Substrate Preference between two Caprellid species: *Caprella mutica* and *Caprella drepanochir*

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Introduction

Caprellids are a type of amphipod found around the world in many different habitats (Figure 3). Their common name is skeleton shrimp and there are numerous species. Most caprellids do not have a larval stage, so they spend their entire lives attached to some kind of substrate (Buschbaum 2005). Substrates for skeleton shrimp then, are very important for feeding and reproduction as well as protection from predators. Caprellids occur on a variety of different substrates including: hydrozoans, macroalgae, seagrasses, bryozoans, sponges, ascidians, and artificial structures such as ropes and boat hulls. The choice must lend to a substrate they can firmly cling on to with their last periopods (Thiel 2003).

One prevalent species found in many areas around the world is *Caprella mutica.* In the United States, they are found along the West Coast from Washington to California in low inter tidal and subtidal areas in bays (Monterey 2007). They are natively found on a type of floating Japanese brown seaweed, *Sargassum muticum* in several areas along Japan's coast. However, *C. mutica* seem to have a wide variety of substrates they are commonly found on. Much of their transportation involves floating on substrates, so a wide variety of choices is advantageous (Buschbaum 2005). Beyond transportation, many caprellids also use their substrates as a way to hide from predators. Their body shape (long and thin) and color match several of their substrates, making them blend in very well. Some species can also change their color to match their substrate (Monterey 2007). Many *C. mutica* have been found on hydroid species over other substrates. Several studies have suggested that caprellids may feed on the polyps of hydroids (which contain nematocysts), or eat the diatoms and detritus off the polyps (Rensel 2007). Another study showed that two of the species of Caprellids collected for their experiment were associated with the hydroid, *Obelia spp.* (Theil 2003).

Based on this association, the hypothesis for this study is that *Caprella mutica* will choose *Obelia spp.* over other types of substrates (including other hydroid species), due to *Caprella mutica*'s better ability to camouflage themselves within the branches of it, since *C. mutica* is closer in shape and size to *Obelia spp.* over other substrates within the area they are found.

Methods

Two species of caprellids (*Caprella mutica* and *Caprella drepanochir*) were collected from the docks in Charleston, OR marina. They were all found on either *Obelia spp.* or *Odonthalia spp.* and were taken back to the lab and separated by species. The *Obelia spp.* and *Odonthalia spp.* they were found on were also taken for experimental use, as well as some *Zostera spp.* and *Bugula spp.* Five *C. drepanochir* and 6 *C. mutica* were divided into small, separate containers with running seawater. Individuals were put in the center of the container and a piece of each substrate type was added (*Obelia spp.*, *Odonthalia spp.*, *Zostera spp.*, and *Bugula spp.*). Another group of 22 *C. mutica* individuals were placed into two small finger bowls with 11 in each bowl. One species of hydroid (either *Obelia spp.* or *Tubularia spp.*) was placed in each bowl to act as a control to ensure *Caprella mutica* chose hydroid. Once all caprellids were attached to hydroid, it was removed and placed in a larger plastic container at opposite ends in the water table separate from the other two containers with 5 *C. drepanochir* and 6 *C. mutica.*

All three containers with the individual setups of *C. drepanochir* and *C. mutica* and the larger setup of 22 *C. mutica* had running seawater and an air stone in or next to the container in the water table.

The containers were checked after 5 different time intervals (ranging from 2 days to 3 hours) for a total of 5 trials. The numbers of caprellids on each substrate were recorded and removed between trials. The substrates were also removed from the containers so the containers could be cleaned and have fresh sea water added after each trial.

Results

The caprellids did not appear to need more than one hour to choose their substrate. Trial 1 was recorded after 2 days, Trial 2 after 1 day, Trial 3 after 8 hours, Trial 4 after 16 hours, and Trial 5 after 3 hours. The results of each trial are recorded in Table 1. One *C. mutica* died between Trials 1 and 2.

For the averages of the smaller containers with 6 *C. mutica* and 5 *C. drepanochir*, there was great variance. For the 6 *Caprella drepanochir*, the average number found on *Bugula spp.* over 5 trials was 0.2, for *Obelia spp.* it was 2, they were not found on

Zostera spp., for the *Odonthalia spp.* it was 2.2, and 0.6 were found on no substrate. The standard deviations were 0.4, 1.6, 0, 1.1, and 0.5 respectively (Figure 1).

For the 5 *Caprella mutica*, the average number of individuals found on *Obelia spp.* was 2.0 and *Odonthalia spp.* was 3.2. There were none found on *Bugula spp.*, *Zostera spp.*, or found on nothing. The standard deviation for *Obelia spp.* was 1.0 and for *Odonthalia spp.* was 0.8. The others substrates had standard deviations of 0.0 due to a lack of individuals found on those substrates (Figure 1).

For the larger container with 22 *Caprella mutica* and the two hydroid species, there was also high variability. The average number of individuals found on *Obelia spp.* was 12.6 with a standard deviation of 3.8. For *Tubularia spp.*, the average was 9.4 with a standard deviation of 3.8 as well (Figure 2).

Table 1: Number of caprellids attached to different substrates over all 5 trials.

	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**
C. mutica					
Bugula spp.	0	0	0	0	0
Obelia spp.	3	1	3	2	1
Zostera spp.	0	0	0	0	0
Odonthalia spp.	3	4	2	3	4
No substrate	0	0	0	0	0
C. drepanochir					
Bugula spp.	0	0	1	0	0
Obelia spp.	3	4	0	1	2
Zostera spp.	0	0	0	0	0
Odonthalia spp.	1	1	3	3	3
No substrate	1	0	1	1	0
Large container-*C. mutica*					
Obelia spp.	17	16	11	8	11
Tubularia spp.	5	6	11	14	11

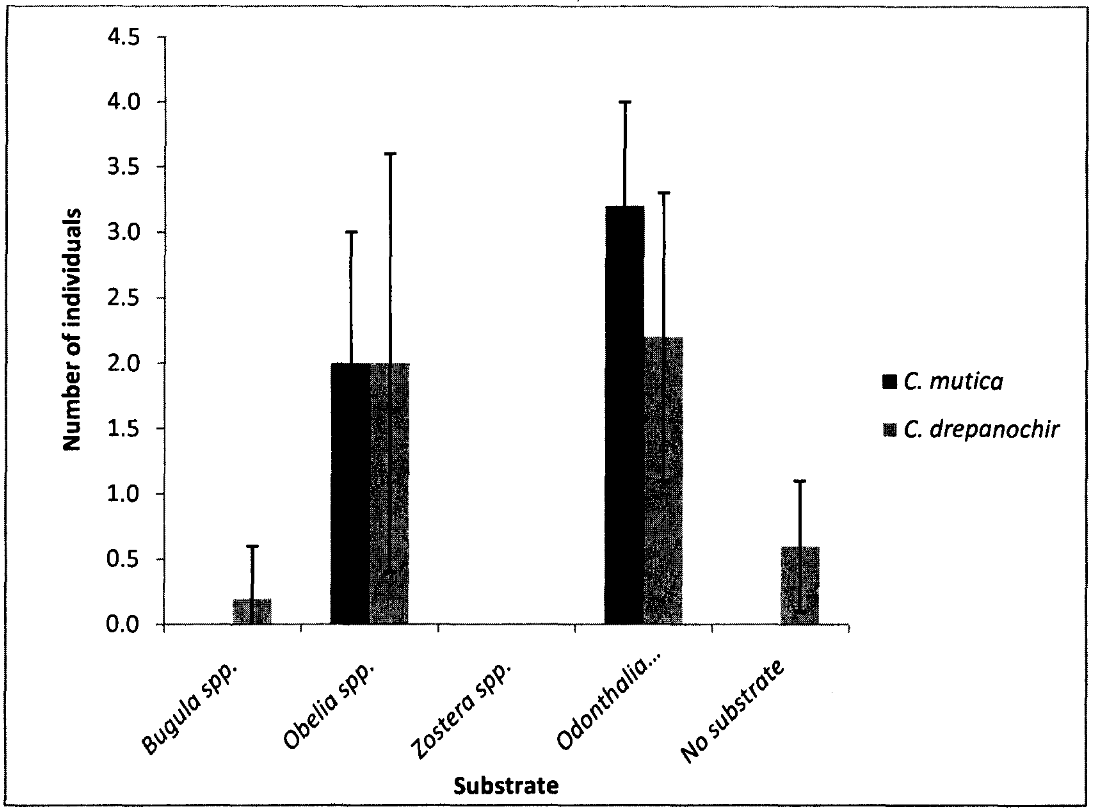

Figure 1: Average number of caprellids (*C. mutica* and *C. drepanochir*) found on each substrate over 5 trials.

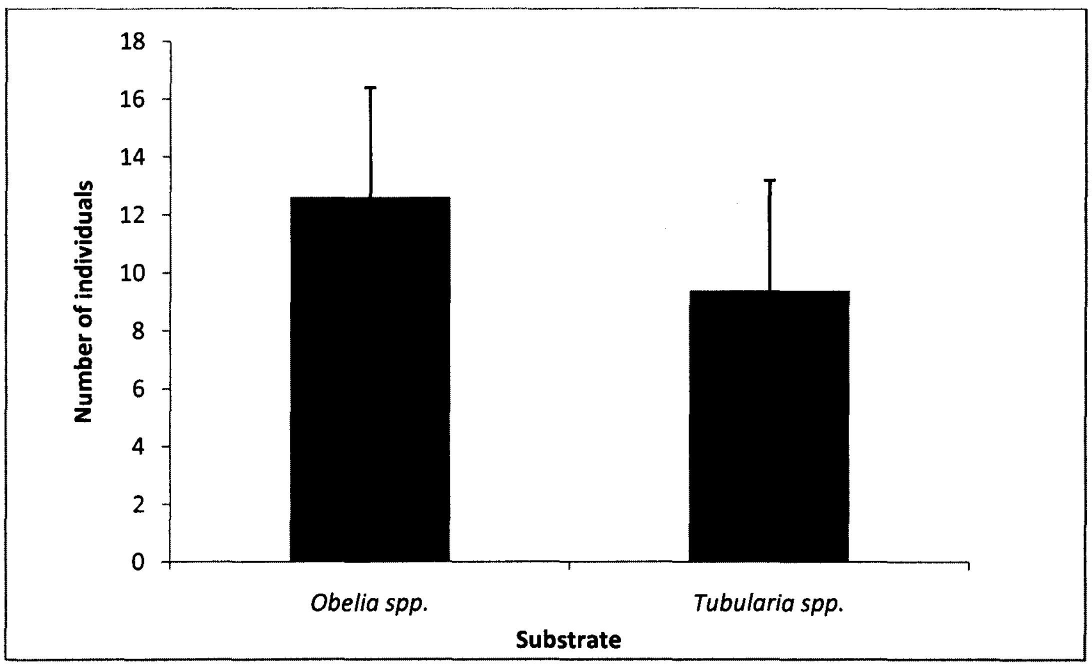

Figure 2: Average number of *C. mutica* found on each species of hydroid (*Obelia spp.* and *Tubularia spp.*) over 5 trials

Discussion

For the species of *C. mutica*, there was an average preference for the red algae, *Odonthalia spp.* over the other substrates and a slight preference for *Obelia spp* (Figure 1). This suggests that there is not a nematocyst preference of *Obelia spp.*, since the *Odonthalia spp.* do not have nematocysts. There still could be an element of camouflage, because the hydroids were generally the same color as both the *Odonthalia spp.* and *Obelia spp.* (perhaps due to switching color), and were equally difficult to locate for each substrate. Also for the *C. drepanochir*, there was wider variety of substrates chosen on average, including no substrate at all (Figure 1). This could suggest that this particular species does not show a real preference for substrates. Several other studies have also discovered an indecisive pattern for substrates in caprellid species. Some caprellid species found in a bay system were relatively unselective when it came to their substrate, which was also found to be generally true for littoral caprellid species (Theil 2003).

The fact that both *C. mutica* and *C. drepanochir* chose *Odonthalia spp.* preferentially may indicate that caprellids do not eat the substrate polyps (since only the *Obelia spp.* had polyps), but the diatoms and detritus on them, meaning the substrate type may be less important (Keith 1969). Overall the hypothesis was refuted regarding preference for hydroid over other substrate choices, as the *Odonthalia spp.* was chosen more often.

In regard to the differences in hydroid species, there was a higher amount of caprellids found on the *Obelia spp.* on average which is a more feathery, branched, and longer species over *Tubularia spp.* which is more clumped together and less branched (Figure 2). There was significant variability in the results (Table 1) as well as error bars (Figures 1, Figure 2), but overall, the hypothesis was supported in a preference for *Obelia spp.* over a more clump-like species. In this case, it may have been due to the nematocysts, or more likely, the camouflage from the *Obelia spp.*

There were several sources of error for this experiment. One was the fact that the substrates were not well separated from each other. After the air stone was introduced, the substrates moved around within the containers (especially the smaller containers with 4 substrates). While counting the individuals, the substrates were observed to be close together, and in some cases even touching each other. This could lead to error, in the caprellids choice of substrates if the substrates were entangled together. Another source of error was the fact that moving the larger container from the water table to the counting area slightly churned up the water, which could have moved caprellids to different substrates if they were not attached tightly enough. The smaller containers were left in the water table when counting and removing caprellids, so they were churned up while moving. The substrates in the containers were slightly stirred when the caprellids were removed from each substrate, however. That could have caused some of the substrates to touch the others within the containers and possibly cause an individual to then switch substrates unnaturally. As mentioned earlier, the error was high for each substrate with a very large variance in the data (Figure 1, Figure 2).

If this experiment were to be completed again, more caprellids would be used to attain a better data set due to the large variance in the small sample size that was used. Also, the substratum would somehow be separated from each other within the containers by possibly anchoring them down more adequately, while still allowing caprellids to move between them. More branched and feathery substrate types should also be used instead to determine if preference of substrates is related to how closely the substrate size and structure resemble the caprellids or to nematocyst presence. Running the experiment for a longer period of time would also help determine trends in preference.

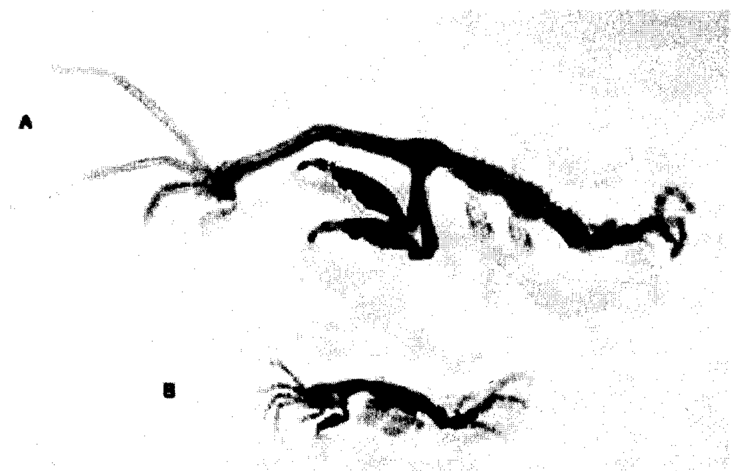

Figure 3: *Caprella mutica*: A is the male and B is the female with brood pouch. http://www.sams.ac.uk/

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