

# SYSTEMATIC MICROBIOTA PROFILING AND DEVELOPMENT OF DECISION SUPPORT TOOLS FOR NEXT GENERATION AQUACULTURE MANAGEMENT

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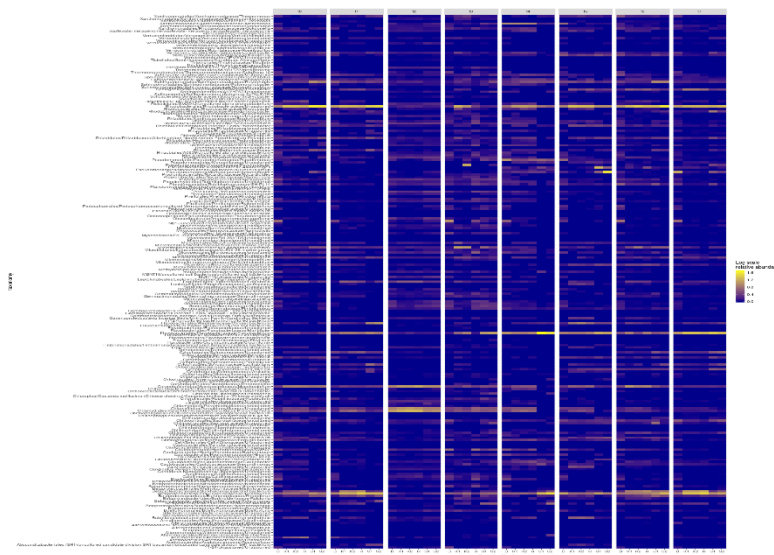
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# MonMic (2017-2020)

- SINTEF, 5 commercial producers of Atlantic salmon smolts (RAS), University of Bielefeld (Germany) and FHF



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# Background

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- The microbiota in land-based aquaculture systems can have great impact on the robustness and health of the fish
- Chemical water quality is well documented, not much is known about the microbiota
- Typical analysis of microbes is mainly limited to the detection of pathogens
  - Often used after a negative impact on fish health has been observed
  - **Counter-actions are often applied too late**
- Detailed characterization of microbial community in aquaculture system during operation is mandatory to understand the microbial community dynamics and to improve fish health, productivity and bio-safety



# MonMic aims at

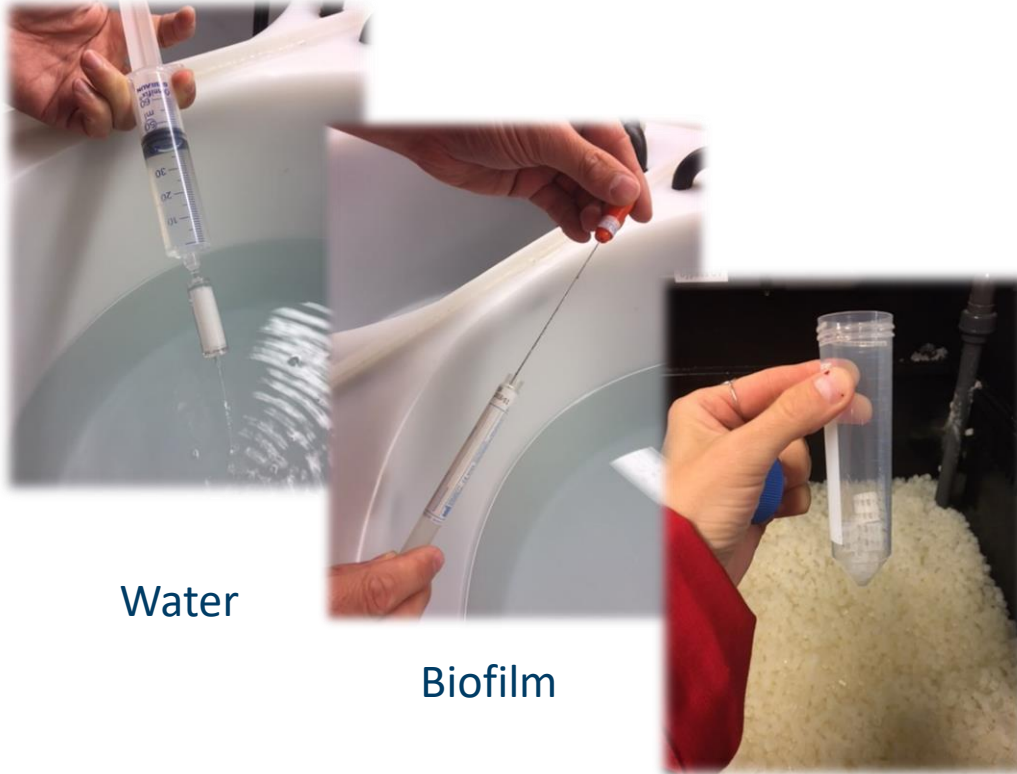
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- Increase the knowledge on microbial communities under normal operation
  - Cross linking biological and chemical water quality
  - Detecting novel bacterial bioindicator species relevant for fish health
- Hypothesis: *Changes in microbiota correlated to fish health can be used to develop predictive and decision support tools*

# Methods

## 6 Sampling Positions



Water

Biofilm

Biofilter

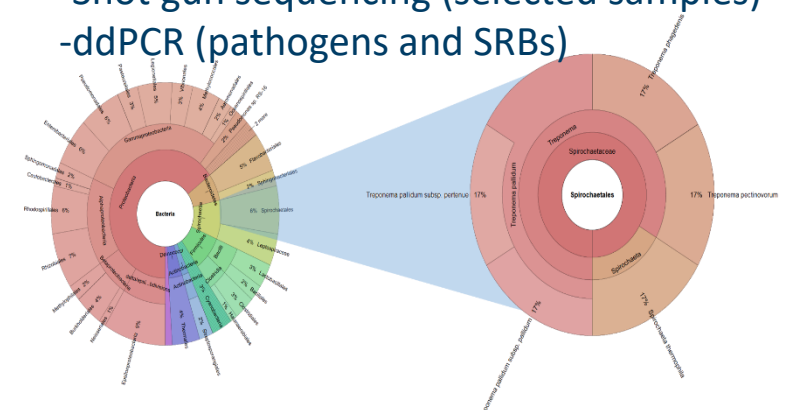
Sampling biweekly for 15 months  
x 5 facilities (RAS)  
~2700 samples

## DNA extraction



## Next generation Sequencing (NGS)

- 16S ribosomal RNA gen amplicon sequencing
- Shot gun sequencing (selected samples)
- ddPCR (pathogens and SRBs)



## Systematic microbiota profiling



## Correlation to

- Chemical water quality
- Operations
- Survival, health and growth of fish

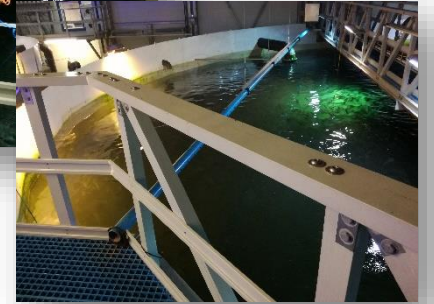


# The five facilities

- Marine Harvest (2)
- Lerøy (2)
- Bremnes Seashore



BREMNES SEASHORE



	1	2	3	4	5
Size fish (g)	30-80 g	0,2-3 g	30-150 g	40-200 g	50-500 g
Disinfection in the loop	UV	UV	Ozon	No	Ozon
Retention time (min)	25	20	30	Max 45	Max 55
Biofilter	FBBR + MBBR	FBBR	MBBR	MBBR	FBBR
Temp (average) °C	14	14	12	10	14
Salinity (‰)	10-15	1-3	0-0,02	< 3	< 3

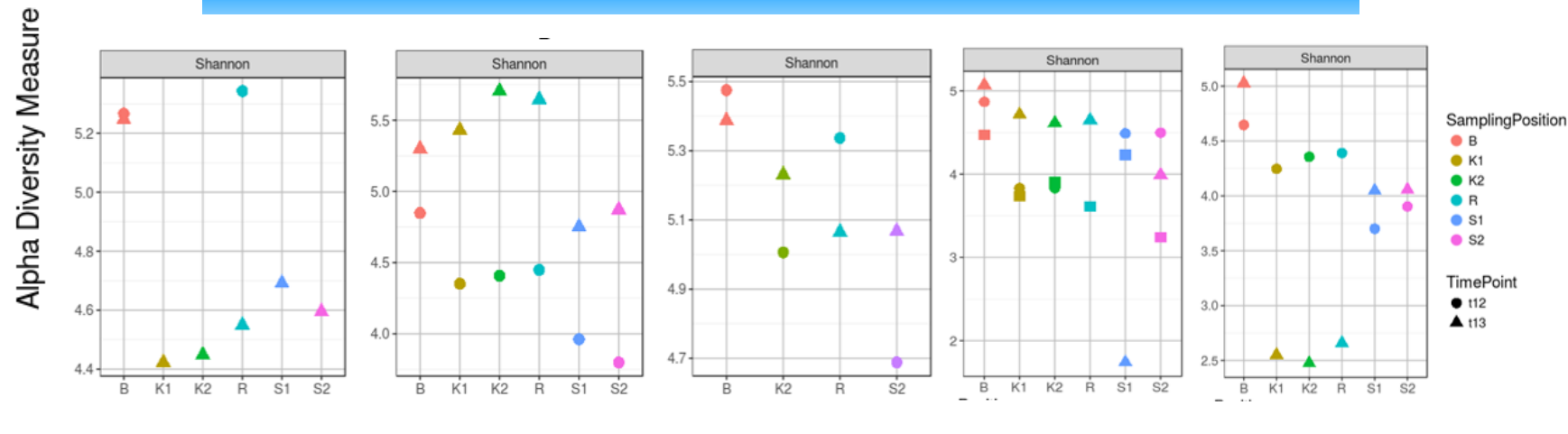
# Results, so far...

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# 1. Highly diverse communities

- > 1000 OTUs found at individual facilities
- Diversity varies between facilities, sampling positions and in time

## Diversity 5 facilities, 2 sampling time points

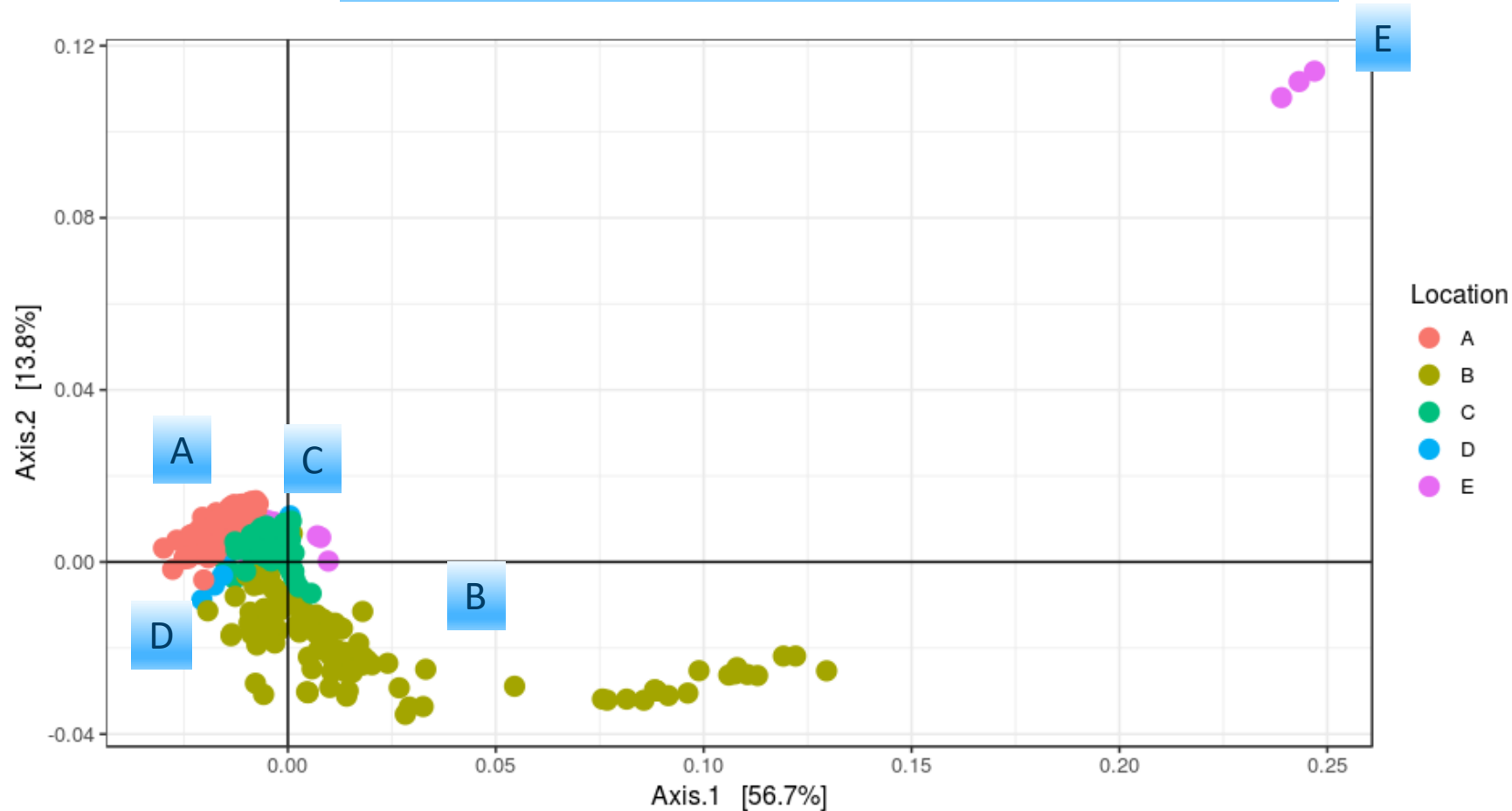


\*OTU= Operational Taxonomic Units

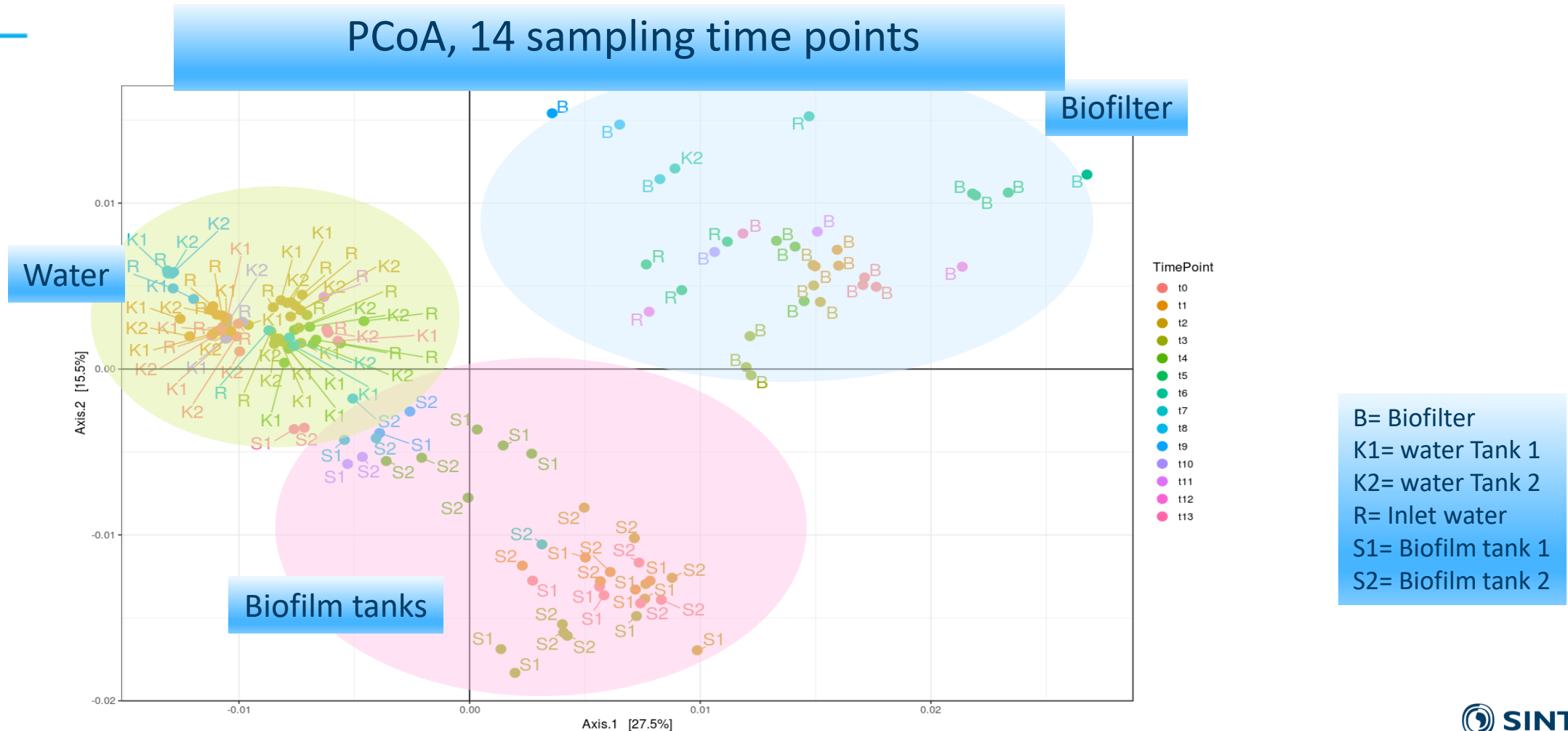


## 2. Microbial communities are different between the facilities

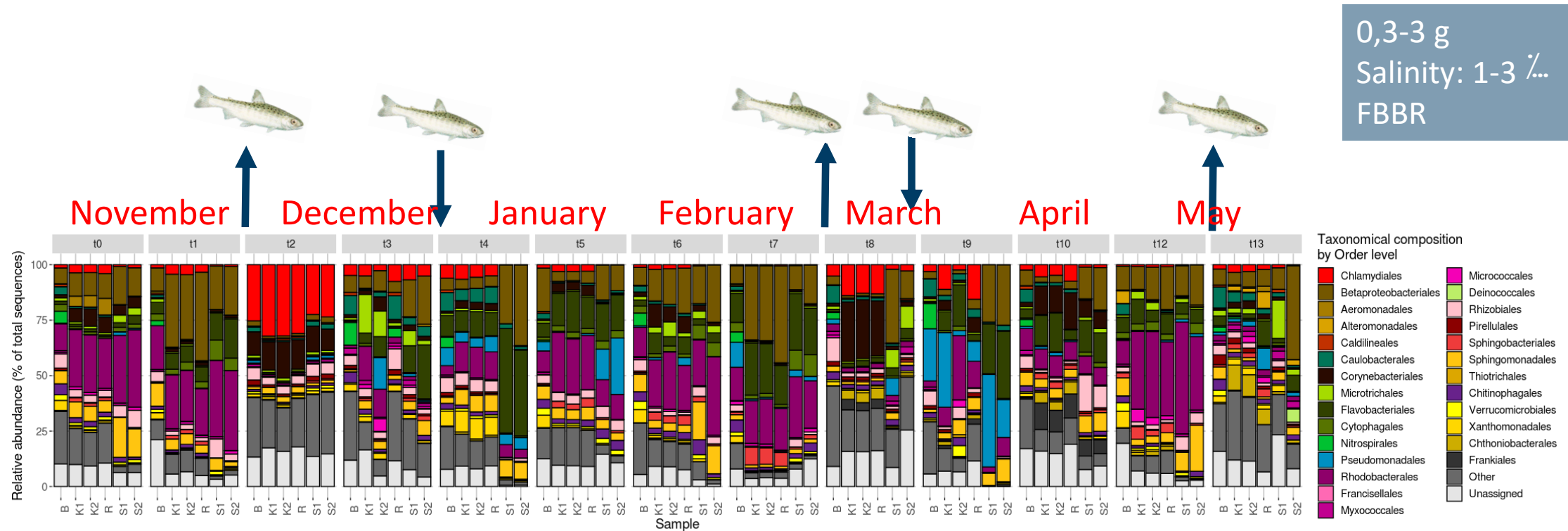
PCoA, 5 facilities, 14 sampling time points



### 3. Microbial communities are different between sampling positions



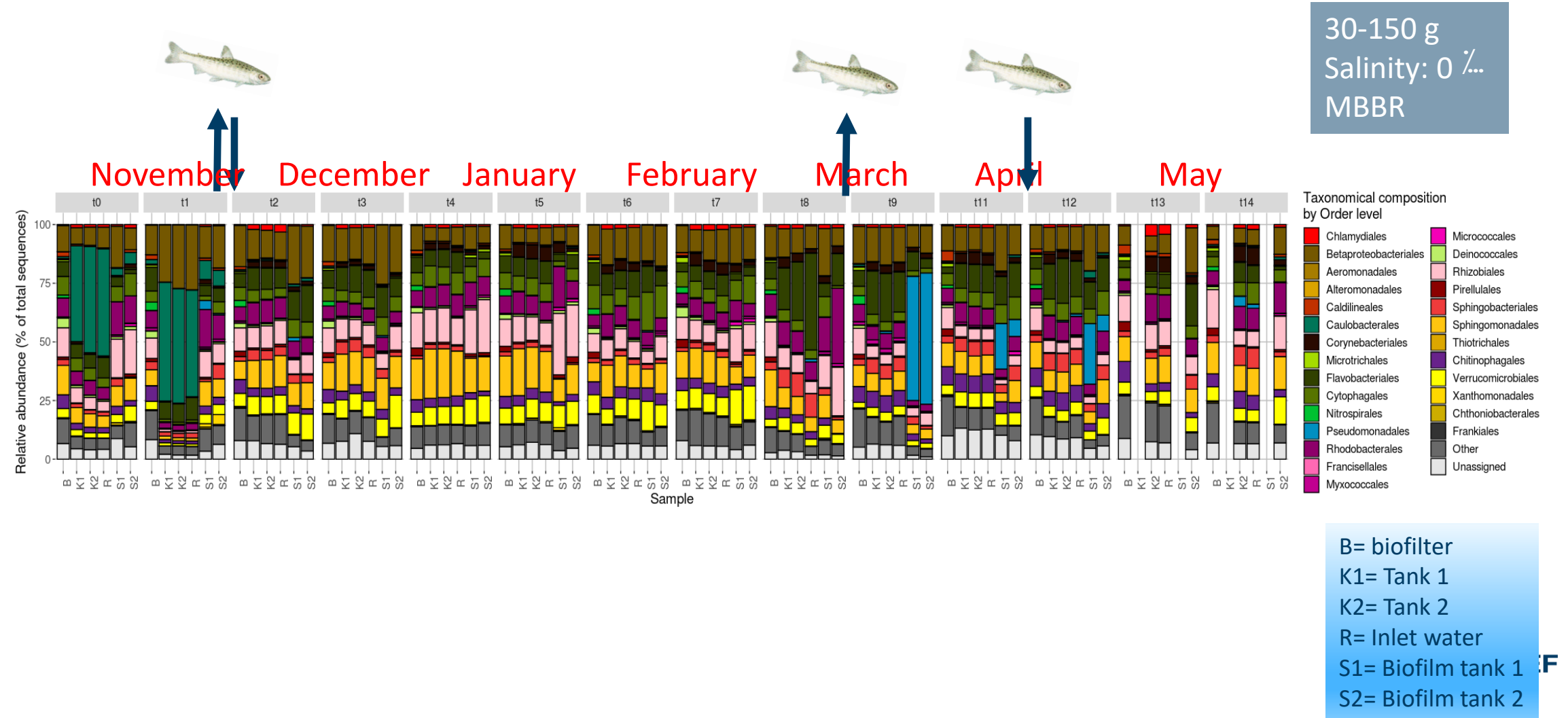
# 4. Microbiota changes during operations



- Change in microbiota
  - Could be related to operations
- Increased mortality in a repeating pattern
  - Related to the change in microbiota?

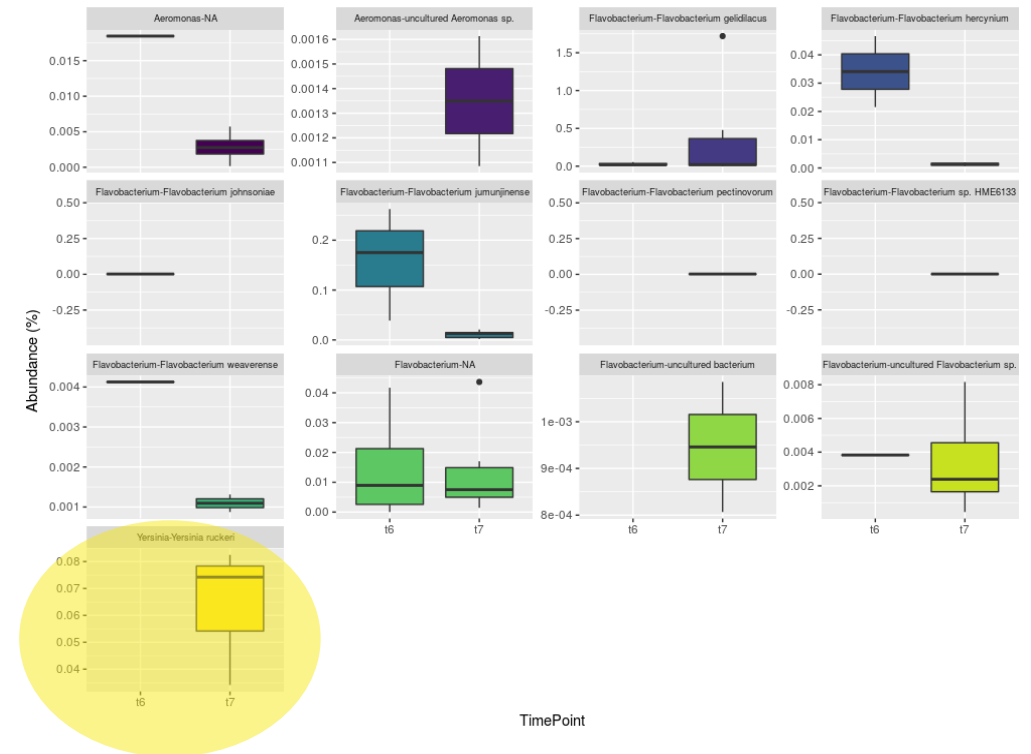
B= biofilter  
K1= water Tank 1  
K2= water Tank 2  
R= Inlet water  
S1= Biofilm tank 1  
S2= Biofilm tank 2

# 5. Microbiota stable during operations



## 6. Low abundance of pathogens

- Detected 3 pathogens:
  - *Yersinia ruckeri*
  - *Flavobacterium phycrophilum*
  - *Candidatus Brachiomonas cysticola*
- 3 facilities
- Detected in inlet water, tanks (biofilm)
- Low abundances





# Further work

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- Continue sampling and analyze data
- Cooperation with NMBU – fish health
- Further increase the knowledge on microbial communities during normal operation
- Develop predictive and decision support tools



# Thank you!

For more information:

[1. Stine.w.dahle@sintef.no](mailto:Stine.w.dahle@sintef.no)

SINTEF Ocean

2. FHF project description (FHF 901392)

<https://www.fhf.no/prosjektdetaljer/?projectNumber=901392>

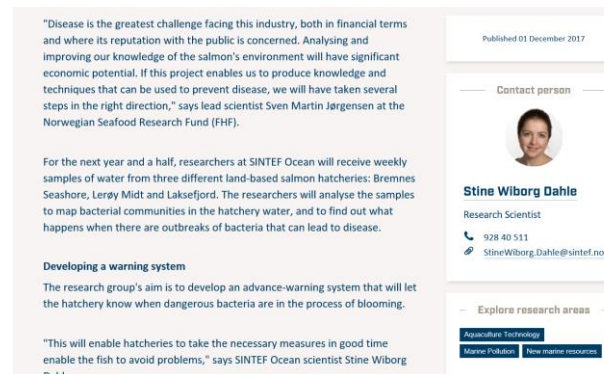


The screenshot shows the project page for 'Program for overvåkning av mikrobiota i lukkede oppdrettsanlegg (MonMic)'. It includes a navigation bar with 'Forside', 'Prosjektarkiv', and 'Prosjekt 901392'. The main content area displays the project title, a brief description, and a table with project details: Project number 901392, Status: Pågår, Start date: 01.09.2017, End date: 30.04.2020, and Field: Havbruk, Fiskehelse og fiskevevelferd. A 'Kontakt' sidebar lists the responsible parties: FHF (Sven Martin Jørgensen), Organisation (SINTEF Ocean AS), and Project leader (Stine Wiborg Dahle). It also lists the project group, steering group, and reference group, each with a dropdown arrow.

3. [www.sintef.no](http://www.sintef.no), search for MonMic



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The screenshot shows the project page for MonMic on the SINTEF website. It includes a quote from lead scientist Sven Martin Jørgensen about the challenges of disease in the industry. Below this, it states that for the next year and a half, researchers at SINTEF Ocean will receive weekly samples of water from three different land-based salmon hatcheries: Bremnes Seashore, Lerøy Midt and Laksefjord. The researchers will analyse the samples to map bacterial communities in the hatchery water, and to find out what happens when there are outbreaks of bacteria that can lead to disease. The page also mentions the development of a warning system, where the research group's aim is to develop an advance-warning system that will let the hatchery know when dangerous bacteria are in the process of blooming. At the bottom, it states that this will enable hatcheries to take the necessary measures in good time to enable the fish to avoid problems, as said by SINTEF Ocean scientist Stine Wiborg Dahle. The page also features a 'Contact person' section with a photo of Stine Wiborg Dahle, her title as Research Scientist, and her contact information: phone number 928 40 511 and email StineWiborg.Dahle@sintef.no. There is also a section for 'Explore research areas' with links to 'Aquaculture Technology', 'Marine Pollution', and 'New marine resources'.



Teknologi for et bedre samfunn