High-resolution description of insular and fjordic benthic food webs along the West Antarctic Peninsula

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Background & Objectives

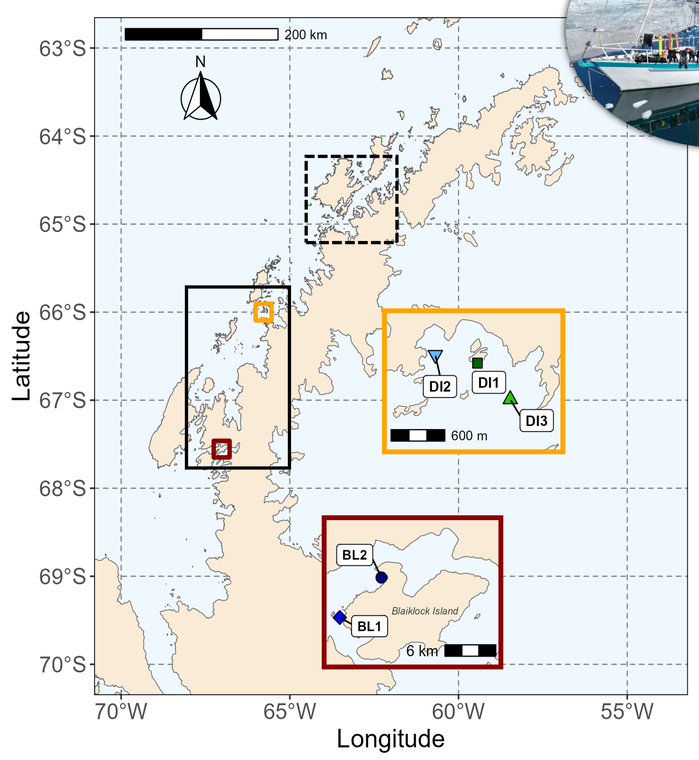
The **West Antarctic Peninsula (WAP)** is experiencing rapid warming, with predicted impact on marine benthic ecosystems[1]. In shallow WAP waters, **macroalgae forests (MF)** and **soft sedimentary bottoms (SSB)** dominate, supporting **"green" and "brown" food webs** respectively[2,3]. **Climate change** is expected to disrupt the equilibrium between these ecosystems, favoring for example the expansion of macroalgae forests into areas previously dominated by sea ice[4]. In this context, the aims of this this project are twofold:

1. **Identify trophic differences between MF and SSB in WAP.**
2. **Explore how changing environmental conditions along the WAP affect "green" and "brown" food webs.**

Invertebrate benthic communities were **sampled from five locations** with varying environmental conditions along the WAP during the **TANGO 2023** (n-stations = 5) **& TANGO 2024** (n-stations = 6) **expeditions**.

Study Area

*Fig.1:Picture of the **RV Australis**, a highly mobile research vessel with a low environmental impact.*



TANGO 2023 stations

2 Macroalgae Forests (**DI1 & DI3**)

3 Soft Sedimentary Bottoms (**DI2**, **BL1 & BL2**)

*Fig.2: Map of TANGO 2023 sampling stations in **Dodman Island (DI)** & **Blaiklock Island (BL)**, WAP, along with TANGO 2024 sampling region (dashed square).*

Sampling Design & Processing

Quantitative sampling of communities:

- ***Transects*** *(10m)* & ***quadrates*** (0.16m²)

Onboard processing:

- ***Wet weight biomass*** measurement
- Dissection and storage (60°C/24H dried)

Stable Isotopes Analysis:

- Grinding & encapsulation of samples (total-n = 507, max n-replicates = 6)
- ***IRMS*** analysis of ***C & N ratios***
- Trophic niche modelling (**SIBER**)

*Fig.3: **Transects** (top) and **quadrates** (bottom) used to collect benthic invertebrates and primary producers.*

Communities Characteristics

Diversity (n consumer morphospecies)

DI1	DI2	DI3	BL1	BL2
15	16	27	24	20

Low number of morphospecies (4/54) ***common*** to all stations

Dominance of :
- **Filter feeders** & **grazers** in **DI**
- **Deposit feeders** & **scavengers** in **BL**

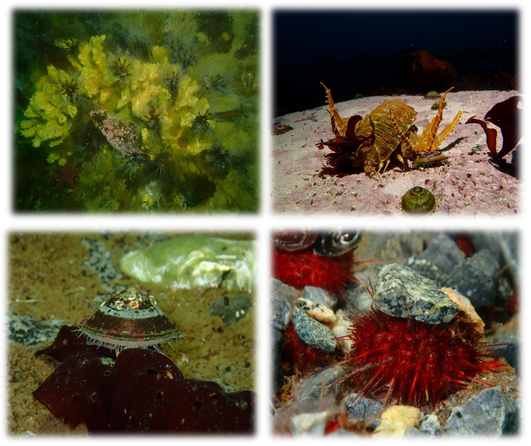


*Fig.4: Organisms sampled (left to right / top to bottom)**:** Dendrilla antarctica, Glyptonotus antarcticus, Nacella concinna, Sterechinus neumayeri.*

Core & Full Trophic Diversity

*Fig.5: Standard ellipses drawn using SIBER for the five benthic consumer communities; each of them encompasses 40% of the data points from the respective community: **DI1** = ■ | **DI2** = ✳ | **DI3** = ▲ | **BL1** = ◆ | **BL2** = ●*

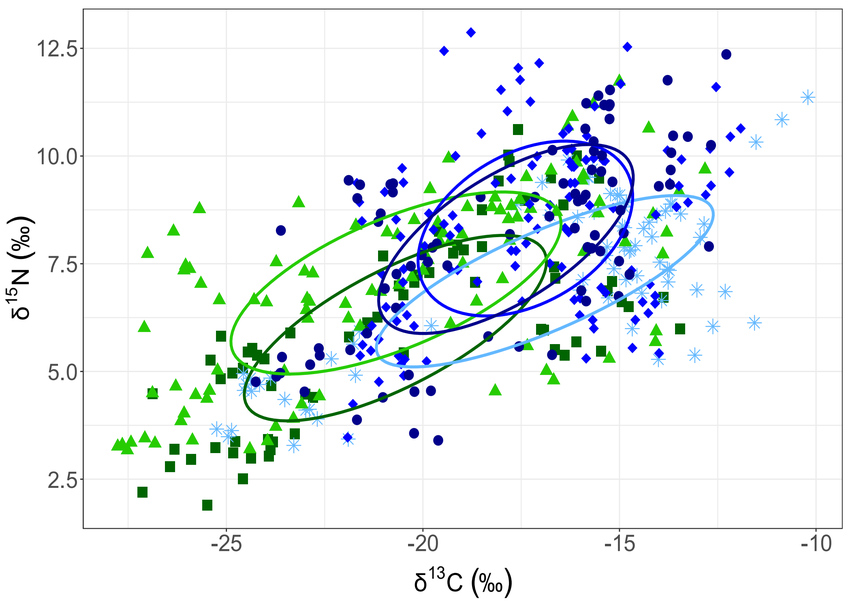
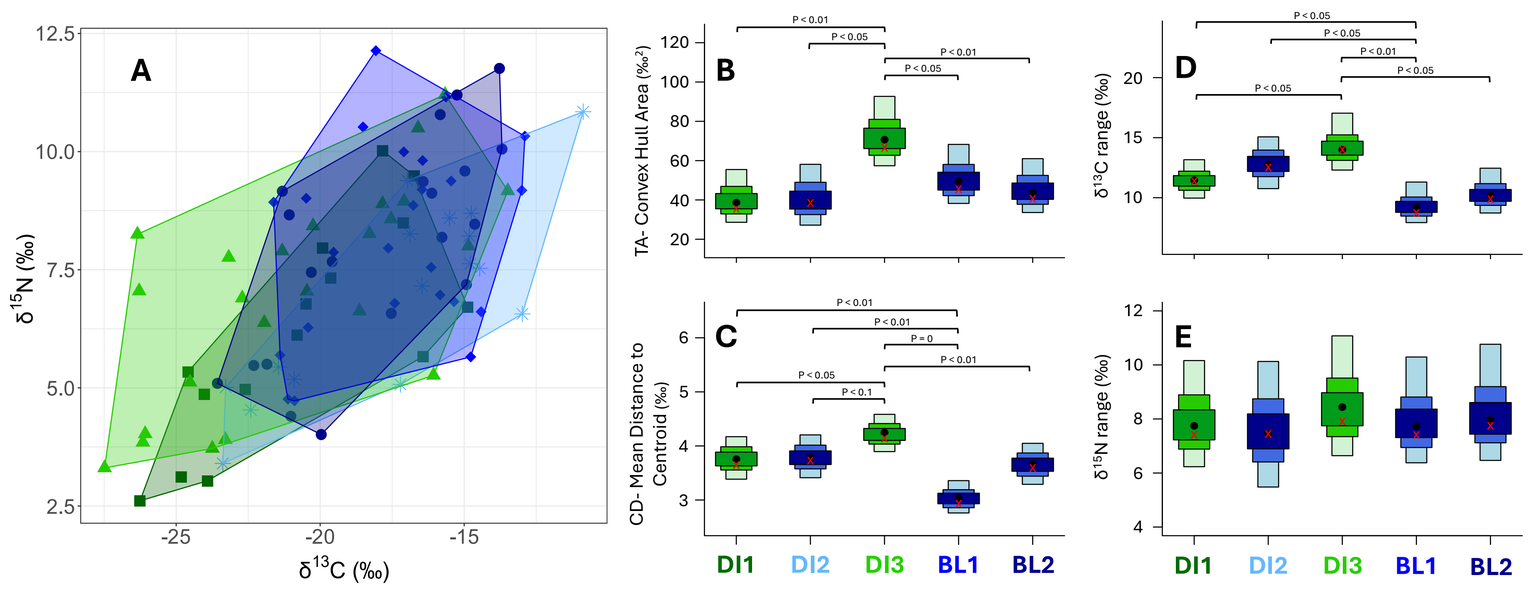


*Fig.6: **(A)** Convex hulls encompassing all mean δ¹³C and δ¹⁵N values of the morphospecies present in each of the five benthic consumer communities: **DI1** = ■ | **DI2** = ✳ | **DI3** = ▲ | **BL1** = ◆ | **BL2** = ● **(B-E)** Density plots of credible intervals from the Bayesian Estimates for four of the Layman Metrics (TA, CD, CR & NR) corresponding to the five benthic consumer communities; modes of the estimates are represented as black dots while the Maximum Likelihood Estimates are represented as red crosses, zones of the density plots correspond to the 50, 75 and 95% credibility intervals for each metric.*



Shift of **consumer** standard ellipses towards **less negative δ¹³C** values in **soft sedimentary bottoms**

No significant differences in SEAb between stations…

Larger Total Convex Hull Area (TA) and **δ¹³C range** in **DI3** macroalgae forest

No significant difference in δ¹⁵N range across stations

Higher Mean Distance to Centroid (CD) in **DI3** macroalgae forest ***VS*** **lower CD** in **BL1** soft sedimentary bottom

Conclusion & Perspectives

Standard ellipses positions point towards a **higher importance of high-δ¹³C basal resources** (e.g. **sympagic algae**) for **soft bottom consumer communities** compared to macroalgae forests communities

In stations **<u>with comparable species diversity</u>**, **TA and CD suggest a higher trophic diversity among macroalgae forest consumers** than in soft bottoms, driven by some species occupying more extreme positions in the isospace…

BUT ! What about the potential influence of latitudinal changes in environmental conditions on communities?

To **distinguish the effect of habitat VS latitude on WAP benthic food webs**, more macroalgal forests and soft sediment communities are needed along the peninsula ⇨ TANGO 2024 samples are on the way!

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- ✓ ***Pictures*** *- ©TANGO Expedition 2023, CC BY 4.0*
- ✓ ***Samples processing -*** *Davide Cadonici*

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