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New time Series for Yellowtail Flounder from the Comparative Experience Between the C/V *Playa de Menduíña* and the R/V *Vizconde de Eza* in the NAFO Regulatory Area of Divisions 3NO, 1995-2002

by

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Abstract

Since 1995, a stratified random spring bottom trawl survey in the NAFO Regulatory Area of Div. 3NO was conducted by Spain. The depth strata surveyed was extended to 1 464 m. The main propose of the surveys was obtain abundance and biomass indices and population structure for the commercial species in the area. In 2001, the trawl vessel was replaced in the realization of the trawls; so, the time series indices were transformed. The transformed entire series of abundance, biomass and length distribution for Yellowtail flounder are presented for the period 1995-2000, and the no-transformed data for the years 2001 and 2002. The standard deviations are shown for abundance and biomass. This resource is in rebuilding and its SSB is increasing in last 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 were 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 trawl, 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 1998-2002, the surveyed depth strata were the same (extended to 1 464 m). The survey area was stratified following the standard stratification schemes (Bishop, 1994). Sets were 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 weighed. Samples of Yellowtail flounder were measured at random to the total length at cm below**.** Length distribution estimated from catches is presented for the period 1995-2002.

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

Yellowtail flounder 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 in the stratum

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 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:

$$\ln(CPUE_{ij} + 1) = \mu + t_i + h_j + \varepsilon_{ij}$$

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

$$\sum_{i=1}^{2} t_i = 0 \Rightarrow t_1 = t = -t_2 \qquad \sum_{j=1}^{90} h_j = 0$$

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

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

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

This model was applys to convert mean catches, abundance and biomass.

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

$$Ratio = \alpha l^{\beta} e^{\delta l}$$

where: $Ratio = \frac{Campelen\ Catch}{Pedreira\ Catch}$ by length (2)

l is the length

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

Data series

For 1995-2000, transformed C/V *Playa de Menduíña* data series are presented. For 2002, 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 obtain 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.

Results

Yellowtail flounder Catches

To convert mean catches, the CPUE was adjusted in model (1), giving the $\hat{F}PC_{bio}$ =0.42698617.

The Yellowtail flounder mean catches by stratum are presented in Table 2, included swept area, number of hauls and SD. Yellowtail flounder stratified mean catches and its SD are presented in Table 3. The Yellowtail flounder indices show a general increasing or maintenance until 2001, and a decreasing in the last year (Fig. 1). The high value of the year 1999 may be due to a change of the catchability, so it is a year effect (Walsh *et al.*, 2001).

Yellowtail flounder Abundance and Biomass

To convert biomass, the CPUE was adjusted in model (1), giving the $\hat{F}PC_{bio}$ =0.42698617. To adjust the abundance, the abundance per unit of effort was adjusted in the same model, obtained $\hat{F}PC_{ab}$ =0.37721844.

Following the recommendations of the 2000 Scientific Council Meeting, the entire time series (1995-2002) of abundance and biomass and their SD estimates of Yellowtail flounder are presented (updated) in Table 4 and Table 5, respectively. Both abundance and biomass had a decreasing last year although the situation seems stabilized above the historic mean (Fig. 2 and 3).

Yellowtail flounder Length Distribution

The result of this model to yellowtail flounder was the following (for more details, see Paz *et al.*, 2002) (cf = conversion factor):

For $l \leq 14$: cf = 2.74
For $15 \leq l \leq 21$: cf = 0.59
For $22 \leq l \leq 46$: cf = exp(11.4618-4.9801 $\ln(l)$)+0.1388 l)
For $47 \leq l$: cf = 0.4

In Table 6 is shown Yellowtail flounder length distribution per thousand, besides the sampled size and its catch for the period 1995-2002. In Fig. 4 we can see the length distribution evolution along the years. It can be seen an increasing in the adult fraction of the population and a quite presence of recruitment. Considering mature individuals at 30 cm (Durán *et al.*, 1998), the spawning stock biomass (SSB) was increasing in last years (Fig. 5).

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TABLE 1.- Spanish spring bottom trawl surveys on NAFO Div. 3NO: 1995-2002.

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	83	>56-1116	May 05-May 23
2002	R/V Vizconde de Eza	125	>56-1464	April 29-May 19

TABLE 2.- Swept area, number of hauls and Yellowtail flounder mean catch (Kg) and SD (**) by stratum. Spanish Spring Survey on NAFO Div. 3NO: 1995-2002.
Swept area in square miles. n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data, and 2001-2002 data are original from R/V *Vizconde de Eza*.
In 2001, (*) indicates transformed data from C/V *Playa de Menduíña*.

Stratum	1995				1996				1997				1998			
	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD
353	0.0353	3	7.43	5.242	0.0371	3	95.62	120.823	0.0480	4	16.03	18.205	0.0465	4	15.61	25.749
354	0.0353	3	2.28	3.944	0.0319	3	1.42	1.079	0.0233	2	1.80	1.993	0.0356	3	1.55	0.307
355	n.s.	n.s.	n.s.	n.s.	0.0221	2	0.32	0.453	0.0233	2	2.81	0.399	0.0221	2	0.16	0.228
356	n.s.	n.s.	n.s.	n.s.	0.0203	2	0.00	0.000	0.0225	2	0.41	0.586	0.0221	2	0.00	0.000
357	0.0109	1	0.00	-	0.0218	2	0.00	0.000	0.0443	4	0.00	0.000	0.0240	2	0.00	0.000
358	0.0319	3	0.00	0.000	0.0319	3	0.17	0.296	0.0563	5	0.02	0.053	0.0236	3	0.00	0.000
359	0.0345	3	1.72	2.983	0.0548	5	1.17	1.057	0.0690	6	0.10	0.176	0.0698	6	0.22	0.277
360	0.3563	31	26.10	51.982	0.3761	31	181.45	164.547	0.3754	32	103.33	198.689	0.2561	25	477.46	804.293
374	0.0225	2	0.00	0.000	0.0233	2	0.00	0.000	0.0353	3	0.00	0.000	0.0353	3	0.06	0.025
375	0.0225	2	1.89	2.394	0.0229	2	52.86	74.757	0.0116	1	0.26	-	0.0345	3	15.80	27.290
376	0.1729	15	44.78	74.947	0.1650	14	91.18	111.020	0.1583	14	207.32	229.635	0.0930	10	356.62	231.505
377	0.0221	2	0.00	0.000	0.0229	2	0.00	0.000	0.0116	1	0.00	-	0.0229	2	0.00	0.000
378	0.0435	4	0.00	0.000	0.0330	3	0.07	0.123	0.0210	2	0.00	0.000	0.0120	2	0.00	0.000
379	0.0221	2	0.00	0.000	0.0113	1	0.00	-	0.0206	2	0.00	0.000	0.0356	3	0.00	0.000
380	n.s.	n.s.	n.s.	n.s.	0.0221	2	0.00	0.000	0.0210	2	0.00	0.000	0.0113	2	0.00	0.000
381	n.s.	n.s.	n.s.	n.s.	0.0229	2	0.00	0.000	0.0221	2	0.00	0.000	0.0229	2	0.00	0.000
382	n.s.	n.s.	n.s.	n.s.	0.0338	3	0.00	0.000	0.0461	4	0.00	0.000	0.0229	3	0.00	0.000
721	n.s.	n.s.	n.s.	n.s.	0.0214	2	0.04	0.060	0.0221	2	0.96	1.359	0.0203	2	0.00	0.000
722	n.s.	n.s.	n.s.	n.s.	0.0206	2	0.00	0.000	0.0214	2	0.00	0.000	0.0101	2	0.00	0.000
723	n.s.	n.s.	n.s.	n.s.	0.0109	1	0.00	-	0.0210	2	0.00	0.000	0.0233	2	0.00	0.000
724	0.0105	1	0.00	-	0.0203	2	0.00	0.000	0.0225	2	0.00	0.000	0.0206	2	0.00	0.000
725	0.0334	3	0.00	0.000	0.0225	2	0.00	0.000	0.0206	2	0.00	0.000	0.0086	1	0.00	-
726	0.0214	2	0.00	0.000	0.0218	2	0.00	0.000	n.s.	n.s.	n.s.	n.s.	0.0094	2	0.00	0.000
727	n.s.	n.s.	n.s.	n.s.	0.0210	2	0.00	0.000	0.0094	1	0.00	-	0.0233	2	0.00	0.000
728	n.s.	n.s.	n.s.	n.s.	0.0218	2	0.00	0.000	0.0214	2	0.00	0.000	0.0206	2	0.00	0.000
752	n.s.	n.s.	n.s.	n.s.	0.0109	1	0.00	-	0.0218	2	0.00	0.000	0.0229	2	0.00	0.000
753	n.s.	n.s.	n.s.	n.s.	0.0199	2	0.00	0.000	0.0214	2	0.00	0.000	0.0218	2	0.00	0.000
754	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0330	3	0.00	0.000	0.0210	2	0.00	0.000
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.	0.0206	2	0.00	0.000
756	n.s.	n.s.	n.s.	n.s.	0.0210	2	0.00	0.000	0.0109	1	0.00	-	0.0225	2	0.00	0.000
757	n.s.	n.s.	n.s.	n.s.	0.0188	2	0.00	0.000	0.0304	3	0.00	0.000	0.0206	2	0.00	0.000
758	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0214	2	0.00	0.000	0.0105	2	0.00	0.000
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.	0.0214	2	0.00	0.000
760	n.s.	n.s.	n.s.	n.s.	0.0210	2	0.00	0.000	0.0105	1	0.00	-	0.0214	2	0.00	0.000
761	n.s.	n.s.	n.s.	n.s.	0.0199	2	0.00	0.000	0.0315	3	0.00	0.000	0.0206	2	0.00	0.000
762	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0308	3	0.00	0.000	0.0094	2	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.	0.0218	2	0.00	0.000
764	n.s.	n.s.	n.s.	n.s.	0.0210	2	0.00	0.000	0.0206	2	0.00	0.000	0.0218	2	0.00	0.000
765	n.s.	n.s.	n.s.	n.s.	0.0199	2	0.00	0.000	0.0206	2	0.00	0.000	0.0098	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	0.0191	2	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.	0.0109	2	0.00	0.000

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

TABLE 2 (cont.).- Swept area, number of hauls and Yellowtail flounder mean catch (Kg) and SD (**) by stratum. Spanish Spring Survey on NAFO Div. 3NO: 1995-2002.
Swept area in square miles. n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data, and 2001-2002 data are original from R/V *Vizconde de Eza*.
In 2001, (*) indicates transformed data from C/V *Playa de Menduíña*.

Stratum	1999				2000				2001				2002			
	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD	Swept area	Tow number	Y. flounder Mean catch	Y. flounder SD
353	0.0360	3	191.78	232.965	0.0356	3	86.66	116.680	0.0341	3	61.42	102.797	0.0476	4	75.13	88.259
354	0.0218	2	0.11	0.151	0.0356	3	2.28	2.462	0.0338	3	0.34	0.322	0.0356	3	0.17	0.289
355	0.0229	2	0.00	0.000	0.0233	2	0.00	0.000	0.0240	2	0.00	0.000	0.0236	2	0.00	0.000
356	0.0229	2	0.00	0.000	0.0225	2	0.00	0.000	0.0240	2	0.01	0.007	0.0233	2	0.00	0.000
357	0.0236	2	0.00	0.000	0.0124	1	0.00	-	0.0244	2	0.00	0.000	0.0240	2	0.00	0.000
358	0.0349	3	0.00	0.000	0.0341	3	0.00	0.000	0.0345	3	0.00	0.000	0.0345	3	0.00	0.000
359	0.0364	3	0.43	0.603	0.0469	4	3.02	3.741	0.0803	7	1.42	2.836	0.0686	6	0.11	0.261
360	0.2325	19	696.18	541.914	0.2396	20	499.52	423.495	0.2423	20	536.80	488.657	0.2865	25	340.23	356.687
374	0.0244	2	94.71	131.760	0.0240	2	26.13	30.069	0.0240	2	238.75	111.369	0.0345	3	32.04	52.542
375	0.0236	2	443.30	214.850	0.0244	2	195.84	2.627	0.0338	3	100.33	68.319	0.0353	3	48.61	68.927
376	0.1219	10	704.38	211.476	0.1200	10	555.83	302.131	0.1155	10	443.12	196.619	0.1140	10	533.62	416.745
377	0.0240	2	0.00	0.000	0.0229	2	0.06	0.082	0.0229	2	0.00	0.000	0.0229	2	0.00	0.000
378	0.0229	2	0.00	0.000	0.0233	2	0.00	0.000	0.0236	2	0.00	0.000	0.0233	2	0.00	0.000
379	0.0236	2	0.00	0.000	0.0225	2	0.00	0.000	0.0229	2	0.00	0.000	0.0229	2	0.00	0.000
380	0.0236	2	0.00	0.000	0.0236	2	0.00	0.000	0.0206	2	0.00 (*)	0.000 (*)	0.0225	2	0.00	0.000
381	0.0229	2	0.00	0.000	0.0236	2	0.00	0.000	0.0236	2	0.00 (*)	0.000 (*)	0.0229	2	0.00	0.000
382	0.0484	4	0.00	0.000	0.0499	4	0.00	0.000	0.0469	4	0.02 (*)	0.038 (*)	0.0341	3	0.00	0.000
721	0.0244	2	0.00	0.000	0.0236	2	0.00	0.000	0.0248	2	0.00	0.000	0.0233	2	0.00	0.000
722	0.0229	2	0.00	0.000	0.0218	2	0.00	0.000	0.0233	2	0.00	0.000	0.0236	2	0.00	0.000
723	0.0229	2	0.00	0.000	0.0248	2	0.00	0.000	0.0240	2	0.00	0.000	0.0233	2	0.00	0.000
724	0.0225	2	0.00	0.000	0.0233	2	0.00	0.000	0.0353	3	0.00	0.000	0.0225	2	0.00	0.000
725	0.0229	2	0.00	0.000	0.0210	2	0.00	0.000	0.0116	1	0.00	-	0.0225	2	0.00	0.000
726	0.0225	2	0.00	0.000	0.0221	2	0.00	0.000	0.0116	1	0.00	-	0.0214	2	0.00	0.000
727	0.0236	2	0.00	0.000	0.0210	2	0.00	0.000	0.0225	2	0.00 (*)	0.000 (*)	0.0233	2	0.00	0.000
728	0.0233	2	0.00	0.000	0.0210	2	0.00	0.000	0.0229	2	0.00 (*)	0.000 (*)	0.0229	2	0.00	0.000
752	0.0233	2	0.00	0.000	0.0206	2	0.00	0.000	0.0210	2	0.07 (*)	0.106 (*)	0.0116	1	0.00	-
753	0.0229	2	0.00	0.000	0.0218	2	0.00	0.000	0.0214	2	0.00 (*)	0.000 (*)	0.0229	2	0.00	0.000
754	0.0206	2	0.00	0.000	0.0195	2	0.00	0.000	0.0195	2	0.00 (*)	0.000 (*)	0.0341	3	0.00	0.000
755	0.0311	3	0.00	0.000	0.0431	4	0.00	0.000	0.0416	4	0.00 (*)	0.000 (*)	0.0338	3	0.00	0.000
756	0.0225	2	0.00	0.000	0.0203	2	0.00	0.000	0.0113	1	0.00	-	0.0229	2	0.00	0.000
757	0.0233	2	0.00	0.000	0.0214	2	0.00	0.000	0.0233	2	0.00 (*)	0.000 (*)	0.0225	2	0.00	0.000
758	0.0214	2	0.00	0.000	0.0210	2	0.00	0.000	0.0218	2	0.00 (*)	0.000 (*)	0.0225	2	0.00	0.000
759	0.0218	2	0.00	0.000	0.0210	2	0.00	0.000	0.0221	2	0.00 (*)	0.000 (*)	0.0225	2	0.00	0.000
760	0.0225	2	0.00	0.000	0.0210	2	0.00	0.000	0.0229	2	0.00	0.000	0.0229	2	0.00	0.000
761	0.0210	2	0.00	0.000	0.0221	2	0.00	0.000	0.0225	2	0.00	0.000	0.0225	2	0.00	0.000
762	0.0210	2	0.00	0.000	0.0203	2	0.00	0.000	0.0116	1	0.00	-	0.0225	2	0.00	0.000
763	0.0311	3	0.00	0.000	0.0416	4	0.00	0.000	0.0330	3	0.00 (*)	0.000 (*)	0.0225	2	0.00	0.000
764	0.0225	2	0.00	0.000	0.0218	2	0.00	0.000	0.0240	2	0.00	0.000	0.0236	2	0.00	0.000
765	0.0221	2	0.00	0.000	0.0203	2	0.00	0.000	0.0113	1	0.00	-	0.0236	2	0.00	0.000
766	0.0218	2	0.00	0.000	0.0214	2	0.00	0.000	0.0203	2	0.00 (*)	0.000 (*)	0.0233	2	0.00	0.000
767	0.0214	2	0.00	0.000	0.0210	2	0.00	0.000	0.0218	2	0.00 (*)	0.000 (*)	0.0225	2	0.00	0.000

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

TABLE 3.- Stratified mean catches (Kg) and SD of Yellowtail flounder by stratum and year (1995-2002). n.s. means stratum not surveyed. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2002 data are original from R/V *Vizconde de Eza*. In 2001, (*) indicates transformed data from C/V *Playa de Menduíña*.

$(\overline{Y})$	1995	1996	1997	1998	1999	2000	2001	2002
353	1998.55	25720.82	4311.82	4198.82	51588.66	23312.22	16521.08	20208.63
354	560.21	0.01	442.21	381.82	26.26	561.26	83.64	41.00
355	n.s.	0.00	208.22	11.93	0.00	0.00	0.00	0.00
356	n.s.	0.00	19.47	0.00	0.00	0.00	0.24	0.00
357	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
358	0.00	38.43	5.38	0.00	0.00	0.00	0.00	0.00
359	725.04	492.55	43.41	92.88	182.76	1270.46	597.82	44.91
360	72640.55	504976.82	287578.45	1328769.37	1937464.08	1390173.12	1493908.83	946847.84
374	0.00	0.00	0.00	12.18	20266.98	5592.61	51092.50	6856.85
375	513.19	14325.30	69.43	4281.39	120133.50	53071.88	27190.33	13173.31
376	59730.11	121627.81	276561.74	475735.24	939642.75	741479.06	591126.08	711849.08
377	0.00	0.00	0.00	0.00	0.00	5.76	0.00	0.00
378	0.00	9.89	0.00	0.00	0.00	0.00	0.00	0.00
379	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
380	n.s.	0.00	0.00	0.00	0.00	0.00	0.00 (*)	0.00
381	n.s.	0.00	0.00	0.00	0.00	0.00	0.00 (*)	0.00
382	n.s.	0.00	0.00	0.00	0.00	0.00	6.59 (*)	0.00
721	n.s.	2.78	62.45	0.00	0.00	0.00	0.00	0.00
722	n.s.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
723	n.s.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
724	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
725	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
726	0.00	0.00	n.s.	0.00	0.00	0.00	0.00	0.00
727	n.s.	0.00	0.00	0.00	0.00	0.00	0.00 (*)	0.00
728	n.s.	0.00	0.00	0.00	0.00	0.00	0.00 (*)	0.00
752	n.s.	0.00	0.00	0.00	0.00	0.00	9.79 (*)	0.00
753	n.s.	0.00	0.00	0.00	0.00	0.00	0.00 (*)	0.00
754	n.s.	n.s.	0.00	0.00	0.00	0.00	0.00 (*)	0.00
755	n.s.	n.s.	n.s.	0.00	0.00	0.00	0.00 (*)	0.00
756	n.s.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
757	n.s.	0.00	0.00	0.00	0.00	0.00	0.00 (*)	0.00
758	n.s.	n.s.	0.00	0.00	0.00	0.00	0.00 (*)	0.00
759	n.s.	n.s.	n.s.	0.00	0.00	0.00	0.00 (*)	0.00
760	n.s.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
761	n.s.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
762	n.s.	n.s.	0.00	0.00	0.00	0.00	0.00	0.00
763	n.s.	n.s.	n.s.	0.00	0.00	0.00	0.00 (*)	0.00
764	n.s.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
765	n.s.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
766	n.s.	n.s.	0.00	0.00	0.00	0.00	0.00 (*)	0.00
767	n.s.	n.s.	n.s.	0.00	0.00	0.00	0.00 (*)	0.00
TOTAL	136167.64	667194.40	569302.58	1813483.63	3069304.99	2215466.38	2180536.91	1699021.61
	20.72	76.02	60.96	175.35	296.78	214.22	210.84	164.28
SD	5.58	10.74	13.66	44.31	35.01	28.36	30.58	24.92

TABLE 4.- Survey estimates (by the swept area method) of Yellowtail flounder 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. 2001-2002 data are original from R/V *Vizconde de Eza*. In 2001, (*) indicates transformed data from C/V *Playa de Menduíña.*

Strata	1995	1996	1997	1998	1999	2000	2001	2002
353	288	3450	724	684	7866	3334	3228	3188
354	0	0	68	76	4	101	22	7
355	n.s.	0	32	1	0	0	0	0
356	n.s.	0	3	0	0	0	0	0
357	0	0	0	0	0	0	0	0
358	0	0	2	0	0	0	0	0
359	92	68	16	20	31	277	126	6
360	20149	135908	110188	507382	543060	340832	429169	261818
374	0	0	0	6	5295	1065	9692	1159
375	104	2753	9	906	33591	14305	6313	3680
376	24618	57624	127419	225745	328628	246898	248948	249811
377	0	0	0	0	0	2	0	0
378	0	0	0	0	0	0	0	0
379	0	0	0	0	0	0	0	0
380	n.s.	0	0	0	0	0	0 (*)	0
381	n.s.	0	0	0	0	0	0 (*)	0
382	n.s.	0	0	0	0	0	3 (*)	0
721	n.s.	0	10	0	0	0	0	0
722	n.s.	0	0	0	0	0	0	0
723	n.s.	0	0	0	0	0	0	0
724	0	0	0	0	0	0	0	0
725	0	0	0	0	0	0	0	0
726	0	0	n.s.	0	0	0	0	0
727	n.s.	0	0	0	0	0	0 (*)	0
728	n.s.	0	0	0	0	0	0 (*)	0
752	n.s.	0	0	0	0	0	2 (*)	0
753	n.s.	0	0	0	0	0	0 (*)	0
754	n.s.	n.s.	0	0	0	0	0 (*)	0
755	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
756	n.s.	0	0	0	0	0	0	0
757	n.s.	0	0	0	0	0	0 (*)	0
758	n.s.	n.s.	0	0	0	0	0 (*)	0
759	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
760	n.s.	0	0	0	0	0	0	0
761	n.s.	0	0	0	0	0	0	0
762	n.s.	n.s.	0	0	0	0	0	0
763	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
764	n.s.	0	0	0	0	0	0	0
765	n.s.	0	0	0	0	0	0	0
766	n.s.	n.s.	0	0	0	0	0 (*)	0
767	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
TOTAL	45251	199803	238470	734820	918475	606813	697503	519668
SD	11974	29790	60212	113999	95174	81440	95696	80292

TABLE 5.- Survey estimates (by the swept area method) of Yellowtail flounder 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. 2001-2002 data are original from R/V *Vizconde de Eza.* In 2001, (*) indicates transformed data from C/V *Playa de Menduíña.*

Strata	1995	1996	1997	1998	1999	2000	2001	2002
353	170	2078	359	361	4299	1963	1452	1697
354	48	33	38	32	2	47	7	3
355	n.s.	2	18	1	0	0	0	0
356	n.s.	0	2	0	0	0	0	0
357	0	0	0	0	0	0	0	0
358	0	4	0	0	0	0	0	0
359	63	45	4	8	15	108	52	4
360	6321	41620	24516	129699	158330	116029	123336	82622
374	0	0	0	1	1663	466	4258	596
375	46	1252	6	372	10170	4355	2417	1121
376	5183	10320	24467	51154	77099	61790	51180	62443
377	0	0	0	0	0	1	0	0
378	0	1	0	0	0	0	0	0
379	0	0	0	0	0	0	0	0
380	n.s.	0	0	0	0	0	0 (*)	0
381	n.s.	0	0	0	0	0	0 (*)	0
382	n.s.	0	0	0	0	0	1 (*)	0
721	n.s.	0	6	0	0	0	0	0
722	n.s.	0	0	0	0	0	0	0
723	n.s.	0	0	0	0	0	0	0
724	0	0	0	0	0	0	0	0
725	0	0	0	0	0	0	0	0
726	0	0	n.s.	0	0	0	0	0
727	n.s.	0	0	0	0	0	0 (*)	0
728	n.s.	0	0	0	0	0	0 (*)	0
752	n.s.	0	0	0	0	0	1 (*)	0
753	n.s.	0	0	0	0	0	0 (*)	0
754	n.s.	n.s.	0	0	0	0	0 (*)	0
755	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
756	n.s.	0	0	0	0	0	0	0
757	n.s.	0	0	0	0	0	0 (*)	0
758	n.s.	n.s.	0	0	0	0	0 (*)	0
759	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
760	n.s.	0	0	0	0	0	0	0
761	n.s.	0	0	0	0	0	0	0
762	n.s.	n.s.	0	0	0	0	0	0
763	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
764	n.s.	0	0	0	0	0	0	0
765	n.s.	0	0	0	0	0	0	0
766	n.s.	n.s.	0	0	0	0	0 (*)	0
767	n.s.	n.s.	n.s.	0	0	0	0 (*)	0
TOTAL	11830	55355	49415	181629	251579	184759	182704	148487
S.D.	3172	7702	10888	24661	29292	24386	25847	23368

TABLE 6.- Yellowtail flounder length distribution. Estimated numbers in frequency in ‰. Spanish Spring Survey on NAFO 3NO: 1995-2002. Indet. means indeterminate. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2002 data are original R/V *Vizconde de Eza* data.

.	1995			1996			1997			1998		
Length (cm.)	Males	Females	Indet.	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	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	0.000	0.000	0.000
10	0.000	0.000	3.884	0.000	0.000	0.116	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	8.662	0.000	0.000	2.724	0.555	0.555	0.000	0.000	0.000	2.949
14	9.802	21.729	50.211	0.000	0.000	6.906	4.351	3.566	0.000	0.000	0.000	0.000
16	17.751	20.868	8.556	0.461	1.357	10.792	4.158	3.658	0.000	0.695	1.235	0.000
18	31.147	49.336	2.043	3.500	34.379	20.662	12.772	7.003	0.000	6.250	4.394	0.000
20	38.737	47.024	0.000	18.811	101.476	5.320	39.482	45.431	0.000	21.224	15.739	0.000
22	54.257	53.939	0.000	27.446	124.505	0.925	88.041	70.299	0.000	27.057	24.952	0.000
24	65.453	82.828	0.000	37.906	120.527	0.000	109.040	99.443	0.000	53.762	45.206	0.000
26	38.165	50.183	0.000	34.579	87.273	0.000	92.277	94.152	0.000	100.991	78.713	0.000
28	25.371	22.552	0.000	30.563	39.387	0.000	65.688	81.571	0.000	105.031	105.954	0.000
30	27.683	39.844	0.000	27.056	38.018	0.000	29.887	50.364	0.000	73.860	95.137	0.000
32	22.738	50.066	0.000	20.142	25.502	0.000	13.717	21.478	0.000	35.580	65.289	0.000
34	17.636	42.452	0.000	22.402	18.938	0.000	9.443	12.525	0.000	11.712	41.690	0.000
36	9.692	23.398	0.000	15.981	28.922	0.000	4.566	9.149	0.000	6.912	26.995	0.000
38	5.513	15.499	0.000	9.004	27.374	0.000	2.832	7.504	0.000	4.321	14.469	0.000
40	5.574	13.342	0.000	5.141	18.447	0.000	1.188	7.440	0.000	1.886	12.461	0.000
42	1.769	9.136	0.000	1.554	13.931	0.000	0.351	4.138	0.000	1.129	7.487	0.000
44	0.108	5.838	0.000	1.717	7.581	0.000	0.263	2.000	0.000	0.111	3.988	0.000
46	0.098	2.390	0.000	0.379	5.216	0.000	0.019	0.571	0.000	0.008	1.186	0.000
48	0.000	2.133	0.000	0.116	1.504	0.000	0.000	0.143	0.000	0.012	1.344	0.000
50	0.000	1.592	0.000	0.000	1.036	0.000	0.000	0.299	0.000	0.000	0.270	0.000
52	0.000	0.673	0.000	0.000	0.262	0.000	0.000	0.000	0.000	0.000	0.000	0.000
54	0.000	0.257	0.000	0.000	0.000	0.000	0.000	0.082	0.000	0.000	0.000	0.000
56	0.000	0.068	0.000	0.000	0.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	371.496	555.147	73.357	256.758	695.796	47.446	478.628	521.372	0.000	450.542	546.509	2.949
Nº Ind.:	1876	3003	81	1837	4584	249	3635	4469	0	2848	3693	3
Nº samples:		43			33			54			48	
Range:		9-56			10-55			12-53			11-49	
Total catch:		1519			7306			6286			15619	
Sampled catch:		1122.790			1591.030			1748.768			1601.630	
Total hauls:		77			112			128			124	

TABLE 6 (cont.).- Yellowtail flounder length distribution. Estimated numbers in frequency in ‰. Spanish Spring Survey on NAFO 3NO: 1995-2002. Indet. means indeterminate. 1995-2000 data are transformed C/V *Playa de Menduíña* data. 2001-2002 data are original R/V *Vizconde de Eza* data.

.	1999			2000			2001			2002		
Length (cm.)	Males	Females	Indet.	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	0.137	0.000	0.000	0.201
8	0.000	0.000	0.847	0.000	0.000	0.000	0.000	0.000	1.005	0.215	0.644	0.823
10	0.711	0.711	2.252	0.000	0.000	0.000	0.000	0.121	3.110	1.385	0.919	0.201
12	12.276	5.041	1.694	1.567	1.180	0.000	0.134	1.251	2.102	2.053	1.596	0.000
14	19.260	19.844	0.000	8.922	13.083	0.000	0.796	1.834	1.754	0.286	0.503	0.000
16	11.276	9.778	0.000	10.879	11.747	0.000	2.344	3.560	0.205	3.148	3.491	0.000
18	12.637	15.474	0.000	21.514	20.888	0.000	7.815	8.145	0.652	4.497	3.105	0.000
20	11.804	11.127	0.000	25.494	30.445	0.000	19.776	20.147	0.077	7.500	6.464	0.000
22	30.198	18.135	0.000	29.542	39.488	0.000	26.061	39.400	0.000	19.726	14.963	0.000
24	44.081	31.251	0.000	28.072	28.206	0.000	28.699	34.438	0.000	30.406	25.945	0.000
26	76.802	45.381	0.000	47.361	37.910	0.000	31.027	30.579	0.000	41.384	39.659	0.000
28	104.708	71.497	0.000	81.922	48.776	0.000	57.475	37.091	0.000	52.845	40.782	0.000
30	83.346	77.946	0.000	95.344	52.856	0.000	87.437	49.478	0.000	83.736	42.848	0.000
32	42.172	79.732	0.000	63.842	69.216	0.000	88.774	69.391	0.000	97.471	72.278	0.000
34	17.842	51.480	0.000	31.383	64.121	0.000	43.602	87.801	0.000	58.725	97.327	0.000
36	11.361	28.459	0.000	10.499	42.364	0.000	17.143	73.139	0.000	17.909	91.267	0.000
38	5.719	18.152	0.000	6.178	27.652	0.000	7.750	52.856	0.000	6.649	59.272	0.000
40	1.980	10.065	0.000	3.896	16.696	0.000	7.091	24.456	0.000	4.107	34.607	0.000
42	0.583	7.261	0.000	1.161	12.280	0.000	1.762	14.030	0.000	1.647	14.083	0.000
44	0.351	3.515	0.000	0.190	8.079	0.000	0.902	7.616	0.000	0.402	8.974	0.000
46	0.037	1.455	0.000	0.006	4.009	0.000	0.373	3.776	0.000	0.000	3.459	0.000
48	0.120	1.121	0.000	0.009	1.947	0.000	0.121	2.113	0.000	0.037	1.466	0.000
50	0.000	0.468	0.000	0.000	0.915	0.000	0.000	0.489	0.000	0.031	0.864	0.000
52	0.000	0.050	0.000	0.000	0.305	0.000	0.000	0.103	0.000	0.031	0.070	0.000
54	0.000	0.000	0.000	0.000	0.057	0.000	0.000	0.067	0.000	0.000	0.000	0.000
56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	487.263	507.943	4.793	467.781	532.219	0.000	429.079	561.879	9.042	434.190	564.584	1.225
Nº Ind.:	4616	5076	6	3323	4100	0	3358	4684	80	3419	4576	7
Nº samples:		39			42			43			43	
Range:		8-52			11-54			6-53			6-52	
Total catch:		21924			16272			16141			14385	
Sampled catch:		2381.485			2144.295			2297.880			2268.965	
Total hauls:		114			118			83			125	

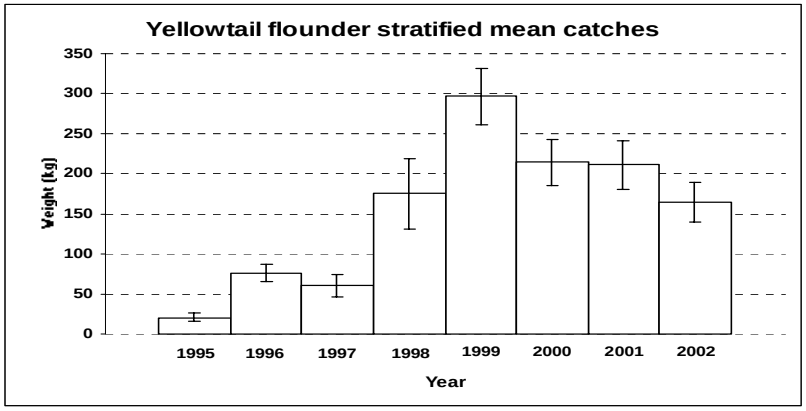

Fig. 1. Yellowtail flounder stratified mean catches in Kg and ±SD by stratum and year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2002 (1995-2000 transformed data from C/V *Playa de Menduíña*; 2001-2002 original data from R/V *Vizconde de Eza*).

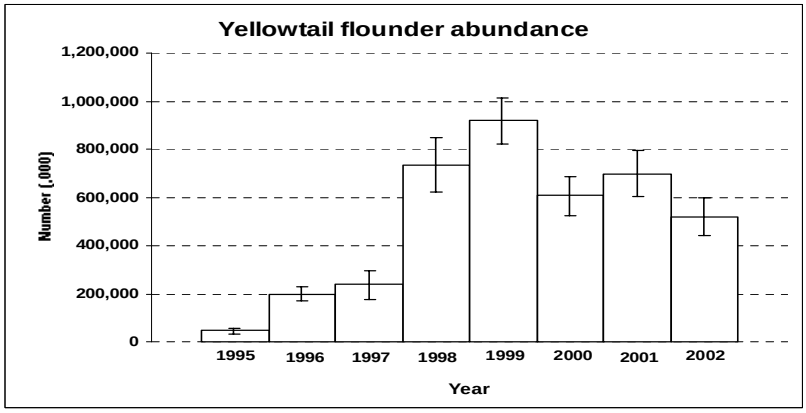

Fig. 2. Yellowtail flounder abundance in thousand and ±SD by stratum and year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2002 (1995-2000 transformed data from C/V *Playa de Menduíña*; 2001-2002 original data from R/V *Vizconde de Eza*).

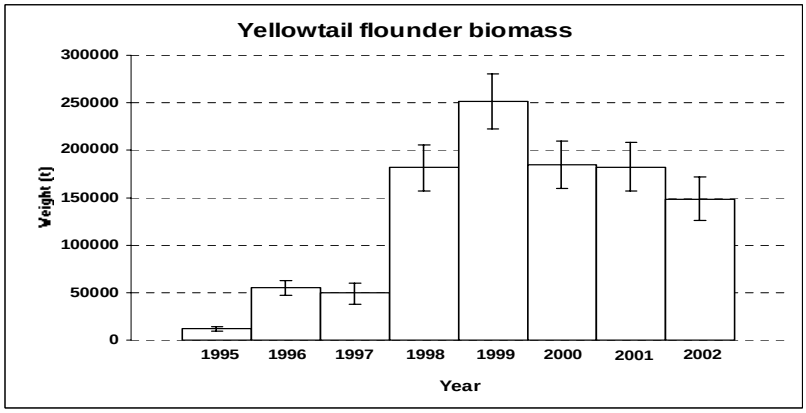

Fig. 3. Yellowtail flounder biomass in tons and ±SD by stratum and year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2002 (1995-2000 transformed data from C/V *Playa de Menduíña*; 2001-2002 original data from R/V *Vizconde de Eza*).

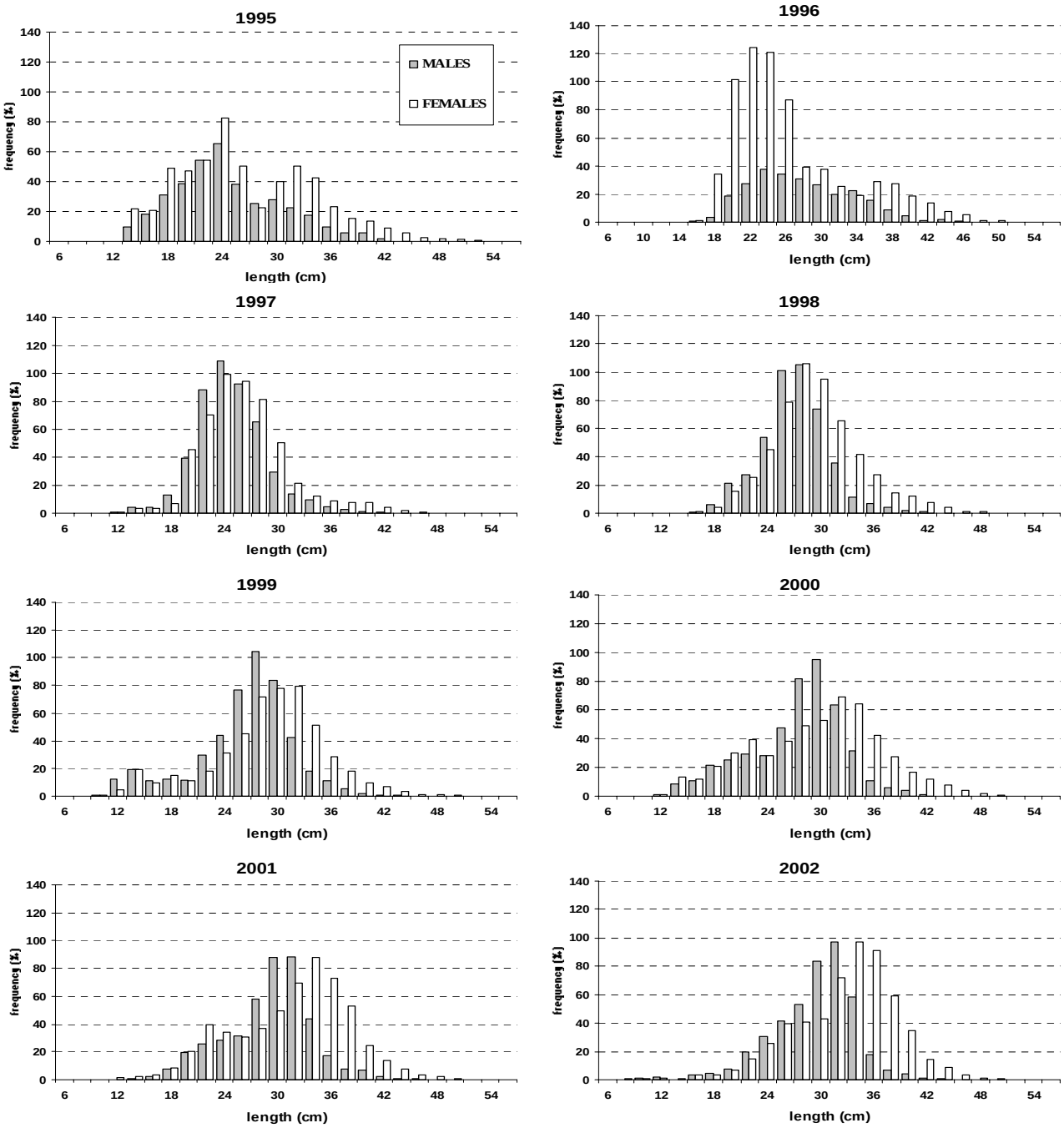

Fig. 4. Yellowtail flounder length distribution (cm) on NAFO 3NO: 1995-2002. Frequency in ‰. 1995-2000 data are transformed data from C/V *Playa de Menduíña*, and 2001-2002 data are original from R/V *Vizconde de Eza*.

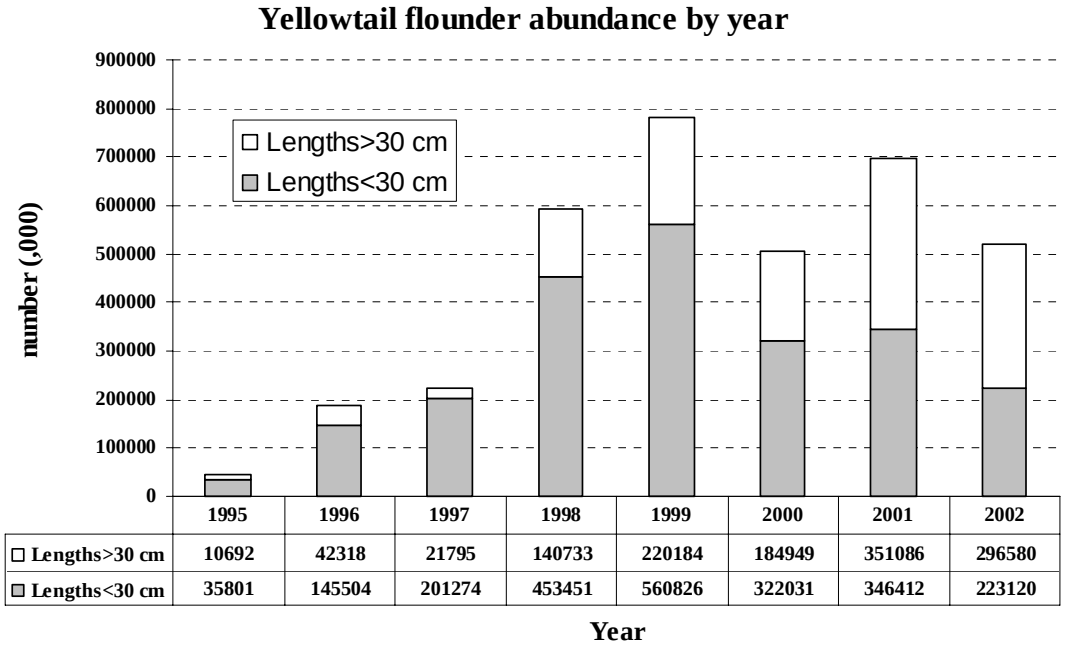

Fig. 5. Presence of mature individuals (length ≥ 30 cm) respect to total abundance of Yellowtail flounder on NAFO 3NO: 1995-2000 data are transformed data from C/V *Playa de Menduíña*, and 2001-2002 data are original from R/V *Vizconde de Eza*.