# Color variation and its relationship with depth in Great Star coral (*Montastrea cavernosa*)

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## Introduction

- The Great Star coral (*Monastrea cavernosa*) lives in coral reefs, a depth and sun light variable environment that ranges from flat, open topography to cavernous, hidden ridges.
- Previous work has demonstrated color variation is not a true polymorphism, but demonstrative of phenotypic plasticity (polyphenism). Color variation has been shown to be adaptively significant (Kelmanson, Matz 2003).
- However, little is known regarding the relationship between morphological variation and environmental variables.

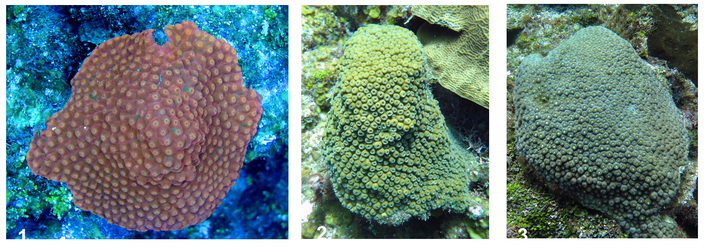
## Objectives

1. To determine whether depth and sunlight influence the color variation of the coral colony.
2. To examine potential tradeoffs between color variation and success of the colony; defined by presence of disease and aggressive invertebrates.
3. To compare the polyp extension of the individual polyps and depth and sun exposure.

## Methods

- Roaming surveys were performed at 4 depth ranges: 1-20 ft, 21-40 ft, 41-60 ft, and 61-80 ft. There was a total of 322 individuals across 11 dive sites.
- Each M. cavernosa from the four depth ranges were analyzed based on color, size, sun light exposure, surrounding lifeforms, disease presence, and polyp extension.
- Color variation was categorized into 6 groups: red, blue, purple, green, cream, and brown.
- Sun light exposure was broken into three options: shaded, partly shaded, and not shaded.

Figure 1-3. Red, brown, and blue morphs




## Methods (continued)

- The relative success of the specimen was determined by the presence of disease and aggressive invertebrates such as *Millepora alcicornis*, *Erythropodium caribaeorum, Siphonodictyon coralliphagum,* etc.
- The amount of polyp extension was noted and compared to depth.
- Photos were taken with a red filter to account for the loss of red wavelength absorption at lower depths.

Figure 4: Scuba diving roaming surveys performed.

## Results

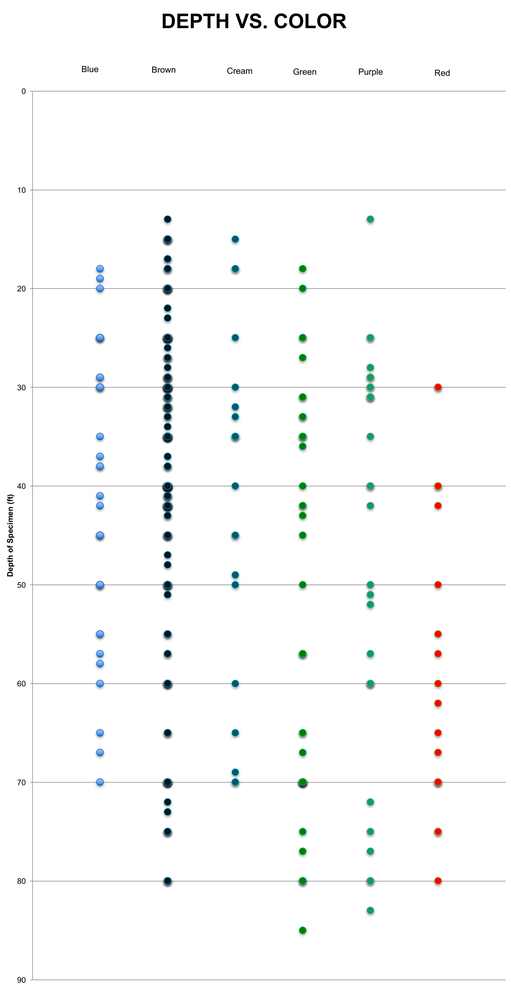



Figure 1. 322 individuals are broken down by color morph and depth measurement. There is a non-significant trend following the red morph with a higher depth average of 58 feet compared to the blue morph depth average of 41 feet.

- All six color morphs had a widespread depth range.
- The red morph was not seen until greater depths, aside from one individual, starting around 40 feet.
- Purple had the widest range of depths; seen at the lowest and highest depths surveyed.
- The brown morph was the dominant variation at each depth.
- The depth range 41-60 feet demonstrated the highest diversity level of color morphs.

## Results (continued)

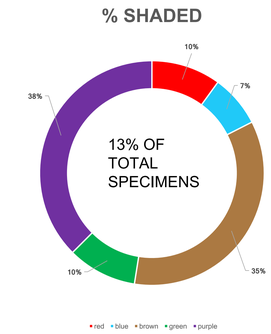
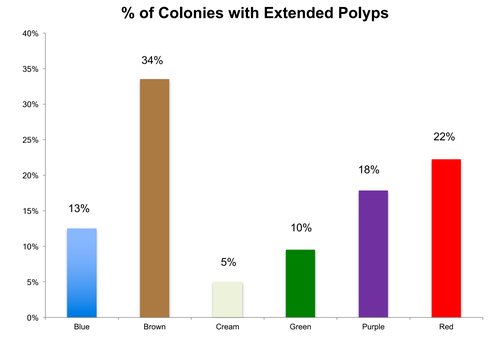



Figure 2. The purple morph showed 38% of the total observed shaded colonies. The brown morph was a similar with 35%. Combined, brown and purple dominated the shaded colonies observed.

Figure 3. The percent of colonies with extended polyps is compared to color morphs. 34% of the brown morphs measured throughout the experiment had polyps extended.



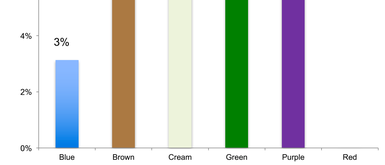




Figure 4. The percent of colonies with AINV is compared to color morphs. Brown and cream both exhibited 10% of their colonies had an aggressive invertebrate. Combined, the two morphs showed a higher percentage of aggressive invertebrates than the other four color morphs.

## Conclusions and Future Work

- Our results imply that there is not a “more successful” color morph based on the wide range of depths recorded for each morph and the relationship between AINV was not significant.
- However, there is a trend suggesting that the red morph occurs at deeper depths as well as the purple morph in the shade.
- The data suggests similar basic conclusions as previous work, but more work needs to be done on a longer-term scale as well as consistent monitoring of the same coral colony.
- Future work could 1) investigate the protein sequence of each color morph via molecular and genetics approaches 2) measure color variation in response to abiotic and biotic stressors such as temperature.

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## Reference

Kelmanson, Ilya V., and Mikhail V. Matz. “Molecular Basis and Evolutionary Origins of Color Diversity in Great Star Coral *Monastrea Cavernosa* (Scleractinia Faviida).” *Molecular Biology and Evolution*, vol. 20, no. 7, 2003, pp. 1125–1133.