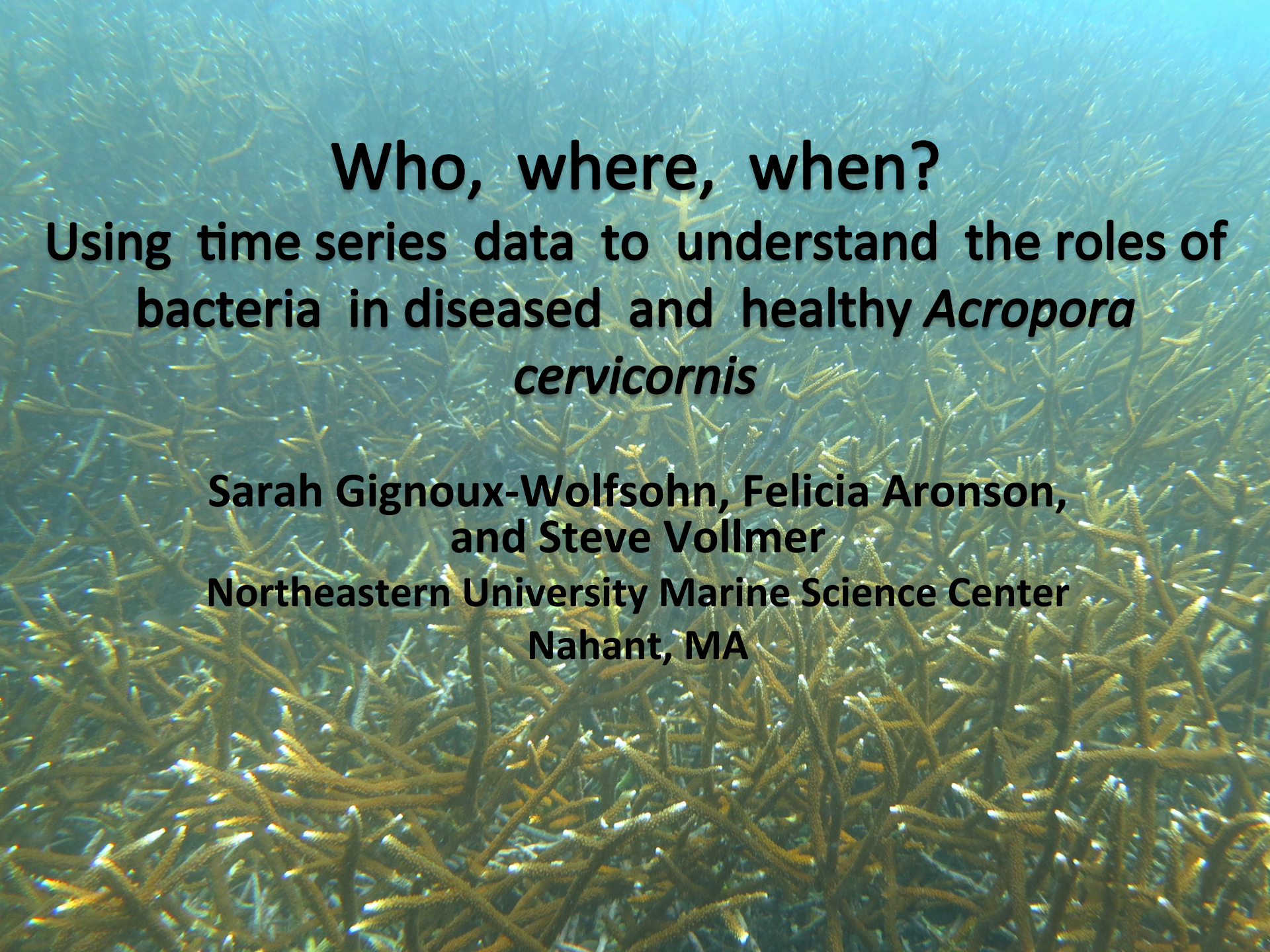


Who, where, when?

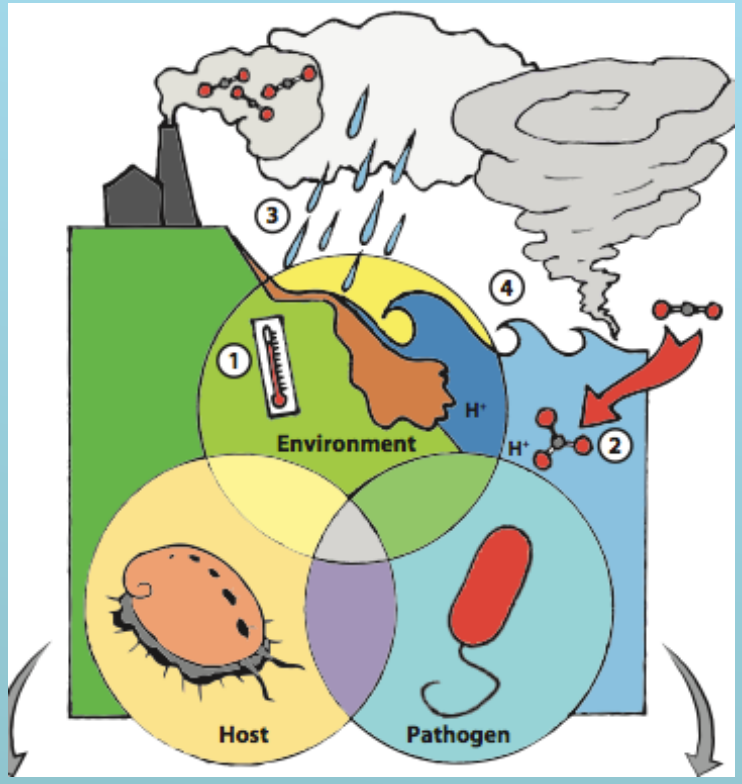
Using time series data to understand the roles of bacteria in diseased and healthy *Acropora cervicornis*

Sarah Gignoux-Wolfsohn, Felicia Aronson, and Steve Vollmer

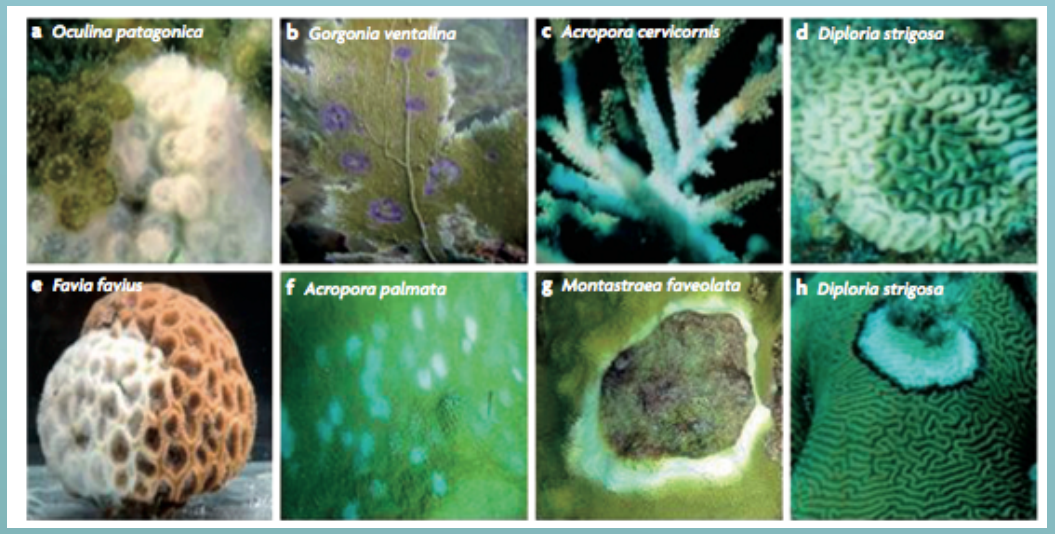
Northeastern University Marine Science Center

Nahant, MA

Marine Diseases



Burge et al 2014

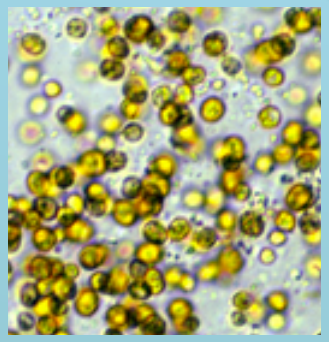


Rosenberg et al. 2007

The Coral Holobiont

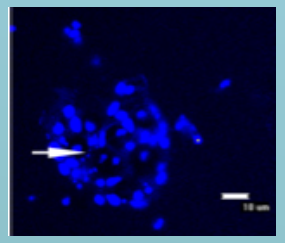
Coral

Veron 1986



Symbiodinium

National coral reef institute



Microbes:

Bacteria

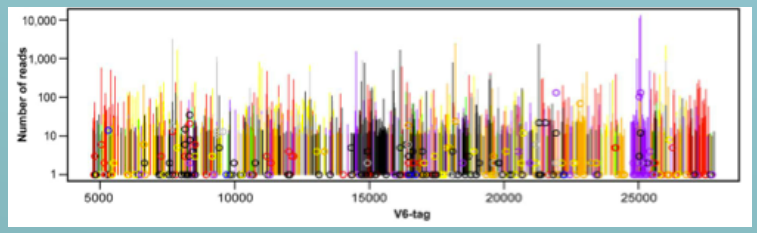
Archaea

Fungi

Viruses

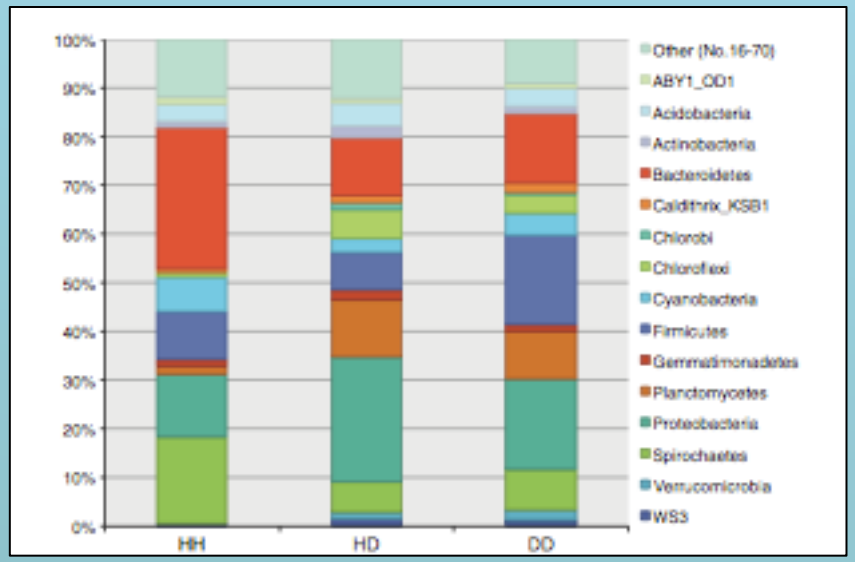
Garren and Azam 2010

Bacterial microbiome

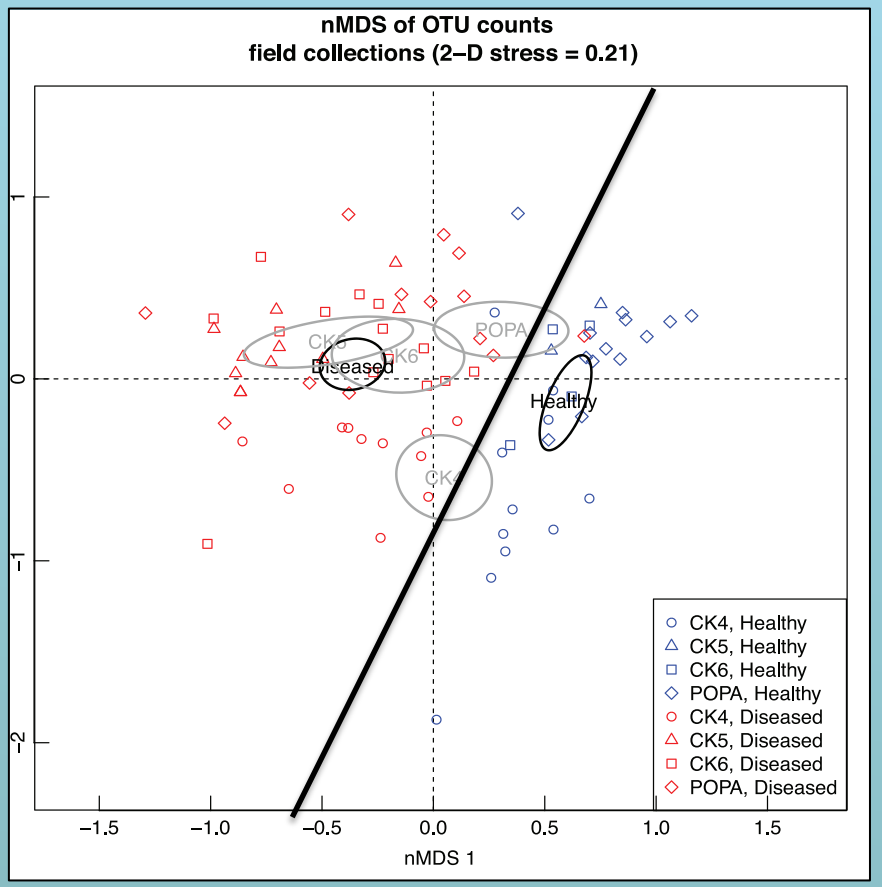


Sunagawa et al. 2009

Healthy vs Diseased microbiome



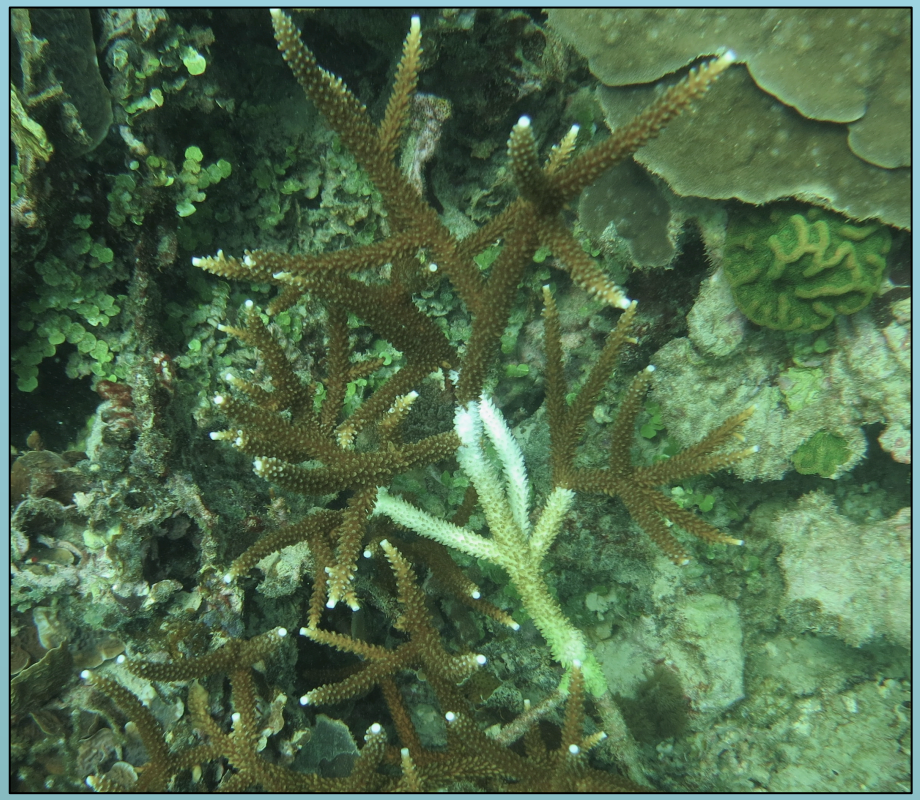
Closek et al. (2014)

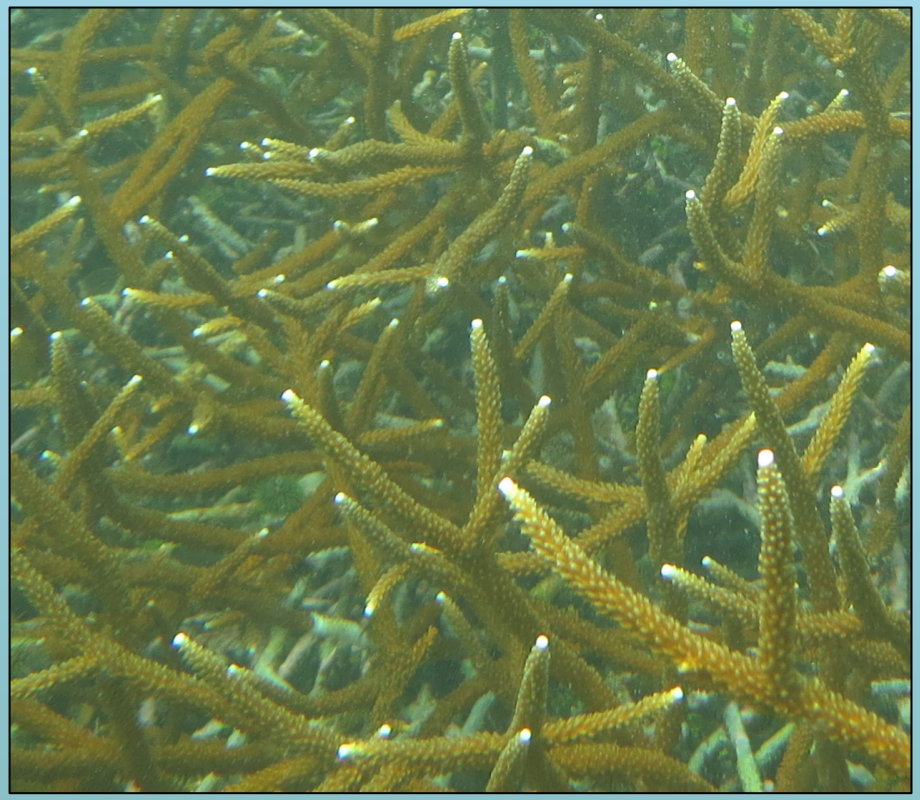


Diversity

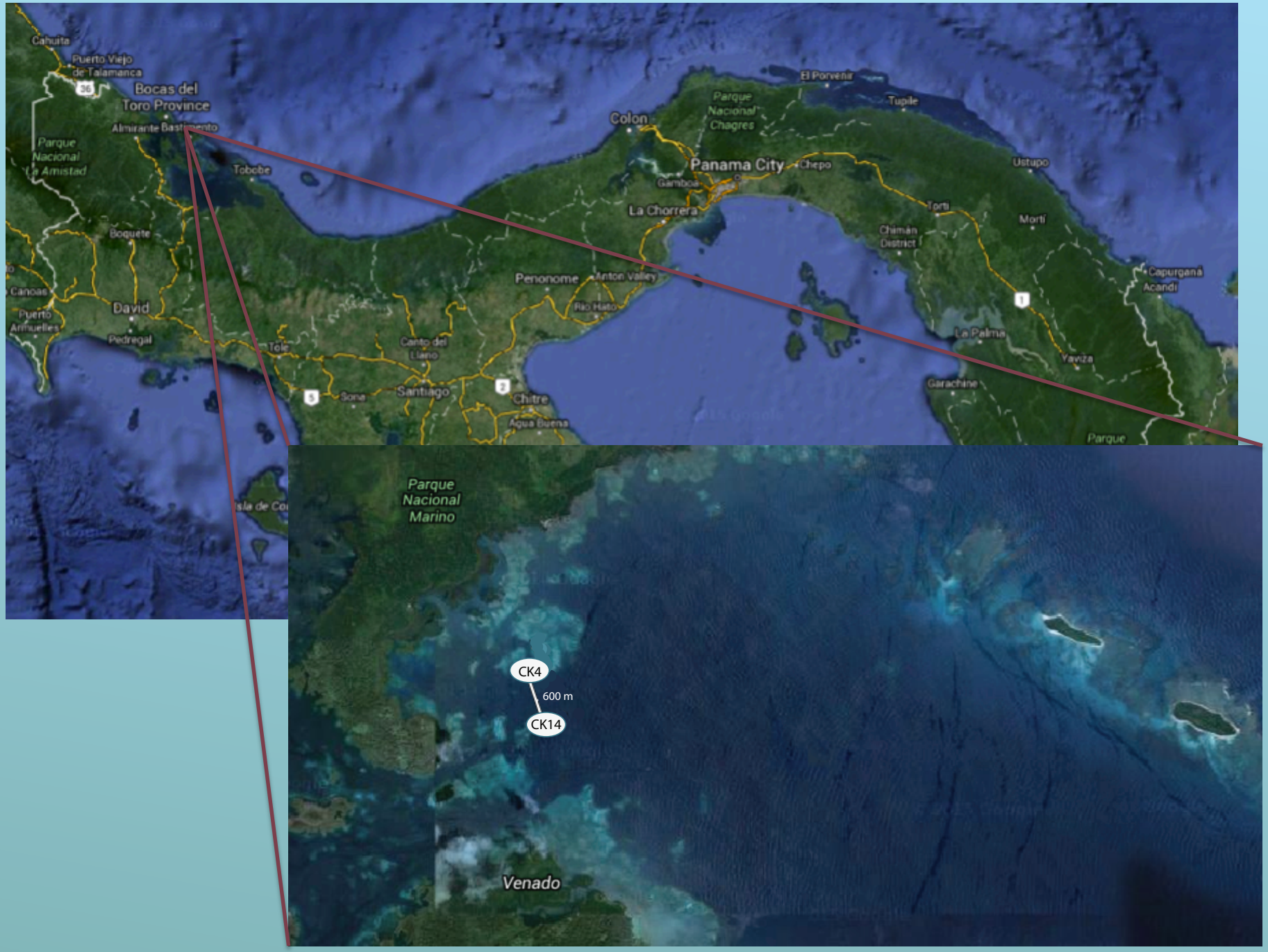
Gignoux-Wolfsohn and Vollmer (2015)

White Band Disease





Gignoux-Wolfsohn and Vollmer (2015)


Cahuita
Puerto Viejo de Talamanca
Bocas del Toro Province
Almirante
Parque Nacional La Amistad
Tobobe
Boquete
David
Puerto Armuelles
Pedregal
Canoas
Tole
Sona
Santiago
Canto del Llano
Penonome
Anton Valley
Rio Hato
Chitre
Agua Buena
Colon
El Porvenir
Tupile
Parque Nacional Chagres
Panama City
Chepo
Gamboa
La Chorrera
Ustupo
Torti
Morti
Chiman District
Capurgana
Acandi
La Palma
Yaviza
Garachine
Parque
Parque Nacional Marino
CK4
600 m
CK14
Venado

22-57 Hrs

10 Hrs

Time 3

CK4 Dose

CK 4 CK 14 | CK 4 CK 14 | CK 4 CK 14

CK4 Control

CK 4 CK 14 | CK 4 CK 14 | CK 4 CK 14

CK14 Dose

CK 4 CK 14 | CK 4 CK 14 | CK 4 CK 14

CK14 Control

CK 4 CK 14 | CK 4 CK 14 | CK 4 CK 14

ACTGACTGACTG

Workflow

DNA Extraction

16S Amplification

Illumina Sequencing

Bioinformatics

Clustering at 97%

GLMMs

275 Samples

65,413,553 Reads

97,933 OTUs (Operational Taxonomic Units aka species)

T1 factors: Colony

T2 and 3 fixed factors:
Final disease state + Site * Inoculant *
Timepoint * Inoculant site

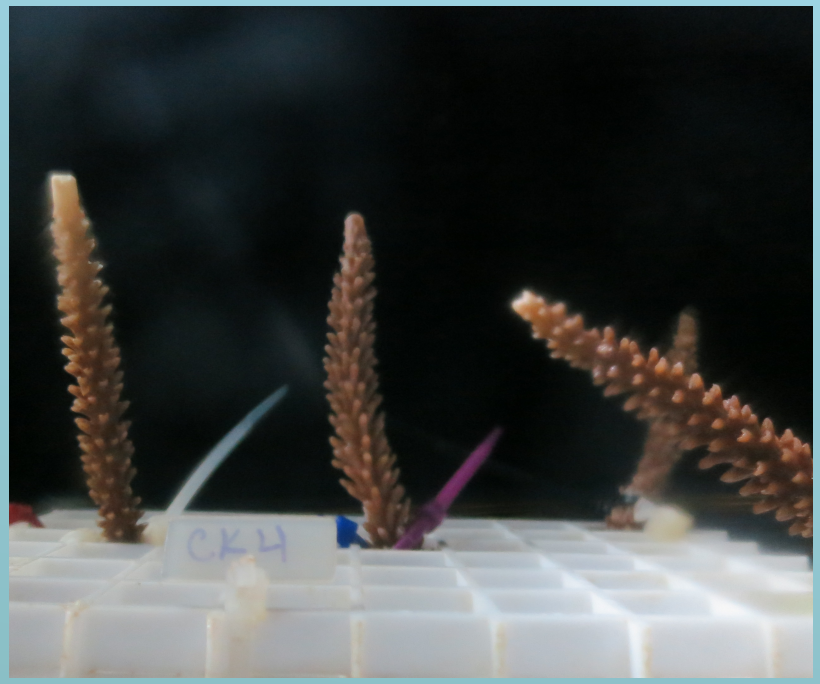
Who, where, when?

- Who are residents of healthy corals?
- How do these residents change in response to dose and disease?
- Who are initially colonizing diseased corals from the dose?
- Who are already present on corals and responding to dose?

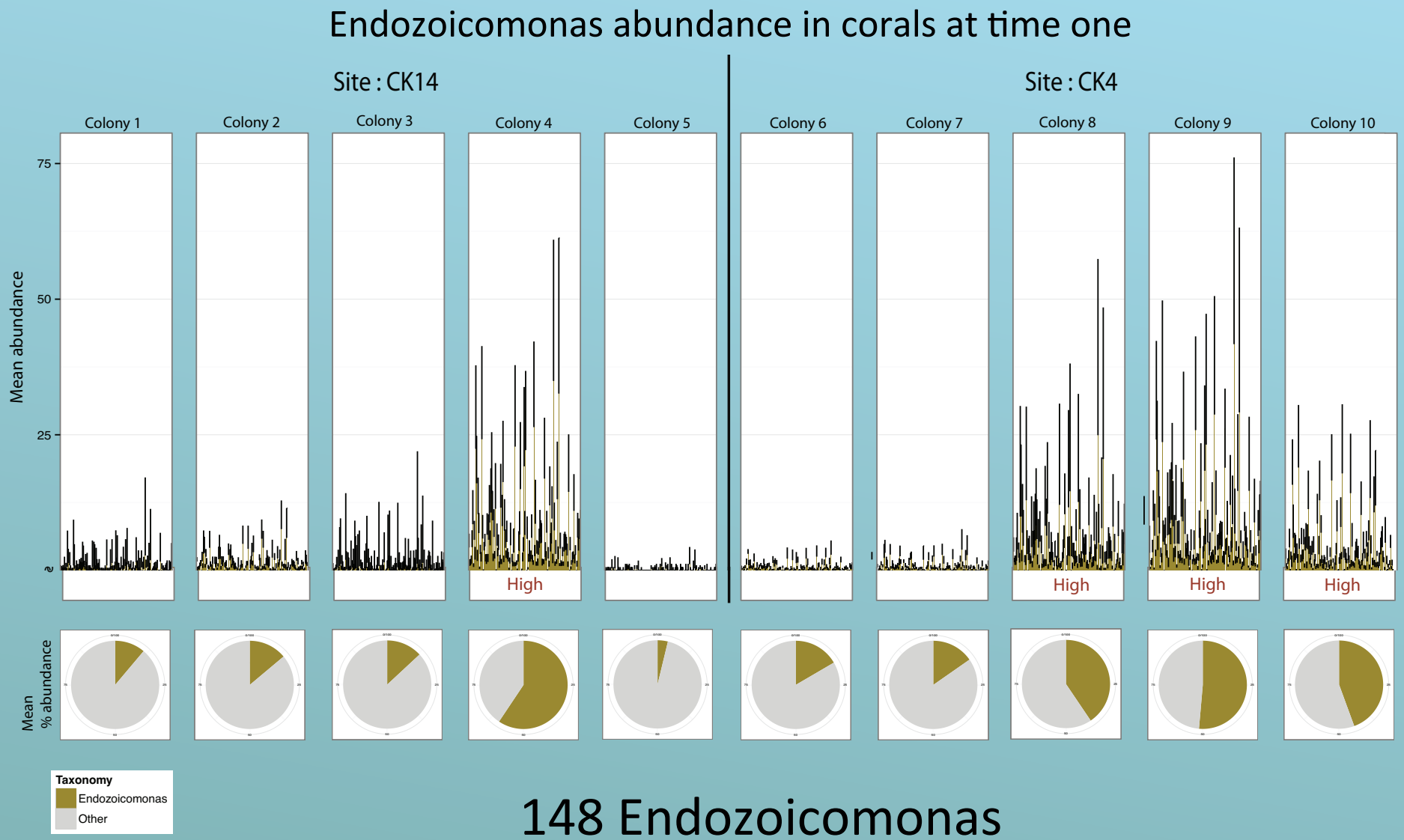
Who are healthy residents?

Colony had a large effect on healthy time one microbiomes (PERMANOVA, R2=0.18, p=0.001)

- Differ between colonies at time 1 (22,000 OTUs)
- Differ according to final disease state: more abundant in control (healthy) corals

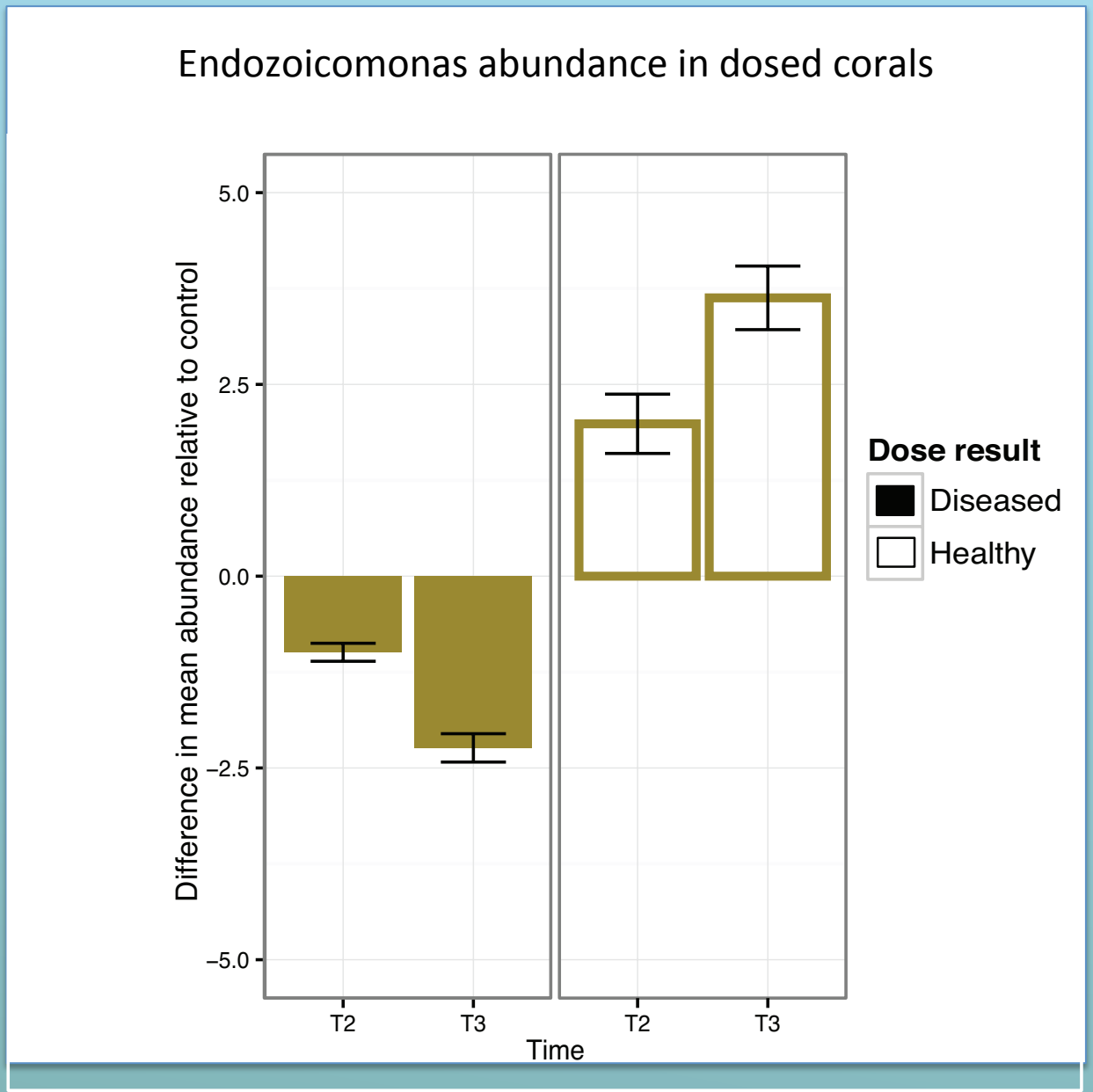


Who are healthy residents?



148 Endozoicomonas

How do these residents change with dose?



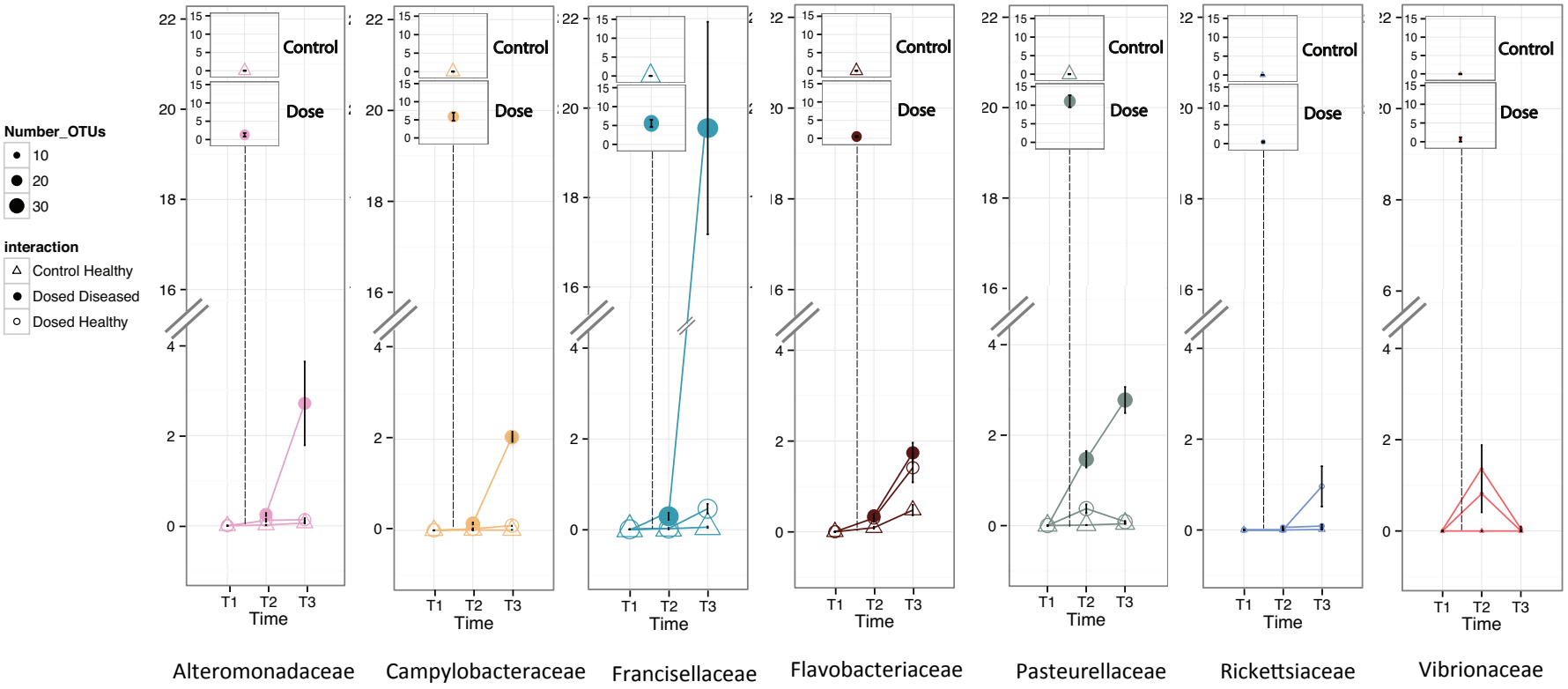
Who are colonizing diseased corals from the dose? When do they colonize?

- More abundant in the dose than control
- Differ based on final disease state
- More abundant in dosed diseased corals than controls
- At time two **and** time three
- Consistent across site

265 OTUS

Who are colonizing diseased corals from the dose? When do they colonize?

Primary Colonizers

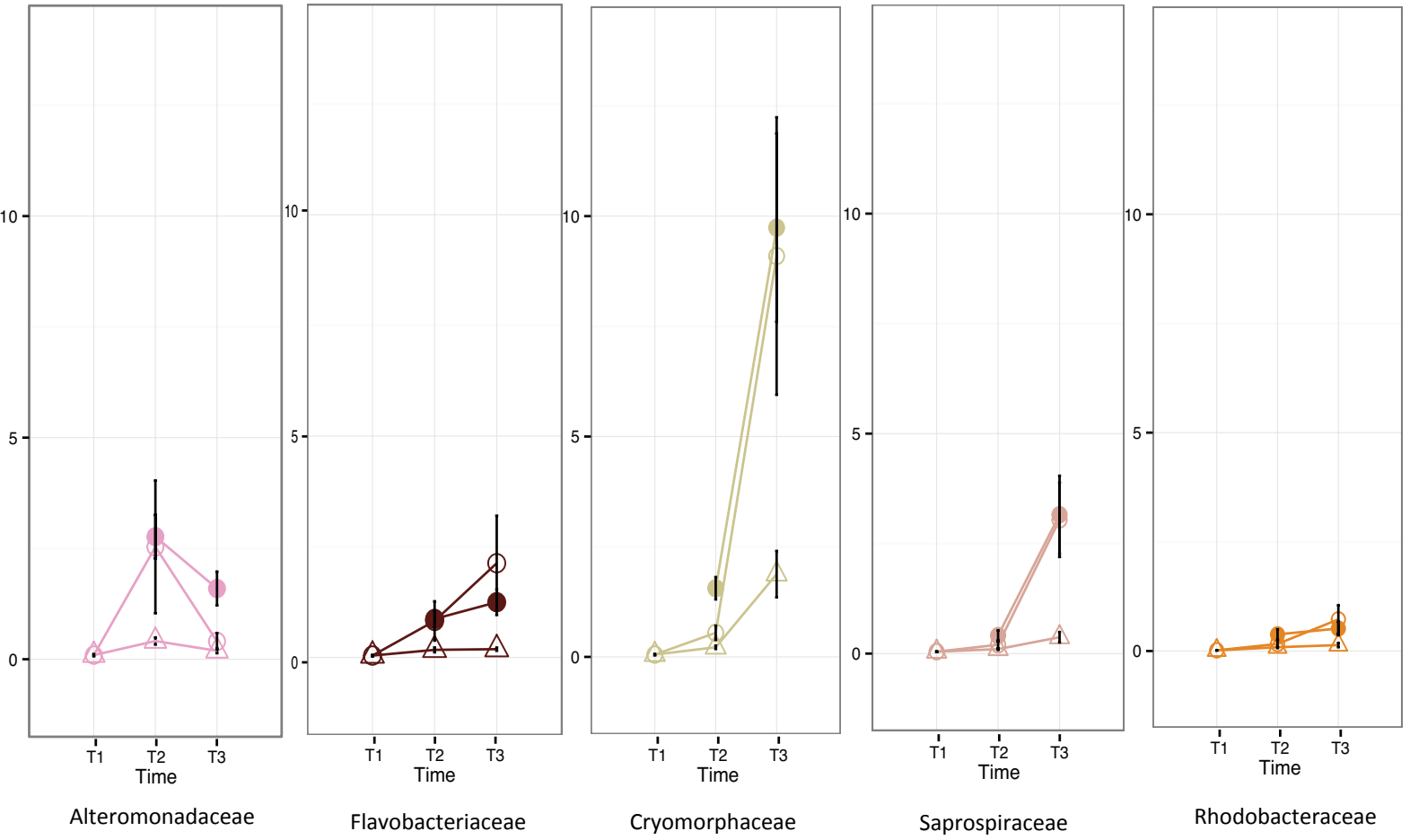


Who are already present on corals and responding to dose?

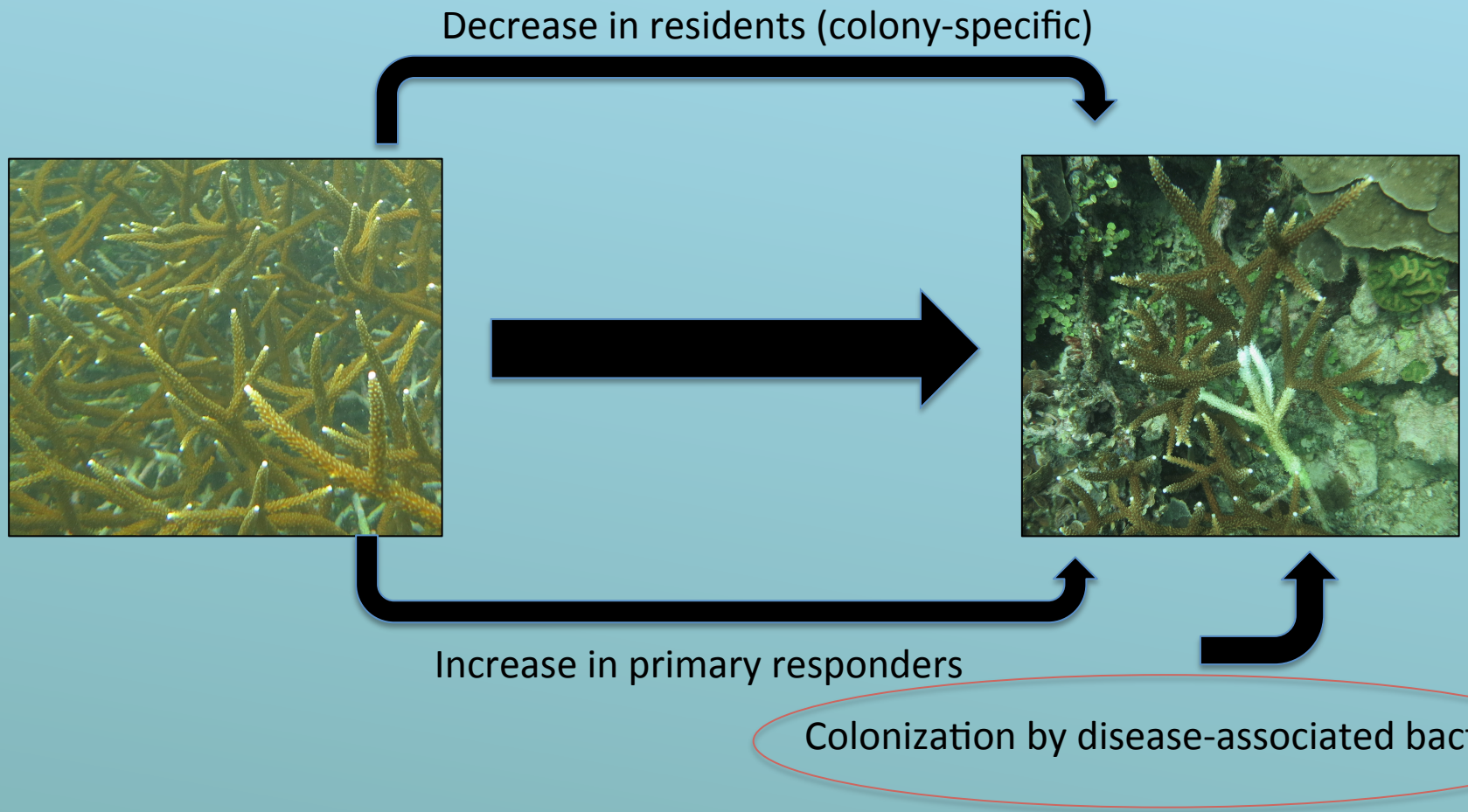
- Differ based on final disease state
- More abundant in dosed diseased corals than controls
- At time two **and** time three
- Consistent across site
- Present on Time 1 corals

272 OTUs

Who are already present on corals and responding to dose?



Conclusions



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https://experiment.com/projects/what-is-killing-caribbean-corals-investigating-a-devastating-coral-disease

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