Dominance of Three Local Hermit Crabs with relation to Shell Selection

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INTRODUCTION:

Hermit crabs all over the world are faced with the challenge of finding a gastropod shell to call their home. The difficulty is finding a shell that is large enough for them to fit their entire body into, but not too large that they can't carry the shell due to its weight. There are many factors that go into shell selection which include: shell weight, shell volume, overall shell size and the protective properties provided by the shell (McClintock 1985). Since all hermit crabs need a shell to inhabit, competition is also going to factor into their home selection. Therefore, I would hypothesize that in the event of two crabs competing for a shell, there is going to be some type of dominance or hierarchy between different species occupying the same tidal zones. Many types of shells are occupied by hermit crabs, and according to Wilber (1990), hermit crabs are not known to change shell preference with prior experience. This means that regardless of the current home being used, there is no preference to find the same species of shell for a new home.

METHODS:

I obtained approximately 50 hermit crabs of all different sizes from South Cove, Cape Arago, Charleston, Oregon during a low tide. During collection, I tried to get all three common species: *Pagurus granosimanus*, *Pagurus hirsutiusculus*, and *Pagurus samuelis*. I also tried to collect crabs that inhabited different types of shells, the most common being *Tegula funebralis*. Other species included *Calliostoma ligatum, Ceratostoma foliatum, Nucella emarginata, Nucella lamellose, & Lirabuccinum dirum*. I

brought back these crabs and placed them into a large plastic container that had a flow of fresh seawater and an air stone within the container. This container was placed in the saltwater table which kept it at the same temperature as their environment and in the event of an escape it allowed them to still survive.

I removed as many of the hermit crabs as I could, which proved to be a difficult task. There were a few papers that I read that suggested various methods. Wilber (1990) removed crabs in his experiment by gently cracking the shell open and removing the crab from the broken pieces, but I wanted to reuse the shells so that method wasn't a plausible one. Another method that I encountered in a students paper was to heat up the apex of their shell with a heat source (Cumiford 2005), but I was unable to make this process work. The third suggestion I tried came from a fellow classmate who suggested vibrating the shell, but that was also found not to work. The method I used was another one I found in a students paper that said to gently pry them out with forceps (Chinn 2005). This proved to be a challenging task, but it worked, and after a few crabs, I became relatively good at the process.

Once the hermit crabs were removed from their shell, they were separated from those crabs that still had shells, as well as from any empty shells. I then would add one empty shell to the container with all the crabs and observe which crab species took the empty shell as its new home. This process was repeated many times until I was able to find a dominance hierarchy. Shells and hermit crabs were reused in following tests, and then released after my testing was complete.

RESULTS:

The results of this experiment suggest that there is no dominance hierarchy. Whichever crab was first to the shell was the first to inhabit it. This was true for every shell that I placed in the container, and size had nothing to do with it. If the crab was too small for the shell, it still inhabited it, and the same goes for crabs that were too large for the shell presented. There was no difference between shells of different gastropod species either. Only once did a larger crab pull another smaller crab out of the shell that was being presented.

DISCUSSION:

I preformed this test at least 30 times over two different days and found that each time the first crab there was the one to take the shell. The first test I preformed was with the *Ceratostoma foliatum*, or Leafy Hornmouth shell and the crab that took it was too small to move the shell. This didn't stop the crab from staying inside the shell though, even when presented with a smaller, more logical choice. When the shell presented was too small for the first crab there, it was still inhabited by the crab even though half of its body was still exposed. I presented the crabs with a variety of sizes of each shell species, except the *Ceratostoma* shell, and found the same result.

This finding doesn't suggest a hierarch by any means; in fact it suggests a first come first serve mentality within the three crab species being tested. Upon further thinking as well as talking amongst classmates, this seems to be the most logical means of shell selection, because crabs aren't likely to vacate just because another larger crab wants the shell that the smaller crab has inhabited. If that were the case, then one species of crab would never have quality shells, most likely resulting in higher predation of that

species. The majority of the hermit crabs that I collected were found inside the *Tegula funebralis* shells, which initially suggested a preference for those shells. After this experiment, I no longer believe that to be true. There was no visible difference at the rate of shell choice between *Tegula* shells and any of the other five species tested.

Overall, I feel that this experiment was good, with a few exceptions. I don't believe that I preformed enough tests to formulate a concrete result; however the data I found seemed to suggest there is no dominance. Had I collected more data I might have found different results, but I doubt it. Another way to ensure there is not a dominance factor would have been to test the same number of each species as well as each size of animal within different species. Had this been done, then the test could be more accurate because there might have been a statistical issue with the experiment. By this I mean there may have been more of one species in the test container, therefore increasing the number of opportunities for that species to get to the shell first. If there were equal numbers of individuals from each species present, then this would not have been a factor. McClintock (1985) says that deshelling the crabs creates an artificial condition that is likely to produce a different result than an experiment preformed with crabs still in their shells. I agree with this statement, but I don't think that I would have been able to find any data by using this method, however it could be an idea for future experiments.

With all this in mind, I feel that I preformed a quality experiment within the allotted time frame. Had I been given more time, I might have been able to come up with more solid data, but as it is I am satisfied with what I learned. This has also opened my eyes to what can actually be done with hermit crabs, which until now were an intertidal animal that I didn't think too much about.

REFERENCES:

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