



# How Extreme Cold Affects Coral Reefs

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## INTRODUCTION

Climate change is making the world warmer and causing the oceans to heat up, but it is also making some places colder. What are the effects of this extreme cold on coral reefs? Many research projects have studied the effects of increasing ocean temperatures, but my experiment strives to explain the effects of colder temperatures on coral reefs.

## RESEARCH METHODOLOGIES

My data was collected through experimentation on coral species: *echinopora lamellosa* and *montipora danae*, under two different changes in temperature; gradual decrease and quick increment change. Three tanks were set up, each tank containing a fragment of each species.

Data was collected twice-daily measuring temperature and coral health. An overhead picture was taken each time to see change.

Experiment repeated and successfully verified results across all tanks.

Results of the same coral species are compared with each other and also cross-compared with other species to determine if there is a specific temperature point that caused bleaching or even death. This comparison determines the significance of the corals’ responses.

## DISCUSSION, ANALYSIS, AND EVALUATION

**Table:**  
Red = Normal Temperatures → Blue = Colder Temperatures  
Dark Green = Healthy, Thriving Corals → White = Bleached

**Tank 1:** Control with no change in conditions

- No change in coral colors
- Polyps remained open
- No bleaching occurred

**Tank 2:** Gradual decrease in temperature (2°/day)

- Color of corals remained consistent for first five days but then quickly lightened
- Polyps closed for Coral 1 on day three, but remained open till day six for Coral 2 and never fully closed
- No bleaching occurred

**Tank 3:** Quick decrease in temperature (5° every other day)

- Colors lightened after one day and continued to get lighter throughout
- Polyps closed for both species after one day and remained closed
- Coral 1 bleached around the edges starting on day four while Coral 2 started bleaching on day six and then fully bleached on day seven

## DATA AND FINDINGS

	Tank 1 Temp (°F)	Coral 1	Coral 2	Tank 2 Temp (°F)	Coral 1	Coral 2	Tank 3 Temp (°F)	Coral 1	Coral 2
Day 1	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None
Day 2	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	77	Color: Natural, Polyps: Fully Extended, Bleach: None	Color: Natural, Polyps: Fully Extended, Bleach: None	74	Color: Slightly Lighter, Polyps: Closed, Bleach: None	Color: Slightly Lighter, Polyps: Closed, Bleach: None
Day 3	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	75	Color: Natural, Polyps: Closed, Bleach: None	Color: Natural, Polyps: Fully Extended, Bleach: None	74	Color: Slightly Lighter, Polyps: Closed, Bleach: None	Color: Slightly Lighter, Polyps: Closed, Bleach: None
Day 4	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	73	Color: Natural, Polyps: Closed, Bleach: None	Color: Natural, Polyps: Fully Extended, Bleach: None	69	Color: Lighter, Polyps: Closed, Bleach: Slight around edges	Color: Slightly Lighter in middle, Polyps: Closed, Bleach: None
Day 5	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	71	Color: Natural, Polyps: Closed, Bleach: None	Color: Natural, Polyps: Fully Extended, Bleach: None	69	Color: Much Lighter, Polyps: Closed, Bleach: Slight around edges	Color: Lighter in middle, Polyps: Closed, Bleach: None
Day 6	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	69	Color: Natural, Polyps: Closed, Bleach: None	Color: Lighter, Polyps: Fully Extended, Bleach: None	64	Color: Much Lighter, Polyps: Closed, Bleach: Slight around edges	Color: Lighter, Polyps: Closed, Bleach: Middle
Day 7	79	Color: Natural, Polyps: Fully Extended Bleach: None	Color: Natural, Polyps: Fully Extended Bleach: None	67	Color: Lighter, Polyps: Closed, Bleach: None	Color: Lighter, Polyps: Half Extended, Bleach: None	64	Color: Almost white, Polyps: Closed, Bleach: Around edges	Color: Much Lighter, Polyps: Closed, Bleach: Full
Day 8				65	Color: Much Lighter, Polyps: Closed, Bleach: None	Color: Much Lighter, Polyps: Half Extended, Bleach: None			

## CONCLUSIONS, IMPLICATIONS, AND NEXT STEPS

Bleached corals are barely holding onto life before only the calcium skeleton remains. But, corals can recover from bleaching as long as their conditions slowly improve. It is believed that coral reefs will be extinct by 2050 at the current rate of carbon dioxide emissions and global warming. The results of this experiment can be applied to the larger picture of coral bleaching and death across the world due to colder temperatures. It shows that these coral species can not survive past a temperature of about 64° F. Also, the experiment proved that corals can survive in colder conditions as long as the temperature change is slower. Multiple degree changes in temperature in a day clearly has a greater effect on coral health as it caused the most dramatic decrease in coral health. The next step to this experiment is to repeat it using more coral species to further research if the results of this study apply universally.

## ACKNOWLEDGEMENTS / REFERENCES

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