Escape Response of Aeolid Nudibranchs in the Presence of *Pycnopodia Helianthoides*: Variability in Rate of Speed of Juveniles and Adults of Three Species

Written by Caitlin Hunter
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Introduction

Within the low rocky intertidal, many predators seek slow moving and sessile prey. Opisthobranchs reside in this low to subtidal habitat with a known fast moving predator, *Pycnopodia helianthodes*. Nudibranchs within Cape Arago, OR were observed within the lower tidepools, overgrown with eelgrass. Variance in size of these nudibranchs within each aeolid species came to interest. The only instances of seeing these animals direct their mobility was within the presence of prey and predators. Most prey items reside in the phylum bryozoa and cnidaria, particularly anthozoans and hydrozoans. *P. helianthodes*, the sunflower sea star and a few species of intertidal fish remain as predators to nudibranchs.

To find out how these slower organisms move in relation to their body size, nudibranchs were placed in the presence of *P. helianthodes* to determine whether a predator escape response occurred and if the rate of speed varied among juveniles and adults. Escape responses have been documented within a certain species of nudibranch, *Melibe leonine*, that swims spontaneously between blades of eelgrass as a foraging strategy. Chemical and tactile stimuli can stimulate this swimming response, such as the touch of *P. helianthoides*' tube foot upon the nudibranch (Caldwell, 2003). Although other local species off the Oregon coast within the northeastern Pacific Ocean usually do not actively swim in avoidance of predators, increased rate of speed is expected to avoid predation. Gastropods locomote by generating rhythmic waves on the ventral surface of

their pedal musculature, and this action varies among species (Miller, 1974). It was hypothesized that adult-sized nudibranchs would crawl at a faster rate of speed in the presence of *P. helianthoides* than juveniles.

Materials and Methods

Eight individuals of three species were collected at North Cove, Cape Arago during low tide. The three species consisted of *Triopha catalinae,* two color phases of *Triopha maculata*, light and dark orange, and *Hermissenda crassicornis*. Each individual aeolid was weighed on a 400g scale to note whether it was of juvenile or adult size. The dark orange phase of *T. maculata* was used as a control due to the similarity in body size (<0.2g difference) to determine whether individual speed was a factor in the study. An individual was placed in a water table with a one foot runway for the nudibranch to crawl through, which was bordered by rocks. One juvenile *P. helianthoides* (diameter of body <3 in.) was placed behind the test subject at the starting point of the apparatus with a water current flowing from predator to prey. The predator was placed to touch the subject in order to maximize locomotion speed. A stopwatch was used to time the reaction of the nudibranch after tactile stimulation. Time was initiated at the point of touch and stopped when the subject's head passed the 12 inch mark.

Results

In the absence of *P. helianthoides*, the nudibranch's crawling was not directed in any specific direction. In response to predatory touch, all individuals increased speed in a directed motion. Juveniles resulted in a slower rate of crawling than adults when in the presence of *P. helianthoides* (Figure 1). One exception to this was the similar rates of speed between adult and juvenile *H. crassicornis*, which will be discussed in the

following section. The control subjects of similar body size moved at alternating rates of speed and one was neither faster nor slower than the other between trials.

Discussion

H. crassicornis was the one species that had a considerable difference in body size among both subjects, but resulted in the adult either moving at a close or slower rate to the juvenile. The adult observed presented nematocysts directed towards *P. helianthoides* which may have slowed the individual. This may be the primary strategy that this species uses to deter predators and increased speed of locomotion may remain a secondary predator avoidance strategy. The juvenile *H. crassicornis* did not present nematocysts to the predator, and this may be due to the fact that it is a younger individual and may not have nematocysts that will have a large effect on its predator. Instead, this individual increased its rate of speed to avoid *P. helianthoides*. The control group did in fact alternate time lengths when placed in the apparatus, which was an expected result due to their similar body lengths and weight. The remaining species resulted in faster adult times, which supports the hypothesis that adults would have a higher increased rate of locomotion than juveniles, upon contact by a predator. It was to be expected that the individuals with longer body lengths and greater surface area would be able to cover more ground, quicker than those individuals that could not stretch their bodies as far. Since data for only two species supported the hypothesis, and one did not, this study remains ultimately inconclusive.

Sample error could have occurred due to one thing, if *P. helianthoides* was not placed correctly to provide sufficient tactile stimulation in the beginning of a trial. This may have been why the first trial performed with the adult and juvenile *T. catalinae*

resulted in the same rate of speed. The following trials with these individuals resulted in more conclusive data that supported the hypothesis. The individuals with larger body size, indicated by weight and an observed difference in body length, had faster rates of speed than the juvenile category. Further trials should be run to increase the sample size and decrease error, as well as including more species, to support this hypothesis thoroughly. Studies on whether presenting nematocysts could result in slower locomotive rates as compared to individuals of the same species that do not use this strategy to deter predators should also be tested.

Works Cited

Caldwell, S. 2003. Energetics of swimming and crawling in the lion nudibranch, *Melibe leonine*. The Veliger vol.46 iss.4: 355-361.

Miller, S.L. 1974. Adaptive design of locomotion and foot form in prosobranch gastropods. Journal of Experimental Marine Biology and Ecology vol.14: 99-156.

Figure 1: Comparison of Rate of Speed Between Adult and Juvenile Aeolid Nudibranchs