



**CALIFORNIA STATE SCIENCE FAIR  
2003 PROJECT SUMMARY**

<b>Name(s)</b> <b>Eric G. Vryheid</b>	<b>Project Number</b> <b>S0109</b>
<b>Project Title</b> <b>Wave Attenuation of Floating Breakwaters with Different Numbers of Mooring Lines</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Floating breakwaters absorb waves to protect the shore. Compared to gravity breakwaters (solid structures resting on the bottom), floating breakwaters are less expensive; do not disturb currents, fish, or sediment movements; are more aesthetic, and transportable. However, floating breakwaters are susceptible to damage by waves and require higher maintenance. This experiment compares the number of lines used to anchor a breakwater to its ability to absorb the energy of approaching waves. It is believed that a floating breakwater with more lines anchoring it to the bottom will absorb more of the wave's energy and result in waves with a smaller height.</p> <p><b>Methods/Materials</b> Waves were made in a rectangular testing tank by dropping a weight into one end of the tank. Wave height was measured behind the breakwater. Styrofoam sphere breakwaters were anchored to the bottom of the tank with one to eight mooring lines. For each number of mooring lines, ten trials were conducted. The data were analyzed with one-factor independent-groups analysis of variances (ANOVA), with number of mooring lines as the categorical independent variable, and wave height as the continuous dependant variable.</p> <p><b>Results</b> The wave heights for each number of mooring lines were statistically significantly different (<math>F = 2.58, p &lt; .025</math>).</p> <p><b>Conclusions/Discussion</b> However, there was no clear trend showing either higher or lower number of lines resulting in lower wave heights. The lower numbers of mooring lines, however, were more likely to tear free from the anchoring tape. The higher number of lines required more material and labor to construct. It is recommended that further studies be done on the durability and expenses of different numbers of lines.</p>	
<b>Summary Statement</b> I explored the relationship between the number of mooring lines anchoring a floating breakwater to the bottom and its effectiveness in attenuating wave energy.	
<b>Help Received</b> Dad introduced me to ANOVA calculation, supported me financially, and gave advice. Mom helped with backboard design. Mr. Linke helped proofread my project and gave guidance. Mr. Larry Nordell introduced me to floating breakwaters.	