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Adaptations of Marine Organisms

7/11/05

Structural Comparsion of the Dactyls of Three Crab Species

Introduction

Crabs are in the class of decapods and can be recognized by a segmented body, exoskeleton, and jointed legs that add flexibility to help with locomotion. There are two types of crabs, anomurans and brachyurans. Brachyurans are known as true crabs and can be identified by their four pairs of visible walking legs, one pair of chelipeds, and antennae between the eyes. Many species of crab fall into this group some of which are, *Pugettia producta*, *Cancer products*, and *Pachygrapsus carssipes*. Each of these three species live in different habitats giving them distinctive adaptations based on where they live.

C. products, red rock crab, can be found from Alaska to California and lives in the middle intertidal zone to 79m (Jensen, 1995). Juvenile crabs can be found higher in the intertidal zone and move lower once they become adults. *C. products* is restricted to gravelly or rocky areas because they lack the adaptations for straining fine debris from the water colony of sandy substrates that other species of crabs have adapted to. During the day *C. products* can be found under rocks and at night they come out to the tide pools to catch prey (Ricketts et al., 1985).

The northern kelp crab, *P. producta*, gets its common name from the kelp habitat it lives in. *P. producta*'s habitat ranges from the kelp canopy to dock pilings and can be found intertidaly to 73m. Its body is well adapted to with stand heavy wave action with

points on the carapace and sharp spins on the legs with long dactyls to help hold onto kelp (Ricketts et al., 1985).

P. crassipes, lined shore crab, is smaller than the kelp and red rock crab, and has some distinct characteristics for the high intertidal zone it lives in. *P. crassipes* lives in rocky to sandy substrate and can usually be found hiding under rocks during the day. This species of crab can spend more time out of water than most crabs making it essential to be more agile out of water. They can be very fast moving on land due to the ability to move backward to forward to escape from predators (Jensen, 1995).

Based on the three distinct habitats of these species they should all have well adapted dactyls to help with locomotion based on the habitats they live in. *P. crassipes's* dactyls should be muscular to aid in agility and speed out of water, the dactyls *C. productus* should be shorter for easy maneuvering over rocky surfaces, and *P. producta* should have long, slender, and sharp dactyls to hold onto kelp.

Methods

Five crabs of each of the three species were taken and placed in salt water holding tanks until they were ready to be measured. *P. crassipes* was taken from under rocks just across the road from the OIMB campus; two of the *C. productus* were caught in crab pots at the OIMB docks while the others were taken from under rocks at South Cove, and *P. producta* was found and taken from bull kelp at North cove. The crabs were then taken one by one from the holding tanks to measure the right fifth dactyl and then end of the carapace in millimeters with calipers. The carapace was measured to obtain a ratio

of dactyl length to carapace width to provide a clear way to compare the dactyls of the three species. See figure 2a and 1a for where exact measurements were taken.

Results

The average ratio of dactyl length to carapace width was found for each of the three species by dividing dactyl length by carapace width. *P. crassipes* had an average ratio of 0.62mm. *C. productus* had an average dactyl to carapace ratio of 0.56mm, and *P. producta* had an average ratio of 0.83mm. See appendix 1.

Discussion

Based on the average ratios of each of the three species my hypothesis was supported. *P. producta* had the longest dactyl to carapace ratio of the crabs. When looking at the dactyl structure of *P. producta* the dactyls were found to be slender and sharp compared to the other two species of crabs. The dactyls of *P. producta* also have pointed projections coming off the exoskeleton. See figure1a. This was to be expected since *P. producta* have to use their dactyls to hold onto the kelp during rough wave action. *C. productus* had the shortest dactyl to carapace ratio. The structure of the dactyls showed to have fine setae to help filter particles out of the respiratory water. The setae are not as well developed as other crab species; this is likely due to the rocky substrate *C. productus* inhabits. See figure 1b. *P. crapssipes* had a dactyl to carapace ratio close to that of *C. productus.* When looking at the structure of the dactyl, a distinct difference from the other two species is apparent; *P. crapssipes* dactyls are wider and have thicker setae than the other two species that were studied. This is likely due to the need to be more agile on land and therefore having well-developed muscles. Since the

dactyl structure of the three crabs is so diverse compared to the substrate they live on it would be interesting to compare the overall body structure. Looking at the body structure could provide insight into the adaptations needed to live in differing environments.

Refernce

Jensen, Gregory C. 1995. *Pacfic Coast Crabs & Shrimps.* Monterey, CA: Sea Challengers.

Ricketts, Edward F., and Jack Calvin. 1985. *Between Pacific Tides.* Stanford, CA: Stanford University Press.

Pachygrapsus crassipes

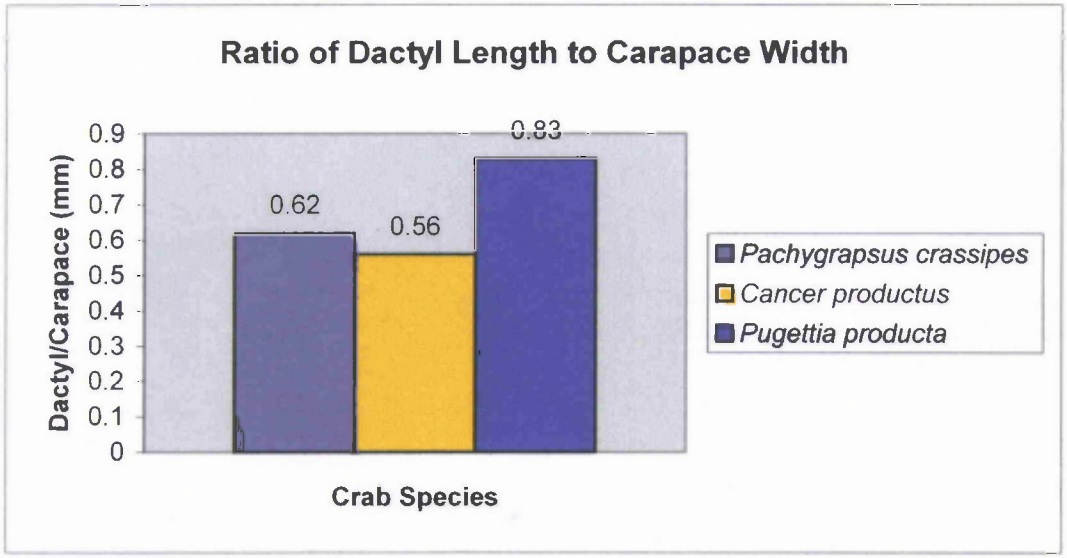
Crab #	Dactyl Length (mm)	Carapace Width (mm)	Ratio (mm)
1	5.50	9.50	0.58
2	6.00	9.20	0.65
3	2.90	5.00	0.58
4	3.90	5.70	0.68
5	5.40	8.60	0.63
		Average Ratio	0.62

Cancer productus

Crab #	Dactyl Length (mm)	Carapace Width (mm)	Ratio (mm)
1	12.00	21.00	0.57
2	11.00	22.00	0.50
3	12.50	25.30	0.49
4	17.60	30.00	0.59
5	19.00	20.00	0.63
		Average Ratio	0.56

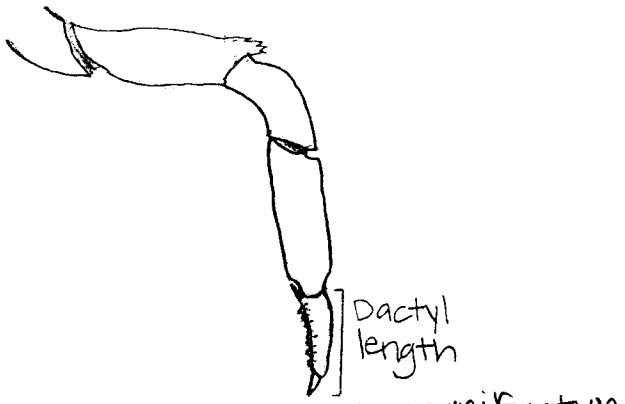
Pugettia producta

Crab #	Dactyl Length (mm)	Carapace Width (mm)	Ratio (mm)
1	7.00	9.20	0.76
2	5.90	7.80	0.76
3	5.10	5.40	0.94
4	4.90	5.60	0.88
5	5.00	6.10	0.82
		Average Ratio	0.83



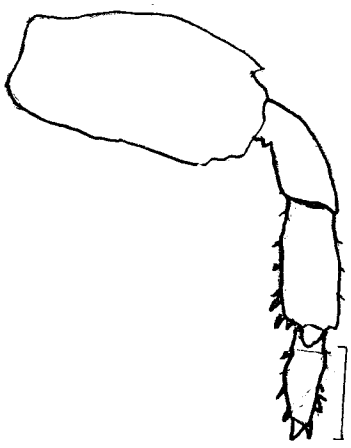
Appendix 1

Figure 1a.



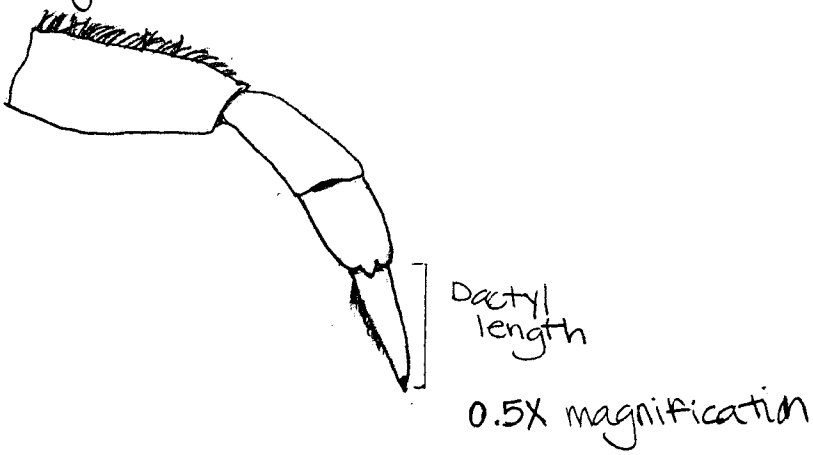
Rygettia producta

Figure 1b.



Pachygrapsus crassipes

Figure 1c.



Cancer productus

Figure 2a.