Exploratory 1:

Comparison of dactyl length and structure of *Pachygrapsus crassipes* and *Pugettia producta*

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Introduction

The *Grapsidae* family of crabs is familiar to anyone that has flipped over a rock at the seashore (Jensen 1995). These shore crabs typically have a square shaped carapace and fairly large eyes. They can also move quickly when out of water. All three of the most common Pacific coast species live fairly high in the intertidal zone. This includes *Pachygrapsus crassipes,* the lined shore crab, which can be distinguished from *Hemigrapsus nudus,* the purple shore crab, by its striped markings and having only two teeth on the carapace following the eye (Jensen 1995). *Pachygrapsus crassipes* is found in tidepools in the high and mid-intertidal zones from Oregon to the Gulf of California (Sept 1999). Within these zones *Pachygrapsus crassipes* is often observed in crevices and under rocks.

On the other hand, the *Majidae* family of crabs is probably less well known. These are the spider crabs and are best known for their ability to camouflage themselves using bits of algae, sponges, bryozoans, and other material (Jensen 1995). Among the slider crabs is *Pugettia producta,* the Northern kelp crab. *Pugettia producta,* like other spider crabs, is not particularly fast and relies on cryptic coloration for protection (Jensen 1995). Like its common name, *Pugettia producta* is usually found in or on seaweed, especially bull kelp, intertidally and to water 240ft (75m) deep and ranges from Alaska to Baja California. *Pugettia producta* are kelp brown or olive green in color and blend well with the kelp in which they live (Jensen 1995, Sept 1999).

An important factor in determining the distribution and morphology of intertidal organisms is wave shock. *Pachygrapsus crassipes* and *Pugettia producta* live in distinctly different environments. The high and mid-intertidal zones that *Pachygrapsus crassipes* live within is greatly influenced by wave action when the tide is coming in or going out so the organisms that inhabit these zones must be able to attach themselves securely to the rocks

(Mohler et al. 1997). However, the lower mid-intertidal, low intertidal and kelp beds that *Pugettia producta* inhabit are impacted by wave action of less force but more consistently. Waves carry a tremendous amount of energy that is focused on the shoreline when they hit. With waves come abrasive particles suspended in the water, hydrostatic pressure, and pressure drag (Levinton 2001). All three of these factors can damage or dislodge an organism in the intertidal. The impact of waves on intertidal organisms can depend on their shape and location. The more an organism stands out from a surface the more drag there will be pulling on it. Consequently, the shape and size of the dactyls ofPachygrapsus *crassipes* and *Pugettia producta* are designed to suit their environments. 1 propose that *Pachygrapsus crassipes* will have shorter, duller dactyls that enable it to seek cover from wave action in rocky sediments than *Pugettia producta,* which will have longer, more pointed dactyls that allow it to cling to kelp.

Methods

Pachygrapsus crassipes and *Pugettia producta* were collected from South Cove of Cape Arago in Coos County, Oregon, at low tide. Only individuals with a carapace width of 2-3.5cm were used. Ten individuals of each species were measured (N=10). The width of the carapace in centimeters was measured after the first tooth and right before the second tooth on the edge of the carapace behind the eye *(Figs la and 2a).* The length of the most posterior, last, leg in centimeters was measured from the top of the ischium to the tip of the dactyl claw *(Figs la and 2a).* The length of the dactyl in centimeters was measured from the base of the propodus, or the top of the dactyl, to the tip of the dactyl claw *(Figs la and 2a).* All measurements were taken with the same calipers.

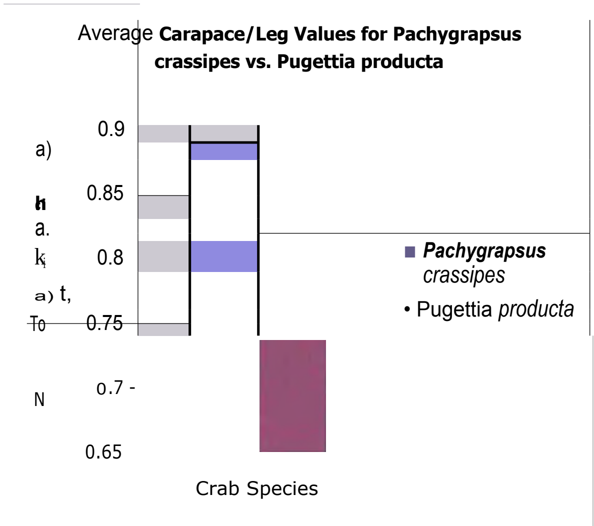
Results

Table 1 shows the averages of the data collected from the measurements of Pachygrapsus *crassipes* and *Pugettia producta's* carapace width, leg length and dactyl length, the carapace/leg ratio, the dactyl/leg ratio, and the dactyl/carapace ratio. The average carapace width of *Pachygrapsus crassipes* (2.63cm) is wider than *Pugettia producta* (2.49cm) by 0.14cm. The average dactyl length ofPugettia *producta* (0.43cm) is longer than *Pachygrapsus crassipes* (0.35cm) by 0.08cm. The average leg length ofPugettia *producta* (3.26cm) is longer than *Pachygrapsus crassipes* (2.95cm) by 0.31cm. The average carapace/leg ratio *ofPachygrapsus crassipes* is 0.89cm whereas the average carapace/leg ratio *of Pugettia producta* in 0.77cm. Graph 1 shows this data. The average dactyl/leg ratios for bothPachygrapsus *crassipes* and *Pugettia producta* are 0.12cm and 0.13cm respectively. The average dactyl/carapace ratio of *Pachygrapsus crassipes* and *Pugettia producta* are 0.13cm and 0.17cm respectively. Graph 2 shows this data.

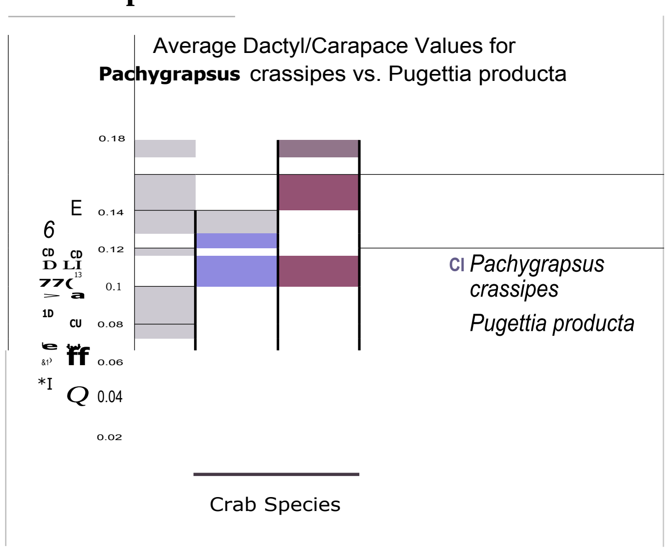
Table 1

Averages (cm)	*Pachygrapsus crassipes*	*Pugettia producta*
Carapace Width	2.63	2.49
Dactyl Length	0.35	0.43
Leg Length	2.95	3.26
Carapace/Leg	0.89	0.77
Dactyl/Leg	0.12	0.13
Dactyl/Carapace	0.13	0.17

Graph 1



Graph 2



Discussion

The data from this investigation support the proposed hypothesis that the dactyls of *Pachygrapsus crassipes* would be shorter and duller than those of Pugettia *producta.* Graph 2 shows that *Pugettia producta* has longer dactyls than *Pachygrapsus crassipes* when the size is standardized against the width of the carapace. Additionally, Table 1 shows the average of the dactyl lengths for each species without standardization for size and Pugettia *producta* still has longer dactyls than *Pachygrapsus crassipes.* Not only are the dactyls longer, but also the total leg length of *Pugettia producta* is longer than that of *Pachygrapsus crassipes,* as Graph 1 shows. However, it is interesting to note that the dactyl/leg ratio for the two species is almost identical, which indicates that the overall leg structures of these species have similar proportions, at least in length.

Upon visual inspection of the dactyls under a dissecting scope, other differences in the structure of the dactyls appeared. The dactyls *ofPachygrapsus crassipes* are thicker and less pointed than *Pugettia producta's* dactyls. The dactyl claw of Pugettia *producta* is a more prominent part of the whole dactyl than it is for *Pachygrapsus crassipes.* Furthermore, the setae on *Pachygrapsus crassipes'* dactyls are wider and both on the top and bottom of the dactyls, whereas *Pugettia producta's* setae are narrow and pointy and only on the bottom of the dactyls.

As Figures lb and 2b show, the shape of the other leg segments differs between the two species. *Pachygrapsus crassipes'* legs are broader but curl up against the main body of the crab much closer than *Pugettia producta's* legs appear capable of doing. For future research, I would look into these structural comparisons of the other leg segments and the overall leg structure in reference to the environments in which each species lives. I would also compare these species with other species of crabs inhabiting the same or similar environments to see if they have similar structural adaptations of the leg.

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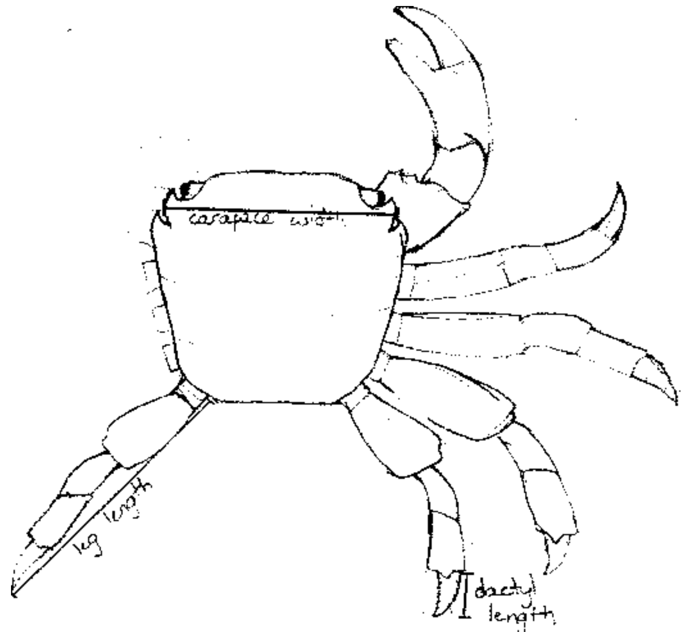

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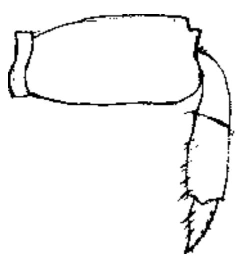

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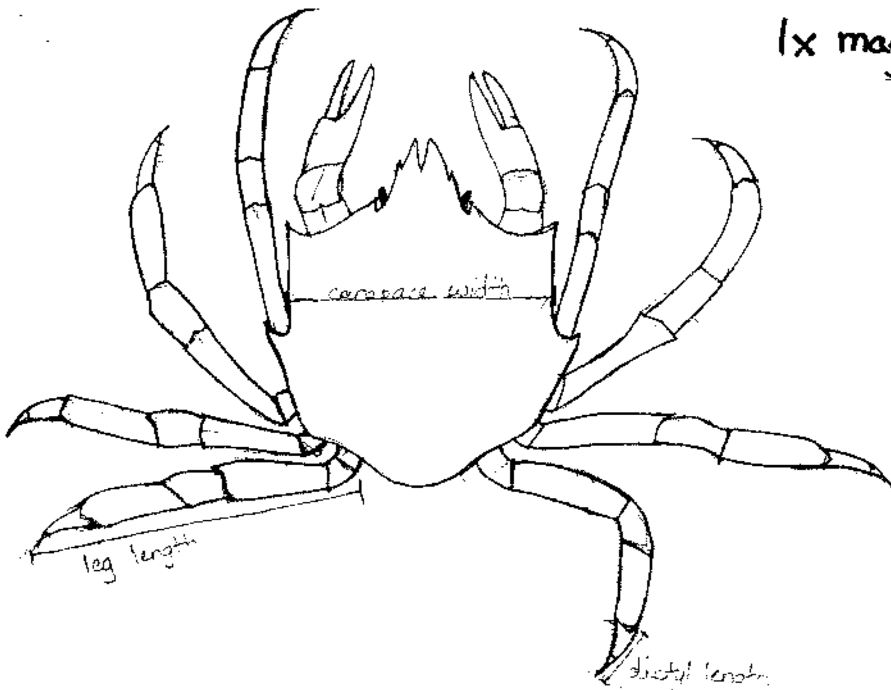
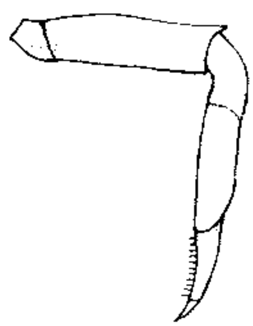


1x magnification



2x magnification

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