

Indicator species of intertidal boulder fields on the French Basque coast

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Introduction

Since 2008, macroalgae surveys are used to assess ecological status on flat benches for the European Water Framework Directive. However, integrative tools based on fauna must also be implemented in assessing good environmental status within the new Marine Strategy Framework Directive. The French Basque coast (South of the Bay of Biscay) is dominated by rocky substrates and remarkable habitats exposed to swells and freshwater incomes. Boulder fields constitute one of the main habitats which presents a high faunistic diversity. Surprisingly, few studies have been conducted locally to assess benthic fauna. This study aims at filling this lack of knowledge by identifying indicator fauna of the intertidal "Boulder fields" habitat.

Results

More than 170 taxa were identified during the study. Among them, we suggest a list with the properties of several related indices measuring the association between indicator taxa for mobile and fixed fauna in the lower and upper mediolittoral boulder fields. The whole list is available in A4 paper.

Candidate taxa	Mobile fauna			Fixed fauna		
	Guéthary 2015	Guéthary 2016*	St J. de Luz 2016*	Guéthary 2015	Guéthary 2016*	St J. de Luz 2016*
Candidate taxa	62	41	44	18	15	16
Final valid combinations (total relevant combinations)	LM=23 (/155) UM=9 (/32)	LM=7 (/87) UM=6 (/7)	LM=8 (/28) UM=1 (/15)	LM=7 (/31) UM=6 (/54)	LM=1 (/43) UM=0 (/1)	LM=1 (/21) UM=0 (/2)
Final valid singletons (total relevant singletons)	LM=5 (/14) UM=4 (/4)	LM=3 (/9) UM=2 (/2)	LM=2 (/4) UM=1 (/2)	LM=3 (/6) UM=2 (/3)	LM=1 (/3) UM=1 (/1)	LM=2 (/3) UM=1 (/2)

Tab. 1. Results of ISA for single and taxa combinations for mobile and fixed fauna in the two study sites. LM: Lower Mediollittoral; UM: Upper Mediollittoral. *Preliminary results (ongoing study). Only common valid species are listed for sites and years.

Mobile fauna



Fig. 3. Indicators taxa for lower mediollittoral zone. 1: *Porcellana platycheles*; 2: *Xantho* spp.; 3: *Lepadogaster lepadogaster*; 4: *Paguridae* spp.; 5: *Ophioderma longicauda*



Fig. 4. Indicators taxa for upper mediollittoral zone. 1: *Eriphia verrucosa*; 2: *Patella* spp.; 3: *Phorcus lineatus*; 4: *Pachygrapsus marmoratus*

Discussion/Conclusion

- Based on a probabilistic approach, ISA revealed valid single and combination taxa indicators for the lower and upper mediollittoral zones.
- A new challenge is to select (with ecological approach) the best taxa or species groups to describe and monitor boulder fields. Introduced species, OSPAR list, ZNIEFF determinant species, disturbance, food webs, distribution area... could be important as additional selection criteria.
- Species combinations with high probabilistic and ecological criteria could constitute more integrative tools than single species indicators.

At the end of this study, some indicators, common to the study sites, could be used to evaluate boulder fields integrity, as an alternative to sampling the entire local biodiversity. These various analysis improve our knowledge for monitoring the Basque intertidal rocky shore in a sustainable way. Finally, within the Marine Strategy Framework Directive, these results allow us to take into account biogeographic specificities to harmonize protocol metrics at the scale of the sub-area Bay of Biscay.

Material & Methods

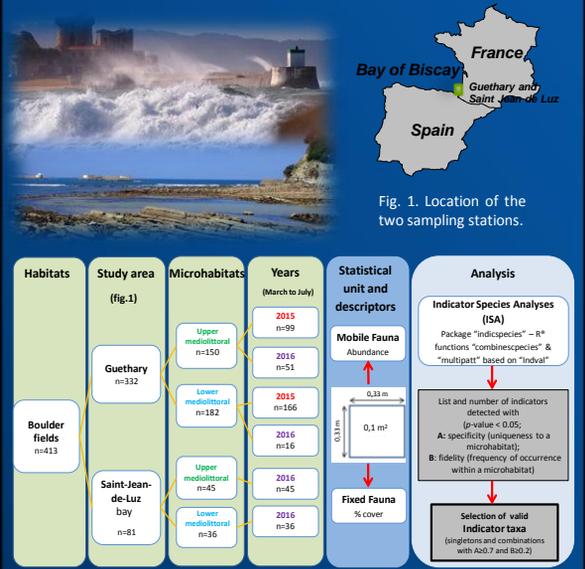


Fig. 2. Experimental design and methods. n: number of quadrats

Benthic fauna was surveyed at two sites from 2015 on (Fig. 1 & 2). A spatially stratified random sampling plan was used. Two independent Indicator Species Analyses (ISA) were carried out on two taxa matrix (mobile and fixed fauna). We discarded taxa (and combinations) with a low indicator value by setting a threshold for components A and B.

Fixed fauna



Fig. 5. Fixed fauna Indicators for upper (1: *Chtalamus* spp.; 2: *Mytilus* sp.) and lower mediollittoral zone (3: *Hydrozoa* (*Sertularella mediterranea*); 4: *Spirobranchus* sp.; 5: *Spirorbinae*).

ZNIEFF determinant species