TRABAJANDO
JUNTOS
PARA COMBATIR
LA RESISTENCIA
A LOS ANTIMICROBIANOS

Financiado por la Unión Europea

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Serie de webinars sobre animales acuáticos

Webinar 3: Diagnósticos tempranos de enfermedades bacterianas

CASA
CENTER FOR ANTIMICROBIAL STEWARDSHIP IN AQUACULTURE

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e-DNA analysis for unraveling microbial communities and pathogen dynamics in recirculating aquaculture systems

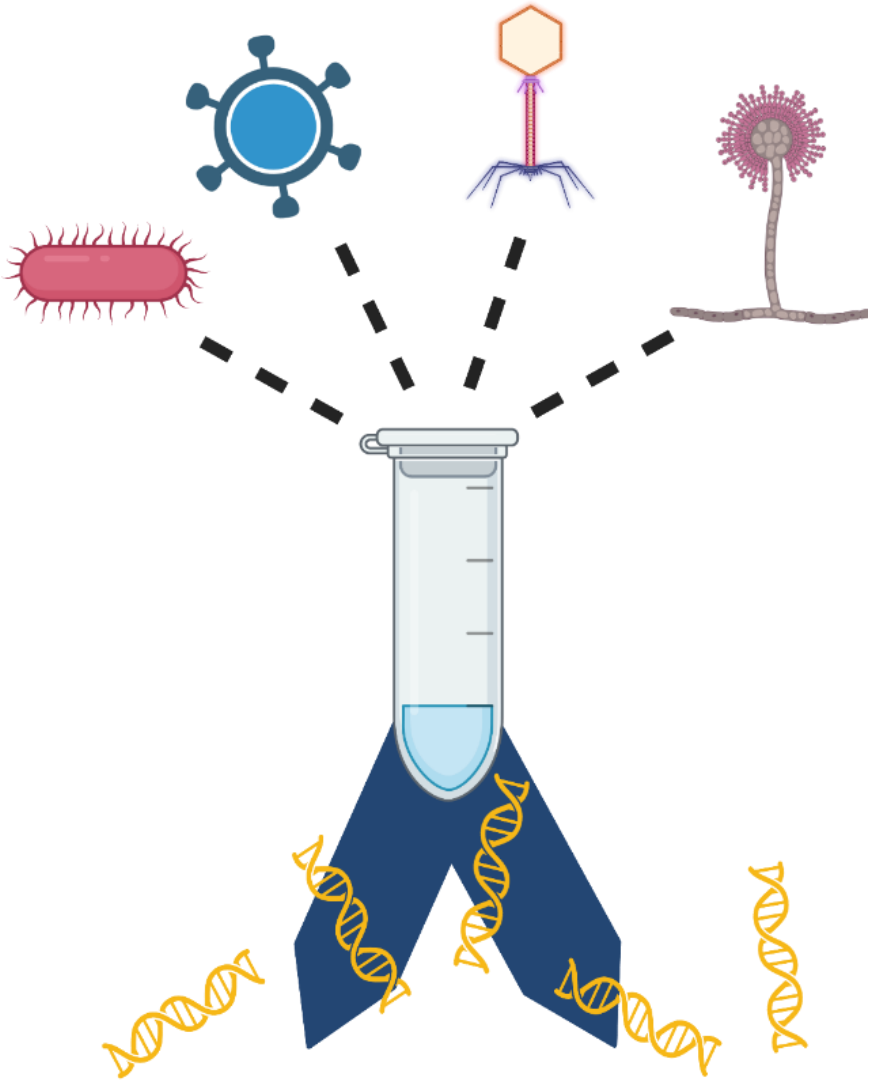
Jessica Rieder

University of Bern (Switzerland)

Institute for Fish and Wildlife Health (FIWI)

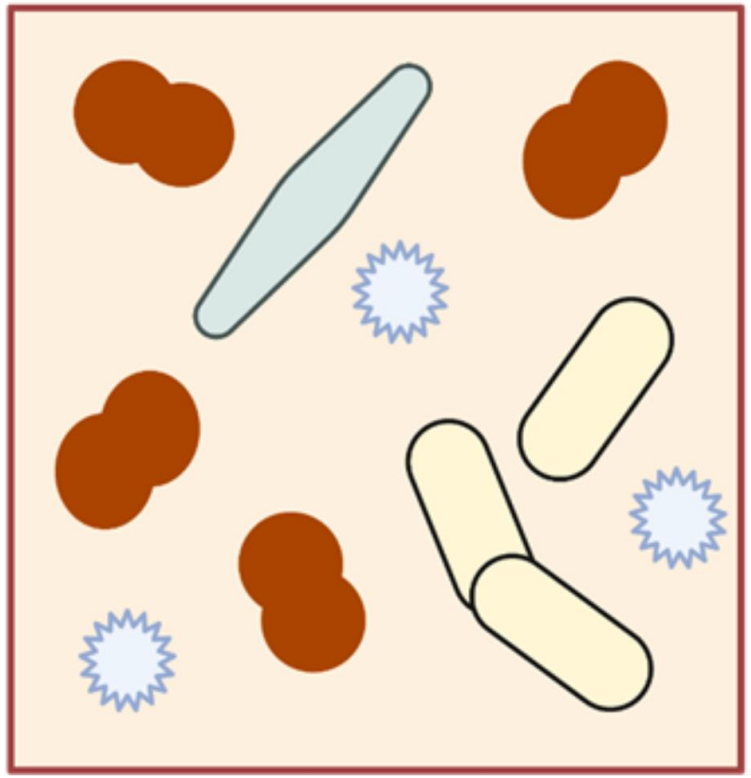
Institute of Ecology and Evolution (IEE)

What is enviromental DNA (eDNA)?



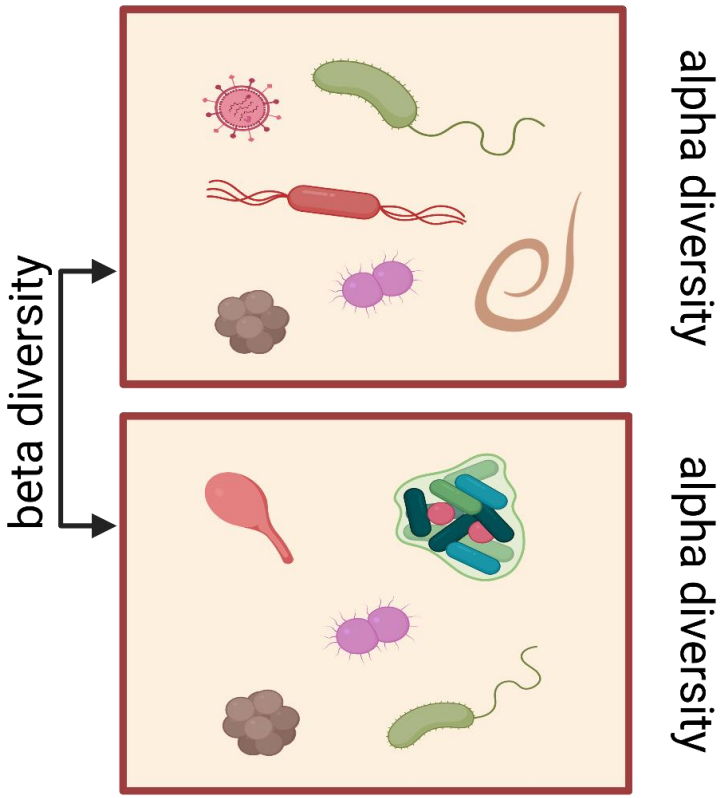
What types of information can be explored with eDNA data?

Community composition



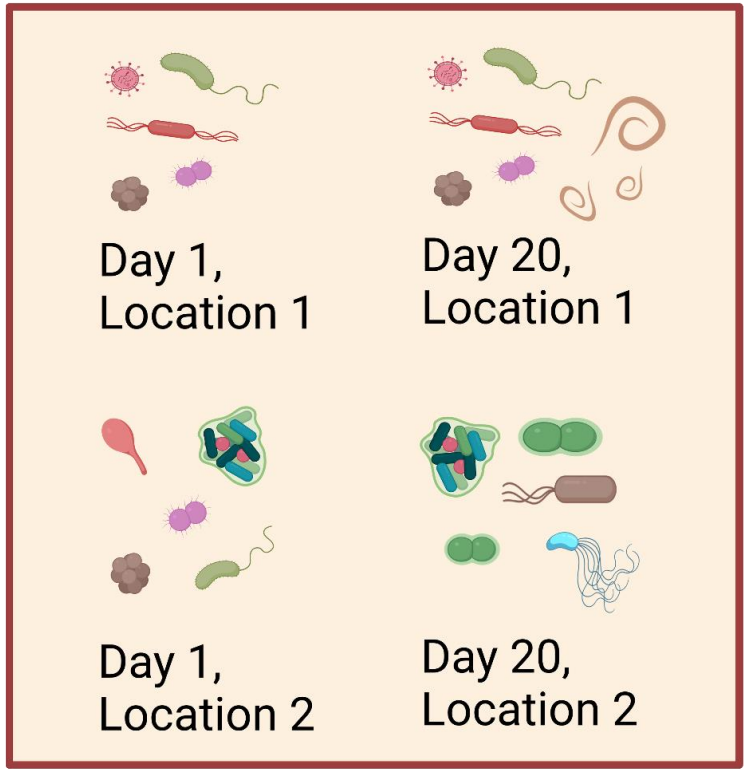
Functional services
Animal health
Pathogens presence

Diversity

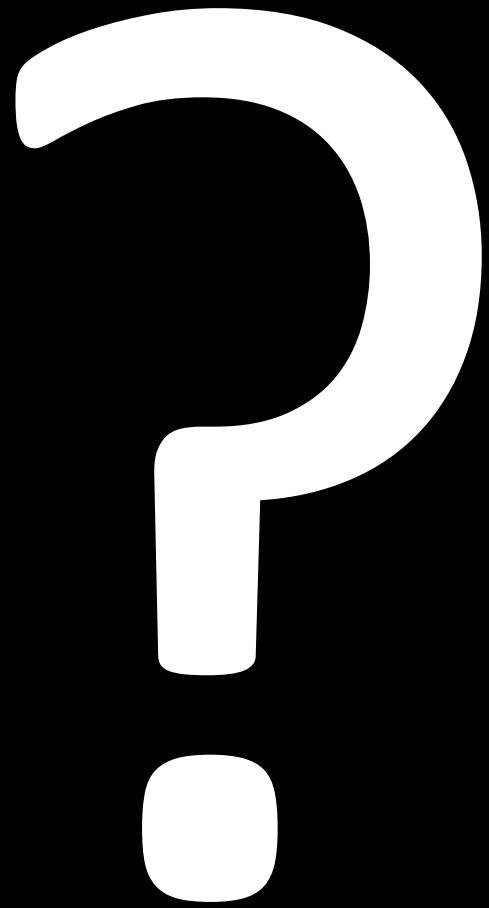


Robustness of a system

Spatiotemporal patterns



How functional services or pathogen presence changes across locations and time



My research explores

Community composition:

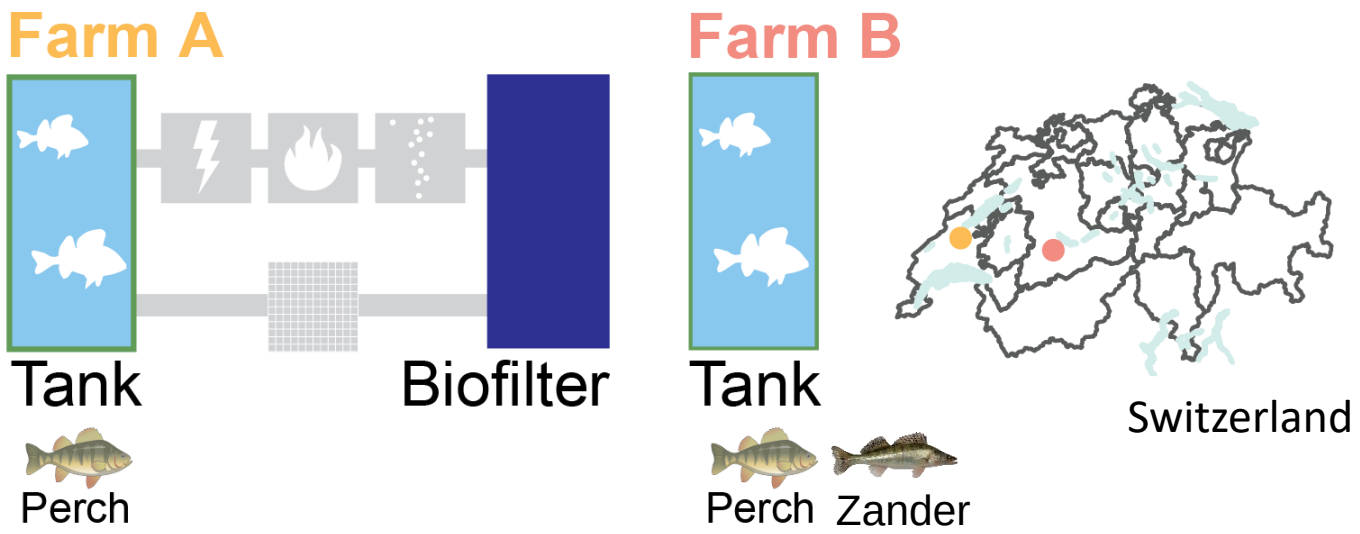
1. How do communties change across farms, compartments, and time?
2. Does management styles impact the communties?

Pathogens detection :

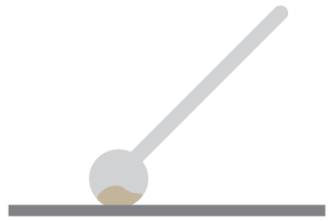
1. Can eDNA methods be used for pathogen surveillance?
2. Do eDNA results support in-house diagnostic reports?

Sampling locations and types of samples collected

Sampling locations



Sample types



Tank biofilm

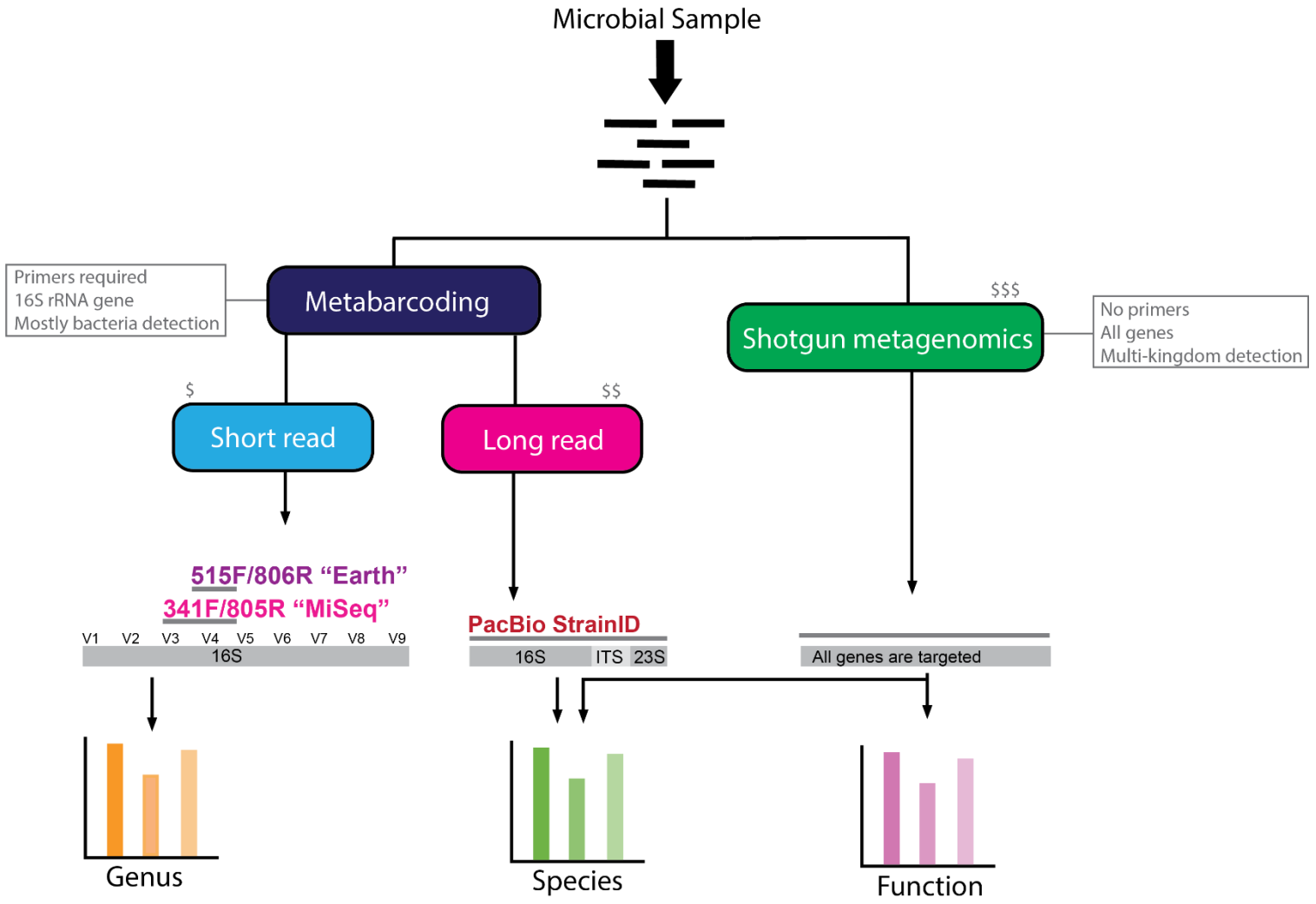
foam swab

Tank water

Biofilter water

120 ml
0.22 um filter

eDNA samples were sequenced with three different sequencing approaches



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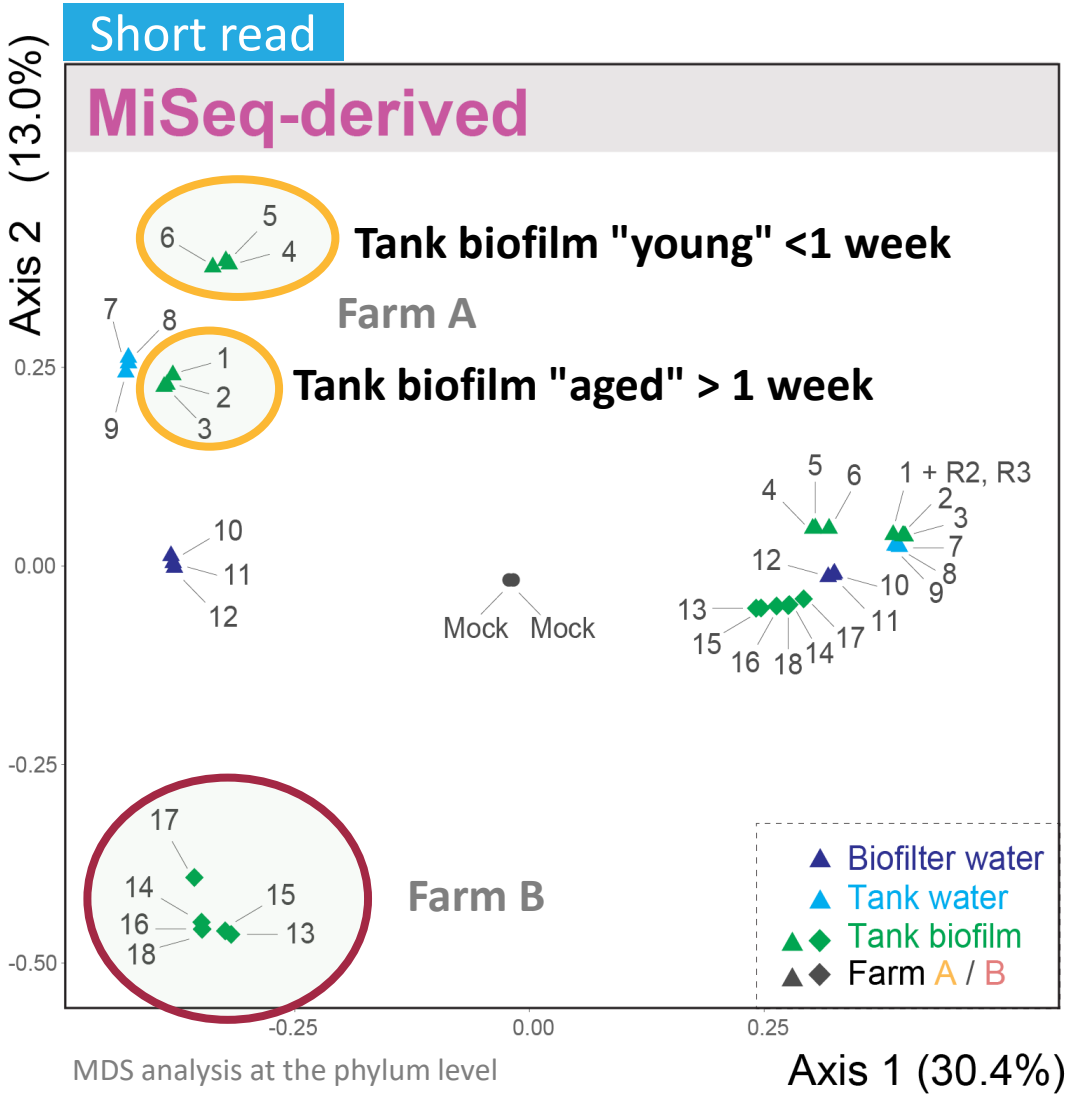
How do biofilm communities change within and between farms, and time?



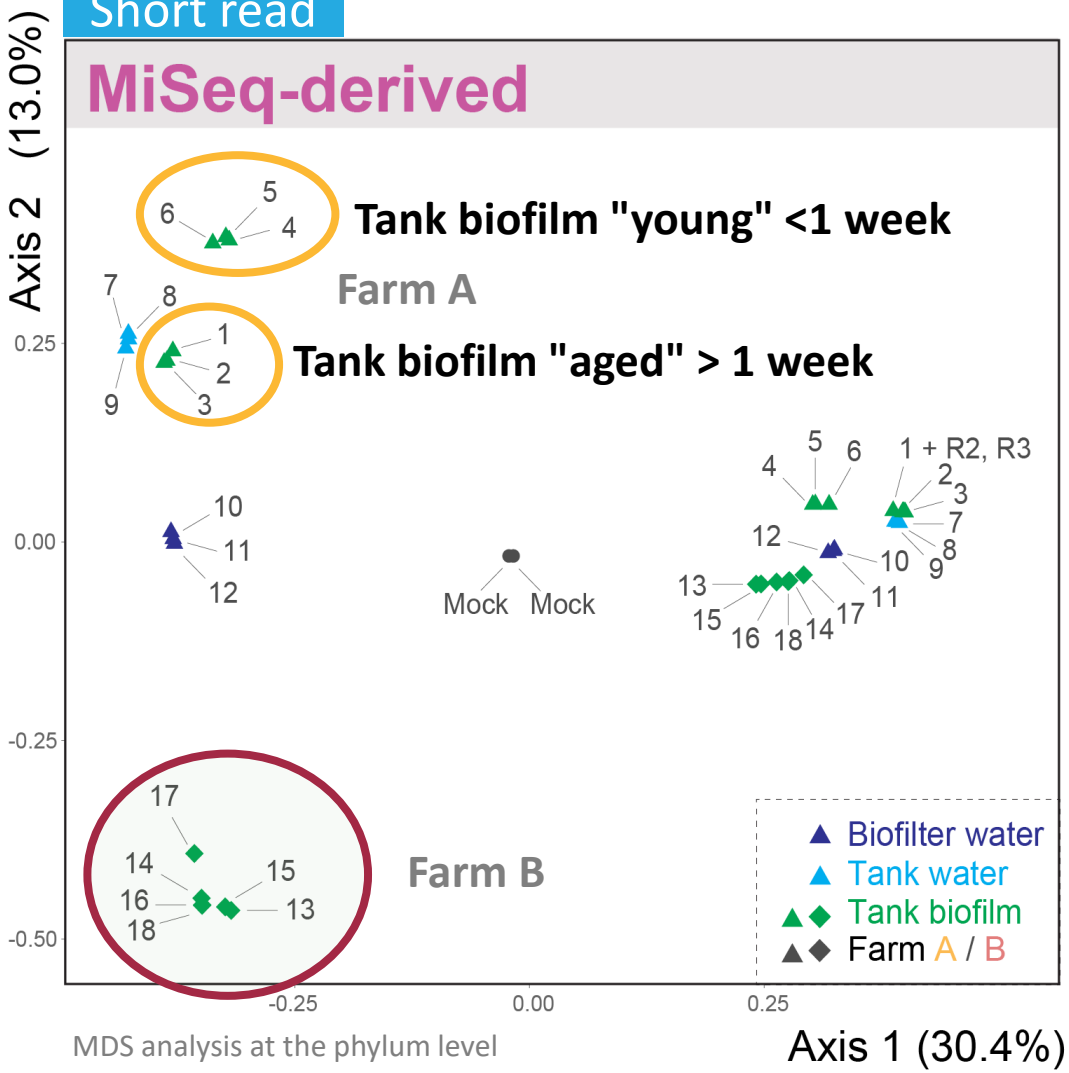
MDS analysis at the phylum level

Rieder (2023)

How do biofilm communities change within and between farms, and time?

Short read

MiSeq-derived



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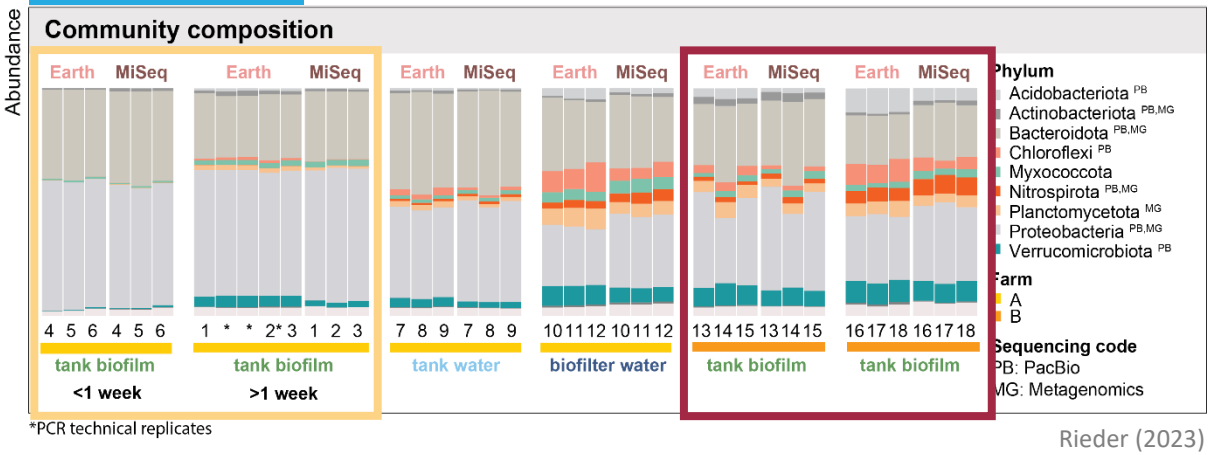

*PCR technical replicates

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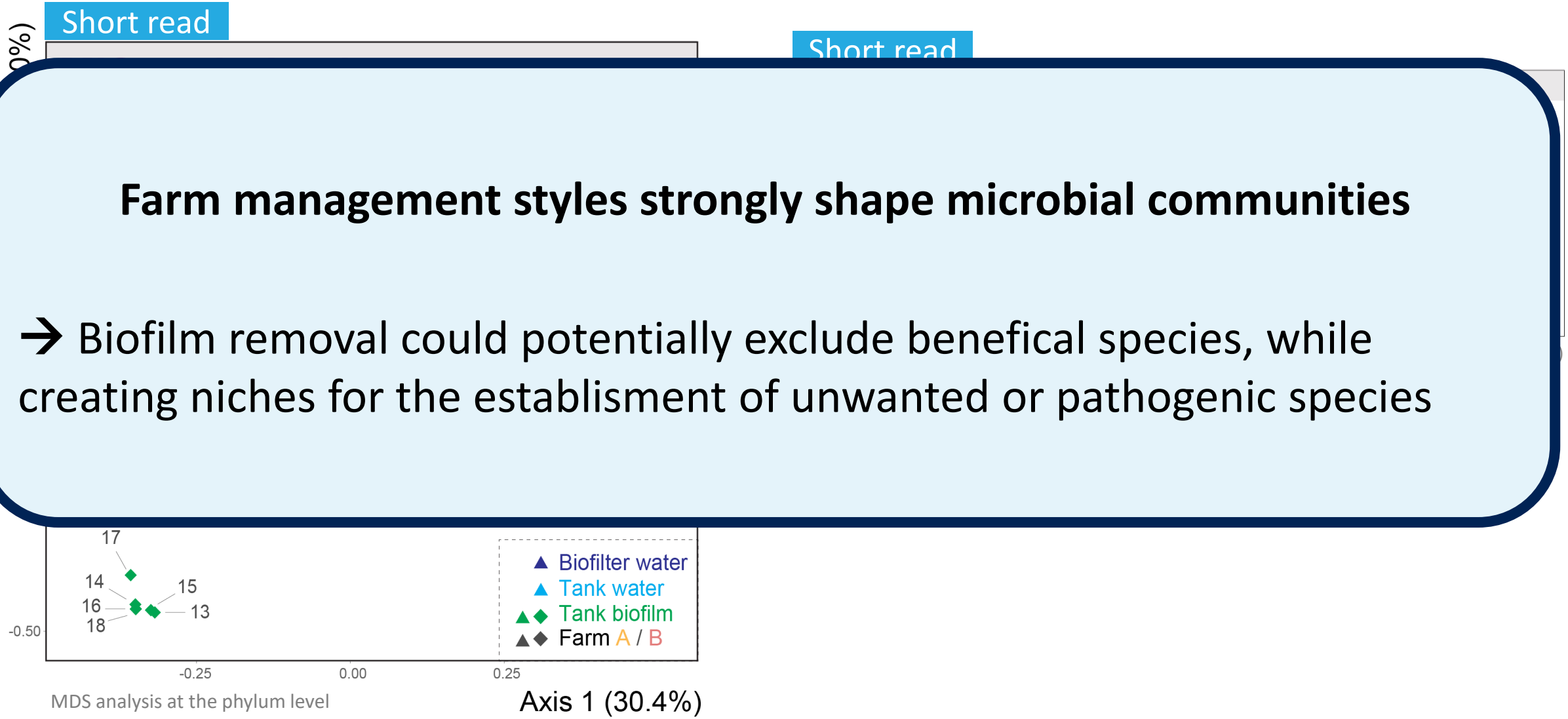


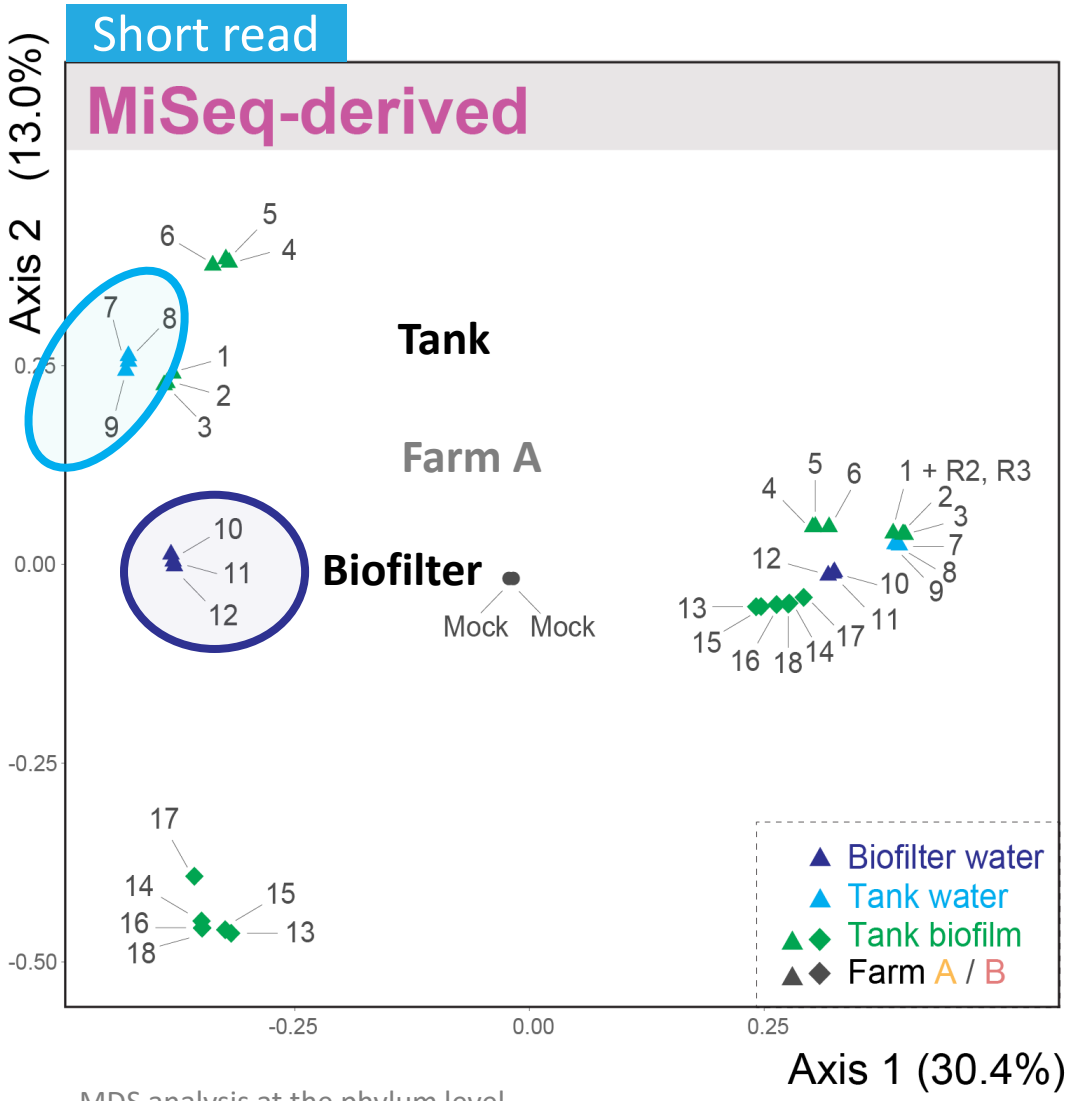
Farm management styles strongly shape microbial communities

→ Biofilm removal could potentially exclude benefical species, while creating niches for the establisment of unwanted or pathogenic species

MDS analysis at the phylum level

Rieder (2023)

How do water communities change between compartments within a farm?



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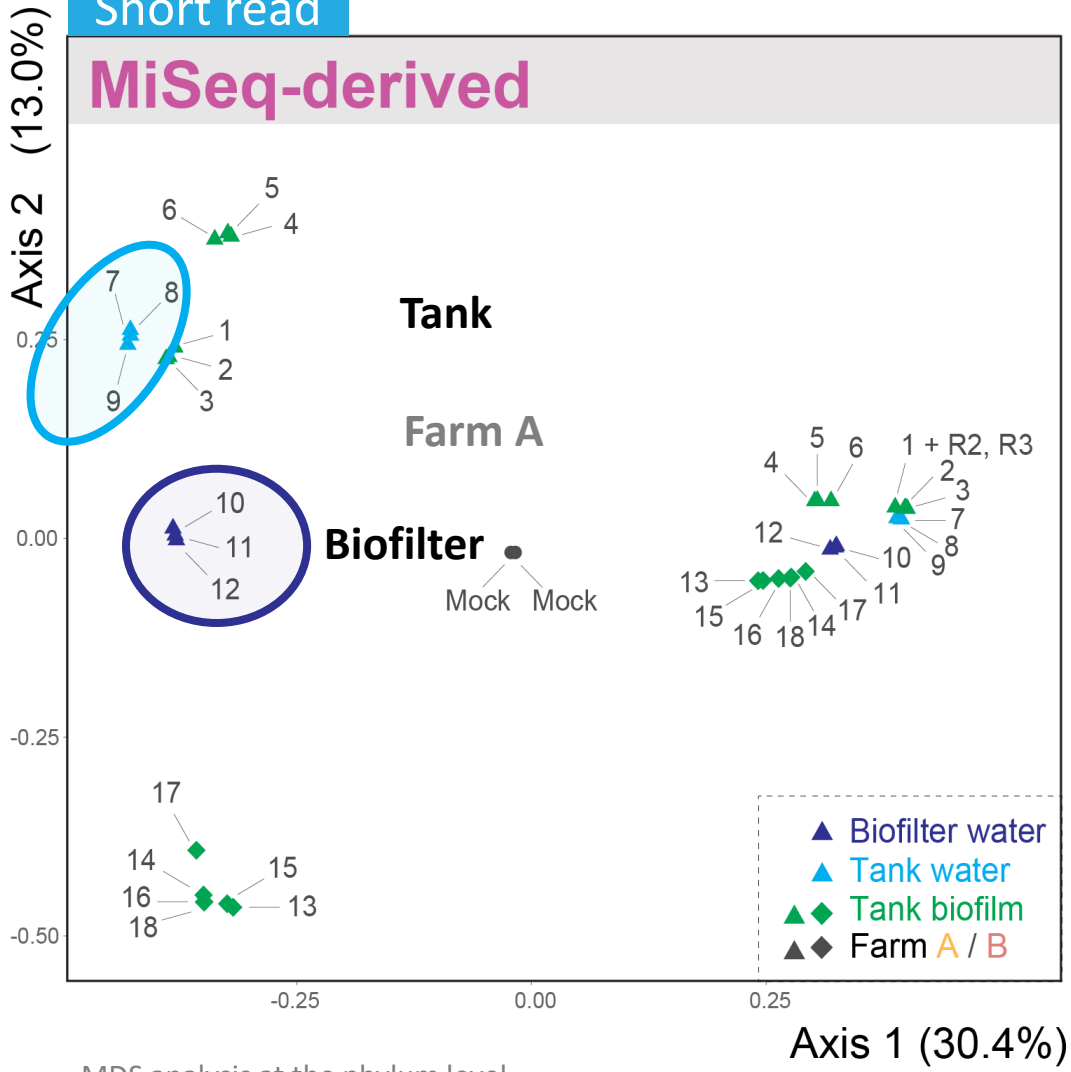

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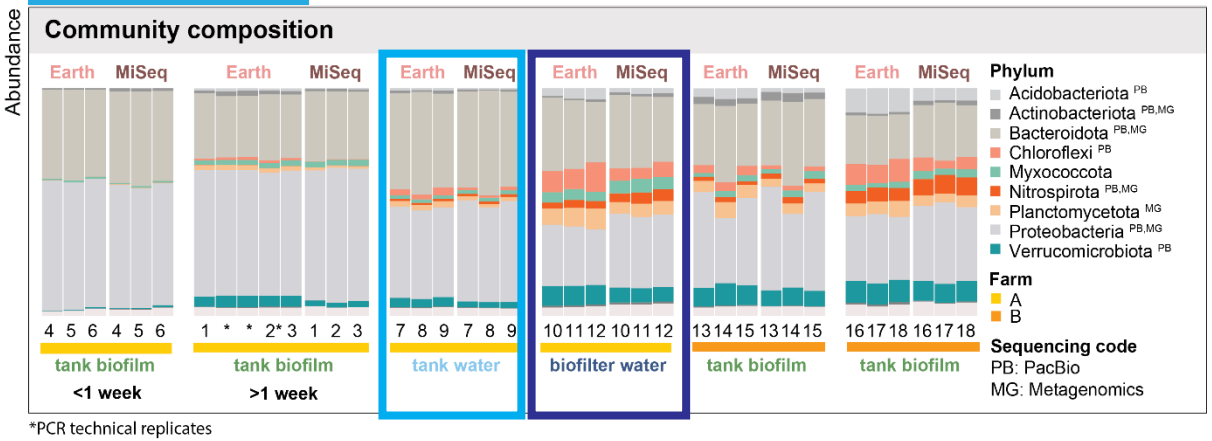

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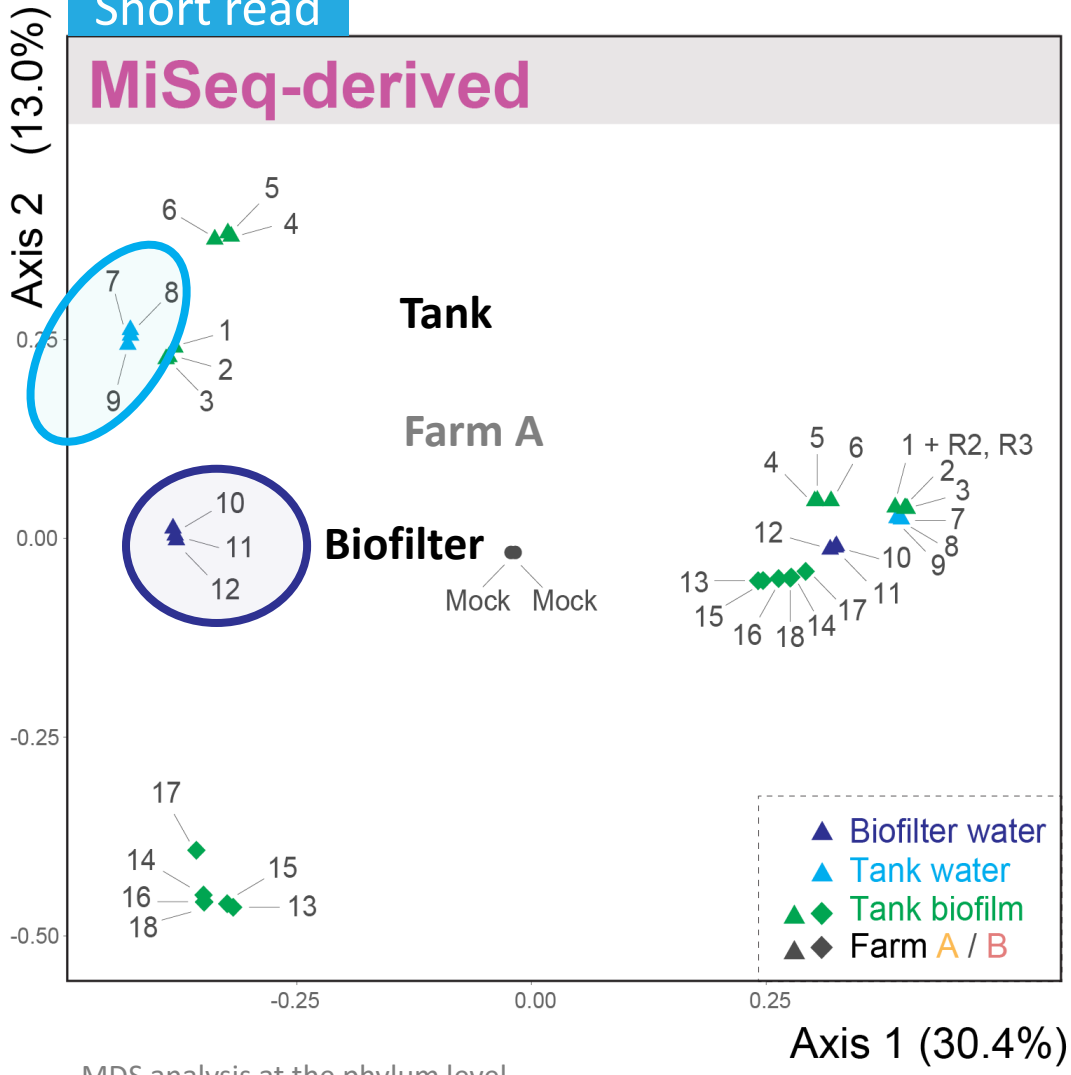

MDS analysis at the phylum level

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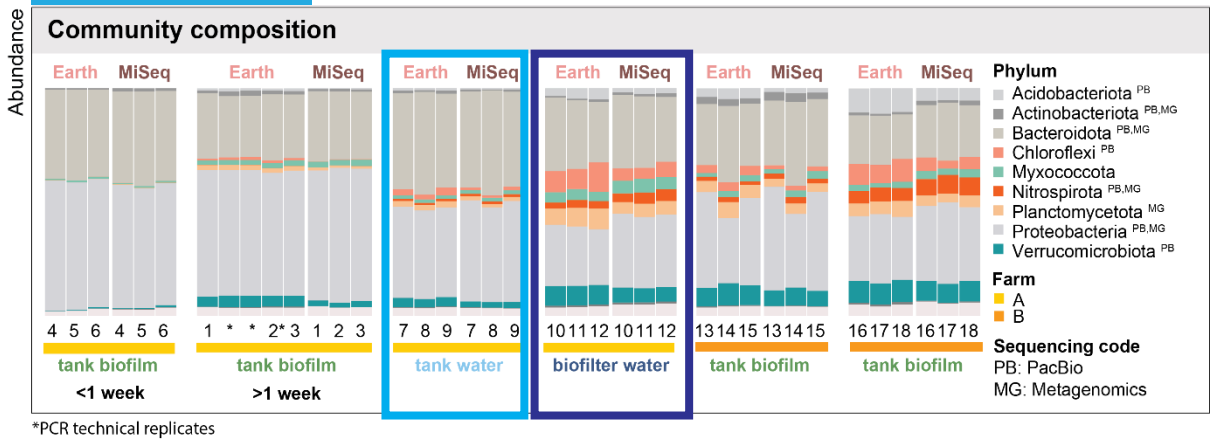
Short read



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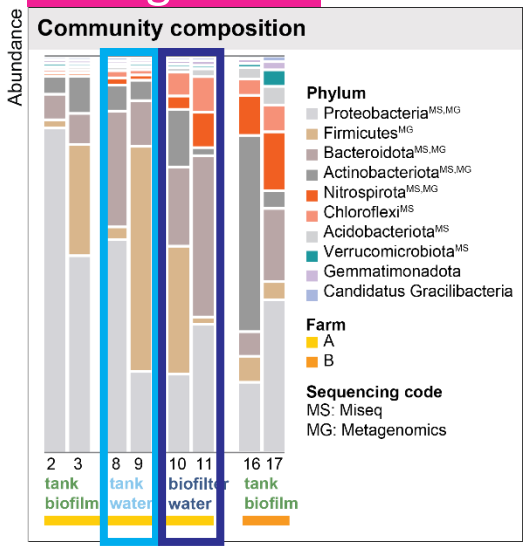
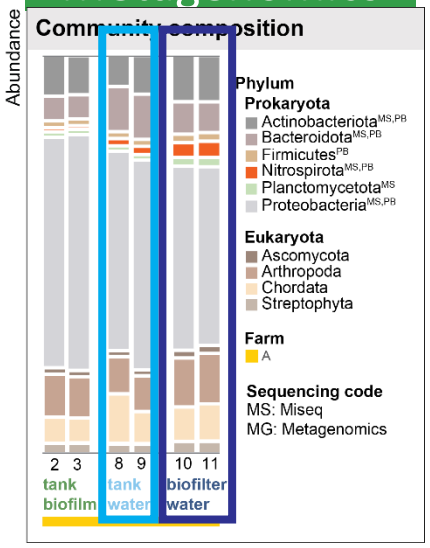
Long read



Rieder (2023)

Metagenomics



Rieder (2023)

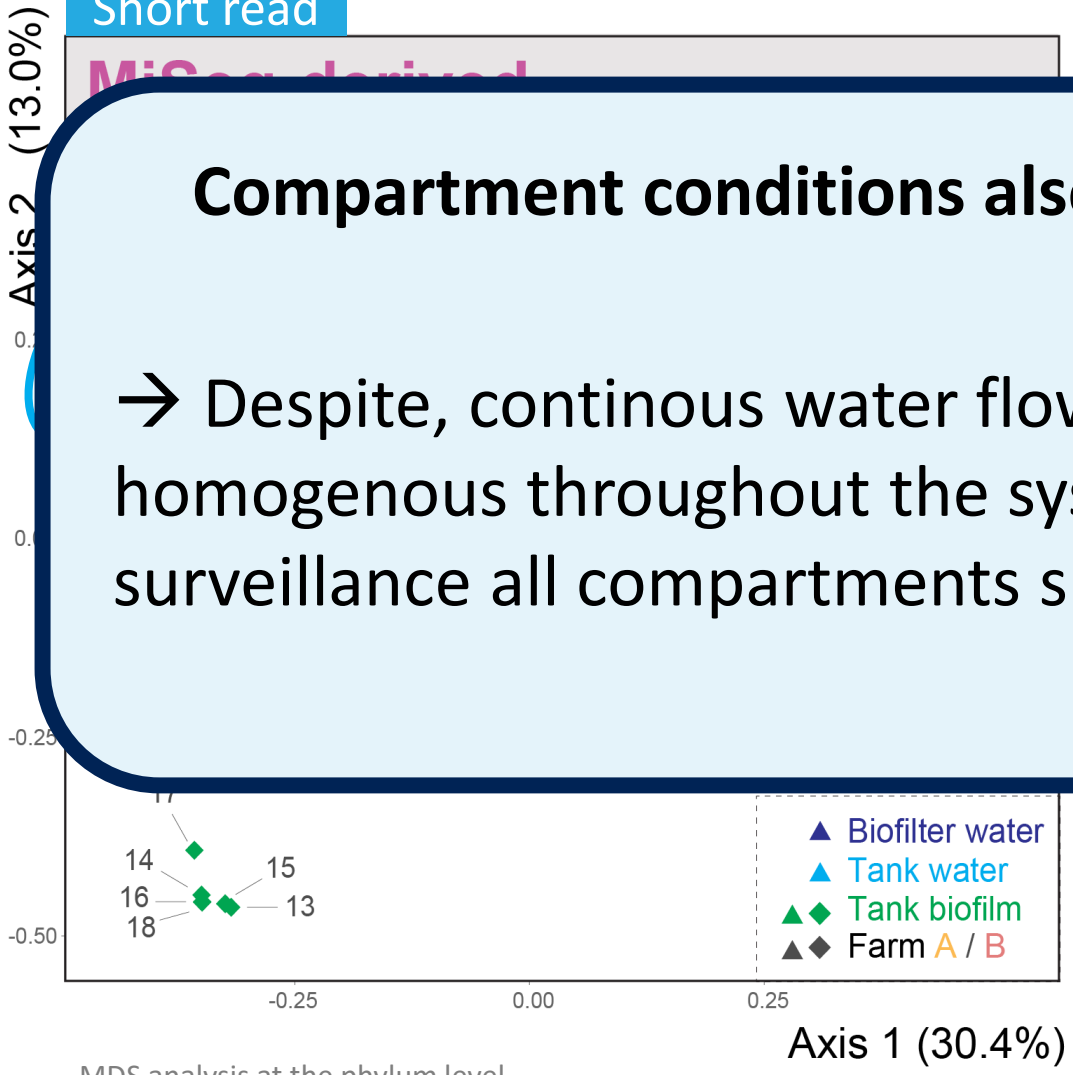
How do water communities change between compartments within a farm?

Short read

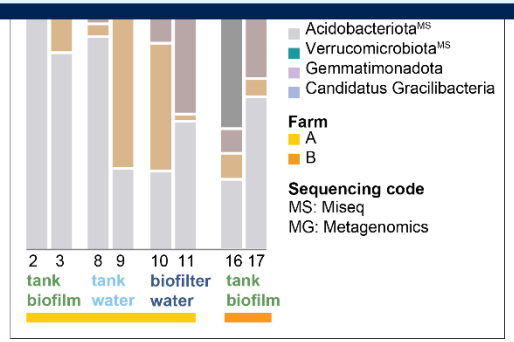
Short read

Compartment conditions also play a role in shaping communities

→ Despite, continous water flow water microbial communities are not homogenous throughout the system. Therefore, for pathogen surveillance all compartments should be sampled



MDS analysis at the phylum level
Rieder (2023)



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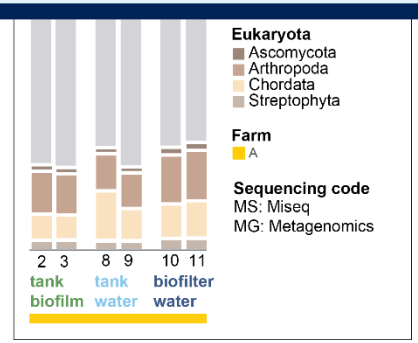

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Long read Metagenomics

Can eDNA methods be used for pathogen surveillance? Support in-house reports?

Who is present?

Flavobacterium succicans – trout gill disease

Flavobacterium columnare – columnaris disease

Flavobacterium psychrophilum – bacterial cold water/rainbow trout fry syndrome

Aeromonas caviae – aeromonas septicaemis

Aeromonas hydrophilia – motile aeromonas septicemia

Aeromonas veronii – ulcer syndrome

Which sample type?

Tank water predominately

Which farm?

Flavobacteria was more present in **Farm A**

Aeromonas was more present in **Farm B**

University of Bern
Institute for Fish and Wildlife Health
Fish Diagnostics*
*national reference laboratory for notifiable fish and aquatic crustacean diseases.

FIWI Institut für Fisch- und Wildtiergesundheit

Were bacterial pathogens present in the farms?

Who is present?

Flavobacterium succicans – trout gill disease

eDNA is adequete for the pathogen surveillance and detection

→ Sequncing approaches offer managers with a highly sensitive and rapid tool for the detection of pathogens

Wh

Flavobacteria was more present in **Farm A**

Aeromonas was more present in **Farm B**

FIWI Institut für Fisch- und Wildtiergesundheit

Summary

Community composition . . .

→ varies across farms with management styles stronly shaping the communties

→ is not homogenous between compartments, suggesting environmental conditions of the compartment plays a role in shaping the communities

→ varies across time, with communties becoming more complex with time

eDNA for pathogen surveillance . . .

→ eDNA is suitable for the monitoring and detection of aquatic pathogens

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Dr. Adamandia "Mado" Kapopoulou

Prof. Kristy Deiner
ETH Zürich
(mentor)

community evolution

THEE

aquatic ecology

FIWI

molecular ecology

bioinformatics

Aquaculture

Enviromental DNA (eDNA)

Microorganims will give you anything you want if you know how to ask them - Kinichiro Sakaguchi

Theoretical Ecology and Evolution (THEE)
Institute for Fish and Wildlife Health (FIWI)

Swiss National Science Foundation

Journal: Environmental Microbiome
Metagenomics and metabarcoding experimental choices and their impact on microbial community characterization in freshwater recirculating aquaculture systems

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¡Thank you! ¡Gracias!

Jessica Rieder. University of Bern, Institute of Ecology and Evolution and Institute for Fish and Wildlife Health.