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## Biodiversity of benthic communities and resilience of continental shelves

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► **To cite this version:**

Thomas Outrequin, Hervé Le Bris, Jacques Grall, Pascal Laffargue. Biodiversity of benthic communities and resilience of continental shelves. ASLO Aquatic Sciences Meeting 2023 "Resilience and recovery in aquatic systems", Jun 2023, Palma De Mallorca, Spain. hal-04142807

**HAL Id: hal-04142807**

**<https://institut-agro-rennes-angers.hal.science/hal-04142807v1>**

Submitted on 27 Jun 2023

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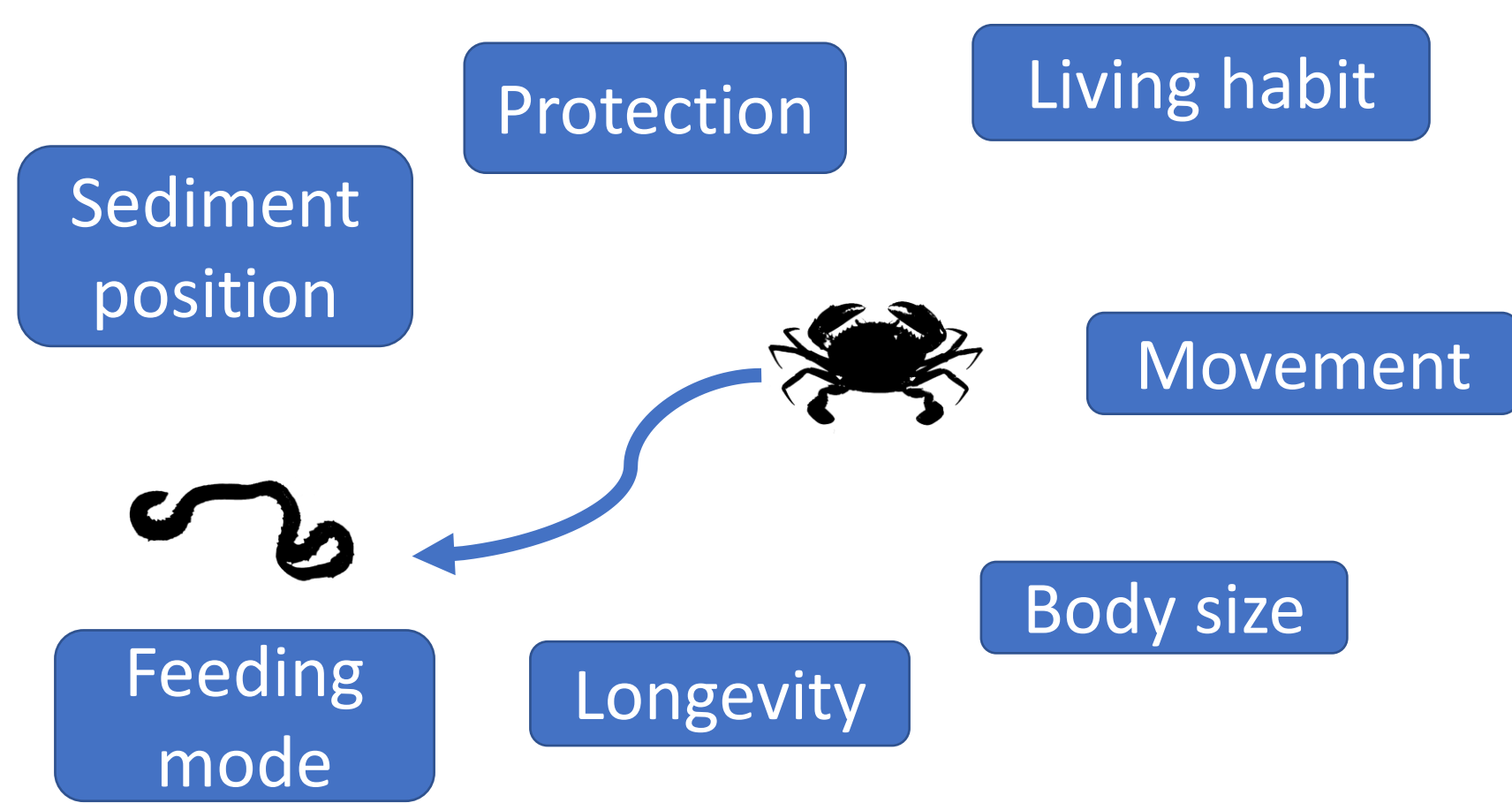
- Continental shelves → ecosystem under strong anthropogenic pressure (Halpern *et al.*, 2008)
- Benthic fauna → Major component of the trophic functioning of continental shelf ecosystems (Lassalle *et al.*, 2011)
- Trophic functioning stability and resilience may depend on functional features (Sanders *et al.*, 2021)

## How benthic biodiversity structures the resilience of trophic functioning though continental shelves ?

### Materials & Methods

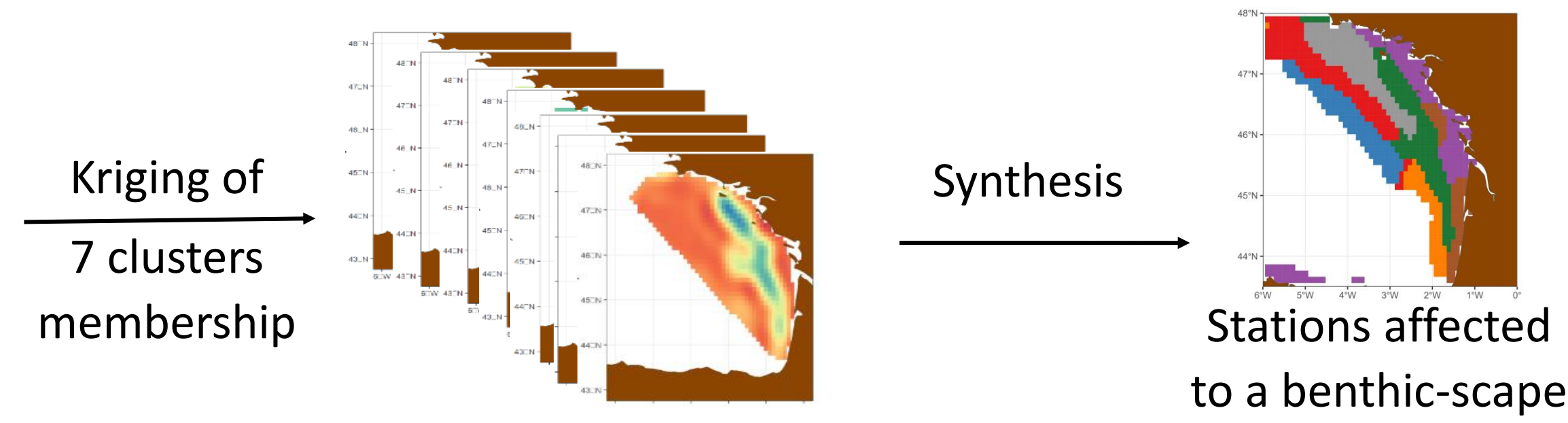
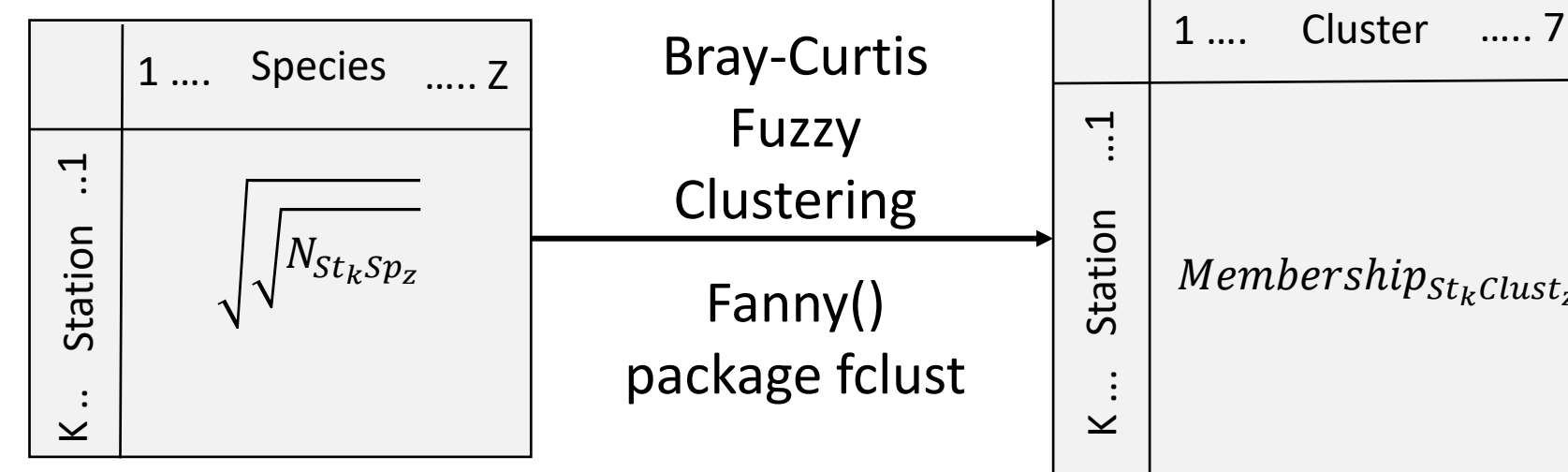
#### Step 0 : Data required

1. Invertebrate epi-megafauna: Trawling abundance data (IBTS EVHOE 2008-2020, depth: 20-200m, Bay of Biscay)
2. Trophic related functional traits (Clare *et al.*, 2022)



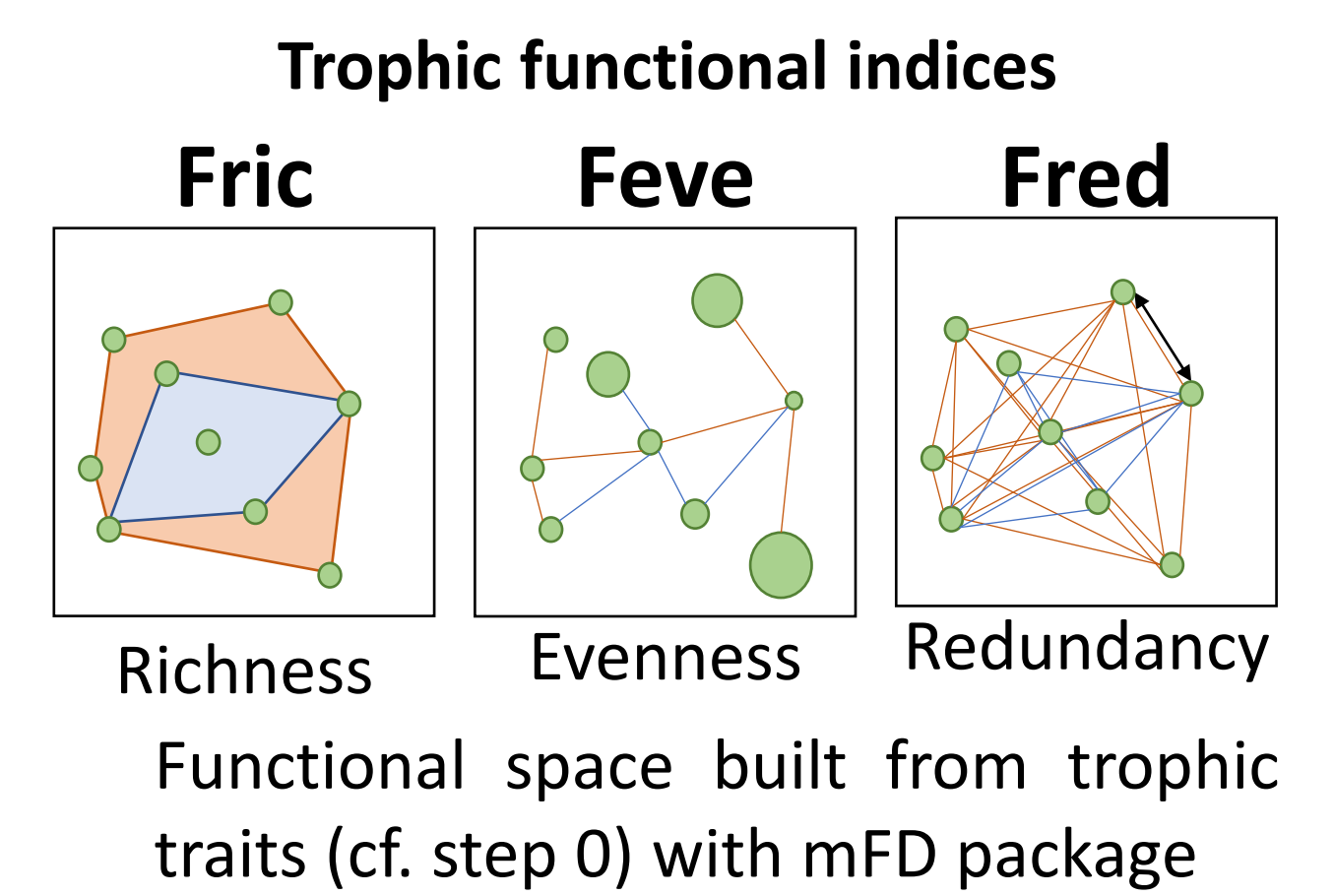
3. Vulnerability to trawling pressure (Beauchard *et al.*, 2021)
4. Drivers of diversity and vulnerability: Trawling disturbance (average swept area) (ICES, 2022) and benthic-scapes defined.

#### Step 1 : Delineation of benthic-scapes



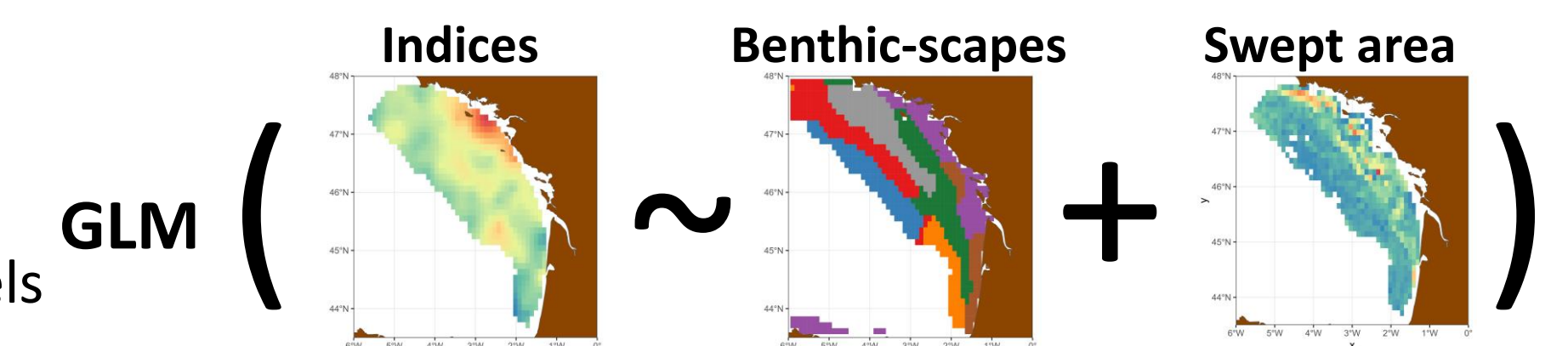
#### Step 2 : Functional diversity indices of benthic-scapes and vulnerability index

- ✓ High functional diversity (richness and evenness) → High resistance to pressure
- ✓ High functional redundancy → High resilience to disturbance
- ✓ Major anthropogenic benthic pressure: bottom trawling
- Vulnerability (VU) index to bottom trawling
- Low vulnerability → Low sensitivity and/or high resilience to bottom trawling
- 4 indices: Functional richness (Fric), Functional evenness (Feve), Functional redundancy (Fred), Vulnerability (VU)



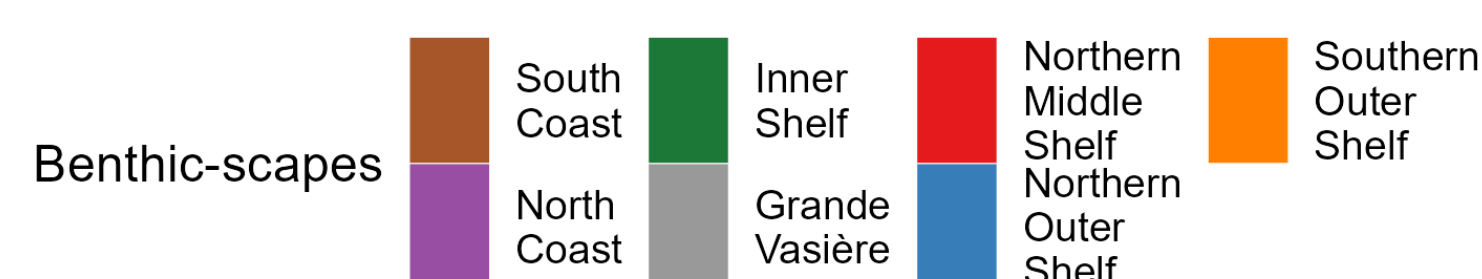
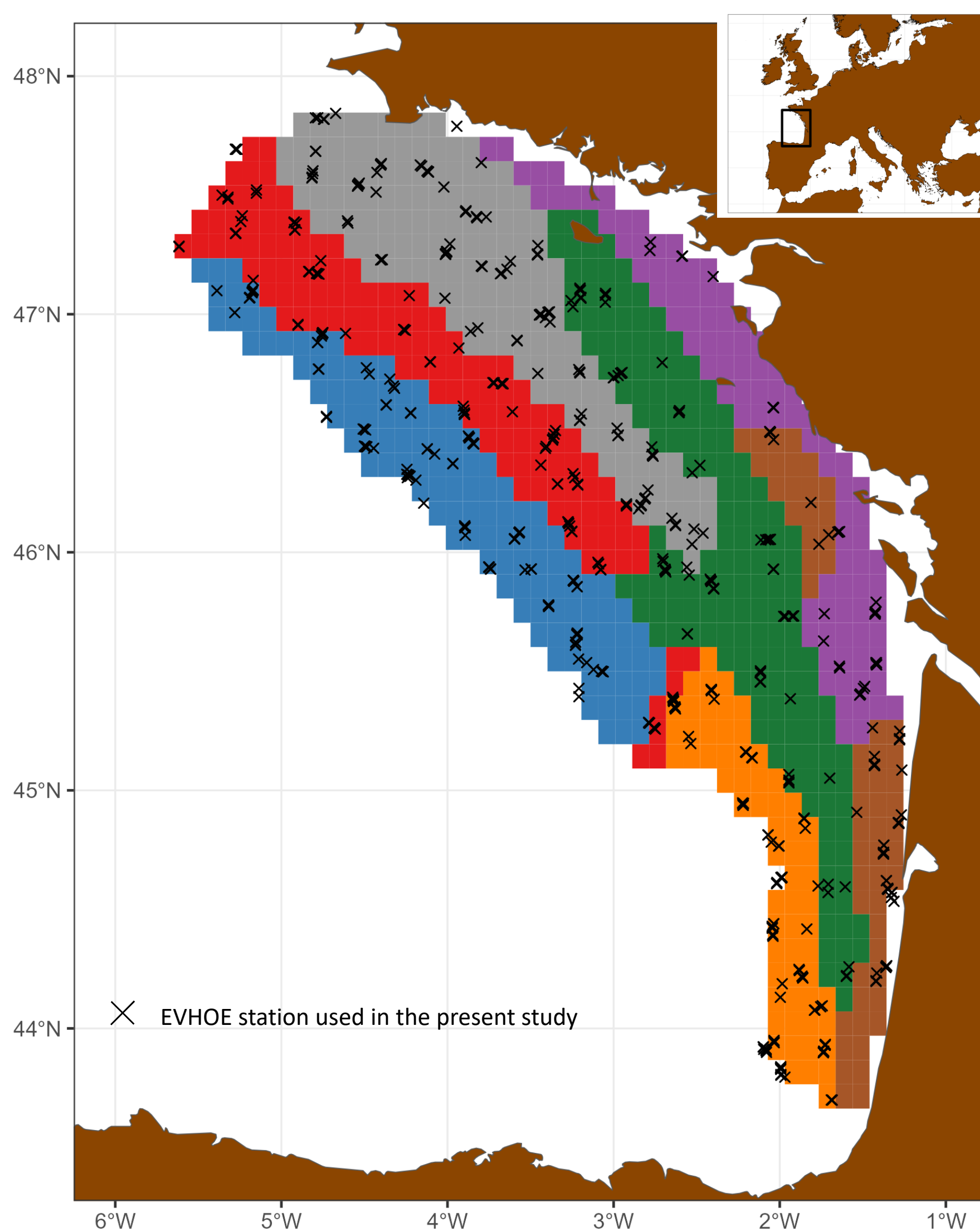
#### Step 3 : Drivers of spatial structuration

- ✓ Kriging of 4 indices (Fric, Feve, Fred, VU)
- ✓ Drivers of indices assessed with Generalized Linear Models

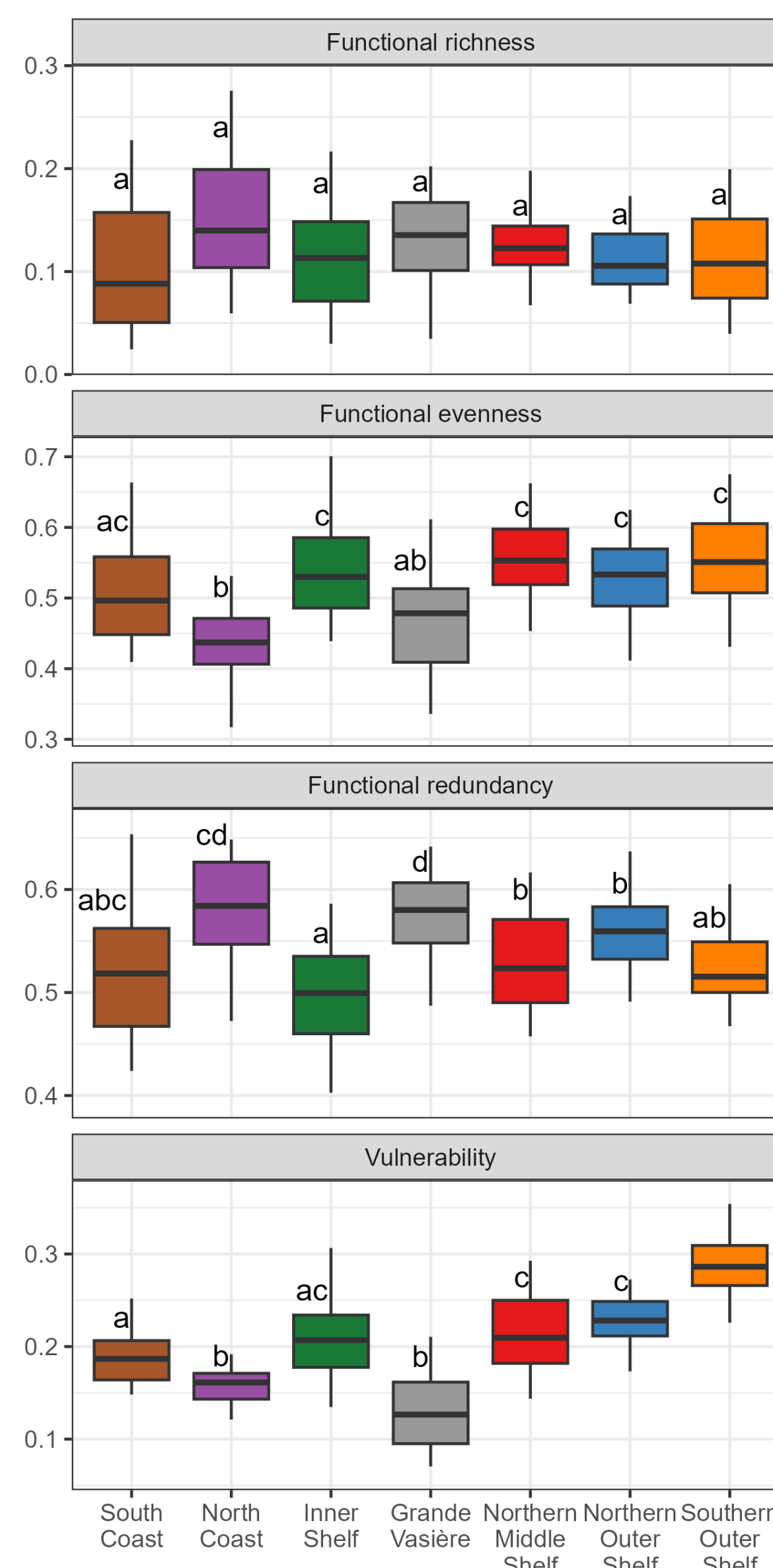


### Results

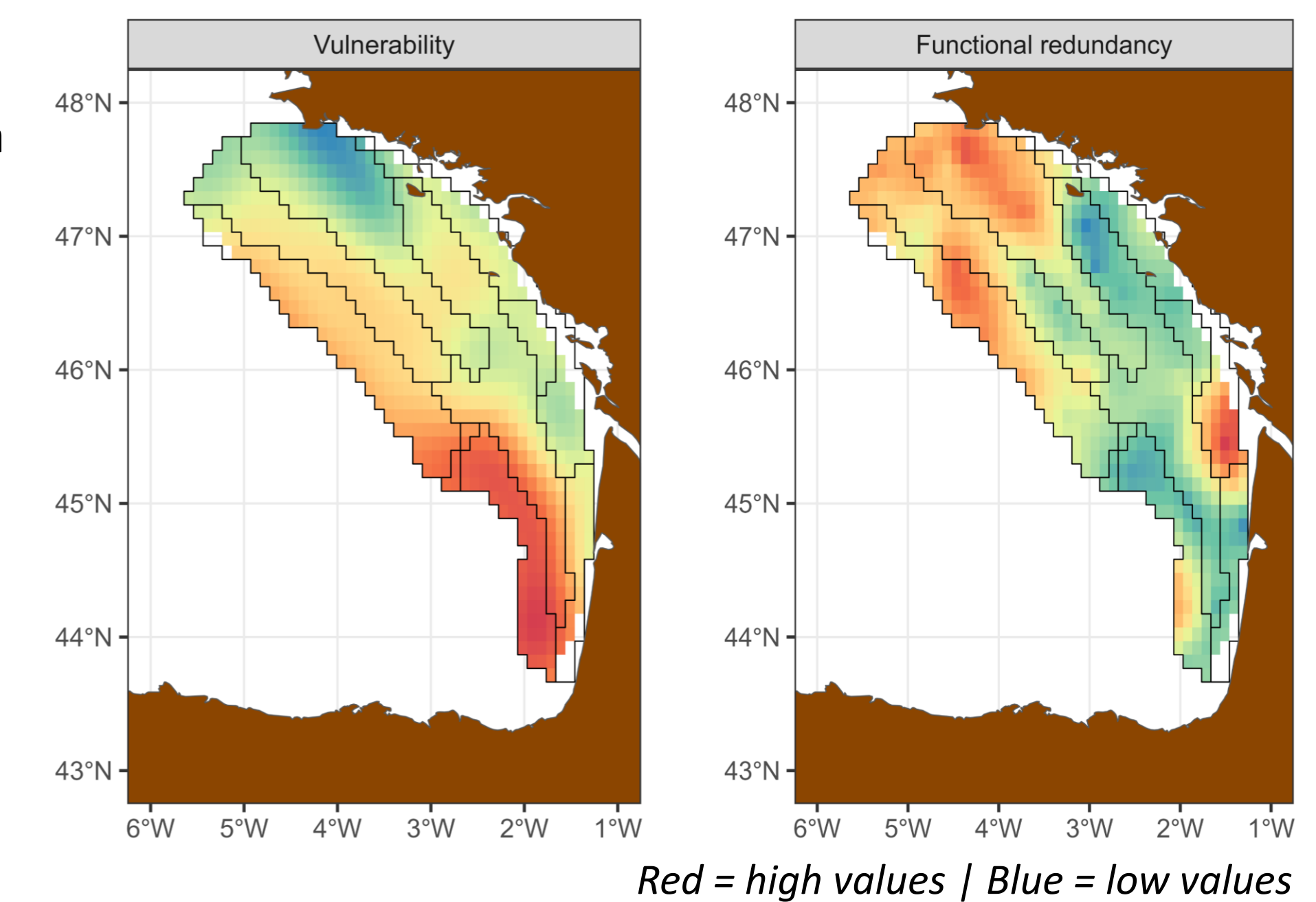
#### Step 1 : Delineation of benthic-scapes



#### Step 2 : Functional diversity indices of benthic-scapes and vulnerability index



- Higher functional richness and lower evenness in coastal area
- Lower richness and higher evenness within offshore benthic-scape
- Three benthic-scapes with high functional redundancy
- Low vulnerability within coastal benthic-scapes and Grande vasière



- Southern outer shelf = high vulnerability to trawling pressure
- 3 hotspots of functional redundancy :
  - North coast
  - North outer shelf
  - Grande vasière
- High intra-benthic-scape variability

#### Step 3 : Drivers of spatial structuration

- Indices variability strongly explained by benthic-scapes
- Functional indices less structured by fishing pressure than vulnerability index

Table 1: Amount of variability explained by each factor

	Benthic-scapes	Swept-area surface
Functional richness	26,1%	0,5%
Functional evenness	50,3%	0%
Functional redundancy	32%	0,1%
Vulnerability	81,2%	7,8%

×% : non-significative factor within glm

### Discussion

- Decrease of resistance and increase of vulnerability from coast to continental margin (lower functional richness offshore)
- Resilience does not decrease linearly : 3 hotspots identified (North coast, Grande Vasière and Northern outer shelf)
  - Resistance and vulnerability correlated with continental shelves gradient, but trophic functioning resilience depends on benthic-scapes
- Benthic-scapes = suitable scale for integrating the spatial structuring of benthic ecosystems and dissociating environmental variability, trophic functioning and vulnerability to fishing pressure.

### References:



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