SURVIVAL OF *SEMIBALANUS BALANOIDES* WITH VARYING LEVELS OF ALGAL COVER AT NAHANT MASSACHUSETTS

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Abstract

Semibalanus balanoides, the acorn barnacle, is one of the most common organisms along rocky intertidal habitats. It is distributed widely throughout the intertidal, and is present in all intertidal zones. This research sought to understand where the survivability of barnacles is the highest, and attempted to understand the factors for this survivability. Transects were measured in the rocky intertidal zone in Nahant Massachusetts along which quadrats were taken. Living barnacle count was measured against total exoskeletons in the quadrat. These were looked at against the amount of algae in the quadrat to attempt to determine whether a significant association exists. Results showed that barnacle survivability is higher in the high intertidal where barnacles are the only organism present, showing that predators may be the most important factor in determining survivability in differing intertidal zones.

Key Words: *Semibalanus balanoides*, Acorn Barnacles, Nahant Massachusetts, survival

Introduction

Acorn barnacles are one of the most prevalent species in the rocky intertidal zone, so much so that in some rocky intertidal zones the recruitment of *S. balanoides* was greater than the space available for those recruits (Bertness, 1989). Desiccation is also a factor in barnacle survivability, and although *S. balanoides* has an exoskeleton to protect it from weather changes, there is a biological trade-off for living in a tidal zone that is too high with the possibility of desiccation (Wethey, 1983). This trade off weighs the importance of gaining nutrients from oceanic waters which will be more abundant in lower tidal zones that may have more predators with living in higher tidal zones that have relatively few predators but very few nutrients from oceanic waters. Previous studies on *S. balanoides* survivability have shown that there is a negative effect on settlement when algal species are present, possibly due to the sweeping of algal fronds disturbing larvae (Jenkins et al, 1999). There has also been data suggesting that the lack of crowding in high intertidal zones allows larva to reach maturity, causing an increase in barnacle density in higher intertidal zones (Bertness, 1989). A final possible causation for changes in survival of barnacles is the varying levels of predation by welks, acorn barnacle's main predator in the intertidal (Dunkin, 1984). If there are an increased amount of welks in the vicinity of barnacles, there could be a correlation between their presence and survival. This study attempts to piece all of this previous data together, and look at barnacle survivability at varying intertidal zones, with varying levels of algal cover, and take into account the possible, yet very difficult to determine presence of predation.

Materials and Methods

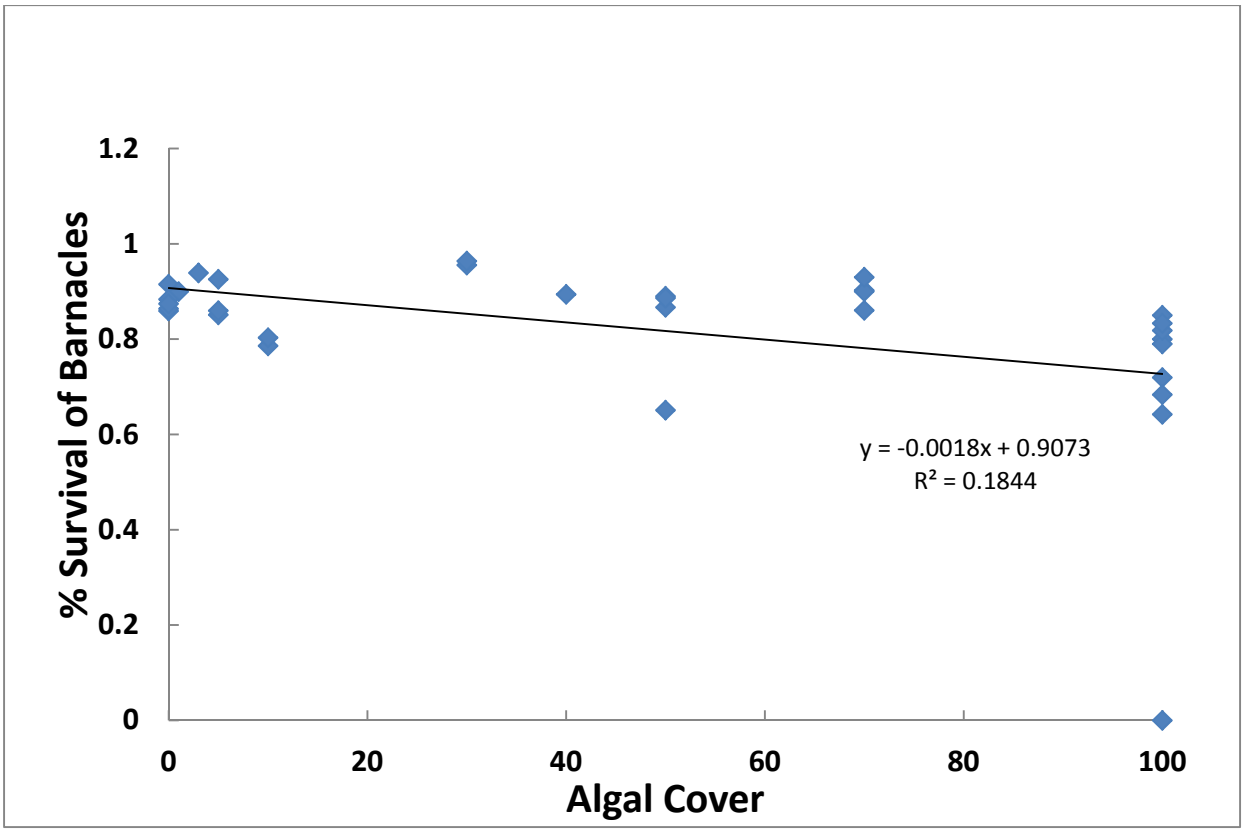
S. balanoides the acorn barnacle is a common inhabitant of rocky intertidal zones. They are hermaphroditic Archaeobalanidae crustaceans that feed using thoracic appendages which are usually covered by plates covering the aperture opening. These plates open when the barnacle is submerged in water to allow for feeding (Arkive, 2012). The location of study in at the Marine Science Center of Northwestern University in Nahant Massachusetts is a common New England rocky intertidal zone with *Ascophyllum nodosum* and *Fucus* species as the primary algal colonizers. The study area was comprised of roughly one acre of bare rock and algal covered rock in a sheltered inlet with some public access and multiple other research operations occurring. For the purpose of this study, high, medium, and low intertidal zones were determined by species present at that location. The high intertidal zone was comprised mainly of barnacles and devoid of all plant life, low intertidal was the area with *Ascophyllum* and *Fucus* species dominating, and the medium intertidal was the area in-between these regions where the dominance of all of these species intertwined and there was no species that was completely dominant. Data was collected on two separate days, September 15th 2012, and on October 25th 2012. To collect data, a 5 meter transect line was laid from the low intertidal to the high intertidal zone. Quadrats were randomly taken along that transect in each zone. Inside these quadrats, the total number of barnacle exoskeletons was counted, along with the number of living barnacles and the percent cover of algae. It was also noted how many *Nucella lapillus* (dog whelks) were

presents along with any other organisms. *N. lapillus* was noted due to its tendency to feed on barnacles.

Results and Discussion

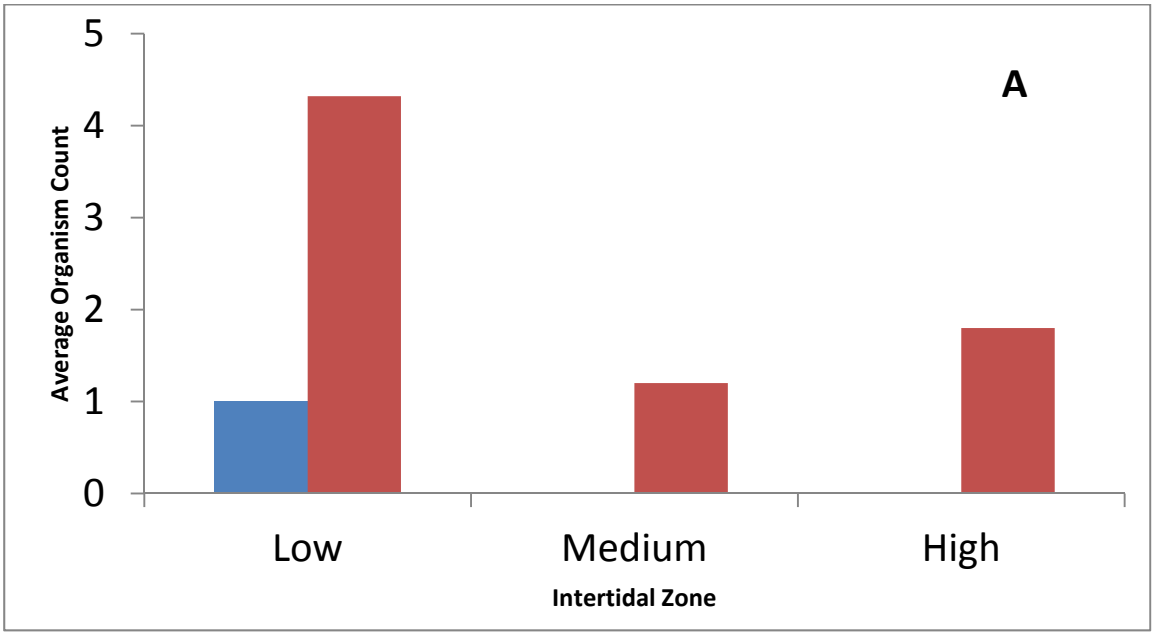
Overall the data shows that barnacle survivability is higher in the high intertidal zone where there is a smaller percentage of algal cover as opposed to the low intertidal zone where there is a higher percentage of algal cover, and even though this the change in survivability was not substantial, it was significant (Fig 1). There is a negative correlation between algal cover and barnacle survivability of -0.043. With a p-value of 0.02, we can determine this result is significant. This could be from the increased competition in these areas, either from predators or other consumers for space, as there is a greater diversity of organisms lower in the intertidal zone (Fig 2).

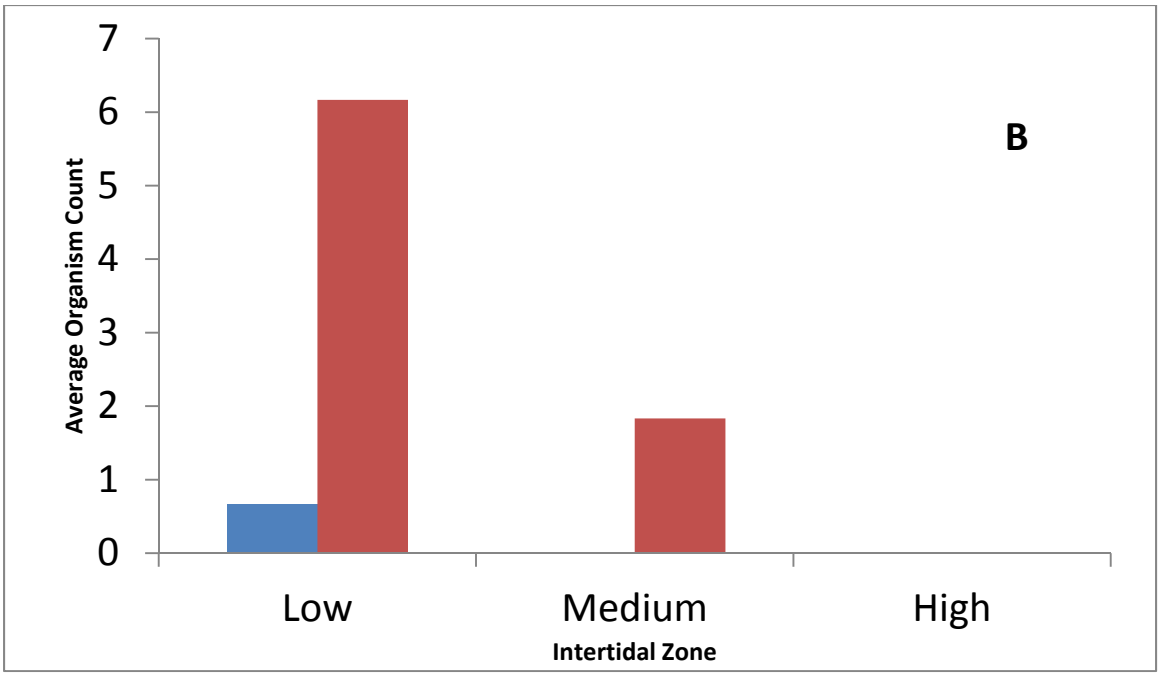
There could be a myriad of other reasons why barnacle survival is decreased in lower intertidal zones, possibilities include increased wave action making it difficult for larvae to attach, competition for space with other organisms having nothing to do with predation, or desiccation being of no factor to survivability in the high intertidal zone. Further research should look at any of these factors when considering survivability.



(Figure 1)

Figure 1 Percent survival of barnacles verses the algal cover of each quadrat sampled. The R^2 p value is significant at .023.





(Figures 2)

Figures 2 A and B show the prevalence of Welks in blue and other organisms in the quadrats in red sorted by high, medium, and low intertidal zones. Welks were separated from other organisms because they are the main predators of barnacles in the intertidal zone, and their presence could have an impact on survival. The other organisms present were mussels, *Littorina* sp and *Carcinus maenus,* which were placed together because they are not predators to acorn barnacles. Figure A is from the 15th of September 2012, and B is from 25 October 2012.

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