Northwest Atlantic Fisheries Organization

Serial No. N4437 **NAFO SCR Doc. 01/59**

SCIENTIFIC COUNCIL MEETING – JUNE 2001

An Assessment of American Plaice in NAFO Divisions 3LNO

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Abstract

Catches from this stock were generally in the range of 40,000 to 50,000 t per year throughout the 1970's and 1980's, before declining to low levels in the early 1990's. There has been no directed fishing on this stock since 1993. The TAC's in 1995-2001 have been set at 0. The catch in 1999 was 2565 t, and in 2000 it was 5176 t. Catch in both years was mainly taken in the NAFO regulatory area (NRA). The Canadian spring surveys show a large decline in abundance and biomass from the mid to late 1980's to the mid 1990's with current biomass being only 25% of that of the mid 1980's. The fall survey has also shown large declines and the biomass is only 35% of that of 1990. There may be a slight increasing trend in both surveys over the last few years. Mortality remains high on the youngest ages but has decreased on the older ages. The survey indicates no good year-classes since the mid-1980s. VPA analyses showed that population abundance and biomass have declined fairly steadily over the 1975 to 1995 time period. Current biomass is estimated to be less than 10% of levels in the mid-1970s and only 11% of levels in the mid-1980s. The VPA also estimates that there have been no good year-classes since the mid-1980s. F has steadily increased since 1995 and in 1999 and 2000 F on ages 9-14 was above 0.2. At current levels of F simulations predict that the population will decline over the next 10 years.

TAC regulation

This stock has been under TAC regulation since 1973 when a TAC of 60,000 t was established. From 1973-87, the TAC varied from 47,000 t to 60,000 t (Table 1) but was lowered to 33,585 t in 1988. Further reductions followed, bringing the TAC to 10,500 t in 1993. In 1994, a TAC of 4,800 t was implemented, but the Fisheries Commission of NAFO stated that no directed fisheries were to take place on this stock. The TAC has been set at 0 since then.

Catch trends

Catches increased from about 20,000 t in the early 1960s to a peak of 94,000 t in 1967, were relatively stable around 45,000-50,000 t in 1973-82, then declined to 39,000 t in 1984-85 (Table 1, Fig. 1). Catches increased to 65,000 t in 1986 and then declined rapidly thereafter, to about 7,400 t in 1994. The catch declined following the moratorium in 1995, but has steadily increased since. Catch in 1999 was 2,565 t and in 2000 it was 5,176 t. Most of these catches occurred as by catch in the skate and G. halibut fisheries in the NRA. In 2000, the Canadian catch totalled about 622 t, much of which was taken as by catch in the yellowtail flounder fishery.

From 1977 to 1982, the catch was taken almost exclusively by Canadian vessels, but the catch by other nations increased rapidly from less than 2,000 t in 1981-82 to over 30,000 t in 1986 as new fisheries were developed in the Regulatory Area. Catches from these fleets have generally declined in recent years, as has the Canadian catch (Tables 1 and 2). Considerable doubts have arisen about some nominal catches in the 1985 to 1994 period, resulting in various catch estimates being used. These include surveillance estimates, breakdowns of unspecified flounder catches by S. Korea prior to 1991 based on reported flounder catches, and any other estimates deemed by Scientific Council to be reliable. There is also some uncertainty regarding catches prior to 1973, when large amounts of unspecified flounder catches from some nations were broken down by species based on estimates of species composition. As well, estimates of discards are not available, and are believed to be substantial during some periods.

Canadian research vessel surveys

Spring

Stratified-random surveys have been carried out on the Grand Bank by Canadian research vessels in the spring (April to June period) of each year from 1971 to 2000, with the exception of 1983. The stratification scheme used is shown in Figure 2. The data can be split into 3 time periods, based on the trawl used in each period: 1971-82 was Yankee 36, 1983-95 was Engel 145, and 1996-98 was Campelen 1800 (see McCallum and Walsh (1996) for a description of the various trawls). Conversions exist for the first to second series (Gavaris and Brodie 1984), and from the second to the third (Morgan et al. 1998). However, data from the first series have not been converted to be comparable with the third series. Thus comparable data exist for 1971-95, and for 1984 to 1998. A full comparison between the Engel and Campelen data series is given in Brodie et al. (1998).

Biomass estimates for each Division by stratum and depth for 1996 to 2000 are given in Tables 3-5. In the spring survey in 2000 the biomass estimates for 3L, 3N and 3O were 37 500, 56 000 and 60 000 t respectively. These values are all down from 1999 when there appeared to be a year affect in the survey. The 3L and 3N values are higher than the values for those Divisions in 1998 while Div. 30 remained essentially unchanged. Biomass in Div. 3LNO combined has increased slightly since 1996 but is only 25% of that of the mid 1980's (Fig. 3).

Tables 6-9 and Fig. 4 and 5 show the abundance by Division and for Div. 3LNO combined from 1985 to 2000. The total abundance has fluctuated with little trend since 1996. Abundance of the oldest ages (12+) has increased since 1996 while the younger ages (0-5) declined from 1996 to 1997 but increased to 1996 levels in 2000 (Table 9). Since 1998, 20-30% of the population was made up of fish age 9+ while this was less than 8% in 1996 and 1997.

American plaice are distributed throughout the Div. 3LNO area but the largest concentration of fish in each year since 1996 has been in the southwestern portion of Div. 3O extending across the border into Div. 3N (Fig. 6). From 1985 to 1990, about 80-85% of the stock was located north of 45 degrees, most of which was in Div. 3L (Fig. 7). The proportion north of 45°N declined rapidly after that and since 1993 less than 50% of the biomass has been north of this latitude.

Fall

Stratified-random surveys have been conducted in Div. 3L in the fall from 1981 to 2000, usually in October-November. From 1990 to 2000, fall surveys were also carried out in Div. 3NO. Surveys from 1983 to 1994 were done with the Engel trawl and starting in fall 1995, a Campelen 1800 trawl was used.

Biomass estimates by stratum and depth are given for each Division in Tables 10-12. Biomass estimates from the fall survey in 2000 were 27 500, 180 000 and 60 000 t for Div. 3L, 3N and 3O respectively. This is a decrease over fall 1999 in Div 3L and a substantial increase in Div. 3N. The large biomass estimate in 3N is heavily influenced by a single large set in stratum 360. The overall biomass for Div. 3LNO has shown an increasing trend since 1995 (Fig. 3). The biomass index remains well below that of 1990 with the average of the 1999 and 2000 indices representing only 35% of that of 1990.

Fig. 4 shows the abundance for Div. 3LNO combined from 1990 to 2000. Tables 13-16 show the abundance by age for 1990 to 1999. Ageing was not available for 2000. Abundance in Div. 3L has declined in each year since 1995, while abundance has been increasing in Div. 3N since 1996. Similar to the spring survey older ages have made up a higher proportion of the abundance in the last few years (Table 16). In 1998-2000, 13-15% of the population was made up of fish ages 9+ compared to less than 5% in 1996 and 1997.

Plots of distribution by weight (Fig. 8) for the fall surveys in 1995 to 2000 show that A. plaice are distributed throughout the Div. 3LNO area. However the area of highest concentration is southern 3NO, particularly the southwest edge and on the tail of the bank in 3N.

Comparison of Spring and Fall Surveys

Biomass and abundance from the spring and fall surveys can be seen in Figures 3 and 4. Both surveys have shown similar trends in biomass and abundance over the 1990 to 2000 period. Abundance at age in both surveys has shown similar trends. In both surveys the number of fish ages 9+ was higher in 1998-2000 than in the recent past. Distribution is also similar between the two surveys.

Catch to RV Biomass ratio

In 2000 STACFIS recommended that *in future catch to survey biomass plots be presented.* Therefore, as a proxy for the exploitation rate on this stock, the ratio of catch to biomass from spring RV surveys was examined. Examination of the catch/biomass ratios from Campelen data from 1985 to 2000 is shown in Figure 9. The Campelen ratios were highest in the 1991-94 period (similar to 1986), and the most recent values (1995-2000) are much lower, reflecting a period of reduced catches (Table 1). However, catch/biomass ratios have increased substantially over the 1995 to 2000 period

Mortality

Estimates of total mortality (Z) from the Campelen or equivalent, spring and fall survey data were calculated for ages 1 to 16 (Fig. 10 & 11). A Lowess smoother has been added to the plots to help visualise trends. Both surveys indicate an increase in mortality up to the mid 1990's. Since that time mortality has declined on older ages (5+) but has remained high on younger ages, although the estimates for these ages are highly variable.

Weights at age

Mean weights at age were calculated for male and female A. plaice for Div. 3LNO using spring survey data from 1990 to 2000. Means were calculated accounting for the length stratified sampling design. There is some indication of a decline in mean weight at some ages from 1996 to 2000 (Fig. 12).

Maturities

Age and length at 50% maturity were produced from spring RV data. For age, female maturity data were collected during research vessel surveys from 1960-2000. Stratified random surveys were used where possible (1971-2000). Data from earlier years came from surveys that were conducted mainly as line transects. The coverage of a stock area would generally not be as complete as the stratified random surveys. For the period of the stratified random surveys, observed proportion mature at age was calculated according to the method of Morgan and Hoenig (1997) to account for the length stratified method of sampling. Prior to this, only data from the aged fish was used without weighting by the length frequencies. This should not have a large impact on the model estimates (Morgan and Hoenig 1997). Data from 1985-1995 were converted to Campelen equivalents.

Estimates were produced both by year and by cohort. For males, A_{50} declined and then showed an increase in both the estimates by year and cohort (Fig. 13 and 14). For females, A_{50} has been relatively stable over the 1985 to 1994 time period dropping in 1995. However when examined by cohort, estimates of A_{50} have been declining since the beginning of the time series. The A_{50} for males in recent cohorts is about 4 years compared to 6 years at the beginning of the time series. For females the A_{50} for recent cohorts is about 8.0 years compared to 11 years for cohorts at the beginning of the time series.

Estimates of maturity at length were produced using data collected from 1975-2000 and are presented by year in Figure 15. Estimates by cohort are presented in Figure 16. L_{50} has been declining for both sexes since the early 1980's but has recovered somewhat in recent years for males. L_{50} calculated by cohort has also declined but recovered in recent cohorts. The current L_{50} for males of about 20 cm is similar to the earliest cohorts estimated. The L_{50} of most recent cohorts for females is in the range of 34-35 cm, lower than the 38 cm of the earliest cohorts.

Recruitment

A multiplicative model was used to estimate the relative year class strength produced by the spawning stock. Similar approaches have been implemented by Healey et al. (2001) for Greenland Halibut in Div. 2GHJ3KLMNO, and by Morgan et al. (1999) for American plaice in Div. 3LNO. Spring and fall survey data were used. Data were Engel or Campelen, converted data were not used. Ages 3-5 were included in the analyses and only cohorts that occurred at least twice in the data were included.

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

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

where:

μ = overall mean

s = survey subscript

a = age subscript

y = year class subscript

I = Index (Abundance in 000's)

Y = year class effect

SA = Survey * Age effect, and

ε = error term.

We assume that $\varepsilon_{s,a,y} \sim N(0,\sigma^2_{group})$, (independently and identically) for pre-specified *group*s. Likelihood ratio tests (Table 17) indicate that a constant variance model (a general linear model) is not statistically different than the full model which estimates a variance parameter for each survey-age combination. Back-transformed estimates of relative cohort strength are shown in Figure 17. Predicted year class strength generally declines over time; the estimates indicate very low recruitment since 1989 and no good year-class since the mid-1980s. The standardized residuals (Figure 18) show no systematic patterns that would indicate violation of model assumptions; however year effects are evident.

EU-Spain Surveys

Surveys have been conducted annually from 1995 to 2001 by EU-Spain in the Regulatory Area in Div. 3NO to a maximum depth of 1 462 m (since 1998). Surveys since 1996 are comparable in coverage. Biomass and abundance declined between 1996 and 1997. Estimates of abundance and biomass from the surveys have been increasing since 1998. In 1999, modal size of males was 30-34 cm, and 40-42 cm for females (Paz et al., 2000). These are similar to those observed in 1999 (Paz and Duran, 1999).

Catch at age

Results of the catch at age calculations for American plaice catches in 1993-1997 are given in detail in Morgan et al. (1999a), and details for the 1998 calculations are given in Morgan et al. (1999b). In this document, catch at age for 1999 and 2000 are presented, including data for Canada for the first time since the 1993 fishery.

Sampling data were available from by-catch of A. plaice in Canadian fisheries in Div. 3LNO in 1999-2000. No Canadian data were available for the period 1994-98. Much of the Canadian catch, and sampling data, came from the yellowtail fishery (Div 3NO in 1999, 3LNO in 2000), although some by-catch was recorded in the fisheries for cod (inshore Div. 3L), redfish (Div. 3O), and Greenland halibut (Div. 3LNO). Total catch in 1999 was 323 tons, 260 of which was taken in Div. 3N (Table 18). In 2000, the Canadian catch increased to 621 tons, largely as a result of the yellowtail TAC increasing from 6,000 tons to 10,000 tons. Also, in 2000, fishing for yellowtail was permitted in Div. 3L, and the catch in that division was 132 tons (Table 19), although the majority of the catch still came from Div. 3N.

Sampling for 1999 consisted of 12,012 length measurements from March-June and July-November, and 715 otoliths. The sampling for 2000 reflected the increased catch from the expanded area, with 29,592 length measurements (also from March-June and July-November), and 1573 otoliths taken. In both years, the Canadian catch was comprised mainly of fish aged 7 to 11 years, with a peak at age 9 (Table 20). This is very similar to the catch at age from the Canadian fishery in the early 1990's (Brodie et al. 1994). The mean fish size and weight were slightly larger in 2000 (0.67 kg compared to 0.62), and weights at age were higher in 2000. The same weight-length relationship was used in both years (see below) and the sum of products check was slightly less than the catch in both years.

For 1999 and 2000, length frequency data were also available from several other countries. Details on the sampling levels and descriptions of the fisheries are contained in the following documents: for Spain (Div. 3L, 3N, and 3O, Junquera et al. 2000; Junquera et al. 2001), for Portugal (Div. 3L, 3N, 3O, Vargas et al. 2000; Vargas et al. 2001) and Russia (Div. 3L and 3N, Sigaev et al. 2000; Div. 3L, 3N, and 3O, Vaskov et al. 2001). For 2000, the Russian catch (318t) was given as a total 3LNO value. To apply this catch to the divisional length frequency data, it was divided based on the proportion of total catch that was taken in each division in 2000. In all cases, age-length keys from the Canadian spring surveys in Div. 3LNO in 1999 and 2000 were used to derive age compositions, which were then combined and adjusted to the total catch to account for all non-sampled catches. Catch at age, weight at age (using the weight-length relationship $Log_{10}\ weight = (3.3247 * Log_{10}\ length - 5.553)$ used in previous assessments of this stock) and sum of products (SOP) for 1999 and 2000 are given in Table 21.

In the total international catch at age, ages 9 and 10 were predominant in both 1999 and 2000. There were no major differences in age compositions among countries in either year. Mean lengths and weights at age in the Canadian catch were higher in both years, likely a result of larger mesh size used in the Canadian fishery and also the use of research vessel age-length keys for the catches of non-Canadian fleets.

Virtual Population Analysis

Several formulations of virtual population analyses (VPA) were presented using catch-at-age and survey information up to 2000. These formulations were based on the results of Morgan and Brodie (2001).

The ADAPT used catch–at-age for ages 5 to 14 with a 15 plus group which included all catch from ages 15 to 21 (Table 22). The ratio of F on the plus group to F on the last true age was set at 1.0. M was set at 0.2 except at 0.53 for all ages from 1989 to 1996. Survey ages 5 to 14 were used in the calibration matrix. Beginning of the year weights-at-age and maturities-at-age are given in Tables 23 and 24.

Three different ADAPT runs were conducted with the above formulation: Canadian fall survey only (Table 25, Figs. 19-21), Canadian spring survey only (Table 26, Figs. 22-24) and both Canadian spring and fall surveys (Table 27, Figs 25-29).

Fall only: the model does not give a good fit to the data. The mean square of the residuals is 0.37 and the average CV on the population estimates is 0.42 with CVs ranging from 0.36 to 0.65 (Table 25). The residuals seem to increase and then decrease (Fig. 19). The model does not predict the survey well, particularly for ages greater than 7 (Fig. 21).

Spring only: there is a much better fit of the model to the data. The mean square of the residuals is 0.21 and the average CV on the population estimates is 0.29 with CVs ranging from 0.2 to 0.48 (Table 26). There is little pattern in the residuals (Fig. 22) although there may be a slight increase from 1985 to 1987. There are no years where the residuals are all positive or negative. The model provides a much better prediction of the survey and this can be seen particularly well in Figure 24.

Spring and Fall: the mean square of the residuals is higher than the spring only run (0.29 Table 27) but the average CV is similar (0.29). Again the model does not predict the fall survey particularly well (Fig. 29). There is little change in the fit of the model compared to the run with spring only, but there is somewhat more pattern in the residuals (Fig. 25). Given that there is little difference in the model fit and no *a priori* reason for eliminating the fall survey index it was decided that the formulation with both indices was the best at this time. Population numbers and F from this run are shown in Table 28.

Biomass was calculated by multiplying the population numbers at age by the beginning of the year weights at age. The VPA analyses showed that population abundance and biomass have declined fairly steadily over the 1975 to 1995 time period. Biomass and abundance have been relatively stable over the last number of years (Fig. 30). Average F on ages 9 to 14 and ages 8 to 12 showed an increasing trend from 1975 to 1992. There was a large peak in F in 1993 which may be an artifact. F since 1995 has been generally lower than in the earlier period but has been increasing steadily and in 1999 and 2000 average F on ages 9-14 was above 0.2. In 2000 F on all ages greater than 9 was above 0.2 and in many instances above 0.25 (Fig. 30, Table 28).

A retrospective analysis was conducted by sequentially removing one year of data from 2000 to 1995 for a comparison of 6 years. The results of this analysis are shown in Figures 31 and 32. There is little evidence of a retrospective pattern when examined for population abundance in total or on an age by age basis. There is some pattern in the analysis on average F. In particular, as more data are added the peak in F in 1993 increases.

Spawning stock biomass was calculated by multiplying the biomass at age by the female maturity ogive. The numbers at age and weights at age from 1960 to 1974 were available from a previous assessment (Brodie, 1985). For 1960 to 1974 numbers at age 5 were not available. Age 5 numbers were calculated using the number at age 6 and the ratio of age 5 to 6 from the 1975 to 1996 time period. There were no estimates of weight at age 5 prior to 1993. Weight at age 5 from 1960 to 1992 was set as the average of 1993-95. SSB has shown 2 peaks, one in the mid 1960's and another in the early to mid 1980's. Since then it declined to a very low level (less than 10 000 t) in 1994 and 1995 (Figure 33). It has increased since then but still remains at a very low level at just over 20 000 t. This is only 10% of the level in the mid 1960's and 15% of the level in the mid-1980s . The stock recruit scatter is also shown in Figure 33. This is similar to the pattern observed in the last assessment (Morgan et. al., 1999). Recruitment has been steadily declining since the 1986 year-class and there have been no good year classes since then. No good recruitment is seen below an SSB of 50 000 t.

The stock recruit relationship underlies any reference points in the precautionary approach and for medium or long term projections. Last year STACFIS recommended that *the stock recruit relationship from the VPA should be explored further*. To address this recommendation and because of the importance of the stock recruit relationship we explored the estimation of recruitment in a number of ways.

A non-parametric analysis of the stock recruit relationship was examined using the estimates as number of recruits and the SSB described above (Evans and Rice, 1988). A clear minimum was detected in the jackknifed prediction sums of squares for both the Gaussian or Cauchy weightings. This minimum was less than that calculated using unweighted mean (Figure 34). The sums of squares using the Gaussian was somewhat less than that for the Cauchy so the Gaussian weighting was used in the prediction of recruitment. In addition the Beverton-Holt and Ricker stock recruit models were fitted using maximum likelihood fitting as described in Myers et al. (1995) and as applied in Shelton and Healey (1999).

Figure 35 shows the observed stock recruit scatter and the predicted recruitment from each of the three methods. The nonparametric method produces predicted recruitments that are relatively independent of SSB. The Beverton-Holt and Ricker models produce very similar estimates of recruitment to each other over most of the range of SSB. However, they both over predict recruitment at low levels of SSB.

There appears to be three SSB/recruit groupings (Figure 36). Below an SSB of 50,000 t no good recruitment has been observed. Between 50 and 155,000 t both poor and good year classes have been observed. Above 155,000 t only good recruitment has been observed. It would seem that 50, 000 t could serve as a B_{lim} for this stock.

Simulations were carried out to examine the trajectory of the stock under 4 scenarios of fishing mortality: F=0, F=0.5*F2000, F=F2000, and F=2*F2000. These followed the same framework as that used in Rivard et. al. (1999). For these simulations the results of the VPA and the CV on these population estimates were used. The starting assumptions are given in Table 29. Simulations were carried out over a 10 year period. Recruitment was resampled from three sections of the estimated stock recruit scatter, depending on SSB. The three sections were 50 000 t of SSB and below (only low recruitment), greater than 50 000 t to 150 000 t (low and high recruitment), and greater than 150 000 t (only high recruitment). At F=F2000 or F=2*F2000 the population is estimated to decline over the 10 year period. At F=0.5*F2000 the population is estimated to grow slowly. At F=0 the population is estimated to grow more quickly and could reach 50 000 t before the end of the 10 year time period (Fig. 37). Yield is estimated to increase slightly over the 10 year time period under the scenario of F=0.5*F2000, but to decline over the time period at F=2000 or F=2*F2000

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Table 1. Nominal catches (t) of American plaice for NAFO Divisions 3LNO, 1960-2000 and TACs from 1973 to 2000.

Year	Canada	France	Poland	USSR/Russia	South Korea[a]	Other	Total	TAC
1960	21,352	2,106	-	569	-	20	24,047	-
1961	14,903	1,473	286	1,248	-	3	17,913	-
1962	15,217	973	171	1,841	-	4	18,206	-
1963	24,591	93	457	466	-	112	25,719	-
1964	35,474	1,582	539	680	-	292	38,567	-
1965	45,365	2,056	977	4,544	-	319	53,261	-
1966	51,225	1,246	860	11,484	-	196	65,011	-
1967	54,190	1,326	3,234	35,139	-	524	94,413	-
1968	48,674	406	203	23,751	-	133	73,167	-
1969	64,815	43	34	14,493	-	52	79,437	-
1970	54,929	389	40	10,232	-	1,055	66,645	-
1971	49,394	323	370	17,173	-	628	67,888	-
1972	41,605	322	2,515	14,164	-	755	59,361	-
1973	38,586	310	1,116	12,516	-	315	52,843	60,000
1974	35,101	418	615	10,074	-	89	46,297	60,000
1975	34,015	442	537	7,682	-	545	43,221	60,000
1976	47,806	305	5	3,280	-	429	51,825	47,000
1977	42,579	31	-	1,023	-	348	43,981	47,000
1978	48,634	168	-	1,048	-	178	50,028	47,000
1979	47,131	113	-	1,190	-	135	48,569	47,000
1980	48,296	183	-	336	-	271	49,086	47,000
1981	48,177	210	-	847	-	924	50,158	55,000
1982	49,620	133	-	67	715	517	51,052	55,000
1983	35,907	41	-	170	815	1,602	38,535	55,000
1984	33,756	140	1	360	1,582	3,606[b]	39,445	55,000
1985	40,024	-	4	81	2,483	11,620[b]	54,212	49,000
1986	33,409	46	-	188	3,952	26,975[b]	64,570	55,000
1987	33,967	17	-	47	2,741	18,240[b]	55,012	48,000
1988	26,832	-	-	159	2,522	11,322[b]	40,835	33,585[d]
1989	27,901	92	-	6	725	14,645[b]	43,369	30,300
1990	22,600	-	-	17	1,117	8,767[b]	32,501	24,900
1991	23,240[a]	-	-	60	1,910	9,471[b]	34,681	25,800
1992	10231[a]	-	-	50	518	2,551[b]	13,350	25,800
1993[c]	7,454	-	-	8	13	9,659[b]	17,122	10,500
1994[e]	71	-	-	-	100	7,207[b]	7,378	4,800[f]
1995[e]	59	-	-	-	-	578[b]	637	0
1996[e]	59	-	-	-	-	854[b]	913	0
1997[e]	114	-	-	-	-	1,293[b]	1,401	0
1998[e]	212	-	-	10	-	1,396[b]	1,618	0
1999[e]	316	-	-	147	-	2,102	2,565	0
2000[g]	622	-	-	318	-	4,236	5,176	0
2001								0

[a] Includes a portion of catches reported as unspecified flounder. See text for details.
[b] Includes some catches estimated from surveillance reports.
[c] Catch may have been as high as 19,400.
[d] Effective TAC.
[e] Provisional.
[f] No directed fishing.
[g] STACFIS unable to determine precise estimates because of discrepancies between various sources

Table 2. Breakdown of catches from Table 1 listed as "other" for 1984-2000.

			Other				
Year	Spain	Portugal	Panama[b]	USA	Caymen Islands[b]	Misc.[a]	Total
1984	1,622	-	1,800	-	-	184	3,606
1985	5,498	27	3,892	1,310	797	96	11,620
1986	11,882	9,240	3,756	1,506	572	19	26,975
1987	14,476	2,516	-	1,248	-	-	18,240
1988	8,956	872	-	1,379	-	115[c]	11,322
1989	10,909	583	-	1,134	-	2,019[c]	14,645
1990	294	356	-	8	-	8,109[c]	8,767
1991	786	187	-	-	-	8,498[c]	9,471
1992	412	139	-	-	-	2,000[c]	2,551
1993	199	92	-	-	-	9,368[c]	9,659
1994	5,476	630	-	575	-	526[c]	7,207
1995	430	148	-	-	-	-	578
1996	554	263	-	-	-	37	854
1997	951	336	-	-	-	6	1,293
1998	999	313	-	-	-	84	1,396
1999	1,242	800	-	-	-	60	2,102
2000	3,522	527	-	-	-	187	4,236

[a]Countries not in Tables 1 or 2.
[b]Not reported to NAFO. Catches estimated from surveillance reports.
[c]Includes some estimated catches.

Table 3 . Biomass estimates ('000t) of A.plaice, by stratum and depth zone (m), from Canadian spring surveys in Div. 3L in 1996-2000 (Campelen). (+) indicates biomass <50 t, (-) means stratum not surveyed.

		Biomass				
Depth	Stratum	Spring 1996	Spring 1997	Spring 1998	Spring 1999	Spring 2000
30-56	784	-	-	0.2	+	-
57-92	350	0.6	0.3	0.3	6.1	1.8
	363	2.3	0.8	0.0	3.2	6.2
	371	0.9	0.2	0.1	2.4	0.9
	372	1.4	0.8	1.3	2.7	3.7
	384	0.7	0.9	0.2	0.8	1.2
	785	-	-	0.2	0.5	-
93-183	328	0.5	0.5	0.1	2.4	0.9
	341	1.8	0.5	0.7	4.5	0.8
	342	0.1	0.1	0.4	0.4	0.2
	343	0.3	0.0	+	0.6	0.2
	348	1.4	0.8	1.2	2.8	1.5
	349	0.8	0.3	0.2	4.4	1.3
	364	2	1.0	0.9	5.6	1.3
	365	1.1	0.5	0.9	1.4	1.2
	370	1.3	0.6	1.6	2.4	1.9
	385	5.6	0.9	0.5	2.5	1.9
	390	0.6	0.4	0.5	0.3	0.3
	786	-	-	0.3	0.5	-
	787	-	-	0.5	0.8	-
	788	-	-	-	0.3	-
	790	-	-	-	+	-
	793	-	-	-	+	-
	794	-	-	-	+	-
	797	-	-	-	+	-
	799	-	-	-	-	-
184-274	344	1	0.3	0.8	1.8	0.5
	347	0.6	0.2	0.6	0.6	0.2
	366	0.4	0.3	0.3	0.5	0.7
	369	0.3	0.2	0.2	1.2	0.7
	386	0.5	0.2	0.4	1.4	1.7
	389	0.4	0.2	0.4	0.6	0.8
	391	0.3	0.1	0.2	0.1	+
	789	-	-	-	0.5	-
	791*	-	-	-	0.3	-
	795	-	-	-	0.1	-
	798	-	-	-	0.1	-
275-366	345	0.5	0.2	0.3	1.5	0.5
	346	0.4	0.3	0.2	0.2	0.5
	368	0.3	0.0	0.1	0.3	0.4
	387	0.6	0.6	0.8	0.4	1.6
	388	0.6	0.2	0.2	0.8	0.3
	392	0.5	0.1	0.4	0.2	0.1
	792	-	-	-	+	-
	796	-	-	-	0.1	-
	800	-	-	-	0.2	-
367-549	729	0.2	0.6	2.2	0.1	1.3
	731	0.5	0.1	+	0.1	1.2
	733	0.7	0.0	0.3	1	0.1
	735	1.4	1.6	1.2	0.6	1.2
550-731	730	+	0.0	0.2	+	0.1
	732	+	0.0	0.0	+	0.3
	734	+	0.0	0.1	0	0
	736	+	0.1	0.0	+	+
732-914	737	-	-	-	-	-
	741	-	-	-	-	-
	745	-	-	-	-	-
	748	-	-	-	-	-
915-1097	738	-	-	-	-	-
	742	-	-	-	-	-
	746	-	-	-	-	-
	749	-	-	-	-	-
1098-1280	739	-	-	-	-	-
	743	-	-	-	-	-
	747	-	-	-	-	-
	750	-	-	-	-	-
1281-1463	740	-	-	-	-	-
	744	-	-	-	-	-
	751	-	-	-	-	-
Grand Total		30.7	13.8	19.0	57.3	37.5

* in 1996 had a depth range of 184-366

Table 4. Biomass estimates ('000t) of A.plaice, by stratum and depth zone (m), from Canadian spring surveys in Div. 3N in 1996-2000 (Campelen). (+) indicates biomass <50 t, (-) means stratum not surveyed.

		Biomass				
Depth	Stratum	Spring 1996	Spring 1997	Spring 1998	Spring 1999	Spring 2000
< 56	375	2.9	2.2	1.1	1.8	5.1
	376	0.8	1.8	2.0	3.2	5.1
57-92	360	8.8	8.6	7.9	27.4	22.8
	361	3.8	1.9	2.0	5.5	4.2
	362	2.8	5.5	4.0	4.6	6.6
	373	1.6	0.5	0.9	8.3	3.2
	374	1.1	0.4	0.3	1.7	0.9
	383	0.5	0.1	+	1.0	0.2
93-183	359	1.1	1.1	1.6	3.3	5.1
	377	0.2	0.1	+	0.2	+
	382	0.1	0.1	0.7	0.2	0.4
184-274	358	0.1	0.1	1.4	0.3	0.6
	378	0.1	0.2	0.2	0.9	+
	381	0.3	0.1	0.1	0.2	0.1
275-366	357	0.1	0.1	0.1	+	0.1
	379	+	0.1	0.1	0.1	0.1
	380	0.2	0.8	0.1	0.2	+
367-549	723	0.2	0.4	0.3	+	0
	725	0.1	0.5	0.2	+	0.4
	727	0.5	2.2	2.0	0.4	1.2
550-731	724	0.2	0.5	0.2	+	0.1
	726	+	0.1	+	+	0.1
	728	0.5	-	0.3	0.2	0.5
732-914	752	-	-	-	-	-
	756	-	-	-	-	-
	760	-	-	-	-	-
915-1097	753	-	-	-	-	-
	757	-	-	-	-	-
	761	-	-	-	-	-
1098-1280	754	-	-	-	-	-
	758	-	-	-	-	-
1281-1463	755	-	-	-	-	-
	759	-	-	-	-	-
Grand Total		26.0	27.4	25.5	59.5	56.1

Table 5. Biomass estimates ('000t) of A.plaice, by stratum and depth zone (m), from Canadian spring surveys in Div. 3O in 1996-2000 (Campelen). (+) indicates biomass <50 t, (-) means stratum not surveyed.

		Biomass				
Depth	Stratum	Spring 1996	Spring 1997	Spring 1998	Spring 1999	Spring 2000
57-92	330	3.8	0.8	6.9	3.5	5.9
	331	1.4	0.3	0.3	2.7	2.3
	338	6.0	5.7	6.0	4.0	2.3
	340	2.2	1.7	1.8	2.9	1.9
	351	2.9	4.4	3.8	4.6	3.4
	352	9.1	13.8	10.6	14.2	13.4
	353	7.8	8.3	10.9	21.5	21.1
93-183	329	1.6	1.4	4.4	4.7	3.9
	332	3.9	2.5	3.8	2.2	0.9
	337	4.6	1.9	3.2	2.7	1.5
	339	1.4	0.8	0.8	2.1	2.1
	354	1.6	1.1	5.0	9.0	1.3
184-274	333	+	0.3	0.1	0.1	+
	336	0.2	0.3	+	0.2	+
	355	0.5	0.3	0.1	0.1	0.1
275-366	334	0.2	0.8	0.0	0.1	+
	335	0.2	0.2	0.0	+	+
	356	0.1	+	+	0.1	+
367-549	717	0.2	1.7	+	0.1	0
	719	0.1	0.5	+	+	0
	721	0.2	0.1	+	0.1	+
550-731	718	+	0.1	+	+	0
	720	+	0.1	+	+	0
	722	1.0	4.2	0.0	0.2	0.1
732-914	764	-	-	-	-	-
	768	-	-	-	-	-
	772	-	-	-	-	-
915-1097	765	-	-	-	-	-
	769	-	-	-	-	-
	773	-	-	-	-	-
Grand Total		49.0	51.2	57.7	75.1	60.2

Table 6. Abundance index (millions) at age of American plaice in Canadian spring surveys in Div. 3L from 1985 to 2000.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0.22	0	0	0	0	0	0	0	0	0.232	0	0.108	0	2.292
2	0	1.316	5.233	4.102	1.86	0	1.317	0	0.302	0	0	8.397	0.63	0.683	1.894	17.727
3	8.105	4.551	11.385	18.835	17.345	5.239	3.225	1.736	2.26	0.356	0.396	29.934	5.438	3.138	5.424	12.316
4	25.759	23.556	50.302	80.856	80.962	70.172	14.001	5.141	5.752	7.483	0.82	91.963	14.039	10.24	6.593	4.938
5	146.337	115.406	242.761	279.242	174.034	137.968	110.189	46.07	22.684	31.029	11.843	82.542	31.696	21.1	25.824	8.948
6	349.774	451.706	566.104	554.371	416.728	231.753	178	61.693	59.147	46.46	17.432	48.498	26.574	36.67	42.987	29.813
7	513.509	496.697	553.704	501.148	351.418	277.315	102.038	89.331	37.416	44.403	31.753	26.1642	14.58	30.438	66.664	28.551
8	317.451	260.246	333.722	277.154	208.589	152.334	79.232	33.108	16.714	13.716	31.276	8.009	6.832	19.433	65.012	27.473
9	152.454	156.89	132.672	188.167	143.331	94.211	43.695	18.531	5.562	6.126	17.628	3.62	2.422	6.38	39.589	18.831
10	85.188	66.889	65.649	60.044	52.544	55.704	19.021	7.074	2.961	1.382	5.281	0.639	0.688	2.899	19.356	10.779
11	44.657	27.007	22.235	32.646	26.898	18.397	10.449	2.877	1.231	0.829	1.142	0.085	0.392	1.604	10.419	5.463
12	22.126	18.069	19.315	20.019	14.771	9.587	6.609	1.444	0.432	0.137	0.209	0.031	0.087	0.64	3.361	1.313
13	12.337	11.837	9.132	10.111	8.566	6.326	2.567	0.64	0.292	0.147	0.062	0.031	0.021	0.173	1.342	0.252
14	5.987	4.402	3.933	5.87	4.845	2.4	1.386	0.378	0.127	0.046	0	0	0	0	0.182	0.087
15	2.988	2.642	2.003	3.271	3.356	1.569	0.989	0.193	0.028	0	0	0	0	0	0.035	0.000
16	1.905	1.575	0.74	1.543	1.066	1.041	0.48	0.064	0.032	0	0	0	0	0.024	0.092	0.071
17	0.391	0.444	0.242	0.362	0.427	0.58	0.177	0	0.043	0	0	0	0	0	0	0
18	0.028	0.216	0.02	0	0.086	0	0.033	0	0	0	0	0	0	0	0	0
19	0.028	0	0	0	0.052	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
unk1	0.227	0.509	0	0.453	0.053	3.035	0.033	0.012	0.687	0	0	0	0	0.119	0.036	0.011
total	1689.251	1643.958	2019.372	2038.194	1506.931	1067.631	573.541	268.292	155.67	152.114	117.842	300.1452	103.399	133.649	288.811	168.866

Table 7. Abundance index (millions) at age of American plaice in Canadian spring surveys in Div. 3N from 1985 to 2000.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.257	0	0	0	0	0.274	0	0	0	0	0	0	0	0.065	0.710	0.462
2	2.327	2.522	17.272	3.673	4.372	4.297	0.432	0.414	0.777	0	0	2.058	0.152	0.236	17.605	12.739
3	33.52	13.39	72.322	45.692	49.061	29.604	2.538	3.146	3.844	1.243	0.737	6.009	1.514	0.236	6.978	44.812
4	109.113	46.724	113.729	87.966	312.984	165.098	30.462	24.496	74.104	4.097	4.078	6.009	4.278	2.999	1.779	20.533
5	60.974	106.132	84.599	62.943	106.444	282.873	117.508	38.481	75.444	29.509	14.993	15.582	5.459	3.99	4.186	3.946
6	60.72	72.839	57.121	27.629	38.678	35.977	75.697	51.692	68.227	12.913	13.294	26.374	16.84	6.124	12.401	6.589
7	30.063	41.094	32.024	17.231	17.284	11.605	12.848	22.658	54.035	12.314	8.385	20.447	24.415	11.919	12.185	17.710
8	25.109	17.896	18.644	13.306	18.085	8.027	5.616	5.577	30.272	7.684	4.622	6.893	15.659	19.735	17.646	15.256
9	20.17	14.527	16.042	11.159	14.707	8.855	5.639	2.673	9.349	4.181	2.454	3.878	5.92	12.515	27.814	21.085
10	20.347	13.206	11.423	8.693	6.771	5.085	5.466	1.254	4.179	1.295	0.81	0.844	1.702	4.963	24.973	16.785
11	15.375	7.298	6.89	4.895	5.228	3.998	3.407	1.037	2.677	1.024	0.277	0.535	0.862	2.069	11.012	9.951
12	9.115	6.106	5.348	3.565	4.337	2.642	1.965	0.723	1.408	0.220	0.048	0.868	0.515	0.802	5.008	4.751
13	4.804	4.162	4.464	2.954	3.7	2.236	1.77	0.274	0.513	0.450	0	0.139	0.202	0.453	2.586	2.084
14	2.927	2.173	3.364	2.001	2.694	2.209	1.159	0.328	0.523	0.596	0	0.069	0.035	0.177	0.785	0.334
15	2.386	2.134	2.999	1.924	2.96	2.338	1.179	0.452	0.160	0.341	0	0.111	0.035	0.062	0.377	0.590
16	0.708	1.268	1.67	0.913	1.106	1.426	0.667	0.298	0.250	0.170	0	0	0	0.061	0.194	0.371
17	0.192	0.978	0.66	0.788	0.958	0.794	0.525	0.029	0.181	0	0	0	0	0	0.188	0.101
18	0	0.181	0.382	0.285	0.427	0.37	0.23	0.03	0.054	0	0	0	0	0	0.170	0.052
19	0	0.05	0.053	0.063	0.106	0.092	0.088	0	0.046	0	0	0	0	0	0	0
20	0	0	0.027	0	0	0.098	0.111	0.094	0	0	0	0	0	0	0.073	0
unk1	0.257	0.229	0.876	0.072	0.026	0.463	0	0.321	0.135	0	0	0.109	0	0	0.036	0
total	398.364	352.909	449.909	295.752	589.928	568.361	267.307	153.977	326.178	76.037	49.698	89.925	77.588	66.406	146.707	178.153

Table 8. Abundance index (millions) at age of American plaice in Canadian spring surveys in Div. 3O from 1985 to 2000.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0.262	0	0	0	0	0	0	0	0	0.114	0.08	0.371	7.720	2.001
2	0	0.579	5.378	0.693	0	5.445	0	4.088	1.298	0	0	35.87	5.788	8.827	22.964	24.095
3	8.596	13.378	16.946	15.845	20.367	10.615	24.859	28.664	3.391	0.936	0.886	63.899	33.35	7.293	22.700	92.192
4	24.121	39.55	57.584	22.467	51.186	113.04	39.651	30.2	40.669	9.534	6.219	27.8141	36.803	39.43	14.114	47.067
5	56.5	34.464	132.854	26.427	55.665	197.908	170.493	25.725	39.926	38.682	15.078	35.5544	28.123	44.707	36.731	22.082
6	44.057	36.816	124.229	34.621	96.359	110.171	110.458	76.756	52.763	46.667	26.798	55.641	40.988	26.402	49.122	30.614
7	52.08	39.365	70.478	25.496	101.467	82.081	65.319	38.926	68.613	28.655	19.745	50.511	40.316	34.386	26.019	31.747
8	47.238	28.916	45.948	24.512	47.051	39.903	28.068	24.718	42.463	21.87	14.039	24.609	26.227	40.223	28.859	21.836
9	35.383	22.234	35.925	18.523	29.599	27.413	18.21	12.916	17.315	9.685	7.402	8.691	10.602	29.014	39.905	19.248
10	34.703	18.022	24.029	16.555	15.364	16.735	10.703	9.175	9.37	2.72	2.248	3.019	3.657	11.698	20.993	19.623
11	24.265	11.65	12.704	11.087	7.717	9.99	8.404	5.533	3.718	2.099	1.245	1.322	1.424	6.255	9.089	12.515
12	13.958	10.203	9.135	8.991	7.963	9.234	4.782	3.235	2.424	1.039	0.282	1.334	1.217	1.839	4.651	3.471
13	5.575	5.736	6.332	5.68	4.559	5.866	2.887	2.429	0.978	0.644	0.031	0.348	0.339	0.998	2.580	1.705
14	5.063	2.328	3.839	4.098	2.111	4.2	2.984	1.061	0.675	0.354	0.035	0.181	0.139	0.268	0.928	0.479
15	4	2.295	3.025	2.36	2.192	2.041	1.886	1.778	0.485	0.133	0	0.102	0.127	0.411	0.743	0.627
16	1.585	0.917	1.834	2.307	1.817	1.705	1.031	1.251	0.554	0.09	0	0.168	0.127	0.051	0.594	0.187
17	0.311	0.722	0.968	0.476	1.066	1.222	0.577	0.242	0.362	0	0	0	0	0	0.321	0.293
18	0.03	0.179	0.461	0.508	0.427	0.547	0.441	0.514	0.087	0	0	0	0	0	0.253	0.140
19	0	0.05	0.196	0.032	0.026	0.219	0.241	0.131	0.082	0	0	0	0	0	0.184	0
20	0.288	0	0	0.031	0.026	0	0.083	0.129	0.05	0	0	0	0	0	0.039	0.110
unk1	0.064	0	0	0.664	0.268	0	2.463	0.867	0.393	0.044	0	0.046	0	0.139	0.028	0.035
total	357.817	267.404	552.127	221.373	445.23	638.335	493.54	268.338	285.616	163.152	94.008	309.2235	229.307	252.312	288.538	330.068

Table 9. Abundance index (millions) at age of American plaice in Canadian spring surveys in Div. 3LNO from 1985 to 2000.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.26	0.00	0.48	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.35	0.08	0.54	8.43	4.76
2	2.33	4.42	27.88	8.47	6.23	9.74	1.75	4.50	2.38	0.00	0.00	46.33	6.57	9.75	42.46	54.56
3	50.22	31.32	100.65	80.37	86.77	45.46	30.62	33.55	9.50	2.54	2.02	99.84	40.30	10.67	35.10	149.32
4	158.99	109.83	221.62	191.29	445.13	348.31	84.11	59.84	120.53	21.11	11.12	125.79	55.12	52.67	22.49	72.54
5	263.81	256.00	460.21	368.61	336.14	618.75	398.19	110.28	138.05	99.22	41.91	133.68	65.28	69.80	66.74	34.98
6	454.55	561.36	747.45	616.62	551.77	377.90	364.16	190.14	180.14	106.04	57.52	130.51	84.40	69.20	104.51	67.01
7	595.65	577.16	656.21	543.88	470.17	371.00	180.21	150.92	160.06	85.37	59.88	97.12	79.31	76.74	104.87	78.01
8	389.80	307.06	398.31	314.97	273.73	200.26	112.92	63.40	89.45	43.27	49.94	39.51	48.72	79.39	111.52	64.57
9	208.01	193.65	184.64	217.85	187.64	130.48	67.54	34.12	32.23	19.99	27.48	16.19	18.94	47.91	107.31	59.16
10	140.24	98.12	101.10	85.29	74.68	77.52	35.19	17.50	16.51	5.40	8.34	4.50	6.05	19.56	65.32	47.19
11	84.30	45.96	41.83	48.63	39.84	32.39	22.26	9.45	7.63	3.95	2.66	1.94	2.68	9.93	30.52	27.93
12	45.20	34.38	33.80	32.58	27.07	21.46	13.36	5.40	4.26	1.40	0.54	2.23	1.82	3.28	13.02	9.54
13	22.72	21.74	19.93	18.75	16.83	14.43	7.22	3.34	1.78	1.24	0.09	0.52	0.56	1.62	6.51	4.04
14	13.98	8.90	11.14	11.97	9.65	8.81	5.53	1.77	1.33	1.00	0.04	0.25	0.17	0.45	1.89	0.90
15	9.37	7.07	8.03	7.56	8.51	5.95	4.05	2.42	0.67	0.47	0.00	0.21	0.16	0.47	1.16	1.22
16	4.20	3.76	4.24	4.76	3.99	4.17	2.18	1.61	0.84	0.26	0.00	0.17	0.13	0.14	0.88	0.63
17	0.89	2.14	1.87	1.63	2.45	2.60	1.28	0.27	0.59	0.00	0.00	0.00	0.00	0.00	0.51	0.39
18	0.06	0.58	0.86	0.79	0.94	0.92	0.70	0.54	0.14	0.00	0.00	0.00	0.00	0.00	0.42	0.19
19	0.03	0.10	0.25	0.10	0.18	0.31	0.33	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.18	0.00
20	0.29	0.00	0.03	0.03	0.03	0.10	0.29	0.22	0.05	0.00	0.00	0.00	0.00	0.00	0.11	0.11
unk1	0.55	0.74	0.88	1.19	0.35	3.50	2.50	1.20	1.22	0.04	0.00	0.16	0.00	0.26	0.10	0.05
Ages 0+	2444.88	2263.53	3020.53	2554.13	2541.74	2270.83	1331.89	689.41	766.25	391.26	261.55	699.14	410.29	452.11	723.96	677.04
Ages 6+	1969.28	1861.97	2209.69	1905.39	1667.46	1248.30	817.22	481.25	495.80	268.39	206.50	293.16	242.94	308.69	548.73	360.89
Ages 9+	529.27	416.39	407.71	429.92	371.80	299.13	159.94	76.79	66.15	33.71	39.15	26.02	30.51	83.36	227.84	151.30
Ages 12+	96.73	78.67	80.14	78.15	69.64	58.74	34.95	15.72	9.79	4.37	0.67	3.38	2.84	5.96	24.69	17.02

Table 10 . Biomass estimates ('000t) of A.plaice, by stratum and depth zone (m), from Canadian fall surveys in Div. 3L in 1995-2000(Campelen).
(+) indicates biomass <50 t, (-) means stratum not surveyed.

		Biomass					
Depth	Stratum	Fall 1995	Fall 1996	Fall 1997	Fall 1998	Fall 1999	Fall 2000
30-56	784	-	+	+	0.0	-	+
57-92	350	0.8	0.9	0.5	1.1	1.0	0.5
	363	3.1	2.0	1.4	2.1	1.9	2.3
	371	1.2	1.1	0.2	0.5	0.4	0.8
	372	1.4	1.6	1.5	0.3	1.7	0.6
	384	1.6	1.6	0.5	0.2	1.5	0.1
	785	-	+	+	+	-	+
93-183	328	3.0	1.6	0.9	0.5	2.0	0.8
	341	1.6	2.8	0.8	2.1	0.6	0.7
	342	0.6	+	0.4	0.2	-	0.2
	343	0.7	0.1	0.0	0.1	-	+
	348	3.1	1.8	1.3	1.5	1.4	0.4
	349	3.4	1.4	1.5	0.8	0.4	0.3
	364	2.8	3.6	2.8	5.2	1.2	1.8
	365	1.7	1.1	1.0	1.4	1.0	-
	370	2.0	6.3	1.3	4.6	3.9	1.1
	385	3.9	7.6	1.9	4.0	2.9	0.8
	390	1.7	1.6	2.2	3.3	2.1	0.7
	786	-	0.3	0.1	0.1	-	0.1
	787	-	0.4	0.5	0.1	-	0.1
	788	-	0.3	0.3	0.1	-	0.1
	790	-	0.2	0.2	+	-	+
	793	-	0.1	0.1	0.1	-	+
	794	-	+	0.1	+	-	-
	797	-	0.1	0.1	+	-	+
	799	-	0.1	0.1	+	-	+
184-274	344	1.0	1.1	0.1	0.5	0.5	0.4
	347	1.8	0.7	0.3	0.8	0.5	0.4
	366	1.6	1.2	0.5	0.8	1.7	0.5
	369	1.0	1.6	0.5	1.8	1.6	0.8
	386	1.8	2.6	1.0	0.9	1.2	0.4
	389	0.6	0.6	0.6	0.7	0.6	0.4
	391	0.4	0.2	0.2	0.2	0.3	+
	789	-	0.2	0.2	0.1	-	0.1
	791*	-	0.5	0.4	0.1	-	0.3
	795	-	+	0.2	0.4	-	+
	798	-	0.2	0.7	0.3	-	+
275-366	345	4.1	2.4	0.8	2.5	1.3	0.6
	346	2.8	1.1	2.2	1.7	1.7	0.4
	368	0.2	0.3	0.2	0.4	0.7	0.6
	387	0.4	0.7	0.7	0.2	1.8	1.0
	388	0.3	0.1	0.4	+	0.9	0.4
	392	+	+	0.2	0.1	0.5	0.2
	796	-	0.6	0.9	0.4	-	-
	800	-	-	-	0.2	-	0.2
367-549	729	+	+	0.2	0.1	0.7	1.6
	731	0.2	-	0.6	0.1	1.0	1.1
	733	0.2	0.2	0.5	0.6	0.3	1.0
	735	0.7	0.7	0.3	0.8	1.9	2.1
	792	-	0.2	1.9	0.3	-	0.2
550-731	730	+	0.0	0.5	0.1	0.2	0.4
	732	+	+	1.3	0.2	1.9	0.7
	734	0	0.2	0.3	0.1	0.1	0.1
	736	0.2	0.5	0.8	0.6	0.6	1.5
732-914	737	0.4	1.5	1.8	3.3	0.8	0.7
	741	-	1.0	2.3	1.7	0.1	0
	745	-	0.1	2.2	0.1	0.7	0
	748	-	1.4	0.7	0.0	1.1	0
915-1097	738	0.6	0.2	0	0	0	0
	742	-	0.1	0	0	+	0
	746	-	0.1	0	+	0	0
	749	-	+	0.2	0	-	0
1098-1280	739	-	0	0	0	0	0
	743	-	0	0	0	0	0
	747	-	0	0	0.1	+	0
	750	-	0.1	0	0	0	0
1281-1463	740	-	0	0	0	0.1	0
	744	-	0.5	0	0.1	-	0
	751	-	0	0	0	-	0
Grand Total			50.9	57.5	43.3	48.6	44.8

* in 1996 stratum 791 covered a depth range of 184-366 m

Table 11. Biomass estimates ('000t) of A.plaice, by stratum and depth zone (m), from Canadian fall surveys in Div. 3N in 1995-2000 (Campelen). (+) indicates biomass <50 t, (-) means stratum not surveyed.

		Biomass					
Depth	Stratum	Fall 1995	Fall 1996	Fall 1997	Fall 1998	Fall 1999	Fall 2000
< 56	375	1.9	1.1	3.9	5.2	0.6	1.7
	376	4.7	2.4	7.7	4.4	4.3	35.8
57-92	360	22.3	7.4	28.4	39.2	43.4	96.4
	361	3.5	4.1	3.3	2.1	1.8	3.9
	362	5.0	1.1	5.1	2.9	2.9	2.6
	373	1.8	0.2	2.3	1.7	4.2	1.7
	374	2.4	0.4	1.8	1.3	2.7	1.7
	383	-	0.3	0.5	0.8	0.8	+
93-183	359	2.2	0.3	3.8	11.6	9.8	32.2
	377	0.5	0.4	2.3	1.1	0.9	0.7
	382	0.3	0.3	0.8	6.1	2.7	1.0
184-274	358	0.8	0.2	0.4	0.3	0.3	0.6
	378	0.1	0.2	0.1	0.1	0.4	0.2
	381	0.1	0.4	0.2	0.1	0.3	0.3
275-366	357	0.1	0.1	0.0	+	-	+
	379	+	0.2	0.1	+	0.3	+
	380	0.1	0.2	0.1	0.1	0.7	0.3
367-549	723	+	+	0.0	0.1	+	+
	725	0.1	0.1	0.0	+	0.1	0.2
	727	+	0.1	0.1	0.1	1.5	0.4
550-731	724	0.1	0.3	0.0	0.0	0.1	0
	726	+	0.3	0.1	+	+	+
	728	+	0.8	0.1	0.1	0.3	0.6
732-914	752	-	-	-	1.5	-	0
	756	-	-	-	0.1	-	-
	760	-	-	-	0.0	-	-
915-1097	753	-	-	-	+	-	0
	757	-	-	-	0.0	-	-
	761	-	-	-	0.0	-	-
1098-1280	754	-	-	-	0.0	-	0
	758	-	-	-	0.0	-	0
1281-1463	755	-	-	-	0.0	-	0
	759	-	-	-	0.0	-	-
Grand Total		46.0	20.9	61.0	77.3	78.1	180.3

Table 12. Biomass estimates ('000t) of A.plaice, by stratum and depth zone (m), from Canadian fall surveys in Div. 3O in 1995-2000 (Campelen). (+) indicates biomass <50 t, (-) means stratum not surveyed.

		Biomass					
Depth	Stratum	Fall 1995	Fall 1996	Fall 1997	Fall 1998	Fall 1999	Fall 2000
57-92	330	7.7	0.8	5.5	5.9	5.4	5.3
	331	1.2	0.3	0.9	1.8	1.0	1.0
	338	6.6	3.3	6.4	3.4	3.8	2.1
	340	7.2	0.4	3.2	1.1	2.8	2.2
	351	1.7	0.9	5.2	3.3	2.9	6.4
	352	4.6	9.1	6.9	8.4	3.2	8.4
	353	5.6	14.4	14.8	19.3	10.3	14.5
93-183	329	3.2	1.5	2.7	5.0	6.6	8.0
	332	3.5	3.9	1.6	3.9	1.9	2.8
	337	2.4	25.3	2.5	1.5	1.4	1.8
	339	6.5	0.9	5.1	1.4	-	3.8
	354	4.5	8.0	2.4	3.7	27.0	3.8
184-274	333	+	-	+	+	0.1	+
	336	+	0.1	0.1	+	0.1	0.1
	355	0.2	5.4	0.1	+	0.3	+
275-366	334	0.0	-	+	+	+	0
	335	+	+	+	+	+	+
	356	0.0	0.1	+	+	+	+
367-549	717	0.0	-	+	0.0	+	+
	719	+	0.2	0.0	+	+	+
	721	+	0.6	0.0	0.0	+	+
550-731	718	0.0	-	0.0	+	0.0	0
	720	0.0	+	-	+	+	+
	722	0.0	+	0.0	0.0	+	0
732-914	764	-	-	-	0.0	-	-
	768	-	-	-	0.0	-	-
	772	-	-	-	0.0	-	-
915-1097	765	-	-	-	0.0	-	-
	769	-	-	-	0.0	-	-
	773	-	-	-	0.0	-	-
Grand Total		54.9	75.2	57.5	58.7	66.9	60.2

Table 13. Abundance index (millions) at age for American plaice from Canadian fall surveys in Div. 3L from 1990 to 1999.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.34
1	0.78	0.12	0.00	0.00	0.00	0.45	1.12	0.17	2.71	14.04
2	2.39	2.09	0.75	3.10	0.00	11.05	16.62	1.52	3.84	19.86
3	26.07	14.38	12.54	21.10	0.00	25.11	57.94	21.44	6.89	10.52
4	309.25	91.21	52.65	71.20	14.48	59.35	170.16	63.91	28.35	7.92
5	597.38	295.78	171.91	123.36	25.75	198.76	149.44	105.70	64.67	29.39
6	548.02	372.37	269.73	218.20	42.96	187.22	84.67	84.48	90.34	50.01
7	303.10	164.87	102.93	138.57	54.51	101.25	31.85	35.87	57.37	46.36
8	145.95	77.59	32.27	27.74	28.54	36.23	6.04	10.59	25.21	37.97
9	95.12	43.16	10.42	7.96	8.82	19.26	2.46	5.73	14.46	24.81
10	36.73	18.31	5.51	2.65	1.88	3.65	0.83	1.27	3.74	8.91
11	17.48	8.27	1.87	1.13	0.29	0.36	0.14	0.82	1.26	4.64
12	9.06	5.12	1.63	0.29	0.06	0.10	0.06	0.19	0.41	2.10
13	5.46	1.95	0.46	0.09	0.02	0.00	0.05	0.14	0.06	0.63
14	3.94	1.51	0.26	0.07	0.07	0.00	0.00	0.00	0.00	0.22
15	1.52	0.88	0.12	0.24	0.00	0.00	0.00	0.01	0.00	0.03
16	0.51	0.23	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.03
17	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
unk	0.31	0.01	0.00	0.00	0.00	1.69	0.00	0.50	0.27	0.08
total	2103.06	1098.06	663.07	615.76	177.38	644.47	521.37	332.31	299.68	257.85

Table 14. Abundance index (millions) at age for American plaice from Canadian fall surveys in Div. 3N from 1990 to 1999.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	2.34	0.82	5.84	0.00	0.00	1.97	0.11	1.81	1.93	46.35
2	40.24	84.64	78.12	1.90	0.00	17.53	1.70	1.34	1.38	69.91
3	134.78	193.91	161.07	52.32	16.51	15.09	4.08	8.06	0.86	11.42
4	295.80	284.75	130.72	283.60	65.29	16.40	3.31	14.95	11.62	2.61
5	169.59	288.82	130.17	135.26	96.33	27.70	9.34	8.33	18.51	7.83
6	30.73	72.35	131.01	67.76	43.86	62.43	13.60	29.97	11.44	12.62
7	9.34	19.55	53.35	74.65	23.60	15.42	12.65	41.44	25.97	12.16
8	3.83	10.86	12.33	23.64	14.33	9.03	4.55	24.91	35.67	29.10
9	6.62	10.35	8.02	8.78	7.29	6.09	1.82	8.00	37.85	25.04
10	3.31	7.24	3.71	4.70	1.97	2.21	0.79	3.60	8.76	18.08
11	2.53	5.98	2.20	2.20	0.78	0.72	0.36	1.64	3.54	9.46
12	1.71	3.26	1.74	1.65	1.00	0.71	0.27	0.43	1.21	7.39
13	1.60	4.31	1.45	0.88	0.42	0.25	0.00	0.49	0.61	2.75
14	1.53	2.50	1.23	0.78	0.69	0.02	0.00	0.34	0.52	0.58
15	1.49	1.45	0.33	0.66	0.29	0.00	0.06	0.15	0.08	0.06
16	1.59	1.05	0.46	0.34	0.00	0.00	0.00	0.04	0.24	0.36
17	0.47	0.48	0.29	0.10	0.00	0.00	0.00	0.00	0.13	0.30
18	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
19	0.00	0.04	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.08
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
unk	0.16	0.06	1.73	0.21	0.09	0.07	0.00	0.19	0.12	0.00
total	707.78	992.55	723.78	659.44	272.46	175.66	52.65	145.70	160.43	256.19

Table 15. Abundance index (millions) at age for American plaice from Canadian fall surveys in Div. 3O from 1990 to 1999.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.61	1.38
1	8.24	0.63	0.00	0.00	0.00	35.77	2.28	1.32	17.60	93.19
2	10.51	12.10	2.58	5.10	0.00	97.32	80.15	16.68	21.30	80.38
3	25.25	56.20	44.10	42.54	3.02	20.35	74.47	71.61	9.03	49.89
4	100.36	73.88	74.88	143.08	23.98	35.12	54.27	67.87	77.71	13.19
5	86.13	139.80	65.85	101.84	68.22	69.48	49.52	39.82	37.99	55.24
6	64.11	134.09	98.45	86.11	64.26	86.70	75.81	45.40	27.31	30.79
7	57.19	64.96	69.79	103.34	56.80	35.29	37.70	42.67	29.30	21.05
8	41.89	27.82	32.12	52.74	46.38	16.19	10.77	17.73	22.54	31.85
9	22.78	28.33	17.21	16.26	12.54	14.17	4.54	9.60	16.11	22.84
10	15.16	18.75	8.47	7.97	3.97	4.89	1.46	2.43	5.45	6.67
11	9.19	11.66	4.38	3.47	1.60	0.80	1.29	0.76	2.14	4.75
12	6.66	5.48	3.48	3.15	0.67	0.50	0.26	0.59	2.01	2.82
13	4.99	5.96	1.43	2.11	0.48	0.20	0.05	0.22	1.37	1.51
14	3.85	2.96	1.67	1.53	0.41	0.28	0.12	0.26	0.32	0.27
15	2.41	2.12	0.70	0.79	0.10	0.05	0.28	0.31	0.10	0.08
16	2.36	1.05	0.67	0.96	0.00	0.00	0.00	0.03	0.14	0.32
17	1.17	0.33	0.24	0.18	0.00	0.00	0.00	0.00	0.31	0.28
18	0.08	0.28	0.27	0.31	0.00	0.00	0.00	0.00	0.05	0.05
19	0.00	0.11	0.06	0.19	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
unk	0.17	1.31	0.13	1.45	0.00	0.00	0.00	0.37	0.81	1.20
total	462.49	587.83	426.46	573.11	282.41	417.10	392.95	317.68	273.20	417.77

Table 16. Abundance index (millions) at age for American plaice from Canadian fall surveys in Div. 3LNO from 1990 to 1999.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	1.72
1	11.36	1.56	5.84	0.00	0.00	38.19	3.52	3.30	22.23	153.58
2	53.13	98.83	81.45	10.10	0.00	125.90	98.46	19.54	26.52	170.15
3	186.10	264.49	217.71	115.95	19.53	60.55	136.49	101.12	16.78	71.84
4	705.41	449.84	258.26	497.88	103.74	110.88	227.74	146.72	117.67	23.72
5	853.10	724.40	367.93	360.45	190.30	295.94	208.29	153.85	121.17	92.46
6	642.86	578.81	499.19	372.08	151.09	336.35	174.08	159.85	129.09	93.43
7	369.63	249.38	226.08	316.57	134.91	151.96	82.20	119.98	112.64	79.57
8	191.67	116.27	76.71	104.12	89.25	61.45	21.37	53.22	83.42	98.92
9	124.52	81.84	35.65	33.00	28.65	39.52	8.82	23.33	68.42	72.70
10	55.20	44.30	17.68	15.32	7.82	10.75	3.08	7.30	17.95	33.66
11	29.20	25.92	8.45	6.80	2.67	1.88	1.78	3.22	6.94	18.85
12	17.43	13.86	6.85	5.10	1.72	1.31	0.59	1.21	3.63	12.31
13	12.05	12.21	3.33	3.08	0.92	0.45	0.10	0.85	2.04	4.89
14	9.32	6.98	3.15	2.38	1.17	0.31	0.12	0.60	0.84	1.08
15	5.42	4.45	1.15	1.68	0.40	0.05	0.35	0.48	0.18	0.16
16	4.45	2.34	1.17	1.36	0.00	0.00	0.00	0.08	0.38	0.71
17	1.64	1.00	0.52	0.27	0.00	0.00	0.00	0.00	0.45	0.58
18	0.21	0.42	0.27	0.31	0.00	0.00	0.00	0.00	0.05	0.12
19	0.00	0.17	0.06	0.22	0.00	0.00	0.00	0.00	0.00	0.08
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
unk	0.64	1.38	1.86	1.65	0.09	1.77	0.00	1.05	1.20	1.28
Ages 0+	3272.68	2677.06	1811.45	1846.66	732.15	1235.46	966.97	794.63	732.11	930.53
Ages 6+	1463.58	1137.94	880.27	862.28	418.59	604.02	292.47	370.11	426.03	417.05
Ages 9+	259.43	193.48	78.29	69.52	43.34	54.26	14.83	37.06	100.88	145.14
Ages 12+	50.51	41.42	16.50	14.40	4.21	2.12	1.15	3.20	7.57	19.93

Table 17. Likelihood Ratio Test to evaluate effect of reducing the number of variance parameters estimated. The alternate model is one with variance parameters estimated for each survey*age combination (12 variance parameters), with (restricted) Loglikelihood=-57.39.

Null Model	Test Statistic	df	p-val
FALL_CAMP[1]	0.1572	2	0.9244
FALL_ENGL[1]	0.1958	2	0.9068
SPR_ENGL[1]	0.6393	2	0.7264
SPR_CAMP[1]	0.1050	2	0.9489
Survey vp[2]	1.2029	8	0.9966
Common vp[3]	3.4018	11	0.9843

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

Table 18. Canadian catches of A. plaice by Division, month, and gear during 1999.

	3L	3N		3O		3LNO
	Gillnet	OT	Gillnet	OT	Gillnet	
Jan					1	1
Feb					1	1
Mar				21		21
Apr		7		1		8
May		28		5	2	35
Jun	1	35	1	1	1	39
Jul	4	5		5		14
Aug	1	48		1		50
Sep	5	45		4		54
Oct	1	49		5		55
Nov		41		3		44
Dec		1				
Total	**12**	**259**	**1**	**46**	**5**	**323**

Summaries:

GN=18	3L=12	Can (N)= 321
OT=305	3N=260	Can (S)= 2
	3O=51	

Table 19. Canadian catches of A. plaice by Division, month, and gear during 2000.

	3L		3N		3O		3LNO
	OT	Gillnet	OT	Shr Trwl	OT	Gillnet	
Jan						4	4
Feb			8		1		9
Mar			43	1	4	1	49
Apr			92	2	1		95
May	88		91		8		187
Jun	6		10		13		29
Jul	1	4	10		5		20
Aug	8	18	3		1		30
Sep	27	8	69		1		105
Oct	2	1	65		1		69
Nov			23		1		24
Dec							
Total	**132**	**31**	**414**	**3**	**36**	**5**	**621**

Summaries:

GN=36	3L=163	Can (N)= 621
OT=582	3N=417	Can (S)= <1
Misc=3	3O=41	

Table 20. Catch at age (000 of fish) and mean length (cm) and weights (kg) at age from the Canadian catch of A. plaice in Div. 3LNO in 1999-2000. S.O.P. is catch numbers x mean weights.

		1999		3LNO			
Age	3LN*	3O	3LNO	Mean len	Mean wgt	S.O.P.
4						
5	2	2	4	29.6	0.224	0.90
6	22	5	27	32.4	0.301	8.13
7	50	5	56	35.0	0.388	21.73
8	81	12	93	37.1	0.474	44.08
9	109	22	131	39.7	0.590	77.29
10	81	17	98	41.5	0.683	66.93
11	45	12	57	44.4	0.849	48.39
12	20	6	27	47.5	1.062	28.67
13	6	3	8	51.0	1.342	10.74
14	2	1	2	53.3	1.563	3.13
15	1		2	55.3	1.766	3.53
16			0.3	59.9	2.292	0.69
17			0.1	58.5	2.100	0.21
18			0.2	63.6	2.783	0.56
Total	419	85	506			315.0
						catch=323 t

* No sampling data available for the 12 t catch in Div. 3L

			2000	3LNO			
Age	3L	3N	3O	Total	Mean len	Mean wgt	S.O.P.
4				0.1	22.5	0.089	0.01
5		1		1	32.3	0.299	0.30
6	4	41	2	47	35.1	0.396	18.61
7	29	82	8	119	36.8	0.461	54.86
8	35	103	12	150	38.1	0.516	77.40
9	76	135	18	229	39.9	0.604	138.32
10	64	115	15	195	42.3	0.731	142.55
11	26	64	6	96	45.0	0.887	85.15
12	14	34	3	50	47.8	1.089	54.45
13	4	10	1	15	50.2	1.281	19.22
14		4		5	55.0	1.727	8.64
15		1		1	57.9	2.055	2.06
16		1		1	62.0	2.559	2.56
17				0.4	64.0	2.846	1.14
18							
Total	252	591	65	910			605.2
							catch=621 t

Table 21. Catch at age data for all fleets, 3LNO A. plaice, 1999 and 2000.

		Portugal				Russia				Spain				Canada				Overall (LF data available)				Japan	Estonia	Total Numbers	Total SOP	
	Age	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	3LNO	3LNO		Age
1999	1	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	0.0	0.000	0			0	0	1
	2	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	0.0	0.000	0			0	0	2
	3	0	17.9	0.041	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	17.9	0.041	0			0	0	3
	4	0	22.4	0.087	0	0	23.9	0.108	0	0	24.3	0.114	0	0	0	0	0	1	23.5	0.101	0			1	0	4
	5	9	28.2	0.185	2	3	27.5	0.171	0	9	28.3	0.189	2	4	29.6	0.224	1	25	28.4	0.191	5			26	5	5
	6	60	31.2	0.261	16	11	30.0	0.228	2	72	31.2	0.260	19	27	32.4	0.301	8	169	31.4	0.265	45			173	46	6
	7	72	32.5	0.299	22	15	32.0	0.282	4	117	31.9	0.280	33	56	35.0	0.388	22	261	32.9	0.309	80			267	82	7
	8	156	34.6	0.366	57	30	34.1	0.349	10	283	33.9	0.342	97	93	37.1	0.474	44	563	34.7	0.371	209			577	214	8
	9	304	36.8	0.449	136	52	36.4	0.432	23	514	36.6	0.443	227	131	39.7	0.590	77	1001	37.1	0.463	464			1025	475	9
	10	323	40.2	0.603	195	53	39.8	0.586	31	574	40.1	0.598	343	98	41.5	0.683	67	1049	40.3	0.607	636			1075	652	10
	11	188	42.5	0.727	137	32	42.9	0.748	24	332	42.4	0.721	239	57	44.4	0.849	48	610	42.7	0.736	449			625	460	11
	12	88	46.1	0.953	84	16	46.7	0.995	16	139	46.0	0.944	131	27	47.5	1.062	29	270	46.3	0.962	260			277	266	12
	13	41	48.4	1.121	46	9	49.0	1.161	11	63	48.9	1.156	73	8	51.0	1.342	11	122	48.9	1.156	141			125	145	13
	14	12	53.2	1.534	19	4	54.1	1.623	7	25	53.8	1.591	40	2	53.3	1.563	3	44	53.7	1.577	69			45	70	14
	15	6	54.9	1.701	10	3	56.0	1.819	6	15	56.0	1.815	27	2	55.3	1.766	4	26	55.7	1.787	46			27	47	15
	16	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	59.9	2.292	1	0	60.1	2.292	1			0	1	16
	17	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	58.5	2.100	0	0	58.5	2.100	0			0	0	17
	18	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	63.6	2.783	1	0	63.7	2.783	1			0	1	18
	19	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	0.0	0.000	0			0	0	19
	20	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	0.0	0.000	0			0	0	20
	Unk	8	37.5	0.478	4	1	62.9	2.670	3	4	64.1	2.841	10	0	0	0	0	13	51.0	1.329	17			13	18	Unk
Total					727				138				1242				315				2422				2482	
Catch (t)					797				138				1242				316					60			2553	
2000	1	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	0.0	0.000	0			0	0	1
	2	0	17.5	0.038	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	17.5	0.038	0			0	0	2
	3	1	18.4	0.045	0	0	0.0	0.000	0	0	20.5	0.064	0	0	0	0	0	1	18.6	0.046	0			1	0	3
	4	5	21.5	0.076	0	4	24.2	0.111	0	2	24.2	0.112	0	0	22.5	0.089	0	11	23.1	0.096	1			11	1	4
	5	6	25.6	0.134	1	5	26.9	0.159	1	11	29.1	0.207	2	1	32.3	0.299	0	23	28.1	0.183	4			24	4	5
	6	36	30.9	0.251	9	48	30.5	0.242	12	173	31.0	0.255	44	47	35.1	0.396	19	304	31.7	0.274	83			316	87	6
	7	99	33.4	0.325	32	114	32.8	0.306	35	580	33.4	0.326	189	119	36.8	0.461	55	912	33.9	0.341	311			947	323	7
	8	138	34.7	0.371	51	131	34.3	0.356	47	905	34.8	0.374	338	150	38.1	0.516	77	1323	35.2	0.388	514			1373	533	8
	9	191	37.6	0.484	92	157	37.2	0.467	73	1287	38.1	0.504	648	229	39.9	0.604	138	1864	38.2	0.511	952			1935	988	9
	10	179	40.7	0.630	113	120	40.7	0.626	75	1208	41.6	0.675	816	195	42.3	0.731	143	1701	41.6	0.673	1146			1766	1189	10
	11	115	43.7	0.795	91	58	43.5	0.784	46	783	44.6	0.849	666	96	45.0	0.887	85	1052	44.5	0.843	887			1092	921	11
	12	37	47.4	1.045	39	17	46.9	1.009	17	328	48.1	1.092	359	50	47.8	1.089	54	432	48.0	1.085	469			449	487	12
	13	17	51.1	1.339	23	4	50.1	1.256	5	151	51.6	1.382	209	15	50.2	1.281	19	187	51.4	1.367	256			195	266	13
	14	6	52.1	1.428	9	1	52.2	1.438	1	30	54.0	1.608	48	5	55.0	1.727	9	42	53.8	1.592	67			43	69	14
	15	4	56.1	1.823	7	1	56.2	1.834	2	53	56.4	1.859	99	1	57.9	2.055	2	59	56.4	1.860	110			62	114	15
	16	2	59.5	2.226	4	0	57.4	1.971	1	31	59.7	2.245	69	1	62.0	2.559	3	34	59.7	2.249	76			35	79	16
	17	2	60.8	2.386	5	1	58.5	2.104	1	12	59.9	2.270	28	0	64.0	2.846	1	16	60.1	2.294	36			16	37	17
	18	0	62.9	2.676	0	0	63.8	2.808	0	0	60.5	2.349	1	0	0	0	0	1	61.6	2.497	2			1	2	18
	19	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0	0	0	0	0	0	0.0	0.000	0			0	0	19
	20	0	60.5	2.349	0	0	65.0	2.974	0	0	60.5	2.349	1	0	0	0	0	1	61.4	2.461	2			1	2	20
	Unk	2	59.9	2.269	4	0	62.5	2.618	1	2	62.5	2.618	5	0	0	0	0	4	61.4	2.468	9			4	9	Unk
Total					481				318				3522				605				4926				5113	
Catch (t)					527				318				3522				621					93	94		5175	

Table 22. Catch-at-age used in the VPA. 15+ is a plus group containing all catch from ages 15 to 21.

Catch	5	6	7	8	9	10	11	12	13	14	15
1975	883.0	3128.0	7220.0	9433.0	9234.0	7903.0	5701.0	4732.0	3788.0	2617.0	2933.0
1976	837.0	3907.0	8781.0	19363.0	16597.0	12338.0	8323.0	5156.0	3024.0	2309.0	2241.0
1977	974.0	6723.0	8743.0	11730.0	13559.0	11157.0	6520.0	4257.0	2369.0	1493.0	1625.0
1978	1558.0	4467.0	9195.0	10397.0	12743.0	13881.0	9938.0	6823.0	3655.0	2239.0	2440.0
1979	1257.0	6551.0	13532.0	18747.0	14977.0	12506.0	8791.0	3775.0	1843.0	714.0	580.0
1980	263.0	2977.0	9531.0	12578.0	14111.0	14212.0	11288.0	8088.0	3732.0	1565.0	1022.0
1981	154.0	554.0	2248.0	4786.0	7921.0	11425.0	13565.0	11872.0	8693.0	5591.0	4697.0
1982	27.0	314.0	1814.0	4799.0	8946.0	12836.0	15801.0	14489.0	7942.0	4224.0	2943.0
1983	119.0	991.0	3053.0	5797.0	8343.0	7707.0	8493.0	7517.0	4588.0	2480.0	1771.0
1984	48.0	397.0	1516.0	3311.0	5853.0	9958.0	12887.0	8964.0	5072.0	2515.0	1602.0
1985	296.0	788.0	2362.0	5652.0	10694.0	15741.0	14528.0	9233.0	4108.0	1969.0	1792.0
1986	4407.0	9707.0	12556.0	12530.0	13372.0	13874.0	14246.0	10376.0	5947.0	2637.0	2155.0
1987	2237.0	4941.0	7691.0	10893.0	15867.0	17640.0	11404.0	6986.0	3076.0	1303.0	1046.0
1988	2908.0	3213.0	4853.0	7269.0	10123.0	10325.0	9260.0	6040.0	2692.0	1156.0	962.0
1989	12745.0	11553.0	11432.0	9652.0	14180.0	12387.0	8405.0	4972.0	2029.0	1027.0	715.0
1990	15134.0	7694.0	4489.0	4604.0	8666.0	8666.0	6452.0	3633.0	1702.0	945.0	548.0
1991	6103.0	12152.0	7846.0	9331.0	7856.0	6589.0	4394.0	2294.0	811.0	364.0	484.0
1992	148.0	1023.0	2591.0	3395.0	3618.0	2154.0	1507.0	875.0	576.0	513.0	579.0
1993	1172.4	3712.9	8820.9	11590.5	5720.0	3376.9	1853.1	1002.5	526.9	354.7	526.8
1994	4316.3	3837.1	5426.1	4459.7	2777.0	736.9	475.6	162.8	120.9	54.7	27.7
1995	99.2	313.9	453.2	333.0	203.3	65.5	13.6	4.1	0.1	0.1	0.4
1996	180.9	742.8	975.0	452.7	211.1	51.9	10.4	8.1	2.3	1.0	1.3
1997	33.4	274.8	852.7	853.1	421.6	146.0	91.4	54.2	23.9	1.3	1.6
1998	10.6	54.8	272.7	767.1	804.9	455.5	278.5	117.3	69.0	49.2	18.3
1999	25.7	173.4	267.0	576.7	1025.4	1074.8	624.6	277.1	125.1	44.6	27.1
2000	24.3	315.8	946.8	1373.4	1934.6	1766.1	1092.1	448.8	194.6	43.5	114.5

Table 23. Beginning of the year weights-at-age from the fishery for Div. 3LNO American plaice

	5	6	7	8	9	10	11	12	13	14	15+
1960	0.118	0.160	0.232	0.320	0.423	0.539	0.663	0.775	0.872	1.041	1.332
1961	0.121	0.160	0.232	0.320	0.423	0.539	0.663	0.775	0.872	1.041	1.332
1962	0.107	0.156	0.227	0.326	0.441	0.549	0.663	0.810	0.885	1.035	1.339
1963	0.095	0.177	0.229	0.326	0.447	0.569	0.668	0.790	0.876	1.021	1.445
1964	0.095	0.198	0.293	0.382	0.458	0.579	0.687	0.789	0.882	1.023	1.579
1965	0.097	0.199	0.323	0.434	0.554	0.620	0.727	0.813	0.891	1.076	1.617
1966	0.095	0.195	0.327	0.427	0.565	0.702	0.828	0.904	0.925	1.095	1.648
1967	0.097	0.199	0.326	0.416	0.552	0.710	0.817	1.003	1.025	1.161	1.776
1968	0.095	0.195	0.316	0.415	0.531	0.652	0.819	0.916	1.052	1.219	1.894
1969	0.097	0.200	0.303	0.379	0.504	0.635	0.740	0.914	1.020	1.227	1.898
1970	0.100	0.194	0.309	0.363	0.470	0.619	0.730	0.813	1.012	1.106	1.752
1971	0.097	0.189	0.302	0.365	0.443	0.573	0.725	0.850	0.933	1.087	1.605
1972	0.103	0.195	0.310	0.400	0.461	0.557	0.679	0.818	0.922	1.102	1.613
1973	0.101	0.183	0.285	0.376	0.501	0.576	0.716	0.885	1.038	1.117	1.693
1974	0.101	0.186	0.288	0.349	0.465	0.600	0.759	0.951	1.190	1.396	1.992
1975	0.100	0.187	0.296	0.376	0.484	0.627	0.789	0.994	1.208	1.439	2.222
1976	0.099	0.189	0.296	0.380	0.482	0.610	0.757	0.955	1.109	1.332	2.088
1977	0.100	0.190	0.305	0.386	0.504	0.612	0.761	0.919	1.119	1.271	2.044
1978	0.090	0.189	0.305	0.384	0.469	0.614	0.718	0.897	1.098	1.303	2.055
1979	0.089	0.210	0.312	0.400	0.476	0.558	0.657	0.847	1.061	1.414	2.066
1980	0.083	0.212	0.362	0.425	0.495	0.560	0.629	0.720	0.958	1.290	2.021
1981	0.093	0.228	0.365	0.430	0.484	0.538	0.560	0.663	0.765	0.993	1.825
1982	0.082	0.202	0.369	0.416	0.469	0.509	0.565	0.638	0.812	1.005	1.852
1983	0.091	0.229	0.375	0.447	0.530	0.582	0.610	0.671	0.842	1.091	1.999
1984	0.089	0.208	0.382	0.466	0.553	0.609	0.676	0.771	0.923	1.177	2.231
1985	0.116	0.213	0.367	0.425	0.503	0.601	0.679	0.849	1.120	1.463	2.646
1986	0.094	0.163	0.302	0.420	0.509	0.605	0.713	0.901	1.195	1.570	2.684
1987	0.101	0.201	0.278	0.349	0.452	0.599	0.749	0.925	1.175	1.500	2.684
1988	0.118	0.187	0.317	0.421	0.463	0.547	0.712	0.934	1.229	1.560	2.869
1989	0.103	0.160	0.257	0.365	0.467	0.545	0.696	0.909	1.223	1.572	2.971
1990	0.091	0.184	0.253	0.341	0.464	0.586	0.745	0.986	1.317	1.697	2.923
1991	0.096	0.206	0.321	0.408	0.520	0.661	0.845	1.104	1.478	1.880	2.720
1992	0.107	0.198	0.330	0.415	0.514	0.667	0.861	1.096	1.412	1.806	2.588
1993	0.088	0.176	0.279	0.358	0.453	0.568	0.730	0.926	1.205	1.466	2.371
1994	0.084	0.148	0.244	0.320	0.441	0.613	0.727	0.906	1.163	1.444	2.298
1995	0.166	0.168	0.252	0.341	0.515	0.742	1.102	1.226	1.313	1.849	2.430
1996	0.116	0.194	0.265	0.386	0.537	0.807	1.058	1.457	1.625	2.109	2.502
1997	0.162	0.189	0.266	0.379	0.542	0.745	0.953	1.187	1.531	1.924	2.486
1998	0.136	0.165	0.255	0.350	0.495	0.633	0.806	0.985	1.260	1.732	2.334
1999	0.159	0.212	0.227	0.316	0.411	0.553	0.673	0.860	1.065	1.387	2.143
2000	0.165	0.229	0.300	0.346	0.435	0.559	0.715	0.893	1.147	1.357	2.125
2001	0.153	0.202	0.261	0.338	0.447	0.581	0.731	0.913	1.157	1.492	2.201

Table 24. Estimated proportion mature-at-age for Div. 3LNO American plaice

	5	6	7	8	9	10	11	12	13	14	15
1960	0.001	0.005	0.013	0.034	0.127	0.214	0.405	0.787	0.922	0.974	0.992
1961	0.003	0.004	0.015	0.039	0.094	0.333	0.540	0.669	0.922	0.974	0.992
1962	0.002	0.009	0.013	0.044	0.112	0.235	0.632	0.835	0.857	0.974	0.992
1963	0.001	0.006	0.029	0.037	0.121	0.281	0.476	0.855	0.956	0.947	0.992
1964	0.001	0.003	0.019	0.083	0.101	0.293	0.549	0.728	0.953	0.990	0.982
1965	0.007	0.005	0.011	0.059	0.219	0.248	0.556	0.791	0.887	0.986	0.998
1966	0.014	0.021	0.020	0.042	0.167	0.464	0.493	0.791	0.922	0.959	0.996
1967	0.003	0.034	0.058	0.070	0.154	0.390	0.727	0.741	0.919	0.973	0.986
1968	0.001	0.009	0.080	0.151	0.220	0.428	0.670	0.892	0.894	0.972	0.991
1969	0.002	0.004	0.023	0.178	0.341	0.515	0.755	0.866	0.962	0.961	0.990
1970	0.001	0.006	0.012	0.061	0.348	0.601	0.800	0.927	0.954	0.987	0.987
1971	0.000	0.002	0.018	0.038	0.150	0.569	0.814	0.938	0.981	0.985	0.996
1972	0.000	0.001	0.007	0.050	0.111	0.324	0.766	0.927	0.983	0.995	0.995
1973	0.000	0.001	0.004	0.023	0.131	0.284	0.565	0.890	0.974	0.995	0.999
1974	0.002	0.002	0.006	0.016	0.078	0.300	0.557	0.779	0.952	0.991	0.999
1975	0.004	0.006	0.007	0.027	0.065	0.231	0.550	0.800	0.905	0.980	0.997
1976	0.005	0.011	0.022	0.031	0.107	0.227	0.516	0.777	0.927	0.963	0.992
1977	0.002	0.013	0.033	0.074	0.125	0.342	0.553	0.792	0.909	0.976	0.986
1978	0.000	0.006	0.035	0.094	0.219	0.388	0.692	0.838	0.931	0.966	0.992
1979	0.001	0.002	0.020	0.093	0.238	0.497	0.738	0.907	0.956	0.980	0.988
1980	0.001	0.004	0.010	0.067	0.222	0.485	0.777	0.926	0.977	0.989	0.994
1981	0.002	0.006	0.025	0.051	0.206	0.443	0.739	0.925	0.982	0.995	0.997
1982	0.000	0.010	0.031	0.125	0.228	0.481	0.689	0.895	0.977	0.996	0.999
1983	0.001	0.003	0.052	0.151	0.446	0.619	0.768	0.861	0.963	0.993	0.999
1984	0.000	0.009	0.030	0.227	0.500	0.820	0.899	0.922	0.945	0.987	0.998
1985	0.004	0.005	0.064	0.229	0.613	0.849	0.963	0.980	0.977	0.980	0.996
1986	0.007	0.022	0.057	0.347	0.738	0.895	0.969	0.993	0.996	0.993	0.993
1987	0.004	0.035	0.111	0.429	0.804	0.964	0.979	0.994	0.999	0.999	0.998
1988	0.002	0.018	0.153	0.411	0.903	0.969	0.996	0.996	0.999	1.000	1.000
1989	0.002	0.011	0.076	0.475	0.795	0.992	0.996	1.000	0.999	1.000	1.000
1990	0.002	0.009	0.050	0.268	0.819	0.956	0.999	0.999	1.000	1.000	1.000
1991	0.005	0.012	0.052	0.208	0.621	0.958	0.992	1.000	1.000	1.000	1.000
1992	0.001	0.021	0.058	0.241	0.566	0.880	0.991	0.999	1.000	1.000	1.000
1993	0.008	0.009	0.078	0.233	0.647	0.866	0.970	0.998	1.000	1.000	1.000
1994	0.029	0.043	0.067	0.256	0.602	0.914	0.970	0.993	1.000	1.000	1.000
1995	0.088	0.111	0.208	0.368	0.582	0.883	0.984	0.994	0.998	1.000	1.000
1996	0.007	0.185	0.343	0.607	0.826	0.849	0.974	0.997	0.999	1.000	1.000
1997	0.003	0.035	0.346	0.686	0.900	0.975	0.958	0.995	1.000	1.000	1.000
1998	0.002	0.023	0.154	0.554	0.901	0.981	0.997	0.989	0.999	1.000	1.000
1999	0.004	0.024	0.136	0.480	0.744	0.974	0.997	1.000	0.997	1.000	1.000
2000	0.004	0.027	0.269	0.517	0.824	0.872	0.994	0.999	1.000	0.999	1.000
2001	0.004	0.027	0.186	0.846	0.879	0.960	0.941	0.999	1.000	1.000	1.000

Table 25. Results of VPA for 3LNO American plaice using fall RV index only

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000659
MEAN SQUARE RESIDUALS 0.371038

Parameters in linear scale

			PAR. EST.	STD. ERR.	REL. ERR.	BIAS	REL. BIAS	Avg CV
Population abundance		6	9.05E+03	5.90E+03	0.653	2.02E+03	0.223	0.4188
Jan 1 2000		7	8.28E+03	3.90E+03	0.471	9.93E+02	0.12	
		8	8.08E+03	3.17E+03	0.392	6.86E+02	0.085	
		9	8.73E+03	3.10E+03	0.355	6.00E+02	0.069	
		10	6.22E+03	2.25E+03	0.361	4.03E+02	0.065	
		11	3.34E+03	1.29E+03	0.388	2.23E+02	0.067	
		12	1.40E+03	5.70E+02	0.407	9.57E+01	0.068	
		13	7.25E+02	2.90E+02	0.4	4.71E+01	0.065	
		14	3.55E+02	1.42E+02	0.399	2.28E+01	0.064	
		15	2.29E+02	8.28E+01	0.362	9.94E+00	0.043	
catchabilities	Fall	5	1.00E-02	2.34E-03	0.234	1.68E-04	0.017	
		6	1.27E-02	2.80E-03	0.221	1.90E-04	0.015	
		7	1.14E-02	2.44E-03	0.215	1.68E-04	0.015	
		8	9.38E-03	1.99E-03	0.213	1.46E-04	0.016	
		9	9.13E-03	1.95E-03	0.213	1.58E-04	0.017	
		10	6.97E-03	1.49E-03	0.214	1.34E-04	0.019	
		11	6.91E-03	1.51E-03	0.218	1.48E-04	0.021	
		12	8.62E-03	1.92E-03	0.222	2.00E-04	0.023	
		13	9.55E-03	2.21E-03	0.231	2.47E-04	0.026	
		14	1.36E-02	3.29E-03	0.242	3.95E-04	0.029	

Table 26. Results of VPA for 3LNO American plaice using spirng RV index only

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000109
MEAN SQUARE RESIDUALS 0.213561

Parameters in linear scale

			PAR. EST.	STD. ERR.	REL. ERR.	BIAS	REL. BIAS	Avg CV
Population abundance		6	1.31E+04	6.28E+03	0.48	1.53E+03	0.117	0.2902
Jan 1 2001		7	1.70E+04	5.86E+03	0.345	1.03E+03	0.061	
		8	1.55E+04	4.54E+03	0.293	6.60E+02	0.043	
		9	1.12E+04	2.99E+03	0.268	3.82E+02	0.034	
		10	1.08E+04	2.75E+03	0.255	3.17E+02	0.029	
		11	7.02E+03	1.86E+03	0.264	1.99E+02	0.028	
		12	4.22E+03	1.14E+03	0.269	1.15E+02	0.027	
		13	1.97E+03	5.19E+02	0.264	5.03E+01	0.026	
		14	9.54E+02	2.49E+02	0.261	2.35E+01	0.025	
		15	5.43E+02	1.10E+02	0.203	6.72E+00	0.012	
catchabilities	Spring	5	2.42E-03	3.12E-04	0.129	1.56E-05	0.006	
		6	4.18E-03	5.21E-04	0.125	2.55E-05	0.006	
		7	5.27E-03	6.46E-04	0.123	3.22E-05	0.006	
		8	4.92E-03	5.98E-04	0.122	3.09E-05	0.006	
		9	4.51E-03	5.48E-04	0.121	2.98E-05	0.007	
		10	3.64E-03	4.43E-04	0.122	2.58E-05	0.007	
		11	3.55E-03	4.36E-04	0.123	2.67E-05	0.008	
		12	4.05E-03	5.03E-04	0.124	3.20E-05	0.008	
		13	4.17E-03	5.30E-04	0.127	3.50E-05	0.008	
		14	4.32E-03	5.66E-04	0.131	3.85E-05	0.009	

Table 27. Results of VPA for 3LNO American plaice using spirng and fall RV indices

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000500
MEAN SQUARE RESIDUALS 0.287136

Parameters linear scale

		PAR.	EST.	STD. ERR	REL. ERR.	BIAS	REL. BIAS	Avg CV
Population abundance		6	1.18E+04	6.58E+03	0.556	1.85E+03	0.156	0.2853
Jan 1 2001		7	1.31E+04	4.35E+03	0.331	7.33E+02	0.056	
		8	1.13E+04	3.07E+03	0.272	4.12E+02	0.036	
		9	8.81E+03	2.17E+03	0.246	2.51E+02	0.029	
		10	8.62E+03	2.03E+03	0.235	2.11E+02	0.025	
		11	5.71E+03	1.41E+03	0.247	1.36E+02	0.024	
		12	3.25E+03	8.40E+02	0.258	7.72E+01	0.024	
		13	1.46E+03	3.76E+02	0.258	3.31E+01	0.023	
		14	7.48E+02	1.86E+02	0.249	1.59E+01	0.021	
		15	4.37E+02	8.77E+01	0.201	5.09E+00	0.012	
catchabilities	Spring	5	2.67E-03	3.89E-04	0.146	2.38E-05	0.009	
		6	4.60E-03	6.49E-04	0.141	3.88E-05	0.008	
		7	5.74E-03	7.98E-04	0.139	4.84E-05	0.008	
		8	5.29E-03	7.32E-04	0.138	4.53E-05	0.009	
		9	4.83E-03	6.68E-04	0.138	4.26E-05	0.009	
		10	3.89E-03	5.39E-04	0.139	3.60E-05	0.009	
		11	3.80E-03	5.29E-04	0.139	3.67E-05	0.01	
		12	4.32E-03	6.07E-04	0.14	4.33E-05	0.01	
		13	4.44E-03	6.33E-04	0.142	4.61E-05	0.01	
		14	4.61E-03	6.70E-04	0.145	4.97E-05	0.011	
	Fall	5	7.54E-03	1.38E-03	0.183	1.08E-04	0.014	
		6	9.96E-03	1.78E-03	0.179	1.38E-04	0.014	
		7	9.34E-03	1.65E-03	0.177	1.29E-04	0.014	
		8	7.94E-03	1.40E-03	0.176	1.11E-04	0.014	
		9	7.62E-03	1.35E-03	0.177	1.11E-04	0.015	
		10	5.74E-03	1.02E-03	0.177	8.61E-05	0.015	
		11	5.59E-03	1.00E-03	0.179	8.74E-05	0.016	
		12	6.94E-03	1.26E-03	0.181	1.12E-04	0.016	
		13	7.57E-03	1.41E-03	0.186	1.31E-04	0.017	
		14	9.38E-3	1.75E-3	0.187	1.63E-4	0.017	

Table 28 Bias adjusted population numbers ('000) and fishing mortalities from final VPA

Bias adjusted population numbers

	5	6	7	8	9	10	11	12	13	14	15	5+
1975	293985.8	228978.5	190859.5	122611.5	76156.98	43254.62	25040.14	15848.64	10882.56	5939.161	6656.308	1020214
1976	276667	239897.6	184646.8	149745.2	91877.22	54030.56	28301.42	15375.79	8729.204	5515.13	5352.71	1060139
1977	232202.5	225759.8	192883.3	143251	105154.4	60285.19	33144.49	15701.18	7966.215	4436.669	4828.926	1025614
1978	218523.2	189231.5	178766.7	150028.4	106704.6	73876	39316.9	21270.48	9032.01	4396.145	4790.796	995936.8
1979	200727.6	177504.5	150896.3	138063.8	113453.3	75878.13	47993.53	23260.93	11295.42	4124.785	3350.666	946548.9
1980	193499.9	163206.5	139414.8	111340.7	96147.83	79393.84	50864.2	31382.22	15645.5	7588.535	4955.58	893439.5
1981	188431.7	158186.7	130933.9	105544.7	79821.01	66009.56	52210.72	31494.49	18427.64	9455.171	7943.291	848458.9
1982	191219.5	154135.7	129011.9	105169.6	82093.05	58210.4	43759.66	30560.89	15154.99	7327.386	5105.231	821748.3
1983	189756	156532.9	125912	103987.8	81774.19	59148.07	36116.78	21672.06	12088.48	5332.241	3807.822	796128.4
1984	191358.5	155251.6	127263.2	100331.4	79906.95	59429.48	41482.28	21935.88	11006.7	5789.308	3687.663	797443
1985	186937.8	156627.8	126750.7	102825.1	79155.33	60142.48	39691.78	22401.6	9940.81	4482.214	4079.293	793034.8
1986	159466.4	152784.3	127524.2	101641.7	79085.78	55172.51	35100.82	19483.87	10082.4	4464.564	3648.516	748455.1
1987	141513	126581.1	116331.2	93087.41	71925.9	52711.86	32705.61	15993.2	6711.085	2971.347	2385.287	662917
1988	159782.1	113840.9	99175.78	88305.14	66396.09	44620.69	27342.04	16557.15	6850.504	2747.459	2286.38	627904.2
1989	182756	128192.5	90304.15	76818.44	65742.2	45243.98	27250.73	14084.85	8145.508	3199.402	2227.432	643965.2
1990	189565.6	97946.25	66741.15	44551.42	37952.58	28092.93	17410.18	9801.529	4614.763	3281.153	1902.721	501860.3
1991	92087.28	100157.4	51844.42	35893.63	22753.64	15865.15	10103.56	5485.854	3087.93	1459.907	1941.195	340680
1992	75084.7	49593.16	49806.16	24621.93	14173.6	7581.049	4497.014	2725.205	1543.978	1213.334	1369.435	232209.6
1993	65835.61	44083.01	28415.95	27357.36	11939.93	5645.474	2860.209	1531.059	955.3381	483.7805	718.5102	189826.2
1994	73784.95	37863.04	23146.07	10179.82	7593.986	2854.801	899.2555	364.8426	188.7191	181.4932	91.90787	157148.9
1995	58309.52	40168.34	19394.39	9572.217	2723.055	2419.349	1131.124	184.4925	95.52683	24.93227	99.72909	134122.7
1996	41369.69	34246.05	23405.36	11072.43	5382.248	1449.321	1374.449	655.4793	105.4881	56.15174	72.99726	119189.7
1997	22352.06	24213.26	19594.83	13038.95	6174.819	3008.303	813.8031	801.1248	379.6804	60.34891	74.27558	90511.46
1998	21605.91	18270.15	19575.96	15273.25	9905.717	4675.165	2331.225	583.9022	607.008	289.2923	107.6026	93225.18
1999	18974.5	17679.85	14908.84	15781.17	11812.39	7384.158	3417.011	1657.657	372.5362	434.7848	264.1854	92687.07
2000	12232.76	15511.79	14318.42	11965.21	12399.93	8746.441	5077.551	2235.491	1107.706	192.8547	507.629	84295.8
2001	17116.8	9993.39	12414.82	10868.74	8558.439	8410.083	5572.244	3175.026	1426.526	731.7506	431.4543	78699.26

geometric mean of 1998 to 2000

Bias adjusted fishing mortalities

	5	6	7	8	9	10	11	12	13	14	15	avg 9-14	avg 8-12
1975	0.003	0.015	0.043	0.089	0.143	0.224	0.288	0.396	0.480	0.656	0.656	0.364	0.228
1976	0.003	0.018	0.054	0.154	0.221	0.289	0.389	0.458	0.477	0.611	0.611	0.407	0.302
1977	0.005	0.033	0.051	0.095	0.153	0.227	0.244	0.353	0.394	0.460	0.460	0.305	0.214
1978	0.008	0.026	0.058	0.079	0.141	0.231	0.325	0.433	0.584	0.809	0.809	0.420	0.242
1979	0.007	0.042	0.104	0.162	0.157	0.200	0.225	0.197	0.198	0.211	0.211	0.198	0.188
1980	0.002	0.020	0.078	0.133	0.176	0.219	0.279	0.332	0.304	0.257	0.257	0.261	0.228
1981	0.001	0.004	0.019	0.051	0.116	0.211	0.336	0.531	0.722	1.026	1.026	0.490	0.249
1982	0.000	0.002	0.016	0.052	0.128	0.277	0.503	0.727	0.845	0.983	0.983	0.577	0.337
1983	0.001	0.007	0.027	0.063	0.119	0.155	0.299	0.478	0.536	0.708	0.708	0.382	0.223
1984	0.000	0.003	0.013	0.037	0.084	0.204	0.416	0.591	0.698	0.643	0.643	0.439	0.266
1985	0.002	0.006	0.021	0.062	0.161	0.338	0.512	0.598	0.600	0.653	0.653	0.477	0.334
1986	0.031	0.073	0.115	0.146	0.206	0.323	0.586	0.866	1.022	1.024	1.024	0.671	0.425
1987	0.018	0.044	0.076	0.138	0.277	0.456	0.481	0.648	0.693	0.651	0.651	0.534	0.400
1988	0.020	0.032	0.055	0.095	0.184	0.293	0.463	0.509	0.561	0.615	0.615	0.438	0.309
1989	0.094	0.123	0.177	0.175	0.320	0.425	0.493	0.586	0.379	0.518	0.518	0.453	0.400
1990	0.108	0.106	0.090	0.142	0.342	0.493	0.625	0.625	0.621	0.452	0.452	0.526	0.445
1991	0.089	0.169	0.215	0.399	0.569	0.731	0.780	0.738	0.404	0.380	0.380	0.600	0.643
1992	0.003	0.027	0.069	0.194	0.391	0.445	0.547	0.518	0.630	0.749	0.749	0.547	0.419
1993	0.023	0.114	0.497	0.752	0.901	1.307	1.529	1.563	1.131	2.041	2.041	1.412	1.210
1994	0.078	0.139	0.353	0.789	0.614	0.396	1.054	0.810	1.494	0.478	0.478	0.808	0.732
1995	0.002	0.010	0.031	0.046	0.101	0.035	0.016	0.029	0.001	0.005	0.005	0.031	0.045
1996	0.006	0.028	0.055	0.054	0.052	0.047	0.010	0.016	0.028	0.023	0.023	0.029	0.036
1997	0.002	0.013	0.049	0.075	0.078	0.055	0.132	0.077	0.072	0.024	0.024	0.073	0.083
1998	0.001	0.003	0.015	0.057	0.094	0.113	0.141	0.249	0.134	0.207	0.207	0.156	0.131
1999	0.001	0.011	0.020	0.041	0.101	0.175	0.224	0.203	0.458	0.120	0.120	0.213	0.149
2000	0.002	0.023	0.076	0.135	0.188	0.251	0.270	0.249	0.215	0.285	0.285	0.243	0.219

Table 29. Starting assumptions for simulations.

Age	Estimate of 2001 population numbers (‘000)	CV on population estimate	Weight-at-age mid year (avg 1975-2000)	Weight-at-age beginning of year (avg 1975-2000)	Maturity-at-age using data from 1949-1993 cohorts	PR calculated over ages 11-14 (avg. 1998-2000)
5	17117	0.556	0.158	0.108	0.015	0.006
6	11800	0.556	0.268	0.193	0.037	0.053
7	13100	0.331	0.348	0.303	0.090	0.161
8	11300	0.272	0.432	0.387	0.202	0.338
9	8810	0.246	0.551	0.487	0.392	0.554
10	8620	0.235	0.677	0.610	0.622	0.781
11	5710	0.247	0.837	0.750	0.808	1
12	3250	0.258	1.043	0.931	0.915	1
13	1460	0.258	1.315	1.167	0.965	1
14	748	0.249	1.694	1.486	0.986	1
15	437	0.201	1.980	1.821	0.994	1
16			2.358	2.155	0.998	1
17			2.717	2.531	0.999	1
18			2.86	2.86	1	1
19			3.02	3.02	1	1
20			3.18	3.18	1	1
21			3.34	3.34	1	1
22			3.5	3.5	1	1
23			3.66	3.66	1	1
24			3.82	3.82	1	1
25			3.98	3.98	1	1

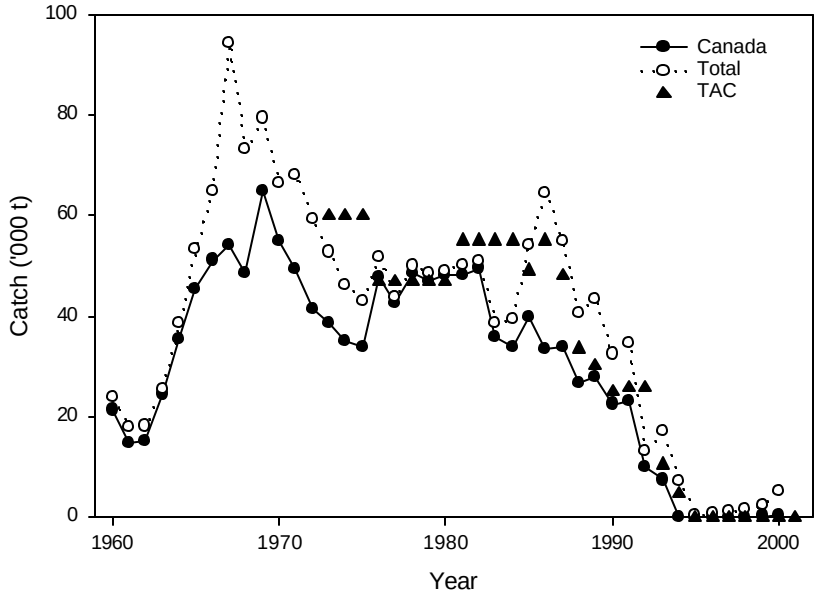


Figure 1. Catches and TAC's of American plaice in Div. 3LNO.

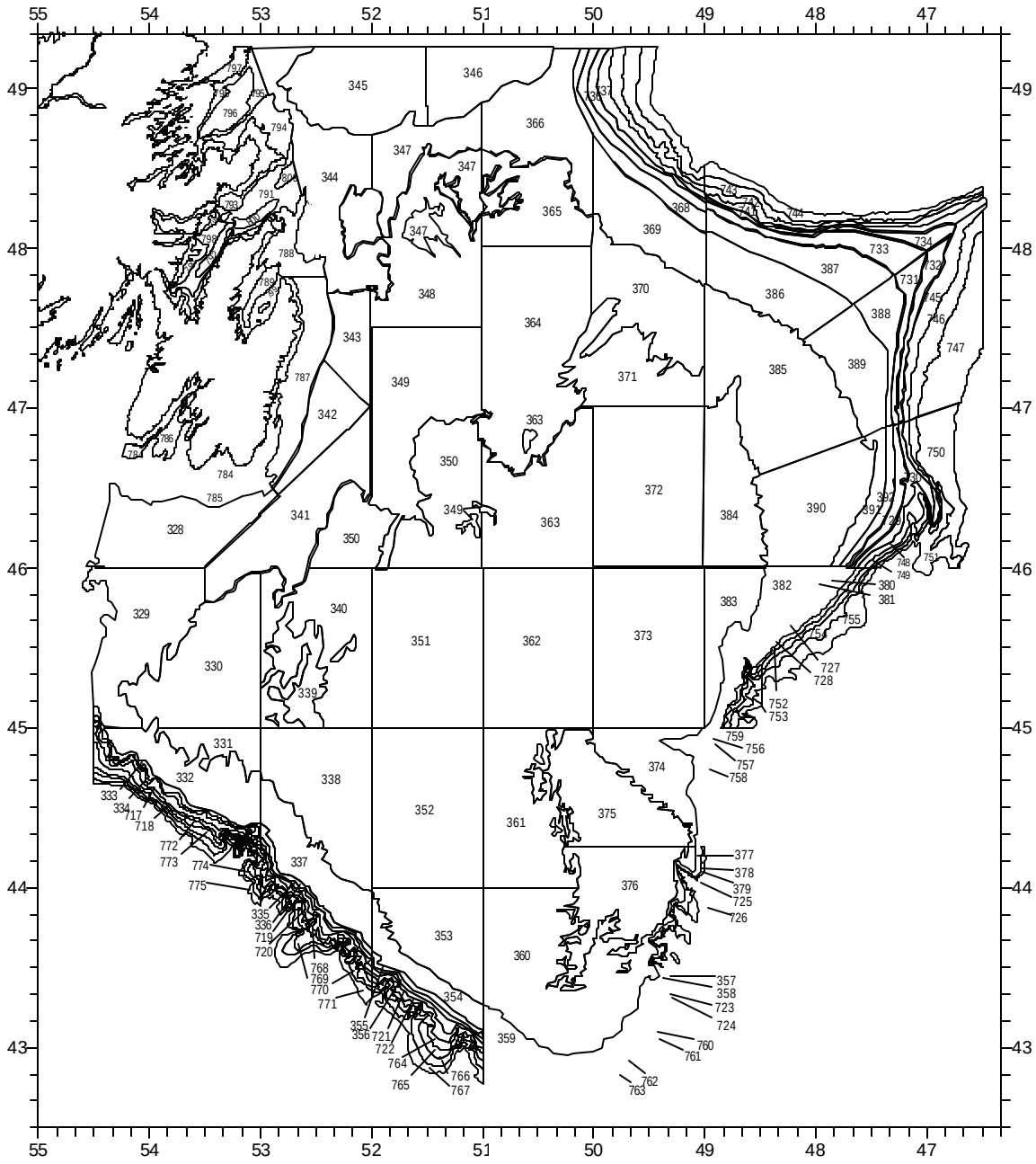


Figure 2. Stratification used in Canadian research vessel surveys of Div. 3LNO.

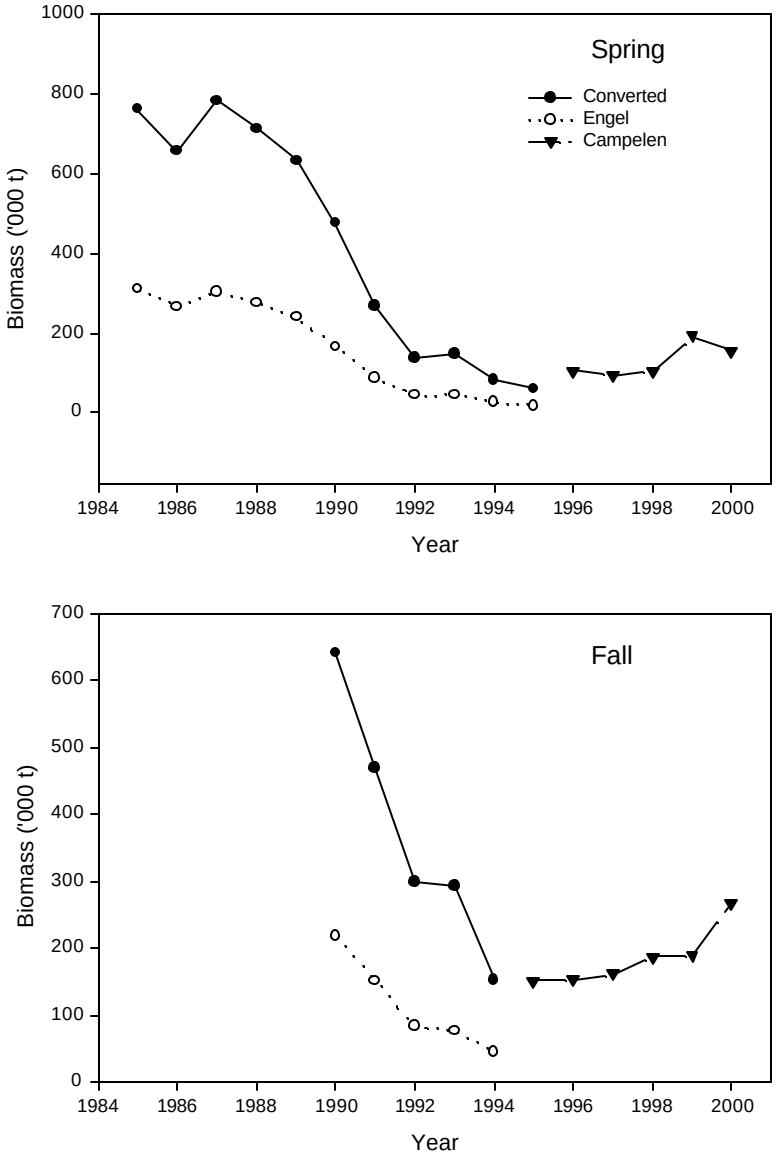


Figure 3. Biomass ('000 tons) of American plaice from spring and fall Canadian surveys in Div. 3LNO combined.

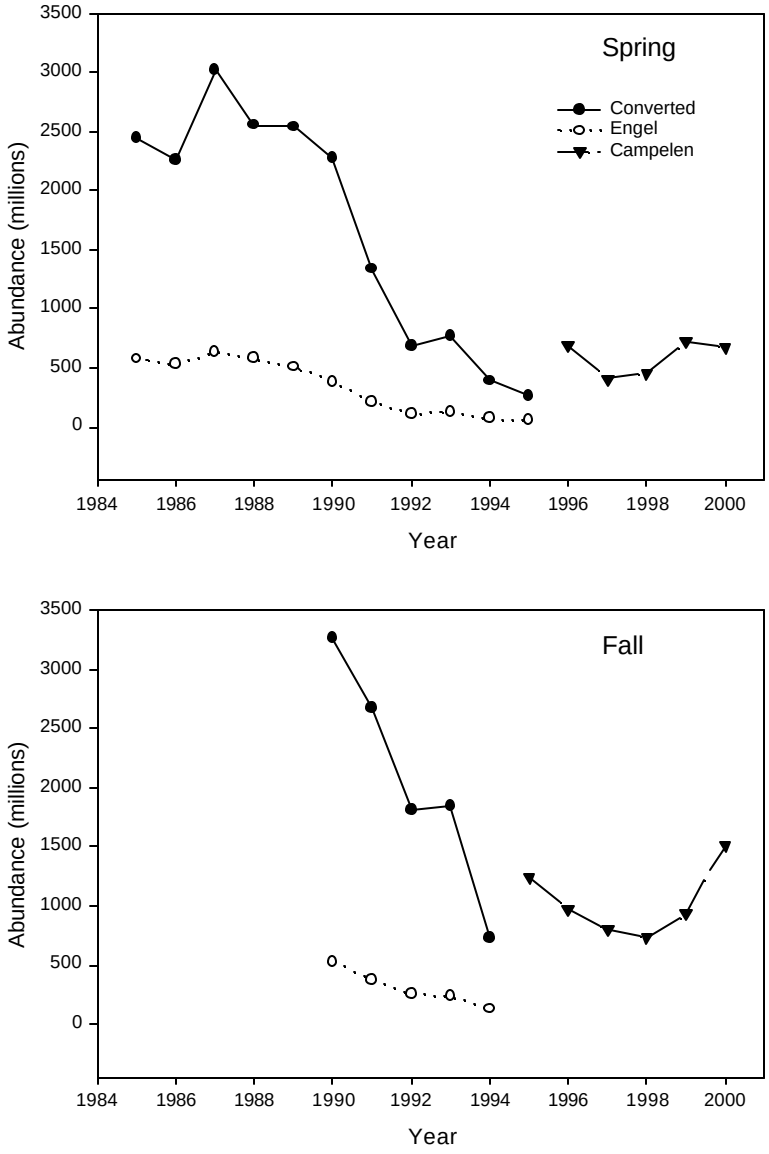


Figure 4. Abundance (millions) of American plaice from spring and fall Canadian surveys in Div. 3LNO combined.

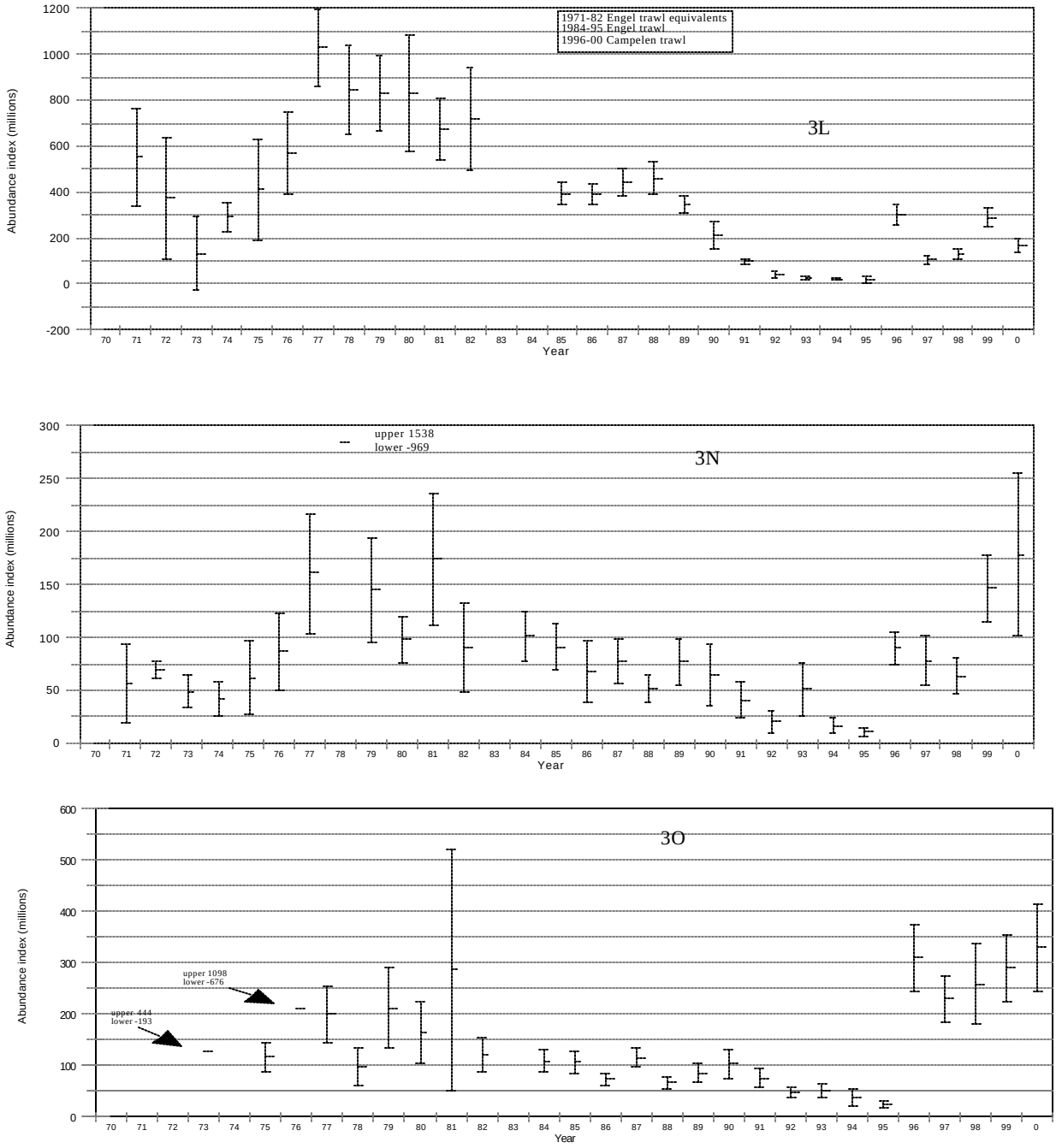


Fig 5. Abundance index and approximate 95% confidence interval for A.plaice in Canadian spring surveys in Div. 3LNO.

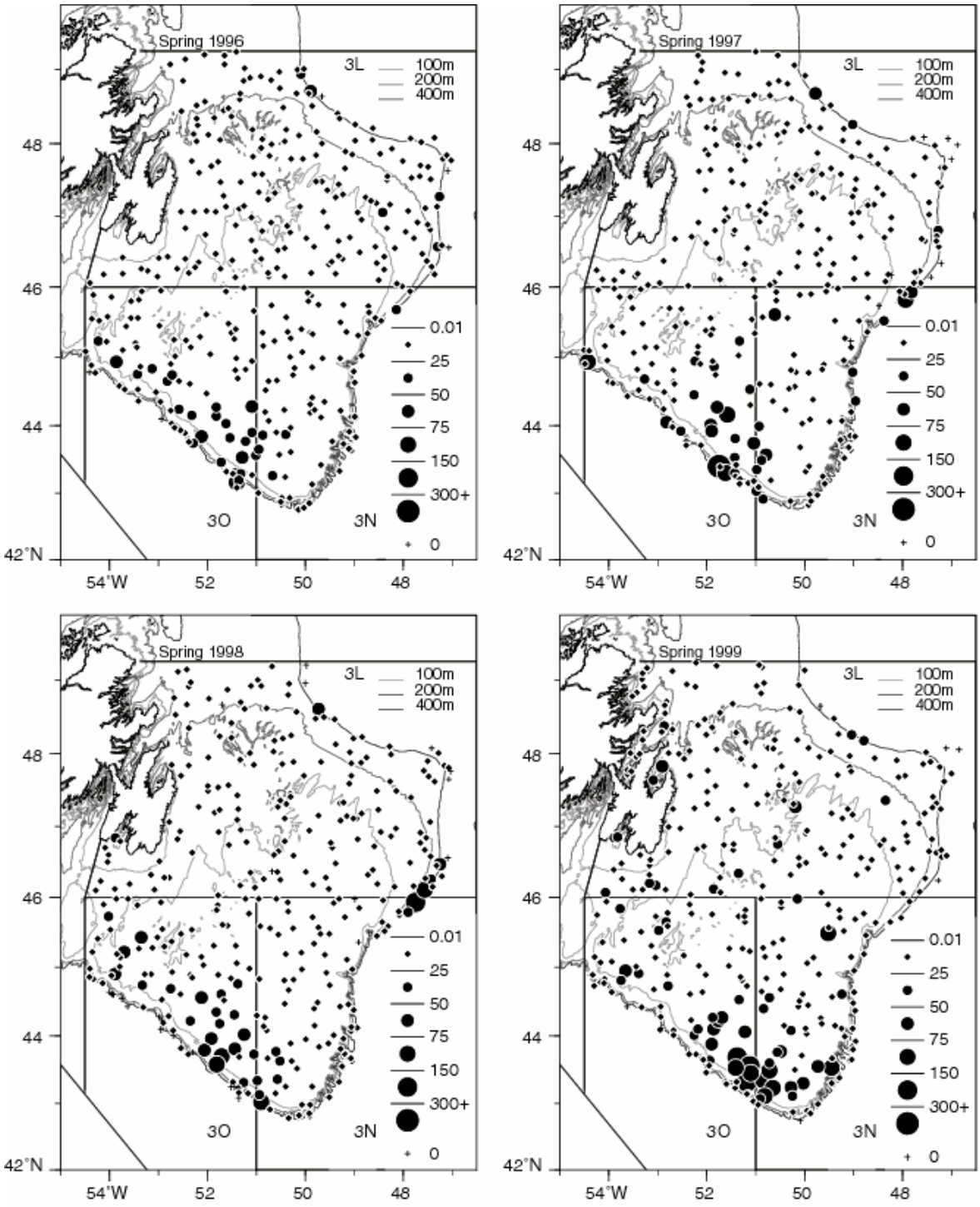


Figure 6. Distribution of American plaice (Kg) from Canadian spring surveys in NAFO Divisions 3LNO from 1996-2000.

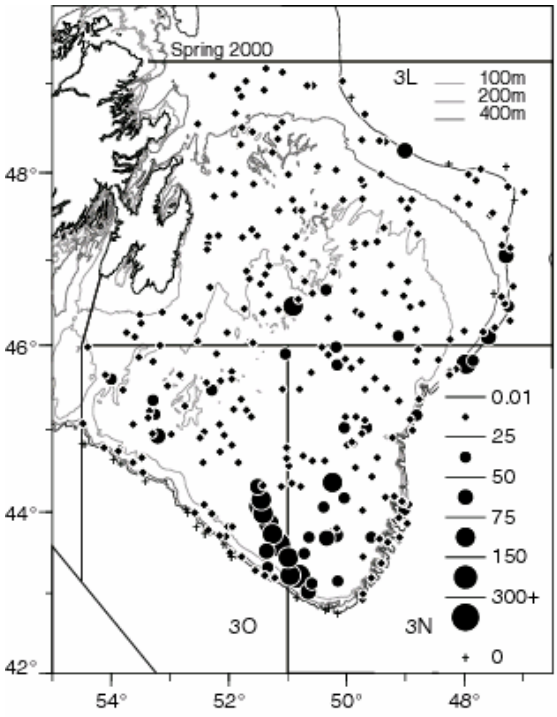


Fig. 6 Cont'd. Distribution of American plaice (Kg) from Canadian spring surveys in NAFO Divisions 3LNO from 1996-2000.

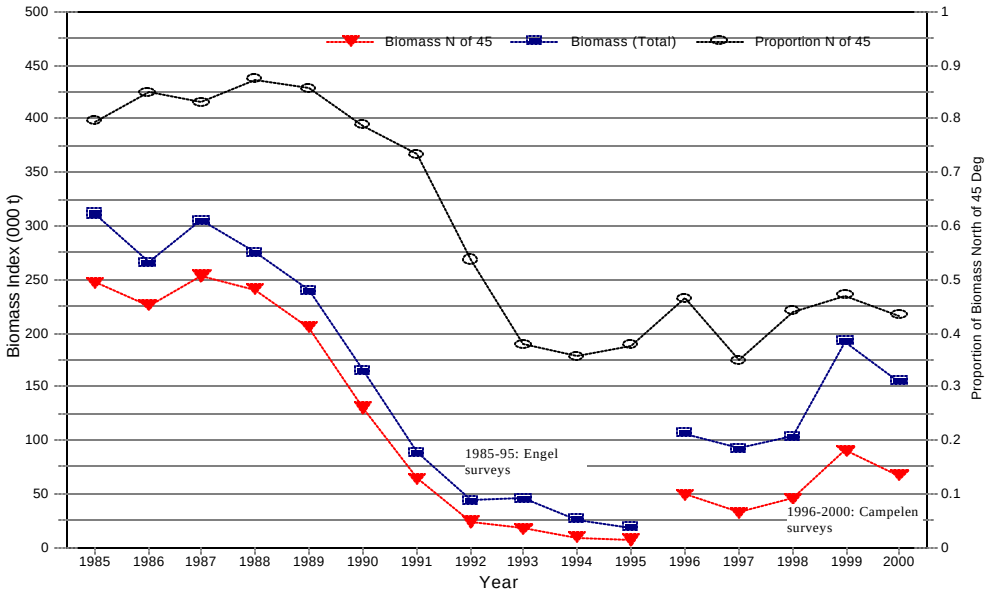


Figure 7. Proportion of American plaice biomass located north of 45° N in Div. 3LNO. All data are from spring surveys.

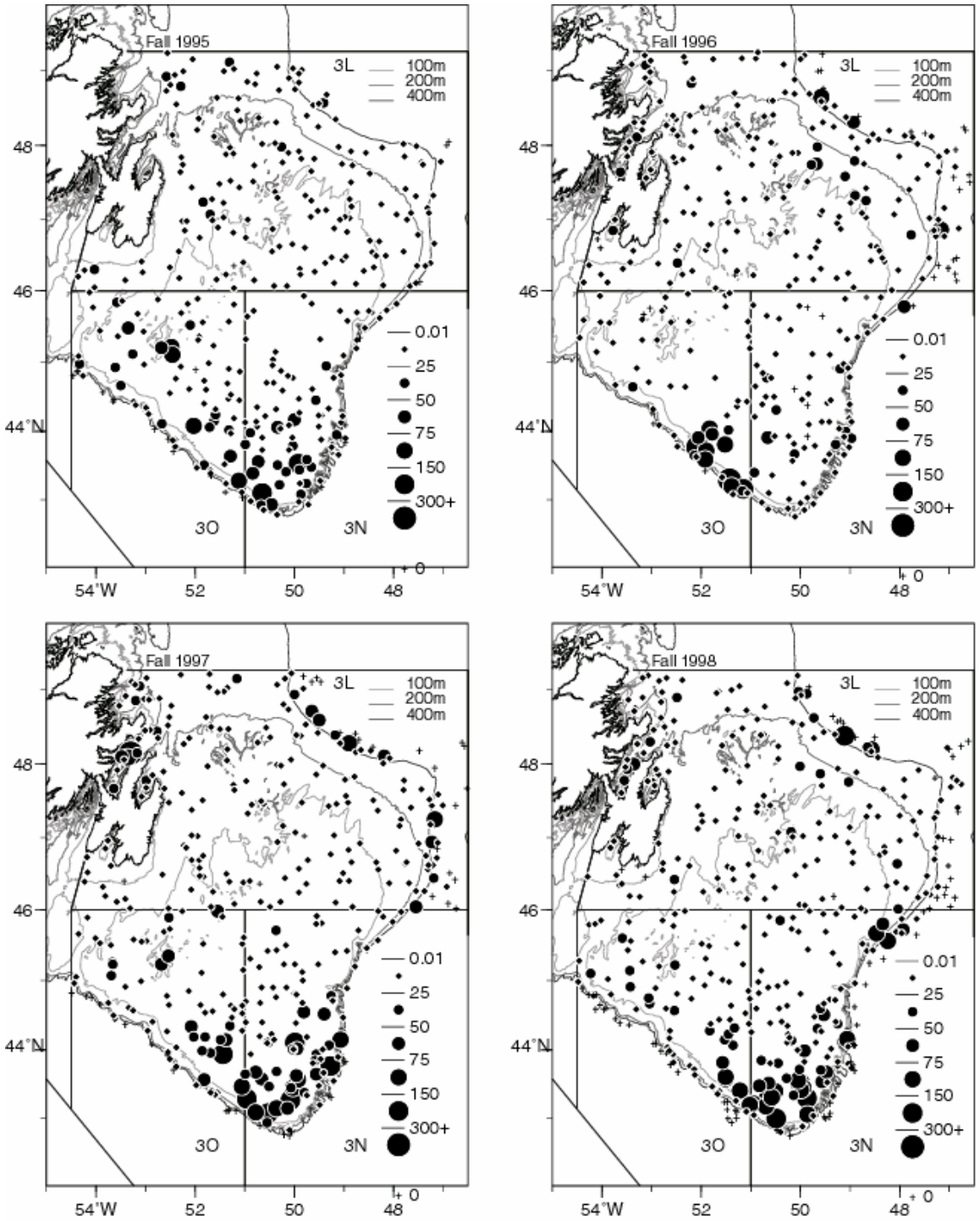


Figure 8. Distribution of American plaice (Kg) from Canadian fall surveys in NAFO Divisions 3LNO from 1995-2000.

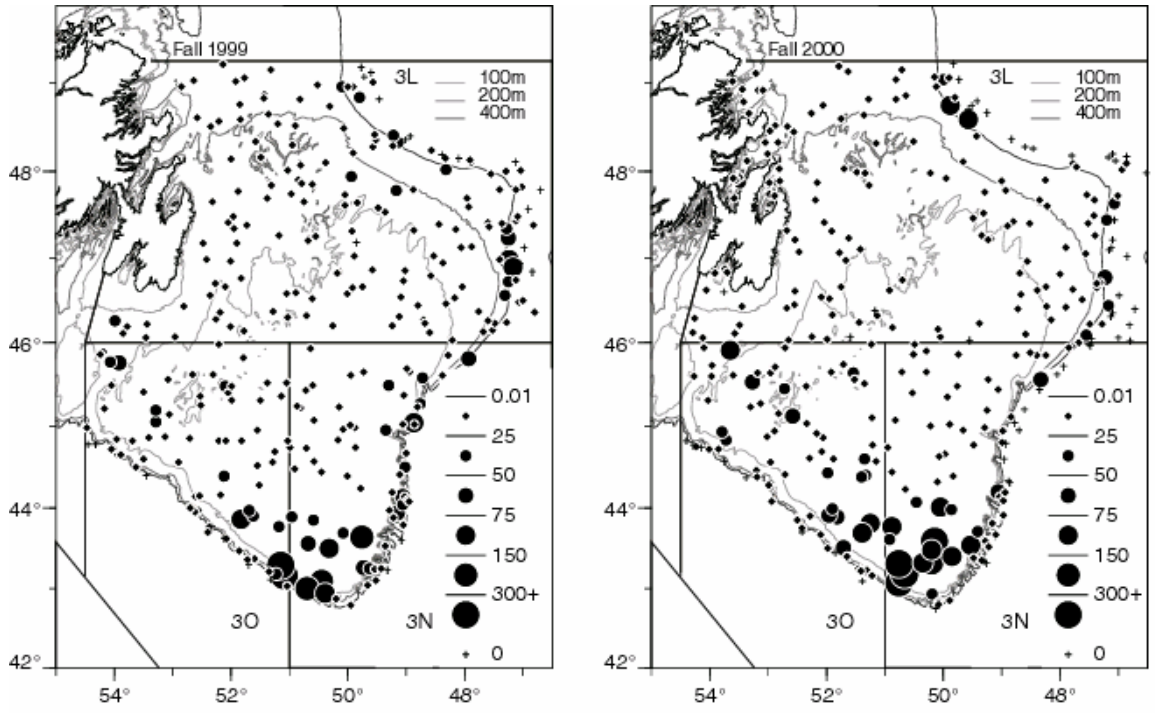


Fig. 8 Cont'd. Distribution of American plaice (Kg) from Canadian fall surveys in NAFO Divisions 3LNO from 1995-2000.

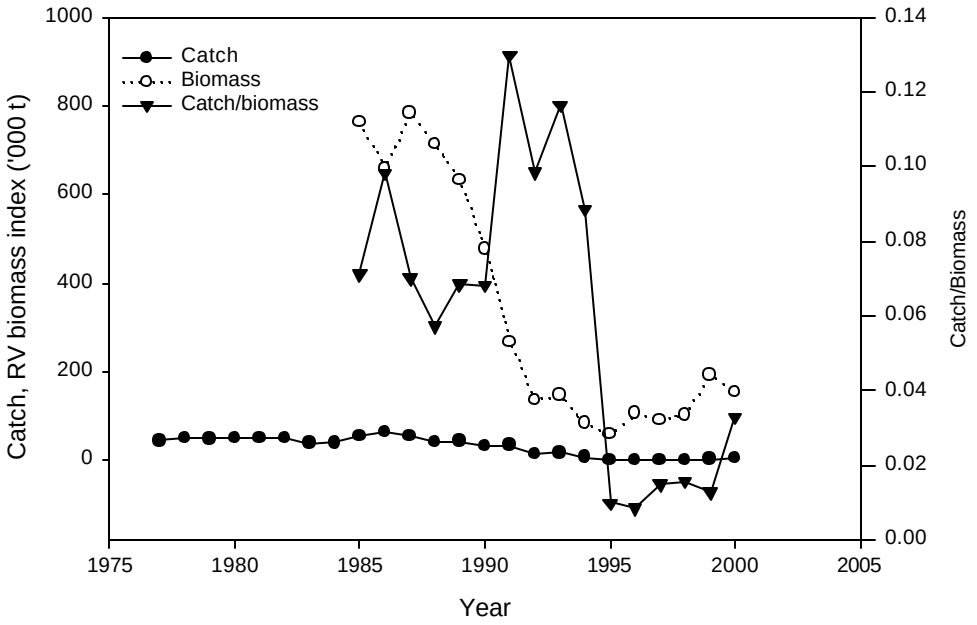


Figure 9. Total catch from 1977 to 2000 and RV biomass index from 1985 to 2000. Also shown is the catch/biomass ratio. Biomass is Campelen or equivalent.

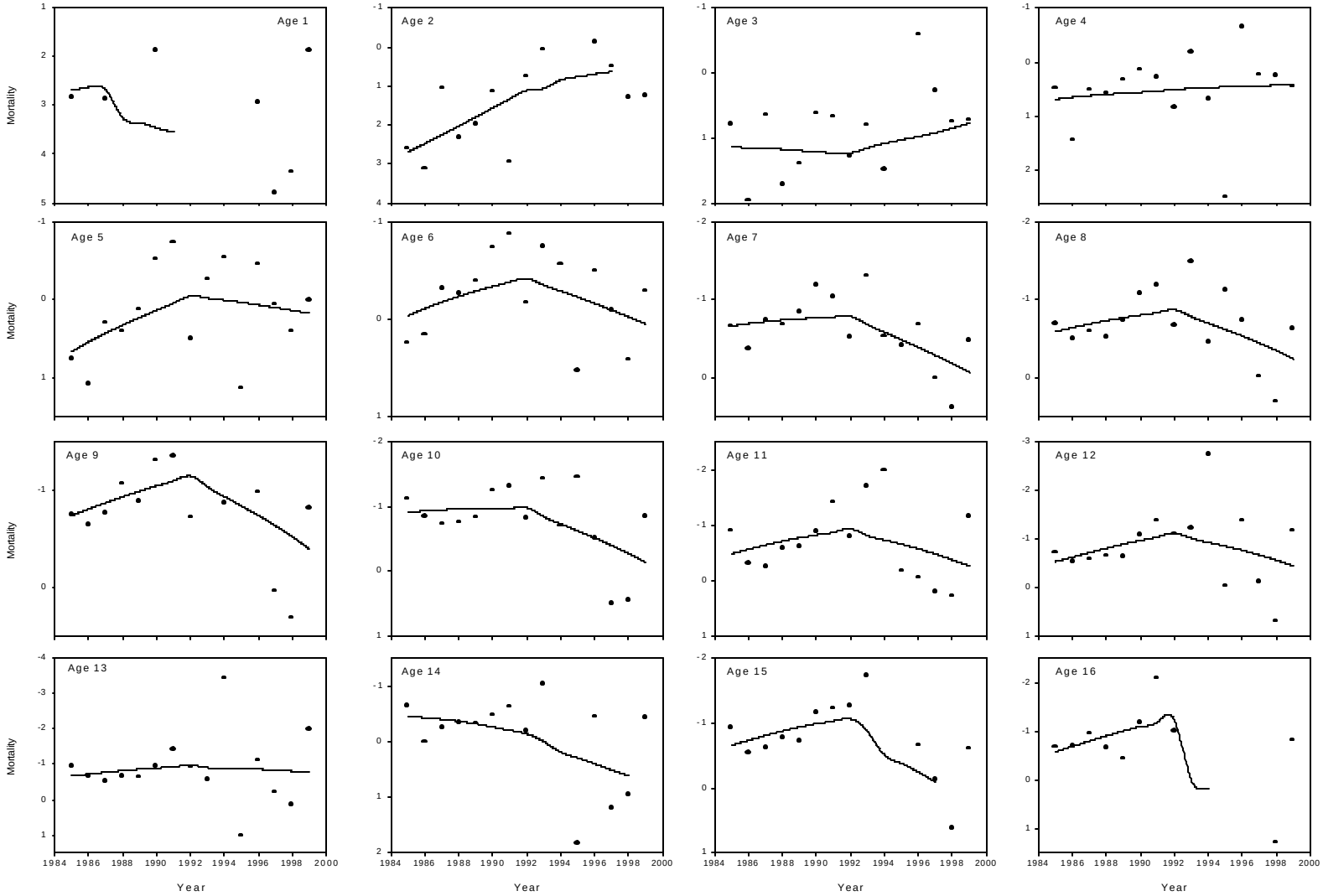


Figure 10. Estimates of mortality for ages 1 to 16 from Canadian spring surveys from 1985 to 2000.

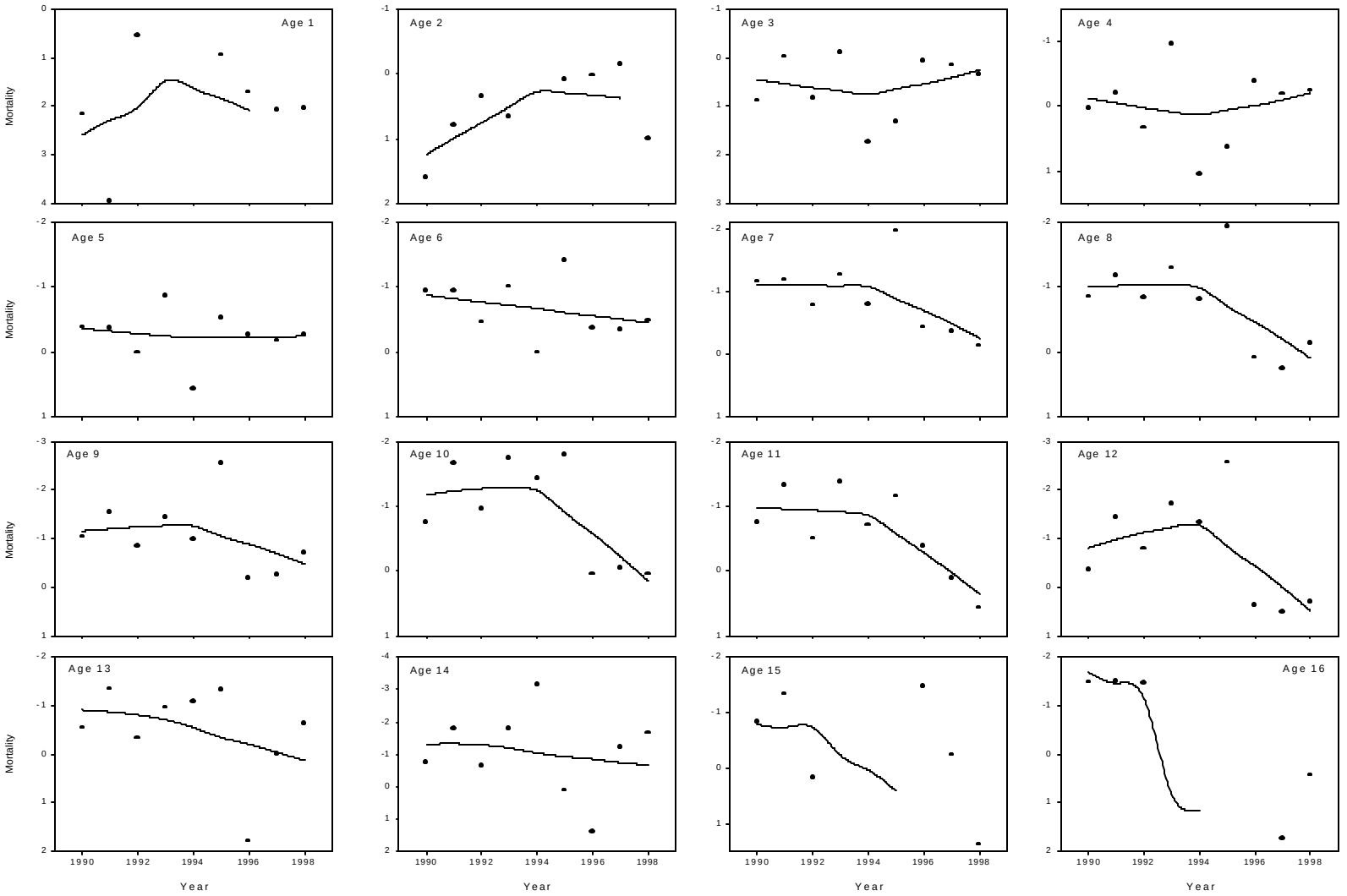


Figure 11. Estimates of mortality for ages 1 to 16 from Canadian fall surveys from 1990 to 1999.

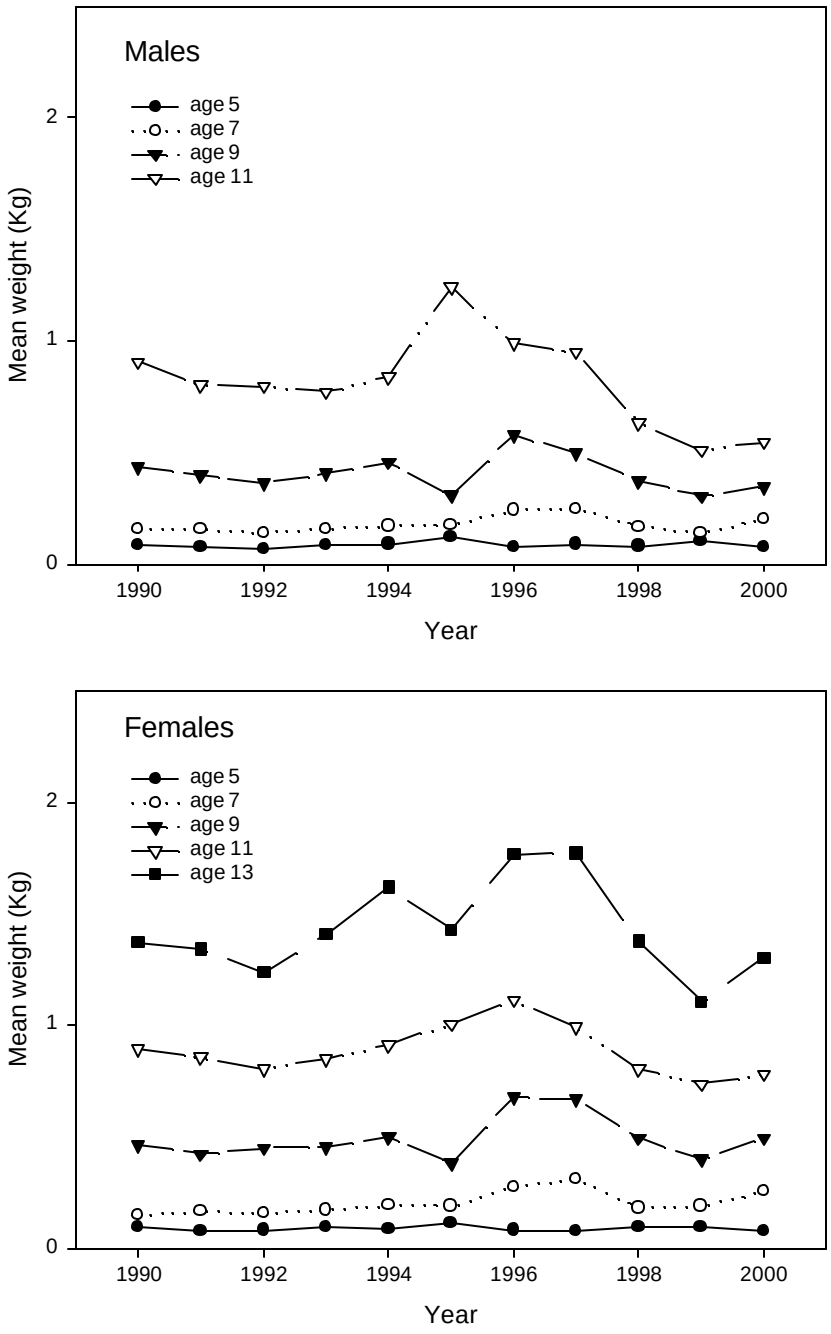


Figure 12. Mean weight at age for selected ages for male and female American plaice in Div. 3LNO.

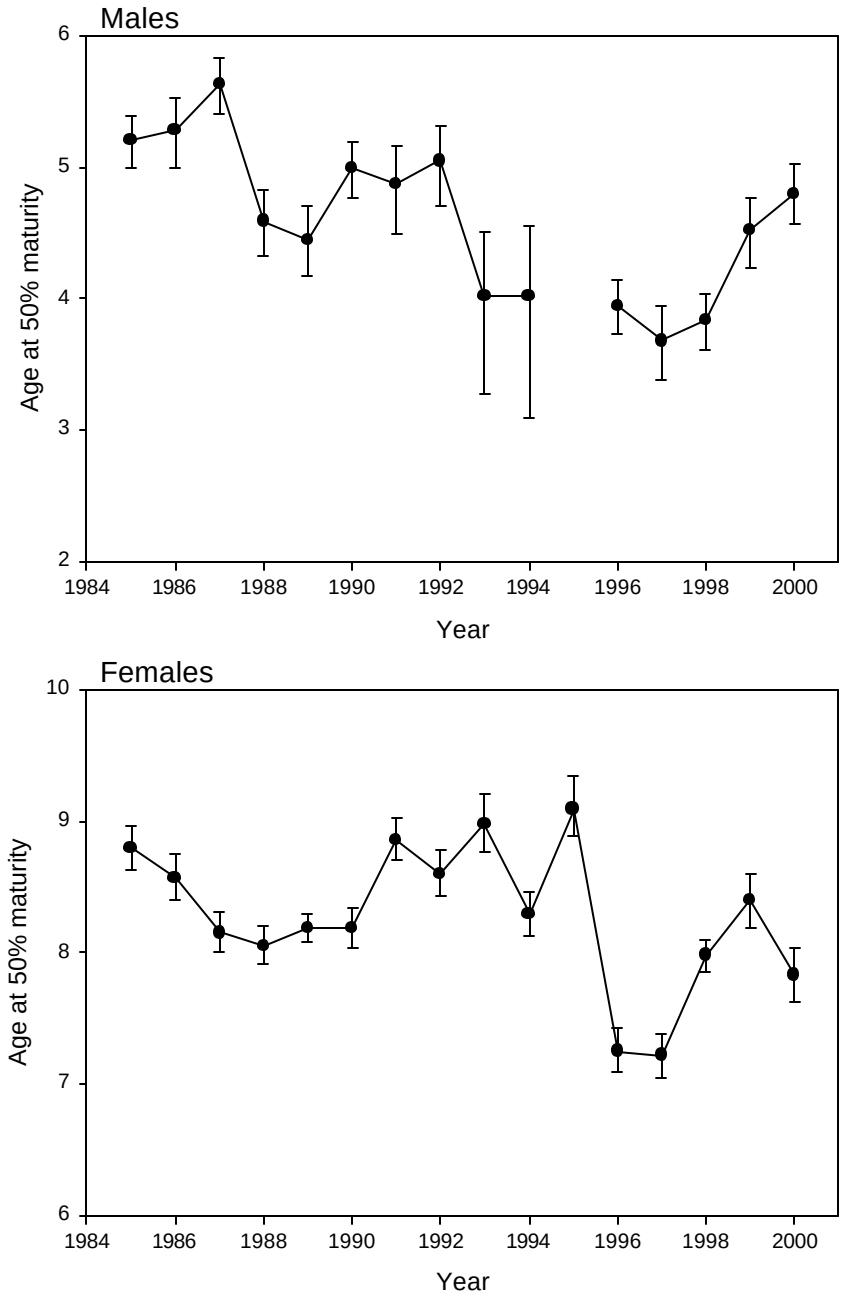


Figure 13. Age at 50% maturity (± 95% fiducial limits) by year for male and female American plaice in NAFO Divs. 3LNO.

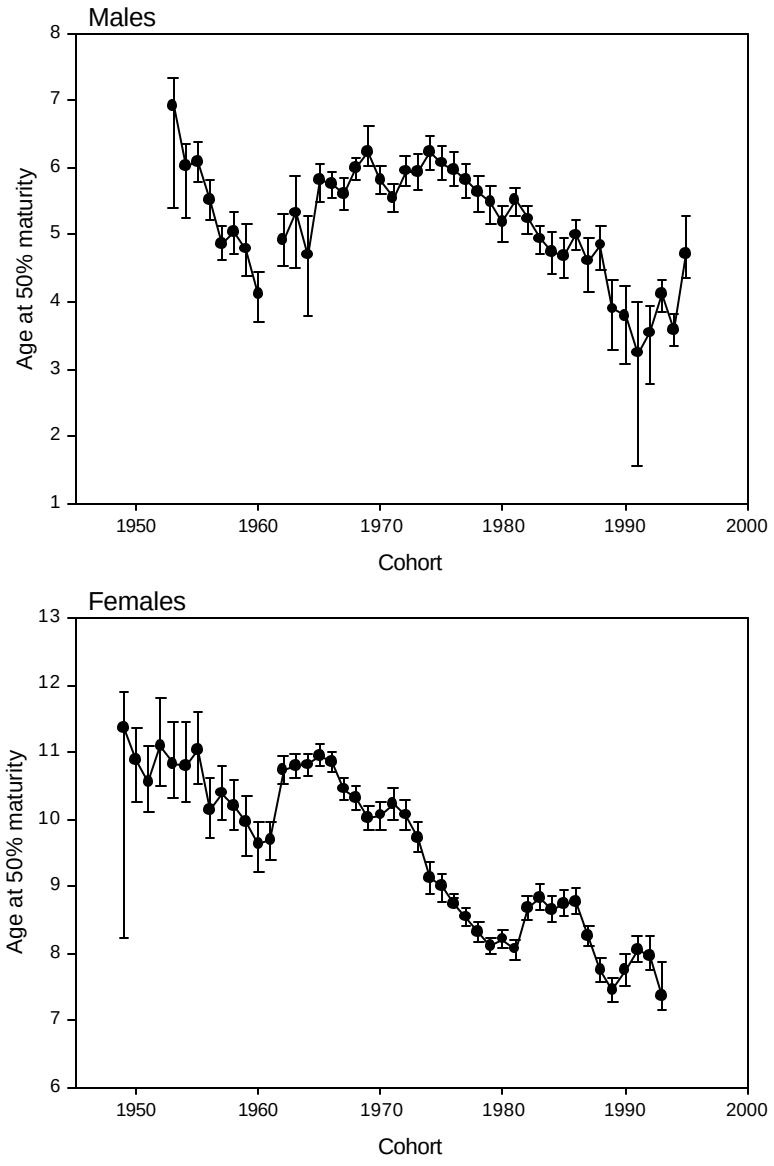
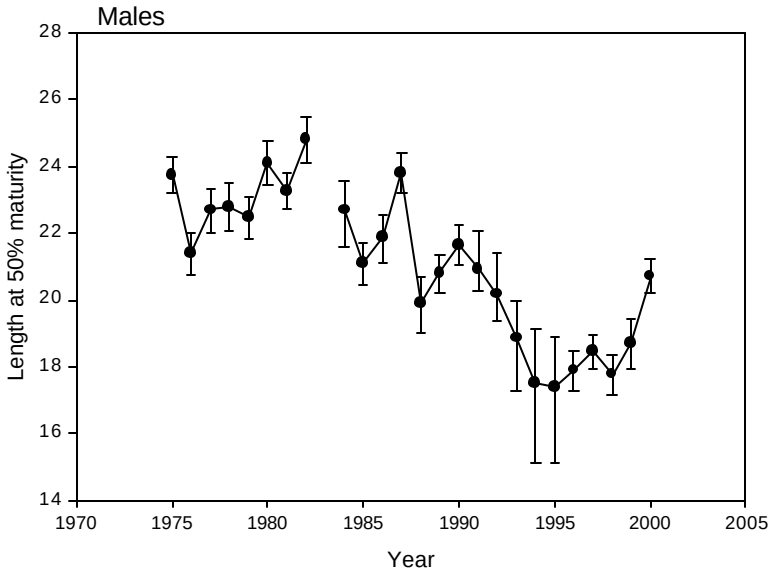


Figure 14. Age at 50% maturity (± 95% fiducial limits) by cohort for male and female American plaice in NAFO Divs. 3LNO.



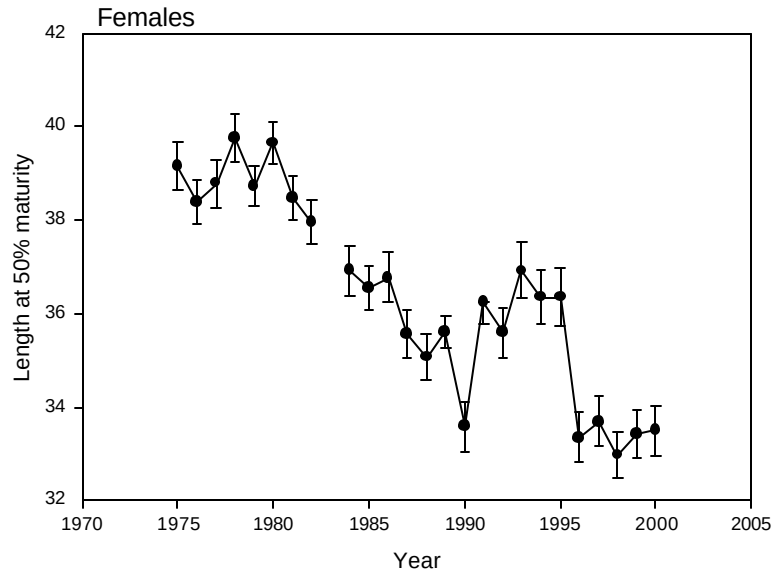


Figure 15. Length at 50% maturity (+ 95% fiducial limits) by year for male and female American plaice in NAFO Divs. 3LNO.

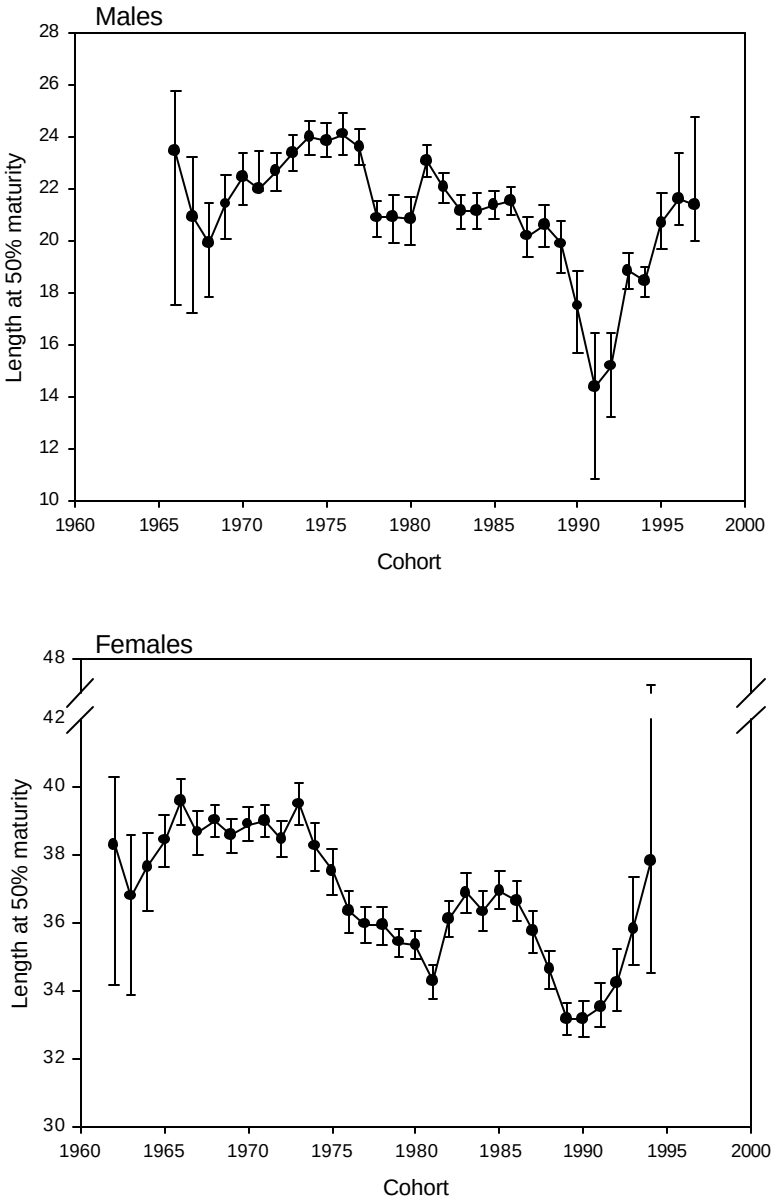


Figure 16. Length at 50% maturity (± 95% fiducial limits) by cohort for male and female American plaice in NAFO Divs. 3LNO.

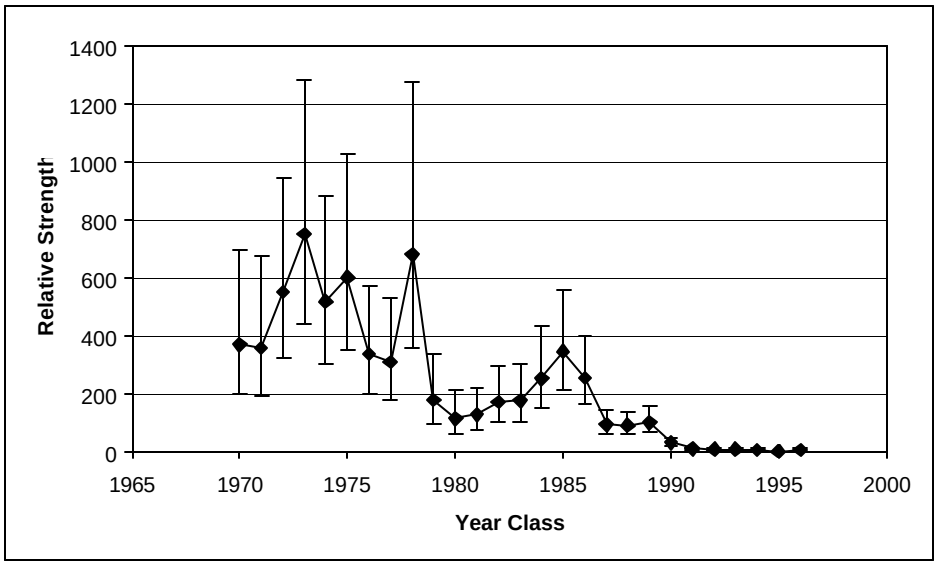


Figure 17. Estimates of relative year-class strength from log-additive model using data from Canadian spring and fall surveys.

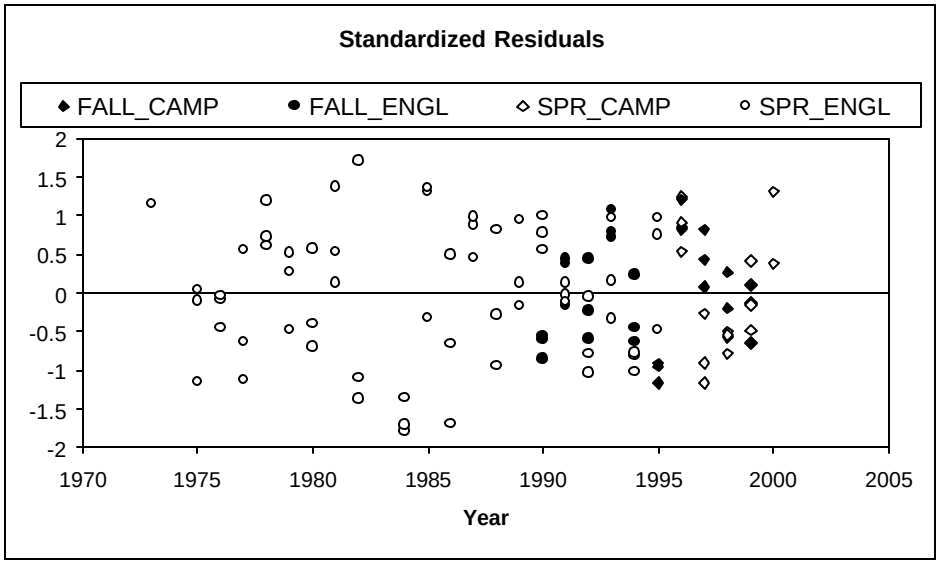


Figure 18. Standardized residuals from log-additive year-class strength model.

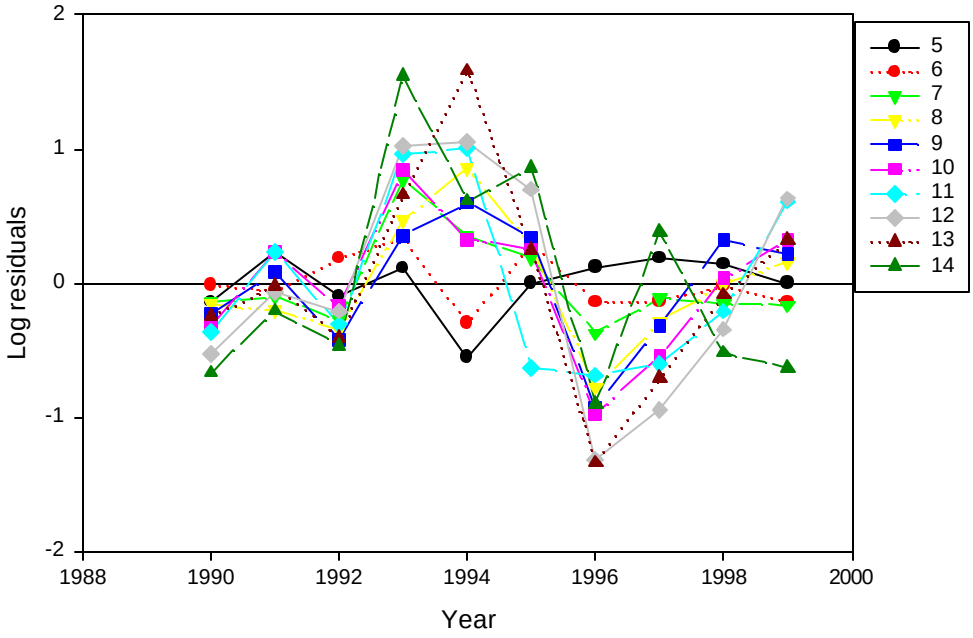


Figure 19. Log residuals from ADAPT for Canadian fall research vessel surveys. Run with fall index only.

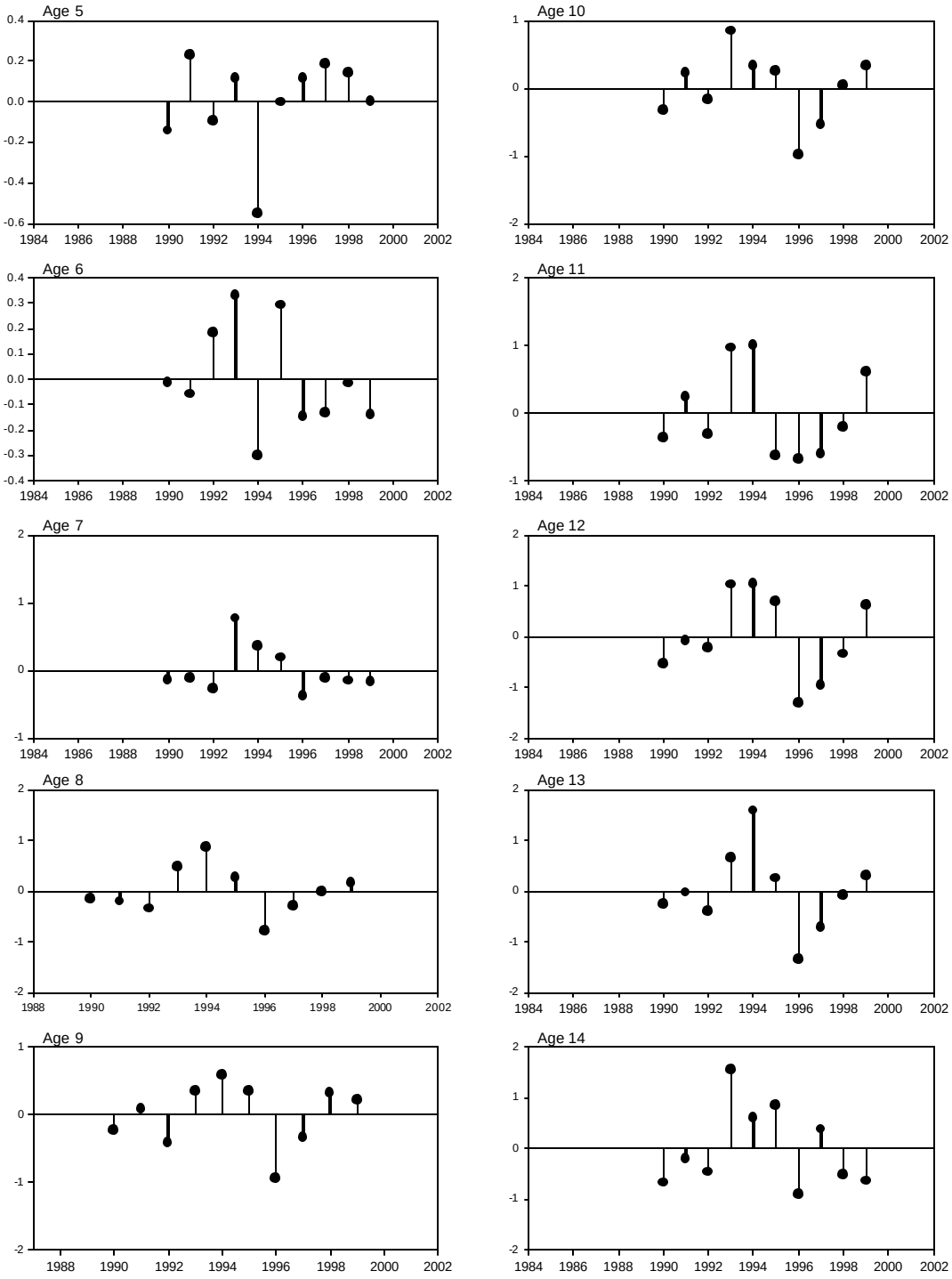


Figure 20. Age by age log residuals from Canadian fall surveys. Run with fall index only.

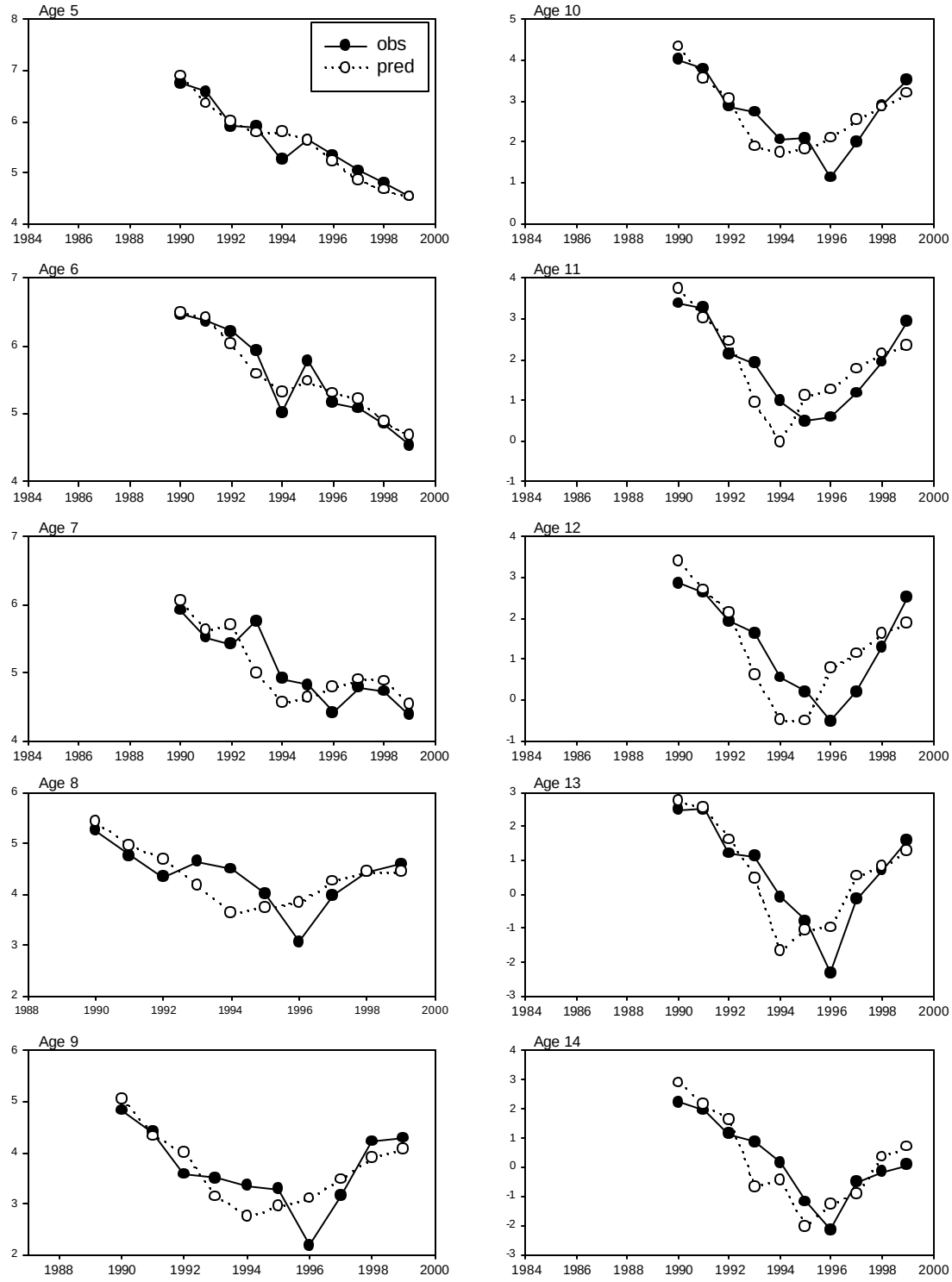


Figure 21. Age by age observed and predicted log abundance index over time from Canadian fall surveys. Run with fall index only.

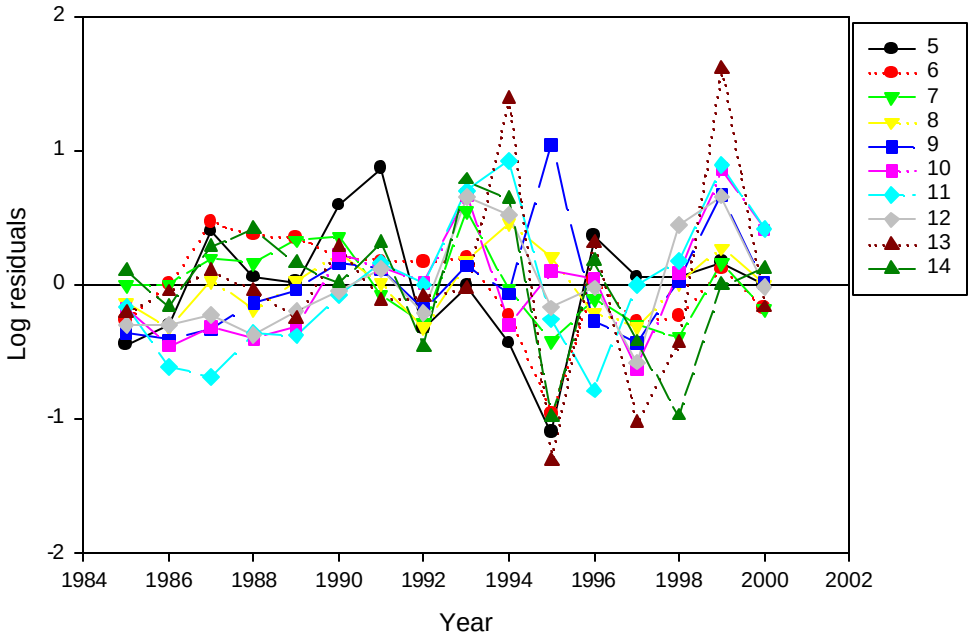


Figure 22. Log residuals from ADAPT for Canadian spring research vessel surveys. Run with spring index only.

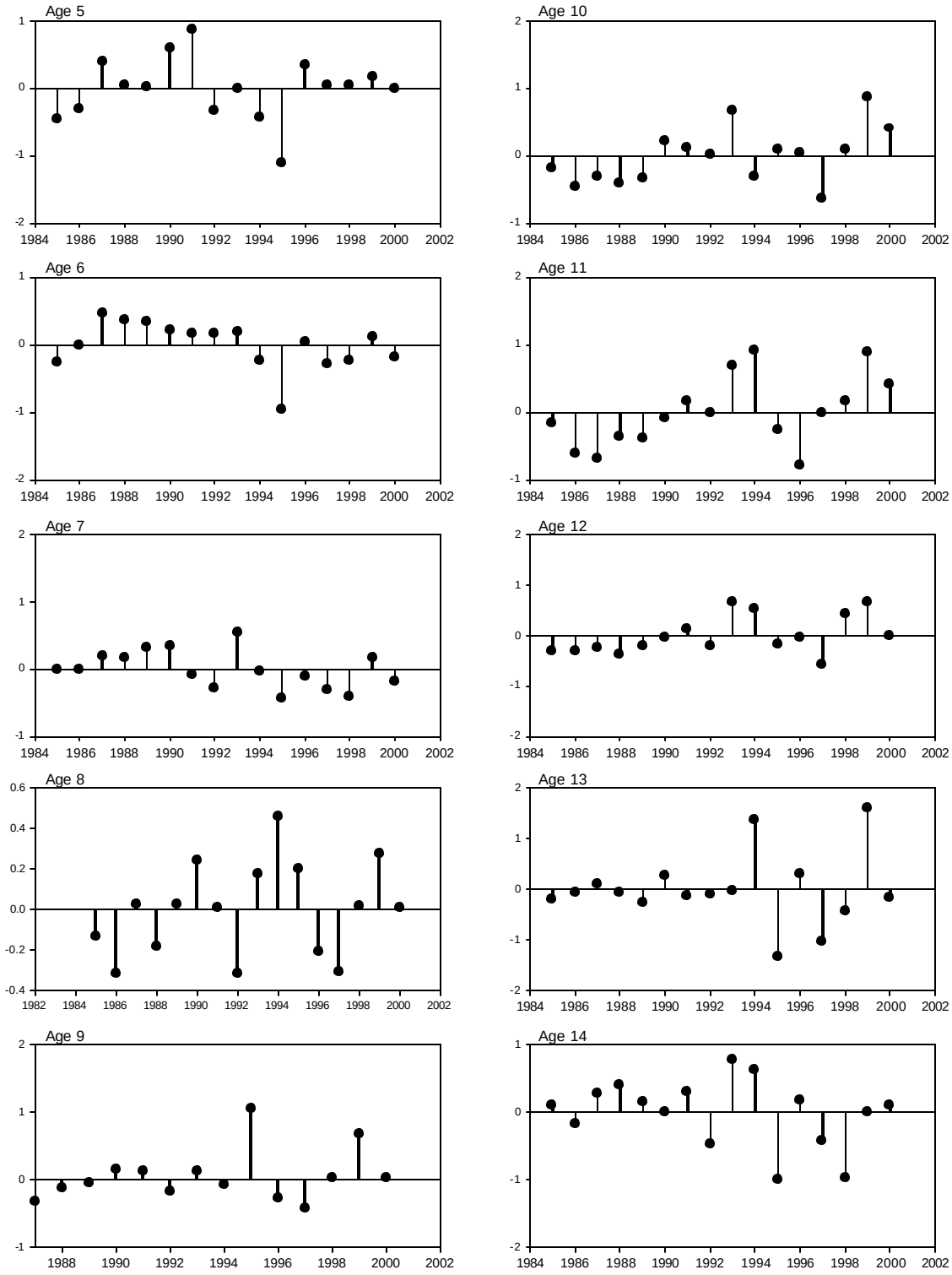


Figure 23. Age by age log residuals from Canadian spring surveys. Run with spring index only.

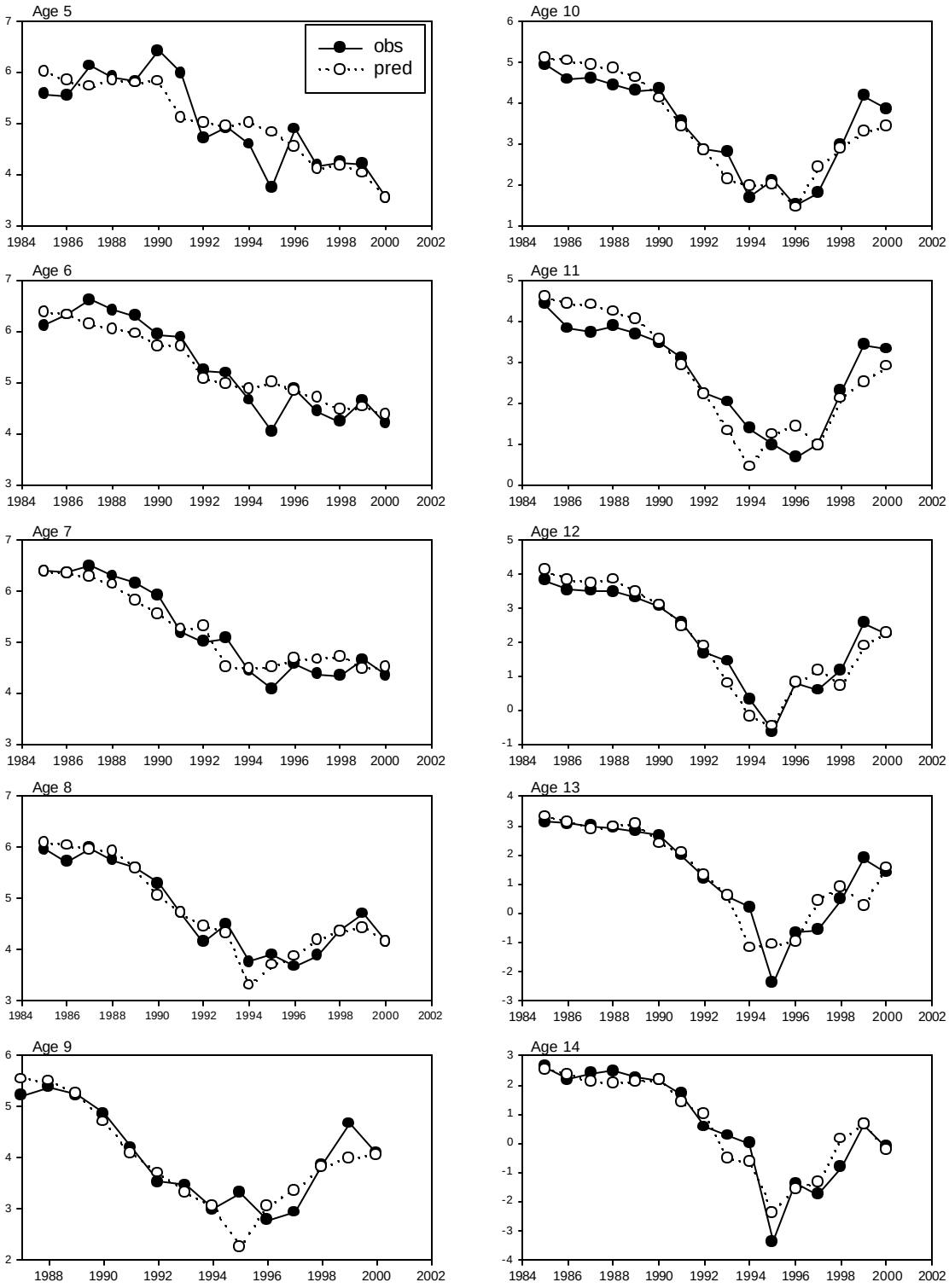


Figure 24. Age by age observed and predicted log abundance index over time from Canadian spring surveys. Run with spring index only.

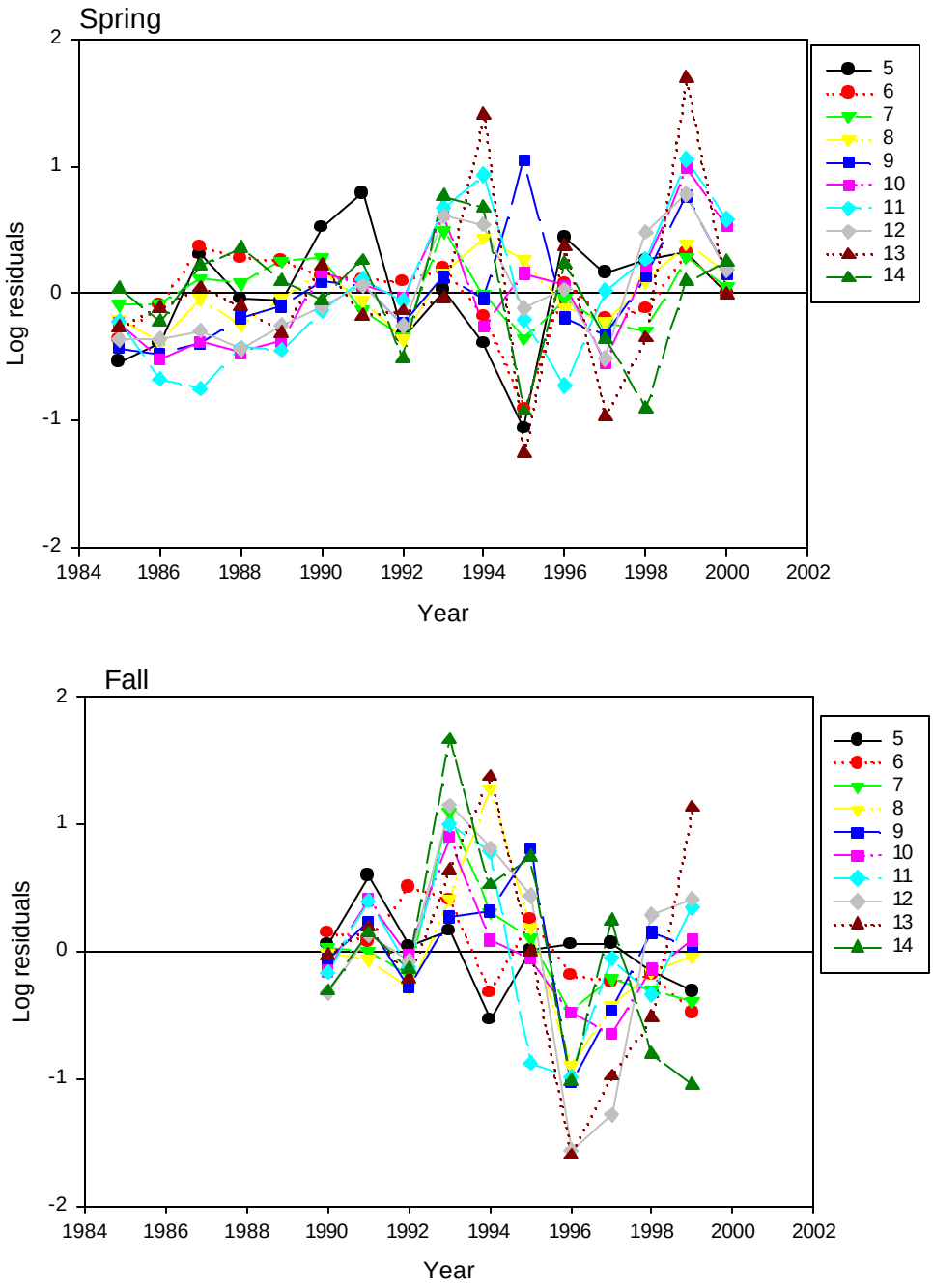


Figure 25. Log residuals from ADAPT for Canadian spring and fall research vessel surveys. Run with both spring and fall indices.

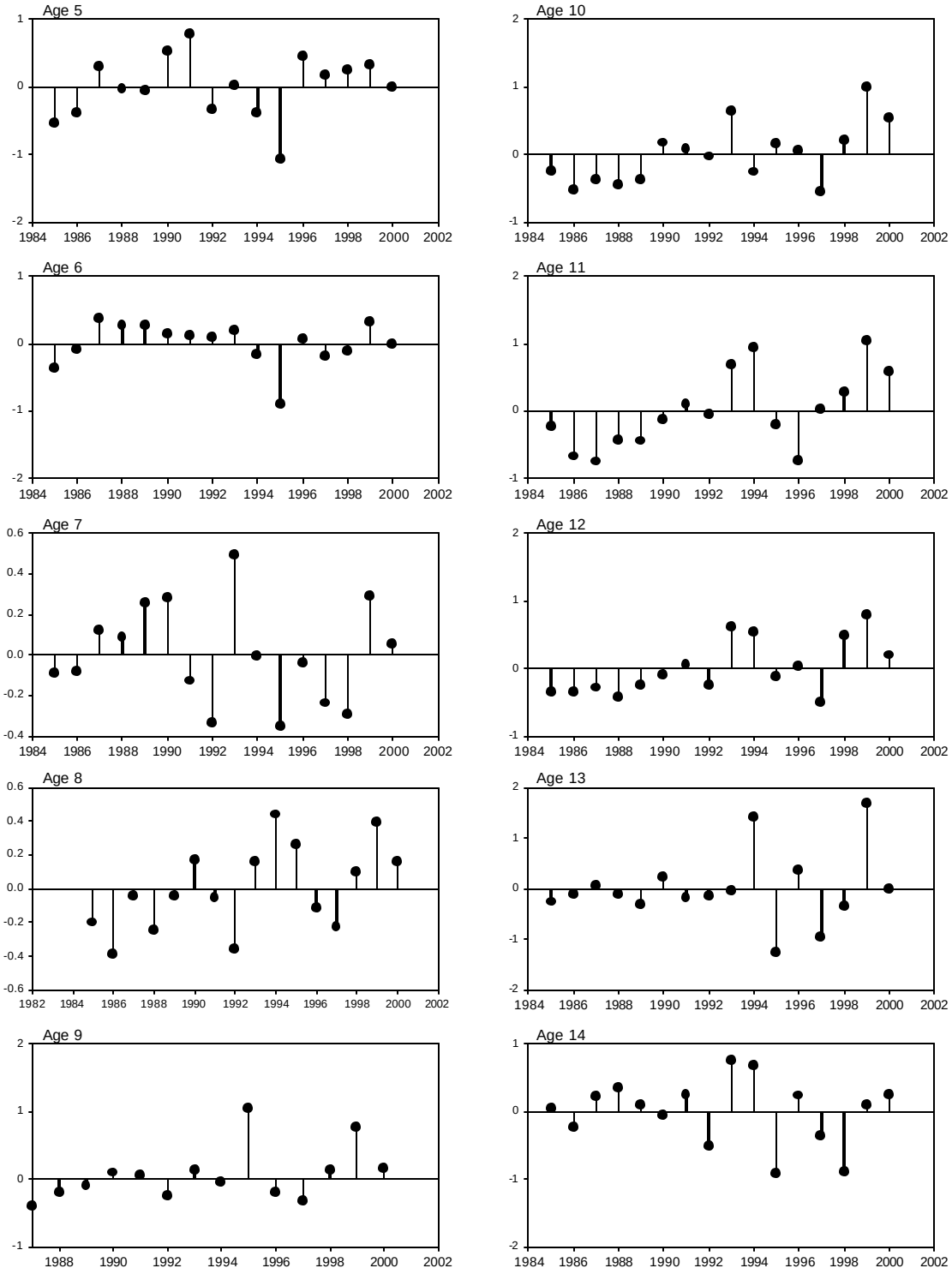


Figure 26. Age by age log residuals from Canadian spring surveys. Run with both spring and fall indices.

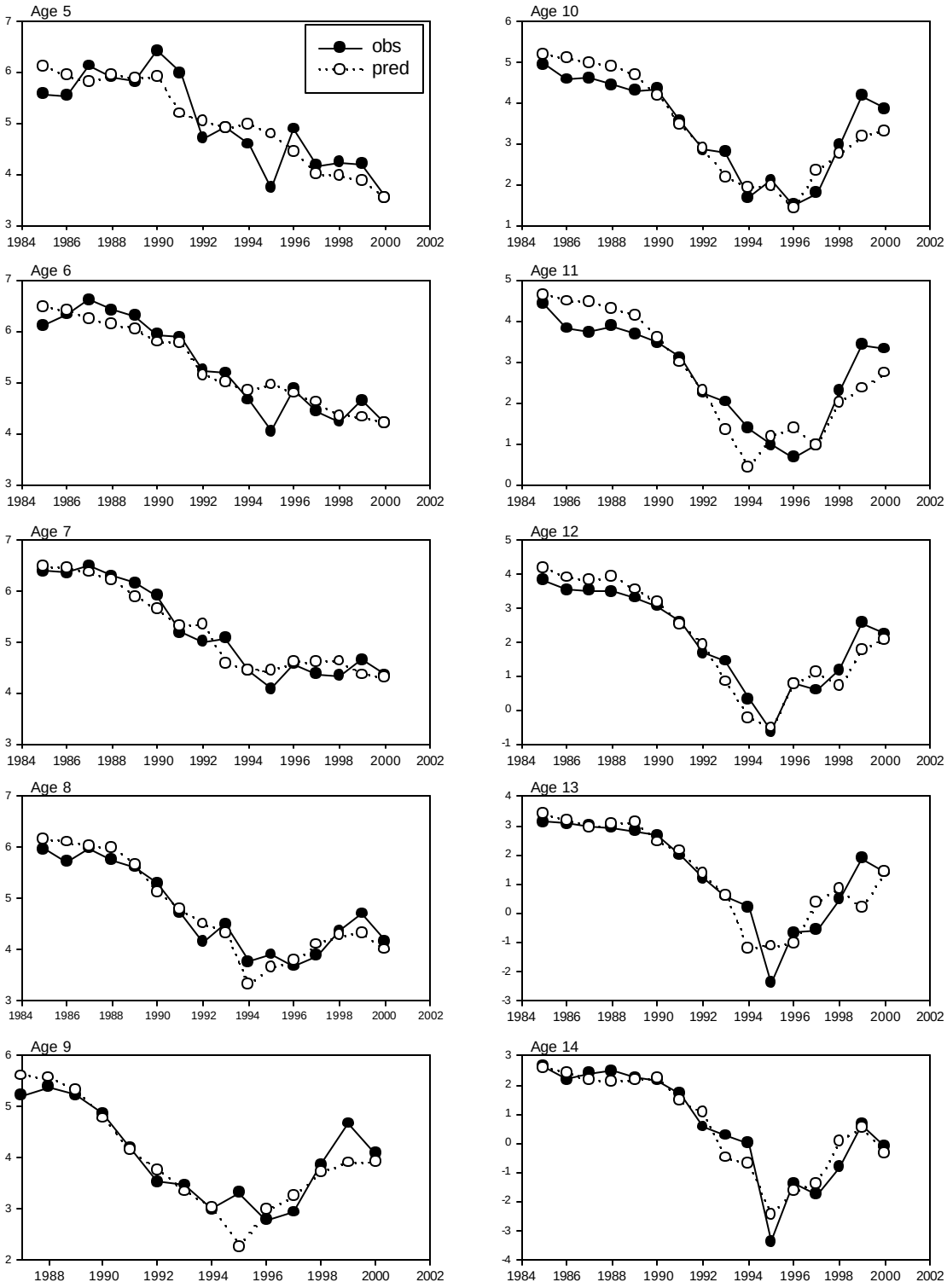


Figure 27. Age by age observed and predicted log abundance index over time from Canadian spring surveys. Run with both spring and fall indices.

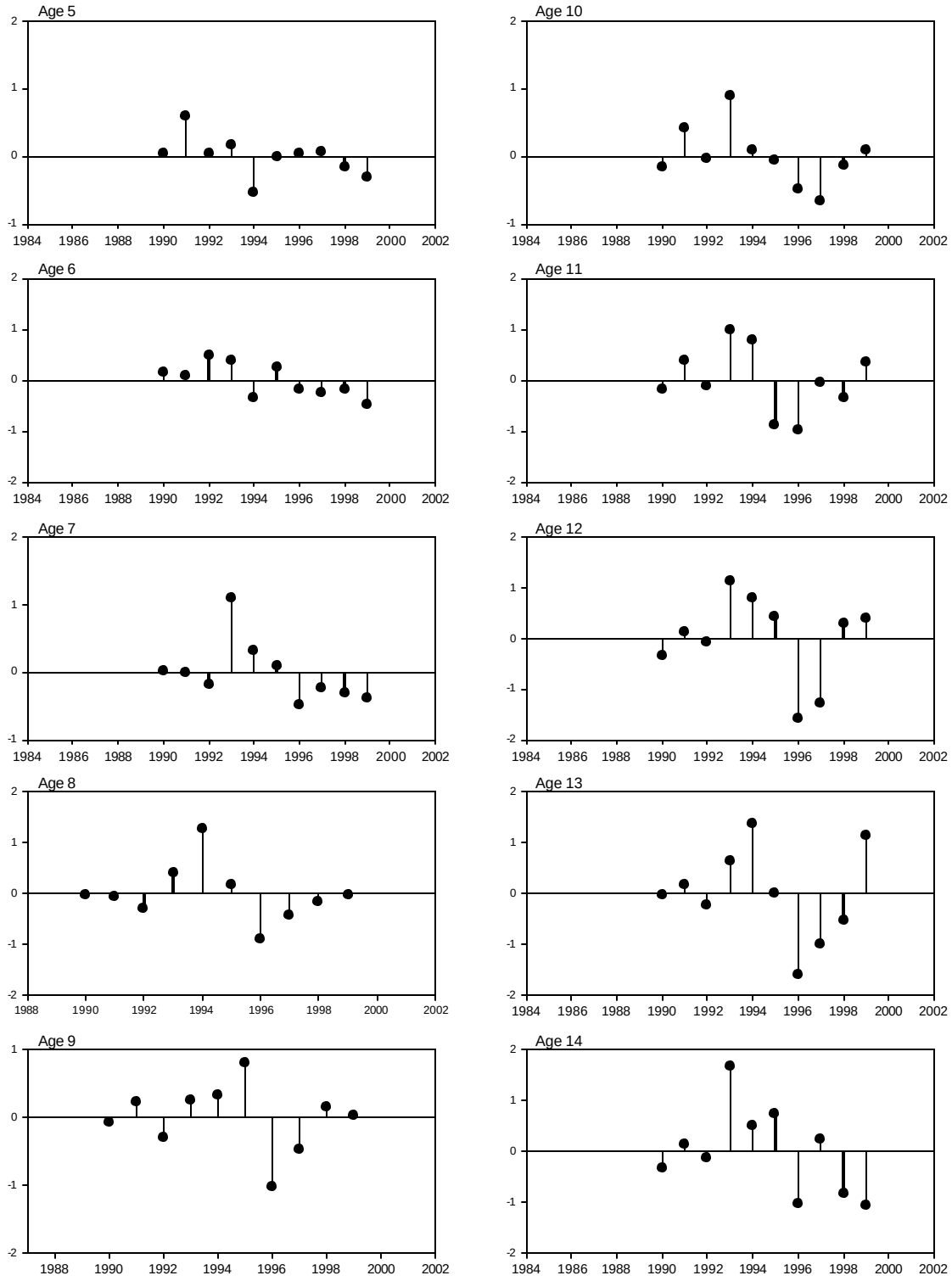


Figure 28. Age by age log residuals from Canadian fall surveys. Run with both spring and fall indices.

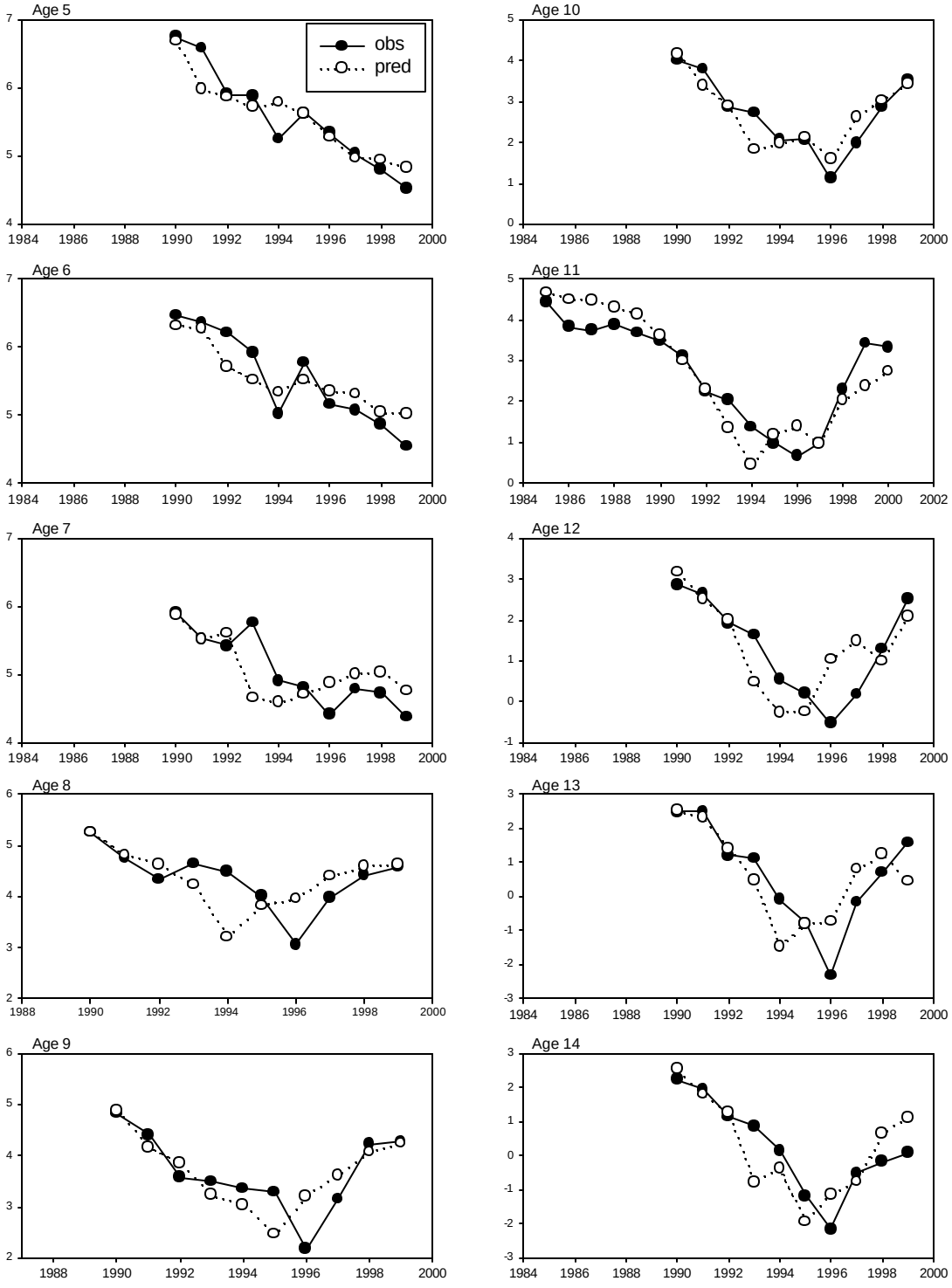


Figure 29. Age by age observed and predicted log abundance index over time from Canadian fall surveys. Run with both spring and fall indices.

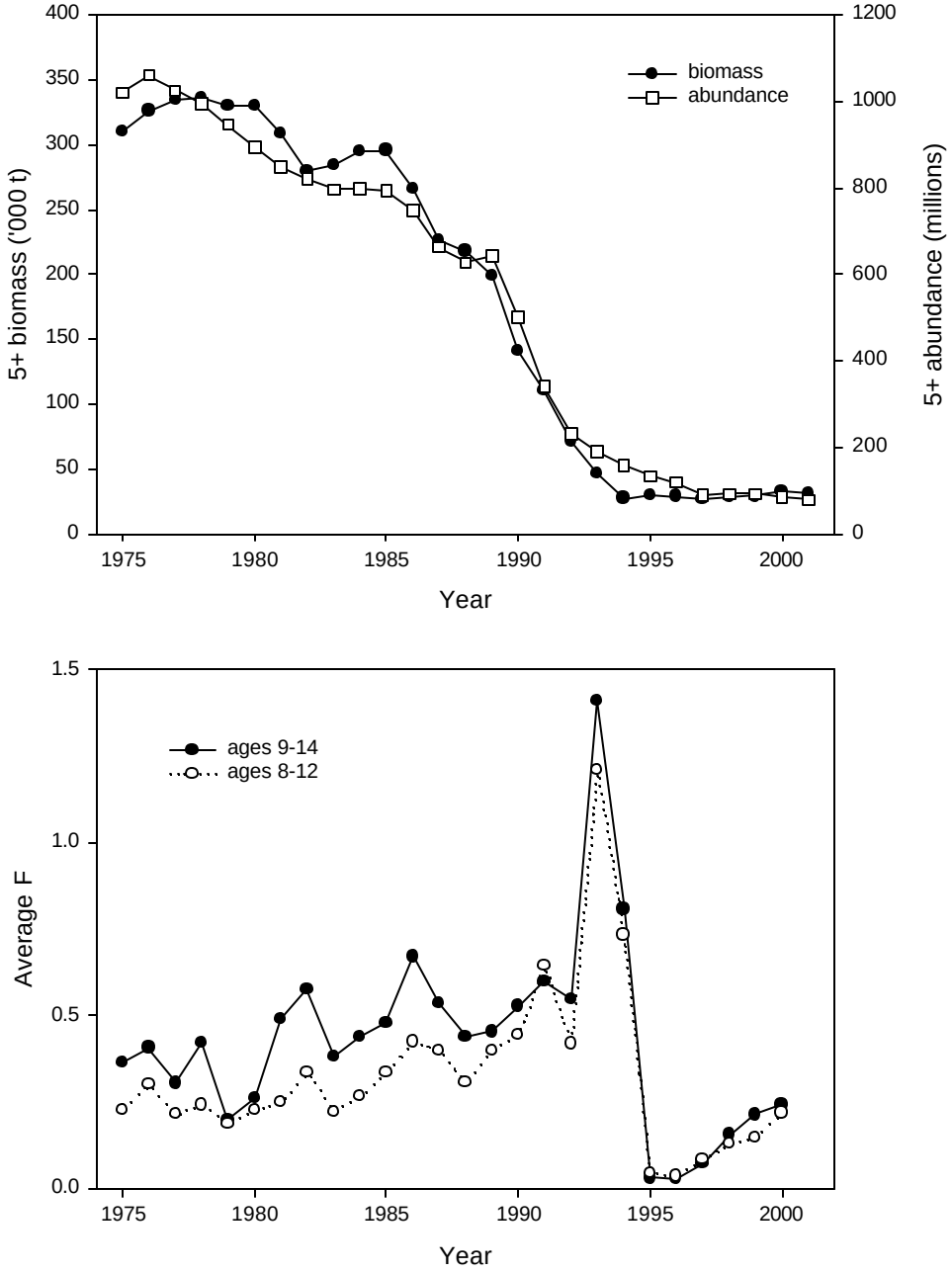


Figure 30. 5+ biomass and biomass (top) and average fishing mortality on ages 9 to 14 and ages 8 to 12 (bottom) from VPA.

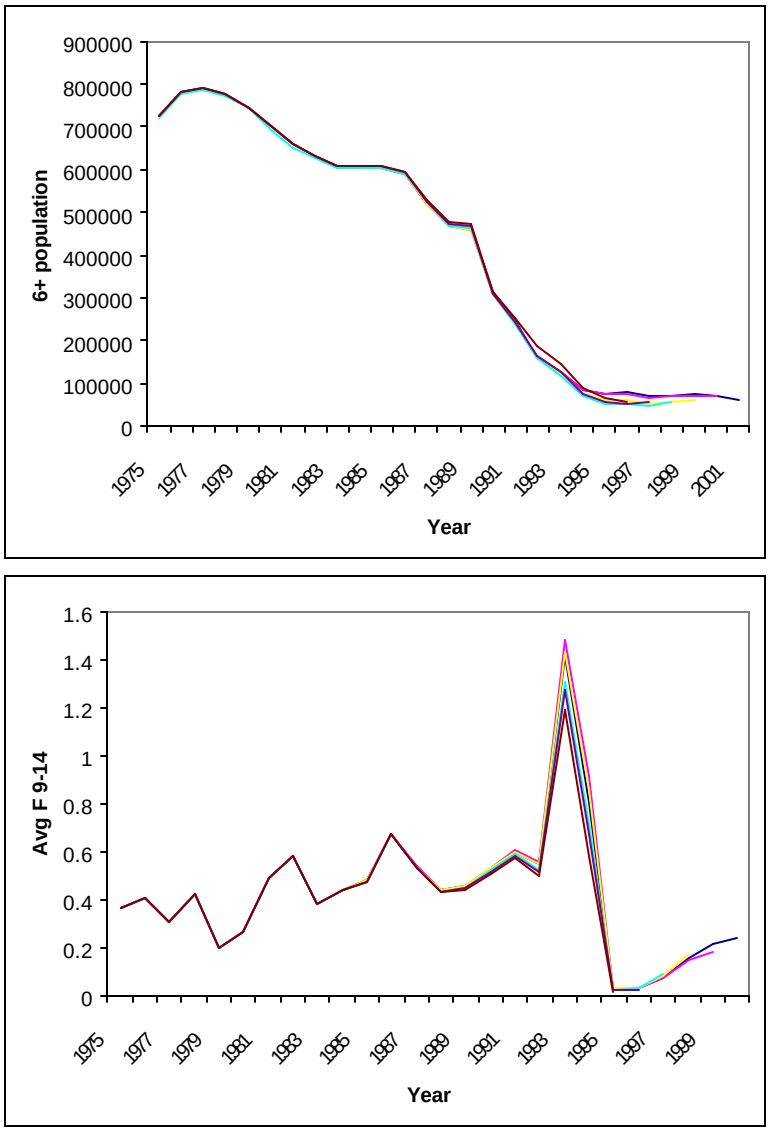


Figure 31 . Retrospective analyses for Div. 3LNO American plaice. Top panel shows 6+ abundance in millions and the bottom panel shows average F over ages 9 to 14.

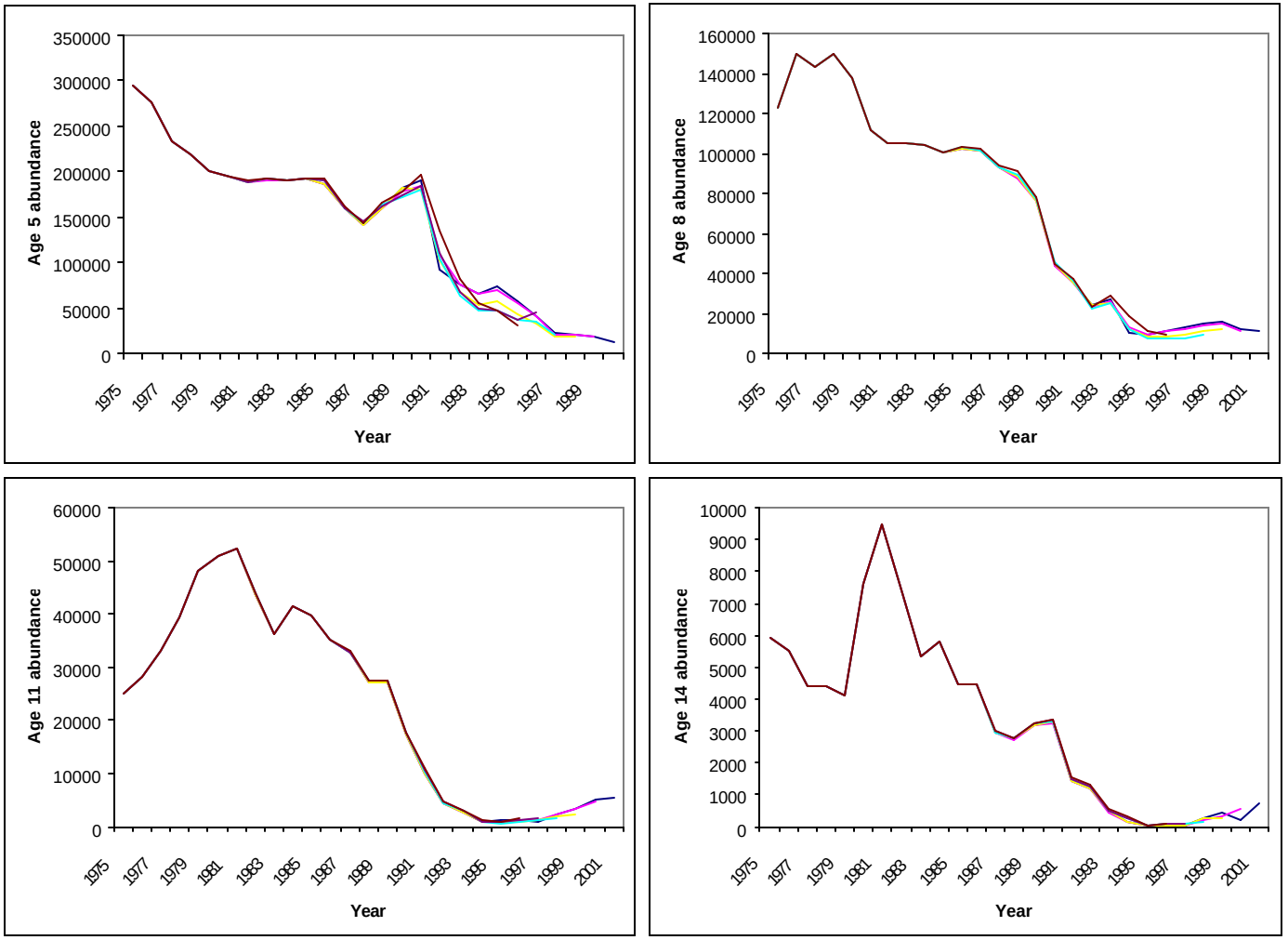


Figure 32. Retrospective analyes for Div. 3LNO American plaice for population abundance for selected ages. Ages 5, 8, 11 and 14 are shown.

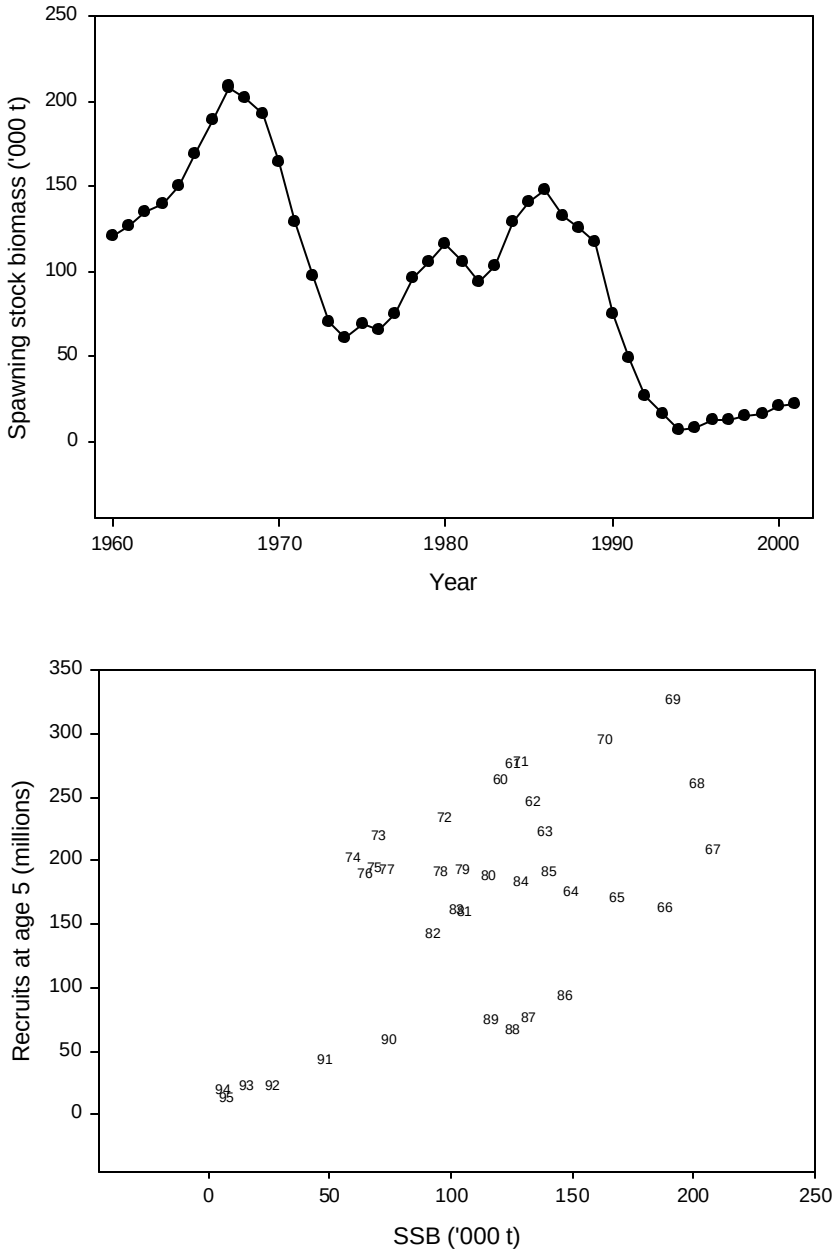


Figure 33. Spawning stock biomass from 1960 to 2001 (top). Spawning stock biomass ('000 t) and recruitment at age 5 (millions) from VPA. The symbols represent the year class.

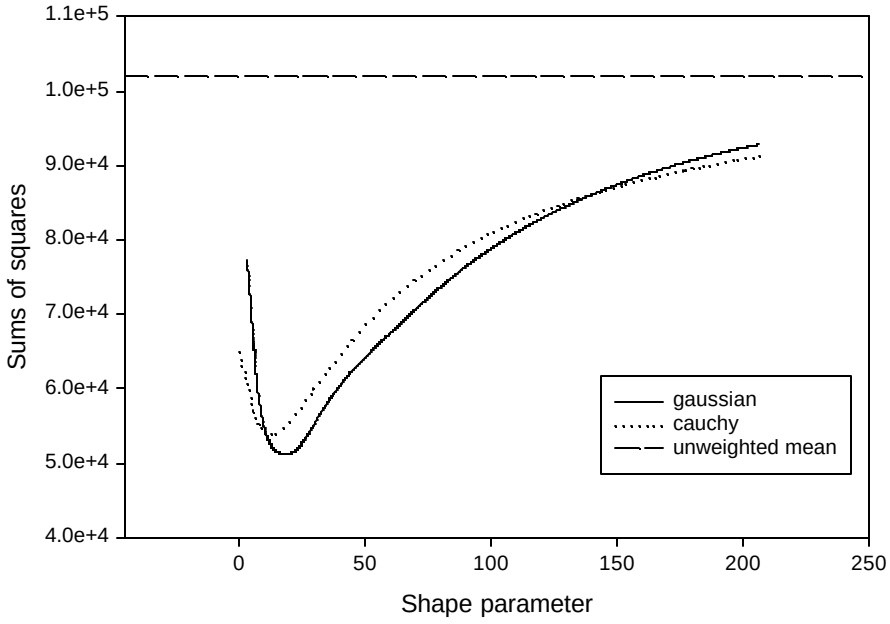


Figure 34. Prediction sums of squares as a function of the shape parameter for Gaussian and Cauchy weighting in the non-parametric stock-recruit model. The sums of squares of the unweighted mean is also shown.

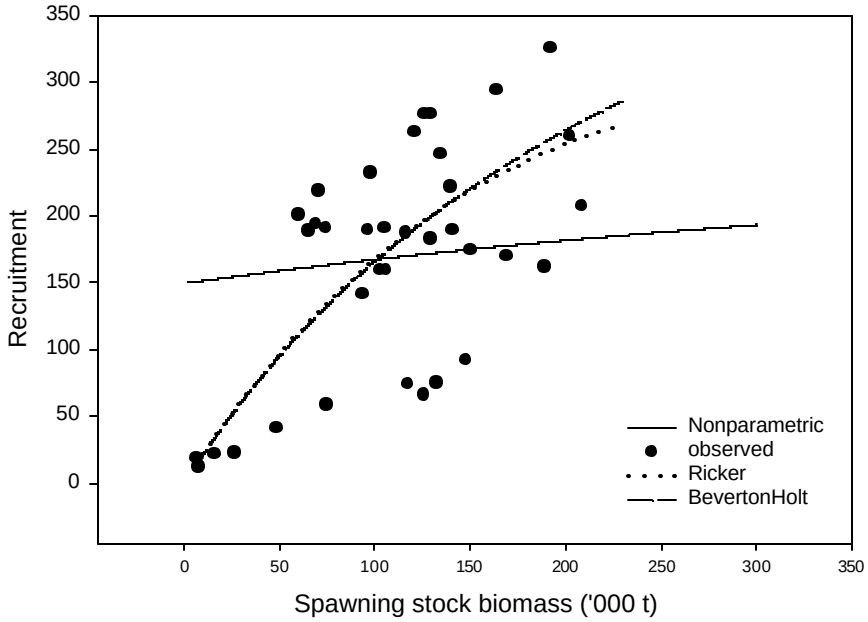


Figure 35. Observed and predicted recruitment at various levels of SSB. Predictions are from nonparametric, Ricker and Beverton-Holt.

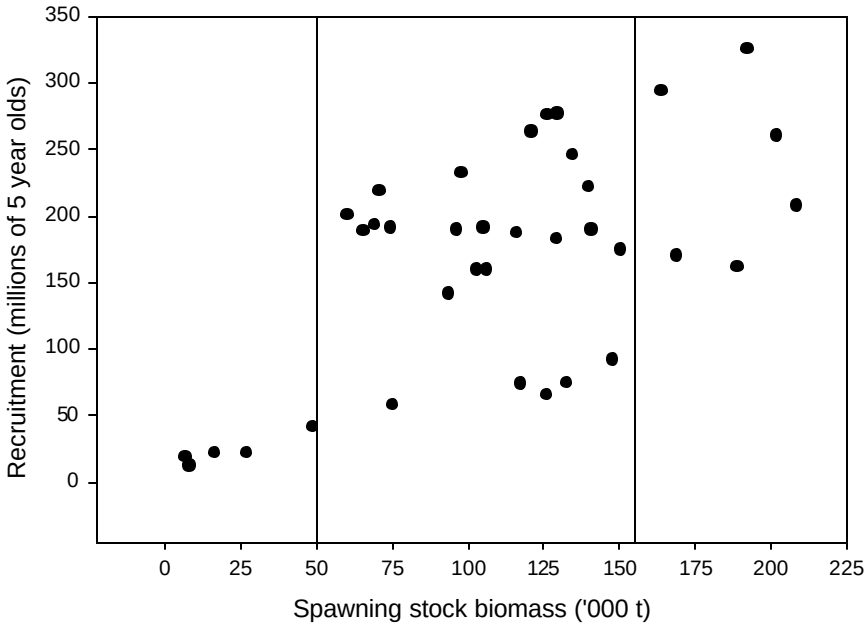


Figure 36. Observed stock recruit scatter. Vertical lines illustrate the 3 levels of recruitment.

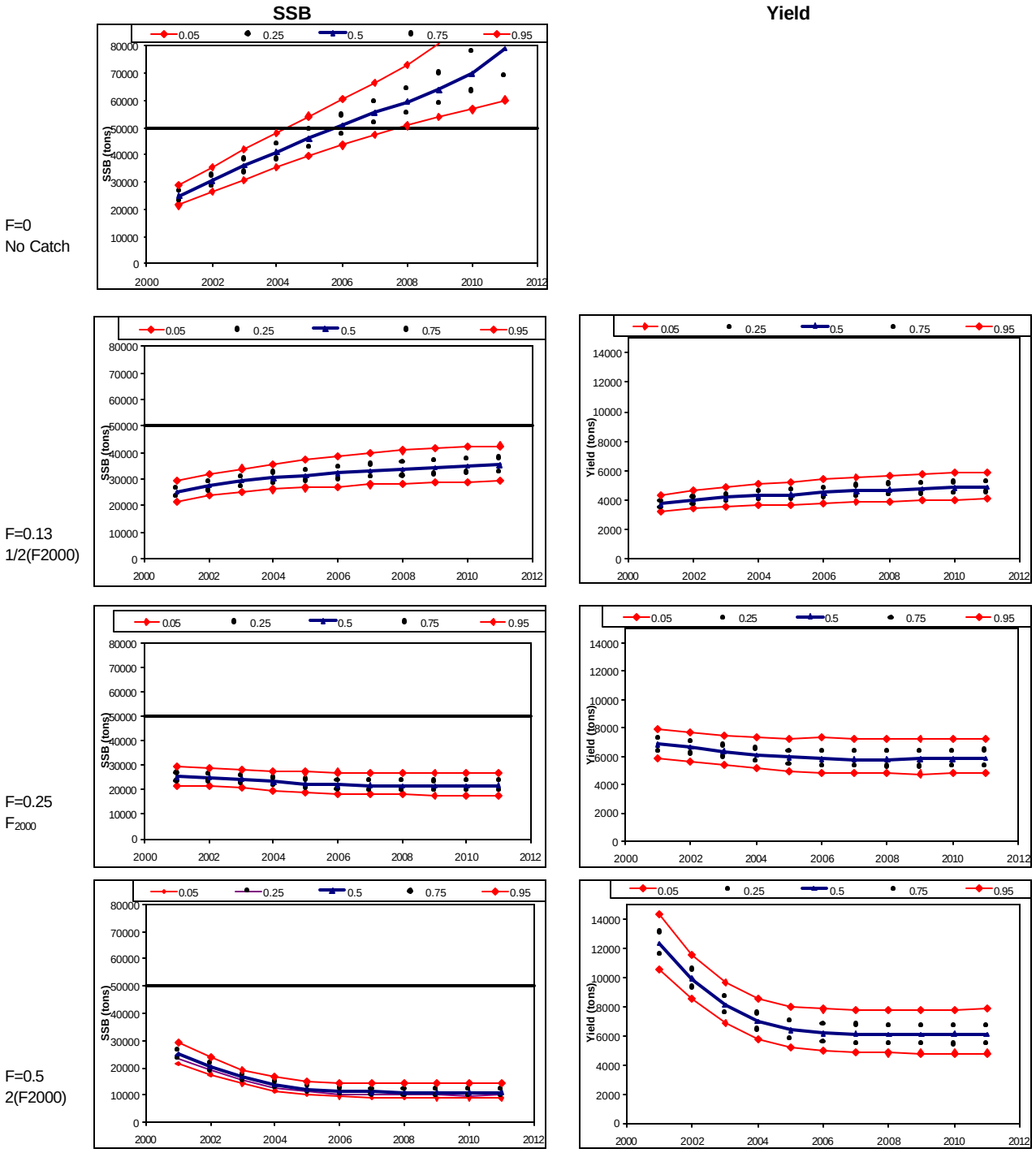


Figure 37. Median spawning stock biomass and yield from projections along with various percentiles. 50 000 t SSB is indicated on the SSB figures.