

# ATMOSPHERIC, LITHIC AND SOLAR ENERGY SOURCES, DRIVE MICROBIAL MAT FORMATION IN A HYPERSALINE LAKE

Short read analysis

ML modeling

MAGs reconstruction

► Trace gas metabolism

f(x) = 0.22

NiFe Group 2a

NiFe Group 1e

FeFe Group A3



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### Overview

### **Objective:**

 To investigate the energy and carbon sources sustaining microbial communities in lithifying and non-lithifying microbial mats in a hypersaline lake.

### **Methods:**

- Collected 11 non-lithifying and 28 lithifying microbial mats across 8 sites in hypersaline lakes on Rottnest Island, Australia.
- Performed shotgun metagenomics sequencing.
- Conducted bioinformatics analysis: short read processing, taxonomic, functional profiling, ML modeling, and MAGs reconstruction.

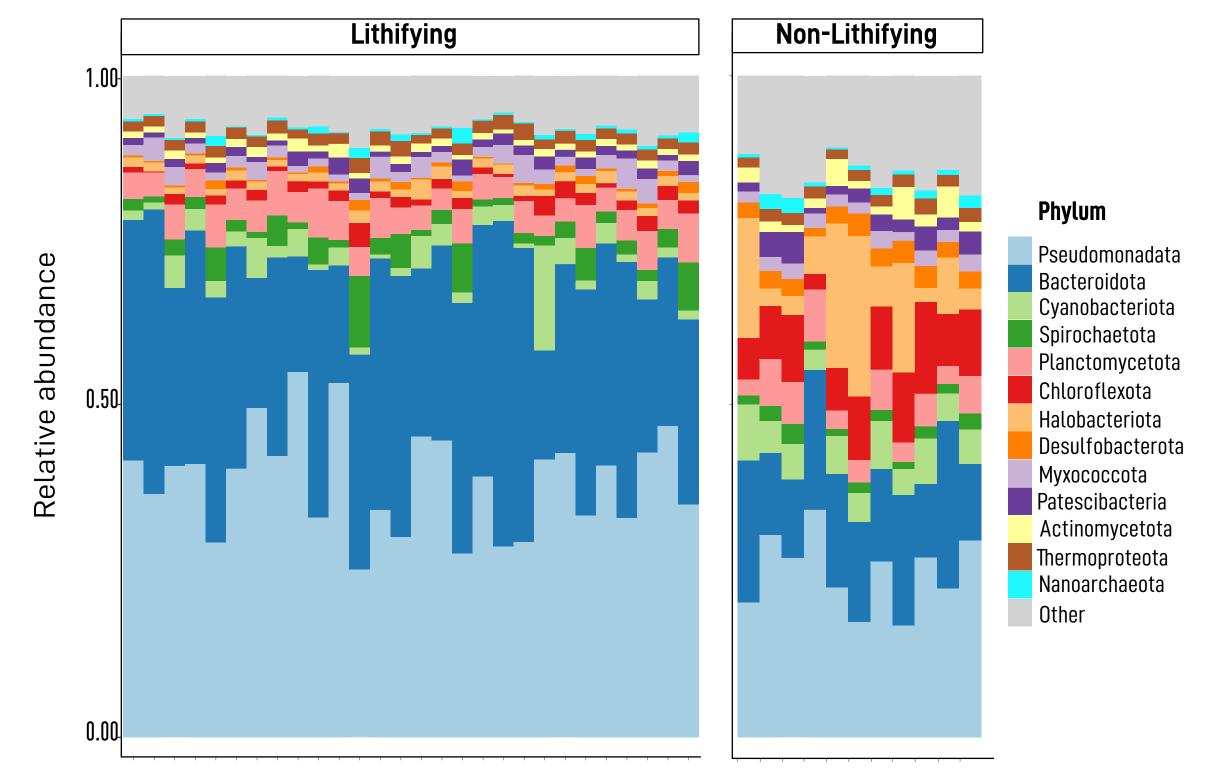
### Results:

- Diversity and functional profile analyses show differences between lithifying and non-lithifying microbial mats.
- There are differences in energy and carbon sources utilization based on the type of microbial mat, whether lithifying or non-lithifying.

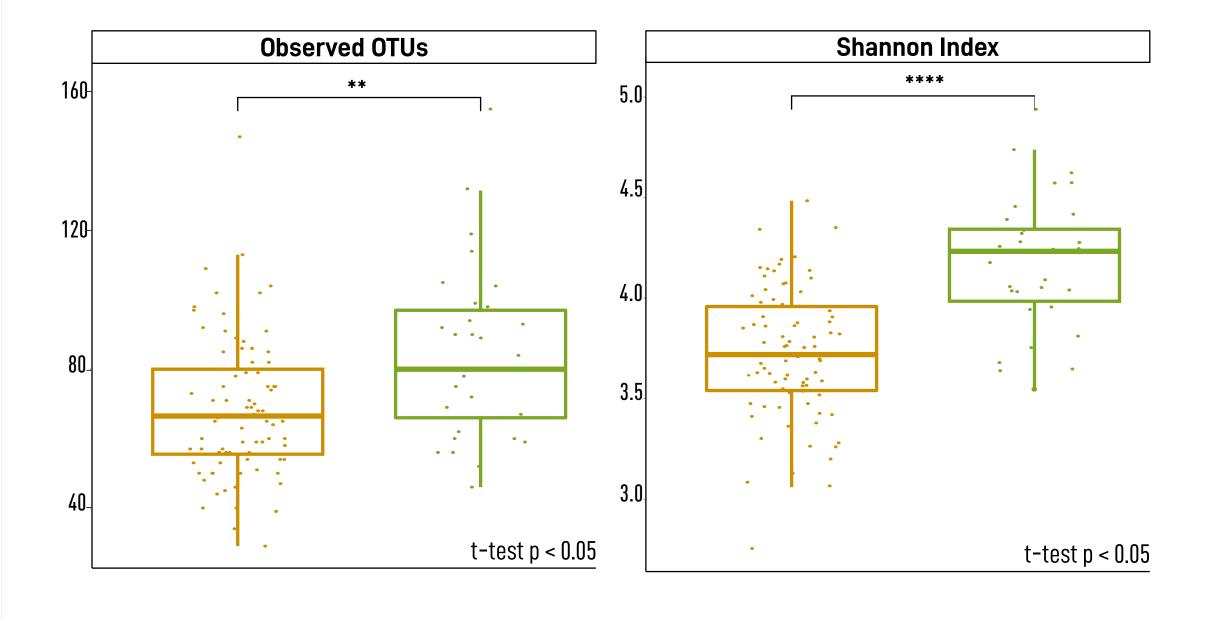
# Microbial mats Lithifying Non-Lithifying Segment Non-Lithifying Segment Porth Segment DNA extraction Segment Segment Segment Segment Segment Non-Lithifying Non-Lithifying Segment Segment

### Results

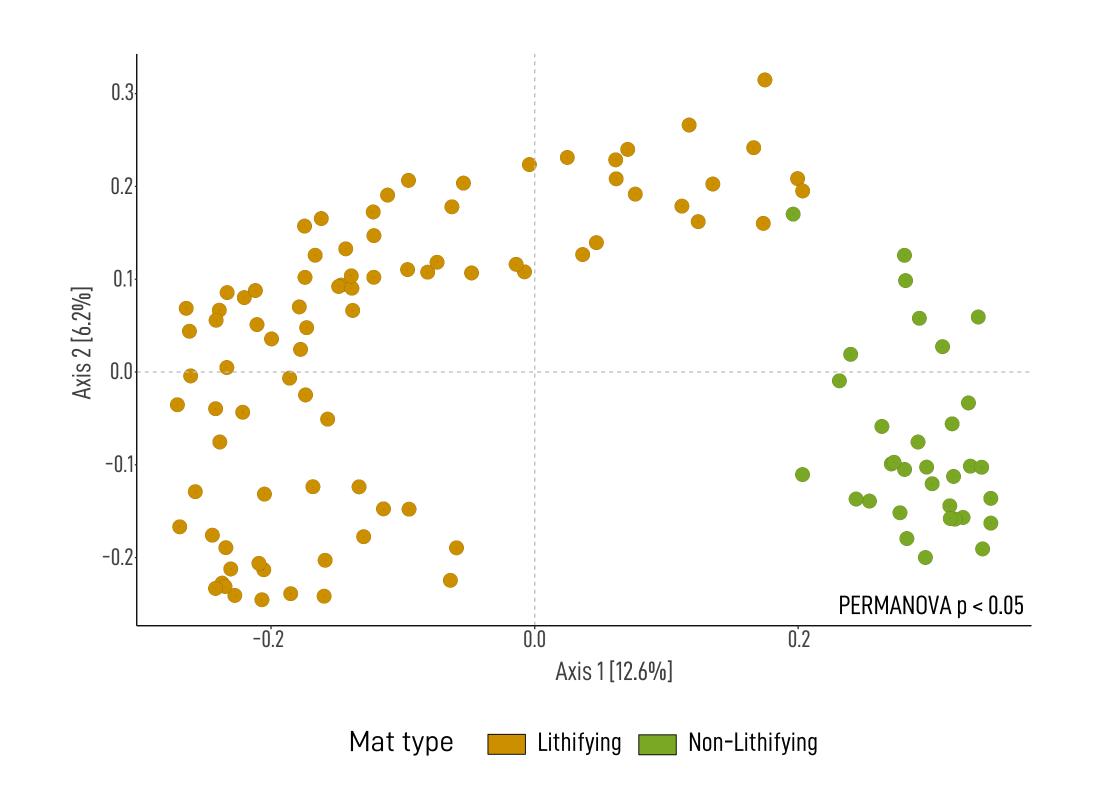
### Taxonomy profile - SingleM



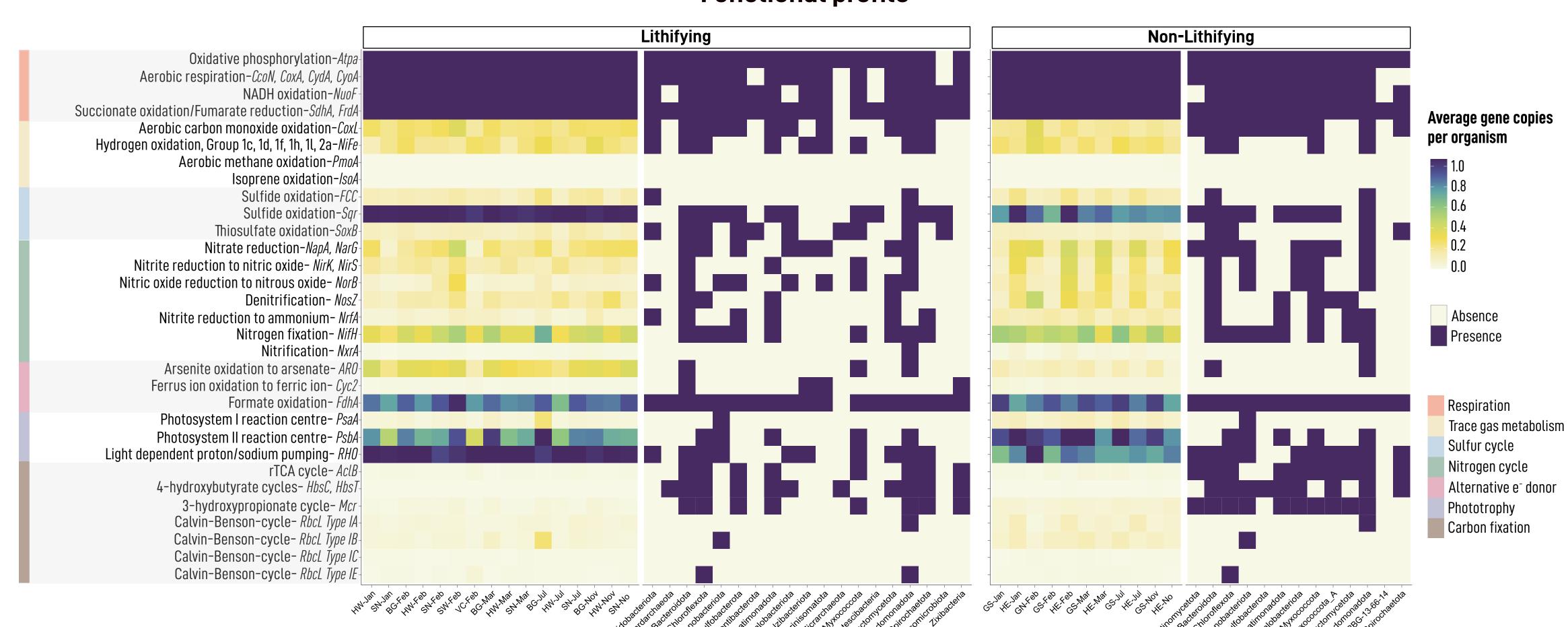
## Alpha diversity



### **Beta diversity**



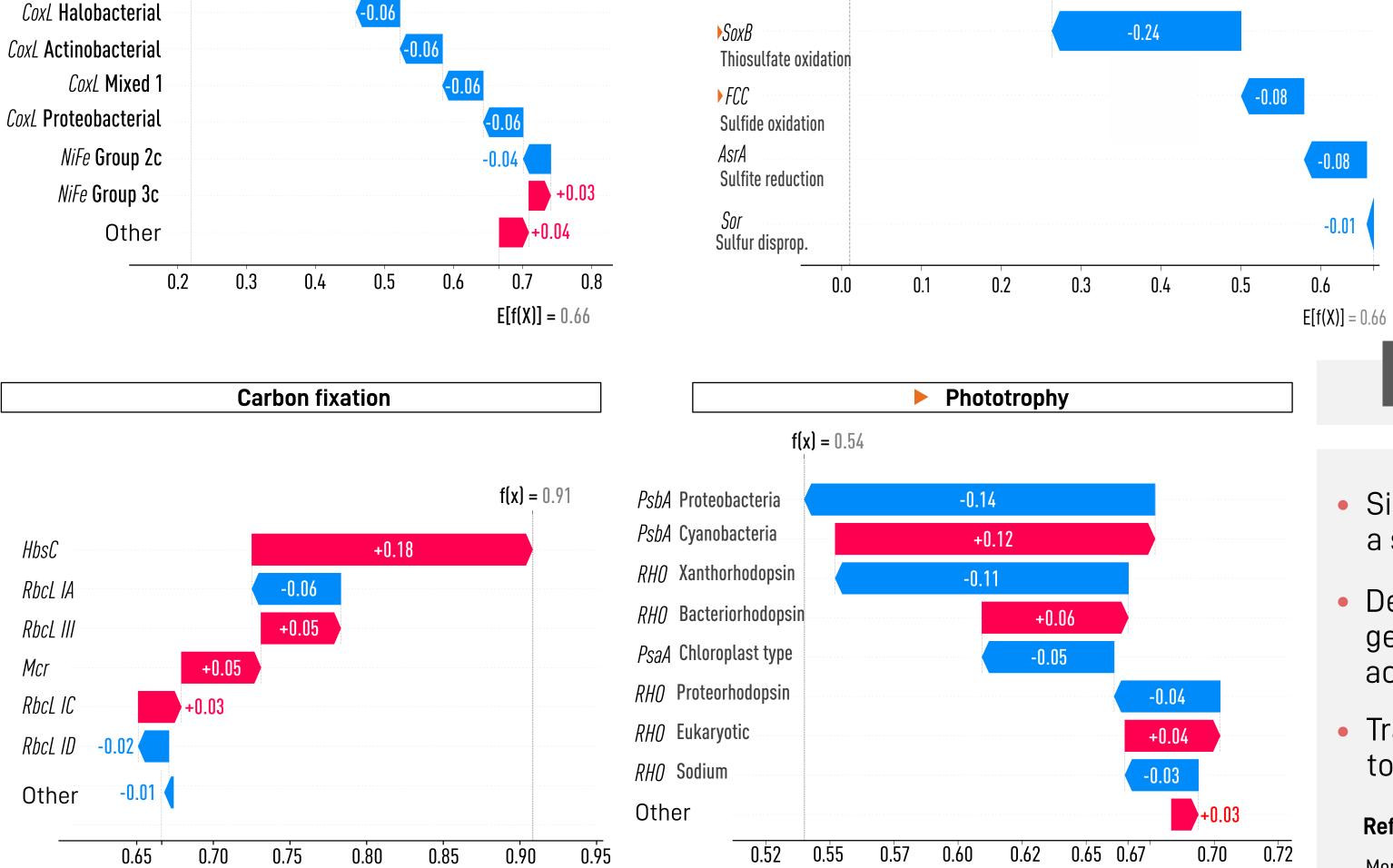
### Functional profile



### Random Forest model

Sulfur cycle

f(x) = 0.01



Lithifying Non-Lithifying

| Nifth | -0.22 | Nitrogen fixation | NapA, NarG | Nitrate reduction | NarA | Nitrite oxidation | NorB | -0.05 | Denitrification | NirK, NirS | Nitrite reduction | NosZ | -0.03 | Denitrification | NrfA | Nitrite reduction | NosZ | -0.03 | Denitrification | NrfA | Nitrite reduction | NosZ | -0.03 | Denitrification | NrfA | Nitrite reduction | NosZ | -0.03 | Denitrification | NrfA | Nitrite reduction | NosZ | -0.05 | Denitrification | NrfA | Nitrite reduction | NosZ | -0.05 | Denitrification | NrfA | Nitrite reduction | NosZ | -0.06 | Denitrification | Denitrification | NosZ | -0.06 | Denitrification | Denitrification | Denitrification | NosZ | -0.06 | Denitrification | Denitrification | NosZ | -0.06 | Denitrification | Denitrification

Nitrogen cycle

- Significant differences in community structure suggest a shift likely associated with the process of lithification.
- Despite similar gene presence, ML analysis shows lower gene abundance in lithifying mats, suggesting reduced activity.
- Trace gases, lithic compounds, and solar energy appear to be crucial energy sources for lithifying processes.

### References:

E[f(X)] = 0.66

Conclusion

Mendes Monteiro, J., Vogwill, R., Bischoff, K., & Gleeson, D. B. (2020). Comparative metagenomics of microbial mats from hypersaline lakes at Rottnest Island (WA, Australia), advancing our understanding of the effect of mat community and functional genes on microbialite accretion. Limnology and Oceanography, 65(S1). https://doi.org/10.1002/lno.11323