BIOFOULING OR "BIOFAVORING?"

UNDERWATER PAPARAZZIS

Benthic biodiversity of natural and artificial habitats in Tjärnö Bay, Sweden

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IMBR Sea

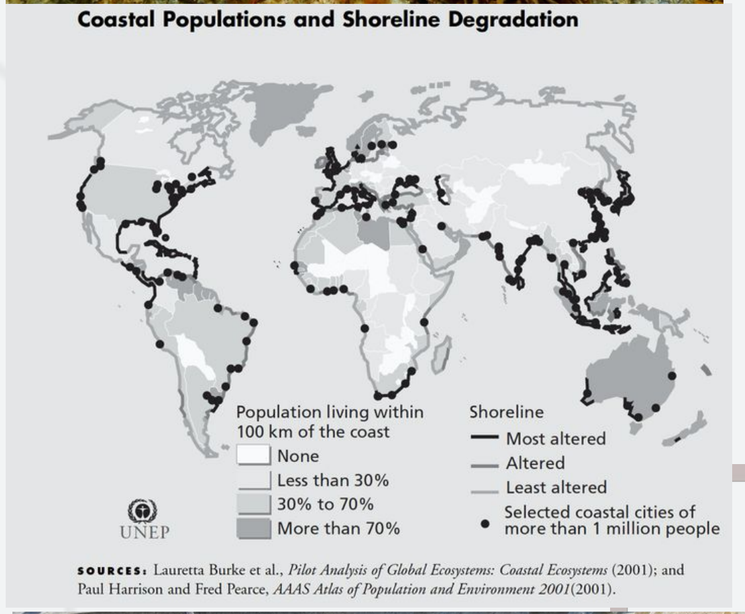
UNIVERSITAS GOTHOBURGENSIS 1891

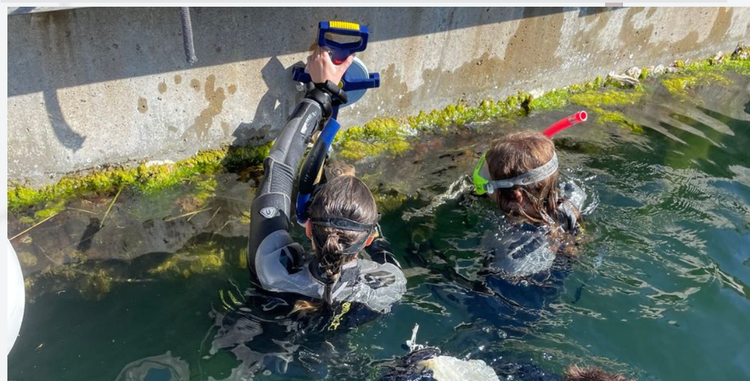
With the support of the Erasmus+ Programme of the European Union

INTRODUCTION

- **Rich biodiversity in coastal waters**
- **Increase of coastal population**
- **Increase of anthropogenic stressors on the environment**
- **Ex: implementation of artificial infrastructures**
- **Reef effect (positive or negative)**

Q: Are artificial infrastructures implemented in coastal waters affecting the benthic biodiversity of an area?





PROJECT AREA

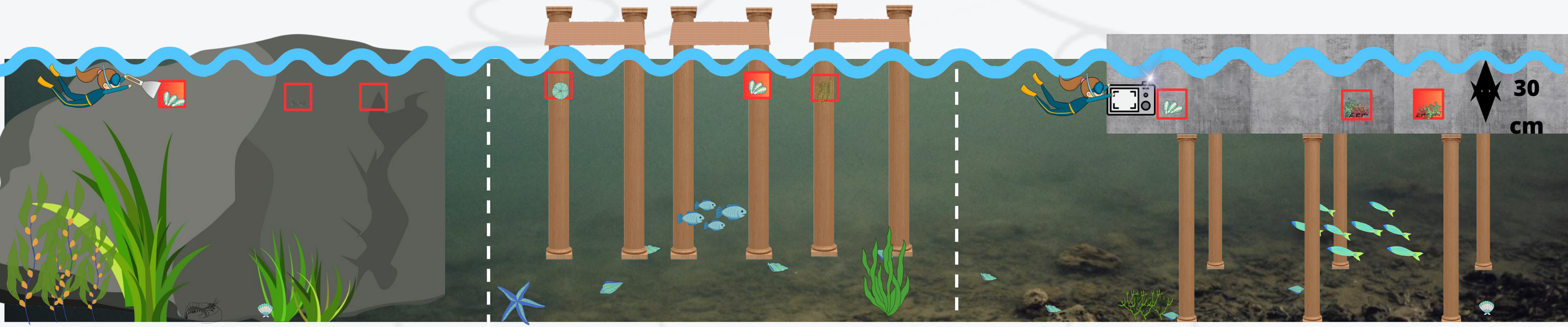
Study of the benthic species located on artificial and natural substrates

Legend

- **Artificial substrate:**
  - **W = Wooden docks (3)**
  - **C = Concrete piers (3)**
- **Natural substrate:**
  - **R = Rocky cliffs (3)**

SAMPLE DESIGN

Rock **Wood** **Concrete**



- **3 substrate types**
- **3 sites for each substrate type (9 total)**
- **3 replicates per site (27 total)**

***Approach to the work done**

Types of quadrats:

Photographed quadrats

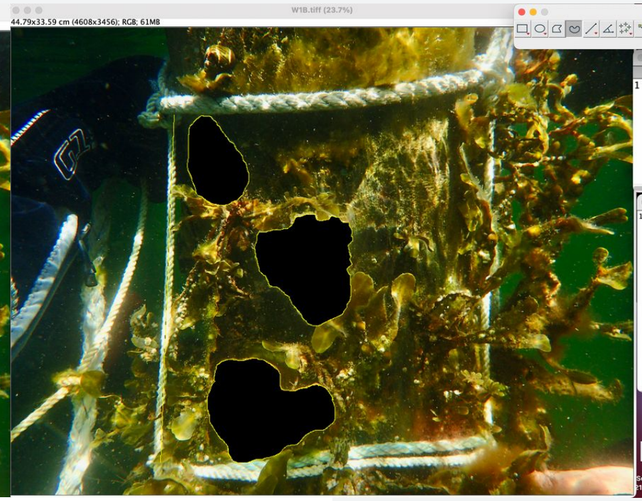
Scraped and photographed quadrats

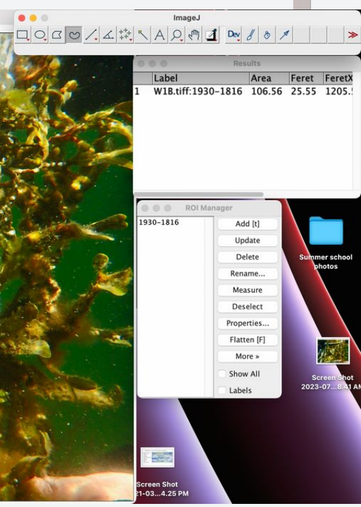
SAMPLE PROCESSING

Scraping

>1cm

Photo ID

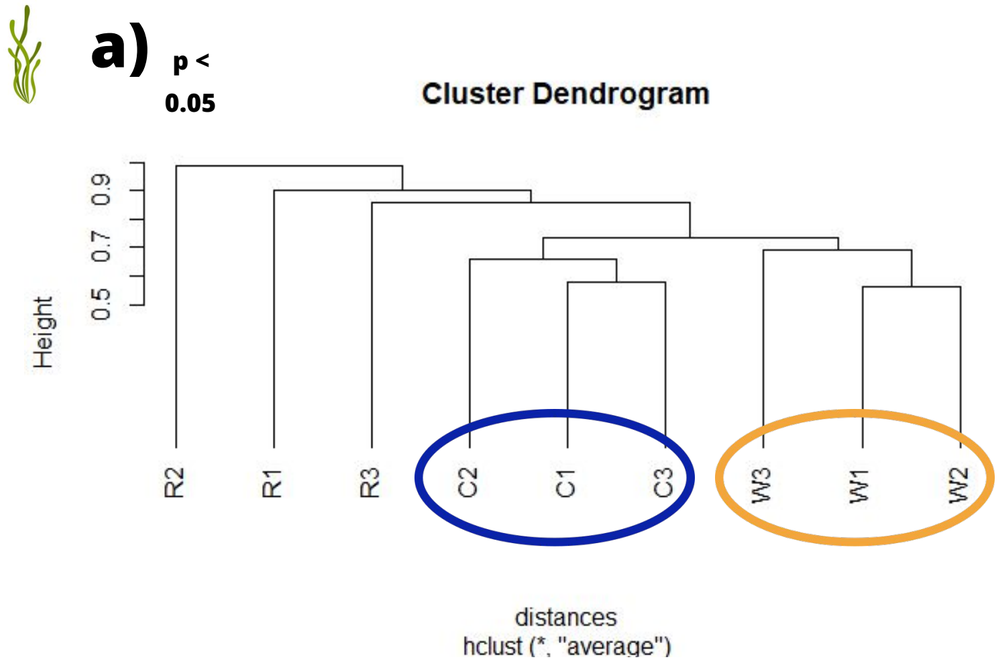




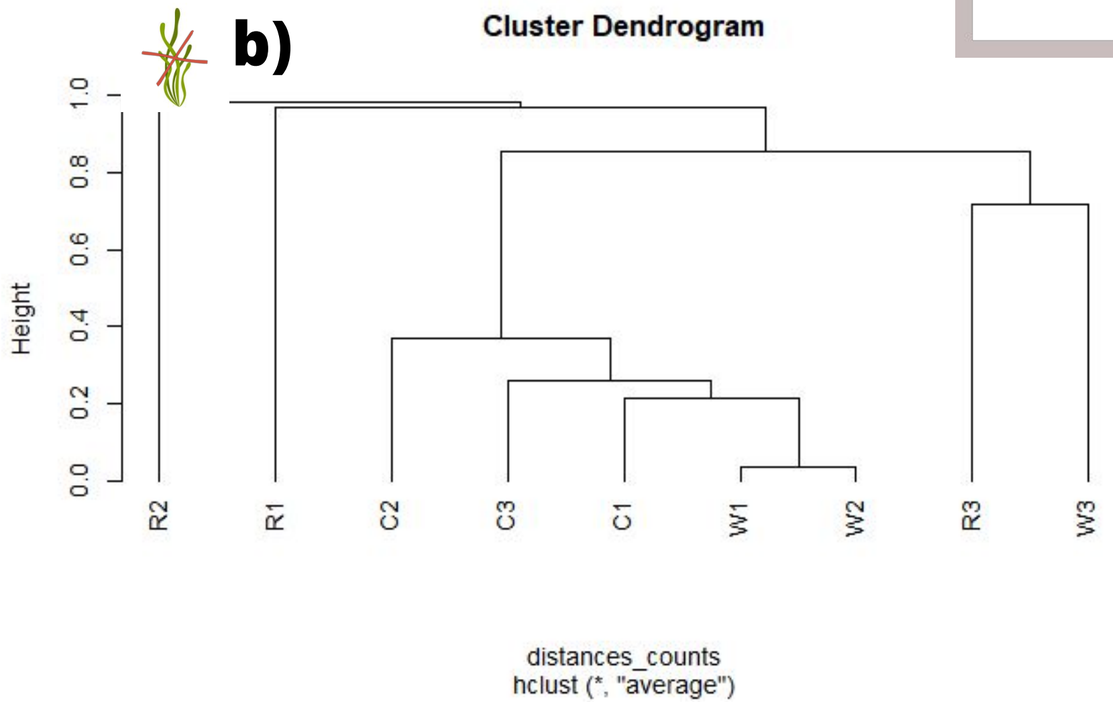
ImageJ

Image Processing and Analysis in Java

RESULTS. Scraping (Occurrence vs. counts)



a) Figure D1. Dendrogram based on the Jaccard index for the species occurrence data obtained from scraping 9 quadrats on rock (R1-R3), concrete (C1-C3), and wood (W1-W3) substrates.



b) Figure D3. Dendrogram based on the Bray-Curtis dissimilarity for the counts data obtained from scraping 9 quadrats on rock (R1-R3), concrete (C1-C3), and wood (W1-W3) substrates (macroalgae species excluded from the analysis).

RESULTS. Scraping

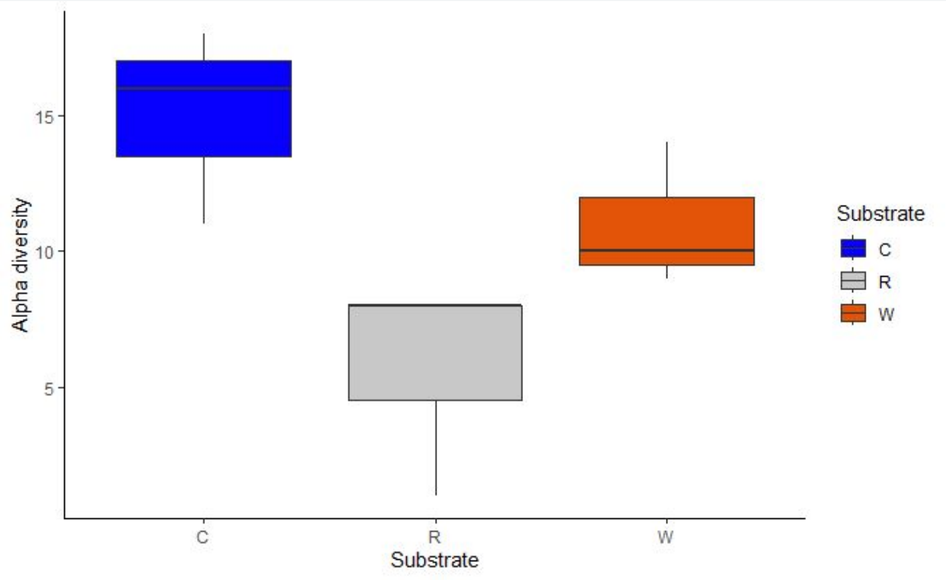


Figure D2. Box plot showing the alpha diversity depending on the type of substrate (C = concrete, R = rock, and W = wood) for the 9 scraped quadrats (3 for concrete, 3 for wood and 3 for rock). The box represents the 25th and 75th percentiles, the horizontal line represents the median, and the vertical lines show the highest and lowest values for each of the substrates.

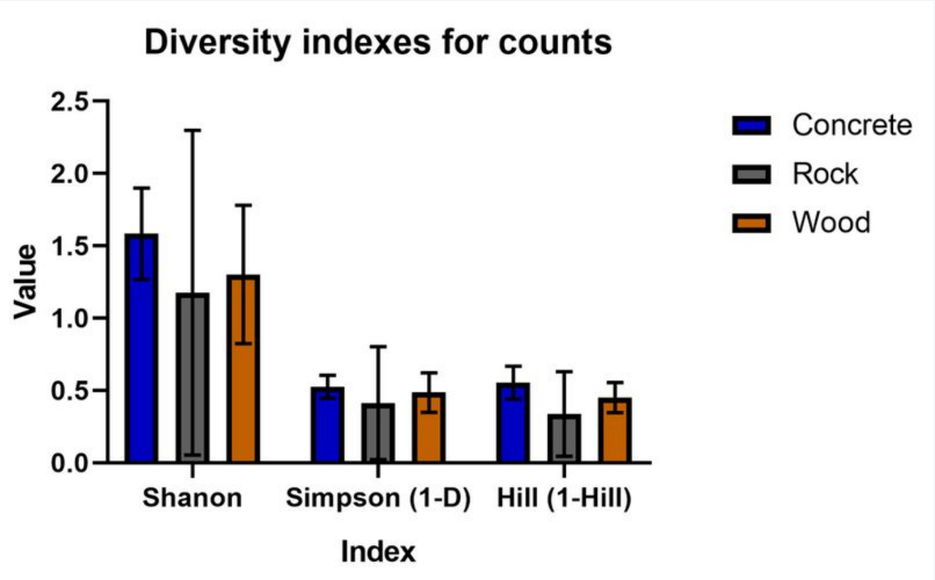
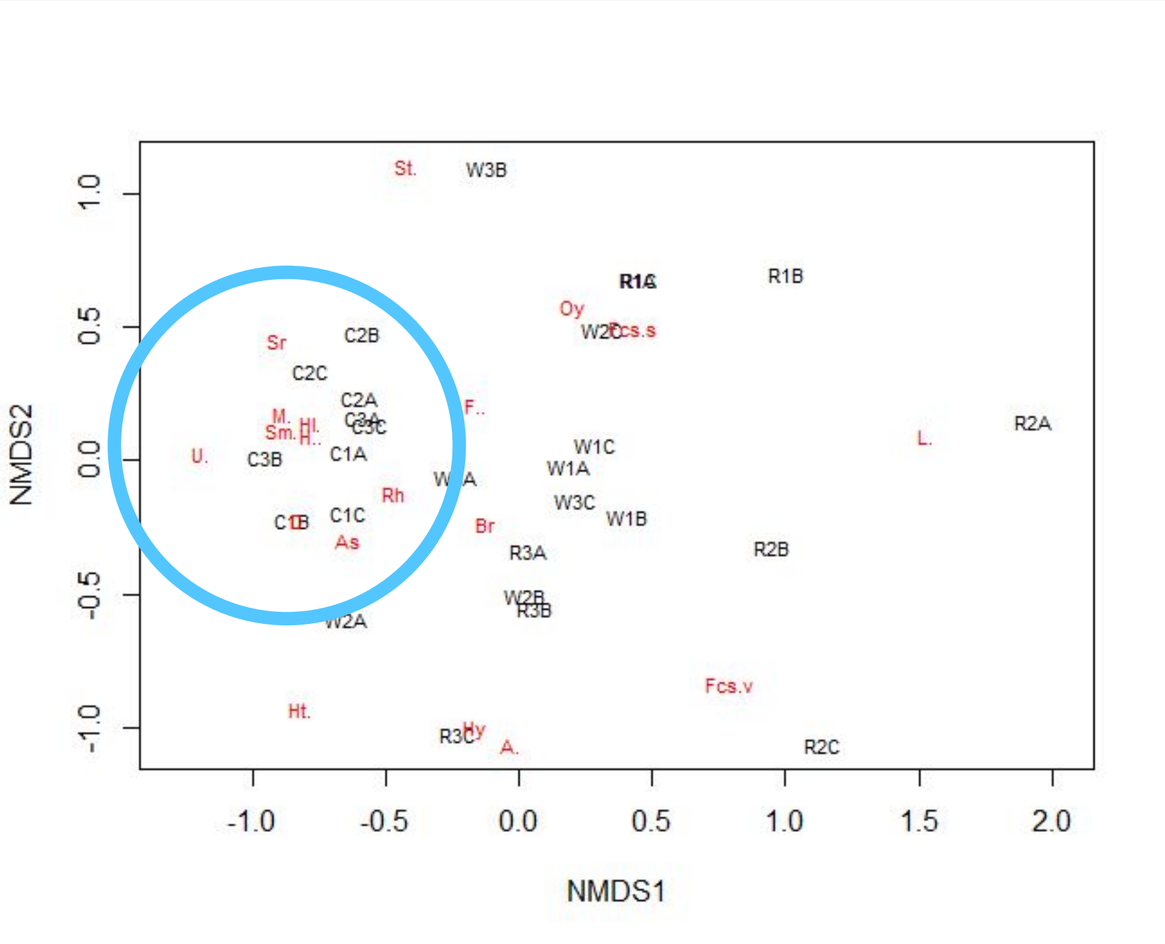


Figure D4. Bar plot of the diversity indexes for the different substrates (concrete: blue, rock: gray, and wood: brown) with the data obtained by scraping 9 quadrats. For each of the substrates and indexes, the mean and the standard deviation are shown.

Table 1. Values of the additive β-diversity between 2 types of substrates. The data was obtained from the 9 scraped quadrats: 3 for concrete, 3 for rock and 3 for wood.

	Concrete vs. Rock	Concrete vs. Wood	Rock vs. Wood
β-diversity	0.771	0.657	0.667

RESULTS. Photo-ID (Ocurrence)



NMDS plot for the counts of individuals of each species from the photo-quadrats (n = 27) placed on concrete piers (C), wooden docks (W), and rocky cliffs (R). The plot was constructed by calculating the Jaccard similarity.

α ← (F = 14.721, p = 6.73e-5)

β

- Concrete - Rock (0.778)
- Concrete - Wood (0.612)
- Rock - Wood (0.385)

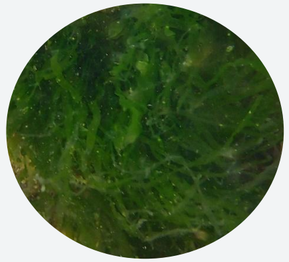
RESULTS. Photo-ID (Percent coverage)

PERMANOVA

(F = 3,4197, p = 1e-04)

→ **SIMPER**

Ulva intestinalis

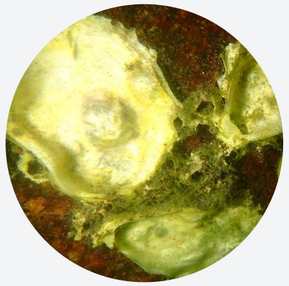


Fucus spiralis

Barnacles

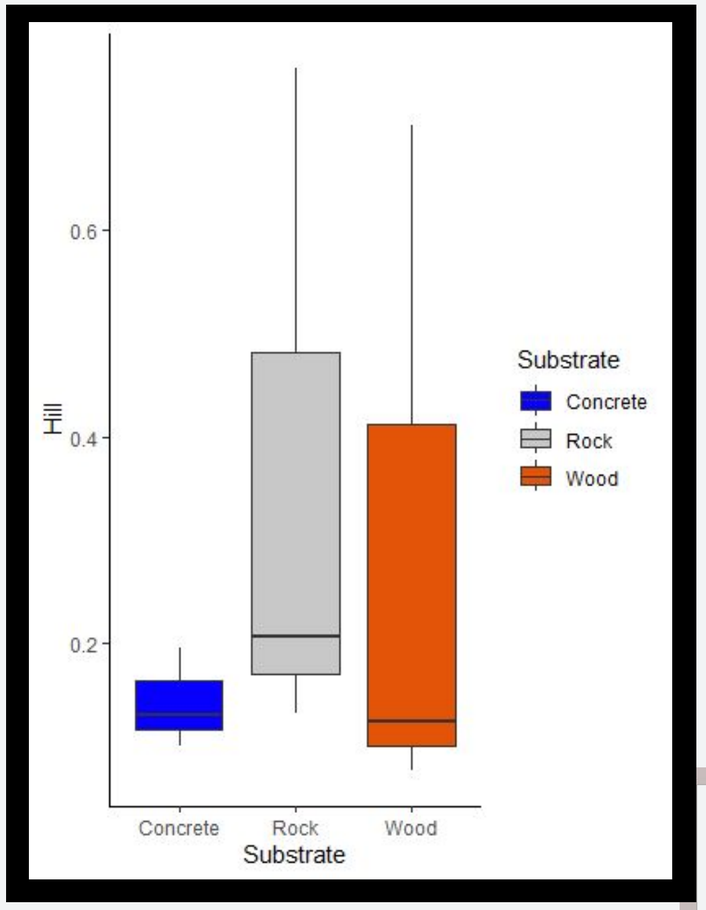
Littorina littorea

Fucus versiculosus



Oyster

Hydrozoa

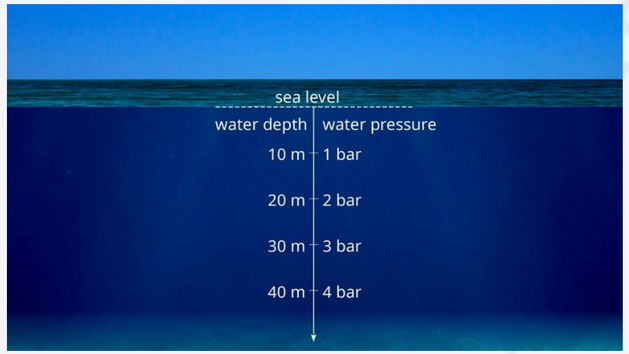


Box plots showing the Hill index depending on the type of substrate (concrete, rock or wood) from the photoID.

DISCUSSION

Factors affecting results:

Depth of the site



Concrete composition

Type of rock (granite)

Future studies and action:

Chemical and physical components of artificial substrates

↓

Promote a positive reef effect

↓

Ecosystem services

CONCLUSIONS

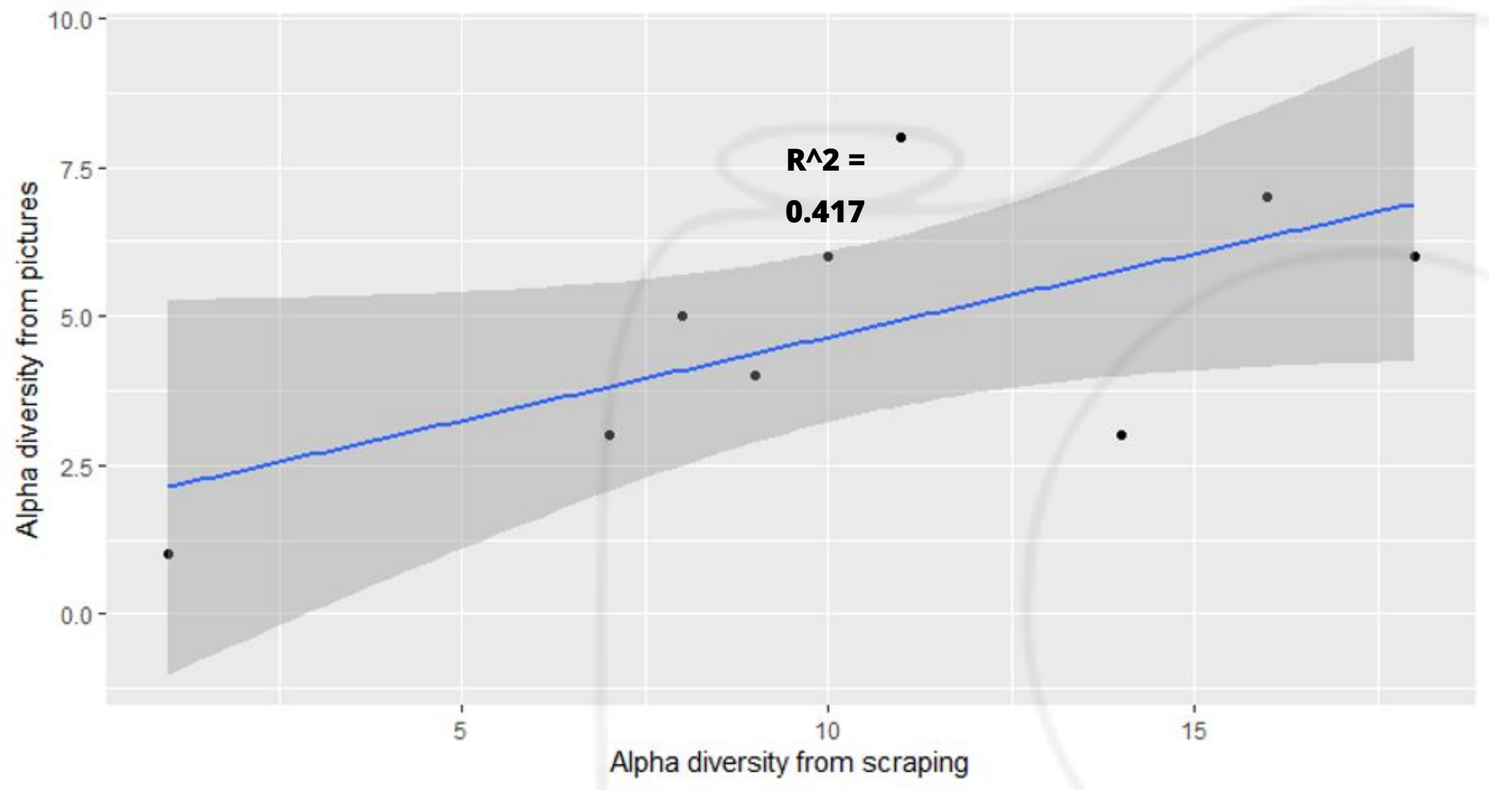


Figure D8. Correlation between the alpha diversity obtained by using photoID and the alpha diversity obtained from scraping (n = 9 quadrats). The shaded band is a pointwise 95% confidence interval on the fitted values (the line).

Significantly higher species richness from the concrete samples

Method limitations:

- **Scraping: lack of quantitative data for macroalgae**
- **Photo-ID: low resolution to ID species**

Thanks for listening!