Use of the Brittlestar Amphioda urtica in Laboratory Studies

The brittlestar *Amphiodia urtica* is the most abundant infaunal organism that inhabits marine reference areas on the southern California mainland shelf (Thompson, et al. 1987), but it does not inhabit contaminated areas nearest wastewater outfalls. This species has been used as a criterion for issuing waste discharge permits; however, little has actually been documented about the details of its basic life history. These facts prompted the Southern California Coastal Water Research Project to develop a study to determine if *A. urtica* would be useful as an experimental organism in wastewater monitoring studies. Jimmy Laughlin and the staff of the benthic laboratory initiated this preliminary study to test if growth rates and arm regeneration rates could be measured, and if reproductive condition could be monitored.

Methods

Sediment was collected from the ocean floor at a depth of 60 m near San Mateo Point and placed in three plastic tubs (three replicates) with a flow-through seawater system; the water temperature was maintained at 15°C throughout the experiment. Twenty individuals of *A. urtica* were placed in each of the three replicates (60 total). Oral width was measured to monitor growth for each individual as described by Lie (1968) at the start of the experiment, and again at 60, 90, 139, and 174 d intervals. Growth was measured as the change in oral width.

Results

The oral width size frequencies showed an initial growth rate of 0.49 (± 0.11) mm after 60 d (Figure 1). Handling these animals while measuring them caused up to 65% of them to lose their disks (Table 1); they did not regenerate their disks until the 174 d interval. The brittlestars exhibited a negative growth rate after 90 d and 139 d because their stomachs are located in their disks and, as a result, were not able to feed. This suggests that they reabsorbed calcium carbonate from other parts of their bodies to regenerate their disks. At the 174 d interval, 80% of the brittlestars that lost their disks had regenerated them, and showed a doubling of their growth rate over 30 d, exhibiting a mean total growth rate of 1.62 (± 0.18) mm per year. This growth rate is 6.5 times faster than Lie (1968) reported for A. urtica from Puget Sound, where colder water temperatures range from 8-13.5°C. Water temperature differences may account for the faster

Table 1. Mean percent of *A. urtica* (n=80) that were gravid and lost their disks during the experiment.

Time (d)	Month	% Gravid	% Disk Loss
60	Nov.	80	22
90	Dec.	24	65
139	Jan.	29	15
174	Feb.	46	9

growth rate observed at 15°C.

One arm was severed at the 10th segment on half the individuals in each replicate tank at the 60 d interval, and regeneration was measured at 90 d. Arm regeneration was very rapid over the 30 d period, averaging a mean arm regeneration rate of 37.3 (± 4.3) mm, with 63% of the individual arms regenerating completely.

High mortality rates were observed in two of the replicate tanks at the 60 d and 139 d intervals. Mortality was probably due to handling during measuring, because mortality was greatest within one week after the animals were measured (Figure 2).

Some brittlestars were gravid during the entire 174 d experiment. The number of gravid individuals was negatively associated with the state of disk regeneration (Table 1). Eighty percent were gravid at the 60 d interval, only 21% were gravid after most of the subjects lost their disks, and 46% were gravid at the end of the experiment after incomplete disk regeneration.

Discussion

This preliminary study shows that *A. urtica* would make an excellent experimental organism that can be maintained easily in the laboratory. Although great care was taken when measuring growth rates, the efforts were confounded by the animals' ability to easily shed their arms and disks. Under natural conditions, ophiuroids regularly lose arms to predation (Sides 1987), but the effects on their growth rates has not been studied. The loss of disks disables their ability to

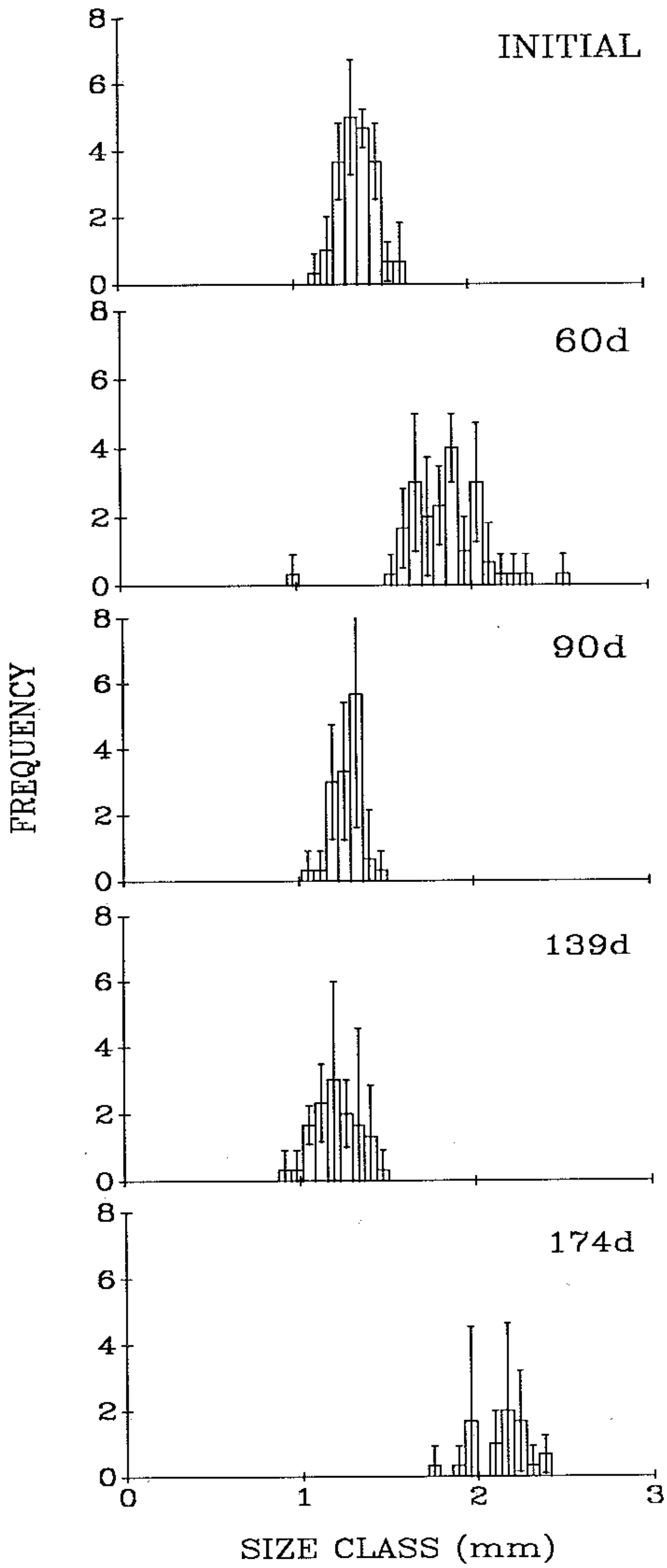


Figure 1. Mean frequencies of oral width of *A. urtica* over time (± S.D.).

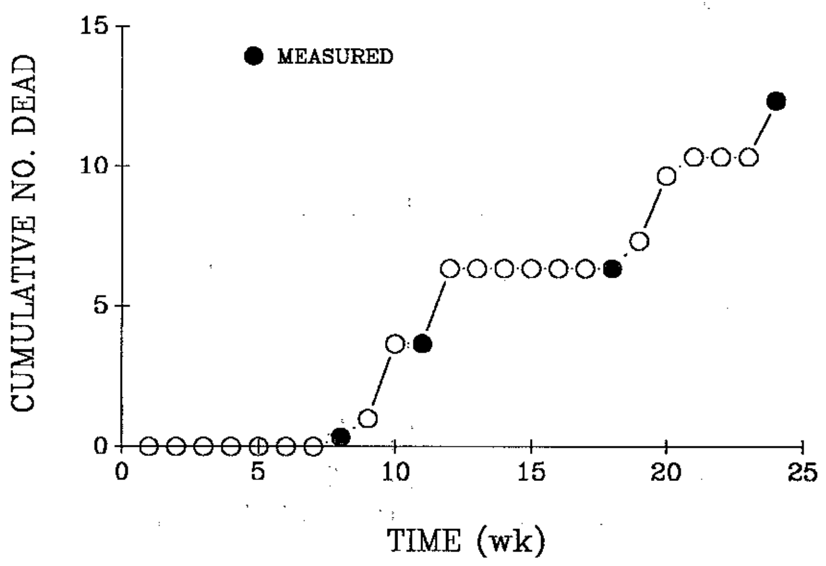
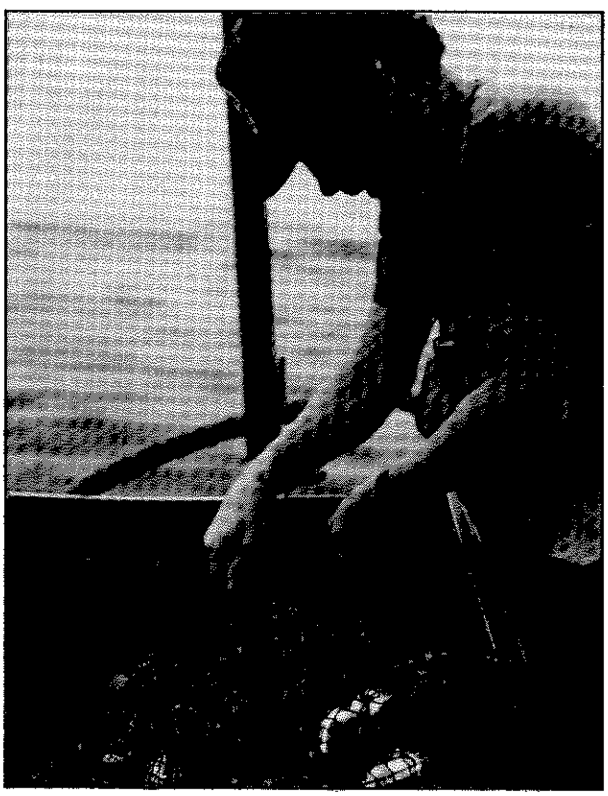


Figure 2. Mean cumulative number of dead *A. urtica* over time. Measurement intervals are indicated to identify handling as a probable cause of mortality.



Jimmy Laughlin prepares to sort and identify invertebrates collected at sea.

feed, and during regeneration they must obtain the calcium carbonate from other sources, which may explain their negative growth rates during this time.

In the future we will test other methods of measuring growth rates, such as measuring Ca^{45} uptake, that may provide growth rate information without frequent handling and the resulting tissue loss. We have maintained *A. urtica* in the laboratory for over one year and believe that if the brittlestars do not lose their disks, they can remain gravid continuously. It may therefore be possible to use reproductive parameters to test their reactions to different toxicity levels.

Acknowledgments

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