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

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INTRODUCTION

Studies on the spatial distribution patterns of cephalopods in the Galician and Cantabrian continental shelf are scarce. Molluscs are the third group in abundance after fish and crustaceans in the area, and it is a target group in fisheries. In the framework of the Ecosystem approach fisheries management, it is necessary to increase knowledge on the ecological aspects of these species at a regional scale.

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 vessel "Cornide de Saavedra" from 2007 to 2011 in autumn. A total of 629 trawling hauls were sampled. Sampler used was an otter trawl "Baca" type (mesh size of 60 mm in the net and 20 mm in the cod end). The sampling unit was a 30-minute haul during daytime at a speed of 3 knots in a randomly stratified scheme by depth with 3 strata among 70 and 500 m (special hauls higher than 500 m have also been included). Cephalopods abundance data were fourth-root transformed and subjected to cluster analysis using the Bray-Curtis similarity index to characterize cephalopods assemblages in soft bottoms. SIMPER analysis was use to identify species typifying each group and a non-metric multidimensional scaling analysis was carried out. Ecological indices per cluster group were also obtained.

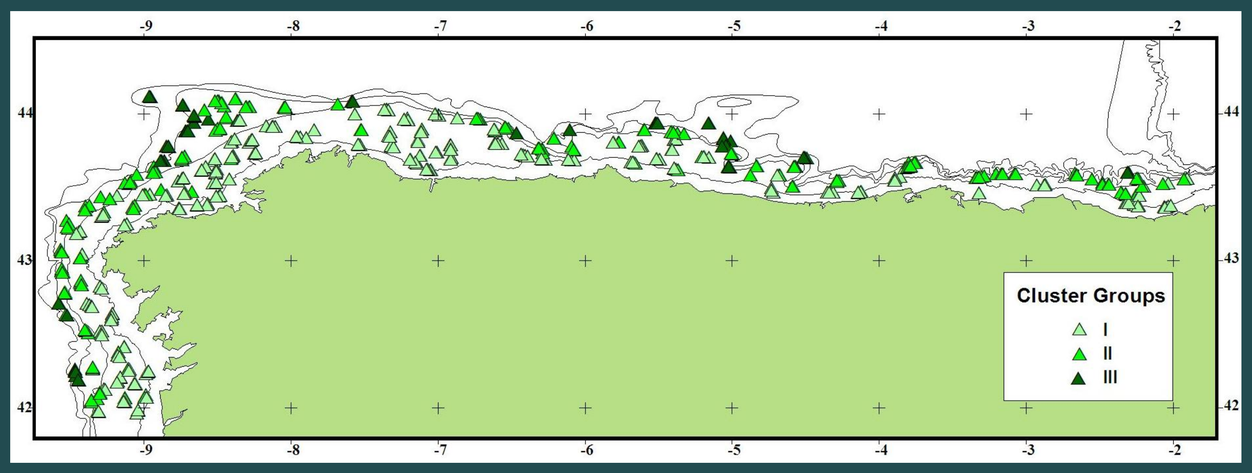


Figure 1. Study area and spatial distribution of hauls classified by cluster groups



Figure 2. Cluster results for analyzed period (2007-2001) and MDS plot.

Group	I				
Average similarity:	60.87				
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Alloteuthis sp	1696.7	26.34	2.38	43.27	43.27
Todaropsis eblanae	18.1	11.46	3.04	18.82	62.1
Eledone cirrhosa	6.1	6.93	1.5	11.38	73.48
Sepia elegans	4.0	5.6	1.33	9.21	82.69
Illex coindetii	3.3	4.35	0.96	7.15	89.83
Sepia orbignyana	1.9	1.36	0.45	2.24	92.07

Group	II				
Average similarity:	47.61				
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Todaropsis eblanae	22.6	16.04	1.86	33.7	33.7
Eledone cirrhosa	3.5	8.75	1.16	18.38	52.08
Illex coindetii	13.2	6.26	0.8	13.15	65.23
Rossia macrosoma	2.4	5.11	0.69	10.73	75.95
Sepietta oweniana	5.7	4.68	0.65	9.83	85.79
Rondeletiola minor	4.6	2.74	0.49	5.75	91.54

Group	III				
Average similarity:	27.38				
Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Bathypolipus sponsalis	1.2	11.77	0.63	42.99	42.99
Todarodes sagittatus	0.8	5.64	0.42	20.59	63.58
Todaropsis eblanae	1.1	4.63	0.37	16.9	80.48
Opistoteuthis agassizii	0.8	2.25	0.21	8.22	88.7
Rossia macrosoma	0.3	1	0.2	3.65	92.35

Table 1. SIMPER results: species contributing most to similarity in the 3 cluster groups.

RESULTS

As a result of a hierarchical classification analysis three assemblages were detected:

I) Shelf assemblage with a medium depth of 135 m.
II) Upper slope assemblage with a medium depth of 235 m.
III) Middle slope assemblage with a medium depth of 525 m.

Depth appears to be the most important factor in structuring assemblages, just like in the entire demersal and epibenthic communities in the study area.

The assemblages are spatially distributed by depth as can be observed in figure 1.

These assemblages are typified by *Alloteuthis sp* in Group I, *Todaropsis eblanae* in Group II and *Bathypolipus sponsalis* in Group III (Table 1).

Group III presents the highest values of richness and diversity indices (Table 2).

These species are also the most abundant in each group (Table 3).

Ecological Indices	Cluster groups I	II	III
Total species (S)	18	19	13
Species richness	2.273	4.392	7.081
Pielou´s evenness (J')	0.087	0.668	0.842
Species diversity (H')	0.252	1.966	2.158

Table 2. Ecological indices per cluster groups.



Species	Cluster groups I	II	III
Alloteuthis africanus	5.15 ± 0.12	0.00 ± 0.00	0.00 ± 0.00
Alloteuthis media/subulata	1696.72 ± 9.53	1.97 ± 0.05	0.00 ± 0.00
Bathypolipus arcticus	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Bathypolipus sponsalis	0.00 ± 0.00	0.06 ± 0.00	1.16 ± 0.03
Eledone cirrhosa	6.11 ± 0.03	3.46 ± 0.02	0.22 ± 0.01
Illex coindetii	3.34 ± 0.01	13.16 ± 0.22	0.33 ± 0.01
Loligo forbesi	6.04 ± 0.11	1.13 ± 0.02	0.00 ± 0.00
Loligo vulgaris	21.61 ± 0.44	0.29 ± 0.01	0.00 ± 0.00
Neorossia caroli	0.01 ± 0.00	0.10 ± 0.00	0.29 ± 0.02
Octopus salutii	0.08 ± 0.00	0.20 ± 0.00	0.06 ± 0.01
Octopus vulgaris	1.02 ± 0.01	0.24 ± 0.00	0.00 ± 0.00
Opistoteuthis agassizii	0.00 ± 0.00	0.00 ± 0.00	0.78 ± 0.05
Rondeletiola minor	1.38 ± 0.01	4.60 ± 0.06	0.03 ± 0.00
Rossia macrosoma	0.35 ± 0.00	2.38 ± 0.01	0.33 ± 0.01
Sepia elegans	4.04 ± 0.02	1.65 ± 0.01	0.00 ± 0.00
Sepia officinalis	0.04 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Sepia orbignyana	1.86 ± 0.01	0.70 ± 0.01	0.05 ± 0.01
Sepietta oweniana	0.76 ± 0.01	5.66 ± 0.05	0.21 ± 0.01
Sepiola sp	1.55 ± 0.01	1.28 ± 0.02	0.10 ± 0.01
Todarodes sagittatus	0.08 ± 0.00	0.71 ± 0.01	0.84 ± 0.02
Todaropsis eblanae	18.10 ± 0.06	22.63 ± 0.26	1.05 ± 0.03
Total	1768.23 ± 2.07	60.23 ± 0.07	5.44 ± 0.01

Table 3. Abundance (Numbers by haul ± SD) of all species by clusters groups.

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