

Frozen meals

What's on the menu for Antarctic benthic feeders?



Anthony Voisin^{1;2}

Martin Dogniez, Gilles Lepoint, Loïc N. Michel,
Julien Thébault and Gauthier Schaal



COLLEGE SCIENCES
DOCTORAL DE LA MER
BRETAGNE ET DU LITTORAL

 **LEMAR**
laboratoire des sciences
de l'environnement marin
UBO | CNRS | IRD | Ifremer

 **LIÈGE**
université

¹Laboratory of Environmental Marine Sciences, UBO, France
²Laboratory of Trophic and Isotope Ecology, ULiege, Belgium

Context

 West Antarctic Peninsula (WAP)



TANGO



Estimating Tipping points in habitability of ANtarctic benthic ecOsystems under future GIObal climate change scenarios

BRAIN-be 2.0

Belgian Research Action through Interdisciplinary Networks

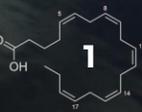


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BE-Polar conference

September 11th, 2025



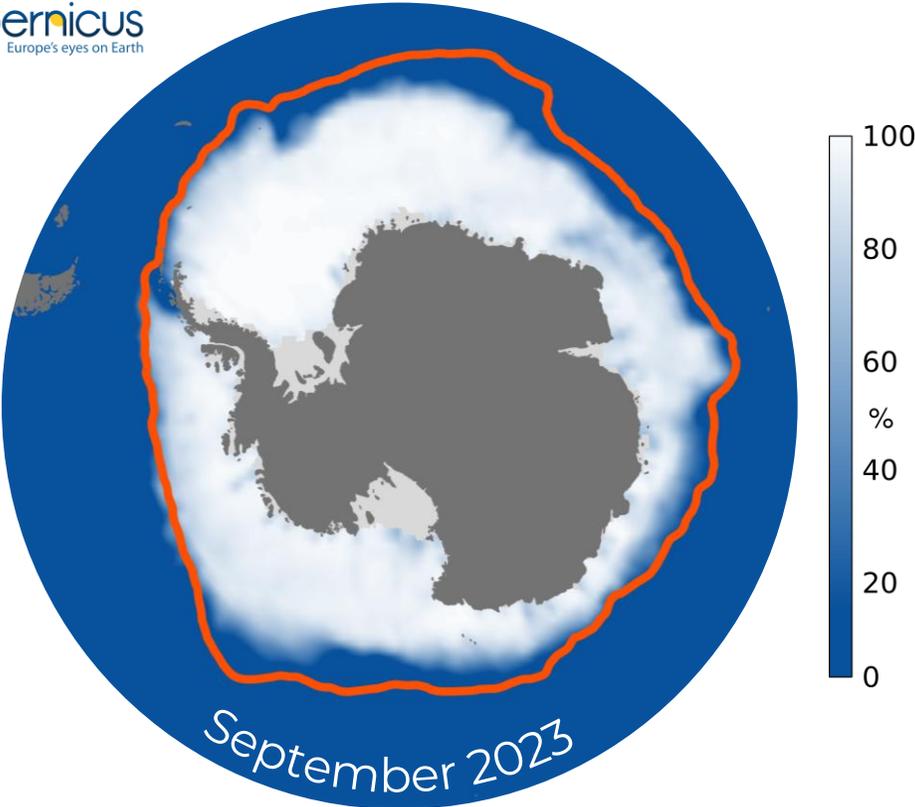
Context



West Antarctic Peninsula (WAP)



Steep environmental changes

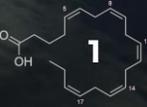


September 2023

Austral winter

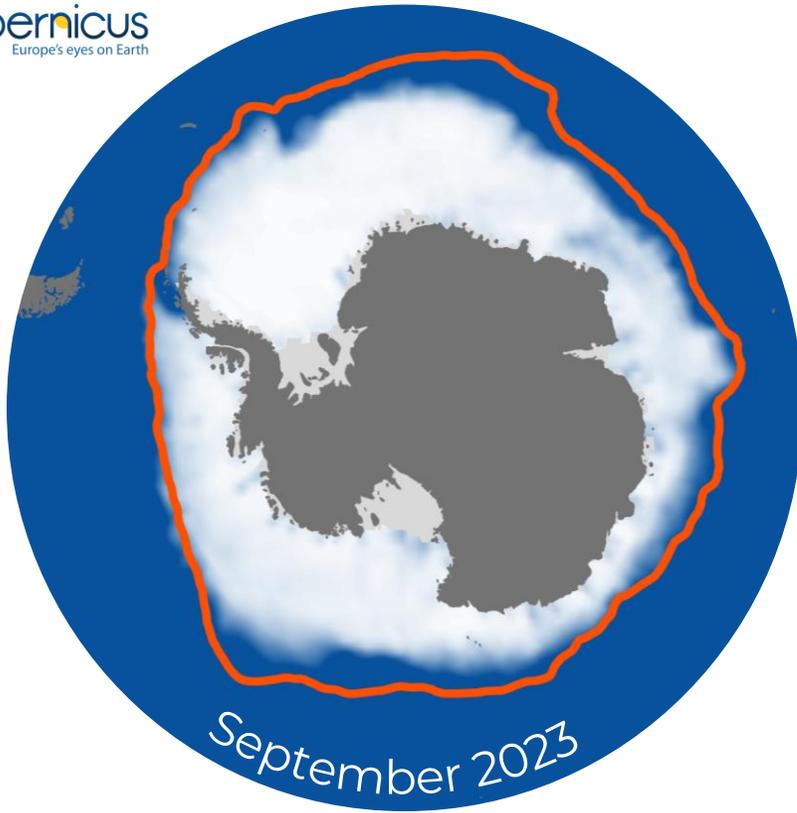


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Context

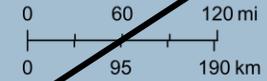
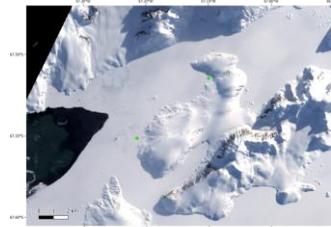
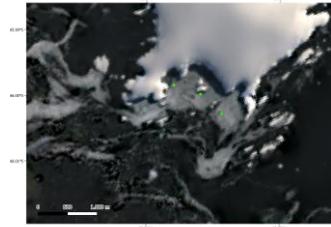
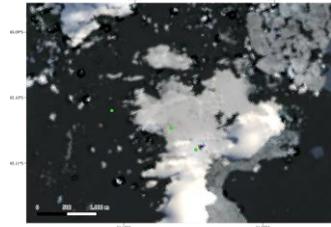
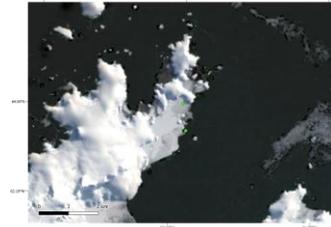
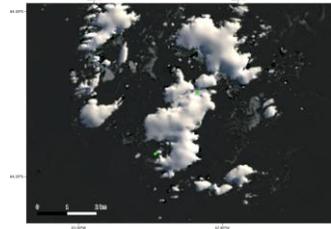
- 🌐 West Antarctic Peninsula (WAP)
- ➡ Steep environmental changes
- ➡ Small-scale particularities



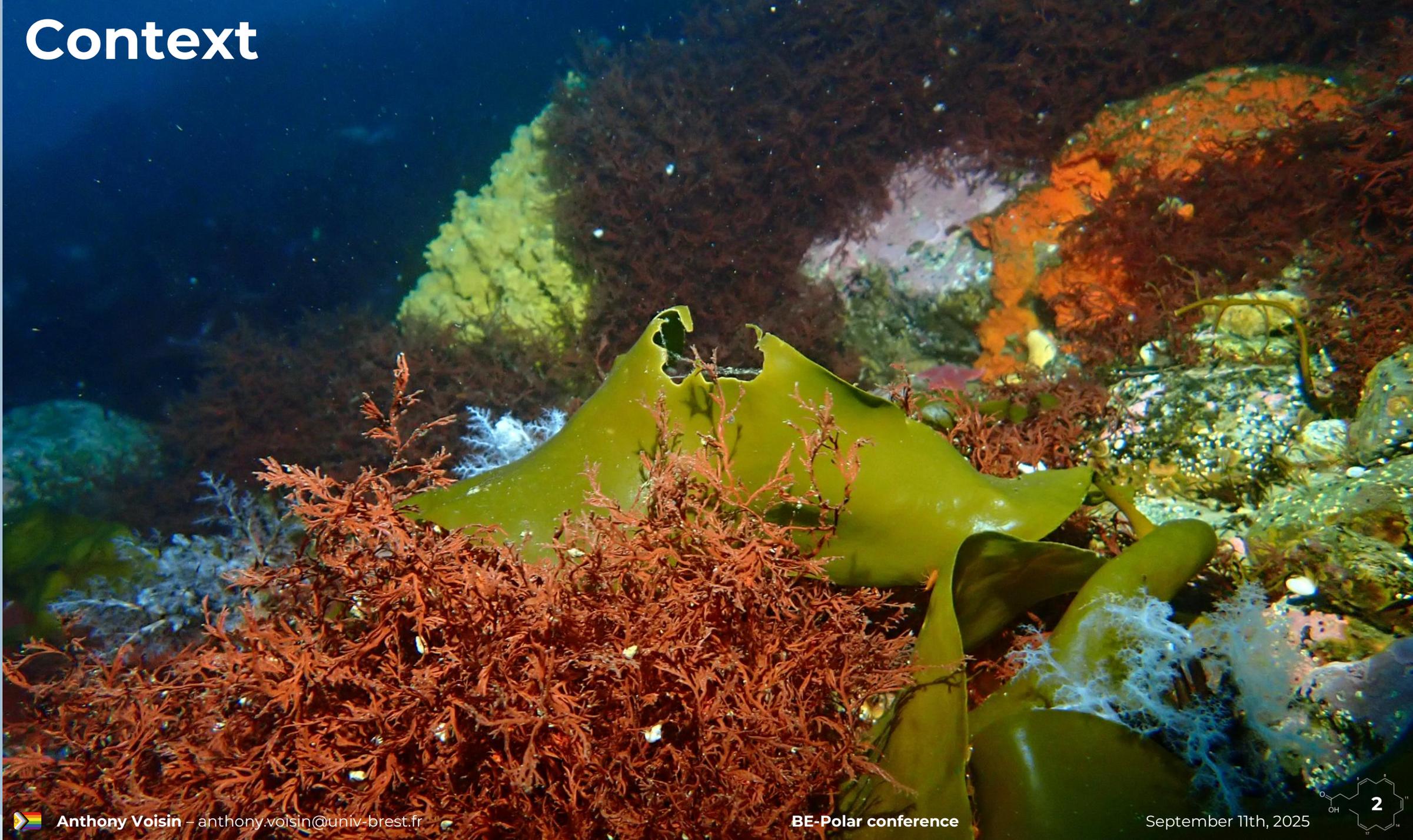
September 2023

Austral winter

Satellite view – ©Axelle Brusselman



Context

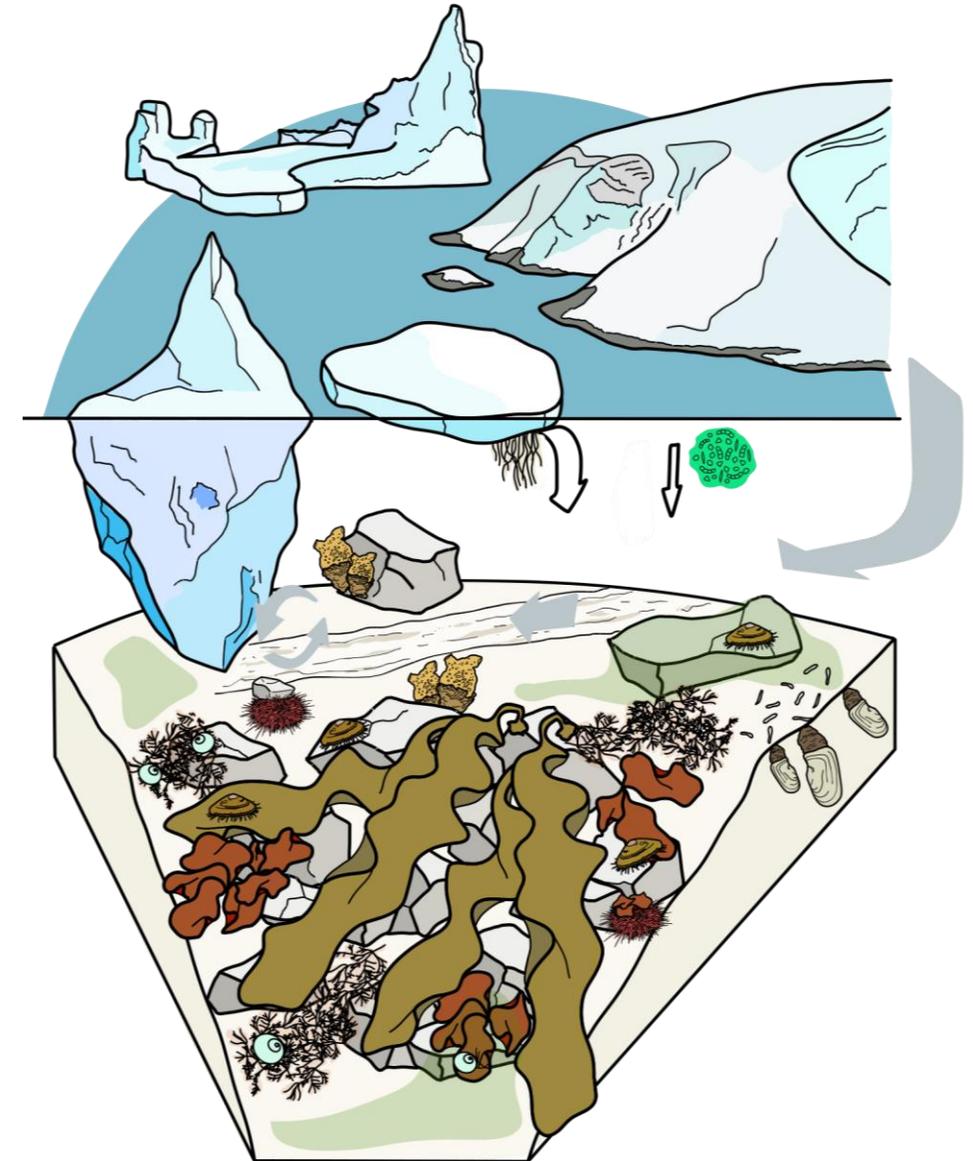


Context

🌐 High environmental variability

- ➔ Ice disturbances
(i.e., glacier calving, iceberg scouring, nutrient input)
- ➔ Food sources availability

WEST ANTARCTIC PENINSULA



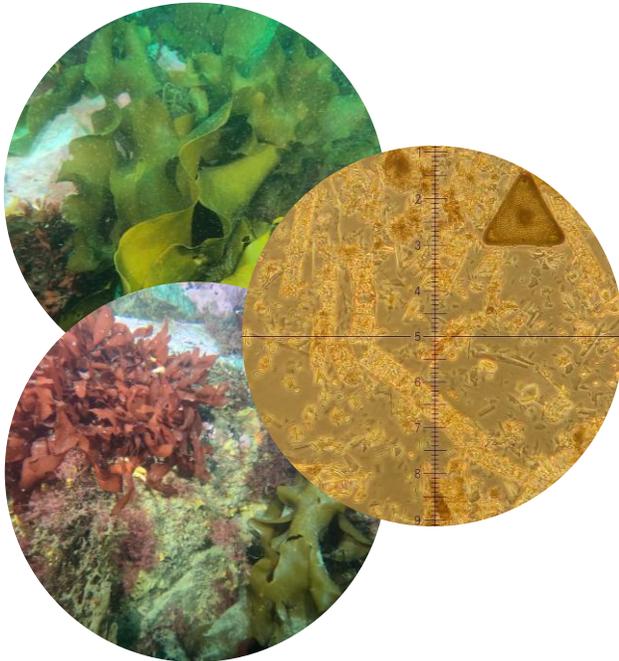
(Ha et al., 2019; Meredith et al., 2019; Ko et al., 2023; Griffith et al., 2024)

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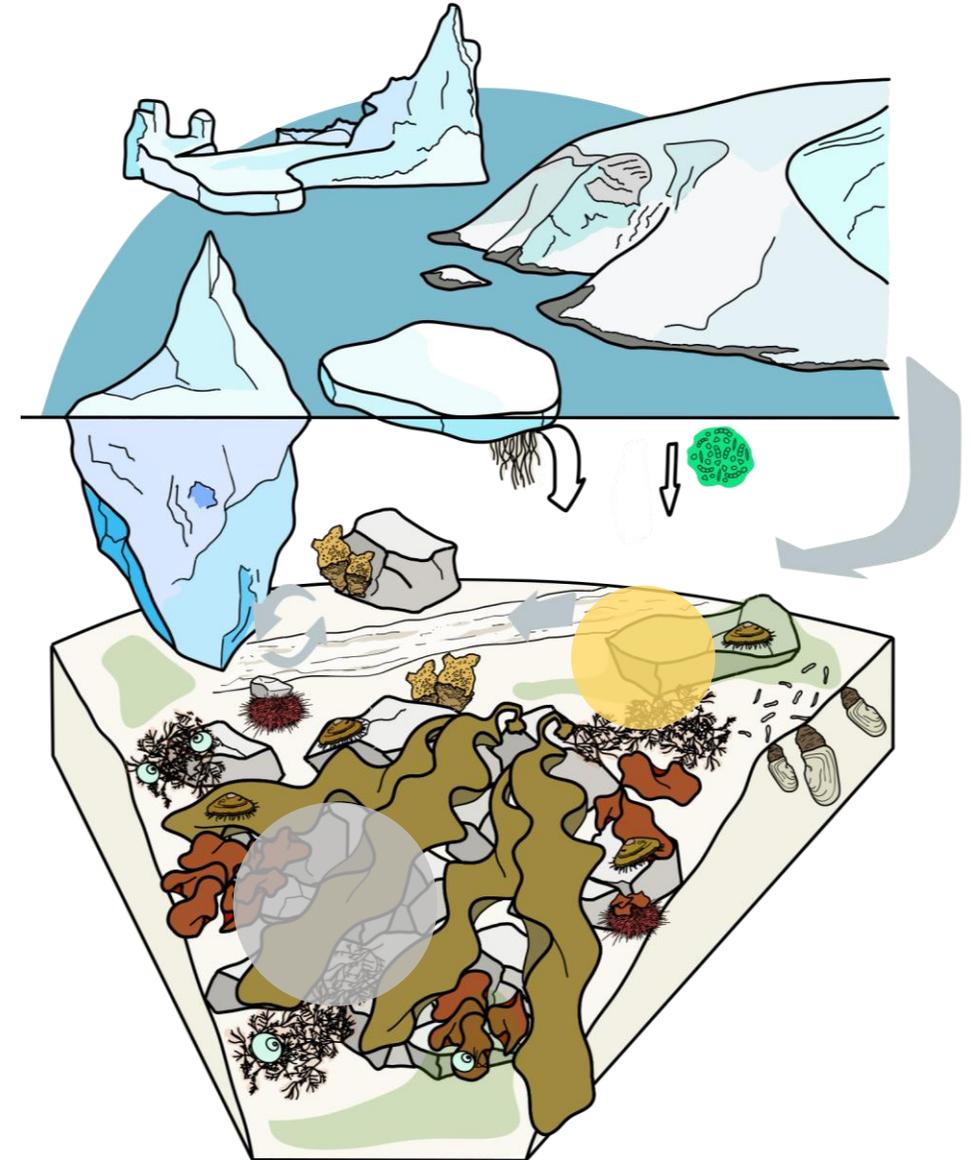
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BENTHIC



WEST ANTARCTIC PENINSULA



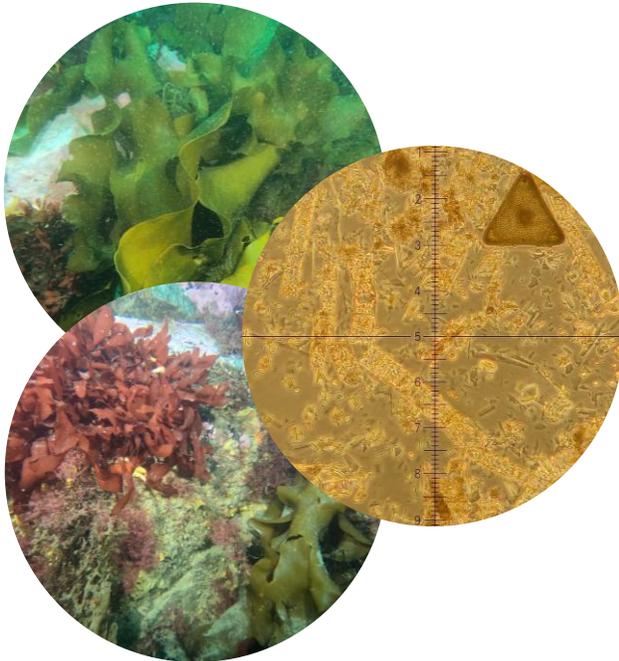
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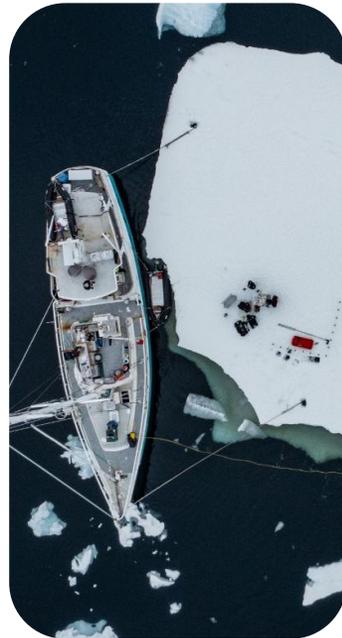
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BENTHIC



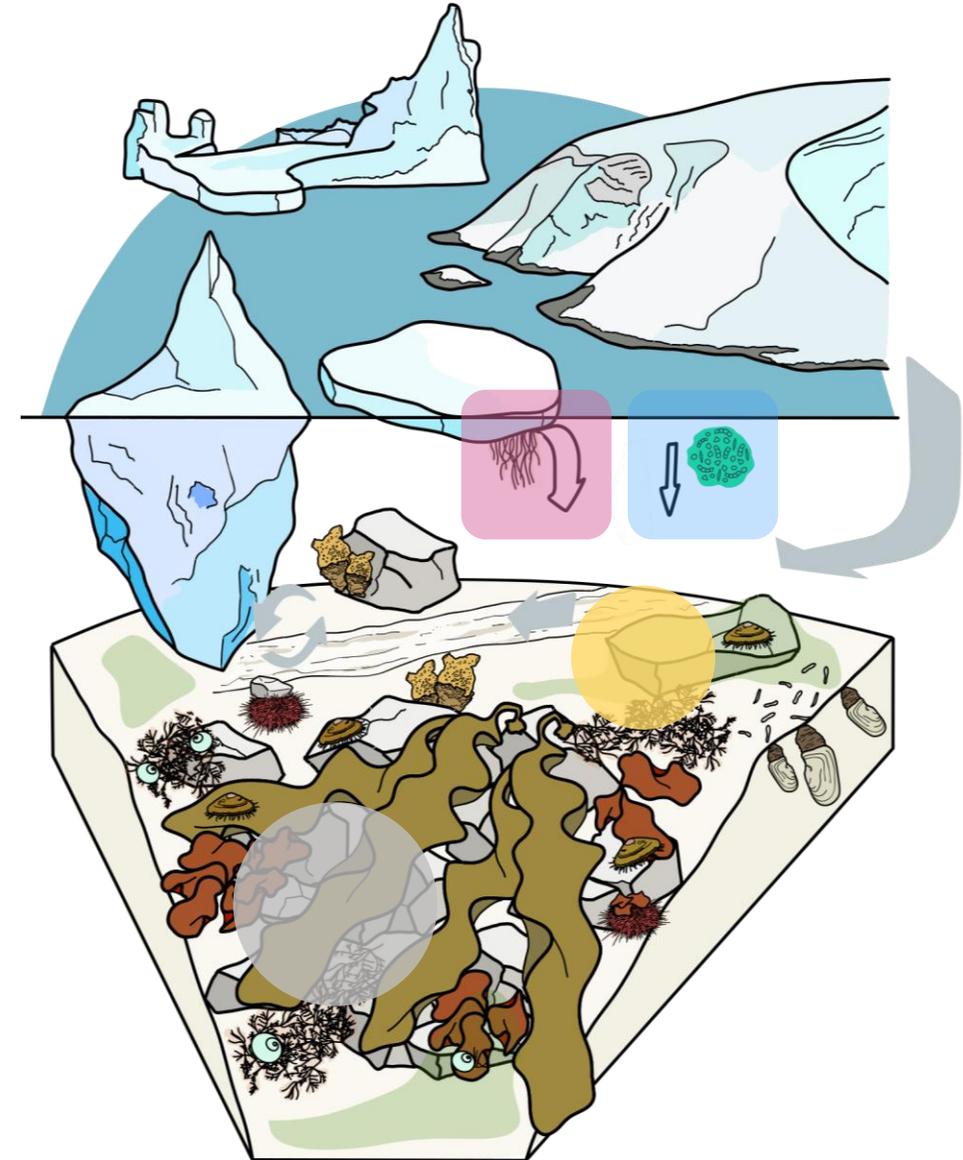
SYMPAGIC



PELAGIC



WEST ANTARCTIC PENINSULA



(Ha et al., 2019; Meredith et al., 2019; Ko et al., 2023; Griffith et al., 2024)

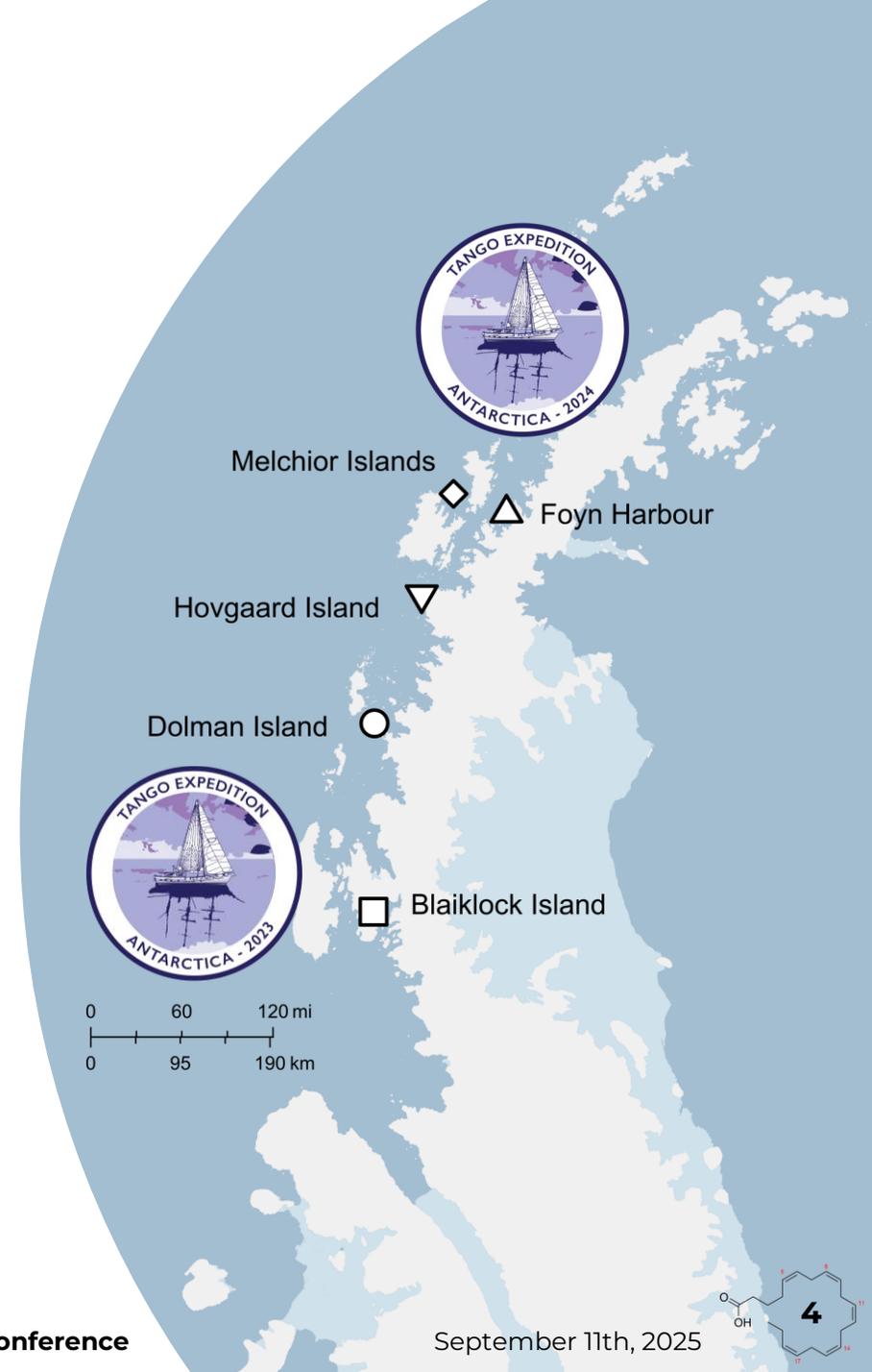
Sampling



TANGO project
(Danis et al., 2023; 2024)



Food sources & consumers



Sampling



TANGO project
(Danis et al., 2023; 2024)

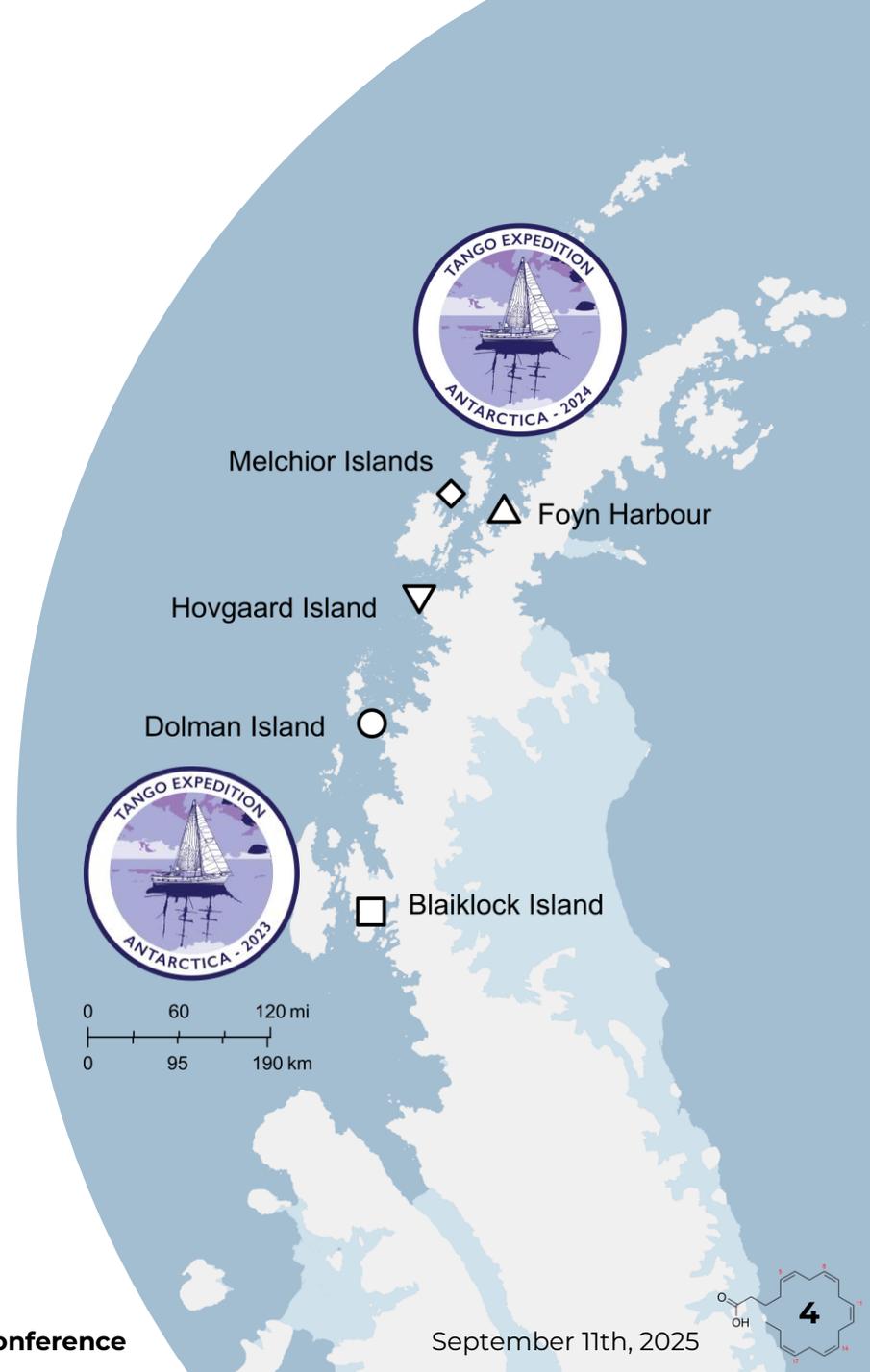


Food sources & consumers

Does combining biomarkers refine the diet of benthic consumers under different environmental conditions?

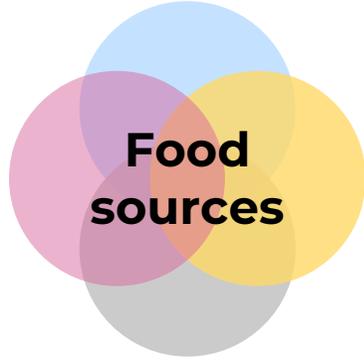


Gastropods grazers

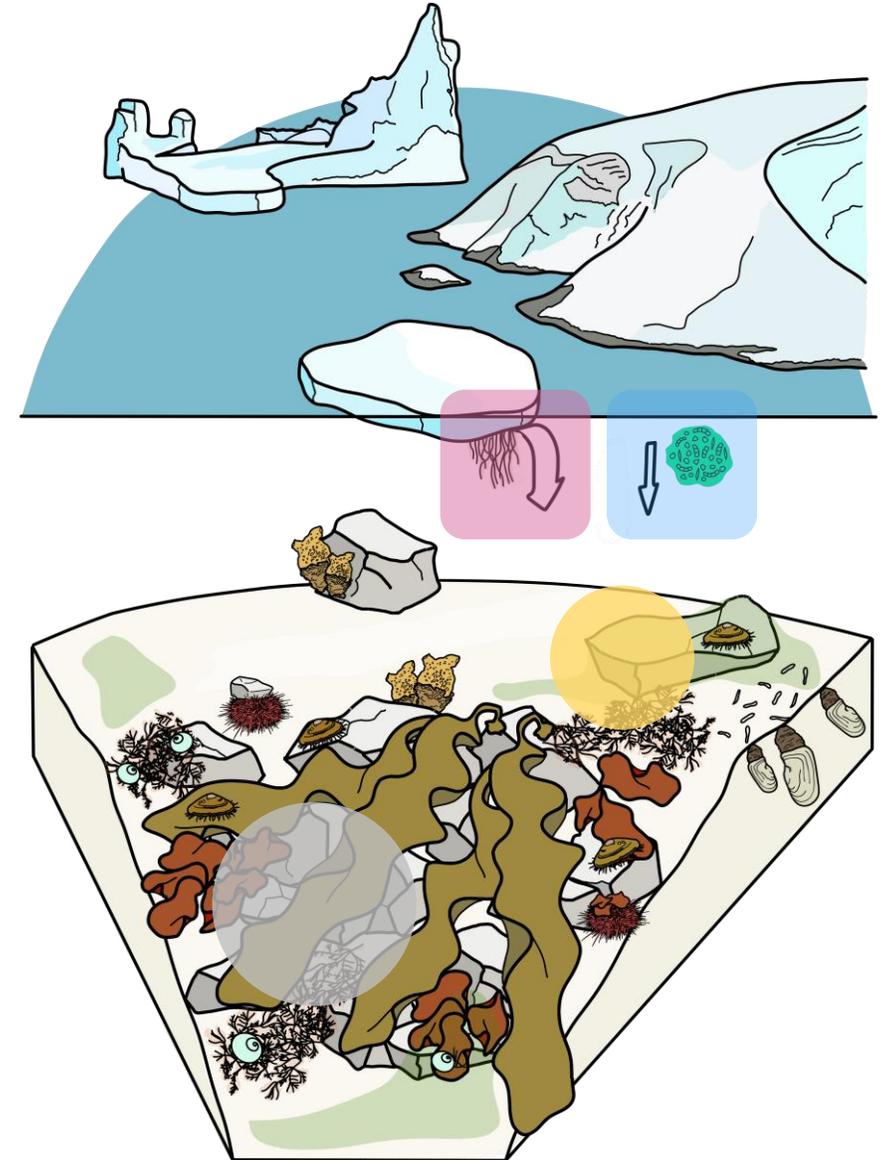


Biomarkers

 Fatty acids (FA)



WEST ANTARCTIC PENINSULA

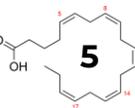


(Kelly and Scheibling, 2012)

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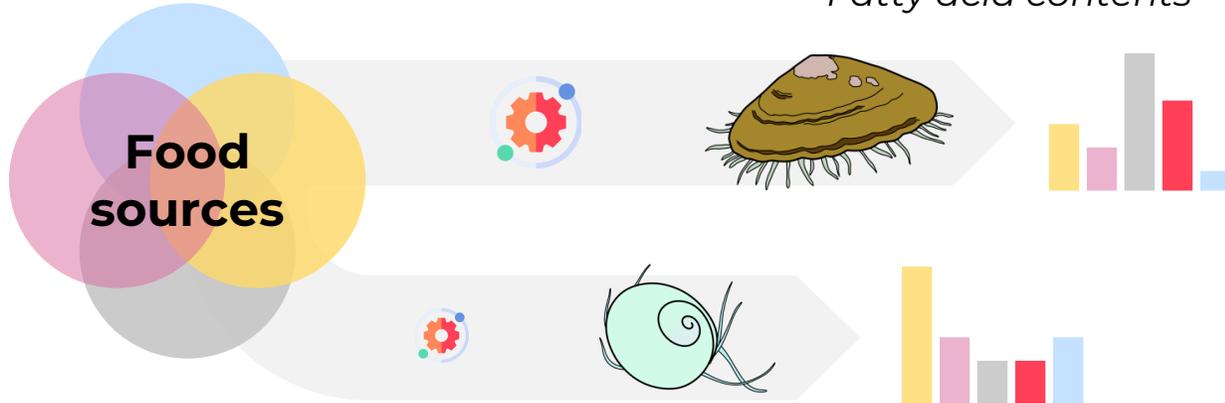
BE-Polar conference

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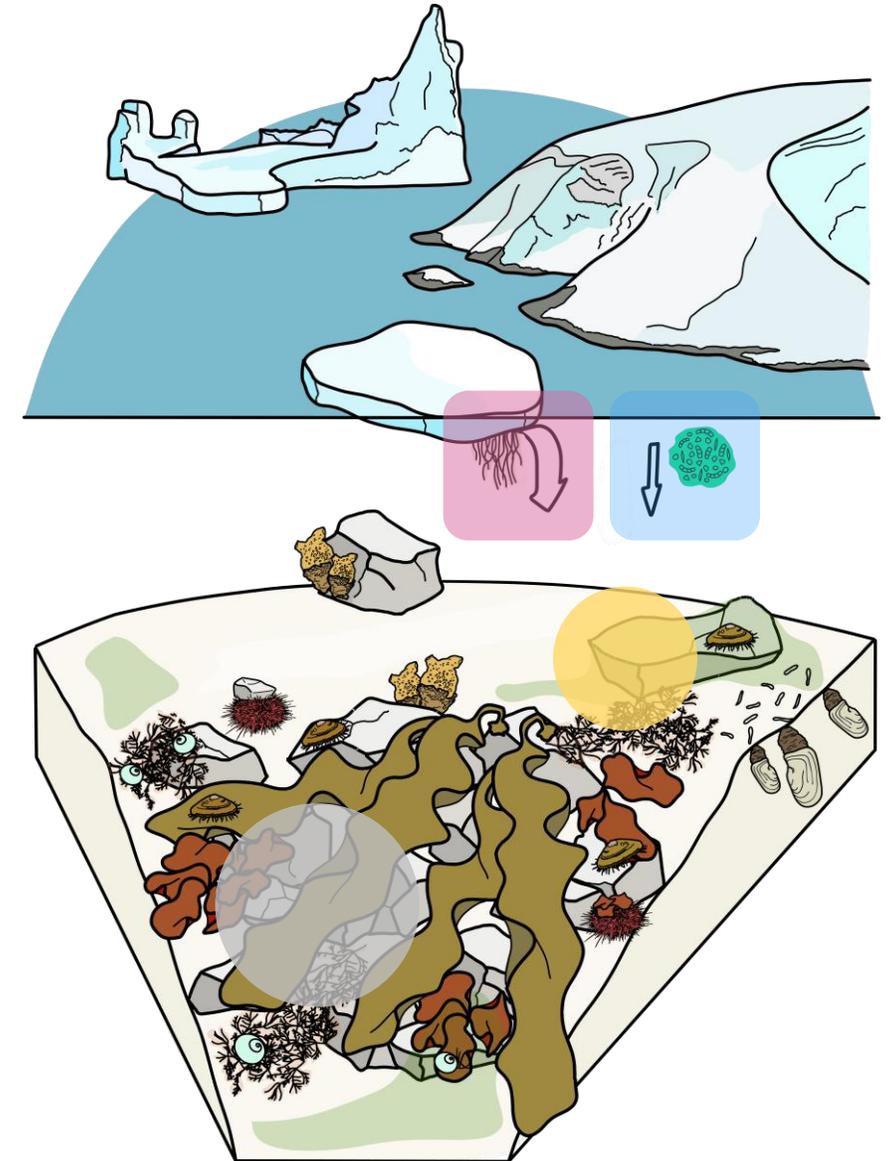


Biomarkers

 Fatty acids (FA)



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(Kelly and Scheibling, 2012)

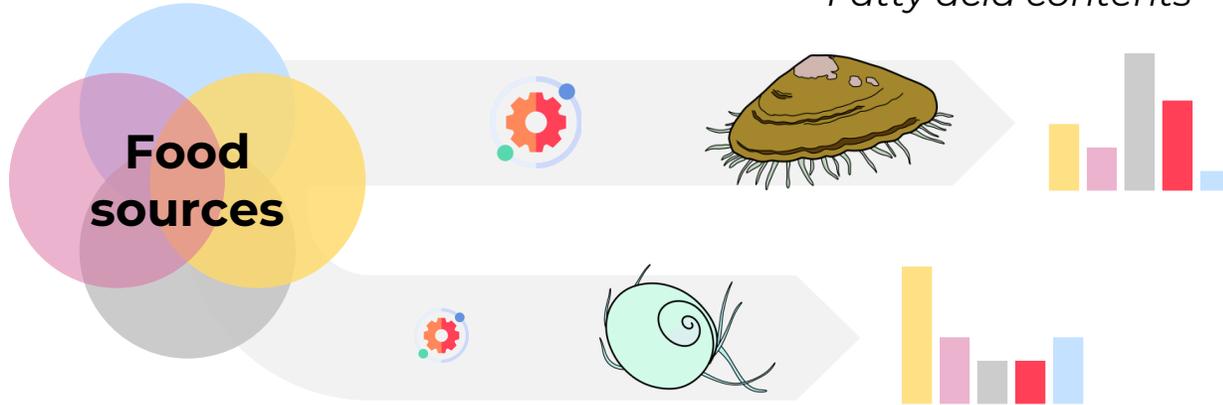
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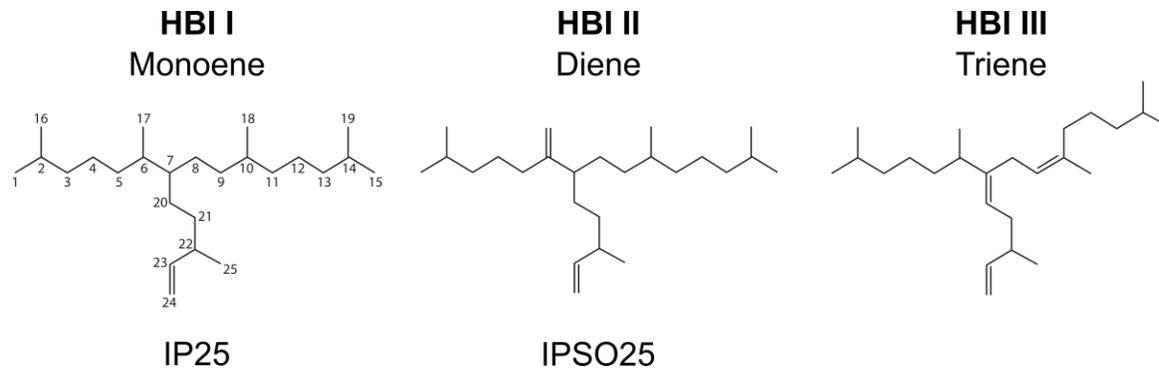
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Biomarkers

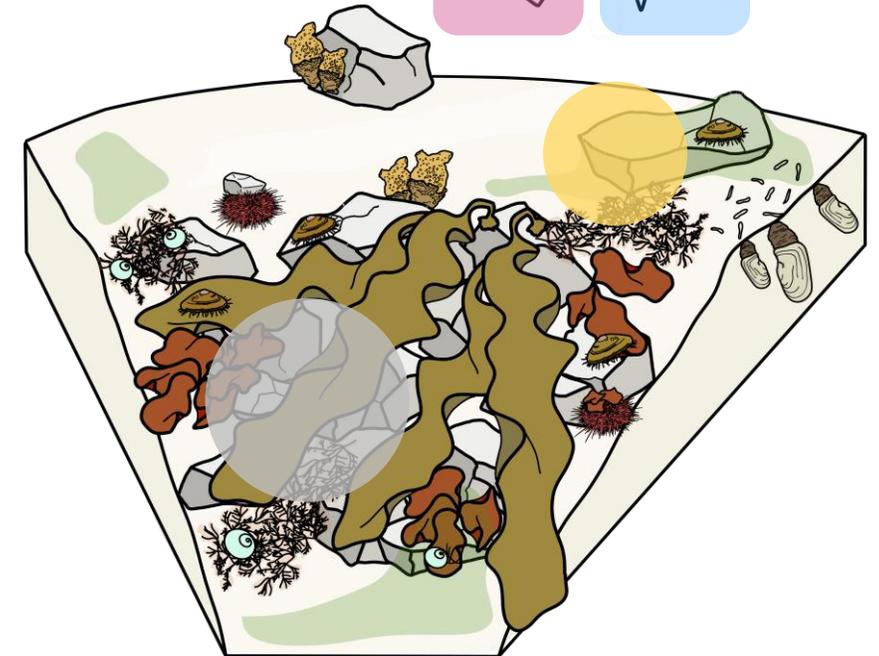
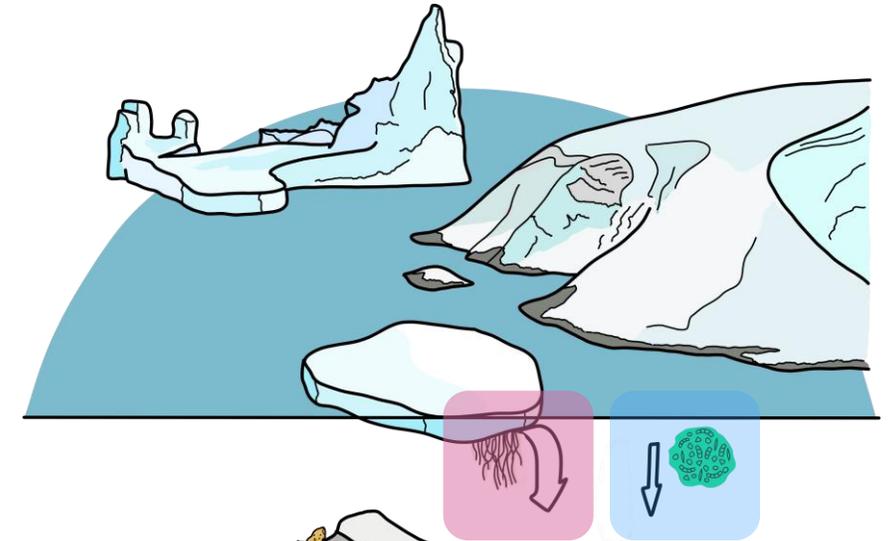
 Fatty acids (FA)



 Highly Branched Isoprenoids (HBI)



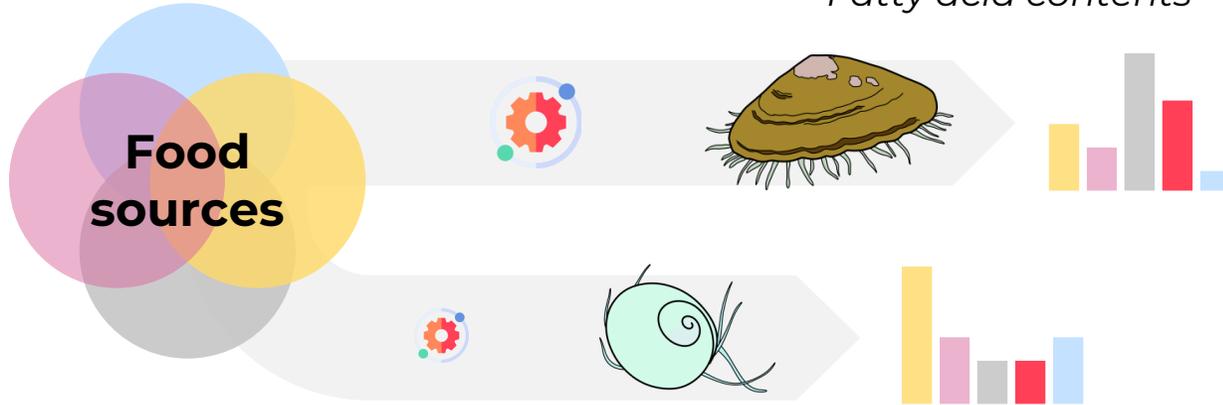
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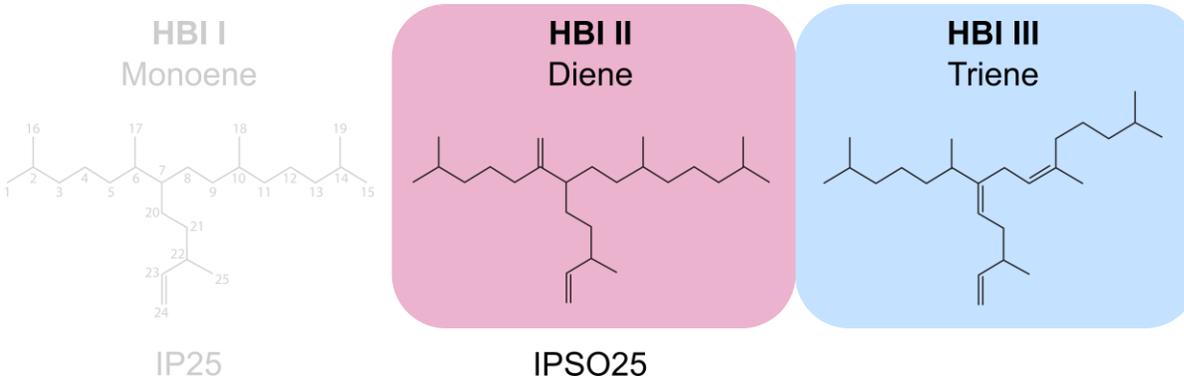
(Kelly and Scheibling, 2012; Massé et al., 2011; Belt, 2018; Koch et al., 2023)

Biomarkers

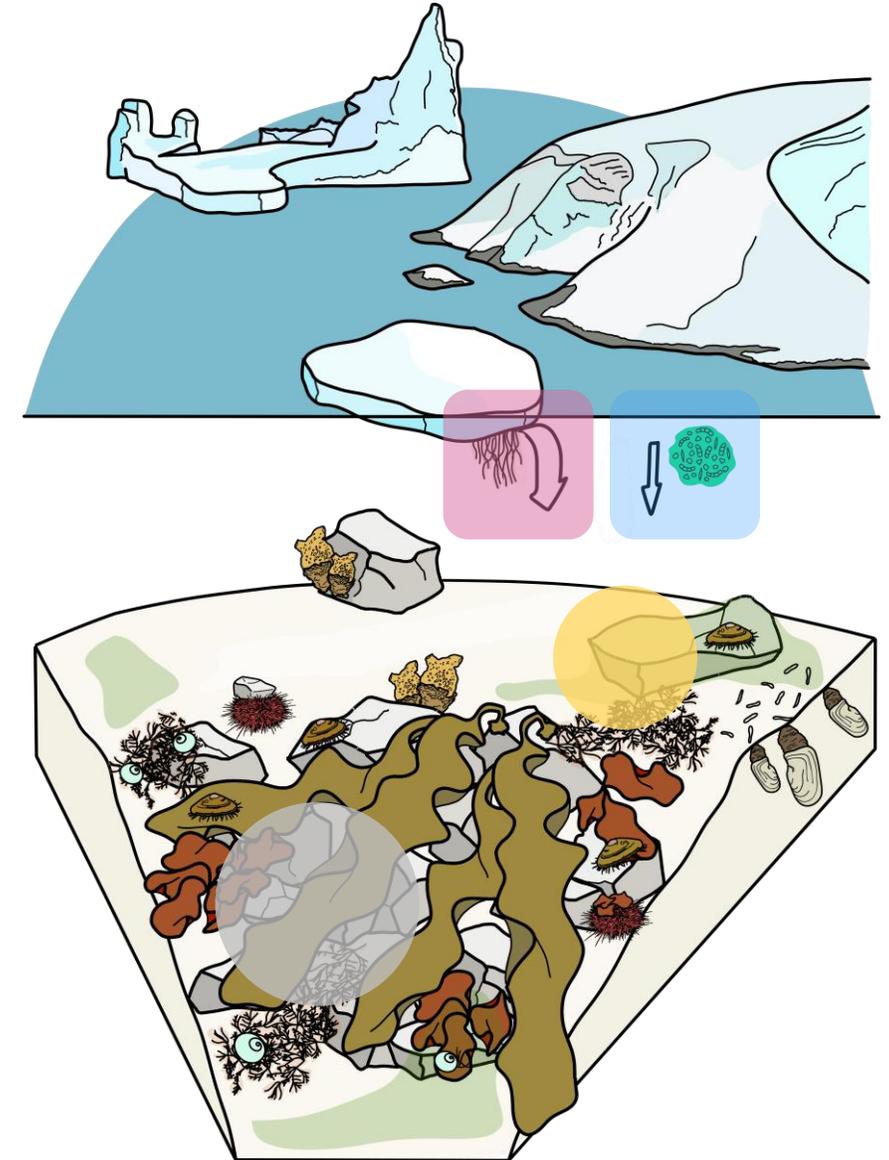
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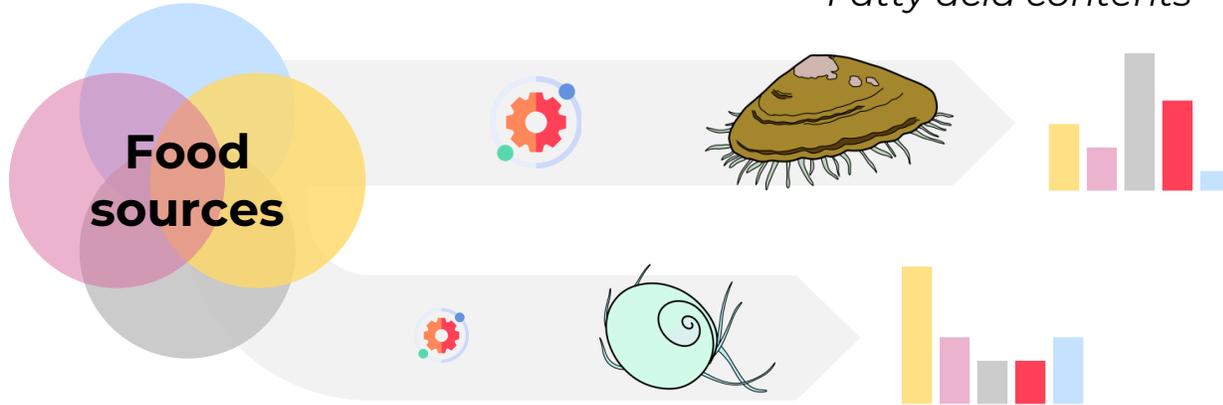
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Biomarkers

 Fatty acids (FA)

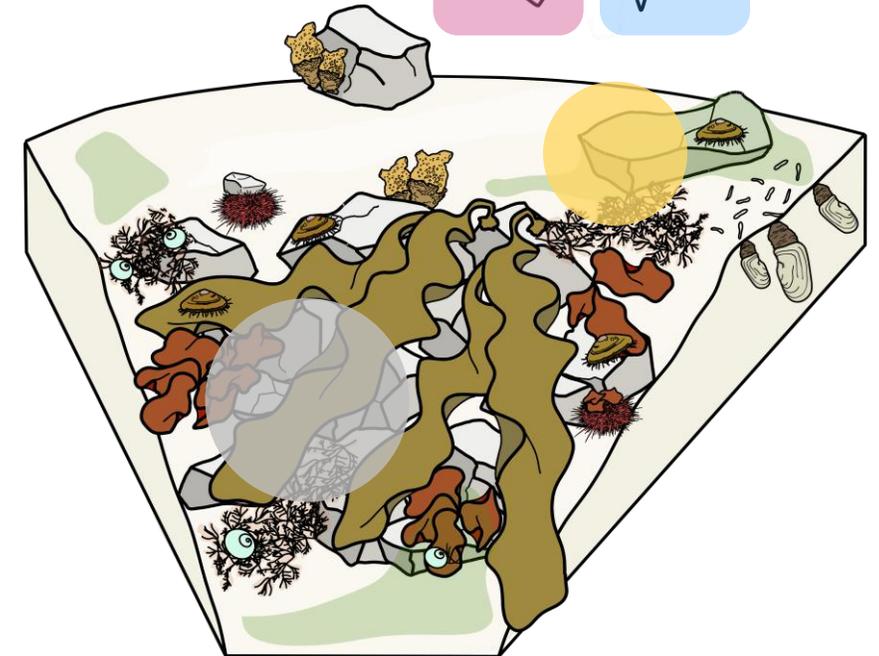
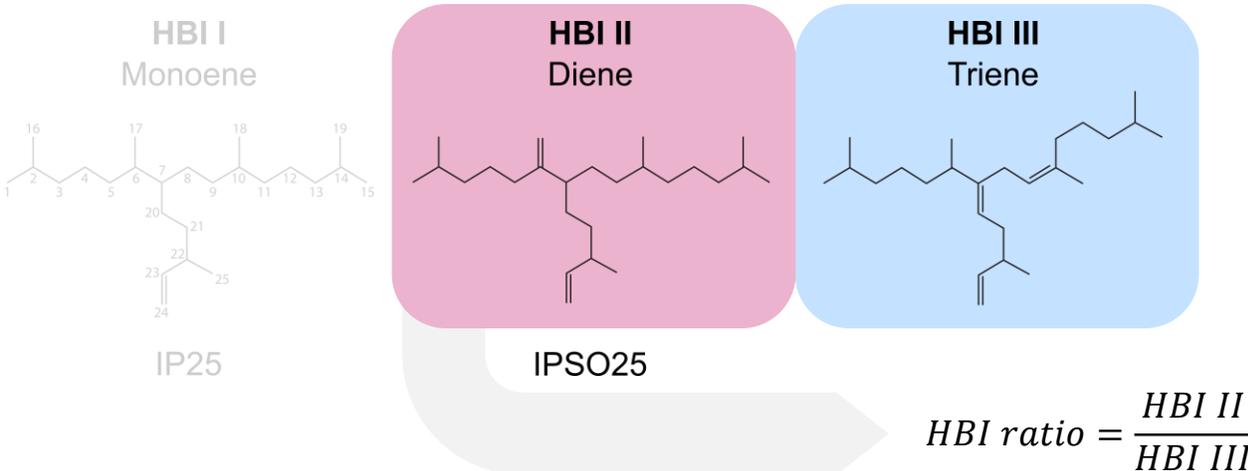


Consumers
Fatty acid contents

WEST ANTARCTIC PENINSULA



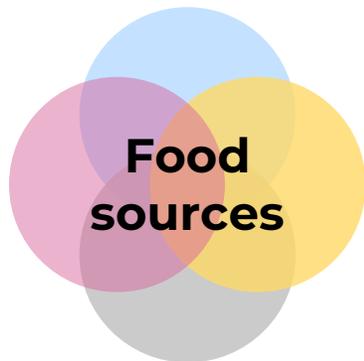
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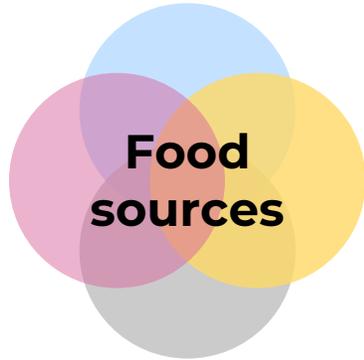
Results & Discussion

 Fatty acids (FA)



Results & Discussion

Fatty acids (FA)

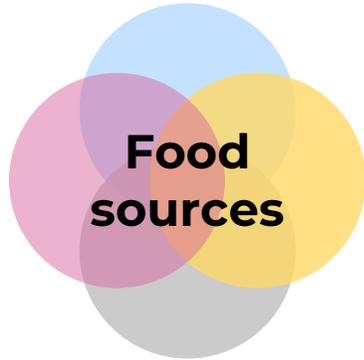


- ➔ Diatoms – $16:1n-7 + 16:4n-1 + 16:3n-4$ 
- ➔ Macroalgae – $18:1n-9 + \text{PUFA C18} + 20:4n-6$ 
- ➔ Bacteria – $18:1n-7 + \text{ante iso} + \text{odd FA}$ 

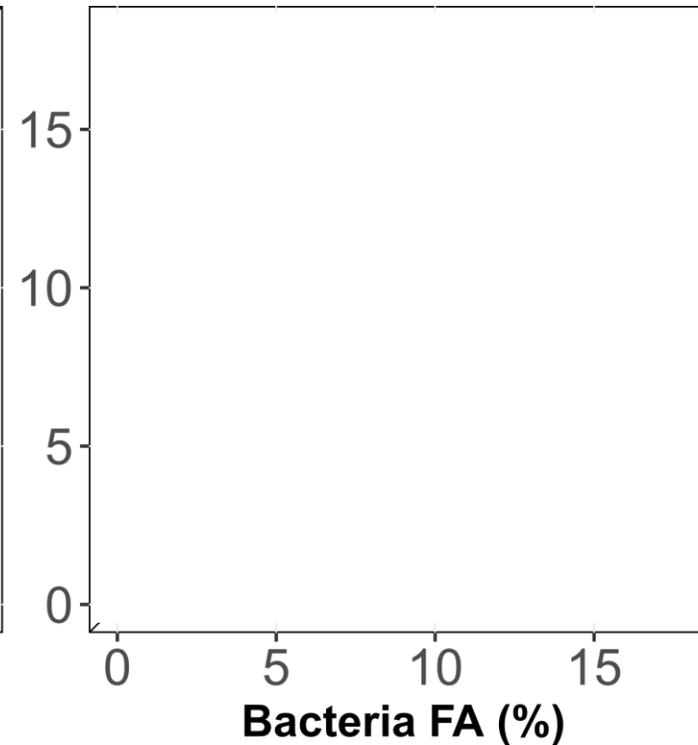
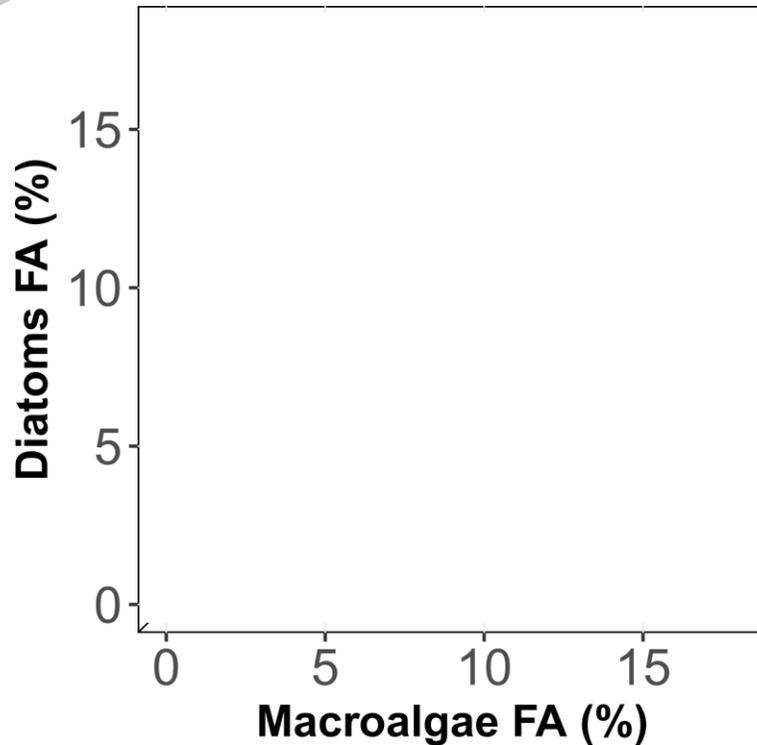
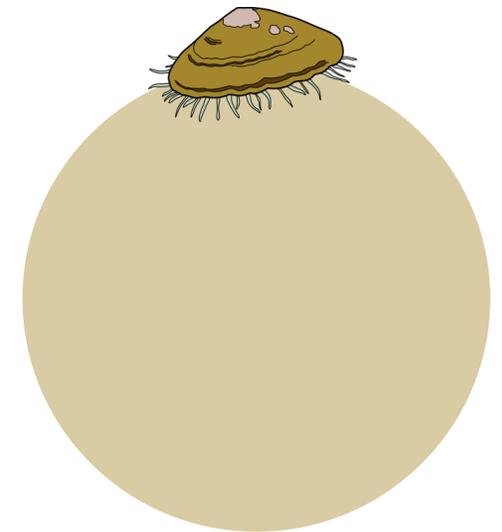
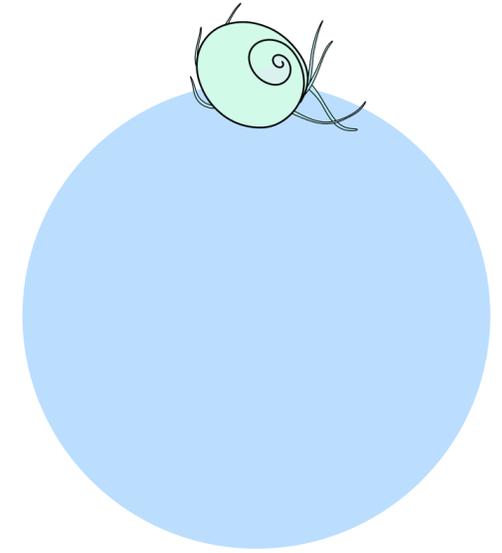


Results & Discussion

 Fatty acids (FA)



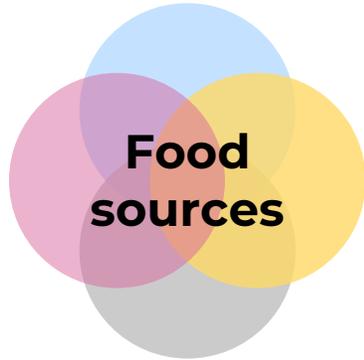
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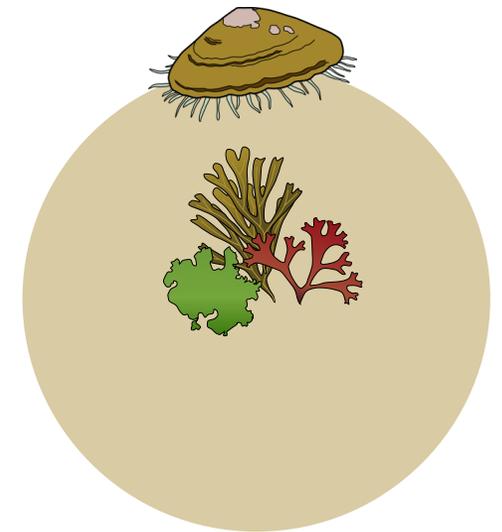
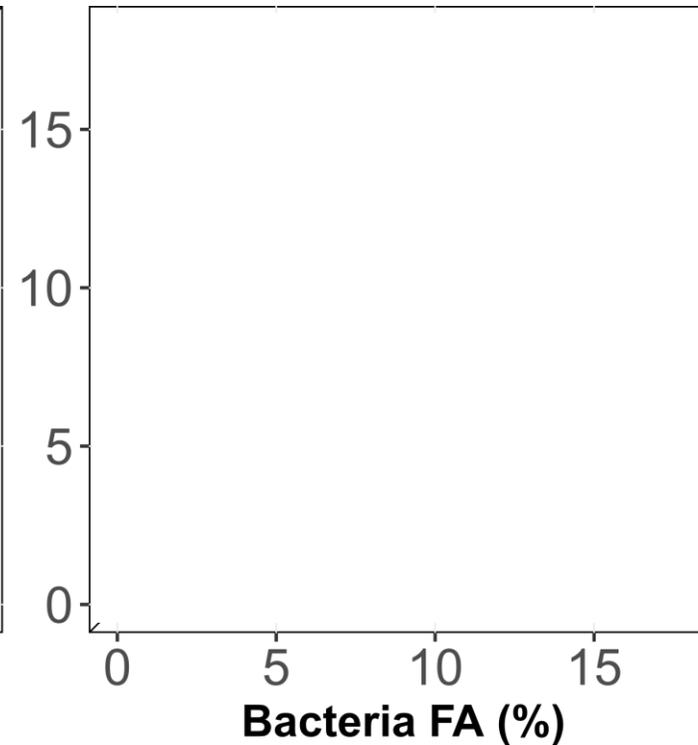
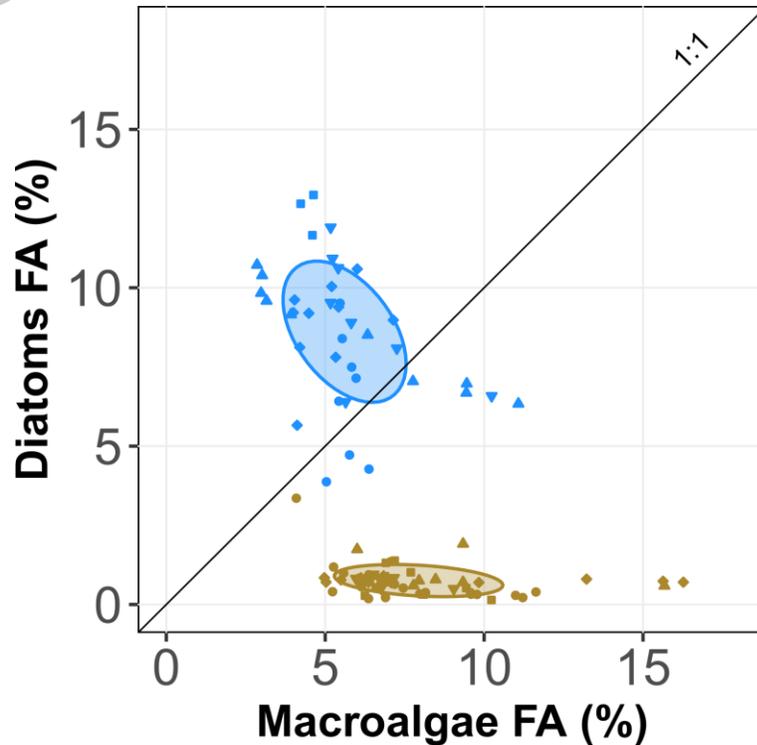
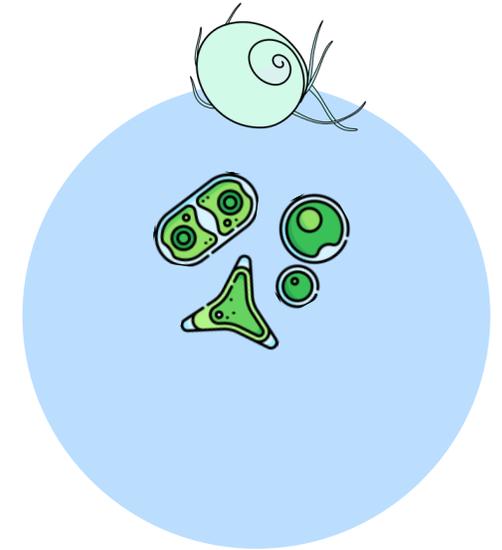
- Blaiklock Island
- Dodman Island
- △ Hovgaard Island
- ▽ Foyen Harbour
- ◇ Melchior Islands

Results & Discussion

 Fatty acids (FA)



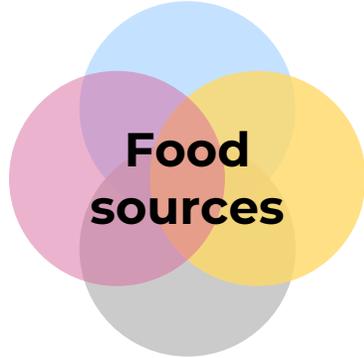
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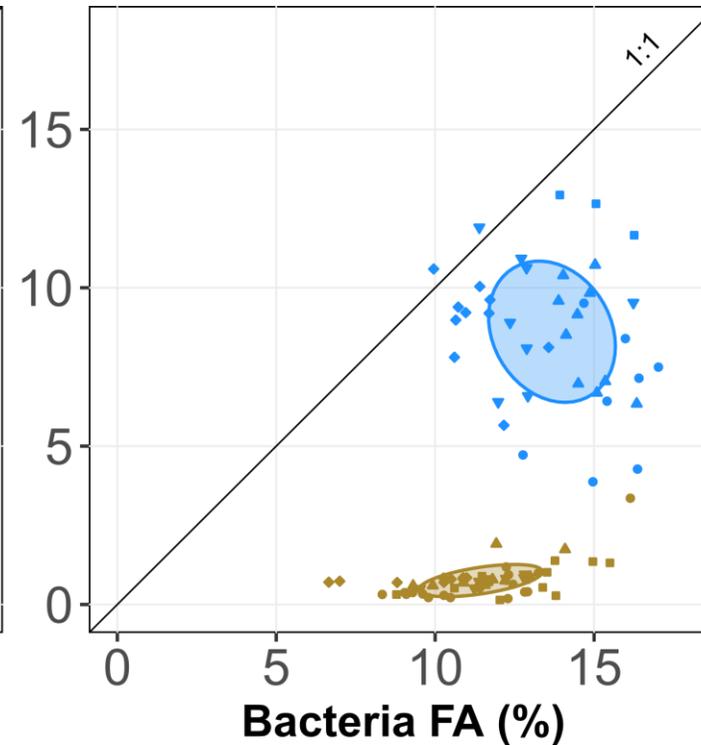
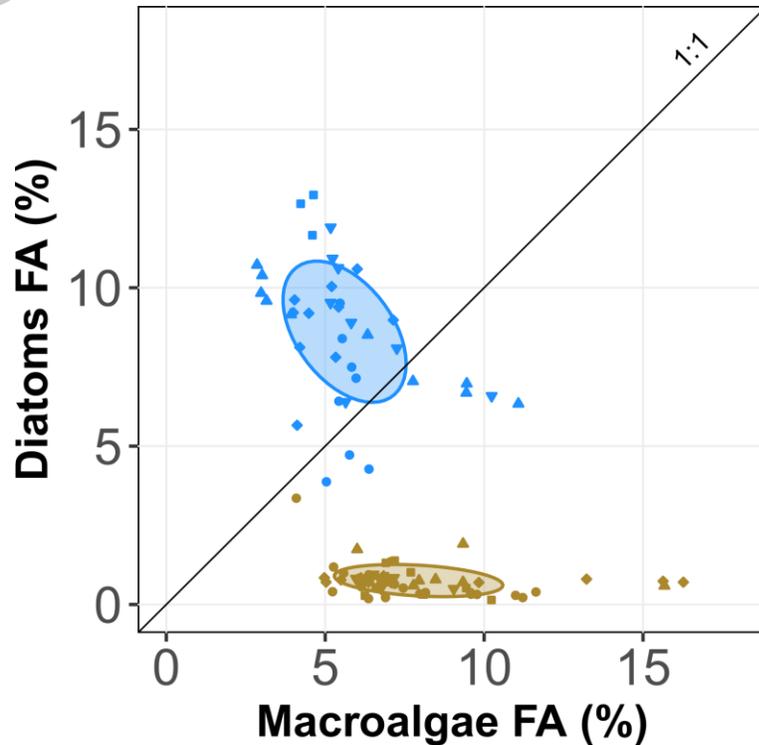
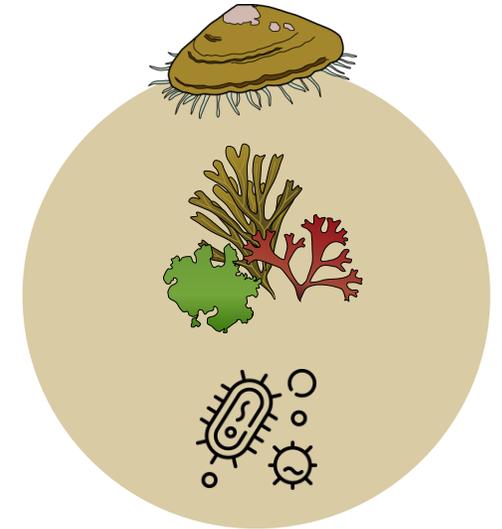
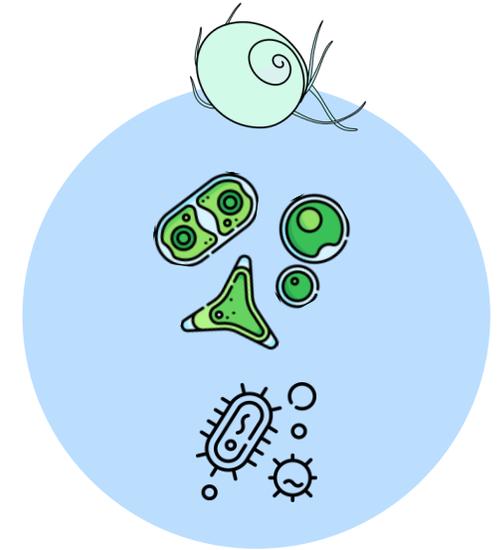
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Results & Discussion

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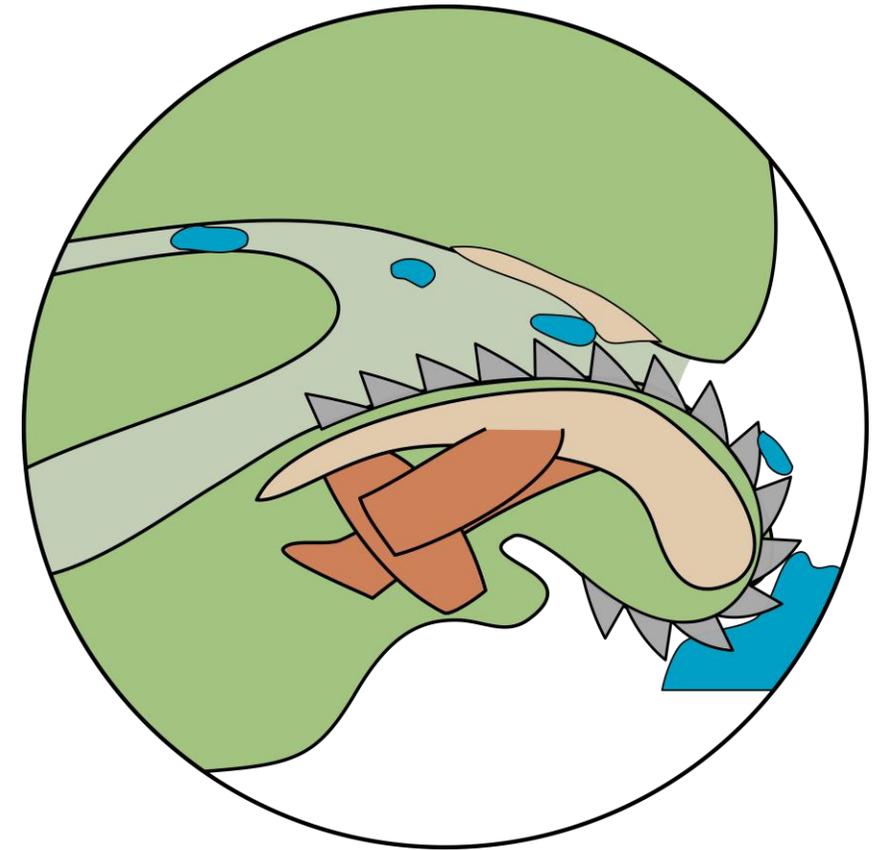
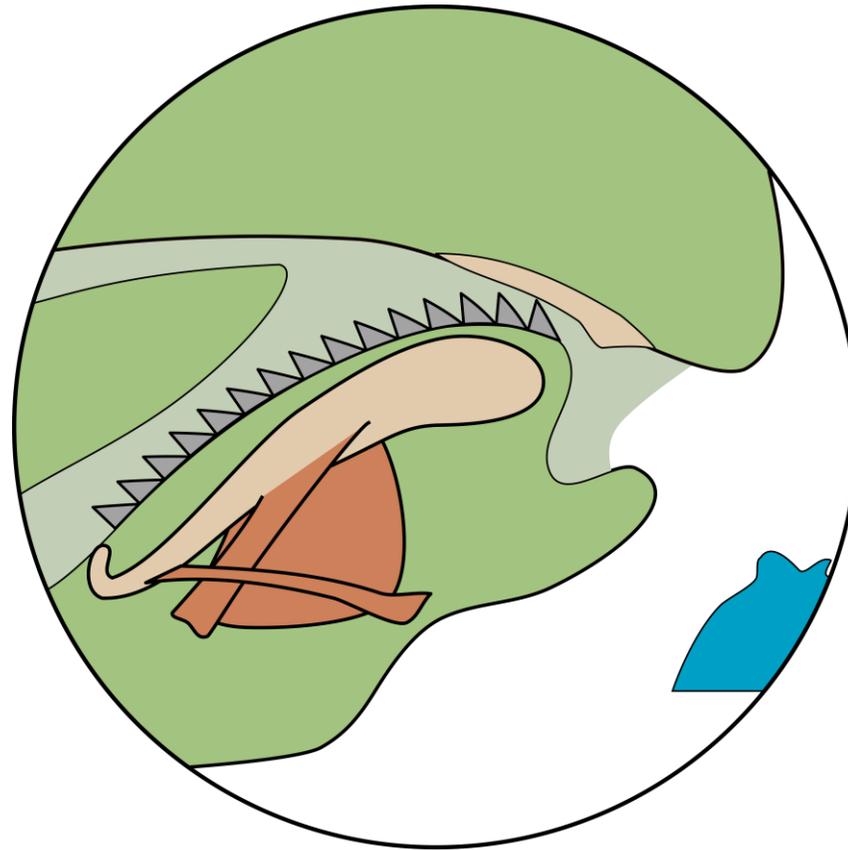
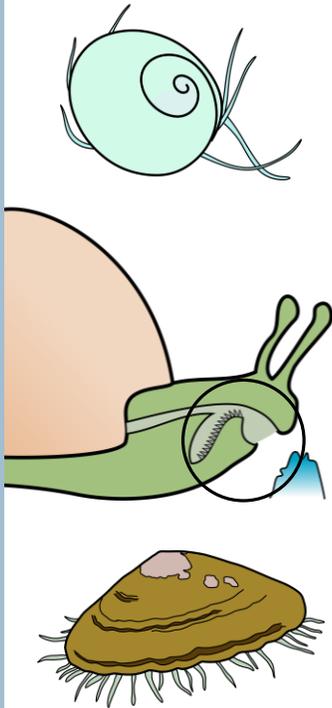


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Results & Discussion



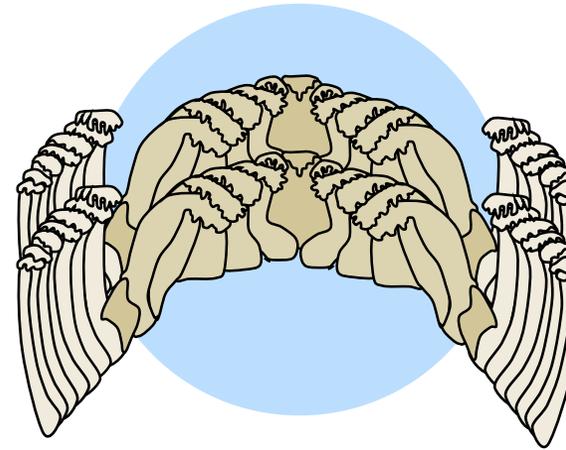
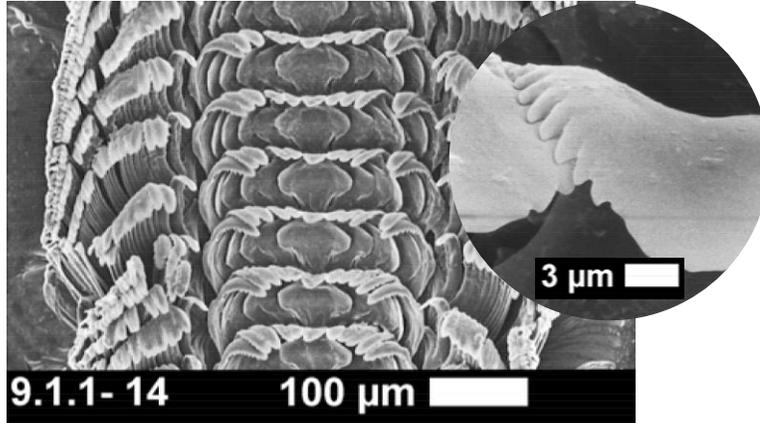
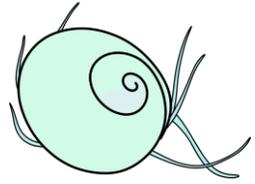
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(Steneck and Watling, 1982; Vortsepneva et al., 2022)

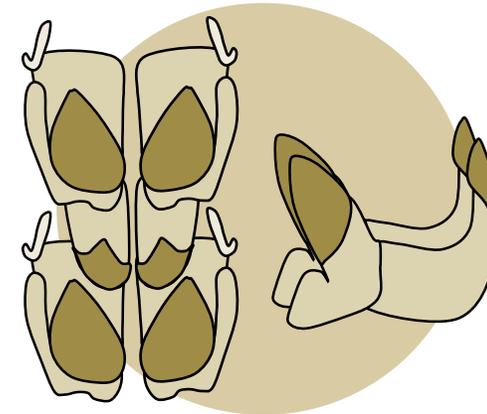
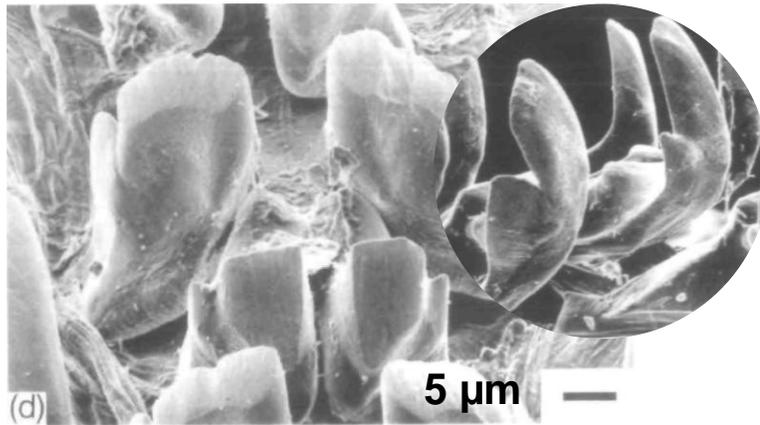
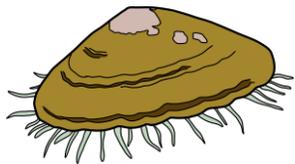
 **Anthony Voisin** – anthony.voisin@univ-brest.fr

Results & Discussion

Rhipidoglossa



Docoglossa

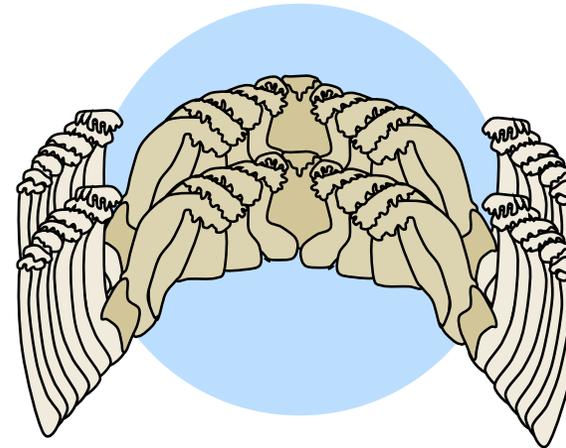
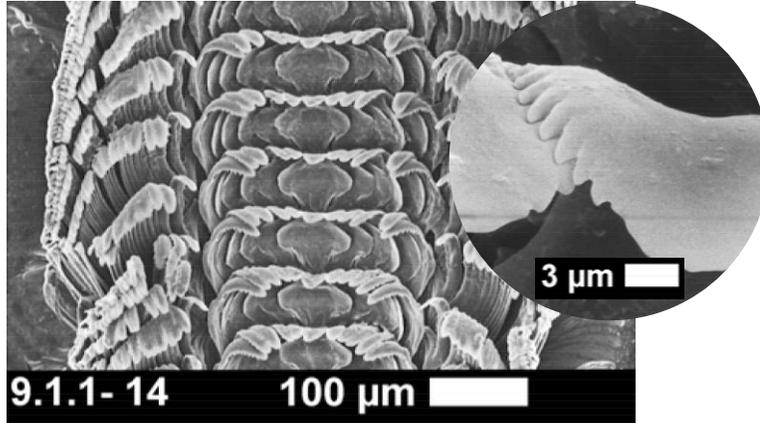
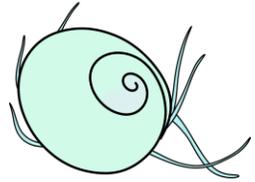


(Steneck and Watling, 1982; Vortsepneva et al., 2022)

Results & Discussion

Gastropods radula

Rhipidoglossa

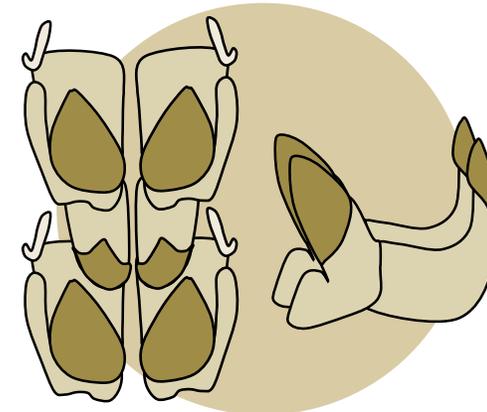
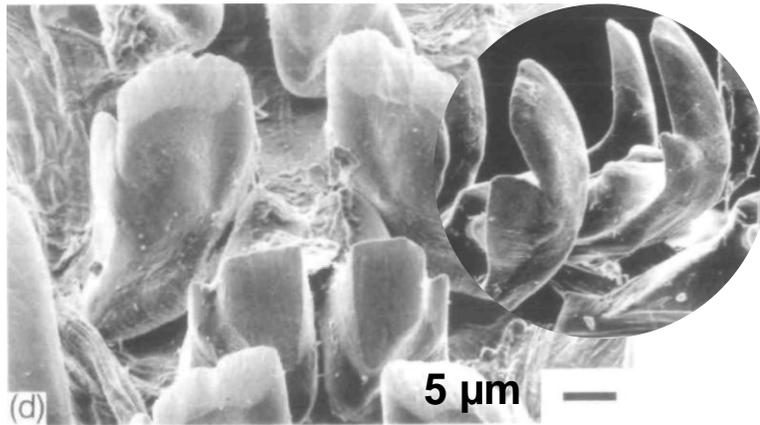
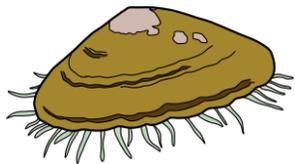


Excavation
capability



“Broom”

Docoglossa



“Shovel”



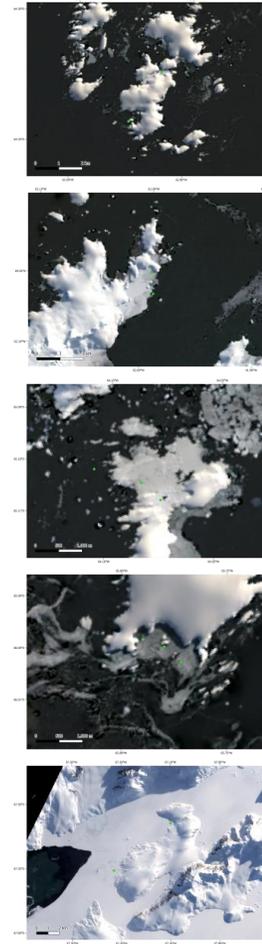
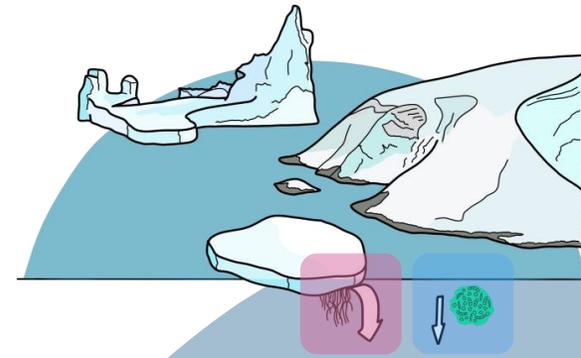
(Steneck and Watling, 1982; Vortsepneva et al., 2022)

Results & Discussion

- Highly branched isoprenoïds (HBI)
 - Diatoms? Yes, but from where?



Satellite view – ©Axelle Brusselman

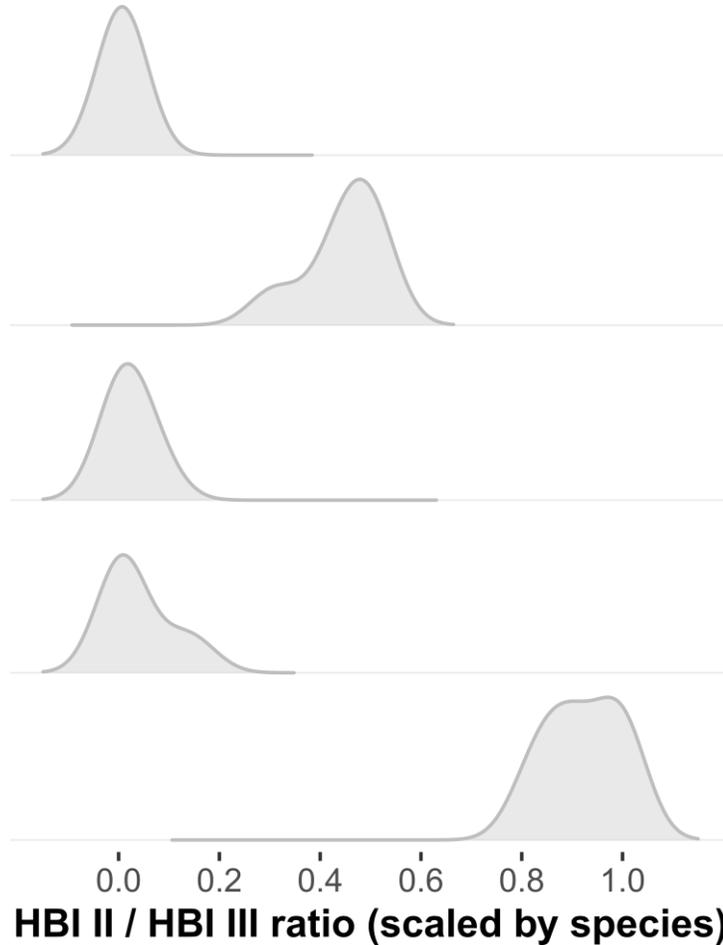


0 60 120 mi
0 95 190 km

Results & Discussion

Highly branched isoprenoids (HBI)

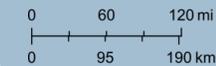
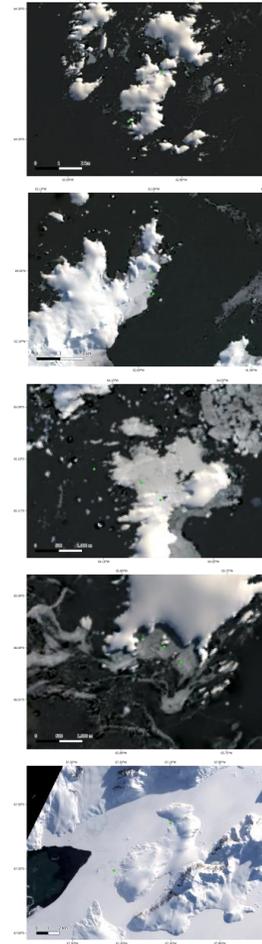
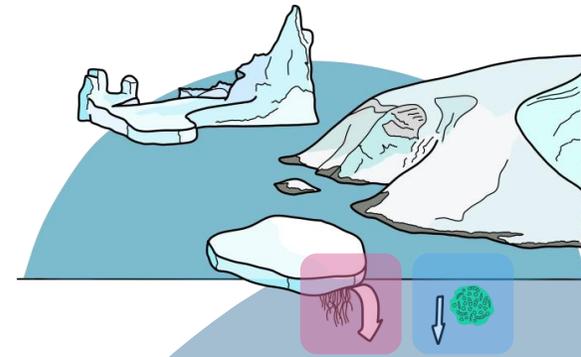
→ Diatoms? Yes, but from where?



(Massé et al., 2011; Belt, 2018; Koch et al., 2023)

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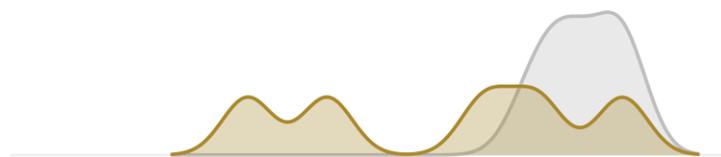
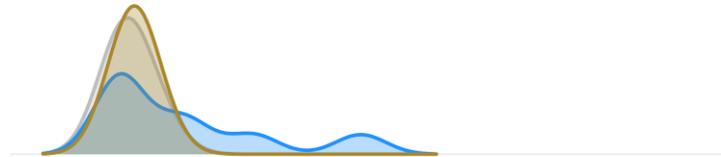
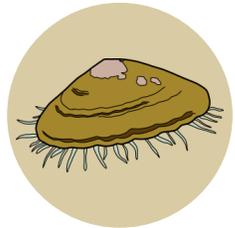
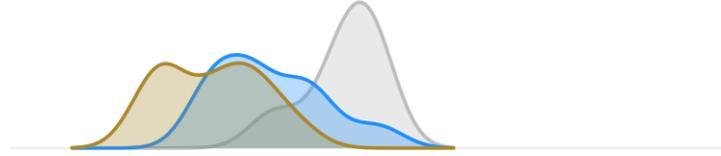
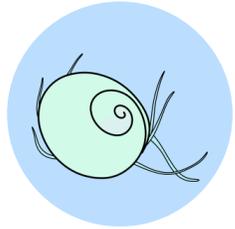
Satellite view – ©Axelle Brusselman



Results & Discussion

Satellite view – ©Axelle Brusselman

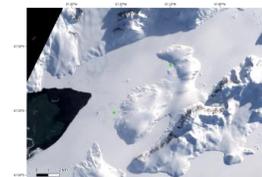
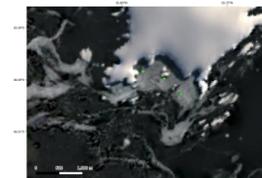
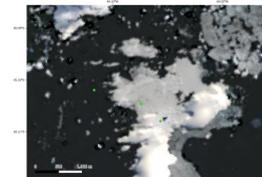
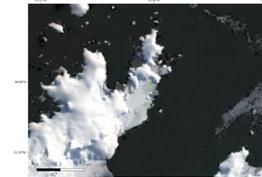
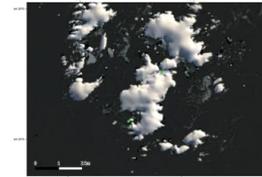
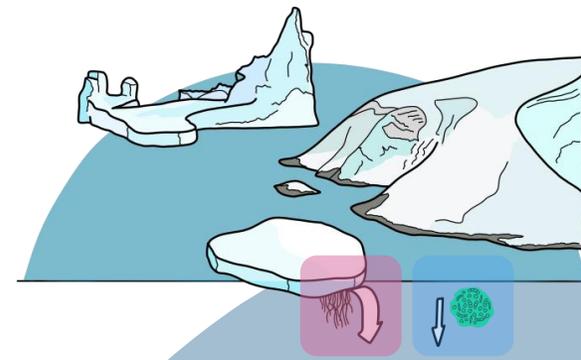
- Highly branched isoprenoids (HBI)
 - ➔ Diatoms? Yes, but from where?



HBI II / HBI III ratio (scaled by species)

(Massé et al., 2011; Belt, 2018; Koch et al., 2023)

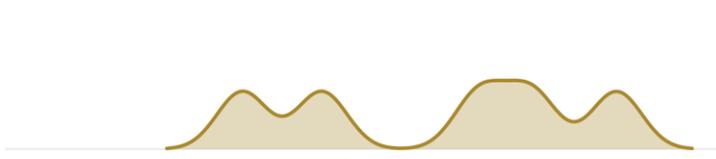
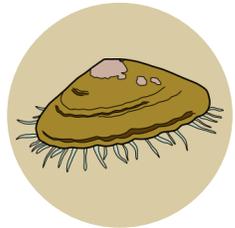
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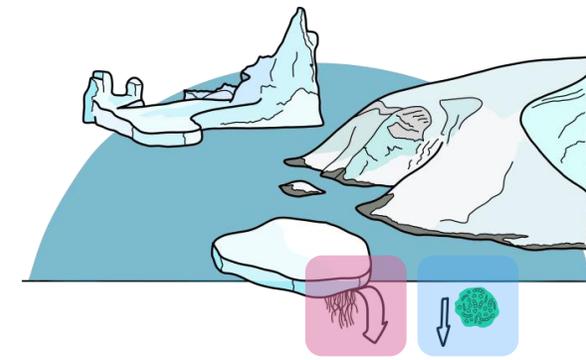
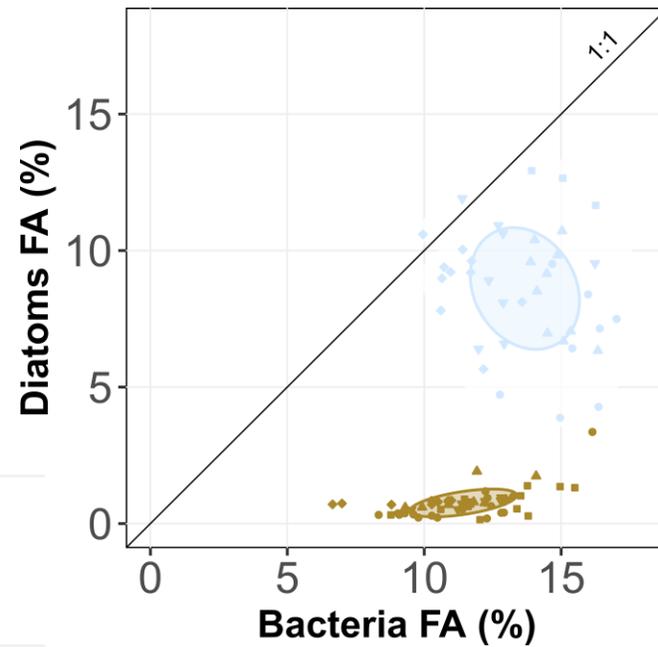
0 60 120 mi
0 95 190 km

Results & Discussion

- Highly branched isoprenoids (HBI)
 - ➔ Diatoms? Yes, but from where?



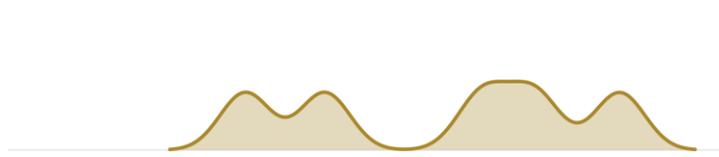
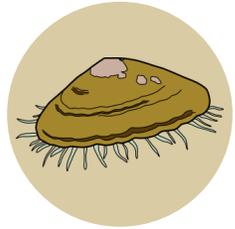
HBI II / HBI III ratio (scaled by species)



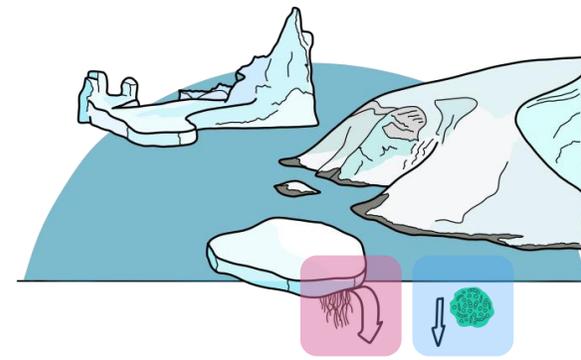
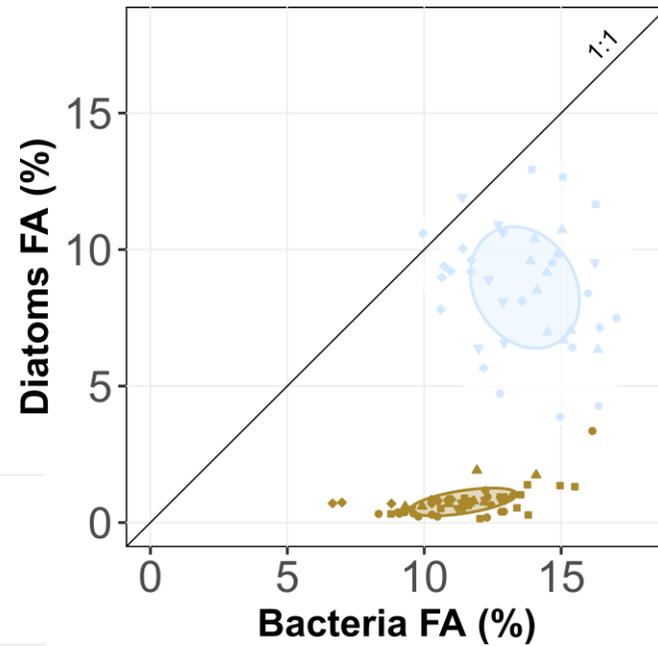
(Barnathan et al., 2009; Bridier et al., 2023)

Results & Discussion

- Highly branched isoprenoids (HBI)
 - ➔ Diatoms? Yes, but from where?



HBI II / HBI III ratio (scaled by species)



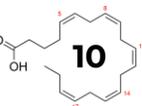
FA synthesis by consumers?

(Barnathan et al., 2009; Bridier et al., 2023)

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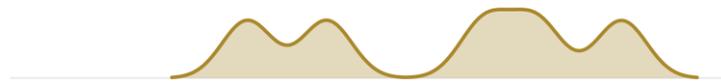
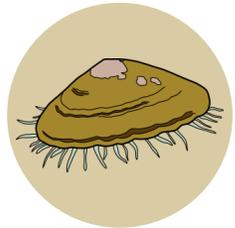
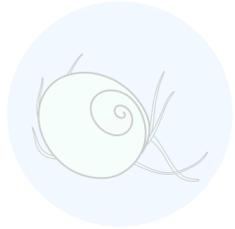
BE-Polar conference

September 11th, 2025



Results & Discussion

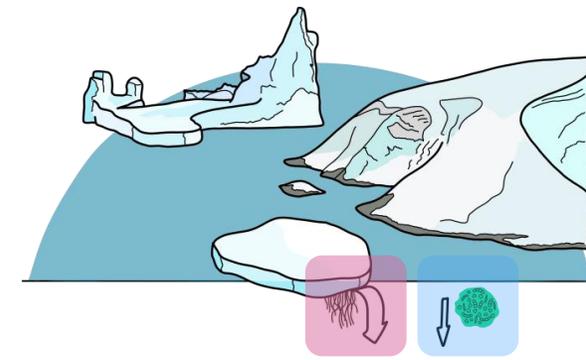
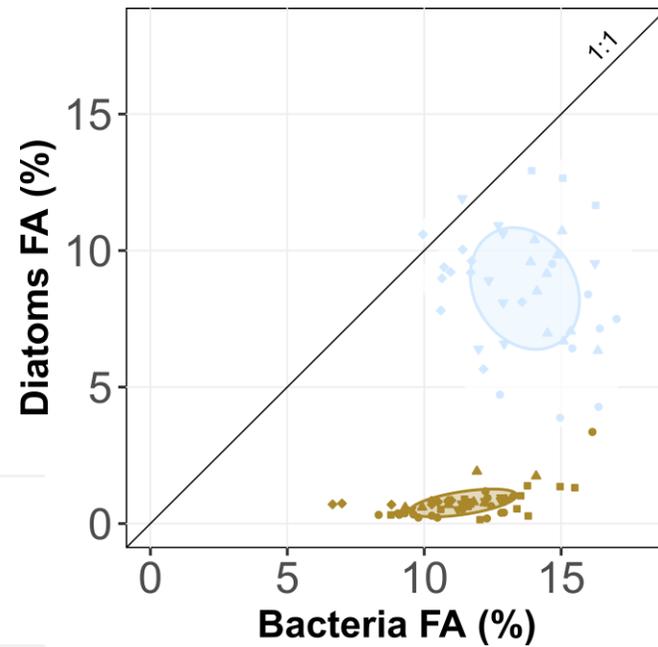
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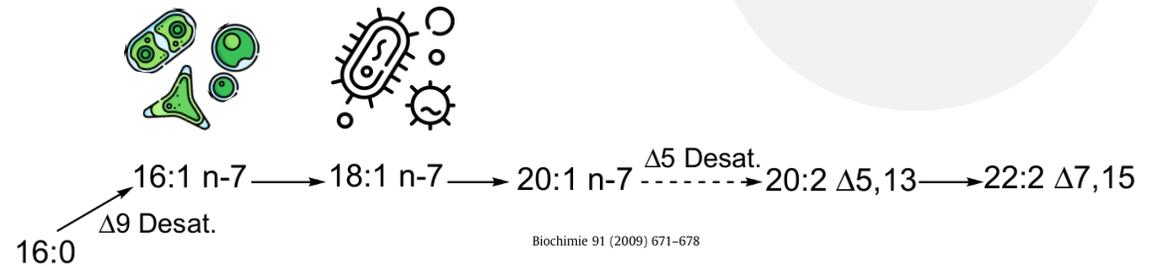
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FA synthesis by consumers?



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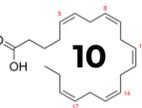


Review
 Non-methylene-interrupted fatty acids from marine invertebrates: Occurrence, characterization and biological properties

Gilles Barnathan*

BE-Polar conference

September 11th, 2025



Take home message

✓ **Combining
biomarkers**



Margarella antarctica



Nacella concinna

FA

HBI

Take home message

✓ **Combining biomarkers**



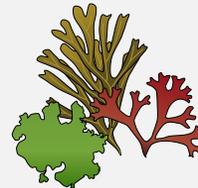
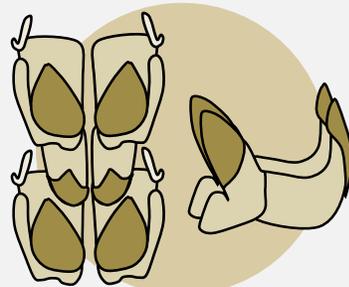
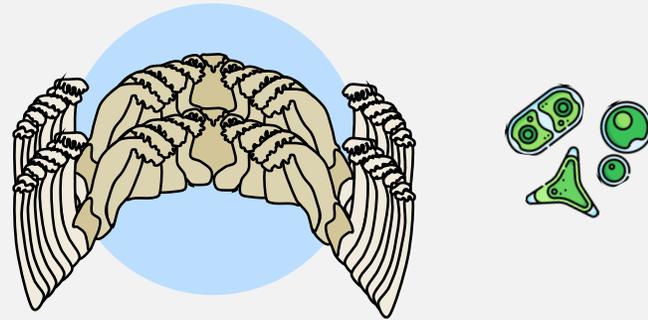
Margarella antarctica



Nacella concinna

FA

Might reflect diet differences based on their feeding structures



HBI

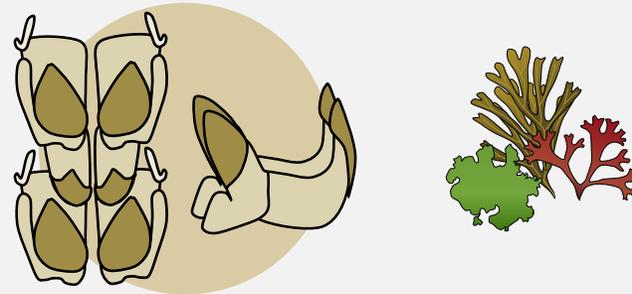
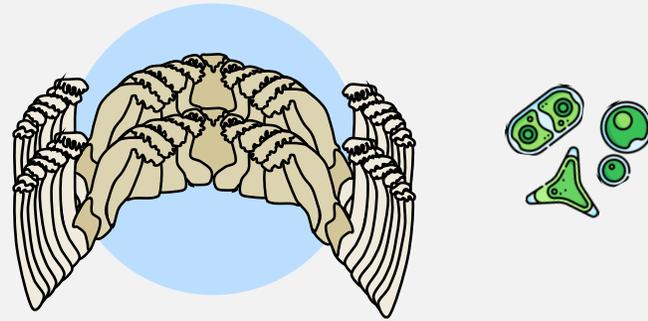
Take home message

✓ **Combining biomarkers**



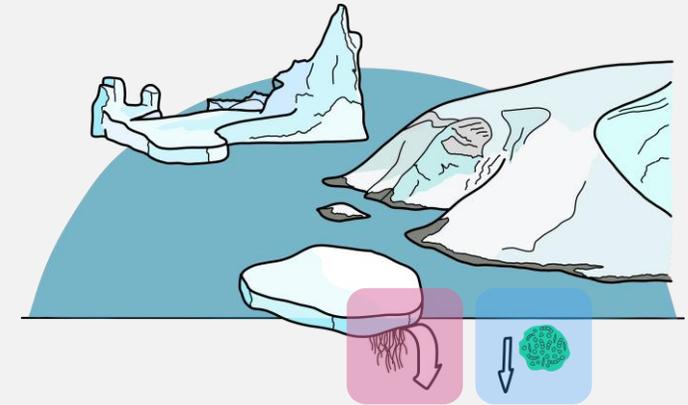
FA

Might reflect diet differences based on their feeding structures



HBI

Higher ratio in sites with a higher mean sea ice cover



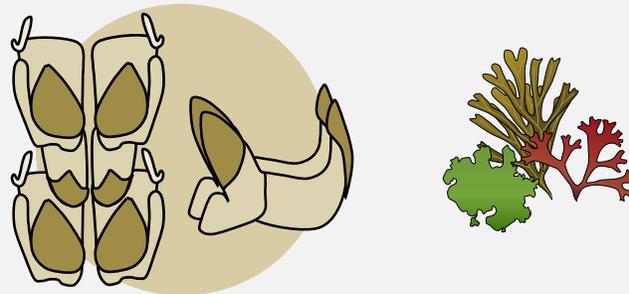
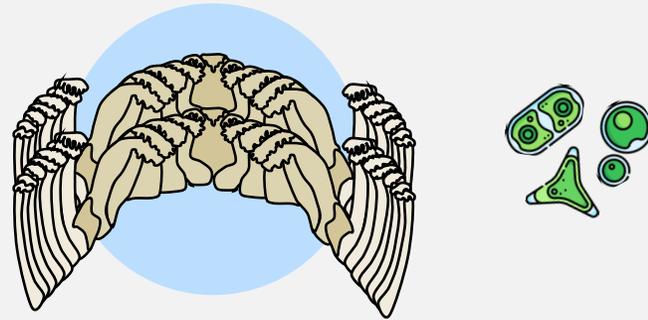
Take home message

✓ Combining biomarkers



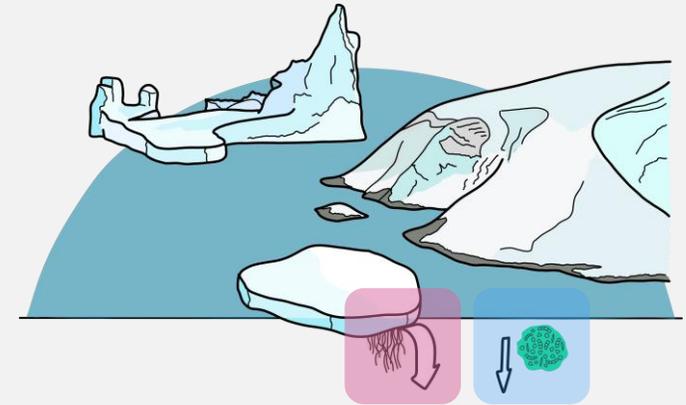
FA

Might reflect diet differences based on their feeding structures



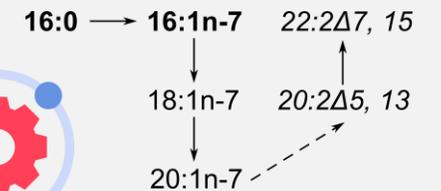
HBI

Higher ratio in sites with a higher mean sea ice cover



⇒ Consumption of sea ice diatoms

⇒ Biosynthesis capabilities



Take home message

✓ **Combining biomarkers**



Margarella antarctica



Nacella concinna

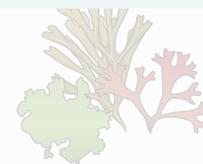
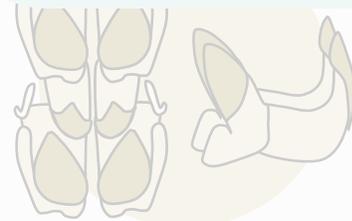
FA

Might reflect diet differences based on their feeding structures

HBI

Higher ratio in sites with a higher mean sea ice cover

Different influences of environmental changes, according to trophic habits and food sources consumed



Thank you for your attention

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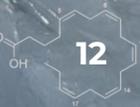
Any questions?

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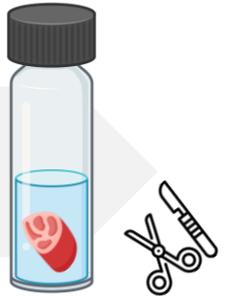
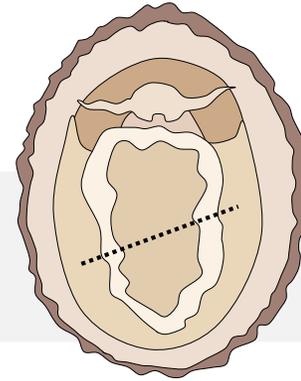
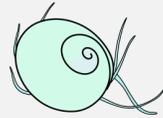
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FA method

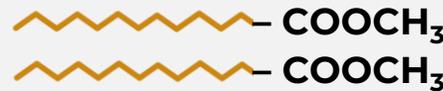
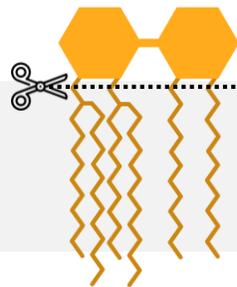
Dissections



Whole organism

Foot muscle

Gas Chromatography Flame Ionization Detector (GC-FID)



CHCl₃/MeOH
(2:1, v:v)

Saponification & Transmethylation
KOH-MeOH (0.5M) & MeOH-H₂SO₄ (3.4%, v:v)

FAME
(Hexane fraction)

GC-FID + MS

HBI method

