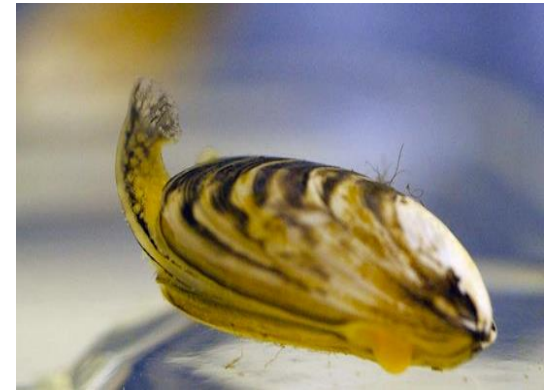




# Metagenomic Approach to Monitor the Abundance and Distribution of Aquatic Invasive Species and to Develop their Biological Control



Michael J. Sadowsky and Chan Lan Chun

# Eurasian Water Milfoil (EWM)

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- Invasive aquatic plant that proliferates in Minnesota due to its ability to grow at wide ranges (even low) of temperature under a variety of nutrient concentrations.
- EWM fragments can re-grow into dense floating mats.
- EWM displaces native aquatic plants, lowers dissolved oxygen content, and causes eutrophication due to nutrient loading from vegetation decay.
- Traditional methods of control include mechanical harvesting and application of chemical herbicides.



# Macrophytes in Waterway

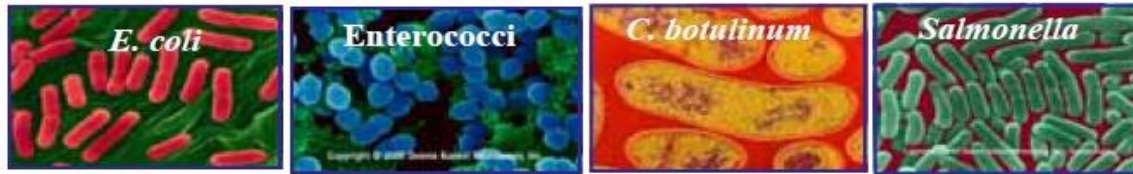
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- Aquatic plants that grow in or near water and are either emergent, submerged, or floating.
- Macrophytes provide cover for fish and substrates for aquatic invertebrates, bacteria, produce oxygen, and act as food sources for bacteria, fish, and wildlife.
- Aquatic plants are capable of supporting growth of a variety of micro- and macroorganisms, including some pathogens.

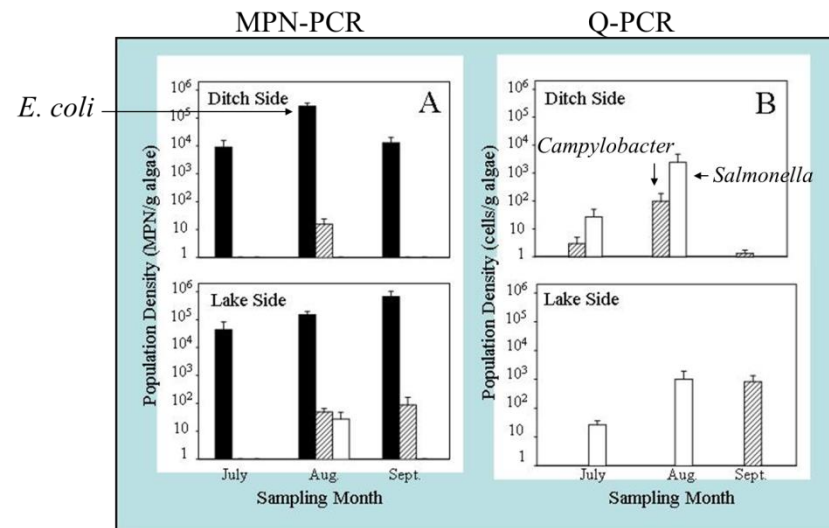
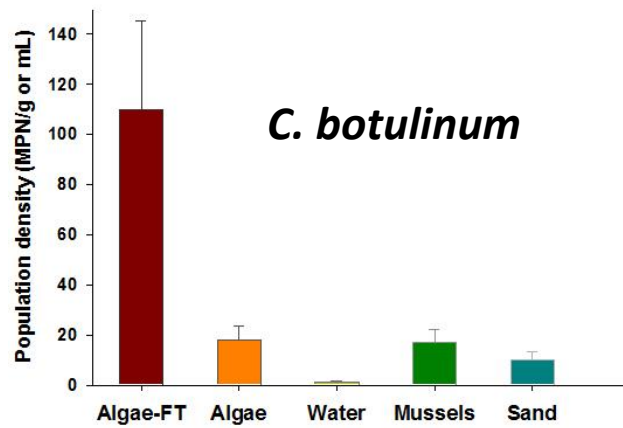


# Bacterial Epiphytes of Macrophytic Aglae

- Large mats of the macrophytic alga, *Cladophora* harbors enteric bacteria, including some pathogens and is of public health concern:



- Higher levels of enteric bacteria in floating mat of macrophytes than other media.



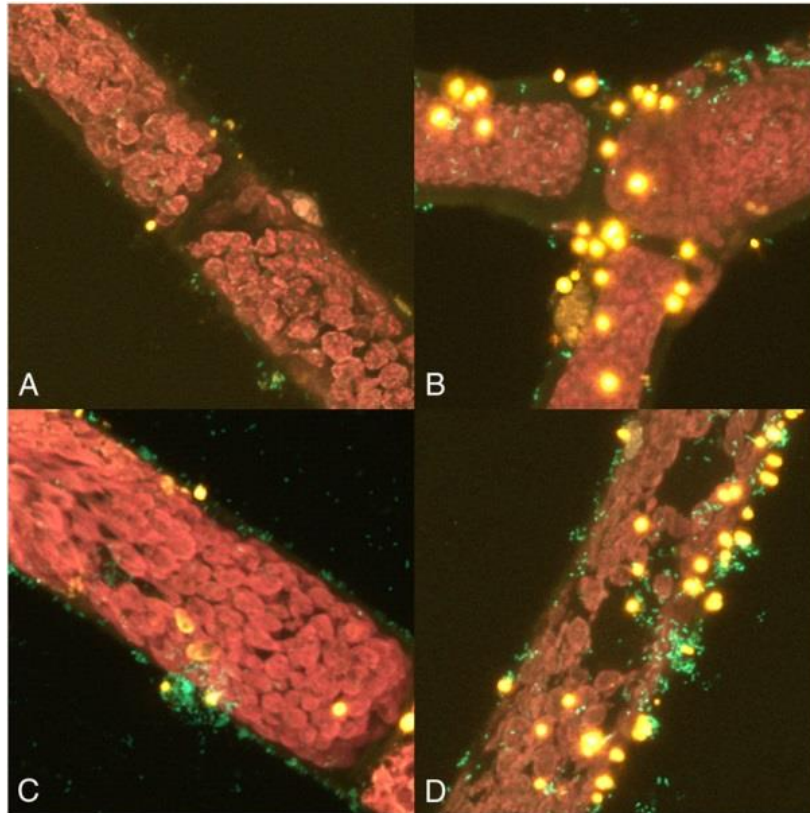
- These bacteria can detach and be released into the surrounding water, influencing water quality and recreational activity.



# Studies on Macrophyte-Microbe Interactions

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- Microscopic observation
  - Visual observation of macrophyte-microbe interactions
  - Fluorescent-labeling techniques



# What is Metagenomics?

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- The study of the totality of genetic material (genomes or their fragments) recovered directly from environmental samples.
- Why use metagenomics
  - The majority of microorganisms in environmental and animal samples remain uncultured (<<1%) or non-culturable.
  - Cultivation-based approaches for discovery of diversity and microbial functions bear the risks of missing novel genes and microbial activities.

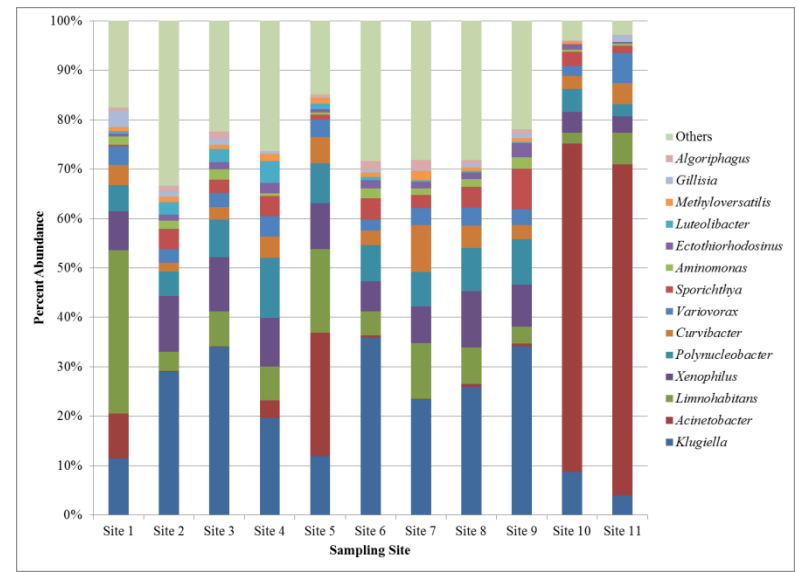
# General Metagenomic Approach



DNA Extraction



Sequencing



# Objectives

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- Characterize the total microbial community structure associated with EWM using a 16S rDNA-based, metagenomics DNA sequencing approach
- Examine microbial biodiversity and ecology within benthic, epiphytic, and endophytic regions of EWM in various states of decay.
- Develop effective, specific, and cost effective microbiological control agents for EWM, which may have advantages over the conventional management methods

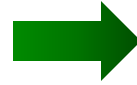


# Development Plans

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## Metagenomic characterization of microbial community of EWM

- Sample collection
- Identify microbial community associated with EWM
- Correlations of EWM microbial community to biological characteristics of EWM



## Development of microbiological control agents for EWM

- Selection of potential symbiotic, pathogenic microbes to EWM
- Laboratory screening of microbes to be lethal to
  - Biological control effectiveness and specificity

# Outcomes

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- Provide a distribution map of microbes associated with EWM that may be extremely distinctive, and also indicative of potential health hazards.
- This characterization may allow us to eventually develop effective, specific, and cost effective biological control agent of EWM. That is, we can identify bacteria that are unique to EWM and use them to develop biocontrol strategies.

**Thank you for your attention!**

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**Questions?**

