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# A Selected Surveyo f Ocean Acidifcation's Effect on Coccolithophore and other Marine Ecosystems

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# A Selected Survey of Ocean Acidification's Effect on *Coccolithophore* and other Marine Ecosystems

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## ABSTRACT

With it's rapid rate of generation, the *coccolithophore* was expected to adapt to the altered pH levels relatively quickly. By analyzing several scientific studies concerning this algae's interaction with various water qualities, the species' response is clarified. These findings are compared to rudimentary data concerning pH levels taken along the coast of Malibu.

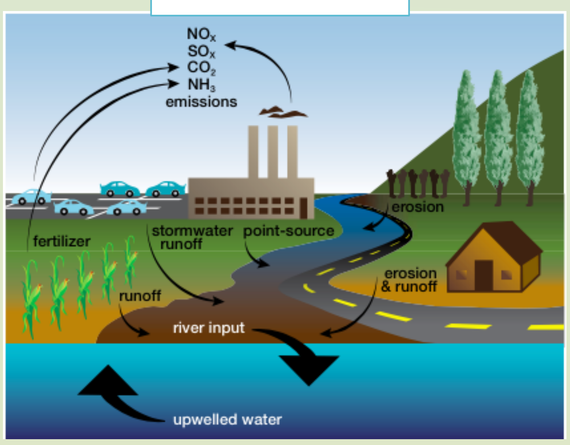
## INTRODUCTION

As climate change continues to alter environmental systems, one place it can be keenly observed is in marine ecosystems. As $CO_2$ concentrations rise in the global atmosphere, the pH levels of marine environments worldwide are affected. Some algae, such as the *coccolithophore*, seem especially well adapted to lowered pH levels, though complex ecosystems such as the coral reefs are unable to adapt as quickly. By surveying the data regarding acidification and environmental adaptation, we hope to be able to more closely understand the impact of ocean acidification on marine ecosystems.

## HYPOTHESIS

As ocean acidity and $CO_2$ levels increase, algae will continue growth by rapidly adapting to the environmental changes.

**Figure D**




## METHODS & MATERIALS

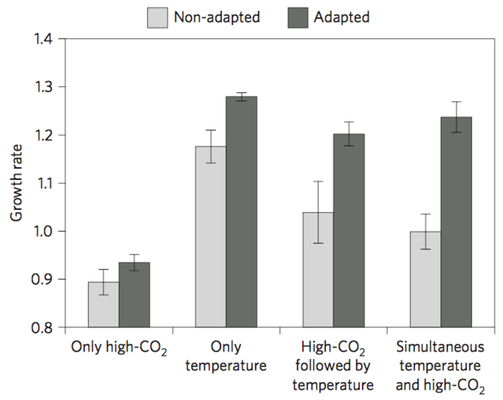
To understand the layered effects of rising $CO_2$ and lowered pH levels in the environment, we consulted three studies. One measuring *coccolithophore* growth and adaptation in a mediterranean environment, one measuring coral reef bleaching due to the same stimuli, and finally a survey of acidification along California's coast combined with our own limited pH readings along the coast of Malibu. Locations measured include Malibu Lagoon, Zuma Beach, and El Matador State Beach.


## RESULTS

**Figure A**

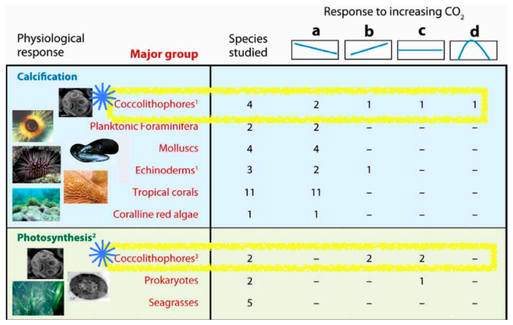
| Location | Average (pH) |
|---|---|
| Malibu Lagoon | 7.331 |
| Zuma Beach | 7.16 |
| El Matador | 7 |

**Figure B**




*(Schluter, Lohbeck, Gutowska, Groger, Riebesell, & Reusch, 2014)*

**Figure C**




*(Hoegh-Guldberg, 2007)*

## STUDY SITES

(1)MALIBU LAGOON, (2)ZUMA BEACH, (3)EL MATADOR

## DISCUSSION

The data shows that *coccolithophore* reacts to the acidification and raised $CO_2$ levels in varied ways. While Figure A implies *coccolithophore* adaptability of the species to $CO_2$-rich and high temperature waters, Figure C presents more conflicting results. In response to increased $CO_2$, over a quarter of the *coccolithophore* species showed decreased rates of calcification. Parabolic and flat rates were also observed.. While the data from Figure B seems to show *coccolithophore* as "adaptable," when this data is tempered by Figure C's findings, it's perhaps more accurate to describe the *coccolithophores* response as "affected." Figure D illustrates the complicated relationship, caused by variety of environmental factors. The results of the data are mixed, suggesting a complicated relationship between climate-changed waters and marine ecosystems. pH samples of local sources (Figure A) show little acidification but should raise mindfulness as this problem affects coastal communities similar to our own.

## CONCLUSION

Rising $CO_2$ levels in the atmosphere have increased acidification in ocean environments. The divisive effects of rising $CO_2$ and it's consequences can be observed in the marine algae *coccolithophore*'s, varied response. While it's growth rate increased in regions of high temperature and $CO_2$, its rate of calcification was affected in various ways in different species. This ambiguity underscores the intricate balance of marine ecosystems and raises concern as acidification rates are expected to increase.

## LITERATURE CITED

1. Hoegh-Guldberg, 2007, 'Coral Reefs Under Rapid Climate Change and Ocean Acidification', Science, vol. 318, pp. 1737-1742.
2. Kelly, 2012, 'Why Ocean Acidification Matters to California, and What California Can Do About it', Center For Ocean Solutions, pp 1-40.
3. Schluter, Lohbeck, Gutowska, Groger, Riebesell, & Reusch, 2014, 'Adaptation of a globally important coccolithophore to ocean warming and acidification', Nature Climate Change, pp. 1-7.