Hyposalinity thresholds for stony corals Montastraea cavernosa, and Porites astreoides in Southeast Florida

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Abstract

- Pulse freshwater releases can reduce marine water salinity on reefs near inlets
- This study aimed to quantify both acute and chronic hyposalinity tolerance thresholds for corals to inform local best management practices
- Ten colonies of each of two prominent species in southeast Florida were collected, fragmented, acclimated, and exposed to acute and chronic hyposalinity stress in a series of two experiments.
- Under acute hyposalinity stress, LC50 is 19 PSU for both *P. astreoides* and *M. cavernosa*
- Chronic exposure to 25 PSU results in LT50 at 17 days for *P. astreoides* and over 21 days for *M. cavernosa*

Background

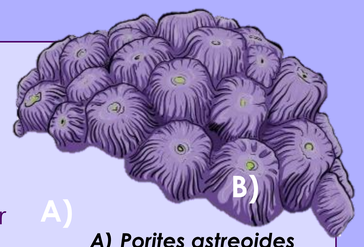
- Freshwater discharge is an increasing concern for nearshore reefs
  - Increased storm intensity [1]
  - Anthropogenically altered watersheds
- Nine inlets in KJCRECA created connectivity between land-based freshwater sources and coral reef habitats
- Pulse freshwater release events can rapidly decrease salinity levels across nearshore reefs [2, 3]
- Long-term monitoring at St. Lucie Reef shows that large freshwater releases and/or major storm events can result in ~25 PSU for up to a week on the reef and can reach as low as 18 PSU for days (DBHydro)
- Lethal hyposalinity thresholds have yet to be determined for several important scleractinian corals on Florida's Coral Reefs (FCR)
- *Montastraea cavernosa* and *Porites astreoides* were selected for this study as prominent FCR species[4, 5]

Inlets within the Kristen Jacobs Coral Reef Ecosystem Conservation Area (KJCRECA)

Methods

Coral Collection and Aquaria Setup

- Coral colony collections (10 per species) in KJCRECA
- Tissue punches collected for future molecular work
- Fragmented corals using diamond blade tile saw lubricated by 35 ppt water
- Fragments fastened to limestone tiles and tagged
- Placed coral fragments into one of six aquaria with stratified random design
- Randomly assigned "control" or "treatment" status to each aquaria so that there were three of each

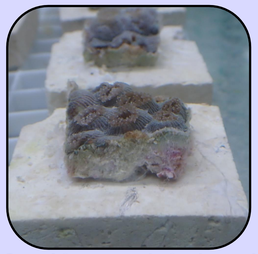


A) Porites astreoides
B) Montastraea cavernosa

Experimental design

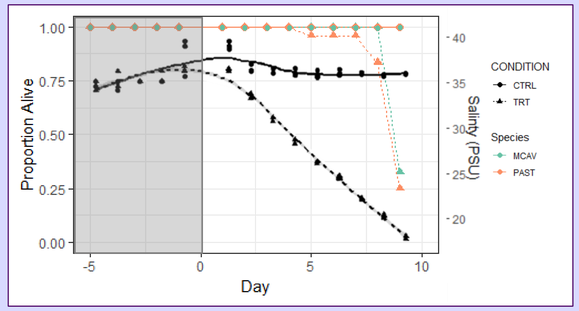
- 5 day acclimation period at initiation of each trial
- Reduced salinity of "treatment" aquaria by 2 PSU daily using 20% water change
  - Exp 1- acute hyposalinity (continuous drop)
  - Exp 2- chronic hyposalinity (drop and hold)
- Recorded health assessment data based on work by Woodley and Downs [7]
- Took scaled photographs of each aquaria daily prior to water change
- Ended experiment at 50% mortality

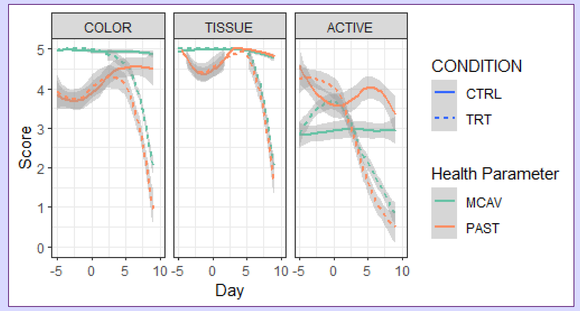
Coral fragmenting with tile saw



Coral fragments fastened to tiles for experimentation

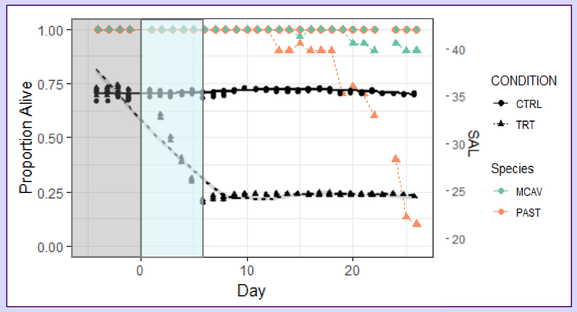
Acute Hyposalinity

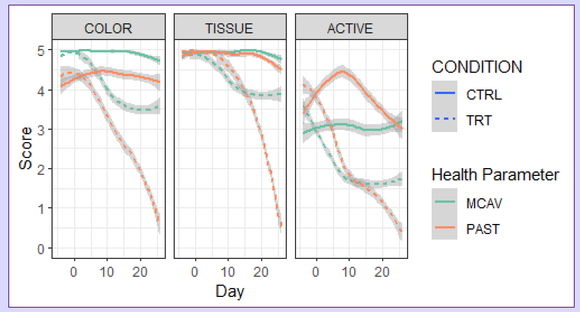




- Both *M. cavernosa* and *P. astreoides* have a LC50 of 19 PSU seawater.
- Polyp activity had strong downward trends for both species beginning at 31 PSU (day 3).
- Color and Tissue Integrity of both species show decreases around 27 PSU (day 5).

Chronic Hyposalinity





- Chronic hyposalinity tolerances at an intermediate stress of 25 PSU was >21 days for *M. cavernosa* and 17 days for *P. astreoides*.
- While M. cavernosa showed no mortality, their polyp activity showed strong downward trends from day 0 to 5, but holds steady beyond that.
- Coloration and tissue integrity of P. astreoides had a strong downward trend from day 0.

Conclusions

- M. cavernosa colonies are highly tolerant of chronic hyposalinity but are still susceptible to acute hyposaline stress
- P. astreoides are less resilient to chronic hyposalinity, yet are similarly tolerant of acute hyposaline stress
- These data suggest longer term slow-release regimes for freshwater may be ore favorable for corals than large-volume pulse-releases
- Coastal development and associated surface-hardening may drive "flash freshening" events on reefs near major inlets and may be associated with declines in coral health in southeast Florida.

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