Manipulation of the coral microbiome: proof of concept

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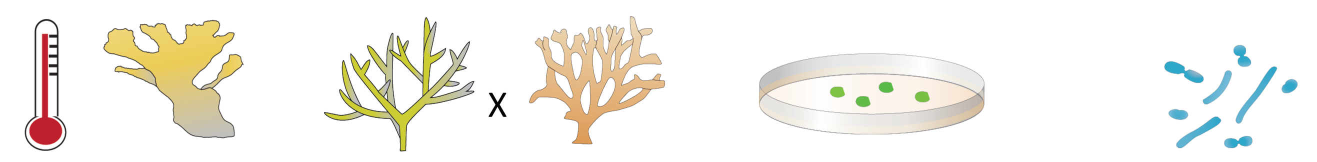
1 Background

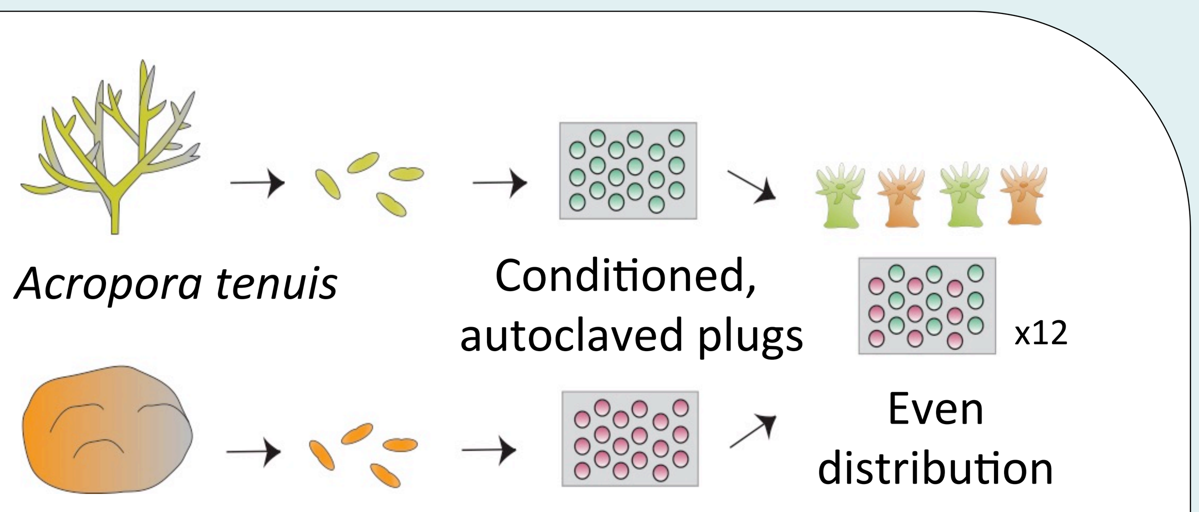
- Coral reefs suffer **massive declines** due to local and global anthropogenic stressors[1,2]
- **Assisted evolution** can accelerate natural evolutionary processes to enable organisms to cope climate change[3]:



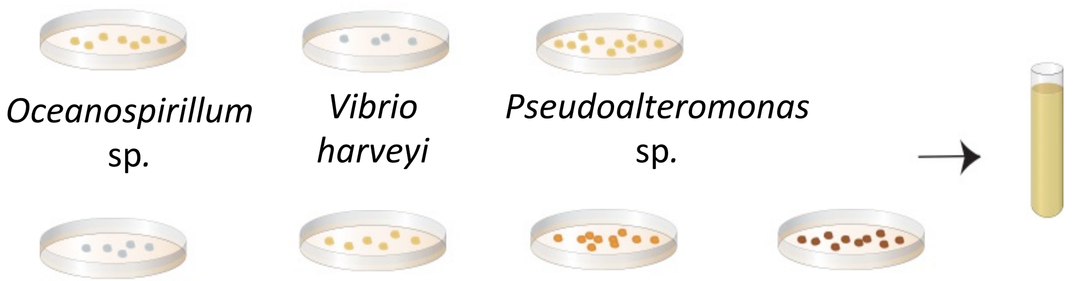
- Is the **manipulation of coral-associated bacteria** feasible[4]?
- Can **coral host species** influence the microbiome?

2 Methods

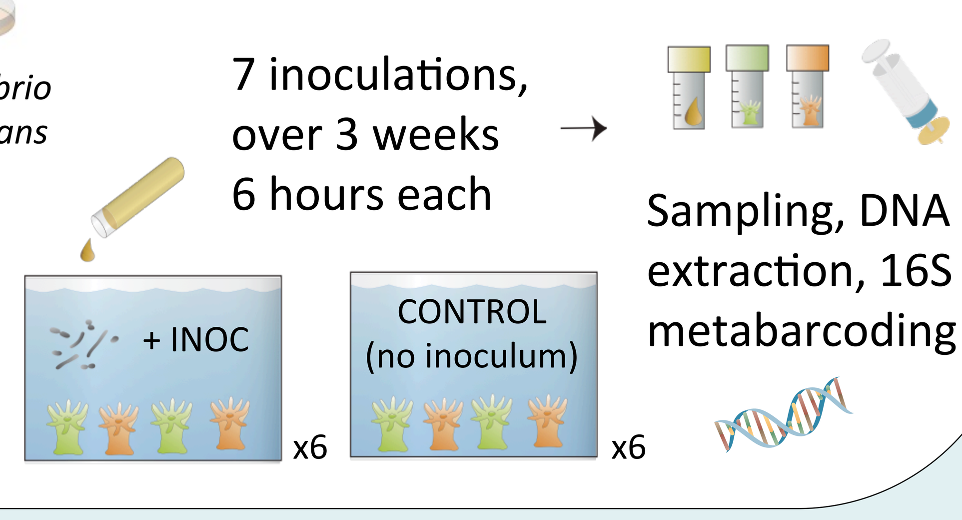
2.1 Spawning, larval settlement and **co-culture** of recruits



2.2 Bacterial cocktail from 7 pure cultures



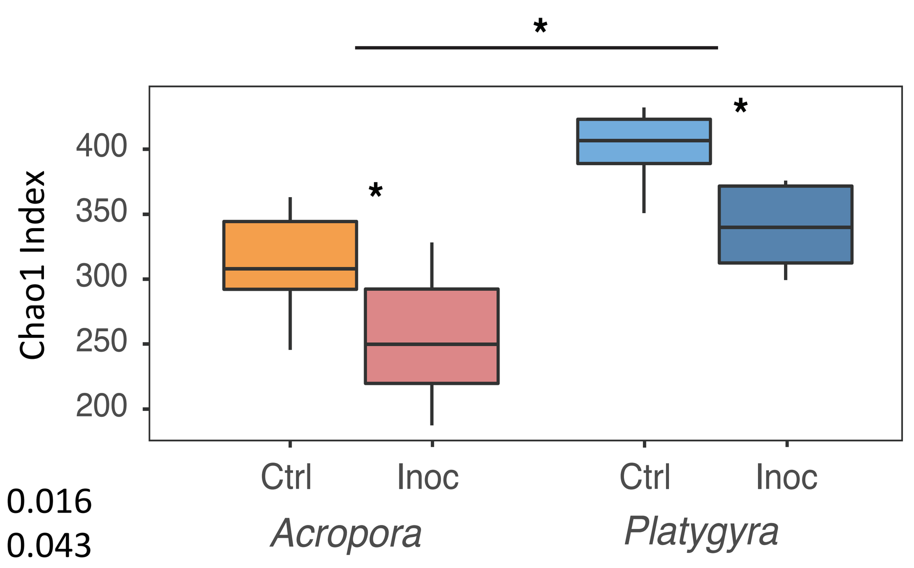
2.3 Inoculation of recruits co-cultured in filtered seawater



3 Results

3.1 Richness: **smaller** in **inoculated** corals and depends on host species

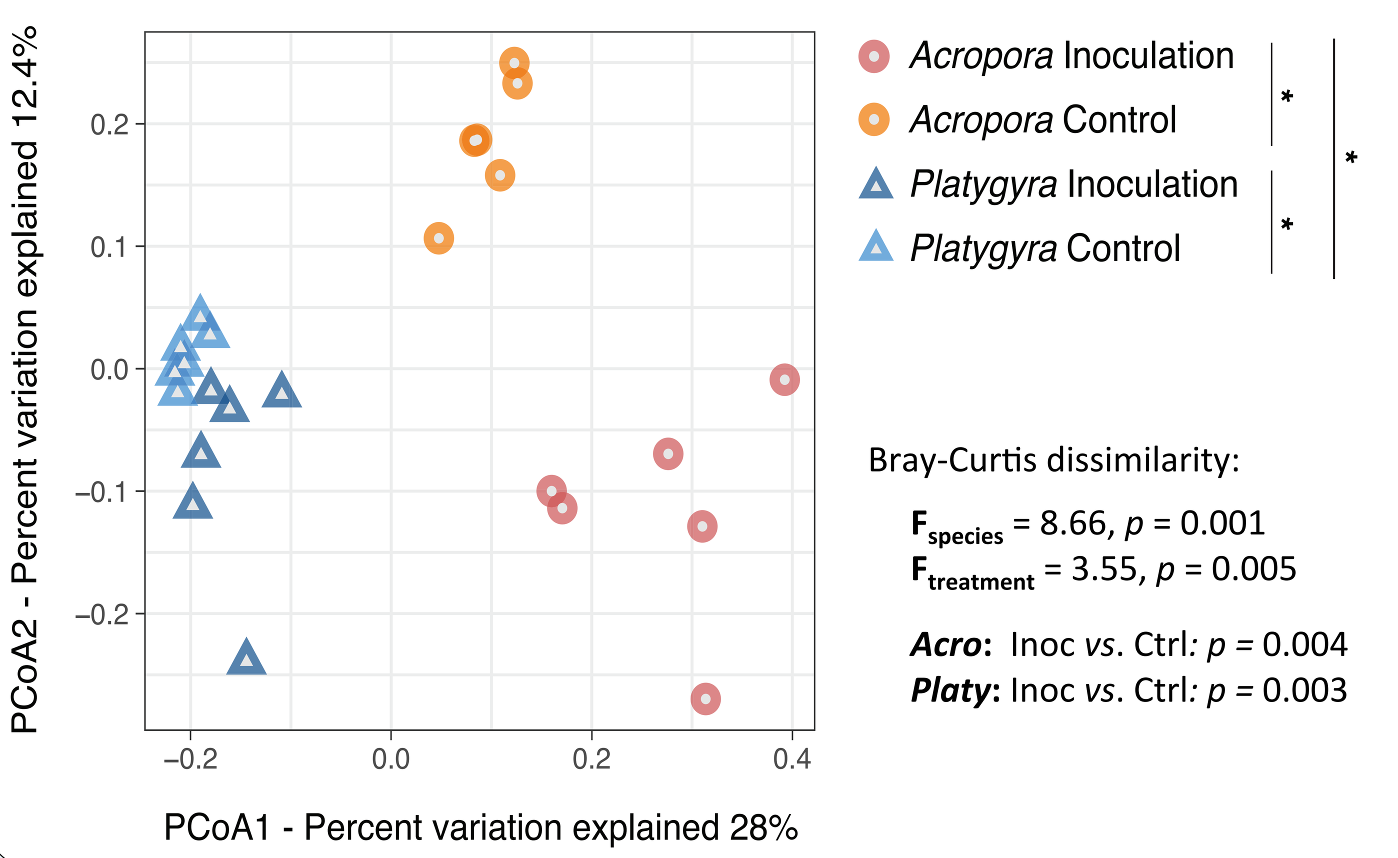
Fig 3.1 Estimated richness in coral recruits



Acro: Inoc *vs.* Ctrl: $z = 2.43$, $p = 0.016$
Platy: Inoc *vs.* Ctrl: $z = 2.03$, $p = 0.043$
Ctrl: *Acro vs. Platy*: $z = 3.09$, $p = 0.002$
Inoc: *Acro vs. Platy*: $z = 3.48$, $p < 0.001$

3.2 Bacterial communities depend on **host species** and **treatment**

Fig 3.2 PCoA of bacterial communities in coral recruits



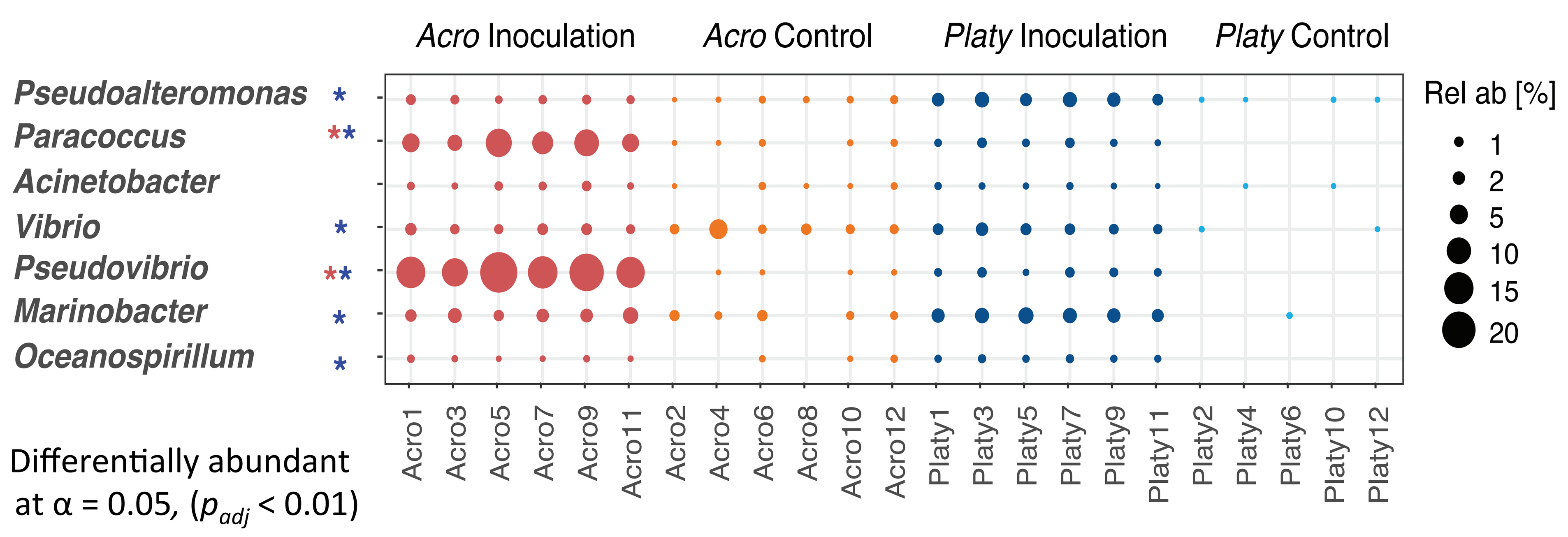
Bray-Curtis dissimilarity:

$F_{species} = 8.66$, $p = 0.001$
$F_{treatment} = 3.55$, $p = 0.005$

Acro: Inoc *vs.* Ctrl: $p = 0.004$
Platy: Inoc *vs.* Ctrl: $p = 0.003$

3.3 The **inoculum** drives the **difference** between treatment and control

Fig 3.3 Relative abundance of the seven bacterial species from the inoculum



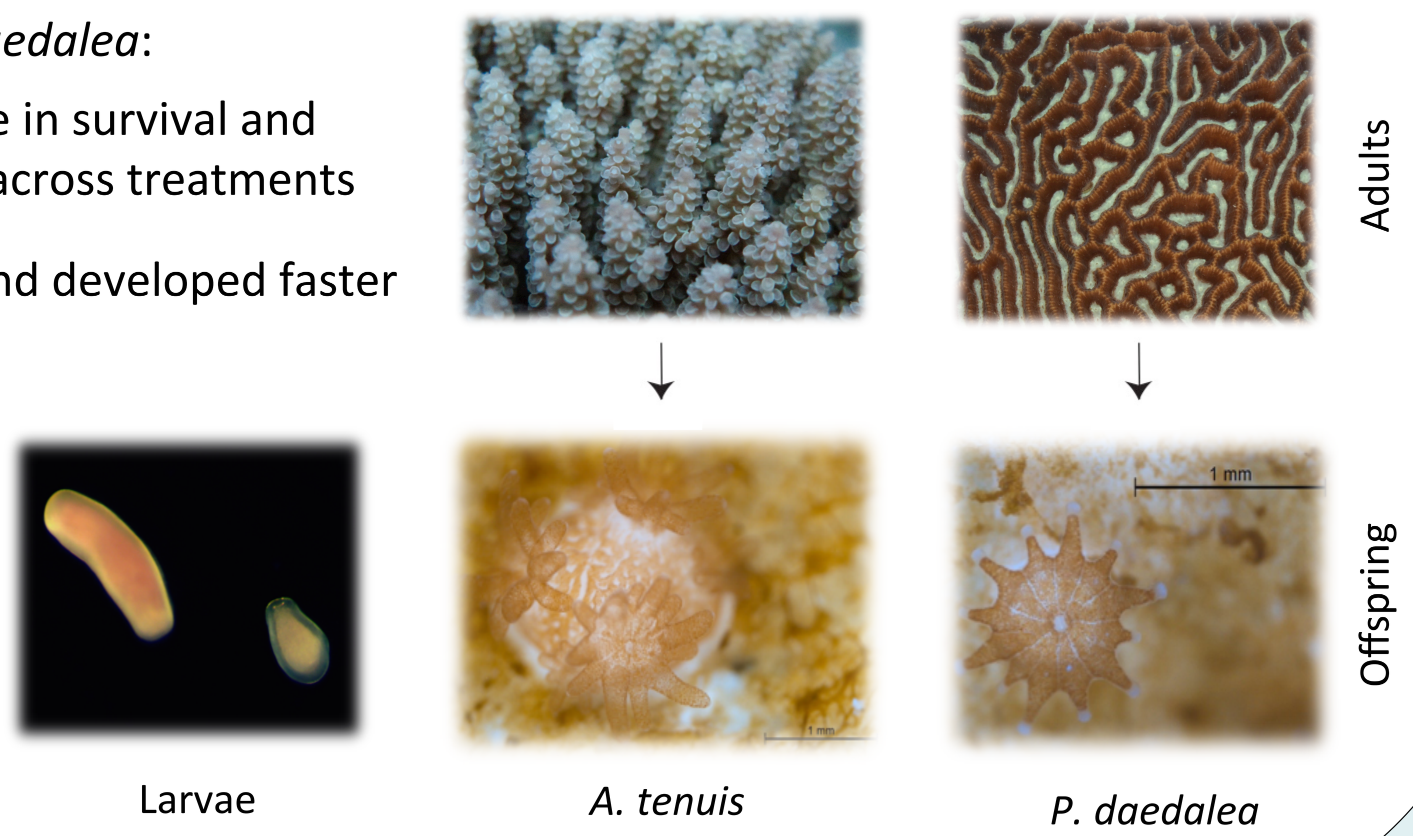
* Differentially abundant at α = 0.05, ($p_{adj} < 0.01$)

3.4 Corals did not exhibit phenotypic differences among treatments

- *A. tenuis* and *P. daedalea*:
  - No difference in survival and growth rate across treatments
- *A. tenuis* settled and developed faster than *P. daedalea*

Average survival:

$Acro_{Ctrl}$	99.2%
$Acro_{Inoc}$	98.6%
$Platy_{Ctrl}$	95.5%
$Platy_{Inoc}$	95.7%



Larvae · *A. tenuis* · *P. daedalea*

4 Conclusions and perspectives

- We **modified the microbiome of recruits** using targeted inoculation in the laboratory
- Coral **host species influenced microbiome** composition and response to inoculation
- The **stability** of the association, the holobiont **phenotypes** and the potential of selected bacterial taxa to **confer tolerance to stress** require investigation

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References: [1] Hoegh-Guldberg, O., 2011, in *Coral Reefs: An Ecosystem in Transition*, p.391-403; [2] Hughes, T.P., et al., 2018, Nature, 556: p. 492–496 [3] van Oppen, M.J.H., et al., 2015, Proceedings of the National Academy of Sciences, 2015, 112: p.2307-2313; [4] Damjanovic, K., et al., 2017, Microbial Biotechnology, 10: p.1236-1243