Northwest Atlantic   Fisheries Organization

SCIENTIFIC COUNCIL MEETING – JUNE 2002

An Assessment of American Plaice (*Hippoglossoides platessoides*) in NAFO Division 3M.

by

R. Alpoim[1], C. Darby [2] and A. Ávila de Melo [1]

[1]Instituto de Investigação das Pescas e do Mar, Av. Brasília 1400 Lisboa, Portugal.
[2] Centre for Fisheries & Aquaculture Science (CEFAS), Lowestoft, United Kingdom.

Abstract

The present assessment evaluates the status of the 3M American plaice stock. Historical data have been revised. The catch at age matrix, EU survey abundance at age and the respective mean weights were updated. Both surveys, XSA and ICA estimated declines to very low values for abundance, biomass and SSB. The F index (C/B) from the EU survey and fishing mortality from XSA and ICA are steady between 0.1 and 0.2 over the last years. There are no changes in the perception of the stock status from last assessment (2000). This stock continues to be in a very poor condition, with only weak year-classes coming in and recruiting to SSB for the next five years at least. Although the level of catches is low since 1996, this stock has been kept at a very low level with no sign of recovery.

Introduction

Catch trends and TAC regulation

On Flemish Cap American plaice mainly occurs at depths shallower than 600 m.

In the early 1960's catches were relatively low with the exception of 1961. Catches were high between 1964 and 1966, with a peak in 1965 of 5,341 tons. Till the end of the 1960's catches remained at a low level within 80 tons and 150 tons, jumping to a higher 600 tons-1 100 tons level over the early 1970's. Since 1974 this stock became regulated and catches ranged from 600 tons (1981) to 5 600 tons (1987). From 1986 to 1989 catches exceed the TAC. Catches declined to 275 tons in 1993, following the fast decline of the stock biomass and the 1992 reduction of the Spanish directed effort. Catch for 2001 was estimated to be 149 tons (Table 1 and Fig.1).

Since 1974 till 1993 a TAC of 2 000 tons has been in effect for this stock with the exception of 1978 (TAC of 4 000 tons). A reduction to 1 000 tons was agreed for 1994 and 1995, and finally a moratorium was agreed thereafter (Table 1 and Fig.1).

In the recent year catches of 3M American plaice by Contracting Parties are mainly a by-catch of trawl fisheries directed to other species.

Input data

Survey data

Biomass and abundance estimates:

The plan of stratification of the Flemish Cap (Bishop, 1994) used by the surveys is presented in Fig.2.

1 - Russian Survey 1972 - 2001.

The USSR conducted regular groundfish surveys in NAFO Div. 3M annually from 1972 to 1996 with the exception of 1994, during the spring-summer period. Details of how these surveys are conducted are found in Bulatova and Chumakov (1986).

Period 1972 - 1989 (Bowering and Chumakov 1990 - SCR Doc 90/71)

From 1972 to 1983 the surveys were conducted according to a fixed-station design and sets were of 1 hour duration. From 1984, for consistency, the USSR adopted the stratified random survey used by Canada and limited survey sets to 30 minutes duration. The fishing gear over the period has remained essentially the same and was, therefore, considered a standard.

The data analysis was conducted first by post-stratifying the surveys in the earlier years when they were conducted using fixed-station design. The data were then analysed using the Canadian "stratified analysis program" (STRAP) in order to obtain mean numbers and weights per set, stratum and year and calculate estimates of abundance and biomass. For strata that were not surveyed in certain years, estimates were obtained using a multiplicative analysis model. Abundance and biomass estimates are shown in Table 2.

Period 1983 - 1993 (Rikhter *et al*. 1991, Borovkov *et al.* 1992, 1993, 1994 - SCS Doc 91/5, 92/12, 93/10 and 94/3)

Since 1983 the trawl surveys were carried out following the NAFO method. As in previous years surveys were conducted by BMRT's, however, in 1985 the survey was made by a PST. As previously the 31/27.2 m trawl small-mesh netting was used, which was towed at 3.5 Knots. In 1983 the towing was made for 1 hour. In 1984 stations 30-min tows were used in order to increase the number of fishing stations. Observations were made on a 24-hour basis. (Bulatova and Chumakov, 1986 - SCR Doc. 86/66)
Abundance and biomass estimates for this period are shown in Table 3A.

Period 1995-2001 (Rikhter *et al*. 1996, 1997, Shibanov *et al*, pers. comm. 2002 - SCS Doc 96/3, 97/3)

The Russian survey series continued in 1995, 1996 and 2001. No data on American plaice were available for the first two surveys. For 2001 the biomass and abundance estimates are presented in Table 3B.

2 - Canadian survey 1978 - 1985. (Bowering and Brodie 1995 - J.Northw. Atl.Fish.Sci. Vol 16: 49-61) (Brodie and Bowering 1992 - SCR Doc 92/76) (Bowering, pers. comm. 2002)

Canada conducted research vessel surveys on Flemish Cap from 1978-1985. Surveys were done with the research vessel GADUS ATLANTICA fishing with a lined Engels 145 otter trawl. The surveys were conducted in January-February of each year from 1978-85, using a stratified random design. Fishing sets were usually of 30 minutes duration, over a distance of 1.75 nautical miles, and covered depths between 130 and 728 m. All strata were surveyed each year, with the exception of 1982, when 4 deeper strata were omitted.

Tables 4 presents information on the biomass and abundance distributions of American plaice from these surveys

3 - EU-Spain/Portugal Survey (1988-2001) (Vazquez 2002 - SCR Doc 02/12) (Vazquez, pers. comm. 2002)

EU- Spain/Portugal conducted a random bottom trawl survey up to a depth of 730 metres (400 fathoms) on Flemish Cap since 1988. All surveys had a stratified design following NAFO specifications. The surveys were conducted in June-July of each year. Towing speed was around 3.5 knots. Trawling effective time is 30 min. The fishing gear used was a Lofoten gear with effective 30mm mesh size in the codend.

Estimates for biomass and abundance are presented in tables 5.

4 - Canadian Deepwater Surveys - 1991, 1994 and 1995. (Brodie *et al.*, 1995 - SCR Doc.95/51)

In order to evaluate the distribution and abundance of Greenland halibut deepwater trawl surveys were conducted in 1991 in Div. 3KLM, and in Div.3KLM and part of Div.3N in 1994 and 1995. The 1991 survey was carried out during summer while the 1994 and 1995 surveys were carried out in winter.

All three surveys were conducted by large offshore trawlers with same fishing gear i.e. an Engel 145' otter trawl with 18" rockhopper footgear and a 28 mm liner in the codend in order to retain the catch of small fish. To standardize sets within and among surveys, the fishing gear was equipped with electronic sensors which recorded when the net was on the bottom, the wing spread, headline height, towing speed and distance towed. This was done to dispel any concern related to the use of different vessels.

At the end of each fishing set the catch numbers and weights (kg) were collected for each species caught and where time was available, length frequencies were obtained for the major groundfish species encountered (Tab 6).

The strata surveyed in those surveys are not the strata of the main distribution of the 3M American plaice, but is interesting to note that American plaice appears in some deeper strata from the Northeast and East slopes of the Flemish Cap (520, 521 and 524 strata).

5 - Japanese Deepwater Survey - 1995. (Yokawa and Koga, 1995 - SCR Doc 95/48)

The purpose of this survey was to collect information of the status of stock of Greenland halibut in the deepwater area in the NAFO Regulatory area and to collect background information for the cooperative survey on Greenland halibut in Subareas 1-3.

The survey was conducted in March and April 1995. The area and strata to be covered by the survey were based on the stratification charts and tables from Bishop (1994). The position of each trawl station was chosen arbitrary within each stratum. Towing speed was between 3.5 and 3.8 knot. Tow duration was around two hours. The mesh size of the codend was 140 mm and no liner was used in the codend.

Swept area method was applied to biomass estimation, assuming a catchability coefficient of 1.0. The results are presented in Table 7.

6 - Canadian survey - 1996. (Brodie *et al.*, 1997 - SCR doc 97/42)

During autumn 1996, a trawl survey of NAFO Div.3M was conducted by Canada, as part of an overall survey of Divs 2GHJ and 3KLMNO. The fishing gear used on the survey vessel was the Campelen 1800 shrimp trawl, outfitted with rock-hopper footgear and a 12.7 mm liner in the codend. The trawl was towed along the bottom for 15 minutes at a speed of 3 knots. Estimates of trawlable abundance and biomass were ca1culated, accounting for swept area. Strata with only one haul were excluded from the ana1yses. (Tables 8).

Results of the 1996 survey are not comparable with the former Canadian series (1978-1985) due to changes in survey gear and timing.

Length composition of the stock.

Length frequencies of the stock are available for the Canadian surveys 1978-1985 (Bowering, pers. com. 2002). In 1987 relative length composition presented in the USSR national report (Borovkov *et al*. 1988 - SCS Doc.88/15) was applied to the 1987 abundance estimated by Bowering and Chumakov in 1990 - 15672 thousands fishes (SCR Doc 90/71). Length compositions from 1988 to 2001 were given by the EU survey (Vazquez, pers. com. 2002). (Table 9)

Length weight relationships

Length weight relationships for the 3M American plaice (1988-2001) were calculated with EU survey length/weight data from both sexes (Vazquez *pers. comm*., 2002) and used in this assessment on an annual basis (Table 10).

Stock abundance at age

Age composition of the stock are available from the Canadian Survey 1978-1985 (Bowering, pers. com. 2002).

Morozova (1991) presented estimates of abundance at age from the 1983-1990 USSR surveys.

The EU survey series presents different age reading criteria due to changes in the age reader along the series. The series can be split in two periods: the first from 1988 to 1992 that follows the criteria of one age reader and a second period from 1993 to 2001 in which several age readers have a very good agreement between them. Some work have been done in order to revisit the otoliths from the former years under the present accepted criteria, but due to the size of the otoliths collections from several years and to the detrioration of some sets due to the enhancing methods used before, this work is not yet finished. In order to have the same criteria for all the series a combined age length key from 1993 to 2001 was used backwards over 1988-1992.
Abundance at age of the stock is presented in Table 11.

Stock mean weights at age

The annual EU survey length weight relationships were used to calculate mean weights at age in the 3M American plaice stock for the period 1988-2001 (Table 12). For assessment purposes, on the years where weight at age data are missing, the average mean weights at age for all the period were used.

Maturity ogive

The criteria applied in this work was the same applied in previous years. The spawning stock biomass was been calculated as 50% of age 5 and age 6 plus.

<div align="center">

Commercial data

</div>

Length composition of the commercial catch and by-catch

The historic length composition data for 3M American plaice were revised in order to get a length composition matrix for the recent years. The length compositions presented in the national reports were used to estimate the length compositions for the total catches, with the exception 1994 and 1995 where the length composition of the EU- survey was used. From each length distribution available a mean weight in the catch was used to transform the correspondent catch in weight into a catch number. Each mean weight was calculated as:

$$\overline{W} = \frac{\sum (N_{LC} * \overline{W}_{LC})}{\sum N_{LC}}$$

where N_{LC} is the number observed in length class *LC* and $\overline{W}_{LC}$ is the mean weight of the length class *LC*. Mean weights at length were given by the length/weight relationships from the EU bottom trawl survey series.

The criteria used to breakdown the total catch by fleet component, was similar to the described in previous assessments. Table 13 shows the breakdown of the total catches and the various mean weights and length compositions used. In Table 14 are presented the length composition of the commercial catch as a whole for the period 1988-2001.

Catch at age

The catch at age was given by the same age length keys already used to get survey abundance at age: a combined age length key built with 1993 to 2001 EU survey age data for the first period (1988-1992). From 1993 onwards the annual age length keys from the EU surveys were used to derive the age composition of the annual catch. Catch numbers at age are presented in Table 15.

Catch mean weights at age

The annual EU survey length weight relationships were used to calculate mean weights at age in the catch of 3M American plaice for the period 1988-2001 (Table 16). Missing weights were filled with the respective average catch mean weight at age for all the period. Average mean weight at age 1 from the stock was also assumed on the commercial catch from that age.

Partial recruitment vector

In order to generate an observed partial recruitment vector, a Findex was first derived from the 1988-2001 ratios at age, between the sum of the annual permiles on the commercial catch and the correspondent annual permiles on EU survey abundance. Those indicators of F at age were then standardised to its highest value, recorded at age 11. Assuming a flat top recruitment curve this observed partial recruitment vector was adjusted to a general logistic curve (Table 17, Fig. 4). The expected vector has been used in the yield per recruit analysis.

Vectors used in yield per recruit analysis

An yield per recruit analysis was conducted incorporating the following sets of vectors (Table 18), all of them considered to be representative, in terms of growth and maturity, of 3M American plaice:

 1) Mean weights at age in the commercial catch.
 2) Mean weights at age in the stock.
 3) Female maturity ogive at age.
 4) Expected partial recruitment vector.
 5) Natural mortality set at 0.2.

Assessment results

Comments on trends on stock indicators.

Both periods of the USSR-Russian survey series, although with a high variability, showed a decreasing trend between the 1972-93 in biomass and abundance. From 1978 till 1985 Canadian series is stable, with survey biomass and abundance around 6 700 tons and 10 million fish. A continuous decline in abundance and biomass is observed since the beginning of EU survey. The 2000 abundance and biomass were the lowest of this series (1204 tons and 1.6 millions fishes) although improving a little in 2001. Results of the 1996 Canadian survey are not comparable with the former Canadian series (1978-1985) but were at the same level of the 1996 EU survey. (Tables 2 to 5 and 8, Fig.3).

A proxy to fishing mortality has been giving by the ratio between catch and EU survey biomass for ages fully recruited to the fishery (ages 8-11). This index dropped to a minimum in 1993 and since then fluctuates around 0.1. (Table 19 and Fig. 6). The apparent stability of the level of the catch/biomass ratio could be influenced by unreported catches.

Age 10, corresponding to the 1991 year-class, was the best represented in the 2001 EU survey (Table 11). Since 1991, all the recruiting year-classes were poorly represented in the EU survey. Survey spawning biomass is declining as well since 1988 reaching also to a minimum in 2000.

Age 3 is the first age to appear in all the years of the EU survey series, so it was used to evaluate the stock/ recruitment relationship. Only 11 points are available, showing very poor recruitment for an SSB less than 7 000 tons. (Tab.20, Fig.7).

In Fig 8 it is plotted an EU survey index of stock reproductive potential, the log of the R/SSB ratio for each year class and with both sexes included in spawning biomass. Two different periods can be shown in this figure, one before 1990 and the other after 1991. During the first period, an average of 0.136 recruits at age 3 were produced per Kg of SSB, while in the second period this average was reduced to only 0.012 recruits per Kg of SSB (Fig.8). This recruitment failure seems not to be caused by the shrimp fishery developed in Flemish Cap since the beginning of 90´s, because estimation of by-catch give a very low figures for American plaice (Kulka, 1999).

Mean weights-at-age in the catch showed a moderate decreasing trend from 1988 to 2001 for ages older than 8 (Table 16).

Yield per recruit analyses

An yield-per-recruit analysis was conducted, incorporating the sets of vectors already described. This analysis give a $F_{0.1} = 0.158$ and a $F_{max} = 0.319$.

XSA

A tentative XSA was performed using the Lowestoft VPA Suite (Darby and Flatman, 1994). The input files for XSA analysis are presented in Table 21. Natural mortality was assumed constant at 0.2. The month with a peak of spawning for 3M American plaice is May (Serebryakov, 1987) and was the one considered for the estimate of the proportion of F and M before spawning.

The ratios between annual catches and EU survey bottom biomass were considered to be a proxy of mean fishing mortalities from 1988 to 2001. The survey biomass can be considered representative of the mean annual biomass (EU survey is conducted around the middle of the year). The 2001 F index was multiplied by the observed PR to have a starting guess of F at age in the terminal year. In order to get the F's for the last age through 1988-2001 the selection at age 15 was multiplied by the F index of each year. The rest of the data were already described above.

Several runs have was been performed, five of them are presented.

In all of these five runs:
- No year weights were applied, due to the short time series.
- Age 10 was considered to be the first age at which q is independent of age.
- A shrink survivor estimates with a mean F for the last 5 years and the 5 older true ages was used.

The differences observed between the five runs are related with different options resumed in Table 22:
- The Log (S.E.) for the F means to which the estimates are shrunk.
- The earliest year to be used for tuning the VPA
- Minimun Log (S.E.) for the terminal population estimates derived from each fleet (Threshold se).

Run 4 was considered to have the best diagnostics and these outputs are presented in Table 23 and the plot of the residual showed in figure 9.

The results of the five runs are presented in tables 24 and figures 10. All the runs show the same trends in the biomass, spawning biomass, recruitment and F. Biomass and spawning stock biomass show a steady decline in the recent years to very low levels. Since 1991 the recruitment decline to values near zero. The rate of exploitation has been relatively constant in recent years at levels close to the assumed value of natural mortality.

ICA

Darby (2002) perform an assessment using Integrated Catch at Age (ICA) analysis. The results from this analysis are included in the tables and figures of the results of the XSA for comparison.

Conclusions

All the results indicate that the stock has been in a continuous decline while catches have drop to low levels. Despite interannual variability, a general decrease can be observed in the biomass and abundance estimated by the several surveys, all of them ending by 2000-20001 on the lowest level of each series. The same trends are given by the XSA and ICA results, both of them declining to very low biomass and SSB levels on the terminal year.
Indices from the EU survey, XSA and ICA indicates no sign of recruitment since 1991 with only weak year-classes expected to be recruited to the SSB within at least five years.
F estimates from the XSA (age 6-10) have been relatively constant in recent years at levels close to the natural mortality (0.2). EU survey F index (age 8-11) is stable at around 0.1 since 1993.

Stock status

This stock continues to be in a very poor condition, with only weak year-classes expected to be recruit to the SSB on the next five years. Although the level of catches since 1992 is low, all the analysis indicate that this stock is kept at a very low level with no sign of recovery.

Acknowledgements

References

Alpoim R., M. Carneiro, M.L.Godinho, and A. M. Ávila de Melo – 1992. Portuguese research report for 1991. NAFO SCS Doc. 92/14. N2082. 68p.

Alpoim R., A. M. Ávila de Melo, M.L.Godinho and E. Santos – 1994. Portuguese research report for 1993. NAFO SCS Doc. 94/13. N2397. 49p.

Alpoim R., M.L.Godinho, A. M. Ávila de Melo and E. Santos – 1997. Portuguese research report for 1996. NAFO SCS Doc. 97/9. N2857. 43p.

Alpoim R., M.L.Godinho, E. Santos and A. M. Ávila de Melo – 1998. Portuguese research report for 1997. NAFO SCS Doc. 98/13. N3025. 38p.

Alpoim R., J. Vargas, E. Santos and A. M. Ávila de Melo – 1999. Portuguese research report for 1998. NAFO SCS Doc. 99/16. N4091. 55p.

Ávila de Melo A. M., L.Godinho, R. Alpoim and M. Carneiro– 1990. Portuguese research report for 1989. NAFO SCS Doc. 90/12. N1768. 22p.

Ávila de Melo A. M., M.L.Godinho, R. Alpoim and E. Santos – 1993. Portuguese research report for 1992. NAFO SCS Doc. 93/15. N2224. 48p.

Bishop C. A.. 1994. Revisions and additions to stratification schemes used during research vessel surveys in NAFO Subareas 2 and 3. NAFO SCR Doc 94/43. N2413, 23p.

Bowering W. R. and A. K. Chumakov. 1990. Trends in biomass and abundance estimates of American p1aice (Hippog1ossoides p1atessoides) from USSR surveys in Divisions 3K, 3L, 3M, 3N and 30. NAFO SCR Doc 90/71. N1793, 18p.

Bowering, W.R. and Brodie, W.B. 1995. Distribution, Age and Growth, and Sexual Maturity of American Plaice (*Hippoglossoides platessoides* (Fabricius)) on Flemish Cap (NAFO Division 3M). J. Northw. Atl. Fish. Sci., Vol.16, 49-61.

Borovkov, V., A.K. Chumakov and S. M. Kovalev -1988. Russian national research report for 1987 Section II. NAFO SCS Doc.88/15. Ser. No. N1476, 15 p.

Borovkov, V., S. Kovalev, P. Savvatimsky, V.A. Rikhter and I.K. Sigaev- 1992. Russian research report for 1991. NAFO SCS Doc. 92/12. Ser. No. N2066, 21 p.

Borovkov, V., K. Gorchinsky, S. Kovalev, P. Savvatimsky, V.A. Rikhter and I.K. Sigaev- 1993. Russian research report for 1992. NAFO SCS Doc. 93/10. Ser. No. N2183, 14 p.

Borovkov, V., K. Gorchinsky, S. Kovalev and P. Savvatimsky -1994. Russian national research report for 1993 Part II. NAFO SCS Doc.94/3. Ser. No. N2353, 14 p.

Brodie, W.B. and W.R. Bowering, 1992. Results for American plaice from Canadian Surveys in Div. 3M, 1978-85. NAFO SCR Doc. 92/76. N2131. 4p.

Brodie, W.B., D.Power and M.J.Morgan, 1995. Distribution and Abundance of Five Major Groundfish Species at the Continental Slope of Division 3KLMN based upon Canadian Deepwater Surveys in 1991,1994 and 1995. NAFO SCR Doc. 95/51. N2562. 26p.

Brodie, W.B., M.J.Morgan and E.F. Murphy, 1997. Results for selected species from a Canadian research vessel survey on Flemish Cap, NAFO Div. 3M, in 1996. NAFO SCR Doc. 97/42. N2876. 15p.

Bulatova, A. Yu., and A. K. Chumakov. 1986. USSR trawl surveys in NAFO Subareas 0, 2, 3. NAFO SCR Doc. 86/66, Ser. No. N1183, 13 p.

Darby, C. and S. Flatman, 1994. Virtual population analysis: version 3.1 (Windows/Dos) user guide. *Info. Tech. Ser., MAFF Direct. Fish. Res*., Lowestoft, (1): 85p.

De Cárdenas E., S. Junquera and A. Vazquez– 1995. Spanish research report for 1994. NAFO SCS Doc. 95/15. N2555. 13p.

Godinho L., R. Alpoim, M. Carneiro and A. M. Ávila de Melo – 1991. Portuguese research report for 1990. NAFO SCS Doc. 91/15. N1926. 51p.

Junquera S., E. Rodriguez-Marin and E. de Cárdenas – 1997. Spanish research report for 1996. NAFO SCS Doc. 97/10. N2873. 9p.

Kulka, D. W. – 1999. Update on the By-catch in the shrimp fisheries in Davis Strait to Flemish Cap. NAFO SCR Doc. 99/96. N4168. 15p.

Morozova, G. N. - 1991. Length-age Characteristic and Fluctuation of American Plaice (*Hippoglossoides platessoides*) Abundance in Division 3M From 1983 to 1990. NAFO SCR Doc. 91/12. . Ser. No. N1884, 11p.

Rikhter, V.A., I.K. Sigaev, V. Borovkov, S. Kovalev and P. Savvatimsky -1991. USSR research report for 1990. NAFO SCS Doc. 91/5. . Ser. No. N1889, 25 p.

Rikhter, V.A., I.K. Sigaev, A.A.Vaskov, P. I. Savvatimsky and V.I.Vinnichenko -1996. Russian research report for 1995. NAFO SCS Doc. 96/3. . Ser. No. N2666, 7 p.

Rikhter, V.A., I.K. Sigaev and A.A.Vaskov - 1997. Russian research report for 1996. NAFO SCS Doc. 97/3. . Ser. No. N2825, 6 p.

Serebryakov V.P., A.V. Astafjeva and V.K. Aldonov, 1987. USSR Ichthyoplankton Investigations on Flemish Cap, 1978-83. NAFO Sci. Coun. Studies, 11. 7-21p

Shibanov, V.N., K.V. Gorchinsky and T.M.Igachov, 2002. Results of Russian trawl survey for bottom fish in Div.3M conducted in May-June 2001. NAFO WP 02/13, 8p

Sigaev, I.K., V.A. Rikhter, P.S. Gasiukov, Vaskov, A.A., Igashov, T.M. and Kiseleva, V.M. - 2000. Russian research report for 1999. NAFO SCS Doc. 00/9. N4221. 22p.

Vargas J., R. Alpoim, E. Santos and A. M. Ávila de Melo – 2001. Portuguese research report for 2000. NAFO SCS Doc. 01/9. N4366. 40p.

Vazquez A. and G. P. Gandarras – 1989. Spanish research report for 1988. NAFO SCS Doc. 89/16. N1632. 10p

Vazquez A. and G. P. Gandarras – 1990. Spanish research report for 1989. NAFO SCS Doc. 90/13. N1769. 13p.

Vazquez A., G. P. Gandarras, J. Paz and J. Zamarro – 1991. Spanish research report for 1990. NAFO SCS Doc. 91/16. N1939. 22p.

Vazquez A., G. Perez-Gandarras, J. Paz and J. Zamarro – 1992. Spanish research report for 1991. NAFO SCS Doc. 92/13. N2067. 10p.

Vazquez A., S. Iglesias – 1993. Spanish research report for 1992. NAFO SCS Doc. 93/14. N2206. 7p

Vazquez A., S. Junquera, J.Paz and L.Motos – 1994. Spanish research report for 1993. NAFO SCS Doc. 94/16. N2408. 13p.

Vazquez, A. - 1995. Results from bottom trawl survey of Flemish Cap in July 1994. NAFO SCR Doc.95/26. N2535. 33p.

Vazquez, A. - 1996. Results from bottom trawl survey of Flemish Cap in July 1995. NAFO SCR Doc.96/54. N2730. 27p.

Vazquez, A. - 2002. Results from bottom trawl survey of Flemish Cap in July 2002. NAFO SCR Doc.02/12. N4613. 43p.

Yokawa, K. and J. Koga, 1995. Result of a deep water survey in the NAFO Regulatory area in the spring of 1995, with emphasis on Greenland halibut. NAFO SCR Doc 95/48. N2559, 12p.

TABLE 1 - Nonimal catches (t) from 1960-2001, Stacfis estimates (t) from 1988-2001 and TAC (t) from 1974-2001 of American plaice from NAFO Division 3M.

Year	Country										Flatfishes (NS)	Yellowtail f.	GRAND	STACFIS	TAC
	Canada	Japan	USSR/SUN	Poland	E/ESP	E/GBR	E/PRT	E/DEU	Other	Total	Total	Total	TOTAL	estimates	
1960	-	-	-	-	-	-	-	-	-	0	316	0	316		
1961	-	-	-	-	-	-	-	-	-	0	2282	0	2282		
1962	14	-	-	-	-	-	-	-	-	14	707	0	721		
1963	-	-	51	108	-	20	-	-	-	179	0	0	179		
1964	-	-	1831	8	-	37	-	-	-	1876	0	0	1876		
1965	19	-	4964	216	-	83	-	-	2	5284	57	0	5341		
1966	-	-	4003	17	-	53	-	-	-	4073	0	0	4073		
1967	57	-	-	63	-	33	-	-	1	154	0	0	154		
1968	100	-	121	-	-	4	-	-	-	225	6	0	231		
1969	12	-	113	-	-	-	-	-	-	125	0	0	125		
1970	-	-	62	-	-	-	-	-	-	62	17	0	79		
1971	-	-	1079	-	-	-	-	-	-	1079	0	0	1079		
1972	-	-	665	8	17	65	-	-	106	861	0	0	861		
1973	68	-	312	39	-	85	-	-	-	504	3	127	634		
1974	211	-	1110	-	-	607	-	-	-	1928	3	12	1943		2000
1975	140	-	958	-	8	80	522	-	-	1708	5	31	1744		2000
1976	191	-	809	15	28	-	149	-	-	1192	0	137	1329		2000
1977	30	-	987	7	18	-	457	1	118	1618	0	10	1628		2000
1978	7	49	581	21	36	2	486	100	51	1333	3	0	1336		4000
1979	10	63	457	2	16	-	248	-	-	796	4	0	800		2000
1980	1	1	909	5	3	-	232	34	-	1185	64	0	1249		2000
1981	-	47	309	-	276	-	-	-	-	632	0	0	632		2000
1982	-	53	1002	-	17	-	-	-	-	1072	3	0	1075		2000
1983	-	9	1238	-	434	-	208	-	-	1889	3	0	1892		2000
1984	-	1	711	-	204	-	196	190	-	1302	1	0	1303		2000
1985	-	2	971	-	163	-	266	318	-	1720	0	0	1720		2000
1986	-	3	962	-	1048	-	1741	-	-	3754	0	3	3757		2000
1987	-	-	501	-	4137	-	969	-	-	5607	20	0	5627		2000
1988	-	78	228	-	1608	-	941	-	6	2861	127	1	2989	2800	2000
1989	-	402	88	-	2166	-	1238	-	-	3894	72	0	3966	3500	2000
1990	-	308	-	-	102	-	359	-	21	790	38	94	922	790	2000
1991	-	450	5	-	605	2	996	-	24	2082	3	1	2086	1600	2000
1992	-	50	-	-	390	-	314	-	11	765	0	1	766	765	2000
1993	-	49	-	-	244	-	231	-	181	705	46	20	771	275	2000
1994	-	-	-	-	3	-	251	-	-	254	0	84	338	669	1000
1995	-	-	-	-	125	-	118	-	-	243	14	0	257	1300	1000
1996	-	-	-	-	105	-	29	-	8	142	2	28	172	300	0
1997 (1)	-	-	-	-	56	-	52	-	-	108	0	0	108	208	0
1998 (1)	-	-	-	-	140	-	47	-	1	188	3	2	193	294	0
1999 (1)	-	-	4	-	220	-	19	-	1	244	5	0	249	255	0
2000 (1)	-	-	55	-	168	-	27	-	1	251	1	11	263	133	0
2001 (1)	-	-	14	-	22	-	162	-	-	198	25	109	332	149	0
2002															0

(1) - Provisional

(2) - Recalculated from NAFO statistical data base using the FISHSTAT Plus program by FAO.
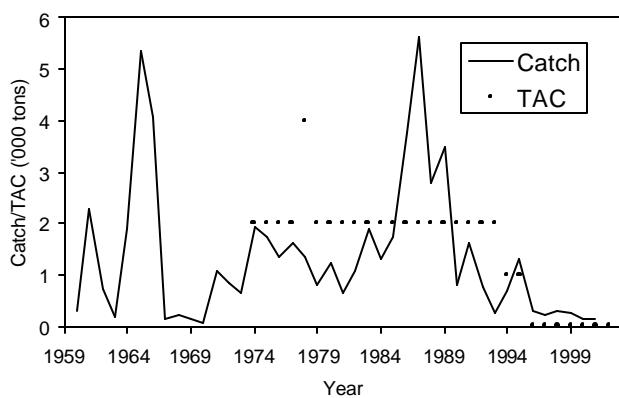
Fig.1 . American plaice in Div.3M: nominal catches and agreed TAC's
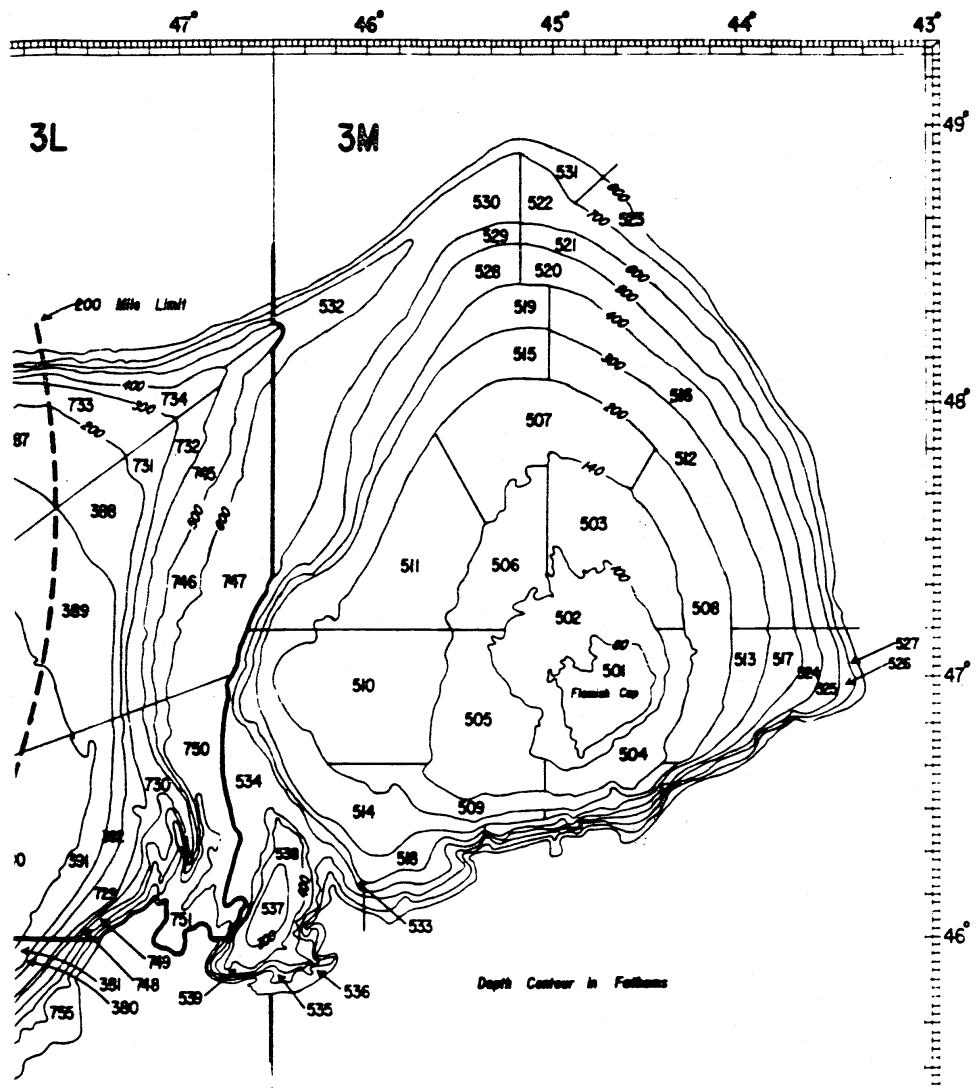
Fig. 2. Stratification scheme for stratified- randowm groundfish surveys in Div 3M. (Bishop 1994).

Table 2 A: Mean number per 30 minute set of American plaice from USSR spring surveys in Division 3M (number of successful sets in brackets).Bowering and Chumakov 1990 - SCR Doc 90/71

Stratum	Depth	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
501	128-146	-	72.51 (2)	54 (2)	-	12.34 (2)	30.6 (2)	19.03 (2)	18.9 (4)	36.63 (3)	47.06 (2)	31.03 (3)	N	54.83 (6)	151.25 (4)	224.5 (4)	81.5 (4)	140.25 (4)	9.83 (6)
502	148-183	27.26 (3)	26.23 (3)	43.97 (2)	39.6 (4)	165.6 (2)	62.57 (3)	-	13.63 (4)	38.47 (5)	46.54 (2)	37.29 (6)	O	60.5 (8)	114 (10)	197.11 (9)	88.4 (10)	23 (9)	26.67 (9)
503	185-256	48.09 (2)	33.17 (2)	67.63 (2)	-	50.23 (3)	101.83 (3)	23.14 (2)	15.3 (4)	8.23 (3)	14.91 (3)	20.4 (6)	O	22.33 (6)	30.71 (7)	48.75 (8)	28.57 (7)	22 (7)	32.86 (7)
504	185-256	-	-	-	-	-	-	-	14.01 (4)	10.46 (3)	16.46 (2)	29.96 (6)		18.75 (4)	8.75 (4)	89.5 (4)	16.25 (4)	17.5 (4)	15 (4)
505	185-256	9 (2)	22.37 (2)	-	-	2.83 (2)	-	6.43 (2)	12.86 (2)	5.4 (2)	-	25.46 (6)	D	36.29 (7)	33.5 (8)	41.63 (8)	25.11 (9)	7.89 (9)	6.5 (10)
506	185-256	5.91 (2)	37.03 (2)	150.69 (2)	110.06 (2)	20.31 (2)	23.4 (2)	-	5.14 (2)	19.67 (4)	-	20.78 (5)	A	27.8 (5)	15 (5)	39 (6)	27 (6)	12.17 (6)	22.67 (6)
507	258-366	11.83 (2)	-	19.29 (2)	-	-	-	-	36.86 (3)	8.23 (2)	11.66 (3)	14.66 (4)	12.03 (5)	T	20.8 (10)	15.7 (10)	17.13 (8)	11.8 (10)	9.67 (9)	13 (9)
508	258-366	4.63 (2)	3.86 (2)	0 (2)	20.4 (3)	4.11 (2)	12 (3)	34.71 (2)	1.8 (2)	2.91 (3)	3.94 (3)	0.77 (2)	A	4.75 (8)	3.1 (10)	5.22 (9)	1.38 (8)	3.25 (8)	1.63 (8)
509	258-366	-	-	-	-	-	12.86 (4)	0.51 (3)	12.65 (5)	0.93 (5)	0.17 (3)	-		3.75 (4)	2 (4)	40 (4)	1 (4)	0 (4)	10.6 (5)
510	258-366	8.74 (2)	-	23.14 (2)	22.11 (2)	-	12.86 (2)	-	9 (4)	22.73 (5)	56.31 (2)	9.77 (4)	A	46.91 (11)	17.45 (11)	50.2 (10)	41.33 (12)	17.7 (10)	12.7 (10)
511	258-366	-	10.54 (2)	-	38.06 (2)	-	24.69 (3)	30.34 (3)	5.66 (7)	21.7 (5)	7.2 (2)	9.43 (3)	V	28.75 (8)	5.78 (8)	19 (9)	11.8 (10)	6 (9)	9.57 (7)
512	367-549	-	-	-	-	-	3.86 (2)	-	1.34 (5)	-	1.29 (2)	0.21 (5)	A	4.88 (8)	1.14 (7)	0.25 (8)	0.11 (9)	0.13 (8)	0.13 (8)
513	367-549	-	-	-	-	23.66 (2)	0 (2)	-	0.31 (5)	-	0 (2)	0.26 (4)	I	8.5 (2)	0.33 (3)	0 (4)	0 (3)	0 (3)	0 (3)
514	367-549	-	-	-	-	-	-	-	0.93 (5)	0.39 (4)	3.86 (2)	1.17 (2)	L	4.63 (8)	5.71 (7)	5.63 (8)	2.63 (8)	6 (7)	1.63 (8)
515	367-549	-	-	-	-	-	-	-	2.4 (3)	1.37 (3)	-	1.37 (6)	A	8.13 (8)	3.29 (7)	1.89 (9)	0.13 (8)	1.5 (8)	0.44 (9)
516	550-731	-	-	-	-	-	-	-	-	-	-	0.13 (4)	B	0.71 (7)	0.57 (7)	0 (8)	0 (8)	0 (8)	0.25 (8)
517	550-731	-	-	-	-	-	-	-	0.26 (2)	-	-	1.24 (3)	L	0 (5)	0 (4)	0 (3)	0 (3)	0 (3)	0 (3)
518	550-731	-	-	-	-	-	-	-	-	-	-	-	E	1.75 (4)	1 (4)	1.33 (3)	0 (4)	3 (3)	0 (4)
519	550-731	-	-	-	-	-	-	-	-	-	-	-		4.4 (5)	0.2 (5)	0 (5)	0 (4)	0.8 (5)	0 (5)
Abundance (000s) (area surveyed)		5989	8099	15121	10971	14025	13292	7395	5186	8562	10592	8822		16864	17573	32376	15672	9736	8072
Abundance (000s) (MM analysis)		10851	12878	21610	26368	61198	17176	16289	5235	8607	12053	8863		16865	18731	32377	15672	9737	8072

Table 2 B: Mean weight (kg) per 30 minute set of American plaice from USSR spring surveys in Division 3M (number of successful sets in brackets). Bowering and Chumakov 1990 - SCR Doc 90/71

Stratum	Depth	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
501	128-146	-	55.85 (2)	40.32 (2)	-	9.85 (2)	15.34 (2)	12.52 (2)	13.36 (4)	32.93 (3)	37.41 (2)	24.34 (3)	N	36.85 (6)	112.85 (4)	129.8 (4)	49.25 (4)	91.7 (4)	6.27 (6)
502	148-183	16.61 (3)	17.57 (3)	30.83 (2)	37.18 (4)	111.93 (2)	134.26 (3)	-	7.62 (4)	26.22 (5)	19.68 (2)	21.54 (6)	O	31.86 (8)	61.72 (10)	120.67 (9)	49.94 (10)	13.23 (9)	13.98 (9)
503	185-256	30.03 (2)	25.12 (2)	49.76 (2)	-	11.66 (3)	31.67 (2)	17 (2)	8.31 (4)	5.3 (3)	6.31 (3)	6.28 (3)	O	7.98 (6)	16.2 (7)	33.53 (8)	15.14 (7)	14 (7)	19.36 (7)
504	185-256	-	-	-	-	-	-	-	6.66 (4)	8.85 (3)	12.37 (2)	12.2 (4)		6.3 (4)	4.85 (4)	71.15 (4)	9.82 (4)	14.38 (4)	10.1 (4)
505	185-256	5.63 (2)	20.34 (2)	-	-	1.59 (2)	-	3.68 (2)	7.02 (2)	3.83 (2)	-	12.77 (6)	D	14.86 (7)	15.7 (8)	22.89 (8)	15.68 (9)	5.52 (8)	4.23 (10)
506	185-256	2.75 (2)	28.34 (2)	135.03 (2)	67.29 (2)	8.69 (2)	8.04 (2)	-	1.75 (2)	13.29 (4)	-	6.33 (5)	A	9.58 (5)	6.42 (5)	21.7 (6)	16.95 (6)	7.58 (6)	14.28 (6)
507	258-366	6.09 (2)	-	13.58 (2)	-	-	-	20.33 (3)	3.57 (2)	5.79 (3)	8.16 (4)	3.36 (5)	T	6.81 (10)	6.93 (10)	10.66 (8)	8.04 (10)	6.42 (9)	7.23 (9)
508	258-366	2.24 (2)	2.83 (2)	0 (2)	5.19 (3)	0.9 (2)	3.46 (3)	20.85 (2)	1.44 (2)	2.74 (3)	2.83 (3)	0.08 (2)	A	1.63 (8)	1.74 (10)	4.5 (9)	0.78 (8)	2.96 (8)	1.33 (8)
509	258-366	-	-	-	-	-	8.96 (4)	0.38 (3)	12.1 (5)	0.57 (5)	0.21 (3)	-		2.17 (4)	0.98 (4)	16.23 (4)	0.73 (4)	0 (4)	6.62 (5)
510	258-366	3.6 (2)	-	19.08 (2)	15.09 (2)	-	6.59 (2)	-	5.22 (4)	15.59 (5)	34.71 (2)	2.43 (4)	A	11.57 (11)	7.55 (11)	21.33 (10)	22.33 (12)	10.16 (10)	14.14 (10)
511	258-366	-	8.33 (2)	-	25.02 (2)	-	10.85 (3)	20.66 (3)	2.88 (7)	14.04 (5)	3.19 (2)	2.73 (3)	V	8.53 (8)	2.36 (8)	10.01 (8)	7.98 (10)	4.23 (9)	5.34 (10)
512	367-549	-	-	-	-	-	1.62 (2)	-	0.85 (5)	-	0.59 (2)	0.1 (5)	A	1.98 (8)	0.43 (7)	0.1 (8)	0.07 (9)	0.15 (8)	0.08 (8)
513	367-549	-	-	-	-	28.83 (2)	0 (2)	-	0.42 (5)	-	0 (2)	0.28 (4)	I	2.55 (2)	0.07 (3)	0 (4)	0 (3)	0 (3)	0 (3)
514	367-549	-	-	-	-	-	-	-	0.6 (5)	0.32 (4)	1.62 (2)	1.1 (2)	L	1.81 (8)	2.56 (7)	2.51 (8)	1.38 (8)	4.04 (7)	0.98 (8)
515	367-549	-	-	-	-	-	-	-	1.82 (3)	0.94 (3)	-	0.82 (6)	A	3.68 (8)	1.47 (7)	0.98 (9)	0.15 (8)	0.81 (8)	0.2 (9)
516	550-731	-	-	-	-	-	-	-	-	-	-	0.14 (4)	B	0.26 (7)	0.26 (7)	0 (8)	0 (8)	0 (8)	0.25 (8)
517	550-731	-	-	-	-	-	-	-	0.31 (2)	-	-	0.52 (3)	L	0 (5)	0 (4)	0 (3)	0 (3)	0 (3)	0 (3)
518	550-731	-	-	-	-	-	-	-	-	-	-	-	E	0.75 (4)	0.55 (4)	0.4 (3)	0 (4)	0 (3)	0 (4)
519	550-731	-	-	-	-	-	-	-	-	-	-	-		2.76 (5)	0.1 (5)	0 (5)	0 (4)	0.54 (5)	0 (5)
Biomass (t) (area surveyed)		3449	6217	12013	7360	8458	11699	4635	2987	5937	5973	3993		6746	9756	19090	9123	6285	4826
Biomass (t) (MM analysis)		6534	9525	17916	14104	47492	13712	10547	3022	5978	7098	4012		6747	10264	19090	9124	6284	4827

Table 3 A - 3M American plaice abundance and biomass estimates
from USSR trawl surveys in 1983-93.
(Rikhter et al. 1991, Borovkov et al. 1992, 1993, 1994)

Year	Abundance (000s)	Biomass (t)
1983	20400	8900
1984	26500	7500
1985	15800	7800
1986	33400	20200
1987	16500	9300
1988	10000	6500
1989	8300	5000
1990	2600	1200
1991	12700	14400
1992	1900	1000
1993	3600	2700

Table 3 B - Results from the Russian trawl survey for American place in Div. 3M, 2001.
(Shibanov *et al*, pers. comm. 2002)

Stratum	Depth m	Area mile2	No of tows	Mean catch on valid tow		Index	
				fish	kg	abundance '000	biomass tons
501	127-146	342	3	8.7	5.5	219.6	138.40
502	147-183	838	3	0.7	0.6	41.4	39.73
503	185-256	628	3	0.0	0.0	0.0	0.00
504	185-256	348	3	2.0	0.9	51.6	23.07
505	185-256	703	3	0.0	0.0	0.0	0.00
506	185-256	496	3	0.0	0.0	0.0	0.00
507	258-366	822	3	0.0	0.0	0.0	0.00
508	258-366	646	3	0.0	0.0	0.0	0.00
509	258-366	314	3	1.0	0.9	23.3	19.77
510	258-366	951	3	0.0	0.0	0.0	0.00
511	258-366	806	3	0.0	0.0	0.0	0.00
512	367-549	670	3	0.3	0.1	16.5	3.54
513	367-549	249	3	0.0	0.0	0.0	0.00
514	367-549	602	3	1.7	1.1	74.3	48.70
515	367-549	666	3	0.7	0.4	32.9	19.21
516	550-731	634	3	0.0	0.0	0.0	0.00
517	550-731	216	2	0.0	0.0	0.0	0.00
518	550-731	210	3	0.7	0.6	10.4	9.36
519	550-731	414	4	0.5	0.5	15.3	13.91
520	732-914	525	3	0.0	0.0	0.0	0.00
524	732-914	253	3	0.3	0.4	6.2	6.97
528	732-914	530	3	2.0	2.0	78.5	79.34
533	732-914	98	2	0.0	0.0	0.0	0.00
521	915-1097	517	3	0.7	0.8	25.5	30.27
525	915-1097	226	2	0.0	0.0	0.0	0.00
529	915-1097	488	3	1.7	2.0	60.2	71.89
532	915-1097	238	3	0.0	0.0	0.0	0.00
534	915-1097	486	3	0.7	0.8	24.0	27.00
522	1098-1280	533	3	0.3	0.4	13.2	16.53
526	1098-1280	177	2	0.0	0.0	0.0	0.00
530	1098-1280	1134	3	0.0	0.0	0.0	0.00
Total		15760	90			692.9	547.7

Table 4 A - Canadian surveys in Div.3M from 1978-85: estimates of biomass (t) of A.plaice.

Stratum	Depth range (m)	Area (sq. n. mi.)	Year 1978	1979	1980	1981	1982	1983	1984	1985
501	128 - 146	342	344.15	49.55	102.69	208.97	88.82	90.88	201.52	587.25
502	147 - 184	838	2735.3	137.97	119.52	268.77	258.48	1046.5	512.67	402.58
503	185 - 256	628	1270.1	181.88	145.55	182.08	49.5	210.36	303.47	288.73
504	185 - 256	348	274.5	28.73	8897.9	1424.7	534.99	3965.4	770.61	152.16
505	185 - 256	703	366.28	121.81	265.83	194.08	175.31	1515.7	606.86	270.45
506	185 - 256	496	335.65	543.71	330.74	507.42	128.72	815.38	347.5	772.56
507	257 - 366	822	265.86	175.13	83.61	68.99	121.72	284.39	482.82	147.47
508	257 - 366	646	179.69	3333.5	61.83	50.11	29.09	94.02	101.83	60.92
509	257 - 366	314	255.54	80.26	111.96	83.67	159.1	190.33	79.55	58.93
510	257 - 366	951	487.82	207.97	416.42	298.17	836.32	522.22	971.49	432.48
511	257 - 366	806	245.69	277.1	396.89	347.06	161.15	306.36	456.79	692.74
512	367 - 549	670	43.25	77.95	46.21	21.79	25.15	69.85	99.96	49.04
513	367 - 549	249	8.46	21.21	0	6.23	10.59	2.18	0	6.23
514	367 - 549	602	189.68	242.81	519.02	369.42	259.83	79.64	569.7	1049
515	367 - 549	666	110.13	323.58	331.83	96.1	.	201.64	412.44	521.17
516	550 - 731	634	16.18	16.18	13.09	6.35	.	4.76	8.33	33.91
517	550 - 731	216	14.71	23.35	0	0	.	310.56	1.08	0
518	550 - 731	210	85.83	0	80.43	60.95	.	2.1	21.02	0
519	550 - 731	414	115.6	72.93	70.5	28.59	.	4.97	18.65	36.05
TOTAL			7344.4	5915.6	11994.0	4223.5	2838.8	9717.2	5966.3	5561.7

Table 4 B - Canadian surveys in Div.3M from 1978-85: estimates of abundance (000s) of A.plaice.

Stratum	Depth range (m)	Area (sq. n. mi.)	Year 1978	1979	1980	1981	1982	1983	1984	1985
501	128 - 146	342	342.72	51.34	96.27	236.18	102.69	97.55	308.06	596.87
502	147 - 184	838	4443.3	157.26	211.59	314.52	463.2	2053	1044.2	710.81
503	185 - 256	628	2196.7	345.7	253.38	318.2	153.21	659.96	648.18	671.75
504	185 - 256	348	417.96	91.43	6373.9	1839	689.63	4649.8	1495.5	326.53
505	185 - 256	703	749.34	219.88	395.78	240.4	287.3	2984.4	1299.5	547.49
506	185 - 256	496	698.1	837.72	484.01	585.07	313.81	1728.6	943.21	1656.8
507	257 - 366	822	593.89	267.38	117.24	117.8	347.78	875.06	1079.8	431.92
508	257 - 366	646	334.05	2440.7	133.35	107.76	70.04	280.17	254.58	163.66
509	257 - 366	314	265.16	76.6	100.17	82.5	170.88	282.84	153.21	129.64
510	257 - 366	951	1019.8	309.34	529.45	428.32	1029.1	971.95	2075.2	987.51
511	257 - 366	806	561.02	484.01	471.91	429.01	385.01	968.03	1222.1	1827.2
512	367 - 549	670	100.59	117.35	37.72	33.53	50.29	206.76	238.89	106.87
513	367 - 549	249	18.69	18.69	0	6.23	18.69	12.46	0	12.46
514	367 - 549	602	321.97	391.63	652.01	451.89	367.16	141.21	1052.2	2259.9
515	367 - 549	666	235.68	487.43	374.95	138.87	.	511.04	962.36	1243.6
516	550 - 731	634	11.9	39.66	17.85	21.15	.	15.86	23.8	41.64
517	550 - 731	216	24.32	32.43	0	0	.	396.62	5.4	0
518	550 - 731	210	181.28	0	83.67	73.56	.	5.25	15.76	0
519	550 - 731	414	223.75	113.95	75.36	43.51	.	18.65	31.08	74.58
TOTAL			12740.2	6482.5	10408.6	5467.5	4448.8	16859.2	12853.0	11789.2

Table 5 A - EU- surveys in Div.3M from 1988-2001: estimates of biomass (t) of A.plaice.

Stratum	Depth range (m)	Area (sq. n. mi.)	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
501	128-146	342	979	750	448	808	532	809	496	1672	1096	286	117	279	259	782
502	148-183	838	2133	2701	1040	1997	1285	950	899	1001	707	555	1190	1357	732	626
503	185-256	628	1025	838	1207	935	473	333	244	189	126	371	213	73	16	70
504	185-256	348	1649	346	661	240	418	429	640	367	201	152	257	40	75	64
505	185-256	703	1949	2319	1406	1055	628	968	922	412	375	464	558	55	42	84
506	185-256	496	359	847	720	376	451	229	606	92	24	10	26	30	19	28
507	258-366	822	880	398	562	292	479	239	237	187	54	62	35	14	11	21
508	258-366	646	313	123	209	188	545	365	128	99	42	92	124	2	0	34
509	258-366	314	77	122	262	0	280	154	15	375	41	27	0	0	0	0
510	258-366	951	1742	1118	1555	981	1054	1094	1677	531	311	215	27	54	34	71
511	258-366	806	889	876	973	301	279	219	227	82	51	24	22	28	17	20
512	367-549	670	7	14	35	13	8	11	25	9	24	5	0	0	0	3
513	367-549	249	2	0	15	0	0	0	0	2	0	0	0	0	0	0
514	367-549	602	6	6	6	292	22	5	18	11	3	0	3	7	0	0
515	367-549	666	17	74	2	73	28	82	30	51	17	5	5	0	0	0
516	550-731	634	4	0	0	3	7	9	4	0	0	0	0	0	0	0
517	550-731	216	0	0	0	0	0	0	0	0	0	0	0	0	0	0
518	550-731	210	0	0	0	0	0	0	0	0	0	0	0	0	0	0
519	550-731	414	0	0	0	11	3	4	2	8	0	0	0	0	0	0
total			12029	10533	9101	7565	6492	5901	6169	5087	3073	2268	2577	1940	1204	1803
S.e.			1387	1533	987	887	719	779	1028	809	681	528	561	654	252	324

Table 5 B - EU-surveys in Div.3M from 1988-2001: estimates of abundance (000s) of A.plaice.

Stratum	Depth range (m)	Area (sq. n. mi.)	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
501	128-146	342	1875	1433	735	1371	902	1278	661	2635	1718	540	203	431	417	1235
502	148-183	838	4679	5969	1924	4128	2036	1579	1223	918	871	572	1140	1188	871	609
503	185-256	628	2158	2346	2632	1469	795	512	356	246	122	409	225	84	27	102
504	185-256	348	2603	643	1070	408	751	638	668	382	212	141	277	48	80	60
505	185-256	703	5456	4079	2474	2320	974	1244	1113	501	465	526	733	70	53	120
506	185-256	496	1372	1914	1886	894	888	536	895	131	50	31	38	46	31	31
507	258-366	822	1776	915	1150	583	668	479	301	269	102	117	65	21	21	28
508	258-366	646	493	283	294	213	675	497	148	103	54	105	120	7	0	28
509	258-366	314	151	213	380	0	496	261	27	695	84	37	0	0	0	0
510	258-366	951	3430	2140	2638	1890	1729	1647	2537	904	536	356	58	100	78	118
511	258-366	806	1616	1757	1512	578	470	462	410	161	117	51	27	57	47	27
512	367-549	670	26	10	50	27	20	22	36	24	31	8	0	0	0	6
513	367-549	249	18	0	18	0	0	0	0	6	0	0	0	0	0	0
514	367-549	602	12	7	15	558	44	7	74	22	8	0	6	15	0	0
515	367-549	666	36	124	6	150	32	125	55	86	15	8	6	0	0	0
516	550-731	634	14	0	0	7	17	23	7	0	0	0	0	0	0	0
517	550-731	216	0	0	0	0	0	0	0	0	0	0	0	0	0	0
518	550-731	210	0	0	0	0	0	0	0	0	0	0	0	0	0	0
519	550-731	414	0	0	0	20	6	18	9	19	0	0	0	0	0	0
total			25714	21834	16784	14616	10502	9329	8520	7102	4386	2901	2899	2067	1624	2365

Table 6 - CANADIAN DEEPWATER SURVEYS: Estimated numbers and biomass per stratum of American plaice
from the summer survey 1991 and the winter surveys in 1994 and 1995.
(Brodie et al., 1995 - SCR Doc.95/51)

Stratum	Depth range (m)	Area (sq nm)	Trawlable Units (000)	Abundance (000's)			Biomass (ton)		
				1991	1994	1995	1991	1994	1995
537	367-549	102	8	-	4	-	-	3	-
538	550-731	194	15	-	10	0	-	9	0
520	732-914	525	39	21	30	-	9	26	-
524	732-914	253	19	-	95	-	-	67	-
528	732-914	530	40	12	60	191	5	22	137
533	732-914	98	7	-	-	18	-	-	10
539	732-914	133	10	-	20	15	-	16	10
521	916-1097	517	39	0	26	-	0	17	-
529	916-1097	488	37	19	171	348	13	116	348
532	916-1097	238	18	0	0	9	0	0	5
534	916-1097	486	36	-	1255	660		1086	503
522	1099-1280	533	40	0	0	-	0	0	-
530	1099-1280	1134	85	0	21	8	0	29	5
535	1099-1280	92	7	-	3	190	-	2	171
523	1282-1463	284	21	-	0	-	-	0	-
527	1282-1463	171	13	-	0	-	-	0	-
531	1282-1463	203	15	0	-	-	0	-	-
536	1282-1463	112	8	-	0	0	-	0	0
Total				52	1695	1439	27	1393	1190
95% Lower				-7	247	607	-13	64	542
95% Upper				111	3142	2272	68	2722	1837

Table 7 - Japanese deepwater survey 1995.
(Yokawa and Koga, 1995 - SCR Doc 95/48)

Stratum	Depth range (m)	Biomass	Standart error
516	550-731	0	0
520	732-914	0	0
521	916-1097	0	0
522	1099-1280	0	0
523	1282-1463	0	0
525	916-1097	0	0
528	732-914	11	9
529	916-1097	96	45
530	1099-1280	0	0
532	916-1097	8	8
	Biomass(t)	115	

Table 8 A - Catches of A.plaice, with associated estimates of abundance and biomass, from Canadian survey in Div.3M in 1996.
(Brodie et al., 1997 - SCR doc 97/42)

Stratum	Depth range (m)	Sets	Units	Numbers				Weights			
				Catch	Av./Set	Total No.	Variance	Catch	Av./Set	Total Wt.	Variance
501	128-146	2	47500	13.0	6.50	308.750	60.5	8.8	4.40	209.000	33.6
502	148-183	6	116389	24.3	4.05	471.098	10.6	20.4	3.41	396.554	5.5
503	185-256	4	87222	3.8	0.94	82.377	1.2	4.7	1.17	102.244	1.8
504	185-256	2	48333	3.6	1.78	85.926	6.3	2.3	1.16	55.852	2.7
505	185-256	5	97639	41.8	8.36	815.827	119.0	37.0	7.39	721.985	76.0
506	185-256	3	68889	27.0	9.00	620.000	171.0	17.8	5.92	407.593	63.2
507	258-366	5	114167	6.2	1.24	142.074	1.0	4.2	0.84	96.407	0.7
508	258-366	4	89722	0.0	0.00	-	0.0	0.0	0.00	-	0.0
509	258-366	2	43611	0.0	0.00	-	0.0	0.0	0.00	-	0.0
510	258-366	6	132083	15.7	2.61	344.884	6.6	10.7	1.78	235.304	5.2
511	258-366	5	111944	6.7	1.33	149.259	2.4	4.4	0.87	97.541	2.1
512	367-549	4	93056	0.0	0.00	-	0.0	0.0	0.00	-	0.0
513	367-549	2	34583	0.0	0.00	-	0.0	0.0	0.00	-	0.0
514	367-549	4	83611	2.0	0.50	41.806	1.0	0.0	0.01	627	0.0002
515	367-549	3	92500	2.0	0.67	61.667	1.3	0.5	0.17	15.417	0.1
516	550-731	4	88056	0.0	0.00	-	0.0	0.0	0.00	-	0.0
517	550-731	2	30000	0.0	0.00	-	0.0	0.0	0.00	-	0.0
518	550-731	2	29167	0.0	0.00	-	0.0	0.0	0.00	-	0.0
519	550-731	3	57500	1.8	0.59	34.074	1.1	1.2	0.39	22.148	0.4
528	732-914	2	73611	2.0	1.00	73.611	2.0	2.0	1.00	73.611	2.0
529	916-1097	2	67778	0.0	0.00	-	0.0	0.0	0.00	-	0.0
530	1099-1280	2	157500	0.0	0.00	-	0.0	0.0	0.00	-	0.0
531	1282-1463	2	28194	0.0	0.00	-	0.0	0.0	0.00	-	0.0
532	916-1097	2	33056	0.0	0.00	-	0.0	0.0	0.00	-	0.0
533	732-914	2	13611	2.0	1.00	13.611	2.0	0.8	0.40	5.444	0.3
534	916-1097	2	67500	0.0	0.00	-	0.0	0.0	0.00	-	0.0
535	1099-1280	2	12778	0.0	0.00	-	0.0	0.0	0.00	-	0.0
536	1282-1463	2	15556	0.0	0.00	-	0.0	0.0	0.00	-	0.0
					1.68	3244.964			1.26	2439.727	

Table 8 B - Abundance and biomass estimates, with approx. 95% C.I., for A.plaice from Canadian survey in Div.3M in 1996
(Brodie et al., 1997 - SCR doc 97/42)

|	Upper	Mean	Lower
Abundance (millions)	5.1	3.2	1.4
Biomass ('000 tons)	3.7	2.4	1.1
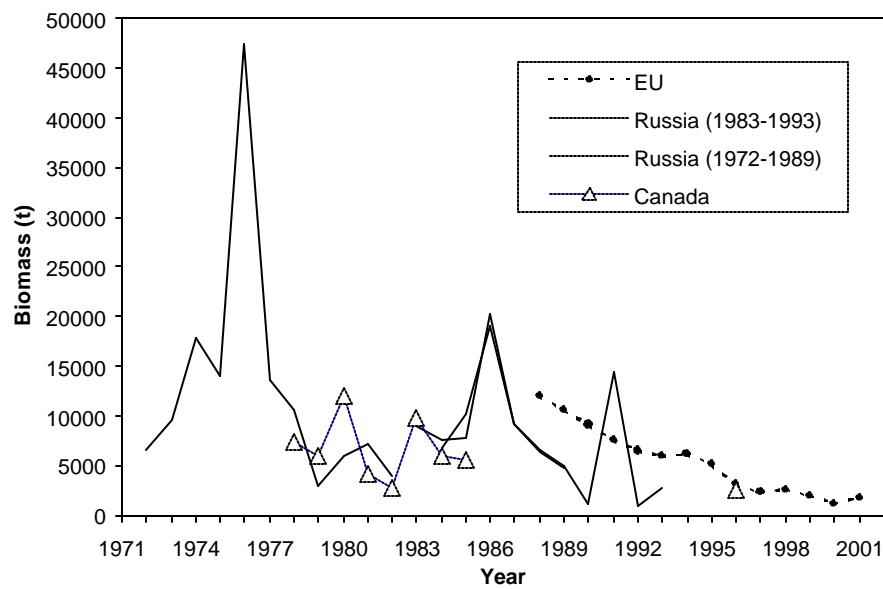
Fig.3A. American plaice in Div. 3M: trends in biomass in the surveys.
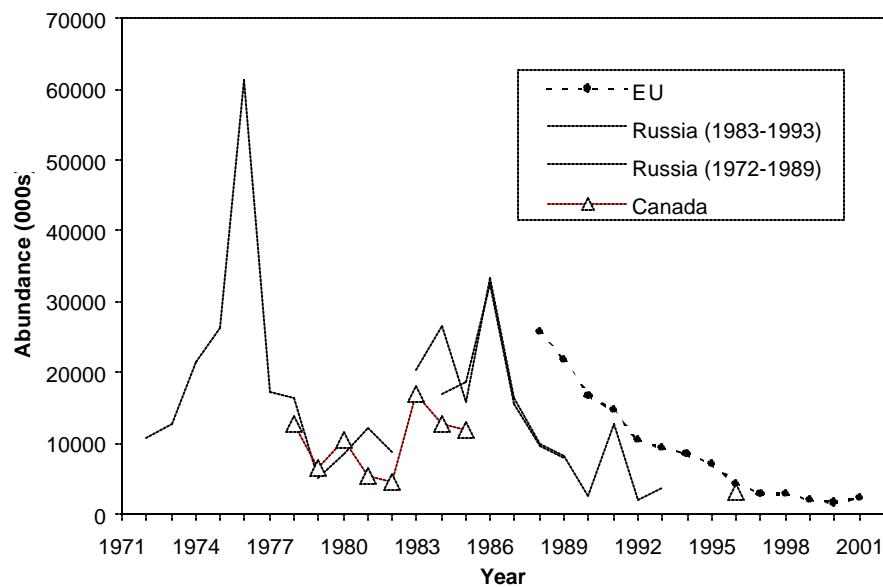

Fig.3B. American plaice in Div. 3M: trends in abundance in the surveys.

Table 9: Length composition (absolute frequencies in '000) of the 3M american plaice stock, 1978-2001.

Canadian winter surveys series / USSR

Length group	1978	1979	1980	1981	1982	1983	1984	1985	1987	Length group
10				11						10
12	4		6	5			6		142	12
14	50		12	40		6		13	727	14
16	17	15			11	11			1044	16
18					38	22	19	37	1202	18
20		8	6	16	111	87	88	13	1044	20
22	50	164	7	27	416	152	161	31	1676	22
24	109	152	55	60	491	345	239	260	1803	24
26	204	73	94	33	95	903	448	495	1313	26
28	372	61	164	45	69	2206	929	804	1313	28
30	791	78	356	83	207	3668	1461	1189	1249	30
32	1266	162	253	178	187	2243	2327	1843	759	32
34	2011	388	147	384	184	827	2128	2068	648	34
36	1516	957	504	684	239	481	1993	1581	506	36
38	1329	704	741	760	311	754	1244	1481	364	38
40	1033	683	982	588	403	821	422	751	395	40
42	663	665	949	507	330	712	358	363	332	42
44	346	450	986	708	302	589	269	162	237	44
46	293	229	783	536	272	751	269	155	206	46
48	354	278	640	370	199	696	150	202	174	48
50	306	454	1047	199	214	762	177	120	127	50
52	165	356	1138	135	130	493	105	107	79	52
54	119	377	758	75	65	211	24	75	95	54
56	11	145	613	5	22	110	24	39	79	56
58		65	190	16			6		47	58
60		8	40			5			32	60
62									47	62
64									16	64
66									16	66
Total	11007	6475	10472	5467	4295	16859	12847	11789	15672	Total
mean length	37.7	42.1	45.7	41.4	37.0	36.2	35.2	35.7	28.2	

EU series

Length group	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Length group
4							6								4
6				18											6
8				18											8
10		36	6	25								6	7		10
12	70	12		42					7	7			6		12
14	577	12		44	42										14
16	1325	90	130	124	199		7	12	6	7					16
18	306	284	357	92	381	17	27	13	28	14			6	7	18
20	58	1047	127	71	218	33	28				14		7	27	20
22	173	2466	163	421	112	171	27		13		14		14		22
24	307	2781	339	756	234	506	37	39	33	26	7	7	7	7	24
26	598	1393	598	428	310	555	110	39	52	7	13	7	27		26
28	969	434	1128	417	337	322	251	98	61	39	39	28	38	46	28
30	1490	554	2571	714	389	589	618	183	99	26	13	7	27	20	30
32	2556	868	2460	1485	489	504	818	552	254	166	67	47	60	58	32
34	3138	1756	1388	2303	952	533	732	573	314	159	190	105	115	170	34
36	3030	2472	1218	2042	1578	949	801	908	548	303	290	181	177	252	36
38	2243	1860	1264	1688	1432	1020	1181	1187	754	484	282	182	183	473	38
40	2339	1398	1016	1038	1115	1059	1052	1007	715	328	355	225	206	309	40
42	2487	1218	927	600	909	880	420	670	441	234	273	151	181	188	42
44	2359	1492	1102	794	462	715	512	347	270	220	276	152	96	124	44
46	717	887	1001	706	456	553	596	341	181	166	256	166	167	103	46
48	439	415	598	481	469	283	560	316	251	226	223	257	122	136	48
50	198	156	236	158	268	335	333	379	195	261	267	212	108	169	50
52	164	140	86	104	101	207	226	236	91	131	199	230	65	156	52
54	77	42	41	26	35	57	102	162	60	26	80	53	19	85	54
56	62	15	20	14	7	23	70	29	32	20	40	33	7		56
58	33	6	6	7		16		6	6	7	6	6		6	58
60								6	6			6			60
62							6								62
64															64
66					7										66
Total	25714	21834	16784	14616	10502	9329	8520	7102	4386	2901	2899	2067	1624	2365	Total
mean length	36.1	33.7	36.0	36.2	37.1	38.3	39.8	40.8	40.6	41.7	43.5	44.6	41.5	41.9	

Table 10: Length weight relationships of 3M American plaice (Vazquez, *pers. comm*. 2002)

Year	a	b	n
1988	0.004794	3.2121	1211
1989	0.005519	3.1810	1192
1990	0.004266	3.2420	1314
1991	0.004328	3.2404	1032
1992	0.004770	3.2130	1296
1993	0.002957	3.3362	1036
1994	0.002948	3.3373	1066
1995	0.002732	3.3474	772
1996	0.004766	3.1978	571
1997	0.004553	3.2116	437
1998	0.004370	3.2260	442
1999	0.004288	3.2294	452
2000	0.008201	3.0444	411
2001	0.004410	3.2074	570
All period	0.0051	3.1886	11802

Table 11: Population abundance (000s) at age (yrs) of A. plaice from surveys in Div. 3M during 1978-2001.

Canadian surveys

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1978		66	13	530	6058	1355	1193	680	255	477	285	74	21			11007
1979			216	183	520	2894	574	302	350	326	627	388	40	57		6477
1980			17	9	766	238	766	3096	1272	967	849	744	936	799		10459
1981		44	52	155	1287	596	1091	1502	300	202	133	33	50		16	5461
1982		10	938	605	227	685	425	492	523	155	132	45	29	13	8	4287
1983			298	9360	1549	973	1323	1108	750	1029	279	174	5			16848
1984			160	1619	8374	1061	543	599	239	140	67	27	7			12836
1985		8	47	1113	4731	4518	474	278	275	193	85	53	7			11782

USSR surveys

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1983		101	3036	3643	6477	2429	1417	1417	810	405	101	162	121	40	40	61	20260
1984		69	1904	2251	5714	3463	1731	1039	519	346	52	87	69	35	17	35	17331
1985		59	784	1372	5097	5293	3333	1764	784	392	98	118	74	20	20	20	19228
1986		300	1335	2336	8342	8676	5673	4004	1335	667	200	233	200	33	33	33	33400
1987		6	969	969	3230	3715	3230	2584	808	323	81	81	81	11	11	24	16123
1988		50	301	603	2110	2110	2009	1808	603	201	40	40	30	5	9	5	9924
1989		42	1665	583	1332	1498	1332	1165	416	166	50	42	33	7	17	7	8355
1990		8	206	283	721	489	386	309	129	51		8					2590

EU surveys

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1988	503	1391	1683	4080	3511	3057	4445	2664	1608	1024	599	381	217	335	138	77	25714
1989	48	1587	5756	2306	2150	1883	2807	1886	1203	805	502	325	172	258	96	48	21834
1990	6	577	1372	4598	2015	1381	2078	1533	1064	739	486	328	188	263	104	52	16784
1991	140	322	1487	2286	2321	1548	2089	1457	1012	686	452	302	151	213	77	74	14616
1992	20	685	762	1030	1175	1230	1772	1200	840	596	402	274	145	222	87	61	10502
1993		24	1376	970	647	340	3108	351	596	281	197	229	281	861	29	36	9339
1994	6	40	38	1789	779	647	706	2471	241	476	166	163	194	398	397	8	8520
1995		25	99	631	1617	989	986	664	1130	126	143	119	120	242	183	27	7102
1996	7	34	103	227	471	1248	663	415	310	477	114	65	68	95	62	25	4379
1997	7	14	96	22	98	314	903	201	314	224	374	103	20	77	40	93	2901
1998		21	27	40	60	203	459	657	389	269	237	231	74	94	48	90	2899
1999	6		20	57	61	58	181	346	379	192	264	165	100	103	50	83	2067
2000	13	21	6	73	87	118	87	112	289	314	173	140	59	44	38	49	1624
2001		34	45	50	82	45	81	192	311	417	350	311	144	130	92	83	2365

Table 12 - Weights at age of the 3M American plaice stock (Kg) from EU surveys, 1988-2001

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+
1988	0.027	0.048	0.152	0.336	0.485	0.610	0.715	0.784	0.799	0.825	0.888	0.974	1.231	1.247	1.573	1.764
1989	0.013	0.090	0.151	0.292	0.514	0.623	0.720	0.816	0.841	0.864	0.924	1.007	1.201	1.216	1.488	1.663
1990	0.010	0.062	0.189	0.311	0.416	0.550	0.701	0.830	0.859	0.901	0.969	1.044	1.197	1.226	1.436	1.595
1991	0.015	0.070	0.157	0.339	0.469	0.553	0.652	0.768	0.798	0.835	0.897	0.966	1.159	1.185	1.442	1.644
1992	0.029	0.063	0.158	0.312	0.506	0.609	0.681	0.760	0.812	0.842	0.926	1.019	1.199	1.217	1.426	1.787
1993		0.061	0.160	0.295	0.399	0.572	0.726	0.760	0.801	0.885	0.927	0.952	1.098	1.249	1.865	1.629
1994	0.001	0.062	0.163	0.314	0.478	0.557	0.645	0.812	0.961	0.935	1.051	1.049	1.303	1.262	1.565	1.895
1995		0.044	0.191	0.326	0.480	0.620	0.669	0.797	0.901	1.239	1.302	1.482	1.531	1.528	1.571	2.108
1996	0.017	0.055	0.190	0.329	0.461	0.584	0.710	0.828	0.947	0.877	1.104	1.400	1.319	1.540	1.663	1.825
1997	0.017	0.049	0.171	0.236	0.421	0.550	0.668	0.637	0.870	1.017	1.031	1.233	1.277	1.450	1.622	1.526
1998		0.090	0.174	0.259	0.378	0.506	0.647	0.781	0.830	1.043	1.256	1.342	1.544	1.519	1.619	1.665
1999	0.010		0.166	0.315	0.431	0.541	0.560	0.778	0.855	1.013	1.196	1.293	1.470	1.729	1.571	1.599
2000	0.016	0.091	0.115	0.245	0.403	0.511	0.610	0.674	0.760	0.754	0.856	0.960	1.236	1.200	1.316	1.392
2001		0.072	0.211	0.245	0.366	0.426	0.520	0.598	0.621	0.709	0.711	0.866	1.100	1.342	1.451	1.496
mean	0.016	0.066	0.168	0.297	0.443	0.558	0.659	0.759	0.833	0.910	1.003	1.113	1.276	1.351	1.543	1.685

Table 13: Criteria applied to convert total catches in weight to total catches in number, for the period 1988-2001

YEAR	TOTAL CATCH (ton)	BREAKDOWN TOTAL CATCH (ton)	LENGTHS COMPOSITION				Mean Weight (Kg)	TOTAL CATCH IN NUMBER (000's)
			Country	Source	Gear	Paper		
1988	2800	2800	Spain	Commercial	OTB	scs 89/16	0.627	4468.2
1989	3500	2270	Spain	Commercial	OTB	scs 90/13	0.636	3567.5
		1230	Portugal	Commercial	OTB	scs 90/12	0.816	1508.3
1990	790	431	Spain	Commercial	OTB	scs 91/16	0.612	704.1
		359	Portugal	Commercial	OTB	scs 91/15	0.902	398.0
1991	1600	602.4	Spain	Commercial	OTB	scs 92/13	0.744	809.4
		977.4	Portugal	Commercial	OTB	scs 92/14	0.871	1122.1
		20.2	Portugal	Commercial	GNS	scs 92/14	0.824	24.5
1992	765	451.0	Spain	Commercial	OTB	scs 93/14	0.805	560.5
		292.3	Portugal	Commercial	OTB	scs 93/15	0.928	315.0
		21.7	Portugal	Commercial	GNS	scs 93/15	0.761	28.5
1993	275	2	Spain	Commercial	PTB	scs 94/16	0.938	2.1
		271	Spain	Commercial	OTB	scs 94/16	0.734	369.0
		2	Portugal	Commercial	GNS	scs 94/13	0.588	3.4
1994	669	13.4	Spain	Commercial	OTB	scs 95/15	0.361	37.0
		655.6	EU Spain/Port	Survey	OTB	scr 95/26	0.726	903.5
1995	1300	1300	EU Spain/Port	Survey	OTB	scr 96/54	0.738	1762.1
1996	300	69.2	Spain	Commercial	OTB	scs 97/10	0.452	153.1
		230.8	Portugal	Commercial	OTB	scs 97/9	0.617	373.9
1997	208	208	Portugal	Commercial	OTB	scs 98/13	0.954	218.0
1998	294	294	Portugal	Commercial	OTB	scs 99/16	1.110	264.8
1999	255	255	Russia	Commercial	OTB	scs 00/9	0.910	280.2
2000	133	133	Portugal	Commercial	OTB	scs 01/9	0.637	208.7
2001	149	149	Portugal	Commercial	OTB	scs 02/06	0.666	223.8

Table 14: Length composition (absolute frequencies in '000) of the 3M American plaice catches, 1988-2001.

length group	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
16		19.3	0.8				0.7	3.0						
18		60.5	3.9				2.9	3.2						
20	6.9	126.5	2.0		5.3	1.8	3.3							
22	10.4	88.0	8.2	5.8	1.3	6.9	3.2						0.3	0.1
24	65.6	35.8	10.4	6.6	1.4	14.3	4.8	9.7	5.1		0.2			0.2
26	186.5	41.3	20.2	0.0	7.4	16.1	18.3	9.7	0.4		0.2		0.7	0.5
28	345.3	131.2	43.2	23.2	23.7	17.1	30.6	24.3	10.0		0.5		9.4	3.0
30	276.2	226.7	91.7	28.2	37.5	23.2	71.1	45.4	31.6		0.7		16.3	10.0
32	303.9	365.4	131.9	109.7	36.7	23.0	94.4	136.9	63.4		1.8	5.2	21.5	18.1
34	611.2	569.3	96.5	203.1	61.0	19.9	81.3	142.1	98.4	14.6	4.0	10.4	23.4	22.5
36	621.5	603.5	86.9	283.0	90.5	28.5	88.0	225.2	86.5	13.0	6.2	25.9	23.6	29.7
38	372.9	477.8	71.1	147.1	122.7	37.5	128.1	294.5	74.7	24.4	15.6	51.9	24.5	31.1
40	372.9	356.7	70.6	146.2	108.2	29.4	112.6	249.8	47.4	37.8	22.6	15.6	23.0	28.9
42	473.1	696.1	82.1	147.7	57.1	34.6	44.9	166.2	47.2	22.8	17.8	20.8	17.1	22.2
44	397.1	630.2	125.0	320.8	67.8	32.6	55.2	86.1	23.3	8.1	44.0	36.3	12.9	18.1
46	158.8	405.0	132.8	295.7	79.8	25.6	63.3	84.6	14.1	17.2	36.5	31.1	11.6	14.3
48	76.0	97.4	73.9	120.1	86.9	23.0	59.4	78.4	12.7	33.5	30.9	46.7	9.8	12.6
50	62.2	68.0	30.3	106.6	63.2	22.0	35.4	94.0	8.4	24.4	37.8	25.9	6.5	6.5
52	72.5	35.8	9.6	9.1	33.1	12.7	24.3	58.5	2.8	16.3	36.1	10.4	6.9	3.6
54	34.5	27.5	6.7	3.0	10.3	3.8	10.8	40.2	0.6	4.1	5.3		0.8	1.5
56	17.3	13.8	3.4	0.0	5.4	1.6	7.4	7.2	0.3	1.7	4.4		0.4	0.5
58	3.5		0.8	0.0	4.8	0.7		1.5			0.0			0.1
60					0.0	0.1		1.5						0.04
62			0.1			0.0	0.6							0.1
64														0.01
Total ('000)	4468.2	5075.7	1102.2	1955.9	904.0	374.5	940.5	1762.1	527.0	218.0	264.8	280.2	208.7	223.8
mean length	37.9	38.7	39.5	41.6	41.8	39.6	39.5	40.8	37.9	44.6	46.7	43.9	39.3	40.3

Table 15 - Catch at age (000s) of the 3M American plaice, 1988-2001.

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1988		7	311	731	549	440	720	532	386	265	173	118	65	102	43	25	4468
1989		175	209	573	527	482	886	715	520	356	230	148	80	118	39	19	5076
1990		7	49	183	112	87	158	147	110	78	55	39	24	33	13	7	1102
1991		1	19	133	185	168	342	331	243	174	124	84	50	68	23	12	1956
1992		4	17	76	75	76	136	124	100	77	60	46	31	45	23	14	904
1993			47	42	26	11	112	13	24	12	9	11	15	49	2	2	375
1994		4	6	219	98	77	75	254	24	48	16	17	20	40	43	1	941
1995		6	24	167	458	235	231	155	250	31	35	30	30	58	45	7	1762
1996			13	60	101	173	63	41	23	34	6	3	3	3	2	0.4	527
1997					4	17	61	12	28	23	35	13	3	9	4	10	218
1998			0.3	1	2	7	28	57	36	31	32	33	8	14	7	10	265
1999				4	6	8	27	59	60	35	40	21	9	5	3	5	280
2000		0.2	0.1	19	25	25	12	13	33	35	17	13	6	3	3	4	209
2001			5	6	16	8	10	21	30	41	35	29	10	6	3	3	224

Table 16 - Mean weight at age of the 3M American plaice catch (Kg) , 1988-2001.

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+
1988		0.097	0.200	0.312	0.449	0.572	0.684	0.762	0.790	0.823	0.886	0.981	1.215	1.271	1.590	1.736
1989		0.079	0.165	0.342	0.479	0.617	0.750	0.842	0.860	0.882	0.928	0.985	1.136	1.185	1.484	1.717
1990		0.072	0.191	0.320	0.424	0.558	0.738	0.889	0.924	0.963	1.031	1.095	1.223	1.262	1.481	1.618
1991		0.115	0.189	0.367	0.480	0.598	0.763	0.891	0.929	0.962	1.035	1.087	1.188	1.206	1.361	1.477
1992		0.086	0.210	0.327	0.487	0.606	0.723	0.855	0.919	0.966	1.074	1.169	1.373	1.381	1.574	1.666
1993			0.162	0.296	0.394	0.580	0.756	0.813	0.865	0.979	1.039	1.059	1.179	1.339	1.819	1.627
1994		0.061	0.155	0.314	0.487	0.562	0.653	0.824	0.969	0.954	1.068	1.065	1.318	1.289	1.561	1.895
1995		0.044	0.190	0.335	0.494	0.626	0.684	0.816	0.925	1.244	1.320	1.474	1.532	1.547	1.571	2.108
1996			0.225	0.331	0.425	0.535	0.671	0.733	0.852	0.825	1.002	1.302	1.202	1.385	1.539	1.333
1997					0.445	0.639	0.726	0.682	0.949	1.059	1.097	1.270	1.261	1.509	1.508	1.513
1998			0.185	0.269	0.396	0.554	0.776	0.889	0.950	1.140	1.337	1.380	1.461	1.509	1.589	1.613
1999				0.365	0.495	0.536	0.581	0.786	0.872	0.943	1.109	1.194	1.337	1.445	1.439	1.389
2000		0.115	0.115	0.268	0.359	0.444	0.566	0.637	0.706	0.692	0.782	0.891	1.225	1.140	1.290	1.389
2001			0.263	0.283	0.340	0.401	0.471	0.595	0.615	0.691	0.703	0.805	0.975	1.150	1.298	1.534
mean		0.084	0.187	0.318	0.439	0.559	0.682	0.787	0.866	0.937	1.029	1.126	1.259	1.330	1.507	1.615

Table17: American plaice exploitation pattern given by the generalized logit of the 1988-01
observed partial recruitment (See text).

Age	F at age index	Observed PR	Logit PR	Squared difference
1	0.000	0.000	0.07	0.005
2	0.182	0.150	0.16	0.000
3	0.446	0.367	0.36	0.000
4	0.944	0.778	0.78	0.000
5	1.056	0.870	1.00	0.017
6	0.966	0.796	1.00	0.042
7	0.965	0.795	1.00	0.042
8	1.113	0.917	1.00	0.007
9	1.134	0.934	1.00	0.004
10	1.155	0.951	1.00	0.002
11	1.214	1.000	1.00	0.000
12	1.209	0.996	1.00	0.000
13	1.091	0.898	1.00	0.010
14	1.129	0.930	1.00	0.005
15	0.963	0.793	1.00	0.043
16	0.904	0.745	1.00	0.065
Minimum sum of squares				0.238

Curve parameters		a	b	m
		-103.841	24.059	0.033

Fig. 4: PR curve for 3M American plaice
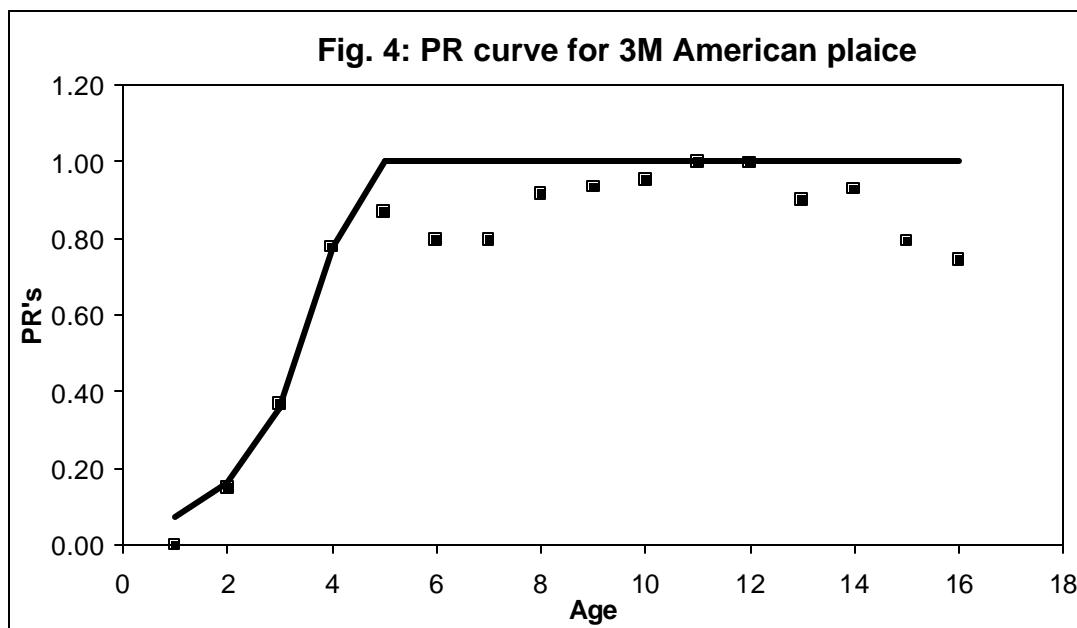
Table 18 A: Yield per recruit parameters for 3M American plaice.

Age	mean weights 1988-01		og mat (%)	PR 88-01	Ref. M
	stock	catch			
1	0.016	*0.016*	0.00	0.074	0.20
2	0.066	0.084	0.00	0.162	0.20
3	0.168	0.187	0.00	0.356	0.20
4	0.297	0.318	0.00	0.780	0.20
5	0.443	0.439	0.50	1.000	0.20
6	0.558	0.559	1.00	1.000	0.20
7	0.659	0.682	1.00	1.000	0.20
8	0.759	0.787	1.00	1.000	0.20
9	0.833	0.866	1.00	1.000	0.20
10	0.910	0.937	1.00	1.000	0.20
11	1.003	1.029	1.00	1.000	0.20
12	1.113	1.126	1.00	1.000	0.20
13	1.276	1.259	1.00	1.000	0.20
14	1.351	1.330	1.00	1.000	0.20
15	1.543	1.507	1.00	1.000	0.20
16+	1.685	1.615	1.00	1.000	0.20

Table 18 B: Yield per recruit results for 3M American plaice.

	Ref F	B	Y	SSB	Slope
	0.000	2485	0	2041	2,119
	0.000	2485	0	2041	1,555
	0.040	1888	62	1456	838
	0.080	1507	96	1085	469
	0.120	1248	114	837	268
F0.1	**0.156**	**1081**	**124**	**678**	**212**
	0.160	1064	125	662	151
	0.200	927	131	535	81
	0.240	822	135	440	38
	0.280	740	136	367	10
Fmax	**0.319**	**675**	**136**	**310**	**0**
	0.320	674	136	309	-8
	0.360	619	136	263	-20
	0.400	573	135	226	-28
	0.440	535	134	195	-33
	0.480	502	133	169	-36
	0.520	473	131	148	-38

Fig.5 - Yield, B and SSB per recruit curve for 3M American plaice
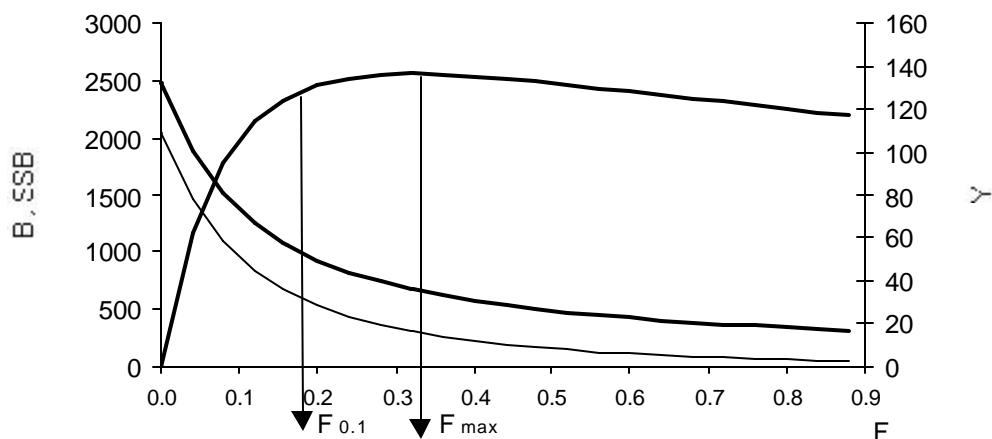
Table 19 - Trend of the 3M American plaice F index
based in EU survey series.

Year	Catch (tons)	Survey (tons)	C/B
1988	1082	4750	0.228
1989	1576	3710	0.425
1990	364	3323	0.110
1991	817	2905	0.281
1992	336	2467	0.136
1993	53	1176	0.045
1994	295	2857	0.103
1995	443	1890	0.234
1996	84	1181	0.071
1997	97	1015	0.096
1998	163	1414	0.115
1999	176	1104	0.159
2000	69	679	0.102
2001	84	852	0.099
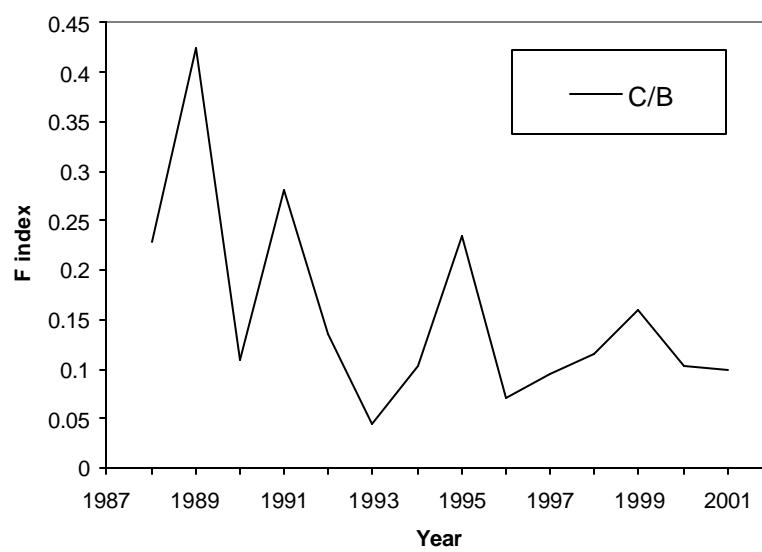
Fig. 6. Trend of the 3M American plaice F index based in EU survey.

Table 20. Evolution of Recruit ('000) and SSB ('000 tons) EU survey index during the period 1988-2001.

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
SSB	12.1	8.5	7.1	6.6	5.7	5.5	5.4	4.6	3.0	2.3	2.6	2.0	1.2	1.8
Age 3 recruits	1683	5756	1372	1487	762	1376	38	99	103	96	27	20	6	45
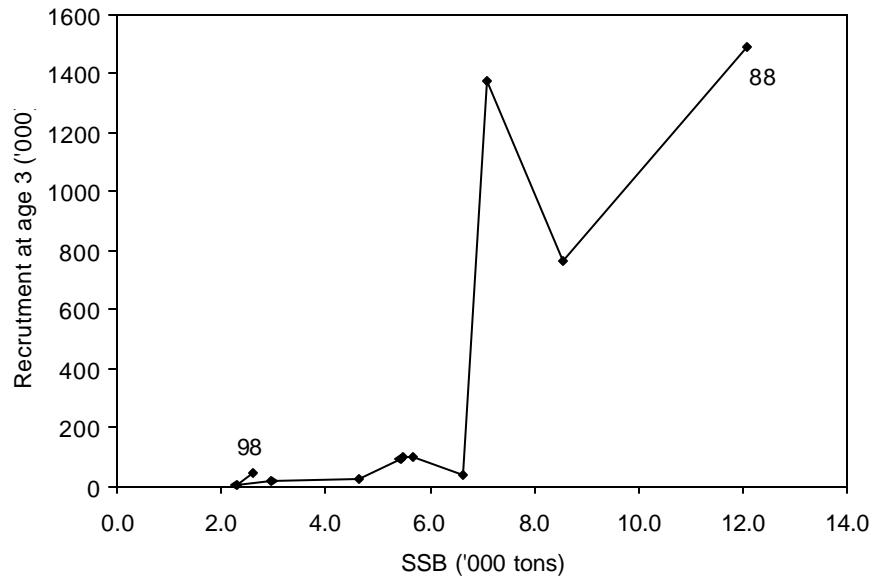
Fig. 7. SSB-Recruitment scatter plot based in EU survey series.

Fig. 8. Recruit at age 3 produced per kg of SSB index from EU indices.

Table 21: Lowestoft XSA input files for 3M American plaice (2002 assessment)

AMERICAN PLAICE NAFO DIVISION 3M INDEX OF INPUT FILES JULY 2002

1	
pla3mla.txt	
pla3mcn.txt	
pla3mcw.txt	
pla3msw.txt	
pla3mnm.txt	
pla3mmo.txt	
pla3mpf.txt	
pla3mpm.txt	
pla3mfo.txt	
pla3mfn.txt	
pla3mtun.txt	

AMERICAN PLAICE NAFO 3M LANDINGS tons

1	1
1988	2001
1	16
5	
2800	
3500	
790	
1600	
765	
275	
669	
1300	
300	
208	
294	
255	
133	
149	

AMERICAN PLAICE NAFO 3M CATCH NUMBERS thousands

1	2														
1988	2001														
1	16														
1															
0	7	311	731	549	440	720	532	386	265	173	118	65	102	43	25
0	175	209	573	527	482	886	715	520	356	230	148	80	118	39	19
0	7	49	183	112	87	158	147	110	78	55	39	24	33	13	7
0	1	19	133	185	168	342	331	243	174	124	84	50	68	23	12
0	4	17	76	75	76	136	124	100	77	60	46	31	45	23	14
0	0	47	42	26	11	112	13	24	12	9	11	15	49	2	2
0	4	6	219	98	77	75	254	24	48	16	17	20	40	43	1
0	6	24	167	458	235	231	155	250	31	35	30	30	58	45	7
0	0	13	60	101	173	63	41	23	34	6	3	3	3	2	0.4
0	0	0	0	4	17	61	12	28	23	35	13	3	9	4	10
0	0	0.3	1	2	7	28	57	36	31	32	33	8	14	7	10
0	0	0	4	6	8	27	59	60	35	40	21	9	5	3	5
0	0.2	0.1	19	25	25	12	13	33	35	17	13	6	3	3	4
0	0	5	6	16	8	10	21	30	41	35	29	10	6	3	3

AMERICAN PLAICE NAFO 3M CATCH WEIGHT AT AGE kg

1	3														
1988	2001														
1	16														
1															
0.016	0.097	0.200	0.312	0.449	0.572	0.684	0.762	0.790	0.823	0.886	0.981	1.215	1.271	1.590	1.736
0.016	0.079	0.165	0.342	0.479	0.617	0.750	0.842	0.860	0.882	0.928	0.985	1.136	1.185	1.484	1.717
0.016	0.072	0.191	0.320	0.424	0.558	0.738	0.889	0.924	0.963	1.031	1.095	1.223	1.262	1.481	1.618
0.016	0.115	0.189	0.367	0.480	0.598	0.763	0.891	0.929	0.962	1.035	1.087	1.188	1.206	1.361	1.477
0.016	0.086	0.210	0.327	0.487	0.606	0.723	0.855	0.919	0.966	1.074	1.169	1.373	1.381	1.574	1.666
0.016	*0.084*	0.162	0.296	0.394	0.580	0.756	0.813	0.865	0.979	1.039	1.059	1.179	1.339	1.819	1.627
0.016	0.061	0.155	0.314	0.487	0.562	0.653	0.824	0.969	0.954	1.068	1.065	1.318	1.289	1.561	1.895
0.016	0.044	0.190	0.335	0.494	0.626	0.684	0.816	0.925	1.244	1.320	1.474	1.532	1.547	1.571	2.108
0.016	*0.084*	0.225	0.331	0.425	0.535	0.671	0.733	0.852	0.825	1.002	1.302	1.202	1.385	1.539	1.333
0.016	*0.084*	*0.187*	*0.318*	0.445	0.639	0.726	0.682	0.949	1.059	1.097	1.270	1.261	1.509	1.508	1.513
0.016	*0.084*	0.185	0.269	0.396	0.554	0.776	0.889	0.950	1.140	1.337	1.380	1.461	1.509	1.589	1.613
0.016	*0.084*	*0.187*	0.365	0.495	0.536	0.581	0.786	0.872	0.943	1.109	1.194	1.337	1.445	1.439	1.389
0.016	0.115	0.115	0.268	0.359	0.444	0.566	0.637	0.706	0.692	0.782	0.891	1.225	1.140	1.290	1.389
0.016	*0.084*	0.263	0.283	0.340	0.401	0.471	0.595	0.615	0.691	0.703	0.805	0.975	1.150	1.298	1.534

AMERICAN PLAICE NAFO 3M STOCK WEIGHT AT AGE kg

1	4														
1988	2001														
1	16														
1															
0.027	0.048	0.152	0.336	0.485	0.610	0.715	0.784	0.799	0.825	0.888	0.974	1.231	1.247	1.573	1.764
0.013	0.090	0.151	0.292	0.514	0.623	0.720	0.816	0.841	0.864	0.924	1.007	1.201	1.216	1.488	1.663
0.010	0.062	0.189	0.311	0.416	0.550	0.701	0.830	0.859	0.901	0.969	1.044	1.197	1.226	1.436	1.595
0.015	0.070	0.157	0.339	0.469	0.553	0.652	0.768	0.798	0.835	0.897	0.966	1.159	1.185	1.442	1.644
0.029	0.063	0.158	0.312	0.506	0.609	0.681	0.760	0.812	0.842	0.926	1.019	1.199	1.217	1.426	1.787
0.016	0.061	0.160	0.295	0.399	0.572	0.726	0.760	0.801	0.885	0.927	0.952	1.098	1.249	1.865	1.629
0.001	0.062	0.163	0.314	0.478	0.557	0.645	0.812	0.961	0.935	1.051	1.049	1.303	1.262	1.565	1.895
0.016	0.044	0.191	0.326	0.480	0.620	0.669	0.797	0.901	1.239	1.302	1.482	1.531	1.528	1.571	2.108
0.017	0.055	0.190	0.329	0.461	0.584	0.710	0.828	0.947	0.877	1.104	1.400	1.319	1.540	1.663	1.825
0.017	0.049	0.171	0.236	0.421	0.550	0.668	0.637	0.870	1.017	1.031	1.233	1.277	1.450	1.622	1.526
0.016	0.090	0.174	0.259	0.378	0.506	0.647	0.781	0.830	1.043	1.256	1.342	1.544	1.519	1.619	1.665
0.010	*0.066*	0.166	0.315	0.431	0.541	0.560	0.778	0.855	1.013	1.196	1.293	1.470	1.729	1.571	1.599
0.016	0.091	0.115	0.245	0.403	0.511	0.610	0.674	0.760	0.754	0.856	0.960	1.236	1.200	1.316	1.392
0.016	0.072	0.211	0.245	0.366	0.426	0.520	0.598	0.621	0.709	0.711	0.866	1.100	1.342	1.451	1.496

Table 21: count.

AMERICAN PLAICE NAFO 3M NATURAL MORTALITY
```
    1       5
 1988    2001
    1      16
    3
  0.2
```

AMERICAN PLAICE NAFO 3M PROPORTION MATURE AT AGE
```
    1       6
 1988    2001
    1      16
    2
```
| 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

AMERICAN PLAICE NAFO 3M PROPORTION OF F BEFORE SPAWNING   AMERICAN PLAICE NAFO 3M PROPORTION OF M BEFORE SPAWNING
```
    1       7                                                    1       8
 1988    2001                                                 1988    2001
    1      16                                                    1      16
    3                                                            3
 0.42                                                          0.42
```

AMERICAN PLAICE NAFO 3M F ON OLDEST AGE GROUP BY YEAR
```
    1       9
 1988    2001
    1      16
    5
0.185
0.264
0.069
0.168
0.093
0.037
0.086
0.203
0.077
0.073
0.090
0.104
0.088
0.066
```

AMERICAN PLAICE NAFO 3M F AT AGE IN LAST YEAR
```
    1      10
 1988    2001
    1      16
    2
```
| 0 | 0.012378 | 0.030331 | 0.06426 | 0.071893 | 0.065784 | 0.065665 | 0.075771 | 0.077188 | 0.078632 | 0.08264 | 0.08231 | 0.07424 | 0.076824 | 0.065539 | 0.061543 |

AMERICAN PLAICE NAFO 3M SURVEY TUNNING DATA
```
  101
```
EU BOTTOM TRAWL SURVEY
```
 1988    2001
    1       1     0.5     0.6
    1      15
```
10555	503	1391	1683	4080	3511	3057	4445	2664	1608	1024	599	381	217	335	138
10555	48	1587	5756	2306	2150	1883	2807	1886	1203	805	502	325	172	258	96
10555	6	577	1372	4598	2015	1381	2078	1533	1064	739	486	328	188	263	104
10555	140	322	1487	2286	2321	1548	2089	1457	1012	686	452	302	151	213	77
10555	20	685	762	1030	1175	1230	1772	1200	840	596	402	274	145	222	87
10555	0	24	1376	970	647	340	3108	351	596	281	197	229	281	861	29
10555	6	40	38	1789	779	647	706	2471	241	476	166	163	194	398	397
10555	0	25	99	631	1617	989	986	664	1130	126	143	119	120	242	183
10555	7	34	103	227	471	1248	663	415	310	477	114	65	68	95	62
10555	7	14	96	22	98	314	903	201	314	224	374	103	20	77	40
10555	0	21	27	40	60	203	459	657	389	269	237	231	74	94	48
10555	6	0	20	57	61	58	181	346	379	192	264	165	100	103	50
10555	13	21	6	73	87	118	87	112	289	314	173	140	59	44	38
10555	0	34	45	50	82	45	81	192	311	417	350	311	144	130	92

Table 22 - 3M American plaice XSA runs.

Run Nº	Earliest year	Shrink se	Threshold se
1	1994	1	0.3
2	1988	1	0.3
3	1994	1.5	0.3
4	1994	1	0.5
5	1994	1.5	0.5

Table 23: Extended Survivor Analysis diagnostics for 2002 (Lowestoft VPA Version 3.1) Run 4

AMERICAN PLAICE NAFO DIVISION 3M INDEX OF INPUT FILES APRIL 2000
CPUE data from file pla3mtun.dat

Catch data for 14 years. 1988 to 2001. Ages 1 to 16.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
EU BOTTOM TRAWL SURV	1994	2001	1	15	0.5	0.6

Time series weights :
   Tapered time weighting not applied

Catchability analysis :
   Catchability independent of stock size for all ages
   Catchability independent of age for ages >=   10

Terminal population estimation :
   Survivor estimates shrunk towards the mean F
   of the final   5 years or the   5 oldest ages.
   S.E. of the mean to which the estimates are shrunk = 1.000
   Minimum standard error for population
   estimates derived from each fleet =   .500
   Prior weighting not applied
Tuning converged after   96 iterations
Regression weights

		1	1	1	1	1	1	1	1

Fishing mortalities

Age		1994	1995	1996	1997	1998	1999	2000	2001
1		0	0	0	0	0	0	0	0
2		0.004	0.017	0	0	0	0	0.001	0
3		0.003	0.033	0.046	0	0.001	0	0.001	0.016
4		0.076	0.122	0.107	0	0.004	0.021	0.079	0.049
5		0.068	0.227	0.1	0.009	0.011	0.029	0.172	0.088
6		0.067	0.232	0.125	0.022	0.02	0.054	0.161	0.076
7		0.098	0.293	0.089	0.059	0.046	0.1	0.108	0.089
8		0.258	0.302	0.077	0.022	0.072	0.128	0.064	0.28
9		0.096	0.436	0.066	0.069	0.085	0.101	0.098	0.206
10		0.237	0.174	0.095	0.087	0.101	0.111	0.079	0.17
11		0.094	0.272	0.046	0.134	0.168	0.184	0.072	0.105
12		0.117	0.257	0.033	0.133	0.18	0.158	0.083	0.17
13		0.109	0.313	0.036	0.042	0.113	0.068	0.062	0.085
14		0.142	0.523	0.046	0.146	0.282	0.096	0.029	0.081
15		0.117	0.236	0.029	0.079	0.162	0.089	0.077	0.037

Table 23 count: Extended Survivor Analysis diagnostics for 2002 (Lowestoft VPA Version 3.1) Run 4
                    1
XSA population numbers (Thousands)

AGE YEAR	1	2	3	4	5	6	7	8	9	10
1994	4.88E+02	1.01E+03	1.98E+03	3.29E+03	1.64E+03	1.31E+03	8.86E+02	1.24E+03	2.89E+02	2.51E+02
1995	5.22E+02	3.99E+02	8.25E+02	1.61E+03	2.50E+03	1.25E+03	1.01E+03	6.58E+02	7.82E+02	2.15E+02
1996	3.97E+02	4.27E+02	3.22E+02	6.53E+02	1.17E+03	1.63E+03	8.14E+02	6.14E+02	3.98E+02	4.14E+02
1997	5.07E+02	3.25E+02	3.50E+02	2.51E+02	4.81E+02	8.66E+02	1.18E+03	6.10E+02	4.66E+02	3.05E+02
1998	2.52E+02	4.15E+02	2.66E+02	2.86E+02	2.06E+02	3.90E+02	6.94E+02	9.08E+02	4.88E+02	3.56E+02
1999	5.13E+02	2.06E+02	3.40E+02	2.18E+02	2.33E+02	1.67E+02	3.13E+02	5.43E+02	6.92E+02	3.67E+02
2000	8.61E+02	4.20E+02	1.69E+02	2.78E+02	1.75E+02	1.86E+02	1.29E+02	2.32E+02	3.91E+02	5.12E+02
2001	1.22E-06	7.05E+02	3.43E+02	1.38E+02	2.10E+02	1.20E+02	1.29E+02	9.50E+01	1.78E+02	2.90E+02

Estimated population abundance at 1st Jan 2002

0.00E+00	1.00E-06	5.77E+02	2.77E+02	1.08E+02	1.58E+02	9.12E+01	9.69E+01	5.88E+01	1.19E+02

Taper weighted geometric mean of the VPA populations:

1.16E+03	1.08E+03	9.85E+02	9.45E+02	8.99E+02	8.21E+02	7.74E+02	6.66E+02	5.81E+02	4.57E+02

Standard error of the weighted Log(VPA populations) :

2.3075	1.1449	1.1786	1.1897	1.0728	1.0294	0.9425	0.8526	0.7337	0.6499

XSA population numbers (Thousands)

AGE YEAR	11	12	13	14	15
1994	1.97E+02	1.70E+02	2.14E+02	3.33E+02	4.29E+02
1995	1.62E+02	1.46E+02	1.24E+02	1.57E+02	2.37E+02
1996	1.48E+02	1.01E+02	9.28E+01	7.40E+01	7.64E+01
1997	3.08E+02	1.15E+02	8.02E+01	7.32E+01	5.79E+01
1998	2.29E+02	2.21E+02	8.27E+01	6.29E+01	5.18E+01
1999	2.64E+02	1.59E+02	1.51E+02	6.05E+01	3.89E+01
2000	2.69E+02	1.80E+02	1.11E+02	1.15E+02	4.50E+01
2001	3.88E+02	2.05E+02	1.35E+02	8.54E+01	9.18E+01

Estimated population abundance at 1st Jan 2002

2.01E+02	2.86E+02	1.42E+02	1.02E+02	6.45E+01

Taper weighted geometric mean of the VPA populations:

3.49E+02	2.50E+02	1.87E+02	1.43E+02	9.32E+01

Standard error of the weighted Log(VPA populations) :

0.6589	0.6648	0.6786	0.6982	0.6949

Log catchability residuals.
Fleet : EU BOTTOM TRAWL SURV

Age		1994	1995	1996	1997	1998	1999	2000	2001
	1	-0.13	99.99	0.23	-0.01	99.99	-0.18	0.08	99.99
	2	-0.27	0.19	0.42	-0.19	-0.03	99.99	-0.04	-0.08
	3	-1.58	0.27	1.25	1.07	0.08	-0.46	-0.97	0.34
	4	0.74	0.43	0.31	-1.13	-0.66	-0.02	0.01	0.32
	5	0.23	0.63	0.08	-0.65	-0.29	-0.39	0.34	0.04
	6	-0.05	0.51	0.42	-0.38	-0.02	-0.41	0.25	-0.32
	7	0.08	0.4	0.1	0.02	-0.13	-0.24	-0.08	-0.16
	8	0.95	0.29	-0.23	-0.98	-0.17	-0.26	-0.57	0.97
	9	-0.08	0.66	-0.17	-0.31	-0.13	-0.5	-0.2	0.72
	10	0.84	-0.37	0.26	-0.19	-0.16	-0.52	-0.38	0.52
	11	-0.05	0.09	-0.17	0.33	0.19	0.17	-0.33	0.02
	12	0.09	0	-0.36	0.03	0.21	0.19	-0.14	0.58
	13	0.03	0.21	-0.22	-1.3	0.02	-0.31	-0.53	0.18
	14	0.32	0.78	0.34	0.2	0.62	0.65	-0.88	0.53
	15	0.05	-0.06	-0.13	-0.26	0.08	0.37	-0.06	0.09

Table 23 count: Extended Survivor Analysis diagnostics for 2002 (Lowestoft VPA Version 3.1) Run 4

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	1	2	3	4	5	6	7	8	9	10
Mean Log q	-13.4261	-12.1078	-11.5214	-10.4606	-10.0924	-9.7738	-9.4116	-9.2715	-9.2039	-9.2218
S.E(Log q)	0.1642	0.2368	0.9697	0.6145	0.4182	0.3627	0.2005	0.6953	0.4444	0.4861

Age	11	12	13	14	15
Mean Log q	-9.2218	-9.2218	-9.2218	-9.2218	-9.2218
S.E(Log q)	0.2164	0.2859	0.5589	0.6269	0.1861

Regression statistics :
Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
1	1.04	-0.117	13.71	0.74	5	0.2	-13.43
2	1.33	-1.03	14.08	0.66	7	0.31	-12.11
3	1.89	-0.981	16.42	0.17	8	1.84	-11.52
4	0.76	1.739	9.4	0.89	8	0.41	-10.46
5	0.84	1.393	9.46	0.92	8	0.33	-10.09
6	0.85	1.454	9.24	0.94	8	0.29	-9.77
7	0.88	1.94	9.02	0.98	8	0.15	-9.41
8	1.15	-0.373	9.72	0.52	8	0.85	-9.27
9	1.42	-0.806	10.52	0.38	8	0.65	-9.2
10	2.19	-0.804	13.31	0.07	8	1.09	-9.22
11	0.86	0.649	8.65	0.77	8	0.19	-9.19
12	0.58	2.459	7.43	0.85	8	0.12	-9.15
13	0.58	1.329	7.51	0.63	8	0.28	-9.46
14	1.13	-0.311	9.45	0.49	8	0.63	-8.9
15	1.03	-0.331	9.35	0.95	8	0.2	-9.21
1							

Terminal year survivor and F summaries :

Age 1 Catchability constant w.r.t. time and dependent on age
Year class = 2000

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	1	0	0	0	0	0	0
F shrinkage mean	0	1				0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
0	0	0	0	0	0

Age 2 Catchability constant w.r.t. time and dependent on age
Year class = 1999

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	577	0.354	0.078	0.22	2	1	0
F shrinkage mean	0	1				0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
577	0.35	0.08	2	0.222	0

Age 3 Catchability constant w.r.t. time and dependent on age
Year class = 1998

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	260	0.334	0.108	0.32	3	0.898	0.017
F shrinkage mean	472	1				0.102	0.01

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
277	0.32	0.14	4	0.435	0.016

Table 23 count: Extended Survivor Analysis diagnostics for 2002 (Lowestoft VPA Version 3.1) Run 4

Age 4 Catchability constant w.r.t. time and dependent on age
Year class = 1997

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	102	0.551	0.582	1.06	2	0.758	0.052
F shrinkage mean	126	1				0.242	0.042

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
108	0.48	0.37	3	0.758	0.049

Age 5 Catchability constant w.r.t. time and dependent on age
Year class = 1996

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	154	0.256	0.058	0.23	5	0.93	0.09
F shrinkage mean	217	1				0.07	0.064

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
158	0.25	0.06	6	0.259	0.088

Age 6 Catchability constant w.r.t. time and dependent on age
Year class = 1995

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	91	0.228	0.115	0.5	6	0.939	0.076
F shrinkage mean	91	1				0.061	0.077

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
91	0.22	0.1	7	0.456	0.076

Age 7 Catchability constant w.r.t. time and dependent on age
Year class = 1994

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	96	0.228	0.194	0.85	6	0.939	0.09
F shrinkage mean	108	1				0.061	0.081

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
97	0.22	0.17	7	0.772	0.089

Age 8 Catchability constant w.r.t. time and dependent on age
Year class = 1993

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	54	0.2	0.206	1.03	8	0.941	0.303
F shrinkage mean	252	1				0.059	0.073

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
59	0.2	0.23	9	1.163	0.28

Age 9 Catchability constant w.r.t. time and dependent on age
Year class = 1992

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	112	0.201	0.176	0.88	8	0.945	0.217
F shrinkage mean	310	1				0.055	0.084

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
119	0.2	0.18	9	0.918	0.206

Table 23 count: Extended Survivor Analysis diagnostics for 2002 (Lowestoft VPA Version 3.1) Run 4

Age 10   Catchability constant w.r.t. time and dependent on age
Year class = 1991

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	193	0.203	0.158	0.78	8	0.943	0.176
F shrinkage mean	373	1				0.057	0.095

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
201	0.2	0.15	9	0.772	0.17

Age 11   Catchability constant w.r.t. time and age (fixed at the value for age) 10
Year class = 1990

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	288	0.194	0.149	0.77	8	0.95	0.104
F shrinkage mean	246	1				0.05	0.121

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
286	0.19	0.14	9	0.714	0.105

Age 12   Catchability constant w.r.t. time and age (fixed at the value for age) 10
Year class = 1989

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	139	0.188	0.173	0.92	8	0.949	0.173
F shrinkage mean	209	1				0.051	0.118

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
142	0.19	0.16	9	0.868	0.17

Age 13   Catchability constant w.r.t. time and age (fixed at the value for age) 10
Year class = 1988

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	100	0.195	0.081	0.42	8	0.947	0.087
F shrinkage mean	136	1				0.053	0.064

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
102	0.19	0.08	9	0.407	0.085

Age 14   Catchability constant w.r.t. time and age (fixed at the value for age) 10
Year class = 1987

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	66	0.201	0.121	0.6	8	0.943	0.079
F shrinkage mean	43	1				0.057	0.12

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
64	0.2	0.12	9	0.586	0.081

Age 15   Catchability constant w.r.t. time and age (fixed at the value for age) 10
Year class = 1986

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	1	0	0	0	0	0	0
F shrinkage mean	21	1				0.052	0.123

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
72	0.2	0.19	9	0.927	0.037

Fig.9. Log catchability residuals

Run 4

Run 4
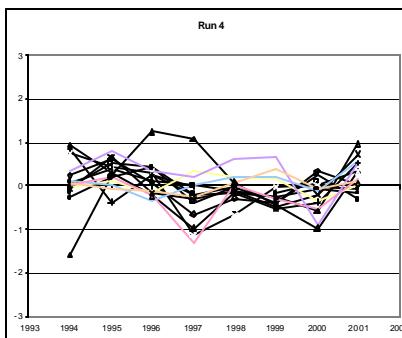
Table 24 A: Extended Survivor Analysis Runs 1 to 5 and ICA results for F (age 6-10)

Year	XSA run					ICA
	1	2	3	4	5	
1988	0.2348	0.2702	0.2393	0.2385	0.2401	0.2670
1989	0.3885	0.4623	0.3992	0.3961	0.4001	0.4564
1990	0.1210	0.1375	0.1246	0.1232	0.1246	0.1404
1991	0.3963	0.4451	0.4108	0.4066	0.4134	0.4474
1992	0.2310	0.2708	0.2434	0.2408	0.2475	0.2582
1993	0.0500	0.0587	0.0526	0.0533	0.0546	0.0610
1994	0.1405	0.1685	0.1482	0.1512	0.1551	0.1808
1995	0.2608	0.3482	0.2796	0.2872	0.2991	0.3845
1996	0.0800	0.1188	0.0871	0.0904	0.0955	0.1356
1997	0.0466	0.0706	0.0513	0.0517	0.0550	0.0741
1998	0.0597	0.0955	0.0667	0.0647	0.0702	0.1180
1999	0.0983	0.1604	0.1122	0.0989	0.1096	0.1346
2000	0.1045	0.1854	0.1210	0.1020	0.1152	0.1160
2001	0.1832	0.3398	0.2215	0.1643	0.1927	0.1614
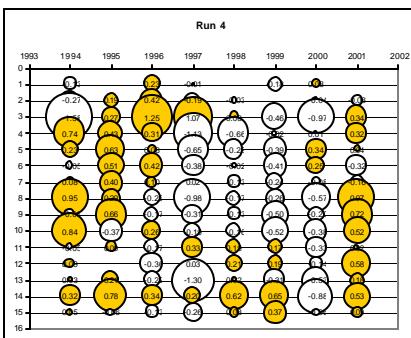
Fig.10 A. Extended Survivor Analysis Runs 1 to 5 and ICA results for F (age 6-10)
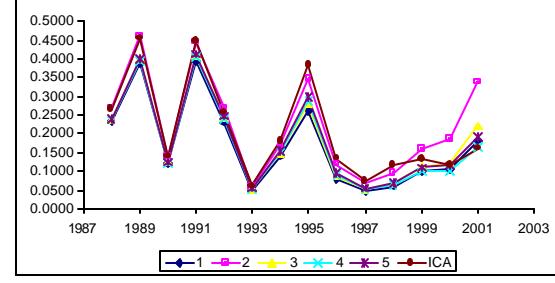

Table 24 B: Extended Survivor Analysis Runs 1 to 5 and ICA results for total biomass (tons)

Year	XSA run					ICA
	1	2	3	4	5	
1988	15833	13998	15528	15547	15433	13792
1989	12872	11146	12560	12563	12444	10902
1990	9225	7521	8905	8886	8760	7372
1991	8385	6762	8058	8015	7875	6493
1992	7548	5760	7174	7123	6950	5440
1993	6885	5125	6499	6446	6255	4883
1994	7265	5332	6829	6797	6566	5159
1995	6555	4889	6122	6160	5909	4649
1996	4648	3235	4254	4320	4075	3057
1997	3976	2671	3605	3696	3460	2657
1998	3670	2401	3310	3386	3151	2364
1999	3152	1968	2817	2907	2683	1908
2000	2184	1277	1926	2044	1859	1262
2001	1851	1028	1622	1712	1550	985

Tfig. 10 B. Extended Survivor Analysis Runs 1 to 5 and ICA results for total biomass (tons)
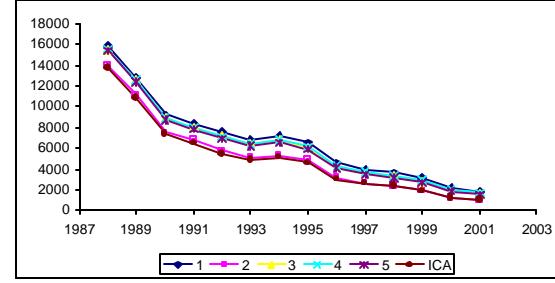
Table 24 C: Extended Survivor Analysis Runs 1 to 5 and ICA results for spawning biomass (tons)

Year	XSA run					ICA
	1	2	3	4	5	
1988	10827	9261	10589	10618	10533	9491
1989	8225	6792	7989	8013	7927	7017
1990	6205	4894	5980	6001	5916	5095
1991	5120	3955	4904	4906	4823	4074
1992	4865	3612	4624	4591	4497	3664
1993	4504	3319	4259	4216	4115	3270
1994	4663	3338	4381	4330	4200	3280
1995	4299	3068	3993	3945	3783	2873
1996	3658	2498	3349	3321	3140	2316
1997	3359	2233	3043	3087	2894	2215
1998	3076	1979	2765	2807	2610	1956
1999	2612	1593	2323	2378	2190	1530
2000	1803	1027	1583	1661	1508	1021
2001	1473	779	1282	1328	1201	728

Fig. 10 C: Extended Survivor Analysis Runs 1 to 5 and ICA results for spawning biomass (tons)
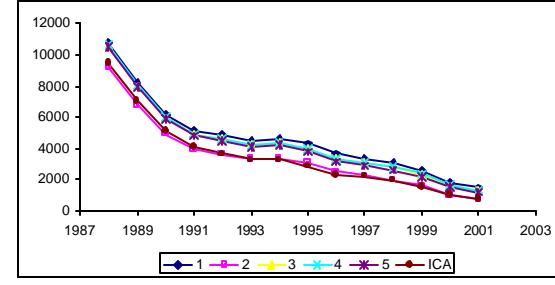

Table 24 D: Extended Survivor Analysis Runs 1 to 5 and ICA results for recruits at age 1 ('000)

Year	XSA run					ICA
	1	2	3	4	5	
1988	4006	3363	3841	3745	3671	2800
1989	4036	3273	3809	3829	3679	3860
1990	4155	2978	3884	3765	3580	2020
1991	6569	4939	6177	6077	5818	2150
1992	2810	2132	2571	2949	2768	1960
1993	1127	830	1002	1236	1127	3070
1994	445	322	390	488	425	1580
1995	537	287	479	522	471	610
1996	367	230	329	397	360	270
1997	471	271	416	507	451	260
1998	240	113	213	252	228	220
1999	441	311	383	513	439	250
2000	789	465	695	861	762	90
2001						390

Fig.10 D: Extended Survivor Analysis Runs 1 to 5 and ICA results for recruits at age 1 ('000)