



# CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

<b>Name(s)</b> <b>Ryan J. Golden</b>	<b>Project Number</b> <b>J2212</b>
<b>Project Title</b> <b>Can Tree Frog Behavior be Used as an Earthquake Indicator to Save Lives in Developing Countries?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> My objective in Frogs and Quakes III, is to build on the past two years of projects and see if tree frog behavior could be used as a cost-effective earthquake early warning system in developing countries. In F&amp;Q I, we proved our hypothesis that tree frogs would climb in their tanks around seismic events, but we were limited in our frog behavior data. In F&amp;Q II, we solved the Frog data collection problem with a security camera system, software and a hard disk drive. We found that frogs were 20-30% more active around a seismic event than in-between events. For F&amp;Q III, I need to look for a correlation between the frog behavior and the early primary "P" wave of an earthquake; if the frogs react consistently to the fastest propagating wave then, in theory, one could use their behavior as a warning system before the damaging, secondary "S" wave arrives. Since tree frogs are everywhere around the world, I thought even poor countries could afford to build a tree frog earthquake warning system instead of using expensive seismographic equipment.</p> <p><b>Methods/Materials</b> 2 terrariums with 16 Australian tree frogs were observed and their behavior logged on a video system for 10 days. The experiment was conducted at a site on the Maacaama fault centered at 39.29N, 123.25W (in our family room). Seismic activity was downloaded from the USGS for the same period, limited to earthquakes greater than 1.0 on the Richter Scale and with epicenters within a 70km radius around the experimental site. We logged our video data at times adjusted for time-of-flight from the seismic epicenters to our experiment site. Then we loaded the frog behavior data and the seismic data into a spreadsheet for graphing and comparison.</p> <p><b>Results</b> 103 seismic events &gt; 1.0 occurred over the 10 days during the experiment after adjusting for aftershocks. The video-log showed that the frogs were more active prior to seismic events at the calculated P wave arrival than during the periods in-between by an average of 2 times.</p> <p><b>Conclusions/Discussion</b> The results show that the frog activity increases and that they actively climb just prior to a seismic event at the arrival of the primary #P# wave. However, their behavior was highly variable and we could find no correlation between frog activity and magnitude of the event. I conclude that it would be difficult to use the frogs as an inexpensive indicator of earthquakes for developing countries.</p>	
<b>Summary Statement</b> My project was designed to see if tree frog behavior could be used to predict earthquakes and provide a cost-effective early warning system for developing countries.	
<b>Help Received</b> My mother helped me glue the printouts onto the board. My brother helped me set-up the cameras. My father helped me buy the Australian frogs and he helped me enter the data into a spreadsheet.	