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Biomass and length distribution for roughhead grenadier, thorny skate and white hake from the surveys conducted by Spain in NAFO 3NO
by

Diana González-Troncoso¹, Ana Gago¹ and Lupe Ramilo¹

¹Instituto Español de Oceanografía
e-mail: diana.gonzalez@ieo.es

Abstract

Data for roughhead grenadier (*Macrourus berglax*), thorny skate (*Amblyraja radiata*) and white hake (*Urophycis tenuis*) from the Spanish Spring survey are presented. Abundance and biomass were estimated for roughhead grenadier and thorny skate for the period 1997-2017 and for white hake for the period 2001-2017. The length distribution is presented as numbers per haul stratified mean catches for the last five years (2013-2017). The roughhead grenadier indices showed no discernible trend during the whole series, reaching a maximum in 2004 and a minimum in 2016. In 2017, a quite good presence of small and medium lengths (1.5-19.5 cm) can be seen. Thorny skate indices follow a large oscillating trend, dropping in 2007 and being since then more or less stables at a low level, reaching the minimum of the series in 2014. In 2017 there is a discrete presence of length between 12 and 18 cm. White hake indices were highest in 2001 and then showed an overall decreasing trend until 2008 with low values, generally increasing since then with some fluctuations. Small recruitment events were detected in 2005, 2013 and 2016, with individuals between 16 - 26 cm. In 2017 the highest numbers are at small lengths, between 20 and 24 cm.

Material and Methods

Spain has carried out a survey in Div. 3NO of the NAFO Regulatory Area, in late Spring, since 1995. To this purpose, the vessel C/V *Playa de Menguña*, equipped with a bottom trawl net type *Pedreira* was used until 2001, when it was replaced by the R/V *Vizconde de Eza* with a bottom trawl net type *Campelen*. The technical specifications and geometry of these gears, their rigging profile and the net plan, and an abstract with the survey technical information are described in Walsh *et al.*, 2001. The number of valid tows, the depth strata covered and survey dates for the period 1997-2017 are shown in Table 1. The survey area was stratified following the standard stratification schemes (Bishop, 1994). The number of hauls was assigned to each stratum proportionally to their size on a random way, with a minimum of two planned hauls per stratum (Doubleday, 1981). The effect of reducing the number of hauls to improve the biological sampling in each haul was investigated via bootstrap, concluding that 7 hauls from the larger strata could be removed with any hardly difference in the indices estimates or their variance. The total number of valid hauls in 2017 was 114. Biomass and abundance indices were calculated by swept area method (Cochran, 1997), assuming a catchability factor of 1. The swept area and number of hauls by stratum for the last five



years (2013-2017) are presented in Table 2. To know the results of the rest of the years, see González-Troncoso *et al.* (2013).

The catch of each haul is sorted and weighted by species and a sample of each species is length measured. For roughhead grenadier, pre-anal length in 0.5 cm intervals to the inferior 0.5 cm is taken. Thorny skate and white hake are measured to the nearest lower cm of total length. This paper presents the 1997-2017 indices for roughhead grenadier and thorny skate. Years 1995 and 1996 are not representative as the deeper strata were not surveyed those years, thus they are excluded from the analysis. White hake data are only available since 2001.

The indices are presented for each species, transformed until 2000 and no-transformed for the period 2002-2017. Total biomass and stratified mean catches and numbers per year, with annual variance, are presented for the entire period. Indices by strata and length distribution are presented for 2013-2017. To see the results of the rest of the years, see González-Troncoso *et al.* (2013). For 2001, there are both transformed data from C/V *Playa de Menduiña* and original data from R/V *Vizconde de Eza*. White hake data did not need calibration (González Troncoso and Paz, 2005). Further information about the calculation of these indices is available in González Troncoso *et al.* (2005).

Figure 1 presents the maps with the distribution of the catches of the three species during the 2017 Spanish 3NO survey.

Results

Roughhead grenadier

There is no directed fishery for roughhead grenadier. Most of the catches are taken as by-catch in the Greenland halibut fishery in Subareas 2 and 3. At the beginning of the Greenland halibut fishery in Subarea 3 of the Regulatory Area in 1988, grenadier catches were systematically misreported as roundnose grenadier. There are no surveys indices available covering the total distribution, in depth and area, of this stock. According to other information this species is predominant at depths ranging from 800 to 1 500 m. An increase is shown since 1995 until 2004-2008 for all available indices. In the most recent period (2013-2016) the information from the surveys in the area of the different indices is contradictory (NAFO, 2017).

Mean Catches and Biomass

Mean catch and SD of roughhead grenadier by stratum are presented in Table 3 and biomass in Table 4 for the period 2013-2017. Total biomass and stratified mean catches and SD by year are presented in Table 5 for 1997-2017. The estimated parameters a and b values of length-weight relationship are presented in Table 6 for the last five years.

The roughhead grenadier biomass fluctuated with no clear trend, reaching the highest values in 2004-2006. Note that lowest values were found in 1997, 2014 and 2016 (Table 5; Figures 2 and 3). Same trend was found for mean catches.

Length Distribution

Table 7 and Figures 2 and 4 present the mean number for 1997-2017, and Table 8 the same index by length besides the sampled size and catch for the period 2013-2017. Results are presented in

length intervals of 1 cm. The 1998 cohort is easily followed, but it has started to disappear over the past years. Recruitment seems to be good recently until 2015, although all the length classes were poor, specially the largest. In 2017, a quite good presence of small and medium lengths (1.5-19.5 cm) can be seen (Figures 4 and 5). The mean number presents the same trend as the mean catch (Table 7 and Figure 2).

Thorny skate

Thorny skate catches comprise the most of the skates catches during the Spanish Spring survey and the Canadian surveys. This species has been managed with a TAC since 2004. Nominal catches increased in the mid-1980s with the beginning of a directed fishery, reaching a minimum during the period 1993-1995. Biomass was relatively stable from 1996 to 2004, but maintaining lower values than in the mid-1980s. Biomass of this stock has been increasing very slowly from low levels since the mid-1990s. Recruitment was above average during 2010-2013, but declined to below average in 2014-2015 (NAFO, 2017).

Mean Catches and Biomass

Mean catch and SD per stratum are presented in Table 9 for 2013-2017, and biomass by stratum in Table 10. Total annual biomass and stratified mean catches per tow by year, next to their SD, are presented in Table 11 for the entire period. The estimated parameters a and b values of length-weight relationship for 2013-2017 are presented in Table 12.

Thorny skate indices oscillated during the entire series. From maximum values in 2000 and 2006, biomass dropped in 2007 and has been since then more or less stable at a lower level, reaching the minimum of the series in 2014 (Table 11; Figures 6 and 7).

Length Distribution

Total mean number per tow by year for the period 1997-2017 is shown in Table 13 and Figure 8. Length distribution by sex and year, sample size and catch for the period 2013-2017 is presented in Table 14 and Figures 8 and 9. The recruitment modal value was in 1997 and the cohort can be roughly followed until 2017. A second modal value at small lengths starting in 1998 can be roughly followed throughout years, reaching a maximum in 2002. Recruitment was also quite good in 2002, but this cohort is not seen in following years. All length classes have been poorer than usual over the last years, but recruitment was quite good in 2010 when all the length classes had more or less the same level. Recruitment was poor over the last years, although in 2017 there is a discrete presence of length between 12 and 18 cm. The mean number presents the same trend as the mean catch (Table 13 and Figure 6).

White hake

Catches of white hake in Div. 3NO peaked in 1987 and then declined until 1994, with non-Canadian landings dropping to 0 following by fishing restriction for foreign countries in 1992. Average catch reached a minimum in 1995-2001, increased in 2002 and 2003 and declined sharply in 2004-2007. Biomass of this stock increased in 1999 and 2000, generated by the large recruitment observed in those years. Subsequently, the biomass index decreased, and remains at very low levels. No large recruitments (<27 cm) have been observed since 2000 (NAFO, 2017).

Mean catches and biomass

Mean catch and SD per stratum are presented in Table 15 for years 2013-2017. Table 16 shows the biomass per stratum for the same period. Table 17 presents the total biomass and the stratified mean catch per tow by year, as well as the annual variance, for 2001-2017. Prior to 2001 there is no available data from the survey for this species. In Table 18 the length weight relationship parameters for the period 2013-2017 are shown.

Biomass index for white hake presented the highest value in 2001, dropping in 2002. Since then until 2008, it showed an overall decreasing trend with low values, generally increasing since then with some fluctuations (Table 17; Figures 10 and 11).

Length distribution

Table 19 presents the mean number per tow by year for 2001-2017. The length distribution by sex and year, number of samples, sample size, sampled catch, length range, total catch and numbers of hauls can be seen in Table 20 for years 2013-2017. White hake was not sexed in 2011 and in 2017.

Individuals within the length range 30-38 cm were very abundant in 2001 and can be followed the next years, but by 2006 can hardly be seen. A small recruitment events were detected in 2005, 2013 and 2016, with individuals between 16 - 26 cm. All year classes have been poor in 2006-2011 and 2014-2015. In 2012, a slight increase in the lengths between 40-44 cm can be seen, corresponding to 48-52 cm in 2013. A slight increase for some length classes was also observed in 2016, with modes at 19 cm, 52 cm and 80 cm. In 2017 the highest numbers are at small lengths, between 20 and 24 cm. The rest of the length range shows low levels. The mean number presents the same trend as the mean catch (Figures 12 and 13).

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Table 1. Spanish spring bottom trawl surveys in NAFO Div. 3N0: 1997-2017

Year	Vessel	Valid tows	Depth strata covered (m)	Dates
1997	C/V <i>Playa de Mendiña</i>	128	42-1263	April 26-May 18
1998	C/V <i>Playa de Mendiña</i>	124	42-1390	May 06-May 26
1999	C/V <i>Playa de Mendiña</i>	114	41-1381	May 07-May 26
2000	C/V <i>Playa de Mendiña</i>	118	42-1401	May 07-May 28
2001 ^(*)	R/V <i>Vizconde de Eza</i>	83	36-1156	May 03-May 24
	C/V <i>Playa de Mendiña</i>	121	40-1500	May 05-May 23
2002	R/V <i>Vizconde de Eza</i>	125	38-1540	April 29-May 19
2003	R/V <i>Vizconde de Eza</i>	118	38-1666	May 11-June 02
2004	R/V <i>Vizconde de Eza</i>	120	43-1539	June 06-June 24
2005	R/V <i>Vizconde de Eza</i>	119	47-1485	June 10-June 29
2005	R/V <i>Vizconde de Eza</i>	119	47-1485	June 10-June 29
2006	R/V <i>Vizconde de Eza</i>	120	45-1480	June 7-June 27
2007	R/V <i>Vizconde de Eza</i>	110	45-1374	May 29-June 19
2008	R/V <i>Vizconde de Eza</i>	122	45-1374	May 27-June 16
2009	R/V <i>Vizconde de Eza</i>	109	45-1374	May 31-June 18
2010	R/V <i>Vizconde de Eza</i>	95	45-1374	May 30-June 18
2011	R/V <i>Vizconde de Eza</i>	122	44-1450	June 5-June 24
2012	R/V <i>Vizconde de Eza</i>	122	44-1450	June 3-June 21
2013	R/V <i>Vizconde de Eza</i>	122	44-1450	June 1-June 21
2014	R/V <i>Vizconde de Eza</i>	122	44-1450	June 2-June 21
2015	R/V <i>Vizconde de Eza</i>	122	44-1450	May 31-June 19
2016	R/V <i>Vizconde de Eza</i>	115	44-1450	May 30-June 18
2017	R/V <i>Vizconde de Eza</i>	113	44-1450	May 23-June 11

(*) A total of 83 hauls from the R/V *Vizconde de Eza* and 40 hauls from the C/V *Playa de Mendiña* (123 hauls in total) were used for data analysis.

Table 2. Swept area and number of hauls by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2013-2017. Swept area in square miles. n.s. means stratum not surveyed.

Stratum	2013		2014		2015		2016		2017	
	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number
353	0.0349	3	0.0379	3	0.0401	3	0.0356	3	0.0360	3
354	0.0338	3	0.0394	3	0.0390	3	0.0345	3	0.0356	3
355	0.0225	2	0.0263	2	0.0263	2	0.0233	2	0.0225	2
356	0.0225	2	0.0266	2	0.0255	2	0.0225	2	0.0233	2
357	0.0236	2	0.0263	2	0.0233	2	0.0233	2	0.0233	2
358	0.0338	3	0.0390	3	0.0349	3	0.0338	3	0.0364	3
359	0.0829	7	0.0908	7	0.0855	7	0.0593	5	0.0596	5
360	0.2231	19	0.2629	20	0.2363	20	0.1995	17	0.2044	17
374	0.0233	2	0.0259	2	0.0229	2	0.0233	2	0.0236	2
375	0.0360	3	0.0390	3	0.0341	3	0.0360	3	0.0364	3
376	0.1305	11	0.1324	10	0.1159	10	0.0945	8	0.0975	8
377	0.0236	2	0.0259	2	0.0233	2	0.0233	2	0.0251	2
378	0.0225	2	0.0263	2	0.0225	2	0.0225	2	0.0236	2
379	0.0240	2	0.0255	2	0.0225	2	0.0229	2	0.0244	2
380	0.0229	2	0.0263	2	0.0229	2	0.0236	2	0.0236	2
381	0.0244	2	0.0259	2	0.0236	2	0.0229	2	0.0229	2
382	0.0484	4	0.0521	4	0.0458	4	0.0465	4	0.0360	3
721	0.0225	2	0.0266	2	0.0240	2	0.0225	2	0.0229	2
722	0.0221	2	0.0259	2	0.0259	2	0.0229	2	0.0233	2
723	0.0221	2	0.0259	2	0.0233	2	0.0225	2	0.0229	2
724	0.0225	2	0.0255	2	0.0236	2	0.0233	2	0.0240	2
725	0.0229	2	0.0255	2	0.0229	2	0.0229	2	0.0244	2
726	0.0221	2	0.0248	2	0.0229	2	0.0225	2	0.0233	2
727	0.0229	2	0.0259	2	0.0225	2	0.0225	2	0.0229	2
728	0.0233	2	0.0248	2	0.0225	2	0.0229	2	0.0229	2
752	0.0233	2	0.0240	2	0.0225	2	0.0236	2	0.0236	2
753	0.0236	2	0.0240	2	0.0233	2	0.0229	2	0.0233	2
754	0.0240	2	0.0225	2	0.0225	2	0.0225	2	0.0218	2
755	0.0454	4	0.0454	4	0.0450	4	0.0458	4	0.0338	3
756	0.0229	2	0.0229	2	0.0229	2	0.0225	2	0.0229	2
757	0.0240	2	0.0244	2	0.0229	2	0.0225	2	0.0225	2
758	0.0225	2	0.0221	2	0.0221	2	0.0221	2	0.0229	2
759	0.0225	2	0.0229	2	0.0229	2	0.0229	2	0.0225	2
760	0.0229	2	0.0364	3	0.0225	2	0.0229	2	0.0236	2
761	0.0225	2	0.0240	2	0.0240	2	0.0225	2	0.0236	2
762	0.0218	2	0.0229	2	0.0229	2	0.0225	2	0.0229	2
763	0.0341	3	0.0233	2	0.0341	3	0.0338	3	0.0353	3
764	0.0214	2	0.0259	2	0.0251	2	0.0225	2	0.0229	2
765	0.0221	2	0.0240	2	0.0236	2	0.0229	2	0.0225	2
766	0.0221	2	0.0221	2	0.0236	2	0.0229	2	0.0225	2
767	0.0218	2	0.0221	2	0.0229	2	0.0229	2	0.0229	2

Table 3. Roughhead grenadier mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2013-2017. n.s. means stratum not surveyed.

Stratum	2013		2014		2015		2016		2017	
	R. grenadier	R. grenadier	R. grenadier	R. grenadier	R. grenadier	R. grenadier	R. grenadier	R. grenadier	R. grenadier	R. grenadier
	Mean catch	SD	Mean catch	SD	Mean catch	SD	Mean catch	SD	Mean catch	SD
353	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
354	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
355	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54	2.18
356	0.00	0.00	0.00	0.00	2.10	2.96	0.00	0.00	0.00	0.00
357	2.33	1.65	0.00	0.00	0.00	0.00	0.15	0.21	3.49	4.93
358	0.91	1.57	0.00	0.00	2.35	4.07	0.17	0.30	0.00	0.00
359	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.33	0.00	0.00
360	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
374	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.67
375	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
376	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
377	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
378	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.86
379	13.66	12.96	2.95	2.21	22.58	9.07	0.21	0.30	8.13	1.36
380	9.39	3.60	7.71	6.99	36.10	31.54	6.57	3.59	4.81	0.77
381	5.40	7.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
382	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
721	0.29	0.41	0.00	0.00	0.00	0.00	0.14	0.14	0.00	0.00
722	7.76	8.49	0.64	0.03	0.51	0.71	4.42	6.25	8.02	6.63
723	5.19	0.26	2.59	1.61	7.93	2.71	2.84	0.21	5.12	0.73
724	10.39	0.90	1.82	1.34	6.54	1.71	5.10	5.80	12.86	7.21
725	5.60	0.83	3.94	1.11	9.30	6.60	2.49	3.13	8.79	0.75
726	27.51	3.17	12.28	6.63	25.39	10.25	17.60	0.70	35.04	19.75
727	22.39	18.26	3.34	1.48	18.25	1.63	14.56	0.08	44.61	40.36
728	16.31	11.29	24.52	1.29	11.77	5.89	9.09	8.36	32.66	12.46
752	4.83	4.11	22.82	27.66	13.77	12.40	20.91	14.29	27.20	21.78
753	30.85	42.46	9.80	8.68	45.20	56.99	15.80	12.45	50.63	42.67
754	59.78	42.87	20.96	26.26	76.89	79.08	16.52	3.71	19.53	5.06
755	24.14	18.70	18.79	11.03	16.99	4.27	27.80	19.78	18.68	7.77
756	20.34	12.95	61.06	55.36	21.23	11.51	21.56	28.30	10.57	13.69
757	28.18	33.58	6.82	8.95	37.72	6.48	21.56	23.38	46.57	39.92
758	19.34	3.10	25.57	25.70	34.28	23.08	15.21	0.70	32.20	1.20
759	40.76	5.78	7.58	3.16	26.20	15.70	4.98	2.12	17.30	4.45
760	5.92	0.94	8.66	4.98	12.34	0.58	1.44	0.45	17.56	9.28
761	4.76	6.34	15.56	13.73	24.92	31.85	19.13	18.88	69.47	38.98
762	12.39	4.62	24.15	17.96	24.98	12.90	6.29	3.19	11.36	13.44
763	17.93	13.97	6.23	1.59	10.69	8.97	6.15	2.51	18.05	11.17
764	4.89	1.58	1.86	2.62	4.19	5.92	0.45	0.36	1.36	1.12
765	3.83	4.79	0.00	0.00	1.20	1.59	0.28	0.13	8.15	7.46
766	2.08	1.15	0.71	0.98	0.74	0.12	0.89	1.24	1.96	2.00
767	2.05	1.27	1.31	1.25	0.66	0.93	0.75	0.14	1.78	1.58

Table 4. Roughhead grenadier survey biomass (t) by stratum in NAFO Div. 3NO: 2013-2017.
n.s. means stratum not surveyed.

Strata	2013	2014	2015	2016	2017	Strata	2013	2014	2015	2016	2017
353	0	0	0	0	0	725	51	32	85	23	76
354	0	0	0	0	0	726	179	71	160	113	217
355	0	0	0	0	0	727	188	25	150	124	374
356	0	0	8	0	0	728	109	155	82	62	223
357	32	0	0	2	2	752	54	249	160	232	302
358	18	0	46	3	3	753	360	113	537	191	601
359	0	0	0	5	5	754	897	335	1230	264	323
360	0	0	0	0	0	755	819	638	581	936	639
374	0	0	0	0	0	756	180	539	187	194	93
375	0	0	0	0	0	757	239	57	336	196	422
376	0	0	0	0	0	758	170	229	307	136	279
377	0	0	0	0	0	759	460	84	291	55	195
378	0	0	0	0	0	760	80	110	169	19	229
379	121	25	213	2	2	761	72	222	355	291	1006
380	79	56	303	53	53	762	242	448	463	119	210
381	64	0	0	0	0	763	411	140	245	143	401
382	0	0	0	0	0	764	46	14	33	4	12
721	2	0	0	1	1	765	43	0	13	3	90
722	59	4	3	32	32	766	27	9	9	11	25
723	73	31	106	39	39	767	30	19	9	10	25
724	114	18	69	54	54						

Table 5. Roughhead grenadier survey biomass (t) with SD and stratified mean catch per tow (kg) and SD by in NAFO Div. 3NO: 1997-2017.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Biomass	3340	6922	4357	7000	5568	4968	6860	11402	10064	10010	5760
SD	290	644	431	807	700	1365	1316	2043	1236	1716	695
MCPT	3.81	7.05	4.53	7.08	5.73	5.46	7.40	12.09	11.10	11.11	6.93
SD	0.31	0.61	0.45	0.85	0.77	1.51	1.42	2.17	1.38	1.89	0.83

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Biomass	7521	8193	5850	6219	8027	5220	3622	6149	3318	5935
SD	1028	286	1773	1508	1073	753	628	1134	496	750
MCPT	7.93	9.15	6.97	6.82	8.59	5.81	4.08	6.79	3.65	6.90
SD	1.11	0.40	2.10	1.61	1.18	0.85	0.70	1.25	0.54	0.84

Table 6. Roughhead grenadier length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2013-2017. E(x) means Error of the parameter x.

Males							Females						Total					
	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N
2013	0.11695	2.86549	0.0803	0.0318	0.996	478	0.1103	2.8903	0.0447	0.0155	0.998	982	0.1315	2.8331	0.0474	0.0169	0.998	1580
2014	0.16008	2.78188	0.1341	0.0552	0.985	352	0.1353	2.8351	0.0600	0.0210	0.997	661	0.1564	2.7873	0.0401	0.0145	0.998	1038
2015	0.18660	2.70917	0.1092	0.0443	0.989	613	0.1201	2.8665	0.0095	0.0274	0.999	998	0.1692	2.7542	0.0583	0.0210	0.996	1652
2016	0.13547	2.83036	0.0728	0.0284	0.998	340	0.1398	2.8252	0.0545	0.0191	0.997	595	0.1309	2.8465	0.0590	0.0214	0.996	947
2017	0.10115	2.94591	0.1296	0.0527	0.994	419	0.1120	2.8977	0.0667	0.0235	0.998	714	0.1260	2.8611	0.0455	0.0163	0.999	1181

Table 7. Roughhead grenadier mean number per tow by year in Spanish Spring Surveys in NAFO Div. 3NO: 1997-2017. Indet. means indeterminate.

	1997				1998				1999				2000				2001				2002			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	3.654	5.191	0.000	8.845	8.176	9.385	0.039	17.600	7.712	9.565	0.033	17.309	10.087	13.633	0.050	23.770	8.149	9.677	0.125	17.952	4.352	7.622	0.090	12.063
	2003				2004				2005				2006				2007				2008			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	8.655	11.875	0.108	20.638	11.623	16.579	0.763	28.964	9.762	15.641	0.403	25.807	8.775	13.935	0.152	22.862	5.432	8.365	0.744	14.541	5.260	8.890	0.073	14.223
	2009				2010				2011				2012				2013				2014			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	5.072	11.265	0.372	16.709	4.238	7.705	0.367	12.310	3.923	6.787	0.174	10.884	5.115	10.678	0.304	16.097	3.481	6.879	0.780	11.139	2.169	4.139	0.266	6.574
	2015				2016				2017															
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total												
MNPT	5.672	8.919	0.246	14.837	3.420	5.185	0.283	8.888	5.618	10.304	0.849	16.770												

Table 8. Roughhead grenadier mean number per tow by length class and year. Spanish Spring Survey in NAFO 3NO: 2013-2017. Indet. means indeterminate.

Length (cm.)	2013				2014				2015				2016				2017			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
1.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.008
2.5	0.000	0.000	0.026	0.026	0.005	0.000	0.008	0.013	0.006	0.000	0.039	0.045	0.000	0.000	0.028	0.028	0.000	0.000	0.157	0.157
3.5	0.032	0.018	0.606	0.656	0.010	0.005	0.171	0.185	0.042	0.000	0.186	0.227	0.000	0.000	0.070	0.070	0.023	0.008	0.415	0.447
4.5	0.007	0.008	0.075	0.091	0.008	0.000	0.064	0.072	0.029	0.015	0.015	0.059	0.046	0.010	0.040	0.096	0.036	0.079	0.139	0.254
5.5	0.060	0.054	0.031	0.144	0.044	0.035	0.023	0.102	0.199	0.143	0.006	0.348	0.157	0.237	0.119	0.513	0.342	0.374	0.074	0.791
6.5	0.152	0.121	0.038	0.310	0.134	0.125	0.000	0.259	0.558	0.471	0.000	1.029	0.182	0.268	0.026	0.476	0.272	0.369	0.006	0.647
7.5	0.039	0.078	0.000	0.117	0.024	0.017	0.000	0.041	0.258	0.242	0.000	0.501	0.136	0.144	0.000	0.280	0.244	0.395	0.000	0.640
8.5	0.247	0.328	0.004	0.580	0.125	0.050	0.000	0.175	0.715	0.649	0.000	1.363	0.168	0.186	0.000	0.353	0.323	0.695	0.000	1.017
9.5	0.195	0.364	0.000	0.559	0.100	0.072	0.000	0.172	0.366	0.420	0.000	0.786	0.253	0.267	0.000	0.520	0.146	0.362	0.000	0.508
10.5	0.212	0.238	0.000	0.450	0.135	0.186	0.000	0.321	0.180	0.243	0.000	0.423	0.211	0.308	0.000	0.518	0.325	0.611	0.008	0.945
11.5	0.167	0.284	0.000	0.452	0.108	0.146	0.000	0.254	0.264	0.277	0.000	0.541	0.171	0.188	0.000	0.359	0.444	0.604	0.000	1.048
12.5	0.212	0.317	0.000	0.530	0.094	0.124	0.000	0.218	0.209	0.345	0.000	0.554	0.184	0.211	0.000	0.394	0.456	0.739	0.000	1.195
13.5	0.178	0.295	0.000	0.473	0.175	0.144	0.000	0.319	0.330	0.342	0.000	0.673	0.227	0.202	0.000	0.430	0.412	0.547	0.038	0.996
14.5	0.237	0.314	0.000	0.551	0.134	0.176	0.000	0.309	0.337	0.389	0.000	0.727	0.234	0.407	0.000	0.641	0.320	0.430	0.013	0.762
15.5	0.211	0.287	0.000	0.498	0.203	0.162	0.000	0.365	0.323	0.549	0.000	0.872	0.269	0.280	0.000	0.550	0.496	0.485	0.000	0.981
16.5	0.330	0.437	0.000	0.767	0.237	0.250	0.000	0.487	0.394	0.459	0.000	0.853	0.296	0.296	0.000	0.591	0.373	0.445	0.000	0.818
17.5	0.430	0.361	0.000	0.791	0.194	0.215	0.000	0.409	0.401	0.321	0.000	0.721	0.307	0.270	0.000	0.577	0.538	0.425	0.000	0.963
18.5	0.275	0.361	0.000	0.636	0.144	0.248	0.000	0.392	0.475	0.413	0.000	0.888	0.221	0.307	0.000	0.528	0.382	0.442	0.000	0.824
19.5	0.219	0.339	0.000	0.558	0.127	0.261	0.000	0.389	0.272	0.455	0.000	0.727	0.125	0.246	0.000	0.370	0.222	0.407	0.000	0.628
20.5	0.122	0.368	0.000	0.490	0.078	0.118	0.000	0.196	0.142	0.461	0.000	0.603	0.104	0.199	0.000	0.303	0.111	0.294	0.000	0.405
21.5	0.058	0.318	0.000	0.376	0.051	0.228	0.000	0.279	0.084	0.373	0.000	0.457	0.067	0.152	0.000	0.219	0.079	0.269	0.000	0.348
22.5	0.039	0.244	0.000	0.283	0.028	0.230	0.000	0.258	0.045	0.387	0.000	0.432	0.029	0.169	0.000	0.197	0.015	0.336	0.000	0.351
23.5	0.015	0.212	0.000	0.226	0.000	0.209	0.000	0.209	0.020	0.280	0.000	0.300	0.000	0.132	0.000	0.132	0.025	0.431	0.000	0.456
24.5	0.030	0.217	0.000	0.247	0.000	0.139	0.000	0.139	0.011	0.331	0.000	0.342	0.008	0.144	0.000	0.153	0.000	0.378	0.000	0.378
25.5	0.005	0.192	0.000	0.197	0.000	0.192	0.000	0.192	0.007	0.289	0.000	0.296	0.007	0.122	0.000	0.130	0.000	0.253	0.000	0.253
26.5	0.000	0.193	0.000	0.193	0.000	0.111	0.000	0.111	0.000	0.279	0.000	0.279	0.003	0.091	0.000	0.094	0.013	0.243	0.000	0.256
27.5	0.000	0.203	0.000	0.203	0.010	0.133	0.000	0.143	0.000	0.192	0.000	0.192	0.000	0.084	0.000	0.084	0.000	0.196	0.000	0.196
28.5	0.000	0.148	0.000	0.148	0.000	0.157	0.000	0.157	0.000	0.170	0.000	0.170	0.018	0.099	0.000	0.117	0.013	0.165	0.000	0.178
29.5	0.010	0.208	0.000	0.218	0.000	0.136	0.000	0.136	0.005	0.123	0.000	0.128	0.000	0.027	0.000	0.027	0.000	0.076	0.000	0.076
30.5	0.000	0.112	0.000	0.112	0.000	0.124	0.000	0.124	0.000	0.100	0.000	0.100	0.000	0.029	0.000	0.029	0.000	0.101	0.000	0.101
31.5	0.000	0.093	0.000	0.093	0.000	0.059	0.000	0.059	0.000	0.088	0.000	0.088	0.000	0.049	0.000	0.049	0.000	0.056	0.000	0.056
32.5	0.000	0.053	0.000	0.053	0.000	0.056	0.000	0.056	0.000	0.065	0.000	0.065	0.000	0.015	0.000	0.015	0.000	0.009	0.000	0.009
33.5	0.000	0.054	0.000	0.054	0.000	0.021	0.000	0.021	0.000	0.013	0.000	0.013	0.000	0.020	0.000	0.020	0.000	0.040	0.000	0.040
34.5	0.000	0.035	0.000	0.035	0.000	0.010	0.000	0.010	0.000	0.013	0.000	0.013	0.000	0.015	0.000	0.015	0.000	0.014	0.000	0.014
35.5	0.000	0.005	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
36.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008
37.5	0.000	0.006	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.009	0.000	0.009	0.000	0.000	0.000	0.000
38.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
39.5	0.000	0.010	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.005
40.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.013
41.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	3.481	6.879	0.780	11.139	2.169	4.139	0.266	6.574	5.672	8.919	0.246	14.837	3.420	5.185	0.283	8.888	5.618	10.304	0.849	16.770
N° samples:				58				50				52				56				56
N° Ind.:	535	1051	131	1717	350	660	33	1043	877	1396	39	2312	520	809	45	1374	811	1543	136	2490
Sampled catch:				883				627				1013				546				985
Range:				2.5-39				2.5-34.5				2-37.5				2.5-37				1.5-40.5
Total catch:				885				630				1035				549				1074
Total hauls:				122				122				122				115				113

Table 9. Thorny skate mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2013-2017. n.s. means stratum not surveyed.

Stratum	2013		2014		2015		2016		2017	
	T. skate	T. skate	T. skate	T. skate	T. skate	T. skate	T. skate	T. skate	T. skate	T. skate
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
353	25.00	16.04	28.18	19.78	27.06	20.81	42.29	33.24	33.84	15.92
354	58.00	38.97	8.08	4.52	58.48	10.58	42.51	59.76	38.26	22.66
355	5.84	8.26	3.17	4.48	11.08	9.59	7.48	10.57	1.97	2.78
356	49.23	35.62	59.53	16.23	45.80	14.07	63.42	43.01	41.25	16.69
357	5.06	1.22	21.65	30.62	8.44	2.02	3.24	4.57	12.04	6.78
358	28.31	44.81	7.28	1.94	52.73	46.99	84.03	119.39	98.08	131.94
359	30.80	21.34	4.47	5.48	39.66	70.22	4.32	5.94	17.44	23.72
360	40.01	34.95	8.65	13.65	22.33	17.22	20.75	33.22	10.38	18.75
374	17.11	17.68	0.48	0.67	2.27	3.20	0.00	0.00	0.00	0.00
375	26.36	4.11	0.00	0.00	18.67	12.68	1.20	2.08	2.39	4.14
376	36.09	29.69	24.07	19.78	27.49	21.65	8.35	11.59	2.07	3.66
377	8.85	4.99	0.00	0.00	9.61	13.59	1.65	2.33	0.00	0.00
378	9.87	3.75	7.12	10.07	64.57	59.57	10.95	6.75	127.82	109.25
379	1.98	2.80	5.60	2.56	2.60	3.68	7.73	2.01	39.82	56.31
380	18.07	20.54	18.17	0.22	4.89	6.92	2.79	0.66	3.02	3.98
381	9.16	12.95	25.04	12.22	22.89	7.65	2.72	0.42	0.74	0.98
382	8.70	7.54	1.05	2.09	35.55	25.27	0.66	1.30	4.23	7.33
721	53.58	32.88	15.80	22.34	0.00	0.00	14.01	6.35	27.91	39.47
722	5.21	1.96	6.15	8.70	4.37	6.18	5.70	0.02	9.69	13.70
723	8.13	6.70	0.00	0.00	0.00	0.00	0.00	0.00	2.23	3.16
724	0.00	0.00	0.00	0.00	0.00	0.00	3.95	5.59	3.65	5.16
725	1.90	2.51	2.15	1.48	0.00	0.00	4.94	6.99	6.52	1.98
726	3.34	4.72	0.00	0.00	2.30	3.25	2.23	3.15	9.42	5.05
727	2.73	3.80	11.60	10.32	27.40	10.42	384.77	221.70	136.69	169.94
728	11.35	5.58	4.30	6.08	9.32	13.18	18.61	0.88	17.93	6.76
752	0.00	0.00	0.00	0.00	0.00	0.00	4.89	1.22	15.17	12.28
753	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
754	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
755	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
756	0.00	0.00	0.00	0.00	0.00	0.00	12.90	13.15	8.44	6.77
757	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
758	0.00	0.00	0.00	0.00	2.39	3.38	0.00	0.00	0.00	0.00
759	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
760	0.00	0.00	2.30	3.98	2.09	2.96	0.00	0.00	2.78	3.93
761	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	1.78
762	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
763	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
764	4.80	6.79	0.00	0.00	7.74	10.94	8.30	11.74	11.73	4.14
765	0.00	0.00	0.00	0.00	3.65	5.16	0.00	0.00	1.45	2.05
766	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
767	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 10. Thorny skate survey biomass (t) by stratum in NAFO Div. 3NO: 2013-2017. n.s. means stratum not surveyed.

Strata	2013	2014	2015	2016	2017	Strata	2013	2014	2015	2016	2017
353	578	600	544	958	759	725	17	18	0	45	56
354	1268	151	1107	909	793	726	22	0	14	14	58
355	38	18	62	48	13	727	23	86	234	3283	1147
356	206	210	169	265	167	728	76	27	65	127	122
357	70	271	119	46	170	752	0	0	0	54	168
358	566	126	1021	1681	1820	753	0	0	0	0	0
359	1095	145	1367	153	616	754	0	0	0	0	0
360	9483	1831	5262	4920	2402	755	0	0	0	0	0
374	315	8	42	0	0	756	0	0	0	116	74
375	595	0	445	27	53	757	0	0	0	0	0
376	4058	2425	3165	944	227	758	0	0	21	0	0
377	75	0	83	14	0	759	0	0	0	0	0
378	122	75	798	135	1504	760	0	29	29	0	36
379	17	47	24	72	346	761	0	0	0	0	18
380	152	133	41	23	25	762	0	0	0	0	0
381	108	279	279	34	9	763	0	0	0	0	0
382	247	28	1066	19	121	764	45	0	62	74	103
721	310	77	0	81	159	765	0	0	38	0	16
722	40	40	28	42	70	766	0	0	0	0	0
723	114	0	0	0	30	767	0	0	0	0	0
724	0	0	0	42	38						

Table 11. Thorny skate survey biomass (t) with SD and stratified mean catch per tow (kg) and SD in NAFO Div. 3NO: 1997-2017.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Biomass	9779	18875	35004	50521	34948	30072	20508	44429	40473	47415	22223
SD	1544	3114	3736	7991	10687	9699	2371	5281	6171	9207	2898
MCPT	11.57	20.41	40.79	57.86	39.23	33.69	22.27	49.46	45.69	55.81	28.10
SD	1.74	3.26	4.32	9.12	6.99	10.91	2.57	5.82	7.00	11.22	3.57

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Biomass	25946	19959	17887	10365	28867	19640	6624	16085	14126	11121
SD	2641	2745	3539	1193	3010	2280	1008	1777	2894	2283
MCPT	28.82	22.10	21.22	11.71	32.65	22.24	8.39	18.45	15.76	12.79
SD	2.92	3.13	4.11	1.32	3.38	2.63	1.26	2.02	3.21	2.68

Table 12. Thorny skate length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2013-2017. E(x) means Error of the parameter x.

	Males						Females						Indet.					
	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N
2013	0.01045	2.96645	0.0932	0.0231	0.996	357	0.00735	3.05973	0.1266	0.0315	0.994	359	0.00979	2.98369	0.0915	0.0229	0.996	716
2014	0.01493	2.89738	0.1439	0.0359	0.991	186	0.01202	2.94873	0.1055	0.0265	0.995	177	0.01218	2.94525	0.1019	0.0258	0.995	363
2015	0.01529	2.89416	0.0997	0.0247	0.996	339	0.01072	2.98652	0.1568	0.0395	0.989	322	0.01090	2.97680	0.0281	0.0258	0.994	661
2016	0.01210	2.93868	0.0676	0.0170	0.998	247	0.00891	3.01588	0.1109	0.0285	0.994	257	0.01018	2.98135	0.0630	0.0163	0.998	504
2017	0.01061	2.96788	0.1039	0.0266	0.998	308	0.00939	3.00615	0.0953	0.0245	0.998	286	0.01132	2.95483	0.0926	0.0236	0.998	594

Table 13. Thorny skate mean number per tow by year in Spanish Spring Surveys in NAFO Div. 3NO: 1997-2017. Indet. means indeterminate.

	1997				1998				1999				2000				2001				2002			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	4.803	5.892	0.000	10.695	7.158	7.649	0.000	14.808	11.173	11.271	0.029	22.472	13.760	14.185	0.000	27.945	8.996	10.572	0.000	19.568	9.903	11.540	0.005	21.448
	2003				2004				2005				2006				2007				2008			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	5.660	6.802	0.000	12.461	11.985	13.529	0.000	25.514	11.235	12.125	0.000	23.360	11.658	15.005	0.000	26.663	5.501	5.955	0.000	11.456	5.484	5.701	0.000	11.184
	2009				2010				2011				2012				2013				2014			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	4.218	3.999	0.000	8.217	5.689	6.037	0.000	11.726	1.811	1.598	0.000	3.410	5.801	5.470	0.000	11.271	4.193	3.782	0.000	7.975	1.753	1.904	0.000	3.657
	2015				2016				2017															
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total												
MNPT	3.419	3.378	0.000	6.798	3.528	3.493	0.000	7.020	3.708	3.452	0.000	7.160												

Height (cm)	2013				2014				2015				2016				2017			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total

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Table 15. White hake mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2013-2017. n.s. means stratum not surveyed.

Stratum	2013		2014		2015		2016		2017	
	White hake Mean catch	White hake SD	White hake Mean catch	White hake SD	White hake Mean catch	White hake SD	White hake Mean catch	White hake SD	White hake Mean catch	White hake SD
353	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
354	45.38	47.93	2.45	4.24	4.77	3.99	13.08	15.38	5.49	9.43
355	26.55	6.12	21.15	24.23	7.95	4.24	27.59	8.22	26.76	3.95
356	17.15	16.48	11.87	6.70	17.36	21.67	57.85	41.77	5.62	0.38
357	1.32	1.87	4.54	6.41	26.72	3.90	59.32	35.22	4.48	6.33
358	2.18	1.94	2.03	3.51	10.95	12.45	0.00	0.00	0.00	0.00
359	4.05	5.44	1.08	2.58	0.00	0.00	0.00	0.00	0.00	0.00
360	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
374	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
375	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
376	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
377	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
378	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
379	0.04	0.06	0.00	0.00	0.00	0.00	0.03	0.05	0.10	0.14
380	0.56	0.79	0.00	0.00	0.11	0.16	0.00	0.00	0.00	0.00
381	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
382	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
721	4.53	1.88	2.99	4.22	23.22	5.62	12.34	3.28	23.54	19.58
722	0.65	0.91	1.15	1.63	1.96	2.76	5.18	7.32	9.71	13.72
723	1.64	0.22	2.79	2.55	1.20	1.69	3.57	2.59	9.31	9.91
724	0.00	0.00	0.00	0.00	2.03	2.86	0.00	0.00	0.00	0.00
725	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.70	0.74	1.04
726	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28	1.80
727	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.17
728	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
752	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
753	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
754	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
755	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
756	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
757	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
758	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
759	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
760	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
761	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
762	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
763	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
764	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
765	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
766	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
767	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 16. White hake survey biomass (t) by stratum in NAFO Div. 3NO: 2013-2017. n.s. means stratum not surveyed.

Strata	2013	2014	2015	2016	2017	Strata	2013	2014	2015	2016	2017
353	0	0	0	0	0	725	0	0	0	11	4
354	992	46	90	280	380	726	0	0	0	0	3
355	175	119	45	176	289	727	0	0	0	0	8
356	72	42	64	242	14	728	0	0	0	0	0
357	18	57	377	837	21	752	0	0	0	0	0
358	44	35	212	0	0	753	0	0	0	0	0
359	144	35	0	0	0	754	0	0	0	0	0
360	0	0	0	0	0	755	0	0	0	0	0
374	0	0	0	0	0	756	0	0	0	0	0
375	0	0	0	0	0	757	0	0	0	0	0
376	0	0	0	0	0	758	0	0	0	0	0
377	0	0	0	0	0	759	0	0	0	0	0
378	0	0	0	0	0	760	0	0	0	0	0
379	0	0	0	0	4	761	0	0	0	0	0
380	5	0	1	0	0	762	0	0	0	0	0
381	0	0	0	0	0	763	0	0	0	0	0
382	0	0	0	0	0	764	0	0	0	0	0
721	26	15	126	71	40	765	0	0	0	0	0
722	5	7	13	38	14	766	0	0	0	0	0
723	23	33	16	49	34	767	0	0	0	0	0
724	0	0	21	0	0						

Table 17. White hake survey biomass (t) with SD and stratified mean catch per tow (kg) and SD by in NAFO Div. 3NO: 2001-2017.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Biomass	3498	1784	688	940	2082	1073	440	74	610
SD	1107	389	224	464	1270	407	94	46	73
MCPT	5.13	2.03	0.75	1.03	2.34	1.26	0.56	0.08	0.61
SD	1.87	0.43	0.24	0.52	1.44	0.48	0.12	0.05	0.08

Year	2010	2011	2012	2013	2014	2015	2016	2017
Biomass	293	822	784	1503	389	965	1704	813
SD	117	361	308	613	131	182	425	199
MCPT	0.34	0.91	0.86	1.64	0.49	1.12	1.90	0.80
SD	0.14	0.40	0.34	0.67	0.17	0.19	0.47	0.22

Table 18. White hake length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2013-2017. E(x) means Error of the parameter x. In 2017 the individuals were not sexed.

	Males						Females						Indet.					
	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N	a	b	E(a)	E(b)	R2	N
2013	0.00336	3.19379	0.1347	0.0358	0.995	100	0.00157	3.38530	0.1715	0.0438	0.992	110	0.00237	3.28346	0.1089	0.0290	0.996	210
2014	0.01681	2.79697	0.7591	0.1920	0.902	50	0.00169	3.39285	0.7146	0.1792	0.973	19	0.01320	2.85934	0.6838	0.1732	0.901	69
2015	0.00395	3.16657	0.1709	0.0440	0.995	45	0.00156	3.40183	0.1500	0.0371	0.996	43	0.00209	3.33109	0.1172	0.0295	0.996	89
2016	0.00279	0.15016	3.2451	0.0398	0.997	89	0.00409	0.22876	3.1684	0.0552	0.995	72	0.00252	0.11825	3.2787	0.0300	0.998	161
2017	-	-	-	-	-	-	-	-	-	-	-	-	0.00271	3.26606	0.1185	0.0306	0.997	150

Table 19. White hake mean number per tow by year in Spanish Spring Surveys in NAFO Div. 3NO: 2001-2017. Indet. means indeterminate. In 2011 and 2017 the individuals were not sexed.

	2001				2002				2003				2004				2005				2006			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	5.462	4.544	0.015	10.022	1.511	1.091	0.000	2.602	0.387	0.295	0.000	0.682	0.480	0.447	0.000	0.927	0.953	0.579	0.000	1.532	0.512	0.172	0.000	0.684
	2007				2008				2009				2010				2011				2012			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
MNPT	0.115	0.161	0.000	0.275	0.025	0.012	0.000	0.037	0.184	0.208	0.002	0.394	0.078	0.085	0.000	0.162	0.000	0.000	0.882	0.882	0.676	0.418	0.000	1.094
	2013				2014				2015				2016				2017							
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total				
MNPT	0.877	0.891	0.000	1.768	0.272	0.117	0.000	0.389	0.239	0.252	0.017	0.508	0.624	0.474	0.000	1.098	0.000	0.000	0.932	0.932				

Table 20. White hake mean number per tow by length class and year. Spanish Spring Survey in NAFO 3NO: 2013-2017. Indet. means indeterminate. In 2017 the individuals were not sexed.

Length (cm)	2013				2014				2015				2016				2017			
	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.008	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.016	0.000	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.016	0.008	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.018	0.000	0.000	0.018	0.000	0.000	0.008	0.008
18	0.047	0.000	0.000	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.018	0.000	0.036	0.000	0.000	0.024	0.024
20	0.059	0.019	0.000	0.078	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.003	0.027	0.018	0.000	0.045	0.000	0.000	0.118	0.118
22	0.070	0.047	0.000	0.117	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.007	0.040	0.000	0.000	0.040	0.000	0.000	0.213	0.213
24	0.064	0.094	0.000	0.158	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.005	0.008	0.000	0.000	0.008	0.000	0.000	0.102	0.102
26	0.031	0.036	0.000	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.005	0.003	0.000	0.000	0.003	0.000	0.000	0.031	0.031
28	0.000	0.009	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.000	0.000	0.018	0.000	0.000	0.020	0.020
30	0.012	0.012	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.009	0.000	0.000	0.009	0.000	0.000	0.020	0.020
32	0.008	0.000	0.000	0.008	0.004	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.050	0.000	0.000	0.050	0.000	0.000	0.026	0.026
34	0.016	0.000	0.000	0.016	0.016	0.000	0.000	0.016	0.003	0.000	0.000	0.003	0.014	0.000	0.000	0.014	0.000	0.000	0.015	0.015
36	0.016	0.016	0.000	0.031	0.008	0.000	0.000	0.008	0.006	0.012	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.023
38	0.042	0.019	0.000	0.061	0.000	0.000	0.000	0.000	0.013	0.006	0.000	0.019	0.020	0.000	0.000	0.020	0.000	0.000	0.019	0.019
40	0.013	0.016	0.000	0.028	0.012	0.016	0.000	0.028	0.012	0.005	0.000	0.017	0.016	0.000	0.000	0.016	0.000	0.000	0.029	0.029
42	0.048	0.042	0.000	0.090	0.008	0.016	0.000	0.024	0.000	0.000	0.000	0.000	0.019	0.003	0.000	0.023	0.000	0.000	0.019	0.019
44	0.077	0.024	0.000	0.101	0.013	0.002	0.000	0.016	0.007	0.014	0.000	0.022	0.039	0.003	0.000	0.042	0.000	0.000	0.030	0.030
46	0.051	0.045	0.000	0.096	0.010	0.014	0.000	0.024	0.008	0.008	0.000	0.016	0.020	0.017	0.000	0.037	0.000	0.000	0.006	0.006
48	0.041	0.040	0.000	0.082	0.026	0.012	0.000	0.038	0.006	0.017	0.000	0.024	0.012	0.015	0.000	0.027	0.000	0.000	0.018	0.018
50	0.058	0.072	0.000	0.130	0.036	0.000	0.000	0.036	0.010	0.003	0.000	0.014	0.026	0.014	0.000	0.040	0.000	0.000	0.014	0.014
52	0.065	0.059	0.000	0.124	0.016	0.000	0.000	0.016	0.005	0.010	0.000	0.015	0.038	0.035	0.000	0.073	0.000	0.000	0.008	0.008
54	0.020	0.077	0.000	0.097	0.016	0.006	0.000	0.022	0.015	0.000	0.000	0.015	0.040	0.016	0.000	0.056	0.000	0.000	0.021	0.021
56	0.021	0.042	0.000	0.062	0.025	0.007	0.000	0.033	0.014	0.002	0.000	0.016	0.037	0.030	0.000	0.067	0.000	0.000	0.006	0.006
58	0.023	0.038	0.000	0.061	0.018	0.003	0.000	0.021	0.013	0.000	0.000	0.013	0.024	0.020	0.000	0.044	0.000	0.000	0.027	0.027
60	0.020	0.027	0.000	0.047	0.028	0.002	0.000	0.031	0.060	0.007	0.000	0.067	0.044	0.012	0.000	0.056	0.000	0.000	0.000	0.000
62	0.010	0.016	0.000	0.026	0.000	0.000	0.000	0.000	0.021	0.022	0.000	0.043	0.028	0.033	0.000	0.061	0.000	0.000	0.012	0.012
64	0.000	0.027	0.000	0.027	0.024	0.013	0.000	0.037	0.023	0.002	0.000	0.026	0.003	0.020	0.000	0.023	0.000	0.000	0.008	0.008
66	0.015	0.008	0.000	0.023	0.004	0.020	0.000	0.023	0.000	0.008	0.000	0.008	0.019	0.018	0.000	0.037	0.000	0.000	0.008	0.008
68	0.002	0.014	0.000	0.017	0.002	0.000	0.000	0.002	0.009	0.003	0.000	0.012	0.008	0.010	0.000	0.018	0.000	0.000	0.018	0.018
70	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.024	0.000	0.024	0.000	0.010	0.000	0.010	0.000	0.000	0.007	0.007
72	0.005	0.011	0.000	0.017	0.000	0.000	0.000	0.000	0.008	0.004	0.000	0.012	0.018	0.010	0.000	0.028	0.000	0.000	0.007	0.007
74	0.003	0.000	0.000	0.003	0.000	0.002	0.000	0.002	0.000	0.024	0.000	0.024	0.000	0.011	0.000	0.011	0.000	0.000	0.018	0.018
76	0.000	0.011	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
78	0.000	0.016	0.000	0.016	0.006	0.000	0.000	0.006	0.000	0.008	0.000	0.008	0.008	0.014	0.000	0.021	0.000	0.000	0.002	0.002
80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.061	0.000	0.061	0.000	0.000	0.016	0.016
82	0.000	0.023	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.019	0.000	0.019	0.000	0.057	0.000	0.057	0.000	0.000	0.007	0.007
84	0.000	0.008	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.018	0.000	0.018	0.000	0.000	0.016	0.016
86	0.000	0.008	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
88	0.000	0.008	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.002	0.000	0.002	0.000	0.000	0.003	0.003
92	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.012
94	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	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	0.000	0.000	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	0.002	0.000	0.002	0.000	0.008	0.000	0.008	0.000	0.000	0.003	0.003
100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	0.877	0.891	0.000	1.768	0.272	0.117	0.000	0.389	0.239	0.252	0.017	0.508	0.624	0.474	0.000	1.098	0.000	0.000	0.932	0.932
Nº samples:				20				12				18				15				16
Nº Ind.:	145	139	0	284	54	23	0	77	44	46	3	93	127	89	0	216	0	0	181	181
Sampled catch:				274				109				192				369				180
Range:				13-89				33-79				15-100				16-98				17-92
Total catch:				276				110				208				373				180
Total hauls:				122				122				122				115				113

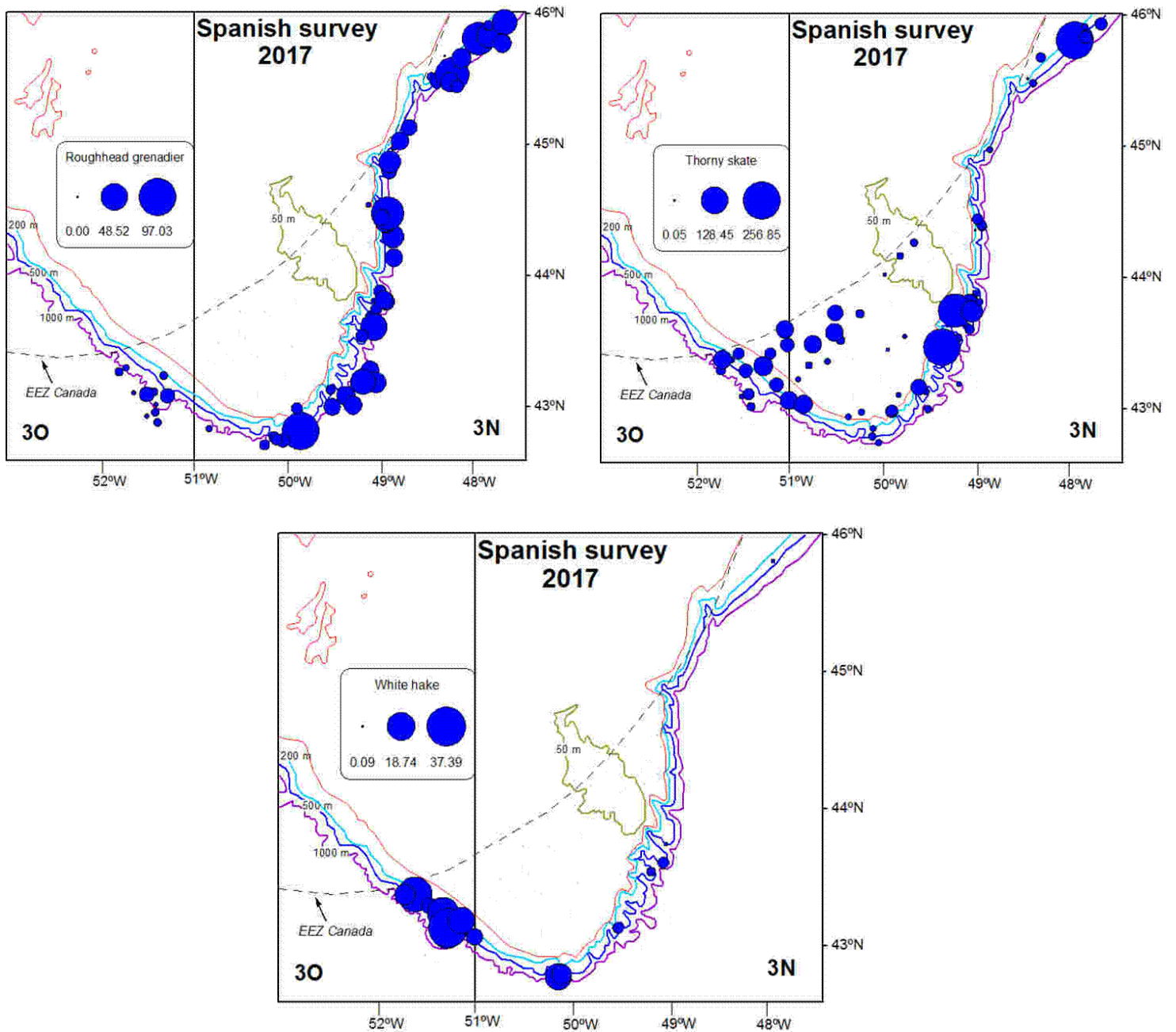


Fig. 1. Position of the hauls and the catch of roughhead grenadier, thorny skate and white hake during the 2017 Spanish 3NO survey. Note that the scale is different in the three graphs.

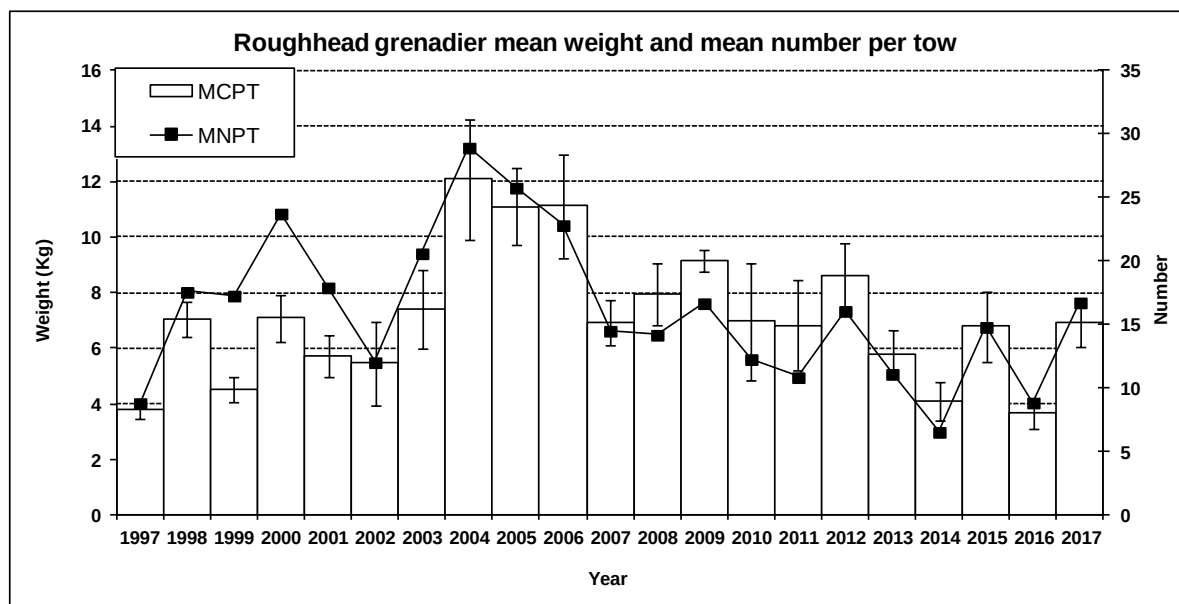


Fig. 2. Roughhead grenadier stratified mean catches in Kg and $\pm$ SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2017.

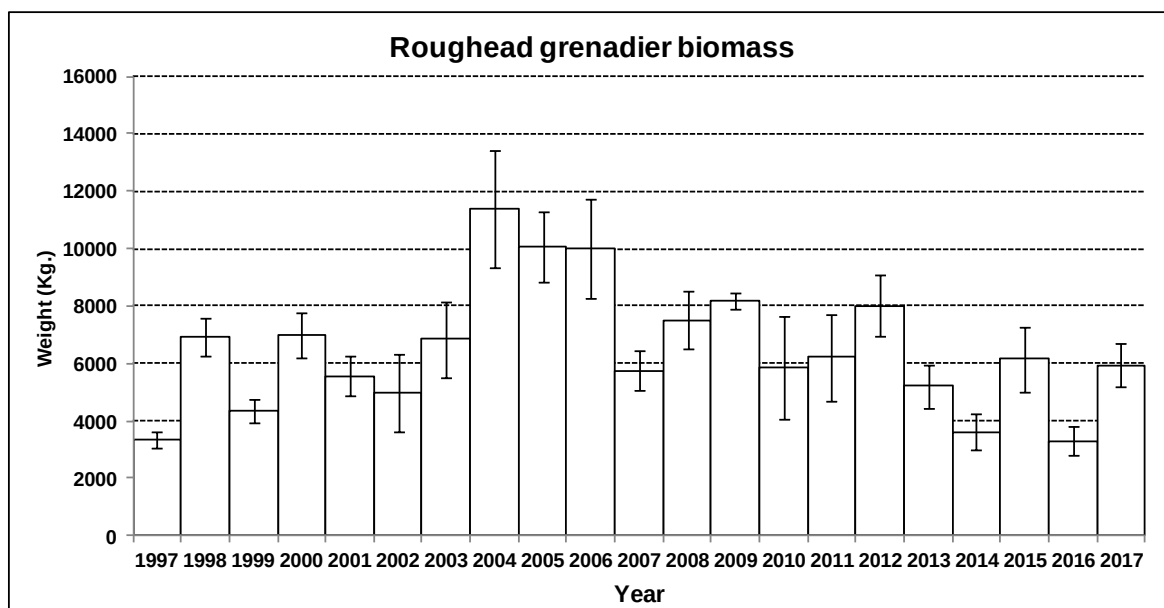


Fig. 3. Roughhead grenadier biomass calculated by the swept area method in tons and $\pm$ SD by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2017.

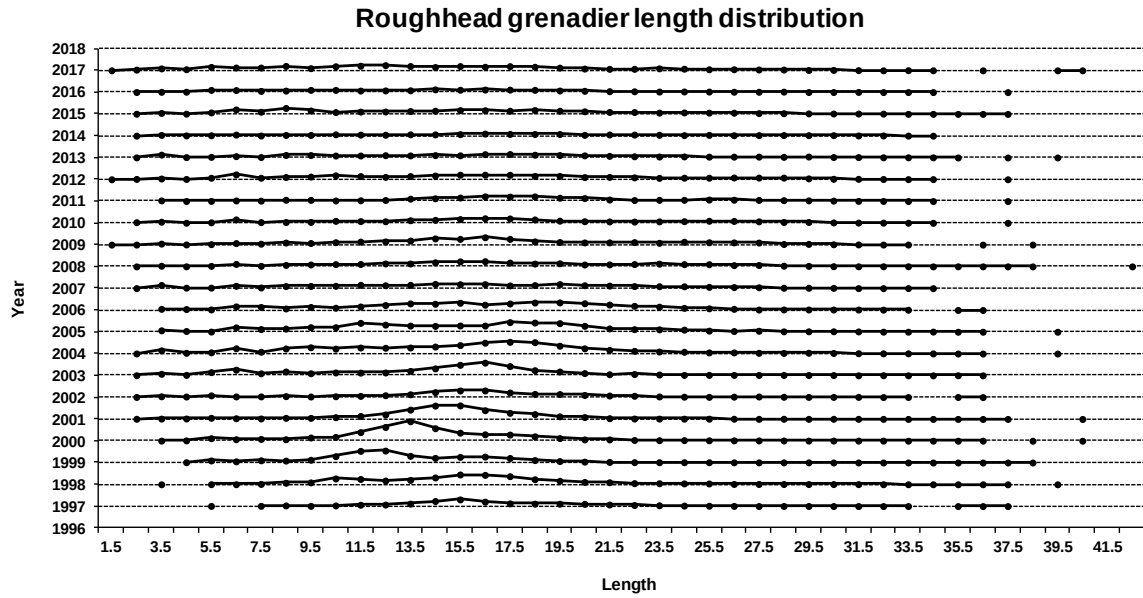


Fig. 4. Roughhead grenadier mean catches per tow length distribution (cm) on NAFO 3NO: 1997-2017. Data from 2013 to 2017 are in Table 8; data for 1997-2012 can be seen in SCR Doc 13/12.

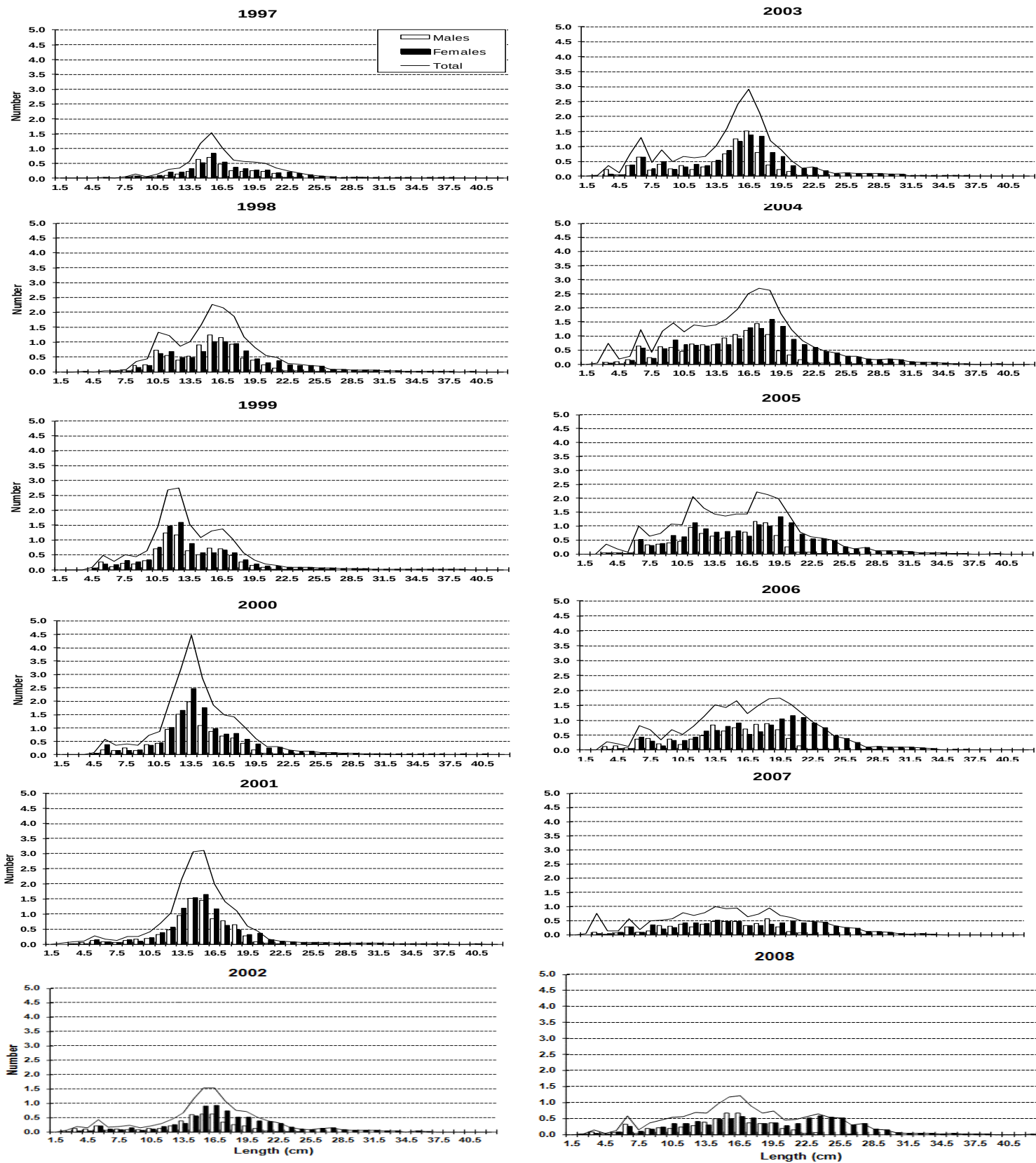


Fig. 5. Roughhead grenadier length distribution (cm) on NAFO 3NO: 1997-2017. Mean catches per tow number. Data from 2013 to 2017 are in Table 8; data for 1997-2012 can be seen in SCR Doc 13/12.

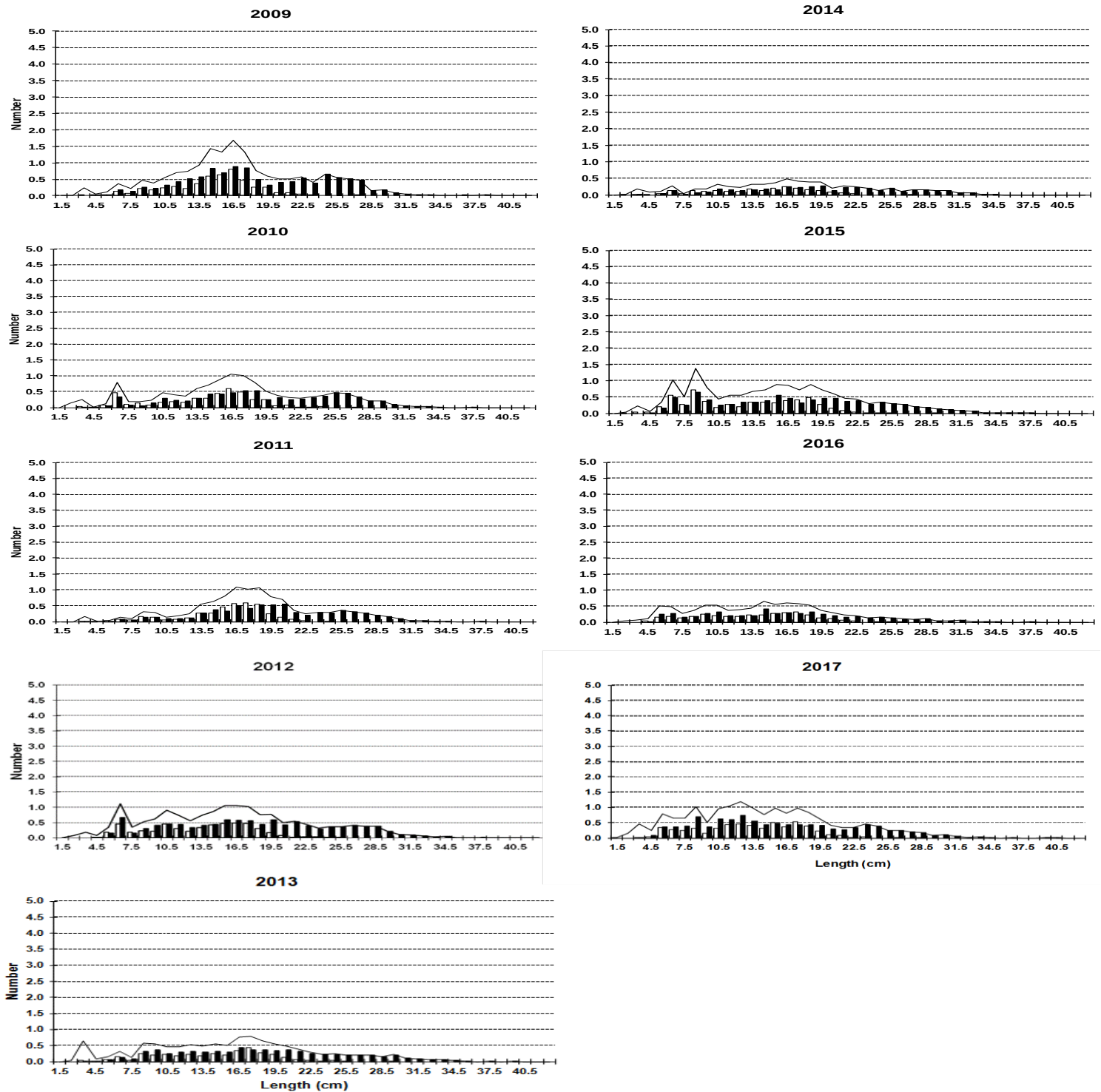


Fig. 5 (cont.). Roughhead grenadier length distribution (cm) on NAFO 3NO: 1997-2017. Mean catches per tow number. Data from 2013 to 2017 are in Table 8; data for 1997-2012 can be seen in SCR Doc 13/12.

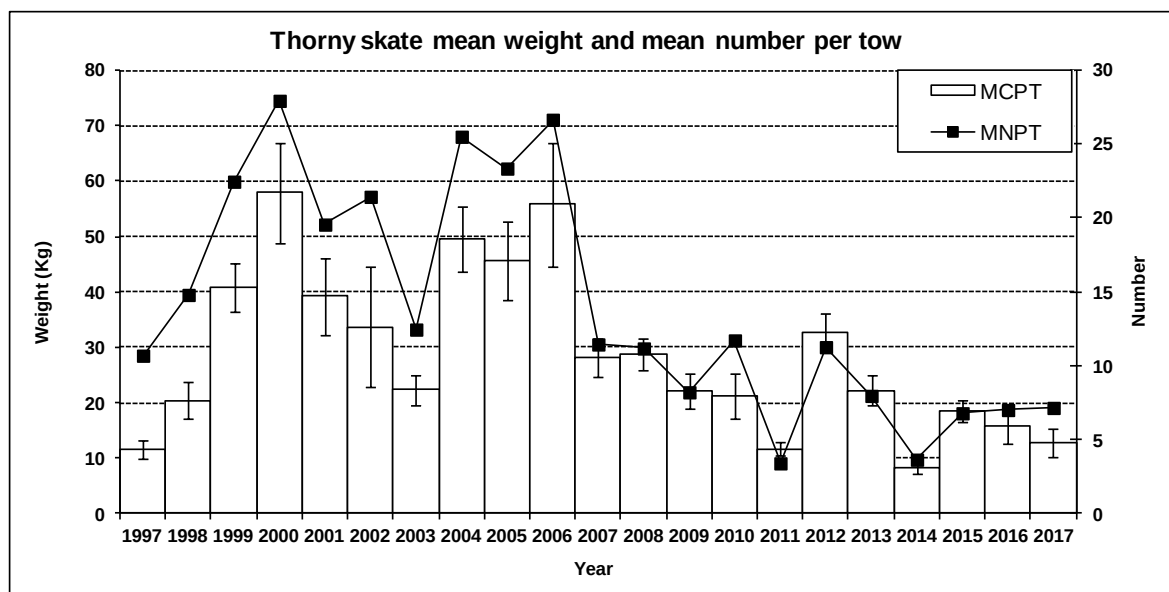


Fig. 6. Thorny skate stratified mean catches in Kg and $\pm$ SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2017.

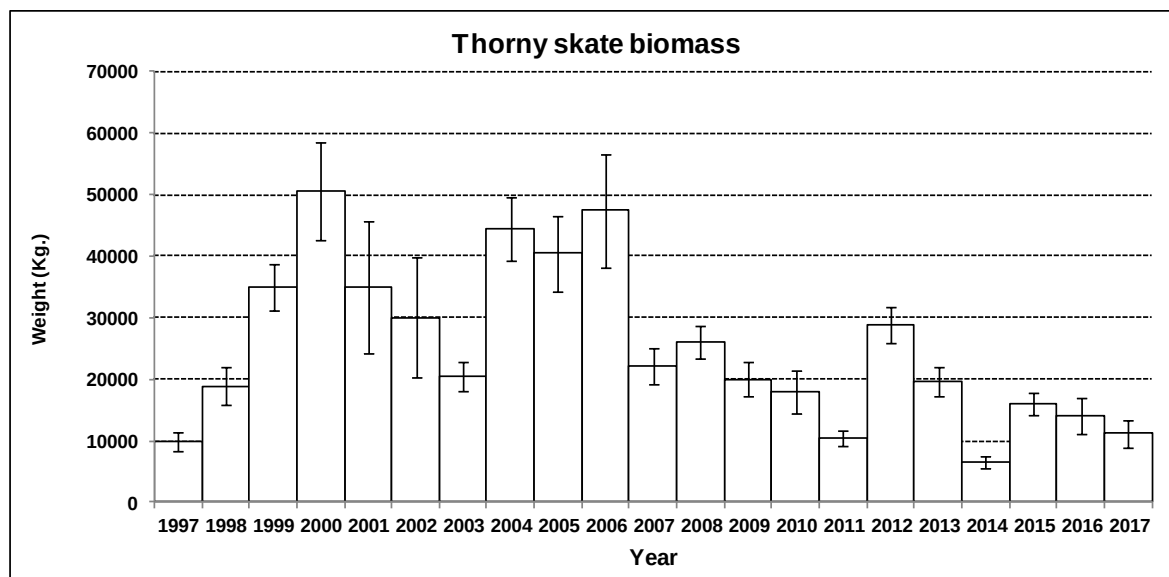


Fig. 7. Thorny skate biomass calculated by the swept area method in tons and $\pm$ SD by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2017.

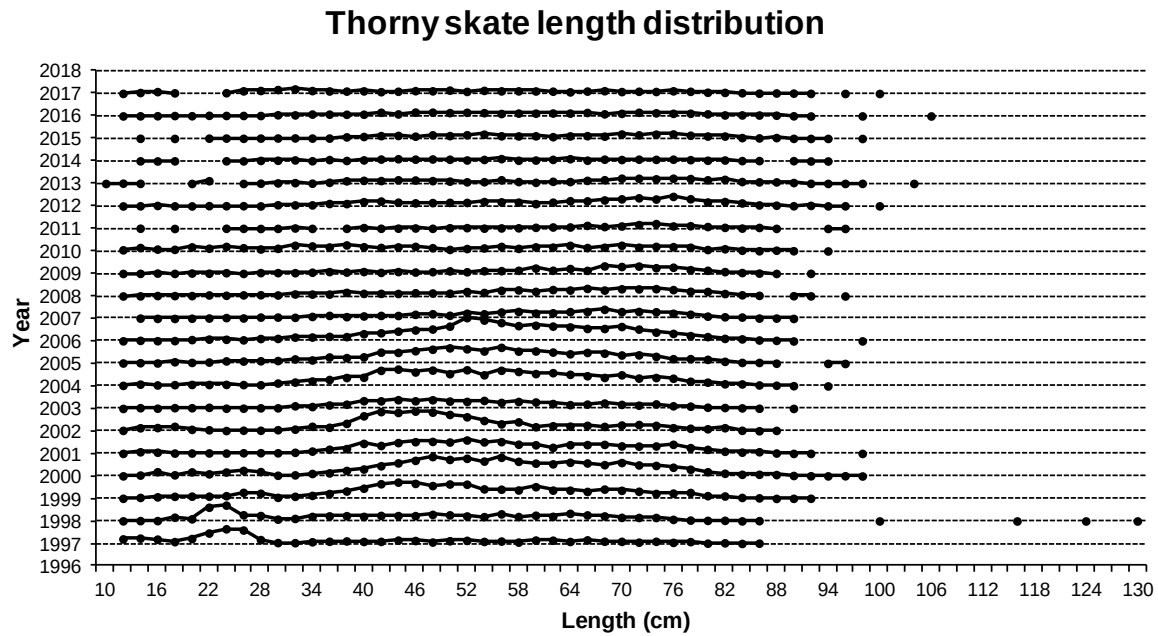


Fig.8. Thorny skate mean catches per tow length distribution (cm) on NAFO 3NO: 1997-2017. Data from 2013 to 2017 are in Table 14; data for 1997-2012 can be seen in SCR Doc 13/12.

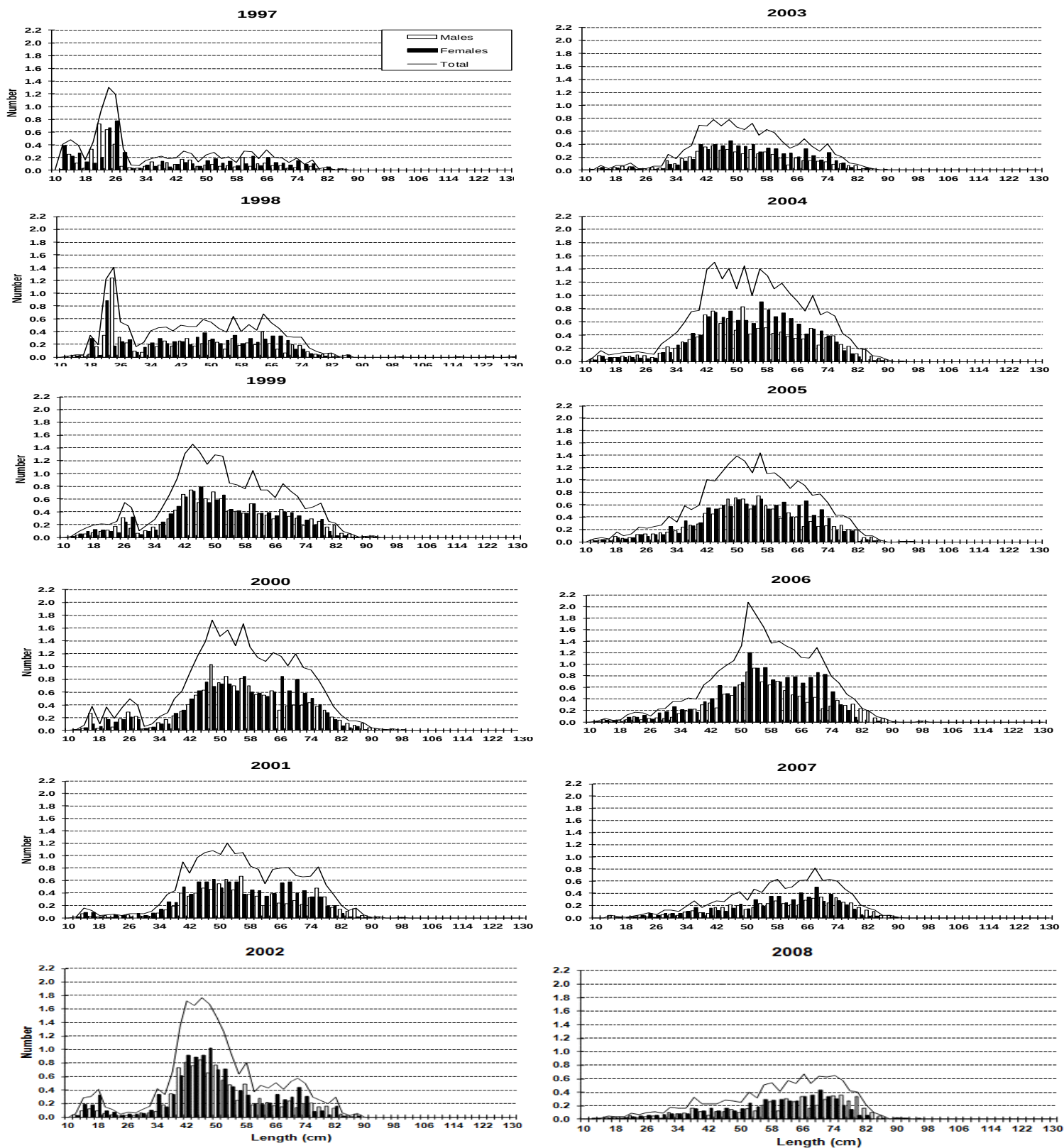


Fig. 9. Thorny skate length distribution (cm) on NAFO 3NO: 1997-2017. Mean catches per tow number. Data from 2013 to 2017 are in Table 14; data for 1997-2012 can be seen in SCR Doc 13/12.

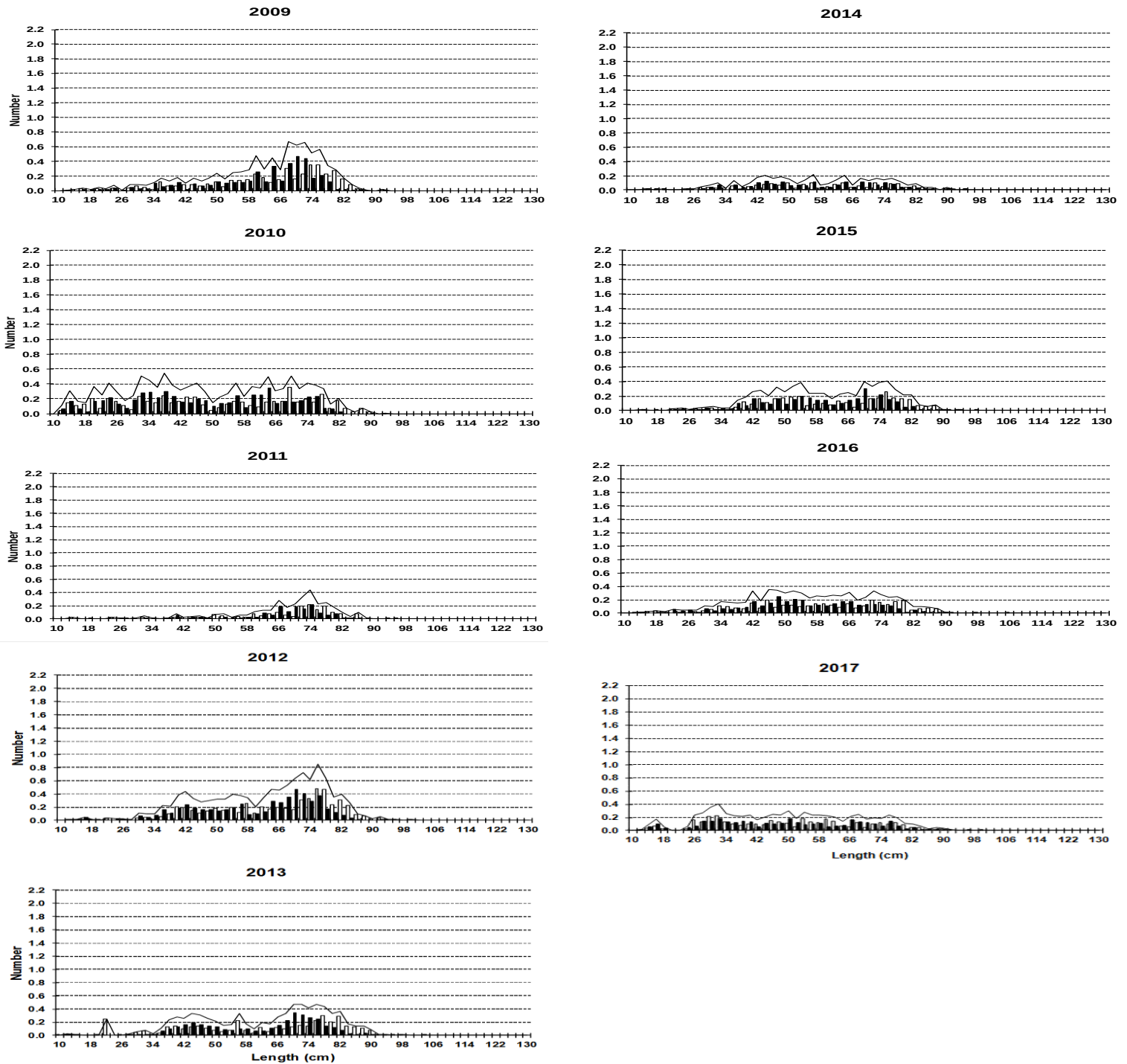


Fig. 9 (cont.). Thorny skate length distribution (cm) on NAFO 3NO: 1997-2017. Mean catches per tow number. Data from 2013 to 2017 are in Table 8; data for 1997-2012 can be seen in SCR Doc 13/12.

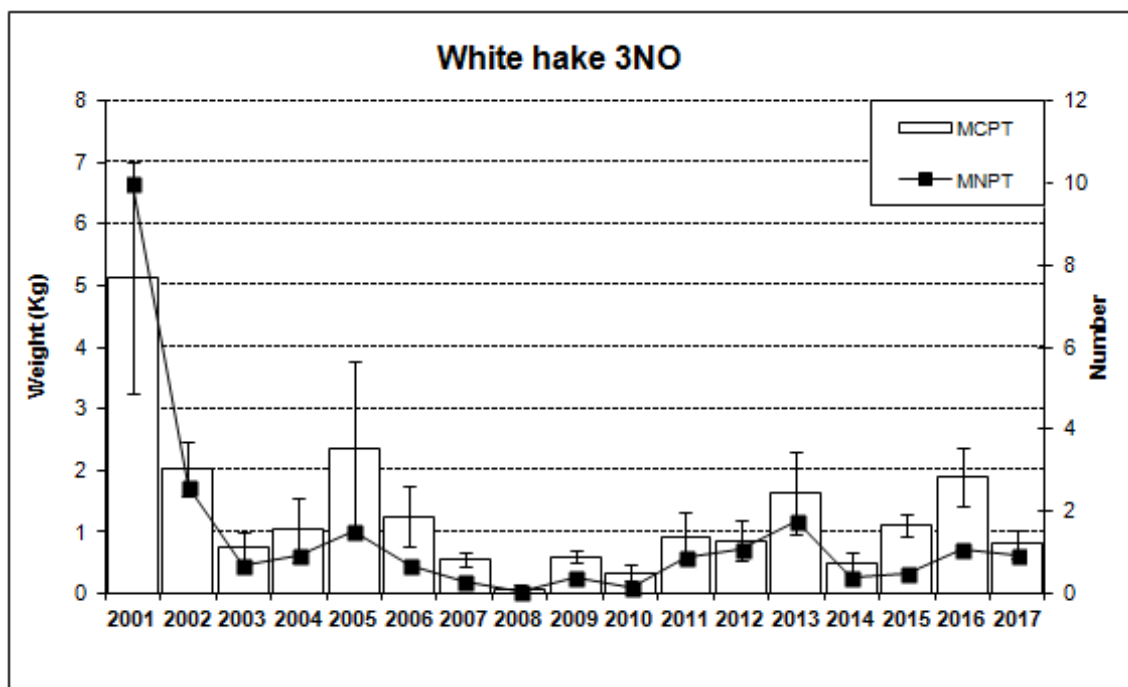


Fig. 10. White hake stratified mean catches in Kg and $\pm$ SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 2001-2017.

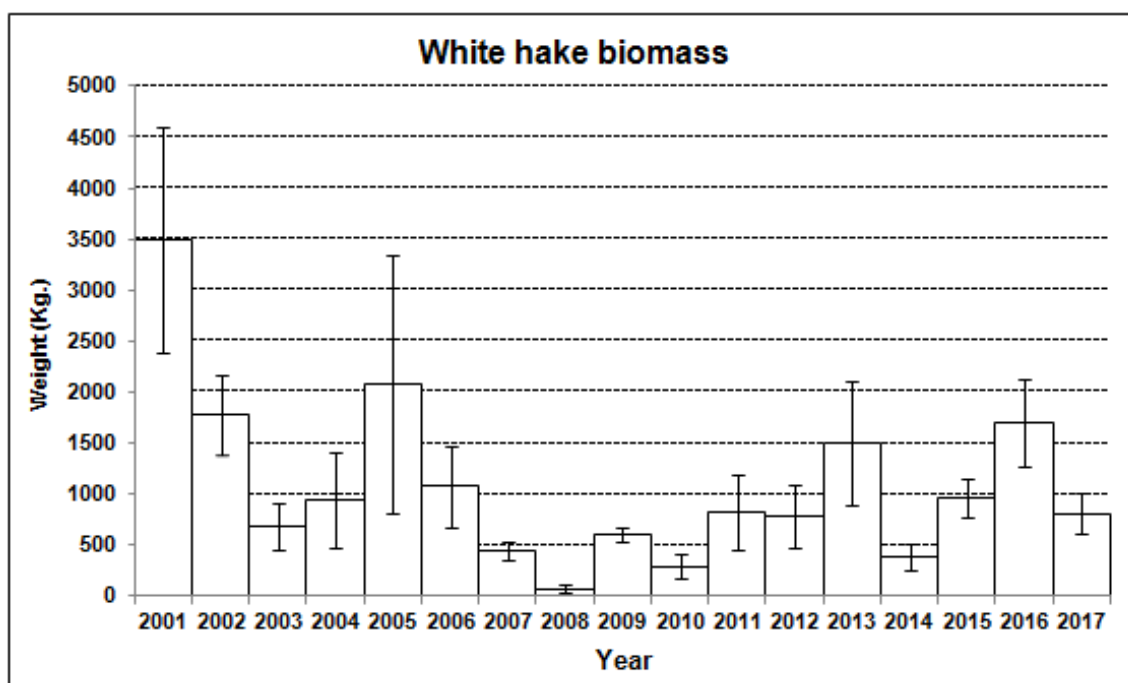


Fig. 11. White hake biomass calculated by the swept area method in tons and $\pm$ SD by year. Spanish Spring surveys in NAFO Div. 3NO: 2001-2017.

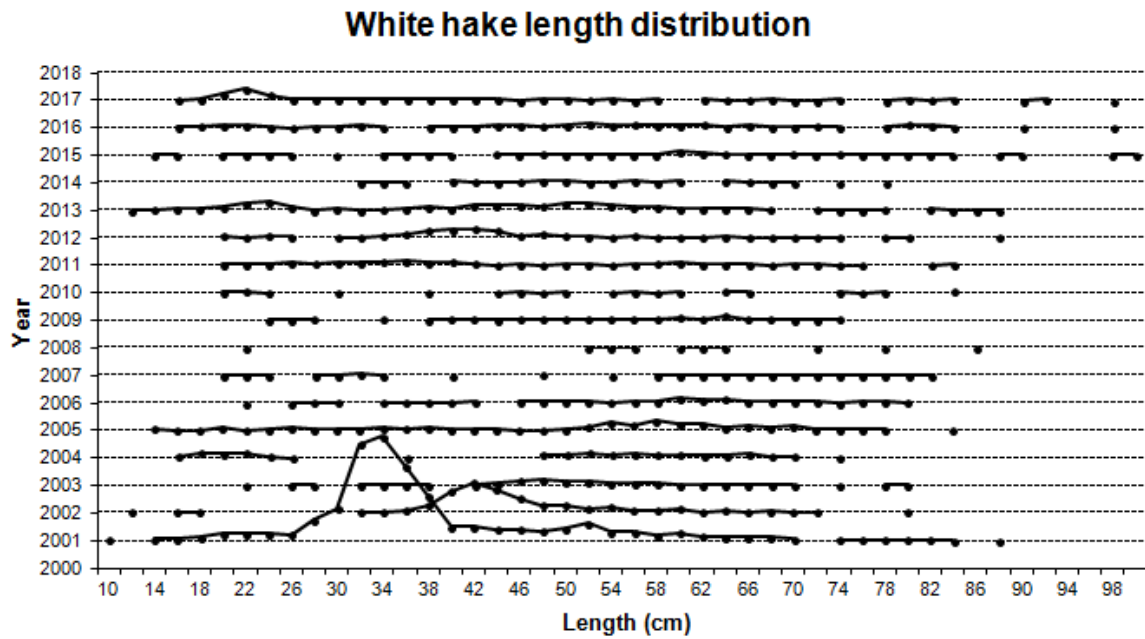


Fig. 12. White hake mean catches per tow length distribution (cm) on NAFO 3NO: 2001-2017. Data from 2013 to 2017 are in Table 20; data for 2001-2012 can be seen in SCR Doc 13/12.

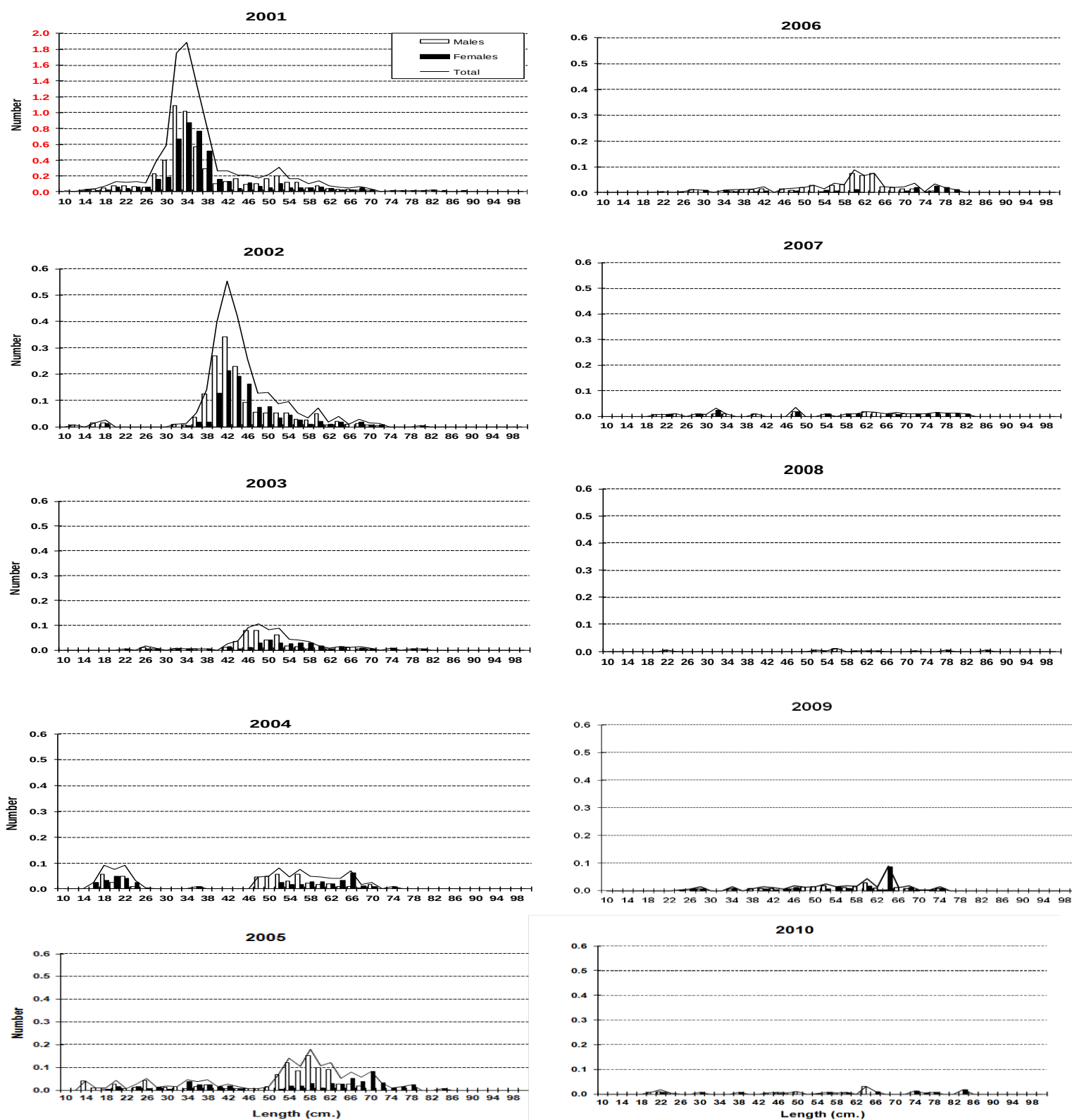


Fig.13. White hake length distribution (cm) on NAFO 3NO: 2001-2017. Mean catches per tow number. Data from 2013 to 2017 are in Table 20; data for 2001-2012 can be seen in SCR Doc 13/12. In 2011 and 2017 the individuals were not sexed.

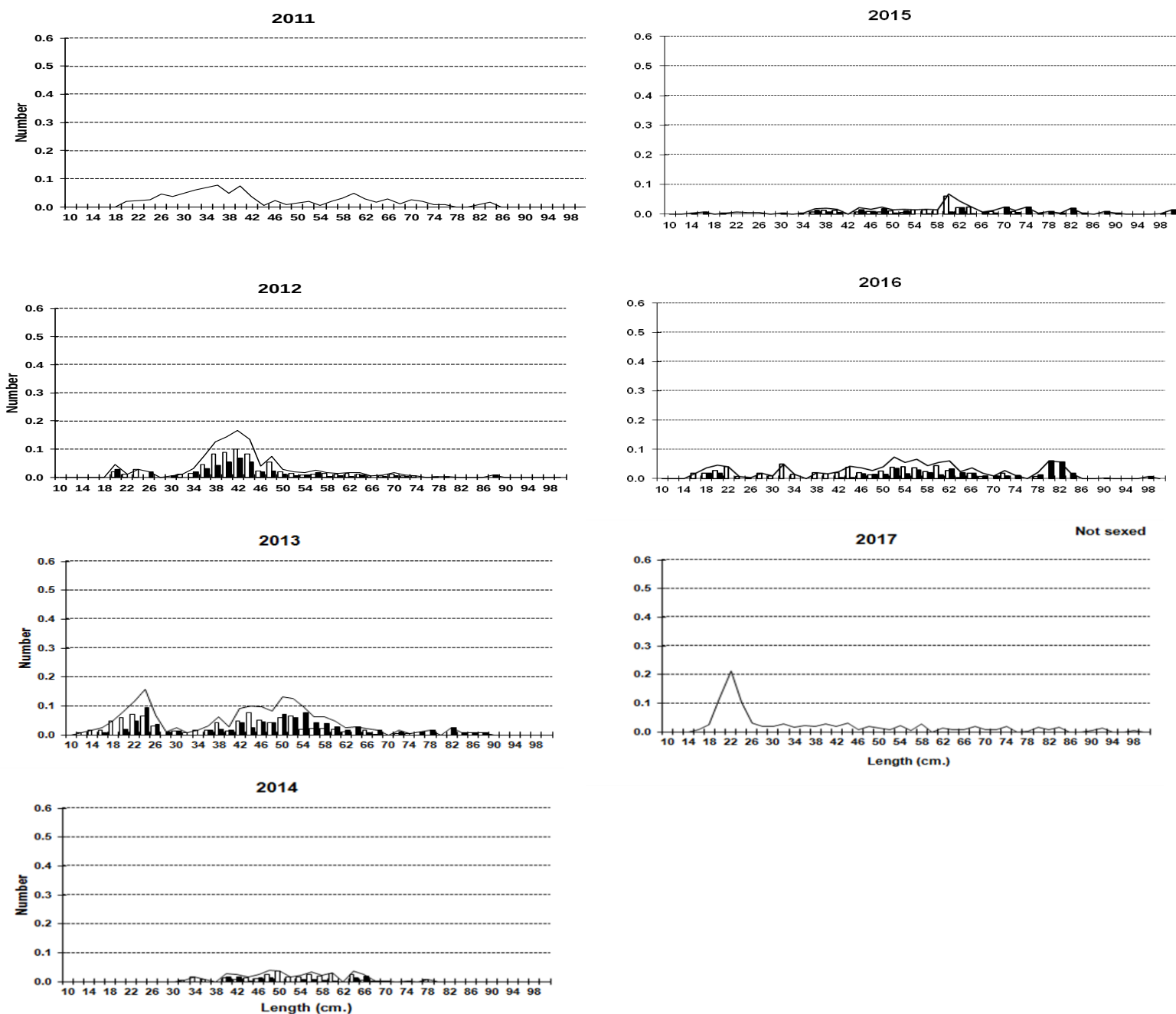


Fig. 13 (cont.). White hake length distribution (cm) on NAFO 3NO: 2001-2017. Mean catches per tow number. Data from 2013 to 2017 are in Table 20; data for 2001-2012 can be seen in SCR Doc 13/12. In 2011 and 2017 the individuals were not sexed.