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Data from the commercial fishery for Greenland halibut in Subarea 0

by

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Abstract

This document updates information from the commercial fishery for Greenland halibut in Subarea 0. Catch at age showed a slight shift to younger fish after 1993, with a peak at age 7 in each year since then. There were no major trends in weight at age during the 1990's. Due to the frequency of fleet changes in this fishery, and the lack of continuity among vessels within fleets, a standardized index of CPUE is not considered to be a reliable indicator of overall stock abundance in this area. Unstandardized CPUE from the Canadian fishery showed a slight increase from 1998 to 1999, but has been relatively stable since 1996.

Introduction

Catches of Greenland halibut in Subarea 0 increased from less than 1000 tons annually in the late 1980's 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 Division 1A in the inshore waters of 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, and 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 4400 tons occurred in 1998, as some allocations were not fished. In 1999 catches in Div 0B (from STATLANT 21A) totalled about 4050 tons, with 517 tons being taken in Div. 0A, for a total of 4567 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 Division 0B. In 1999, there was no exploratory fishing in Div. 0A and catches in this Division were part of the regular commercial fishery.

Catches have been taken mainly by otter trawl, although catches by gillnet are becoming more important. Relatively small amounts of longline catch also occur. In 1997, about 70% of the catch of 5740 tons was taken by otter trawl, but this percentage was lower in 1998 and lower again in 1999 at about 40% (Table 1). Vessels from Canada, Japan, Faroes, Russia, and Norway have been the main participants in the fishery since the late 1980's, although there have been many changes to fleet compositions over time. During the 1990's, 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 in 1999. This paper updates catch at age and mean weights at age from the offshore fishery in Div. 0AB from 1999, and examines CPUE data from stern otter trawlers for the period 1990-99.

Methods and Materials

Brodie (1999) presented catch at age and mean weight at age data from 1988-98, 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 (eg. Jorgensen 1999, 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 1999, samples were available from the otter trawl and longline catches, and were used to generate the catch at age and weights at age for 1999. Similar procedures were used as in previous years, although in the 1999 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. In this paper, revised catch data for 1994, 1996, and 1999 were available during the June 2000 Scientific Council meeting, resulting in revisions to the catch at age for these years.

CPUE data were collected by observers on a set by set basis, and aggregated in this analysis by vessel and month. A total of 429 observations were analyzed, only 4 of which came from 1999. Data from the exploratory fishery in Div 0A in 1996-98 were included in the catch rate analysis where available, but excluded from the catch at age calculations. As noted previously, there was no exploratory fishery in Div. 0A in 1999, but the commercial fishery did operate there. As well, there are no data from the shrimp fishery in Subarea 0 included in this paper, as the catch of Greenland halibut in that fishery has generally been dealt with elsewhere.

Results and Discussion

Catch at age

Table 2 shows the catch at age calculations for the 1999 fishery. Sampling of the longline fishery consisted of length frequencies collected in the months of June, July, and October, totaling about 950 measurements, while the otter trawl component contained many samples from September to December, consisting of over 16,000 measurements. As was the case with the 1997 and 1998 data, this discrepancy can be explained by the deployment of observers on all almost all otter trawl trips in the fishery in 1999. Longline sampling was applied to the gillnet catch, as the latter gear was not sampled in 1999. This was the reverse of the situation in the 1998 fishery, and highlights the difficulty in obtaining samples from the fixed gear fleets operating in Subarea 0.

Age length keys, from both the longline (608 otoliths) and otter trawl (823 otoliths) fleets, were used to derive the age composition of Greenland halibut caught in 1999. Age composition in the otter trawl fishery was very similar to previous years, with ages 7 and 8 dominating (Table 2). Longline catches were dominated by ages 9 and 10, although it should be noted that the gillnet landings, which comprised a much larger component of the fixed gear catch, were not sampled in 1999.

Table 3 (a and b) shows the catch at age and mean weights at age for 1988-1999 along with a sum-of-products (S.O.P.) check (Table 3c). The nominal catches used to derive the total catch at age values were taken from Jorgensen (2000). As noted previously, the total catch at age for 1994, 1996, and 1999 in these tables was corrected for changes in reported catch in these years. For 1999, as in 1998, 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 1994-99, 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 ages 7 to 12 showed little in the way of trends over time (Fig. 1). The S.O.P. check (Table 3c) indicated a slight bias toward underestimating the catch weight in most years, the reason for which is not apparent, although there is no length weight relationship available for Subarea 0 during the period studied here.

CPUE

In previous papers (Brodie 1999, Brodie and Bowering 1998), a standardized CPUE was calculated from available data using a multiplicative model (Gavaris 1980). 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 9 years of the time series, and that there was only one fleet involved in the 1999 fishery for which data were available, resulting in only 4 data points for that year. As in 1999, the data for Subareas 0 and 1 have been combined in an attempt to produce a CPUE index for the entire stock (Jorgensen 2000).

Fig. 2 shows the unstandardized CPUE data for most fleets in the fishery in Subarea 0 from 1990-99. One of the longer series, Faroes TC 7, shows a relatively constant increase over time, although this fleet did not fish in 1998 or 1999. The Canadian fleet has had relatively stable CPUE during 1996-99, and was the only fleet involved in the fishery in each of these years. Other factors besides stock abundance which could affect CPUE include learning, since the otter trawl fishery was new in 1990 and many fleets joined the fishery for short periods in the 1990's, and migration of G. halibut in either direction between Subarea 0 and 1, given the geographic features of the depth contours in the area of the boundary. There are no recent research vessel surveys of Div. 0B to verify trends in CPUE, although USSR/Russia conducted stratified random trawl surveys in this area from 1979-92 (Gorchinsky 1993). These data show a sharp drop in biomass from higher levels in 1979-86 to a much lower value in 1987. The biomass increased slightly up to 1990, then declined in 1992 to just above the 1987 value. Given the wide confidence limits around the standardized CPUE estimates from the 1998-99 analyses, and the lack of continuity in the fleet composition, it is unlikely that the CPUE data available for Subarea 0 can be considered a reliable index of overall stock abundance.

A research vessel survey of Division 0A was conducted in 1999 (Treble et al. 2000). A survey of Division 0B is planned for 2000, and in 2001, a survey of both Divisions is planned. The 1999 survey and those planned for 2000-01 will be comparable with the surveys of Subarea 1 on the same vessel, and thus, if continued, the surveys could eventually provide a fishery independent index of abundance for the offshore stock of G. halibut in Subareas 0+1.

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Table 1. Catches of Greenland halibut in Divisions 0A and 0B in 1999.

	0A			0B					0AB
	Can(M) OT	Can(N) OT	**Total**	Can(M) OT	Can(N) OT	Can(N) LL	Can(N) GN	**Total**	**TOTAL**
Jan									
Feb									
Mar									
Apr									
May				203			85		**288**
Jun				130		112	472	**714**	**714**
Jul				3		141	614	**758**	**758**
Aug							233	**233**	**233**
Sep	85	140	**225**		9	146	315	**470**	**695**
Oct	128	148	**276**	63	137		270	**470**	**746**
Nov		15	**15**	25	333		1	**359**	**374**
Dec					453			**453**	**453**
Total	**213**	**303**	**516**	**424**	**932**	**399**	**1990**	**3457**	***4261***

Data are preliminary, from Canadian catch statistic files. Excludes inshore catches.
Total catch from 0AB, from Statlant 21A is 4567 t.

Table 2. Catch at age and means lengths and weights at age, for Greenland halibut in the commercial fishery in Subarea O in 1999.

	LL+GN				**OT**			
Age	Catch (000)	Av. len (cm)	Av wt (kg)	SOP (tons)	Catch (000)	Av. len (cm)	Av wt (kg)	SOP (tons)
4					1	35.88	0.367	0.4
5					23	38.51	0.466	10.7
6					135	41.63	0.599	80.9
7	29	48.94	1.009	29.3	540	46.49	0.859	463.9
8	103	53.88	1.381	142.2	385	52.07	1.240	477.4
9	171	58.39	1.794	306.8	152	58.09	1.764	268.1
10	111	63.69	2.377	263.8	75	63.61	2.366	177.5
11	68	68.70	3.037	206.5	43	68.45	3.004	129.2
12	71	73.62	3.807	270.3	26	72.56	3.634	94.5
13	87	79.02	4.803	417.9	10	77.00	4.431	44.3
14	50	82.24	5.464	273.2	3	82.17	5.441	16.3
15	31	88.10	6.834	211.9	1	88.27	6.899	6.9
16	16	92.78	8.091	129.5	1	91.49	7.706	7.7
17	7	96.58	9.211	64.5	1	92.50	7.977	8.0
18	1	100.94	10.611	10.6				
19	1	104.11	11.736	11.7				
Totals	746			**2338**	1396			**1786**

Sampling only available from LL catches, applied to LL+GN catches.
Data from Canadian 1999 fishery in 0AB. LL catch =399 t, GN catch =1990 tons, OT catch =1871 (0AB).
Totals not adjusted for revision of 1999 catch to 4567 tons at June 2000 meeting.

Table 3. A) Catch-at-Age B) mean weight-at-age C) sum of products, for Greenland Halibut in Subarea O (mainly Div. OB)
Total catch at age for 1994, 1996, and 1999 revised to reflect change in reported catch for these years.

A) Revised Catch-at-Age (000's)

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

B) Weight- at Age (kg)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1												
2												
3											0.173	
4					0.196	0.175	0.228		0.269	0.241	0.337	0.367
5			0.376	0.356	0.333	0.302	0.406	0.358	0.351	0.359	0.450	0.466
6			0.562	0.554	0.572	0.526	0.559	0.568	0.537	0.547	0.630	0.599
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
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
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
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
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
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
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
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
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
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
17	10.772		12.804		11.951		10.006	9.937	8.694	8.641		9.104
18							6.655					10.611
19												11.736

C) Sum of products (t)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

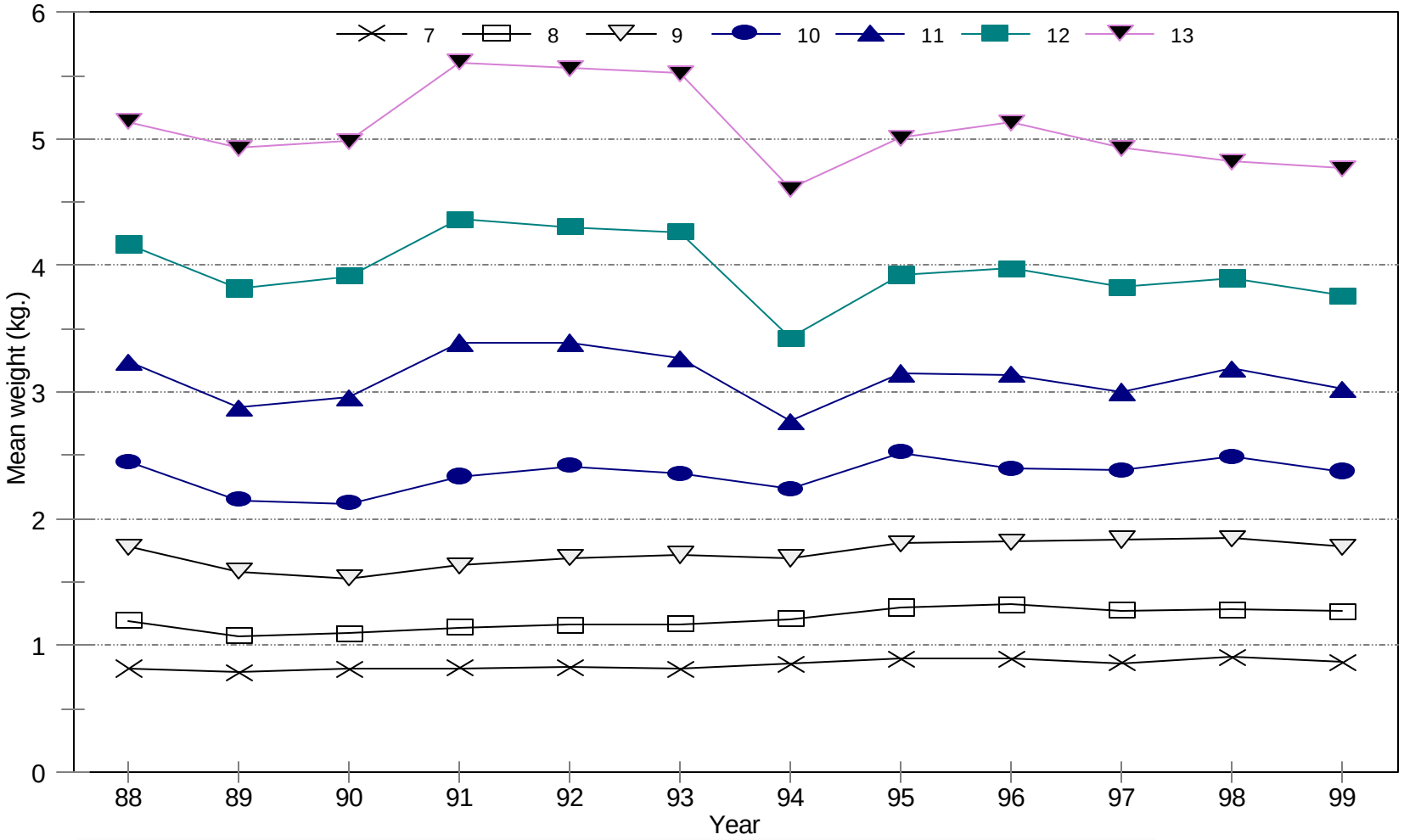

Fig. 1. Mean weights at age of G.halibut caught in the commercial fishery in Subarea 0.

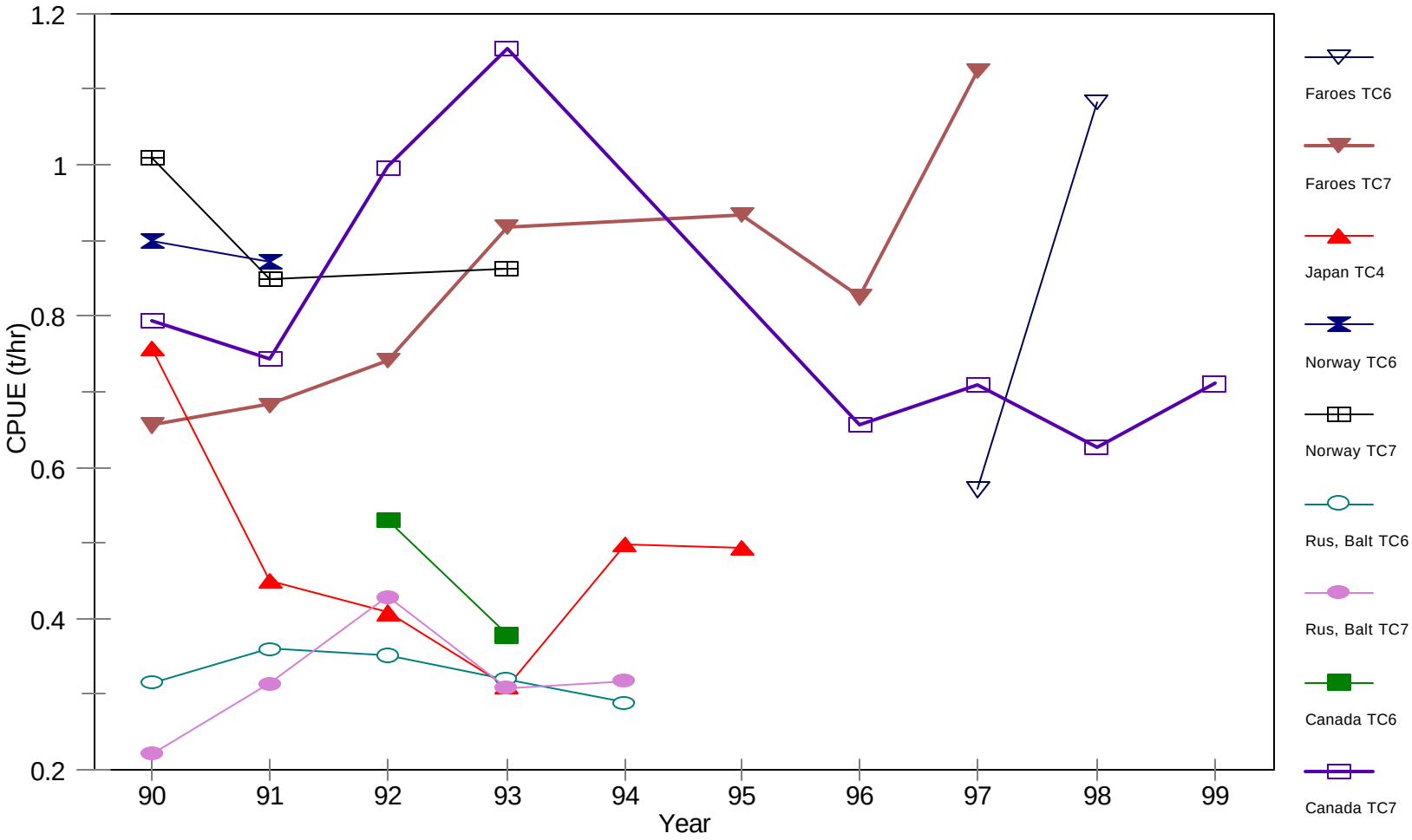

Fig. 2. CPUE data (unstandardized) from various fleets fishing for G.halibut in Subarea 0, 1990-99.