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Inter-annual variability of the macrobenthic community in the surf zone of a sandy beach in the SW Atlantic

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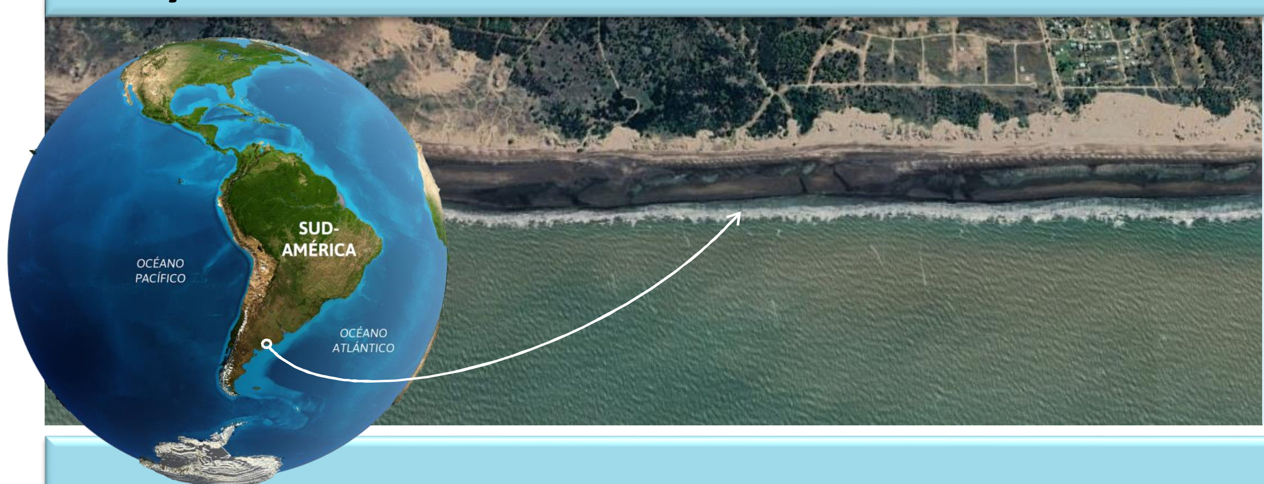
INTRODUCTION & AIM

The surf zone encompasses the region of sandy beaches where waves break alongshore. Among the diverse life forms sustaining this sublittoral ecosystems, macrobenthic invertebrates inhabiting the water/bottom layer represent a highly abundant and diverse community, playing essential roles in ecosystem functioning, such as organic matter decomposition and important links for energy circulation in marine food webs.

In this study, we integrate seasonal data from two periods, to understand the inter-annual variability in the biological descriptors of the community.

METHODS

Study area



The selected beach is located in Argentina (39°00'S, 61°57'W), in the SW Atlantic coast. It is a tide-modified intermediate beach.

Sampling

The macrobenthic community was sampled seasonally by hand-towing a benthic sledge across transects parallel to the shore. Samples (n=3) were analyzed in laboratory, and organisms were identified to the lowest taxonomic level, and counted.

We integrate seasonal data from two periods:
Period 1 (P1): 2009 – 2010: Autumn – Winter – Spring – Summer
Period 2 (P2): 2015 – 2016: Spring – Summer – Autumn – Winter

Data analysis

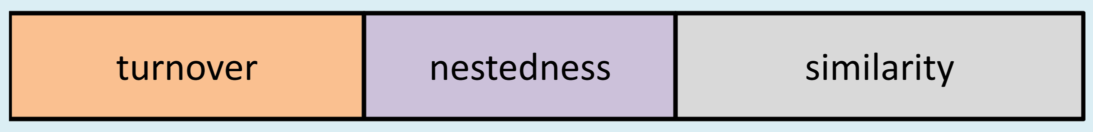
Species **richness** and **diversity** of the community was assessed using two diversity metrics (^0D & ^1D) of the Hill family (Chao et al. 2014), and compared between periods and seasons (Hsieh et al. 2016). The β-diversity was calculated on presence-absence data using the Sørensen dissimilarity measure and then partitioned into turnover and nestedness components (Baselga 2010).

Total **density**, and density of Arthropods (Decapoda and Peracarida), Mollusca (Bivalvia and Gastropoda), and other groups (Porifera, Cnidaria, Bryozoa) were calculated and compared between periods using a *glmm* model, and a *nb* distribution. For each period, density values were compared between seasons using *glm* with *nb* distributions.

RESULTS

Richness & Diversity: A total of 61 species were collected
P1: 19 species - P2: 53 species → difference between periods ($p < 0.01$)

Dissimilarity periods: 61 %
- turnover: 33 %
- nestedness: 29 %

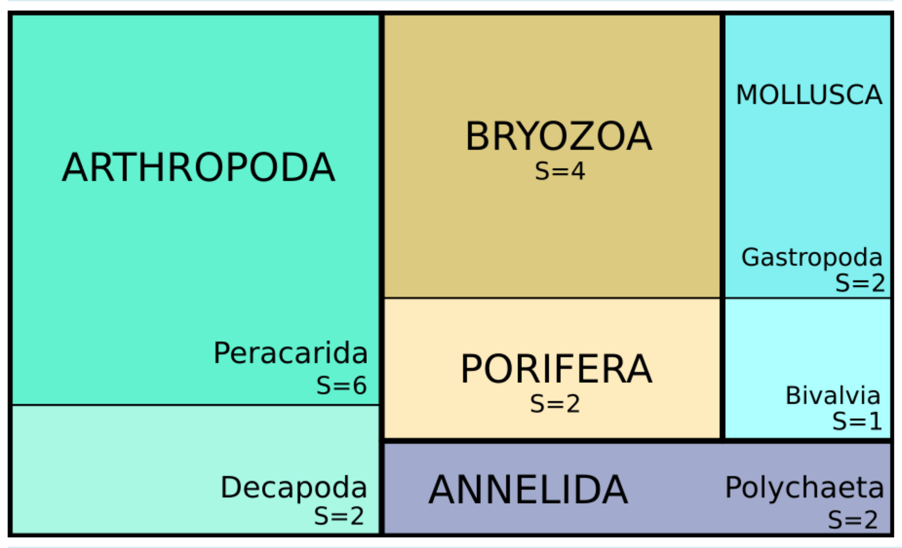


P1: 2009 - 2010

No difference in species **richness** between seasons ($p > 0.05$)

higher **diversity** in summer, lower in autumn ($p < 0.05$)

Dissimilarity seasons: 0.61%

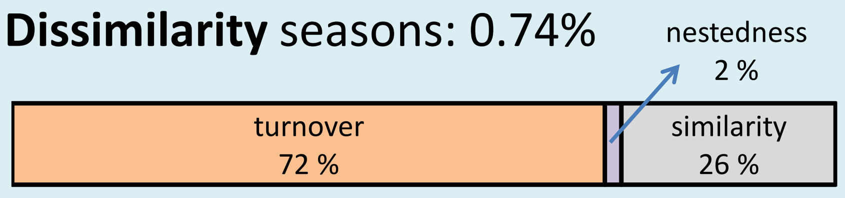


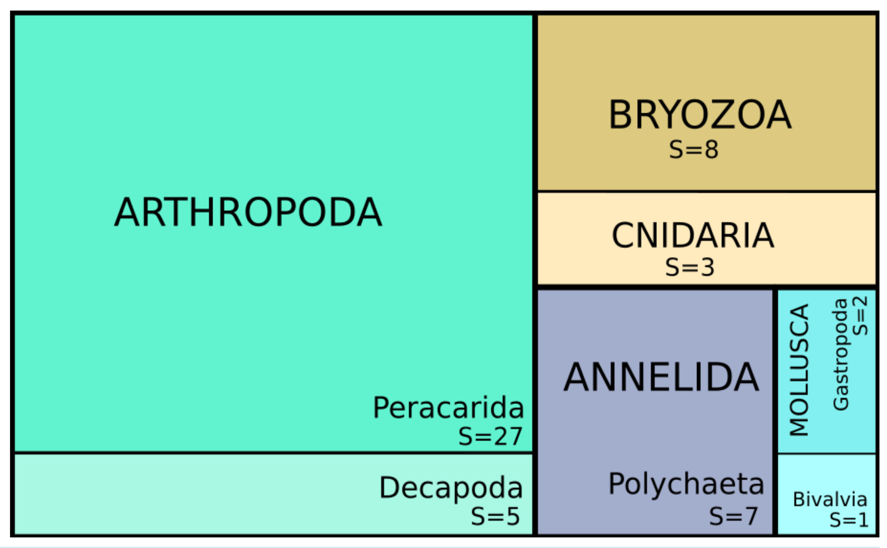
P2: 2015 - 2016

Lower species **richness** in winter ($p < 0.05$)

Lower **diversity** in winter ($p < 0.05$)

Dissimilarity seasons: 0.74%





Density: Higher in P2 (Chisq: 58.43, Df: 1, $p < 0.01$)
P1: 39.58 ± 50.36 ind/m^2 – P2: 14,514.42 ± 23,516.72 ind/m^2

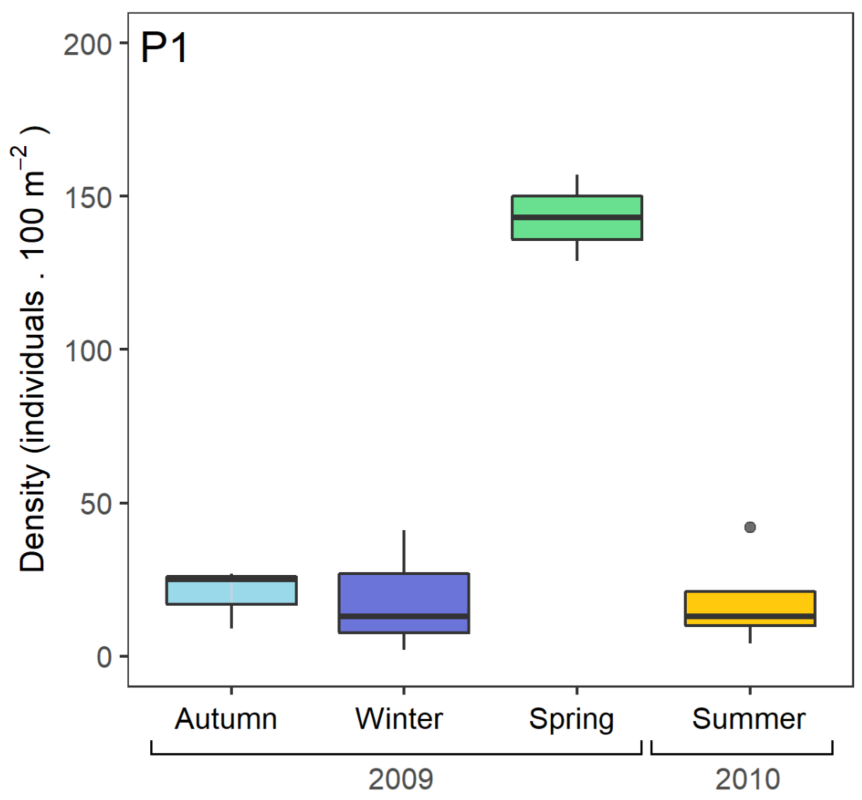
Higher density in P2 of Arthropoda (Chisq: 56.6, Df: 1, $p < 0.001$), Decapoda (Chisq: 48.2, Df: 1, $p < 0.01$) and Peracarida (Chisq: 55.4, Df: 1, $p < 0.01$)

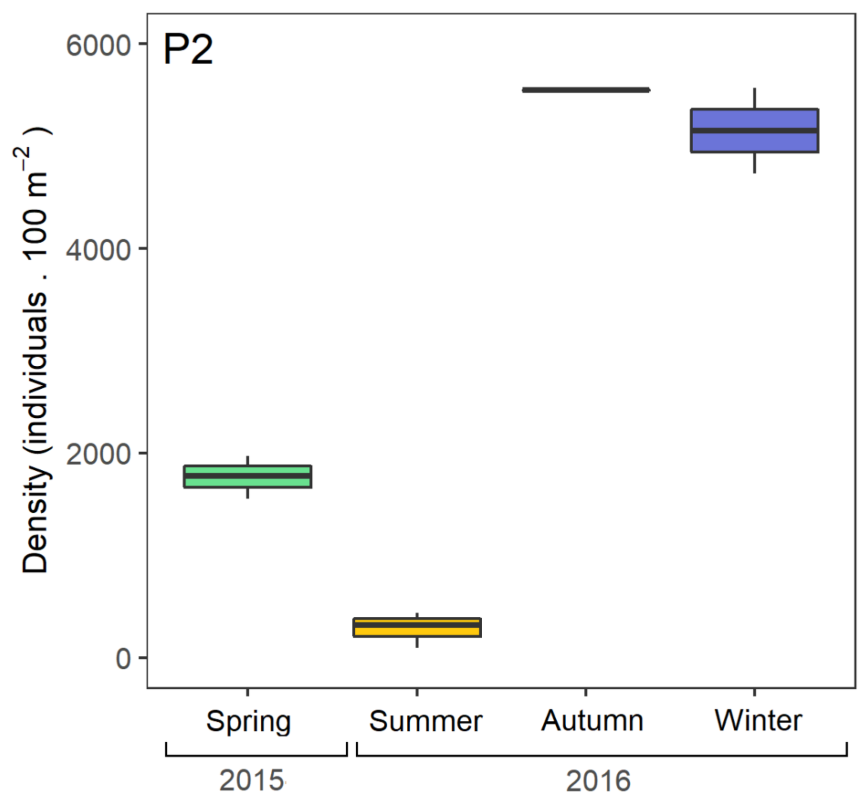
P1: 2009 - 2010

Higher **density** in spring
Total (Chisq: 18.7, Df: 3, $p < 0,01$)
Peracarida (Chisq: 18.7, Df: 3, $p < 0,01$)
- *Pseudobranchiomysis arenae* (mysid)
- *Leptoserolis bonaerensis* (isopod)

P2: 2015 - 2016

Higher **density** in autumn & winter
Total (Chisq: 67.8, Df: 3, $p < 0,01$)
Peracarida (Chisq: 68.1, Df: 3, $p < 0,01$)
- *Arthromysis magellanica* (mysid)
- *Neomysis americana* (mysid)





CONCLUSION

- A high inter-annual variability was found between periods based on a high replacement of species, and a lower richness in P1 (nested within P2).
- In both periods, lower diversities were found in autumn-winter, and a high replacement of species between seasons.
- The higher density found in P2 were mainly due to dense patches of two mysids, registered during the cold season (autumn – winter), explained by their migratory pattern, which arrives to the surf zone only during certain physical conditions. During P1, when the presence of these species were not registered, the higher density occurred in spring, when other peracarids dominates.
- Given that the studied beach is subjected to low anthropogenic impact, the significant inter-annual variability observed in this ecosystem could be explained by its dynamic nature, emphasizing the importance of an extensive dataset to understand the physical and biological factors involved.

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