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Depth Influence on the Structure and Functioning of Benthic Communities on an Exposed Sandy Shore in the SW Atlantic

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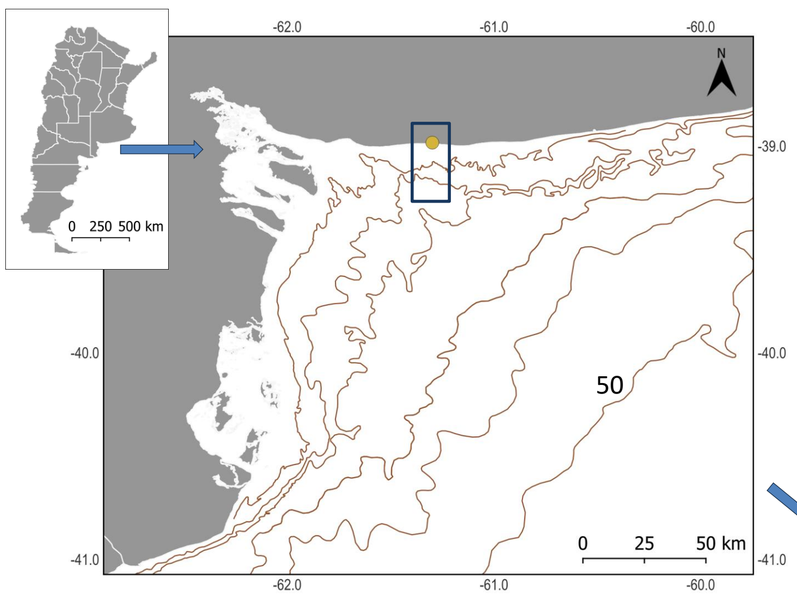
INTRODUCTION & AIM

Sandy shores are the dominant ecosystems at the land-sea interface worldwide, providing essential ecosystem functions. Benthic invertebrates are the dominant organisms of the sublittoral zones within these environments, playing essential roles in organic matter decomposition, nutrient and contaminant cycling, and food web dynamics. Studies that simultaneously explore benthic communities in both the surf zone and the adjacent nearshore zone have reported contrasting results regarding the variation of community descriptors with depth.

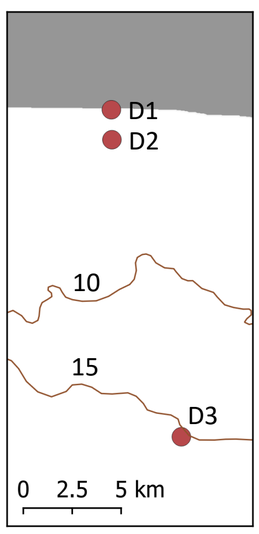
To better understand the connection between these zones and the distribution patterns of benthic invertebrates, we analyze community descriptors, along with taxonomic and biological traits, across a depth gradient on an exposed sandy shore.

METHOD



The “El Rincón” area is located on the northern Patagonian shelf of Argentina, extending approximately 200 km offshore to the 50 m isobath.

The sampled transect is situated on the northern coast, in front of a tourist beach classified as tide-modified, wave-dominated intermediate state (38°69′ S, 61°15′ W).



Biological samples were collected during spring 2018 and autumn 2019 at three depths (1m, 5m, and 15m) using a benthic sledge (500 µm mesh size), along a 22 km transect.

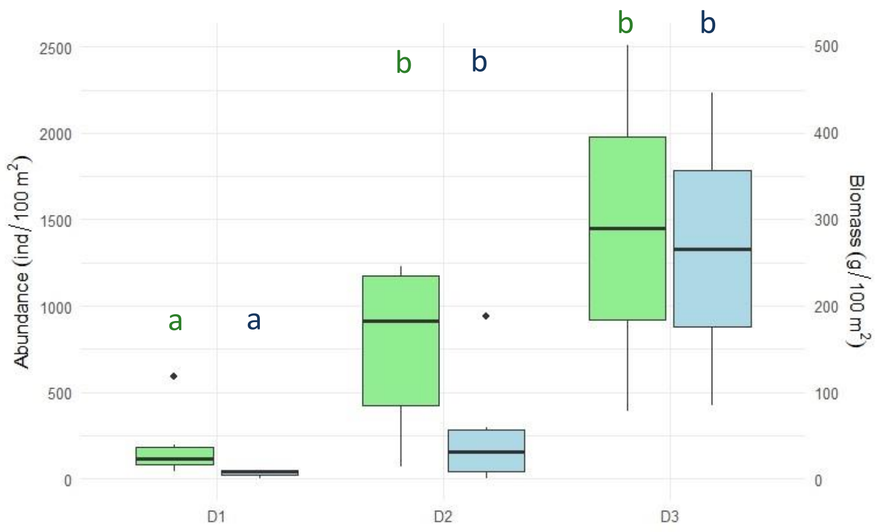
All organisms were counted, weighed, and morphologically identified to the lowest possible taxonomic level. Each species was further classified according to their biological traits: mobility, trophic level, and feeding mechanism.

Data analysis:

- Total abundances and biomass, and relative abundance of taxonomic groups and biological traits were compared between depths (GLM/GLMM).
- Richness and species diversity was evaluated using Hill diversity metrics: ^0D, ^1D, and ^2D (Chao et al. 2014; Hsieh et al. 2016).
- β-diversity indices were calculated along the depth gradient, using Sorensen dissimilarity measure (Baselga 2010).

RESULTS & DISCUSSION

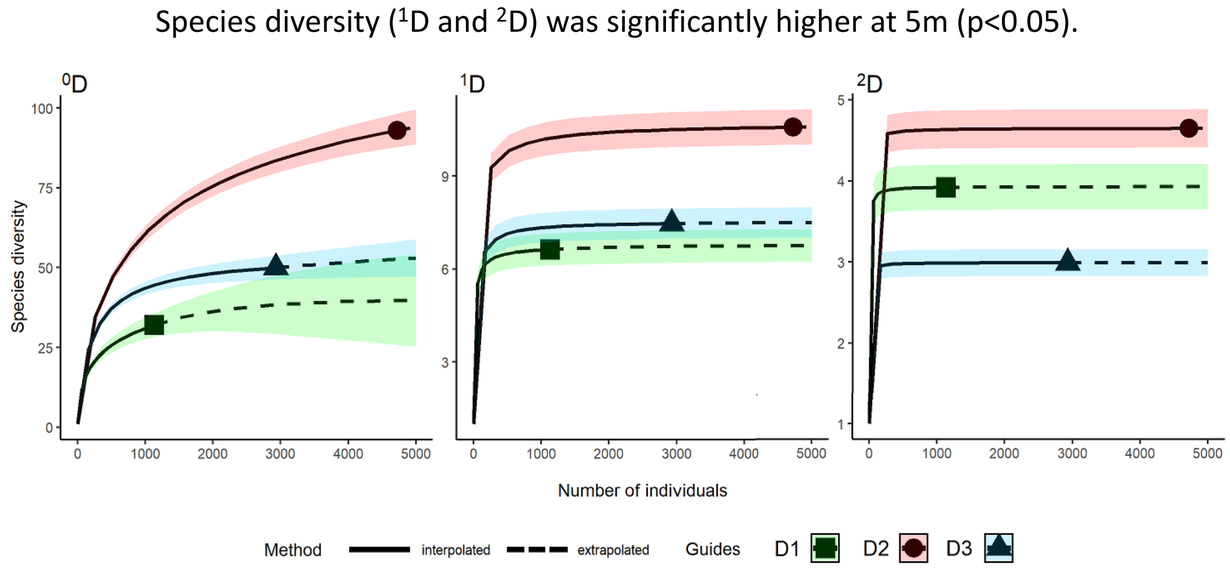
A total of 10,055 individuals from 132 taxa were identified.



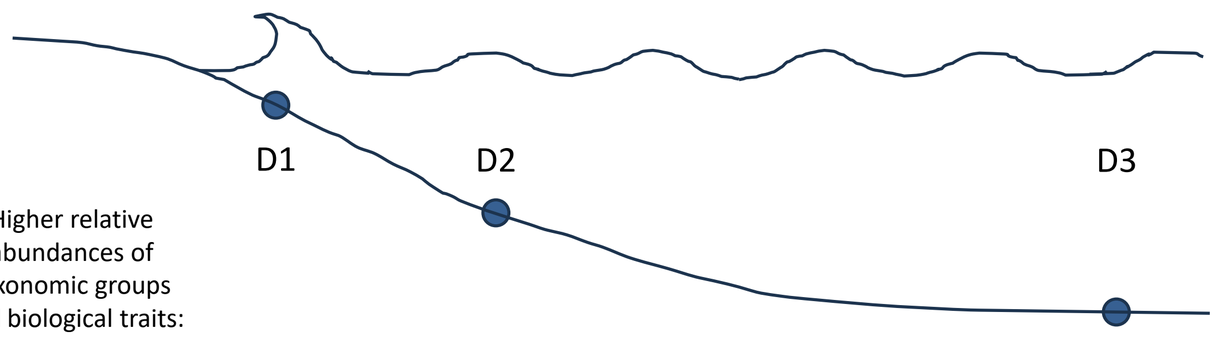
The highest abundance and biomass values were recorded at 15m and 5m depth, compared with 1m.

Different letters indicate significant differences between means ($p<0.05$).

α-diversity (^0D) was higher at 5m depth, compared with 1m and 15m.
Species diversity (^1D and ^2D) was significantly higher at 5m ($p<0.05$).



β-diversity indicated high replacement of species across the total gradient ($\beta_{SOR}=0.72$).
The turnover component was higher than the nestedness component ($\beta_{SIM}=0.55>\beta_{NES}=0.17$).



Higher relative abundances of taxonomic groups and biological traits:

Arthropods	Annelids / Mollusks	
Mobile	Sedentary	
Deposit-feeder	Filter-feeder	
Detritivore/Predator	Detritivore	Omnivore/Predator

CONCLUSION

Our analysis identified two distinct zones regarding benthic macroinvertebrate abundance and biomass. The first zone corresponds to site D1, located at shallow depths near 1 m, while the second encompasses sites D2 and D3, situated at depths ranging from 5 to 15 m. The benthic community transitions markedly from an area characterized by constant wave action and continuously shifting sands (the surf zone) to one with gentler surges and relatively stable sediments (the nearshore zone). These two faunal sub-communities differ primarily in their hydrodynamic conditions, but also in their species composition, with some taxa being exclusive to each zone, while others are shared between them.
At D1, the lowest abundance, biomass, and diversity suggested that fewer species are adapted to this area, where increased mobility is advantageous to cope with the turbulence of wave action (e.g., arthropod species). At D2 and D3, where environmental conditions are more stable, sedentary and filter-feeding species, such as some annelids and mollusks, prevail. The higher richness and diversity found at D2 can be attributed to the presence of hard substrates interspersed within the soft sandy sediment, creating spatial heterogeneity. This structural complexity at D2 likely enhances local diversity by providing a variety of microhabitats for different species.

REFERENCES

Baselga A (2010) Partitioning the turnover and nestedness components of beta diversity. Global Ecol Biogeogr 19(1):134–143

Chao A, Gotelli NJ, Hsieh TC, Sander EL, Ma KH, Colwell RK, Ellison AM (2014) Rarefaction and extrapolation with Hill numbers: a framework for sampling and estimation in species diversity studies. Ecol Monogr 84(1):45–67

Hsieh TC, Ma KH, Chao A (2016) iNEXT: an R package for rarefaction and extrapolation of species diversity (Hill numbers). Methods Ecol Evol 7(12):1451–1456