Name(s)
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Project Number
S1213

Project Title
Effects of Acidification on Freshwater Microorganisms: A 4 Year Study of Components of Climate Change on Microorganisms

Abstract

Objectives/Goals
This 4-year project determined the effects of climate change components on freshwater microorganisms at the Arcata Marsh:
2015: Salinity Tolerance, 2016: Increased agricultural/industrial pollutants, 2017: Temperature increase, 2018: Acidification.

Methods/Materials
Yeast, juice, carbon dioxide system, Arcata Marsh water, pH meter, microscope.
Bubble carbon dioxide into tanks of Arcata Marsh water to establish 5.0 pH, 5.5 pH, and 6.0 pH. Observe and count Daphnia, Cyclops, amphipods, Coleps, Euglena, diatoms, Chlamydomonas, rotifers, and Hypotrichida daily for a month to identify mortality rates compared to the control: an unaltered tank of marsh water.

Results
In 5.0 pH, diatoms, Euglena, and Chlamydomonas increased exponentially. The 5.0 pH tanks became cloudy (bacteria) and mortality rates for non-algal microorganisms rose rapidly. In 5.5 pH, algal organisms increased in populations up to ten-fold. All other unicellular microorganisms significantly dropped in numbers over the span of a month. Amphipods remained relatively stable. In 6.0 pH, by the end of the month, all organisms, other than Daphnia and Cyclops (which decreased by 80%), increased similar to the control.

Conclusions/Discussion
As pH decreases, mortality rates for unicellular, non-algal organisms increases. Algal organisms mimic an algal bloom with the increased available carbon dioxide in the environment. The increase in algae increases the oxygen, thereby increasing the bacteria in the water which affects the equilibrium of the microorganisms in the system. Amphipods proved to be tolerant of acidification, although analysis of the structure of the exoskeletons would be an important study to determine if the lack of necessary minerals because of the increased carbonic acid led to weaker exoskeleton structure. In previous years, the microorganism mortality rates rose exponentially with chlorine pollutants, high concentrations of fertilizer, and salinity. Low concentrations of fertilizer pollutants had positive effects and higher temperatures increased Hypotrichida but proved detrimental to all other microorganisms in the study over a month. As the current trend of planetary warming continues and human populations increase, these freshwater ecosystems face real threats to their sustainability. Many components of this trend prove detrimental, and all of them, at the very least, change the dynamics of the organism populations.

Summary Statement
This project determined that freshwater microorganisms have varying sensitivities to the components of the current planetary warming trend including salinity, pollutants, increased temperatures, and acidification.

Help Received
A graduate student, Corianna Flannery, supplied advice about utilizing yeast and juice as a carbon dioxide source.