



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Keaton Hudson; Scott Messier	Project Number J1911
Project Title The Effects of Physical and Biological Factors on Limpet Densities	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals We examined differences in limpet densities in two areas, one between the wave protected and wave exposed sides of the Santa Barbara Breakwater, the other between the mid and high tidal zones of the Breakwater. We wanted to discover if differences in limpet densities are because of physical factors or because of biological factors.</p> <p>Methods/Materials Our first study compared limpet densities in the mid zone between the protected and exposed sides of the Breakwater. We randomly placed ten quadrats along a transect tape estimating the percent cover of mussels, algae, and barnacles, and counted the number of limpets inside each quadrat. Our second study compared the mid and high tide zones on the exposed side of the Breakwater, using the same methods as our first study. Lastly, we conducted a controlled experiment. We created five pairs of two side-by-side plots in both the mid and high zones of the exposed side and recorded the biological communities inside the plots. For one plot from each pair we removed mussels in the mid zone, and barnacles and algae in the high zone. The other plot from each pair was left undisturbed. We returned three times over the next month measuring community changes after the removal compared to before the removal. We compared changes over time between removal and control plots to estimate the effect of removing mussels from the mid zone, and barnacles and algae from the high zone, on limpet densities.</p> <p>Results Our comparative studies found a greater density of limpets on the exposed side, and a greater density of limpets in the high tide zone. After removing mussels from the mid zone, limpet densities did not change in the removal plots relative to control plots. After barnacle and algae removal from the high tide zone, the density of limpets decreased relative to control plots.</p> <p>Conclusions/Discussion In the mid tide zone, wave exposure has a bigger effect on limpet densities than interactions with mussels. The difference in limpet densities between exposed and protected areas could be a result of differences in pollution or larval delivery resulting from wave exposure. In the high zone, interactions with barnacles and algae have a bigger effect on limpet densities than tidal height. Difference in limpet densities between mid and high tidal zones could be a result of a positive association of limpets with barnacles or algae, which are both more abundant in the high than mid zone.</p>	
Summary Statement We examined the effects of physical and biological factors on limpet densities by comparing the protected and exposed sides and the mid and high tide zones of the Santa Barbara Breakwater, and conducting a controlled experiment.	
Help Received Mentor helped conduct experiments, create graphs and edit text. Parents provided transportation.	