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An Assessment of the Cod Stock in NAFO Divisions 3NO

by

D. Power, J. Morgan, E.F. Murphy, J. Brattey and B. Healey

Science Branch, Fisheries and Oceans Canada,
P. O. Box 5667, St. John's, Newfoundland, Canada A1C-5X1

Abstract

Cod in Divisions 3NO inhabit the southern Grand Bank of Newfoundland. The stock declined dramatically during the mid-1980's and although at a low level, has experienced an improvement in recent years. Estimates from a population model utilizing the ADAPTive framework (Gavaris 1988) indicate the Jan 1 2010 total biomass and spawner biomass remain low but are estimated to be at their highest levels since 1992. Fishing mortality has been declining since 2006. Estimates for ages 4-6 in 2008 and 2009 are less than 0.06 and are amongst the lowest estimated during a moratorium that has been in place since February 1994. Recruitment remains low but has been improving in recent years with current estimates of the 2005-2007 year classes comparable to those from the mid-late 1980s. The current estimate of spawner stock biomass is 12 700 t which is still well below the current best estimate of Blim (60,000 t). Stochastic projections over the short term suggest there is an 88% probability the stock will remain below Blim to 2013.

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 has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994 and continues into 2010. 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.

Catch levels coupled with poor recruitment prospects have resulted in high fishing mortality and impeded stock recovery based on the last thorough assessment of this stock in 2007. This assessment updates the status of the stock, based primarily on a population model incorporating Canadian spring and fall research vessel surveys conducted in Div. 3NO. Population and spawner stock biomass estimates for 1959-2010 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 last full year of a directed fishery.

Since the moratorium, including Canadian surveillance and NAFO Scientific Council estimates (Table 1, Fig 1), increased from 170 t in 1995, peaked at about 4 800 t in 2003 then declined to 600 t in 2006. Since 2006 catches have increased steadily to 1, 100 t in 2009.

Sampling data for 2009 was available from Canadian, Spanish (González-Costas et al., MS 2010), Portuguese (Vargas et al., MS 2010) and Russian (Skryabin and Pochtar MS 2010) otter trawl fisheries. Sampling data for 2007 and 2008 were obtained from National Research reports for 2007-2008 as follows: Spain (González et al., MS 2008; González et al., MS 2009), Portugal (Vargas et al., MS 2008; Vargas et al., MS 2009), and Russia (Vaskov et al., MS 2008; Skryabin et al MS 2009). The total catch-at-age from by-catches in 2007-2009 (Table 3) was compiled in the most judicious manner possible given the sampling deficiencies noted (Table 4). Sampling was not conducted on the Canadian longline fleets which have accounted for 20%-40% of the Canadian landings over this period. Length sampling was available for 2007-2008 from Russia, 2007-2009 from EU-Portugal and 2007-2009 from EU-Spain. The catch-at-age for non-Canadian fleets was constructed by applying Canadian survey age length keys to the available length sampling. A review of the sampling over the period 1995-2009 used to produce a catch-at-age for this stock (Table 4) 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 pattern 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. For 2007 to 2009, catch-at-age was compiled as detailed in Table 5. The 1997 and 1998 year classes had been a prominent in the catch from 2003 to 2006. The catch at age also reveals ages 3-6 have dominated the catch throughout the history of the fisheries and persists today (Table 5, Fig. 2).

Catch-at-age and mean weights-at-age from the fisheries in the 1959-2009 period are presented in Tables 5 and 6. Inadequate sampling also presents problems for computing mean weight at age. To fill the 1996-1998 gaps, a geometric mean was computed at each age, using the three nearest non-zero values on either side of the three year window.

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. The stratification scheme used for these surveys is based on depth and is presented in Fig. 3. The surveys from 1991 onwards covered areas to a maximum of 732m (400 fathoms) but prior to this only covered to a maximum of 367m (200 fathoms). 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 primarily by the *WILFRED TEMPLEMAN* or its sister ship *ALFRED NEEDLER*.

Autumn surveys have been carried out in Divisions 3NO from 1990 to 2008 using the *WILFRED TEMPLEMAN* for strata less than 732 m. Starting in 1995 the *Teleost* was used for sampling strata greater than 732m to a maximum depth of 1463m (800 fathoms), but coverage has not been consistent in these greater depths. Because of vessel difficulties in 1996 the *ALFRED NEEDLER* conducted the survey in strata less than 732m. In 2009 the autumn survey was conducted by the *ALFRED NEEDLER* with only partial coverage of Div. 3N strata greater than 732m by Teleost..

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 7-16 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 to about 2006. The swept area survey biomass estimate from index strata (<200 fathoms) surveyed in 3NO combined for 2009 spring and autumn are about 144, 000 t and 85, 000 t respectively. There was also an unusual finding of cod in stratum 727 (201-300 fathom range) in the spring that resulted in estimate of about 33, 000t.

The mean numbers per tow at age for the index strata (< 200 fathoms) in 3NO combined are given in Table 17 for the spring survey and Table 18 for the autumn survey, and are plotted in Fig. 6 (age aggregated). Both the spring and autumn indices have been extremely low from 1994-2006 increased to 2000 then declined again to 2002 where it again remained amongst the lowest values in the index until 2004. There has been a substantial increase in abundance since then to a level comparable to the early 1990s. An index derived from a juvenile flatfish survey conducted by Canada from 1989 to 1994 is presented in Table 19.

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 (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 1995-2009 (Gonzales-Troncoso et al MS 2010). 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. 7) 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. Since 2005 there has been a steady increase to the highest estimate in the series in 2009. The peaks in 1998 and 2001 were influenced by large single tows in those years. The abundance follows a similar pattern.

Analysis

Lengths-at -age

Mean lengths-at-age were calculated for cod in Div. 3NO using spring survey data from 1975 to 2009 except for 1983 (no survey) and 2006 when survey coverage was too poor to be considered representative. Means were calculated accounting for the length stratified sampling design. Although there is variation in length-at-age there is little indication of any long-term trend (Fig. 8, left panel).

Recently at least two year-classes (2005 and 2006) have appeared to be stronger than cohorts seen since the early 1990's. Mean length-at-age for cohorts that have been in the spring survey since the introduction of the Campelen trawl were compared to those for the 2005 and 2006 cohorts at ages 2 to 4. The 2005 cohort was substantially smaller at age than other cohorts during the time period. However, the 2006 cohort (at age 2 and 3) was similar in length-at-age to other cohorts from 1995 to 2009 (Fig. 8, right panel).

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 observed proportions mature at age from sampling conducted during Canadian spring surveys. The model fitted the data for all cohorts from 1953 to 2004, except for the 1991 and 2000 cohorts. 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. Estimates for the 1991 cohort were produced by averaging the observed proportions from the two adjacent years. The estimated proportion of females mature at age from the fitted cohort model is given in Table 20. 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 estimates from the 3 previous and 3

subsequent years for the appropriate age (shaded cells in table 20). Estimated annual maturities for 1975-2009 are plotted (Fig. 10) to show trends for selected ages. Estimated proportion mature for these ages have all increased over this time period.

Sequential Population Analysis

Survey Indices: Cohort Tracking

The last thorough assessment of this stock utilized a sequential population analysis applying the ADAPT framework (Gavaris 1988) estimation of population size. Prior to the implementation of this analysis on the updated database, cohort tracking and consistency within the survey data was evaluated by a number of illustrative and standardized age-disaggregated plots. For each survey series that extended to 2009 in 3NO (Canadian Spring, Canadian Autumn and Spanish Spring) the following were evaluated: (a) age-disaggregated plots of mean number per tow 3NO, (b) pair-wise scatter plots and correlations of age-disaggregated survey data (log-scale) and (c) standardized proportions by age across years (SPAY) and by year across ages (SPYA). In the SPAY plots the annual index proportions were standardized at each age to have a mean of 0 and a variance of 1. For the SPYA plots a similar procedure was followed, but the proportions for each age were computed across years prior to standardizing by the mean and variance computed across all ages.

For the 1984-2009 Canadian Spring survey the 1989 and 1990 year classes were the most dominant in the series from 1990 to 2008 (Fig. 11a) but at different ages. For example, the 1989 year class was dominant at ages 2, 4, 7, 9 and 10 whereas the 1990 year class was dominant at ages 3 and 8. Nevertheless, a decline in density is also quite dramatic by age 7 for most cohorts. The pairwise plots and correlations (Fig. 11b) indicate generally good tracking between ages for cohorts. This is also confirmed by the standardized plots which indicate the tracking of the strong 1989 and 1990 cohorts through to age 10 (Fig. 11c) and the general higher proportions of all ages in the pre-1988 years.

For the 1990-2009 Canadian Autumn survey the 1989 and 1990 year classes were amongst the most dominant in the series (Fig. 12a) and also illustrate a similar pattern as the spring. The 1989 year class was dominant at ages except 7 whereas the 1990 cohort is only dominant at age 7, 8. The 1997 and/or 1998 cohorts were also very apparent at ages 3-9, something not so obvious in the spring series. A decline in density is also quite dramatic by age 5 for most cohorts. The pairwise plots and correlations (Fig. 12b) also indicate generally good tracking between ages for cohorts although correlations were not as good as in the spring. This tracking is also confirmed by the standardized plots which indicate the persistent 1989-1990 cohorts and the 1997-98 cohorts for many years (Fig. 12c).

The Spanish 3NO survey in May only began in 1997 but shows modes consistently for the 1997-1998 year classes between ages 1-9 (Fig. 13a). The pairwise plots and correlations (Fig. 13b) also indicate generally good tracking between ages although the correlations were not as good overall as both Canadian surveys. This is confirmed in the standardized plots which indicate the tracking of the 1997-1998 cohorts to about 2004 and the 1989-90 cohorts for a few years in the earliest surveys (Fig. 13c).

Standardized indices by age for all surveys are compared in Fig. 14. The results indicate generally good tracking for the Canadian surveys but less so for the EU-Spain survey which has used Canadian age-length keys as the basis for aging information.

ADAPTive Framework

The catch at age (Table 5) was used in a sequential population analysis applying the ADAPT framework (Gavaris 1988). 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 based on fishery sampling although for some contracting parties constructing catch at age required using Canadian RV age-length keys (see table 4).

The ADAPT was calibrated with Canadian RV survey indices at age from spring 1984-2005 and 2007-2009, autumn 1990-2009 and a Canadian juvenile survey 1989-94 to estimate population numbers $N_{i,t}$,

where i = 3 to 12, for t = 2010 (10 parameters) and i =12, for t=1994 to 2009 (16 parameters),

and Catchabilities

$q1_i$ where i = 2 to 10 for the Canadian Research Vessel survey spring (RV1) (9 parameters)
$q2_i$ where i = 2 to 10 for the Canadian Research Vessel survey autumn (RV2) (9 parameters)
$q3_i$ where i = 2 to 10 for the Juvenile Research Vessel survey (RV3) (9 parameters)

The following structure was imposed:

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

Input data were:

Catch numbers at age,
Ci,t where i = 2 to 12 and t = 1959 to 2009 ,
Canadian Research Vessel survey estimates of mean numbers per tow-at-age (Campelen or Campelen equivalent values),
RV1i,t where i = 2 to 10 and t = 1984 to 2005 and 2007-2009, spring
RV2i,t where i = 2 to 10 and t = 1990 to 2009, fall
and Canadian juvenile Research Vessel survey estimates of mean numbers per tow-at-age (Yankee 41.5 shrimp trawl in August – September)
RV3i,t where i = 2 to 10 and t = 1989 to 1994 .

The objective function minimized is

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

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

This particular model formulation was selected since it follows the accepted VPA from the last assessment in 2007 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 21. The mean square error of the residuals of the model fit was 0.646 based on an estimation of 53 parameters. For the survivors estimated in 2010, the relative error in the parameter estimates decreased with age from a high of 58% at age 3 to 32% at age 12. Relative bias was a high of 18% at age 3 decreasing to 5% at age 12.

The estimated survey catchabilities (q's) with associated standard errors are also provided in Table 21 and Fig. 15. Survey catchabilities (q's) generally decrease with age for all three surveys with the spring and autumn tending to having similar q's for ages 7-10. The Yankee 41.5 (juvenile survey) catchability for age 2 is more than three times that for the Campelen surveys.

Diagnostic residual plots from the ADAPT run are presented in Fig. 16-18. Overall the spring and autumn 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 (mostly positive) and 1989, 1995, 2002 (mostly negative) (Fig. 16-17). 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 a negative year effect in 1989 and a positive one in 1994 (Fig. 18).

Bias-adjusted estimates of population numbers (Fig. 19) and fishing mortality at age (Fig. 20) are given in Tables 22 and 23 respectively. The age 2 value in 2010 is the geometric mean of the 2007-2009 age 2 estimates from the ADAPT. Population numbers remain low although there has been an increase since 2006 to a level comparable to the early 1990s in 2010. The recent improvement in recruitment from the 2005 and 2006 year classes has accounted

for much of this increase (Fig. 21). The 1989 year-class, which had been the most recent evidence of non-negligible recruitment, is no longer contributing to the VPA population (since 2001). The estimate of the 2006 year class, although only based on a few data points, suggests it is at least as strong as the 1989 year class. In general, estimated recruitment has been very low for the 15 years prior to the recent improvement. The 2003-2006 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. Fishing mortality (Table 23, Fig. 20) has generally been low since 2005 (< 0.1) on the prominent ages groups in the fishery.

Beginning of year mean weight-at-age calculated from the commercial catch is presented in Table 24. These weights are used to calculate biomass, given in Table 25. Stock biomass reached an historic low in 1995 before a period marginal increase which peaked in 2001 and declined to 2004. Since then there has been a steady increase to 2010 which is the highest level since 1991. The maturities computed from the cohort model were applied to the population numbers to compute the spawner stock biomass (Table 26, Fig. 22). Current SSB is estimated to be about 12, 700 t, which is approximately 21% of B_{lim} (60,000 t).

Retrospective analysis

A retrospective analysis was conducted to investigate whether systematic trends were apparent in the population modeling. A 5 year period was chosen to evaluate whereby a complete year of data was removed, one year at a time in succession (for catch at age and survey indices at age), and the estimation with identical structure to the VPA formulation above was repeated for each case. Five year retrospective indicates recruitment (Table 27, Fig. 23) 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, however Fs have generally been low in recent years (Fig. 23).

Stochastic Projections

Simulations were carried out to examine the trajectory of the stock under two scenarios of fishing mortality: F=0, F=0.07 (the average F on ages 4-6 from 2007-2009). For these simulations the terminal year survivors from the ADAPT (i.e. Jan 2010 Population numbers), estimates of age by age relative error and the correlation matrix of population estimates were used. The following inputs were the basis of these projections:

Age	Estimate of 2010 population numbers ('000)	Relative error on population estimate	Weight-at-age mid-year (avg. 2007-2009)	Weight-at-age beginning of year (avg. 2007-2009)	Maturity-at-age (avg. 2007-2009)	PR rescaled relative to ages 4-6 (avg. 2007-2009)
3	6257.6	0.584	0.47	0.36	0.02	0.36
4	14752.1	0.419	0.90	0.66	0.12	0.67
5	6264.0	0.346	1.43	1.22	0.35	1.27
6	1686.3	0.342	2.21	1.76	0.73	1.05
7	1368.8	0.323	2.83	2.49	0.92	1.22
8	390.2	0.311	3.71	3.10	0.99	0.81
9	128.2	0.312	5.18	4.32	1.00	0.40
10	50.0	0.322	6.95	6.15	1.00	0.90
11	55.8	0.308	6.85	6.63	1.00	0.53
12	159.4	0.324	9.08	7.84	1.00	0.82

Given the current estimate of SSB is well below Blim simulations were limited to a 3-year period. In addition, recruitment (at age 3) was only re-sampled from 1994-2009 as this represents a reasonable expectation of what has occurred under low productivity conditions. The fishery selectivity (i.e. partial recruitment – PR) was rescaled to ensure these age groups would endure the projected fishing mortality.

At F=0 spawner stock biomass is estimated to increase and there is an 88% probability that SSB will remain under Blim by 2013 (Table 28, Fig. 24). At F=0.07 the population is estimated to grow more slowly. If the fishing mortality in 2010-2012 remains at the average estimated in 2007-2009 then yield is estimated to increase over the 3-year time period.

Conclusion

Fishing mortality on 3NO cod has been declining since 2006. Estimates for ages 4-6 in 2008 and 2009 are less than 0.06 and are amongst the lowest estimated during a moratorium that has been in place since February 1994. Recruitment remains low but has been improving in recent years with current estimates of the 2005-2007 year classes comparable to those from the mid- late 1980s. The stock remains relatively low but has improved in recent years to levels just prior to the moratorium. The current estimate of spawner stock biomass is 12 700 t which is still well below the current best estimate of Blim (60,000 t). Stochastic projections over the short term suggest there is an 88% probability the stock will remain below Blim to 2013 at F=0.

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Table 1. Catch (t) of cod in NAFO Divisions 3NO from 1953-2009

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 [2]	17396 [3]	29452	13600
1992	7859	4893 [3]	12752	13600
1993	5370	5276 [3]	10646	10200
1994	47	2655 [3]	2702	6000 [5]
1995	64	108 [3]	172	ndf [5]
1996	99	75 [3]	174	ndf [5]
1997	286	97 [3]	383	ndf [5]
1998	396	151 [3]	547	ndf [5]
1999	568	351 [3]	919	ndf [5]
2000	207	843 [3]	1050	ndf [5]
2001	560	750 [3]	1310	ndf [5]
2002	444	1750 [3]	2194	ndf [5]
2003	818	4052 [3]	4870	ndf [5]
2004	442	492 [3]	934	ndf [5]
2005	461	263 [3]	724	ndf [5]
2006	108	492 [3]	600	ndf [5]
2007	203	645 [3]	848	ndf [5]
2008	247	676 [3]	923	ndf [5]
2009 [1]	165	918 [3]	1083	ndf [5]

[1] **Provisional**
[2] **Includes an estimate of 4000 t deemed misreported to Div. 3L.**
[3] **Includes estimates by Canadian Surveillance and by NAFO Scientific Council.**
[4] **Catch could not be precisely estimated but is in the range of 4, 280 - 5, 460 tons**
[5] **There has been no directed fishery since February 1994.**

Table 2. Cod landings (t) by month and gear from NAFO Divisions 3NO by Canada in 2007, 2008 and 2009.

	Canada (N)					Canada (M)			
2007	3N		3O			3N	3O		
Month	Ottertrawl		Ottertrawl	Gillnet	Longline	Longline	Ottertrawl	Longline	
Jan	0.00		0.00	0.00	0.16	0.00	0.00	0.00	
Feb	0.00		0.00	0.00	0.15	0.00	0.00	0.00	
Mar	0.00		0.00	0.00	0.00	1.22	0.00	0.02	
Apr	0.78		3.92	0.00	0.00	0.19	0.00	2.41	
May	0.77		8.33	0.00	0.00	6.66	0.00	10.88	
Jun	0.00		0.06	1.83	0.38	3.55	0.00	10.24	
Jul	7.16		5.77	0.75	0.63	22.88	0.00	7.90	
Aug	9.55		0.00	0.00	0.03	1.09	0.00	0.12	
Sep	9.05		1.05	0.00	4.13	0.00	0.00	0.00	
Oct	6.47		33.66	0.00	0.00	4.89	0.00	4.89	
Nov	1.91		25.50	0.00	0.00	0.00	0.00	0.00	
Dec	1.11		3.08	0.00	0.00	0.00	0.00	0.00	
	36.80		81.37	2.58	5.48	40.47	0.00	36.46	203.17

	Canada (N)					Canada (M)			
2008	3N		3O			3N	3O		
Month	Ottertrawl	Longline	Ottertrawl	Gillnet	Longline	Longline	Ottertrawl	Longline	
Jan	0.90	0.00	0.00	0.00	0.04		0.00	1.02	
Feb	0.00	0.00	0.00	0.00	0.74	1.25	0.00		
Mar	0.02	0.00	0.00	0.00	0.49	2.34	0.00	4.91	
Apr	1.15	1.89	23.82	0.00	13.72	0.45	0.00	1.89	
May	7.30	0.00	29.70	0.00	8.32	0.00	0.00		
Jun	8.01	0.00	0.18	2.81	3.91	0.25	0.00	0.99	
Jul	22.65	0.00	0.03	1.19	8.38	1.70	0.00		
Aug	17.78	0.46	22.06	0.16	4.02	0.91	0.00	0.19	
Sep	11.89	0.00	11.80	0.09	2.01	0.88	0.00		
Oct	12.82	0.00	7.86	0.00	0.03	0.00	0.00	0.00	
Nov	1.81	0.00	0.91	0.00	0.14	0.00	0.00	0.00	
Dec	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	85.12	2.35	96.36	4.25	41.81	7.79	0.00	9.00	246.68

	Canada (N)					Canada (M)			
2009	3N		3O			3N	3O		
Month	Ottertrawl	Longline	Ottertrawl	Gillnet	Longline	Longline	Ottertrawl	Longline	
Jan	0.01	1.35	0.00	0.00	0.31	0.00	0.00	0.00	
Feb	0.06	1.55	0.14	0.00	0.00	0.00	0.00	0.00	
Mar	0.00	1.92	0.00	0.00	0.24	0.00	0.00	3.51	
Apr	0.54	0.21	0.07	0.00	3.49	0.00	0.00	0.00	
May	0.43	0.00	38.95	0.00	8.69	0.00	0.00	0.06	
Jun	0.71	0.00	6.77	0.36	7.02	1.40	0.00	0.01	
Jul	0.00	0.00	0.00	0.05	0.00	0.40	0.00	0.04	
Aug	2.02	0.24	12.11	0.00	0.00	0.16	0.00	0.00	
Sep	9.29	0.40	31.00	0.00	0.59	0.12	0.00	0.00	
Oct	0.81	0.00	12.54	0.00	1.26	0.00	0.00	0.00	
Nov	0.45	0.00	9.92	0.00	0.00	0.00	0.00	0.00	
Dec	0.61	0.00	3.50	0.00	0.00	0.00	0.00	0.00	
	14.92	5.67	115.00	0.41	21.60	2.08	0.00	3.62	163.30

Table 3. Total catch number ('000 fish with standard error and coefficient of variation), average weight and length at age for the cod fishery in Division 3NO for 2007-2009.

2007						
AGE	WEIGHT (kg.)	LENGTH (cm.)	SOP	NUMBER (000'S)	STD ERR.	CV
1	0.05	18.80	0.02	0.31	0.04	0.14
2	0.26	30.92	1.03	3.97	1.02	0.26
3	0.61	41.27	126.15	205.23	9.20	0.04
4	1.00	48.11	290.55	289.21	11.12	0.04
5	1.39	53.44	129.27	93.21	7.11	0.08
6	2.52	65.02	63.49	25.15	3.01	0.12
7	2.90	67.45	27.44	9.46	2.02	0.21
8	4.71	79.18	26.12	5.54	1.03	0.19
9	5.16	81.04	44.11	8.55	1.21	0.14
10	6.75	89.03	69.36	10.28	1.48	0.14
11	6.67	88.85	15.95	2.39	0.47	0.20
12	8.39	96.19	1.24	0.15	0.06	0.41
13	11.10	105.96	3.37	0.30	0.17	0.55
14	6.14	86.08	1.19	0.19	0.14	0.75
15	13.10	112.00	0.07	0.01	0.01	1.09
16	13.66	113.51	0.62	0.05	0.02	0.51
17	13.10	112.00	0.23	0.02	0.01	0.77
18	12.34	109.86	0.75	0.06	0.04	0.58
19	17.93	124.00	1.16	0.06	0.00	0.02
20	0.00	0.00	0.00	0.00	0.00	
		848	802.08	94.59%		

2008						
AGE	WEIGHT (kg.)	LENGTH (cm.)	SOP	NUMBER (000'S)	STD ERR.	CV
1	0.09	22.00	0.00	0.00	0.00	1.07
2	0.15	25.49	0.09	0.65	0.36	0.55
3	0.35	33.75	1.36	3.91	1.19	0.30
4	1.04	48.48	60.18	57.87	6.74	0.12
5	1.59	55.63	261.23	164.59	11.19	0.07
6	1.95	59.40	80.53	41.28	7.03	0.17
7	2.91	67.86	57.80	19.83	4.01	0.20
8	2.63	65.66	5.67	2.16	1.25	0.58
9	5.84	85.25	18.45	3.16	1.14	0.36
10	5.90	84.84	116.13	19.67	4.68	0.24
11	6.36	86.63	81.50	12.81	3.99	0.31
12	10.03	101.67	69.17	6.90	0.69	0.10
13	0.00	0.00	0.00	0.00	0.00	
14	14.25	114.19	44.78	3.14	0.29	0.09
15	14.16	113.78	3.68	0.26	0.13	0.52
16	12.62	109.33	6.03	0.48	0.02	0.03
17	12.30	109.00	1.92	0.16	0.11	0.73
18	15.68	117.75	11.83	0.75	0.13	0.17
19	16.98	121.00	1.24	0.07	0.07	0.93
20	0.00	0.00	0.00	0.00	0.00	
		921	821.59	89.21%		

2009						
AGE	WEIGHT (kg.)	LENGTH (cm.)	SOP	NUMBER (000'S)	STD ERR.	CV
1	0.13	25.00	0.03	0.22	0.11	
2	0.20	28.79	2.35	11.66	1.61	0.14
3	0.46	37.12	119.81	261.78	12.31	0.05
4	0.65	41.82	108.15	166.95	9.79	0.06
5	1.31	52.18	178.15	136.29	7.49	0.05
6	2.16	61.11	194.30	90.04	5.46	0.06
7	2.68	65.07	69.60	26.00	2.91	0.11
8	3.80	73.74	41.08	10.80	2.17	0.20
9	4.55	79.39	5.10	1.12	0.74	0.66
10	8.20	95.05	33.29	4.06	1.43	0.35
11	7.51	92.74	49.85	6.64	2.08	0.31
12	8.81	96.09	140.54	15.95	2.97	0.19
13	12.06	108.87	19.39	1.61	0.98	0.61
14	13.10	112.00	6.87	0.52	0.57	1.08
15	13.10	112.00	13.74	1.05	0.79	0.75
16	0.00	0.00	0.00	0.00	0.00	
17	0.00	0.00	0.00	0.00	0.00	
18	0.00	0.00	0.00	0.00	0.00	
19	0.00	0.00	0.00	0.00	0.00	
20	0.00	0.00	0.00	0.00	0.00	
		1083	982.25	90.70%		

Table 4. A review of sampling used to compile catch at age for 3NO cod from 1995 to 2009.
Highlighted years note use of Canadian RV age/length keys to some commercial catches

	Sampling	Canada	Spain	Portugal	Other
1995	No Spanish sampling.Sampling available from Portuguese gill net and otter trawl fisheries	14/GN 60/LL	29	15/OT 15/GN	79
1996	No Spanish sampling.Sampling insufficient	19/OT 31/GN 47/LL 1 MWT Total 98	5	26/OT 6/GN	38
1997	Sampling insufficient	203/GN 83/OT 40/LL 2/MWT 329 Total		113	
1998	Some Canadian otter trawl frequencies and age samples but nothing for gillnets. Portuguese length frequencies but no aging.	185/OT 160/GN 50/LL 396 Total		95/OT	56
1999	Length and age sampling for Canadian by-catch was limited to the otter trawl fishery in 3N and gillnet fishery in 3O. Where deemed appropriate sampling was used for the adjacent division. Canadian catch at age was prorated by 135 t for catch with no sampling was available. Some monthly frequencies by division were provided by Portugal and these in conjunction with keys from the Canadian Spring RV surveys were use to partition the Portuguese and Spanish catch. Age composition by division was provided by Russia.	122OT 351/GN 66/LL 2/ST 26/UK	3	322	26
2000	Length sampling for Canadian by-catch was limited to the otter trawl fishery in 3N and 3O. Age sampling was inadequate so spring and fall rv keys were used. Canadian catch at age was prorated for 77 t of catch with no sampling. Frequencies provided by Portugal and Spain were used with Canadian RV survey key to calculate catch for Portugal and Spain. Age composition by division was provided by Russia.	128/OT 29/GN 43/LL 7/UK	200	500	143
2001	Length sampling for Canadian by-catch was limited to the otter trawl fishery in 3N and 3O.However this comprised 85% of the Canadian catch.89 t caught in other gears added to the overall Canadian, Spanish and Portuguese catch at age. Age sampling for Canadian catch adequate . Portugal provided catch by area and month and length sampling. Spain provided catch by division and length sampling. Portuguese catch at age compiled using monthly sampling and keys created from Canadian Spring and Autumn RV surveys using only data from strata stradiling or outside 200mile limit. Spanish catch at age compiled using yearly frequencies by division provided and a key created by combining the two RV keys. Russia provided catch at age for sampled fish. Estonian catch at age based on Russian data. Individual countries catch at age scaled to catch agreed on at June 2002 STACFIS meeting.	470/OT 24/GN 61/LL 4/SS	89/OT	392/OT	271
2002	Adequete length measurment from Canadian ottertrawl fishery by-catch . Canadian sampling of the gillnet by-catch is minimal however this gear accounts for less than 5% of the catch. With such small amounts being landed it's next to impossible to capture a representative sample. Longline by-catch makes up ~8 % of the Canadian catch and it is not sampled at all. Frequencies from Portugal, Spain and Russia were used with Canadian commercial keys to partition catch into catch at age.	370/GN 2933/OR	255/OT	8484/OT	9577/OT
2003	Adequete length measurment from Canadian ottertrawl fishery by-catch . However by-catch in other Canadian fisheries accounted for ~25% of the Canadian catch. This was poorly sampled and age distribution of this catch may not reflect reality. Ample length samples were provided by the Portugal and Russia. these were used inconjunction with Canadian Research survey keys to create catch at age for Russia and Portugal. Catch by Spain was partitioned using frequencies from Portugal. Catch by Norway, Lithuania and Estonia was partitioned using frequencies from Russia.	45/GN 86/LL 5437/OT		13236/OT	5291/OT
2004	Length sampling limited to Canadian by-catch in the otter trawl fishery. This sampling is sparce and should be improved as there are observers aboard the vessels fishing Yellow tail flounder. By-catch by other gears accounted for 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
2007	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tail, redfish and hake. The ottertrawl fishery was sampled by observers. About 40 % of the Canadian catch was taken in longline fisheries and no sampling exist for this catch	1457/ OT NO LL	401 (135 mm mesh) /OT No sampling for 280mm mesh	376 (130mm mesh)/OT; 18 (280mm mesh)/OT	811 /OT /Russian fishery
2008	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tail, redfish and hake. The ottertrawl fishery was sampled by observers. About 25 % of the Canadian catch was taken in longline fisheries and no sampling exist for this catch	1796 OT NO LL	408 OT	41 OT for 3O	519 OT
2009	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tail, redfish and hake. The ottertrawl fishery was sampled by observers. About 20 % of the Canadian catch was taken in longline fisheries and no sampling exist for this catch. Canadian research survey keys used to age all catch	246/OT length and 24 aged fish	511(130mm, 3N)/OT; 98(280mm, 3N)/OT	1935 OT	

Table 5. Catch-at-age used in this assessment for Divisions 3NO cod, 1959-2009 ('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
2007	4	205	289	93	25	9	6	9	10	2	0	653
2008	1	4	58	165	41	20	2	3	20	13	7	333
2009	12	262	167	136	90	26	11	1	4	7	16	731

Table 6. Catch weight-at-age used in this assessment for Divisions 3NO cod, 1959-2009 ('000s). (Shaded values are estimates based on a geometric mean - see text)

Year\Age	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
1960	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1961	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1962	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1963	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1964	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1965	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1966	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1967	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1968	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1969	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1970	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1971	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1972	0.54	0.97	1.44	2.08	2.89	3.56	5.95	7.95	8.32	10.14
1973	0.57	1.00	1.43	2.19	3.63	4.63	6.25	9.56	11.17	13.99
1974	0.42	0.73	1.20	1.96	2.86	4.67	7.32	5.46	8.40	7.51
1975	0.38	0.89	1.28	2.13	3.14	4.16	5.53	6.74	5.27	7.09
1976	0.50	0.91	1.41	2.33	3.25	4.03	6.67	8.74	9.14	12.49
1977	0.57	1.00	1.48	2.48	3.51	4.74	7.17	8.81	11.70	11.47
1978	0.72	1.05	1.55	2.25	3.74	4.61	6.19	7.23	9.48	12.87
1979	0.65	0.98	1.39	2.09	2.87	3.70	4.75	7.15	7.98	10.11
1980	0.71	1.04	1.69	2.50	3.69	5.49	7.98	9.22	10.60	12.61
1981	0.90	1.27	1.84	2.69	3.55	5.33	7.13	9.10	9.01	10.15
1982	0.94	1.17	1.50	2.20	3.83	5.26	7.49	8.80	9.82	12.28
1983	0.85	1.17	1.87	2.63	3.80	5.20	6.27	8.08	8.99	11.01
1984	0.79	1.15	1.51	2.28	3.04	4.05	5.76	7.22	8.92	12.61
1985	0.48	0.86	1.37	2.05	3.25	4.65	6.62	8.32	9.15	11.13
1986	0.39	1.01	1.52	2.16	3.49	5.41	7.95	9.82	9.94	9.88
1987	0.49	0.82	1.30	1.83	2.89	4.76	7.26	8.95	9.85	12.59
1988	0.74	1.00	1.38	1.79	2.23	3.77	5.12	6.88	9.37	11.07
1989	0.51	0.97	1.60	2.24	3.27	4.61	7.08	8.31	9.47	12.25
1990	0.55	1.01	1.46	2.51	2.73	4.14	5.02	8.37	9.29	11.25
1991	0.55	0.85	1.59	2.30	3.83	5.56	7.53	9.04	11.98	13.98
1992	0.33	0.65	1.06	1.80	2.82	4.85	5.56	7.43	8.64	10.65
1993	0.36	0.78	1.35	1.84	2.82	4.11	5.87	7.76	8.79	8.67
1994	0.27	0.46	0.91	1.63	1.84	4.04	4.94	7.54	3.44	7.52
1995	0.42	0.75	1.21	2.03	2.29	2.08	6.60	6.22	6.41	8.03
1996	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03
1997	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03
1998	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03
1999	0.50	0.94	1.59	2.07	2.23	2.83	3.99	6.05	6.73	7.38
2000	0.60	0.82	1.45	2.39	3.44	2.90	2.64	3.78	5.25	6.07
2001	0.58	1.09	1.38	2.07	4.06	5.22	5.32	5.51	7.51	8.60
2002	0.67	1.01	1.52	2.24	3.38	5.15	5.99	7.11	8.47	9.32
2003	0.67	0.94	1.40	2.02	3.01	4.10	7.63	7.74	8.52	9.23
2004	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
2006	0.33	0.68	1.11	1.36	2.05	2.60	3.26	4.66	7.07	7.39
2007	0.61	1.00	1.39	2.52	2.90	4.71	5.16	6.75	6.67	8.39
2008	0.35	1.04	1.59	1.95	2.91	2.63	5.84	5.90	6.36	10.03
2009	0.46	0.65	1.31	2.16	2.68	3.80	4.55	8.20	7.51	8.81

Table 7. Cod abundance (000's) from Canadian spring RV surveys in Division 3N for depths <200 fathoms.

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

Depth range (fath)	Strata	Vessel Area Sq. mi.	AN 27 1984	WT 29 AN 43 1985	WT 47 1986	WT 58-59 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			02-May-84	27-Apr-85	29-Apr-86	09-May-87	01-May-88	02-May-89	12-May-90	07-May-91	08-May-92	13-May-93	18-May-94	18-May-95	25-May-96
0-30	375	1593	22302	12390	2240	6223	3134	4868	3236	111	148	74	0	0	0
	376	1499	149223	149	787	88795	2533	599	268	119	0	0	0	69	165
31-50	360	2992	136658	27167	9750	31721	35911	1053	3020	900	2731	907	0	0	449
	361	1853	29339	50443	5585	47837	15405	9136	6634	2574	804	836	103	625	1077
	362	2520	68550	20045	5400	117654	6860	7054	8400	1120	58	117	0	0	39
	373	2520	27500	4161	1600	11738	2625	3096	1575	223	0	0	0	0	39
	374	931	10431	776	86	931	879	52	388	26	129	0	0	0	85
	383	674	62	0	0	967	686	499	47	62	0	0	0	0	0
51-100	359	421	2339	0	40375	7163	5584	1637	819	1199	1696	2193	0	0	33
	377	100	1771	2451	465	6396	0	424	0	0	0	28	49	0	0
	382	647	0	3572	22	60	180	1588	3325	0	0	0	0	0	0
101-150	358	225	2703	5766	4063	4359	5328	3984	8297	1047	16484	3391	109	156	310
	378	139	2481	43824	6313	2124	1921	1612	2751	875	3707	608	222	97	163
	381	182	1534	12968	8249	392	3185	3741	3665	202	88	0	13	114	160
151-200	357	164	0	11571	444	**1428**	11	68	888	2528	2676	68	433	23	90
	379	106	788	3195	5010	7	44	206	1318	2311	8782	545	191	66	204
	380	116	209	3681	526	934	1498	967	2062	3859	870	20654	0	32	471
total all strata fished < 200 fathoms			455890	202158	90915	327301	85786	40583	46692	17156	38174	29420	1120	1182	3283
total <200 fathoms adjusted			455890	202159	90915	328729	85784	40584	46693	17156	38173	29421	1120	1182	3285
upper limit			891831	278710	543939	531816	118657	53692	79795	35126	63165	286252	7723	2774	5144
t-value			2.776	2.776	12.706	2.228	2.145	2.365	4.303	4.303	4.303	12.706	12.706	2.447	2.365
1 std dev			157039	27576	35654	91793	15324	5543	7693	4176	5808	20213	520	651	787

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000	WT 367-369 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 759-762 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			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	22-Jun-07	11-Jun-08	02-Jun-09
0-30	375	1593	131	292	5259	329	351	131	263	175	877	11213	14846	394
	376	1499	0	1272	103	206	41	0	41	1004	41	18046	11599	330
31-50	360	2992	86	823	150	41	82	453	659	2552	1784	11271	10290	1957
	361	1853	549	2258	2650	1869	510	1997	892	3035	2185	17801	9023	3271
	362	2520	50	139	1042	1271	1078	193	39	314	260	3983	1425	762
	373	2520	50	35	77	0	193	77	0	39	193	354	87	390
	374	931	38	0	85	0	128	43	0	0	43	43	192	0
	383	674	0	0	0	0	0	0	0	0	46	0	46	0
51-100	359	421	138	26	58	29	87	29	0	0	463	927	1332	8108
	377	100	0	7	0	0	0	0	0	7	199	138	1204	17
	382	647	0	0	45	134	0	0	0	0	579	102	0	0
101-150	358	225	261	41	1254	69	3111	234	8940	155	1045	4380	4591	97233
	378	139	136	96	38	209	108	44	1523	1000	365	1635	2798	4214
	381	182	13	0	150	0	1152	0	113	300	7489	235	1828	22
151-200	357	164	20	219	73	282	872	168	110	43	60	160	23	9656
	379	106	194	72	58	21	642	105	129	49	65	93	10	241
	380	116	6239	48	96	117	511	23	609	207	145	19	95	186
total all strata fished < 200 fathoms			7905	5328	11138	4577	8866	3497	13318	8878	15839	70400	59389	126781
total <200 fathoms adjusted			7905	5328	11138	4577	8866	3497	13318	8878	158839	70396	59389	126781
upper limit			85516	8714	15958	6928	48358	5573	127402	16024	96713	95034	78719	1372029
t-value			12.71	2.14	2.45	214	12.71	2.36	12.71	2.131	12.71	2.13	2.16	12.71
1 std dev			6106	1582	1967	11	3107	880	8976	3353	6363	11565	8949	97974

Table 8. Cod biomass (t) from Canadian spring RV surveys in Division 3N for depths < 200 fathoms.
Shaded Numbers are estimates for non sampled strata. Data for 1984-1995 has been converted to Campellan equivalent units.

Depth range (fath)	Strata	Vessel Area Sq. mi.	AN 27 1984	WT 29 AN 43 1985	WT 47 1986	WT 58-59 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			02-May-84	27-Apr-85	29-Apr-86	09-May-87	01-May-88	02-May-89	12-May-90	07-May-91	08-May-92	13-May-93	18-May-94	18-May-95	25-May-96
0-30	375	1593	7018	26266	21041	13506	23154	25148	16134	1835	2331	1145	0	0	0
	376	1499	16673	713	2954	9148	6555	1256	3791	1483	0	0	0	51	62
31-50	360	2992	21843	17007	3781	4155	3792	2145	10488	1032	1445	46	0	0	457
	361	1853	20008	52794	61130	50358	25677	19517	30149	16646	399	3455	64	47	647
	362	2520	75781	29914	31327	144250	19890	26588	37344	4343	668	1522	0	0	21
	373	2520	33487	5274	4378	14596	9738	8996	5802	856	0	0	0	0	9
	374	931	14987	1523	1338	1832	5872	937	5050	516	30	0	0	0	11
	383	674	502	0	0	1664	236	574	615	224	0	0	0	0	0
51-100	359	421	308	0	2639	779	637	213	101	66	113	433	0	0	36
	377	100	145	219	138	1720	0	46	0	0	0	9	8	0	0
	382	647	0	257	84	42	59	782	298	0	0	0	0	0	0
101-150	358	225	822	906	1724	4255	1317	1701	1089	131	2650	1699	164	135	131
	378	139	692	4601	1084	358	441	432	399	145	413	247	64	76	84
	381	182	765	5397	2913	247	786	216	800	399	15	0	57	44	40
151-200	357	164	0	6352	640	**566**	33	64	274	331	706	46	237	24	18
	379	106	382	1198	1587	9	37	98	318	852	2592	205	121	46	66
	380	116	411	2128	366	1018	656	498	704	676	181	9823	0	9	100
total all strata fished < 200 fathoms			193825	154547	137124	247937	98880	89212	113355	29536	11544	18629	714	433	1682
total <200 fathoms adjusted			193824	154549	137124	248503	98880	89211	113356	29535	11543	18630	715	432	1682
upper limit			256272	192257	211519	326927	125247	115281	141017	49183	19173	143715	1950	761	2843
t-value			2.093	2.064	2.201	2.093	2.086	2.11	2.02	2.306	2.776	12.706	4.303	2.776	2.101
1 std dev			29836	18270	33801	37740	12640	12355	13694	8520	2748	9845	287	118	553

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000	WT 367-369 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 759-762 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			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	22-Jun-07	11-Jun-08	02-Jun-09
0-30	375	1593	92	108	3225	54	592	88	1229	89	632	2669	2016	208
	376	1499	0	75	4	43	6	0	458	286	8	528	1810	451
31-50	360	2992	15	12	315	19	588	244	1417	84	1798	1057	8204	89
	361	1853	378	682	3496	533	240	1856	1987	299	2582	7983	1619	885
	362	2520	317	407	946	1328	1110	22	2	2134	1746	5449	2499	128
	373	2520	168	9	50	0	8	11	0	2	74	458	3	76
	374	931	136	0	11	0	30	15	0	0	10	6	327	0
	383	674	0	0	0	0	0	0	0	0	42	0	9	0
51-100	359	421	199	1	114	194	54	7	0	0	71	2385	434	9025
	377	100	0	15	0	0	0	0	0	29	298	33	990	8
	382	647	0	0	9	27	0	0	0	0	239	79	0	0
101-150	358	225	104	73	1171	23	1818	327	14117	258	611	3049	4361	39777
	378	139	109	80	21	184	92	16	739	377	118	1101	710	1927
	381	182	2		16	0	708	0	12	49	2276	159	702	2
151-200	357	164	9	221	51	242	676	158	204	60	59	262	28	3063
	379	106	104	24	12	8	536	74	68	22	82	72	5	242
	380	116	3457	13	18	14	71	14	97	36	43	8	51	18
total all strata fished < 200 fathoms			5090	1720	9459	2669	6529	2832	20330	3726	10689	25298	23769	55898
total <200 fathoms adjusted			5090	1720	9459	2669	6529	2832	20330	3726	10689	25297	23769	55898
upper limit			48785	2783	16197	5747	12873	6743	200410	8706	17805	36782	35391	574634
t-value			12.71	2.14	2.23	2.26	3.18	2.57	12.71	2.31	2.57	2.16	3.18	12.71
1 std dev			3438	497	3022	1362	1995	1522	14168	2160	2769	5317	3652	40813

Table 9. Cod abundance (000's) from Canadian spring RV surveys in Division 3N for depths > 200 fathoms.Data for 1991-1995 has been converted to Campellan equivalent units.

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000
mean survey date			07-May-91	08-May-92	13-May-93	18-May-94	18-May-95	25-May-96	16-May-97	22-May-98	31-May-99	30-May-00
201-300	723	155	1970	13573	43	32	0	46	77	53	0	139
	725	105	401	**nf**	0	95	73	34	16	49	33	361
	727	160	833	2144	1444	222	211	1394	109	55	44	383
301-400	724	124	69	112	9	34	17	0	50	61	0	0
	726	72	0	0	0	0	70	0	12	0	0	0
	728	156	0	0	0	0	43	0	0	0	0	0
401-500	752	134	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	756	106	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	760	154	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			20429	54003	30916	1504	1597	4789	8165	5545	11214	5460
upper			38845	212125	287928	3892	3156	24093	85786	8939	16037	7953
t-value			4.303	12.706	12.706	4.303	2.365	12.706	12.71	2.14	2.45	2.13
1 STD			4280	12445	20228	555	659	1519	6107	1586	1969	1170

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 367-369 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 759-762 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			24-May-01	23-May-02	25-May-03	26-May-03	03-Jun-05	22-Jun-07	11-Jun-08	02-Jun-09
201-300	723	155	3179	1658	550	85	0	19	0	81
	725	105	661	148	0	0	0	0	0	12
	727	160	528	446	50	0	0	0	0	105624
301-400	724	124	45	62	8	9	0	0	**nf**	0
	726	72	0	36	0	0	0	0	0	0
	728	156	0	0	0	0	0	13	0	0
401-500	752	134	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	756	106	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	760	154	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			13279	5845	13926	8972	15839	70428	59339	232497
upper			31301	28722	128156	16121	96713	95066	78719	1559273
t-value			4.3	12.71	12.71	2.13	12.71	2.13	2.16	12.71
1 STD			4191	1800	8990	3356	6363	11567	8972	104388

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

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-153 1994	WT 168-169 1995	WT 188-189 1996	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000
mean survey date			07-May-91	08-May-92	13-May-93	18-May-94	18-May-95	25-May-96	16-May-97	22-May-98	31-May-99	30-May-00
201-300	723	155	662	3415	30	26	0	35	80	77	0	270
	725	105	186	**nf**	0	32	8	19	9	10	13	163
	727	160	486	805	313	86	41	677	71	25	6	180
301-400	724	124	30	32	9	22	26	0	40	191	0	0
	726	72	0	0	0	0	31	0	5	0	0	0
	728	156	0	0	0	0	26	0	0	0	0	0
401-500	752	134	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	756	106	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	760	154	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			30901	15795	18982	880	566	2430	5295	2024	9479	3281
upper			50596	28054	144081	2151	888	6155	49001	3168	16216	6357
t-value			2.306	3.182	12.706	4.303	2.571	4.303	12.71	2.13	2.23	2.23
1 STD			8541	3853	9846	295	125	866	3439	537	3021	1379

Depth range (fath)	Strata	Vessel Area Sq. mi.	WT 367-369 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 759-762 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			24-May-01	23-May-02	25-May-03	26-May-03	03-Jun-05	22-Jun-07	11-Jun-08	02-Jun-09
201-300	723	155	2233	1598	956	46	0	60	0	168
	725	105	443	100	0	0	0	0	0	5
	727	160	295	96	25	0	0	0	0	33157
301-400	724	124	100	36	25	6	0	0	**nf**	0
	726	72	0	12	0	0	0	0	0	0
	728	156	0	0	0	0	0	4	0	0
401-500	752	134	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	756	106	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	760	154	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			9601	4673	21336	3778	10692	25361	23769	89228
upper			18074	11424	201747	8759	17805	36847	35391	639214
t-value			3.18	3.18	12.71	2.31	2.57	2.16	3.18	12.71
1 STD			2664	2123	14199	2156	2768	5318	3652	43272

Table 11. Cod abundance (000's) from Canadian Spring RV Surveys in Division 3O for depths <200 fathoms.
Shaded Numbers are estimates for non-sampled strata. Data for 1984-1995 have been converted to Campellen equivalent units

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984	AN 43 1985	WT 47 1986	WT 58-60 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			03-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	04-May-94	07-May-95	11-May-96
31-50	330	2089	7761	7892	3707	11315	5384	1609	4990	1424	203	373	0	0	4824
	331	456	3863	1921	744	1900	1425	792	**1052**	158	32	0	0	0	348
	338	1898	23356	9724	8933	20210	6623	20166	8436	24463	2285	835	132	264	2109
	340	1716	10606	9414	10282	146151	2826	1960	3628	2569	334	119	286	0	1441
	351	2520	78342	17578	117725	71723	13335	6112	6242	2071	1050	350	250	0	525
	352	2580	41362	17656	9803	35888	56193	10474	14499	9752	3852	1331	1299	1111	1115
	353	1282	0	2226	2773	29082	44478	4731	6499	1297	4229	223	0	285	677
51-100	329	1721	5928	2390	2838	133032	5259	5577	13147	22309	508	1673	13959	1100	330
	332	1047	436	3432	1115	30014	2908	3112	5700	683773	29607	296105	0	2399	3184
	337	948	1909	5688	1369	1799	2337	10402	2133	22436	6913	231602	132	527	2502
	339	585	14625	894	135	2383	488	27	1625	1571	609	406	0	0	46
	354	474	2238	1843	2216	65669	2271	593	395	9019	1679	1415	0	0	66
101-150	333	151	0	42	105	566	0	378	136	692	975	514	2205	10	688
	336	121	0	17	126	17	8	8	143	160	5537	437	605	0	8
	355	103	0	4070	29	207	43	987	193	2339	944	236	50	7	2573
151-200	334	92	0	236	1323	26	121	141	543	1214	971	1137	533	200	184
	335	58	0	0	68	8	12	16	97	27	1275	342	157	52	490
	356	61	0	0	13	4	51	131	110	546	2665	424	491	13	93
total strata fished < 200 fathoms			190427	85023	163306	549997	143763	67215	68515	785821	63667	537522	20100	5967	21202
total <200 fathoms adjusted			190426	85023	163304	549994	143762	67216	69568	785820	63668	537522	20099	5968	21203
upper limit			242768	109795	363874	823914	229667	89730	90269	2506436	126262	3992300	58534	10117	32019
t-value			2.228	2.052	2.16	2.306	2.201	2.052	2.11	2.571	2.776	12.706	2.776	2.306	2.365
1 std dev			23492	12072	92856	118784	39030	10972	10310	669240	22549	271901	13845	1800	4574

Depth range (fath)	Strata	Vessel Area Sq. mi	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000	WT 365 +367 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 759-762 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			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	13-May-07	27-May-08	19-May-09
31-50	330	2089	509	4310	4037	8680	1519	616	270	1204	5090	3818	2504	1514
	331	456	0	8343	452	2635	3858	220	63	1725	1976	502	27035	215407
	338	1898	160	895	15015	6571	7006	3264	1044	970	9095	4700	4700	2176
	340	1716	529	173	1770	3682	567	189	330	283	519	923	354	13691
	351	2520	453	277	1631	12046	1820	545	217	43	1127	2080	7106	520
	352	2580	927	1278	14932	5481	3372	1730	754	877	5989	22182	12625	5790
	353	1282	0	564	507	1693	397	321	220	139	887	18473	529	0
51-100	329	1721	765	8194	8370	1278	2746	379	2557	440	1868	4545	710	1089
	332	1047	432	720	8121	27653	816	672	96	3271	0	1296	4081	23834
	337	948	681	1239	9389	3032	1130	478	565	366	452	1130	1000	956
	339	585	0	121	497	40	281	201	0	0	80	138	0	0
	354	474	0	4583	4864	587	163	33	33	0	246	3130	0	0
101-150	333	151	1447	194	25	92	71	20	9	10	10	48	9	0
	336	121	128	25	17	0	42	92	0	67	0	7	17	0
	355	103	6	50	44	39	234	31	21	65	6	50	21	50
151-200	334	92	94	26	28	70	54	1017	19	17	0	44	17	634
	335	58	211	36	37	13	278	357	4	0	0	4	4	12
	356	61	70	82	67	96	62	149	22	67	0	50	15	35
total strata fished < 200 fathoms			6412	31110	69803	73688	24416	10314	6224	9545	27345	63120	60727	265709
total <200 fathoms adjusted			6412	31110	69803	73688	24416	10314	6224	9545	27345	63119	60727	265709
upper limit			25638	65284	102583	110064	31201	14550	12891	19085	43328	91678	402410	2975301
t-value			12.706	2.78	2.2	2.45	2.14	2.36	2.776	4.303	2	2	13	13
1 std dev			1513	12293	14900	14847	3171	1795	2402	2217	6772	12101	26891	213186

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

Depth range (fath)	Strata	Vessel Area Sq. mi	AN 27 1984	AN 43 1985	WT 47 1986	WT 58-60 1987	WT 70 1988	WT 82 1989	WT 95-96 1990	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996
mean survey date			03-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	04-May-94	07-May-95	11-May-96
31-50	330	2089	7964	9372	4167	12075	4486	3318	5091	266	32	92	0	0	7103
	331	456	4536	4891	1295	1982	2176	481	**2191**	236	224	0	0	0	983
	338	1898	43090	13670	23245	20013	14538	25430	9315	10283	11883	4981	1841	3439	1535
	340	1716	13654	10780	12024	161120	16447	5478	10296	384	52	1936	160	0	239
	351	2520	68620	34516	90852	114632	25324	19777	22343	6595	2063	1198	131	0	104
	352	2580	51655	41868	24245	76430	82226	43865	38424	22512	16671	8225	1584	3784	1528
	353	1282	0	9451	1831	15552	4512	4012	5892	1267	1780	3260	0	609	118
51-100	329	1721	1776	1931	1114	116331	16127	1690	4684	4195	97	219	10523	2187	191
	332	1047	4410	17134	4092	12848	11718	2156	11266	39264	3927	108245	0	1702	1534
	337	948	741	2976	11644	4299	1005	5735	3354	5566	20721	79783	813	1659	3299
	339	585	3355	730	73	943	496	219	385	92	87	43	0	0	5
	354	474	955	660	569	6915	1211	87	562	3325	191	1319	0	0	85
101-150	333	151	0	330	411	1837	0	1486	381	877	273	1661	8549	26	1625
	336	121	0	81	120	35	39	44	318	111	1733	375	661	0	19
	355	103	0	724	29	259	38	538	198	329	63	169	32	31	2344
151-200	334	92	0	898	4773	120	473	294	826	1385	1018	1408	959	333	259
	335	58	0	0	159	38	82	16	110	10	276	2522	453	342	680
	356	61	0	0	42	15	178	154	219	88	308	387	257	16	46
total strata fished < 200 fathoms			200758	150013	180686	545446	181076	114780	113664	96783	61399	215824	25964	14127	21696
total <200 fathoms adjusted			200756	150012	180685	545444	181076	114780	115855	96785	61399	215823	25963	14128	21697
upper limit			259926	187944	303904	774350	254658	184780	143844	187783	120673	1396053	56360	20543	32630
t-value			2.228	2.032	2.16	2.131	2.11	2.16	2.021	2.571	2.776	12.706	2.571	2.074	2.306
1 std dev			26557	18667	57045	107416	34873	32407	14933	35395	21352	92888	11823	3094	4742

Depth range (fath)	Strata	Vessel Area Sq. mi	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000	WT 365 +367 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 759-762 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			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	13-May-07	27-May-08	19-May-09
31-50	330	2089	357	12526	8593	8401	2296	190	20	2806	5951	1345	10114	509
	331	456	0	34685	1105	6842	1738	1251	326	8186	773	218	2641	53267
	338	1898	196	5069	9416	6982	13092	2456	4712	1625	1688	3486	2607	2622
	340	1716	186	512	3857	2164	1469	33	25	1735	1901	1178	381	5325
	351	2520	286	1888	5269	47572	4266	38	38	583	1293	237	3401	65
	352	2580	2869	5341	14309	8226	11344	6932	3093	3130	6446	9602	9189	5946
	353	1282	0	18	1719	7130	529	4394	607	758	141	1129	523	0
51-100	329	1721	614	13037	9671	628	896	63	1623	173	1569	2050	430	170
	332	1047	1558	2136	1350	4360	272	42	462	906	0	240	494	19689
	337	948	527	1720	3095	1040	553	160	171	890	360	211	1399	504
	339	585	0	441	1210	1	733	48	0	0	3	1	0	0
	354	474	0	2258	1088	218	737	218	474	0	484	438	0	0
101-150	333	151	974	255	26	77	43	31	13	2	20	32	6	0
	336	121	322	16	18	0	46	95	0	96	0	3	20	0
	355	103	15	74	26	13	169	27	2	51	22	33	17	48
151-200	334	92	305	46	72	98	33	1241	18	87	0	67	28	227
	335	58	734	75	207	37	254	437	8	0	0	3	5	26
	356	61	47	102	108	442	69	142	26	131	0	45	19	53
total strata fished < 200 fathoms			8990	80199	61139	94231	38539	17798	11618	21158	20651	20318	22175	88452
total <200 fathoms adjusted			8990	80199	61139	94231	38539	17798	11618	21158	20650	20318	22175	88452
upper limit			15716	546664	86203	206438	52036	27516	18496	135184	30645	32054	32051	703206
t-value			2.201	12.71	2.09	2.36	2.09	2.18	2.13	12.71	2.14	2.23	2.20	12.71
1 std dev			3056	36701	11992	47545	6458	4458	3229	8974	4670	5263	4487	48368

Table 13. 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)	Strata	Vessel Area Sq. mi	WT 105-106 1991	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000
mean survey date			24-Apr-91	26-Apr-92	30-Apr-93	04-May-94	07-May-95	11-May-96	16-May-97	22-May-98	19-May-99	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

Depth range (fath)	Strata	Vessel Area Sq. mi	WT 365 +367 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 659-652 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			07-May-01	05-May-02	11-May-03	18-May-04	16-May-05	13-May-07	27-May-08	19-May-09
201-300	717	166	838	183	114	553	34	44	170	180
	719	76	134	0	21	8	52	0	0	21
	721	76	67	9	19	5	0	0	48	12
301-400	718	134	0	18	0	0	0	0	0	0
	720	105	7	17	0	0	0	0	0	0
	722	93	17	0	0	0	0	0	0	0
401-500	764	105	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	772	135	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			25478	10540	6378	10112	27432	63164	60945	265922
upper			32326	14786	13046	17319	43416	91722	402630	2975514
t-value			2.1	2.36	2.776	3.18	2.36	2.36	12.706	12.71
1 STD			3261	1799	2402	2266	6773	12101	26892	213186

Table 14. 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	WT 119-120 1992	WT 136-137 1993	WT 152-154 1994	WT 168-169 1995	WT 188-189 1996	WT 204-208 1997	WT 221-222 1998	WT 238-241 1999	WT 315-318 2000
mean survey date			24-Apr-91	26-Apr-92	30-Apr-93	04-May-94	07-May-95	11-May-96	16-May-97	22-May-98	19-May-99	16-May-00
201-300	717	166	15218	436	1870	2094	339	57	238	30	47	108
	719	76	143	179	330	727	927	37	133	2	243	59
	721	76	88	12153	304	16	10	95	53	16	11	20
301-400	718	134	7	0	159	791	91	0	16	0	0	0
	720	105	0	139	9	222	34	3	164	11	20	0
	722	93	0	70	0	0	0	28	5	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			112240	74377	218496	29814	15528	21915	9598	80256	61459	94418
upper			202678	137245	1398738	60382	22196	32850	16345	546724	86530	206626
t-value			2.447	2.571	12.706	2.571	2.069	2.306	2.201	12.71	2.09	2.36
1 STD			36959	24453	92889	11890	3223	4742	3065	36701	11996	47546

Depth range (fath)	Strata	Vessel Area Sq. mi	WT 365 +367 2001	WT 419-424 2002	WT 478-481 2003	WT 546-549 2004	WT 618-621 2005	WT 659-652 2007	WT 827-829 2008	AN 904-906 2009
mean survey date			07-May-01	05-May-02	11-May-03	18-May-04	16-May-05	13-May-07	27-May-08	19-May-09
201-300	717	166	585	164	190	1224	71	147	191	110
	719	76	137	0	33	23	26	0	0	48
	721	76	323	22	39	9	0	0	74	19
301-400	718	134	0	18	0	0	0	0	0	0
	720	105	41	25	0	0	0	0	0	0
	722	93	52	0	0	0	0	0	0	0
401-500	764	105	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	772	135	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			39677	18027	11880	22415	20747	20465	22441	88629
upper			53209	27747	18765	137134	30744	32202	32321	703384
t-value			2.09	2.18	2.13	12.71	2.18	2.23	2.201	12.71
1 STD			6475	4459	3232	9026	4586	5263	4489	48368

Table 15. Abundance ('000) and Biomass (t) of cod from Autumn stratified random surveys in Division 3N. Data for 1990-1994 have been converted to Campellen equivalent units.

Abundance

Depth Range	Strata	Area	WT 101-102 1990 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	WT 770-772 Tel 750-751 2007 31-Oct-07	WT 835-837 2008 27-Oct-08	AN 913-915 Tel 894-895 2009 12-Oct-09
0-30	375	1593	5421	66596	**nf**	2047	1947	5001	0	603	329	14518	8163	4492	2849	446	438	3671	3999	4024	13586	4821
	376	1499	32419	455280	354763	260	312	3956	93	41	1598	361	819	876	317	324	2062	7099	987	10516	20758	112129
31-50	360	2992	28703	12311	8311	3463	0	437		137	309	2367	1132	2345	360	1242	1543	2036	14200	12142	470	6709
	361	1853	6273	14155	20718	6177	7549	3788	2025	2156	5761	1733	3161	6780	1173	4952	4282	12672	4384	30180	9431	9198
	362	2520	12855	73045	49583	1300	622	910	104	898	792	7924	6478	6438	314	99	198	1882	495	4727	14906	520
	373	2520	1336	22575	1400	750	0	70	130	50	149	3004	341	446	149	57	149	106	248	451	2253	469
	374	931	879	20754	**nf**	819	1034	57	65	43	171	512	85	1836	256	0	171	0	640	840	3522	1729
	383	674	530	530	**nf**	0	0	47	0	0	46	0	0	0	0	0	46	0	46	0	0	46
51-100	359	421	702	0	497	88	0	29	52	29	0	0	550	290	463	434	116	608	145	1319	898	347
	377	100	243	**nf**	493	0	7	7	12	0	0	21	21	481	51	0	206	35	76	297	5475	2586
	382	647	210	359	270	494	0	0	33	0	0	134	134	0	45	0	0	89	0	316	0	158
101-150	358	225	766	1500	5063	47	94	56	14	15	247	340	1156	342	437	356	279	512	1024	4797	3363	584
	378	139	550	2046	1602	48	10	10	0	17	10	1472	1785	226	476	36	315	1520	1430	850	8824	3142
	381	182	**nf**	0	**nf**	202	0	0	233	8	13	138	338	1702	13	0	2078	82	138	5858	3089	67
151-200	357	164	683	399	194	1526	57	20	39	0	124		168	61	10	102	124	229	302	56	124	121
	379	106	213	**nf**	596	655	81	33	52	79	13	988	164	663	47	52	54	91	58	73	131	32
	380	116	**nf**	798	**nf**	48	16	57	24	16	0	383	563	14	465	104	96	56	83	32	326	199
total strata fished <= 200			91783	670348	443490	17924	11729	14478	3359	4092	9562	33895	25058	26992	7425	8204	12158	30688	28255	76478	87158	142858
UPPER			156111	1657056	1675218	26592	20479	21567	6774	5741	14597	59471	41671	37378	16677	10433	20572	57783	59612	110533	147039	461901
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	2.26	2.776	4.3
1 std			29227	355442	286249	4041	3576	3221	1328	757	2228	9200	7551	4853	2909	1013	3027	11059	13287	15069	21571	74196
201-300	723	155	**nf**	0	**nf**	97	0	0	43	6	0	0	0	0	0	0	0	0	0	31	9	0
	725	105	**nf**	**nf**	0	80	0	12	22	0	7	7	0	7	14	0	**nf**	7	63	0	7	0
	727	160	**nf**	**nf**	**nf**	878	11	9	267	0	0	22	49	0	11	25	0	0	9	0	0	39
301-400	724	124	**nf**	0	**nf**	17	0	0	19	0	0	0	0	0	0 nf		0	0	0	60	0	0
	726	72	**nf**	**nf**	**nf**	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	16
	728	156	**nf**	**nf**	**nf**	**nf**	0	0	76	0	0	0	0	0	0	0	43	0	0	0	0	0
Total strata > 200 fathoms			0	0	0	1072	11	21	437	6	7	29	49	7	25	25	43	7	72	91	16	55
Total all strata fished			91783	670348	443490	18996	11741	14498	3795	4098	9568	33924	25115	26972	7447	8229	12201	30696	28326	76568	87175	142913
Upper limit			156111	1657056	1675228	27812	20490	21588	7257	5747	14604	59500	41720	37386	16702	10459	20616	57783	59684	110624	147056	461956
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	2.26	2.776	4.3
1 std			29227	355442	286251	4137	3575	3221	1375	757	2228	9200	7548	4866	2910	1014	3027	11056	13287	15069	21571	74196

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	WT 770-772 Tel 750-751 2007 31-Oct-07	WT 835-837 2008 27-Oct-08	AN 913-915 Tel 894-895 2009 12-Oct-09
0-30	375	1593	31395	69276	**nf**	3305	9447	3162	0	594	839	2022	8642	1490	2135	192	47	487	6913	6277	5111	3038
	376	1499	5147	80732	116390	152	993	4035	806	12	791	46	2677	2351	813	1025	23	5798	2112	910	11121	31762
31-50	360	2992	7585	4456	4572	8072	0	1329	319	1226	1258	8681	1536	3183	217	2917	5334	2220	12038	2291	2231	7251
	361	1853	24777	16326	12485	12996	12111	8626	1734	3255	3811	1060	1986	3319	4519	6749	9089	8438	2887	3624	8548	9296
	362	2520	9636	40955	22852	1576	1001	337	29	2581	713	4955	2840	4146	1597	582	54	3160	1582	1640	6235	247
	373	2520	9722	26255	4114	254	0	39	49	26	60	1948	125	324	154	1	14	33	95	99	544	815
	374	931	2501	9699	**nf**	1102	2414	15	27	45	196	111	20	1042	172	0	31	0	1501	99	1015	793
	383	674	216	164	**nf**	0	0	54	0	0	0	0	0	0	0	0	6	0	34	0	0	23
51-100	359	421	39	0	156	39	0	12	36	25	0	0	458	249	601	814	94	317	217	296	456	328
	377	100	122	**nf**	257	0	13	11	11	0	0	6	3	660	68	0	382	19	89	66	1720	1601
	382	647	129	73	115	168	0	0	93	0	0	93	116	0	12	0	0	16	0	93	0	42
101-150	358	225	404	430	2464	45	51	61	10	80	327	197	933	470	467	358	105	262	468	4112	1613	400
	378	139	362	635	461	12	11	8	0	21	9	729	1156	174	276	43	99	711	832	486	2644	2144
	381	182	**nf**	0	**nf**	119	0	0	118	5	8	39	86	1583	9	0	1890	80	34	3303	888	21
151-200	357	164	370	205	120	629	42	46	19	0	245		311	172	9	66	201	221	184	50	89	214
	379	106	318	**nf**	317	240	96	20	27	108	8	644	129	675	79	53	133	41	38	27	102	33
	380	116	**nf**	117	**nf**	32	10	26	12	10	0	223	178	3	879	48	54	48	37	28	205	106
total strata <= 200 fathoms			92723	249323	164303	28741	26189	17781	3290	7988	8265	20754	21196	19841	12007	12848	17558	21851	29061	23401	42523	58118
UPPER			151903	392215	555906	46078	45182	26812	6083	11520	16104	33819	32744	28793	19789	20811	33657	37701	55222	41653	82763	159551
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	2.57	3.182	4.3
1 std			25023	64135	91007	7956	7249	4298	1185	1681	3200	5781	5346	4203	3490	3571	6793	6469	11576	7102	12646	23589
201-300	723	155	**nf**	0	**nf**	63	0	0	24	18	0	0	0	0	0	0	0	0	0	49	27	0
	725	105	**nf**	**nf**	0	90	0	10	13	0	18	10	0	6	6	0	**nf**	4	49	0	11	0
	727	160	**nf**	**nf**	**nf**	484	12	3	97	0	0	39	34	0	11	10	0	0	3	0	0	17
301-400	724	124	**nf**	0	**nf**	12	0	0	40	0	0	0	0	0	0	**nf**	0	0	0	65	0	0
	726	72	**nf**	**nf**	**nf**	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	13
	728	156	**nf**	**nf**	**nf**	**nf**	0	0	34	0	0	0	0	0	0	0	44	0	0	0	0	0
Total strata > 200 fathoms			0	0	0	649	12	13	223	18	18	49	34	6	17	10	44	4	52	114	38	30
Total all strata fished			92723	249323	16303	29389	26200	17793	3510	8006	8283	20823	21230	19847	12024	12857	17602	21858	29113	23516	42561	58148
Upper limit			151903	392216	555901	46760	45195	26825	6314	11538	16122	33869	32779	28799	19806	20821	33699	37705	55275	41768	82800	159581
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	2.57	3.182	4.3
1 std			25023	64135	125400	7972	8397	4299	1186	1681	3200	5773	5347	4203	3490	3571	6821	6468	11576	7102	12646	23589

Table 16. 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	WT 113-115	WT 128-130	WT 144-146	WT 160-161	WT 176-177	WT 200 Tel 41-42 AN 253	WT 212-214	Tel 76 WT 229-233	WT 244-247	Tel 338-339 WT 319-323	Tel 357 WT 372	Tel 411-412 WT 427-428	WT 485-487 Tel 468	WT 557-558	WT 627-630 Tel 608-609	WT 704-706	WT 770-772 Tel 750-751	WT 835-837	AN 913-915 Tel 894-895
mean survey date			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	20-Oct-07	13-Oct-08	12-Oct-09
31-50	330	2089	10709	10264	7036	5271	2072	3946	279	1006	3113	6178	4428	9339	4133	1293	886	1533	1485	14991	15403	6540
	331	456	507	6682	222	222	95	760	32	31	408	721	1505	265	376	94	157	470	345	4610	1004	1157
	338	1898	20199	10334	857	6221	330	2478	264	52	835	4804	3580	209	835	261	112	3081	2611	5065	5993	1484
	340	1716	4158	5625	7746	1859	763	1668	95	519	1747	5665	6945	2172	2408	1369	1039	964	991	1457	2859	2822
	351	2520	29085	24185	3558	10450	661	2709	198	1684	347	9244	11737	9013	2091	1436	842	2327	2526	22015	6586	6718
	352	2580	10248	24761	2747	4710	717	972	287	1006	761	2789	9419	6405	2980	4780	1680	3397	4741	32905	6033	3042
	353	1282	1781	223	0	0	0	415	0	0	0	661	0	0	0	44	756	1146	453	882	118	44
51-100	329	1721	531	1605	558	239	1036	574	478	95	710	521	255	710	326	331	101	0	221	900	16301	473
	332	1047	1721	1127	436	2036	242	0	0	48	288	576	624	96	331	48	1296	946	288	2358	912	43
	337	948	1001	66	198	307	0	0	0	0	0	130	82	130	0	174	0	143	43	7694	297	87
	339	585	163	0	41	528	41	41	0	80	126		40	80	322	443	46	80	80	201	268	46
	354	474	1580	0	1712	0	0	165	340	130	33	554	33	0	6181	0	37	32	65	10610	1710	58
101-150	333	151	21	0	10	0	0	0	**nf**	0	0	0	10	0	0	0	0	0	0	27	9	0
	336	121	6	0	0	67	0	0	8	0	0	0	42	0	0	0	0	0	0	0	15	**nf**
	355	103	**nf**	887	64	172	0	13	342	0	0	28	14	0	0	0	28	0	63	38	25	6
151-200	334	92	13	0	0	9	0	0	**nf**	0	0	0	0	0	0	0	0	0	6	0	0	7
	335	58	12	4	0	0	0	0	133	12	4	0	4	0	0	0	0	0	0	0	4	0
	356	61	**nf**	4	0	102	0	0	40	0	17	7	25	4	4	0	0	0	4	4	0	17
Total strata fished <= 200 fathoms			81735	85767	25185	32193	5957	13741	2496	4663	8388	31880	38743	28424	19988	10274	6980	14122	13923	103756	42866	22545
upper			117569	117451	40427	48506	11071	18760	3870	6604	11951	43691	51707	35723	99783	15883	10678	20041	18846	133648	69431	30439
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	2.16	2.306	2.08
1 std			17121	15463	6229	7605	2162	2367	562	916	1598	5651	6086	3443	6278	2515	1681	2805	2344	13839	11520	3795
201-300	717	93	0	**nf**	**nf**	0	0	0	**nf**	0	0	10	0	0	0	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	0	0	0
	721	76	**nf**	0	**nf**	0	0	0	0	0	5	0	0	0	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	0	0	0
	720	105	**nf**	**nf**	**nf**	0	0	0	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	0		0
total strata fished > 200 fathoms			0	0	0	0	5	0	37	0	5	10	3	0	0	0	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	103757	42866	22545
upper			117569	117451	40427	48506	11077	18760	3907	6604	11957	43705	51710	35723	99783	15833	10678	20041	18846	133648	69431	30439
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	2.16	2.306	2.08
1 STD			17574	15471	6229	7605	2163	2368	561	916	1598	5653	6086	3443	6278	2438	1681	2805	2344	13838	11520	3795

Biomass

Depth Range	Strata	Area	WT 101-102	WT 113-115	WT 128-130	WT 144-146	WT 160-161	WT 176-177	WT 200 Tel 41-42 AN 253	WT 212-214	Tel 76 WT 229-233	WT 244-247	Tel 338-339 WT 319-323	Tel 357 WT 372	Tel 411-412 WT 427-428	WT 485-487 Tel 468	WT 557-558	WT 627-630 Tel 608-609	WT 704-706	WT 770-772 Tel 750-751	WT 835-837	AN 913-915 Tel 894-895
mean survey date			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-07	20-Oct-07	13-Oct-08	12-Oct-09
31-50	330	2089	6651	2374	2574	4278	1928	6035	302	1779	2027	2379	1817	5922	4037	1547	440	1664	1347	1463	1813	3019
	331	456	27	1047	191	267	172	1455	11	85	735	367	574	155	481	243	641	442	713	141	296	189
	338	1898	13966	7122	2760	3763	91	5283	26	167	1786	16088	5978	558	493	238	267	3592	1804	1010	1220	1712
	340	1716	3635	6247	6711	1231	832	3149	37	951	2108	2902	5371	1785	2542	2028	2663	3002	421	1540	1305	1714
	351	2520	17027	21473	3142	9895	679	5052	74	4806	815	7355	5249	8149	2296	2002	685	4017	1348	4093	1907	4705
	352	2580	21151	32262	3137	4920	4775	3195	1353	3220	1198	9096	14518	7207	4081	8617	3025	4231	4782	19781	3344	4502
	353	1282	4593	56	0	0	0	2238	0	0	0	716	0	0	0	2	239	1604	1105	184	91	53
51-100	329	1721	1291	1019	109	245	1546	1052	370	159	820	684	86	810	1407	566	267	0	185	292	333	622
	332	1047	767	74	254	1323	452	0	0	0.48	1	18	33	41	960	62	225	31	312	165	167	21
	337	948	2331	70	373	176	0	0	0	0	0	21	12	91	0	111	0	25	17	2891	175	13
	339	585	1242	0	64	447	56	46	0	276	606		161	50	447	769	23	145	25	111	59	100
	354	474	66	0	896	0	0	161	260	96	42	184	18	0	8920	0	3	4	26	11472	991	43
101-150	333	151	12	0	12	0	0	0	**nf**	0	0	0	4	0	0	0	0	0	0	1	5	0
	336	121	29	0	0	107	0	0	11	0	0	0	49	0	0	0	0	0	0	0	24	**nf**
	355	103	**nf**	155	31	104	0	15	235	0	0	25	11	0	0	0	19	0	51	30	30	4
151-200	334	92	16	0	0	21	0	0	**nf**	0	0	0	0	0	0	0	0	0	6	0	0	6
	335	58	13	8	0	0	0	0	303	16	8	0	1	0	0	0	0	0	0	0	6	0
	356	61	**nf**	8	0	68	0	0	39	0	30	13	28	2	11	0	0	0	9	5	0	33
Total strata fished <= 200 fathoms			72817	71915	20254	26845	10531	27681	3021	11555.48	10177	39849	33912	24769	25674	16184	8499	18756	12150	43179	11767	16737
upper			97492	98551	29947	43938	17481	41388	6586	16785	13788	84258	48733	33277	139889	30377	14807	28652	17312	90433	17152	23929
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	2.78	2.179	2.11
1 std			11789	12726	4404	7412	3158	6346	1387	2467	1753	15974	6737	4051	8993	5989	2867	4624	2470	16998	2471	3409
201-300	717	93	0	**nf**	**nf**	0	0	0	**nf**	0	0	1	0	0	0	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	0	0	0
	721	76	**nf**	0	**nf**	0	0	0	0	0	9	0	0	0	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	0	0	0
	720	105	**nf**	**nf**	**nf**	0	0	0	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	0	0	0
total strata fished > 200 fathoms			0	0	0	0	14	0	55	0	9	1	5	0	0	0	0	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	43179	11767	16737
upper			97492	98552	29947	43938	17496	41388	6641	16785	13797	84259	48738	33277	139888	30377	14808	28652	17312	90433	17152	23929
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	2.78	2.179	2.11
1 STD			11789	43649	4404	7412	3158	6346	1386	2467	1753	15974	6737	4051	8986	5989	2868	4624	2470	16998	2471	3409

Table 17. Mean number per tow at age of cod from spring RV surveys in NAFO Divisions 3NO as calculated using the conversion from Warren (1997) for surveys in 1984-1995. Results for 1996 -2009 are actual Campelen surveys.

Spring	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

	2001	2002	2003	2004	2005	2006	2007	2008	2009
0	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
1	0.15	0.23	0.30	1.18	2.64		14.87	0.36	0.65
2	1.88	0.66	0.58	1.12	2.05		6.12	12.89	7.02
3	2.91	0.98	0.47	0.50	2.76		3.91	9.63	59.57
4	1.01	0.40	0.51	0.19	0.48		1.95	1.37	8.28
5	0.26	0.23	1.03	0.13	0.20		0.46	1.03	3.94
6	0.01	0.10	0.82	0.18	0.07		0.11	0.21	1.94
7	0.06	0.01	0.12	0.18	0.33		0.05	0.07	0.61
8	0.07	0.06	0.01	0.07	0.26		0.09	0.01	0.14
9	0.01	0.01	0.05	0.02	0.13		0.14	0.02	0.02
10	0.01	0.02	0.02	0.08	0.02		0.13	0.18	0.07
11	0.16	0.01	0.02	0.02	0.07		0.11	0.14	0.08
12	0.40	0.03	0.01	0.03	0.02		0.01	0.08	0.16
13	0.04	0.16	0.08	0.02	0.00		0.01	0.00	0.02
14	0.02	0.00	0.08	0.02	0.00		0.01	0.02	0.01
15	0.00	0.01	0.01	0.10	0.03		0.00	0.01	0.01
16	0.01	0.00	0.00	0.01	0.02		0.03	0.01	0.00
17	0.00	0.00	0.00	0.00	0.00		0.01	0.01	0.00
18	0.00	0.00	0.00	0.01	0.00		0.04	0.01	0.00
19	0.00	0.00	0.00	0.00	0.00		0.01	0.00	0.00
1+	7.00	2.91	4.11	3.86	9.08		28.06	26.05	82.52

Table 18. 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. Results from 1995-2009 are actual Campelen surveys.

Autumn	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

Autumn	2001	2002	2003	2004	2005	2006	2007	2008	2009
0	0.06	0.13	0.16	1.08	0.27	0.21	0.15	0.53	0.08
1	0.34	0.33	0.96	0.97	4.24	0.19	13.95	1.32	3.25
2	2.64	0.61	0.27	0.63	2.42	2.10	15.61	13.79	8.10
3	4.70	1.13	0.26	0.35	1.24	3.94	3.70	8.96	16.37
4	2.55	1.58	0.35	0.14	0.23	1.27	3.28	1.30	5.11
5	0.98	1.31	0.78	0.12	0.07	0.47	0.44	0.92	1.07
6	0.07	0.39	0.83	0.23	0.06	0.13	0.18	0.20	0.65
7	0.16	0.03	0.14	0.24	0.27	0.05	0.05	0.07	0.12
8	0.06	0.06	0.01	0.12	0.38	0.20	0.05	0.00	0.06
9	0.02	0.04	0.02	0.01	0.10	0.09	0.14	0.01	0.00
10	0.02	0.00	0.05	0.04	0.00	0.12	0.23	0.03	0.00
11	0.00	0.03	0.00	0.00	0.04	0.04	0.06	0.03	0.03
12	0.05	0.03	0.00	0.00	0.01	0.01	0.00	0.09	0.05
13	0.01	0.05	0.02	0.00	0.03	0.00	0.02	0.00	0.01
14	0.00	0.01	0.02	0.07	0.00	0.00	0.01	0.03	0.00
15	0.00	0.00	0.00	0.03	0.02	0.01	0.01	0.01	0.01
16	0.00	0.01	0.00	0.00	0.03	0.02	0.01	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1+	11.60	5.61	3.71	2.95	9.14	8.64	37.74	26.79	34.90

Table 19. Mean number per tow at age of cod from Juvenile Surveys conducted by Canada in Divisions 3NO during August and September

	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 20. Estimated proportions mature for female cod from NAFO Divs. 3NO from DFO surveys from 1975 to 2008 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 and 2000) the average of estimates for the same age group from adjacent years was used; darker shaded cells are averages extrapolated forward or backward from the same age group from 3 previous or subsequent 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	0.0006	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	0.0011	0.0029	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	0.0007	0.0055	0.0163	0.1598	0.7908	0.9514	0.9775	0.9957	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
2004	0.0008	0.0032	0.0260	0.1370	0.8429	0.9891	0.9981	0.9984	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
2005	0.0016	0.0049	0.0142	0.1143	0.6135	0.9934	0.9995	0.9999	0.9999	0.9999	1.0000	1.0000	1.0000	1.0000
2006	0.0010	0.0063	0.0298	0.0609	0.3841	0.8722	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2007	0.0010	0.0048	0.0249	0.1602	0.2257	0.7510	0.9678	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2008	0.0010	0.0048	0.0230	0.0936	0.5421	0.5671	0.9358	0.9930	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2009	0.0010	0.0048	0.0230	0.1049	0.2946	0.8803	0.8548	0.9860	0.9985	1.0000	1.0000	1.0000	1.0000	1.0000
2010	0.0010	0.0048	0.0230	0.1049	0.3541	0.6281	0.9786	0.9636	0.9971	0.9997	1.0000	1.0000	1.0000	1.0000
2011	0.0010	0.0048	0.0230	0.1049	0.3541	0.6918	0.8722	0.9965	0.9917	0.9994	0.9999	1.0000	1.0000	1.0000
2012	0.0010	0.0048	0.0230	0.1049	0.3541	0.6918	0.9019	0.9650	0.9994	0.9981	0.9999	1.0000	1.0000	1.0000
2013	0.0010	0.0048	0.0230	0.1049	0.3541	0.6918	0.9019	0.9750	0.9911	0.9999	0.9996	1.0000	1.0000	1.0000
2014	0.0010	0.0048	0.0230	0.1049	0.3541	0.6918	0.9019	0.9750	0.9941	0.9978	1.0000	0.9999	1.0000	1.0000
2015	0.0010	0.0048	0.0230	0.1049	0.3541	0.6918	0.9019	0.9750	0.9941	0.9986	0.9995	1.0000	1.0000	1.0000

Table 21. Estimated survivors and catchabilities in linear scale from ADAPT

ORTHOGONALITY OFFSET..... 0.000958
MEAN SQUARE RESIDUALS 0.645765

Survivors Year	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
1994	12	84.40	66.30	0.785	13.900	0.165
1995	12	51.90	24.90	0.48	4.740	0.091
1996	12	31.30	11.30	0.36	1.850	0.059
1997	12	66.70	21.90	0.328	3.460	0.052
1998	12	93.40	32.10	0.343	5.260	0.056
1999	12	46.50	16.70	0.36	2.710	0.058
2000	12	51.60	16.10	0.313	2.360	0.046
2001	12	461.00	133.00	0.288	18.100	0.039
2002	12	220.00	62.10	0.282	8.500	0.039
2003	12	31.50	8.89	0.282	1.190	0.038
2004	12	39.70	11.90	0.299	1.600	0.04
2005	12	67.20	20.70	0.308	2.770	0.041
2006	12	71.60	23.60	0.33	3.310	0.046
2007	12	17.8	5.71	0.321	0.861	0.048
2008	12	114	38.4	0.338	5.790	0.051
2009	12	244	79.8	0.327	11.900	0.049
2010	3	7620.00	4450.00	0.584	1360.000	0.178
2010	4	16300.00	6820.00	0.419	1540.000	0.095
2010	5	6710.00	2320.00	0.346	448.000	0.067
2010	6	1800.00	615.00	0.342	113.000	0.063
2010	7	1450.00	468.00	0.323	79.300	0.055
2010	8	411.00	128.00	0.311	20.400	0.05
2010	9	135.00	42.00	0.312	6.440	0.048
2010	10	52.70	17.00	0.322	2.700	0.051
2010	11	58.50	18.00	0.308	2.720	0.047
2010	12	168.00	54.30	0.324	8.080	0.048

Catchabilities	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
RV Spr	2	0.000937	0.000158	0.169	0.000007	0.007
RV Spr	3	0.001370	0.000230	0.168	0.000010	0.007
RV Spr	4	0.000678	0.000114	0.168	0.000005	0.007
RV Spr	5	0.000479	0.000082	0.171	0.000004	0.008
RV Spr	6	0.000324	0.000057	0.175	0.000003	0.009
RV Spr	7	0.000349	0.000062	0.179	0.000004	0.011
RV Spr	8	0.000351	0.000064	0.184	0.000004	0.013
RV Spr	9	0.000392	0.000074	0.187	0.000006	0.015
RV Spr	10	0.000516	0.000099	0.192	0.000010	0.019
RV_Fall	2	0.000916	0.000176	0.192	0.000009	0.01
RV_Fall	3	0.001040	0.000198	0.191	0.000010	0.01
RV_Fall	4	0.000841	0.000163	0.194	0.000009	0.01
RV_Fall	5	0.000712	0.000141	0.199	0.000008	0.012
RV_Fall	6	0.000612	0.000125	0.204	0.000008	0.014
RV_Fall	7	0.000415	0.000088	0.211	0.000007	0.017
RV_Fall	8	0.000411	0.000091	0.222	0.000008	0.02
RV_Fall	9	0.000317	0.000074	0.232	0.000008	0.025
RV_Fall	10	0.000438	0.000110	0.25	0.000016	0.036
RV_Juvenile	2	0.003600	0.001190	0.331	0.000177	0.049
RV_Juvenile	3	0.001890	0.000623	0.33	0.000093	0.049
RV_Juvenile	4	0.001370	0.000455	0.331	0.000068	0.049
RV_Juvenile	5	0.001130	0.000376	0.332	0.000055	0.049
RV_Juvenile	6	0.000836	0.000280	0.335	0.000040	0.047
RV_Juvenile	7	0.000622	0.000212	0.341	0.000030	0.048
RV_Juvenile	8	0.000497	0.000172	0.346	0.000025	0.051
RV_Juvenile	9	0.000321	0.000113	0.352	0.000018	0.057
RV_Juvenile	10	0.000286	0.000104	0.364	0.000020	0.07

Table 22. Estimated bias adjusted population numbers ('000) from ADAPT for cod in NAFO Division 3NO.

Pop #s Bias Adj(analytical)	2	3	4	5	6	7	8	9	10	11	12	Total
1959	63623	53067	92911	19327	16484	12049	4268	3076	3217	2287	324	270633
1960	98989	52090	41903	64326	11271	8099	6336	2246	1838	1803	786	289687
1961	130098	81045	40981	28451	32902	6449	4497	2947	1315	1157	675	330518
1962	94606	106515	65621	29586	12832	13314	3473	2185	1652	900	925	331609
1963	135041	77456	86281	50223	22233	9081	7673	2149	1189	964	534	392824
1964	195488	110562	63133	65447	31040	13843	5695	2858	722	432	500	489720
1965	252970	160052	84924	37711	36087	18299	9287	3665	1632	298	320	605245
1966	221171	207114	130125	62667	24021	17671	6202	3302	2030	239	99	674641
1967	121541	181079	168890	89951	33653	9146	6895	1137	1076	183	87	613638
1968	154111	99509	130150	82351	28883	11073	3234	1531	719	719	86	512366
1969	96818	126175	66743	55815	24240	7265	3431	1228	801	429	508	383452
1970	101648	79268	95947	43016	21651	9853	4073	1563	542	394	231	358185
1971	74517	83223	62998	60832	25515	9253	4801	1872	795	310	121	324237
1972	42188	61009	67279	27529	22783	10441	4442	1704	1083	471	164	239094
1973	44123	34541	49888	37315	11560	6720	3316	2127	1138	693	316	191736
1974	27761	36125	19251	16285	17043	4127	3733	1842	1108	713	444	128433
1975	32961	22729	23794	7287	3682	4318	1379	1147	605	307	204	98414
1976	54555	26986	18003	11616	2818	800	837	198	132	90	31	116066
1977	50004	44666	18443	8002	4211	1337	465	471	123	75	62	127861
1978	20887	40940	36021	12876	4281	2104	583	223	199	43	25	118182
1979	23691	17101	32688	25583	8276	2769	1404	386	130	117	28	112173
1980	33041	19397	13936	23314	12696	4280	1475	911	264	91	85	109490
1981	26242	27052	15641	10458	15656	8347	2819	1008	663	188	67	108141
1982	42436	21485	21692	11821	7425	10749	5124	1792	652	458	117	123753
1983	49761	34744	17315	15976	8245	5167	7424	2856	934	345	230	142998
1984	39415	40741	27382	13593	11374	5666	3613	5041	1643	551	210	149227
1985	10598	32270	33303	21515	9857	7222	3542	2310	3301	851	355	125125
1986	7770	8677	26369	24604	12047	5346	3655	2183	1478	2223	463	94816
1987	15495	6362	6966	19007	14374	5949	3020	2141	1286	875	1505	76980
1988	15391	12510	4743	5322	12419	8672	3779	1885	997	611	361	66691
1989	6149	12370	9993	3597	2987	4511	3568	2188	1034	436	277	47109
1990	6811	4920	8401	6219	1601	1319	2006	1771	1355	637	207	35247
1991	24281	5206	3071	2867	1257	515	701	996	929	716	387	40927
1992	7694	14463	3271	1909	1455	543	171	246	310	313	245	30621
1993	779	6224	7797	1103	815	644	235	82	113	140	120	18052
1994	483	608	3914	3514	337	242	241	126	45	58	70	9637
1995	920	396	290	1139	1875	164	115	174	96	36	47	5250
1996	1281	753	324	173	914	1499	132	94	142	78	29	5420
1997	453	1047	613	261	139	733	1205	106	75	113	63	4807
1998	2733	370	846	486	204	109	572	946	82	58	88	6493
1999	5798	2237	300	672	379	158	85	443	737	63	44	10916
2000	5409	4705	1747	209	459	274	116	64	342	554	49	13928
2001	2130	4419	3531	1125	93	320	205	85	49	268	443	12669
2002	974	1735	3449	2619	777	66	224	147	63	38	212	10304
2003	944	708	1224	2329	1760	509	46	159	109	49	30	7867
2004	1950	734	278	285	773	842	297	33	114	82	38	5427
2005	5037	1587	568	187	189	550	623	225	26	87	64	9143
2006	4447	4123	1298	464	152	151	425	461	166	21	68	11775
2007	11698	3600	3182	911	306	105	119	339	375	134	17	20788
2008	22362	9574	2763	2345	662	228	78	92	269	298	108	38779
2009	7656	18307	7835	2210	1771	505	169	62	73	202	232	39023
2010	12605	6258	14752	6264	1686	1369	390	128	50	56	159	43717

Table 23. Bias adjusted fishing mortality from ADAPT for cod in NAFO Divisions 3NO.

F Bias Adj(analytical)	2	3	4	5	6	7	8	9	10	11	12	Fbar6-9	Fbar4-6
1959	0.000	0.036	0.168	0.339	0.511	0.443	0.442	0.315	0.379	0.868	0.428	0.428	0.339
1960	0.000	0.040	0.187	0.470	0.358	0.388	0.566	0.335	0.263	0.782	0.412	0.412	0.339
1961	0.000	0.011	0.126	0.596	0.705	0.419	0.522	0.379	0.179	0.024	0.506	0.506	0.476
1962	0.000	0.011	0.067	0.086	0.146	0.351	0.280	0.408	0.339	0.322	0.296	0.296	0.100
1963	0.000	0.004	0.076	0.281	0.274	0.267	0.788	0.891	0.813	0.456	0.555	0.555	0.210
1964	0.000	0.064	0.315	0.395	0.328	0.199	0.241	0.360	0.684	0.099	0.282	0.282	0.346
1965	0.000	0.007	0.104	0.251	0.514	0.882	0.834	0.391	1.721	0.902	0.655	0.655	0.290
1966	0.000	0.004	0.169	0.422	0.766	0.741	1.496	0.921	2.208	0.811	0.981	0.981	0.452
1967	0.000	0.130	0.518	0.936	0.912	0.839	1.305	0.259	0.203	0.553	0.829	0.829	0.789
1968	0.000	0.199	0.647	1.023	1.180	0.972	0.768	0.448	0.317	0.148	0.842	0.842	0.950
1969	0.000	0.074	0.239	0.747	0.700	0.379	0.586	0.618	0.509	0.419	0.571	0.571	0.562
1970	0.000	0.030	0.256	0.322	0.650	0.519	0.578	0.476	0.359	0.983	0.556	0.556	0.409
1971	0.000	0.013	0.628	0.782	0.694	0.534	0.836	0.347	0.323	0.436	0.603	0.603	0.701
1972	0.000	0.001	0.389	0.668	1.021	0.947	0.536	0.203	0.247	0.201	0.677	0.677	0.693
1973	0.000	0.385	0.920	0.584	0.830	0.388	0.388	0.453	0.267	0.245	0.515	0.515	0.778
1974	0.000	0.218	0.771	1.287	1.173	0.896	0.980	0.913	1.083	1.052	0.991	0.991	1.077
1975	0.000	0.033	0.517	0.750	1.327	1.441	1.740	1.960	1.705	2.097	1.617	1.617	0.865
1976	0.000	0.181	0.611	0.815	0.546	0.342	0.374	0.279	0.366	0.173	0.385	0.385	0.657
1977	0.000	0.015	0.159	0.425	0.494	0.629	0.538	0.662	0.859	0.899	0.581	0.581	0.360
1978	0.000	0.025	0.142	0.242	0.236	0.205	0.213	0.337	0.330	0.231	0.248	0.248	0.207
1979	0.000	0.005	0.138	0.501	0.459	0.430	0.233	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	0.162	0.170	0.385	0.452	0.437	0.489	0.292	0.292	0.143
1983	0.000	0.038	0.042	0.140	0.175	0.158	0.187	0.353	0.328	0.298	0.218	0.218	0.119
1984	0.000	0.002	0.041	0.121	0.254	0.270	0.247	0.223	0.458	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	0.371	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	0.271	0.565	0.545	0.685	0.349	0.349	0.200
1988	0.019	0.025	0.077	0.378	0.813	0.688	0.347	0.400	0.627	0.590	0.562	0.562	0.422
1989	0.023	0.187	0.274	0.609	0.618	0.611	0.501	0.279	0.284	0.547	0.502	0.502	0.500
1990	0.069	0.271	0.875	1.399	0.935	0.432	0.500	0.445	0.438	0.299	0.578	0.578	1.070
1991	0.318	0.265	0.275	0.478	0.639	0.905	0.846	0.966	0.886	0.872	0.839	0.839	0.464
1992	0.012	0.418	0.887	0.651	0.615	0.639	0.528	0.578	0.599	0.759	0.590	0.590	0.718
1993	0.048	0.264	0.597	0.987	1.015	0.783	0.424	0.405	0.474	0.484	0.657	0.657	0.866
1994	0.000	0.540	1.035	0.428	0.521	0.546	0.126	0.073	0.025	0.000	0.000	0.316	0.661
1995	0.000	0.000	0.318	0.020	0.024	0.014	0.000	0.006	0.000	0.000	0.000	0.011	0.121
1996	0.002	0.006	0.017	0.019	0.021	0.019	0.025	0.024	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	0.060	0.050	0.054	0.046	0.040
1998	0.000	0.009	0.030	0.049	0.056	0.052	0.055	0.049	0.055	0.079	0.065	0.053	0.045
1999	0.009	0.047	0.163	0.181	0.124	0.103	0.081	0.059	0.086	0.054	0.052	0.092	0.156
2000	0.002	0.087	0.240	0.608	0.161	0.088	0.120	0.071	0.043	0.024	0.046	0.110	0.336
2001	0.005	0.048	0.099	0.170	0.139	0.160	0.132	0.096	0.046	0.038	0.030	0.132	0.136
2002	0.120	0.149	0.193	0.198	0.223	0.162	0.143	0.102	0.054	0.029	0.032	0.157	0.204
2003	0.051	0.732	1.257	0.903	0.537	0.338	0.127	0.133	0.084	0.046	0.037	0.284	0.899
2004	0.006	0.057	0.196	0.214	0.140	0.100	0.081	0.034	0.070	0.041	0.029	0.089	0.183
2005	0.000	0.001	0.002	0.012	0.024	0.058	0.102	0.103	0.043	0.039	0.035	0.072	0.012
2006	0.011	0.059	0.154	0.216	0.165	0.037	0.026	0.005	0.013	0.000	0.000	0.058	0.178
2007	0.000	0.065	0.105	0.119	0.094	0.099	0.057	0.030	0.030	0.017	0.000	0.070	0.106
2008	0.000	0.000	0.023	0.081	0.071	0.102	0.029	0.037	0.085	0.049	0.074	0.059	0.058
2009	0.002	0.016	0.024	0.070	0.058	0.058	0.075	0.018	0.063	0.039	0.079	0.052	0.051

Table 24. Beginning of year mean weights at age calculated from the commercial catches for cod in Divisions 3NO.

Year\Age	3	4	5	6	7	8	9	10	11	12
1959	0.301	0.664	1.001	1.622	2.572	3.129	3.670	4.419	4.843	5.691
1960	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1961	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1962	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1963	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1964	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1965	0.287	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1966	0.351	0.615	1.052	1.636	2.482	3.446	4.636	5.532	6.292	7.332
1967	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1968	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1969	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1970	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1971	0.338	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1972	0.397	0.682	1.138	1.676	2.487	3.354	5.005	7.100	7.999	9.262
1973	0.504	0.735	1.178	1.776	2.748	3.658	4.717	7.542	9.423	10.789
1974	0.289	0.645	1.095	1.674	2.503	4.117	5.822	5.842	8.961	9.159
1975	0.246	0.611	0.967	1.599	2.481	3.449	5.082	7.024	5.364	7.717
1976	0.354	0.588	1.120	1.727	2.631	3.557	5.268	6.952	7.849	8.113
1977	0.420	0.707	1.161	1.870	2.860	3.925	5.375	7.666	10.112	10.239
1978	0.617	0.774	1.245	1.825	3.046	4.023	5.417	7.200	9.139	12.271
1979	0.514	0.840	1.208	1.800	2.541	3.720	4.679	6.653	7.596	9.790
1980	0.531	0.822	1.287	1.864	2.777	3.969	5.434	6.618	8.706	10.031
1981	0.789	0.950	1.383	2.132	2.979	4.435	6.256	8.522	9.114	10.373
1982	0.843	1.026	1.380	2.012	3.210	4.321	6.318	7.921	9.453	10.519
1983	0.731	1.049	1.479	1.986	2.891	4.463	5.743	7.779	8.894	10.398
1984	0.757	0.989	1.329	2.065	2.828	3.923	5.473	6.728	8.490	10.647
1985	0.331	0.824	1.255	1.759	2.722	3.760	5.178	6.923	8.128	9.964
1986	0.269	0.696	1.143	1.720	2.675	4.193	6.080	8.063	9.094	9.508
1987	0.343	0.566	1.146	1.668	2.498	4.076	6.267	8.435	9.835	11.187
1988	0.646	0.700	1.064	1.525	2.020	3.301	4.937	7.067	9.158	10.442
1989	0.362	0.847	1.265	1.758	2.419	3.206	5.166	6.523	8.072	10.714
1990	0.442	0.718	1.190	2.004	2.473	3.679	4.811	7.698	8.786	10.322
1991	0.506	0.684	1.267	1.832	3.101	3.896	5.583	6.737	10.014	11.396
1992	0.215	0.598	0.949	1.692	2.547	4.310	5.560	7.480	8.838	11.295
1993	0.318	0.507	0.937	1.397	2.253	3.404	5.336	6.569	8.081	8.655
1994	0.162	0.407	0.842	1.483	1.840	3.375	4.506	6.653	5.167	8.130
1995	0.309	0.450	0.746	1.359	1.932	1.956	5.164	5.543	6.951	5.255
1996	0.309	0.573	0.986	1.552	2.332	2.781	3.125	6.284	6.314	7.173
1997	0.309	0.573	1.005	1.606	2.310	3.007	3.982	5.301	6.193	7.173
1998	0.282	0.573	1.005	1.606	2.310	3.007	3.982	5.301	6.193	7.173
1999	0.386	0.628	1.114	1.638	2.106	2.754	3.672	5.328	6.346	6.877
2000	0.442	0.639	1.163	1.951	2.669	2.543	2.732	3.887	5.632	6.394
2001	0.444	0.805	1.067	1.730	3.115	4.237	3.931	3.813	5.330	6.717
2002	0.569	0.767	1.285	1.762	2.643	4.569	5.590	6.151	6.834	8.364
2003	0.571	0.795	1.188	1.753	2.600	3.722	6.264	6.807	7.782	8.841
2004	0.483	0.785	1.138	1.745	2.474	3.442	4.876	8.072	8.664	8.647
2005	0.324	0.985	1.505	2.173	2.931	3.868	4.819	7.340	9.371	10.525
2006	0.554	0.736	1.385	2.243	2.987	3.587	4.796	6.460	8.287	12.359
2007	0.473	0.824	1.240	1.855	2.435	3.502	4.097	5.607	6.864	7.874
2008	0.254	0.799	1.263	1.645	2.712	2.762	5.245	5.516	6.552	8.178
2009	0.427	0.474	1.166	1.851	2.285	3.329	3.458	6.921	6.658	7.486
2010	0.384	0.699	1.223	1.783	2.478	3.198	4.267	6.015	6.692	7.846
Mean	**0.409**	**0.695**	**1.137**	**1.735**	**2.557**	**3.533**	**4.811**	**6.362**	**7.464**	**8.683**

Table 25. 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	232729	94464
1971	28101	41407	67053	43369	24062	17513	9670	5551	2501	1123	240349	103788
1972	24210	45908	31340	38178	25966	14898	8526	7691	3769	1521	202006	100549
1973	17397	36660	43948	20528	18465	12129	10034	8584	6527	3404	177676	79671
1974	10423	12418	17839	28533	10329	15369	10726	6471	6392	4065	122565	81885
1975	5581	14547	7044	5887	10712	4756	5831	4250	1646	1574	61829	34657
1976	9541	10587	13013	4867	2105	2976	1044	920	707	250	46010	12869
1977	18758	13041	9287	7875	3824	1827	2533	941	760	635	59481	18394
1978	25266	27867	16030	7813	6408	2347	1205	1433	389	307	89065	19902
1979	8788	27458	30907	14896	7037	5223	1805	865	890	271	98140	30987
1980	10297	11458	30003	23668	11887	5856	4950	1745	794	854	101511	49753
1981	21353	14852	14467	33380	24867	12504	6306	5649	1713	700	135790	85118
1982	18103	22259	16316	14939	34501	22143	11323	5168	4330	1231	150312	93634
1983	25390	18159	23631	16376	14941	33131	16402	7264	3068	2390	160753	93573
1984	30848	27072	18067	23486	16021	14172	27588	11057	4675	2232	175216	99230
1985	10678	27451	27006	17342	19659	13316	11961	22851	6920	3542	160726	95591
1986	2334	18360	28130	20724	14300	15327	13274	11920	20213	4402	148983	100159
1987	2182	3939	21779	23973	14863	12307	13419	10849	8608	16841	128760	100860
1988	8086	3320	5662	18945	17519	12475	9306	7045	5593	3771	91721	74653
1989	4483	8466	4549	5252	10913	11439	11304	6748	3520	2971	69645	52147
1990	2177	6029	7401	3209	3261	7379	8518	10433	5601	2133	56143	40536
1991	2634	2100	3633	2304	1596	2732	5562	6257	7169	4411	38398	30032
1992	3104	1955	1812	2462	1383	735	1369	2322	2771	2768	20683	13811
1993	1982	3956	1033	1138	1451	799	439	743	1129	1040	13711	6740
1994	98	1593	2960	499	445	814	567	299	298	573	8146	3495
1995	122	130	849	2548	316	224	898	531	250	248	6118	5015
1996	233	186	170	1419	3495	368	294	890	495	211	7759	7171
1997	324	351	262	223	1693	3623	420	398	701	454	8448	7511
1998	104	485	488	327	252	1721	3765	434	358	632	8567	7490
1999	863	188	749	620	332	233	1627	3928	402	301	9245	7445
2000	2081	1116	243	896	731	296	175	1330	3120	315	10303	6863
2001	1963	2841	1200	161	998	870	332	186	1430	2974	12955	6951
2002	987	2646	3364	1369	175	1021	824	387	260	1770	12803	5806
2003	404	973	2767	3084	1324	172	994	742	380	268	11107	6964
2004	355	219	325	1348	2082	1024	162	918	711	330	7472	6575
2005	514	560	282	410	1611	2411	1082	193	813	678	8554	7198
2006	2282	955	643	340	450	1524	2209	1071	171	844	10491	6611
2007	1701	2621	1130	568	256	416	1388	2105	919	133	11239	5786
2008	2432	2209	2961	1089	619	216	482	1486	1954	882	14330	6728
2009	7812	3715	2576	3278	1155	562	215	502	1348	1740	22903	8799
2010	2406	10313	7660	3007	3391	1248	547	300	373	1251	30498	10119

Table 26. Estimated spawner biomass using annual ogives, beginning of the year weights and bias adjusted population numbers from ADAPT for cod in NAFO Division 3NO.

	3	4	5	6	7	8	9	10	11	12	SSB
1959	126	1396	1073	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	1322	1423	2975	1037	920	707	250	9138
1977	16	185	908	1787	2726	1571	2533	940	760	635	12062
1978	35	230	1498	2986	5076	2213	1142	1433	389	307	15311
1979	128	364	2266	6328	5485	5119	1789	850	890	271	23488
1980	35	797	3419	10159	9997	5579	4942	1742	789	854	38313
1981	42	351	3977	18420	21816	12182	6252	5648	1712	698	71097
1982	63	361	2383	9828	31803	21822	11281	5160	4330	1230	88262
1983	7	295	2880	8964	13552	32840	16377	7260	3067	2390	87632
1984	25	75	1311	12657	14343	13892	27562	11055	4674	2232	87826
1985	21	160	704	4688	17846	13100	11914	22849	6920	3542	81743
1986	5	247	1149	4246	9108	15145	13243	11910	20212	4402	79667
1987	13	76	1893	5652	10594	10985	13399	10845	8607	16841	78905
1988	2	111	889	7567	12103	11974	9075	7043	5593	3771	58126
1989	21	26	774	3346	8980	10774	11255	6712	3520	2971	48380
1990	37	227	326	1761	3076	7159	8446	10428	5595	2133	39188
1991	21	135	886	932	1402	2715	5537	6249	7169	4410	29456
1992	1	109	391	1789	1258	718	1369	2321	2770	2768	13493
1993	0	48	315	595	1388	794	438	743	1129	1040	6488
1994	0	24	836	382	362	809	566	299	298	573	4150
1995	1	5	496	2361	304	212	898	531	250	248	5306
1996	5	13	84	1408	3487	365	289	889	495	211	7247
1997	4	54	106	207	1693	3622	420	397	701	454	7658
1998	2	52	285	283	250	1721	3765	434	358	632	7782
1999	1	19	393	568	327	233	1627	3928	402	301	7799
2000	2	15	106	815	723	296	175	1330	3120	315	6896
2001	13	79	201	135	987	869	332	186	1430	2974	7206
2002	7	361	1440	1023	170	1020	824	387	260	1770	7262
2003	7	155	2188	2935	1294	171	994	742	380	268	9133
2004	9	30	274	1334	2078	1022	162	918	711	330	6867
2005	7	64	173	407	1611	2410	1082	193	813	678	7439
2006	68	58	247	297	450	1524	2209	1071	171	844	6940
2007	42	420	255	427	248	416	1388	2105	919	133	6354
2008	56	207	1605	618	579	214	482	1486	1954	882	8083
2009	180	390	759	2885	987	554	215	502	1348	1740	9559
2010	55	1082	2713	1889	3319	1202	545	300	373	1251	12730

Table 27. Five year retrospective estimates of Age 3 recruits, spawner biomass and fishing mortality (Fbar 4-6) for 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	2009	2008	2007	2006	2005
2010	6258	*	*	*	*	*
2009	18307	10480	*	*	*	*
2008	9574	8184	7703	*	*	*
2007	3600	2713	2777	1310	*	*
2006	4123	3473	3431	2415	1603	*
2005	1587	1392	1413	1273	1016	562

SSB		Retro				
(Jan 1)	Current VPA	2009	2008	2007	2006	2005
2010	12730	*	*	*	*	*
2009	9559	8312	*	*	*	*
2008	8083	7465	7648	*	*	*
2007	6354	6116	6284	5841	*	*
2006	6940	6823	6987	6713	7274	*
2005	7439	7357	7493	7293	6613	5873

Avg F		Retro				
(ages 4-6)	Current VPA	2009	2008	2007	2006	2005
2009	0.051	*	*	*	*	*
2008	0.058	0.072	*	*	*	*
2007	0.106	0.126	0.128	*	*	*
2006	0.178	0.196	0.192	0.223	*	*
2005	0.012	0.013	0.012	0.014	0.014	*

Table 28. Stochastic projection results for 3NO cod to 2013 (see text for details)

F=0	Beginning of Year SSB			
Percentile	2010	2011	2012	2013
0.95	17456	30414	50423	66023
0.75	14963	25056	39827	51819
0.5	13498	22181	34369	44368
0.25	12150	19752	30157	38374
0.05	10283	16572	24722	31190

F=0.07	Beginning of Year SSB			
Percentile	2010	2011	2012	2013
0.95	17358	27999	42894	52622
0.75	14853	23418	34660	42223
0.5	13388	20791	30294	36493
0.25	12028	18165	26116	31222
0.05	10261	15263	21474	25067

F=0.07	Yield			
Percentile	2010	2011	2012	2013
0.95	2843	4092	4343	4602
0.75	2356	3237	3382	3567
0.5	2054	2765	2862	2957
0.25	1768	2351	2419	2461
0.05	1478	1877	1904	1909

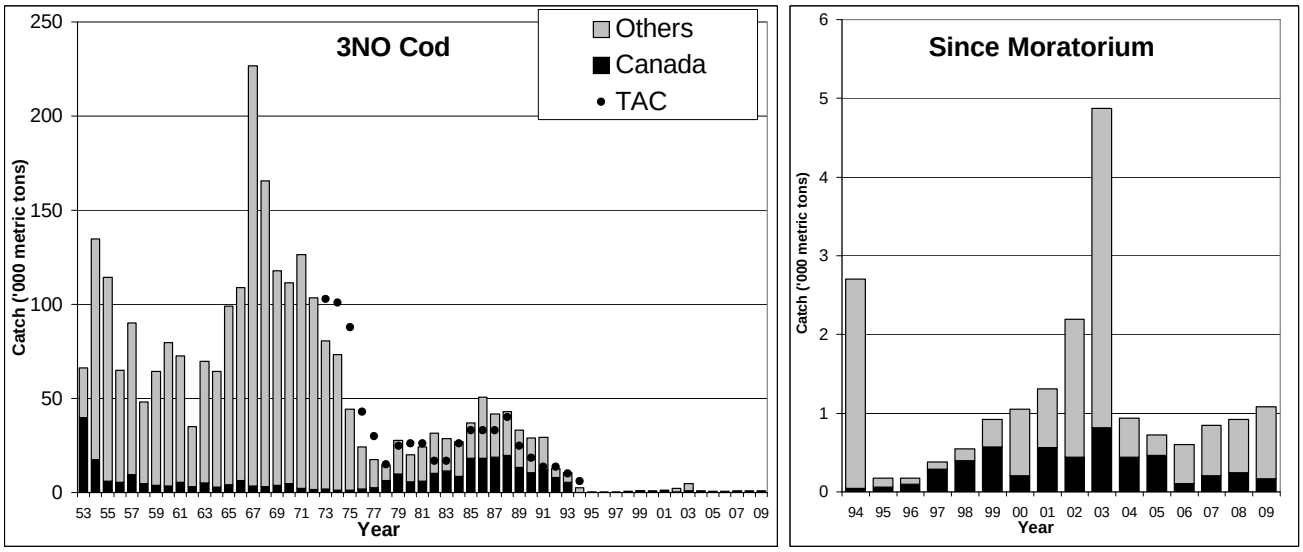

Fig. 1. Catches of cod in NAFO Div. 3NO from 1953-2009. Panel on right for years since the moratorium in Feb. 1994.

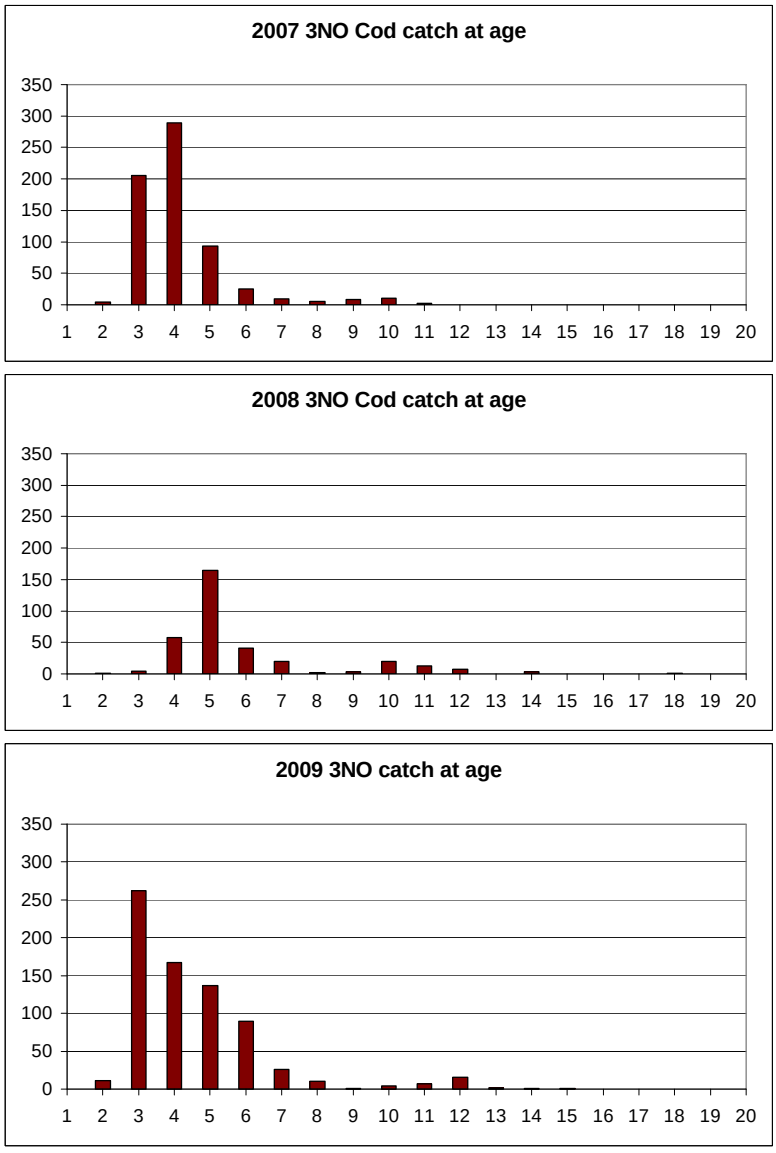

Fig. 2. Plot of Div. 3NO Cod catch-at-age for 2007-2009

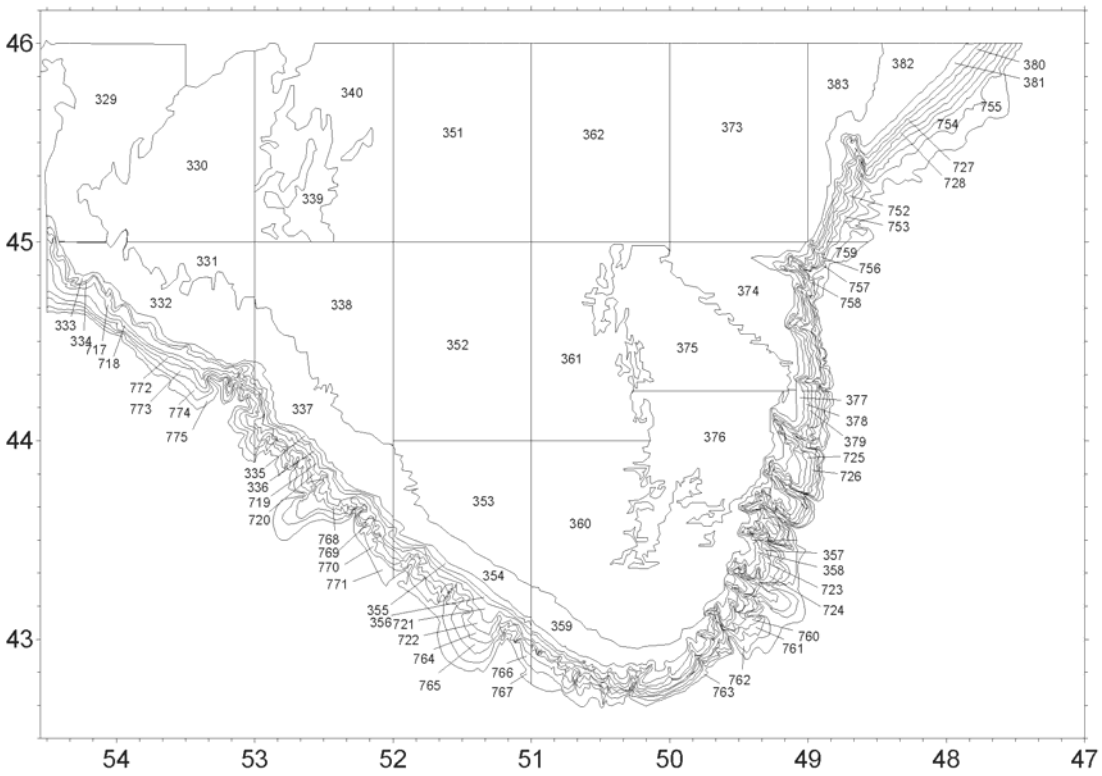

Figure 3 - Stratification scheme for Divisions 3NO.

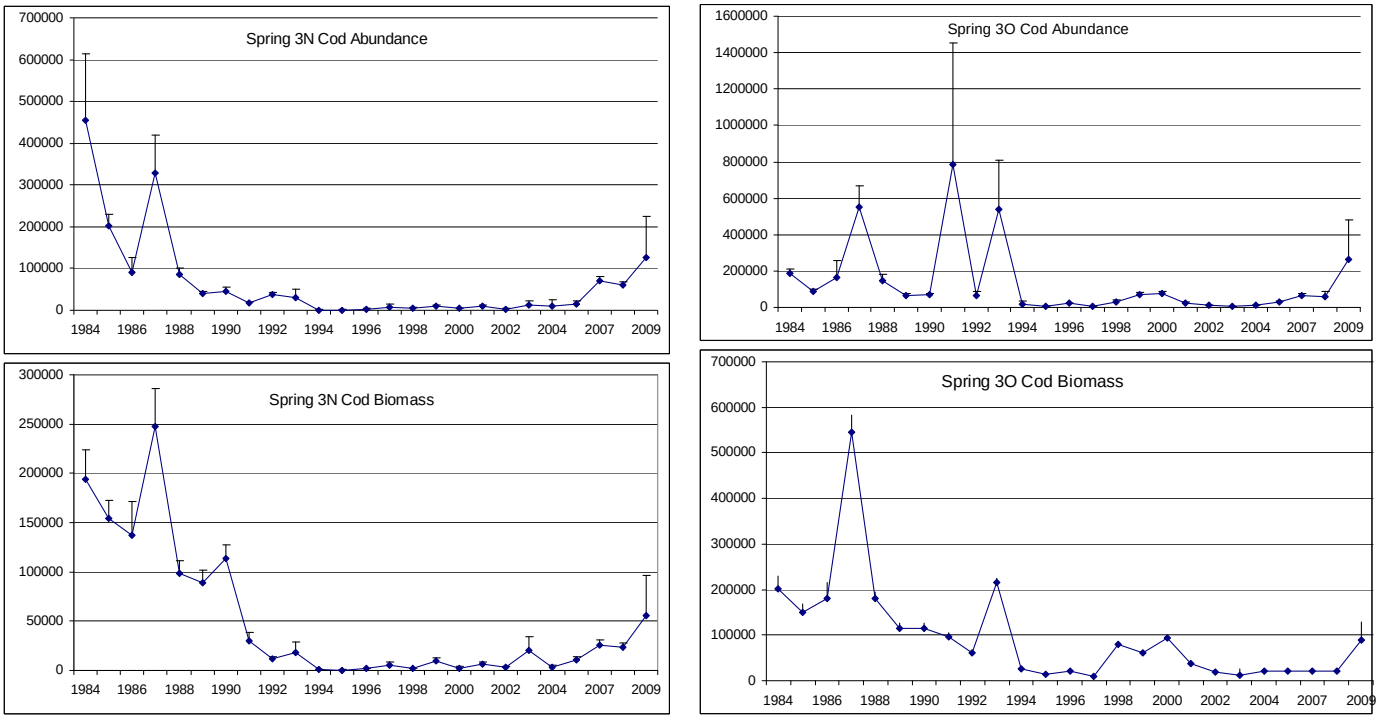

Figure 4 – Abundance (000's) and biomass (t) for the Canadian Spring Research Vessel survey series with 1 standard deviation for strata<200 fathoms.

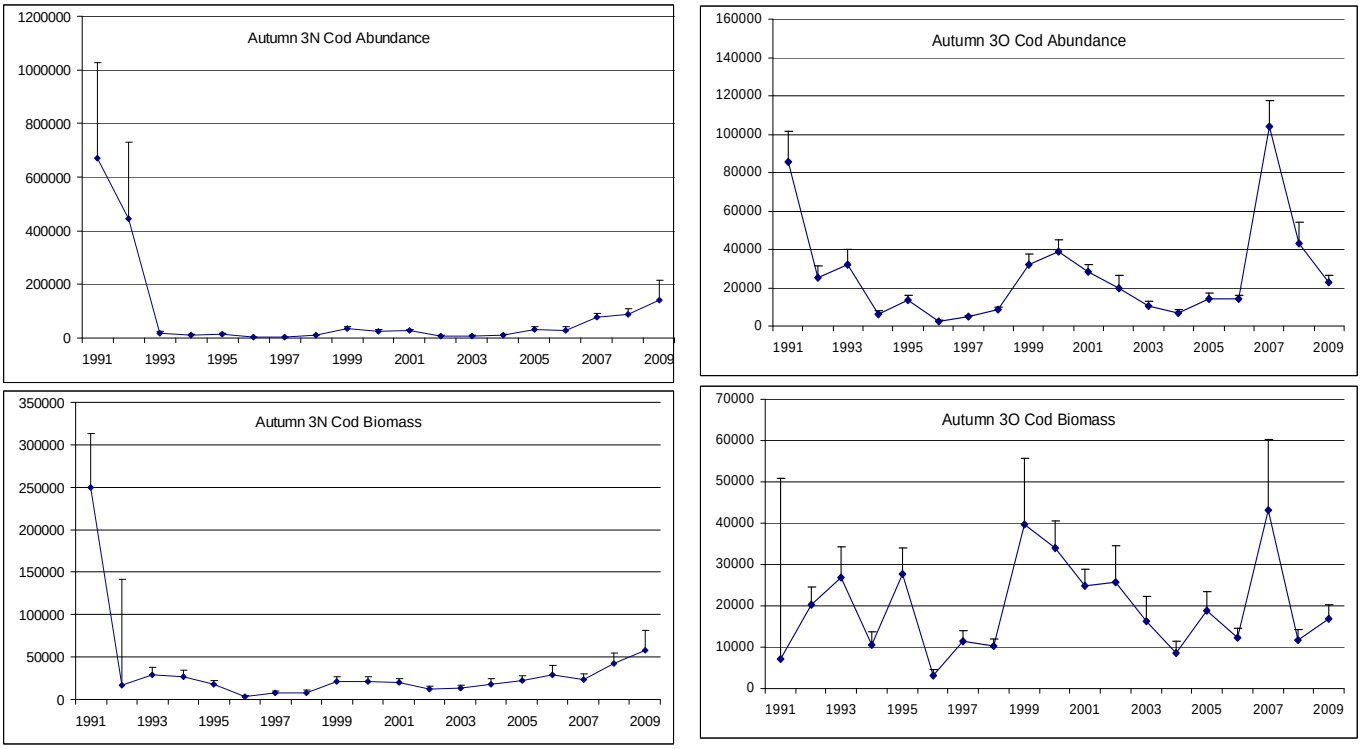

Figure 5– Abundance (000's) and biomass (t) for the Canadian Autumn Research Vessel survey series with 1 standard deviation for strata<200 fathoms.

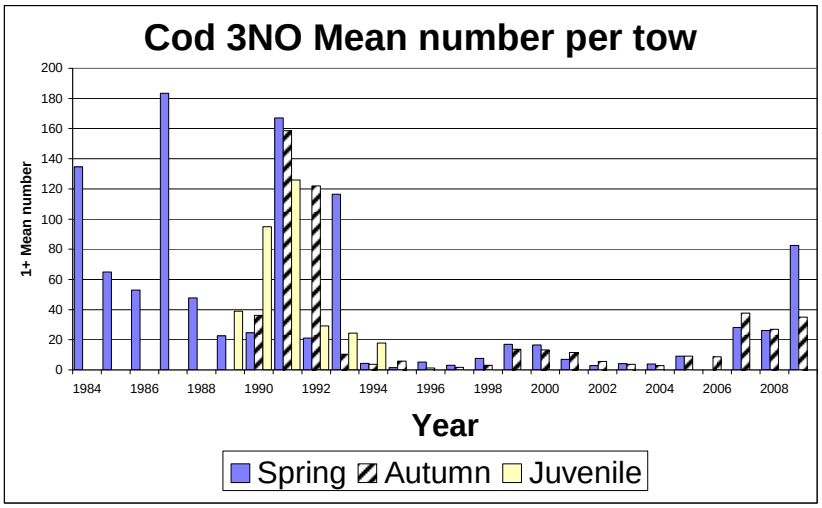

Fig 6. Spring and autumn Canadian RV estimates of 1+ mean number/tow of cod in Divisions 3NO

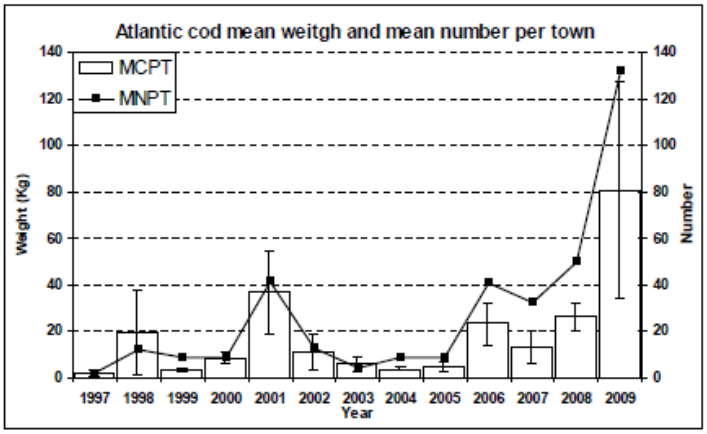

Fig. 7. Mean number and weight (kg) per tow from Spain Div. 3NO surveys of the regulatory area .

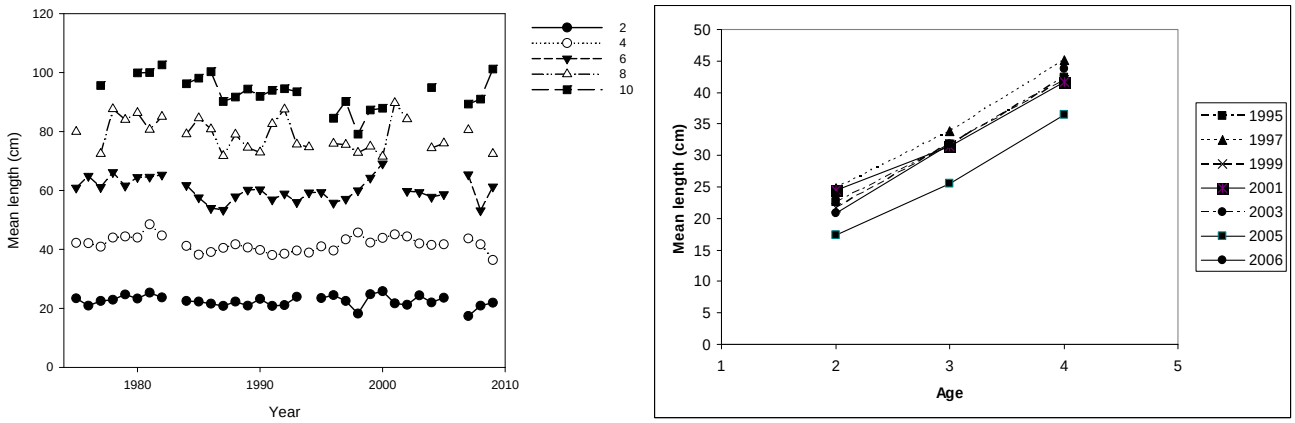

Figure 8. Mean length-at-age for selected ages of Div. 3NO cod from Canadian spring RV surveys (left panel). Mean length at ages 2 to 4 for selected cohorts of Div. 3NO cod from 1995 to 2006 in the Canadian spring survey (right panel.

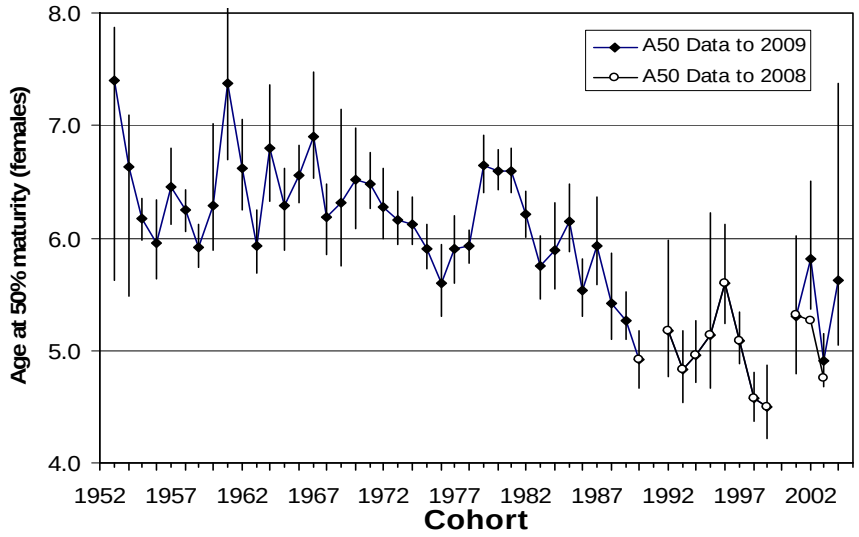

Fig. 9 - Age at 50% maturity by cohort (1953-2004, excluding 1991 and 2000) for female cod sampled during DFO spring research vessel bottom-trawl surveys of NAFO Divs. 3NO. Error bars are 95% fiducial limits.

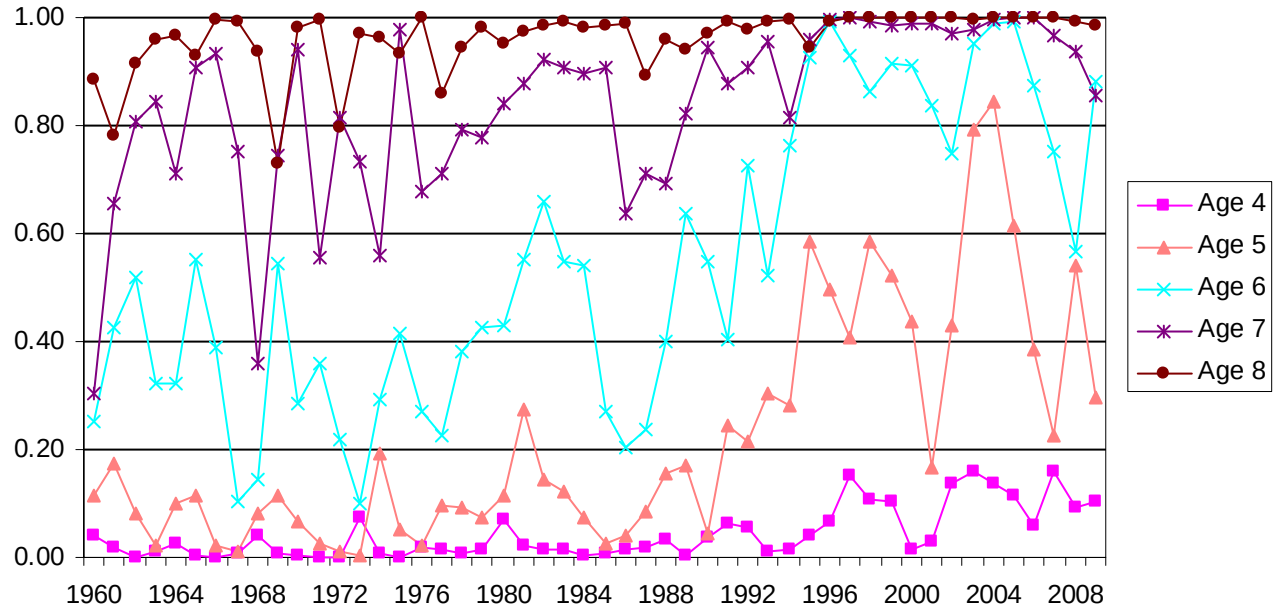

Fig. 10. Estimated proportions mature at ages 4-8 for female cod sampled during Canadian research vessel bottom-trawl surveys in NAFO Divs 3NO. Model fitted by cohort to observed proportions mature at age from 1975-2009.

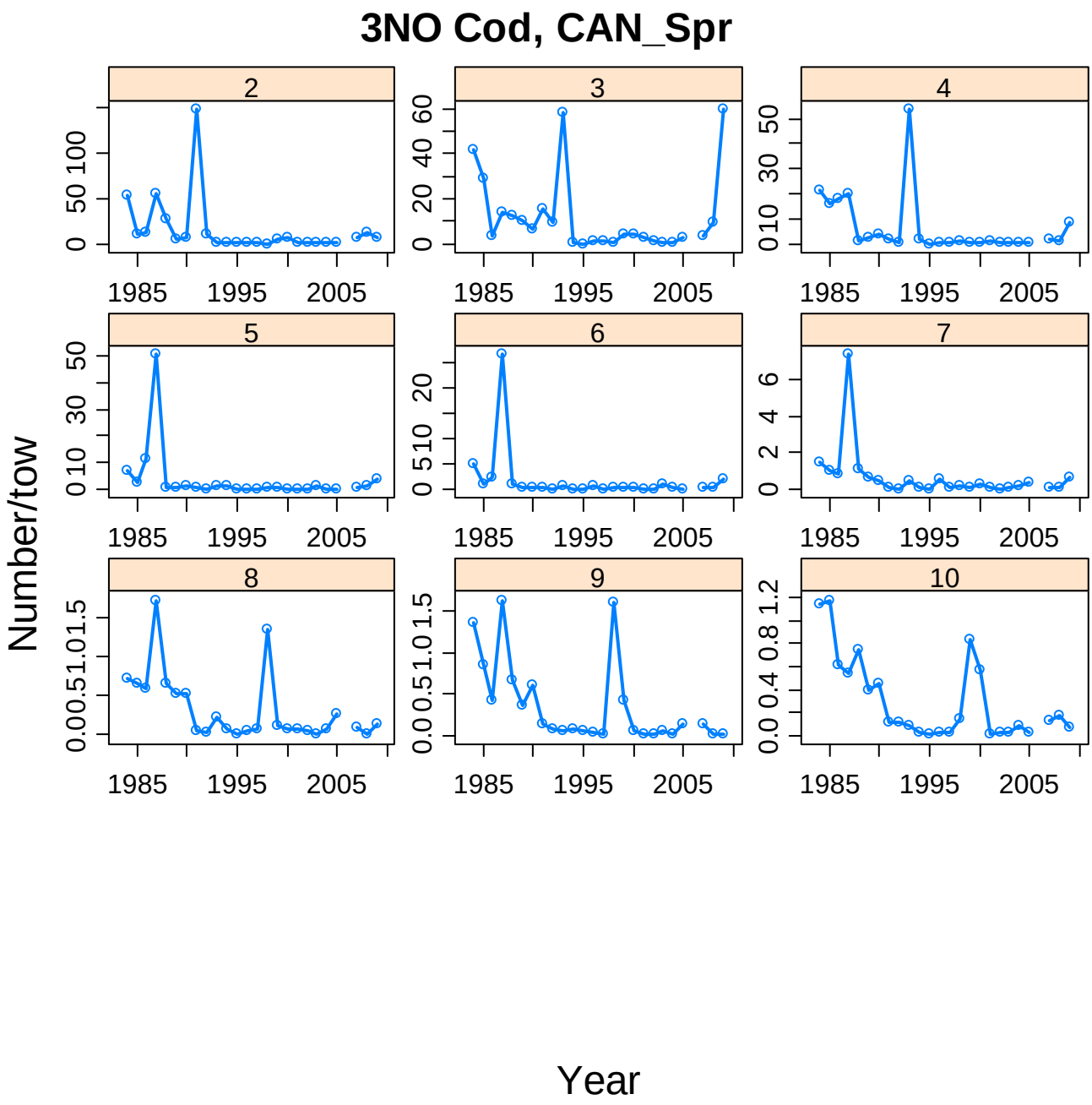

Fig. 11a. Age by age disaggregated plots of mean number per tow from Canadian SPRING surveys from 1984-2009.

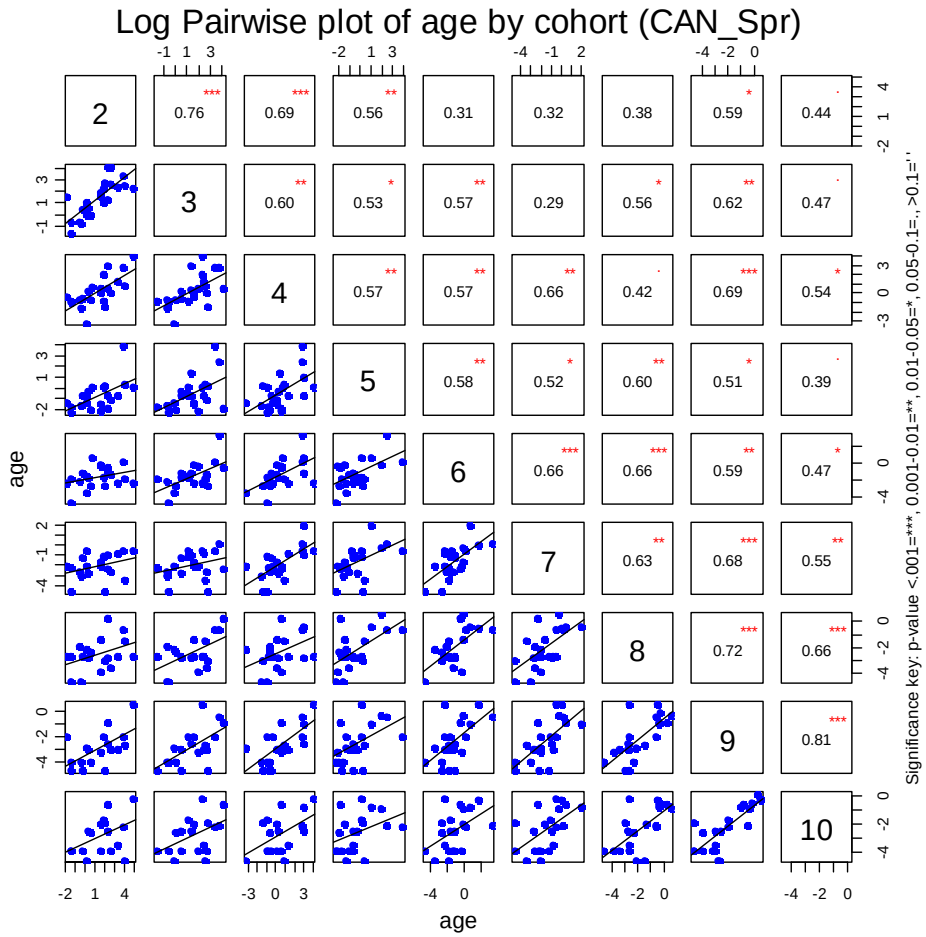

Fig. 11b. Pair-wise scatter plot of age-disaggregated survey data (log-scale) from Canadian SPRING surveys in Divs. 3NO (1984-2009). Data points in the panels below the numbered diagonal compare the logarithm of survey data at different ages for a common cohort. The solid line in each panel is the linear least squares regression line with the correlation coefficient provided in the corresponding diagonal panel (p-values significantly different than 0 noted with asterisk (see key on right side of diagram).

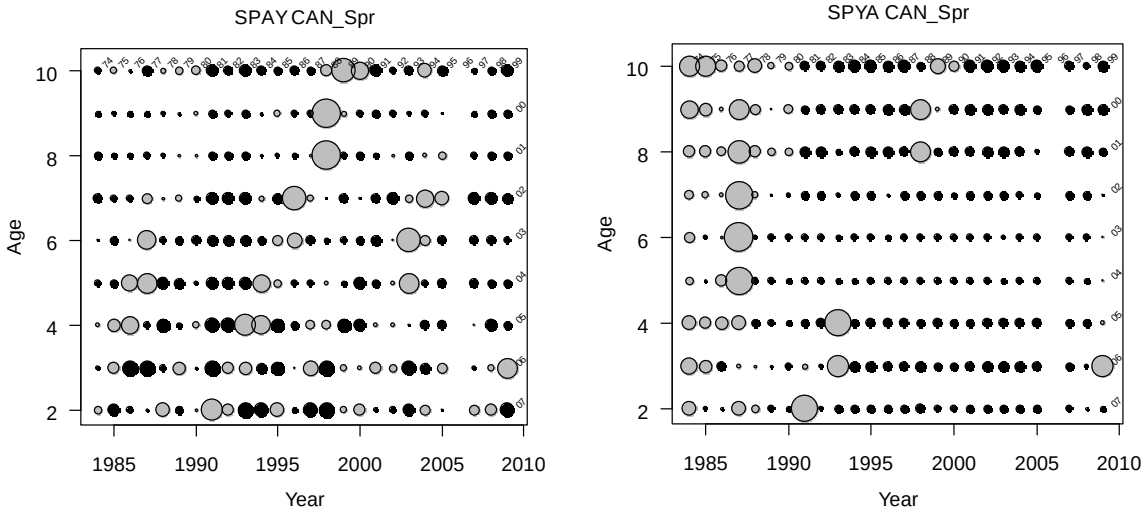

Fig. 11c. Cohort consistency plots for the Canadian Spring surveys in 3NO (1984-2009). Age disaggregated mean number per tow were converted to proportions within an age (left panel, SPAY) or within a year (right panel, SPYA). For each survey-age, the survey data are standardized to have a mean of 0 and a variance of 1. Symbol sizes are scaled and values greater than average are shown as grey circles, average values are shown as small dots, and less than average values are shown as black circles.

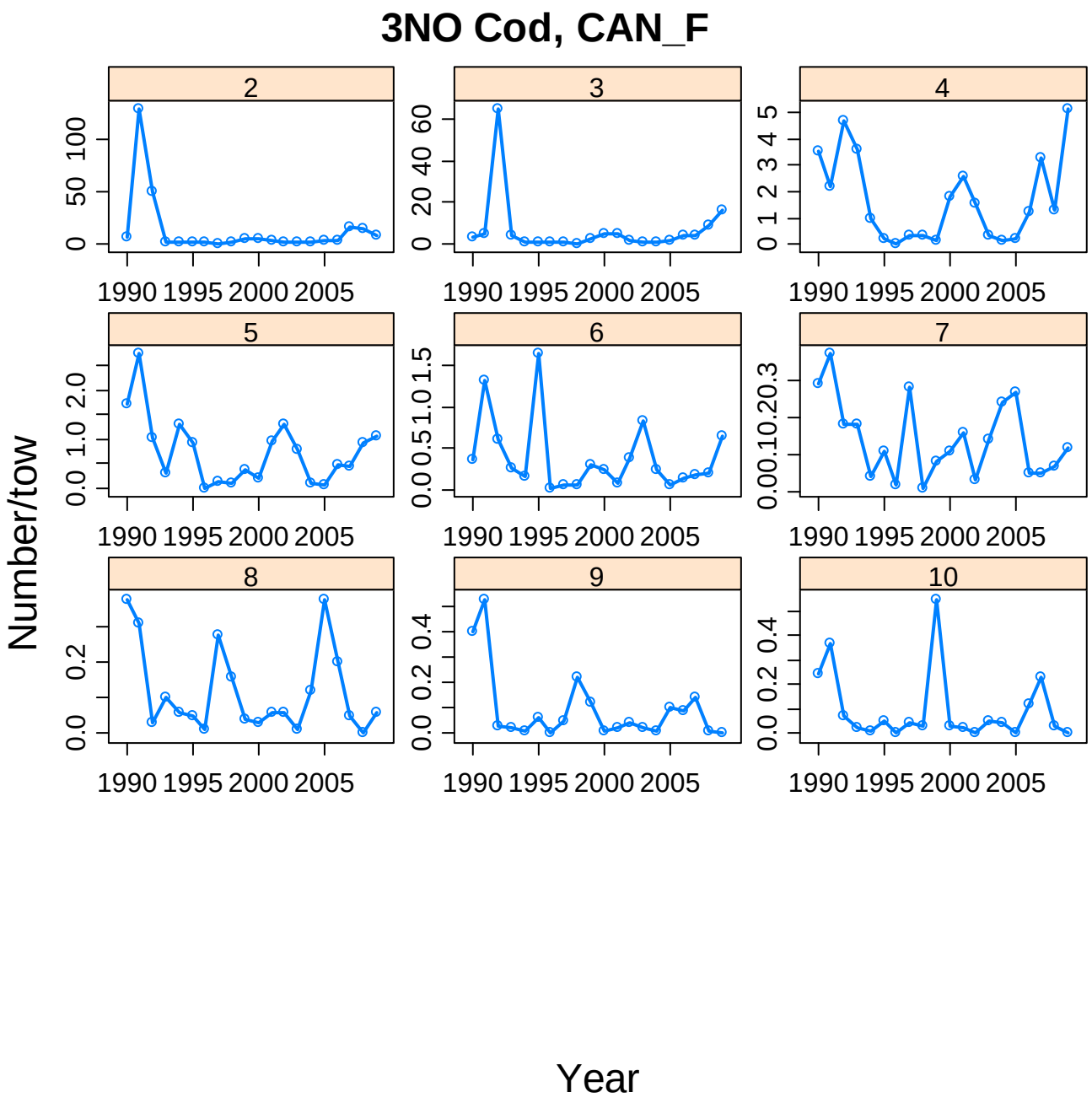

Fig. 12a. Age by age disaggregated plots of mean number per tow from Canadian AUTUMN surveys from 1984-2009.

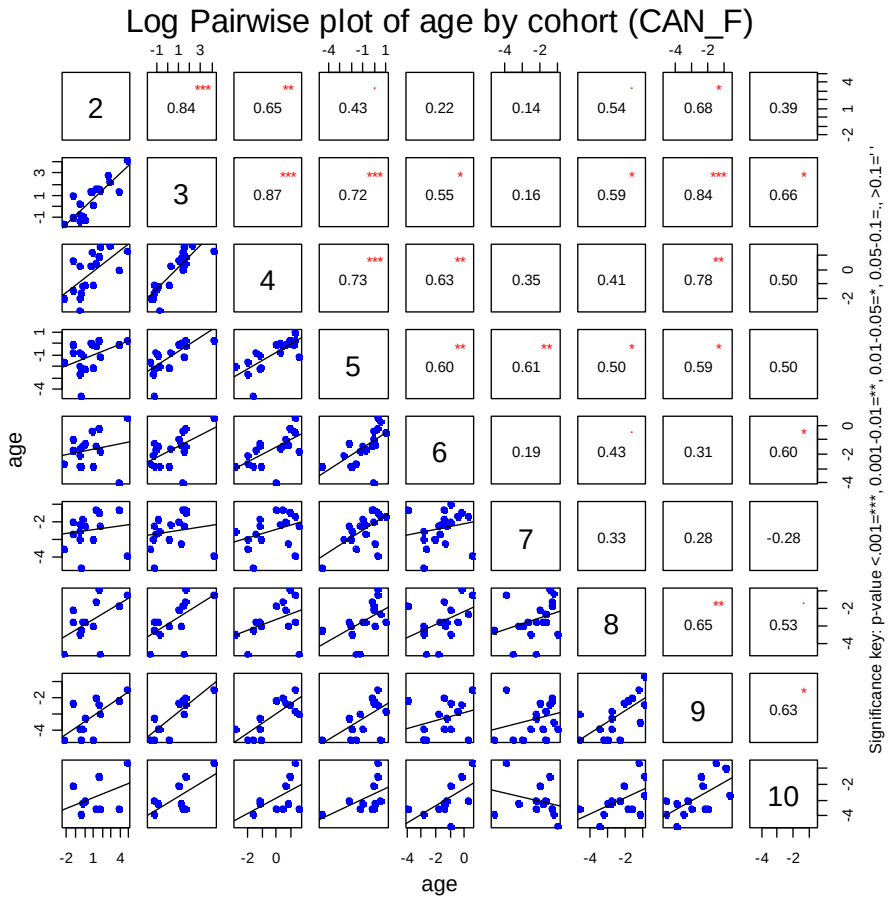

Fig. 12b. Pair-wise scatter plot of age-disaggregated survey data (log-scale) from Canadian AUTUMN surveys in Divs. 3NO (1990-2009). Data points in the panels below the numbered diagonal compare the logarithm of survey data at different ages for a common cohort. The solid line in each panel is the linear least squares regression line with the correlation coefficient provided in the corresponding diagonal panel (p-values significantly different than 0 noted with asterisk (see key on right side of diagram).

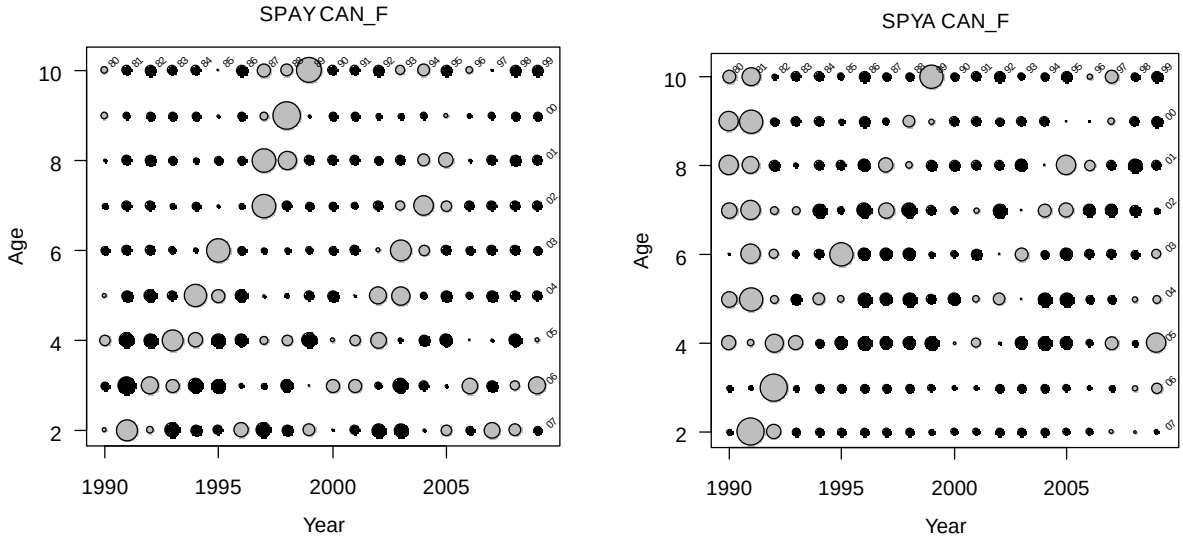

Fig. 12c. Cohort consistency plots for the Canadian AUTUMN surveys in 3NO (1990-2009). Age disaggregated mean number per tow were converted to proportions within an age (left panel, SPAY) or within a year (right panel, SPYA). For each survey-age, the survey data are standardized to have a mean of 0 and a variance of 1. Symbol sizes are scaled and values greater than average are shown as grey circles, average values are shown as small dots, and less than average values are shown as black circles.

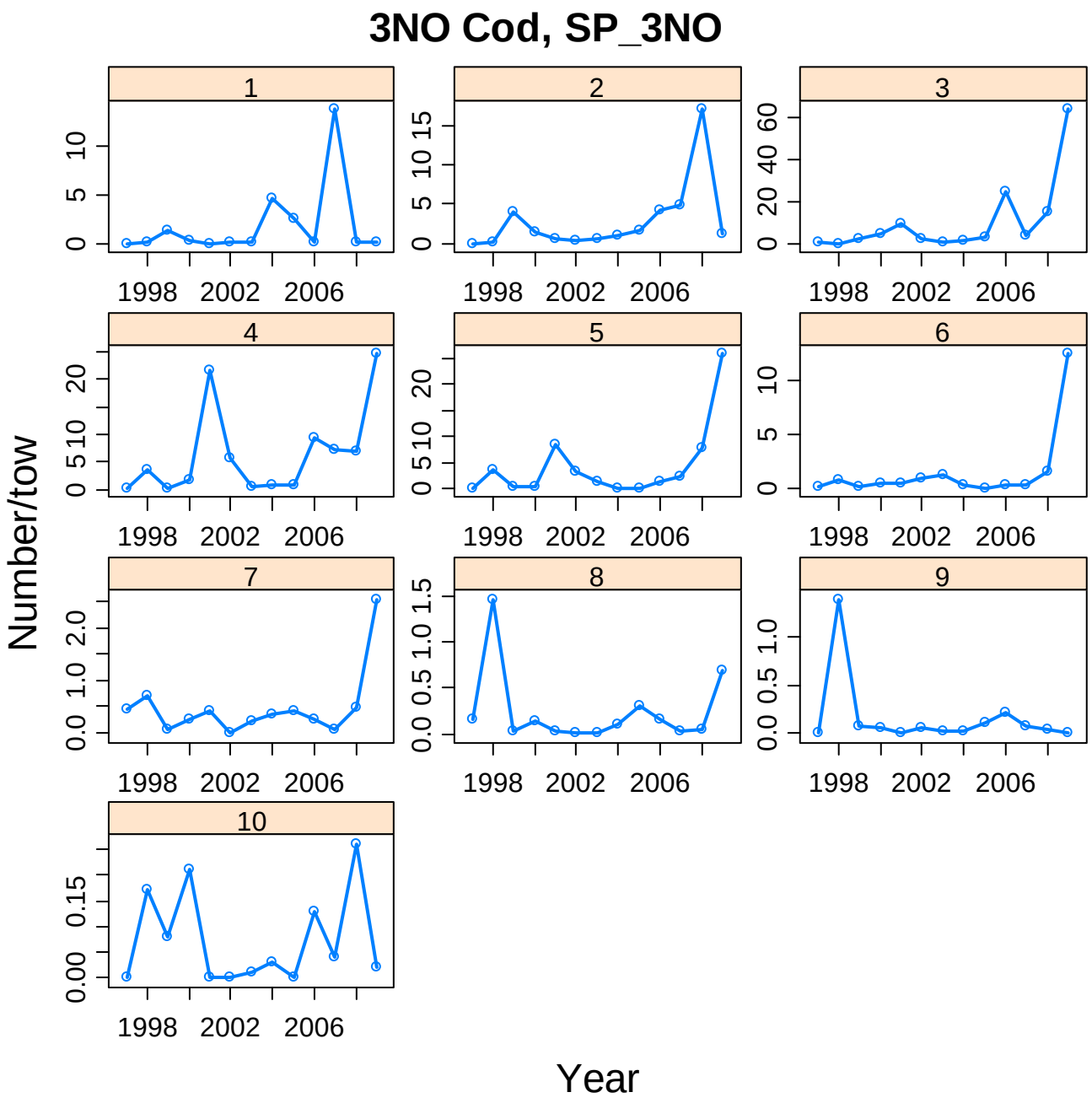

Fig. 13a. Age by age disaggregated plots of mean number per tow from Spanish 3NO surveys from 1997-2009.

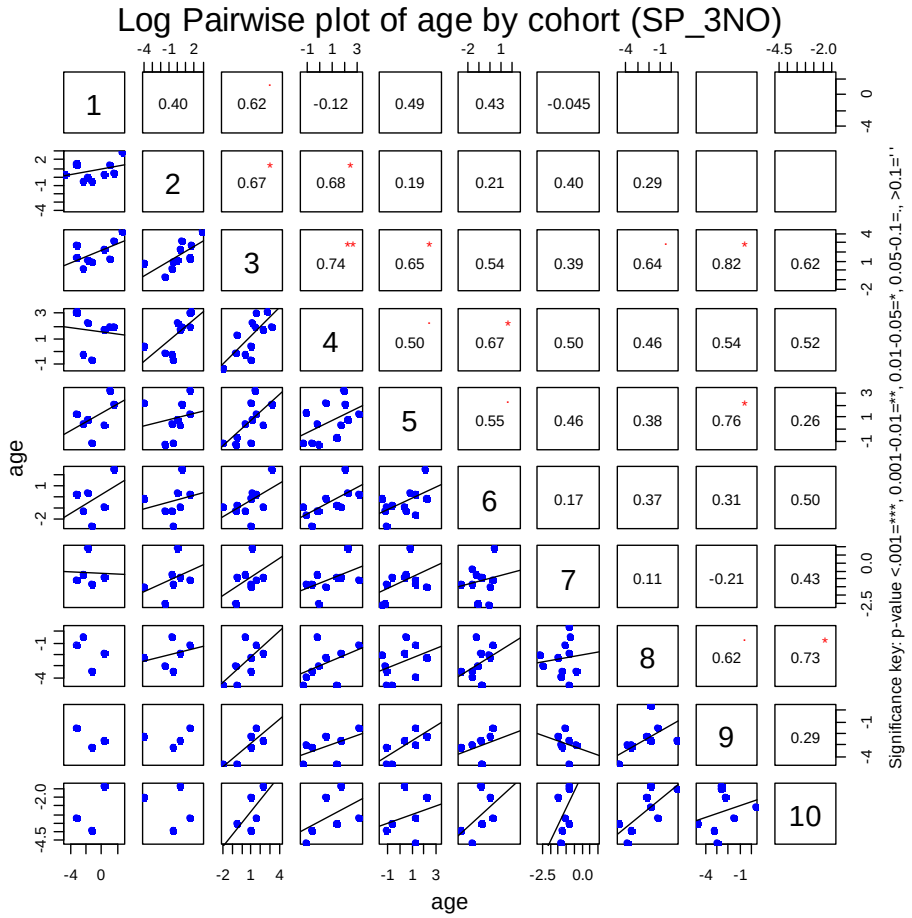

Fig. 13b. Pair-wise scatter plot of age-disaggregated survey data (log-scale) from Spanish surveys in Divs. 3NO (1997-2009). Data points in the panels below the numbered diagonal compare the logarithm of survey data at different ages for a common cohort. The solid line in each panel is the linear least squares regression line with the correlation coefficient provided in the corresponding diagonal panel (p-values significantly different than 0 noted with asterisk (see key on right side of diagram).

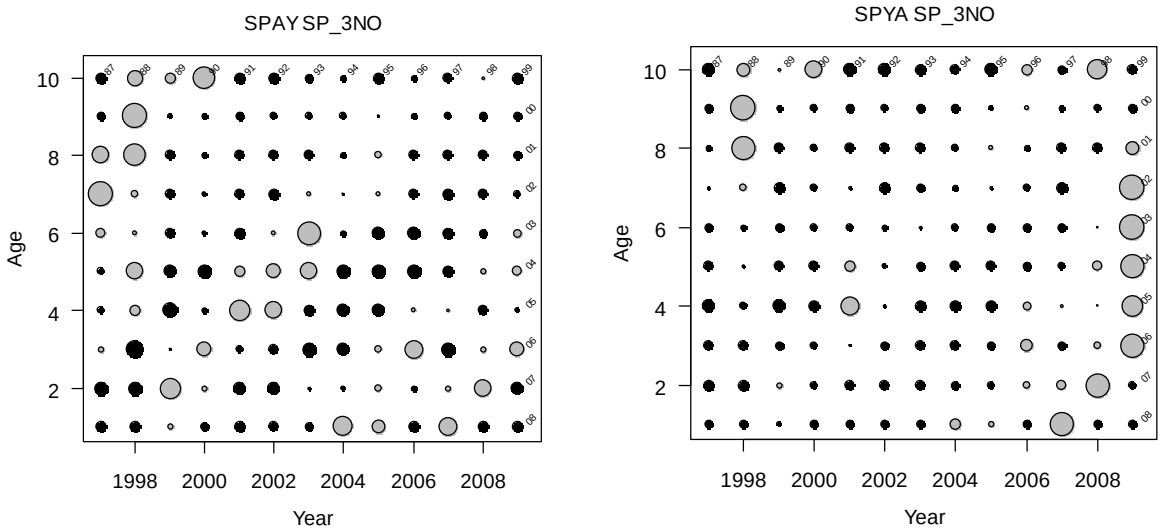

Fig. 13c. Cohort consistency plots for the Spanish surveys in 3NO (1997-2009). Age disaggregated mean number per tow were converted to proportions within an age (left panel, SPAY) or within a year (right panel, SPYA). For each survey-age, the survey data are standardized to have a mean of 0 and a variance of 1. Symbol sizes are scaled and values greater than average are shown as grey circles, average values are shown as small dots, and less than average values are shown as black circles.

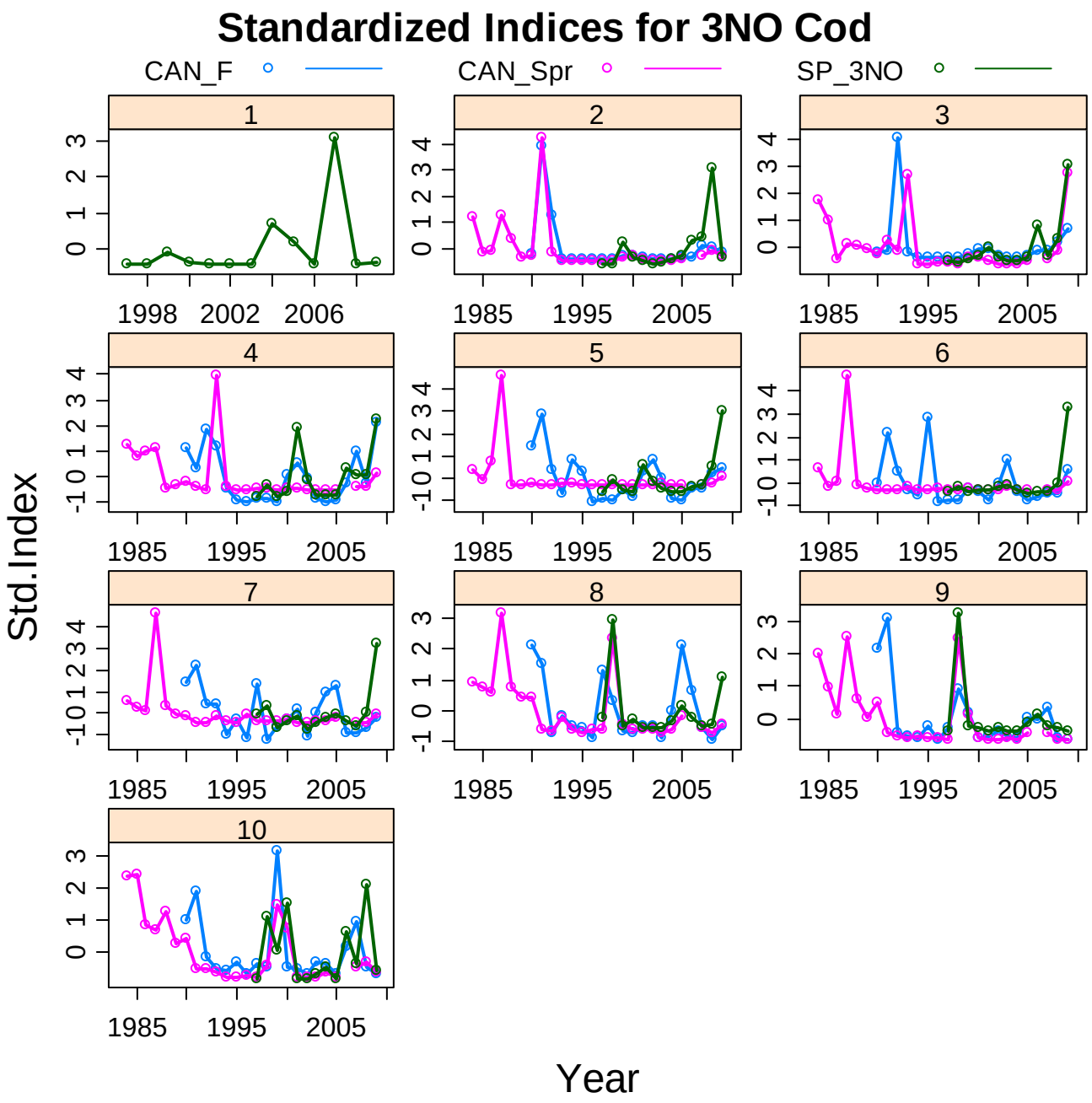

Fig. 14. Cohort consistency plots for survey indices for 3NO cod (Canadian SPRING, Canadian Autumn and Spanish 3NO). Plotted are standardized indices at age.

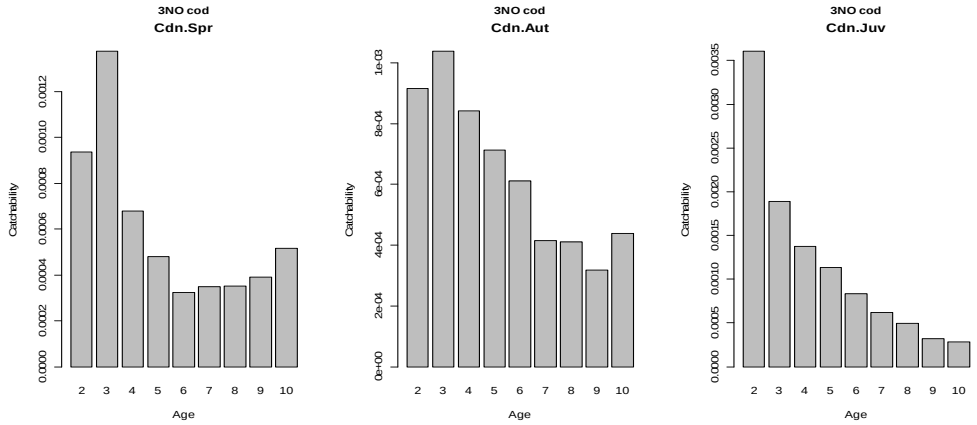

Fig. 15. Estimated catchabilities from ADAPT.

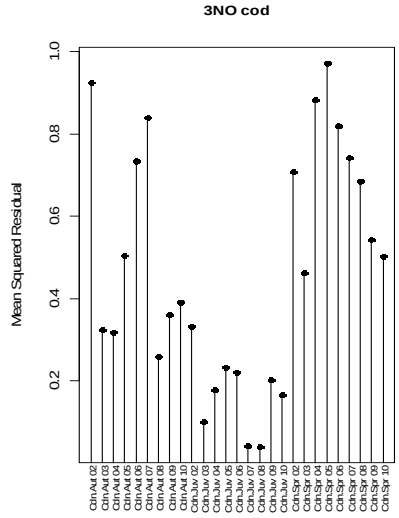

Fig. 16. Mean squared residual at age for each index in the ADAPT.

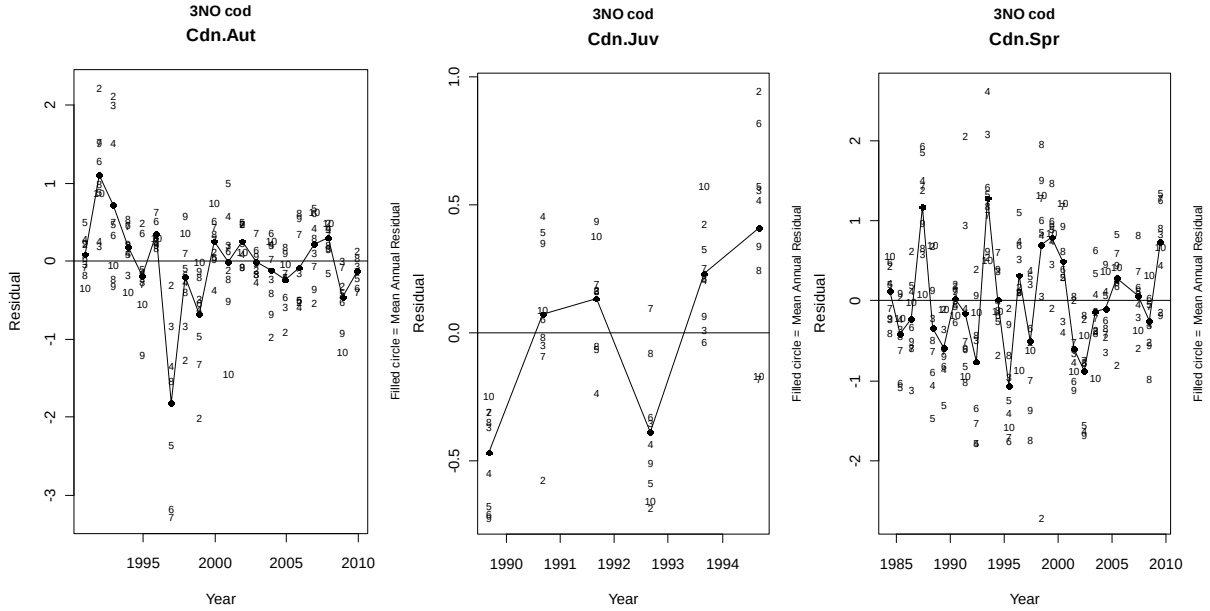

Fig. 17. Residuals at age for each index in the ADAPT.

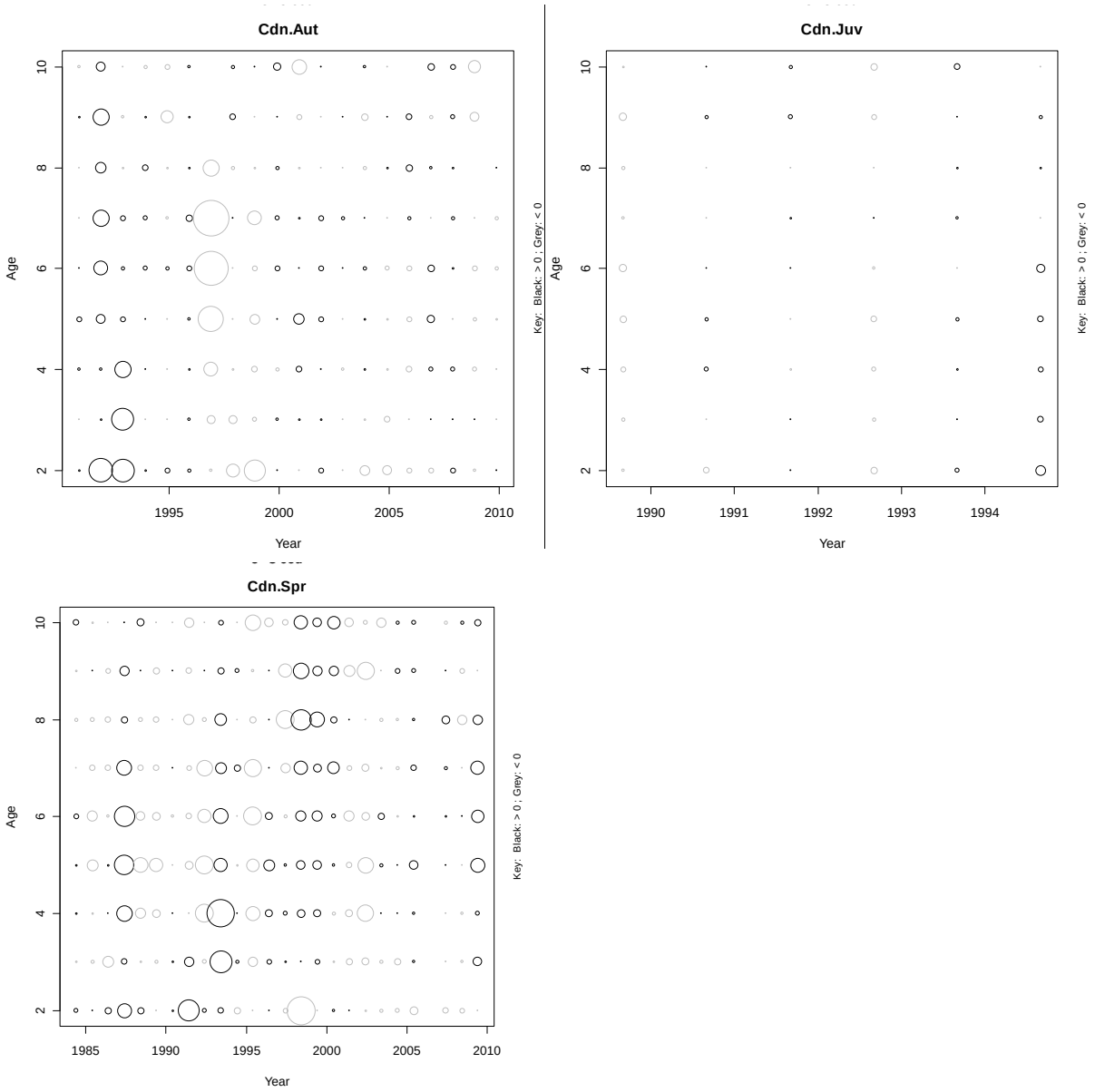

Fig. 18. Residuals at age represented by circles scaled to the magnitude of the value with color representing positive (black) or negative (grey) values for each index in the ADAPT.

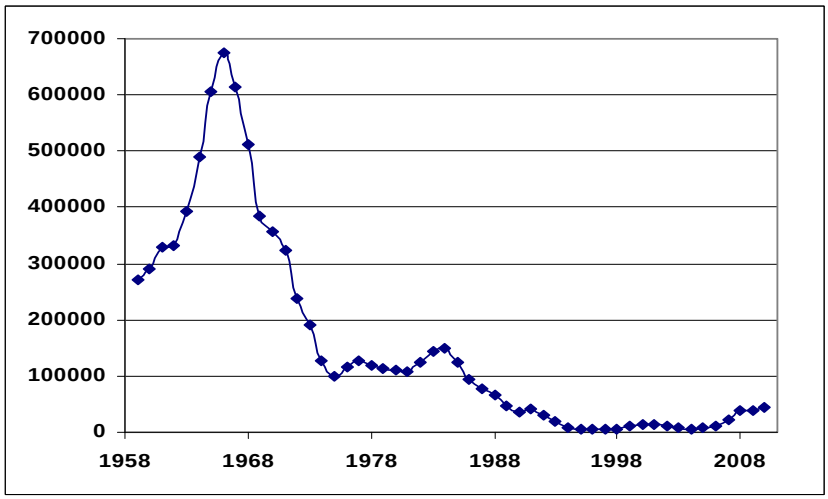

Fig. 19. Bias corrected Population Abundance for cod in Divs. 3NO (000's) as estimated from ADAPT

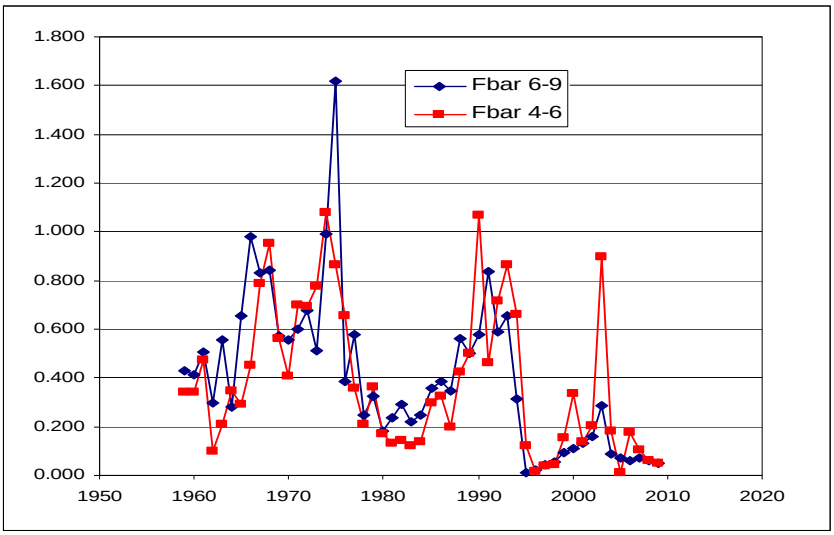

Fig. 20. Fishing Mortality for cod in Div. 3NO as estimated from ADAPT.

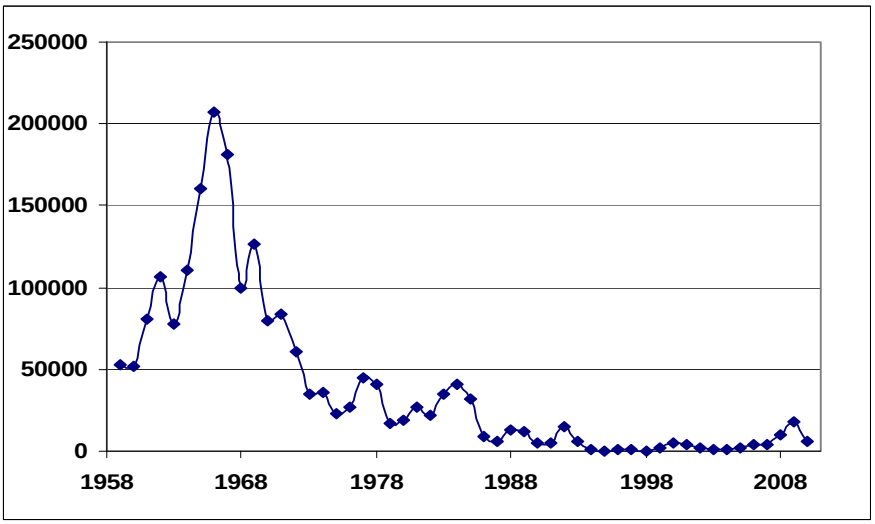

Fig. 21. Age 3 recruits for cod in Div. 3NO as estimated from ADAPT.

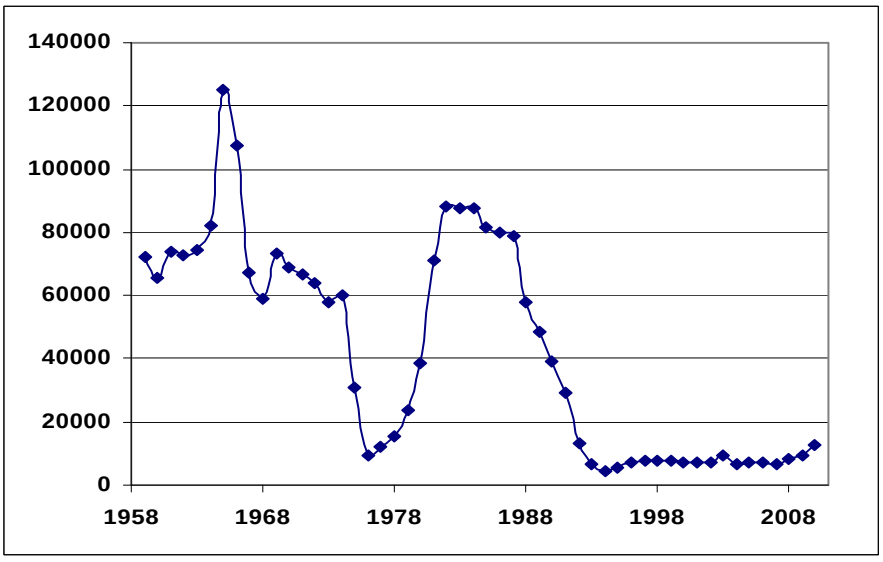

Fig. 22. Spawner biomass for cod in Div. 3NO as estimated from ADAPT.

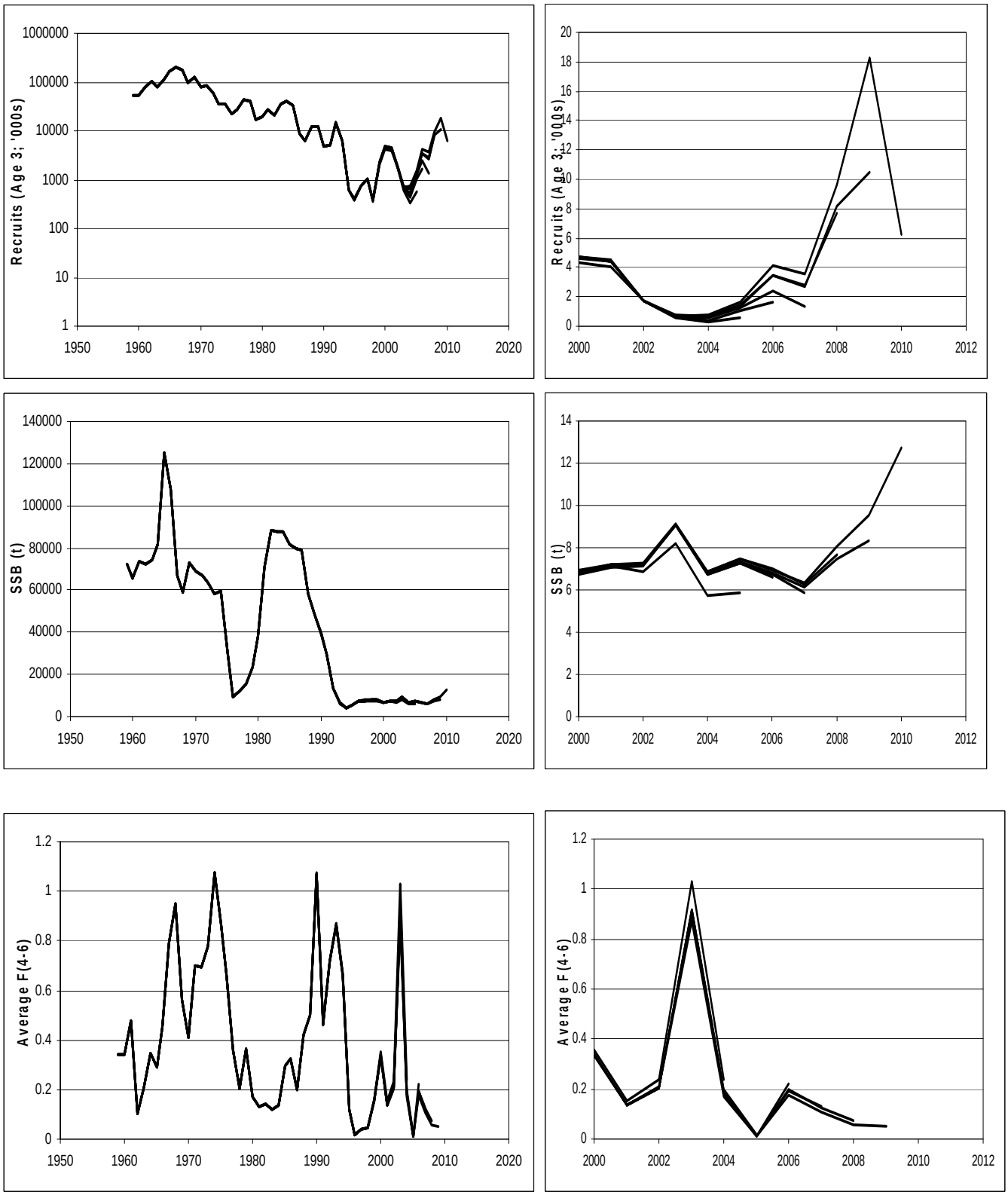

Fig. 23. Retrospective estimates of Age 3 recruits (left panel on log scale), spawner biomass and fishing mortality (Fbar 4-6) for cod in Div. 3NO. Right panels indicate the estimates over a shorter timeframe to emphasize recent trends (3+ recruits are not on log scale).

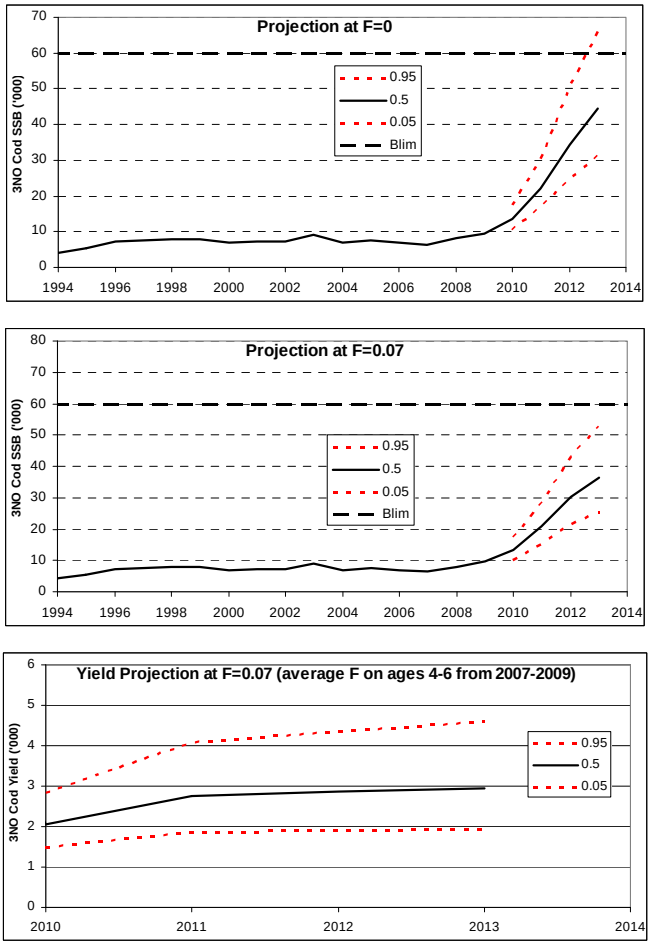

Fig. 24. Stochastic projections at F=0 and F=0.07 (the average F on ages 4-6 from 2007-2009).