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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 is impeding stock recovery. Estimates from the ADAPTive framework indicate that spawner biomass decreased to its lowest level in 2004, and since then has varied with little trend. The population abundance was reduced by about 26% 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. Population abundance declined further in 2004 but was higher in 2005 and 2006, although still 25% less than the level of 2002. Fishing mortality over ages 6-9 is estimated to be lower in the last 2 years but increased at younger ages in 2006. 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 Divisions 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 Division 3O and Subdivision 3Ps may occur. This stock declined in the late 1980's and early 1990's and has been at an extremely low biomass level in recent years. It has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994. Catches increased considerably during the moratorium from about 170 t 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 2005 and the Canadian fall research vessel survey conducted in fall 2006. Population and spawning stock biomass estimates for the 1959-2007 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 TAC's in the early 1990's 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 was the first time since 1999 that the catch was below 1,000 t. The catch in 2005 and 2006 was estimated to be 736 t and 601 t, respectively.

Sampling data for 2005 were limited to Canadian (Table 2-3), Spanish (Gonzalez et al., MS 2006) and Russian (Vaskov et al., MS 2006) otter trawl fisheries. Sampling data for 2006 came from Canadian (Table 2-3), Portuguese (Vargas et al., MS 2007), and Russian (Vaskov at al., MS 2007) research reports. The total catch-at-age from by-catches in 2005 and 2006 is presented in Table 4. A review of the sampling over the period 1995-2006 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 2005 to 2006, catch-at-age was compiled as detailed in Table 5. The 1997 and 1998 year classes have been prominent in the catch since 2003 but in 2006 catch-at-age shifted to much younger ages with ages 2-5 (the 2001-2004 year classes) dominating (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 1959-2006 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 Divs. 3N and 3O since 1971 and 1973, respectively, with the exceptions of 1983 in Div. 3N and 1974 and 1983 in Div. 3O. In 2006 survey coverage was incomplete and the 2006 spring survey is not considered an index of population size. 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 Divisions 3NO from 1990 to 2006 using the *WILFRED TEMPLEMAN* for strata less than 730 m. Starting in 1995 the *Teleost* was used for strata greater than 731 to a maximum depth of 1500m, but coverage has not been consistent in these greater depths. Because of vessel difficulties in 1996 the *ALFRED NEEDLER* concluded the survey in strata less than 731m.

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 Figs. 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 3NO combined for 2005 spring and autumn are 43,184 t and 40,607 t respectively. The swept area estimates in Divs. 3NO combined for 2006 autumn was 41,211t.

The mean numbers per tow at age for the index strata (i.e. strata with depths < 200 fathoms) in 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 are among the lowest observations in the series and represented the fourth consecutive year of decline. There was a slight increase in 2005. The 2003 year-class, although still very weak, appears slightly stronger than the 2000-2001 year-classes. 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 are described in Maddock Parsons et al. (MS 2005). 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. These surveys have been discontinued.

Stratified-random surveys were conducted by Spain in the NRA area of Div. 3NO from 1995-2006 (Gonzales-Troncoso et al MS 2007). 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. There was a large increase in 2006, with that value being the second largest in the time series. 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 Sub-Div 3Ps (Brattey et al. 2002), NAFO Divs. 2J+3KL (Lilly et al. 2003), and also for American Plaice in NAFO Divs. 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 estimated age at 50% maturity (A50) ranged between 5.6 and 7.4 years for cohorts produced from the 1950's to 1980's (Fig. 9). Age at 50% maturity declined during 1980-1990 from approximately 6.8 to 4.9. Estimates of A50 since the 1990 cohort, although variable, have generally been lower than those estimated for cohorts produced from the 1950's 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 1975-2005 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 1984-2005, Canadian RV survey fall 1990-2006 at age and Canadian juvenile survey 1989-94 indices was applied to estimate terminal numbers $N_{i, t}$,

where $i = 3$ to 12, for $t = 2007$ and $i = 12$, for $t = 1994$ to 2006,

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 fall
$q3_i$ 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,
$C_{i,t}$ where $i = 2$ to 12 and $t = 1959$ to 2006 ,
Canadian Research Vessel survey estimates of mean numbers per tow-at-age (Campelen or Campelen equivalent values),
$RV1_{i,t}$ where $i = 2$ to 10 and $t = 1984$ to 2005, spring
$RV2_{i,t}$ where $i = 2$ to 10 and $t = 1990$ to 2006, fall
and Canadian juvenile Research Vessel survey estimates of mean numbers per tow-at-age (Yankee 41.5 shrimp trawl in August – September)
$RV3_{i,t}$ 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 and in 2006 (by estimating survivors at age 12 in these years). The statistics associated with the ADAPT output are given in Table 22. The mean square error for the model fit (MSE) was 0.685. The relative error in the parameter estimates of abundance decreased with age from a high of 86% at age 3 to a low of 33% at age 12. Relative bias was a high of 38% at age 3 decreasing to 5% at age 12.

The estimated survivors and catchabilities (Fig. 11) together with standard errors of the estimates are also provided in Table 22. Catchabilities generally decrease with age for all three surveys with the spring and fall having similar 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. Overall the spring and fall surveys show little pattern in the residuals, although there are some year effects. These are evident in the spring survey in 1987, 1993, 1996 and 1998 (positive) and 1989, 1995, 2002 (negative) (Fig 12). The fall 1996 estimates have large negative residuals. Large residuals in the fall survey for 1996 are ages 5, 6 and 7. The juvenile survey residuals show 1989 had a negative year effect.

Bias-adjusted estimates of population numbers (Fig. 13, left panel) and fishing mortality at age (Fig. 14) are given in Tables 23 and 24 respectively. The age 2 value in 2007 is the geometric mean of the 2004-2006 age 2 estimates. Population numbers remain very low although there has been a slight increase since 2005. The 1989 year-class, the most recent evidence of non-negligible recruitment (Fig. 15), is no longer contributing to the VPA population (since 2001). 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. The 2003 year-class is the largest since those year-classes but lower than the 1996-1998 year-classes.

Beginning of year mean weight-at-age calculated from the commercial catch is presented in Table 25. These weights are used to calculate biomass, given in Table 26. Stock biomass, which increased from the time of the moratorium until 1997, has been relatively stable since then. The maturities computed using the cohort model are used to compute the spawning stock biomass (Table 27, Fig. 16). Current SSB is estimated to be about 7,500 t, which is approximately 12% of B_{lim} (60,000 t).

Estimates of fishing mortalities in 2006 for most ages are 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 $\overline{F}_{4:6}$ increased dramatically in 2006 due to a shift in catch to ages 2 to 5. The population abundance was reduced by about 26% 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. Population abundance declined further in 2004 but was higher in 2005 and 2006, although still 25% less than the level of 2002.

Retrospective analysis

A retrospective analysis was conducted, and seven years of successive data were removed, and the estimation (identical structure to the VPA above) was repeated for each case. Estimation of population numbers at January 1 2006 (1 year retrospective) has the same number of years of spring survey index as the present assessment since the spring survey in 2006 was not considered a reasonable index of the stock due to poor coverage. Recruitment (Table 28, Fig. 17) and SSB tended to be under estimated as successive years of data were excluded from the analysis. Conversely, mean $\overline{F}_{4–6}$ was over estimated in the year of the assessment in most years, but estimates of F were virtually identical in the last 2 years (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 morttality (all averages over the final three years of SPA) as well as F=0. Input data for the projections are in table 29. 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 2004-2006 is about 0.14 compared to a historical average of 0.72 for the 1959-2006 time series.

The projections indicate that after some small increase under conditions of current F, SSB declines slightly by the end of the projection period (Fig 18). Under the F=0 scenario there is some increase in SSB over the time period of the projection with SSB reaching 11800 t by 2012. The SSB is 1.6 times higher at the end of the projection period under the F=0 scenario than at F=current. The projection is more optimistic than the projection in the last assessment because a decline in F and a slightly stronger 2003 year class have resulted in some small increase in the estimate of population abundance. In addition the under F=current conditions in the last assessment included the very high estimates of F in 2003 in the average calculated to represent current F. In both scenarios SSB remains at extremely low levels compared to historic values and well below B_{lim}.

Conclusion

The 2005 spring and fall research vessel surveys, and the 2006 fall survey indicate that the current stock size remains at an extremely low level. Survey abundance and mean numbers per tow have increased somewhat since the last assessment of this stock. The survey by EU-Spain showed an increase in biomass in 2006. Estimates from the ADAPTive framework indicate that spawner biomass decreased to its lowest level in 2004, and since then has varied with little trend. Fishing mortality over ages 6-9 is estimated to be lower in the last 2 years but increased at younger ages in 2006. 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. <mark>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.</mark>

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Table 1. Catch (t) of cod in NAFO Divisions 3NO. 1953 -2006

Year	Canada	Others	Total	TAC
1953	39884	26313	66197	
1954	17392	117369	134761	
1955	6053	108303	114356	
1956	5363	59519	64882	
1957	9641	80549	90190	
1958	4812	43239	48051	
1959	3687	60683	64370	
1960	3408	76269	79677	
1961	5428	67296	72724	
1962	3235	31749	34984	
1963	5079	64663	69742	
1964	2882	61579	64461	
1965	4229	94958	99187	
1966	6501	102418	108919	
1967	3446	223338	226784	
1968	3287	162224	165511	
1969	3664	114041	117705	
1970	4771	106790	111561	
1971	2311	123985	126296	
1972	1736	101638	103374	
1973	1832	78597	80429	103000
1974	1360	72029	73389	101000
1975	1189	42985	44174	88000
1976	2065	22218	24283	43000
1977	2532	15072	17604	30000
1978	6246	8472	14718	15000
1979	9938	17913	27851	25000
1980	5589	14402	19991	26000
1981	6096	18248	24344	26000
1982	10185	21420	31605	17000
1983	11374	17445	28819	17000
1984	8705	18398	27103	26000
1985	18179	18720	36899	33000
1986	18035	32610	50645	33000
1987	18652	22967	41619	33000
1988	19727	23423	43150	40000
1989	13433	19782	33215	25000
1990	10620	18226	28846	18600
1991	12056 [1]	17396 [2]	29453	13600
1992	7859	4893 [2]	12752	13600
1993	5370	5276 [2]	10646	10200
1994	47	2655 [2]	2702	6000
1995	64	108 [2]	172	0
1996	99	75 [2]	174	0
1997	286	97 [2]	383	0
1998	396	151 [2]	547	0
1999	568	351 [2]	919	0
2000	207	843 [2]	1050	0
2001	560	750 [2]	1310	0
2002	444	1750 [2]	2194	0
2003	818	4052 [2]	4870 [3]	0
2004	442	492 [2]	934	0
2005	473	263 [2]	736	0
2006	109	492 [2]	601	0

[1] **Includes an estimate of 4000 t deemed misreported to Div. 3L.**

[2] **Includes estimates by NAFO Scientific Council.**

[3] **Catch could not be precisely estimated but is in the range of 4, 280 - 5, 460 tons**

Table 2. Cod landings (t) by month and gear from NAFO Divisions 3NO by Canada in 2005 and 2006.

2005	Canada (N)				Canada (M)			
	3N	3O			3N	3O		
Month	Ottertrawl	Ottertrawl	Gillnet	Longline	Longline	Ottertrawl	Longline	
Jan	0.33	24.03	0.04	3.22	0.00	0.00	0.00	
Feb	0.00	0.00	0.03	9.13	0.00	0.00	0.00	
Mar	0.16	0.00	0.00	10.68	0.00	0.00	0.50	
Apr	2.18	22.04	0.41	13.18	0.00	0.00	0.00	
May	3.30	15.32	2.41	4.43	0.00	2.60	0.60	
Jun	3.85	3.91	2.71	0.00	14.50	0.00	3.40	
Jul	0.00	0.00	0.01	0.17	3.00	0.00	1.50	
Aug	0.00	24.02	0.00	0.00	0.00	0.00	0.00	
Sep	37.43	85.35	0.26	0.00	0.00	0.00	0.00	
Oct	89.47	52.22	0.00	0.00	1.00	0.00	0.00	
Nov	22.43	9.65	0.03	0.00	0.00	0.00	0.00	
Dec	16.81	1.41	0.00	0.00	0.00	0.00	0.00	
	175.96	237.96	5.90	40.81	18.50	2.60	6.00	487.72

2006	Canada (N)				Canada (M)			
	3N	3O			3N	3O		
Month	Ottertrawl	Ottertrawl	Gillnet	Longline	Longline	Ottertrawl	Longline	
Jan	0.09	23.66	1.71	1.61	0.00	0.00	0.50	
Feb	0.00	7.29	0.03	3.76	0.00	0.00	0.00	
Mar	0.00	0.00	0.00	4.42	0.00	0.00	1.90	
Apr	0.00	18.61	0.00	5.16	0.00	0.00	0.00	
May	0.00	1.16	1.55	0.00	1.30	0.00	0.00	
Jun	0.00	0.51	2.18	0.00	2.30	0.00	12.90	
Jul	0.00	0.00	0.00	0.27	7.60	0.00	6.20	
Aug	0.00	0.00	0.09	0.00	3.00	0.00	0.00	
Sep	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Oct	0.22	0.00	0.35	0.00	0.00	0.00	0.60	
Nov	0.00	0.09	0.00	0.00	0.00	0.00	0.30	
Dec	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0.31	51.33	5.91	15.22	14.20	0.00	22.40	109.36

Table 3. Commercial sampling by Canada used to estimate catch at age for Divisions 3NO in 2005.

Ages by quarter					Measurements by month	
Qtr.	Gear	Div.	No. Aged		Month	No. meas
2	LL	3O	2		3	2
	OT	3N	113		4	27
		3N			5	58
		3N			6	84
		3N			9	330
4		3N	164		10	1176
		3N			11	446
		3N			12	99
2	OT	3O	122		4	269
		3O			5	463
		3O			6	17
3	OT	3O	174		8	166
		3O			9	813
4		3O	35		10	758

Table 3 (cont'd). Commercial sampling by Canada used to estimate catch at age for Divisions 3NO in 2006

Ages by quarter					Measurements by month	
Qtr.	Gear	Div.	No. Aged		Month	No. meas
	GN	3O	29		5	7
					6	37
	OT				3	478

Table 4. Total catch, average weight and length at age for the fishery in Division 3NO during 2005 and 2006 .

2005 AGE	AVERAGE WEIGHT (kg.)	LENGTH (cm.)	Catch NUMBER (000'S)	2006 AGE	AVERAGE WEIGHT (kg.)	LENGTH (cm.)	Catch NUMBER (000'S)
1	0.18	28.00	0	1	0.09	22.00	0
2	0.36	34.21	1	2	0.33	33.47	45
3	0.49	37.82	1	3	0.68	42.21	214
4	1.41	52.98	1	4	1.11	49.76	168
5	2.46	63.52	2	5	1.36	53.20	82
6	3.43	71.90	4	6	2.05	61.08	21
7	3.95	75.30	28	7	2.60	66.08	5
8	4.94	80.74	55	8	3.26	70.99	10
9	5.90	85.51	20	9	4.66	78.84	2
10	9.30	98.06	1	10	7.07	91.13	2
11	10.28	102.36	3	11	7.39	92.19	0
12	11.42	106.80	2	12	14.86	116.50	0
13	12.48	110.09	2	13	14.34	115.00	0
14	12.77	110.40	0	14	0.00	0.00	0
15	15.12	116.64	2	15	0.00	0.00	0
16	13.09	111.62	4	16	12.57	110.50	0
17	12.86	110.81	0	17	16.20	119.50	0
18	19.76	127.89	0	18	0.00	0.00	0
19	0.00	0.00	0	19	0.00	0.00	0
20	17.09	121.74	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 2006.

	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	Adequate 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 catch into catch at age.	370/GN 2933/OR	255/OT	8484/OT	9577/OT
2003	Adequate 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 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
2005	Bycatch in Canadian ottertrawl fishery was adequetly sampled providing frequencies and keys. Length frequencies provided by Spain and Russia were used in conjunction with Canadian Research Surveys keys to create catch at age for Spain, Portugal, Russia and Estonia.	2/LL 4706/OT	6109/OT		125/OT
2006	Canadian cod bycatch was taken mainly in the ottertrawl and gillnet fishery for redfish and hake , sampling was limited mainly to frequencies. Canadian autumn research keys were used.Frequencies provided by Portugal and Russia were used in conjunction with Canadian autumn research keys to compile catch at age for Portugal, Spain, Estonia and Lithuania.	44/GN 478/OT		3269/OT	125/OT

Table 6. Catch-at-age used in this assessment for Divisions 3NO cod, 1959-2006 (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
2005	1	1	1	2	4	28	55	20	1	3	2	128
2006	45	214	168	82	21	5	10	2	2	0	0	552

Table 7 Catch weight-at-age for Divisions 3NO cod, 1959-2006. Shaded estimates were not derived from sampling (see text)

Year/Age	2	3	4	5	6	7	8	9	10	11	12
1959	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17	13.50
1960	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17	13.50
1961	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17	13.50
1962	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17	13.50
1963	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17	13.50
1964	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17	13.50
1965	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17	13.50
1966	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24	13.50
1967	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24	13.50
1968	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24	13.50
1969	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24	13.50
1970	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24	13.50
1971	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24	13.50
1972	0.54	0.97	1.44	2.08	2.89	3.56	5.95	7.95	8.32	10.14	13.50
1973	0.57	1.00	1.43	2.19	3.63	4.63	6.25	9.56	11.17	13.99	13.50
1974	0.42	0.73	1.20	1.96	2.86	4.67	7.32	5.46	8.40	7.51	13.50
1975	0.38	0.89	1.28	2.13	3.14	4.16	5.53	6.74	5.27	7.09	13.50
1976	0.50	0.91	1.41	2.33	3.25	4.03	6.67	8.74	9.14	12.49	13.50
1977	0.57	1.00	1.48	2.48	3.51	4.74	7.17	8.81	11.70	11.47	13.50
1978	0.72	1.05	1.55	2.25	3.74	4.61	6.19	7.23	9.48	12.87	13.50
1979	0.65	0.98	1.39	2.09	2.87	3.70	4.75	7.15	7.98	10.11	13.50
1980	0.71	1.04	1.69	2.50	3.69	5.49	7.98	9.22	10.60	12.61	13.50
1981	0.90	1.27	1.84	2.69	3.55	5.33	7.13	9.10	9.01	10.15	13.50
1982	0.94	1.17	1.50	2.20	3.83	5.26	7.49	8.80	9.82	12.28	13.50
1983	0.85	1.17	1.87	2.63	3.80	5.20	6.27	8.08	8.99	11.01	13.50
1984	0.79	1.15	1.51	2.28	3.04	4.05	5.76	7.22	8.92	12.61	13.50
1985	0.48	0.86	1.37	2.05	3.25	4.65	6.62	8.32	9.15	11.13	13.50
1986	0.39	1.01	1.52	2.16	3.49	5.41	7.95	9.82	9.94	9.88	13.50
1987	0.49	0.82	1.30	1.83	2.89	4.76	7.26	8.95	9.85	12.59	13.50
1988	0.74	1.00	1.38	1.79	2.23	3.77	5.12	6.88	9.37	11.07	13.50
1989	0.51	0.97	1.60	2.24	3.27	4.61	7.08	8.31	9.47	12.25	13.50
1990	0.55	1.01	1.46	2.51	2.73	4.14	5.02	8.37	9.29	11.25	11.91
1991	0.55	0.85	1.59	2.30	3.83	5.56	7.53	9.04	11.98	13.98	13.60
1992	0.33	0.65	1.06	1.80	2.82	4.85	5.56	7.43	8.64	10.65	14.11
1993	0.36	0.78	1.35	1.84	2.82	4.11	5.87	7.76	8.79	8.67	12.74
1994	0.27	0.46	0.91	1.63	1.84	4.04	4.94	7.54	3.44	7.52	10.00
1995	0.42	0.75	1.21	2.03	2.29	2.08	6.60	6.22	6.41	8.03	11.32
1996	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03	11.32
1997	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03	11.32
1998	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03	11.32
1999	0.50	0.94	1.59	2.07	2.23	2.83	3.99	6.05	6.73	7.38	11.70
2000	0.60	0.82	1.45	2.39	3.44	2.90	2.64	3.78	5.25	6.07	10.19
2001	0.58	1.09	1.38	2.07	4.06	5.22	5.32	5.51	7.51	8.60	9.84
2002	0.67	1.01	1.52	2.24	3.38	5.15	5.99	7.11	8.47	9.32	10.64
2003	0.26	0.67	0.94	1.40	2.02	3.01	4.10	7.63	7.74	8.52	9.23
2004	0.38	0.69	0.92	1.38	2.17	3.03	3.93	5.79	8.54	9.70	8.77
2005	0.36	0.49	1.41	2.46	3.43	3.95	4.94	5.90	9.30	10.28	11.42
2006	0.33	0.68	1.11	1.36	2.05	2.60	3.26	4.66	7.07	7.39	14.86

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 02-May-84	WT 29 AN 43 1985 27-Apr-85	WT 47 1986 29-Apr-86	WT 58-59 1987 09-May-87	WT 70 1988 01-May-88	WT 82 1989 02-May-89	WT 95-96 1990 12-May-90	WT 105-106 1991 07-May-91	WT 119-120 1992 08-May-92	WT 136-137 1993 13-May-93	WT 152-153 1994 18-May-94	WT 168-169 1995 18-May-95
0-30	375	1593	22302	12390	2240	6223	3134	4868	3236	111	148	74	0	0
	376	1499	149223	149	787	88795	2533	599	268	119	0	0	0	69
31-50	360	2992	136658	27167	9750	31721	35911	1053	3020	900	2731	907	0	0
	361	1853	29339	50443	5585	47837	15405	9136	6634	2574	804	836	103	625
	362	2520	68550	20045	5400	117654	6860	7054	8400	1120	58	117	0	0
	373	2520	27500	4161	1600	11738	2625	3096	1575	223	0	0	0	0
	374	931	10431	776	86	931	879	52	388	26	129	0	0	0
	383	674	62	0	0	967	686	499	47	62	0	0	0	0
51-100	359	421	2339	0	40375	7163	5584	1637	819	1199	1696	2193	0	0
	377	100	1771	2451	465	6396	0	424	0	0	0	28	49	0
	382	647	0	3572	22	60	180	1588	3325	0	0	0	0	0
101-150	358	225	2703	5766	4063	4359	5328	3984	8297	1047	16484	3391	109	156
	378	139	2481	43824	6313	2124	1921	1612	2751	875	3707	608	222	97
	381	182	1534	12968	8249	392	3185	3741	3665	202	88	0	13	114
151-200	357	164	0	11571	444	1428	11	68	888	2528	2676	68	433	23
	379	106	788	3195	5010	7	44	206	1318	2311	8782	545	191	66
	380	116	209	3681	526	934	1498	967	2062	3859	870	20654	0	32
total all strata fished < 200 fathoms			455890	202158	90915	327301	85786	40583	46692	17156	38174	29420	1120	1182
total <200 fathoms adjusted			455890	202159	90915	328729	85784	40584	46693	17156	38173	29421	1120	1182
upper limit			891831	278710	543939	531816	118657	53692	79795	35126	63165	286252	7723	2774
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
1 std dev			157039	27576	35654	91793	15324	5543	7693	4176	5808	20213	520	651

Table 8 Cont'd. Cod abundance (000's) from Canadian spring RV surveys

in Division 3N for depths <200 fathoms.

WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
188-189	204-208	221-222	238-241	315-318	367-369	419-424	478-481	546-549	618-621
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
25-May-96	16-May-97	22-May-98	31-May-99	30-May-00	24-May-01	23-May-02	25-May-03	31-May-04	03-Jun-05
0	131	292	5259	329	351	131	263	175	877
165	0	1272	103	206	41	0	41	1004	41
449	86	823	150	41	82	453	659	2552	1784
1077	549	2258	2650	1869	510	1997	892	3035	2185
39	50	139	1042	1271	1078	193	39	314	260
39	50	35	77	0	193	77	0	39	193
85	38	0	85	0	128	43	0	0	43
0	0	0	0	0	0	0	0	0	46
33	138	26	58	29	87	29	0	0	463
0	0	7	0	0	0	0	0	7	199
0	0	0	45	134	0	0	0	0	579
310	261	41	1254	69	3111	234	8940	155	1045
163	136	96	38	209	108	44	1523	1000	365
160	13	0	150	0	1152	0	113	300	7489
90	20	219	73	282	872	168	110	43	60
204	194	72	58	21	642	105	129	49	65
471	6239	48	96	117	511	23	609	207	145
3283	7905	5328	11138	4577	8866	3497	13318	8878	15839
3285	7905	5328	11138	4577	8866	3497	13318	8878	15839
5144	85516	8714	15958	6928	48358	5573	127402	16024	96713
2.365	12.71	2.14	2.45	214	12.71	2.36	12.71	2.131	12.71
787	6106	1582	1967	11	3107	880	8976	3353	6363

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 02-May-84	WT 29 AN 43 1985 27-Apr-85	WT 47 1986 29-Apr-86	WT 58-59 1987 09-May-87	WT 70 1988 01-May-88	WT 82 1989 02-May-89	WT 95-96 1990 12-May-90	WT 105-106 1991 07-May-91	WT 119-120 1992 08-May-92	WT 136-137 1993 13-May-93	WT 152-153 1994 18-May-94	WT 168-169 1995 18-May-95
0-30	375	1593	7018	26266	21041	13506	23154	25148	16134	1835	2331	1145	0	0
	376	1499	16673	713	2954	9148	6555	1256	3791	1483	0	0	0	51
31-50	360	2992	21843	17007	3781	4155	3792	2145	10488	1032	1445	46	0	0
	361	1853	20008	52794	61130	50358	25677	19517	30149	16646	399	3455	64	47
	362	2520	75781	29914	31327	144250	19890	26588	37344	4343	668	1522	0	0
	373	2520	33487	5274	4378	14596	9738	8996	5802	856	0	0	0	0
	374	931	14987	1523	1338	1832	5872	937	5050	516	30	0	0	0
	383	674	502	0	0	1664	236	574	615	224	0	0	0	0
51-100	359	421	308	0	2639	779	637	213	101	66	113	433	0	0
	377	100	145	219	138	1720	0	46	0	0	0	9	8	0
	382	647	0	257	84	42	59	782	298	0	0	0	0	0
101-150	358	225	822	906	1724	4255	1317	1701	1089	131	2650	1699	164	135
	378	139	692	4601	1084	358	441	432	399	145	413	247	64	76
	381	182	765	5397	2913	247	786	216	800	399	15	0	57	44
151-200	357	164	0	6352	640	566	33	64	274	331	706	46	237	24
	379	106	382	1198	1587	9	37	98	318	852	2592	205	121	46
	380	116	411	2128	366	1018	656	498	704	676	181	9823	0	9
total all strata fished < 200 fathoms			193825	154547	137124	247937	98880	89212	113355	29536	11544	18629	714	433
total <200 fathoms adjusted			193824	154549	137124	248503	98880	89211	113356	29535	11543	18630	715	432
upper limit			256272	192257	211519	326927	125247	115281	141017	49183	19173	143715	1950	761
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
1 std dev			29836	18270	33801	37740	12640	12355	13694	8520	2748	9845	287	118

Table 9 Cont'd. Cod biomass (t) from Canadian spring RV surveys in Division 3N for depths < 200 fathoms.

WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
188-189	204-208	221-222	238-241	315-318	367-369	419-424	478-481	546-549	618-621
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
25-May-96	16-May-97	22-May-98	31-May-99	30-May-00	24-May-01	23-May-02	25-May-03	25-May-03	03-Jun-05
0	92	108	3225	54	592	88	1229	89	632
62	0	75	4	43	6	0	458	286	8
457	15	12	315	19	588	244	1417	84	1798
647	378	682	3496	533	240	1856	1987	299	2582
21	317	407	946	1328	1110	22	2	2134	1746
9	168	9	50	0	8	11	0	2	74
11	136	0	11	0	30	15	0	0	10
0	0	0	0	0	0	0	0	0	42
36	199	1	114	194	54	7	0	0	71
0	0	15	0	0	0	0	0	29	298
0	0	0	9	27	0	0	0	0	239
131	104	73	1171	23	1818	327	14117	258	611
84	109	80	21	184	92	16	739	377	118
40	2		16	0	708	0	12	49	2276
18	9	221	51	242	676	158	204	60	59
66	104	24	12	8	536	74	68	22	82
100	3457	13	18	14	71	14	97	36	43
1682	5090	1720	9459	2669	6529	2832	20330	3726	10689
1682	5090	1720	9459	2669	6529	2832	20330	3726	10689
2843	48785	2783	16197	5747	12873	6743	200410	8706	17805
2.101	12.71	2.14	2.23	2.26	3.18	2.57	12.71	2.306	3
553	3438	497	3022	1362	1995	1522	14168	2160	2769

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) mean survey date	Strata	Vessel Area Sq. mi.	WT 105-106 1991 07-May-91	WT 119-120 1992 08-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
201-300	723	155	1970	13573	43	32	0	46	77	53	0
	725	105	401	nf	0	95	73	34	16	49	33
	727	160	833	2144	1444	222	211	1394	109	55	44
301-400	724	124	69	112	9	34	17	0	50	61	0
	726	72	0	0	0	0	70	0	12	0	0
	728	156	0	0	0	0	43	0	0	0	0
401-500	752	134	nf	nf	nf	0	nf	nf	nf	nf	nf
	756	106	nf	nf	nf	0	nf	nf	nf	nf	nf
	760	154	nf	nf	nf	0	nf	nf	nf	nf	nf
total all strata fished			20429	54003	30916	1504	1597	4789	8165	5545	11214
upper			38845	212125	287928	3892	3156	24093	85786	8939	16037
t-value			4.303	12.706	12.706	4.303	2.365	12.706	12.71	2.14	2.45
1 STD			4280	12445	20228	555	659	1519	6107	1586	1969

Table 10 Cont'd

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 26-May-03	WT 618-621 2005 03-Jun-05
139	3179	1658	550	85	0
361	661	148	0	0	0
383	528	446	50	0	0
0	45	62	8	9	0
0	0	36	0	0	0
0	0	0	0	0	0
nf	nf	nf	nf	nf	nf
nf	nf	nf	nf	nf	nf
nf	nf	nf	nf	nf	nf
5460	13279	5845	13926	8972	15839
7953	31301	28722	128156	16121	96713
2.13	4.3	12.71	12.71	2.13	12.71
1170	4191	1800	8990	3356	6363

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) mean survey date	Strata	Vessel Area Sq. mi.	WT 105-106 1991 07-May-91	WT 119-120 1992 08-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
201-300	723	155	662	3415	30	26	0	35	80	77	0
	725	105	186	nf	0	32	8	19	9	10	13
	727	160	486	805	313	86	41	677	71	25	6
301-400	724	124	30	32	9	22	26	0	40	191	0
	726	72	0	0	0	0	31	0	5	0	0
	728	156	0	0	0	0	26	0	0	0	0
401-500	752	134	nf	nf	nf	0	nf	nf	nf	nf	nf
	756	106	nf	nf	nf	0	nf	nf	nf	nf	nf
	760	154	nf	nf	nf	0	nf	nf	nf	nf	nf
total all strata fished			30901	15795	18982	880	566	2430	5295	2024	9479
upper			50596	28054	144081	2151	888	6155	49001	3168	16216
t-value			2.306	3.182	12.706	4.303	2.571	4.303	12.71	2.13	2.23
1 STD			8541	3853	9846	295	125	866	3439	537	3021

Table 11 Cont'd

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 26-May-03	WT 618-621 2005 03-Jun-05
270	2233	1598	956	46	0
163	443	100	0	0	0
180	295	96	25	0	0
0	100	36	25	6	0
0	0	12	0	0	0
0	0	0	0	0	0
nf	nf	nf	nf	nf	nf
nf	nf	nf	nf	nf	nf
nf	nf	nf	nf	nf	nf
3281	9601	4673	21336	3778	10692
6357	18074	11424	201747	8759	17805
2.23	3.18	3.18	12.71	2.31	2.57
1379	2664	2123	14199	2156	2768

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 03-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 04-May-94	WT 168-169 1995 07-May-95
31-50	330	2089	7761	7892	3707	11315	5384	1609	4990	1424	203	373	0	0
	331	456	3863	1921	744	1900	1425	792	1052	158	32	0	0	0
	338	1898	23356	9724	8933	20210	6623	20166	8436	24463	2285	835	132	264
	340	1716	10606	9414	10282	146151	2826	1960	3628	2569	334	119	286	0
	351	2520	78342	17578	117725	71723	13335	6112	6242	2071	1050	350	250	0
	352	2580	41362	17656	9803	35888	56193	10474	14499	9752	3852	1331	1299	1111
	353	1282	0	2226	2773	29082	44478	4731	6499	1297	4229	223	0	285
51-100	329	1721	5928	2390	2838	133032	5259	5577	13147	22309	508	1673	13959	1100
	332	1047	436	3432	1115	30014	2908	3112	5700	683773	29607	296105	0	2399
	337	948	1909	5688	1369	1799	2337	10402	2133	22436	6913	231602	132	527
	339	585	14625	894	135	2383	488	27	1625	1571	609	406	0	0
	354	474	2238	1843	2216	65669	2271	593	395	9019	1679	1415	0	0
101-150	333	151	0	42	105	566	0	378	136	692	975	514	2205	10
	336	121	0	17	126	17	8	8	143	160	5537	437	605	0
	355	103	0	4070	29	207	43	987	193	2339	944	236	50	7
151-200	334	92	0	236	1323	26	121	141	543	1214	971	1137	533	200
	335	58	0	0	68	8	12	16	97	27	1275	342	157	52
	356	61	0	0	13	4	51	131	110	546	2665	424	491	13
total strata fished < 200 fathoms			190427	85023	163306	549997	143763	67215	68515	785821	63667	537522	20100	5967
total <200 fathoms adjusted			190426	85023	163304	549994	143762	67216	69568	785820	63668	537522	20099	5968
upper limit			242768	109795	363874	823914	229667	89730	90269	2506436	126262	3992300	58534	10117
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
1 std dev			23492	12072	92856	118784	39030	10972	10310	669240	22549	271901	13845	1800

Table 12 Cont'd Cod abundance (000's) from Canadian Spring RV Surveys in Division 3O for depths <200 fathoms

WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
188-189	204-208	221-222	238-241	315-318	365 +367	419-424	478-481	546-549	618-621
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
11-May-96	16-May-97	22-May-98	19-May-99	16-May-00	07-May-01	05-May-02	11-May-03	18-May-04	16-May-05
4824	509	4310	4037	8680	1519	616	270	1204	5090
348	0	8343	452	2635	3858	220	63	1725	1976
2109	160	895	15015	6571	7006	3264	1044	970	9095
1441	529	173	1770	3682	567	189	330	283	519
525	453	277	1631	12046	1820	545	217	43	1127
1115	927	1278	14932	5481	3372	1730	754	877	5989
677	0	564	507	1693	397	321	220	139	887
330	765	8194	8370	1278	2746	379	2557	440	1868
3184	432	720	8121	27653	816	672	96	3271	0
2502	681	1239	9389	3032	1130	478	565	366	452
46	0	121	497	40	281	201	0	0	80
66	0	4583	4864	587	163	33	33	0	246
688	1447	194	25	92	71	20	9	10	10
8	128	25	17	0	42	92	0	67	0
2573	6	50	44	39	234	31	21	65	6
184	94	26	28	70	54	1017	19	17	0
490	211	36	37	13	278	357	4	0	0
93	70	82	67	96	62	149	22	67	0
21202	6412	31110	69803	73688	24416	10314	6224	9545	27345
21203	6412	31110	69803	73688	24416	10314	6224	9545	27345
32019	25638	65284	102583	110064	31201	14550	12891	19085	43328
2.365	12.706	2.78	2.2	2.45	2.14	2.36	2.776	4.303	2
4574	1513	12293	14900	14847	3171	1795	2402	2217	6772

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 03-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 04-May-94	WT 168-169 1995 07-May-95
31-50	330	2089	7964	9372	4167	12075	4486	3318	5091	266	32	92	0	0
	331	456	4536	4891	1295	1982	2176	481	2191	236	224	0	0	0
	338	1898	43090	13670	23245	20013	14538	25430	9315	10283	11883	4981	1841	3439
	340	1716	13654	10780	12024	161120	16447	5478	10296	384	52	1936	160	0
	351	2520	68620	34516	90852	114632	25324	19777	22343	6595	2063	1198	131	0
	352	2580	51655	41868	24245	76430	82226	43865	38424	22512	16671	8225	1584	3784
	353	1282	0	9451	1831	15552	4512	4012	5892	1267	1780	3260	0	609
51-100	329	1721	1776	1931	1114	116331	16127	1690	4684	4195	97	219	10523	2187
	332	1047	4410	17134	4092	12848	11718	2156	11266	39264	3927	108245	0	1702
	337	948	741	2976	11644	4299	1005	5735	3354	5566	20721	79783	813	1659
	339	585	3355	730	73	943	496	219	385	92	87	43	0	0
	354	474	955	660	569	6915	1211	87	562	3325	191	1319	0	0
101-150	333	151	0	330	411	1837	0	1486	381	877	273	1661	8549	26
	336	121	0	81	120	35	39	44	318	111	1733	375	661	0
	355	103	0	724	29	259	38	538	198	329	63	169	32	31
151-200	334	92	0	898	4773	120	473	294	826	1385	1018	1408	959	333
	335	58	0	0	159	38	82	16	110	10	276	2522	453	342
	356	61	0	0	42	15	178	154	219	88	308	387	257	16
total strata fished < 200 fathoms			200758	150013	180686	545446	181076	114780	113664	96783	61399	215824	25964	14127
total <200 fathoms adjusted			200756	150012	180685	545444	181076	114780	115855	96785	61399	215823	25963	14128
upper limit			259926	187944	303904	774350	254658	184780	143844	187783	120673	1396053	56360	20543
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
1 std dev			26557	18667	57045	107416	34873	32407	14933	35395	21352	92888	11823	3094

Table 13. Cod biomass (t) from Canadian Spring RV Surveys in Division 3O for depths <200 fathoms

WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
188-189	204-208	221-222	238-241	315-318	365 +367	419-424	478-481	546-549	618-621
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
11-May-96	16-May-97	22-May-98	19-May-99	16-May-00	07-May-01	05-May-02	11-May-03	31-May-04	16-May-05
7103	357	12526	8593	8401	2296	190	20	2806	5951
983	0	34685	1105	6842	1738	1251	326	8186	773
1535	196	5069	9416	6982	13092	2456	4712	1625	1688
239	186	512	3857	2164	1469	33	25	1735	1901
104	286	1888	5269	47572	4266	38	38	583	1293
1528	2869	5341	14309	8226	11344	6932	3093	3130	6446
118	0	18	1719	7130	529	4394	607	758	141
191	614	13037	9671	628	896	63	1623	173	1569
1534	1558	2136	1350	4360	272	42	462	906	0
3299	527	1720	3095	1040	553	160	171	890	360
5	0	441	1210	1	733	48	0	0	3
85	0	2258	1088	218	737	218	474	0	484
1625	974	255	26	77	43	31	13	2	20
19	322	16	18	0	46	95	0	96	0
2344	15	74	26	13	169	27	2	51	22
259	305	46	72	98	33	1241	18	87	0
680	734	75	207	37	254	437	8	0	0
46	47	102	108	442	69	142	26	131	0
21696	8990	80199	61139	94231	38539	17798	11618	21158	20651
21697	8990	80199	61139	94231	38539	17798	11618	21158	20650
32630	15716	546664	86203	206438	52036	27516	18496	135184	30645
2.306	2.201	12.71	2.09	2.36	2.09	2.18	2.13	12.71	2.14
4742	3056	36701	11992	47545	6458	4458	3229	8974	4670

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 04-May-94	WT 168-169 1995 07-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
201-300	717	166	3701	336	1615	1441	242	27	176	20	37	122
	719	76	274	749	301	443	164	21	39	5	107	18
	721	76	190	72390	348	11	5	84	103	5	5	7
301-400	718	134	15	0	100	503	102	0	7	0	0	0
	720	105	0	569	15	211	29	6	103	12	7	0
	722	93	0	149	0	0	0	11	6	0	0	0
401-500	764	105	nf	nf	nf	0	nf	nf	nf	nf	nf	nf
	772	135	nf	nf	nf	0	nf	nf	nf	nf	nf	nf
total all strata fished			790001	137860	539900	22708	6510	21352	6844	31153	69960	73837
upper			2510624	1092111	3994696	61281	10713	32169	26139.7	65326	102739	110211
t-value			2.571	12.706	12.706	2.776	2.306	2.365	12.706	2.78	2.2	2.45
1 STD			669243	75102	271903	13895	1823	4574	1519	12292	14900	14847

Table 14 Cont'd

WT 365 +367 2001 07-May-01	WT 419-424 2002 05-May-02	WT 478-481 2003 11-May-03	WT 546-549 2004 18-May-04	WT 618-621 2005 16-May-05
838	183	114	553	34
134	0	21	8	52
67	9	19	5	0
0	18	0	0	0
7	17	0	0	0
17	0	0	0	0
nf	nf	nf	nf	nf
nf	nf	nf	nf	nf
25478	10540	6378	10112	27432
32326	14786	13046	17319	43416
2.1	2.36	2.776	3.18	2.36
3261	1799	2402	2266	6773

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)	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 04-May-94	WT 168-169 1995 07-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 07-May-01	WT 419-424 2002 05-May-02	WT 478-481 2003 11-May-03	WT 546-549 2004 18-May-04	WT 618-621 2005 16-May-05
201-300	717	166	15218	436	1870	2094	339	57	238	30	47	108	585	164	190	1224	71
	719	76	143	179	330	727	927	37	133	2	243	59	137	0	33	23	26
	721	76	88	12153	304	16	10	95	53	16	11	20	323	22	39	9	0
301-400	718	134	7	0	159	791	91	0	16	0	0	0	0	18	0	0	0
	720	105	0	139	9	222	34	3	164	11	20	0	41	25	0	0	0
	722	93	0	70	0	0	0	28	5	0	0	0	52	0	0	0	0
401-500	764	105	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	772	135	nf	nf	nf	0	nf	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	20747
upper			202678	137245	1398738	60382	22196	32850	16345	546724	86530	206626	53209	27747	18765	137134	30744
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	2.18
1 STD			36959	24453	92889	11890	3223	4742	3065	36701	11996	47546	6475	4459	3232	9026	4586

Table 15 Cont'd

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							Tel 42		Tel 76		Tel 338-339	Tel 357	Tel 411-412	WT 485-487	WT 557-558	WT 627-630	WT 704-706
			WT	WT	WT	WT	WT	WT	AN253 WT	WT	WT	WT	WT	WT	WT	Tel 468		Tel 608-609	
			101-102	113-115	128-130	144-146	160-161	176-177	200	212-214	229-233	244-247	319-323	372-373	427-428				
			1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
			06-Dec-90	03-Nov-91	29-Oct-92	07-Nov-93	02-Nov-94	13-Oct-95	01-Dec-96	16-Oct-97	20-Nov-98	13-Nov-99	12-Nov-00	18-Oct-01	20-Oct-02	28-Oct-03	18-Nov-04	21-Oct-05	16-Oct-06
0-30	375	1593	5421	66596	nf	2047	1947	5001	0	603	329	14518	8163	4492	2849	446	438	3671	3999
	376	1499	32419	455280	354763	260	312	3956	93	41	1598	361	819	876	317	324	2062	7099	987
31-50	360	2992	28703	12311	8311	3463	0	437 `		137	309	2367	1132	2345	360	1242	1543	2036	14200
	361	1853	6273	14155	20718	6177	7549	3788	2025	2156	5761	1733	3161	6780	1173	4952	4282	12672	4384
	362	2520	12855	73045	49583	1300	622	910	104	898	792	7924	6478	6438	314	99	198	1882	495
	373	2520	1336	22575	1400	750	0	70	130	50	149	3004	341	446	149	57	149	106	248
	374	931	879	20754	nf	819	1034	57	65	43	171	512	85	1836	256	0	171	0	640
	383	674	530	530	nf	0	0	47	0	0	46	0	0	0	0	0	46	0	46
51-100	359	421	702	0	497	88	0	29	52	29	0	0	550	290	463	434	116	608	145
	377	100	243	nf	493	0	7	7	12	0	0	21	21	481	51	0	206	35	76
	382	647	210	359	270	494	0	0	33	0	0	134	134	0	45	0	0	89	0
101-15	358	225	766	1500	5063	47	94	56	14	15	247	340	1156	342	437	356	279	512	1024
	378	139	550	2046	1602	48	10	10	0	17	10	1472	1785	226	476	36	315	1520	1430
	381	182	nf	0	nf	202	0	0	233	8	13	138	338	1702	13	0	2078	82	138
151-20	357	164	683	399	194	1526	57	20	39	0	124		168	61	10	102	124	229	302
	379	106	213	nf	596	655	81	33	52	79	13	988	164	663	47	52	54	91	58
	380	116	nf	798	nf	48	16	57	24	16	0	383	563	14	465	104	96	56	83
total strata fished <= 200			91783	670348	443490	17924	11729	14478	3359	4092	9562	33895	25058	26992	7425	8204	12158	30688	28255
UPPER			156111	1657056	1675218	26592	20479	21567	6774	5741	14597	59471	41671	37378	16677	10433	20572	57783	59612
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	2.45	2.36
1 std			29227	355442	286249	4041	3576	3221	1328	757	2228	9200	7551	4853	2909	1013	3027	11059	13287
201-30	723	155	nf	0	nf	97	0	0	43	6	0	0	0	0	0	0	0	0	0
	725	105	nf	nf	0	80	0	12	22	0	7	7	0	7	14	0	nf	7	63
	727	160	nf	nf	nf	878	11	9	267	0	0	22	49	0	11	25	0	0	9
301-40	724	124	nf	0	nf	17	0	0	19	0	0	0	0	0	0	nf	0	0	0
	726	72	nf	nf	nf	0	0	0	10	0	0	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	0	0
Total strata > 200 fathoms			0	0	0	1072	11	21	437	6	7	29	49	7	25	25	43	7	72
Total all strata fished			91783	670348	443490	18996	11741	14498	3795	4098	9568	33924	25115	26972	7447	8229	12201	30696	28326
Upper limit			156111	1657056	1675228	27812	20490	21588	7257	5747	14604	59500	41720	37386	16702	10459	20616	57783	59684
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	2.45	2.36
1 std			29227	355442	286251	4137	3575	3221	1375	757	2228	9200	7548	4866	2910	1014	3027	11056	13287

Table 16 Cont'd Biomass

Depth Range	Strata	Area	WT 101-102 1990 06-Dec-90	WT 113-115 1991 03-Nov-91	WT 128-130 1992 29-Oct-92	WT 144-146 1993 07-Nov-93	WT 160-161 1994 02-Nov-94	WT 176-177 1995 13-Oct-95	Tel 42 AN253 WT 200 1996 01-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	WT 627-630 Tel 608-609 2005 21-Oct-05	WT 704-706 2006 16-Oct-06
0-30	375	1593	31395	69276	nf	3305	9447	3162	0	594	839	2022	8642	1490	2135	192	47	487	6913
	376	1499	5147	80732	116390	152	993	4035	806	12	791	46	2677	2351	813	1025	23	5798	2112
31-50	360	2992	7585	4456	4572	8072	0	1329	319	1226	1258	8681	1536	3183	217	2917	5334	2220	12038
	361	1853	24777	16326	12485	12996	12111	8626	1734	3255	3811	1060	1986	3319	4519	6749	9089	8438	2887
	362	2520	9636	40955	22852	1576	1001	337	29	2581	713	4955	2840	4146	1597	582	54	3160	1582
	373	2520	9722	26255	4114	254	0	39	49	26	60	1948	125	324	154	1	14	33	95
	374	931	2501	9699	nf	1102	2414	15	27	45	196	111	20	1042	172	0	31	0	1501
	383	674	216	164	nf	0	0	54	0	0	0	0	0	0	0	0	6	0	34
51-100	359	421	39	0	156	39	0	12	36	25	0	0	458	249	601	814	94	317	217
	377	100	122	nf	257	0	13	11	11	0	0	6	3	660	68	0	382	19	89
	382	647	129	73	115	168	0	0	93	0	0	93	116	0	12	0	0	16	0
101-15	358	225	404	430	2464	45	51	61	10	80	327	197	933	470	467	358	105	262	468
	378	139	362	635	461	12	11	8	0	21	9	729	1156	174	276	43	99	711	832
	381	182	nf	0	nf	119	0	0	118	5	8	39	86	1583	9	0	1890	80	34
151-20	357	164	370	205	120	629	42	46	19	0	245		311	172	9	66	201	221	184
	379	106	318	nf	317	240	96	20	27	108	8	644	129	675	79	53	133	41	38
	380	116	nf	117	nf	32	10	26	12	10	0	223	178	3	879	48	54	48	37
total strata <= 200 fathoms			92723	249323	164303	28741	26189	17781	3290	7988	8265	20754	21196	19841	12007	12848	17558	21851	29061
UPPER			151903	392215	555906	46078	45182	26812	6083	11520	16104	33819	32744	28793	19789	20811	33657	37701	55222
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	2.45	2.26
1 std			25023	64135	91007	7956	7249	4298	1185	1681	3200	5781	5346	4203	3490	3571	6793	6469	11576
201-30	723	155	nf	0	nf	63	0	0	24	18	0	0	0	0	0	0	0	0	0
	725	105	nf	nf	0	90	0	10	13	0	18	10	0	6	6	0	nf	4	49
	727	160	nf	nf	nf	484	12	3	97	0	0	39	34	0	11	10	0	0	3
301-40	724	124	nf	0	nf	12	0	0	40	0	0	0	0	0	0	nf	0	0	0
	726	72	nf	nf	nf	0	0	0	15	0	0	0	0	0	0	0	0	0	0
	728	156	nf	nf	nf	nf	0	0	34	0	0	0	0	0	0	44	0	0	0
Total strata > 200 fathoms			0	0	0	649	12	13	223	18	18	49	34	6	17	10	44	4	52
Total all strata fished			92723	249323	16303	29389	26200	17793	3510	8006	8283	20823	21230	19847	12024	12857	17602	21858	29113
Upper limit			151903	392216	555901	46760	45195	26825	6314	11538	16122	33869	32779	28799	19806	20821	33699	37705	55275
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	2.45	2.26
1 std			25023	64135	125400	7972	8397	4299	1186	1681	3200	5773	5347	4203	3490	3571	6821	6468	11576

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 06-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 05-Nov-04	WT 627-630 Tel 608-609 2005 08-Oct-05	WT 704-706 2006 04-Oct-06
31-50	330	2089	10709	10264	7036	5271	2072	3946	279	1006	3113	6178	4428	9339	4133	1293	886	1533	1485
	331	456	507	6682	222	222	95	760	32	31	408	721	1505	265	376	94	157	470	345
	338	1898	20199	10334	857	6221	330	2478	264	52	835	4804	3580	209	835	261	112	3081	2611
	340	1716	4158	5625	7746	1859	763	1668	95	519	1747	5665	6945	2172	2408	1369	1039	964	991
	351	2520	29085	24185	3558	10450	661	2709	198	1684	347	9244	11737	9013	2091	1436	842	2327	2526
	352	2580	10248	24761	2747	4710	717	972	287	1006	761	2789	9419	6405	2980	4780	1680	3397	4741
	353	1282	1781	223	0	0	0	415	0	0	0	661	0	0	0	44	756	1146	453
51-100	329	1721	531	1605	558	239	1036	574	478	95	710	521	255	710	326	331	101	0	221
	332	1047	1721	1127	436	2036	242	0	0	48	288	576	624	96	331	48	1296	946	288
	337	948	1001	66	198	307	0	0	0	0	0	130	82	130	0	174	0	143	43
	339	585	163	0	41	528	41	41	0	80	126		40	80	322	443	46	80	80
	354	474	1580	0	1712	0	0	165	340	130	33	554	33	0	6181	0	37	32	65
101-150	333	151	21	0	10	0	0	0	nf	0	0	0	10	0	0	0	0	0	0
	336	121	6	0	0	67	0	0	8	0	0	0	42	0	0	0	0	0	0
	355	103	nf	887	64	172	0	13	342	0	0	28	14	0	0	0	28	0	63
151-200	334	92	13	0	0	9	0	0	nf	0	0	0	0	0	0	0	0	0	6
	335	58	12	4	0	0	0	0	133	12	4	0	4	0	0	0	0	0	0
	356	61	nf	4	0	102	0	0	40	0	17	7	25	4	4	0	0	0	4
Total strata fished <= 200 fathoms			81735	85767	25185	32193	5957	13741	2496	4663	8388	31880	38743	28424	19988	10274	6980	14122	13923
upper			117569	117451	40427	48506	11071	18760	3870	6604	11951	43691	51707	35723	99783	15883	10678	20041	18846
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	2.11	2.1
1 std			17121	15463	6229	7605	2162	2367	562	916	1598	5651	6086	3443	6278	2515	1681	2805	2344
201-300	717	93	0	nf	nf	0	0	0	nf	0	0	10	0	0	0	0	0	0	0
	719	76	0	0	nf	0	5	0	37	0	0	0	3	0	0	0	0	0	0
	721	76	nf	0	nf	0	0	0	0	0	5	0	0	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	0	nf
	720	105	nf	nf	nf	0	0	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	0	0
total strata fished > 200 fathoms			0	0	0	0	0	5	37	0	5	10	3	0	0	0	0	0	0
total all strata fished			81735	85767	25185	32193	5961	13740	2534	4663	8394	31891	38746	28424	19988	10274	6980	14122	13923
upper			117569	117451	40427	48506	11077	18760	3907	6604	11957	43705	51710	35723	99783	15833	10678	20041	18846
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	2.11	2.1
1 STD			17574	15471	6229	7605	2163	2368	561	916	1598	5653	6086	3443	6278	2438	1681	2805	2344

Table 17 Cont'd Biomass

			Biomass						WT 200 Tel 41-42 AN 253		Tel 76				Tel 357	Tel 411-412	WT 485-487 Tel 468	WT 557-558	WT 627-630 Tel 608-609	WT 704-706
Depth			WT	WT	WT	WT	WT	WT		WT	WT	WT	WT	WT	WT	WT				WT
Range	Strata	Area	101-102	113-115	128-130	144-146	160-161	176-177		212-214	229-233	244-247	319-323	372	427-428				
	mean survey date		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
			26-Nov-90	24-Oct-91	23-Oct-92	27-Oct-93	31-Oct-94	10-Oct-95	10-Dec-96	16-Oct-97	20-Nov-98	22-Oct-99	18-Oct-00	06-Oct-00	10-Oct-02	11-Oct-03	05-Nov-04	08-Oct-05	04-Oct-06
31-50	330	2089	6651	2374	2574	4278	1928	6035	302	1779	2027	2379	1817	5922	4037	1547	440	1664	1347
	331	456	27	1047	191	267	172	1455	11	85	735	367	574	155	481	243	641	442	713
	338	1898	13966	7122	2760	3763	91	5283	26	167	1786	16088	5978	558	493	238	267	3592	1804
	340	1716	3635	6247	6711	1231	832	3149	37	951	2108	2902	5371	1785	2542	2028	2663	3002	421
	351	2520	17027	21473	3142	9895	679	5052	74	4806	815	7355	5249	8149	2296	2002	685	4017	1348
	352	2580	21151	32262	3137	4920	4775	3195	1353	3220	1198	9096	14518	7207	4081	8617	3025	4231	4782
	353	1282	4593	56	0	0	0	2238	0	0	0	716	0	0	0	2	239	1604	1105
51-100	329	1721	1291	1019	109	245	1546	1052	370	159	820	684	86	810	1407	566	267	0	185
	332	1047	767	74	254	1323	452	0	0	0.48	1	18	33	41	960	62	225	31	312
	337	948	2331	70	373	176	0	0	0	0	0	21	12	91	0	111	0	25	17
	339	585	1242	0	64	447	56	46	0	276	606		161	50	447	769	23	145	25
	354	474	66	0	896	0	0	161	260	96	42	184	18	0	8920	0	3	4	26
101-150	333	151	12	0	12	0	0	0	nf	0	0	0	4	0	0	0	0	0	0
	336	121	29	0	0	107	0	0	11	0	0	0	49	0	0	0	0	0	0
	355	103	nf	155	31	104	0	15	235	0	0	25	11	0	0	0	19	0	51
151-200	334	92	16	0	0	21	0	0	nf	0	0	0	0	0	0	0	0	0	6
	335	58	13	8	0	0	0	0	303	16	8	0	1	0	0	0	0	0	0
	356	61	nf	8	0	68	0	0	39	0	30	13	28	2	11	0	0	0	9
Total strata fished <= 200 fathoms			72817	71915	20254	26845	10531	27681	3021	11555.48	10177	39849	33912	24769	25674	16184	8499	18756	12150
upper			97492	98551	29947	43938	17481	41388	6586	16785	13788	84258	48733	33277	139889	30377	14807	28652	17312
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	2.14	2.09
1 std			11789	12726	4404	7412	3158	6346	1387	2467	1753	15974	6737	4051	8993	5989	2867	4624	2470
201-300	717	93	0	nf	nf	0	0	0	nf	0	0	1	0	0	0	0	0	0	0
	719	76	0	0	nf	0	14	0	55	0	0	0	5	0	0	0	0	0	0
	721	76	nf	0	nf	0	0	0	0	0	9	0	0	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	0	nf
	720	105	nf	nf	nf	0	0	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	0	0
total strata fished > 200 fathoms			0	0	0	0	0	14	0	55	0	9	1	5	0	0	0	0	0
total all strata fished			72817	7195	20254	26845	10546	27681	3078	11555	10186	39850	33917	24769	25675	16184	8499	18756	12150
upper			97492	98552	29947	43938	17496	41388	6641	16785	13797	84259	48738	33277	139888	30377	14808	28652	17312
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	2.14	2.09
1 STD			11789	43649	4404	7412	3158	6346	1386	2467	1753	15974	6737	4051	8986	5989	2868	4624	2470

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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
19	0.00	0.02	0.03	0.02	0.03	0.03	0.05	0.00	0.01	0.01	0.01	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

Table 18 Cont'd

2001	2002	2003	2004	2005
0.00	0.00	0.00	0.00	0.00
0.15	0.23	0.30	1.18	2.64
1.88	0.66	0.58	1.12	2.05
2.91	0.98	0.47	0.50	2.76
1.01	0.40	0.51	0.19	0.48
0.26	0.23	1.03	0.13	0.20
0.01	0.10	0.82	0.18	0.07
0.06	0.01	0.12	0.18	0.33
0.07	0.06	0.01	0.07	0.26
0.01	0.01	0.05	0.02	0.13
0.01	0.02	0.02	0.08	0.02
0.16	0.01	0.02	0.02	0.07
0.40	0.03	0.01	0.03	0.02
0.04	0.16	0.08	0.02	0.00
0.02	0.00	0.08	0.02	0.00
0.00	0.01	0.01	0.10	0.03
0.01	0.00	0.00	0.01	0.02
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.01	0.00
0.00	0.00	0.00	0.00	0.00
7.00	2.91	4.11	3.86	9.08

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
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.07
1	18.89	14.87	0.41	1.30	0.00	1.15	0.08	0.03	1.67	4.44	2.12
2	6.15	129.66	49.65	0.72	0.62	1.02	0.74	0.10	0.29	5.01	3.77
3	3.25	4.36	65.00	3.63	0.28	0.46	0.29	0.40	0.20	2.52	4.75
4	3.56	2.19	4.70	3.59	0.96	0.20	0.06	0.33	0.32	0.13	1.81
5	1.73	2.73	1.02	0.30	1.32	0.94	0.01	0.14	0.11	0.37	0.20
6	0.37	1.33	0.61	0.27	0.16	1.64	0.02	0.06	0.06	0.30	0.24
7	0.29	0.37	0.18	0.18	0.04	0.11	0.02	0.28	0.01	0.08	0.11
8	0.38	0.31	0.03	0.10	0.06	0.05	0.01	0.28	0.16	0.04	0.03
9	0.40	0.53	0.03	0.02	0.01	0.06	0.00	0.05	0.22	0.12	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
11	0.20	0.45	0.00	0.06	0.03	0.00	0.00	0.00	0.01	0.04	0.24
12	0.09	0.33	0.06	0.04	0.03	0.02	0.00	0.00	0.00	0.00	0.01
13	0.15	0.27	0.12	0.04	0.02	0.02	0.01	0.00	0.00	0.00	0.01
14	0.07	0.21	0.03	0.05	0.06	0.00	0.01	0.01	0.00	0.02	0.00
15	0.16	0.12	0.03	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00
16	0.21	0.38	0.02	0.02	0.03	0.00	0.01	0.01	0.00	0.02	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
18	0.02	0.06	0.08	0.02	0.01	0.00	0.00	0.00	0.01	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
1+	36.26	158.70	122.07	10.43	3.67	5.72	1.26	1.74	3.09	13.68	13.33

Table 19 Cont'd

	2001	2002	2003	2004	2005	2006
	0.06	0.13	0.16	1.08	0.27	0.21
	0.34	0.33	0.96	0.97	4.24	0.19
	2.64	0.61	0.27	0.63	2.42	2.10
	4.70	1.13	0.26	0.35	1.24	3.94
	2.55	1.58	0.35	0.14	0.23	1.27
	0.98	1.31	0.78	0.12	0.07	0.47
	0.07	0.39	0.83	0.23	0.06	0.13
	0.16	0.03	0.14	0.24	0.27	0.05
	0.06	0.06	0.01	0.12	0.38	0.20
	0.02	0.04	0.02	0.01	0.10	0.09
	0.02	0.00	0.05	0.04	0.00	0.12
	0.00	0.03	0.00	0.00	0.04	0.04
	0.05	0.03	0.00	0.00	0.01	0.01
	0.01	0.05	0.02	0.00	0.03	0.00
	0.00	0.01	0.02	0.07	0.00	0.00
	0.00	0.00	0.00	0.03	0.02	0.01
	0.00	0.01	0.00	0.00	0.03	0.02
	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
	11.60	5.61	3.71	2.95	9.14	8.64

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 2005 projected forward to 2010 and back to 1954
Estimates were obtained from a probit model fitted by cohort to observed proportions mature at age. When the model did not fit
the data for a particular cohort (I.e 1991 cohort) the average of estimates for the same age group from adjacent years
was used; yellow cells are 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	0.0170	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	0.1035	0.5240	0.9155	0.9834	0.9991	1.0000	1.0000	1.0000	0.9998	1.0000	1.0000
2000	0.0000	0.0003	0.0011	0.0135	0.4356	0.9095	0.9882	0.9982	0.9999	1.0000	1.0000	1.0000	0.9999	1.0000
2001	0.0000	0.0002	0.0066	0.0278	0.1676	0.8377	0.9892	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2002	0.0000	0.0002	0.0067	0.1366	0.4280	0.7473	0.9718	0.9988	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2003	0.0000	0.0002	0.0048	0.1599	0.7908	0.9514	0.9775	0.9957	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
2004	0.0000	0.0002	0.0048	0.1081	0.8430	0.9891	0.9981	0.9984	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
2005	0.0000	0.0002	0.0048	0.1081	0.6873	0.9934	0.9995	0.9999	0.9999	0.9999	1.0000	1.0000	1.0000	1.0000
2006	0.0000	0.0002	0.0048	0.1081	0.6873	0.9780	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2007	0.0000	0.0002	0.0048	0.1081	0.6873	0.9780	0.9991	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2008	0.0000	0.0002	0.0048	0.1081	0.6873	0.9780	0.9991	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2009	0.0000	0.0002	0.0048	0.1081	0.6873	0.9780	0.9991	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2010	0.0000	0.0002	0.0048	0.1081	0.6873	0.9780	0.9991	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 22. Estimated survivors and catchabilities in linear scale from ADAPT

ORTHOGONALITY OFFSET.........   0.001261
MEAN SQUARE RESIDUALS 0.685267

Survivors

Year	Age	Estimate	Standard Error	Bias	Relative Bias
1994	12	81.95	67.45	14.76	0.18
1995	12	51.13	25.45	5.05	0.10
1996	12	30.92	11.52	1.97	0.06
1997	12	66.23	22.44	3.69	0.06
1998	12	93.53	33.16	5.66	0.06
1999	12	46.46	17.29	2.91	0.06
2000	12	51.36	16.61	2.53	0.05
2001	12	457.29	136.00	19.38	0.04
2002	12	218.36	63.74	9.09	0.04
2003	12	31.16	9.10	1.27	0.04
2004	12	39.24	12.13	1.70	0.04
2005	12	65.97	21.05	2.95	0.04
2006	12	70.33	24.08	3.52	0.05
2007	3	2101.55	1801.41	792.86	0.38
2007	4	2071.48	1088.89	291.01	0.14
2007	5	774.62	343.50	74.79	0.10
2007	6	219.32	94.08	18.34	0.08
2007	7	116.49	46.88	8.97	0.08
2007	8	114.73	44.25	8.69	0.08
2007	9	373.70	137.84	25.36	0.07
2007	10	380.89	135.04	22.91	0.06
2007	11	138.56	47.77	7.54	0.05
2007	12	17.66	5.87	0.92	0.05

Catchabilities	Age	Estimate	Standard Error	Bias	Relative Bias
RV Spr	2	0.00103	0.00019	0.00001	0.00846
RV Spr	3	0.00138	0.00025	0.00001	0.00874
RV Spr	4	0.00068	0.00012	0.00001	0.00922
RV Spr	5	0.00045	0.00008	0.00000	0.01002
RV Spr	6	0.00030	0.00006	0.00000	0.01096
RV Spr	7	0.00032	0.00006	0.00000	0.01246
RV Spr	8	0.00034	0.00007	0.00000	0.01468
RV Spr	9	0.00040	0.00008	0.00001	0.01714
RV Spr	10	0.00050	0.00010	0.00001	0.02121
RV Fall	2	0.00098	0.00021	0.00001	0.01316
RV Fall	3	0.00109	0.00023	0.00001	0.01302
RV Fall	4	0.00087	0.00019	0.00001	0.01401
RV Fall	5	0.00076	0.00017	0.00001	0.01616
RV Fall	6	0.00064	0.00014	0.00001	0.01790
RV Fall	7	0.00042	0.00010	0.00001	0.02083
RV Fall	8	0.00041	0.00010	0.00001	0.02369
RV Fall	9	0.00033	0.00008	0.00001	0.02956
RV Fall	10	0.00046	0.00013	0.00002	0.04154
RV Juvenile	2	0.00361	0.00123	0.00019	0.05210
RV Juvenile	3	0.00189	0.00064	0.00010	0.05196
RV Juvenile	4	0.00138	0.00047	0.00007	0.05227
RV Juvenile	5	0.00113	0.00039	0.00006	0.05139
RV Juvenile	6	0.00084	0.00029	0.00004	0.05003
RV Juvenile	7	0.00062	0.00022	0.00003	0.05117
RV Juvenile	8	0.00050	0.00018	0.00003	0.05410
RV Juvenile	9	0.00032	0.00012	0.00002	0.05987
RV Juvenile	10	0.00029	0.00011	0.00002	0.07412

Table 23. Estimated bias adjusted population numbers ('000) from ADAPT for cod in NAFO Divisions 3NO.

Population numbers			Scale:	1000								
s Bias Adj(anal	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	66742	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	34540	49888	37315	11560	6720	3316	2127	1138	693	316	191735
1974	27761	36125	19251	16285	17043	4127	3733	1842	1108	713	444	128433
1975	32960	22729	23794	7287	3682	4318	1379	1147	605	307	204	98412
1976	54553	26986	18003	11616	2818	800	837	198	132	90	31	116064
1977	49999	44664	18443	8002	4211	1337	465	471	123	75	62	127854
1978	20885	40936	36020	12875	4281	2104	583	223	199	43	25	118174
1979	23689	17099	32685	25582	8276	2769	1404	386	130	117	28	112164
1980	33038	19395	13934	23311	12696	4280	1475	911	264	91	85	109480
1981	26231	27049	15639	10457	15653	8347	2819	1008	663	188	67	108122
1982	42428	21476	21690	11820	7424	10747	5124	1792	652	458	117	123728
1983	49758	34737	17308	15975	8244	5167	7422	2856	934	345	230	142975
1984	39389	40738	27376	13587	11373	5665	3612	5040	1643	551	210	149183
1985	10590	32249	33301	21511	9852	7221	3541	2310	3300	851	355	125081
1986	7767	8670	26352	24602	12043	5342	3655	2183	1478	2222	463	94776
1987	15490	6359	6960	18993	14373	5946	3016	2140	1286	875	1505	76942
1988	15388	12506	4741	5318	12408	8671	3777	1882	996	610	361	66659
1989	6147	12368	9989	3595	2983	4502	3567	2186	1032	436	277	47081
1990	6808	4918	8400	6216	1600	1316	1998	1770	1354	636	206	35221
1991	24245	5204	3070	2865	1255	514	699	990	928	715	386	40870
1992	7676	14434	3269	1908	1454	541	170	244	306	313	244	30559
1993	776	6210	7773	1101	814	643	233	81	111	136	120	17999
1994	479	605	3902	3494	335	241	241	124	44	56	67	9590
1995	910	392	288	1129	1859	163	114	173	95	35	46	5204
1996	1270	745	321	171	906	1486	131	94	141	77	29	5371
1997	451	1038	606	258	137	727	1194	105	75	113	63	4767
1998	2715	369	839	480	202	108	567	937	81	58	88	6443
1999	5711	2222	299	666	374	156	84	439	730	63	44	10788
2000	5448	4634	1735	208	454	270	115	63	339	548	49	13863
2001	2086	4451	3473	1115	92	316	202	83	48	266	438	12572
2002	980	1699	3476	2571	769	66	220	145	62	38	209	10235
2003	710	713	1195	2350	1721	503	46	156	107	48	30	7578
2004	1564	543	283	262	790	810	292	33	111	80	38	4806
2005	2945	1271	411	191	169	564	597	220	26	85	63	6542
2006	1648	2410	1040	335	154	135	436	439	162	20	67	6848
2007	1965	1309	1780	700	201	108	106	348	358	131	17	7023

Table 24 Bias adjusted fishing mortality from ADAPT for cod in NAFO Divisons 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	1.084	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	0.233	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	0.163	0.170	0.385	0.452	0.437	0.490	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	0.458	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	0.196	0.409	0.356	0.356	0.298
1986	0.000	0.020	0.127	0.337	0.506	0.372	0.335	0.329	0.324	0.190	0.385	0.385	0.324
1987	0.014	0.094	0.069	0.226	0.305	0.254	0.272	0.565	0.545	0.686	0.349	0.349	0.200
1988	0.019	0.025	0.077	0.378	0.814	0.688	0.347	0.401	0.627	0.590	0.562	0.562	0.423
1989	0.023	0.187	0.274	0.610	0.619	0.612	0.501	0.279	0.285	0.548	0.503	0.503	0.501
1990	0.069	0.271	0.875	1.400	0.936	0.433	0.502	0.446	0.439	0.300	0.579	0.579	1.071
1991	0.319	0.265	0.275	0.478	0.641	0.908	0.851	0.976	0.887	0.875	0.844	0.844	0.465
1992	0.012	0.419	0.888	0.652	0.615	0.643	0.533	0.585	0.612	0.761	0.594	0.594	0.718
1993	0.048	0.265	0.600	0.989	1.017	0.784	0.428	0.410	0.483	0.503	0.660	0.660	0.869
1994	0.000	0.543	1.040	0.431	0.524	0.547	0.127	0.074	0.025	0.000	0.000	0.318	0.665
1995	0.000	0.000	0.321	0.020	0.024	0.014	0.000	0.006	0.000	0.000	0.000	0.011	0.122
1996	0.002	0.006	0.017	0.020	0.021	0.019	0.026	0.024	0.024	0.014	0.000	0.022	0.019
1997	0.002	0.013	0.033	0.048	0.041	0.048	0.042	0.054	0.061	0.050	0.054	0.046	0.041
1998	0.000	0.009	0.031	0.049	0.056	0.052	0.056	0.049	0.056	0.080	0.065	0.054	0.045
1999	0.009	0.048	0.163	0.182	0.125	0.104	0.082	0.059	0.087	0.054	0.052	0.093	0.157
2000	0.002	0.088	0.242	0.611	0.163	0.090	0.122	0.072	0.043	0.024	0.046	0.112	0.338
2001	0.005	0.047	0.101	0.172	0.140	0.162	0.134	0.097	0.047	0.038	0.031	0.133	0.138
2002	0.119	0.152	0.191	0.202	0.225	0.163	0.145	0.104	0.055	0.030	0.032	0.159	0.206
2003	0.069	0.725	1.318	0.890	0.553	0.343	0.128	0.136	0.086	0.047	0.038	0.290	0.921
2004	0.008	0.078	0.193	0.236	0.137	0.105	0.083	0.034	0.072	0.042	0.030	0.090	0.188
2005	0.000	0.001	0.003	0.012	0.026	0.056	0.107	0.105	0.043	0.040	0.036	0.074	0.014
2006(	0.031	0.103	0.196	0.312	0.162	0.042	0.026	0.005	0.014	0.000	0.000	0.059	0.223

Table 25 Beginning of the year mean weights at age calculated from the commercial catches for cod in Divisions 3NO

sw	3	4	5	6	7	8	9	10	11	12
1959	0.30	0.66	1.00	1.62	2.57	3.13	3.67	4.42	4.84	5.69
1960	0.30	0.59	1.01	1.56	2.34	3.09	3.67	4.32	4.96	5.69
1961	0.30	0.59	1.01	1.56	2.34	3.09	3.67	4.32	4.96	5.69
1962	0.30	0.59	1.01	1.56	2.34	3.09	3.67	4.32	4.96	5.69
1963	0.30	0.59	1.01	1.56	2.34	3.09	3.67	4.32	4.96	5.69
1964	0.30	0.59	1.01	1.56	2.34	3.09	3.67	4.32	4.96	5.69
1965	0.29	0.59	1.01	1.56	2.34	3.09	3.67	4.32	4.96	5.69
1966	0.35	0.61	1.05	1.64	2.48	3.45	4.64	5.53	6.29	7.33
1967	0.35	0.66	1.10	1.70	2.60	3.65	5.17	6.98	8.07	9.31
1968	0.35	0.66	1.10	1.70	2.60	3.65	5.17	6.98	8.07	9.31
1969	0.35	0.66	1.10	1.70	2.60	3.65	5.17	6.98	8.07	9.31
1970	0.35	0.66	1.10	1.70	2.60	3.65	5.17	6.98	8.07	9.31
1971	0.34	0.66	1.10	1.70	2.60	3.65	5.17	6.98	8.07	9.31
1972	0.40	0.68	1.14	1.68	2.49	3.35	5.00	7.10	8.00	9.26
1973	0.50	0.73	1.18	1.78	2.75	3.66	4.72	7.54	9.42	10.79
1974	0.29	0.65	1.10	1.67	2.50	4.12	5.82	5.84	8.96	9.16
1975	0.25	0.61	0.97	1.60	2.48	3.45	5.08	7.02	5.36	7.72
1976	0.35	0.59	1.12	1.73	2.63	3.56	5.27	6.95	7.85	8.11
1977	0.42	0.71	1.16	1.87	2.86	3.92	5.38	7.67	10.11	10.24
1978	0.62	0.77	1.24	1.82	3.05	4.02	5.42	7.20	9.14	12.27
1979	0.51	0.84	1.21	1.80	2.54	3.72	4.68	6.65	7.60	9.79
1980	0.53	0.82	1.29	1.86	2.78	3.97	5.43	6.62	8.71	10.03
1981	0.79	0.95	1.38	2.13	2.98	4.43	6.26	8.52	9.11	10.37
1982	0.84	1.03	1.38	2.01	3.21	4.32	6.32	7.92	9.45	10.52
1983	0.73	1.05	1.48	1.99	2.89	4.46	5.74	7.78	8.89	10.40
1984	0.76	0.99	1.33	2.06	2.83	3.92	5.47	6.73	8.49	10.65
1985	0.33	0.82	1.26	1.76	2.72	3.76	5.18	6.92	8.13	9.96
1986	0.27	0.70	1.14	1.72	2.67	4.19	6.08	8.06	9.09	9.51
1987	0.34	0.57	1.15	1.67	2.50	4.08	6.27	8.44	9.83	11.19
1988	0.65	0.70	1.06	1.53	2.02	3.30	4.94	7.07	9.16	10.44
1989	0.36	0.85	1.26	1.76	2.42	3.21	5.17	6.52	8.07	10.71
1990	0.44	0.72	1.19	2.00	2.47	3.68	4.81	7.70	8.79	10.32
1991	0.51	0.68	1.27	1.83	3.10	3.90	5.58	6.74	10.01	11.40
1992	0.21	0.60	0.95	1.69	2.55	4.31	5.56	7.48	8.84	11.30
1993	0.32	0.51	0.94	1.40	2.25	3.40	5.34	6.57	8.08	8.65
1994	0.16	0.41	0.84	1.48	1.84	3.38	4.51	6.65	5.17	8.13
1995	0.31	0.45	0.75	1.36	1.93	1.96	5.16	5.54	6.95	5.25
1996	0.31	0.57	0.99	1.55	2.33	2.78	3.13	6.28	6.31	7.17
1997	0.31	0.57	1.01	1.61	2.31	3.01	3.98	5.30	6.19	7.17
1998	0.28	0.57	1.01	1.61	2.31	3.01	3.98	5.30	6.19	7.17
1999	0.39	0.63	1.11	1.64	2.11	2.75	3.67	5.33	6.35	6.88
2000	0.44	0.64	1.16	1.95	2.67	2.54	2.73	3.89	5.63	6.39
2001	0.44	0.80	1.07	1.73	3.11	4.24	3.93	3.81	5.33	6.72
2002	0.57	0.77	1.28	1.76	2.64	4.57	5.59	6.15	6.83	8.36
2003	0.57	0.79	1.19	1.75	2.60	3.72	6.26	6.81	7.78	8.84
2004	0.48	0.79	1.14	1.74	2.47	3.44	4.88	8.07	8.66	8.65
2005	0.32	0.99	1.50	2.17	2.93	3.87	4.82	7.34	9.37	10.52
2006	0.46	0.74	1.38	2.24	2.99	3.59	4.80	6.46	8.29	12.36
2007	0.42	0.84	1.34	2.05	2.80	3.63	4.83	7.29	8.77	10.51

Table 26. 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	61693	19346	26737	30989	13355	11290	14216	11074	1846	206498	109507
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	232728	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	122565	81885
1975	5581	14547	7044	5887	10712	4756	5831	4250	1646	1574	61829	34657
1976	9541	10587	13012	4867	2105	2976	1044	920	707	250	46009	12869
1977	18758	13041	9287	7875	3824	1826	2533	940	760	635	59479	18394
1978	25263	27866	16030	7813	6408	2347	1205	1433	389	307	89061	19902
1979	8787	27455	30906	14896	7037	5222	1805	865	890	271	98134	30986
1980	10296	11457	30000	23666	11886	5856	4950	1745	794	854	101502	49750
1981	21351	14850	14465	33375	24866	12503	6306	5649	1713	700	135777	85110
1982	18095	22257	16314	14937	34495	22141	11321	5168	4330	1230	150289	93623
1983	25385	18151	23629	16374	14939	33124	16400	7262	3068	2390	160722	93558
1984	30846	27066	18059	23483	16018	14170	27581	11055	4674	2232	175183	99212
1985	10671	27449	27000	17333	19656	13313	11959	22844	6919	3541	160685	95564
1986	2332	18348	28128	20718	14289	15324	13270	11916	20205	4400	148930	100121
1987	2181	3936	21763	23971	14855	12294	13414	10844	8605	16834	128697	100817
1988	8083	3319	5657	18928	17517	12466	9292	7041	5589	3768	91660	74601
1989	4482	8463	4547	5245	10891	11437	11293	6733	3517	2967	69575	52083
1990	2176	6028	7397	3206	3254	7352	8515	10420	5585	2129	56063	40461
1991	2633	2099	3631	2300	1592	2722	5527	6253	7155	4395	38308	29945
1992	3098	1954	1811	2460	1378	731	1358	2285	2766	2756	20599	13735
1993	1978	3944	1031	1137	1450	793	435	732	1097	1037	13633	6680
1994	98	1588	2944	497	444	812	561	295	291	546	8075	3445
1995	121	130	842	2527	314	223	896	525	246	242	6066	4972
1996	230	184	169	1407	3465	365	292	887	489	208	7696	7113
1997	321	347	260	220	1679	3591	417	396	699	449	8378	7450
1998	104	481	482	324	249	1705	3731	431	357	630	8494	7427
1999	857	188	742	613	329	231	1612	3890	399	299	9160	7373
2000	2049	1109	242	887	721	293	173	1316	3087	312	10188	6788
2001	1977	2794	1190	160	985	857	328	184	1415	2941	12831	6870
2002	966	2666	3303	1355	174	1006	810	381	257	1750	12668	5733
2003	407	949	2793	3016	1307	170	976	727	374	264	10984	6836
2004	262	222	298	1379	2004	1005	161	899	695	325	7250	6468
2005	412	405	287	368	1653	2310	1061	191	796	663	8146	7043
2006	1107	765	465	346	403	1566	2108	1048	169	826	8803	6466
2007	552	1487	939	413	301	385	1683	2610	1150	176	9696	6717

Table 27. Estimated spawner biomass (t) using cohort 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	1362	18267	11827	11078	14177	11069	1846	72220
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	1321	1423	2975	1037	920	707	250	9138
1977	16	185	908	1787	2726	1571	2533	940	760	635	12061
1978	35	230	1498	2986	5076	2213	1142	1433	389	307	15310
1979	128	364	2266	6328	5484	5119	1789	850	890	271	23487
1980	35	797	3419	10158	9996	5579	4942	1742	789	854	38311
1981	42	351	3976	18417	21814	12181	6251	5648	1712	698	71091
1982	63	361	2382	9827	31798	21820	11280	5160	4330	1230	88251
1983	7	295	2879	8962	13550	32833	16375	7259	3067	2390	87618
1984	25	75	1310	12656	14341	13889	27555	11053	4673	2231	87809
1985	21	160	704	4685	17844	13097	11911	22842	6919	3541	81723
1986	5	247	1149	4245	9101	15141	13239	11907	20205	4400	79638
1987	13	76	1891	5652	10589	10973	13395	10841	8603	16834	78866
1988	2	111	888	7560	12101	11966	9062	7040	5589	3768	58085
1989	21	26	774	3342	8962	10771	11245	6697	3517	2967	48322
1990	37	227	326	1759	3068	7132	8443	10415	5579	2129	39116
1991	21	135	885	931	1398	2705	5503	6246	7155	4393	29372
1992	1	109	390	1787	1253	714	1357	2284	2766	2756	13418
1993	0	48	314	594	1386	788	433	732	1096	1037	6429
1994	0	24	832	380	361	807	560	294	291	546	4097
1995	1	5	492	2341	302	211	895	525	246	242	5260
1996	5	13	83	1396	3456	363	288	887	489	208	7189
1997	4	53	105	205	1678	3590	417	395	699	449	7595
1998	2	52	282	280	247	1705	3731	431	356	630	7715
1999	1	19	389	561	323	231	1612	3890	399	299	7724
2000	2	15	105	806	713	292	173	1316	3087	312	6822
2001	13	78	199	134	974	855	328	184	1415	2941	7122
2002	6	364	1414	1012	169	1005	809	381	257	1750	7168
2003	2	152	2209	2870	1278	170	976	727	374	264	9021
2004	1	24	251	1364	2000	1004	161	899	695	325	6724
2005	2	44	197	366	1652	2310	1061	191	796	663	7282
2006	5	83	319	339	403	1566	2108	1048	169	826	6866
2007	3	161	646	404	301	385	1683	2610	1150	176	7516

Table 28. Retrospective estimates of Age 3 recruits, spawner biomass and fishing mortality (Fbar 4-6) 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		Retro						
(Jan 1)	Current VPA	2006	2005	2004	2003	2002	2001	2000
2007	1309	*	*	*	*	*	*	*
2006	2410	1596	*	*	*	*	*	*
2005	1271	1013	560	*	*	*	*	*
2004	543	426	326	239	*	*	*	*
2003	713	678	619	527	343	*	*	*
2002	1699	1699	1684	1625	1141	1383	*	*
2001	4451	4396	3998	3927	2539	3200	3123	*
2000	4634	4730	4332	4273	3176	3527	3700	2676

SSB		Retro						
(Jan 1)	Current VPA	2006	2005	2004	2003	2002	2001	2000
2007	7516	*	*	*	*	*	*	*
2006	6866	6724	*	*	*	*	*	*
2005	7282	7254	5497	*	*	*	*	*
2004	6724	6720	5678	5225	*	*	*	*
2003	9021	9039	8382	8010	5823	*	*	*
2002	7168	7216	6709	6466	5850	6280	*	*
2001	7122	7221	7104	6951	6841	7200	7458	*
2000	6822	6925	6855	6743	6658	6958	7202	6722

Avg F		Retro						
(ages4-6)	Current VPA	2006	2005	2004	2003	2002	2001	2000
2006	0.223	*	*	*	*	*	*	*
2005	0.014	0.014	*	*	*	*	*	*
2004	0.188	0.198	0.241	*	*	*	*	*
2003	0.921	0.921	1.034	1.098	*	*	*	*
2002	0.206	0.209	0.236	0.251	0.375	*	*	*
2001	0.138	0.139	0.152	0.165	0.196	0.202	*	*
2000	0.338	0.339	0.356	0.383	0.394	0.402	0.428	*

Table 29. Input data to 5 year deterministic projection of Jan 1 2007 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 25)		0.401813	0.852217	1.410705	2.156551	2.905053	3.695659	4.815105	7.0301	8.810677	11.13148
Mats at age (from Table 21)	1998	0.016973	0.107647	0.583705	0.864244	0.991668	0.999999	0.999998	0.999898	0.999089	0.999999
	1999	0.000932	0.103493	0.523982	0.915522	0.983423	0.999097	1	1	0.999986	0.999771
	2000	0.001091	0.01352	0.43561	0.909455	0.988203	0.998194	0.999903	1	1	0.999998
	2001	0.006574	0.027787	0.167563	0.837671	0.989207	0.998458	0.999806	0.99999	1	1
	2002	0.0067	0.136579	0.428004	0.74725	0.971832	0.998806	0.9998	0.999979	0.999999	1
	2003	0.004788	0.159896	0.790841	0.951432	0.977489	0.995684	0.999869	0.999974	0.999998	1
	2004	0.004788	0.108087	0.843037	0.989056	0.998054	0.998435	0.999352	0.999986	0.999997	1
	2005	0.004788	0.108087	0.687294	0.993445	0.999537	0.999926	0.999893	0.999903	0.999998	1
	2006	0.004788	0.108087	0.687294	0.977978	0.999766	0.999981	0.999997	0.999993	0.999985	1
	2007	0.004788	0.108087	0.687294	0.977978	0.999119	0.999992	0.999999	1	1	0.999998
	2008	0.004788	0.108087	0.687294	0.977978	0.999119	0.999966	1	1	1	1
	2009	0.004788	0.108087	0.687294	0.977978	0.999119	0.999966	0.999999	1	1	1
	2010	0.004788	0.108087	0.687294	0.977978	0.999119	0.999966	0.999999	1	1	1
	2011	0.004788	0.108087	0.687294	0.977978	0.999119	0.999966	0.999999	1	1	1
	2012	0.004788	0.108087	0.687294	0.977978	0.999119	0.999966	0.999999	1	1	1
Avg F (3 yrs) (from Table 24)		0.060629	0.130309	0.186538	0.108547	0.067503	0.071685	0.048157	0.04288	0.027272	0.021814
Avg PR (3 yrs)		0.223029	0.489607	0.702916	0.449293	0.367821	0.477403	0.382095	0.250777	0.183407	0.153232
Rescaled Avg PR		0.407528	0.894632	1.284399	0.820969	0.672098	0.872332	0.698181	0.458231	0.335129	0.279993
F_current (3 year avg over ages 4-6)		0.141798 avg									
Proj F (F_current x Rescaled Avg PR)		0.057787	0.126857	0.182125	0.116412	0.095302	0.123695	0.099001	0.064976	0.047521	0.039702
Avg R/S (3 yrs)		0.173549									

Fig. 1. Catches of cod in NAFO Div. 3NO from 1953-2006. Panel on right for years since the moratorium in Feb. 1994.

Fig. 2. Plot of Div. 3NO Cod catch-at-age for 2005 and 2006
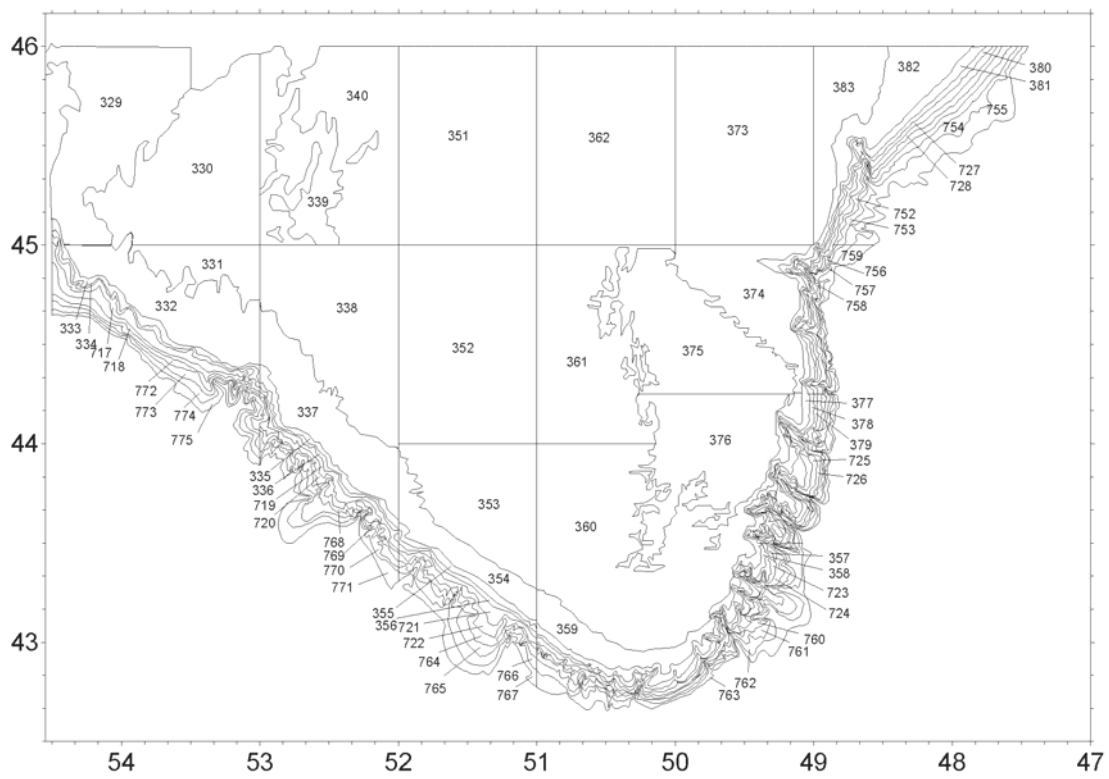
Figure 3 - Stratification scheme for Divisions 3NO.
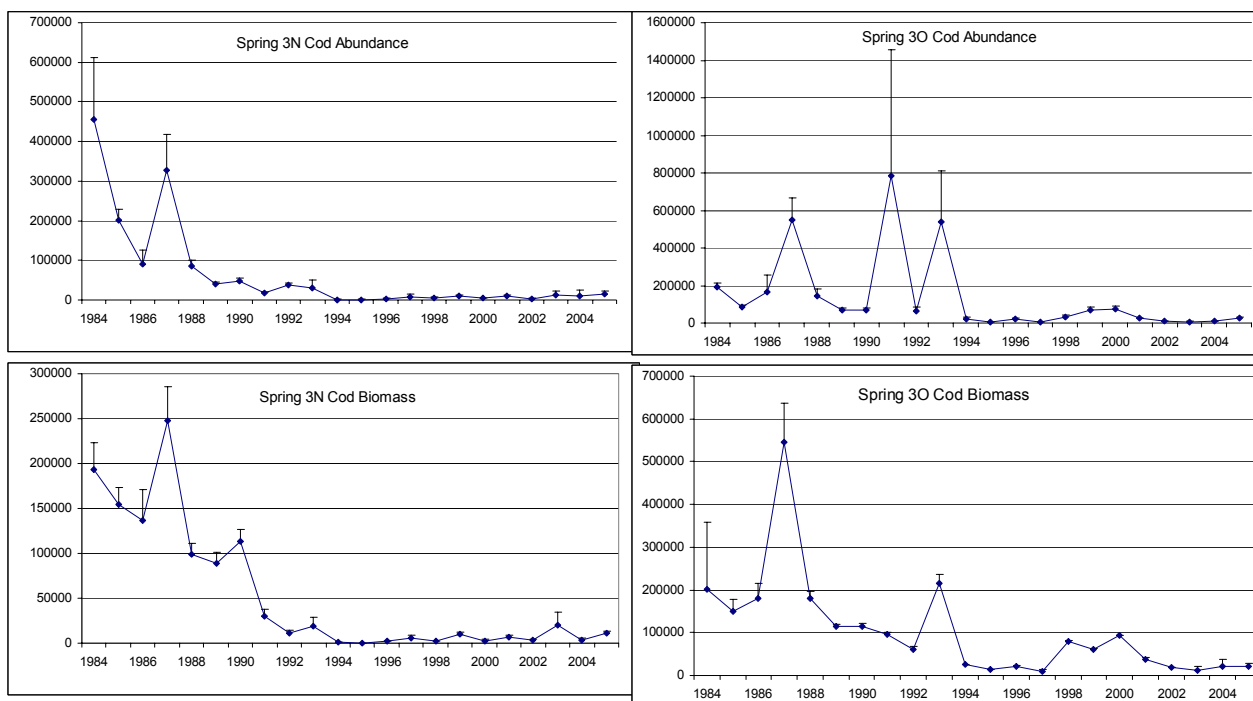
Figure 4 – Abundance (000's) and biomass (t) for the Canadian Spring Research Vessel survey series with 1 standard deviation for strata<200 fathoms.
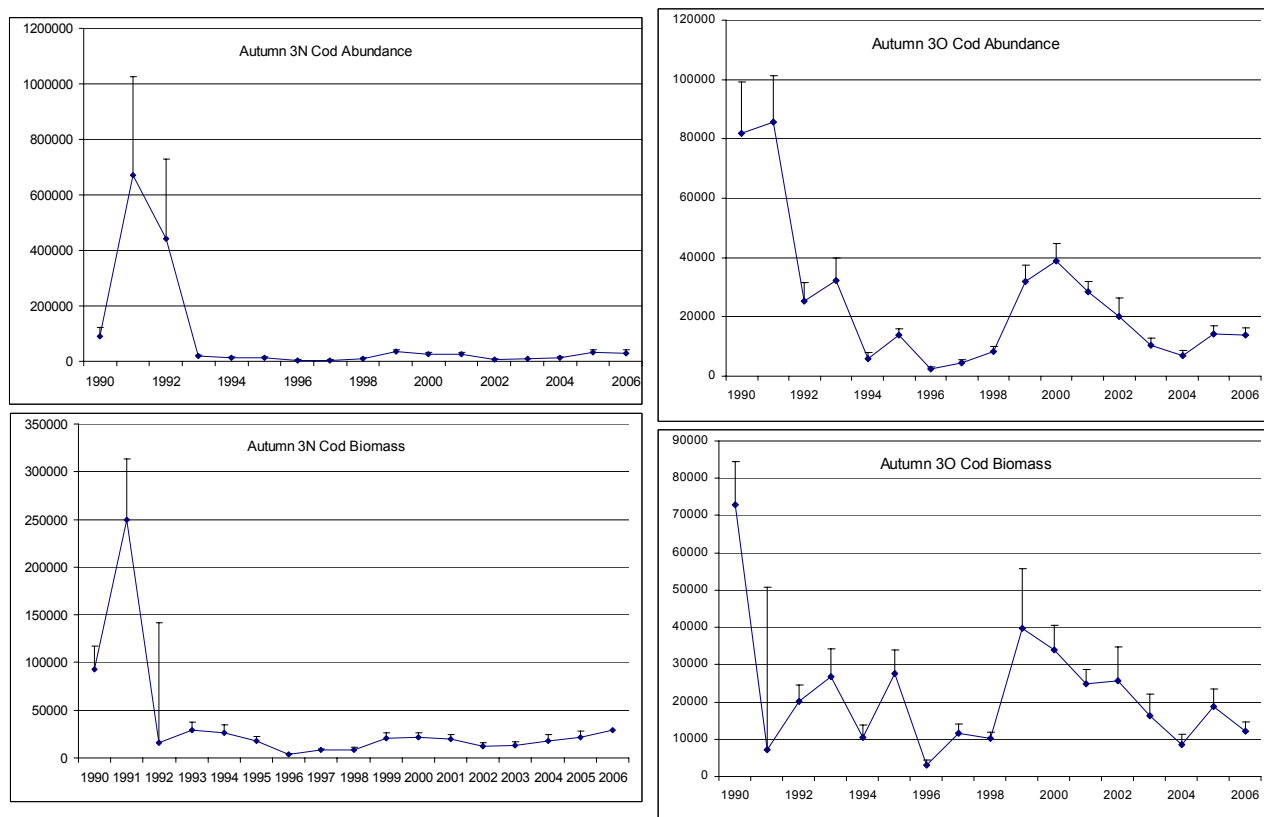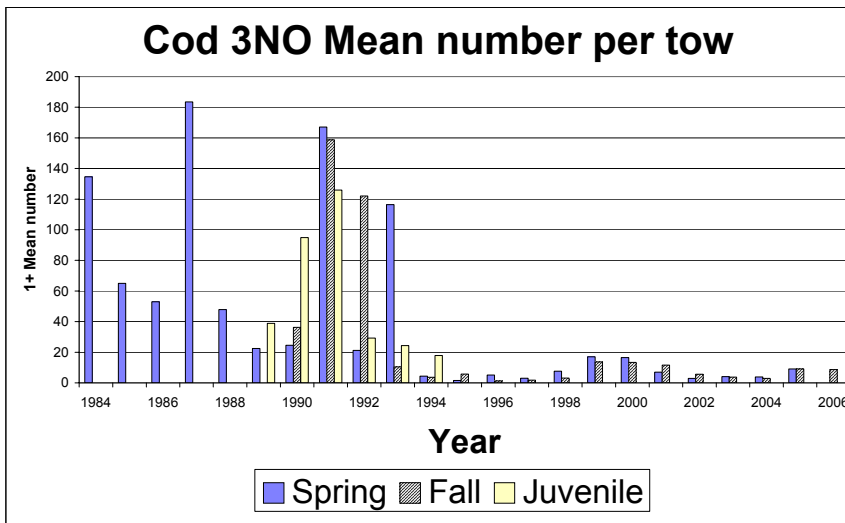

Figure 5– Abundance (000's) and biomass (t) for the Canadian Autumn Research Vessel survey series with 1 standard deviation for strata<200 fathoms.

Fig 6. Spring and autumn Canadian RV estimates of 1+ mean number/tow of cod in Divisions 3NO
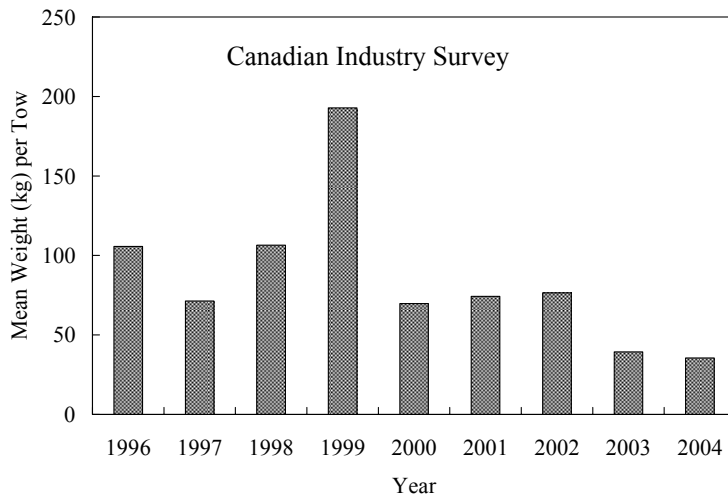
Fig. 7. Mean weight (kg) per tow from Canadian Industry surveys conducted in July in NAFO Div. 3NO.
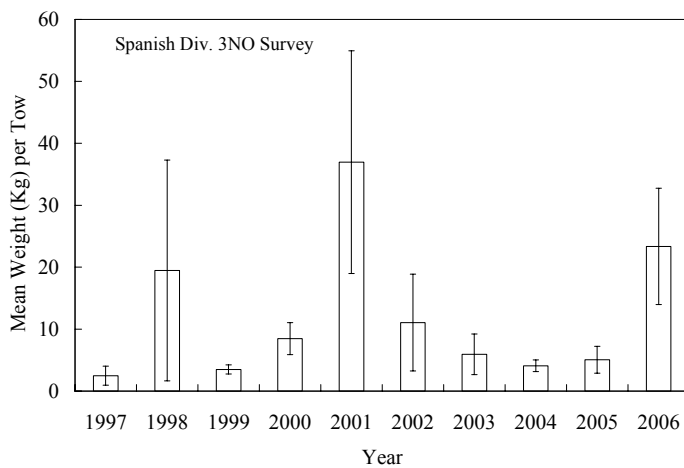
Fig. 8. Mean weight (kg) per tow from Spain Div. 3NO surveys of the regulatory area .
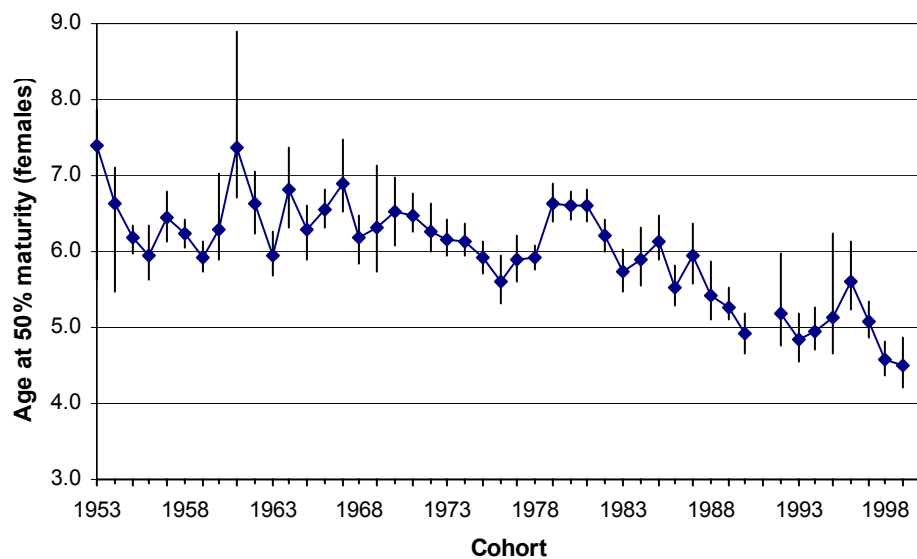
Figure 9 - Age at 50% maturity for cod in Divs. 3NO (by cohort).
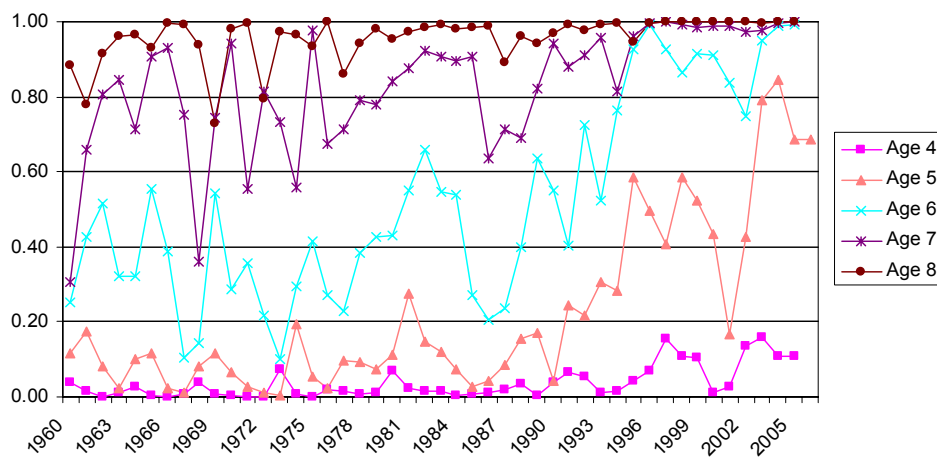
Fig. 10. Estimated proportions mature at ages 5-7 for female cod sampled during DFO research vessel bottom-trawl surveys in NAFO Divs 3NO during 1975-2005. Model fitted by cohort to observed proportions mature at age from DFO RV survey data 1975-2005.
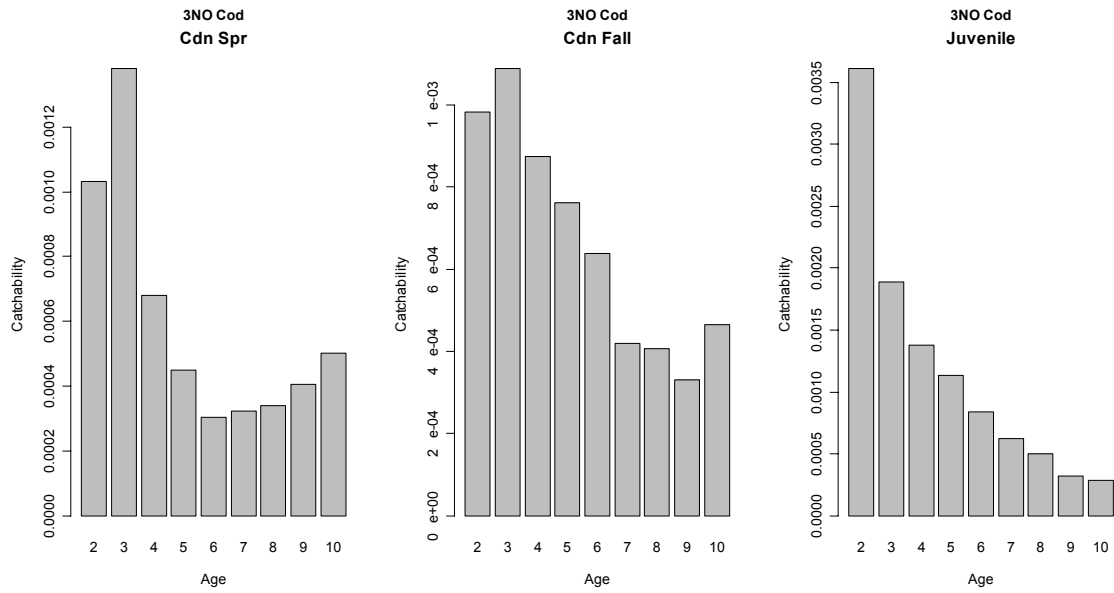
Fig. 11. Estimated catchabilities from ADAPT.
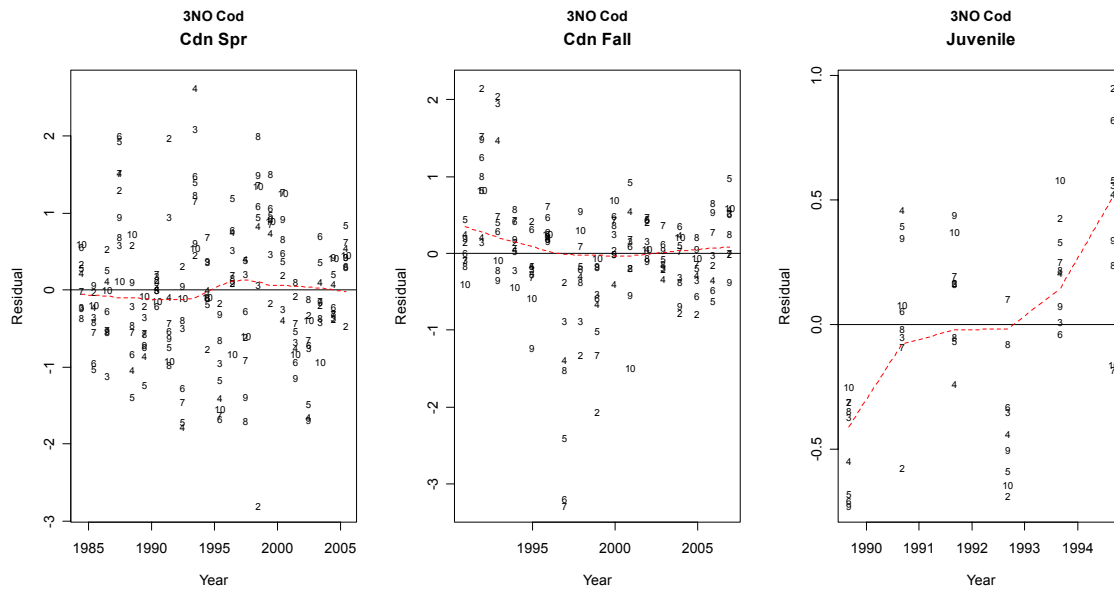
Fig. 12. Residuals at age for each index in the ADAPT.
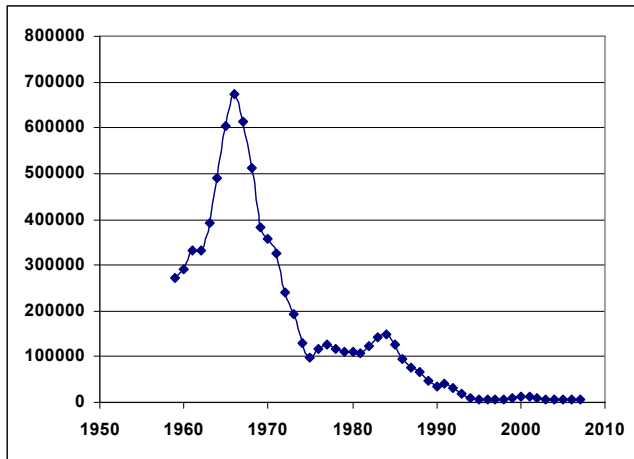
Fig. 13. Bias corrected Population Abundance for cod in Divs. 3NO (000's) as estimated from ADAPT
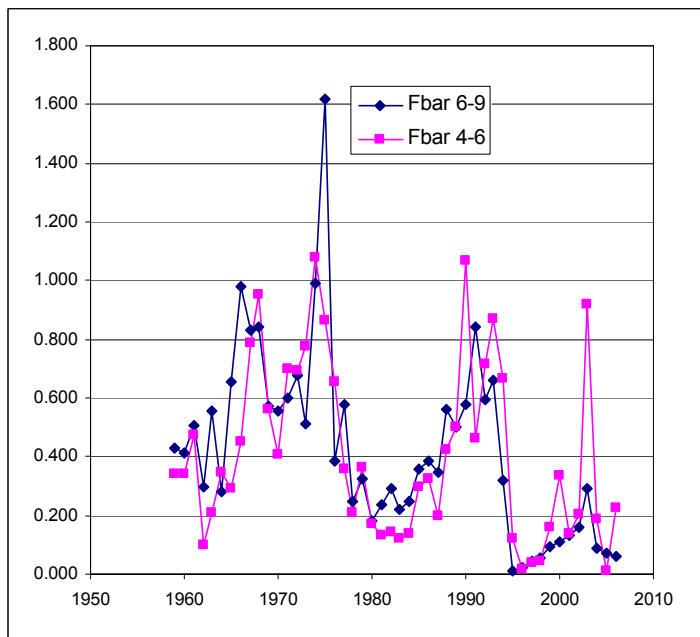
Fig. 14. Fishing Mortality for cod in Div. 3NO as estimated from ADAPT.
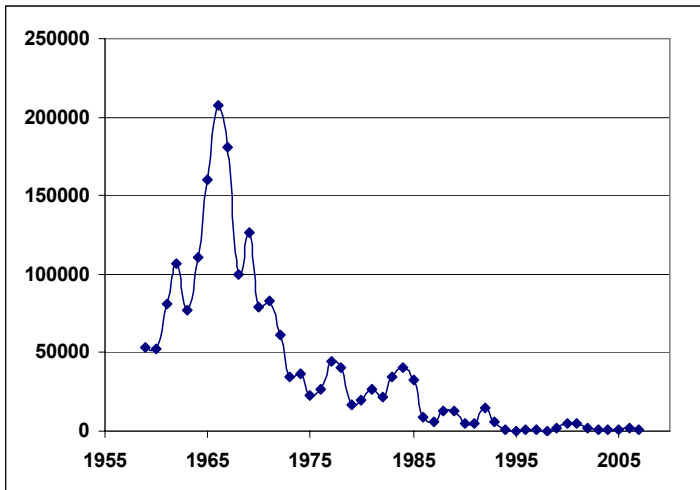
Fig. 15. Age 3 recruits for cod in Div. 3NO as estimated from ADAPT.
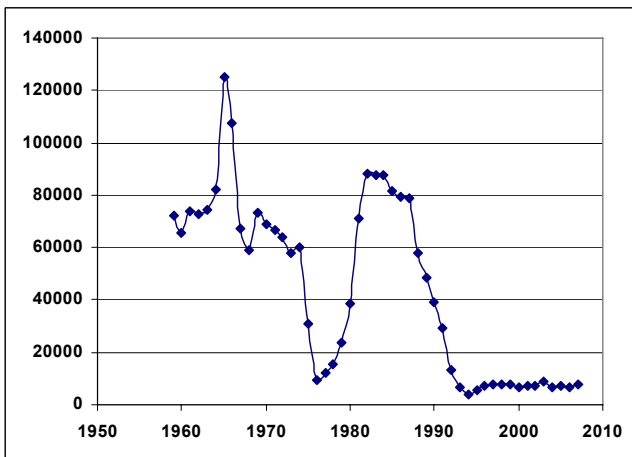
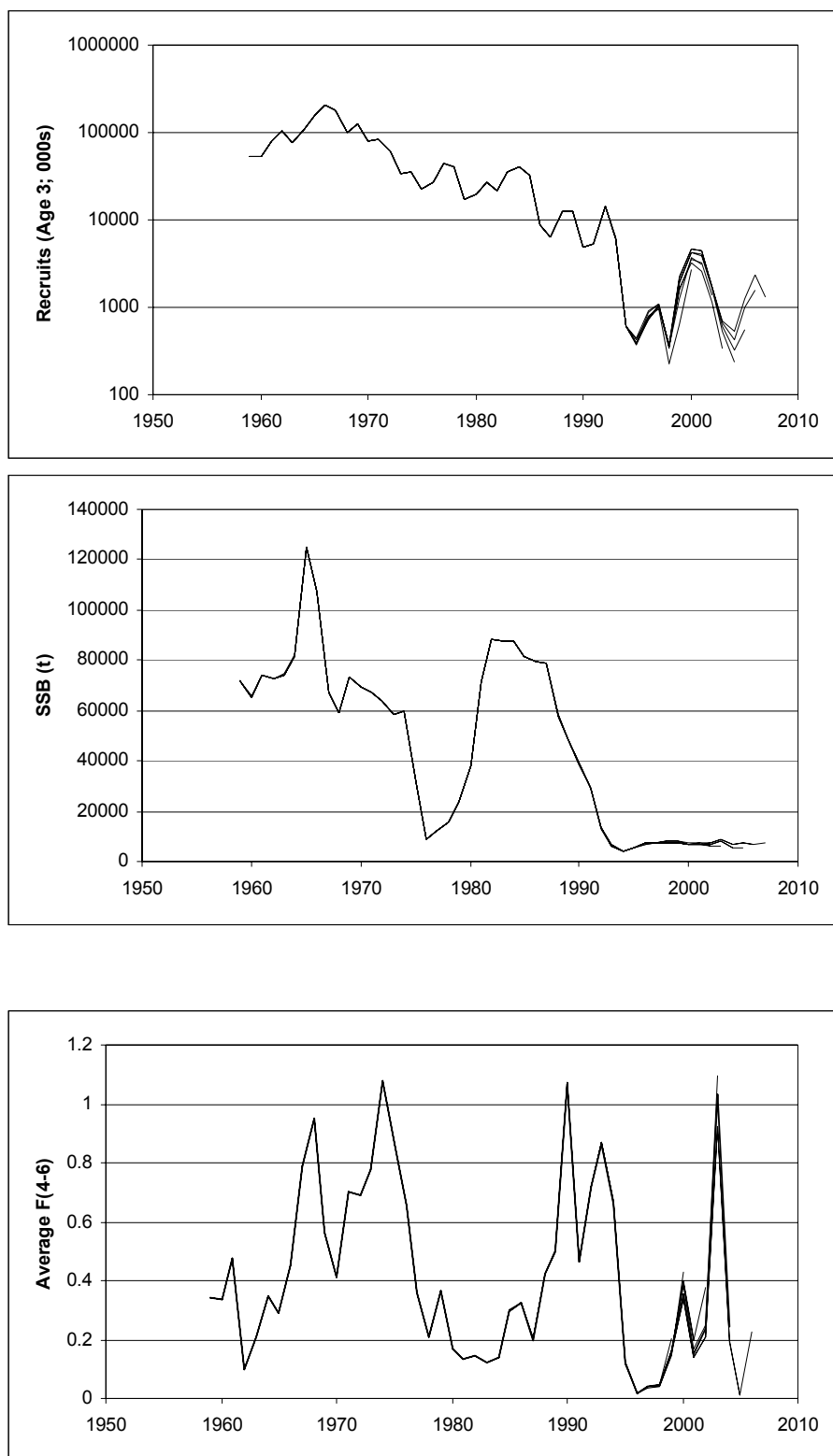**Fig. 16. Spawner biomass for cod in Div. 3NO as estimated from ADAPT.**

Fig. 17. Retrospective estimates of Age 3 recruits (log scale), spawner biomass and fishing mortality (Fbar 4-6) for cod in Div. 3NO.
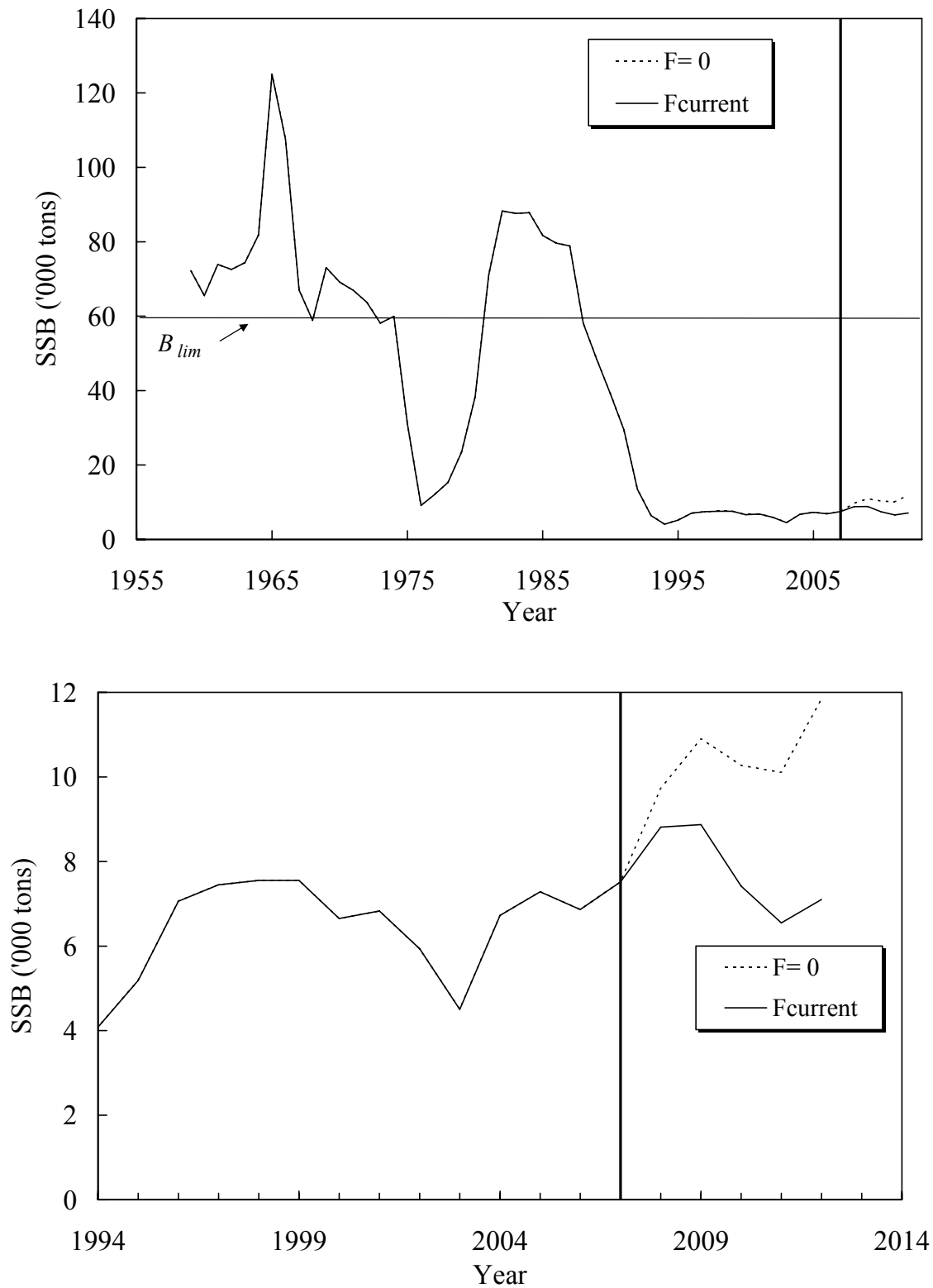
Fig. 18: Deterministic Projections under F=0 (dashed line) and F_current = 0.142. Lower panel highlights trend since 1994.