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Calcification Rates Indicate Thermal Stress Tolerance in Belize "BackReef" Corals

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Calcification Rates and Symbiont Concentrations Indicate Stress Tolerance in Belize 'Back Reef' Corals

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Background

Symbiodinium algae live within coral tissue

Provide colors and up to 90% of the coral's nutrition

Environmental stress → corals expel symbionts→ "Coral bleaching"

Long-term loss of symbionts = Death (no food)

Photo courtesy of Pixshark

Study Focus

Heat stress is a major cause of bleaching and is a key focus of the Barshis lab

Research question: Do corals from sites with high temperature fluctuations tolerate thermal stress better than corals from low fluctuation sites?

Hypothesis: Corals experiencing high temperature fluctuations will show better stress response (as shown by higher symbiont concentrations and greater calcification rates)

Methods

Coral Collection

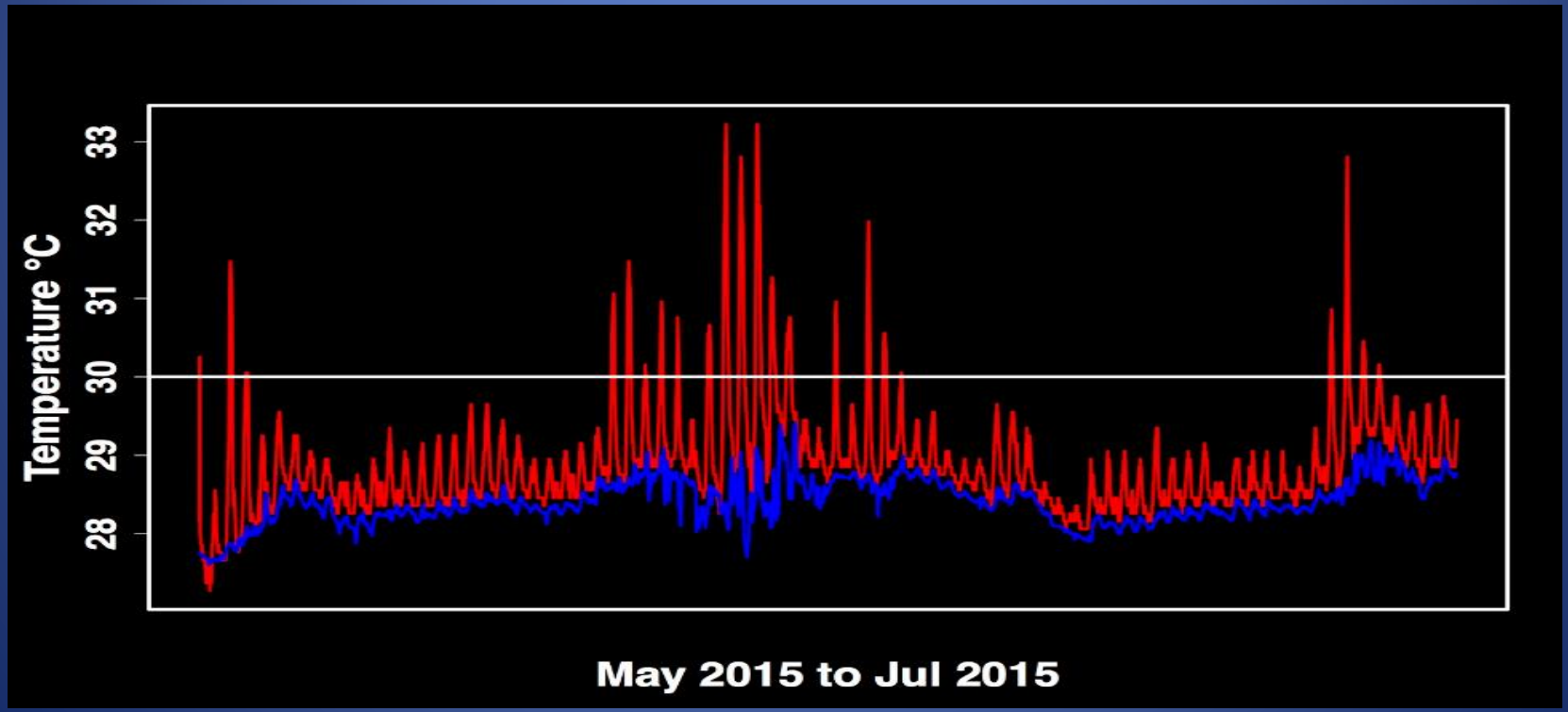
Porites astreoides (mustard hill coral) colonies were collected from Carrie Bow Cay in Belize (April 2015)

P. astreoides is a common Caribbean coral

Methods

Collection Sites

High temperature fluctuation site (Back Reef) and low temperature fluctuation site (Karen Koltes Reef)



Methods

Heat Stress Experiment

The original colonies were cut into separate coral nubbins: (N=32)

Nubbins were distributed among 2 Heated tubs (H1/H2) and 2 Control tubs (C1/C2), then placed in a tank for 6 weeks (Heated=31°C; Control=27°C)

Methods

Measuring Calcification Rates

Coral buoyant weight technique – only measures increase of skeletal growth (not tissue growth)

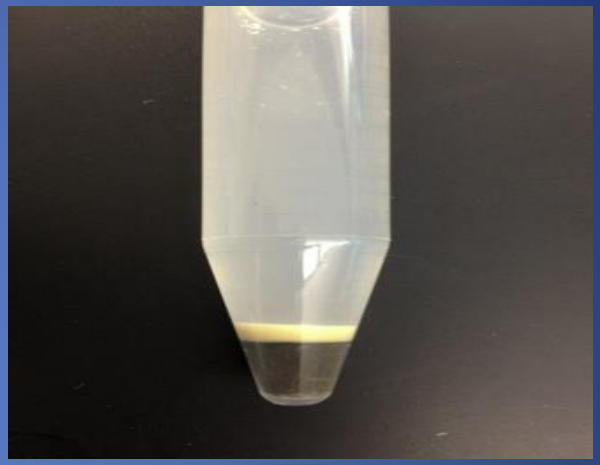
Calcification rate is the

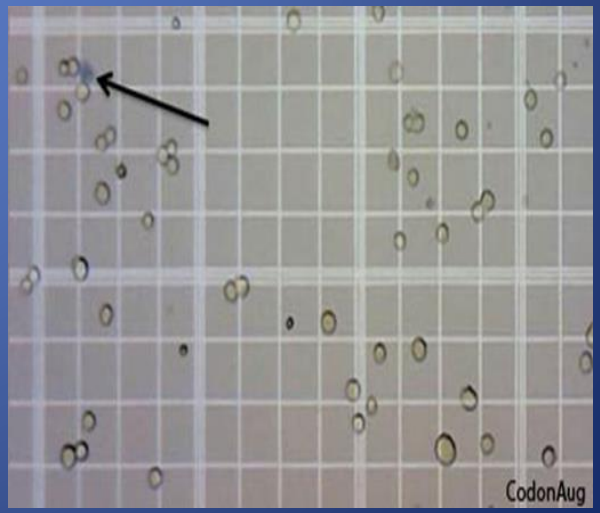
Percent weight gain

$$\left(\frac{final\ weight - initial\ weight}{initial\ weight}\right)$$

Methods

Symbiont Counts





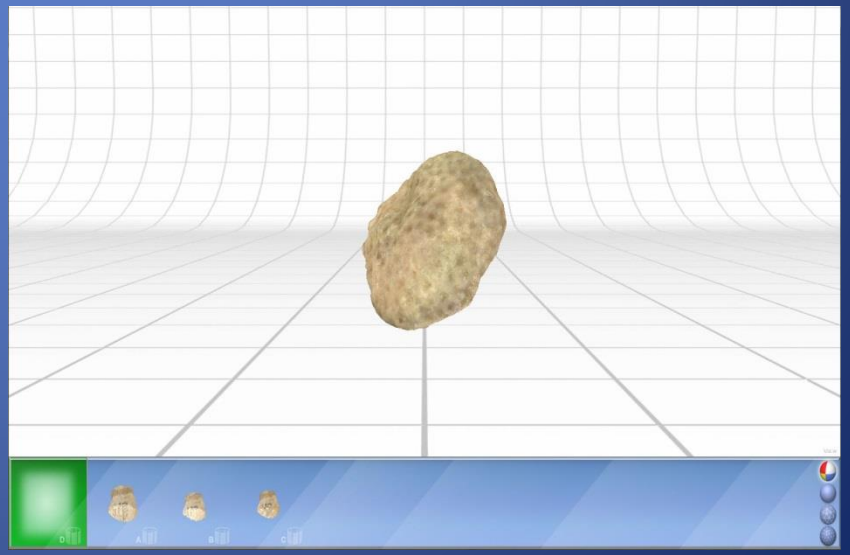
Top right photo: Courtney Klepec
Bottom right photo: bitesizebio.com

Methods

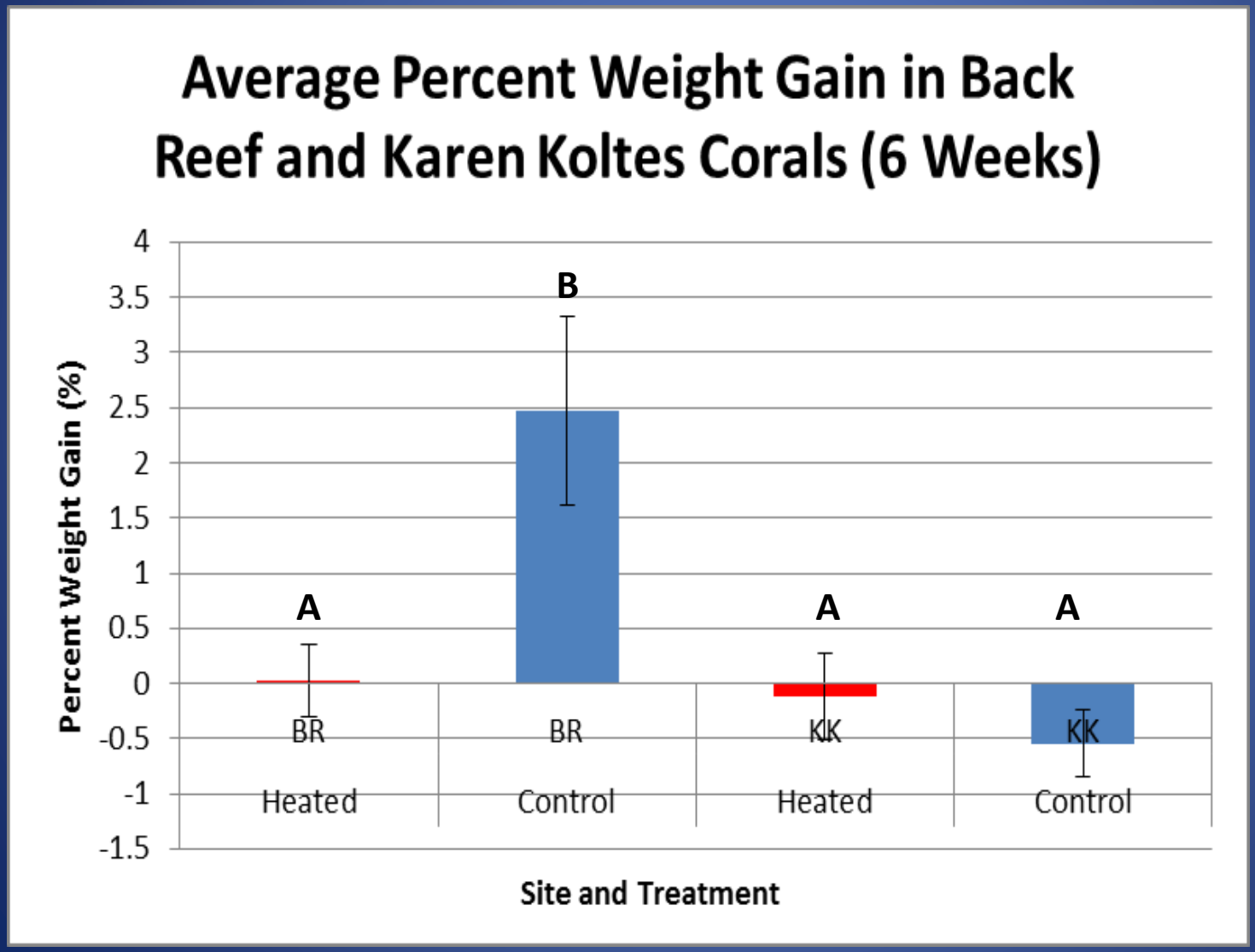
Surface Area Calculations

Each nubbin was measured for surface area using the *Next Engine 3D Scanner*; only the surfaces with coral tissue were measured

$$Symbiont\ Concentration = \frac{total\ symbionts}{surface\ area\ (cm^2)}$$



Higher Calcification Rates for Back Reef Corals

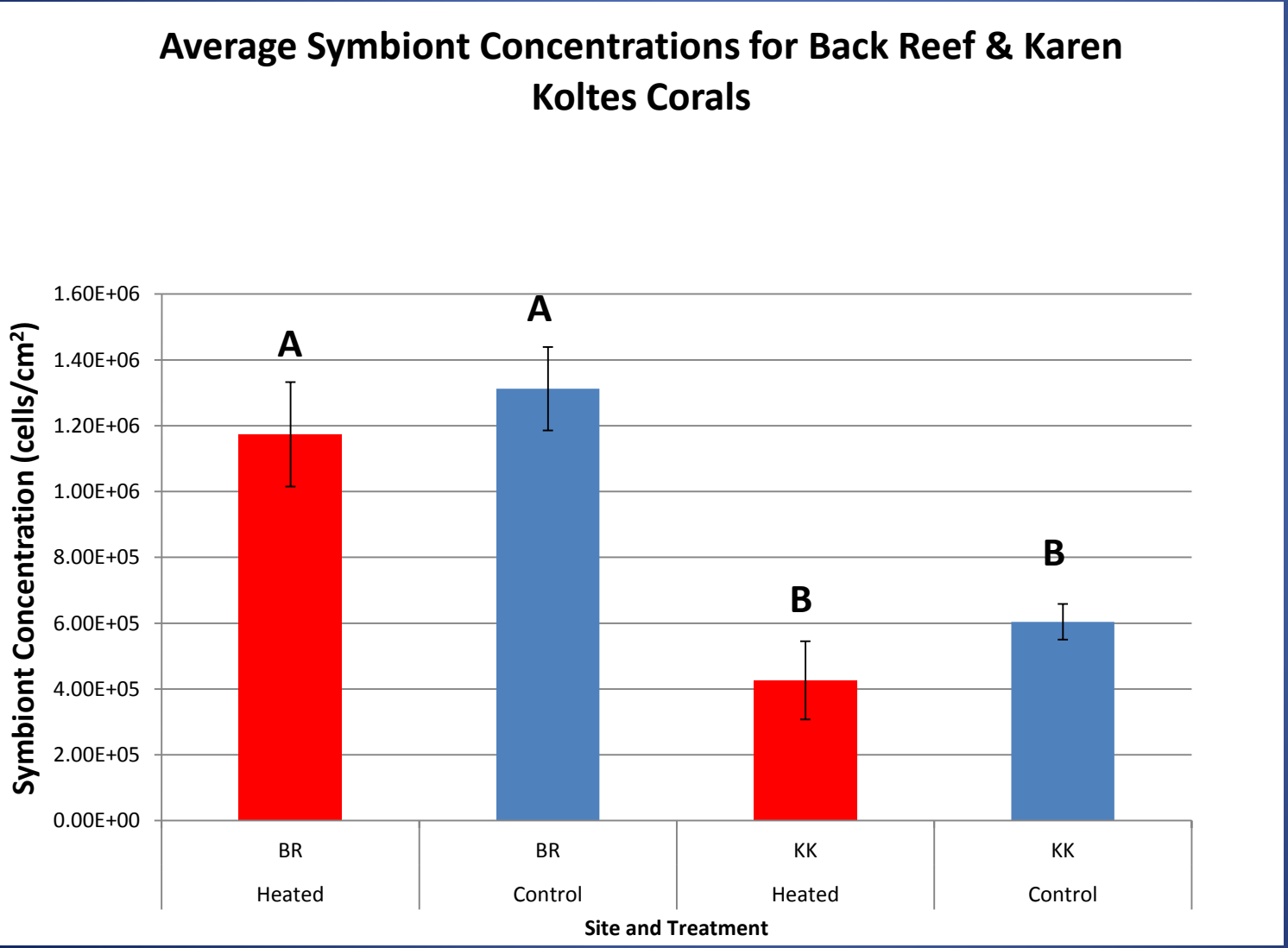


Treatment= 0.06

Site =0.005 **Significant**

Treatment* Site=0.01 **Significant**

Higher Symbiont Concentrations for Back Reef Corals



Treatment = 0.21

Site <0.001 **Significant**

Site* Treatment =0.86

Discussion

Only Control Back Reef corals showed skeletal growth; Karen Koltes did not. Suggests low stress tolerance of KK corals compared to Back Reef

The symbiont concentrations of Back Reef corals were higher than and significantly different from Karen Koltes corals, suggesting high stress tolerance for the Back Reef

But are the different responses due to ***thermal*** stress?

Discussion

Only 1 example of differential response to heated vs. control treatments (Control Back Reef corals for calcification rates); no significant difference for all other groups

See difference in stress response, but cannot confirm thermal stress as cause ; more complex factors at work

Did Back Reef corals had more symbiodinium (thus greater growth) to begin with? Stress in controls?

Research Significance

Understanding corals' stress tolerance → Understanding coral physiology

Corals with strong stress tolerance = best candidates for transplanting and protections (as through Marine Protected Areas)

Image courtesy of Wikipedia

Acknowledgements

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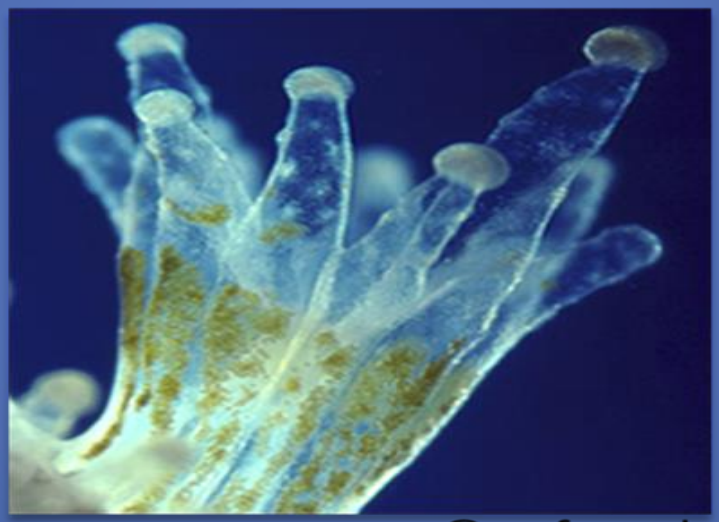

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