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An Assessment of the Cod Stock in NAFO Divisions 3NO

by

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Abstract

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

Introduction

The Div. 3NO cod stock occupies the southern part of the Grand Bank of Newfoundland. Fish are distributed over the shallower parts of the bank in summer, particularly in the Southeast Shoal area (Div. 3N), and on the slopes of the bank in winter when cooling occurs. Some seasonal mixing between fish in Div. 3O and Subdiv. 3Ps may occur. This stock declined in the late-1980s and early-1990s and is currently at an extremely low biomass level. It has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994. Catches have increased considerably during the moratorium (172 tons in 1995 to 2 194 tons in 2002) and are currently at levels that will impede stock recovery. This assessment updates the status of the stock, based primarily on the Canadian spring and fall research vessel surveys carried out in 2001 and 2002. Population and spawning stock biomass estimates for the 1959-2003 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 a low of 15 000 tons in 1978. From 1979 to 1991 catches ranged from 20 000 to 50 000 tons (Table 1, Fig. 1a). Continued reduction in recommended TAC's reduced catches in the early-1990s to a level of about 10 000 tons in 1993. The fishery on this stock was suspended in February 1994 and has been under NAFO moratorium since then. In 1998 the Scientific Council Report recommended that there should be no directed fishing for cod in Div. 3N and 3O in 1999 and that by-catches in fisheries targeting other species should be kept at the lowest possible level. All subsequent assessments have re-iterated this advice.

Landings since 1994 (Fig 1b), including Canadian surveillance and NAFO Scientific Council estimates (Table 1), have been increasing from 170 tons in 1995 to 1 059 tons in 2000. Catches since the last assessment (Stansbury *et al.*, 2001) have been 1 309 tons in 2001 and 2 194 tons in 2002. This is substantial increase over previous years and is over a 10-fold increase over the catch in 1995, the first full year of the moratorium.

Sampling data for 2001 were limited to Canadian (Table 2), Portuguese (SCS Doc. 02/6), Spanish (SCS Doc. 02/7) and Russian (SCS Doc. 02/4) otter trawl fisheries. Sampling data for 2002 came from Canadian (Table 2), Portuguese (SCS Doc. 03/07), Spanish (SCS Doc. 03/11) and Russian (SCS Doc. 03/06) research reports. The total catch at age from by-catches in 2001 and 2002 is presented in Table 3. Table 4 provides a review of the sampling over the period 1995-2002 used to produce a catch at age for this stock. This table indicates considerable sampling deficiencies in recent years. In 1996, 1997, and 1998 the sampling was considered to be inadequate to develop a catch at age. An approach for developing catch at age for this period based on using an average partial recruitment vector, is presented in Stansbury *et al*. (1999). For 1999 and 2000 there are still 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 calculated. In 2001 and 2002, catch at age was compiled as detailed in Table 4.

Inadequate sampling also presents problems for computing mean weight at age. To fill the 1996-98 gap, a geometric mean was computed at each age, using the three nearest non-zero values on either side of the three year window. Catch-at-age and mean weights-at-age from the fisheries in the 1959-2002 period are presented in Tables 5 and 6.

Research vessel survey data

Stratified-random bottom trawl surveys have been conducted in spring by Canadian research vessels in Div. 3N and 3O since 1971 and 1973, respectively, with the exceptions of 1983 in Div. 3N and 1974 and 1983 in Div. 3O. Surveys from 1971 to 1982 were conducted by the research vessel *A.T. CAMERON* and those since 1984 were conducted by the sister ships *ALFRED NEEDLER* and *WILFRED TEMPLEMAN*. The stratification scheme used for these surveys is based on depth and is presented in Fig. 2. Fall surveys have been carried out in Divisions 3NO from 1990 to 1998 using the *WILFRED TEMPLEMAN* for strata less than 730 m and the *Teleost* for strata greater than 731 to a maximum depth of 1500m. Because of vessel difficulties in 1996 the *ALFRED NEEDLER* concluded the survey in strata less than 731m.

In the fall 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 in Fig. 3-4. Abundance and biomass have been extremely low in both Div. 3N and 3O from 1994 onwards. The swept area biomass estimate from index surveyed strata in Div. 3N and 3O combined for 2001 spring and fall are 45 068 tons and 44 610 tons, respectively. The swept area estimates in Div. 3NO combined for 2002 spring and fall are 20 630 tons and 37 681 tons, respectively. Preliminary information received during the course of the meeting indicates that the 2003 spring biomass index will be comparable to the values of the past few surveys.

Distribution plots of these surveys (Fig. 5) show that no large concentrations of cod have been encountered since 1996. The inserts in these plots detail catch and length information from the survey sets. These indicate that large catches of cod are infrequent and that few large (i.e. older) cod are encountered.

The mean numbers per tow at age for the index strata (i.e. strata with depths < 200 fathoms) in 3NO combined are given in Table 17 for the spring survey and Table 18 for the fall survey, and are plotted in Fig. 6 (age aggregated).

Both the spring and fall indices have been extremely low in all years after 1993. The 2002 values are much less than those in the previous three years, among the lowest observations. Note that a slight adjustment has been made to the 1999 fall mean numbers per tow, due to a previous omission. These changes are small in magnitude. An index derived from a juvenile flatfish survey conducted by Canada from 1989 to 1994 is presented in Table 19.

Ancillary survey information for Div. 3NO cod is available from the co-operative DFO/FPI grid survey (Maddock Parsons *et al*., 2003). This survey initially used a grid design contained completely within Div. 3NO, but the original grid has since been expanded, and the extended grid now covers Div. 3LNO. Some of the grids have fixed sampling stations, and other grids have randomly chosen sampling locations. The results of this survey are consistent with the Canadian fall and spring research surveys: there are few sizable catches of cod in the grid survey.

Analysis

Maturity at age

In the 2001 assessment of this stock, female maturities were modeled using a probit model with logit link, modeling year and age effects. From this, the annual proportions mature at age were produced. In this assessment, annual proportion mature at age is modeled by cohort, not year. This method has been used to estimate maturities in cod in Subdiv. 3Ps Cod (Brattey *et al*., 2002), Div. 2J+3KL cod (Lilly *et al*., 2003), and also for American Plaice in Div. 3LNO (Morgan *et al*., 2002). A probit model with logit link with age and cohort effects were fitted to Canadian spring survey data. The observed data are quite variable, particularly in recent years, partly as a consequence of small sample sizes. The estimated age at 50% maturity (A_{50}) was quite variable for cohorts throughout the 1950's and 1960's ranging between 5.9 and 7.4 years (Fig. 8). Estimated A_{50} decreased steadily until the 1976 cohort; and following an increase A_{50} centered around the 1980 cohort, A_{50} again decreased; estimated to be less than age 5 for the 1990 cohort. The model did not fit for the 1991 cohort. Estimates for the 1991 cohort were produced by averaging the estimates from the two adjacent years. Recent estimates have shown some improvement, but A_{50} is still lower than historical estimates. The model predicted proportion of females mature at age 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 using the previous/following 3 years for the appropriate age (shaded in the table). Estimated annual mortalities for 1975-2002 are plotted for selected ages as an illustration in Fig. 8. Estimated proportion mature for these ages have all increased over this time period.

Estimates of Total Mortality (Z) from survey data

Estimates of total mortality were computed for the Canadian Fall and Spring Campelen (or equivalents) survey series. Total mortality is derived directly from the basic cohort equation:

$$N_{a+1,y+1} = e^{-Z_{a,y}} N_{a,y} \quad \Leftrightarrow \quad Z_{a,y} = -\ln\left(\frac{N_{a+1,y+1}}{N_{a,y}}\right) = \ln\left(\frac{N_{a,y}}{N_{a+1,y+1}}\right).$$

Estimated mortalities using the Spring series (Fig. 9), are quite variable, yet still show increasing trends since the moratorium was instituted. The estimates of mortality from the Fall survey data (Fig. 10), also somewhat erratic, indicate that over the last 5 to 7 years, age-specific mortality has generally been constant or has increased.

Estimates of relative year-class strength from survey data

A multiplicative model was used to estimate the relative year class strength produced by the spawning stock based upon survey indices at ages 2 and 3. The model formulation is identical to that used in the previous assessment of

this stock. Similar approaches have been implemented by Healey et al. (2002) for Greenland Halibut in Div. 2GHJ3KLMNO, and by Morgan et al. (2002) for American Plaice in Div. 3LNO.

On a log-scale the model can be written as follows:

$$\log(I_{s,a,y}) = \mu + Y_y + (SA)_{s,a} + \varepsilon_{s,a,y}$$

where:

μ = overall mean
s = survey subscript
a = age subscript
y = year class subscript
I = Index (Abundance in 000's)
Y = year class effect
SA = Survey * Age effect, and
ε = error term.

It is assumed that $\varepsilon_{s,a,y} \sim N(0, \sigma^2_{group})$, (independently and identically) for pre-specified groups (e.g. *group*=survey estimates a unique variance parameter for each survey). Index values of zero were adjusted as in Healey *et al*. (2002). Likelihood ratio tests indicate that a constant variance model (general linear model) is not statistically different than the full model which estimates a variance parameter for each survey-age combination.

Null Model	Test Statistic	Df	p-val
FALL_CAMP[1]	2.9084	1	0.0881
FALL_ENGL[1]	0.0244	1	0.8759
SPR_ENGL[1]	0.7414	1	0.3892
SPR_CAMP[1]	0.1803	1	0.6711
Juvenile[1]	2.5934	1	0.1073
Survey vp[2]	3.9494	5	0.5567
Common vp[3]	6.7435	9	0.6638

[1] Survey for which survey*age variance parameters are collapsed to a survey variance parameter.
[2] Survey variance parameter estimated for each survey.
[3] One variance parameter estimated (GLM).

Estimates of cohort strength for 1969-2000 (Fig. 11) are back-transformed. Estimates of year-class strength indicate that all cohorts since 1990 have been extremely weak. Of these, the 1997 and 1998 year-classes are estimated as being the strongest over the recent period. The standardized residuals (Fig. 12) indicate no systematic problems.

Sequential population analysis

The catch at age used in the sequential population analysis applying the ADAPT framework (Gavaris, 1988) is presented in Table 21. 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 1959-87. Due to inadequate sampling of removals, total catch for 1996-98 was proportioned by age using the average partial recruitment vector from 1990-93 (from a previous ADAPT run) with the fully recruited F estimated from a catch projection so as to match the observed catch (further details in catch-at-age section). Catches since that time have been age-disaggregated using samples from contracting parties and Canadian RV age-length data.

The ADAPT was calibrated with Canadian RV survey spring 1984-2002, Canadian RV survey fall 1990-2002 at age and Canadian juvenile survey 1989-94 indices was applied to estimate terminal numbers $N_{i,\,t}$,

where i = 3 to 12, for t = 2003 and i =12, for t=1994 to 2002,

and catchabilities:

$q1_i$ where *i* = 2 to 10 for the Canadian Research Vessel survey spring
$q2_i$ where *i* = 2 to 10 for the Canadian Research Vessel survey fall
$q3_i$ where *i* = 2 to 10 for the Juvenile Research Vessel survey.

The following structure was imposed:

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

Input data were:

Catch numbers at age,
Ci,t where i = 2 to 12 and t = 1959 to 2002 ,
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 2002, spring
RV2i,t where i = 2 to 10 and t = 1990 to 2002, fall
and Canadian juvenile Research Vessel survey estimates of mean numbers per tow-at-age (Yankee 41.5 shrimp trawl in August – September)
RV3i,t where i = 2 to 10 and t = 1989 to 1994 .

The objective function minimized is

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

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

This particular model formulation was selected since it follows the accepted VPA from the last assessment and effectively deals with problems associated with zeros in the catch matrix at the age 12 for 1994-96 (by estimating survivors at age 12 in these years). The statistics associated with the ADAPT output are given in Table 22. The mean square error for the model fit (MSE) was 0.76. The relative error in the parameter estimates of abundance decreased with age from a high of 68% at age 3 to a low of 31% at age 12. Relative bias was a high of 23% at age 3 and decreased to 5% at age 10.

The estimated survivors and catchabilities (Fig. 13, 14) together with standard errors of the estimates are provided in Table 22. Catchabilities generally decrease with age for all three surveys with the spring and fall having nearly equal q's for ages 7-10 (Fig 13). The Yankee 41.5 (juvenile survey) catchability for age 2 is more than twice that for the Campelen surveys.

Bubble plots of residuals from the ADAPT run are presented in Fig. 16. Residual plots indicate that year effects are evident in the spring survey in 1987, 1993 (positive) and 1995, 1999, 2000 (negative) (Fig 17). The fall 1996 estimates have large negative residuals. The juvenile survey residuals show no year effects. Large residuals in the fall survey for 1996 are ages 5, 6 and 7 while all other years for the three ages are positive (Fig. 18).

Bias-adjusted estimates of population numbers (Fig. 19, 20) and fishing mortality at age (Fig. 21) are given in Tables 23 and 24, respectively. The age 2 value in 2003 is the geometric mean of the 2000-2002 age 2 estimates. The 2003 estimate of total survivors is the lowest in the time series. The 1989 year-class, the most recent evidence of non-negligible recruitment (Fig. 22), is no longer contributing to the VPA population (since 2001), and a plot of population abundance at age (Fig. 20) indicates that no year-classes of significance exist. Further, estimated recruitment for the past decade has been extremely low. Thus, future prospects for this stock are extremely poor. The 1996-98 year-classes are now the most prominent year-classes in the population, but the strength of these year-classes is quite low relative to previously observed levels. Beginning of year mean weight-at-age calculated from

the commercial catch is presented in Table 25. These weights are used to calculate biomass, given in Table 26 and presented in Fig. 23. Stock biomass, which increased from the time of the moratorium until 2001, is again decreasing. The maturities computed using the cohort model are used to compute the spawning stock biomass (Table 27, Fig. 24). Current SSB is estimated to be 4 502 tons, which is approximately 8% of B_{lim}. Given the sporadic sampling in the earlier time period, the estimated maturities from the cohort model differ from those estimated by the annual maturities model, particularly in the historic time period. The annual estimates of maturity produce a slightly different view of historic SSB. The SSB computed using the maturities from the 2001 assessment (computed by year) were plotted along with the current SSB trajectory are plotted for comparison in Fig. 25. To produce estimates for 2002 and 2003 maturities for comparison, the 2001 values were carried forward. The comparison plot of SSB indicates some differences in the historic trajectories, but near-identical trajectories since 1974. Differences in the 2002 and 2003 values in each series result from the fact that the maturities from the last assessment end in 2001. The stock recruit scatter (Fig. 26) is also altered by the use of the maturities using the cohort model. However, these changes do not suggest alteration of the current B_{lim} of 60 000 tons, especially considering this value is to be reviewed if the spawner biomass reaches 30, 000 t. Current estimates of recruits-per-spawner (Fig. 27) are also among the lowest observed values.

Estimates of fishing mortalities in 2003 for most ages are large, particularly for the younger ages, and are cause for concern for a stock under moratorium. Two reference F's are considered, both the age 6 – 9 average and the average F from ages 4-6. The $\overline{F}_{4:6}$ decreased slightly in 2001 due to the fact that relatively few age 6 fish were caught. At present, these F's are estimated to be at or above the levels seen in the early-1980s during which time a sizable fishery existed. Increasing by-catches since the imposition of the moratorium are preventing the recovery of the stock.

Retrospective analysis

A retrospective analysis was conducted, and five years of successive data were removed, and the estimation (identical structure to the VPA above) was repeated for each case. Population numbers (Fig. 28) and SSB (Fig. 29) display persistent trends for under estimation as successive years of data were excluded from the analysis. Conversely, mean $\overline{F}_{6–9}$ was over estimated in the year of the assessment (Fig. 30).

Sensitivity runs

Two exploratory runs were carried out to examine the influence of the tuning indices on the estimates. One run was carried out with spring and juvenile surveys only and another run was carried out with fall and juvenile surveys only. Assessment using spring or fall alone proved problematic in the 2001 assessment and were not repeated. Summary plots of population numbers, SSB, mean and average F over ages 6-9 are given in Fig. 31. Note that population numbers, SSB, and age 3 recruitment are plotted on a log-scale to distinguish differences between the runs. Tuning without the Canadian RV spring series gives lower estimates of population numbers and tuning without the Canadian RV fall series gives higher estimates.

Deterministic Projections

Given the depressed state of the stock, coupled with the fact that no strong year-classes exist in the current population structure, it was felt that stochastic projections would not alter perceptions about stock status in the short to medium term. However, deterministic projections still prove informative. The projections were carried out using three year averages of recruits-per-spawner, partial recruitment at age, and stock weights-at-age. The three year average of $\overline{F}_{4–6}$ is 0.322. This fishing mortality was applied to the three-year average PR vector, which was re-scaled to the average PR over ages 4-6. The projection inputs are tabled in Table 28. Female maturities come from Table 20. Five year projections of SSB under F=0 and F=0.322 are presented in Fig. 32. Projections beyond five-years would be dominated by projection assumptions, as opposed to the SPA results. Results suggest that under current biological and productivity conditions, SSB will remain extremely low.

Conclusion

The 2002 spring and fall research vessel surveys indicate that the current stock size remains at an extremely low level. Survey abundance and mean numbers per tow have further declined since the last assessment of this stock. Estimates of recent year-class size from survey data indicate that recruitment has been almost non-existent since the 1989 and 1990 year-classes. The predominant year-classes remaining in this stock are the 1997 and 1998 year-classes, which are very weak compared to all historical year-classes. Estimates from the ADAPTive framework indicate that spawner biomass increased from 1995-2000, but has since decreased as by-catches have further increased. Fishing mortality is currently estimated to be at or above mid-1980s levels, during which time a sizable fishery existed. Low spawner biomass, low recruitment and high fishing mortality point to poor prospects for this stock in the medium term. This stock is currently well below the existing B_{lim}. Recovery will require a number of relatively strong year-classes that survive to maturity, rebuilding the spawner biomass. It will also require that by-catch mortality should be kept at an extremely low level, as current levels of catch are impeding stock recovery. Projections indicate that SSB will remain extremely low under current conditions.

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References

Brattey, J., N.G. Cadigan, B.P. Healey, G.R. Lilly, E.F Murphy, P.A. Shelton, D.E. Stansbury, , and J.-C. Mahé, 2002. An assessment of the cod (Gadus morhua) stock in NAFO Subdiv. 3Ps in October 2002. Can. Sci. Adv. Sec. Res. Doc. 2002/096.

Cadigan, N.G. and P.A. Shelton. 1997. Associations between 2J3KL fall survey catches of cod and bottom temperatures. NAFO SCR Doc. 97/43, 19p.

Gavaris, S. MS 1988. An adaptive framework for the estimation of population size. CAFSAC Res. Doc. 88/29, 12p.

Healey, B.P., N.G. Cadigan, and W.B. Brodie. 2002. Analysis of Pre-recruit Data from Surveys for Greenland Halibut in NAFO Subarea 2 and Divisions 3KLMNO. NAFO SCR Doc. 02/21. Ser. No. N4625.

Lilly, G.R., P.A. Shelton, J. Brattey, N.G. Cadigan, B.P. Healey, E.F. Murphy, D.E. Stansbury and N. Chen. 2003. An assessment of the cod stock in NAFO Divisions 2J+3KL in February 2003. Can. Sci. Adv. Sec Res. Doc. 2003/023.

Maddock Parsons, D., W.B. Brodie, and K. Dwyer. 2003. Update on Cooperative Surveys of Yellowtail Flounder in NAFO Divisions 3LNO, 1996-2002. NAFO SCR Doc. 03/18. Ser. No. N4825.

Morgan, M.J., W.B. Brodie, D. Maddock Parsons, B.P. Healey, and D. Power. 2002. An Assessment of American Plaice in NAFO Divisions 3LNO. NAFO SCR Doc. 02/70. Ser. No. N4683.

Perry, R.I., and S.J. Smith. 1993. Identifying habitat associations of marine fishes using durvey data: An application to the Northwest Atlantic. Can. J. Fish Aquat. Sci. 51:589-602.

Shelton, P.A. and M.J. Morgan. MS 1993a. An analysis of NAFO Division 2J3KL cod spawner biomass and recruitment. NAFO SCR Doc. 93/37, 14p.

Shelton, P.A. and M.J. Morgan. MS 1993b. Assessing the risk of failing to achieve replacement recruitment. ICES C.M. 1993/D:54, 20p.

Shelton, P.A. and M.J. Morgan. MS 1994a. NAFO Div. 3NO cod stock - spawner biomass and recruitment required for replacement. NAFO SCR Doc. 94/1, 10p.

Shelton, P.A. and M.J. Morgan. MS 1994b. An analysis of spawner biomass and recruitment of cod (*Gadus morhua*) in Division 2J and 3KL. NAFO Sci. Coun. Studies. 21:67-82.

Stansbury, D.E., C.A. Bishop, E.F. Murphy and M.B. Davis. MS 1995. An assessment of the cod stock in NAFO Div. 3NO. NAFO SCR Doc. 95/70, 34p.

Stansbury, D.E. MS 1996. Conversion factors from comparative fishing grids for Engels 145 otter trawl on the FRV Gadus Atlantica and the Campelen 1800 shrimp trawl on the FRV Teleost. NAFO SCR Doc. 96/77.

Stansbury, D.E. MS 1997. Conversion factors from comparative fishing grids for Engels 145 otter trawl and the Campelen 1800 shrimp trawl used on research vessels. NAFO SCR Doc. 97/31.

Warren, W.G. MS 1997. Report on the comparative fishing trial between the Gadus Atlantica and Teleost. NAFO Sci. Coun. Studies 2: 81-92.

Warren, W.G., Brodie, W., Stansbury, D., Walsh, S., Morgan, J., and Orr, D. MS 1997. Analysis of the 1996 comparative fishing trial between the Alfred Needler with the Engel 145 trawl and the Wilfred Templeman with the Campelen 1800 trawl. NAFO SCR Doc. 97/68.

Table 1. Catch (t) of cod in NAFO Divisions 3NO. 1953 -2002

Year	Canada	Spain	Portugal	Rus. Fed.	Others	Total	TAC
1953	39884	12633	7919		5761	66197	
1954	17392	88674	24045		4650	134761	
1955	6053	64987	27711		15605	114356	
1956	5363	42624	15505		1390	64882	
1957	9641	51990	21740		6819	90190	
1958	4812	29436	11608		2195	48051	
1959	3687	39994	17730	48	2911	64370	
1960	3408	33972	14347	24204	3746	79677	
1961	5428	32284	9059	22854	3099	72724	
1962	3235	17413	3653	7971	2712	34984	
1963	5079	37632	10004	10184	6843	69742	
1964	2882	37185	8095	9510	6789	64461	
1965	4229	64652	1692	17166	11448	99187	
1966	6501	52533	5070	39023	5792	108919	
1967	3446	77948	9703	118845	16842	226784	
1968	3287	69752	6752	78820	6900	165511	
1969	3664	71160	4940	29173	8768	117705	
1970	4771	67034	3185	28338	8233	111561	
1971	2311	89915	6589	19307	8174	126296	
1972	1736	76324	11537	12198	1579	103374	
1973	1832	42403	7759	27849	586	80429	103000
1974	1360	38338	6602	26911	178	73389	101000
1975	1189	16616	5560	20785	24	44174	88000
1976	2065	9880	2620	8992	726	24283	43000
1977	2532	8827	1742	4041	462	17604	30000
1978	6246	5813	641	1819	199	14718	15000
1979	9938	13782	1140	2446	545	27851	25000
1980	5589	8999	1145	3261	997	19991	26000
1981	6096	13299	1091	3187	671	24344	26000
1982	10185	14361	2466	3985	608	31605	17000
1983	11374	12320	1109	3238	778	28819	17000
1984	8705	13590	1071	3306	431	27103	26000
1985	18179	13682	608	3968	462	36899	33000
1986	18035	23395	6890	1181	1144	50645	33000
1987	18652	15788	4108	764	2307	41619	33000
1988	19727	15889	3927	2973	634	43150	40000
1989	13433	17904	913	108	857	33215	25000
1990	10620	4678	2145	18	11385	28846	18600
1991	12056 [2]	5448	1063	61	10824 [3]	29452 [3]	13600
1992	7859	1927	449	68	2449 [3]	12752 [3]	13600
1993	5370	3764	525	287	700 [3]	10646 [3]	10200
1994	47	1783	50		822 [3]	2702 [3]	6000 [4]
1995	64	29			79 [3]	172 [3]	0 [4]
1996	99		33		42 [3]	174 [3]	0 [4]
1997	286	1	96			383	0 [4]
1998	396		95		56	547	0 [4]
1999	568	3	322	26		919	0 [4]
2000 [1]	207	200	500	137	6	1050 [3]	0 [4]
2001 [1]	560	87	392	227	44	1310	0 [4]
2002 [1]	444	40	405	338	967 [3]	2194	0 [4]

[1] Provisional

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

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

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

Table 2. Commercial sampling by Canada used to estimate catch at age for Divisions 3NO in 2001.

Qtr.	Gear	Div.	No. Aged	Month	No. meas
2	OT	3O	309	Apr	200
				May	37
		3NO		May	68
2	OT	3N	65	May	51
		3O		June	471
3	OT	3N	159	Sep	1906
		3O	134	Sep	486
		3NO			586
4	OT	3N	334	Oct	1884
		3O	272	Oct	3703
		3NO		Oct	986
4	OT	3N		Nov	828
		3O		Nov	661
		3NO		Nov	504
	TOTAL		1273		12371

Table 2. Commercial sampling by Canada used to estimate catch at age for Divisions 3NO in 2002.

Qtr.	Gear	Div.	No. Aged	Month	No. meas
2	GN	3NO		Apr	230
		3O		Jun	140
				Mar	
1	OT	3O		Mar	202
2	OT	3N	174	Apr	5
		3O	99	Apr	276
2		3N		May	122
3	OT	3N	236	Sep	348
		3O	263		
		3NO		Sep	253
4	OT	3N	236	Oct	202
		3O	310	Oct	1386
		3NO		Dec	139
	TOTAL		1318		3303

Table 3. Total catch, average weight and length at age for the fishery in Division 3NO during 2001 and 2002.

2001	AVERAGE		Catch	2002	AVERAGE		Catch
	WEIGHT	LENGTH	NUMBER		WEIGHT	LENGTH	NUMBER
AGE	(kg.)	(cm.)	(000'S)	AGE	(kg.)	(cm.)	(000'S)
1	0.00	0.00	0	1	0.18	28.00	0
2	0.31	33.00	10	2	0.46	37.67	100
3	0.58	40.39	187	3	0.67	42.45	218
4	1.09	49.51	302	4	1.01	48.34	550
5	1.38	53.48	160	5	1.52	55.07	427
6	2.07	60.56	11	6	2.24	62.57	141
7	4.06	75.84	43	7	3.38	71.34	9
8	5.22	82.50	23	8	5.15	81.93	27
9	5.32	83.00	7	9	5.99	86.02	13
10	5.51	83.08	2	10	7.11	90.95	3
11	7.51	92.95	9	11	8.47	96.29	1
12	8.60	96.93	12	12	9.32	99.29	6
13	8.54	96.74	2	13	10.46	103.41	10
14	10.84	103.13	1	14	10.78	103.88	1
15	10.51	103.70	0	15	12.57	108.85	0
16	14.21	115.00	0	16	15.70	118.69	0
17	0.00	0.00	0	17	0.00	0.00	0
18	0.00	0.00	0	18	0.00	0.00	0
19	23.85	136.00	0	19	0.00	0.00	1
20	0.00	0.00	0	20	0.00	0.00	0

Table 4. A review of sampling used to compile catch at age for 3NO cod from 1995 to 2002.

		Catch by gear			
	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, Spainish and Portuguese catch at age. Age sampling for Canadian catch was adequate. Portugal provided catch by area and month and length sampling. Spain provided catch by division and length sampling. Portuguese catch at age was compiled using monthly sampling and keys created from Canadian Spring and Autumn RV surveys using only data from strata straddiling or outside 200mile limit. Spanish catch at age was 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	Length sampling for Canadian by-catch was from the otter trawl and gillnet fishery in 3N and 3O. No sampling was available for longline catch which comprised 8% of the Canadian catch. Age sampling for Canadian catch adequate. Portugal provided catch by area and length sampling by month and quarter. Spain provided catch by division and limited length sampling. Portuguese catch at age was compiled using annual divisional length frequencies provided and keys created by combining sampling from Canadian Spring and Autumn RV surveys (using only data from strata straddiling or outside 200mile limit) and Canadian commercial keys derived from by-catch in the Yellowtail fishery. Spanish catch at age was compiled using annual Portuguese frequencies by division provided and the Canadian keys. Russia provided length sampling and catch at age was derived using this and Canadian keys. Estonian catch at age was derived using Russian frequencies and Canadian keys. Individual countries catch at age was scaled to catch agreed at June 2003 STACFIS meeting.	389/OT 21/GN 35/LL	56/OT	1348/OT	446/OT

Table 5. Catch-at-age for Divisions 3NO cod, 1959-2000 (000s) . Age 13 is a plus group

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

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

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	505	305	1179	58	57	153	516	277	1917	1064	1103
4	1091	1978	647	1000	2953	2865	422	318	2182	4505	673
5	1262	1591	1893	1411	6203	6423	3491	1527	1502	4341	995
6	2297	1012	1204	2324	3036	4370	3445	6347	1260	895	544
7	1902	1528	686	1220	2519	1512	1213	3955	1887	422	282
8	574	1492	1152	720	797	948	653	1009	1284	721	368
9	192	595	774	918	459	558	845	567	485	581	568
10	94	211	238	551	533	373	494	425	233	439	502
11	41	162	81	106	261	349	398	249	168	150	383
12	13	27	41	42	97	135	404	142	100	83	202
13	32	52	36	70	71	86	188	298	285	106	337
3+	8003	8953	7931	8420	16986	17772	12069	15114	11303	13307	5957
6+	5145	5079	4212	5951	7773	8331	7640	12992	5702	3397	3186

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	4508	1314	232	0				94	356	187	218
4	1769	3209	2326	72				41	339	302	550
5	837	637	1117	20				101	87	160	427
6	612	479	125	40				40	62	11	141
7	235	321	93	2				14	21	43	9
8	64	74	26	0				6	12	23	27
9	99	25	8	1				23	4	7	13
10	128	39	1	0				55	13	2	3
11	153	49	0	0				3	12	9	1
12	100	53	0	0				2	2	12	6
13	217	160	0	0				3	1	2	10
3+	8722	6360	3928	135				380	909	758	1405
6+	1608	1200	253	43				144	127	108	210

Table 6. Mean weight-at-age for Divisions 3NO cod, 1959-2002.
Values for age 13 is the average of the plus group
Shaded cells are estimated values (see text).

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

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

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

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	0.33	0.36	0.27	0.42	0.42	0.42	0.42	0.50	0.60	0.58	0.67
4	0.65	0.78	0.46	0.75	0.75	0.75	0.75	0.94	0.82	1.09	1.01
5	1.06	1.35	0.91	1.21	1.21	1.21	1.21	1.59	1.45	1.38	1.52
6	1.80	1.84	1.63	2.03	2.03	2.03	2.03	2.07	2.39	2.07	2.24
7	2.82	2.82	1.84	2.29	2.29	2.29	2.29	2.23	3.44	4.06	3.38
8	4.85	4.11	4.04	2.08	2.08	2.08	2.08	2.83	2.90	5.22	5.15
9	5.56	5.87	4.94	6.60	6.6	6.6	6.6	3.99	2.64	5.32	5.99
10	7.43	7.76	7.54	6.22	6.22	6.22	6.22	6.05	3.78	5.51	7.11
11	8.64	8.79	3.44	6.41	6.41	6.41	6.41	6.73	5.25	7.51	8.47
12	10.65	8.67	7.52	8.03	8.03	8.03	8.03	7.38	6.07	8.60	9.32
13	14.11	12.74	10.00	11.32	11.32	11.32	11.32	11.70	10.19	9.84	10.64

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

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	Strata	Vessel	AN	WT 29	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
range		Area	27	AN 43	47	58-59	70	82	95-96	105-106	119-120	136-137	152-153	168-169	188-189	204-208	221-222	238-241	315-318	367-369	419-424
(fath)		Sq. mi.	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
mean survey date			2-May-84	27-Apr-85	29-Apr-86	9-May-87	1-May-88	2-May-89	12-May-90	7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96	16-May-97	22-May-98	31-May-99	30-May-00	24-May-01	23-May-02
0-30	375	1593	7018	26266	21041	13506	23154	25148	16134	1835	2331	1145	0	0	0	92	108	3225	54	592	88
	376	1499	16673	713	2954	9148	6555	1256	3791	1483	0	0	0	51	62	0	75	4	43	6	0
31-50	360	2992	21843	17007	3781	4155	3792	2145	10488	1032	1445	46	0	0	457	15	12	315	19	588	244
	361	1853	20008	52794	61130	50358	25677	19517	30149	16646	399	3455	64	47	647	378	682	3496	533	240	1856
	362	2520	75781	29914	31327	144250	19890	26588	37344	4343	668	1522	0	0	21	317	407	946	1328	1110	22
	373	2520	33487	5274	4378	14596	9738	8996	5802	856	0	0	0	0	9	168	9	50	0	8	11
	374	931	14987	1523	1338	1832	5872	937	5050	516	30	0	0	0	11	136	0	11	0	30	15
	383	674	502	0	0	1664	236	574	615	224	0	0	0	0	0	0	0	0	0	0	0
51-100	359	421	308	0	2639	779	637	213	101	66	113	433	0	0	36	199	1	114	194	54	7
	377	100	145	219	138	1720	0	46	0	0	0	9	8	0	0	0	15	0	0	0	0
	382	647	0	257	84	42	59	782	298	0	0	0	0	0	0	0	0	9	27	0	0
101-150	358	225	822	906	1724	4255	1317	1701	1089	131	2650	1699	164	135	131	104	73	1171	23	1818	327
	378	139	692	4601	1084	358	441	432	399	145	413	247	64	76	84	109	80	21	184	92	16
	381	182	765	5397	2913	247	786	216	800	399	15	0	57	44	40	2		16	0	708	0
151-200	357	164	0	6352	640	**566**	33	64	274	331	706	46	237	24	18	9	221	51	242	676	158
	379	106	382	1198	1587	9	37	98	318	852	2592	205	121	46	66	104	24	12	8	536	74
	380	116	411	2128	366	1018	656	498	704	676	181	9823	0	9	100	3457	13	18	14	71	14
total all strata fished < 200 fathoms			193825	154547	137124	247937	98880	89212	113355	29536	11544	18629	714	433	1682	5090	1720	9459	2669	6529	2832
total <200 fathoms adjusted			193824	154549	137124	248503	98880	89211	113356	29535	11543	18630	715	432	1682	5090	1720	9459	2669	6529	2832
upper limit			256272	192257	211519	326927	125247	115281	141017	49183	19173	143715	1950	761	2843	48785	2783	16197	5747	12873	6743
1 std dev			29836	18270	33801	37740	12640	12355	13694	8520	2748	9845	287	118	553	3438	497	3022	1362	1995	1522

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	WT 367-369 2001	WT 419-424 2002
mean survey date			7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96	16-May-97	22-May-98	31-May-99	30-May-00	24-May-01	23-May-02
201-300	723	155	1970	13573	43	32	0	46	77	53	0	139	3179	1658
	725	105	401	**nf**	0	95	73	34	16	49	33	361	661	148
	727	160	833	2144	1444	222	211	1394	109	55	44	383	528	446
301-400	724	124	69	112	9	34	17	0	50	61	0	0	45	62
	726	72	0	0	0	0	70	0	12	0	0	0	0	36
	728	156	0	0	0	0	43	0	0	0	0	0	0	0
401-500	752	134	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	756	106	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	760	154	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			20429	54003	30916	1504	1597	4789	8165	5545	11214	5460	13279	5845
1 STD			4280	12445	20228	555	659	1519	6107	1586	1969	1170	4191	1800

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	WT 367-369 2001	WT 419-424 2002
mean survey date			7-May-91	8-May-92	13-May-93	18-May-94	18-May-95	25-May-96	16-May-97	22-May-98	31-May-99	30-May-00	24-May-01	23-May-02
201-300	723	155	662	3415	30	26	0	35	80	77	0	270	2233	1598
	725	105	186	**nf**	0	32	8	19	9	10	13	163	443	100
	727	160	486	805	313	86	41	677	71	25	6	180	295	96
301-400	724	124	30	32	9	22	26	0	40	191	0	0	100	36
	726	72	0	0	0	0	31	0	5	0	0	0	0	12
	728	156	0	0	0	0	26	0	0	0	0	0	0	0
401-500	752	134	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	756	106	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	760	154	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			30901	15795	18982	880	566	2430	5295	2024	9479	3281	9601	4673
1 STD			8541	3853	9846	295	125	866	3439	537	3021	1379	2664	2123

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	Strata	Vessel	AN	AN	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
range		Area	27	43	47	58-60	70	82	95-96	105-106	119-120	136-137	152-154	168-169	188-189	204-208	221-222	238-241	315-318	365 +367	419-424
(fath)		Sq. mi	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	mean survey date		3-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96	16-May-97	22-May-98	19-May-99	16-May-00	7-May-01	5-May-02
31-50	330	2089	7761	7892	3707	11315	5384	1609	4990	1424	203	373	0	0	4824	509	4310	4037	8680	1519	616
	331	456	3863	1921	744	1900	1425	792	**1052**	158	32	0	0	0	348	0	8343	452	2635	3858	220
	338	1898	23356	9724	8933	20210	6623	20166	8436	24463	2285	835	132	264	2109	160	895	15015	6571	7006	3264
	340	1716	10606	9414	10282	146151	2826	1960	3628	2569	334	119	286	0	1441	529	173	1770	3682	567	189
	351	2520	78342	17578	117725	71723	13335	6112	6242	2071	1050	350	250	0	525	453	277	1631	12046	1820	545
	352	2580	41362	17656	9803	35888	56193	10474	14499	9752	3852	1331	1299	1111	1115	927	1278	14932	5481	3372	1730
	353	1282	0	2226	2773	29082	44478	4731	6499	1297	4229	223	0	285	677	0	564	507	1693	397	321
51-100	329	1721	5928	2390	2838	133032	5259	5577	13147	22309	508	1673	13959	1100	330	765	8194	8370	1278	2746	379
	332	1047	436	3432	1115	30014	2908	3112	5700	683773	29607	296105	0	2399	3184	432	720	8121	27653	816	672
	337	948	1909	5688	1369	1799	2337	10402	2133	22436	6913	231602	132	527	2502	681	1239	9389	3032	1130	478
	339	585	14625	894	135	2383	488	27	1625	1571	609	406	0	0	46	0	121	497	40	281	201
	354	474	2238	1843	2216	65669	2271	593	395	9019	1679	1415	0	0	66	0	4583	4864	587	163	33
101-150	333	151	0	42	105	566	0	378	136	692	975	514	2205	10	688	1447	194	25	92	71	20
	336	121	0	17	126	17	8	8	143	160	5537	437	605	0	8	128	25	17	0	42	92
	355	103	0	4070	29	207	43	987	193	2339	944	236	50	7	2573	6	50	44	39	234	31
151-200	334	92	0	236	1323	26	121	141	543	1214	971	1137	533	200	184	94	26	28	70	54	1017
	335	58	0	0	68	8	12	16	97	27	1275	342	157	52	490	211	36	37	13	278	357
	356	61	0	0	13	4	51	131	110	546	2665	424	491	13	93	70	82	67	96	62	149
total strata fished < 200 fathoms			190427	85023	163306	549997	143763	67215	68515	785821	63667	537522	20100	5967	21202	6412	31110	69803	73688	24416	10314
total <200 fathoms adjusted			190426	85023	163304	549994	143762	67216	69568	785820	63668	537522	20099	5968	21203	6412	31110	69803	73688	24416	10314
1 std dev			23492	12072	92856	118784	39030	10972	10310	669240	22549	271901	13845	1800	4574	1513	12293	14900	14847	3171	1795

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		Vessel	AN	AN	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
range		Area	27	43	47	58-60	70	82	95-96	105-106	119-120	136-137	152-154	168-169	188-189	204-208	221-222	238-241	315-318	365 +367	419-424
(fath)	Strata	Sq. mi	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	mean survey date		3-May-84	15-Apr-85	22-Apr-86	27-Apr-87	24-Apr-88	23-Apr-89	27-Apr-90	24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96	16-May-97	22-May-98	19-May-99	16-May-00	7-May-01	5-May-02
31-50	330	2089	7964	9372	4167	12075	4486	3318	5091	266	32	92	0	0	7103	357	12526	8593	8401	2296	190
	331	456	4536	4891	1295	1982	2176	481	**2191**	236	224	0	0	0	983	0	34685	1105	6842	1738	1251
	338	1898	43090	13670	23245	20013	14538	25430	9315	10283	11883	4981	1841	3439	1535	196	5069	9416	6982	13092	2456
	340	1716	13654	10780	12024	161120	16447	5478	10296	384	52	1936	160	0	239	186	512	3857	2164	1469	33
	351	2520	68620	34516	90852	114632	25324	19777	22343	6595	2063	1198	131	0	104	286	1888	5269	47572	4266	38
	352	2580	51655	41868	24245	76430	82226	43865	38424	22512	16671	8225	1584	3784	1528	2869	5341	14309	8226	11344	6932
	353	1282	0	9451	1831	15552	4512	4012	5892	1267	1780	3260	0	609	118	0	18	1719	7130	529	4394
51-100	329	1721	1776	1931	1114	116331	16127	1690	4684	4195	97	219	10523	2187	191	614	13037	9671	628	896	63
	332	1047	4410	17134	4092	12848	11718	2156	11266	39264	3927	108245	0	1702	1534	1558	2136	1350	4360	272	42
	337	948	741	2976	11644	4299	1005	5735	3354	5566	20721	79783	813	1659	3299	527	1720	3095	1040	553	160
	339	585	3355	730	73	943	496	219	385	92	87	43	0	0	5	0	441	1210	1	733	48
	354	474	955	660	569	6915	1211	87	562	3325	191	1319	0	0	85	0	2258	1088	218	737	218
101-150	333	151	0	330	411	1837	0	1486	381	877	273	1661	8549	26	1625	974	255	26	77	43	31
	336	121	0	81	120	35	39	44	318	111	1733	375	661	0	19	322	16	18	0	46	95
	355	103	0	724	29	259	38	538	198	329	63	169	32	31	2344	15	74	26	13	169	27
151-200	334	92	0	898	4773	120	473	294	826	1385	1018	1408	959	333	259	305	46	72	98	33	1241
	335	58	0	0	159	38	82	16	110	10	276	2522	453	342	680	734	75	207	37	254	437
	356	61	0	0	42	15	178	154	219	88	308	387	257	16	46	47	102	108	442	69	142
total strata fished < 200 fathoms			200758	150013	180686	545446	181076	114780	113664	96783	61399	215824	25964	14127	21696	8990	80199	61139	94231	38539	17798
total <200 fathoms adjusted			200756	150012	180685	545444	181076	114780	115855	96785	61399	215823	25963	14128	21697	8990	80199	61139	94231	38539	17798
1 std dev			26557	18667	57045	107416	34873	32407	14933	35395	21352	92888	11823	3094	4742	3056	36701	11992	47545	6458	4458

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	WT 365 +367 2001	WT 419-424 2002
mean survey date			24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96	16-May-97	22-May-98	19-May-99	16-May-00	7-May-01	5-May-02
201-300	717		3701	336	1615	1441	242	27	176	20	37	122	838	183
	719		274	749	301	443	164	21	39	5	107	18	134	0
	721		190	72390	348	11	5	84	103	5	5	7	67	9
301-400	718		15	0	100	503	102	0	7	0	0	0	0	18
	720		0	569	15	211	29	6	103	12	7	0	7	17
	722		0	149	0	0	0	11	6	0	0	0	17	0
401-500	764		**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	772		**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			790001	137860	539900	22708	6510	21352	6844	31153	69960	73837	25478	10540
1 STD			669243	75102	271903	13895	1823	4574	1519	12292	14900	14847	3261	1799

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	WT 365 +367 2001	WT 419-424 2002
mean survey date			24-Apr-91	26-Apr-92	30-Apr-93	4-May-94	7-May-95	11-May-96	16-May-97	22-May-98	19-May-99	16-May-00	7-May-01	5-May-02
201-300	717	717	15218	436	1870	2094	339	57	238	30	47	108	585	164
	719	719	143	179	330	727	927	37	133	2	243	59	137	0
	721	721	88	12153	304	16	10	95	53	16	11	20	323	22
301-400	718	718	7	0	159	791	91	0	16	0	0	0	0	18
	720	720	0	139	9	222	34	3	164	11	20	0	41	25
	722	722	0	70	0	0	0	28	5	0	0	0	52	0
401-500	764	764	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
	772	772	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**
total all strata fished			112240	74377	218496	29814	15528	21915	9598	80256	61459	94418	39677	18027
1 STD			36959	24453	92889	11890	3223	4742	3065	36701	11996	47546	6475	4459

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 6-Dec-90	WT 113-115 1991 3-Nov-91	WT 128-130 1992 29-Oct-92	WT 144-146 1993 7-Nov-93	WT 160-161 1994 2-Nov-94	WT 176-177 1995 13-Oct-95	Tel 42 AN253 WT 200 1996 1-Dec-96	WT 212-214 1997 16-Oct-97	Tel 76 WT 229-233 1998 20-Nov-98	WT 244-247 1999 13-Nov-99	Tel 338-339 WT 319-323 2000 12-Nov-00	Tel 357 WT 372-373 2001 18-Oct-01	Tel 411-412 WT 427-428 2002 20-Oct-02
0-30	375	1593	5421	66596	**nf**	2047	1947	5001	0	603	329	14518	8163	4492	2849
	376	1499	32419	455280	354763	260	312	3956	93	41	1598	361	819	876	317
31-50	360	2992	28703	12311	8311	3463	0	437		137	309	2367	1132	2345	360
	361	1853	6273	14155	20718	6177	7549	3788	2025	2156	5761	1733	3161	6780	1173
	362	2520	12855	73045	49583	1300	622	910	104	898	792	7924	6478	6438	314
	373	2520	1336	22575	1400	750	0	70	130	50	149	3004	341	446	149
	374	931	879	20754	**nf**	819	1034	57	65	43	171	512	85	1836	256
	383	674	530	530	**nf**	0	0	47	0	0	46	0	0	0	0
51-100	359	421	702	0	497	88	0	29	52	29	0	0	550	290	463
	377	100	243	**nf**	493	0	7	7	12	0	0	21	21	481	51
	382	647	210	359	270	494	0	0	33	0	0	134	134	0	45
101-15	358	225	766	1500	5063	47	94	56	14	15	247	340	1156	342	437
	378	139	550	2046	1602	48	10	10	0	17	10	1472	1785	226	476
	381	182	**nf**	0	**nf**	202	0	0	233	8	13	138	338	1702	13
151-20	357	164	683	399	194	1526	57	20	39	0	124		168	61	10
	379	106	213	**nf**	596	655	81	33	52	79	13	988	164	663	47
	380	116	**nf**	798	**nf**	48	16	57	24	16	0	383	563	14	465
total strata fished <= 200			91783	670348	443490	17924	11729	14478	3359	4092	9562	33895	25058	26992	7422
UPPER			156111	1657056	1675218	26592	20479	21567	6774	5741	14597	59471	41671	37378	16677
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
1 std			29227	355442	286249	4041	3576	3221	1328	757	2228	9200	7551	4853	2910
201-30	723	155	**nf**	0	**nf**	97	0	0	43	6	0	0	0	0	0
	725	105	**nf**	**nf**	0	80	0	12	22	0	7	7	0	7	14
	727	160	**nf**	**nf**	**nf**	878	11	9	267	0	0	22	49	0	11
301-40	724	124	**nf**	0	**nf**	17	0	0	19	0	0	0	0	0	0
	726	72	**nf**	**nf**	**nf**	0	0	0	10	0	0	0	0	0	0
	728	156	**nf**	**nf**	**nf**	**nf**	0	0	76	0	0	0	0	0	0
Total strata > 200 fathoms			0	0	0	1072	11	21	437	6	7	29	49	7	25
Total all strata fished			91783	670348	443490	18996	11741	14498	3795	4098	9568	33924	25115	26972	7447
1 std			29227	355442	286251	4137	3575	3221	1375	757	2228	9200	7548	4866	2910

Biomass

Depth Range	Strata	Area	WT 101-102 1990 6-Dec-90	WT 113-115 1991 3-Nov-91	WT 128-130 1992 29-Oct-92	WT 144-146 1993 7-Nov-93	WT 160-161 1994 2-Nov-94	WT 176-177 1995 13-Oct-95	Tel 42 AN253 WT 200 1996 1-Dec-96	WT 212-214 1997 16-Oct-97	Tel 76 WT 229-233 1998 20-Nov-98	WT 244-247 1999 13-Nov-99	Tel 338-339 WT 319-323 2000 12-Nov-00	Tel 357 WT 372-373 2001 18-Oct-01	Tel 411-412 WT 427-428 2002 20-Oct-02
0-30	375	1593	31395	69276	**nf**	3305	9447	3162	0	594	839	2022	8642	1490	2135
	376	1499	5147	80732	116390	152	993	4035	806	12	791	46	2677	2351	813
31-50	360	2992	7585	4456	4572	8072	0	1329	319	1226	1258	8681	1536	3183	217
	361	1853	24777	16326	12485	12996	12111	8626	1734	3255	3811	1060	1986	3319	4519
	362	2520	9636	40955	22852	1576	1001	337	29	2581	713	4955	2840	4146	1597
	373	2520	9722	26255	4114	254	0	39	49	26	60	1948	125	324	154
	374	931	2501	9699	**nf**	1102	2414	15	27	45	196	111	20	1042	172
	383	674	216	164	**nf**	0	0	54	0	0	0	0	0	0	0
51-100	359	421	39	0	156	39	0	12	36	25	0	0	458	249	601
	377	100	122	**nf**	257	0	13	11	11	0	0	6	3	660	68
	382	647	129	73	115	168	0	0	93	0	0	93	116	0	12
101-15	358	225	404	430	2464	45	51	61	10	80	327	197	933	470	467
	378	139	362	635	461	12	11	8	0	21	9	729	1156	174	276
	381	182	**nf**	0	**nf**	119	0	0	118	5	8	39	86	1583	9
151-20	357	164	370	205	120	629	42	46	19	0	245		311	172	9
	379	106	318	**nf**	317	240	96	20	27	108	8	644	129	675	79
	380	116	**nf**	117	**nf**	32	10	26	12	10	0	223	178	3	879
total strata <= 200 fathoms			92723	249323	164303	28741	26189	17781	3290	7988	8265	20754	21196	19841	12007
UPPER			151903	392215	555906	46078	45182	26812	6083	11520	16104	33819	32744	28793	19789
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
1 std			25023	64135	91007	7956	7249	4298	1185	1681	3200	5781	5346	4203	3490
201-30	723	155	**nf**	0	**nf**	63	0	0	24	18	0	0	0	0	0
	725	105	**nf**	**nf**	0	90	0	10	13	0	18	10	0	6	6
	727	160	**nf**	**nf**	**nf**	484	12	3	97	0	0	39	34	0	11
301-40	724	124	**nf**	0	**nf**	12	0	0	40	0	0	0	0	0	0
	726	72	**nf**	**nf**	**nf**	0	0	0	15	0	0	0	0	0	0
	728	156	**nf**	**nf**	**nf**	**nf**	0	0	34	0	0	0	0	0	0
Total strata > 200 fathoms			0	0	0	649	12	13	223	18	18	49	34	6	17
Total all strata fished			92723	249323	16303	29389	26200	17793	3510	8006	8283	20823	21230	19847	12024
1 std			25023	64135	125400	7972	8397	4299	1186	1681	3200	5773	5347	4203	3490

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
mean survey date			1990 26-Nov-90	1991 24-Oct-91	1992 23-Oct-92	1993 27-Oct-93	1994 31-Oct-94	1995 10-Oct-95	1996 10-Dec-96	1997 16-Oct-97	1998 20-Nov-98	1999 22-Oct-99	2000 18-Oct-00	2001 6-Oct-00	2002 10-Oct-02
31-50	330	2089	10709	10264	7036	5271	2072	3946	279	1006	3113	6178	4428	9339	4133
	331	456	507	6682	222	222	95	760	32	31	408	721	1505	265	376
	338	1898	20199	10334	857	6221	330	2478	264	52	835	4804	3580	209	835
	340	1716	4158	5625	7746	1859	763	1668	95	519	1747	5665	6945	2172	2408
	351	2520	29085	24185	3558	10450	661	2709	198	1684	347	9244	11737	9013	2091
	352	2580	10248	24761	2747	4710	717	972	287	1006	761	2789	9419	6405	2980
	353	1282	1781	223	0	0	0	415	0	0	0	661	0	0	0
51-100	329	1721	531	1605	558	239	1036	574	478	95	710	521	255	710	326
	332	1047	1721	1127	436	2036	242	0	0	48	288	576	624	96	331
	337	948	1001	66	198	307	0	0	0	0	0	130	82	130	0
	339	585	163	0	41	528	41	41	0	80	126		40	80	322
	354	474	1580	0	1712	0	0	165	340	130	33	554	33	0	6181
101-150	333	151	21	0	10	0	0	0	**nf**	0	0	0	10	0	0
	336	121	6	0	0	67	0	0	8	0	0	0	42	0	0
	355	103	**nf**	887	64	172	0	13	342	0	0	28	14	0	0
151-200	334	92	13	0	0	9	0	0	**nf**	0	0	0	0	0	0
	335	58	12	4	0	0	0	0	133	12	4	0	4	0	0
	356	61	**nf**	4	0	102	0	0	40	0	17	7	25	4	4
Total strata fished <= 200 fathoms			81735	85767	25185	32193	5957	13741	2496	4663	8388	31880	38743	28424	19988
upper			117569	117451	40427	48506	11071	18760	3870	6604	11951	43691	51707	35723	99783
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
1 std			17121	15463	6229	7605	2162	2367	562	916	1598	5651	6086	3443	6278
201-300	717	93	0	**nf**	**nf**	0	0	0	**nf**	0	0	10	0	0	0
	719	76	0	0	**nf**	0	5	0	37	0	0	0	3	0	0
	721	76	**nf**	0	**nf**	0	0	0	0	0	5	0	0	0	0
301-400	718	111	**nf**	**nf**	**nf**	0	0	0	**nf**	0	0	0	0	0	0
	720	105	**nf**	**nf**	**nf**	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
total strata fished > 200 fathoms			0	0	0	0	5	0	37	0	5	10	3	0	0
total all strata fished			81735	85767	25185	32193	5961	13740	2534	4663	8394	31891	38746	28424	19988
1 STD			17574	15471	6229	7605	2163	2368	561	916	1598	5653	6086	3443	6278

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
mean survey date			1990 26-Nov-90	1991 24-Oct-91	1992 23-Oct-92	1993 27-Oct-93	1994 31-Oct-94	1995 10-Oct-95	1996 10-Dec-96	1997 16-Oct-97	1998 20-Nov-98	1999 22-Oct-99	2000 18-Oct-00	2001 6-Oct-00	2002 10-Oct-02
31-50	330	2089	6651	2374	2574	4278	1928	6035	302	1779	2027	2379	1817	5922	4037
	331	456	27	1047	191	267	172	1455	11	85	735	367	574	155	481
	338	1898	13966	7122	2760	3763	91	5283	26	167	1786	16088	5978	558	493
	340	1716	3635	6247	6711	1231	832	3149	37	951	2108	2902	5371	1785	2542
	351	2520	17027	21473	3142	9895	679	5052	74	4806	815	7355	5249	8149	2296
	352	2580	21151	32262	3137	4920	4775	3195	1353	3220	1198	9096	14518	7207	4081
	353	1282	4593	56	0	0	0	2238	0	0	0	716	0	0	0
51-100	329	1721	1291	1019	109	245	1546	1052	370	159	820	684	86	810	1407
	332	1047	767	74	254	1323	452	0	0	0.48	1	18	33	41	960
	337	948	2331	70	373	176	0	0	0	0	0	21	12	91	0
	339	585	1242	0	64	447	56	46	0	276	606		161	50	447
	354	474	66	0	896	0	0	161	260	96	42	184	18	0	8920
101-150	333	151	12	0	12	0	0	0	**nf**	0	0	0	4	0	0
	336	121	29	0	0	107	0	0	11	0	0	0	49	0	0
	355	103	**nf**	155	31	104	0	15	235	0	0	25	11	0	0
151-200	334	92	16	0	0	21	0	0	**nf**	0	0	0	0	0	0
	335	58	13	8	0	0	0	0	303	16	8	0	1	0	0
	356	61	**nf**	8	0	68	0	0	39	0	30	13	28	2	11
Total strata fished <= 200 fathoms			72817	71915	20254	26845	10531	27681	3021	11555.48	10177	39849	33912	24769	25674
1 std			11789	12726	4404	7412	3158	6346	1387	2467	1753	15974	6737	4051	8993
201-300	717	93	0	**nf**	**nf**	0	0	0	**nf**	0	0	1	0	0	0
	719	76	0	0	**nf**	0	14	0	55	0	0	0	5	0	0
	721	76	**nf**	0	**nf**	0	0	0	0	0	9	0	0	0	0
301-400	718	111	**nf**	**nf**	**nf**	0	0	0	**nf**	0	0	0	0	0	0
	720	105	**nf**	**nf**	**nf**	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
total strata fished > 200 fathoms			0	0	0	0	14	0	55	0	9	1	5	0	0
total all strata fished			72817	7195	20254	26845	10546	27681	3078	11555	10186	39850	33917	24769	25675
1 STD			11789	43649	4404	7412	3158	6346	1386	2467	1753	15974	6737	4051	8986

Table 17. Mean number per tow of cod (in index strata) from spring RV surveys in NAFO Divisions 3NO as calculated using the conversion from Warren 1997 for surveys in 1984-1995. 1996 -2000 are actual Campelen surveys.

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.16	0.37	0.38	5.00	0.18	0.38	0.90	0.57	0.00	0.00	0.00	0.00	0.10	0.06	1.71	4.69	2.15	0.15	0.23
2	53.39	9.88	12.77	54.15	26.45	4.77	7.25	147.62	10.07	1.17	0.22	0.76	1.35	0.24	0.16	4.71	6.46	1.88	0.66
3	41.57	29.27	3.63	14.13	12.91	10.39	6.77	15.44	9.66	58.27	0.91	0.20	1.65	1.67	0.51	4.55	4.58	2.91	0.98
4	21.35	16.14	17.87	19.67	1.02	2.40	3.80	1.59	0.24	53.63	1.63	0.04	0.44	0.58	1.23	0.38	0.69	1.01	0.40
5	7.17	2.76	11.53	50.35	0.47	0.34	1.46	0.47	0.11	1.25	1.05	0.15	0.24	0.16	0.52	0.70	0.10	0.26	0.23
6	5.04	0.90	2.11	26.41	1.10	0.31	0.25	0.16	0.09	0.68	0.07	0.10	0.57	0.03	0.17	0.30	0.20	0.01	0.10
7	1.51	1.03	0.82	7.38	1.13	0.61	0.41	0.07	0.03	0.46	0.12	0.01	0.56	0.09	0.13	0.11	0.29	0.06	0.01
8	0.72	0.66	0.58	1.71	0.66	0.52	0.52	0.06	0.03	0.22	0.07	0.02	0.05	0.07	1.35	0.12	0.07	0.07	0.06
9	1.36	0.84	0.42	1.63	0.67	0.36	0.61	0.14	0.08	0.05	0.07	0.05	0.04	0.01	1.61	0.42	0.06	0.01	0.01
10	1.15	1.18	0.61	0.54	0.75	0.40	0.46	0.12	0.11	0.08	0.02	0.01	0.03	0.02	0.15	0.84	0.57	0.01	0.02
11	0.61	0.88	1.02	0.70	0.35	0.51	0.34	0.11	0.13	0.17	0.04	0.01	0.02	0.03	0.03	0.07	1.10	0.16	0.01
12	0.25	0.48	0.51	0.60	0.44	0.33	0.34	0.09	0.14	0.12	0.05	0.02	0.00	0.02	0.01	0.03	0.13	0.40	0.03
13	0.10	0.23	0.31	0.68	0.69	0.27	0.16	0.12	0.12	0.07	0.07	0.05	0.00	0.01	0.03	0.03	0.02	0.04	0.16
14	0.03	0.14	0.15	0.23	0.55	0.39	0.37	0.13	0.10	0.07	0.02	0.02	0.03	0.00	0.00	0.02	0.00	0.02	0.00
15	0.05	0.08	0.08	0.21	0.21	0.21	0.44	0.12	0.09	0.09	0.03	0.03	0.02	0.01	0.02	0.01	0.01	0.00	0.01
16	0.08	0.08	0.04	0.12	0.11	0.11	0.22	0.18	0.09	0.05	0.01	0.02	0.00	0.00	0.01	0.00	0.02	0.01	0.00
17	0.05	0.03	0.04	0.00	0.11	0.09	0.14	0.07	0.06	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00
18	0.01	0.01	0.03	0.01	0.04	0.04	0.06	0.04	0.01	0.01	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00
1+	134.60	64.98	52.93	183.54	47.87	22.46	24.55	167.10	21.17	116.42	4.42	1.49	5.11	3.01	7.64	17.00	16.45	7.00	2.91

Table 18. Mean number per tow of cod (in index strata) from autumn RV surveys in NAFO Divisions 3NO as calculated using the conversion from Warren 1997 for surveys in 1984-1994. 1995-2000 are actual Campelen surveys.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.07	0.06	0.13
1	18.89	14.87	0.41	1.30	0.00	1.15	0.08	0.03	1.67	4.46	2.12	0.34	0.33
2	6.15	129.66	49.65	0.72	0.62	1.02	0.74	0.10	0.29	5.03	3.77	2.64	0.61
3	3.25	4.36	65.00	3.63	0.28	0.46	0.29	0.40	0.20	2.53	4.75	4.70	1.13
4	3.56	2.19	4.70	3.59	0.96	0.20	0.06	0.33	0.32	0.13	1.81	2.55	1.58
5	1.73	2.73	1.02	0.30	1.32	0.94	0.01	0.14	0.11	0.37	0.20	0.98	1.31
6	0.37	1.33	0.61	0.27	0.16	1.64	0.02	0.06	0.06	0.30	0.24	0.07	0.39
7	0.29	0.37	0.18	0.18	0.04	0.11	0.02	0.28	0.01	0.08	0.11	0.16	0.03
8	0.38	0.31	0.03	0.10	0.06	0.05	0.01	0.28	0.16	0.04	0.03	0.06	0.06
9	0.40	0.53	0.03	0.02	0.01	0.06	0.00	0.05	0.22	0.12	0.01	0.02	0.04
10	0.24	0.37	0.07	0.02	0.01	0.05	0.00	0.04	0.03	0.55	0.03	0.02	0.00
11	0.20	0.45	0.00	0.06	0.03	0.00	0.00	0.00	0.01	0.04	0.24	0.00	0.03
12	0.09	0.33	0.06	0.04	0.03	0.02	0.00	0.00	0.00	0.00	0.01	0.05	0.03
13	0.15	0.27	0.12	0.04	0.02	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.05
14	0.07	0.21	0.03	0.05	0.06	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.01
15	0.16	0.12	0.03	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.21	0.38	0.02	0.02	0.03	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.01
17	0.07	0.16	0.03	0.01	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
18	0.02	0.06	0.08	0.02	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
19	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01		0.01	0.00	0.00	0.00
1+	36.26	158.70	122.07	10.43	3.67	5.72	1.26	1.74	3.09	13.72	13.33	11.60	5.61

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

Age	1989	1990	1991	1992	1993	1994
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	0.2	0.21	0.23	0	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 2002 projected forward to 2010. Estimates were obtained from a probit model fitted by cohort to observed proportions mature at age. When the model did not fit the data for a particular cohort (I.e 1991 cohort) the average of estimates for the same age group from adjacent years was used; yellow cells are averages extrapolated forward or backward from the same age group from 3 previous (or next) years.

	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14
1953	0.0001	0.0004	0.0020	0.0112	0.0593	0.2425	0.5895	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1954	0.0000	0.0004	0.0020	0.0112	0.0593	0.2425	0.5895	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1955	0.0001	0.0000	0.0020	0.0112	0.0593	0.2425	0.5895	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1956	0.0001	0.0003	0.0001	0.0112	0.0593	0.2425	0.5895	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1957	0.0003	0.0007	0.0018	0.0008	0.0593	0.2425	0.5895	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1958	0.0001	0.0016	0.0041	0.0102	0.0065	0.2425	0.5895	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1959	0.0000	0.0006	0.0079	0.0226	0.0554	0.0509	0.5895	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1960	0.0000	0.0000	0.0032	0.0393	0.1158	0.2510	0.3043	0.8855	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1961	0.0002	0.0001	0.0001	0.0168	0.1731	0.4255	0.6569	0.7809	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1962	0.0000	0.0012	0.0009	0.0012	0.0823	0.5172	0.8072	0.9163	0.9667	0.9972	0.9996	0.9999	1.0000	1.0000
1963	0.0000	0.0002	0.0057	0.0099	0.0229	0.3201	0.8458	0.9595	0.9843	0.9958	0.9996	0.9999	1.0000	1.0000
1964	0.0000	0.0000	0.0010	0.0266	0.1001	0.3212	0.7118	0.9656	0.9926	0.9972	0.9995	0.9999	1.0000	1.0000
1965	0.0014	0.0000	0.0000	0.0049	0.1163	0.5527	0.9054	0.9284	0.9931	0.9987	0.9995	0.9999	1.0000	1.0000
1966	0.0000	0.0043	0.0005	0.0006	0.0234	0.3878	0.9321	0.9949	0.9855	0.9986	0.9998	0.9999	1.0000	1.0000
1967	0.0000	0.0001	0.0132	0.0067	0.0097	0.1038	0.7530	0.9935	0.9997	0.9972	0.9997	1.0000	1.0000	1.0000
1968	0.0000	0.0000	0.0012	0.0398	0.0818	0.1449	0.3591	0.9362	0.9994	1.0000	0.9995	0.9999	1.0000	1.0000
1969	0.0000	0.0000	0.0003	0.0090	0.1143	0.5425	0.7455	0.7304	0.9860	0.9999	1.0000	0.9999	1.0000	1.0000
1970	0.0032	0.0000	0.0001	0.0029	0.0664	0.2864	0.9404	0.9806	0.9291	0.9971	1.0000	1.0000	1.0000	1.0000
1971	0.0000	0.0093	0.0000	0.0009	0.0275	0.3578	0.5553	0.9953	0.9989	0.9845	0.9994	1.0000	1.0000	1.0000
1972	0.0000	0.0002	0.0269	0.0000	0.0101	0.2177	0.8137	0.7952	0.9996	0.9999	0.9967	0.9999	1.0000	1.0000
1973	0.0001	0.0000	0.0013	0.0754	0.0039	0.1018	0.7323	0.9716	0.9236	1.0000	1.0000	0.9993	1.0000	1.0000
1974	0.0000	0.0006	0.0001	0.0083	0.1938	0.2933	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	0.0531	0.4146	0.9781	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	0.2720	0.6761	0.9998	0.9937	0.9996	0.9999	0.9973	1.0000	1.0000
1977	0.0006	0.0001	0.0009	0.0142	0.0977	0.2269	0.7134	0.8602	1.0000	0.9994	1.0000	1.0000	0.9991	1.0000
1978	0.0001	0.0029	0.0014	0.0082	0.0935	0.3820	0.7922	0.9431	0.9477	1.0000	0.9999	1.0000	1.0000	0.9997
1979	0.0000	0.0005	0.0145	0.0132	0.0732	0.4250	0.7791	0.9802	0.9910	0.9816	1.0000	1.0000	1.0000	1.0000
1980	0.0002	0.0002	0.0034	0.0695	0.1138	0.4286	0.8412	0.9527	0.9984	0.9986	0.9937	1.0000	1.0000	1.0000
1981	0.0000	0.0007	0.0020	0.0236	0.2748	0.5513	0.8770	0.9743	0.9914	0.9999	0.9998	0.9978	1.0000	1.0000
1982	0.0000	0.0000	0.0035	0.0162	0.1461	0.6579	0.9216	0.9855	0.9963	0.9985	1.0000	1.0000	0.9993	1.0000
1983	0.0000	0.0001	0.0003	0.0162	0.1217	0.5476	0.9070	0.9912	0.9984	0.9995	0.9997	1.0000	1.0000	0.9998
1984	0.0000	0.0003	0.0008	0.0028	0.0725	0.5383	0.8954	0.9802	0.9991	0.9998	0.9999	1.0000	1.0000	1.0000
1985	0.0002	0.0002	0.0019	0.0059	0.0261	0.2701	0.9076	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	0.2053	0.6366	0.9880	0.9977	0.9992	1.0000	1.0000	1.0000	1.0000
1987	0.0001	0.0000	0.0058	0.0194	0.0867	0.2359	0.7134	0.8924	0.9986	0.9997	0.9998	1.0000	1.0000	1.0000
1988	0.0011	0.0006	0.0002	0.0335	0.1571	0.3988	0.6910	0.9600	0.9752	0.9998	1.0000	1.0000	1.0000	1.0000
1989	0.0001	0.0043	0.0047	0.0031	0.1702	0.6374	0.8224	0.9419	0.9957	0.9946	1.0000	1.0000	1.0000	1.0000
1990	0.0000	0.0011	0.0170	0.0377	0.0442	0.5485	0.9431	0.9700	0.9916	0.9996	0.9989	1.0000	1.0000	1.0000
1991	0.0000	0.0000	0.0079	0.0645	0.2439	0.4053	0.8780	0.9936	0.9956	0.9988	1.0000	0.9998	1.0000	1.0000
1992	0.0000	0.0000	0.0004	0.0556	0.2154	0.7266	0.9095	0.9771	0.9993	0.9994	0.9998	1.0000	0.9999	1.0000
1993	0.0001	0.0004	0.0002	0.0121	0.3041	0.5222	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	0.2820	0.7642	0.8131	0.9945	0.9995	0.9993	1.0000	1.0000	1.0000	1.0000
1995	0.0002	0.0030	0.0078	0.0417	0.5848	0.9263	0.9601	0.9454	0.9993	1.0000	0.9999	1.0000	1.0000	1.0000
1996	0.0004	0.0014	0.0230	0.0682	0.4950	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	0.1537	0.4053	0.9281	0.9999	0.9999	0.9992	0.9964	1.0000	1.0000	1.0000	1.0000
1998	0.0000	0.0000	0.0171	0.1076	0.5841	0.8639	0.9916	1.0000	1.0000	0.9999	0.9991	1.0000	1.0000	1.0000
1999	0.0001	0.0000	0.0001	0.1035	0.5236	0.9157	0.9834	0.9991	1.0000	1.0000	1.0000	0.9998	1.0000	1.0000
2000	0.0001	0.0009	0.0011	0.0036	0.4343	0.9093	0.9882	0.9982	0.9999	1.0000	1.0000	1.0000	0.9999	1.0000
2001	0.0001	0.0009	0.0061	0.0274	0.1402	0.8362	0.9892	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2002	0.0001	0.0009	0.0061	0.0449	0.4310	0.8800	0.9714	0.9988	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2003	0.0001	0.0009	0.0061	0.0449	0.3352	0.9531	0.9970	0.9956	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
2004	0.0001	0.0009	0.0061	0.0449	0.3352	0.8898	0.9982	0.9999	0.9993	1.0000	1.0000	1.0000	1.0000	1.0000
2005	0.0001	0.0009	0.0061	0.0449	0.3352	0.8898	0.9888	0.9999	1.0000	0.9999	1.0000	1.0000	1.0000	1.0000
2006	0.0001	0.0009	0.0061	0.0449	0.3352	0.8898	0.9888	0.9985	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2007	0.0001	0.0009	0.0061	0.0449	0.3352	0.8898	0.9888	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2008	0.0001	0.0009	0.0061	0.0449	0.3352	0.8898	0.9888	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2009	0.0001	0.0009	0.0061	0.0449	0.3352	0.8898	0.9888	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2010	0.0001	0.0009	0.0061	0.0449	0.3352	0.8898	0.9888	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000

Table 21. Catch-at-age used in this assessment for Divisions 3NO cod, 1959-2000 (000s) .

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

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

ORTHOGONALITY OFFSET.....0.000433
MEAN SQUARE RESIDUALS.....0.762523

Survivors Year	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
1994	12	85.1	73.1	0.9	17.0	0.2
1995	12	52.2	27.5	0.5	5.8	0.1
1996	12	31.3	12.4	0.4	2.3	0.1
1997	12	66.8	24.0	0.4	4.2	0.1
1998	12	93.1	35.0	0.4	6.3	0.1
1999	12	46.8	18.4	0.4	3.3	0.1
2000	12	51.0	17.5	0.3	2.8	0.1
2001	12	447.0	141.0	0.3	21.3	0.0
2002	12	213.0	66.2	0.3	10.0	0.0
2003	3	447.0	304.0	0.7	104.0	0.2
2003	4	851.0	442.0	0.5	113.0	0.1
2003	5	1200.0	592.0	0.5	132.0	0.1
2003	6	1020.0	471.0	0.5	96.0	0.1
2003	7	288.0	143.0	0.5	29.3	0.1
2003	8	41.2	18.3	0.4	3.6	0.1
2003	9	163.0	60.7	0.4	10.3	0.1
2003	10	114.0	37.4	0.3	5.9	0.1
2003	11	47.2	15.0	0.3	2.2	0.0
2003	12	30.1	9.4	0.3	1.4	0.0

Catchabilities	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
RV Spr	2	0.0012	0.0003	0.2100	0.0000	0.0120
RV Spr	3	0.0015	0.0003	0.2080	0.0000	0.0130
RV Spr	4	0.0007	0.0001	0.2080	0.0000	0.0140
RV Spr	5	0.0004	0.0001	0.2100	0.0000	0.0150
RV Spr	6	0.0003	0.0001	0.2130	0.0000	0.0160
RV Spr	7	0.0003	0.0001	0.2160	0.0000	0.0170
RV Spr	8	0.0003	0.0001	0.2190	0.0000	0.0190
RV Spr	9	0.0004	0.0001	0.2230	0.0000	0.0210
RV Spr	10	0.0005	0.0001	0.2290	0.0000	0.0260
RV_Fall	2	0.0013	0.0003	0.2600	0.0000	0.0210
RV_Fall	3	0.0012	0.0003	0.2560	0.0000	0.0220
RV_Fall	4	0.0010	0.0003	0.2590	0.0000	0.0240
RV_Fall	5	0.0008	0.0002	0.2630	0.0000	0.0260
RV_Fall	6	0.0007	0.0002	0.2680	0.0000	0.0290
RV_Fall	7	0.0004	0.0001	0.2740	0.0000	0.0310
RV_Fall	8	0.0004	0.0001	0.2790	0.0000	0.0330
RV_Fall	9	0.0003	0.0001	0.2940	0.0000	0.0400
RV_Fall	10	0.0004	0.0001	0.3160	0.0000	0.0550
RV_Juvenile	2	0.0037	0.0013	0.3600	0.0002	0.0580
RV_Juvenile	3	0.0019	0.0007	0.3590	0.0001	0.0580
RV_Juvenile	4	0.0014	0.0005	0.3600	0.0001	0.0580
RV_Juvenile	5	0.0011	0.0004	0.3610	0.0001	0.0570
RV_Juvenile	6	0.0008	0.0003	0.3640	0.0000	0.0560
RV_Juvenile	7	0.0006	0.0002	0.3710	0.0000	0.0570
RV_Juvenile	8	0.0005	0.0002	0.3760	0.0000	0.0600
RV_Juvenile	9	0.0003	0.0001	0.3840	0.0000	0.0670
RV_Juvenile	10	0.0003	0.0001	0.3970	0.0000	0.0830

Table 23. Estimated bias adjusted population numbers from ADAPT for cod in NAFO Division 3NO.

Pop #s Bia	2	3	4	5	6	7	8	9	10	11	12	2+
1959	63623	53067	92911	19327	16484	12049	4268	3076	3217	2287	324	270,633
1960	98989	52090	41903	64326	11271	8099	6336	2246	1838	1803	786	289,687
1961	130098	81045	40981	28451	32902	6449	4497	2947	1315	1157	675	330,518
1962	94606	106515	65621	29586	12832	13314	3473	2185	1652	900	925	331,609
1963	135041	77456	86281	50223	22233	9081	7673	2149	1189	964	534	392,824
1964	195488	110562	63133	65447	31040	13843	5695	2858	722	432	500	489,720
1965	252970	160052	84924	37711	36087	18299	9287	3665	1632	298	320	605,245
1966	221171	207114	130125	62667	24021	17671	6202	3302	2030	239	99	674,641
1967	121541	181079	168890	89951	33653	9146	6895	1137	1076	183	87	613,638
1968	154111	99509	130150	82351	28883	11073	3234	1531	719	719	86	512,366
1969	96818	126175	66742	55815	24240	7265	3431	1228	801	429	508	383,452
1970	101648	79268	95947	43016	21651	9853	4073	1563	542	394	231	358,185
1971	74517	83223	62998	60832	25515	9253	4801	1872	795	310	121	324,237
1972	42188	61009	67279	27529	22783	10441	4442	1704	1083	471	164	239,094
1973	44123	34540	49888	37315	11560	6720	3316	2127	1138	693	316	191,735
1974	27761	36125	19251	16285	17043	4127	3733	1842	1108	713	444	128,433
1975	32961	22729	23794	7287	3682	4318	1379	1147	605	307	204	98,413
1976	54554	26986	18003	11616	2818	800	837	198	132	90	31	116,065
1977	50000	44665	18443	8002	4211	1337	465	471	123	75	62	127,855
1978	20885	40937	36020	12875	4281	2104	583	223	199	43	25	118,175
1979	23689	17099	32686	25582	8276	2769	1404	386	130	117	28	112,166
1980	33039	19395	13935	23312	12696	4280	1475	911	264	91	85	109,482
1981	26234	27050	15639	10457	15654	8347	2819	1008	663	188	67	108,126
1982	42429	21479	21691	11820	7424	10747	5124	1792	652	458	117	123,733
1983	49757	34738	17310	15975	8244	5167	7423	2856	934	345	230	142,978
1984	39396	40738	27377	13588	11373	5665	3612	5040	1643	551	210	149,192
1985	10592	32255	33301	21511	9853	7221	3541	2310	3300	851	355	125,091
1986	7768	8672	26357	24601	12044	5343	3655	2183	1478	2222	463	94,785
1987	15491	6360	6962	18996	14372	5946	3017	2141	1286	875	1505	76,950
1988	15380	12506	4742	5319	12411	8671	3777	1883	996	610	361	66,657
1989	6147	12361	9989	3595	2984	4504	3567	2186	1033	436	277	47,079
1990	6803	4918	8394	6216	1600	1317	2000	1770	1354	636	206	35,214
1991	24152	5200	3070	2861	1255	514	699	992	928	715	386	40,771
1992	7629	14357	3265	1908	1451	541	170	245	307	313	244	30,430
1993	767	6171	7711	1098	814	640	233	82	112	137	120	17,886
1994	460	598	3871	3443	333	241	238	125	44	57	68	9,479
1995	914	377	282	1104	1817	161	114	171	95	36	46	5,117
1996	1258	748	309	166	886	1452	130	93	140	78	29	5,288
1997	424	1028	609	248	134	710	1166	104	75	112	63	4,671
1998	2050	346	831	482	193	105	553	914	80	58	87	5,700
1999	3930	1678	281	660	376	149	81	428	711	62	44	8,400
2000	3113	3176	1289	193	449	272	110	61	329	533	48	9,573
2001	1405	2539	2280	751	80	312	204	79	46	258	425	8,379
2002	529	1141	1910	1594	471	56	217	146	58	36	203	6,362
2003	1323	343	738	1070	922	259	38	153	108	45	29	5,027

Table 24 Bias adjusted fishing mortality from ADAPT for cod in NAFO Divisions 3NO.

F Bias Adj(ar	2	3	4	5	6	7	8	9	10	11	12	FBAR 6-9	FBAR 4-6
1959	0	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	0.218	0.771	1.287	1.173	0.896	0.980	0.913	1.084	1.052	0.991	0.991	1.077
1975	0	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	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	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	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	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	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	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	0.016	0.106	0.160	0.163	0.170	0.385	0.452	0.437	0.490	0.292	0.292	0.143
1983	0	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	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	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	0.020	0.127	0.338	0.506	0.372	0.335	0.329	0.324	0.190	0.385	0.385	0.324
1987	0.014	0.094	0.069	0.226	0.305	0.254	0.271	0.565	0.545	0.686	0.349	0.349	0.200
1988	0.019	0.025	0.077	0.378	0.814	0.688	0.347	0.401	0.627	0.590	0.562	0.562	0.423
1989	0.023	0.187	0.274	0.609	0.618	0.612	0.501	0.279	0.285	0.547	0.503	0.503	0.501
1990	0.069	0.271	0.876	1.400	0.936	0.432	0.502	0.446	0.439	0.300	0.579	0.579	1.071
1991	0.320	0.265	0.275	0.479	0.641	0.907	0.850	0.973	0.887	0.874	0.843	0.843	0.465
1992	0.012	0.422	0.889	0.652	0.618	0.642	0.531	0.583	0.608	0.761	0.594	0.594	0.720
1993	0.049	0.266	0.606	0.993	1.017	0.789	0.427	0.408	0.480	0.498	0.660	0.660	0.872
1994	0.000	0.551	1.055	0.439	0.528	0.548	0.128	0.073	0.025	0.000	0.000	0.319	0.674
1995	0.000	0.000	0.328	0.020	0.025	0.014	0.000	0.006	0.000	0.000	0.000	0.011	0.124
1996	0.002	0.006	0.018	0.020	0.021	0.019	0.026	0.024	0.024	0.014	0.000	0.023	0.020
1997	0.003	0.013	0.033	0.050	0.042	0.049	0.043	0.055	0.061	0.051	0.054	0.047	0.042
1998	0.001	0.010	0.031	0.049	0.059	0.054	0.057	0.051	0.056	0.080	0.066	0.055	0.046
1999	0.013	0.064	0.175	0.184	0.125	0.109	0.085	0.061	0.089	0.055	0.052	0.095	0.161
2000	0.004	0.132	0.340	0.677	0.165	0.089	0.129	0.075	0.045	0.025	0.047	0.114	0.394
2001	0.008	0.085	0.158	0.267	0.163	0.164	0.133	0.103	0.049	0.039	0.032	0.141	0.196
2002	0.233	0.236	0.379	0.348	0.398	0.195	0.148	0.103	0.058	0.031	0.033	0.211	0.375

		2	3	4	5	6	7	8	9	10	11	12	mean 6-9	mean 4-6
mean f	1959-2002	0.017	0.096	0.303	0.459	0.505	0.448	0.461	0.393	0.446	0.418	0.435	0.452	0.422
	1959-81	0.000	0.066	0.318	0.533	0.618	0.553	0.638	0.499	0.592	0.530	0.577	0.593	0.506
	1982-93	0.042	0.134	0.291	0.490	0.538	0.481	0.406	0.438	0.468	0.489	0.466	0.466	0.439
	1994-2002	0.029	0.122	0.280	0.228	0.170	0.138	0.083	0.061	0.045	0.033	0.031	0.113	0.226
	2001-2002	0.120	0.160	0.268	0.307	0.281	0.180	0.140	0.103	0.054	0.035	0.032	0.176	0.285

Table 25. 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	0.613	0.767	1.285	1.762	2.643	4.569	5.590	6.151	6.834	8.364
2003	0.500	0.737	1.172	1.814	2.809	3.783	4.084	4.617	5.932	7.158

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

	3	4	5	6	7	8	9	10	11	12	3+	6+
1959	15951	61707	19343	26729	30989	13354	11291	14215	11073	1846	206,498	109,498
1960	15658	24591	65125	17597	18992	19590	8251	7934	8935	4471	191,145	85,771
1961	24361	24050	28804	51368	15123	13906	10823	5677	5736	3842	183,689	106,474
1962	32017	38510	29954	20034	31221	10739	8025	7130	4463	5263	187,356	86,875
1963	23282	50634	50847	34712	21295	23723	7892	5133	4777	3040	225,336	100,572
1964	33233	37050	66260	48461	32461	17607	10497	3116	2141	2848	253,674	117,130
1965	45921	49838	38180	56341	42910	28715	13461	7044	1478	1822	285,710	151,770
1966	72602	80003	65934	39288	43864	21368	15310	11231	1504	726	351,832	133,293
1967	63476	111006	99150	57199	23783	25148	5877	7515	1474	809	395,437	121,805
1968	34882	85543	90774	49092	28795	11796	7909	5020	5801	801	320,413	109,214
1969	44230	43868	61523	41201	18893	12516	6344	5590	3458	4725	242,347	92,726
1970	27787	63063	47415	36800	25622	14856	8076	3785	3177	2148	232,728	94,464
1971	28101	41407	67053	43369	24062	17513	9670	5551	2501	1123	240,349	103,788
1972	24210	45908	31340	38178	25966	14898	8526	7691	3769	1521	202,006	100,549
1973	17397	36660	43948	20528	18465	12129	10034	8584	6527	3404	177,676	79,671
1974	10423	12418	17839	28533	10329	15369	10726	6471	6392	4065	122,565	81,885
1975	5581	14547	7044	5887	10712	4756	5831	4250	1646	1574	61,829	34,657
1976	9541	10587	13012	4867	2105	2976	1044	920	707	250	46,009	12,869
1977	18758	13041	9287	7875	3824	1826	2533	940	760	635	59,480	18,394
1978	25264	27866	16030	7813	6408	2347	1205	1433	389	307	89,062	19,902
1979	8787	27456	30906	14896	7037	5222	1805	865	890	271	98,135	30,986
1980	10296	11457	30000	23667	11886	5856	4950	1745	794	854	101,504	49,751
1981	21352	14851	14466	33376	24866	12503	6306	5649	1713	700	135,780	85,112
1982	18097	22258	16314	14937	34496	22141	11322	5168	4330	1230	150,295	93,625
1983	25385	18153	23630	16374	14939	33126	16401	7263	3068	2390	160,729	93,561
1984	30845	27067	18061	23484	16019	14170	27582	11055	4674	2232	175,189	99,216
1985	10673	27448	27001	17335	19657	13314	11959	22845	6919	3541	160,693	95,571
1986	2332	18351	28128	20718	14292	15325	13271	11917	20207	4400	148,941	100,129
1987	2181	3937	21767	23970	14856	12297	13415	10845	8605	16835	128,711	100,825
1988	8083	3319	5658	18933	17516	12467	9296	7042	5590	3768	91,673	74,612
1989	4480	8463	4548	5247	10897	11436	11294	6737	3518	2968	69,587	52,097
1990	2176	6024	7398	3207	3256	7359	8514	10421	5589	2130	56,075	40,477
1991	2631	2099	3625	2300	1594	2725	5537	6252	7157	4399	38,318	29,963
1992	3082	1952	1811	2454	1379	732	1361	2295	2765	2757	20,589	13,744
1993	1965	3912	1029	1137	1443	794	436	735	1105	1036	13,593	6,686
1994	97	1575	2901	494	444	804	561	296	293	554	8,018	3,445
1995	116	127	823	2470	311	223	886	525	247	244	5,973	4,906
1996	231	177	164	1375	3386	361	292	877	490	209	7,561	6,989
1997	318	349	249	214	1639	3507	412	396	691	449	8,225	7,309
1998	98	476	485	310	242	1663	3640	426	356	622	8,319	7,260
1999	647	176	735	616	314	224	1570	3790	394	299	8,766	7,208
2000	1405	824	224	876	725	279	167	1280	3001	308	9,089	6,636
2001	1128	1834	801	139	972	862	310	177	1374	2857	10,455	6,692
2002	700	1465	2048	829	148	990	816	358	248	1698	9,299	5,086
2003	172	544	1254	1673	727	142	625	497	267	206	6,107	4,137

Table 27. 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	1397	1072	1362	18268	11825	11079	14175	11069	1846	72,219
1960	51	966	7542	4418	5780	17348	8096	7912	8932	4471	65,515
1961	1	404	4985	21855	9935	10859	10620	5661	5733	3842	73,896
1962	29	45	2466	10362	25201	9840	7758	7111	4461	5263	72,535
1963	132	502	1163	11111	18011	22761	7768	5112	4775	3040	74,374
1964	34	987	6630	15566	23106	17002	10419	3107	2139	2847	81,838
1965	2	246	4442	31137	38850	26658	13368	7034	1477	1822	125,034
1966	37	45	1542	15238	40886	21259	15088	11216	1504	726	107,540
1967	835	739	963	5938	17909	24984	5875	7494	1473	809	67,019
1968	40	3406	7430	7113	10339	11044	7904	5020	5798	801	58,895
1969	13	395	7030	22350	14084	9142	6255	5589	3458	4725	73,040
1970	2	181	3148	10539	24094	14568	7503	3774	3177	2148	69,135
1971	0	38	1847	15519	13361	17430	9659	5464	2499	1123	66,940
1972	652	2	316	8312	21128	11848	8523	7691	3756	1520	63,747
1973	22	2764	169	2090	13521	11785	9267	8584	6527	3402	58,131
1974	1	104	3457	8369	5766	14817	10686	6303	6392	4065	59,960
1975	18	25	374	2441	10476	4441	5809	4248	1632	1574	31,040
1976	19	197	288	1324	1423	2975	1037	920	707	250	9,140
1977	16	185	907	1787	2728	1571	2533	940	760	635	12,063
1978	35	230	1499	2984	5076	2213	1142	1433	389	307	15,310
1979	127	363	2261	6331	5483	5119	1789	850	890	271	23,484
1980	35	796	3413	10144	9998	5579	4942	1742	789	854	38,293
1981	42	351	3976	18401	21807	12182	6251	5648	1712	698	71,068
1982	63	360	2384	9827	31793	21819	11280	5160	4330	1230	88,247
1983	7	295	2875	8967	13550	32834	16375	7259	3067	2390	87,619
1984	25	75	1309	12643	14343	13890	27557	11053	4673	2231	87,800
1985	21	161	705	4682	17840	13098	11912	22843	6919	3541	81,720
1986	5	246	1150	4253	9098	15142	13240	11908	20206	4400	79,649
1987	13	76	1888	5655	10598	10974	13396	10842	8604	16835	78,882
1988	2	111	889	7550	12104	11968	9065	7041	5590	3768	58,088
1989	21	26	774	3344	8962	10771	11246	6701	3518	2968	48,331
1990	37	227	327	1759	3071	7139	8442	10417	5583	2130	39,131
1991	21	135	884	932	1399	2708	5512	6244	7156	4398	29,390
1992	1	109	390	1783	1254	715	1361	2294	2765	2757	13,428
1993	0	47	313	594	1380	789	434	735	1105	1036	6,433
1994	0	24	818	378	361	799	561	296	293	554	4,083
1995	1	5	481	2288	298	211	885	525	247	244	5,186
1996	5	12	81	1364	3377	359	288	877	490	209	7,062
1997	4	54	101	199	1639	3506	412	395	691	449	7,450
1998	2	51	283	268	240	1663	3640	426	356	622	7,551
1999	0	18	385	564	309	224	1570	3790	394	299	7,554
2000	1	3	97	797	717	278	167	1280	3001	308	6,649
2001	7	50	112	116	961	861	310	177	1374	2857	6,827
2002	4	66	883	730	143	989	815	358	248	1698	5,934
2003	1	24	420	1594	725	142	625	497	267	206	4,502

Table 28. Input data to deterministic projections.

	3	4	5	6	7	8	9	10	11	12
M	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Avg wt (3yrs)	0.519093	0.769464	1.174305	1.768675	2.855629	4.196312	4.535043	4.860326	6.032259	7.41305
Avg PR (3 yrs)	0.368018	0.682262	0.958058	0.618725	0.412973	0.352906	0.251944	0.13164	0.087328	0.090324
Rescaled Avg PR	0.488726	0.906041	1.272296	0.821663	0.548426	0.468657	0.33458	0.174817	0.115971	0.11995
F_current(3 yrs)	0.321681 avg									
Proj F	0.157214	0.291456	0.409273	0.264313	0.176418	0.150758	0.107628	0.056235	0.037306	0.038586

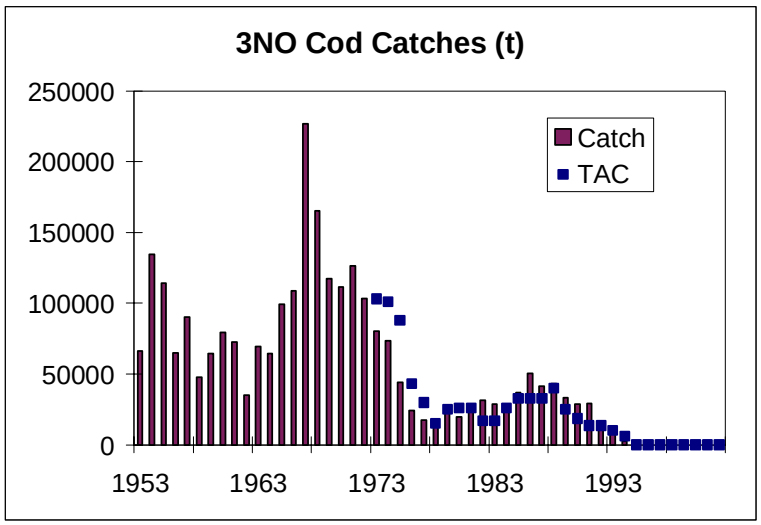

Fig. 1a. Landings of Cod in NAFO Div. 3NO from 1953-2002.

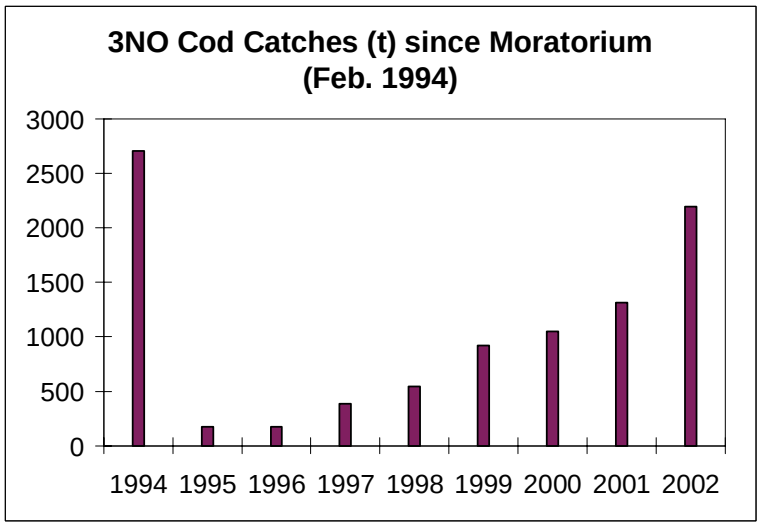

Fig. 1b. Landings since moratorium.

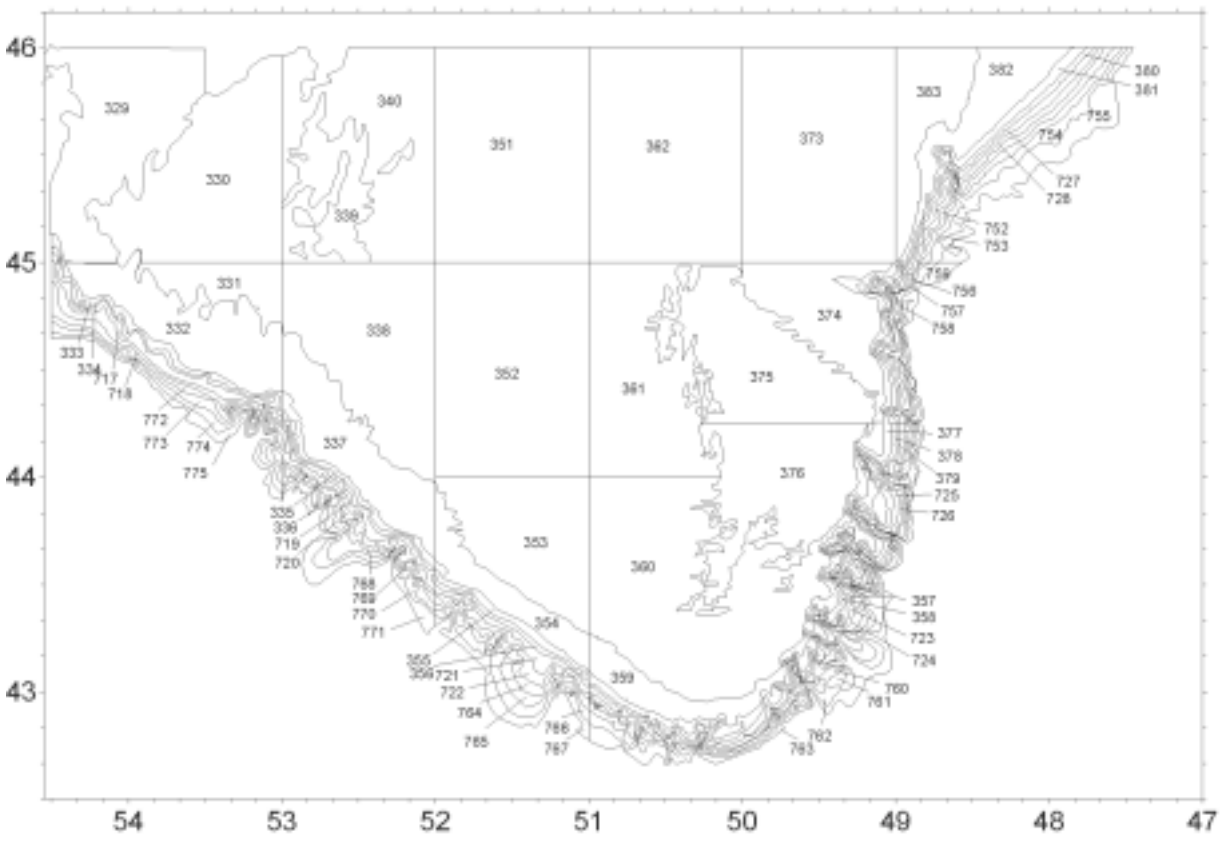

Fig. 2. Stratification scheme for Div. 3NO.

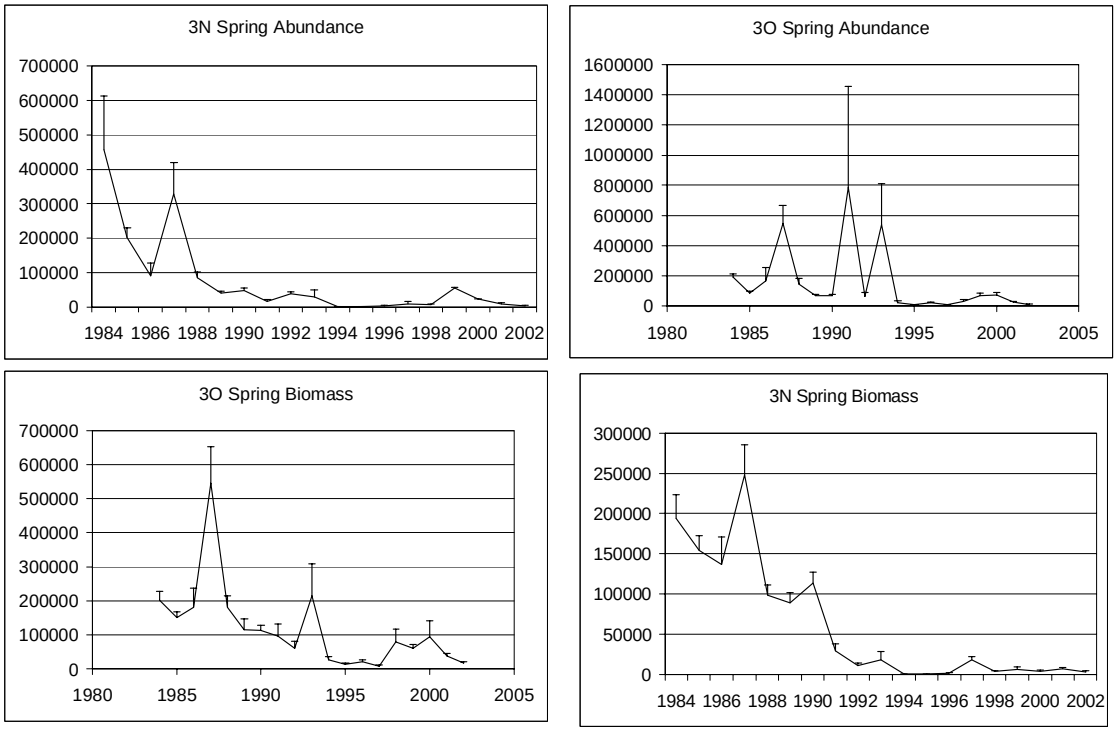

Fig. 3. Abundance (000's) and biomass (t) for the Canadian Spring Research Vessel survey series with 1 standard deviation.

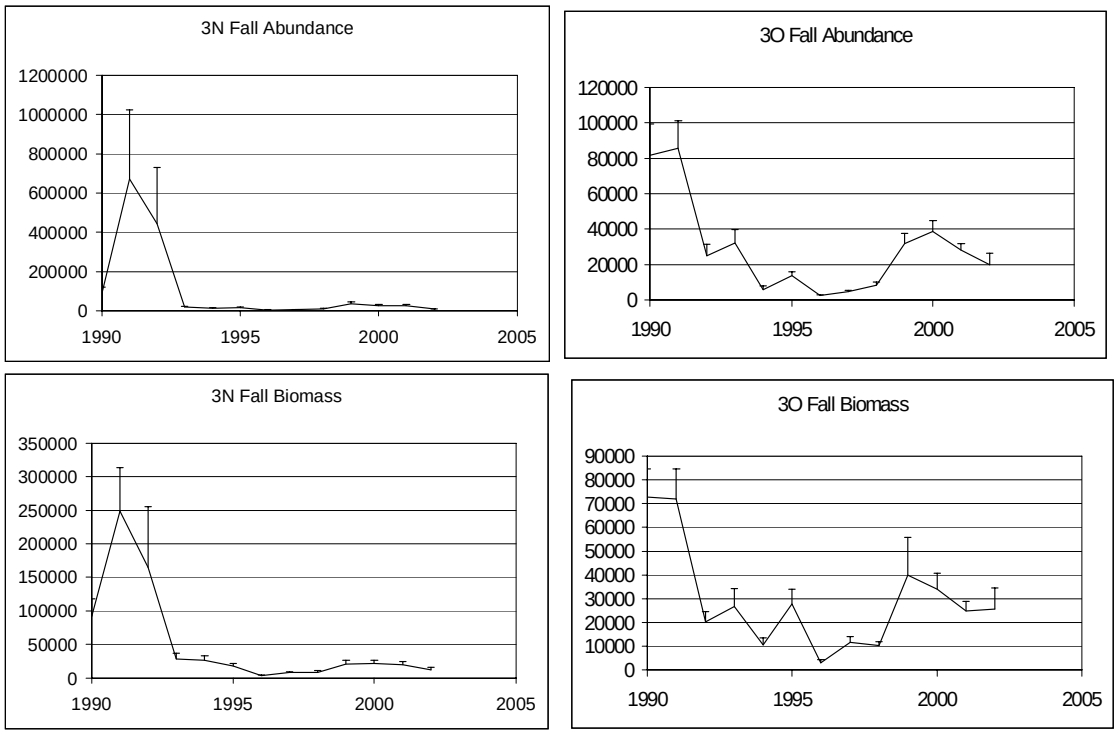

Fig. 4. Abundance (000's) and biomass (t) for the Canadian Fall Research Vessel survey series with 1 standard deviation.

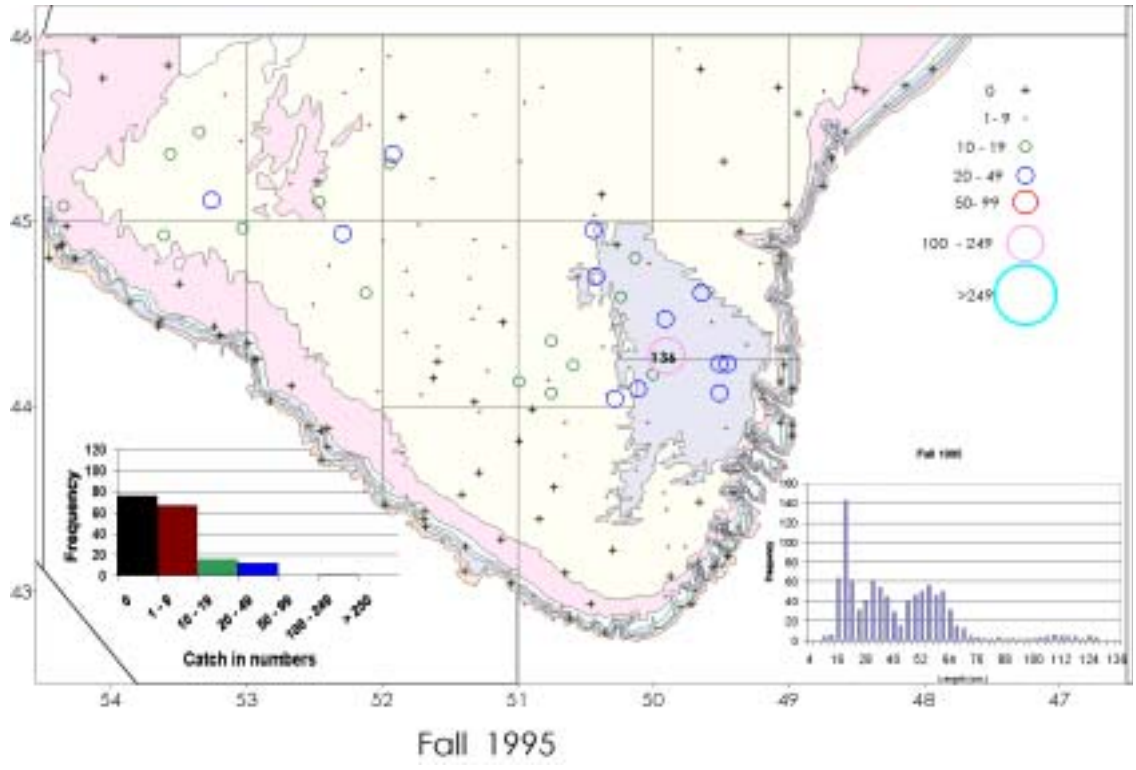

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

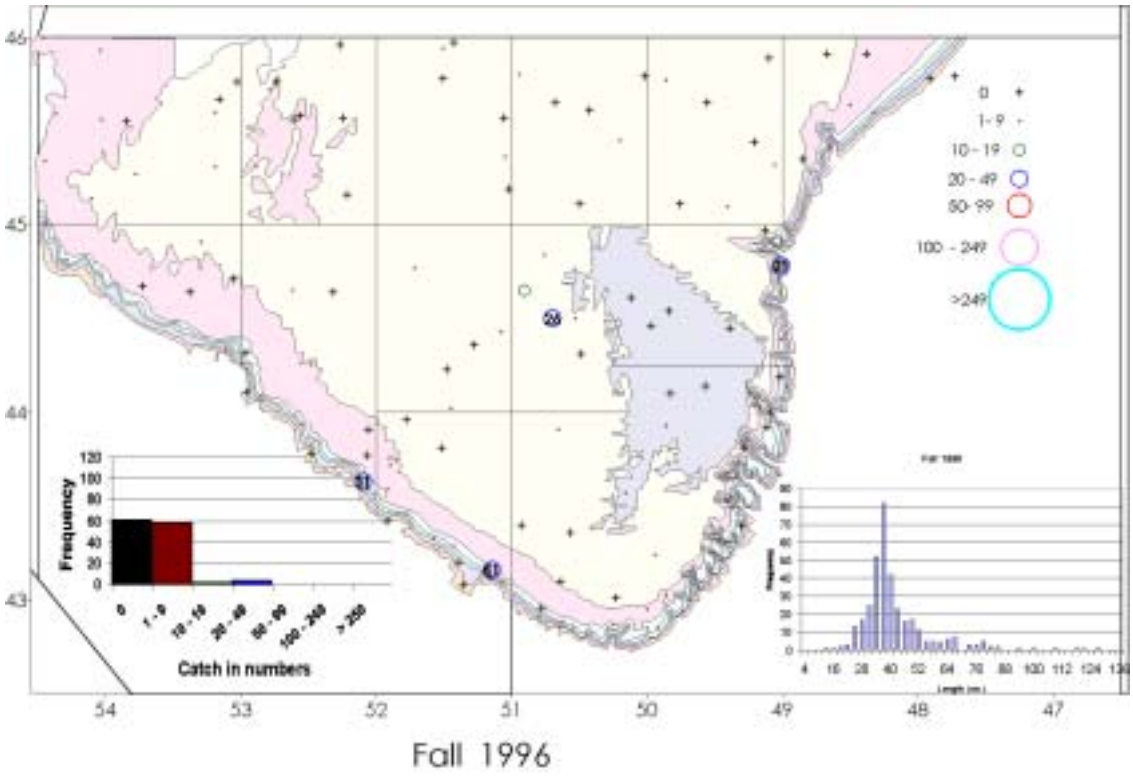

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

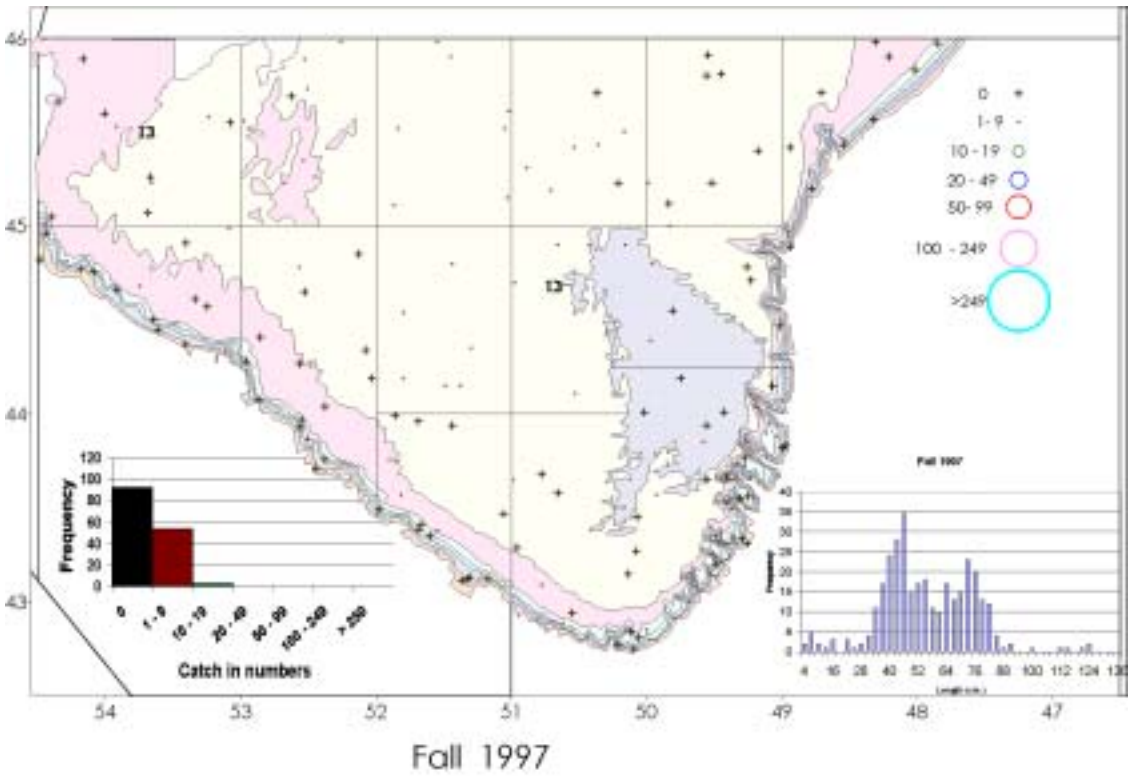

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

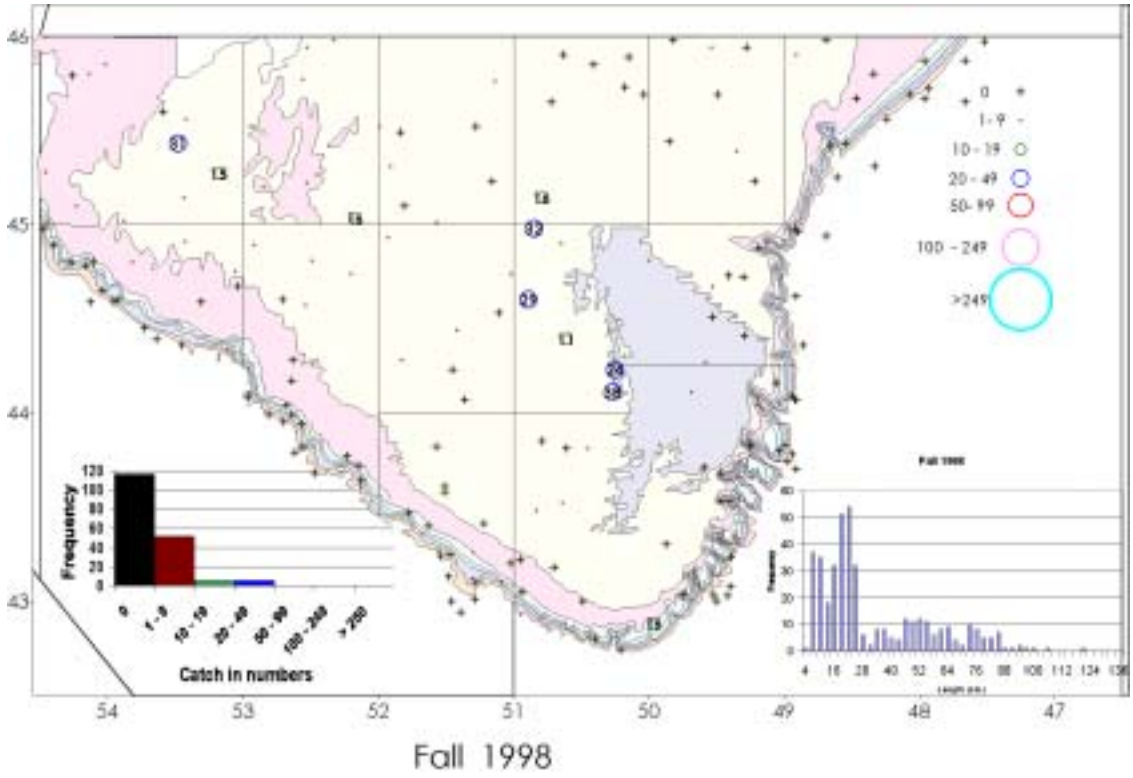

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

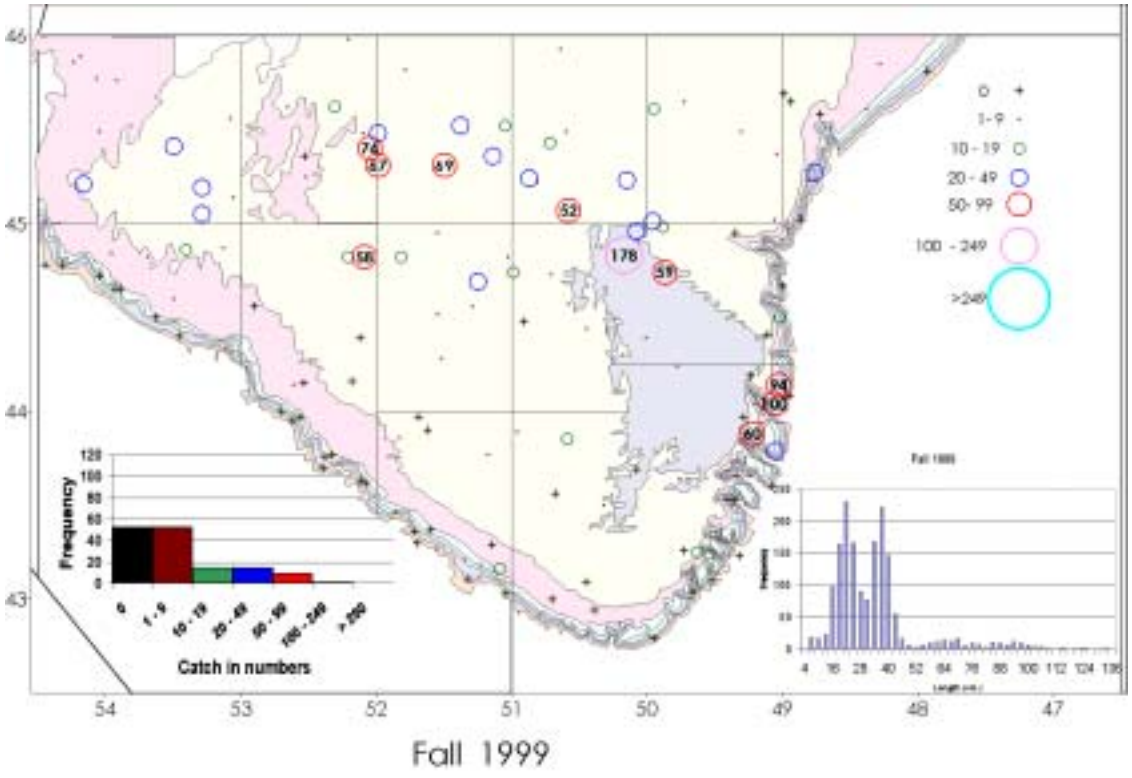

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

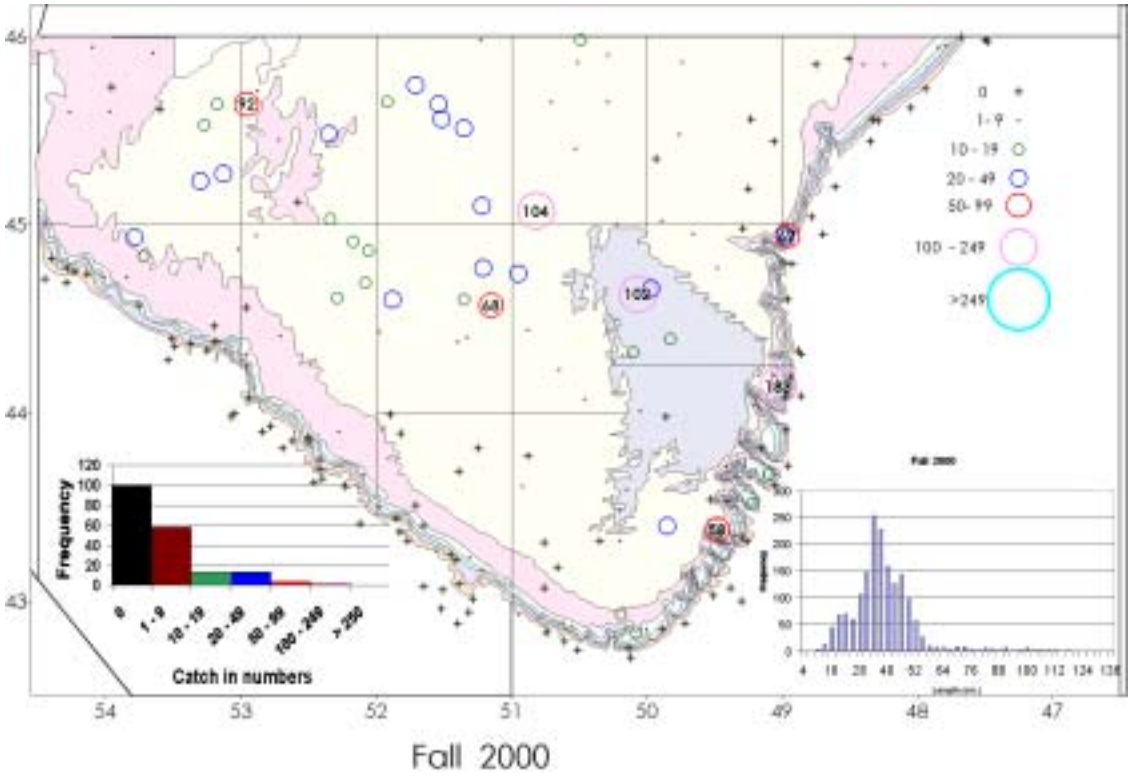

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

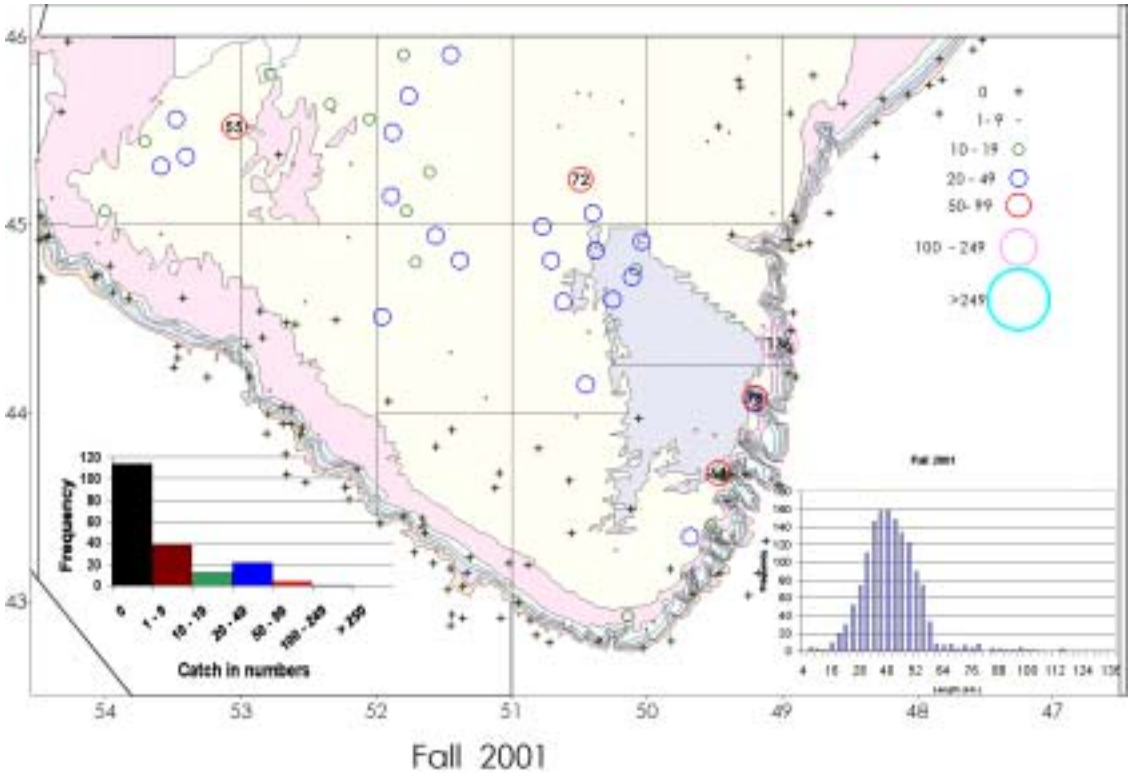

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

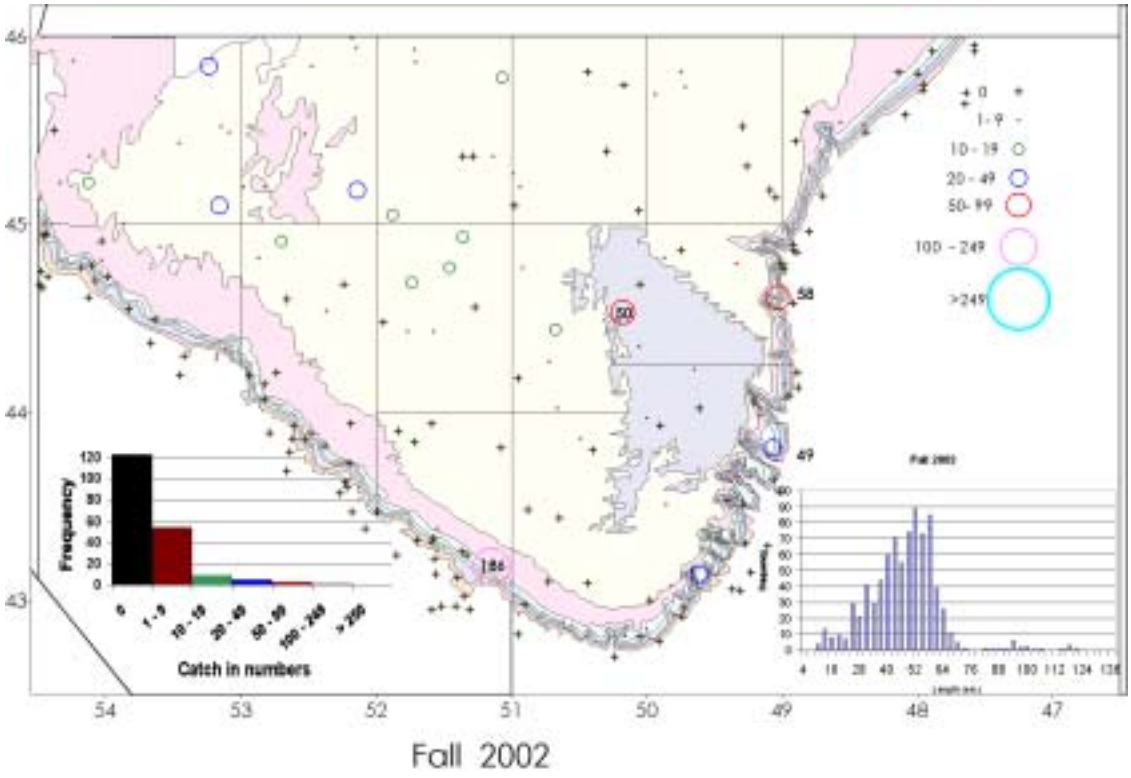

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

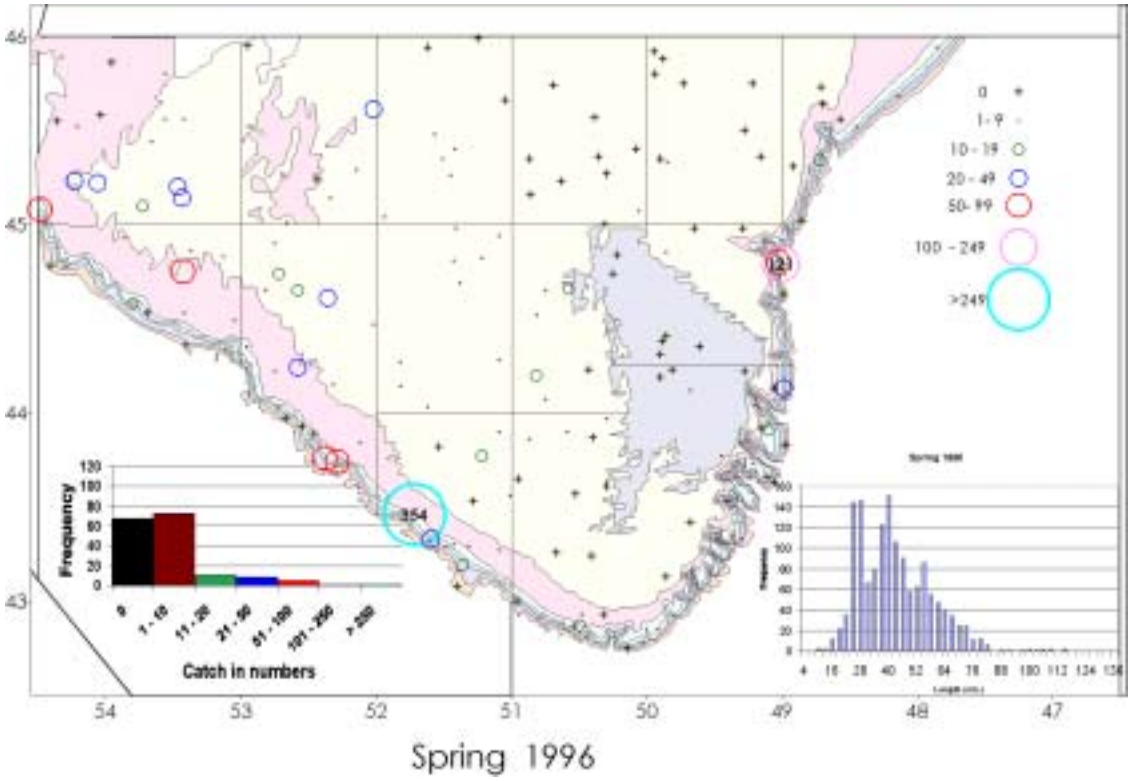

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

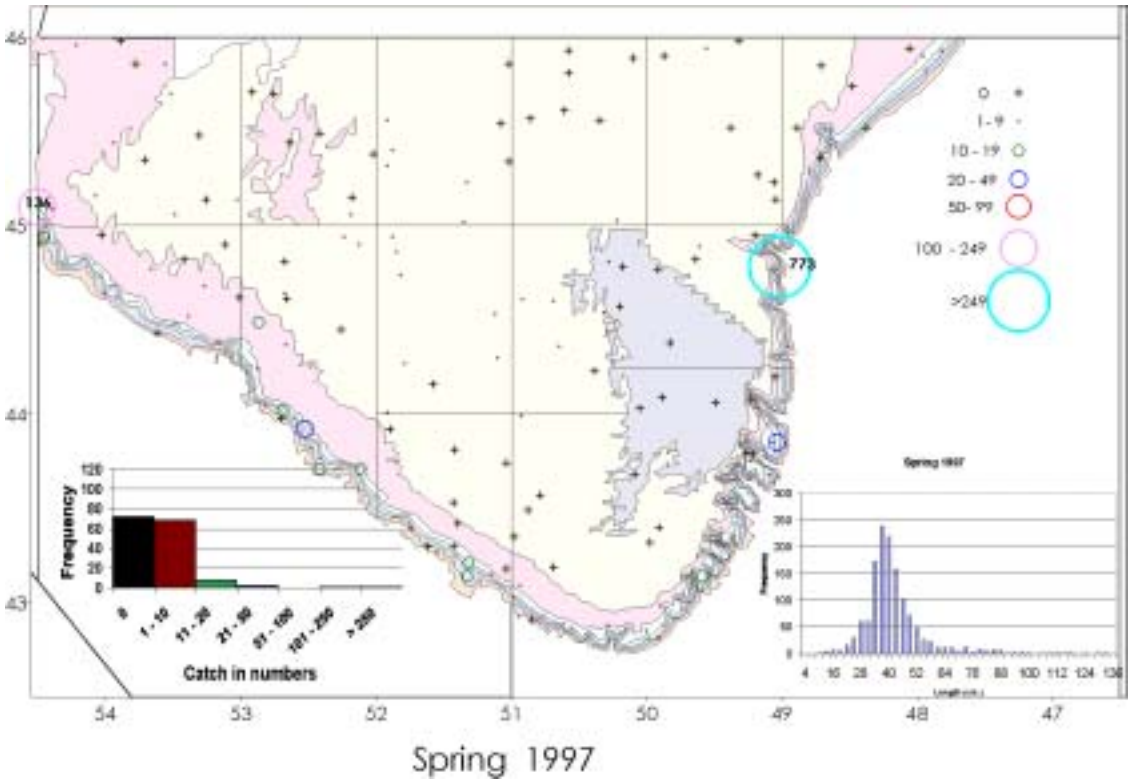

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

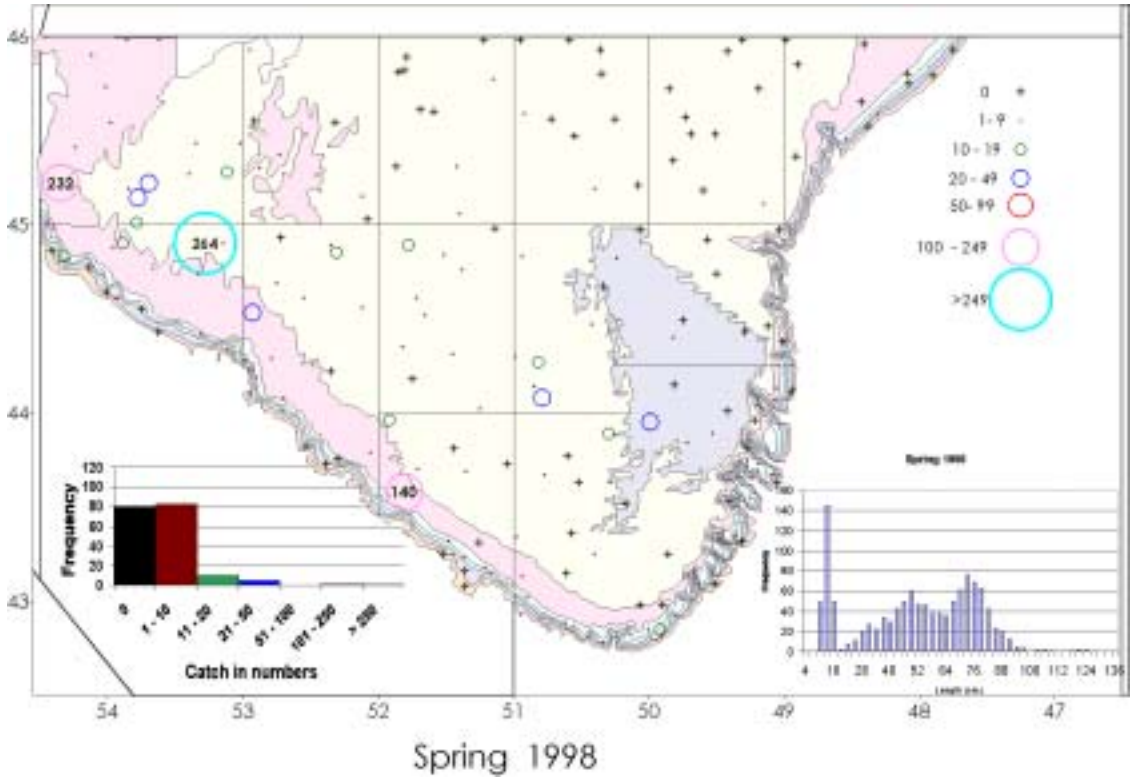

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

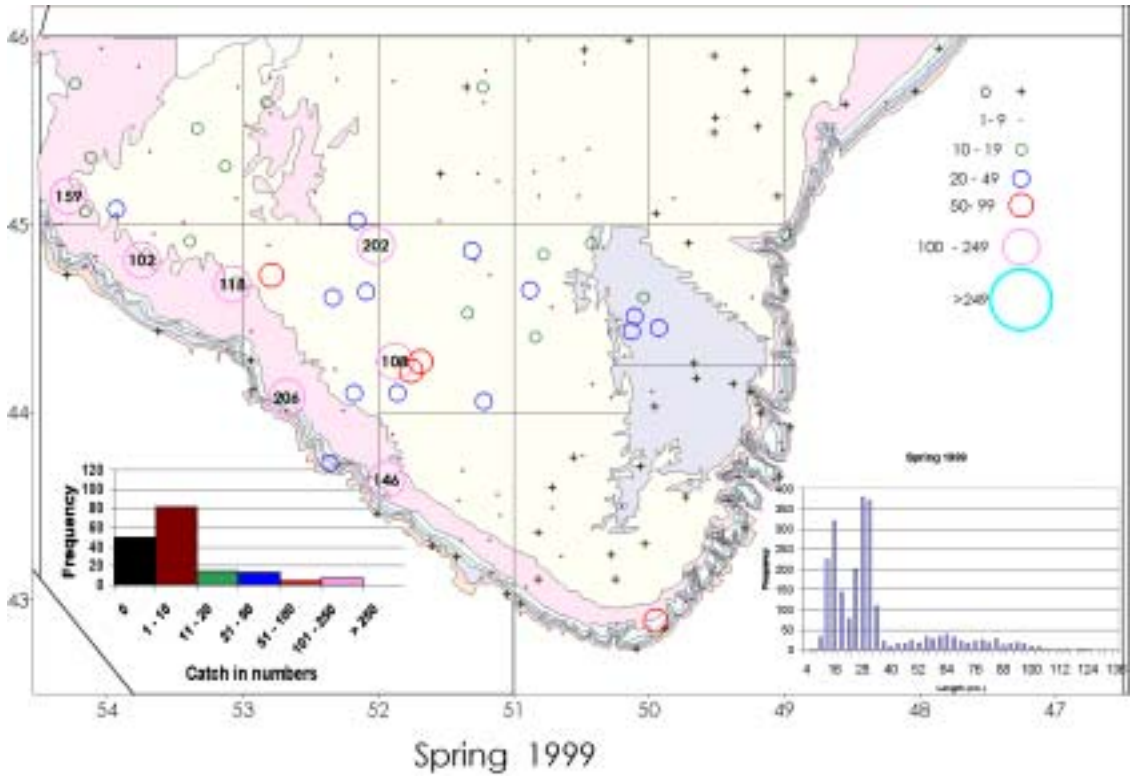

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

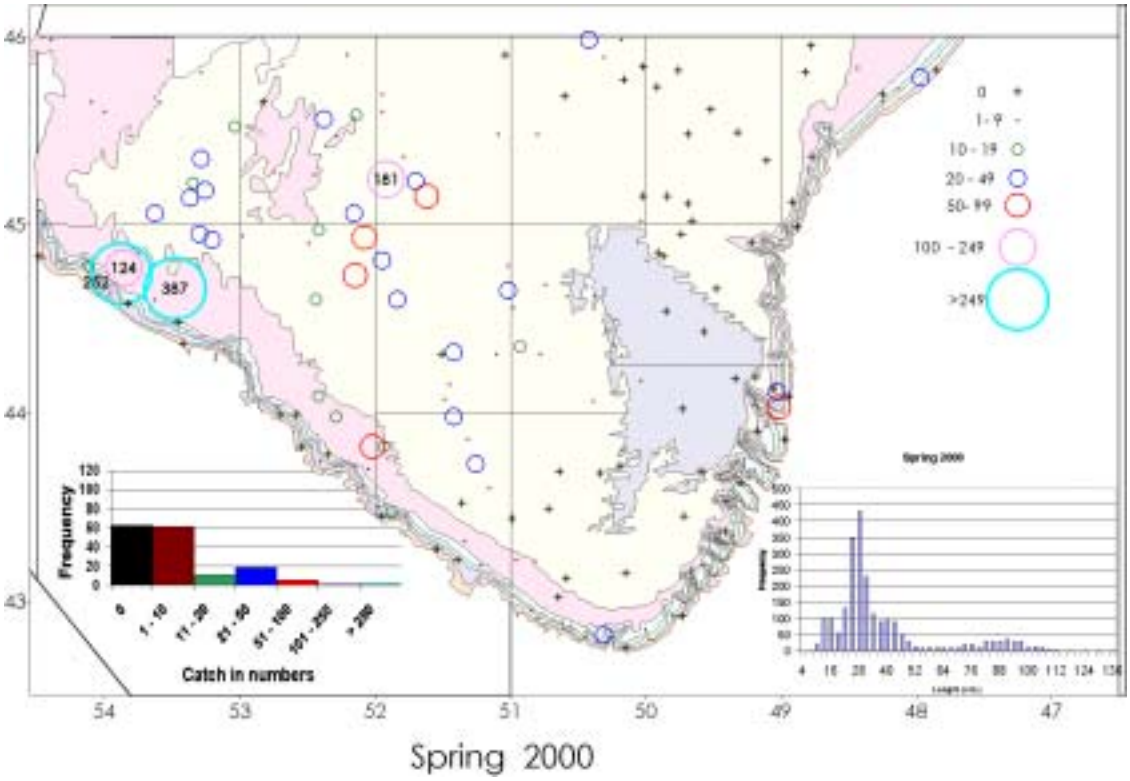

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

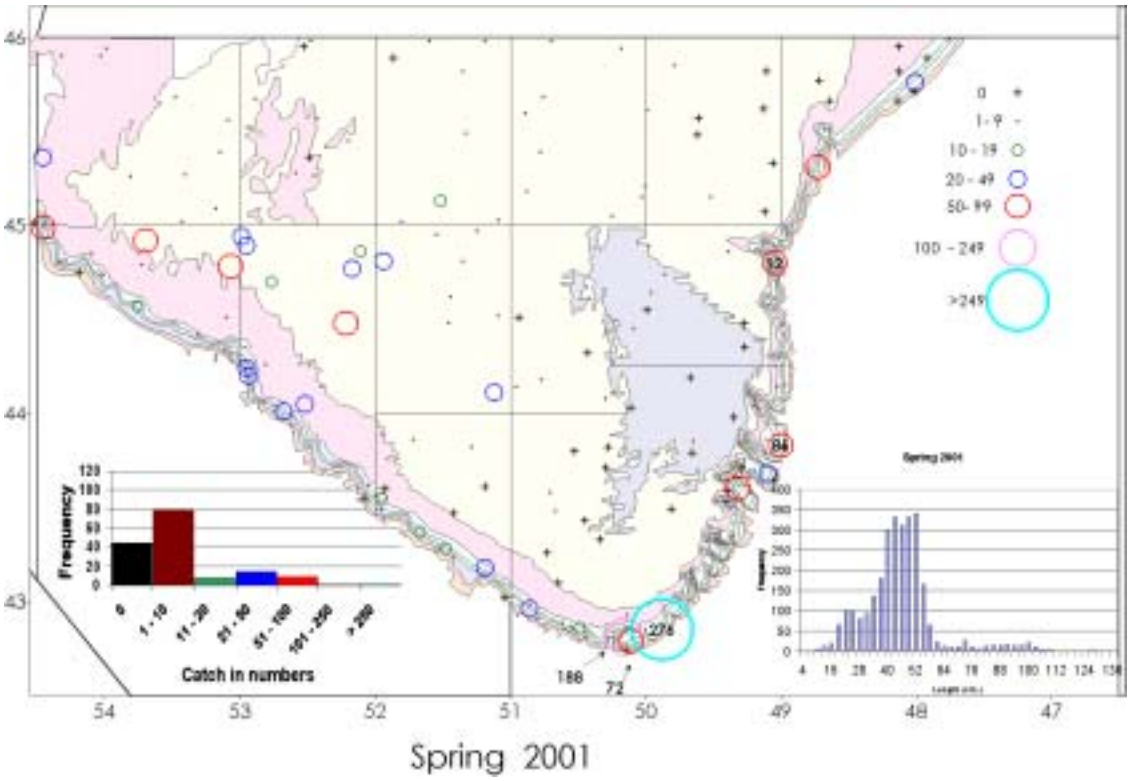

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

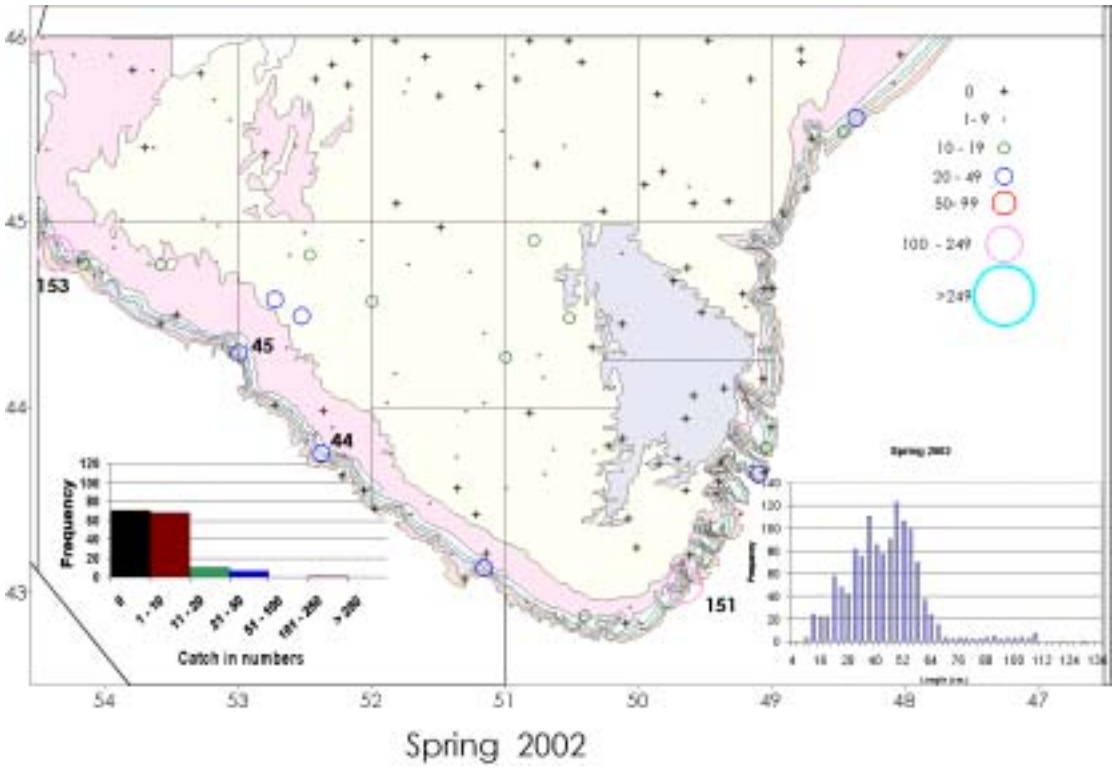

Fig. 5. Cod Distribution in Div. 3NO from Canadian Research Surveys.

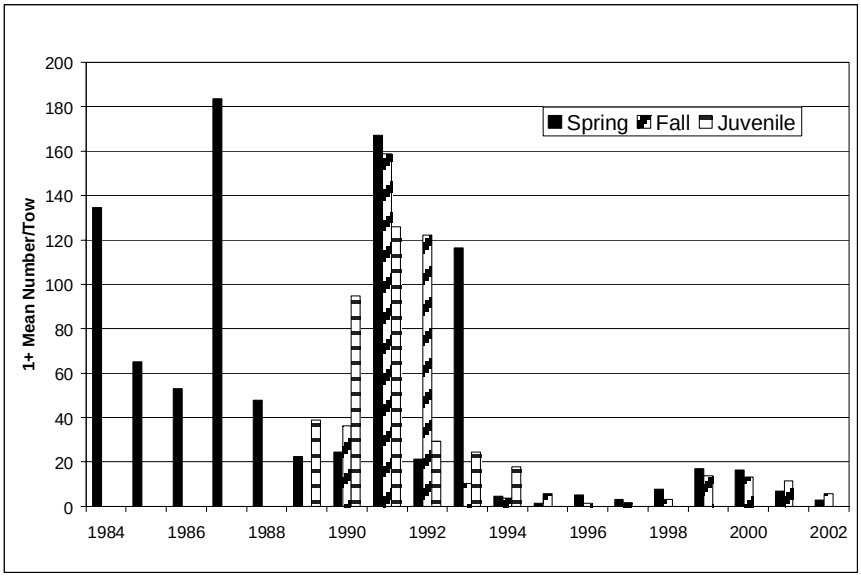

Fig. 6. Mean Number per tow of cod in Div. 3NO, from Canadian Spring and Fall Surveys.

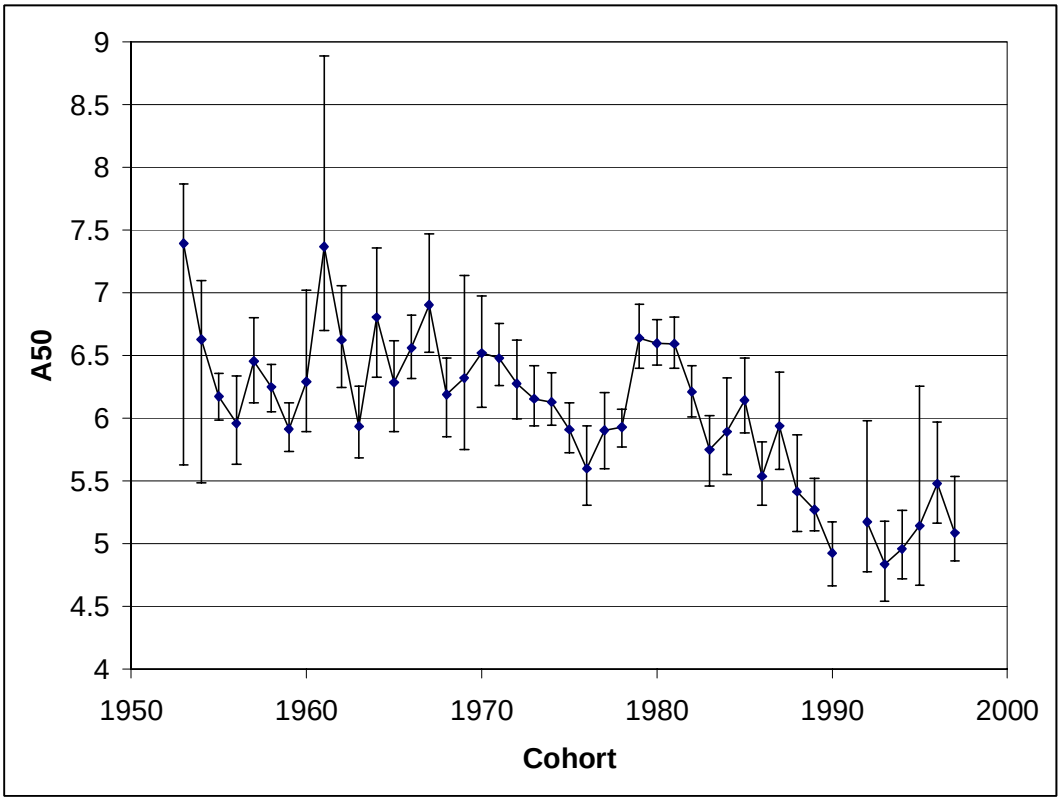

Fig. 7. Age at 50% maturity for cod in Div. 3NO (by cohort).

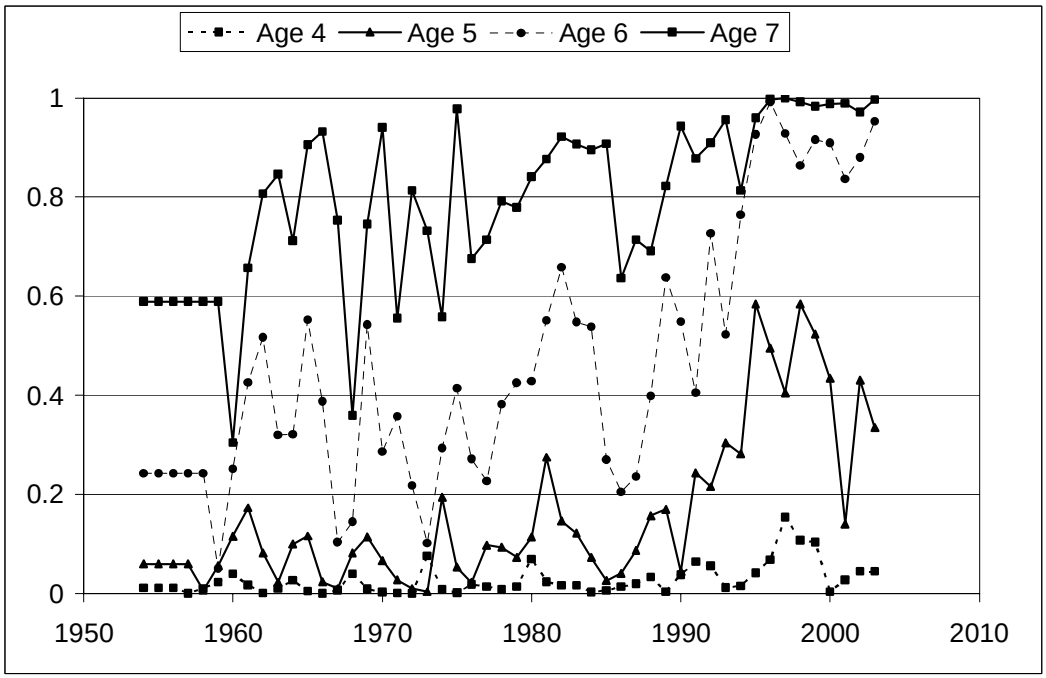

Fig. 8. Estimated proportion mature-at-age for select ages, Div. 3NO Cod, based on Canadian sampling.

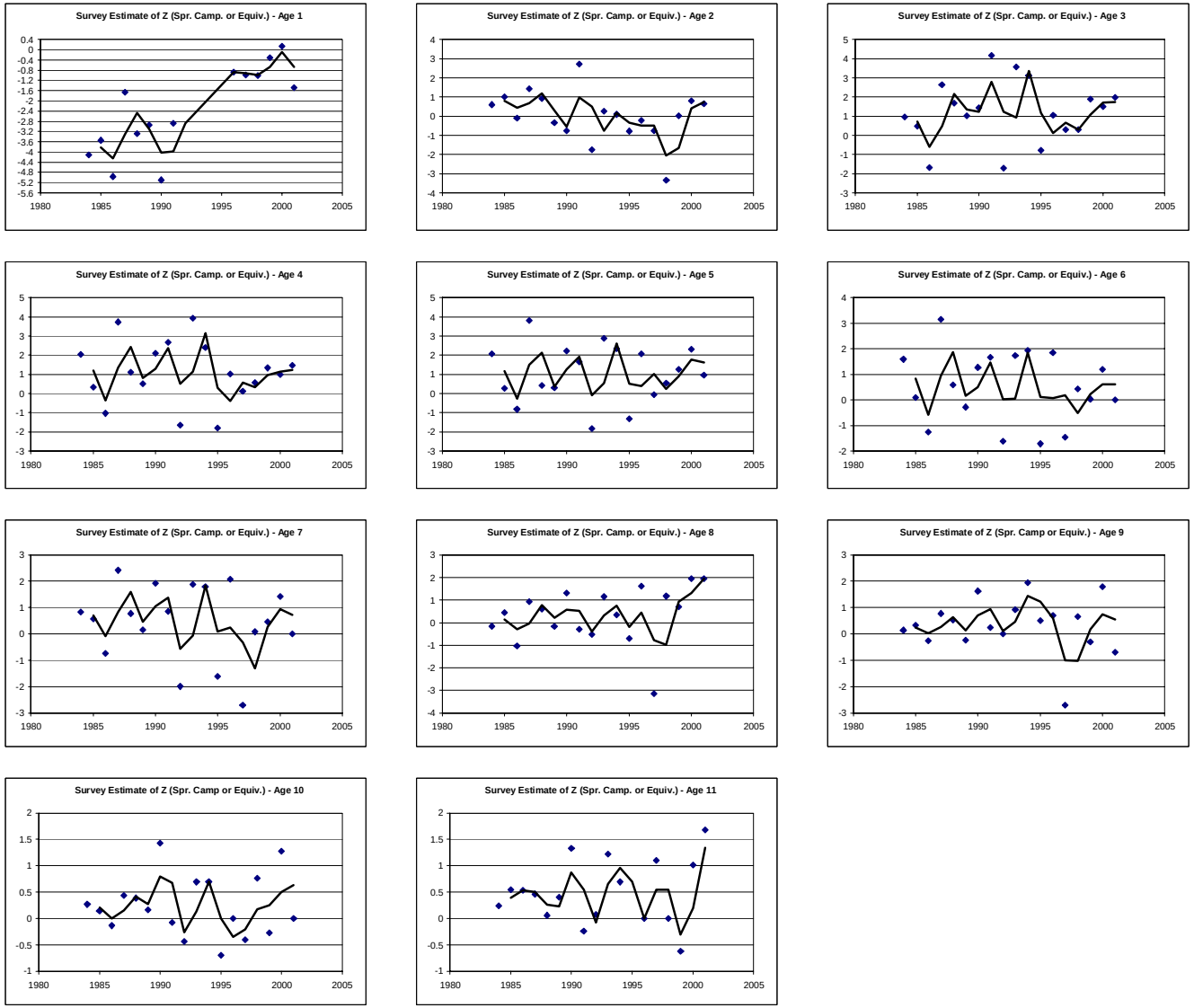

Fig. 9. Estimates of Total Mortality from Canadian Spring Surveys.

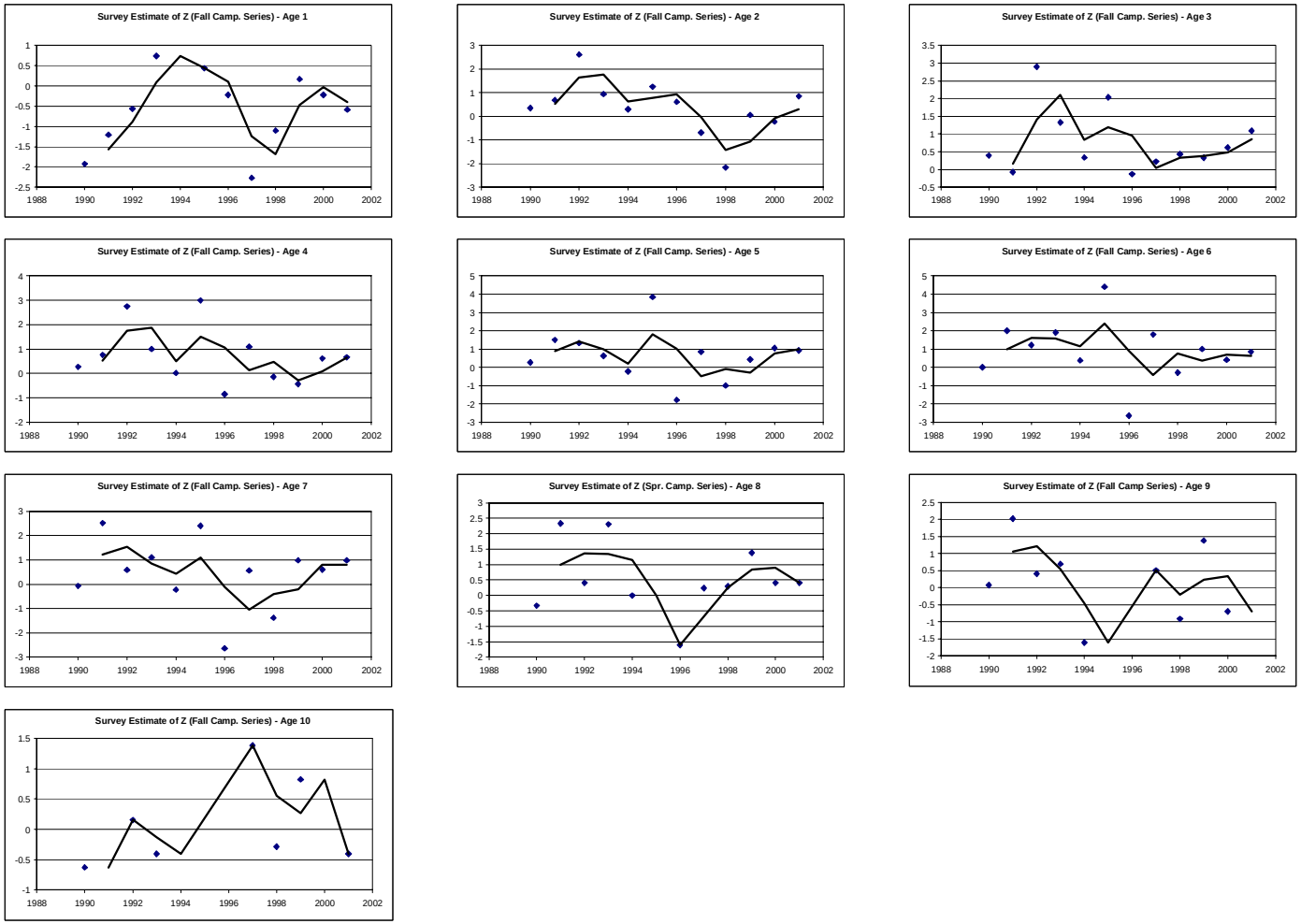

Fig. 10. Estimates of Total Mortality from Canadian Fall Surveys.

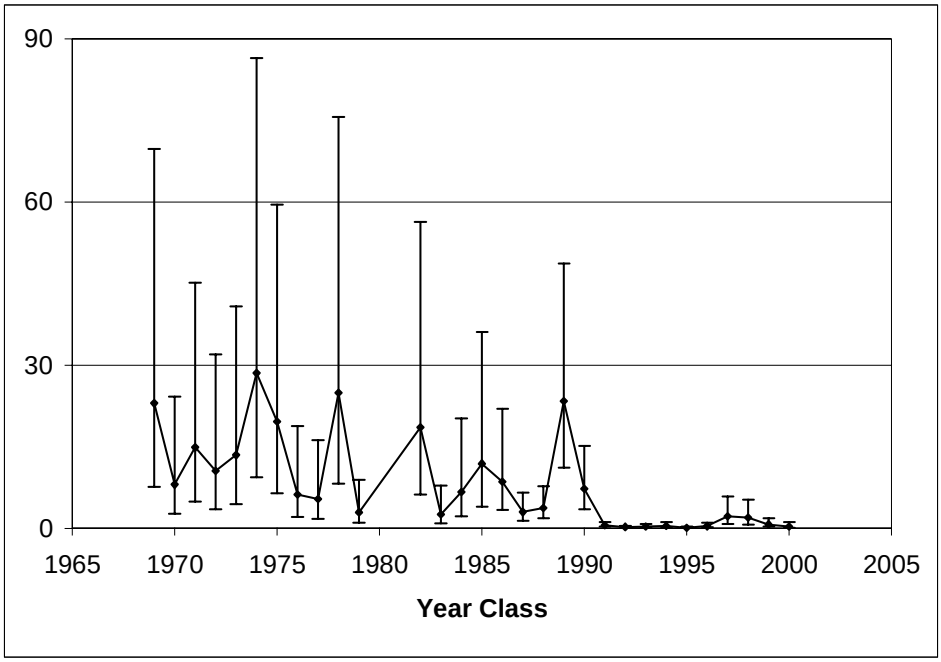

Fig. 11. Estimated Year-Class strength.

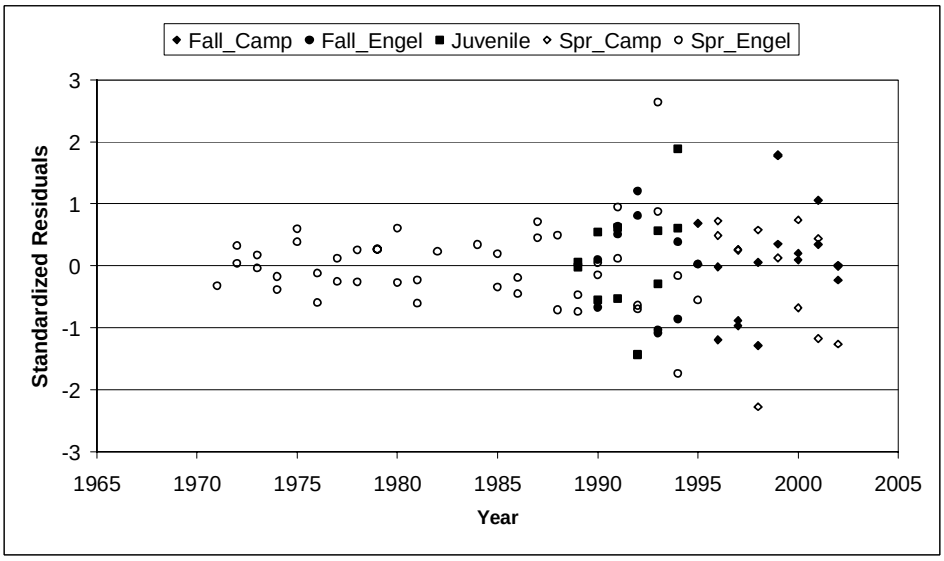

Fig. 12. Standardized Residuals from Year-Class Strength Model.

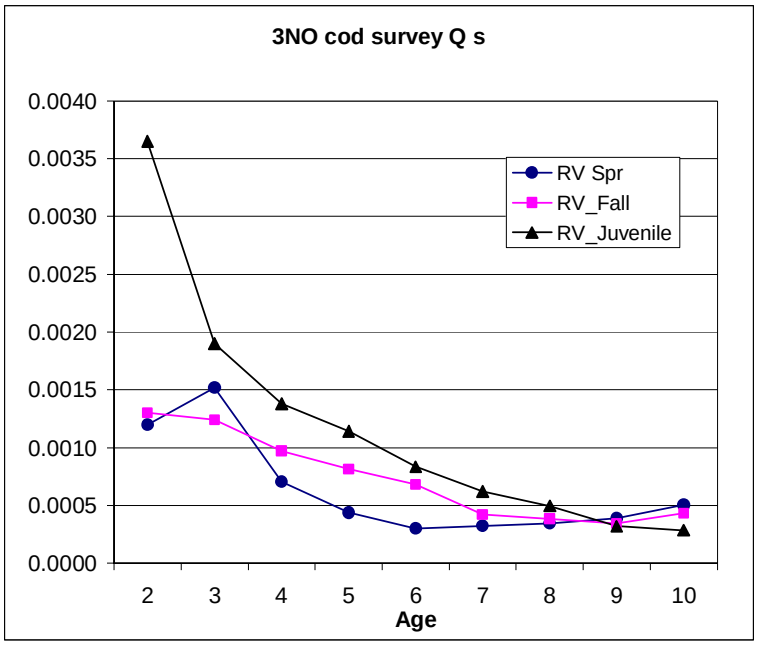

Fig. 13. Estimated Catchabilities from ADAPT.

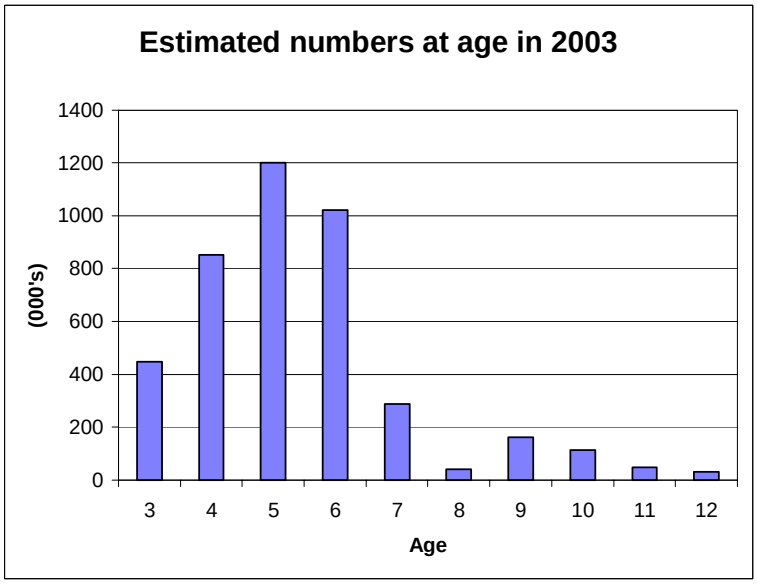

Fig. 14. Estimated survivors from ADAPT.

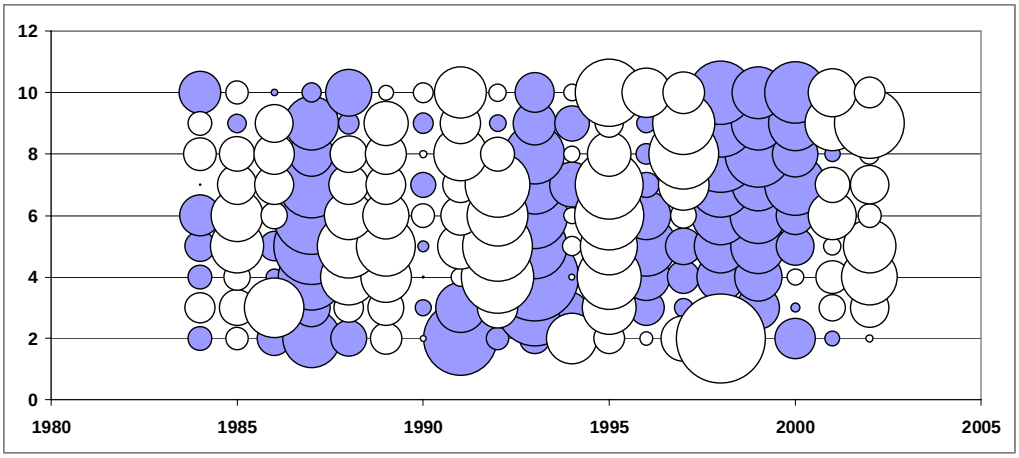

Fig. 16a. RV Spring Residuals at age. Positive residuals have shaded bubbles.

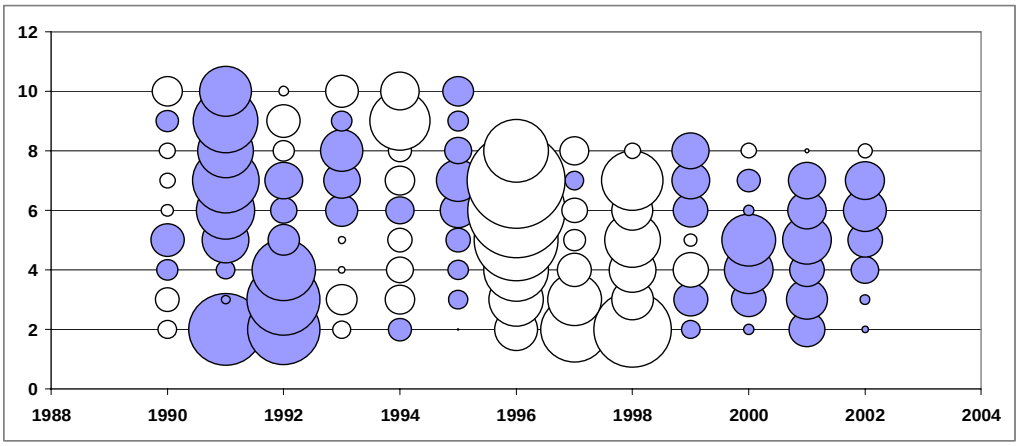

Fig. 16b. RV Fall Residuals at age. Positive residuals have shaded bubbles.

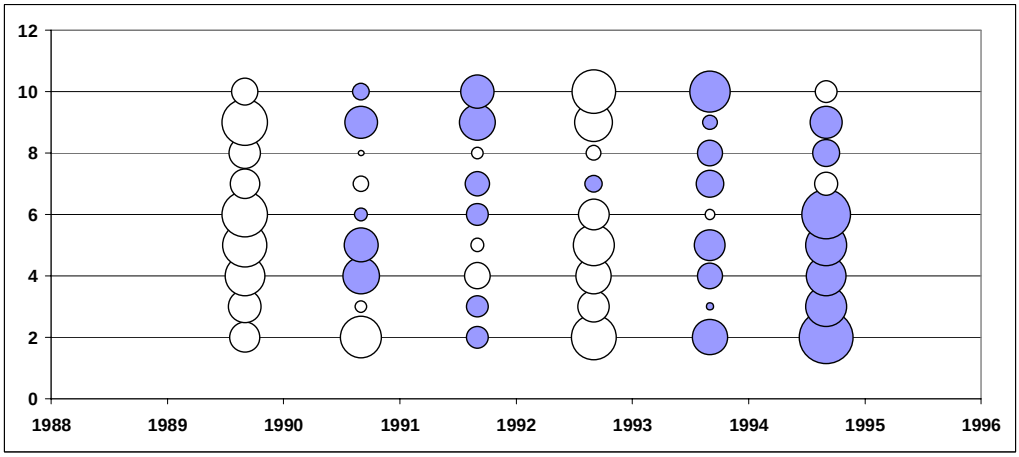

Fig. 16c. RV Juvenile Residuals at age. Positive residuals have shaded bubbles.

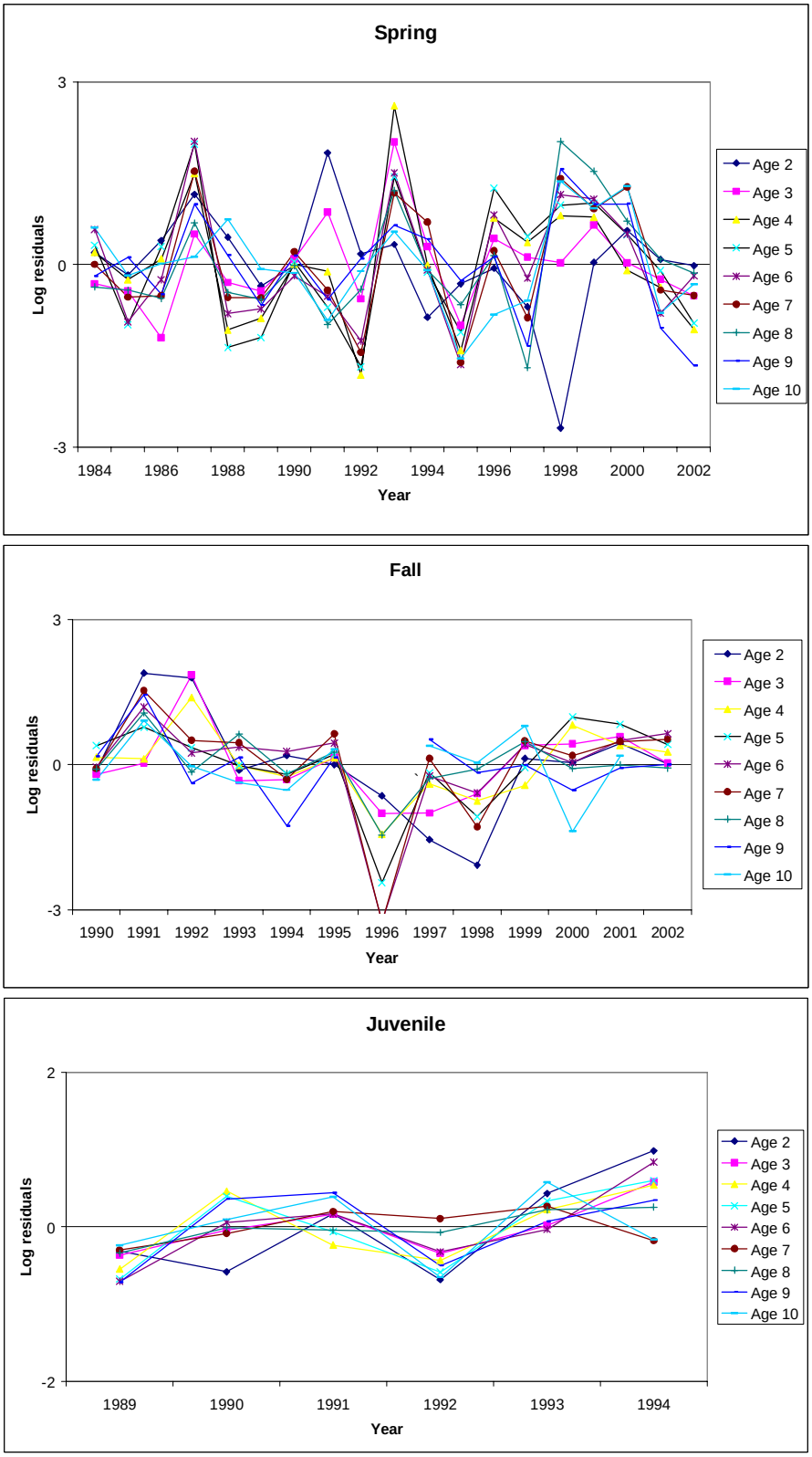

Fig. 17. Residuals at age for each survey.

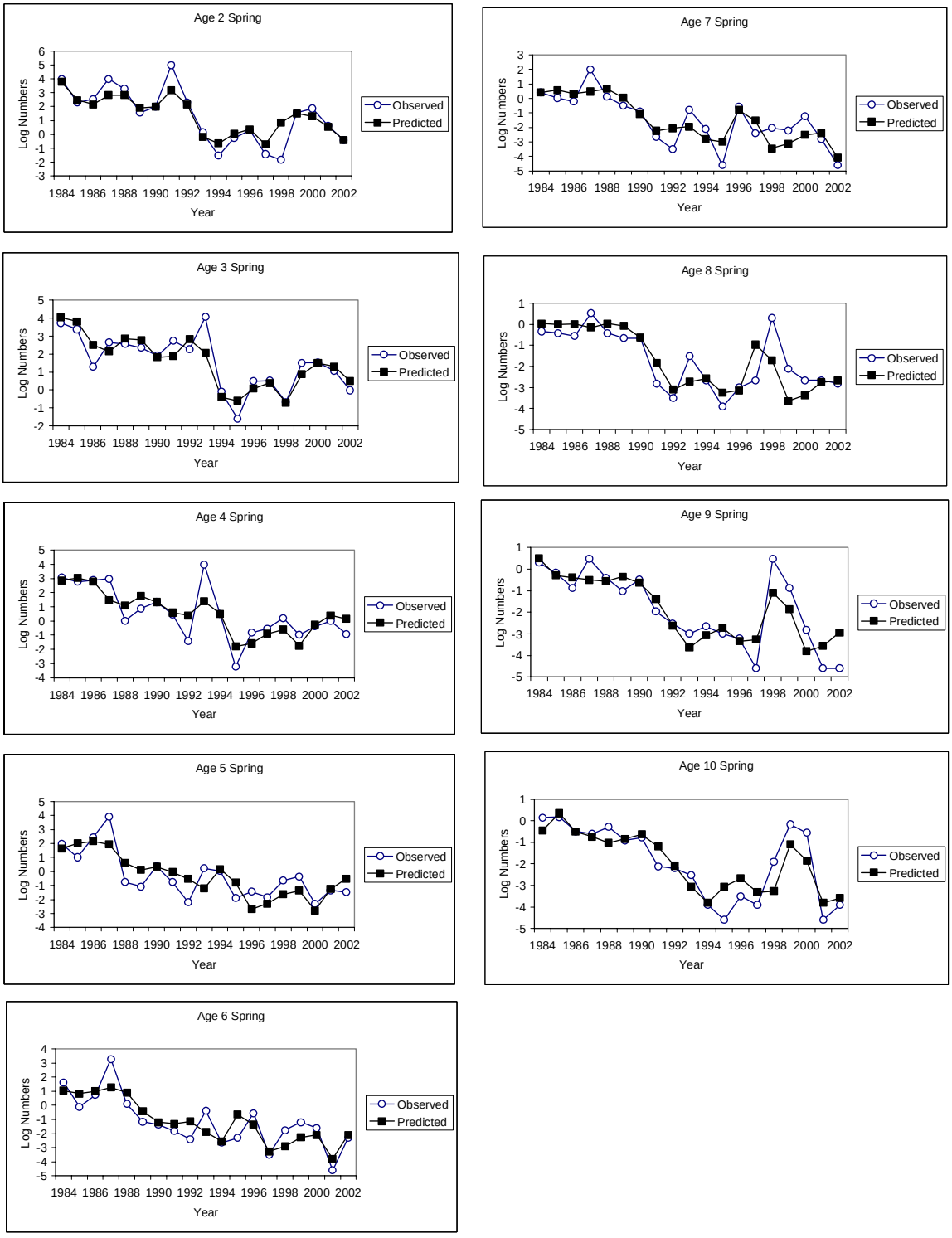

Fig. 18a. Age by age observed and predicted log abundance index over time from Canadian spring surveys for cod in Div. 3NO.

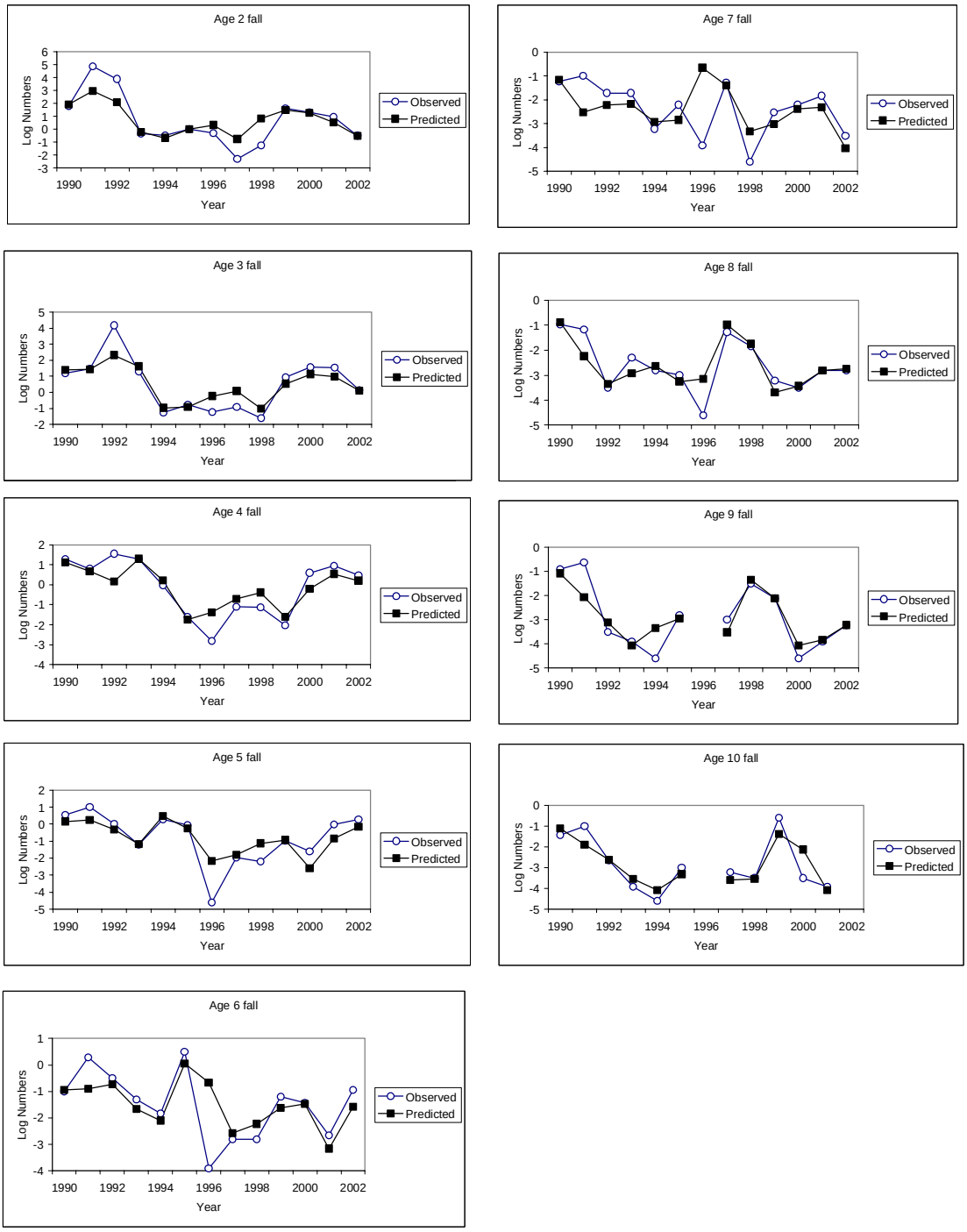

Fig. 18b. Age by age observed and predicted log abundance index over time from Canadian fall surveys for cod in Div. 3NO.

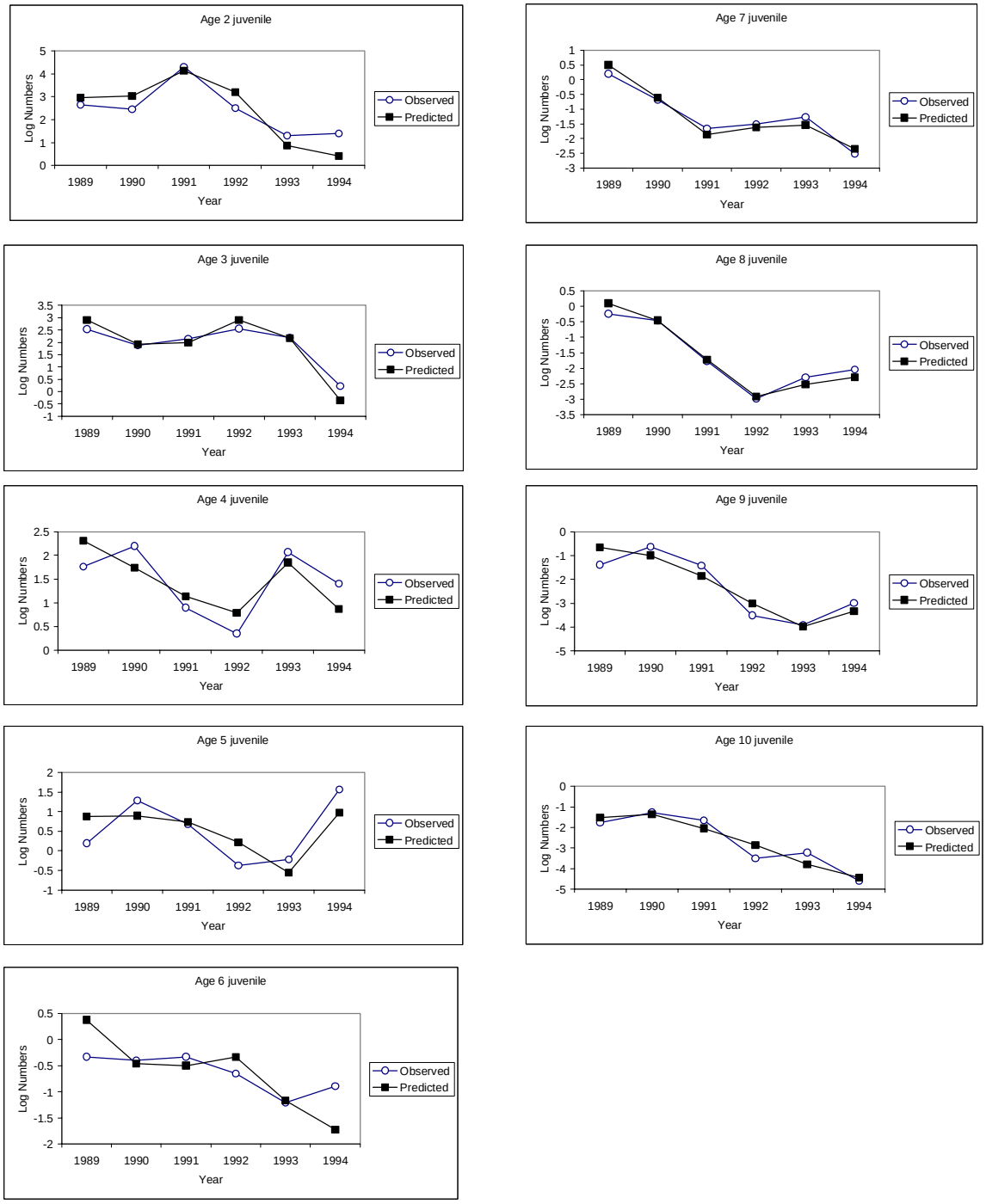

Fig. 18c. Age by age observed and predicted log abundance index over time from Canadian juvevile surveys for cod in Div. 3NO.

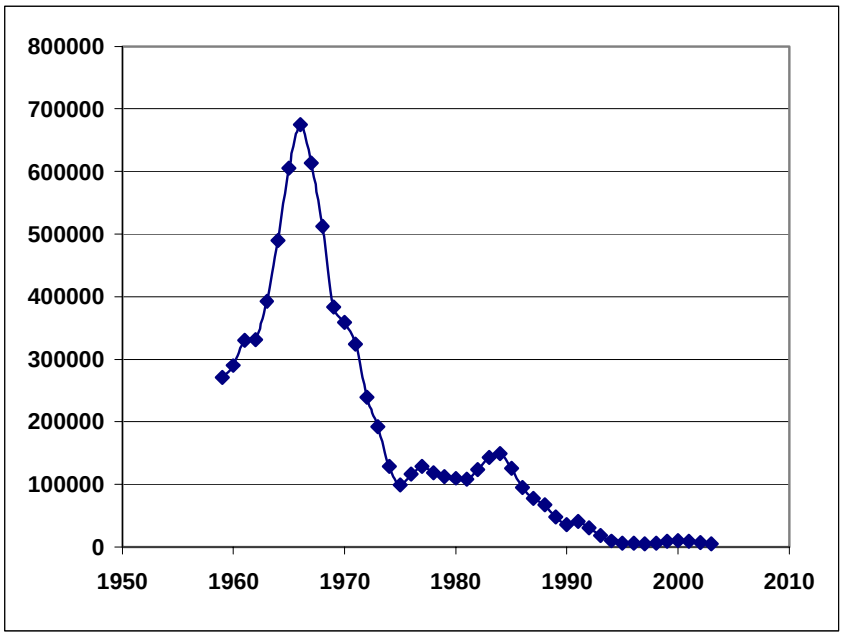

Fig. 19. Population Abundance for cod in Divs. 3NO (000's) as estimated from ADAPT.

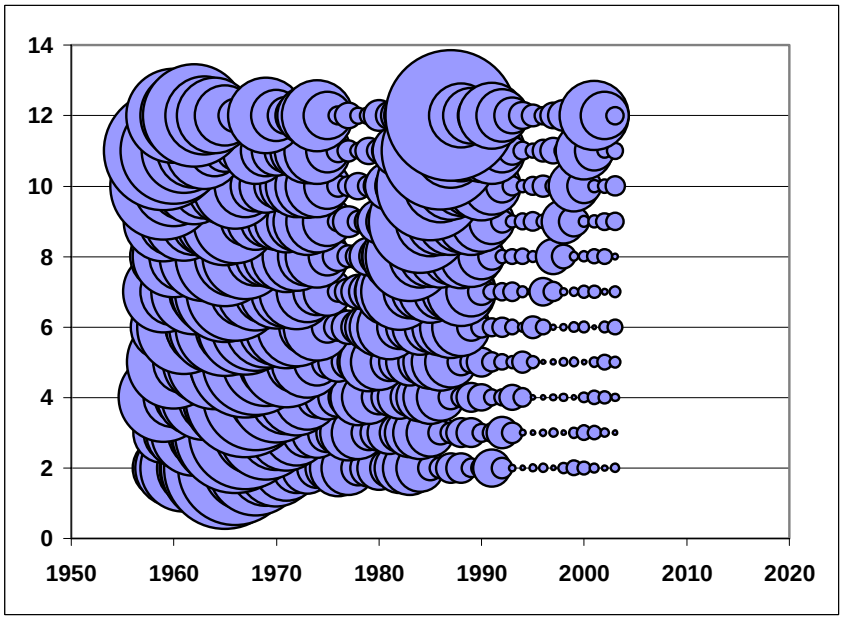

Fig. 20. Population Abundance at age as estimated from ADAPT. Bubble sizes are age-specific (separate scaling for each age).

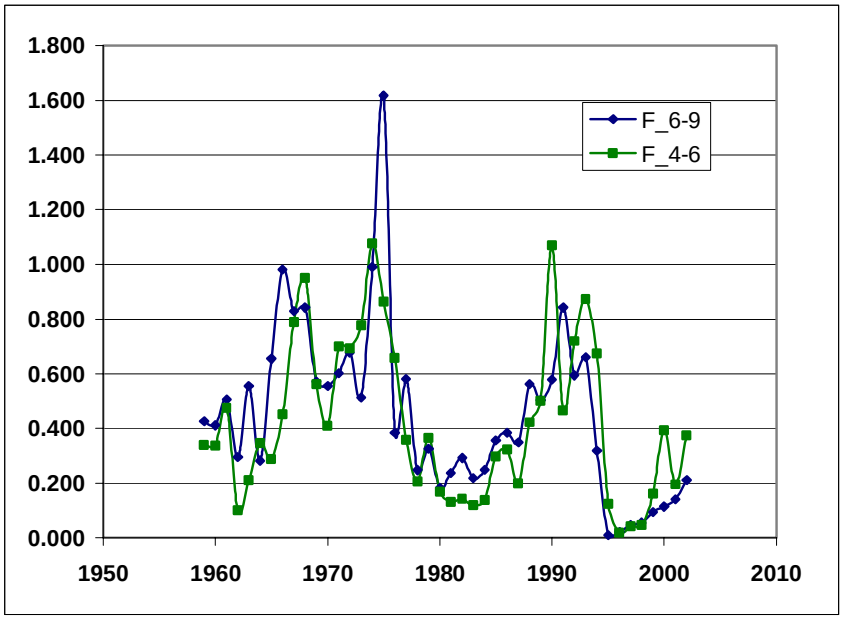

Fig. 21. Fishing Mortality for cod in Div. 3NO as estimated from ADAPT.

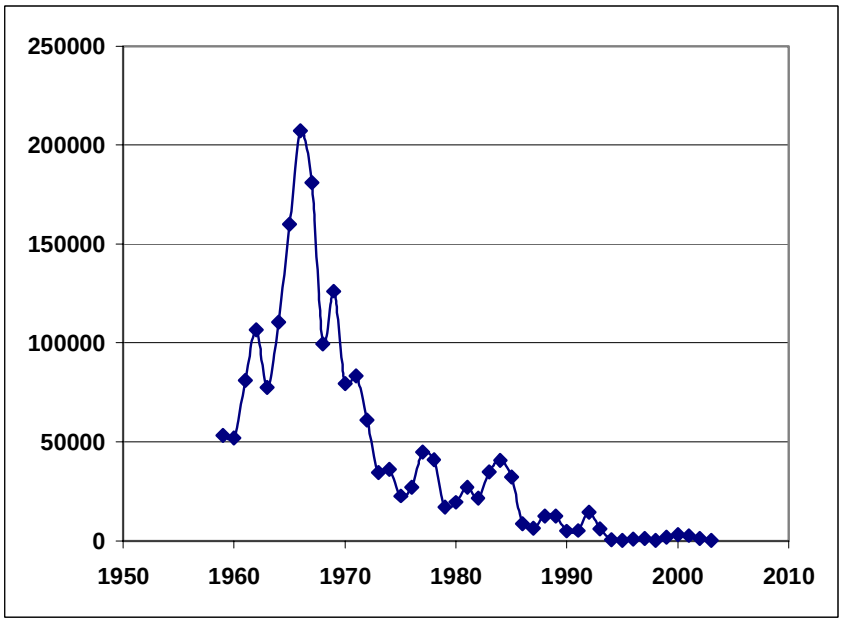

Fig. 22. Recruits at Age 3 (000's) for cod in Div. 3NO as estimated from ADAPT.

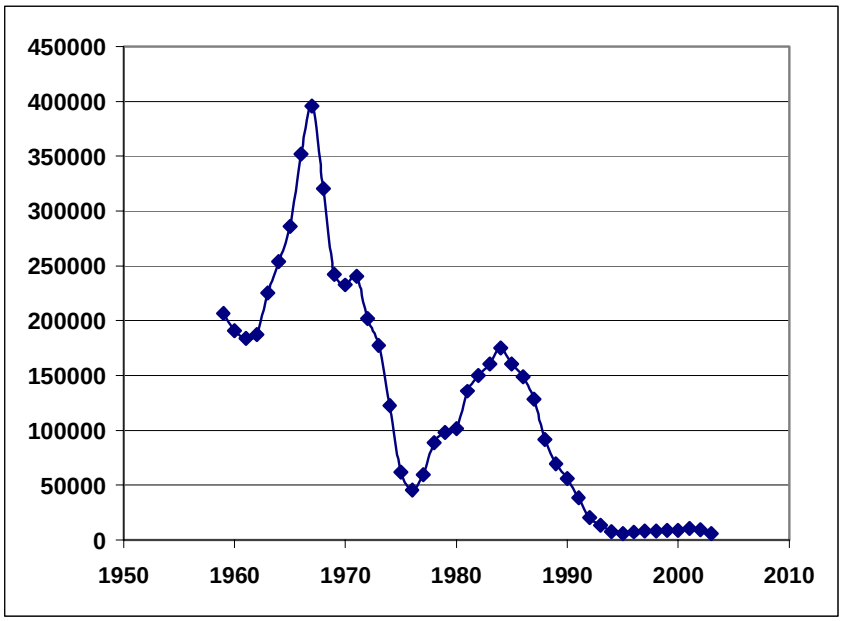

Fig. 23. Population Biomass for cod in Div. 3NO (t) as estimated from ADAPT.

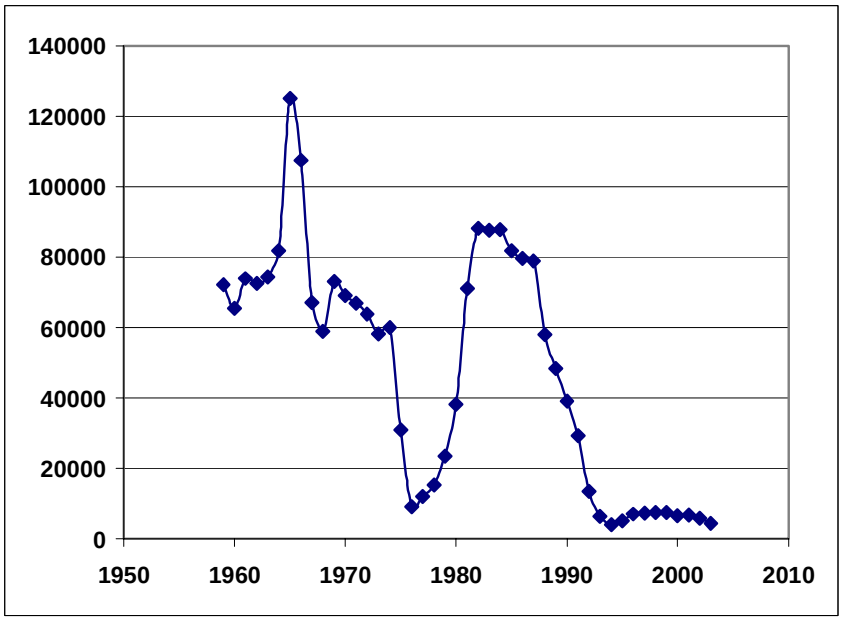

Fig. 24. Spawner Biomass (t) for cod in Div. 3NO as estimated from ADAPT.

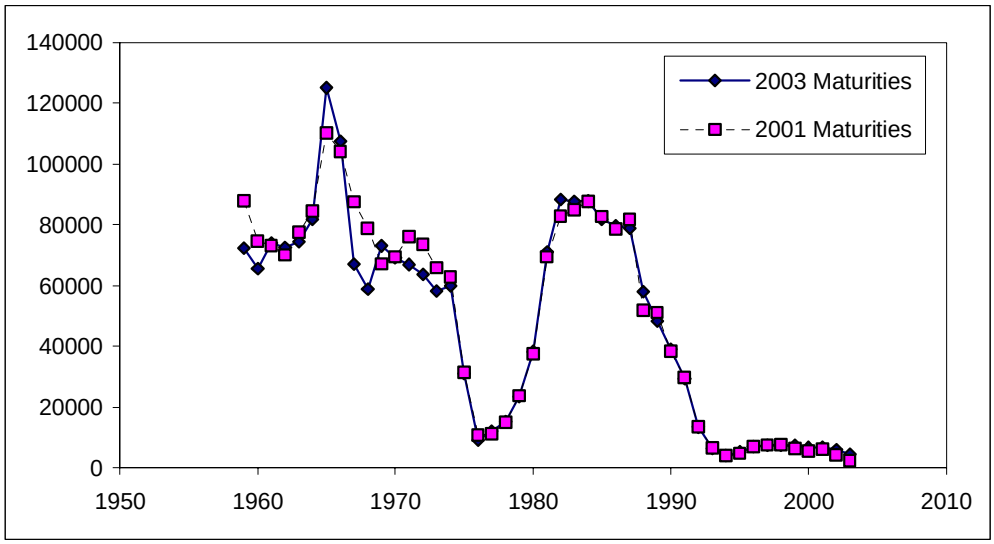

Fig. 25. Comparison of Spawner Biomass trends using the maturities of the 2001 assessment (modeled annually) and those of the present assessment (modeled by cohort).

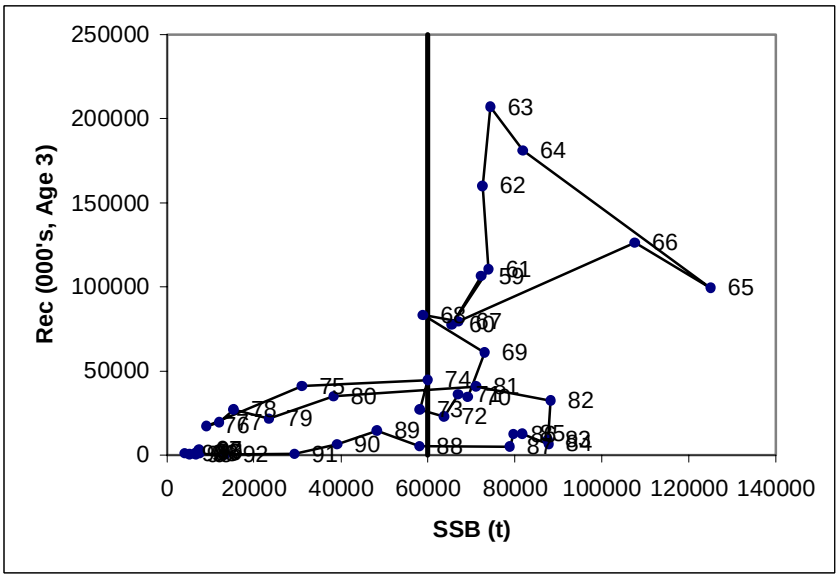

Fig. 26. Stock-Recruit scatter for cod in Div. 3NO.

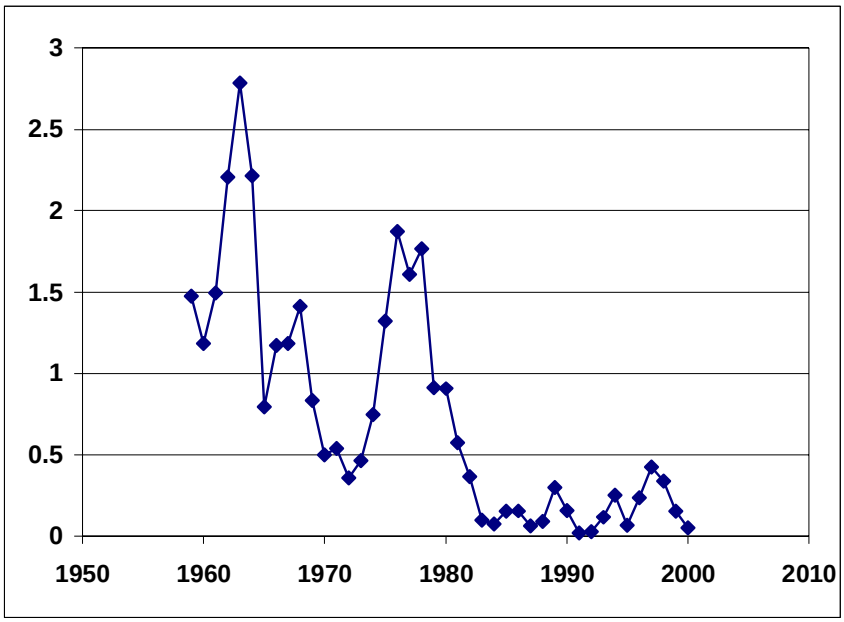

Fig. 27. Recruits per spawner for cod in Div. 3NO as estimated from ADAPT.

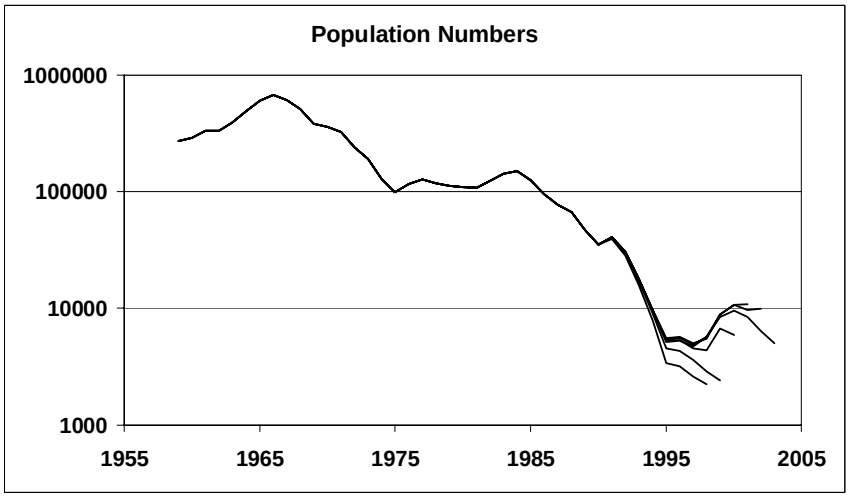

Fig. 28. Retrospective estimates of population numbers (log scale) for cod in Div. 3NO.

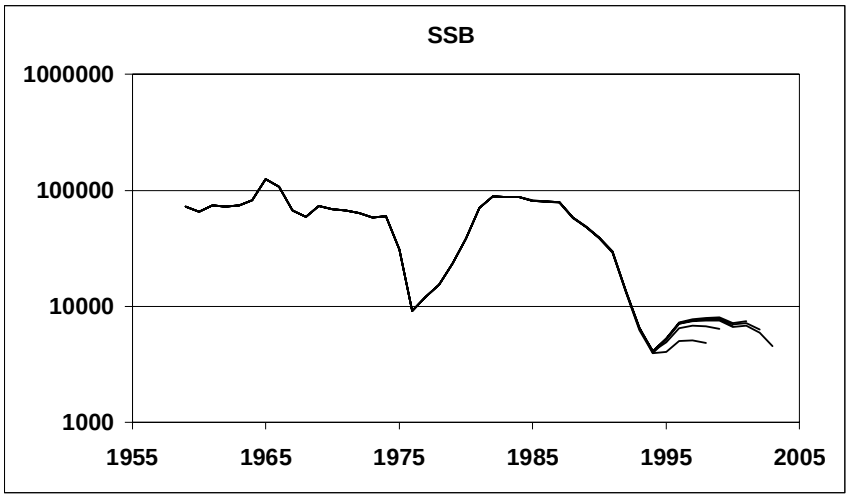

Fig. 29. Retrospective estimates of spawner biomass (log scale) for cod in Div. 3NO.

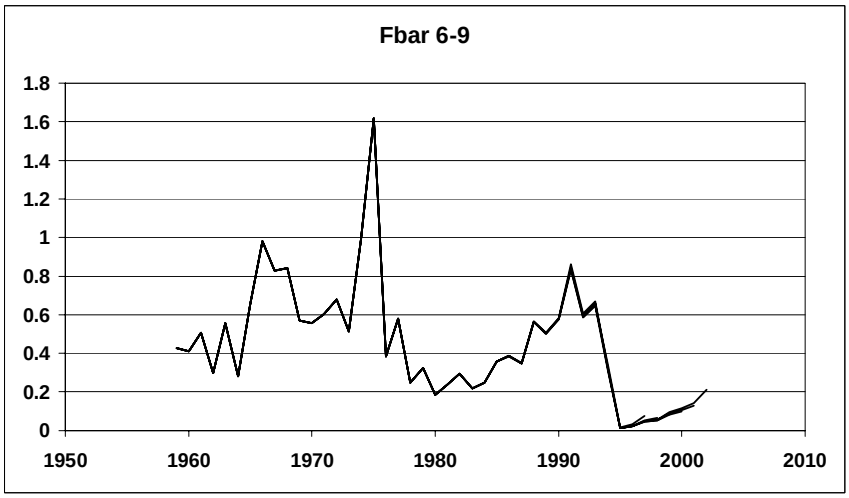

Fig. 30. Retrospective estimates of fishing mortality for cod in Div. 3NO.

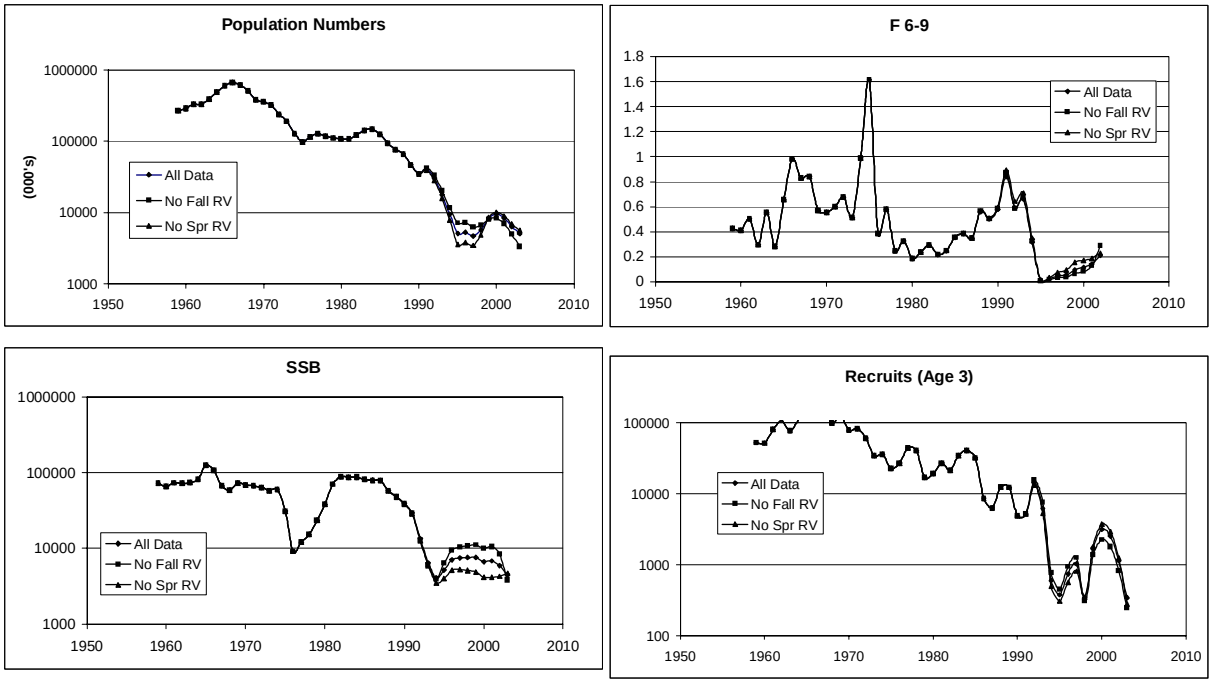

Fig. 31. Exploratory Assessments for cod in Div. 3NO. Legend indicates the survey data included (All Data=Canadian RV Fall, Canadian RV Spring, and Canadian Juvenile survey).

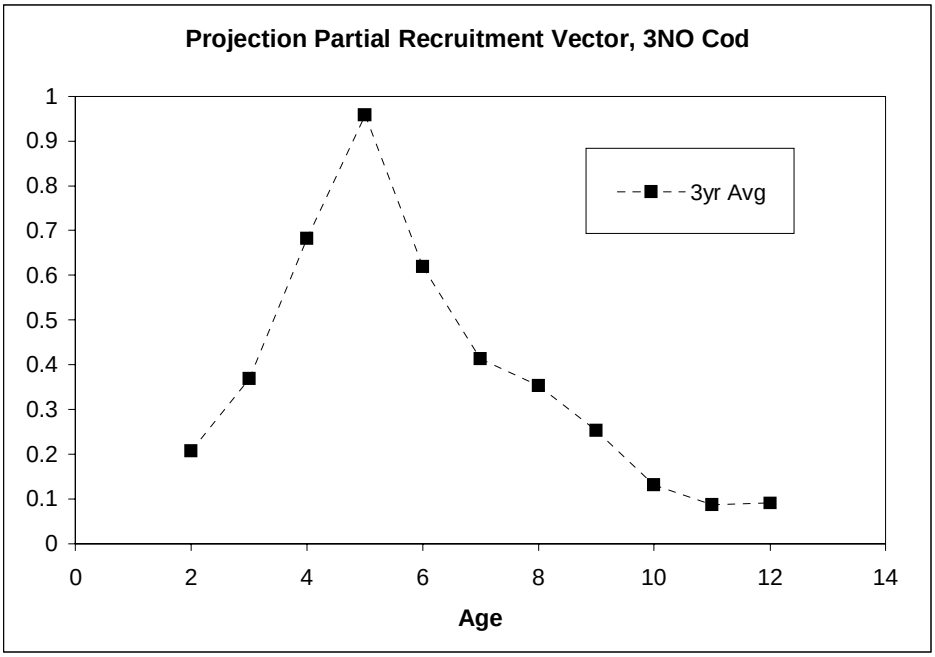

Fig. 32. Three year average partial recruitment vector, from estimated fishing mortalities.

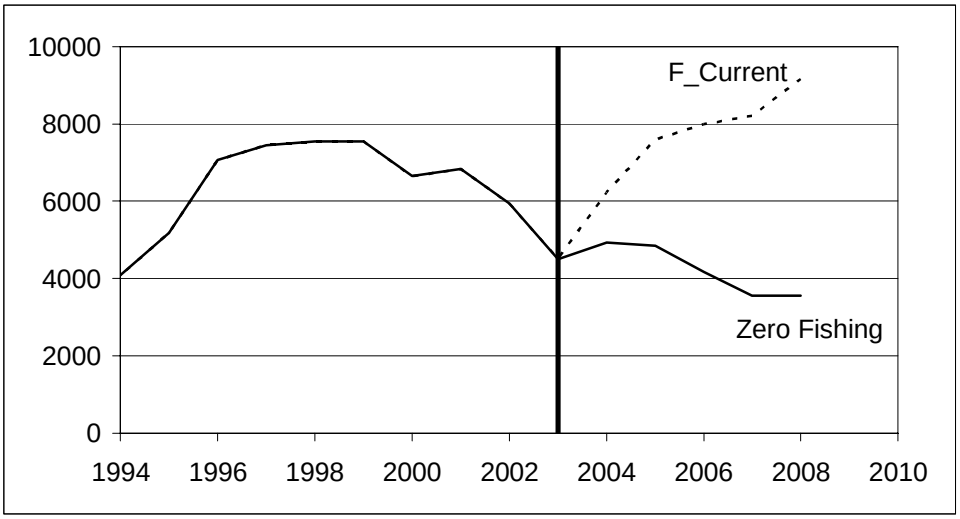

Fig. 33. Deterministic Projection of cod SSB in Div. 3NO using a three-year average of Jan. 1 weight-at-age, under F = 0 and $F_{current}$. Maturities come from Table 20.