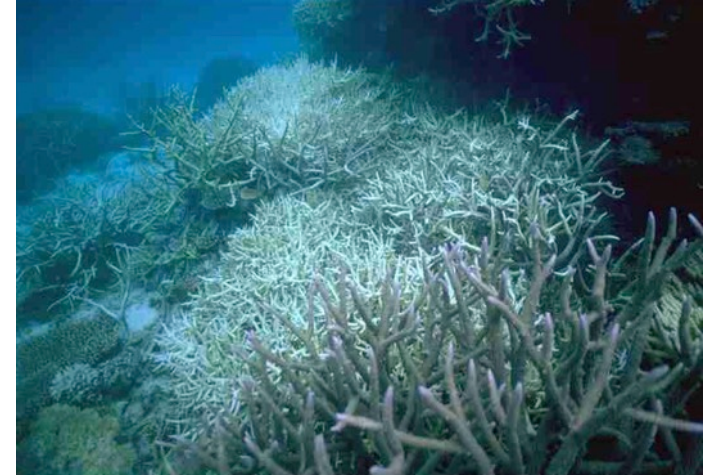


# Harnessing Basic Science to Advance Solutions for Coral Reefs

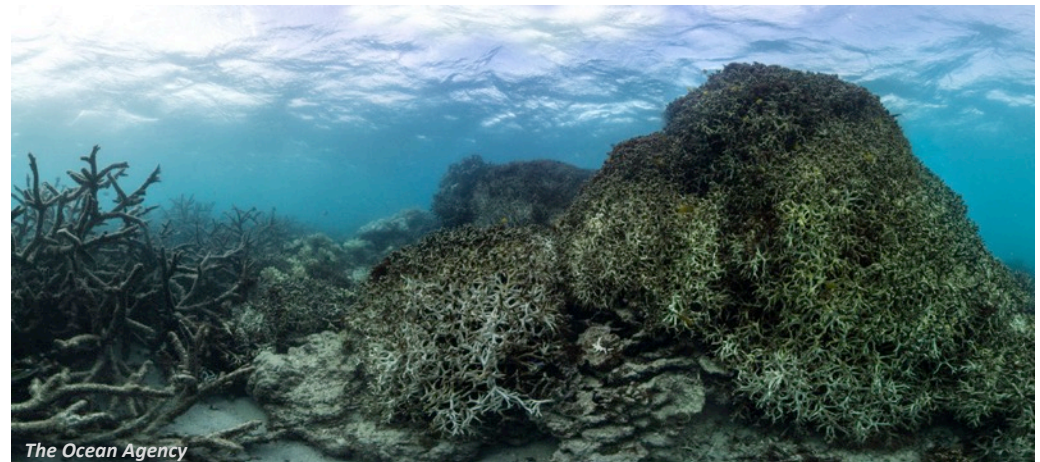


**Dr. Ruth D. Gates**  
Hawaii Institute of Marine Biology  
University of Hawaii at Manoa

# CONTEXT: Climate Change and Local Stress Driving Worldwide Declines in Coral Reef Health



Rates of environmental change are outpacing innate capacity of corals to adapt

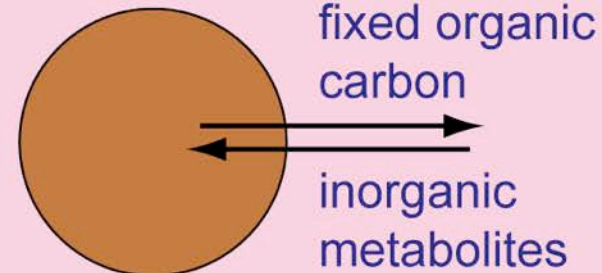




# WHAT IS A CORAL: Ancient symbiotic organisms, ecosystem engineers



## Coral Endodermal Tissue

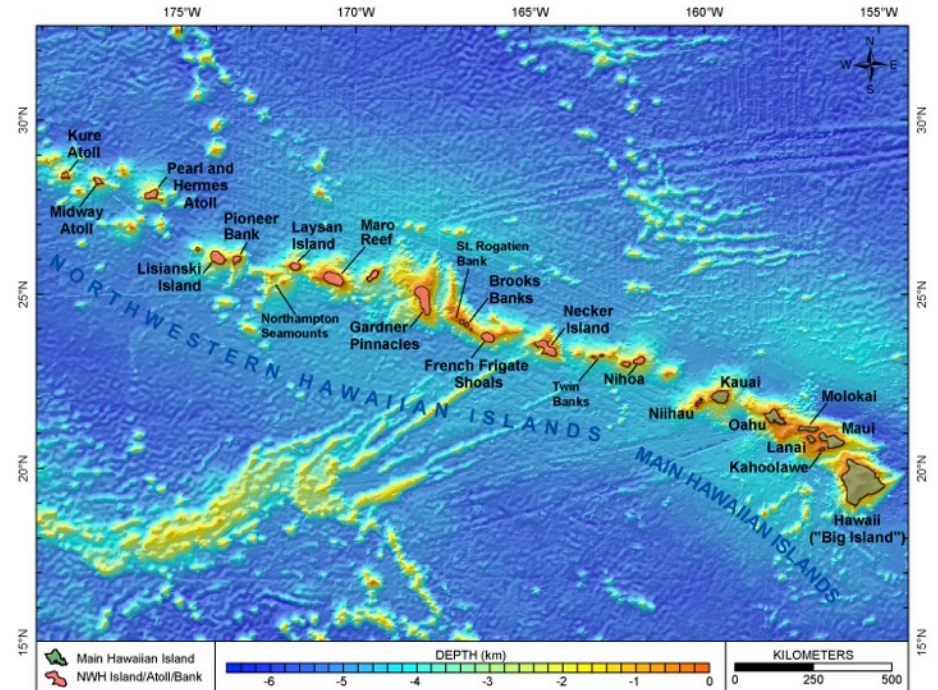
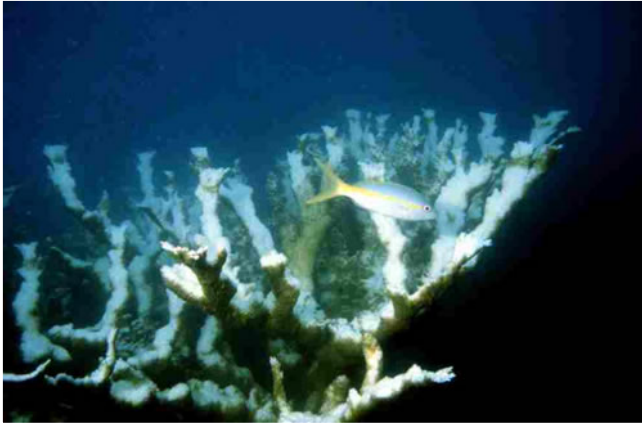


*Symbiodinium*

- Photosynthesis
- Nutrient recycling
- Calcification

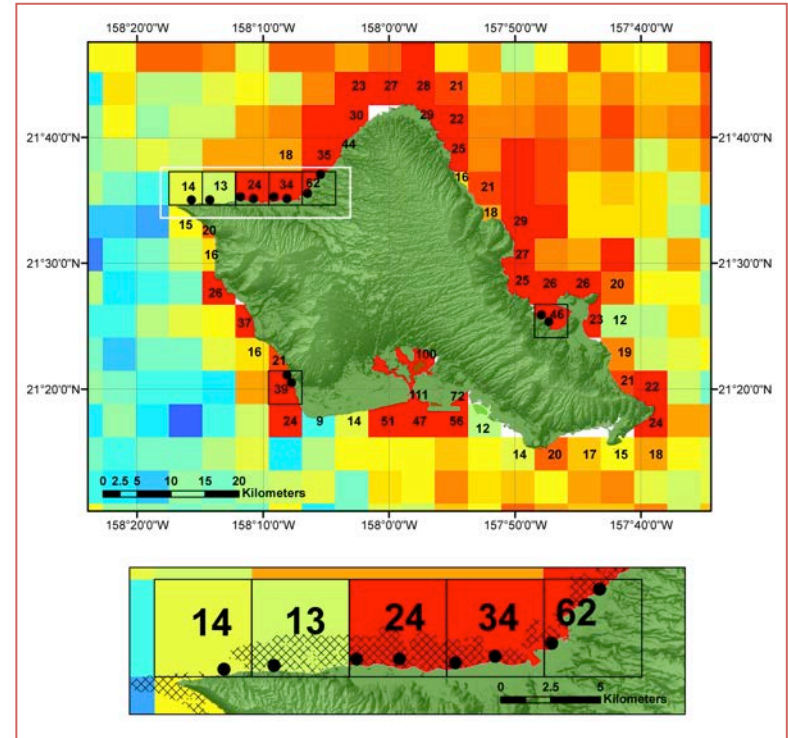
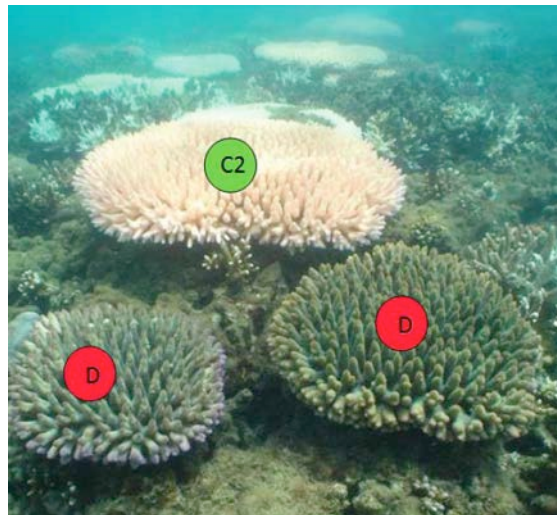


# STRESS RESPONSE: Highly variable at all scales



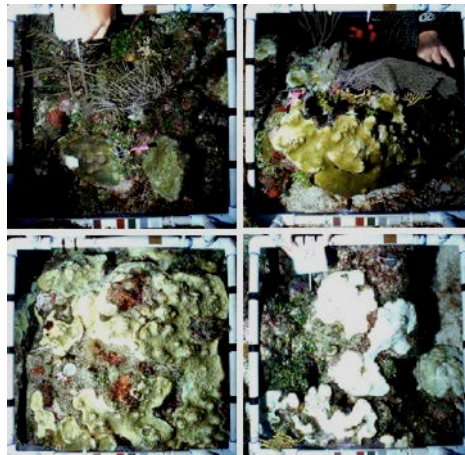


# VARIABILITY REFLECTS: Who you are, who you partner with, environmental history



# CHALLENGE: Use our science to improve the outlook for reefs

Close the gap between rates of change in the environment and rates of adaptation in corals



Focus on the survivors

# APPROACH: “Assist” the biology

**Assisted Evolution (AE)** accelerates naturally occurring evolutionary processes to enhance stress tolerance using:

1. Selective breeding
2. Modifying partnerships/symbioses
3. Manipulating environmental experience

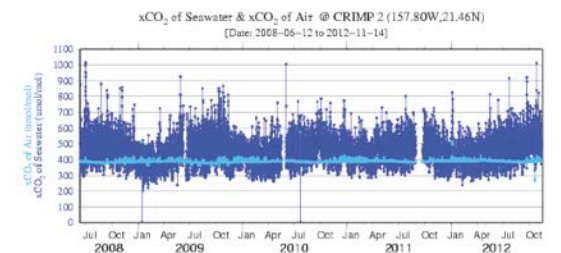
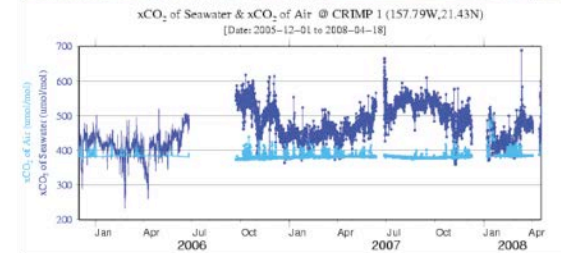
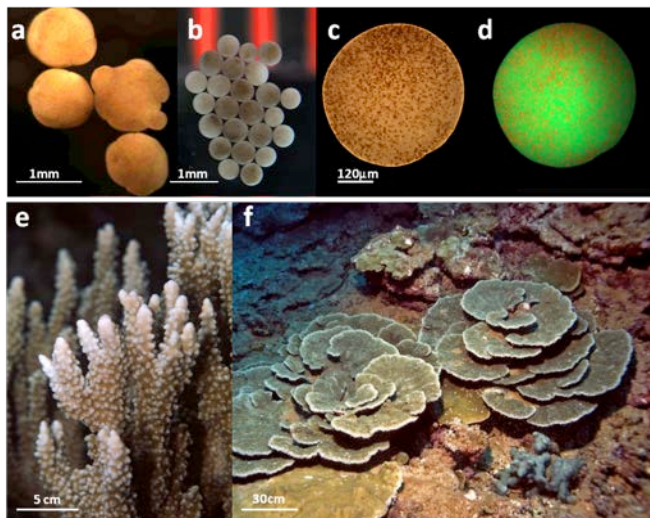


# 1. Selective Breeding

Intentional breeding of organisms with a desirable trait to produce offspring with improved traits – **genetic change**

## Mix brood stocks (gene pools):

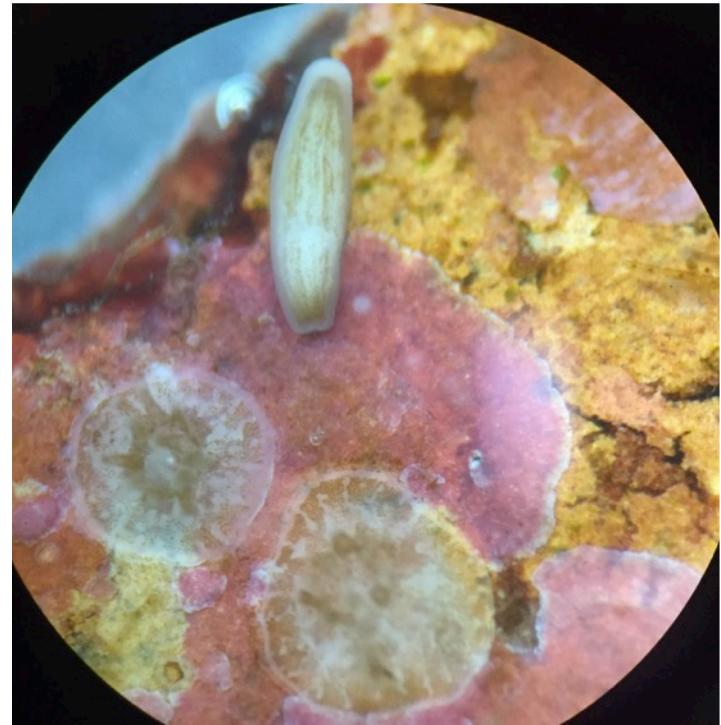
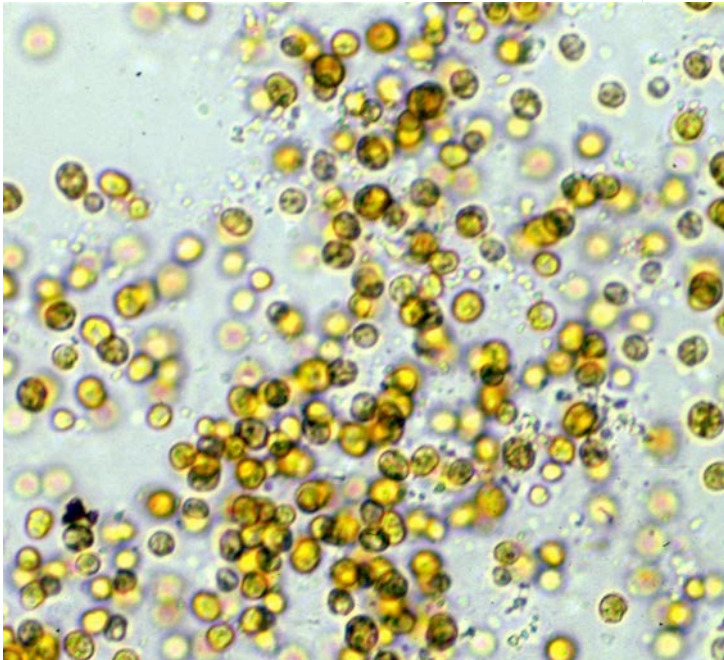
- Within species, populations from distinct environments
- Between closely related species





## 2. Modify the partnerships/symbioses

- Create new coral-symbiont combinations
- Evolve partners using environmental exposures



### 3. Manipulating environmental experience

Induce rapid adaptation (acclimatization) through exposure of natural stock to sub-lethal stress



“What doesn’t kill you makes you stronger”



# GOAL: Develop capacity for climate change adaptation on coral reefs

Use these “assisted” corals to:

- Restore damaged reefs
- Re-connect fragmented reefs
- Increase resilience on vulnerable reefs



# CONCERNS: Expressed by colleagues

*GMO for Corals*

*Designer Reefs*

*Mono-Species Reefs*

*Unnatural Selection – Ecosystem Engineering*

*Next Cane Toad?*

*Genetic Narrowing*

*Presents False Hope - Distracts from the Mitigation Efforts*

PROOF OF CONCEPT

RIGOROUS SCIENCE - LEVERAGING TECHNOLOGY

EVIDENCE BASED, DATA DRIVEN



# PROCESS: Changing the way we do business

- Mission and timeline focused
- Transdisciplinary collaboration - TEAMWORK
- Rapid data releases
- Transparent, report progress (success and failure)
- Commitment to outreach and education



# THE MILLION DOLLAR QUESTION: Is the approach scalable?

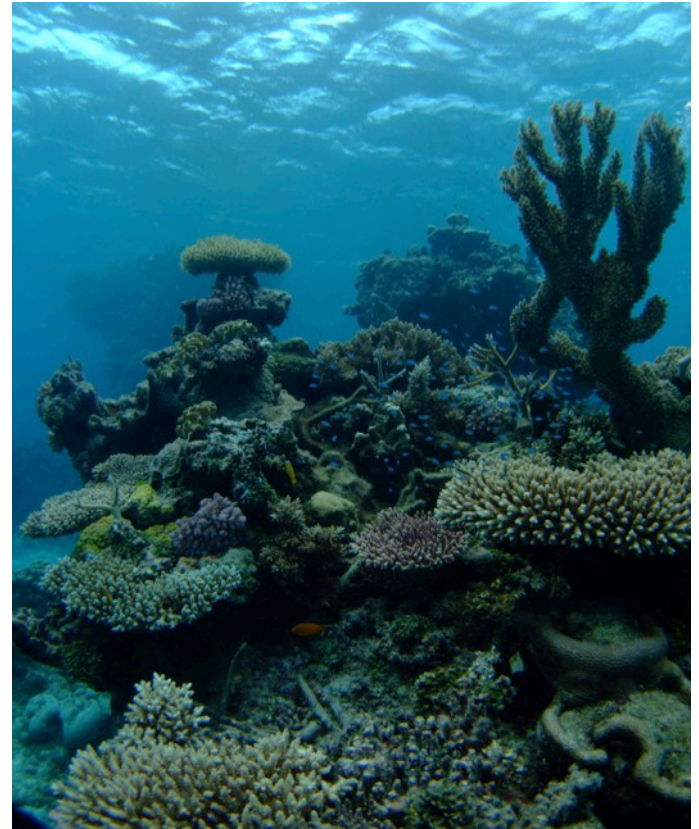


Interacting science with practitioners, building the network, the power of parallelized action



# WHAT IS AT STAKE?

- Food Security
- Coastal Security
- Tourism
- Cultural Value



# ACKNOWLEDGEMENTS



HIMB and the University of Hawaii  
AIMS  
Paul G Allen Family Foundation

