

# Distribution of Zoochlorellae vs. Zooxanthellae at Boat Basin Beach

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## Introduction

Zoochlorellae and Zooxanthellae are two algal symbionts found within the body of many freshwater and marine invertebrates and protozoan's. When viewed, zoochlorellae are green and zooxanthellae a golden brown. The coloration of the symbionts attributes to the coloration of their host. For this study I am going to focus on the mutualistic relationship of these symbionts and two host species: *Anthopleura elegantissima* and *Anthopleura xanthogrammica*. In this mutual relationship, both the host and symbiont have important roles that need to be fulfilled to ensure the others survival. The symbiont provides its host with energy in the form of translocated reduced carbon compounds derived from photosynthesis. In turn, the host provides the symbiont with protection, shelter and a constant supply of the carbon dioxide required for photosynthesis.

While both Zoochlorellae and Zooxanthellae are found in both *A. elegantissima* and *A. xanthogrammica*, I would like to determine if location of the host within the intertidal zone determines which symbiont is present. I hypothesize that Zoochlorellae will be present in hosts sampled in the lower-mid intertidal, and that Zooxanthellae will be found in hosts inhabiting the upper mid-high intertidal zones.

## Materials and Methods

Specimens for this experiment were collected from Boat Basin Beach at the end of Boat Basin Road in Charleston, Oregon. Twenty samples were collected over a two day period, ten collected each day. On August 3, 2007, ten samples were taken from the tentacles of *A. xanthogrammica* during a low tide. On August 8, 2007, ten samples were taken; 4 from *A. elegantissima* and 6 from *A. xanthogrammica* during a high tide. Samples were taken using forceps and a scalpel or with a slide and razor blade. Samples were then placed in small plastic tubes with lids and taken to the lab. Lab testing was done the same day as collection in both instances. Samples were placed individually on slides then diced with a razor blade. Samples were viewed under a microscope to determine the abundance of each symbiont. Results were categorized into 100% zoochlorellae, 100% zooxanthellae, 50/50, mixed with either zoochlorellae or zooxanthellae dominant. I would also like to add that during specimen collection, I noted in my field notes where within the intertidal zone the sample was taken and also took photographs of each individual host to compare its coloration with the symbiont found in its tissues.

## Results

Of the 20 samples taken, 5 contained 100% zoochlorellae and 7 contained 100% zooxanthellae. Of these 7 samples, 4 were taken from *A. elegantissima*. Seven samples were mixed, with 5 being zoochlorellae dominant and 2 being zooxanthellae dominant. One specimen contained equal amounts of each symbiont.

Of the nine samples taken from the low-mid intertidal zone, 4 of them contained 100% zoochlorellae and 3 contained 100% zooxanthellae. Two samples were mixed, with one being zoochlorellae dominant and the other zooxanthellae dominant. See Table 1 below.

8/3 Samples(L/T)		Zooxanthellae	Mixed-Zoochlo Dom	Mixed-Zooxan Dom	Mixed 50/50
1-S		X			
2-S	X				
3-S				X	
4-S			X		
5-E	X				
6-E	X				
7-S			X		
8-E			X		
9-S		X			
10-S				X	
<b>8/8 Samples(H/T)</b>					
1-S*		X			
2-E*		X			
3-E*		X			
4-E					X
5-E			X		
6-S	X				
7-S		X			
8-S	X				
9-E			X		
10-S*		X			
<b>TOTAL</b>	5	7	5	2	1

**Table 1: \*** *Anthopleura elegantissima*

Shaded box indicates sample was taken from low-mid intertidal zone.

S=Submerged when sampled; E=Exposed when sampled

## Discussion

After reviewing the results, I found that I was able to partially validate my hypothesis. Of the nine samples taken from the low-mid intertidal zone, four contained 100% zoochlorellae. Four of the seven samples containing 100% zooxanthellae were found in the upper intertidal zone. Of these seven samples, four were taken from *A. elegantissima* of which all contained 100% zooxanthellae. The majority of samples that were declared mixed were found in the mid-high intertidal zone. These results are consistent with those found in a study conducted by Secord and Augustine (2000). They found that zoochlorellae was predominant in low intertidal and zooxanthellae was dominant in high intertidal regions. They also found that zoochlorellae was predominantly found in *A. xanthogrammica* and zooxanthellae was found in *A. elegantissima*. This would suggest that zooxanthellae is capable of withstanding harsher environmental conditions in the high intertidal zone. These conditions include temperature, sun exposure, and wave action. This can be supported by the results found in a study conducted by Bates (2000). She found that when *A. xanthogrammica* containing 100% zoochlorellae was transplanted to the high intertidal zone, zooxanthellae eventually become the dominant symbiont in the anemone. When transplanting *A. xanthogrammica* containing 100% zooxanthellae to the low intertidal zone, the zooxanthellae remained the dominant symbiont. I find this to be very interesting and would like to conduct a similar experiment on my own.

Finally, in concluding my experiment, I found there are a few changes I would make with hopes of obtaining clearer results. First, I would map the entire intertidal zone from low to high tide marks at low tide. I would then run a transect line from the low intertidal zone to the high intertidal zone, measuring the height from the transect line to the surface every half meter. I would then return at high tide and record with samples and tidepools are fully submerged or exposed to wave action during the high tide. I would also take more extensive measurements of the tidepools such as temperature, salinity, dissolved oxygen, cover (plant, rock, etc) and vegetation present. I believe these are additional measurements are important because there were some cases where two anemones in the same tidepool showed totally opposite concentrations of each symbiont.

## References

- Bates, Amanda. (2000). The intertidal distribution of two algal symbionts hosted by *Anthopleura xanthogrammica*. *Journal of Experimental Marine Biology and Ecology*. 249: 249-262.
- Secord, David and Augustine, Leon. (2000). Biogeography and microhabitat variation in temperate algal-invertebrate symbiosis: zooxanthellae and zoochlorellae in two Pacific intertidal sea anemones, *Anthopleura elegantissima* and *A. xanthogrammica*. *Invertebrate Biology*. 119(2): 136-146.