Feeding behavior of *Anthopleura artemisia* and *Anthopleura elegantissima*

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Introduction

Three species of *Anthopleura* inhabit the Western Pacific Coast (Potts 1987). *Anthopleura artemisia* (up to 6 cm in diameter) and *Anthpleura elegantissima* (colonal, up to 6 cm in diameter) occur in similar size classes, although *A. artemisia* is often found in holes excavated by boring clam (Morris 1980). This unique environment has bestowed a number of fascinating adaptations; *A. artemisia* can elongate its column to over 5 times its diameter, and only exhibit verrucae on the upper third of the column (Morris 1980). However, there is limited literate available regarding the feeding behavior of *A. artemisia*. This study compares the feeding behavior of *A. elegantissima* and *A. artemisia*. The null hypothesis presented is that there will be no variation in feeding behavior between the 2 species, *A. elegantissima* and *A. artemisia*. Using three standards of comparison this study addresses the hypothesis that *A. artemisia* exhibits more aggressive feeding behavior than *A. elegantissima* .

Material and Methods

Individuals of *A. elegantissima* and *A. artemisia* of similar size were collected on the basis of comparable size. All individuals had an oral disc ranging from 1-3.5cm in diameter. They were each assigned an alphabetical letter for identification (A-R). They were sub-dived into 3 size groups. Both *A. elegantissima* and *A. artemisia* had three in each size class. They were grouped into classes: 1-1.5cm, 2cm, and 2.5-3.5cm (Fig 4, 5)

A. artemisia individuals (9) were collected from Fossil Point, Charleston, Oregon on July 15th 2008 at low tide. Individuals were placed in rocks previously inhabited by boring clams,and ranged in size from 1-2.5cm in diameter of the oral disc. They were kept without food (refused food offered) for one week before experimentation began. Ten

A. elegantissima were collected from the Boat House Beach near OIMB campus (Charleston, Oregon) on July 22nd 2008 at low tide. They ranged from 1-3.5cm in oral disc diameter. Both groups were contained in salt water tables with constant water flow between 11.5-12 °C. Feeding was reserved for experimentation time, and both groups were provided with the choice of rocky substrate.

Three components were used to test the hypothesis that *A. artemisia* exhibits more aggressive feeding behavior: The percent of each species able to catch swimming prey, feeding style, and time taken to paralyze prey.

Prey capture was assessed according to the ability to contact and hold prey. Gammerid amphipods were released within 2 cm of each anemone. The ability to catch prey was evaluated twice for each anemone, and 'contact' or 'no contact' was recorded in each trial for each anemone.

In recording feeding style, four behaviors were observed: held in tentacle, closed immediately, put tentacles into mouth (used 1-3 tentacles to put prey into mouth), and no response. Gammerid amphipods were placed on the tentacle ring with forceps in order to initiate the feeding response. Feeding style was recorded for each anemone over 2 trails. The reaction was monitored for two minutes, although most responses were instantaneous.

The final component of this exploratory was conducted by holding Gammerid amphipods (1-1.5cm) with forceps on the tentacles of the three largest individuals of both *A. artemisia* and A. *elegantissima*. They were timed from initial contact until paralysis of the amphipod resulting in cessation of movement. Several trials, as many as 5, were conducted with each anemone; however, many trials were not successful, as observations cannot be made once the anemone has closed. Forceps were used as a tool to prevent the individual from closing but were not always effective. The data used in this section reflects the minimum of 2 observations made on the 6 largest anemones (2-3.5cm).

Results

Feeding behavior between and among *A. elegentissima* and *A. artemisia* showed differences. For clarification in figures, anemones were grouped into classes.

A. elegentissima more often closed their tentacles immediately after prey contact, while *A. artemisia* showed more use of tentacles when putting food in their mouth (Fig 1).

Both species exhibited a response to the prey stimulus in each trial, and only one (A. elegentissima) held the Gammerid amphipod in its tentacles(Fig 1).

Forty-five percent of the *A. elegentissima* made contact with the swimming prey. Nearly twice as many, 89% of the *A. artemisia* , however, contacted prey (Fig 2).

Overall A. Artemisia paralyzed prey faster than A. elegantissima. The average time incur Gammerid amphipod paralysis was 34.5 ± 7.3 seconds and 49.8 ± 12.1 seconds for *A. artemisia* and *A. elegantissima* respectively.

Discussion

My results support the hypothesis that there is variation in feeding behavior among species, and that *A. artemisia* appears to be more aggressive. In all three components of analysis *A. artemisia* proved to catch more live prey, used a different feeding style, and paralyzed their prey faster on average than *A. elegentissima.*

A. artemisia inhabits sandy areas and can be buries up to 30cm under the surface and only expose the ring of tentacles to the surface (Sept 1999). This habitat may have few feeding opportunities, which may influence the feeding behavior of the anemone. Unlike species found in tidepools, *A. artemisia* must rely on quick and aggressive behavior in order to seize prey. Investigation found Gammerid amphipods to be the preferred prey of *A. artemisia.* This benthic crustacean's mobility and behavior demonstrates why *A. artemisia* might exhibit different feeding behavior than *A. elegantissima* . *A. elegantissima* inhabits areas that allow for behavior of a sit and wait predator, situations in which sessile organism, such as mussels, fall into the tentacle ring or oral disc.

In order to have a more comprehensive analysis, more individuals, as well as more trials would be necessary. In future studies other means of measuring the strength of prey paralysis, such as nematocyst concentration, would be beneficial. *A. artemisia* was quite difficult to acclimate in a control setting and might function better in their natural habitat. Holes made from boring clams were essential in getting the *A. artemisia* acclimated and to eat

Feeding behavior of another solitary azooxanthellate and solitary *Anthopleura* , like *A. artemisia* , *A. midori*, has been studied in Japan. The feeding technique documented in this journal summarizes similar feeding behavior styles that are associated with mechanical and chemical mechanism (Nagai 1973). *A. midori* was used to isolate specific amino acids (alanine, glycine and histidine) involved in this process (Nagai 1973). It would be interesting to see if similarities would extend to the same biochemical components that triggered similar feeding style behaviors (retention of food on tentacle, mouth opening, ingestion) that were mirrored in the *A. artemisia* (Nagai 1973). Perhaps such mechanical and chemical mechanisms could attribute to reaction time and aggression in *A. artemisia.* A future study which would encompass asymbiotic anemones not characterized as sit and wait predators and their biochemical and mechanical mechanisms associated with feeding behavior would be interesting.

Several more comprehensive investigations should be made in order to better understand the physiology and behavior of the *A. artemisia.* My exploratory suggests that there are clear differences in the feeding behavior between these two *Anthopleura* species. *A. artemisia* exhibited more aggressive feeding behavior than *A. elegentissima,* possible attributed to the differing microhabitats inhabited by each species respectively.

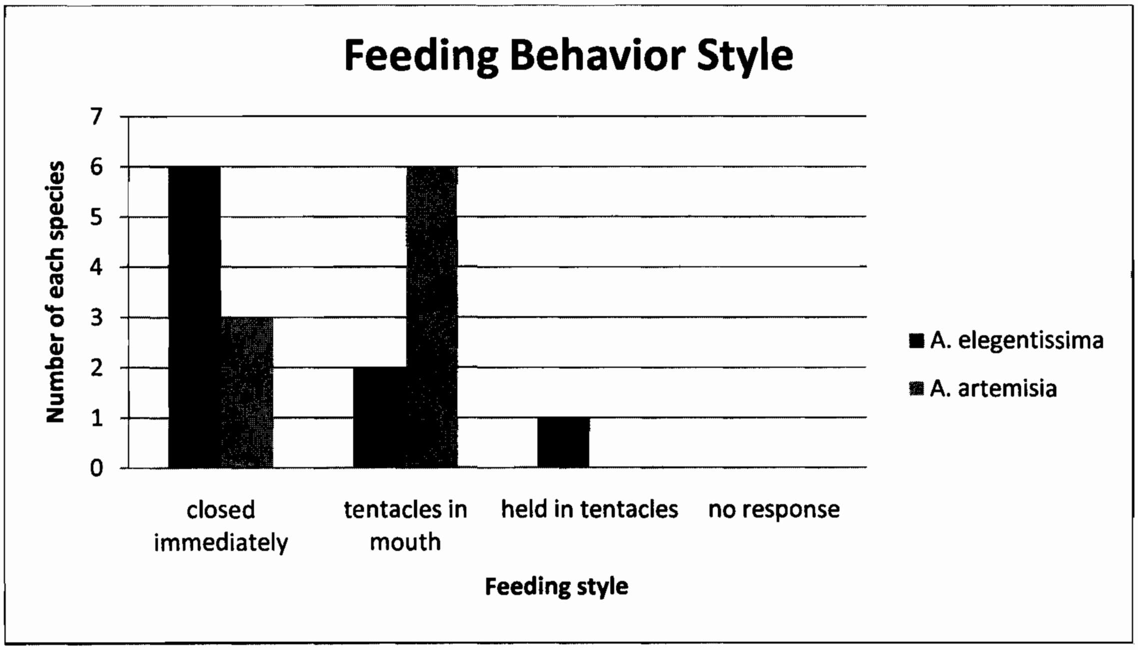

Figure 1 gives the feeding behavior observations and style classification between *A. elegantissima* and *A. artemisia*.

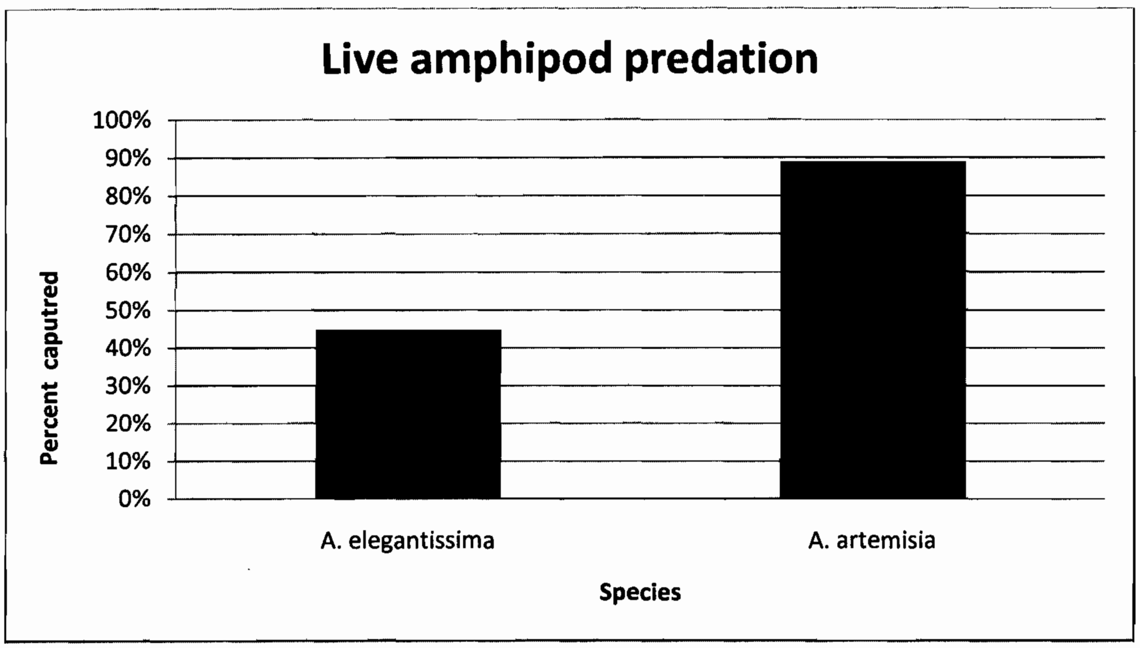

Figure 2 represents the percent of sample population of A. Artemisia and A. elegantissima capable of capturing prey: *A. elegantissima* 45%, *A. artemisia* 89%.

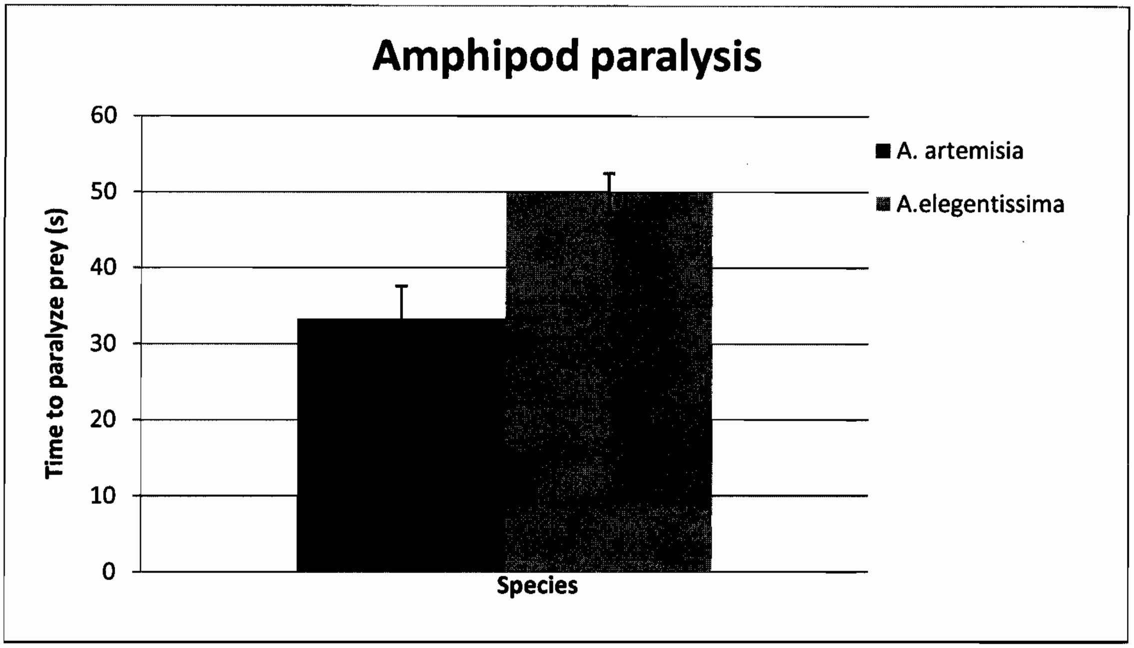

Figure 3 shows time taken to paralyze amphipod prey (ceasation of movement) by *A. artemisia and A. elegantissima.*

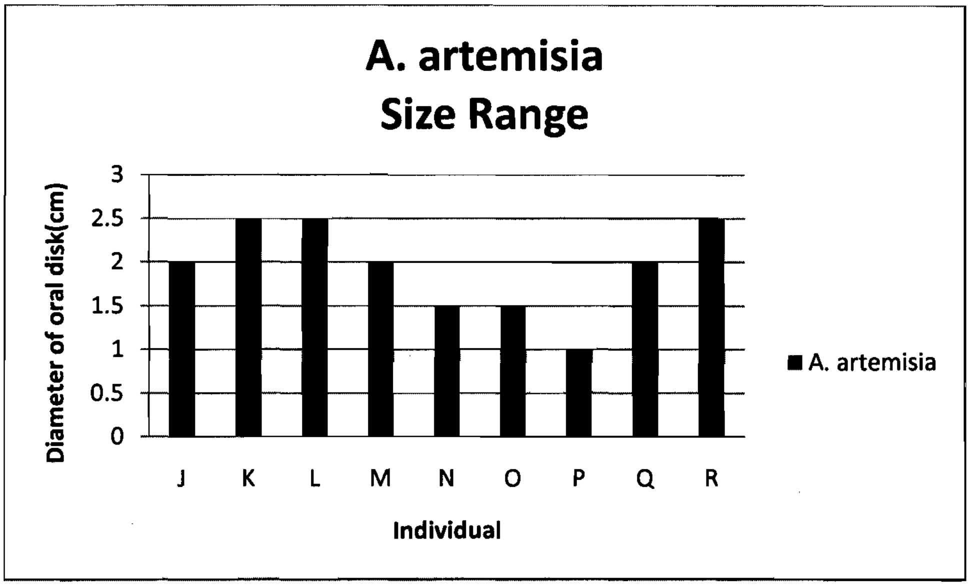

Figure 4. Individuals (J-R) of *A. artemisia*, size measured by diameter of oral disc in centimeters.

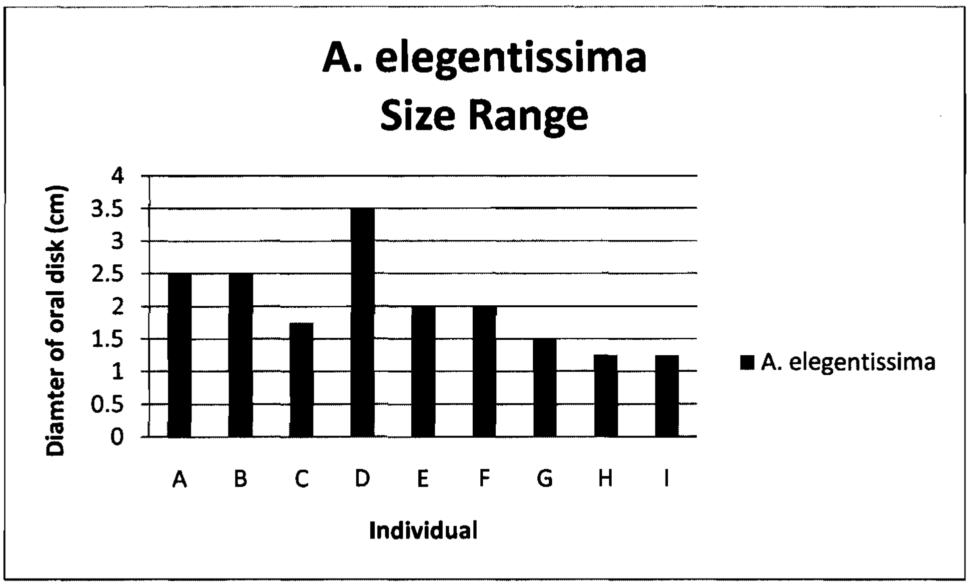

Figure 4. Individuals (A-I) of *A. elegantissima*, size measured by diameter of oral disc in centimeters.

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