Northwest Atlantic Fisheries Organization

Serial No. N6880 **NAFO SCR Doc. 18/063**

NAFO/ICES *PANDALUS* ASSESSMENT GROUP MEETING - OCTOBER 2018

Northern Shrimp (*Pandalus borealis*, Krøyer) from EU-Spain Bottom Trawl Survey 2018 in NAFO Div. 3LNO

by

Casas, J.M., E. Román and M. Álvarez
Instituto Español de Oceanografía, Aptdo. 1552. 36200 - Vigo. Spain.

Abstract

The Spanish Institute of Oceanography carried out in 2018 two bottom trawl surveys in the NAFO Regulatory Area in Division 3NO and 3L during the months of June and August respectively. The results on Northern shrimp (*Pandalus borealis*) are presented and compared with those from previous surveys from the same series. As recent years in 2018the shrimp catch (0.528 kg.) and estimated biomass (2.413 t.) in Divisions 3NO remain between the lowest of the series, confirming the decrease of shrimp importance from 2004. The Northern shrimp catches in 3L Division have declined from 2009, the shrimp catch (1352 kg.) and biomass estimated in 2018 (7807 t.) remain between the lowest values in the historical series.

Introduction

Northern shrimp (*Pandalus borealis* Krøyer, 1883) is a protrandric, circumpolar species, discontinuously distributed in the North Atlantic and of considerable commercial importance. The greatest abundance is being in the Northwest Atlantic at latitudes above 46ºN. The stock of this species in Div. 3LNO, NAFO is distributed along the entire edge of the Grand Bank, mainly in Div. 3L, at depths generally ranging from 185 to 550 metres, although historically at least 92.7% of the 3LNO shrimp biomass had been found within Division 3L. The proportion of biomass in 3LNO within the NAFO Regulatory Area (NRA), over the period 1996 – 2014, accounted for between 4 and 32.6% (Orr and Sullivan, 2014).

Since 1995, Canadian multi-species stratified random surveys have been used to estimate northern shrimp biomass and abundance indices within NAFO Div. 3LNO. In this series of surveys, Div. 3N accounts for between 0.2 and 8.1% of the total 3LNO biomass. Between 0 and 100% of the 3N biomass was located outside the 200 Nmi limit. The biomass in Division 3O accounts for less than 1% of the biomass in Div. 3LNO and only a negligible amount of the biomass in Div. 3O is beyond the 200 mile limit (Orr and Sullivan, 2014).

The fishery began in 1993 and came under TAC control in 2000. The TAC was then reduced annually until no directed fishing was implemented for 2015. The Oceanographic Spanish Institute (IEO) is conducting research cruises since 1995 in the NAFO Regulatory Area in Div. 3NO beyond Canada's EEZ. A stratified, random, bottom trawl, multi-species research sampling program was carried out to obtain abundance and biomass indices as well as other biological data for the most important commercial species present in the area. In the surveys conducted between 1995 and 2000, the catches of northern shrimp were insignificant. This could be explained

by the low efficiency of the fishing gear "pedreira", with this species (Paz et al., 1995), used in those years.

Since 2001, the survey was carried out on board R/V "*Vizconde de Eza*" using a Campelen 1800 net (Walsh et al., 2001). Despite the improvements incorporated with the new vessel and the use of a Campelen 1800 net, which is highly efficient for this species (Vazquez, 2002), total catches in 2001 were poor, i.e., 29 kg. In the following years a significant increase of the catches of northern shrimp was noted in 3NO Division where catches were higher than 300 kg. Since 2007 the catches have declined to levels next to the lowest in the historical series.

Also, since 2003 a new research survey was conducted in Division 3L as an extension of the survey carried out in 3NO (Román *et al.*, 2008). The estimated biomass in 3L Division always was very superior to that estimated in 3NO. Since 2009 year the catches have declined to low levels staying in the last years between the lowest in the historical series.

This work presents data on the geographical distribution in the NAFO Regulatory Area (Div. 3LNO), on biomass, length frequencies and age structure of catches of northern shrimp on EU-Spanish bottom trawl surveys 2018.

Materials and Methods

In 2018 the EU-Spanish bottom trawl surveys were carried out in 3NO (from 2nd to 21st June) and 3L (from 31st July to 19th August) following set guidelines previously established for the series of Spanish research surveys (Walsh *et al.*, 2001). These surveys took place in Div. 3NO and 3L, with a total of 114 and 100 valid hauls respectively ranging depths between 47 and 1442 m approximately. All strata were surveyed.

Shrimp samples of approximately 1.5 kg were taken to determine length frequencies. Males and females were separated with reference to the endopod of the first pleopod (Rasmussen, 1953). Following this criterion, individuals that were in the middle of a sex change were considered as females. The females were differentiated into mature and immature, following the sternal spines criteria (McCray, 1971). Ovigerous females were considered as an independent group not included within the mature females.

Individuals were measured onboard by noting the distance from the base of the eye to the posterior mid dorsal point of the carapace -CL- (Shumway *et al*., 1985). Such measurements were made to the lower half millimetre using electronic callipers.

Furthermore, in 2018 survey some samples were frozen onboard to determine the length-weight relationship in the laboratory.

Results and Discussion

The Table 1 shows the catches, biomass and standard errors estimated by swept area method of northern shrimp from the EU-Spanish multi-species surveys, carried out by IEO Vigo from 1995-2018 in the NAFO Div. 3NO and from 2003-2018 in Division 3L. In the summer of 2005 the research survey could not be carried out in Division 3L. From the year 2002 an abrupt increase with respect to earlier years occurred in 3NO Division, both in terms of catch and biomass (Diaz *et al*., 2002). These initial data were considered with caution due to the fact that, until 2001, the "Pedreira" gear used as a sampler (Paz *et al*., 1995) was not efficient for catching shrimp. However, although in 2001, the gear "type Pedreira" was changed for a new type "Campelen 1800" (Walsh *et al*., 2001) with high efficiency for catching this species (Vazquez, 2002), the catches and biomass estimated stayed at low levels.

From 2002 to 2006, the increase of shrimp catches in 3NO was confirmed, in terms of the period 1995-2001. After that, in the last years the catches and estimated biomasses of shrimp have decreased markedly and they are now at levels of the beginning of the series. The estimated biomass in 2018 was around 2.41 t. (Figure 1).

Unlike 3NO, the estimated biomass in 3L Division showed a general upward trend from 63647 t. in 2003 to 149265 t. in 2008. This trend changed in 2009 with the strong decline of the biomass estimated (74091 t, about 50% with respect to 2008) and since then the biomass decreased up to the historical minimum recorded in 2018 (7807 t.). (Figure 1).

The distribution of northern shrimp catches in the EU-Spanish trawl surveys 2018 is shown in Figure 2. As in previous years the catches in 3NO Division were residuals.

The Tables 2 and 3 show the shrimp biomass by depth strata from 1995 to 2018 surveys in 3NO Divisions and from 2003 to 2018 in 3L Division. Although it is considered that the shrimp in Div. 3LNO is distributed along the entire edge of the Grand Bank, at depths generally ranging from 51 to 300 fathoms (93-550 m.), the depth of the bulk of biomass in 3L Division was generally in depths lower than 200 ft (90% of the biomass in 2018). From 2013 to 2015 this general pattern changed and the percentage of the estimated biomass in depths lower than 200 ft decreased up to 44%, 77% and 85% of the biomass in 2013, 2014 and 2015 respectively. In 3NO the percentage of the estimated biomass in depths lower than 200 ft. varied along the years, showing a deeper distribution in 2004, 2005 and 2011 (26%, 34% and 21% respectively).

The length distribution by sex estimated in 3NO and 3L Divisions are presented in the tables 4, 5 and Figure 3. In 3NO, the main modes were around 12 mm. for males and 19.5 mm. for females; and 14 mm. for males and 23 mm. for females in 3L Division. In 2018 the sex ratio was different in both Divisions, showing a higher percentage of the males (92%) in 3NO.

The MIX modal size analysis programme was used with the length distribution by sex estimated in 3L Divisions (Table 6). From the cited analysis the males presented three modes at 14.8, 18.9 and 21.2 mm. corresponding with ages 2, 3 and 4 respectively. The females showed several modes at 17.7, 20.5, 23.4 and 25.8 mm (ages 3, 4, 5 and 6 respectively).

The Table 7 shows the length-weight relationship estimated in 2018 surveys by sex and maturity stage as well the parameters of the relationship, number of specimens sampled and determination coefficient R^2. 97 and 1539 individuals were selected in 3NO and 3L Divisions respectively, dried and weighed with a precision of 0.01g to calculate the length-weight relationship in each Division.

Acknowledge

The data used in this paper have been funded by the EU through the European Maritime and Fisheries Fund (EMFF) within the National Program of collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy.

References

Díaz, P., T. Patrocinio, and X. Paz. 2002. Increased Catches of Northern Shrimp (*Pandalus borealis*, Krøyer) in a 2002 Spanish Bottom Trawl Survey in NAFO Division 3N. *NAFO SCR Doc*., No. 143. Serial No.N4772, 11p.

McCRay, J.A. 1971. Sternal spines as a characteristic for differentiating between females of some Pandalidae. *J. Fish. Res. Bd. Can.*, **28**: 98-100.

Orr, D. C. and D. J. Sullivan. 2014. The 2014 assessment of the Northern Shrimp (*Pandalus borealis*, Kroyer) resource in NAFO Divisions 3LNO. *NAFO SCR Doc., No.* 048. Serial No. N6350, 73 p.

Paz, X., J. Martínez, and E. De Cárdenas. 1995. Preliminary results from the 95 Spanish bottom trawl survey in the NAFO Regulatory Area for Divisions 3NO. *NAFO SCR Doc*., No. 55. Serial No. N2568, 10 p.

Rasmussen, B. 1953. On the geographical variation in growth and sexual development of the Deep Sea Prawn (*Pandalus borealis*, Kr.) . *Norweg. Fish. And Mar. invest. Rep*., **10** (3):1-160.

Román, E., C. González-Iglesias, Á. Armesto, and D. González-Troncoso. 2008. Results for the Spanish Survey in the NAFO Regulatory Area of Division 3L for the period 2003-2007. *NAFO SCR Doc*., No. 20. Serial No. N5514, 25p.

Shumway, S.E., H. C. Perkins, D. F. Schick, and A. P. Stikney. 1985. Synopsis of biological data on the Pink Shrimp (*Pandalus borealis*, Krøyer,1838). *NOAA Techn. Rep.* NMFS **30**, 57 p.

Vázquez, A. 2002. Catchability comparison between Lofoten and Campelen gears. *NAFO SCR. Doc.,* No.74. Serial No. N4688, 7p.

Walsh, S. J., X. Paz, and P. Durán. 2001. A preliminary investigation of the efficiency of Canadian and Spanish survey bottom trawls on the southern Grand Bank. *NAFO SCR. Doc*., No. 74. Serial No. N4453, 18 p.

Table 1.- Northern shrimp biomass estimated by swept area (t), standard error and catches (kg) from EU-Spanish bottom trawl surveys in NAFO Div. 3NO, 1995-2018 and 3L 2003-2018.

3NO

Year	Biomass		Catch (kg)
	tons	Std. err.	
1995[1]	14	13	5
1996[1]	18	17	2
1997[1]	1	1	0
1998[1]	23	17	5
1999[1]	81	36	13
2000[1]	26	9	6
2001[2]	178	72	29
2002[2]	2043	814	408
2003[2]	1618	716	325
2004[2]	2654	1693	550
2005[2]	1627	590	368
2006[2]	1274	352	278
2007[2]	401	285	71
2008[2]	144	98	24
2009[2]	140	111	33
2010[2]	114	35	21
2011[2]	37	24	9
2012[2]	3.86	3.04	0.92
2013[2]	38	15	9
2014[2]	2.97	0.63	0.84
2015[2]	1.96	0.60	0.53
2016[2]	2.36	1.93	0.39
2017[2]	3.02	1.39	0.59
2018[2]	2.41	0.17	0.53

3L

Year	Biomass		Catch (kg)
	tons	Std. err	
2003[2]	63647	20105	5836
2004[2]	94270	40332	5093
2005	Not surveyed		
2006[2]	125850	12690	17805
2007[2]	113402	13445	18098
2008[2]	149265	48490	23720
2009[2]	74091	37999	12173
2010[2]	37803	9836	6103
2011[2]	24346	4449	4092
2012[2]	10784	3724	1838
2013[2]	17438	5363	3101
2014[2]	10846	2764	1860
2015[2]	8435	1930	1450
2016[2]	20125	7903	3418
2017[2]	12893	2804	2149
2018[2]	7807	1726	1352

[1] Pedreira codend 35 mm. mesh size.

[2] Campelen codend 44 mm. mesh size. (inner codend 20mm)

Table 2.- Northern shrimp biomass (kg.) by strata from Spanish bottom trawl survey 1995-2018 in NAFO Div. 3NO.

St	A	D	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	2	0	0	0		0	0	0	3	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0		0	0	0	1	0	0	0	3	4	0	0	0	0	3	0	0	0	0	0	0	0
3	2	3	0	0		0	0	0	7	0	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
3	2	3	0	0		0	0	0	2	1	3	2	0	0	4	0	1	1	1	0	5	0	0	7	9	1
3	2	3	0	0		0	0	0	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	8	0
3	2	5	0	0		0	0	0	8	0	2	6	0	0	1	0	0	5	8	0	2	0	0	0	1	0
3	4	5	0	0		0	1	0	6	8	1	4	4	2	9	4	0	5	4	0	3	2	0	0	0	7
3	1	5	0	0		0	2	4	0	2	7	1	3	3	8	6	4	0	0	0	0	0	0	0	4	0
3	3	5		0		0	2	2		1	3	2	8	9	1	4	0	0	0	0	0	0	0	3	0	0
3	7	1		0		0	0	0	1	1	7	6	6	9	2	2	0	9	0	1	8	1	3	0	0	0
3	2	1	0	0		0	3	0	7	3	3	1	3	2	2	2	0	1	1	0	2	0	0	0	0	0
3	1	1	0	0		8	1	1	1	6	1	7	3	1	1	4	7	1	0	0	0	0	0	1	0	0
3	1	1		0		6	1	1		8	2	2	1	7	3	1	4	2	8	1	4	7	3	1	1	7
3	4	1		0		0	0	0	1	0	1	1	8	2	2	6	3	4	3	0	0	0	4	0	0	6
3	1	1	0	1		0	0	0	6	1	4	1	3	1	9	1	9	1	2	0	0	1	0	2	0	0
3	1	1	0	0	7	0	1	0	1	7	2	7	3	1	1	2	5	1	1	2	8	1	4	5	2	1
3	9	1		0		1	9	1		1	6	2	1	6	6	1	1	2	7	3	2	1	6	3	1	1
7	6	2		0		0	0	0	2	3	1	8	2	3	0	2	3	6	6	1	3	5	5	0	0	2
7	1	2		0		0	1	0	0	1	9	4	3	5	1	9	0	9	3	0	9	1	0	0	0	7
7	1	2	1	0		0	0	0	2	5	9	1	7	2	4	5	2	7	0	0	2	2	6	1	3	2
7	9	2		0		1	0	1		2	2	9	3	6	1	3	1	6	2	8	9	5	1	3	2	0
7	8	3		0		0	3	7	2	6	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	3	0	0		0	0	0	0	5	6	5	1	5	2	0	0	0	3	0	0	0	0	0	0	0
7	7	3	0	0		0	0	0	0	7	5	2	0	4	1	0	5	1	0	0	0	0	0	1	0	1
7	7	3		0		0	0	1		7	0	0	8	1	0	0	4	1	0	0	4	0	0	0	0	0
7	1	4		0		0	0	0		8	0	4	2	5	3	0	1	1	0	0	7	0	0	0	0	0
7	1	4		0		0	0	0	0	0	4	4	8	8	2	8	3	0	0	0	0	0	0	0	0	0
7	1	4		0		0	0	0	0	0	2	4	0	0	5	0	0	0	0	0	0	0	0	0	0	0
7	1	4		0		0	0	0	4	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
7	1	5		0		0	0	0		0	0	0	0	1	0	0	0		0	0	0	0	0	0	3	0
7	1	5		0		0	0	0		2	0	0	2	0	6	0	0	1	0	0	0	0	0	0	0	0
7	1	5		0		0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0
7	1	5		0		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	6				0	0	0		0	0	0	0	0	0	2	0	9	0	0	0	0	0	0	0	0
7	9	6				0	0	9		1	0	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2	6				0	0	0	0	8	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
7	1	6				0	0	0		1	5	0	0	0		0	0	3	0	0	0	0	0	0	0	0
7	3	7				0	0	8		0	1	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0
7	1	7				0	0	0		1	0	4	0	0		0	0	9	0	0	0	0	0	0	0	0
7	2	7				0	0	0		0	0	0	0	0		0			0	0	0	0	0	0	0	0
7	1	7				0	0	0		0	0	0	0	0		0			0	0	0	0	0	0	0	0
Biom			1	1	1	2	8	2	1	2	1	2	1	1	4	1	1	1	3	3	3	2	1	2	3	2
Std.			1	1	1	1	3	9	7	8	7	1	5	3	2	9	1	3	2	3	1	0	0	1	1	0
Biomass			0	1	1	4	7	4	9	9	8	2	3	7	8	9	9	9	2	9	7	5	5	9	9	8

Table 3.- Northern shrimp biomass (kg.) by strata from Spanish bottom trawl survey 2003-2018 in NAFO Div. 3L

Stratum	Area Mn²	Depth range fth.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
385	118	51-100	420	175		2485867	2416545	8265541	140724	12046	975	4998	31	68	0	0	315	37
390	815	51-100	1014	3780		2577958	5404325	317330	37466118	145874	2020	49686	414	2340	492	94	238	12
389	509	101-150	14397492	41654297		53639329	49120205	74404070	25997291	21705956	979731	630153	149429	318135	148994	176622	879985	213006
391	282	101-150	1116135	1299793		3712072	12397477	24948041	28071	120096	11940	99221	3115	16223	9267	8073	1677	16544
387	256	151-200	17618619	21721973		29967360	11782827	14287154	6473372	7874303	15006844	6644446	5206921	3955026	4608862	10305953	5244142	4391914
388	357	151-200	25169595	24779540		32585066	26954928	21602795	2348269	5096163	8113071	2136050	1979045	3858773	1811165	8512571	5268078	2095031
392	145	151-200	2821419	1866379		193967	1199955	3675300	1564098	1608469	24550	118649	329956	155247	553694	174468	695049	273519
729	186	201-300	20371	1465049		88481	172095	16126	11533	95976	149	2618	11348	2331	18320	5156	30569	491
731	216	201-300	2449416	1467221		177357	666240	1501056	54100	1083034	2647	799077	2191919	1644180	875000	288113	101120	525416
733	234	201-300		4077		390052	3281339	240647	6718	51397	194095	285343	7544711	833091	400587	653016	671788	290774
730	170	301-400	0	876		1485	76	32	20	581	92	0	36	907	0	0	294	10
732	231	301-400	34907	5643		14535	4723	1905	226	4266	1349	596	3229	34455	1088	453	62	100
734	153	301-400		408		10554	136	2144	70	129	4910	1553	15628	16075	2625	421	0	41
741	100	401-500	0	56		1379	22	486	0	0	662	189	402	1893	3429	82	0	0
745	348	401-500	17642	0		1699	186	1950	0	2716	1911	250	1613	5068	591	55	0	12
748	159	401-500	292	696		366	499	66	0	49	108	0	21	83	0	0	0	21
742	64	501-600	0	0		462	0	0	0	1718	57	11202	9	0	473	31	0	0
746	392	501-600	0	0		134	0	74	70	225	381	0	395	1068	0	45	0	0
749	126	501-600	0	23		99	0	0	0	0	11	0	0	140	28	0	0	0
743	51	601-700		0		1020	0	23	0	0	2	20	0	18	0	0	0	0
747	724	601-700		0		147	0	41	201	51	32	0	116	753	21	51	0	6
750	556	601-700		0		58	0	132	295	0	308	0	37	178	95	0	0	0
744	66	701-800		0		185	0	0	0	0	0	0	0	9	18	0	0	0
751	229	701-800				0	0	0	0	0	0	0	21	21	0	0	0	0
Biomasa (t.)			63647	94270		125850	113402	149265	74091	37803	24346	10784	17478	10846	8435	20125	12893	7807
Std. Error (t)			20105	40332		12690	13445	48490	37999	9836	4449	3724	5363	2764	1930	7903	2804	1726
Biomass % < 200 fth			96	97		99	96	99	100	97	99	90	44	77	85	95	94	90

Table 4.- Northern shrimp size distribution ('000) by sex from Spanish bottom trawl survey 2018 in NAFO Div. 3NO.

CL (mm)	Males	Females	Total
6	0	0	0
6.5	0	0	0
7	0	0	0
7.5	0	0	0
8	0	0	0
8.5	0	0	0
9	0	0	0
9.5	15	0	15
10	15	0	15
10.5	7	0	7
11	60	0	60
11.5	37	0	37
12	136	0	136
12.5	126	0	126
13	123	0	123
13.5	48	0	48
14	65	0	65
14.5	85	0	85
15	36	0	36
15.5	118	0	118
16	82	0	82
16.5	52	0	52
17	44	0	44
17.5	28	0	28
18	0	5	5
18.5	15	0	15
19	0	15	15
19.5	0	47	47
20	0	0	0
20.5	0	0	0
21	0	11	11
21.5	0	15	15
22	0	0	0
22.5	0	0	0
23	0	0	0
23.5	0	0	0
24	0	0	0
24.5	0	0	0
25	0	0	0
25.5	0	0	0
26	0	0	0
26.5	0	0	0
27	0	0	0
27.5	0	0	0
28	0	0	0
29	0	0	0
29.5	0	0	0
30	0	0	0
30.5	0	0	0
Total	1092	93	1185
	92%	8%	

Table 5.- Northern shrimp size distribution ('000) by sex from Spanish bottom trawl survey 2018 in NAFO Div. 3L.

CL (mm)	Males	Females	Total
6	0	0	0
6.5	0	0	0
7	0	0	0
7.5	0	0	0
8	0	0	0
8.5	6	0	6
9	7	0	7
9.5	6	0	6
10	427	0	427
10.5	1767	0	1767
11	3442	0	3442
11.5	4941	0	4941
12	10203	0	10203
12.5	6643	0	6643
13	24162	347	24510
13.5	21519	0	21519
14	49084	560	49644
14.5	34017	288	34305
15	30953	953	31907
15.5	19843	1593	21437
16	19907	3887	23793
16.5	24402	12268	36670
17	29052	15574	44627
17.5	30948	20988	51936
18	26599	20873	47472
18.5	31424	21772	53196
19	30732	29463	60195
19.5	26170	28499	54668
20	20246	39699	59944
20.5	18736	38136	56872
21	18860	43570	62430
21.5	5601	39095	44696
22	8164	48934	57098
22.5	636	45182	45819
23	345	68060	68405
23.5	291	53725	54016
24	0	60102	60102
24.5	0	45828	45828
25	0	48307	48307
25.5	0	35361	35361
26	0	22130	22130
26.5	0	15811	15811
27	0	14694	14694
27.5	0	7618	7618
28	0	3176	3176
29	0	2214	2214
29.5	0	1493	1493
30	0	317	317
30.5	0	0	0
Total	499135	791348	1290483
	39%	61%	

Table 6.- Results of the modal analysis (MIX) by sex and maturity stage Spanish bottom trawl survey 3L 2018.

		3L		
	Males		***Females***	
Age	***Prop.***	***St. Dev.***	***Prop.***	***St. Dev.***
1				
2	0.525	0.0001		
3	0.402	0.0001	0.115	0.00002
4	0.073	0.0001	0.257	0.00002
5			0.410	0.00003
6			0.218	0.00004
7				
Age	***Mean CL***	***St. Dev.***	***Mean CL***	***St. Dev.***
1				
2	14.8	0.0003		
3	18.9	0.0003	17.7	0.00013
4	21.2	0.0004	20.5	0.00016
5			23.4	0.00020
6			25.8	0.00022
7				
Age	***Sigma***	***St. Dev.***	***Sigma***	***St. Dev.***
1				
2	1.6264	0.0002		
3	1.3378	0.0002	0.7952	FCV
4	0.7214	0.0003	0.9202	FCV
5			1.0516	FCV
6			1.1611	FCV
7				

Table 7.-Northern shrimp length-weight relationship by sex, maturity stage and all combined from Spanish bottom trawl survey 2018 in NAFO Div. 3L.

	a	b	R^2	N
Division 3NO				
Males	0.0013	2.7203	0.8746	86
Inmature females	0.0012	2.7633	0.8002	10
Mature females	-			1
Ovigerous females	-			-
All combined	0.0009	2.7633	0.9163	97
Division 3L				
Males	0.0008	2.9303	0.9388	610
Inmature females	0.0014	2.7346	0.9020	490
Mature females	0.0019	2.6590	0.8198	250
Ovigerous females	0.0052	2.3518	0.5398	189
All combined	0.0007	2.9570	0.9718	1539

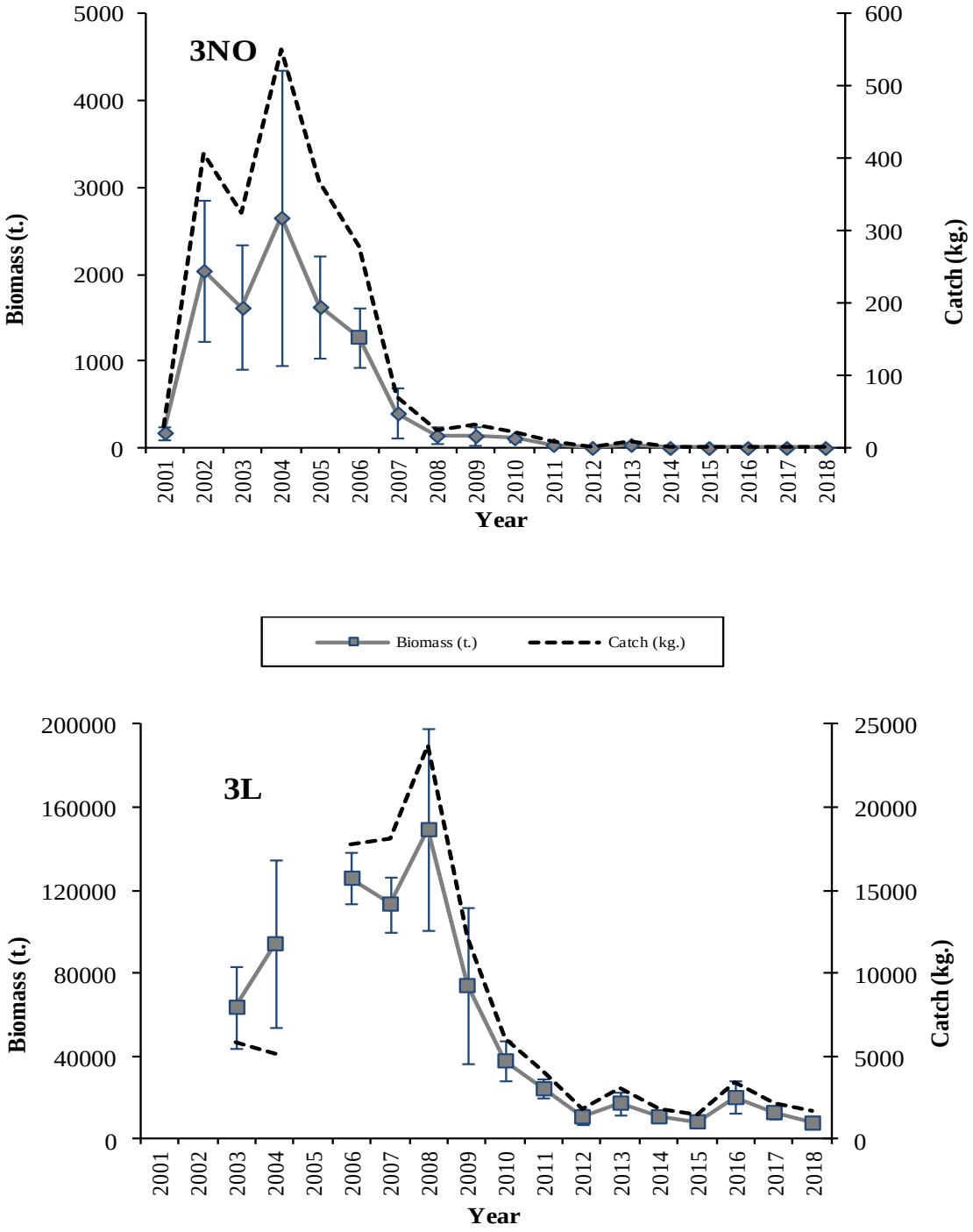


Fig. 1. Northern shrimp biomass (tons) and catch (kg) from Spanish research surveys in NAFO Div. 3NO 2001-2018 and 3L 2003-2018.

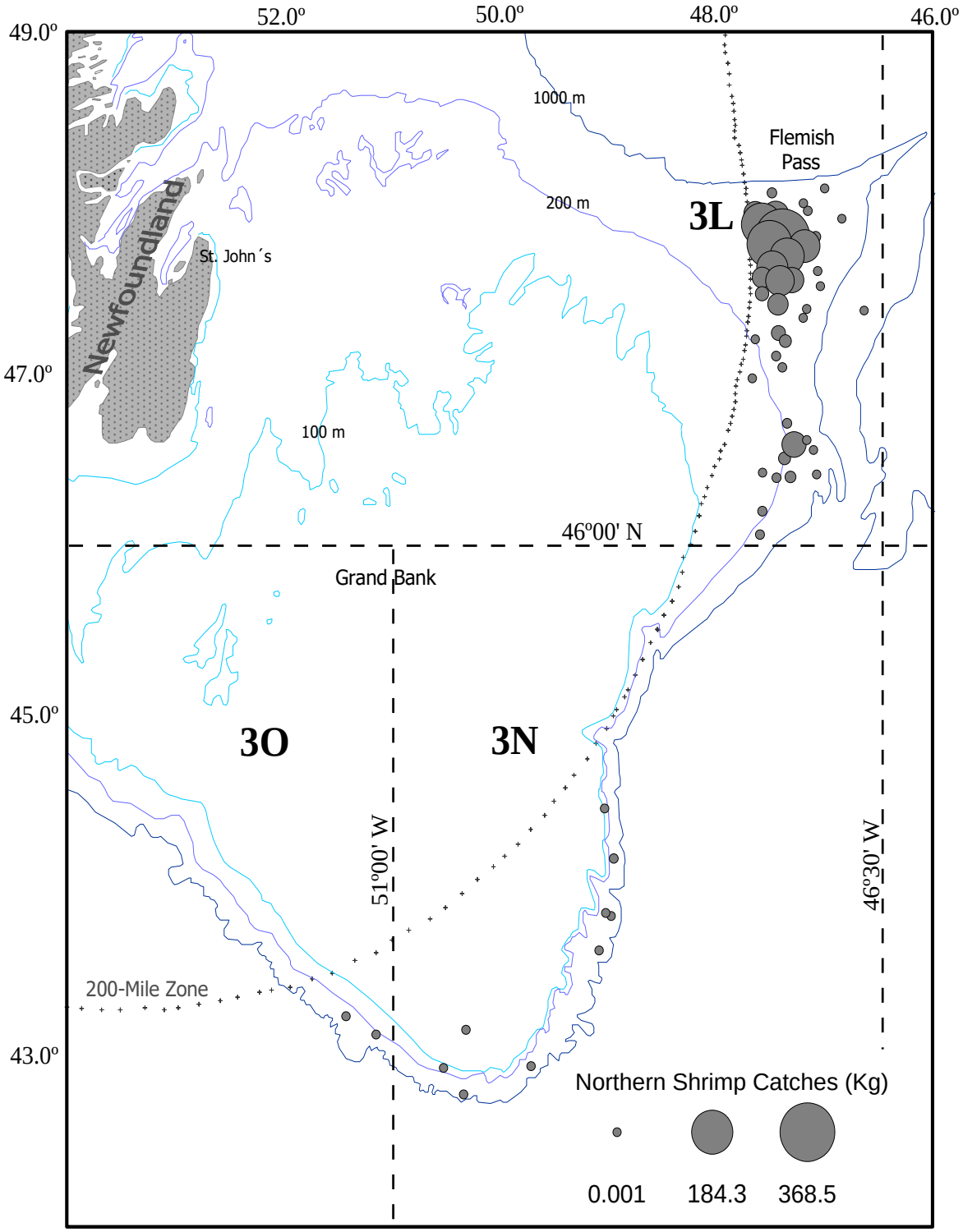
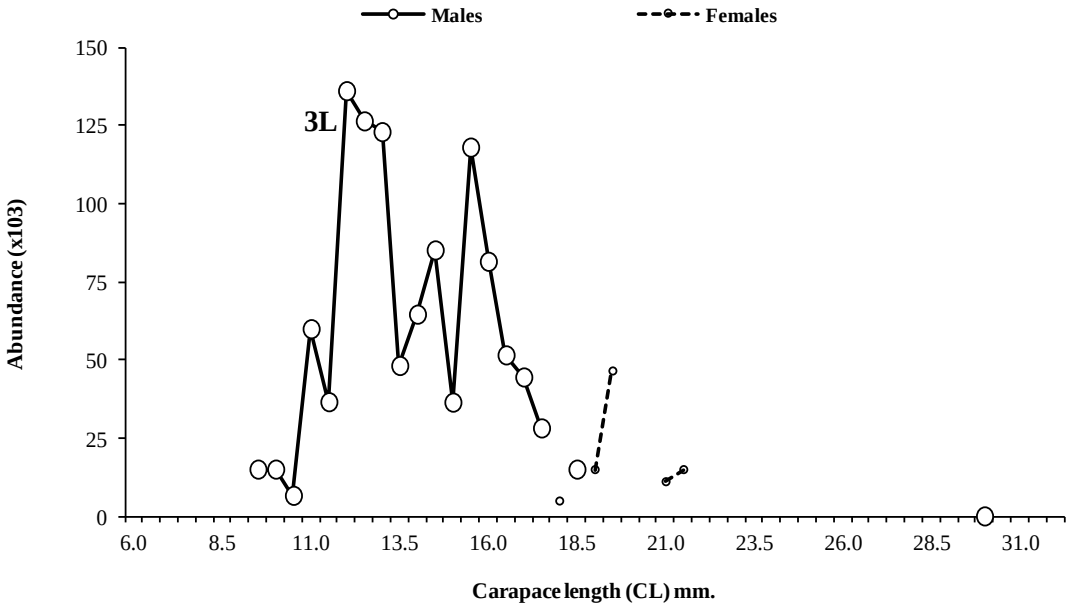


Fig. 2. Geographic distribution of Northern shrimp catches from Spanish bottom trawls surveys 2018.



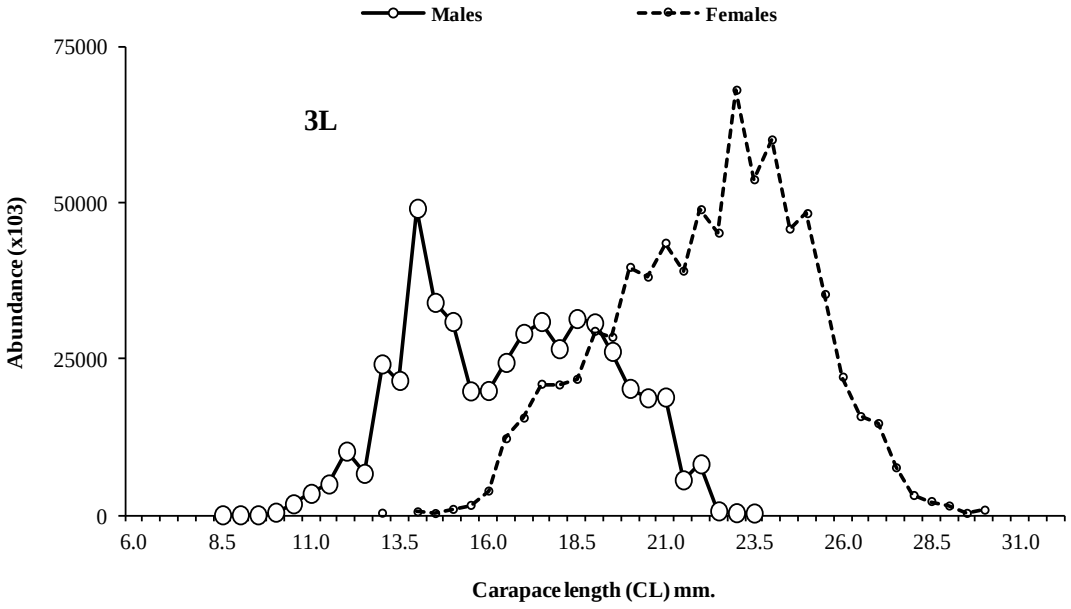


Fig. 3. Northern shrimp size distribution, by sex from Spanish bottom trawl survey (2018) in Divs. 3NO and 3L.