897	0.896	0.862	0.909	0.866	0.905	0.916
8	1.200	1.076	1.098	1.143	1.162	1.170	1.210	1.302	1.321	1.276	1.280	1.270	1.268	1.320
9	1.781	1.585	1.533	1.632	1.692	1.716	1.690	1.810	1.814	1.838	1.845	1.780	1.828	1.821
10	2.446	2.149	2.122	2.333	2.420	2.357	2.235	2.523	2.397	2.378	2.490	2.372	2.399	2.416
11	3.244	2.878	2.961	3.390	3.390	3.264	2.767	3.152	3.141	3.005	3.185	3.024	3.046	3.053
12	4.169	3.822	3.916	4.364	4.309	4.266	3.426	3.927	3.979	3.831	3.903	3.761	3.829	3.654
13	5.136	4.929	4.986	5.610	5.555	5.519	4.608	5.007	5.132	4.932	4.819	4.765	4.768	4.715
14	6.317	6.265	6.275	7.022	7.176	6.803	6.038	5.893	5.943	5.713	6.025	5.463	5.596	6.005
15	7.736	7.825	8.049	8.669	8.786	7.976	6.534	6.849	6.568	6.783	6.858	6.835	6.369	6.413
16	9.511	9.883	10.354	10.849	10.269	9.786	6.106	8.654	8.168	8.002	7.977	8.068	7.926	10.448
17	10.772		12.804		11.951		10.006	9.937	8.694	8.641		9.104	8.964	
18							6.655					10.611	10.138	
19												11.736		

Table 3. continued.

3C) Sum of products (t) Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	1.8	0.2	0.5	0.0	0.7	1.4	2.0	0.4	0.0	0.0
5	0.0	0.0	0.7	5.0	14.9	8.9	18.5	6.4	12.0	20.8	18.9	11.5	30.7	6.2
6	0.0	0.0	29.9	115.2	299.7	174.9	101.2	107.4	158.9	194.2	141.8	86.7	246.6	138.2
7	0.8	1.6	324.0	976.8	1722.5	1351.4	885.0	1124.8	1546.1	1097.3	526.3	528.1	680.6	636.6
8	6.0	9.7	1522.9	2158.2	3181.9	2261.6	889.3	834.6	1576.5	1339.8	532.5	664.3	848.3	525.4
9	16.0	17.4	1817.8	1728.9	2856.4	1529.4	815.7	702.3	1080.2	878.6	566.4	616.2	738.5	529.9
10	44.0	27.9	1405.9	1043.2	1590.3	1117.6	313.9	618.1	741.4	513.6	630.0	472.9	710.1	732.0
11	77.9	40.3	990.9	592.1	736.2	510.5	235.4	529.5	420.8	519.9	713.4	359.8	804.1	696.1
12	129.2	114.7	719.6	533.6	631.9	377.7	281.3	659.7	334.3	344.8	378.6	391.0	708.4	504.3
13	200.3	157.7	911.5	538.9	665.4	276.9	264.4	310.4	175.0	330.4	361.4	495.4	433.9	212.2
14	189.5	213.0	698.0	349.6	433.8	147.2	149.3	170.9	101.3	85.7	295.2	310.3	235.0	120.1
15	185.7	156.5	506.0	257.4	206.6	102.0	109.9	109.6	64.0	61.0	41.1	227.1	203.8	25.7
16	76.1	79.1	140.2	47.4	57.5	38.5	66.4	43.3	19.9	56.0	8.0	147.0	47.6	0.4
17	10.8	0.0	24.8	0.0	13.4	0.0	19.8	9.9	10.6	8.6	0.0	78.1	9.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	11.4	1.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	0.0	0.0
SOP	936.3	817.9	9092.2	8346.3	12412.1	7896.7	4157.0	5227.0	6241.8	5452.3	4215.8	4400.1	5697.6	4127.0
SOP/ catch	**0.91**	**0.90**	**0.96**	**0.97**	**1.00**	**1.05**	**0.97**	**0.99**	**0.93**	**0.95**	**0.96**	**0.96**	**1.06**	**0.84**