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Thorny Skate Indices from the Spanish Surveys Conducted in the NAFO Regulatory  
Area of Divisions 3NO, 1995-2003

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 was transformed. The transformed entire series of mean catches, abundance and biomass for Thorny skate are presented for the period 1995-2000, and the length distribution for the period 1997-2000, 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. A decreasing in Thorny skate abundance and biomass is observed in last years (2001-2003).

**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 Menduïña* (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 Menduïña* 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 Thorny skate were measured to the total length to the nearest lower cm. Length distribution estimated from catches is presented for the period 1997-2003.

*R/V Vizconde de Eza* had replaced *C/V Playa de Menduïña* 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 them 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 Mendiña* series to R/V *Vizconde de Eza* series.

#### Thorny skate 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:

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

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

$\mu$  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):

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

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:

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

where:

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

$l$  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, abundance and biomass were obtained from the two methods and compared. For obtained the biomass from the length distribution, we use the following formula:

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

where:

$W = \text{weight}$

$l = \text{length}$

$N = \text{number}$

### Data series

For 1995-2000, transformed C/V *Playa de Menduñña* 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 obtaine 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 Menduñña* data were 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 Menduñña* are offered.

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**

### Thorny skate Mean Catches

To convert mean catches, the CPUE was adjusted in model (1), giving the  $FPC_{bio} = 0.24610793$ .

The Thorny skate mean catches by stratum are presented in Table 2, included swept area, number of hauls and SD. Thorny skate 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 Thorny skate indices show a general increasing until 2000, and a decreasing in last years (Fig. 1).

### Thorny skate Biomass

The entire time series (1995-2003) of biomass and their SD estimates of Thorny skate are presented (updated) 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  $FPC_{bio} = 0.24610793$ . Besides the transformed biomass series, we present the biomass obtained from the transformed 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 is not the same in both series: since in the MCG series we can see a decreasing since 2001, in the length series we only can see the decreasing last year (Fig. 3).

### Thorny skate Abundance

As in biomass, the entire time series (1995-2003) of abundance and their SD estimates of Thorny skate are presented (updated) in Table 6. The abundance table shows an increasing in the survey estimates until 2000, and a decreasing since that year (Fig. 4).

To convert abundance, the abundance per unit of effort was adjusted in model (1), giving the  $FPC_{ab} = 0.22950685$ . 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 series indices. The trend is not the same in both series: since in the MCG series we can see a decreasing in the year 2001, in the length series this decreasing has not been observed (Fig. 5).

#### Thorny skate Length Distribution

The result of the model proposed by Warren (2) for Thorny skate was the following:

$$\text{Ln(Ratio)} = \exp(4.5402 - 2.71751 \ln(l) + 0.0749 l)$$

Figure 6 shows the ratios and their fit. In this figure, we observed that, under 28 cm, the fit is very poor, so another conversion factor is applied for these values. So, two length classes are formed as follow (cf = conversion factor):

For  $l \leq 28$ : cf = 0.2114

For  $l \geq 29$ : cf =  $\exp(4.5402 - 2.71751 \ln(l) + 0.0749 l)$

In Table 7 is shown Thorny skate length distribution per thousand, besides the sampled size and its catch for the period 1997-2003. For years 1995 and 1996, we have not length data. In Figure 7 we can see the length distribution evolution along the years. It can be seen a quite presence of recruitment in 2002, that has not occurred last year.

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**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 Menguíña	77	>56-731	May 18-May 29
1996	C/V Playa de Menguíña	112	>56-1098	May 07-May 24
1997	C/V Playa de Menguíña	128	>56-1280	April 26-May 18
1998	C/V Playa de Menguíña	124	>56-1464	May 06-May 26
1999	C/V Playa de Menguíña	114	>56-1464	May 07-May 26
2000	C/V Playa de Menguíña	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 Thorny skate 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 Mendiña* data, and 2001-2003 data are original from R/V *Vizconde de Eza*. In 2001, (\*) indicates transformed data from C/V *Playa de Mendiña*.

Stratum	1995				1996				1997			
	Swept area	Tow number	T. skate Mean catch	T. skate SD	Swept area	Tow number	T. skate Mean catch	T. skate SD	Swept area	Tow number	T. skate Mean catch	T. skate SD
353	0.0353	3	9.22	3.937	0.0371	3	34.66	15.46	0.0480	4	6.21	1.73
354	0.0353	3	11.81	9.820	0.0319	3	25.37	8.94	0.0233	2	1.20	1.12
355	n.s.	n.s.	n.s.	n.s.	0.0221	2	10.77	9.10	0.0233	2	27.19	22.38
356	n.s.	n.s.	n.s.	n.s.	0.0203	2	2.90	1.78	0.0225	2	2.72	0.61
357	0.0109	1	4.92	-	0.0218	2	9.19	2.91	0.0443	4	1.32	1.56
358	0.0319	3	18.14	27.019	0.0319	3	6.98	6.83	0.0563	5	1.56	1.52
359	0.0345	3	11.99	15.152	0.0548	5	14.93	7.45	0.0690	6	7.47	2.92
360	0.3563	31	7.95	7.076	0.3761	31	29.65	22.45	0.3754	32	10.11	11.61
374	0.0225	2	0.58	0.818	0.0233	2	2.07	1.32	0.0353	3	2.29	1.19
375	0.0225	2	1.84	1.140	0.0229	2	4.00	5.66	0.0116	1	0.84	-
376	0.1729	15	4.17	4.411	0.1650	14	24.30	27.89	0.1583	14	15.16	16.62
377	0.0221	2	0.55	0.783	0.0229	2	1.13	0.35	0.0116	1	1.28	-
378	0.0435	4	5.35	3.401	0.0330	3	8.61	13.39	0.0210	2	2.07	0.59
379	0.0221	2	3.69	5.221	0.0113	1	1.72	-	0.0206	2	0.54	0.24
380	n.s.	n.s.	n.s.	n.s.	0.0221	2	3.43	1.27	0.0210	2	1.27	0.37
381	n.s.	n.s.	n.s.	n.s.	0.0229	2	9.98	0.82	0.0221	2	6.17	7.81
382	n.s.	n.s.	n.s.	n.s.	0.0338	3	5.21	5.73	0.0461	4	0.64	0.95
721	n.s.	n.s.	n.s.	n.s.	0.0214	2	0.97	1.37	0.0221	2	2.28	0.18
722	n.s.	n.s.	n.s.	n.s.	0.0206	2	5.09	3.83	0.0214	2	7.54	10.66
723	n.s.	n.s.	n.s.	n.s.	0.0109	1	4.10	-	0.0210	2	6.32	7.25
724	0.0105	1	4.92	-	0.0203	2	0.09	0.12	0.0225	2	2.06	2.45
725	0.0334	3	0.41	0.710	0.0225	2	0.06	0.08	0.0206	2	0.27	0.31
726	0.0214	2	1.90	2.532	0.0218	2	0.00	0.00	n.s.	n.s.	n.s.	n.s.
727	n.s.	n.s.	n.s.	n.s.	0.0210	2	1.82	0.97	0.0094	1	3.37	-
728	n.s.	n.s.	n.s.	n.s.	0.0218	2	7.57	10.70	0.0214	2	1.45	1.11
752	n.s.	n.s.	n.s.	n.s.	0.0109	1	0.15	-	0.0218	2	4.25	2.51
753	n.s.	n.s.	n.s.	n.s.	0.0199	2	24.48	31.06	0.0214	2	13.56	17.61
754	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0330	3	45.32	25.00
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	1.22	0.27	0.0109	1	13.91	-
757	n.s.	n.s.	n.s.	n.s.	0.0188	2	7.27	8.02	0.0304	3	32.68	39.04
758	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0214	2	52.54	7.90
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	3.03	0.12	0.0105	1	0.00	-
761	n.s.	n.s.	n.s.	n.s.	0.0199	2	33.89	2.89	0.0315	3	59.26	86.28
762	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0308	3	50.77	82.75
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	33.41	19.09	0.0206	2	14.84	5.60
765	n.s.	n.s.	n.s.	n.s.	0.0199	2	28.19	35.39	0.0206	2	14.88	18.39
766	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0308	3	15.23	9.42
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 Thorny skate 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 Mendiña* data, and 2001-2003 data are original from R/V *Vizconde de Eza*. In 2001, (\*) indicates transformed data from C/V *Playa de Mendiña*.

Stratum	1998				1999				2000			
	Swept area	Tow number	T. skate Mean catch	T. skate SD	Swept area	Tow number	T. skate Mean catch	T. skate SD	Swept area	Tow number	T. skate Mean catch	T. skate SD
353	0.0465	4	26.06	11.09	0.0360	3	319.35	89.29	0.0356	3	149.95	44.45
354	0.0356	3	68.23	87.97	0.0218	2	20.21	28.57	0.0356	3	82.44	34.12
355	0.0221	2	3.43	0.23	0.0229	2	12.40	17.54	0.0233	2	33.14	41.19
356	0.0221	2	0.69	0.42	0.0229	2	1.55	0.28	0.0225	2	2.21	0.51
357	0.0240	2	1.69	1.37	0.0236	2	2.98	1.74	0.0124	1	0.00	-
358	0.0236	3	0.99	1.17	0.0349	3	2.81	2.22	0.0341	3	15.49	17.71
359	0.0698	6	7.93	5.95	0.0364	3	13.25	14.73	0.0469	4	71.73	91.22
360	0.2561	25	17.95	23.86	0.2325	19	67.68	55.88	0.2396	20	132.15	142.67
374	0.0353	3	0.41	0.61	0.0244	2	5.91	0.14	0.0240	2	0.71	1.00
375	0.0345	3	1.97	1.81	0.0236	2	6.57	0.77	0.0244	2	3.48	0.40
376	0.0930	10	24.06	35.48	0.1219	10	75.94	45.71	0.1200	10	68.84	52.60
377	0.0229	2	0.32	0.31	0.0240	2	1.04	0.18	0.0229	2	0.57	0.81
378	0.0120	2	2.07	2.40	0.0229	2	8.32	5.01	0.0233	2	5.54	3.31
379	0.0356	3	1.69	1.09	0.0236	2	0.76	0.53	0.0225	2	1.10	0.51
380	0.0113	2	4.50	2.78	0.0236	2	3.96	1.95	0.0236	2	1.26	1.17
381	0.0229	2	7.65	0.24	0.0229	2	1.03	0.28	0.0236	2	3.94	0.36
382	0.0229	3	1.02	0.85	0.0484	4	4.44	3.05	0.0499	4	5.36	0.80
721	0.0203	2	8.17	9.33	0.0244	2	1.16	1.64	0.0236	2	6.54	6.27
722	0.0101	2	38.34	45.25	0.0229	2	10.79	15.26	0.0218	2	13.79	6.07
723	0.0233	2	2.62	0.40	0.0229	2	3.77	3.99	0.0248	2	4.05	4.37
724	0.0206	2	12.29	3.71	0.0225	2	9.83	6.80	0.0233	2	2.33	3.29
725	0.0086	1	3.89	-	0.0229	2	3.63	5.13	0.0210	2	4.11	5.03
726	0.0094	2	0.26	0.37	0.0225	2	0.89	1.25	0.0221	2	9.68	10.56
727	0.0233	2	6.02	2.84	0.0236	2	2.83	0.63	0.0210	2	0.58	0.60
728	0.0206	2	4.68	2.68	0.0233	2	4.91	3.22	0.0210	2	1.85	1.22
752	0.0229	2	58.62	78.69	0.0233	2	2.24	1.11	0.0206	2	1.20	1.30
753	0.0218	2	4.01	5.19	0.0229	2	17.13	19.39	0.0218	2	3.01	4.26
754	0.0210	2	112.25	14.65	0.0206	2	16.66	23.56	0.0195	2	54.96	23.46
755	0.0206	2	7.84	5.34	0.0311	3	0.00	0.00	0.0431	4	2.74	5.48
756	0.0225	2	63.66	36.74	0.0225	2	16.21	19.54	0.0203	2	3.69	3.64
757	0.0206	2	67.38	86.94	0.0233	2	10.74	10.98	0.0214	2	55.50	20.36
758	0.0105	2	235.97	239.70	0.0214	2	117.49	142.60	0.0210	2	55.87	79.01
759	0.0214	2	114.12	147.96	0.0218	2	0.43	0.26	0.0210	2	41.86	56.21
760	0.0214	2	6.73	3.05	0.0225	2	9.20	11.14	0.0210	2	12.97	11.59
761	0.0206	2	17.62	10.16	0.0210	2	0.71	0.32	0.0221	2	10.20	13.55
762	0.0094	2	5.24	4.35	0.0210	2	8.28	10.49	0.0203	2	5.54	7.83
763	0.0218	2	0.00	0.00	0.0311	3	0.00	0.00	0.0416	4	0.00	0.00
764	0.0218	2	12.47	10.81	0.0225	2	0.00	0.00	0.0218	2	0.00	0.00
765	0.0098	2	12.08	15.52	0.0221	2	0.00	0.00	0.0203	2	1.35	1.91
766	0.0191	2	0.51	0.20	0.0218	2	0.00	0.00	0.0214	2	0.00	0.00
767	0.0109	2	2.83	3.87	0.0214	2	0.00	0.00	0.0210	2	0.00	0.00

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



**TABLE 2 (cont.).**- Swept area, number of hauls and Thorny skate 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 Menduña* data, and 2001-2003 data are original from R/V *Vizconde de Eza*. In 2001, (\*) indicates transformed data from C/V *Playa de Menduña*.

Stratum	2001				2002				2003			
	Swept area	Tow number	T. skate Mean catch	T. skate SD	Swept area	Tow number	T. skate Mean catch	T. skate SD	Swept area	Tow number	T. skate Mean catch	T. skate SD
353	0.0341	3	351.90	283.060	0.0476	4	356.30	215.772	0.0334	3	78.36	33.796
354	0.0338	3	67.63	19.515	0.0356	3	89.80	80.809	0.0338	3	40.33	40.683
355	0.0240	2	20.60	11.031	0.0236	2	2.67	3.723	0.0229	2	19.53	22.422
356	0.0240	2	0.29	0.410	0.0233	2	1.55	2.192	0.0225	2	5.19	7.333
357	0.0244	2	2.35	1.669	0.0240	2	2.00	2.828	0.0229	2	2.25	3.182
358	0.0345	3	4.05	6.974	0.0345	3	11.47	19.861	0.0338	3	21.14	25.809
359	0.0803	7	15.45	24.999	0.0686	6	72.34	148.583	0.0791	7	25.86	23.965
360	0.2423	20	67.67	79.827	0.2865	25	20.63	24.987	0.2254	20	35.53	29.397
374	0.0240	2	0.73	1.032	0.0345	3	0.30	0.520	0.0225	2	0.00	0.000
375	0.0338	3	0.51	0.878	0.0353	3	1.40	2.425	0.0330	3	2.29	2.414
376	0.1155	10	22.67	19.650	0.1140	10	12.59	12.093	0.1125	10	10.77	12.802
377	0.0229	2	5.70	2.270	0.0229	2	1.17	1.655	0.0225	2	0.46	0.438
378	0.0236	2	0.16	0.099	0.0233	2	0.02	0.021	0.0225	2	2.98	4.076
379	0.0229	2	0.00	0.000	0.0229	2	5.45	1.909	0.0229	2	0.01	0.014
380	0.0206	2	(*) 1.35	(*) 0.209	0.0225	2	4.42	4.476	0.0229	2	4.09	0.559
381	0.0236	2	(*) 0.74	(*) 0.419	0.0229	2	0.71	0.071	0.0229	2	3.40	3.394
382	0.0469	4	(*) 1.77	(*) 1.265	0.0341	3	0.65	0.257	0.0454	4	0.00	0.000
721	0.0248	2	0.00	0.000	0.0233	2	0.00	0.000	0.0225	2	10.63	7.481
722	0.0233	2	10.10	5.374	0.0236	2	0.00	0.000	0.0221	2	0.91	0.021
723	0.0240	2	2.40	2.121	0.0233	2	0.60	0.849	0.0229	2	5.19	4.865
724	0.0353	3	67.38	91.221	0.0225	2	25.85	14.354	0.0225	2	26.32	0.226
725	0.0116	1	2.78	-	0.0225	2	1.82	2.574	0.0229	2	1.31	0.506
726	0.0116	1	2.30	-	0.0214	2	3.30	1.980	0.0225	2	0.00	0.000
727	0.0225	2	(*) 0.64	(*) 0.905	0.0233	2	3.05	4.313	0.0218	2	96.69	91.097
728	0.0229	2	(*) 1.65	(*) 1.531	0.0229	2	6.69	9.454	0.0225	2	17.23	8.301
752	0.0210	2	(*) 8.93	(*) 5.430	0.0116	1	0.49	0.686	0.0229	2	183.35	38.537
753	0.0214	2	(*) 13.11	(*) 15.123	0.0229	2	12.90	18.243	0.0229	2	7.99	1.775
754	0.0195	2	(*) 98.76	(*) 126.307	0.0341	3	595.65	819.042	0.0218	2	3.35	4.731
755	0.0416	4	(*) 0.14	(*) 0.283	0.0338	3	0.00	0.000	0.0221	2	0.00	0.000
756	0.0113	1	9.70	-	0.0229	2	9.36	7.835	0.0221	2	133.16	187.864
757	0.0233	2	(*) 15.10	(*) 19.889	0.0225	2	1.55	2.192	0.0221	2	6.99	9.885
758	0.0218	2	(*) 184.47	(*) 248.733	0.0225	2	32.45	41.224	0.0221	2	4.29	6.060
759	0.0221	2	(*) 4.93	(*) 3.950	0.0225	2	3.70	5.233	0.0113	1	3.89	#i DIV/0!
760	0.0229	2	6.47	5.282	0.0229	2	1.89	2.673	0.0218	2	30.68	30.717
761	0.0225	2	66.60	89.661	0.0225	2	11.90	4.667	0.0225	2	0.00	0.000
762	0.0116	1	0.00	-	0.0225	2	0.00	0.000	0.0225	2	2.99	1.570
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	2.45	3.465	0.0236	2	0.00	0.000	0.0221	2	42.05	45.064
765	0.0113	1	0.00	-	0.0236	2	0.71	1.004	0.0113	1	2.23	-
766	0.0203	2	(*) 0.00	(*) 0.000	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	0.00	0.000	0.0229	2	1.13	0.215

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

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

Strata	1995	1996	1997	1998	1999	2000	2001	2002	2003
353	2480.41	9322.49	1669.97	7010.90	85905.05	40337.51	94661.10	95844.70	21079.74
354	2906.04	6239.92	295.14	16784.41	4970.54	20279.74	16637.80	22090.80	9922.00
355	n.s.	796.77	2012.42	254.06	917.88	2452.15	1524.40	197.40	1444.85
356	n.s.	136.49	127.82	32.39	72.76	104.05	13.63	72.85	243.70
357	807.23	1506.50	216.74	276.48	488.38	0.00	385.40	328.00	369.00
358	4081.08	1570.78	351.96	223.34	632.19	3484.89	910.50	2580.00	4755.75
359	5045.88	6285.07	3142.88	3339.74	5577.75	30200.14	6505.05	30455.91	10885.26
360	22135.01	82512.78	28142.65	49941.51	188345.34	367770.68	188311.70	57415.52	98885.56
374	123.77	442.40	490.16	87.78	1264.01	151.68	156.22	64.20	0.00
375	498.55	1083.80	226.76	533.56	1780.76	942.07	137.31	379.40	619.69
376	5568.10	32416.89	20225.18	32095.39	101299.43	91833.65	30244.45	16788.39	14361.84
377	55.37	113.21	127.98	31.99	103.98	56.97	569.50	117.05	46.00
378	744.05	1196.17	287.36	287.36	1156.26	769.70	22.24	2.09	413.87
379	391.31	182.61	57.26	179.13	80.48	116.74	0.00	577.70	1.06
380	n.s.	329.59	121.68	432.36	380.38	121.44	(*) 129.94	423.84	392.16
381	n.s.	1437.07	887.94	1102.17	148.85	567.92	(*) 106.50	102.24	489.60
382	n.s.	1786.78	220.75	350.60	1522.42	1838.77	(*) 607.79	224.32	0.00
721	n.s.	63.19	148.37	531.10	75.19	425.20	0.00	0.00	690.95
722	n.s.	427.93	633.11	3220.86	906.51	1158.73	848.40	0.00	76.02
723	n.s.	635.14	979.42	406.26	584.98	627.32	372.00	93.00	804.45
724	610.35	10.68	254.82	1524.34	1219.17	288.39	8355.12	3205.40	3263.68
725	43.07	5.81	28.43	408.29	381.16	431.94	291.90	191.10	137.81
726	136.89	0.00	n.s.	18.61	63.79	697.27	165.60	237.60	0.00
727	n.s.	174.84	323.68	577.66	271.70	56.11	(*) 61.43	292.80	9281.76
728	n.s.	590.29	113.26	364.73	382.97	143.97	(*) 128.62	521.43	1343.94
752	n.s.	19.34	556.95	7679.60	293.39	157.17	(*) 1170.32	63.54	24018.85
753	n.s.	3377.61	1871.36	553.60	2364.16	416.05	(*) 1808.52	1780.20	1101.93
754	n.s.	n.s.	8157.59	20204.97	2999.07	9892.06	(*) 17777.36	107217.00	602.10
755	n.s.	n.s.	n.s.	3017.84	0.00	1054.11	(*) 54.48	0.00	0.00
756	n.s.	123.66	1404.41	6429.24	1636.83	372.60	979.70	945.36	13449.16
757	n.s.	741.79	3333.76	6873.20	1095.75	5660.73	(*) 1540.20	158.10	712.98
758	n.s.	n.s.	5201.49	23360.86	11631.70	5530.78	(*) 18262.55	3212.55	424.22
759	n.s.	n.s.	n.s.	14493.27	54.38	5316.60	(*) 626.68	469.90	494.03
760	n.s.	466.18	0.00	1036.58	1417.48	1997.36	995.61	291.06	4724.72
761	n.s.	5795.03	10133.38	3013.25	121.20	1744.82	11388.60	2034.90	0.00
762	n.s.	n.s.	10763.16	1111.32	1755.68	1173.93	0.00	0.00	633.88
763	n.s.	n.s.	n.s.	0.00	0.00	0.00	(*) 0.00	0.00	0.00
764	n.s.	3340.92	1484.03	1246.54	0.00	0.00	245.00	0.00	4204.50
765	n.s.	3495.00	1844.78	1498.40	0.00	167.85	0.00	88.04	276.52
766	n.s.	n.s.	2192.53	73.89	0.00	0.00	(*) 0.00	0.00	0.00
767	n.s.	n.s.	n.s.	446.89	0.00	0.00	(*) 0.00	0.00	178.22
TOTAL	45627.11	166626.77	108029.16	211054.49	421901.59	598341.10	405995.60	348466.38	230329.79
( $\bar{Y}$ )	6.94	18.99	11.57	20.41	40.79	57.86	(**) 36372.22 39.26	33.69	22.27
S.D.	1.00	1.84	1.74	3.26	4.32	9.12	(**) 46.27	10.91	2.57

**TABLE 4.-** Survey estimates (by the swept area method) of Thorny skate 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 Mendiña* data. 2001-2003 data are original from *R/V Vizconde de Eza*. In 2001, (\*) indicates transformed data from *C/V Playa de Mendiña*, and (\*\*) represent the original results of *R/V Vizconde de Eza* without the *C/V Playa de Mendiña* data. The last row presents the biomass obtained from the length distribution.

Strata	1995	1996	1997	1998	1999	2000	2001	2002	2003
353	211	753	139	603	7159	3397	8322	8050	1895
354	247	587	25	1413	457	1708	1479	1860	882
355	n.s.	72	173	23	80	211	127	17	126
356	n.s.	13	11	3	6	9	1	6	22
357	74	139	20	23	41	0	32	27	32
358	384	148	31	19	54	306	79	224	423
359	439	574	273	287	460	2577	567	2663	963
360	1926	6801	2399	4307	15392	30696	15547	5010	8775
374	11	38	42	7	104	13	13	6	0
375	44	95	20	46	151	77	12	32	56
376	483	2751	1789	2779	8312	7653	2619	1473	1277
377	5	10	11	3	9	5	50	10	4
378	68	109	27	25	101	66	2	0	37
379	35	16	6	15	7	10	0	51	0
380	n.s.	30	12	38	32	10	(*) 13	38	34
381	n.s.	126	80	96	13	48	(*) 9	9	43
382	n.s.	159	19	31	126	147	(*) 52	20	0
721	n.s.	6	13	52	6	36	0	0	61
722	n.s.	41	59	301	79	107	73	0	7
723	n.s.	58	93	35	51	51	31	8	70
724	58	1	23	148	108	25	711	285	290
725	4	1	3	47	33	41	25	17	12
726	13	0	n.s.	2	6	63	14	22	0
727	n.s.	17	35	50	23	5	(*) 5	25	853
728	n.s.	54	11	35	33	14	(*) 11	46	119
752	n.s.	2	51	671	25	15	(*) 111	6	2100
753	n.s.	340	175	51	207	38	(*) 169	156	96
754	n.s.	n.s.	742	1924	291	1015	(*) 1823	9374	55
755	n.s.	n.s.	n.s.	293	0	98	(*) 5	0	0
756	n.s.	12	129	571	145	37	87	83	1216
757	n.s.	79	329	666	94	530	(*) 132	14	64
758	n.s.	n.s.	487	2148	1088	527	(*) 1679	286	38
759	n.s.	n.s.	n.s.	1356	5	506	(*) 57	42	44
760	n.s.	44	0	97	126	190	87	25	434
761	n.s.	583	965	292	12	158	1012	181	0
762	n.s.	n.s.	1050	108	167	116	0	0	56
763	n.s.	n.s.	n.s.	0	0	0	(*) 0	0	0
764	n.s.	318	144	115	0	0	20	0	380
765	n.s.	352	179	143	0	17	0	7	25
766	n.s.	n.s.	214	8	0	0	(*) 0	0	0
767	n.s.	n.s.	n.s.	40	0	0	(*) 0	0	16
					0				
TOTAL	4004	14328	9779	18875	35004	50521	34979 (**) 30911	30072	20508
S.D.	593	1359	1544	3114	3736	7991	6272	9699	2371
Warren Method			6515	10468	20150	27416	28684	29269	18101

**TABLE 5.-** Length weight relationships in the calculation of Thorny skate biomass. The equation is  $Weight = a(l+0.5)^b$   
 Spanish Spring Surveys on NAFO Div. 3NO: 1997-2003. To calculate the parameters for the indeterminate individuals, we used the total data (males + females + indeterminate individuals)

		1997	1998	1999	2000	2001	2002	2003
Males	a	0.0069 Error = 0.202	0.0064 Error = 0.259	0.025 Error = 0.456	0.0506 Error = 0.192	0.0085 Error = 0.091	0.0075 Error = 0.086	0.0079 Error = 0.101
	b	3.0921 Error = 0.052	3.1161 Error = 0.075	2.769 Error = 0.124	2.5954 Error = 0.049	3.0171 Error = 0.022	3.0566 Error = 0.022	3.0414 Error = 0.026
		R2 = 0.987 N = 107	R2 = 0.986 N = 67	R2 = 0.967 N = 33	R2 = 0.983 N = 199	R2 = 0.998 N = 104	R2 = 0.996 N = 374	R2 = 0.995 N = 426
Females	a	0.0072 Error = 0.182	0.0098 Error = 0.169	0.0294 Error = 0.268	0.0313 Error = 0.223	0.0073 Error = 0.119	0.0061 Error = 0.074	0.0067 Error = 0.101
	b	3.0927 Error = 0.046	2.9904 Error = 0.046	2.7383 Error = 0.072	2.7247 Error = 0.058	3.0509 Error = 0.031	3.1115 Error = 0.019	3.0887 Error = 0.026
		R2 = 0.991 N = 113	R2 = 0.992 N = 89	R2 = 0.985 N = 53	R2 = 0.977 N = 245	R2 = 0.996 N = 77	R2 = 0.997 N = 425	R2 = 0.996 N = 477
Indet.	a	0.0068 Error = 0.144	0.0072 Error = 0.166	0.0267 Error = 0.205	0.0423 Error = 0.174	0.0077 Error = 0.079	0.0066 Error = 0.068	0.0075 Error = 0.095
	b	3.099 Error = 0.037	3.073 Error = 0.046	2.7618 Error = 0.055	2.6472 Error = 0.045	3.0411 Error = 0.020	3.0887 Error = 0.018	3.0552 Error = 0.025
		R2 = 0.993 N = 220	R2 = 0.991 N = 156	R2 = 0.990 N = 86	R2 = 0.984 N = 444	R2 = 0.998 N = 181	R2 = 0.998 N = 800	R2 = 0.995 N = 903

**TABLE 6.-** Survey estimates (by the swept area method) of Thorny skate 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 Mendiña* data. 2001-2003 data are original from *R/V Vizconde de Eza*. In 2001, (\*) indicates transformed data from *C/V Playa de Mendiña*, and (\*\*) represent the original results of *R/V Vizconde de Eza* without the *C/V Playa de Mendiña* data. The last row presents the biomass obtained from the length distribution.

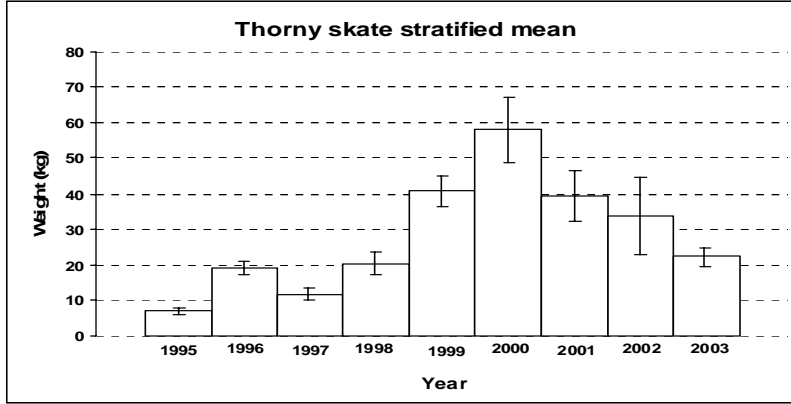
Strata	1995	1996	1997	1998	1999	2000	2001	2002	2003
353	97	0	0	0	3785	1941	3495	4520	927
354	74	0	0	0	130	534	692	1099	729
355	n.s.	0	0	0	35	62	74	9	87
356	n.s.	0	0	0	4	7	2	2	17
357	0	0	0	34	30	0	20	14	7
358	0	0	118	156	65	157	118	182	120
359	306	0	243	0	234	1555	278	1715	468
360	1710	0	1642	0	9409	12554	7017	2245	3779
374	0	0	33	0	58	8	9	6	0
375	49	0	5	0	76	36	8	15	25
376	270	0	1009	0	5779	3441	1270	642	498
377	3	0	0	3	11	3	39	22	18
378	0	0	87	180	286	74	0	6	56
379	0	0	0	0	14	0	0	28	5
380	n.s.	105	48	98	56	26	(*) 14	98	59
381	n.s.	735	488	273	51	103	(*) 16	23	44
382	n.s.	379	71	62	144	240	(*) 37	40	0
721	n.s.	0	0	0	2	10	0	0	35
722	n.s.	0	0	0	23	29	40	0	8
723	n.s.	0	0	0	40	23	19	13	34
724	0	0	0	73	53	10	324	114	154
725	0	0	0	0	23	24	9	9	9
726	0	0	n.s.	4	0	43	12	20	0
727	n.s.	0	115	119	22	8	(*) 6	66	722
728	n.s.	0	0	73	38	12	(*) 13	48	107
752	n.s.	0	0	1621	21	25	(*) 92	6	1676
753	n.s.	0	0	38	143	20	(*) 113	132	60
754	n.s.	n.s.	344	1110	146	792	(*) 959	7158	25
755	n.s.	n.s.	n.s.	99	0	0	(*) 0	0	0
756	n.s.	0	160	674	93	30	54	93	907
757	n.s.	0	0	367	75	234	(*) 75	9	32
758	n.s.	n.s.	241	1077	616	288	(*) 991	165	18
759	n.s.	n.s.	n.s.	556	4	308	(*) 26	17	34
760	n.s.	0	0	33	42	84	40	13	241
761	n.s.	0	0	145	7	51	517	76	0
762	n.s.	n.s.	0	27	74	50	0	0	19
763	n.s.	n.s.	n.s.	0	0	0	(*) 0	0	0
764	n.s.	0	0	0	0	0	8	0	149
765	n.s.	0	0	0	0	3	0	5	11
766	n.s.	n.s.	0	0	0	0	(*) 0	0	0
767	n.s.	n.s.	n.s.	0	0	0	(*) 0	0	21
TOTAL	2510	1220	4603	6822	21592	22785	16390 (**) 14046	18611	11099
S.D.	308	287	281	1971	2492	3330	2807	7205	1379
Warren Method			4756	5832	10678	12282	14048	18612	11099

**TABLE 7.-** Thorny skate length distribution. Estimated numbers in frequency in %. Spanish Spring Survey on NAFO 3NO: 1997-2003. Indet. means indeterminate. 1997-2000 data are transformed C/V *Playa de Mendiña* data. 2001-2003 data are original R/V *Vizconde de Eza* data. (\*) indicates untransformed data.

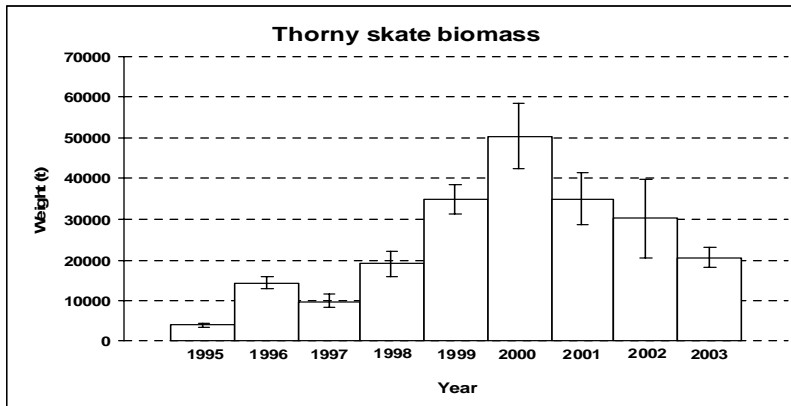
Length (cm.)	1997			1998			1999			2000		
	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
12	0.000	0.624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	7.196	4.539	0.000	0.785	0.000	0.000	0.999	0.999	0.197	0.666	0.579	0.000
16	12.750	10.075	0.000	0.789	0.393	0.000	1.183	3.163	0.394	4.116	2.230	0.000
18	14.554	17.838	0.000	0.785	1.178	0.000	1.578	2.666	0.000	1.773	0.905	0.000
20	12.785	19.909	0.000	2.355	1.550	0.000	2.958	2.366	0.000	2.190	1.781	0.000
22	30.609	26.506	0.000	1.157	21.951	0.000	2.564	2.818	0.000	2.222	3.801	0.000
24	30.469	21.617	0.000	24.897	3.522	0.000	4.123	3.352	0.000	1.638	2.901	0.000
26	34.719	39.205	0.000	10.149	5.672	0.000	5.350	4.179	0.000	6.103	3.494	0.000
28	19.155	29.135	0.000	11.503	11.110	0.000	9.254	9.630	0.000	6.821	6.180	0.000
30	8.674	13.882	0.000	16.138	11.384	0.000	5.644	6.644	0.000	3.234	3.530	0.000
32	13.172	12.524	0.000	17.012	16.378	0.000	9.490	7.537	0.000	5.244	5.578	0.000
34	7.090	13.787	0.000	22.348	39.124	0.000	13.611	10.891	0.000	5.740	7.588	0.000
36	23.156	17.029	0.000	24.210	34.050	0.000	13.237	12.951	0.000	10.569	7.028	0.000
38	12.435	16.771	0.000	22.809	33.213	0.000	16.677	25.087	0.000	11.879	12.052	0.000
39	18.587	12.289	0.000	22.229	27.686	0.000	19.766	18.943	0.000	14.296	14.226	0.000
40	14.889	13.791	0.000	24.049	19.688	0.000	30.990	29.806	0.000	16.887	19.729	0.000
42	15.972	15.011	0.000	20.087	19.810	0.000	31.315	30.611	0.000	18.085	23.352	0.000
44	23.337	12.807	0.000	19.010	16.838	0.000	27.776	34.014	0.000	23.840	23.620	0.000
48	12.022	12.437	0.000	13.918	21.278	0.000	20.914	25.961	0.305	25.490	23.317	0.000
50	9.513	13.124	0.000	16.229	17.463	0.000	21.963	23.899	0.000	27.457	24.489	0.000
52	12.520	17.815	0.000	19.527	20.567	0.000	25.867	19.085	0.000	24.943	19.684	0.000
54	11.109	14.713	0.000	8.172	12.804	0.000	17.503	17.285	0.000	24.258	19.967	0.000
56	7.285	19.171	0.000	14.871	22.782	0.000	16.039	20.442	0.000	22.355	20.248	0.000
58	5.360	13.855	0.000	15.710	14.961	0.000	14.798	13.368	0.000	19.934	23.442	0.000
60	15.060	8.004	0.000	18.425	16.703	0.000	18.606	15.649	0.000	18.411	13.470	0.000
62	11.356	25.075	0.000	11.705	14.799	0.000	19.092	11.823	0.000	16.074	15.284	0.000
64	8.900	4.225	0.000	18.279	16.929	0.000	13.311	15.706	0.000	19.535	16.304	0.000
66	8.192	19.994	0.000	16.440	20.130	0.000	14.155	13.670	0.000	15.282	20.184	0.000
68	17.062	8.248	0.000	9.511	24.515	0.000	16.230	11.989	0.000	13.082	24.851	0.000
70	5.417	12.523	0.000	7.193	20.512	0.000	15.080	16.743	0.000	14.460	26.983	0.000
72	8.111	13.069	0.000	10.619	17.352	0.000	15.483	16.187	0.000	15.008	26.220	0.000
74	9.138	14.724	0.000	11.680	5.436	0.000	13.897	15.312	0.000	17.960	20.438	0.000
76	3.215	12.867	0.000	3.719	4.586	0.000	13.462	7.145	0.000	17.504	14.472	0.000
78	2.931	8.655	0.000	8.327	3.935	0.000	20.969	16.666	0.000	15.838	19.684	0.000
80	6.503	6.103	0.000	3.440	2.514	0.000	9.318	7.476	0.000	12.480	7.094	0.000
82	8.154	3.445	0.000	2.980	1.286	0.000	10.873	3.873	0.000	13.680	6.065	0.000
84	0.000	3.601	0.000	4.984	0.531	0.000	11.647	3.370	0.000	8.617	3.990	0.000
86	4.018	0.000	0.000	0.578	0.000	0.000	2.550	0.324	0.000	8.467	4.383	0.000
88	5.599	0.000	0.000	0.000	2.708	0.000	5.031	0.317	0.000	5.719	2.926	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000	1.617	0.000	0.000	8.323	0.000	0.000
92	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.774	0.000	1.904	0.000	0.000
94	0.000	0.000	0.000	0.000	0.000	0.000	1.458	0.000	0.000	1.481	0.000	0.000
96	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.330	0.000	0.000
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.528	0.000	0.000
100	0.000	0.000	0.000	0.000	1.643	0.000	0.000	0.000	0.000	0.000	0.510	0.000
102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
116	0.000	0.000	0.000	2.533	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
118	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
124	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
126	0.000	0.000	0.000	5.828	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
132	0.000	0.000	0.000	0.000	8.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	471.013	528.987	0.000	464.979	535.021	0.000	516.380	482.723	0.897	507.423	492.577	0.000
Nº Ind. (*)	404	425	0	723	812	0	2082	2200	4	2397	2429	0
Nº samples:		33			33			88			83	
Range:		12-87			13-131			13-93			13-99	
Total catch:		1580			2696			3672			5076	
Sampled catch:		212			461			1526			2289	
Total hauls:		139			136			117			123	

**TABLE 7 (cont.).-** Thorny skate length distribution. Estimated numbers in frequency in ‰. Spanish Spring Survey on NAFO 3NO: 1997-2003. Indet. means indeterminate. 1997-2000 data are transformed C/V *Playa de Menduña* data. 2001-2003 data are original R/V *Vizconde de Eza* data. (\*) indicates untransformed data.

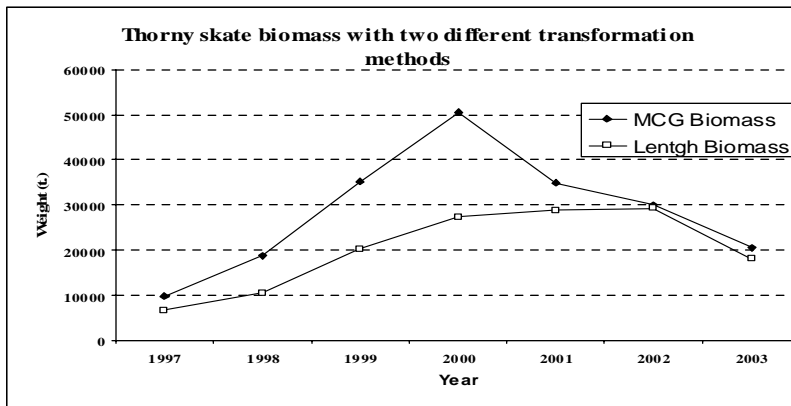
Length (cm.)	2001			2002			2003		
	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
12	0.000	0.000	0.000	0.000	0.371	0.000	0.000	0.000	0.000
14	0.000	4.550	0.000	4.960	1.893	0.000	2.535	0.634	0.000
16	5.138	4.496	0.000	5.112	14.343	0.373	0.634	2.535	0.000
18	1.284	4.496	0.000	7.054	6.665	0.000	1.901	1.268	0.000
20	2.569	0.642	0.000	3.898	18.765	0.000	3.803	3.169	0.000
22	0.000	3.211	0.000	1.981	3.896	0.000	4.436	3.803	0.000
24	0.642	1.284	0.000	1.187	1.570	0.000	0.634	1.268	0.000
26	0.000	1.284	0.000	1.167	2.762	0.000	1.935	1.268	0.000
28	1.981	3.853	0.000	0.767	2.288	0.000	3.854	0.000	0.000
30	0.642	3.211	0.000	1.777	1.495	0.000	3.923	2.591	0.000
32	2.569	2.654	0.000	4.318	6.064	0.000	8.429	4.600	0.000
34	2.623	5.834	0.000	3.199	8.672	0.000	9.045	11.693	0.000
36	2.569	7.924	0.000	7.356	13.547	0.000	15.109	10.449	0.000
38	8.566	11.738	0.000	11.175	8.617	0.000	17.691	12.381	0.000
40	15.043	23.446	0.000	24.784	20.117	0.000	23.360	25.821	0.000
42	19.375	17.789	0.000	35.320	40.574	0.000	31.033	29.268	0.000
44	20.714	26.958	0.000	33.850	42.321	0.000	32.914	33.018	0.000
46	22.889	27.299	0.000	40.705	36.380	0.000	36.980	36.823	0.000
48	20.962	33.165	0.000	33.608	44.834	0.000	22.713	34.282	0.000
50	30.719	26.610	0.000	27.662	38.342	0.000	25.108	34.783	0.000
52	26.874	19.375	0.000	32.447	32.194	0.000	28.326	26.980	0.000
54	21.550	29.148	0.000	24.395	24.073	0.000	24.553	36.049	0.000
56	27.918	24.799	0.000	17.515	21.698	0.000	23.826	24.365	0.000
58	31.717	17.124	0.000	15.148	11.493	0.000	25.867	23.662	0.000
60	12.528	19.584	0.000	18.505	11.140	0.000	23.697	21.071	0.000
62	15.105	21.348	0.000	9.452	11.007	0.000	12.766	17.866	0.000
64	14.887	15.714	0.000	12.249	8.077	0.000	11.555	17.806	0.000
66	15.206	22.958	0.000	10.037	9.379	0.000	11.537	15.896	0.000
68	15.206	29.217	0.000	5.221	19.184	0.000	8.908	17.841	0.000
70	13.124	24.514	0.000	10.721	17.518	0.000	13.978	15.883	0.000
72	15.128	20.814	0.000	8.501	13.099	0.000	9.572	12.779	0.000
74	14.346	16.861	0.000	6.569	19.619	0.000	9.506	13.348	0.000
76	20.521	18.887	0.000	12.621	4.163	0.000	7.033	10.158	0.000
78	23.718	15.908	0.000	7.778	5.870	0.000	5.157	10.774	0.000
80	13.813	7.707	0.000	7.352	3.454	0.000	6.355	1.901	0.000
82	10.493	8.403	0.000	6.805	6.988	0.000	3.203	3.169	0.000
84	8.033	1.284	0.000	5.558	1.524	0.000	3.833	1.268	0.000
86	10.068	1.339	0.000	2.296	0.402	0.000	1.289	0.634	0.000
88	2.035	0.642	0.000	1.410	0.374	0.000	1.268	0.000	0.000
90	1.393	0.000	0.000	0.396	0.000	0.000	0.634	0.000	0.000
92	0.642	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
94	0.697	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	0.642	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
116	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
118	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
124	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	473.929	526.071	0.000	464.855	534.771	0.373	478.900	521.100	0.000
N° Ind. (*):	629	632	0	888	928	1	743	811	0
N° samples:		66			78			88	
Range:		13-99			12-89			13-90	
Total catch:		3413			4271			2656	
Sampled catch:		2777			2961			2627	
Total hauls:		83			127			122	



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

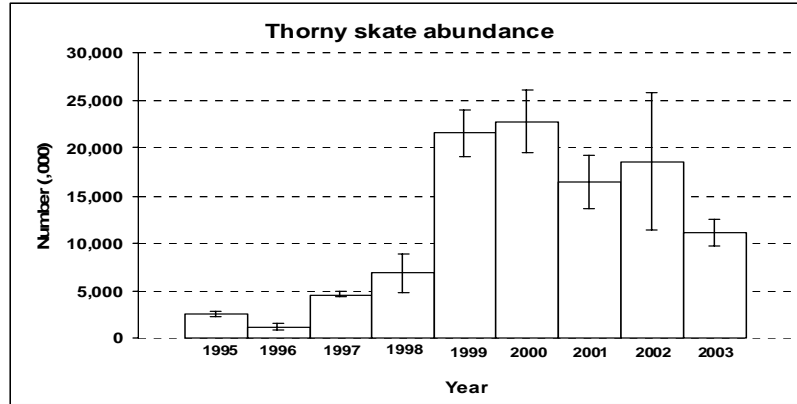


**FIGURE 2.-** Thorny skate biomass in tons and  $\pm$ SD by year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2003 (1995-2000 transformed data from C/V *Playa de Menduïña*; 2001-2003 original data from R/V *Vizconde de Eza*).

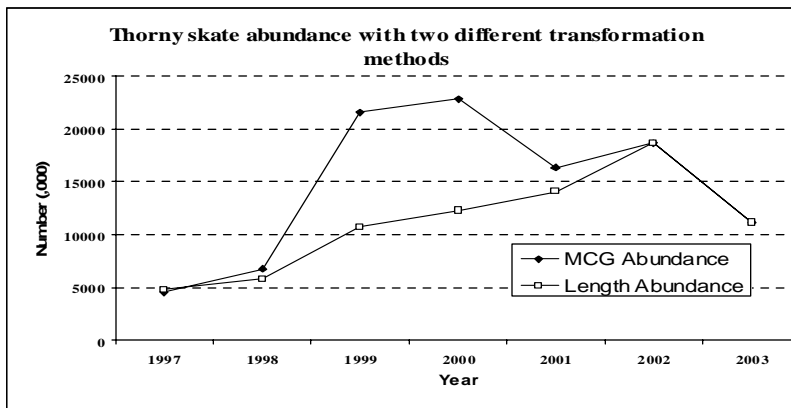


**FIGURE 3.-** Thorny skate biomass in tons transformed with the two different methods: MCG and Warren.

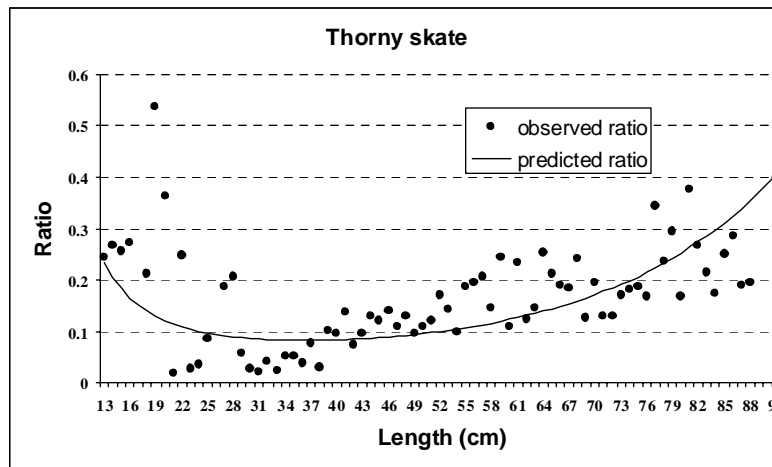




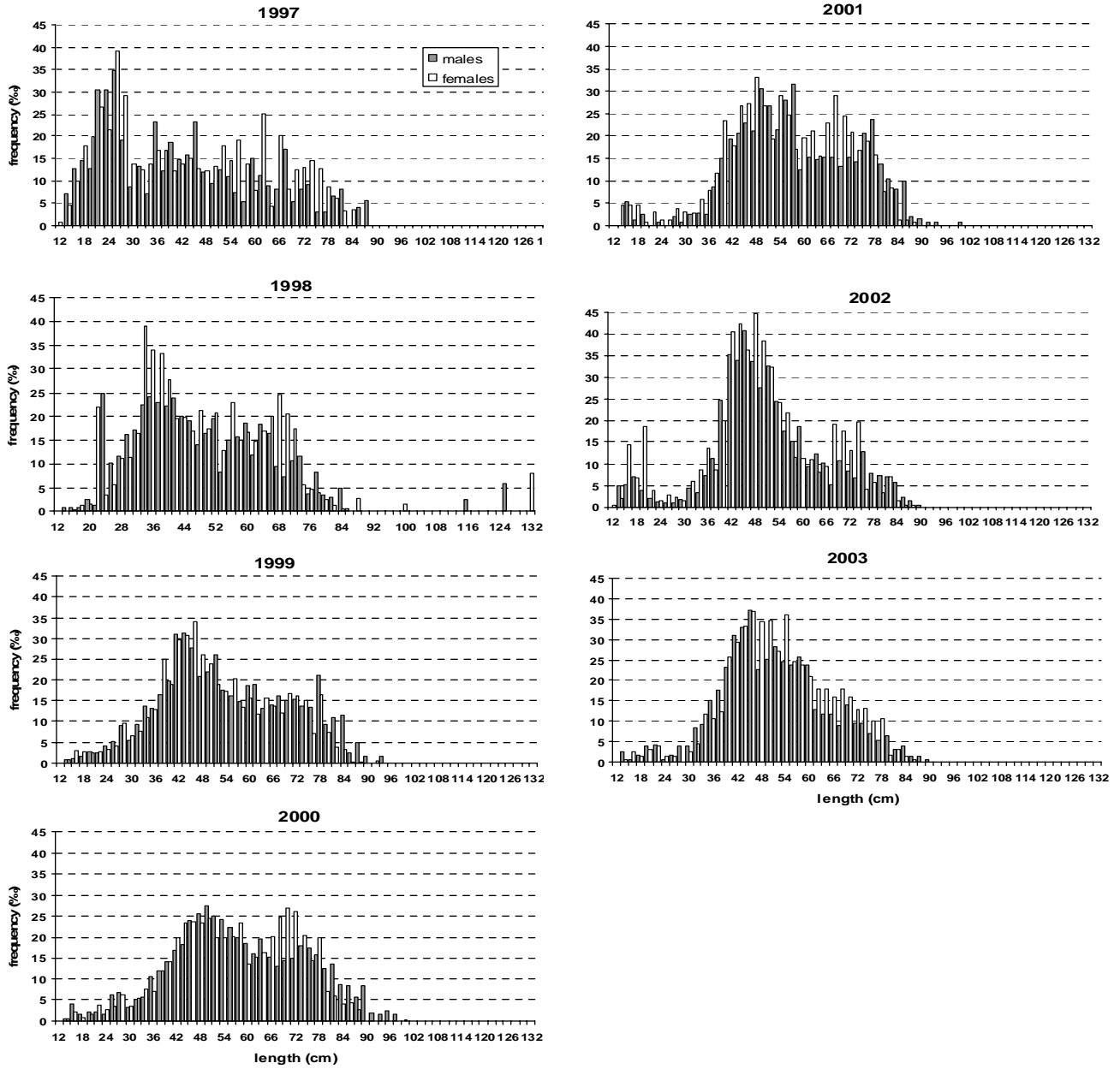
**FIGURE 4.-** Thorny skate abundance in thousand and  $\pm$ SD by year. Spanish Spring surveys on NAFO Div. 3NO: 1995-2003 (1995-2000 transformed data from C/V *Playa de Menduña*; 2001-2003 original data from R/V *Vizconde de Eza*).



**FIGURE 5.-** Thorny skate abundance in thousands transformed with the two different methods: MCG and Warren.



**FIGURE 6.-** Ratios of *Campelen* catch to *Pedreira* catch, by length group, of Thorny skate, from comparative fishing trials between the two gears on the C/V *Playa de Menduña* and the R/V *Vizconde de Eza*. The dots are the observed ratios and the curve is the fitted line.



**FIGURE 7.-** Thorny skate length distribution (cm) on NAFO 3NO: 1997-2003. Frequency in %. 1997-2000 data are transformed data from C/V *Playa de Menduña*, and 2001-2003 data are original from R/V *Vizconde de Eza*.