

December 19, 2011
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Rufford Small Grant Mid-Term Report

The first few months of my project were filled with trips to find 10 different study sites, attempting to get a representative sampling of the entire Ecuadorian coastline. In the end, the sites span a territory of over 250 kilometers from North to South. I have sampled a variety of areas with varying degrees of several environmental factors, including wave exposure, sedimentation rates, rock type, and nearshore depth. These sites would become the basis for the first phase of my project, a comprehensive evaluation of the intertidal communities in rocky shores along the coast of Ecuador. At each site I performed 60 quadrats of 50x50 cm. Each quadrat was laid on the ground in the rocky intertidal area, and I then counted all mobile organisms within the area, as well as recording the percent cover of each different sessile organism (algae, barnacles, mussels, etc.). I performed 10 quadrats along each of 2 100m transects at each of three tidal zones (high, mid, and low zones). I also took diversity samples of all the different algal types within the quadrat, and a sample of biomass, taking all algae from within a 10x10 cm square in the center of each quadrat. I am now processing these data in the computer, and the samples in the laboratory.

I also established a field experiment that will allow me to evaluate the differences in how ecological factors are affecting patterns of organism recruitment and growth, and how this is shaping intertidal communities. I set up 6 plots of 4 plates each at one northern site, Playa Escondida, and one southern site, Machalilla. In each plot, two of the plates are black and two are white. These plates are bolted to the ground, with a smaller acrylic square glued to the top of the plates for the recruitment of marine organisms. By observing the different patterns of ecological succession in the different colored plates, I should be able to discern how both nutrient availability and temperature are guiding the structure of intertidal communities.

Last month I returned to the two experimental sites to see if the plates that I had bolted to the rock remained there, or if they had been washed away by the waves or stolen. Only two plates were missing in total, both from the same site where the soft sandstone did not provide a very good anchor for the screws. The rest of the experiment was intact and progressing nicely. It seemed that I already had some very interesting results. For example, in the northern site, Playa Escondida, there was very little growing on the plates in general, especially those placed high in the intertidal zone. However, in the plot of 4 plates from the lowest zone, we found the white plates to be overgrown with approximately 100 small barnacles (see attached photo). The black plates in the same plot had very little growing on them. There is the possibility that the barnacle larvae exhibit phototaxis, and are drawn to lighter-colored surfaces, but this is unlikely. Also, the control "plates" of open rock had a temperature more similar to the white plates in the field

measurements, but had an almost black color; the controls, too, had heavy barnacle recruitment.

When we travelled south to visit the second study site, we also had the pleasant surprise that all plates were still bolted firmly to the rock. Additionally, we observed staggering differences between these and the plates we had set in the North. Large quantities of filamentous green algae and juvenile barnacles were already growing like a carpet over the majority of the plates. A preliminary observation indicated that there were little differences between the black and white plates within each plot, implying that, at least during this ecological phase (which could be considered as colonization of primary space), in high-ecological productivity areas, temperature becomes less important in determining the development of the intertidal community. Until now, I have not been able to detect any difference between the plates surrounded by anti-mollusc paint and those that were not.

I also started taking data on the differences in temperature produced by the different color of recruiting plates (white vs. black). I have been taking 5 temperature measurements using a thermocouple thermometer of the surface of the plate. The mean results from these measurements taken at Playa Escondida and Los Frailes are displayed in the Table below.

Given the preliminary success of the experiment, I continued to place 6 more plots at one more southern (Playita) and one more northern (Galera) site. These two sites are very close to the first two, but are more exposed to wave damage and less sedimentation. This should give me another factor, wave exposure, to consider in the analysis. Now I will have to go each month to each of the 4 sites to clean the white and black plates around the central acetate plates that serve as the experimental unit in order to maintain the temperature differences and to ensure that the experiment is running smoothly.

I also took data loggers and placed them at 4 different sites along the coast, so that they will record temperature and light incidence data for the remainder of the experiment: Cabo Pasado, La Tiñosa, Punta Blanca, and Anconcito. Each of these loggers is bolted to the rock with 4 stainless steel screws and a wire mesh. I hope to find them safe and sound, with no damage or thievery, in 3 months.

At this moment my tasks involve processing the rest of the images from the first round of community sampling quadrats and the algae samples from this first round, perform maintenance on the plates, perform the second phase of community sampling, and finally remove the plates and loggers, process the images showing ecological succession, process biomass, diversity, etc. for whatever grows on the plates, and write. Finally, I am also hoping to take more concrete data on mollusc collection, which is hindered by the imprecise nature of the fishery, and take direct measurements of nutrient levels at the different sites along the coast. Currently, I have processed approximately half of the images from the community sampling. Here I have provided a few figures showing basic descriptive characteristics of what I have found so far.

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Figure 1: Two plates from the same plot in the low zone at Playa Escondida. Note the dense cover of juvenile barnacles on the white plate compared to none on the black plate (each brown spot is a barnacle). This implies that the substrate temperature has a major impact on the recruitment of these sedentary crustaceans.

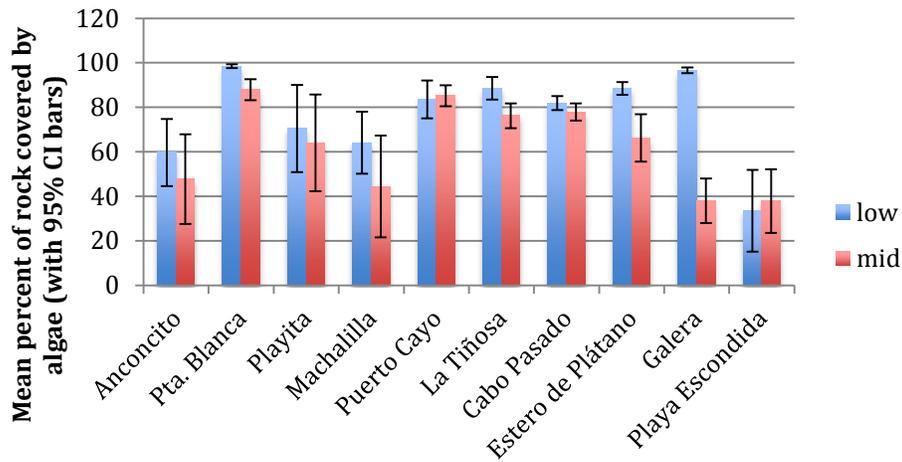


Figure 2: Two plates of the same type from the same intertidal zone but from the two different sites. Note the large amount of green algae growing on the plate from the Los Frailes in comparison to what is growing on the plate at Playa Escondida. This implies that overall marine productivity is much higher in the southern part of the country.

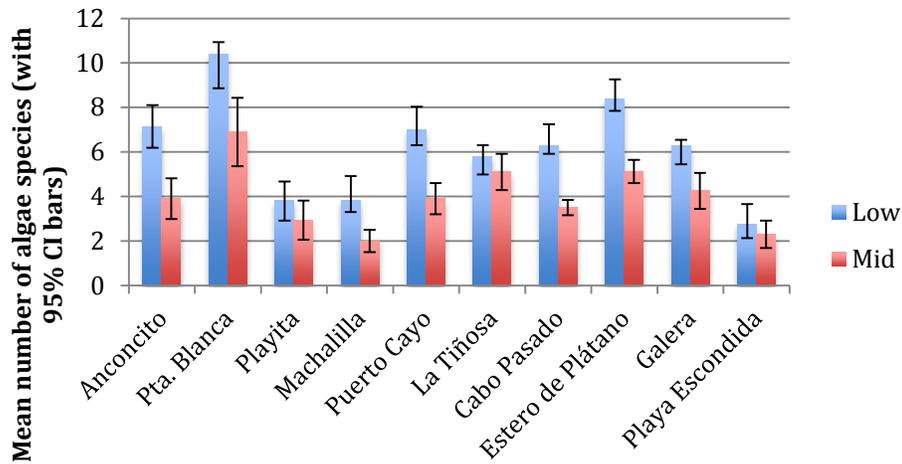
<u>Plate Type</u>	<u>Conditions</u>		Grand Total
	Cloudy	Sunny	
Black	25.61777778	29.49	26.32181818
White	25.07333333	26.69	25.36727273
Control	25.445	27.88	25.932
Grand Total	25.36363636	28.048	25.86074074

Table 1: Plate surface temperatures taken as the mean from 5 measurements taken of each plate. The black plates were an average 0.53 degrees C hotter than the white plates on cloudy days and 2.8 degrees C on sunny days. The control plates maintain an approximately average value between that of the two different colored plates.

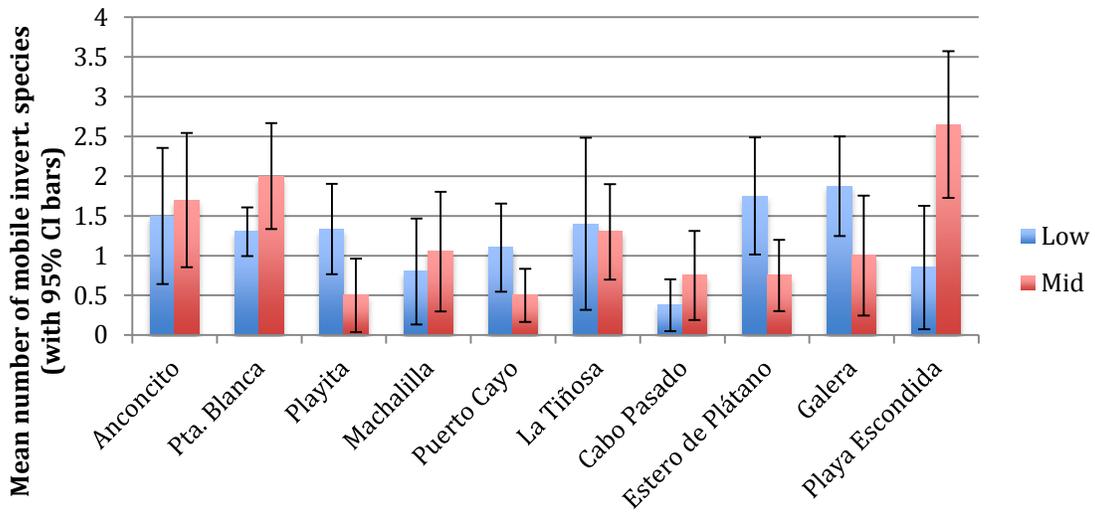
Mean Algal Percent Cover



Mean Algal Species Richness



Mean Mobile Invertebrate Species Richness



Predatory Mollusks

