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Marine Adaptations

Exploratory 1

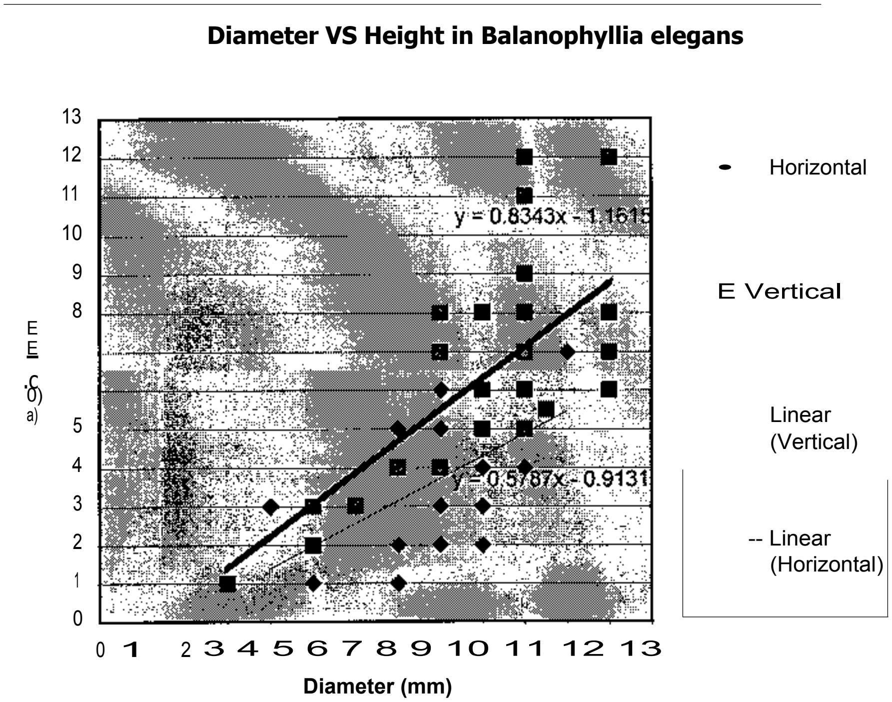
Orange Cup Coral Size Distribution

Introduction: Sessile suspension feeders such as Anthozoans rely on moving water to capture food and nutrients, which has an impact on their morphology (Helmuth 1992). This implies that these organisms have to adapt well to water currents so that they are not dislodged or broken from surfaces (Little1996). Sessile suspension feeders that minimize drag are in contact with faster moving water compared to suspension feeders that are in contact with slower moving water (Vogel 1983). These suspension feeders in slower moving water increase their amount of surface area exposed to the flow of water to enhance their exchange of material with the water column (Vogel 1983). There are several studies that examine the effects of morphology and orientation on the feeding capabilities in sessile suspension feeders. A study in 1992 on the Scleractinian coral *Agaricia agaricites* was conducted to determine a mechanism for maximizing particle capture. The purpose of the experiment was to see if a variation in colony morphology and orientation to flow represents this mechanism (Helmuth 1992). This coral shows a variety of morphologies including flat unifacial plates (on vertical and horizontal surfaces), upright bifacial plates and irregular encrusting colonies (Helmuth 1992). One of the significant findings of the study found that unifacial *A. agaricites* facing into the flow (vertical surfaces) captured more food than colonies oriented parallel to the flow (horizontal surfaces) (Helmuth 1992). The authors discovered that the orientation of bifacial A. *agaricites* does increase their particle capture rate in which they think this morphology may have evolved secondarily as a mechanism for maximizing particle capture (Helmuth 1992). By using growth rates of corals, scientists can try and maximize growth rates of corals in environments disturbed by human interactions. This led me to wonder if orange cup corals *Balanophyllia elegans* orientation influences their morphology and their food capture methods.

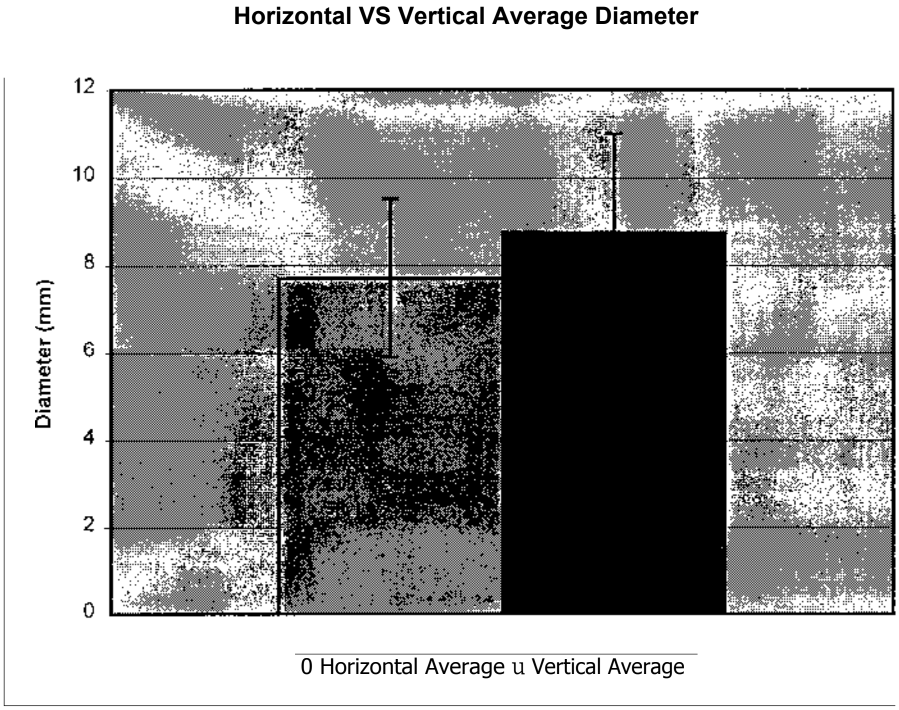
B.elegans belong to the phylum Cnidaria and class Anthozoa. They are found from B.C. all along the west coast to Baja California the orange cup coral is located from the low intertidal zone to sub tidal depths of 10m (Sept 1999). They are sessile suspension feeders that prefer protected areas under shady rocks and ledges. They exhibit a bright orange color and have a hard outer cup-like skeleton, which can reach 1 cm in diameter and height. There are many retractable fluorescent tentacles that surround *B. elegans* cup-like skeleton (Sept 1999). This solitary true coral resembles a sea anemone, which also uses its tentacles to trap food particles. *B. elegans* have planular larvae that remain on the bottom for a few days before attaching and undergoing metamorphosis (Altieri 2003). Their larvae dispersal is limited because they disperse a distance of only 40cm. The larvae usually aggregate on vertical surfaces but sometimes are found on horizontal surfaces (Altieri 2003). This led me to wonder if they have a different morphology with orientation on different substrates. These different degrees of surfaces do not necessarily experience flow of the same magnitude, which affects the amount of food they receive (Little 1996). My hypothesis is that *B.elegans* on vertical surfaces has a greater height and tentacle length to enhance maximum particle capture as compared to horizontal surfaces.

Methods: The study was conducted in Coos Bay, Oregon at Cape Arago in a rocky intertidal zone of middle cove. 31 cup corals were found and measured under rocks or boulders on vertical surfaces (no slanted surfaces but straight up and down). Another 31 *B. elegans* were found and measured from horizontal surfaces. A clear metric ruler was used to take measurements, which were then recorded into a field notebook. The diameter was measured in millimeters from one end of the calcareous skeleton to the other. After measuring each diameter, the height of all 62 *B. elegans* were measured from where the calcareous skeleton started on the top (not including the tentacles if extended) to the bottom of the column base. Out of the 31 *B.elegans* measured on the vertical surfaces, four were scraped off of their habitat and put into a plastic zip lock bag containing seawater so that it can be taken back to the lab. This was also done with four horizontal *B.elegans.* Back in the lab, the four vertical surface and the four horizontal surface corals were placed in separate finger bowls. They were placed horizontally with their tentacles parallel to the table so that they could be measured properly. The tentacle length of all 8 tentacles was measured using a microscope and a ruler. The ruler was placed between the bottom of the microscope and the bottom of the fingerbowl. Tentacle length was measured only when the tentacles were fully extended. The tentacle length measurement was taken from where the calcareous skeleton ends to the tip of the tentacles.

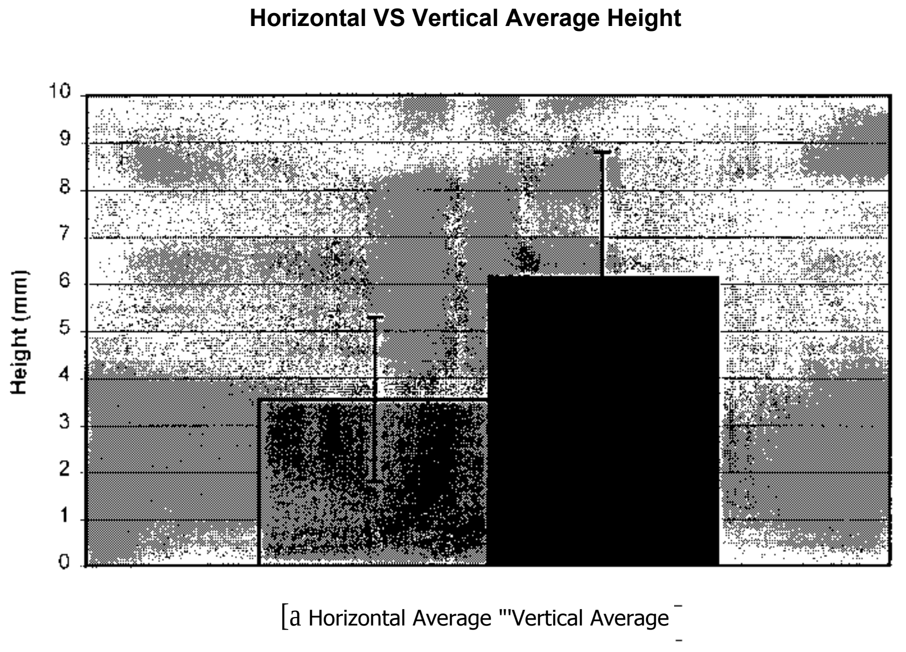
Results: Graph 1: This graph shows the diameter and height of each *B.elegans* in vertical and horizontal surfaces. The lines of best fit show that the horizontal *B.elegans* individuals have a thicker diameter for their height. The vertical surface corals have more individuals with thick diameters, but are narrow for their height. The thick diameter of the vertical surface individuals is due to their tall height.



Graph 2: This graph shows the average diameter of the B.elegans on vertical versus horizontal Surfaces (all 62 B.elegans). It seems as though on average vertical B.elegans have a greater diameter then horizontal B.elegans. The standard deviation for the horizontal diameter is +-1.810958 and the vertical standard deviation is +-2.246742. On Average the height and diameter of vertical B.elegans is greater than horizontal B.elegans.



Graph 3: This graph shows the average height of the B.elegans on vertical versus horizontal surfaces. It seems as though on average vertical B.elegans have a greater height then horizontal B.elegans. The standard deviation for the horizontal height is +-1.748117 and the vertical standard deviation is +-2.6495.



Graph 4: This graph shows the average tentacle length of all 4 horizontal and all 4 vertical *B. elegans* compared to their diameter. The average of each individual's tentacle length was found by adding up all 8 tentacles length (millimeters) and dividing it by 8. It seem as though the vertical line slope is less than the horizontal slope. This indicates that the average tentacle length in horizontal *B.elegans* is more positively correlated with their diameter than in vertical *B. elegans.* On average 3 of the 4 vertical tentacle lengths in *B.elegans* are greater than in horizontal *B. elegans*

TOP- oral view

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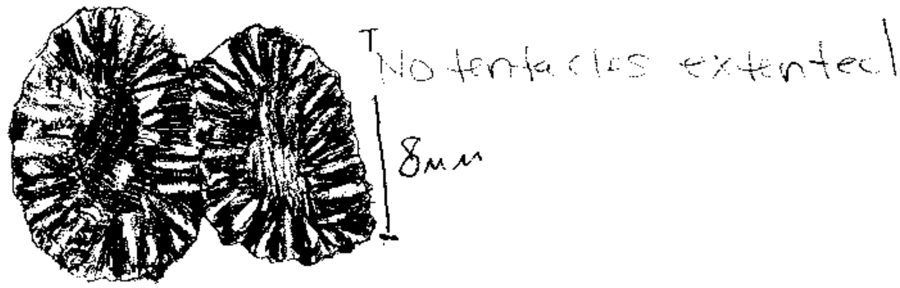

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