Distribution of sea cucumbers in the circalittoral soft-bottoms of the southern Bay of Biscay

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Introduction

Holothuroidea:

- Class Echinodermata.
- Detritivorous feeding behavior.
- Process large amounts of sediment → High level impact of physical bioturbation and biochemistry reworking (Hudson *et al.,* 2004)

Problems:

- Globally, holothurids are a fishery target taxa with high commercial value. However, in this area, they are not currently a commercial targeted group.
- By catch and potential threats on habitats.
- Scarce studies in Bay of Biscay (e.g. Serrano *et al*., 2006)

Data to study:

- Data from 1993 to 2011 collected by the Spanish Institute of Oceanography (IEO) along the coasts of the southern Bay of Biscay through the annual bottom trawl survey "Demersales".

Methods

The study has been developed considering (1) different depth (m) intervals (<70, 70-120, 121-200, 201-500, >500) and (2) geographical regions (MF: Miño-Fisterra;FE: Fisterra-Estaca; EP: Estaca-Peñas; PA: Peñas-Ajo; AB: Ajo-Bidasoa) (Fig. 1, 2 & 3). Sampling was carried out with a baca 44/60 otter trawl gear with an inner line of 10 mm mesh. A total of 2362 hauls were performed. A stratified random haul sampling was used. Temperature, salinity and sediment composition were also recorded.
General linear models (GLM) were used to detect potential effects of environmental parameters on holothurids abundance (Poisson distribution) and presence/absence (binomial distribution) of *Parastichopus regalis* and *P. tremulus*. Coefficients were analyzed in order to explain habitat preferences for the different species (Maunder & Punt, 2004). R software (v.2.14.0) was used.

Results

Holothurid catch data is displayed in the table 1. The most abundant orders during the studied period were Aspidochirotida and Elasipodida. Only 3 species, *P. regalis., P. tremulus* and *Laetmogone violacea*, appeared in more than a 1% of the hauls.

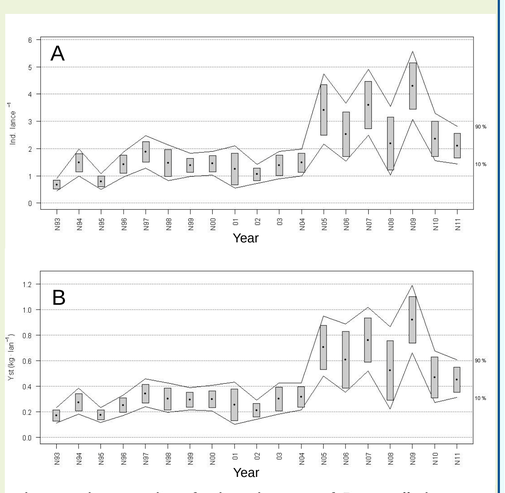
Table 1. List of holothurids presents in "Demersales" survey and number of total hauls in which were found.

Species	Number of hauls
Parastichopus regalis	*814*
Parastichopus tremulus	*214*
Laetmogone violacea	*27*
Benthogone rosea	*Less than 5*
Holothuria forskali	*Less than 5*
Holothuria polii	*Less than 5*
Holothuria sanctori	*Less than 5*
Leptosynapta bergensis	*Less than 5*
Leptosynapta inhaerens	*Less than 5*
Psolus squamatus	*Less than 5*
Sphaeroturia talismani	*Less than 5*
Thyone fusus	*Less than 5*
Trachythyone elongata	*Less than 5*
Trachythyone tergestina	*Less than 5*
Total hauls	*2362*

Parastichopus regalis (Cuvier, 1817)



- High statistical significance was found in all factors analyzed with GLMs (Table 2).
- It appeared mostly **from 70 to 200 m** and in **coarse and medium sands.**
- Mainly present in the **eastern Bay of Biscay.**
- It is the most generalist species related to substrate type, depth range and geographical location.



Time series results of abundances of *P. regalis* by haul: A) number, B) biomass (kg).

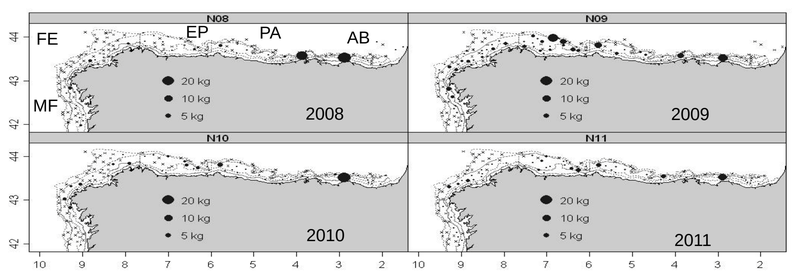


Fig. 1. Geographical distribution of *P. regalis* (data from 2008-2011).

Laetmogone violacea (Théel, 1879)



- Present only in areas **deeper than 150m.**
- More common in **fine sands**.
- **Larger animals** occurred in **deeper waters.**
- It was **absent** in the **eastern Bay of Biscay.**

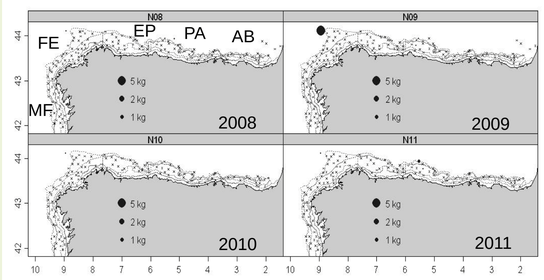
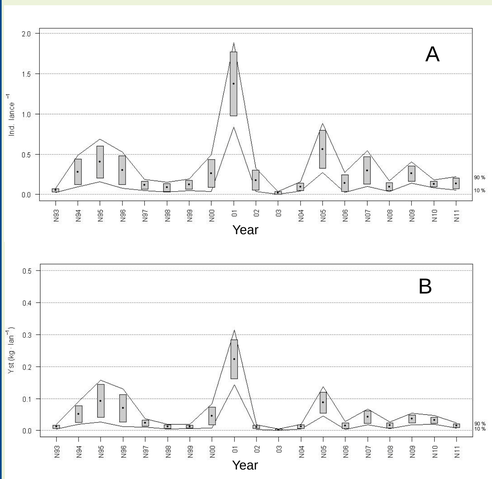


Fig. 2. Geographical distribution of *L. violacea* (data from 2008-2011).

Parastichopus tremulus (Gunnerus, 1767)



Time series results of abundances of *P. tremulus* by haul: A) number, B) biomass (kg).



- All the factors are highly significant with GLMs (Table 2).
- Appeared **below 70 m**.
- **Coarse** and **medium sands.**
- Distributed **all along** the **southern Bay of Biscay.**
- A **high variance** was explained **by number**.

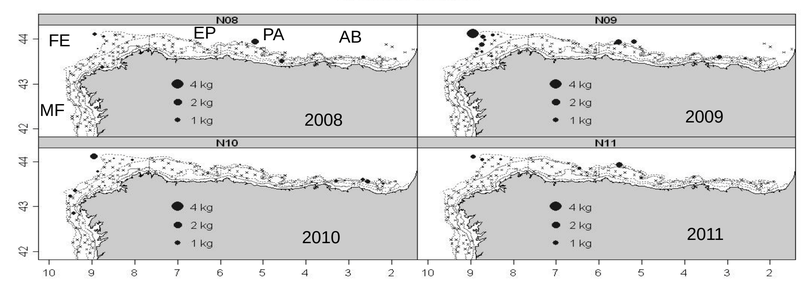


Fig. 3. Geographical distribution of *P. tremulus* (data from 2008-2011).

A) ANOVA GLM abundance by number. *P. regalis*	Df	Deviance	Resid. Df	Resid. Dev	F test value	P-value
None			834	121504.46		
Year	18	5355.62	816	116148.85	297.53	< 2.2e-16 ***
Depth stratum	4	7207.89	812	108940.96	1801.97	< 2.2e-16 ***
Sector	4	10483.94	808	98457.02	2620.99	< 2.2e-16 ***
Sediment type	4	9569.61	804	88887.41	2392.40	< 2.2e-16 ***
Deviance explained= 26.63%						

B) ANOVA GLM Presence/ Absence. *P. regalis*	Df	Deviance	Resid. Df	Resid. Dev	F test value	P-value
None			2309	3022.68		
Year	18	75.75	2291	2946.93	4.21	4.690e-09 ***
Depth stratum	4	295.23	2287	2651.70	73.81	< 2.2e-16 ***
Sector	4	123.57	2283	2528.12	30.89	< 2.2e-16 ***
Sediment type	4	25.32	2279	2502.81	6.33	4.342e-05 ***
Deviance explained= 16.94%						

Table 2. ANOVA tables.

A) Abundance by number *P. regalis*.
B) Presence/absence. *P. regalis.*
C) Abundance by number *P. tremulus*.
D) Presence/absence. *P. tremulus.*

C) ANOVA GLM abundance by number. *P. tremulus*	Df	Deviance	Resid. Df	Resid. Dev	F test value	P-value
None			200	64699.06		
Year	18	18615.01	182	46084.05	1034.17	< 2.2e-16 ***
Depth stratum	3	17339.46	179	28744.59	5779.82	< 2.2e-16 ***
Sector	4	7902.30	175	20842.29	1975.57	< 2.2e-16 ***
Sediment type	4	6349.74	171	14492.55	1587.44	< 2.2e-16 ***
Deviance explained= 77.63%						

D) ANOVA GLM Presence/ Absence. *P. tremulus*	Df	Deviance	Resid. Df	Resid. Dev	F test value	P-value
None			2309	1365.54		
Year	18	59.43	2291	1306.11	3.30	2.524e-06 ***
Depth stratum	4	160.63	2287	1145.47	40.16	< 2.2e-16 ***
Sector	4	43.83	2283	1101.64	10.96	6.956e-09 ***
Sediment type	4	17.82	2279	1083.82	4.46	1.337e-03 **
Deviance explained= 20.88%						

Remarks

Parastichopus regalis appeared in depths above 200 m, being replaced in deeper levels by *Parastichopus tremulus.*

Parastichopus regalis was significantly more abundant in the eastern Bay of Biscay than in the western part where *Parastichopus tremulus* was the predominant species.

Parastichopus tremulus appeared in coarser sediments and in muddy bottoms. The occurrence of this species in muddy bottoms could be also related to depth.

Laetmogone violacea occurred mainly in deeper locations in muddy sediments.

Larger and more precise sampling should be performed to obtain more reliable results.

Acknowledgements

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