



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Julie A. Fukunaga	Project Number S1110
Project Title Autonomous Solar-Powered Boat for Algae Control	
Abstract Objectives/Goals The warmer weather and current drought in California can stimulate a rapid growth of algae, or algal bloom. This process is also accelerated by the contamination of nitrates and phosphates in fertilizer runoff (cultural eutrophication) that drains to the water supply, depletes the aquatic life of dissolved oxygen, and causes high levels of water turbidity. The purpose of this project is to build an autonomous solar-powered boat to control algal blooms in a more environmentally and cost-effective way (chemical-free and not labor-intensive). Methods/Materials I built a device that transmits 40 kHz ultrasonic sound waves via a transducer to break the algae vacuole. Then, I tested the device by measuring the amount of chlorophyll before and after the device's treatment using a spectrophotometer. The chlorophyll level was determined by measuring the absorbance and percent transmittance of light of eight samples at various wavelengths (410 to 650 nanometers) daily for 9 days. I mounted the device on a solar-powered catamaran made of PVC and ABS plumbing pipes. This autonomous boat, navigating using infrared and ultrasonic sensors, detects obstacles and automatically changes direction, like the Roomba vacuum cleaner. Results After calculating the average rate of change in percent transmittance as compared to the control, the eight samples showed an overall increase of up to 87.29% in average percent transmittance (and decrease in absorbance) at 410 nanometers. Conclusions/Discussion The results show that as the transducer was used, less algae (or less chlorophyll) was present in the samples. The autonomous solar-powered boat can be a natural alternative to chemicals in controlling algal blooms. It can further be adapted to measure the amount of chlorophyll, pH, dissolved oxygen, and temperature and can be used in monitoring ponds, lakes, pools, and aquaculture.	
Summary Statement The purpose of this project is to build an autonomous solar-powered boat to control algal blooms in a more environmentally and cost-effective way.	
Help Received Dr. Gerald Oliver offered advice; my father helped with the building of the device and my mother with the board. Mrs. Kathy Grant, Lodi's Stormdrain Detectives coordinator, helped me contact people for supplies, and Dr. Brenna Aegerter from UC Davis provided the spectrophotometer.	