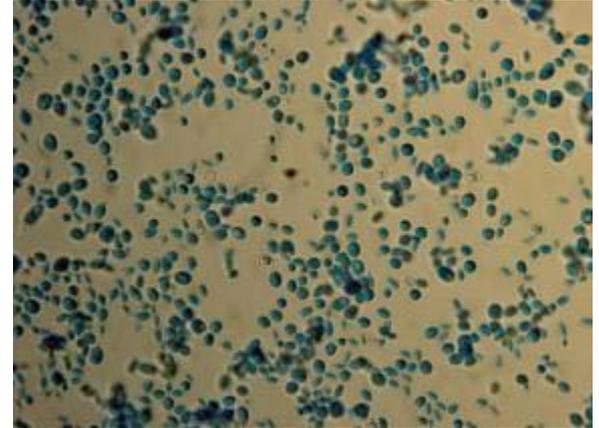


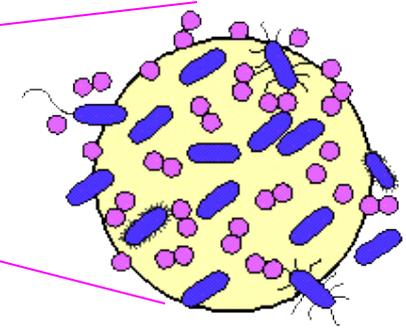
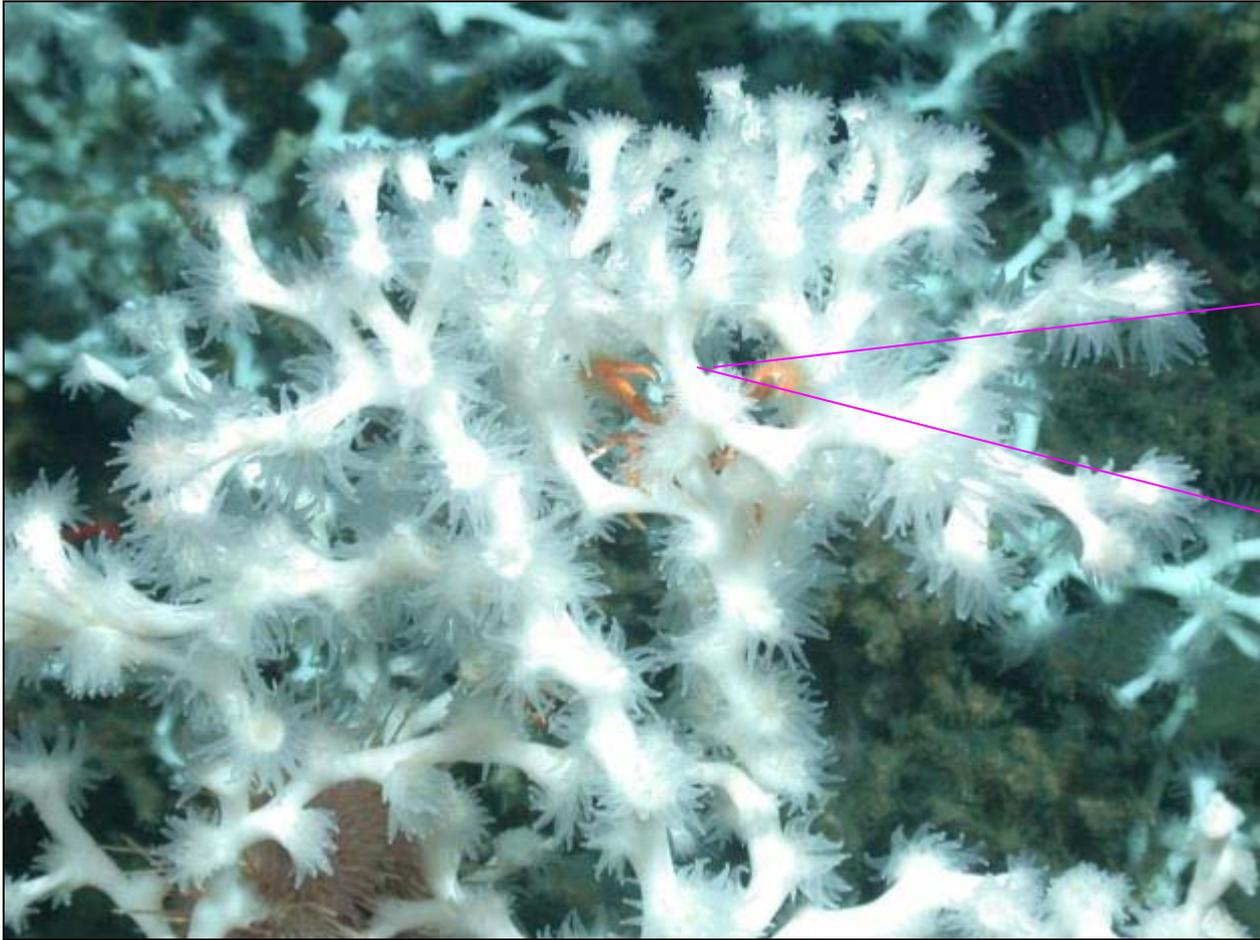


# *Lophelia* II: Cold-water Coral Microbiology

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**Julia P. Galkiewicz**  
**Michael A. Gray**  
**Sarah H. Stellick**  
U.S. Geological Survey



# Why do the microbes matter?



# Coral Biology

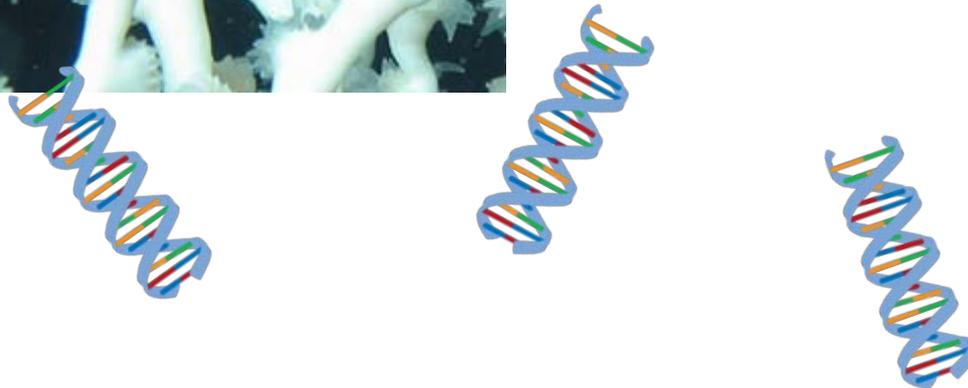


- Sterile corals are dead corals
- Disease & stress can be caused by (and detected by) changes in the coral-associated microbial community

# Climate Change



- Changes in the coral's microbiome can be made in hours/days and are the fastest way for the coral to adapt



# Biodiversity



- Each coral, sponge, crab, fish, etc. is a microbial universe and likely hosts new species of microbes
- Bioprospecting applications

# Ecosystem Engineering



- Microbial biofilms can trigger settling behavior or metamorphosis in some marine invertebrates
- What ends up where shapes the habitat

# Coral Microbial Ecology

Coral = animal + ~~algae~~ + bacteria +  
archaea + fungi + viruses

Coral = animal + microbiome



Photo credit: Cheryl Morrison

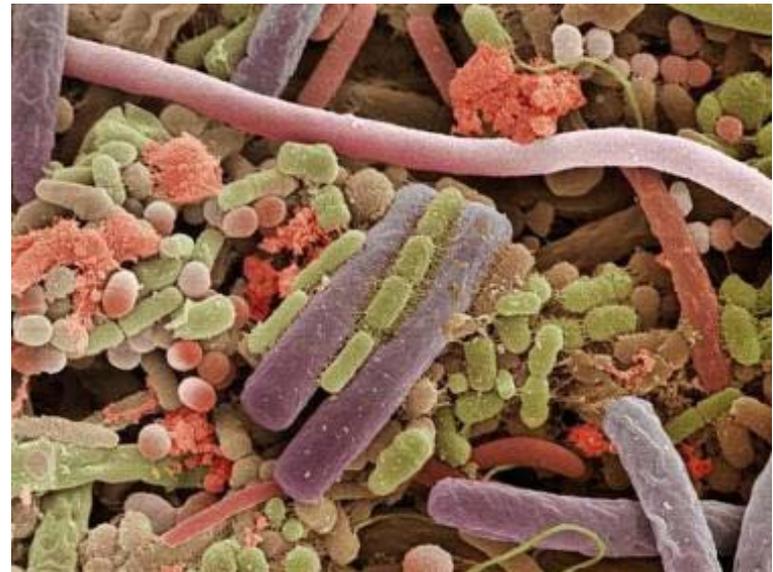


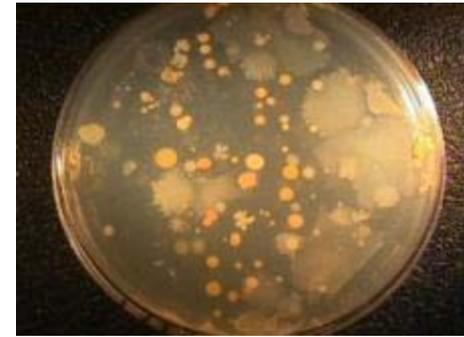
Photo credit: Brandon Brill, *Microcosmos*

# Sampling Concerns

- Contact issues – water column, sediment, other invertebrates
- Taking samples through an environmental gradient of pressure, temperature, and light

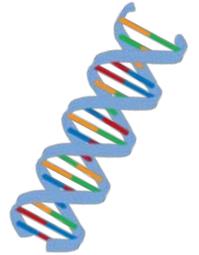


# *Lophelia* I – Recap

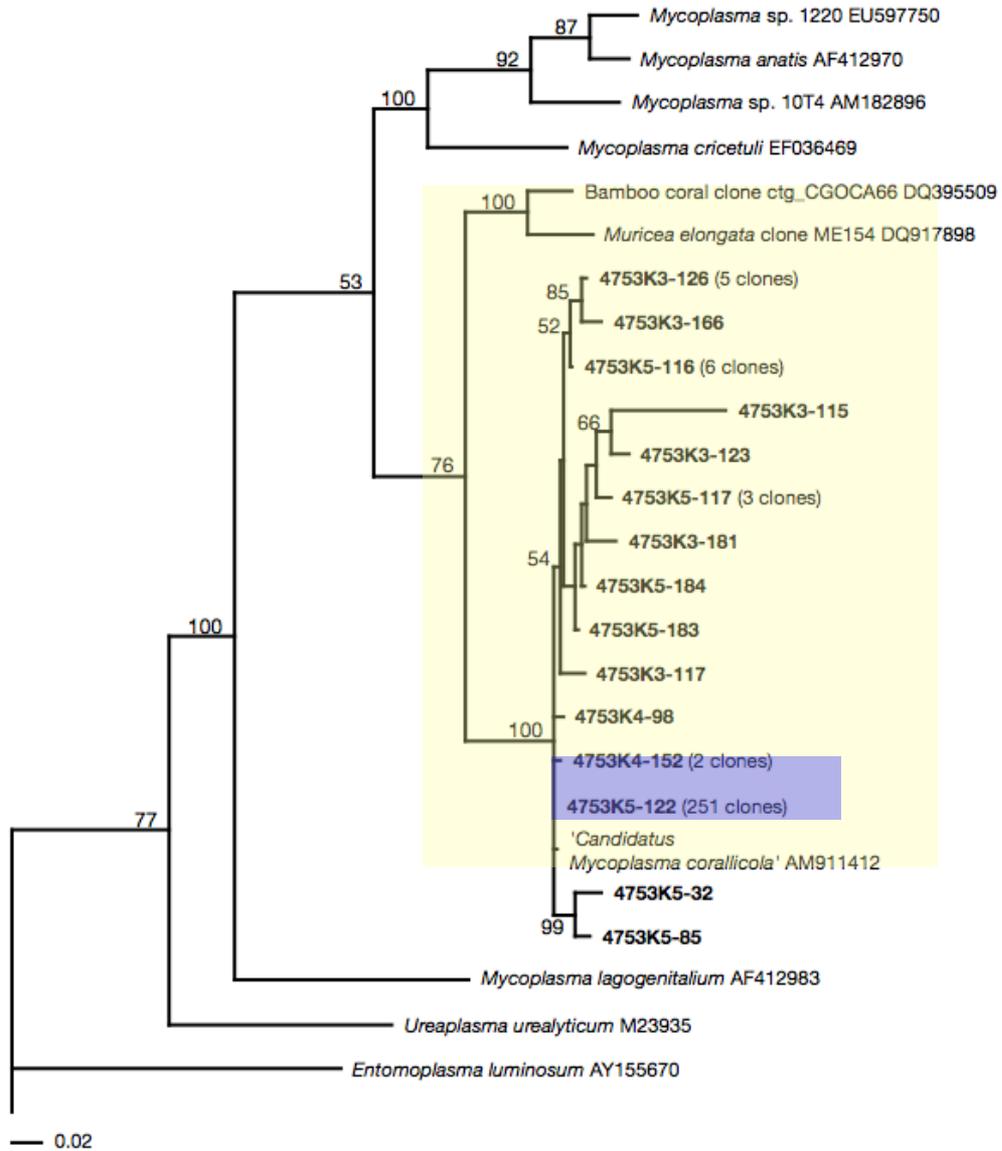


- Culture data
  - First study on diversity of cultured bacteria from *Lophelia*
  - Bacterial groups include both those commonly cultured from shallow-water tropical corals and psychrophiles
  - Unusual isolates are being characterized in depth to define new type species

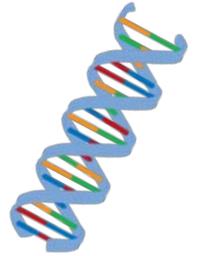
# *Lophelia* I – Recap



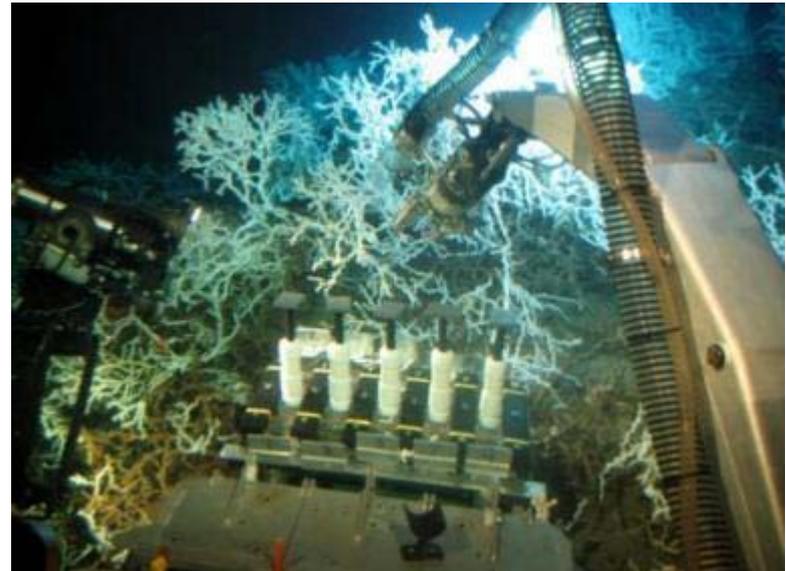
- Molecular data
  - Largest number of *Lophelia*-associated clones analyzed to date: 508
    - Norwegian paper = 340 clones, Med paper = 12 clones
  - Many novel sequences, but similar to coral-assoc
  - *Lophelia*-specific bacteria (Candidatus *Mycoplasma coralicola* and thiotroph cluster)

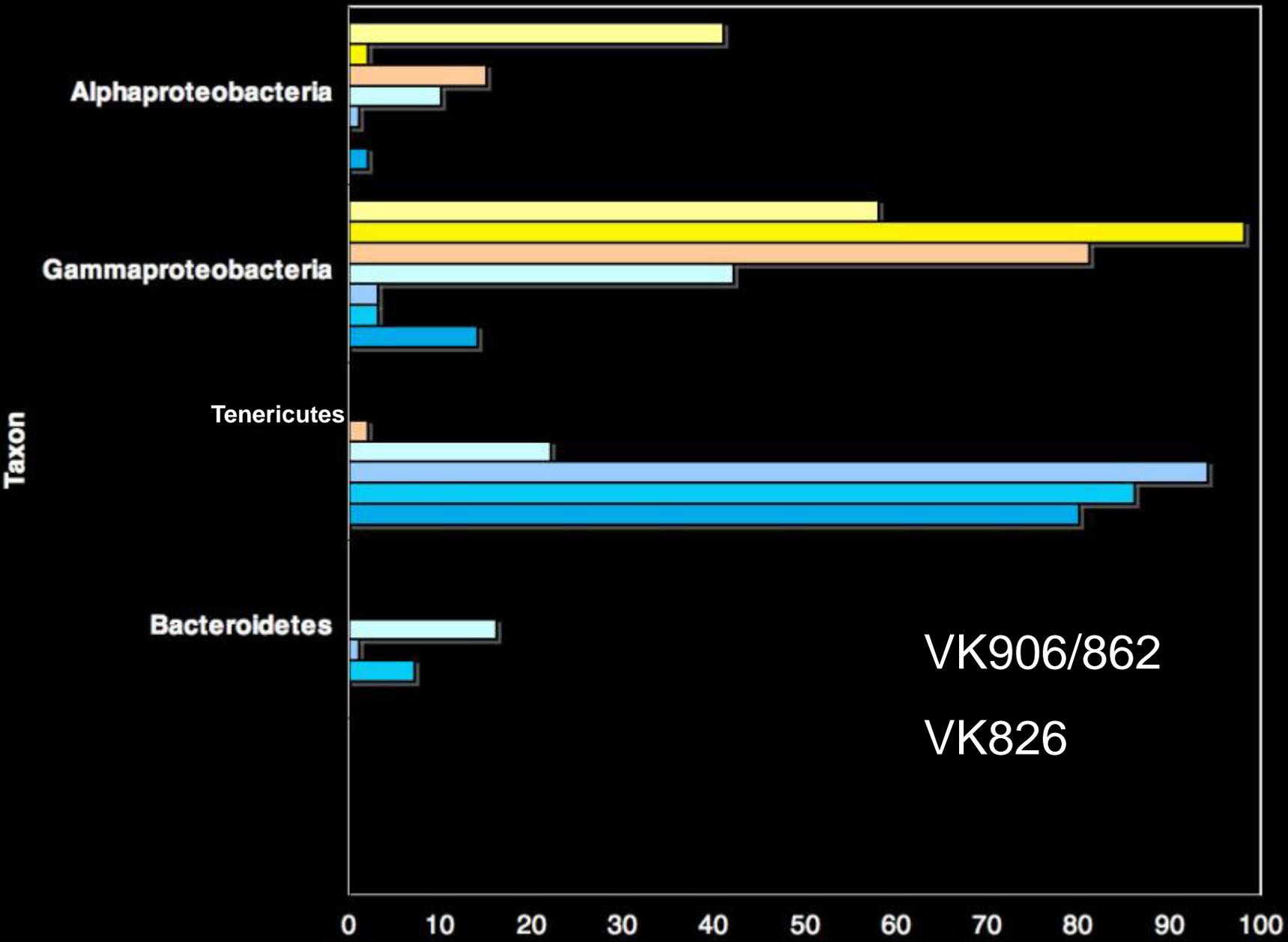


# *Lophelia* l – Recap



- Molecular data
  - Comparison of two Viosca Knoll sites
  - Indications that shifts in microbial community composition may signal stress





# *Lophelia* I – Recap



- Culture & molecular data
  - First microbial description of three gorgonian species from the Aleutian Islands
    - *Paragorgea arborea*
    - *Plumarella superba*
    - *Cryogorgia koolsae*
  - Mycoplasmas were again found to be dominant members of the coral-associated community

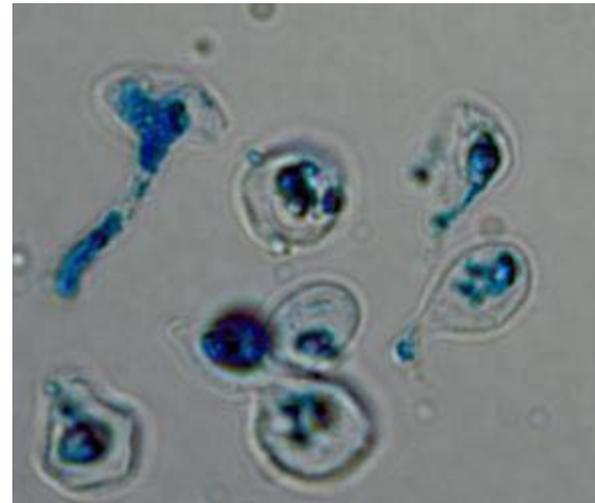
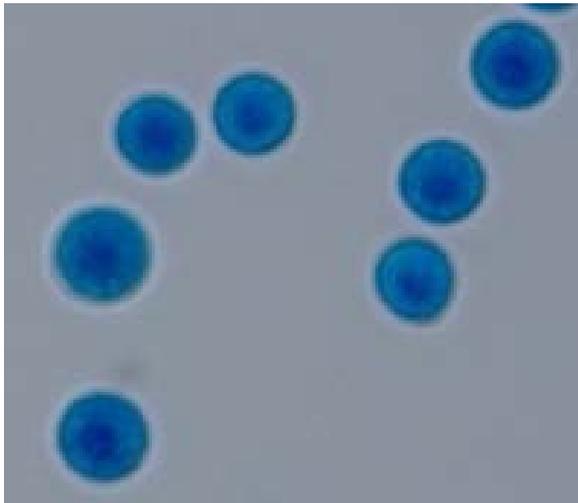


**Lophelia II  
2008 - 2011**

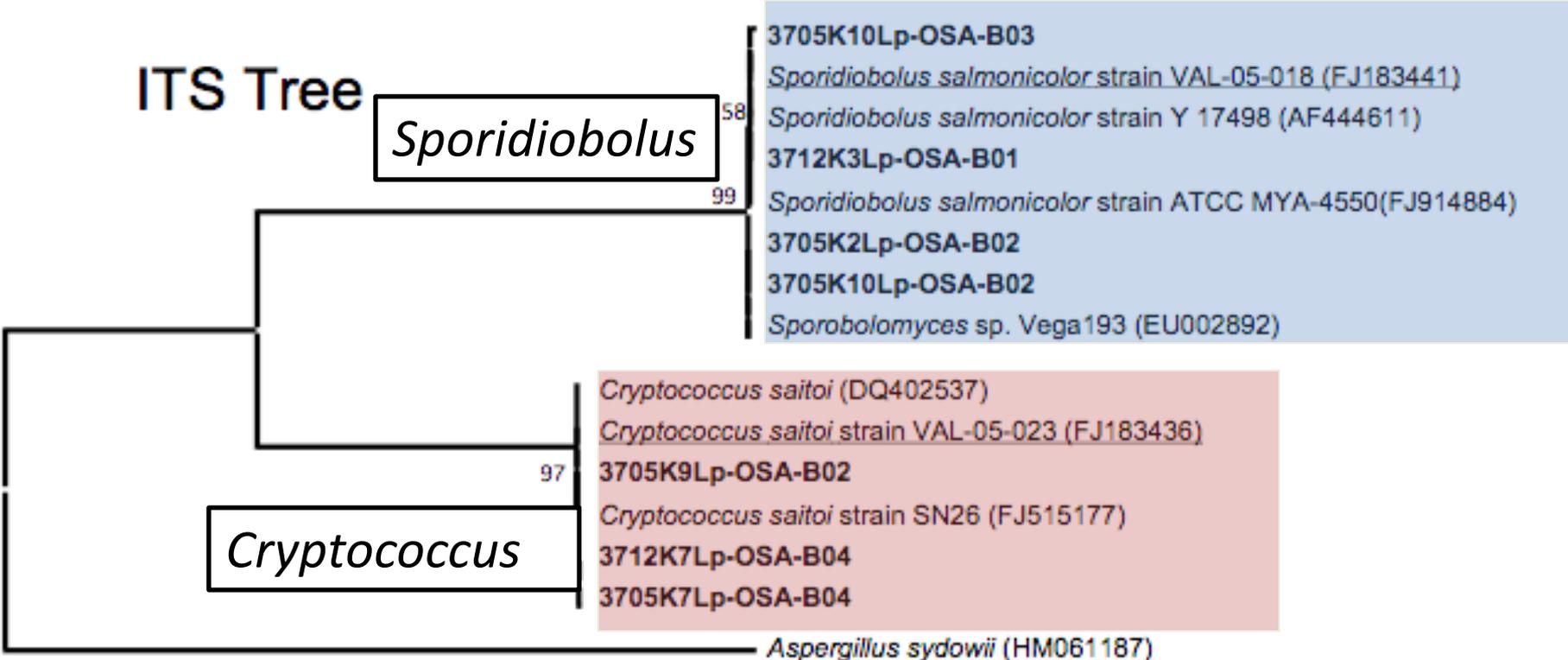
**Cold corals,  
hot microbiology**

# *Lophelia II*

- Coral biology & biodiversity
  - First fungi isolated from *Lophelia*
  - Multiple genera, including yeasts *Sporidiobolus* and *Cryptococcus* plus filamentous forms

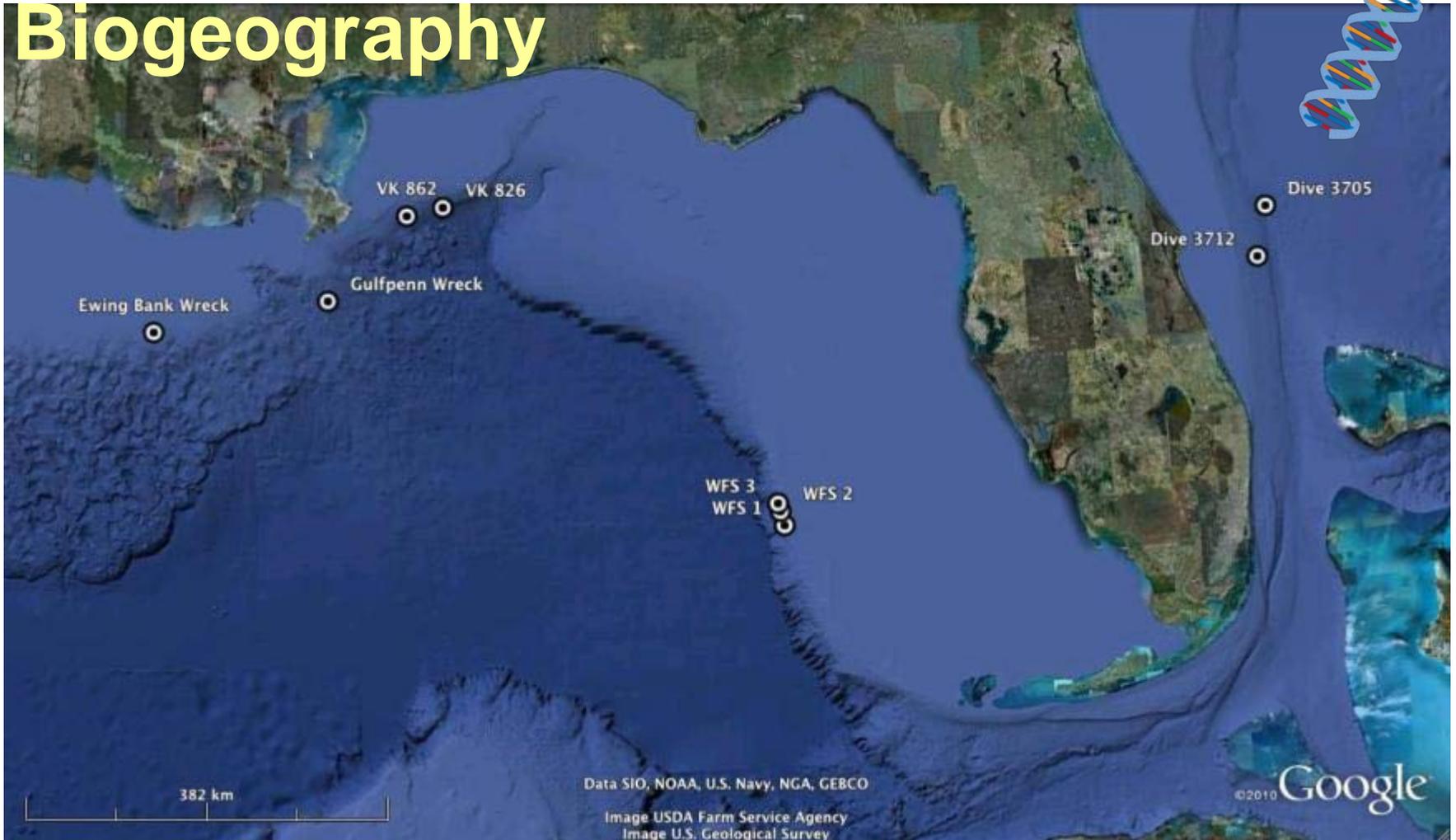
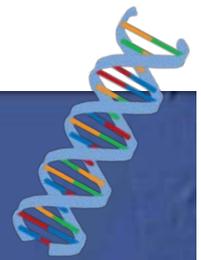


# ITS Tree



0.2

# Biogeography



# Sequencing *Lophelia's* metagenome



Photo credit: Jo Handelsman

- Metagenome = all genes from microbiome
- Comparing Atlantic & Gulf samples
- Next generation sequencing (454)

# Ecosystem Engineering



- Settling plates deployed on lander in GOM for 1 year
- Control and four bacterial treatments
- Retrieving 2011?

# Future Plans

- Get all the *Lophelia II* data published!
- Collaborations with Norwegian researchers
  - Another area where cold-water corals meet oil and gas extraction





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Julie Galkiewicz



# DISCOVRE

Diversity, Systematics, and Connectivity of Vulnerable Reef Ecosystems

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Funded by the USGS Terrestrial, Aquatic and  
Marine Ecosystems Program in support of  
BOEMRE research needs