

The microbiome of the dominant algae in glacier-fed streams

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Introduction

- Hydrurus foetidus* is a major player in glacier-fed streams.
- Unicellular** algae which form **macroscopic** structures (up to 30cm).
- Seasonal blooms occur under **oligotrophic** conditions.
- Does *H. foetidus* have a distinct microbial community, and how does it change across seasons?**

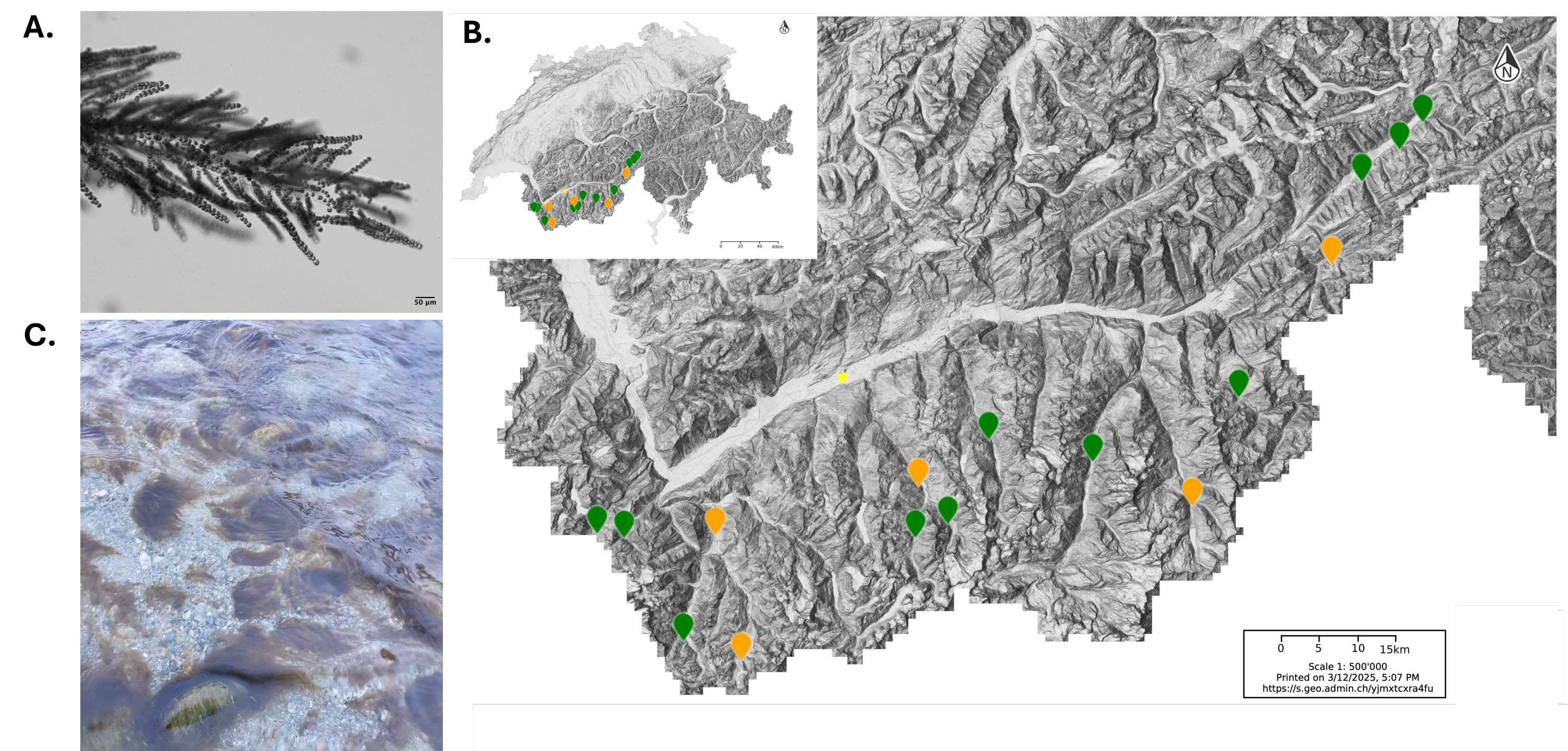


Figure 1: A. Microscopy image of *H. foetidus*. B. Sampling map of streams sampled in Winter and Autumn 2024 (green pin) or only in Winter 2024 (orange pin). For each site, *H. foetidus* was sampled in triplicates and streamwater was filtered for microbial community analysis. C. Bloom of *H. foetidus*, Blatten, 01.12.2023.

Methods

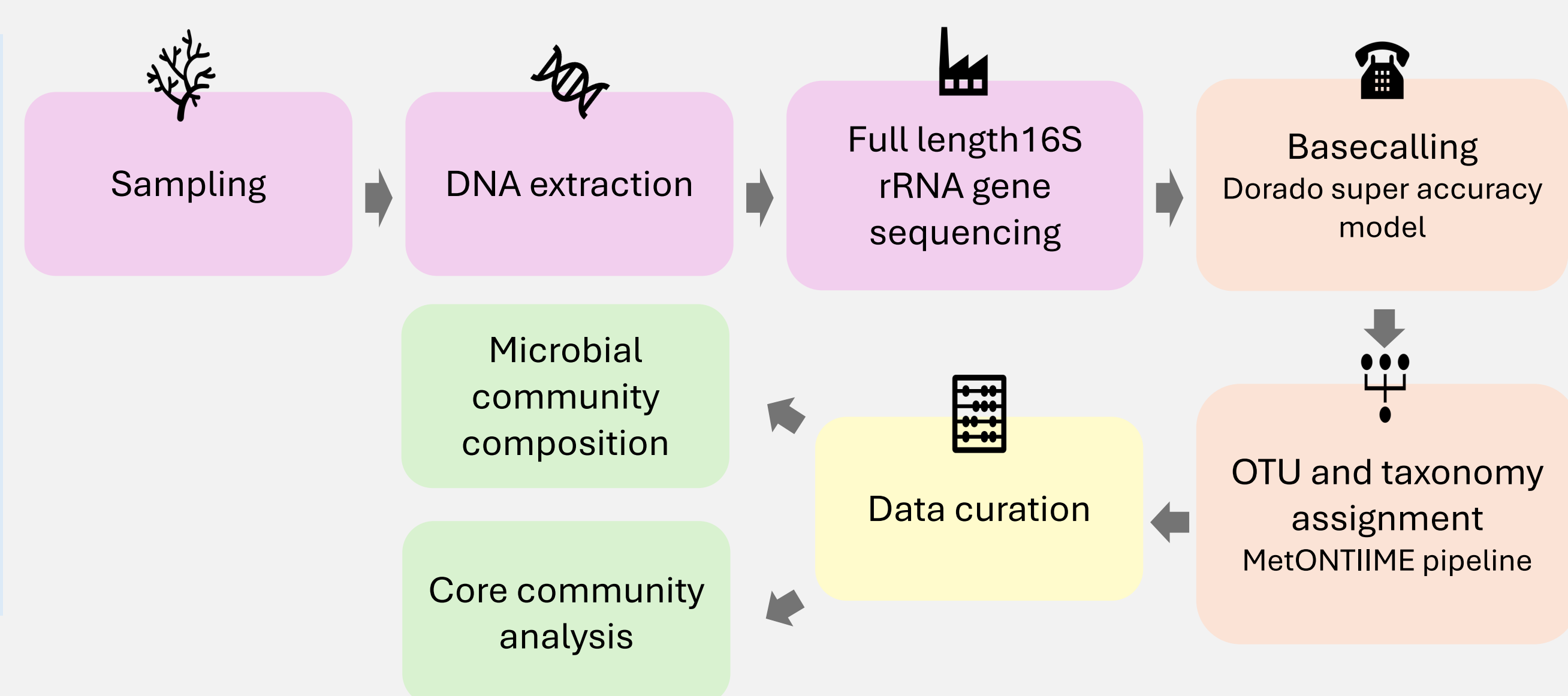


Figure 2: Visual summary of bioinformatic analyses performed.

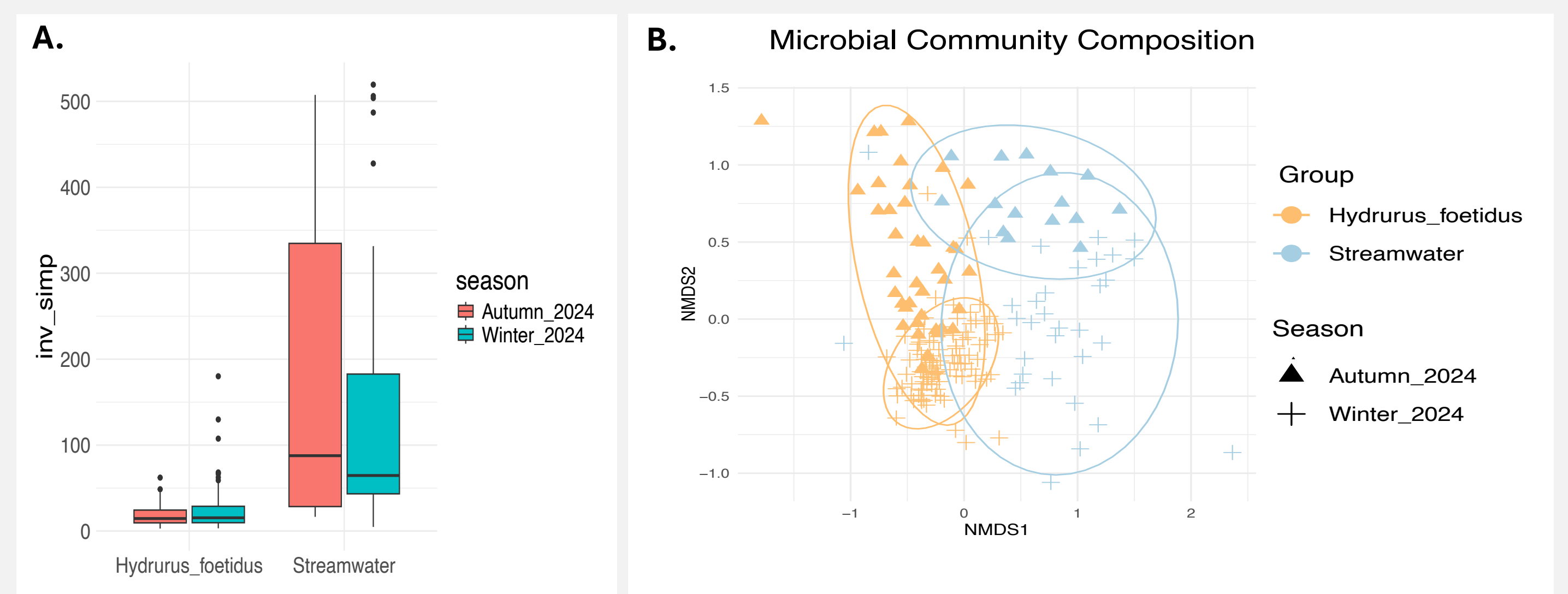


Figure 3: A. Alpha diversity (inverse Simpson index) of *H. foetidus* and Streamwater samples across seasons. Wilcoxon test on sample type: p -value < 0.001; Wilcoxon test for seasonal differences: not significant. B. NMDS of the microbial community of *H. foetidus* (orange) and Streamwater (blue) samples across autumn (triangle) and winter (cross). PERMANOVA p -values < 0.001.

Results

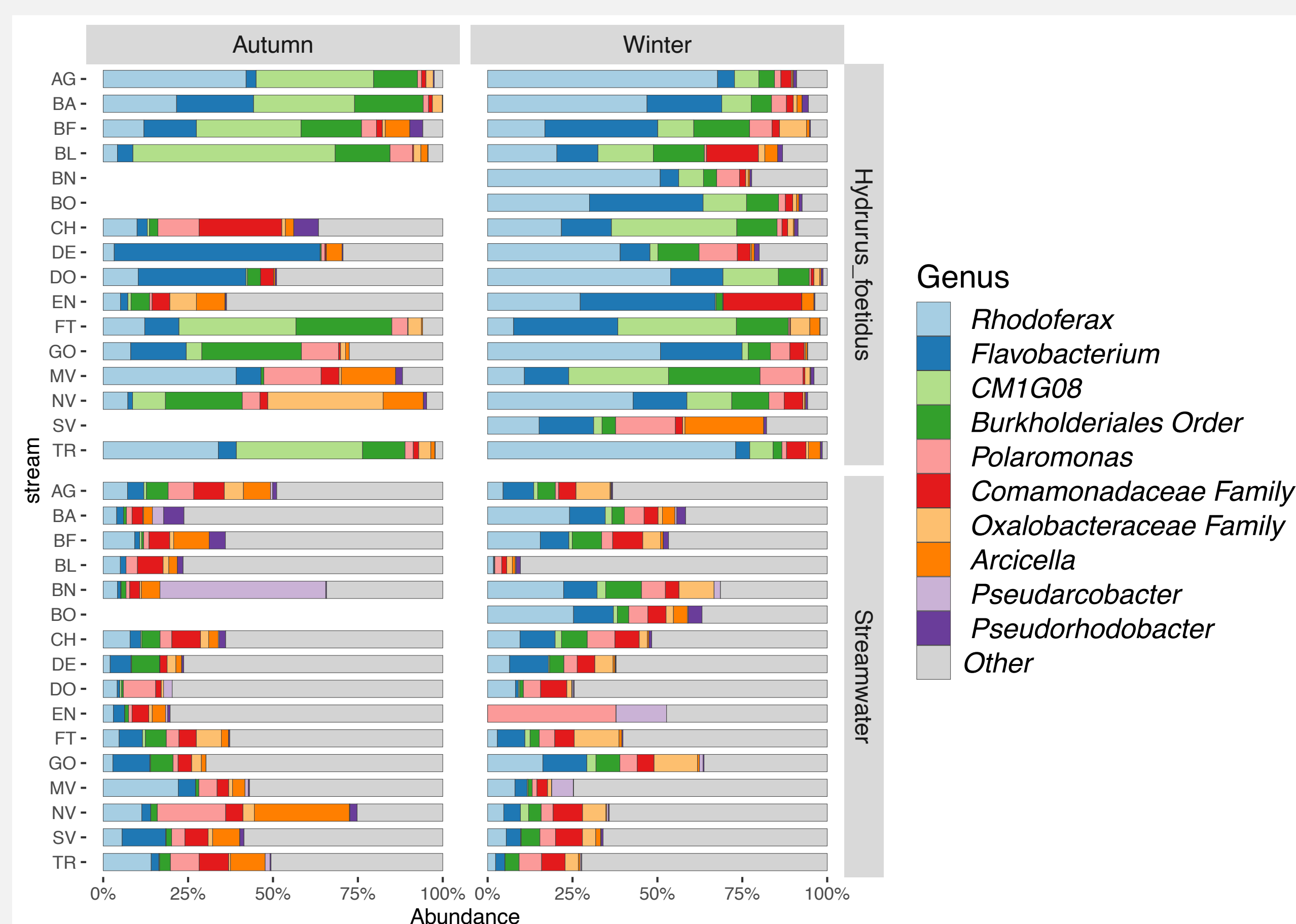


Figure 4: Microbial community composition of *H. foetidus* and Streamwater samples (rows) across seasons (columns). Empty columns stand for streams not sampled.

Phylum	Class	Order	Family	Genus	Log2FoldChange	AdjustedPValue	Regulation
Proteobacteria	Gammaproteobacteria	Burkholderiales	Methylophilaceae	Methylotenera	-2.38	5.76E-03	Down
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Polaromonas	-1.26	8.77E-04	Down
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Rhodoferrax	-1.14	1.45E-04	Down
Verrucomicrobiota	Verrucomicrobiae	Verrucomicrobiales	Rubritaleaceae	Luteolibacter	-4.32	6.84E-05	Down
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Hydrogenophaga	-5.48	9.49E-06	Down
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Polaromonas	-2.37	4.92E-06	Down
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Leptothrix	-6.19	2.56E-09	Down
Bacteroidota	Bacteroidia	Cytophagales	Spirosomaceae	Arcicella	-1.01	1.36E-11	Down
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Sphaerotilus	-5.45	8.64E-14	Down

Table 1: Taxa significantly less abundant in *H. foetidus* samples in Autumn compared to Winter.

Phylum	Class	Order	Family	Genus	Mean abund (%)
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Rhodoferrax	33.43
Bacteroidota	Bacteroidia	Flavobacteriales	Flavobacteriaceae	Flavobacterium	16.96
Proteobacteria	Gammaproteobacteria	Burkholderiales	Oxalobacteraceae	CM1G08	15.11
Proteobacteria	Gammaproteobacteria	Burkholderiales	NA	NA	10.91
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	Polaromonas	4.33
Proteobacteria	Gammaproteobacteria	Burkholderiales	Comamonadaceae	NA	2.97
Proteobacteria	Gammaproteobacteria	Burkholderiales	Oxalobacteraceae	NA	2.9
Bacteroidota	Bacteroidia	Cytophagales	Spirosomaceae	Arcicella	1.78
Proteobacteria	Alphaproteobacteria	Rhodobacterales	Rhodobacteraceae	Pseudorhodobacter	0.85

Table 2: Composition of *H. foetidus* core microbial community and its taxa mean abundance with 75% prevalence across *H. foetidus* samples.

Conclusion

- H. foetidus* harbours its own microbial community** which differs from the streamwater. It is enriched in *Rhodoferrax*, *Flavobacterium*, and *CM1G08*, a genus from the *Oxalobacteraceae* family.
- H. foetidus* associated microbial community **varies significantly across season** and is enriched in *Rhodoferrax*, *Polaromonas*, and *Arcicella* genera in winter.
- H. foetidus* has a **core community** i.e., microbial community independent of space and time, which dominates its global microbial community.

References: Klaveness D. Hydrurus foetidus (Chrysophyceae)—an inland macroalga with potential. J Appl Phycol. 2017 Jun;29(3):1485–91.

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