

Aquaponics in a Bottle Teacher Recommendations

- If possible, take students on a field trip to collect organisms like small fishes, snails, and aquatic plants from nearby streams. If you cannot collect enough organisms for the entire class, you can purchase small fishes and aquatic plants from a pet store.
- Allow the water to sit out for at least 24 hours so the chlorine in the tap water evaporates (or use commercially available drops to treat the water).
- Pre-rinse the gravel so that there is no mud or sand. You will need enough gravel to fill the bottom of the bottles and hold the Elodea plants in place.
- You can build one larger system for the whole class, or have multiple systems with smaller tank/basket combinations.
- You may want to pre-drill the holes in the baskets so students only have to assemble it.

Important Note to the Teacher:

- **Invasive species concerns:** It is important to dispose of organisms (plants, fish, snails, etc) properly so that native habitats are not harmed. Return organisms to the place where you caught them, but do not release organisms bought from the pet store into the natural environment. The release of pet store guppies is likely the reason for their presence in Hawaiian streams and their negative impact on native species:
 - See DLNR page on guppies for more info: <https://dlnr.hawaii.gov/ais/other-ais/guppies/>
 - See <http://www.habitattitude.net/> for guidance on aquarium disposal.
- **Care of living organisms:** This activity involves observation and experimentation with small fish, which are vertebrates. Consideration of proper, humane care of vertebrates is important. Provide explicit guidance for students to develop an understanding of and value for life and living organisms. The guppies must be provided with appropriate daily care so that they remain healthy during the course of the experiment and should not be subjected to pain or discomfort.
- Students need to be supervised by a teacher that understands the safe and responsible use of animals in the classroom and who understands and follows Hawai'i Department of Education policies and other relevant regulations. Teachers must develop and implement a plan for the future care of the fish and other organisms following the study.
(Adapted from the National Science Teacher Association's 2005 Position Paper: "Responsible Use of Live Animals and Dissection in the Science Classroom")

Proper care of small fish, like guppies includes:

1. Feeding them daily, i.e. making sure there is a source of food such as elodea, or providing fish food flakes.
2. The temperature of the water must be between 72° and 82° F.,
3. Change approximately 1/3 of the water every 1 to 2 weeks, or as needed to keep the water in good condition.
4. Create a happy or natural environment by adding things like gravel and plants to the tank. Care of the guppies must be provided daily, including weekends, holidays, and other times school is not in session. When the experiment is over you must continue care of the guppies in the classroom or implement another plan for the continued proper care of the guppies, as they cannot be re-introduced into Hawai'i's environment.

For further information regarding current policies and regulations in Hawai'i contact the Science Section of the Instructional Services Branch of the Office of Curriculum, Instruction, and Student Support at the Hawai'i Department of Education.