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Homing Behavior of the Limpet Species *Collisella scabra* Living on the Limpet Species *Lottia gigantea*

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Limpets are one-shelled marine mollusks that live on rocky beaches in the intertidal zone. The limpet species *Collisella scabra* is also found living on the shell of the limpet species *L. gigantea*. *C. scabra* exhibits an interesting phenomenon known as homing. This means that while not feeding, *C. scabra* are always found on the same spot on the rock or shell where they live. The *C. scabra* leave this spot, known as a home scar, to feed, but always return to it after they are done feeding. In this research, Chris Miller, Bryant Low, Christian Armstrong, and I examined the homing behavior of *C. scabra* limpets that are found living on the shell of *L. gigantea*. The research was performed at the Monterey Bay Marine Life Refuge in Monterey, California.

There have been many studies performed on the homing behavior of *C. scabra* that live on the rocks, but not much has been done on the homing behavior of those limpets that live on the shell of *L. gigantea*. We examined the homing behavior of *C. scabra* living on *L. gigantea* and hypothesized that *C. scabra* would have to move off the shell of the *L. gigantea* to feed to find enough food to support its needs.

Another focus of our research was to provide further support for previous research that *C. scabra* uses a knowledge of the topography of the shell of *L. gigantea* to return to its home scar as opposed to a mucous trail. We also wanted to see if we could observe any specific homing patterns displayed by *C. scabra*.

The research site that we chose was a sheer rock face, exposed to heavy wave action. The site was 5.07 meters wide by 1.14 meters high. We selected eighteen *L. gigantea* for the study. Each *L. gigantea* had one to four *C. scabra* living on its shell, for a total of thirty-two *C. scabra* in the study. We labeled all the limpets and recorded their widths and heights.

The movements of the limpets were observed during five consecutive nighttime high tides. Direct observations were performed by using a spotting scope placed on a rock perch approximately seven meters from the research site and three meters above the water level. After sunset two flashlights were used to view the research site. The position of each *C. scabra* noted and recorded at one-hour intervals over the course of a four-hour period surrounding high tide.

Two additional experiments were performed which we called *Collisella* transfer and dog pile. In the *Collisella* transfer experiment we moved *C. scabra* living on *L. gigantea* from their home scar to another spot on the shell. Their position at the next low tide was recorded to see if they had returned to their home scar. We also had a control group where *C. scabra* were lifted off their home scar and then placed back on the home scar. The dog pile experiment involved placing multiple *C. scabra* on the shell of different *L. gigantea* to observe the reaction of the *C.*

scabra. In one group we used only *C. scabra* living on the rock face and in another group we used *C. scabra* living on the shell of *L. gigantea*.

Our research led to some interesting conclusions about the interactions between *C. scabra* and *L. gigantea*. Our observations showed that *C. scabra* do not leave the shell of their host *L. gigantea*. Our study showed that this is not due to their inability to leave, but that there is enough food on the shell of *L. gigantea* to support the *C. scabra* that lived on its shell. We saw that the *C. scabra* exhibit linear, triangular, and even figure eight homing patterns. Each limpet tends to follow the same pattern every time it feeds.

From our *Collisella* transfer experiment we found further proof that *C. scabra* uses the topography of the rocks to find their way back to the rock as we observed the limpets that we moved were able to find their way back to their home scar.

From our observations we collected a lot of data on how far each *C. scabra* moved while feeding. We performed statistical tests on this data to see if we could find any correlations between how far the limpets moved and their characteristics, such as size. One characteristic we chose was the number of *C. scabra* on the *L. gigantea* host to see if this affected movement. The t-test we performed showed that there was no significant difference in distance moved. When we divided the limpets into two different size classes, the t-test showed that the larger-sized group moved significantly more than the smaller-sized group. But a regression analysis test showed that no correlation could be found between the size of a limpet and the distance it moved while feeding.

Further research needs to be conducted with a larger sample size and larger variation in size of the *C. scabra*. This may prove that there is in fact a correlation between the size of *C. scabra* and the distance it moves while feeding.

My research group had a few obstacles to overcome before we were able to collect relevant data. We knew we wanted to observe the limpets to see if we could find any new information about the way the limpets interacted. Observing the limpets was difficult, however, because most of the time the limpets do not move. When they do move it is when waves are crashing up over them. We finally devised a way to observe the limpets at these times of heavy wave action. We used a spotting scope from a good distance away and high enough that we stayed dry for the most part. When a wave subsided we noted the movements of the limpets. Using this method we were able to observe most but not all of the limpets at a given time. Another obstacle was figuring out a way to affix labels to the limpets without them falling off in the heavy waves. We tried a few different glues, but Super Glue worked the best.

This experience was valuable to me because I learned how to conduct a research project and deal with the problems that research entails. I am graduating in April and will then attend medical school where I will use what I learned from this project to conduct other research.