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An Assessment of the Cod Stock in NAFO Divisions 3NO

by

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Abstract

Cod in Divisions 3NO inhabit the southern Grand Bank of Newfoundland. The stock declined dramatically during the mid-1980's, and is currently at an extremely low level. Despite the instigation of a directed-fishing moratorium in February 1994, by-catch has increased considerably to a point where by-catch is impeding stock recovery. Survey abundance and mean numbers per tow indices continue to decline. Population estimates are derived using the ADAPTive framework, and indicate that stock prospects are poor. Estimates of age 3 recruits indicate all recent recruitment has been weak. Low spawner biomass, low recruitment and high fishing mortality, point to poor prospects for this stock in the medium term. This stock is currently well below B_{lim}. Recovery will require a number of relatively strong year-classes that survive to maturity, rebuilding the spawner biomass.

Introduction

The Div. 3NO cod stock occupies the southern part of the Grand Bank of Newfoundland. Fish are distributed over the shallower parts of the bank in summer, particularly in the Southeast Shoal area (Div. 3N), and on the slopes of the bank in winter when cooling occurs. Some seasonal mixing between fish in Div. 3O and Subdiv. 3Ps may occur. This stock declined in the late 1980s and early 1990s and is currently at an extremely low biomass level. It has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994. Catches have increased considerably during the moratorium from about 170 tons in 1995 peaking at about 4,800 tons in 2003. Recent catch levels have resulted in high fishing mortality and if continued will impede stock recovery. This assessment updates the status of the stock, based primarily on the Canadian spring and fall research vessel surveys carried out in 2003 and 2004. Population and spawning stock biomass estimates for the 1959-2005 are provided from ADAPT, applied to the catch at age and calibrated using three Canadian research vessel surveys.

Nominal catch and catch at age

Catches from this stock peaked at 227 000 tons (t) in 1967, mainly by the former USSR and Spain, but declined steadily thereafter to 15 000 t in 1978. From 1979 to 1991 catches ranged from 20 000 to 50 000 t (Table 1, Fig. 1). A consecutive decline in TACs in the early 1990s reduced catches to a level of about 10 000 t in 1993. The fishery on this stock was suspended in February 1994 and has been under NAFO moratorium since then. In 1998 the Scientific Council Report recommended that there should be no directed fishing for cod in Div. 3N and 3O in 1999 and that by-catches in fisheries targeting other species should be kept at the lowest possible level. All subsequent assessments have re-iterated this advice.

Landings since 1994 (Fig 1), including Canadian surveillance and NAFO Scientific Council estimates (Table 1), have been increasing from 170 t in 1995 to 4 800 t in 2003. The 2003 catch could not be precisely estimated but is believed to be between a range of 4,300 t -5 450 t. The 2004 catch was estimated to be about 900 t. This is the first time since 1999 that the catch was below 1 000 t.

Sampling data for 2003 were limited to Canadian (Tables 2-3), Portuguese (Vargas *et al*., MS 2004), Spanish (Gonzalez *et al*., MS 2004) and Russian (Sigaev and Rikhter, MS 2004) otter trawl fisheries. Sampling data for 2004 came from Canadian (Table 2-3), Portuguese (Vargas *et al*., MS 2005), Spanish (Gonzalez *et al*., MS 2005) and Russian (Vaskov *at al*., MS 2005) research reports. The total catch at age from by-catches in 2003 and 2004 is presented in Table 4. A review of the sampling over the period 1995-2004 used to produce a catch at age for this stock is provided in Table 5. This table indicates considerable sampling deficiencies. In 1996, 1997, and 1998 the sampling was considered to be inadequate to develop a catch at age. An approach for developing catch at age for this period based on using an average partial recruitment vector, is presented in Stansbury *et al*. (1999). For 1999 and 2000 there are also gaps in the data but through the use of sampling collected by other contracting countries and by making use of Canadian research vessel survey age length keys, the catch at age was estimated. In 2003 and 2004, catch at age was compiled as detailed in Table 5. The catch for these years was dominated by the 1997-1999 year classes at ages between 4-6 years old (Fig. 2).

Inadequate sampling also presents problems for computing mean weight at age. To fill the 1996-1998 gap, a geometric mean was computed at each age, using the three nearest non-zero values on either side of the three year window. Catch-at-age and mean weights-at-age from the fisheries in the 1959-2004 period are presented in Tables 6 and 7. Historically, age 4-6 year old fish have dominated the catches.

Research vessel survey data

Stratified-random bottom trawl surveys have been conducted in spring by Canadian research vessels in Div. 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*. The stratification scheme used for these surveys is based on depth and is presented in Fig. 3. Autumn surveys have been carried out in Div. 3NO from 1990 to 1998 using the *Wilfred Templeman* for strata less than 730 m and the *Teleost* for strata greater than 731 to a maximum depth of 1 500 m. Because of vessel difficulties in 1996 the *Alfred Needler* concluded the survey in strata less than 731 m.

In the autumn of 1995, the Campelen 1800 shrimp trawl with rockhopper footgear was introduced in the Canadian groundfish survey, replacing the Engel 145 Hi-rise trawl that had been previously used. The Campelen trawl is towed at 3.0 knots for 15 min instead of 3.5 knots for 30 minutes in the case of the Engel trawl. The selectivities of the two nets were estimated in comparative fishing experiments in 1995 and 1996 and were found to be markedly different, with the Campelen being far more effective at catching small cod and slightly less effective at catching large cod (Warren, 1997; Warren *et al*., 1997). Conversion of Engels catches to Campelen equivalent catches are reported by Stansbury (1996, 1997).

Abundance and biomass estimates for these surveys are presented in Tables 8-19 and are plotted for the index strata (<200 fathoms) in Fig. 4-5. Abundance and biomass have been extremely low in both Div. 3N and Div. 3O from 1994 onwards. The swept area biomass estimate from index strata surveyed in Div. 3N and 3O combined for 2003 spring and autumn are 31 948 t and 29 032 t, respectively. The swept area estimates in Div. 3NO combined for 2004 spring and autumn are 24 884 t and 26 057 t, respectively.

The mean numbers per tow at age for the index strata (i.e. strata with depths <200 fathoms) in Div. 3NO combined are given in Table 18 for the spring survey and Table 19 for the autumn survey, and are plotted in Fig. 6 (age aggregated). Both the spring and fall indices have been extremely low in all years after 1993. The 2004 values among the lowest observations in the series and represent the fourth consecutive year of decline. Note that a slight adjustment has been made to the 1999 fall mean numbers per tow, due to a previous omission. These changes are small in magnitude. An index derived from a juvenile flatfish survey conducted by Canada from 1989 to 1994 is presented in Table 20.

Fixed station grid surveys conducted in July by a Canadian based fishing company in cooperation with the Canadian Department of Fisheries and Oceans were available for the period 1996 to 2004 for Div. 3NO (Maddock Parsons *et al.*, 2005). These surveys were designed to gather information for yellowtail flounder but also recorded information for cod. This survey initially used a grid design contained completely within Div. 3NO, but the original grid has since been expanded, and the extended grid now covers Div. 3LNO. Some of the grids have fixed sampling stations, and other grids have randomly chosen sampling locations. The area of coverage is about 9 500 square nautical miles or approximately 27% of the area of Div. 3NO less than 200 fathoms. The surveys conduct one hour tows at the stations with the same trawl and configuration throughout the series. Catch rate of cod (Fig. 7, kg/hour) increased from about 70 kg in 1997 to 193 kg in 1999, declined sharply to about 70 kg in 2000 and was stable to 2002. Catch rate declined to the lowest level in the time series at about 36 kg in 2004.

Stratified-random surveys were conducted by Spain in the NRA area of Div. 3NO from 1995-2004. The series began utilizing a Pedreira trawl on the C/V *Playa de Menduiña* then converted to a Campelen 1800 trawl on the R/V *Vizconde de Eza* in 2001. The 1997-2000 data were converted into Campelen units by modeling data collected during comparative fishing trials in 2001. The data for 1995-1996 were not presented because the deeper strata in the area of coverage were not sampled. The mean weight per tow (Fig. 8) increased from 2.5 kg in 1997 to 19.5 kg in 1998 then declined to 3.5 kg in 1999. The index increased again to 37 kg in 2001 then declined rapidly to 11 kg in 2002 followed by successive declines to 4 kg in 2004. The peaks in 1998 and 2001 were influenced by large single tows in those years.

Analysis

Maturity at age

As in the 2003 assessment, annual proportion mature is modeled by cohort. This method has been used to estimate maturities of cod in NAFO Subdiv. 3Ps (Brattey *et al.*, 2002), NAFO Div. 2J+3KL (Lilly *et al.*, 2003), and also for American plaice in NAFO Div. 3LNO (Morgan *et al.*, 2002). A probit model with a logit link function was fitted by cohort to Canadian spring survey data. The model fitted the data for all cohorts from 1953 to 1999, except for the 1991 cohort. The estimates are quite variable, particularly for recent cohorts (1993-1999); this may partly be a consequence of small sample sizes especially during surveys conducted in 2002-2004. The estimated age at 50% maturity (A_{50}) ranged between 5.6 and 7.4 years for cohorts produced from the 1950s to 1980s (Fig. 9). Age at 50% maturity declined during 1980-1990 from approximately 6.8 to 4.9. Estimates of A_{50} since the 1990 cohort, although variable, have generally been lower than those estimated for cohorts produced from the 1950s to the early 1980s, and the estimates for the two most recent cohorts (1998 and 1999) are the lowest observed in the time series. Estimates for the 1991 cohort were produced by averaging the estimates from the two adjacent years. The model predicted proportion of females mature at age is given in Table 21. As the estimation is by cohort, special considerations are needed to fill the older ages for the starting years, and also for the younger ages for current years. These values were produced by averaging using the previous/following 3 years for the appropriate age (shaded cells in Table 21). Estimated annual maturities for 1975-2004 are plotted for selected ages as an illustration in Fig. 10. Estimated proportion mature for these ages have all increased over this time period.

 Sequential population analysis

The catch at age used in the sequential population analysis applying the ADAPT framework (Gavaris, 1988) is presented in Table 22. The catch for age 2 is from the NAFO SCR Docs series presented from 1988 to 1998. Zero catch was assumed for age 2 in years 1959-1987. Due to inadequate sampling of removals, total catch for 1996-1998 was proportioned by age using the average partial recruitment vector from 1990-93 (from a previous ADAPT run) with the fully recruited *F* estimated from a catch projection so as to match the observed catch (further details in catch-at-age section). Catches since that time have been age-disaggregated using samples from contracting parties and Canadian RV age-length data.

The ADAPT was calibrated with Canadian RV survey spring 1984-2004, Canadian RV survey autumn 1990-2004 at age and Canadian juvenile survey 1989-94 indices was applied to estimate terminal numbers $N_{i,t}$,

where $i = 3$ to 12, for $t = 2004$ and $i = 12$, for $t = 1994$ to 2004,

and catchabilities

$q1_i$ where i = 2 to 10 for the Canadian Research Vessel survey spring

$q2_i$ where i = 2 to 10 for the Canadian Research Vessel survey autumn

$q3_i$ where i = 2 to 10 for the Juvenile Research Vessel survey.

The following structure was imposed:

natural mortality was assumed to be 0.2,
fishing mortality on the oldest age (12) set equal to the average F for ages 6 to 9 for years 1959-1993,
no "plus" age-class,
equal weighting of all indices,
no error in the catch numbers-at-age.

Input data were:

Catch numbers at age,
Ci,t where i = 2 to 12 and t = 1959 to 2004 ,
Canadian Research Vessel survey estimates of mean numbers per tow-at-age (Campelen or Campelen equivalent values),
$RV1i,t$ where i = 2 to 10 and t = 1984 to 2004, spring
$RV2i,t$ where i = 2 to 10 and t = 1990 to 2004, fall
and Canadian juvenile Research Vessel survey estimates of mean numbers per tow-at-age (Yankee 41.5 shrimp trawl in August- September)
$RV3i,t$ where i = 2 to 10 and t = 1989 to 1994 .

The objective function minimized is

$$SS = \sum_{s,i,t} \{\ln(RV_{s,i,t}) - \ln(q_{s,i}N_{i,t})\}^2$$

where s = Survey 1 to 3 , i = age 2 to 10, t = year of survey.

This particular model formulation was selected since it follows the accepted VPA from the last assessment and effectively deals with problems associated with zeros in the catch matrix at the age 12 for 1994-1996 (by estimating survivors at age 12 in these years). The statistics associated with the ADAPT output are given in Table 23. The mean square error for the model fit (MSE) was 0.706. The relative error in the parameter estimates of abundance decreased with age from a high of 62% at age 3 to a low of 32% at age 12. Relative bias was a high of 20% at age 3 decreasing to 5% at age 10.

The estimated survivors and catchabilities (Fig. 11) together with standard errors of the estimates are also provided in Table 23. Catchabilities generally decrease with age for all three surveys with the spring and fall having nearly equal $q's$ for ages 7-10 (Fig. 11). The Yankee 41.5 (juvenile survey) catchability for age 2 is more than three times that for the Campelen surveys.

Residual plots from the ADAPT run are presented in Fig. 12. These indicate that year effects are evident in the spring survey in 1987, 1993 and 1996 (positive) and 1989, 1995, 2002 (negative) (Fig. 12). The fall 1996 estimates have large negative residuals. The juvenile survey residuals show 1989 had a negative year effect. Large residuals in the fall survey for 1996 are ages 5, 6 and 7 while most other years for these three ages are positive.

Bias-adjusted estimates of population numbers (Fig. 13, left panel) and fishing mortality at age (Fig. 14) are given in Tables 24 and 25, respectively. The age 2 value in 2005 is imputed based on the geometric mean of the 2000-2004 age 2 estimates. The 2005 estimate of total survivors is the second lowest in the time series, the lowest population was estimated to be in 2004. The 1989 year-class, the most recent evidence of non-negligible recruitment (Fig. 15), is no longer contributing to the VPA population (since 2001), and a plot of population abundance at age (Fig. 11, right panel) indicates the next pulses of recruitment occurred in 1997 and 1998. These year classes were of similar

abundance but each was less than 30% of the 1989 year-class. In general, estimated recruitment for the past decade has been extremely low. Thus, future prospects for this stock are extremely poor. The 1996-1998 year-classes are now the most prominent year-classes in the population, but the strength of these year-classes is quite low relative to historic estimates.

Beginning of year mean weight-at-age calculated from the commercial catch is presented in Table 26. These weights are used to calculate biomass, given in Table 27. Stock biomass, which increased from the time of the moratorium until 2001, is again decreasing, with the 2005 estimate the lowest in the series. The maturities computed using the cohort model are used to compute the spawning stock biomass (Table 28, Fig. 16). Current SSB is estimated to be about 5 500 t, which is approximately 9% of B_{lim} (60 000 t). Given the sporadic sampling in the earlier time period, the estimated maturities from the cohort model differ from those estimated by the annual maturities model, particularly in the historic time period. The annual estimates of maturity produce a slightly different view of historic SSB. It was noted in last analytical assessment (Healey et. al, 2003) that the use of the cohort model compared to the annual maturities model of SSB indicates some differences in the historic trajectories, but near-identical trajectories since 1974. There are also differences for recent years as a result of updating the cohort model. However, these changes do not suggest alteration of the current B_{lim} of 60 000 t, especially considering this value is to be reviewed if the spawner biomass reaches 30 000 t.

Estimates of fishing mortalities in 2003 for most ages are extremely high, particularly for the younger ages, and are cause for concern for a stock under moratorium. Two reference F's are considered, both the age 6- 9 average and the average F from ages 4-6. The $\overline{F}_{4:6}$ decreased slightly in 2004 due to the fact that relatively few age 6 fish were caught. The population abundance was reduced by about 50% in 2003 as a result of the 4 870 t catch used which was the midpoint in a range that could not be precisely estimated. The population abundance has been steadily declining since the recruitment of the 1996-1998 year classes. At present, these Fs are estimated to be at or above the levels seen in the early 1980s during which time a sizable fishery existed. Increasing by-catches since the imposition of the moratorium are preventing the recovery of the stock.

Retrospective analysis

A retrospective analysis was conducted, and five years of successive data were removed, and the estimation (identical structure to the VPA above) was repeated for each case. Population numbers (Table 29, Fig. 17) and SSB display persistent trends for under estimation as successive years of data were excluded from the analysis. Conversely, mean $\overline{F}_{6-9}$ was over estimated in the year of the assessment (Fig. 17).

Deterministic Projections

Given the depressed state of the stock, coupled with the fact that no strong year-classes exist in the current population structure, it was regarded that stochastic projections would not alter perceptions about stock status in the short to medium term. However, deterministic projections still prove informative. The projections were carried out to forecast spawning stock biomass over 5 years assuming a fixed recruits-per-spawner rate, weight-at-age, natural mortality, and current fishing mortality (all averages over the final three years of SPA) as well as $F = 0$. Input data for the projections are tabled below. The partial recruitment vector was computed by averaging the PR vector over the last three years, then re-scaling this vector by the mean values over ages 4 to 6. The average R/S from 1999-2001 is about 0.12 compared to a historical average of 0.74 from 1959-2001.

The projections indicate that even under the scenario of no removals, spawner biomass is expected to decline by 11% to 4 900 tons by 2010 (Fig. 18). If the stock continues to be fished at current rates, spawner biomass will decrease by 76% to about 1 300 tons. This projection is more pessimistic than the projection provided in 2003 because of the subsequent high catches that have reduced the population and recent low recruitment rate.

Conclusion

The 2004 spring and autumn research vessel surveys indicate that the current stock size remains at an extremely low level. Survey abundance and mean numbers per tow have further declined since the last assessment of this stock. Estimates of recent year-class size from survey data indicate that recruitment has been almost non-existent since the

1989 and 1990 year-classes. The predominant year-classes remaining in this stock are the 1997 and 1998 year-classes, which are very weak compared to all historical year-classes. Estimates from the ADAPTive framework indicate that spawner biomass increased from 1995-2000, but has since decreased as by-catches have further increased. Fishing mortality is currently estimated to be at or above mid-1980s levels, during which time a sizable fishery existed. Low spawner biomass, low recruitment and high fishing mortality point to poor prospects for this stock in the medium term. This stock is currently well below the existing B_{lim}. Recovery will require a number of relatively strong year-classes that survive to maturity, rebuilding the spawner biomass. It will also require that by-catch mortality should be kept at an extremely low level, as current levels of catch are impeding stock recovery.

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Table 1. Catch (t) of cod in NAFO Divisions 3NO. 1953 -2004

Year	Canada	Spain	Portugal	USSR/Russia	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	13600
1992	7859	1927	449	68	2449 [3]	12752	13600
1993	5370	3764	525	287	700 [3]	10646	10200
1994	47	1783	50		822 [3]	2702	6000 [5]
1995	64	29			79 [3]	172	0
1996	99		33		42 [3]	174	0
1997	286	1	96		[3]	383	0
1998	396		95		56 [3]	547	0
1999	568	3	322	26	[3]	919	0
2000 [1]	207	200	500	137	6 [3]	1050	0
2001 [1]	560	87	392	227	44 [3]	1310	0
2002 [1]	444	40	405	338	967 [3]	2194	0
2003 [1]	818		577	175	3300 [3]	4870 [4]	0
2004 [1]	442	9	257	96	130 [3]	934	0

[1] **Provisional**
[2] **Includes an estimate of 4000 t deemed misreported to Div. 3L.**
[3] **Includes estimates by Canadian Surveillance and by NAFO Scientific Council.**
[4] **Catch could not be precisely estimated but is in the range of 4, 280 - 5, 460 tons**
[5] **Directed fishery suspended in February 1994 and has since been under moratorium.**

Table 2. Cod landings (t) by month and gear from NAFO Divisions 3NO by Canada in 2003.

Month	Canada (N)				Canada (M)			
	3N	3O			3N	3O		
	Ottertrawl	Ottertrawl	Gillnet	Longline	Longline	Ottertrawl	Longline	
Jan	0.28	0.01	0.04				0.07	
Feb	0.22		0.06	0.02				
Mar	0.07	1.65		2.77			16.18	
Apr	0.10	0.02		55.92			32.88	
May	3.15	35.35	0.26	16.02			48.35	
Jun	1.45	9.67	6.58	1.62				
Jul	0.40	1.55	1.31	3.69	4.39			
Aug	3.61	85.10	1.87				0.86	
Sep	15.76	99.76						
Oct	56.35	123.94	0.06	6.53		0.24		
Nov	80.08	72.62	6.17				0.93	
Dec	7.30	12.87						
	168.78	442.56	16.35	86.56	4.39	0.24	99.27	818.14

Table 2 cont. Cod landings (t) by month and gear from NAFO Divisions 3NO by Canada in 2004

Month	Canada (N)				Canada (M)			
	3N	3O			3N	3O		
	Ottertrawl	Ottertrawl	Gillnet	Longline	Longline	Ottertrawl	Longline	
Jan	0.054							
Feb	0.078			0.09				
Mar	0.246		0.141	6.875			11.1445	
Apr	1.838	10.012	2.912	4.543		3.266	0.7629	
May	19.122	66.133	2.862			10.9559	0.6675	
Jun	15.944	3.977	6.409			1.9968	2.4819	
Jul	0.747	1.663	1.788		10.031			
Aug		3.236	2.435	0.248				
Sep	0.229	106.7		3.632				
Oct	10.057	73.905						
Nov	6.499	81.598						
Dec	1.519	6.427						
	56.33	353.65	16.55	15.39	10.03	16.22	15.06	483.23

Table 3. Commercial sampling by Canada used to estimate catch at age for Divisions 3NO in 2003.

Qtr.	Gear	Div.	No. Aged	Month	No. meas
2	GN	3O	5	June	5
				Nov	44
2	LL	3O	21	Oct	86
2		3N	11	Aug	375
4			232	Oct	323
				Nov	460
				Dec	7
2		3O	121	May	434
				June	79
				Aug	388
				Sep	934
				Oct	1902
				Nov	424
				Dec	111

Table 3 (cont'd). Commercial sampling by Canada used to estimate catch at age for Divisions 3NO in 2004.

Qtr.	Gear	Div.	No. Aged	Month	No. meas
2	LL	3O	6	Apr	14
	OT	3O	118	Apr	85
				May	296
	OT	3NO	107		
3	OT	3O	167	Sep	1869
4	OT	3NO	28		
		3O	82	Oct	473
		3N		Dec	54

Table 4. Total catch, average weight and length at age for the fishery in Division 3NO during 2003 and 2004 .

| 2003 | AVERAGE | | Catch | 2004 | AVERAGE | | Catch |
| | WEIGHT | LENGTH | NUMBER | | WEIGHT | LENGTH | NUMBER |
AGE	(kg.)	(cm.)	(000'S)	AGE	(kg.)	(cm.)	(000'S)
1	0.11	23.95	0	1	0.11	23.40	1
2	0.26	31.23	43	2	0.38	34.82	11
3	0.67	42.34	337	3	0.69	42.44	37
4	0.94	47.24	810	4	0.92	46.80	45
5	1.40	53.85	1274	5	1.38	53.49	50
6	2.02	60.21	669	6	2.17	61.57	92
7	3.01	68.83	133	7	3.03	68.82	73
8	4.10	76.13	5	8	3.93	75.02	21
9	7.63	93.43	18	9	5.79	85.12	1
10	7.74	93.83	8	10	8.54	96.51	7
11	8.52	95.62	2	11	9.70	100.84	3
12	9.23	99.09	1	12	8.77	96.72	1
13	9.98	101.72	3	13	10.42	103.30	1
14	11.34	106.42	5	14	12.22	109.04	5
15	11.85	108.25	0	15	12.95	111.02	8
16	11.05	106.00	0	16	14.10	114.19	0
17	15.39	118.00	0	17	0.00	0.00	0
18	0.00	0.00	0	18	17.93	124.00	0
19	20.75	130.00	0	19	0.00	0.00	0
20	0.00	0.00	0	20	0.00	0.00	0

Table 5. A review of sampling used to compile catch at age for 3NO cod from 1995 to 2004.

	Sampling	Canada	Spain	Portugal	Other
1995	No Spanish sampling.Sampling available from Portuguese gill net and otter trawl fisheries	14/GN 60/LL	29	15/OT 15/GN	79
1996	No Spanish sampling.Sampling insufficient	19/OT 31/GN 47/LL 1 MWT Total 98	5	26/OT 6/GN	38
1997	Sampling insufficient	203/GN 83/OT 40/LL 2/MWT 329 Total		113	
1998	Some Canadian otter trawl frequencies and age samples but nothing for gillnets. Portuguese length frequencies but no aging.	185/OT 160/GN 50/LL 396 Total		95/OT	56
1999	Length and age sampling for Canadian by-catch was limited to the otter trawl fishery in 3N and gillnet fishery in 3O. Where deemed appropriate sampling was used for the adjacent division. Canadian catch at age was prorated by 135 t for catch with no sampling was available. Some monthly frequencies by division were provided by Portugal and these in conjunction with keys from the Canadian Spring RV surveys were use to partition the Portuguese and Spanish catch. Age composition by division was provided by Russia.	122OT 351/GN 66/LL 2/ST 26/UK	3	322	26
2000	Length sampling for Canadian by-catch was limited to the otter trawl fishery in 3N and 3O. Age sampling was inadequate so spring and fall rv keys were used. Canadian catch at age was prorated for 77 t of catch with no sampling. Frequencies provided by Portugal and Spain were used with Canadian RV survey key to calculate catch for Portugal and Spain. Age composition by division was provided by Russia.	128/OT 29/GN 43/LL 7/UK	200	500	143
2001	Length sampling for Canadian by-catch was limited to the otter trawl fishery in 3N and 3O.However this comprised 85% of the Canadian catch.89 t caught in other gears added to the overall Canadian, Spanish and Portuguese catch at age. Age sampling for Canadian catch adequate . Portugal provided catch by area and month and length sampling. Spain provided catch by division and length sampling. Portuguese catch at age compiled using monthly sampling and keys created from Canadian Spring and Autumn RV surveys using only data from strata stradiling or outside 200mile limit. Spanish catch at age compiled using yearly frequencies by division provided and a key created by combining the two RV keys. Russia provided catch at age for sampled fish. Estonian catch at age based on Russian data. Individual countries catch at age scaled to catch agreed on at June 2002 STACFIS meeting.	470/OT 24/GN 61/LL 4/SS	89/OT	392/OT	271
2002	Adequete length measurment from Canadian ottertrawl fishery by-catch . Canadian sampling of the gillnet by-catch is minimal however this gear accounts for less than 5% of the catch. With such small amounts being landed it's next to impossible to capture a representative sample. Longline by-catch makes up ~8 % of the Canadian catch and it is not sampled at all. Frequencies from Portugal, Spain and Russia were used with Canadian commercial keys to partition commercial catch into catch at age.	370/GN 2933/OR	255/OT	8484/OT	9577/OT
2003	Adequete length measurment from Canadian ottertrawl fishery by-catch . However by-catch in other Canadian fisheries accounted for ~25% of the Canadian catch. This was poorly sampled and age distribution of this catch may not reflect reality. Ample length samples were provided by the Portugal and Russia. these were used inconjunction with Canadian Research survey keys to create catch at age for Russia and Portugal. Catch by Spain was partitioned using frequencies from Portugal. Catch by Norway, Lithuania and Estonia was partitioned using frequencies from Russia.	45/GN 86/LL 5437/OT		13236/OT	5291/OT
2004	Length sampling limited to Canadian by-catch in the otter trawl fishery. This sampling is sparce and should be improved as there are observers aboard the vessels fishing Yellow tail flounder. By-catch by other gears accounted for on 6% of the catch and this not sampled. Monthly and quarterly frequencies provided by Portugal and Russia were used in conjunction with Canadian Research Survey keys to create catch at age for Portugal, Spain, Russia and Estonia.	14/LL 2777/OT	905/OT	2333/OT	1508/OT

Table 6. Catch-at-age for Divisions 3NO cod, 1959-2004(000s) . Age 13 is a plus group

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
3	1711	1846	812	1026	313	6202	1013	753	20086	16359	8154
4	13036	6503	4400	3882	5757	15555	7611	18413	62442	56775	12924
5	5068	22050	11696	2206	11210	19496	7619	19681	50317	48608	26949
6	6025	3095	15258	1581	4849	7919	13258	11795	18517	18485	11191
7	3935	2377	2014	3594	1935	2273	9861	8486	4774	6337	2089
8	1392	2504	1672	773	3840	1109	4827	4467	4651	1592	1393
9	757	583	847	668	1165	788	1081	1829	236	505	518
10	926	387	196	433	608	328	1248	1694	180	178	292
11	1220	898	25	226	322	37	163	122	71	90	134
12	103	242	245	216	208	112	141	57	45	45	202
13	1128	1409	392	846	473	56	276	183	335	51	574
3+	35301	41894	37557	15451	30680	53875	47098	67480	161654	149025	64420
6+	15486	11495	20649	8337	13400	12622	30855	28633	28809	27283	16393

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
3	2105	950	69	10058	6425	671	4054	607	920	72	266
4	19703	26900	19797	27600	9501	8781	7534	2469	4337	3827	1055
5	10799	30300	12289	15098	10907	3528	5945	2531	2518	9208	3812
6	9481	11700	13432	5989	10872	2505	1084	1500	818	2784	2275
7	3646	3500	5883	1971	2247	3057	211	572	354	883	761
8	1635	2500	1686	972	2147	1059	238	177	102	265	222
9	541	500	285	707	1015	921	44	209	58	58	92
10	149	200	216	243	676	461	37	65	51	17	31
11	227	100	78	137	428	252	13	41	8	12	8
12	90	50	74	116	257	152	9	25	5	7	13
13	1472	700	350	173	881	396	17	36	21	16	2
3+	49848	77400	54159	63064	45356	21783	19186	8232	9192	17149	8537
6+	17241	19250	22004	10308	18523	8803	1653	2625	1417	4042	3404

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	505	305	1179	58	57	153	516	277	1917	1064	1103
4	1091	1978	647	1000	2953	2865	422	318	2182	4505	673
5	1262	1591	1893	1411	6203	6423	3491	1527	1502	4341	995
6	2297	1012	1204	2324	3036	4370	3445	6347	1260	895	544
7	1902	1528	686	1220	2519	1512	1213	3955	1887	422	282
8	574	1492	1152	720	797	948	653	1009	1284	721	368
9	192	595	774	918	459	558	845	567	485	581	568
10	94	211	238	551	533	373	494	425	233	439	502
11	41	162	81	106	261	349	398	249	168	150	383
12	13	27	41	42	97	135	404	142	100	83	202
13	32	52	36	70	71	86	188	298	85	106	337
3+	8003	8953	7931	8420	16986	17772	12069	15114	11303	13307	5957
6+	5145	5079	4212	5951	7773	8331	7640	12992	5702	3397	3186

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	4508	1314	232	0				94	356	165	218
4	1769	3209	2326	72				41	339	257	550
5	837	637	1117	20				101	87	141	427
6	612	479	125	40				40	62	9	141
7	235	321	93	2				14	21	36	9
8	64	74	26	0				6	12	16	27
9	99	25	8	1				23	4	4	13
10	128	39	1	0				55	13	1	3
11	153	49	0	0				3	12	7	1
12	100	53	0	0				2	2	10	6
13	217	160	0	0				3	1	2	12
3+	8722	6360	3928	135				380	909	648	1407
6+	1608	1200	253	43				144	127	84	212

	2003	2004
3	337	37
4	810	45
5	1274	50
6	669	92
7	133	73
8	5	21
9	18	1
10	8	7
11	2	3
12	1	1
13	9	15
3+	3267	346
6+	845	214

Table 7. Mean weight-at-age for Divisions 3NO cod, 1959-2000. Age 13 is a plus group and the estimate tabled is the catch weighted average of ages in the plus group. Shaded estimates were not derived from sampling (see text)

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
3	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.48	0.48	0.48	0.48
4	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.90	0.90	0.90	0.90
5	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.35	1.35	1.35	1.35
6	1.95	1.95	1.95	1.95	1.95	1.95	1.95	2.14	2.14	2.14	2.14
7	2.82	2.82	2.82	2.82	2.82	2.82	2.82	3.16	3.16	3.16	3.16
8	3.39	3.39	3.39	3.39	3.39	3.39	3.39	4.21	4.21	4.21	4.21
9	3.98	3.98	3.98	3.98	3.98	3.98	3.98	6.34	6.34	6.34	6.34
10	4.68	4.68	4.68	4.68	4.68	4.68	4.68	7.69	7.69	7.69	7.69
11	5.25	5.25	5.25	5.25	5.25	5.25	5.25	8.46	8.46	8.46	8.46
12	6.17	6.17	6.17	6.17	6.17	6.17	6.17	10.24	10.24	10.24	10.24
13	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
3	0.48	0.48	0.54	0.57	0.42	0.38	0.50	0.57	0.72	0.65	0.71
4	0.90	0.90	0.97	1.00	0.73	0.89	0.91	1.00	1.05	0.98	1.04
5	1.35	1.35	1.44	1.43	1.20	1.28	1.41	1.48	1.55	1.39	1.69
6	2.14	2.14	2.08	2.19	1.96	2.13	2.33	2.48	2.25	2.09	2.50
7	3.16	3.16	2.89	3.63	2.86	3.14	3.25	3.51	3.74	2.87	3.69
8	4.21	4.21	3.56	4.63	4.67	4.16	4.03	4.74	4.61	3.70	5.49
9	6.34	6.34	5.95	6.25	7.32	5.53	6.67	7.17	6.19	4.75	7.98
10	7.69	7.69	7.95	9.56	5.46	6.74	8.74	8.81	7.23	7.15	9.22
11	8.46	8.46	8.32	11.17	8.40	5.27	9.14	11.70	9.48	7.98	10.60
12	10.24	10.24	10.14	13.99	7.51	7.09	12.49	11.47	12.87	10.11	12.61
13	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	0.90	0.94	0.85	0.79	0.48	0.39	0.49	0.74	0.51	0.55	0.55
4	1.27	1.17	1.17	1.15	0.86	1.01	0.82	1.00	0.97	1.01	0.85
5	1.84	1.50	1.87	1.51	1.37	1.52	1.30	1.38	1.60	1.46	1.59
6	2.69	2.20	2.63	2.28	2.05	2.16	1.83	1.79	2.24	2.51	2.30
7	3.55	3.83	3.80	3.04	3.25	3.49	2.89	2.23	3.27	2.73	3.83
8	5.33	5.26	5.20	4.05	4.65	5.41	4.76	3.77	4.61	4.14	5.56
9	7.13	7.49	6.27	5.76	6.62	7.95	7.26	5.12	7.08	5.02	7.53
10	9.10	8.80	8.08	7.22	8.32	9.82	8.95	6.88	8.31	8.37	9.04
11	9.01	9.82	8.99	8.92	9.15	9.94	9.85	9.37	9.47	9.29	11.98
12	10.15	12.28	11.01	12.61	11.13	9.88	12.59	11.07	12.25	11.25	13.98
13	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	11.91	13.60

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	0.33	0.36	0.27	0.42	0.42	0.42	0.42	0.50	0.60	0.58	0.67
4	0.65	0.78	0.46	0.75	0.78	0.78	0.78	0.94	0.82	1.09	1.01
5	1.06	1.35	0.91	1.21	1.30	1.30	1.30	1.59	1.45	1.38	1.52
6	1.80	1.84	1.63	2.03	1.99	1.99	1.99	2.07	2.39	2.07	2.24
7	2.82	2.82	1.84	2.29	2.68	2.68	2.68	2.23	3.44	4.06	3.38
8	4.85	4.11	4.04	2.08	3.38	3.38	3.38	2.83	2.90	5.22	5.15
9	5.56	5.87	4.94	6.60	4.70	4.70	4.70	3.99	2.64	5.32	5.99
10	7.43	7.76	7.54	6.22	5.98	5.98	5.98	6.05	3.78	5.51	7.11
11	8.64	8.79	3.44	6.41	6.41	6.41	6.41	6.73	5.25	7.51	8.47
12	10.65	8.67	7.52	8.03	8.03	8.03	8.03	7.38	6.07	8.60	9.32
13	14.11	12.74	10.00	11.32	11.32	11.32	11.32	11.70	10.19	10.09	10.64

	2003	2004
3	0.67	0.69
4	0.94	0.92
5	1.40	1.38
6	2.02	2.17
7	3.01	3.03
8	4.10	3.93
9	7.63	5.79
10	7.74	8.54
11	8.52	9.70
12	9.23	8.77
13	10.64	12.68

Table 8. Cod abundance (000's) from Canadian spring RV surveys in Division 3N for depths <200 fathoms.

Shaded Numbers are estimates for non sampled strata. Data for 1984-1995 has been converted to Campellan equivalent units.

Depth range (fath) mean survey date	Strata	Vessel Area Sq. mi.	AN 27 1984 2-May-84	WT 29 AN 43 1985 27-Apr-85	WT 47 1986 29-Apr-86	WT 58-59 1987 9-May-87	WT 70 1988 1-May-88	WT 82 1989 2-May-89	WT 95-96 1990 12-May-90	WT 105-106 1991 7-May-91	WT 119-120 1992 8-May-92	WT 136-137 1993 13-May-93	WT 152-153 1994 18-May-94	WT 168-169 1995 18-May-95	WT 188-189 1996 25-May-96	WT 204-208 1997 16-May-97	WT 221-222 1998 22-May-98	WT 238-241 1999 31-May-99	WT 315-318 2000 30-May-00	WT 367-369 2001 24-May-01	WT 419-424 2002 23-May-02	WT 478-481 2003 25-May-03	WT 546-549 2004
0-30	375	1593	22302	12390	2240	6223	3134	4868	3236	111	148	74	0	0	0	131	292	5259	329	351	131	263	175
	376	1499	149223	149	787	88795	2533	599	268	119	0	0	0	69	165	0	1272	103	206	41	0	41	1004
31-50	360	2992	136658	27167	9750	31721	35911	1053	3020	900	2731	907	0	0	449	86	823	150	41	82	453	659	2552
	361	1853	29339	50443	5585	47837	15405	9136	6634	2574	804	836	103	625	1077	549	2258	2650	1869	510	1997	892	3035
	362	2520	68550	20045	5400	117654	6860	7054	8400	1120	58	117	0	0	39	50	139	1042	1271	1078	193	39	314
	373	2520	27500	4161	1600	11738	2625	3096	1575	223	0	0	0	0	39	50	35	77	0	193	77	0	39
	374	931	10431	776	86	931	879	52	388	26	129	0	0	0	85	38	0	85	0	128	43	0	0
	383	674	62	0	0	967	686	499	47	62	0	0	0	0	0	0	0	0	0	0	0	0	0
51-100	359	421	2339	0	40375	7163	5584	1637	819	1199	1696	2193	0	0	33	138	26	58	29	87	29	0	0
	377	100	1771	2451	465	6396	0	424	0	0	28	49	0	0	0	0	7	0	0	0	0	0	7
	382	647	0	3572	22	60	180	1588	3325	0	0	0	0	0	0	0	45	134	0	0	0	0	0
101-150	358	225	2703	5766	4063	4359	5328	3984	8297	1047	16484	3391	109	156	310	261	41	1254	69	3111	234	8940	155
	378	139	2481	43824	6313	2124	1921	1612	2751	875	3707	608	222	97	163	136	96	38	209	108	44	1523	1000
	381	182	1534	12968	8249	392	3185	3741	3665	202	88	0	13	114	160	13	0	150	0	1152	0	113	300
151-200	357	164	0	11571	444	1428	11	68	888	2528	2676	68	433	23	90	20	219	73	282	872	168	110	43
	379	106	788	3195	5010	7	44	206	1318	2311	8782	545	191	66	204	194	72	58	21	642	105	129	49
	380	116	209	3681	526	934	1498	967	2062	3859	870	20654	0	32	471	6239	48	96	117	511	23	609	207
total all strata fished < 200 fathoms			455890	202158	90915	327301	85786	40583	46692	17156	38174	29420	1120	1182	3283	7905	5328	11138	4577	8866	3497	13318	8878
total <200 fathoms adjusted			455890	202159	90915	328729	85784	40584	46693	17156	38173	29421	1120	1182	3285	7905	5328	11138	4577	8866	3497	13318	8878
upper limit			891831	278710	543939	531816	118657	53692	79795	35126	63165	286252	7723	2774	5144	85516	8714	15958	6928	48358	5573	127402	16024
t-value			2.776	2.776	12.706	2.228	2.145	2.365	4.303	4.303	4.303	12.706	12.706	2.447	2.365	12.71	2.14	2.45	214	12.71	2.36	12.71	2.131
1 std dev			157039	27576	35654	91793	15324	5543	7693	4176	5808	20213	520	651	787	6106	1582	1967	11	3107	880	8976	3353

Table 9. Cod biomass (t) from Canadian spring RV surveys in Division 3N for depths < 200 fathoms.

Shaded Numbers are estimates for non sampled strata. Data for 1984-1995 has been converted to Campellan equivalent units.

Depth range (fath) mean survey date	Strata	Vessel Area Sq. mi.	AN 27 1984 2-May-84	WT 29 AN 43 1985 27-Apr-85	WT 47 1986 29-Apr-86	WT 58-59 1987 9-May-87	WT 70 1988 1-May-88	WT 82 1989 2-May-89	WT 95-96 1990 12-May-90	WT 105-106 1991 7-May-91	WT 119-120 1992 8-May-92	WT 136-137 1993 13-May-93	WT 152-153 1994 18-May-94	WT 168-169 1995 18-May-95	WT 188-189 1996 25-May-96	WT 204-208 1997 16-May-97	WT 221-222 1998 22-May-98	WT 238-241 1999 31-May-99	WT 315-318 2000 30-May-00	WT 367-369 2001 24-May-01	WT 419-424 2002 23-May-02	WT 478-481 2003 25-May-03	WT 546-549 2004 25-May-03
0-30	375	1593	7018	26266	21041	13506	23154	25148	16134	1835	2331	1145	0	0	0	92	108	3225	54	592	88	1229	89
	376	1499	16673	713	2954	9148	6555	1256	3791	1483	0	0	0	51	62	0	75	4	43	6	0	458	286
31-50	360	2992	21843	17007	3781	4155	3792	2145	10488	1032	1445	46	0	0	457	15	12	315	19	588	244	1417	84
	361	1853	20008	52794	61130	50358	25677	19517	30149	16646	399	3455	64	47	647	378	682	3496	533	240	1856	1987	299
	362	2520	75781	29914	31327	144250	19890	26588	37344	4343	668	1522	0	0	21	317	407	946	1328	1110	22	2	2134
	373	2520	33487	5274	4378	14596	9738	8996	5802	856	0	0	0	0	9	168	9	50	0	8	11	0	2
	374	931	14987	1523	1338	1832	5872	937	5050	516	30	0	0	0	11	136	0	11	0	30	15	0	0
	383	674	502	0	0	1664	236	574	615	224	0	0	0	0	0	0	0	0	0	0	2	0	0
51-100	359	421	308	0	2639	779	637	213	101	66	113	433	0	0	36	199	1	114	194	54	7	0	0
	377	100	145	219	138	1720	0	46	0	0	9	8	0	0	0	15	0	0	0	0	0	0	29
	382	647	0	257	84	42	59	782	298	0	0	0	0	0	0	0	9	27	0	0	0	0	0
101-150	358	225	822	906	1724	4255	1317	1701	1089	131	2650	1699	164	135	131	104	73	1171	23	1818	327	14117	258
	378	139	692	4601	1084	358	441	432	399	145	413	247	64	76	84	109	80	21	184	92	16	739	377
	381	182	765	5397	2913	247	786	216	800	399	15	0	57	44	40	2	0	16	0	708	0	12	49
151-200	357	164	0	6352	640	566	33	64	274	331	706	46	237	24	18	9	221	51	242	676	158	204	60
	379	106	382	1198	1587	9	37	98	318	852	2592	205	121	46	66	104	24	12	8	536	74	68	22
	380	116	411	2128	526	1018	656	498	704	676	181	9823	0	9	100	3457	13	18	14	71	14	97	36
total all strata fished < 200 fathoms			193825	154547	137124	247937	98880	89212	113355	29536	11544	18629	714	433	1682	5090	1720	9459	2669	6529	2832	20330	3726
total <200 fathoms adjusted			193824	154549	137124	248503	98880	89211	113356	29535	11543	18630	715	432	1682	5090	1720	9459	2669	6529	2832	20330	3726
upper limit			256272	192257	211519	326927	125247	115281	141017	49183	19173	143715	1950	761	2843	48785	2783	16197	5747	12873	6743	200410	8706
t-value			2.093	2.064	2.201	2.093	2.086	2.11	2.02	2.306	2.776	12.706	4.303	2.776	2.101	12.71	2.14	2.23	2.26	3.18	2.57	12.71	2.306
1 std dev			29836	18270	33801	37740	12640	12355	13694	8520	2748	9845	287	118	553	3438	497	3022	1362	1995	1522	14168	2160

Table 10. Cod abundance (000's) from Canadian spring RV surveys in Division 3N
for depths > 200 fathoms.Data for 1991-1995 has been converted to Campellan equivalent units.

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000	WT 367-369 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004
mean survey date			7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96	16-May-97	22-May-98	31-May-99	30-May-00	24-May-01	23-May-02	25-May-03	26-May-03
201-300	723	155	1970	13573	43	32	0	46	77	53	0	139	3179	1658	550	85
	725	105	401	nf	0	95	73	34	16	49	33	361	661	148	0	0
	727	160	833	2144	1444	222	211	1394	109	55	44	383	528	446	50	0
301-400	724	124	69	112	9	34	17	0	50	61	0	0	45	62	8	9
	726	72	0	0	0	0	70	0	12	0	0	0	0	36	0	0
	728	156	0	0	0	0	43	0	0	0	0	0	0	0	0	0
401-500	752	134	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	756	106	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	760	154	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
total all strata fished			20429	54003	30916	1504	1597	4789	8165	5545	11214	5460	13279	5845	13926	8972
upper			38845	212125	287928	3892	3156	24093	85786	8939	16037	7953	31301	28722	128156	16121
t-value			4.303	12.706	12.706	4.303	2.365	12.706	12.71	2.14	2.45	2.13	4.3	12.71	12.71	2.13
1 STD			4280	12445	20228	555	659	1519	6107	1586	1969	1170	4191	1800	8990	3356

Table 11. Cod biomass (t)) from Canadian spring RV surveys in Division 3N
for depths > 200 fathoms.Data for 1991-1995 has been converted to Campellan equivalent units.

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000	WT 367-369 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004
mean survey date			7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96	16-May-97	22-May-98	31-May-99	30-May-00	24-May-01	23-May-02	25-May-03	26-May-03
201-300	723	155	662	3415	30	26	0	35	80	77	0	270	2233	1598	956	46
	725	105	186	nf	0	32	8	19	9	10	13	163	443	100	0	0
	727	160	486	805	313	86	41	677	71	25	6	180	295	96	25	0
301-400	724	124	30	32	9	22	26	0	40	191	0	0	100	36	25	6
	726	72	0	0	0	0	31	0	5	0	0	0	0	12	0	0
	728	156	0	0	0	0	26	0	0	0	0	0	0	0	0	0
401-500	752	134	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	756	106	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	760	154	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
total all strata fished			30901	15795	18982	880	566	2430	5295	2024	9479	3281	9601	4673	21336	3778
upper			50596	28054	144081	2151	888	6155	49001	3168	16216	6357	18074	11424	201747	8759
t-value			2.306	3.182	12.706	4.303	2.571	4.303	12.71	2.13	2.23	2.23	3.18	3.18	12.71	2.31
1 STD			8541	3853	9846	295	125	866	3439	537	3021	1379	2664	2123	14199	2156

Table 12. Cod abundance (000's) from Canadian Spring RV Surveys in Division 3O for depths <200 fathoms.
Shaded Numbers are estimates for non-sampled strata. Data for 1984-1995 have been converted to Campellen equivalent units

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984 3-May-84	AN 43 1985 15-Apr-85	WT 47 1986 22-Apr-86	WT 58-60 1987 27-Apr-87	WT 70 1988 24-Apr-88	WT 82 1989 23-Apr-89	WT 95-96 1990 27-Apr-90	WT 105-106 1991 24-Apr-91	WT 119-120 1992 26-Apr-92	WT 136-137 1993 30-Apr-93	WT 152-154 1994 4-May-94	WT 168-169 1995 7-May-95	WT 188-189 1996 11-May-96	WT 204-208 1997 16-May-97	WT 221-222 1998 22-May-98	WT 238-241 1999 19-May-99	WT 315-318 2000 16-May-00	WT 365+367 2001 7-May-01	WT 419-424 2002 5-May-02	WT 478-481 2003 11-May-03	WT 546-549 2004 31-May-04
31-50	330	2089	7761	7892	3707	11315	5384	1609	4990	1424	203	373	0	0	4824	509	4310	4037	8680	1519	616	270	1204
	331	456	3863	1921	744	1900	1425	792	1052	158	32	0	0	0	348	0	8343	452	2635	3858	220	63	1725
	338	1898	23356	9724	8933	20210	6623	20166	8436	24463	2285	835	132	264	2109	160	895	15015	6571	7006	3264	1044	970
	340	1716	10606	9414	10282	146151	2826	1960	3628	2569	334	119	286	0	1441	529	173	1770	3682	567	189	330	283
	351	2520	78342	17578	117725	71723	13335	6112	2071	1050	350	250	0		525	453	277	1631	1820	545	217		43
	352	2580	41362	17656	9803	35888	56193	10474	14499	9752	3852	1331	1299	1111	1115	927	1278	14932	5481	3372	1730	754	877
	353	1282	0	2226	2773	29082	44478	4731	6499	1297	4229	223	0	285	677	0	564	507	1693	397	321	220	139
51-100	329	1721	5928	2390	2838		5259	5577	13147	22309	508	1673	13959	1100	330	765	8194	8370	1278	2746	379	2557	440
	332	1047	436	3432	1115	30014	2908	3112	5700	683773	29607	296105	0	2399	3184	432	720	8121	27653	816	672	96	3271
	337	948	1909	5688	1369	1799	2337	10402	2133	22436	6913	231602	132	527	2502	681	1239	9389	3032	1130	478	565	366
	339	585	14625	894	135	2383	488	27	1625	1571	609	406	0	0	46	0	121	497	40	281	201	0	0
	354	474	2238	1843	2216	65669	2271	593	395	9019	1679	1415	0	0	66	0	4583	4864	587	163	33	33	0
101-150	333	151	0	42	105	566	0	378	136	692	975	514	2205	10	688	1447	194	25	92	71	20	9	10
	336	121	0	17	126	17	8	8	143	160	5537	437	605	0	8	128	25	17	0	42	92	0	67
	355	103	0	4070	29	207	43	987	193	2339	944	236	50	7	2573	6	50	44	39	234	31	21	65
151-200	334	92	0	236	1323	26	121	141	543	1214	971	1137	533	200	184	94	26	28	70	54	1017	19	17
	335	58	0	0	68	8	12	16	97	27	1275	342	157	52	490	211	36	37	13	278	357	4	0
	356	61	0	0	13	4	51	131	110	546	2665	424	491	13	93	70	82	67	96	62	149	22	67
total strata fished < 200 fathoms			190427	85023	163306	549997	143763	67215	68515	785821	63667	537522	20100	5967	21202	6412	31110	69803	73688	24416	10314	6224	9545
total <200 fathoms adjusted			190426	85023	163304	549994	143762	67216	69568	785820	63668	537522	20099	5968	21203	6412	31110	69803	73688	24416	10314	6224	9545
upper limit			242768	109795	363874	823914	229667	89730	90269	2506436	126262	3992300	58534	10117	32019	25638	65284	102583	110064	31201	14550	12891	19085
t-value			2.228	2.052	2.16	2.306	2.201	2.052	2.11	2.571	2.776	12.706	2.776	2.306	2.365	12.706	2.78	2.2	2.45	2.14	2.36	2.776	4.303
1 std dev			23492	12072	92856	118784	39030	10972	10310	669240	22549	271901	13845	1800	4574	1513	12293	14900	14847	3171	1795	2402	2217

Table 13. Cod biomass (t) from Canadian Spring RV Surveys in Division 3O for depths <200 fathoms.
Shaded Numbers are estimates for non-sampled strata. Data for 1984-1995 have been converted to Campellen equivalent units

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984 3-May-84	AN 43 1985 15-Apr-85	WT 47 1986 22-Apr-86	WT 58-60 1987 27-Apr-87	WT 70 1988 24-Apr-88	WT 82 1989 23-Apr-89	WT 95-96 1990 27-Apr-90	WT 105-106 1991 24-Apr-91	WT 119-120 1992 26-Apr-92	WT 136-137 1993 30-Apr-93	WT 152-154 1994 4-May-94	WT 168-169 1995 7-May-95	WT 188-189 1996 11-May-96	WT 204-208 1997 16-May-97	WT 221-222 1998 22-May-98	WT 238-241 1999 19-May-99	WT 315-318 2000 16-May-00	WT 365+367 2001 7-May-01	WT 419-424 2002 5-May-02	WT 478-481 2003 11-May-03	WT 546-549 2004 31-May-04
31-50	330	2089	7964	9372	4167	12075	4486	3318	5091	266	32	92	0	0	7103	357	12526	8593	8401	2296	190	20	2806
	331	456	4536	4891	1295	1982	2176	481	2191	236	224	0	0	0	983	0	34685	1105	6842	1738	1251	326	8186
	338	1898	43090	13670	23245	20013	14538	25430	9315	10283	11883	4981	1841	3439	1535	196	5069	9416	6982	13092	2456	4712	1625
	340	1716	13654	10780	12024	161120	16447	5478	10296	384	52	1936	160	0	239	186	512	3857	2164	1469	33	25	1735
	351	2520	68620	34516	90852	114632	25324	19777	22343	6595	2063	1198	131	0	104	286	1888	5269	47572	4266	38	38	583
	352	2580	51655	41868	24245	76430	82226	43865	38424	22512	16671	8225	1584	3784	1528	2869	5341	14309	8226	11344	6932	3093	3130
	353	1282	0	9451	1831	15552	4512	4012	5892	1267	1780	3260	0	609	118	0	18	1719	7130	529	4394	607	758
51-100	329	1721	1776	1931	1114	116331	16127	1690	4684	4195	97	219	10523	2187	191	614	13037	9671	628	896	63	1623	173
	332	1047	4410	17134	4092	12848	11718	2156	11266	39264	3927	108245	0	1702	1534	1558	2136	1350	4360	272	42	462	906
	337	948	741	2976	11644	4299	1005	5735	3354	5566	20721	79783	813	1659	3299	527	1720	3095	1040	553	160	171	890
	339	585	3355	730	73	943	496	219	385	92	87	43	0	0	5	0	441	1210	1	733	48	0	0
	354	474	955	660	569	6915	1211	87	562	3325	191	1319	0	0	85	0	2258	1088	218	737	218	474	0
101-150	333	151	0	330	411	1837	0	1486	381	877	273	1661	8549	26	1625	974	255	26	77	43	31	13	2
	336	121	0	81	120	35	39	44	318	111	1733	375	661	0	19	322	16	18	0	46	95	0	96
	355	103	0	724	29	259	38	538	198	329	169	32	31		2344	15	74	26	13	169	27	2	51
151-200	334	92	0	898	4773	120	473	294	826	1385	1018	1408	959	333	259	305	46	72	98	33	1241	18	87
	335	58	0	0	159	38	82	16	110	10	276	2522	453	342	680	734	75	207	37	254	437	8	0
	356	61	0	0	42	18	178	154	219	88	308	387	257	16	46	102	108	442	108	142	26		131
total strata fished < 200 fathoms			200758	150013	180686	545446	181076	114780	113664	96783	61399	215824	25964	14127	21696	8990	80199	61139	94231	38539	17798	11618	21158
total <200 fathoms adjusted			200756	150012	180685	545444	181076	114780	115855	96785	61399	215823	25963	14128	21697	8990	80199	61139	94231	38539	17798	11618	21158
upper limit			259926	187944	303904	774350	254658	184780	143844	187783	120673	1396053	56360	20543	32630	15716	546664	86203	206438	52036	27516	18496	135184
t-value			2.228	2.032	2.16	2.131	2.11	2.16	2.021	2.571	2.776	12.706	2.571	2.074	2.306	2.201	12.71	2.09	2.36	2.09	2.18	2.13	12.706
1 std dev			26557	18667	57045	107416	34873	32407	14933	35395	21352	92888	11823	3094	4742	3056	36701	11992	47545	6458	4458	3229	8974

Table 14. Cod abundance (000's) from Canadian Spring RV Surveys in Division 3O
for depths >200 fathoms Data for 1991-1995 have been converted to Campellen equivalent units.

Depth range (fath) mean survey date	Strata	Vessel Area Sq. mi	WT 105-106 1991 24-Apr-91	WT 119-120 1992 26-Apr-92	WT 136-137 1993 30-Apr-93	WT 152-154 1994 4-May-94	WT 168-169 1995 7-May-95	WT 188-189 1996 11-May-96	WT 204-208 1997 16-May-97	WT 221-222 1998 22-May-98	WT 238-241 1999 19-May-99	WT 315-318 2000 16-May-00	WT 365 +367 2001 7-May-01	WT 419-424 2002 5-May-02	WT 478-481 2003 11-May-03	WT 546-549 2004 18-May-04
201-300	717		3701	336	1615	1441	242	27	176	20	37	122	838	183	114	553
	719		274	749	301	443	164	21	39	5	107	18	134	0	21	8
	721		190	72390	348	11	5	5	84	103	5	5	7	67	9	19	5
301-400	718		15	0	100	503	102	0	7	0	0	0	0	18	0	0
	720		0	569	15	211	29	6	103	12	7	0	7	17	0	0
	722		0	149	0	0	0	11	6	0	0	0	17	0	0	0
401-500	764		nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	772		nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
total all strata fished			790001	137860	539900	22708	6510	21352	6844	31153	69960	73837	25478	10540	6378	10112
upper			2510624	1092111	3994696	61281	10713	32169	26139.7	65326	102739	110211	32326	14786	13046	17319
t-value			2.571	12.706	12.706	2.776	2.306	2.365	12.706	2.78	2.2	2.45	2.1	2.36	2.776	3.18
1 STD			669243	75102	271903	13895	1823	4574	1519	12292	14900	14847	3261	1799	2402	2266

Table 15. Cod biomass (t) from Canadian Spring RV Surveys in Division 3O
for depths >200 fathoms Data for 1991-1995 have been converted to Campellen equivalent units.

Depth range (fath) mean survey date	Strata	Vessel Area Sq. mi	WT 105-106 1991 24-Apr-91	WT 119-120 1992 26-Apr-92	WT 136-137 1993 30-Apr-93	WT 152-154 1994 4-May-94	WT 168-169 1995 7-May-95	WT 188-189 1996 11-May-96	WT 204-208 1997 16-May-97	WT 221-222 1998 22-May-98	WT 238-241 1999 19-May-99	WT 315-318 2000 16-May-00	WT 365 +367 2001 7-May-01	WT 419-424 2002 5-May-02	WT 478-481 2003 11-May-03	WT 546-549 2004 18-May-04
201-300	717	717	15218	436	1870	2094	339	57	238	30	47	108	585	164	190	1224
	719	719	143	179	330	727	927	37	133	2	243	59	137	0	33	23
	721	721	88	12153	304	16	10	95	53	16	11	20	323	22	39	9
301-400	718	718	7	0	159	791	91	0	16	0	0	0	0	18	0	0
	720	720	0	139	9	222	34	3	164	11	20	0	41	25	0	0
	722	722	0	70	0	0	0	28	5	0	0	0	52	0	0	0
401-500	764	764	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	772	772	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
total all strata fished			112240	74377	218496	29814	15528	21915	9598	80256	61459	94418	39677	18027	11880	22415
upper			202678	137245	1398738	60382	22196	32850	16345	546724	86530	206626	53209	27747	18765	137134
t-value			2.447	2.571	12.706	2.571	2.069	2.306	2.201	12.71	2.09	2.36	2.09	2.18	2.13	12.71
1 STD			36959	24453	92889	11890	3223	4742	3065	36701	11996	47546	6475	4459	3232	9026

Table 16. Abundance ('000) and Biomass (t) of cod from autumn stratified random surveys in Division 3N.
Data for 1990-1994 have been converted to Campellen equivalent units.

abundance

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	Tel 42 AN253 WT 200 1996 1-Dec-96	WT 212-214 1997 16-Oct-97	Tel 76 WT 229-233 1998 20-Nov-98	WT 244-247 1999 13-Nov-99	Tel 338-339 WT 319-323 2000 12-Nov-00	Tel 357 WT 372-373 2001 18-Oct-01	Tel 411-412 WT 427-428 2002 20-Oct-02	WT 485-487 Tel 468 2003 28-Oct-03	WT 557-558 2004 18-Nov-04
0-30	375	1593	5421	66596	nf	2047	1947	5001	0	603	329	14518	8163	4492	2849	446	438
	376	1499	32419	455280	354763	260	312	3956	93	41	1598	361	819	876	317	324	2062
31-50	360	2992	28703	12311	8311	3463	0	437 `		137	309	2367	1132	2345	360	1242	1543
	361	1853	6273	14155	20718	6177	7549	3788	2025	2156	5761	1733	3161	6780	1173	4952	4282
	362	2520	12855	73045	49583	1300	622	910	104	898	792	7924	6478	6438	314	99	198
	373	2520	1336	22575	1400	750	0	70	130	50	149	3004	341	446	149	57	149
	374	931	879	20754	nf	819	1034	57	65	43	171	512	85	1836	256	0	171
	383	674	530	530	nf	0	0	47	0	0	46	0	0	0	0	0	46
51-100	359	421	702	0	497	88	0	29	52	29	0	0	550	290	463	434	116
	377	100	243	nf	493	0	7	7	12	0	0	21	21	481	51	0	206
	382	647	210	359	270	494	0	0	33	0	0	134	134	0	45	0	0
101-15	358	225	766	1500	5063	47	94	56	14	15	247	340	1156	342	437	356	279
	378	139	550	2046	1602	48	10	10	0	17	10	1472	1785	226	476	36	315
	381	182	nf	0	nf	202	0	0	233	8	13	138	338	1702	13	0	2078
151-20	357	164	683	399	194	1526	57	20	39	0	124		168	61	10	102	124
	379	106	213	nf	596	655	81	33	52	79	13	988	164	663	47	52	54
	380	116	nf	798	nf	48	16	57	24	16	0	383	563	14	465	104	96
total strata fished <= 200			91783	670348	443490	17924	11729	14478	3359	4092	9562	33895	25058	26992	7425	8204	12158
UPPER			156111	1657056	1675218	26592	20479	21567	6774	5741	14597	59471	41671	37378	16677	10433	20572
TVALUE			2.201	2.776	4.303	2.145	2.447	2.201	2.571	2.179	2.26	2.78	2.2	2.14	3.18	2.2	2.78
1 std			29227	355442	286249	4041	3576	3221	1328	757	2228	9200	7551	4853	2909	1013	3027
201-30	723	155	nf	0	nf	97	0	0	43	6	0	0	0	0	0	0	0
	725	105	nf	nf	0	80	0	12	22	0	7	7	0	7	14	0	nf
	727	160	nf	nf	nf	878	11	9	267	0	0	22	49	0	11	25	0
301-40	724	124	nf	0	nf	17	0	0	19	0	0	0	0	0	0 nf	0	0
	726	72	nf	nf	nf	0	0	0	10	0	0	0	0	0	0	0	0
	728	156	nf	nf	nf	nf	0	0	76	0	0	0	0	0	0	0	43
Total strata > 200 fathoms			0	0	0	1072	11	21	437	6	7	29	49	7	25	25	43
Total all strata fished			91783	670348	443490	18996	11741	14498	3795	4098	9568	33924	25115	26972	7447	8229	12201
Upper limit			156111	1657056	1675228	27812	20490	21588	7257	5747	14604	59500	41720	37386	16702	10459	20616
t-value			2.201	2.776	4.303	2.131	2.447	2.201	2.517	2.179	2.26	2.78	2.2	2.14	3.18	2.2	2.78
1 std			29227	355442	286251	4137	3575	3221	1375	757	2228	9200	7548	4866	2910	1014	3027

Biomass

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	Tel 42 AN253 WT 200 1996 1-Dec-96	WT 212-214 1997 16-Oct-97	Tel 76 WT 229-233 1998 20-Nov-98	WT 244-247 1999 13-Nov-99	Tel 338-339 WT 319-323 2000 12-Nov-00	Tel 357 WT 372-373 2001 18-Oct-01	Tel 411-412 WT 427-428 2002 20-Oct-02	WT 485-487 Tel 468 2003 28-Oct-03	WT 557-558 2004 18-Nov-04
0-30	375	1593	31395	69276	nf	3305	9447	3162	0	594	839	2022	8642	1490	2135	192	47
	376	1499	5147	80732	116390	152	993	4035	806	12	791	46	2677	2351	813	1025	23
31-50	360	2992	7585	4456	4572	8072	0	1329	319	1226	1258	8681	1536	3183	217	2917	5334
	361	1853	24777	16326	12485	12996	12111	8626	1734	3255	3811	1060	1986	3319	4519	6749	9089
	362	2520	9636	40955	22852	1576	1001	337	29	2581	713	4955	2840	4146	1597	582	54
	373	2520	9722	26255	4114	254	0	39	49	26	60	1948	125	324	154	1	14
	374	931	2501	9699	nf	1102	2414	15	27	45	196	111	20	1042	172	0	31
	383	674	216	164	nf	0	0	54	0	0	0	0	0	0	0	0	6
51-100	359	421	39	0	156	39	0	12	36	25	0	0	458	249	601	814	94
	377	100	122	nf	257	0	13	11	11	0	0	6	3	660	68	0	382
	382	647	129	73	115	168	0	0	93	0	0	93	116	0	12	0	0
101-15	358	225	404	430	2464	45	51	61	10	80	327	197	933	470	467	358	105
	378	139	362	635	461	12	11	8	0	21	9	729	1156	174	276	43	99
	381	182	nf	0	nf	119	0	0	118	5	8	39	86	1583	9	0	1890
151-20	357	164	370	205	120	629	42	46	19	0	245		311	172	9	66	201
	379	106	318	nf	317	240	96	20	27	108	8	644	129	675	79	53	133
	380	117	nf	110	nf	32	10	26	12	0	0	223	178	3	879	48	54
total strata <= 200 fathoms			92723	249323	164303	28741	26189	17781	3290	7988	8265	20754	21196	19841	12007	12848	17558
UPPER			151903	392215	555906	46078	45182	26812	6083	11520	16104	33819	32744	28793	19789	20811	33657
TVALUE			2.365	2.228	4.303	2.179	2.62	2.101	2.356	2.101	2.45	2.26	2.16	2.13	2.23	2.23	2.37
1 std			25023	64135	91007	7956	7249	4298	1185	1681	3200	5781	5346	4203	3490	3571	6793
201-30	723	155	nf	0	nf	63	0	0	24	18	0	0	0	0	0	0	0
	725	105	nf	nf	0	90	0	10	13	0	18	10	0	6	6	0	nf
	727	160	nf	nf	nf	484	12	3	97	0	0	39	34	0	11	10	0
301-40	724	124	nf	0	nf	12	0	0	40	0	0	0	0	0	0	0	nf
	726	72	nf	nf	nf	0	0	0	15	0	0	0	0	0	0	0	0
	728	156	nf	nf	nf	nf	0	0	34	0	0	0	0	0	0	0	44
Total strata > 200 fathoms			0	0	0	649	12	13	223	18	18	49	34	6	17	10	44
Total all strata fished			92723	249323	16303	29389	26200	17793	3510	8006	8283	20823	21230	19847	12024	12857	17602
Upper limit			151903	392216	555901	46760	45195	26825	6314	11538	16122	33869	32779	28799	19806	20821	33699
t-value			2.365	2.228	4.303	2.179	2.262	2.101	2.365	2.101	2.45	2.26	2.16	2.13	2.23	2.23	2.36
1 std			25023	64135	125400	7972	8397	4299	1186	1681	3200	5773	5347	4203	3490	3571	6821

Table 17. Abundance ('000) and Biomass (t) of cod from autumn stratified random surveys in Division 3O.
Data for 1990-1994 have been converted to Campellen equivalent units.

Abundance

Depth Range	Strata	Area	WT 101-102 1990 26-Nov-90	WT 113-115 1991 24-Oct-91	WT 128-130 1992 23-Oct-92	WT 144-146 1993 27-Oct-93	WT 160-161 1994 31-Oct-94	WT 176-177 1995 10-Oct-95	WT 200 Tel 41-42 AN 253 1996 10-Dec-96	WT 212-214 1997 16-Oct-97	Tel 76 WT 229-233 1998 20-Nov-98	WT 244-247 1999 22-Oct-99	Tel 338-339 WT 319-323 2000 18-Oct-00	Tel 357 WT 372 2001 6-Oct-00	Tel 411-412 WT 427-428 2002 10-Oct-02	WT 485-487 Tel 468 2003 11-Oct-03	WT 557-558 2004 5-Nov-04
31-50	330	2089	10709	10264	7036	5271	2072	3946	279	1006	3113	6178	4428	9339	4133	1293	886
	331	456	507	6682	222	222	95	760	32	31	408	721	1505	265	376	94	157
	338	1898	20199	10334	857	6221	330	2478	264	52	835	4804	3580	209	835	261	112
	340	1716	4158	5625	7746	1859	763	1668	95	519	1747	5665	6945	2172	2408	1369	1039
	351	2520	29085	24185	3558	10450	661	2709	198	1684	347	9244	11737	9013	2091	1436	842
	352	2580	10248	24761	2747	4710	717	972	287	1006	761	2789	9419	6405	2980	4780	1680
	353	1282	1781	223	0	0	0	415	0	0	0	661	0	0	0	44	756
51-100	329	1721	531	1605	558	239	1036	574	478	95	710	521	255	710	326	331	101
	332	1047	1721	1127	436	2036	242	0	0	48	288	576	624	96	331	48	1296
	337	948	1001	66	198	307	0	0	0	0	0	130	82	130	0	174	0
	339	585	163	0	41	528	41	41	0	80	126		40	80	322	443	46
	354	474	1580	0	1712	0	0	165	340	130	33	554	33	0	6181	0	37
101-150	333	151	21	0	10	0	0	0	nf	8	0	0	0	10	0	0	0
	336	121	6	0	0	67	0	0	8	0	0	0	42	0	0	0	0
	355	103	nf	887	64	172	0	13	342	0	0	28	14	0	0	0	28
151-200	334	92	13	0	0	9	0	0	nf	0	0	0	0	0	0	0	0
	335	58	12	4	0	0	0	0	133	12	4	0	4	0	0	0	0
	356	61	nf	4	0	102	0	0	40	0	17	7	25	4	4	0	0
Total strata fished <= 200 fathoms			81735	85767	25185	32193	5957	13741	2496	4663	8388	31880	38743	28424	19988	10274	6980
upper			117569	117451	40427	48506	11071	18760	3870	6604	11951	43691	51707	35723	99783	15883	10678
t-value			2.093	2.049	2.447	2.145	2.365	2.12	2.447	2.12	2.23	2.09	2.13	2.12	12.71	2.23	2.2
1 std			17121	15463	6229	7605	2162	2367	562	916	1598	5651	6086	3443	6278	2515	1681
201-300	717	93	0	nf	nf	0	0	0	nf	0	0	10	0	0	0	0	0
	719	76	0	0	nf	0	5	0	37	0	0	0	3	0	0	0	0
	721	76	nf	0	nf	0	0	0	0	0	5	0	0	0	0	0	0
301-400	718	111	nf	nf	nf	0	0	0	nf	0	0	0	0	0	0	0	0
	720	105	nf	nf	nf	0	0	0	0	0	0	0	0	0	0	0	0
	722	93	nf	0	nf	0	0	0	0	0	0	0	0	0	0	0	0
total strata fished > 200 fathoms			0	0	0	0	5	0	37	0	5	10	3	0	0	0	0
total all strata fished			81735	85767	25185	32193	5961	13740	2534	4663	8394	31891	38746	28424	19988	10274	6980
upper			117569	117451	40427	48506	11077	18760	3907	6604	11957	43705	51710	35723	99783	15833	10678
t-value			2.039	2.048	2.447	2.145	2.365	2.12	2.447	2.12	2.23	2.09	2.13	2.12	12.71	2.28	2.2
1 STD			17574	15471	6229	7605	2163	2368	561	916	1598	5653	6086	3443	6278	2438	1681

Biomass

Depth Range	Strata	Area	WT 101-102 1990 26-Nov-90	WT 113-115 1991 24-Oct-91	WT 128-130 1992 23-Oct-92	WT 144-146 1993 27-Oct-93	WT 160-161 1994 31-Oct-94	WT 176-177 1995 10-Oct-95	WT 200 Tel 41-42 AN 253 1996 10-Dec-96	WT 212-214 1997 16-Oct-97	Tel 76 WT 229-233 1998 20-Nov-98	WT 244-247 1999 22-Oct-99	Tel 338-339 WT 319-323 2000 18-Oct-00	Tel 357 WT 372 2001 6-Oct-00	Tel 411-412 WT 427-428 2002 10-Oct-02	WT 485-487 Tel 468 2003 11-Oct-03	WT 557-558 2004 5-Nov-04
31-50	330	2089	6651	2374	2574	4278	1928	6035	302	1779	2027	2379	1817	5922	4037	1547	440
	331	456	27	1047	191	267	172	1455	11	85	735	367	574	155	481	243	641
	338	1898	13966	7122	2760	3763	91	5283	26	167	1786	16088	5978	558	493	238	267
	340	1716	3635	6247	6711	1231	832	3149	37	951	2108	2902	5371	1785	2542	2028	2663
	351	2520	17027	21473	3142	9895	679	5052	74	4806	815	7355	5249	8149	2296	2002	685
	352	2580	21151	32262	3137	4920	4775	3195	1353	3220	1198	9096	14518	7207	4081	8617	3025
	353	1282	4593	56	0	0	0	2238	0	0	0	716	0	0	0	2	239
51-100	329	1721	1291	1019	109	245	1546	1052	370	159	820	684	86	810	1407	566	267
	332	1047	767	74	254	1323	452	0	0	0.48	1	18	33	41	960	62	225
	337	948	2331	70	373	176	0	0	0	0	0	21	12	91	0	111	0
	339	585	1242	0	64	447	56	46	0	276	606		161	50	447	769	23
	354	474	66	0	896	0	0	161	260	96	42	184	18	0	8920	0	3
101-150	333	151	12	0	12	0	0	0	nf	0	0	0	0	4	0	0	0
	336	121	29	0	0	107	0	0	11	0	0	0	49	0	0	0	0
	355	103	nf	155	31	104	0	15	235	0	0	25	11	0	0	0	19
151-200	334	92	16	0	0	21	0	0	nf	0	0	0	0	0	0	0	0
	335	58	13	8	0	0	0	0	303	16	8	0	1	0	0	0	0
	356	61	nf	8	0	68	0	0	39	0	30	13	28	2	11	0	0
Total strata fished <= 200 fathoms			72817	71915	20254	26845	10531	27681	3021	11555.48	10177	39849	33912	24769	25674	16184	8499
upper			97492	98551	29947	43938	17481	41388	6586	16785	13788	84258	48733	33277	139889	30377	14807
t-value			2.093	2.093	2.201	2.306	2.201	2.16	2.571	2.12	2.06	2.78	2.2	2.1	12.7	2.37	2.2
1 std			11789	12726	4404	7412	3158	6346	1387	2467	1753	15974	6737	4051	8993	5989	2867
201-300	717	93	0	nf	nf	0	0	0	nf	0	0	1	0	0	0	0	0
	719	76	0	0	nf	0	14	0	55	0	0	0	5	0	0	0	0
	721	76	nf	0	nf	0	0	0	0	0	9	0	0	0	0	0	0
301-400	718	111	nf	nf	nf	0	0	0	nf	0	0	0	0	0	0	0	0
	720	105	nf	nf	nf	0	0	0	0	0	0	0	0	0	0	0	0
	722	93	nf	0	nf	0	0	0	0	0	0	0	0	0	0	0	0
total strata fished > 200 fathoms			0	0	0	0	14	0	55	0	9	1	5	0	0	0	0
total all strata fished			72817	7195	20254	26845	10546	27681	3078	11555	10186	39850	33917	24769	25675	16184	8499
upper			97492	98552	29947	43938	17496	41388	6641	16785	13797	84259	48738	33277	139889	30377	14808
t-value			2.093	2.093	2.201	2.306	2.201	2.16	2.571	2.12	2.06	2.78	2.2	2.1	12.71	2.37	2.2
1 STD			11789	43649	4404	7412	3158	6346	1386	2467	1753	15974	6737	4051	8986	5989	2868

Table 18. Mean number per tow of cod from spring RV surveys in NAFO Divisions 3NO as calculated using the conversion from
Warren 1997 for surveys in 1984-1995. 1996 -2004 are actual Campelen surveys.

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.10	0.06	1.71	4.69	2.15	0.15	0.23	0.30	1.18
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	0.24	0.16	4.71	6.46	1.88	0.66	0.58	1.12
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	1.67	0.51	4.55	4.58	2.91	0.98	0.47	0.50
4	21.35	16.14	17.87	19.67	1.02	2.40	3.80	1.59	0.24	53.63	1.63	0.04	0.44	0.58	1.23	0.38	0.69	1.01	0.40	0.51	0.19
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	0.16	0.52	0.70	0.10	0.26	0.23	1.03	0.13
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	0.03	0.17	0.30	0.20	0.01	0.10	0.82	0.18
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	0.09	0.13	0.11	0.29	0.06	0.01	0.12	0.18
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	0.07	1.35	0.12	0.07	0.07	0.06	0.01	0.07
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	0.01	1.61	0.42	0.06	0.01	0.01	0.05	0.02
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	0.02	0.15	0.84	0.57	0.01	0.02	0.02	0.08
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	0.03	0.03	0.07	1.10	0.16	0.01	0.02	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	0.00	0.02	0.01	0.03	0.13	0.40	0.03	0.01	0.03
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	0.00	0.01	0.03	0.03	0.02	0.04	0.16	0.08	0.02
14	0.03	0.14	0.15	0.23	0.55	0.39	0.37	0.13	0.10	0.07	0.02	0.02	0.03	0.00	0.00	0.02	0.00	0.02	0.00	0.08	0.02
15	0.05	0.08	0.08	0.21	0.21	0.21	0.44	0.12	0.09	0.09	0.03	0.03	0.02	0.01	0.02	0.01	0.01	0.00	0.01	0.01	0.10
16	0.08	0.08	0.04	0.12	0.11	0.11	0.22	0.18	0.09	0.05	0.01	0.02	0.00	0.00	0.01	0.00	0.02	0.01	0.00	0.00	0.01
17	0.05	0.03	0.04	0.00	0.11	0.09	0.14	0.07	0.06	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
18	0.01	0.01	0.03	0.01	0.04	0.04	0.06	0.04	0.01	0.01	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0.00	0.00	0.02	0.03	0.03	0.03	0.05	0.04	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1+	134.60	64.98	52.93	183.54	47.87	22.46	24.55	167.10	21.17	116.42	4.42	1.49	5.11	3.01	7.64	17.00	16.45	7.00	2.91	4.11	3.86

Table 19. Mean number per tow of cod from autumn RV surveys in NAFO Divisions 3NO as calculated using the conversion from
Warren 1997 for surveys in 1984-1994. 1995-2004 are actual Campelen surveys.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.07	0.06	0.13	0.16	1.08
1	18.89	14.87	0.41	1.30	0.00	1.15	0.08	0.03	1.67	4.44	2.12	0.34	0.33	0.96	0.97
2	6.15	129.66	49.65	0.72	0.62	1.02	0.74	0.10	0.29	5.01	3.77	2.64	0.61	0.27	0.63
3	3.25	4.36	65.00	3.63	0.28	0.46	0.29	0.40	0.20	2.52	4.75	4.70	1.13	0.26	0.35
4	3.56	2.19	4.70	3.59	0.96	0.20	0.06	0.33	0.32	0.13	1.81	2.55	1.58	0.35	0.14
5	1.73	2.73	1.02	0.30	1.32	0.94	0.01	0.14	0.11	0.37	0.20	0.98	1.31	0.78	0.12
6	0.37	1.33	0.61	0.27	0.16	1.64	0.02	0.06	0.06	0.30	0.24	0.07	0.39	0.83	0.23
7	0.29	0.37	0.18	0.18	0.04	0.11	0.02	0.28	0.01	0.08	0.11	0.16	0.03	0.14	0.24
8	0.38	0.31	0.03	0.10	0.06	0.05	0.01	0.28	0.16	0.04	0.03	0.06	0.06	0.01	0.12
9	0.40	0.53	0.03	0.02	0.01	0.06	0.00	0.05	0.22	0.12	0.01	0.02	0.04	0.02	0.01
10	0.24	0.37	0.07	0.02	0.01	0.05	0.00	0.04	0.03	0.55	0.03	0.02	0.00	0.05	0.04
11	0.20	0.45	0.00	0.06	0.03	0.00	0.00	0.00	0.01	0.04	0.24	0.00	0.03	0.00	0.00
12	0.09	0.33	0.06	0.04	0.03	0.02	0.00	0.00	0.00	0.00	0.01	0.05	0.03	0.00	0.00
13	0.15	0.27	0.12	0.04	0.02	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.05	0.02	0.00
14	0.07	0.21	0.03	0.05	0.06	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.01	0.02	0.07
15	0.16	0.12	0.03	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
16	0.21	0.38	0.02	0.02	0.03	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.01	0.00	0.00
17	0.07	0.16	0.03	0.01	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
18	0.02	0.06	0.08	0.02	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
19	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01		0.01	0.00	0.00	0.00	0.00	0.00
1+	36.26	158.70	122.07	10.43	3.67	5.72	1.26	1.74	3.09	13.68	13.33	11.60	5.61	3.71	2.95

Table20. Mean number per tow at age of cod from Juvenile Surveys
conducted by Canada in Divisions 3NO during August and September

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
0						0.00	0.00	0.00	0.00	0.00	0.00
1						1.40	60.88	36.33	0.84	1.98	2.75
2						14.16	11.62	74.04	12.28	3.70	4.03
3						12.58	6.53	8.54	12.89	8.85	1.25
4						5.82	8.99	2.45	1.42	7.91	4.07
5						1.21	3.62	1.96	0.69	0.80	4.79
6						0.72	0.67	0.72	0.52	0.30	0.41
7						1.22	0.50	0.19	0.22	0.28	0.08
8						0.79	0.63	0.17	0.05	0.10	0.13
9						0.25	0.53	0.24	0.03	0.02	0.05
10						0.17	0.28	0.19	0.03	0.04	0.01
11						0.20	0.21	0.23	0.00	0.10	0.05
12						0.11	0.04	0.18	0.02	0.08	0.06
13						0.09	0.08	0.17	0.10	0.06	0.08
14						0.16	0.27	0.48	0.13	0.09	0.09
1+						38.88	94.85	125.89	29.22	24.31	17.85

Table 21. Estimated proportions mature for female cod from NAFO Divs. 3NO from DFO surveys from 1975 to 2004 projected forward to 2010 and back to 1954. Estimates were obtained from a probit model fitted by cohort to observed proportions mature at age. The model did not fit the data for the 1991 cohort so the average of estimates for the same age group from adjacent years was used; yellow cells indicate averages extrapolated forward or backward from the same age group from 3 previous (or next) years.

Year	Age 1	Age2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1954	0.0000	0.0004	0.0020	0.0112	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1955	0.0001	0.0000	0.0020	0.0112	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1956	0.0001	0.0003	0.0001	0.0112	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1957	0.0003	0.0007	0.0018	0.0008	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1958	0.0001	0.0016	0.0041	0.0102	0.0065	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1959	0.0000	0.0006	0.0079	0.0226	0.0555	0.0509	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1960	0.0000	0.0000	0.0033	0.0393	0.1157	0.2512	0.3043	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1961	0.0002	0.0001	0.0001	0.0168	0.1731	0.4251	0.6572	0.7809	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1962	0.0000	0.0012	0.0009	0.0012	0.0825	0.5172	0.8069	0.9164	0.9667	0.9972	0.9996	0.9999	1.0000	1.0000
1963	0.0000	0.0002	0.0056	0.0099	0.0229	0.3206	0.8458	0.9594	0.9843	0.9958	0.9996	0.9999	1.0000	1.0000
1964	0.0000	0.0000	0.0010	0.0266	0.1000	0.3219	0.7124	0.9656	0.9926	0.9972	0.9995	0.9999	1.0000	1.0000
1965	0.0014	0.0000	0.0000	0.0049	0.1162	0.5526	0.9057	0.9286	0.9931	0.9987	0.9995	0.9999	1.0000	1.0000
1966	0.0000	0.0043	0.0005	0.0006	0.0234	0.3875	0.9321	0.9949	0.9856	0.9986	0.9998	0.9999	1.0000	1.0000
1967	0.0000	0.0001	0.0132	0.0067	0.0097	0.1037	0.7527	0.9935	0.9997	0.9972	0.9997	1.0000	1.0000	1.0000
1968	0.0000	0.0000	0.0012	0.0398	0.0820	0.1450	0.3587	0.9361	0.9994	1.0000	0.9995	0.9999	1.0000	1.0000
1969	0.0000	0.0000	0.0003	0.0090	0.1144	0.5429	0.7457	0.7301	0.9860	0.9999	1.0000	0.9999	1.0000	1.0000
1970	0.0032	0.0000	0.0001	0.0029	0.0665	0.2866	0.9405	0.9807	0.9290	0.9971	1.0000	1.0000	1.0000	1.0000
1971	0.0000	0.0093	0.0000	0.0009	0.0275	0.3582	0.5555	0.9953	0.9989	0.9844	0.9994	1.0000	1.0000	1.0000
1972	0.0000	0.0002	0.0269	0.0000	0.0101	0.2176	0.8140	0.7954	0.9996	0.9999	0.9967	0.9999	1.0000	1.0000
1973	0.0001	0.0000	0.0013	0.0754	0.0038	0.1018	0.7320	0.9717	0.9236	1.0000	1.0000	0.9993	1.0000	1.0000
1974	0.0000	0.0006	0.0001	0.0083	0.1939	0.2928	0.5582	0.9641	0.9963	0.9741	1.0000	1.0000	0.9999	1.0000
1975	0.0000	0.0003	0.0033	0.0017	0.0530	0.4148	0.9780	0.9337	0.9962	0.9995	0.9915	1.0000	1.0000	1.0000
1976	0.0000	0.0001	0.0020	0.0186	0.0221	0.2715	0.6763	0.9998	0.9937	0.9996	0.9999	0.9973	1.0000	1.0000
1977	0.0006	0.0001	0.0009	0.0142	0.0978	0.2269	0.7128	0.8603	1.0000	0.9994	1.0000	1.0000	0.9991	1.0000
1978	0.0001	0.0029	0.0014	0.0083	0.0935	0.3823	0.7922	0.9429	0.9478	1.0000	0.9999	1.0000	1.0000	0.9997
1979	0.0000	0.0005	0.0145	0.0133	0.0733	0.4248	0.7794	0.9802	0.9910	0.9817	1.0000	1.0000	1.0000	1.0000
1980	0.0002	0.0002	0.0034	0.0695	0.1140	0.4292	0.8410	0.9528	0.9984	0.9986	0.9937	1.0000	1.0000	1.0000
1981	0.0000	0.0007	0.0020	0.0236	0.2749	0.5518	0.8773	0.9743	0.9914	0.9999	0.9998	0.9979	1.0000	1.0000
1982	0.0000	0.0000	0.0035	0.0162	0.1460	0.6579	0.9218	0.9855	0.9963	0.9985	1.0000	1.0000	0.9993	1.0000
1983	0.0000	0.0001	0.0003	0.0163	0.1219	0.5474	0.9070	0.9912	0.9985	0.9995	0.9997	1.0000	1.0000	0.9998
1984	0.0000	0.0003	0.0008	0.0028	0.0726	0.5389	0.8953	0.9802	0.9991	0.9998	0.9999	1.0000	1.0000	1.0000
1985	0.0002	0.0002	0.0019	0.0058	0.0261	0.2703	0.9078	0.9837	0.9960	0.9999	1.0000	1.0000	1.0000	1.0000
1986	0.0000	0.0010	0.0021	0.0134	0.0409	0.2049	0.6369	0.9881	0.9977	0.9992	1.0000	1.0000	1.0000	1.0000
1987	0.0001	0.0000	0.0058	0.0194	0.0869	0.2358	0.7128	0.8925	0.9986	0.9997	0.9998	1.0000	1.0000	1.0000
1988	0.0011	0.0006	0.0002	0.0335	0.1570	0.3994	0.6908	0.9598	0.9752	0.9998	1.0000	1.0000	1.0000	1.0000
1989	0.0001	0.0043	0.0047	0.0031	0.1702	0.6371	0.8229	0.9418	0.9957	0.9947	1.0000	1.0000	1.0000	1.0000
1990	0.0000	0.0011	0.0170	0.0377	0.0441	0.5486	0.9431	0.9701	0.9915	0.9995	0.9989	1.0000	1.0000	1.0000
1991	0.0000	0.0000	0.0079	0.0645	0.2438	0.4047	0.8780	0.9936	0.9956	0.9988	1.0000	0.9998	1.0000	1.0000
1992	0.0000	0.0000	0.0004	0.0557	0.2155	0.7265	0.9092	0.9771	0.9993	0.9994	0.9998	1.0000	0.9999	1.0000
1993	0.0001	0.0004	0.0002	0.0121	0.3045	0.5225	0.9563	0.9933	0.9961	0.9999	0.9999	1.0000	1.0000	1.0000
1994	0.0004	0.0008	0.0040	0.0153	0.2825	0.7646	0.8134	0.9945	0.9995	0.9993	1.0000	1.0000	1.0000	1.0000
1995	0.0002	0.0030	0.0078	0.0418	0.5844	0.9266	0.9602	0.9455	0.9993	1.0000	0.9999	1.0000	1.0000	1.0000
1996	0.0004	0.0014	0.0229	0.0683	0.4952	0.9922	0.9975	0.9944	0.9857	0.9999	1.0000	1.0000	1.0000	1.0000
1997	0.0000	0.0026	0.0130	0.1536	0.4059	0.9282	0.9999	0.9999	0.9992	0.9964	1.0000	1.0000	1.0000	1.0000
1998	0.0000	0.0001	0.0169	0.1076	0.5837	0.8642	0.9917	1.0000	1.0000	0.9999	0.9991	1.0000	1.0000	1.0000
1999	0.0000	0.0000	0.0009	0.1032	0.5240	0.9155	0.9834	0.9991	1.0000	1.0000	1.0000	0.9998	1.0000	1.0000
2000	0.0000	0.0000	0.0010	0.0135	0.4346	0.9095	0.9882	0.9982	0.9999	1.0000	1.0000	1.0000	0.9999	1.0000
2001	0.0000	0.0002	0.0019	0.0258	0.1674	0.8370	0.9892	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2002	0.0000	0.0001	0.0068	0.1007	0.4040	0.7467	0.9717	0.9988	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2003	0.0000	0.0001	0.0032	0.1600	0.8701	0.9456	0.9774	0.9957	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
2004	0.0000	0.0001	0.0032	0.0955	0.8404	0.9975	0.9978	0.9984	0.9993	1.0000	1.0000	1.0000	1.0000	1.0000
2005	0.0000	0.0001	0.0032	0.0955	0.7048	0.9932	1.0000	0.9999	0.9999	0.9999	1.0000	1.0000	1.0000	1.0000
2006	0.0000	0.0001	0.0032	0.0955	0.7048	0.9788	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2007	0.0000	0.0001	0.0032	0.0955	0.7048	0.9788	0.9992	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2008	0.0000	0.0001	0.0032	0.0955	0.7048	0.9788	0.9992	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2009	0.0000	0.0001	0.0032	0.0955	0.7048	0.9788	0.9992	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2010	0.0000	0.0001	0.0032	0.0955	0.7048	0.9788	0.9992	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 22. Catch-at-age used in this assessment for Divisions 3NO cod, 1959-2004 (000s).

Year\Age	2	3	4	5	6	7	8	9	10	11	12	Total
1959	0	1711	13036	5068	6025	3935	1392	757	926	1220	103	34173
1960	0	1846	6503	22050	3095	2377	2504	583	387	898	242	40485
1961	0	812	4400	11696	15258	2014	1672	847	196	25	245	37165
1962	0	1026	3882	2206	1581	3594	773	668	433	226	216	14605
1963	0	313	5757	11210	4849	1935	3840	1165	608	322	208	30207
1964	0	6202	15555	19496	7919	2273	1109	788	328	37	112	53819
1965	0	1013	7611	7619	13258	9861	4827	1081	1248	163	141	46822
1966	0	753	18413	19681	11795	8486	4467	1829	1694	122	57	67297
1967	0	20086	62442	50317	18517	4774	4651	236	180	71	45	161319
1968	0	16359	56775	48608	18485	6337	1592	505	178	90	45	148974
1969	0	8154	12924	26949	11191	2089	1393	518	292	134	202	63846
1970	0	2105	19703	10799	9481	3646	1635	541	149	227	90	48376
1971	0	950	26900	30300	11700	3500	2500	500	200	100	50	76700
1972	0	69	19797	12289	13432	5883	1686	285	216	78	74	53809
1973	0	10058	27600	15098	5989	1971	972	707	243	137	116	62891
1974	0	6425	9501	10907	10872	2247	2147	1015	676	428	257	44475
1975	0	671	8781	3528	2505	3057	1059	921	461	252	152	21387
1976	0	4054	7534	5945	1084	211	238	44	37	13	9	19169
1977	0	607	2469	2531	1500	572	177	209	65	41	25	8196
1978	0	920	4337	2518	818	354	102	58	51	8	5	9171
1979	0	72	3827	9208	2784	883	265	58	17	12	7	17133
1980	0	266	1055	3812	2275	761	222	92	31	8	13	8535
1981	0	505	1091	1262	2297	1902	574	192	94	41	13	7971
1982	0	305	1978	1591	1012	1528	1492	595	211	162	27	8901
1983	0	1179	647	1893	1204	686	1152	774	238	81	41	7895
1984	0	58	1000	1411	2324	1220	720	918	551	106	42	8350
1985	0	57	2953	6203	3036	2519	797	459	533	261	97	16915
1986	0	153	2865	6423	4370	1512	948	558	373	349	135	17686
1987	195	516	422	3491	3445	1213	653	845	494	398	404	12076
1988	256	277	318	1527	6347	3955	1009	567	425	249	142	15072
1989	127	1917	2182	1502	1260	1887	1284	485	233	168	100	11145
1990	410	1064	4505	4341	895	422	721	581	439	150	83	13611
1991	6028	1103	673	995	544	282	368	568	502	383	202	11648
1992	83	4508	1769	837	612	235	64	99	128	153	100	8588
1993	33	1314	3209	637	479	321	74	25	39	49	53	6233
1994	0	232	2326	1117	125	93	26	8	1	0	0	3928
1995	0	0	72	20	40	2	0	1	0	0	0	135
1996	2	4	5	3	17	25	3	2	3	1	0	66
1997	1	12	18	11	5	31	45	5	4	5	3	140
1998	1	3	23	21	10	5	28	41	4	4	5	144
1999	46	94	41	101	40	14	6	23	55	3	2	424
2000	10	356	339	87	62	21	12	4	13	12	2	918
2001	10	187	302	160	11	43	23	7	2	9	12	766
2002	100	218	550	427	141	9	27	13	3	1	6	1495
2003	43	337	810	1274	669	133	5	18	8	2	1	3309
2004	11	37	45	50	92	73	21	1	7	3	1	356

Table 23. Estimated survivors and catchabilities in linear scale from ADAPT

ORTHOGONALITY OFFSET.........   0.001103
MEAN SQUARE RESIDUALS 0.706305

Survivors Year	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
1994	12	89.20	71.90	0.81	16.00	0.18
1995	12	53.60	26.90	0.50	5.45	0.10
1996	12	32.10	12.10	0.38	2.14	0.07
1997	12	68.30	23.50	0.34	3.99	0.06
1998	12	95.50	34.40	0.36	6.05	0.06
1999	12	47.60	18.00	0.38	3.12	0.07
2000	12	52.30	17.20	0.33	2.71	0.05
2001	12	462.00	140.00	0.30	20.70	0.05
2002	12	220.00	65.30	0.30	9.71	0.04
2003	12	31.30	9.30	0.30	1.36	0.04
2004	12	38.90	12.30	0.32	1.80	0.05
2004	3	701.00	433.00	0.62	141.00	0.20
2004	4	265.00	126.00	0.48	31.00	0.12
2004	5	148.00	77.60	0.53	19.00	0.13
2004	6	186.00	99.40	0.53	25.00	0.13
2004	7	413.00	210.00	0.51	49.50	0.12
2004	8	533.00	234.00	0.44	46.50	0.09
2004	9	171.00	71.70	0.42	13.50	0.08
2004	10	25.70	8.98	0.35	1.53	0.06
2004	11	89.80	30.00	0.34	4.59	0.05
2004	12	66.10	21.40	0.32	3.15	0.05

Catchabilities	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
RV Spr	2	0.00113	0.00022	0.190	0.00001	0.008
RV Spr	3	0.00141	0.00027	0.189	0.00001	0.008
RV Spr	4	0.00068	0.00013	0.190	0.00001	0.009
RV Spr	5	0.00044	0.00008	0.193	0.00000	0.010
RV Spr	6	0.00031	0.00006	0.196	0.00000	0.012
RV Spr	7	0.00032	0.00006	0.200	0.00000	0.013
RV Spr	8	0.00034	0.00007	0.205	0.00001	0.015
RV Spr	9	0.00039	0.00008	0.208	0.00001	0.018
RV Spr	10	0.00049	0.00010	0.213	0.00001	0.022
RV_Fall	2	0.00110	0.00025	0.229	0.00001	0.013
RV_Fall	3	0.00112	0.00026	0.227	0.00002	0.014
RV_Fall	4	0.00090	0.00021	0.232	0.00001	0.016
RV_Fall	5	0.00077	0.00018	0.237	0.00001	0.018
RV_Fall	6	0.00067	0.00016	0.242	0.00001	0.021
RV_Fall	7	0.00042	0.00011	0.249	0.00001	0.024
RV_Fall	8	0.00039	0.00010	0.255	0.00001	0.027
RV_Fall	9	0.00032	0.00009	0.267	0.00001	0.032
RV_Fall	10	0.00043	0.00012	0.283	0.00002	0.044
RV_Juvenile	2	0.00361	0.00125	0.346	0.00019	0.053
RV_Juvenile	3	0.00189	0.00065	0.345	0.00010	0.053
RV_Juvenile	4	0.00137	0.00048	0.347	0.00007	0.054
RV_Juvenile	5	0.00113	0.00039	0.348	0.00006	0.053
RV_Juvenile	6	0.00083	0.00029	0.351	0.00004	0.051
RV_Juvenile	7	0.00062	0.00022	0.357	0.00003	0.052
RV_Juvenile	8	0.00049	0.00018	0.362	0.00003	0.055
RV_Juvenile	9	0.00032	0.00012	0.369	0.00002	0.062
RV_Juvenile	10	0.00028	0.00011	0.381	0.00002	0.076

Table 24. Estimated bias adjusted population numbers from ADAPT for cod in NAFO Division 3NO.

Pop #s (Bias Adj)	2	3	4	5	6	7	8	9	10	11	12	Total
1959	63623	53067	92911	19327	16484	12049	4268	3076	3217	2287	324	270633
1960	98989	52090	41903	64326	11271	8099	6336	2246	1838	1803	786	289687
1961	130098	81045	40981	28451	32902	6449	4497	2947	1315	1157	675	330518
1962	94606	106515	65621	29586	12832	13314	3473	2185	1652	900	925	331609
1963	135041	77456	86281	50223	22233	9081	7673	2149	1189	964	534	392824
1964	195488	110562	63133	65447	31040	13843	5695	2858	722	432	500	489720
1965	252970	160052	84924	37711	36087	18299	9287	3665	1632	298	320	605245
1966	221171	207114	130125	62667	24021	17671	6202	3302	2030	239	99	674641
1967	121541	181079	168890	89951	33653	9146	6895	1137	1076	183	87	613638
1968	154111	99509	130150	82351	28883	11073	3234	1531	719	719	86	512366
1969	96818	126175	66743	55815	24240	7265	3431	1228	801	429	508	383452
1970	101648	79268	95947	43016	21651	9853	4073	1563	542	394	231	358185
1971	74517	83223	62998	60832	25515	9253	4801	1872	795	310	121	324237
1972	42188	61009	67279	27529	22783	10441	4442	1704	1083	471	164	239094
1973	44123	34541	49888	37315	11560	6720	3316	2127	1138	693	316	191736
1974	27761	36125	19252	16285	17043	4127	3733	1842	1108	713	444	128434
1975	32962	22729	23794	7287	3682	4318	1379	1147	605	307	204	98415
1976	54556	26987	18003	11616	2818	800	837	198	132	90	31	116069
1977	50010	44667	18444	8002	4212	1337	465	471	123	75	62	127868
1978	20889	40945	36022	12876	4281	2104	583	223	199	43	25	118189
1979	23694	17102	32692	25584	8277	2769	1404	386	130	117	28	112182
1980	33043	19399	13937	23317	12697	4281	1475	911	264	91	85	109500
1981	26253	27054	15642	10459	15658	8348	2820	1008	663	188	67	108159
1982	42447	21494	21694	11822	7426	10751	5125	1792	653	458	117	123778
1983	49767	34752	17322	15978	8246	5168	7426	2856	934	345	230	143024
1984	39436	40746	27388	13598	11375	5667	3613	5042	1644	551	210	149270
1985	10605	32287	33307	21521	9861	7223	3542	2311	3302	852	356	125167
1986	7774	8683	26383	24607	12052	5350	3656	2184	1479	2224	463	94854
1987	15503	6365	6971	19018	14377	5952	3023	2142	1287	876	1506	77019
1988	15401	12517	4746	5326	12429	8674	3782	1888	997	611	361	66733
1989	6155	12378	9998	3599	2990	4518	3570	2190	1037	437	278	47149
1990	6813	4924	8408	6223	1603	1321	2012	1772	1357	639	207	35281
1991	24274	5208	3075	2872	1261	516	703	1001	930	718	388	40947
1992	7687	14458	3272	1912	1460	546	172	248	315	314	246	30630
1993	776	6219	7793	1104	818	648	237	83	115	143	121	18056
1994	476	606	3910	3510	338	244	244	128	46	59	73	9632
1995	909	390	288	1135	1872	165	116	176	97	37	48	5233
1996	1272	744	319	171	911	1496	133	95	144	80	30	5395
1997	442	1039	606	257	138	731	1202	106	76	115	64	4776
1998	2458	361	840	480	200	108	570	944	82	59	89	6192
1999	5342	2012	293	667	374	155	84	442	736	64	45	10211
2000	4894	4332	1562	203	455	270	114	63	341	553	50	12836
2001	2068	3998	3225	974	88	317	202	83	48	267	442	11713
2002	866	1684	3104	2368	654	62	221	145	61	38	211	9414
2003	446	619	1183	2047	1555	408	43	156	107	48	30	6640
2004	696	326	207	252	546	675	215	31	112	80	37	3176
2005	1222	560	234	129	161	364	487	157	24	85	63	3486

Table 25 Bias adjusted fishing mortality from ADAPT for cod in NAFO Divisions 3NO.

F (Bias Adj)	2	3	4	5	6	7	8	9	10	11	12	Fbar6-9	Fbar4-6
1959	0.000	0.036	0.168	0.339	0.511	0.443	0.442	0.315	0.379	0.868	0.428	0.428	0.339
1960	0.000	0.040	0.187	0.470	0.358	0.388	0.566	0.335	0.263	0.782	0.412	0.412	0.339
1961	0.000	0.011	0.126	0.596	0.705	0.419	0.522	0.379	0.179	0.024	0.506	0.506	0.476
1962	0.000	0.011	0.067	0.086	0.146	0.351	0.280	0.408	0.339	0.322	0.296	0.296	0.100
1963	0.000	0.004	0.076	0.281	0.274	0.267	0.788	0.891	0.813	0.456	0.555	0.555	0.210
1964	0.000	0.064	0.315	0.395	0.328	0.199	0.241	0.360	0.684	0.099	0.282	0.282	0.346
1965	0.000	0.007	0.104	0.251	0.514	0.882	0.834	0.391	1.721	0.902	0.655	0.655	0.290
1966	0.000	0.004	0.169	0.422	0.766	0.741	1.496	0.921	2.208	0.811	0.981	0.981	0.452
1967	0.000	0.130	0.518	0.936	0.912	0.839	1.305	0.259	0.203	0.553	0.829	0.829	0.789
1968	0.000	0.199	0.647	1.023	1.180	0.972	0.768	0.448	0.317	0.148	0.842	0.842	0.950
1969	0.000	0.074	0.239	0.747	0.700	0.379	0.586	0.618	0.509	0.419	0.571	0.571	0.562
1970	0.000	0.030	0.256	0.322	0.650	0.519	0.578	0.476	0.359	0.983	0.556	0.556	0.409
1971	0.000	0.013	0.628	0.782	0.694	0.534	0.836	0.347	0.323	0.436	0.603	0.603	0.701
1972	0.000	0.001	0.389	0.668	1.021	0.947	0.536	0.203	0.247	0.201	0.677	0.677	0.693
1973	0.000	0.385	0.920	0.584	0.830	0.388	0.388	0.453	0.267	0.245	0.515	0.515	0.778
1974	0.000	0.218	0.771	1.287	1.173	0.896	0.980	0.913	1.083	1.052	0.991	0.991	1.077
1975	0.000	0.033	0.517	0.750	1.327	1.441	1.740	1.960	1.705	2.097	1.617	1.617	0.865
1976	0.000	0.181	0.611	0.815	0.546	0.342	0.374	0.279	0.366	0.173	0.385	0.385	0.657
1977	0.000	0.015	0.159	0.425	0.494	0.629	0.538	0.662	0.859	0.899	0.581	0.581	0.360
1978	0.000	0.025	0.142	0.242	0.236	0.205	0.213	0.337	0.330	0.231	0.248	0.248	0.207
1979	0.000	0.005	0.138	0.501	0.459	0.430	0.232	0.181	0.155	0.120	0.326	0.326	0.366
1980	0.000	0.015	0.087	0.198	0.219	0.217	0.181	0.118	0.139	0.102	0.184	0.184	0.168
1981	0.000	0.021	0.080	0.143	0.176	0.288	0.253	0.235	0.170	0.274	0.238	0.238	0.133
1982	0.000	0.016	0.106	0.160	0.162	0.170	0.384	0.452	0.437	0.489	0.292	0.292	0.143
1983	0.000	0.038	0.042	0.140	0.175	0.158	0.187	0.353	0.328	0.298	0.218	0.218	0.119
1984	0.000	0.002	0.041	0.121	0.254	0.270	0.247	0.223	0.457	0.238	0.249	0.249	0.139
1985	0.000	0.002	0.103	0.380	0.412	0.481	0.284	0.246	0.195	0.409	0.356	0.356	0.298
1986	0.000	0.020	0.127	0.337	0.505	0.371	0.335	0.329	0.324	0.190	0.385	0.385	0.323
1987	0.014	0.094	0.069	0.225	0.305	0.253	0.271	0.564	0.544	0.685	0.348	0.348	0.200
1988	0.019	0.025	0.077	0.377	0.812	0.688	0.346	0.399	0.626	0.589	0.561	0.561	0.422
1989	0.023	0.187	0.274	0.609	0.617	0.609	0.500	0.279	0.283	0.546	0.501	0.501	0.500
1990	0.069	0.271	0.874	1.397	0.933	0.431	0.498	0.445	0.437	0.298	0.577	0.577	1.068
1991	0.318	0.265	0.275	0.477	0.637	0.901	0.842	0.958	0.884	0.869	0.834	0.834	0.463
1992	0.012	0.418	0.886	0.650	0.612	0.635	0.524	0.573	0.588	0.756	0.586	0.586	0.716
1993	0.048	0.264	0.598	0.985	1.010	0.776	0.419	0.399	0.467	0.470	0.651	0.651	0.864
1994	0.000	0.542	1.037	0.429	0.519	0.540	0.125	0.072	0.024	0.000	0.000	0.314	0.661
1995	0.000	0.000	0.320	0.020	0.024	0.013	0.000	0.006	0.000	0.000	0.000	0.011	0.121
1996	0.002	0.006	0.017	0.019	0.021	0.019	0.025	0.023	0.023	0.014	0.000	0.022	0.019
1997	0.002	0.013	0.033	0.048	0.041	0.048	0.042	0.053	0.060	0.049	0.053	0.046	0.041
1998	0.000	0.009	0.031	0.049	0.057	0.052	0.056	0.049	0.055	0.078	0.064	0.053	0.046
1999	0.010	0.053	0.167	0.182	0.125	0.105	0.082	0.059	0.086	0.053	0.051	0.093	0.158
2000	0.002	0.095	0.272	0.632	0.162	0.090	0.123	0.072	0.043	0.024	0.046	0.112	0.356
2001	0.005	0.053	0.109	0.199	0.148	0.162	0.134	0.098	0.047	0.038	0.030	0.135	0.152
2002	0.136	0.154	0.217	0.221	0.270	0.173	0.145	0.104	0.055	0.030	0.032	0.173	0.236
2003	0.112	0.897	1.346	1.122	0.634	0.441	0.137	0.136	0.086	0.047	0.037	0.337	1.034
2004	0.018	0.133	0.273	0.246	0.205	0.127	0.114	0.037	0.072	0.042	0.030	0.121	0.241
Mean F	2	3	4	5	6	7	8	9	10	11	12	Fbar6-9	Fbar4-6
1959-2004	0.02	0.11	0.32	0.46	0.50	0.44	0.45	0.38	0.43	0.40	0.42	0.440	0.426
1959-1981		0.07	0.32	0.53	0.62	0.55	0.64	0.50	0.59	0.53	0.58	0.577	0.490
1982-1993	0.04	0.13	0.29	0.49	0.54	0.48	0.40	0.44	0.46	0.49	0.46	0.463	0.438
1994-2004	0.03	0.18	0.35	0.29	0.20	0.16	0.09	0.06	0.05	0.03	0.03	0.129	0.279
2002-2004	0.09	0.39	0.61	0.53	0.37	0.25	0.13	0.09	0.07	0.04	0.03	0.210	0.504

Table 26. Beginning of year mean weights at age calculated from the commercial catches for cod in Divisions 3NO.

Year\Age	3	4	5	6	7	8	9	10	11	12
1959	0.301	0.664	1.001	1.622	2.572	3.129	3.670	4.419	4.843	5.691
1960	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1961	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1962	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1963	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1964	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1965	0.287	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1966	0.351	0.615	1.052	1.636	2.482	3.446	4.636	5.532	6.292	7.332
1967	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1968	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1969	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1970	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1971	0.338	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1972	0.397	0.682	1.138	1.676	2.487	3.354	5.005	7.100	7.999	9.262
1973	0.504	0.735	1.178	1.776	2.748	3.658	4.717	7.542	9.423	10.789
1974	0.289	0.645	1.095	1.674	2.503	4.117	5.822	5.842	8.961	9.159
1975	0.246	0.611	0.967	1.599	2.481	3.449	5.082	7.024	5.364	7.717
1976	0.354	0.588	1.120	1.727	2.631	3.557	5.268	6.952	7.849	8.113
1977	0.420	0.707	1.161	1.870	2.860	3.925	5.375	7.666	10.112	10.239
1978	0.617	0.774	1.245	1.825	3.046	4.023	5.417	7.200	9.139	12.271
1979	0.514	0.840	1.208	1.800	2.541	3.720	4.679	6.653	7.596	9.790
1980	0.531	0.822	1.287	1.864	2.777	3.969	5.434	6.618	8.706	10.031
1981	0.789	0.950	1.383	2.132	2.979	4.435	6.256	8.522	9.114	10.373
1982	0.843	1.026	1.380	2.012	3.210	4.321	6.318	7.921	9.453	10.519
1983	0.731	1.049	1.479	1.986	2.891	4.463	5.743	7.779	8.894	10.398
1984	0.757	0.989	1.329	2.065	2.828	3.923	5.473	6.728	8.490	10.647
1985	0.331	0.824	1.255	1.759	2.722	3.760	5.178	6.923	8.128	9.964
1986	0.269	0.696	1.143	1.720	2.675	4.193	6.080	8.063	9.094	9.508
1987	0.343	0.566	1.146	1.668	2.498	4.076	6.267	8.435	9.835	11.187
1988	0.646	0.700	1.064	1.525	2.020	3.301	4.937	7.067	9.158	10.442
1989	0.362	0.847	1.265	1.758	2.419	3.206	5.166	6.523	8.072	10.714
1990	0.442	0.718	1.190	2.004	2.473	3.679	4.811	7.698	8.786	10.322
1991	0.506	0.684	1.267	1.832	3.101	3.896	5.583	6.737	10.014	11.396
1992	0.215	0.598	0.949	1.692	2.547	4.310	5.560	7.480	8.838	11.295
1993	0.318	0.507	0.937	1.397	2.253	3.404	5.336	6.569	8.081	8.655
1994	0.162	0.407	0.842	1.483	1.840	3.375	4.506	6.653	5.167	8.130
1995	0.309	0.450	0.746	1.359	1.932	1.956	5.164	5.543	6.951	5.255
1996	0.309	0.573	0.986	1.552	2.332	2.781	3.125	6.284	6.314	7.173
1997	0.309	0.573	1.005	1.606	2.310	3.007	3.982	5.301	6.193	7.173
1998	0.282	0.573	1.005	1.606	2.310	3.007	3.982	5.301	6.193	7.173
1999	0.386	0.628	1.114	1.638	2.106	2.754	3.672	5.328	6.346	6.877
2000	0.442	0.639	1.163	1.951	2.669	2.543	2.732	3.887	5.632	6.394
2001	0.444	0.805	1.067	1.730	3.115	4.237	3.931	3.813	5.330	6.717
2002	0.569	0.767	1.285	1.762	2.643	4.569	5.590	6.151	6.834	8.364
2003	0.571	0.795	1.188	1.753	2.600	3.722	6.264	6.807	7.782	8.841
2004	0.528	0.785	1.138	1.745	2.474	3.442	4.876	8.072	8.664	8.647
2005	0.556	0.782	1.204	1.753	2.573	3.911	5.577	7.010	7.760	8.617

Table 27. Estimated biomass using beginning of the year weights and bias adjusted population numbers from ADAPT for cod in NAFO Divisions 3NO.

	3	4	5	6	7	8	9	10	11	12	3+	6+
1959	15951	61707	19343	26729	30989	13354	11291	14215	11073	1846	206498	109498
1960	15658	24591	65125	17597	18992	19590	8251	7934	8935	4471	191145	85771
1961	24361	24050	28804	51368	15123	13906	10823	5677	5736	3842	183689	106474
1962	32017	38510	29954	20034	31221	10739	8025	7130	4463	5263	187356	86875
1963	23282	50634	50847	34712	21295	23723	7892	5133	4777	3040	225336	100572
1964	33233	37050	66260	48461	32461	17607	10497	3116	2141	2848	253674	117130
1965	45921	49838	38180	56341	42910	28715	13461	7044	1478	1822	285710	151770
1966	72602	80003	65934	39288	43864	21368	15310	11231	1504	726	351832	133293
1967	63476	111006	99150	57199	23783	25148	5877	7515	1474	809	395437	121805
1968	34882	85543	90774	49092	28795	11796	7909	5020	5801	801	320413	109214
1969	44230	43868	61523	41201	18893	12516	6344	5590	3458	4725	242347	92726
1970	27787	63063	47415	36800	25622	14856	8076	3785	3177	2148	232729	94464
1971	28101	41407	67053	43369	24062	17513	9670	5551	2501	1123	240349	103788
1972	24210	45908	31340	38178	25966	14898	8526	7691	3769	1521	202006	100549
1973	17397	36660	43948	20528	18465	12129	10034	8584	6527	3404	177676	79671
1974	10423	12418	17839	28533	10329	15369	10726	6471	6392	4065	122566	81885
1975	5581	14547	7044	5887	10712	4756	5831	4250	1646	1574	61830	34657
1976	9541	10587	13013	4867	2105	2976	1044	920	707	250	46010	12869
1977	18759	13042	9287	7875	3824	1827	2533	941	760	635	59482	18395
1978	25269	27868	16031	7813	6408	2347	1205	1433	389	307	89070	19903
1979	8788	27461	30908	14897	7037	5223	1806	866	890	271	98146	30989
1980	10298	11459	30007	23669	11887	5856	4951	1745	794	854	101520	49756
1981	21355	14853	14468	33385	24869	12505	6307	5650	1713	700	135804	85127
1982	18110	22261	16318	14941	34507	22145	11324	5169	4331	1231	150335	93646
1983	25396	18166	23633	16378	14943	33138	16404	7265	3069	2391	160783	93588
1984	30851	27079	18074	23488	16023	14175	27595	11058	4676	2232	175252	99248
1985	10684	27454	27013	17350	19662	13319	11964	22858	6922	3542	160768	95617
1986	2335	18370	28134	20732	14310	15331	13278	11923	20221	4403	149035	100197
1987	2183	3942	21792	23977	14872	12320	13423	10853	8611	16849	128823	100905
1988	8090	3322	5666	18960	17523	12485	9318	7048	5597	3773	91783	74704
1989	4486	8471	4552	5257	10931	11445	11317	6761	3524	2974	69718	52210
1990	2179	6034	7406	3213	3268	7402	8525	10449	5616	2137	56229	40609
1991	2635	2102	3640	2310	1601	2741	5590	6265	7186	4427	38496	30119
1992	3103	1957	1815	2469	1391	740	1379	2353	2779	2783	20769	13894
1993	1980	3954	1034	1142	1460	807	444	752	1156	1046	13775	6807
1994	98	1591	2957	501	449	824	575	304	304	595	8198	3552
1995	120	130	847	2544	318	228	911	539	254	253	6144	5047
1996	230	183	169	1414	3489	370	298	902	503	215	7772	7191
1997	321	347	258	221	1688	3616	423	404	711	461	8450	7524
1998	102	481	482	322	250	1715	3759	437	364	642	8552	7487
1999	776	184	743	612	326	231	1622	3921	405	306	9126	7423
2000	1916	998	236	888	720	290	173	1325	3113	317	9977	6827
2001	1775	2595	1039	153	987	856	325	184	1425	2967	12306	6896
2002	958	2381	3043	1151	165	1008	809	378	258	1762	11912	5531
2003	353	940	2432	2726	1062	160	979	726	370	265	10012	6288
2004	172	162	287	952	1670	740	149	902	694	321	6050	5429
2005	311	183	155	283	936	1904	876	170	661	542	6021	5372

Table 28. Estimated spawner biomass using annual ogives, beginning of the year weights and bias adjusted population numbers from ADAPT for cod in NAFO Division 3NO.

	3	4	5	6	7	8	9	10	11	12	SSB
1959	126	1396	1073	1361	18267	11826	11079	14175	11069	1846	72218
1960	51	966	7534	4421	5779	17348	8096	7912	8932	4471	65509
1961	1	405	4985	21835	9939	10859	10620	5661	5733	3842	73881
1962	29	45	2471	10362	25192	9841	7758	7111	4461	5263	72532
1963	131	501	1166	11129	18011	22759	7768	5112	4775	3040	74393
1964	34	985	6627	15600	23125	17002	10419	3107	2139	2847	81886
1965	2	245	4436	31131	38863	26664	13368	7034	1477	1822	125043
1966	37	45	1540	15223	40885	21259	15089	11216	1504	726	107524
1967	836	740	964	5930	17901	24984	5875	7494	1473	809	67006
1968	40	3409	7440	7121	10329	11042	7904	5020	5798	801	58904
1969	13	395	7036	22368	14089	9137	6255	5589	3458	4725	73065
1970	2	181	3152	10547	24097	14568	7502	3774	3177	2148	69149
1971	0	38	1845	15536	13367	17430	9659	5464	2499	1123	66962
1972	652	2	316	8306	21136	11851	8523	7691	3756	1520	63752
1973	22	2766	169	2090	13517	11786	9268	8584	6527	3402	58130
1974	1	103	3459	8354	5766	14817	10686	6303	6392	4065	59946
1975	19	25	373	2442	10476	4441	5809	4248	1632	1574	31040
1976	19	197	288	1322	1423	2975	1037	920	707	250	9138
1977	16	185	908	1787	2726	1571	2533	940	760	635	12062
1978	35	230	1498	2987	5076	2213	1143	1433	389	307	15312
1979	128	364	2266	6329	5485	5119	1789	850	890	271	23490
1980	35	797	3419	10159	9998	5580	4943	1742	789	854	38316
1981	42	351	3977	18422	21817	12183	6252	5649	1713	698	71104
1982	63	361	2383	9830	31809	21824	11282	5161	4331	1231	88273
1983	7	295	2880	8965	13554	32847	16379	7261	3068	2391	87647
1984	25	75	1312	12658	14346	13894	27569	11057	4675	2232	87843
1985	21	161	704	4690	17849	13102	11916	22856	6922	3542	81763
1986	5	247	1149	4248	9114	15148	13247	11914	20220	4403	79695
1987	13	76	1894	5653	10601	10996	13403	10849	8610	16849	78945
1988	2	111	889	7572	12106	11983	9087	7047	5596	3773	58167
1989	21	26	775	3350	8995	10779	11268	6725	3524	2974	48437
1990	37	227	327	1762	3082	7181	8453	10444	5610	2137	39260
1991	21	136	887	935	1406	2723	5565	6257	7185	4426	29541
1992	1	109	391	1794	1264	723	1378	2351	2778	2783	13574
1993	0	48	315	597	1396	801	443	752	1156	1046	6554
1994	0	24	835	383	365	819	575	304	304	595	4205
1995	1	5	495	2357	305	215	910	539	254	253	5335
1996	5	12	84	1403	3481	368	294	902	503	215	7266
1997	4	53	105	205	1687	3616	422	403	711	461	7668
1998	2	52	281	278	248	1715	3759	437	364	642	7776
1999	1	19	389	560	321	231	1622	3921	405	306	7775
2000	2	14	103	808	712	290	173	1325	3113	317	6855
2001	3	67	174	128	976	855	325	184	1425	2967	7104
2002	7	240	1229	860	160	1007	808	378	258	1762	6709
2003	1	150	2116	2577	1038	159	979	726	370	265	8382
2004	1	15	241	949	1666	739	149	902	694	321	5678
2005	1	17	109	281	936	1904	876	170	661	542	5497

Table 29. Retrospective estimates of Age 3 recruits, spawner biomass and fishing mortality (Fbar 6-9) for cod in Div. 3NO. Estimates are beginning of year for recruits and SSB and for the terminal year for fishing mortality.

Age 3 recruits (Jan 1)	Current VPA	Retro				
		2004	2003	2002	2001	2000
2005	560	*	*	*	*	*
2004	326	239	*	*	*	*
2003	619	527	343	*	*	*
2002	1684	1625	1141	1383	*	*
2001	3998	3927	2539	3200	3123	*
2000	4332	4273	3176	3527	3700	2676

SSB (Jan 1)	Current VPA	Retro				
		2004	2003	2002	2001	2000
2005	5497	*	*	*	*	*
2004	5678	5225	*	*	*	*
2003	8382	8010	5823	*	*	*
2002	6709	6466	5850	6280	*	*
2001	7104	6951	6841	7200	7458	*
2000	6855	6743	6658	6958	7202	6722

Avg F (ages 6-9)	Current VPA	Retro				
		2004	2003	2002	2001	2000
2004	0.241	*	*	*	*	*
2003	1.034	1.098	*	*	*	*
2002	0.236	0.251	0.375	*	*	*
2001	0.152	0.165	0.196	0.202	*	*
2000	0.356	0.383	0.394	0.402	0.428	*

Table 30. Input data to 5 year deterministic projection of Jan 1 2005 population size from SPA.

Age		3	4	5	6	7	8	9	10	11	12
M		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Avg wt (3yrs) (from Table 26)		0.555763	0.782199	1.2035	1.753211	2.572663	3.911094	5.576518	7.009914	7.759971	8.617181
Mats at age (from Table 21)	1998	0.01694	0.107647	0.583705	0.864244	0.991668	0.999999	0.999998	0.999898	0.999089	0.999999
	1999	0.000935	0.103215	0.523982	0.915522	0.983423	0.999097	1	1	0.999986	0.999771
	2000	0.00103	0.013533	0.434626	0.909455	0.988203	0.998194	0.999903	1	1	0.999998
	2001	0.00187	0.025756	0.167423	0.83699	0.989207	0.998458	0.999806	0.99999	1	1
	2002	0.006848	0.100743	0.403958	0.746683	0.971667	0.998806	0.9998	0.999979	0.999999	1
	2003	0.003249	0.160031	0.870118	0.945577	0.977379	0.995653	0.999869	0.999974	0.999998	1
	2004	0.003249	0.09551	0.840372	0.99751	0.99776	0.998424	0.999347	0.999986	0.999997	1
	2005	0.003249	0.09551	0.704816	0.993173	0.999958	0.999912	0.999892	0.999902	0.999998	1
	2006	0.003249	0.09551	0.704816	0.978753	0.999751	0.999999	0.999997	0.999993	0.999985	1
	2007	0.003249	0.09551	0.704816	0.978753	0.999156	0.999991	1	1	0.999999	0.999998
	2008	0.003249	0.09551	0.704816	0.978753	0.999156	0.999968	1	1	1	1
	2009	0.003249	0.09551	0.704816	0.978753	0.999156	0.999968	0.999999	1	1	1
	2010	0.003249	0.09551	0.704816	0.978753	0.999156	0.999968	0.999999	1	1	1
Avg F (3 yrs) (from Table 25)		0.394547	0.611801	0.529616	0.37002	0.247012	0.131885	0.092141	0.071032	0.039756	0.03317
Avg PR (3 yrs)		0.574205	0.933655	0.850068	0.740713	0.477132	0.351113	0.206727	0.176848	0.099719	0.085377
Rescaled Avg PR		0.682376	1.109541	1.010207	0.880251	0.567017	0.417257	0.245671	0.210163	0.118504	0.101461
F_current (3 year avg over ages 4-6)		0.503813 avg									
Proj F (F_current x Rescaled Avg PR)		0.34379	0.559001	0.508955	0.443482	0.28567	0.210219	0.123772	0.105883	0.059704	0.051117
Avg R/S (3 yrs)		0.117608									
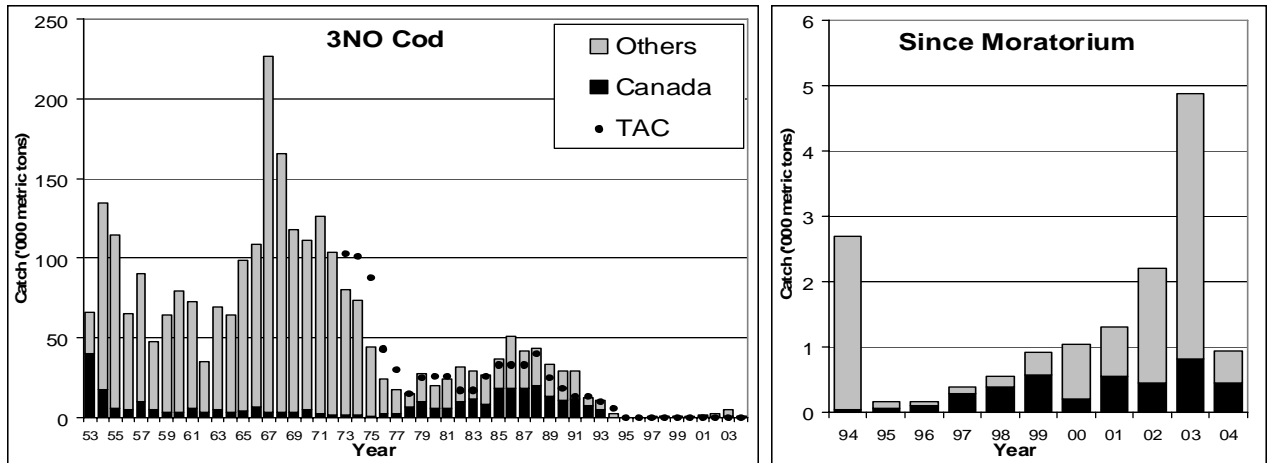
Fig. 1. Catches of cod in NAFO Div. 3NO from 1953-2004. Panel on left for years since the moratorium in Feb. 1994.
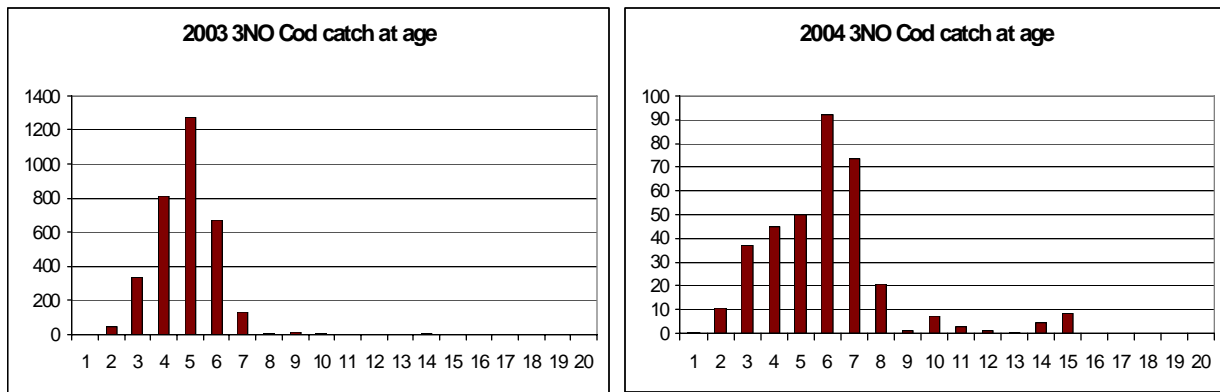
Fig. 2. Plot of Div. 3NO Cod catch-at-age for 2003 and 2004
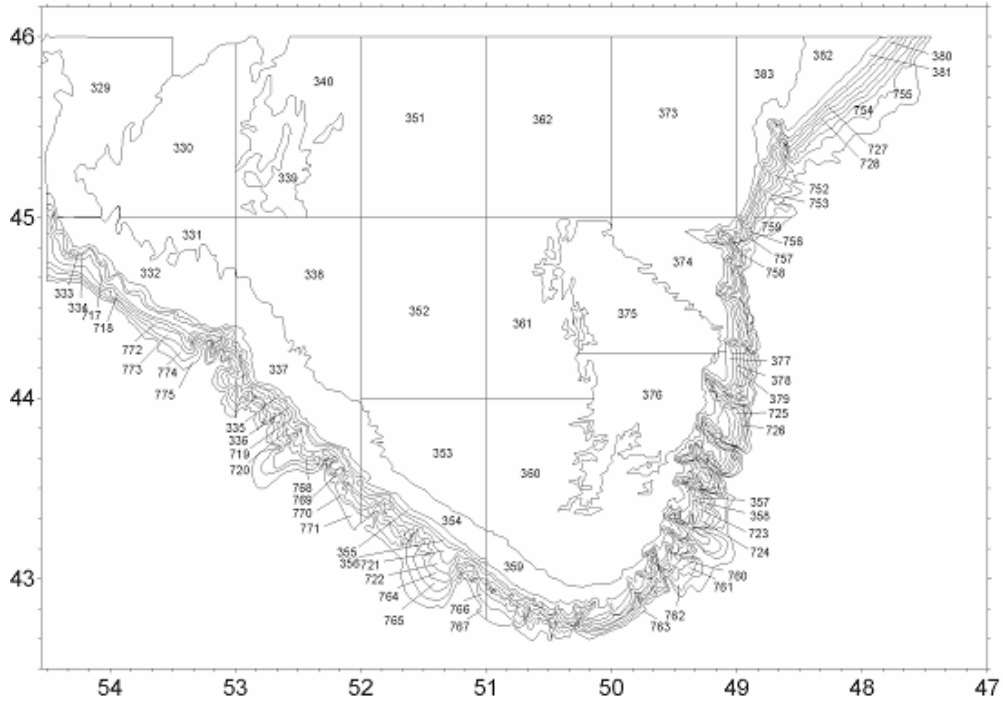
Fig. 3.   Stratification scheme for Div. 3NO.
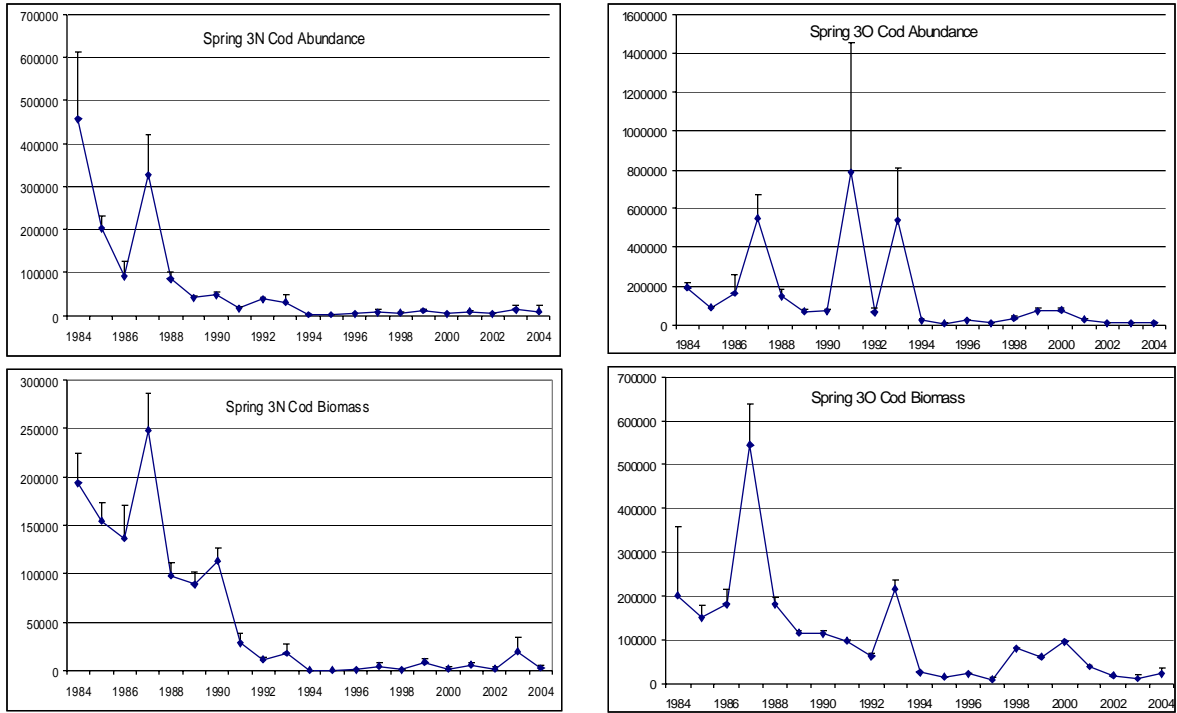
Fig. 4.   Abundance (000's) and biomass (t) for the Canadian Spring Research Vessel survey series with 1 standard deviation for strata<200 fathoms.
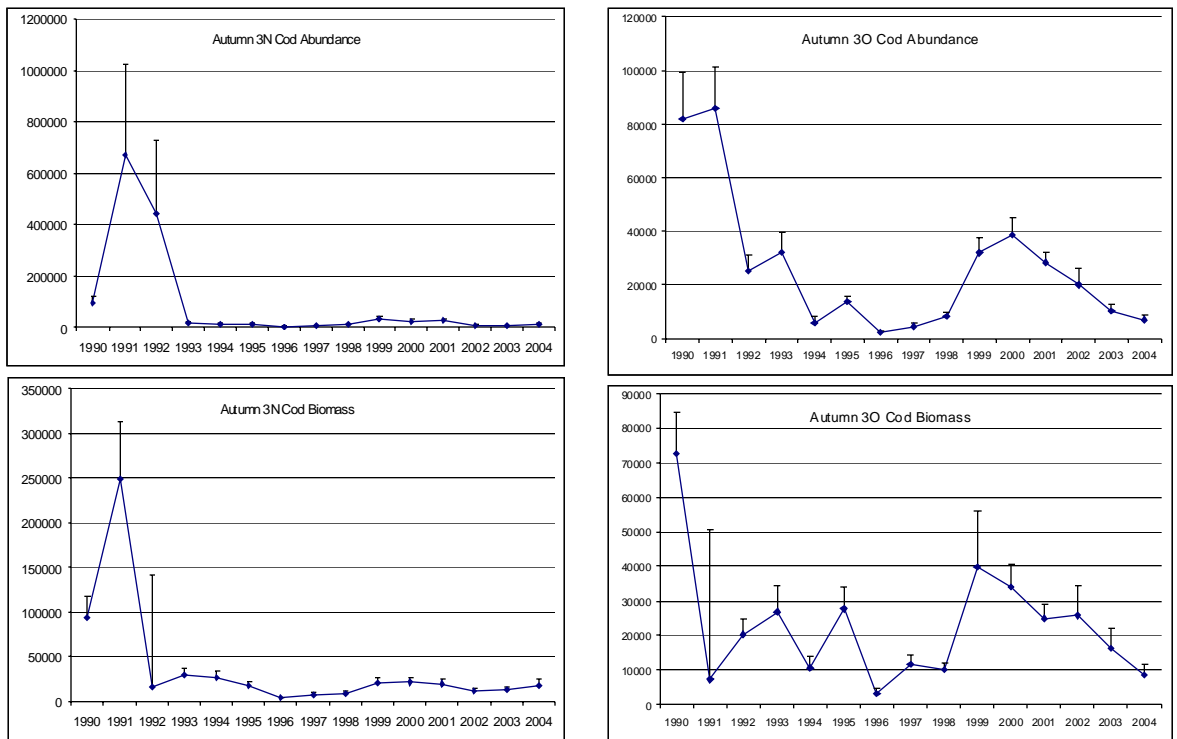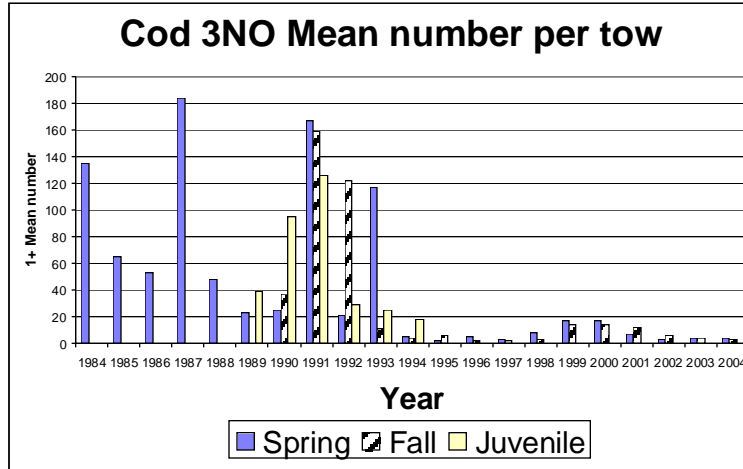

Fig. 5.   Abundance (000's) and biomass (t) for the Canadian Autumn Research Vessel survey series with 1 standard deviation for strata<200 fathoms.

Fig 6. Spring and autumn Canadian RV estimates of 1+ mean number/tow of cod in Divisions 3NO
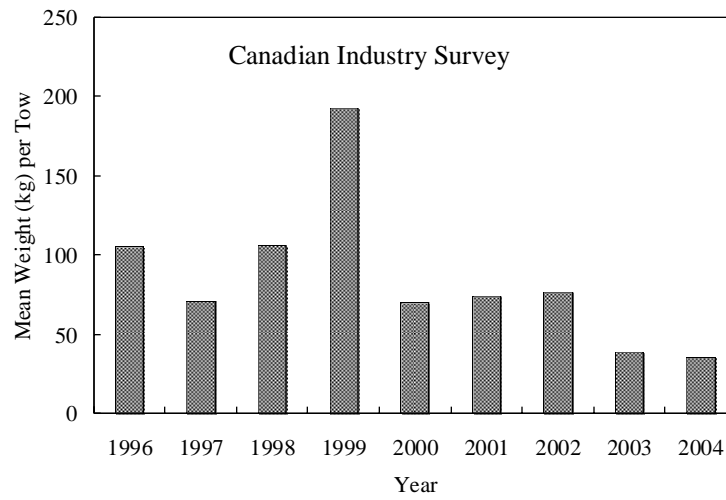
Fig. 7. Mean weight (kg) per tow from Canadian Industry surveys conducted in July in NAFO Div. 3NO.
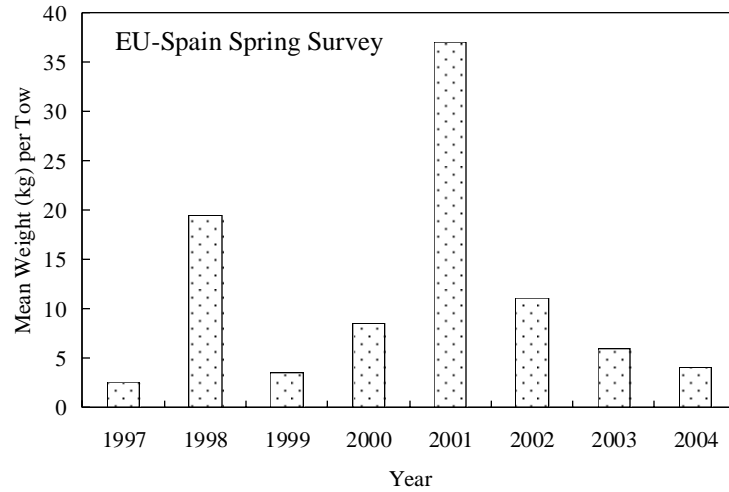
Fig. 8. Mean weight (kg) per tow from EU-Spain spring surveys of the regulatory area of NAFO Div. 3NO.
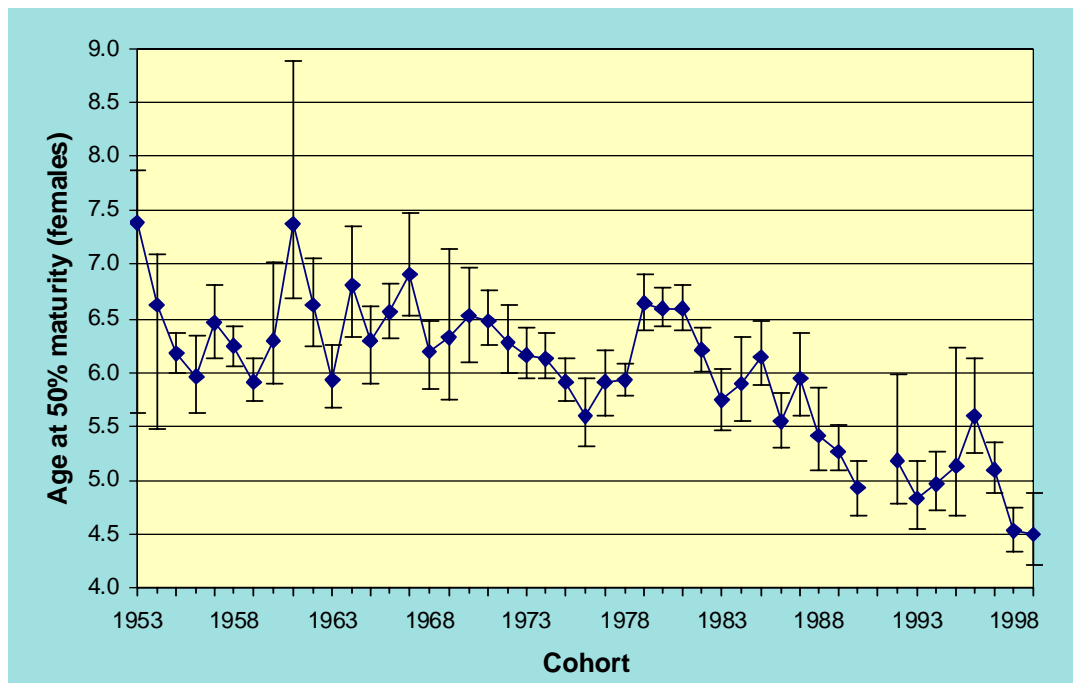
Fig. 9 Age at 50% maturity for cod in Div. 3NO (by cohort).
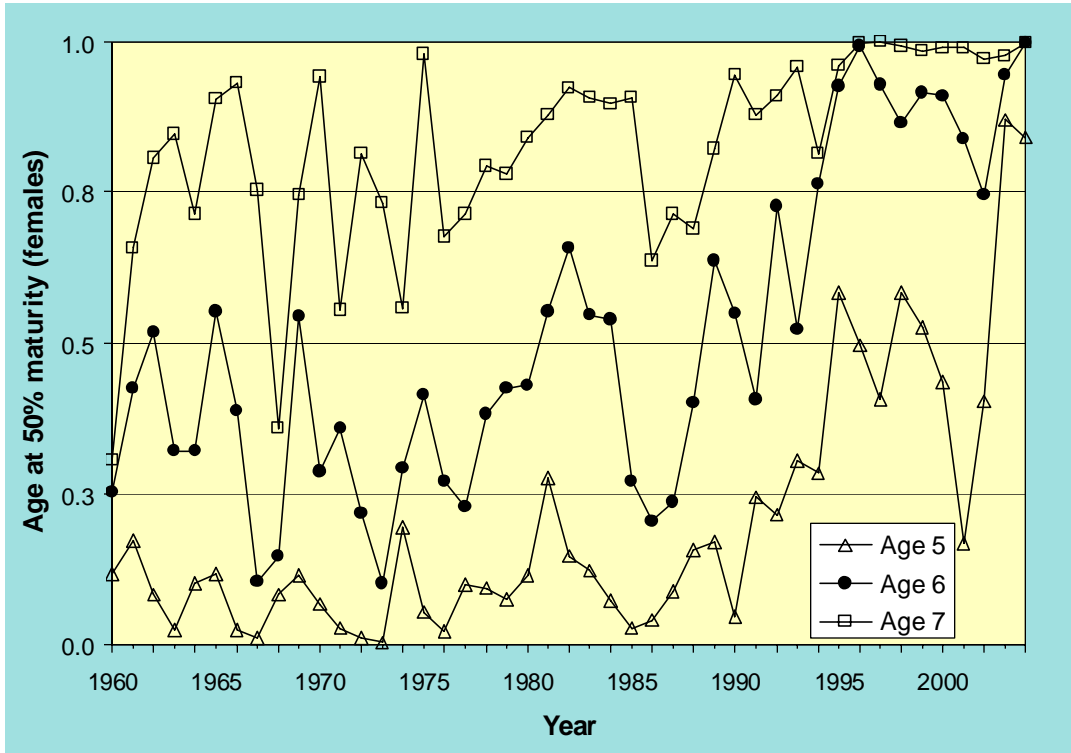
Fig. 10. Estimated proportions mature at ages 5-7 for female cod sampled during DFO research vessel bottom-trawl surveys in NAFO Div. 3NO during 1975-2004. Model fitted by cohort to observed proportions mature at age from DFO RV survey data 1975-2004.
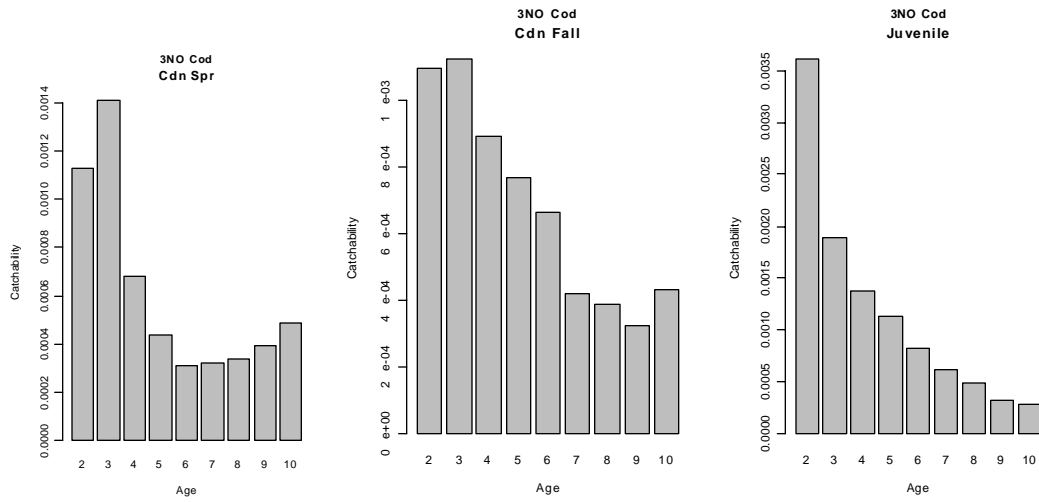
Fig. 11. Estimated catchabilities from ADAPT.
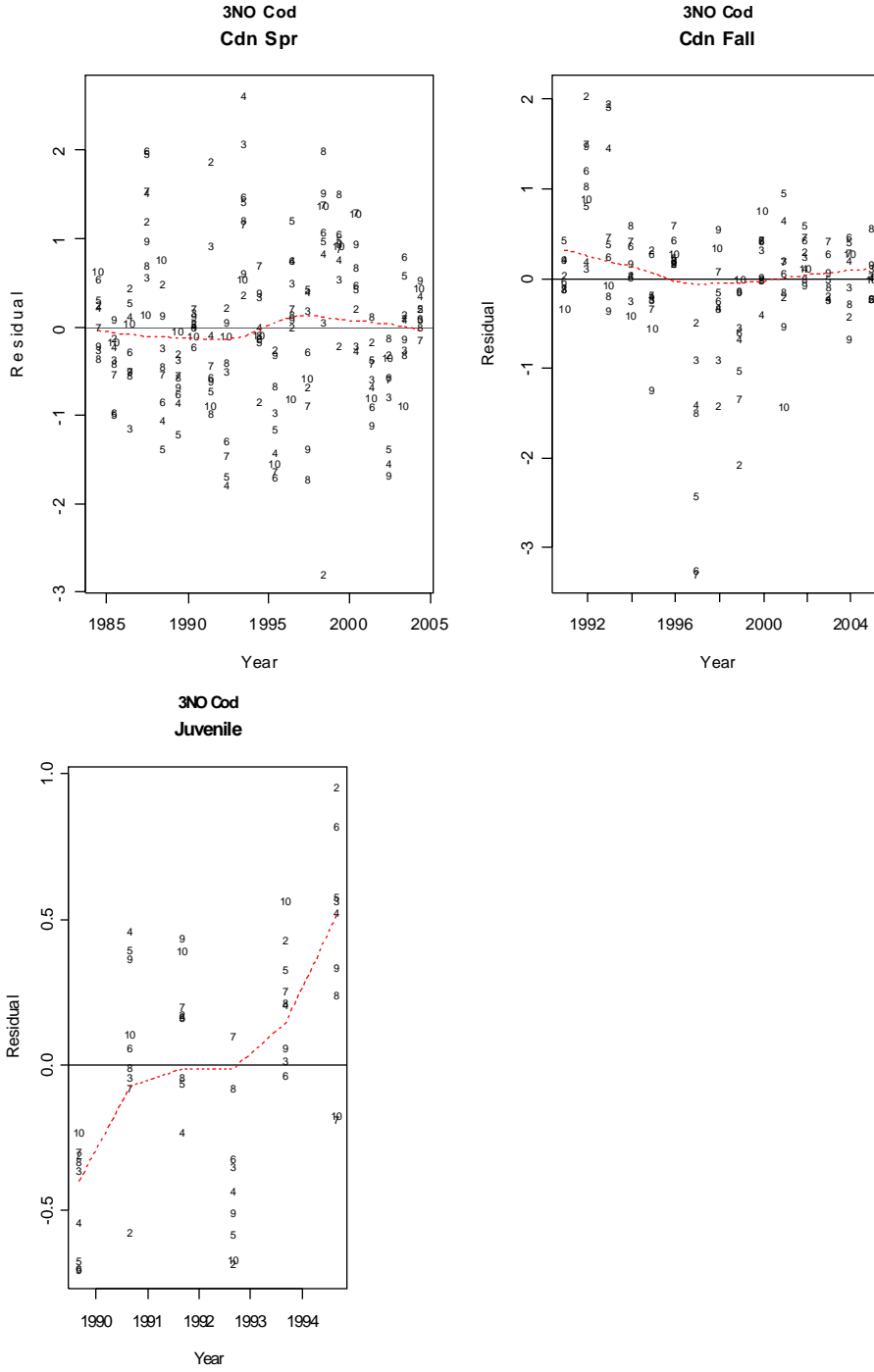
Fig. 12. Residuals at age for each index in the ADAPT.
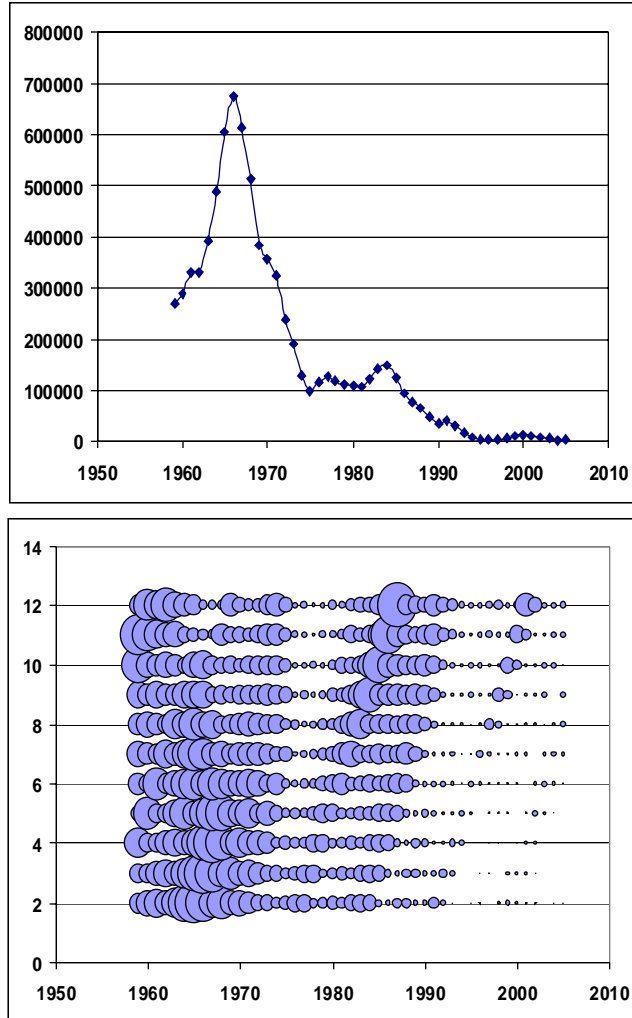
Fig. 13. Bias corrected Population Abundance for cod in Div. 3NO (000's) as estimated from ADAPT (left panel: total over all ages, right panel: age by age scaled to mean within each year.
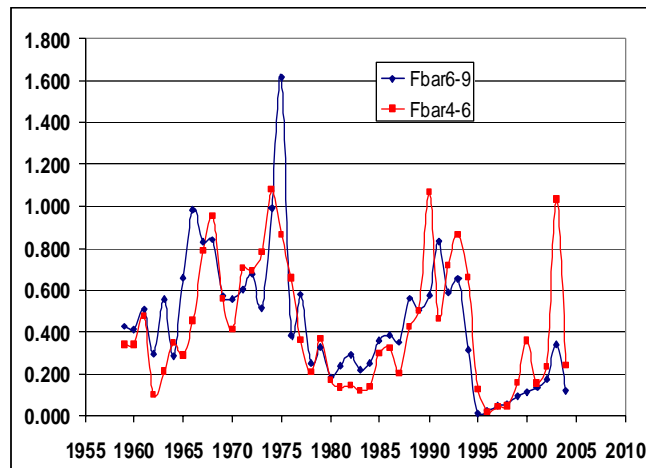
Fig. 14. Fishing Mortality for cod in Div. 3NO as estimated from ADAPT.
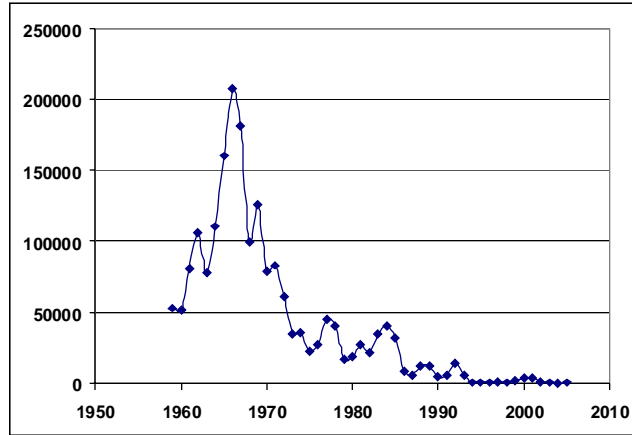
Fig. 15. Age 3 recruits for cod in Div. 3NO as estimated from ADAPT.
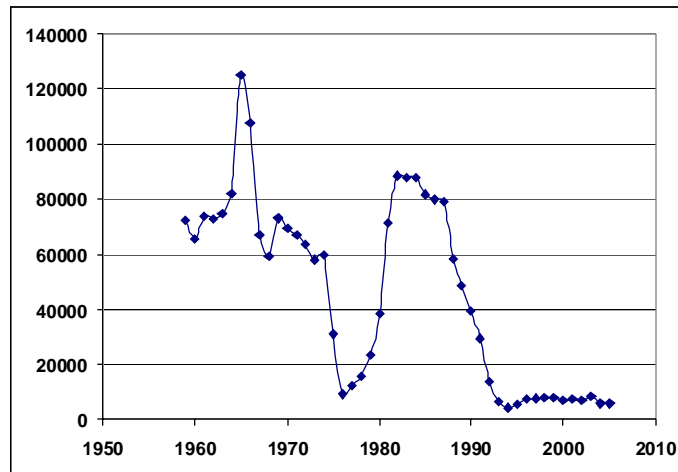
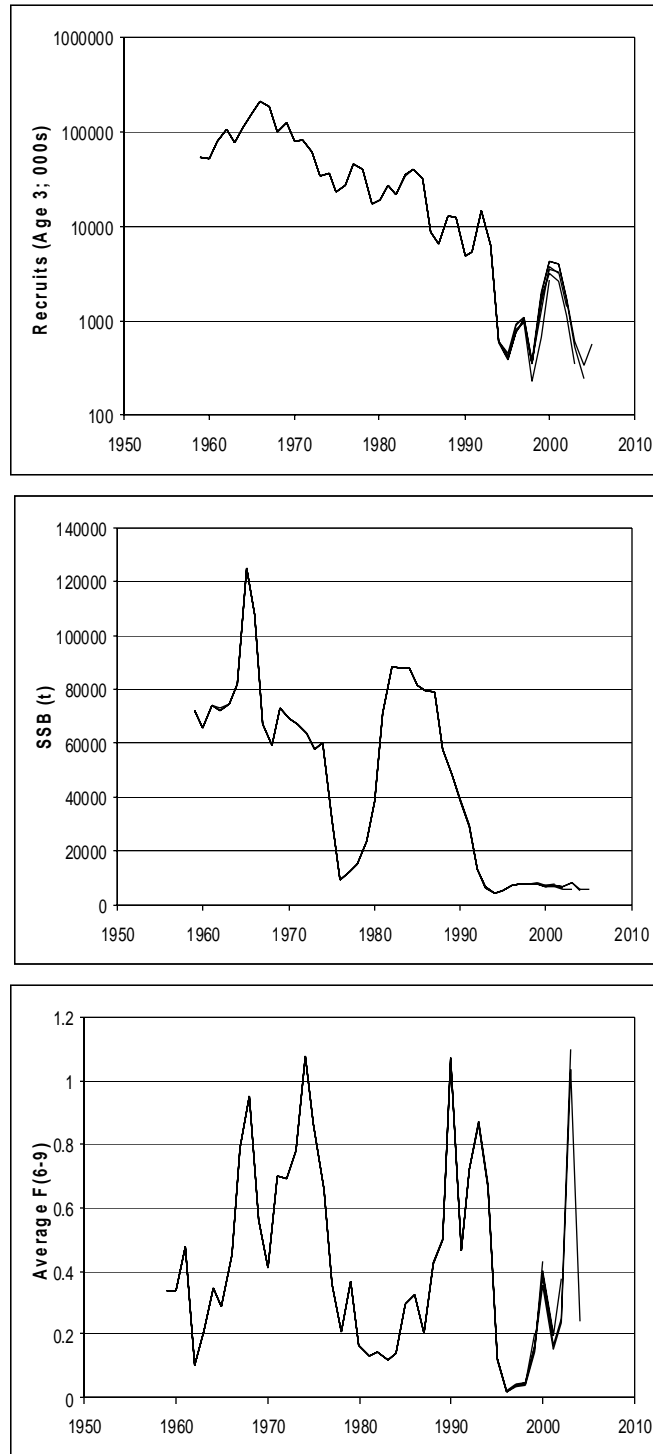Fig. 16. Spawner biomass for cod in Div. 3NO as estimated from ADAPT.

Fig. 17. Retrospective estimates of Age 3 recruits (log scale), spawner biomass and fishing mortality (F_{bar} 6-9) for cod in Div. 3NO.
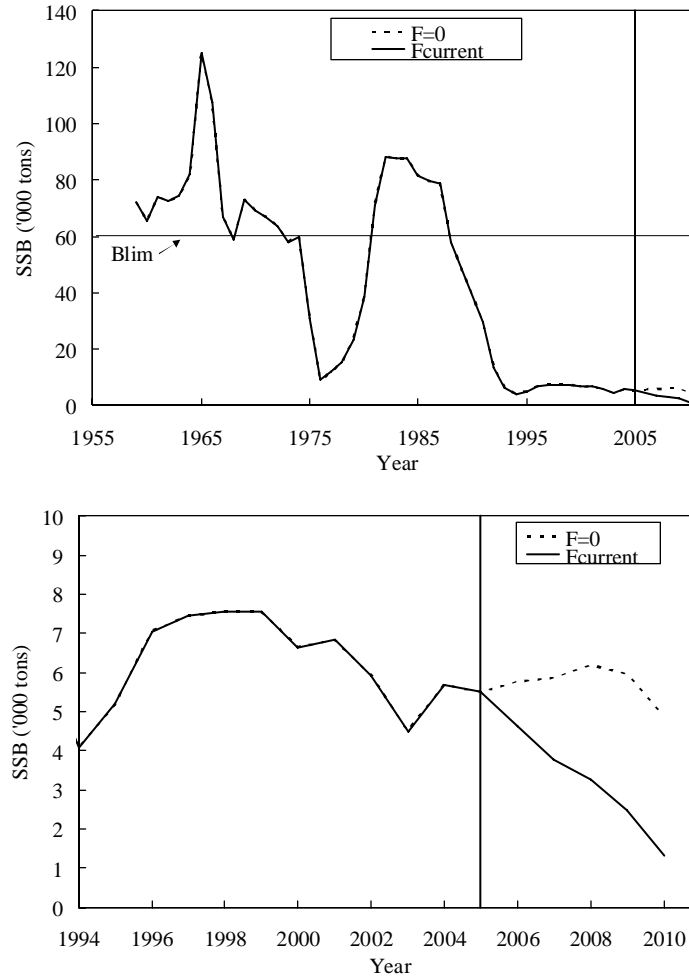
Fig. 18. Deterministic Projections under $F = 0$ (dashed line) and $F_{current} = 0.5038$. Lower panel highlights trend since 1994.