Recurrent and unique patterns of microbial seasonality in the Arctic Ocean revealed by autonomous sampling

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The Arctic is changing

Long-term observations essential:
identify natural variability vs. human impact
The AWI „Hausgarten“ / FRAM LTER
Year-round moorings + annual summer expeditions

- Biology from surface to seafloor
- Physical oceanography
- Benthopelagic coupling

Images of sediment trap, AUV, Lander, and MUC.
High-resolution, automated microbial time-series

Remote Access Sampler

Dynamics and drivers of Arctic microbiomes
Amplicon and metagenome sequencing
Context with nutrients & oceanography
Annual oscillations in microbes & nutrients

Wietz et al. doi: 10.1101/2021.04.08.436999
Three annual cycles: consistent seasonal boundaries
Recurrent patterns in major planktonic microbes
However:

bloom phenologies differ
Microbial modules and their drivers

- **Summer-autumn**: *** *** ** ***
- **Autumn-winter**: *** n.s. * n.s.
- **Mid-winter**: *** *** *** ***
- **Winter-spring**: *** *** ** ***
- **Spring-summer**: *** n.s. * n.s.

Ecotypes?

- **NS9 marine group**
- **SAR92 clade**
Functional seasonality: metagenomes from polar night

- Carbohydrates - 146,419 (11.90%)
- Amino Acids and Derivatives - 131,952 (10.73%)
- Miscellaneous - 110,672 (9.00%)
- Protein Metabolism - 94,607 (7.69%)
- Cofactors, Vitamins, Prosthetic Groups, Pigments - 82,568 (6.57%)
- RNA Metabolism - 73,391 (5.97%)
- Fatty Acids, Lipids, and Isoprenoids - 55,541 (4.52%)
- Cell Wall and Capsule - 49,002 (3.98%)
- DNA Metabolism - 36,808 (3.16%)
- Stress Response - 34,403 (2.80%)
Perspectives

• Towards a system-level understanding of (temporal) ecosystem structuring
• Functional capacities in context of the Biological Carbon Pump
• Define community indicators for specific times and conditions
• Baseline for modelling the future Arctic Ocean microbiome

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