ECO-CRAB

Engineered Chemical Optimization for Coral Reef Acidity Balancing

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Reef Restoration Concepts

- Is local altering of ocean chemistry feasible?
- Can coral be “fertilized” to protect them against changing ocean conditions?

Ocean Conditions and Coral Threats

- 37 Billion tons of CO_2 are emitted annually
  - 1/3rd ends up in the ocean
- 90% of coral are at risk of bleaching
- 30% of those coral will experience bleaching or death

Figure 1: Reef after and before bleaching event

Aragonite Reactors

- Use ocean acidity to dissolve aragonite
- Sized for low flow rates and “long” refill intervals
- Common marine materials and off the shelf parts

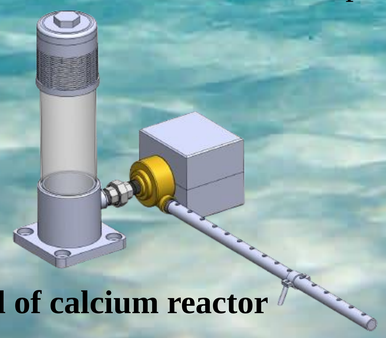


Figure 2: Model of calcium reactor

System Configuration

- Reactors installed in sandy patches
- Anchored via 3D printed concrete coral heads
- Distribution lines run parallel to coastline to utilize wave aided mixing

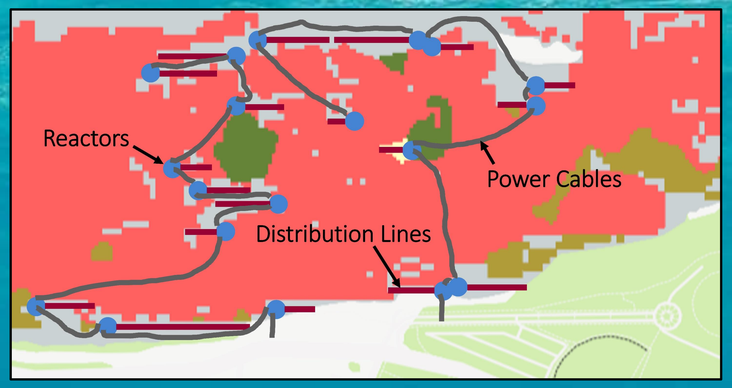
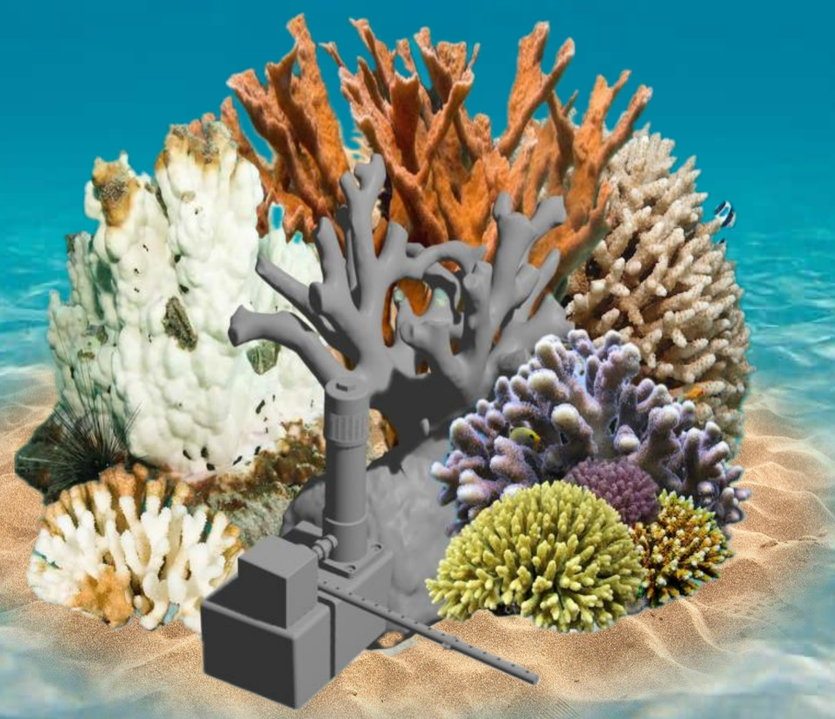


Figure 3: Example system layout on San Juan Reef



System Power

- Wave power is an insufficient source of mixing
- Green energy sources were found to be insufficient to power the system due to both scale and cost

Scaling and CFD

- CFD study will optimize system organization
- Multiphase simulation to predict effective range of each reactor

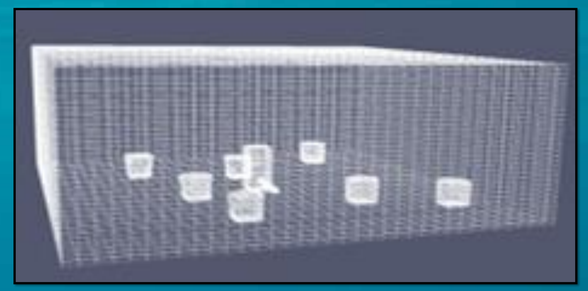


Figure 4: Mesh of CFD simulation

Implementation Limits

- Limited effective range necessitates excessive amount of reactors
- Reactors and concrete coral would make up 40% of reef area

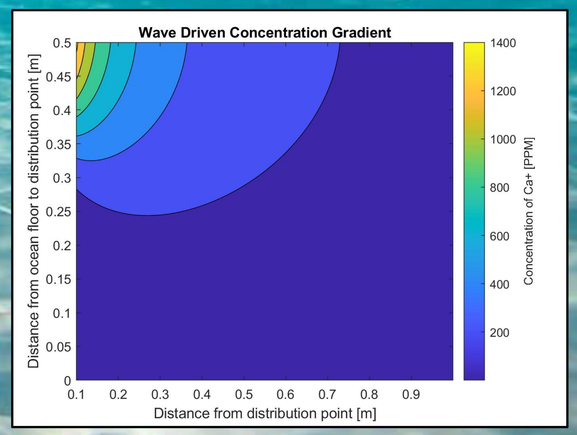


Figure 5: Wave mixing concentration gradient