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

by

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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 1997-2018 and for white hake for the period 2001-2018. The length distribution is presented as numbers per haul stratified mean catches for the last five years (2014-2018). The roughhead grenadier indices showed no discernible trend during the whole series, reaching a maximum in 2004 and a minimum in 2018. 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, being around 34 cm in 2018. The estimated biomass of squid is inconstant and very low in general. There were no catches of squid during the 2002 and 2013-2015 surveys. In 2018, a step increase in biomass was observed during the survey, being 5.5 times the second value of the series in 2011. Unfortunately, length samples were taken only in 2011 and 2017. The lengths range between 8.5 and 18.5 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 Menduíña*, 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 1997-2018 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). 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 (2014-2018) are presented in Table 2. To know the results of the rest of the years, see González-Troncoso *et al.* (2014).

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. Measures of squid are of the total body in 0.5 cm intervals to the inferior 0.5 cm. This paper presents the 1997-2018 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. Squid indices are presented since 2002 as no calibration was made for this species.

The indices are presented for each species but squid, transformed until 2000 and no-transformed for the period 2002-2018. 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 2014-2018. To see the results of the rest of the years, see González-Troncoso *et al.* (2014). 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).

In the case of squid, only total biomass and length distribution in total numbers (abundance) are presented for 2002-2018.

Figure 1 presents the maps with the distribution of the catches of the four species during the 2018 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 2013-2016, the information from the surveys in the area of the different indices is contradictory. In 2017 all indices, except the EU 3L, show an increase with respect to 2016 (NAFO, 2018).

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 2014-2018. Total biomass and stratified mean catches and SD by year are presented in Table 5 for 1997-2018. 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, 2016 and 2018 (Table 5; Figures 2 and 3). Same trend was found for mean catches.

Length Distribution

Table 7 and Figures 4 and 5 present the mean number for 1997-2018, and Table 8 the same index by length besides the sampled size and catch for the period 2014-2018. 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 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. Recruitment in 2017 was above average (NAFO, 2018).

Mean Catches and Biomass

Mean catch and SD per stratum are presented in Table 9 for 2014-2018, 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 2014-2018 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 stables 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 1997-2018 is shown in Table 13 and Figure 8. Length distribution by sex and year, sample size and catch for the period 2014-2018 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, 2018).

Mean catches and biomass

Mean catch and SD per stratum are presented in Table 15 for years 2014-2018. 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 2001-2018. 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 2014-2018 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 2001-2018. 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 2014-2018. 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. Some smaller individuals, between 8 and 12 cm, were presented in 2018. 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, being around 34 cm in 2018. The mean number presents the same trend as the mean catch (Figures 12 and 13).

Squid

The species has a lifespan of less than one year and is considered a single stock. Since 1999, there has been no directed fishery in Subarea 4 and there were no catches in Subarea 3 during 2013-2015. The highest catch since 1999 occurred during 2006, when 20.5% (6 982 t) of the current quota of 34 000 t was harvested, but since 2007 only 0.04% to 2.1% of the quota has been harvested each year. Biomass indices from the July Div. 4VWX surveys have been below the 1982-2016 mean since 2010, but increased in 2017 (16.1 kg per tow) to the second highest level of the time series and was 22% higher than the high productivity period average (13.2 kg per tow during 1976-1981). The high increase in the biomass index during 2017 did not translate into similarly high catches in the Subarea 3 fishery and catch/biomass ratios have been well below the 1982-2016 low productivity period average since 2004. If the post-1981 episodic trend holds, persistence of the high biomass and mean body weight indices are unlikely in 2018. Regardless, the Subarea 3 fishery only harvested a minor percentage (1.1%) of the 2017 quota despite the very high biomass index (NAFO, 2018).

Biomass

The estimated biomass of squid during the survey is shown in Table 21 and Figure 14, and is inconstant and very low in general. There were no catches of squid during the 2002 and 2013-2015 surveys, and in 2016 an unique catch of 8 grams in one haul led to a total biomass of 36 Kg. Before 2018, the highest biomass are in 2004 and 2011. In 2018, a step increase in biomass was observed during the survey, being 5.5 times the second value of the series in 2011.

Length distribution

Table 22 and Figure 15 present the total abundance in thousands for the years in which sampled were taken. Unfortunately, samples were taken only in 2011 and 2017. The lengths range between 8.5 and 18.5 cm. The mode in 2011 was in 14 cm and in 12 cm in 2017. In 2017 a peak in 9 cm can be seen.

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Table 1. Spanish spring bottom trawl surveys in NAFO Div. 3NO: 1997-2018

Year	Vessel	Valid tows	Depth strata covered (m)	Dates
1997	C/V *Playa de Menduíña*	128	42-1263	April 26-May 18
1998	C/V *Playa de Menduíña*	124	42-1390	May 06-May 26
1999	C/V *Playa de Menduíña*	114	41-1381	May 07-May 26
2000	C/V *Playa de Menduíña*	118	42-1401	May 07-May 28
2001(*)	R/V *Vizconde de Eza*	83	36-1156	May 03-May 24
	C/V *Playa de Menduíña*	121	40-1500	May 05-May 23
2002	R/V *Vizconde de Eza*	125	38-1540	April 29-May 19
2003	R/V *Vizconde de Eza*	118	38-1666	May 11-June 02
2004	R/V *Vizconde de Eza*	120	43-1539	June 06–June 24
2005	R/V *Vizconde de Eza*	119	47-1485	June 10–June 29
2005	R/V *Vizconde de Eza*	119	47-1485	June 10–June 29
2006	R/V *Vizconde de Eza*	120	45-1480	June 7–June 27
2007	R/V *Vizconde de Eza*	110	45-1374	May 29–June 19
2008	R/V *Vizconde de Eza*	122	45-1374	May 27–June 16
2009	R/V *Vizconde de Eza*	109	45-1374	May 31–June 18
2010	R/V *Vizconde de Eza*	95	45-1374	May 30–June 18
2011	R/V *Vizconde de Eza*	122	44-1450	June 5–June 24
2012	R/V *Vizconde de Eza*	122	44-1450	June 3–June 21
2013	R/V *Vizconde de Eza*	122	44-1450	June 1–June 21
2014	R/V *Vizconde de Eza*	122	44-1450	June 2–June 21
2015	R/V *Vizconde de Eza*	122	44-1450	May 31-June 19
2016	R/V Vizconde de Eza	115	44-1450	May 30-June 18
2017	R/V Vizconde de Eza	113	44-1450	May 23-June 11
2018	R/V *Vizconde de Eza*	114	44-1450	June 2-June 21

(*) A total of 83 hauls from the R/V *Vizconde de Eza* and 40 hauls from the C/V *Playa de Menduíña* (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 2014-2018. Swept area in square miles. n.s. means stratum not surveyed.

	2014		2015		2016		2017		2018	
Stratum	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number	Swept area	Tow number
353	0.0379	3	0.0401	3	0.0356	3	0.0360	3	0.0338	3
354	0.0394	3	0.0390	3	0.0345	3	0.0356	3	0.0341	3
355	0.0263	2	0.0263	2	0.0233	2	0.0225	2	0.0233	2
356	0.0266	2	0.0255	2	0.0225	2	0.0233	2	0.0225	2
357	0.0263	2	0.0233	2	0.0233	2	0.0233	2	0.0236	2
358	0.0390	3	0.0349	3	0.0338	3	0.0364	3	0.0345	3
359	0.0908	7	0.0855	7	0.0593	5	0.0596	5	0.0589	5
360	0.2629	20	0.2363	20	0.1995	17	0.2044	17	0.1939	17
374	0.0259	2	0.0229	2	0.0233	2	0.0236	2	0.0225	2
375	0.0390	3	0.0341	3	0.0360	3	0.0364	3	0.0356	3
376	0.1324	10	0.1159	10	0.0945	8	0.0975	8	0.0908	8
377	0.0259	2	0.0233	2	0.0233	2	0.0251	2	0.0233	2
378	0.0263	2	0.0225	2	0.0225	2	0.0236	2	0.0229	2
379	0.0255	2	0.0225	2	0.0229	2	0.0244	2	0.0225	2
380	0.0263	2	0.0229	2	0.0236	2	0.0236	2	0.0225	2
381	0.0259	2	0.0236	2	0.0229	2	0.0229	2	0.0225	2
382	0.0521	4	0.0458	4	0.0465	4	0.0360	3	0.0450	4
721	0.0266	2	0.0240	2	0.0225	2	0.0229	2	0.0229	2
722	0.0259	2	0.0259	2	0.0229	2	0.0233	2	0.0236	2
723	0.0259	2	0.0233	2	0.0225	2	0.0229	2	0.0240	2
724	0.0255	2	0.0236	2	0.0233	2	0.0240	2	0.0233	2
725	0.0255	2	0.0229	2	0.0229	2	0.0244	2	0.0233	2
726	0.0248	2	0.0229	2	0.0225	2	0.0233	2	0.0225	2
727	0.0259	2	0.0225	2	0.0225	2	0.0229	2	0.0225	2
728	0.0248	2	0.0225	2	0.0229	2	0.0229	2	0.0225	2
752	0.0240	2	0.0225	2	0.0236	2	0.0236	2	0.0233	2
753	0.0240	2	0.0233	2	0.0229	2	0.0233	2	0.0236	2
754	0.0225	2	0.0225	2	0.0225	2	0.0218	2	0.0225	2
755	0.0454	4	0.0450	4	0.0458	4	0.0338	3	0.0338	3
756	0.0229	2	0.0229	2	0.0225	2	0.0229	2	0.0229	2
757	0.0244	2	0.0229	2	0.0225	2	0.0225	2	0.0225	2
758	0.0221	2	0.0221	2	0.0221	2	0.0229	2	0.0225	2
759	0.0229	2	0.0229	2	0.0229	2	0.0225	2	0.0225	2
760	0.0364	3	0.0225	2	0.0229	2	0.0236	2	0.0356	3
761	0.0240	2	0.0240	2	0.0225	2	0.0236	2	0.0124	1
762	0.0229	2	0.0229	2	0.0225	2	0.0229	2	0.0225	2
763	0.0233	2	0.0341	3	0.0338	3	0.0353	3	0.0345	3
764	0.0259	2	0.0251	2	0.0225	2	0.0229	2	0.0225	2
765	0.0240	2	0.0236	2	0.0229	2	0.0225	2	0.0233	2
766	0.0221	2	0.0236	2	0.0229	2	0.0225	2	0.0229	2
767	0.0221	2	0.0229	2	0.0229	2	0.0229	2	0.0236	2

Table 3. Roughhead grenadier mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2014-2018. n.s. means stratum not surveyed.

	2014		2015		2016		2017		2018	
Stratum	R. grenadier Mean catch	R. grenadier SD	R. grenadier Mean catch	R. grenadier SD	R. grenadier Mean catch	R. grenadier SD	R. grenadier Mean catch	R. grenadier SD	R. grenadier Mean catch	R. grenadier 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	1.54	2.18	0.00	0.00
356	0.00	0.00	2.10	2.96	0.00	0.00	0.00	0.00	1.93	2.72
357	0.00	0.00	0.00	0.00	0.15	0.21	3.49	4.93	0.00	0.00
358	0.00	0.00	2.35	4.07	0.17	0.30	0.00	0.00	0.00	0.00
359	0.00	0.00	0.00	0.00	0.15	0.33	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	0.48	0.67	0.00	0.00
375	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04
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	0.27	0.38
378	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.86	0.00	0.00
379	2.95	2.21	22.58	9.07	0.21	0.30	8.13	1.36	4.76	5.08
380	7.71	6.99	36.10	31.54	6.57	3.59	4.81	0.77	0.73	1.03
381	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.15
382	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
721	0.00	0.00	0.00	0.00	0.14	0.14	0.00	0.00	0.00	0.00
722	0.64	0.03	0.51	0.71	4.42	6.25	8.02	6.63	1.18	0.66
723	2.59	1.61	7.93	2.71	2.84	0.21	5.12	0.73	5.87	4.16
724	1.82	1.34	6.54	1.71	5.10	5.80	12.86	7.21	8.04	4.79
725	3.94	1.11	9.30	6.60	2.49	3.13	8.79	0.75	3.37	0.05
726	12.28	6.63	25.39	10.25	17.60	0.70	35.04	19.75	3.23	0.48
727	3.34	1.48	18.25	1.63	14.56	0.08	44.61	40.36	9.84	1.05
728	24.52	1.29	11.77	5.89	9.09	8.36	32.66	12.46	4.00	0.96
752	22.82	27.66	13.77	12.40	20.91	14.29	27.20	21.78	10.64	4.21
753	9.80	8.68	45.20	56.99	15.80	12.45	50.63	42.67	11.99	10.87
754	20.96	26.26	76.89	79.08	16.52	3.71	19.53	5.06	14.66	3.34
755	18.79	11.03	16.99	4.27	27.80	19.78	18.68	7.77	18.77	11.22
756	61.06	55.36	21.23	11.51	21.56	28.30	10.57	13.69	28.86	18.32
757	6.82	8.95	37.72	6.48	21.56	23.38	46.57	39.92	47.46	61.25
758	25.57	25.70	34.28	23.08	15.21	0.70	32.20	1.20	23.03	5.41
759	7.58	3.16	26.20	15.70	4.98	2.12	17.30	4.45	6.66	4.43
760	8.66	4.98	12.34	0.58	1.44	0.45	17.56	9.28	5.78	2.14
761	15.56	13.73	24.92	31.85	19.13	18.88	69.47	38.98	8.17	-
762	24.15	17.96	24.98	12.90	6.29	3.19	11.36	13.44	5.51	3.75
763	6.23	1.59	10.69	8.97	6.15	2.51	18.05	11.17	13.14	3.15
764	1.86	2.62	4.19	5.92	0.45	0.36	1.36	1.12	1.18	1.39
765	0.00	0.00	1.20	1.59	0.28	0.13	8.15	7.46	7.79	4.13
766	0.71	0.98	0.74	0.12	0.89	1.24	1.96	2.00	0.27	0.38
767	1.31	1.25	0.66	0.93	0.75	0.14	1.78	1.58	3.28	3.97

Table 4. Roughhead grenadier survey biomass (t) by stratum in NAFO Div. 3NO: 2014-2018. n.s. means stratum not surveyed.

Strata	2014	2015	2016	2017	2018	Strata	2014	2015	2016	2017	2018
353	0	0	0	0	0	**725**	32	85	23	76	30
354	0	0	0	0	0	**726**	71	160	113	217	21
355	0	0	0	0	0	**727**	25	150	124	374	84
356	0	8	0	0	8	**728**	155	82	62	223	28
357	0	0	2	2	0	**752**	249	160	232	302	120
358	0	46	3	3	0	**753**	113	537	191	601	140
359	0	0	5	5	0	**754**	335	1230	264	323	235
360	0	0	0	0	0	**755**	638	581	936	639	642
374	0	0	0	0	0	**756**	539	187	194	93	255
375	0	0	0	0	1	**757**	57	336	196	422	430
376	0	0	0	0	0	**758**	229	307	136	279	203
377	0	0	0	0	2	**759**	84	291	55	195	75
378	0	0	0	0	0	**760**	110	169	19	229	75
379	25	213	2	2	45	**761**	222	355	291	1006	113
380	56	303	53	53	6	**762**	448	463	119	210	104
381	0	0	0	0	1	**763**	140	245	143	401	298
382	0	0	0	0	0	**764**	14	33	4	12	10
721	0	0	1	1	0	**765**	0	13	3	90	83
722	4	3	32	32	8	**766**	9	9	11	25	3
723	31	106	39	39	76	**767**	19	9	10	25	44
724	18	69	54	54	86						

Table 5. Roughhead grenadier survey biomass (t) with SD and stratified mean catch per tow (kg) and SD by in NAFO Div. 3NO: 1997-2018.

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	2018
Biomass	7521	8193	5850	6219	8027	5220	3622	6149	3318	5935	3227
SD	1028	286	1773	1508	1073	753	628	1134	496	750	488
MCPT	7.93	9.15	6.97	6.82	8.59	5.81	4.08	6.79	3.65	6.90	3.57
SD	1.11	0.40	2.10	1.61	1.18	0.85	0.70	1.25	0.54	0.84	0.54

Table 6. Roughhead grenadier length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2014-2018. 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**
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
2018	**0.15392**	**2.76705**	0.10617	0.0412	0.99548	337	**0.1051**	**2.9125**	0.0464	0.0162	0.99908	540	**0.1367**	**2.8250**	0.0617	0.0222	0.99803	893

Table 7. Roughhead grenadier mean number per tow by year in Spanish Spring Surveys in NAFO Div. 3NO: 1997-2018. 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				2018			
	Males	Females	Indet.	Total	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	3.161	4.869	0.162	8.192

Table 8. Roughhead grenadier mean number per tow by length class and year. Spanish Spring Survey in NAFO 3NO: 2014-2018. Indet. means indeterminate.

	2014				2015				2016				2017				2018			
Lenght (cm.)	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	0.008	0.000	0.000	0.008	0.000	0.000	0.000	0.000
2.5	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	0.006	0.000	0.028	0.033
3.5	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	0.036	0.005	0.123	0.163
4.5	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	0.014	0.019	0.012	0.045
5.5	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	0.171	0.233	0.000	0.405
6.5	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	0.384	0.392	0.000	0.776
7.5	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	0.104	0.145	0.000	0.249
8.5	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	0.112	0.199	0.000	0.311
9.5	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	0.101	0.112	0.000	0.214
10.5	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	0.217	0.207	0.000	0.424
11.5	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	0.104	0.225	0.000	0.330
12.5	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	0.118	0.127	0.000	0.245
13.5	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	0.285	0.209	0.000	0.493
14.5	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	0.183	0.232	0.000	0.415
15.5	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	0.195	0.233	0.000	0.428
16.5	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	0.244	0.193	0.000	0.436
17.5	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	0.242	0.281	0.000	0.523
18.5	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	0.286	0.295	0.000	0.581
19.5	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	0.119	0.269	0.000	0.388
20.5	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	0.114	0.264	0.000	0.378
21.5	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	0.042	0.197	0.000	0.239
22.5	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	0.043	0.154	0.000	0.197
23.5	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	0.006	0.096	0.000	0.102
24.5	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	0.000	0.159	0.000	0.159
25.5	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	0.019	0.083	0.000	0.102
26.5	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	0.000	0.168	0.000	0.168
27.5	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	0.000	0.088	0.000	0.088
28.5	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	0.006	0.073	0.000	0.078
29.5	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	0.012	0.065	0.000	0.077
30.5	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	0.000	0.054	0.000	0.054
31.5	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	0.000	0.015	0.000	0.015
32.5	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	0.000	0.038	0.000	0.038
33.5	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	0.000	0.007	0.000	0.007
34.5	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	0.000	0.012	0.000	0.012
35.5	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	0.000	0.006	0.000	0.006
36.5	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	0.000	0.007	0.000	0.007
37.5	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	0.000	0.006	0.000	0.006
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	0.000	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	0.000	0.000	0.000	0.000
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	0.013	0.000	0.013	0.000	0.000	0.000	0.000
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	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	3.161	4.869	0.162	8.192
Nº samples:				50				52				56				56				54
Nº Ind.:	350	660	33	1043	877	1396	39	2312	520	809	45	1374	811	1543	136	2490	415	695	22	1132
Sampled catch:				627				1013				546				985				526
Range:				2.5-34.5				2-37.5				2.5-37				1.5-40.5				2-37.5
Total catch:				630				1035				549				1074				531
Total hauls:				122				122				115				113				114

Table 9. Thorny skate mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2014-2018. n.s. means stratum not surveyed.

	2014		2015		2016		2017		2018	
Stratum	T. skate Mean	T. skate SD	T. skate Mean	T. skate SD	T. skate Mean	T. skate SD	T. skate Mean	T. skate SD	T. skate Mean	T. skate SD
353	28.18	19.78	27.06	20.81	42.29	33.24	33.84	15.92	39.39	24.09
354	8.08	4.52	58.48	10.58	42.51	59.76	38.26	22.66	12.61	7.80
355	3.17	4.48	11.08	9.59	7.48	10.57	1.97	2.78	1.23	1.73
356	59.53	16.23	45.80	14.07	63.42	43.01	41.25	16.69	16.10	0.02
357	21.65	30.62	8.44	2.02	3.24	4.57	12.04	6.78	7.09	10.02
358	7.28	1.94	52.73	46.99	84.03	119.39	98.08	131.94	1.70	2.95
359	4.47	5.48	39.66	70.22	4.32	5.94	17.44	23.72	116.48	143.42
360	8.65	13.65	22.33	17.22	20.75	33.22	10.38	18.75	14.17	20.45
374	0.48	0.67	2.27	3.20	0.00	0.00	0.00	0.00	4.53	6.40
375	0.00	0.00	18.67	12.68	1.20	2.08	2.39	4.14	1.86	3.22
376	24.07	19.78	27.49	21.65	8.35	11.59	2.07	3.66	25.53	43.16
377	0.00	0.00	9.61	13.59	1.65	2.33	0.00	0.00	1.70	2.40
378	7.12	10.07	64.57	59.57	10.95	6.75	127.82	109.25	6.30	3.81
379	5.60	2.56	2.60	3.68	7.73	2.01	39.82	56.31	3.98	5.63
380	18.17	0.22	4.89	6.92	2.79	0.66	3.02	3.98	3.39	0.58
381	25.04	12.22	22.89	7.65	2.72	0.42	0.74	0.98	6.63	9.38
382	1.05	2.09	35.55	25.27	0.66	1.30	4.23	7.33	4.17	5.03
721	15.80	22.34	0.00	0.00	14.01	6.35	27.91	39.47	13.47	0.71
722	6.15	8.70	4.37	6.18	5.70	0.02	9.69	13.70	8.68	12.27
723	0.00	0.00	0.00	0.00	0.00	0.00	2.23	3.16	3.82	5.40
724	0.00	0.00	0.00	0.00	3.95	5.59	3.65	5.16	2.27	3.21
725	2.15	1.48	0.00	0.00	4.94	6.99	6.52	1.98	2.11	2.99
726	0.00	0.00	2.30	3.25	2.23	3.15	9.42	5.05	2.29	3.23
727	11.60	10.32	27.40	10.42	384.77	221.70	136.69	169.94	45.39	55.13
728	4.30	6.08	9.32	13.18	18.61	0.88	17.93	6.76	3.72	5.26
752	0.00	0.00	0.00	0.00	4.89	1.22	15.17	12.28	6.61	9.34
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	1.09	1.37
756	0.00	0.00	0.00	0.00	12.90	13.15	8.44	6.77	2.10	2.97
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	2.39	3.38	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	2.30	3.98	2.09	2.96	0.00	0.00	2.78	3.93	0.00	0.00
761	0.00	0.00	0.00	0.00	0.00	0.00	1.26	1.78	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	7.74	10.94	8.30	11.74	11.73	4.14	0.00	0.00
765	0.00	0.00	3.65	5.16	0.00	0.00	1.45	2.05	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 10. Thorny skate survey biomass (t) by stratum in NAFO Div. 3NO: 2014-2018. n.s. means stratum not surveyed.

Strata	2014	2015	2016	2017	2018	Strata	2014	2015	2016	2017	2018
353	600	544	958	759	942	**725**	18	0	45	56	19
354	151	1107	909	793	273	**726**	0	14	14	58	15
355	18	62	48	13	8	**727**	86	234	3283	1147	387
356	210	169	265	167	67	**728**	27	65	127	122	26
357	271	119	46	170	98	**752**	0	0	54	168	74
358	126	1021	1681	1820	33	**753**	0	0	0	0	0
359	145	1367	153	616	4165	**754**	0	0	0	0	0
360	1831	5262	4920	2402	3459	**755**	0	0	0	0	37
374	8	42	0	0	86	**756**	0	0	116	74	19
375	0	445	27	53	42	**757**	0	0	0	0	0
376	2425	3165	944	227	3003	**758**	0	21	0	0	0
377	0	83	14	0	15	**759**	0	0	0	0	0
378	75	798	135	1504	77	**760**	29	29	0	36	0
379	47	24	72	346	38	**761**	0	0	0	18	0
380	133	41	23	25	29	**762**	0	0	0	0	0
381	279	279	34	9	85	**763**	0	0	0	0	0
382	28	1066	19	121	127	**764**	0	62	74	103	0
721	77	0	81	159	77	**765**	0	38	0	16	0
722	40	28	42	70	62	**766**	0	0	0	0	0
723	0	0	0	30	49	**767**	0	0	0	0	0
724	0	0	42	38	24						

Table 11. Thorny skate survey biomass (t) with SD and stratified mean catch per tow (kg) and SD in NAFO Div. 3NO: 1997-2018.

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	2018
Biomass	25946	19959	17887	10365	28867	19640	6624	16085	14126	11121	13334
SD	2641	2745	3539	1193	3010	2280	1008	1777	2894	2283	3217
MCPT	28.82	22.10	21.22	11.71	32.65	22.24	8.39	18.45	15.76	12.79	14.82
SD	2.92	3.13	4.11	1.32	3.38	2.63	1.26	2.02	3.21	2.68	3.58

Table 12. Thorny skate length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2014-2018. 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**
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
2018	**0.01692**	**2.86552**	0.1756	0.0439	0.99267	199	**0.00622**	**3.11829**	0.1341	0.0345	0.99665	205	**0.00930**	**3.01404**	0.1612	0.0414	0.99329	404

Table 13. Thorny skate mean number per tow by year in Spanish Spring Surveys in NAFO Div. 3NO: 1997-2018. 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				2018			
	Males	Females	Indet.	Total	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	2.613	2.852	0.000	5.464

Table 14. Thorny skate mean number per tow by length class and year. Spanish Spring Survey in NAFO 3NO: 2014-2018. Indet. means indeterminate.

	2014				2015				2016				2017				2018			
Lenght (cm.)	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	0.009	0.000	0.009
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.008	0.005	0.005	0.000	0.010	0.000	0.003	0.000	0.003
14	0.009	0.007	0.000	0.016	0.000	0.021	0.000	0.021	0.009	0.009	0.000	0.018	0.033	0.057	0.000	0.090	0.005	0.008	0.000	0.013
16	0.000	0.007	0.000	0.007	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.026	0.073	0.097	0.000	0.171	0.000	0.023	0.000	0.023
18	0.000	0.016	0.000	0.016	0.009	0.000	0.000	0.009	0.034	0.009	0.000	0.042	0.022	0.037	0.000	0.058	0.005	0.000	0.000	0.005
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.017	0.000	0.025	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.016
22	0.000	0.000	0.000	0.000	0.021	0.009	0.000	0.031	0.000	0.063	0.000	0.063	0.000	0.000	0.000	0.000	0.013	0.021	0.000	0.034
24	0.005	0.014	0.000	0.019	0.014	0.026	0.000	0.039	0.009	0.041	0.000	0.049	0.023	0.047	0.000	0.070	0.010	0.018	0.000	0.028
26	0.015	0.000	0.000	0.015	0.000	0.019	0.000	0.019	0.000	0.050	0.000	0.050	0.166	0.073	0.000	0.239	0.005	0.024	0.000	0.029
28	0.034	0.019	0.000	0.053	0.023	0.014	0.000	0.037	0.029	0.016	0.000	0.045	0.129	0.141	0.000	0.270	0.031	0.015	0.000	0.046
30	0.033	0.036	0.000	0.069	0.005	0.041	0.000	0.046	0.037	0.072	0.000	0.109	0.216	0.139	0.000	0.354	0.021	0.018	0.000	0.040
32	0.029	0.070	0.000	0.099	0.041	0.014	0.000	0.054	0.062	0.039	0.000	0.101	0.226	0.181	0.000	0.408	0.020	0.054	0.000	0.073
34	0.023	0.000	0.000	0.023	0.019	0.021	0.000	0.040	0.110	0.064	0.000	0.174	0.128	0.132	0.000	0.260	0.041	0.081	0.000	0.121
36	0.055	0.074	0.000	0.128	0.008	0.031	0.000	0.039	0.104	0.061	0.000	0.165	0.103	0.125	0.000	0.228	0.021	0.067	0.000	0.088
38	0.013	0.035	0.000	0.048	0.050	0.095	0.000	0.145	0.079	0.077	0.000	0.156	0.076	0.139	0.000	0.215	0.048	0.090	0.000	0.138
40	0.048	0.051	0.000	0.099	0.117	0.064	0.000	0.181	0.072	0.088	0.000	0.159	0.105	0.131	0.000	0.235	0.051	0.068	0.000	0.119
42	0.069	0.104	0.000	0.173	0.092	0.166	0.000	0.258	0.154	0.177	0.000	0.331	0.101	0.061	0.000	0.162	0.033	0.077	0.000	0.110
44	0.081	0.122	0.000	0.203	0.164	0.111	0.000	0.276	0.079	0.106	0.000	0.186	0.092	0.110	0.000	0.202	0.033	0.053	0.000	0.086
46	0.089	0.076	0.000	0.165	0.114	0.095	0.000	0.209	0.198	0.152	0.000	0.350	0.154	0.099	0.000	0.252	0.017	0.057	0.000	0.074
48	0.074	0.108	0.000	0.182	0.162	0.165	0.000	0.327	0.092	0.249	0.000	0.342	0.130	0.112	0.000	0.241	0.085	0.042	0.000	0.127
50	0.100	0.059	0.000	0.158	0.170	0.090	0.000	0.260	0.124	0.176	0.000	0.301	0.116	0.186	0.000	0.302	0.168	0.129	0.000	0.298
52	0.029	0.065	0.000	0.094	0.183	0.155	0.000	0.338	0.121	0.210	0.000	0.331	0.060	0.127	0.000	0.186	0.046	0.122	0.000	0.168
54	0.082	0.058	0.000	0.140	0.194	0.191	0.000	0.385	0.103	0.195	0.000	0.298	0.190	0.089	0.000	0.279	0.150	0.134	0.000	0.284
56	0.099	0.113	0.000	0.212	0.072	0.170	0.000	0.242	0.115	0.109	0.000	0.223	0.132	0.104	0.000	0.236	0.079	0.142	0.000	0.221
58	0.028	0.039	0.000	0.067	0.092	0.141	0.000	0.233	0.140	0.120	0.000	0.261	0.122	0.114	0.000	0.236	0.082	0.124	0.000	0.205
60	0.043	0.041	0.000	0.085	0.100	0.141	0.000	0.241	0.142	0.110	0.000	0.252	0.173	0.055	0.000	0.228	0.129	0.090	0.000	0.219
62	0.075	0.072	0.000	0.148	0.083	0.081	0.000	0.164	0.123	0.144	0.000	0.267	0.142	0.066	0.000	0.208	0.103	0.098	0.000	0.201
64	0.096	0.108	0.000	0.204	0.129	0.102	0.000	0.232	0.089	0.170	0.000	0.258	0.065	0.080	0.000	0.145	0.074	0.166	0.000	0.239
66	0.032	0.041	0.000	0.073	0.108	0.144	0.000	0.252	0.139	0.176	0.000	0.315	0.057	0.162	0.000	0.218	0.097	0.109	0.000	0.206
68	0.057	0.107	0.000	0.164	0.046	0.166	0.000	0.211	0.074	0.120	0.000	0.194	0.120	0.128	0.000	0.248	0.072	0.165	0.000	0.237
70	0.037	0.095	0.000	0.132	0.101	0.299	0.000	0.400	0.108	0.128	0.000	0.236	0.049	0.124	0.000	0.173	0.114	0.156	0.000	0.269
72	0.101	0.064	0.000	0.165	0.161	0.168	0.000	0.330	0.198	0.133	0.000	0.331	0.098	0.103	0.000	0.201	0.163	0.213	0.000	0.376
74	0.049	0.097	0.000	0.146	0.172	0.215	0.000	0.386	0.164	0.119	0.000	0.283	0.116	0.065	0.000	0.182	0.139	0.221	0.000	0.360
76	0.085	0.076	0.000	0.161	0.256	0.149	0.000	0.405	0.131	0.109	0.000	0.240	0.102	0.138	0.000	0.241	0.086	0.079	0.000	0.165
78	0.088	0.032	0.000	0.120	0.175	0.119	0.000	0.293	0.175	0.070	0.000	0.245	0.125	0.072	0.000	0.196	0.180	0.066	0.000	0.246
80	0.032	0.036	0.000	0.069	0.168	0.053	0.000	0.221	0.184	0.009	0.000	0.193	0.089	0.024	0.000	0.113	0.144	0.066	0.000	0.210
82	0.058	0.031	0.000	0.089	0.158	0.062	0.000	0.220	0.051	0.046	0.000	0.097	0.051	0.048	0.000	0.100	0.131	0.040	0.000	0.172
84	0.035	0.004	0.000	0.039	0.071	0.012	0.000	0.083	0.069	0.028	0.000	0.097	0.049	0.018	0.000	0.066	0.085	0.000	0.000	0.085
86	0.021	0.018	0.000	0.039	0.054	0.002	0.000	0.056	0.079	0.011	0.000	0.090	0.003	0.027	0.000	0.030	0.026	0.000	0.000	0.026
88	0.000	0.000	0.000	0.000	0.070	0.014	0.000	0.084	0.069	0.004	0.000	0.073	0.020	0.027	0.000	0.047	0.076	0.004	0.000	0.080
90	0.028	0.004	0.000	0.032	0.007	0.006	0.000	0.013	0.014	0.006	0.000	0.020	0.031	0.005	0.000	0.036	0.002	0.000	0.000	0.002
92	0.002	0.000	0.000	0.002	0.008	0.000	0.000	0.008	0.003	0.000	0.000	0.003	0.014	0.000	0.000	0.014	0.009	0.000	0.000	0.009
94	0.000	0.004	0.000	0.004	0.004	0.005	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
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	0.005	0.000	0.005	0.000	0.000	0.000	0.000
98	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.005	0.008	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	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	0.000	0.005	0.000	0.000	0.000	0.000
102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
106	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
116	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
118	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
124	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
130	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	1.753	1.904	0.000	3.657	3.419	3.378	0.000	6.798	3.528	3.493	0.000	7.020	3.708	3.452	0.000	7.160	2.613	2.852	0.000	5.464
Nº samples:				55				74				58				60				63
Nº Ind.:	183	179	0	362	339	321	0	660	388	350	0	738	331	306	0	637	251	281	0	532
Sampled catch:				907				1907				1789				1322				1441
Range:				14-94				14-99				12-107				13-100				10-92
Total catch:				948				2075				2074				1774				1497
Total hauls:				122				122				115				113				114

Table 15. White hake mean catch (kg) and SD by stratum. Spanish Spring Surveys in NAFO Div. 3NO: 2014-2018. n.s. means stratum not surveyed.

	2014		2015		2016		2017		2018	
Stratum	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	0.01	0.01	0.00	0.00	0.00	0.00	0.46	0.80
354	2.45	4.24	4.77	3.99	13.08	15.38	5.49	9.43	4.64	4.20
355	21.15	24.23	7.95	4.24	27.59	8.22	26.76	3.95	4.94	3.96
356	11.87	6.70	17.36	21.67	57.85	41.77	5.62	0.38	5.20	6.05
357	4.54	6.41	26.72	3.90	59.32	35.22	4.48	6.33	9.11	10.88
358	2.03	3.51	10.95	12.45	0.00	0.00	0.00	0.00	1.43	1.25
359	1.08	2.58	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.73
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	0.00	0.00	0.00	0.00	0.03	0.05	0.10	0.14	0.00	0.00
380	0.00	0.00	0.11	0.16	0.00	0.00	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	2.99	4.22	23.22	5.62	12.34	3.28	23.54	19.58	6.50	9.20
722	1.15	1.63	1.96	2.76	5.18	7.32	9.71	13.72	0.00	0.00
723	2.79	2.55	1.20	1.69	3.57	2.59	9.31	9.91	2.40	3.39
724	0.00	0.00	2.03	2.86	0.00	0.00	0.00	0.00	0.00	0.00
725	0.00	0.00	0.00	0.00	1.20	1.70	0.74	1.04	0.00	0.00
726	0.00	0.00	0.00	0.00	0.00	0.00	1.28	1.80	0.00	0.00
727	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.17	0.03	0.04
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	0.01	0.01
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	0.01	-
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	2.58	3.64
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: 2014-2018. n.s. means stratum not surveyed.

Strata	2014	2015	2016	2017	2018
353	0	0	0	0	11
354	46	90	280	380	100
355	119	45	176	289	31
356	42	64	242	14	22
357	57	377	837	21	126
358	35	212	0	0	28
359	35	0	0	0	17
360	0	0	0	0	0
374	0	0	0	0	0
375	0	0	0	0	0
376	0	0	0	0	0
377	0	0	0	0	0
378	0	0	0	0	0
379	0	0	0	4	0
380	0	1	0	0	0
381	0	0	0	0	0
382	0	0	0	0	0
721	15	126	71	40	37
722	7	13	38	14	0
723	33	16	49	34	31
724	0	21	0	0	0

Strata	2014	2015	2016	2017	2018
725	0	0	11	4	0
726	0	0	0	3	0
727	0	0	0	8	0
728	0	0	0	0	0
752	0	0	0	0	0
753	0	0	0	0	0
754	0	0	0	0	0
755	0	0	0	0	0
756	0	0	0	0	0
757	0	0	0	0	0
758	0	0	0	0	0
759	0	0	0	0	0
760	0	0	0	0	0
761	0	0	0	0	0
762	0	0	0	0	0
763	0	0	0	0	0
764	0	0	0	0	23
765	0	0	0	0	0
766	0	0	0	0	0
767	0	0	0	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: 2001-2018.

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	2018
Biomass	293	822	784	1503	389	965	1704	813	427
SD	117	361	308	613	131	182	425	199	136
MCPT	0.34	0.91	0.86	1.64	0.49	1.12	1.90	0.80	0.48
SD	0.14	0.40	0.34	0.67	0.17	0.19	0.47	0.22	0.15

Table 18. White hake length weight relationships in Spanish Spring Surveys in NAFO Div. 3NO: 2014-2018. 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**
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
2018	**0.01164**	**2.87207**	0.3348	0.0965	0.98455	45	**0.00231**	**3.30650**	0.2720	0.0695	0.99539	29	**0.00664**	**3.04278**	0.2497	0.0681	0.99038	74

Table 19. White hake mean number per tow by year in Spanish Spring Surveys in NAFO Div. 3NO: 2001-2018. 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				2018			
	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	0.877	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	0.290	0.198	0.000	0.488

Table 20. White hake mean number per tow by length class and year. Spanish Spring Survey in NAFO 3NO: 2014-2018. Indet. means indeterminate. In 2017 the individuals were not sexed.

	2014				2015				2016				2017				2018			
Lenght (cm.)	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total	Males	Females	Indet.	Total
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.016
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	0.005	0.000	0.000	0.005
12	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
14	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	0.000	0.000	0.000	0.000
16	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	0.000	0.000	0.000	0.000
18	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	0.008	0.008	0.000	0.017
20	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	0.005	0.000	0.000	0.005
22	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	0.016	0.000	0.000	0.016
24	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	0.024	0.000	0.000	0.024
26	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	0.034	0.004	0.000	0.038
28	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	0.020	0.008	0.000	0.029
30	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	0.008	0.008	0.000	0.017
32	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	0.024	0.000	0.000	0.024
34	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	0.017	0.045	0.000	0.062
36	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	0.027	0.012	0.000	0.039
38	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	0.019	0.008	0.000	0.028
40	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	0.004	0.000	0.000	0.004
42	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	0.006	0.011	0.000	0.017
44	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	0.008	0.000	0.000	0.008
46	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	0.021	0.008	0.000	0.029
48	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	0.004	0.013	0.000	0.017
50	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	0.004	0.000	0.000	0.004
52	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	0.000	0.000	0.000	0.000
54	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	0.000	0.000	0.000	0.000
56	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	0.000	0.008	0.000	0.008
58	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	0.000	0.000	0.000	0.000
60	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	0.000	0.000	0.000	0.000
62	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	0.000	0.008	0.000	0.008
64	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	0.000	0.002	0.000	0.002
66	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	0.011	0.000	0.000	0.011
68	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	0.000	0.000	0.000	0.000
70	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	0.000	0.000	0.000	0.000
72	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	0.000	0.000	0.000	0.000
74	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	0.008	0.020	0.000	0.028
76	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	0.000	0.000	0.000	0.000
78	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	0.000	0.008	0.000	0.008
80	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	0.000	0.000	0.000	0.000
82	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	0.000	0.010	0.000	0.010
84	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	0.000	0.000	0.000	0.000
86	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
88	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	0.000	0.000	0.000	0.000
90	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	0.000	0.012	0.000	0.012
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	0.012	0.012	0.000	0.000	0.000	0.000
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	0.003	0.000	0.003
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	0.002	0.000	0.002	0.000	0.008	0.000	0.008	0.000	0.000	0.003	0.003	0.000	0.000	0.000	0.000
100	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	0.000	0.000	0.000	0.000
Total	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	0.290	0.198	0.000	0.488
Nº samples:				12				18				15				16				19
Nº Ind.:	54	23	0	77	44	46	3	93	127	89	0	216	0	0	181	181	45	29	0	74
Sampled catch:				109				192				369				180				77
Range:				33-79				15-100				16-98				17-92				9-95
Total catch:				110				208				373				180				83
Total hauls:				122				122				115				113				114

Table 21. Squid total biomass (Kg) by stratum and year, and yearly SD. Spanish Spring Survey in NAFO 3NO: 2002-2018.

Stratum	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
353		0	3427	656	159	281	2034	335	191	3540	0				0	0	3443
354		0	124141	2512	33652	15460	1376	20526	22129	3476108	0				0	26047	60157
355		0	20510	5986	5561	302	87	22439	1375	17053	0				0	81459	607118
356		0	1381	1395	6541	546	0	210	3839	8749	0				0	4556	112320
357		0	283191	811	3330	1139	113	141954	700	6538	0				0	1340	18049
358		773	14659	3613	26742	0	933	37556	0	18783	0				0	12105	241572
359		4177	37404	1811	222443	335	174	10665	442	418018	0				0	70714	3221052
360		1235	284806	5626	57194	1557	500	478	19032	9250	166				0	101815	17695284
374		0	5431	0	0	722	1105	0	4689	0	0				0	6042	2073
375		0	0	0	0	0	341	0	298	0	0				0	0	0
376		0	6520	5683	0	0	0	0	220	3954	0				0	0	37176
377		0	545517	2968	0	0	443	396	2873	413	0				0	4279	0
378		618	157657	2483	26700	48988	17491	10397	5535	4170	0				0	3283	565
379		0	0	1750	516	18108	12321	13633	2586	2295	0				0	644	0
380		630	1736	252	743	1404	2927	2195	4746	592	0				0	321	158
381		0	448	1858	1303	1602	2587	422	15797	4174	0				0	252	339
382		0	1487	825	841	5559	1747	152	8616	358	0				0	0	5183
721		0	676	176	1032	39	0	369	0	0	0				0	622	7956
722		0	2394	1048	1061	504	102	0	0	575	0				0	2135	1988
723		976	31440	667	2861	39	207	1433	489	3150	0				0	427	4469
724		788	5105	1168	0	773	280	1024	0	0	0				0	1622	3083
725		0	327	1333	298	705	2951	2515	5735	446	0				0	370	3744
726		0	512	960	288	1489	218	94	4023	144	0				0	1211	1280
727		309	3716	588	141	444	1718	299	2276	495	0				0	43772	0
728		0	0	430	0	239	807	529	471	0	0				0	184	884
752		115	1103	333	233	0	0	842	136	0	0				0	599	124
753		302	0	215	0	343	830	0		0	0				0	1051	280
754		828	0	560	0	128	1084	0	1248	0	0				0	1341	0
755		2958	0	171	0	2738	2277	1523	0	0	0				0	6080	878
756		0	418	391	0	292	376	2797	503	372	0				0	472	296
757		0	1032	227	0	214	2121	2065	189	0	0				0	2067	0
758		0	926	440	273	1104	560	1716	480	13	0				36	489	1153
759		3725	356	555	0		0	1863	2263	806	0				0	1146	0
760		1572	2993	424	0	1570	992	734	438	0	0				0	12920	0
761		2964	1778	39	1177	3496	760	0	949	0	0				0	4133	0
762		3345	9118	1979	2097		0	1102	306	1687	0				0	1001	735
763		2558	1040	2229	766		361			0	0				0	7560	1059
764		226	1574	211	5622	733	0	86		924	0				0	2549	3396
765		0	661	163	1680	0	0	0	639	375	0				0	2463	4347
766		192	1664	164	3632		0	0	736	1632	0				0	4954	38
767		0	6175	0	1679		0			761	0				0	5546	0
Total		28289	1561323	52697	408563	110854	59821	280347	113951	3985376	166				36	417571	22040198
SD		3979	635346	8319	220686	51536	8284	113584	28756	3539602	168				36	134739	17359051

Table 22. Squid total abundance (thousands) by length class and year, in the years in which samples were taken. Spanish Spring Survey in NAFO 3NO: 2002-2018.

Length	2011	2017
8.5	0	0
9.0	0	34
9.5	0	0
10.0	163	46
10.5	653	185
11.0	653	256
11.5	3040	425
12.0	2908	698
12.5	1765	462
13.0	5823	278
13.5	7525	163
14.0	11520	185
14.5	9328	46
15.0	7952	4
15.5	5597	8
16.0	4353	0
16.5	1866	0
17.0	1866	0
17.5	1244	0
18.0	622	0
18.5	0	0
Total	66875	2788

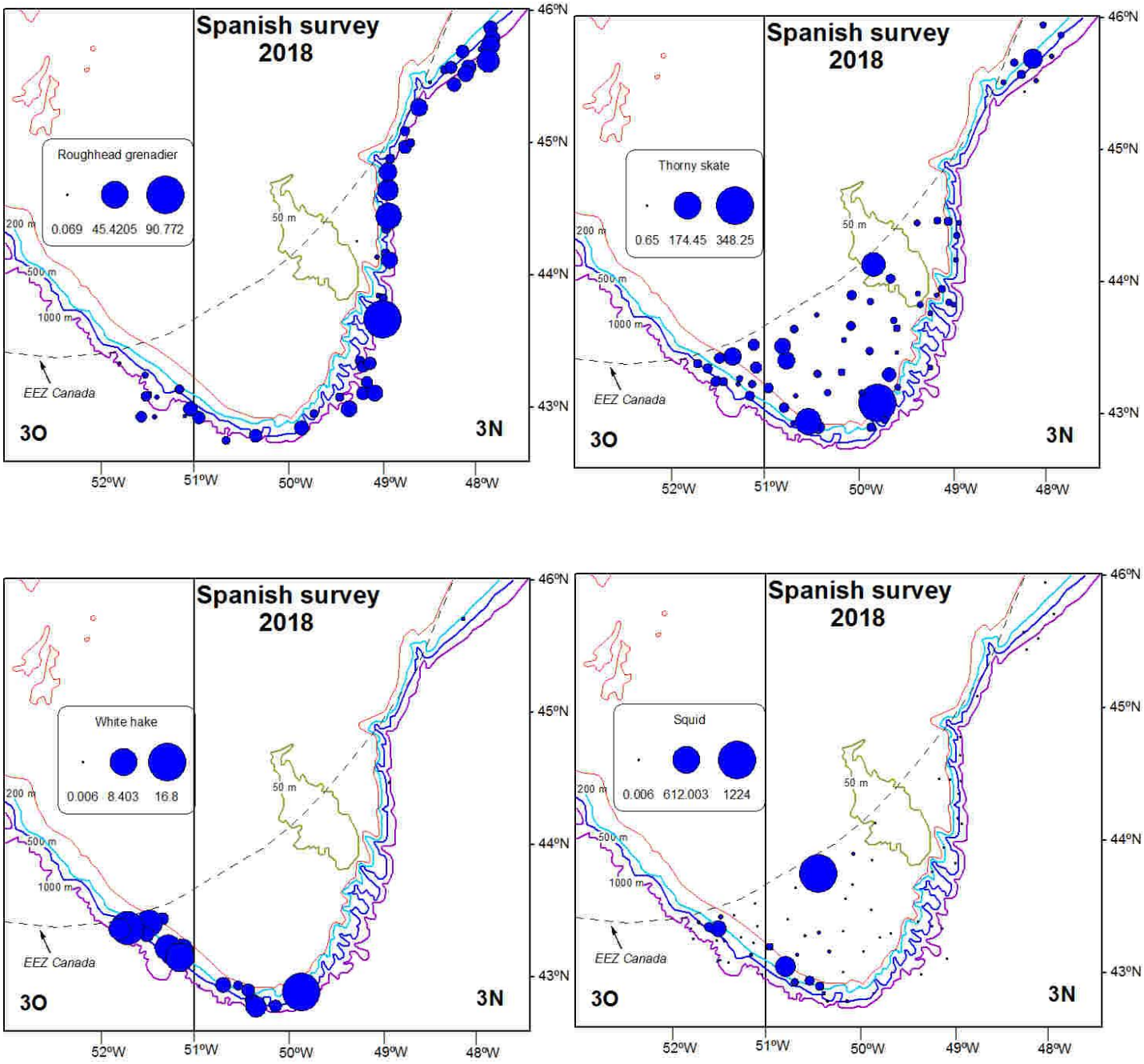

Figure 1. Position of the hauls and the catch of roughhead grenadier, thorny skate, white hake and squid during the 2018 Spanish 3NO survey. Note that the scale is different in the four graphs.

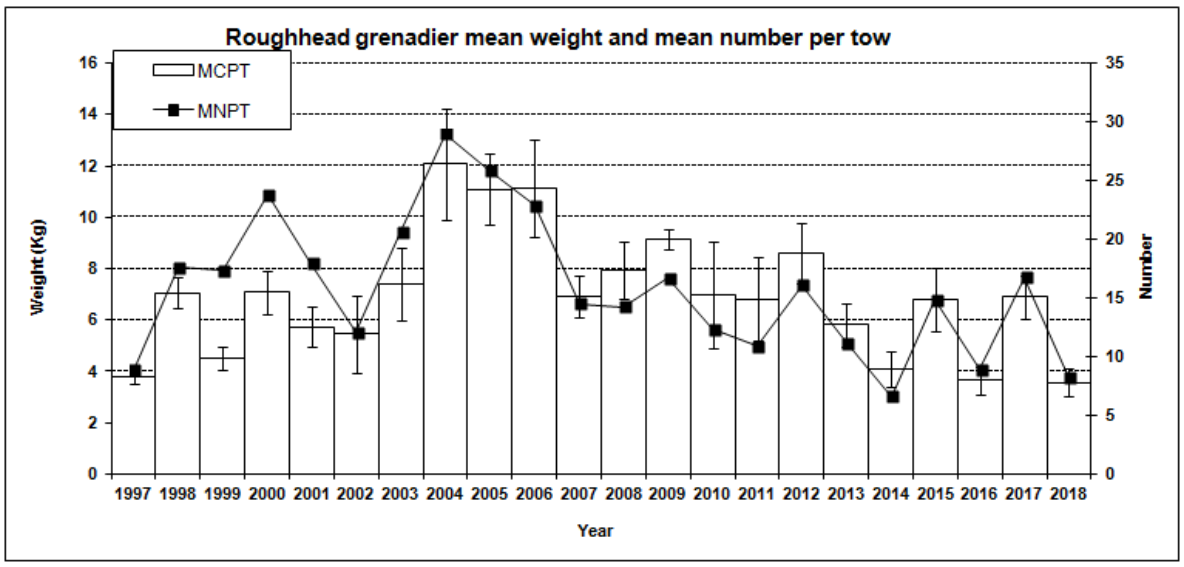

Figure 2. Roughhead grenadier stratified mean catches in Kg and ±SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2018.

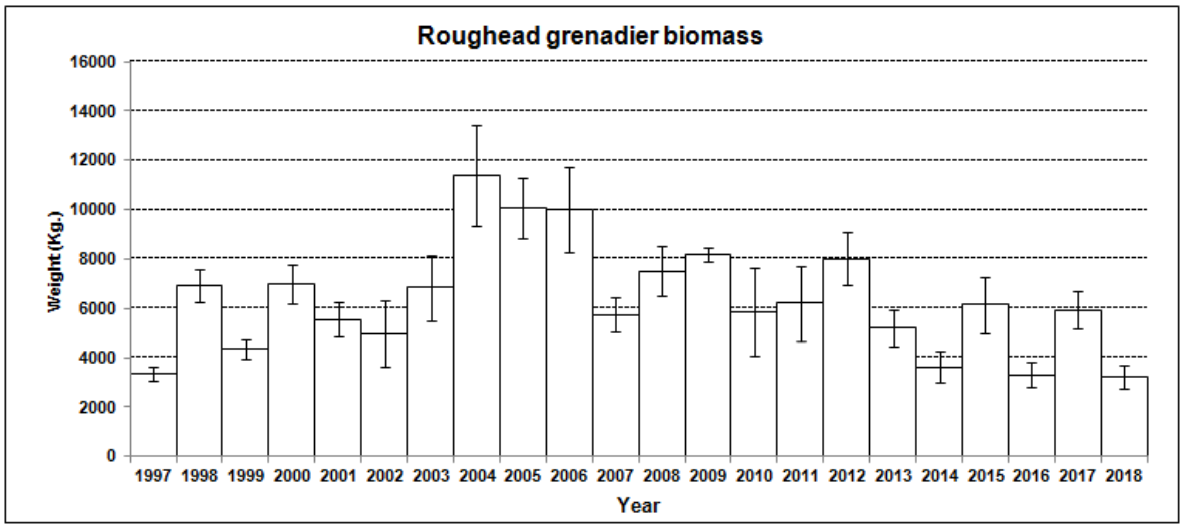

Figure 3. Roughhead grenadier biomass calculated by the swept area method in tons and ±SD by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2018.

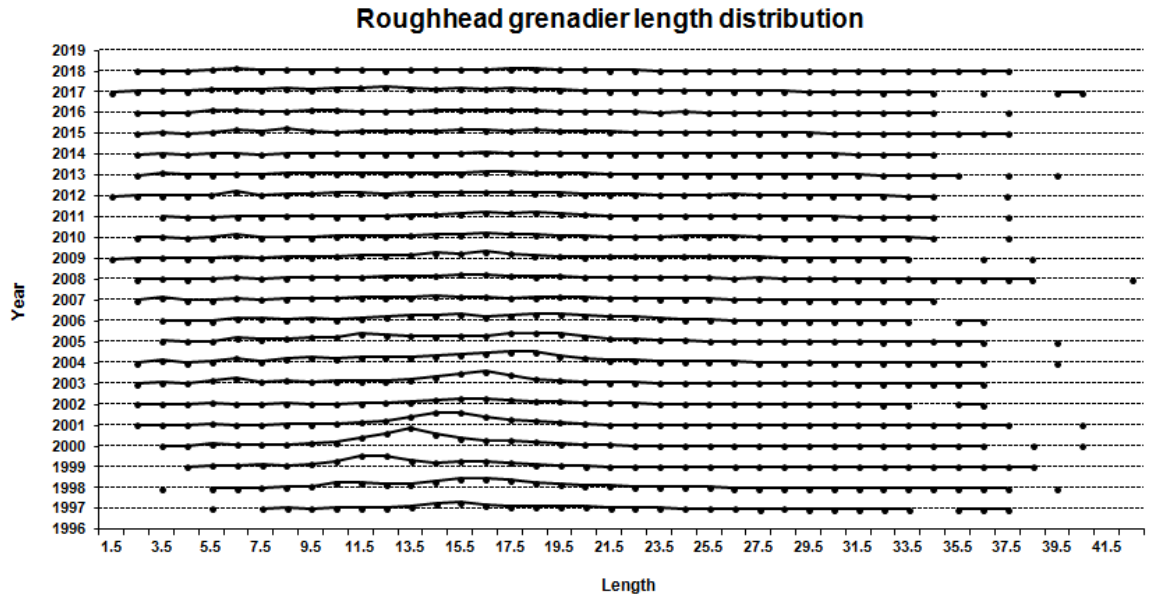

Figure 4. Roughhead grenadier mean catches per tow length distribution (cm) on NAFO 3NO: 1997-2018. Data from 2014 to 2018 are in Table 8; data for 1997-2013 can be seen in SCR Doc 14/007.

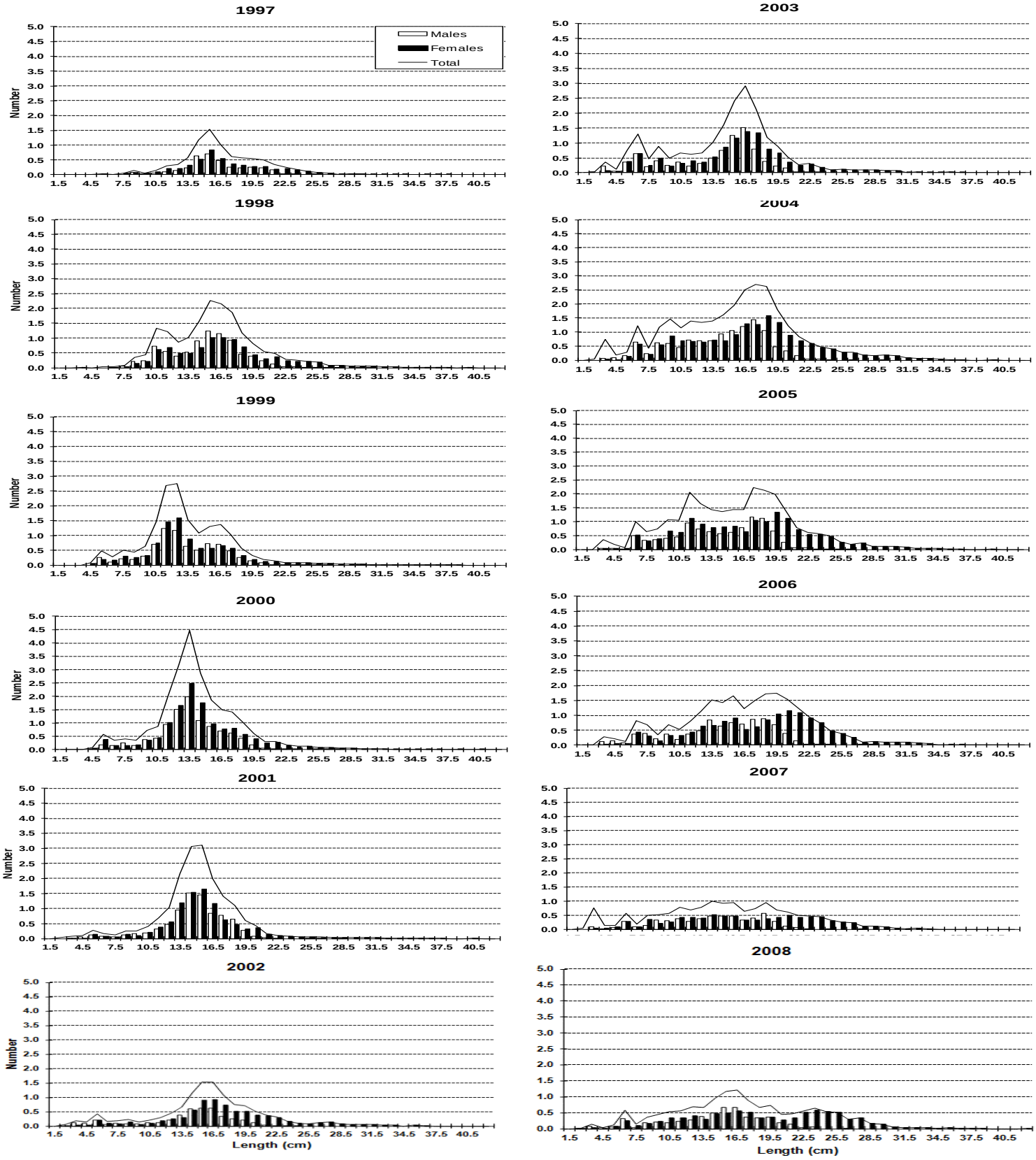

Figure 5. Roughhead grenadier length distribution (cm) on NAFO 3NO: 1997-2018. Mean catches per tow number. Data from 2014 to 2018 are in Table 8; data for 1997-2013 can be seen in SCR Doc 14/007.

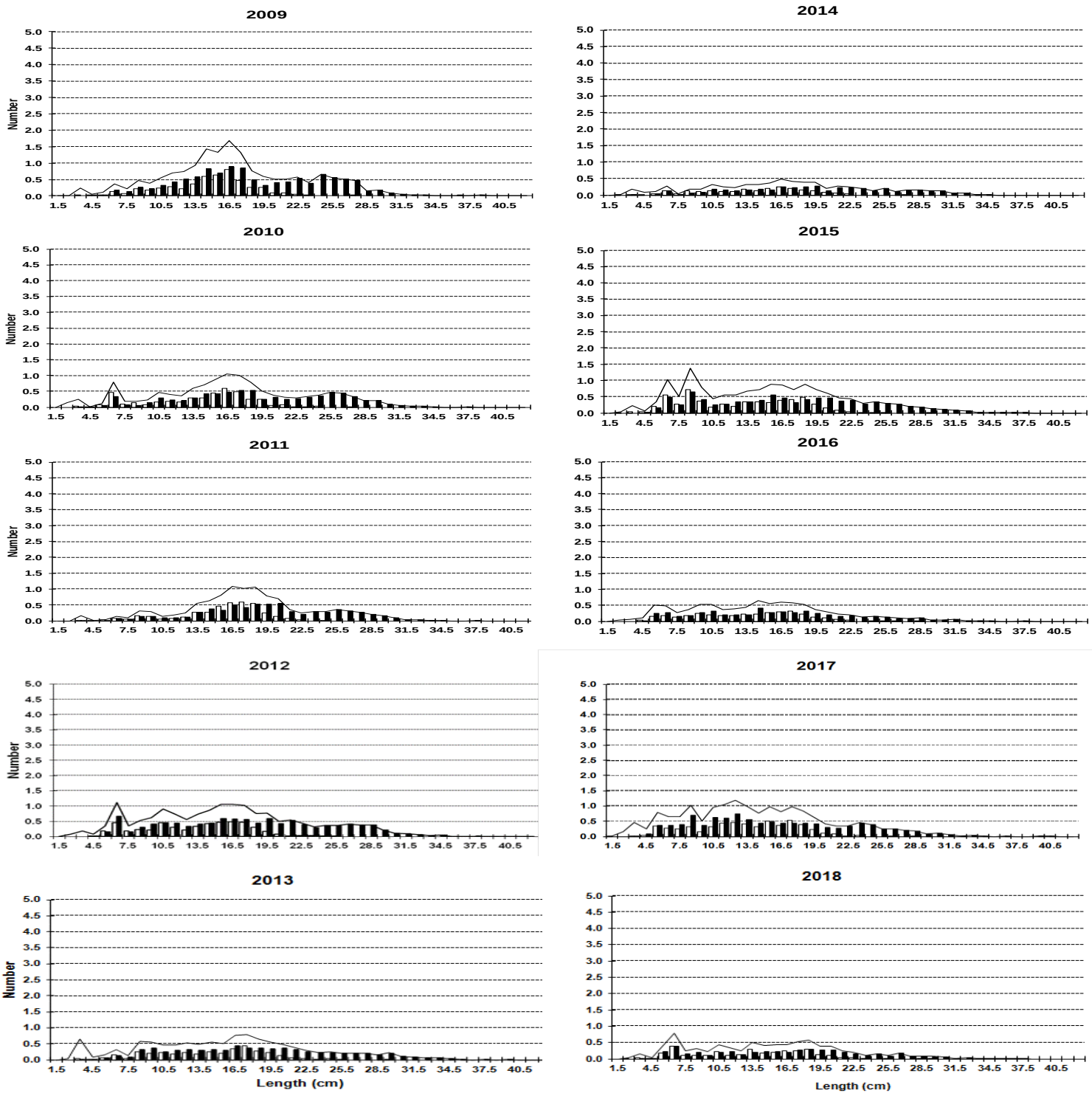

Figure 5 (cont.). Roughhead grenadier length distribution (cm) on NAFO 3NO: 1997-2018. Mean catches per tow number. Data from 2014 to 2018 are in Table 8; data for 1997-2013 can be seen in SCR Doc 14/007.

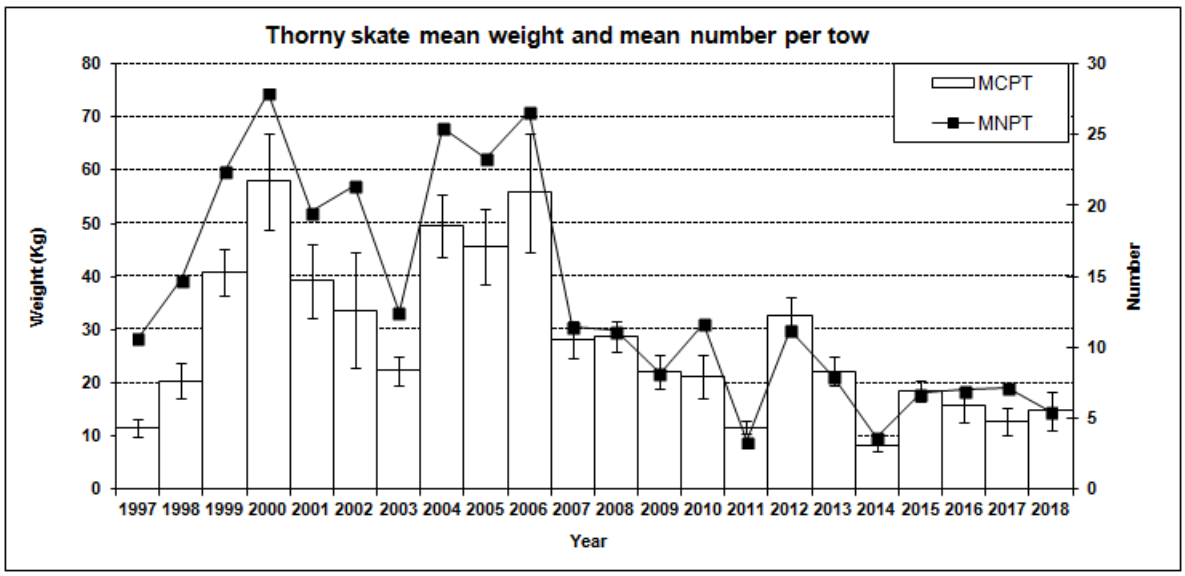

Figure 6. Thorny skate stratified mean catches in Kg and ±SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2018.

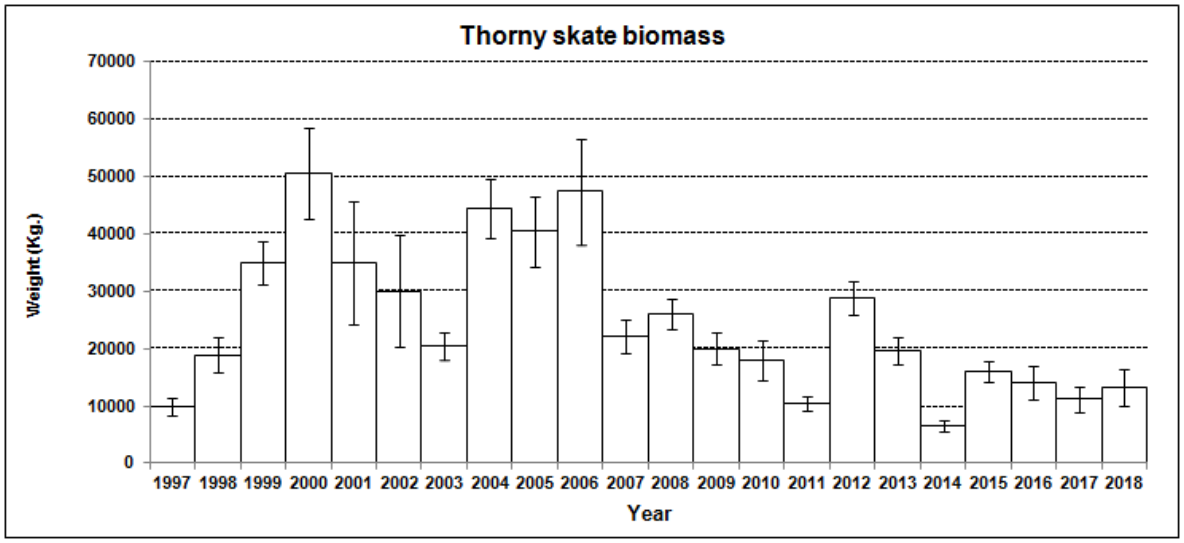

Figure 7. Thorny skate biomass calculated by the swept area method in tons and ±SD by year. Spanish Spring surveys in NAFO Div. 3NO: 1997-2018.

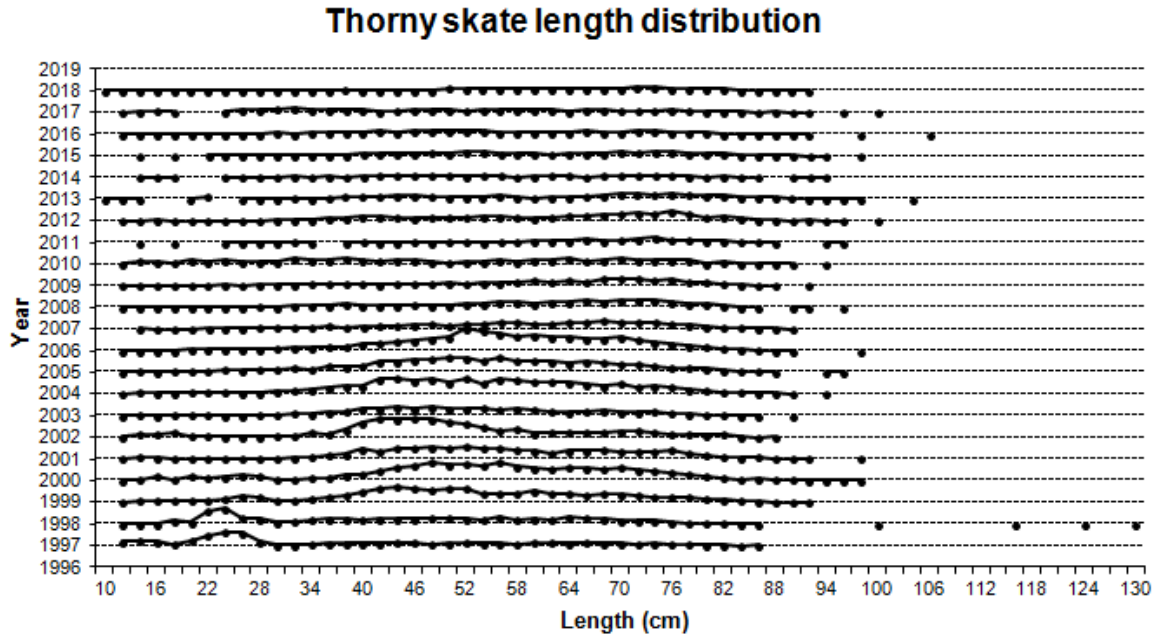

Figure 8. Thorny skate mean catches per tow length distribution (cm) on NAFO 3NO: 1997-2018. Data from 2014 to 2018 are in Table 14; data for 1997-2013 can be seen in SCR Doc 14/007.

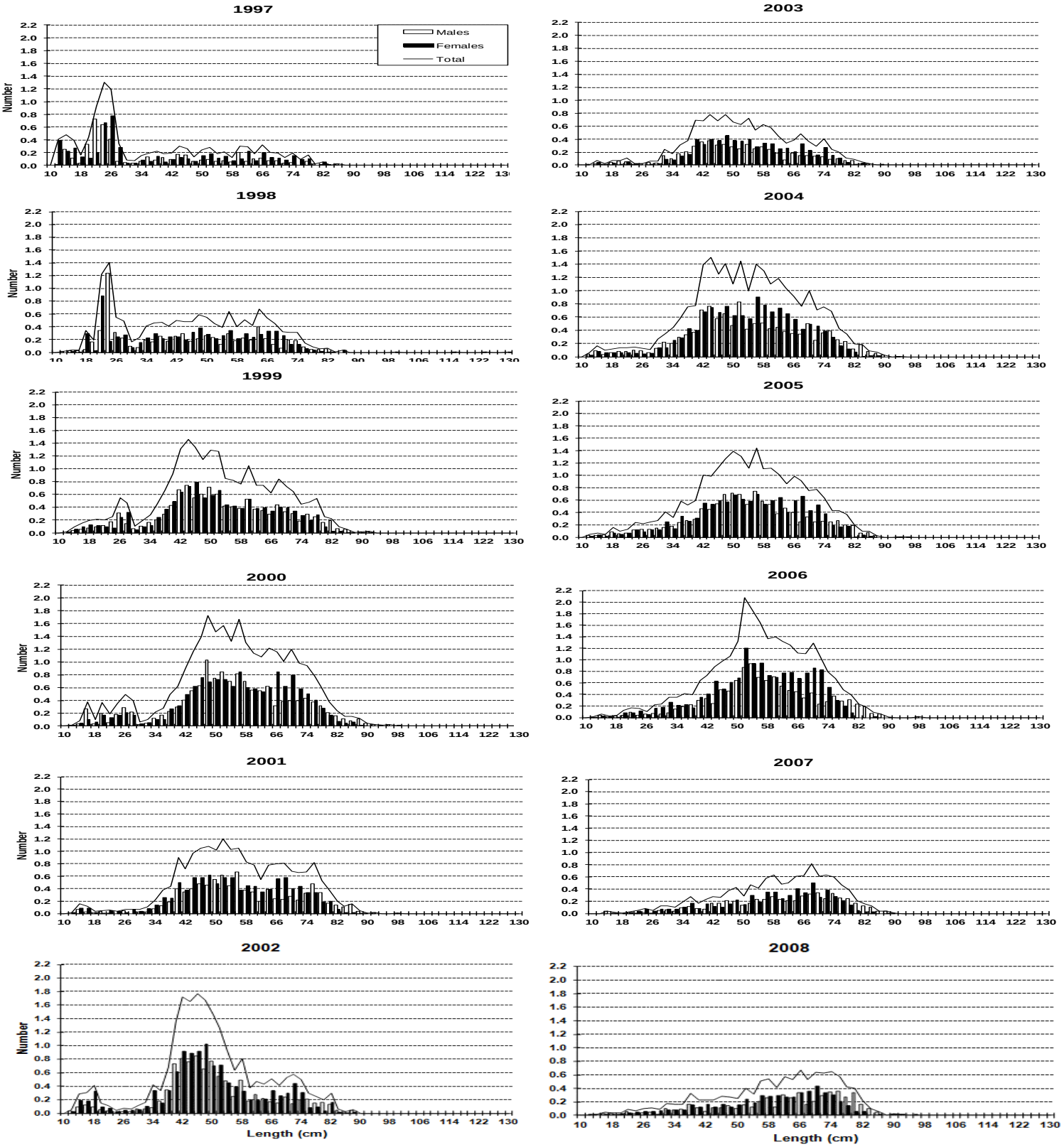

Figure 9. Thorny skate length distribution (cm) on NAFO 3NO: 1997-2018. Mean catches per tow number. Data from 2014 to 2018 are in Table 14; data for 1997-2013 can be seen in SCR Doc 14/07.

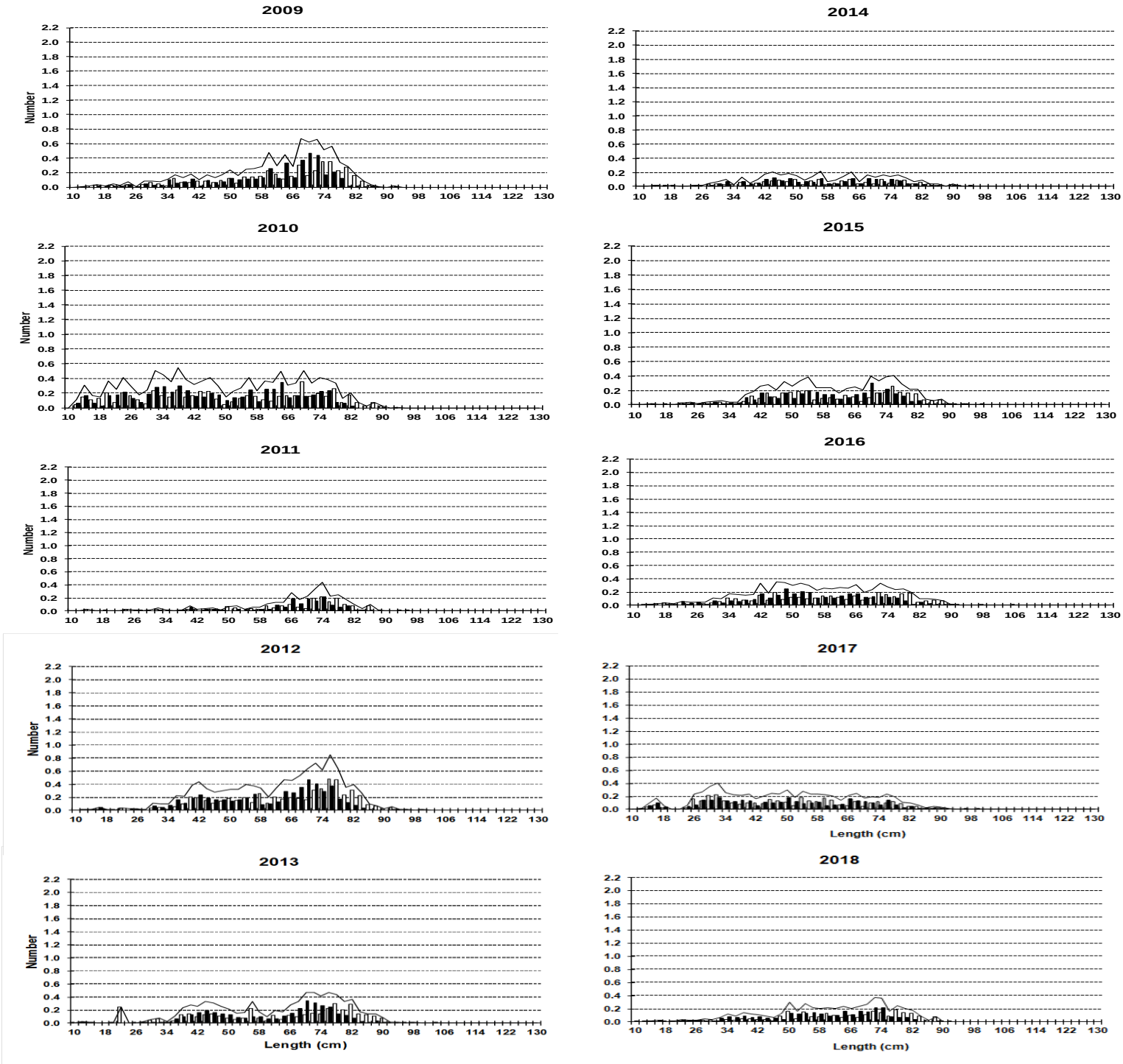

Figure 9 (cont.). Thorny skate length distribution (cm) on NAFO 3NO: 1997-2018. Mean catches per tow number. Data from 2014 to 2018 are in Table 8; data for 1997-2013 can be seen in SCR Doc 14/07.

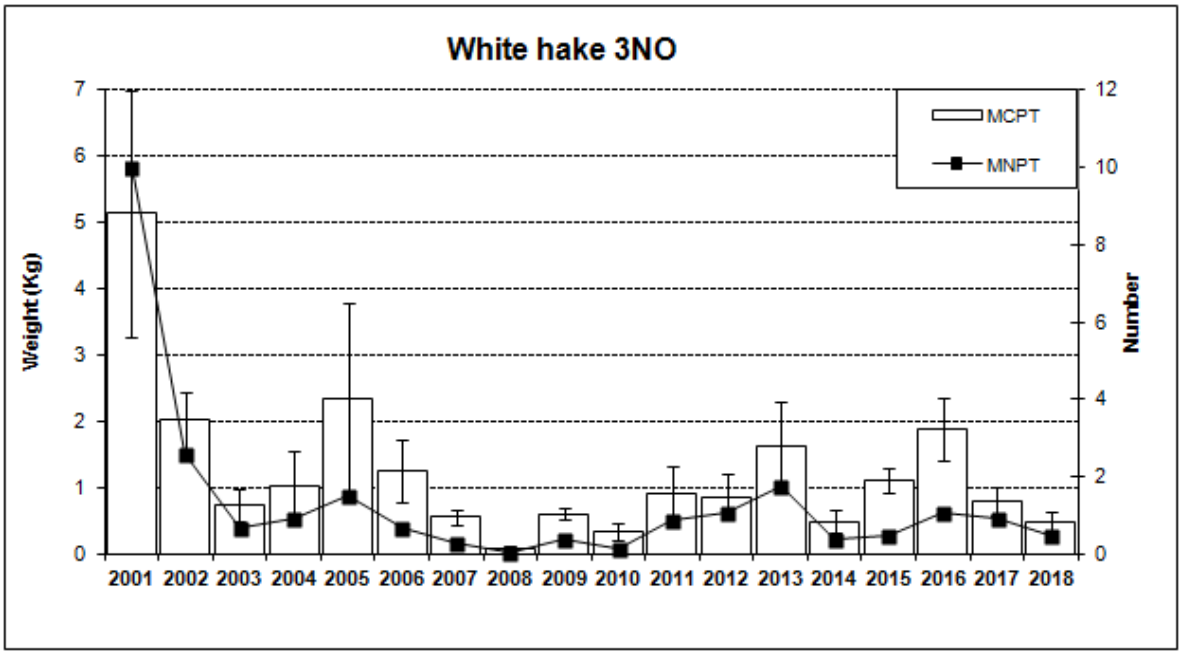

Figure 10. White hake stratified mean catches in Kg and ±SD by year and mean number by year. Spanish Spring surveys in NAFO Div. 3NO: 2001-2018.

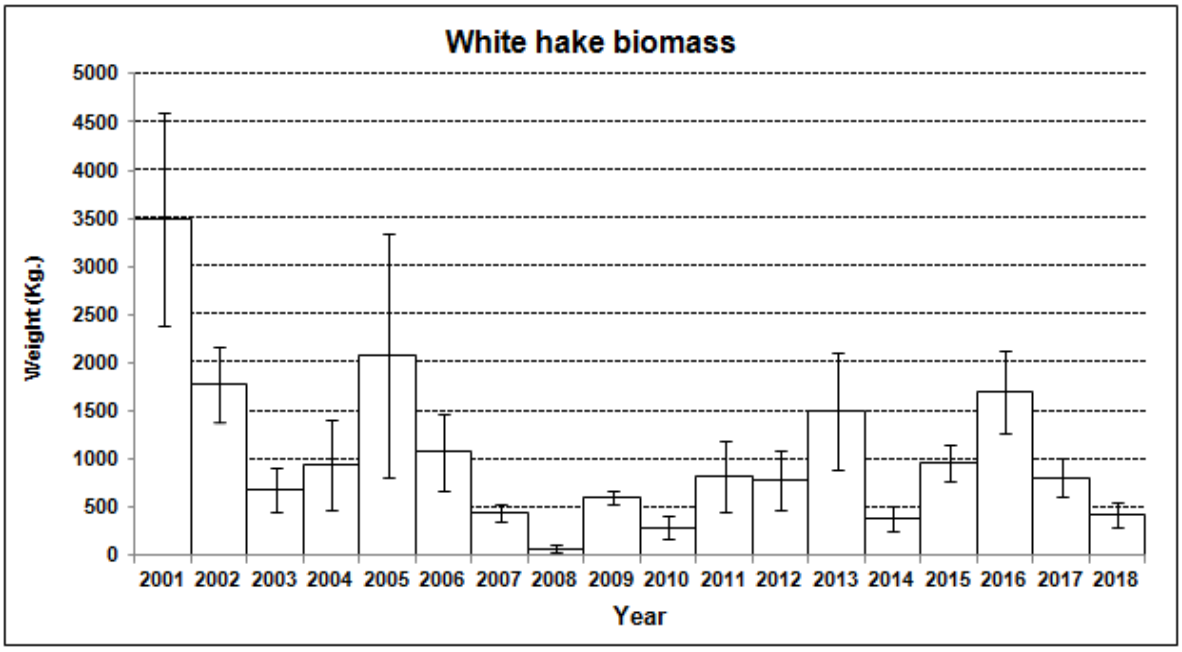

Figure 11. White hake biomass calculated by the swept area method in tons and ±SD by year. Spanish Spring surveys in NAFO Div. 3NO: 2001-2018.

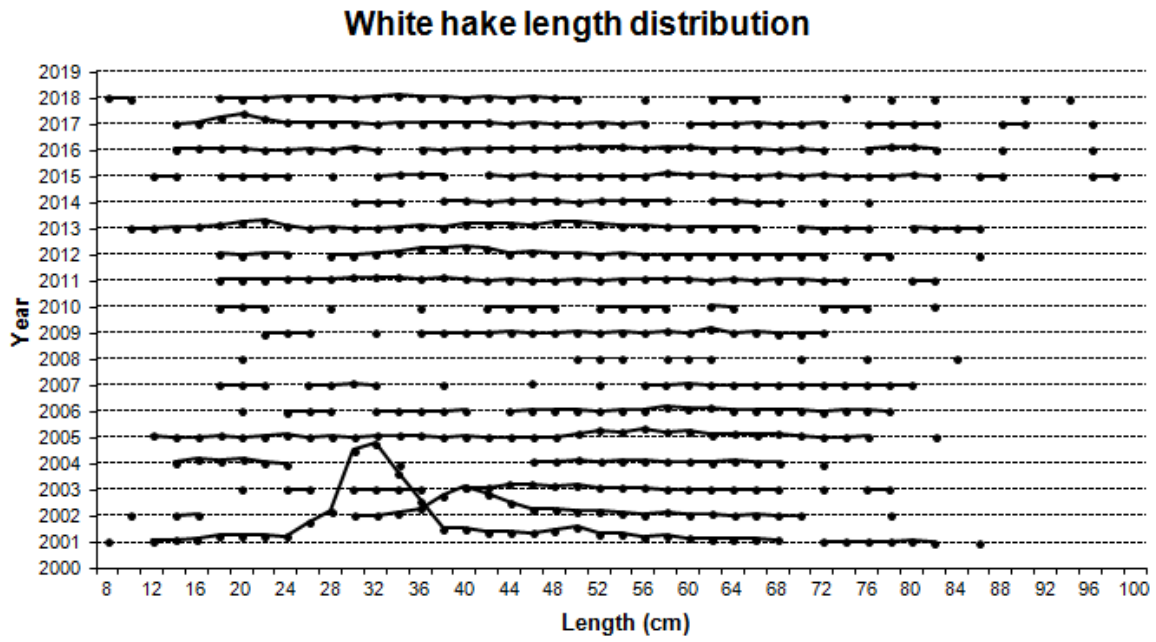

Figure 12. White hake mean catches per tow length distribution (cm) on NAFO 3NO: 2001-2018. Data from 2014 to 2018 are in Table 20; data for 2001-2013 can be seen in SCR Doc 14/07.

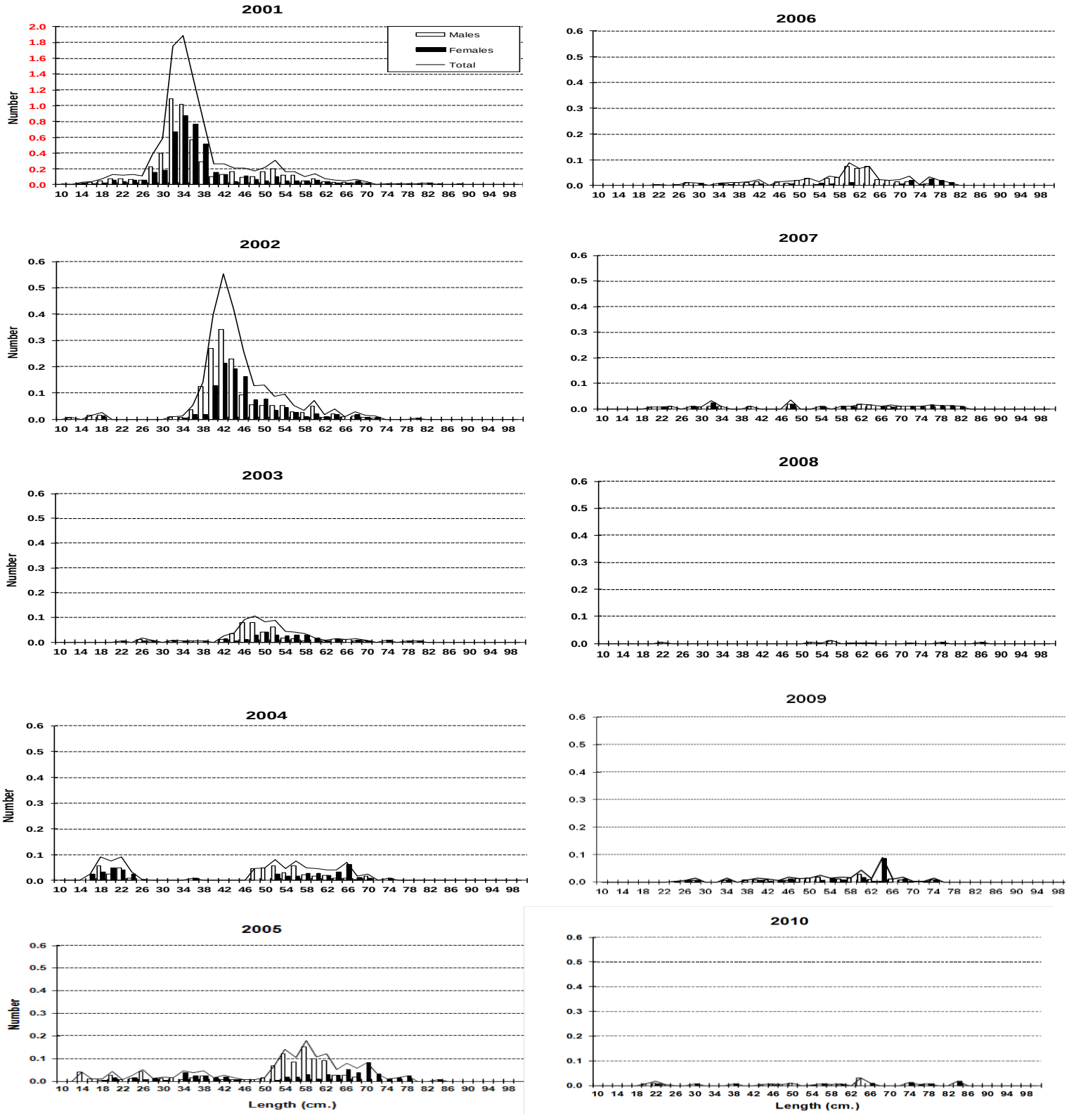

Figure 13. White hake length distribution (cm) on NAFO 3NO: 2001-2018. Mean catches per tow number. Data from 2014 to 2018 are in Table 20; data for 2001-2013 can be seen in SCR Doc 14/07. In 2011 and 2017 the individuals were not sexed. In 2018, the X-axis has a different range.

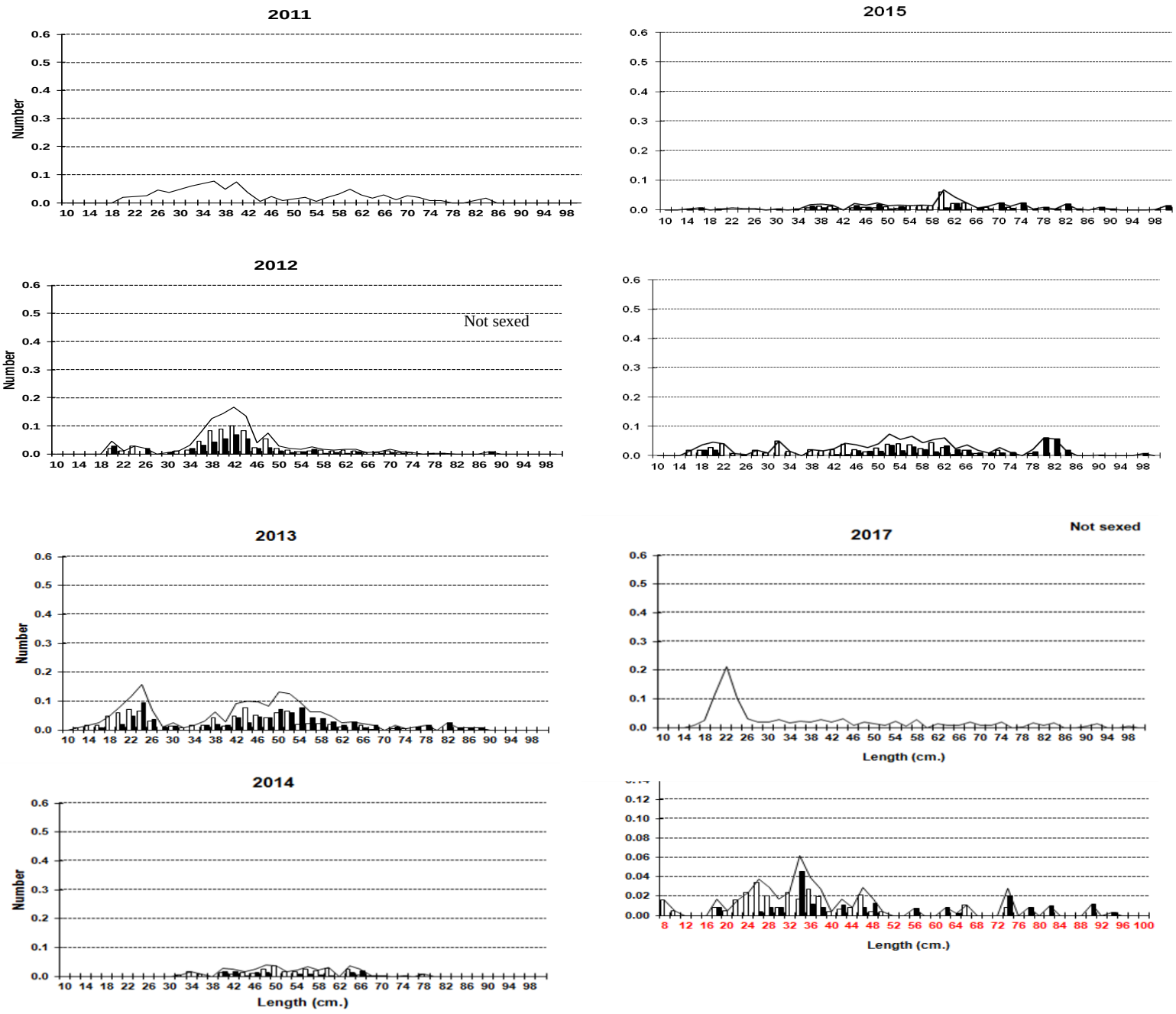

Figure 13 (cont.). White hake length distribution (cm) on NAFO 3NO: 2001-2018. Mean catches per tow number. Data from 2014 to 2018 are in Table 20; data for 2001-2013 can be seen in SCR Doc 14/07. In 2011 and 2017 the individuals were not sexed. In 2018, the X-axis has a different range.

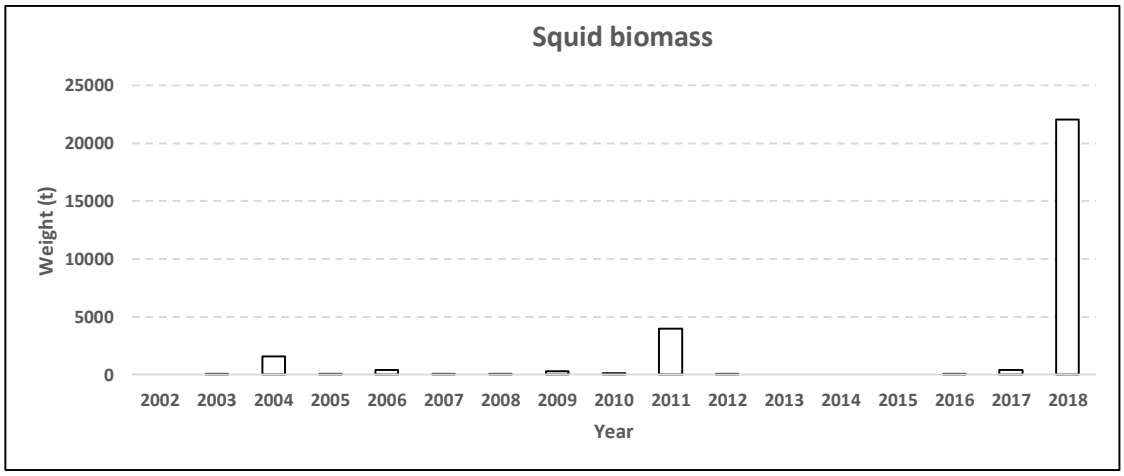

Figure 14. Squid biomass calculated by the swept area method in tons and ±SD by year. Spanish Spring surveys in NAFO Div. 3NO: 2002-2018.

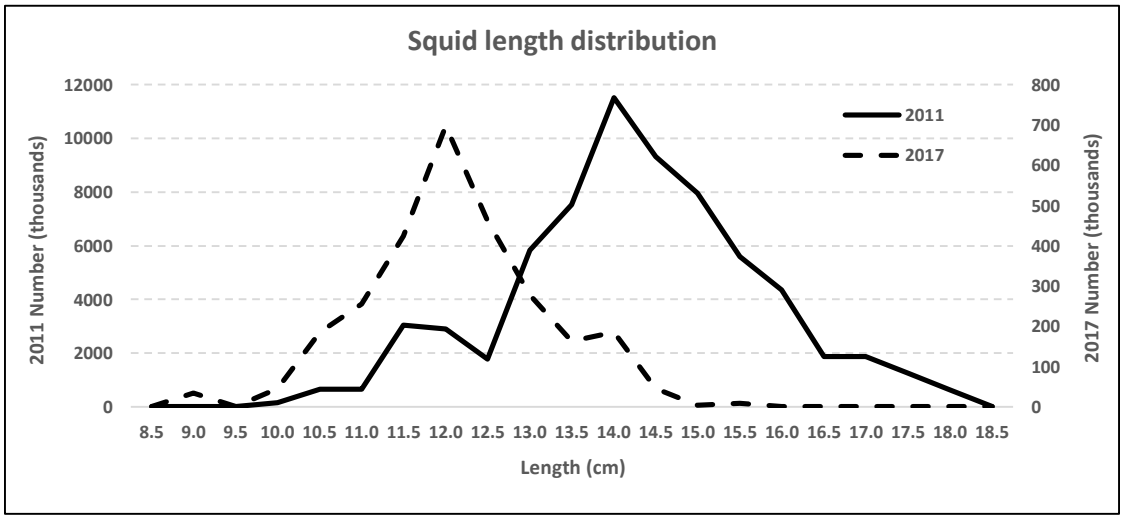

Figure 15. Squid length distribution (cm), in the years in which samples were taken, on NAFO 3NO: 2002-2018. Total abundance in thousands. Each year is represented in a different Y-axis.