Spatial distribution of crustacean demersal assemblages in trawl grounds off Galician and Cantabrian shelf

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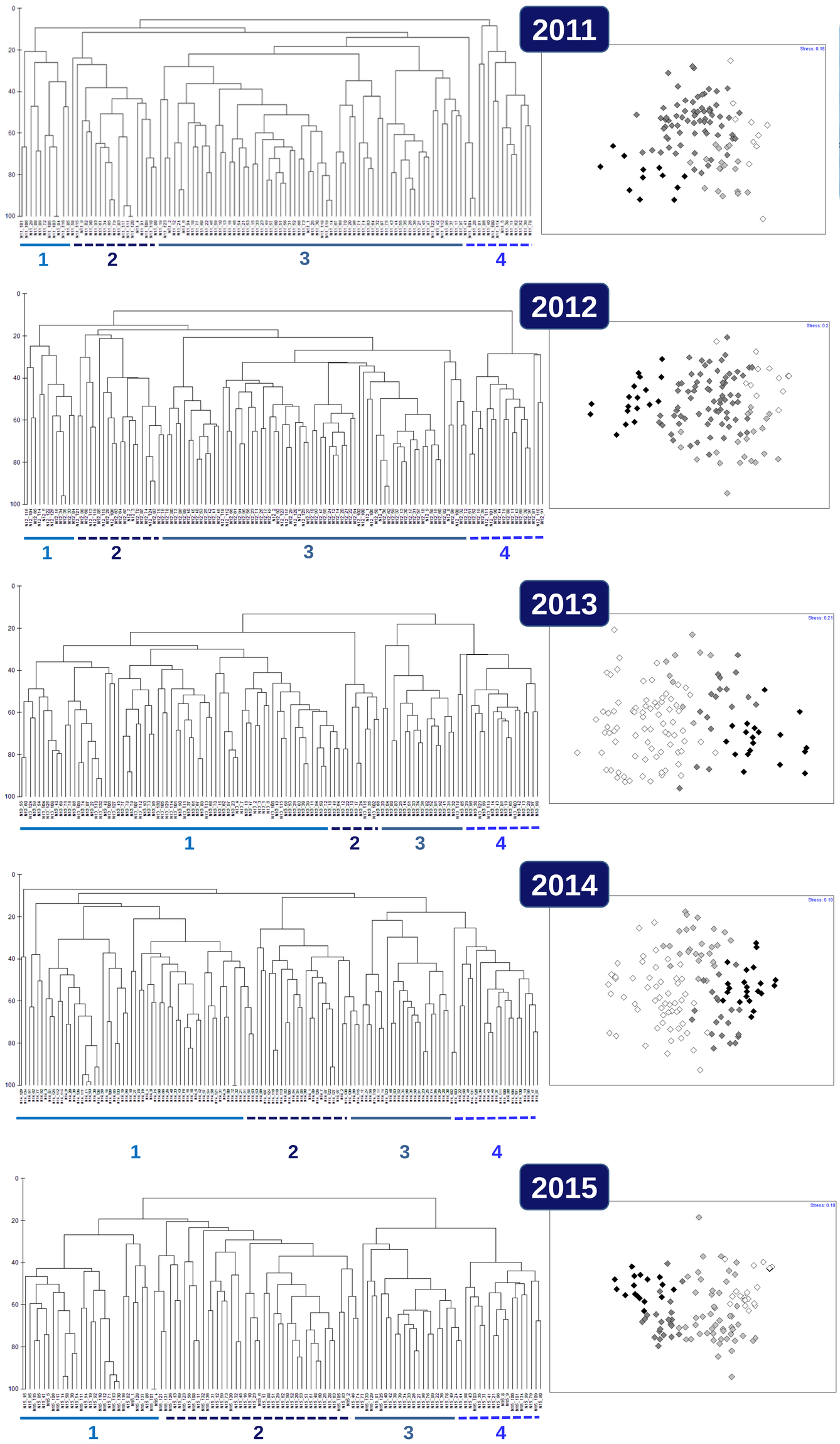
Introduction

In spite of crustaceans are the second group in abundance after fish in the Galician and Cantabrian continental shelf, studies on the spatial distribution patterns in the area are scarce. In the framework of the Ecosystem approach to fisheries management, it is necessary to study catches and discards and to increase the knowledge on the ecological aspects of these species at a regional scale.



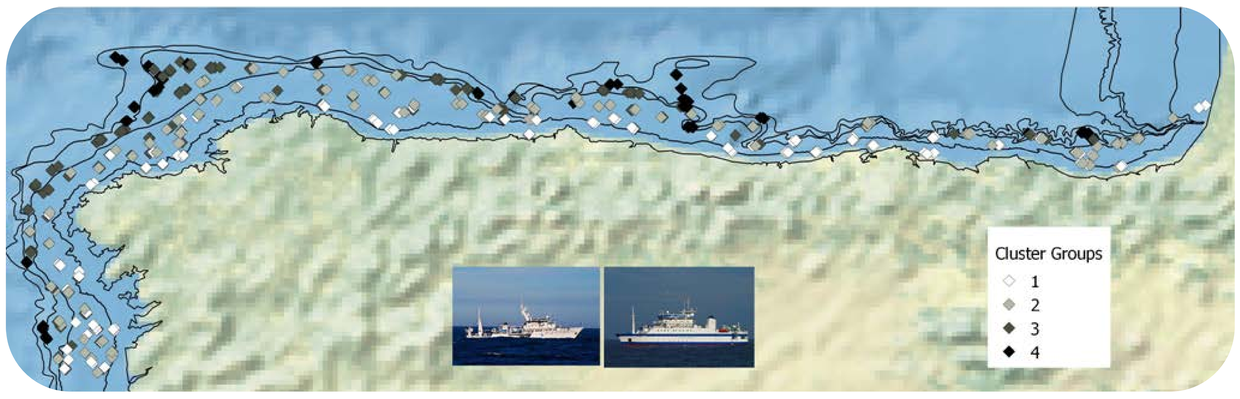


Figure 1. Study area and spatial distribution of hauls classified by cluster groups

Material and methods

The study area includes the Galician and Cantabrian continental shelf and slope. Data come from IEO surveys carried out on the oceanographic vessels "Cornide de Saavedra" and "Miguel Oliver" from 2011 to 2015 in autumn. A total of 614 trawling hauls were sampled using an otter trawl "Baca" type. The sampling unit was a 30-minute haul during daytime at a speed of 3 knots in a randomly stratified scheme by depth. Crustacean abundance data were fourth-root transformed and subjected to cluster analysis using the Bray-Curtis similarity index to characterize crustacean assemblages. SIMPER analysis was use to identify species typifying each group and a non-metric multidimensional scaling analysis was carried out.

Table 1. Abundance (Numbers by haul ± SD) of most abundant species (more than 50 individuals) by clusters groups.

Species	Cluster groups 1	2	3	4
Alpheus glaber	0.28 ± 0.01	0.10 ± 0.00	0.18 ± 0.00	0.13 ± 0.00
Anapagurus laevis	0.08 ± 0.00	0.09 ± 0.00	0.18 ± 0.01	0.11 ± 0.01
Aristeomorpha foliacea	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.65 ± 0.03
Chlorotocus crassicornis	1.70 ± 0.02	1.22 ± 0.02	8.93 ± 0.08	0.16 ± 0.01
Dichelopandalus bonnieri	0.02 ± 0.00	0.10 ± 0.00	11.05 ± 0.16	10.34 ± 0.43
Ephyrina figueirai	0.00 ± 0.00	0.00 ± 0.00	0.04 ± 0.00	1.02 ± 0.08
Galathea sp.	0.29 ± 0.01	0.18 ± 0.00	0.21 ± 0.01	0.03 ± 0.00
Geryon trispinosus	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	3.23 ± 0.13
Goneplax rhomboides	0.88 ± 0.03	0.18 ± 0.00	0.29 ± 0.01	0.86 ± 0.02
Inachus dorsettensis	0.36 ± 0.01	0.20 ± 0.01	0.13 ± 0.00	0.00 ± 0.00
Inachus leptochirus	0.03 ± 0.00	0.37 ± 0.02	0.00 ± 0.00	0.01 ± 0.00
Liocarcinus depurator	0.33 ± 0.01	0.39 ± 0.02	3.16 ± 0.10	0.02 ± 0.00
Macropipus tuberculatus	0.39 ± 0.01	0.50 ± 0.02	2.51 ± 0.04	0.14 ± 0.01
Macropodia longipes	2.17 ± 0.03	2.43 ± 0.04	1.70 ± 0.02	0.73 ± 0.02
Munida intermedia	0.49 ± 0.01	1.16 ± 0.06	11.02 ± 0.50	0.14 ± 0.01
Munida iris	0.11 ± 0.00	0.93 ± 0.07	27.79 ± 1.54	0.02 ± 0.00
Munida sarsi	0.25 ± 0.01	1.17 ± 0.06	3410.32 ± 64.49	0.91 ± 0.03
Nephrops norvegicus	0.08 ± 0.00	0.05 ± 0.00	1.19 ± 0.02	4.23 ± 0.12
Pagurus alatus	0.22 ± 0.01	0.97 ± 0.03	1.95 ± 0.04	12.20 ± 0.23
Pagurus bernhardus	0.78 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Pagurus excavatus	3.39 ± 0.03	0.56 ± 0.01	1.36 ± 0.02	0.05 ± 0.00
Pagurus prideaux	8.13 ± 0.17	14.48 ± 0.40	11.36 ± 0.24	0.56 ± 0.03
Parapagurus pilosimanus	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.61 ± 0.03
Pasiphaea multidentata	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.70 ± 0.03
Pasiphaea sivado	0.09 ± 0.00	0.16 ± 0.00	10.16 ± 0.26	58.35 ± 1.56
Philocheras echinulatus	0.09 ± 0.00	0.13 ± 0.01	1.65 ± 0.03	7.32 ± 0.17
Plesionika heterocarpus	2.48 ± 0.06	170.43 ± 6.24	193.70 ± 3.08	0.11 ± 0.01
Plesionika martia	0.00 ± 0.00	0.00 ± 0.00	0.05 ± 0.00	19.58 ± 0.28
Polycheles typhlops	0.01 ± 0.00	0.01 ± 0.00	0.14 ± 0.01	7.80 ± 0.17
Pontophilus norvegicus	0.00 ± 0.00	0.00 ± 0.00	0.09 ± 0.00	2.01 ± 0.06
Pontophilus spinosus	0.41 ± 0.01	0.23 ± 0.01	3.00 ± 0.04	4.03 ± 0.16
Processa canaliculata	0.10 ± 0.00	0.31 ± 0.01	0.38 ± 0.00	0.64 ± 0.02
Psathyrocaris infima	0.01 ± 0.00	0.01 ± 0.00	0.00 ± 0.00	0.73 ± 0.03
Sergia robusta	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	1.15 ± 0.04
Solenocera membranacea	0.22 ± 0.01	0.28 ± 0.01	1.05 ± 0.01	5.23 ± 0.14
Systellaspis debilis	0.04 ± 0.00	0.02 ± 0.00	0.07 ± 0.00	3.97 ± 0.18
Total	23.42 ± 0.00	196.65 ± 0.00	3703.70 ± 0.01	147.76 ± 0.09

Results

Four assemblages were detected as a result of the cluster analysis:

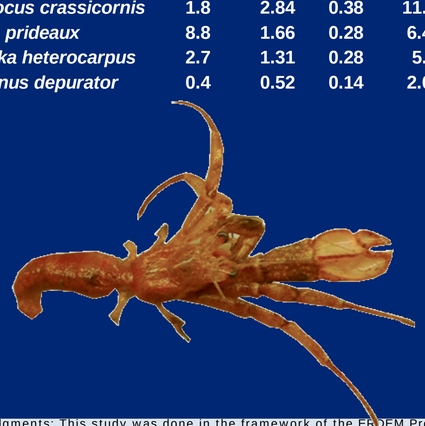
1. **Shallower shelf assemblage with a medium depth of 135 m typified by the pagurid *Pagurus excavatus*.**
2. **Shelf assemblage with a medium depth of 164 m typified by the pagurid *Pagurus prideaux*.**
3. **Upper slope assemblage with a medium depth of 230 m typified by the pandalid *Plesionika heterocarpus*.**
4. **Middle slope assemblage with a medium depth of 536 m typified by the pasiphaeid *Pasiphaea sivado*.**

Depth appears to be the most important factor in structuring assemblages, just like it has been described in the study area for other associations.

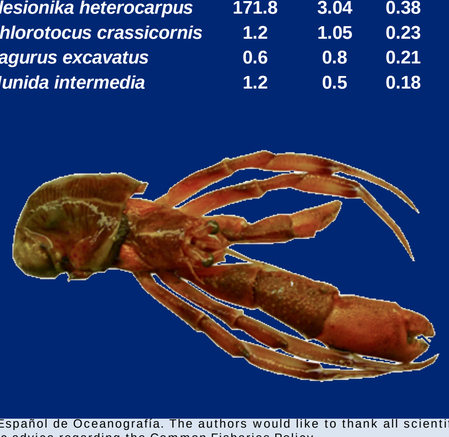
Figure 2. Cluster results for analyzed period (2011-2015) and MDS plots.

Table 2. SIMPER results: species contributing most to similarity in the 4 cluster groups.

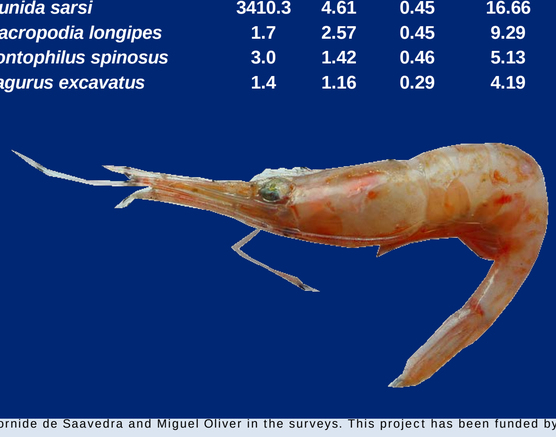
Group 1					
Average similarity:	25.71				
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Pagurus excavatus	3.7	12.84	0.78	49.93	49.93
Macropodia longipes	2.3	4.01	0.45	15.59	65.53
Chlorotocus crassicornis	1.8	2.84	0.38	11.06	76.58
Pagurus prideaux	8.8	1.66	0.28	6.44	83.02
Plesionika heterocarpus	2.7	1.31	0.28	5.1	88.12
Liocarcinus depurator	0.4	0.52	0.14	2.02	90.14



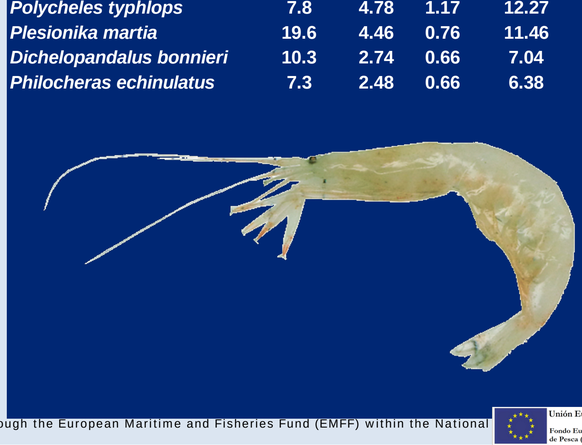
Group 2					
Average similarity:	24.01				
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Pagurus prideaux	14.6	10.54	0.69	43.91	43.91
Macropodia longipes	2.5	5.52	0.54	22.98	66.89
Plesionika heterocarpus	171.8	3.04	0.38	12.66	79.55
Chlorotocus crassicornis	1.2	1.05	0.23	4.36	83.91
Pagurus excavatus	0.6	0.8	0.21	3.34	87.25
Munida intermedia	1.2	0.5	0.18	2.08	89.33



Group 3					
Average similarity:	27.69				
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Plesionika heterocarpus	193.7	7.55	0.74	27.28	27.28
Chlorotocus crassicornis	8.9	4.77	0.62	17.25	44.53
Munida sarsi	3410.3	4.61	0.45	16.66	61.19
Macropodia longipes	1.7	2.57	0.45	9.29	70.47
Pontophilus spinosus	3.0	1.42	0.46	5.13	75.61
Pagurus excavatus	1.4	1.16	0.29	4.19	79.8



Group 4					
Average similarity:	38.92				
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Pasiphaea sivado	58.4	8.55	1.59	21.98	21.98
Pagurus alatus	12.2	5.77	1.21	14.83	36.81
Polycheles typhlops	7.8	4.78	1.17	12.27	49.08
Plesionika martia	19.6	4.46	0.76	11.46	60.54
Dichelopandalus bonnieri	10.3	2.74	0.66	7.04	67.58
Philocheras echinulatus	7.3	2.48	0.66	6.38	73.96



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