



Relationships between Tilapia skin and pond water microbiomes for healthy aquaculture ponds in Malawi

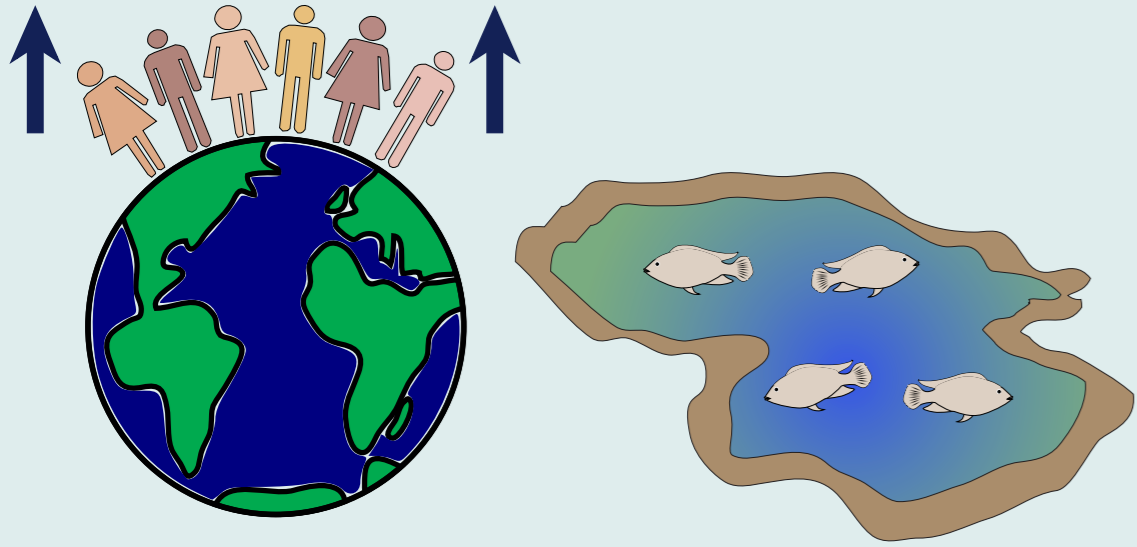
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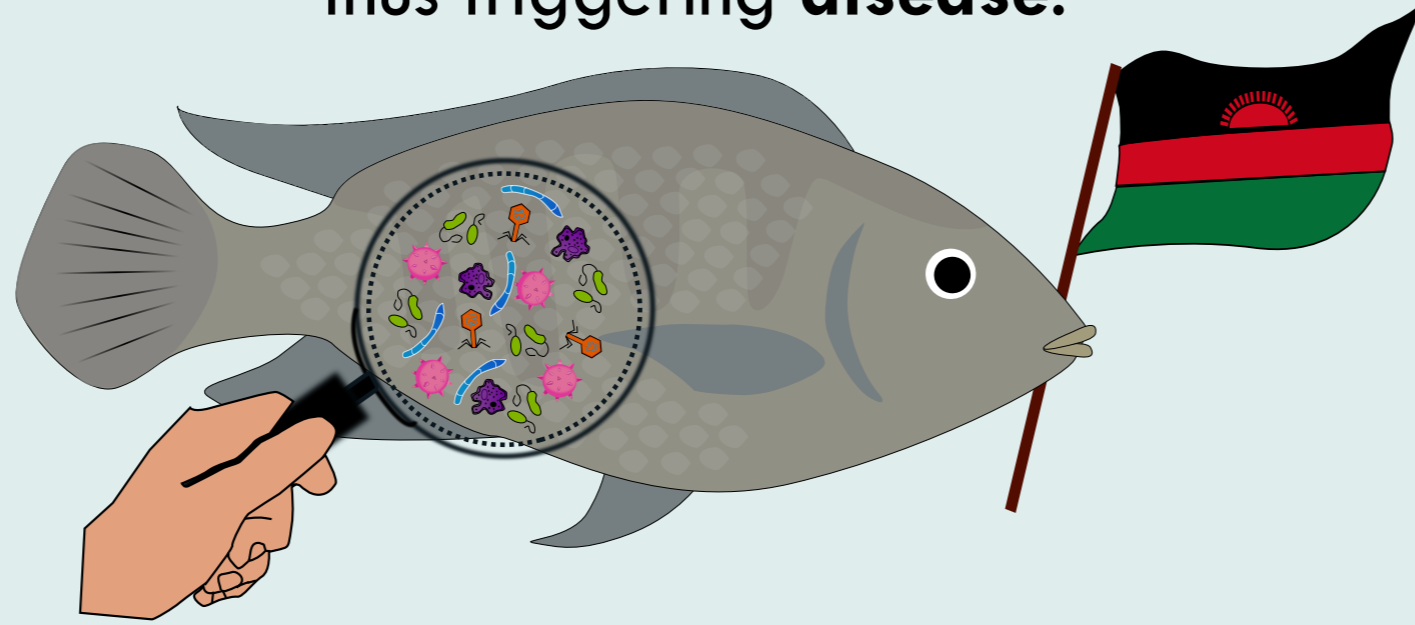
Introduction

Aquaculture (fish farming) is the **fastest growing** major food production sector and is undergoing major **intensification** to meet the demands of a **growing population**.¹



Intensification practices include **high stocking densities** and large feed inputs, which often leads to **poor water quality**.²

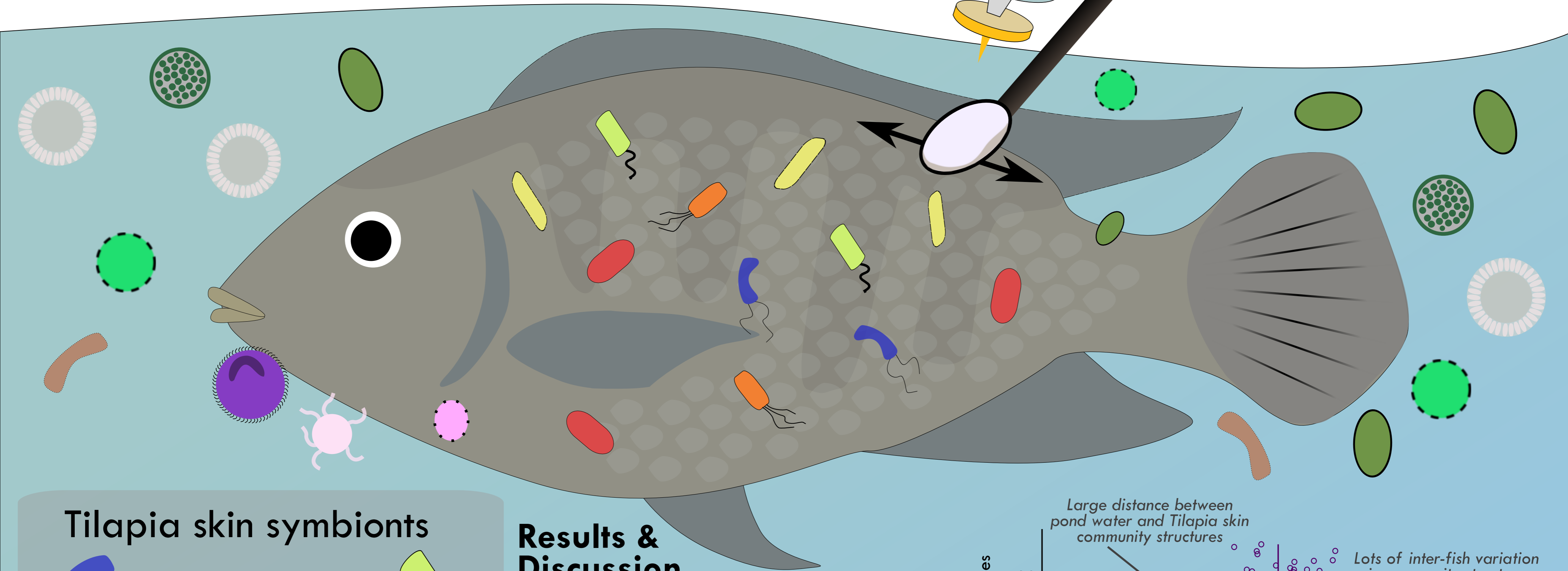
Fish microbiomes are the community of microorganisms that support growth, immunity and health. Intensive aquaculture practices can **disrupt** these microbiomes, thus triggering **disease**.^{3,4}



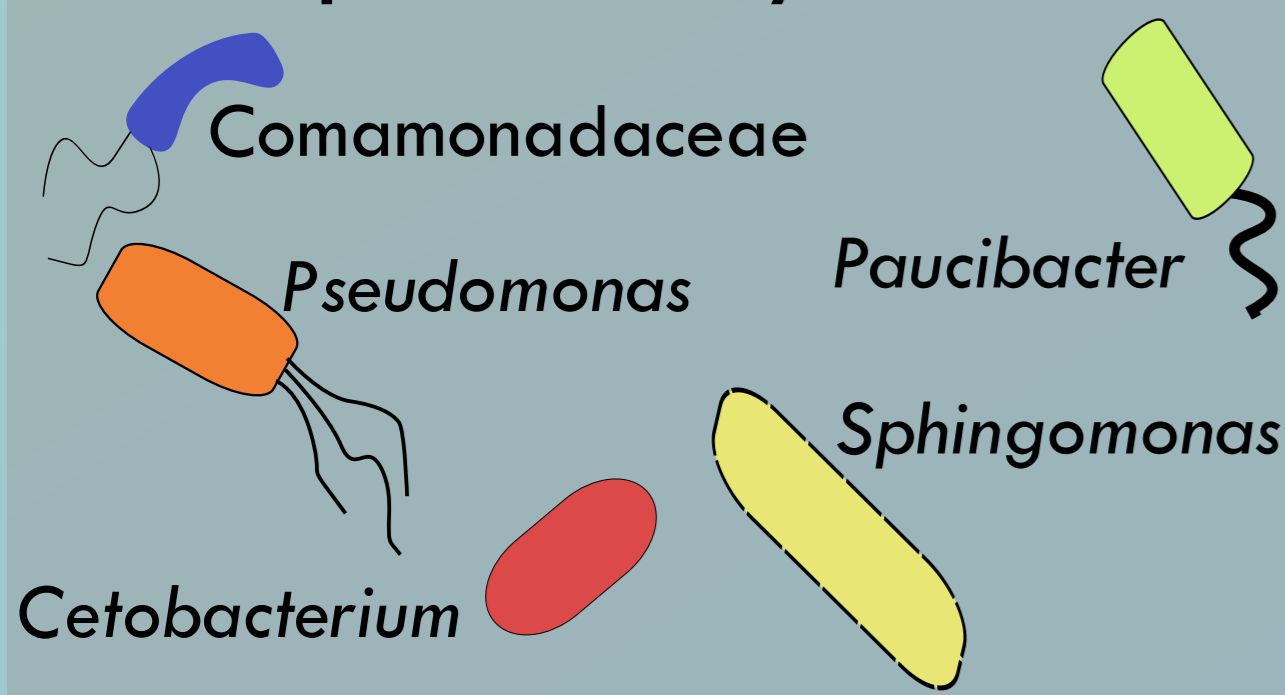
We sampled **seven aquaculture ponds** in **Malawi** to establish relationships between pond water and Tilapia skin for **healthy environments**.

Methods

1. **Tilapia skin** was swabbed and **pond water** was filtered to sample the **microbiome**.
2. Sample DNA was extracted, **16S** and **18S** genes amplified and **sequenced** on the Illumina platform.
3. This enabled a holistic characterisation of **bacteria, fungi, protists and parasites**.



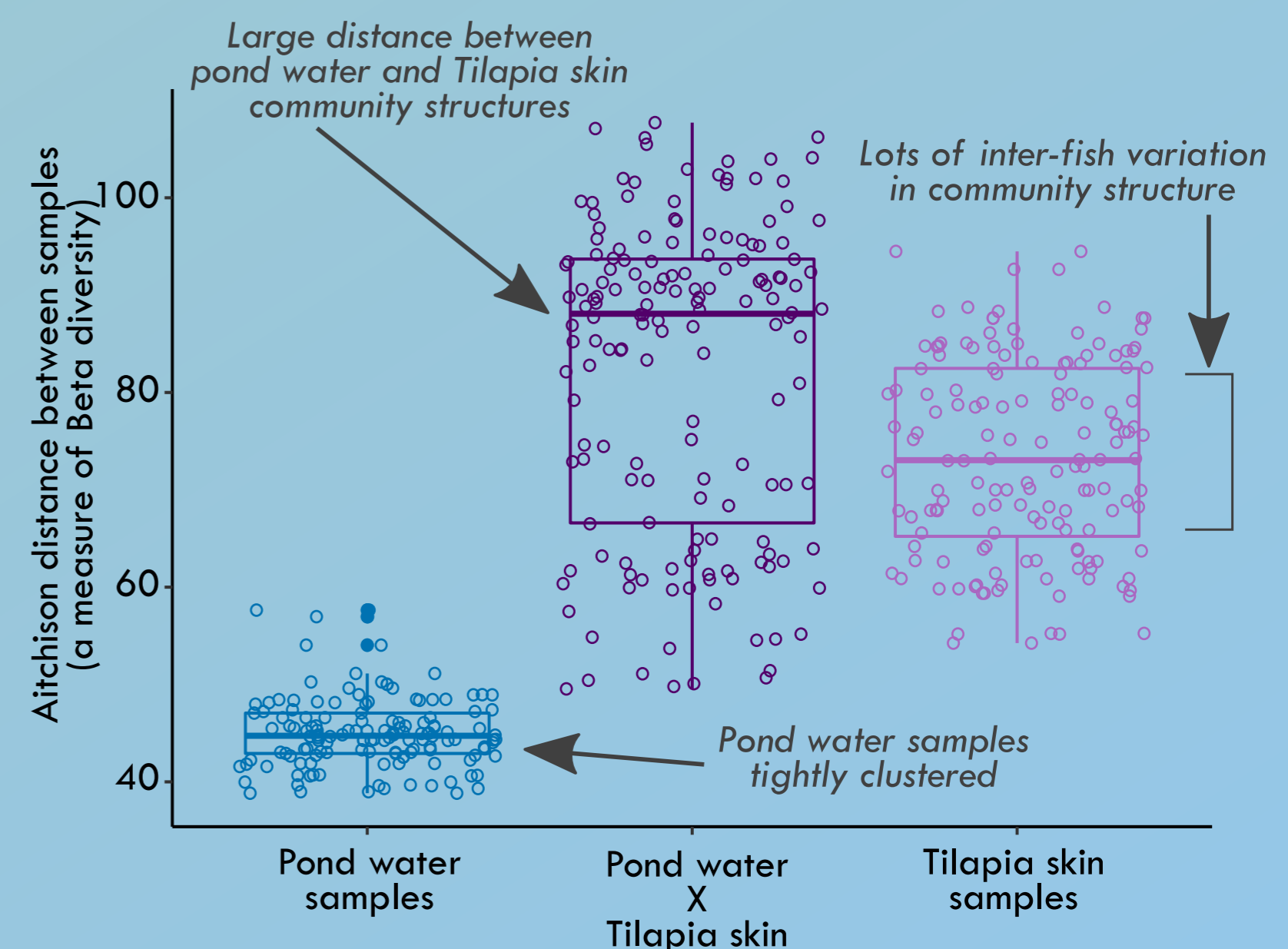
Tilapia skin symbionts



Results & Discussion

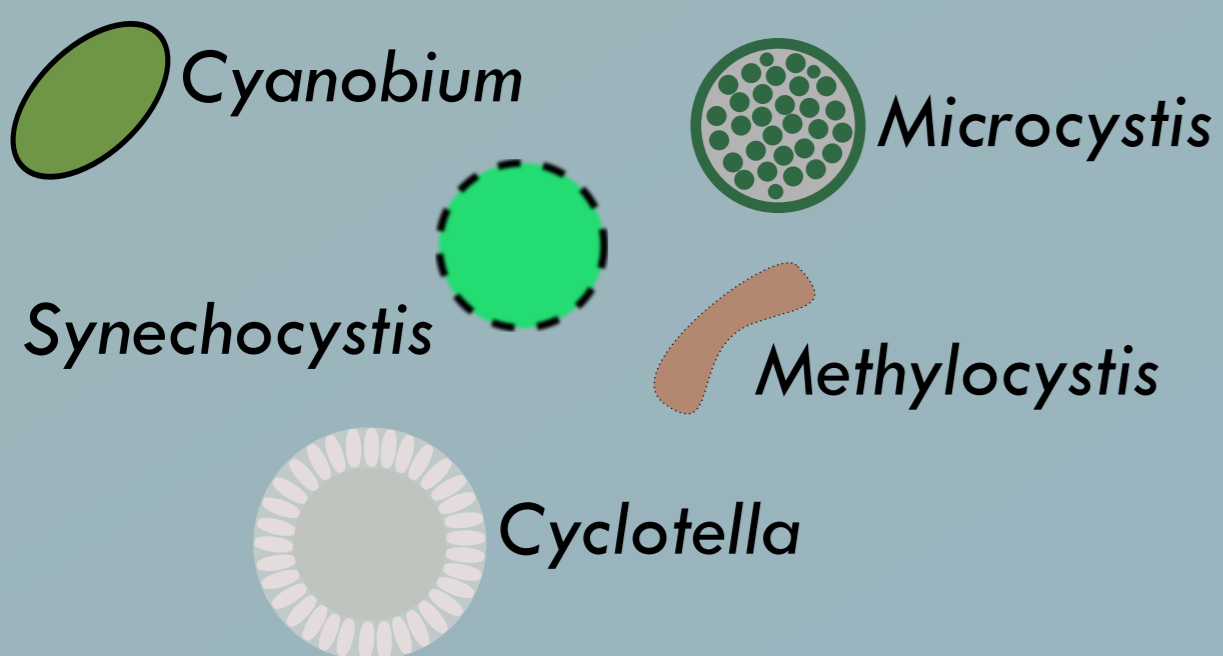


The majority of bacteria are detected in both skin and water microbial communities.

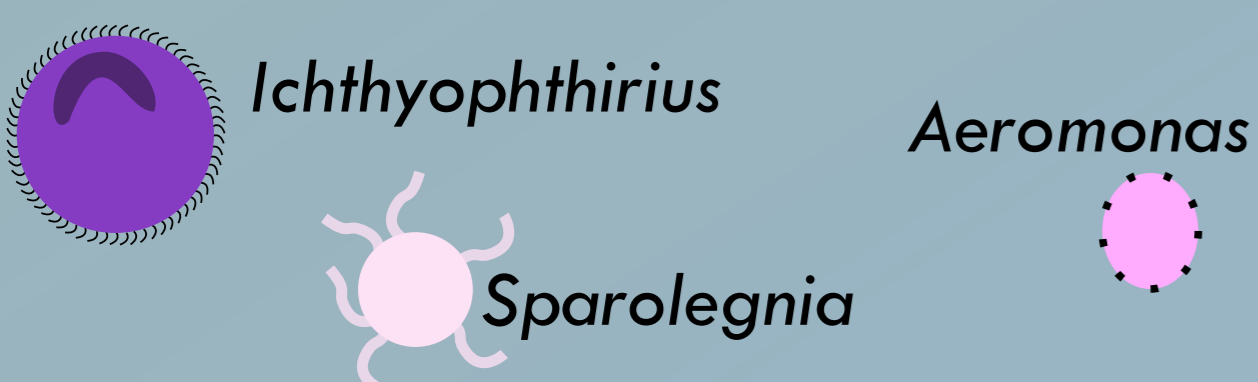


Each microbial community is uniquely structured, with differing abundance and variance profiles

Pond water plankton



Opportunistic 'pathogens'



- Tilapia skin commensals included 14 taxa in the core microbiome and 25 taxa whose abundance was significantly enriched in skin compared to pond water.
- Monitoring the abundance and dynamics of these taxa in the fish skin may be used to signal for dysbiotic events associated with disease onset.
- Among the most abundant pond water plankton were Cyanobacteria and diatoms (that contribute to oxygen cycling), methanotrophs and in some ponds the harmful algal bloom agent *Microcystis*.
- Numerous taxa with the potential to be opportunistic pathogens were detected at very low abundance in pond water and on skin.
- Stressors associated with aquaculture intensification that result in skin microbiome dysbiosis may allow these opportunistic pathogens to cause disease.

1) FAO, 2018. The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals.
 2) Sunth, H., et al., 2019. Reduced water quality associated with higher stocking density disturbs the intestinal barrier functions of Atlantic salmon. Aquaculture
 3) Kelly, C., Salinas, I., 2017. Under Pressure: Interactions between Commensal Microbiota and the Telost Immune System. Front. Immunol
 4) Boutin, S., et al., Network analysis highlights complex interactions between pathogen, host and commensal microbiota. PLoS One.