Northwest Atlantic Fisheries Organization

Serial No. N4954 **NAFO SCR Doc. 04/9**

SCIENTIFIC COUNCIL MEETING – JUNE 2004

American Plaice Biomass and Abundance from the Surveys Conducted by Spain in the NAFO Regulatory Area of Divisions 3NO, 1995-2003

by

D. González Troncoso, C. González and X. Paz

Instituto Español de Oceanografía,
P.O. Box 1552. Vigo, Spain.

Abstract

Since 1995, a stratified random spring bottom trawl survey in the NAFO Regulatory Area of Div. 3NO was conducted by Spain. In 2001, the trawl vessel was replaced; so, the time series indices was transformed. The transformed entire series of mean catches, abundance, biomass and length distribution for American plaice are presented for the period 1995-2000, and the no-transformed data for the years 2001-2003. The standard deviation are shown for abundance and biomass. The summed abundance and biomass based on conversion of the length frequencies are presented and compared to the estimates from the method used to convert the CPUE. The results from the length distribution are smaller in all cases. A decreasing in American plaice abundance and biomass is observed in last years (2001-2002), although this recent year an increasing occurs. A high percent of juvenile individuals shows a good recruitment in recent years.

Material and Methods

Survey design and gear used

The surveys on NAFO Regulatory Area of Div. 3NO was initiated by Spain in 1995. Until 2001, the surveys was carried out in spring (May), on board the Spanish vessel *C/V Playa de Menduiña* (338 GT and 800 HP) using bottom trawl net type *Pedreira*. Since that year, the *R/V Vizconde de Eza* replaced the *C/V Playa de Menduíña* as the research vessel for the survey, using bottom trawl net type *Campelen*. The main specifications and geometry of these gears, as the rigging profile and the net plan, and a sheet with the resume of the main technical data of the survey are described in previous paper (Walsh *et. al.*, 2001). In the Table 1 are presented the number of valid tows, the depth strata covered and the dates of the survey series. In the period 1998-2003, the surveyed depth strata was the same (extended to 1464 m). The survey area was stratified following the standard stratification schemes (Bishop, 1994). Set number was allocated to strata proportionally to their size, with a minimum of two planned hauls per stratum and the trawl positions were chosen at random (Doubleday, 1981).

Biomass and abundance indices were calculated by the swept area method (Cochran, 1997), assuming catchability factor of 1.

The catch from each haul was sorted by species and weighted. Random samples of American plaice were measured to the total length to the nearest lower cm**.** Length distribution estimated from catches is presented for the period 1995-2003.

R/V *Vizconde de Eza* had replaced C/V *Playa de Menduíña* in 2001 survey, so, in order to maintain the data series obtained since 1995, comparative fishing trials were conducted in spring 2001 to develop factors between the two

fishing vessel and gear combinations. A series of 92 paired hauls was carried out, 90 of then were valid hauls. Mean catch, stratified mean catch, abundance, biomass and their respective standard deviations, and length distribution, were transformed from C/V *Playa de Menduíña* series to R/V *Vizconde de Eza* series.

American plaice stratified mean catches and SD

The mean catch ($\overline{y}_i$) and the variance (Var_i) are calculated by stratum by the following formulas:

$$\overline{y}_i = \sum_{j=1}^{T_i} \frac{y_j}{T_i}, \quad i = 1,...,h$$

$$Var_i = \sum_{j=1}^{T_i} \frac{(y_j - \overline{y}_i)^2}{T_i - 1}, \quad i = 1,...,h$$

where: y_j is the catch in haul j

T_i is the number of hauls in the stratum i

h is the total number of strata

and the stratified mean catch ($\overline{y}_i^{str}$) and the stratified variance (Var_i^{str}) by stratum are obtained as follow:

$$\overline{y}_i^{str} = \overline{y}_i n_i, \quad i = 1,...,h$$

$$Var_i^{str} = Var_i \frac{n_i^2}{T_i}, \quad i = 1,...,h$$

where: n_i is the area of the stratum i, $i = 1,...,h$

Then the total stratified mean catch ($\overline{y}$) and the variance (Var) by year are calculated according to the formulas:

$$\overline{Y} = \sum_{i=1}^{h} \frac{\overline{y}_i^{str}}{N}$$

$$Var = \sum_{i=1}^{h} \frac{Var_i^{str}}{N^2}$$

where: $N = \sum_{i=1}^{h} n_i$ is the total area by year

The stratified standard deviation (SD) by year is calculated as the square root of the stratified variance by year.

Conversion factors

To convert data series it was necessary to calculate the factor power correction (FPC), typically estimated by use of catch per unit of effort (CPUE) observations for the two vessels. In this case, a multiplicative model solved by generalized method by haul was adjusted to convert mean catch, abundance and biomass. Although there are many models to convert the CPUE, we choose one of them that has less error (Wilderbuer *et al*., 1998, González Troncoso and Paz, 2003).

Robson (1966) proposed the following multiplicative model to establish the relationship between the CPUEs for the two ships:

$$CPUE_{ij} = e^{\mu + t_i + h_j + \varepsilon_{ij}}$$

where: t_i is the effect of the ship i, $i = 1,2$

h_j is the effect of the haul j, $j = 1,...,90$

μ is the model parameter

ε is the model error

A logarithmic transformation is performed in order to obtain a linear expression:

$$\ln(CPUE_{ij}) = \mu + t_i + h_j + \varepsilon_{ij}$$

This equation was adjusted by generalized linear regression assuming the following restriction necessary to estimate all parameters:

$$\sum_{i=1}^{2} t_i = 0 \Rightarrow t_1 = t = -t_2$$

giving the following estimation of the FPC (Sissenwine and Bowman, 1978):

$$FPC = \frac{\overline{CPUE}_2}{\overline{CPUE}_1} = e^{2t(1+0.5s^2)} \qquad (1)$$

where s^2 is the variance obtained in the estimate of t.

This model was applied to convert mean catches and biomass. To convert abundance, we used the same formula but with abundance per unit of effort, instead of CPUE.

In the other hand, to convert the length distribution, the following multiplicative model, proposed by Warren (1997) was adjusted:

$$Ratio = \alpha l^{\beta} e^{\delta l} \qquad (2)$$

where: $Ratio = \frac{Campelen\ Catch}{Pedreira\ Catch}$ by length

l is the length

α, β *and* δ are the estimated parameters.

For more details, see Paz *et al*. (2002).

We use, in all cases, only the hauls in which both vessels had non cero catch.

Following the recommendations of the 2003 Scientific Council Meeting, abundance and biomass were obtained from the two methods and compared. For obtained the biomass from the length distribution, we use the following formula:

$$W = a\left(l + 0.5\right)^b N$$

where: $W = weight$
$l = length$
$N = number$

Data series

For 1995-2000, transformed C/V *Playa de Menduíña* data series are presented. For 2002 and 2003, original R/V *Vizconde de Eza* data series are presented. In 2001, the deeper strata was not surveyed by the calibration experience. As the objective is to have data in all the strata surveyed last years, to obtained the more annual homogeneity possible in the series, in the no surveyed strata by the R/V *Vizconde de Eza* the transformed C/V *Playa de Menduíña* data are put. This was made to mean catch, stratified mean catch, abundance and biomass. In this way, in the strata surveyed the original R/V *Vizconde de Eza* data are presented and in the strata not surveyed the transformed C/V *Playa de Menduíña* are offered.

A few errors were found in the data series, so they were updated and the FPC parameter recalculated for the new data. The results were quite the same.

The method to convert the indices from the length distribution has some problems: no accurate variance and, as the fit is very poor in the extreme data, we must apply another parameters for the extreme lengths, and the cut points are choosing without objective criterion. Because of that, we do not consider this method the best one for estimating the indices.

Results

American plaice Mean Catches

To convert mean catches, the CPUE was adjusted in model (1), giving the $\hat{F}PC_{bio}$ =0.31093714.

The American plaice mean catches by stratum are presented in Table 2, included swept area, number of hauls and SD. American plaice stratified mean catches and its SD are presented in Table 3. Data from year 1995 are added, although in that year a few sets were made, so it is not representative. The American plaice indices show an increasing until 2000, a decreasing in 2001 and 2002, and an increasing last year even upper values of the 2001 (Fig. 1).

American plaice Biomass

The entire time series (1995-2003) of biomass and their SD estimates of American plaice are presented (updated and converted) in Table 4. The biomass presents the same trend as mean catches (Fig. 2).

To convert biomass, the CPUE was adjusted in model (1), giving the $\hat{F}PC_{bio}$ =0.31093714. Besides the transformed biomass series, we present the biomass obtained from the length distribution. Parameters a and b are presented in Table 5, and in Table 4 we present the comparison between the two indices. The trend in both cases is the same (Fig. 3), although the biomass obtained from the length distribution is smaller in all cases. Years 2001-2003 have the original data, so both values are almost the same.

American plaice Abundance

As in biomass, the entire time series (1995-2003) of abundance and their SD estimates of American plaice are presented (updated and converted) in Table 6. The abundance table shows an increasing in the survey estimates until 2000, a decreasing in years 2001 and 2002 and an increasing in last year, although the trend is decreasing (Fig. 4).

Anyway, the decreasing in abundance is quite less than in biomass. It shows that although the number of individual has increased, its mean weight has fell.

To convert abundance, the abundance per unit of effort was adjusted in model (1), giving the FPC_{ab}=0.41189363. Besides the transformed abundance series, we present the abundance obtained summing the transformed length distribution. In Table 6 we present the comparison between the two indices. The trend in both cases is the same (Fig. 5), although the abundance obtained from the length distribution is smaller in all cases. Years 2001-2003 have the original data, so both values are almost the same.

American plaice Length Distribution

The result of the model proposed by Warren (2) for American plaice was the following (for more details, see Paz *et al*., 2002) (cf = conversion factor):

For $l \leq 12$: cf = 9
For $13 \leq l \leq 21$: cf = 0.63
For $22 \leq l \leq 51$: cf = exp(13.4096-5.7315ln(l)+0.1524 l)
For $l \geq 52$: cf = 0.4

In Table 7 is shown American plaice length distribution per thousand, besides the sampled size and its catch for the period 1995-2003, and in Table 8 is presented the length distribution in estimated numbers for 1999-2003. In Fig. 6 and Fig. 7 we can see the length distribution evolution by sex along the years. The evolution of males and females is almost the same in the period 1999-2003 (Fig. 7). The presence of juveniles (length ≤ 20 cm.) is presented in Fig. 8.

References

BISHOP, C. A. 1994. Revisions and additions to stratification schemes used during research vessel surveys in NAFO Subareas 2 and 3. NAFO SCR Doc., No 43, Serial No N2413, 23 pp.

COCHRAN, W. G.. 1997. Sampling techniques. J. Wiley and Sons, N.Y., 428 pp.

DOUBLEDAY, W. G. 1981. Manual on groundfish surveys in the Northwest Atlantic. NAFO Sci. Coun. Studies, 2, 55.

GONZÁLEZ TRONCOSO, D. and X. PAZ. 2003. Testing methods for estimating the Factor Power Correction obtained from the comparative Fishing Trial: C/V *Playa de Menduíña* versus R/V *Vizconde de Eza*. NAFO SCR Doc. 03/XX. Serial nº XXXX.

PAZ, X., D. GONZÁLEZ TRONCOSO and P. DURÁN MUÑOZ. 2002. Comparative Exercise between the C/V *Playa de Menduíña* and the R/V *Vizconde de Eza* in the NAFO Divisions 3NO in May 2001. NAFO SCR Doc. 02/5. Serial nº 4603, 25 pp.

ROBSON, D. S. 1966. Estimation of the relative fishing power in individual ships. Res. Bull. Int. Comm. N. W. Atl. Fish. 3: 5-14

SISSENWINE, M. P. and E. W. BOWMAN. 1978. An analysis of some factors affecting the catchability of fish by bottom trawls. ICNAF, Res. Bull. 13: 81-97

WALSH, J.S., X. PAZ and P. DURÁN. 2001. A preliminary investigation of the efficiency of Canadian and Spanish Survey bottom trawls on the Southern Bank. NAFO SCR Doc., 01/74, Serial Number 4453, 18 pp.

WARREN, W. G. 1997. Report on the comparative fishing trial between the *Gadus Atlantica* and *Teleost*. NAFO Sci. Coun. Studies, 29: 81-92

WILDERBUER, T. K., R. F. KAPPENMAN and D. R. GUNDERSON. 1998. Analysis of fishing power correction factor estimates from a trawl comparison experiment. N. Am. J. Fish. Manage, 18: 11-18.

TABLE 1.- Spanish spring bottom trawl surveys on NAFO Div. 3NO: 1995-2003

Year	Vessel	Valid tows	Depth strata covered (m)	Dates
1995	C/V Playa de Menduíña	77	>56-731	May 18-May 29
1996	C/V Playa de Menduíña	112	>56-1098	May 07-May 24
1997	C/V Playa de Menduíña	128	>56-1280	April 26-May 18
1998	C/V Playa de Menduíña	124	>56-1464	May 06-May 26
1999	C/V Playa de Menduíña	114	>56-1464	May 07-May 26
2000	C/V Playa de Menduíña	118	>56-1464	May 07-May 28
2001	R/V Vizconde de Eza	90	>56-1116	May 05-May 23
2002	R/V Vizconde de Eza	125	>56-1464	April 29-May 19
2003	R/V Vizconde de Eza	118	>56-1464	May 11-Jun 02

TABLE 2. Swept area, number of hauls and American plaice mean catch (kg) and SD (**) by stratum. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2003. Swept area in square miles. n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data, and 2001-2003 data are original from R/V *Vizconde de Eza*. In 2001, (*) indicates transformed data from C/V *Playa de Menduiña.*

Stratum	1995				1996				1997			
	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD
353	0.0353	3	71.03	41.915	0.0371	3	216.10	31.461	0.0480	4	47.97	25.084
354	0.0353	3	124.67	66.375	0.0319	3	129.67	41.646	0.0233	2	34.16	18.447
355	n.s.	n.s.	n.s.	n.s.	0.0221	2	55.19	24.845	0.0233	2	14.02	4.617
356	n.s.	n.s.	n.s.	n.s.	0.0203	2	7.74	0.660	0.0225	2	8.15	4.133
357	0.0109	1	8.82	-	0.0218	2	6.41	6.431	0.0443	4	1.86	1.051
358	0.0319	3	22.40	13.283	0.0319	3	7.29	4.579	0.0563	5	4.44	4.415
359	0.0345	3	57.22	63.004	0.0548	5	45.04	22.168	0.0690	6	30.12	15.773
360	0.3563	31	35.26	28.303	0.3761	31	72.01	43.340	0.3754	32	26.15	17.839
374	0.0225	2	3.29	2.979	0.0233	2	11.60	1.671	0.0353	3	8.40	3.170
375	0.0225	2	2.13	1.275	0.0229	2	25.28	25.944	0.0116	1	1.85	-
376	0.1729	15	5.57	1.723	0.1650	14	30.26	24.303	0.1583	14	12.53	8.741
377	0.0221	2	7.94	4.133	0.0229	2	23.57	8.487	0.0116	1	20.96	-
378	0.0435	4	11.15	0.679	0.0330	3	9.79	3.055	0.0210	2	1.87	1.583
379	0.0221	2	13.10	12.719	0.0113	1	6.87	-	0.0206	2	1.78	1.568
380	n.s.	n.s.	n.s.	n.s.	0.0221	2	6.86	2.397	0.0210	2	1.41	0.079
381	n.s.	n.s.	n.s.	n.s.	0.0229	2	6.59	3.210	0.0221	2	1.55	0.895
382	n.s.	n.s.	n.s.	n.s.	0.0338	3	8.90	6.303	0.0461	4	0.59	0.340
721	n.s.	n.s.	n.s.	n.s.	0.0214	2	14.78	7.687	0.0221	2	13.40	12.225
722	n.s.	n.s.	n.s.	n.s.	0.0206	2	7.28	8.223	0.0214	2	46.66	65.850
723	n.s.	n.s.	n.s.	n.s.	0.0109	1	2.77	-	0.0210	2	8.79	5.464
724	0.0105	1	10.48	-	0.0203	2	9.42	4.881	0.0225	2	13.33	17.024
725	0.0334	3	13.76	20.672	0.0225	2	0.82	0.550	0.0206	2	1.31	0.882
726	0.0214	2	2.62	2.561	0.0218	2	2.35	0.506	n.s.	n.s.	n.s.	n.s.
727	n.s.	n.s.	n.s.	n.s.	0.0210	2	6.02	3.353	0.0094	1	9.37	-
728	n.s.	n.s.	n.s.	n.s.	0.0218	2	50.93	52.196	0.0214	2	32.09	23.965
752	n.s.	n.s.	n.s.	n.s.	0.0109	1	29.01	-	0.0218	2	112.70	128.072
753	n.s.	n.s.	n.s.	n.s.	0.0199	2	218.00	230.068	0.0214	2	56.78	41.643
754	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0330	3	5.50	6.447
755	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
756	n.s.	n.s.	n.s.	n.s.	0.0210	2	22.01	0.528	0.0109	1	75.68	-
757	n.s.	n.s.	n.s.	n.s.	0.0188	2	84.76	118.596	0.0304	3	626.06	753.372
758	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0214	2	0.60	0.447
759	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
760	n.s.	n.s.	n.s.	n.s.	0.0210	2	15.28	2.309	0.0105	1	17.16	-
761	n.s.	n.s.	n.s.	n.s.	0.0199	2	0.00	0.000	0.0315	3	1.21	1.954
762	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0308	3	0.00	0.000
763	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
764	n.s.	n.s.	n.s.	n.s.	0.0210	2	0.45	0.242	0.0206	2	0.17	0.237
765	n.s.	n.s.	n.s.	n.s.	0.0199	2	0.00	0.000	0.0206	2	0.00	0.000
766	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0308	3	0.00	0.000
767	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

$$(**)\ SD = \frac{\sum (x_i - \bar{x})}{n-1}$$

TABLE 2 (cont.).- Swept area, number of hauls and American plaice mean catch (kg) and SD (**) by stratum. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2003. Swept area in square miles. n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data, and 2001-2003 data are original from R/V *Vizconde de Eza.* In 2001, (*) indicates transformed data from C/V *Playa de Menduiña.*

	1998				1999				2000			
Stratum	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD	Swept	area	Tow number	A. Plaice Mean catch	A. Plaice SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD
353	0.0465	4	267.95	103.830		0.0360	3	388.97	37.624	0.0356	3	426.02	210.639
354	0.0356	3	381.49	146.407		0.0218	2	184.12	100.017	0.0356	3	147.44	84.780
355	0.0221	2	134.67	132.931		0.0229	2	60.82	30.122	0.0233	2	60.01	1.539
356	0.0221	2	14.23	5.343		0.0229	2	31.47	23.877	0.0225	2	28.11	24.368
357	0.0240	2	2.33	0.484		0.0236	2	3.06	1.913	0.0124	1	0.55	-
358	0.0236	3	6.73	1.265		0.0349	3	9.06	15.047	0.0341	3	298.64	437.609
359	0.0698	6	198.60	199.740		0.0364	3	484.88	84.636	0.0469	4	659.75	139.208
360	0.2561	25	107.53	64.858		0.2325	19	263.77	91.624	0.2396	20	324.76	269.238
374	0.0353	3	4.00	0.906		0.0244	2	44.00	1.495	0.0240	2	5.60	0.440
375	0.0345	3	5.93	3.550		0.0236	2	42.21	15.545	0.0244	2	30.11	9.300
376	0.0930	10	82.92	73.283		0.1219	10	119.90	62.748	0.1200	10	250.98	179.289
377	0.0229	2	47.18	59.694		0.0240	2	86.16	117.320	0.0229	2	27.02	29.064
378	0.0120	2	5.22	2.199		0.0229	2	7.14	4.199	0.0233	2	19.74	22.646
379	0.0356	3	2.65	1.804		0.0236	2	0.78	0.308	0.0225	2	2.30	1.146
380	0.0113	2	1.69	0.945		0.0236	2	2.22	0.066	0.0236	2	1.74	0.402
381	0.0229	2	8.41	10.927		0.0229	2	0.59	0.231	0.0236	2	2.03	1.269
382	0.0229	3	4.35	3.017		0.0484	4	2.25	0.610	0.0499	4	1.92	0.562
721	0.0203	2	7.68	6.464		0.0244	2	20.06	10.378	0.0236	2	4.21	4.725
722	0.0101	2	1.99	2.375		0.0229	2	2.43	0.704	0.0218	2	1.21	1.715
723	0.0233	2	10.04	8.619		0.0229	2	34.05	29.946	0.0248	2	10.67	7.344
724	0.0206	2	10.84	2.528		0.0225	2	9.89	10.466	0.0233	2	12.31	1.803
725	0.0086	1	0.62	-		0.0229	2	2.48	0.073	0.0210	2	8.64	8.707
726	0.0094	2	2.95	2.726		0.0225	2	39.96	47.051	0.0221	2	8.24	4.177
727	0.0233	2	9.02	3.782		0.0236	2	7.56	7.651	0.0210	2	4.59	2.089
728	0.0206	2	15.58	4.617		0.0233	2	37.93	22.294	0.0210	2	22.82	0.178
752	0.0229	2	49.95	7.102		0.0233	2	35.68	10.927	0.0206	2	128.14	25.680
753	0.0218	2	146.98	13.280		0.0229	2	14.74	4.969	0.0218	2	169.96	216.964
754	0.0210	2	2.67	3.782		0.0206	2	0.00	0.000	0.0195	2	0.00	0.000
755	0.0206	2	0.39	0.550		0.0311	3	0.05	0.090	0.0431	4	0.00	0.000
756	0.0225	2	199.76	258.188		0.0225	2	124.34	44.457	0.0203	2	31.68	11.829
757	0.0206	2	82.24	100.918		0.0233	2	17.07	3.782	0.0214	2	5.12	6.827
758	0.0105	2	4.03	5.695		0.0214	2	0.31	0.438	0.0210	2	1.32	1.649
759	0.0214	2	0.00	0.000		0.0218	2	0.34	0.484	0.0210	2	1.99	2.814
760	0.0214	2	8.04	5.519		0.0225	2	20.30	28.275	0.0210	2	43.59	58.396
761	0.0206	2	3.47	1.605		0.0210	2	0.00	0.000	0.0221	2	0.19	0.264
762	0.0094	2	0.00	0.000		0.0210	2	18.49	26.142	0.0203	2	0.00	0.000
763	0.0218	2	0.08	0.110		0.0311	3	0.00	0.000	0.0416	4	0.30	0.606
764	0.0218	2	0.25	0.352		0.0225	2	0.00	0.000	0.0218	2	0.00	0.000
765	0.0098	2	0.00	0.000		0.0221	2	0.00	0.000	0.0203	2	0.00	0.000
766	0.0191	2	0.00	0.000		0.0218	2	0.00	0.000	0.0214	2	0.00	0.000
767	0.0109	2	0.00	0.000		0.0214	2	0.00	0.000	0.0210	2	0.11	0.156

$$(**)\ SD = \frac{\sum (x_i - \bar{x})}{n-1}$$

TABLE 2 (cont.).- Swept area, number of hauls and American plaice mean catch (kg) and SD (**) by stratum. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2003. Swept area in square miles. n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data, and 2001-2003 data are original from R/V *Vizconde de Eza.* In 2001, (*) indicates transformed data from C/V *Playa de Menduiña.*

	2001				2002				2003			
Stratum	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD
353	0.0341	3	451.08	185.936	0.0476	4	630.50	240.448	0,0334	3	470,86	217,828
354	0.0338	3	172.21	144.326	0.0356	3	207.67	77.048	0,0338	3	806,33	68,178
355	0.0240	2	206.75	85.065	0.0236	2	100.75	40.659	0,0229	2	112,14	7,297
356	0.0240	2	83.56	40.362	0.0233	2	53.95	51.548	0,0225	2	159,80	99,561
357	0.0244	2	76.85	105.720	0.0240	2	5.18	2.015	0,0229	2	59,40	76,650
358	0.0345	3	35.80	28.161	0.0345	3	27.67	21.202	0,0338	3	26,50	16,096
359	0.0803	7	347.89	328.624	0.0686	6	177.40	129.497	0,0791	7	459,09	433,737
360	0.2423	20	261.79	173.177	0.2865	25	143.72	117.177	0,2254	20	229,12	120,612
374	0.0240	2	14.95	1.909	0.0345	3	3.42	1.630	0,0225	2	15,33	4,207
375	0.0338	3	4.77	1.680	0.0353	3	1.41	1.073	0,0330	3	9,96	10,915
376	0.1155	10	46.95	32.487	0.1140	10	47.96	50.207	0,1125	10	62,92	55,173
377	0.0229	2	21.09	10.204	0.0229	2	34.05	39.527	0,0225	2	48,61	30,816
378	0.0236	2	2.75	1.287	0.0233	2	8.10	6.364	0,0225	2	9,42	8,040
379	0.0229	2	0.84	0.092	0.0229	2	5.75	5.445	0,0229	2	3,47	4,667
380	0.0206	2	(*) 2.97	(*) 0.638	0.0225	2	7.25	1.768	0,0229	2	6,68	0,735
381	0.0236	2	(*) 2.35	(*) 0.154	0.0229	2	3.81	2.821	0,0229	2	7,70	3,111
382	0.0469	4	(*) 3.02	(*) 0.929	0.0341	3	1.09	0.904	0,0454	4	2,12	0,643
721	0.0248	2	115.20	86.974	0.0233	2	18.20	12.445	0,0225	2	222,75	273,155
722	0.0233	2	30.29	35.511	0.0236	2	30.10	42.568	0,0221	2	14,31	15,493
723	0.0240	2	36.15	39.244	0.0233	2	7.20	0.849	0,0229	2	2,10	2,687
724	0.0353	3	26.47	26.158	0.0225	2	47.05	41.931	0,0225	2	7,02	7,050
725	0.0116	1	3.63	-	0.0225	2	3.55	4.313	0,0229	2	3,34	0,049
726	0.0116	1	2.10	-	0.0214	2	2.83	0.948	0,0225	2	0,00	0,000
727	0.0225	2	(*) 8.46	(*) 5.277	0.0233	2	2.85	1.061	0,0218	2	42,85	21,001
728	0.0229	2	(*) 5.85	(*) 1.143	0.0229	2	9.58	13.467	0,0225	2	40,45	23,264
752	0.0210	2	(*) 15.79	(*) 7.922	0.0116	1	0.00	-	0,0229	2	27,05	12,516
753	0.0214	2	(*) 59.95	(*) 68.378	0.0229	2	3.60	5.091	0,0229	2	0,00	0,000
754	0.0195	2	(*) 1.26	(*) 1.781	0.0341	3	8.60	14.206	0,0218	2	0,00	0,000
755	0.0416	4	(*) 0.00	(*) 0.000	0.0338	3	0.00	0.000	0,0221	2	0,00	0,000
756	0.0113	1	5.80	-	0.0229	2	11.73	12.551	0,0221	2	1,83	0,884
757	0.0233	2	(*) 105.18	(*) 148.300	0.0225	2	31.15	13.223	0,0221	2	5,17	7,304
758	0.0218	2	(*) 0.16	(*) 0.220	0.0225	2	1.27	0.523	0,0221	2	0,00	0,000
759	0.0221	2	(*) 0.26	(*) 0.374	0.0225	2	0.00	0.000	0,0113	1	0,00	-
760	0.0229	2	37.80	37.618	0.0229	2	4.75	6.718	0,0218	2	0,00	0,000
761	0.0225	2	0.25	0.346	0.0225	2	1.90	1.577	0,0225	2	0,00	0,000
762	0.0116	1	0.00	-	0.0225	2	0.30	0.424	0,0225	2	0,00	0,000
763	0.0330	3	0.00 (*)	0.000 (*)	0.0225	2	0.00	0.000	0,0311	3	0,00	0,000
764	0.0240	2	0.35	0.205	0.0236	2	0.50	0.707	0,0221	2	0,63	0,884
765	0.0113	1	0.10	-	0.0236	2	0.64	0.792	0,0113	1	0,00	-
766	0.0203	2	0.48 (*)	0.677 (*)	0.0233	2	0.00	0.000	0,0225	2	0,00	0,000
767	0.0218	2	0.00 (*)	0.000 (*)	0.0225	2	0.05	0.071	0,0229	2	0,00	0,000

$$(**)\ SD = \frac{\sum (x_i - \bar{x})}{n-1}$$

TABLE 3.- Stratified mean catches (Kg) by stratum and year and SD by year of American plaice (1995-2003). n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data (by FPC). 2001-2003 data are original from R/V *Vizconde de Eza*. In 2001, (*) indicates transformed data from C/V *Playa de Menduíña*, and (**) represent the original results of *R/V Vizconde de Eza* without the *C/V Playa de Menduíña* data.

Stratum	1995	1996	1997	1998	1999	2000	2001	2002	2003
353	19106.64	58131.25	12903.67	72078.57	104632.35	114599.70	121339.6233	169604.50	126660.44
354	30667.61	0.53	8402.49	93846.24	45293.87	36269.52	42363.66	51086.00	198357.18
355	n.s.	0.75	1037.72	9965.35	4500.63	4440.80	15299.5	7455.50	8298.36
356	n.s.	0.16	382.89	668.59	1478.94	1321.33	3927.32	2535.65	7510.60
357	1445.67	1051.74	304.55	382.45	502.29	90.77	12602.58	848.70	9741.60
358	5040.68	1640.58	999.88	1513.72	2037.49	67195.07	8055	6225.00	5962.50
359	24090.80	18962.83	12680.29	83608.73	204132.53	277756.52	146459.8857	74685.40	193275.09
360	98139.11	200401.13	72766.01	299247.75	734066.28	903798.01	728547.655	399985.01	637653.48
374	703.67	2481.96	1796.59	856.16	9415.49	1197.73	3199.3	731.88	3279.55
375	577.21	6850.66	500.53	1606.63	11438.83	8160.97	1291.766667	381.21	2698.26
376	7427.51	40370.93	16719.30	110620.38	159942.67	334810.31	62631.3	63978.64	83931.28
377	794.44	2356.90	2095.72	4718.47	8616.07	2702.20	2108.5	3405.00	4861.00
378	1549.99	1361.44	259.32	726.10	991.91	2744.49	382.25	1125.90	1308.69
379	1388.41	728.40	188.36	281.25	82.40	243.73	88.51	609.50	367.82
380	n.s.	658.19	134.92	162.68	213.43	167.31	(*) 285.07	696.00	641.28
381	n.s.	949.23	222.76	1211.16	84.85	291.71	(*) 338.05	547.92	1108.80
382	n.s.	3053.79	202.64	1493.12	770.56	657.24	(*) 1037.19	372.73	726.30
721	n.s.	960.42	871.09	499.21	1303.60	273.96	7488	1183.00	14478.75
722	n.s.	611.18	3919.11	167.16	203.73	101.86	2544.36	2528.40	1201.62
723	n.s.	428.94	1362.72	1556.71	5277.38	1653.10	5603.25	1116.00	325.50
724	1299.34	1168.25	1653.48	1343.68	1226.09	1526.83	3281.866667	5834.20	869.86
725	0.13	86.52	137.94	65.30	260.04	907.63	381.15	372.75	350.18
726	188.61	169.03	n.s	212.68	2876.79	593.27	151.2	203.76	0.00
727	n.s.	578.34	899.68	865.65	725.35	440.29	(*) 811.92	273.60	4113.60
728	n.s.	101.86	2502.92	1215.08	2958.88	1780.30	(*) 455.96	747.05	3155.10
752	n.s.	3800.37	14763.59	6543.72	4674.08	16785.97	(*) 2068.61	0.00	3543.55
753	n.s.	30083.73	7835.24	20283.24	2033.90	23454.24	(*) 8281.50	496.80	0.00
754	n.s.	n.s.	989.34	481.33	0.00	0.00	(*) 226.67	1548.60	0.00
755	n.s.	n.s.	n.s	149.64	19.95	0.00	(*) 0.00	0.00	0.00
756	n.s.	2223.45	7643.89	20175.92	12558.72	3200.13	585.8	1184.23	184.33
757	n.s.	8645.67	63857.75	8388.77	1741.19	522.51	(*) 10728.11	3177.30	526.83
758	n.s.	n.s.	59.81	398.64	30.63	130.83	(*) 15.39	125.73	0.00
759	n.s.	n.s.	n.s	0.00	43.44	252.73	(*) 33.57	0.00	0.00
760	n.s.	2353.51	2643.21	1237.81	3126.85	6713.38	5821.2	731.50	0.00
761	n.s.	0.00	206.83	592.85	0.00	31.90	41.895	324.05	0.00
762	n.s.	n.s.	0.00	0.00	3918.87	0.00	0	63.60	0.00
763	n.s.	n.s.	n.s	20.29	0.00	79.13	(*) 0.00	0.00	0.00
764	n.s.	45.09	16.71	24.87	0.00	0.00	34.5	50.00	62.50
765	n.s.	0.00	0.00	0.00	0.00	0.00	12.4	79.36	0.00
766	n.s.	n.s.	0.00	0.00	0.00	0.00	(*) 62.68	0.00	0.00
767	n.s.	n.s.	n.s	0.00	0.00	17.44	(*) 0.00	7.90	0.00
TOTAL	192419.82	390256.84	240960.96	747209.90	1331180.06	1814912.89	1198587.19	804322.34	1315194.03
							(**) 1174242.47		
$(\bar{Y})$	29.27	44.47	25.80	72.25	128.72	175.49	115.90	77.77	127.17
							(**) 149.39		
S.D.	3.64	4.01	5.09	6.51	6.85	19.24	12.32	7.46	10.79

TABLE 4.- Survey estimates (by the swept area method) of American plaice biomass (t) and SD by stratum and year on NAFO Div. 3NO. n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2003 data are original from R/V *Vizconde de Eza*. In 2001, (*) indicates transformed data from C/V *Playa de Menduíña*, and (**) represent the original results of *R/V Vizconde de Eza* without the *C/V Playa de Menduíña* data. The last row presents the biomass obtained from the length distribution.

Stratum	1995	1996	1997	1998	1999	2000	2001	2002	2003
353	1626	4697	1075	6200	8719	9651	10667	14245	11385
354	2610	3002	723	7903	4165	3054	3766	4302	17632
355	n.s.	369	89	901	393	382	1275	631	726
356	n.s.	36	34	60	129	117	327	218	668
357	133	97	28	32	43	7	1034	71	852
358	474	154	89	130	175	5907	700	541	530
359	2095	1732	1103	7192	16836	23702	12775	6530	17099
360	8540	16517	6203	25808	59988	75434	60148	34903	56586
374	63	214	153	73	773	100	267	64	292
375	51	599	43	140	968	670	115	32	245
376	644	3425	1479	9578	13124	27901	5423	5612	7461
377	72	206	180	413	718	236	184	298	432
378	143	124	25	62	87	236	32	97	116
379	126	65	18	24	7	22	8	53	32
380	n.s.	59	13	14	18	14	(*) 28	62	56
381	n.s.	83	20	106	7	25	(*) 29	48	97
382	n.s.	271	18	131	64	53	(*) 89	33	64
721	n.s.	90	79	49	107	23	605	102	1287
722	n.s.	59	367	16	18	9	219	214	109
723	n.s.	39	130	134	461	134	467	96	28
724	124	115	147	130	109	131	279	519	77
725	130	8	13	8	23	86	33	33	31
726	18	16	n.s.	21	256	54	13	19	0
727	n.s.	55	96	74	61	42	(*) 72	24	378
728	n.s.	365	234	118	255	170	(*) 40	65	280
752	n.s.	349	1358	572	402	1628	(*) 197	143	310
753	n.s.	3027	733	1865	178	2157	(*) 775	43	0
754	n.s.	n.s.	90	46	0	0	(*) 23	6	0
755	n.s.	n.s.	n.s.	15	2	0	(*) 0	0	0
756	n.s.	212	703	1793	1116	316	52	104	17
757	n.s.	922	6307	813	150	49	(*) 923	282	48
758	n.s.	n.s.	6	37	3	12	(*) 1	11	0
759	n.s.	n.s.	n.s.	0	4	24	(*) 3	0	0
760	n.s.	224	252	116	278	639	509	64	0
761	n.s.	0	20	57	0	3	4	29	0
762	n.s.	n.s.	0	0	373	0	0	6	0
763	n.s.	n.s.	n.s.	2	0	8	(*) 0	0	0
764	n.s.	4	2	2	0	0	3	4	6
765	n.s.	0	0	0	0	0	1	7	0
766	n.s.	n.s.	0	0	0	0	(*) 2	0	0
767	n.s.	n.s.	n.s.	0	0	2	(*) 0	1	0
TOTAL	16848	37138	21827	64635	110010	152997	101089	69511	116842
							(**) 98907		
S.D.	2050	3137	4495	5946	5825	16740	10841	7097	9777
Warren Method	14712	28126	15830	42931	72155	117814	103173	62585	109359

TABLE 5.- Length weight relationships in the calculation of American plaice biomass. The equation is $Weight = a(l + 0.5)^b$ Spanish Spring Surveys on NAFO Div. 3NO: 1995-2003. To calculate the parameters for the indeterminate individuals, we used the total data (males + females + indeterminate individuals)

		1995	1996	1997	1998	1999	2000	2001	2002	2003
Males	a	0.0055	0.0075	0.0043	0.0041	0.0049	0.0024	0.0064	0.0041	0.0037
		Error = 0.1552	Error = 0.1349	Error = 0.1296	Error = 0.1200	Error = 0.2799	Error = 0.1281	Error = 0.1556	Error = 0.0660	Error = 0.0752
	b	3.1272	3.0239	3.1794	3.1943	3.1454	3.3523	3.0742	3.1930	3.2287
		Error = 0.0447	Error = 0.0392	Error = 0.0378	Error = 0.0348	Error = 0.0817	Error = 0.0382	Error = 0.0485	Error = 0.0205	Error = 0.0234
		R^2 = 0.994	R^2 = 0.994	R^2 = 0.995	R^2 = 0.996	R^2 = 0.983	R^2 = 0.995	R^2 = 0.992	R^2 = 0.988	R^2 = 0.998
		N = 590	N = 233	N = 1050	N = 573	N = 183	N = 321	N = 188	N = 384	N = 622
Females	a	0.0039	0.0038	0.0027	0.0027	0.0048	0.0020	0.0039	0.0032	0.0030
		Error = .1112	Error = 0.1204	Error = 0.1058	Error = 0.0595	Error = 0.1420	Error = 0.0981	Error = 0.0624	Error = 0.0628	Error = 0.0549
	b	3.2383	3.2354	3.3263	3.3218	3.1704	3.4049	3.2256	3.2752	3.2918
		Error = 0.0307	Error = 0.0326	Error = 0.0291	Error = 0.0162	Error = 0.0389	Error = 0.0271	Error = 0.0177	Error = 0.0178	Error = 0.0157
		R^2 = 0.996	R^2 = 0.994	R^2 = 0.998	R^2 = 0.999	R^2 = 0.993	R^2 = 0.998	R^2 = 0.998	R^2 = 0.998	R^2 = 0.999
		N = 477	N = 367	N = 1396	N = 937	N = 201	N = 402	N = 370	N = 703	N = 960
Indet.	a	0.0040	0.0038	0.0026	0.0028	0.0022	0.0020	0.0054	0.0035	0.0032
		Error = .0990	Error = 0.1096	Error = 0.0928	Error = 0.0602	Error = 0.1531	Error = 0.0817	Error = 0.0866	Error = 0.0599	Error = 0.0581
	b	3.2295	3.2348	3.3370	3.3153	3.3812	3.4049	3.1409	3.2527	3.2795
		Error = 0.0274	Error = 0.0297	Error = 0.0255	Error = 0.0164	Error = 0.0431	Error = 0.0226	Error = 0.0248	Error = 0.0171	Error = 0.0167
		R^2 = 0.997	R^2 = 0.995	R^2 = 0.997	R^2 = 0.999	R^2 = 0.989	R^2 = 0.997	R^2 = 0.996	R^2 = 0.998	R^2 = 0.998
		N = 1067	N = 604	N = 2446	N = 1513	N = 386	N = 726	N = 573	N = 1087	N = 1587

TABLE 6.- Survey estimates (by the swept area method) of American plaice abundance (,000) and SD by stratum and year on NAFO Div. 3NO. n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2003 data are original from R/V *Vizconde de Eza*. In 2001, (*) indicates transformed data from C/V *Playa de Menduíña*, and (**) represent the original results of *R/V Vizconde de Eza* without the *C/V Playa de Menduíña* data. The last row presents the biomass obtained from the length distribution.

Strata	1995	1996	1997	1998	1999	2000	2001	2002	2003
353	7846	23780	4081	18626	27734	47168	50091	69143	49841
354	13009	14619	3451	25087	14295	8553	14254	21378	64937
355	n.s.	1649	373	2577	611	1107	3949	1767	2072
356	n.s.	189	158	188	350	257	1070	848	1882
357	627	360	102	93	82	27	3963	273	4182
358	2323	866	452	399	387	10840	2707	3171	2458
359	18117	9339	4860	22283	49395	66859	46680	44928	78397
360	55365	73742	24608	75429	157596	247635	296315	113601	194988
374	333	1114	748	225	2187	290	1685	298	1113
375	228	1444	134	388	2401	1441	321	92	602
376	3273	10995	4829	21996	29930	60686	14492	12313	15639
377	491	1238	1096	1047	3211	672	2079	2447	4166
378	1037	782	109	209	263	564	430	891	1093
379	640	461	83	105	20	56	14	268	74
380	n.s.	413	98	72	54	49	(*) 115	307	449
381	n.s.	823	164	669	49	181	(*) 158	302	1171
382	n.s.	2206	132	667	405	255	(*) 374	362	234
721	n.s.	417	317	135	321	59	2011	425	4864
722	n.s.	244	2841	52	33	17	795	583	277
723	n.s.	205	556	364	1208	307	1498	407	68
724	452	444	573	384	250	250	1455	1025	248
725	497	42	71	19	78	280	117	200	119
726	55	61	n.s.	71	747	172	37	30	0
727	n.s.	369	612	296	219	136	(*) 227	293	1055
728	n.s.	2249	1473	596	910	528	(*) 112	177	704
752	n.s.	1334	5953	2414	1662	5204	(*) 607	304	641
753	n.s.	10851	2548	6787	554	6470	(*) 2067	90	0
754	n.s.	n.s.	259	145	0	0	(*) 49	8	0
755	n.s.	n.s.	n.s.	61	0	0	(*) 0	0	0
756	n.s.	784	2619	5360	3352	887	126	283	78
757	n.s.	3393	21986	2696	467	94	(*) 2252	535	124
758	n.s.	n.s.	13	88	10	25	(*) 6	69	0
759	n.s.	n.s.	n.s.	0	12	67	(*) 5	0	0
760	n.s.	1175	690	262	647	1188	848	114	0
761	n.s.	0	49	154	0	0	8	46	0
762	n.s.	n.s.	0	0	789	0	0	44	0
763	n.s.	n.s.	n.s.	5	0	13	(*) 0	0	0
764	n.s.	0	6	7	0	0	42	30	32
765	n.s.	0	0	0	0	0	11	57	0
766	n.s.	n.s.	0	0	0	0	(*) 15	0	0
767	n.s.	n.s.	n.s.	0	0	3	(*) 0	7	0
TOTAL	104296	165591	86045	189956	300227	462342	450985	277115	431509
							(**) 444998		
S.D.	16155	15161	16174	16422	16424	57620	60580	24570	41665
Warren Method	76889	98746	48073	98923	171249	383158	444998	277115	431509

TABLE 7.- American plaice length distribution. Estimated numbers in frequency in ‰. Spanish Spring Survey on NAFO 3NO: 1995-2003. Indet. means indeterminate. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2003 data are original R/V *Vizconde de Eza* data. (*) indicates untransformed data.

	1995			1996			1997		
Lenght (cm.)	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	1.697	1.990	0.000	0.000	0.000	0.000	0.000	0.000
14	0.679	0.484	1.329	0.000	0.000	0.243	0.147	0.142	0.000
16	1.077	5.722	0.261	0.862	3.809	0.438	0.359	0.356	0.000
18	6.531	11.143	0.000	4.963	10.275	0.617	4.816	7.033	0.000
20	36.786	34.135	0.000	11.922	30.778	0.049	12.831	12.348	0.208
22	103.187	85.413	0.000	17.880	30.095	1.222	24.183	16.204	0.000
24	115.179	92.469	0.000	34.539	26.569	0.000	30.227	21.193	0.000
26	85.220	70.200	0.000	78.402	42.826	0.653	35.855	32.906	0.000
28	50.770	54.813	0.000	94.576	80.031	0.000	66.473	38.820	0.000
30	26.007	40.627	0.000	59.176	84.795	0.000	105.671	39.695	0.000
32	15.529	35.756	0.000	32.328	74.213	0.000	64.801	56.262	0.000
34	9.372	28.678	0.000	19.089	59.625	0.076	53.024	61.659	0.000
36	5.781	18.623	0.000	13.110	52.238	0.000	34.951	61.304	0.000
38	3.531	13.070	0.000	5.755	37.386	0.000	13.839	59.359	0.000
40	2.143	9.758	0.000	2.820	23.790	0.000	9.032	44.139	0.000
42	1.275	8.054	0.000	1.736	16.625	0.000	2.640	31.089	0.000
44	0.635	5.292	0.000	1.021	12.016	0.000	2.204	20.892	0.000
46	0.468	3.995	0.000	0.399	7.239	0.000	1.608	8.776	0.000
48	0.023	2.753	0.000	0.227	5.114	0.000	0.175	8.830	0.000
50	0.051	2.798	0.000	0.065	4.693	0.000	0.054	7.856	0.000
52	0.000	1.885	0.000	0.000	3.909	0.000	0.000	2.289	0.000
54	0.000	1.273	0.000	0.000	4.150	0.000	0.000	2.016	0.000
56	0.000	1.147	0.000	0.000	2.493	0.000	0.000	1.171	0.000
58	0.000	0.421	0.000	0.000	1.183	0.000	0.000	0.595	0.000
60	0.000	0.648	0.000	0.000	0.977	0.000	0.000	0.619	0.000
62	0.000	0.743	0.000	0.000	0.658	0.000	0.000	0.314	0.000
64	0.000	0.041	0.000	0.000	1.245	0.000	0.000	0.397	0.000
66	0.000	0.447	0.000	0.000	0.642	0.000	0.000	0.450	0.000
68	0.000	0.000	0.000	0.000	0.279	0.000	0.000	0.189	0.000
70	0.000	0.000	0.000	0.000	0.122	0.000	0.000	0.000	0.000
72	0.000	0.091	0.000	0.000	0.058	0.000	0.000	0.000	0.000
74	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
76	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
78	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	464.243	532.177	3.580	378.870	617.833	3.297	462.890	536.902	0.208
Nº Ind. (*):	6652	6614	9	6569	10111	21	8297	5729	3
Nº samples:		77			100			116	
Range:		12-71			14-71			14-68	
Total catch:		2166			5186			4163	
Sampled catch:		994			1507			1390	
Total hauls:		77			112			128	

TABLE 7 (cont.).- American plaice length distribution. Estimated numbers in frequency in ‰. Spanish Spring Survey on NAFO 3NO: 1995-2003. Indet. means indeterminate. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2003 data are original R/V *Vizconde de Eza* data. (*) indicates untransformed data.

	1998			1999			2000		
Lenght (cm.)	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	10.215	10.215	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	40.858	13.694	10.747	25.701	0.697
14	0.095	0.047	0.000	0.000	0.820	0.385	15.382	18.462	0.016
16	3.246	0.756	0.000	2.605	5.972	0.000	79.451	93.233	0.000
18	0.047	1.268	0.000	3.838	9.929	0.000	89.198	130.856	0.016
20	1.352	2.764	0.000	1.284	0.206	0.000	25.515	47.908	0.000
22	5.054	2.564	0.000	2.684	4.661	0.000	5.751	6.281	0.000
24	12.517	11.151	0.000	5.342	2.798	0.000	3.751	2.610	0.000
26	27.225	24.942	0.000	20.938	5.197	0.000	3.872	3.469	0.000
28	38.182	30.358	0.000	50.289	21.443	0.000	6.740	1.601	0.000
30	56.116	37.116	0.000	75.530	36.523	0.000	19.072	4.804	0.000
32	61.680	45.408	0.000	86.938	39.546	0.000	35.042	9.455	0.000
34	47.197	73.071	0.000	61.278	35.331	0.000	30.649	21.010	0.000
36	28.879	96.719	0.000	37.153	44.041	0.000	19.645	24.703	0.000
38	14.846	104.539	0.000	18.802	68.372	0.000	10.304	29.010	0.000
40	7.063	80.918	0.000	8.776	67.062	0.000	5.130	39.585	0.000
42	2.475	61.957	0.000	3.281	66.358	0.000	1.862	43.141	0.000
44	1.230	43.536	0.000	1.237	45.953	0.000	0.835	39.260	0.000
46	0.789	26.929	0.000	0.706	28.114	0.000	0.574	28.427	0.000
48	0.379	18.736	0.000	0.000	18.466	0.000	0.506	18.067	0.000
50	0.018	9.278	0.000	0.066	14.653	0.000	0.095	11.684	0.000
52	0.000	5.813	0.000	0.000	8.886	0.000	0.272	12.245	0.000
54	0.000	3.400	0.000	0.000	7.748	0.000	0.000	7.865	0.000
56	0.475	2.958	0.000	0.000	5.625	0.000	0.000	5.848	0.000
58	0.000	2.195	0.000	0.000	2.381	0.000	0.000	3.033	0.000
60	0.000	2.640	0.000	0.000	1.579	0.000	0.000	2.373	0.000
62	0.000	0.600	0.000	0.000	1.030	0.000	0.000	2.352	0.000
64	0.000	0.683	0.000	0.000	0.853	0.000	0.000	1.091	0.000
66	0.000	0.441	0.000	0.000	0.250	0.000	0.000	0.674	0.000
68	0.000	0.349	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.100	0.000
72	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000
74	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
76	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
78	0.000	0.000	0.000	0.000	0.087	0.000	0.000	0.000	0.000
Total	308.863	691.137	0.000	380.747	594.960	24.294	364.391	634.880	0.729
Nº Ind. (*):	4640	7390	0	4541	7742	4	3732	7721	5
Nº samples:		108			93			96	
Range:		13-68			10-77			11-72	
Total catch:		8536			10565			15533	
Sampled catch:		1617			1858			1697	
Total hauls:		124			114			118	

TABLE 7 (cont.).- American plaice length distribution. Estimated numbers in frequency in ‰. Spanish Spring Survey on NAFO 3NO: 1995-2003. Indet. means indeterminate. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2003 data are original R/V *Vizconde de Eza* data. (*) indicates untransformed data.

	2001			2002			2003		
Lenght (cm.)	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
6	0.000	0.000	1.192	0.000	0.000	0.000	0.077	0.000	0.181
8	0.021	0.032	4.613	0.026	0.000	0.169	0.722	0.205	0.412
10	0.294	0.686	0.985	0.586	1.306	0.000	0.450	0.367	0.167
12	1.915	3.100	0.432	7.108	14.576	0.468	0.492	0.807	0.029
14	8.895	12.887	1.267	14.487	17.729	0.114	2.909	3.061	0.000
16	10.853	13.335	0.201	4.276	5.762	0.000	5.502	4.253	0.000
18	44.285	48.188	0.020	10.335	12.819	0.000	24.747	23.182	0.000
20	123.739	107.422	0.000	26.639	27.380	0.000	24.052	22.506	0.000
22	97.613	101.564	0.000	54.975	38.631	0.000	15.807	17.120	0.000
24	31.528	49.790	0.000	107.492	95.184	0.000	43.300	26.127	0.000
26	8.114	11.576	0.000	88.930	119.780	0.000	104.263	34.020	0.000
28	5.438	5.230	0.000	34.962	69.061	0.000	109.544	90.346	0.000
30	14.805	2.829	0.000	14.692	23.490	0.000	52.318	123.411	0.000
32	28.915	2.546	0.000	18.181	7.458	0.000	21.204	69.059	0.000
34	34.747	6.459	0.000	20.738	4.457	0.000	21.169	26.210	0.000
36	24.994	14.652	0.000	15.765	4.408	0.000	16.174	8.843	0.000
38	9.627	22.493	0.000	9.927	8.116	0.000	11.674	4.718	0.000
40	4.338	25.245	0.000	3.758	17.625	0.000	5.236	7.382	0.000
42	1.871	25.718	0.173	1.808	21.227	0.000	1.151	12.468	0.000
44	1.222	26.655	0.000	0.527	21.186	0.000	0.412	12.990	0.000
46	0.258	23.126	0.000	0.260	18.817	0.000	0.114	13.230	0.000
48	0.000	13.860	0.000	0.026	12.071	0.000	0.062	11.684	0.000
50	0.000	7.571	0.000	0.071	8.838	0.000	0.000	8.082	0.000
52	0.000	4.674	0.000	0.058	4.187	0.000	0.000	5.700	0.000
54	0.000	2.836	0.000	0.058	4.099	0.000	0.000	5.466	0.000
56	0.000	2.345	0.000	0.000	2.493	0.000	0.000	2.897	0.000
58	0.000	0.799	0.000	0.000	1.400	0.000	0.000	1.989	0.000
60	0.000	0.868	0.000	0.000	0.415	0.000	0.000	0.936	0.000
62	0.000	0.739	0.000	0.000	0.654	0.000	0.000	0.299	0.000
64	0.000	0.216	0.000	0.000	0.116	0.000	0.000	0.215	0.000
66	0.000	0.000	0.000	0.000	0.136	0.000	0.000	0.260	0.000
68	0.000	0.159	0.000	0.000	0.144	0.000	0.000	0.000	0.000
70	0.000	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000
72	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
76	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
78	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	453.472	537.646	8.883	435.686	563.564	0.751	461.380	537.831	0.789
Nº Ind. (*):	4996	7906	114	5873	7234	12	6122	7333	9
Nº samples:		81			108			91	
Range:		5-70			7-68			6-66	
Total catch:		11477			9201			13955	
Sampled catch:		3388			3675			3885	
Total hauls:		83			125			122	

TABLE 8.- American plaice length distribution in estimated numbers (,000). Spanish Spring Survey on NAFO 3NO: 1999-2003. Indet. means indeterminate. 1999-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2003 data are original from R/V *Vizconde de Eza*. (*) indicates untransformed data.

	1999			2000			2001		
Lenght (cm.)	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
6	0	3067	3067	0	0	0	0	0	530
8	0	12267	4111	0	0	0	9	14	2053
10	0	246	116	0	0	0	131	305	438
12	782	1793	0	4969	11883	322	852	1379	192
14	1152	2981	0	7112	8536	7	3958	5735	564
16	385	62	0	36734	43106	0	4830	5934	90
18	806	1399	0	41240	60500	7	19707	21444	9
20	1604	840	0	11797	22150	0	55064	47802	0
22	6286	1560	0	2659	2904	0	43438	45196	0
24	15098	6438	0	1734	1207	0	14030	22157	0
26	22676	10965	0	1790	1604	0	3611	5151	0
28	26101	11873	0	3116	740	0	2420	2328	0
30	18397	10607	0	8818	2221	0	6588	1259	0
32	11154	13222	0	16201	4372	0	12867	1133	0
34	5645	20527	0	14170	9714	0	15462	2874	0
36	2635	20134	0	9083	11421	0	11122	6520	0
38	985	19922	0	4764	13412	0	4284	10009	0
40	371	13796	0	2372	18302	0	1930	11234	0
42	212	8441	0	861	19946	0	833	11444	77
44	0	5544	0	386	18151	0	544	11861	0
46	20	4399	0	265	13143	0	115	10291	0
48	0	2668	0	234	8353	0	0	6167	0
50	0	2326	0	44	5402	0	0	3369	0
52	0	1689	0	126	5661	0	0	2080	0
54	0	715	0	0	3636	0	0	1262	0
56	0	474	0	0	2704	0	0	1044	0
58	0	309	0	0	1402	0	0	356	0
60	0	256	0	0	1097	0	0	386	0
62	0	75	0	0	1088	0	0	329	0
64	0	0	0	0	504	0	0	96	0
66	0	0	0	0	312	0	0	0	0
68	0	0	0	0	0	0	0	71	0
70	0	0	0	0	46	0	0	20	0
72	0	0	0	0	14	0	0	0	0
74	0	26	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0
Total	114309	178621	7294	168475	293531	336	201794	239251	3953
Nº Ind. (*):	4541	7742	4	3732	7721	5	4996	7906	114
Nº samples:		93			96			81	
Range:		10-77			11-72			5-70	
Estimated Biomass:		110010			152997			98907	
Total catch:		10565			15533			11477	
Sampled catch:		1858			1697			3388	
Total hauls:		117			123			83	

TABLE 8 (cont.).- American plaice length distribution in estimated numbers (,000). Spanish Spring Survey on NAFO 3NO: 1999-2003. Indet. means indeterminate. 1999-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2003 data are original from R/V *Vizconde de Eza*. (*) indicates untransformed data.

	2002			2003		
Lenght (cm.)	Males	Females	Indet.	Males	Females	Indet.
6	0	0	0	33	0	78
8	7	0	47	312	88	178
10	162	362	0	194	158	72
12	1970	4039	130	212	348	13
14	4015	4913	32	1255	1321	0
16	1185	1597	0	2374	1835	0
18	2864	3552	0	10678	10003	0
20	7382	7587	0	10379	9711	0
22	15234	10705	0	6821	7387	0
24	29788	26377	0	18684	11274	0
26	24644	33193	0	44990	14680	0
28	9689	19138	0	47269	38985	0
30	4071	6509	0	22576	53253	0
32	5038	2067	0	9150	29799	0
34	5747	1235	0	9135	11310	0
36	4369	1221	0	6979	3816	0
38	2751	2249	0	5037	2036	0
40	1041	4884	0	2259	3185	0
42	501	5882	0	497	5380	0
44	146	5871	0	178	5605	0
46	72	5214	0	49	5709	0
48	7	3345	0	27	5042	0
50	20	2449	0	0	3488	0
52	16	1160	0	0	2459	0
54	16	1136	0	0	2359	0
56	0	691	0	0	1250	0
58	0	388	0	0	858	0
60	0	115	0	0	404	0
62	0	181	0	0	129	0
64	0	32	0	0	93	0
66	0	38	0	0	112	0
68	0	40	0	0	0	0
70	0	0	0	0	0	0
72	0	0	0	0	0	0
74	0	0	0	0	0	0
76	0	0	0	0	0	0
78	0	0	0	0	0	0
Total	120735	156172	208	199089	232079	341
Nº Ind. (*):	5873	7234	12	6122	7333	9
Nº samples:		108			91	
Range:		7-68			6-66	
Estimated Biomass:		69511			116842	
Total catch:		9201			13955	
Sampled catch:		3675			3885	
Total hauls:		127			122	

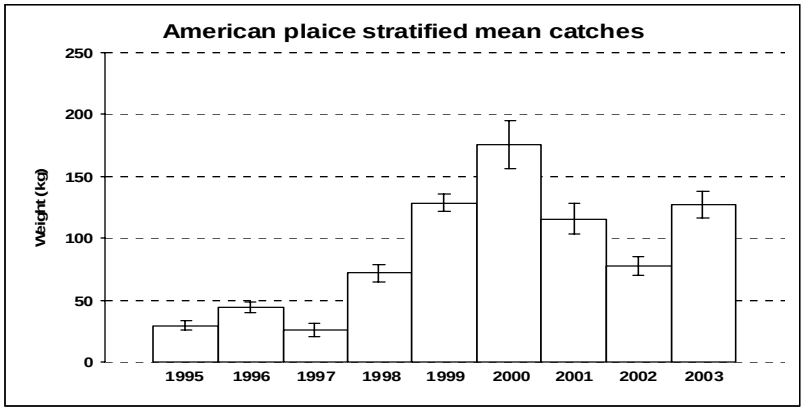

FIGURE 1.- American plaice stratified mean catches in Kg and ±SD by year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2003 (1995-2000 transformed data from C/V *Playa de Menduíña*; 2001-2003 original data from R/V *Vizconde de Eza*).

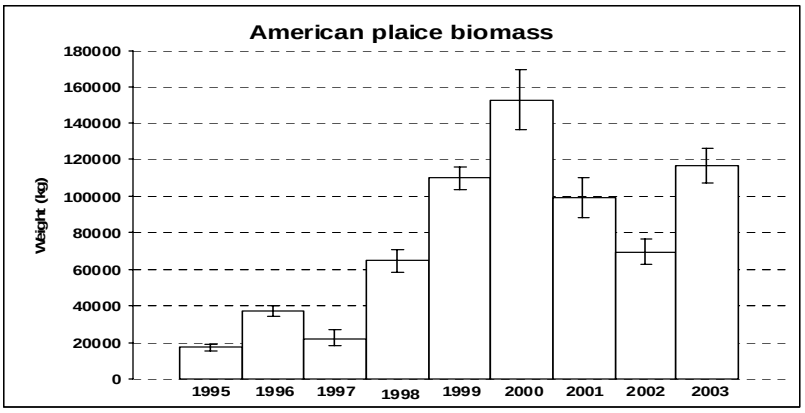

FIGURE 2.- American plaice biomass in tons and ±SD by year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2003 (1995-2000 transformed data from C/V *Playa de Menduíña*; 2001-2003 original data from R/V *Vizconde de Eza*).

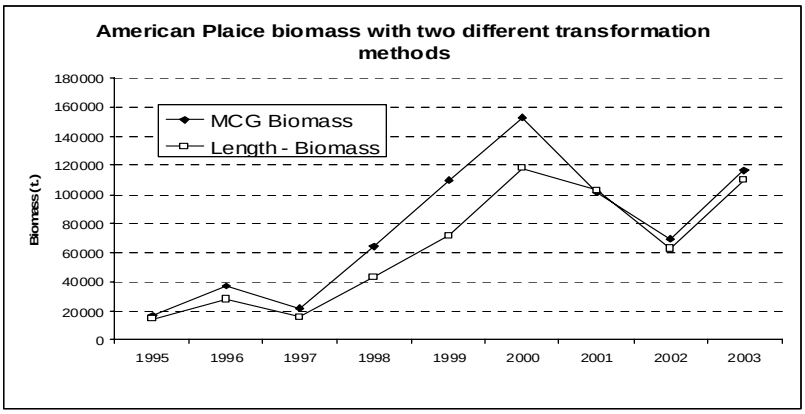

FIGURE 3.- American plaice biomass in tons transformed with the two different methods: MCG and Warren.

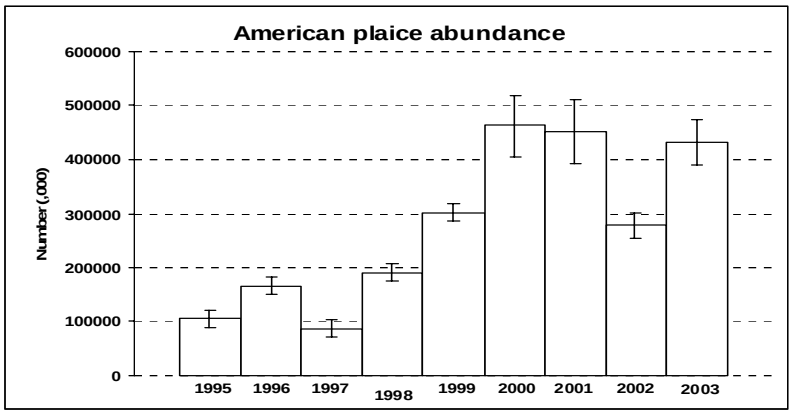

FIGURE 4.- American plaice abundance in thousand and ±SD by year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2003 (1995-2000 transformed data from C/V *Playa de Menduíña*; 2001-2003 original data from R/V *Vizconde de Eza*).

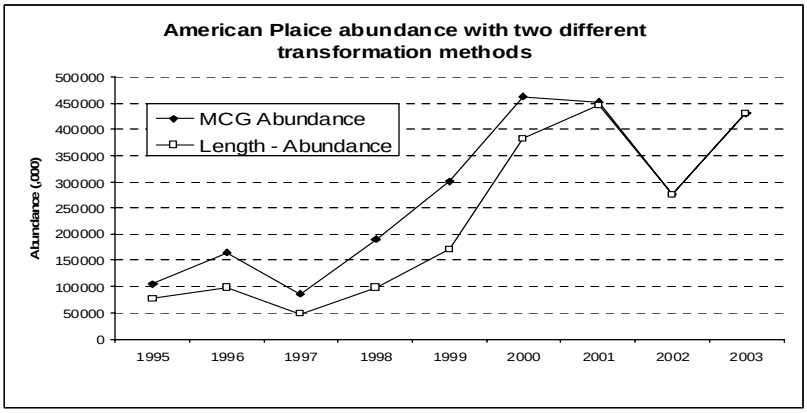

FIGURE 5.- American plaice abundance in thousands transformed with the two different methods: MCG and Warren.

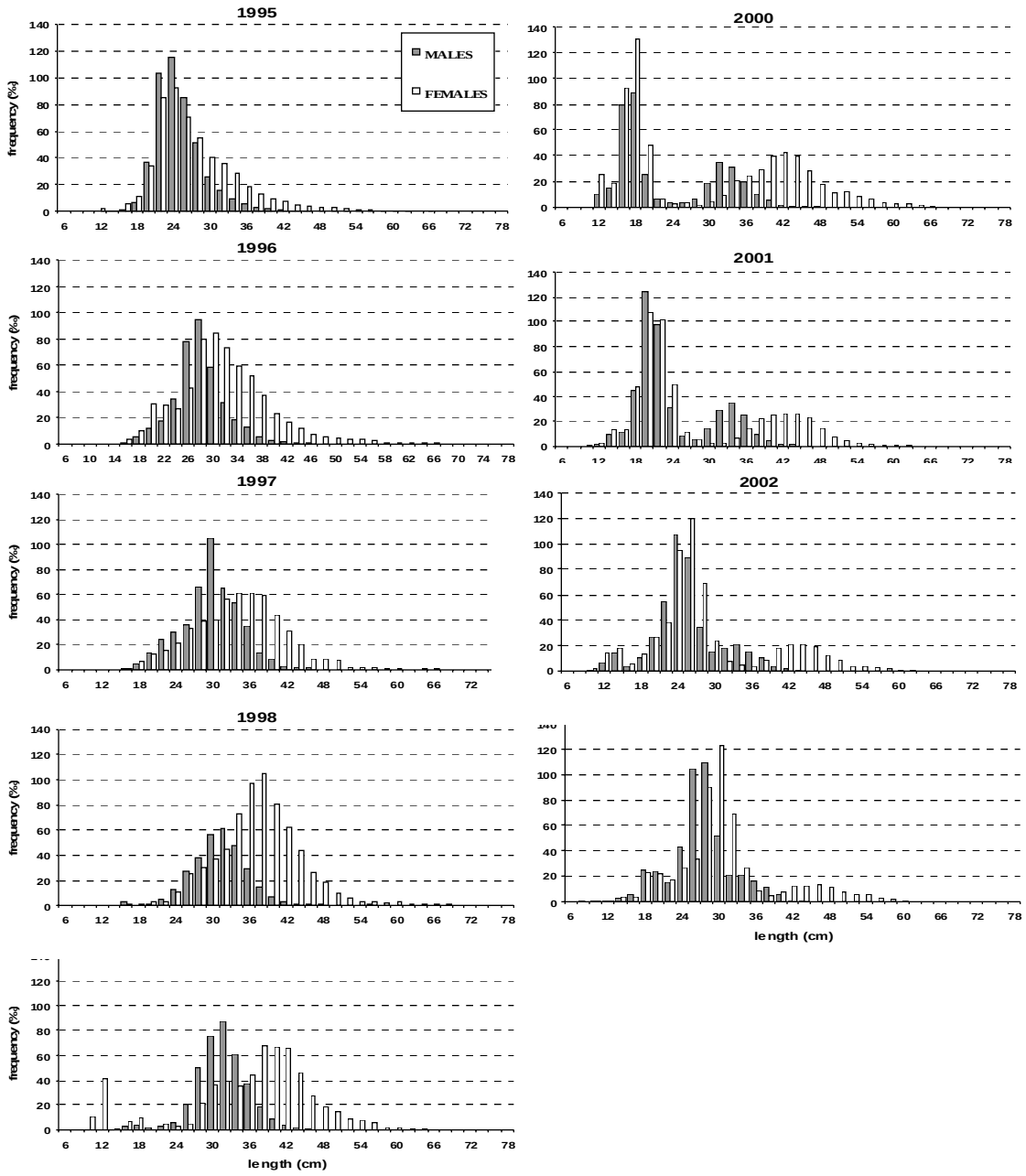

FIGURE 6.- American plaice length distribution (cm) on NAFO 3NO: 1995-2003. Frequency in ‰. 1995-2000 data are transformed data from C/V *Playa de Menduíña*, and 2001-2003 data are original from R/V *Vizconde de Eza*.

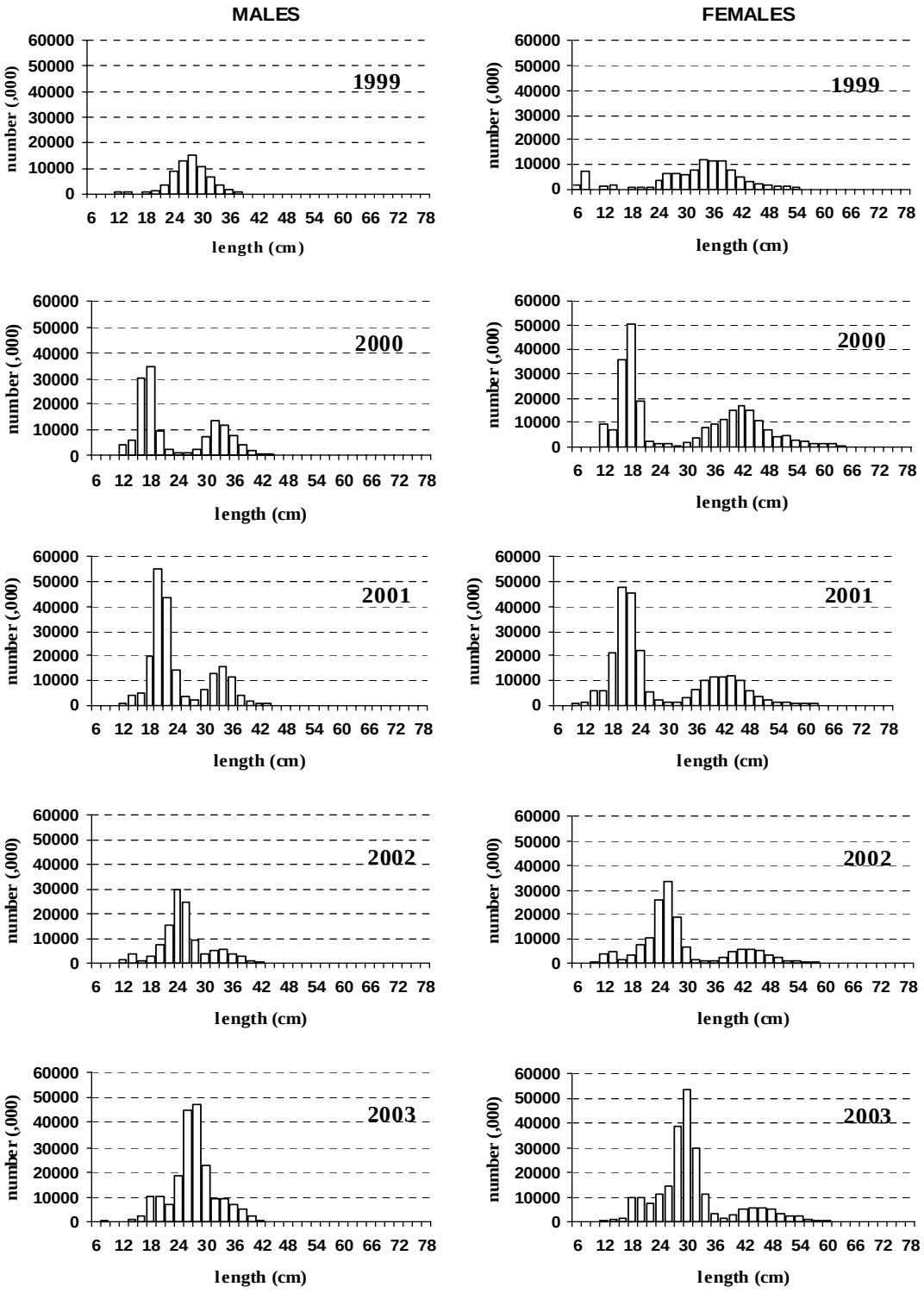

FIGURE 7.- Length distribution by sex of American plaice in estimated numbers (,000) on NAFO 3NO for the period 1999-2003. 1999-2000 data are transformed C/V *Playa de Menduíña* data.