Québec-Océan Réunion Scientifique Annuelle
2017 November, 14

Benthic communities of Sept-Îles and human activites: a peaceful cohabitation?

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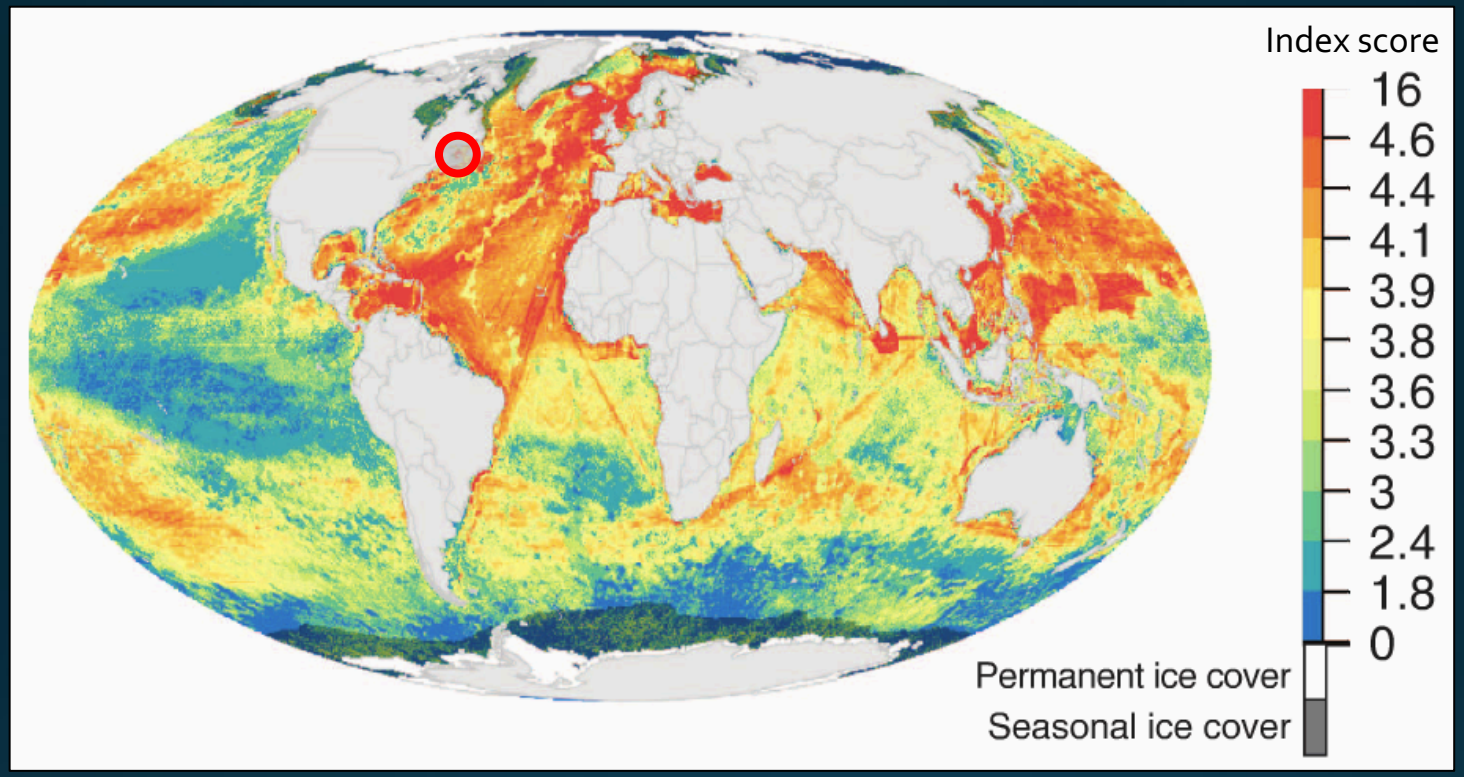
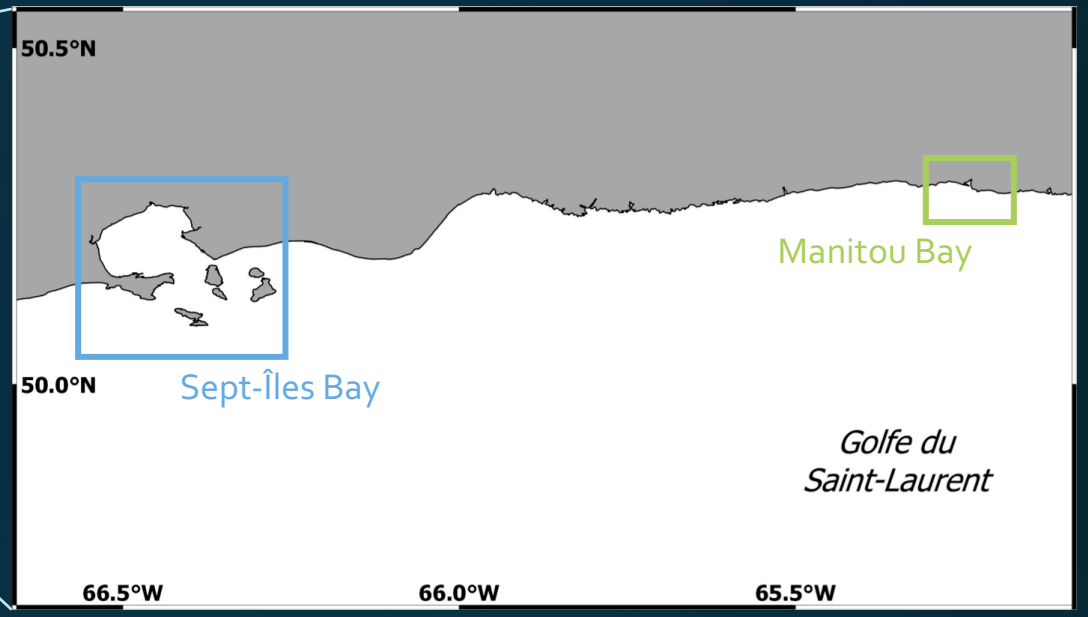
Cumulative impact score for ecosystems of the world



Different human activities impact marine ecosystems → What are the effects of activities cumulation on communities?...
... at a fine spatial scale (0.01 km²)?

Halpern et al. 2015



Third port of Quebec

22 MT of exchanged goods (2016)

High international targeting

98 % of imports-exports (2016)

Urbanisation and waste waters discharge

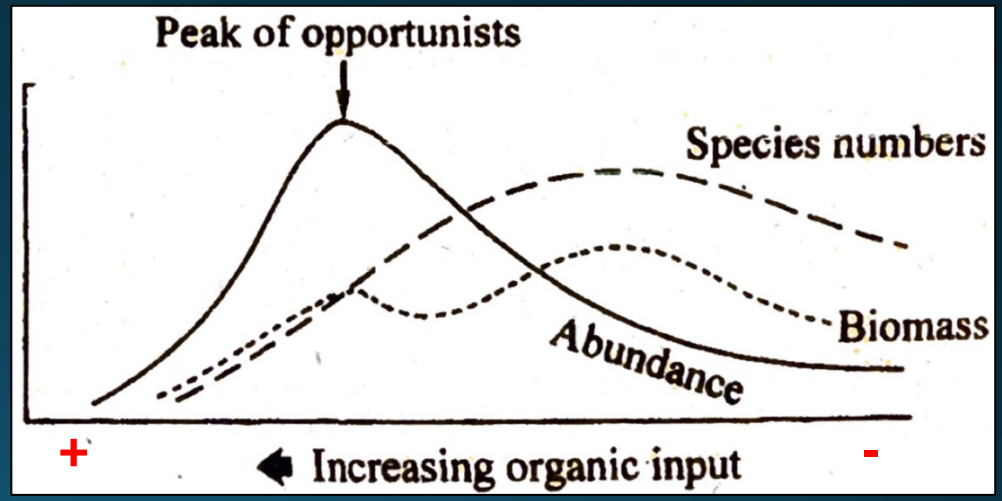
Activities and sewers from industry

Shipping activities

+ Fishing, tourism…

Why benthic species ?

- Important for the ecosystem
- Important for mankind
- Respond to anthropogenic perturbations



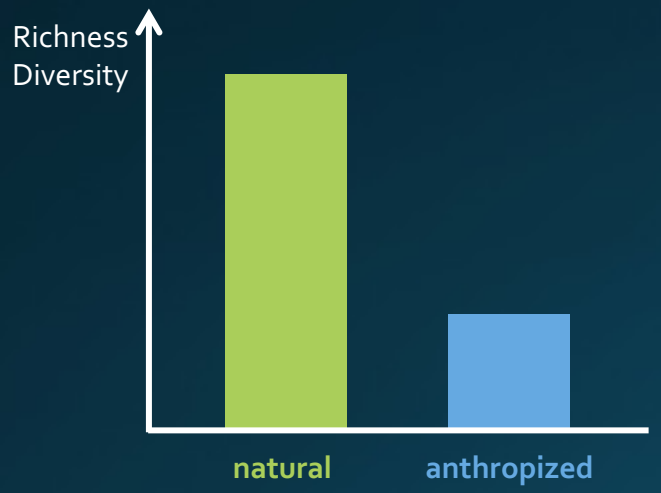
Pearson & Rosenberg, 1978

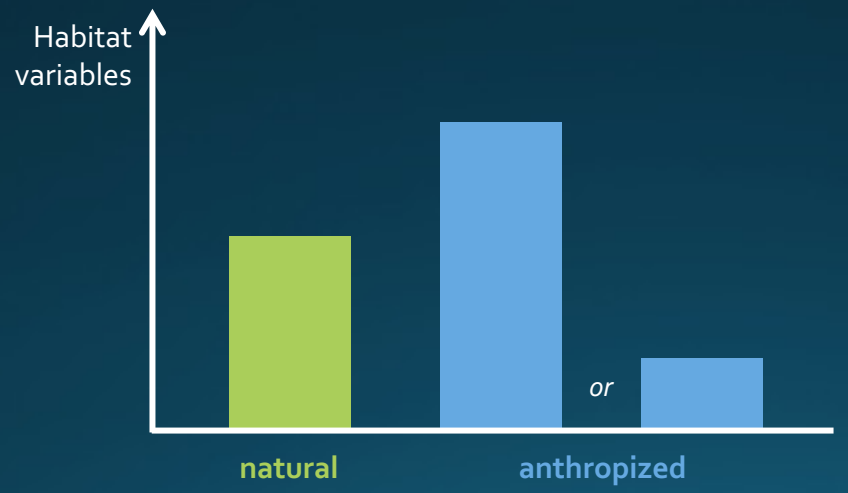
- Describe structure of the benthic subtidal ecosystems

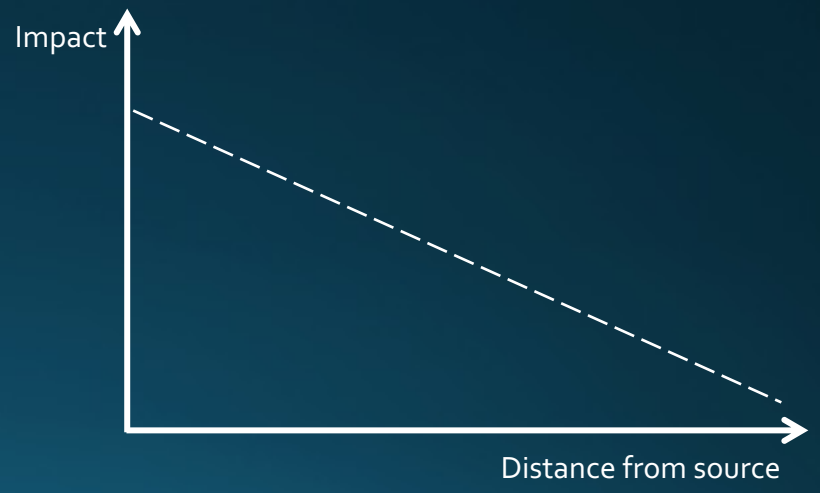
- Characterise the human influence on these ecosystems

  Hypothesis 1 biotic and abiotic parameters : « anthropized » ecosystems ≠ « natural » ecosystems.

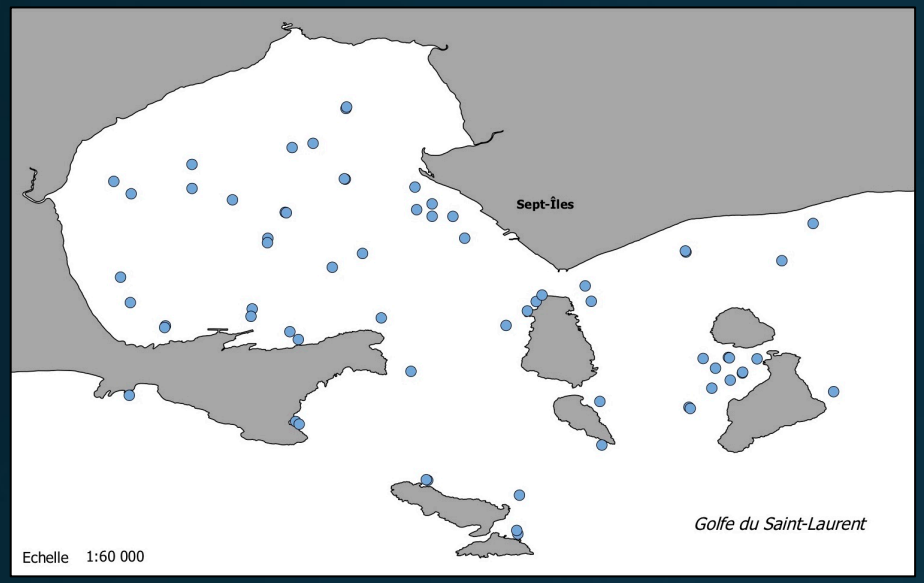
  Hypothesis 2 most impacted zones from human activities : close to their source.



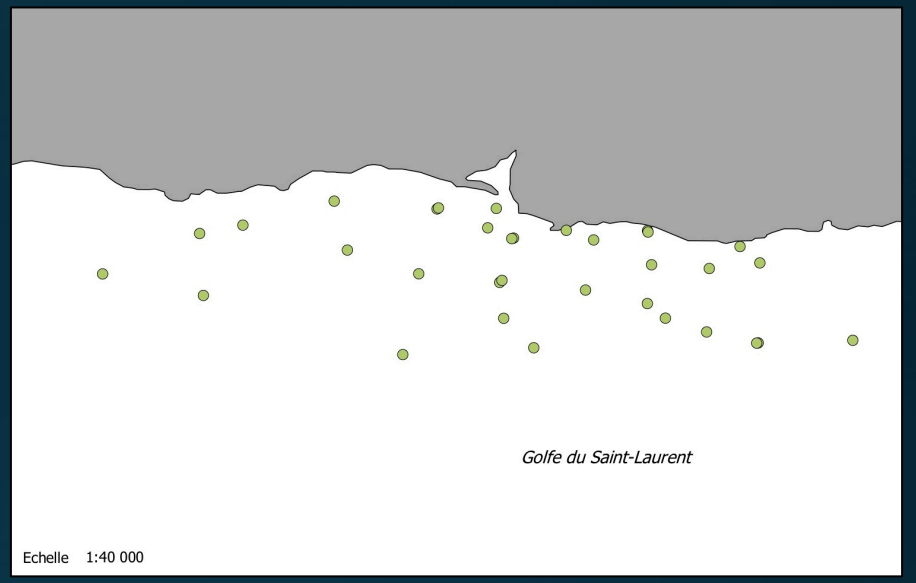




Sampling sites



Sept-Îles Bay (BSI)
63 stations



Manitou Bay (BM)
33 stations

2 ecosystems : « natural » and « anthropized »

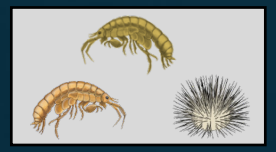
Sampled in 2016 and 2017

Depth between 0 and 70 m

Collected parameters

COMMUNITIES

- species identity
  S



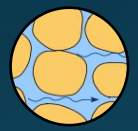
- individuals density
  N

HABITAT

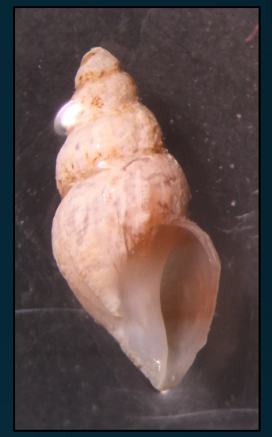
- metadata
  Z , Z_{secchi}

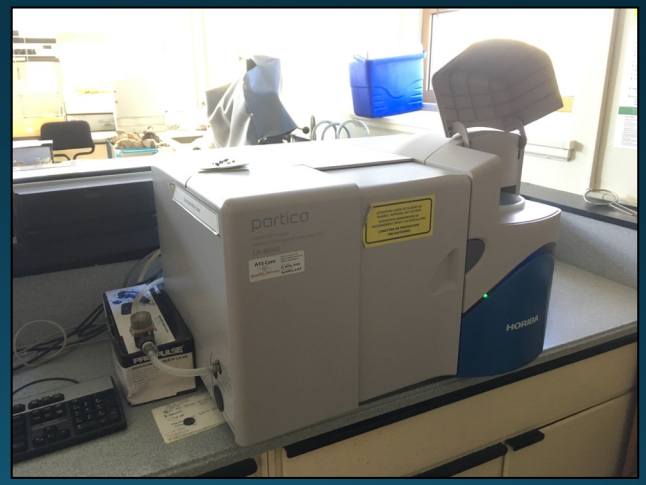
- organic matter content
  $\%_{OM}$

- water retention capacity
  $\%_{water}$

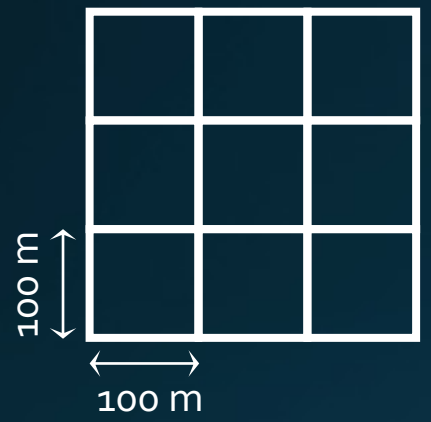


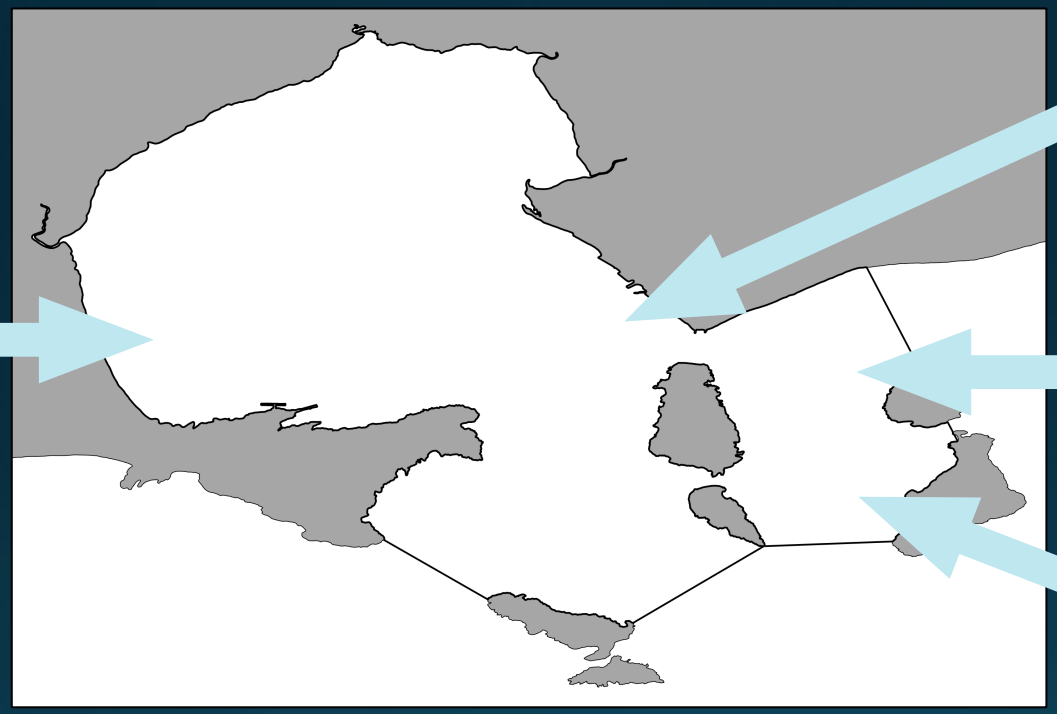
- sediment grain-size distribution
  $\%_{gravel}$, $\%_{sand}$, $\%_{mud}$





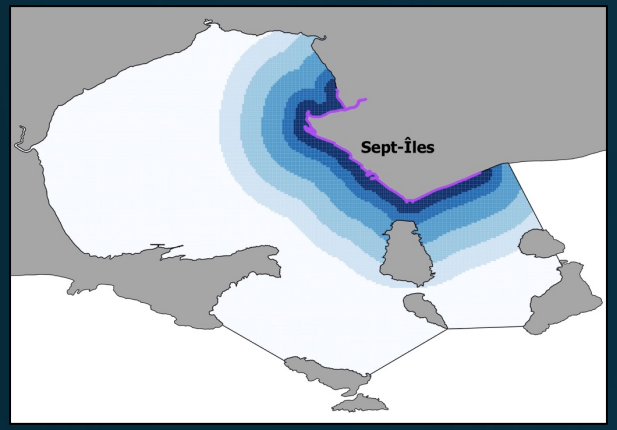
Stress score for each considered activity

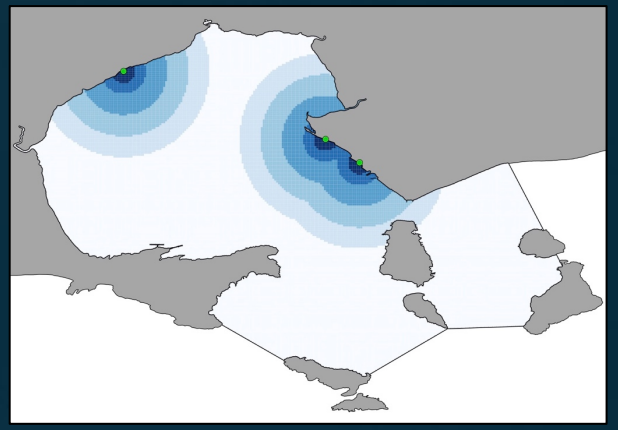




Stress score for each considered activity

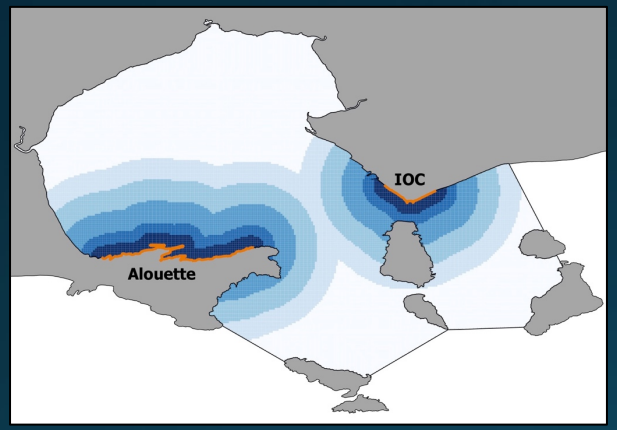
Municipal diffuse runoff

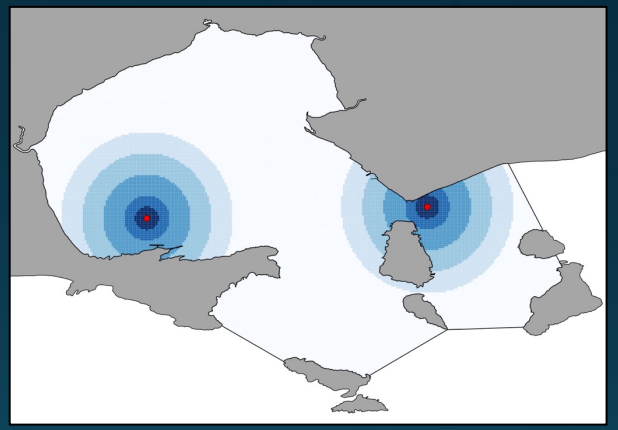




Municipal sewer discharge

Industrial diffuse runoff





Dredging

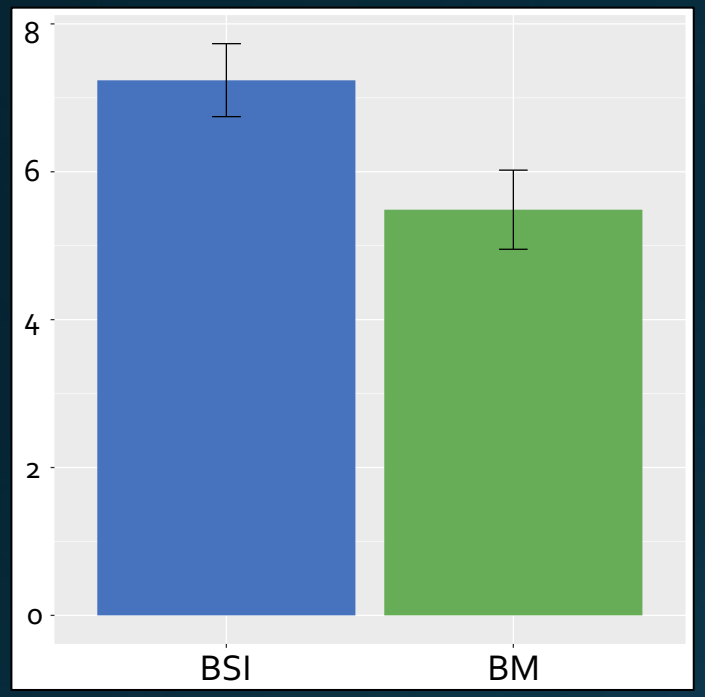
Distance from source

Score :

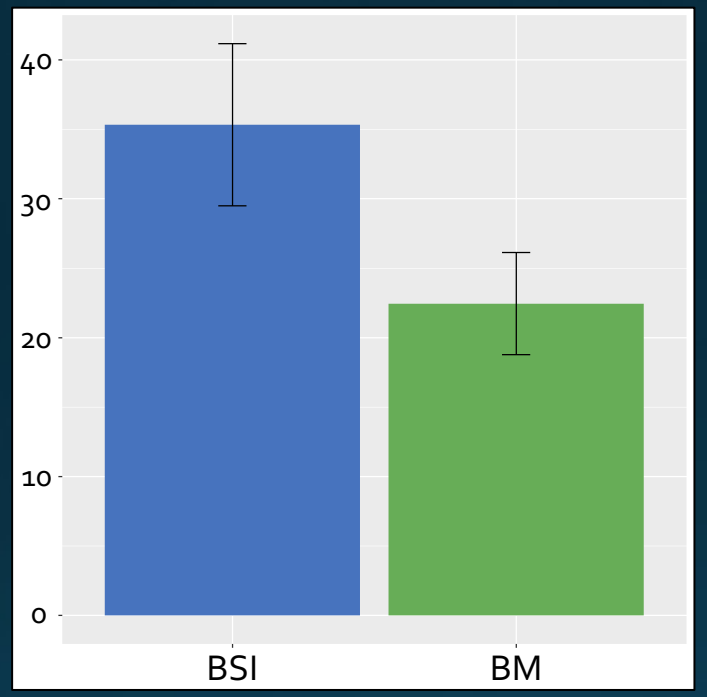
Hypothesis 1 :

Biotic and abiotic parameters:
« anthropized » ecosystems ≠ « natural » ecosystems

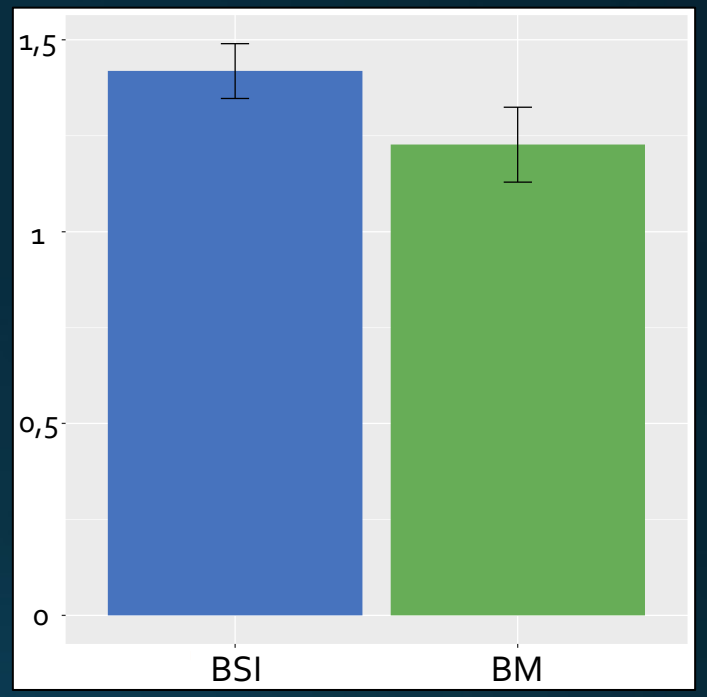
Diversity (BSI vs BM)



Species richness
1 < S < 16



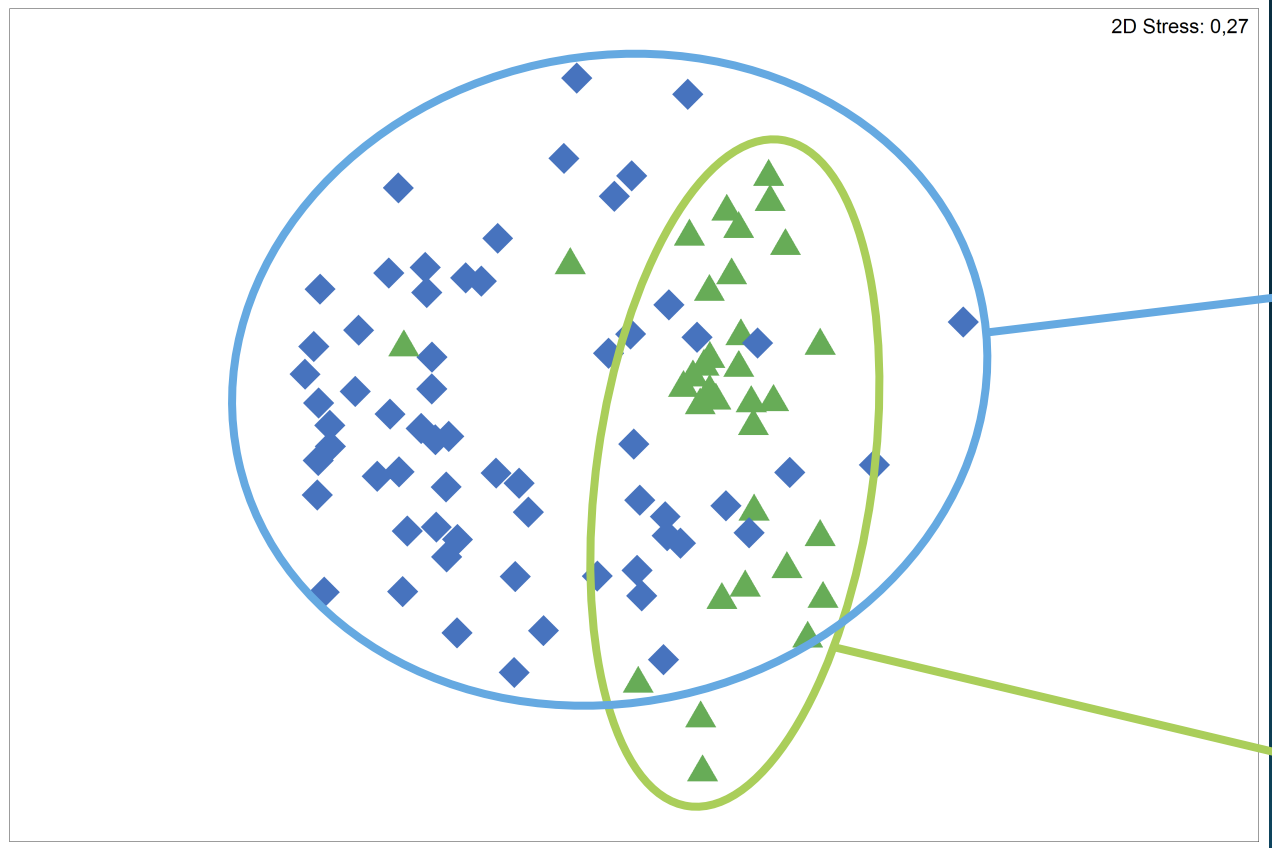
Individual density
1 < N < 320



Shannon-Wiever index
1 < H' < 2,5

No significative differences between BSI and BM (ANOVA)

Communities (BSI vs BM)



Non-metric MDS (4th root of abundances)

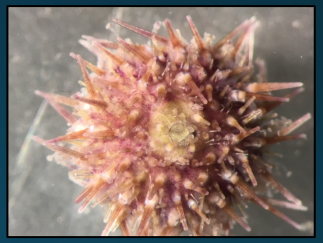
Different communities in BSI and BM
(PERMANOVA : $p < 0,05$, SIMPER)

Chalcky Macoma
(29 %)

Bivalve *E. tenuis*
(10,5 %)

Cumacean *E. integra*
(10,2 %)

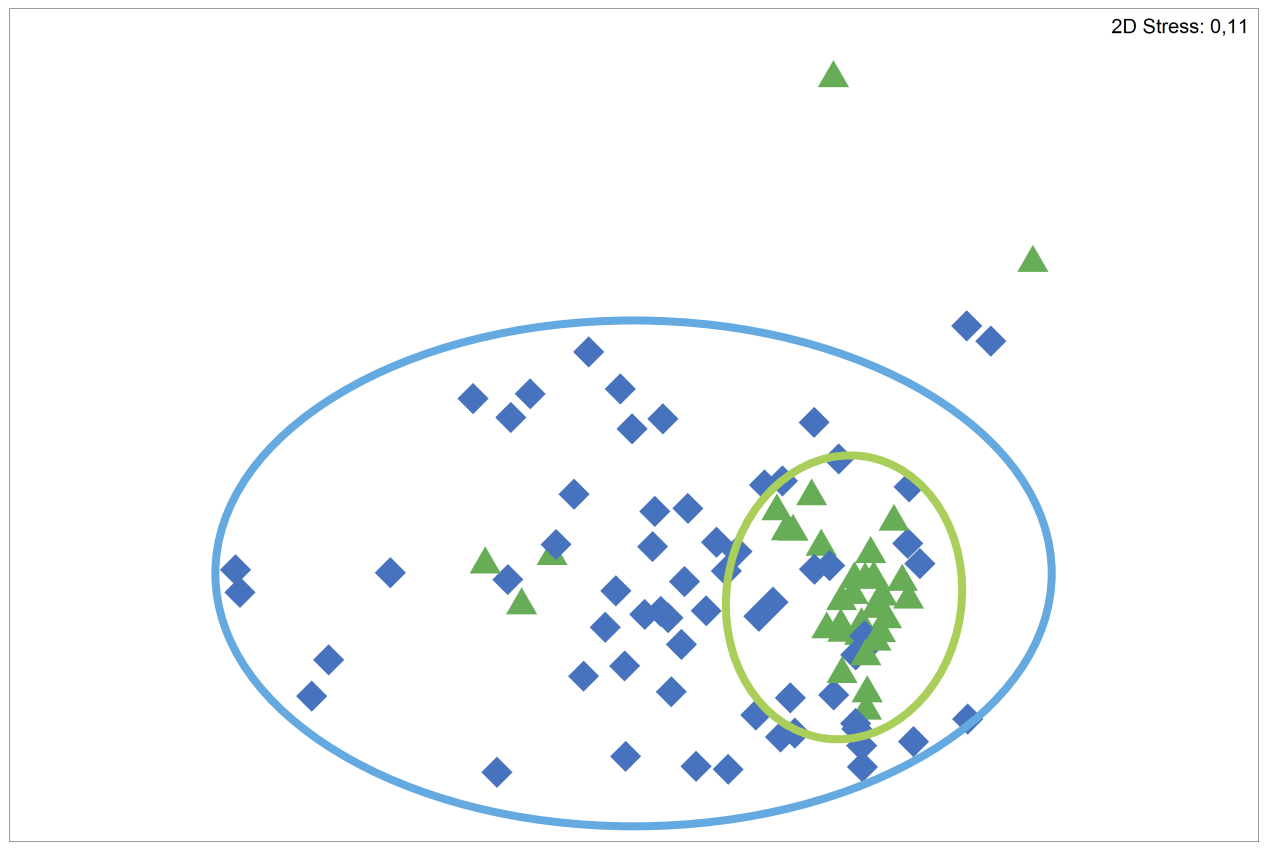
Sand Dollar
(59,4 %)



Green urchin
(8,4 %)

Arctic clovisse
(8,39 %)

Habitat (BSI vs BM)



Non-metric MDS (standardized variables)

Different habitats in BSI and BM (PERMANOVA : $p < 0,05$)

Z , Z_{secchi} , $\%_{OM}$, $\%_{water}$, $\%_{gravel}$ explain the most the communities variability (DistLM, dbRDA)

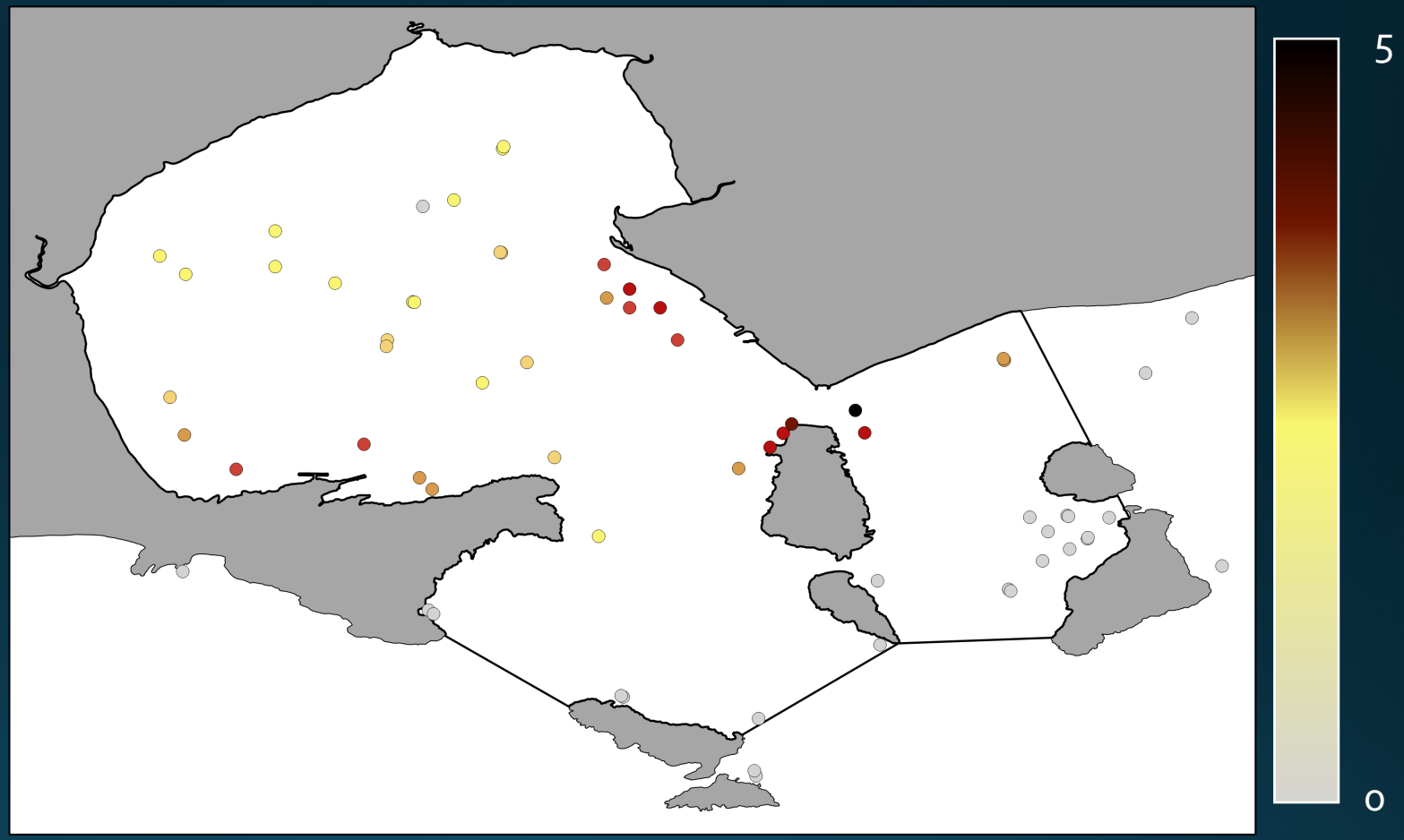
Hypothesis 2 :

Most impacted zones from human activites: close to their source

Calculation of stress scores (BSI)

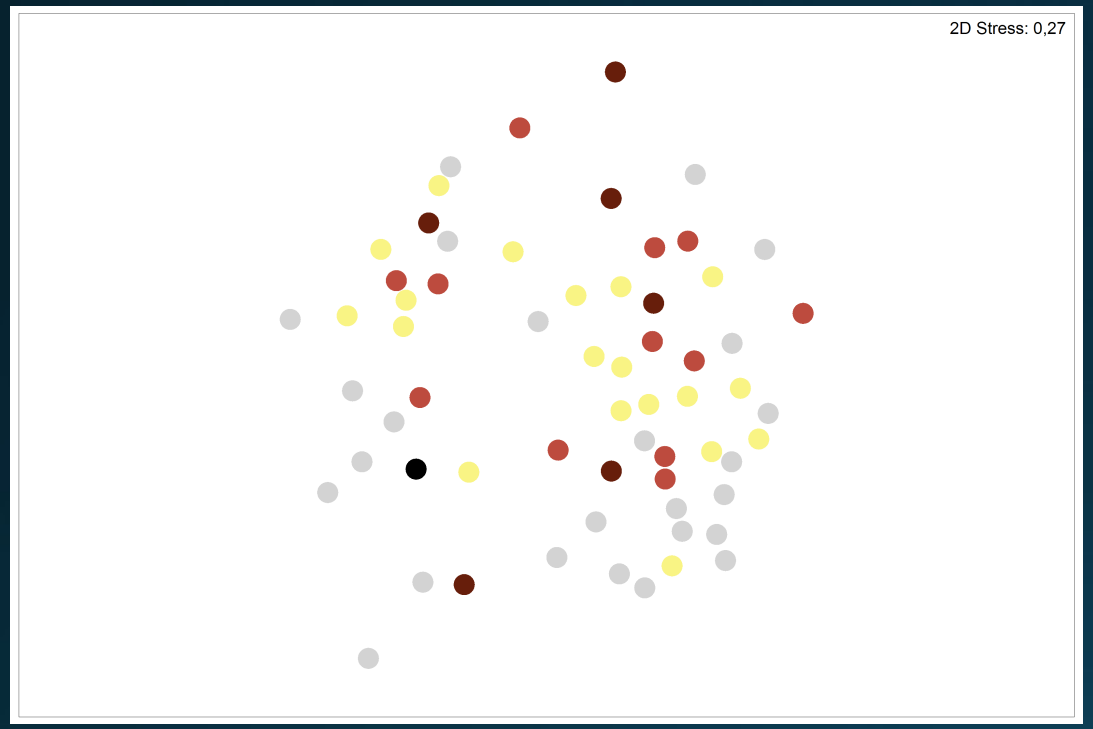
Addition of the scores for each human activity

Regroupement based on the score



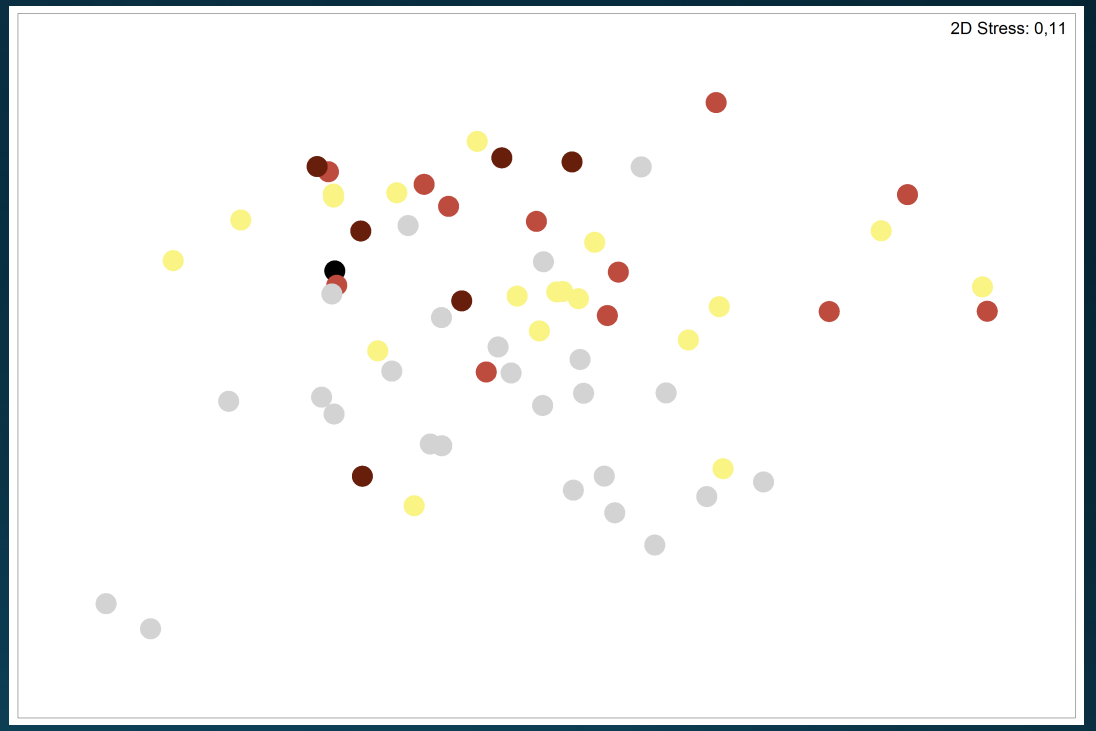
Link with stress scores (BSI)

Communities



Non-metric MDS (4th root of abundances)

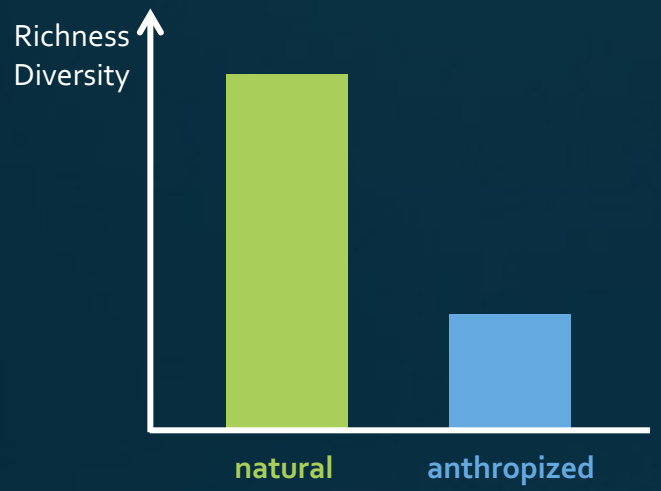
Habitat

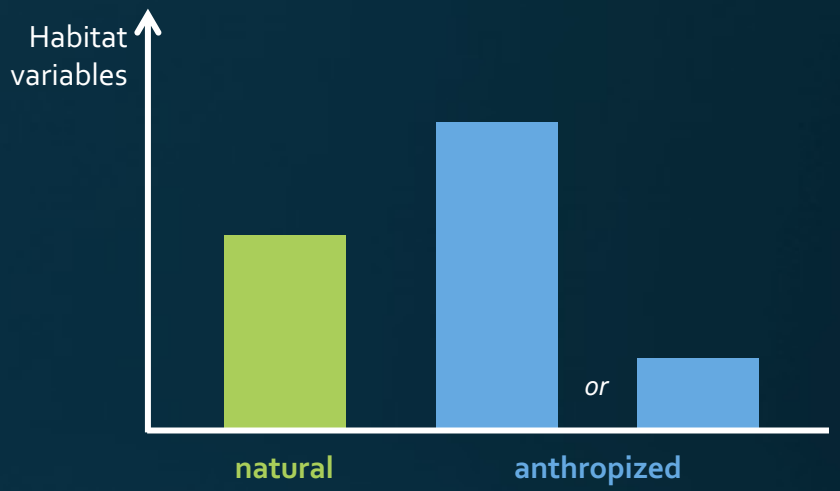


Non-metric MDS (standardised variables)

No significative differences between stress groups (PERMANOVA)
No tendencies in the data (multiple regressions)

Hypothesis 1



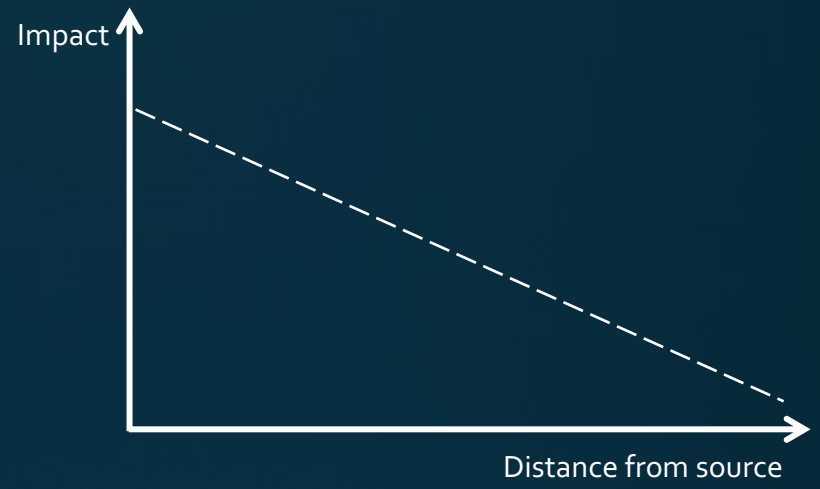


➡ BM is not more diversified than BSI, but…
…BSI and BM have different species assemblages.

➡ The abiotic enviroment is not the same between BSI and BM.
Most explanatory variables : Z , Z_{secchi} , $\%_{OM}$, $\%_{water}$, $\%_{gravel}$

Which amount is due to human activities?

Hypothesis 2



- Scores and stress groups do not explain differences between the stations at BSI.
- Groups badly defined?
  - More complex distribution for the activies?
  - Effects more or less pronounced for each activity?

  Complex interactions between activities?

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Thanks for your attention!

Questions?

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