Bella Suhr, Olivia Berman, Bailey Wallace, Lucy Baker
Wildlands French Polynesia 2023
8/2/23

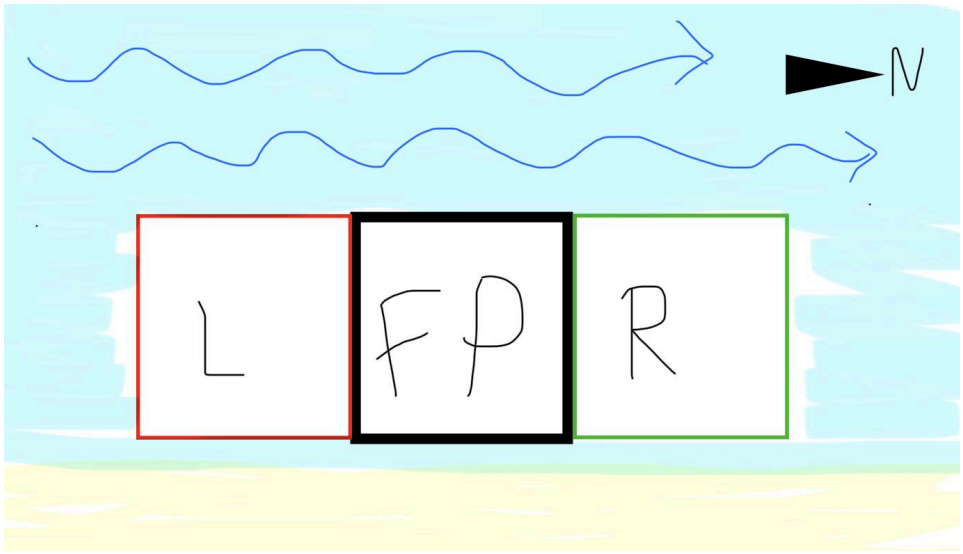
Fish Pond Substrate Composition Survey

Metadata:
Time: 12:20-1:56pm
Temperature: 26 C
Cloud Cover: 11% coverage
Weather: Clear skies, Beaufort 1 and no precipitation

Introduction:
We began this experimental survey as a follow up to the Wildlands 2022 French Polynesia group of whom conducted a substrate composition survey of a locally owned traditional fish pond in Taverea, Tahiti, the Western side of the island. The owner of the fish pond requested insight regarding the main composition and type of substrate cover occurring in his pond. The previous research indicated the highest composition to be sand at 49.4%, then micro algae at 27.3%. This previous study had a sampling universe that included the pond and a 1 meter buffer around the ponds rock barrier and used randomly selected sample sites. This resulted in placing the inside and outside of the fish pond in one data set rather than separate resulting values that would allow for the comparison of the two.

This previous survey provided a good basis for our prospective substrate composition but after further discussion with the owner of the pond. We decided to complete a new survey to observe any differences between the substrate within the fish pond, the region left of the fishpond, and to the right of the fish pond. These are observed looking at the fish pond from the shore. This is due to the fact that a channel in the lagoon causes the current to flow South to North, or left to right when looking at the fish pond from the shore. This means the water flows through the left side, then through the rock barrier of the pond and out to the right side. This produced our research question; If the fish pond is acting as a barrier or filter for the South to North current in the lagoon, what effect does the fish pond have on the substrate composition along the shore? To investigate this we decided to formulate our own methods that allowed us to compare the fish pond substrate composition to its surrounding areas.

Methods:



We began by taking measurements with a tape measure of the inner wall of the fish pond and found it to be 14.1x13 m (width x depth). The image above demonstrates our sampling universe, with the black square representing the fish pond, the red square showing our sample area to the left of the pond and the green square showing our sample area to the right of the fish pond. Using 2 transects we layed out a 14.1x13m grid in each of our three locations. We determined the x-axis to be 14.1 m (horizontal to the beach) and the y-axis to be 13 m (vertical to the beach). With a random number generator we determined 10 random coordinates on the x-axis and y-axis for each location, thus adding up to a total of 30 coordinates for the whole sampling universe. The bottom left corner of each box was deemed the (0,0) coordinate and a grid was formed. At each coordinate we used a 1 meter by 1 meter quadrat to assess the percent coverage on the grid, only considering the uppermost primary substrate layer**.** We classified the substrate by alive coral, sand, dead coral, rock, micro algae, and macro algae. For this study, we considered microalgae to encompass algae less than 1cm and macroalgae to be larger than 1cm.

One person held the quadrat down in place, another person recorded the values, and the final two people acted as the observers of substrate type. The two observers would look into the water with snorkel masks and estimate the percent of each substrate within the quadrat.. The two agreed on the percentages for each sample quadrat and reported them to the recorder. When assessing percent coverage we did not go over 100%, we recorded only the topmost layer of substrate. The values were recorded on waterproof slates and this sampling method was repeated for each of the 30 random coordinates, keeping the data for each of the left, fish pond, and right area’s separate from each other.

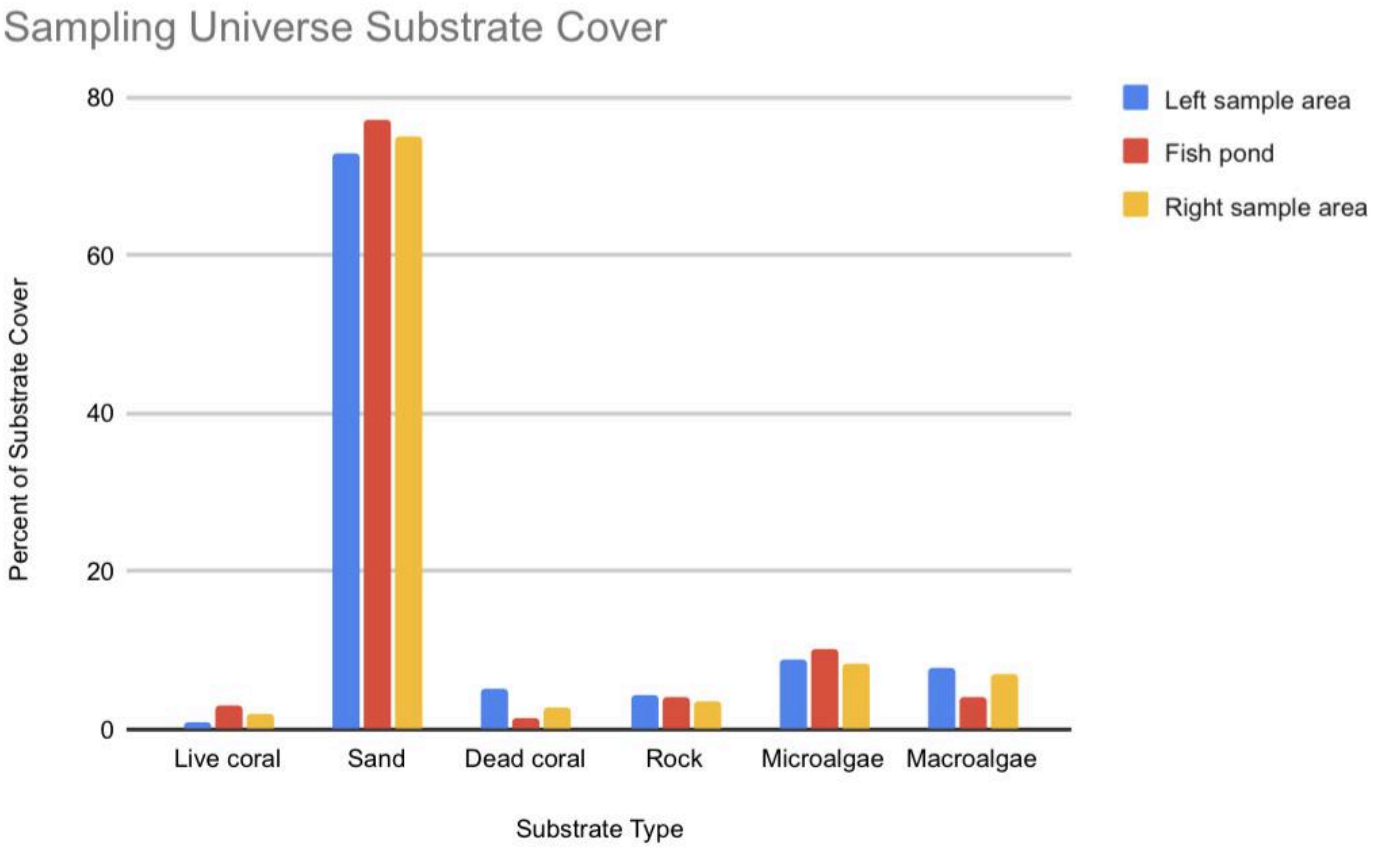
Results:
The data collected throughout our study is represented in the tables below.

Left Sample Area Substrate	**Average Substrate Cover (%)**	**Standard Deviation**	**Confidence Interval**
Live coral	0.9	1.66	0.9+/-1.031
Sand	73	20.61	73+/-12.776
Dead coral	5.2	6.56	5.2+/-4.067
Rock	4.3	4.24	4.3+/-2.63
Microalgae	8.8	9.33	8.8+/-5.783
Macroalgae	7.8	5.59	7.8+/-3.467

Fish Pond Area Substrate	**Average Substrate Cover (%)**	**Standard Deviation**	**Confidence Interval**
Live coral	3.1	3.44	3.1+/-2.136
Sand	77.1	12.34	77+/-7.653
Dead coral	1.5	2.07	1.5+/-1.282
Rock	4	1.69	4+/-1.053
Microalgae	10.1	8.13	10+/-5.039
Macroalgae	4.2	7.00	4.2+/-4.342

Right Sample Area Substrate	**Average Substrate Cover (%)**	**Standard Deviation**	**Confidence Interval**
Live coral	2.1	2.558	2.1+/-1.586
Sand	75	16.872	75+/-10.457
Dead coral	2.7	1.567	2.7+/-0.97
Rock	3.7	2.452	3.7+/-1.52
Microalgae	8.3	7.257	8.3+/-4.499

Macroalgae	7	8.756	7+/-5.427



Analysis:
Upon comparing the mean substrate coverages with independent sample t-tests between the left and fishpond, fishpond and right, and left and right sample areas for each substrate category, we found that there is no statistically significant difference in mean substrate coverage in all 3 sample universes.

In regards to our research question (if the fish pond is acting as a barrier or filter for the South to North current in the lagoon, what effect does the fish pond have on the substrate composition along the shore?), our results suggest that the fish pond has a negligible impact on the substrate coverage on the area immediately surrounding the fish pond.

This could indicate that, in terms of substrate, the fish pond is not significantly altering the substrate coverage directly surrounding the fish pond thus the substrate environment is similar inside the fish pond as it is directly to the right and left of it.

When comparing this years data to last years, we did notice that the substrate coverage of sand has increased (2022 - 49% sand, 2023 - 77% sand inside the fish pond. We are not able determine statistical significance between these averages due to the differences in sampling universe, but it is a noticeable difference that could be due to various factors. One factor could be that last years sample universe included the rock barrier of the fish pond itself. Another factor could be that the sand substrate coverage did actually increase, but we cannot determine that for sure with the data we collected.

As an anecdotal observation, we did notice that the particle size of the sand varied between the three sample sights and in smaller microhabitats. We did not have the instruments, resources, or time to properly investigate this observation.

In a future study, a possible endeavor could be the investigation and analysis of the substrate depth and its relation to size of sand particles. As the current could be pushing sediment through the fish pond and acting as a sieve that only allows smaller particles to pass through. Meaning a build up of sand could be occurring and the substrate could be being affected in that way rather than a substrate coverage alteration.

Therefore there is room for more investigation of the substrate within and around the fish pond and we look forward to future results. Thank you.