ESCAPE RESPONSE OF TWO LIMPETS, *LOTTIA PELTA* AND *TECTURA SCUTUM* TO TWO SEASTARS, *PISASTER OCHRACEUS* AND *PYCNOPODIA HELIANTHOIDES*

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Introduction

Lottia pelta and *Tectura scutum* are two limpets that share both geographical range and habitat. T. scutum can be found from Alaska to Baja, California on rocks in high to low intertidal zones. L. pelta has a range from Alaska to Mexico and can be found on rock and among mussel beds between the high and low intertidal zones. It can also be found on various species of brown algae.
Two seastars that share similar ranges with the limpets are *Pycnopodia helianthoides* and *Pisaster ochraceus*. Both species are found from Alaska to southern California. P. ochraceus can be found in mid to lower intertidal zones while *P. helianthoides* is found on soft bottoms and rocky shores in the low intertidal zone. Favorite prey items of *P. ochraceus* include goose barnacles and California mussels. *P. helianthoides* feeds on clams and crustaceans.
For this experiment, I wanted to determine whether or not a greater escape response would be exhibited by each limpet species when exposed to *P. helianthoides* versus *P. ochraceus*. I hypothesize that both limpet species will exhibit a greater escape response to *P. ochraceus* than to *P. helianthoides* because *P. ochraceus* is a known predator of limpets and *P. helianthoides* is not. With that, because *P. ochraceus* is a known limpet predator, the limpets will recognize this seastar as a threat. I believe the limpets will not recognize *P. helianthoides* as a predator and will illicit little or no response.

Specimen Collection

All limpet specimens were collected from the rocky intertidal zone at South Cove Beach, Charleston, Oregon, USA. The seastars used in this experiment were borrowed from the Oregon Institute of Marine Biology outdoor wet lab, Charleston, Oregon, USA.

Methods

To begin this experiment I first acquired a 1 X 2 ft. piece of clear plexiglass. On this piece of plexiglass, I drew a 1 X 1 cm. grid. I then submersed the plexiglass sheet beneath 4-5 inches of water, using a water table. First, I placed a limpet at the end of the grid. I then gave the limpet a 2 minute period to acclimate to the new conditions. After the two minutes was up, I placed a seastar within touching distance of the limpet. By touching distance, I mean, able to touch the limpet with its tube feet extended. Once contact was made between the tube feet of the seastar and the shell of the limpet, I began keeping time. The amount of time I observed the reaction was one minute. While observing I noted the distance the seastar moved in any direction. If the limpet moved in one direction and rotated and began moving in another direction, I would add the distance moved in each direction.
For this experiment, I used 10 specimens of each species of limpet. I had one specimen of each species of seastar. Each species of limpet was first exposed *P. ochraceus* then to *P. helianthoides.*

Results

I first tested the response of *T. scutum* to *P. ochraceus.* All ten specimens of *T. scutum* responded to *P. ochraceus.* The greatest response was 3.2 cm and the least was 0.5 cm. Limpets #1 and 9 did not fully escape from the seastar, with tube feet still attached to the shell of the limpet at the end of one minute. In six cases, the limpet moved forward and then rotated its direction 90 degrees and continued. In five of the six cases, the limpet turned to the left.
I next tested the response of *L. pelta* to *P. ochraceus.* Six of the ten *L. pelta* specimens responded to *P. ochraceus.* The greatest response exhibited was 3.3 cm with the least being zero. Four specimens did not fully escape from the seastar, having tube feet still attached to their shells at the end of one minute. Five specimens rotated at some point during the one minute interval. Specimens 1 and 5 exhibited slight mushrooming behavior, lifting their shells off the surface. Specimen 1 exhibited mushrooming behavior along with rotation, turning to face the seastar. It did not retreat.
Third, I tested the response of *L. pelta* to *P. helianthoides.* Zero of the ten specimens responded to the touch of the seastar. With that, the seastar continued its movement as if the limpet was not there, going around or over the limpet.
Last, I tested the response of *T. scutum* to *P. helianthoides.* Seven of the ten specimens reacted to the touch of the seastar. The greatest response exhibited was 4.5cm and the least was zero. Five specimens rotated during the one

minute trial. In five cases, the seastar showed no interest in the limpet, moved around or in the opposite direction of the limpet.
See figures 1 and 2 for comparisons in the escape response of each limpet species to each seastar species.

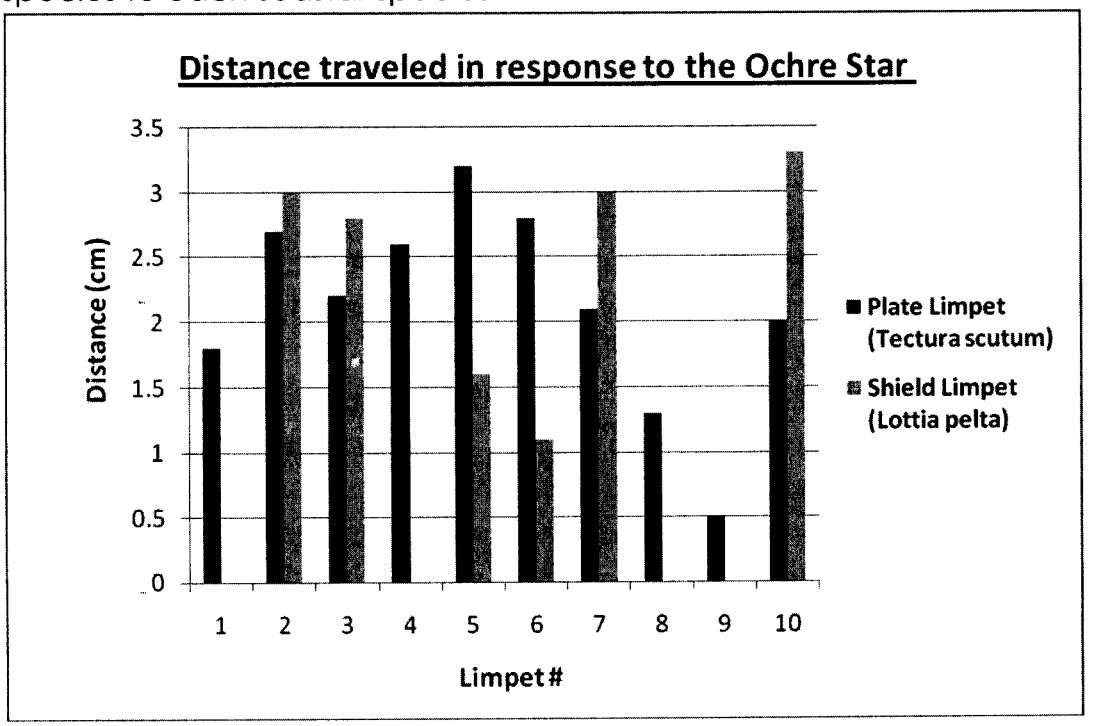

Figure 1

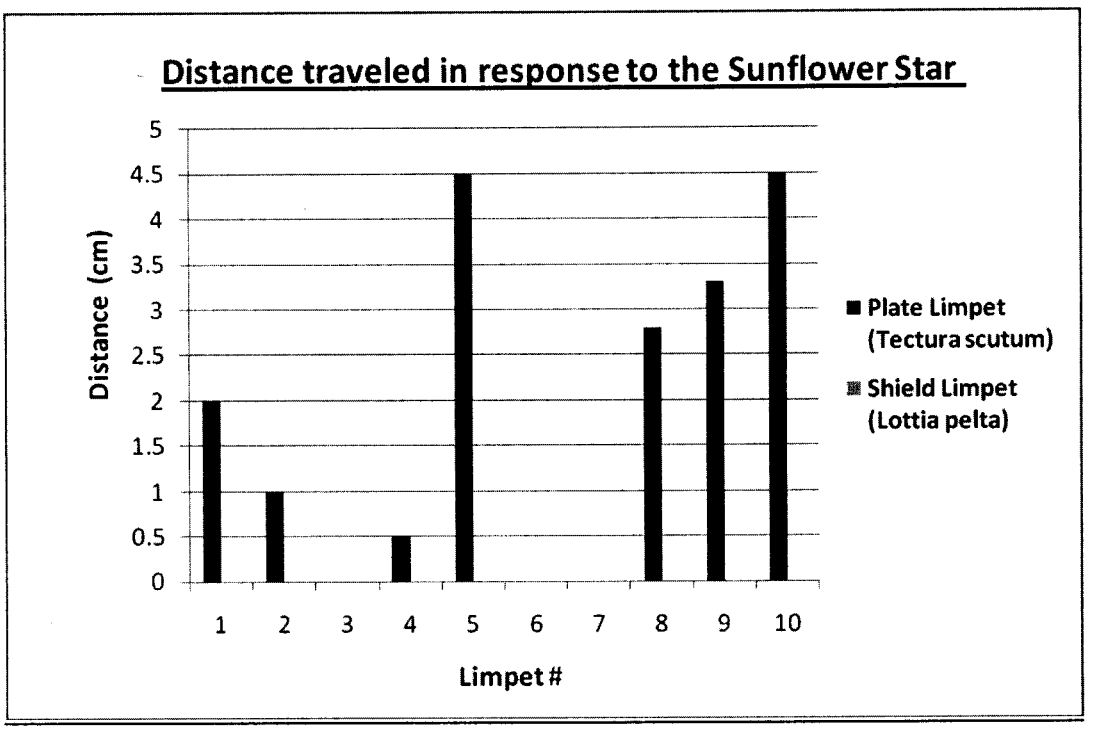

Figure 2

Discussion

In the end, I was able to partially validate my hypothesis with both *L. pelta* and *T. scutum* responding to *P. ochraceus*. These results are similar to a study conducted by W.E. Bros (1986), in which both limpet species attempted to avoid capture by P. ochraceus, but L. pelta was unable to outrun the seastar. This leads me to wonder if, of the specimens that were still in contact with the seastar, at the end of the one minute trial would these limpets have eventually been consumed or would they have been able to escape.

In the case of *L. pelta's* lack of response to the contact of *P. helianthoides*, I believe there are two factors that may explain this. One may be that *L. pelta* is familiar with *P. helianthoides* and knows it is not a threat. A second reason may be that *L. pelta* has never been exposed to *P. helianthoides* and therefore did not know how to react to the seastar, so remained still and inactive. In a study conducted by Espoz and Castilla (2000) the escape response of four Chilean limpet species to three seastar species was observed. The limpets showed escape responses to *Heliaster helianthus*, a known limpet predator, but showed no response to the other two species, *Stichaster striatus* and *Patiria chilensis*. The latter two species do not typically prey on limpets.

To close, I am satisfied with the results of this study, but would make a couple of alterations. In a study conducted by Phillips and Castore (1982) on the defensive responses of two limpet species to predatory seastars, each limpet was not tested more than once per 24 hour period. Also, if the tube feet of the seastar were still attached at the end of the initial observation period, the observation would continue to see whether or not the limpet would eventually escape or likely be consumed. If I were to reconduct this study, I would include the methods mentioned above so that the results would be more extensive. I would like to include data from observations made at the time of contact between the limpet and seastar to the eventual escape or consumption of the seastar.

References

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