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An Assessment of American Plaice in NAFO Divisions 3LNO

by

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Abstract

Catches from this stock were generally in the range of 40 000 to 50 000 tons per year throughout the 1970s and 1980s, before declining to low levels in the early 1990s. There has been no directed fishing on this stock since 1993. The TACs in 1995-2004 have been set at 0. Catch in rose in 2003 to 8 700 tons though there was much variation around catch estimates. It was lower in 2004, at 6 100 tons. Catch in recent 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 1980s to the mid-1990s with the average biomass index of the last 2 years (expressed as mean weight per tow) being only 21% of that of the mid-1980s. The autumn survey has also shown large declines and the biomass index is only 36% of that of 1990. There may be a slight increase in both surveys since the mid-1990s. By Division, the largest decrease in both surveys for biomass and abundance has been in Div. 3L. In autumn 2004, there is a large increase in mean number per tow in Div. 3O. Mortality on younger (less than 5) ages has remained high throughout the time series. For older ages mortality declined after the mid 1990's but has increased in the last few years on most ages over 6 in both surveys. The survey indicates no good year-classes since the mid-1980s. The VPA analyses showed that population abundance and biomass declined fairly steadily from the mid-1970s. Biomass has increased slightly in the past few years. *F* increased fairly steadily from 1995 to 2000 but declined somewhat in 2004. *F* has been slightly lower since then. Average F on ages 11-14 in 2004 was 0.22, higher than in 2002, but lower than average *F* in 2003 (0.25) consistent with the increase, then decline in catch. Since 2001 the SSB has increased very slightly to 23, 000 tons in the current year. This is still only 11% of the level in the mid-1960s and 17% of the level in the mid-1980s. Recruitment has been steadily declining since the 1989 year-class and there have been no good year-classes since then. No good recruitment is seen below an SSB of 50 000 tons, the B_{lim} for this stock.

TAC Regulation

This stock has been under TAC regulation since 1973 when a TAC of 60 000 tons was established. From 1973-87, the TAC varied from 47 000 tons to 60 000 tons (Table 1) but was lowered to 33 585 tons in 1988. Further reductions followed, bringing the TAC to 10 500 tons in 1993. In 1994, a TAC of 4 800 tons 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 tons in the early 1960s to a peak of 94 000 tons in 1967, were relatively stable around 45 000-50 000 tons in 1973-82, then declined to 39 000 tons in 1984-85 (Table 1, Fig. 1). Catches increased to 65 000 tons in 1986 and then declined rapidly thereafter, to about 7 400 tons in 1994. The catch declined for a couple of years following the moratorium in 1995 but has been increasing in recent years and remains high at 3 000 tons in 2004. Most of these catches occurred as by catch in the skate and Greenland halibut fisheries in the NRA. In

2003, the Canadian catch totalled about 1 607 tons and in 2004, it was about 1 296 tons, most 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 tons in 1981-82 to over 30 000 tons in 1986 as new fisheries were developed in the Regulatory Area (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. In recent years there has been increasing problems in resolving catches in recent years, resulting in variation in estimates (in 2003, estimates of catch ranged from 6 855-10 599 tons, with a mean of 8 727 tons). It was somewhat lower in 2004, at 6 158 tons.

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 2004, with the exception of 1983. The stratification scheme used is shown in Fig. 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 1996-2004 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 2004. 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 2004 are given in Tables 3-5. In 2003, the spring survey biomass estimates for Div. 3L, 3N and 3O were 25 000, 73 000 and 61 000 tons, respectively. In the spring survey for 2004 the biomass estimates for Div. 3L, 3N and 3O were 19 000, 64 000 and 59 000 tons, respectively. From 1996 to 1998 the estimate for Div. 3N biomass was approximately half of the estimate for Div. 3O while from 1999 to 2004 the estimates in the two divisions are similar. Biomass in Div. 3LNO combined has increased somewhat since 1996 but in 2003-2004 is only 20% of that of the mid-1980s (Fig. 3).

In Fig. 4 and 5 the biomass index is shown as mean weight per tow. In Fig. 4 the index is presented by division and in Fig. 5 for Div. 3LNO combined. Overall the combined index shows the same trend as the swept area estimate of biomass with a large decline followed by a slight increase since 1996. As with the swept area estimate the average mean weight per tow in the last 2 years is 21% of the average of the mid-1980s. The decrease in mean weight per tow has been greatest in Div. 3L (Fig. 4).

Figure 6 shows the abundance for Div. 3LNO combined from 1985 to 2004. The total abundance has fluctuated since 1996 with perhaps a slight increase over the period. Mean number per tow for Div. 3LNO combined shows the same trend (Fig. 7). As with the biomass estimate, mean number per tow has shown the greatest decline in Div. 3L (Fig. 8).

Tables 6-9 show the abundance at age from the Canadian spring surveys by division and for Div. 3LNO combined. Although the proportion of fish that are ages 0 to 5 was lower in 2004, in recent years has been amongst the highest in the time series. However, these ages are probably ‘under converted’ in the 1985 to 1995 data (Table 9).

There has been an increase in weight per tow with respect to the distribution plots of American plaice for selected years in Div. 3NO. Further, from 1996 to 1999, although there is a trend towards a concentration of fish in the southern portion of Div. 3O, this concentration has moved into the southern portion of Div. 3N, outside the 200-mile limit (Fig. 9) in more recent years. The concentration of fish in the southern area can also be seen in the low proportion of fish north of 45°N (Fig. 10). The majority of the stock now can be found in southern Div. 3NO.

Autumn

Stratified-random surveys have been conducted in Div. 3L in the autumn from 1981 to 2004, usually in October-November. From 1990 to 2004, autumn surveys were also carried out in Div. 3NO. Surveys from 1983 to 1994 were done with the Engel trawl and starting in autumn 1995, a Campelen 1800 trawl was used.

Biomass estimates by stratum and depth are given for each Division in Tables 9-11. Biomass estimates from the autumn survey in 2003 were 26 000, 127 000 and 68 000 tons for Div. 3L, 3N and 3O, respectively. In 2004, the biomass estimates for these Divisions were 21 000, 143 000 and 68 000 tons. Over the past number of years, there has been a large biomass estimate in Div. 3N, fairly consistently which is heavily influenced by large sets in stratum 360 (Table 11). The low biomass value in Div. 3L in 2004 was probably at least partly a result of the poor survey coverage in that year (Healey and Dwyer, 2005). During 1995 to 1997, Div. 3N constituted on average 40% of the Div. 3NO total while in 2003 and 2004 it averaged more than 65% of the Div. 3NO total.

The overall biomass for Div. 3LNO in the autumn has shown a slight increasing trend since 1995 (Fig. 3). The biomass index remains well below that of 1990 with the average of the 2003-04 indices representing only 36% of that of 1990. The biomass index expressed as mean weight per tow shows the same overall trend with the average of the last 3 years being 34% of the level of 1990 (Fig. 5). Mean weight per tow has shown the largest decline in Div. 3L (Fig. 11). Mean weight per tow estimates from Div. 3N have increased since 1996, while mean weight per tow in Div. 3O has increased slightly (Fig. 11).

Figure 6 shows the abundance for Div. 3LNO combined from 1990 to 2004. Abundance showed a substantial decline from 1990 to 1998 but has been somewhat higher since 1998. Mean numbers per tow show the same pattern (Fig. 7). By Division, the largest decline was once again in Div. 3L (Fig. 12) but increases were shown in both Div. 3N and 3O. There was a large increase in mean numbers per tow in Div. 3O; the 2004 value was the highest in the time series (Fig. 12).

Tables 12-15 show the abundance by age for 1990 to 2003. Ageing was not available for 2004. Abundance in Div. 3L declined in each year since 1995 to 2000 but increased in 2001 and has remained at that level ever since. The age composition has been rather stable over the time period, although younger ages have made up a higher proportion of the population in the last 2 years (Table 15).

Plots of distribution by weight (Fig. 13) for the autumn surveys for selected years show that A. plaice are distributed throughout the Div. 3LNO area. However the area of highest concentration is southern Div. 3NO, particularly the southern edge of Div. 3O and on the tail of the bank in Div. 3N.

Comparison of Spring and Autumn Surveys

Biomass and abundance from the spring and autumn surveys can be seen in Fig. 3 and 6. Both surveys have shown similar trends in biomass and abundance over the 1990 to 2004 period. Both surveys have shown the largest decline in Div. 3L. There are some larger catches in Div. 3L in the autumn but overall, distribution is also similar between the two surveys, with the majority of the fish being distributed in southern Div. 3NO.

Catch to RV Biomass Ratio

In 2000 STACFIS recommended that *in future catch to survey biomass plots be presented.* Therefore, as a proxy for fishing mortality 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 2004 is shown in Fig. 14. The Campelen ratios were highest in the 1991-94 period, and were reduced from 1995-1999, reflecting a period of reduced catches (Table 1). However, catch/biomass ratios have increased substantially over the 1999 to 2004 period.

Mortality

Estimates of total mortality (Z) from the Campelen or equivalent, spring and autumn survey data were calculated for ages 1 to 16 (Fig. 15 and 16). Both surveys indicate an increase in mortality up to the mid-1990s for most ages. Mortality on younger (less than 5) ages has remained high throughout the time series, particularly in the spring survey data. For older ages mortality declined after the mid 1990's but has increased in the last few years on most ages over 6 in both surveys.

Averages of the estimates of total mortality show the large increase during the early to mid-1990s. The late 1990s showed a drop in mortality. Since then mortality has increased for most ages, although it is generally still less than the mortality experienced during the early 1990s (Table 16 and 17).

Weights and Lengths-at-age

Mean weights-at-age were calculated for male and female American plaice for Div. 3LNO using spring survey data from 1990 to 2004. Mean lengths-at-age were calculated using data from 1985 to 2004. Means were calculated accounting for the length stratified sampling design. There is little indication of trend over the time period in either mean length or mean weight (Fig. 17 and 18).

Maturities

Age and length at 50% maturity were produced from spring RV data. Maturity data were collected during research vessel surveys from 1960-2004. Stratified random surveys were used where possible (1971-2004). 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 by cohort. For males, A_{50} were fairly stable for cohorts of the 1960s to mid-1970s, with perhaps a slight increase over that time period. Male A_{50} then began a fairly steady decline to the 1991 cohort which had an A_{50} of just over 3 years. Male A_{50} then showed an increase to the 1996 cohort, but has declined since (Fig. 19). For females, estimates of A_{50} have shown a large, almost continuous decline, since the beginning of the time series (Fig. 19). The A_{50} for males in recent cohorts (last 5 estimated) 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 7.5 years compared to 11 years for cohorts at the beginning of the time series (Fig. 19).

Estimates of maturity at length were produced using the data described above and are presented by cohort in Fig. 20. L_{50} declined for both sexes 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 34-37 cm, somewhat lower than the 39 cm of the earliest cohorts (Fig. 20).

Recruitment

A multiplicative model was used to estimate the relative year-class strength produced by the spawning stock. Survey abundance data at ages 3-5 from four surveys - the Canadian spring and autumn (both Engels and Campelen) - are included in the analysis. The model formulation is identical to that used in the previous assessment of American plaice in Div. 3LNO (Morgan *et al*., 2003).

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 18) 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. Estimates (Fig. 21) are back-

transformed. Predicted year-class strength generally declines over time; the estimates indicate no substantial recruitment since 1989. The 1998 cohort is estimated as the strongest cohort over the past ten years; although we emphasize its magnitude is estimated to be much smaller than any of the cohorts of the 1980s (Fig. 21). The standardized residuals (Fig. 22) show no systematic patterns indicating violation of model assumptions; however year effects are evident.

Subsequently, the model was re-run including age 2 data from all four survey series. Inclusion of the age 2 data provides additional information on the strength of each year-class. Consistent with the previous exercise, we find that the full variance parameter model and the common variance parameter model are not statistically different. The model estimates (Fig. 23) are quite similar to the results using ages 3-5 with one notable exception (see Fig. 24 for comparison of results). The result produced from the age 3-5 data suggests that the earlier year-classes (pre-1990) are stronger relative to more recent year-classes (post-1989). Notwithstanding this effect, the current year-classes are all estimated to be quite poor in relation to the earlier (pre-1990) year-classes. Standardized residuals (Fig. 25) from the model including ages 2-5 are free of systematic patterns. We suggest the estimates produced from the age 2-5 dataset as the most parsimonious representation of year-class strength.

Each set of results from the multiplicative model were correlated with the VPA recruitment estimates (age 5 in Table 27 of Morgan *et al*., 2003) from the previous assessment of this stock (Fig. 24). The correlation measures in each case were quite high (>0.75).

Survey by EU-Spain Divisions 3NO

Numbers-at-age

Since 1995, Spain has carried out a random-stratified spring bottom trawl survey in Div. 3NO of the NAFO Regulatory Area. In 2001, the trawl vessel (C/V *Playa de Menduiña*) and gear (*Pedreira*) were replaced by the R/V *Vizconde de Eza* using a *Campelen* trawl. Canadian spring RV age-length keys (for Div. 3N only, as the Survey by EU-Spain 3NO surveys such a small portion of Div. 3O) were applied to Spanish length frequency data (separate sexes, mean number-per-tow) from 1997-2000 converted data and 2001-2004 Campelen data. This data is found in Table 25 and was used in some exploratory VPA analyses. The age composition for this survey was similar to the Canadian RV spring survey.

Catch-at-age

Results of the catch-at-age calculations for American plaice catches in 1993-2002 are given in detail in Morgan *et al*. (1999a, b; 2001; 2002, 2003). In 2003 and 2004, sampling data were available from by-catch of A. plaice in Canadian fisheries targeting other species in Div. 3LNO. As has been the case since it reopened in 1998, much of the Canadian sampling data came from 100% observer coverage in the yellowtail fishery. Some sampling was also available from the relatively small by-catch in the fishery for Greenland halibut in both years.

Total Canadian catch of A. plaice in 3LNO in 2004 was 1 295 tons, which was 308 tons lower than in 2003. The main reason for the reduction was the change in the yellowtail fishery in 2004, which caught 2 203 tons of yellowtail in the first quarter of the year, compared to 351 tons in the same period in 2003. Although the total annual catch of yellowtail was similar in both years, this seasonal change is significant as the by-catch of A. plaice is low during that time (42 tons in 2004, 31 tons in 2003). The relatively small remainder of reported Canadian catch in both years came as by-catch in various other fisheries, e.g. winter flounder in Div. 3L; skate and monkfish in Div. 3NO; and redfish and Atlantic halibut in Div. 3O. Since the beginning of 2000, fishing for yellowtail has been permitted in Div. 3L, resulting in some by-catch of American plaice there, although most of the catch in 2003 and 2004 came from Div. 3N, as in the previous years. The catch in Div. 3L in 2004 was the highest in a number of years, resulting from increased yellowtail effort in this area late in the year. In 2004, almost two-thirds of the Canadian catch occurred in April to June, while the catch was more evenly spread over months in 2003. Catches are lower during the summer at there has usually been a closure of the yellowtail fishery during mid-June to late July, which is intended to cover the spawning period for yellowtail.

Sampling of the Canadian catch in 2003 consisted of 50 628 length measurements, from all months, and 2 551 otoliths. These sampling levels were about 9% lower than 2002 for length data and almost identical for otoliths. In 2004, 37 140 length measurements were collected, from all months except January and July, along with 2 333 otoliths.

The same weight-length relationship was used as in recent years (Log_{10} *weight* = *(3.3247 * Log_{10} length – 5.553*) and the sum of products check in 2003 and 2004 was within 3% of the catch. The Canadian catch in 2003 and 2004 consisted of about 1.78 and 2.18 million A. plaice, which was in the range of the 2001 and 2002 catch numbers. The catch in both years was comprised mainly of fish aged 6 to 10 years old, with a peak at age 8 in 2003 and 7 in 2004. The peak age in the catch numbers has declined from 9 or 10 in 1999-2001 to age 8 in 2002-03 and to age 7 in 2004. Age 6 comprised almost 20% of the catch numbers in 2004, compared to about 10% for this age in 2003. Overall, the catch at age in 2003-04 was similar to that calculated for 1999-2002, as well as that from the Canadian fishery for A. plaice on the Grand Bank in the early 1990's (Brodie *et al*., 1994).

The mean fish size and weight in 2003 and 2004 were almost identical (0.713 and 0.716 kg for the mean fish weight), up slightly from the 2000-02 values (0.67-0.70 kg). Individual weights at age were mostly higher in 2004 than in 2003, continuing a trend in recent years. There is an increase in weights at age over the 1999-2004 period, suggesting an increase in growth rate. For example, the mean weight at age 8 in the Canadian fishery has increased steadily from 0.47 kg in 1999 to 0.65 kg in 2004. This appears to be a real increase in the size of fish in the population as it is also reflected in the Canadian spring survey data (Fig. 26). The size-at-age in the Canadian spring survey has shown similar changes in the past but since 1985 there has been no overall trend in size-at-age.

There is a slight difference in the estimate of Canadian catch between this data (estimated from ZIFF data) and STATLANT 21A data, which, when examined, showed the same total for Div. 3LNO combined, but a slightly different breakdown by Division. When the catch was recombined using these new proportions of catch by Division, there were almost no differences in catch at age.

For 2003 and 2004, length frequency data were also available from Portugal, Russia and Spain. Details on the sampling levels and descriptions of the fisheries are contained in Vargas *et al*. (MS 2004, MS 2005), Gonzalez *et al*. (MS 2004, MS 2005) and Vaskov et al. (MS 2004, MS 2005). In all cases, age-length keys from the Canadian spring surveys in Div. 3LNO in 2003 and 2004, respectively, 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 used above) and sum of products (SOP) for 2003 and 2004 are given in Table 23 and 24.

In 2003, ages 8 to 11 were the most dominant ages in the Portuguese catch, but there was also a large number of age 5 fish as well. The Russian catch also showed this large peak at age 5. While this peak was also prevalent in the Spanish catch, the age distribution of that country showed a larger peak at ages 8-10. In 2004, age 6 was the most abundant age in catches for Portugal, Russia and Spain, but Spain also had large catches made up of fish 9-12 years old. Mean lengths and weights at age in the Canadian fishery were slightly higher than in international catches, 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.

It was also noted that data was available from the Ukraine for American plaice (Div. 3N) in 2004 but this was not presented in detail.

Virtual Population Analysis (VPA)

A formulation of ADAPT using the same structure that was used in the accepted VPA from the 2001, 2002 and 2003 assessments (Morgan *et al*., MS 2001, 2002, 2003) was run. The ADAPT used catch-at-age for ages 5 to 14 with an age 15 plus group which included all catch from ages 15 to 21 (Table 26). 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 (Morgan and Brodie, 2001). 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 27 and 28. Numbers at age 5 to 14 from the Canadian spring (1985 to 2004) and autumn (1990 to 2003) surveys were used (Table 25a, b).

The results of an ADAPT run using the formulation described above are given in Table 29 and Fig. 27-29. The model provides a good fit to the data. The mean square of the residuals was 0.28. Relative errors on the population estimates ranged from 0.20 to 0.55. The relative errors on the catchabilities were all less than 0.2. The residuals from the spring survey showed little pattern although there was a tendency for them to be larger in more recent years (Fig. 27 and 28). The residuals from the autumn survey seem to display some pattern which is caused by some all positive years in the early part of the time series, and two almost all negative years in 1996 and 1997 (Fig. 27 and 28). The most recent year also shows almost all negative residuals. There is some tendency for there to

be a lag between the predicted and observed survey estimates at age for the autumn survey but a better fit for the spring survey. Residuals are larger for the older ages in the autumn survey but this appears to be caused by a few large residuals (Fig. 27 and 29a). It may be that the autumn survey catches these older fish infrequently. Survey catchabilities show that catachability is lower for the youngest fish and also older fish in the autumn, whereas the catchability for spring seems more constant across age (Fig. 29b).

Population numbers and F from this run are shown in Table 30. 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 declined fairly steadily from the mid-1970s. Biomass has been relatively stable over the last number of years (Fig. 30), increasing slightly in the last three years. Average *F* on ages 9 to 14 and ages 11 to 14 showed an increasing trend from about 1965 to 1985. 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 increased fairly steadily from 1995 to 2000. *F* has been slightly lower since then. Average *F* on ages 11-14 in 2004 was 0.22, higher than in 2002, but lower than average F in 2003 (0.25) consistent with the increase, then decline in catch (Table 30, Fig. 30).

Spawning stock biomass was calculated by multiplying the biomass at age by the female maturity ogive. SSB has shown 2 peaks, one in the mid-1960s and another in the early to mid-1980s. Since then it declined to a very low level (less than 10 000 tons) in 1994 and 1995 (Fig. 31). Since 2001 the SSB has increased very slightly to 23 000 tons in the current year. This is still only 11% of the level in the mid-1960s and 17% of the level in the mid-1980s. The stock recruit scatter is also shown in Fig. 31. Recruitment has been steadily declining since the 1986 year-class and there have been no good year-classes since then. An examination of the stock recruit scatter shows that there has been only good recruitment observed above 155 000 tons and no good recruitment observed at SSB below 50 000 tons (Fig. 32). This level of 50 000 tons has been taken as a B_{lim} for this stock.

A retrospective analysis was conducted by sequentially removing one year of data from 2004 to 1999 for a comparison of 6 years. The results of this analysis are shown in Fig. 33 to 35. There is little evidence of a retrospective pattern when examined for population abundance in total (Fig. 33) or on an age by age basis (Fig. 35). A retrospective pattern is evident for average *F* estimates for 1995. This is not an uncommon result given the sudden increase in average *F*.

ADAPT Formulation Including Survey by EU-Spain Divisions 3NO

An additional ADAPT analysis was explored, which included the survey by EU-Spain- Div. 3NO index. This survey has 8 years of converted/Campelen data and the Canadian age length key was applied to it. We compare the results of this analysis against the previous ADAPT formulation (called Run 1).

This Run was attempted although the survey by EU-Spain Div. 3NO in the NAFO Regulatory Area (NRA) covers only 11% (Dwyer *et al*., 2002) of the total area of the American plaice stock. Although trends in the size of the stock estimated from the Canadian survey in the NRA are similar to the trends from the survey by EU-Spain Div. 3NO, the perception of the stock as surveyed by the entire survey area (Div. 3LNO) is different. This topic was examined in NAFO SCR Doc. 02/65. It was decided at that time not to include the survey by EU-Spain in the assessment. The correlation including the new data comparing the Canadian 3LNO survey and the survey by EU-Spain in Div. 3NO is 0.68 (correlation comparing Canadian 3NO and the survey by EU-Spain Div. 3NO is 0.87).

Inclusion of survey by EU-Spain Div. 3NO - RUN 2

The survey by EU-Spain was included as a tuning index, using the converted (*Pedreira* to Campelen) 1997-2000 length frequency data and the 2001-2004 Campelen series length frequencies. The length frequencies were converted to age by using age length keys from the Canadian spring RV surveys in Div. 3N (see above and Table 25). Ages 5-14 were used in the tuning index. The structure of the ADAPT from Run 1 is otherwise unchanged.

Including the survey by EU-Spain into the ADAPT gives the following summary results:

- Mean square residuals for the survey by EU-Spain is 0.36 (Table 31).
- Estimate of relative error on population numbers are within a similar range to Run 1, or lower (0.2 to 0.45); the relative errors on catchabilities at age are higher for the survey by EU-Spain (>0.2 for all ages) (Table 31).

- The plot of biomass and average *F* on ages 11-14 when compared with those from the Run 1 VPA show very similar trends, except biomass, SSB and *F* are estimated slightly higher in recent years in the run including the survey by EU-Spain (Fig. 36 and 37).
- Catchabilities from the survey by EU-Spain show a similar pattern to Canadian spring surveys (lower because MNPT) but catch far fewer younger fish (Fig. 38).
- Residuals from the survey by EU-Spain show a year effect for 1997 but no pattern in recent years (Fig. 39).
- Residuals for the survey by EU-Spain are higher by age than other surveys, almost double the highest in Canadian autumn RV survey, especially at the youngest and oldest ages (Fig. 40).
- Plot of observed *versus* predicted index indicates poor model fit for the survey by EU-Spain index (Fig 41).

Another ADAPT formulation was considered; in this run the 1997 data for the survey by EU-Spain was excluded as the residuals in 1997 (from the above run) were all negative. Note that in 1997, the survey had poor coverage for the survey by EU-Spain. It was found that dropping this year improved the pattern of residuals and the overall fit of the data to the model. However, the survey by EU-Spain was ultimately not included in the final ADAPT run for American plaice because at present, it is uncertain whether this survey is representative of the stock as a whole. It was recommended that several ADAPT formulations be examined for this stock in the future.

Thus Run 1 (Canadian surveys only) was the accepted ADAPT formulation for the 2005 assessment of the stock.

Medium-term Projections

Deterministic projections were carried out for 5 years to examine the trajectory of the spawning stock biomass under 2 scenarios of fishing mortality: $F = 0$, $F = F_{current}$. For these deterministic projections the results of the VPA were used. $F_{current}$ was set as the average F on age 9 (the fully recruited age in the VPA) over the last 3 years and was 0.30. PR and weights were averaged over the last 3 years. Recruitment was the average R/S for the last 3 year-classes and was equal to 2.41. In addition the following values were used:

Age	5	6	7	8	9	10	11	12	13	14	15+
M	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
PR	0.07	0.21	0.49	0.89	1	0.87	0.92	0.90	0.66	0.59	0.59
Stock Weight	0.19	0.27	0.37	0.45	0.54	0.64	0.77	0.95	1.18	1.45	1.87
Maturities											
2004	0.03	0.13	0.43	0.74	0.96	0.99	1.0	1.0	1.0	1.0	1.0
2005	0.03	0.13	0.43	0.79	0.91	0.99	1.0	1.0	1.0	1.0	1.0
2006	0.03	0.13	0.43	0.79	0.95	0.98	1.0	1.0	1.0	1.0	1.0
2007	0.03	0.13	0.43	0.79	0.95	0.99	0.99	1.0	1.0	1.0	1.0
2008	0.03	0.13	0.43	0.79	0.95	0.99	1.0	1.0	1.0	1.0	1.0

The stock is estimated to increase under both $F = F_{current}$ and $F = 0$, with the increase in SSB being 4 times greater than $F = 0$ than at current *F*. The increase under current conditions of *F* is only about 12 000 tons over the 5-year period and the stock does not exceed B_{lim}. The spawning stock reaches the B_{lim} of 50 000 tons by 2009 and 66 000 tons by 2010 with $F = 0$ (Fig. 42). The average R/S has been considerably higher in recent years and thus the assumed recruitment value used in projections is higher than in 2003 projections.

Reference Points

Currently there is a suggested B_{lim} of 50 000 tons of SSB for this stock based on examination of the stock recruit scatter which shows that below that level of SSB good recruitment has not been observed (Fig. 32). There is currently no suggested F_{lim}. Potential limit reference points were examined through different methods.

Long-term simulations

Results of the accepted ADAPT formulation were used in simulations using the same framework as for the short-term projections. These simulations were run at various levels of *F*, to determine the equilibrium level of yield, biomass and SSB at each *F*. Recruitment for these simulations comes from the fit of a nonparametric stock

recruit relationship (Evans and Rice, 1988, Fig. 43 and 44). These simulations show a maximum sustainable yield of 54 000 tons that occurs at an F_{MSY} of 0.25, which could serve as a F_{lim} for this stock. The SSB that gives this MSY is 232 000 tons (Fig. 45 and 46). Taking 30% of this SSB as a B_{lim} would give 70 000 tons. It should be noted, that the predicted recruitment is not forced through the origin and may over estimate recruitment at small SSB. This would result in an over estimation of sustainable yield and population size at higher levels of F.

Segmented regression

A segmented regression was fit to the stock-recruit observations with recruits of 5 year olds. The segmented regression fit is statistically significant at the 95% level of significance (P-value <0.01), and the model explains 73% of variability in recruitment (coefficient of determination). Maximum likelihood estimate of the change point, the SSB at which recruitment begins to be impaired with decreasing SSB, is 97 520 tons, and 80% profile likelihood confidence interval was given by 80 136 tons and 125 747 tons (Fig. 47). The LRP corresponding to 50% R_{max} from the segmented regression, SG50, is 48 760 tons SSB. However, it should be noted that this change point is sensitive to the addition and deletion of data.

YPR and SPR

Yield per recruit (YPR) and spawner per recruit (SPR) were calculated using the same weights at age, maturities and partial recruitment as in the short term projections and an M = 0.2. From YPR $F_{0.1}$ was calculated as 0.19. From SPR the F at 35%SPR was calculated as 0.18 (Fig. 48 and 49).

Suggested reference points

Given that the various estimates of B_{lim} are not that different and both new estimates bracket the current suggested B_{lim} it seems reasonable to maintain the current B_{lim} of 50 000 tons of SSB. F_{MSY} (F = 0.25) could serve as F_{lim} for this stock as suggested by the Limit Reference Point Study Group (NAFO SCS Doc. 04/12). $F_{0.1}$ could serve as a possible buffer reference point for fishing mortality.

Since the estimate of F_{MSY} greatly depends on the exploitation pattern (PR), stock recruitment model and natural mortality rates used in the computation depends on current assumptions which might change, it was decided not to use F_{MSY} as F_{lim} for this stock at this time but to explore this further.

Trajectory of Stock

Taking the suggested limit reference points, the trajectory of the stock was plotted on the NAFO PA framework (Fig. 50). This shows that the stock grew in the 1960s while the F was below $F_{0.1}$. Starting in the late 1960s F exceeded $F_{0.1}$ and the stock rapidly declined. A series of good year-classes helped to maintain the stock above B_{lim} in the 1970s. F increased in the mid to late 1980s and starting in the late 1980s recruitment declined. By 1992 the stock was below B_{lim} and has been below that level since. With the imposition of the moratorium on directed fishing F dropped below $F_{0.1}$ in the mid-1990s but increased in 1998 and 1999 and has remained at or above $F_{0.1}$ since.

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Table 1. Nominal catch (tons) of American plaice for NAFO Div. 3LNO, 1960-2003 and TACs from 1973 to 2004.

Year	Canada	Other	Total	STACFIS[a]	TAC
1960	21,353	20	21,373		-
1961	14,897	1,476	16,373		-
1962	15,210	982	16,192		-
1963	24,591	1,594	25,719		-
1964	35,474	3,773	38,567		-
1965	45,365	12,440	53,261		-
1966	51,225	25,270	65,011		-
1967	54,190	75,362	94,413		-
1968	48,674	48,244	73,167		-
1969	64,815	29,115	79,437		-
1970	54,929	21,956	66,653		-
1971	49,394	36,105	67,888		-
1972	41,605	32,175	59,361		-
1973	38,586	26,773	52,843		60,000
1974	35,101	21,270	46,297		60,000
1975	34,015	17,317	43,221		60,000
1976	47,806	7,726	51,824		47,000
1977	42,579	2,700	43,981		47,000
1978	48,634	2,491	50,021		47,000
1979	47,131	2,752	48,568		47,000
1980	48,296	1,391	49,086		47,000
1981	48,177	3,723	50,158		55,000
1982	49,620	1,253	50,337		55,000
1983	35,907	3,582	37,720		55,000
1984	33,756	4,363	36,028		55,000
1985	40,024	13,600	48,018	54,212	49,000
1986	33,409	45,350	57,449	64,570	55,000
1987	33,967	36,529	53,457	55,012	48,000
1988	26,832	22,080	38,925	40,835	33,585[c]
1989	27,901	24,803	41,206	43,369	30,300
1990	22,600	2,073	24,006	32,501	24,900
1991	22,510	4,026	25,503	34,681	25,800
1992	9,663	1,808	10,870	13,350	25,800
1993[b]	7,454	761	7,916	17,122	10,500
1994	73	973	560	7,378	4,800[d]
1995	67	962	548	637	0
1996	49	1,641	875	913	0
1997	75	2,573	1,365	1,401	0
1998	227	2,640	1,560	1,618	0
1999	323	4,203	2,436	2,565	0
2000[e]	623	3,932	2,600	5,176	0
2001	1,618	2,753	2,998	5,739	0
2002	1,343	3,452	3,117	4,870	0
2003[e]	1,607	2,215	3,822	8,727	0
2004	1,295	1,563	2,858	6,158	0

Values for countries back to 2000 are provisional.

[a] May include some catch estimated from surveillance reports or miscellaneous information. See text for details.

[b] Catch may have been as high as 19,400.

[c] Effective TAC.

d No directed fishing.

[e] STACFIS unable to determine precise estimates because of discrepancies between various sources.

Table 2. Biomass estimates ('000 tons) of A. plaice by stratum and depth zone (m), from Canadian spring surveys in Div. 3L in 1996-2004 (Campelen). (+) indicates biomass <50 tons. (-) means stratum not surveyed.

		Biomass								
Depth	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004
30-56	784	-	-	0.2	+	-	+	0.0	-	+
	Total	-	-	0.2	+	-	+	0.0	-	+
57-92	350	0.6	0.3	0.3	6.1	1.8	0.4	0.2	0.7	0.7
	363	2.3	0.8	0.0	3.2	6.2	0.6	0.1	3.4	2.1
	371	0.9	0.2	0.1	2.4	0.9	0.1	+	0.2	0.5
	372	1.4	0.8	1.3	2.7	3.7	1.2	0.3	2.2	1.2
	384	0.7	0.9	0.2	0.8	1.2	0.3	0.4	0.3	0.5
	785	-	-	0.2	0.5	-	0.7	+	-	+
	Total	5.9	3.0	2.1	15.7	13.8	3.3	1.0	6.9	5.0
93-183	328	0.5	0.5	0.1	2.4	0.9	1.3	0.5	0.2	0.6
	341	1.8	0.5	0.7	4.5	0.8	1.5	0.2	0.6	0.6
	342	0.1	0.1	0.4	0.4	0.2	0.1	+	0.1	+
	343	0.3	0.0	+	0.6	0.2	+	+	0.1	+
	348	1.4	0.8	1.2	2.8	1.5	0.4	0.3	0.4	1.3
	349	0.8	0.3	0.2	4.4	1.3	0.5	0.3	0.6	1.1
	364	2	1.0	0.9	5.6	1.3	1.5	1.2	0.7	1.7
	365	1.1	0.5	0.9	1.4	1.2	0.3	0.6	0.6	0.5
	370	1.3	0.6	1.6	2.4	1.9	0.9	0.6	0.5	1.1
	385	5.6	0.9	0.5	2.5	1.9	1.4	0.7	0.4	1.4
	390	0.6	0.4	0.5	0.3	0.3	0.4	1.0	0.3	0.2
	786	-	-	0.3	0.5	-	0.4	-	-	0.1
	787	-	-	0.5	0.8	-	0.1	-	-	+
	788	-	-	-	0.3	-	-	-	-	-
	790	-	-	-	+	-	-	-	-	-
	793	-	-	-	+	-	-	-	-	-
	794	-	-	-	+	-	-	-	+	-
	797	-	-	-	+	-	-	-	+	-
	799	-	-	-	-	-	-	-	-	+
	Total	15.5	5.5	7.8	28.9	11.5	8.8	5.4	4.5	8.6
184-274	344	1	0.3	0.8	1.8	0.5	0.3	0.2	0.3	0.3
	347	0.6	0.2	0.6	0.6	0.2	0.4	0.1	0.5	0.3
	366	0.4	0.3	0.3	0.5	0.7	0.7	0.9	0.6	0.6
	369	0.3	0.2	0.2	1.2	0.7	0.9	0.8	0.4	0.5
	386	0.5	0.2	0.4	1.4	1.7	0.4	0.5	0.4	0.5
	389	0.4	0.2	0.4	0.6	0.8	0.8	0.3	0.4	0.7
	391	0.3	0.1	0.2	0.1	+	0.2	0.2	0.2	0.1
	789	-	-	-	0.5	-	-	-	+	-
	791*	-	-	-	0.3	-	-	-	-	0.1
	795	-	-	-	0.1	-	-	-	-	-
	798	-	-	-	0.1	-	-	-	+	-
	Total	3.5	1.5	2.9	7.2	4.6	3.7	3.0	2.8	3.0
275-366	345	0.5	0.2	0.3	1.5	0.5	0.7	0.7	0.2	0.4
	346	0.4	0.3	0.2	0.2	0.5	0.1	0.8	0.8	0.9
	368	0.3	0.0	0.1	0.3	0.4	0.2	0.2	0.2	0.2
	387	0.6	0.6	0.8	0.4	1.6	0.8	0.1	0.4	0.4
	388	0.6	0.2	0.2	0.8	0.3	0.4	0.1	0.1	0.1
	392	0.5	0.1	0.4	0.2	0.1	0.1	0.3	0.1	0.2
	792	-	-	-	+	-	0.1	-	0.1	-
	796	-	-	-	0.1	-	-	-	0.1	-
	800	-	-	-	0.2	-	-	-	-	0.1
	Total	2.9	1.4	2.0	3.7	3.4	2.4	2.2	1.8	2.4
367-549	729	0.2	0.6	2.2	0.1	1.3	1.1	1.3	1.2	+
	731	0.5	0.1	+	0.1	1.2	0.3	0.2	0.1	0.1
	733	0.7	0.0	0.3	1	0.1	2.3	0.5	2.1	0.3
	735	1.4	1.6	1.2	0.6	1.2	2.1	1.2	4.9	-
	Total	2.8	2.4	3.7	1.8	3.8	5.8	3.2	8.3	0.4
550-731	730	+	0.0	0.2	+	0.1	0.1	0.3	+	+
	732	+	0.0	0.0	+	0.3	3.4	0.6	0.6	0.0
	734	+	0.0	0.1	0	0	0.1	0.9	0.5	0.0
	736	+	0.1	0.0	+	+	+	0.5	0.1	+
	Total	0.1	0.1	0.3	+	0.4	3.6	2.3	1.2	0.0
732-914	737	-	-	-	-	-	-	-	-	-
	741	-	-	-	-	-	-	-	-	-
	745	-	-	-	-	-	-	-	-	-
	748	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
915-1097	738	-	-	-	-	-	-	-	-	-
	742	-	-	-	-	-	-	-	-	-
	746	-	-	-	-	-	-	-	-	-
	749	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
1098-1280	739	-	-	-	-	-	-	-	-	-
	743	-	-	-	-	-	-	-	-	-
	747	-	-	-	-	-	-	-	-	-
	750	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
1281-1463	740	-	-	-	-	-	-	-	-	-
	744	-	-	-	-	-	-	-	-	-
	751	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
Grand Total		30.7	13.8	19.0	57.3	37.5	27.6	17.1	25.4	19.3

in 1996 had a depth range of 184-366

Table 3. Biomass estimates ('000 tons) of A. plaice by stratum and depth zone (m), from Canadian spring surveys in Div. 3N in 1996-2004 (Campelen). (+) indicates biomass <50 tons. (-) means stratum not surveyed.

		Biomass								
Depth	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004
≤ 56	375	2.9	2.2	1.1	1.8	5.1	2.1	3.9	2.1	2.3
	376	0.8	1.8	2.0	3.2	5.1	9.3	8.6	9.6	11.7
	Total	3.7	4.0	3.1	5.0	10.2	11.4	12.5	11.8	14.1
57-92	360	8.8	8.6	7.9	27.4	22.8	50.3	28.0	29.6	29.2
	361	3.8	1.9	2.0	5.5	4.2	9.0	6.0	9.3	8.3
	362	2.8	5.5	4.0	4.6	6.6	7.0	2.7	4.7	2.5
	373	1.6	0.5	0.9	8.3	3.2	2.5	0.4	2.7	1.1
	374	1.1	0.4	0.3	1.7	0.9	1.0	0.6	3.2	2.1
	383	0.5	0.1	+	1.0	0.2	0.1	+	0.3	0.5
	Total	18.6	17.0	15.1	48.5	37.9	69.9	37.7	49.7	43.7
93-183	359	1.1	1.1	1.6	3.3	5.1	5.1	0.6	7.0	3.7
	377	0.2	0.1	+	0.2	+	0.9	0.1	0.2	0.2
	382	0.1	0.1	0.7	0.2	0.4	0.1	0.1	0.1	0.1
	Total	1.4	1.3	2.3	3.7	5.5	6.1	0.8	7.3	4.0
184-274	358	0.1	0.1	1.4	0.3	0.6	0.5	0.1	0.3	0.3
	378	0.1	0.2	0.2	0.9	+	0.1	0.1	0.5	0.4
	381	0.3	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.8
	Total	0.5	0.4	1.7	1.4	0.7	0.7	0.3	1.0	1.5
275-366	357	0.1	0.1	0.1	+	0.1	0.1	0.1	0.1	0.1
	379	+	0.1	0.1	0.1	0.1	0.1	0.1	0.3	+
	380	0.2	0.8	0.1	0.2	+	0.1	+	0.4	0.2
	Total	0.3	1.0	0.3	0.3	0.2	0.3	0.2	0.9	0.3
367-549	723	0.2	0.4	0.3	+	0.0	0.1	0.3	1.1	0.1
	725	0.1	0.5	0.2	+	0.4	0.1	+	0.3	+
	727	0.5	2.2	2.0	0.4	1.2	2.5	0.1	0.5	0.4
	Total	0.8	3.1	2.5	0.4	1.6	2.7	0.4	1.8	0.6
550-731	724	0.2	0.5	0.2	+	0.1	0.1	0.5	0.1	+
	726	+	0.1	+	+	0.1	+	+	+	+
	728	0.5	-	0.3	0.2	0.5	1.0	0.4	0.1	+
	Total	0.7	0.5	0.5	0.2	0.7	1.1	0.9	0.3	+
732-914	752	-	-	-	-	-	-	-	-	-
	756	-	-	-	-	-	-	-	-	-
	760	-	-	-	-	-	-	-	-	-
	Total			-	-	-	-	-	-	-
915-1097	753	-	-	-	-	-	-	-	-	-
	757	-	-	-	-	-	-	-	-	-
	761	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
1098-1280	754	-	-	-	-	-	-	-	-	-
	758	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
1281-1463	755	-	-	-	-	-	-	-	-	-
	759	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
Grand Total		26.0	27.4	25.5	59.5	56.8	92.1	52.8	72.7	64.1

Table 4. Biomass estimates ('000 tons) of A. plaice, by stratum and depth zone (m), from Canadian spring surveys in Div. 3O in 1996-2004 (Campelen). (+) indicates biomass <50 tons, (-) means stratum not surveyed.

		Biomass								
Depth	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004
57-92	330	3.8	0.8	6.9	3.5	5.9	4.2	2.1	1.3	2.9
	331	1.4	0.3	0.3	2.7	2.3	2.6	2.2	2.6	0.8
	338	6.0	5.7	6.0	4.0	2.3	6.0	3.1	5.0	4.3
	340	2.2	1.7	1.8	2.9	1.9	1.7	0.5	1.5	0.7
	351	2.9	4.4	3.8	4.6	3.4	6.5	3.2	2.4	3.5
	352	9.1	13.8	10.6	14.2	13.4	17.5	18.6	10.1	10.0
	353	7.8	8.3	10.9	21.5	21.1	20.6	14.8	25.2	21.2
	Total	33.2	34.9	40.3	53.4	50.3	59.1	44.5	48.0	43.4
93-183	329	1.6	1.4	4.4	4.7	3.9	1.9	1.4	1.8	3.1
	332	3.9	2.5	3.8	2.2	0.9	2.2	3.1	1.4	1.9
	337	4.6	1.9	3.2	2.7	1.5	1.2	1.4	1.4	1.6
	339	1.4	0.8	0.8	2.1	2.1	2.6	0.9	0.9	0.7
	354	1.6	1.1	5.0	9.0	1.3	1.6	6.4	5.3	8.1
	Total	13.1	7.8	17.2	20.7	9.7	9.5	13.2	10.9	15.3
184-274	333	+	0.3	0.1	0.1	+	+	0.3	+	+
	336	0.2	0.3	+	0.2	+	0.1	+	+	+
	355	0.5	0.3	0.1	0.1	0.1	0.4	0.4	0.6	0.3
	Total	0.7	0.9	0.2	0.4	0.1	0.5	0.7	0.6	0.3
275-366	334	0.2	0.8	0.0	0.1	+	+	0.2	0.2	+
	335	0.2	0.2	0.0	+	+	+	+	+	+
	356	0.1	+	+	0.1	+	+	+	0.4	+
	Total	0.5	1.0	+	0.2	+	+	0.2	0.5	+
367-549	717	0.2	1.7	+	0.1	0.0	+	0.4	0.2	0.0
	719	0.1	0.5	+	+	0.0	+	+	+	+
	721	0.2	0.1	+	0.1	+	0.2	+	0.1	0.0
	Total	0.5	2.2	+	0.2	+	0.2	0.4	0.3	0.0
550-731	718	+	0.1	+	+	0.0	+	+	0.3	0.0
	720	+	0.1	+	+	0.0	0.1	0.0	+	0.0
	722	1.0	4.2	0.0	0.2	0.1	0.2	0.1	0.2	0.0
	Total	1.0	4.4	+	0.2	0.1	0.2	0.1	0.2	0.0
732-914	764	-	-	-	-	-	-	-	-	-
	768	-	-	-	-	-	-	-	-	-
	772	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
915-1097	765	-	-	-	-	-	-	-	-	-
	769	-	-	-	-	-	-	-	-	-
	773	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-
Grand Total		49.0	51.2	57.7	75.1	60.2	69.5	59.1	60.5	59.0

Table 5. Abundance index at age (millions) for American plaice in NAFO Div. 3L from Canadian spring surveys from 1985 to 2004.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.11	0.00	2.29	1.15	0.00	0.13	0.05
2	0.00	1.32	5.23	4.10	1.86	0.00	1.32	0.00	0.30	0.00	0.00	8.40	0.63	0.68	1.89	17.73	37.91	7.65	1.66	3.76
3	8.11	4.55	11.39	18.84	17.35	5.24	3.23	1.74	2.26	0.36	0.40	29.93	5.44	3.14	5.42	12.32	32.83	34.07	20.64	9.38
4	25.76	23.56	50.30	80.86	80.96	70.17	14.00	5.14	5.75	7.48	0.82	91.96	14.04	10.24	6.59	4.94	15.63	18.24	29.59	24.62
5	146.34	115.41	242.76	279.24	174.03	137.97	110.19	46.07	22.68	31.03	11.84	82.54	31.70	21.10	25.82	8.95	5.95	7.98	17.73	35.53
6	349.77	451.71	566.10	554.37	416.73	231.75	178.00	61.69	59.15	46.46	17.43	48.50	26.57	36.67	42.99	29.81	9.41	5.19	8.55	14.35
7	513.51	496.70	553.70	501.15	351.42	277.32	102.04	89.33	37.42	44.40	31.75	26.16	14.58	30.44	66.66	28.55	18.61	9.46	7.73	8.27
8	317.45	260.25	333.72	277.15	208.59	152.33	79.23	33.11	16.71	13.72	31.28	8.01	6.83	19.43	65.01	27.47	16.40	9.72	11.96	4.93
9	152.45	156.89	132.67	188.17	143.33	94.21	43.70	18.53	5.56	6.13	17.63	3.62	2.42	6.38	39.59	18.83	17.27	8.67	10.35	5.64
10	85.19	66.89	65.65	60.04	52.54	55.70	19.02	7.07	2.96	1.38	5.28	0.64	0.69	2.90	19.36	10.78	15.22	6.50	6.90	4.66
11	44.66	27.01	22.24	32.65	26.90	18.40	10.45	2.88	1.23	0.83	1.14	0.09	0.39	1.60	10.42	5.46	7.50	4.22	4.04	3.62
12	22.13	18.07	19.32	20.02	14.77	9.59	6.61	1.44	0.43	0.14	0.21	0.03	0.09	0.64	3.36	1.31	2.97	1.00	2.42	1.92
13	12.34	11.84	9.13	10.11	8.57	6.33	2.57	0.64	0.29	0.15	0.06	0.03	0.02	0.17	1.34	0.25	0.81	0.35	0.73	0.69
14	5.99	4.40	3.93	5.87	4.85	2.40	1.39	0.38	0.13	0.05	0.00	0.00	0.00	0.00	0.18	0.09	0.13	0.14	0.23	0.21
15	2.99	2.64	2.00	3.27	3.36	1.57	0.99	0.19	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.05	0.00	0.00	0.00
16	1.91	1.58	0.74	1.54	1.07	1.04	0.48	0.06	0.03	0.00	0.00	0.00	0.00	0.02	0.09	0.07	0.10	0.00	0.00	0.01
17	0.39	0.44	0.24	0.36	0.43	0.58	0.18	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.03	0.22	0.02	0.00	0.09	0.00	0.03	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
19	0.03	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.10	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
unk1	0.23	0.51	0.00	0.45	0.05	3.04	0.03	0.01	0.69	0.00	0.00	0.00	0.00	0.12	0.04	0.01	0.05	0.16	0.04	0.17
Ages 0+	1689.25	1643.96	2019.37	2038.19	1506.93	1067.63	573.54	268.29	155.67	152.11	117.84	300.15	103.40	133.65	288.81	168.87	182.03	113.35	122.68	117.81
Ages 6+	1508.82	1498.62	1709.47	1654.71	1232.68	851.22	444.78	215.33	123.99	113.25	104.78	87.08	51.60	98.26	249.04	122.63	88.51	45.24	52.90	44.30
Ages 9+	328.09	289.97	255.94	322.03	255.94	189.82	85.51	31.20	10.71	8.67	24.32	4.41	3.61	11.72	74.38	36.80	44.09	20.87	24.66	16.75
Ages 12+	45.79	39.19	35.39	41.18	33.17	21.50	12.34	2.72	0.95	0.33	0.27	0.06	0.11	0.84	5.01	1.72	4.10	1.48	3.38	2.83

Table 6. Abundance index at age (millions) for American plaice in NAFO Div. 3N from Canadian spring surveys from 1985 to 2004.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.26	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.71	0.46	1.31	0.00	0.00	3.34
2	2.33	2.52	17.27	3.67	4.37	4.30	0.43	0.41	0.78	0.00	0.00	2.06	0.15	0.24	17.60	12.74	16.04	3.61	1.02	2.68
3	33.52	13.39	72.32	45.69	49.06	29.60	2.54	3.15	3.84	1.24	0.74	6.01	1.51	0.24	6.98	44.81	155.19	15.10	10.97	2.76
4	109.11	46.72	113.73	87.97	312.98	165.10	30.46	24.50	74.10	4.10	4.08	6.01	4.28	3.00	1.78	20.53	47.80	34.75	18.51	11.47
5	60.97	106.13	84.60	62.94	106.44	282.87	117.51	38.48	75.44	29.51	14.99	15.58	5.46	3.99	4.19	3.95	4.18	14.76	75.91	25.09
6	60.72	72.84	57.12	27.63	38.68	35.98	75.70	51.69	68.23	12.91	13.29	26.37	16.84	6.12	12.40	6.59	7.98	7.29	28.56	67.31
7	30.06	41.09	32.02	17.23	17.28	11.61	12.85	22.66	54.04	12.31	8.39	20.45	24.42	11.92	12.19	17.71	22.99	7.95	16.07	18.39
8	25.11	17.90	18.64	13.31	18.09	8.03	5.62	5.58	30.27	7.68	4.62	6.89	15.66	19.74	17.65	15.26	21.47	16.35	16.26	7.18
9	20.17	14.53	16.04	11.16	14.71	8.86	5.64	2.67	9.35	4.18	2.45	3.88	5.92	12.52	27.81	21.08	23.17	10.66	18.41	6.61
10	20.35	13.21	11.42	8.69	6.77	5.09	5.47	1.25	4.18	1.30	0.81	0.84	1.70	4.96	24.97	16.79	17.00	6.91	6.86	6.80
11	15.38	7.30	6.89	4.90	5.23	4.00	3.41	1.04	2.68	1.02	0.28	0.54	0.86	2.07	11.01	9.95	18.15	8.76	6.04	3.22
12	9.12	6.11	5.35	3.57	4.34	2.64	1.97	0.72	1.41	0.22	0.05	0.87	0.52	0.80	5.01	4.75	7.67	6.70	6.37	4.48
13	4.80	4.16	4.46	2.95	3.70	2.24	1.77	0.27	0.51	0.45	0.00	0.14	0.20	0.45	2.59	2.08	2.28	1.82	2.15	2.57
14	2.93	2.17	3.36	2.00	2.69	2.21	1.16	0.33	0.52	0.60	0.00	0.07	0.04	0.18	0.78	0.33	1.17	1.39	1.04	1.93
15	2.39	2.13	3.00	1.92	2.96	2.34	1.18	0.45	0.16	0.34	0.00	0.11	0.04	0.06	0.38	0.59	0.82	0.13	0.54	0.50
16	0.71	1.27	1.67	0.91	1.11	1.43	0.67	0.30	0.25	0.17	0.00	0.00	0.00	0.06	0.19	0.37	0.35	0.26	0.21	0.12
17	0.19	0.98	0.66	0.79	0.96	0.79	0.53	0.03	0.18	0.00	0.00	0.00	0.00	0.00	0.19	0.10	0.34	0.04	0.08	0.00
18	0.00	0.18	0.38	0.29	0.43	0.37	0.23	0.03	0.05	0.00	0.00	0.00	0.00	0.00	0.17	0.05	0.22	0.00	0.04	0.11
19	0.00	0.05	0.05	0.06	0.11	0.09	0.09	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.04	0.00	0.00
20	0.00	0.00	0.03	0.00	0.00	0.10	0.11	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.04	0.00
unk1	0.26	0.23	0.88	0.07	0.03	0.46	0.00	0.32	0.14	0.00	0.00	0.11	0.00	0.00	0.04	0.00	0.08	0.08	0.54	0.52
Ages 0+	398.36	352.91	449.91	295.75	589.93	568.36	267.31	153.98	326.18	76.04	49.70	89.93	77.59	66.41	146.71	178.15	348.31	136.60	209.62	165.06
Ages 6+	191.92	183.91	161.11	95.41	117.04	85.75	116.37	87.12	171.87	41.19	29.89	60.16	66.19	58.88	115.41	95.66	123.71	68.30	102.68	119.20
Ages 9+	76.02	52.08	53.32	37.24	42.99	30.14	22.21	7.19	19.34	8.28	3.59	6.44	9.27	21.10	73.18	56.10	71.26	36.71	41.79	26.33
Ages 12+	20.13	17.05	18.97	12.49	16.29	12.21	7.69	2.23	3.14	1.78	0.05	1.19	0.79	1.56	9.38	8.28	12.93	10.38	10.49	9.70

Table 7. Abundance index at age (millions) for American plaice in NAFO Div. 3O from Canadian spring surveys from 1985 to 2004.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.08	0.37	7.72	2.00	2.76	0.31	0.10	3.66
2	0.00	0.58	5.38	0.69	0.00	5.45	0.00	4.09	1.30	0.00	0.00	35.87	5.79	8.83	22.96	24.10	47.02	26.61	5.19	11.26
3	8.60	13.38	16.95	15.85	20.37	10.62	24.86	28.66	3.39	0.94	0.89	63.90	33.35	7.29	22.70	92.19	87.85	49.52	42.95	17.01
4	24.12	39.55	57.58	22.47	51.19	113.04	39.65	30.20	40.67	9.53	6.22	27.81	36.80	39.43	14.11	47.07	49.56	97.60	46.99	41.71
5	56.50	34.46	132.85	26.43	55.67	197.91	170.49	25.73	39.93	38.68	15.08	35.55	28.12	44.71	36.73	22.08	18.72	33.76	94.61	35.92
6	44.06	36.82	124.23	34.62	96.36	110.17	110.46	76.76	52.76	46.67	26.80	55.64	40.99	26.40	49.12	30.61	18.95	28.85	35.39	80.28
7	52.08	39.37	70.48	25.50	101.47	82.08	65.32	38.93	68.61	28.66	19.75	50.51	40.32	34.39	26.02	31.75	32.26	34.53	22.26	24.63
8	47.24	28.92	45.95	24.51	47.05	39.90	28.07	24.72	42.46	21.87	14.04	24.61	26.23	40.22	28.86	21.84	24.57	27.75	21.53	17.22
9	35.38	22.23	35.93	18.52	29.60	27.41	18.21	12.92	17.32	9.69	7.40	8.69	10.60	29.01	39.91	19.25	17.98	18.93	11.21	7.67
10	34.70	18.02	24.03	16.56	15.36	16.74	10.70	9.18	9.37	2.72	2.25	3.02	3.66	11.70	20.99	19.62	12.82	11.01	4.32	4.10
11	24.27	11.65	12.70	11.09	7.72	9.99	8.40	5.53	3.72	2.10	1.25	1.32	1.42	6.26	9.09	12.52	8.91	7.05	3.69	2.37
12	13.96	10.20	9.14	8.99	7.96	9.23	4.78	3.24	2.42	1.04	0.28	1.33	1.22	1.84	4.65	3.47	5.37	4.86	2.67	1.80
13	5.58	5.74	6.33	5.68	4.56	5.87	2.89	2.43	0.98	0.64	0.03	0.35	0.34	1.00	2.58	1.70	2.45	1.84	1.62	1.23
14	5.06	2.33	3.84	4.10	2.11	4.20	2.98	1.06	0.68	0.35	0.04	0.18	0.14	0.27	0.93	0.48	1.47	0.48	0.89	0.57
15	4.00	2.30	3.03	2.36	2.19	2.04	1.89	1.78	0.49	0.13	0.00	0.10	0.13	0.41	0.74	0.63	1.10	0.40	0.49	0.29
16	1.59	0.92	1.83	2.31	1.82	1.71	1.03	1.25	0.55	0.09	0.00	0.17	0.13	0.05	0.59	0.19	0.61	0.44	0.34	0.20
17	0.31	0.72	0.97	0.48	1.07	1.22	0.58	0.24	0.36	0.00	0.00	0.00	0.00	0.00	0.32	0.29	0.38	0.17	0.16	0.00
18	0.03	0.18	0.46	0.51	0.43	0.55	0.44	0.51	0.09	0.00	0.00	0.00	0.00	0.00	0.25	0.14	0.15	0.10	0.09	0.01
19	0.00	0.05	0.20	0.03	0.03	0.22	0.24	0.13	0.08	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.04	0.00	0.19	0.00
20	0.29	0.00	0.00	0.03	0.03	0.00	0.08	0.13	0.05	0.00	0.00	0.00	0.00	0.00	0.04	0.11	0.04	0.00	0.00	0.00
unk1	0.06	0.00	0.00	0.66	0.27	0.00	2.46	0.87	0.39	0.04	0.00	0.05	0.00	0.14	0.03	0.04	0.71	0.24	0.00	0.29
Ages 0+	357.82	267.40	552.13	221.37	445.23	638.34	493.54	268.34	285.62	163.15	94.01	309.22	229.31	252.31	288.54	330.07	333.74	344.45	294.69	250.21
Ages 6+	268.54	179.43	339.10	155.28	317.74	311.33	256.07	178.79	199.94	113.96	71.83	145.93	125.16	151.55	184.28	142.60	127.12	136.41	104.86	140.35
Ages 9+	125.16	74.34	98.45	70.65	72.87	79.17	52.23	38.39	36.10	16.76	11.24	15.17	17.63	50.53	80.28	58.40	51.34	45.28	25.68	18.23
Ages 12+	30.81	22.43	25.79	24.48	20.19	25.03	14.91	10.77	5.70	2.26	0.35	2.13	1.95	3.57	10.29	7.01	11.62	8.29	6.46	4.09

Table 8. Abundance index at age (millions) for American plaice in NAFO Div. 3LNO from Canadian spring surveys from 1985 to 2004.

Age/Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	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	5.22	0.31	0.22	7.29
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	100.97	37.86	8.56	14.48
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	275.88	98.69	73.59	28.10
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	112.98	150.59	80.28	73.07
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	28.85	56.50	150.38	93.50
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	36.35	41.33	61.47	148.54
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	73.86	51.94	20.27	44.59
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	62.44	53.82	43.33	20.04
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	58.43	38.25	47.63	27.12
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	45.04	24.42	27.03	25.99
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	34.57	20.03	25.47	17.58
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	16.02	12.56	22.44	16.04
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	5.54	4.01	8.92	8.98
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	2.77	2.01	4.25	5.41
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	1.96	0.53	1.97	1.57
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	1.05	0.70	1.11	0.65
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	0.72	0.21	0.49	0.00
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	0.37	0.10	0.25	0.23
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	0.18	0.04	0.39	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	0.04	0.00	0.08	0.00
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	0.83	0.48	0.41	0.52
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	863.24	593.91	578.14	533.18
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	339.33	249.95	265.12	316.74
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	166.69	102.86	140.05	103.57
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	28.65	20.16	39.92	32.88
proportion 0 to 5	0.19	0.18	0.27	0.25	0.34	0.45	0.39	0.30	0.35	0.31	0.21	0.58	0.41	0.32	0.24	0.47	0.61	0.58	0.54	0.41
proportion 9+	0.22	0.18	0.13	0.17	0.15	0.13	0.12	0.11	0.09	0.09	0.15	0.04	0.07	0.18	0.31	0.22	0.19	0.17	0.24	0.19

Table 9. Biomass estimates (‘000 tons) of A. plaice by stratum and depth zone (m), from Canadian autumn surveys in Div. 3L in 1996-2004 (Campelen). (+) indicates biomass <50 tons. (-) means stratum not surveyed.

Biomass

Depth	Stratum	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
30-56	784	-	+	+	0.0	-	+	+	+	+	+
	Total	-	+	+	0.0	-	+	+	+	+	+
57-92	350	0.8	0.9	0.5	1.1	1.0	0.5	7.7	0.5	0.2	0.4
	363	3.1	2.0	1.4	2.1	1.9	2.3	3.7	0.7	0.3	0.5
	371	1.2	1.1	0.2	0.5	0.4	0.8	0.8	1.8	0.3	0.2
	372	1.4	1.6	1.5	0.3	1.7	0.6	2.5	0.9	1.1	0.4
	384	1.6	1.6	0.5	0.2	1.5	0.1	1.3	2.2	0.1	0.1
	785	-	+	+	+	-	+	0.1	0.1	0.1	+
	Total	8.1	7.2	4.0	4.2	6.5	4.3	16.1	6.2	2.2	1.5
93-183	328	3.0	1.6	0.9	0.5	2.0	0.8	1.6	7.3	0.7	1.1
	341	1.6	2.8	0.8	2.1	0.6	0.7	0.9	0.8	0.4	0.3
	342	0.6	+	0.4	0.2	-	0.2	0.1	0.1	0.2	0.1
	343	0.7	0.1	0.0	0.1	-	+	0.1	0.1	0.1	+
	348	3.1	1.8	1.3	1.5	1.4	0.4	0.6	1.0	0.6	1.0
	349	3.4	1.4	1.5	0.8	0.4	0.3	0.6	0.1	0.7	1.3
	364	2.8	3.6	2.8	5.2	1.2	1.8	2.9	2.1	1.0	0.7
	365	1.7	1.1	1.0	1.4	1.0	-	0.4	0.6	0.5	-
	370	2.0	6.3	1.3	4.6	3.9	1.1	2.2	3.7	0.8	-
	385	3.9	7.6	1.9	4.0	2.9	0.8	3.5	5.4	3.3	6.5
	390	1.7	1.6	2.2	3.3	2.1	0.7	3.1	1.0	0.5	0.6
	786	-	0.3	0.1	0.1	-	0.1	0.2	0.1	0.1	0.1
	787	-	0.4	0.5	0.1	-	0.1	0.1	0.1	0.1	0.1
	788	-	0.3	0.3	0.1	-	0.1	+	0.3	+	0.2
	790	-	0.2	0.2	+	-	+	+	+	+	0.1
	793	-	0.1	0.1	0.1	-	+	0.1	+	+	0.1
	794	-	+	0.1	+	-	-	+	+	+	+
	797	-	0.1	0.1	+	-	+	+	0.1	+	+
	799	-	0.1	0.1	+	-	+	+	0.4	+	+
	Total	24.5	29.4	15.6	24.1	15.5	7.1	16.4	23.2	9.1	12.1
184-274	344	1.0	1.1	0.1	0.5	0.5	0.4	0.6	0.7	0.3	0.8
	347	1.8	0.7	0.3	0.8	0.5	0.4	0.4	0.7	0.2	0.7
	366	1.6	1.2	0.5	0.8	1.7	0.5	0.3	0.4	0.7	-
	369	1.0	1.6	0.5	1.8	1.6	0.8	2.7	1.1	0.3	-
	386	1.8	2.6	1.0	0.9	1.2	0.4	1.3	2.3	0.9	-
	389	0.6	0.6	0.6	0.7	0.6	0.4	1.4	0.4	0.6	0.4
	391	0.4	0.2	0.2	0.2	0.3	+	0.1	0.1	0.4	0.1
	789	-	0.2	0.2	0.1	-	0.1	0.2	0.1	+	+
	791*	-	0.5	0.4	0.1	-	0.3	0.3	0.7	+	0.1
	795	-	+	0.2	0.4	-	+	+	0.1	0.2	0.2
	798	-	0.2	0.7	0.3	-	+	0.2	+	+	0.3
	Total	8.2	8.9	4.6	6.6	6.4	3.3	7.5	6.6	3.6	2.6
275-366	345	4.1	2.4	0.8	2.5	1.3	0.6	0.8	1.3	0.6	1.9
	346	2.8	1.1	2.2	1.7	1.7	0.4	0.9	0.8	0.5	1.4
	368	0.2	0.3	0.2	0.4	0.7	0.6	0.3	0.5	0.1	-
	387	0.4	0.7	0.7	0.2	1.8	1.0	0.4	0.2	0.5	-
	388	0.3	0.1	0.4	+	0.9	0.4	0.1	0.1	0.1	0.1
	392	+	+	0.2	0.1	0.5	0.2	0.1	0.1	0.1	+
	796	-	0.6	0.9	0.4	-	-	0.2	0.1	0.1	0.1
	800	-	-	-	0.2	-	0.2	0.3	0.3	0.2	0.2
	Total	7.8	5.2	5.5	5.5	6.9	3.4	3.1	3.4	2.2	3.8
367-549	729	+	+	0.2	0.1	0.7	1.6	0.4	+	0.1	0.1
	731	0.2	-	0.6	0.1	1.0	1.1	0.1	+	0.1	0.1
	733	0.2	0.2	0.5	0.6	0.3	1.0	0.6	0.3	0.4	0.2
	735	0.7	0.7	0.3	0.8	1.9	2.1	1.6	1.1	0.1	-
	792	-	0.2	1.9	0.3	-	0.2	0.6	0.1	0.2	0.1
	Total	1.1	1.1	3.6	1.9	3.9	6.0	3.3	1.5	0.9	0.5
550-731	730	+	0.0	0.5	0.1	0.2	0.4	0.9	0.1	+	0.5
	732	+	+	1.3	0.2	1.9	0.7	1.3	+	+	0.1
	734	0.0	0.2	0.3	0.1	0.1	0.1	+	+	0.0	-
	736	0.2	0.5	0.8	0.6	0.6	1.5	1.3	1.7	0.3	-
	Total	0.2	0.7	2.8	1.0	2.8	2.7	3.5	1.8	0.3	0.6
732-914	737	0.4	1.5	1.8	3.3	0.8	0.7	1.4	1.0	1.1	-
	741	-	1.0	2.3	1.7	0.1	0.0	0.0	0.6	0.1	-
	745	-	0.1	2.2	0.1	0.7	0.0	0.0	0.0	0.3	-
	748	-	1.4	0.7	0.0	1.1	0.0	0.0	+	1.1	-
	Total	0.4	4.0	7.0	5.1	2.7	0.7	1.4	1.6	2.6	-
915-1097	738	0.6	0.2	0.0	0.0	0.0	0.0	+	+	2.2	-
	742	-	0.1	0.0	0.0	+	0.0	0.0	0.0	3.5	-
	746	-	0.1	0.0	+	0.0	0.0	0.0	0.0	0.0	-
	749	-	+	0.2	0.0	-	0.0	0.0	0.0	+	-
	Total	0.6	0.4	0.2	+	+	0.0	+	+	5.7	-
1098-1280	739	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
	743	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
	747	-	0.0	0.0	0.1	+	0.0	0.0	0.0	0.0	-
	750	-	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
	Total	-	0.1	0.0	0.1	+	0.0	0.0	0.0	0.0	-
1281-1463	740	-	0.0	0.0	0.0	0.1	0.0	0.0	0.0	+	-
	744	-	0.5	0.0	0.1	-	0.0	0.0	0.0	0.0	-
	751	-	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-
	Total	-	0.5	0.0	0.1	0.1	0.0	0.0	0.0	+	-
Grand Total		50.9	57.5	43.3	48.6	44.8	27.5	51.3	44.3	26.4	21.0

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

Table 10. Biomass estimates ('000 tons) of A. plaice by stratum and depth zone (m), from Canadian autumn surveys in Div. 3N in 1996-2004 (Campelen). (+) indicates biomass <50 tons. (-) means stratum not surveyed.

		Biomass									
Depth	Stratum	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
≤ 56	375	1.9	1.1	3.9	5.2	0.6	1.7	0.6	9.8	2.3	2.3
	376	4.7	2.4	7.7	4.4	4.3	35.8	15.4	34.1	6.4	11.1
	Total	6.6	3.5	11.6	9.6	4.9	37.5	16.0	43.9	8.7	13.4
57-92	360	22.3	7.4	28.4	39.2	43.4	96.4	46.0	67.4	99.9	105.5
	361	3.5	4.1	3.3	2.1	1.8	3.9	2.3	9.2	3.1	7.2
	362	5.0	1.1	5.1	2.9	2.9	2.6	5.3	6.1	2.6	2.2
	373	1.8	0.2	2.3	1.7	4.2	1.7	6.9	2.9	1.9	0.5
	374	2.4	0.4	1.8	1.3	2.7	1.7	3.7	0.5	0.6	0.6
	383	-	0.3	0.5	0.8	0.8	+	0.5	0.5	0.1	+
	Total	35.0	13.5	41.4	48.0	55.8	106.3	64.7	86.6	108.2	116.0
93-183	359	2.2	0.3	3.8	11.6	9.8	32.2	4.0	17.5	7.1	9.2
	377	0.5	0.4	2.3	1.1	0.9	0.7	3.0	6.1	1.9	1.4
	382	0.3	0.3	0.8	6.1	2.7	1.0	3.5	2.2	0.0	0.2
	Total	3.0	1.0	6.9	18.8	13.4	33.9	10.5	25.8	9.0	10.9
184-274	358	0.8	0.2	0.4	0.3	0.3	0.6	1.0	0.2	0.0	0.4
	378	0.1	0.2	0.1	0.1	0.4	0.2	0.1	0.4	0.5	0.3
	381	0.1	0.4	0.2	0.1	0.3	0.3	0.3	0.1	0.5	0.6
	Total	1.0	0.8	0.7	0.5	1.0	1.1	1.4	0.7	1.0	1.3
275-366	357	0.1	0.1	0.0	+	-	+	+	+	0.0	+
	379	+	0.2	0.1	+	0.3	+	0.1	+	0.0	0.5
	380	0.1	0.2	0.1	0.1	0.7	0.3	0.1	+	0.1	0.1
	Total	0.2	0.5	0.2	0.1	1.0	0.3	0.2	+	0.1	0.6
367-549	723	+	+	0.0	0.1	+	+	+	0.0	0.0	+
	725	0.1	0.1	0.0	+	0.1	0.2	+	0.0	0.0	-
	727	+	0.1	0.1	0.1	1.5	0.4	0.1	0.3	0.3	0.2
	Total	0.1	0.2	0.2	0.2	1.6	0.6	0.1	0.3	0.3	0.2
550-731	724	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0	-	+
	726	+	0.3	0.1	+	+	+	+	0.0	0.0	+
	728	+	0.8	0.1	0.1	0.3	0.6	+	0.1	0.0	1.1
	Total	0.1	1.4	0.2	0.1	0.4	0.6	+	0.1	0.0	1.1
732-914	752	-	-	-	1.5	-	0.0	0.0	0.0	-	-
	756	-	-	-	0.1	-	-	0.0	0.0	-	-
	760	-	-	-	0.0	-	-	0.0	0.0	-	-
	Total				0.0	-	0.0	0.0	0.0	-	-
915-1097	753	-	-	-	+	-	0.0	0.0	0.0	-	-
	757	-	-	-	0.0	-	-	0.0	0.0	-	-
	761	-	-	-	0.0	-	-	0.0	0.0	-	-
	Total	-	-	-	+	-	0.0	0.0	0.0	-	-
1098-1280	754	-	-	-	0.0	-	0.0	0.0	0.0	-	-
	758	-	-	-	0.0	-	0.0	0.0	0.0	-	-
	762	-	-	-	-	-	-	0.0	0.0	-	-
	Total	-	-	-	0.0	-	0.0	0.0	0.0	-	-
1281-1463	755	-	-	-	0.0	-	0.0	0.0	0.0	-	-
	759	-	-	-	0.0	-	-	0.0	0.0	-	-
	763	-	-	-	-	-	-	0.0	0.0	-	-
	Total	-	-	-	0.0	-	0.0	0.0	0.0	-	-
Grand Total		46.0	20.9	61.0	77.3	78.1	180.3	92.9	157.4	127.4	143.4

Table 11. Biomass estimates ('000 tons) of A. plaice by stratum and depth zone (m), from Canadian spring surveys in Div. 3O in1996-2004 (Campelen). (+) indicates biomass <50 tons. (-) means stratum not surveyed.

Biomass

Depth	Stratum	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
57-92	330	7.7	0.8	5.5	5.9	5.4	5.3	5.9	4.5	4.0	5.6
	331	1.2	0.3	0.9	1.8	1.0	1.0	1.1	1.2	1.5	1.0
	338	6.6	3.3	6.4	3.4	3.8	2.1	4.4		6.7	5.3
	340	7.2	0.4	3.2	1.1	2.8	2.2	1.7	3.7	0.9	2.6
	351	1.7	0.9	5.2	3.3	2.9	6.4	4.3	2.9	3.7	3.9
	352	4.6	9.1	6.9	8.4	3.2	8.4	8.0	6.7	7.7	10.9
	353	5.6	14.4	14.8	19.3	10.3	14.5	13.9	11.2	14.4	24.6
	Total	34.6	29.2	42.9	43.2	29.4	39.9	39.3	30.2	38.8	54.0
93-183	329	3.2	1.5	2.7	5.0	6.6	8.0	7.6	3.7	1.6	5.2
	332	3.5	3.9	1.6	3.9	1.9	2.8	1.3	2.5	3.0	3.7
	337	2.4	25.3	2.5	1.5	1.4	1.8	0.5	1.3	0.6	1.1
	339	6.5	0.9	5.1	1.4	-	3.8	2.4	3.2	3.3	2.2
	354	4.5	8.0	2.4	3.7	27.0	3.8	2.7	3.0	21.1	1.9
	Total	20.1	39.6	14.4	15.5	36.9	20.2	14.5	13.7	29.6	14.1
184-274	333	+	-	+	+	0.1	+	0.0	0.1	+	+
	336	+	0.1	0.1	+	0.1	0.1	+	0.1	+	+
	355	0.2	5.4	0.1	+	0.3	+	0.1	0.1	+	0.1
	Total	0.2	5.5	0.2	+	0.5	0.1	0.1	0.3	+	0.1
275-366	334	0.0	-	+	+	+	0.0	0.0	0.0	0.0	+
	335	+	+	+	+	+	+	+	+	+	+
	356	0.0	0.1	+	+	+	+	0.0	0.0	+	+
	Total	+	0.1	0.1	+	0.1	0.0	0.0	0.0	0.0	+
367-549	717	0.0	-	+	0.0	+	+	+	0.0	0.0	0.0
	719	+	0.2	0.0	+	+	+	0.0	0.0	+	+
	721	+	0.6	0.0	0.0	+	+	0.0	0.0	0.0	0.0
	Total	+	0.8	+	+	+	+	0.0	0.0	0.0	0.0
550-731	718	0.0	-	0.0	+	0.0	0.0	0.0	0.0	0.0	0.0
	720	0.0	+	-	+	+	+	0.0	0.0	0.0	0.0
	722	0.0	+	0.0	0.0	+	0.0	0.0	0.0	0.0	0.0
	Total	0.0	+	0.0	+	+	+	0.0	0.0	0.0	0.0
732-914	764	-	-	-	0.0	-	-	0.0	0.0	-	-
	768	-	-	-	0.0	-	-	0.0	0.0	-	-
	772	-	-	-	0.0	-	-	-	0.0	0.0	-
	Total	-	-	-	0.0	-	-	0.0	0.0	0.0	-
915-1097	765	-	-	-	0.0	-	-	0.0	0.0	-	-
	769	-	-	-	0.0	-	-	0.0	0.0	-	-
	773	-	-	-	0.0	-	-	0.0	0.0	0.0	-
	Total	-	-	-	0.0	-	-	0.0	0.0	0.0	-
1098-1280	766	-	-	-	-	-	0.0	0.0	0.0	-	-
	770	-	-	-	-	-	0.0	0.0	0.0	-	-
	774	-	-	-	-	-	0.0	0.0	0.0	0.0	-
	Total	-	-	-	-	-	0.0	0.0	0.0	0.0	-
1281-1463	767	-	-	-	-	-	0.0	0.0	0.0	-	-
	771	-	-	-	-	-	0.0	0.0	0.0	-	-
	775	-	-	-	-	-	0.0	0.0	0.0	0.0	-
	Total	-	-	-	-	-	0.0	0.0	0.0	0.0	-
Grand Total		54.9	75.2	57.5	58.7	66.9	60.2	53.9	44.2	68.4	68.1

Table 12. Abundance index (millions) at age for A. plaice in Div. 3L from Canadian autumn surveys from 1990 to 2003.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.34	0.00	0.00	0.00	0.00
1	0.78	0.12	0.00	0.00	0.00	0.45	1.12	0.17	2.71	14.04	16.17	8.93	3.06	1.22
2	2.39	2.09	0.75	3.10	0.00	11.05	16.62	1.52	3.84	19.86	31.38	102.85	66.37	18.37
3	26.07	14.38	12.54	21.10	0.00	25.11	57.94	21.44	6.89	10.52	26.11	70.83	119.40	79.37
4	309.25	91.21	52.65	71.20	14.48	59.35	170.16	63.91	28.35	7.92	8.33	34.69	35.23	74.00
5	597.38	295.78	171.91	123.36	25.75	198.76	149.44	105.70	64.67	29.39	27.69	20.68	16.94	23.57
6	548.02	372.37	269.73	218.20	42.96	187.22	84.67	84.48	90.34	50.01	34.64	21.12	14.52	6.57
7	303.10	164.87	102.93	138.57	54.51	101.25	31.85	35.87	57.37	46.36	22.80	34.07	21.47	4.59
8	145.95	77.59	32.27	27.74	28.54	36.23	6.04	10.59	25.21	37.97	12.56	31.22	25.94	5.15
9	95.12	43.16	10.42	7.96	8.82	19.26	2.46	5.73	14.46	24.81	8.54	25.12	18.13	2.94
10	36.73	18.31	5.51	2.65	1.88	3.65	0.83	1.27	3.74	8.91	2.73	10.85	10.36	2.42
11	17.48	8.27	1.87	1.13	0.29	0.36	0.14	0.82	1.26	4.64	1.77	8.38	7.94	1.47
12	9.06	5.12	1.63	0.29	0.06	0.10	0.06	0.19	0.41	2.10	0.33	3.24	2.04	0.42
13	5.46	1.95	0.46	0.09	0.02	0.00	0.05	0.14	0.06	0.63	0.12	0.55	0.25	0.23
14	3.94	1.51	0.26	0.07	0.07	0.00	0.00	0.00	0.00	0.22	0.00	0.32	0.05	0.03
15	1.52	0.88	0.12	0.24	0.00	0.00	0.00	0.01	0.00	0.03	0.05	0.07	0.00	0.00
16	0.51	0.23	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.00	0.00	0.00
17	0.00	0.19	0.00	0.00	0.00	0.00	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	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	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	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	0.17	0.46	0.22	0.01
Ages 0+	2103.06	1098.06	663.07	615.76	177.38	644.47	521.37	332.31	299.68	257.85	193.46	373.37	341.93	220.35
Ages 6+	1166.89	694.48	425.23	397.01	137.15	348.06	126.10	139.08	192.86	175.70	83.59	134.94	100.71	23.81
Ages 9+	169.82	79.65	20.29	12.50	11.14	23.36	3.54	8.15	19.94	41.36	13.59	48.53	38.79	7.51
Ages 12+	20.50	9.90	2.49	0.75	0.15	0.10	0.11	0.33	0.48	3.00	0.56	4.17	2.35	0.68

Table 13. Abundance index (millions) at age for A. plaice in Div. 3N from Canadian autumn surveys from 1990 to 2003.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
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	0.05
1	2.34	0.82	5.84	0.00	0.00	1.97	0.11	1.81	1.93	46.35	20.47	8.24	1.79	7.76
2	40.24	84.64	78.12	1.90	0.00	17.53	1.70	1.34	1.38	69.91	158.97	19.95	25.17	6.13
3	134.78	193.91	161.07	52.32	16.51	15.09	4.08	8.06	0.86	11.42	264.89	130.79	50.82	41.45
4	295.80	284.75	130.72	283.60	65.29	16.40	3.31	14.95	11.62	2.61	53.91	42.75	190.06	95.11
5	169.59	288.82	130.17	135.26	96.33	27.70	9.34	8.33	18.51	7.83	22.80	5.07	63.36	196.95
6	30.73	72.35	131.01	67.76	43.86	62.43	13.60	29.97	11.44	12.62	38.99	17.05	11.46	39.70
7	9.34	19.55	53.35	74.65	23.60	15.42	12.65	41.44	25.97	12.16	59.27	27.83	26.02	19.89
8	3.83	10.86	12.33	23.64	14.33	9.03	4.55	24.91	35.67	29.10	53.08	22.08	29.25	13.36
9	6.62	10.35	8.02	8.78	7.29	6.09	1.82	8.00	37.85	25.04	39.83	12.52	17.22	7.71
10	3.31	7.24	3.71	4.70	1.97	2.21	0.79	3.60	8.76	18.08	39.29	9.91	13.31	6.11
11	2.53	5.98	2.20	2.20	0.78	0.72	0.36	1.64	3.54	9.46	19.14	13.06	16.11	5.38
12	1.71	3.26	1.74	1.65	1.00	0.71	0.27	0.43	1.21	7.39	5.20	6.16	11.43	4.00
13	1.60	4.31	1.45	0.88	0.42	0.25	0.00	0.49	0.61	2.75	2.49	1.39	6.35	1.25
14	1.53	2.50	1.23	0.78	0.69	0.02	0.00	0.34	0.52	0.58	0.68	0.58	0.54	0.33
15	1.49	1.45	0.33	0.66	0.29	0.00	0.06	0.15	0.08	0.06	0.34	0.27	1.05	0.27
16	1.59	1.05	0.46	0.34	0.00	0.00	0.00	0.04	0.24	0.36	0.00	0.11	1.06	0.18
17	0.47	0.48	0.29	0.10	0.00	0.00	0.00	0.00	0.13	0.30	0.34	0.12	0.00	0.00
18	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
19	0.00	0.04	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.08	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	0.00	0.00	0.00	0.05
unk	0.16	0.06	1.73	0.21	0.09	0.07	0.00	0.19	0.12	0.00	0.00	0.18	0.08	0.23
Ages 0+	707.78	992.55	723.78	659.44	272.46	175.66	52.65	145.70	160.43	256.19	779.70	318.07	465.09	445.89
Ages 6+	64.87	139.55	216.12	186.17	94.24	96.89	34.10	111.02	126.02	118.06	258.66	111.09	133.81	98.22
Ages 9+	20.97	36.80	19.43	20.11	12.44	10.01	3.30	14.70	52.93	64.19	107.32	44.12	67.08	25.27
Ages 12+	8.51	13.22	5.50	4.43	2.40	0.98	0.33	1.45	2.79	11.60	9.07	8.63	20.44	6.08

Table 14. Abundance index (millions) at age for A. plaice in Div. 3O from Canadian autumn surveys from 1990 to 2003.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.61	1.38	0.00	0.00	0.08	0.05
1	8.24	0.63	0.00	0.00	0.00	35.77	2.28	1.32	17.60	93.19	54.15	28.67	5.95	8.76
2	10.51	12.10	2.58	5.10	0.00	97.32	80.15	16.68	21.30	80.38	139.26	61.24	58.23	22.83
3	25.25	56.20	44.10	42.54	3.02	20.35	74.47	71.61	9.03	49.89	124.51	100.89	53.27	56.51
4	100.36	73.88	74.88	143.08	23.98	35.12	54.27	67.87	77.71	13.19	60.63	39.78	70.08	101.12
5	86.13	139.80	65.85	101.84	68.22	69.48	49.52	39.82	37.99	55.24	23.18	28.22	25.26	101.92
6	64.11	134.09	98.45	86.11	64.26	86.70	75.81	45.40	27.31	30.79	58.38	29.01	16.41	36.55
7	57.19	64.96	69.79	103.34	56.80	35.29	37.70	42.67	29.30	21.05	33.52	35.87	25.42	21.92
8	41.89	27.82	32.12	52.74	46.38	16.19	10.77	17.73	22.54	31.85	18.15	10.36	20.70	13.07
9	22.78	28.33	17.21	16.26	12.54	14.17	4.54	9.60	16.11	22.84	13.45	11.07	5.70	6.15
10	15.16	18.75	8.47	7.97	3.97	4.89	1.46	2.43	5.45	6.67	6.91	6.58	3.13	1.72
11	9.19	11.66	4.38	3.47	1.60	0.80	1.29	0.76	2.14	4.75	4.47	4.91	2.93	2.89
12	6.66	5.48	3.48	3.15	0.67	0.50	0.26	0.59	2.01	2.82	1.53	2.29	2.28	1.45
13	4.99	5.96	1.43	2.11	0.48	0.20	0.05	0.22	1.37	1.51	0.48	0.90	1.24	0.21
14	3.85	2.96	1.67	1.53	0.41	0.28	0.12	0.26	0.32	0.27	0.16	0.23	0.40	0.47
15	2.41	2.12	0.70	0.79	0.10	0.05	0.28	0.31	0.10	0.08	0.13	0.16	0.31	0.30
16	2.36	1.05	0.67	0.96	0.00	0.00	0.00	0.03	0.14	0.32	0.19	0.27	0.27	0.34
17	1.17	0.33	0.24	0.18	0.00	0.00	0.00	0.00	0.31	0.28	0.37	0.11	0.18	0.00
18	0.08	0.28	0.27	0.31	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.16	0.00	0.13
19	0.00	0.11	0.06	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
20	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
unk	0.17	1.31	0.13	1.45	0.00	0.00	0.00	0.37	0.81	1.20	0.09	0.10	0.00	0.25
Ages 0+	462.49	587.83	426.46	573.11	282.41	417.10	392.95	317.68	273.20	417.77	539.57	360.85	291.88	376.63
Ages 6+	231.82	303.91	238.92	279.10	187.20	159.07	132.27	120.01	107.15	123.29	137.74	101.94	79.02	85.20
Ages 9+	68.64	77.04	38.57	36.91	19.77	20.90	7.99	14.21	28.00	39.59	27.69	26.69	16.48	13.65
Ages 12+	21.51	18.30	8.51	9.22	1.65	1.04	0.71	1.42	4.31	5.33	2.86	4.12	4.73	2.89

Table 15. Abundance index (millions) at age for A. plaice in Div. 3LNO from Canadian autumn surveys from 1990 to 2003.

Age/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	1.72	0.00	0.00	0.08	0.10
1	11.36	1.56	5.84	0.00	0.00	38.19	3.52	3.30	22.23	153.58	90.79	45.83	10.80	17.74
2	53.13	98.83	81.45	10.10	0.00	125.90	98.46	19.54	26.52	170.15	329.62	184.04	149.76	47.32
3	186.10	264.49	217.71	115.95	19.53	60.55	136.49	101.12	16.78	71.84	415.51	302.51	223.50	177.32
4	705.41	449.84	258.26	497.88	103.74	110.88	227.74	146.72	117.67	23.72	122.87	117.22	295.37	270.23
5	853.10	724.40	367.93	360.45	190.30	295.94	208.29	153.85	121.17	92.46	73.67	53.98	105.56	322.44
6	642.86	578.81	499.19	372.08	151.09	336.35	174.08	159.85	129.09	93.43	132.01	67.18	42.39	82.82
7	369.63	249.38	226.08	316.57	134.91	151.96	82.20	119.98	112.64	79.57	115.59	97.77	72.91	46.40
8	191.67	116.27	76.71	104.12	89.25	61.45	21.37	53.22	83.42	98.92	83.79	63.67	75.89	31.57
9	124.52	81.84	35.65	33.00	28.65	39.52	8.82	23.33	68.42	72.70	61.82	48.71	41.05	16.80
10	55.20	44.30	17.68	15.32	7.82	10.75	3.08	7.30	17.95	33.66	48.92	27.34	26.80	10.24
11	29.20	25.92	8.45	6.80	2.67	1.88	1.78	3.22	6.94	18.85	25.38	26.36	26.98	9.74
12	17.43	13.86	6.85	5.10	1.72	1.31	0.59	1.21	3.63	12.31	7.07	11.69	15.76	5.87
13	12.05	12.21	3.33	3.08	0.92	0.45	0.10	0.85	2.04	4.89	3.09	2.83	7.85	1.68
14	9.32	6.98	3.15	2.38	1.17	0.31	0.12	0.60	0.84	1.08	0.84	1.13	0.99	0.82
15	5.42	4.45	1.15	1.68	0.40	0.05	0.35	0.48	0.18	0.16	0.53	0.50	1.36	0.57
16	4.45	2.34	1.17	1.36	0.00	0.00	0.00	0.08	0.38	0.71	0.24	0.38	1.33	0.52
17	1.64	1.00	0.52	0.27	0.00	0.00	0.00	0.00	0.45	0.58	0.71	0.23	0.18	0.00
18	0.21	0.42	0.27	0.31	0.00	0.00	0.00	0.00	0.05	0.12	0.00	0.16	0.00	0.13
19	0.00	0.17	0.06	0.22	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.04	0.00
20	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	0.05
unk	0.64	1.38	1.86	1.65	0.09	1.77	0.00	1.05	1.20	1.28	0.27	0.74	0.30	0.49
Ages 0+	3272.68	2677.06	1811.45	1846.66	732.15	1235.46	966.97	794.63	732.11	930.53	1512.46	1051.54	1098.61	1042.38
Ages 6+	1463.58	1137.94	880.27	862.28	418.59	604.02	292.47	370.11	426.03	417.05	479.99	347.97	313.54	207.23
Ages 9+	259.43	193.48	78.29	69.52	43.34	54.26	14.83	37.06	100.88	145.14	148.60	119.34	122.35	46.43
Ages 12+	50.51	41.42	16.50	14.40	4.21	2.12	1.15	3.20	7.57	19.93	12.49	16.93	27.51	9.65
proportion 0 to 5	0.55	0.57	0.51	0.53	0.43	0.51	0.70	0.53	0.42	0.55	0.68	0.67	0.71	0.80
proportion 9+	0.08	0.07	0.04	0.04	0.06	0.04	0.02	0.05	0.14	0.16	0.10	0.11	0.11	0.04

Table 16. Average estimates of total mortality for ages 1 to 16 for 5 year periods from Canadian spring surveys.

Years/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1985-89	-2.85	-2.22	-1.3	-0.66	-0.53	0.12	0.66	0.61	0.83	0.86	0.53	0.63	0.69	0.4	0.66	0.68
1990-94	-1.87	-1.23	-0.97	-0.35	0.32	0.62	0.92	0.98	1.21	1.11	1.36	1.51	1.46	0.9	0.98	1.42
1995-99	-3.49	-0.72	-1.06	-0.55	-0.23	-0.01	0.24	0.44	0.65	0.38	0.19	0.4	0.43	-0.55	0.15	-0.24
2000-03	-3.14	-0.86	0.27	0.37	-0.12	0.14	0.18	0.3	0.52	0.38	0.48	0.8	0.46	0.47	0.39	0.86

Table 17. Average estimates of total mortality for ages 1 to 16 for 5 year periods from Canada autumn surveys.

Years/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1990-94	-2.22	-0.85	-0.66	-0.05	0.21	0.67	1.03	1	1.17	1.31	0.93	1.13	0.86	1.62	0.67	1.49
1995-99	-1.51	-0.37	-0.49	-0.19	0.17	0.48	0.57	0.44	0.82	0.41	0.37	0.55	0.39	0.41	-0.02	-0.72
2000-02	-1.12	-0.09	0.37	0.28	0.19	0.04	0.57	0.82	0.94	0.54	0.93	1.19	1.44	0.29	0.11	0.39

Table 18. Likelihood ratio tests to evaluate reduction in number of variance parameters estimated. The alternative is a model with a variance parameter estimated for each survey*age combination (12 parameters). The null model has -2*RLL=150.9.

Null Model	Test Statistic	df	p-val
Survey vp	2.5239	8	0.9606
Common vp	5.4277	11	0.9087

Table 19. Canadian catches of A. plaice by Division, month and gear during 2003.

	3L		3N	3O		3LNO
	OT	Gillnet	OT	OT	Gillnet	Total
Jan			13	1		14
Feb			10		2	12
Mar	1		6	10	1	18
Apr	5		71	107		183
May	60		141	31		232
Jun	13		187			200
Jul	1	1	7	4		13
Aug	4		18	91		113
Sep			72	134		206
Oct	9		157	102		268
Nov			173	66		239
Dec			67	38		105
Total	**93**	**1**	**922**	**584**	**3**	**1603**

Summaries:

	GN=4	3L=94
	OT=1599	3N=922
		3O=587

By-catch in directed yellowtail fishery = 1501
By-catch in directed G.halibut fishery = 79
By-catch in other directed fisheries = 23

Table 20. Canadian catches of A. plaice by Division, month and gear during 2004.

	3L		3N	3O		3LNO
	OT	Gillnet	OT	OT	Gillnet	Total
Jan			5			5
Feb			10			10
Mar			27		2	29
Apr	9		162	10		181
May	11		169	263	2	445
Jun	29		137	11	2	179
Jul	4	1	7	6		18
Aug				5		5
Sep	30	4	1	49		84
Oct	16	4	14	34		68
Nov	127		36	3		166
Dec	98		7			105
Total	**324**	**9**	**575**	**381**	**6**	**1295**

Summaries:

	GN=15	3L=333
	OT=1280	3N=575
		3O=387

By-catch in directed yellowtail fishery = 1254
By-catch in directed G.halibut fishery = 29
By-catch in other directed fisheries = 12

Table 21. 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 2003. S.O.P. is catch numbers x mean weights

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						2003		3LNO
Age	3L	3N	3O	Total	Pctg	Mean len	Mean wgt	S.O.P. (t)
3		0.2	0.3	0.5	0.02	24.9	0.123	0.1
4		3	6	9	0.41	31.3	0.272	2.4
5	0.08	63	48	110	5.04	34.4	0.367	40.4
6	30	112	83	225	10.31	35.9	0.424	95.4
7	18	161	177	357	16.36	37.8	0.504	179.9
8	39	194	250	484	22.18	40.0	0.606	293.3
9	40	200	134	374	17.14	42.2	0.726	271.5
10	24	126	68	219	10.04	44.0	0.837	183.3
11	13	123	56	192	8.80	46.5	1.000	192.0
12	3	83	45	131	6.00	49.1	1.194	156.4
13	1	37	11	49	2.25	52.8	1.529	74.9
14	0.2	10	6	16	0.73	55.7	1.814	29.0
15	0.03	8	2	10	0.46	58.4	2.123	21.2
16		2	0.8	3	0.14	61.9	2.575	7.7
17		0.4	0.3	1	0.05	61.8	2.530	2.5
18		0.4	0.2	1	0.05	64.2	2.865	2.9
19		0.02	0.2	0.2	0.01	62.9	2.684	0.5
20		0.4		0.4	0.02	74.0	4.598	1.8
Total	168	1123	887.8	2182	100.00			1555
							catch=	1603

Table 22. 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 2004. S.O.P. is catch numbers x mean weights. An asterisk indicates catch of less than 500 fish.

						2004		3LNO
Age	3L	3N	3O	Total	Pctg	Mean len	Mean wgt	S.O.P. (t)
4	1	1	1	3	0.17	31.2	0.273	0.8
5	15	16	27	58	3.26	33.3	0.335	19.4
6	105	116	123	344	19.33	36.1	0.432	148.6
7	88	157	116	362	20.34	38.3	0.526	190.4
8	78	123	112	313	17.58	40.8	0.650	203.5
9	54	111	85	250	14.04	42.6	0.751	187.8
10	44	87	41	172	9.66	45.4	0.930	160.0
11	30	69	30	129	7.25	47.3	1.059	136.6
12	12	46	18	76	4.27	49.7	1.250	95.0
13	6	21	10	37	2.08	53.0	1.541	57.0
14	5	10	5	21	1.18	56.0	1.852	38.9
15	1	3	5	9	0.51	58.4	2.109	19.0
16		2	1	4	0.22	63.3	2.761	11.0
17		0.5	0.6	1	0.06	65.6	3.110	3.1
18		0.2	0.3	0.5	0.03	68.6	3.616	1.8
19		0.4	0.1	0.5	0.03	67.8	3.451	1.7
Total	439	763.1	575	1780	100.00			1275
							catch=	1295

Table 23. Catch at age for all fleets Div. 3LNO American plaice for 2003.

		Portugal				Russia				Spain			
	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.
2003	1	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0
	2	0	11.9	0.010	0	0	0.0	0.000	0	0	11.9	0.010	0
	3	6	21.7	0.078	0	0	21.9	0.080	0	2	22.0	0.082	0
	4	36	25.0	0.124	4	4	25.7	0.136	1	10	24.4	0.115	1
	5	733	30.0	0.228	167	69	29.5	0.217	15	275	30.3	0.234	65
	6	488	32.7	0.304	148	40	30.8	0.249	10	209	33.0	0.314	66
	7	455	35.0	0.382	174	38	32.8	0.307	12	232	35.3	0.392	91
	8	691	37.0	0.460	318	49	35.0	0.380	19	448	36.9	0.452	203
	9	940	40.3	0.610	573	47	39.9	0.588	28	592	39.6	0.576	340
	10	517	43.5	0.787	407	36	44.0	0.816	30	405	41.8	0.687	278
	11	457	45.3	0.898	411	34	46.4	0.975	33	296	43.6	0.793	234
	12	448	48.1	1.096	491	44	49.6	1.217	53	239	46.8	0.998	238
	13	193	50.7	1.303	251	30	53.0	1.514	45	79	49.5	1.201	95
	14	90	53.7	1.584	143	17	55.0	1.711	30	30	52.5	1.469	43
	15	36	57.6	1.999	72	12	58.0	2.040	25	10	57.6	1.992	20
	16	19	60.4	2.339	45	8	61.2	2.441	19	6	61.0	2.408	15
	17	7	61.2	2.434	17	3	61.1	2.426	7	2	60.8	2.390	4
	18	5	62.1	2.568	13	2	62.8	2.652	7	2	62.4	2.604	5
	19	0	68.5	3.550	0	0	68.5	3.550	1	0	68.5	3.550	0
	20	0	0.0	0.000	0	0	70.5	3.907	1	0	0.0	0.000	0
	Unk	3	64.8	2.945	9	4	67.5	3.379	12	4	57.3	1.958	7
Total					3244				346				1705

		Canada				Overall (LF data available)				Japan	Estonia	Lithuania
	Age	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	3LNO	
2003	1	0	0	0	0	0	0.0	0.000	0			
	2	0	0	0	0	1	11.9	0.010	0			
	3	1	24.9	0.123	0	9	22.0	0.081	1			
	4	9	31.3	0.272	2	59	26.2	0.146	9			
	5	110	34.4	0.367	40	1187	30.5	0.242	287			
	6	225	35.9	0.424	95	962	33.6	0.332	319			
	7	357	37.8	0.504	180	1082	36.1	0.422	456			
	8	484	40.0	0.606	293	1672	37.9	0.498	833			
	9	374	42.2	0.726	272	1952	40.6	0.621	1213			
	10	219	44.0	0.837	183	1177	43.1	0.763	898			
	11	192	46.5	1.000	192	979	45.2	0.889	870			
	12	131	49.1	1.194	156	861	48.0	1.090	939			
	13	49	52.8	1.529	75	351	51.0	1.329	466			
	14	16	55.7	1.814	29	153	53.9	1.600	245			
	15	10	58.4	2.123	21	69	57.8	2.023	139			
	16	3	61.9	2.575	8	36	60.8	2.393	86			
	17	1	61.8	2.530	3	12	61.2	2.434	30			
	18	1	64.2	2.865	3	10	62.5	2.623	28			
	19	0	62.9	2.684	1	1	66.5	3.212	2			
	20	0	74	4.598	2	1	72.4	4.268	3			
	Unk	0	0	0	0	10	63.4	2.750	28			
Total					1555				6851	71	59	16

		Total 3LNO Numbers@ age (000s)	Total SOP
	Age	3LNO	
2003	1	0	0
	2	1	0
	3	10	1
	4	60	9
	5	1212	293
	6	983	326
	7	1105	466
	8	1708	850
	9	1994	1238
	10	1202	917
	11	1000	889
	12	880	959
	13	358	476
	14	157	250
	15	70	142
	16	37	88
	17	13	31
	18	11	28
	19	1	2
	20	1	3
	Unk	10	29
Total			6997

Table 24. Catch at age for all fleets Div. 3LNO American plaice for 2004.

		Portugal				Russia				Spain			
	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.
2004	1	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0
	2	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0
	3	0	16.0	0.028	0	1	47.5	1.048	1	0	20.1	0.060	0
	4	39	27.8	0.177	7	15	47.2	1.028	15	11	27.0	0.160	2
	5	189	29.3	0.210	40	19	18.8	0.048	1	73	29.0	0.203	15
	6	1104	32.9	0.311	343	70	27.0	0.160	11	340	32.2	0.288	98
	7	525	35.6	0.402	211	34	29.4	0.214	7	268	33.8	0.338	90
	8	389	37.7	0.486	189	24	31.6	0.272	7	221	35.9	0.415	92
	9	464	41.3	0.660	306	30	37.9	0.498	15	319	39.7	0.577	184
	10	445	44.0	0.814	362	31	42.0	0.698	22	343	43.0	0.754	259
	11	263	46.4	0.973	256	22	43.5	0.782	17	310	44.2	0.826	256
	12	238	48.0	1.091	260	23	47.3	1.034	24	241	46.8	1.003	241
	13	123	50.7	1.304	160	18	51.6	1.387	25	135	50.5	1.288	174
	14	73	55.8	1.796	132	26	56.5	1.874	49	76	54.8	1.691	129
	15	25	61.7	2.514	62	11	63.4	2.740	29	44	63.4	2.748	120
	16	12	55.1	1.718	21	1	48.0	1.086	1	10	54.3	1.642	16
	17	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0
	18	3	60.5	2.349	6	1	60.5	2.349	3	1	62.3	2.589	3
	19	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0
	20	0	0.0	0.000	0	0	0.0	0.000	0	0	0.0	0.000	0
	Unk	1	64.5	2.904	3	1	69.4	3.713	5	13	68.2	3.494	44
Total					2357				233				1723

		Canada				Overall (LF data available)				Japan	Estonia	Ukraine
	Age	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	Mean len	Mean wgt	S.O.P.	3LNO	3LNO	
2004	1	0	0	0	0	0	0.0	0.000	0			
	2	0	0	0	0	0	0.0	0.000	0			
	3	0	0	0	0	1	40.6	0.622	1			
	4	3	31.2	0.273	1	68	34.6	0.365	25			
	5	58	33.3	0.335	19	339	29.7	0.221	75			
	6	344	36.1	0.432	149	1858	33.3	0.324	601			
	7	362	38.3	0.526	190	1190	36.0	0.420	499			
	8	313	40.8	0.650	203	947	38.4	0.518	491			
	9	250	42.6	0.751	188	1063	41.1	0.652	693			
	10	172	45.4	0.930	160	992	43.9	0.810	803			
	11	129	47.3	1.059	137	724	45.6	0.920	666			
	12	76	49.7	1.250	95	578	47.8	1.073	620			
	13	37	53.0	1.541	57	313	51.0	1.330	417			
	14	21	56.0	1.852	39	197	55.6	1.772	349			
	15	9	58.4	2.109	19	88	62.5	2.616	229			
	16	4	63.3	2.761	11	27	56.1	1.826	49			
	17	1	65.6	3.110	3	1	65.8	3.110	3			
	18	1	68.6	3.616	2	6	61.7	2.505	14			
	19	1	67.8	3.451	2	1	67.9	3.451	2			
	20	0	0	0	0	0	0.0	0.000	0			
	Unk	0	0	0	0	15	68.1	3.481	52			
Total					1275				5588	39	85	79

		Total 3LNO Numbers@ age (000s)	Total SOP
	Age	3LNO	
2004	1	0	0
	2	0	0
	3	1	1
	4	70	25
	5	346	76
	6	1899	614
	7	1216	510
	8	968	501
	9	1086	708
	10	1014	821
	11	740	681
	12	591	634
	13	320	426
	14	201	357
	15	90	234
	16	27	50
	17	1	3
	18	6	15
	19	1	2
	20	0	0
	Unk	15	53
Total			5712

Table 25. Numbers at age of American plaice from the Canadian spring RV survey (1985-2004) (a), Canadian autumn RV survey (1990- 2004) and survey by EU-Spain Div. 3NO from 1997-2004 (c).

a. Canadian spring survey

Spring	5	6	7	8	9	10	11	12	13	14
1985	263.811	454.551	595.652	389.798	208.007	140.238	84.297	45.199	22.716	13.977
1986	256.002	561.361	577.156	307.058	193.651	98.117	45.955	34.378	21.735	8.903
1987	460.214	747.454	656.206	398.314	184.639	101.101	41.829	33.798	19.928	11.136
1988	368.612	616.621	543.875	314.972	217.849	85.292	48.628	32.575	18.745	11.969
1989	336.143	551.765	470.169	273.725	187.637	74.679	39.843	27.071	16.825	9.650
1990	618.749	377.901	371.001	200.264	130.479	77.524	32.385	21.463	14.428	8.809
1991	398.190	364.155	180.205	112.916	67.544	35.190	22.260	13.356	7.224	5.529
1992	110.276	190.141	150.915	63.403	34.120	17.503	9.447	5.402	3.343	1.767
1993	138.054	180.137	160.064	89.449	32.226	16.510	7.626	4.264	1.783	1.325
1994	99.220	106.040	85.372	43.270	19.992	5.397	3.952	1.396	1.241	0.996
1995	41.914	57.524	59.883	49.937	27.484	8.339	2.664	0.539	0.093	0.035
1996	133.678	130.513	97.122	39.511	16.189	4.502	1.942	2.233	0.518	0.250
1997	65.278	84.402	79.311	48.718	18.944	6.047	2.678	1.819	0.562	0.174
1998	69.797	69.196	76.743	79.391	47.909	19.560	9.928	3.281	1.624	0.445
1999	66.741	104.510	104.869	111.518	107.309	65.322	30.521	13.021	6.508	1.894
2000	34.977	67.015	78.009	64.565	59.164	47.188	27.929	9.536	4.042	0.900
2001	28.853	36.351	73.856	62.438	58.427	45.042	34.569	16.018	5.541	2.771
2002	56.503	41.334	51.938	53.824	38.253	24.420	20.028	12.561	4.006	2.010
2003	150.376	61.473	20.270	43.327	47.626	27.035	25.469	22.441	8.924	4.254
2004	93.502	148.539	44.594	20.036	27.118	25.986	17.579	16.035	8.979	5.414

b. Canadian autumn survey

Fall	5	6	7	8	9	10	11	12	13	14
1990	853.098	642.862	369.626	191.668	124.519	55.198	29.201	17.43	12.054	9.316
1991	724.397	578.812	249.38	116.271	81.837	44.303	25.916	13.857	12.207	6.977
1992	367.927	499.192	226.077	76.712	35.653	17.68	8.451	6.848	3.333	3.151
1993	360.452	372.076	316.567	104.116	33	15.316	6.798	5.095	3.077	2.383
1994	190.297	151.085	134.913	89.251	28.649	7.822	2.667	1.723	0.919	1.168
1995	278.383	322.484	123.253	55.26	26.66	7.981	1.619	1.211	0.452	0.307
1996	208.293	174.079	82.201	21.365	8.82	3.077	1.781	0.587	0.098	0.116
1997	153.853	159.848	119.979	53.224	23.331	7.304	3.217	1.208	0.849	0.595
1998	121.174	129.09	112.639	83.42	68.417	17.949	6.944	3.63	2.041	0.844
1999	92.461	93.426	79.565	98.916	72.701	33.661	18.853	12.311	4.889	1.076
2000	73.671	132.006	115.595	83.788	61.816	48.924	25.380	7.069	3.091	0.843
2001	53.977	67.182	97.770	63.670	48.712	27.344	26.360	11.691	2.834	1.128
2002	105.561	42.394	72.913	75.893	41.055	26.800	26.982	15.759	7.846	0.989
2003	322.438	82.825	46.399	31.569	16.799	10.242	9.740	5.871	1.683	0.824

c. Survey by EU-Spain Div. 3NO

Year/Age	5	6	7	8	9	10	11	12	13	14
1997	5.483	16.952	25.554	15.782	5.602	1.637	0.709	0.571	0.187	0.016
1998	7.627	12.528	27.857	48.800	36.451	15.357	6.553	2.564	1.379	1.328
1999	10.564	32.892	31.214	40.285	60.375	51.005	22.890	11.380	6.570	2.900
2000	19.299	15.126	40.682	34.068	49.551	47.086	31.738	16.994	8.451	1.919
2001	5.454	9.476	28.139	27.634	29.066	21.669	24.807	10.269	2.758	1.359
2002	48.046	14.666	10.432	18.862	13.748	8.986	11.522	8.280	2.171	1.079
2003	254.477	67.910	26.119	18.560	19.191	7.994	8.288	10.630	4.272	1.967
2004	63.696	209.866	53.371	15.859	13.347	13.168	6.405	9.156	5.119	4.421

Table 26. Catch at age used in the virtual population analyses. Age 15 is a plus group.

catch	5	6	7	8	9	10	11	12	13	14	15
1960	44.7	318.8	841.8	1365.9	1738.3	2280.0	2540.0	3473.6	2752.5	2564.7	4588.8
1961	28.1	200.4	531.2	1230.9	2463.9	3174.2	2467.1	2272.0	3894.1	2579.4	5102.7
1962	62.4	445.1	657.2	1096.1	1184.5	1669.1	2432.4	2697.6	2409.5	3276.8	5958.8
1963	144.3	1029.7	1866.4	1434.1	1546.8	2237.6	3104.3	4174.8	3896.9	3851.9	5622.8
1964	268.6	1916.7	4997.5	3253.4	6174.5	8768.6	6960.2	6149.8	3245.9	3033.6	5552.8
1965	475.5	3157.0	7234.8	9305.9	7048.0	7562.9	5731.6	5790.8	5214.6	4333.2	6510.2
1966	1759.8	6271.7	10036.6	11132.5	9516.7	7266.3	7106.4	5667.6	5731.0	5009.8	8475.7
1967	433.9	3345.3	10834.8	7647.2	9504.5	13713.2	13672.7	14564.6	9495.5	6572.1	13247.8
1968	275.8	2342.3	4139.2	9785.9	11210.5	11631.0	7735.4	13842.2	8778.0	6339.2	8419.3
1969	690.3	2453.1	7875.0	14186.6	18181.9	12778.9	12735.3	10396.6	7053.8	5305.1	7666.2
1970	115.9	2172.2	2554.1	10006.8	13536.7	11286.1	11179.1	8248.5	5556.4	4661.3	9285.0
1971	1135.9	1749.6	8411.7	10457.6	15504.1	14164.8	10993.1	9026.5	5195.2	3720.6	7130.5
1972	578.2	2573.8	2367.8	7696.8	11301.7	12765.9	12718.0	10706.0	6783.8	4354.0	7033.1
1973	46.4	1079.1	6329.1	10518.1	13016.7	10042.3	9980.4	6762.3	6589.6	3733.8	7013.8
1974	354.0	5955.0	10475.0	10069.0	7768.0	9004.0	7086.0	4596.0	3809.0	2278.0	2164.0
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	19.4	134.9	543.7	719.4	409.4	149.3	93.5	56.8	26.2	1.4	1.4
1998	10.6	54.8	272.7	767.1	804.9	455.5	278.5	117.3	69.0	49.2	18.3
1999	26.0	174.5	268.4	579.2	1029.9	1079.4	627.4	278.1	125.6	39.6	38.3
2000	15.2	226.3	726.8	915.1	1442.7	1532.7	979.1	429.1	195.2	43.9	116.6
2001	111.0	331.5	1139.1	1413.3	1583.8	1595.5	1403.9	665.1	232.4	86.1	109.1
2002	312.2	308.3	609.9	1488.3	1431.7	1082.1	1059.3	605.2	203.5	62.4	60.6
2003	1212.4	983.0	1104.7	1707.9	1993.6	1201.8	999.9	879.7	358.2	156.5	131.8
2004	346.2	1898.8	1215.9	967.5	1086.1	1013.6	739.9	591.1	320.1	201.4	124.4

Table 27. Commercial weight-at-age for Div. 3LNO American plaice (Jan. 1).

	5	6	7	8	9	10	11	12	13	14	15+
1960	0.227	0.198	0.232	0.320	0.423	0.539	0.663	0.775	0.872	1.041	1.274
1961	0.227	0.198	0.232	0.320	0.423	0.539	0.663	0.775	0.872	1.041	1.274
1962	0.201	0.192	0.227	0.326	0.441	0.549	0.663	0.810	0.885	1.035	1.281
1963	0.179	0.218	0.229	0.326	0.447	0.569	0.668	0.790	0.876	1.021	1.357
1964	0.178	0.244	0.293	0.382	0.458	0.579	0.687	0.789	0.882	1.023	1.352
1965	0.182	0.246	0.323	0.434	0.554	0.620	0.727	0.813	0.891	1.076	1.420
1966	0.178	0.241	0.327	0.427	0.565	0.702	0.828	0.904	0.925	1.095	1.444
1967	0.182	0.245	0.326	0.416	0.552	0.710	0.817	1.003	1.025	1.161	1.563
1968	0.177	0.240	0.316	0.415	0.531	0.652	0.819	0.916	1.052	1.219	1.612
1969	0.182	0.246	0.303	0.379	0.504	0.635	0.740	0.914	1.020	1.227	1.623
1970	0.188	0.240	0.309	0.363	0.470	0.619	0.730	0.813	1.012	1.106	1.495
1971	0.181	0.233	0.302	0.365	0.443	0.573	0.725	0.850	0.933	1.087	1.354
1972	0.193	0.241	0.310	0.400	0.461	0.557	0.679	0.818	0.922	1.102	1.365
1973	0.190	0.226	0.285	0.376	0.501	0.576	0.716	0.885	1.038	1.117	1.466
1974	0.191	0.229	0.288	0.349	0.465	0.600	0.759	0.951	1.190	1.396	1.705
1975	0.192	0.231	0.296	0.376	0.484	0.627	0.789	0.994	1.208	1.439	1.817
1976	0.183	0.236	0.296	0.380	0.482	0.610	0.757	0.955	1.109	1.332	1.683
1977	0.187	0.234	0.305	0.386	0.504	0.612	0.761	0.919	1.119	1.271	1.631
1978	0.152	0.233	0.305	0.384	0.469	0.614	0.718	0.897	1.098	1.303	1.626
1979	0.167	0.251	0.312	0.400	0.476	0.558	0.657	0.847	1.061	1.414	1.681
1980	0.155	0.262	0.362	0.425	0.495	0.560	0.629	0.720	0.958	1.290	1.757
1981	0.175	0.281	0.365	0.430	0.484	0.538	0.560	0.663	0.765	0.993	1.446
1982	0.210	0.250	0.369	0.416	0.469	0.509	0.565	0.638	0.812	1.005	1.336
1983	0.290	0.313	0.375	0.447	0.530	0.582	0.610	0.671	0.842	1.091	1.502
1984	0.245	0.306	0.382	0.466	0.553	0.609	0.676	0.771	0.923	1.177	1.638
1985	0.222	0.298	0.367	0.425	0.503	0.601	0.679	0.849	1.120	1.463	1.921
1986	0.079	0.203	0.302	0.420	0.509	0.605	0.713	0.901	1.195	1.570	2.082
1987	0.219	0.189	0.278	0.349	0.452	0.599	0.749	0.925	1.175	1.500	2.017
1988	0.163	0.242	0.317	0.421	0.463	0.547	0.712	0.934	1.229	1.560	2.062
1989	0.065	0.178	0.257	0.365	0.467	0.545	0.696	0.909	1.223	1.572	2.070
1990	0.103	0.158	0.253	0.341	0.464	0.586	0.745	0.986	1.317	1.697	2.049
1991	0.168	0.215	0.321	0.408	0.520	0.661	0.845	1.104	1.478	1.880	2.224
1992	0.234	0.238	0.330	0.415	0.514	0.667	0.861	1.096	1.412	1.806	2.327
1993	0.088	0.228	0.279	0.358	0.453	0.568	0.730	0.926	1.205	1.466	2.008
1994	0.084	0.148	0.244	0.320	0.441	0.613	0.727	0.906	1.163	1.444	1.792
1995	0.166	0.168	0.252	0.341	0.515	0.742	1.102	1.226	1.313	1.849	1.776
1996	0.116	0.194	0.265	0.386	0.537	0.807	1.058	1.457	1.625	2.109	2.353
1997	0.162	0.189	0.266	0.379	0.542	0.745	0.953	1.187	1.531	1.924	2.613
1998	0.136	0.165	0.255	0.350	0.495	0.633	0.806	0.985	1.260	1.732	2.014
1999	0.153	0.212	0.227	0.316	0.411	0.553	0.673	0.860	1.064	1.356	1.809
2000	0.119	0.238	0.313	0.360	0.445	0.566	0.716	0.896	1.147	1.356	1.756
2001	0.185	0.231	0.345	0.426	0.468	0.584	0.750	0.932	1.164	1.391	1.789
2002	0.185	0.268	0.356	0.435	0.510	0.581	0.723	0.940	1.128	1.404	1.742
2003	0.209	0.273	0.369	0.444	0.541	0.637	0.760	0.943	1.201	1.407	1.883
2004	0.178	0.280	0.373	0.468	0.570	0.709	0.838	0.976	1.204	1.535	1.978
2005	0.191	0.274	0.366	0.449	0.540	0.642	0.773	0.953	1.177	1.449	1.868

Table 28. Estimated proportion mature-at-age for Div. 3LNO American plaice.

	5	6	7	8	9	10	11	12	13	14	15
1960	0.002	0.004	0.016	0.040	0.127	0.232	0.561	0.810	0.932	0.977	0.992
1961	0.003	0.005	0.014	0.046	0.105	0.333	0.564	0.810	0.932	0.977	0.992
1962	0.002	0.009	0.013	0.041	0.126	0.250	0.632	0.847	0.932	0.977	0.992
1963	0.001	0.006	0.027	0.037	0.117	0.298	0.486	0.855	0.960	0.977	0.992
1964	0.001	0.002	0.019	0.082	0.100	0.291	0.556	0.728	0.953	0.990	0.992
1965	0.005	0.004	0.009	0.056	0.218	0.240	0.559	0.787	0.884	0.986	0.998
1966	0.013	0.016	0.017	0.038	0.158	0.468	0.474	0.797	0.916	0.956	0.996
1967	0.005	0.033	0.050	0.063	0.141	0.371	0.735	0.720	0.924	0.970	0.984
1968	0.003	0.012	0.082	0.143	0.209	0.404	0.649	0.897	0.880	0.974	0.990
1969	0.003	0.008	0.031	0.190	0.346	0.509	0.737	0.853	0.965	0.955	0.991
1970	0.001	0.009	0.023	0.078	0.381	0.627	0.802	0.921	0.948	0.989	0.984
1971	0.000	0.002	0.025	0.062	0.183	0.618	0.842	0.941	0.980	0.983	0.996
1972	0.000	0.002	0.008	0.065	0.160	0.372	0.809	0.944	0.984	0.995	0.994
1973	0.000	0.001	0.007	0.026	0.158	0.353	0.610	0.918	0.982	0.996	0.999
1974	0.002	0.001	0.006	0.025	0.086	0.338	0.611	0.806	0.967	0.994	0.999
1975	0.002	0.006	0.007	0.025	0.085	0.248	0.581	0.818	0.917	0.987	0.998
1976	0.002	0.007	0.021	0.029	0.108	0.258	0.537	0.790	0.928	0.967	0.995
1977	0.001	0.007	0.023	0.070	0.121	0.359	0.563	0.803	0.911	0.974	0.987
1978	0.000	0.004	0.023	0.073	0.212	0.386	0.723	0.827	0.935	0.965	0.991
1979	0.001	0.001	0.015	0.070	0.209	0.491	0.742	0.924	0.947	0.980	0.987
1980	0.001	0.004	0.008	0.057	0.193	0.469	0.775	0.929	0.983	0.985	0.994
1981	0.002	0.006	0.024	0.047	0.192	0.432	0.747	0.925	0.984	0.996	0.996
1982	0.000	0.010	0.031	0.122	0.224	0.483	0.707	0.908	0.978	0.996	0.999
1983	0.001	0.003	0.051	0.152	0.442	0.628	0.786	0.884	0.971	0.994	0.999
1984	0.000	0.009	0.030	0.229	0.501	0.818	0.908	0.936	0.960	0.991	0.998
1985	0.004	0.005	0.064	0.228	0.620	0.850	0.962	0.983	0.983	0.987	0.997
1986	0.008	0.022	0.055	0.345	0.738	0.900	0.970	0.993	0.997	0.996	0.996
1987	0.004	0.036	0.112	0.424	0.803	0.964	0.980	0.994	0.999	1.000	0.999
1988	0.002	0.018	0.155	0.412	0.904	0.969	0.996	0.996	0.999	1.000	1.000
1989	0.002	0.010	0.077	0.474	0.796	0.992	0.996	1.000	0.999	1.000	1.000
1990	0.003	0.009	0.050	0.272	0.815	0.956	0.999	0.999	1.000	1.000	1.000
1991	0.006	0.013	0.052	0.209	0.626	0.956	0.992	1.000	1.000	1.000	1.000
1992	0.001	0.022	0.059	0.241	0.573	0.883	0.991	0.999	1.000	1.000	1.000
1993	0.005	0.008	0.082	0.232	0.647	0.872	0.971	0.998	1.000	1.000	1.000
1994	0.026	0.034	0.067	0.260	0.595	0.914	0.972	0.993	1.000	1.000	1.000
1995	0.075	0.106	0.195	0.377	0.579	0.877	0.984	0.994	0.999	1.000	1.000
1996	0.009	0.173	0.345	0.627	0.837	0.843	0.972	0.997	0.999	1.000	1.000
1997	0.004	0.040	0.349	0.701	0.921	0.977	0.954	0.994	1.000	1.000	1.000
1998	0.018	0.026	0.160	0.578	0.913	0.988	0.997	0.988	0.999	1.000	1.000
1999	0.015	0.067	0.137	0.463	0.779	0.979	0.998	1.000	0.997	1.000	1.000
2000	0.008	0.064	0.218	0.488	0.797	0.900	0.995	1.000	1.000	0.999	1.000
2001	0.016	0.044	0.234	0.520	0.851	0.947	0.959	0.999	1.000	1.000	1.000
2002	0.025	0.093	0.213	0.576	0.808	0.972	0.988	0.983	1.000	1.000	1.000
2003	0.053	0.129	0.387	0.614	0.858	0.942	0.995	0.997	0.993	1.000	1.000
2004	0.032	0.172	0.458	0.796	0.903	0.964	0.984	0.999	0.999	0.997	1.000
2005	0.032	0.131	0.437	0.827	0.960	0.982	0.992	0.996	1.000	1.000	0.999

Table 29. Results of ADAPT for Div. 3LNO American plaice using Canadian spring and autumn surveys (Run 1).

ORTHOGONALITY OFFSET..... 0.000630
MEAN SQUARE RESIDUALS 0.281991

Parameter	Est.	Std. Err.	Rel. Err.	Bias	Rel. Bias
N[2005 6]	2.97E+04	1.63E+04	0.549	4.51E+03	0.152
N[2005 7]	3.20E+04	1.07E+04	0.333	1.78E+03	0.056
N[2005 8]	7.32E+03	2.13E+03	0.291	2.86E+02	0.039
N[2005 9]	2.34E+03	7.51E+02	0.321	9.08E+01	0.039
N[2005 10]	2.57E+03	8.02E+02	0.312	8.93E+01	0.035
N[2005 11]	2.75E+03	8.36E+02	0.304	8.85E+01	0.032
N[2005 12]	2.13E+03	6.16E+02	0.289	6.14E+01	0.029
N[2005 13]	1.80E+03	5.05E+02	0.280	4.80E+01	0.027
N[2005 14]	1.45E+03	4.00E+02	0.276	3.82E+01	0.026
N[2005 15]	1.90E+03	3.74E+02	0.197	2.44E+01	0.013
q ID#[1]	7.63E-03	1.14E-03	0.149	6.07E-05	0.008
q ID#[2]	9.59E-03	1.41E-03	0.147	7.69E-05	0.008
q ID#[3]	9.92E-03	1.45E-03	0.146	8.26E-05	0.008
q ID#[4]	8.38E-03	1.23E-03	0.146	7.31E-05	0.009
q ID#[5]	7.46E-03	1.09E-03	0.147	6.85E-05	0.009
q ID#[6]	5.76E-03	8.48E-04	0.147	5.48E-05	0.010
q ID#[7]	5.92E-03	8.80E-04	0.149	5.89E-05	0.010
q ID#[8]	6.48E-03	9.80E-04	0.151	6.87E-05	0.011
q ID#[9]	6.06E-03	9.37E-04	0.155	6.67E-05	0.011
q ID#[10]	6.43E-03	9.95E-04	0.155	7.09E-05	0.011
q ID#[11]	2.84E-03	3.58E-04	0.126	1.58E-05	0.006
q ID#[12]	4.70E-03	5.78E-04	0.123	2.57E-05	0.005
q ID#[13]	5.81E-03	7.10E-04	0.122	3.34E-05	0.006
q ID#[14]	5.71E-03	6.97E-04	0.122	3.57E-05	0.006
q ID#[15]	5.42E-03	6.63E-04	0.122	3.57E-05	0.007
q ID#[16]	4.38E-03	5.37E-04	0.123	3.01E-05	0.007
q ID#[17]	4.33E-03	5.33E-04	0.123	3.06E-05	0.007
q ID#[18]	4.81E-03	5.99E-04	0.124	3.56E-05	0.007
q ID#[19]	4.54E-03	5.73E-04	0.126	3.48E-05	0.008
q ID#[20]	4.57E-03	5.87E-04	0.128	3.55E-05	0.008

Table 30. Bias adjusted population numbers (000 t) and fishing mortalities from VPA (Run 1).

Pop #s Bias	5	6	7	8	9	10	11	12	13	14	15
1960	299711	215972	141212	120313	90754	59599	48429	34426	21984	16264	29100
1961	283342	245342	176535	114854	97270	72734	46737	37358	25054	15519	30700
1962	265661	231955	200688	144055	92923	77414	56684	36039	28536	17006	30925
1963	270974	217448	189507	163716	116952	75009	61874	44214	27073	21190	30932
1964	260403	221724	177102	153470	132744	94355	59392	47856	32435	18655	34147
1965	288220	212957	179802	140486	122713	103109	69345	42353	33640	23629	35500
1966	250042	235545	171504	140679	106625	94109	77596	51606	29459	22846	38652
1967	223369	203128	187185	131359	105137	78715	70496	57122	37142	18963	38224
1968	176502	182487	163286	143478	100647	77508	52103	45415	33683	21879	29058
1969	174804	144258	147292	129950	108641	72298	52983	35691	24763	19692	28456
1970	164081	142494	115893	113486	93606	72579	47691	31933	19890	13941	27770
1971	204824	134234	114703	92579	83891	64445	49259	28997	18734	11295	21647
1972	242725	166670	108321	86323	66372	54731	40026	30446	15643	10674	17241
1973	292802	198204	134134	86548	63734	44166	33335	21363	15334	6744	12668
1974	280066	239684	161301	104107	61381	40472	27132	18336	11425	6663	6330
1975	293988	228979	190860	122612	76157	43255	25040	15849	10883	5939	6656
1976	276670	239899	184647	149745	91877	54031	28301	15376	8729	5515	5353
1977	232208	225762	192885	143252	105155	60285	33145	15701	7966	4437	4829
1978	218534	189236	178769	150030	106705	73876	39317	21271	9032	4396	4791
1979	200747	177513	150900	138065	113454	75878	47994	23261	11295	4125	3351
1980	193541	163222	139422	111344	96149	79395	50864	31382	15646	7589	4956
1981	188529	158220	130947	105551	79824	66011	52211	31495	18428	9455	7943
1982	191315	154215	129039	105180	82098	58213	43761	30561	15155	7327	5105
1983	189916	156611	125977	104010	81783	59152	36119	21673	12089	5332	3808
1984	191547	155383	127327	100385	79925	59437	41486	21937	11007	5790	3688
1985	187602	156782	126858	102878	79199	60158	39698	22404	9942	4483	4080
1986	159697	153328	127651	101730	79129	55208	35113	19489	10085	4466	3649
1987	142180	126770	116777	93191	71998	52747	32735	16003	6715	2973	2387
1988	162335	114387	99330	88670	66481	44680	27371	16581	6859	2751	2289
1989	190649	130282	90751	76945	66041	45313	27299	14108	8165	3206	2232
1990	185846	102590	67970	44814	38027	28268	17451	9830	4628	3292	1909
1991	92522	97969	54577	36617	22908	15909	10205	5509	3104	1468	1952
1992	63344	49849	48520	26227	14597	7671	4522	2784	1557	1223	1380
1993	55164	37172	28567	26600	12883	5893	2913	1546	989	492	730
1994	61951	31582	19081	10268	7159	3393	1035	393	196	201	102
1995	58235	33205	15701	7196	2773	2168	1446	262	112	29	116
1996	39400	34202	19307	8899	3984	1479	1227	841	151	66	85
1997	24441	23054	19569	10627	4896	2185	831	714	489	87	87
1998	22453	19993	18753	15531	8052	3639	1654	596	533	377	140
1999	21926	18373	16319	15107	12023	5866	2569	1104	383	375	362
2000	14278	17928	14885	13119	11846	8915	3832	1539	654	201	533
2001	9295	11676	14474	11531	9915	8399	5919	2257	875	360	456
2002	16485	7510	9260	10823	8167	6692	5441	3584	1251	508	493
2003	48966	13215	5870	7031	7520	5398	4504	3501	2390	841	708
2004	31112	38996	9932	3812	4222	4366	3339	2789	2076	1634	1009
2005	29284	25160	30213	7036	2252	2481	2664	2068	1752	1412	1871

F Bias Adj(a	5	6	7	8	9	10	11	12	13	14	15
1960	0.000	0.002	0.007	0.013	0.021	0.043	0.060	0.118	0.148	0.190	0.190
1961	0.000	0.001	0.003	0.012	0.028	0.049	0.060	0.069	0.187	0.202	0.202
1962	0.000	0.002	0.004	0.008	0.014	0.024	0.048	0.086	0.098	0.238	0.238
1963	0.001	0.005	0.011	0.010	0.015	0.033	0.057	0.110	0.172	0.223	0.223
1964	0.001	0.010	0.032	0.024	0.053	0.108	0.138	0.152	0.117	0.197	0.197
1965	0.002	0.016	0.045	0.076	0.065	0.084	0.095	0.163	0.187	0.225	0.225
1966	0.008	0.030	0.067	0.091	0.103	0.089	0.106	0.129	0.241	0.276	0.276
1967	0.002	0.018	0.066	0.066	0.105	0.213	0.240	0.328	0.329	0.477	0.477
1968	0.002	0.014	0.028	0.078	0.131	0.180	0.178	0.407	0.337	0.382	0.382
1969	0.004	0.019	0.061	0.128	0.203	0.216	0.306	0.385	0.374	0.350	0.350
1970	0.001	0.017	0.025	0.102	0.173	0.188	0.298	0.333	0.366	0.456	0.456
1971	0.006	0.014	0.084	0.133	0.227	0.276	0.281	0.417	0.363	0.447	0.447
1972	0.003	0.017	0.024	0.103	0.207	0.296	0.428	0.486	0.641	0.590	0.590
1973	0.000	0.006	0.053	0.144	0.254	0.287	0.398	0.426	0.633	0.921	0.921
1974	0.001	0.028	0.074	0.113	0.150	0.280	0.338	0.322	0.454	0.469	0.469
1975	0.003	0.015	0.043	0.089	0.143	0.224	0.288	0.396	0.480	0.656	0.656
1976	0.003	0.018	0.054	0.154	0.221	0.289	0.389	0.458	0.477	0.611	0.611
1977	0.005	0.033	0.051	0.095	0.153	0.227	0.244	0.353	0.394	0.460	0.460
1978	0.008	0.026	0.058	0.079	0.141	0.231	0.325	0.433	0.584	0.809	0.809
1979	0.007	0.042	0.104	0.162	0.157	0.200	0.225	0.197	0.198	0.211	0.211
1980	0.002	0.020	0.078	0.133	0.176	0.219	0.279	0.332	0.304	0.257	0.257
1981	0.001	0.004	0.019	0.051	0.116	0.211	0.336	0.531	0.722	1.026	1.026
1982	0.000	0.002	0.016	0.052	0.128	0.277	0.503	0.727	0.845	0.983	0.983
1983	0.001	0.007	0.027	0.063	0.119	0.155	0.299	0.477	0.536	0.708	0.708
1984	0.000	0.003	0.013	0.037	0.084	0.204	0.416	0.591	0.698	0.643	0.643
1985	0.002	0.006	0.021	0.062	0.161	0.338	0.511	0.598	0.600	0.653	0.653
1986	0.031	0.072	0.115	0.146	0.206	0.323	0.586	0.865	1.021	1.024	1.024
1987	0.018	0.044	0.075	0.138	0.277	0.456	0.480	0.647	0.693	0.651	0.651
1988	0.020	0.031	0.055	0.095	0.183	0.293	0.463	0.508	0.560	0.614	0.614
1989	0.090	0.121	0.176	0.175	0.319	0.424	0.491	0.585	0.378	0.517	0.517
1990	0.110	0.101	0.089	0.141	0.341	0.489	0.623	0.623	0.618	0.450	0.450
1991	0.088	0.173	0.203	0.390	0.564	0.728	0.769	0.733	0.402	0.377	0.377
1992	0.003	0.027	0.071	0.181	0.377	0.438	0.544	0.504	0.623	0.741	0.741
1993	0.028	0.137	0.493	0.782	0.804	1.209	1.473	1.533	1.066	1.957	1.957
1994	0.094	0.169	0.445	0.779	0.665	0.323	0.845	0.728	1.379	0.423	0.423
1995	0.002	0.012	0.038	0.061	0.099	0.040	0.012	0.020	0.001	0.004	0.004
1996	0.006	0.028	0.067	0.068	0.070	0.046	0.011	0.012	0.020	0.020	0.020
1997	0.001	0.006	0.031	0.078	0.097	0.078	0.132	0.092	0.061	0.018	0.018
1998	0.001	0.003	0.016	0.056	0.117	0.148	0.205	0.244	0.154	0.155	0.155
1999	0.001	0.011	0.018	0.043	0.099	0.226	0.312	0.324	0.445	0.124	0.124
2000	0.001	0.014	0.055	0.080	0.144	0.210	0.329	0.365	0.396	0.275	0.275
2001	0.013	0.032	0.091	0.145	0.193	0.234	0.302	0.390	0.344	0.304	0.304
2002	0.021	0.046	0.075	0.164	0.214	0.196	0.241	0.205	0.197	0.145	0.145
2003	0.028	0.086	0.232	0.310	0.344	0.280	0.279	0.323	0.180	0.229	0.229
2004	0.012	0.055	0.145	0.326	0.332	0.294	0.279	0.265	0.186	0.146	0.146

Table 31. Results of ADAPT for Div. 3LNO American plaice using Canadian spring and autumn surveys (Run 2, survey by EU-Spain included).

ORTHOGONALITY OFFSET 0.002382
MEAN SQUARED RESIDUALS 0.362801

Parameter	Est.	Std. Err.	Re. Err.	Bias	Rel. Bias
N[2005 6]	4.61E+04	2.08E+04	0.451	4.84E+03	0.105
N[2005 7]	6.52E+04	1.91E+04	0.292	2.96E+03	0.045
N[2005 8]	1.28E+04	3.19E+03	0.25	4.11E+02	0.032
N[2005 9]	3.01E+03	8.27E+02	0.274	9.69E+01	0.032
N[2005 10]	2.58E+03	7.41E+02	0.287	8.24E+01	0.032
N[2005 11]	2.54E+03	7.36E+02	0.29	7.92E+01	0.031
N[2005 12]	1.73E+03	5.03E+02	0.291	5.24E+01	0.03
N[2005 13]	1.39E+03	4.03E+02	0.29	4.07E+01	0.029
N[2005 14]	1.30E+03	3.54E+02	0.271	3.50E+01	0.027
N[2005 15]	2.07E+03	4.18E+02	0.202	2.95E+01	0.014
q ID#[1]	7.04E-0.3	1.18E-0.3	0.167	7.42E-0.5	0.011
q ID#[2]	9.26E-0.3	1.53E-0.3	0.166	9.80E-0.5	0.011
q ID#[3]	9.89E-0.3	1.63E-0.3	0.165	1.07E-0.4	0.011
q ID#[4]	8.47E-0.3	1.40E-0.3	0.165	9.48E-0.5	0.011
q ID#[5]	7.56E-0.3	1.25E-0.3	0.166	8.79E-0.5	0.012
q ID#[6]	5.83E-0.3	9.71E-0.4	0.166	7.01E-0.5	0.012
q ID#[7]	5.93E-0.3	9.96E-0.4	0.168	7.45E-0.5	0.013
q ID#[8]	6.38E-0.3	1.09E-0.3	0.171	8.52E-0.5	0.013
q ID#[9]	5.89E-0.3	1.02E-0.3	0.174	8.18E-0.5	0.014
q ID#[10]	6.25E-0.3	1.09E-0.3	0.174	8.69E-0.5	0.014
q ID#[11]	2.62E-0.3	3.69E-0.4	0.141	1.90E-0.5	0.007
q ID#[12]	4.43E-0.3	6.13E-0.4	0.139	3.19E-0.5	0.007
q ID#[13]	5.65E-0.3	7.78E-0.4	0.138	4.18E-0.5	0.007
q ID#[14]	5.69E-0.3	7.83E-0.4	0.138	4.43E-0.5	0.008
q ID#[15]	5.47E-0.3	7.55E-0.4	0.138	4.47E-0.5	0.008
q ID#[16]	4.43E-0.3	6.14E-0.4	0.138	3.76E-0.5	0.008
q ID#[17]	4.37E-0.3	6.08E-0.4	0.139	3.86E-0.5	0.009
q ID#[18]	4.82E-0.3	6.78E-0.4	0.141	4.47E-0.5	0.009
q ID#[19]	4.48E-0.3	6.38E-0.4	0.142	4.29E-0.5	0.01
q ID#[20]	4.47E-0.3	6.45E-0.4	0.144	4.35E-0.5	0.01
q ID#[21]	8.69E-0.4	2.02E-0.4	0.233	1.92E-0.5	0.022
q ID#[22]	1.47E-0.3	3.30E-0.4	0.225	3.00E-0.5	0.02
q ID#[23]	2.33E-0.3	5.19E-0.4	0.222	4.77E-0.5	0.02
q ID#[24]	2.92E-0.3	6.48E-0.4	0.222	6.22E-0.5	0.021
q ID#[25]	3.52E-0.3	7.83E-0.4	0.222	7.84E-0.5	0.022
q ID#[26]	3.30E-0.3	7.36E-0.4	0.223	7.62E-0.5	0.023
q ID#[27]	3.95E-0.3	8.88E-0.4	0.225	9.52E-0.5	0.024
q ID#[28]	4.80E-0.3	1.10E-0.3	0.228	1.23E-0.4	0.026
q ID#[29]	3.54E-0.3	8.25E-0.4	0.233	9.47E-0.5	0.027
q ID#[30]	3.03E-0.3	7.22E-0.4	0.238	8.41E-0.5	0.028

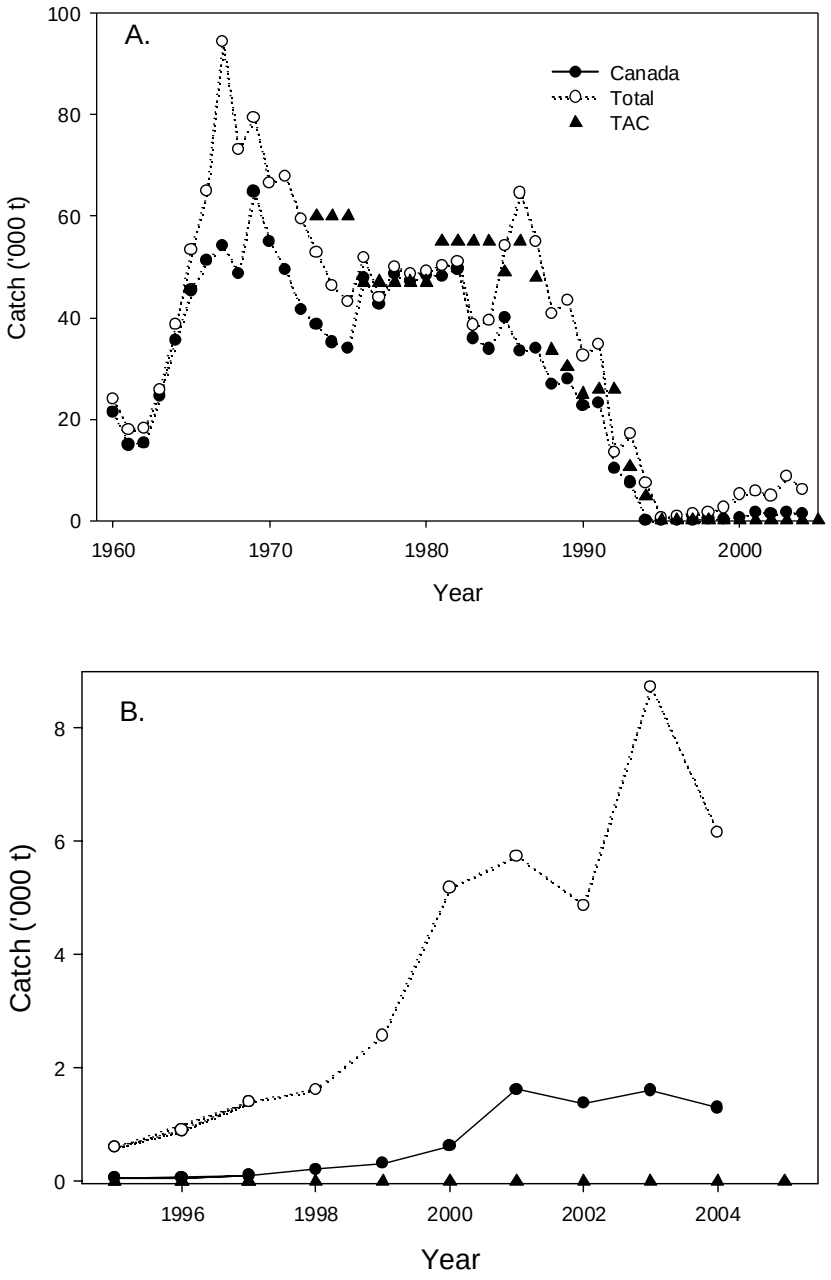


Fig. 1. American plaice catches ('000 tons) from 1960-2004 (A) and since the moratorium (1995-2004) (B).

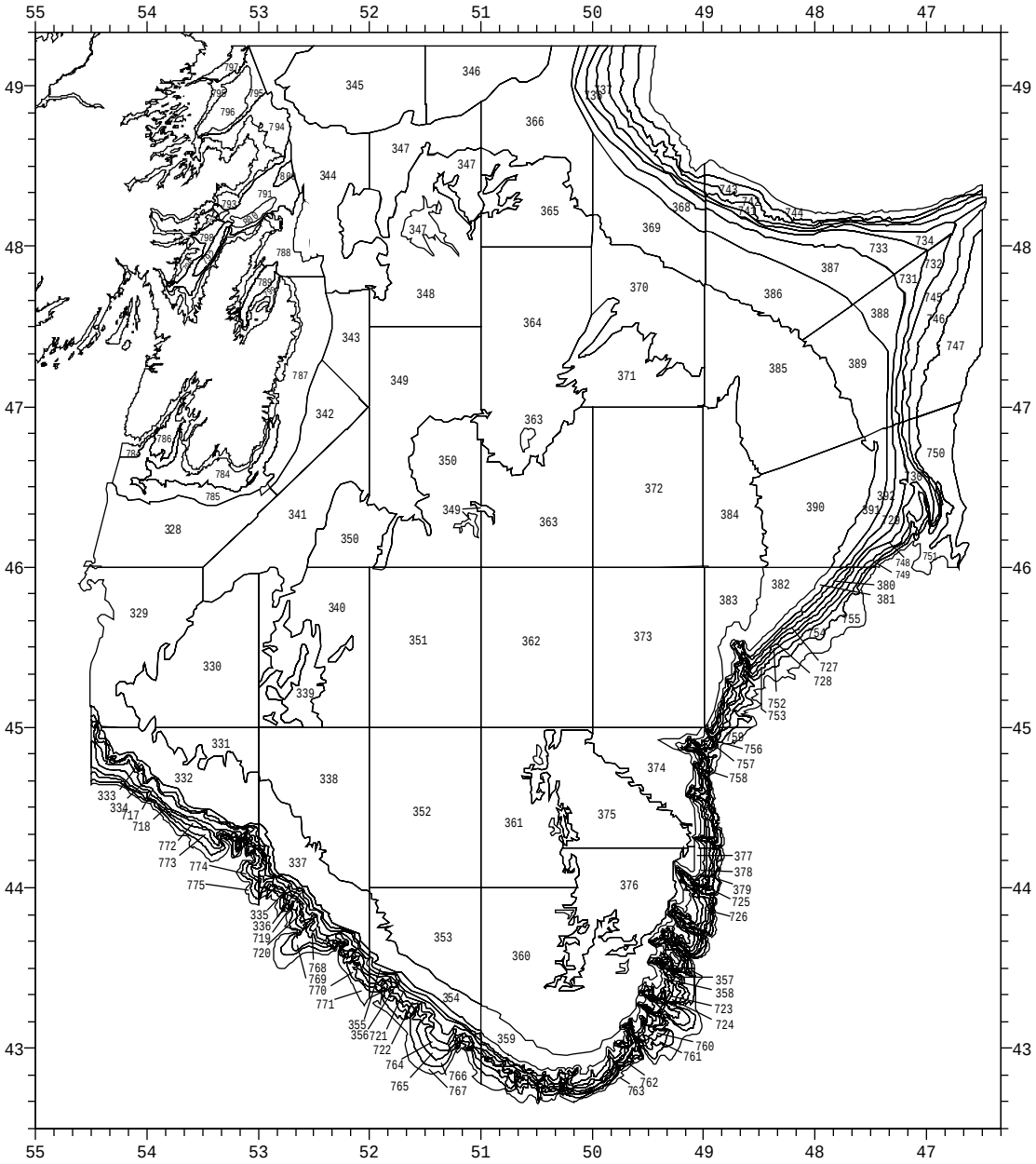


Fig. 2. Stratification scheme used in Canadian research vessel surveys of Div. 3LNO.

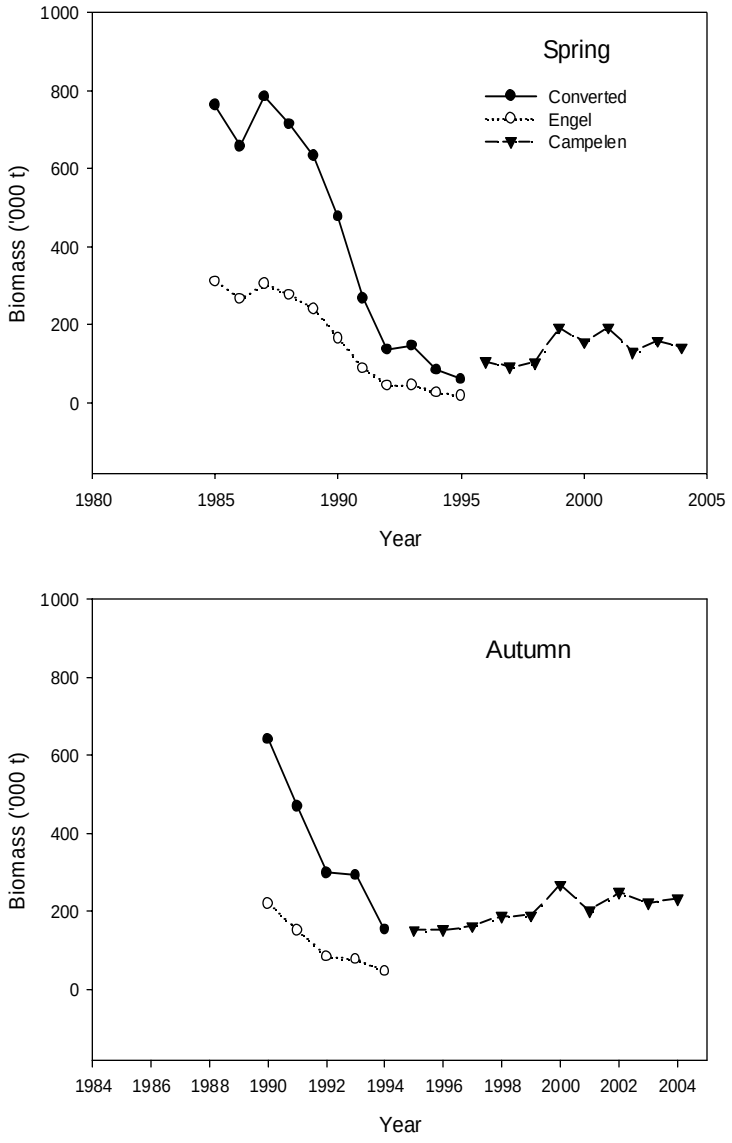


Fig. 3. Biomass ('000 tons) of American plaice from spring and autumn Canadian surveys in Div. 3LNO combined.

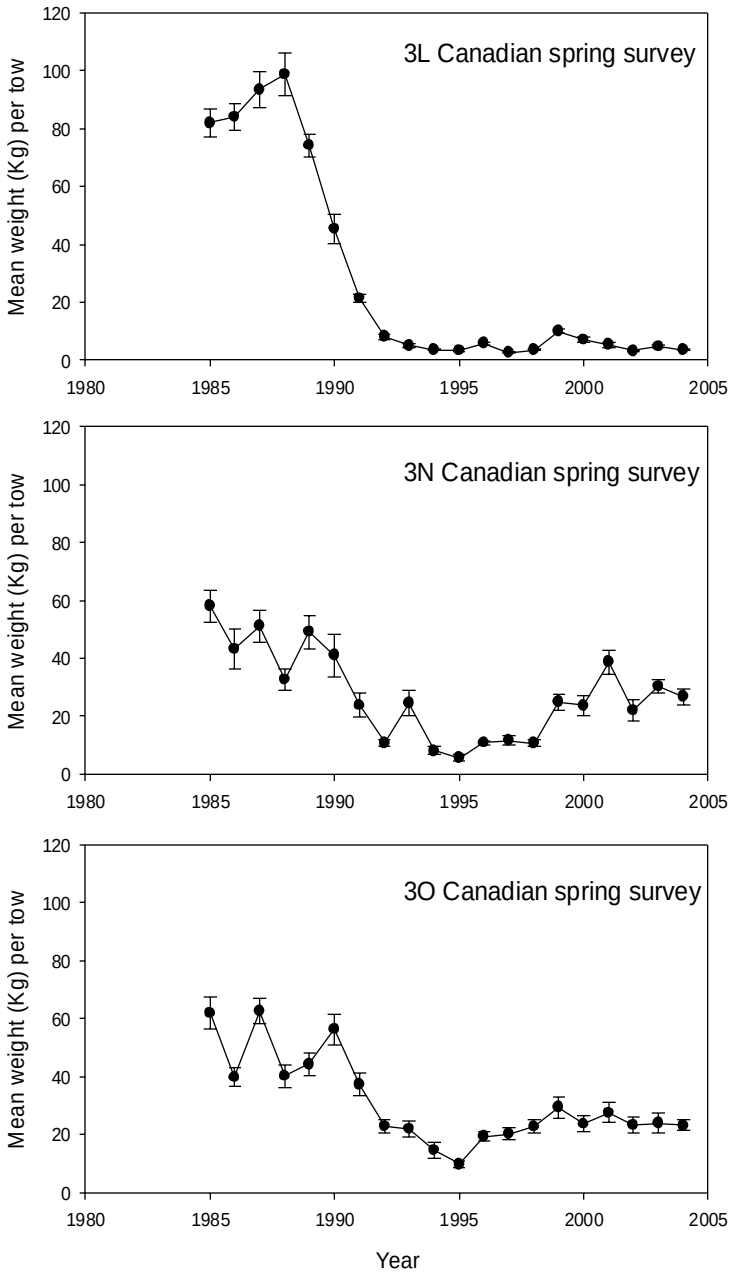
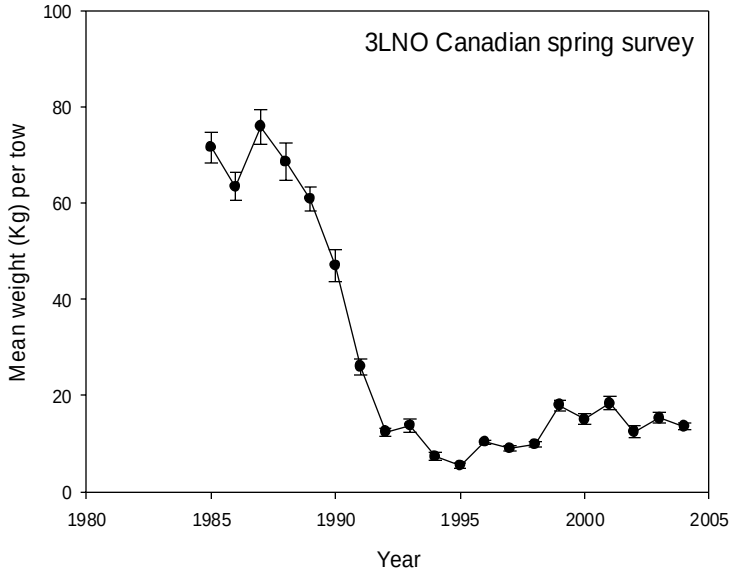


Fig. 4. Mean (± Std. Dev.) weight per tow (kg) of American plaice from Canadian spring surveys of Div. 3L, 3N and 3O.



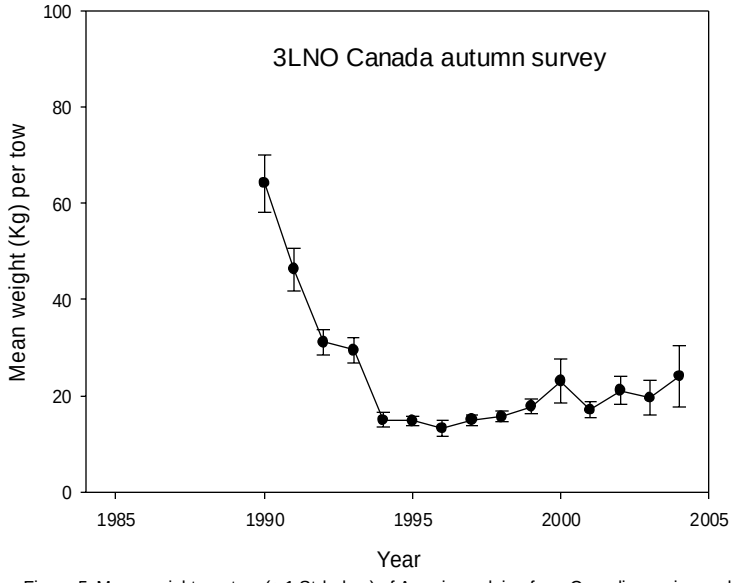


Fig. 5. Mean weight per tow (± Std. Dev.) of American plaice from Canadian spring and autumn surveys of Div. 3LNO combined.

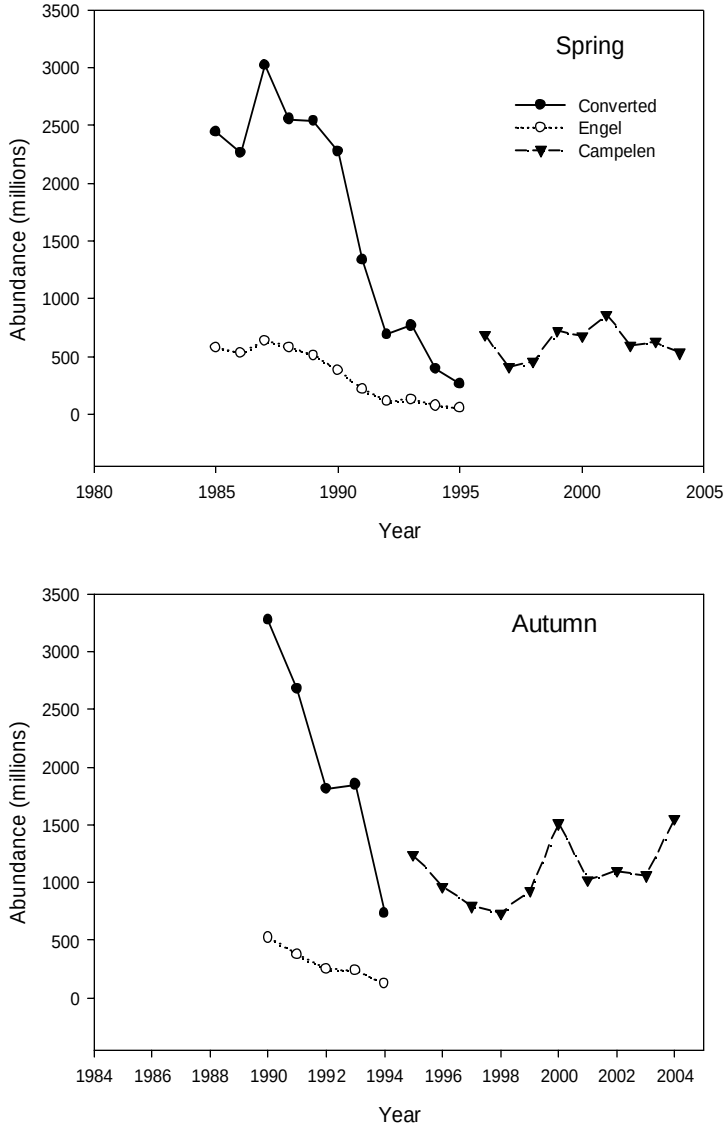


Fig. 6. Abundance (millions) of American plaice from spring and autumn Canadian surveys in Div. 3LNO combined.

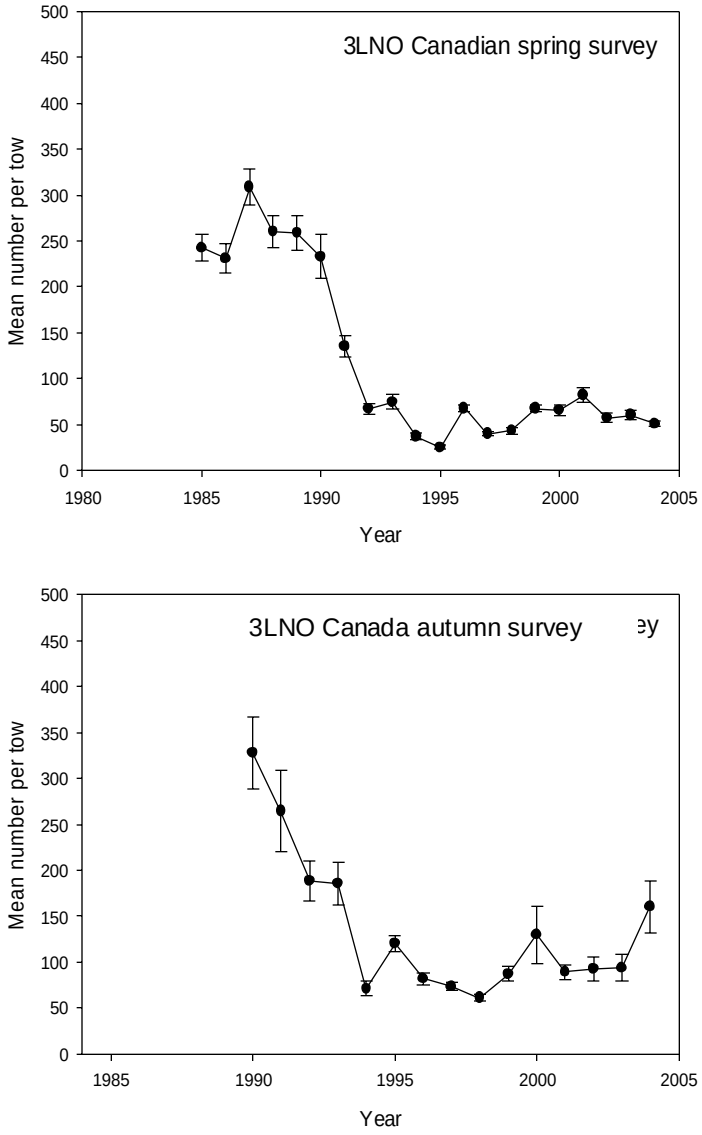


Fig. 7. Mean (± Std. Dev.) number per tow of American plaice from Canadian spring and autumn surveys of Div. 3LNO combined.

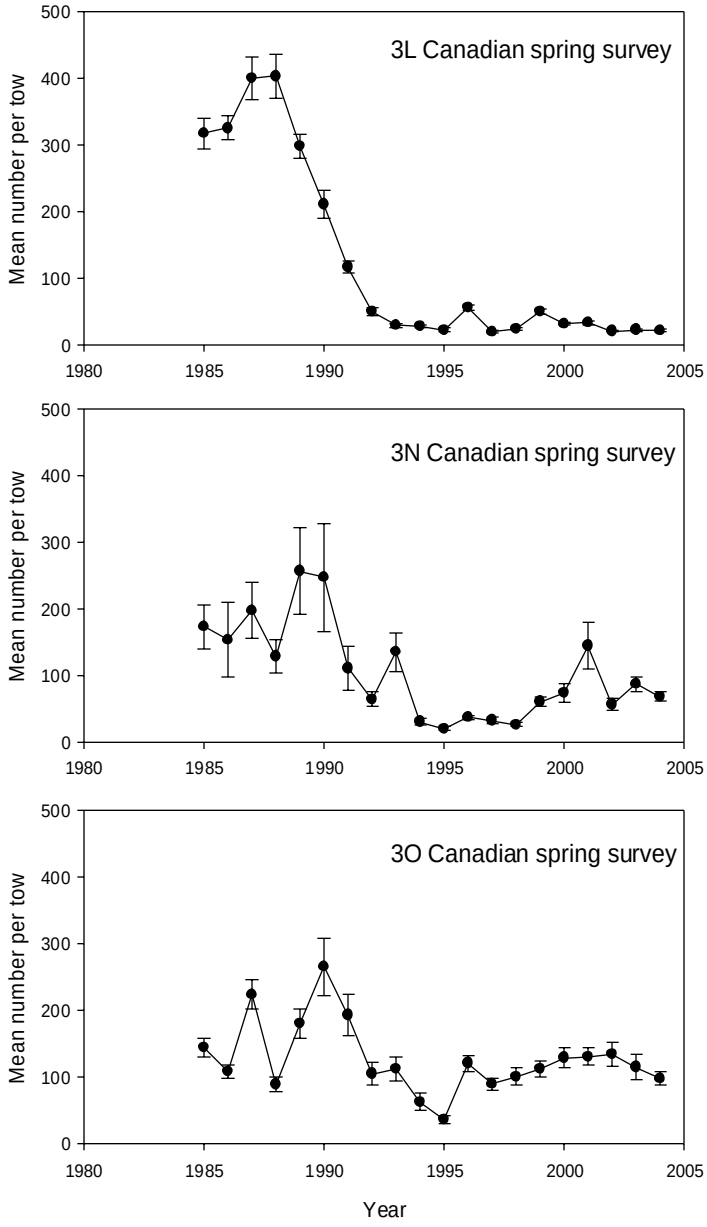


Fig. 8. Mean (± Std. Dev.) number per tow of American plaice from Canadian spring surveys of Div. 3L, 3N and 3O.

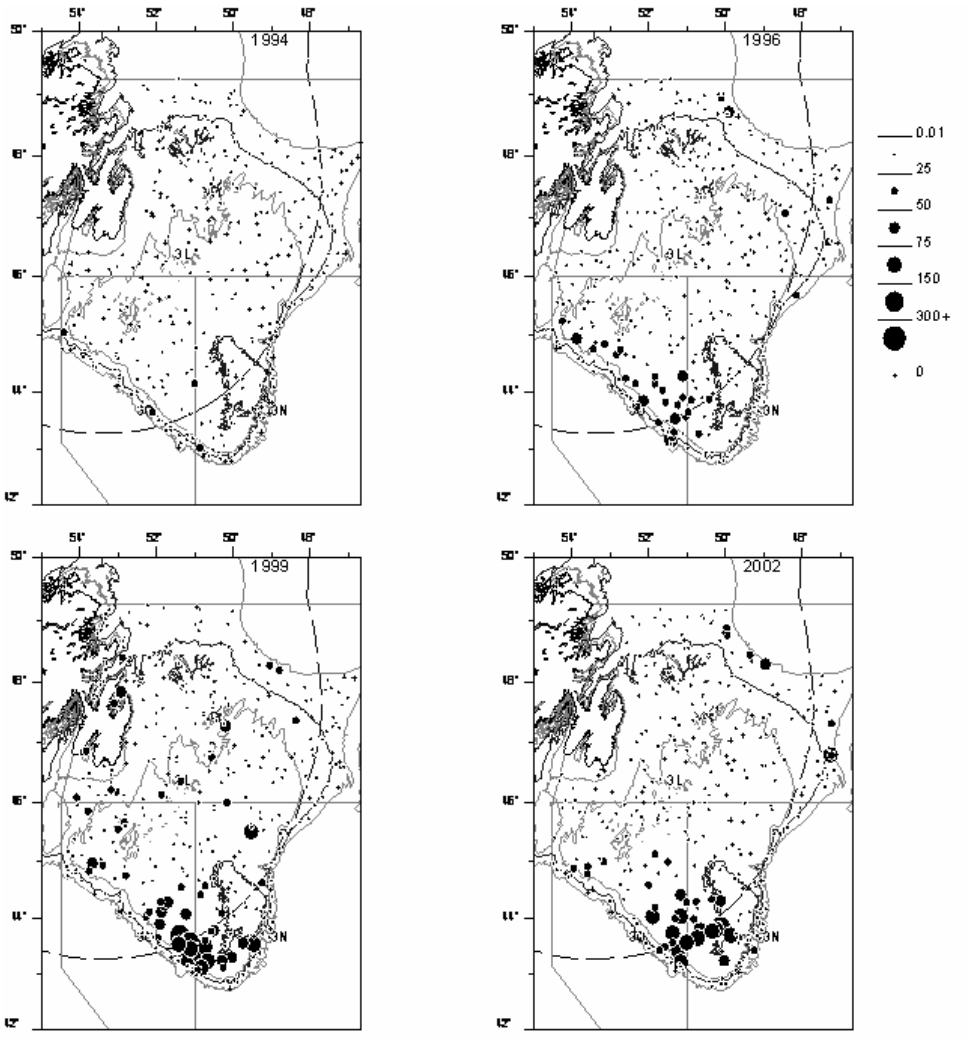


Fig. 9a. Distribution of American plaice (kg per tow) from Canadian spring surveys in NAFO Div. 3LNO in select years from 1994 to 2002.

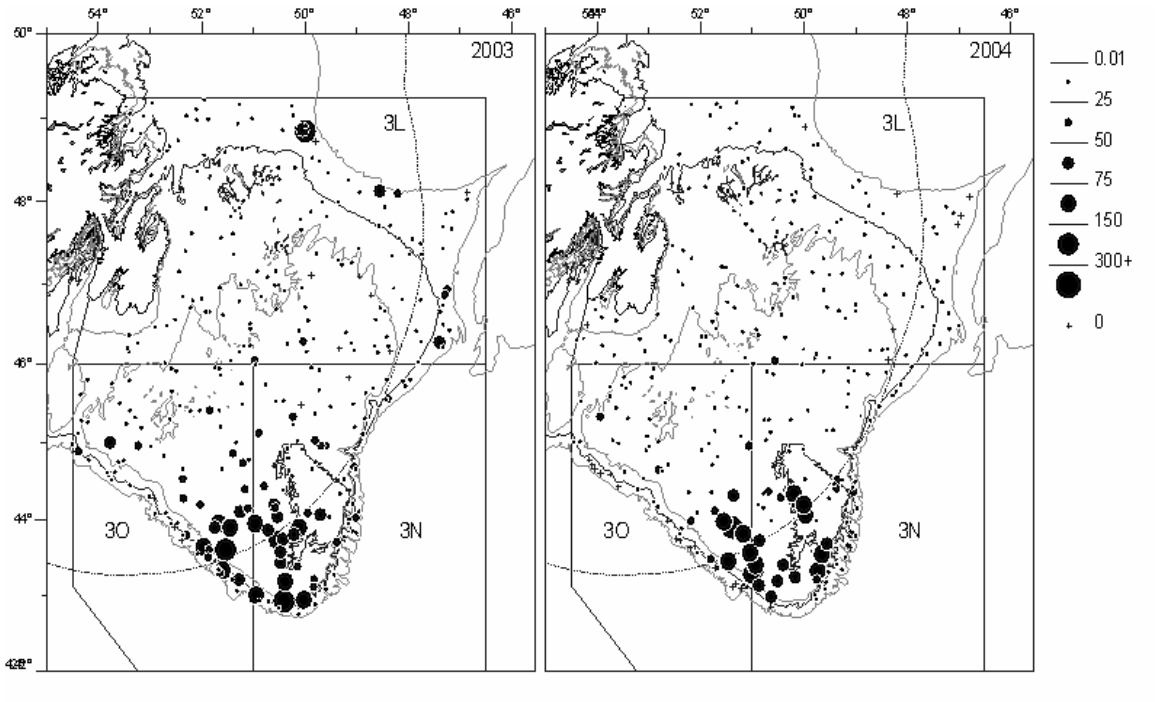


Fig. 9b. Distribution of American plaice (kg per tow) from Canadian spring surveys in NAFO Div. 3LNO in 2003 and 2004.

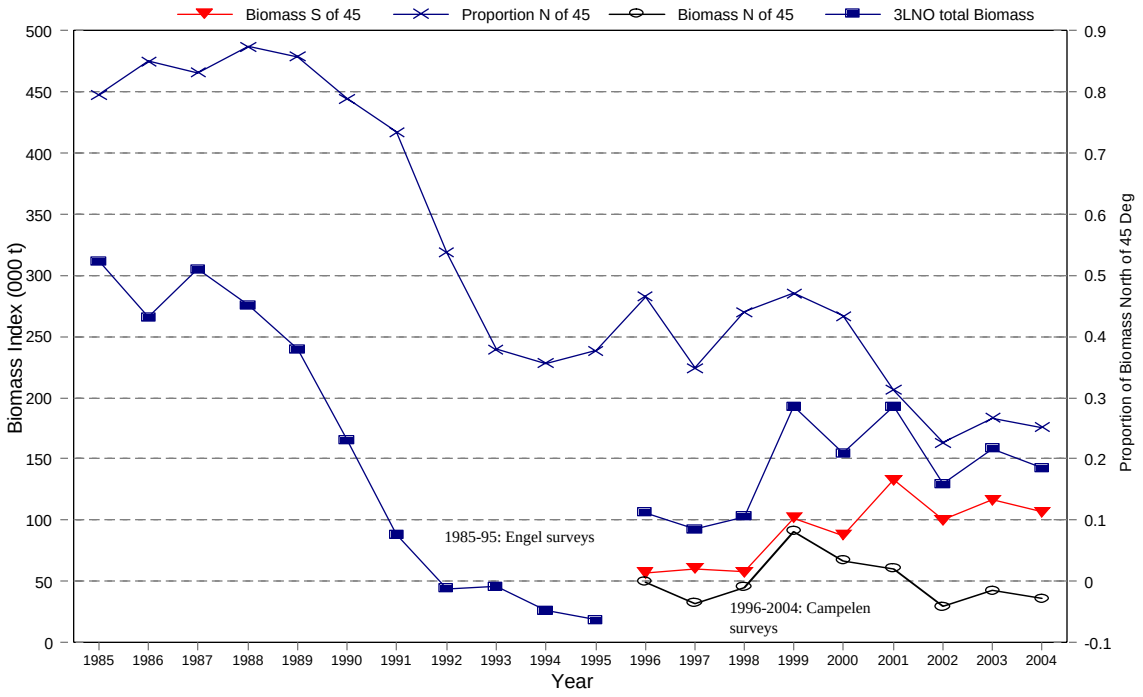


Fig. 10. Proportion of American plaice biomass located north of 45 N in Div. 3LNO in Canadian spring surveys.

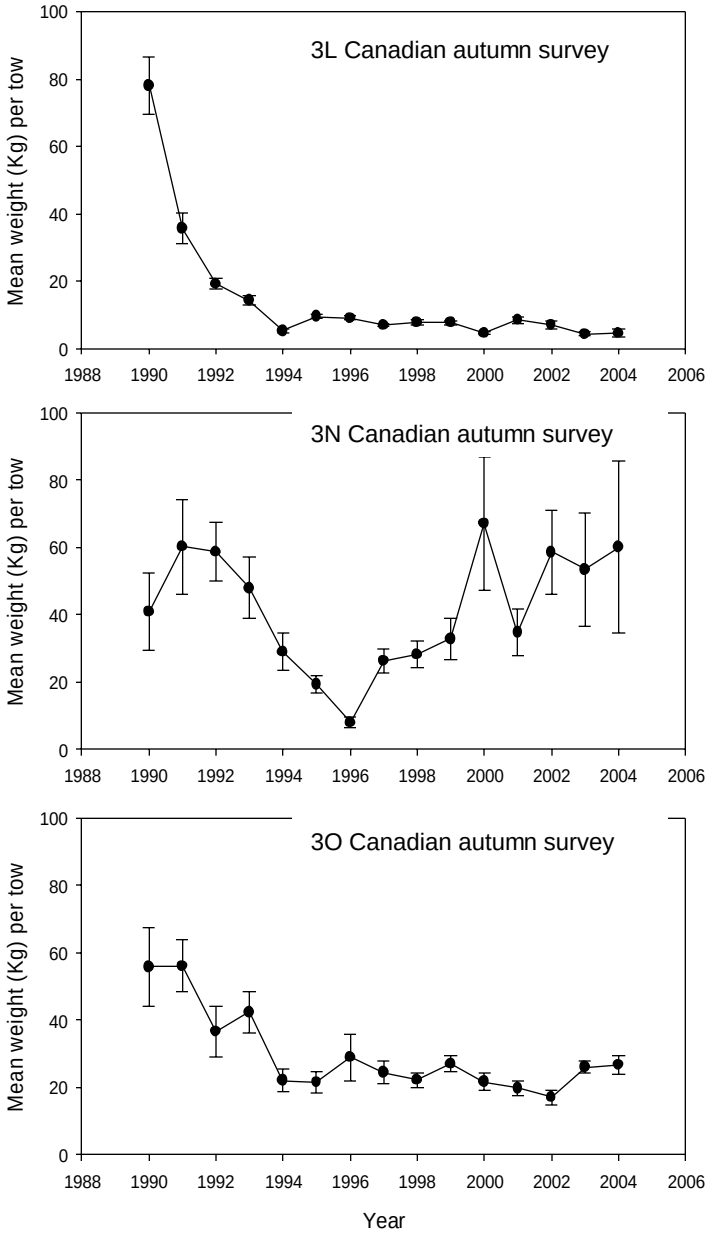
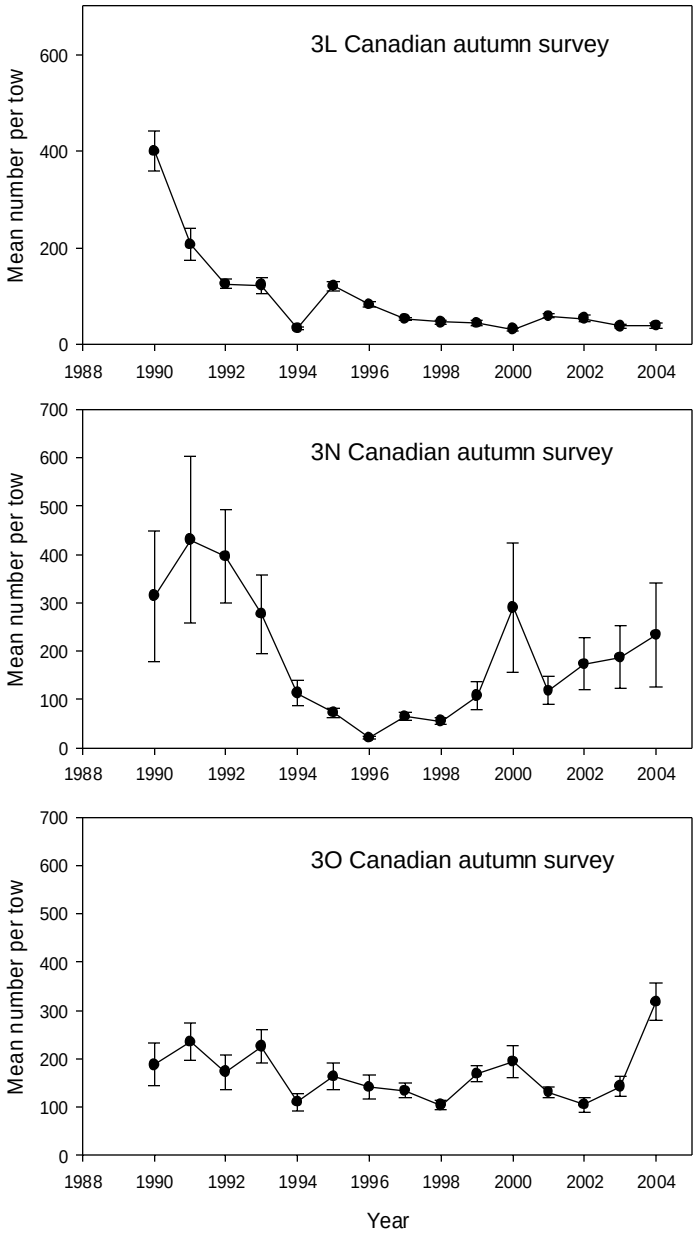


Fig. 11. Mean (± 1 Std. Dev.) weight (kg) per tow of American plaice from Canadian autumn surveys in Div. 3L, 3N and 3O.


3L Canadian autumn survey
3N Canadian autumn survey
3O Canadian autumn survey
Mean number per tow
Year
0
100
200
300
400
500
600
700
1988
1990
1992
1994
1996
1998
2000
2002
2004

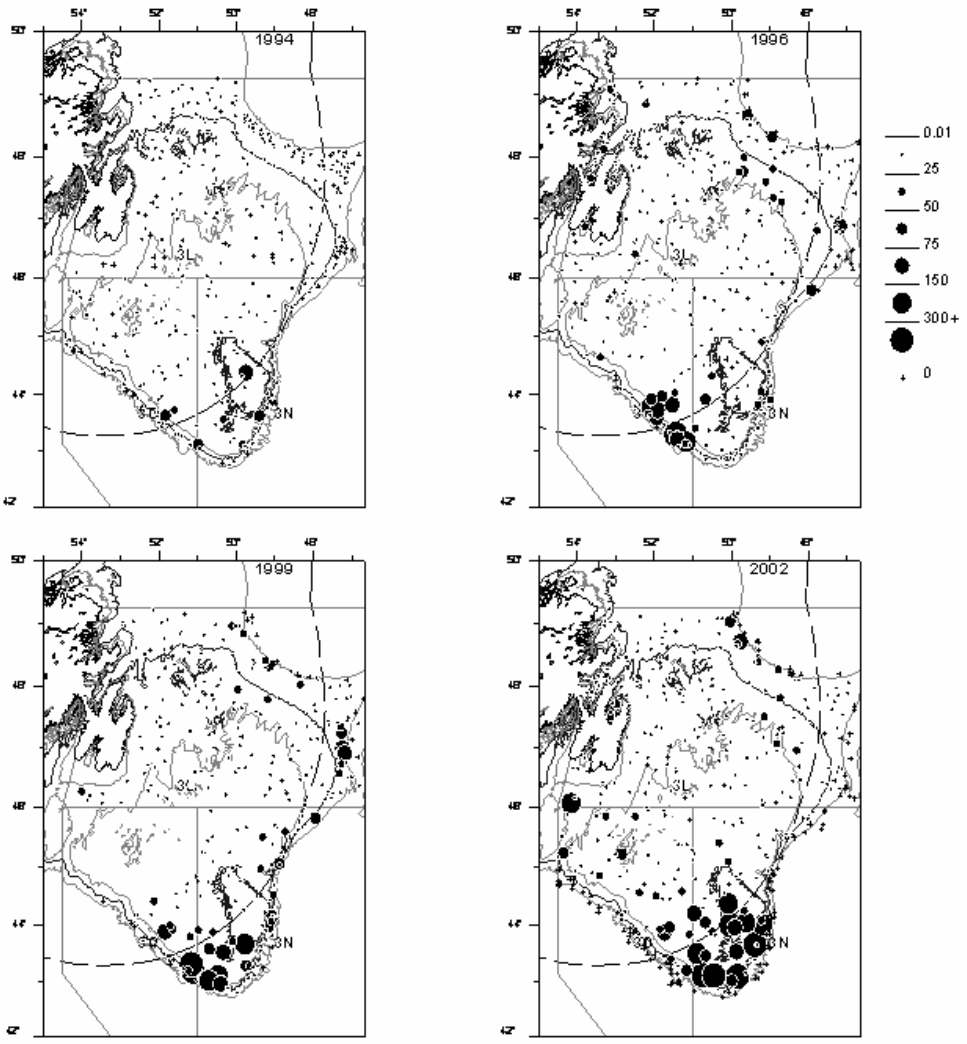


Fig. 13a. Distribution of American plaice (kg per tow) from Canadian autumn surveys in NAFO Div. 3LNO in select years from 1994 to 2002.

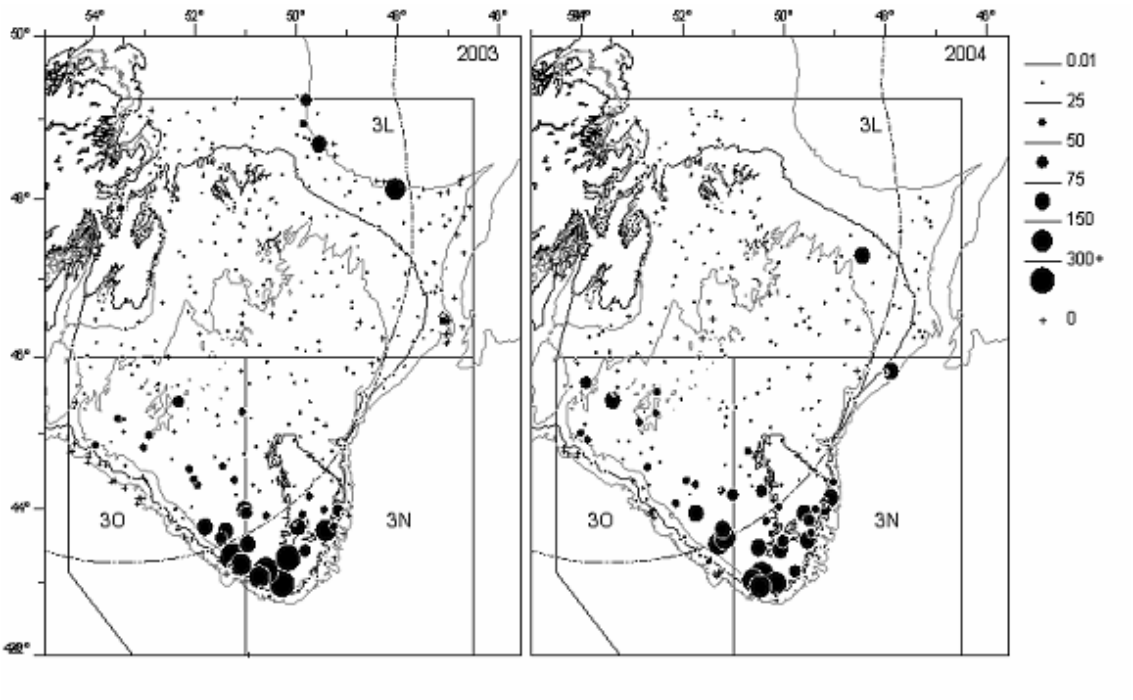


Fig. 13b. Distribution of American plaice (kg per tow) from Canadian autumn surveys in NAFO Div. 3LNO for 2003 and 2004.

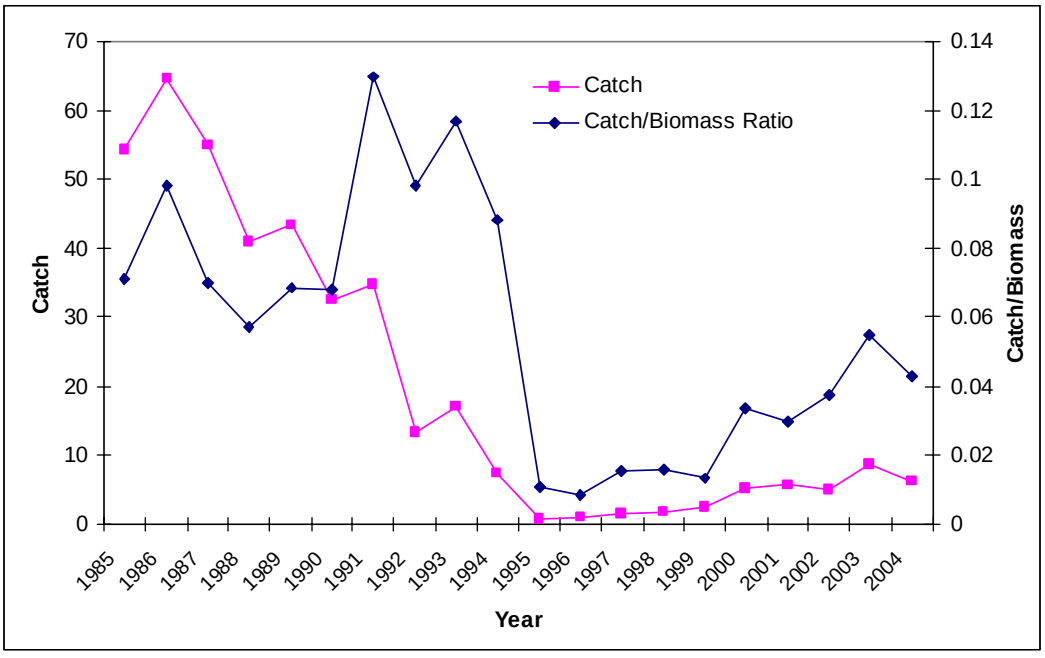


Fig. 14. Total catch from 1985 to 2004 and the catch/biomass ratio for the same period.

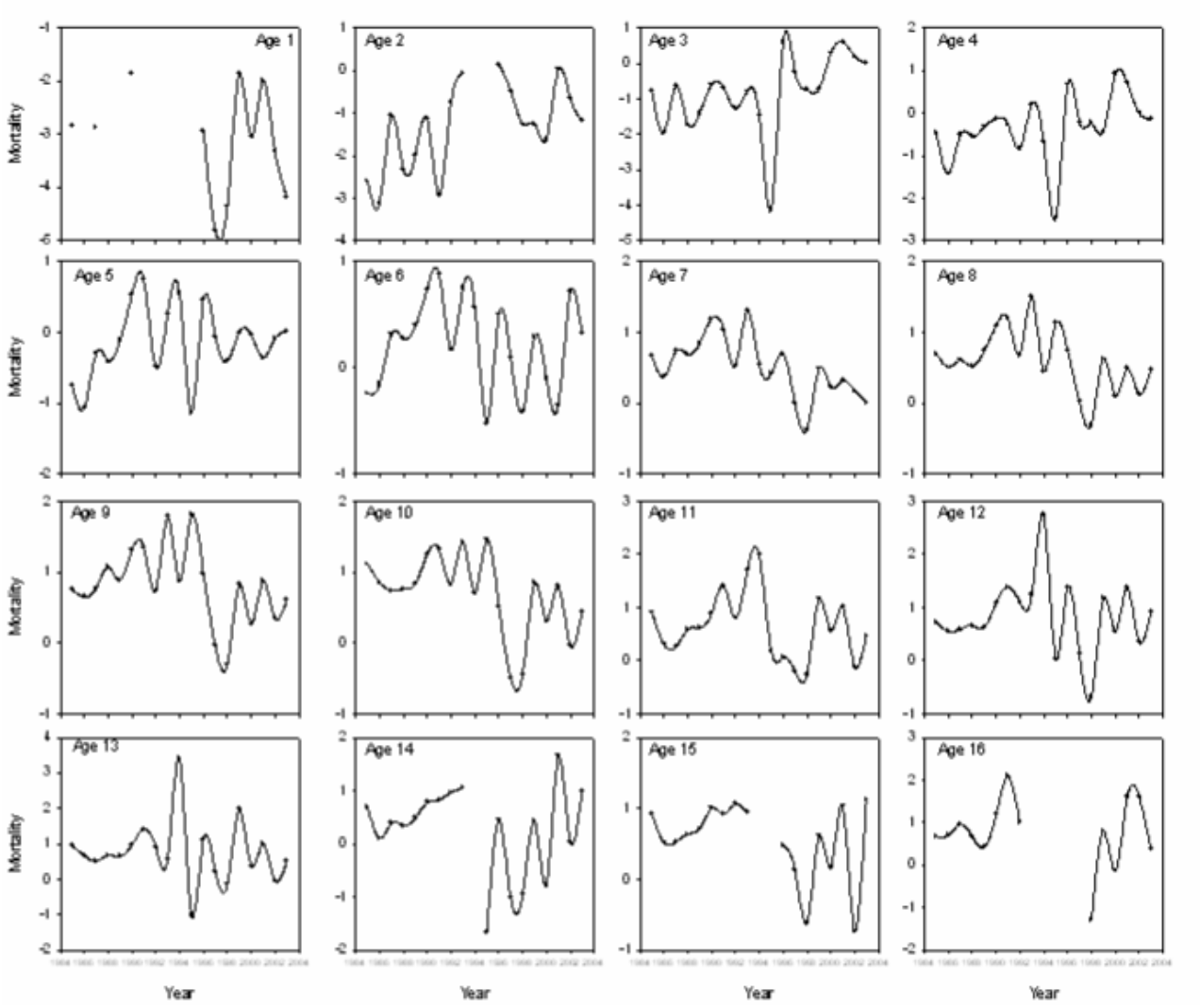


Fig. 15. Estimates of mortality for ages 1 to 16 from Canadian spring surveys from 1985 to 2004.

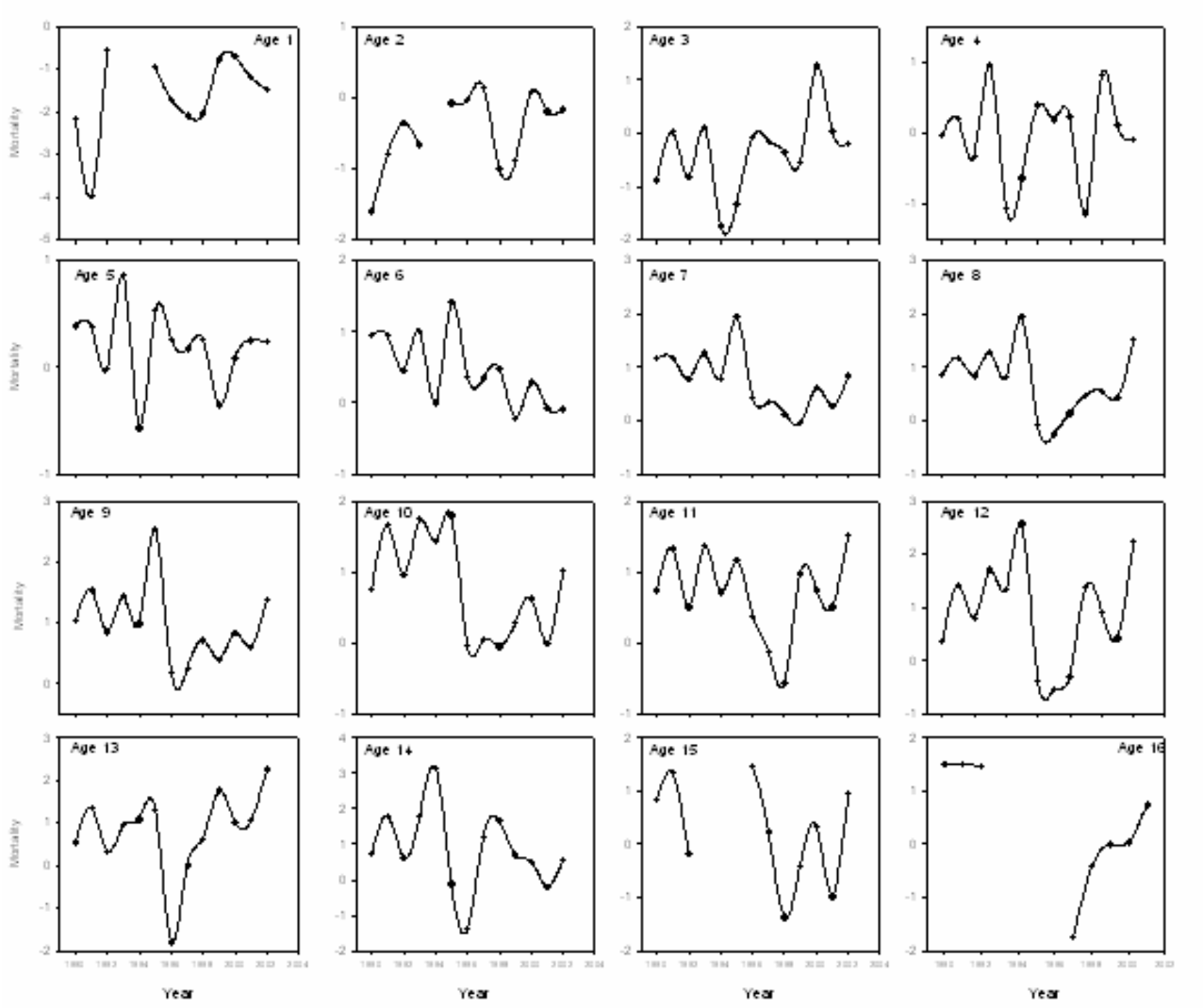


Fig. 16. Estimates of mortality for ages 1 to 16 from Canadian autumn surveys from 1990 to 2003.

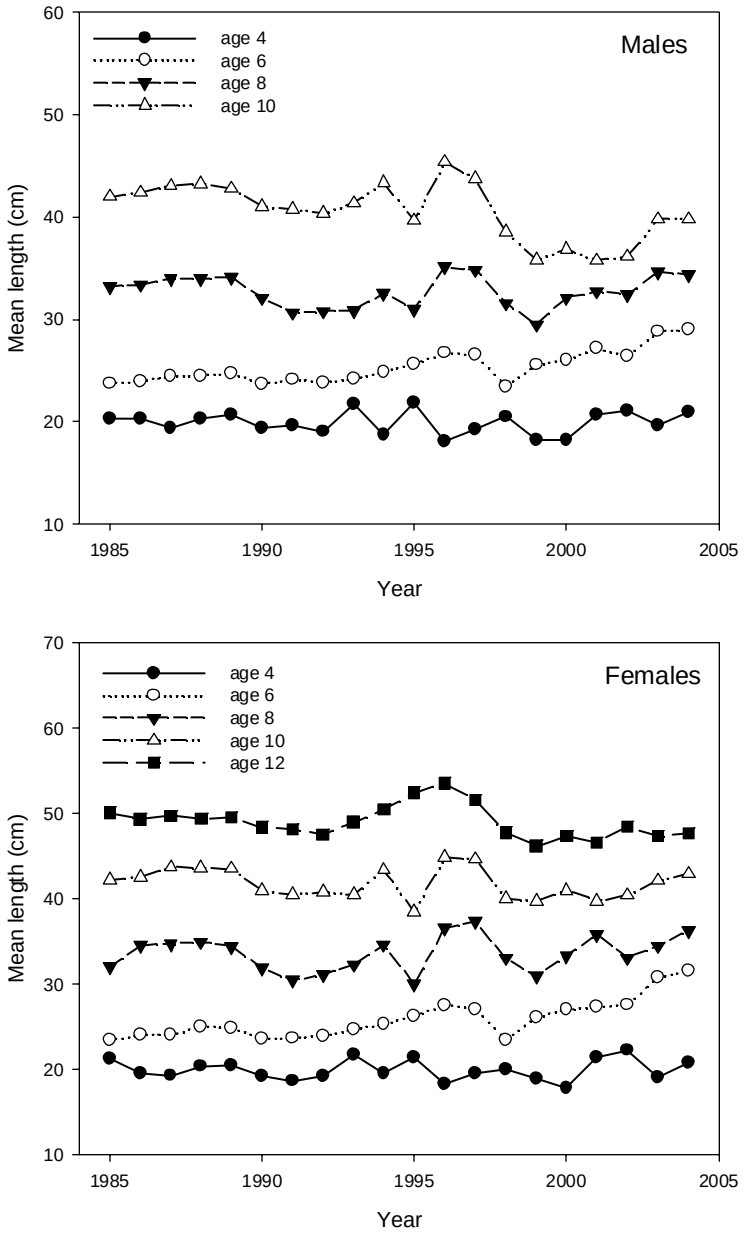


Fig. 17. Mean length-at-age for selected ages of Div. 3LNO American plaice from Canadian spring RV surveys.

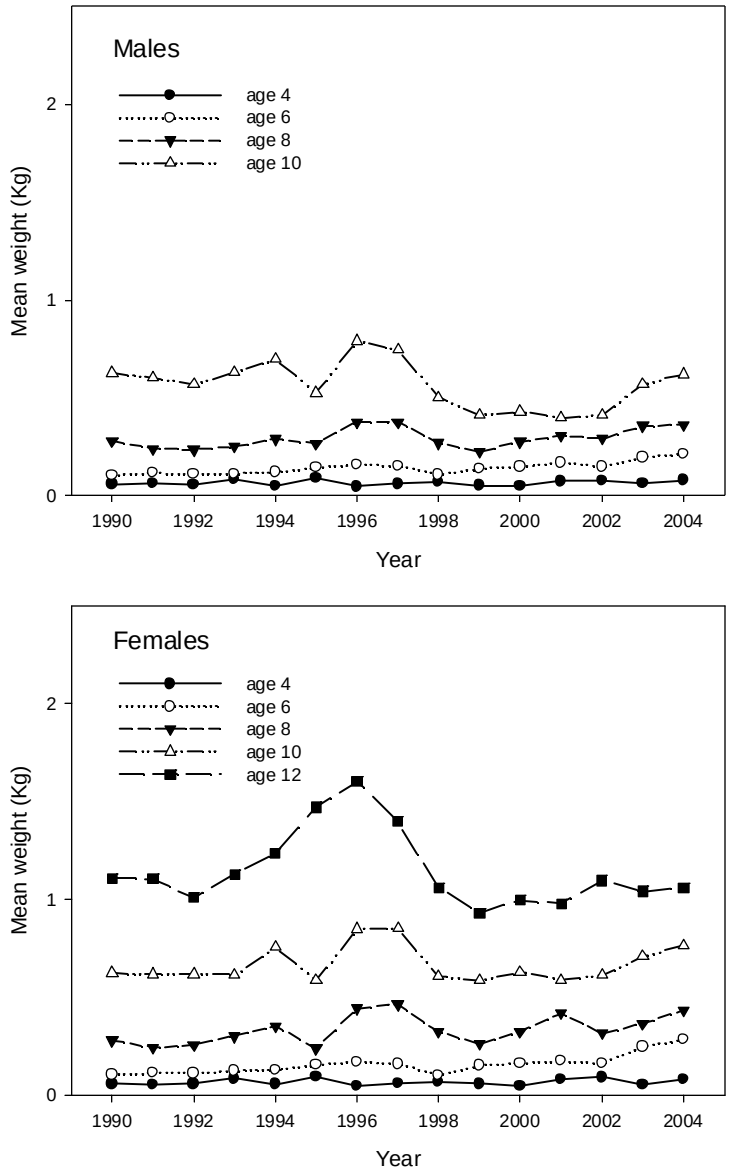


Fig. 18. Mean weight-at-age for selected ages of Div. 3LNO American plaice from Canadian spring RV surveys.

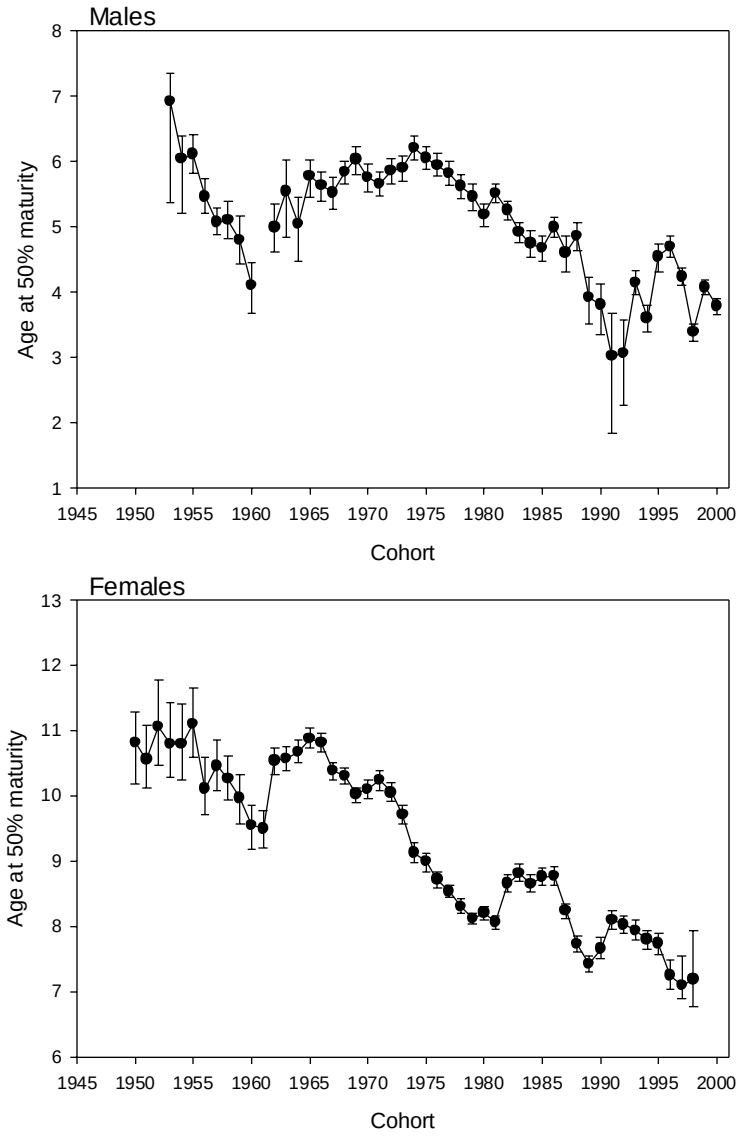


Fig. 19. Age at 50% maturity (± 95% fiducial limits) by cohort for male and female American plaice in NAFO Div. 3LNO.

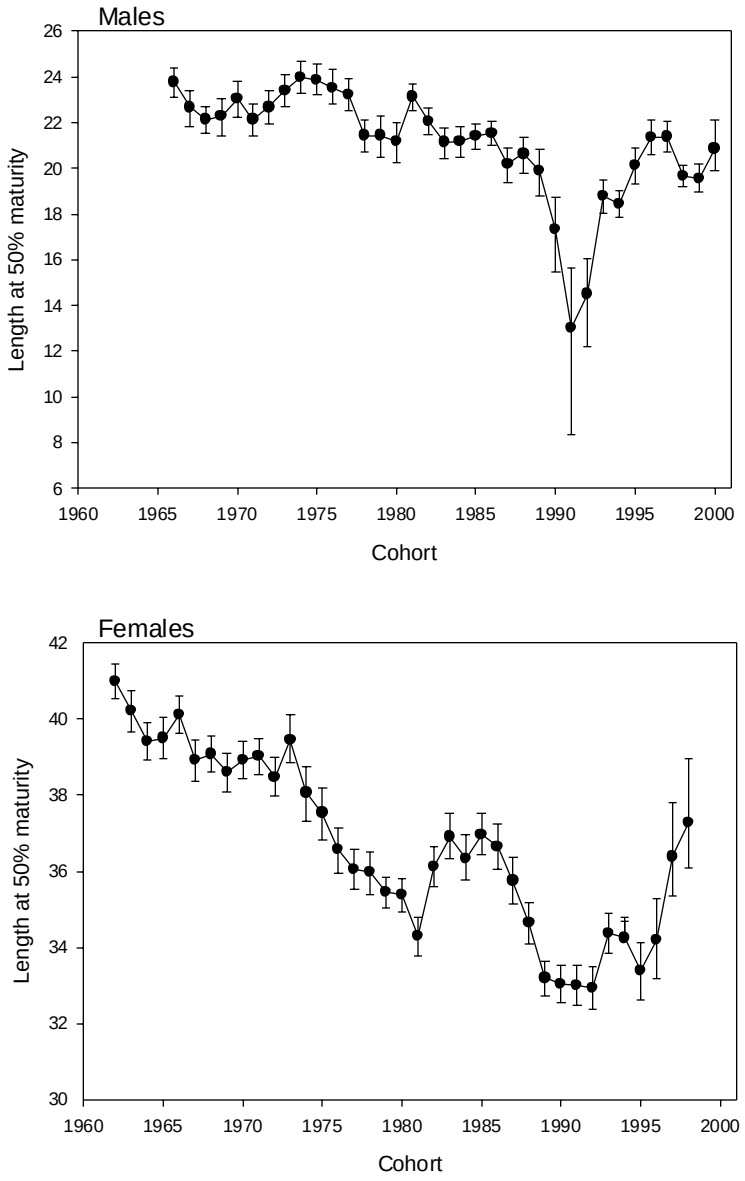


Fig. 20. Length at 50% maturity (± 95% fiducial limits) by cohort for male and female American plaice in NAFO Div. 3LNO.

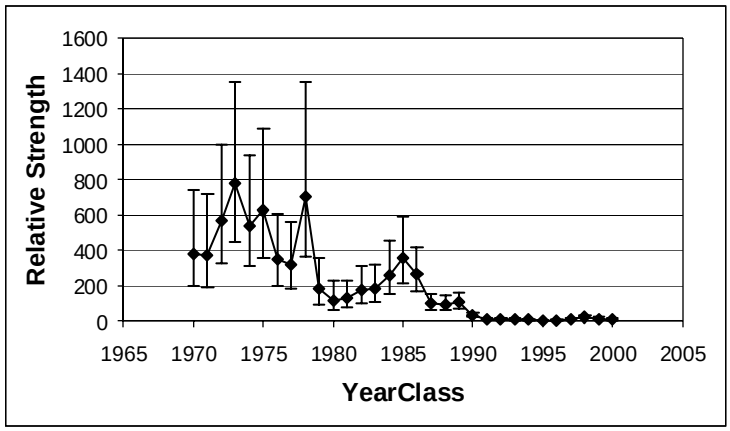


Fig. 21. Estimates of relative year-class strength of Div. 3LNO American Plaice, from survey data ages 3-5.

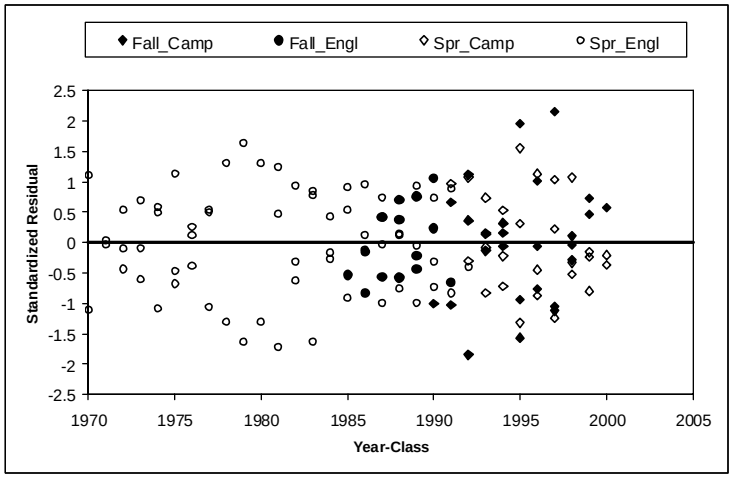


Fig. 22. Standardized residuals from relative year-class strength model for Div. 3LNO American Plaice (including ages 3-5).

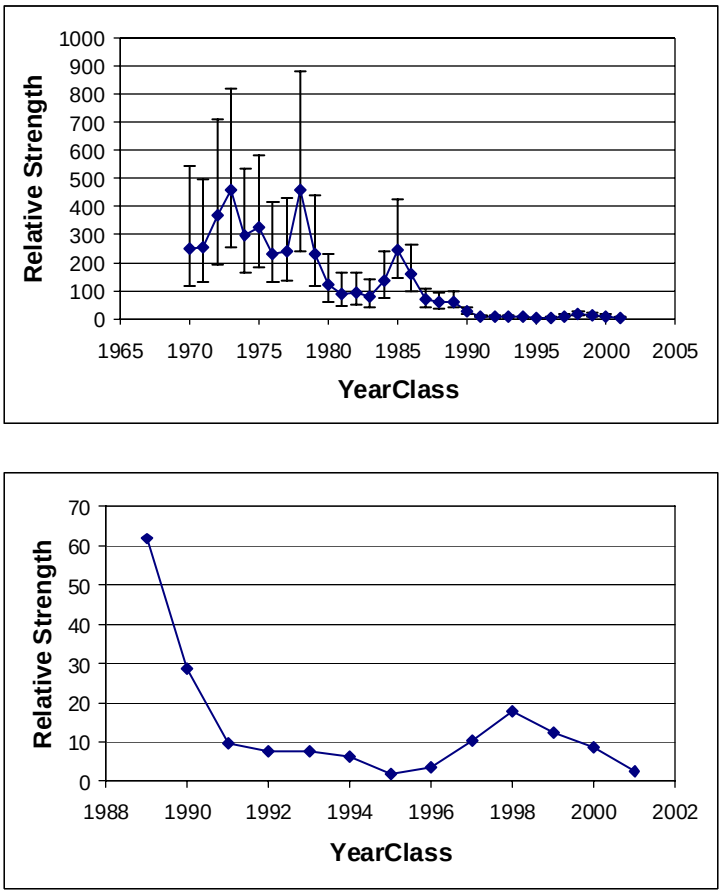


Fig. 23. Estimates of relative year-class strength of Div. 3LNO American Plaice, from survey data ages 2-5. Lower panel highlights estimates since 1989.

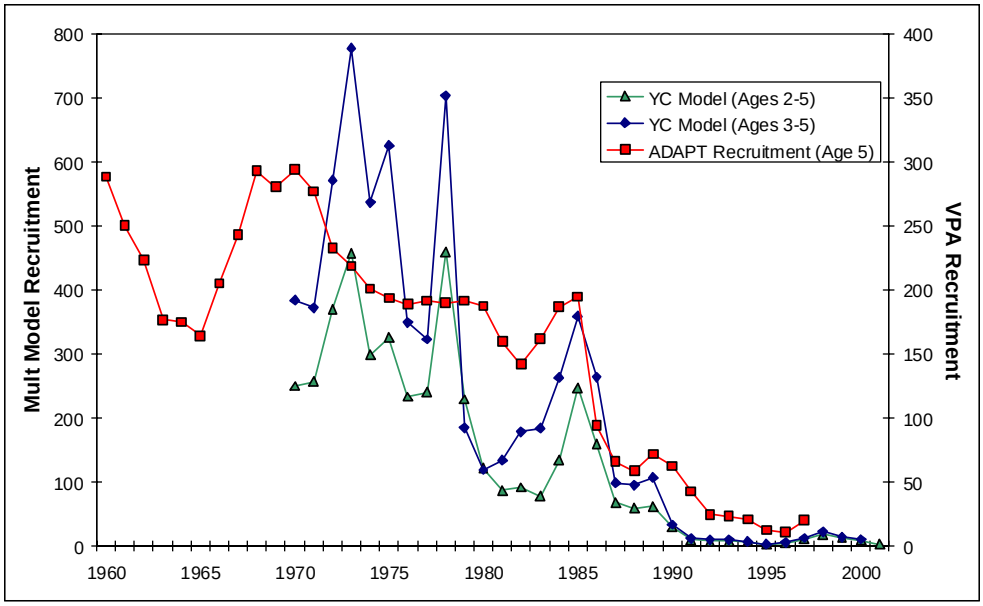


Fig. 24. Estimates of recruitment from VPA (2003 Assessment), and estimates from multiplicative models (from age 2-5 data and age 3-5 data).

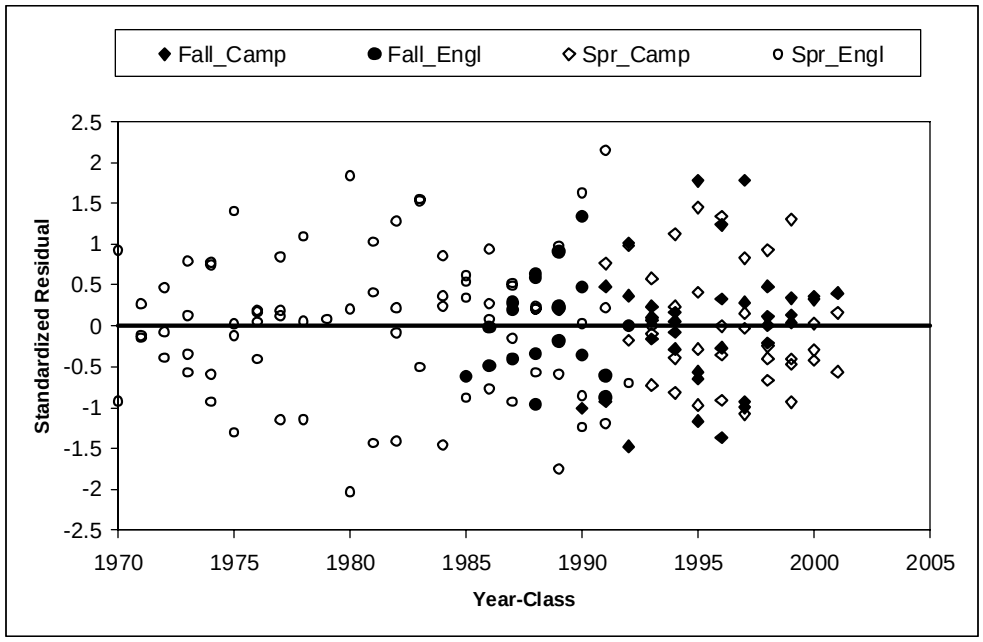


Fig. 25. Standardized residuals from relative year-class strength model for Div. 3LNO American Plaice (including ages 2-5).

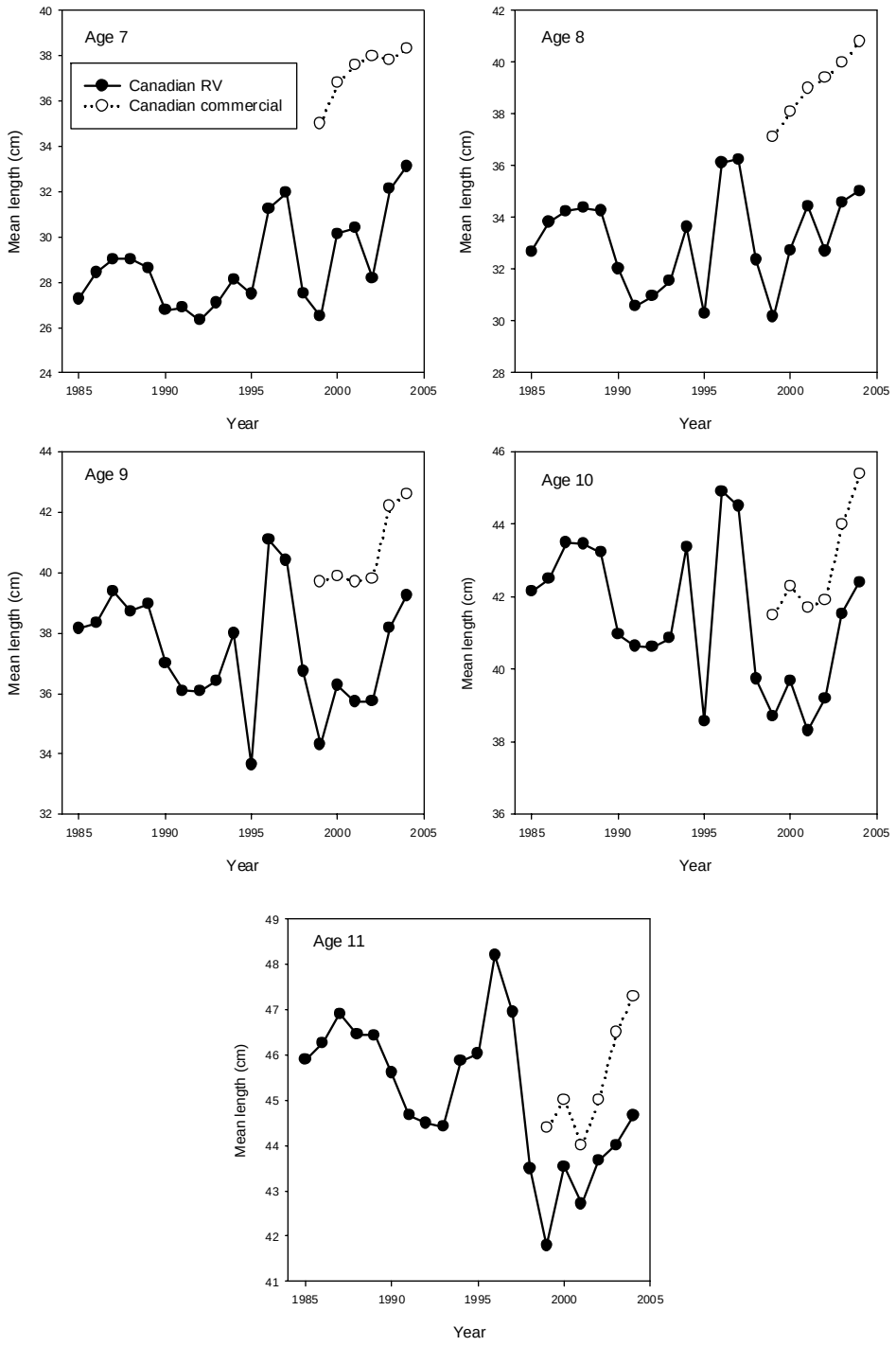


Fig. 26. Mean length-at-age for ages 7 to 11 American plaice in Div. 3LNO from the Canadian spring RV survey and for by-catch in the Canadian commercial fishery.

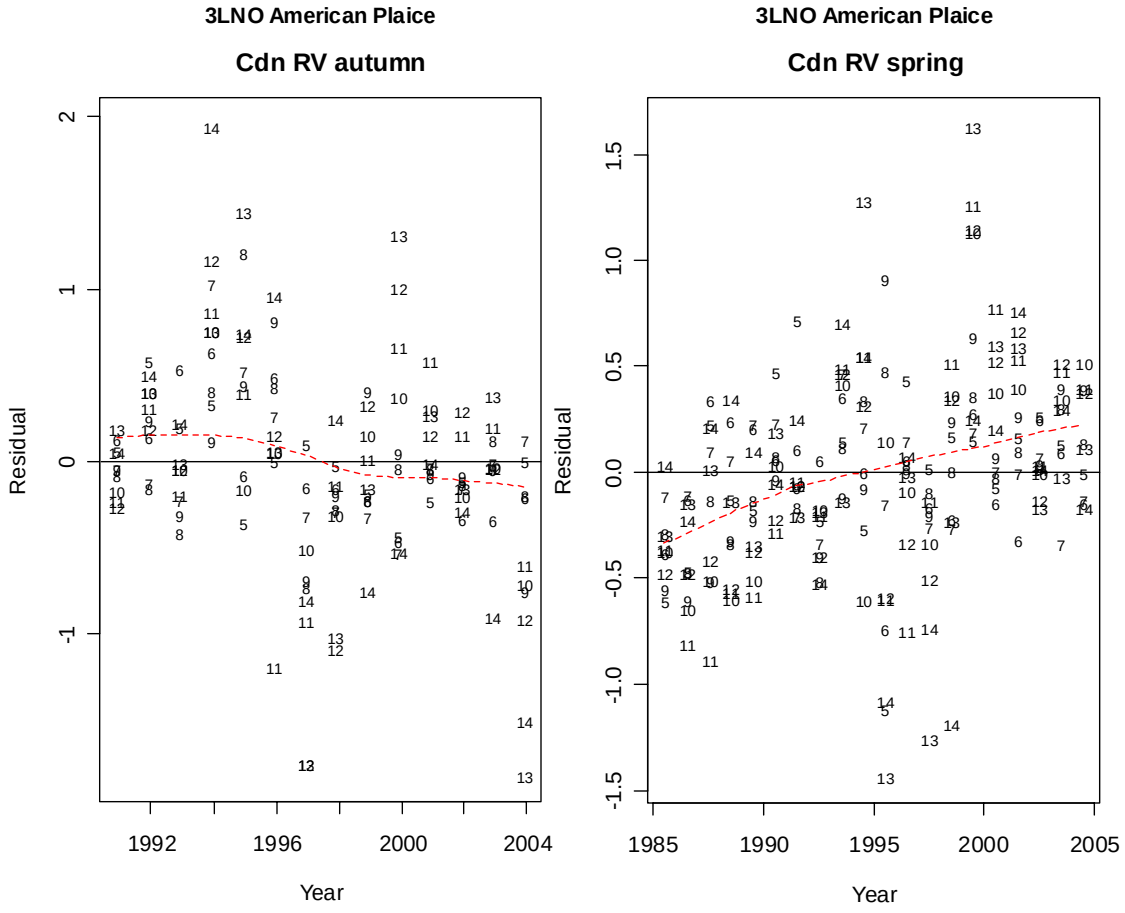


Fig. 27. Residuals by year and month (numbers represent ages) for Canadian autumn survey (right) and spring survey (left). Red line is a Lowess smoother. Note the scales are different for each plot.

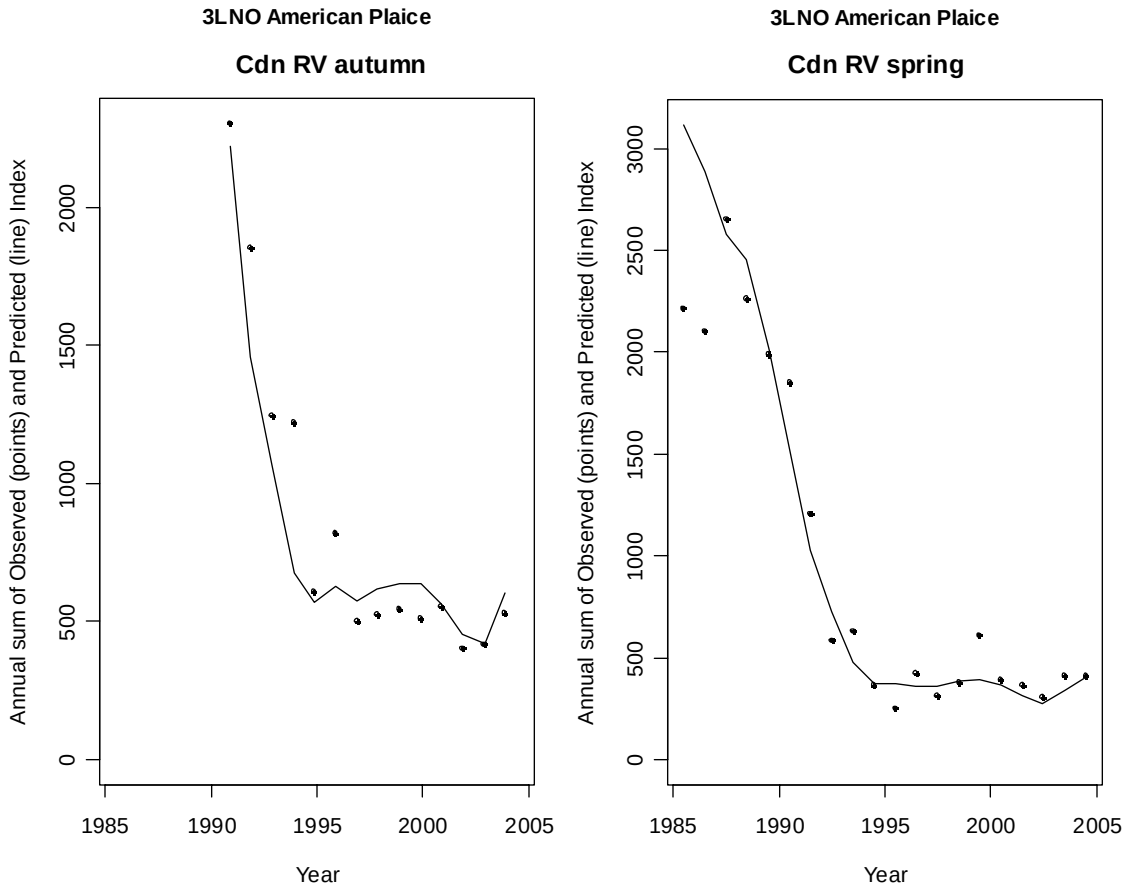


Fig. 28. Observed versus predicted abundance for autumn and spring indices over time.

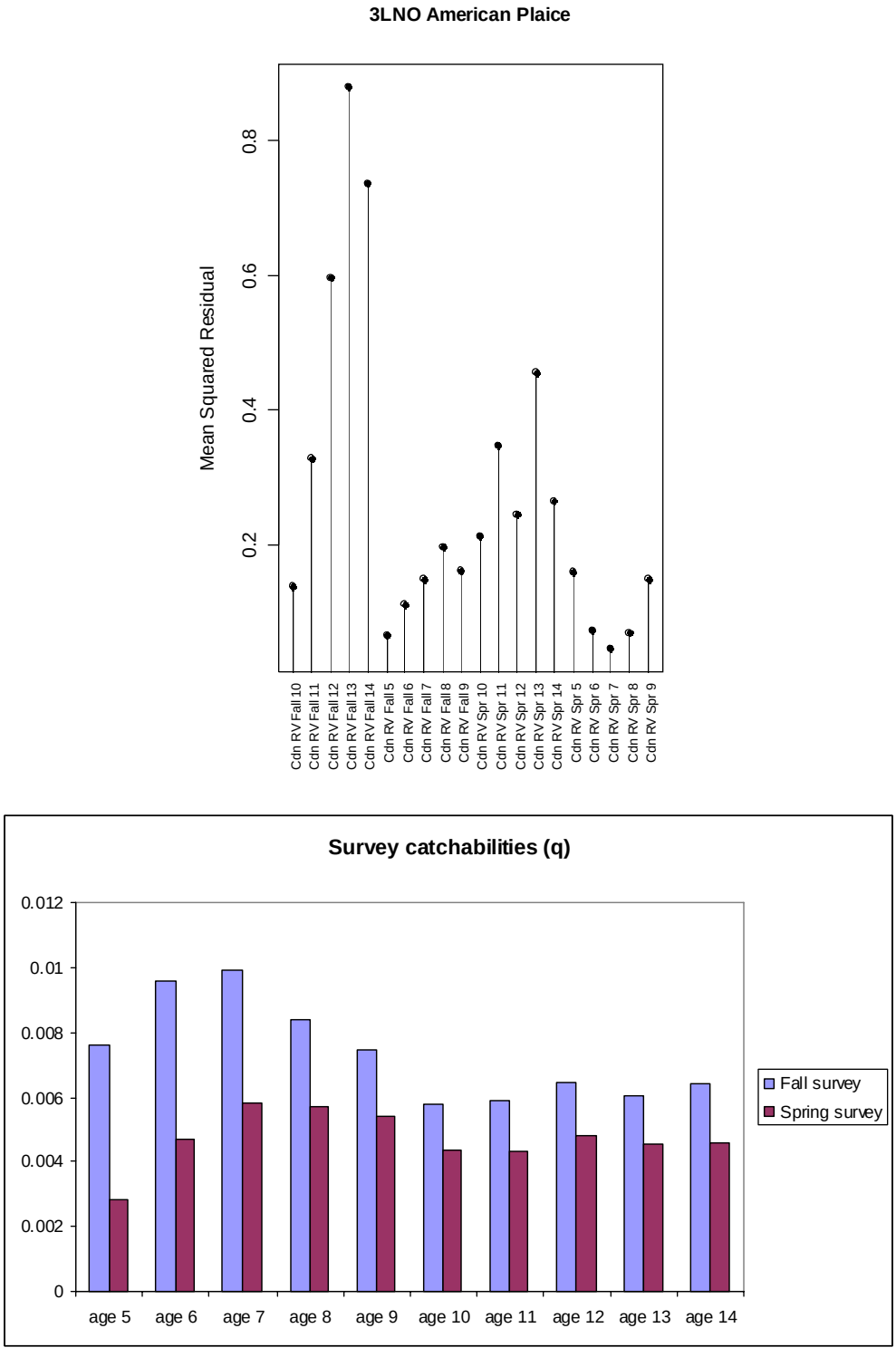


Fig. 29. Top panel is the mean squared residuals by age for each of autumn and spring surveys. Bottom panel shows the survey catchabilities (q) for each survey by age.

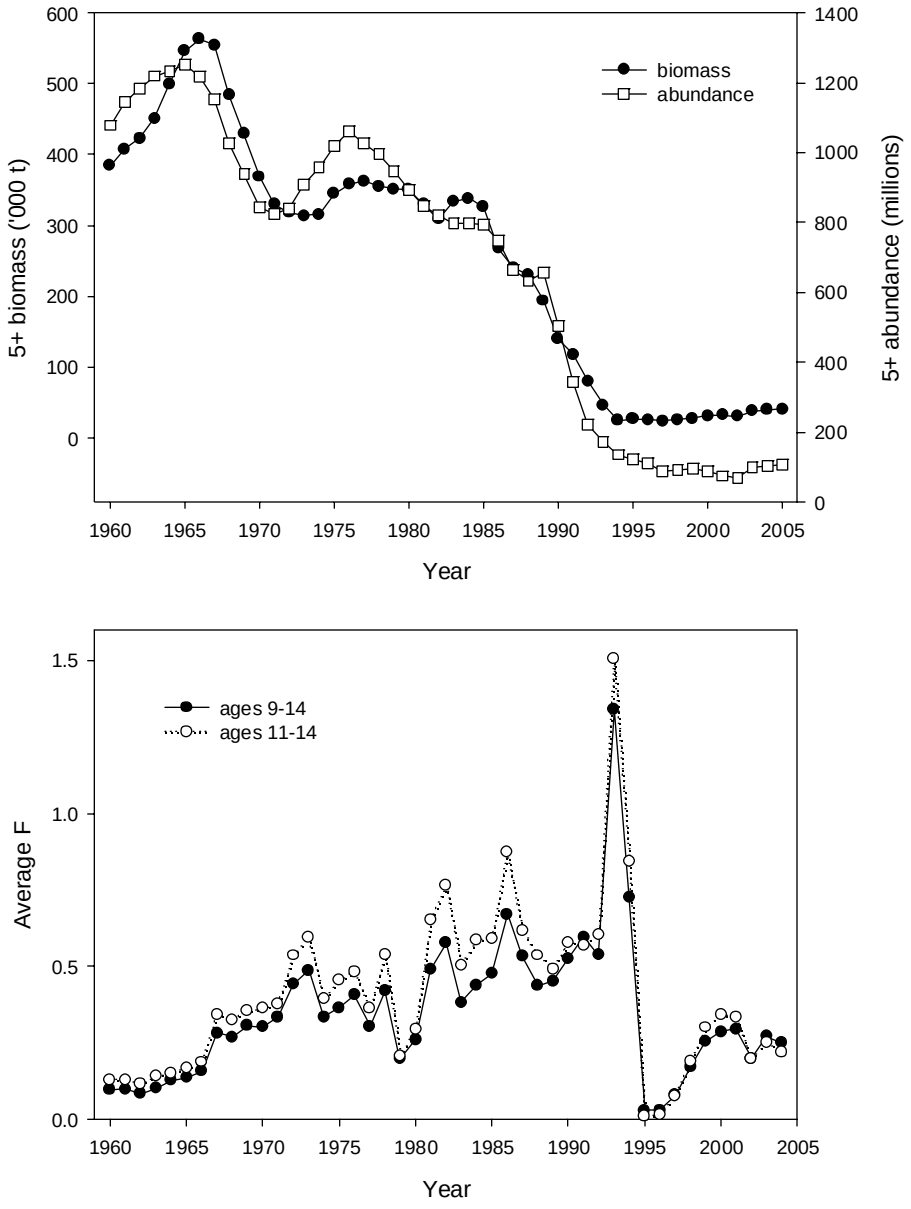


Fig. 30. 5 + biomass and abundance (top) and average fishing mortality on ages 9-14 and ages 11-14 (bottom) from VPA.

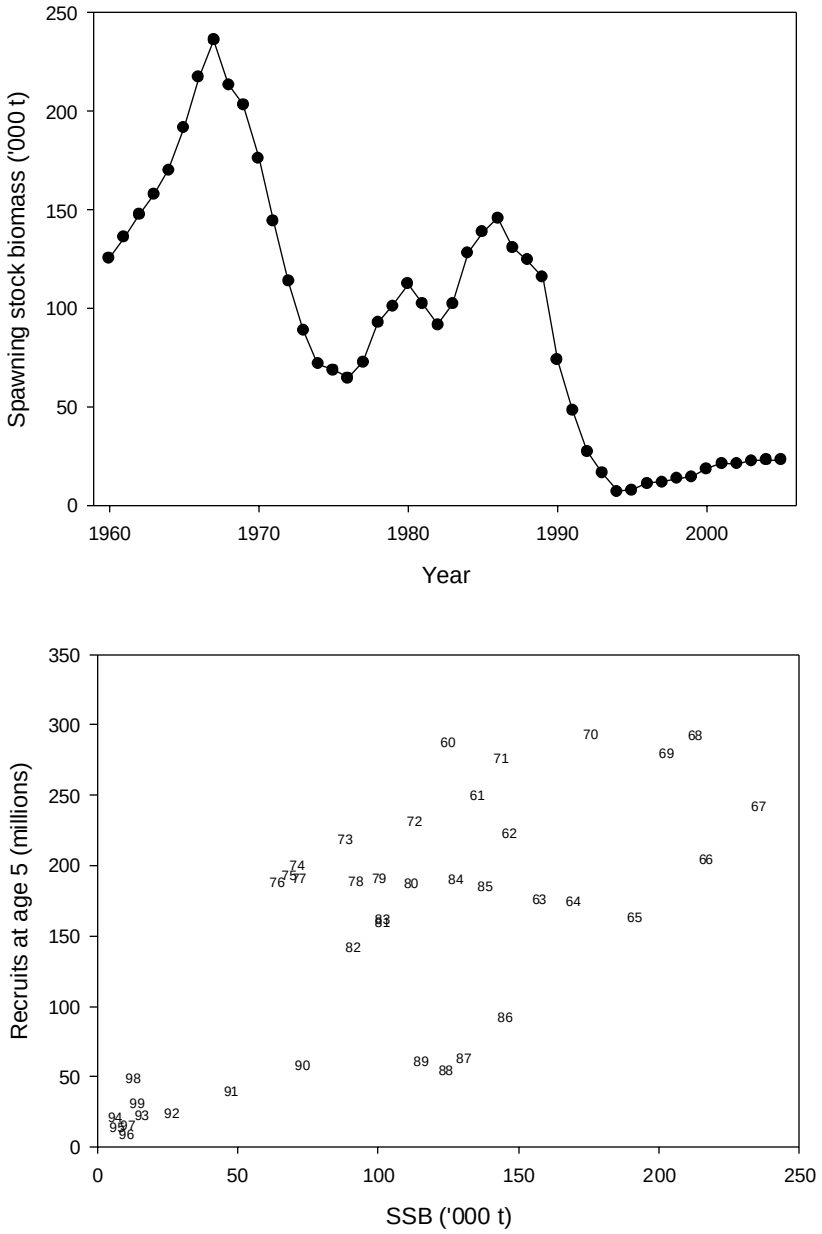


Fig. 31. Spawning stock biomass from 1960 to 2005 (top). Spawning stock biomass (000 tons) and recruitment at age 5 (millions) from VPA. The symbols represent the year-class.

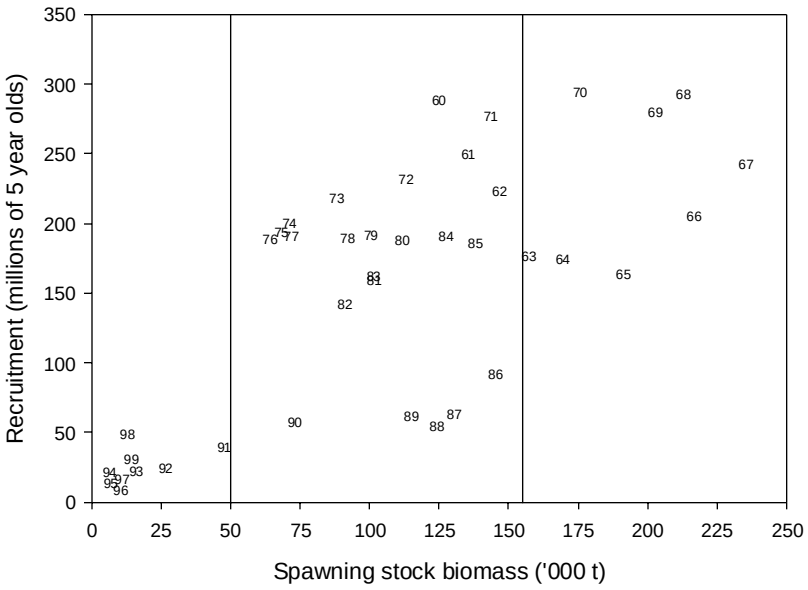


Fig. 32. Observed stock recruit scatter. Vertical lines illustrate the 3 levels of recruitment.

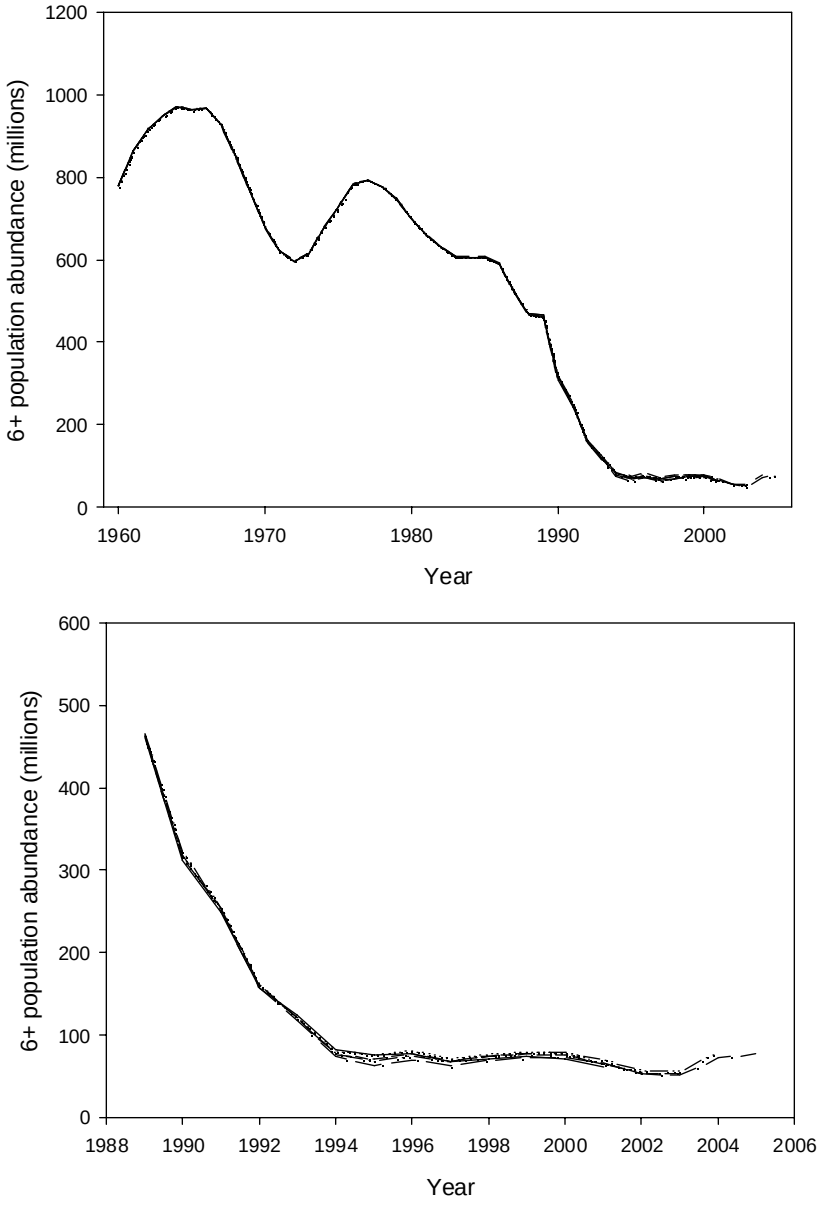


Fig. 33. Results of retrospective analysis for Div. 3LNO American plaice. Top panel shows 6+ population abundance for the whole time period while the bottom panel shows only the time period from 1989.

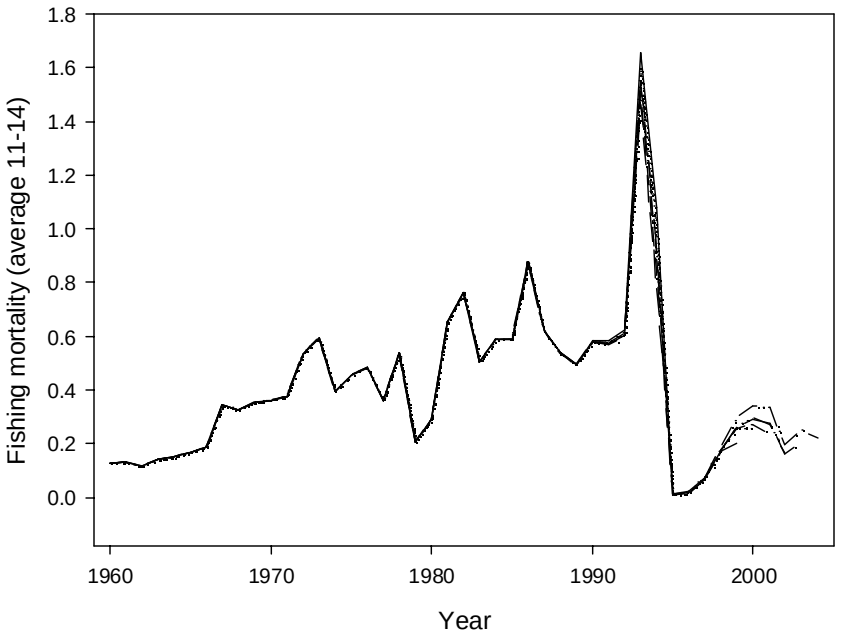


Fig. 34. Results of retrospective analysis for Div. 3LNO American plaice. Average fishing mortality over ages 11 to 14.

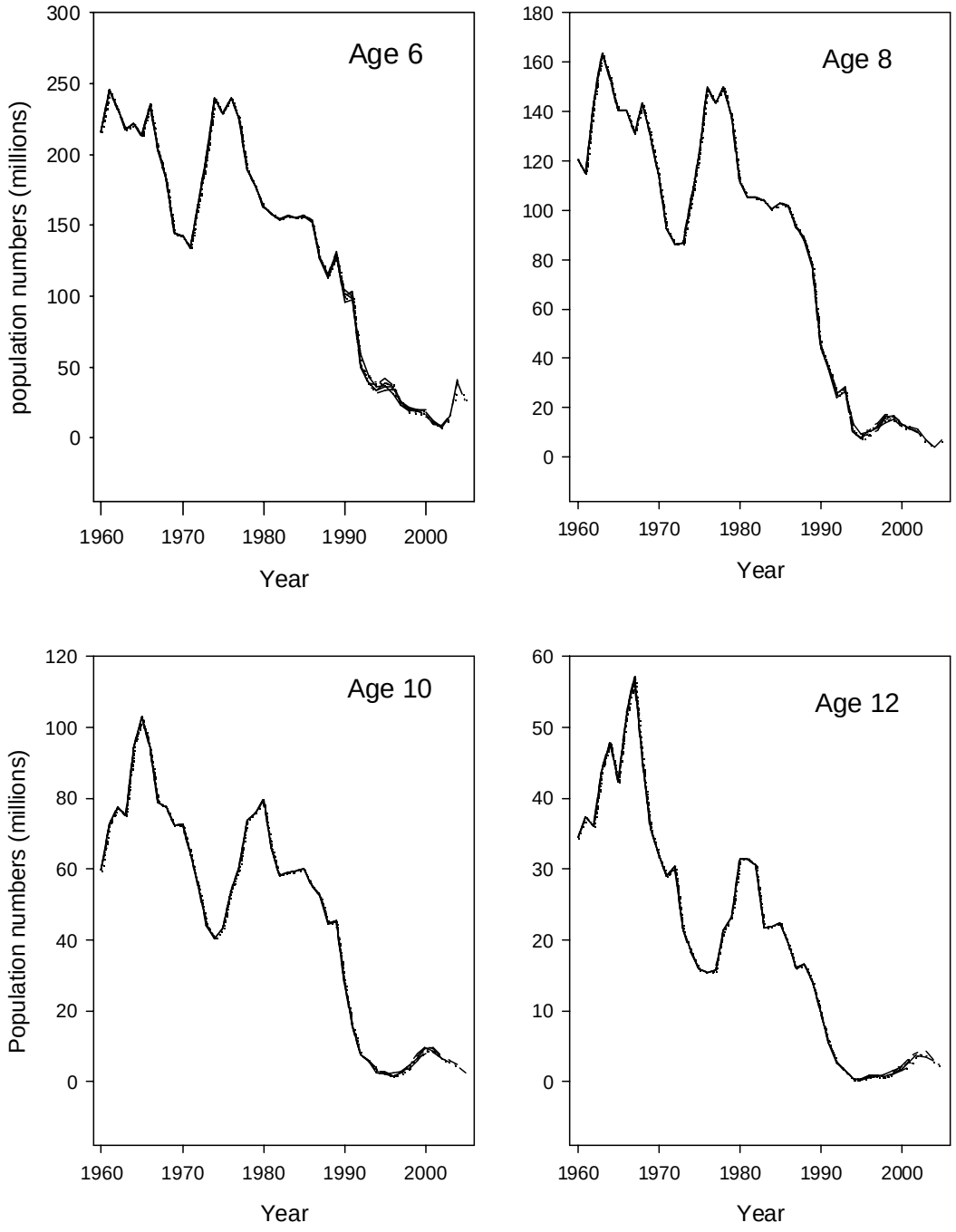


Fig. 35. Results of retrospective analysis for Div. 3LNO American plaice. Population numbers (millions) for selected ages.

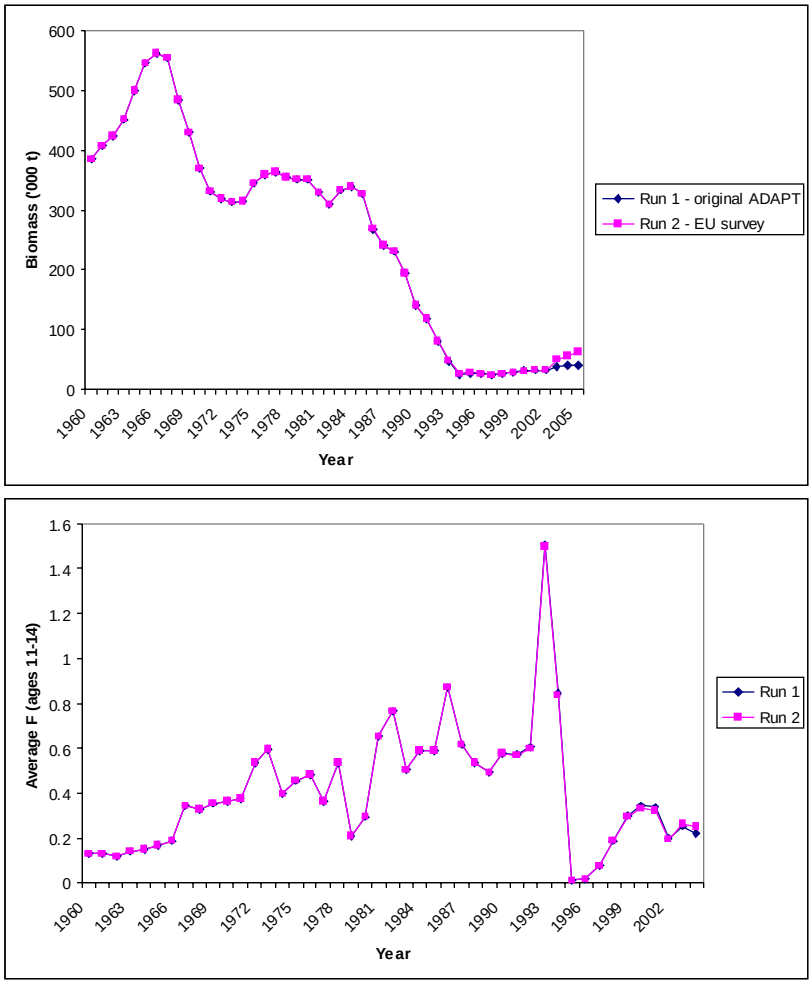


Fig. 34. 5 + biomass (top) and average fishing mortality on ages 11-14 (bottom) from VPA from Run 1 and with the survey by EU-Spain added as a tuning index (Run 2).

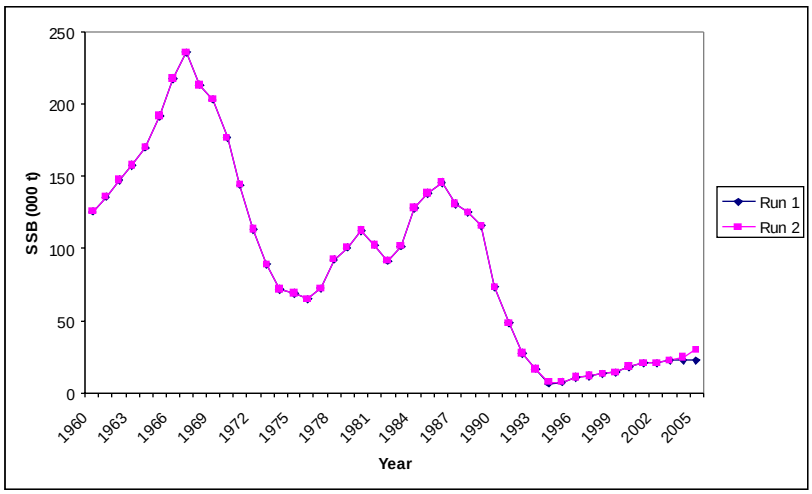


Fig. 35. Spawning stock biomass from 1960 to 2005 (top) from VPA (Run 1 *vs* Run 2).

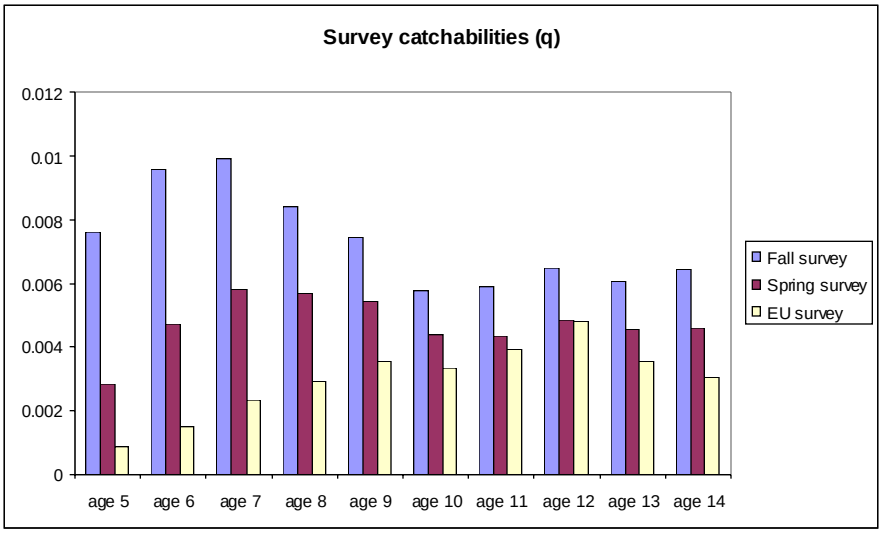


Fig. 38. Survey catchabilities (q) for each survey by age for the three surveys in Run 2.

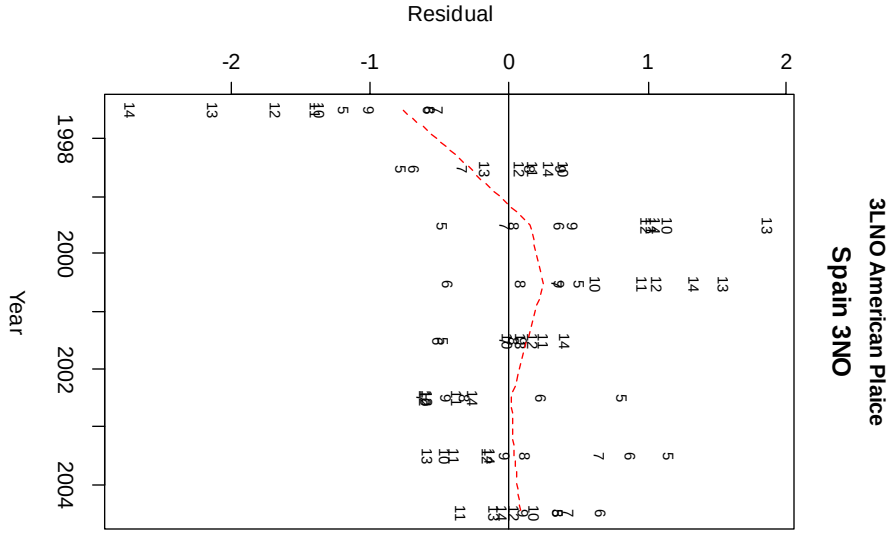


Fig. 39. Residuals by year and month (numbers represent ages) for the survey by EU-Spain 1997-2004. Red line is a Lowess smoother.

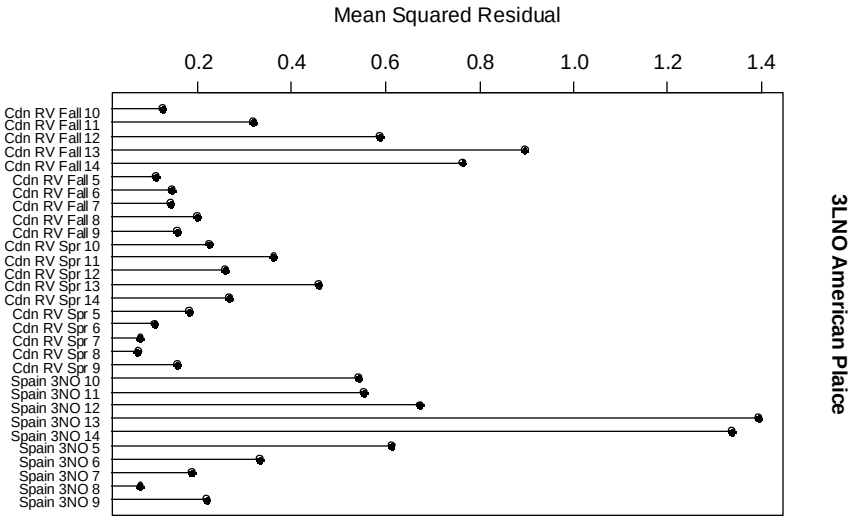


Fig. 40. Mean squared residuals by age for each of autumn, spring and the survey by EU-Spain.

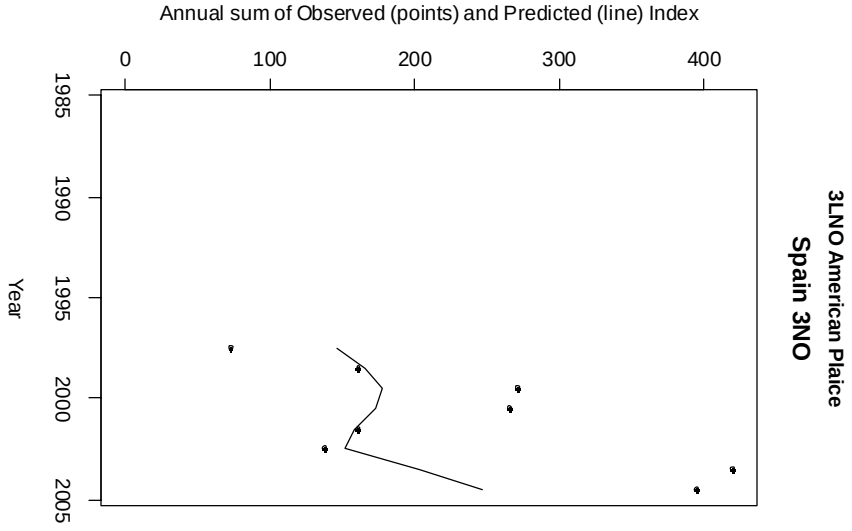


Fig. 41. Observed versus predicted abundance for the survey by EU-Spain index from 1997-2004.

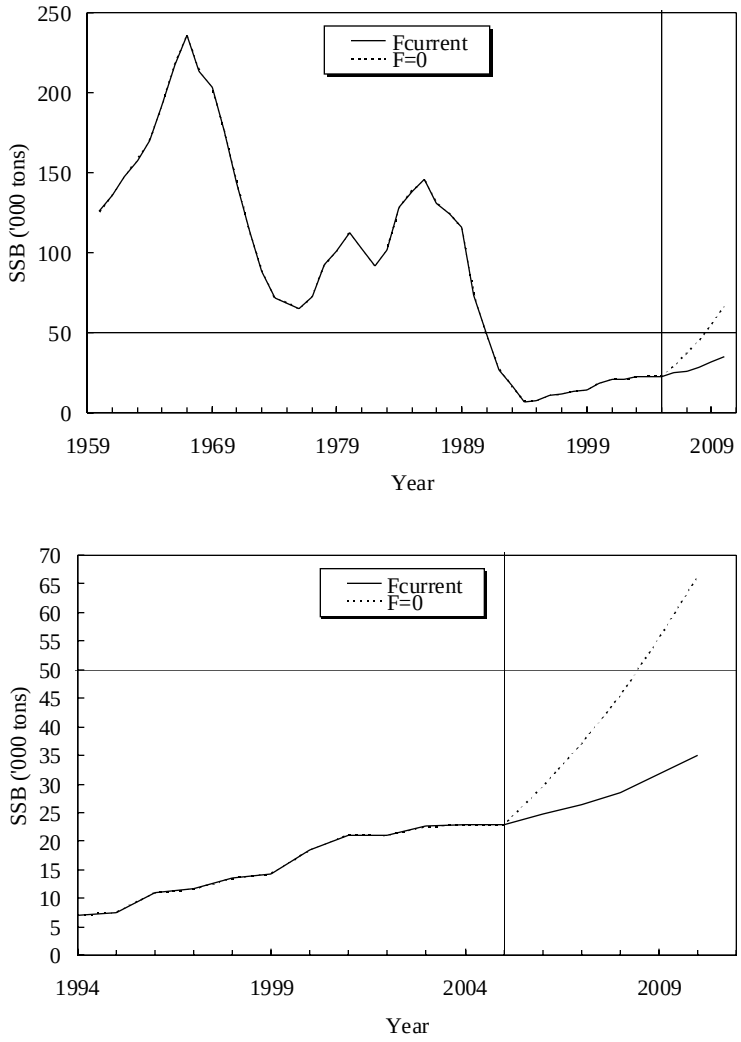


Fig. 42. Estimated spawning stock biomass in medium term projections at current F=0. The vertical line indicates the start of the projection period. The horizontal line in the top panel gives the B_{lim} of 50 000 tons. The top panel shows the period of the projection along with the historic time series, the bottom panel shows only since 1994.

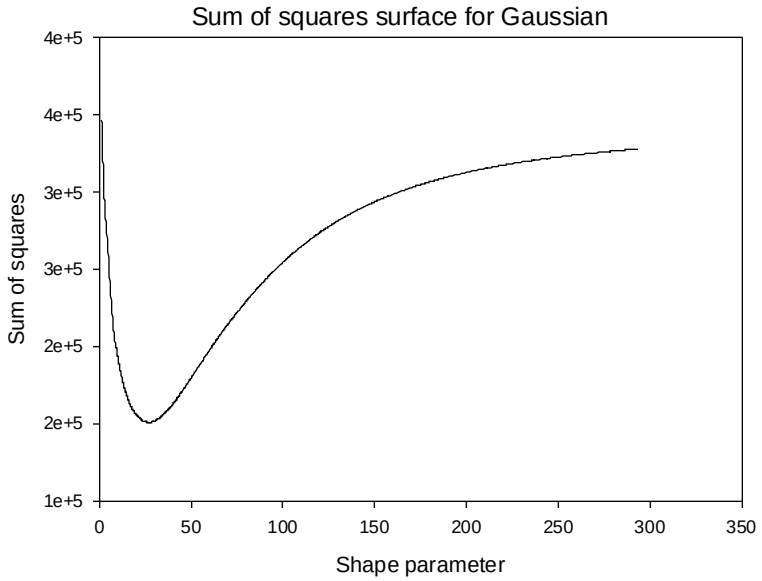


Fig. 43. Prediction sums of squares as a function of the shape parameter for Gaussian weighting used in the non-parametric stock recruit model.

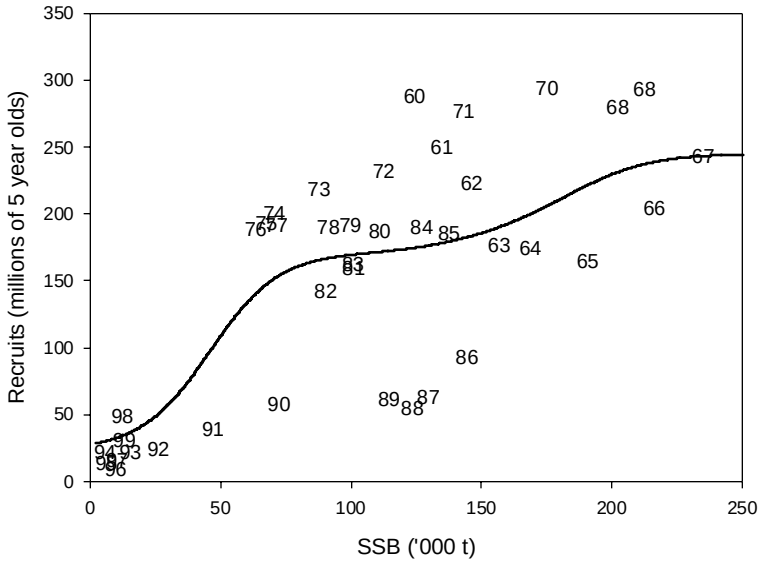


Fig. 44. Predicted recruitment from the non-parametric stock recruit relationship *versus* SSB along with the observed stock recruit points.

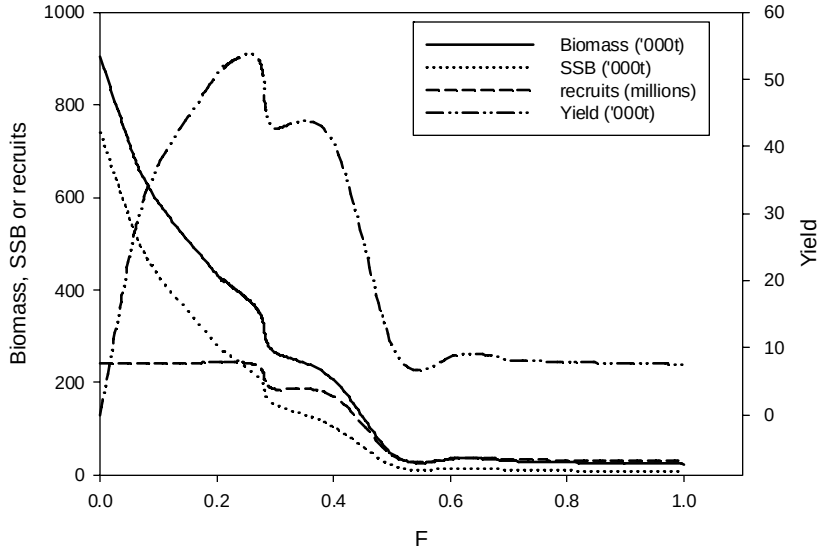


Fig. 45. Equilibrium biomass, SSB, recruitment and yield at different levels of *F*.

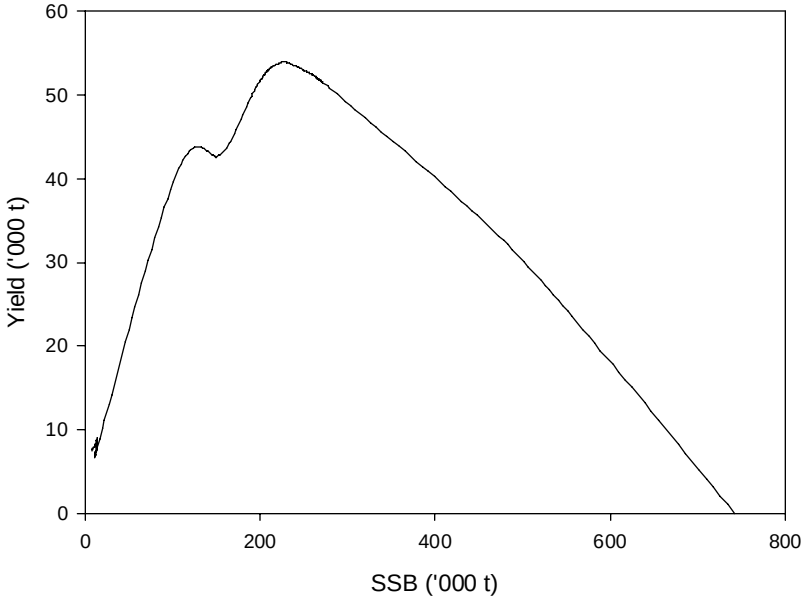


Fig. 46. Equilibrium yield and SSB from the simulations.

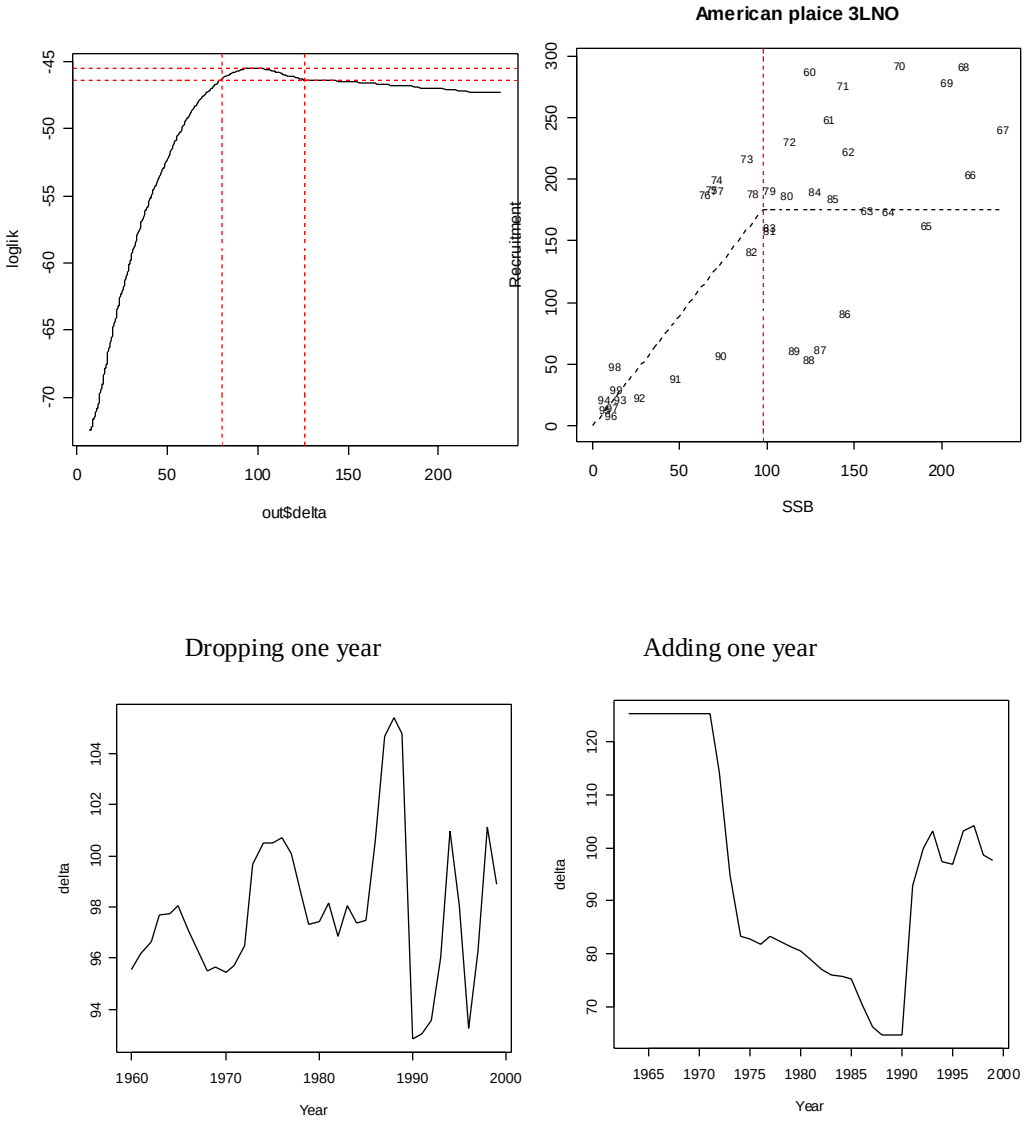


Fig. 47. Results of segmented regression. The bottom panels show the results of deleting and adding one year of data.

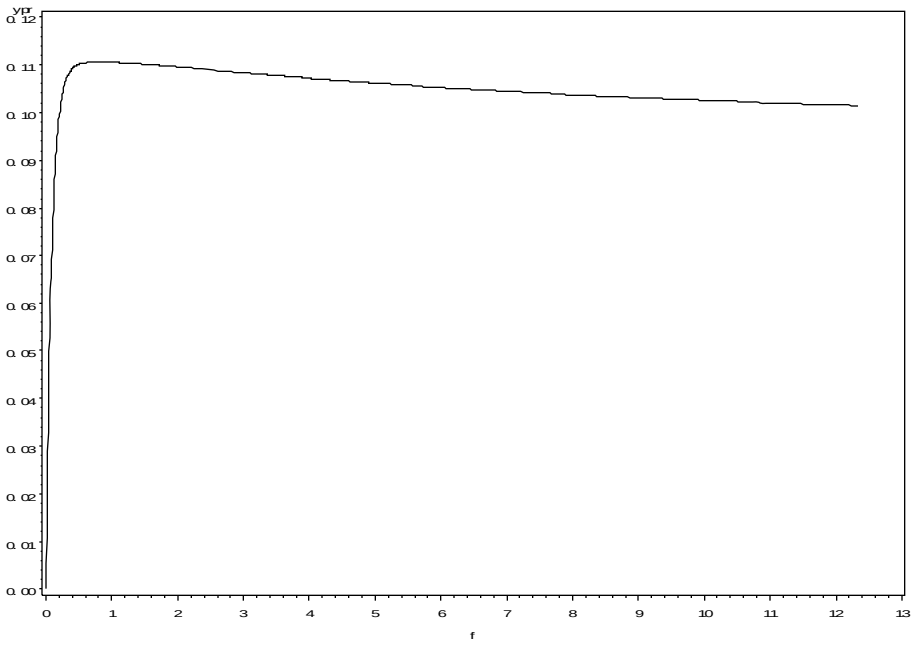


Fig. 48. Yield per recruit curve.

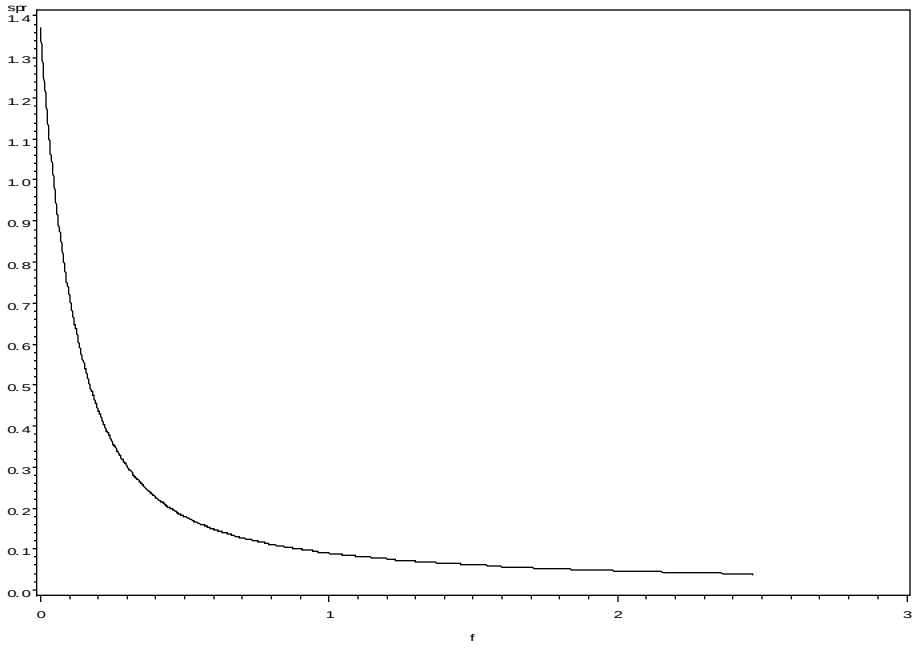


Fig. 49. Spawner per recruit curve.

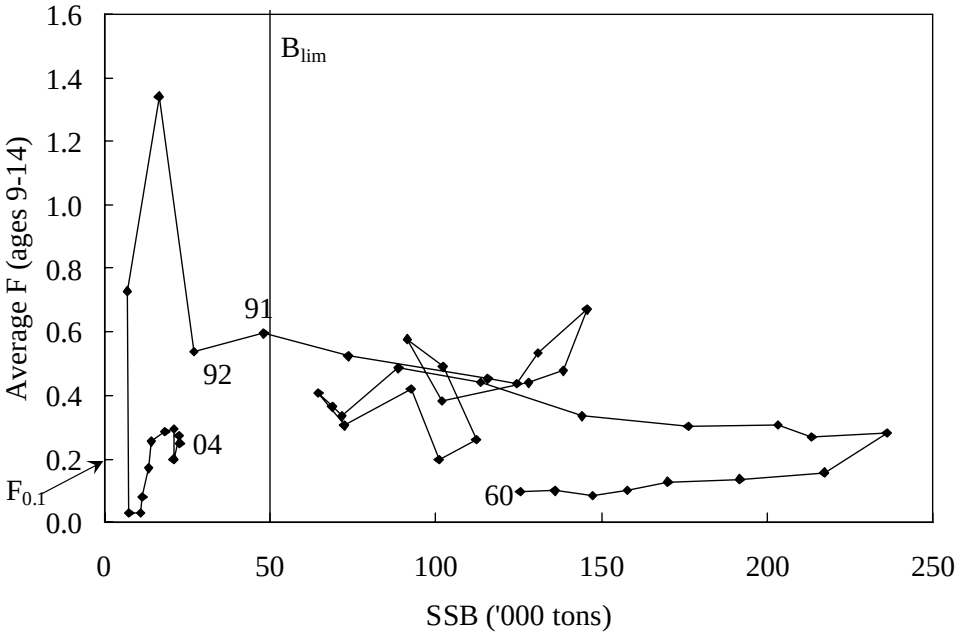


Fig. 50. The stock trajectory for Div. 3LNO American plaice on the NAFO PA framework.