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Assessment of the Eastern Georges Bank Haddock

by

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ABSTRACT

Canadian haddock landings in 1992 decreased by about 1,500 t from the previous year's level of 5446 t while USA landings increased from 931 t in 1991 to 1,629 t. The 1985 and 1987 yearclasses comprised 70% of the 1992 landings. Preliminary reports from the 1993 USA fishery indicated a decline in landings whereupon the USA extended the spawning season closure into June. Although catches by Canada in Jan. and Feb., 1993, were good, catches following the Mar. to May spawning closure were reported as being poor. The Canadian spring survey and USA spring and fall surveys indicated that abundance was at the lowest historical levels observed. Early indications from surveys suggest that the 1992 yearclass may be moderate in size.

The calibration framework employed to estimate stock parameters was the same as used last year and population abundance estimates were adjusted for bias. Adult biomass (ages 3+) has dropped below 5,000 t, which is near the historic low. The 1983, 1985 and 1987 year-classes have been the most abundant since the large 1975 and 1978 year-classes. Recruitment since then has been poor. The fishing mortality rate for ages 4+ was the highest observed. The 1992 yearclass will likely account for a large fraction of the landed weight during 1994. High exploitation has resulted in a greatly reduced biomass and future catches will fluctuate in response to variable recruitment. If these rates of exploitation are maintained, potential yield will be lost as fish are harvested before their growth potential is realized and there is an increased chance that undersized fish will be caught and may be discarded.

RÉSUMÉ

En 1992, les débarquements canadiens d'aiglefin ont diminué d'environ 1 500 t par rapport à l'année précédente, où ils étaient de 5 446 t, tandis que les débarquements américains sont passés de 931 t en 1991 à 1 629 t en 1992. Les classes d'âge de 1985 et 1987 représentaient 70 % de tous les débarquements. Les rapports préliminaires sur la pêche de 1993 par les Américains ayant révélé une baisse des débarquements, les États-Unis ont prolongé jusqu'en juin la fermeture pour la saison de frai. Les prises canadiennes ont été bonnes en janvier et février 1993, mais d'après les indications reçues, celles qui ont suivi la période de fermeture due au frai (mars-mai) étaient médiocres. Selon le relevé de recherche de printemps du Canada et les relevé de recherche de printemps et d'automne des États-Unis, l'abondance était la plus basse de toutes celles que l'on avait observées auparavant. Les premières indications de ces relevés de recherche permettent de penser que la classe d'âge de 1992 pourrait être de taille moyenne.

On a utilisé la même méthode d'étalonnage que l'an dernier pour estimer les paramètres du stock et on a corrigé les estimations de l'abondance de la population pour en éliminer les distorsions. La biomasse d'adultes (âges 3+) a chuté en dessous des 5 000 t, ce qui est proche du seuil record. Après les fortes classes d'âge de 1975 et de 1978, celles de 1983, de 1985 et de 1987 ont été les plus abondantes. Depuis, le recrutement a été faible. Le taux de mortalité due à la pêche pour les âges 4+ était le plus haut jamais enregistré. La classe d'âge de 1992 représentera vraisemblablement une part importante du poids débarqué en 1994. La forte exploitation a abouti à une biomasse très réduite et les prises futures varieront en fonction du recrutement, lui-même changeant. Le maintien des taux d'exploitation actuels risque d'occasionner une perte de rendement; en effet, les poissons étant récoltés avant d'avoir atteint leur pleine croissance il existe un plus grand risque que de petits poissons soient capturés et peut-être rejetés.

DESCRIPTION OF THE FISHERY

The haddock on Georges Bank have supported a commercial fishery since the early 1920's (Clark et al 1982). Record landings were reported in the 1960s, reaching about 60,000 t for eastern Georges Bank, unit areas 5Zjm (Fig. 1). Since 1969 landings have ranged between 2,500 and 25,000 t (Table 1, Fig. 2) and in recent years have fluctuated around 5,000 tons. Since 1977, only Canada and the USA have conducted haddock fisheries on Georges Bank and following the establishment of a maritime boundary in 1984 by the International Court of Justice, each country's fishery has been restricted to their respective jurisdictions.

Bottom otter trawl and longline have been the predominant gears in the Canadian fishery (Table 2). During 1992 the longlines maintained their catch at the same level as 1991 but the otter trawls did not reach their allocation resulting in a decline in landings of about 1,500 t. In recent years, landings have generally peaked during June or July (Table 3). Reports from field staff indicated that catch rates dropped quickly, within two weeks, following the opening of the mobile gear fishery in June of 1992. With the introduction of ITQs in 1992, the otter trawl fishery was permitted to operate in January and February of 1993 for the first time in recent years. Good catches were reported and the fish were generally larger and in spawning condition. However, catches in early June 1993, immediately following the end of the spawning closure, were reported lower than in previous years.

The USA fishery is almost exclusively an otter trawl fishery (Table 4) and in recent years catches during the second half of the year have been minimal (Table 5). During 1992, USA landings increased to 1,629 t and bottom pair trawl catches accounted for a significant quantity for the first time. Initial reports indicated a decline in landings during 1993 and the USA extended the February to May spawning season closure into June.

In 1992, recognizing the depleted state of the stock, CAFSAC recommended that the Canadian catch be limited to 2,500 tons. Due to lack of consensus on the value of Canada independently restricting exploitation, the Canadian allocation was maintained at 5,000 t for 1993.

CATCH AND WEIGHT AT AGE

The 1992 commercial catch was well sampled for length and age composition with 34 samples taken from the Canadian fishery and 23 samples taken from the USA fishery. The catch and weight at age for 1969 to 1991 were taken from Gavaris and Van Eeckhaute (1992) and those for 1992 were calculated in a similar manner. Both fisheries were largely supported by the 1985 (average length of 66 cm) and 1987 (average length of 58 cm) yearclasses which comprised over 70% of the landed weight (Tables 6 - 11). There

were no persistent long term trends in weight at age. The 1989 and 1990 year-classes did not contribute to the landings to the extent which had been forecast from the previous assessment and the 1985 and 1987 year-classes made up the shortfall (Fig. 3).

RESEARCH SURVEYS

Annual stratified random surveys have been conducted by the USA in the spring since 1968 and in the fall since 1963 and by Canada in the spring since 1986. Conversion factors to account for vessel and door changes (Tables 12 and 13) were applied to the USA surveys as suggested in Hayes and Buxton (1992). The trends indicate a decline in adult abundance to about the lowest levels observed (Tables 14-16). The abundance of ages 3 to 8 from the Canadian spring survey and the USA fall survey declined by about 70% and 40% respectively between the beginning of 1992 and 1993. The USA spring survey results for 1993 were not available. Survey results on incoming recruitment (ages 1 and 2) identified the strong 1975 and 1978 year-classes and the moderate 1983, 1985, and 1987 year-classes. Recruitment since then has been low. The strength of the 1992 year-class is not well estimated but early indications suggest that it is moderate, comparable to those of 1983, 1985 and 1987.

ESTIMATION OF STOCK PARAMETERS

The adaptive framework, ADAPT, (Gavaris 1988) was used to calibrate the sequential population analysis with the research survey results using the same model described by Gavaris and Van Eeckhaute (1992). The model formulation employed assumed that the error in the catch at age was negligible. The error in the survey abundance indices was assumed to be independent and identically distributed after taking natural logarithms of the values. All available data since 1968 were used except when the indices were 0 (logarithm not defined) or when discarding was high and survey independent estimates of the catch were not available. The spring survey results were compared to beginning of year population abundance in the same year while the fall survey results were compared to beginning of year population abundance in the following year for the respective cohort. Natural mortality was assumed constant and equal to 0.2 and fishing mortality for age 8 was assumed equal to the arithmetic average for ages 4 to 7.

The population abundance estimates show a large relative error and substantial bias (Table 17). The abundance of the 1992 year-class is particularly poorly determined. Though there are some large residuals which warrant investigation, they do not indicate a lack of fit to the model (Fig. 4).

ASSESSMENT RESULTS

For each cohort, the terminal population abundance estimates

from ADAPT were adjusted for bias and used to construct the history of stock status (Tables 18-21). This simple approach for bias adjustment, in the absence of an unbiased point estimator with optimal statistical properties, was considered preferrable to using the biased point estimates.

The 1983, 1985 and 1987 year-classes were estimated to be the most abundant since the strong 1975 and 1978 year-classes (Fig. 5). The strength of other year-classes in recent years has been very weak. Indications are that the 1992 year class is of moderate strength comparable to those of 1983, 1985 and 1987 but it is too early to estimate its strength reliably. Adult biomass (ages 3+) declined rapidly since 1990 as the 1985 and 1987 year-classes were fished down to below 5,000 t, near the historic low observed during the early 1970s (Fig. 6). The fishing mortality rate for ages 4+ in 1992 was the highest observed, corresponding to harvesting of roughly 60% to 70% of the population, primarily exploiting the 1985 and 1987 year-classes (Fig. 7). The previous occasion when the fishing mortality exceeded 0.5 was during the early 1970s when abundance was at its lowest.

PROGNOSIS

Yield projections were done using 1993 beginning of year population numbers as estimated from ADAPT.

Age	Population numbers (thousands)	Weight (kg) Avg. for year	Weight (kg) Beg. of year	Partial Recruitment
1	15360	0.59	0.43	0
2	3604	1.12	0.82	0.5
3	1242	1.43	1.21	1.0
4	729	1.75	1.55	1.0
5	17	2.13	1.95	1.0
6	590	2.53	2.33	1.0
7	4	2.90	2.72	1.0
8	74	3.13	3.02	1.0
9	6	3.50	3.25	1.0
10	0		3.60	

As with the population abundance estimates, the simple adjustment for bias of the projected yield was considered more appropriate than using the biased point estimate. Projections were done assuming that the combined Canadian and USA catch in 1993 would be 5,000 t. A catch of this magnitude would generate exploitation rates comparable to or exceeding those observed in 1992. If the 1992 year-class proves to be as abundant as those of 1983, 1985, and 1987, the adult biomass will increase to about 10,000 t at the beginning of 1995 (Fig. 8). The projected yield at $F_{0.1}$ in 1994 would be about 2,000 t with the 1992 year-class accounting for about 75% of the landed weight.

High exploitation has resulted in a greatly reduced biomass and future cathes will fluctuate in response to variable

recruitment. If these rates of exploitation are maintained, potential yield will be lost as fish are harvested before their growth potential is realized and there is an increased chance that undersized fish will be caught and may be discarded.

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Table 1. Nominal catches (t) of haddock from unit areas 5Zj and 5Zm from 1969-92. For "others" it was assumed that 40% of the total 5Z catch was in 5Zj and 5Zm.

Year	Canada	USA	Others	Total
1969	3941	6622	695	11258
1970	1970	3153	357	5480
1971	1610	3534	770	5914
1972	609	1551	502	2662
1973	1565	1396	396	3357
1974	462	955	573	2750*
1975	1353	1705	29	3087
1976	1355	973	24	2352
1977	2871	2429	0	9174*
1978	9968	4724	0	16269*
1979	5080	5211	0	10291
1980	10017	5615	0	25036*
1981	5658	9077	0	14735
1982	4872	6280	0	11152
1983	3208	4454	0	7662
1984	1463	5121	0	6583
1985	3484	1683	0	5167
1986	3415	2200	0	5615
1987	4703	1418	0	6111
1988	4046**	1693	0	5739
1989	3059	787	0	3846
1990	3340	1189	0	4529
1991	5446	931	0	6377
1992	4061	1629	0	5690

* Values augmented by 760, 3874, 1577, and 9404 in 1974, 1977, 1978, and 1980, respectively, to account for USA discards.

** 1895 T excluded because of suspected misreporting.

Table 2. Canadian catch (t) of haddock in unit areas 5Zj and 5Zm by gear category and otter trawl tonnage class from 1969-92.

	OTTER TRAWL SIDE				OTTER TRAWL STERN					LONGLINE	OTHER	TOTAL
Year	2	3	4	Total	2	3	4	5	Total			
1969	1	7	769	777	0	1	225	2902	3127	23	15	3941
1970	0	24	551	575	2	0	133	1179	1314	78	2	1970
1971	0	0	495	501	0	0	16	939	955	151	3	1610
1972	0	2	146	148	0	0	2	260	263	195	3	609
1973	0	25	608	633	0	0	60	766	826	105	0	1565
1974	0	0	27	27	0	6	8	332	346	88	1	462
1975	0	1	221	222	0	1	60	963	1024	107	0	1353
1976	0	2	193	217	0	2	59	905	967	156	15	1355
1977	5	46	319	370	92	243	18	2025	2378	94	28	2871
1978	70	134	2252	2456	237	812	351	5639	7039	169	305	9968
1979	13	190	1419	1622	136	858	627	1564	3185	271	2	5080
1980	9	15	1419	1444	354	359	950	6254	7917	587	69	10017
1981	4	87	387	478	448	629	737	2344	4159	1019	2	5658
1982	1	25	89	115	189	318	187	3341	4045	712	0	4872
1983	17	89	0	106	615	431	107	1130	2283	815	4	3208
1984	0	5	0	5	180	269	21	149	620	835	3	1463
1985	0	72	0	72	840	1401	155	348	2745	626	41	3484
1986	4	48	0	51	829	1378	95	432	2734	594	35	3415
1987	6	41	0	48	782	1448	49	1241	3521	1046	89	4703
1988*	0	41	31	72	1091	1456	186	398	3183	695	97	4046
1989	0	0	0	0	489	573	376	536	1976	977	106	3059
1990	0	0	0	0	928	890	116	471	2411	853	76	3340
1991	0	0	0	0	1610	1647	81	679	4018	1309	119	5446
1992	0	0	0	0	797	1084	56	645	2583	1387	90	4061

* Catches of 26, 776, 1091 and 2 T for side otter trawlers class 3 and stern otter trawlers classes 2, 3 and 5 respectively were exluded because of suspected misreporting.

Table 3. Monthly catch (t) of haddock by Canada in unit areas 5Zj and 5Zm for 1969-92.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
1969	105	74	6	291	588	691	559	580	551	360	102	34	3941
1970	2	105	0	1	574	345	103	456	242	103	26	12	1970
1971	0	9	1	0	400	132	283	278	97	246	141	21	1610
1972	0	119	2	0	2	111	84	116	98	68	7	2	609
1973	4	10	0	0	0	184	198	572	339	232	22	4	1565
1974	19	0	1	0	0	58	63	53	96	61	92	19	462
1975	4	14	0	0	0	166	256	482	100	166	118	45	1353
1976	0	7	62	68	60	587	152	190	186	26	9	7	1355
1977	102	177	7	0	23	519	1059	835	13	59	56	22	2871
1978	104	932	44	22	21	319	405	85	642	5433	1962	0	9968
1979	123	898	400	175	69	1393	885	396	406	261	53	22	5080
1980	38	134	14	29	223	2956	2300	965	1411	1668	104	176	10017
1981	38	481	568	4	254	1357	1241	726	292	82	378	239	5658
1982	129	309	1	11	46	1060	769	682	585	837	398	44	4872
1983	32	67	29	47	60	1288	387	483	526	195	88	6	3208
1984	3	5	81	88	73	433	219	254	211	71	25	0	1463
1985	1	11	33	99	26	354	392	1103	718	594	61	93	3484
1986	11	28	79	99	40	1339	1059	369	233	139	12	8	3415
1987	24	26	138	70	12	1762	1383	665	405	107	97	14	4703
1988*	39	123	67	79	15	1816	1360	315	130	65	13	24	4046
1989**	32	94	48	7	20	1398	356	566	141	272	108	18	3059
1990	35	14	50	0	7	1179	668	678	469	199	18	22	3340
1991	144	166	49	26	21	1928	1004	705	566	576	123	137	5446
1992	118	205	97	152	36	1380	617	414	399	401	213	28	4061

* Catches of 3, 1846 and 46 T for Jan., Feb., and Mar., respectively for otter trawlers were excluded because of suspected misreporting.

** Early closure of fishery for otter trawlers in June (per. comm. P. Partington).

Table 4. USA catch (t) of haddock in unit areas 5Zj and 5Zm by gear category and otter trawl class for 1969-92.

Year	Otter Trawl Class 3	Otter Trawl Class 4	Otter Trawl Total	LL	Misc.	Total
1969	3010	3610	6621	0	0	6621
1970	1602	1551	3154	0	0	3154
1971	1760	1768	3533	0	0	3533
1972	861	690	1551	0	0	1551
1973	637	759	1396	0	0	1396
1974	443	512	955	0	0	955
1975	993	675	1668	0	36	1705
1976	671	302	972	0	2	974
1977	1721	700	2423	0	5	2428
1978	3140	1573	4713	0	11	4725
1979	3281	1927	5208	0	4	5212
1980	3654	2955	5611	0	4	5615
1981	3591	5408	9031	0	45	9075
1982	2585	3657	6242	11	26	6279
1983	1162	3261	4423	11	18	4453
1984	1854	3260	5115	2	3	5120
1985	856	823	1679	0	4	1683
1986	985	1207	2192	0	9	2201
1987	778	639	1417	0	1	1418
1988	920	768	1688	0	6	1694
1989	359	419	780	0	6	785
1990	486	688	1178	0	4	1182
1991	400	517	918	0	13	931
1992	597	740	1337	0	292	1629

Table 5. Monthly catch (t) of haddock by USA in unit areas 5Zj and 5Zm for 1969-92.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	525	559	976	1825	670	809	204	219	249	226	203	157	6622
1970	169	219	242	375	608	374	324	333	179	219	61	50	3153
1971	155	361	436	483	668	503	338	152	147	165	58	68	3534
1972	150	196	91	90	239	261	97	164	84	63	52	64	1551
1973	90	111	77	85	138	365	217	196	37	3	22	55	1396
1974	135	70	47	70	122	160	165	43	27	6	19	91	955
1975	152	123	32	116	388	489	138	95	57	24	52	39	1705
1976	116	147	83	106	323	162	7	6	5	2	3	13	973
1977	75	211	121	154	374	372	434	191	73	52	146	226	2429
1978	336	437	263	584	752	750	467	221	245	426	194	49	4724
1979	274	329	352	548	766	816	588	659	224	202	281	172	5211
1980	632	1063	742	784	711	461	324	254	221	91	110	222	5615
1981	550	1850	634	627	882	1326	1233	873	321	284	242	255	9077
1982	425	754	502	347	718	1801	757	145	201	216	276	138	6280
1983	492	931	272	181	310	1145	231	178	187	110	227	190	4454
1984	540	961	366	281	627	1047	370	302	250	196	92	89	5121
1985	165	190	254	300	352	206	60	47	1	24	41	43	1683
1986	184	396	334	479	496	221	31	6	12	6	6	29	2200
1987	225	52	43	307	233	342	67	30	24	4	23	68	1418
1988	196	152	207	245	366	316	30	19	6	1	45	110	1693
1989	114	56	47	164	161	145	15	8	1	5	25	46	787
1990	148	21	155	274	214	306	23	3	5	5	16	19	1189
1991	105	28	76	133	89	434	1	20	6	0	19	19	931
1992	253	81	51	149	353	669	20	20	17	3	2	12	1629

Table 6. Canadian commercial catch-at-age (numbers 000's) of haddock from unit areas 5Zj and 5Zm.

Year	Age Groups 1	2	3	4	5	6	7	8	9+	0-9+
1969	0	7	558	101	105	963	275	28	89	2127
1970	4	35	3	129	57	46	410	131	60	875
1971	0	491	71	6	67	41	33	173	84	968
1972	90	0	88	19	5	16	6	3	85	312
1973	107	829	1	188	15	3	18	3	49	1213
1974	0	240	66	0	10	1	0	9	16	341
1975	0	117	620	91	2	16	0	1	14	863
1976	53	119	120	391	57	0	7	0	10	757
1977	0	2398	34	63	94	46	0	3	1	2639
1978	1	250	5865	97	55	98	35	1	2	6404
1979	0	14	99	2196	136	70	56	11	2	2585
1980	2	8608	305	130	668	58	15	11	5	9802
1981	0	243	2279	140	275	390	38	3	18	3386
1982	0	313	469	1400	93	106	195	9	5	2590
1983	0	161	359	258	679	76	34	89	4	1660
1984	0	12	38	63	52	172	61	33	104	535
1985	0	2022	305	114	89	55	87	22	62	2755
1986	6	38	1701	86	70	52	29	40	21	2042
1987	0	1986	90	1088	59	32	30	28	68	3381
1988	4	51	1878	81	390	53	7	16	86	2566
1989	0	1132	68	623	64	202	13	8	37	2146
1990	2	6	1070	55	501	14	122	29	34	1833
1991	6	429	62	1809	50	297	28	123	57	2861
1992	7	230	237	62	1020	14	212	3	86	1871

Table 7. Average weight-at-age (kg) of haddock from the Canadian commercial fishery in unit areas 5Zj and 5Zm.

Year	Age Groups 1	2	3	4	5	6	7	8
1969	-	0.766	1.324	1.513	1.679	1.887	2.364	2.807
1970	0.721	1.062	0.812	1.653	1.905	2.137	2.201	2.855
1971	-	0.950	1.147	1.284	2.141	2.346	2.274	2.684
1972	0.759	-	1.703	1.820	2.209	2.624	2.469	2.792
1973	0.683	1.054	1.367	1.789	2.296	1.760	3.003	3.097
1974	-	1.025	1.449	-	1.995	3.760	-	3.145
1975	-	0.868	1.544	2.096	1.997	2.425	4.114	3.557
1976	0.596	0.996	1.351	2.076	2.808	-	3.251	-
1977	-	0.964	1.466	1.871	2.500	3.035	-	3.502
1978	0.619	1.168	1.505	2.186	3.100	3.290	3.188	3.364
1979	-	1.024	1.364	1.891	2.387	2.920	3.353	3.383
1980	0.405	0.888	1.032	1.792	2.294	2.593	3.948	3.803
1981	-	0.915	1.391	1.721	2.383	2.822	3.698	5.013
1982	-	1.056	1.556	1.915	2.348	2.801	2.909	3.414
1983	-	1.031	1.401	1.822	2.200	2.543	2.821	3.007
1984	-	0.883	1.401	2.010	2.257	2.770	2.918	3.326
1985	-	0.948	1.264	2.068	2.169	2.942	3.289	3.238
1986	0.452	0.981	1.458	2.104	2.913	2.899	3.646	4.248
1987	-	0.832	1.391	2.073	2.253	2.598	2.906	3.623
1988	0.421	0.974	1.315	1.787	2.234	2.264	2.978	3.036
1989	-	0.861	1.449	1.789	2.215	2.604	2.795	3.014
1990	0.639	0.956	1.461	1.711	2.232	2.281	2.736	2.396
1991	0.581	1.204	1.220	1.838	2.023	2.630	2.341	2.891
1992	0.538	1.163	1.687	1.694	2.264	2.073	2.977	2.633

Table 8. USA commercial catch-at-age (numbers 000's) of haddock from unit areas 5Zj and 5Zm.

	Age Groups									
Year	1	2	3	4	5	6	7	8	9+	0-9+
1969	0	10	818	145	207	1739	489	53	175	3636
1970	9	42	4	199	82	71	657	212	111	1387
1971	0	566	155	23	150	102	112	462	269	1837
1972	125	0	235	42	13	55	27	8	248	754
1973	42	662	5	155	20	6	17	5	104	1015
1974	0	552	133	0	20	2	0	18	33	757
1975	0	65	784	144	4	29	1	2	24	1053
1976	0	28	53	421	62	0	9	0	11	584
1977	0	1307	30	115	211	117	0	12	13	1806
1978	0	39	2770	63	115	201	46	9	7	3249
1979	0	8	103	2207	189	112	138	28	11	2795
1980	0	911	46	175	1722	134	113	41	7	3149
1981	0	419	4313	244	310	830	84	27	6	6234
1982	0	401	579	1409	103	273	529	53	60	3406
1983	0	44	223	254	973	146	74	324	28	2065
1984	0	67	214	285	204	890	135	127	227	2149
1985	0	41	70	62	101	68	284	30	52	708
1986	0	0	856	87	72	71	89	133	19	1327
1987	0	5	37	427	37	24	52	40	40	661
1988	0	0	267	40	487	56	29	30	12	921
1989	0	21	10	111	66	118	18	13	7	364
1990	0	1	195	71	241	54	41	13	8	624
1991	0	12	27	232	39	92	45	22	3	472
1992	0	0	74	65	426	75	103	22	3	768

Table 9. Average weight-at-age (kg) of haddock from the USA commercial fishery in unit areas 5Zj and 5Zm.

	Age Groups							
Year	1	2	3	4	5	6	7	8
1969	-	0.760	1.253	1.543	1.633	1.807	2.261	2.918
1970	0.721	1.071	0.813	1.653	1.873	2.116	2.198	2.833
1971	-	0.909	1.018	1.269	1.952	2.218	2.258	2.586
1972	0.759	-	1.509	1.719	2.125	2.470	2.397	2.414
1973	0.683	0.937	1.367	1.823	2.133	1.573	2.758	3.398
1974	-	0.946	1.402	-	1.979	3.760	-	3.120
1975	-	0.878	1.508	2.041	1.997	2.420	4.114	3.557
1976	-	0.785	1.163	1.654	2.057	-	2.293	-
1977	-	0.981	1.414	1.776	2.264	2.720	-	3.007
1978	-	1.043	1.280	1.852	2.397	2.737	2.808	2.745
1979	-	0.920	1.235	1.719	2.076	2.735	3.164	3.233
1980	-	0.929	1.050	1.640	2.045	2.593	3.481	3.553
1981	-	0.876	1.194	1.518	2.170	2.511	3.418	3.882
1982	-	0.894	1.207	1.657	2.308	2.463	2.976	3.551
1983	-	1.001	1.245	1.678	2.061	2.491	2.906	3.130
1984	-	0.875	1.345	1.801	2.134	2.573	2.828	3.084
1985	-	1.049	1.081	1.635	2.278	2.509	2.745	3.138
1986	-	-	1.142	1.630	1.830	2.576	2.749	3.367
1987	-	1.118	1.529	1.758	1.978	2.588	2.980	3.661
1988	-	1.160	1.239	1.546	1.888	2.431	3.019	3.449
1989	-	1.246	1.455	1.706	2.152	2.381	3.170	3.650
1990	-	1.416	1.184	1.846	1.953	2.570	3.016	4.288
1991	-	0.939	1.288	1.515	2.169	2.485	3.276	3.687
1992	-	1.311	1.417	1.616	1.946	2.573	3.011	3.505

Table 10. Total[1] commercial catch-at-age (numbers 000's) of haddock from unit areas 5Zj and 5Zm.

	Age Groups							
Year	1	2	3	4	5	6	7	8
1969	0	19	1449	262	333	2881	816	88
1970	25	83	7	350	148	127	1140	366
1971	0	1219	261	32	249	163	166	748
1972	281	1	398	75	22	87	42	13
1973	1015	1728	7	360	37	10	37	8
1974	17	2080[2]	272	0	40	3	0	35
1975	0	184	1418	237	6	46	1	3
1976	67	148	175	818	121	0	16	0
1977	0	7623[2]	65	178	305	163	0	15
1978	1	289	9832[2]	160	169	299	81	10
1979	0	22	202	4403	325	182	195	39
1980	2	9519	351	305	2391	192	128	52
1981	0	661	6593	384	585	1220	121	31
1982	0	714	1048	2809	196	379	724	62
1983	0	205	582	512	1652	221	108	413
1984	0	79	252	348	256	1062	196	160
1985	0	2063	374	176	189	123	371	53
1986	6	38	2557	173	142	122	118	173
1987	0	1990	127	1515	96	56	82	68
1988	4	51	2145	121	877	109	36	46
1989	0	1153	78	734	129	320	31	20
1990	2	7	1265	126	743	68	163	42
1991	6	441	89	2041	88	389	72	145
1992	7	230	311	127	1446	89	315	26

[1]Total catch includes small mesh foreign fishery.
[2]Includes discard estimates based on trip interviews.

Table 11. Average weight-at-age (kg) of haddock from the commercial fishery in unit areas 5Zj and 5Zm.

	Age Groups							
Year	1	2	3	4	5	6	7	8
1969	-	0.763	1.282	1.531	1.649	1.836	2.298	2.879
1970	0.721	1.067	0.812	1.653	1.886	2.124	2.199	2.841
1971	-	0.928	1.059	1.272	2.011	2.255	2.262	2.613
1972	0.759	-	1.562	1.750	2.147	2.505	2.411	2.514
1973	0.683	1.002	1.367	1.804	2.202	1.631	2.885	3.295
1974	-	0.970	1.418	-	1.984	3.760	-	3.128
1975	-	0.872	1.524	2.062	1.997	2.422	4.114	3.557
1976	0.596	0.956	1.293	1.857	2.417	-	2.702	-
1977	-	0.970	1.442	1.809	2.337	2.809	-	3.095
1978	0.619	1.151	1.433	2.055	2.623	2.919	2.972	2.829
1979	-	0.987	1.298	1.805	2.206	2.806	3.219	3.277
1980	0.405	0.892	1.034	1.705	2.115	2.593	3.535	3.608
1981	-	0.890	1.262	1.592	2.270	2.611	3.505	4.009
1982	-	0.965	1.363	1.786	2.327	2.557	2.958	3.531
1983	-	1.024	1.341	1.750	2.118	2.509	2.879	3.104
1984	-	0.876	1.354	1.838	2.159	2.605	2.856	3.134
1985	-	0.950	1.230	1.915	2.227	2.702	2.872	3.180
1986	0.452	0.981	1.352	1.866	2.367	2.712	2.969	3.570
1987	-	0.833	1.431	1.984	2.148	2.594	2.953	3.646
1988	0.421	0.974	1.305	1.708	2.042	2.350	3.011	3.305
1989	-	0.868	1.450	1.777	2.183	2.522	3.012	3.411
1990	0.639	0.999	1.419	1.787	2.141	2.509	2.807	3.002
1991	0.581	1.197	1.241	1.802	2.087	2.596	2.918	3.012
1992	0.538	1.163	1.622	1.654	2.171	2.491	2.988	3.388

Table 12. Vessel and door used in the spring survey on Georges Bank, and conversion coefficients (from Hayes and Buxton 1992).

Year(s)	Vessel	Door	Conversion coefficient
1968-80	ALBATROSS IV	BMV	1.633
1981-82	DELAWARE II	BMV	1.391
1983-84	ALBATROSS IV	BMV	1.633
1985-88	ALBATROSS IV	POLY	1.000
1989-91	DELAWARE II	POLY	0.852
1992	ALBATROSS IV	POLY	1.000

Table 13. Vessel and door used in the fall survey on Georges Bank, and conversion coefficients (from Hayes and Buxton 1992).

Year(s)	Vessel	Door	Conversion coefficient
1963-76	ALBATROSS IV	BMV	1.633
1977-81	DELAWARE II	BMV	1.391
1982-84	ALBATROSS IV	BMV	1.633
1985-88	ALBATROSS IV	POLY	1.000
1989-91	DELAWARE II	POLY	0.852
1992	ALBATROSS IV	POLY	1.000

Table 14. Total estimated abundance-at-age (numbers in 000's) of haddock from unit areas 5Zj and 5Zm from the Canadian spring surveys.

	Age Group									
Year	1	2	3	4	5	6	7	8	9+	1-9+
1986	5057	306	8175	997	189	348	305	425	401	16205
1987	46	4286	929	3450	653	81	387	135	1132	11099
1988	971	49	12714	257	4345	274	244	130	686	19670
1989	47	6473	959	2814	241	523	40	36	259	11391
1990	726	108	12302	166	4465	299	1370	144	389	19968
1991	400	2175	137	10776	115	1868	117	497	220	16306
1992	1914	3879	1423	221	4810	18	1277	52	655	14249
1993	3448	1759	545	431	34	1186	19	281	15	7849

Table 15. Total estimated abundance-at-age (numbers in 000's) of haddock in unit areas 5Zj and 5Zm from the spring USA surveys. From 1973-81 a 41 Yankee trawl was used while a 36 Yankee was used in other years. Conversion factors to adjust for changes in door type and survey vessel were applied.

	Age Group							
Year	1	2	3	4	5	6	7	8
1969	19	38	673	257	573	3543	1337	392
1970	524	209	0	614	1094	484	3473	2748
1971	0	718	286	0	158	111	63	1270
1972	2843	0	845	144	28	52	231	29
1973	2691	6180	0	1131	169	0	302	0
1974	1450	22573	4476	0	388	0	47	79
1975	579	621	6593	1165	0	239	139	50
1976	9073	441	475	1347	638	0	0	0
1977	151	28410	323	937	894	642	0	24
1978	0	815	22861	703	965	1275	98	26
1979	11503	483	1439	10701	521	78	488	46
1980	4782	74483	1237	1224	6381	688	418	773
1981	4093	3462	31529	3287	819	2720	382	65
1982	665	4208	1877	8816	848	509	761	0
1983	260	844	752	394	2840	32	0	875
1984	1497	1551	1092	1097	1026	1365	151	97
1985	40	8911	1396	674	1496	588	1995	127
1986	3334	280	3597	246	210	333	235	560
1987	122	5480	144	1394	157	231	116	370
1988	305	61	1868	235	611	203	218	178
1989	87	6925	643	1395	278	822	61	95
1990	1719	73	10742	621	1083	114	190	0
1991	769	2152	449	3513	199	211	68	91
1992	530	287	214	141	609	32	46	46

Table 16. Total estimated abundance-at-age (numbers in 000's) of haddock in unit areas 5Zj and 5Zm from the fall USA survey. Conversion factors to adjust for changes in door type and survey vessel were applied.

	Age Groups							
Year	0	1	2	3	4	5	6	7
1968	60	124	877	30	41	2437	599	194
1969	420	0	0	569	69	33	825	502
1970	0	7014	368	18	454	369	548	989
1971	2878	0	864	107	0	290	30	80
1972	5202	2626	0	254	0	0	58	0
1973	1474	18409	1760	0	197	1	0	18
1974	166	256	1053	185	0	6	0	0
1975	33279	728	211	1116	243	0	0	0
1976	859	145350	500	28	531	78	0	19
1977	53	271	29969	506	142	240	96	4
1978	16670	623	603	8774	64	48	107	0
1979	1791	24041	16	373	1663	50	13	0
1980	4077	3207	6691	0	115	1235	124	29
1981	701	5256	2942	3133	120	155	338	0
1982	68	0	733	504	2823	174	100	514
1983	3956	487	355	476	311	434	21	10
1984	50	4219	856	242	230	47	278	0
1985	12148	381	1646	199	70	68	46	30
1986	30	7471	109	961	52	50	72	24
1987	508	4	839	28	152	38	22	0
1988	122	3983	206	2326	155	400	142	140
1989	174	86	2748	117	529	70	76	0
1990	1265	1076	25	1532	94	179	22	5
1991	733	344	285	71	277	26	10	0
1992	3484	1052	172	110	0	95	0	18

Table 17. Statistical properties of population abundance and survey calibration constants as estimated from ADAPT.

Par.	Est.	Std. Err.	Rel. Err.	Bias	Rel. Bias
Population Abundance					
Age 1	21804	16409	0.75	6444	0.30
2	4114	1957	0.48	510	0.12
3	1364	568	0.42	122	0.09
4	802	360	0.45	73	0.09
5	28	27	0.96	11	0.39
6	720	465	0.65	130	0.18
7	9	10	1.06	5	0.55
8	97	69	0.71	23	0.24
9	6	3	0.46	0	0.03
Survey Calibration Constants					
USA Fall Survey					
Age 1	0.159	0.034	0.217	0.003	0.017
2	0.359	0.080	0.224	0.007	0.018
3	0.249	0.053	0.213	0.004	0.017
4	0.229	0.049	0.213	0.004	0.017
5	0.190	0.042	0.222	0.004	0.020
6	0.185	0.040	0.214	0.004	0.020
7	0.198	0.045	0.227	0.004	0.022
8	0.214	0.057	0.267	0.008	0.035
USA Spring Survey					
Age 1	0.166	0.037	0.224	0.003	0.018
2	0.404	0.088	0.218	0.007	0.018
3	0.561	0.122	0.217	0.010	0.018
4	0.622	0.135	0.217	0.011	0.017
5	0.680	0.144	0.212	0.012	0.018
6	0.502	0.111	0.222	0.010	0.020
7	0.899	0.199	0.222	0.019	0.021
8	0.912	0.207	0.227	0.022	0.024
Canadian Spring Survey					
Age 1	0.159	0.061	0.383	0.009	0.055
2	0.423	0.157	0.370	0.022	0.052
3	0.991	0.363	0.366	0.053	0.053
4	0.800	0.292	0.365	0.041	0.052
5	1.049	0.400	0.381	0.072	0.068
6	0.710	0.262	0.370	0.042	0.060
7	1.206	0.467	0.388	0.081	0.067
8	0.992	0.372	0.375	0.067	0.067

Table 18. Estimated population numbers (000's) at the beginning of the year for haddock in unit areas 5Zj and 5Zm.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	797	3662	191	5119	11015	2837	3415	54142	6261	4122	40631
2	169	653	2976	157	3936	8100	2307	2795	44267	5126	3374
3	3167	122	459	1334	127	1659	4749	1723	2155	29345	3936
4	875	1282	93	140	732	98	1112	2605	1252	1706	15130
5	863	480	733	47	47	273	81	696	1392	864	1252
6	6647	405	258	375	19	5	187	60	460	864	554
7	2260	2835	216	64	229	7	2	112	49	230	437
8	235	1112	1290	27	14	153	6	0	77	40	115
9	0	113	579	379	10	4	94	2	0	50	24
1+	15014	10664	6796	7641	16130	13137	11952	62135	55914	42347	65451
2+	14217	7001	6605	2522	5115	10301	8538	7993	49652	38225	24821
3+	14047	6348	3629	2366	1179	2201	6231	5198	5386	33098	21447
4+	10880	6227	3170	1032	1051	542	1481	3475	3231	3753	17511

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	6118	4390	2023	2283	15060	1434	12161	949	12915	450
2	33266	5007	3594	1656	1869	12330	1174	9952	777	10570
3	2743	18622	3501	2297	1170	1459	8229	927	6347	590
4	3040	1928	9281	1918	1353	730	855	4423	644	3255
5	8403	2213	1231	5057	1108	794	439	544	2251	419
6	731	4717	1282	830	2646	675	478	231	358	1049
7	289	425	2758	707	479	1206	441	281	138	195
8	182	120	238	1603	482	215	651	255	156	81
9	59	102	71	139	939	249	128	377	147	86
1+	54829	37524	23979	16490	25106	19092	24558	17938	23734	16695
2+	48711	33134	21957	14207	10046	17658	12396	16989	10819	16245
3+	15445	28127	18362	12551	8177	5327	11222	7038	10042	5675
4+	12703	9504	14861	10255	7006	3869	2993	6111	3695	5085

Year	1990	1991	1992	1993
1	2438	2170	4409	15360
2	369	1994	1771	3604
3	7611	296	1234	1242
4	413	5087	161	729
5	2001	224	2318	17
6	226	966	103	590
7	569	123	439	4
8	132	318	35	74
9	47	70	129	6
1+	13805	11248	10600	21626
2+	11367	9078	6191	6266
3+	10998	7084	4419	2662
4+	3387	6788	3186	1420

Table 19. Estimated population biomass (t 000's) at the beginning of the year for haddock in unit areas 5Zj and 5Zm.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	359	2328	89	3380	6319	1412	1623	25318	2712	2020	19992
2	115	522	2435	121	3433	6593	1668	2117	33676	4260	2637
3	3132	96	488	1606	149	1978	5773	1829	2530	34603	4811
4	1226	1867	94	191	1229	154	1902	4382	1914	2936	24331
5	1370	815	1337	78	93	517	153	1554	2901	1882	2665
6	11564	757	533	841	36	15	411	140	1199	2256	1503
7	4641	5697	474	149	614	14	7	286	133	663	1339
8	605	2841	3092	63	41	461	17	0	222	112	359
9	0	363	1828	1081	26	17	305	8	0	164	69
1+	23011	15286	10372	7511	11938	11163	11859	35635	45289	48896	57706
2+	22652	12958	10283	4131	5619	9751	10236	10317	42577	46876	37714
3+	22538	12436	7848	4009	2187	3157	8568	8200	8900	42616	35076
4+	19406	12340	7359	2403	2038	1179	2795	6371	6370	8013	30265

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	1671	2077	929	1133	7182	673	4056	447	3789	209
2	24338	3007	2735	1298	1355	9309	901	6110	594	6391
3	2772	19761	3857	2613	1378	1514	9325	1099	6618	701
4	4522	2474	13934	2963	2125	1175	1296	7245	1008	4957
5	16417	4354	2369	9835	2153	1606	934	1089	4531	808
6	1747	11083	3090	2005	6215	1630	1176	572	805	2381
7	910	1281	7663	1919	1283	3298	1250	795	387	518
8	619	454	838	4857	1447	648	2086	838	487	258
9	203	388	303	493	2984	816	431	1500	593	302
1+	53199	44877	35718	27117	26122	20668	21453	19695	18812	16526
2+	51528	42800	34789	25984	18940	19995	17398	19248	15023	16317
3+	27190	39793	32054	24685	17585	10687	16497	13138	14429	9926
4+	24418	20033	28197	22073	16207	9173	7172	12040	7811	9224

Year	1990	1991	1992	1993
1	1138	891	1811	6596
2	285	1744	1456	2968
3	8447	329	1719	1497
4	664	8135	231	1127
5	3902	433	4585	33
6	528	2277	236	1373
7	1515	332	1222	11
8	396	925	110	224
9	172	209	402	18
1+	17048	15276	11772	13848
2+	15910	14385	9962	7252
3+	15624	12641	8506	4284
4+	7177	12311	6786	2787

Table 20. Estimated mid-year population biomass (t 000's) for haddock in unit areas 5Zj and 5Zm.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	434	2385	104	3416	6480	1538	1857	29249	3405	2312	22095
2	110	587	1899	141	2641	6086	1744	2353	35220	5185	3009
3	2672	87	285	1567	153	1939	5440	1906	2771	30748	4503
4	1007	1624	86	149	840	160	1831	3596	1892	3015	20644
5	998	675	1074	67	42	452	140	1378	2587	1829	2135
6	8212	639	314	740	19	12	355	148	932	1828	1142
7	3719	4315	204	80	544	17	2	252	121	493	936
8	480	2320	1945	42	28	379	12	0	192	89	275
1+	17631	12632	5911	6203	10749	10582	11382	38882	47120	45498	54740
2+	17197	10247	5807	2787	4268	9045	9525	9633	43715	43186	32645
3+	17087	9659	3908	2646	1627	2959	7781	7280	8495	38001	29636
4+	14415	9573	3623	1079	1474	1020	2340	5373	5724	7253	25133

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	2245	2387	1100	1241	8190	780	4986	516	4929	245
2	22517	3748	2796	1433	1450	9633	1026	6677	662	7821
3	2391	16931	3586	2392	1263	1390	8289	1112	6043	719
4	4440	2473	12422	2583	1928	1095	1283	6381	894	4580
5	13501	3872	2367	7884	1886	1387	766	955	3214	681
6	1462	9529	2471	1602	4773	1486	1006	469	630	1980
7	681	1131	6296	1691	941	2586	1008	627	322	485
8	497	375	651	3853	1106	534	1791	714	389	213
1+	47734	40445	31690	22680	21537	18891	20156	17452	17083	16724
2+	45488	38058	30590	21438	13347	18112	15169	16936	12154	16479
3+	22971	34310	27794	20005	11897	8478	14144	10259	11492	8659
4+	20580	17379	24207	17613	10634	7088	5855	9147	5450	7939

	1990	1991	1992
1	1411	1141	2149
2	331	1896	1734
3	8890	275	1556
4	552	6349	106
5	3042	326	2741
6	424	1734	76
7	1212	204	613
8	293	631	55
1+	16154	12556	9031
2+	14743	11415	6881
3+	14412	9519	5147
4+	5523	9244	3591

Table 21. Estimated fishing mortality rate for haddock in unit areas 5Zj and 5Zm.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.00	0.01	0.00	0.06	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.13	0.15	0.60	0.01	0.66	0.33	0.09	0.06	0.21	0.06	0.01	0.38	0.16	0.25
3	0.70	0.07	0.99	0.40	0.06	0.20	0.40	0.12	0.03	0.46	0.06	0.15	0.50	0.40
4	0.40	0.36	0.47	0.89	0.79	0.00	0.27	0.43	0.17	0.11	0.39	0.12	0.25	0.41
5	0.56	0.42	0.47	0.71	1.98	0.18	0.09	0.21	0.28	0.24	0.34	0.38	0.35	0.19
6	0.65	0.43	1.20	0.29	0.84	0.97	0.32	0.00	0.50	0.48	0.45	0.34	0.34	0.40
7	0.51	0.59	1.90	1.29	0.20	0.01	2.41	0.18	0.00	0.49	0.68	0.67	0.38	0.34
8	0.54	0.45	1.02	0.81	0.96	0.29	0.82	0.00	0.24	0.33	0.47	0.38	0.33	0.34

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.15	0.05	0.20	0.04	0.25	0.08	0.13	0.02	0.28	0.16
3	0.33	0.27	0.33	0.42	0.16	0.47	0.16	0.20	0.41	0.33
4	0.35	0.33	0.31	0.25	0.48	0.23	0.29	0.41	0.59	2.05
5	0.45	0.30	0.31	0.44	0.22	0.56	0.42	0.53	0.57	1.17
6	0.35	0.59	0.23	0.33	0.31	0.41	0.41	0.41	0.59	3.04
7	0.18	0.60	0.42	0.35	0.39	0.34	0.19	0.38	1.05	1.58
8	0.33	0.46	0.32	0.35	0.35	0.39	0.33	0.44	0.70	1.63

Table 22. Projections for haddock in unit areas 5Zj and 5Zm.

Weight at age (mid-year)

	1993	1994
1	0.59	0.59
2	1.12	1.12
3	1.43	1.43
4	1.75	1.75
5	2.13	2.13
6	2.53	2.53
7	2.90	2.90
8	3.13	3.13
9	3.50	3.50

Weight at age (beginning year)

	1993	1994	1995
1	0.43	0.43	0.43
2	0.82	0.82	0.82
3	1.21	1.21	1.21
4	1.55	1.55	1.55
5	1.95	1.95	1.95
6	2.33	2.33	2.33
7	2.72	2.72	2.72
8	3.02	3.02	3.02
9	3.25	3.25	3.25
10	3.60	3.60	3.60

Population Numbers

	1993	1994	1995
1	15360	5000	5000
2	3604	12576	4094
3	1242	1549	8019
4	729	280	769
5	17	165	139
6	590	4	82
7	4	133	2
8	74	1	66
9	6	17	0
10	0	1	8
1+	21626	19726	18179
2+	6266	14726	13179
3+	2662	2150	9086
4+	1420	601	1067

Population Biomass (beginning of year)

	1993	1994	1995
1	6596	2147	2147
2	2968	10357	3371
3	1497	1868	9667
4	1127	434	1190
5	33	321	272
6	1373	9	190
7	11	362	5
8	224	3	200
9	18	54	1
10	0	5	30
1+	13848	15560	17075
2+	7252	13413	14928
3+	4284	3056	11556
4+	2787	1188	1889

Population Numbers (Mid-Year)

	1993	1994
1	13921	4532
2	2434	10127
3	646	1114
4	379	202
5	9	118
6	307	3
7	2	96
8	39	1
9	3	12
1+	17740	16204
2+	3819	11672
3+	1385	1545
4+	739	431

Population Biomass (Mid-Year)

	1993	1994
1	8159	2656
2	2725	11338
3	922	1591
4	663	352
5	19	252
6	777	7
7	6	278
8	121	2
9	10	42
1+	13402	16519
2+	5243	13863
3+	2518	2525
4+	1596	934

Table 22. (continued)

Fishing Mortality

	1993	1994
1	0.00	0.00
2	0.64	0.25
3	1.29	0.50
4	1.29	0.50
5	1.29	0.50
6	1.29	0.50
7	1.29	0.50
8	1.29	0.50
9	1.29	0.50

Catch Numbers at Age

	1993	1994
1	0	0
2	1568	2532
3	832	557
4	488	101
5	11	59
6	396	1
7	3	48
8	50	0
9	4	6
1+	3352	3304
2+	3352	3304
3+	1784	773
4+	952	216

Catch Biomass at Age

	1993	1994
1	0	0
2	1756	2835
3	1188	795
4	854	176
5	24	126
6	1001	4
7	8	139
8	156	1
9	13	21
1+	5000	4097
2+	5000	4097
3+	3244	1262
4+	2056	467

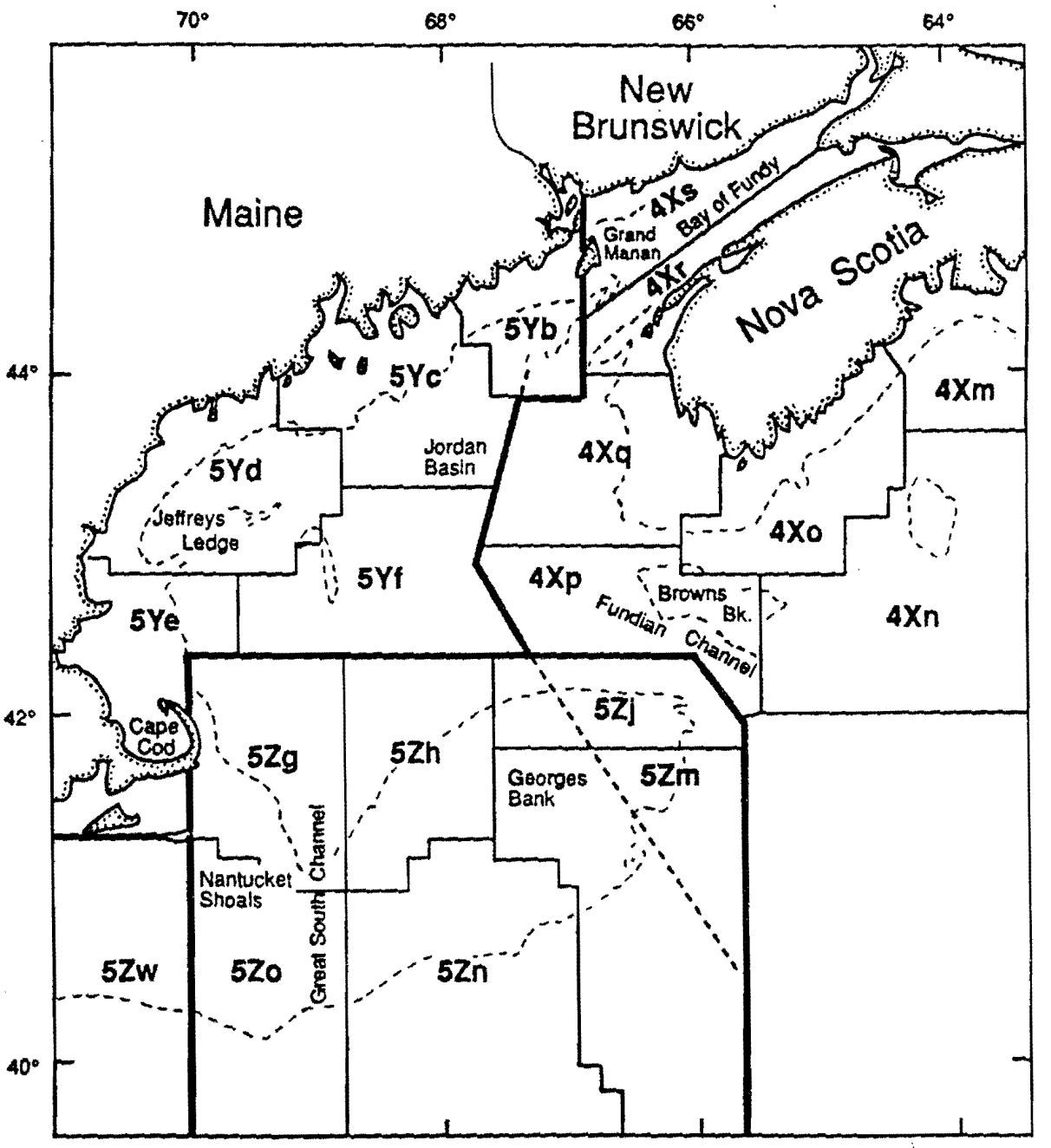

Fig. 1. Map of the Gulf of Maine area.

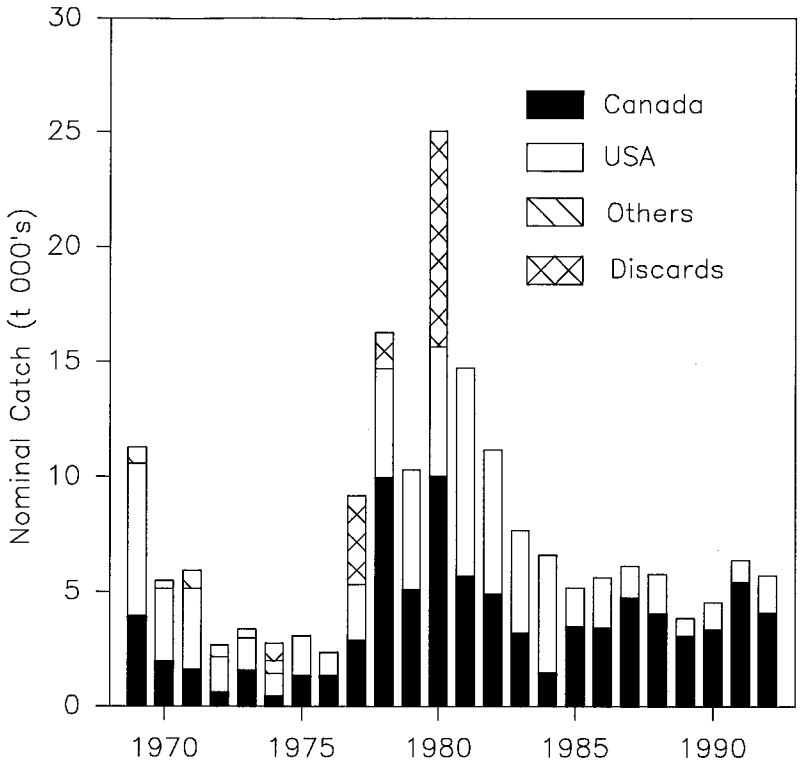

Fig. 2. Nominal catch of haddock in unit areas 5Zj and 5Zm.

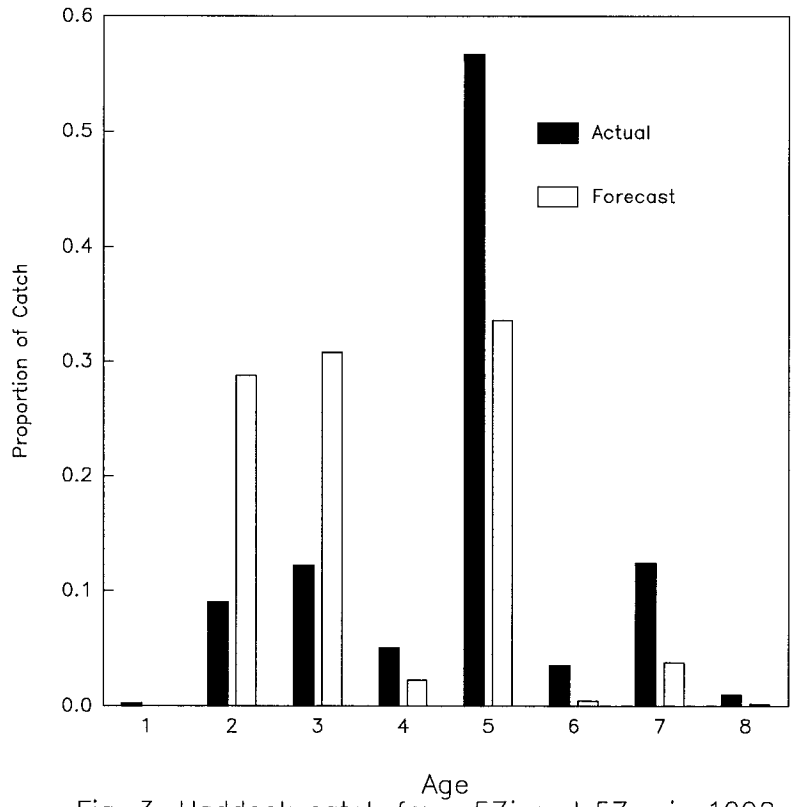

Fig. 3. Haddock catch from 5Zj and 5Zm in 1992, actual and forecast.

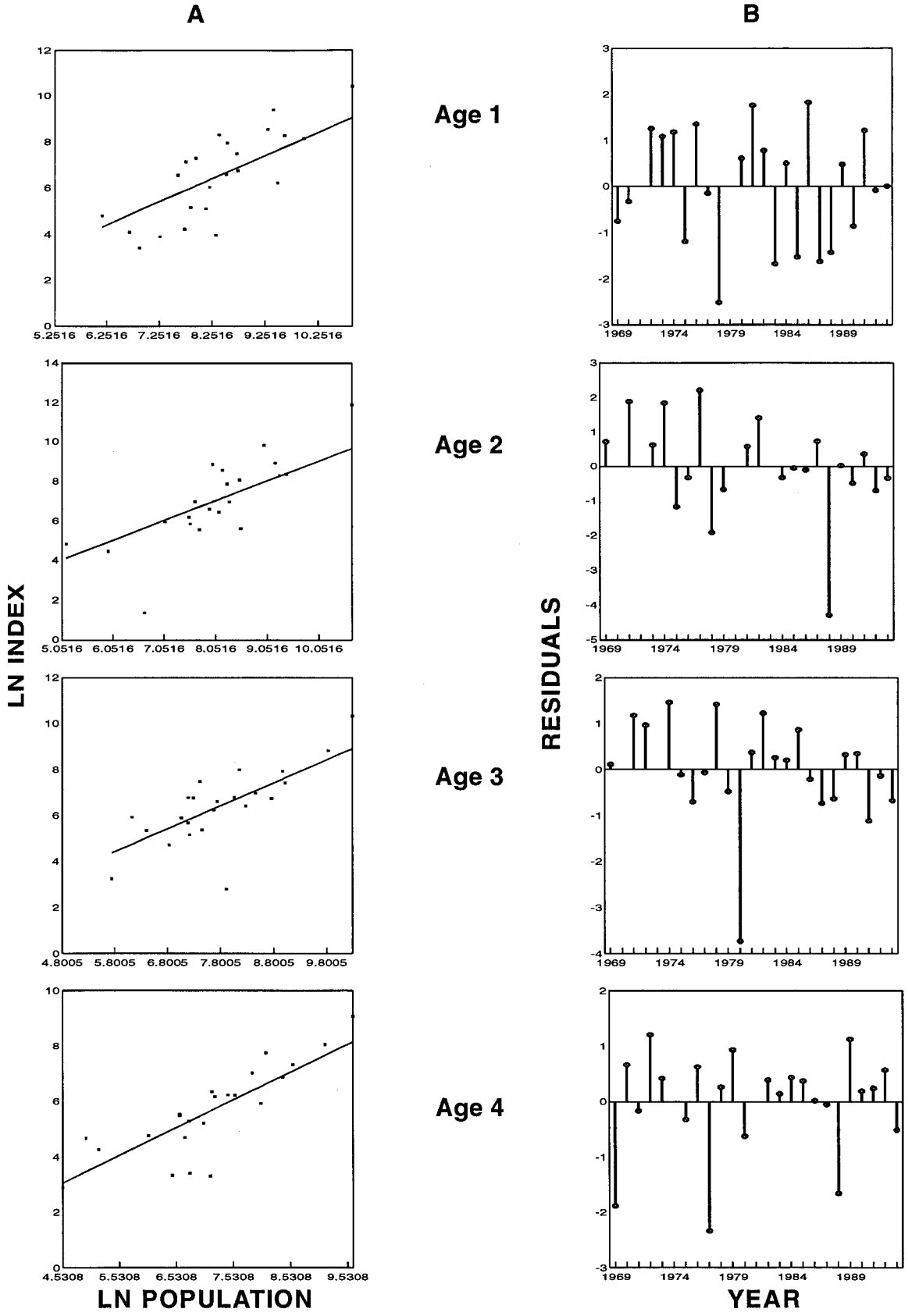

Fig. 4a. Age by age plots of A) the observed and predicted ln abundance index versus ln population numbers and B) residuals plotted against year for haddock in 5Zj,m for the USA fall survey.

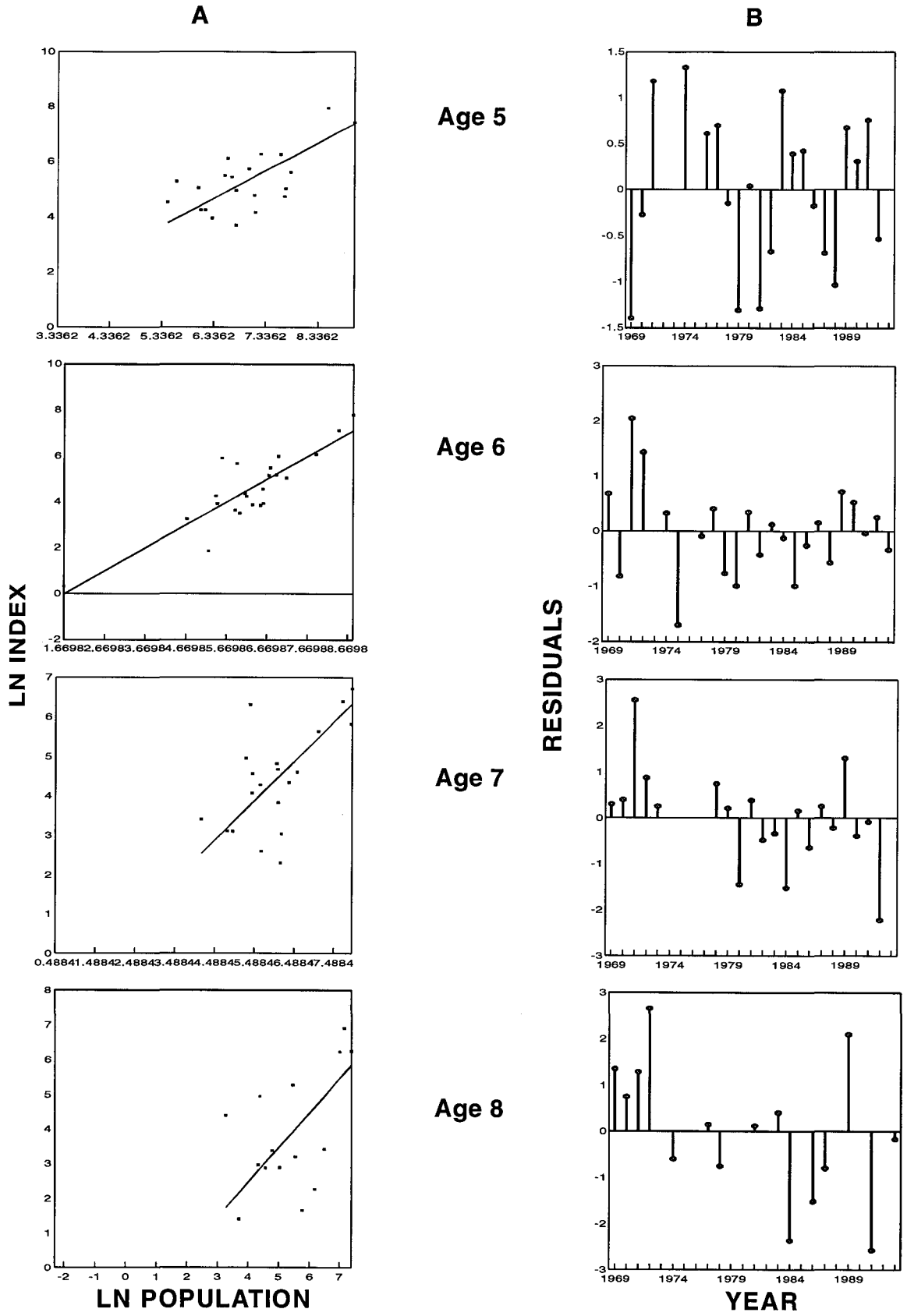

Fig. 4a. (continued)

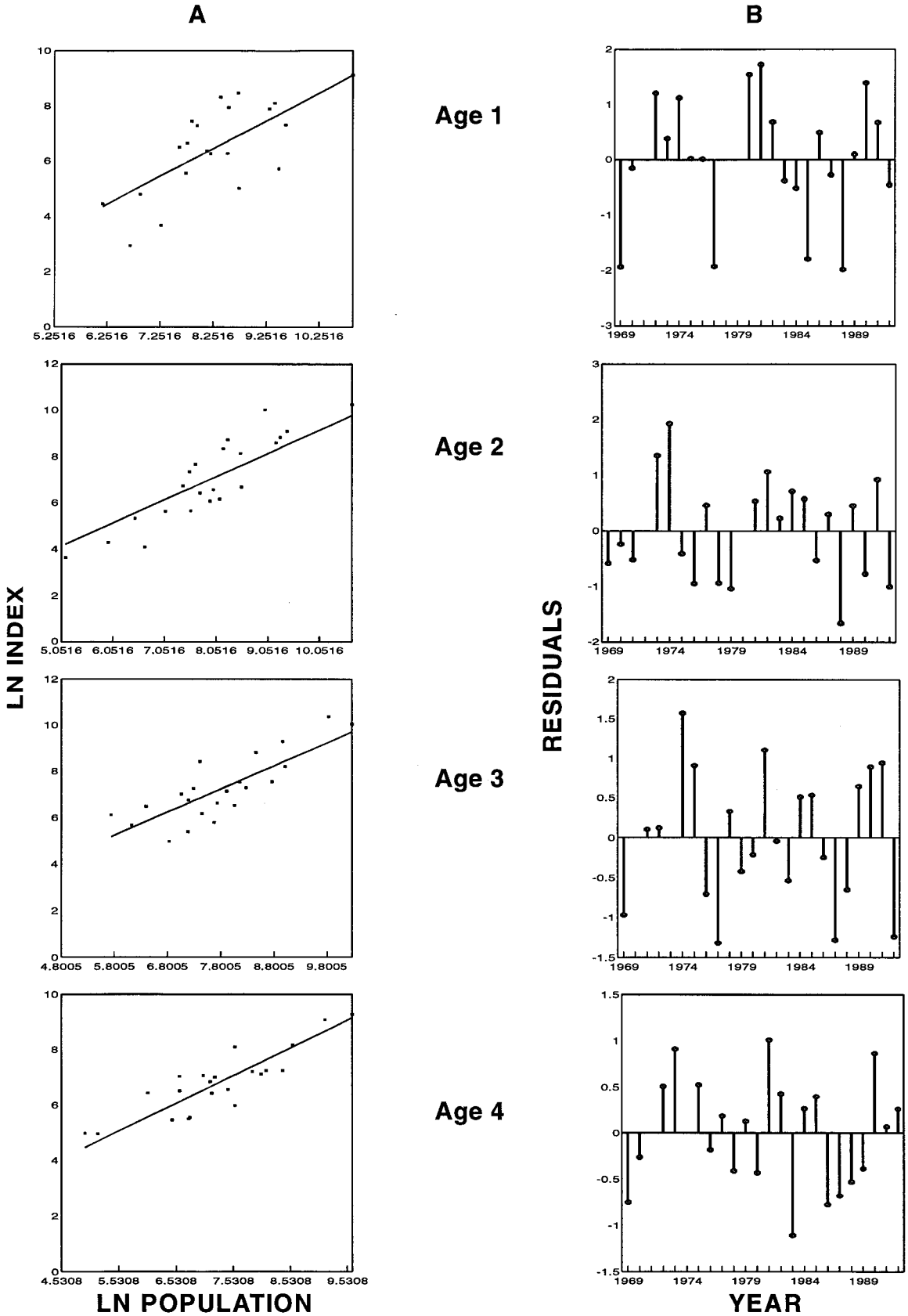

Fig. 4b. Age by age plots of A) the observed and predicted ln abundance index versus ln population numbers and B) residuals plotted against year for haddock in 5Zj,m for the USA spring survey.

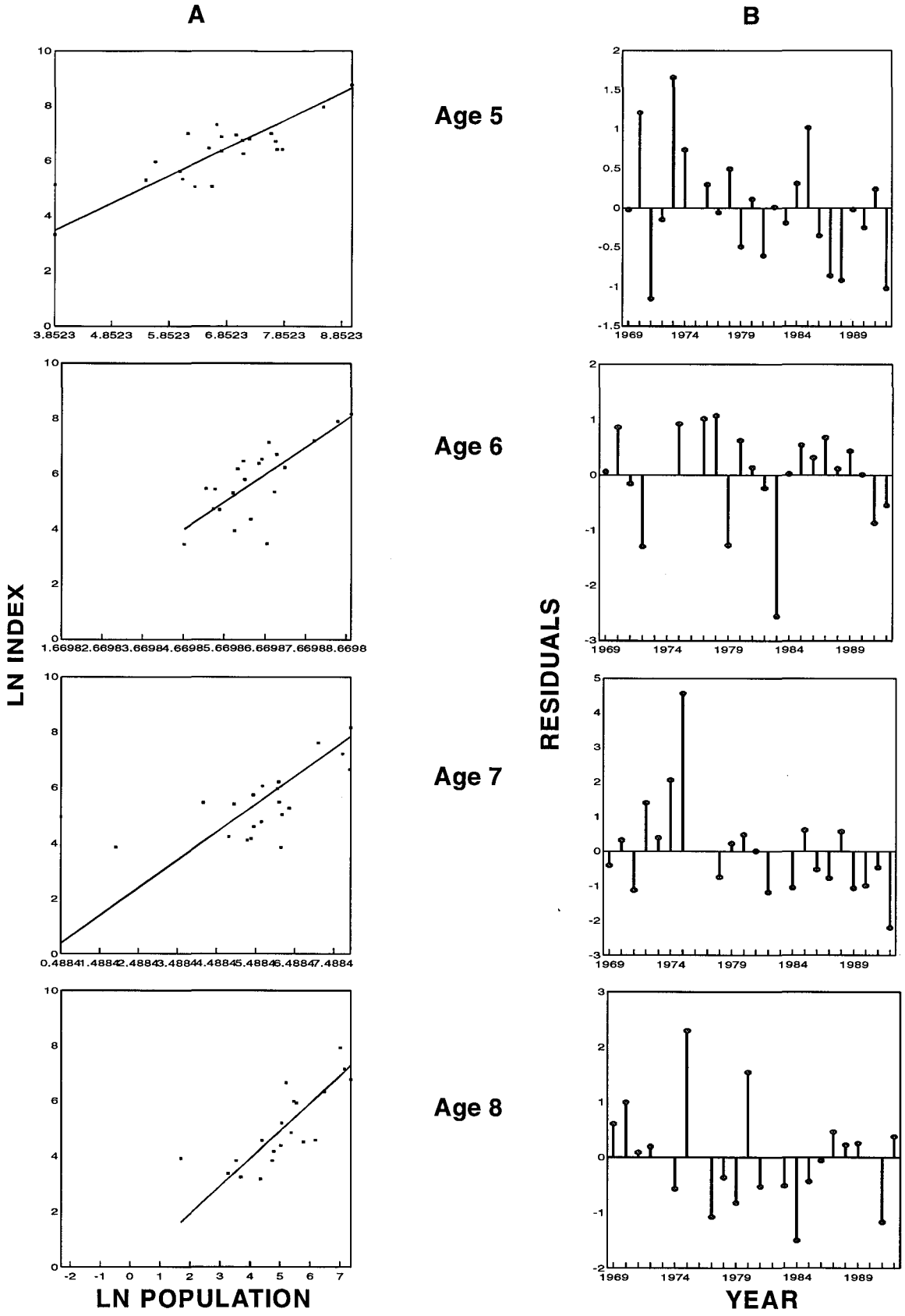

Fig. 4b. (continued)

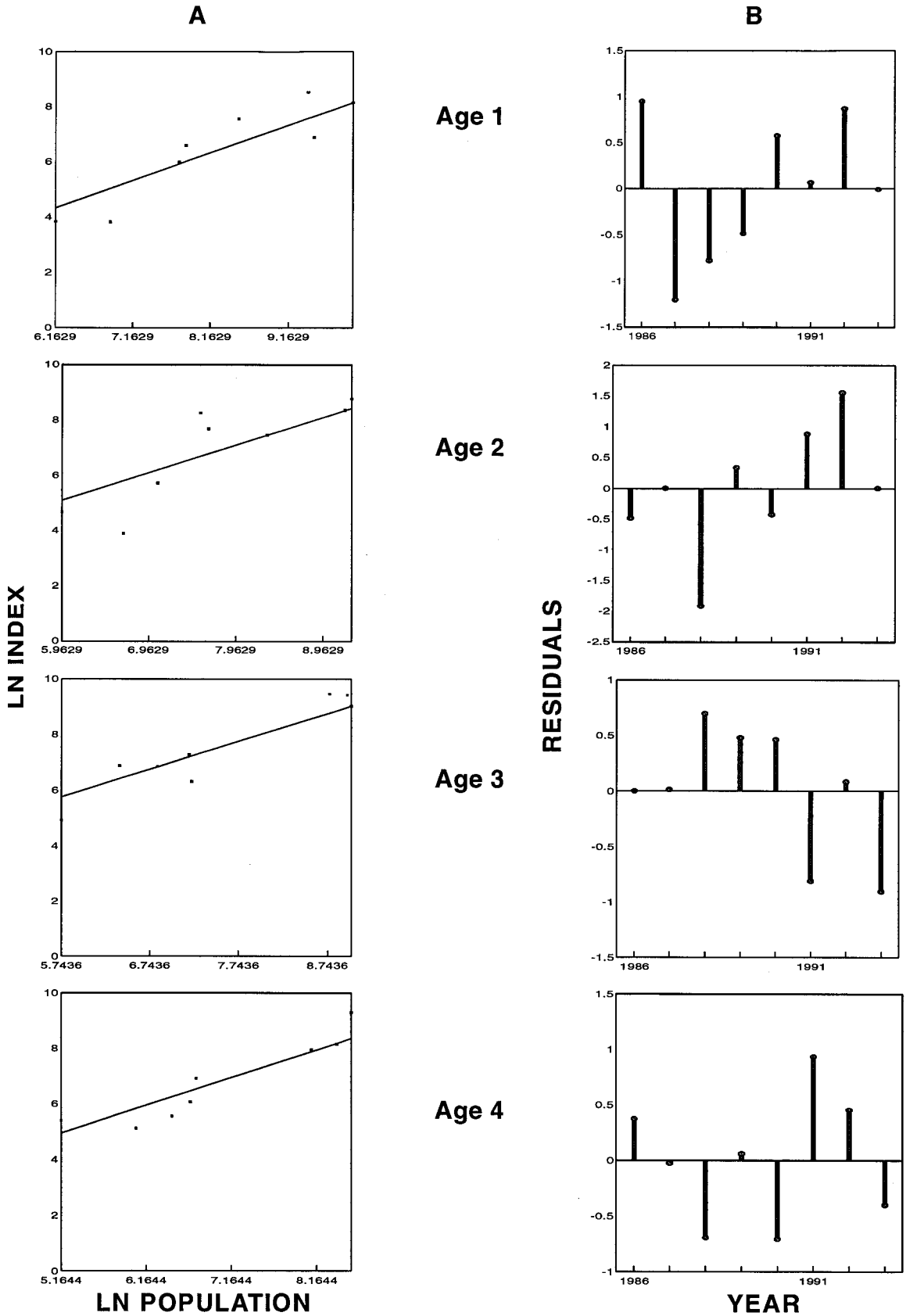

Fig. 4c. Age by age plots of A) the observed and predicted ln abundance index versus ln population numbers and B) residuals plotted against year for haddock in 5Zj,m for the Canadian spring survey.

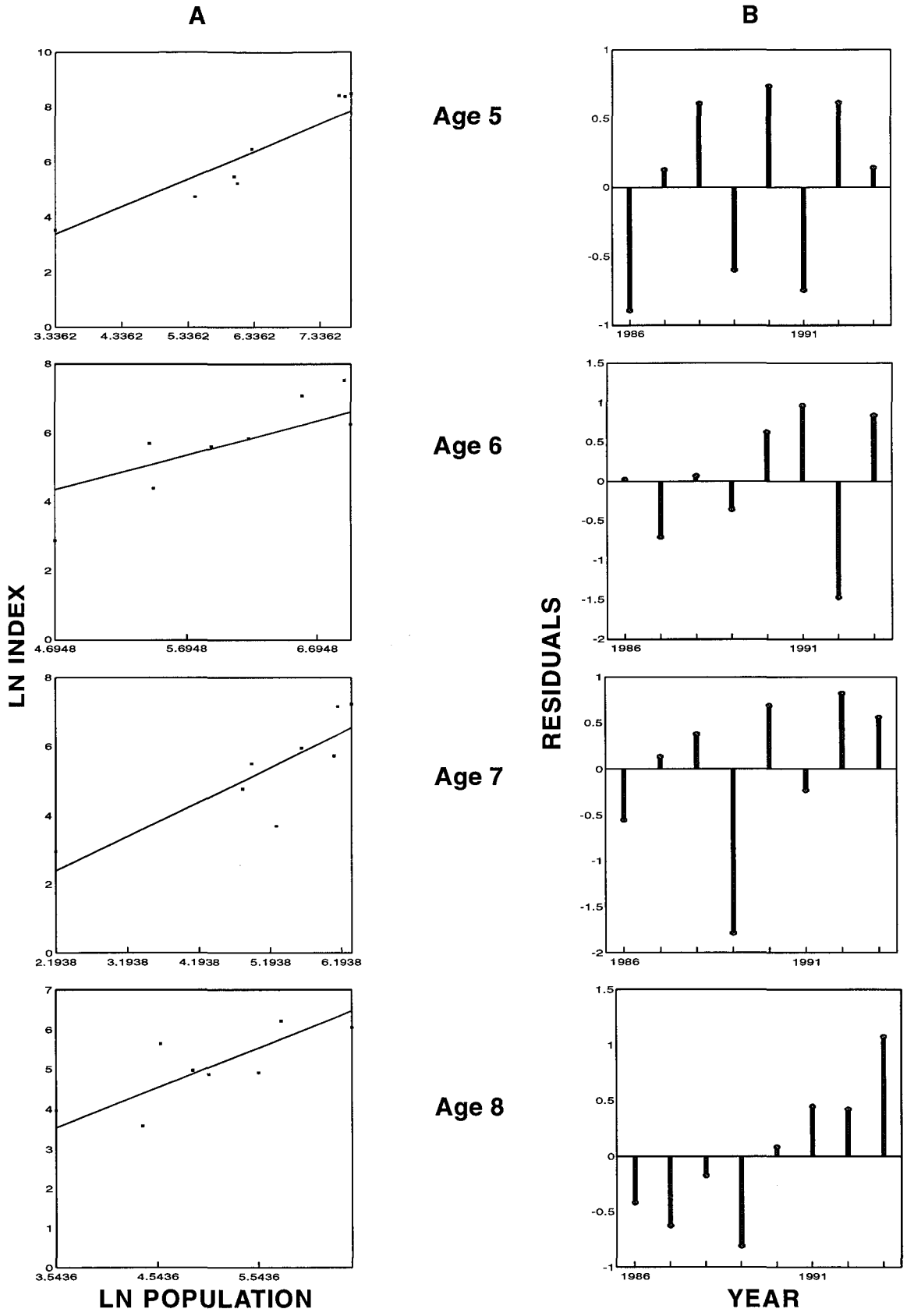

Fig. 4c. (continued)

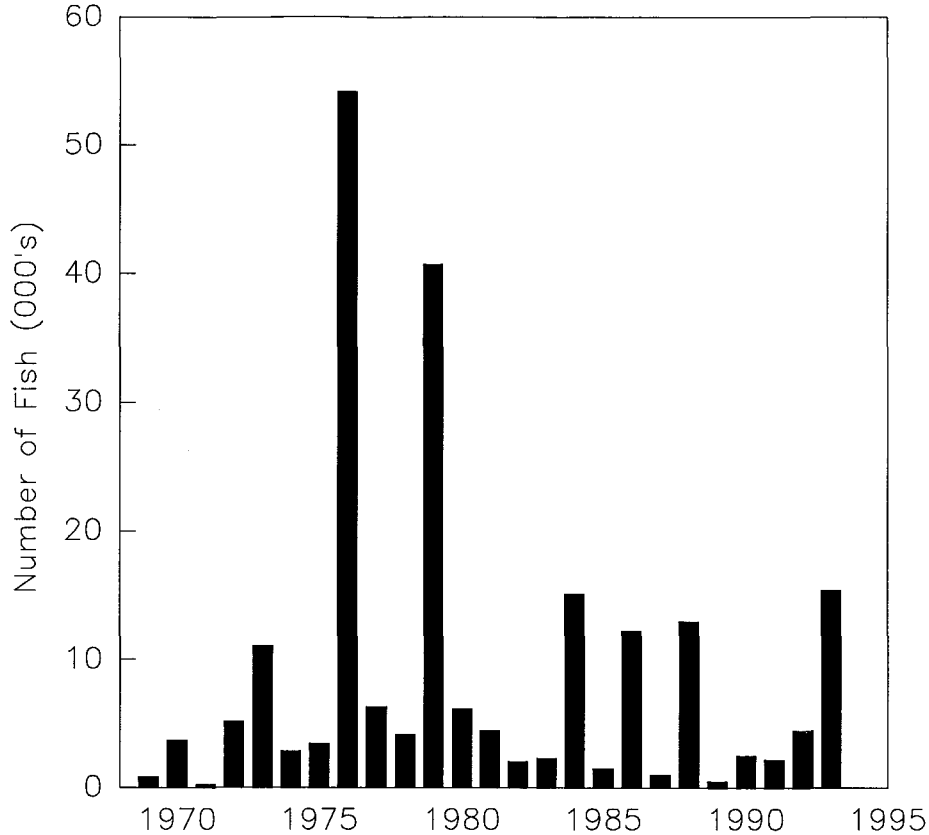

Fig. 5. Recruitment for haddock (age 1) in unit areas 5Zj and 5Zm.

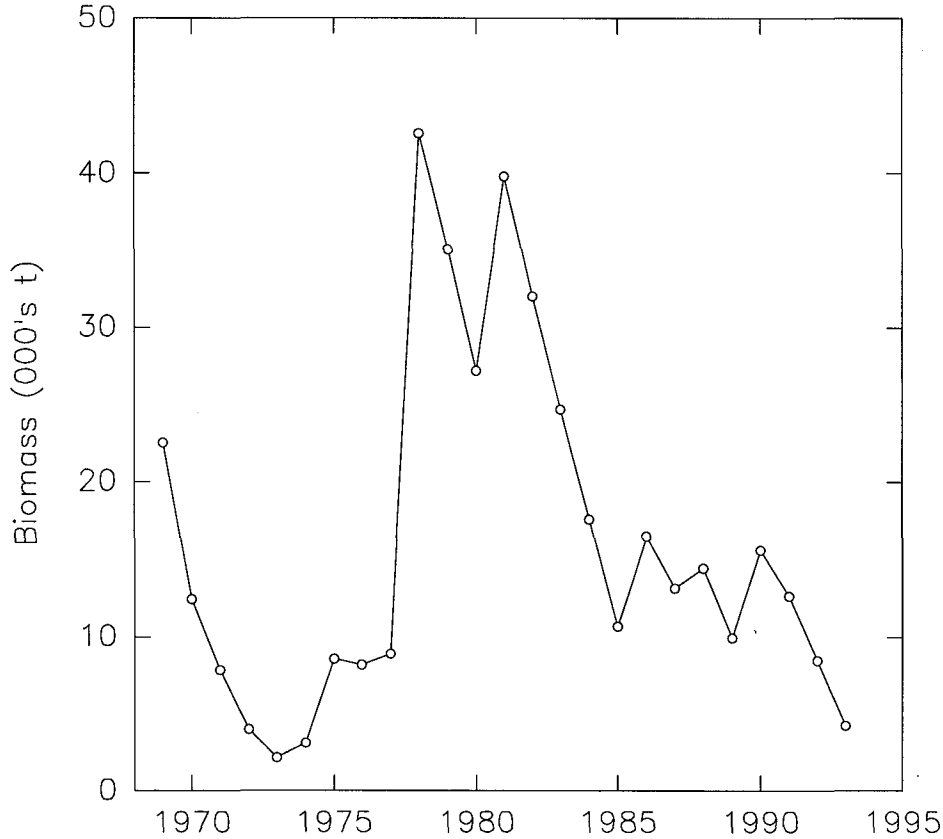

Fig. 6. Biomass (3+) for haddock in unit areas 5Zj and 5Zm.

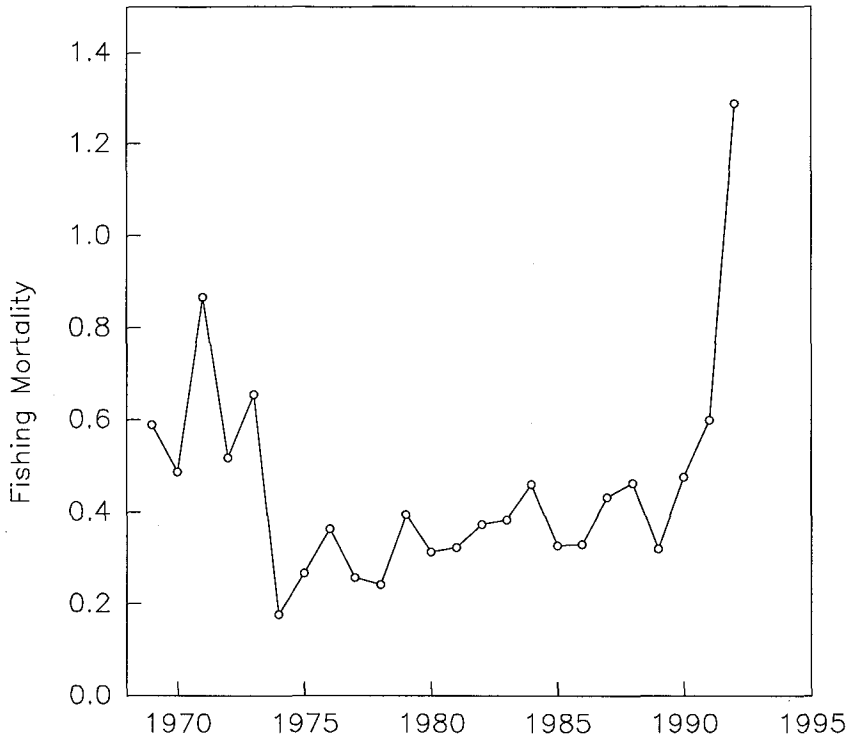

Fig. 7. Fishing mortality (4+) for haddock in unit areas 5Zj and 5Zm.

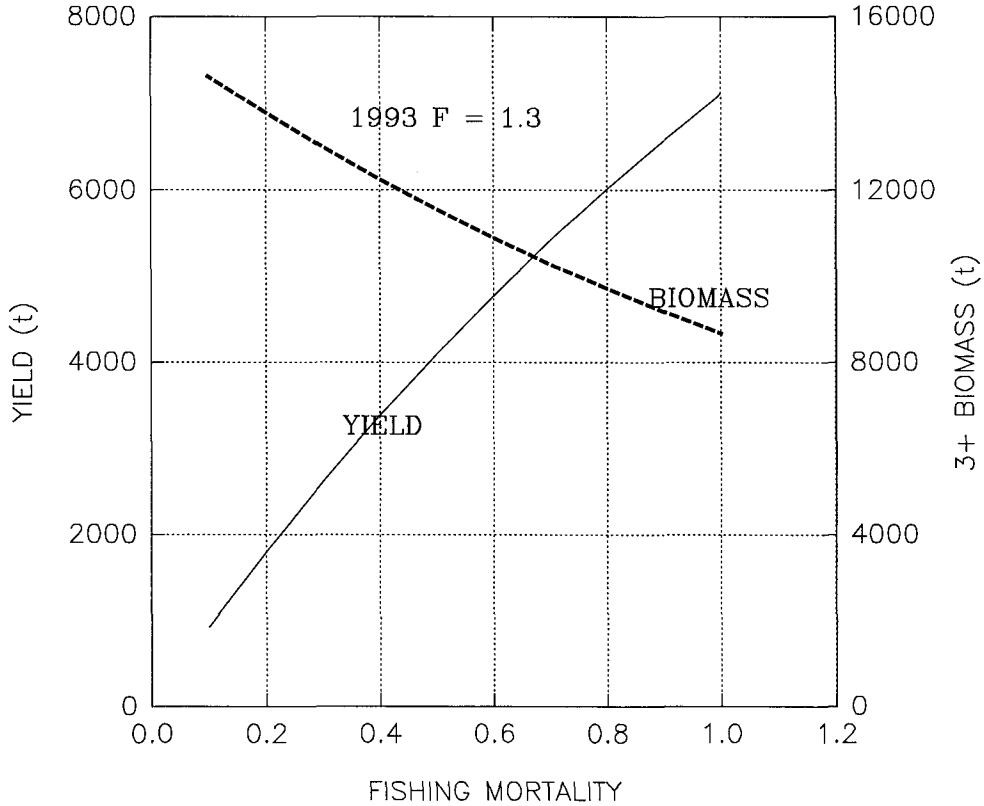

Fig. 8. Projected 5Zj,m haddock yield for 1994 and beginning of year biomass in 1995.