The distribution of seapens (O. Pennatulacea) and their associated habitat in the Northern Atlantic Spanish shelf

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Seapens have played a key role in the current definition and nomination of the habitats in the EU Directives (OSPAR habitat). Different seapen species have been associated with fine mud and burrowing megafauna and used as indicators of habitats decline and sensitivity. However, few studies have focused on distribution and ecology of the seapens in the northern Spanish shelf.

The Northern Spanish Shelf Groundfish Surveys in the Cantabrian Sea and Off Galician (SPNGFS) from 1993 to 2011 allowed us to make out the distribution, abundance and the relationship with environmental variables and species of the pennatulaceans from families Funiculinidae, Pennatulidae, Pteroeididae and Veretillidae over the years. Methodology in these surveys follows the IBTS protocols for the Western and Southern IBTS areas (ICES, 2010). In each survey around 126 hauls of 30 minutes at a speed of 3 knots are performed in the area. The sampling design used was random stratified to the area, with five geographical sectors and three depth strata (70–120 m, 120-200 m, 200 – 500 m) and extra hauls to cover shallow (<70 m) and deeper (>500 m) grounds.

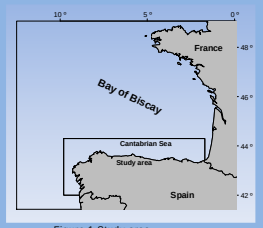
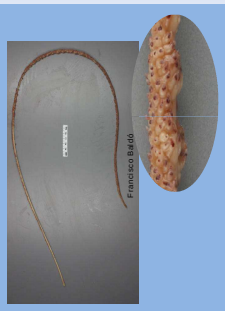


Figure 1 Study area

Funiculina quadrangularis

•It was the most abundant species (about 93% of the pennatulaceans mean stratified abundance caught).
• Higher abundances were found in the central area of Cantabrian Sea (Fig. 2).
• It dwelled between 84 and 793 m, although higher biomass were found between 120 and 200 m (Fig. 3).
• *F. quadrangularis* was mainly found in fine sand and very fine sand (Fig. 2).



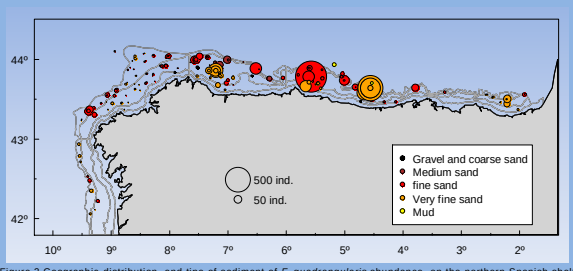


Figure 2 Geographic distribution and tipe of sediment of *F. quadrangularis* abundance on the northern Spanish shelf

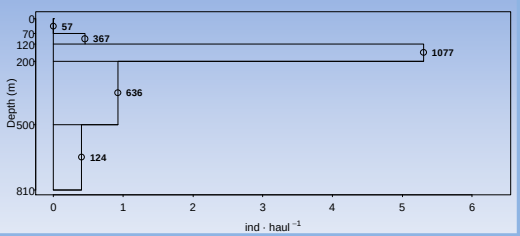


Figure 3 Bathymetric abundance profile of *F. quadrangularis* in the northern Spanish shelf. Numbers mark total hauls of each depth strata.

Table 1 Accompanying species of *F. quadrangularis* and thier frequencies (%) in fine sediment of the northern Spanish shelf.

Circalitoral fine sediment			Upper bathyal fine sediment		
Taxa	Species	%	Taxa	Species	%
Porifera	*Phakelia ventilabrum*	9.5	Hidrozoa	*Aglaophenia elongata*	7.7
Hidrozoa	*Lytocarpia myriophyllum*	28.6	Anthozoa	*Actinauge richardi*	53.8
	Sertularella sp.	2.4		*Epizoanthus incrustatus*	7.7
	Plumularia sp.	7.1	Gastropoda	*Ranella olearium*	7.7
Anthozoa	*Actinauge richardi*	64.3		*Galeodea rugosa*	7.7
	Caryophyllia smithii	4.8		*Neptunea contraria*	15.4
	Dendrophyllia cornigera	2.4		*Colus gracilis*	7.7
	Pennatula sp.	19.0		*Buccinum sp.*	7.7
Polychaeta	*Hyalinoecia tubicola*	4.8		*Scaphander lignarius*	53.8
Gastropoda	*Neptunea contraria*	4.8		*Calliostoma granulatum*	15.4
	Colus gracilis	2.4	Cephalopoda	*Rossia macrosoma*	92.3
	Lunatia fusca	11.9		*Sepiola sp.*	30.8
	Galeodea rugosa	11.9		*Sepietta oweniana*	38.5
	Ranella olearium	9.5		*Rondeletiola minor*	7.7
	Charonia lampas	2.4		*Sepia orbignyana*	38.5
	Scaphander lignarius	11.9		*Eledone cirrhosa*	69.2
	Pseudosimnia carnea	2.4		*Octopus vulgaris*	15.4
	Calliostoma granulatum	23.8		*Octopus salutii*	38.5
Bivalvia	*Pygnodontha cochlear*	2.4		*Bathypolypus sponsalis*	23.1
Cephalopoda	*Sepia elegans*	42.9	Natantia	*Pontophilus spinosus*	38.5
	Sepia orbignyana	40.5		*Philocheras equinulatus*	15.4
	Sepia officinalis	7.1	Anomura	*Pagurus prideaux*	30.8
	Sepiola sp.	26.2		*Pagurus excavatus*	7.7
	Sepietta oweniana	11.9		*Pagurus alatus*	23.1
	Rondeletiola minor	7.1		*Munida sarsi*	84.6
	Rossia macrosoma	45.2		*Munida intermedia*	53.8
	Eledone cirrhosa	85.7		*Munida iris*	7.7
	Octopus vulgaris	16.7		*Galathea intermedia*	7.7
	Octopus salutii	31.0	Macrura	*Nephrops norvegicus*	38.5
Natantia	*Pontophilus spinosus*	16.7	Brachyura	*Bathynectes maravigna*	7.7
Anomura	*Pagurus prideaux*	59.5		*Liocarcinus depurator*	53.8
	Pagurus excavatus	21.4		*Macropipus tuberculatus*	69.2
	Pagurus alatus	2.4		*Macropodia longipes*	69.2
	Munida intermedia	28.6		*Inachus dorsettensis*	7.7
	Munida iris	4.8	Cirripeda	*Scalpellum scalpellum*	7.7
	Munida sarsi	31.0	Crinoidea	*Leptometra celtica*	23.1
	Galathea intermedia	9.5	Asteroidea	*Luidia ciliaris*	7.7
Macrura	*Nephrops norvegicus*	11.9		*Astropecten irregularis*	92.3
	Polycheles typhlops	2.4		*Anseropoda placenta*	23.1
Brachyura	*Cancer pagurus*	2.4		*Asteronyx loveni*	15.4
	Liocarcinus depurator	47.6	Ophiuroidea	*Ophiura ophiura*	46.2
	Macropipus tuberculatus	19.0		*Ophiotrix fragilis*	7.7
	Inachus leptochirus	4.8	Echinoidea	*Gracilechinus acutus*	23.1
	Macropodia longipes	83.3	Holothuroidea	*Parastichopus regalis*	30.8
	Goneplax rhomboides	2.4		*Parastichopus tremulus*	15.4
Cirripeda	*Scalpellum scalpellum*	28.6	Ascidiacea	*Diazona violacea*	7.7
Crinoidea	*Leptometra celtica*	42.9			
Asteroidea	*Luidia ciliaris*	4.8			
	Luidia sarsi	4.8			
	Marthasterias gracialis	2.4			
	Astropecten irregularis	83.3			
	Anseropoda placenta	16.7			
Ophiuroidea	*Ophiura ophiura*	42.9			
	Ophiotrix fragilis	23.8			
Echinoidea	*Gracilechinus acutus*	23.8			
	Brissopsis lyrifera	2.4			
	Echinocardium cordatum	2.4			
Holothuroidea	*Parastichopus regalis*	47.6			
Ascidiacea	*Corella parallelogramma*	14.3			

•The accompanying species of *F.quadrangularis (*Table 1) were grouped in two habitat with specific environmental factors (Circalitoral fine sediment and Upper bathyal fine sediment).
• This habitat was the result after joining the four habitats EUNIS of *F. quadrangularis* proposed in the area (Circalitoral fine sand, Circalitoral muddy sand, Circalitoral fine mud and Deep sea muddy sand)
•The hauls with *F. quadrangularis* stratified biomass over 4 Kg/Km^2 and stratified abundance over 200 ind/Km^2 were selected to describe the accompanying species of the two type of habitats.
•Pelagic species, large mobile animals and epifhyte species were not listed.

Other seapens

Pennatula phosphorea, Pennatula aculeata, Pteroeides spinosum and Veretillum cynomorium were found in a quite small percentage. However, some trends have been observed.



Pennatula spp.

•There were few well sorted specimes of *P. phosphorea* and *P. aculeata* in the overall time series.
•*Pennatula* spp. showed higher abundance in Galician waters (Fig. 4).
•*Pennatula* spp. showed a depth range between 91 and 793 m, although in the overall time series, higher abundance were found in the depth strata 120-200 m.
• *Pennatula* spp. was mainly found in fine sand (Fig. 4)



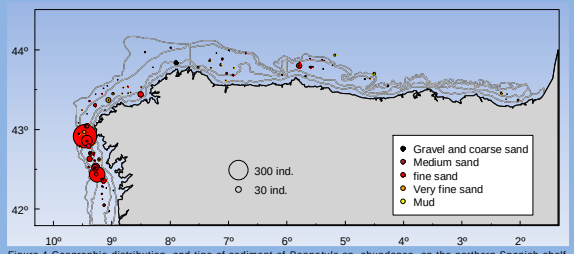


Figure 4 Geographic distribution and tipe of sediment of *Pennatula sp.* abundance on the northern Spanish shelf



Pteroeides spinosum

• Small abundances have been found in the overall time series.
• *P. spinosum* extended throughout the northern Spanish shelf, although no clear pattern was found in the spatial distribution (Fig.5).
• it occurred from 50 to 296 m and showed higher abundances below 120 m.
• *P. spinosum* was found in all tipe of sediments (Fig. 5).

Veretillum cynomorium

• Very small abundances appeared in the overall time series but a large value was found in 2009 in an extra haul at a depth of 50 m .
• *V. cynomorium* ocurred deeper than 50 m in the eastern area at a longitude around 2° W (Fig. 5).
• it showed a depth range between 50 and 372 m, although ocurred frequently from 70 to 120 m.
• *V. cynomorium* was mainly found in very fine sand (Fig. 5).



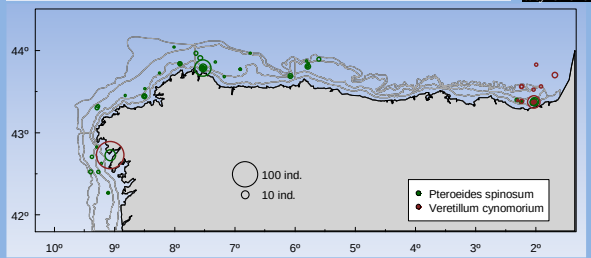


Figure 5 Geographic distribution of *P. spinosum* and *V. cynomorium* abundance on the northern Spanish shelf

CONCLUSIONS

•Although the design of the surveys is not aimed to sample pennatulaceans, the surveys allowed us to show the distribution of seapens and their associated habitat in the northern Spanish shelf , where had been never reported before in spite of they are widely considered to be of conservation significance (Connor *et al*, 2004, OSPAR, 2008).
•The two seapens *F. quadrangularis* and *Pennatula* spp. were mainly distributed in the opposite areas. Higher abundance of *Pennatula* spp. were found in Galician waters, where *F. qudrangularis* occurred scarcely and the former species have hardly showed abundance in the Cantabrian Sea, where the latter species were widely distributed.
• All of the species showed a wide bathymetric range, but *P. spinosum* and *V. cynomorium* were the shallower species.
• *V. cynomorium* was found at an unusual depth of 372 m, never reported before (Altuna, pers. comm.)
•Special effort should be made to distinguish between the two species of *Pennatula* in following years.
•Most of the species caught toghether with *F.quadrangularis* are common in the northern Spanish shelf, and although they are not exactly associated to it, with the exception of *Asteronyx loveni,* our results showed that there are accompanying species of *F. quadrangularis* that could describe the habitat. *F. quadrangularis* is a sensitive species to potential disturbances and a key species in habitat clasification (Hughes, 1998) and therefore a deeply study of the associated habitat to *F. quadrangularis* should be made in the area, as well as that ones associated to *P. phosphorea* and *P. spinosum*.

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