

Northwest Atlantic



Fisheries Organization

Serial No. N2579

NAFO SCR Doc. 95/64

SCIENTIFIC COUNCIL MEETING - JUNE 1995

An Assessment of the Greenland Halibut Resource in  
NAFO Subarea 2 and Divisions 3KLMN

by

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Catch History and TACs

The fishery for Greenland halibut in Subarea 2 and Div. 3KLMN began in the early-1960s using synthetic gillnets in the deepwater bays of eastern Newfoundland particularly Trinity Bay. As catches declined here, the effort moved northward to Bonavista Bay, then Notre Dame Bay and finally White Bay on Newfoundland's northeast coast. Subsequently, vessels moved more offshore to the deep channels running between the shallow fishing banks. Catches increased from fairly low levels in the early-1960s to over 36,000 tons by 1969 and ranged from 24,000 tons to 39,000 tons over the next 15 years (Fig. 1). From 1986 to 1989, catches exceeded 20,000 tons only in 1987 (Table 1; Fig. 1). In 1990, a high effort fishery for Greenland halibut developed in the deepwater area of the NAFO Regulatory area near the boundary of Div. 3L and Div. 3M in areas known as the Sackville Spur and the Flemish Pass. The development of this fishery quickly resulted in increased catches to about 47,000 tons in 1990. It was estimated that the catch in 1991 was at least as high as 55,000 tons (Table 1; Fig. 1 and 2) although some estimates put the catch at nearer 75,000 tons. Catches during 1992 and 1993 remained high and were estimated to be about 63,000 and 62,000 tons, respectively. Best estimates of catch suggested a decline to about 48,000 tons during 1994 although some estimates ranged as high as 56,000 tons. The major participants in this fishery have been EU/Spain and EU/Portugal, as well as a variety of non NAFO-member countries such as Panama although by 1994, more than 80% of the catch is estimated to have been caught by EU (Spain) alone. Catches listed as "Subarea 3 Outside" in Table 1 include all non-Canadian catches during recent years and are illustrated in Fig. 2 for comparison with traditional fishing areas of Subarea 2 and 3 inside the Canadian zone.

Up until 1990, Canada, USSR, GDR, and Poland were usually the main participants in the fishery, although Portugal and Japan had become increasingly involved in the fishery since 1984.

Canadian catches have been taken mostly by gillnet with a significant proportion taken by otter trawlers. With the exception of 1987, catches have been declining steadily inside the Canadian zone since the early 1980's from a high of 30,000 tons to less than 3,000 tons by 1994. This declining trend was a result of reduced catch rates, low prices and multi-licensed vessels fishing other species that offered a better return on costs.

The traditional gillnet fishery has been conducted by relatively small vessels (<20 m) fishing in the deepwater channels near the Newfoundland and Labrador coast as well as the Newfoundland east coast deepwater bays. However, this component of the fishery has declined rapidly in recent years and has now virtually collapsed due to very low abundance of fishable stock in traditional areas. The Canadian gillnet catches taken during recent years are from a newly developed fishery along the deep edge of the continental slope especially in Div. 3KL and Div. 2G although some catches are also taken in Div. 2H and 2J (Table 1).

Canadian otter trawl catches peaked at about 8,000 tons in 1982, declined to less than 1,000 tons in 1988, then increased to about 7,400 tons in 1991 which is the highest level since 1982. In 1992, otter trawl catches were less than half that of 1991 due to low catch rates. The catch in 1993 was just over 1,500 tons and by 1994 was less than 600 tons. Catch rates were very poor due to the low abundance of fish larger than 45 cm.

The TAC for this resource in Subarea 2 and Div. 3KL only, increased from 35,000 tons in 1980 to 55,000 tons in 1981-84, 75,000 tons in 1985, and 100,000 tons in 1986-89 (Fig. 1). These increases in TACs were the result of research vessel survey estimates of stock biomass (in excess of 400,000 tons) which indicated both high levels of fishable biomass as well as prospects of several better than average recruiting year-classes. After observing an estimated reduction in stock biomass from the late-1970s to the late-1980s in Subarea 2 and Div. 3KL of about 50%, the TAC was reduced to 50,000 tons in 1990 and this level was maintained to 1993 despite the substantive declines in stock size throughout the normal range of observed historical stock distribution. Although the Scientific Council, in its deliberations during June 1993, could not advise an appropriate catch level for 1994 the TAC was reduced to 25,000 tons by Canada in Subarea 2 and Divisions 3KL in consideration of low levels of stock size estimated for the area. It was intended that this catch should include all catches in the area of Subarea 2 and 3 for conservation purposes.

In 1994, management responsibility of Greenland halibut in Subarea 2 and Div. 3KLMN was accepted by the NAFO Fisheries Commission which imposed a TAC of 27,000 tons for 1995.

### **Commercial Fishery Data**

#### **i) Catch and effort**

A detailed analysis of all available catch and effort data from both the inshore and offshore gillnet fisheries and offshore trawlers has been undertaken and is presented in another document (this meeting).

#### **ii) Catch-at-age and mean weights-at-age**

Sampling data from the catches of Canada in 1994 were not processed in time to be available for this meeting.

Due to uncertainty regarding catch information on fisheries in the Regulatory Area, catch-at-age for Canadian catch only were calculated for 1988-93 for the purpose of this document. Catch numbers-at-age and catch weights-at-age (kg) for these data are presented in Tables 2 and 3. The data prior to 1989 represent the entire annual fishery (Tables 4 and 5).

Ages 6-8 dominated the catch in most years up to 1991 (Table 2 and 4), which is typical of the traditional Canadian catch. Although the Canadian catch was much lower in 1992 and 1993 than in previous years, there were significant increases in the proportions of older fish (ages 9-13) (Table 2) in the catch. This is due to a considerable change in the fishing pattern with exploitation of Greenland halibut now mainly in the deepwater along the continental slope by gillnetters using a 200 mm mesh size in depths greater than 1000 m compared to a 130-190 mm mesh size at depths of less than 500 m. Although data were not available for the Canadian fishery in 1994, the fishery was conducted in a similar manner as that in 1992 and 1993 predominated by the same NAFO divisions (Table 1).

### **Research Vessel Surveys**

#### **i) Biomass and abundance indices**

Biomass estimates from Canadian stratified-random groundfish surveys in autumn in Div. 2J for 1977-92 are presented in Table 6. Due to a revision of the stratification scheme in 1993 strata are not directly comparable, therefore, the results for Div. 2J in 1993-94 are presented separately in Table 7. Similarly, the biomass estimates for Div. 3K during 1978-92 and 1993-94 are shown in Tables 8 and 9, respectively. Biomass indices from autumn surveys in Div. 3L, during 1981-94 are detailed in Table 10. In all cases the total annual biomass estimates are accompanied by 95% confidence limits. Annual biomass estimates are also illustrated by division separately in Fig. 3 and cumulatively for Div. 2J, 3K and 3L in Fig. 4.

It should be noted that in Div. 2J and 3K, the strata from 1001-1500 m were rarely surveyed and thus were not included in the indices. In Div. 3L, the deepest strata are only 732 m, and these areas were not surveyed in all years. No Canadian survey data are available in Div. 2GH since those presented in Brodie and Baird (1992).

Cumulative abundance indices at age from Div. 2J, 3K and 3L are provided in Table 11 and illustrated by year in Fig. 5. A summary of annual abundance by various age groups i.e. Ages 1+; Ages 3-5; Ages 6-9; Ages 10+ are also shown in Fig. 5. Although there were no surveys in the fall of 1978-80 in Div. 3L estimates of abundance were obtained for these years by averaging estimates from spring surveys of adjacent years.

Biomass indices of Greenland halibut have been declining in Div. 2J since 1982 from a level of over 100,000 tons to less than 9,000 tons by 1992 (Table 6; Fig. 3 and 4). There was a slight increase in 1993 to near that of 1991 (Table 7) but still at a very low level. The 1994 estimate is similar to that of the previous year (Table 7). The biomass index in Div. 3K peaked at 112,000 tons in 1984 but by 1987 biomass in this division also began a steep decline similar to Div. 2J and reached a low of just over 20,000 tons in 1992 (Table 8; Fig. 3 and 4). In 1993, there was a similar proportional increase in biomass as in Div. 2J to a level slightly lower than that of 1991. The 1994 survey, however, estimated the biomass to be at the same level as indicated for 1992 which is the lowest in the time series (Table 9). Estimates for Div. 3L to a depth of 366 meters were relatively stable from 1981 to 1990 at about 15,000 tons (Table 10; Fig. 3 and 4). Between 1990 and 1991, the biomass index fell from nearly 17,000 tons to 7,300 tons and further to 6,700 tons in 1992 despite the fact that survey coverage in 1991-92 was complete to depths of more than 720 meters. Unlike the divisions to the north the biomass estimate in Div. 3L in 1993 declined from that of 1992 to a level near half the 1991 and 1992 estimates and is the lowest during the period. The 1994 estimate continues to be low and is within a 10% variation of the 1993 estimate (Table 10).

The cumulative biomass index for all three divisions (Fig. 4) has steadily declined from a high of over 200,000 tons in 1984 to 37,000 tons in 1992 by far the lowest in the time series. Although the overall index increased to nearly 50,000 tons in 1993, the 1994 estimate returned to the 1992 level of 37,000 tons (Fig. 4).

Declines in abundance are less apparent than indicated by the biomass indices due to the fact that the declines are not consistent across all age classes (Table 11; Fig. 5 and 6). An examination of the age structure in Fig. 5 and 6 shows that the ages 6-9 abundance has been declining possibly since the mid 1980's but very dramatically since 1990 and by 1993 and again in 1994 the age 6-9 abundance is far below anything ever observed. It is now at a level of about one third of that estimated in 1992 and less than 10% of the 1982-90 average. Age 10+ has been declining since the early 1980's and in 1993 and 1994 had virtually disappeared from the survey catches. On the other hand, ages 3-5 were slowly increasing from the early 1980's to about 1989. From 1989 to 1992, however, these age groups also declined to a relatively low level at less than half the 1988 estimate. The index for these ages increased sharply in 1993 to the second highest in the time series and was maintained at a relatively high level in the 1994 survey (Fig. 5).

#### ii) Recruitment indices and year-class strengths

In order to better examine strengths of recruiting year-classes the trends in the abundance indices for individual ages 1-5, inclusive from fall surveys in Div. 2J and 3K combined are presented in Fig. 7 with 95% confidence limits. In addition, trends in individual ages 2-10 from Table 11 are presented in Fig 8 to compare pre-recruiting age groups with the major age groups comprising the commercial fishery.

There would appear to be little useful information in the estimates at age 1 as they are poorly recruited to even the survey trawl, show little in the way of trends and have relatively high confidence limits (Fig. 7).

At age 2 the estimates for most years are much more stable with tighter confidence limits. The 1991 year-class estimate at age 2 is significantly larger than any other in the time series with the 1992 year-class also estimated to be larger than any in the previous 10 years although to a much lesser degree than that of the 1991 year-class. The 1990 year-class estimate appears about average but variable (Fig. 7).

At age 3 the 1990 year-class estimate is significantly larger than any other in the time series by a wide margin despite the fact that it only appeared average at age 2 above. The 1991

year-class was also larger than anything previously estimated at age 3 although much smaller relatively than that of the 1990 year-class (Fig. 7).

At age 4, the 1970's year-classes all appear to be weaker than those of the mid to late 1980's. The 1990 year-class is estimated to be similar in strength to those year-classes at the higher end of the range of estimates (Fig. 7).

At age 5 the trend is similar to age 4 up about the 1990 survey year beyond which all estimates at this age declined considerably to the point that the most recent three estimates are below anything that has been observed in previous years (Fig. 7).

The major commercial age groups (ages 6-10) have been declining at rapid rates individually for a number of years (Fig. 8). For ages 5, 6 and 7, trends in abundance were rather stable until about 1990 when steep declines occurred. For ages 8, 9 and 10, however, the declines appear to have begun at some earlier time probably about the mid to late 1980's.

It has been hypothesized that the very steep declining trend in the stock component in at least Div. 2J and 3K, is a result of a migration southeast to the Flemish Pass area. This occurred at a time that is coincident with the build up of considerable fishing effort and subsequently, very high catch levels which have now depleted the stock of larger, older fish. While the number of larger, older fish remains low according to current survey data, there continues to be indications of average to better than average 'pre-recruit' year-classes similar to those observed in the previous assessment.

Given the observation above with respect to the diverging abundance pattern between ages 4 and 5 since 1990, the ratio of the same year classes at these ages is presented in Figure 9. Generally, the average ratio is between 1.25 and 1.6 from 1978-88 indicating that Greenland halibut at age 4 are not fully recruited to the survey gear. From 1988-90 the ratio dropped substantially to about 0.5 in 1990 and remained at that level to 1994. It is suggested that between 1988 and 1990 a significant change occurred in migration and/or mortality and the pattern remained to the present. It may be hypothesized that recruits migrate from the survey area in the north in abundance and this migration occurs between ages 4 and 5 and probably move to the Regulatory Area.

**iii) Combined abundance-at-age**

In order to derive a more complete abundance index at age from the data available, the survey catch at age from the fall surveys in Div. 2J and 3KL for 1991 and 1993-94 is combined with the catch data age from the deepwater surveys in Div. 3KLM in 1991 and 1994-95 (appropriately lagged) and presented in Figure 10. With the exception of Div. 2J the figures represent estimates to a maximum depth of 1500 meters. The maximum depth for Div. 2J is 1000 meters. Estimates for commonly surveyed areas are not included to avoid double counting.

The results indicate that the area surveyed during the regular fall surveys account for most of the estimates at all ages (Fig. 10). It also suggests that there has been an overall decline in the abundance between 1993 and 1994 (fall equivalent). However, in both years the 1990 and 1991 year classes comprise most of the observed abundance.

Table 1. Catches of Greenland halibut in the Northwest Atlantic by division and selected areas from 1977-94.

Year	Div. 2C	Div. 2H	Div. 2J	Div. 3K	Div. 3L	Total	Subarea 3	Overall
					Inside	Inside	Outside	Total
1977	1778	1524	8237	13446	6956	31941	-	31941
1978	1899	1207	3723	24107	7596	38532	-	38532
1979	577	1623	3415	19843	8610	34068	-	34068
1980	36	444	1466	17923	12773	32642	-	32642
1981	1799	2141	1358	16472	8912	30682	-	30682
1982	369	8985	5931	6794	4135	26214	-	26214
1983	111	5671	6028	11374	4655	27839	-	27839
1984	214	4663	6368	8432	5120	24797	1900	26697
1985	193	2358	6724	5775	3061	18111	2200	20311
1986	455	1564	6823	4237	2794	15873	2100	17973
1987	2700	2631	12464	6860	4786	29441	3000	32441
1988	2068	2463	1971	6389	2019	14910	3500	18410
1989	837	1821	2952	7840	2860	16310	2600	18910
1990	905	1158	2911	4952	2020	11946	35500	47446
1991	1556	2591	3034	2019	1590	10790	54200	64990
1992	1264	107	382	3489	1694	6936	56225	63161
1993	961	426	159	2186	943	4675	57550	62225
1994	1045	196	203	1031	257	2935	44570	47505

Note: catches in Subarea 2, 3K and 3L inside for 1992-94 are Canadian only.  
 Catches in Subarea 3 outside include estimates of non-reported catches.  
 1994 Inside includes 203 tons from Div. 3NO

Table 2. Catch at age (000) of Greenland halibut from the Canadian fishery in SA 2 + 3 from 1988 - 1993.

Age	1988	1989	1990	1991	1992	1993
5	41	166	148	159	18	33
6	2124	1878	2979	1684	255	281
7	5429	7076	6706	4348	1319	847
8	1659	3568	1813	2121	840	411
9	404	597	300	900	359	190
10	130	90	78	295	316	169
11	25	19	34	89	268	173
12	10	4	21	80	234	192
13	2	2	11	21	119	107
14	2	1	13	21	70	54
15	1	1	9	4	36	31
16	1	1	2	1	8	12
17	0	1	1	1	4	2
5+	9828	13404	12115	9724	3846	2502

Table 3. Weight at age (kg) of Greenland halibut from the Canadian fishery in SA 2 + 3 from 1988 - 1993.

Age	1988	1989	1990	1991	1992	1993
5	0.397	0.403	0.416	0.410	0.386	0.398
6	0.583	0.561	0.587	0.596	0.560	0.580
7	0.801	0.765	0.754	0.808	0.797	0.814
8	1.157	1.065	1.052	1.179	1.252	1.196
9	1.640	1.619	1.542	1.736	1.937	1.815
10	2.240	2.201	2.116	2.404	2.544	2.445
11	2.837	2.980	2.850	3.078	3.169	3.064
12	3.593	3.981	3.632	3.821	3.942	3.984
13	4.456	4.455	4.524	5.294	5.111	5.120
14	5.512	5.623	5.567	5.940	6.220	6.091
15	6.821	6.962	6.906	6.674	7.194	7.125
16	7.782	7.547	8.546	9.001	8.290	8.462
17	0.000	9.659	9.601	9.659	10.623	9.763

Table 4. Commercial Greenland halibut catch at age matrix for Subarea 2 and Div. 3KL, 1975-88.

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	322	19	464	3016	2182	204	810	236	766	858	1662	245	128	269
6	2719	680	4351	8511	7980	2032	4242	2020	3889	2211	4449	1958	1779	2900
7	5547	3600	9374	9072	11726	8913	9209	5552	10714	5560	4955	5604	10293	7405
8	4781	6030	6377	7662	5611	9429	10753	5064	8215	7308	2933	4450	8358	3986
9	3821	4199	2546	2898	1069	5258	4045	3112	2509	3888	1156	1284	2652	1172
10	1628	2457	879	1454	440	3729	836	1480	756	1198	429	412	798	423
11	677	923	191	731	262	987	240	524	229	387	133	213	359	183
12	130	290	113	371	136	125	133	225	83	136	83	122	263	96
13	269	113	101	225	131	52	40	143	116	101	73	61	210	97
14	131	36	26	110	84	14	27	70	93	55	40	49	157	56
15	63	21	18	58	76	9	20	55	74	73	18	32	99	48
16	41	1	22	54	56	2	13	29	10	28	12	20	53	11
17	43	1	7	39	44	1	5	14	14	18	2	1	17	2
5+	20172	18370	24469	34201	29797	30755	30373	18524	27468	21821	15945	14451	25166	16648

Table 5. Commercial Greenland halibut mean weights at age (kg) for Subarea 2 and Div. 3KL, 1975-88.

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	0.609	0.609	0.609	0.609	0.609	0.514	0.392	0.525	0.412	0.377	0.568	0.350	0.364	0.363
6	0.760	0.760	0.760	0.760	0.760	0.659	0.598	0.684	0.629	0.583	0.749	0.584	0.589	0.569
7	0.955	0.955	0.955	0.955	0.955	0.869	0.789	0.891	0.861	0.826	0.941	0.811	0.836	0.805
8	1.190	1.190	1.190	1.190	1.190	1.050	0.985	1.130	1.180	1.100	1.240	1.100	1.160	1.163
9	1.580	1.580	1.580	1.580	1.580	1.150	1.240	1.400	1.650	1.460	1.690	1.580	1.590	1.661
10	2.210	2.210	2.210	2.210	2.210	1.260	1.700	1.790	2.230	1.940	2.240	2.120	2.130	2.216
11	2.700	2.700	2.700	2.700	2.700	1.570	2.460	2.380	3.010	2.630	2.950	2.890	2.820	3.007
12	3.370	3.370	3.370	3.370	3.370	2.710	3.510	3.470	3.960	3.490	3.710	3.890	3.600	3.925
13	3.880	3.880	3.880	3.880	3.880	3.120	4.790	4.510	5.060	4.490	4.850	4.950	4.630	5.091
14	4.560	4.560	4.560	4.560	4.560	4.420	5.940	5.850	6.060	5.730	6.130	6.090	5.480	6.203
15	5.920	5.920	5.920	5.920	5.920	5.040	8.060	7.530	7.310	6.850	7.160	7.640	6.670	7.644
16	7.140	7.140	7.140	7.140	7.140	7.020	8.710	8.680	8.600	8.330	8.920	9.810	7.850	9.187
17	7.890	7.890	7.890	7.890	7.890	10.100	9.580	11.500	11.300	9.570	11.800	10.100	9.840	11.444

Table 6. Biomass (tons) of Greenland halibut per stratum from fall surveys in Division 2J from 1977-92.

Stratum	Depth (m)	Area	Units	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
206	101-200	2582	194	4031	1508	1572	1959	7206	3628	1686	2105	861	781	79	345	126	182	23	37
207		2246	169	1312	4306	4752	1163	3072	1742	1290	1055	368	204	44	8	7	0	0	0
201		1427	107	778	146	48	303	289	1036	398	517	44	105	20	9	86	57	6	0
205		1823	137	2870	900	1397	513	2044	3297	1950	954	197	152	48	144	53	41	48	8
Total				20790	6860	4769	3939	12612	9702	5324	4631	1469	1242	192	506	272	280	78	45
215	201-300	1270	95	3592	2100	678	1764	1173	3649	1378	4004	1545	1415	1132	859	514	671	324	251
234		508	38	1870	3757	2487	3012	1983	3737	1781	3459	699	486	197	772	388	187	111	70
228		1428	107	700	235	899	1972	858	992	1107	1769	682	1116	566	279	565	914	228	159
214		1171	88	3425	4235	1935	1354	5283	7411	3923	5874	779	1208	525	1941	525	447	68	105
202		440	33	705	541	727	958	1139	1503	1016	3063	332	281	587	16	16	111	70	43
210		774	58	1128	512	554	627	290	1213	2411	1562	302	213	232	458	393	687	138	137
213		1725	129	2131	1704	1242	2970	3798	4427	3011	2654	4639	2546	1442	757	304	293	32	79
209		1608	121	7876	2657	10675	12644	6720	15648	6370	4517	4161	1650	1032	1354	1241	990	304	223
Total				21427	15741	19196	25302	21243	38580	28997	26280	18234	8485	6095	6420	3945	4301	1276	1067
208	301-400	448	34	6260	4909	3051	5032	8096	11725	3699	16686	13658	6377	3462	2825	6785	5749	1240	697
229		567	43	1661	613	1014	1091	1298	915	1553	468	553	624	252	137	131	96	301	389
203		440	36	1137	1444	2354	761	1874	2318	8173	6459	901	3889	1003	1225	3242	877	1109	201
222		481	33	3817	2136	2539	2992	1846	6223	4353	916	1126	74	1092	1374	265	471	32	71
211		330	25	866	2113	1164	1804	886	1381	3338	1381	4062	2550	1102	2019	578	3749	440	145
216		384	29	2964	4202	5228	5369	1823	6205	2959	4987	2356	998	1474	101	362	228	89	90
Total				16705	15417	15348	17048	15822	28767	24076	30896	22657	14514	8384	7681	11362	11169	3211	1593
227	401-500	686	51	5938	4473	1415	3798	2240	2827	1983	1888	1912	1064	1891	1648	2697	2103	658	1014
217		268	20	2856	3385	1753	3138	825	1172	1298	1537	2917	2187	834	880	121	645	87	69
223		180	14	3398	1146	864	1838	1280	1189	834	1537	1084	1715	284	858	213	317	41	45
204		354	27	4669	12879	6918	-	4531	7547	6665	6909	438	7104	3893	4411	15073	3326	1490	988
235		420	32	3707	3375	2648	4035	1230	2827	7961	2585	2680	5762	3742	2215	4579	5862	404	285
Total				20568	25258	13599	12809	10105	15562	18740	12919	9032	17832	10644	10012	22683	12252	2681	2402
230	501-750	237	18	4328	1436	-	3014	1072	548	1654	382	467	1819	1209	787	770	827	551	1032
212		664	50	9451	7517	11575	5159	7564	7182	2230	3530	5470	19079	18665	3751	2131	3988	1062	1336
218		420	32	6870	7508	2482	4083	4934	1261	1230	954	954	2592	1544	1844	567	1329	668	94
224		270	20	3519	1595	2482	664	2331	740	1024	760	567	4949	1286	53	53	250	134	107
Total				24168	18057	14058	12920	15701	9731	6138	4673	7458	28439	22704	7659	3520	6394	2414	2569
236	751-1000	122	9	898	-	-	-	410	611	925	485	781	2050	860	119	-	1014	1014	360
231		182	14	878	1893	-	2548	767	1281	700	1349	1636	386	526	2329	-	1704	374	465
219		213	16	1776	-	0	2548	1177	1892	1647	1834	3756	7011	2728	723	560	1502	200	130
Total				1776	1893	0	2548	1177	1892	3272	1834	3756	7011	2728	3172	560	4220	1588	954
225	1001-1250	177	13	531	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
232		236	18	869	482	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220		324	24	1399	1384	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total				1399	1866	0	0	0	0	0	0	0	0	0	0	0	0	0	0
233	1251-1500	180	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
221		268	20	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
226		180	14	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total				0	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Biomass (t)			106834	85135	66969	74565	76660	104234	78547	81234	62605	77522	50747	35450	42342	38617	11248	8630
	95% Lower			90708	62722	53867	54260	49579	82993	63918	55160	47364	47571	25957	26531	-74245	29215	8574	5267
	95% Upper			122960	107550	80071	94867	103742	125473	93175	107308	77842	107539	75986	44364	158923	48018	13925	11993

Table 7. Estimated biomass (tons) per stratum of *G. halibut* from the autumn survey of the *GADUS ATLANTICA* in Div. 2J during 1993-94. Based on the new stratification system.

Depth Range (m)	Stratum	Area (sq. nm)	Trawlable Units (000)	Biomass (t)	
				1993	1994
101-200	201	633	48	1	10
	205	1594	120	1	5
	206	1870	140	11	32
	207	2264	170	0	10
	237	733	55	0	0
	238	778	58	-	-
Total				14	58
201-300	202	621	47	1	107
	209	680	51	166	33
	210	1035	78	253	50
	213	1583	119	62	156
	214	1341	101	241	171
	215	1302	98	502	321
	228	2196	165	345	943
	234	530	40	407	59
Total				1977	1840
301-400	203	487	37	863	547
	208	588	44	433	1908
	211	251	19	573	336
	216	360	27	166	171
	222	450	34	78	199
	229	536	40	119	410
Total				2231	3570
401-500	204	288	22	975	1366
	217	241	18	143	123
	223	158	12	77	76
	227	598	45	843	913
	235	414	31	340	439
	240	133	10	43	58
Total				2421	2975
501-750	212	557	42	2732	814
	218	362	27	137	76
	224	228	17	54	165
	230	185	14	79	191
	239	120	9	556	615
Total				3559	1862
751-1000	219	283	21	429	1105
	231	186	14	406	393
	236	193	14	558	136
Total				1394	1634
1001-1250	220	303	23	-	-
	225	195	15	-	-
	232	228	17	-	-
Total				-	-
1251-1500	221	330	25	-	-
	226	201	15	-	-
	233	237	18	-	-
Total				-	-
Biomass (t)				11595	11939
95% Lower				9598	16064
95% Upper				13589	7816





Table 9. Biomass (tons) per stratum of *G. halibut* from the autumn survey of the *GADUS ATLANTICA* in Div. 3K during 1993-94.  
Based on the new stratification system.

Depth Range(m)	Area Stratum	Area (sq. nm.)	Trawl units ('000)	1993	1994
101-200	618	1347	101	0	3
	619	1753	132	0	0
Total				0	
201-300	620	2545	191	34	470
	621	2736	205	407	483
	624	1105	83	286	212
	634	1555	117	391	505
	635	1274	96	51	29
	636	1455	109	395	181
	637	1132	85	201	30
Total				1765	1909
301-400	617	593	45	1957	871
	623	494	37	496	668
	625	888	67	1005	677
	626	1113	84	1178	1564
	628	1085	81	544	642
	629	495	37	582	612
	630	332	25	430	559
	633	2067	155	1516	1145
	638	2059	155	1253	748
	639	1463	110	700	310
Total				9660	7796
401-500	622	691	52	2788	1205
	627	1255	94	10455	2425
	631	1321	99	3580	3188
	640	69	5	40	52
	645	216	16	56	72
	650	134	10	95	148
Total				17014	7090
501-750	641	230	17	228	58
	646	325	24	58	257
	651	359	27	387	468
Total				673	783
751-1000	642	418	31	1014	1423
	647	360	27	1618	1148
	652	516	39	1521	906
Total				4154	3476
1001-1250	643	733	55	-	-
	648	228	17	-	-
	653	531	40	1180	0
Total				1180	0
1251-1500	644	474	36	-	-
	649	212	16	-	-
	654	479	36	-	-
Total				-	-
Biomass (t)				34445	21057
95% Lower				29067	17763
95% Upper				39821	24352



Table 11. Abundance (000s) of Greenland halibut at age from Canadian research vessel surveys in Div. 23KL combined from 1978-94.

Age (Yrs)	1978	1979	1980	1981	1982	1983	1984	Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	2538	2805	2994	7563	2137	1004	1452	7460	13005	1491	4025	3407	547	5814	1684	7510	3581	
2	25686	22523	8911	22486	5991	5905	7148	18147	22185	8685	12436	10414	5347	6726	14858	62818	23464	
3	54708	28846	15315	30875	23771	19036	21435	20024	32997	47694	28404	35816	14506	11369	26664	97955	58363	
4	55914	25799	22680	21226	31204	31465	36094	36224	55685	35752	50345	69334	68019	37832	34313	46098	60582	
5	57650	35886	35995	34277	31061	40182	72180	44886	45213	35854	58938	77935	65410	38273	23316	18385	21864	
6	45141	38805	42154	38654	29062	34742	38931	37715	57886	33486	33956	39603	56524	48199	27416	17109	6912	4685
7	28923	18843	27942	26647	32070	38908	30683	22359	45327	33956	29733	32108	28837	9020	8406	2520	2084	
8	13379	7378	9511	11458	32617	31538	24712	12761	12676	20722	9257	9627	6828	2455	962	739	561	
9	6983	3316	4207	5281	13535	11559	10222	6293	3306	7621	2525	2884	1839	475	95	63	53	
10	5112	3179	3229	2824	5375	3040	4132	3498	1430	2156	809	675	718	231	48	0	32	
11	4257	2102	3601	2255	2801	2049	1869	1592	960	1065	542	558	488	104	13	0	11	
12	2541	1843	2393	1030	1790	1497	1216	1218	961	642	309	161	267	61	0	13	5	
13	1611	1520	1551	579	1276	1089	964	517	441	504	267	56	160	14	0	0	0	
14	476	762	858	276	1306	713	804	636	411	200	210	210	73	5	0	0	0	
15	335	493	326	155	835	306	427	330	213	151	151	151	77	0	0	0	0	
16	243	426	182	19	325	81	294	210	62	100	81	81	23	27	2	0	0	
17	130	153	53	0	51	0	140	161	0	10	38	0	0	0	0	0	0	
Ages 1+	305607	194679	181902	205605	215407	223114	249703	214031	292758	230089	237673	299672	241356	139497	127468	243013	175285	
Ages 3-5	168272	90531	73990	86378	86236	90683	129709	101134	133895	119300	137687	183085	147935	87474	84293	162438	140809	
Ages 6-9	94426	68342	83814	82040	107284	116747	101548	79128	119195	95785	81118	101143	85703	39066	26572	10234	7383	
Ages 10+	14685	10478	12193	7138	13759	8775	9846	8162	4478	4828	2407	1623	1824	417	61	13	48	

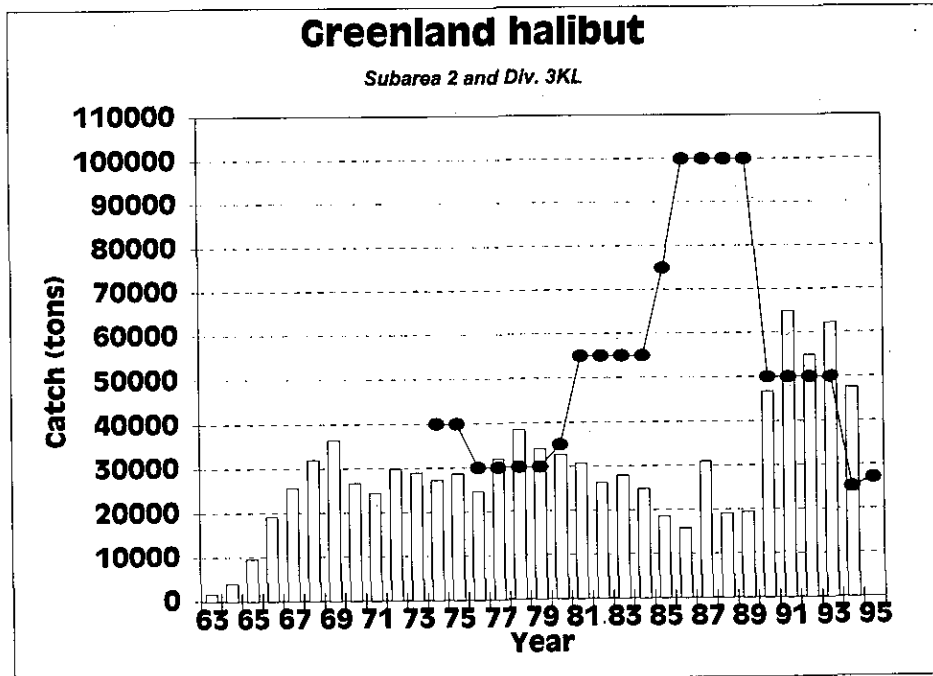


Fig. 1 Nominal catches of G. halibut in Subarea 2 and Div. 3KL from 1963-94. Recent years include Div. 3MNO.

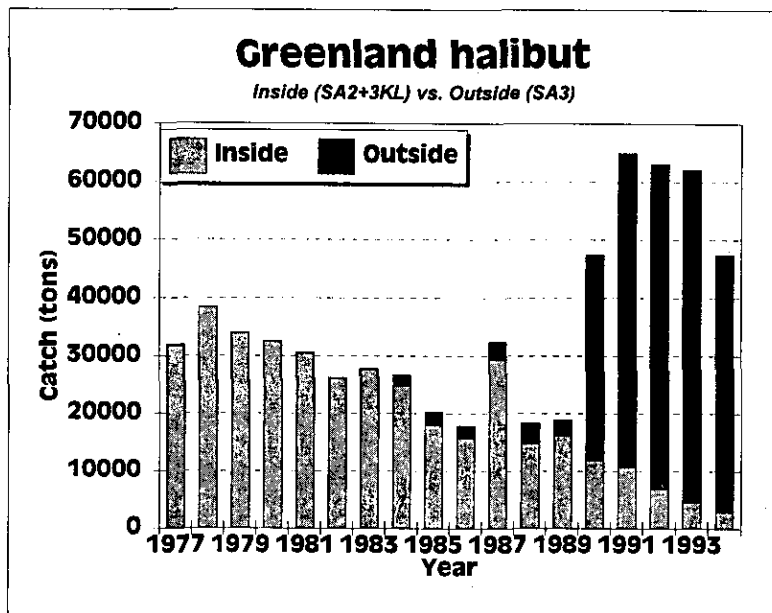


Fig. 2 Catch of G. halibut inside 200 miles for Subarea 2 + Div. 3KL compared to the catch outside 200 miles (Subarea 3) from 1977-94.

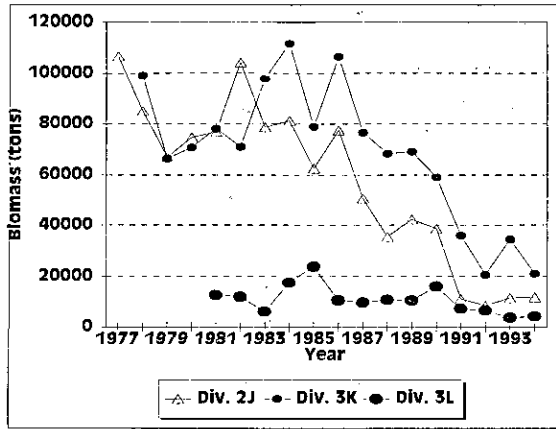


Fig. 3 G. halibut biomass estimates separately by division from research surveys in Div. 2J,3KL during 1977-94.

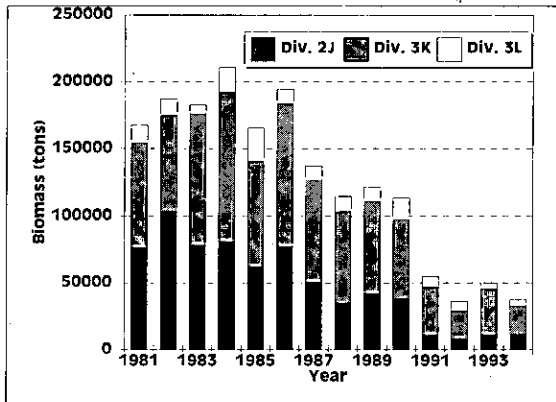


Fig. 4 G. halibut cumulative biomass estimates by division from research surveys in Div. 2J,3KL during 1981-94.

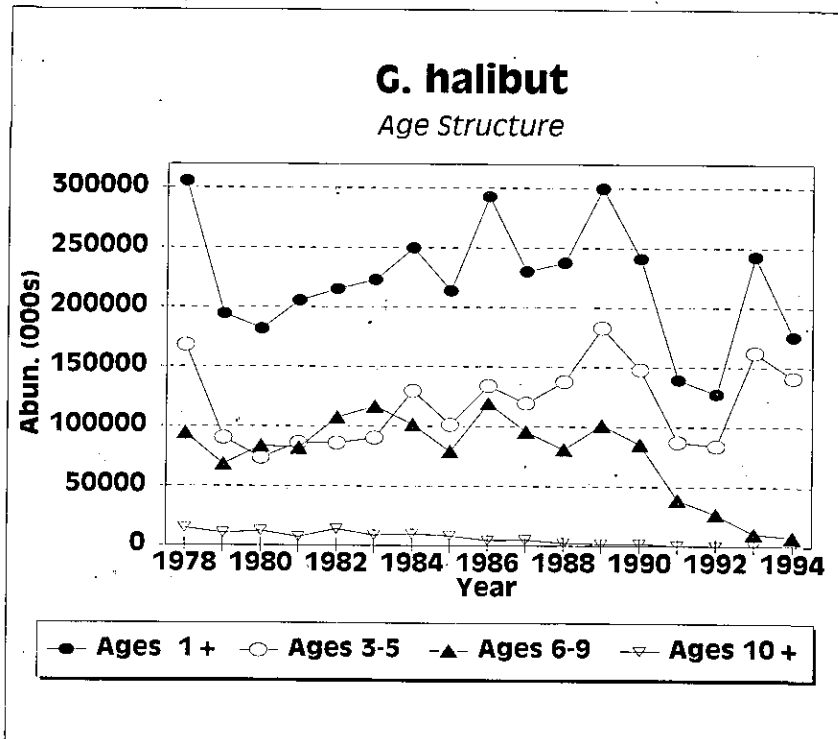


Fig. 5 Age composition of G. halibut by age range from research surveys in Div. 2J,3KL during the fall of 1978-94.

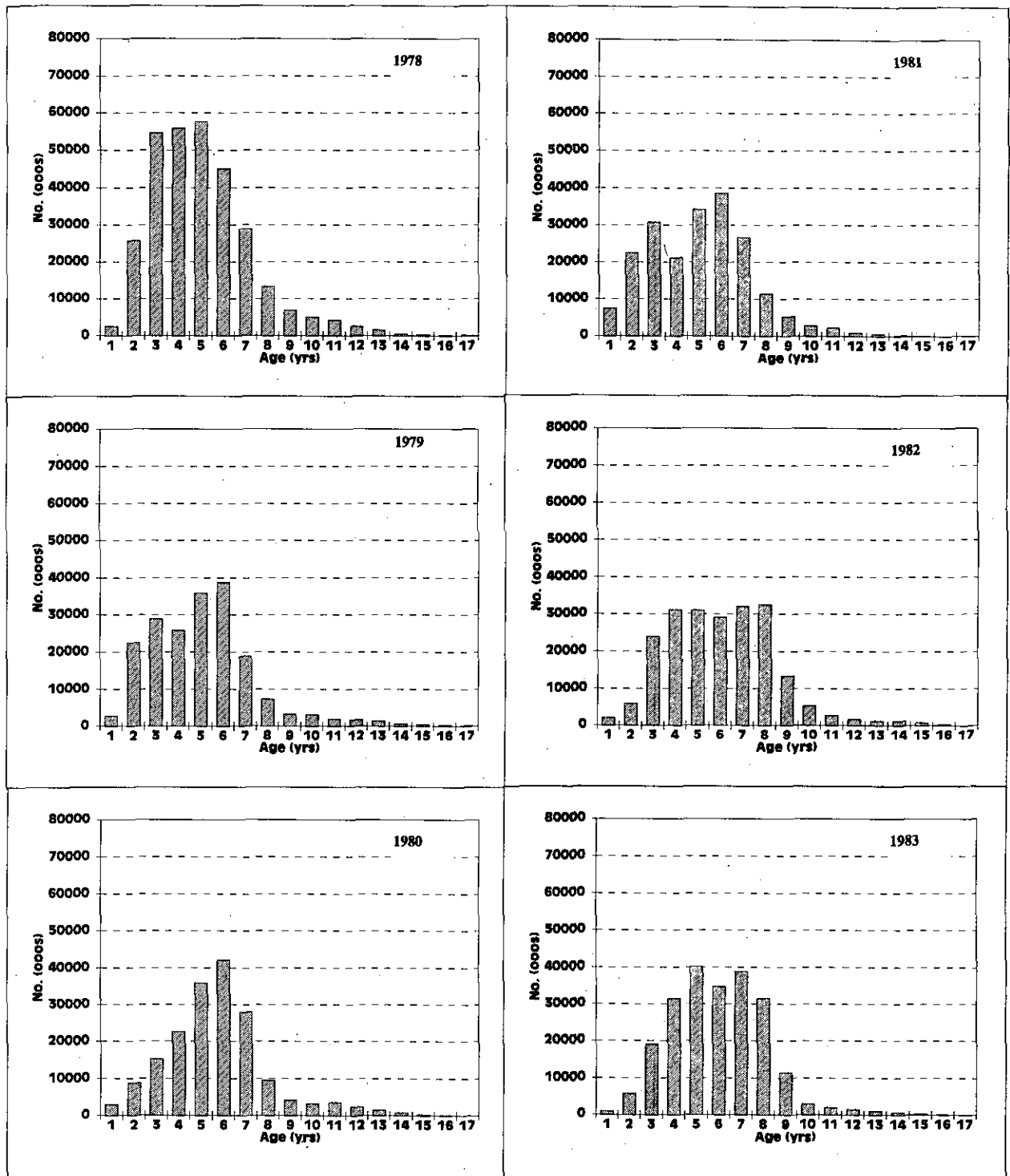


Fig. 6 Abundance estimates at age of *G. halibut* from research vessel surveys in Div. 2J,3KL from 1978-94.

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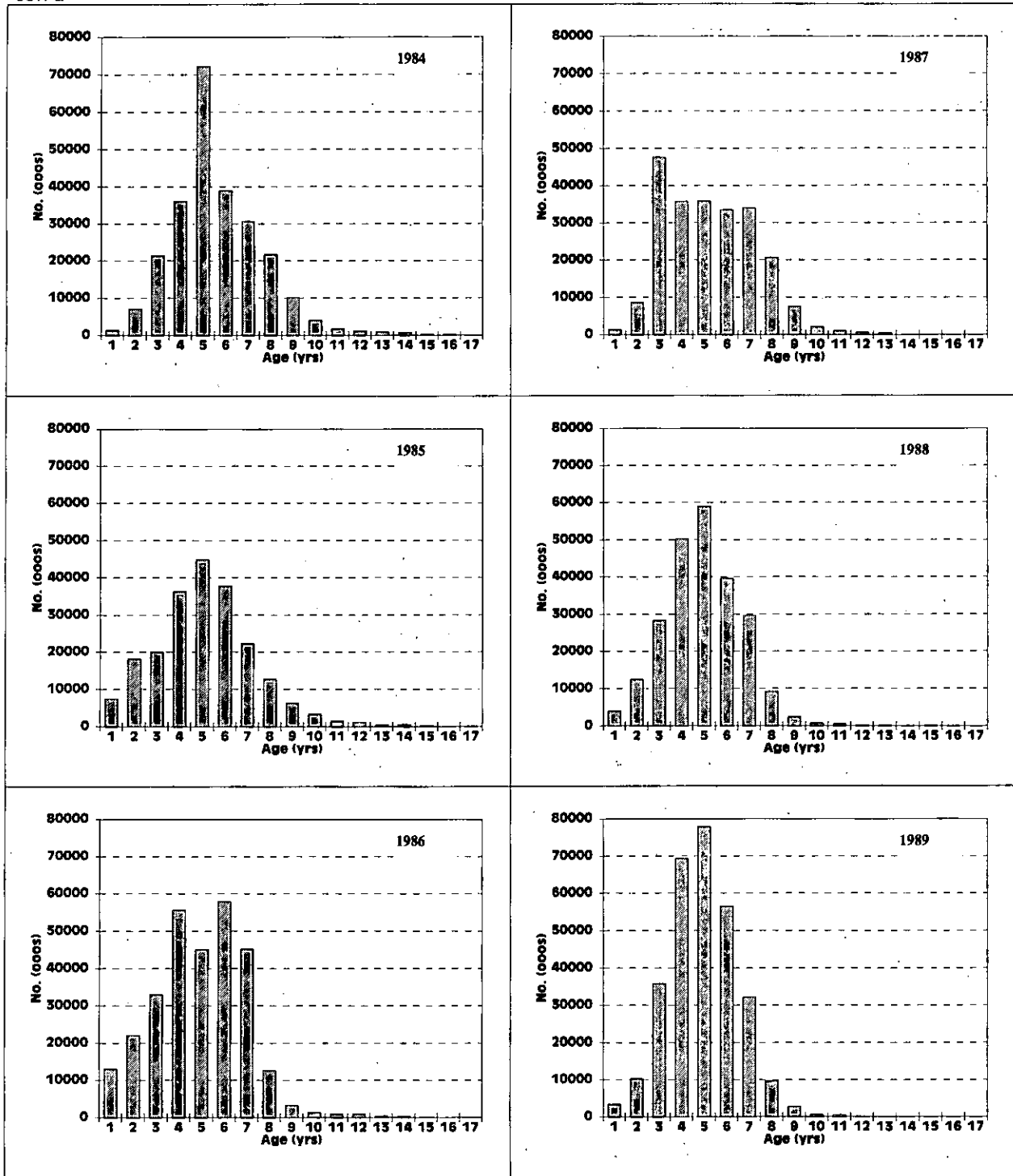


Fig. 6 Abundance estimates at age of G. halibut from research vessel surveys in Div. 2J,3KL from 1978-94.

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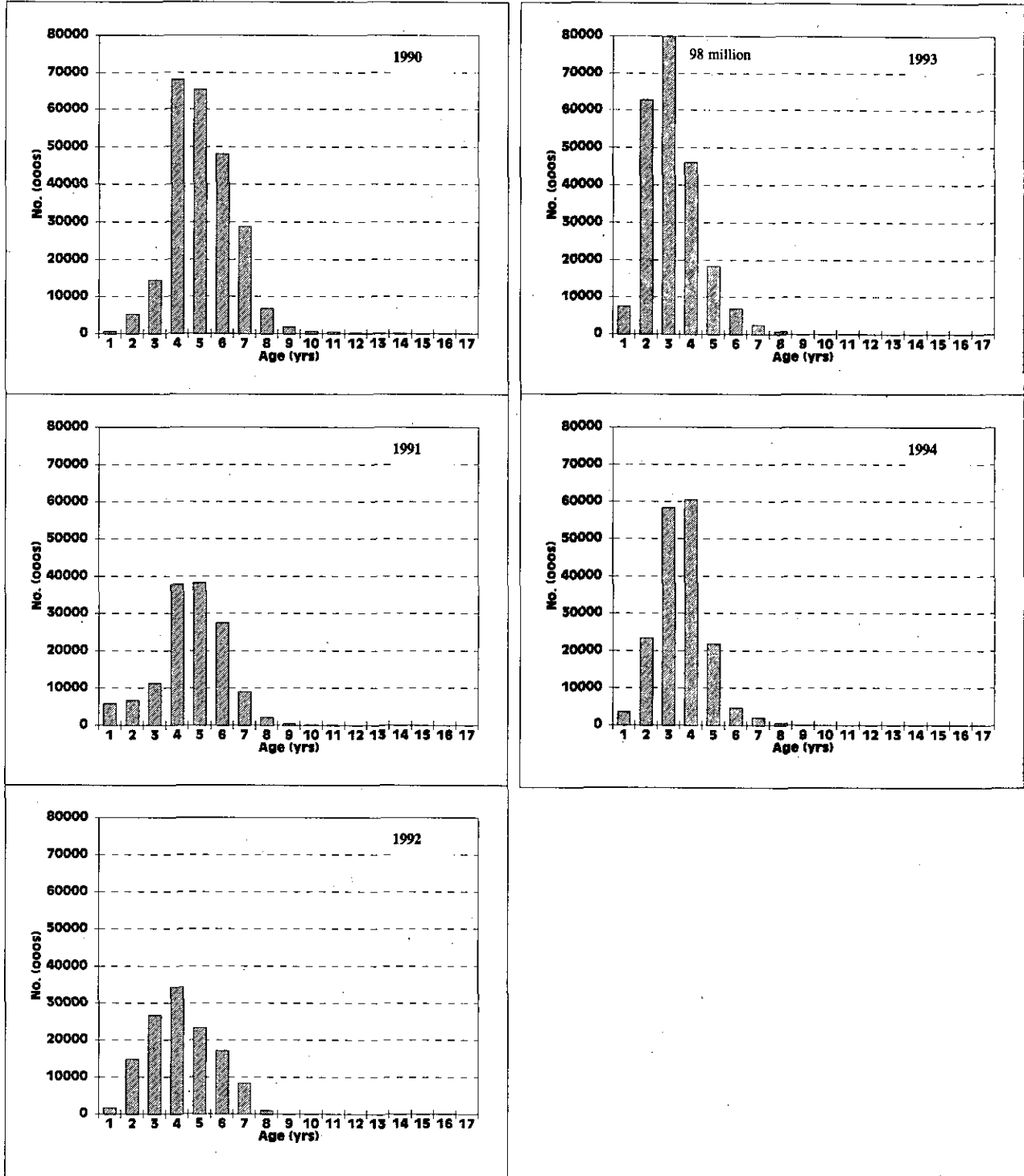


Fig. 6 Abundance estimates at age of G. hallbut from research vessel surveys in Div. 2J,3KL from 1978-94.

(Cont)



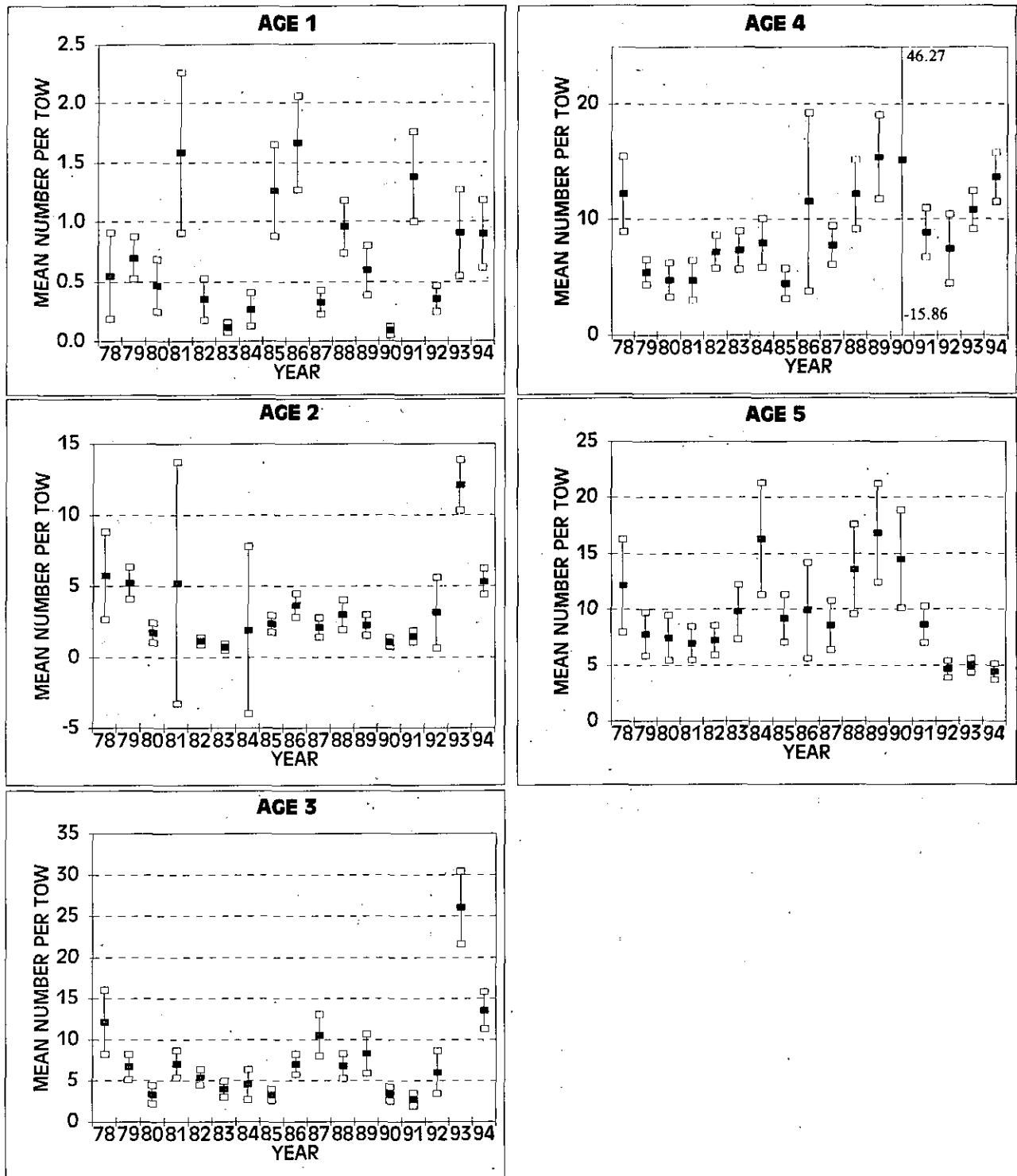


Fig. 7 Abundance indices by age (with 95% C.I.) for pre-recruit *G. halibut* ages 1-5 from research surveys in Div. 2J and 3K combined.

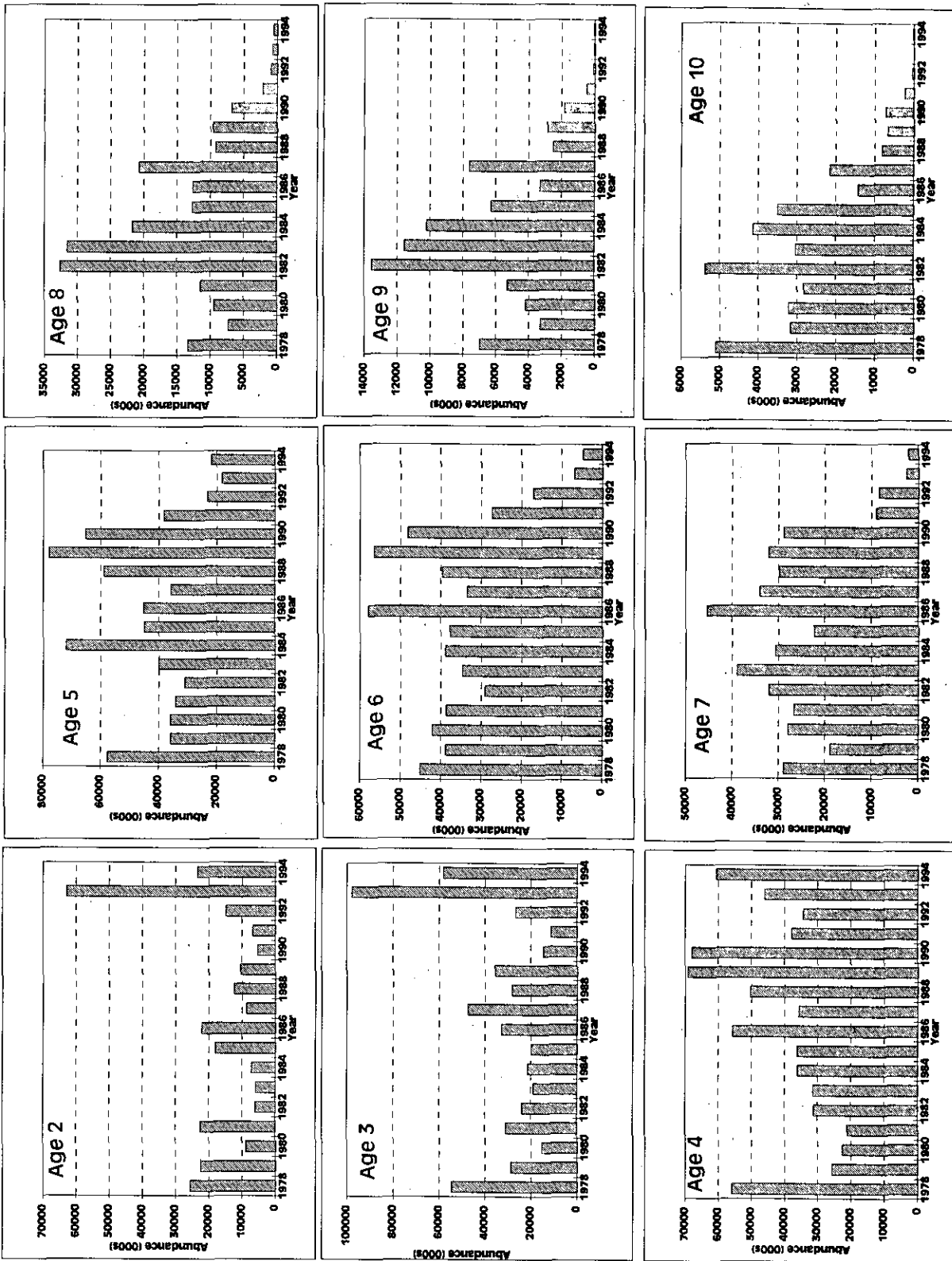


Fig. 8. Abundance of G. halibut from surveys in Div. 2J3KL at ages 2-10 separately from 1978-94.

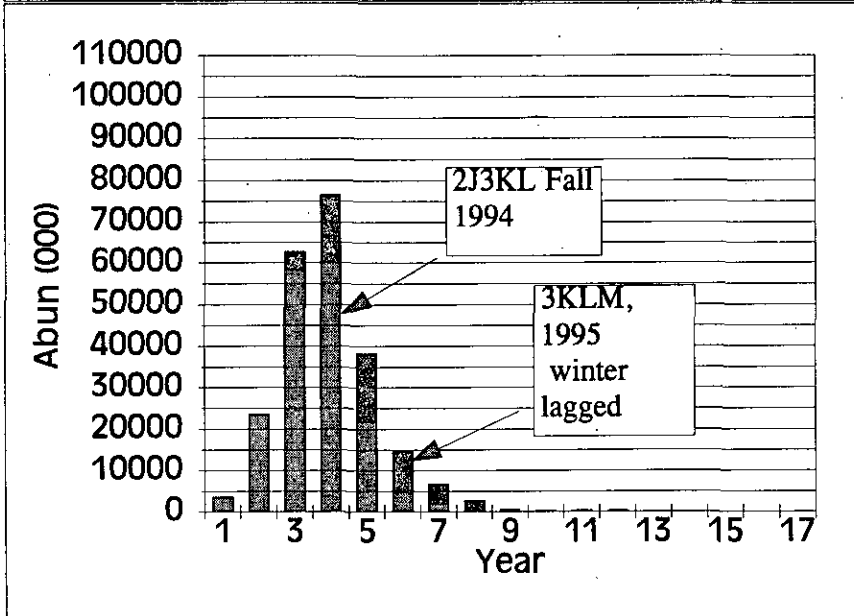
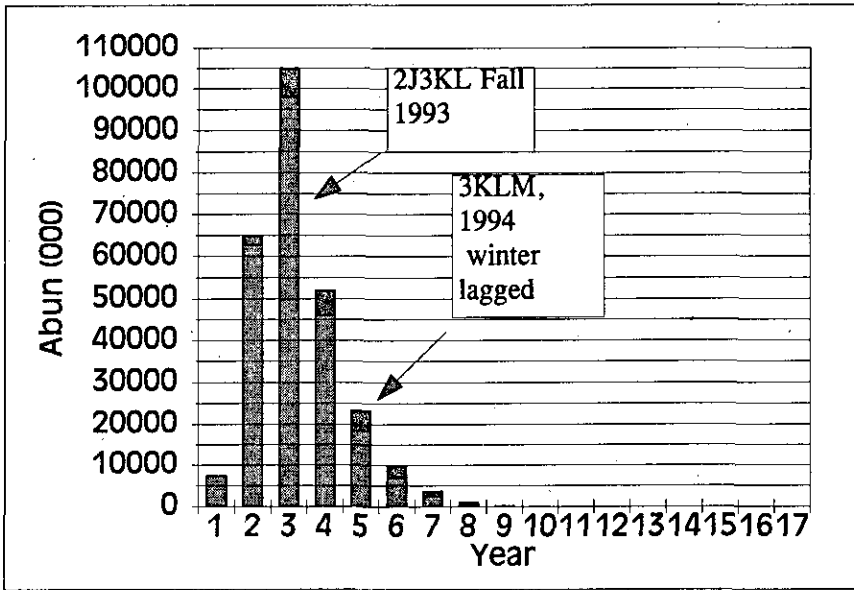
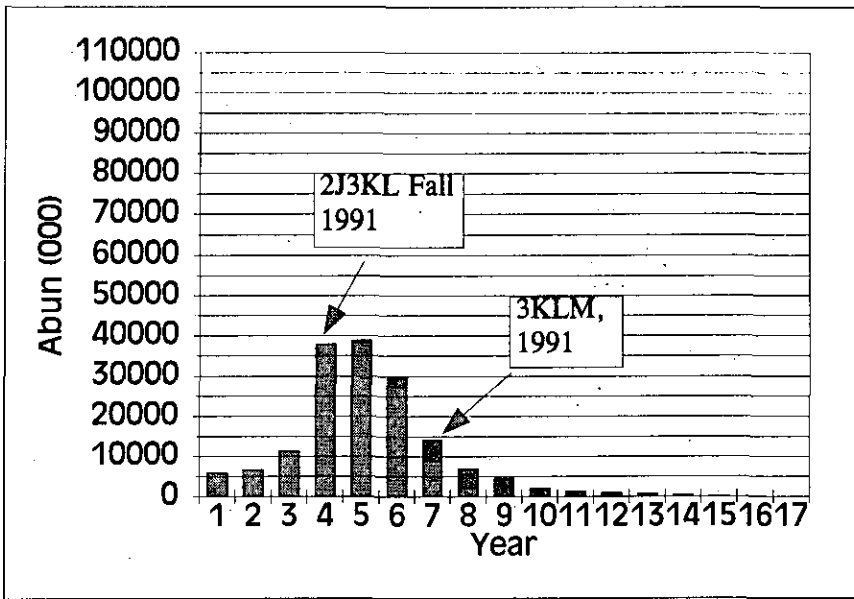


Fig. 10 Combined abundance from Canadian fall surveys and deepwater surveys. Deepwater surveys lagged in 1993 and 1994 for direct comparison.

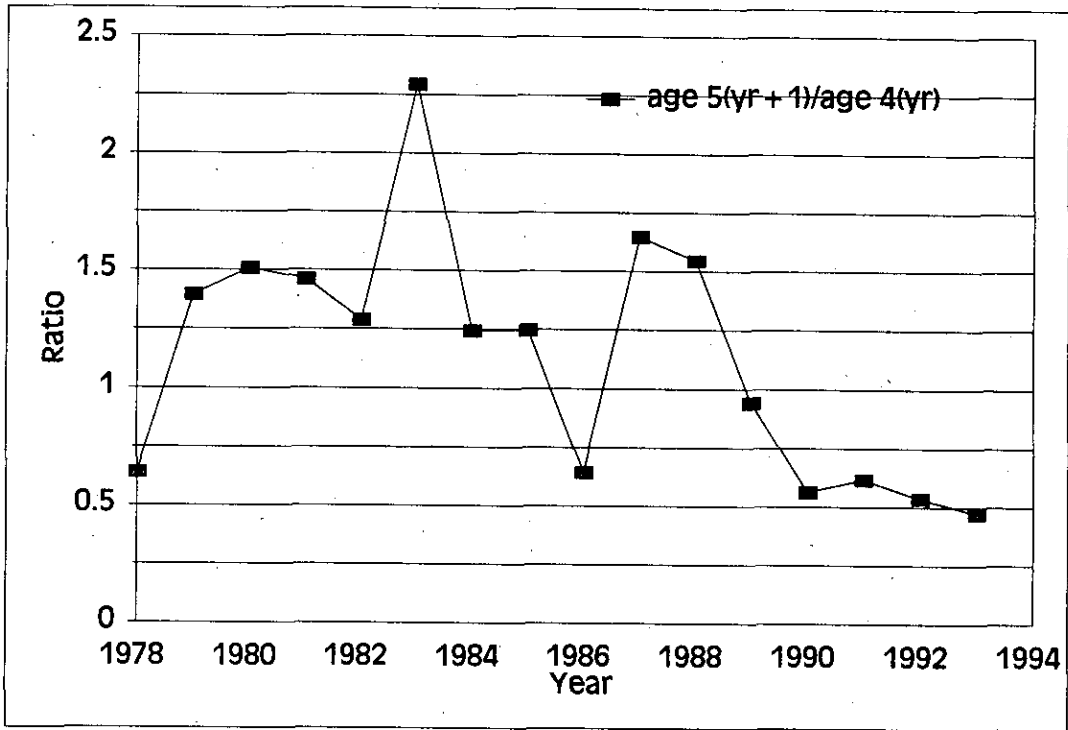


Fig. 9 Ratio of age 5 (year + 1) to age 4 (year) from fall surveys in Div. 2J, 3KL.