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Results for the Roughead Grenadier from the Spanish Surveys Conducted in the NAFO  
Regulatory Area of Divisions 3NO, 1997-2004

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. In 2001, the trawl vessel was replaced; so, the time series indices were transformed. The transformed entire series of mean catches, biomass and length distribution for Roughead grenadier are presented for the period 1997-2000, and the no-transformed data for the years 2002-2004. In 2001, there are data from the two vessels. The summed biomass based on conversion of the length frequencies are presented and compared to the estimates from the method used to convert the CPUE. The indices of this species remains stable along the years, although an increasing is observed in last year (2004).

**Material and Methods**

Survey design and gear used

The survey 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 Mendiña* (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 Mendiña* 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 (1997-2004). In the period 1998-2004, 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 Roughead grenadier were measured to from tip of snout to base of first anal-fin ray, in 0.5 cm intervals to the nearest lower 0.5 cm. Length distribution estimated from catches is presented for the period 1997-2004. Years 1995 and 1996 are not representative, because these years the deeper strata were not surveyed, so they are not included in the analysis of the indices.

Research Vessel *Vizconde de Eza* had replaced *C/V Playa de Mendiña* in 2001 survey, so, in order to maintain the data series obtained since 1997, comparative fishing trials were conducted in spring 2001 to develop factors between

the two fishing vessels and gears combinations. A series of 92 paired hauls was carried out, 90 of them were valid hauls. Mean catch, stratified mean catch, biomass and their respective standard deviations, and length distribution, were transformed from C/V *Playa de Mendiña* series to R/V *Vizconde de Eza* series.

#### Roughead grenadier stratified mean catches and SD

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

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

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

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

$$\bar{y}_i^{str} = \bar{y}_i n_i, \quad i = 1, \dots, h$$

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

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

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

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

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

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 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  $j$ ,  $j = 1, \dots, 90$

$\mu$  is the model parameter

$\varepsilon$  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):

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

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

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

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

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

$l$  is the length

$\alpha$ ,  $\beta$  and  $\delta$  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 zero catch.

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

$$W = a(l + 0.25)^b N$$

where:  $W = weight\ in\ gr$   
 $l = length\ in\ cm$   
 $N = number$

The length distribution in number per haul stratified mean catch is presented. In order to adjust the differences between the biomass transformed by FPC and the biomass obtained from the transformed length distribution in the series, in the period 1997-2001 we convert the length distribution by multiplying each length to the factor  $\frac{Biomass_{FPC}}{Biomass_{length}}$ , where  $Biomass_{FPC}$  is the result of the converted biomass by the FPC, and  $Biomass_{length}$  is the biomass obtained from the length distribution (in years 2002-2004, we assume that this factor is 1). Then, to get the length distribution in number per haul stratified mean catches, the length distribution obtained before is multiplying by the factor  $\frac{Stratified\ mean\ catch}{Biomass}$ , where the biomass is obtained by the swept method, transformed or not.

### Data series

For 1997-2000, transformed C/V *Playa de Mendiña* data series are presented. For 2002-2004, 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 Mendiña* data were put, and in the strata surveyed, the original R/V *Vizconde de Eza* data are presented. Besides this, in 2001 there were five hauls made by the C/V *Playa de Mendiña* in five strata surveyed by the R/V *Vizconde de Eza* too. These five hauls were transformed, too, and incorporated to the R/V *Vizconde de Eza* catches.

In this way, we present per strata the mean catches and variance, the stratified mean catches and the biomass. The length distribution in number per haul stratified mean catch is presented.

The method to convert the indices from the length distribution has no accurate variance. Besides this, 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 as the best one for estimating the biomass indices.

## **Results**

### Roughead grenadier Mean Catches and Biomass

To convert mean catches and biomass, the CPUE was adjusted in model (1), giving the  $\widehat{FPC} = 0.17025899$ .

The Roughead grenadier mean catches by stratum are presented in Table 2, included swept area, number of hauls and SD. Roughead grenadier stratified mean catches and its SD are presented in Table 3. The entire time series (1997-2004) of biomass and their SD estimates are presented in Table 4. Besides the transformed biomass series, we present the biomass obtained from the transformed length distribution. The length-weight relationship 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 bigger until 2001. Years 2002-2004 have the original data, so both values are almost the same.

The Roughead grenadier indices show no clear trend until 2003, and an important increasing last year (Fig. 1 and 2).

### Roughead grenadier Length Distribution

The result of the model proposed by Warren (2) for Roughead grenadier was the following:

$$\text{Ln(Ratio)} = \exp(0.7518 - 0.9336 \ln(l) + 0.0203 l)$$

Figure 4 shows the ratios and their fit. In this figure, we observed that, under 9 cm, the fit is very poor, so for these values the mean of the ratios factor is applied. So, two length classes are formed as follow (cf = conversion factor):

For  $l \leq 9$  : cf = 0.7437

For  $l \geq 9.5$  : cf =  $\exp(0.7518 - 0.9336 \ln(l) + 0.0203l)$

In Table 6 is shown Roughead grenadier number per stratified mean catches by sex, besides the sampled size and its catch for the period 1997-2004. In Fig. 5 and 6 we can see the mean number per tow evolution along the years. We can follow easily a cohort since 1999. This last years it can be seen a quite good recruitment.

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**TABLE 1.-** Spanish spring bottom trawl surveys on NAFO Div. 3NO: 1997-2004

Year	Vessel	Valid tows	Depth strata covered (m)	Dates
1997	<i>C/V Playa de Mendiña</i>	128	56-1280	April 26-May 18
1998	<i>C/V Playa de Mendiña</i>	124	56-1464	May 06-May 26
1999	<i>C/V Playa de Mendiña</i>	114	56-1464	May 07-May 26
2000	<i>C/V Playa de Mendiña</i>	118	56-1464	May 07-May 28
2001 <sup>(*)</sup>	<i>R/V Vizconde de Eza</i>	83	56-1116	May 03-May 24
	<i>C/V Playa de Mendiña</i>	121	56-1464	May 05-May 23
2002	<i>R/V Vizconde de Eza</i>	125	56-1464	April 29-May 19
2003	<i>R/V Vizconde de Eza</i>	118	56-1464	May 11-Jun 02
2004	<i>R/V Vizconde de Eza</i>	120	56-1464	Jun 06 – Jun 24

(\*) We took, for the calculation of the series, 83 hauls from the *R/V Vizconde de Eza* and 40 hauls from the *C/V Playa de Mendiña* (123 hauls in total)



**TABLE 2.-** Swept area, number of hauls and Roughhead grenadier mean catch (kg) and SD (\*\*) by stratum. Spanish Spring Surveys on NAFO Div. 3NO: 1997-2004. Swept area in square miles. n.s. means stratum not surveyed. 1997-2000 data are transformed C/V *Playa de Menduñá* data, and 2002-2004 data are original from R/V *Vizconde de Eza*. In 2001, there are data from the two vessels.

Stratum	1997				1998				1999				2000			
	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD
353	0.0480	4	0.000	0.000	0.0465	4	0.000	0.000	0.0360	3	0.000	0.000	0.0356	3	0.002	0.004
354	0.0233	2	0.000	0.000	0.0356	3	0.000	0.000	0.0218	2	0.000	0.000	0.0356	3	0.000	0.000
355	0.0233	2	0.000	0.000	0.0221	2	0.000	0.000	0.0229	2	0.000	0.000	0.0233	2	0.083	0.117
356	0.0225	2	0.000	0.000	0.0221	2	0.426	0.602	0.0229	2	0.019	0.026	0.0225	2	0.084	0.016
357	0.0443	4	0.101	0.202	0.0240	2	0.000	0.000	0.0236	2	0.216	0.152	0.0124	1	0.473	-
358	0.0563	5	0.000	0.000	0.0236	3	0.000	0.000	0.0349	3	0.233	0.403	0.0341	3	0.000	0.000
359	0.0690	6	0.000	0.000	0.0698	6	0.000	0.000	0.0364	3	0.000	0.000	0.0469	4	0.000	0.000
360	0.3754	32	0.000	0.000	0.2561	25	0.000	0.000	0.2325	19	0.000	0.000	0.2396	20	0.000	0.000
374	0.0353	3	0.000	0.000	0.0353	3	0.000	0.000	0.0244	2	0.000	0.000	0.0240	2	0.000	0.000
375	0.0116	1	0.000	-	0.0345	3	0.000	0.000	0.0236	2	0.000	0.000	0.0244	2	0.000	0.000
376	0.1583	14	0.000	0.000	0.0930	10	0.000	0.000	0.1219	10	0.000	0.000	0.1200	10	0.000	0.000
377	0.0116	1	0.000	-	0.0229	2	0.000	0.000	0.0240	2	0.000	0.000	0.0229	2	0.000	0.000
378	0.0210	2	0.447	0.632	0.0120	2	0.000	0.000	0.0229	2	0.298	0.421	0.0233	2	0.149	0.211
379	0.0206	2	0.000	0.000	0.0356	3	0.011	0.020	0.0236	2	0.024	0.034	0.0225	2	0.511	0.722
380	0.0210	2	0.219	0.309	0.0113	2	0.000	0.000	0.0236	2	0.003	0.005	0.0236	2	0.157	0.220
381	0.0221	2	0.000	0.000	0.0229	2	0.000	0.000	0.0229	2	0.000	0.000	0.0236	2	0.074	0.100
382	0.0461	4	0.000	0.000	0.0229	3	0.000	0.000	0.0484	4	0.000	0.000	0.0499	4	0.004	0.009
721	0.0221	2	0.000	0.000	0.0203	2	0.758	0.253	0.0244	2	2.443	0.132	0.0236	2	0.812	0.778
722	0.0214	2	0.026	0.036	0.0101	2	3.950	0.385	0.0229	2	3.865	3.202	0.0218	2	4.767	1.204
723	0.0210	2	0.000	0.000	0.0233	2	0.255	0.361	0.0229	2	2.367	2.528	0.0248	2	2.859	1.554
724	0.0225	2	0.562	0.048	0.0206	2	1.064	0.349	0.0225	2	3.678	0.217	0.0233	2	4.130	1.074
725	0.0206	2	0.000	0.000	0.0086	1	0.077	-	0.0229	2	3.718	3.790	0.0210	2	12.646	17.511
726	n.s.	n.s.	n.s.	n.s.	0.0094	2	2.213	2.336	0.0225	2	7.296	0.205	0.0221	2	14.727	0.120
727	0.0094	1	0.358	-	0.0233	2	0.196	0.181	0.0236	2	0.661	0.236	0.0210	2	2.499	2.726
728	0.0214	2	0.835	0.167	0.0206	2	0.919	0.457	0.0233	2	17.996	15.217	0.0210	2	7.249	6.640
752	0.0218	2	8.836	3.973	0.0229	2	8.172	6.983	0.0233	2	9.032	3.744	0.0206	2	26.663	9.968
753	0.0214	2	15.528	7.705	0.0218	2	35.635	9.342	0.0229	2	28.442	30.760	0.0218	2	49.154	1.830
754	0.0330	3	70.193	8.839	0.0210	2	60.723	3.985	0.0206	2	26.373	8.716	0.0195	2	66.801	41.403
755	n.s.	n.s.	n.s.	n.s.	0.0206	2	42.088	3.130	0.0311	3	23.467	7.041	0.0431	4	28.192	7.595
756	0.0109	1	3.252	-	0.0225	2	6.895	5.707	0.0225	2	29.642	5.995	0.0203	2	17.852	0.205
757	0.0304	3	20.873	17.870	0.0206	2	39.313	39.079	0.0233	2	8.896	5.646	0.0214	2	88.705	79.940
758	0.0214	2	46.823	8.232	0.0105	2	77.034	32.807	0.0214	2	46.200	23.151	0.0210	2	55.334	32.746
759	n.s.	n.s.	n.s.	n.s.	0.0214	2	66.392	41.956	0.0218	2	22.491	13.002	0.0210	2	32.826	6.694
760	0.0105	1	3.916	-	0.0214	2	8.862	1.890	0.0225	2	4.010	1.409	0.0210	2	17.758	2.817
761	0.0315	3	19.198	3.744	0.0206	2	25.190	8.102	0.0210	2	16.592	10.125	0.0221	2	11.535	5.093
762	0.0308	3	24.278	18.462	0.0094	2	30.068	18.564	0.0210	2	17.354	9.397	0.0203	2	18.990	4.928
763	n.s.	n.s.	n.s.	n.s.	0.0218	2	10.820	5.285	0.0311	3	11.447	3.789	0.0416	4	14.523	15.110
764	0.0206	2	6.393	4.081	0.0218	2	4.827	2.059	0.0225	2	4.044	1.240	0.0218	2	4.427	2.047
765	0.0206	2	11.752	5.592	0.0098	2	6.734	3.431	0.0221	2	6.197	1.421	0.0203	2	7.755	4.467
766	0.0308	3	7.741	2.498	0.0191	2	6.895	1.902	0.0218	2	5.516	3.371	0.0214	2	3.184	1.156
767	n.s.	n.s.	n.s.	n.s.	0.0109	2	6.529	2.950	0.0214	2	4.844	0.277	0.0210	2	2.537	0.506

$$(**)SD = \frac{\sum (x_i - \bar{x})^2}{n-1}$$



**TABLE 2 (cont.).**- Swept area, number of hauls and Roughhead grenadier mean catch (kg) and SD (\*\*) by stratum. Spanish Spring Surveys on NAFO Div. 3NO: 1997-2004. Swept area in square miles. n.s. means stratum not surveyed. 1997-2000 data are transformed C/N *Playa de Menduña* data, and 2002-2004 data are original from R/V *Vizconde de Eza*. In 2001, there are data from the two vessels.

Stratum	2001				2002				2003				2004			
	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD	Swept area	Tow number	R. grenadier Mean catch	R. grenadier SD
353	0.0341	3	0.000	0.000	0.0476	4	0.000	0.000	0.0334	3	0.000	0.000	0.033750	3	0.000	0.000
354	0.0338	3	0.000	0.000	0.0356	3	0.000	0.000	0.0338	3	0.000	0.000	0.034500	3	0.000	0.000
355	0.0240	2	0.000	0.000	0.0236	2	0.000	0.000	0.0229	2	0.000	0.000	0.022875	2	0.000	0.000
356	0.0240	2	0.000	0.000	0.0233	2	0.000	0.000	0.0225	2	0.115	0.163	0.022125	2	1.225	1.732
357	0.0244	2	0.170	0.240	0.0240	2	1.050	1.061	0.0229	2	1.385	1.959	0.022875	2	0.027	0.037
358	0.0345	3	0.000	0.000	0.0345	3	0.500	0.700	0.0338	3	0.000	0.000	0.033000	3	0.007	0.012
359	0.0803	7	0.000	0.000	0.0686	6	0.041	0.100	0.0791	7	0.000	0.000	0.079125	7	0.479	1.267
360	0.2423	20	0.390	1.744	0.2865	25	0.000	0.000	0.2254	20	0.000	0.000	0.231000	20	0.000	0.000
374	0.0240	2	0.000	0.000	0.0345	3	0.000	0.000	0.0225	2	0.000	0.000	0.023250	2	0.000	0.000
375	0.0338	3	0.000	0.000	0.0353	3	0.000	0.000	0.0330	3	0.000	0.000	0.033750	3	0.000	0.000
376	0.1155	10	0.000	0.000	0.1140	10	0.000	0.000	0.1125	10	0.000	0.000	0.116625	10	0.000	0.000
377	0.0229	2	0.000	0.000	0.0229	2	0.273	0.386	0.0225	2	0.000	0.000	0.021750	2	0.000	0.000
378	0.0236	2	0.000	0.000	0.0233	2	0.008	0.011	0.0225	2	0.000	0.000	0.022500	2	0.000	0.000
379	0.0229	2	0.430	0.580	0.0229	2	0.265	0.375	0.0229	2	0.124	0.175	0.012375	1	3.960	-
380	0.0206	2	0.03	0.048	0.0225	2	0.008	0.011	0.0229	2	0.085	0.120	0.022125	2	278.650	209.516
381	0.0236	2	0.00	0.00	0.0229	2	0.000	0.000	0.0229	2	0.000	0.000	0.022500	2	4.145	5.169
382	0.0469	4	0.00	0.00	0.0341	3	0.002	0.004	0.0454	4	0.000	0.000	0.046125	4	0.080	0.160
721	0.0248	2	0.220	0.085	0.0233	2	1.250	1.768	0.0225	2	0.000	0.000	0.022125	2	3.473	0.449
722	0.0233	2	2.465	2.878	0.0236	2	10.930	14.213	0.0221	2	4.315	4.547	0.021750	2	4.530	2.676
723	0.0240	2	1.705	0.304	0.0233	2	0.700	0.283	0.0229	2	8.370	3.253	0.022875	2	10.053	4.938
724	0.0353	3	7.507	3.835	0.0225	2	10.000	4.384	0.0225	2	4.980	1.669	0.021375	2	10.746	0.701
725	0.0116	2	1.415	1.832	0.0225	2	2.650	1.344	0.0229	2	0.377	0.532	0.022500	2	92.415	82.046
726	0.0116	2	4.304	5.509	0.0214	2	2.650	1.909	0.0225	2	0.000	0.000	0.022500	2	59.865	19.608
727	0.0225	2	0.21	0.132	0.0233	2	0.570	0.806	0.0218	2	21.900	24.607	0.023250	2	16.700	1.697
728	0.0229	2	1.00	0.241	0.0229	2	0.620	0.876	0.0225	2	32.650	3.748	0.018000	2	15.650	9.687
752	0.0210	2	6.04	3.455	0.0116	1	1.950	2.758	0.0229	2	77.900	100.268	0.021375	2	94.610	95.162
753	0.0214	2	31.57	21.165	0.0229	2	5.400	7.637	0.0229	2	57.050	55.791	0.021750	2	63.835	45.912
754	0.0195	2	75.61	17.890	0.0341	3	98.450	82.237	0.0218	2	65.600	40.729	0.021375	2	33.355	11.377
755	0.0416	4	24.29	19.579	0.0338	3	1.460	1.307	0.0221	2	18.200	25.597	0.031875	3	14.658	21.304
756	0.0113	2	12.796	11.520	0.0229	2	11.750	10.819	0.0221	2	7.160	9.051	0.021750	2	9.772	3.778
757	0.0233	2	20.43	16.686	0.0225	2	16.250	16.193	0.0221	2	8.575	2.765	0.021750	2	12.890	8.330
758	0.0218	2	69.10	46.916	0.0225	2	141.550	101.470	0.0221	2	41.050	58.053	0.021375	2	32.955	10.260
759	0.0221	2	59.11	50.035	0.0225	2	69.250	97.934	0.0113	1	78.080	-	0.021375	2	39.980	4.921
760	0.0229	2	7.195	9.468	0.0229	2	11.950	4.172	0.0218	2	40.650	3.465	0.022125	2	76.475	94.293
761	0.0225	2	15.515	2.524	0.0225	2	5.350	5.445	0.0225	2	12.750	9.263	0.022125	2	25.610	28.055
762	0.0116	2	2.839	3.040	0.0225	2	0.325	0.460	0.0225	2	14.650	3.861	0.023250	2	15.729	4.594
763	0.0330	3	15.35	12.271	0.0225	2	1.225	1.732	0.0311	3	2.717	4.705	0.032625	3	28.000	21.696
764	0.0240	2	5.550	3.323	0.0236	2	20.050	11.526	0.0221	2	19.420	19.771	0.022875	2	40.790	41.988
765	0.0113	2	4.385	0.685	0.0236	2	2.700	2.404	0.0113	1	10.400	-	0.022500	2	5.347	2.710
766	0.0203	2	2.65	1.233	0.0233	2	9.125	9.016	0.0225	2	5.690	6.548	0.022500	2	7.214	1.582
767	0.0218	2	3.09	1.673	0.0225	2	9.150	12.940	0.0229	2	3.130	2.461	0.021750	2	3.667	0.401

$$(**) SD = \frac{\sum (x_i - \bar{x})^2}{n-1}$$

**TABLE 3.-** Stratified mean catches (Kg) by stratum and year and SD by year of Roughhead grenadier (1997-2004). n.s. means stratum not surveyed. 1997-2000 data are transformed C/V *Playa de Menguña* data. 2002-2004 data are original from R/V *Vizconde de Eza*. In 2001, there are data from the two vessels.

Strata	1997	1998	1999	2000	2001	2002	2003	2004
353	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00
354	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
355	0.00	0.00	0.00	6.11	0.00	0.00	0.00	0.00
356	0.00	20.01	0.88	3.96	0.00	0.00	5.41	57.58
357	16.54	0.00	35.46	77.62	27.88	172.20	227.14	4.35
358	0.00	0.00	52.35	0.00	0.00	112.50	0.00	1.50
359	0.00	0.00	0.00	0.00	0.00	17.19	0.00	201.66
360	0.00	0.00	0.00	0.00	1085.37	0.00	0.00	0.00
374	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
375	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
376	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
377	0.00	0.00	0.00	0.00	0.00	27.30	0.00	0.00
378	62.12	0.00	41.42	20.71	0.00	1.04	0.00	0.00
379	0.00	1.20	2.53	54.14	45.58	28.09	13.14	419.76
380	21.00	0.00	0.33	15.12	3.27	0.72	8.16	26750.40
381	0.00	0.00	0.00	10.67	0.00	0.00	0.00	596.88
382	0.00	0.00	0.00	1.46	0.00	0.80	0.00	27.44
721	0.00	49.25	158.81	52.79	14.30	81.25	0.00	225.71
722	2.15	331.80	324.65	400.45	207.06	918.12	362.46	380.48
723	0.00	39.59	366.82	443.22	264.28	108.50	1297.35	1558.14
724	69.67	131.95	456.02	512.18	930.83	1240.00	617.52	1332.50
725	0.00	8.04	390.44	1327.83	148.53	278.25	39.53	9703.58
726	n.s.	159.36	525.28	1060.37	309.91	190.80	0.00	4310.28
727	34.32	18.80	63.42	239.94	20.43	54.72	2102.40	1603.20
728	65.14	71.71	1403.72	565.40	78.35	48.32	2546.70	1220.70
752	1157.57	1070.59	1183.22	3492.80	790.67	255.45	10204.90	12393.91
753	2142.81	4917.66	3924.96	6783.22	4356.11	745.20	7872.90	8809.23
754	12634.78	10930.12	4747.16	12024.20	13610.16	17721.00	11808.00	6003.90
755	n.s.	16203.89	9034.94	10853.88	9350.67	562.10	7007.00	5643.46
756	328.45	696.44	2993.85	1803.02	1292.39	1186.75	723.16	986.92
757	2129.06	4009.91	907.40	9047.90	2083.97	1657.50	874.65	1314.78
758	4635.47	7626.33	4573.78	5478.08	6840.86	14013.45	4063.95	3262.55
759	n.s.	8431.85	2856.38	4168.89	7507.47	8794.75	9916.16	5077.46
760	603.06	1364.74	617.48	2734.73	1108.03	1840.30	6260.10	11777.15
761	3282.93	4307.46	2837.19	1972.49	2653.07	914.85	2180.25	4379.31
762	5147.01	6374.36	3678.97	4025.85	601.93	68.90	3105.80	3334.44
763	n.s.	2824.01	2987.69	3790.53	4005.31	319.73	709.05	7307.91
764	639.32	482.68	404.37	442.67	555.00	2005.00	1942.00	4079.00
765	1457.26	834.98	768.48	961.66	543.70	334.80	1289.60	662.97
766	1114.72	992.95	794.36	458.47	381.98	1314.00	819.36	1038.74
767	n.s.	1031.65	765.33	400.82	488.25	1445.70	494.54	579.31
TOTAL	35543.40	72931.33	46897.68	73231.81	59305.36	56459.28	76491.23	125045.18
( $\bar{Y}$ )	3.81	7.05	4.53	7.08	5.73	5.46	7.40	12.09
S.D.	0.31	0.61	0.45	0.85	0.77	1.51	1.42	2.17

**TABLE 4.-** Survey estimates (by the swept area method) of Roughhead grenadier biomass (t) and SD by stratum and year on NAFO Div. 3NO. n.s. means stratum not surveyed. 1997-2000 data are transformed C/V *Playa de Mendiña* data. 2002-2004 data are original from R/V *Vizconde de Eza*. In 2001, there are data from the two vessels. The last row presents the biomass obtained from the length distribution.

Strata	1997	1998	1999	2000	2001	2002	2003	2004
353	0	0	0	0	0	0	0	0
354	0	0	0	0	0	0	0	0
355	0	0	0	1	0	0	0	0
356	0	2	0	0	0	0	0	5
357	1	0	3	6	2	14	20	0
358	0	0	5	0	0	10	0	0
359	0	0	0	0	0	2	0	18
360	0	0	0	0	90	0	0	0
374	0	0	0	0	0	0	0	0
375	0	0	0	0	0	0	0	0
376	0	0	0	0	0	0	0	0
377	0	0	0	0	0	2	0	0
378	6	0	4	2	0	0	0	0
379	0	0	0	5	4	2	1	34
380	2	0	0	1	0	0	1	2418
381	0	0	0	1	0	0	0	53
382	0	0	0	0	0	0	0	2
721	0	5	13	4	1	7	0	20
722	0	31	28	37	18	78	33	35
723	0	3	32	36	22	9	113	136
724	6	13	41	44	79	110	55	125
725	0	1	34	126	13	25	3	863
726	0	15	47	96	25	18	0	383
727	4	2	5	23	2	5	193	138
728	6	7	121	54	7	4	226	136
752	106	94	102	339	75	22	892	1160
753	200	452	343	624	407	65	688	810
754	1149	1041	460	1233	1395	1549	1086	562
755	n.s.	1571	871	1007	899	50	633	531
756	30	62	266	178	113	104	65	91
757	210	389	78	847	179	147	79	121
758	434	701	428	522	629	1246	367	305
759	n.s.	789	263	397	679	782	881	475
760	57	128	55	260	97	161	576	1065
761	313	418	270	178	236	81	194	396
762	502	618	350	398	54	6	276	287
763	n.s.	260	288	364	364	28	68	672
764	62	44	36	41	46	170	176	357
765	141	80	69	95	49	28	115	59
766	109	104	73	43	38	113	73	92
767	n.s.	93	72	38	45	129	43	53
TOTAL	3340	6922	4357	7000	5568	4968	6860	11402
S.D.	290	644	431	807	700	1365	1316	2043
Warren Method	3651	7693	4920	8448	6098	4520	6388	11094

**TABLE 5.-** Length weight relationships in the calculation of Roughead grenadier biomass. The equation is  $Weight = a(l + 0.25)^b$  Spanish Spring Surveys on NAFO Div. 3NO: 1997-2004. To calculate the parameters for the indeterminate individuals, we used the total data (males + females + indeterminate individuals).

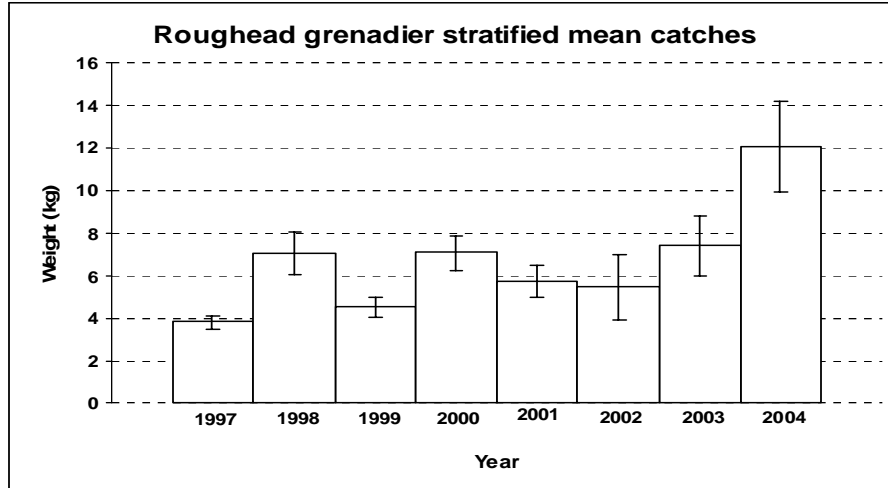
		1997	1998	1999	2000	2001	2002	2003	2004
Males	a	0.0686563 Error = 0.3814	0.1094310 Error = 0.0983	0.0649997 Error = 0.1812	0.0554275 Error = 0.1403	0.1095131 Error = 0.0689	0.0881514 Error = 0.0485	0.1141263 Error = 0.0628	0.0903821 Error = 0.0792
	b	3.0452545 Error = 0.1340	2.8929179 Error = 0.09370	3.1084774 Error = 0.0728	3.1410878 Error = 0.0547	2.8905752 Error = 0.0279	2.9672036 Error = 0.0200	2.8805354 Error = 0.0262	2.9517438 Error = 0.0311
		R2 = 0.979 N = 26	R2 = 0.995 N = 201	R2 = 0.984 N = 102	R2 = 0.989 N = 269	R2 = 0.997 N = 116	R2 = 0.998 N = 292	R2 = 0.997 N = 496	R2 = 0.995 N = 525
Females	a	0.0937428 Error = 0.1618	0.0673134 Error = 0.0938	0.1184983 Error = 0.1245	0.0789802 Error = 0.0608	0.2842789 Error = 0.3519	0.0855960 Error = 0.0950	0.1131568 Error = 0.0441	0.0804420 Error = 0.0351
	b	2.9394836 Error = 0.0531	3.0550714 Error = 0.0315	2.8738821 Error = 0.0422	3.0192313 Error = 0.0209	2.5396540 Error = 0.1311	2.9736202 Error = 0.0336	2.8864205 Error = 0.0156	2.9918664 Error = 0.0123
		R2 = 0.993 N = 41	R2 = 0.993 N = 450	R2 = 0.987 N = 233	R2 = 0.997 N = 548	R2 = 0.901 N = 168	R2 = 0.992 N = 477	R2 = 0.998 N = 788	R2 = 0.999 N = 806
Indet.	a	0.0908568 Error = 0.1433	0.0907145 Error = 0.0484	0.1184514 Error = 0.1043	0.0736017 Error = 0.0625	0.1862139 Error = 0.1546	0.1039522 Error = 0.0542	0.1104181 Error = 0.0425	0.0924286 Error = 0.0578
	b	2.9493921 Error = 0.0475	2.9631140 Error = 0.0164	2.8772707 Error = 0.0357	3.0408785 Error = 0.0218	2.6892207 Error = 0.0603	2.9096048 Error = 0.0196	2.8948522 Error = 0.0151	2.9466412 Error = 0.0207
		R2 = 0.994 N = 67	R2 = 0.998 N = 655	R2 = 0.990 N = 338	R2 = 0.997 N = 820	R2 = 0.977 N = 292	R2 = 0.997 N = 787	R2 = 0.998 N = 1288	R2 = 0.997 N = 1379

**TABLE 6.-** Roughhead grenadier length distribution. Estimated numbers per haul stratified mean catches. Spanish Spring Survey on NAFO 3NO: 1997-2004. Indet. means indeterminate. 1997-2000 data are transformed C/V *Playa de Mendiña* data. 2002-2004 data are original R/V *Vizconde de Eza* data. In 2001, there are data from the two vessels. (\*) indicates untransformed data.

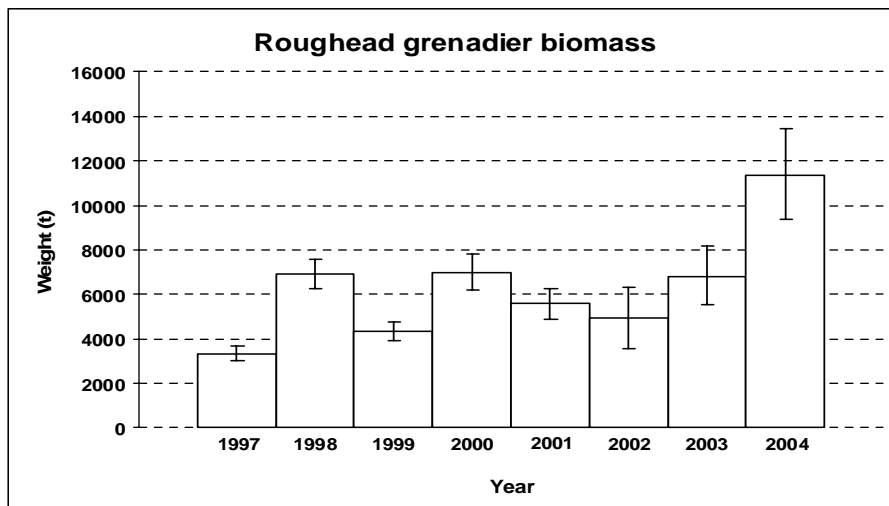
Length (cm.)	1997				1998				1999				2000			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.012
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.065	0.009	0.075	0.015	0.057	0.000	0.072
5	0.000	0.028	0.000	0.028	0.000	0.000	0.032	0.032	0.277	0.195	0.019	0.491	0.206	0.400	0.000	0.606
6	0.000	0.000	0.000	0.000	0.010	0.013	0.016	0.038	0.113	0.165	0.006	0.283	0.189	0.190	0.023	0.403
7	0.000	0.052	0.000	0.052	0.090	0.043	0.005	0.139	0.300	0.391	0.000	0.691	0.307	0.215	0.000	0.522
8	0.091	0.071	0.000	0.162	0.295	0.250	0.000	0.546	0.293	0.389	0.000	0.683	0.276	0.274	0.000	0.549
9	0.003	0.036	0.000	0.039	0.237	0.305	0.000	0.542	0.425	0.518	0.000	0.944	0.406	0.461	0.000	0.867
10	0.031	0.083	0.000	0.114	0.598	0.595	0.000	1.194	0.710	0.872	0.000	1.582	0.340	0.421	0.000	0.760
11	0.068	0.144	0.000	0.213	0.523	0.669	0.000	1.192	1.343	1.543	0.000	2.886	0.807	0.902	0.000	1.709
12	0.128	0.195	0.000	0.324	0.373	0.515	0.000	0.889	1.217	1.650	0.000	2.867	1.307	1.454	0.000	2.761
13	0.193	0.306	0.000	0.499	0.484	0.506	0.000	0.990	0.643	0.894	0.000	1.537	1.742	2.233	0.000	3.975
14	0.531	0.452	0.000	0.983	0.801	0.723	0.000	1.523	0.499	0.527	0.000	1.026	0.974	1.587	0.000	2.560
15	0.637	0.760	0.000	1.396	1.023	0.959	0.000	1.982	0.666	0.521	0.000	1.187	0.799	0.877	0.000	1.675
16	0.396	0.481	0.000	0.877	1.049	0.992	0.000	2.041	0.613	0.656	0.000	1.269	0.655	0.737	0.000	1.393
17	0.242	0.352	0.000	0.595	0.699	0.836	0.000	1.536	0.412	0.499	0.000	0.911	0.563	0.778	0.000	1.341
18	0.240	0.290	0.000	0.531	0.394	0.649	0.000	1.043	0.211	0.293	0.000	0.504	0.397	0.585	0.000	0.982
19	0.268	0.260	0.000	0.528	0.297	0.413	0.000	0.710	0.128	0.179	0.000	0.307	0.168	0.427	0.000	0.596
20	0.213	0.275	0.000	0.488	0.217	0.326	0.000	0.542	0.055	0.125	0.000	0.180	0.060	0.273	0.000	0.334
21	0.162	0.193	0.000	0.356	0.105	0.379	0.000	0.484	0.019	0.124	0.000	0.143	0.024	0.306	0.000	0.330
22	0.050	0.233	0.000	0.283	0.041	0.246	0.000	0.287	0.008	0.084	0.000	0.092	0.007	0.183	0.000	0.190
23	0.019	0.186	0.000	0.205	0.026	0.269	0.000	0.295	0.002	0.076	0.000	0.079	0.007	0.126	0.000	0.133
24	0.000	0.117	0.000	0.117	0.003	0.222	0.000	0.225	0.001	0.073	0.000	0.074	0.000	0.160	0.000	0.160
25	0.005	0.101	0.000	0.106	0.001	0.229	0.000	0.231	0.001	0.065	0.000	0.066	0.005	0.114	0.000	0.118
26	0.000	0.057	0.000	0.057	0.004	0.103	0.000	0.107	0.001	0.050	0.000	0.051	0.004	0.113	0.000	0.117
27	0.000	0.026	0.000	0.026	0.009	0.097	0.000	0.105	0.000	0.042	0.000	0.042	0.003	0.091	0.000	0.094
28	0.000	0.044	0.000	0.044	0.000	0.093	0.000	0.093	0.000	0.039	0.000	0.039	0.000	0.069	0.000	0.069
29	0.014	0.031	0.000	0.045	0.004	0.077	0.000	0.081	0.002	0.038	0.000	0.039	0.000	0.047	0.000	0.047
30	0.000	0.020	0.000	0.020	0.001	0.083	0.000	0.084	0.000	0.018	0.000	0.018	0.000	0.049	0.000	0.049
31	0.000	0.019	0.000	0.019	0.000	0.070	0.000	0.070	0.000	0.016	0.000	0.016	0.000	0.040	0.000	0.040
32	0.000	0.018	0.000	0.018	0.000	0.032	0.000	0.032	0.000	0.011	0.000	0.011	0.000	0.023	0.000	0.023
33	0.000	0.011	0.000	0.011	0.000	0.030	0.000	0.030	0.000	0.019	0.000	0.019	0.000	0.006	0.000	0.006
34	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.023	0.000	0.006	0.000	0.006	0.000	0.018	0.000	0.018
35	0.000	0.005	0.000	0.005	0.000	0.010	0.000	0.010	0.000	0.003	0.000	0.003	0.000	0.003	0.000	0.003
36	0.000	0.007	0.000	0.007	0.000	0.006	0.000	0.006	0.000	0.001	0.000	0.001	0.000	0.024	0.000	0.024
37	0.000	0.003	0.000	0.003	0.000	0.008	0.000	0.008	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.006	0.000	0.006
39	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002
Total	3.293	4.859	0.000	8.152	7.284	9.781	0.053	17.118	7.939	10.150	0.034	18.124	9.262	13.252	0.035	22.548
Nº samples(*):		14				47				53				57		
Nº Ind. (*):	416	609	2	1027	1647	2421	8	4076	2501	3512	7	6020	1957	2967	4	4928
Sampled catch:		89				338				379				318		
Range(*):		5.5-37				3.5-39.5				4-38				3-40.5		
Total catch:		626				892				650				1080		
Total hauls(*):		128				124				117				123		

**TABLE 6 (cont.).**- Roughhead grenadier length distribution. Estimated numbers per haul stratified mean catches. Spanish Spring Survey on NAFO 3NO: 1997-2004. Indet. means indeterminate. 1997-2000 data are transformed C/V *Playa de Mendiña* data. 2002-2004 data are original R/V *Vizconde de Eza* data. In 2001, there are data from the two vessels. (\*) indicates untransformed data.

Length (cm.)	2001				2002				2003				2004			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
2	0.000	0.000	0.026	0.026	0.036	0.011	0.020	0.066	0.023	0.000	0.023	0.046	0.000	0.000	0.030	0.030
3	0.007	0.007	0.031	0.044	0.135	0.046	0.066	0.247	0.301	0.109	0.116	0.525	0.073	0.030	0.714	0.818
4	0.053	0.010	0.023	0.086	0.099	0.053	0.019	0.172	0.048	0.054	0.023	0.125	0.079	0.006	0.090	0.175
5	0.123	0.126	0.008	0.257	0.210	0.225	0.006	0.441	0.383	0.427	0.000	0.810	0.154	0.130	0.006	0.290
6	0.081	0.115	0.000	0.196	0.053	0.108	0.007	0.167	0.729	0.779	0.000	1.507	0.619	0.570	0.000	1.189
7	0.062	0.065	0.000	0.127	0.108	0.090	0.000	0.198	0.216	0.309	0.000	0.525	0.263	0.202	0.000	0.465
8	0.121	0.184	0.000	0.305	0.088	0.163	0.000	0.251	0.444	0.535	0.000	0.979	0.597	0.559	0.000	1.156
9	0.143	0.112	0.000	0.256	0.095	0.070	0.000	0.165	0.294	0.266	0.000	0.559	0.573	0.841	0.000	1.414
10	0.153	0.171	0.000	0.324	0.129	0.108	0.000	0.237	0.375	0.370	0.000	0.744	0.401	0.707	0.000	1.108
11	0.246	0.320	0.000	0.567	0.127	0.197	0.000	0.325	0.270	0.405	0.000	0.675	0.704	0.571	0.000	1.275
12	0.434	0.461	0.000	0.896	0.214	0.248	0.000	0.462	0.344	0.368	0.000	0.712	0.640	0.631	0.000	1.271
13	0.894	1.046	0.000	1.940	0.402	0.312	0.000	0.714	0.483	0.600	0.000	1.083	0.638	0.670	0.000	1.308
14	1.435	1.440	0.000	2.875	0.576	0.591	0.000	1.167	0.776	0.896	0.000	1.672	0.920	0.696	0.000	1.616
15	1.336	1.485	0.000	2.821	0.633	0.912	0.000	1.545	1.235	1.199	0.000	2.433	1.043	0.954	0.000	1.997
16	0.794	1.060	0.000	1.854	0.598	0.976	0.000	1.574	1.549	1.378	0.000	2.928	1.148	1.391	0.000	2.539
17	0.743	0.591	0.000	1.334	0.337	0.740	0.000	1.076	0.798	1.291	0.000	2.089	1.373	1.364	0.000	2.736
18	0.658	0.494	0.000	1.152	0.253	0.489	0.000	0.742	0.385	0.808	0.000	1.193	1.031	1.664	0.000	2.695
19	0.302	0.315	0.000	0.617	0.197	0.527	0.000	0.723	0.197	0.611	0.000	0.808	0.427	1.411	0.000	1.838
20	0.075	0.373	0.000	0.448	0.112	0.402	0.000	0.514	0.153	0.364	0.000	0.516	0.302	0.946	0.000	1.248
21	0.022	0.161	0.000	0.183	0.035	0.346	0.000	0.382	0.008	0.263	0.000	0.271	0.142	0.700	0.000	0.842
22	0.001	0.112	0.000	0.113	0.018	0.271	0.000	0.289	0.015	0.284	0.000	0.299	0.024	0.591	0.000	0.615
23	0.000	0.095	0.000	0.095	0.007	0.143	0.000	0.149	0.008	0.179	0.000	0.186	0.030	0.430	0.000	0.461
24	0.000	0.066	0.000	0.066	0.007	0.085	0.000	0.092	0.000	0.100	0.000	0.100	0.018	0.395	0.000	0.414
25	0.002	0.075	0.000	0.076	0.000	0.082	0.000	0.082	0.000	0.123	0.000	0.123	0.000	0.280	0.000	0.280
26	0.009	0.042	0.000	0.050	0.000	0.112	0.000	0.112	0.000	0.077	0.000	0.077	0.006	0.273	0.000	0.279
27	0.000	0.034	0.000	0.034	0.000	0.157	0.000	0.157	0.000	0.112	0.000	0.112	0.000	0.188	0.000	0.188
28	0.002	0.043	0.000	0.044	0.000	0.089	0.000	0.089	0.000	0.109	0.000	0.109	0.000	0.140	0.000	0.140
29	0.000	0.028	0.000	0.028	0.000	0.068	0.000	0.068	0.000	0.094	0.000	0.094	0.006	0.177	0.000	0.183
30	0.000	0.048	0.000	0.048	0.000	0.053	0.000	0.053	0.000	0.092	0.000	0.092	0.000	0.140	0.000	0.140
31	0.000	0.041	0.000	0.041	0.000	0.066	0.000	0.066	0.000	0.023	0.000	0.023	0.000	0.079	0.000	0.079
32	0.000	0.031	0.000	0.031	0.000	0.024	0.000	0.024	0.000	0.025	0.000	0.025	0.000	0.055	0.000	0.055
33	0.000	0.011	0.000	0.011	0.000	0.029	0.000	0.029	0.000	0.015	0.000	0.015	0.000	0.055	0.000	0.055
34	0.000	0.011	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.039	0.000	0.039
35	0.000	0.009	0.000	0.009	0.000	0.035	0.000	0.035	0.000	0.024	0.000	0.024	0.000	0.018	0.000	0.018
36	0.000	0.006	0.000	0.006	0.000	0.013	0.000	0.013	0.000	0.008	0.000	0.008	0.000	0.012	0.000	0.012
37	0.000	0.004	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
39	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.006
40	0.000	0.001	0.000	0.001	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	7.694	9.197	0.088	16.979	4.467	7.841	0.118	12.426	9.032	12.303	0.162	21.497	11.213	16.921	0.841	28.975
N° samples(*):		22				48				43				59		
N° Ind. (*):	149	208	10	367	604	1018	18	1640	1089	1500	21	2610	1535	2270	157	3962
Sampled catch:		107				754				931				1742		
Range(*):		2.5-29				2-36.5				2.5-36				2.5-39		
Total catch:		453				877				990				2055		
Total hauls(*):		83				127				122				122		



**Fig. 1.** Roughhead grenadier stratified mean catches in Kg and  $\pm$ SD by year. Spanish Spring surveys on NAFO Div. 3NO: 1997-2004 (1997-2000 transformed data from C/V *Playa de Mendiña*; 2002-2004 original data from R/V *Vizconde de Eza*. In 2001, there are data from the two vessels).



**Fig. 2.** Roughhead grenadier biomass in tons and  $\pm$ SD by year. Spanish Spring surveys on NAFO Div. 3NO: 1997-2004 (1997-2000 transformed data from C/V *Playa de Mendiña*; 2002-2004 original data from R/V *Vizconde de Eza*. In 2001, there are data from the two vessels).

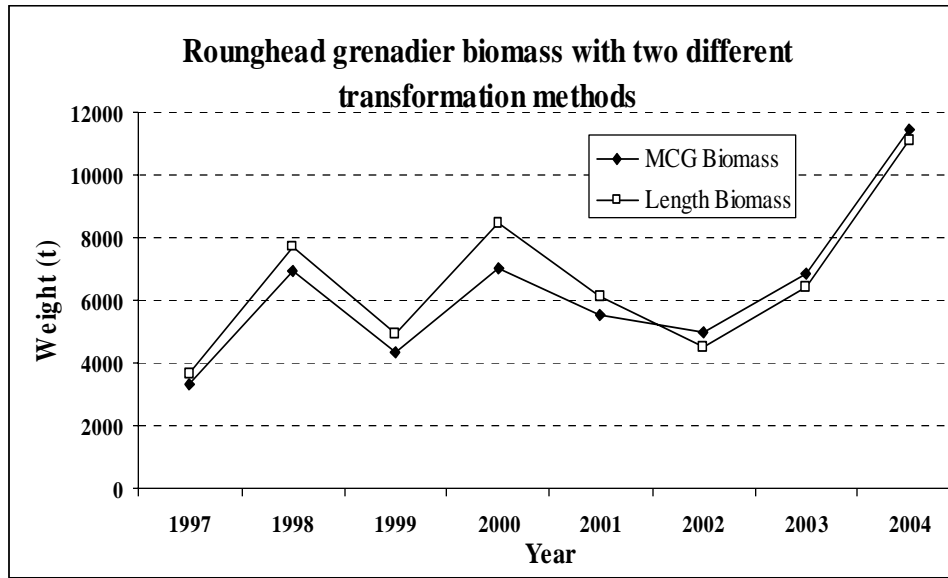


Fig. 3. Routhead grenadier biomass in tons transformed with the two different methods: MCG and Warren.

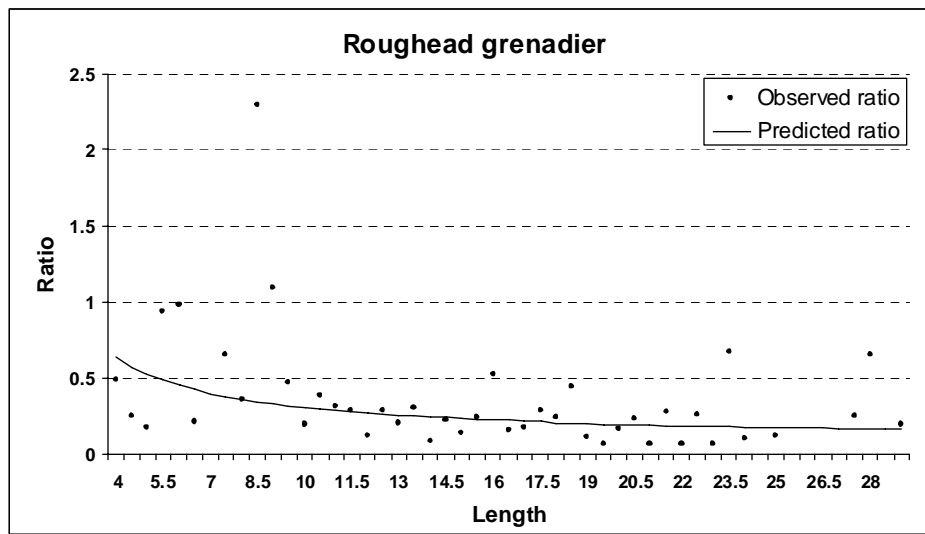
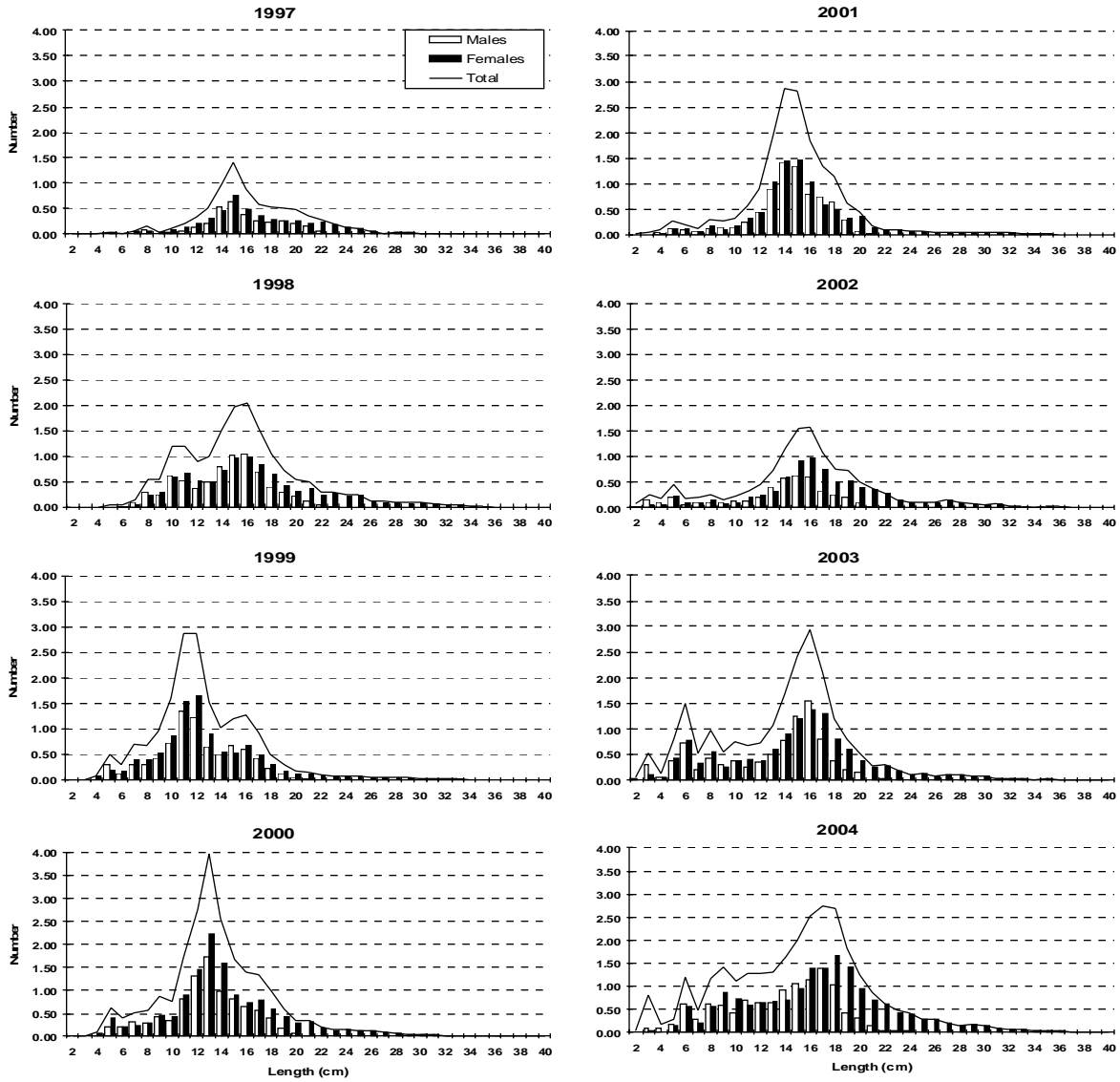
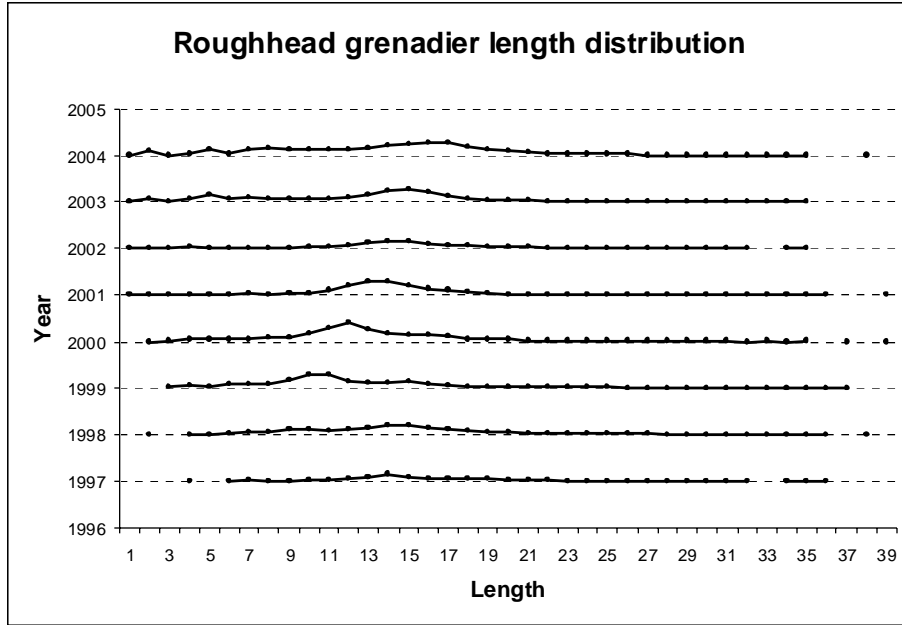


Fig. 4. Ratios of *Campelen* catch to *Pedreira* catch, by length group, of Routhead grenadier, from comparative fishing trials between the two gears on the C/V *Playa de Menduíña* and the R/V *Vizconde de Eza*. The dots are the observed ratios and the curve is the fitted line.





**Fig. 5.** Roughhead grenadier length distribution (cm) on NAFO 3NO: 1997-2004. Estimated numbers per haul stratified mean catches. 1997-2000 data are transformed data from *C/V Playa de Mendiña*, and 2002-2004 data are original from *R/V Vizconde de Eza*. In 2001, there are data from the two vessels.



**Fig. 6.** Roughhead grenadier length distribution (cm) on NAFO 3NO: 1997-2004.