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ITA IN THE BAY OF BISCAY FOR CONTRASTING HABITATS

LUCA MARSAGLIA

Index

Introduction: ITA in BoB

Selection of habitats: Methodology and results

Questions and methods

Data analysis: results

Integrated Trend Analysis (ITA)

- Tool used in Integrated Ecosystem Assesment (IEA)
- Summarize changes occured in recent decades
- Find connections between physical, ecological, anthropogenic variables
- Done for the the whole BoB

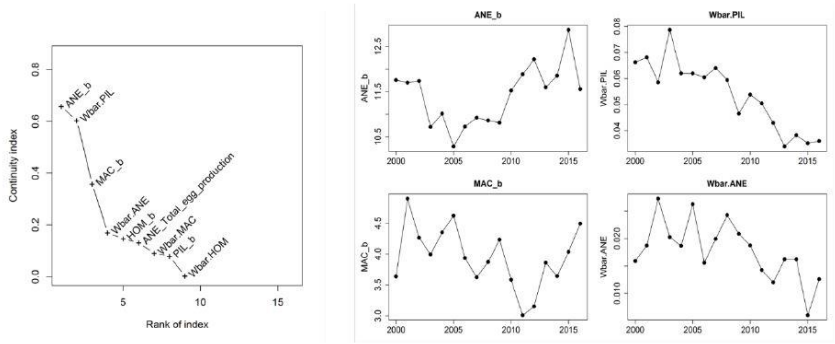


Figure 2.2.3: Results of the MAFA realized on the small pelagic fish compartment. Left: ranking of available variable according to their continuity index. Right: time-series of the most continuous variables. ANE_b is anchovy biomass, Wbar_PIL is mean weight of sardine, MAC_b is mackerel biomass, Wbar_ANE is mean weigth of anchovy.

Isaac et al. In prep

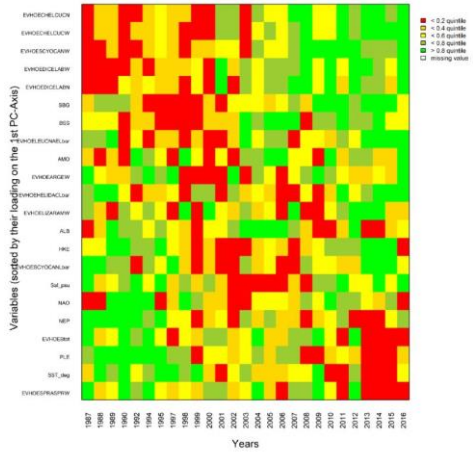


Figure 2.2.2: Traffic light plot of the temporal development of the Bay of Biscay ecosystem time-series. Variables are transformed to quantiles, colour coded (red- high values, green- low values) and sorted in numerically descending order according to their loadings of the first principle component.

Analyze contrasting areas in BoB

- First time, an analysis for smaller / contrasting areas in BoB is performed
- Consider the BoB as an « averaged » ecosystem => might be problematic when we want to assess the connections with a human activity at a local scale (e.g. wind farms)
- The analysis could shed light on important characteristics of some areas in BoB
- There could be differences or shifts in trends across areas of the BoB that do not emerge from analysis over the all BoB

ITA in BoB for contrasting habitats

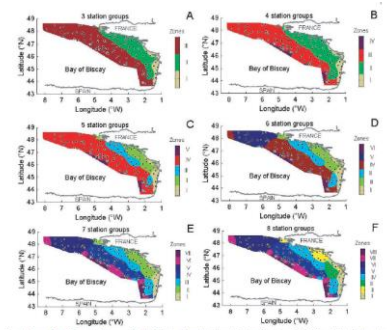


Fig. 6. Maps of the different habitat zones for the following hierarchical levels: 3(A), 4(B), 5(C), 6(D), 7(E) and 8(F). Each colour represents the median depth according to colour scale bar of Fig. 5. Dark violet colour indicates the deeper sites (median depth = 375 m).

Defining contrasting habitats

Data analysis within areas

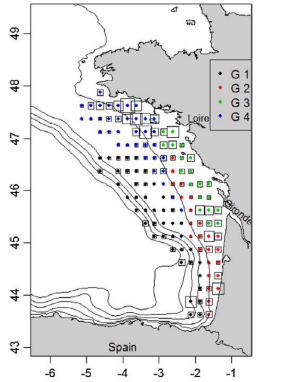
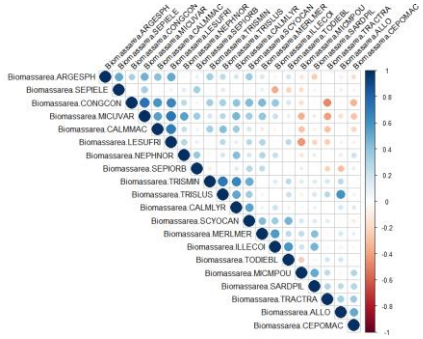
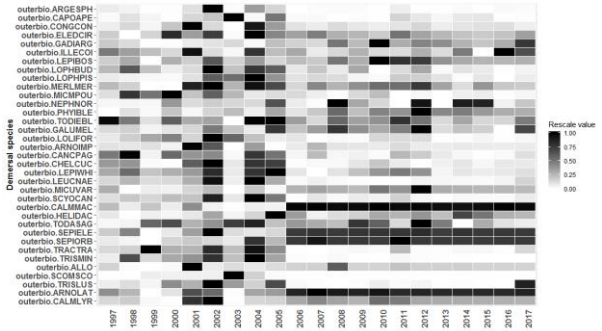


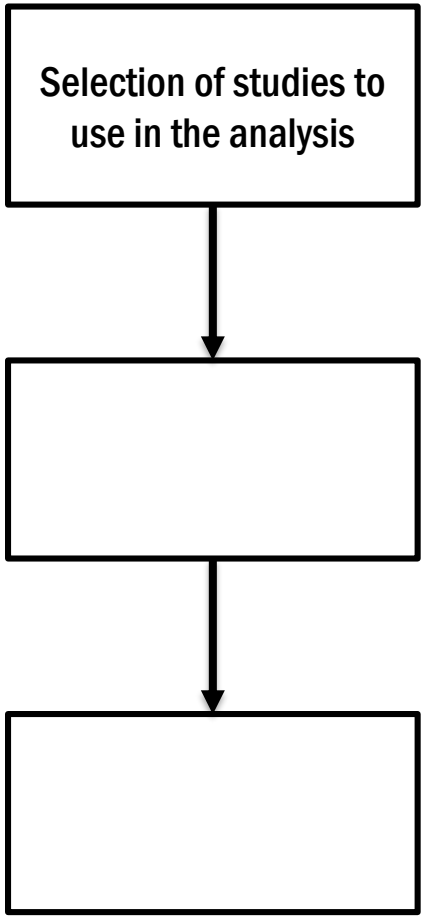
Fig. 5. Map of Bay of Biscay seascapes as identified by applying MFA on all ecosystem compartments. Map of grid cell clusters and their variability in time over the years 2009–2014. Colors are that of the clusters (Fig. 3). Squares are proportional to the variability in time at each grid point (inertia). The isobaths are 100, 200, 500, 1000, 2000 m.





Selection of habitats - Methodology

- 20 studies on BoB demersal and pelagic distribution – eco structure reviewed
- Preference to studies presenting spatial units




A new multivariate mapping method for studying species assemblages and their habitats: example using bottom trawl surveys in the Bay of Biscay (France)

SARSIA


Ecosystem spatial structure revealed by integrated survey data

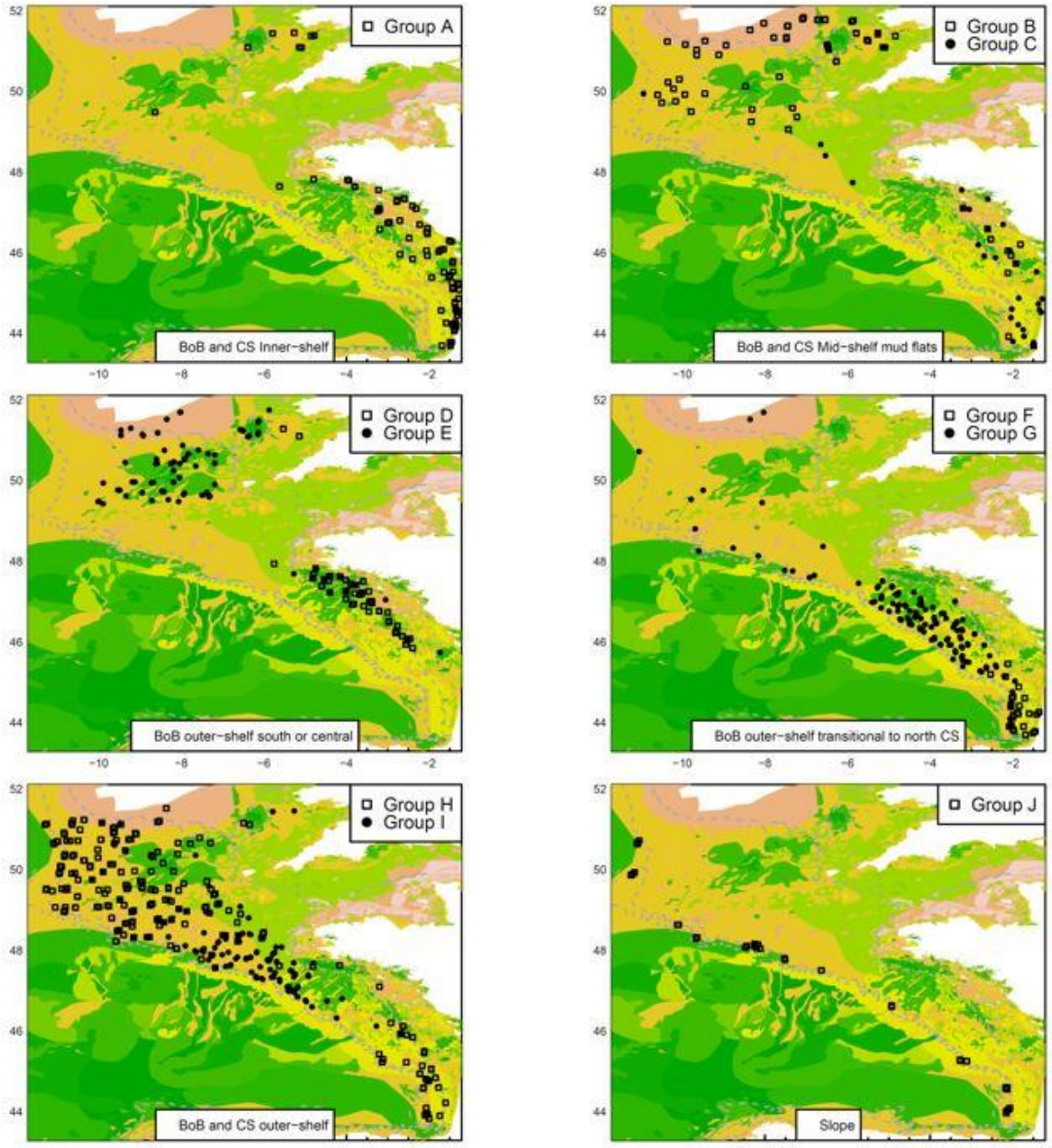


Figure 3 - Assemblages, The Inner/mid shelf habitats **(groups A, B and C)**, Mid-shelf mud flats **(groups D and E)** , Outer shelf habitats **(F : south BoB, G: central, I: Transitional, H: north CS mainly and south BoB)**

Table 2 - Summary of habitats and benthic communities (A to J) as defined from clustering process for combined sampled years for the Bay of Biscay (BoB) and the Celtic Sea (CS)., indicate mean species richness for all years, total number of observed stations.

Habitat Name (groups)	**Main location**	**Median depth**	**Habitat summary**
Inner Shelf (A)	BoB and CS	A:38m	Various shallow coastal habitats in the vicinity of semi-enclosed bays or under estuarine influence
Inner/Mid Shelf (B,C)	BoB and CS	B:78m C:81m	Various soft bottom habitats in shallow coastal areas
Mid-shelf Mud flats (D,E)	North BoB and Central CS	D:103m, E:107m	Mid-shelf muddy habitats
Outer shelf south (F)	Southern BoB	106m	Sandy dominated habitat in the intermediate area surrounding the shelf break
Outer shelf central (G)	BoB	138m	patchy muddy-sands to sandy habitats, transitional between the slope and the mid-shelf mud flats
Outer shelf transitional (I)	CS and BoB "transition"	146m	Sandy dominated habitat in the intermediate area surrounding the shelf break
Outer shelf north (H)	BoB south and north CS	143m	Sandy dominated habitat in the intermediate area surrounding the shelf break
Slope (J)	CS and BoB	489m	Muddy grounds on the upper slope of the shelf break

CS: Celtic Sea - **BoB**: Bay of Biscay

ehensive geo-referenced data over large sea areas
ıtion and spatio-temporal sampling scale. These
organization and spatial scale that are useful for
ed data series, we applied a generic procedure
nt ecosystem spatial units in the Bay of Biscay.
organized as a time series of matrices containing
rows. The multi-table analysis method known as
atrices, thus separating in the analysis the spatial
ased on their relative positions in the MFA space
n spatial patterns across ecosystem components.
are consistent over the years together with a map
in agreement with sub-regional production sys-
ity to characterize and monitor ecosystem spatial
system assessments. Also, it highlights the im-
or ecosystem description, assessment and man-

Se

Souissi et a

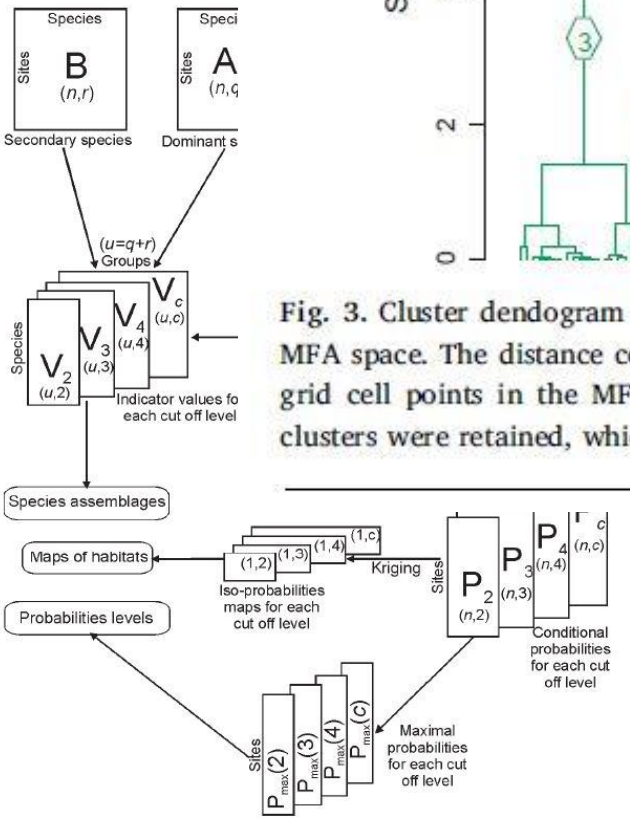


Fig. 2. Diagram of the analysis steps for the multivariate mapping method. The different steps explaining the connections between the input matrices A(n: sites, q: dominant species) and B(n: sites, r: secondary species) and the final resulting map of fish habitats and indicator species for each hierarchical level. The different steps of the diagram are detailed in Materials and Methods section.

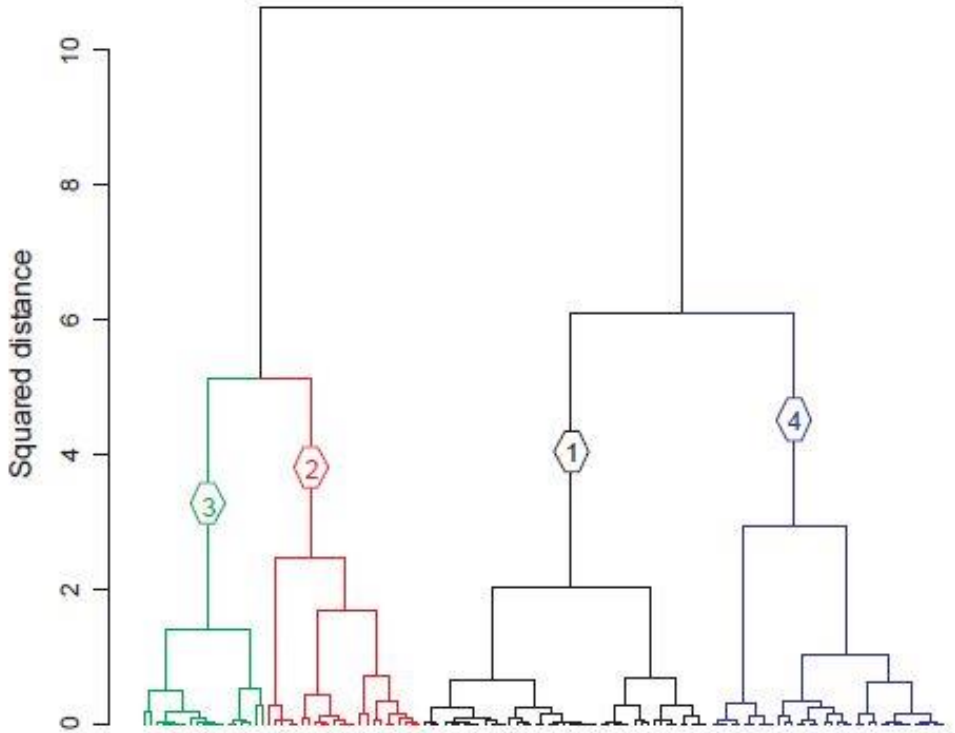


Fig. 3. Cluster dendogram of grid cells obtained by their hierarchical clustering in the MFA space. The distance considered is the squared Euclidian distance between average grid cell points in the MFA plane made of the first two principal components. Four clusters were retained, which are shown in different colors.

time series was from 2009
ms of variable are defined

Selection
No
Yes
Yes
No
Yes
No
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No
Yes
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No
Yes
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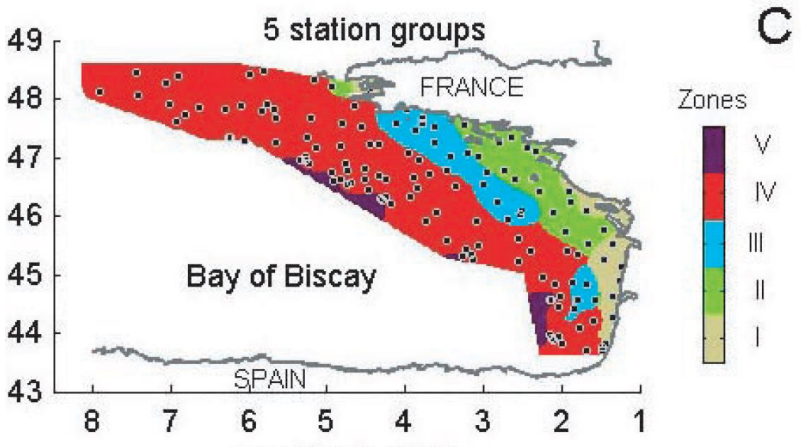
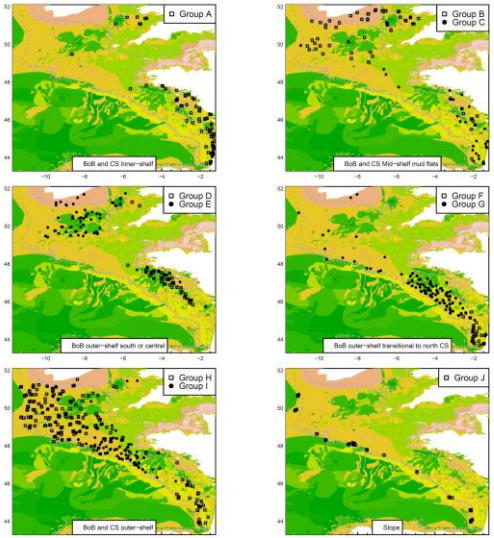
ient to
d average
g to map
ecosystem structure

Selection of habitats – Studies used

Souissi et al. 2001



Laffargue – EVHOE (Unpublished)



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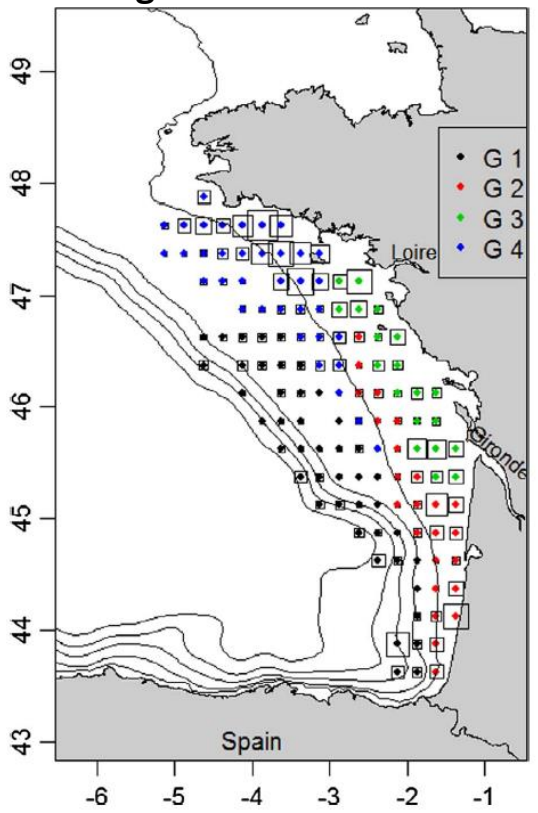
CS: Celtic Sea - **BoB**: Bay of Biscay

Petitgas et al. 2017



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There will be…

Areas in which benthic and pelagic communities are well structured and maintain their structure throughout the whole year

Selection of habitats - Methodology

- 20 studies on BoB demersal and pelagic distribution reviewed
- Preference to studies presenting spatial units

- Qgis csv transformation into points or polygons and georeferencing
- Different layers overlayed each other

Selection of studies to use in the analysis

Importing and overlaying strata from different studies


A new multivariate mapping method for studying species assemblages and their habitats: example using bottom trawl surveys in the Bay of Biscay (France)

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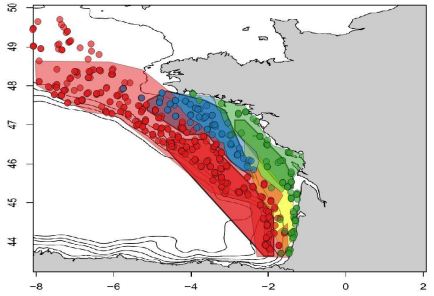


Selection of habitats – Overlap of studies strata

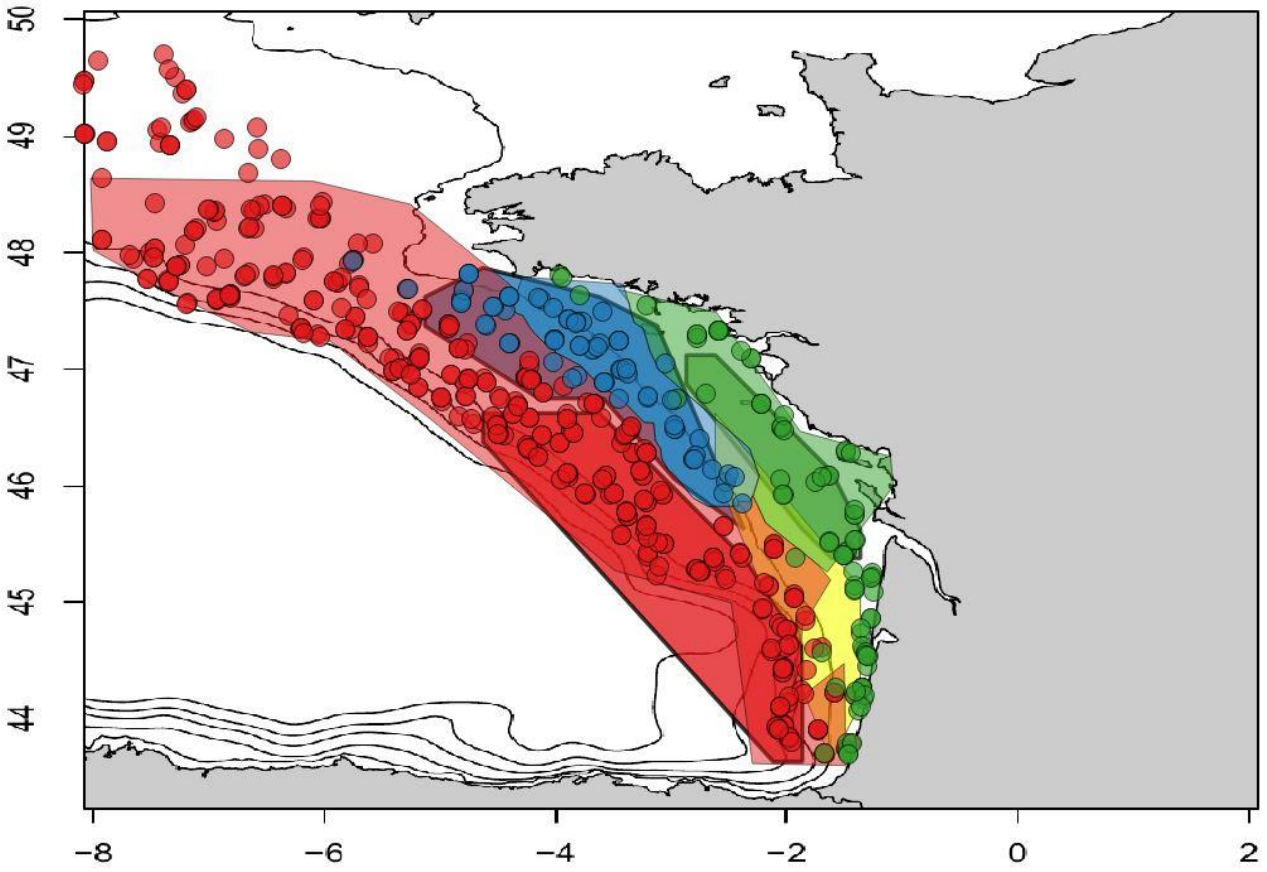


Figure 1 shows the three different strata from the selected studies Souissi et al 2001 as the non-bordered polygons, Petitgas 2017 as the bordered areas and Pascal 8 EVHOE as the points. Green represents coastal riverine – influenced areas, blue La Grande Vasière, red the outer shelf and tiled-yellow the southern area of the bay.

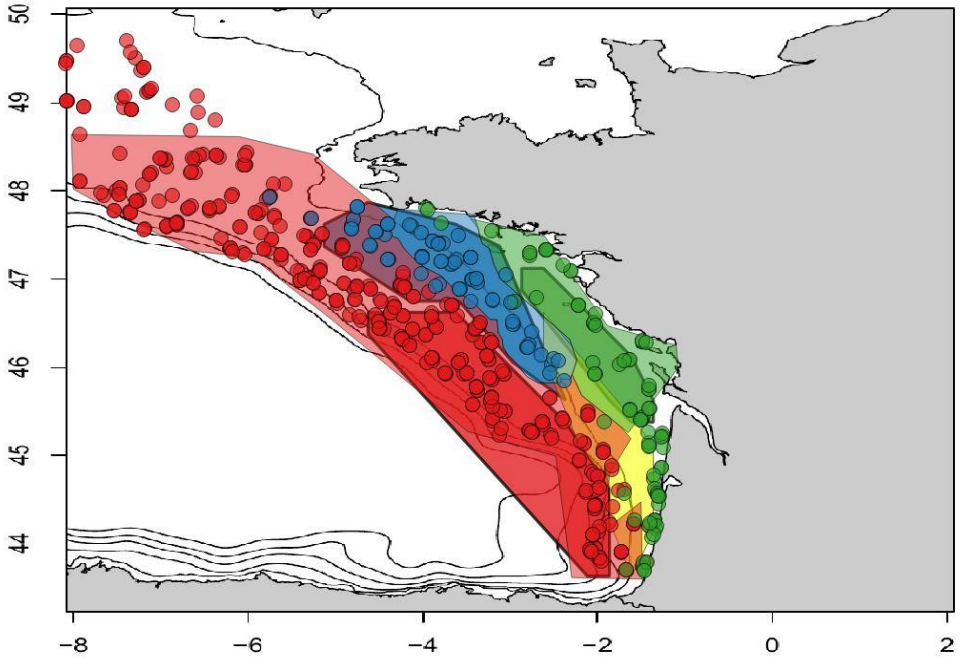
Selection of habitats - Overlap of studies strata

- Overlap:

1. Coastal (Green)
2. La Grande Vasière (Blue)
3. Outer shelf (Red)

- Time of year + species depth range to cause mismatch in La Grande Vasière?

- Severe mixing in southern BoB area?



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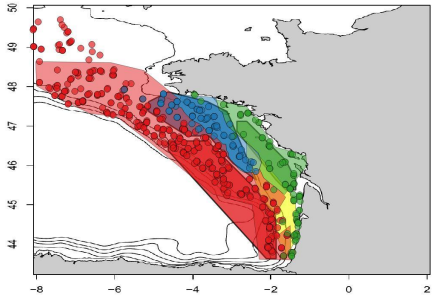
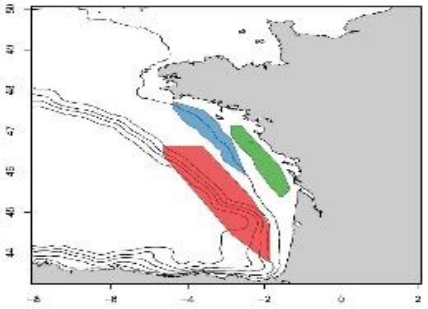
Importing and overlaying strata from different studies



- Clip Function to export only areas in common between polygons

Exporting final habitats to use in the analysis



Selection of habitats – Final habitats

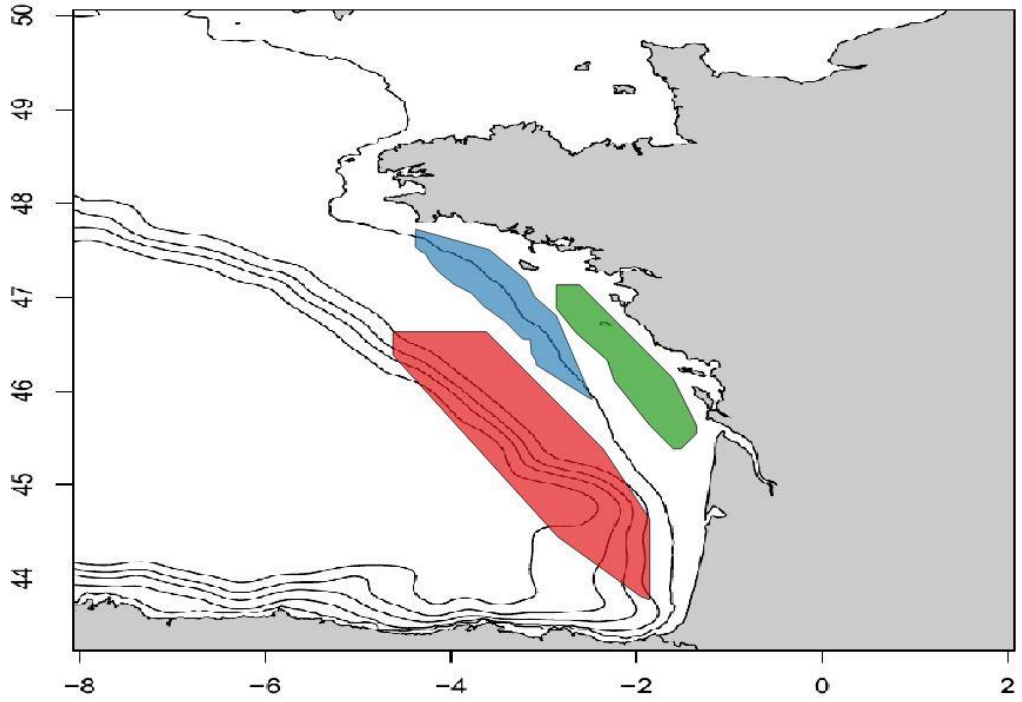


Figure 2 shows the three final core habitat for the Bay of Biscay. Green coastal riverine – influenced areas, blue La Grand Vasiere, and red the outer shelf.

Specific questions and methods

Questions	Method
How to characterize the different areas in regards to community composition?	β diversity analysis Species Biomass Histogram
Do species show different trends in different areas in recent decades?	Time series

Data used: EVHOE (Demersal species) + PELGAS (Pelagic species)

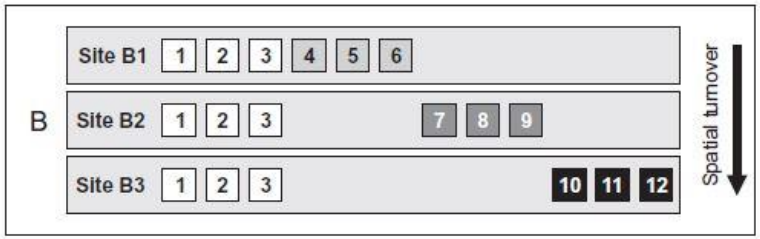
β diversity analysis – Baselga 2010

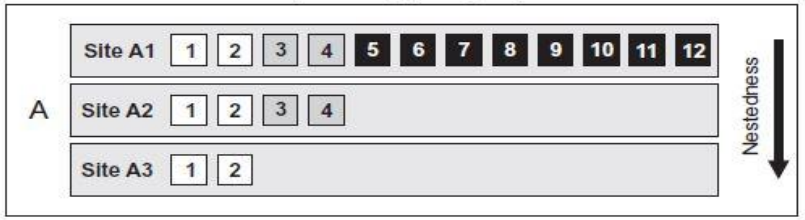
Overall β Diversity

$$\frac{\left[\sum_{i<j}\min(b_{ij},b_{ji})\right]+\left[\sum_{i<j}\max(b_{ij},b_{ji})\right]}{2\left[\sum_{i}S_i-S_T\right]+\left[\sum_{i<j}\min(b_{ij},b_{ji})\right]+\left[\sum_{i<j}\max(b_{ij},b_{ji})\right]}$$

Species Turnover

Species Nestedness





$$\frac{\left[\sum_{i<j}\min(b_{ij},b_{ji})\right]}{\left[\sum_{i}S_i-S_T\right]+\left[\sum_{i<j}\min(b_{ij},b_{ji})\right]}$$

$$\frac{\left[\sum_{i<j}\max(b_{ij},b_{ji})\right]-\left[\sum_{i<j}\min(b_{ij},b_{ji})\right]}{2\left[\sum_{i}S_i-S_T\right]+\left[\sum_{i<j}\min(b_{ij},b_{ji})\right]+\left[\sum_{i<j}\max(b_{ij},b_{ji})\right]}\times\frac{\sum_{i}S_i-S_T}{\left[\sum_{i}S_i-S_T\right]+\left[\sum_{i<j}\min(b_{ij},b_{ji})\right]}$$

where S_i is the total number of species in site i and S_T is the total number of species in all sites. B_{ij} and B_{ji} represent the number of species present only in site i and j respectively.

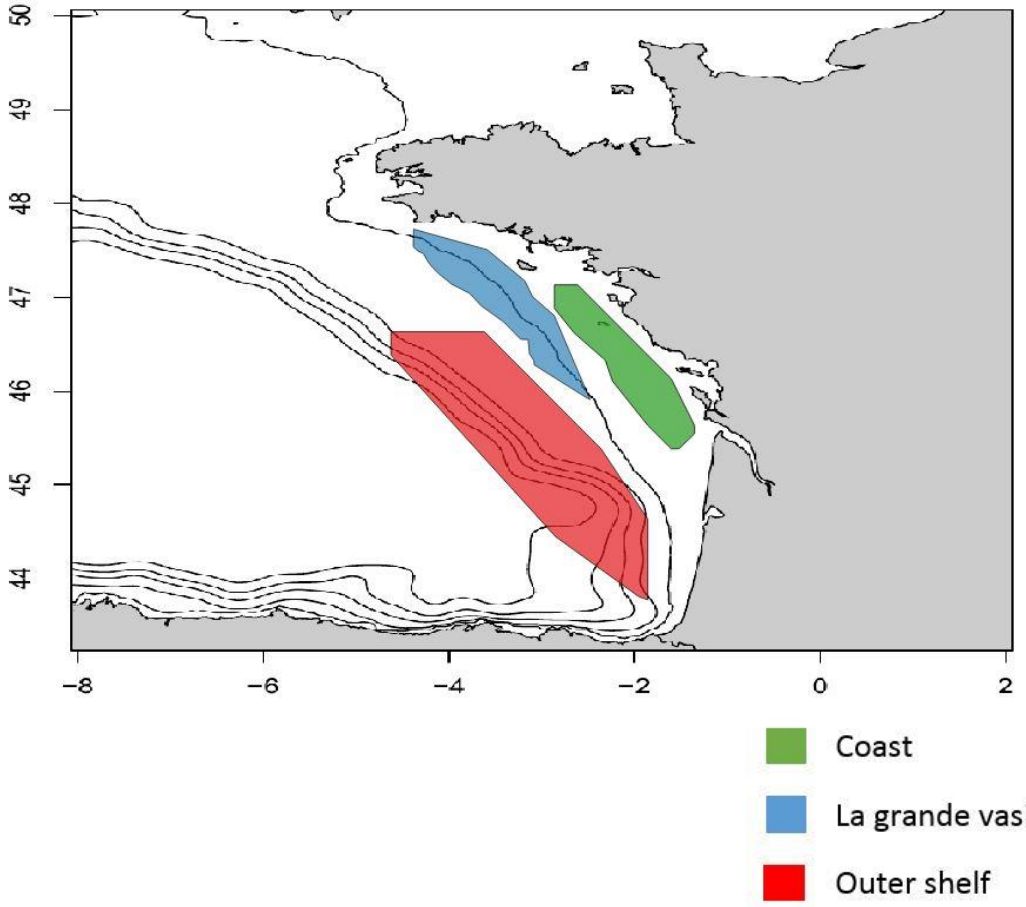
β diversity analysis

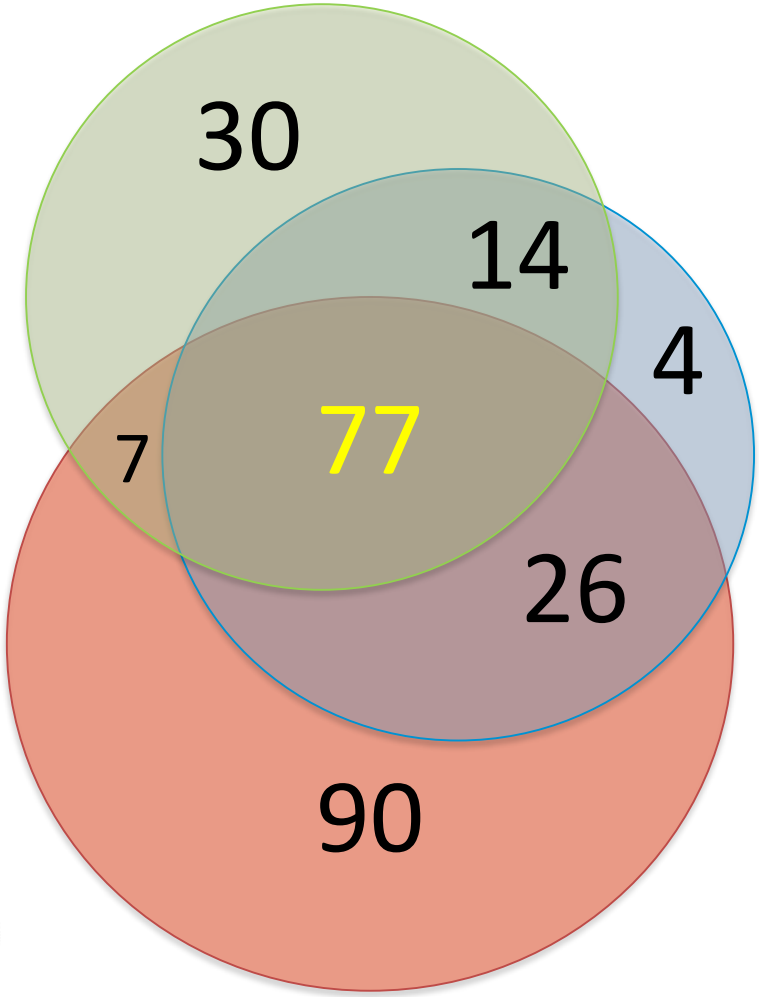
	Demersal species (EVHOE)			Pelagic species (PELGAS)		
Species Turnover	βsim	Coast	Gran Vasière	βsim	Coast	Gran Vasière
	Gran Vasière	0.24		Gran Vasière	0	
	Outer Shelf	0.35	0.16	Outer Shelf	0	0.083
Species Nestedness	βsne	Coast	Gran Vasière	βsne	Coast	Gran Vasière
	Gran Vasière	0.024		Gran Vasière	0.043	
	Outer Shelf	0.13	0.20	Outer Shelf	0.043	0
Overall β Diversity	βsor	Coast	Gran Vasière	βsor	Coast	Gran Vasière
	Gran Vasière	0.25		Gran Vasière	0.043	
	Outer Shelf	0.49	0.36	Outer Shelf	0.043	0.083

- The coast has a high species turnover with both La Gran Vasiere and the Outer Shelf. Coast has species that are not present in neither Outer and Gran Vasiere, and Vice Versa.

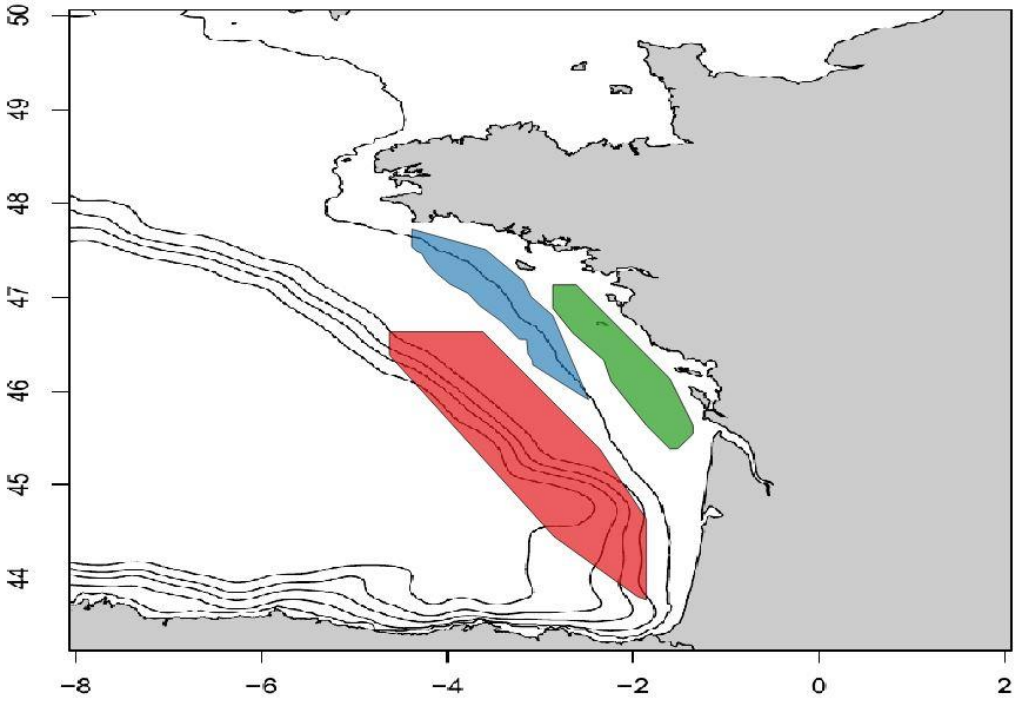
- The diversity between Gran Vasiere and Outer is a quite even mix of species turnover and nestedness.

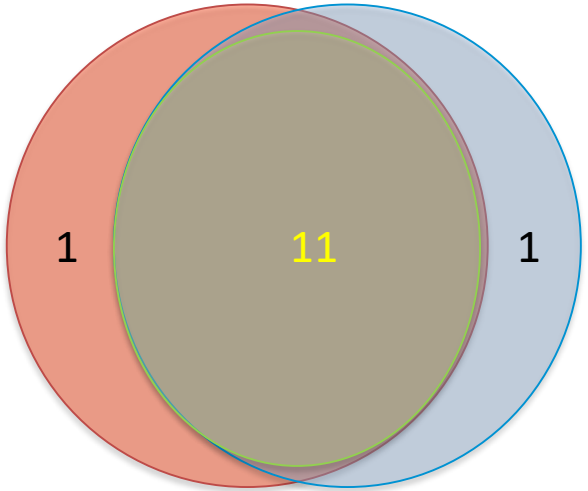
β diversity analysis - EVHOE





β diversity analysis - PELGAS



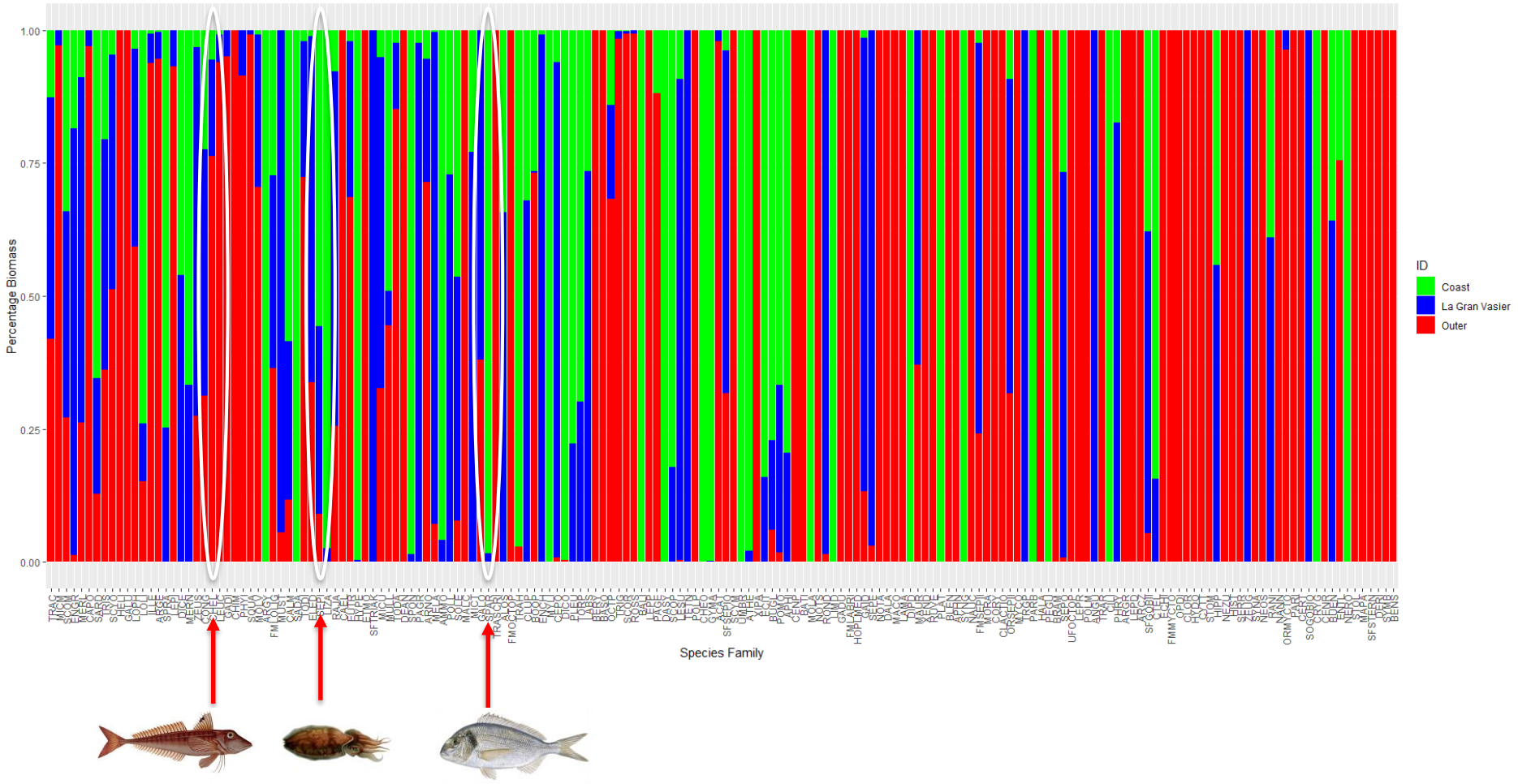


Coast

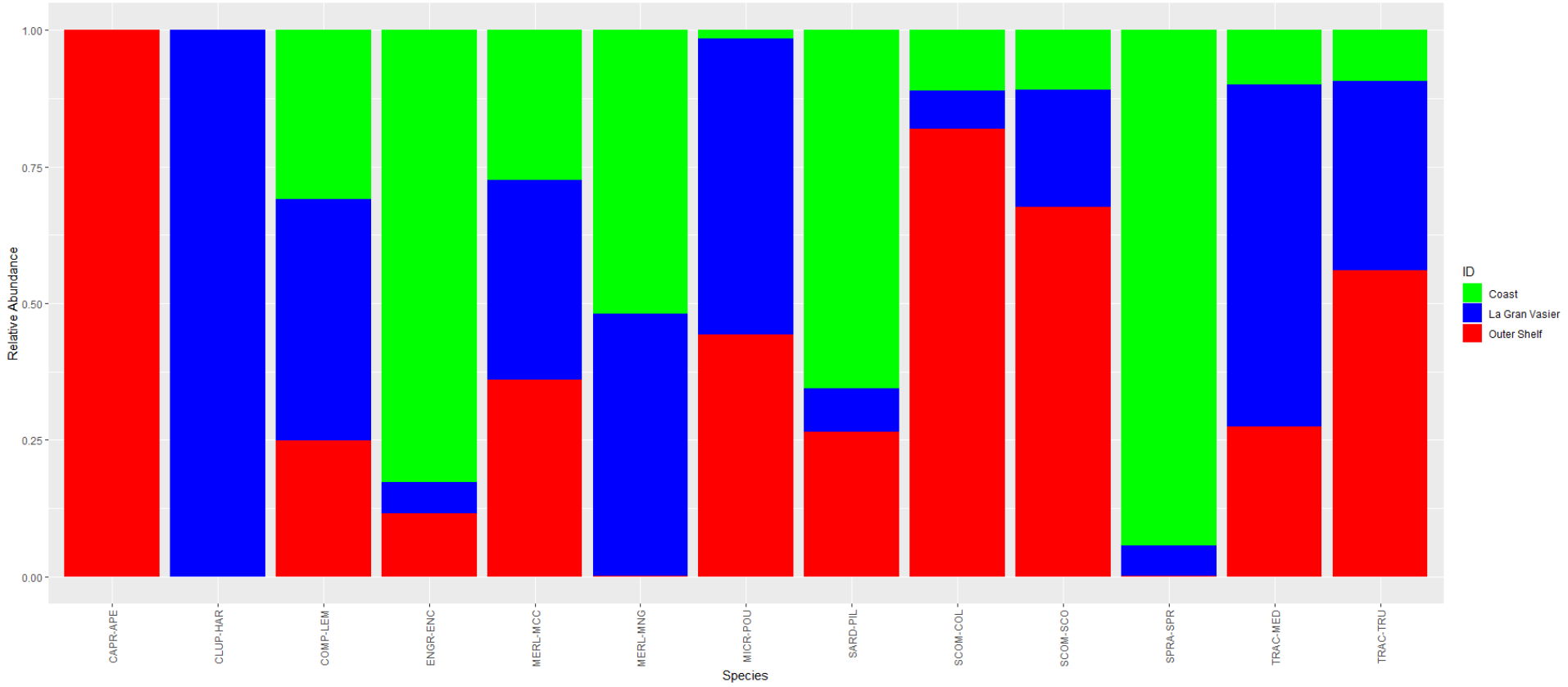
La grande vasière

Outer shelf

Species biomass histogram- EVHOE



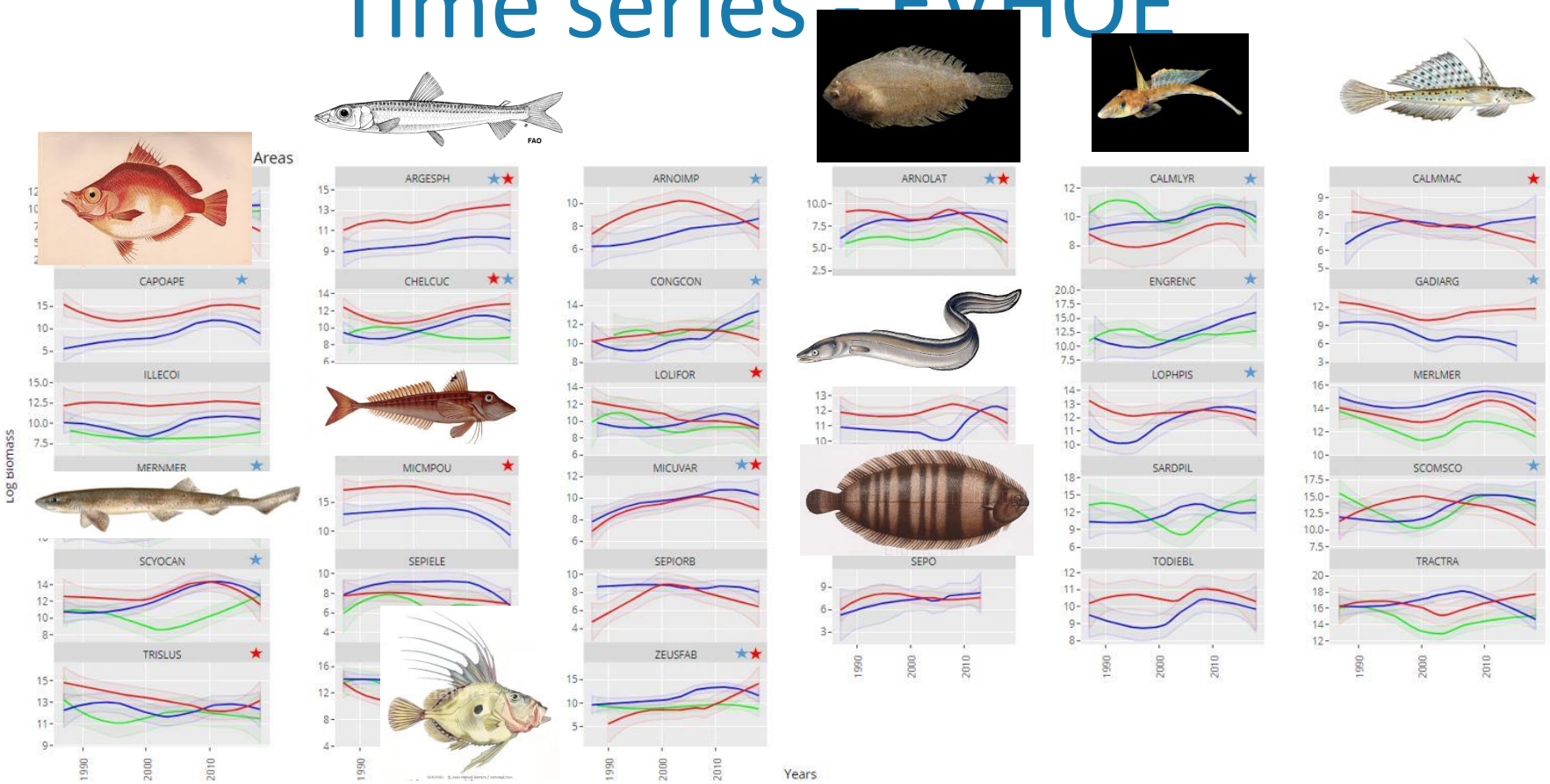
Species biomass histogram- PELGAS



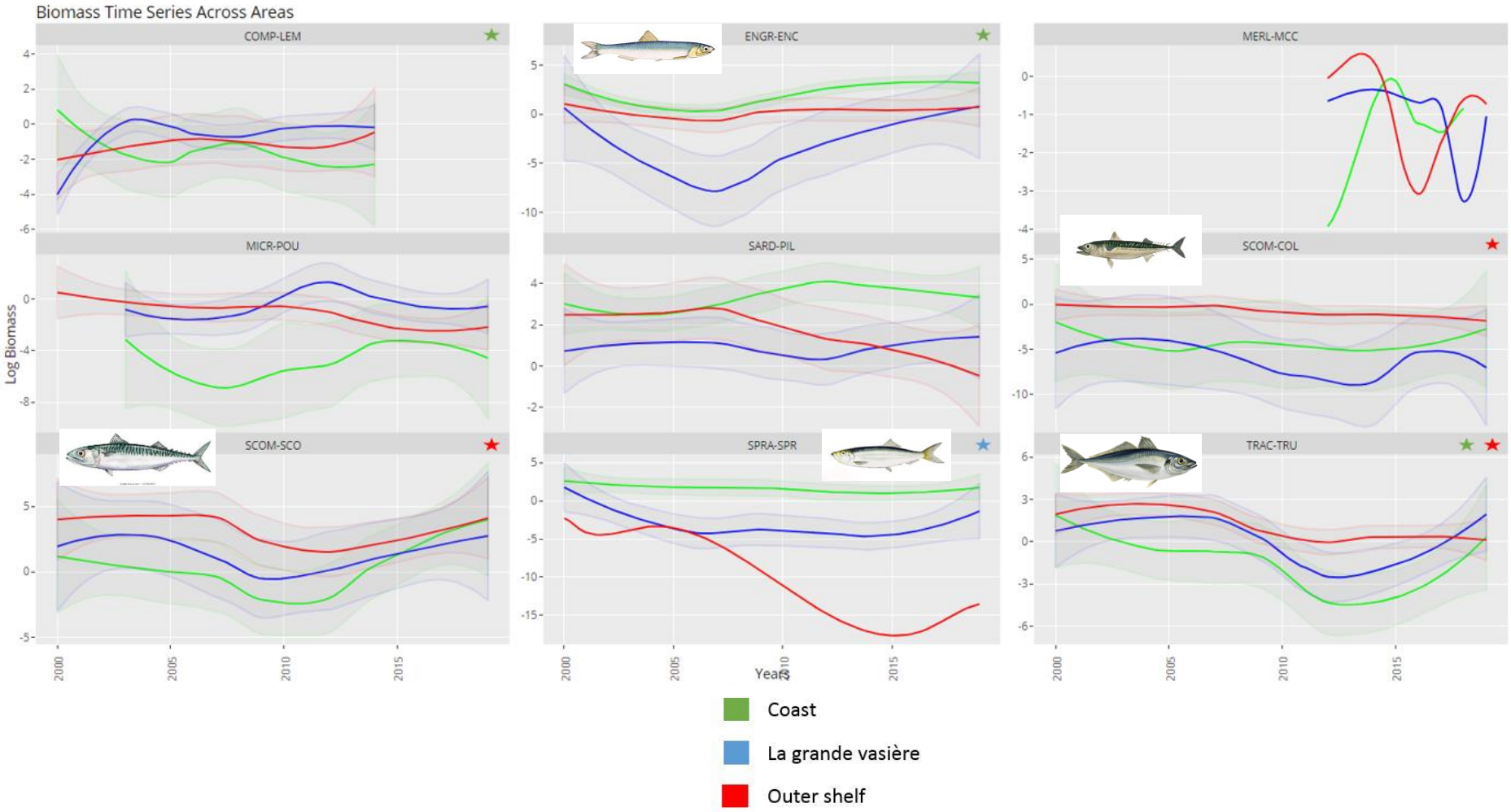
Questions and methods

Questions	Method
How to characterize the different areas in regards to community composition?	Species biomass x area histogram B diversity analysis
Do species show different trends in different areas in recent decades?	Time series

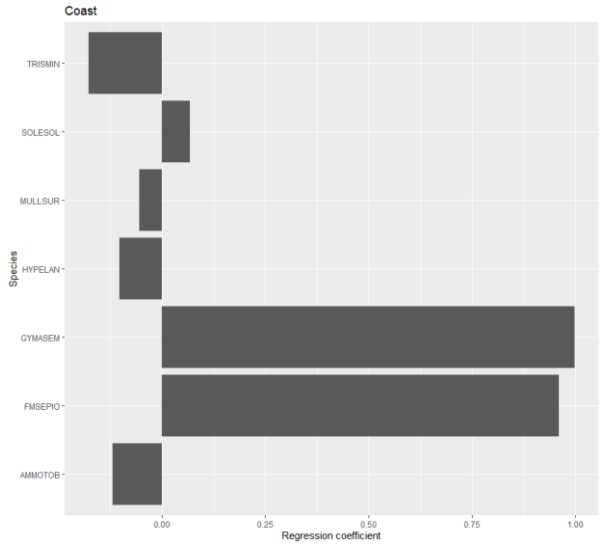
Time series - EVHOE

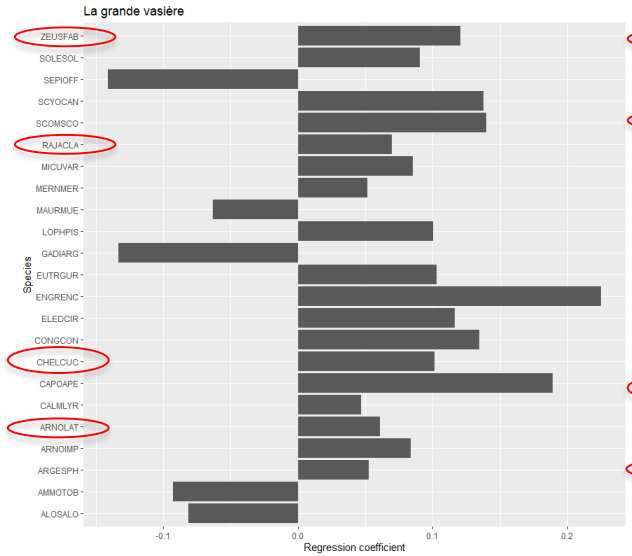


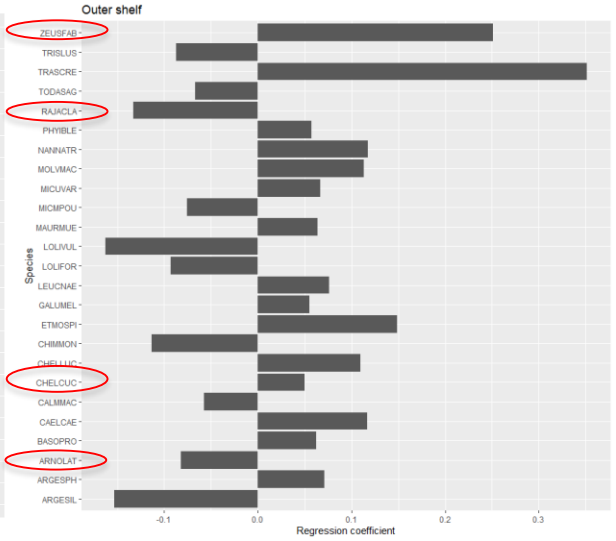
Time series - PELGAS



Regression coefficients - EVHOE







Conclusion

- Match between demersal- defined habitat and pelicagic-defined habitat
- Demersal fishes show different community composition in different habitats
- The three areas seem different according to β diversity
- Some trends of demersal fishes seem to differ across areas
- Pelagic fishes composition and trends are more homogenus across habitats compared to demersal

Perspective

- Looking at finer scale (e.g. cohorts instead of entire population)
- Looking at mean weight
- Including other informations (abiotic, anthropogenic) if spatial resolution allows it

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QUESTIONS?

MERCI POUR VOTRE ATTENTION