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Calculation of the calibration factors for witch flounder and squid from the comparative experience between the R/V *Cornide de Saavedra* and the R/V *Vizconde de Eza* in Flemish Cap in 2003 and 2004

by

Diana González Troncoso
Instituto Español de Oceanografía
Cabo Estay – Canido 36200 Vigo, Spain
diana.gonzalez@vi.ieo.es

Abstract

EU carries out a stratified random summer bottom trawl survey in Flemish Cap, Division 3M of the NAFO Regulatory Area, since 1988. Since 1991, the survey was made with the R/V *Cornide de Saavedra*. In 2003, this vessel was replaced for the R/V *Vizconde de Eza*, so, in order to maintain the series obtained from the old vessel, a two year comparative fishing trial between the two vessels was made in the years 2003 and 2004. This work presents the methods used for the transformation of the series and their results for biomass and length distribution for two species in the area: witch flounder and squid. For both species, the R/V *Vizconde de Eza* is more efficient that the R/V *Cornide de Saavedra* for the biomass, with values of FPC equal to 1.7573 in the case of the witch flounder and 1.2792 in the case if the squid. Witch flounder biomass and abundance are very fluctuating, especially since 2003, with the change of vessel, and in general, small individuals are not present during the survey. For squid the biomass and abundance are low except for years 1991, 1992, 2006 and 2008. In 2013 and 2015, no catches were reported during the survey. All the numbers are very poor in general.

Material and Methods

The survey on NAFO Regulatory Area of Div. 3M was initiated by EU in 1988. Surveys were carried out in summer (July). Until 2002, the survey was carried out on board the Spanish vessel R/V *Cornide de Saavedra* using bottom trawl net type *Lofoten* until a depth of 730 m. Since 2003, the survey has been performed by the *R/V Vizconde de Eza* using the same trawl net until a depth of 1430 m all years except in 2003 in which the coverage of the deeper strata was poor, so only the data until 700 m is used in that year. For more details about the surveys, see Vázquez *et al.*, 2013. Dates, vessel, number of valid tows and dates of the 1988-2015 surveys are presented in Table 1, and in Table 2 the number of hauls by strata by year.

R/V *Vizconde de Eza* replaced R/V *Cornide de Saavedra* in the 2003 survey. The objective of this change was to improve the Greenland halibut indices of abundance and biomass reaching deeper depths. Due to the impossibility of the R/V *Cornide de Saavedra* to fish in depths of more than 730 m, it was necessary to change the vessel. In order to maintain the data series obtained since 1988, comparative fishing trials between the two vessels were conducted in summers 2003 and 2004 to develop factors between the two fishing vessels indices. A series of 130 paired hauls until 730 m was carried out, 61 in 2003 and 69 in 2004; 111 of them were valid hauls in both vessels. Mean catch and biomass, with their respective standard deviations, and length distribution, were transformed from R/V *Cornide de Saavedra* series to R/V *Vizconde de Eza* series.

The distance during the trawls between the two vessels was the minimum possible, from 0.25 to 0.5 miles, depending of sea conditions. The relative position between the two vessels during the trawls (in starboard or port each of the other), was varying.

Although the fishing procedure in the new vessel was attempted to remain similar than in previous years, there are some differences in the fishing management as the trawl warp length as well as different characteristics of some fishing elements: trawl warp diameter, trawl winch control, presence or not of dan leno bobbin, that could modify the behaviour of the gear (geometry) and vary the catchability of some species. Also, the automatic system of the trawl winch in the new vessel maintains the same tension in the two trawl warps, heaving and setting out the adequate warp length, allowing to conserve the geometry of the gear and to optimise the yields in the bottom trawls.

To convert data series it was necessary to calculate the factor power correction (FPC), typically estimated by the 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, one of them that has less error was chosen (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, $j = 1, \ldots, 90$

μ is the model parameter

ε is the model error

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

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

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

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

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

$$FPC = \frac{CPUE_2}{CPUE_1} = e^{2t(1+0.5s^2)} \qquad (1)$$

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:

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

where:

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

l is the length

$\alpha,\ \beta\ and\ \delta$ are the estimated parameters.

In all cases, only the hauls in which both vessels had non cero catch were used.

Indices are given to 2003 until 700 m, corresponding to the first 19 strata of Flemish Cap, which was the depth that the R/V *Cornide de Saavedra* reached during the survey. From 2004 the R/V *Vizconde de Eza* has reached depths until 1400 m, so in this case both the indices until 700 m and until 1400 m are given in order to compare the total time series.

Results

During the 22 days employed in the calibration experience, a total of 111 valid paired hauls were carried out. However, when the correcting factors were calculated, the number of valid hauls was appreciably reduced in some of the species, due to the high number of hauls with catch 0 or outliers in some of the two vessels, that were not included in the analysis.

Witch flounder (*Glyptocephalus cynoglossus*)

Results of the calibration

The witch flounder was present in 85 valid paired hauls, but it was present only in 45 of them in both vessels simultaneously.

To convert the biomass, method (1) was fitted. The result of this fit gave a value of $\widehat{FPC}$= 1.7573, that indicates that the new vessel, R/V *Vizconde de Eza,* is more or less 76% more efficient fishing witch flounder than the old vessel, R/V *Cornide de Saavedra*. Although it seems that the pair with highest catches, corresponding to (60.1,77.8) kg, could be an outlier, when it was taken out of the analysis the $\widehat{FPC}$ was almost the same, so it was considered not an outlier for the fit (Figure 1).

The ratios of the witch flounder length distribution between the two vessels present no clear trend in the analysed range. Length 51 cm was considered an outlier, as the ratio between both vessels was 4.5, so it was removed from the analysis. The result of the model (2) for witch flounder was the following:

$$\ln(Ratio) = \exp(-25.1425 + 9.7545 \ln(l) - 0.2568\ l)$$

Figure 2 shows the ratios and their fit. Although in some of the lengths the curve doesn´t fit quite well the ratios, as they are fairly scarce it was decided to use the equation in all the range.

It seems that the new vessel is more efficient than the old vessel for all the length range.

Survey indices

Small catches of witch flounder have been consistently reported in Div. 3M since 1986. Witch flounder in Div. 3M is not likely related to the Div. 2J3KL witch stock. In 2015, the Fisheries Commission requests the

Scientific Council to *provide survey biomass trend(s) of witch flounder in Div. 3M for as long as data is available*. This is the aim of this part of the SCR.

Witch flounder mean per standard tow and its SD by strata and the total, both for <700 m and <1400 m, is presented in Table 3. In Table 4, total biomass per strata and the total for both depth ranges is shown. As can be seen, there is only a very small part of the biomass at depths of more than 700 m.

Abundance by length every 2 cm is presented in Table 5 until 700 m, and until 1400 m in Table 6.

Figure 3 shows the total biomass and abundance along the time series. Both indices of witch flounder in the Division 3M are very fluctuating, especially since 2003, with the change of vessel. Figure 4 presents the total (males+females+indeterminates) length distribution until 700 m. In general, small individuals are not present during the survey; we have data for all the years just from around 30 cm. We can follow a first cohort from 1988 that disappeared around 1996. Another cohort, stronger, can be tracked in the last years, reaching in 2015 around 44 cm.

Squid (*Illex illecebrosus*)

Results of the calibration

The squid was present in 105 valid paired hauls, but it was present only in 74 of them in the two vessels.

To convert the biomass, method (1) was fitted. The result of this fit gave a value of $\widehat{FPC}$= 1.2792, that indicates that the new vessel, R/V *Vizconde de Eza,* is more or less 28% more efficient fishing squid than the old vessel, R/V *Cornide de Saavedra*. Although it seems that the pair with highest catches, corresponding to (7,4) kg, could be an outlier, when it was taken out of the analysis the $\widehat{FPC}$ was almost the same, so it was considered not an outlier for the fit (Figure 5).

The ratios of the squid length distribution between the two vessels present no clear trend in the analysed range. The result of the model (2) for squid was the following:

$$\ln(\text{Ratio}) = \exp(-0.4944 + 0.1860 \ln(l) + 0.0018\, l)$$

Figure 6 shows the ratios and their fit. Although in some of the lengths the curve doesn´t fit quite well the ratios, as they are fairly scarce it was decided to use the equation in all the range.

It seems that the new vessel is more efficient for the smallest individuals (< 10.5 cm) and for the middle lengths, and a bit less efficient in the biggest individuals (> 20 cm).

Survey indices

Squid mean per standard tow and its SD by strata and the total, both for <700 m and <1400 m, is presented in Table 7. In Table 8, total biomass per strata and the total for both depth ranges is shown. As can be seen, there is only a very small part of the biomass at depths of more than 700 m.

Abundance by length every 1 cm is presented in Table 9 until 700 m, and until 1400 m in Table 10.

Figure 7 shows the total biomass and abundance along the time series. Both indices have the same trend. Until 2005, the squid indices are very low except for years 1990 and 1991. In 2006, a quick increase in the indices can be seen, following for a decrease in 2007 and a huge increase in 2008, reaching the maximum of the series. The 2006 increase is mainly due to catches in strata 17-19, while in 2008 because of catches in strata 16-18. In 2013 and 2015, no catches were reported during the survey.

Figure 8 presents the length distribution until 700 m. In general, all the cohorts are very poor. We cannot see good recruitments during all the series, although between 1997 and 2009 more smaller individuals were present. In the years with more biomass (1990, 1991, 2006 and 2008), the most abundant length range was between 14 and 20 cm.

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Table 1. Dates, vessel, number of valid tows (including the number of valid tows until 700 m in brackets since 2002) and dates of the 1988-2015 surveys.

Year	Vessel	Valid tows	Dates
1988	Cornide de Saavedra	115	8/7 – 22/7
1989	Cryos	116	12/7 – 1/8
1990	Ignat Pavlyuchenkov	113	18/7 – 6/8
1991	Cornide de Saavedra	117	24/6 – 11/7
1992	Cornide de Saavedra	117	29/6 – 18/7
1993	Cornide de Saavedra	101	23/6 – 8/7
1994	Cornide de Saavedra	116	6/7 – 23/7
1995	Cornide de Saavedra	121	2/7 – 19/7
1996	Cornide de Saavedra	117	28/6 – 14/7
1997	Cornide de Saavedra	117	16/7 – 1/8
1998	Cornide de Saavedra	119	17/7 – 2/8
1999	Cornide de Saavedra	117	2/7 – 20/7
2000	Cornide de Saavedra	120	10/7 – 28/7
2001	Cornide de Saavedra	120	3/7 – 20/7

Year	Vessel	Valid tows	Dates
2002	Cornide de Saavedra	120	30/6 – 17/7
2003	Vizconde de Eza	177 (114)	2/6 – 2/7
	Cornide de Saavedra	50**	7/6 – 17/6
2004	Vizconde de Eza	177 (124)	25/6 – 2/8
	Cornide de Saavedra	61**	23/7 – 2/8
2005	Vizconde de Eza	176 (117)	1/7 – 21/8
2006	Vizconde de Eza	179 (115)	1/7-26/7
2007	Vizconde de Eza	174 (117)	23/6-19/7
2008	Vizconde de Eza	179 (111)	23/6-19/7
2009	Vizconde de Eza	178 (119)	23/6-20/7
2010	Vizconde de Eza	153 (97)	22/6-21/7
2011	Vizconde de Eza	128 (79)	29/6-9/8
2012	Vizconde de Eza	174(118)	26/6-24/7
2013	Vizconde de Eza	181(120)	26/6-23/7
2014	Vizconde de Eza	181(120)	25/6-23/7
2015	Vizconde de Eza	181(120)	23/6-22/7

( ) valid tows carried out in depths lesser than 400 fathoms ** calibration tows

Table 2. Number of hauls by strata during the 1988-2015 surveys.

Strata	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	5	4	4	4	4	4	4	3	4	4	4	4
2	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	9	14	10	10	10	9	10	7	7	10	10	10	10
3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	5	7	7	7	7
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	3	4	4	3	4	4	4	4
5	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	8	6	5	8	8	8	8
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6	6
7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	9	8	6	9	9	9	9
8	7	7	7	7	7	6	6	7	7	7	7	7	7	7	7	7	7	7	7	7	6	7	6	5	7	7	7	7
9	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3
10	9	11	11	11	11	8	11	11	11	11	11	11	11	11	11	11	12	11	11	10	9	11	7	5	10	11	11	11
11	9	8	9	9	9	9	9	9	9	9	9	9	9	9	9	8	10	9	7	9	9	9	7	6	9	9	9	9
12	8	8	7	8	8	7	7	9	8	7	7	7	8	8	8	7	8	8	8	8	8	8	8	5	8	8	8	8
13	3	3	2	2	2	2	2	3	3	3	3	3	3	3	3	3	2	3	2	3	3	3	3	2	3	3	3	3
14	6	6	6	7	8		6	7	6	7	7	6	7	7	7	4	7	7	7	5	6	6	5	4	7	7	7	7
15	6	6	8	7	6	6	8	8	7	7	8	8	8	8	8	9	8	6	7	8	6	8	6	5	8	8	8	8
16	7	7	7	7	7	7	7	7	6	7	7	6	7	7	7	7	7	7	6	7	7	7	5	5	7	7	7	7
17	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2
18	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	5	5	2	5	5	4	4	5	5	4	5	5	5	5	5	5	3	5	5	5	4	5	4	3	4	5	5	5
20																	5	6	6	4	6	6	5	5	6	6	6	6
21																	4	4	6	4	5	6	5	6	5	6	6	6
22																	6	6	6	4	3	5	4	5	3	6	6	6
23																	3	2	2	3	3	2	2	2	2	3	3	3
24																	3	2	3	2	3	3	3	2	3	3	3	3
25																	2	2	2	2	2	3	3	2	3	3	3	3
28																	6	6	6	6	6	6	5	4	6	6	6	6
29																	5	6	6	6	6	6	5	4	6	6	6	6
30																	10	11	11	11	11	11	12	10	11	11	11	11
31																	2	2	2	2	2	2	2	2	2	2	2	2
32																	2	2	2	2	3	2	3	2	2	2	2	2
33																	2	2	2	2	2	2	2	2	2	2	2	2
34																	3	3	5	5	4	5	4	3	5	5	5	5
Total<700m	115	116	113	117	117	101	115	121	117	117	119	117	120	120	120	114	125	118	115	117	111	119	98	79	118	120	120	120
Total<1400m																	178	172	174	170	167	178	153	128	174	181	181	181

Table 3. Witch flounder mean catch per standard towed mile by strata and its standard error in the 1988-2015 surveys. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

		1988		1989		1990		1991		1992		1993		1994		1995		1996		1997		1998		1999		2000		2001	
Strata	Area	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error
1	342	7.90	4.15	4.03	2.68	1.32	0.98	0.80	0.49	5.90	2.37	1.63	0.92	0.92	0.92	16.85	7.17	14.36	9.01	6.12	4.31	3.26	1.38	1.35	0.71	9.75	2.18	10.43	3.75
2	838	6.09	2.21	2.92	2.21	1.57	0.34	4.55	1.08	4.74	1.88	7.13	2.00	4.31	0.71	3.08	1.38	2.46	0.86	2.80	0.95	1.48	0.43	3.48	0.74	4.86	2.31	3.51	1.23
3	628	0.31	0.22	0.12	0.12	1.08	0.68	5.38	2.58	0.49	0.40	1.94	0.65	0.83	0.28	0.74	0.46	0.71	0.25	0.65	0.31	0.86	0.43	0.83	0.40	0.37	0.37	0.18	0.18
4	348	1.48	0.28									2.03	0.58	0.58	0.37	0.46	0.31	3.84	3.23	1.01	0.58	1.11	0.40	1.69	0.71	0.40	0.40	0.62	0.46
5	703	5.60	3.23	1.63	0.40	1.63	0.68	4.00	1.60	5.75	1.88	4.61	1.11	3.57	0.62	2.34	0.86	1.29	0.37	0.65	0.28	0.65	0.25	1.94	0.98	0.37	0.18	2.40	0.89
6	496	1.20	0.46	0.80	0.40	1.35	0.68	1.14	0.34	2.64	1.14	4.21	0.34	3.23	1.01	0.89	0.31	0.92	0.31			0.18	0.18	0.89	0.52	0.28	0.15	1.05	0.40
7	822	0.98	0.34	0.86	0.40	1.05	0.43	1.17	0.74	0.86	0.40	1.11	0.43	0.77	0.25	0.68	0.31	0.00	0.00	0.46	0.25	0.15	0.15	0.40	0.22			0.18	0.18
8	646	0.28	0.22	0.09	0.09	0.12	0.12	0.31	0.18	1.63	0.83	2.52	1.32	3.04	1.38	0.92	0.83	0.06	0.06	0.55	0.25	0.62	0.25	0.58	0.28	0.00	0.00	0.40	0.40
9	314	0.43	0.43			1.29	0.65	0.46	0.46	1.72	1.72	0.40	0.40	2.03	1.63	6.80	5.17	0.28	0.25	0.37	0.37			0.09	0.09	1.51	1.17	0.09	0.09
10	951	3.97	0.95	0.74	0.28	3.14	1.26	2.98	1.01	2.24	0.65	3.69	0.89	3.57	0.92	1.05	0.43	0.43	0.15	0.55	0.25	0.65	0.28	1.08	0.31	0.68	0.25	0.49	0.18
11	806	3.08	1.11	0.58	0.37	0.92	0.49	3.08	0.80	2.55	0.80	3.72	1.23	1.05	0.37	0.40	0.25	0.25	0.18	0.15	0.12	0.43	0.22	0.46	0.18	0.09	0.03	0.03	0.03
12	670	0.09	0.09			0.18	0.18	0.06	0.03	0.18	0.06	0.03	0.03	0.09	0.06	0.22	0.18					0.12	0.09	0.37	0.37			0.03	0.03
13	249									0.06	0.06											0.00	0.00						
14	602	0.34	0.22			0.09	0.09			0.22	0.22			0.18	0.18	0.65	0.34	0.25	0.25	0.06	0.06							0.34	0.34
15	666	0.52	0.34	0.28	0.18	0.15	0.09	0.09	0.06	0.65	0.31	1.05	0.40	1.97	0.89	0.34	0.22	1.08	0.71	0.15	0.15	0.18	0.18	0.12	0.09	0.18	0.12	0.68	0.34
16	634							0.22	0.15	0.09	0.06	0.06	0.06	0.09	0.06	0.06	0.06												
17	216									0.12	0.12																		
18	210																			0.37	0.37							0.28	0.28
19	414	0.18	0.18	0.09	0.09			0.06	0.03	0.18	0.12	0.52	0.22	0.89	0.37														
20	525																												
21	517																												
22	533																												
23	284																												
24	253																												
25	226																												
28	530																												
29	488																												
30	1134																												
31	203																												
32	238																												
33	98																												
34	486																												
<700 m	10555	2.00	0.33	0.72	0.21	0.91	0.15	1.68	0.24	1.80	0.25	2.27	0.24	1.72	0.17	1.56	0.32	1.11	0.32	0.70	0.17	0.52	0.08	0.83	0.11	0.90	0.20	1.01	0.17
<1400 m	16070																												

Table 3 (cont.). Witch flounder mean catch per standard towed mile by strata and its standard error in the 1988-2015 surveys. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015	
Strata	Area	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error	Mean	Error
1	342	0.65	0.22	9.35	2.36	32.57	15.19	48.62	28.18	18.74	9.59	5.08	2.54	3.05	1.17	6.07	1.24	25.34	22.10	23.43	17.55	25.78	12.76	4.62	2.85	1.40	0.72	3.71	2.45
2	838	1.54	0.43	4.95	2.29	4.71	0.98	4.71	2.45	3.50	0.46	3.12	0.88	23.19	11.92	3.76	0.95	11.73	5.86	2.96	0.74	12.43	5.15	3.40	0.96	9.36	2.28	11.29	3.80
3	628	1.23	0.34	1.37	0.53	1.35	0.72	0.75	0.30	0.58	0.18	1.68	0.79	4.03	1.79	0.86	0.44	0.49	0.23	1.38	0.63	3.64	0.93	1.23	0.42	4.64	1.56	4.29	1.52
4	348	1.26	0.37	0.51	0.30	2.68	1.26	1.73	0.82	1.23	0.16	2.12	0.67	0.81	0.40	0.89	0.40	0.63	0.32	4.03	2.26	4.25	0.58	0.47	0.26	1.07	0.46	0.89	0.39
5	703	1.26	0.34	1.49	0.44	2.89	0.68	0.56	0.37	0.42	0.33	1.02	0.42	2.40	0.95	1.35	0.47	1.93	0.81	0.35	0.23	1.87	0.56	2.01	0.72	2.01	0.77	5.76	2.19
6	496	0.86	0.55	0.63	0.35	0.81	0.46	0.42	0.14	0.58	0.39	0.86	0.44	1.30	0.49	1.00	0.51	1.66	0.39	3.36	0.77	2.24	0.72	2.57	0.51	2.29	0.68	3.33	0.68
7	822	0.31	0.18	0.61	0.30	0.25	0.18	0.32	0.18	0.16	0.11	0.04	0.04	0.54	0.18	0.61	0.23	0.16	0.09	0.82	0.35	1.31	0.33	1.03	0.21	1.68	0.47	1.89	0.58
8	646			0.16	0.11	0.32	0.23	0.02	0.02	0.00	0.00	0.16	0.11	0.49	0.14	0.51	0.23	0.21	0.07	0.30	0.21	0.47	0.26	1.49	0.51	2.78	0.75	0.88	0.33
9	314	0.22	0.22			0.07	0.07	0.09	0.09	0.02	0.02	0.25	0.25			0.39	0.35			2.33	1.19	0.09	0.09			1.37	1.10	0.81	0.81
10	951	0.25	0.09	0.28	0.11	0.32	0.12	0.42	0.18	0.47	0.19	0.21	0.11	1.38	0.32	0.91	0.26	1.24	0.44	1.14	0.75	1.70	0.32	1.51	0.42	2.38	0.49	3.59	0.70
11	806	0.09	0.09	0.51	0.16	0.26	0.07	0.19	0.11	0.11	0.09	0.21	0.11	1.33	0.54	0.63	0.23	0.14	0.05	1.51	0.65	1.12	0.33	0.67	0.19	2.00	0.58	1.80	0.61
12	670	0.03	0.03											0.04	0.02	0.00	0.00	0.09	0.05	0.07	0.05	0.02	0.02	0.09	0.07	0.11	0.05	0.33	0.16
13	249											0.04	0.04																
14	602	0.15	0.09			0.14	0.14	0.30	0.14	0.49	0.30	0.04	0.04	0.25	0.14	0.02	0.02	0.28	0.14	0.54	0.33	0.33	0.18	0.23	0.09	2.03	1.24	1.07	0.60
15	666	0.09	0.09	0.02	0.02	0.05	0.04					0.04	0.04	0.21	0.18	0.14	0.05	1.19	0.70	0.05	0.04	0.16	0.09	0.18	0.11	0.61	0.16	0.47	0.16
16	634					0.12	0.12	0.07	0.07					0.00	0.00	0.02	0.02	0.11	0.05	0.05	0.04	0.16	0.07	0.25	0.11	0.25	0.09	0.58	0.25
17	216																					0.04	0.04					0.53	0.09
18	210									0.32	0.32							0.02	0.02	1.40	1.40	0.32	0.14	0.16	0.02				
19	414	0.09	0.09													0.12	0.09	0.54	0.19	0.21	0.14	0.30	0.14	0.77	0.26	0.58	0.37	0.14	0.09
20	525																			0.04	0.04	0.02	0.02	0.12	0.05	0.05	0.05	0.11	0.07
21	517																					0.05	0.05						
22	533																												
23	284																												
24	253																												
25	226																												
28	530													0.05	0.05	0.02	0.02	0.07	0.05	0.39	0.28	1.14	0.49	0.98	0.37	0.68	0.26	0.46	0.14
29	488																	0.02	0.02	0.02	0.02	0.05	0.05	0.04	0.04	0.28	0.21	0.68	0.63
30	1134																							0.02	0.02				
31	203																												
32	238																			0.49	0.49								
33	98																	0.07	0.07	0.05	0.05	0.23	0.23			0.26	0.07	0.12	0.12
34	486															0.11	0.09	0.02	0.02	0.23	0.16	0.12	0.05	0.30	0.12	0.18	0.11	0.33	0.21
<700 m	10555	0.46	0.06	1.05	0.20	1.94	0.51	2.21	0.93	1.11	0.32	0.75	0.13	2.75	0.96	0.95	0.11	2.28	0.86	1.84	0.59	2.84	0.59	1.20	0.15	2.25	0.24	2.69	0.37
<1400 m	16070					1.28	0.33	1.45	0.61	0.74	0.21	0.49	0.09	1.80	0.63	0.63	0.07	1.51	0.56	1.24	0.39	1.91	0.39	0.84	0.11	1.52	0.16	1.82	0.25

Table 4. Witch flounder total biomass by strata in the 1988-2015 surveys. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

Strata	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	206	105	39	21	155	42	25	439	374	160	84	35	255	272	18	243	849	1267	488	132	79	158	660	611	672	121	37	97
2	388	188	109	290	302	455	274	197	158	179	95	221	311	223	98	316	300	300	223	199	1480	240	749	188	793	217	597	720
3	16	7	44	258	23	93	40	35	33	32	42	39	18	9	60	65	64	36	28	80	193	41	23	66	174	59	222	206
4	39					53	16	12	102	26	30	44	11	16	33	14	71	46	32	56	21	24	17	107	113	12	28	24
5	301	86	88	214	308	248	192	127	69	33	35	104	21	128	67	80	154	30	22	55	129	72	103	19	100	108	108	309
6	44	30	51	42	100	158	121	33	35		7	33	11	39	32	24	30	16	22	33	49	38	63	127	85	97	87	125
7	62	53	56	74	54	69	49	42	0	28	11	26		11	18	39	16	20	10	3	34	38	10	52	82	65	105	119
8	14	5	7	14	79	125	149	46	4	26	30	30	0	19		8	15	1	0	7	24	25	10	15	24	73	137	43
9	11		32	11	40	9	49	162	7	9		2	37	2	5		2	2	1	6		9		56	2		33	19
10	288	54	230	216	162	267	258	76	30	40	47	77	49	35	18	20	23	31	34	15	100	67	89	83	124	109	173	261
11	188	37	53	190	156	228	65	25	14	9	26	28	5	4	7	31	16	11	7	13	81	38	9	93	68	41	122	111
12	4		11	4	11	2	5	11			5	19		2	2						2	0	4	4	1	4	5	17
13					2						0									1								
14	16		5		11		9	30	12	4				16	7		6	13	22	2	11	1	13	25	15	10	93	49
15	26	14	9	5	32	54	100	18	54	7	9	7	9	33	5	1	2			2	11	7	60	3	8	9	31	24
16				11	5	2	5	4									6	3			0	1	5	3	8	12	12	28
17					2	5																		2	1			9
18										5				5					5				0	22	5	3		
19	7	4		2	5	16	28								4							4	17	7	10	24	18	5
20																								1	1	5	2	4
21																									2			
22																												
23																												
24																												
25																												
28																					2	0	3	15	46	39	27	18
29																							0	1	2	2	10	26
30																										1		
31																												
32																								9				
33																							1	0	2		2	1
34																						4	1	8	4	11	7	12
Total <700 m	1608	583	733	1351	1446	1826	1387	1255	893	559	422	666	726	814	373	841	1554	1776	894	604	2214	763	1832	1483	2285	964	1808	2166
sd <700 m	269	165	121	195	199	193	138	254	260	134	61	88	163	140	47	165	406	752	254	101	770	85	690	473	473	117	196	299
Total <1400 m																	1554	1776	894	604	2216	767	1837	1517	2342	1022	1856	2227
sd <1400 m																	407	750	257	107	771	86	686	471	471	129	193	300

Table 5. Witch flounder length distribution (,000) in the 1988-2015 surveys until 700 m. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

	1988				1989				1990				1991				1992				1993			
Length	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2	7	0	0	7	0	0	0	0
16	1	0	0	1	0	0	0	0	3	0	0	3	7	0	0	7	21	0	0	21	1	0	0	1
18	13	0	2	15	0	0	2	2	1	0	0	1	16	0	0	16	12	0	0	12	3	0	0	3
20	7	0	7	14	0	0	0	0	5	0	0	5	18	0	0	18	22	11	4	37	5	0	11	16
22	10	0	0	10	0	0	0	0	11	0	0	11	44	0	0	44	31	18	11	60	54	72	12	138
24	24	9	0	33	0	10	0	10	0	6	5	11	13	12	0	25	52	28	41	120	29	56	36	122
26	11	17	0	29	0	7	8	15	0	0	7	7	70	52	0	122	39	71	48	158	33	17	70	120
28	39	11	0	51	0	0	0	0	0	18	17	36	0	55	0	55	13	19	50	82	13	232	181	427
30	55	16	112	183	13	13	0	26	0	10	40	51	0	43	10	53	0	85	27	112	16	164	97	277
32	107	152	37	297	13	13	13	38	10	22	12	44	13	23	0	37	0	43	69	111	0	82	99	181
34	186	251	273	711	12	49	27	88	23	71	26	120	0	90	14	103	14	90	61	165	19	199	88	306
36	298	187	414	898	16	190	68	274	12	74	76	162	0	155	25	181	0	186	143	329	0	246	53	299
38	213	266	539	1019	39	141	66	246	0	197	171	368	0	389	80	469	0	364	47	411	16	359	81	456
40	107	50	63	220	40	50	77	166	34	63	182	279	0	259	260	519	16	235	120	371	0	413	172	585
42	163	47	182	392	12	24	25	61	11	25	74	110	0	109	212	320	15	74	205	294	0	150	224	374
44	93	55	202	350	23	22	0	45	11	21	26	58	0	58	83	140	14	93	159	266	0	49	197	246
46	65	68	121	254	11	20	0	31	0	33	32	65	0	94	61	155	0	62	91	152	0	35	99	133
48	65	22	72	159	0	9	28	38	0	18	36	54	0	46	58	104	0	23	57	81	0	44	96	141
50	90	23	20	132	0	25	8	33	7	8	8	23	0	17	33	51	0	52	31	83	13	39	70	122
52	17	17	36	70	0	14	15	29	0	0	7	7	0	8	61	69	0	0	46	46	8	12	34	54
54	0	0	34	34	0	6	12	18	0	0	7	7	0	0	13	13	0	0	31	31	0	7	36	43
56	12	0	0	12	0	5	6	11	0	0	5	5	0	0	6	6	0	0	25	25	6	0	0	6
58	0	0	11	11	0	0	0	0	0	0	4	4	0	0	5	5	0	0	11	11	0	0	0	0
60	0	0	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1576	1193	2135	4904	178	599	355	1132	130	567	738	1434	184	1409	921	2514	256	1452	1277	2985	217	2175	1658	4050
Range	16-60				18-57				12-59				10-58				13-58				12-56			

Table 5 (cont.). Witch flounder length distribution (,000) in the 1988-2015 surveys until 700 m. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

	1994				1995				1996				1997				1998				1999			
Length	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
16	3	0	0	3	1	0	0	1	2	0	0	2	0	0	0	0	3	1	0	3	3	0	0	3
18	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	8	0	1	10
20	3	0	0	3	0	2	0	2	7	0	0	7	3	0	0	3	0	0	0	0	9	0	0	9
22	20	5	0	24	0	0	4	4	14	0	0	14	0	0	4	4	0	0	0	0	43	5	8	56
24	0	21	25	46	0	12	0	12	0	0	0	0	0	20	12	32	0	0	0	0	6	0	5	12
26	31	40	66	137	0	14	0	14	7	0	0	7	0	0	0	0	7	0	0	7	0	8	17	25
28	31	130	128	290	0	80	0	80	0	0	0	0	0	0	0	0	0	0	19	19	0	29	10	40
30	68	202	141	411	0	118	49	167	23	66	0	89	0	23	0	23	0	0	10	10	11	11	10	32
32	28	258	236	523	0	251	57	308	36	72	34	142	0	54	12	66	0	34	11	45	47	34	34	115
34	0	120	181	301	12	206	111	329	27	91	64	182	0	108	27	135	0	84	25	109	97	38	24	159
36	14	83	59	156	12	130	115	257	78	163	39	280	15	98	27	139	0	90	38	128	51	73	39	163
38	0	158	54	212	0	327	28	356	31	119	39	189	0	75	85	160	0	75	103	178	129	37	62	229
40	0	272	82	354	0	267	24	291	39	177	25	241	0	128	27	154	14	36	49	98	24	26	74	124
42	13	51	325	390	0	155	134	289	26	145	51	221	0	0	66	66	0	24	82	106	93	34	57	184
44	0	36	102	138	0	112	143	255	48	23	22	93	13	25	61	99	0	0	79	79	10	0	78	88
46	11	23	69	103	0	60	84	143	11	52	31	94	0	12	68	79	0	21	31	52	29	10	72	112
48	0	0	61	61	0	36	37	73	30	47	28	104	10	0	51	61	0	0	28	28	19	0	19	37
50	8	27	67	102	0	16	24	41	0	16	9	25	9	0	9	18	0	0	0	0	8	0	9	17
52	0	0	15	15	0	0	7	7	8	7	22	37	0	0	16	16	0	7	7	14	0	0	0	0
54	0	0	30	30	0	0	32	32	6	0	0	6	0	0	7	7	0	0	0	0	0	0	7	7
56	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	234	1426	1647	3306	26	1788	849	2663	393	978	364	1734	55	541	475	1072	27	371	482	879	588	305	528	1420
Range		16-57				15-55				15-54				21-60				10-53				16-54		

Table 5 (cont.). Witch flounder length distribution (,000) in the 1988-2015 surveys until 700 m. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

	2000				2001				2002				2003				2004				2005			
Length	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	2	0	0	2	0	0	0	0	0	0	0	0	0	7	0	7	0	0	0	0	0	0	0	0
18	2	0	0	2	0	0	0	0	0	2	2	4	0	0	0	0	0	0	7	7	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15	0	0	0	0	8	0	0	8
22	9	0	0	9	0	0	12	12	5	5	0	9	0	8	0	8	0	0	8	8	0	0	8	8
24	0	12	5	18	12	0	5	17	6	0	0	6	8	0	0	8	14	8	8	29	0	0	0	0
26	8	0	16	23	16	0	7	23	0	8	0	8	0	0	0	0	5	0	14	19	0	8	8	15
28	0	36	0	36	9	9	17	36	0	0	9	9	0	0	0	0	14	19	14	47	0	0	0	0
30	0	51	0	51	0	39	0	39	10	11	33	54	0	15	15	31	12	22	0	34	0	32	16	47
32	0	34	0	34	0	43	22	66	0	48	12	59	0	23	15	38	28	56	44	128	0	118	24	142
34	0	187	0	187	12	188	0	201	0	26	50	76	8	133	37	177	97	135	11	242	8	243	0	251
36	0	167	13	180	25	234	12	271	0	106	26	131	0	109	21	130	120	321	52	494	31	619	15	665
38	13	133	55	201	38	98	86	222	0	55	13	68	0	163	14	177	97	241	54	392	0	573	66	639
40	0	120	64	184	0	108	97	205	0	65	53	118	0	167	29	196	107	190	137	434	8	498	79	585
42	0	49	124	174	24	151	116	291	0	13	37	50	0	176	54	230	91	84	112	286	0	229	144	373
44	0	46	92	138	22	11	86	120	13	0	35	47	0	72	112	184	116	114	119	349	22	136	235	393
46	0	32	31	63	10	10	51	71	0	11	55	65	0	43	91	134	60	19	102	181	22	29	130	181
48	0	19	78	97	0	9	64	73	0	0	28	28	0	41	54	95	22	16	47	84	0	14	79	93
50	0	8	32	41	0	0	24	24	0	8	9	17	0	7	50	57	22	23	53	98	15	7	50	72
52	0	0	7	7	0	0	7	7	0	0	15	15	0	0	23	23	17	6	23	45	0	0	21	21
54	0	0	6	6	0	0	0	0	0	0	7	7	0	0	0	0	0	5	10	15	0	0	7	7
56	0	0	0	0	0	0	5	5	0	0	0	0	0	0	8	8	0	0	12	12	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	34	895	522	1452	168	903	613	1684	34	357	382	773	15	963	539	1517	821	1256	833	2911	114	2507	880	3502
Range		14-55				22-57				19-54				17-56				19-58				21-55		

Table 5 (cont.). Witch flounder length distribution (,000) in the 1988-2015 surveys until 700 m. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

	2006				2007				2008				2009				2010				2011			
Length	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	20	0	0	20	0	0	9	9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	26	13	20	59	7	7	0	14	0	7	0	7	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	21	14	15	50	0	0	0	0	0	0	0	0	0	0	0	0
14	0	7	7	14	0	0	0	0	16	7	8	31	19	0	0	19	0	10	20	30	0	0	0	0
16	0	0	0	0	0	0	0	0	32	45	37	115	0	6	0	6	12	10	12	34	0	0	0	0
18	16	9	0	24	0	0	0	0	110	81	122	314	13	13	0	26	10	33	77	121	0	0	0	0
20	7	0	0	7	0	0	0	0	54	7	77	137	51	21	20	92	0	0	57	57	0	9	54	63
22	7	7	7	20	7	0	0	7	0	7	7	14	58	0	48	106	9	40	56	105	0	19	40	59
24	8	0	13	21	0	14	13	27	0	0	0	0	27	33	118	178	38	16	82	137	0	59	48	107
26	0	7	15	22	0	21	15	35	8	16	0	24	26	34	34	94	60	146	107	312	0	53	89	142
28	0	0	7	7	0	7	0	7	0	87	44	130	7	7	12	25	68	81	121	269	0	54	121	174
30	7	20	0	27	0	17	0	17	7	29	63	99	0	13	6	19	28	86	104	218	0	64	76	140
32	0	0	0	0	0	14	6	20	0	29	48	77	0	26	12	39	0	100	133	233	0	43	93	136
34	7	59	13	79	7	26	14	47	0	45	37	82	12	19	7	39	10	38	32	80	0	94	66	161
36	13	177	0	190	0	124	6	130	0	248	145	393	6	52	13	72	0	38	19	58	0	135	170	305
38	6	347	6	360	0	137	26	163	0	527	218	745	7	72	13	92	0	232	20	252	20	112	94	226
40	13	261	54	328	0	132	33	165	0	570	360	930	6	167	34	207	0	267	23	290	0	247	30	277
42	0	111	98	208	0	53	27	80	0	176	234	410	13	118	46	177	12	565	60	637	0	364	43	407
44	0	53	94	147	0	33	121	153	7	110	197	314	0	80	99	179	10	271	133	414	0	206	35	242
46	0	40	78	118	0	26	40	66	0	57	274	331	6	6	84	96	0	102	180	282	0	53	157	209
48	0	0	72	72	0	0	40	40	0	30	205	235	12	14	78	104	12	22	150	185	0	9	121	130
50	13	0	39	51	0	0	52	52	0	7	88	96	6	6	46	59	0	0	120	120	0	0	117	117
52	0	0	0	0	0	0	13	13	0	0	36	36	0	0	25	25	0	0	32	32	0	9	58	67
54	0	0	13	13	0	0	7	7	0	0	22	22	0	0	0	0	0	0	22	22	0	9	18	27
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7	0	0	0	0	0	0	10	10
58	0	0	0	0	0	0	6	6	0	0	15	15	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	95	1097	516	1707	59	616	439	1115	261	2100	2263	4623	271	694	703	1667	268	2058	1561	3887	20	1537	1441	2999
Range		15-55				9-59				9-59				10-56				14-55				20-57		

Table 5 (cont.). Witch flounder length distribution (,000) in the 1988-2015 surveys until 700 m. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

	2012				2013				2014				2015			
Length	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total
2	0	0	0	0	7	0	0	7	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	7	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	9	9	0	1	0	1	0	0	0	0	0	0	0	0
18	0	9	7	16	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	6	0	6	0	0	0	0
22	9	17	23	49	0	0	0	0	0	0	0	0	0	0	0	0
24	0	41	41	83	7	0	30	37	0	0	0	0	0	8	0	8
26	0	69	66	134	14	27	47	88	0	14	6	20	0	0	16	16
28	0	73	91	164	7	7	41	55	0	78	68	145	0	7	8	14
30	0	61	149	210	17	67	87	171	0	58	66	124	0	14	28	43
32	0	45	43	88	0	87	139	227	0	72	103	174	0	94	68	162
34	0	122	152	274	13	102	100	215	0	180	99	279	0	74	101	175
36	0	153	98	251	0	86	99	185	0	214	113	327	0	168	123	291
38	0	279	128	407	0	142	100	242	0	208	130	338	0	225	153	379
40	0	475	64	538	7	77	132	216	7	323	119	449	0	222	140	362
42	15	499	51	566	0	116	65	181	0	240	135	376	0	294	250	545
44	7	439	116	563	0	64	33	97	0	209	107	316	7	344	187	538
46	0	126	170	296	0	51	58	109	0	161	99	260	0	214	164	378
48	0	34	157	192	0	20	85	105	0	59	168	227	0	77	158	235
50	7	21	133	161	0	6	93	99	0	33	108	141	7	13	152	172
52	0	7	108	115	0	0	26	26	0	0	48	48	0	7	60	66
54	0	0	21	21	0	0	14	14	0	0	7	7	0	0	20	20
56	0	0	7	7	0	0	0	0	0	0	6	6	0	0	7	7
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	6	0	0	6	0	0	0	0
Total	46	2471	1633	4150	72	854	1150	2076	13	1854	1383	3251	20	1761	1635	3415
Range		15-56				3-55				21-68				9-56		

Table 6. Witch flounder length distribution (,000) in the 2004-2015 surveys until 1400 m. Original from R/V *Vizconde de Eza*.

	2004				2005				2006				2007				2008				2009			
Length	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	20	0	0	9	9	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	26	13	20	59	7	7	0	14	0	7	0	7
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	14	15	50	0	0	0	0
14	0	0	0	0	0	0	0	0	0	7	7	14	0	0	0	0	16	7	8	31	19	0	0	19
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	45	37	115	7	6	0	13
18	0	0	7	7	0	0	0	0	16	9	0	24	0	0	0	0	110	81	122	314	13	13	0	26
20	0	0	0	0	8	0	0	8	7	0	0	7	0	0	0	0	54	7	77	137	58	21	20	99
22	0	0	8	8	0	0	8	8	7	7	7	20	7	0	0	7	0	7	7	14	58	8	48	114
24	14	8	8	29	0	0	0	0	8	0	13	21	0	14	13	27	0	0	0	0	27	33	118	178
26	5	0	14	19	0	8	8	15	0	7	15	22	0	21	15	35	8	16	0	24	26	34	34	94
28	14	19	14	47	0	0	0	0	0	0	7	7	0	7	0	7	0	86	44	130	7	7	12	25
30	12	22	0	34	0	32	16	47	7	20	0	27	0	17	0	17	7	29	63	99	0	13	6	19
32	28	56	44	128	0	118	24	142	0	0	0	0	0	14	6	20	0	29	48	77	0	26	12	39
34	97	135	11	242	8	243	0	251	7	59	13	79	7	26	14	47	0	45	37	82	12	19	7	39
36	120	321	52	493	31	619	15	665	13	177	0	190	0	124	6	130	0	255	145	400	6	52	13	72
38	97	240	54	392	0	573	66	639	6	347	6	360	0	137	26	164	0	527	218	744	7	72	13	92
40	107	190	137	434	8	498	79	585	13	261	54	328	0	132	33	165	0	570	360	930	6	174	34	214
42	91	84	112	286	0	229	144	373	0	111	98	208	0	53	27	80	0	176	234	410	13	118	46	177
44	115	114	119	348	22	136	235	393	0	53	94	147	0	33	121	154	7	110	197	314	0	80	99	180
46	59	19	102	180	22	29	130	181	0	40	78	118	0	26	40	66	0	57	273	331	6	6	84	96
48	22	16	47	84	0	14	79	93	0	0	72	72	0	0	40	40	0	30	205	235	12	14	78	104
50	22	23	53	98	15	7	50	72	13	0	39	51	0	0	52	52	0	7	88	95	6	6	46	59
52	17	6	23	45	0	0	21	21	0	0	0	0	0	0	13	13	0	0	36	36	0	0	25	25
54	0	5	10	15	0	0	7	7	0	0	13	13	0	0	7	7	0	0	22	22	0	0	0	0
56	0	0	12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7
58	0	0	5	5	0	0	0	0	0	0	0	0	0	0	6	6	0	0	15	15	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	820	1256	833	2909	114	2507	880	3502	95	1097	516	1707	60	617	440	1116	260	2105	2261	4627	284	709	703	1697
Range		19-58				21-55				15-55				9-59				9-59				10-56		

Table 6 (cont.). Witch flounder length distribution (,000) in the 2004-2015 surveys until 1400 m. Original from R/V *Vizconde de Eza*.

	2010				2011				2012				2013				2014				2015			
Length	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total	Ind	M	H	Total
2	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	10	30	40	0	0	0	0	7	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
16	12	10	12	34	0	0	0	0	0	0	9	9	0	7	0	7	7	0	0	7	0	0	0	0
18	10	33	87	130	0	0	11	11	0	9	7	16	0	7	0	7	0	0	0	0	0	0	0	0
20	0	46	57	104	0	9	54	63	0	0	0	0	0	0	0	0	0	6	0	6	0	0	0	0
22	9	50	60	119	0	19	54	73	17	17	47	80	0	0	0	0	0	0	0	0	0	0	7	7
24	38	16	96	150	0	70	84	154	12	57	80	149	7	7	37	52	0	0	0	0	0	8	14	22
26	60	146	107	312	0	73	89	162	0	102	104	206	23	77	91	191	4	23	6	33	0	7	16	23
28	67	81	121	269	0	76	163	240	8	104	167	279	14	35	112	162	0	98	95	193	0	7	14	21
30	28	86	104	218	0	64	87	151	8	106	210	323	17	96	153	266	0	77	115	192	0	22	50	72
32	0	100	133	233	0	54	93	147	0	45	43	88	0	102	160	263	0	78	171	249	0	111	103	215
34	10	38	32	80	0	94	66	160	0	122	152	273	13	102	115	229	4	188	128	319	0	88	173	261
36	0	38	19	58	0	135	169	304	0	153	98	251	0	86	99	185	0	217	115	331	0	175	144	319
38	0	232	20	252	20	111	94	225	0	279	128	407	0	142	100	242	0	212	131	343	0	225	167	392
40	0	267	23	290	0	260	30	290	0	474	63	538	7	77	132	216	7	326	119	452	0	221	140	361
42	12	565	60	637	0	364	43	407	15	499	51	565	0	116	65	181	0	241	139	381	0	294	250	544
44	10	271	133	414	0	206	35	241	7	439	116	562	0	64	33	97	0	203	100	303	7	343	187	537
46	0	102	180	282	0	53	156	209	0	126	170	296	0	51	58	109	0	160	100	261	0	213	164	377
48	12	22	150	184	0	9	121	130	0	34	157	192	0	20	85	104	0	59	169	228	0	77	158	235
50	0	0	120	120	0	0	127	127	7	21	133	161	0	6	93	99	0	33	102	135	7	13	152	172
52	0	0	32	32	0	9	58	67	0	7	108	115	0	0	26	26	0	0	49	49	0	7	60	66
54	0	0	22	22	0	9	18	27	0	0	21	21	0	0	14	14	0	0	7	7	0	0	20	20
56	0	0	0	0	0	0	9	9	0	0	7	7	0	0	0	0	0	0	6	6	0	0	7	7
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6	0	0	0	0
Total	268	2113	1597	3978	20	1613	1563	3197	81	2593	1870	4545	88	996	1374	2457	28	1921	1553	3502	20	1812	1825	3657
Range		14-55				18-57				15-56				3-55				16-68				9-56		

Table 7. Squid mean catch per standard towed mile by strata and its standard error in the 1988-2015 surveys. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

		1988		1989		1990		1991		1992		1993		1994		1995		1996		1997		1998		1999		2000		2001	
Strata	Area	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	342					0.54	0.36	0.02	0.02	0.02	0.02			0.63	0.40			0.02	0.02			0.29	0.16						
2	838	0.02	0.02	0.00	0.00	1.81	0.81	0.27	0.16	0.18	0.11			0.29	0.13			0.09	0.07	0.11	0.07	0.27	0.11	0.04	0.02			0.00	0.00
3	628					0.20	0.07	1.95	0.63	0.02	0.02			0.13	0.07			0.22	0.07	0.04	0.02	0.09	0.04	0.02	0.02			0.02	0.00
4	348					0.07	0.04	0.11	0.11	0.16	0.09			0.31	0.18			0.09	0.04	0.04	0.04	0.09	0.09	0.02	0.02				
5	703	0.04	0.04	0.07	0.04	19.83	9.72	0.07	0.04	0.38	0.25			1.07	0.31	0.00	0.00	0.47	0.16	0.16	0.07	0.22	0.04	0.04	0.02			0.00	0.00
6	496			0.00	0.00	12.13	6.56	12.51	7.10	0.09	0.07			0.27	0.18	0.00	0.00	0.18	0.07	0.20	0.11	0.18	0.04	0.04	0.02				
7	822	0.02	0.02			0.36	0.16	2.08	0.85	0.02	0.00	0.00	0.00	0.11	0.04			0.09	0.02	0.04	0.02	0.02	0.00	0.02	0.02			0.00	0.00
8	646					0.02	0.02	0.60	0.29	0.04	0.04	0.00	0.00	0.16	0.13			0.27	0.18	0.04	0.02	0.16	0.07	0.02	0.02			0.00	0.00
9	314			0.07	0.07	0.98	0.78	0.16	0.02	0.11	0.11			0.27	0.11			0.09	0.09	0.18	0.18	0.07	0.07						
10	951	0.04	0.04	0.04	0.04	2.82	1.32	8.91	3.90	0.22	0.09	0.00	0.00	1.12	0.29			0.38	0.09	0.25	0.04	0.29	0.04	0.04	0.02			0.00	0.00
11	806					2.06	0.78	0.65	0.38	0.20	0.07			0.43	0.09	0.00	0.00	0.04	0.02	0.22	0.09	0.04	0.02	0.04	0.02			0.02	0.00
12	670							0.02	0.02							0.00	0.00	0.04	0.02	0.02	0.02	0.02	0.00	0.02	0.02	0.02	0.00	0.02	0.00
13	249							0.07	0.07					0.40	0.29					0.09	0.04	0.00	0.00	0.02	0.02	0.00	0.00		
14	602					0.07	0.04	0.47	0.20	0.09	0.04			0.11	0.07	0.00	0.00	0.09	0.04	0.13	0.09	0.07	0.07	0.02	0.02			0.02	0.00
15	666					0.09	0.07	0.25	0.13	0.04	0.04			0.07	0.02			0.02	0.02	0.02	0.02	0.02	0.00	0.02	0.00	0.00	0.00	0.02	0.02
16	634							0.09	0.07									0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.00	0.02	0.00	0.04	0.00
17	216									0.04	0.04			0.11	0.11					0.02	0.02			0.04	0.04	0.02	0.02		
18	210			0.00	0.00	0.07	0.07			0.09	0.02			0.25	0.16					0.02	0.02	0.02	0.02					0.00	0.00
19	414							0.09	0.07	0.00	0.00			0.02	0.02	0.02	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.00	0.02	0.02	0.02	0.02
20	525																												
21	517																												
22	533																												
23	284																												
24	253																												
25	226																												
28	530																												
29	488																												
30	1134																												
31	203																												
32	238																												
33	98																												
34	486																												
<700 m	10555	0.00	0.00	0.01	0.00	1.46	0.42	1.05	0.28	0.06	0.01	0.00	0.00	0.19	0.03	0.00	0.00	0.08	0.01	0.06	0.01	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00
<1400 m	16070																												

Table 7 (cont.). Squid mean catch per standard towed mile by strata and its standard error in the 1988-2015 surveys. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015	
Strata	Area	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	342			0.18	0.09	1.61	0.75	0.07	0.04	14.77	13.77	0.04	0.04	0.28	0.12	0.53	0.28	0.02	0.02	0.05	0.05	0.05	0.04						
2	838	0.00	0.00	0.46	0.19	0.56	0.11	0.11	0.04	18.50	8.79	0.16	0.07	27.18	18.81	4.64	3.75	0.09	0.05	0.23	0.11	0.18	0.11						
3	628	0.00	0.00	0.16	0.04	0.39	0.05	0.05	0.04	0.16	0.07	1.30	0.61	1.38	0.35	3.29	1.51	0.02	0.02	0.02	0.02	0.04	0.02			0.00	0.00		
4	348	0.00	0.00	0.07	0.00	1.94	1.30	0.07	0.05	4.90	4.38	0.02	0.02	0.23	0.23	0.67	0.23					0.04	0.02			0.02	0.02		
5	703	0.00	0.00	1.51	1.03	1.66	0.40	0.09	0.05	27.20	19.37	0.75	0.19	6.67	4.45	5.32	1.91	0.05	0.04	0.04	0.04	0.16	0.05			0.00	0.00		
6	496	0.00	0.00	0.12	0.04	0.68	0.33	0.11	0.04	5.88	2.82	1.52	0.47	0.98	0.35	0.54	0.21	0.07	0.02	0.07	0.05	0.02	0.02						
7	822	0.00	0.00	0.35	0.16	0.61	0.14	0.09	0.05	0.46	0.09	0.61	0.14	0.77	0.32	0.54	0.33	0.05	0.02	0.02	0.02	0.02	0.00			0.00	0.00		
8	646	0.00	0.00	0.16	0.07	0.18	0.05	0.04	0.02	0.14	0.05	0.47	0.26	0.77	0.35	0.74	0.09	0.05	0.05	0.07	0.07	0.00	0.00			0.04	0.02		
9	314	0.00	0.00	0.09	0.05	1.05	0.74			0.05	0.05	0.93	0.49	0.68	0.42	14.42	7.37			0.23	0.23								
10	951	0.02	0.00	0.35	0.18	0.72	0.19	0.25	0.04	0.37	0.11	0.79	0.11	35.33	28.33	4.95	1.65	0.23	0.07	0.33	0.12	0.12	0.04			0.00	0.00		
11	806	0.00	0.00	0.19	0.11	0.60	0.12	0.21	0.05	1.40	0.37	1.44	0.79	1.70	0.44	0.67	0.28	0.05	0.02	0.46	0.19	0.09	0.04			0.00	0.00		
12	670	0.02	0.00	0.11	0.07	0.21	0.05	0.02	0.00	0.05	0.05	0.04	0.02	0.04	0.02	0.46	0.40					0.00	0.00						
13	249	0.00	0.00	0.02	0.02	0.46	0.46	0.04	0.04							0.04	0.04												
14	602			0.21	0.12	0.33	0.18	0.09	0.04	0.04	0.04	0.12	0.05	2.31	0.75	1.14	0.53	0.11	0.04	0.11	0.11					0.00	0.00		
15	666	0.02	0.00	0.11	0.07	0.07	0.04	0.11	0.05	0.09	0.05	0.05	0.02	0.98	0.63	0.04	0.02			0.00	0.00								
16	634	0.02	0.00	0.02	0.02	0.09	0.02	0.07	0.02					0.04	0.02	0.00	0.00												
17	216	0.07	0.04	0.00	0.00	0.05	0.05	0.14	0.05					0.02	0.02			0.02	0.02										
18	210			0.05	0.05	0.07	0.07	0.00	0.00					0.09	0.09	0.19	0.09					0.05	0.05						
19	414	0.04	0.02	0.02	0.02	0.09	0.04	0.05	0.02	0.04	0.02			0.02	0.02	0.04	0.04												
20	525					0.02	0.02	0.07	0.02	0.00	0.00					0.02	0.00												
21	517					0.00	0.00			0.02	0.02			0.02	0.02	0.00	0.00												
22	533					0.00	0.00	0.00	0.00	0.00	0.00									0.00	0.00								
23	284					0.02	0.02			0.00	0.00																		
24	253					0.05	0.04	0.04	0.04							0.04	0.04												
25	226									0.04	0.04			0.07	0.07	0.02	0.02												
28	530					0.02	0.02	0.00	0.00	0.12	0.11					0.00	0.00												
29	488									0.05	0.02					0.02	0.02					0.02	0.02						
30	1134					0.02	0.02			0.04	0.02			0.00	0.00	0.02	0.00					0.00	0.00						
31	203					0.05	0.05									0.14	0.14												
32	238									0.00	0.00											0.00	0.00						
33	98					0.21	0.21																						
34	486					0.07	0.07							0.11	0.11	0.02	0.02					0.05	0.05						
<700 m	10555	0.00	0.00	0.16	0.04	0.33	0.04	0.06	0.01	2.52	0.88	0.29	0.05	3.65	1.70	1.20	0.25	0.03	0.00	0.06	0.01	0.03	0.01			0.00	0.00		
<1400 m	16070					0.22	0.03	0.04	0.00	1.66	0.58	0.19	0.03	2.40	1.12	0.00	0.16	0.02	0.00	0.04	0.01	0.02	0.00			0.00	0.00		

Table 8. Squid total biomass by strata in the 1988-2015 surveys. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

Strata	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1			15	0	0		17		0		8					5	42	2	385	1	7	13	0	1	1			
2	1	0	120	18	12		19		6	8	17	3		0	0	29	36	7	1181	10	1736	296	6	14	11			
3			9	93	1		6		12	3	5	1		1	0	8	19	2	8	62	66	158	1	1	1		0	
4			3	3	4		8		3	1	3	0			0	2	51	2	130	0	6	17			1		0	
5	1	4	1090	4	20		58	0	26	9	12	3		0	0	81	89	5	1457	40	357	285	3	2	8		0	
6		0	468	472	4		10	0	6	8	6	1			0	5	26	4	222	58	37	21	3	3	0			
7	1		22	130	1	0	8		5	3	1	1		0	0	22	39	6	28	38	48	34	3	1	1		0	
8			1	29	3	0	8		13	3	8	1		0	0	8	8	1	7	24	38	36	2	4	0		1	
9		1	24	4	3		6		3	4	1				0	2	25		1	22	16	345		5				
10	3	4	216	646	17	0	81		28	18	20	3		1	1	25	52	17	26	56	2560	359	16	24	8		0	
11			128	40	12		27	0	3	13	4	3		1	0	12	36	13	86	88	104	41	3	28	5		0	
12				1				0	3	1	1	1	1	1	1	6	11	1	3	2	2	23			0			
13				1			8			1	0	0	0		0	0	9	1				0						
14			4	22	4		5	0	4	6	4	1		1		10	15	4	1	6	106	52	5	5			0	
15			5	13	3		4		1	1	0	1	0	1	1	6	3	6	4	3	49	2		0				
16				4					0	1	1	1	1	1	1	1	4	4			2	0						
17					0		1			0		0	0		1	0	1	2			0		0					
18		0	1		1		4			0	0			0		1	1	0			1	3			1			
19				3	0		0	0	1	1	1	1	0	1	1	1	3	2	1		0	1						
20																	1	3	0			0						
21																	0		0		1	0						
22																	0	0	0					0				
23																	1		0									
24																	1	1				1						
25																			1		1	0						
28																	1	0	5			0						
29																			2			0			1			
30																	1		3		1	1			0			
31																	1					2						
32																			0						0			
33																	2											
34																	2				4	1			2			
Total <700 m	6	9	2107	1483	83	1	269	1	113	81	92	22	3	10	8	222	470	79	3541	411	5137	1688	43	89	38		3	
sd <700 m	4	4	604	395	18	1	33	1	15	12	12	4	1	3	3	60	55	8	1244	64	2392	346	7	19	8		1	
Total <1400 m																	479	83	3551	411	5144	1694	43	90	41		3	
sd <1400 m																	55	8	1244	64	2392	346	7	19	8		1	

Table 9. Squid length distribution (,000) in the 1988-2015 surveys until 700 m. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1																				7								
2											6					8												
3			6	6						7	6	9	6		13	9		18	7			7						
4										7	92	55	12	94	64	123	91	95	23		10	15			7			
5					7			6		29	104	60	33	102	53	151	182	144	16			30						
6		6		7	0			7		21	99	128	29	169	85	29	291	159	23		20	70			57			
7	48	22			8			7	15	53	24	83	43	55	43	8	79	75	16	14	10	47			16			
8		35			8			7	0	53	32	53	15	45	35	11	68	122	43		20	84						
9	19	16			8			6	14	24	59	58	37	55	75	8	46	56	92		20	23					27	
10		7		26	40	9		22	29	38	32	32	7	19	23	22	45	8	205	120	248	88	20		14			
11				80	41	12	24	7	22	99	60	87		9	24	63	40	44	191	203	119	473		32	38			
12			39	412	26		228		133	86	116	79		30	23	207	73	74	162	502	337	865	26	41	137			
13			238	1349	115	11	616		213	63	59	84		30	8	240	122	26	64	904	694	1331	103	19	180			
14			1446	2627	249		657		373	45	60	28			0	954	224	40	809	1199	1270	3163	136	10	175		28	
15			3667	4860	259		861		296	62	142	26			0	1441	199	58	1099	916	3403	5187	102	44	38			
16			6992	4053	208		776		177	111	165	18			0	536	350	170	2044	566	11469	6113	103	15	16			
17			5657	2934	71		314		176	193	133				10	71	533	169	5450	621	12441	4192	79	115	8			
18			1975	547	43		144		59	163	173					17	773	72	9195	554	13880	1169	12	59	8			
19			868	153	33		130		34	51	119						592	80	5915	160	2907	152	12	130			28	
20			157	9					8								614	55	2154	26	1270	20	23	169				
21			81						11								246		783		248			52				
22			34														91		295		89			14				
23			16														15		29		20							
24																					10							
25			9																									
Total	67	86	21184	17064	1114	32	3749	62	1561	1104	1481	801	182	608	457	3898	4675	1463	28614	5793	48476	23029	616	699	695		83	

Table 10. Squid length distribution (,000) in the 2004-2015 surveys until 1400 m. Original from R/V *Vizconde de Eza*.

Length	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1				7								
2												
3		18	7			7						
4	100	124	57		10	15			8			
5	226	188	57		0	30			19			
6	348	206	66		20	70			65			
7	103	129	49	14	10	47			26			
8	104	149	60		20	84			8			
9	66	85	120		20	23			0		27	
10	49	18	244	120	258	89	20		14		0	
11	51	43	227	203	119	474	0	32	38		0	
12	104	84	207	502	337	868	26	42	138		0	
13	122	26	63	904	695	1336	103	20	181		0	
14	223	39	816	1199	1280	3180	136	10	177		28	
15	198	57	1114	916	3404	5205	102	44	39		0	
16	349	169	2050	566	11493	6133	103	15	26		0	
17	544	168	5446	621	12456	4205	79	116	18		0	
18	796	72	9198	554	13895	1174	12	60	8		0	
19	594	80	5912	160	2908	152	12	131			28	
20	611	55	2153	26	1270	20	23	170				
21	249		783		248			53				
22	91		295		89			14				
23	15		29		20							
24					10							
25												
Total	4944	1711	28953	5793	48563	23112	616	707	765		83	

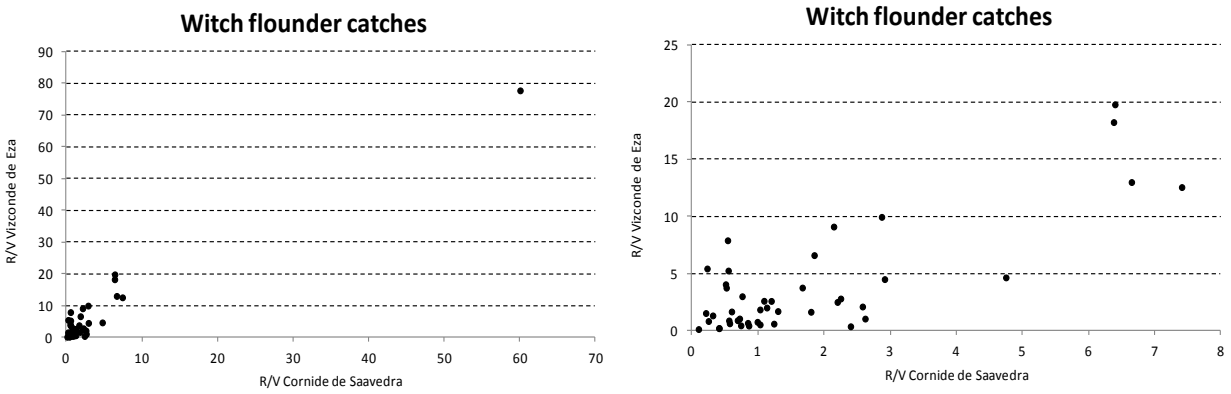

Fig. 1. Witch flounder observed R/V *Cornide de Saavedra* catches versus observed R/V *Vizconde de Eza* catches from comparative fishing trials between the two vessels. In the left plot there are all the hauls with no zero catches of witch flounder; in the right plot the largest pair of catches is omitted.

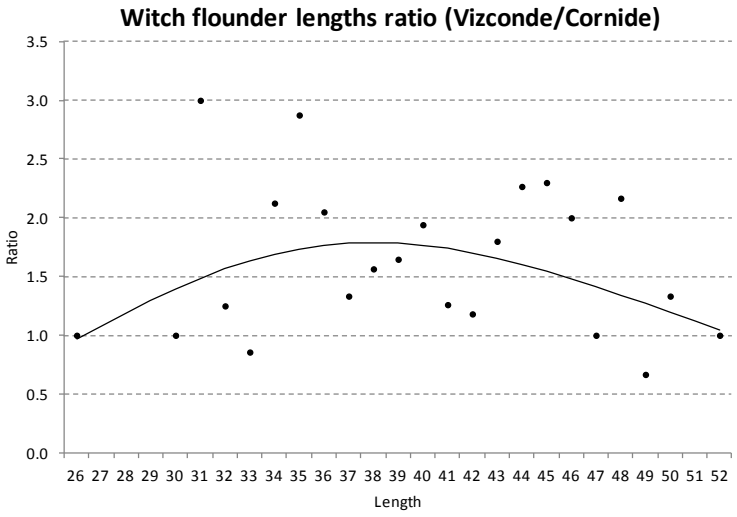

Fig. 2. Witch flounder ratios of R/V *Vizconde de Eza* numbers to R/V *Cornide de Saavedra* numbers by length group from comparative fishing trials between the two vessels. The dots are the observed ratios and the curve is the fitted line.

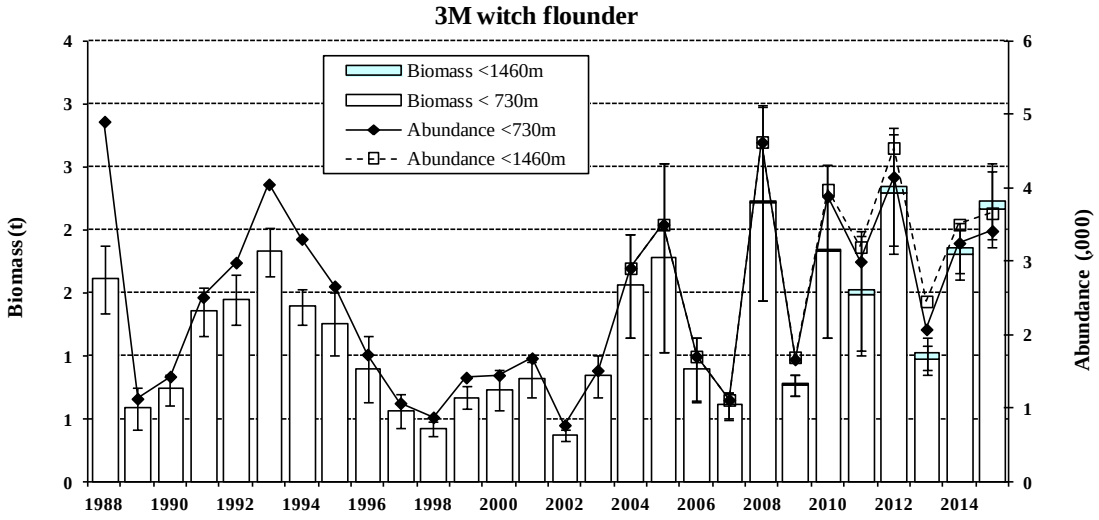

Fig. 3. Witch flounder biomass (t) and abundance (,000) during the EU 3M survey. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

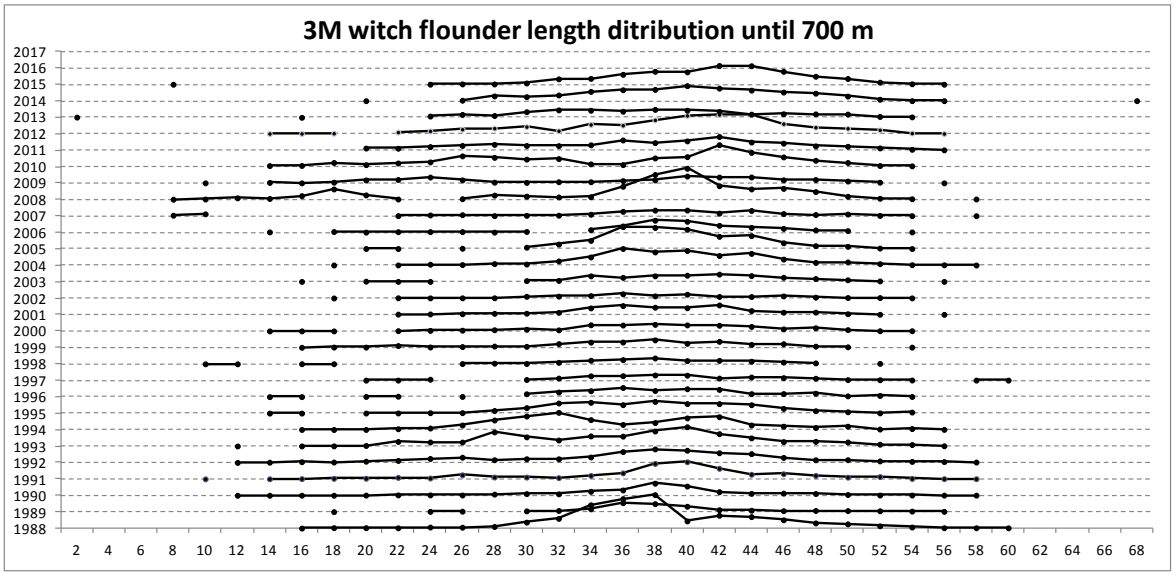

Fig. 4. Witch flounder length distribution until 700 m during the EU 3M survey. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

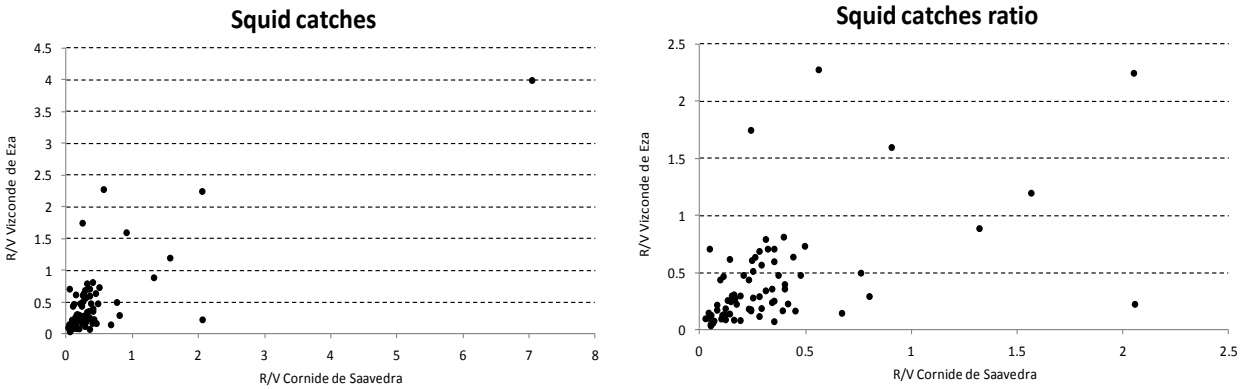

Fig. 5. Squid observed R/V *Cornide de Saavedra* catches versus observed R/V *Vizconde de Eza* catches from comparative fishing trials between the two vessels. In the left plot there are all the hauls with no zero catches of squid; in the right plot the largest pair of catches is omitted.

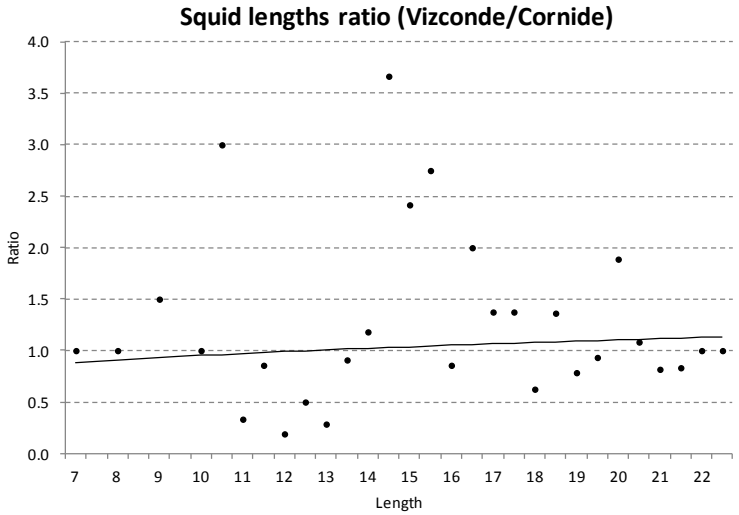

Fig. 6. Squid ratios of R/V *Vizconde de Eza* numbers to R/V *Cornide de Saavedra* numbers by length group from comparative fishing trials between the two vessels. The dots are the observed ratios and the curve is the fitted line.

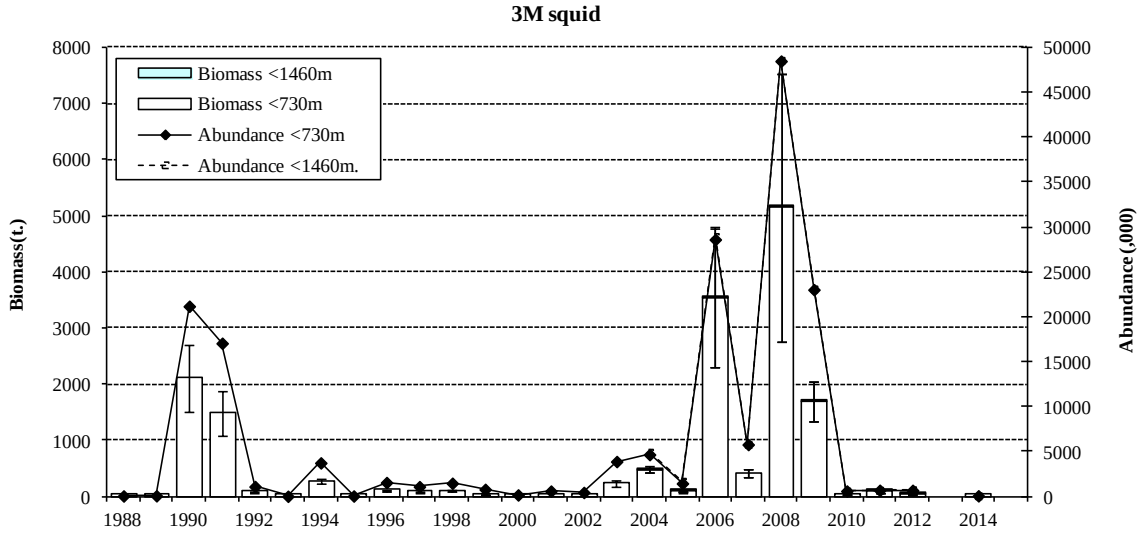

Fig. 7. Squid biomass (t) and abundance (,000) during the EU 3M survey. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.

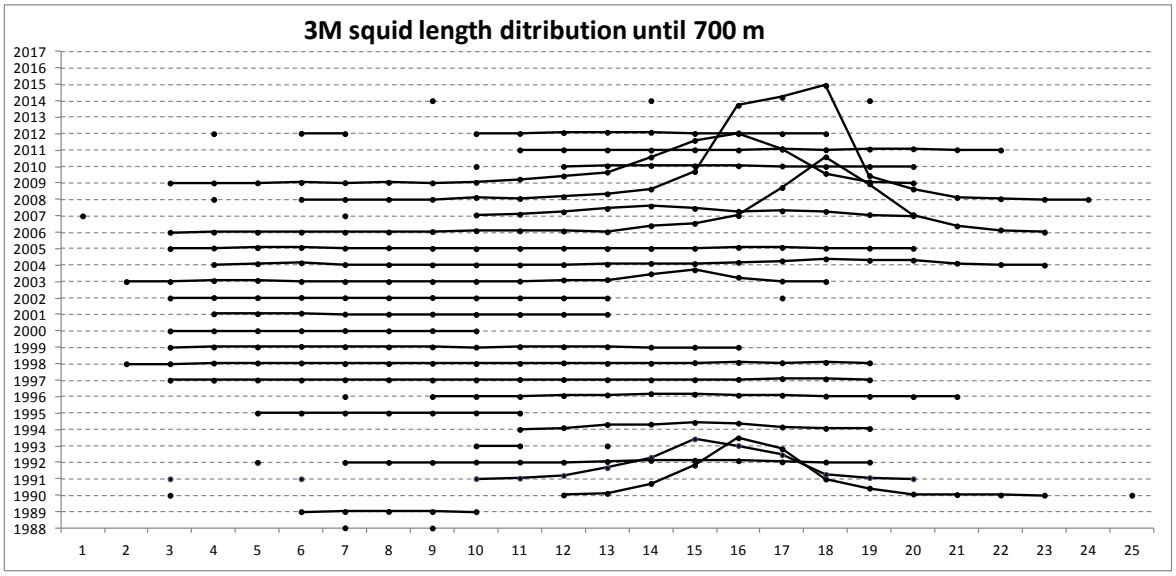

Fig.8. Squid length distribution until 700 m during the EU 3M survey. 1988-2002 data are transformed R/V *Cornide de Saavedra* data, and 2003-2015 data are original from R/V *Vizconde de Eza*.