Northwest Atlantic Fisheries Organization

Serial No. N6812 **NAFO SCR Doc. No. 18/028**

SCIENTIFIC COUNCIL MEETING – JUNE 2018

An Assessment of the Cod Stock in NAFO Divisions 3NO

by

R.M. Rideout, B. Rogers, D.W. Ings

Abstract

Cod in Divisions 3NO inhabit the southern Grand Bank of Newfoundland. The stock declined dramatically during the mid-1980's and has been under a fishing moratorium since 1994. Estimates from a population model utilizing the ADAPTive framework (Gavaris 1988) indicate that the spawner biomass increased from 2010-2015 but has subsequently declined and the 2018 estimate of 18,537 t represents only 31% of Blim (60,000 t). Fishing mortality (ages 4-6) has been low and well below F_{lim} (0.3) for over a decade. The strong 2006 year class observed in previous assessments continues to be strong in 2017 and at ages 12 makes up more than 60% of the total spawner biomass. More recent year classes, however, do not appear strong, which raises concern for the stock going forward. Because the current model formulation does not include a plus-group, the strong 2006 year class would be 'artificially' removed from the population in any attempt to project the stock forward. Therefore projections for the stock were not performed and a modification of the assessment model to include a plus-group is strongly recommended for the next assessment.

Introduction

The Divisions 3NO cod stock occupies the southern part of the Grand Bank of Newfoundland. Fish are distributed over the shallower parts of the bank in summer, particularly in the Southeast Shoal area (Div. 3N), and on the slopes of the bank in winter when cooling occurs. Some seasonal mixing between fish in Division 3O and Subdivision 3Ps may occur. This stock has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994. 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.

This assessment updates the status of the stock, based primarily on a population model incorporating Canadian spring and fall research vessel surveys conducted in Div. 3NO. Population and spawner stock biomass estimates for 1959-2017 are provided from ADAPT utilizing the catch at age and calibrated using three Canadian research vessel surveys.

Nominal catch and catch at age

Catches from this stock peaked at 227,000 tons (t) in 1967, mainly by the former USSR and Spain, but declined steadily thereafter to 15,000 t in 1978. From 1979 to 1991 catches ranged from 20,000 to 50,000 t (Table 1, Fig. 1). A consecutive decline in TAC's in the early 1990's reduced catches to a level of about 10,000 t in 1993 the last full year of a directed fishery. Total catches since the moratorium (Table 1, Fig. 1), increased from 170 t in 1995, peaked at about 4 800 t in 2003 and have been between 600 t and 1100 t since that time. The total

catch in 2017 was 637 t. The Canadian catch in 2015 and 2016 made up 26% and 22% respectively of the total catch and was taken predominantly (80%) as bycatch from the yellowtail flounder bottom trawl fishery (Table 2).

Commercial sampling data for 2015-2016 were available from Spanish (González-Costas et al., MS 2016, 2017), Portuguese (Vargas et al., MS 2016, 2017), Russian (Fomin and Pochtar MS 2016, MS 2017) and Estonian (Tõrra et al. MS 2016, Hubel and Sirp MS 2017) otter trawl fisheries. Data were not available from the Portuguese trawl fishery in 2017 and data were inadequate or not available from Canadian fisheries in 2015-2017. Therefore, length frequency data from Spain (130 mm and 280 mm combined) were applied to Canadian catches in 2015-17, since similar ages were historically sampled by Canada and Spain. Likewise, length frequency data from Spain (130 mm) were applied to the Portuguese catch in 2017. The total catch-at-age from by-catches in 2015-2017 (Fig. 2) was compiled in the most judicious manner possible given the sampling deficiencies noted (Table 3). The catch-at-age for non-Canadian fleets was constructed by applying Canadian survey age length keys to the available length sampling. A review of the sampling over the period 1995-2016 used to produce a catch-at-age for this stock (Table 4) indicates considerable sampling deficiencies. Various methods have been used in this and previous assessments to compensate for these sampling deficiencies but it is emphasized here that the inadequate sampling of commercial catches has complicated the estimation of (and raised concerns over the reliability of) catch-at-age and commercial weights at age. The current assessment model assumes that estimates of catch numbers are accurate and therefore the poor commercial sampling may add unaccounted for uncertainty to the model outputs. Estimates of catch-at-age and mean weights-at-age from the fisheries in the 1959-2017 period are presented in Table 4 and Table 5.

Research vessel survey data

Stratified-random bottom trawl surveys have been conducted in spring by Canadian research vessels in Divs. 3N and 3O since 1971 and 1973, respectively, with the exceptions of 1983 in Div. 3N, and 1974 and 1983 in Div. 3O. The stratification scheme used for these surveys is based on depth (Fig. 3, Table 6). The surveys from 1991 onwards covered areas to a maximum of 732m (400 fathoms) but prior to this only covered to a maximum of 367m (200 fathoms). In 2006 survey coverage was incomplete and the 2006 spring survey is not considered an index of population size. Surveys from 1971 to 1982 were conducted by the research vessel *A.T. CAMERON* and those since 1984 were conducted primarily by the *WILFRED TEMPLEMAN* or its sister ship *ALFRED NEEDLER* (Table 7). The 2015 and 2017 spring surveys were conducted by the Alfred Needler and the 2016 survey was conducted by the *TELEOST.* All index strata were covered in these surveys (See Rideout and Ings 2018 for details on set coverage for these surveys).

Autumn surveys have been carried out in Divisions 3NO from 1990 to 2008 using the *WILFRED TEMPLEMAN* for strata less than 732 m. Starting in 1995 the *Teleost* was used for sampling strata greater than 732m to a maximum depth of 1463m (800 fathoms), but coverage has not been consistent in these greater depths. Because of vessel difficulties in 1996 the *ALFRED NEEDLER* conducted the survey in strata less than 732m. In 2009 the autumn survey was conducted by the *ALFRED NEEDLER* with only partial coverage of Div. 3N strata greater than 732m by Teleost. The Autumn survey of Divisions 3NO in 2014 was not completed due to vessel mechanical issues. All index strata were completed in 2015 and 2017. In 2016, one index stratum (stratum 336) was not completed (only one successful set). Details on the number of successful sets for each survey are available in Rideout and Ings 2018.

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

The location of fishing sets for the Spring and Autumn surveys and the standardized total weight of fish caught at each station are demonstrated in Fig. 4 and Fig. 5 respectively. It is clear from these plots that the largest

survey catches of 3NO cod in recent years have come from southern 3N in the NAFO Regulatory Area. However, catches in the NRA in 2015 and 2016 were not as large as those in the two years prior. The lack of large fishing sets results in lower stratum-specific estimates of biomasses (Fig. 6 and Fig. 7).

Abundance and biomass estimates for the entire stock area are presented in Table 8-Table 15. Trends in the total abundance and biomass estimates are plotted for the index strata (<200 fathoms) in Fig. 8-Fig. 9. Spring abundance and biomass estimates were extremely low in both Div. 3N and Div. 3O from 1994 to about 2006. Survey indices increased after 2006, particularly from 2011-2014 and particularly in Div. 3N, but the 2015-2016 estimates are much lower. The swept area survey biomass estimate from index strata (<200 fathoms) surveyed in 3NO combined for 2016 spring is 16,788 t and for autumn is 46,667 t.

Analysis

Maturity at age

Annual proportion mature was modeled by fitting a probit model with a logit link function by cohort to observed proportions mature at age from sampling conducted during Canadian spring surveys. The model fitted the data for all cohorts from 1953 to 2011, except for the 1991 and 2000 cohorts. The estimated age at 50% maturity (A50) ranged between 5.6 and 7.4 years for cohorts produced from the 1950's to 1980's (Fig. 10). Age at 50% maturity declined between 1980 and the late 1990's from approximately 6.8 to 4.5. Age at 50% maturity increased from about 4.5 years in the late 1990s to over six years of age in the mid-2000s, but in subsequent years has decreased again to just above five years of age. The estimated proportion of females mature at age from the fitted cohort model is given in Table 19. Estimates for the 1991 and 2000 cohorts were produced by averaging the observed proportions from the two adjacent years. As the estimation is by cohort, special considerations are needed to fill the older ages for the starting years, and also for the younger ages for current years. These values were produced by averaging estimates from the 3 previous and 3 subsequent years for the appropriate age (shaded cells in Table 19). Estimated annual maturities for 1975-2017 are plotted (Fig. 11) to show trends for selected ages. These trends generally reflect the overall change in size at maturity.

Sequential Population Analysis

Survey Indices: Cohort Tracking

The assessment of this stock utilizes a sequential population analysis applying the ADAPT framework (Gavaris 1988) estimation of population size. Before updating the assessment, cohort tracking and consistency within the survey data are explored by a number of illustrative and standardized age-disaggregated plots, including (a) age-disaggregated plots of mean number per tow 3NO, (b) pair-wise scatter plots and correlations of age-disaggregated survey data (log-scale) and (c) standardized proportions by age across years (SPAY). In the SPAY plots the annual index proportions were standardized at each age to have a mean of 0 and a variance of 1.

For the Canadian Spring survey, the 1989 and 1990 year classes were the most dominant in the series from 1990 to 2008 (Fig. 12) but at different ages. For example, the 1989 year class was dominant at ages 2, 4, 7, 9 and 10 whereas the 1990 year class was dominant at ages 3 and 8. The 2006 year class shows up strong as age 3 in 2009. In 2015 and 2016 this cohort continued to show up as strong at ages 9 and 10 respectively. Pairwise plots and correlations (Fig. 13) indicate generally good tracking between ages for cohorts.

For the Canadian Autumn survey the 1989 and 1990 year classes were amongst the most dominant in the series (Fig. 15) and also illustrate a similar pattern as the spring. The 1989 year class was dominant at ages except 7 whereas the 1990 cohort is only dominant at age 7, 8. The 1997 and/or 1998 cohorts were also very apparent at ages 3-9, something not so obvious in the spring series. A decline in density is also quite dramatic by age 5 for most cohorts. The pairwise plots and correlations (Fig. 16) also indicate generally good tracking between ages for cohorts although correlations were not as good as in the spring.

Standardized indices by age for the Canadian Spring and Autumn surveys are compared in Fig. 18. The EU-Spain survey is also included for comparison. The results indicate generally good tracking for the Canadian surveys.

ADAPTive Framework

The catch at age (Table 4) was used in a sequential population analysis applying the ADAPT framework (Gavaris 1988). The catch for age 2 is from the NAFO SCR Docs series presented from 1988 to 1998. Zero catch was assumed for age 2 in years 1959-1987. Due to inadequate sampling of removals, total catch for 1996-1998 was proportioned by age using the average partial recruitment vector from 1990-93 (from a previous ADAPT run) with the fully recruited *F* estimated from a catch projection so as to match the observed catch. Catches since that time have been based on fishery sampling although for some contracting parties constructing catch at age required using Canadian RV age-length keys (see Table 3).

The ADAPT was calibrated with Canadian RV survey indices at age from spring 1984-2005 and 2007-2017 (Table 16), autumn 1990-2013 and 2015-2017 (Table 17) and a Canadian juvenile survey 1989-94 (Table 18) to estimate population numbers $N_{i,t}$,

where *i* = 3 to 12, for *t* = 2018 (10 parameters) and *i* =12, for *t*=1994 to 2017 (24 parameters),

and Catchabilities

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

The following structure was imposed:

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

Input data were:

Catch numbers at age,
Ci,t where i = 2 to 12 and t = 1959 to 2017 ,
Canadian Research Vessel survey estimates of mean numbers per tow-at-age (Campelen or Campelen equivalent values),
RV1i,t where i = 2 to 10 and t = 1984 to 2005 and 2007-2017, spring
RV2i,t where i = 2 to 10 and t = 1990 to 2013 and 2015-2017, autumn
and Canadian juvenile Research Vessel survey estimates of mean numbers per tow-at-age (Yankee 41.5 shrimp trawl in August – September)
RV3i,t where i = 2 to 10 and t = 1989 to 1994 .

The objective function minimized is

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

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

This particular model formulation was selected since it follows the accepted VPA from the last assessment in 2015 and effectively deals with problems associated with zeros in the catch matrix at the age 12 (by estimating survivors at age 12 in these years). The statistics associated with the ADAPT output are given in Table 20. The mean square error of the residuals of the model fit was 0.611 based on an estimation of 61 parameters. For the

survivors estimated in 2018, the relative error in the parameter estimates decreased with age from a high of 57% at age 3 to 25-27% at ages 8-12.

The estimated survey catchabilities (q's) with associated standard errors are also provided in Table 20 and Fig. 19. Survey catchabilities (q's) generally decrease with age for all three surveys with the spring and autumn tending to having similar q's for ages 7-10. The Yankee 41.5 (juvenile survey) catchability for age 2 is much higher than that for the Campelen surveys.

Diagnostic residual plots from the ADAPT run are presented in Fig. 20-Fig. 21. Overall the spring and autumn surveys show little pattern in the residuals, although there are some year effects. These are evident in the spring survey in 1987, 1993, 1996 and 1998 (mostly positive) and 1989, 1995, 2002 (mostly negative). The fall 1997 estimates have large negative residuals, particularly for ages 5, 6 and 7. The 2017 autumn survey has relatively large negative residuals for older ages.

Bias-adjusted estimates of population numbers (Fig. 22) and fishing mortality at age (Fig. 23) are given in Table 21 and Table 22 respectively. The age 2 value in 2018 is the geometric mean of the 2015-2017 age 2 estimates from the ADAPT. Population numbers remain low. There was a small increase between 2006-2008 but there has been declining trend since that time. No good recruitment (Fig. 24) has been observed since 2009 (i.e. the 2006 year class). Fishing mortality (Table 22, Fig. 23) on the prominent age groups in the fishery has been very low for over a decade.

Beginning of year mean weight-at-age calculated from the commercial catch is presented in Table 23. These weights are used to calculate biomass, given in Table 24. Stock biomass reached an historic low in 1995. Biomass slowly increased over the 2004-2012 period, reaching a high value of over 26,000 t, and has subsequently declined to an estimated 21,000 t in 2018. The maturities computed from the cohort model were applied to the population numbers to compute the spawning stock biomass (Table 25, Fig. 25). SSB increased from 2010-2015, reaching a high of 23,299 t, and subsequently declined to an estimated 18,537 t in 2018 (31% of Blim (60,000 t)). Due to the poor strength of post-2006 year classes, the relatively strong 2006 year class, which are now 12 years old, still make up 61% of the estimated SSB in 2018.

Retrospective analysis

A retrospective analysis was conducted to investigate whether systematic trends were apparent in the population modeling. A 5 year period was chosen to evaluate whereby a complete year of data was removed, one year at a time in succession (for catch at age and survey indices at age), and the estimation with identical structure to the VPA formulation above was repeated for each case. In general, retrospective patterns are not large but in some cases there is evidence of a relatively consistent bias in the retrospective plots (Fig. 26).

Projections

The current formulation of the ADAPT assessment model estimates numbers at age for ages 3-12. There is no plus group so fish beyond age 12 are not part of the virtual population and as far as the model is concerned do not exist. In the current assessment, fish of age 12 belong to the 2006 year class, which remains strong relative to other more recent cohorts and comprises over half of the estimated SSB in 2018. Because these fish would become age 13 in 2019 and be excluded from the virtual population, any projection forward of the stock would result in a sharp and artificial decline in SSB between 2018 and 2019. Therefore no projections of the stock are presented. Reformatting the assessment model to include older ages in the form of a plus-group is considered a priority for this stock.

References

Fomin, K., and Pochtar, M. 2016. Russian Research Report for 2015. SCS Doc. 16/10. Ser. No. N6562.

Fomin, K., and Pochtar, M. 2017. Russian Research Report for 2016. SCS Doc. 17/11. Ser. No. N6686.

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

González-Costas F., Ramilo,G., Román, E., González-Troncoso, D., Casas, M., Sacau, M., Guijarro, E., and Lorenzo, J. MS 2017. Spanish Research Report for 2016. NAFO SCS Doc. 17/4, Ser. No. N6656.

González-Costas F., Ramilo,G., Román, E., Casas, M., Sacau, M., Guijarro, E., González-Troncoso, D., and Lorenzo, J. MS 2016. Spanish Research Report for 2015. NAFO SCS Doc. 16/5, Ser. No. N6539.

Hubel, K., Sirp, S. 2017. Estonian Research Report for 2016. NAFO SCS Doc. 17/09, Ser No N6681.

Rideout, R.M., Ings, D.W., Brattey, J., and Dwyer, K. 2015. An assessment of the cod stock in NAFO Divisions 3NO. NAFO SCR Doc. 15/34, Ser. No. N6460.

Rideout, R.M., Ings, D.W. 2018. Temporal And Spatial Coverage Of Canadian (Newfoundland And Labrador Region) Spring And Autumn Multi-Species RV Bottom Trawl Surveys, With An Emphasis On Surveys Conducted In 2017. NAFO SCR Doc. 18/17.

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.

Stansbury, D.E., P.A. Shelton, E.F. Murphy and J. Brattey. MS 1999. An assessment of the cod stock in NAFO Div. 3NO. NAFO SCR Doc. 99/62 (revised), Ser No. N4121, 41p.

Tõrra, T., Sirp, S., and Hubel, K. MS 2016. Estonian Research Report for 2015. NAFO SCS Doc. 16/08, Ser. No. N6554.

Vargas, J., Alpoim, R., Santos, E. and Ávila de Melo, A.M. MS 2016. Portuguese Research Report for 2015. NAFO SCS Doc. 16/09, Ser. No. N6555.

Vargas, J., Alpoim, R., Santos, E. and Ávila de Melo, A.M. MS 2017. Portuguese Research Report for 2016. NAFO SCS Doc. 17/05, Ser. No. N6658.

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.

Year	Canada	Others	Total	TAC
1953	39884	26313	66197	
1954	17392	117369	134761	
1955	6053	108303	114356	
1956	5363	59519	64882	
1957	9641	80549	90190	
1958	4812	43239	48051	
1959	3687	60683	64370	
1960	3408	76269	79677	
1961	5428	67296	72724	
1962	3235	31749	34984	
1963	5079	64663	69742	
1964	2882	61579	64461	
1965	4229	94958	99187	
1966	6501	102418	108919	
1967	3446	223338	226784	
1968	3287	162224	165511	
1969	3664	114041	117705	
1970	4771	106790	111561	
1971	2311	123985	126296	
1972	1736	101638	103374	
1973	1832	78597	80429	103000
1974	1360	72029	73389	101000
1975	1189	42985	44174	88000
1976	2065	22218	24283	43000
1977	2532	15072	17604	30000
1978	6246	8472	14718	15000
1979	9938	17913	27851	25000
1980	5589	14402	19991	26000
1981	6096	18248	24344	26000
1982	10185	21420	31605	17000
1983	11374	17445	28819	17000
1984	8705	18398	27103	26000
1985	18179	18720	36899	33000
1986	18035	32610	50645	33000
1987	18652	22967	41619	33000
1988	19727	23423	43150	40000
1989	13433	19782	33215	25000
1990	10620	18226	28846	18600
1991	12056 [2]	17396 [3]	29454	13600
1992	7859	4893 [3]	12752	13600
1993	5370	5276 [3]	10646	10200
1994	47	2655 [3]	2702	6000 [5]
1995	64	108 [3]	172	ndf
1996	99	75 [3]	174	ndf
1997	286	97 [3]	383	ndf
1998	396	151 [3]	547	ndf
1999	568	351 [3]	919	ndf
2000	207	843 [3]	1050	ndf
2001	560	750 [3]	1310	ndf
2002	444	1750 [3]	2194	ndf
2003	818	4052 [3]	4870 [4]	ndf
2004	442	492 [3]	934	ndf
2005	461	263 [3]	724	ndf
2006	108	492 [3]	600	ndf
2007	203	645 [3]	848	ndf
2008	247	676 [3]	923	ndf
2009	165	918 [3]	1083	ndf
2010	107	839 [3]	946	ndf
2011	44	823	867	ndf
2012	26	708	734	ndf
2013	226	887	1113	ndf
2014	197	537	734	ndf
2015 [1]	151	435	586	ndf
2016 [1]	147	519	666	ndf
2017 [1]	91	558	649	ndf

[1] Provisional

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

[3] Includes estimates by Canadian Surveillance and by NAFO Scientific Council.

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

[5] There has been no directed fishery since February 1994.

Table 2. Cod landings (t) by month and gear from NAFO Divisions 3NO by Canada in 2015-2017.

	Canada (N)						Canada (M)				
2015	3N		3O				3N		3O		
Month	Ottertrawl	Longline	Ottertrawl	Gillnet	Longline	Other	Ottertrawl	Longline	Ottertrawl	Longline	
Jan			0.952								
Feb											
Mar	0.13		2.20								
Apr	0.04	0.40	18.13		0.96				2.23	0.04	
May	0.37	0.67	2.82					6.49	2.07	0.96	
Jun	9.46	0.59	33.02					2.95		0.11	
Jul								1.20		2.38	
Aug	0.29		14.16	0.08				0.75		0.06	
Sep	0.19		14.82					0.56		7.01	
Oct	3.09	0.38	18.05								
Nov	1.10		0.97								
Dec	4.22		2.47								
	18.88	2.04	107.58	0.08	0.96	0.00	0.00	11.96	4.30	10.55	156.35

	Canada (N)						Canada (M)				
2016	3N		3O				3N		3O		
Month	Ottertrawl	Longline	Ottertrawl	Gillnet	Longline	Other	Ottertrawl	Longline	Ottertrawl	Longline	
Jan	12.38		0.291								
Feb	3.43		2.01		0.13						
Mar			4.87							0.03	
Apr			18.42		0.04			0.03	0.33	1.42	
May			0.48					2.42	0.37	2.09	
Jun	7.31	0.36						0.33		3.41	
Jul	17.85	0.35						0.33		0.06	
Aug	1.63	0.62	0.18	0.51				1.20			
Sep	16.51	0.36	8.13			0.24					
Oct	2.45		7.84								
Nov	15.18		5.52								
Dec	8.88		0.21								
	85.62	1.69	47.95	0.51	0.17	0.24	0.00	4.31	0.71	7.01	148.21

	Canada (N)						Canada (M)				
2017	3N		3O				3N		3O		
Month	Ottertrawl	Longline	Ottertrawl	Gillnet	Longline	Other	Ottertrawl	Longline	Ottertrawl	Longline	
Jan	2.53										
Feb	3.09										
Mar			7.16								
Apr	0.04		1.39						1.29	0.29	
May	6.67								0.07	5.93	
Jun	12.60	0.11	0.24	0.05				2.69		1.09	
Jul	4.45		0.20	0.27				4.81	0.02	1.03	
Aug				0.08				0.67	0.03		
Sep	2.79		6.68								
Oct	4.37		2.01		0.16						
Nov	0.61										
Dec	2.89										
	40.04	0.11	17.68	0.40	0.16	0.00	0.00	8.17	1.41	8.34	76.31

Table 3. A review of sampling used to compile catch at age for 3NO cod. Highlighted years note use of Canadian RV age/length keys to some commercial catches. Details for the estimation of catch at age for previous years are available in Rideout et al. (2015).

	Sampling	Canada	Spain	Portugal	Other
2005	Bycatch in Canadian ottertrawl fishery was adequetly sampled providing frequencies and keys. Length frequencies provided by Spain and Russia were used in conjunction with Canadian Research Surveys keys to create catch at age for Spain, Portugal, Russia and Estonia.	2/LL 4706/OT	6109/OT		125/OT
2006	Canadian cod bycatch was taken mainly in the ottertrawl and gillnet fishery for redfish and hake , sampling was limited mainly to frequencies. Canadian autumn research keys were used. Frequencies provided by Portugal and Russia were used in conjunction with Canadian autumn research keys to compile catch at age for Portugal, Spain, Estonia and Lithuania.	44/GN 478/OT		3269/OT	125/OT
2007	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tail, redfish and hake. The ottertrawl fishery was sampled by observers. About 40 % of the Canadian catch was taken in longline fisheries and no sampling exist for this catch	1457/ OT NO LL	401 (135 mm mesh) /OT No sampling for 280mm mesh	376 (130mm mesh)/OT; 18 (280mm mesh)/OT	811 /OT /Russian fishery
2008	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tail, redfish and hake. The ottertrawl fishery was sampled by observers. About 25 % of the Canadian catch was taken in longline fisheries and no sampling exist for this catch	1796 OT NO LL	408 OT	41 OT for 3O	519 OT
2009	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tail, redfish and hake. The ottertrawl fishery was sampled by observers. About 20 % of the Canadian catch was taken in longline fisheries and no sampling exist for this catch. Canadian research survey keys used to age all catch	246/OT length and 24 aged fish	511(130mm, 3N)/OT; 98(280mm, 3N)/OT	1935 OT	
2010	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tail and amounted to 109 t. Canadian research survey keys used to age all catch	90 comercial and 997 research ages	1354 measured	2467 130mm and 223 280mm mesh measured	171 measured
2011	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tailand amounted to 54 t. Canadian research survey keys used to age all catch.	23 commercial and 959 research aged	396 measured	5042 measured	100 measured
2012	Canadian cod by catch was taken in the ottertrawl fishery for yellow-tailand amounted to 26 t. Canadian research survey keys used to age all catch	1441 research ages	2411 measured	4484 measured	
2013	Canadian cod bycatch was taken primarily in the ottertrawl fishery for yellowtail flounder. The ottertrawl fishery was sampled by observers. Q4 length frequencies for otter trawls (130 mm) from Spain applied to Q4 Canadian otter trawl catch. Canadian research survey keys used to age all catch.	1120 / OT and 66 aged fish	174 (130 mm, 3NO)/OT, 865 (280mm, 3N)/ OT	6293 (130 mm, 3NO)/OT, 561 (280mm, 3N)/OT	387 OT/Estonia
2014	Canadian cod bycatch was primarily taken in the ottertrawl fishery for yellowtail flounder. Annual length frequencies for EU Spain otter trawls (130 mm) applied to all Canadian otter trawl catch. Canadian research survey keys from spring 2014 used to age 2014 spring catch, but fall 2013 keys used to age fall catch.	no length or age data available	454 (130 mm, 3NO)/OT, 795 (280 mm, 3NO)/OT	4327 (130 mm, 3NO)/OT, 84 (280 mm, 3N)/OT	none
2015	Canadian cod bycatch was taken in the ottertrawl fishery for …. . Annual length frequencies for EU Spain otter trawls (130 mm) applied to all Canadian otter trawl catch. Canadian research survey keys from spring and fall 2015 were used to age all catch.	no length or age data available	246 (130 mm, 3N)/OT, 539 (280 mm, 3NO)/OT	7460 (130 mm, 3NO)/OT	101 OT/Estonia , 255 OT/Russia
2016	Canadian cod bycatch was taken in the ottertrawl fishery for yellowtail flounder and witch flounder. Annual length frequencies for EU Spain otter trawls (130 mm) applied to all Canadian otter trawl catch. Canadian research survey keys from spring and fall 2016 were used to age all catch.	no length or age data available	141 (130 mm, 3O)/OT, 902 (280 mm, 3NO)/OT	1888 (130 mm, 3NO)/OT	221 OT/Estonia , 40 OT/Russia
2017	Canadian cod bycatch was taken in the ottertrawl fishery for yellowtail flounder and witch flounder. Annual length frequencies for EU Spain otter trawls (130 & 280 mm combined) applied to all Canadian otter trawl catch. Annual length frequencies for EU Spain otter trawls (130 mm) applied to Portuguese catch. Canadian research survey keys from spring and fall 2017 were used to age all catch.	no length or age data available	329 (130 mm, 3NO)/OT,48 (280 mm, 3O)/OT	no length or age data available	192 OT/Russia

Table 4. Catch at age used in this assessment for Divisions 3NO cod ('000s).

Cn	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
2003	43	337	810	1274	669	133	5	18	8	2	1
2004	11	37	45	50	92	73	21	1	7	3	1
2005	1	1	1	2	4	28	55	20	1	3	2
2006	45	214	168	82	21	5	10	2	2	0	0
2007	4	205	289	93	25	9	6	9	10	2	0
2008	1	4	58	165	41	20	2	3	20	13	7
2009	12	262	167	136	90	26	11	1	4	7	16
2010	249	214	459	195	75	39	13	0	2	0	1
2011	44	187	56	133	44	47	46	7	4	1	0
2012	26	217	197	38	96	35	16	14	5	1	0
2013	21	169	239	151	41	121	54	24	10	4	0
2014	60	194	144	156	59	55	29	13	4	2	0
2015	10	60	101	51	82	32	9	38	7	2	0
2016	12	81	103	77	30	45	30	5	29	15	0
2017	45	147	124	44	32	21	20	9	1	15	7

Table 5. Catch weight at age used in this assessment for Divisions 3NO cod.

Cw	3	4	5	6	7	8	9	10	11	12
1959	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1960	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1961	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1962	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1963	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1964	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1965	0.42	0.82	1.25	1.95	2.82	3.39	3.98	4.68	5.25	6.17
1966	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1967	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1968	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1969	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1970	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1971	0.48	0.90	1.35	2.14	3.16	4.21	6.34	7.69	8.46	10.24
1972	0.54	0.97	1.44	2.08	2.89	3.56	5.95	7.95	8.32	10.14
1973	0.57	1.00	1.43	2.19	3.63	4.63	6.25	9.56	11.17	13.99
1974	0.42	0.73	1.20	1.96	2.86	4.67	7.32	5.46	8.40	7.51
1975	0.38	0.89	1.28	2.13	3.14	4.16	5.53	6.74	5.27	7.09
1976	0.50	0.91	1.41	2.33	3.25	4.03	6.67	8.74	9.14	12.49
1977	0.57	1.00	1.48	2.48	3.51	4.74	7.17	8.81	11.70	11.47
1978	0.72	1.05	1.55	2.25	3.74	4.61	6.19	7.23	9.48	12.87
1979	0.65	0.98	1.39	2.09	2.87	3.70	4.75	7.15	7.98	10.11
1980	0.71	1.04	1.69	2.50	3.69	5.49	7.98	9.22	10.60	12.61
1981	0.90	1.27	1.84	2.69	3.55	5.33	7.13	9.10	9.01	10.15
1982	0.94	1.17	1.50	2.20	3.83	5.26	7.49	8.80	9.82	12.28
1983	0.85	1.17	1.87	2.63	3.80	5.20	6.27	8.08	8.99	11.01
1984	0.79	1.15	1.51	2.28	3.04	4.05	5.76	7.22	8.92	12.61
1985	0.48	0.86	1.37	2.05	3.25	4.65	6.62	8.32	9.15	11.13
1986	0.39	1.01	1.52	2.16	3.49	5.41	7.95	9.82	9.94	9.88
1987	0.49	0.82	1.30	1.83	2.89	4.76	7.26	8.95	9.85	12.59
1988	0.74	1.00	1.38	1.79	2.23	3.77	5.12	6.88	9.37	11.07
1989	0.51	0.97	1.60	2.24	3.27	4.61	7.08	8.31	9.47	12.25
1990	0.55	1.01	1.46	2.51	2.73	4.14	5.02	8.37	9.29	11.25
1991	0.55	0.85	1.59	2.30	3.83	5.56	7.53	9.04	11.98	13.98
1992	0.33	0.65	1.06	1.80	2.82	4.85	5.56	7.43	8.64	10.65
1993	0.36	0.78	1.35	1.84	2.82	4.11	5.87	7.76	8.79	8.67
1994	0.27	0.46	0.91	1.63	1.84	4.04	4.94	7.54	3.44	7.52
1995	0.42	0.75	1.21	2.03	2.29	2.08	6.60	6.22	6.41	8.03
1996	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03
1997	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03
1998	0.42	0.78	1.30	1.99	2.68	3.38	4.70	5.98	6.41	8.03
1999	0.50	0.94	1.59	2.07	2.23	2.83	3.99	6.05	6.73	7.38
2000	0.60	0.82	1.45	2.39	3.44	2.90	2.64	3.78	5.25	6.07
2001	0.58	1.09	1.38	2.07	4.06	5.22	5.32	5.51	7.51	8.60
2002	0.67	1.01	1.52	2.24	3.38	5.15	5.99	7.11	8.47	9.32
2003	0.67	0.94	1.40	2.02	3.01	4.10	7.63	7.74	8.52	9.23
2004	0.69	0.92	1.38	2.17	3.03	3.93	5.79	8.54	9.70	8.77
2005	0.49	1.41	2.46	3.43	3.95	4.94	5.90	9.30	10.28	11.42
2006	0.68	1.11	1.36	2.05	2.60	3.26	4.66	7.07	7.39	14.86
2007	0.61	1.00	1.39	2.52	2.90	4.71	5.16	6.75	6.67	8.39
2008	0.35	1.04	1.59	1.95	2.91	2.63	5.84	5.90	6.36	10.03
2009	0.46	0.65	1.31	2.16	2.68	3.80	4.55	8.20	7.51	8.81
2010	0.33	0.67	0.89	1.95	2.73	3.14	6.04	4.42	10.06	10.19
2011	0.49	0.62	1.13	1.60	3.47	4.77	5.53	4.72	5.58	9.68
2012	0.55	0.75	1.13	1.64	1.91	4.20	5.64	6.50	8.72	9.68
2013	0.43	0.70	1.12	1.52	2.17	2.29	4.60	6.05	6.54	12.04
2014	0.46	0.82	1.22	1.39	2.06	2.05	3.02	6.69	6.96	10.47
2015	0.56	0.84	1.24	1.87	2.27	2.41	2.96	3.35	4.05	14.34
2016	0.51	0.73	0.98	1.34	2.51	2.61	2.60	4.21	4.72	15.27
2017	0.49	0.66	1.13	1.52	3.20	4.15	7.88	3.76	5.34	5.47

Table 6. Details on the stratification scheme used for the assessment of 3NO cod.

NAFO Div.	Depth Range (fathoms)	Strata	Area Sq. mi.
3N	0-30	375	1593
		376	1499
	31-50	360	2992
		361	1853
		362	2520
		373	2520
		374	931
		383	674
	51-100	359	421
		377	100
		382	647
	101-150	358	225
		378	139
		381	182
	151-200	357	164
		379	106
		380	116
	201-300	723	155
		725	105
		727	160
	301-400	724	124
		726	72
		728	156

NAFO Div.	Depth Range (fathoms)	Strata	Area Sq. mi.
3O	31-50	330	2089
		331	456
		338	1898
		340	1716
		351	2520
		352	2580
		353	1282
	51-100	329	1721
		332	1047
		337	948
		339	585
		354	474
	101-150	333	151
		336	121
		355	103
	151-200	334	92
		335	58
		356	61
	201-300	717	166
		719	76
		721	76
	301-400	718	134
		720	105
		722	93

Table 7. Information on the timing and vessel/trip numbers for the Canadian Spring and Autumn surveys.

Year	Spring Survey			Autumn Survey		
	Vessel(s) & Trips	Start Date (mm/dd)	End Date (mm/dd)	Vessel(s) & Trips	Start Date (mm/dd)	End Date (mm/dd)
1984	AN 27	04/28	05/08			
1985	AN 43	04/11	04/25			
1986	WT 47	04/18	05/04			
1987	WT 58-60	04/23	05/14			
1988	WT 70	04/21	05/05			
1989	WT 82	04/20	05/06			
1990	WT 95-96	05/05	06/01	WT 101-102	11/22	12/09
1991	WT 105-106	04/19	05/11	WT 113-115	10/19	11/10
1992	WT 119-120	04/22	05/13	WT 128-130	10/20	11/05
1993	WT 136-137	04/27	05/18	WT 144-146	10/24	11/12
1994	WT 152-153	04/30	05/22	WT 160-161	10/25	11/13
1995	WT 168-169	05/03	05/27	WT 176-177	09/26	10/26
1996	WT 188-189	05/07	05/30	WT 200, TEL 42, AN 253	11/24	12/17
1997	WT 204-208	04/30	06/04	WT 212-214	09/26	11/05
1998	WT 221-222	05/12	06/04	WT 229-233, TEL 76	10/10	12/16
1999	WT 238-241	05/11	06/07	WT 244-247	10/13	11/22
2000	WT 315-318	05/11	06/09	WT 319-323, TEL 338-339	10/11	12/05
2001	WT 367-369	05/05	06/06	WT 372-373, TEL 357	09/22	10/29
2002	WT 419-424	04/27	05/29	WT 427-428, TEL 411-412	10/05	10/26
2003	WT 479-481	05/08	06/04	WT 485-487, TEL 469	09/23	11/07
2004	WT 546-548	05/12	06/08	WT 557-558	10/31	11/23
2005	WT 618-621	05/09	06/19	WT 627-628,630, TEL 608-609, AN 657	10/04	11/19
2006				WT 704-706	09/30	10/21
2007	WT 759-762	05/03	06/29	WT 770-772, TEL 750-751	10/06	11/14
2008	WT 827-829	05/23	06/22	WT 835-837	10/03	11/01
2009	AN 904-906	05/13	06/11	AN 913-916, TEL 894-895	10/02	11/12
2010	AN 932-934	05/08	06/06	AN 942-944, TEL 979	09/30	12/12
2011	AN 403-404	05/08	05/30	AN 409-413	09/29	11/20
2012	AN 417-420	04/27	06/03	AN 424-426	09/30	11/05
2013	AN 432-434	04/24	05/22	AN 438-442	09/19	10/18
2014	TEL 139-140	05/29	06/17			
2015	AN 452-454	05/10	06/03	AN 458-461	09/25	10/26
2016	TEL 159, 169-170	05/19	05/31	AN 466-467,469	09/16	11/07
2017	AN 484,486	05/12	06/14	AN 479-481	09/14	10/22

Table 8. Cod abundance (000's) from Canadian spring RV surveys in Division 3N. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates from non-sampled strata.

Year	Index Strata (<200 fathoms)																		Total	1 std	Deep Strata (≥200 fathoms)						Total
	375	**376**	**360**	**361**	**362**	**373**	**374**	**383**	**359**	**377**	**382**	**358**	**378**	**381**	**357**	**379**	**380**		**Index**		**723**	**725**	**727**	**724**	**726**	**728**	>200
1984	22089	147797	135352	29059	67895	27237	10331	62	2317	1754	0	2677	2457	1519	0	780	207		**451532**	158609	nf	nf	nf	nf	nf	nf	-
1985	12272	147	26907	49961	19854	4121	768	0	0	2428	3538	5711	43405	12844	11460	3164	3646		**200225**	28273	nf	nf	nf	nf	nf	nf	-
1986	2219	779	9656	5531	5348	1585	85	0	39989	461	22	4024	6253	8170	440	4963	521		**90046**	35723	nf	nf	nf	nf	nf	nf	-
1987	6163	87946	31417	47380	116529	11626	922	958	7094	6335	59	4318	2103	388	(1428)	7	926		**324172**	93197	nf	nf	nf	nf	nf	nf	-
1988	3104	2509	35568	15258	6794	2600	871	680	5531	0	178	5277	1903	3155	11	44	1484		**84966**	15707	nf	nf	nf	nf	nf	nf	-
1989	4821	593	1043	9049	6986	3067	51	494	1622	420	1572	3946	1597	3705	68	204	957		**40195**	5707	nf	nf	nf	nf	nf	nf	-
1990	3205	265	2991	6571	8320	1560	384	46	811	0	3293	8218	2725	3630	880	1305	2043		**46246**	7797	nf	nf	nf	nf	nf	nf	-
1991	110	118	892	2549	1109	221	26	62	1187	0	0	1037	867	200	2504	2289	3822		**16992**	4214	1970	401	833	69	0	0	3273
1992	146	0	2705	797	58	0	128	0	1679	0	0	16327	3671	88	2651	8698	862		**37809**	5893	13573	nf	2144	112	0	0	15829
1993	73	0	898	828	116	0	0	0	2172	28	0	3358	602	0	68	540	20457		**29139**	20236	43	0	1444	9	0	0	1496
1994	0	0	0	102	0	0	0	0	0	48	0	108	220	13	429	190	0		**1109**	521	32	95	222	34	0	0	383
1995	0	69	0	619	0	0	0	0	0	0	0	155	96	113	23	66	32		**1171**	655	0	73	211	17	70	43	414
1996	0	165	449	1077	39	39	85	0	33	0	0	310	163	160	90	204	471		**3283**	787	46	34	1394	0	0	0	1474
1997	131	0	86	549	50	50	38	0	138	0	0	261	136	13	20	194	6239		**7906**	6106	77	16	109	50	12	0	264
1998	292	1272	823	2258	139	35	0	0	26	7	0	41	96	0	219	72	48		**5327**	1583	53	49	55	61	0	0	218
1999	5259	103	150	2650	1042	77	85	0	58	0	45	1254	38	150	73	58	96		**11137**	1968	0	33	44	0	0	0	77
2000	329	206	41	1869	1271	0	0	0	29	0	134	69	209	0	282	21	117		**4577**	1098	139	361	383	0	0	0	883
2001	351	41	82	510	1078	193	128	0	87	0	0	3111	108	1152	872	642	511		**8865**	3107	3179	661	528	45	0	0	4413
2002	131	0	453	1997	193	77	43	0	29	0	0	234	44	0	168	105	23		**3495**	880	1658	148	446	62	36	0	2350
2003	263	41	659	892	39	0	0	0	0	0	0	8940	1523	113	110	129	609		**13318**	8976	550	0	50	8	0	0	608
2004	175	1004	2552	3035	314	39	0	0	0	7	0	155	1000	300	43	49	207		**8878**	3353	85	0	0	9	0	0	94
2005	877	41	1784	2185	260	193	43	46	463	199	579	1045	365	7489	60	65	145		**15839**	6363	0	0	0	0	0	0	0
2006																											
2007	11213	18046	11271	17801	3983	435	43	0	927	138	102	4380	1635	307	158	93	14		**70544**	11497	19	0	0	0	0	13	32
2008	14846	11599	10290	9023	1425	87	192	46	1332	1204	0	4591	2798	1828	23	10	95		**59389**	8949	0	0	0	nf	0	0	0
2009	394	330	1957	3271	762	390	0	0	8108	17	0	97233	4214	22	9656	241	186		**126781**	97974	81	12	105624	0	0	0	105717
2010	1402	1871	700	2337	900	0	85	0	0	96	45	4154	6283	49	43	1222	31985		**51172**	32121	11	6	439	0	5	0	461
2011	52412	371	864	821	265	270	43	0	0	30	0	12	61	11	6820	1326	323		**63629**	51873	69	593	1068	0	22	11	1763
2012	2260	124	4392	3417	4151	1682	4269	93	8513	7146	0	3002	3263	4967	135	110	1147		**48673**	9517	10	217	46	nf	7	0	280
2013	1972	660	1171	2129	847	1964	1323	211	8867	9410	79	9244	3260	13	662	557	391		**42760**	11212	45	10	35	0	0	0	90
2014	682	137	755	1020	1040	555	192	424	27316	11122	5785	318	3276	2466	41	97	170		**55396**	29066	0	0	13	0	0	0	13
2015	565	516	412	5319	1634	495	0	46	1042	392	267	4746	2132	10009	305	29	2074		**29983**	10047	0	0	0	0	0	0	0
2016	175	495	4898	807	501	563	0	46	434	0	0	325	218	1052	4791	3235	487		**18026**	5458	0	14	506	0	0	0	521
2017	274	137	522	1020	136	520	0	0	993	76	0	307	11582	25	184	739	419		**16933**	9562	0	144	1082	nf	0	976	2202

Table 9. Cod biomass (t) from Canadian spring RV surveys in Division 3N. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates for non-sampled strata.

Year	Index Strata (<200 fathoms)																	**Total**	1 std	Deep Strata (≥200 fathoms)						Total
	375	**376**	**360**	**361**	**362**	**373**	**374**	**383**	**359**	**377**	**382**	**358**	**378**	**381**	**357**	**379**	**380**	**Index**		**723**	**725**	**727**	**724**	**726**	**728**	>200
1984	6951	16514	21635	19816	75056	33166	14844	497	305	144	0	814	686	758	0	378	407	**191972**	30721	nf	nf	nf	nf	nf	nf	-
1985	26015	706	16845	52290	29628	5223	1508	0	0	217	254	897	4557	5345	6291	1186	2108	**153070**	18986	nf	nf	nf	nf	nf	nf	-
1986	20840	2926	3745	60545	31028	4336	1325	0	2614	137	83	1708	1074	2885	634	1571	362	**135813**	34396	nf	nf	nf	nf	nf	nf	-
1987	13377	9060	4115	49876	142872	14456	1815	1648	771	1703	41	4214	355	245	(566)	9	1008	**245567**	38873	nf	nf	nf	nf	nf	nf	-
1988	22932	6492	3755	25431	19700	9645	5816	234	631	0	58	1305	436	779	32	37	650	**97934**	13093	nf	nf	nf	nf	nf	nf	-
1989	24907	1244	2125	19331	26333	8910	928	569	211	45	775	1685	428	214	64	97	493	**88359**	12759	nf	nf	nf	nf	nf	nf	-
1990	15980	3754	10388	29860	36987	5747	5002	609	100	0	295	1079	396	792	271	315	697	**112271**	14230	nf	nf	nf	nf	nf	nf	-
1991	1818	1468	1022	16487	4301	847	512	222	66	0	0	129	144	395	328	844	670	**29254**	8642	662	186	486	30	0	0	1364
1992	2309	0	1431	395	661	0	29	0	112	0	0	2625	409	15	699	2567	180	**11433**	2788	3415	nf	805	32	0	0	4252
1993	1134	0	45	3422	1508	0	0	0	429	9	0	1683	244	0	46	203	9729	**18451**	9859	30	0	313	9	0	0	352
1994	0	0	0	63	0	0	0	0	0	8	0	162	63	56	235	120	0	**708**	289	26	32	86	22	0	0	166
1995	0	51	0	47	0	0	0	0	0	0	0	133	75	44	24	46	9	**429**	120	0	8	41	26	31	26	132
1996	0	62	457	647	21	9	11	0	36	0	0	131	84	40	18	66	100	**1682**	553	35	19	677	0	0	0	731
1997	92	0	15	378	317	168	136	0	199	0	0	104	109	2	9	104	3457	**5090**	3438	80	9	71	40	5	0	205
1998	108	75	12	682	407	9	0	0	1	15	0	73	80	0	221	25	13	**1721**	496	77	10	25	191	0	0	303
1999	3225	4	315	3496	946	50	11	0	114	0	9	1171	21	16	51	12	18	**9461**	3021	0	13	6	0	0	0	19
2000	54	43	19	533	1328	0	0	0	194	0	27	23	184	0	242	8	14	**2669**	1362	270	163	180	0	0	0	613
2001	592	6	589	241	1110	8	30	0	54	0	0	1818	92	708	676	536	71	**6529**	1995	2233	443	295	100	0	0	3071
2002	88	0	244	1856	22	11	15	0	7	0	0	327	16	0	158	74	14	**2832**	1522	1598	100	96	36	12	0	1842
2003	1229	458	1417	1987	2	0	0	0	0	0	0	14117	739	12	204	68	97	**20329**	14168	956	0	25	25	0	0	1006
2004	89	286	84	299	2134	2	0	0	0	29	0	258	377	49	60	22	36	**3726**	2160	46	0	0	6	0	0	52
2005	632	1	1798	2582	1746	74	10	42	71	298	239	611	118	2276	59	82	53	**10692**	2768	0	0	0	0	0	0	0
2006																										
2007	2669	528	1057	7983	5449	603	6	0	2385	33	79	3049	1101	171	262	72	6	**25452**	5245	60	0	0	0	0	4	64
2008	2016	1810	8204	1619	2499	3	327	9	434	990	0	4361	711	702	28	5	51	**23769**	3653	0	0	0	nf	0	0	0
2009	208	451	89	885	128	76	0	0	9025	8	0	39777	1927	2	3063	242	18	**55898**	40813	168	5	33157	0	0	0	33330
2010	43	4913	0	82	1595	1245	0	26	160	1423	32	3946	641	14002	18	5	0	**28131**	14733	56	34	377	0	2	0	469
2011	11042	56	248	302	463	135	8	0	0	23	0	6	33	1	5469	1019	61	**18865**	12119	125	476	950	0	17	15	1583
2012	2407	398	15514	1764	2970	878	3227	32	8550	4683	0	3025	4331	3184	297	149	558	**51966**	11191	13	51	41	nf	16	0	121
2013	1271	63	2393	3842	1400	1587	951	158	14188	8663	74	18176	5130	1	1298	742	183	**60120**	15879	178	7	54	0	0	0	239
2014	45	25	940	55	956	565	470	192	54329	19272	9802	341	4205	2783	79	273	196	**94527**	57143	0	0	12	0	0	0	12
2015	898	4011	1240	5527	5014	792	0	22	2388	434	797	11035	2070	2822	716	69	469	**38303**	6280	0	0	0	0	0	0	0
2016	11	16	219	119	451	22	0	3	36	0	0	1203	39	322	6140	2058	39	**10678**	6345	0	28	237	0	0	0	265
2017	33	17	867	76	16	398	0	0	345	49	0	209	8316	2	558	251	192	**11328**	6948	0	433	494	nf	0	599	1526

Table 10. Cod abundance (000's) from Canadian spring RV surveys in Division 3O. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates for non-sampled strata.

Year	Index Strata (<200 fathoms)																		**Total**	1 std	Deep Strata (≥200 fathoms)						Total
	330	**331**	**338**	**340**	**351**	**352**	**353**	**329**	**332**	**337**	**339**	**354**	**333**	**336**	**355**	**334**	**335**	**356**	**Index**		**717**	**719**	**721**	**718**	**720**	**722**	>200
1984	7687	3826	23133	10504	77593	40966	0	5871	432	1891	14485	2217	0	0	0	0	0	0	**188606**	24310	nf	nf	nf	nf	nf	nf	-
1985	7816	1903	9631	9324	17410	17487	2204	2367	3399	5634	885	1826	42	17	4031	234	0	0	**84210**	12468	nf	nf	nf	nf	nf	nf	-
1986	3672	737	8848	10184	116600	9709	2746	2811	1104	1356	134	2195	104	125	28	1310	68	13	**161744**	93579	nf	nf	nf	nf	nf	nf	-
1987	11207	1882	20017	144754	71037	35545	28804	131760	29727	1782	2361	65041	561	17	205	25	8	4	**544739**	121065	nf	nf	nf	nf	nf	nf	-
1988	5332	1411	6560	2799	13208	55656	44053	5208	2881	2315	483	2250	0	8	43	120	12	50	**142388**	39654	nf	nf	nf	nf	nf	nf	-
1989	1594	784	19973	1941	6053	10374	4686	5524	3082	10302	27	587	374	8	978	139	16	130	**66572**	11285	nf	nf	nf	nf	nf	nf	-
1990	4943	(1052)	8355	3593	6182	14360	6437	13021	5646	2113	1609	391	135	141	191	538	96	109	**67860**	10620	nf	nf	nf	nf	nf	nf	-
1991	1411	157	24229	2544	2051	9659	1285	22096	677236	22222	1556	8933	685	158	2317	1202	27	541	**778308**	672162	3701	274	190	15	0	0	4180
1992	201	31	2263	330	1040	3815	4188	503	29324	6846	604	1663	966	5484	935	962	1263	2639	**63059**	22768	336	749	72390	0	569	149	74193
1993	369	0	827	118	347	1318	220	1657	293274	229388	402	1402	509	433	234	1126	339	420	**532383**	272306	1615	301	348	100	15	0	2379
1994	0	0	131	283	248	1287	0	13826	0	130	0	0	2184	599	50	528	156	487	**19907**	13914	1441	443	11	503	211	0	2609
1995	0	0	261	0	0	1100	282	1089	2376	522	0	0	10	0	7	198	52	13	**5910**	1824	242	164	5	102	29	0	542
1996	4777	345	2089	1428	520	1104	670	327	3153	2478	46	65	682	8	2548	182	485	92	**21000**	4659	27	21	84	0	6	11	149
1997	509	0	160	529	453	927	0	765	432	681	0	0	1447	128	6	94	211	70	**6411**	1513	176	39	103	7	103	6	434
1998	4310	8343	895	173	277	1278	564	8194	720	1239	121	4583	194	25	50	26	36	82	**31111**	12292	20	5	5	0	12	0	42
1999	4037	452	15015	1770	1631	14932	507	8370	8121	9389	497	4864	25	17	44	28	37	67	**69804**	14900	37	107	5	0	7	0	156
2000	8680	2635	6571	3682	12046	5481	1693	1278	27653	3032	40	587	92	0	39	70	13	96	**73690**	14846	122	18	7	0	0	0	147
2001	1519	3858	7006	567	1820	3372	397	2746	816	1130	282	163	71	42	234	54	278	62	**24415**	3171	838	134	67	0	7	17	1063
2002	616	220	3264	189	545	1730	321	379	672	478	201	33	20	92	31	1017	357	149	**10312**	1796	183	0	9	18	17	0	227
2003	270	63	1044	330	217	754	220	2557	96	565	0	33	9	0	21	19	4	22	**6224**	2402	114	21	19	0	0	0	154
2004	1204	1725	970	283	43	877	139	440	3271	366	0	0	10	67	65	17	0	67	**9545**	2217	553	8	5	0	0	0	566
2005	5090	1976	9095	519	1127	5989	887	1868	0	452	80	246	10	0	6	0	0	0	**27346**	6772	34	52	0	0	0	0	86
2006																											
2007	3818	502	4700	923	2080	22182	18473	4545	1296	1130	138	3130	48	7	50	44	4	50	**63119**	12101	44	0	0	0	0	0	44
2008	2504	27036	4700	354	7106	12625	529	710	4081	1000	0	0	9	17	21	17	4	15	**60727**	26891	170	0	48	0	0	0	218
2009	1514	215407	2176	13691	520	5790	0	1089	23834	956	0	0	0	0	50	634	12	35	**265709**	213186	180	21	12	0	0	0	213
2010	3800	63	9269	226	515	2524	176	1415	21503	1377	80	94	27	0	25	11	32	28	**41164**	20330	154	23	0	0	0	0	177
2011	2641	376	1649	451	303	2755	250	5471	0	464	179	217	9	33	62	28	4	28	**14921**	5418	54	0	0	0	nf	0	54
2012	2668	439	2008	944	1541	6073	1411	3064	192	149	121	33	23	8	0	0	8	29	**18711**	3995	15	0	0	0	0	0	15
2013	6269	1084	1392	661	1430	6344	3615	4674	0	0	80	0	10	0	0	12	5	0	**25578**	5702	0	0	0	0	0	0	0
2014	4310	376	4439	1495	763	5820	705	4735	792	0	604	1299	10	0	0	0	0	21	**25370**	5480	26	0	0	0	0	0	26
2015	1197	533	3916	803	1486	2310	294	5634	912	0	0	33	0	17	14	83	16	8	**17256**	5453	497	0	16	0	0	0	513
2016	845	753	3264	2549	1295	1341	3792	4309	14979	1695	0	98	0	19	85	7	0	4	**35033**	10134	nf	6	17	nf	10	0	33
2017	944	94	3603	59	1758	1538	59	237	0	65	80	0	0	8	40	0	0	8	**8495**	3382	11	0	0	0	0	0	11

Table 11. Cod biomass (t) from Canadian spring RV surveys in Division 3O. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates for non-sampled strata.

Year	Index Strata (<200 fathoms)																			**Total**	1 std	Deep Strata (≥200 fathoms)						Total
	330	**331**	**338**	**340**	**351**	**352**	**353**	**329**	**332**	**337**	**339**	**354**	**333**	**336**	**355**	**334**	**335**	**356**	**Index**		**717**	**719**	**721**	**718**	**720**	**722**	>200
1984	7888	4493	42678	13523	67964	51161	0	1759	4368	734	3323	946	0	0	0	0	0	0	**198839**	27418	nf	nf	nf	nf	nf	nf	-
1985	9282	4844	13539	10677	34186	41468	9360	1913	16971	2948	723	654	327	81	717	889	0	0	**148579**	19373	nf	nf	nf	nf	nf	nf	-
1986	4128	1282	23022	11909	89983	24013	1814	1104	4052	11533	72	564	408	119	28	4728	157	42	**178959**	57845	nf	nf	nf	nf	nf	nf	-
1987	11960	1963	19822	159580	113537	75699	15404	115219	12725	4258	934	6849	1819	34	256.5	119	38	15	**540232**	109863	nf	nf	nf	nf	nf	nf	-
1988	4443	2155	14399	16289	25082	81440	4469	15973	11606	995	491	1199	0	39	38	469	81	177	**179345**	35693	nf	nf	nf	nf	nf	nf	-
1989	3287	476	25187	5426	19588	43446	3974	1674	2136	5680	216	86	1472	43	533	291	15	153	**113683**	32915	nf	nf	nf	nf	nf	nf	-
1990	5042	(2191)	9226	10198	22130	38056	5836	4639	11158	3321	381	557	378	315	196	818	109	216	**112578**	15471	nf	nf	nf	nf	nf	nf	-
1991	264	233	10185	380	6532	22297	1255	4155	38888	5512	91	3293	868	110	326	1372	10	87	**95858**	35755	15218	143	88	7	0	0	15456
1992	31	222	11769	51	2043	16512	1763	96	3889	20523	87	189	270	1716	63	1009	274	305	**60812**	21564	436	179	12153	0	139	70	12977
1993	91	0	4934	1918	1187	8147	3229	217	107210	79021	43	1307	1645	371	167	1395	2498	383	**213762**	93050	1870	330	304	159	9	0	2672
1994	0	0	1824	159	129	1569	0	10423	0	805	0	0	8467	655	32	950	449	255	**25716**	11919	2094	727	16	791	222	0	3850
1995	0	0	3406	0	0	3748	603	2166	1685	1643	0	0	26	0	31	330	339	16	**13992**	3159	339	927	10	91	34	0	1401
1996	7035	974	1520	237	103	1514	117	189	1519	3267	5	84	1610	19	2321	256	673	46	**21489**	4831	57	37	95	0	3	28	220
1997	357	0	196	186	286	2869	0	614	1558	527	0	0	974	322	15	305	734	47	**8990**	3056	238	133	53	16	164	5	609
1998	12526	34685	5069	512	1888	5341	18	13037	2136	1720	441	2258	255	16	74	46	75	102	**80197**	36701	30	2	16	0	11	0	59
1999	8593	1105	9416	3857	5269	14308	1719	9671	1350	3095	1210	1088	26	18	26	72	207	108	**61137**	11993	47	243	11	0	20	0	321
2000	8401	6842	6982	2164	47572	8226	7130	628	4360	1040	1	218	77	0	13	98	37	442	**94231**	47545	108	59	20	0	0	0	187
2001	2296	1738	13092	1469	4266	11344	529	896	272	553	733	737	43	46	169	33	254	69	**38539**	6458	585	137	323	0	41	52	1138
2002	190	1251	2456	33	38	6932	4394	63	42	160	48	218	31	95	27	1241	437	142	**17799**	4457	164	0	22	18	25	0	229
2003	20	326	4712	25	38	3093	607	1623	462	171	0	474	13	0	2	18	8	26	**11618**	3229	190	33	39	0	0	0	262
2004	2806	8186	1625	1735	583	3130	758	173	906	891	0	0	2	96	51	87	0	131	**21158**	8974	1224	23	9	0	0	0	1256
2005	5951	773	1688	1901	1293	6446	141	1569	0	360	3	484	20	0	22	0	0	0	**20650**	4670	71	26	0	0	0	0	97
2006																											
2007	1345	218	3486	1178	237	9602	1129	2050	241	211	1	438	32	3	33	67	3	45	**20318**	5263	147	0	0	0	0	0	147
2008	1014	2641	2607	381	3401	9189	523	430	494	1399	0	0	6	20	17	28	5	19	**22175**	4487	191	0	74	0	0	0	265
2009	509	53267	2622	5325	65	5946	0	170	19689	504	0	0	0	0	48	227	26	53	**88452**	48368	110	48	19	0	0	0	177
2010	1614	506	1468	39	756	1463	5	460	1897	111	46	74	18	0	43	6	37	23	**8567**	2165	100	47	0	0	0	0	147
2011	1030	298	690	746	217	3347	1148	7367	0	87	781	471	34	34	98	81	11	82	**16523**	7243	151	0	0	0	nf	0	151
2012	696	527	239	824	2922	7950	12683	2694	54	63	25	55	19	7	0	0	20	74	**28853**	13497	23	0	0	0	0	0	23
2013	959	198	1374	88	172	5458	642	1479	0	0	6	0	12	0	0	24	15	0	**10427**	2086	0	0	0	0	0	0	0
2014	5896	332	1411	725	860	4048	4869	3772	1054	0	882	3296	60	0	0	0	0	50	**27254**	7632	140	0	0	0	0	0	140
2015	156	460	1840	345	1392	3478	2108	1577	341	0	0	156	0	38	41	147	20	45	**12147**	2840	479	0	29	0	0	0	507
2016	66	61	1733	319	197	751	466	950	764	610	0	2	0	14	150	20	0	8	**6111**	1329	nf	28	57	nf	25	0	110
2017	72	24	406	4	244	551	11	73	0	10	3	0	0	5	124	0	0	64	**1590**	546	15	0	0	0	0	0	15

Table 12. Cod abundance (000's) from Canadian Autumn RV surveys in Division 3N. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates for non-sampled strata.

Year	Index Strata (<200 fathoms)																	**Total**	1 std	Deep Strata (≥200 fathoms)						Total
	375	**376**	**360**	**361**	**362**	**373**	**374**	**383**	**359**	**377**	**382**	**358**	**378**	**381**	**357**	**379**	**380**	**Index**		**723**	**725**	**727**	**724**	**726**	**728**	>200
1990	5421	32419	28703	6273	12855	1336	879	530	702	243	210	766	550	nf	683	213	nf	**91783**	29227	nf	nf	nf	nf	nf	nf	-
1991	66596	455280	12311	14155	73045	22575	20754	530	0	nf	359	1500	2046	0	399	nf	798	**670348**	355442	0	nf	nf	0	nf	nf	0
1992	nf	354763	8311	20718	49583	1400	nf	nf	497	493	270	5063	1602	nf	194	596	nf	**443490**	286249	nf	0	nf	nf	nf	nf	0
1993	2047	260	3463	6177	1300	750	819	0	88	0	494	47	48	202	1526	655	48	**17924**	4041	97	80	878	17	0	nf	1072
1994	1947	312	0	7549	622	0	1034	0	0	7	0	94	10	0	57	81	16	**11729**	3576	0	0	11	0	0	0	11
1995	4954	3918	433	3751	901	69	57	46	29	7	0	55	10	0	20	32	57	**14339**	3284	0	12	9	0	0	0	21
1996	0	92	480	2005	103	129	64	0	51	12	32	14	0	230	38	52	24	**3326**	1341	43	22	267	19	10	76	437
1997	603	41	137	2156	898	50	43	0	29	0	0	15	17	8	0	79	16	**4092**	757	6	0	0	0	0	0	6
1998	329	1598	309	5761	792	149	171	46	0	0	0	247	10	13	124	13	0	**9562**	2228	0	7	0	0	0	0	7
1999	14518	361	2367	1733	7924	3004	512	0	0	21	134	340	1472	138		988	383	**33895**	9200	0	7	22	0	0	0	29
2000	8163	819	1132	3161	6478	341	85	0	550	21	134	1156	1785	338	168	164	563	**25058**	7551	0	0	49	0	0	0	49
2001	4492	876	2315	6780	6438	446	1836	0	290	481	0	342	226	1702	61	663	14	**26962**	4867	0	7	0	0	0	0	7
2002	2849	317	360	1173	314	149	256	0	463	51	45	437	476	13	10	47	465	**7425**	2909	0	14	11	0	0	0	25
2003	446	324	1242	4952	99	57	0	0	434	0	0	356	36	0	102	52	104	**8204**	1013	0	0	25	nf	0	0	25
2004	438	2062	1543	4282	198	149	171	46	116	206	0	279	315	2078	124	54	96	**12158**	3027	0	nf	0	0	0	43	43
2005	3671	7099	2036	12672	1882	106	0	0	608	35	89	512	1520	82	229	91	56	**30688**	11059	0	7	0	0	0	0	7
2006	3999	987	14200	4384	495	248	640	46	145	76	0	1024	1430	138	302	58	83	**28255**	13287	0	63	9	0	0	0	72
2007	4024	10516	12142	30180	4727	451	840	0	1319	297	316	4797	850	5858	56	73	32	**76478**	15069	31	0	0	60	0	0	91
2008	13586	20758	470	9431	14906	2253	3522	0	898	5475	0	3363	8824	3089	124	131	326	**87156**	21572	9	7	0	0	0	0	16
2009	4821	112129	6709	9198	520	469	1729	46	347	2586	158	584	3142	67	121	32	199	**142857**	74196	0	0	39	0	16	0	55
2010	10902	16032	4956	16569	1684	545	1195	46	319	467	0	552		114	113	40	32	**53566**	12251	17	nf	11	0	0	0	28
2011	6793	1804	3013	3257	870	485	1409	46	2734	3384	140	867	4646	11129	56	645	454	**41732**	12798	0	17	0	0	23	0	39
2012	2763	22786	2337	16183	2427	1634	1708	46	931	812	45	851	180	38	53	144	769	**53704**	10810	14	7	279	17	0	0	317
2013	25853	4691	5362	13612	6834	3518	14051	185	116	813	134	297	4872	2790	11	7	993	**84138**	21554	0	0	11	0	0	0	11
2014																										
2015	5478	2114	875	15167	792	545	683	0	596	289	0	93	3038	225	30	414	828	**31167**	4354.7	11	7	20	0	0	0	37
2016	4531	2217	11987	12252	1387	149	384	0	232	307	89	46	3751	224	34	17	1657	**39264**	10940	0	0	11	0	0	0	11
2017	2144	2784	3293	7749	255	297	1224	0	87	126	89	860	2263	22	35	205	646	**22079**	5930	24	124	0	11	0	57	217

Table 13. Cod biomass (t) from Canadian Autumn RV surveys in Division 3N. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates for non-sampled strata.

Year	Index Strata (<200 fathoms)																	**Total**	1 std	Deep Strata (≥200 fathoms)						Total
	375	**376**	**360**	**361**	**362**	**373**	**374**	**383**	**359**	**377**	**382**	**358**	**378**	**381**	**357**	**379**	**380**	**Index**		**723**	**725**	**727**	**724**	**726**	**728**	>200
1990	31395	5147	7585	24777	9636	9722	2501	216	39	122	129	404	362	nf	370	318	nf	**92723**	25023	nf	nf	nf	nf	nf	nf	-
1991	69276	80732	4456	16326	40955	26255	9699	164	0	nf	73	430	635	0	205	nf	117	**249323**	64135	0	nf	nf	0	nf	nf	0
1992	nf	116390	4572	12485	22852	4114	nf	nf	156	257	115	2464	461	nf	120	317	nf	**164303**	91007	nf	0	nf	nf	nf	nf	0
1993	3305	152	8072	12996	1576	254	1102	0	39	0	168	45	12	119	629	240	32	**28741**	7956	63	90	484	12	0	nf	649
1994	9447	993	0	12111	1001	0	2414	0	0	13	0	51	11	0	42	96	10	**26189**	7249	0	0	12	0	0	0	12
1995	3162	4035	1329	8626	337	39	15	54	12	11	0	61	8	0	46	20	26	**17781**	4298	0	10	3	0	0	0	13
1996	0	799	316	1717	28	49	26	0	36	11	92	9	0	117	19	27	12	**3258**	1199	24	13	97	40	15	34	223
1997	594	12	1226	3255	2581	26	45	0	25	0	0	80	21	5	0	108	10	**7988**	1681	18	0	0	0	0	0	18
1998	839	791	1258	3811	713	60	196	0	0	0	0	327	9	8	245	8	0	**8265**	3200	0	18	0	0	0	0	18
1999	2022	46	8681	1060	4955	1948	111	0	0	6	93	197	729	39		664	223	**20774**	5772	0	10	39	0	0	0	49
2000	8642	2677	1536	1986	2840	125	20	0	458	3	116	933	1156	86	311	129	178	**21196**	5346	0	0	34	0	0	0	34
2001	1490	2351	3183	3319	4146	324	1042	0	249	660	0	470	174	1583	172	675	3	**19841**	4203	0	6	0	0	0	0	6
2002	2135	813	217	4519	1597	154	172	0	601	68	12	467	276	9	9	79	879	**12007**	3490	0	6	11	0	0	0	17
2003	192	1025	2917	6749	582	1	0	0	814	0	0	358	43	0	66	53	48	**12848**	3571	0	0	10	nf	0	0	10
2004	47	23	5334	9089	54	14	31	6	94	382	0	105	99	1890	201	133	54	**17558**	6793	0	nf	0	0	0	44	44
2005	487	5798	2220	8438	3160	33	0	0	317	19	16	262	711	80	221	41	48	**21851**	6469	0	4	0	0	0	0	4
2006	6913	2112	12038	2887	1582	95	1501	34	217	89	0	468	832	34	184	38	37	**29061**	11576	0	49	3	0	0	0	52
2007	6277	910	2291	3624	1640	99	99	0	296	66	93	4112	486	3303	50	27	28	**23401**	7102	49	0	0	65	0	0	114
2008	5111	11121	2231	8548	6235	544	1015	0	456	1720	0	1613	2644	888	89	102	205	**42522**	12646	27	11	0	0	0	0	38
2009	3038	31762	7251	9296	247	815	793	23	328	1601	42	400	2144	21	214	33	106	**58114**	23590	0	0	17	0	13	0	30
2010	2963	17484	8031	4621	3604	315	755	51	257	310	0	638		165	130	55	26	**39405**	14438	27	nf	6	0	0	0	32.33
2011	3120	1139	10504	2562	834	286	661	22	3173	3416	180	1104	4836	5166	154	841	421	**38419**	9968	0	22	0	0	18	0	40
2012	1946	27994	11207	23494	2873	1635	427	34	1254	1102	13	974	138	15	116	254	850	**74327**	24017	66	16	534	40	0	0	656
2013	5440	4200	17535	12422	3913	5647	28073	244	66	994	96	266	9370	2856	43	8	1192	**92366**	32654	0	0	3	0	0	0	3
2014																										
2015	8095	2729	2716	10597	1022	171	1235	0	918	178	0	119	1808	76	17	341	657	**30680**	8058	18	13	18	0	0	0	49
2016	5571	943	19136	6320	276	154	245	0	307	92	37	17	2779	143	63	55	729	**36866**	11042	0	0	6	0	0	0	6
2017	675	1998	3526	3950	109	549	479	0	28	39	4	311	1801	22	50	116	215	**13873**	3633	19	89	0	6	0	27	142

Table 14. Cod abundance (000's) from Canadian Autumn RV surveys in Division 3O. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates for non-sampled strata.

Year	Index Strata (<200 fathoms)																		**Total**	1 std	Deep Strata (≥200 fathoms)						Total
	330	**331**	**338**	**340**	**351**	**352**	**353**	**329**	**332**	**337**	**339**	**354**	**333**	**336**	**355**	**334**	**335**	**356**	**Index**		**717**	**719**	**721**	**718**	**720**	**722**	>200
1990	10709	507	20199	4158	29085	10248	1781	531	1721	1001	163	1580	21	6	nf	13	12	nf	**81735**	17121	0	0	nf	nf	nf	nf	0
1991	10264	6682	10334	5625	24185	24761	223	1605	1127	66	0	0	0	0	887	0	4	4	**85767**	15463	nf	0	0	nf	nf	0	0
1992	7036	222	857	7746	3558	2747	0	558	436	198	41	1712	10	0	64	0	0	0	**25185**	6229	nf	nf	nf	nf	nf	nf	0
1993	5271	222	6221	1859	10450	4710	0	239	2036	307	528	0	0	67	172	9	0	102	**32193**	7605	0	0	0	0	0	0	0
1994	2072	95	330	763	661	717	0	1036	242	0	41	0	0	0	0	0	0	0	**5957**	2162	0	5	0	0	0	0	5
1995	3946	760	2478	1668	2709	972	415	574	0	0	41	165	0	0	13	0	0	0	**13741**	2367	0	0	0	0	0	0	0
1996	277	31	261	94	196	284	0	473	0	0	0	337	nf	8	339	nf	132	40	**2472**	571	nf	37	0	nf	0	0	37
1997	1006	31	52	519	1684	1006	0	95	48	0	80	130	0	0	0	0	12	0	**4663**	916	0	0	0	0	0	0	0
1998	3113	408	835	1747	347	761	0	710	288	0	126	33	0	0	0	0	4	17	**8389**	1597	0	0	5	0	0	0	5
1999	6178	721	4804	5665	9244	2789	661	521	576	130		554	0	0	28	0	0	7	**31878**	5652	10	0	0	0	0	0	10
2000	4428	1505	3580	6945	11737	9419	0	255	624	82	40	33	10	42	14	0	4	25	**38743**	6086	0	3	0	0	0	0	3
2001	9339	265	209	2172	9013	6405	0	710	96	130	80	0	0	0	0	0	0	4	**28423**	3443	0	0	0	0	0	0	0
2002	4133	376	835	2408	2091	2980	0	326	331	0	322	6181	0	0	0	0	0	4	**19987**	6278	0	0	0	0	0	0	0
2003	1293	94	261	1369	1436	4780	44	331	48	174	443	0	0	0	0	0	0	0	**10273**	2516	0	0	0	0	0	0	0
2004	886	157	112	1039	842	1680	756	101	1296	0	46	37	0	0	28	0	0	0	**6980**	1681	0	0	0	0	0	0	0
2005	1533	470	3081	964	2327	3397	1146	0	946	143	80	32	0	0	0	0	0	0	**14119**	2807	0	0	0	0	0	0	0
2006	1485	345	2611	991	2526	4741	453	221	288	43	80	65	0	0	63	6	0	4	**13922**	2345	0	0	0	nf	0	0	0
2007	14991	4610	5065	1457	22015	32905	882	900	2358	7694	201	10610	27	0	38	0	0	4	**103757**	13838	0	0	0	0	0	0	0
2008	15403	1004	5993	2859	6586	6033	118	1631	912	297	268	1710	9	15	25	0	4	0	**42867**	11520	0	0	0	0	0	0	0
2009	6540	1157	1484	2822	6718	3042	44	473	43	87	46	58	0	nf	6	7	0	17	**22544**	3796	0	0	0	0	0	0	0
2010	3044	282	2402	1665	3075	9492	88	384	43	82	40	811	9	0	7	6	0	0	**21430**	4311	0	0	0	0	0	0	0
2011	3496	282	2611	2408	2080	6236	485	832	55	43	0	65	0	0	0	0	0	4	**18597**	4272	0	0	0	0	0	0	0
2012	10409	860	6313	1416	3566	6794	88	421	128	87	112	65	0	0	0	0	0	0	**30259**	6479	0	0	0	0	0	0	0
2013	4922	188	3916	1175	8133	4107	44	605	0	0	241	0	0	0	0	0	0	0	**23332**	4085	0	0	0	0	0	0	0
2014																											
2015	3079	282	5065	2630	2328	8501	265	1705	576	261	40	0	0	0	0	0	0	0	**24731**	5690	0	0	0	0	0	0	0
2016	1581	878	3290	1511	1684	9633	0	473	192	130	40	0	0	nf	0	0	0	0	**19412**	3592	0	0	0	0	0	0	0
2017	4146	596	4909	6185	4110	3078	0	379	1440	43	161	0	0	0	0	7	0	0	**25054**	7582	11	0	0	0	0	nf	11

Table 15. Cod biomass (t) from Canadian Autumn RV surveys in Division 3O. Both index strata and the most commonly fished deep strata are shown. The index strata are the basis for the assessment. Data for 1984-1995 have been converted to Campelan equivalent units. Values in brackets are estimates for non-sampled strata.

Year	Index Strata (<200 fathoms)																		**Total**	1 std	Deep Strata (≥200 fathoms)						Total
	330	**331**	**338**	**340**	**351**	**352**	**353**	**329**	**332**	**337**	**339**	**354**	**333**	**336**	**355**	**334**	**335**	**356**	**Index**		**717**	**719**	**721**	**718**	**720**	**722**	>200
1990	6651	27	13966	3635	17027	21151	4593	1291	767	2331	1242	66	12	29	nf	16	13	nf	**72817**	11789	0	0	nf	nf	nf	nf	0
1991	2374	1047	7122	6247	21473	32262	56	1019	74	70	0	0	0	0	155	0	8	8	**71915**	12726	nf	0	0	nf	nf	0	0
1992	2574	191	2760	6711	3142	3137	0	109	254	373	64	896	12	0	31	0	0	0	**20254**	4404	nf	nf	nf	nf	nf	nf	0
1993	4278	267	3763	1231	9895	4920	0	245	1323	176	447	0	0	107	104	21	0	68	**26845**	7412	0	0	0	0	0	0	0
1994	1928	172	91	832	679	4775	0	1546	452	0	56	0	0	0	0	0	0	0	**10531**	3158	0	14	0	0	0	0	14
1995	6035	1455	5283	3149	5052	3195	2238	1052	0	0	46	161	0	0	15	0	0	0	**27681**	6346	0	0	0	0	0	0	0
1996	299	11	26	37	73	1340	0	367	0	0	0	258	nf	11	233	nf	300	39	**2994**	1397	nf	55	0	nf	0	0	55
1997	1779	85	167	951	4806	3220	0	159	0	0	276	96	0	0	0	0	16	0	**11555**	2467	0	0	0	0	0	0	0
1998	2027	735	1786	2108	815	1198	0	820	1	0	606	42	0	0	0	0	8	30	**10176**	1753	0	0	9	0	0	0	9
1999	2379	367	16088	2902	7355	9096	716	684	18	21		184	0	0	25	0	0	13	**39848**	15975	1	0	0	0	0	0	1
2000	1817	574	5978	5371	5249	14518	0	86	33	12	161	18	4	49	11	0	1	28	**33910**	6738	0	5	0	0	0	0	5
2001	5922	155	558	1785	8149	7207	0	810	41	91	50	0	0	0	0	0	0	2	**24770**	4051	0	0	0	0	0	0	0
2002	4037	481	493	2542	2296	4081	0	1407	960	0	447	8920	0	0	0	0	0	11	**25675**	8993	0	0	0	0	0	0	0
2003	1547	243	238	2028	2002	8617	2	566	62	111	769	0	0	0	0	0	0	0	**16185**	5988	0	0	0	0	0	0	0
2004	440	641	267	2663	685	3025	239	267	225	0	23	3	0	0	19	0	0	0	**8499**	2867	0	0	0	0	0	0	0
2005	1664	442	3592	3002	4017	4231	1604	0	31	25	145	4	0	0	0	0	0	0	**18757**	4624	0	0	0	0	0	0	0
2006	1347	713	1804	421	1348	4782	1105	185	312	17	25	26	0	0	51	6	0	9	**12151**	2469	0	0	0	nf	0	0	0
2007	1463	141	1010	1540	4093	19781	184	292	165	2891	111	11472	1	0	30	0	0	5	**43179**	16998	0	0	0	0	0	0	0
2008	1813	296	1220	1305	1907	3344	91	333	167	175	59	991	5	24	30	0	6	0	**11766**	2472	0	0	0	0	0	0	0
2009	3019	189	1712	1714	4705	4502	53	622	21	13	100	43	0	nf	4	6	0	33	**16736**	3409	0	0	0	0	0	0	0
2010	1596	214	508	940	3003	8294	64	210	38	50	2	651	14	0	11	4	0	0	**15599**	4027	0	0	0	0	0	0	0
2011	2049	198	3527	1500	2296	6939	1457	754	86	24	0	62	0	0	0	0	0	8	**18900**	4645	0	0	0	0	0	0	0
2012	10556	256	1587	1270	2896	7022	300	376	2	123	156	52	0	0	0	0	0	0	**24596**	6811	0	0	0	0	0	0	0
2013	1671	177	2502	890	5549	4081	12	629	0	0	11	0	0	0	0	0	0	0	**15522**	3010	0	0	0	0	0	0	0
2014																											0
2015	3282	145	409	827	3013	2511	1265	1059	85	72	42	0	0	0	0	0	0	0	**12711**	3285	0	0	0	0	0	0	0
2016	634	366	1279	1232	352	5296	0	629	5	9	0	0	0	nf	0	0	0	0	**9801**	2413	0	0	0	0	0	0	0
2017	2649	21	1825	959	1636	2275	0	53	770	17	4	0	0	0	0	4	0	0	**10212**	2938	5	0	0	0	0	nf	5

Table 16. Mean number per tow at age of cod from spring RV surveys in NAFO Divisions 3NO as calculated using the conversion from Warren (1997) for surveys in 1984-1995. Results for 1996 -2017 are actual Campelen surveys.

Year	AGE																				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1+
1984	0.00	0.16	53.39	41.57	21.35	7.17	5.04	1.51	0.72	1.36	1.15	0.61	0.25	0.10	0.03	0.05	0.08	0.05	0.01	0.00	134.60
1985	0.00	0.37	9.88	29.27	16.14	2.76	0.90	1.03	0.66	0.84	1.18	0.88	0.48	0.23	0.14	0.08	0.08	0.03	0.01	0.02	64.98
1986	0.00	0.38	12.77	3.63	17.87	11.53	2.11	0.82	0.58	0.42	0.61	1.02	0.51	0.31	0.15	0.08	0.04	0.04	0.03	0.03	52.93
1987	0.00	5.00	54.15	14.13	19.67	50.35	26.41	7.38	1.71	1.63	0.54	0.70	0.60	0.68	0.23	0.21	0.12	0.00	0.01	0.02	183.54
1988	0.00	0.18	26.45	12.91	1.02	0.47	1.10	1.13	0.66	0.67	0.75	0.35	0.44	0.69	0.55	0.21	0.11	0.11	0.04	0.03	47.87
1989	0.00	0.38	4.77	10.39	2.40	0.34	0.31	0.61	0.52	0.36	0.40	0.51	0.33	0.27	0.39	0.21	0.11	0.09	0.04	0.03	22.46
1990	0.00	0.90	7.25	6.77	3.80	1.46	0.25	0.41	0.52	0.61	0.46	0.34	0.34	0.16	0.37	0.44	0.22	0.14	0.06	0.05	24.55
1991	0.00	0.57	147.62	15.44	1.59	0.47	0.16	0.07	0.06	0.14	0.12	0.11	0.09	0.12	0.13	0.12	0.18	0.07	0.04	0.00	167.10
1992	0.00	0.00	10.07	9.66	0.24	0.11	0.09	0.03	0.03	0.08	0.11	0.13	0.14	0.12	0.10	0.09	0.09	0.06	0.01	0.01	21.17
1993	0.00	0.00	1.17	58.27	53.63	1.25	0.68	0.46	0.22	0.05	0.08	0.17	0.12	0.07	0.07	0.09	0.05	0.02	0.01	0.01	116.42
1994	0.00	0.00	0.22	0.91	1.63	1.05	0.07	0.12	0.07	0.07	0.02	0.04	0.05	0.07	0.02	0.03	0.01	0.00	0.03	0.01	4.42
1995	0.00	0.00	0.76	0.20	0.04	0.15	0.10	0.01	0.02	0.05	0.01	0.01	0.02	0.05	0.02	0.03	0.02	0.00	0.00	0.00	1.49
1996	0.00	0.10	1.35	1.65	0.44	0.24	0.57	0.56	0.05	0.04	0.03	0.02	0.00	0.00	0.03	0.02	0.00	0.01	0.00	0.00	5.11
1997	0.00	0.06	0.24	1.67	0.58	0.16	0.03	0.09	0.07	0.01	0.02	0.03	0.02	0.01	0.00	0.01	0.00	0.00	0.01	0.00	3.01
1998	0.00	1.71	0.16	0.51	1.23	0.52	0.17	0.13	1.35	1.61	0.15	0.03	0.01	0.03	0.00	0.02	0.01	0.00	0.00	0.00	7.64
1999	0.00	4.69	4.71	4.55	0.38	0.70	0.30	0.11	0.12	0.42	0.84	0.07	0.03	0.03	0.02	0.01	0.00	0.02	0.00	0.00	17.00
2000	0.00	2.15	6.46	4.58	0.69	0.10	0.20	0.29	0.07	0.06	0.57	1.10	0.13	0.02	0.00	0.01	0.02	0.00	0.00	0.00	16.45
2001	0.00	0.15	1.88	2.91	1.01	0.26	0.01	0.06	0.07	0.01	0.01	0.16	0.40	0.04	0.02	0.00	0.01	0.00	0.00	0.00	7.00
2002	0.00	0.23	0.66	0.98	0.40	0.23	0.10	0.01	0.06	0.01	0.02	0.01	0.03	0.16	0.00	0.01	0.00	0.00	0.00	0.00	2.91
2003	0.00	0.30	0.58	0.47	0.51	1.03	0.82	0.12	0.01	0.05	0.02	0.02	0.01	0.08	0.08	0.01	0.00	0.00	0.00	0.00	4.11
2004	0.00	1.18	1.12	0.50	0.19	0.13	0.18	0.18	0.07	0.02	0.08	0.02	0.03	0.02	0.02	0.10	0.01	0.00	0.01	0.00	3.86
2005	0.00	2.64	2.05	2.76	0.48	0.20	0.07	0.33	0.26	0.13	0.02	0.07	0.02	0.00	0.00	0.03	0.02	0.00	0.00	0.00	9.08
2006																					
2007	0.00	14.87	6.12	3.91	1.95	0.46	0.11	0.05	0.09	0.14	0.13	0.11	0.01	0.01	0.01	0.00	0.03	0.01	0.04	0.01	28.06
2008	0.00	0.36	12.89	9.63	1.37	1.03	0.21	0.07	0.01	0.02	0.18	0.14	0.08	0.00	0.02	0.01	0.01	0.01	0.01	0.00	26.05
2009	0.00	0.65	7.02	59.57	8.28	3.94	1.94	0.61	0.14	0.02	0.07	0.08	0.16	0.02	0.01	0.01	0.00	0.00	0.00	0.00	82.52
2010	0.00	4.30	4.21	3.09	5.08	1.57	0.64	0.36	0.06	0.01	0.02	0.01	0.04	0.02	0.00	0.01	0.00	0.00	0.00	0.00	19.42
2011	0.00	0.04	3.92	8.01	1.72	1.65	0.69	0.25	0.16	0.01	0.02	0.01	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	16.51
2012	0.00	1.13	1.04	3.80	3.01	0.70	2.56	0.94	0.34	0.32	0.06	0.05	0.03	0.07	0.08	0.01	0.01	0.00	0.00	0.00	14.16
2013	0.00	1.12	3.43	1.48	2.11	1.99	0.46	2.13	1.04	0.37	0.19	0.04	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	14.37
2014	0.00	1.21	1.40	2.16	0.61	2.59	2.78	0.57	3.90	1.46	0.23	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.96
2015	0.00	1.29	3.58	1.84	0.70	0.27	0.55	0.40	0.11	0.82	0.19	0.17	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.93
2016	0.00	1.94	6.20	1.38	0.51	0.28	0.14	0.23	0.20	0.03	0.16	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.15
2017	0.00	0.49	1.49	1.28	1.12	0.43	0.21	0.06	0.10	0.08	0.02	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.36

Table 17. Mean number per tow at age of cod from Autumn RV surveys in NAFO Divisions 3NO as calculated using the conversion from Warren (1997) for surveys in 1984-1994. Results for 1995 -2017 are actual Campelen surveys.

Year	AGE																				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1+
1990	0.00	18.89	6.15	3.25	3.56	1.73	0.37	0.29	0.38	0.40	0.24	0.20	0.09	0.15	0.07	0.16	0.21	0.07	0.02	0.03	36.26
1991	0.00	14.87	129.66	4.36	2.19	2.73	1.33	0.37	0.31	0.53	0.37	0.45	0.33	0.27	0.21	0.12	0.38	0.16	0.06	0.00	158.70
1992	0.00	0.41	49.65	65.00	4.70	1.02	0.61	0.18	0.03	0.03	0.07	0.00	0.06	0.12	0.03	0.03	0.02	0.03	0.08	0.00	122.07
1993	0.00	1.30	0.72	3.63	3.59	0.30	0.27	0.18	0.10	0.02	0.02	0.06	0.04	0.04	0.05	0.06	0.02	0.01	0.02	0.00	10.43
1994	0.00	0.00	0.62	0.28	0.96	1.32	0.16	0.04	0.06	0.01	0.01	0.03	0.03	0.02	0.06	0.01	0.03	0.02	0.01	0.00	3.67
1995	0.00	1.15	1.02	0.46	0.20	0.94	1.64	0.11	0.05	0.06	0.05	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	5.72
1996	0.00	0.08	0.74	0.29	0.06	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	1.26
1997	0.00	0.03	0.10	0.40	0.33	0.14	0.06	0.28	0.28	0.05	0.04	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	1.74
1998	0.00	1.67	0.29	0.20	0.32	0.11	0.06	0.01	0.16	0.22	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	3.09
1999	0.39	4.44	5.01	2.52	0.13	0.37	0.30	0.08	0.04	0.12	0.55	0.04	0.00	0.00	0.02	0.00	0.02	0.03	0.00	0.01	13.68
2000	0.07	2.12	3.77	4.75	1.81	0.20	0.24	0.11	0.03	0.01	0.03	0.24	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	13.33
2001	0.06	0.34	2.64	4.70	2.55	0.98	0.07	0.16	0.06	0.02	0.02	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	11.60
2002	0.13	0.33	0.61	1.13	1.58	1.31	0.39	0.03	0.06	0.04	0.00	0.03	0.03	0.05	0.01	0.00	0.01	0.00	0.00	0.00	5.61
2003	0.16	0.96	0.27	0.26	0.35	0.78	0.83	0.14	0.01	0.02	0.05	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	3.71
2004	1.08	0.97	0.63	0.35	0.14	0.12	0.23	0.24	0.12	0.01	0.04	0.00	0.00	0.00	0.07	0.03	0.00	0.00	0.00	0.00	2.95
2005	0.27	4.24	2.42	1.24	0.23	0.07	0.06	0.27	0.38	0.10	0.00	0.04	0.01	0.03	0.00	0.02	0.03	0.00	0.00	0.00	9.14
2006	0.21	0.19	2.10	3.94	1.27	0.47	0.13	0.05	0.20	0.09	0.12	0.04	0.01	0.00	0.00	0.01	0.02	0.00	0.00	0.00	8.64
2007	0.15	13.95	15.61	3.70	3.28	0.44	0.18	0.05	0.05	0.14	0.23	0.06	0.00	0.02	0.01	0.01	0.01	0.00	0.00	0.00	37.74
2008	0.53	1.32	13.79	8.96	1.30	0.92	0.20	0.07	0.00	0.01	0.03	0.03	0.09	0.00	0.03	0.01	0.00	0.00	0.03	0.00	26.79
2009	0.08	3.25	8.10	16.37	5.11	1.07	0.65	0.12	0.06	0.00	0.00	0.03	0.05	0.01	0.00	0.01	0.00	0.00	0.00	0.00	34.83
2010	0.29	4.52	3.37	2.07	3.09	1.38	0.41	0.30	0.21	0.05	0.00	0.03	0.02	0.07	0.01	0.00	0.00	0.00	0.00	0.00	15.53
2011	0.13	0.66	3.10	3.55	0.73	2.99	0.82	0.32	0.24	0.03	0.03	0.01	0.00	0.06	0.01	0.00	0.01	0.00	0.00	0.00	12.56
2012	0.64	4.16	2.12	2.95	2.25	0.73	2.76	1.09	0.43	0.28	0.15	0.00	0.02	0.02	0.02	0.00	0.01	0.00	0.00	0.00	17.00
2013	0.16	5.19	5.98	2.07	2.25	2.50	0.86	2.26	0.80	0.25	0.15	0.10	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	22.43
2014																					
2015	1.18	3.52	3.19	1.36	0.72	0.30	0.52	0.25	0.14	0.36	0.16	0.05	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	10.57
2016	0.26	2.29	5.95	1.98	0.39	0.34	0.08	0.29	0.15	0.03	0.37	0.18	0.02	0.03	0.00	0.01	0.00	0.00	0.00	0.00	12.11
2017	0.57	2.21	3.35	2.40	0.59	0.23	0.19	0.09	0.11	0.05	0.01	0.05	0.03	0.00	0.02	0.01	0.00	0.00	0.00	0.00	9.34

Table 18. Mean number per tow at age of cod from Juvenile Surveys conducted by Canada in Divisions 3NO during August and September.

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

Table 19. Estimated proportions mature for female cod from NAFO Divs. 3NO from DFO surveys from 1975 to 2012 projected forward to 2012 and back to 1954. Estimates were obtained from a probit model fitted by cohort to observed proportions mature at age. When the model did not fit the data for a particular cohort (I.e 1991 and 2000 cohorts) the average of estimates for the same age group from adjacent years was used; dark shaded cells are averages extrapolated forward or backward from the same age group from 3 previous (or next) years.

Year	Age 1	Age2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1954	0.0000	0.0004	0.0020	0.0112	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1955	0.0001	0.0000	0.0020	0.0112	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1956	0.0001	0.0003	0.0001	0.0112	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1957	0.0003	0.0007	0.0018	0.0008	0.0592	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1958	0.0001	0.0016	0.0041	0.0102	0.0065	0.2424	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1959	0.0000	0.0006	0.0079	0.0226	0.0555	0.0509	0.5895	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1960	0.0000	0.0000	0.0033	0.0393	0.1157	0.2512	0.3043	0.8856	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1961	0.0002	0.0001	0.0001	0.0168	0.1731	0.4251	0.6572	0.7809	0.9812	0.9972	0.9996	0.9999	1.0000	1.0000
1962	0.0000	0.0012	0.0009	0.0012	0.0825	0.5172	0.8069	0.9164	0.9667	0.9972	0.9996	0.9999	1.0000	1.0000
1963	0.0000	0.0002	0.0056	0.0099	0.0229	0.3206	0.8458	0.9594	0.9843	0.9958	0.9996	0.9999	1.0000	1.0000
1964	0.0000	0.0000	0.0010	0.0266	0.1000	0.3219	0.7124	0.9656	0.9926	0.9972	0.9995	0.9999	1.0000	1.0000
1965	0.0014	0.0000	0.0000	0.0049	0.1162	0.5526	0.9057	0.9286	0.9931	0.9987	0.9995	0.9999	1.0000	1.0000
1966	0.0000	0.0043	0.0005	0.0006	0.0234	0.3875	0.9321	0.9949	0.9856	0.9986	0.9998	0.9999	1.0000	1.0000
1967	0.0000	0.0001	0.0132	0.0067	0.0097	0.1037	0.7527	0.9935	0.9997	0.9972	0.9997	1.0000	1.0000	1.0000
1968	0.0000	0.0000	0.0012	0.0398	0.0820	0.1450	0.3587	0.9361	0.9994	1.0000	0.9995	0.9999	1.0000	1.0000
1969	0.0000	0.0000	0.0003	0.0090	0.1144	0.5429	0.7457	0.7301	0.9860	0.9999	1.0000	0.9999	1.0000	1.0000
1970	0.0032	0.0000	0.0001	0.0029	0.0665	0.2866	0.9405	0.9807	0.9290	0.9971	1.0000	1.0000	1.0000	1.0000
1971	0.0000	0.0093	0.0000	0.0009	0.0275	0.3582	0.5555	0.9953	0.9989	0.9844	0.9994	1.0000	1.0000	1.0000
1972	0.0000	0.0002	0.0269	0.0000	0.0101	0.2176	0.8140	0.7954	0.9996	0.9999	0.9967	0.9999	1.0000	1.0000
1973	0.0001	0.0000	0.0013	0.0754	0.0038	0.1018	0.7320	0.9717	0.9236	1.0000	1.0000	0.9993	1.0000	1.0000
1974	0.0000	0.0006	0.0001	0.0083	0.1939	0.2928	0.5582	0.9641	0.9963	0.9741	1.0000	1.0000	0.9999	1.0000
1975	0.0000	0.0003	0.0033	0.0017	0.0530	0.4148	0.9780	0.9337	0.9962	0.9995	0.9915	1.0000	1.0000	1.0000
1976	0.0000	0.0001	0.0020	0.0186	0.0221	0.2715	0.6763	0.9998	0.9937	0.9996	0.9999	0.9973	1.0000	1.0000
1977	0.0006	0.0001	0.0009	0.0142	0.0978	0.2269	0.7128	0.8603	1.0000	0.9994	1.0000	1.0000	0.9991	1.0000
1978	0.0001	0.0029	0.0014	0.0083	0.0935	0.3823	0.7922	0.9429	0.9478	1.0000	0.9999	1.0000	1.0000	0.9997
1979	0.0000	0.0005	0.0145	0.0133	0.0733	0.4248	0.7794	0.9802	0.9910	0.9817	1.0000	1.0000	1.0000	1.0000
1980	0.0002	0.0002	0.0034	0.0695	0.1140	0.4292	0.8410	0.9528	0.9984	0.9986	0.9937	1.0000	1.0000	1.0000
1981	0.0000	0.0007	0.0020	0.0236	0.2749	0.5518	0.8773	0.9743	0.9914	0.9999	0.9998	0.9979	1.0000	1.0000
1982	0.0000	0.0000	0.0035	0.0162	0.1460	0.6579	0.9218	0.9855	0.9963	0.9985	1.0000	1.0000	0.9993	1.0000
1983	0.0000	0.0001	0.0003	0.0163	0.1219	0.5474	0.9070	0.9912	0.9985	0.9995	0.9997	1.0000	1.0000	0.9998
1984	0.0000	0.0003	0.0008	0.0028	0.0726	0.5389	0.8953	0.9802	0.9991	0.9998	0.9999	1.0000	1.0000	1.0000
1985	0.0002	0.0002	0.0019	0.0058	0.0261	0.2703	0.9078	0.9837	0.9960	0.9999	1.0000	1.0000	1.0000	1.0000
1986	0.0000	0.0010	0.0021	0.0134	0.0409	0.2049	0.6369	0.9881	0.9977	0.9992	1.0000	1.0000	1.0000	1.0000
1987	0.0001	0.0000	0.0058	0.0194	0.0869	0.2358	0.7128	0.8925	0.9986	0.9997	0.9998	1.0000	1.0000	1.0000
1988	0.0011	0.0006	0.0002	0.0335	0.1570	0.3994	0.6908	0.9598	0.9752	0.9998	1.0000	1.0000	1.0000	1.0000
1989	0.0001	0.0043	0.0047	0.0031	0.1702	0.6371	0.8229	0.9418	0.9957	0.9947	1.0000	1.0000	1.0000	1.0000
1990	0.0000	0.0011	0.0170	0.0377	0.0441	0.5486	0.9431	0.9701	0.9915	0.9995	0.9989	1.0000	1.0000	1.0000
1991	0.0000	0.0000	0.0079	0.0645	0.2438	0.4047	0.8780	0.9936	0.9956	0.9988	1.0000	0.9998	1.0000	1.0000
1992	0.0000	0.0000	0.0004	0.0557	0.2155	0.7265	0.9092	0.9771	0.9993	0.9994	0.9998	1.0000	0.9999	1.0000
1993	0.0001	0.0004	0.0002	0.0121	0.3045	0.5225	0.9563	0.9933	0.9961	0.9999	0.9999	1.0000	1.0000	1.0000
1994	0.0004	0.0008	0.0040	0.0153	0.2825	0.7646	0.8134	0.9945	0.9995	0.9993	1.0000	1.0000	1.0000	1.0000
1995	0.0002	0.0030	0.0078	0.0418	0.5844	0.9266	0.9602	0.9455	0.9993	1.0000	0.9999	1.0000	1.0000	1.0000
1996	0.0004	0.0014	0.0229	0.0683	0.4952	0.9922	0.9975	0.9944	0.9857	0.9999	1.0000	1.0000	1.0000	1.0000
1997	0.0000	0.0026	0.0130	0.1536	0.4059	0.9282	0.9999	0.9999	0.9992	0.9964	1.0000	1.0000	1.0000	1.0000
1998	0.0000	0.0001	0.0170	0.1076	0.5837	0.8642	0.9917	1.0000	1.0000	0.9999	0.9991	1.0000	1.0000	1.0000
1999	0.0000	0.0000	0.0009	0.1035	0.5240	0.9155	0.9834	0.9991	1.0000	1.0000	1.0000	0.9998	1.0000	1.0000
2000	0.0000	0.0003	0.0011	0.0135	0.4356	0.9095	0.9882	0.9982	0.9999	1.0000	1.0000	1.0000	0.9999	1.0000
2001	0.0006	0.0002	0.0066	0.0278	0.1676	0.8377	0.9892	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2002	0.0011	0.0029	0.0067	0.1366	0.4280	0.7473	0.9718	0.9988	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2003	0.0006	0.0055	0.0163	0.1598	0.7908	0.9514	0.9775	0.9957	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
2004	0.0024	0.0028	0.0259	0.1370	0.8429	0.9891	0.9981	0.9984	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
2005	0.0025	0.0110	0.0132	0.1143	0.6138	0.9934	0.9995	0.9999	0.9999	0.9999	1.0000	1.0000	1.0000	1.0000
2006	0.0001	0.0094	0.0484	0.0589	0.3846	0.8726	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2007	0.0008	0.0007	0.0344	0.1889	0.2269	0.7518	0.9680	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2008	0.0012	0.0037	0.0039	0.1179	0.5160	0.5793	0.9362	0.9931	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2009	0.0004	0.0045	0.0159	0.0202	0.3343	0.8299	0.8660	0.9861	0.9986	1.0000	1.0000	1.0000	1.0000	1.0000
2010	0.0000	0.0026	0.0162	0.0663	0.0991	0.6534	0.9571	0.9681	0.9971	0.9997	1.0000	1.0000	1.0000	1.0000
2011	0.0014	0.0000	0.0165	0.0564	0.2381	0.3696	0.8762	0.9903	0.9930	0.9994	0.9999	1.0000	1.0000	1.0000
2012	0.0006	0.0062	0.0005	0.0982	0.1786	0.5791	0.7575	0.9637	0.9979	0.9985	0.9999	1.0000	1.0000	1.0000
2013	0.0007	0.0036	0.0268	0.0212	0.4136	0.4415	0.8583	0.9433	0.9901	0.9995	0.9997	1.0000	1.0000	1.0000
2014	0.0007	0.0033	0.0203	0.1076	0.5010	0.8204	0.7419	0.9638	0.9888	0.9973	0.9999	0.9999	1.0000	1.0000
2015	0.0007	0.0033	0.0158	0.1061	0.3455	0.9789	0.9673	0.9127	0.9915	0.9979	0.9993	1.0000	1.0000	1.0000
2016	0.0007	0.0033	0.0158	0.0783	0.4052	0.6980	0.9995	0.9948	0.9744	0.9981	0.9996	0.9998	1.0000	1.0000
2017	0.0007	0.0033	0.0158	0.0783	0.4172	0.7962	0.9101	1.0000	0.9992	0.9928	0.9996	0.9999	0.9999	1.0000
2018	0.0007	0.0033	0.0158	0.0783	0.4172	0.8244	0.9573	0.9779	1.0000	0.9999	0.9980	0.9999	1.0000	1.0000

Table 20. Estimated survivors and catchabilities in linear scale from ADAPT.

Orthogonality offset	0.000155
Mean square residuals	0.610582

Year	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
1994	12	139.332	85.334	0.612	16.177	0.116
1995	12	70.484	30.571	0.434	5.352	0.076
1996	12	40.287	13.566	0.337	2.109	0.052
1997	12	83.525	25.769	0.309	3.873	0.046
1998	12	113.245	36.664	0.324	5.731	0.051
1999	12	56.869	19.153	0.337	2.978	0.052
2000	12	61.102	18.001	0.295	2.538	0.042
2001	12	531.378	144.468	0.272	19.031	0.036
2002	12	250.072	67.075	0.268	8.851	0.035
2003	12	35.351	9.477	0.268	1.224	0.035
2004	12	43.181	12.289	0.285	1.592	0.037
2005	12	75.839	21.978	0.290	2.845	0.038
2006	12	82.486	25.469	0.309	3.419	0.041
2007	12	19.983	6.106	0.306	0.879	0.044
2008	12	127.085	40.615	0.320	5.866	0.046
2009	12	276.237	85.427	0.309	12.197	0.044
2010	12	193.059	59.078	0.306	8.458	0.044
2011	12	53.864	15.847	0.294	2.299	0.043
2012	12	35.060	10.961	0.313	1.613	0.046
2013	12	62.865	17.100	0.272	2.260	0.036
2014	12	131.707	34.958	0.265	4.568	0.035
2015	12	417.215	103.043	0.247	13.283	0.032
2016	12	449.623	109.512	0.244	14.414	0.032
2017	12	962.203	219.353	0.228	28.148	0.029
2018	3	1882.512	1070.887	0.569	317.099	0.168
2018	4	2225.693	928.609	0.417	204.051	0.092
2018	5	1117.521	404.452	0.362	75.983	0.068
2018	6	488.649	172.568	0.353	30.790	0.063
2018	7	520.705	168.102	0.323	27.666	0.053
2018	8	223.320	72.767	0.326	11.534	0.052
2018	9	604.647	170.576	0.282	24.830	0.041
2018	10	650.286	163.950	0.252	22.314	0.034
2018	11	228.228	56.237	0.246	7.276	0.032
2018	12	1535.658	352.296	0.229	45.030	0.029

Catchabilities	Age	Estimate	Standard Error	Relative Error	Bias	Relative Bias
RV Spring	2	0.001056	0.000155	0.146	0.000004	0.003
RV Spring	3	0.001391	0.000203	0.146	0.000005	0.004
RV Spring	4	0.000719	0.000106	0.147	0.000003	0.004
RV Spring	5	0.000499	0.000075	0.151	0.000003	0.005
RV Spring	6	0.000349	0.000054	0.155	0.000002	0.006
RV Spring	7	0.000337	0.000053	0.159	0.000003	0.008
RV Spring	8	0.000318	0.000052	0.163	0.000003	0.010
RV Spring	9	0.000308	0.000051	0.166	0.000004	0.011
RV Spring	10	0.000377	0.000064	0.169	0.000005	0.014
RV Fall	2	0.001157	0.000190	0.164	0.000006	0.005
RV Fall	3	0.001158	0.000190	0.164	0.000007	0.006
RV Fall	4	0.000806	0.000135	0.168	0.000006	0.007
RV Fall	5	0.000677	0.000117	0.173	0.000006	0.008
RV Fall	6	0.000543	0.000096	0.178	0.000005	0.010
RV Fall	7	0.000379	0.000070	0.184	0.000005	0.012
RV Fall	8	0.000363	0.000069	0.191	0.000005	0.015
RV Fall	9	0.000253	0.000050	0.198	0.000005	0.018
RV Fall	10	0.000323	0.000068	0.211	0.000008	0.024
RV Juvenile	2	0.003505	0.001129	0.322	0.000163	0.046
RV Juvenile	3	0.001835	0.000589	0.321	0.000085	0.046
RV Juvenile	4	0.001323	0.000427	0.322	0.000062	0.047
RV Juvenile	5	0.001076	0.000348	0.324	0.000049	0.046
RV Juvenile	6	0.000780	0.000255	0.327	0.000035	0.045
RV Juvenile	7	0.000563	0.000187	0.333	0.000026	0.046
RV Juvenile	8	0.000441	0.000149	0.337	0.000022	0.049
RV Juvenile	9	0.000279	0.000096	0.343	0.000015	0.055
RV Juvenile	10	0.000244	0.000086	0.352	0.000016	0.065

Table 21. Estimated bias adjusted population numbers ('000) from ADAPT for cod in NAFO Divs. 3NO.

Pop #s Bias Adj(analytical)	2	3	4	5	6	7	8	9	10	11	12	Total
1959	63623	53067	92911	19327	16484	12049	4268	3076	3217	2287	324	270633
1960	98989	52090	41903	64326	11271	8099	6336	2246	1838	1803	786	289687
1961	130098	81045	40981	28451	32902	6449	4497	2947	1315	1157	675	330518
1962	94606	106515	65621	29586	12832	13314	3473	2185	1652	900	925	331609
1963	135041	77456	86281	50223	22233	9081	7673	2149	1189	964	534	392824
1964	195489	110562	63133	65447	31040	13843	5695	2858	722	432	500	489720
1965	252970	160052	84924	37711	36087	18299	9287	3665	1632	298	320	605245
1966	221171	207114	130125	62667	24021	17671	6202	3302	2030	239	99	674641
1967	121541	181079	168891	89951	33653	9146	6895	1137	1076	183	87	613638
1968	154111	99509	130150	82351	28883	11073	3234	1531	719	719	86	512367
1969	96818	126175	66743	55815	24240	7265	3431	1228	801	429	508	383453
1970	101649	79268	95947	43016	21651	9853	4073	1563	542	394	231	358186
1971	74518	83223	62998	60832	25515	9253	4802	1872	795	310	121	324238
1972	42190	61010	67279	27529	22783	10441	4442	1704	1083	471	164	239097
1973	44128	34542	49888	37316	11560	6720	3316	2127	1138	693	316	191743
1974	27766	36129	19253	16285	17044	4127	3733	1842	1108	713	444	128444
1975	32974	22733	23797	7288	3683	4318	1379	1147	605	307	204	98435
1976	54579	26997	18006	11619	2819	800	837	198	132	90	31	116108
1977	50096	44686	18452	8005	4213	1338	466	471	123	75	62	127987
1978	20922	41016	36037	12883	4283	2106	584	223	199	43	25	118320
1979	23735	17129	32750	25596	8282	2771	1405	386	130	117	28	112331
1980	33088	19433	13959	23364	12707	4285	1477	912	264	91	85	109666
1981	26430	27090	15670	10477	15697	8356	2823	1009	664	188	68	108472
1982	42606	21639	21723	11845	7441	10783	5132	1795	653	459	117	124193
1983	49846	34883	17441	16002	8265	5180	7452	2862	936	346	230	143443
1984	39821	40811	27495	13695	11395	5682	3623	5063	1648	553	210	149997
1985	10735	32602	33361	21608	9941	7239	3555	2319	3319	855	357	125892
1986	7838	8789	26641	24650	12123	5415	3669	2194	1485	2238	466	95509
1987	15623	6417	7058	19229	14412	6011	3076	2153	1295	881	1518	77671
1988	15538	12615	4788	5398	12602	8703	3830	1931	1006	618	366	67395
1989	6226	12490	10078	3634	3048	4658	3593	2229	1072	444	283	47756
1990	6882	4983	8500	6289	1631	1369	2126	1791	1389	668	213	35841
1991	24803	5265	3123	2947	1313	539	742	1094	946	744	412	41926
1992	7917	14889	3318	1951	1520	588	190	279	390	327	267	31638
1993	807	6407	8145	1141	849	697	271	98	140	204	131	18892
1994	509	631	4063	3797	368	269	284	156	58	80	123	10338
1995	983	417	309	1259	2106	189	137	209	120	47	65	5841
1996	1361	805	341	188	1013	1688	153	112	170	98	38	5968
1997	469	1112	656	275	151	814	1360	123	90	137	80	5265
1998	2832	383	900	520	215	119	638	1073	96	70	108	6954
1999	6032	2318	311	716	407	167	93	497	841	75	54	11512
2000	5598	4897	1813	218	495	297	124	71	386	639	59	14597
2001	2175	4574	3688	1179	100	350	224	91	54	305	512	13253
2002	992	1772	3576	2747	821	72	247	163	68	43	241	10743
2003	901	722	1254	2432	1865	546	51	178	122	53	34	8158
2004	1726	699	290	309	856	927	327	37	130	92	42	5436
2005	4717	1404	539	197	208	618	693	249	30	100	73	8827
2006	4436	3861	1148	440	159	167	481	518	186	23	79	11498
2007	8185	3591	2968	789	287	112	132	385	422	150	19	17040
2008	13524	6698	2755	2169	562	212	83	103	307	337	121	26871
2009	2132	11071	5480	2203	1627	423	156	66	81	233	264	23738
2010	4654	1735	8828	4336	1681	1251	323	117	53	63	185	23227
2011	3807	3586	1227	6813	3374	1309	989	253	96	42	52	21548
2012	1434	3077	2767	954	5458	2723	1029	768	201	75	33	18520
2013	2023	1150	2323	2088	747	4382	2198	828	616	160	61	16576
2014	1423	1638	790	1687	1573	575	3479	1750	656	496	127	14193
2015	2222	1111	1166	517	1240	1235	421	2822	1421	534	404	13093
2016	3227	1810	856	863	377	942	982	336	2276	1157	435	13262
2017	1962	2631	1409	608	637	282	730	777	271	1837	934	12078
2018	2414	1565	2022	1042	458	493	212	580	628	221	1491	11124

Table 22. Bias adjusted fishing mortality from ADAPT for cod in NAFO Divs. 3NO.

F Bias Adj(analytical)	2	3	4	5	6	7	8	9	10	11	12	Fbar6-9	Fbar4-6
1959	0.000	0.036	0.168	0.339	0.511	0.443	0.442	0.315	0.379	0.868	0.428	0.428	0.339
1960	0.000	0.040	0.187	0.470	0.358	0.388	0.566	0.335	0.263	0.782	0.412	0.412	0.339
1961	0.000	0.011	0.126	0.596	0.705	0.419	0.522	0.379	0.179	0.024	0.506	0.506	0.476
1962	0.000	0.011	0.067	0.086	0.146	0.351	0.280	0.408	0.339	0.322	0.296	0.296	0.100
1963	0.000	0.004	0.076	0.281	0.274	0.267	0.788	0.891	0.813	0.456	0.555	0.555	0.210
1964	0.000	0.064	0.315	0.395	0.328	0.199	0.241	0.360	0.684	0.099	0.282	0.282	0.346
1965	0.000	0.007	0.104	0.251	0.514	0.882	0.834	0.391	1.721	0.902	0.655	0.655	0.290
1966	0.000	0.004	0.169	0.422	0.766	0.741	1.496	0.921	2.208	0.811	0.981	0.981	0.452
1967	0.000	0.130	0.518	0.936	0.912	0.839	1.305	0.259	0.203	0.553	0.829	0.829	0.789
1968	0.000	0.199	0.647	1.023	1.180	0.972	0.768	0.448	0.317	0.148	0.842	0.842	0.950
1969	0.000	0.074	0.239	0.747	0.700	0.379	0.586	0.618	0.509	0.419	0.571	0.571	0.562
1970	0.000	0.030	0.256	0.322	0.650	0.519	0.578	0.476	0.359	0.983	0.556	0.556	0.409
1971	0.000	0.013	0.628	0.782	0.694	0.534	0.836	0.347	0.323	0.436	0.603	0.603	0.701
1972	0.000	0.001	0.389	0.668	1.021	0.947	0.536	0.203	0.247	0.201	0.677	0.677	0.693
1973	0.000	0.385	0.920	0.584	0.830	0.388	0.388	0.453	0.267	0.245	0.514	0.514	0.778
1974	0.000	0.218	0.771	1.287	1.173	0.896	0.980	0.913	1.083	1.052	0.991	0.991	1.077
1975	0.000	0.033	0.517	0.750	1.327	1.441	1.740	1.959	1.705	2.097	1.617	1.617	0.864
1976	0.000	0.181	0.611	0.814	0.545	0.342	0.374	0.279	0.366	0.173	0.385	0.385	0.657
1977	0.000	0.015	0.159	0.425	0.494	0.629	0.537	0.661	0.859	0.899	0.580	0.580	0.359
1978	0.000	0.025	0.142	0.242	0.236	0.204	0.213	0.337	0.330	0.231	0.247	0.247	0.206
1979	0.000	0.005	0.138	0.500	0.459	0.429	0.232	0.181	0.155	0.120	0.325	0.325	0.366
1980	0.000	0.015	0.087	0.198	0.219	0.217	0.181	0.118	0.138	0.101	0.184	0.184	0.168
1981	0.000	0.021	0.080	0.142	0.176	0.288	0.253	0.235	0.169	0.274	0.238	0.238	0.133
1982	0.000	0.016	0.106	0.160	0.162	0.169	0.384	0.451	0.437	0.488	0.292	0.292	0.143
1983	0.000	0.038	0.042	0.140	0.175	0.158	0.186	0.352	0.327	0.297	0.218	0.218	0.119
1984	0.000	0.002	0.041	0.120	0.254	0.269	0.246	0.222	0.456	0.237	0.248	0.248	0.138
1985	0.000	0.002	0.103	0.378	0.408	0.479	0.283	0.245	0.194	0.407	0.354	0.354	0.296
1986	0.000	0.019	0.126	0.337	0.502	0.366	0.333	0.327	0.322	0.188	0.382	0.382	0.321
1987	0.014	0.093	0.068	0.223	0.304	0.251	0.266	0.561	0.540	0.679	0.345	0.345	0.198
1988	0.018	0.025	0.076	0.371	0.795	0.685	0.341	0.388	0.619	0.580	0.552	0.552	0.414
1989	0.023	0.185	0.272	0.601	0.601	0.585	0.496	0.273	0.273	0.535	0.489	0.489	0.491
1990	0.068	0.267	0.859	1.367	0.907	0.412	0.464	0.439	0.425	0.283	0.556	0.556	1.044
1991	0.310	0.262	0.270	0.462	0.603	0.842	0.777	0.833	0.861	0.823	0.764	0.764	0.445
1992	0.012	0.403	0.867	0.632	0.580	0.574	0.460	0.491	0.446	0.713	0.526	0.526	0.693
1993	0.046	0.255	0.563	0.933	0.948	0.697	0.356	0.327	0.365	0.306	0.582	0.582	0.815
1994	0.000	0.514	0.972	0.389	0.465	0.475	0.106	0.058	0.019	0.000	0.000	0.276	0.609
1995	0.000	0.000	0.296	0.018	0.021	0.012	0.000	0.005	0.000	0.000	0.000	0.010	0.111
1996	0.002	0.005	0.016	0.018	0.019	0.016	0.022	0.020	0.020	0.011	0.000	0.019	0.018
1997	0.002	0.012	0.031	0.045	0.037	0.043	0.037	0.046	0.050	0.041	0.042	0.041	0.038
1998	0.000	0.009	0.029	0.046	0.053	0.047	0.050	0.043	0.047	0.065	0.053	0.048	0.042
1999	0.008	0.046	0.157	0.169	0.115	0.097	0.074	0.052	0.075	0.045	0.042	0.084	0.147
2000	0.002	0.083	0.230	0.574	0.148	0.081	0.113	0.064	0.038	0.021	0.038	0.102	0.318
2001	0.005	0.046	0.095	0.162	0.129	0.145	0.120	0.089	0.041	0.033	0.026	0.121	0.128
2002	0.118	0.146	0.185	0.187	0.209	0.148	0.128	0.092	0.050	0.026	0.028	0.144	0.194
2003	0.054	0.712	1.200	0.844	0.498	0.311	0.114	0.118	0.075	0.042	0.033	0.261	0.848
2004	0.007	0.060	0.187	0.196	0.126	0.091	0.073	0.030	0.061	0.036	0.027	0.080	0.170
2005	0.000	0.001	0.002	0.011	0.021	0.051	0.091	0.093	0.038	0.034	0.031	0.064	0.012
2006	0.011	0.063	0.175	0.229	0.157	0.034	0.023	0.004	0.012	0.000	0.000	0.054	0.187
2007	0.001	0.065	0.113	0.139	0.101	0.093	0.051	0.026	0.026	0.015	0.000	0.068	0.118
2008	0.000	0.001	0.023	0.088	0.084	0.110	0.027	0.033	0.075	0.043	0.066	0.063	0.065
2009	0.006	0.026	0.034	0.070	0.063	0.070	0.081	0.017	0.056	0.034	0.069	0.058	0.056
2010	0.061	0.146	0.059	0.051	0.050	0.035	0.045	0.000	0.042	0.000	0.006	0.033	0.053
2011	0.013	0.059	0.052	0.022	0.014	0.040	0.053	0.031	0.047	0.027	0.000	0.035	0.029
2012	0.020	0.081	0.082	0.045	0.020	0.014	0.017	0.020	0.028	0.015	0.000	0.018	0.049
2013	0.012	0.176	0.120	0.083	0.062	0.031	0.027	0.032	0.018	0.028	0.000	0.038	0.089
2014	0.048	0.140	0.224	0.107	0.042	0.111	0.009	0.008	0.007	0.004	0.000	0.043	0.124
2015	0.005	0.061	0.100	0.115	0.076	0.029	0.024	0.015	0.005	0.004	0.000	0.036	0.097
2016	0.004	0.051	0.142	0.103	0.092	0.054	0.034	0.017	0.014	0.014	0.000	0.049	0.112
2017	0.026	0.064	0.102	0.083	0.057	0.086	0.031	0.013	0.004	0.009	0.008	0.047	0.081

Table 23. Beginning of year mean weights at age calculated from commercial catches of cod in Divs. 3NO.

Year\Age	3	4	5	6	7	8	9	10	11	12
1959	0.301	0.664	1.001	1.622	2.572	3.129	3.670	4.419	4.843	5.691
1960	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1961	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1962	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1963	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1964	0.301	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1965	0.287	0.587	1.012	1.561	2.345	3.092	3.673	4.316	4.957	5.691
1966	0.351	0.615	1.052	1.636	2.482	3.446	4.636	5.532	6.292	7.332
1967	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1968	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1969	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1970	0.351	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1971	0.338	0.657	1.102	1.700	2.600	3.647	5.166	6.982	8.066	9.308
1972	0.397	0.682	1.138	1.676	2.487	3.354	5.005	7.100	7.999	9.262
1973	0.504	0.735	1.178	1.776	2.748	3.658	4.717	7.542	9.423	10.789
1974	0.289	0.645	1.095	1.674	2.503	4.117	5.822	5.842	8.961	9.159
1975	0.246	0.611	0.967	1.599	2.481	3.449	5.082	7.024	5.364	7.717
1976	0.354	0.588	1.120	1.727	2.631	3.557	5.268	6.952	7.849	8.113
1977	0.420	0.707	1.161	1.870	2.860	3.925	5.375	7.666	10.112	10.239
1978	0.617	0.774	1.245	1.825	3.046	4.023	5.417	7.200	9.139	12.271
1979	0.514	0.840	1.208	1.800	2.541	3.720	4.679	6.653	7.596	9.790
1980	0.531	0.822	1.287	1.864	2.777	3.969	5.434	6.618	8.706	10.031
1981	0.789	0.950	1.383	2.132	2.979	4.435	6.256	8.522	9.114	10.373
1982	0.843	1.026	1.380	2.012	3.210	4.321	6.318	7.921	9.453	10.519
1983	0.731	1.049	1.479	1.986	2.891	4.463	5.743	7.779	8.894	10.398
1984	0.757	0.989	1.329	2.065	2.828	3.923	5.473	6.728	8.490	10.647
1985	0.331	0.824	1.255	1.759	2.722	3.760	5.178	6.923	8.128	9.964
1986	0.269	0.696	1.143	1.720	2.675	4.193	6.080	8.063	9.094	9.508
1987	0.343	0.566	1.146	1.668	2.498	4.076	6.267	8.435	9.835	11.187
1988	0.646	0.700	1.064	1.525	2.020	3.301	4.937	7.067	9.158	10.442
1989	0.362	0.847	1.265	1.758	2.419	3.206	5.166	6.523	8.072	10.714
1990	0.442	0.718	1.190	2.004	2.473	3.679	4.811	7.698	8.786	10.322
1991	0.506	0.684	1.267	1.832	3.101	3.896	5.583	6.737	10.014	11.396
1992	0.215	0.598	0.949	1.692	2.547	4.310	5.560	7.480	8.838	11.295
1993	0.318	0.507	0.937	1.397	2.253	3.404	5.336	6.569	8.081	8.655
1994	0.162	0.407	0.842	1.483	1.840	3.375	4.506	6.653	5.167	8.130
1995	0.309	0.450	0.746	1.359	1.932	1.956	5.164	5.543	6.951	5.255
1996	0.309	0.573	0.986	1.552	2.332	2.781	3.125	6.284	6.314	7.173
1997	0.309	0.573	1.005	1.606	2.310	3.007	3.982	5.301	6.193	7.173
1998	0.282	0.573	1.005	1.606	2.310	3.007	3.982	5.301	6.193	7.173
1999	0.386	0.628	1.114	1.638	2.106	2.754	3.672	5.328	6.346	6.877
2000	0.442	0.639	1.163	1.951	2.669	2.543	2.732	3.887	5.632	6.394
2001	0.444	0.805	1.067	1.730	3.115	4.237	3.931	3.813	5.330	6.717
2002	0.569	0.767	1.285	1.762	2.643	4.569	5.590	6.151	6.834	8.364
2003	0.571	0.795	1.188	1.753	2.600	3.722	6.264	6.807	7.782	8.841
2004	0.483	0.785	1.138	1.745	2.474	3.442	4.876	8.072	8.664	8.647
2005	0.324	0.985	1.505	2.173	2.931	3.868	4.819	7.340	9.371	10.525
2006	0.554	0.736	1.385	2.243	2.987	3.587	4.796	6.460	8.287	12.359
2007	0.473	0.824	1.240	1.855	2.435	3.502	4.097	5.607	6.864	7.874
2008	0.254	0.799	1.263	1.645	2.712	2.762	5.245	5.516	6.552	8.178
2009	0.380	0.474	1.166	1.851	2.285	3.329	3.458	6.921	6.658	7.486
2010	0.243	0.552	0.760	1.595	2.427	2.900	4.790	4.485	9.086	8.748
2011	0.400	0.454	0.866	1.196	2.599	3.608	4.166	5.337	4.968	9.868
2012	0.481	0.605	0.836	1.360	1.749	3.818	5.186	5.990	6.416	7.302
2013	0.317	0.620	0.912	1.307	1.886	2.092	4.393	5.841	6.517	10.249
2014	0.336	0.595	0.926	1.247	1.765	2.110	2.633	5.546	6.488	8.274
2015	0.491	0.617	1.005	1.512	1.780	2.227	2.464	3.180	5.208	9.990
2016	0.493	0.637	0.906	1.289	2.170	2.437	2.504	3.528	3.972	7.867
2017	0.264	0.519	0.745	1.074	1.301	3.161	3.702	3.380	4.623	5.074
2018	0.416	0.591	0.886	1.292	1.750	2.608	2.890	3.363	4.601	7.644

Table 24. Estimated biomass using beginning of the year weights and bias adjusted population numbers from ADAPT for cod in NAFO Divs. 3NO.

	3	4	5	6	7	8	9	10	11	12	3+	6+
1959	15951	61693	19346	26737	30989	13355	11290	14216	11074	1846	206498	109507
1960	15658	24591	65125	17597	18992	19590	8251	7934	8935	4471	191145	85771
1961	24361	24050	28804	51368	15123	13906	10823	5677	5736	3842	183689	106474
1962	32017	38510	29954	20034	31221	10739	8025	7130	4463	5263	187356	86875
1963	23282	50634	50847	34712	21295	23723	7892	5133	4777	3040	225336	100572
1964	33233	37050	66260	48461	32461	17607	10497	3116	2141	2848	253674	117130
1965	45921	49838	38180	56341	42910	28715	13461	7044	1478	1822	285710	151770
1966	72602	80003	65934	39288	43864	21368	15310	11231	1504	726	351832	133293
1967	63476	111006	99150	57199	23783	25148	5877	7515	1474	809	395437	121805
1968	34882	85543	90774	49092	28795	11796	7909	5020	5801	801	320413	109214
1969	44230	43868	61523	41201	18893	12516	6344	5590	3458	4725	242348	92727
1970	27787	63063	47415	36800	25622	14856	8076	3785	3177	2148	232729	94464
1971	28101	41407	67053	43369	24062	17513	9670	5551	2501	1123	240350	103789
1972	24210	45908	31340	38178	25966	14898	8526	7691	3769	1521	202007	100550
1973	17398	36660	43949	20528	18465	12130	10034	8584	6527	3404	177679	79672
1974	10424	12419	17840	28534	10329	15369	10726	6471	6392	4065	122569	81886
1975	5582	14549	7045	5888	10712	4756	5831	4251	1646	1574	61835	34659
1976	9545	10588	13015	4869	2105	2977	1044	921	707	250	46021	12873
1977	18767	13047	9290	7879	3826	1827	2534	941	760	635	59506	18402
1978	25312	27880	16039	7817	6413	2349	1206	1434	389	308	89146	19916
1979	8802	27510	30923	14906	7041	5228	1807	866	891	271	98246	31011
1980	10316	11477	30068	23688	11899	5862	4956	1747	795	855	101664	49802
1981	21383	14880	14494	33468	24894	12520	6313	5657	1715	701	136026	85269
1982	18232	22292	16349	14971	34610	22175	11342	5176	4337	1233	150715	93843
1983	25491	18291	23669	16416	14978	33255	16437	7283	3075	2397	161291	93840
1984	30901	27184	18204	23529	16067	14214	27711	11090	4692	2239	175830	99542
1985	10788	27498	27123	17490	19706	13366	12006	22979	6953	3558	161467	96058
1986	2364	18550	28183	20855	14483	15386	13340	11977	20350	4433	149921	100824
1987	2201	3991	22034	24037	15017	12536	13490	10924	8665	16980	129875	101649
1988	8153	3352	5742	19223	17582	12642	9532	7111	5659	3820	92815	75569
1989	4527	8538	4596	5359	11270	11521	11518	6992	3582	3034	70936	53275
1990	2205	6100	7484	3270	3385	7821	8618	10693	5870	2197	57643	41854
1991	2664	2135	3734	2405	1672	2891	6109	6371	7445	4697	40122	31589
1992	3196	1984	1852	2572	1498	820	1553	2914	2891	3020	22301	15268
1993	2040	4132	1069	1186	1571	923	525	919	1650	1136	15153	7911
1994	102	1654	3199	546	496	959	701	386	411	1001	9455	4500
1995	129	139	939	2863	365	268	1081	666	324	342	7116	5909
1996	249	195	185	1572	3937	425	351	1071	621	274	8881	8251
1997	344	375	276	243	1879	4089	488	478	847	571	9591	8596
1998	108	515	523	345	276	1919	4271	508	435	771	9672	8525
1999	894	195	798	667	352	257	1826	4482	475	371	10315	8428
2000	2166	1159	253	966	793	316	194	1502	3599	374	11322	7744
2001	2031	2968	1258	174	1089	951	357	208	1623	3441	14099	7843
2002	1008	2743	3530	1447	191	1131	911	419	292	2018	13688	6408
2003	412	996	2890	3269	1419	190	1117	829	412	302	11835	7537
2004	337	228	352	1494	2295	1126	182	1047	801	360	8221	7304
2005	455	531	296	452	1812	2682	1199	217	936	768	9349	8067
2006	2137	845	610	358	498	1725	2485	1200	193	977	11028	7436
2007	1697	2444	978	532	272	462	1576	2369	1031	150	11512	6392
2008	1702	2203	2739	924	575	230	538	1693	2207	991	13803	7159
2009	4207	2598	2569	3011	967	518	230	563	1553	1977	18192	8818
2010	421	4870	3296	2682	3036	937	563	240	572	1615	18232	9645
2011	1434	557	5898	4036	3402	3569	1053	513	208	509	21179	13290
2012	1481	1675	798	7423	4762	3929	3984	1202	482	244	25979	22025
2013	364	1439	1905	977	8265	4596	3638	3600	1041	621	26446	22738
2014	550	470	1563	1962	1014	7340	4610	3640	3215	1052	25416	22834
2015	545	719	520	1876	2198	938	6952	4521	2780	4035	25083	23298
2016	893	545	782	486	2043	2393	843	8030	4598	3424	24037	21816
2017	695	731	453	685	367	2309	2876	916	8493	4739	22264	20385
2018	651	1194	922	592	863	552	1676	2112	1017	11394	20973	18205

Table 25. Estimated spawner biomass using annual ogives, beginning of the year weights and bias adjusted population numbers from ADAPT for cod in NAFO Division 3NO.

	3	4	5	6	7	8	9	10	11	12	SSB
1959	126	1396	1073	1362	18267	11827	11078	14177	11069	1846	72220
1960	51	966	7534	4421	5779	17348	8096	7912	8932	4471	65509
1961	1	405	4985	21835	9939	10859	10620	5661	5733	3842	73881
1962	29	45	2471	10362	25192	9841	7758	7111	4461	5263	72532
1963	131	501	1166	11129	18011	22759	7768	5112	4775	3040	74393
1964	34	985	6627	15600	23125	17002	10419	3107	2139	2847	81886
1965	2	245	4436	31131	38863	26664	13368	7034	1477	1822	125043
1966	37	45	1540	15223	40885	21259	15089	11216	1504	726	107524
1967	836	740	964	5930	17901	24984	5875	7494	1473	809	67006
1968	40	3409	7440	7121	10329	11042	7904	5020	5798	801	58904
1969	13	395	7036	22368	14089	9137	6255	5589	3458	4725	73065
1970	2	181	3152	10547	24097	14568	7502	3774	3177	2148	69149
1971	0	38	1845	15537	13367	17430	9659	5464	2499	1123	66963
1972	652	2	316	8306	21136	11851	8523	7691	3756	1520	63752
1973	22	2766	169	2090	13517	11786	9268	8584	6527	3402	58130
1974	1	104	3459	8354	5766	14817	10686	6303	6392	4065	59947
1975	19	25	373	2443	10476	4441	5809	4249	1632	1574	31041
1976	19	197	288	1322	1424	2976	1038	920	707	250	9140
1977	16	185	908	1788	2727	1572	2534	940	760	635	12066
1978	35	230	1499	2988	5080	2215	1143	1434	389	308	15322
1979	128	365	2267	6333	5488	5124	1791	851	891	271	23507
1980	35	798	3426	10168	10008	5585	4948	1745	790	855	38357
1981	42	351	3984	18468	21839	12198	6259	5656	1715	699	71212
1982	63	361	2388	9849	31903	21853	11300	5168	4337	1233	88456
1983	7	297	2884	8985	13586	32963	16412	7279	3074	2397	87884
1984	25	75	1321	12680	14385	13932	27686	11088	4692	2238	88123
1985	21	161	707	4728	17889	13149	11958	22977	6953	3558	82100
1986	5	249	1151	4273	9225	15203	13309	11967	20350	4433	80165
1987	13	77	1915	5667	10704	11189	13471	10920	8664	16980	79600
1988	2	112	901	7678	12146	12134	9296	7109	5659	3820	58857
1989	21	27	782	3415	9274	10850	11468	6955	3581	3034	49407
1990	38	230	330	1794	3192	7588	8545	10688	5864	2197	40465
1991	21	138	910	973	1468	2872	6082	6363	7445	4696	30968
1992	1	111	399	1869	1362	801	1552	2912	2891	3020	14918
1993	0	50	326	620	1502	917	523	919	1650	1136	7643
1994	0	25	904	417	403	954	701	386	411	1001	5203
1995	1	6	549	2652	351	254	1080	666	324	342	6225
1996	6	13	92	1560	3927	423	346	1071	621	274	8333
1997	4	58	112	226	1879	4089	488	476	847	571	8750
1998	2	55	305	299	273	1919	4271	508	435	771	8838
1999	1	20	418	611	346	257	1826	4482	475	370	8805
2000	2	16	110	879	784	315	194	1502	3599	374	7775
2001	13	82	211	145	1077	949	357	208	1623	3441	8108
2002	7	375	1511	1081	186	1129	911	419	292	2018	7928
2003	7	159	2286	3110	1387	189	1116	829	412	302	9797
2004	9	31	296	1478	2290	1124	182	1047	801	360	7618
2005	6	61	182	449	1811	2682	1199	217	936	768	8312
2006	103	50	234	312	498	1725	2485	1200	193	977	7778
2007	58	462	222	400	263	462	1576	2369	1031	150	6994
2008	7	260	1413	536	539	228	538	1693	2207	991	8412
2009	67	53	859	2499	837	511	229	563	1553	1977	9147
2010	7	323	327	1753	2906	907	561	240	572	1615	9210
2011	24	31	1405	1492	2981	3534	1046	513	208	509	11742
2012	1	165	143	4298	3607	3786	3975	1200	482	244	17901
2013	10	31	788	431	7094	4336	3602	3598	1041	621	21551
2014	11	51	783	1610	753	7075	4558	3630	3215	1052	22738
2015	9	76	180	1836	2126	856	6893	4511	2778	4035	23299
2016	14	43	317	340	2042	2380	821	8015	4596	3423	21990
2017	11	57	189	545	334	2309	2874	909	8490	4739	20457
2018	10	94	385	488	826	540	1676	2112	1015	11393	18537

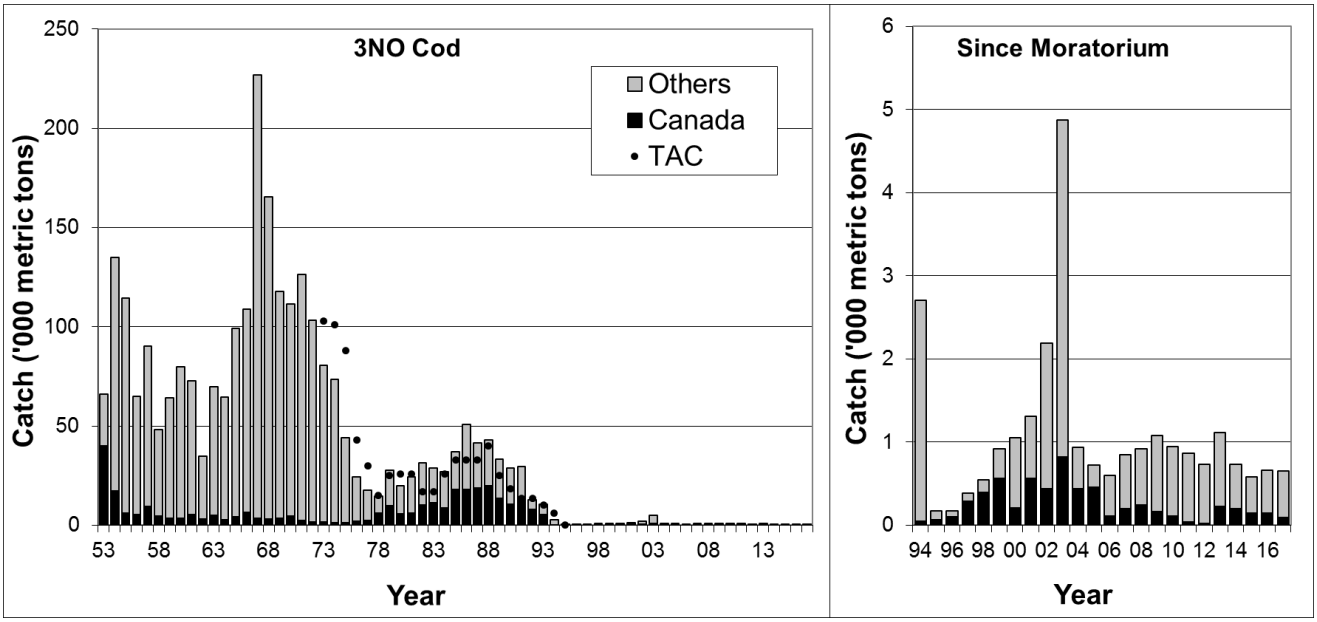

Fig. 1. Catches of cod in NAFO Divs. 3NO. The panel on the right represents catches since the moratorium in Feb. 1994.

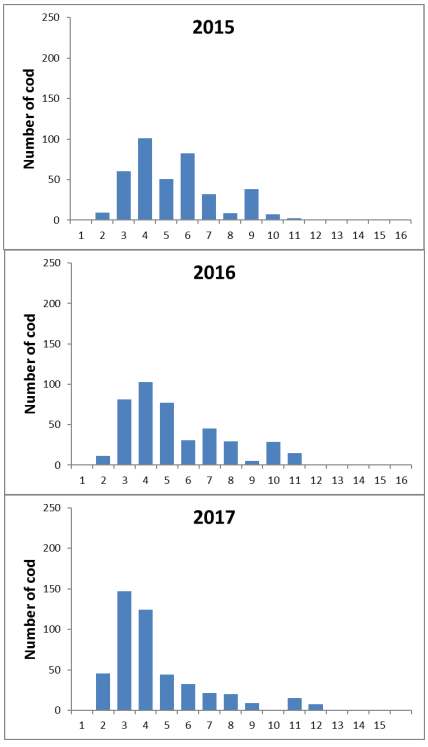

Fig. 2. Plot of recent catch-at-age estimates for cod from NAFO Divs. 3NO.

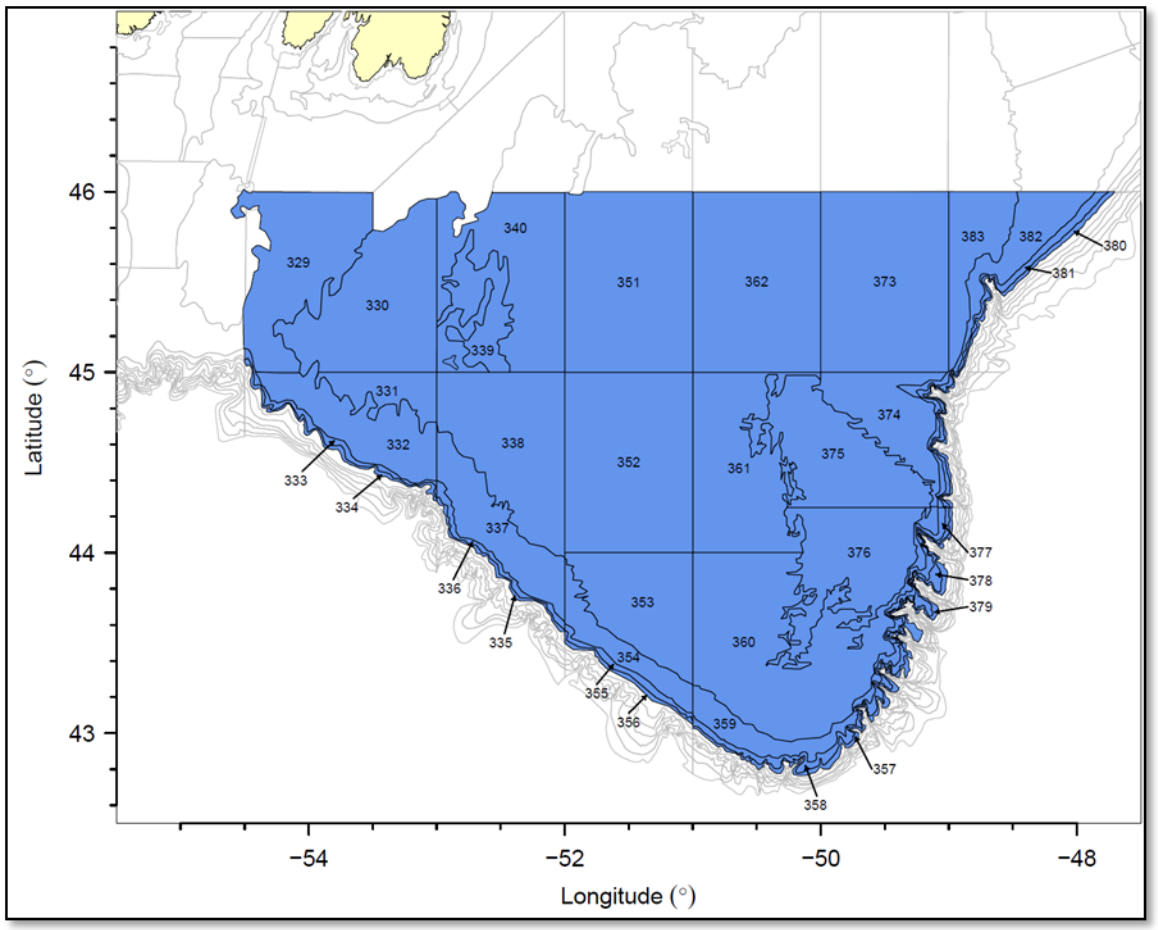

Fig. 3. Stratification scheme for Divs. 3NO. Index strata for Divs. 3NO cod are highlighted blue.

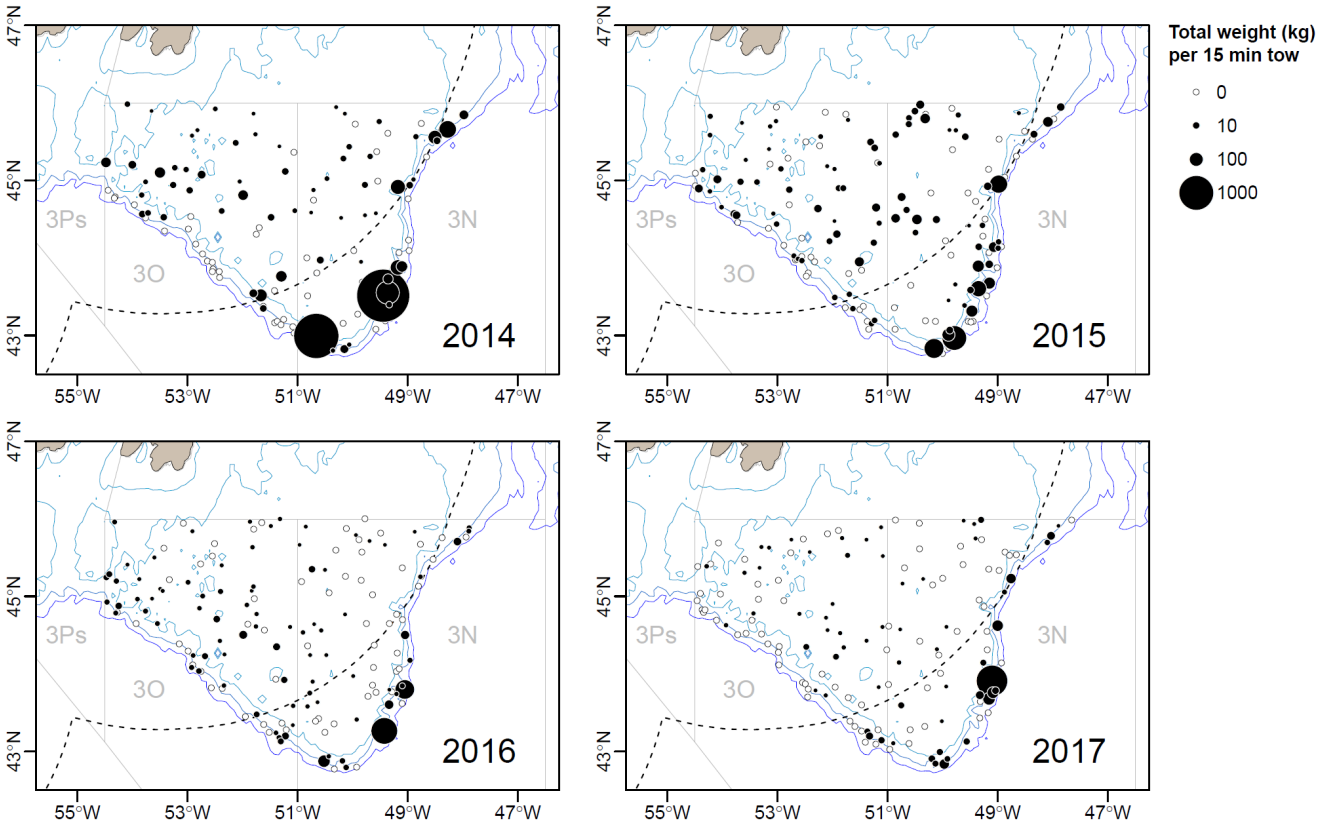

Fig. 4. Distribution plots demonstrating Spring survey set locations and total weight of fish caught at each location. Symbol area is proportional to catch weight.

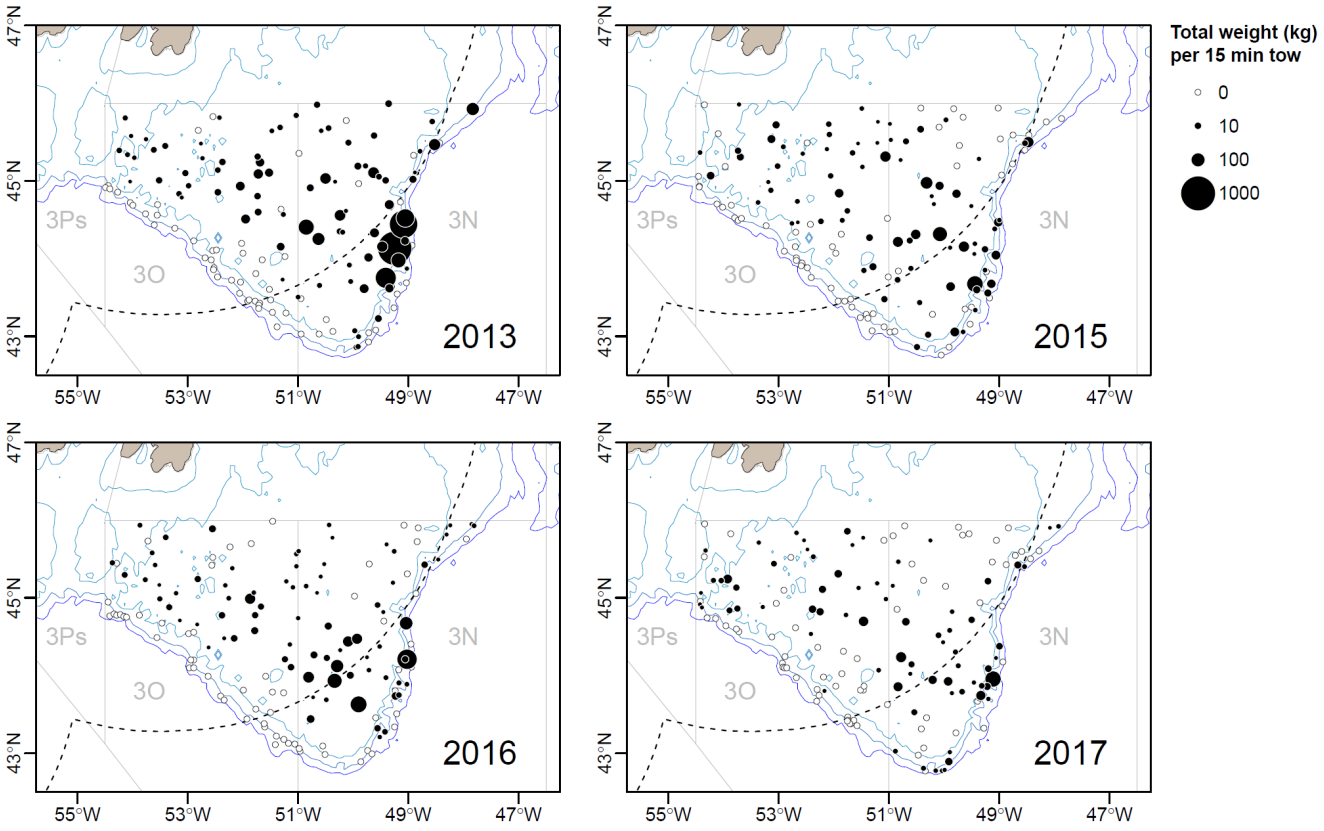

Fig. 5. Distribution plots demonstrating Autumn survey set locations and total weight of fish caught at each location. Symbol area is proportional to catch weight. Note that Divs. 3NO were not covered in autumn 2014.

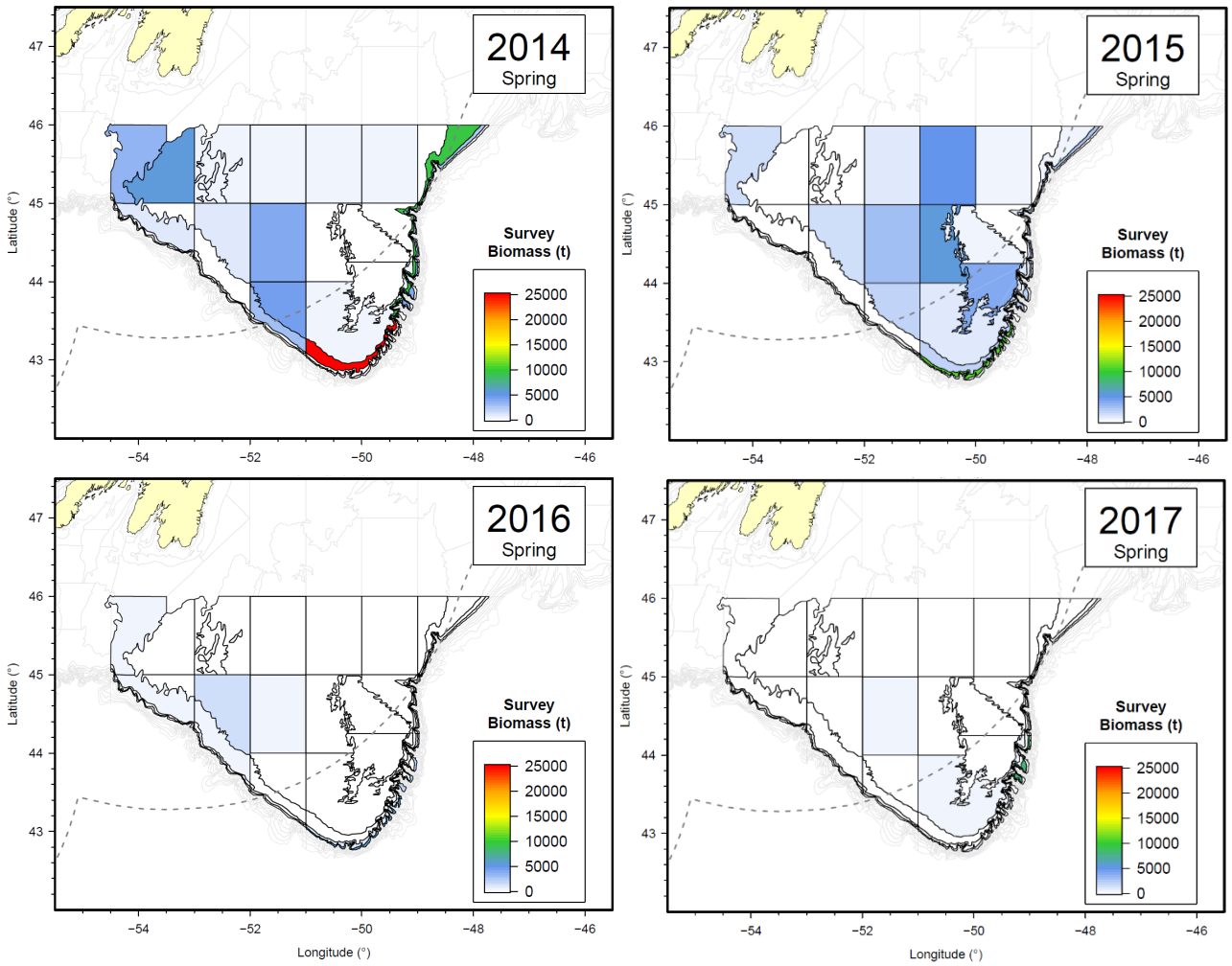

Fig. 6. Spring biomass distribution plots for 2014-2017. Individual strata are colour-coded based on stratum specific biomass estimates from Canadian RV surveys.

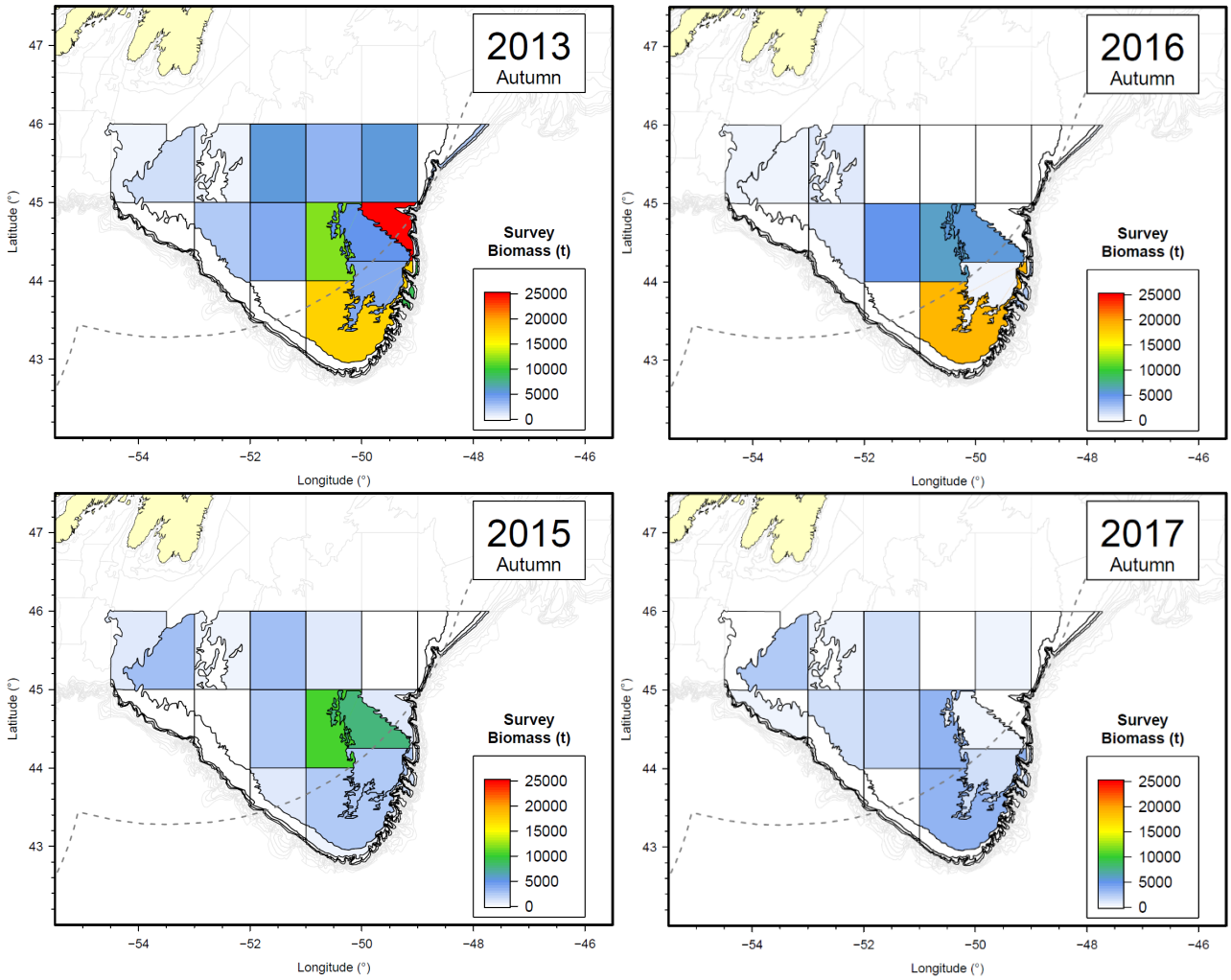

Fig. 7. Autumn biomass distribution plot for 2013-2017 (note that the survey was not completed in autumn 2014). Individual strata are colour-coded based on stratum specific biomass estimates from Canadian RV surveys.

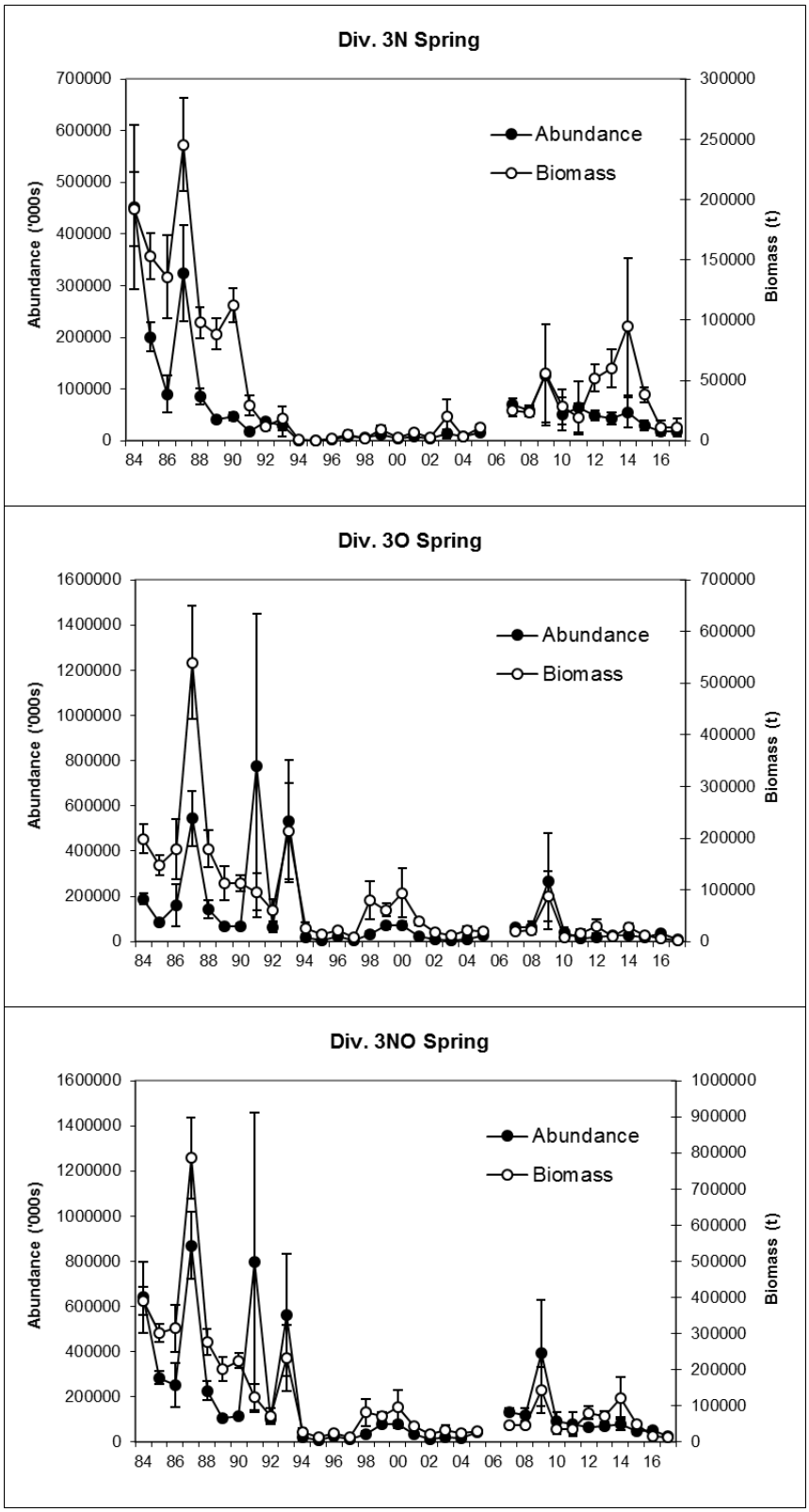

Fig. 8. Abundance (000's) and biomass (t) for the Canadian Spring Research Vessel survey series with 1 standard deviation for strata<200 fathoms.

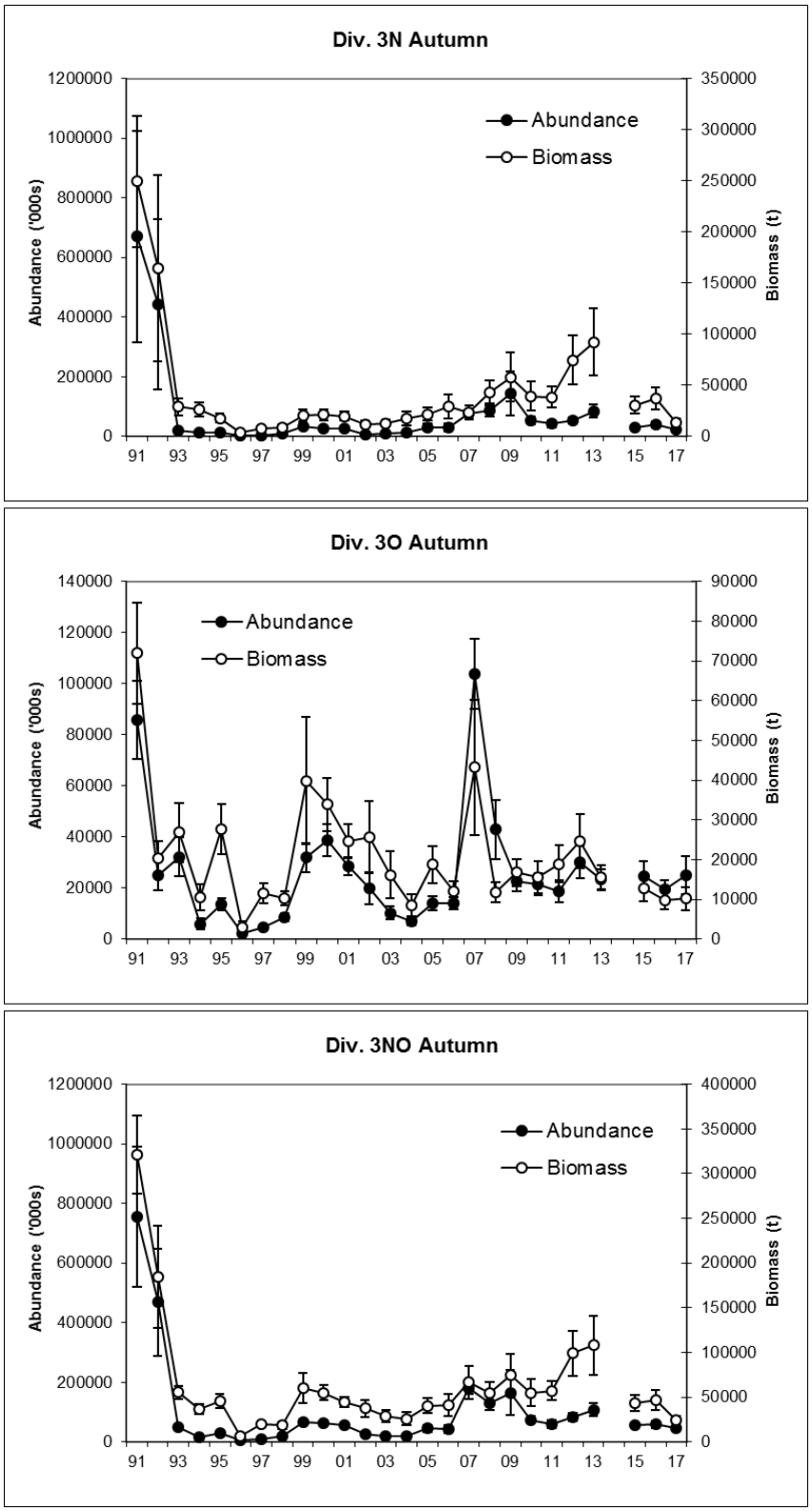

Fig. 9. Abundance (000's) and biomass (t) for the Canadian Autumn Research Vessel survey series with 1 standard deviation for strata<200 fathoms.

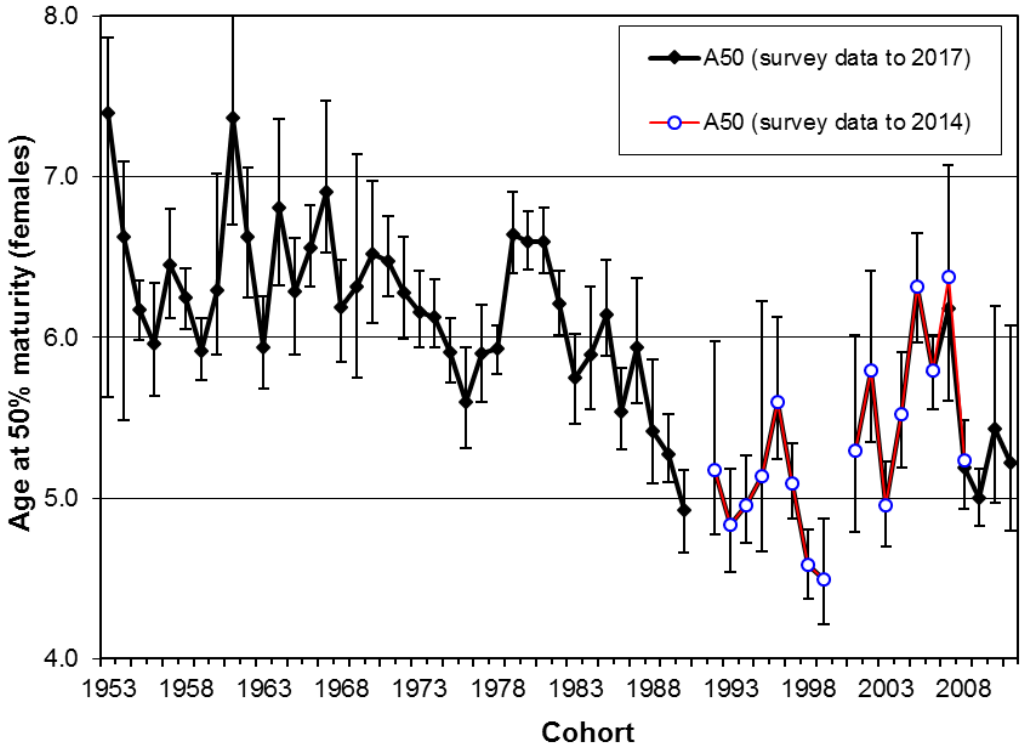

Fig. 10. Age at 50% maturity by cohort for female cod sampled during DFO spring research vessel bottom-trawl surveys of NAFO Divs. 3NO. Error bars are 95% fiducial limits.

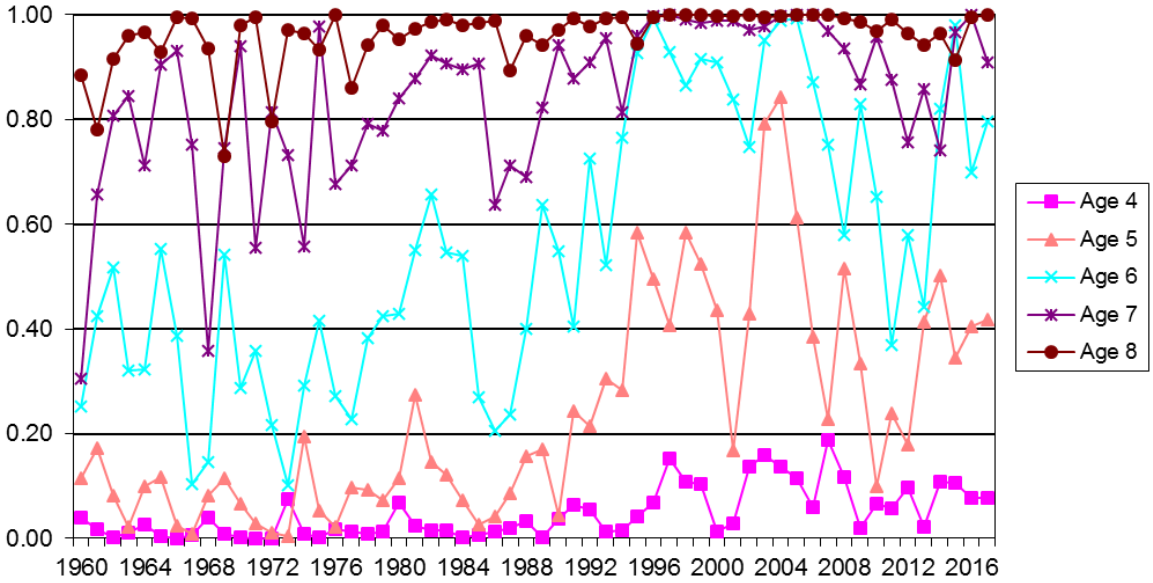

Fig. 11. Estimated proportions mature at ages 4-8 for female cod sampled during Canadian research vessel bottom-trawl surveys in NAFO Divs 3NO. Model fitted by cohort to observed proportions mature.

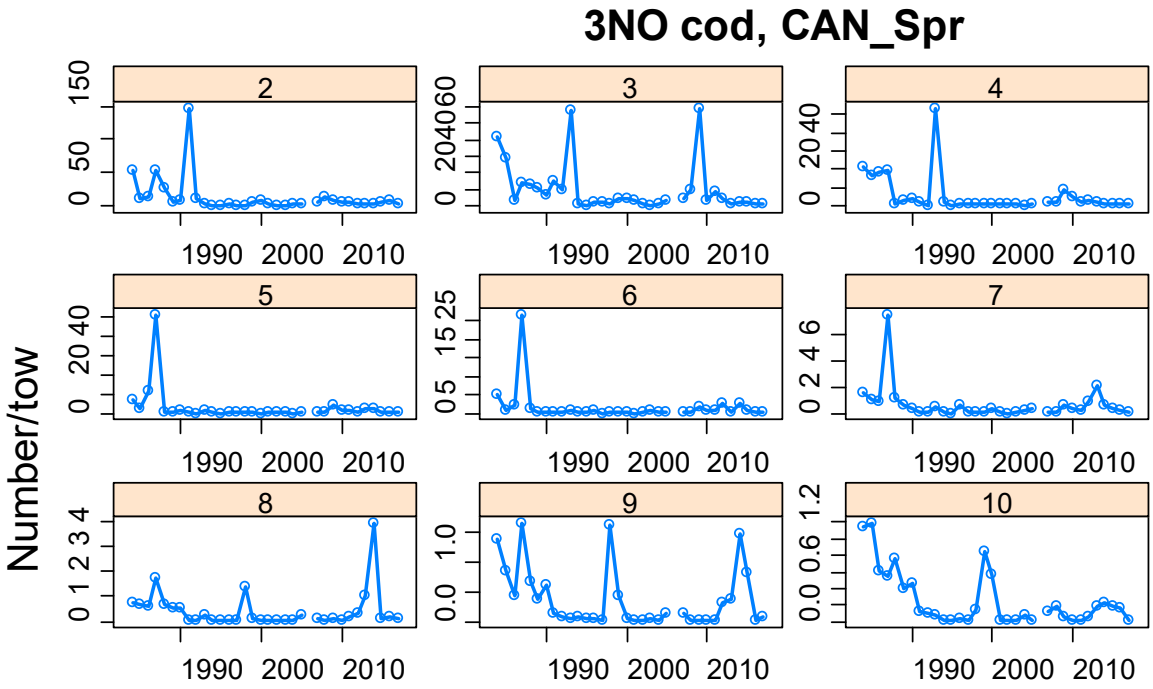

Fig. 12. Age by age disaggregated plots of mean number per tow from Canadian SPRING surveys from 1984-2017.

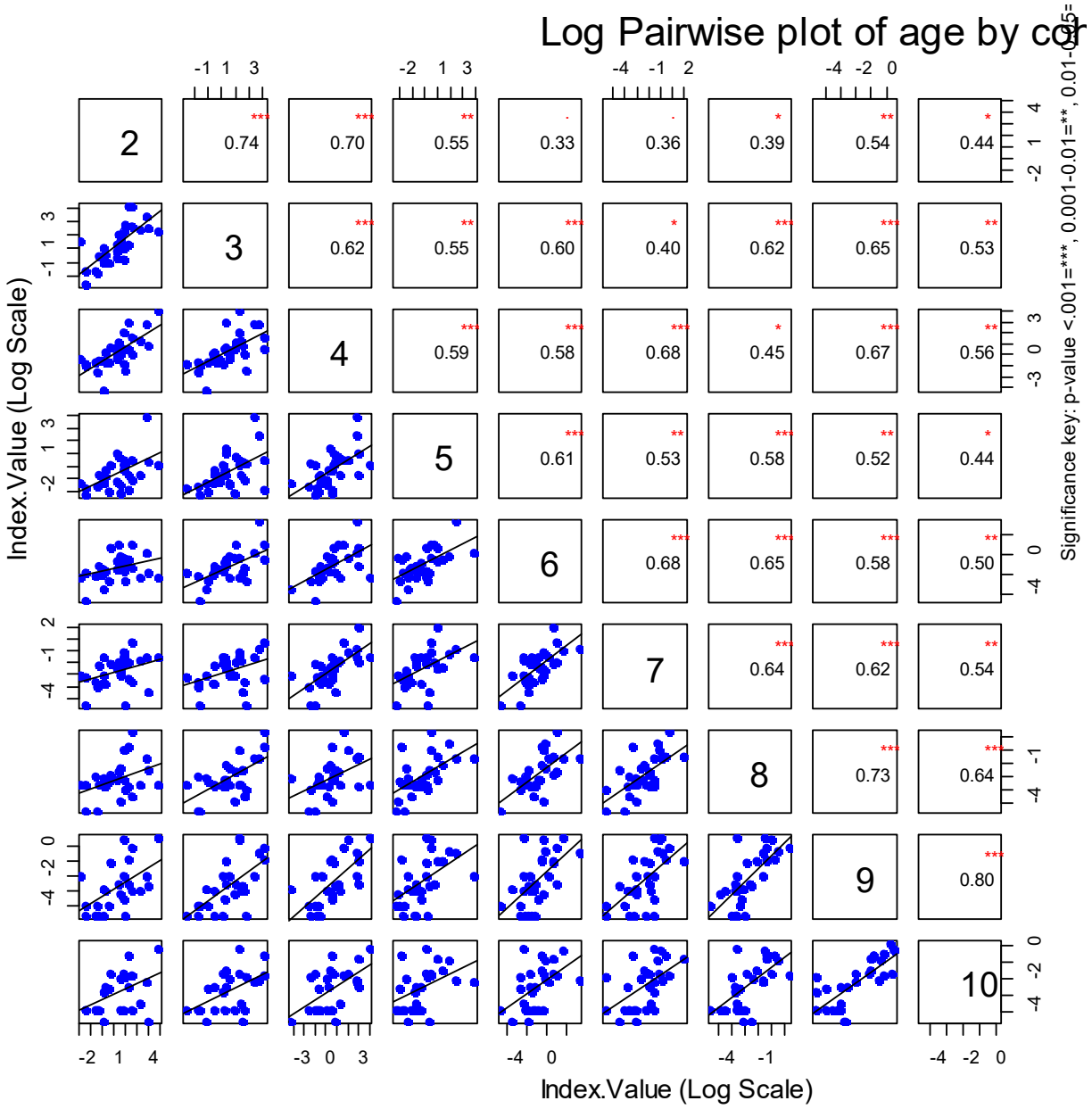

Fig. 13. Pair-wise scatter plot of age-disaggregated survey data (log-scale) from Canadian SPRING surveys in Divs. 3NO (1984-2017). Data points in the panels below the numbered diagonal compare the logarithm of survey data at different ages for a common cohort. The solid line in each panel is the linear least squares regression line with the correlation coefficient provided in the corresponding diagonal panel (p-values significantly different than 0 noted with asterisk (see key on right side of diagram).

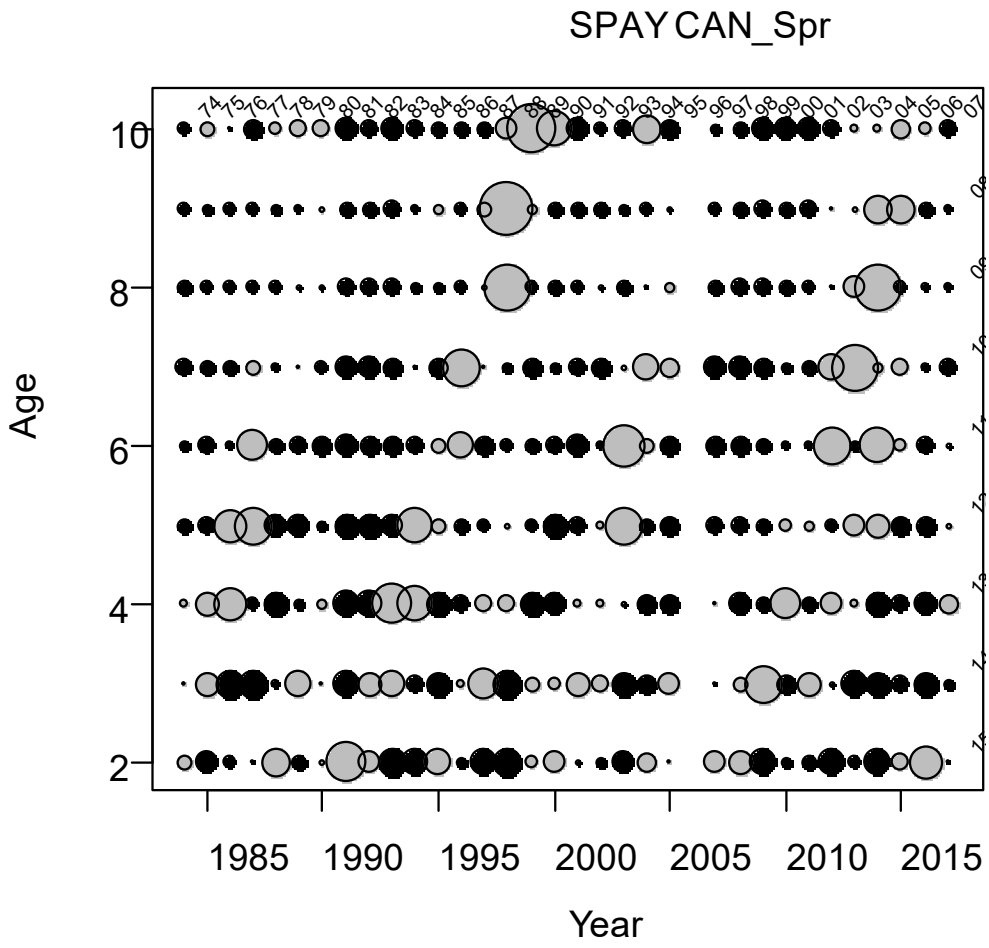

Fig. 14. Plot of standardized proportions at age across years (SPAY) for the Canadian Spring surveys in 3NO (1984-2017). Age disaggregated mean number per tow were converted to proportions within an age. For each survey-age, the survey data are standardized to have a mean of 0 and a variance of 1. Symbol sizes are scaled and values greater than average are shown as grey circles, average values are shown as small dots, and less than average values are shown as black circles.

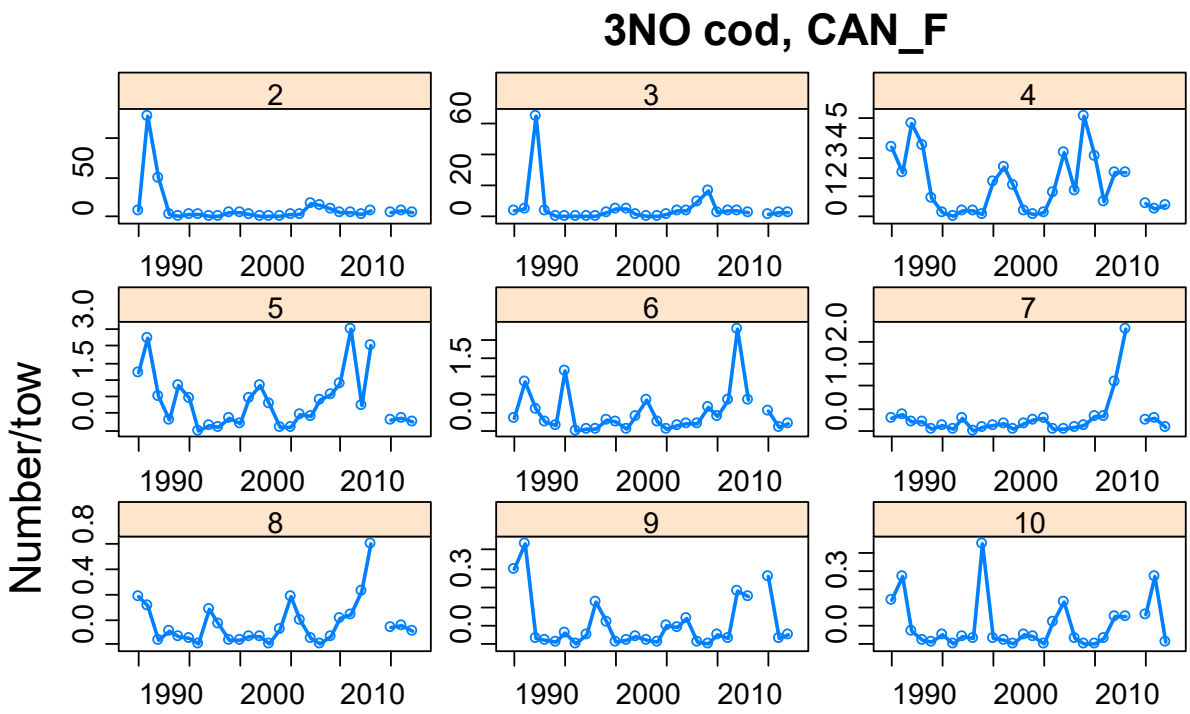

Fig. 15. Age by age disaggregated plots of mean number per tow from Canadian AUTUMN surveys from 1984-2017.

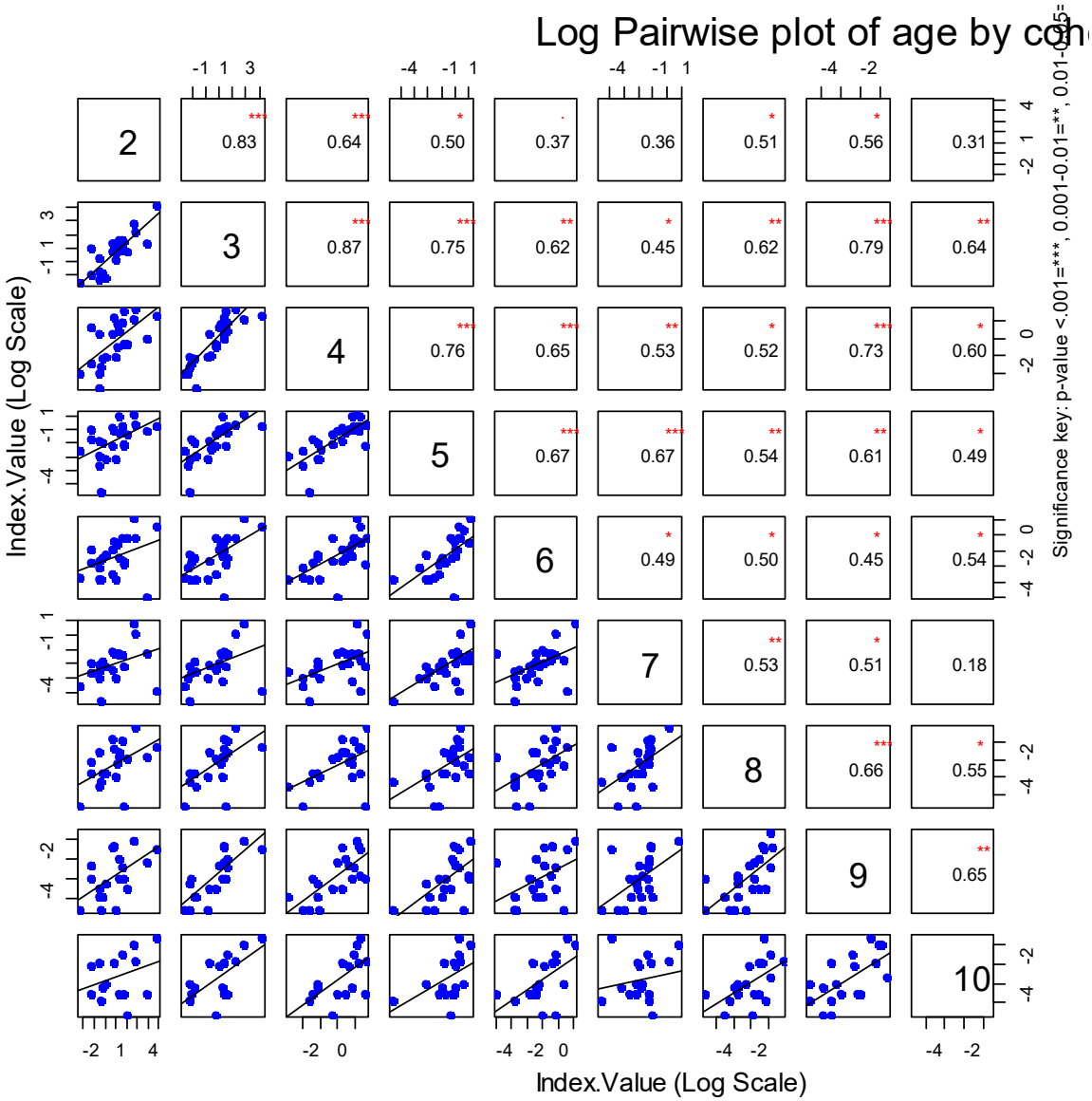

Fig. 16. Pair-wise scatter plot of age-disaggregated survey data (log-scale) from Canadian AUTUMN surveys in Divs. 3NO (1990-2017). Data points in the panels below the numbered diagonal compare the logarithm of survey data at different ages for a common cohort. The solid line in each panel is the linear least squares regression line with the correlation coefficient provided in the corresponding diagonal panel (p-values significantly different than 0 noted with asterisk (see key on right side of diagram).

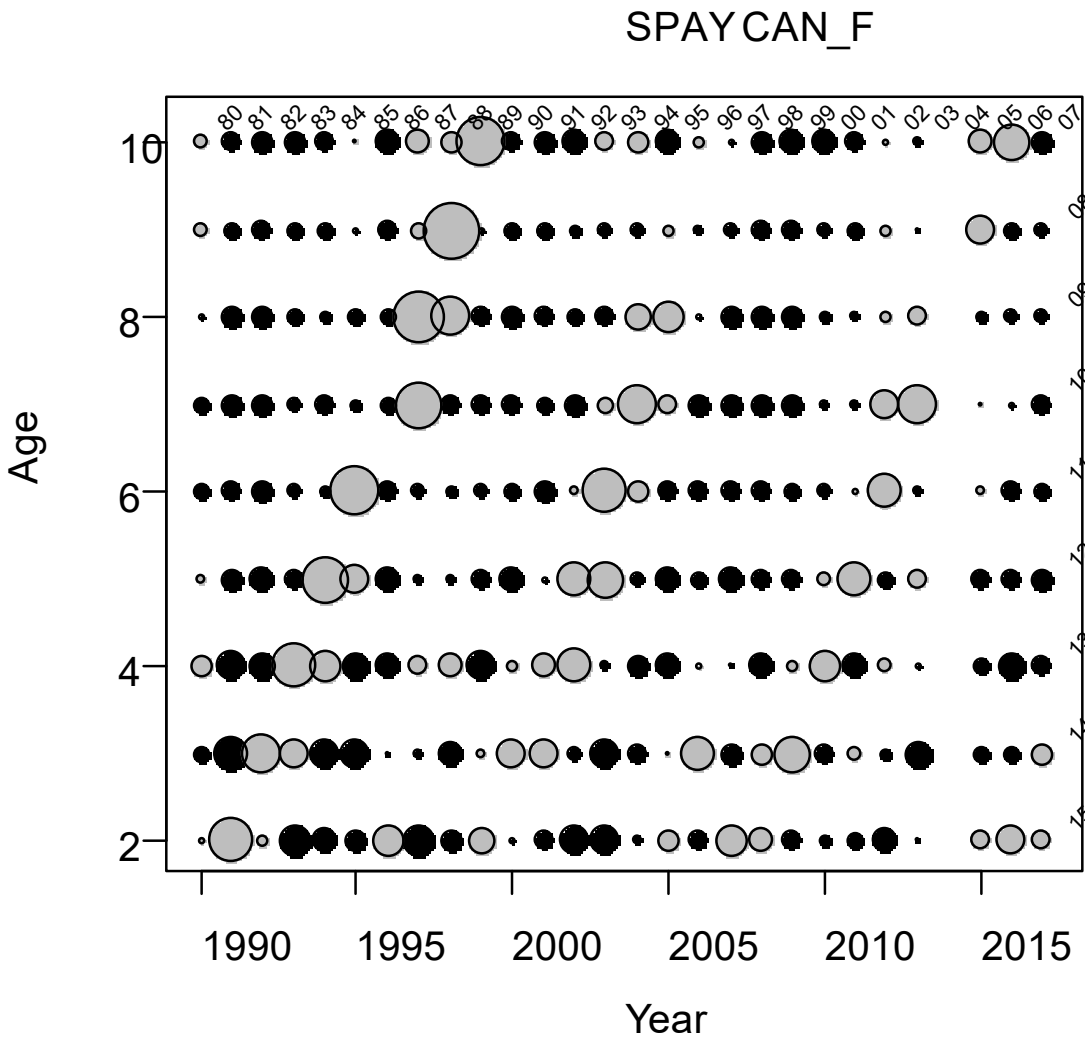

Fig. 17. Plot of standardized proportions at age across years (SPAY) for the Canadian Autumn surveys in 3NO (1984-2017). Age disaggregated mean number per tow were converted to proportions within an age. For each survey-age, the survey data are standardized to have a mean of 0 and a variance of 1. Symbol sizes are scaled and values greater than average are shown as grey circles, average values are shown as small dots, and less than average values are shown as black circles.

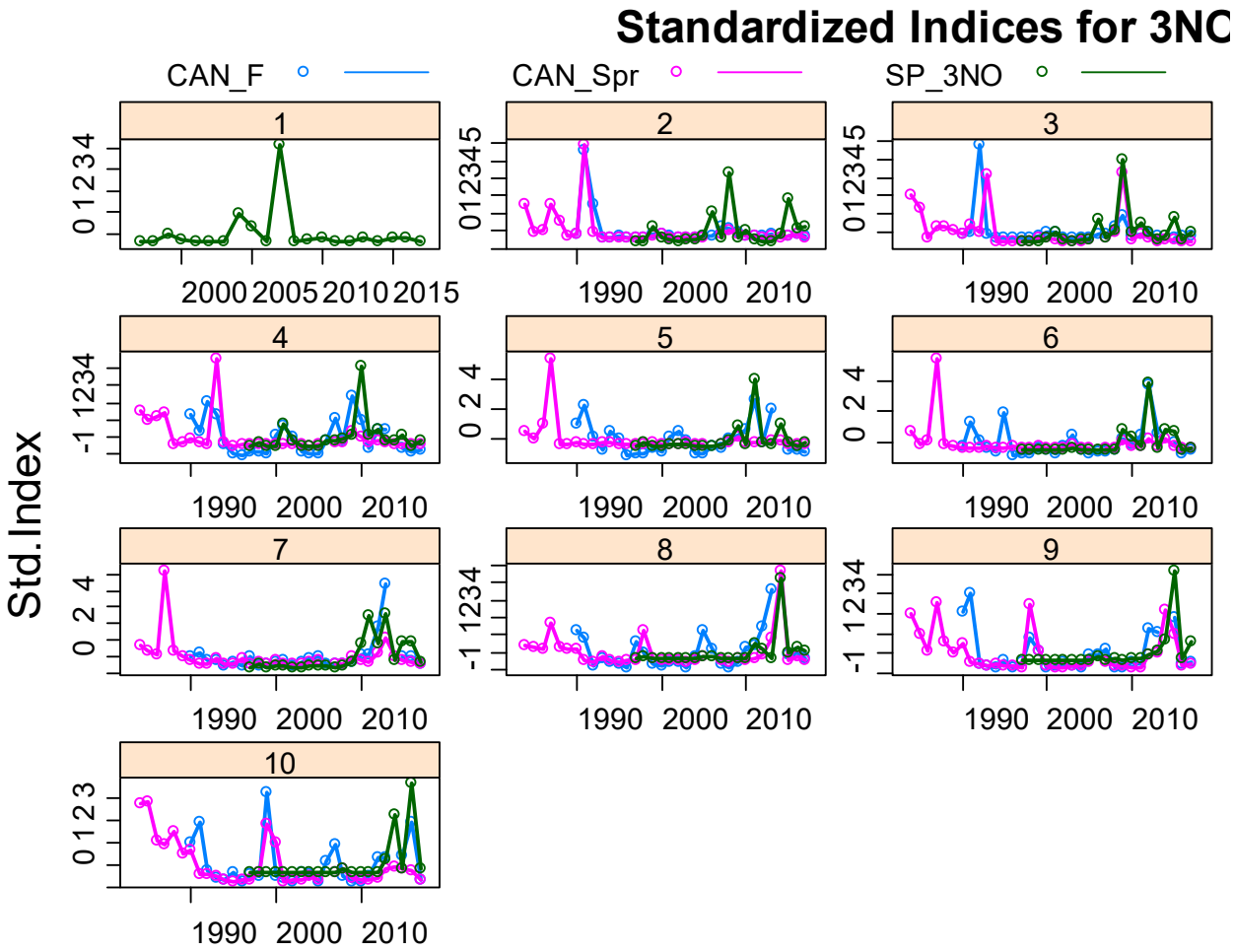

Fig. 18. Cohort consistency plots for survey indices for 3NO cod (Canadian SPRING, Canadian Autumn and Spanish 3NO). Plotted are standardized indices at age.

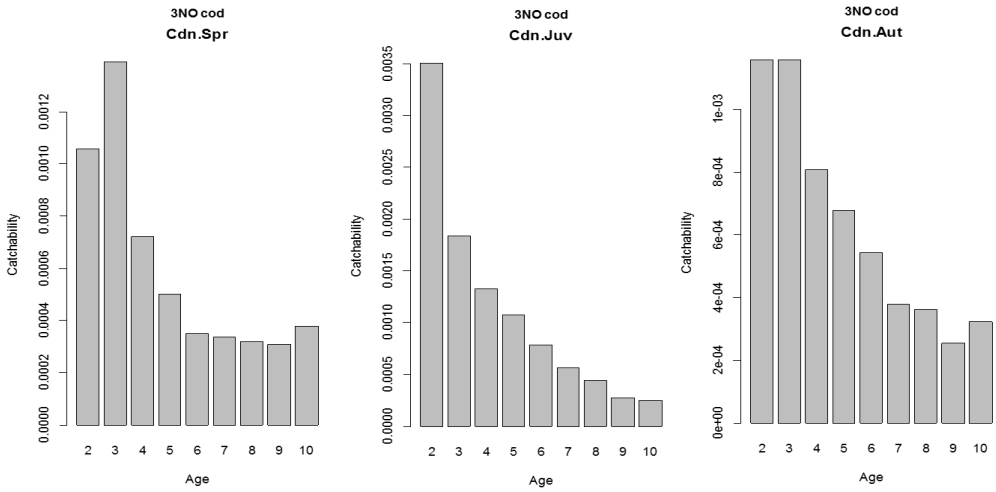

Fig. 19. Estimated catchabilities from ADAPT.

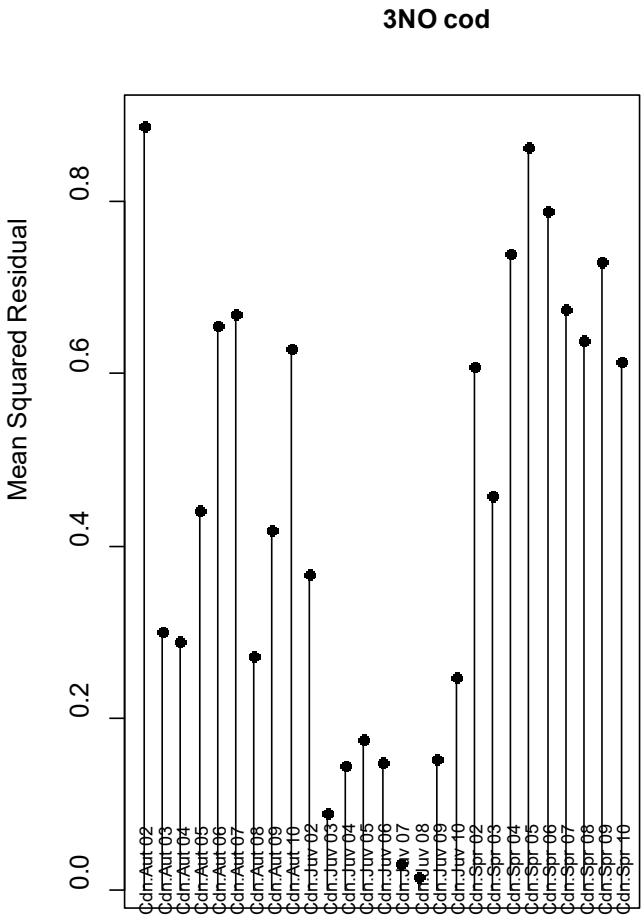

Fig. 20. Mean squared residual at age for each index in the ADAPT.

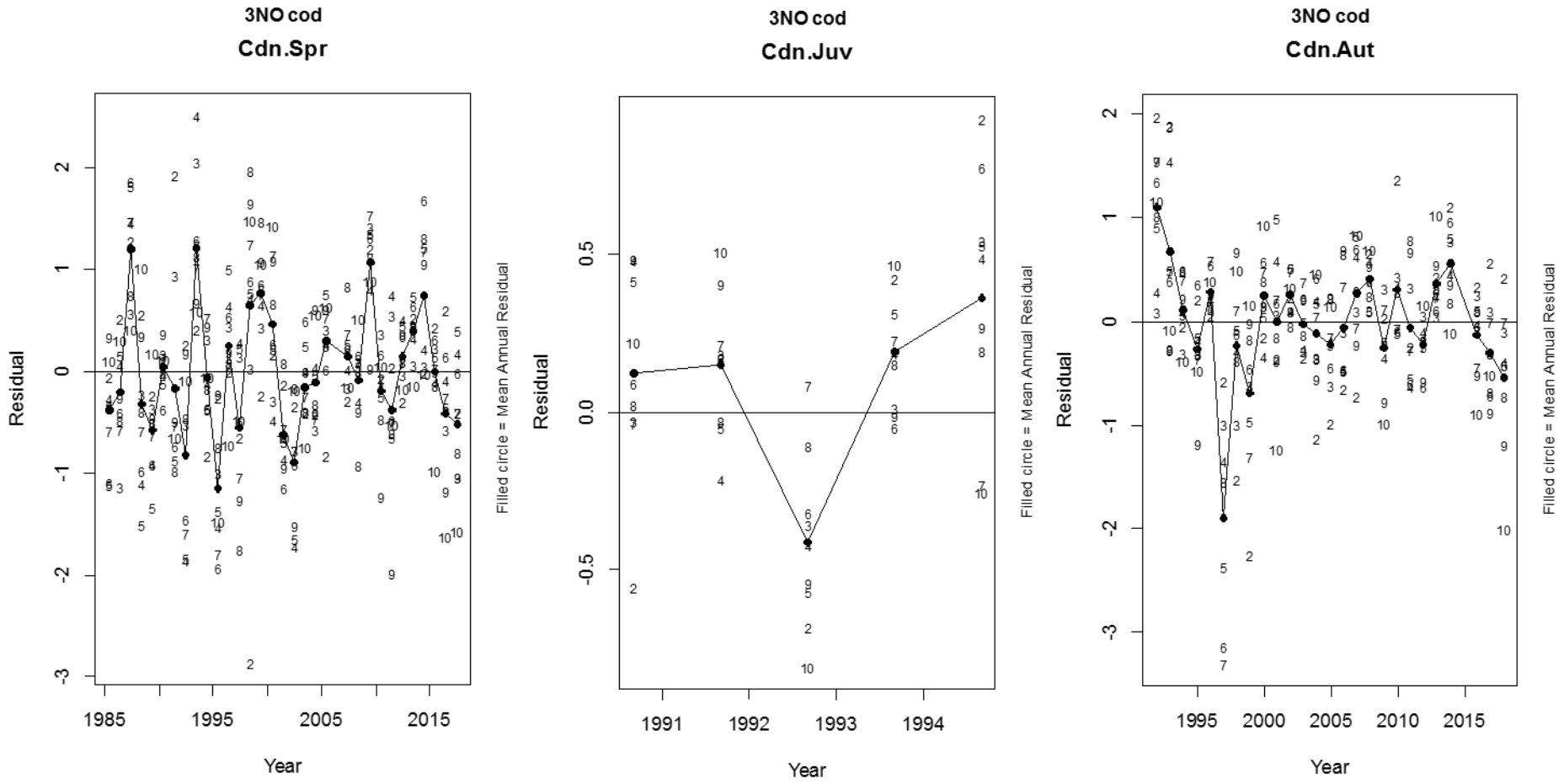

Fig. 21. Residuals at age for each index in the ADAPT.

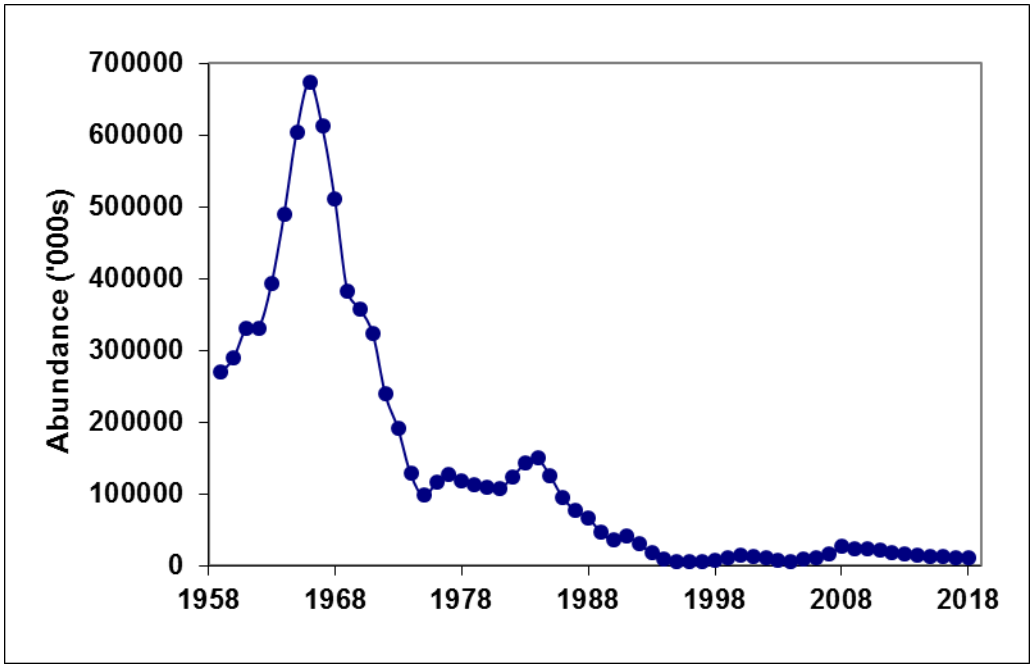

Fig. 22. Bias corrected Population Abundance for cod in Divs. 3NO as estimated from ADAPT.

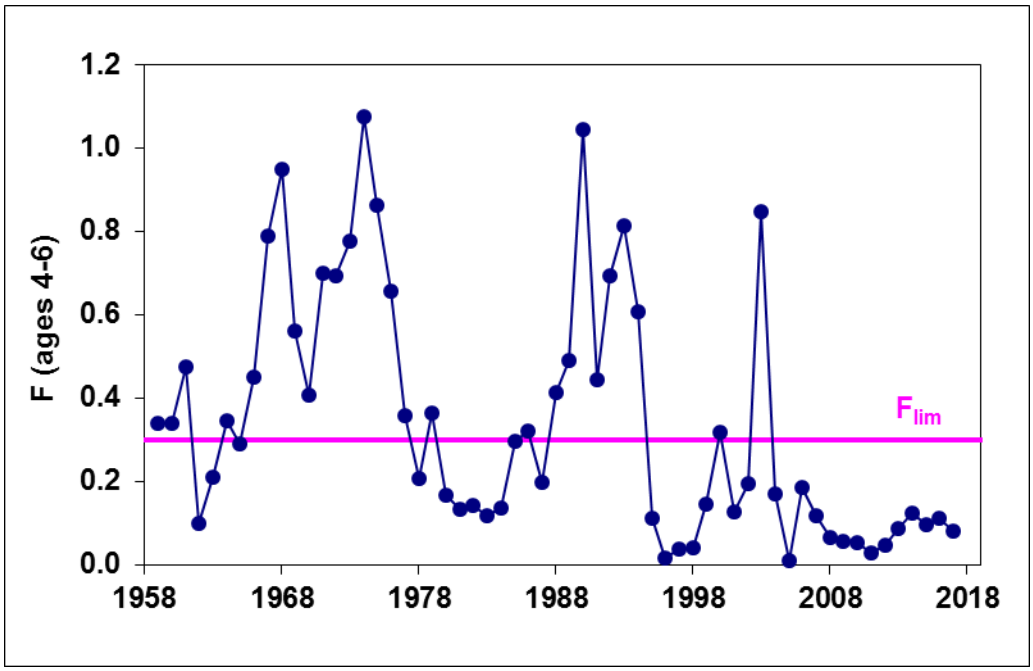

Fig. 23. Fishing Mortality for cod in Div. 3NO as estimated from ADAPT.

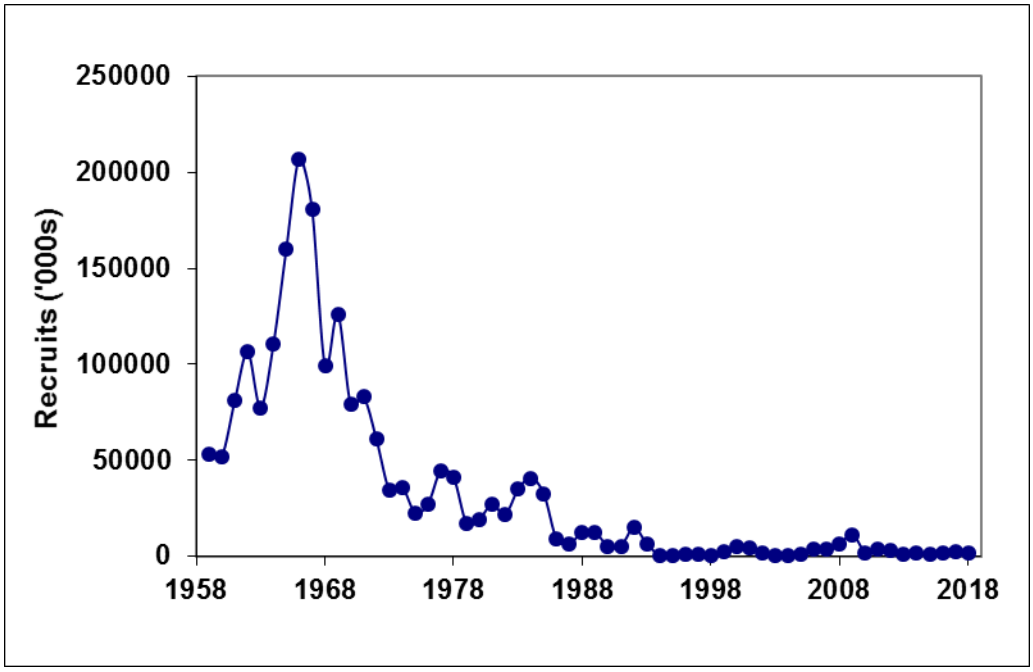

Fig. 24. Age 3 recruits for cod in Div. 3NO as estimated from ADAPT.

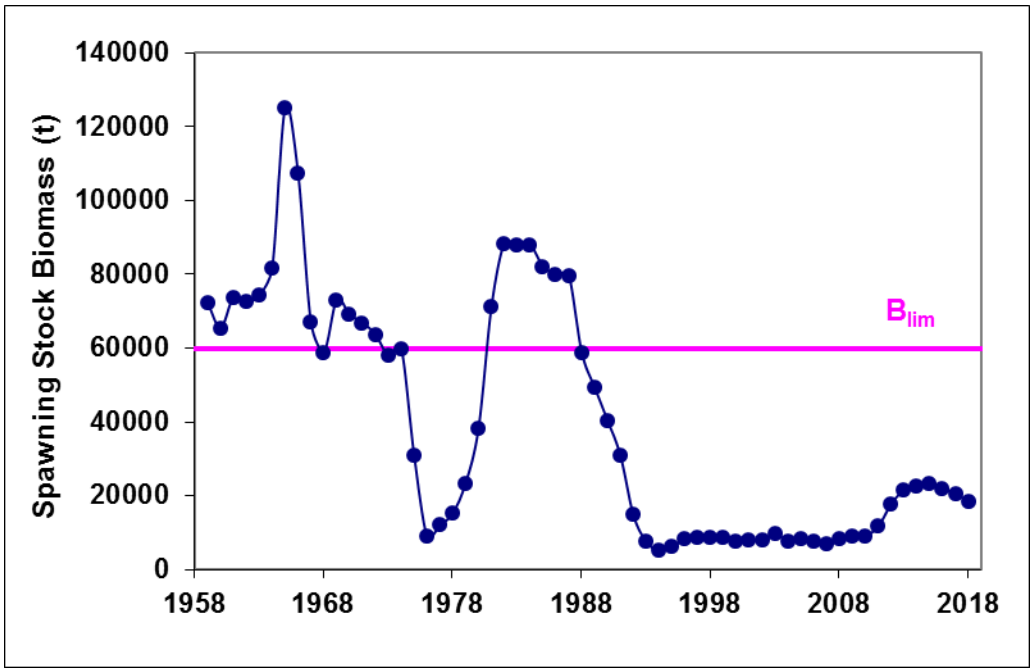

Fig. 25. Spawner biomass for cod in Div. 3NO as estimated from ADAPT.

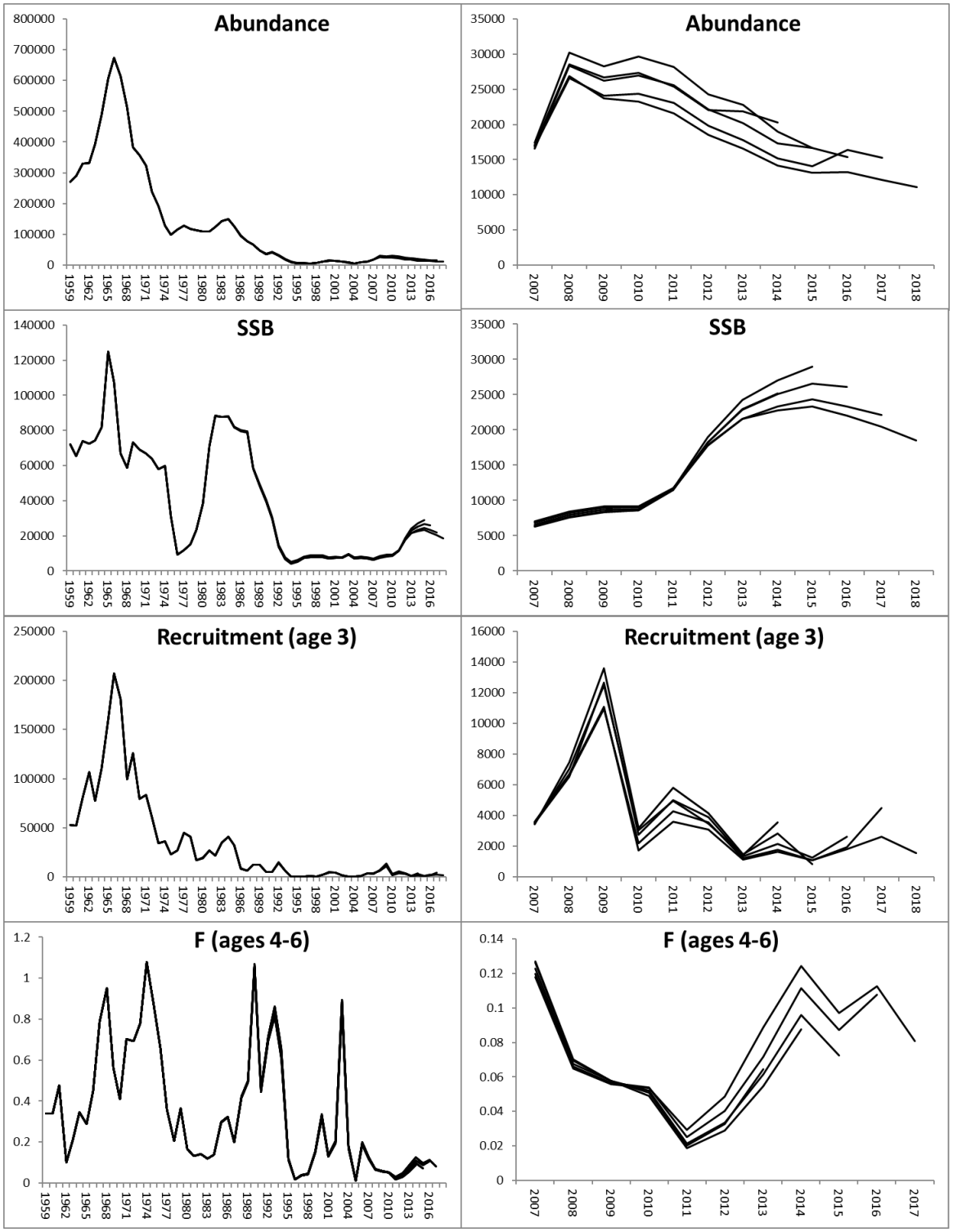

Fig. 26. Retrospective estimates of abundance, spawner biomass, age 3 recruits, and fishing mortality for cod in Div. 3NO.