



How Does Water Depth Affect Algae Growth?

Oliver Evans

Introduction

Much of the change in the San Diego bay is due to human influence. Over the years, the San Diego Bay has been made deeper to make room for the many industries in and around the bay. The expansion of industry in San Diego has also caused much pollution in the bay in the past. The pollution has added to issues with massive algae growth, leading to eutrophication and public health issues (Hornworthy, 1970). We have encountered multiple types of algae at and around our four research sites in the Shelter Island Basin.

The San Diego Bay has had problems with algae blooms in the past and even as recently as last year. In November of 2023, the discovery of invasive and rapidly spreading *Caulerpa prolifera* algae sparked an emergency clean-up before it became too big of a problem (Salas, 2023). Not all algae is bad. Algae like *Laurencia pectinifera* are an important part of most marine ecosystems. For our oyster recruitment research, we have shell strings at each site to measure oyster recruitment by depth. We are using these same strings to measure algae growth. It is important to take into account that each site has different conditions and are in different parts of the basin. One of our sites, for example, has higher sewage exposure than the others because it is near a drainage pipe.

The goal of this research is to find out if algae growth changes based on water depth. It is important to know if the deepening of the bay has affected algae growth because of the negative effects certain algae can have. Our research is going to the Port of SD and to our partners at our Yacht Club research sites to help their efforts to improve the water quality and the ecosystem of the bay. Because algae is photosynthetic and needs sunlight, I predict that more algae will grow close to the surface and it will get progressively less and less as we go down.

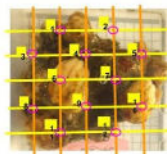


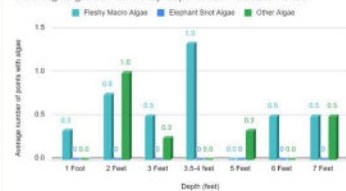
Figure 1
Analyzing the shell strings



Figure 2
Demo shell string



How algae growth varies by depth at our research sites



Results

This study references data collected by High Tech High students at four sites: San Diego Yacht Club (SDYC), Southwestern Yacht Club (SWYC), Shelter Island Marina (SIM), and Silvergate Yacht Club (SIGYC) in Shelter Island Basin. Algae data was gathered from 2022 - 2024 by measuring the abundance of Algae by Depth in feet.

The depths with the least amount of algae were 1 foot and 5 feet. Elephant Snout algae not present. Most algae appeared between 2 and 4 feet.

Statistical Significance

When depth and algae population size was significance tested with an ANOVA, there was not a strong relationship between depth and algae species. The p value was 0.6952.

Discussion

While algae were found at all depths monitored, the amount per depth fluctuated.

More algae appeared on the top half of the shell string than on the bottom. This makes sense because algae are photosynthetic and need sunlight, so it would appear further up. Most algae appeared between depths 2 and 4. This makes sense because of the proximity to the dock float, at depth 2. The dock float is an area of dense biodiversity and it makes sense that the species there would spread to what they are closest to. Depths 5 feet and below have lower amounts of algae. This could be because of competition with other organisms.

There were high concentrations of tunicates in those depths, which would leave less room for algae to settle on the shell string (Serrano, 2024).

My hypothesis was not sufficiently because there was a decrease from shallow to deep with the exception of 7 feet as the outlier. but instead, the graph follows a rough bell curve. I recommend that data be collected for more than one month as my data was only collected from one month. I think that a much more conclusive and clear finding would be possible. It would definitely be interesting to research more factors that could be contributing to the fluctuations in my graph.

Figure 3

This graph shows the data collected for algae growth by depth at each site. The data was collected in February 2024 by 11th students. Only depth 2 and 3 reflect data from all four sites. This data reflects biofouling photo quantitat analysis.

The Oyster Project

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Oysters are a little celebrated species but these bivalve shellfish are indicator species. This means that they provide significant environmental services to the ecosystems that they reside in so that a struggling indicator species foreshadows negative ecosystem impacts in the future. There has been an escalating interest in restoration and environmental assessment using oysters with a number of local, state and federal projects. The Oyster Project is a student scientist monitoring project providing youth with direct access to the resources their community relies on and capacity building skills to measure and document the human impacts affecting them. The project bridges university and agency conducted research and scientists with high school students while the students serve as stewards of their research to community stakeholders such as recreational groups, younger students and the general public. Connecting students to the environment, educating the public and receiving professional mentorship are essential to empowering participants and fostering a sense of agency and ownership within their physical and cultural community. Capacity building within our class allows students with a scaffold to develop and investigate their own scientific research questions.

During the project, students partnered with Shelter Island Basin Yacht Clubs, the Port of San Diego, San Diego State University and rotating regional experts in the academic and private sectors. Some ways students shared their learning was through Student Led Investigation of Biotic or Abiotic Factors (integrating monitoring technology), Foundational Skill Build: Ecology, Surveying, Microcomputer programming and by presenting at SDSU Coastal Marine Institute Science Fair

Teacher Reflection

This project has been incredibly successful in terms of authenticity, supportive and lasting partnerships, potential for student learning and proximity! For my next iteration, students will be choosing to research one of the recommendations from this Spring's students.

—Kalle Applegate Palmer

Student Reflection

My oyster research and poster Pproduction went very well...I did not believe I could finish it but I did! A high was getting feedback from the Port of San Diego and just getting praised for my hard work and dedication to turn in quality work.

—Dani R.

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