THE EFFECTS OF DIFFERENT TYPES OF CONCRETE COMPOSITIONS ON BENTHIC ORGANISMS UNDER AN ECODOCK

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PROBLEM

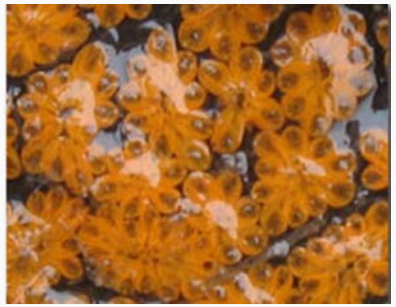
- The human population is increasing and more of them are moving toward the water.
- It is projected within 10 years, 75% of the population will live on or near the water (Bulleri 2010).
- To support the growing population wanting to live on the water, piers, seawalls, and breakwaters must be constructed.
- In order to construct these infrastructures, the natural coastline is destroyed and the habitat of many organisms is gone.

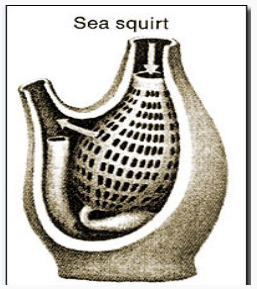
BACKGROUND INFO

- Portland Cement is the material used on artificial coastlines.
- Although it supports the increasing population, it is unnatural to organisms in the water. This is in regards to pH and alkalinity. (Abdus-Samad 2013).
- In the past many people have tried different techniques to protect marine organisms while at the same time supporting the increasing population.
- Textured substrates typically recruit more organisms.

HYPOTHESIS

- If Portland cement is replaced by concrete matrices varying in composition and texture, it will increase biological recruitment of benthic organisms. This will also help with the long term usage of concrete for coastal infrastructure.





WHAT IS EXPECTED TO BE SEEN?

Turf algae, hydrozoa, Golden Star Tunicates, Oysters, and sea squirts are among the many organisms that is assumed to recruit on the ECOncrete sets.

ECONCRETE

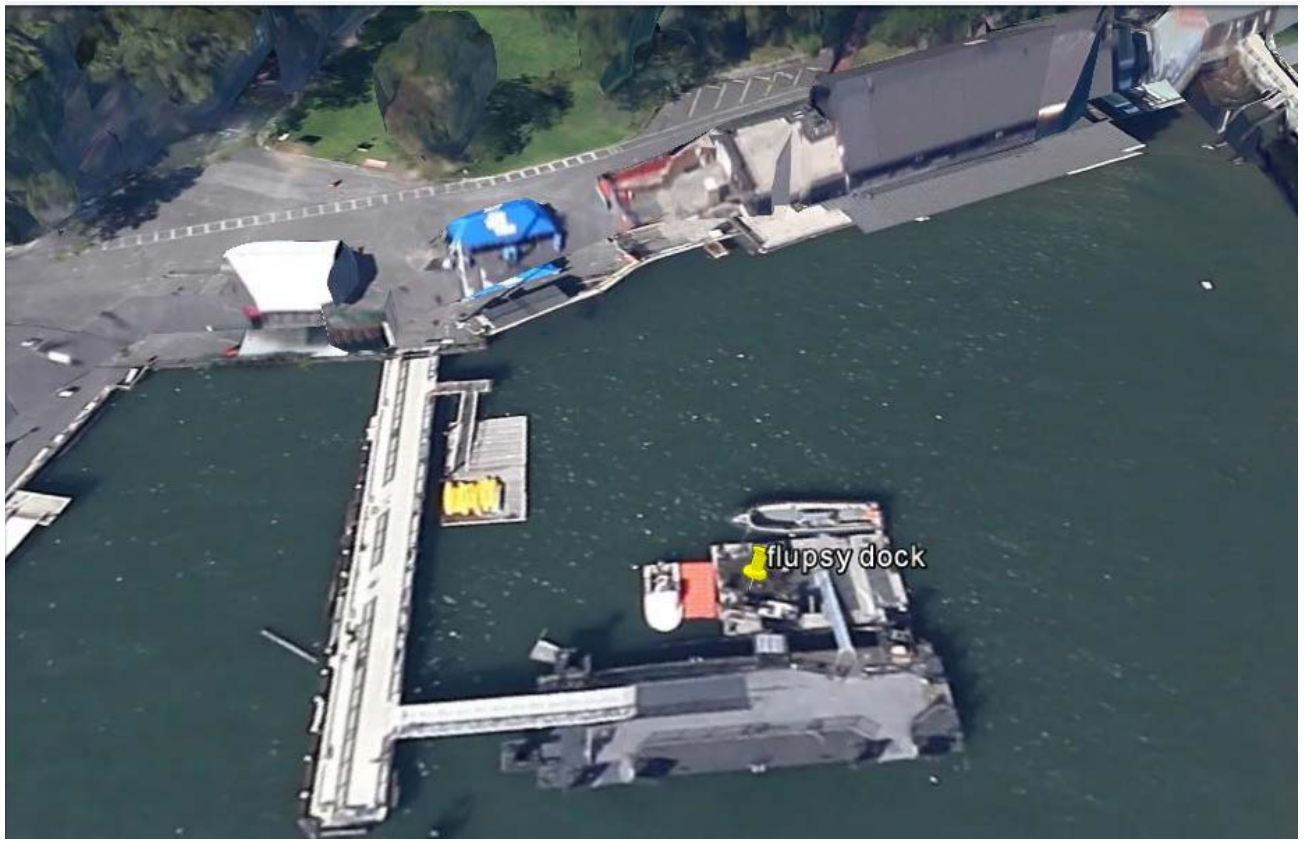
Table 1: Physical parameters of the various innovative concrete matrices in comparison to Portland cement.

Matrix	Water/ Cement Ratio	pH	Average Compression Strength (Mpa)	Weight (Kg/m^3)	Water Pressure Penetration Resistance (mm)	Chloride Penetration Resistance (Coulombs)
M1	0.3	9-10	32.5	2300-2500	<20	<1500
M2	0.3	9.5-10.5	48.5	2300-2500	<20	<1000
M3	0.3	9.5-10.5	39.3	2300-2500	<20	<1000
M4	0.3	9-10	31.1	1400-1800	NR	NR
M5	0.3	9-10	31.9	1400-1800	NR	NR
Portland	0.30 -0.25	12.5-13.5	32	2300-2500	<20	>2000

NR- Not relevant for high air content concrete

LOCALITY

The experiment will take place on the ecodock on pier 101 (40. The sets will be placed under the ecodock horizontally next to the oyster cages. 40◦ 41’ 29.96’’ N, 70◦ 0’ 44.37’’ W



METHODS

- The sets are sampled by measuring percent cover with a grid. Every organism is quantified using percent cover or abundance method. Data for percent cover was taken from each tile on the smooth and textured sides and then averaged out amongst the three sets. After that it was graphed on excel.
- Species abundance was analyzed using the Shannon Weaver Index
- Materials used for sampling were dissection kits, lifejackets, magnifying glasses, a percent cover grid, and a camera.

SAMPLING ECONCRETE

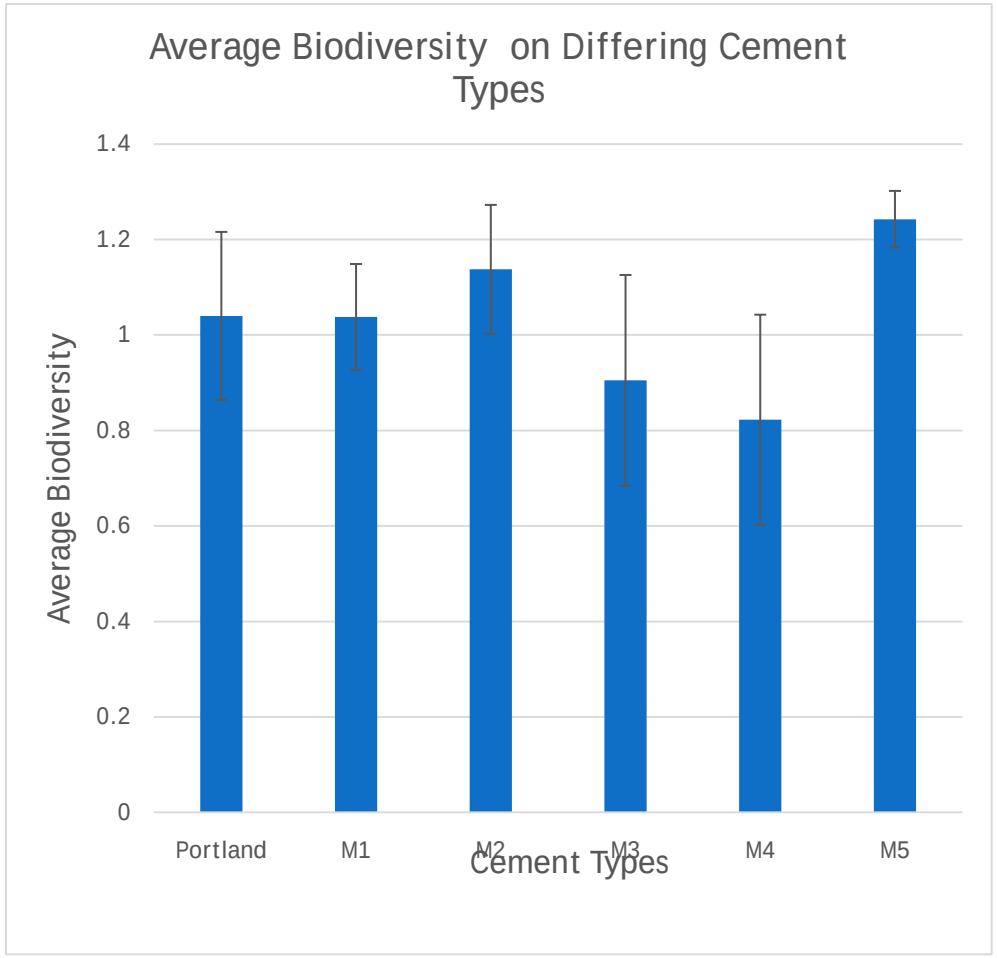
A student checking tile number on ECOncrete.

RESULTS

Organisms Found

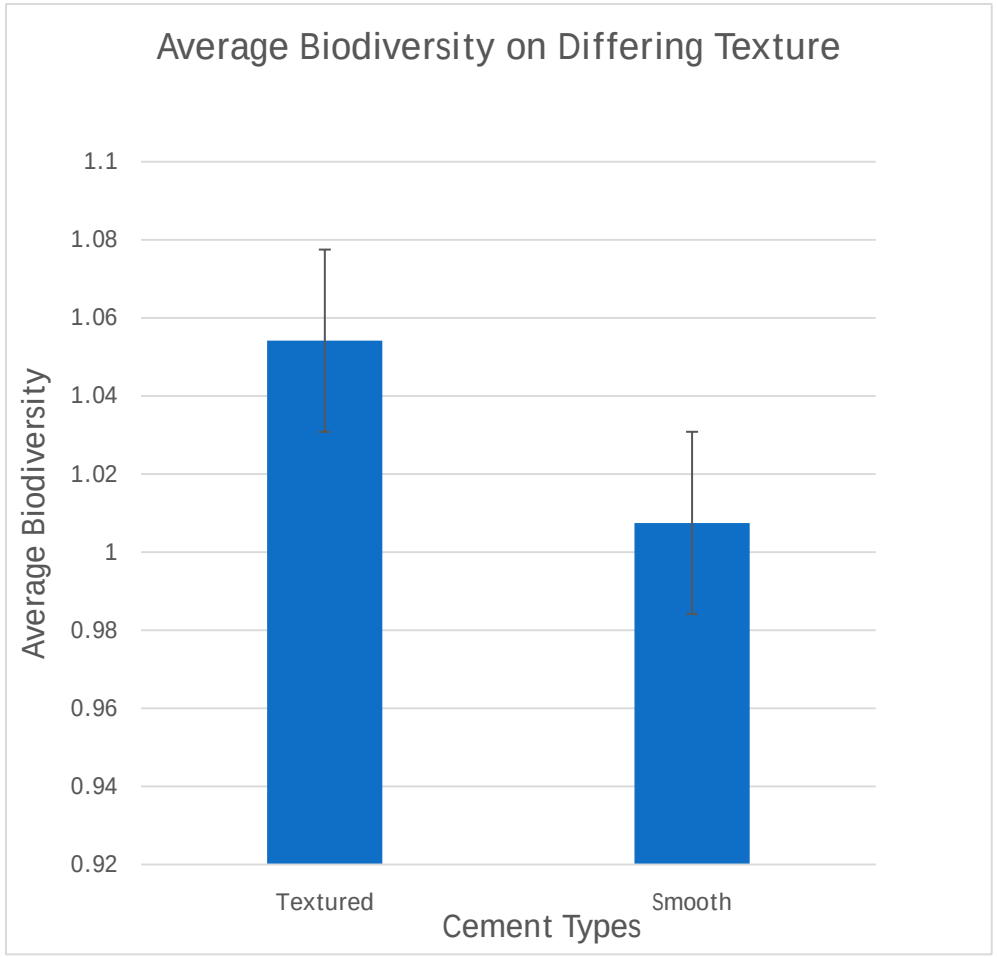
- Colonial and solitary tunicates (*Botryllus schlosseri* and *Molgula* respectively)
- Barnacles (*Semibalanus balanoides)*
- Crabs
- polychaete worms
- Whelks (*Eupleura caudata* and *Urosalpinx cinerea*)
- Hydrozoa
- Anemones

RESULTS



- Average Biodiversity on Different Cement Types shows the average biodiversity for all six cement types. Also displayed is the standard error of the cement types. M5 has the smallest standard error and the highest biodiversity average.

RESULTS



- Average Biodiversity on Different Textures shows the average recruitment amongst textured and smooth cement types. In addition to that, standard error is displayed. The textured and smooth cement types did not differ by much in average recruitment.

RESULTS

ANALYSIS

- M5 had the highest biodiversity recruitment followed by Portland cement.
- M5 and Portland Cement have very different chemical parameters.
- No explanation of this due to lack of data and low number of replicates.
- Textured side had a slightly higher recruitment than the smooth side.
- That can be supported from previous experiments.

CONCLUSION

- Ideally there are four replicates of ECOncrete.
- In this experiment two sets were lost therefore, the results were altered.
- M5 and Portland cement were close in biodiversity.
- Portland cement had a bigger standard error therefore, M5 is the better concrete type for organisms.
- This conclusion is supported from past experiments.

SUGGESTIONS FOR FURTHER RESEARCH

- Make others more aware of placement
- Testing more

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