THE FRESHWATER CLASSROOM AQUARIUM

The best possible motivation for your students to become involved in these activities is an aquarium in your classroom. Many of the Living in Water activities have suggestions for using your aquarium for related work. Your students will develop a better understanding for the animals and plants used in Living in Water when the creatures are members of their classroom family. Care and feeding of the aquarium becomes a reward for good behavior or a well done assignment and teaches responsibility. Setting up and maintaining a freshwater aquarium is easy. If you are an old pro at aquarium keeping, you might choose to try salt water. If you want a saltwater aquarium, practice with fresh water first and read information beforehand. For a FRESHWATER AQUARIUM, you will need:

FRESH WATER AQUARIUM MATERIALS:

- tank (long and wide, not tall and skinny; 20-30 gallons is a good size)
- heater(s) (10 watts per gallon; need more than one for tank bigger than 20 gallons)
- floating thermometer
- light source (indirect sunlight or plant grow light and timer)
- undergravel filter (the same size as the tank) and air lift columns
- plastic air tubing
- air pump (the biggest, quietest one you can afford)
- air valve (gang valve)
- medium-size quartz gravel - 1/l6-l/4" (not colored) 15 lbs/sq ft of tank bottom
- clean rocks, clay flower pots or other structures
- plastic screen or cover for top of tank
- large plastic bucket(s)
- large plastic tubing or a siphon to move water in and out of the tank
- net
- log book to record feeding and water changes

OPTIONAL:

- power filter
- ice scraper for removing algae from sides of tank

FRESH WATER AQUARIUM INHABITANTS:
TO START:

- two 2" fish suited to the water temperature you have chosen
- tropical fish "flake" food

SAMPLE LIST FOR 20 GALLON TROPICAL FRESHWATER TANK AFTER IT IS BROKEN IN:

- 6 guppies (swordtails or platys 1-2")

- *Plecostomus* (fish with a scraping mouth)
- 6 zebras
- 1-2 small catfish
- 10 snails
- a crayfish
- several large bunches of *Elodea*
- rooted water plants

Read this entire section before starting. You will need to complete the following tasks a full month before the aquarium can be completely stocked. Start setting it up with the class watching and talk about the function of each part as it is added. The students will enjoy watching their tank taking shape before their eyes over the weeks.

1. Rinse the aquarium tank with water. Do not wash it with soap. If it is an old one and needs scrubbing, use a soapless sponge and table salt for scouring. Rinse thoroughly.

2. Pick the location for the aquarium. No direct sunlight. Indirect light from a window is ideal. Do not put it over a heater. Pick a location away from rapid temperature changes. The aquarium will be very heavy, so the location must be sturdy and level. The tank cannot be moved if there is any water in it so make sure you have it where it is going to stay. An electrical outlet must be nearby.

3. Put the tank in place and add the undergravel plastic filter plate and air lift columns.

4. Put the quartz gravel in a bucket and wash it with tap water until the water is clear. Pour the water off.

5. Gently add the gravel and spread it over the filter plate. It should be at least an inch deep.

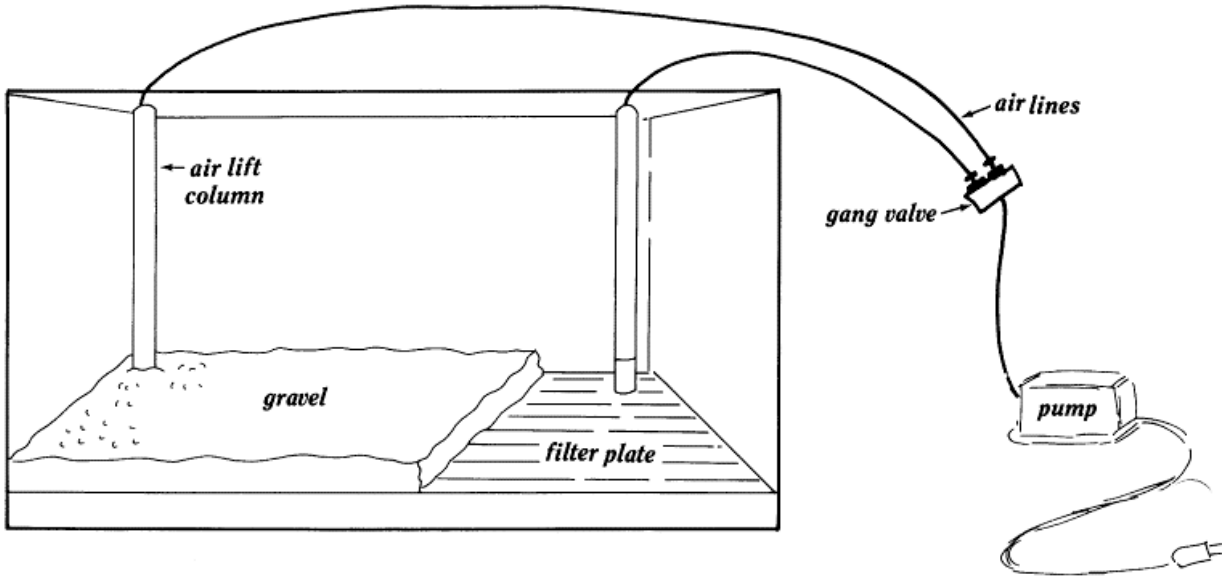
6. If you can, add about one cup of gravel from an established aquarium. This will have the kind of bacteria you want to grow on your gravel. If you cannot do this, you will still have bacteria because they are in the air. They may take a bit longer to get going, however.

7. Put a bowl on the gravel so that when you pour water in, it will hit the bowl and not dig a hole in the gravel. Fill the tank part way with water. You may use tap water as you are not going to put any animals in today. In the future, you will let your water sit in a bucket for several days to "age." This gets the chlorine out so that it does not hurt the animals. You may also use chlorine remover purchased from a pet store. Put a heater in the bucket several hours before the water change to warm the new water.

8. Use clean rocks and/or flowerpots to make hills and caves in several places. Make hiding places for your crayfish. Do not add corals or shells to a freshwater aquarium as they can alter the pH of the water.

9. Attach air tubing to the air lift columns and the air pump. The little gang valve will help you regulate the airflow. Plug in the pump. Bubbles should be traveling up the air lift columns. Water is pulled down through the gravel and then up the columns by these bubbles. This traps food and feces in the gravel, filtering it out of the water. Bacteria will take up residence on the surface of the stones and break down organic material like food particles. Bacteria also become established that convert the toxic waste product of aquatic animal urine, ammonia, to nitrate which is less

toxic. These bacteria are essential and take about a month to grow. You cannot put all your animals in until this month is up!



10. Add water until the top of the air lift column is covered. Adjust the air flow so it is even.

11. Add the thermometer and heater(s). Make sure the heaters are immersed correctly. Refer to the package for instructions. Plug them in and set them for 76 °F if you are going to have freshwater tropical fish. 65 °F should be about right for temperate freshwater species. Let the aquarium sit for a day and check the temperature. Adjust the heaters if needed. NEVER LET THE WATER LEVEL FALL BELOW THE HEATERS. UNPLUG THEM WHEN DOING WATER CHANGES AND REPLUG WHEN DONE.

12. Get the top ready. If it has a light built in, plug it in. You need a top to keep your fish from accidentally jumping out. If you have crayfish, the top must fit very tightly as they are genuine escape artists. If you have a lighted top, the light should be turned on and off on a regular daily cycle to avoid stress to the animals. A simple timer made to turn your home lights on will take care of this. Tropical fish should have 12 hrs of light and 12 hrs of dark.

13. Let the tank sit with the air pump running for at least one full day. The water should be clear and clean. If there is still dust from the gravel, siphon the water out and add more.

14. When the temperature is correct, acclimate (see below) and add several small (2") fish. Wait at least two weeks to add the "fancy" fish or go collecting. Use goldfish or bait fish for a 65 °F tank or big guppies for a tropical tank. Feed them "flake" food from a pet store. These will be the only occupants for two weeks. If you ignore this two week wait, you may lose all the animals in your tank because of toxic waste buildup.

15. After two weeks, your aquarium should be beginning to have a bacterial population. You can add some animals now IF you do a good partial water change each week and continue to do so. That means draining about 1/3 of the water and replacing it with tap water that has aged by sitting in a bucket several days before being added. If you load the tank up and do not do water changes, the fish may die from the build up of their own wastes. After one month, add plants and a few more animals. After one month the volume of water change can be reduced to about 1/4 of

the water every second week. NOTE: check the temperature of the aged tap water before adding. If it is more than 5 °F below that of the tank, immerse the heater in it to warm it. Replace the water slowly with aged tap water to avoid temperature shock. Unplug the heaters before removing water and plug them in again when done.

ADDING AQUARIUM ANIMALS AND PLANTS

Choose a variety of plants and animals. Some plants may be floating while others are rooted. Include several varieties of fish and some invertebrates such as snails and a crayfish. Experiments in this curriculum use goldfish, snails, crayfish, and plants called *Elodea* (also called *Anachris*). Select other species that are non-aggressive, but active swimmers that are fun to watch or have interesting adaptations. Also look for animals that occupy different parts of the aquarium such as bottom-dwelling algae-eaters. If you have designed a habitat with lots of places to hide and plants that form structure, a diverse community of animals is possible. Do not use species that have weird anatomy, such as fancy goldfish. Regular goldfish do better at a lower temperature than tropical fish. If you purchase the fish from a pet store, the staff can help you make selections. Most biological supply catalogs will also have some information on each species offered.

If you are collecting local species, make sure the temperature of your tank matches that of the fishes' natural environment so that the animals are not temperature shocked. Taking fish from a cold pond in the late fall into a heated classroom could kill them. Also make sure collecting is legal. Whatever kind of fish you choose, get small ones and avoid species like oscars that grow to dinner plate size. Also avoid large predators. If you bring home a largemouth bass from a farm pond, it will grow to eat all its tankmates. RESIST THE TEMPTATION TO OVERLOAD THE TANK.

To add plants, unplug the heaters. Drain about 1/2 of the water from the tank and "plant" the rooted plants in the gravel. Try for natural looking clumps rather than an even spacing. Gently, refill with aged tap water or the drained water. Go slow if the temperature is different from the tank. Plug the heater back in. To add fish, acclimate the animals to the tank by floating the fish or other animals in plastic dishes or their shipping bags on the surface of the tank. Roll the top of the plastic bags to trap air so they float. Gradually, add a bit of tank water until the temperatures are the same. Slowly release the animals into the tank. Acclimation should take about 30 minutes.

DAILY TASKS

These tasks can be done by students. Initially you should supervise them. They will develop the ability to do them without your help.

1. Feed daily with just a little bit of food. Feed little tiny bits at a time for five minutes and then quit. Use commercial flake food and a variety of other things. We know one teacher who kept her tank going entirely with worms and insects the children caught plus carefully selected, non-greasy bits of meat from their lunch sacks. DO NOT OVERFEED. Unused food will decay, causing bacterial growth.

2. Remove any dead or dying organisms.

3. Check temperature.

4. Record everything done each day in a log (notebook). Record water changes, addition of plants and animals, feeding, daily temperature, and any behavioral observations about the animals. If you have any problems, the key may be in the notes. This also encourages observation and recording of data, good scientific practices.

WEEKLY OR BIWEEKLY TASKS

1. Do a partial water change. Use a siphon to remove water at the gravel surface, getting the "grunge" off the bottom. Replace the water slowly with tap water that has been sitting out overnight in a bucket. Use a slow siphon to gradually replace the water. Rate of flow can be regulated by tying a knot in the tubing to pinch it shut or using a tubing clamp.

2. If you have a power filter, stir the gravel gently, avoiding disturbing the plants. Put the power filter in place and let it run overnight.

WHERE TO FIND HELP

If you have purchased your supplies from a locally owned pet store, the staff will probably be a good source of information. Pet stores have books on aquarium keeping written for the general public. Check the card catalog at your local library under aquariums. Ask the staff of a local nature center or math/science center if they keep aquariums. Ask your science supervisor for suggestions about persons who might be knowledgeable about aquariums. Join your local aquarium society. Large public aquariums receive so many calls that they are generally unable to answer them and may have a policy of not doing so. If you purchase animals and plants from biological supply houses, they may send you information with the shipment, such as Carolina's Freshwater Aquarium Handbook.

SOURCES OF EQUIPMENT

The best way to get an aquarium is to have a family donate it. Many an attic has an aquarium. Yard sales and want ads are also sources. Make sure that the tank has no cracks in the glass or plastic. If it leaks along a seam, a tube of silicone sealant can cure the problem. Remove the old sealer and use generous amounts of the new to replace it. Is there equipment gathering dust on a school shelf? Check around your school system. Ask your science supervisor. Most teachers we know have found free tanks within their system, leaving their limited funds to purchase the rest of the supplies. Aquarium equipment can be purchased at pet stores. Most scientific supply houses also offer aquarium supplies. Both offer packages with all the parts in one order. Most package deals will need an additional heater to be adequate for cold school rooms over a long weekend. Packages are easiest, but more expensive.

SOURCES OF PLANTS AND ANIMALS

Pet stores and biological supply catalogues carry a wide range of animals and plants suitable for aquariums. Stick to the cheap, common species unless you are going to get very involved in this project. Stores that sell live bait for fishing are a cheap source of an interesting variety of animals that are tough and inexpensive.

If you live at the seashore or in the country where there are farm ponds, you may collect

animals yourself. Make sure you are collecting legally. Federal, state and county parks generally prohibit collecting without a permit. Many states require permits or fishing licenses regardless of location. Freshwater pond animals are great aquarium specimens if you get small ones. Marine species from cold waters or that live along rocky shores where there are waves are hard to keep alive without special tanks. Animals from warm estuaries or that live completely below the low tide line in tropical areas are more likely to survive.

DEALING WITH SCHOOL VACATIONS

In these energy-conscious days, schools can become very cold over the weekend or a break. Regardless of what kind of fish you keep, you should purchase a heater(s). Buy more watts than needed: 10 watts per gallon for tanks over 20 gallons. Heaters are designed for homes, not freezing schools, so make sure you have power.

Fish and invertebrates do not use food energy to keep warm, so they eat less than birds or mammals. One of the most frequent mistakes made by new aquarium owners is overfeeding. Fish and invertebrates can do fine without eating over the weekend. For a week break, feed and do a water change just before you leave and immediately on returning.

AT THE END OF THE SCHOOL YEAR

Tropical species may be adopted by students or their parents for home aquariums. Pet stores may accept the return of healthy specimens. If the animals came from the wild, they may be returned only if they go back to exactly the same place you got them and are slowly acclimated to the water.

NEVER RELEASE ANY PLANTS OR ANIMALS THAT ARE NOT NATIVE TO THE EXACT BODY OF WATER THEY ARE ENTERING. INTRODUCTION OF FOREIGN SPECIES CAN DO INCALCULABLE ECOLOGICAL DAMAGE.

MAKING WATER WITHOUT CHLORINE or HOW TO AGE TAP WATER

Water supplied by most municipal districts is treated with chlorine to kill bacteria which might be in the water. Chlorine is also toxic to most aquatic plants and animals. Consequently, if you put fish or plants in water right out of the tap, they may die. The chlorine is a gas dissolved in the water. If the water is exposed to air for 24 hrs, the chlorine gas will diffuse out of the water. Gases in the water will reach equilibrium with those in the air during this time. Fortunately, there is very little chlorine gas in the air, so the chlorine leaves the water. Always allow water from the tap to sit for 24 hrs before animals or plants come in contact with it.