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An Assessment of the Cod Stock in NAFO Divisions 3NO

by

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Nominal catch

Catches of cod from the Div. 3NO stock peaked at 227,000 metric tonnes in 1967 and declined steadily thereafter to a low of 15,000t in 1978. From 1979 to 1991 catches ranged from 20,000 to 50,000t (Table 1, Figure 1). Continued reductions in recommended TAC's contributed to reduced catches in recent years to a level of about 10,000t in 1993. The fishery on this cod stock ceased about mid-year in 1994 when the TAC of 6,000t had been reached. There has been no directed cod fishery in Div. 3NO since 1994. The 1996 NAFO Scientific Council Report recommended that there should be no directed fishing for cod in Div. 3NO in 1997 and that by-catches in fisheries targeting other species should be kept at the lowest possible level.

Over the past several years, catches from the Regulatory Area have been those reported by contracting parties combined with estimates from Canadian surveillance authorities. Other catches (non-contracting parties) are those estimated by Canadian surveillance. Landings during 1996 (Table 2) totaled 174 tonnes comprised of 99 tons as by-catch from Canadian fisheries, 33 tons from EU countries and 42 tonnes from non-contracting parties fishing in the Regulatory Area.

The low 1996 catch resulted in very limited sampling dispersed among Canadian long line and gill net fishing gear (Table 3). As a result, an estimate of total removals at age for the 1996 catch could not be derived. However, length frequency information for the sampled catch is presented in Table 4 Figure 2.

Research vessel survey data

Stratified-random research vessel surveys have been conducted in spring by Canada in Divs. 3N and 3O since 1971 and 1973 respectively with the exceptions of 1983 in Div. 3N and 1974 and 1983 in Div. 3O. Surveys from 1971 to 1982 were conducted by the research vessel *A.T. CAMERON* and those since 1984 were conducted by the sister ships *ALFRED NEEDLER* and *WILFRED TEMPLEMAN*.

In the fall of 1995, the Campelen 1800 trawl was introduced in the Canadian groundfish survey, replacing the Engel 145 hi-rise trawl. The selectivities of the two nets were tested through intensive comparative fishing experiments in 1995 and 1996 and were found to be markedly different (Warren et al. 1996). An analysis of the data to derive appropriate conversion factors for Engel catches vs. Campelen equivalents was completed and conversions of the 1984-spring 1995 RV trawl data have been made. Abundance and biomass estimates are presented in Campelen equivalents up to the spring of 1995 and as direct measures in autumn 1995 and throughout 1996.

Abundance and biomass estimates for these surveys are presented in Tables 5-12 and in Figure 3. Since 1984 biomass has been declining steadily, with the exception of what appears to be an anomalously high 1987 estimate. The increase in 1987 was caused by a large increase in Division 3O. Estimates of the Div. 3NO total biomass increased in 1993 over the 1992 and 1991 values but declined again in 1994 and have remained to date at very low levels.

Trends in Divs. 3NO cod abundance are similar to those observed for biomass with a large value occurring in 1987. While the abundance estimates for the 1988 to 1990 period are among the lowest observed in the Canadian time series of RV abundance for this stock, the 1991 and 1993 estimates were considerably higher. This resulted from increased estimates for the 1989 and 1990 year-classes. Abundance has been very low since 1994.

Age composition data for Canadian spring surveys from 1971 to 1995 are presented in Table 15-16. The dominant year classes in the 1992 to 1994 surveys have been from the 1989 and 1990 cohort. They were present in the 1996 spring survey but have all but disappeared in the 1996 fall survey.

Stratified random surveys have been conducted by Canada during the autumn from 1990 to 1996. Again, the 1990-94 data has been converted to Campelen 1800 trawl equivalents while the 1995-96 data are direct measures. The results of these surveys are presented in Tables 13-14 and Figures 4. Biomass and abundance have been low since 1991-92.

Mean length at age from spring surveys

Because sampling for otoliths was length-stratified by Division, mean length at age was determined for each Division by weighting the value for each individual fish by the ratio of the population number per 3 cm length class to the number of fish sampled in the same length class. The population number was calculated by areal expansion of the stratified mean catch at length per tow (Smith and Somerton 1981). Mean lengths at age are provided for Divisions 3N and 3O in Table 17. Many of the lengths at age in 1972-1982 are based on small sample sizes. Mean length at age for Division 3NO as a whole was calculated for each year as the mean of the Divisional means, weighted by the Divisional population numbers at age (Table 17; Fig. 5). In general, mean lengths at age increased from the early 1970s to the early 1980s and then declined a little. There has been little

consistent change since the mid-1980s, except in ages greater than about age 8, which have declined in recent years.

Maturity at age

Maturity-at-age has been estimated from the spring survey male and female maturity data using a probit model (Tables 18-21). The estimate of age at 50% maturity for females has varied around 6 for the time period 1975 to 1994. However, the 1992-1994 estimates are among the lowest in the time series. While the age at 50% maturity rose to over six years in 1995, it dropped to less than 5 in 1996 for the first time in the time series. These latter values are significantly lower than the age at maturity in the late 1980s (Fig. 6).

The estimate of length at 50% maturity for females has varied around approximately 55-65 cm for the time period 1975 to 1994. The estimated length at 50% maturity fell to approximately 51 cm in 1995 and 48 cm in 1996.

Data are available for the proportion mature at age of male cod for the period 1975-95. Males typically mature at an earlier age than females. However, for four of the seven years prior to 1995, the age at 50% maturity dropped below 5 years.

The estimate of length at 50% maturity for males has varied around approximately 55 cm for the time period 1975 to 1988. However, the length at 50% maturity has been dropping since 1989 has been below 50 cm for that last three years.

Cohort Strength

Relative cohort strength for 3NO cod derived from 1984-1996 Canadian spring and fall survey data is presented in Figure 7. The last strong year classes for this stock were observed over the period 1979-82. With the exception of 1989, recruitment for the period from 1983-93 has been low. The 1989 year class was considered to be relatively strong when it first appeared in surveys but was subjected to high removals just prior to the closure of directed fishing. As a result, there are no strong year classes in the current population.

References

Smith, S.J. and G.D. Somerton. 1981. STRAP: A user-oriented computer analysis system for groundfish research trawl survey data. Can.Tech. Rep. Fish. Aquat. Sci. 1030: iv + 66 p.

Warren, W. 1996. Report on the comparative fishing trial between the *Gadus atlantica* and *Teleost*. NAFO SCR Doc. 96/28 Serial No. N2701.

Table 1. Catch (t) of cod in NAFO Divisions 3NO. 1953 -1996

Year	Canada	Spain	Portugal	USSR	Others	Total	TAC
1953	39884	12633	7919		5761	66197	
1954	17392	88674	24045		4650	134761	
1955	6053	64987	27711		15605	114356	
1956	5363	42624	15505		1390	64882	
1957	9641	51990	21740		6819	90190	
1958	4812	29436	11608		2195	48051	
1959	3687	39994	17730	48	2911	64370	
1960	3408	33972	14347	24204	3746	79677	
1961	5428	32284	9059	22854	3099	72724	
1962	3235	17413	3653	7971	2712	34984	
1963	5079	37632	10004	10184	6843	69742	
1964	2882	37185	8095	9510	6789	64461	
1965	4229	64652	1692	17166	11448	99187	
1966	6501	52533	5070	39023	5792	108919	
1967	3446	77948	9703	118845	16842	226784	
1968	3287	69752	6752	78820	6900	165511	
1969	3664	71160	4940	29173	8768	117705	
1970	4771	67034	3185	28338	8233	111561	
1971	2311	89915	6589	19307	8174	126296	
1972	1736	76324	11537	12198	1579	103374	
1973	1832	42403	7759	27849	586	80429	103000
1974	1360	38338	6602	26911	178	73389	101000
1975	1189	16616	5560	20785	24	44174	88000
1976	2065	9880	2620	8992	726	24283	43000
1977	2532	8827	1742	4041	462	17604	30000
1978	6246	5813	641	1819	199	14718	15000
1979	9938	13782	1140	2446	545	27851	25000
1980	5589	8999	1145	3261	997	19991	26000
1981	6096	13299	1091	3187	671	24344	26000
1982	10185	14361	2466	3985	608	31605	17000
1983	11374	12320	1109	3238	778	28819	17000
1984	8705	13590	1071	3306	431	27103	26000
1985	18179	13682	608	3968	462	36899	33000
1986	18035	23395	6890	1181	1144	50645	33000
1987	18652	15788	4108	764	2307	41619	33000
1988	19727	15889	3927	2973	634	43150	40000
1989	13433	17904	913	108	857	33215	25000
1990	10620	4678	2145	18	11385	28846	18600
1991	12056 [2]	5448	1063	61	10824 [3]	29454 [3]	13600
1992	7859	1927	449	68	2449 [3]	12752 [3]	13600
1993 [1]	5370	3764	525	287	700 [3]	10646 [3]	10200
1994 [1]	47	1783	50		822 [3]	2702 [3]	6000 [4]
1995 [1]	64	29			79 [3]	172 [3]	0 [4]
1996 [1]	99	5	33		38 [3]	175	0 [4]

[1] **Provisional**

[2] **Figure is 4000 t higher than Canadian Statistics as this is an amount deemed to be misreported as 3L catch.**

[3] **Includes Canadian Surveillance Estimates and NAFO Scientific Council Estimates**

[4] **The fishery for cod was suspended in February 1994 and has been under a NAFO moratiun since then.**

Table 2. Cod landings (t) by month and gear from NAFO Divisions 3NO by Canada in 1996.

Month	Can/N					Total	
	3N	3O					
	OT	GN	LL	OT	MWT	Can/N	
Jan						0	
Feb						0	
Mar		0			0	0	
Apr		13	1	2	0	16	
May		13	6	2		20	
Jun		1				1	
Jul	1			6		7	
Aug		1		0		1	
Sep				0		0	
Oct						0	
Nov				6		6	
Dec				0		0	
Total	1	28	8	15	0	52	
Month	Can/M					Total	
	3N	3O					
	LL	OT	MWT	GN	LL	Can/M	Totals
Jan						0	0
Feb						0	0
Mar	0				2	3	3
Apr		3	1	3	13	19	36
May	0		0		4	4	24
Jun						0	1
Jul					1	1	9
Aug	5				2	7	8
Sep					2	2	2
Oct		0			2	2	2
Nov		0			4	4	10
Dec		0			4	4	4
Total	6	3	1	3	33	46	99

Table 3. Sampling avaliable to estimate catch at age for Divisions 3NO in 1996.

Division	Gear	Month	No. measured	Quarter	No. aged	Sample wt (t)
3N	LL	2	28	1		
		10	61	4		
3O	LL	2	228	1		
		5	410	2		
	GN	3	43	1	43	
		4	335	2	192	

Table 4 . Frequencies available for partitioning catch at a

LEN	3OGN	3OLL	3NGN
49	0	0	0
52	0	4	2
55	5	8	0
58	12	15	3
61	17	44	2
64	13	49	10
67	16	73	7
70	9	51	8
73	14	50	4
76	15	50	6
79	12	45	3
82	26	20	5
85	16	20	7
88	30	18	5
91	17	17	2
94	22	13	3
97	12	18	3
100	19	14	4
103	10	16	2
106	9	10	0
109	18	17	1
112	13	24	5
115	18	13	3
118	19	21	3
121	12	11	1
124	10	6	0
127	6	3	0
130	5	6	0
133	2	2	0
136	0	0	0
139	0	0	0
142	1	0	0
145	0	1	0
148	0	0	0
TOT	378	638	89

Table 5. Cod abundance from Canadian spring RV surveys in Division 3N for depths <200 fathoms.Shaded Numbers are estimates for non sampled strata.

Depth range (fath)	Strata	Vessel Area Sq. mi.	AN 27 1984	WT 29 AN 43 1985	WT 47 1986	WT 58-59 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			2-May-84	27-Apr-85	29-Apr-86	9-May-87	1-May-88	2-May-89	12-May-90	7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96
0-30	375	1593	22302	12390	2240	6223	3134	4868	3236	111	148	74	0	0	0
	376	1499	149223	149	787	88795	2533	599	268	119	0	0	0	69	165
31-50	360	2992	136658	27167	9750	31721	35911	1053	3020	900	2731	907	0	0	449
	361	1853	29339	50443	5585	47837	15405	9136	6634	2574	804	836	103	625	1077
	362	2520	68550	20045	5400	117654	6860	7054	8400	1120	58	117	0	0	39
	373	2520	27500	4161	1600	11738	2625	3096	1575	223	0	0	0	0	39
	374	931	10431	776	86	931	879	52	388	26	129	0	0	0	85
	383	674	62	0	0	967	686	499	47	62	0	0	0	0	0
51-100	359	421	2339	0	40375	7163	5584	1637	819	1199	1696	2193	0	0	33
	377	100	1771	2451	465	6396	0	424	0	0	0	28	49	0	0
	382	647	0	3572	22	60	180	1588	3325	0	0	0	0	0	0
101-150	358	225	2703	5766	4063	4359	5328	3984	8297	1047	16484	3391	109	156	310
	378	139	2481	43824	6313	2124	1921	1612	2751	875	3707	608	222	97	163
	381	182	1534	12968	8249	392	3185	3741	3665	202	88	0	13	114	160
151-200	357	164	0	11571	444	1428	11	68	888	2528	2676	68	433	23	90
	379	106	788	3195	5010	7	44	206	1318	2311	8782	545	191	66	204
	380	116	209	3681	526	934	1498	967	2062	3859	870	20654	0	32	471
total all strata fished < 200 fathoms			455890	202158	90915	327301	85786	40583	46692	17156	38174	29420	1120	1182	3283
1 std dev			157039	27576	35654	91793	15324	5543	7693	4176	5808	20213	520	651	787

Table 6. Cod biomass (t) from Canadian spring RV surveys in Division 3N for depths < 200 fathoms. Shaded Numbers are estimates for non sampled strata.

Depth range (fath)	Strata	Vessel Area Sq. mi.	AN 27 1984	WT 29 AN 43 1985	WT 47 1986	WT 58-59 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			2-May-84	27-Apr-85	29-Apr-86	9-May-87	1-May-88	2-May-89	12-May-90	7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96
0-30	375	1593	7018	26266	21041	13506	23154	25148	16134	1835	2331	1145	0	0	0
	376	1499	16673	713	2954	9148	6555	1256	3791	1483	0	0	0	51	62
31-50	360	2992	21843	17007	3781	4155	3792	2145	10488	1032	1445	46	0	0	457
	361	1853	20008	52794	61130	50358	25677	19517	30149	16646	399	3455	64	47	647
	362	2520	75781	29914	31327	144250	19890	26588	37344	4343	668	1522	0	0	21
	373	2520	33487	5274	4378	14596	9738	8996	5802	856	0	0	0	0	9
	374	931	14987	1523	1338	1832	5872	937	5050	516	30	0	0	0	11
	383	674	502	0	0	1664	236	574	615	224	0	0	0	0	0
51-100	359	421	308	0	2639	779	637	213	101	66	113	433	0	0	36
	377	100	145	219	138	1720	0	46	0	0	0	9	8	0	0
	382	647	0	257	84	42	59	782	298	0	0	0	0	0	0
101-150	358	225	822	906	1724	4255	1317	1701	1089	131	2650	1699	164	135	131
	378	139	692	4601	1084	358	441	432	399	145	413	247	64	76	84
	381	182	765	5397	2913	247	786	216	800	399	15	0	57	44	40
151-200	357	164	0	6352	640	566	33	64	274	331	706	46	237	24	18
	379	106	382	1198	1587	9	37	98	318	852	2592	205	121	46	66
	380	116	411	2128	366	1018	656	498	704	676	181	9823	0	9	100
total all strata fished < 200 fathoms			193825	154547	137124	247937	98880	89212	113355	29536	11544	18629	714	433	1682
1 std dev			29836	18270	33801	37740	12640	12355	13694	8520	2748	9845	287	118	553

Table 7. Cod abundance (000's) from Canadian spring RV surveys in Division 3N for depths > 200 fathoms.Shaded Numbers are estimates for non sampled strata.

Depth	Strata	Vessel	AN	WT 29	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
range		Area	27	AN 43	47	58-59	70	82	95-96	105-106	119-120	136-137	152-153	168-169	188-189
(fath)		Sq. mi.	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
mean survey date			2-May-84	27-Apr-85	29-Apr-86	9-May-87	1-May-88	2-May-89	12-May-90	7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96
201-300	723	155	nf	nf	nf	nf	nf	nf	nf	1970	13573	43	32	0	46
	725	105	nf	nf	nf	nf	nf	nf	nf	401	nf	0	95	73	34
	727	160	nf	nf	nf	nf	nf	nf	nf	833	2144	1444	222	211	1394
301-400	724	124	nf	nf	nf	nf	nf	nf	nf	69	112	9	34	17	0
	726	72	nf	nf	nf	nf	nf	nf	nf	0	0	0	0	70	0
	728	156	nf	nf	nf	nf	nf	nf	nf	0	0	0	0	43	0
401-500	752	134	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
	756	106	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
	760	154	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
total strata fished >200 fathoms			nf	nf	nf	nf	nf	nf	nf	3273	15829	1496	383	414	1474
total all strata fished			455890	202158	90915	327301	85786	40583	46692	20429	54003	30916	1504	1597	4789
1 STD			157039	27576	35654	91793	15385	5543	7693	4280	12445	20228	555	659	1519

Table 8. Cod biomass (t) from Canadian spring RV surveys in Division 3N for depths >200 fathoms.Shaded Numbers are estimates for non sampled strata.

Depth	Strata	Vessel	AN	WT 29	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
range		Area	27	AN 43	47	58-59	70	82	95-96	105-106	119-120	136-137	152-153	168-169	188-189
(fath)		Sq. mi.	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
mean survey date			2-May-84	27-Apr-85	29-Apr-86	9-May-87	1-May-88	2-May-89	12-May-90	7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96
201-300	723	155	nf	nf	nf	nf	nf	nf	nf	662	3415	30	26	0	35
	725	105	nf	nf	nf	nf	nf	nf	nf	186	nf	0	32	8	19
	727	160	nf	nf	nf	nf	nf	nf	nf	486	805	313	86	41	677
301-400	724	124	nf	nf	nf	nf	nf	nf	nf	30	32	9	22	26	0
	726	72	nf	nf	nf	nf	nf	nf	nf	0	0	0	0	31	0
	728	156	nf	nf	nf	nf	nf	nf	nf	0	0	0	0	26	0
401-500	752	134	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
	756	106	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
	760	154	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
total strata fished >200 fathoms			nf	nf	nf	nf	nf	nf	nf	1364	4252	352	166	132	731
total all strata fished			193825	154547	137124	247937	98880	89212	113355	30901	15795	18982	880	566	2430
1 STD			29836	18270	33801	37740	12640	12322	13694	8541	3853	9846	295	125	866

Table 9. Cod abundance (000's) from Canadian (Spring) RV Surveys in Division 3O for depths <200 fathoms.Shaded Numbers are estimates for non-sampled strata.

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984	AN 43 1985	WT 47 1986	WT 58-60 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			3-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96
31-50	330	2089	7761	7892	3707	11315	5384	1609	4990	1424	203	373	0	0	4824
	331	456	3863	1921	744	1900	1425	792	1052	158	32	0	0	0	348
	338	1898	23356	9724	8933	20210	6623	20166	8436	24463	2285	835	132	264	2109
	340	1716	10606	9414	10282	146151	2826	1960	3628	2569	334	119	286	0	1441
	351	2520	78342	17578	117725	71723	13335	6112	6242	2071	1050	350	250	0	525
	352	2580	41362	17656	9803	35888	56193	10474	14499	9752	3852	1331	1299	1111	1115
	353	1282	0	2226	2773	29082	44478	4731	6499	1297	4229	223	0	285	677
51-100	329	1721	5928	2390	2838	133032	5259	5577	13147	22309	508	1673	13959	1100	330
	332	1047	436	3432	1115	30014	2908	3112	5700	683773	29607	296105	0	2399	3184
	337	948	1909	5688	1369	1799	2337	10402	2133	22436	6913	231602	132	527	2502
	339	585	14625	894	135	2383	488	27	1625	1571	609	406	0	0	46
	354	474	2238	1843	2216	65669	2271	593	395	9019	1679	1415	0	0	66
101-150	333	151	0	42	105	566	0	378	136	692	975	514	2205	10	688
	336	121	0	17	126	17	8	8	143	160	5537	437	605	0	8
	355	103	0	4070	29	207	43	987	193	2339	944	236	50	7	2573
151-200	334	92	0	236	1323	26	121	141	543	1214	971	1137	533	200	184
	335	58	0	0	68	8	12	16	97	27	1275	342	157	52	490
	356	61	0	0	13	4	51	131	110	546	2665	424	491	13	93
total strata fished < 200 fathoms			190427	85023	163306	549997	143763	67215	68515	785821	63667	537522	20100	5967	21202
1 std dev			23492	12072	92856	118784	39030	10972	10310	669240	22549	271901	13845	1800	4574

Table 10. Cod biomass (t) from Canadian (Spring) RV Surveys in Division 3O for depths < 200 fathoms.Shaded Numbers are estimates for non-sampled strata.

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984	AN 43 1985	WT 47 1986	WT 58-60 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			3-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96
31-50	330	2089	7964	9372	4167	12075	4486	3318	5091	266	32	92	0	0	7103
	331	456	4536	4891	1295	1982	2176	481	2191	236	224	0	0	0	983
	338	1898	43090	13670	23245	20013	14538	25430	9315	10283	11883	4981	1841	3439	1535
	340	1716	13654	10780	12024	161120	16447	5478	10296	384	52	1936	160	0	239
	351	2520	68620	34516	90852	114632	25324	19777	22343	6595	2063	1198	131	0	104
	352	2580	51655	41868	24245	76430	82226	43865	38424	22512	16671	8225	1584	3784	1528
	353	1282	0	9451	1831	15552	4512	4012	5892	1267	1780	3260	0	609	118
51-100	329	1721	1776	1931	1114	116331	16127	1690	4684	4195	97	219	10523	2187	191
	332	1047	4410	17134	4092	12848	11718	2156	11266	39264	3927	108245	0	1702	1534
	337	948	741	2976	11644	4299	1005	5735	3354	5566	20721	79783	813	1659	3299
	339	585	3355	730	73	943	496	219	385	92	87	43	0	0	5
	354	474	955	660	569	6915	1211	87	562	3325	191	1319	0	0	85
101-150	333	151	0	330	411	1837	0	1486	381	877	273	1661	8549	26	1625
	336	121	0	81	120	35	39	44	318	111	1733	375	661	0	19
	355	103	0	724	29	259	38	538	198	329	63	169	32	31	2344
151-200	334	92	0	898	4773	120	473	294	826	1385	1018	1408	959	333	259
	335	58	0	0	159	38	82	16	110	10	276	2522	453	342	680
	356	61	0	0	42	15	178	154	219	88	308	387	257	16	46
total strata fished < 200 fathoms			200758	150013	180686	545446	181076	114780	113664	96783	61399	215824	25964	14127	21696
1 std dev			26557	18667	57045	107416	34873	32407	14933	35395	21352	92888	11823	3094	4742

Table 11. Cod abundance (000's) from Canadian (Spring) RV Surveys in Division 3O for depths >200 fathoms.Shaded Numbers are estimates for non-sampled strata.

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984	AN 43 1985	WT 47 1986	WT 58-60 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			3-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96
201-300	717		nf	nf	nf	nf	nf	nf	nf	3701	336	1615	1441	242	27
	719		nf	nf	nf	nf	nf	nf	nf	274	749	301	443	164	21
	721		nf	nf	nf	nf	nf	nf	nf	190	72390	348	11	5	84
301-400	718		nf	nf	nf	nf	nf	nf	nf	15	0	100	503	102	0
	720		nf	nf	nf	nf	nf	nf	nf	0	569	15	211	29	6
	722		nf	nf	nf	nf	nf	nf	nf	0	149	0	0	0	11
401-500	764		nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
	772		nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
total strata fished > 200 fathoms			nf	nf	nf	nf	nf	nf	nf	4180	74193	2379	2609	542	149
total all strata fished			190427	85023	163306	549997	143763	67215	68515	790001	137860	539900	22708	6510	21352
1 STD			22957	12072	92856	118784	39030	10972	10310	669243	75102	271903	13895	1823	4574

Table 12. Cod biomass (t) from Canadian (Spring) RV Surveys in Division 3O for depths >200 fathoms.Shaded Numbers are estimates for non-sampled strata.

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984	AN 43 1985	WT 47 1986	WT 58-60 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			3-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96
201-300	717	717	nf	nf	nf	nf	nf	nf	nf	15218	436	1870	2094	339	57
	719	719	nf	nf	nf	nf	nf	nf	nf	143	179	330	727	927	37
	721	721	nf	nf	nf	nf	nf	nf	nf	88	12153	304	16	10	95
301-400	718	718	nf	nf	nf	nf	nf	nf	nf	7	0	159	791	91	0
	720	720	nf	nf	nf	nf	nf	nf	nf	0	139	9	222	34	3
	722	722	nf	nf	nf	nf	nf	nf	nf	0	70	0	0	0	28
401-500	764	764	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
	772	772	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf
total strata fished > 200 fathoms															
total all strata fished			200758	150013	180686	545446	181076	114780	113664	112240	74377	218496	29814	15528	21915
1 STD			26557	18667	57045	107416	34873	32420	14933	36959	24453	92889	11890	3223	4742

Table 13. Abundance ('000) and Biomass (t) of cod from autumn stratified random surveys in Division 3N.

			abundance						Tel 42	Biomass						Tel 42
Depth Range	Strata	Area	WT 101-102 1990 6-Dec-90	WT 113-115 1991 3-Nov-91	WT 128-130 1992 29-Oct-92	WT 144-146 1993 7-Nov-93	WT 160-161 1994 2-Nov-94	WT 176-177 1995 13-Oct-95	AN253 WT 200 1996 1-Dec-96	WT 101-102 1990 6-Dec-90	WT 113-115 1991 3-Nov-91	WT 128-130 1992 29-Oct-92	WT 144-146 1993 7-Nov-93	WT 160-161 1994 2-Nov-94	WT 176-177 1995 13-Oct-95	AN253 WT 200 1996 1-Dec-96
0-30	375	1593	5421	66596	nf	2047	1947	5001	0	31395	69276	nf	3305	9447	3162	0
	376	1499	32419	455280	354763	260	312	3956	93	5147	80732	116390	152	993	4035	806
31-50	360	2992	28703	12311	8311	3463	0	437	485	7585	4456	4572	8072	0	1329	319
	361	1853	6273	14155	20718	6177	7549	3788	2025	24777	16326	12485	12996	12111	8626	1734
	362	2520	12855	73045	49583	1300	622	910	104	9636	40955	22852	1576	1001	337	29
	373	2520	1336	22575	1400	750	0	70	130	9722	26255	4114	254	0	39	49
	374	931	879	20754	nf	819	1034	57	65	2501	9699	nf	1102	2414	15	27
	383	674	530	530	nf	0	0	47	0	216	164	nf	0	0	54	0
51-100	359	421	702	0	497	88	0	29	52	39	0	156	39	0	12	36
	377	100	243	nf	493	0	7	7	12	122	nf	257	0	13	11	11
	382	647	210	359	270	494	0	0	33	129	73	115	168	0	0	93
101-150	358	225	766	1500	5063	47	94	56	14	404	430	2464	45	51	61	10
	378	139	550	2046	1602	48	10	10	0	362	635	461	12	11	8	0
	381	182	nf	0	nf	202	0	0	233	nf	0	nf	119	0	0	118
151-200	357	164	683	399	194	1526	57	20	39	370	205	120	629	42	46	19
	379	106	213	nf	596	655	81	33	52	318	nf	317	240	96	20	27
	380	116	nf	798	nf	48	16	57	24	nf	117	nf	32	10	26	12
total strata fished <= 200 fathom			91783	670348	443490	17924	11729	14478	3359	92723	249323	164303	28741	26189	17781	3290
1 std			29227	355442	286249	4041	3576	3221	1328	25023	64135	91007	7956	7249	4298	1185
201-300	723	155	nf	0	nf	97	0	0	43	nf	0	nf	63	0	0	24
	725	105	nf	nf	0	80	0	12	22	nf	nf	0	90	0	10	13
	727	160	nf	nf	nf	878	11	9	267	nf	nf	nf	484	12	3	97
301-400	724	124	nf	0	nf	17	0	0	19	nf	0	nf	12	0	0	40
	726	72	nf	nf	nf	0	0	0	10	nf	nf	nf	0	0	0	15
	728	156	nf	nf	nf	nf	0	0	76	nf	nf	nf	nf	0	0	34
Total all strata fished			91783	670348	443490	18996	11741	14498	3795	92723	249323	16303	29389	26200	17793	3510
1 std			29227	355442	286251	4137	3575	3221	1375	25023	64135	125400	7972	8397	4299	1186

[1] **Note the fall index has not been filled for missing strata .**

nf strata not fished.

Table 14. Biomass (t) and Abundance (000's) of cod from autumn stratified random surveys in Division 3O.

			Abundance							Biomass						
									WT 200 TELOST							WT 200 TELOST
Depth Range	Strata	Area	WT 101-102 1990	WT 113-115 1991	WT 128-130 1992	WT 144-146 1993	WT 160-161 1994	WT 176-177 1995	41-42 AN 253 1996	WT 101-102 1990	WT 113-115 1991	WT 128-130 1992	WT 144-146 1993	WT 160-161 1994	WT 176-177 1995	41-42 AN 253 1996
	mean survey date		26-Nov-90	24-Oct-91	23-Oct-92	27-Oct-93	31-Oct-94	10-Oct-95	10-Dec-96	26-Nov-90	24-Oct-91	23-Oct-92	27-Oct-93	31-Oct-94	10-Oct-95	10-Dec-96
31-50	330	2089	10709	10264	7036	5271	2072	3946	279	6651	2374	2574	4278	1928	6035	302
	331	456	507	6682	222	222	95	760	32	27	1047	191	267	172	1455	11
	338	1898	20199	10334	857	6221	330	2478	264	13966	7122	2760	3763	91	5283	26
	340	1716	4158	5625	7746	1859	763	1668	95	3635	6247	6711	1231	832	3149	37
	351	2520	29085	24185	3558	10450	661	2709	198	17027	21473	3142	9895	679	5052	74
	352	2580	10248	24761	2747	4710	717	972	287	21151	32262	3137	4920	4775	3195	1353
	353	1282	1781	223	0	0	0	415	0	4593	56	0	0	0	2238	0
51-100	329	1721	531	1605	558	239	1036	574	478	1291	1019	109	245	1546	1052	370
	332	1047	1721	1127	436	2036	242	0	0	767	74	254	1323	452	0	0
	337	948	1001	66	198	307	0	0	0	2331	70	373	176	0	0	0
	339	585	163	0	41	528	41	41	0	1242	0	64	447	56	46	0
	354	474	1580	0	1712	0	0	165	340	66	0	896	0	0	161	260
101-150	333	151	21	0	10	0	0	0	nf	12	0	12	0	0	0	nf
	336	121	6	0	0	67	0	0	8	29	0	0	107	0	0	11
	355	103	nf	887	64	172	0	13	342	nf	155	31	104	0	15	235
151-200	334	92	13	0	0	9	0	0	nf	16	0	0	21	0	0	nf
	335	58	12	4	0	0	0	0	133	13	8	0	0	0	0	303
	356	61	nf	4	0	102	0	0	40	nf	8	0	68	0	0	39
Total strata fished <= 200 fathoms			81735	85767	25185	32193	5957	13741	2496	72817	71915	20254	26845	10531	27681	3021
1 std			17121	15463	6229	7605	2162	2367	562	11789	12726	4404	7412	3158	6346	1387
201-300	717	93	0	nf	nf	0	0	0	nf	0	nf	nf	0	0	0	nf
	719	76	0	0	nf	0	5	0	37	0	0	nf	0	14	0	55
	721	76	nf	0	nf	0	0	0	0	nf	0	nf	0	0	0	0
301-400	718	111	nf	nf	nf	0	0	0	nf	nf	nf	nf	0	0	0	nf
	720	105	nf	nf	nf	0	0	0	0	nf	nf	nf	0	0	0	0
	722	93	nf	0	nf	0	0	0	0	nf	0	nf	0	0	0	0
total strata fished > 200 fathoms			0	0	0	0	5	0	37	0	0	0	0	14	0	55
total all strata fished			81735	85767	25185	32193	5961	13740	2534	72817	7195	20254	26845	10546	27681	3078
1 STD			17574	15471	6229	7605	2163	2368	561	11789	43649	4404	7412	3158	6346	1386

[1] Note the fall index has not been filled for missing strata .
nf strata not fished.

Table 15. Mean number per tow of cod from spring RV surveys in NAFO Divisions 3NO as calculated using the conversion from Warren 1997. 1984-1995 1996 is actual Campelen survey.

3NO	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	0.16	0.37	0.38	5.00	0.18	0.38	0.90	0.57	0.00	0.00	0.00	0.00	0.1
2	53.39	9.88	12.77	54.15	26.45	4.77	7.25	147.62	10.07	1.17	0.22	0.76	1.35
3	41.57	29.27	3.63	14.13	12.91	10.39	6.77	15.44	9.66	58.27	0.91	0.20	1.65
4	21.35	16.14	17.87	18.67	1.02	2.40	3.80	1.59	0.24	53.63	1.63	0.04	0.44
5	7.17	2.76	11.53	50.35	0.47	0.34	1.46	0.47	0.11	1.25	1.05	0.15	0.24
6	5.04	0.90	2.11	26.41	1.10	0.31	0.25	0.16	0.09	0.68	0.07	0.10	0.57
7	1.51	1.03	0.82	7.38	1.13	0.61	0.41	0.07	0.03	0.46	0.12	0.01	0.56
8	0.72	0.66	0.58	1.71	0.66	0.52	0.52	0.06	0.03	0.22	0.07	0.02	0.05
9	1.36	0.84	0.42	1.63	0.67	0.36	0.61	0.14	0.08	0.05	0.07	0.05	0.04
10	1.15	1.18	0.61	0.54	0.75	0.40	0.46	0.12	0.11	0.08	0.02	0.01	0.03
11	0.61	0.88	1.02	0.70	0.35	0.51	0.34	0.11	0.13	0.17	0.04	0.01	0.02
12	0.25	0.48	0.51	0.60	0.44	0.33	0.34	0.09	0.14	0.12	0.05	0.02	0
13	0.10	0.23	0.31	0.68	0.69	0.27	0.16	0.12	0.12	0.07	0.07	0.05	0
14+	0.255	0.380	0.404	0.592	1.070	0.894	1.275	0.530	0.354	0.240	0.093	0.057	0.05
1+	134.64	64.99	52.96	183.54	47.88	22.47	24.53	167.06	21.17	116.40	4.42	1.45	5.10

Table 16. Mean number per tow of cod from fall RV surveys in NAFO Divisions 3NO as calculated using the conversion from Warren 1997. 1990-1994 1995 and 1996 are actual Campelen survey.

	1990	1991	1992	1993	1994	1995	1996
1	18.894	14.875	0.405	1.301	0.000	1.15	0.07
2	6.154	129.664	49.650	0.718	0.624	1.02	0.71
3	3.245	4.356	65.000	3.634	0.282	0.46	0.28
4	3.559	2.188	4.699	3.594	0.856	0.2	0.06
5	1.730	2.733	1.015	0.298	1.315	0.94	0.01
6	0.371	1.330	0.606	0.268	0.163	1.64	0.02
7	0.294	0.368	0.177	0.178	0.041	0.11	0.02
8	0.382	0.311	0.034	0.098	0.061	0.05	0.01
9	0.401	0.534	0.034	0.020	0.010	0.06	0
10	0.241	0.373	0.066	0.019	0.010	0.05	0
11	0.198	0.450	0.000	0.063	0.030	0	0
12	0.089	0.327	0.063	0.043	0.030	0.02	0
13	0.149	0.274	0.121	0.039	0.024	0.02	0
14 +	0.603	0.928	0.196	0.167	0.136	0.150	0.030
1+	36.310	158.713	122.067	10.437	3.683	5.870	1.210

Table 17. Mean length-at-age (cm) of cod caught during resource assessment bottom-trawl surveys in Divisions 3N and 3O during the springs of 1972-1996. Entries in shaded cells are based on a sample size of less than 5.

Division 3N

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																									15.4
2	22.3	22.3	22.6	24.5	22.2	22.7	24.1	25.4	24.2	26.4	25.2		23.1	22.2	21.8	21.2	22.2	20.3	23.7	22.5	21.6	21.5		22.6	25.2
3	30.7	30.5	31.6	30.9	29.0	32.3	35.1	33.6	35.1	36.1	36.4		28.3	31.1	30.5	33.0	31.4	32.9	30.1	33.8	31.5	32.5	30.2	29.4	32.8
4	39.9	37.7	39.7	43.6	48.0	41.1	43.9	44.6	44.8	48.7	45.5		41.0	38.8	38.4	41.7	44.4	42.6	41.3	37.5	43.8	41.2	38.9	36.4	41.6
5	49.8	48.4	48.2	50.9	57.6	51.0	55.7	53.9	56.0	57.2	56.5		49.3	51.6	45.7	48.6	51.9	51.6	52.1	48.6	48.7	48.2	45.7	45.8	46.6
6	61.9	57.8	58.1	61.1	62.5	60.7	67.2	62.7	63.4	66.2	67.3		61.5	58.4	59.6	53.9	60.5	62.9	61.2	57.7	59.2	53.0	56.5	53.8	50.1
7	71.4	65.4	67.3	74.2	68.5	65.5	75.7	74.6	70.7	75.9	74.5		69.3	70.7	74.6	60.3	68.4	66.6	68.9	65.5	59.9	59.2	65.3		78.0
8	79.0	72.1	74.3	80.5		74.5	78.1	87.0	83.2	85.3	87.2		79.4	85.3	85.4	74.0	78.1	72.4	72.9	80.0	57.9	64.3			
9	87.3	84.0	88.2	86.6		83.7	83.0	88.1	97.7	95.2	93.9		89.4	96.0	98.4	83.5	90.6	82.0	78.8	76.6	74.9	85.8	88.1		
10	96.1	90.7	87.2	88.5	102.0	96.0	103.0	109.0	99.8	103.9	101.1		96.5	100.1	103.9	92.0	91.5	94.4	93.9	92.2	70.0	90.0			
11	94.3	87.8	77.4	78.0		106.0		114.4	104.0	102.0	108.2		100.3	102.0	105.4	95.9	100.3	99.7	106.2	101.4	81.0	100.5			
12	102.8	97.1	101.0			103.7	125.4		117.0	119.9	108.0		106.5	108.5	108.0	103.2	108.5	112.7	108.9	107.9	103.0	94.7			

Division 3O

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																									13.5
2		22.1		22.6	22.2	18.6	22.6	24.6	22.0	22.2	21.3		20.8	20.3	22.2	20.0	22.6	21.1	22.2	20.6	21.0	25.0	20.0	24.6	24.6
3		30.7		30.7	32.7	36.6	34.8	34.0	30.4	34.6	32.7		31.7	30.8	32.8	30.9	30.8	31.7	28.7	29.2	30.0	31.3	32.3	31.1	30.7
4		37.8		41.5	42.3		44.1	44.2	42.3	45.6	43.9		41.3	36.6	39.3	40.0	39.9	39.3	39.0	38.6	34.8	39.6	38.9	40.4	39.0
5		44.5		48.6	52.6		53.9	51.6	55.3	51.6	56.2		49.7	49.6	45.0	46.9	51.2	49.5	49.0	50.2	50.1	49.7	48.1	50.3	48.0
6		61.0		60.6	64.4	71.3	62.6	61.2	64.1	60.2	64.3		61.6	57.1	52.8	53.1	56.8	58.7	56.7	56.2	58.9	56.2	58.9	60.1	56.0
7		74.2		92.5	69.5	74.1	73.9	69.3	82.9	64.6	74.6		69.5	73.4	60.0	64.5	67.7	66.7	64.6	62.3	65.5	67.9	61.9	68.5	67.0
8		81.7		76.7	75.6	83.8	92.5	80.7	83.5	73.0	82.9		79.4	84.5	80.4	71.2	79.2	77.2	73.0	82.7	88.7	77.9	75.4	84.0	74.3
9		87.1		104.3	89.2	74.0	96.0	89.4	93.6	88.9	92.4		89.6	92.9	89.4	82.1	87.9	91.3	82.1	88.0	95.8	90.7	86.7	82.5	70.1
10		109.0		107.4	100.0	92.7	103.0		98.4	89.4	106.3		95.2	96.6	96.1	89.4	91.8	94.7	89.3	94.0	94.9	93.7	85.0	84.0	82.3
11		98.0			94.0		113.9	105.5	97.4	108.0	103.8		100.2	101.1	99.9	85.7	95.1	100.5	95.4	101.0	100.7	96.3	95.0	90.5	101.1
12		106.8		114.0		106.0			106.9	91.4	112.5		104.5	104.7	103.7	102.1	104.3	101.6	100.8	106.6	107.4	97.6	100.5	102.7	

Divisions 3N and 3O combined

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																									14.8
2		22.1		23.8	22.2	22.3	23.2	24.9	23.2	25.2	23.9		22.8	22.2	21.8	20.7	22.5	20.8	23.2	20.9	21.2	24.3	20.0	24.3	24.7
3		30.6		30.8	32.5	33.1	35.0	33.9	33.0	35.9	35.1		29.2	31.0	31.9	31.9	31.1	32.2	29.2	31.0	30.5	31.4	32.2	30.9	31.2
4		37.7		42.4	42.4	41.1	44.0	44.3	44.0	48.2	44.6		41.2	38.2	39.2	40.6	41.2	40.3	39.9	38.1	37.8	39.7	38.9	39.7	39.4
5		46.7		49.7	53.2	51.0	55.0	51.8	55.8	55.9	56.3		49.5	50.7	45.1	47.5	51.4	50.5	50.3	49.7	49.1	49.5	48.0	48.4	47.6
6		58.8		61.0	64.2	61.2	65.1	61.4	63.6	64.7	65.4		61.5	57.5	53.5	53.3	58.0	60.7	59.3	56.4	59.1	55.8	58.8	59.3	55.7
7		69.6		74.6	69.1	66.5	75.0	70.3	79.6	72.1	74.6		69.4	72.5	62.3	63.3	67.8	66.6	67.0	63.1	62.4	65.9	62.0	68.5	67.3
8		76.0		79.5	75.6	77.0	82.3	83.3	83.4	81.0	85.1		79.4	84.8	81.2	71.5	79.0	75.0	73.0	82.6	83.5	75.9	75.4	84.0	74.3
9		85.8		94.3	89.2	82.9	87.7	89.1	94.6	93.1	93.3		89.5	94.1	93.6	82.3	88.4	89.2	80.8	87.3	91.9	90.1	86.8	82.5	70.1
10		92.6		100.6	100.7	94.4	103.0	109.0	98.8	99.2	102.3		95.9	97.8	99.9	90.1	91.7	94.6	91.5	93.5	94.6	93.5	85.0	84.0	82.3
11		90.6		78.0	94.0	106.0	113.9	109.8	98.6	105.9	106.3		100.3	101.5	103.2	87.4	96.5	100.3	99.1	101.1	100.5	96.6	95.0	90.5	101.1
12		104.8		114.0		104.2	125.4		108.0	109.6	111.5		105.6	106.1	106.1	102.3	106.1	105.1	103.9	106.9	106.9	97.4	100.5	102.7	

Table 18. Proportion mature at age of female Atlantic cod (Gadus morhua) in NAFO Div. 3NO (1975-1996). A50=median age at maturity (years); L95% and U95%=lower and upper 95% confidence intervals. Parameter estimates of the logit model are shown: Int=intercept; SE=standard error;

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	0	0		0	0	0	0	0			0	0	0			0	0					0
2	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0		0	0
3	0	0	0	0	0	0.01	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0.03	0	0	0.02	0	0.07	0.00		0	0	0	0	0	0.01	0.03	0.07	0	0.01	0	0	0.05
5	0	0.05	0.08	0.07	0.06	0.13	0.53	0.10		0.05	0.04	0.04	0.11	0.09	0.20	0.03	0.30	0.35	0.43	0.30	0.44	0.58
6	0.56	0.48	0.19	0.39	0.48	0.47	0.47	0.48		0.56	0.37	0.17	0.34	0.28	0.85	0.61	0.41	0.58	0.48	0.62	0.85	0.97
7	0.97	1	0.62	0.81	0.89	0.84	0.87	0.96		0.88	0.93	0.56	0.75	0.50	0.95	0.87	0.84	1	0.97	0.79	0.7	0.99
8	0.98	1	0.89	1	1	0.84	1	1		0.96	1	1	0.87	0.93	0.98	0.85	1	1	0.97	1	1	1
9	1	1	1	1	1	1	1	0.89		1	1	1	0.94	0.98	1	1	1	1	0.84	1	1	1
10	1	1	1	1		1	1	1		1	1	1	1	1	1	1	1	1	1	1		1
11		1			1	1	1	1		1	0.99	1	1	1	1	1	1	1	1	1	1	1
12	1		1	1		1	0.78	1		1	1	1	1	1	1	1	1	1	1	1		
13	1		1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	
A50	5.98	6.09	6.74	6.24	6.06	6.14	5.73	6.00		5.98	6.17	6.70	6.45	6.75	5.59	6.24	5.82	5.59	5.71	5.73	6.19	4.9
L 95%	5.73	5.72	6.44	6.03	5.87	5.92	5.42	5.78		5.86	6.02	6.51	6.23	6.47	5.34	5.97	5.51	5.25	5.45	5.42	5.65	4.7
U 95%	6.19	6.93	7.15	6.55	6.30	6.42	6.09	6.23		6.11	6.33	6.90	6.69	7.02	5.83	6.51	6.22	5.98	5.97	6.12	6.58	5.12
Slope	3.50	2.34	1.70	2.25	2.32	1.69	1.24	2.46		2.48	2.74	2.22	1.49	1.65	2.34	1.69	1.5	2.24	1.82	1.62	1.76	3.21
SE	0.74	0.62	0.27	0.34	0.29	0.21	0.15	0.30		0.27	0.27	0.24	0.15	0.22	0.28	0.18	0.21	0.43	0.22	0.27	0.51	0.49
Int	-20.90	-14.26	-11.48	-14.08	-14.05	-10.37	-7.12	-14.78		-14.86	-16.90	-14.90	-9.62	-11.16	-13.06	-10.56	-8.74	-12.51	-10.41	-9.27	-10.9	-15.74
SE	4.48	3.38	1.68	2.00	1.66	1.20	0.83	1.81		1.63	1.66	1.60	0.98	1.53	1.64	1.14	1.12	2.39	1.27	1.47	3.24	2.39
n	244	184	270	297	471	440	290	481		648	810	606	535	409	567	552	379	268	318	188	76	303

Table 19. Proportion mature at age of male Atlantic cod (Gadus morhua) in NAFO Div. 3NO (1975-1996). A50=median age at maturity (years); L95% and U95%=lower and upper 95% confidence intervals. Parameter estimates of the logit model are shown: Int=intercept; SE=standard error; n=sample size; period=no fish sampled.

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	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
3	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0
4	0.07	0.08	0.02	0.03	0.08	0.12	0.18	0.06		0.01	0.05	0.01	0.11	0.03	0.01	0.08	0.08	0.21	0.09	0.18	0.29
5	0.37	0.36	0.33	0.32	0.30	0.35	0.54	0.34		0.12	0.21	0.20	0.20	0.31	0.69	0.3	0.54	0.59	0.87	0.74	0.71
6	0.61	1	0.89	0.44	0.66	0.78	0.78	0.66		0.80	0.47	0.46	0.57	0.58	0.89	0.78	0.55	0.89	0.8	1	0.85
7	0.97	1	0.75	0.94	1	0.9	0.86	0.89		0.98	0.93	0.7	0.89	0.85	1	0.93	0.86	0.86	1	1	1
8	1	1	1	1	0.96	1	1	1		1	1	0.98	1	0.98	0.98	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1
11	1		1	1	1	1	1	1		1	1	1	0.64	1	1	1	1	1	1	1	1
12			1	1		1	1	1		1	1	1	1	1	1	1	1	1	1	1	1
13		1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1
A50	5.43	5.19	5.40	5.69	5.50	5.34	5.14	5.57		5.58	5.81	6.10	5.95	5.82	4.99	5.42	5.34	4.96	4.94	4.59	5.61
L 95%	5.15	4.96	5.19	5.43	5.32	5.15	4.91	5.34		5.46	5.65	5.90	5.68	5.55	4.78	5.19	5.06	4.66	4.68	4.39	4.85
U 95%	5.76	5.59	5.64	6.03	5.70	5.55	5.38	5.82		5.70	5.99	6.32	6.22	6.07	5.23	5.68	5.69	5.27	5.27	4.77	6.00
Slope	1.90	2.35	2.06	1.78	1.80	1.82	1.58	1.72		3.06	1.85	1.61	1.00	1.64	2.65	1.89	1.57	2.02	2.28	2.77	1.56
SE	0.27	0.51	0.29	0.26	0.19	0.21	0.17	0.16		0.32	0.15	0.15	0.09	0.20	0.39	0.24	0.22	0.30	0.33	0.47	0.41
Int	-10.30	-12.20	-11.10	-10.13	-9.90	-9.70	-8.13	-9.56		-17.12	-16.90	-9.84	-5.96	-9.55	-13.22	-10.25	-8.41	-10.03	-11.24	-12.71	-8.73
SE	1.37	2.44	1.55	1.35	0.99	1.11	0.87	0.86		1.85	1.66	0.90	0.53	1.25	1.89	1.24	1.10	1.48	1.54	2.21	2.52
n	253	205	257	259	492	451	359	517		719	802	633	602	432	501	518	374	278	251	173	112

Table 20. Proportion mature at length of female Atlantic cod (Gadus morhua) in NAFO Div. 3NO (1975-1996). L50=median length at 50% maturity (cm); L95% and U95%=lower and upper confidence intervals. Length in 3 cm intervals: e.g., 55 cm=54-56 cm. Parameter estimates of the logit model are shown: Int=intercept; SE=standard error; n=sample size; period=no fish sampled.

LEN	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
31	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0.03	0	0	0	.	0
40	0	0	0	0	0.08	0.03	0	0	.	0	0	0	0	0	0	0	0	0	0.01	0	0	0.02
43	0	0.08	0	0	0	0	0	0	.	0	0	0	0	0	0	0.11	0	0	0.01	0.12	0.20	0.08
46	0	0	0	0	0	0.08	0	0	.	0	0	0.06	0.10	0.10	0	0	0.36	0.16	0.18	0.34	0.40	0.26
49	0	0	0.06	0	0	0	0.06	0	.	0.04	0.04	0.06	0	0.02	0.20	0	0.33	0.20	0.32	0.20	0.00	0.60
52	0	0	0.06	0	0.07	0.12	0.30	0	.	0.04	0	0.09	0.24	0.18	0.28	0.05	0.28	0.61	0.35	0.70	0.71	0.86
55	0.18	0.14	0.11	0	0.03	0.05	0.33	0.06	.	0.08	0.12	0.07	0.36	0.28	0.50	0.07	0.37	0.94	0.36	0.57	0.60	0.96
58	0.56	0	0	0.05	0.09	0.27	0.49	0.07	.	0.37	0.26	0.30	0.20	0.14	0.81	0.44	0.60	0	0.81	0.55	0.80	0.99
61	0.71	0.50	0.08	0.26	0.44	0.23	0.46	0.14	.	0.53	0.44	0.80	0.93	0.37	1	0.48	0.74	1	0.88	0.50	0.60	1
64	1	0.33	0.46	0.33	0.44	0.25	0.34	0.65	.	0.79	0.66	0.91	0.66	0.52	1	0.75	1	0.59	0.93	0.62	1	1
67	0.9	1	0.46	0.50	0.50	0.43	0.62	0.63	.	0.84	0.86	0.72	1	0.56	1	0.96	1	0.75	1	0.80	1	1
70	1	0	0.81	0.84	0.89	0.57	0.84	0.84	.	0.91	1	1	0.97	0.50	1	1	.	1	0.86	0.67	1	1
73	1	.	0.81	1	0.96	0.78	1	1	.	0.94	1	1	0.89	1	1	0.95	1	1	0.89	1	1	1
76	1	.	1	1	1	0.81	1	1	.	1	1	1	1	0.77	1	1	1	1	1	1	.	1
79	1	.	1	0.67	1	0.82	1	0.89	.	1	0.92	1	0.9	0.80	1	1	1	1	1	1	.	1
82	1	1	1	0.60	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	.	1
85	1	1	1	0.68	1	1	1	1	.	1	1	1	1	1	1	1	1	1	0.71	1	1	.
88	1	.	1	.	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	.
91	1	.	.	1	1	1	1	1	.	1	1	1	0.88	1	1	1	1	1	1	1	1	1
94	1	1	1	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	.	.
97	1	.	.	1	.	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	.
100	.	.	.	.	.	.	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	1
L50	58.48	64.71	66.06	68.79	64.61	67.46	61.25	64.80	.	60.88	61.49	59.57	59.24	64.67	53.98	59.93	55.18	53.51	55.15	56.30	50.88	48.10
L 95%	56.74	60.86	64.04	66.21	62.94	65.20	58.90	63.09	.	59.66	60.19	58.04	57.34	62.02	52.41	58.21	53.01	50.84	52.97	53.23	44.92	46.88
U 95%	60.30	72.95	68.40	72.31	66.68	70.07	63.97	66.72	.	62.08	62.90	61.35	61.25	67.32	55.52	61.60	57.82	56.95	57.45	59.86	56.07	49.60
Slope	0.45	0.22	0.25	0.20	0.24	0.18	0.20	0.33	.	0.31	0.33	0.32	0.20	0.17	0.46	0.29	0.23	0.24	0.19	0.15	0.13	0.48
SE	0.09	0.06	0.04	0.03	0.03	0.02	0.03	0.05	.	0.03	0.38	0.04	0.02	0.02	0.08	0.04	0.04	0.04	0.02	0.02	0.03	0.08
int	-26.31	-14.26	-16.75	-13.70	-15.74	-11.84	-12.40	-21.34	.	-18.76	-20.14	-18.96	-11.83	-11.22	-24.83	-17.32	-12.82	-12.94	-10.27	-8.50	-6.61	-23.23
SE	5.42	3.33	2.79	2.00	1.93	1.40	1.70	3.22	.	2.02	2.28	2.51	1.26	1.40	4.26	2.40	1.99	2.82	1.30	1.32	1.81	4.00
n	244	184	270	297	471	440	289	481	.	648	809	604	535	409	564	551	378	268	318	188	76	303

Table 21. Proportion mature at length of male Atlantic cod (Gadus morhua) in NAFO Div. 3NO (1975-1996). L50=median length at 50% maturity (cm); L95% and U95%=lower and upper confidence intervals. Length in 3 cm intervals: e.g., 55 cm=54-56 cm. Parameter estimates of the logit model are shown: Int=intercept; SE=standard error; n=sample size; period=no fish sampled.

LEN	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
31	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0.11	0	0	0.1
37	0	0	0	0	0	0	0	0.06	.	0	0	0	0.10	0	0	0.08	0	0	0	0.12	0	0.04
40	0	0.14	0	0.08	0.07	0.07	0	0.08	.	0	0.08	0.08	0	0	0	0.20	0.06	0.29	0.02	0.11	0.25	0.11
43	0.17	0.14	0.13	0.06	0	0.05	0.08	0.04	.	0.06	0.11	0.08	0	0.15	0	0.22	0.36	0.47	0.17	0.63	0.6	0.28
46	0	0.20	0.11	0	0.19	0.15	0.44	0.05	.	0	0.12	0.12	0.26	0.08	0.13	0.13	0.31	0.36	0.29	0.81	0.6	0.54
49	0.38	0.09	0.25	0.05	0.26	0.16	0.19	0.03	.	0	0.07	0.11	0.30	0.16	0.30	0.17	0.63	0.67	0.26	0.89	0.75	0.78
52	0.20	0.27	0	0.10	0.26	0.33	0.16	0.22	.	0.14	0.32	0.42	0.23	0.44	0.75	0.34	0.55	0.64	0.65	0.76	0.88	0.92
55	0.48	0.30	0.53	0.18	0.24	0.17	0.56	0.26	.	0.49	0.30	0.60	0.70	0.73	0.90	0.48	0.64	0.82	0.87	0.82	0.83	0.97
58	0.50	0.43	0.80	0.66	0.62	0.46	0.72	0.44	.	0.70	0.48	0.72	0.67	0.57	0.86	0.83	0.67	0.87	0.80	1	0.75	0.99
61	0.57	0.60	1	0.28	0.62	0.65	0.77	0.43	.	1	0.70	0.66	0.76	0.69	1	1	1	1	1	1	1	1
64	1	1	0.92	0.39	0.78	0.60	0.62	0.86	.	0.93	0.94	0.83	0.92	0.88	0.93	0.90	1	0.79	1	1	1	1
67	1	.	1	1	0.93	0.90	0.85	0.74	.	0.95	0.71	1	0.94	0.69	1	1	0.86	1	1	1	1	1
70	1	1	1	1	0.83	1	0.89	0.86	.	1	0.93	1	1	0.89	1	1	1	1	1	1	.	1
73	1	.	1	1	1	1	0.58	1	.	1	1	1	1	1	1	1	1	1	1	1	.	1
76	1	1	1	0.56	1	1	1	0.88	.	1	1	1	1	1	1	1	1	1	1	1	.	1
79	1	1	1	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	1
82	1	1	1	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	.	1
85	1	.	1	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	.
88	1	1	1	.	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	.	1
91	.	.	.	1	.	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	.
94	1	1	1	.	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	.
97	1	1	.	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	.	1
100	1	.	1	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	.	1	1
L50	55.56	57.43	54.06	62.45	57.00	58.54	56.07	59.90	.	55.74	57.00	54.45	54.12	55.51	51.08	52.83	50.05	48.55	50.2	43.89	44.2	45.53
L 95%	53.25	54.37	52.22	59.94	55.31	56.66	53.95	57.90	.	54.65	55.58	52.91	52.36	53.27	49.46	50.91	47.82	46.04	48.13	41.86	38.45	43.91
U 95%	58.31	62.03	55.91	65.68	58.86	60.55	58.36	62.17	.	56.83	58.48	56.10	55.86	57.67	52.83	54.86	52.67	51.15	52.48	45.86	47.8	47.14
Slope	0.22	0.17	0.30	0.17	0.19	0.19	0.16	0.19	.	0.42	0.21	0.23	0.23	0.19	0.36	0.21	0.21	0.23	0.25	0.27	0.17	0.37
SE	0.03	0.03	0.04	0.03	0.02	0.02	0.02	0.02	.	0.05	0.02	0.02	0.02	0.02	0.06	0.02	0.03	0.04	0.04	0.05	0.04	0.05
Int	-12.48	-9.98	-16.06	-10.86	-10.97	-11.20	-9.12	-11.47	.	-23.33	-12.24	-12.60	-12.38	-10.5	-18.53	-11.2	-10.65	-11.22	-12.63	-11.95	-7.56	-16.96
SE	1.84	1.65	2.45	1.52	1.09	1.28	1.00	1.14	.	2.83	1.12	1.31	1.37	1.32	2.94	1.32	1.51	1.75	1.85	2.13	1.98	2.42
n	252	205	257	259	492	451	359	517	.	719	802	629	601	432	499	516	374	277	251	173	112	311

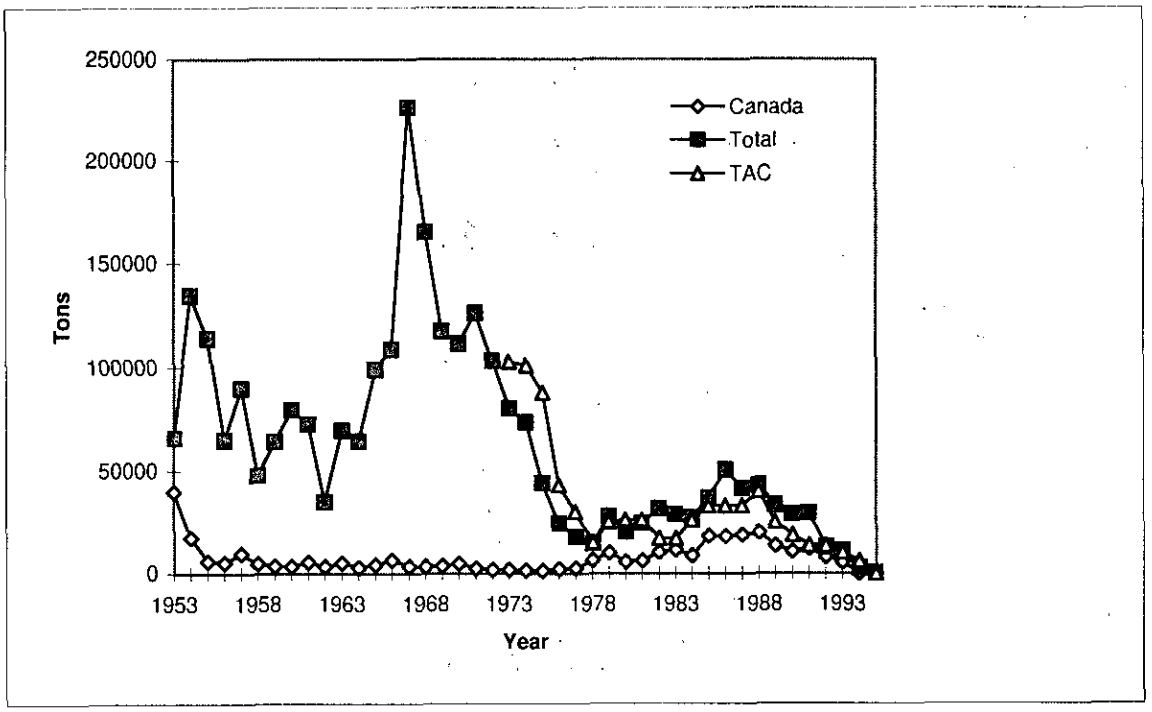

Figure 1. Catches for the period 1953-1996.

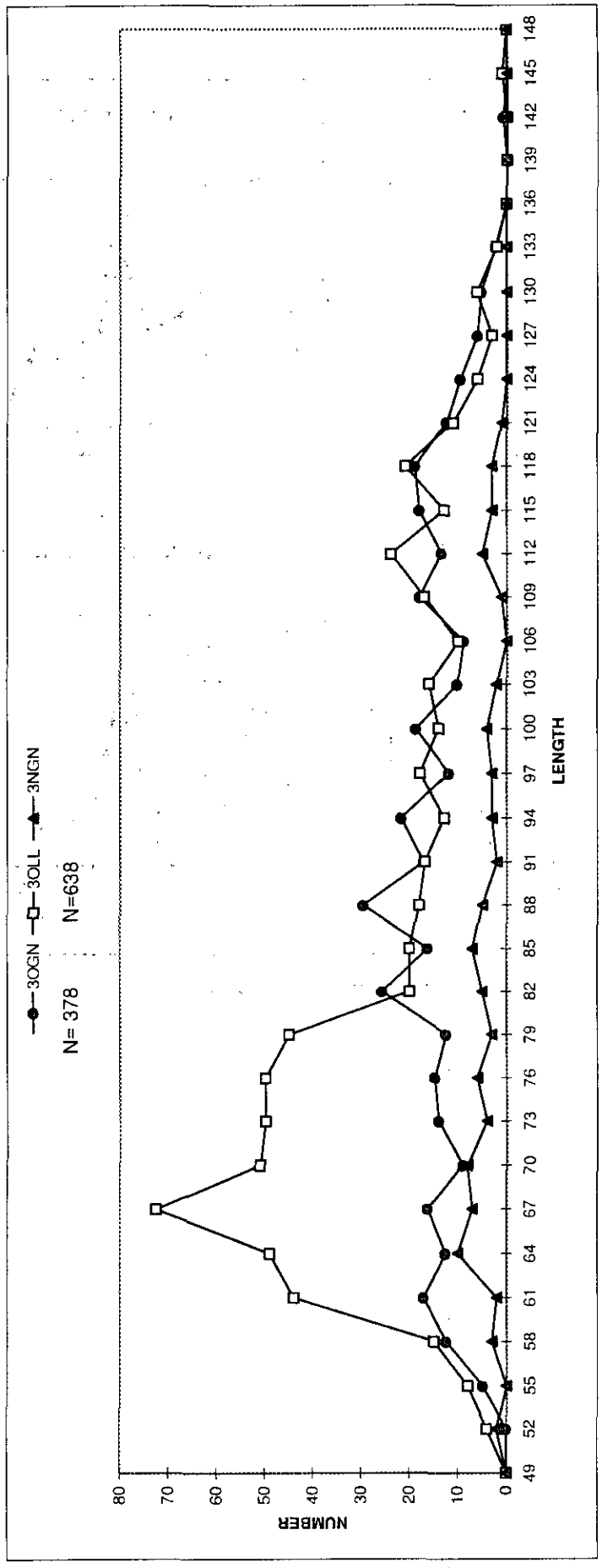

Figure 2. Length frequencies for sampled catch in 1996.

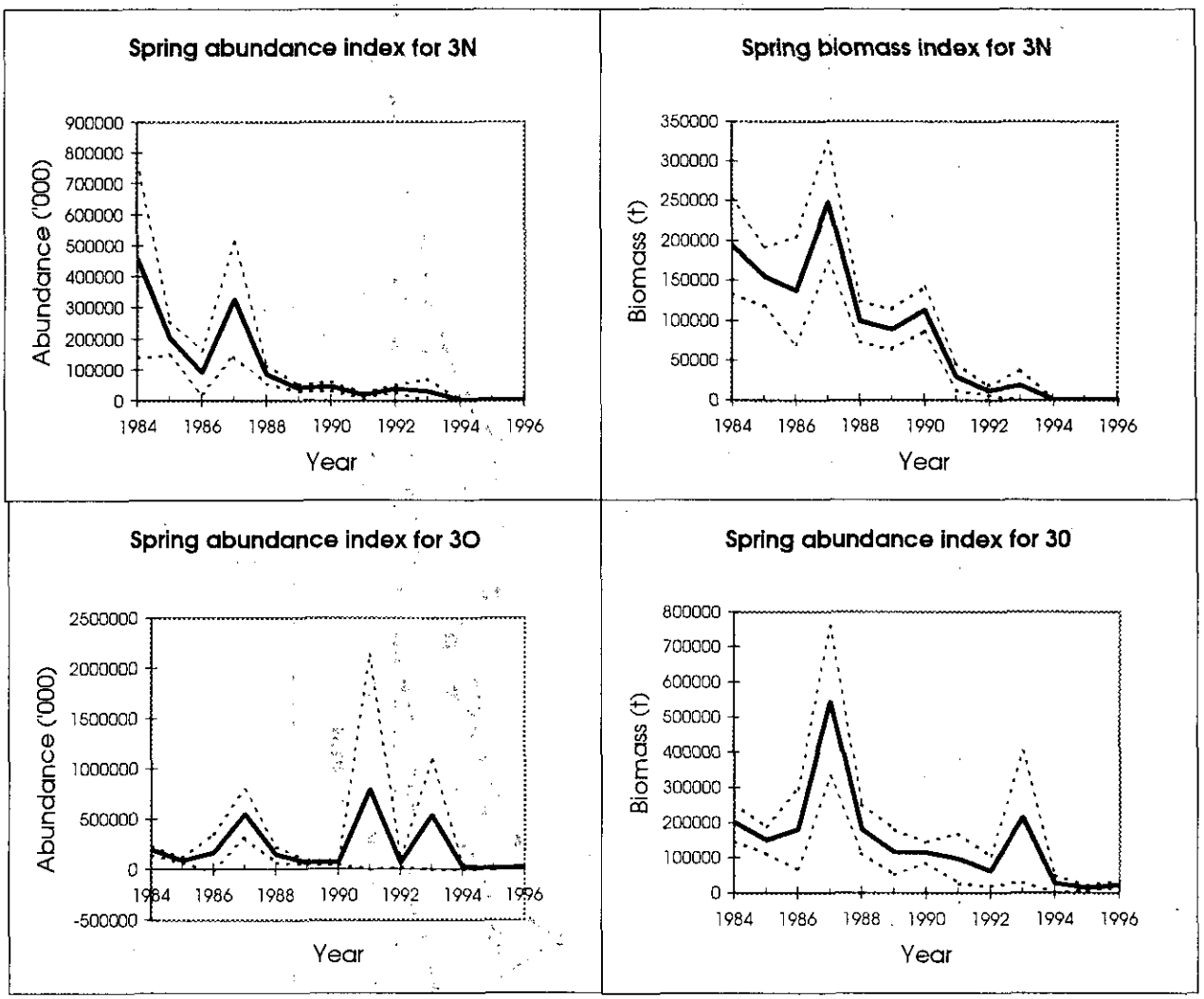

Figure 3. Biomass and Abundance Estimates for Spring Research Vessel Surveys

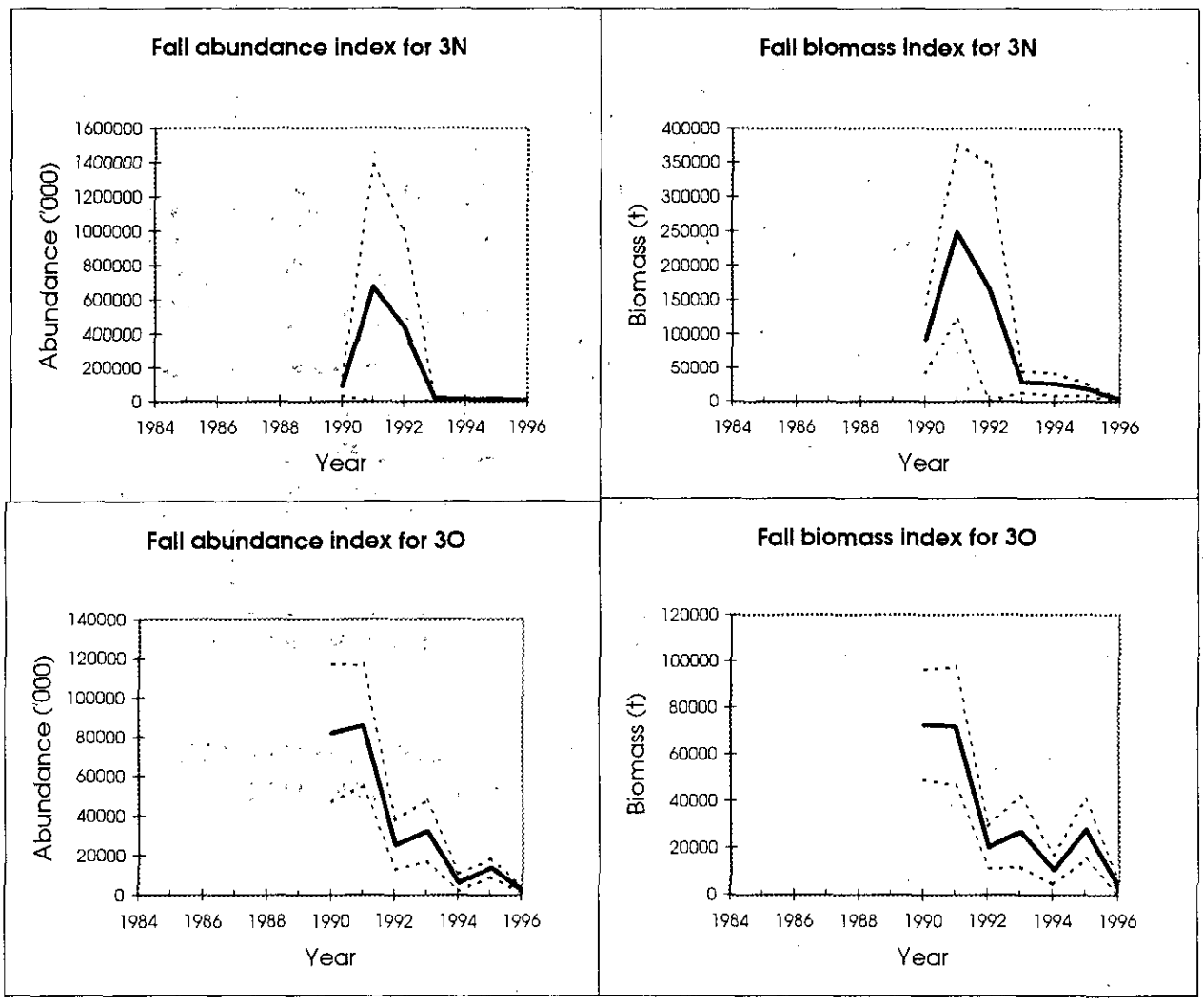

Figure 4. Biomass and Abundance Estimates for Fall Research Vessel Surveys

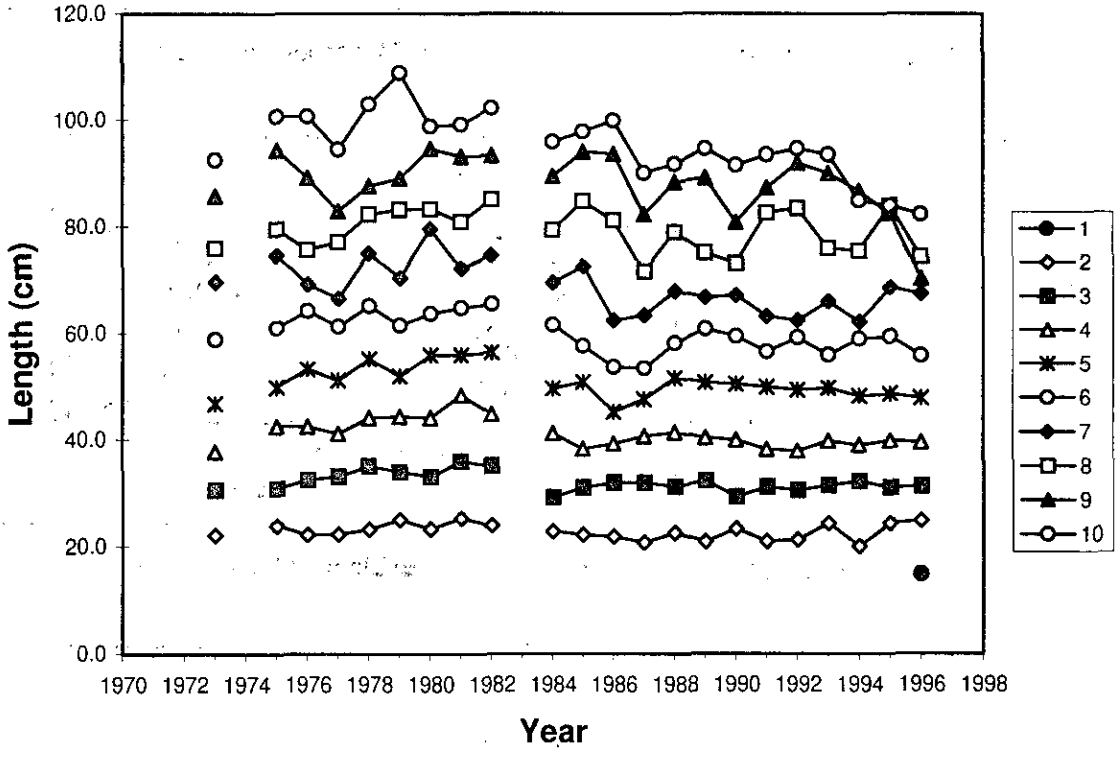

Figure 5 Mean length at ages 1-10 of cod in Divisions 3N and 3O combined in 1973-1996, as determined from catches and sampling during the bottom-trawl surveys in Spring.

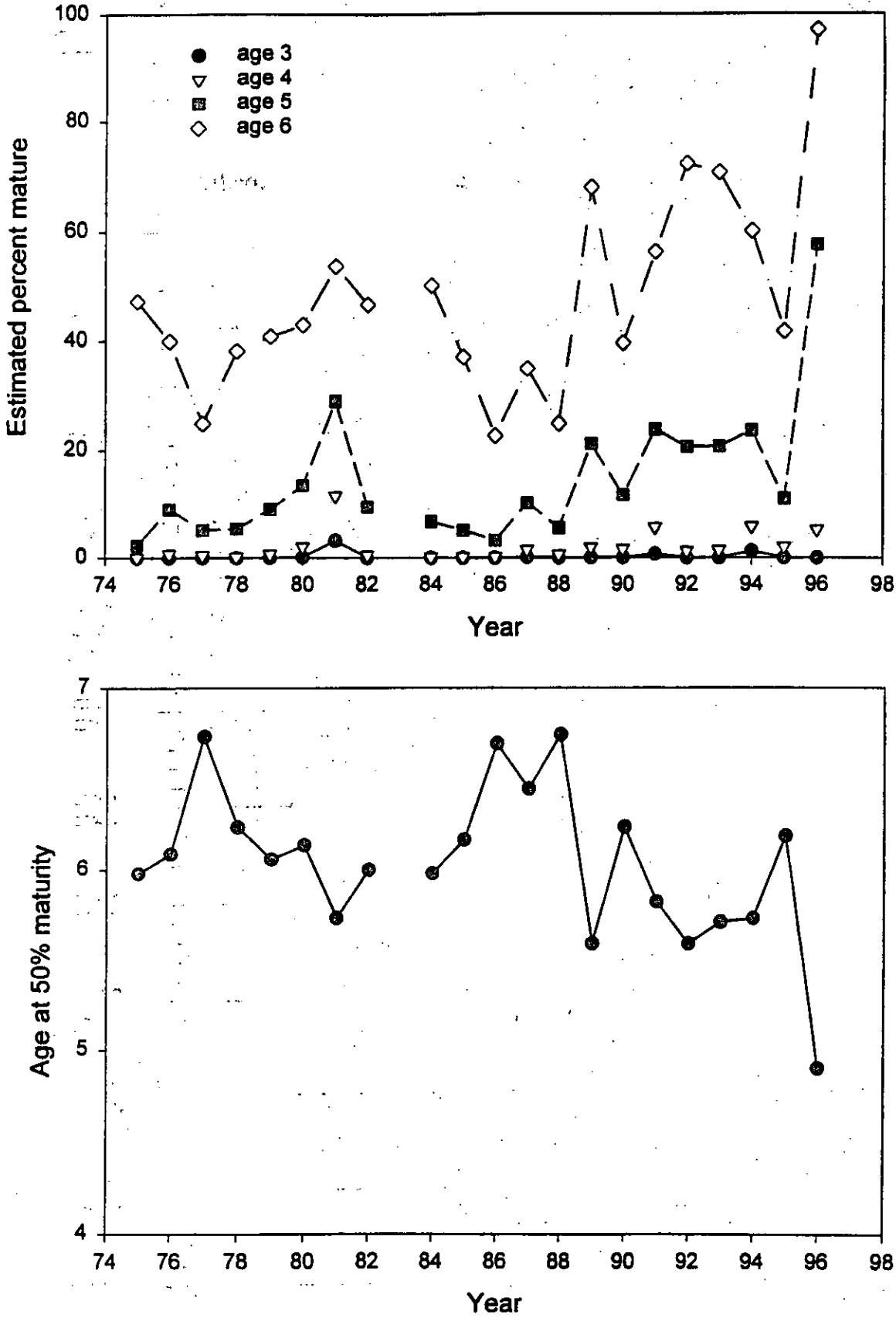

Figure 6. Estimated proportion mature at ages 3-6 for female cod in NAFO Div. 3NO for 1975 to 1996 (top). Age at 50% maturity over the same time period is shown in the bottom panel.

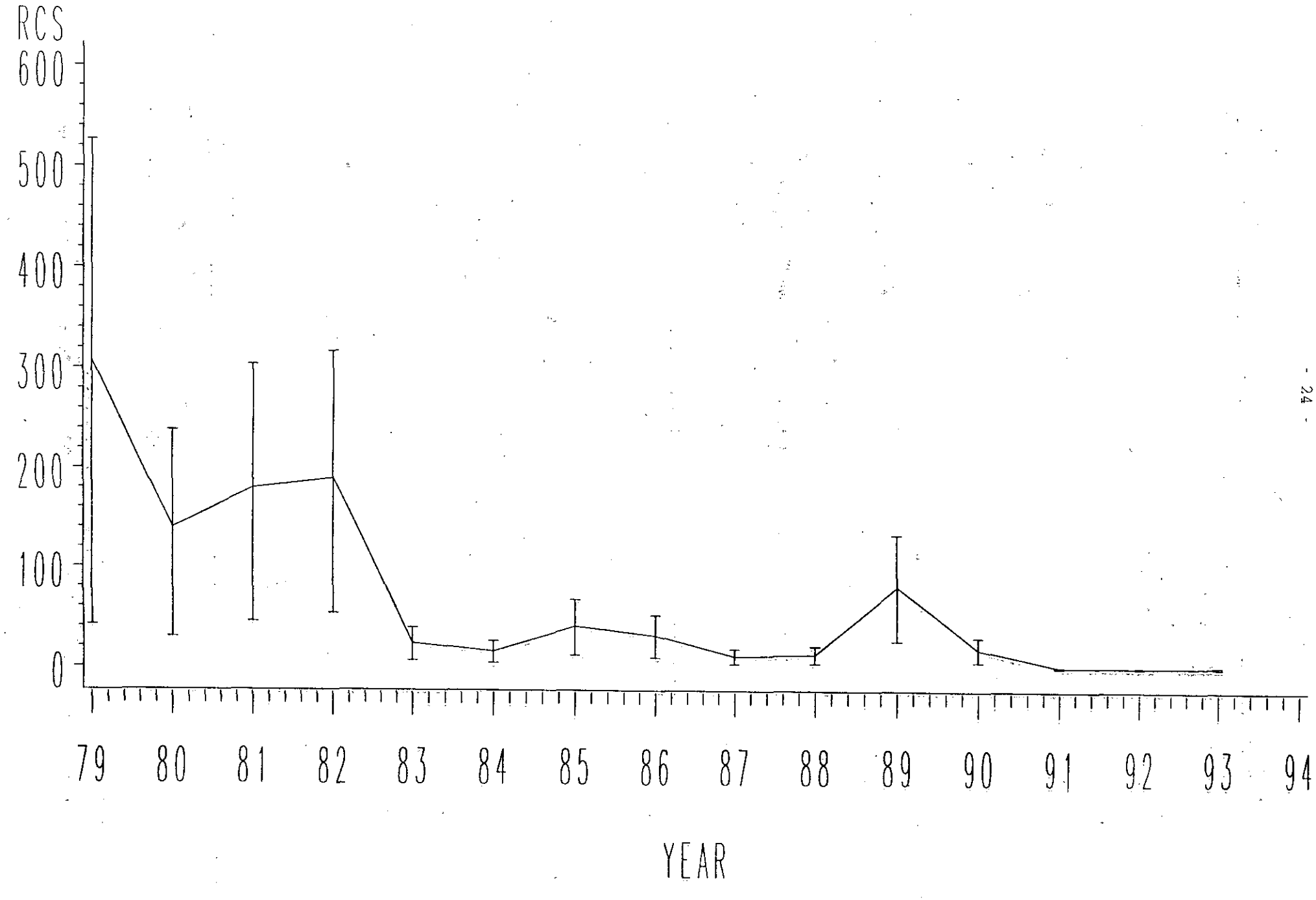

Fig 7 : Relative cohort strength for 3NO cod using Canadian