Investigating the restorative effects of *Saccharina latissima* on the biodiversity of degraded marine ecosystems

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Abstract

The loss of kelp would not only alter the structure of kelp forests with implications for higher-order consumers but would also alter the functioning of these ecosystems with a reduction in filter feeders, carnivores, and detritivore trophic groups likely to impact secondary productivity in these systems (Carbajal et al., 2021 p. 10). Our research will help us conclude what are the restorative effects of *Saccharina latissima* on the biodiversity of degraded marine ecosystems. This will be determined by adding sugar kelp to an established ecosystem to measure any beneficial effects on its biodiversity. There are innumerable potential positive implications that kelp may provide in restoring degraded ecosystems as a result of humans or natural disasters. A refractometer, Lamont test kits, and several other instruments will be used to measure several water parameters. Invertebrates will be collected from muck within the saltwater environment around areas with and without sugar kelp. Targeted DNA will be isolated and sequenced at GeneWiz. Invertebrates will be identified using dichotomous keys and Subway's Blue Line BLASTN by comparing the DNA to a databank. At both the experimental and control sites of the experiment, organisms were collected. These collected organisms were DNA barcoded to see which species they belonged to. The results of this experiment show that *Saccharina latissima* does not have a significant impact on the biodiversity of its environment. The results from the experimental and control sites were extremely similar, and no conclusive outcomes were identified. The most important finding of this experiment was that *Saccharina lattisima* did not have an impact on the biodiversity of the marine ecosystem in that it existed.

Introduction

- Kelp is part of the Chromista kingdom, made of multicellular photosynthetic, eukaryotic cells.
- Kelp forests have a significant impact on marine ecosystems around the world and their destruction would be detrimental to organisms that rely on them.
- Kelp is largely understudied, especially in the area of kelp harvesting and how it impacts biodiversity of an ecosystem.
- Sugar kelp (*Saccharina latissima),* a naturalized kelp found along the shoreline of Long Island, is growing in the pond at Long Beach High School. Kelp provides a habitat for both micro and macro invertebrates, many which are difficult to identify.
- DNA barcoding can be used to correctly identify the samples taken to determine how kelp affects the biodiversity of these organisms within their ecosystem.

Methods & Materials

- Gather materials as listed to the side
- Arrive at the pond and put on the proper safety equipment such as gloves, coats, boots and goggles
- Collect muck and water samples from both the site without kelp and the one with the growing kelp
- Record specific weather conditions such as temperature
- Immediately take dissolved O2 test straight from the water sites
- Return back to our lab with all of our samples and store them in the refrigerator.
- Conduct Ph, Nitrates, Phosphates and salinity test on the water samples
- With the use of a sieve, filter through both muck samples separately and store specimens in 1.5 ml centrifuge tubes with 75% proof ethanol
- Photograph the samples with the use of a microscope at 50X and upload the photos to google drive
- Microscopes
- Shovels and spoons
- Scouples
- Ethanol
- BLI DNA barcoding protocol materials
- Dichotomous key
- Buckets
- Tweezers
- Gloves, googles, lab coats and boots
- Filters and sieves
- Fridge and freezers
- Ph, Dissolved O2, Nitrate and Phosphate test
- Refractometer

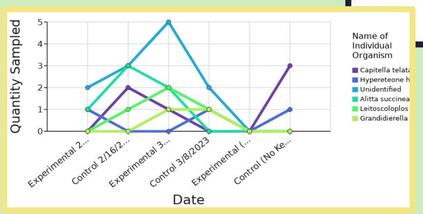


Figure 2.1 Sample from project

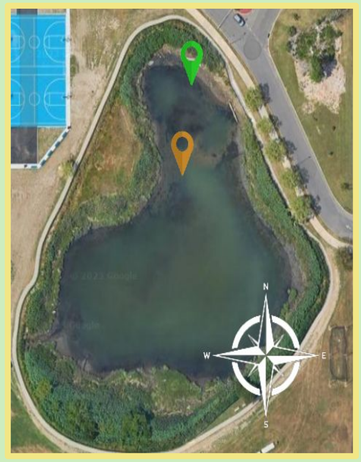
Figure 2.2 Sample from project

Figure 2.3 Sample from project

Figure 2.4 Sample from project

Figure 2.5 Sample from project

Figure 2.6 Sample from project



	Location	Date (DD/MM/YY	Air Temp. (°C)	Weather Description	Water Temp. (°C)	Dissolved O2	Water Salinity	Water pH	Time	Nitrates	Notes
1	Kelp 1	2/1	3* C	cold and sun	7* C	3 ppm	32 ppt	8.3	1:38 PM	4 ppm	1st try, went smoothly
2	Control 1	2/1	3* C	^	7* C	4 ppm	32 ppt	8.3	1:38 PM	4 ppm	
3	Kelp 2	2/16	6* C	overcast and chilly	6* C	0 ppm	35 ppt	7.4	1 :30 PM	3 ppm	
4	Control 2	2/16	6* C	^	6* C	3 ppm	38 ppt	7.4	1:30 PM	3 ppm	
5	Kelp 3	3/8	8* C	chilly and sun	5* C	2 ppm	34 ppt	7.6	3:15 PM	3 ppm	after school
6	Control 3	3/8	8* C	^	5* C	3 ppm	34 ppt	7.9	3:15 PM	3 ppm	

Disscution

- No noticeable change in biodiversity was observed between the control and experimental sites.
- Seven unidentified species were found at the experimental site, whereas the control site had five different unidentified species.
- five different known species were found in both the experimental and control sites (*Capitella teleta*, *Hypereteone heteropoda*, *Alitta succinea, Leitoscoloplos,* and *Grandidierella japonica*).
- At the control site, the quantities in which each organism was found were five *Capitella teletas*, two *Hypereteone heteropodas*, three *Alitta succineas*, two *Leitoscoloplos*, and one *Grandidierella japonica*.
- At the experimental site, the quantities in which each organism was found were one *Capitella teleta*, one *Hypereteone heteropoda*, three *Alitta succineas*, two *Leitoscoloplos*, and one *Grandidierella japonica*.

Results

- The research suggests that introducing kelp to various environments may have varying effects, and it's unclear whether those effects are positive or negative.
- Some challenges that were encountered were inaccurate metadata tests, fluctuating tides, and rainwater altering the salinity of the water.
- The tests employed in the experiment were considered new but not entirely accurate.
- The types of organisms present in the water may have been influenced by the incoming and outgoing tides.
- Finally, the salinity level of the water may have been affected by recent rainfall, potentially causing some discrepancies in the metadata.

References

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