

Living Material Care Guide

Mealworms (Insects Kit, Grade 2)

Darkling Beetle (Environments, Grade 5)



Mealworms (*Tenebrio obscurus*) will arrive in a cup of bran meal with a piece of potato. The mealworms are the *larvae of the adult Darkling Beetle*. Store the mealworms in a cool (45-65 degrees) place, out of direct sunlight. The potato is for moisture. Kept cool and a fresh piece of potato added, the mealworms will remain as larvae for several days. At warmer temperatures, larvae will soon pupate.

To keep the larvae for a longer period of time, transfer them to the 1 ½ gal plastic tank with about 2 inches of bran meal, some pieces of fresh potato or a banana peel, and a couple sheets of toilet paper, misted with water, for them to crawl under. Replace the food as necessary, or if it becomes moldy.

The beetles start laying eggs 7 to 10 days after emergence and the eggs hatch about 14 days later. At warmer room temperatures (77-86 degrees F) the larvae grow rapidly to about 1 ¼ inches long, and then pupate. Adult beetles emerge in 1-2 weeks.

FAQs:

Do these insects bite?

No. They are completely harmless to people.

Can mealworms be refrigerated?

Yes, all stages can be refrigerated, but do not freeze.

Are mealworms pests?

They can damage stored grain. Mealworms are generally beneficial because they feed on organic matter not usually eaten by other animals. They are also food for other animals. Some people raise mealworms as live food for pet reptiles or wild birds.

How can I tell the male beetles from the females?

They are identical. Male and female beetles probably recognize each other with special scents or pheromones.

Milkweed Bugs (Insects Kit, Grade 2)



Milkweed Bug (*Oncopeltus fasciatus*) eggs are shipped in a wad of cotton and may be kept in the container in the refrigerator for a short time. But at room temperature, the eggs will hatch within a couple days. Plan to introduce the eggs to the students as soon as possible. As eggs mature, their color turns from pale yellow to deep orange.

If they have hatched upon arrival, immediately have the students prepare habitat bags. (Part 2 of the Milkweed Bugs Investigation) and move the hatchlings directly to the bags. Do not put them into vials as described in Part 1.

The newly emerged nymph is about the size of a pinhead and is bright orange. The nymph grows by a series of molts. It takes about a month for the nymph to become an adult, which lives for about an additional month. Females lay eggs on the cotton placed in the habitat bags.

FAQs:

How often should I change the sunflower seeds?

The nymphs and adults do not completely eat the seeds. Replace the seeds when they become shrunken or dirty.

How can I tell male from female milkweed bugs?

In adult bugs, the ventral side of the 4th abdominal segment (counting from the thorax) bears a black band in the male and 2 prominent black spots in the female.

How can I tell nymphs from adults?

The nymphs do not have wings. As is typical of insects that undergo *incomplete metamorphosis*, the wing pads begin to appear in the early stages, gradually increase in size at each molt, and become prominent in the last nymph stage.

When will the bugs produce eggs?

Mating takes place 5 to 12 days after the last molt for females and 2 to 3 days for males. Egg-laying begins 1 to 15 days after mating and peaks at about 20 days.

Painted Lady Butterfly larvae (Insects Kit, Grade 2)



Painted lady butterfly larvae (*Vanessa cardui*) are shipped with their own food in a ventilated plastic cup. Maintain the container out of direct sunlight. No further care is necessary, as they will pupate (form a chrysalis) within 7 to 10 days. Do not disturb the chrysalises for at least 1 to 2 days until they harden.

Then, open the cup, remove the paper with the chrysalises attached, and tape the paper to the butterfly cage. At room temperature the butterflies should emerge 7 to 10 days later.

Prepare a sugar-water feeding solution by dissolving 2 teaspoons of sugar in a cup of water. Keep solution refrigerated when not in use. Replace the solution in the vial/wick feeder (see Teacher Guide) every other day. With proper nutrition, adult butterflies generally live for 1 to 3 weeks.

FAQs:

My caterpillars aren't moving. Are they dead?

Probably not. Caterpillars often rest for hours at a time, especially just before molting. Open the cup and gently touch the caterpillar with the tip of a soft brush. This should cause the caterpillar to move slightly.

Can I take the larvae out of the cup?

It is best to leave the cup closed until you are ready to move the chrysalises into the flight cage. There are oils on your hands that can harm the caterpillars. Opening the cup also might allow bacteria or mold to spoil the food.

My butterflies just came out and there's red liquid all over. Is it blood?

Your butterflies are fine. The red liquid is *meconium*—liquid waste mixed with extra pigment left over from wing formation.

How can I tell the male from the female?

Female butterflies have a larger, more rounded abdomen, which is caused by the egg mass. The sides of the female's abdomen curve outward. The abdomen of a male, when viewed from the top, has fairly straight sides.

Freshwater fish:

Goldfish (Animals 2X2 Kit, Grade K)

Guppies (Animals 2X2, Grade K)

Mosquito Fish (Organisms Kit, Grade 1)

(Gambusia affinis, Carassius auratus)



Conditioning tap water: All tap water should be aged and de-chlorinated, i.e., conditioned, before use with living cultures, plants or animals (fish & snails). To condition tap water, fill the 1 or 1 ½ gallon tanks and let them sit for *48 hours*. This allows time for dissolved chlorine gas to come out of solution and escape. It also allows time for the water to reach room temperature.

Avoiding temperature shock is essential to acclimate fish and other aquatic organisms. To reduce stress and prolong the health of the fish, dissolve ½ teaspoon of the *Aquarium or Rock Salt* per gallon of conditioned water.

Acclimatize the fish: Float the opened bag(s) containing the fish in your tank filled with conditioned water for about 15 minutes to equalize the temperature. When temperatures are equal, remove and discard about ¼ of the water from the bag and replace it with water from the holding tank. Wait 15 minutes and repeat the above step. After another 15 minutes, carefully remove the fish from the bag with a net and place them in the tank. Discard the water in the shipping bag.

FAQs:

What are the three deadly stresses?

Temperature shock, pH stress and toxin buildup can cause the fish to be more vulnerable to disease and death. Follow conditioning and acclimation procedures and change ¼ of the water monthly with conditioned water.

How much food should I feed the fish?

Feed the fish only as much as they can eat in a few minutes. Don't feed more than once a day. Any food the fish do not eat may become food for bacteria. Too many bacteria can deplete the water's oxygen content, stressing the fish and other animals in the aquarium.

Redworm (Animals 2X2, Grade K)(Soils Kit, Grade 3)

Earthworm or Night crawler (Animals 2X2 Kit, Grade K)

(Pictured: *top*; earthworms compared to *bottom*; redworm)



Redworms (*Eisenia foetida*) and Earthworms (*Lumbricus terrestris*) may be kept in the shipping container for short periods of time. Upon arrival, open the container and mist the soil to moisten. Don't soak the soil. To maintain worms for more than one day place the container in the

refrigerator. As soon as you can, provide a suitable habitat with rich, moist soil. Sprinkle damp, crushed dead leaves over the surface of the soil for a food source.

Redworms and earthworms are *Annelids* or segmented worms. They are very similar, but earthworms reach much larger sizes than redworms do. Redworms require a much higher organic content in the soil than earthworms. Because of this, redworms are often used to speed composting. Earthworms are sometimes called night crawlers from their habit of emerging from the soil at night.

Earthworms require cool temperatures of 60 degrees or lower to do well. This makes it difficult to maintain earthworms for lengthy periods in the classroom. Redworms tolerate higher temperatures, up to 77 degrees, which makes them a much better choice for extended classroom use, but anything above 84 degrees can be harmful.

Worm Compost Bin Handling Procedures

(Soils Unit, Grade 3)

- The worm compost bin can to enrich your Soils kit investigations.
- Read the materials sent with the bin to get familiar with the care of the worm bin.
- Do not send the worm bin back with the kits, they will be picked up separately and reused at the next school to receive the Soils unit.
- Keep the worm bins in the classroom until the requested pickup date.
- Encourage the students to feed the bin each week.
- Use the tongue depressor to gently stir in each food item.
- By stirring and burying the foods, flies are eliminated.
- Keep the compost moist, *never pour water into bin*.
- If too wet; remove drain plug, tip to drain the excess water and replace plug.

Tip: This “compost tea” is excellent fertilizer!

- To start:
 - Assemble bedding materials
 - “Brown stuff”; the carbon source (newspaper or dried leaves)
 - “Green stuff”; the nitrogen source (green leaves)
 - “Starter soil”; the nutrient source (worm compost provided)
 - “Aged” water; the moisture source, in a spray bottle
 - Locate rubber stopper taped inside bin.
 - Plug the drain hole from the *outside*.
 - Find a suitable location in the room for the bin.
 - Avoid sunny areas; too much heat can cause odors.
 - Spread the absorbent pad *under* the bin, blue side down, to protect the table.
 - Layer the bedding materials
 - Tear newspaper into thin strips, place in bin, and spray with water.
 - Add “green” stuff, also shredded, about half the volume of paper.
 - Scatter a layer of starter soil over all.
 - Repeat layers until up to the bottom of the air holes.
- Add worms
 - Dump the worms on top of the bedding.
 - Be sure to do this with the students so they can watch them disappear!
 - If too wet or too dry, they may try to crawl out.
- Cut the garbage bag to fit inside, and place on top of the layered bedding.

- Put lid on securely to prevent escapes. Be sure plug is secure, too.

WHAT TO FEED YOUR WORMS

Vegetable scraps
Grains
Fruit rinds and peels and cores
Breads
Coffee grounds, filters
Tea bags
Melon rinds are a favorite!

WHAT NOT TO FEED YOUR WORMS

Meat
Cheese, Yogurt
Fish
Butter, Oily foods
Plastic bags
Other plastic, metal
Pet wastes

FAQs:

How can I tell the difference between male and female earthworms?

Each redworm and earthworm is both male and female. In a copulating pair, each worm gives and receives sperm.

Our worms died after a few weeks. What happened?

Although they are land animals, redworms and earthworms are dependent on moisture in the material that surrounds them. They breathe through their skins, which must be kept moist at all times. Be certain that they have adequate moisture. Use only conditioned tap water (see Goldfish and Guppy: Conditioning Tap Water) Keep both redworms and earthworms under darkened conditions, sunlight can kill them. Remember that earthworms need cool temperatures.

What is the difference between an earthworm and a redworm?

Other than average size, the anatomical differences (differences in body structure) are technical and difficult to observe. They do differ in behavior. Redworms live in the upper 25 cm or so of the soil, usually under a thick layer of litter or other organic matter. Earthworms go much deeper and build vertical, more-or-less permanent burrows in which they live.



Isopods:

***Sowbugs (Animals 2X2, Grade K)
and (Organisms Kit, Grade 1)***

Pillbugs (Animals 2X2 Kit, Grade K)



As soon as your isopods (pill bugs or sow bugs) arrive, open the shipping container and check their condition. The isopods come in a damp paper towel to provide the humidity they require. After examining, close the container and prepare a habitat using any available plastic container with a lid. Punch air holes in the lid, mist inside the container with room-temperature water, and place a cup of moist potting soil in the bottom. Put a slice of raw potato or apple on the soil.

Empty the contents of the shipping container (including the paper towel) into the habitat. Gently unfold the paper towel and shake off as many of the isopods as possible. If you are unable to dislodge all of them, leave the paper towel in a loose tangle and replace the lid. Leave in a darkened area for at least an hour. Most of the isopods should move down to the damp soil. Use a camel-hair brush to remove any that remain on the paper towel. Mist the inside of the container again and replace the lid. You can keep the isopods like this over a weekend.

Habitat Set-up and Maintenance: Put 4 to 5 cm of moist potting soil in a terrarium. Cover the surface, preferably with leaf litter or hardwood mulch. Do not use pine bark or mulch treated with chemicals. Cover to maintain humidity.

Direct sunlight may kill the isopods, so place the terrarium in indirect light. Maintain at 20 to 22° C (68 to 72° F). Soil should be damp, with decaying wood, leaves, or compost in the terrarium. Mist the habitat to keep it humid; if it gets moldy, increase ventilation or reduce misting. Other than humidity, isopods need little care. Feed fish food flakes, leaf litter, and pieces of raw potatoes, apples, or carrots. Immediately remove moldy food.

FAQs:

Our pill bugs disappeared. Where are they?

Isopods avoid light. They are probably under some leaf litter, or they have burrowed into the soil. Leave raw potato or apple on the soil overnight. Gently lift it and you will probably find the isopods underneath. You are more likely to observe the isopods if you keep the terrarium in a dimly lit area.

Our pill bugs died while we were observing them with magnifiers. What happened?

Isopods' gills dry quickly, which can kill them. To observe isopods with a hand lens, place in a shallow cup with damp soil or paper towel. When done, return the isopods to the terrarium quickly.

Can other animals be kept in the terrarium?

Yes, animals such as millipedes, Bess bugs, and other organisms with similar habitat requirements. Spiders and lizards may eat isopods.

In our terrarium, we are seeing lots of tiny bugs that look a bit like small pill bugs. What are they?

You have provided a good habitat for the isopods and they are reproducing. The young resemble the adults, except for their smaller size and paler color, and will molt 4 to 5 times as they grow.

Pond Snails

(Animals 2X2, Grade K) and (Organisms Kit, Grade 1)

As soon as your shipment arrives, open the container of snails. Allow at least 30 minutes for them to reach room temperature. Prepare a holding pail or habitat with room-temperature conditioned tap water. (See Goldfish and Guppy for information on conditioning tap water.) Rinse water plants and add to the holding pail.

Newly arrived snails often do not move for the first 2 or 3 days. If you think a snail is dead, use a pencil to gently pry against the hard flap at the shell opening. If it resists probing or is tightly closed, the animal is alive. Avoid overcrowding the habitat; do not hold more than 15 to 20 snails per 1 to 2 gallons of water.

Immediately change the water if it becomes cloudy or foul smelling, then check for and discard any dead snails. A dead snail will have a foul odor and usually hang out of its shell when picked up.

All water used in the habitat must be conditioned and de-chlorinated. Place the aquarium in an area where the temperature is fairly constant, between 18 to 25° C (64 to 77° F). An aquarium needs diffuse light; do not place in direct sunlight or unusually bright artificial light. Remember that snails are cold-blooded. An aquarium in direct sunlight may

have a temperature as much as 5° C above the temperature of the room. At night such an aquarium cools rapidly, stressing the snails and leaving them vulnerable to disease.

FAQs:

I have a snail that is floating. Does that mean its dead?

Probably not. The snail has collected a gas bubble under its shell. In time it will sink.

What should I feed my snails?

Snails do not need extra food if they live in an aquarium with fish and plants.

Snails are crawling on the water plants. Are they eating them?

Perhaps. They are probably eating algae growing on the plants. However, if there is not enough other food for the snails, they may eat the plants. Also, if the plants are weakened and beginning to die, the snails may eat them.

A snail has retracted into its shell and hasn't moved. Is it dead?

Probably not. Snails often do this for a few hours or even for days. As long as the shell is tightly closed, it is alive. A snail that hangs limply out of its shell is dead and you should discard it.

All the snails died soon after we put them in the aquaria. What went wrong?

If you properly acclimate the snails, it could be the water. Some city water systems now use chlorinators that are not removed by aging the tap water. In those cities, use a chemical water conditioner that removes chloramines. Still, your tap water may contain metal ions that are toxic to snails. This is especially likely if the water pipes at your school are less than 3 years old or if there have been recent major repairs to the plumbing. Snails are more sensitive to metal ions than are most other aquarium animals, including fish. You may have to use water from another source, such as bottled water.

Land Snails (Animals 2X2 Kit, Grade K)

Catawba Science Center has a culture of Perforate Dome Snails (*Ventidens demissus*) for loaning out for classroom use. These have been collected locally, so special permits to use these are not necessary. The snails sent out for classroom use are to be returned within 5 days.

A classroom set of 10 snails will be delivered in a small terrarium to keep them in. Keep the paper lining the bottom of the terrarium damp, along with the bark pieces. Mist the habitat, but if it gets moldy, mist less and increase ventilation. Other than humidity, snails

need little care. Feed pieces of raw potatoes, apples, lettuce, mushrooms, or carrots. Remove any moldy food.

Handle gently, the snail's shell is fragile. To pick up, do not pull up on the shell. Slide and gradually peel the snail's foot off the surface he's crawling on. Another way to remove him is to wet the snail with aged tap water.

A source of calcium like eggshells, broken pieces of clamshell, or limestone or marble chips will help maintain snails' shells. Snails leave a slime trail, so clean the terrarium bi-weekly or monthly.

FAQs:

My snails haven't moved. Are they dead?

A dead snail will have a very bad odor. Snails undergo periods of inactivity, but they also contract into their shells if humidity is too low. Spray them with room-temperature dechlorinated water and place them on moist paper towel. Bright light will also cause snails to remain inactive. The snails will be more active under conditions of low light and high humidity. Maintain at 20 to 22° C (68 to 72° F).

I see clusters of what look like small translucent plastic beads in the soil. Are these snail eggs?

That is an accurate description of snail eggs; they should hatch in about 2 to 4 weeks. They will look like miniature adults and will need the same care.

How can I tell if I have both male and female snails?

Each snail is both male and female. However, a snail cannot inseminate itself, so 2 are needed to procreate.

Bess Beetles (Organisms Kit, Millipede alternate, Grade 1) and (Environments Kit, Grade 5)



The Bess beetle (*Odontotaenius disjunctus*) is a large, shiny, black beetle 1 1/4 to 1 3/8 inches long, sometimes called the patent leather beetle. Its body is divided into 3 distinct parts: head, thorax, and abdomen. The Bess beetle has 3 pairs of legs, a pair of antennae, and strong jaws that protrude from the front of its head. It eats microorganisms found in wood, chewing through damp, rotting wood to create tunnels inside the log where it lives.

The larvae (which are white) and adults (which feed the larvae with prechewed wood) share the tunnels. In this sense, they are social insects. However, they are not as organized as termites, ants, wasps, or bees, which divide jobs among the group.

Adults and larvae stridulate, meaning they produce sounds. Adults stridulate by rubbing a rough area under their wings against a similar area on the top of their abdomens. Larvae stridulate by rubbing the tip of the third leg against the joint of the second leg.

Although adult beetles have 2 pairs of wings, they rarely, if ever, fly. They are easily maintained if kept in damp (not soggy) wood, and they prefer darkness.

Terrariums: Follow the directions in your Teacher's Guide for setting up the terrariums. Think about where you will keep the terrariums. Remember that direct sunlight may overheat and kill the beetles, so place the terrarium in an area of indirect light. Maintain at room temperature (20° to 22° C, 68° to 72° F). Bess beetles need humidity, so the terrarium soil should be damp.

There should be decaying organic material (wood, leaves, compost, etc.) in the terrarium. Mist the habitat to keep it humid, but if mold becomes a problem, increase the ventilation or reduce the amount of misting.

Care: Other than humidity, Bess beetles need little care. If they eat all the rotten wood shipped with them, collect additional rotten wood (preferably hardwood) locally.

FAQs

Can Bess beetles bite?

Bess beetles are harmless. Although their jaws are strong, they are adapted for chewing rotten wood, not human skin. Bess beetles can be safely handled as described in your Teacher's Guide. Notice the hooks on the beetles' legs. These can cling so tightly to some fabrics, especially the yarn of sweaters, that the beetle may be injured while being pulled off. For this reason, don't allow beetles to crawl on clothing.

What is that squeaking sound?

That's called stridulation, as explained above. Since the beetles are somewhat social, the sounds may be communications among colony members.

How long do Bess beetles live?

Bess beetles can live as adults for up to 1 1/2 years, unusually long for a beetle. They also undergo complete metamorphosis, so their entire life cycle (egg, larva, pupa, and adult) can extend beyond 2 years. The beetles you receive are of unknown age, but they will probably live for at least 6 months.

Will my Bess beetles reproduce?

This is unlikely. They must have a very stable environment, like that provided by a large rotting log, for reproduction.

Millipedes (Organisms, Bess beetle alternate, Grade 1) (Environments, G5) and (Animal Studies, G4)



Millipedes (*Orthoporus texicolons*) are also known as thousand-legged worms. Although none actually have 1,000 legs, large millipedes certainly have several hundred legs, 2 per body segment. The legs work in groups to produce

locomotion; thus, waves of motion travel down the rows of legs as the animal crawls. This allows a millipede to exert a lot of force as it pushes its way through leaf litter or loose soil. The harder the animal has to push, the greater the number of legs involved in generating the push.

They are herbivores, eating mostly decomposing vegetable material. Millipedes are secretive animals with few defenses, so they hide under any available material, although some forage in the open at night. Primarily they depend on their hard exoskeletons for protection. When disturbed, many curl up, protecting their soft undersides.

Millipedes do not bite or sting, but many have repugnatorial glands, which secrete a liquid that can be irritating to the skin. The millipedes provided by Carolina Biological Supply Company have a very mild secretion, but even so, when handling them, avoid touching your eyes or mouth, and wash your hands afterwards.

Terrariums: Follow the directions in your Teacher's Guide for setting up the terrariums. Give some thought to where you will keep the terrariums. Remember that direct sunlight may overheat and kill the millipedes, so place the terrarium in an area of indirect light. Maintain at room temperature (20° to 22° C, 68° to 72° F). Millipedes need humidity, so the terrarium soil should be damp, and there should be decaying organic material (wood, leaves, compost, etc.) in the terrarium. Mist the habitat to keep it humid, but if mold becomes a problem, increase the ventilation or reduce the amount of water used to mist the habitat.

Care: Other than humidity, millipedes need little care. Feed them fish food flakes, leaf litter, and pieces of raw potatoes, apples, lettuce, mushrooms, or carrots. Even though millipedes feed on rotting vegetation in nature, remove any old food from the habitat if mold begins to develop. In case there are any baby millipedes, check old food before discarding it—the babies often attach themselves to it.

FAQs

Our millipedes disappeared. Where are they?

Millipedes avoid light. They are probably under some leaf litter, or they have burrowed into the soil in the terrarium. You are more likely to observe the millipedes if you keep the terrarium in a dimly lit or dark area of your room.

How do I keep my millipedes healthy?

Remember that millipedes need humidity. Regularly spray the habitat with room temperature conditioned water. Chitin is essential to millipedes for molting and growth of a new exoskeleton. Oak leaves are rich sources of this nutrient, so be sure to add leaf litter to the habitat. Millipedes thrive under somewhat unkempt conditions, so don't be too fussy about keeping their terrarium clean. Given this preference, millipedes are themselves clean animals. They spend a lot of time cleaning their antennae, exoskeleton, and legs.

Our millipedes have tiny bugs on them. What are they?

They are probably mites, which are symbiotic with the millipedes and do not harm them. The mites clean up bits of rotting materials that are discarded or missed by the millipedes.

Fiddler Crabs (Animal Studies Kit, Grade 4)



Fiddler crabs (*Uca pugilator*, *Uca pugnax*) are small burrowing crustaceans. Functioning as scavengers, they live along the shores of beaches, salt marshes, and estuaries in tropical and temperate zones. The crabs supplied by Carolina Biological Supply Company are the freshwater type and are easy to maintain in the classroom.

Fiddler crabs are easily sexed. The female has 2 small claws, which are used for feeding. The male has one large claw and one small claw; he uses his large claw to threaten other fiddlers and to attract females during the mating season. The waving motion of the large claw has been compared to the movements a musician makes while playing the fiddle, hence the name “fiddler crab.” Occasionally, the male loses his large claw during a fight. The missing claw will be replaced during the next molt; however, the large claw will be on the opposite side. This explains why some fiddlers have the large claw on the right while others have it on the left.

Terrariums: Follow the directions in your Teacher’s Guide for setting up the specialized terrariums needed by fiddler crabs. Give some thought to where you will keep the terrariums. Remember that direct sunlight may overheat and kill the crabs, so place the terrariums in an area of indirect light. Maintain at room temperature (20° to 25° C, 68° to 77° F). The crabs will be more active at the warmer temperatures.

Acclimating and holding fiddler crabs: Refer to Appendix A in the *Animal Studies Teacher’s Guide* and prepare the holding pails prior to the arrival of the crabs.

IMPORTANT! IMMEDIATELY RELEASE CRABS TO HOLDING PAILS OR HABITATS—DO NOT LEAVE THEM IN THE SHIPPING BAGS! Open the bags slightly to pour out and discard the shipping water. Carefully release half the crabs into each holding pail. Put one pinch (4 to 5 pieces) of dried plankton in the water, and one pinch on the sand. Do not overfeed the crabs. Punch air holes in the holding pail lids and then cover the pails. Provide a safe environment (i.e., room temperature, indirect light), and do not handle the crabs until you are ready to use them.

Care: Keep the water bowl half full at all times, and change it when it becomes dirty. The sand should not be deeper than the height of the water bowl. Keep the lid on the terrarium after the crabs are placed inside.

FAQs

How do I keep my fiddler crabs healthy?

The most important things to do are to keep them at a consistent temperature and to keep the water in the bowl changed on a regular basis.

Will the fiddler crabs mate?

You may observe courtship behavior in which the male waves his large claw to attract the female. Usually the male must have a burrow before the female will mate with him. There is not enough sand in the terrarium for the male to excavate a burrow, although he may try.

How long do fiddler crabs live?

In the wild, no one knows. In captivity they can live for a school year with good care.

Can I keep 2 or more males in a terrarium?

Probably. Male fiddler crabs may wrestle, push, and shove each other, especially in the presence of a female. These matches rarely result in injury, but a losing crab may be stressed.

A crab has molted. What do I do?

In most cases, no additional care is needed. Do not remove the molted skin. Over the next several days the crab will eat it, providing needed calcium. The crab will be fragile for several days after a molt. If another crab is bothering it, remove it for a few days.

Dwarf African Frog (Animal Studies Kit, Grade 4)



(*Hymenochirus boulengeri*)

Frogs are amphibians, which is Greek for “double life.” They undergo metamorphosis, changing from an egg to a tadpole to a young frog. The dwarf African frog, also known as the dwarf aquarium frog, is strictly aquatic and found primarily in pools or sluggish water. These small frogs, which grow to about 1 ½ inches in length, are gray or brown with a darker marbling pattern on their backs and light-colored abdomens. They have

webbed feet, necessary for an aquatic existence, with claws on the 3 inner toes of each hind foot.

Dwarf aquarium frogs have small, lidless eyes, and although it is difficult to distinguish the sexes, the male is usually smaller and develops a yellowish swelling just behind its forelimbs during breeding.

Aquaria: Follow the directions in your Teacher’s Guide for setting up the aquaria. Treat all water for holding tanks and aquaria with the water conditioner included in your kit. Give some thought to where you will keep the aquaria. It is best to select an area where the temperature is fairly constant, between 18° to 25° C (64° to 77° F). An aquarium needs diffuse light and should not be placed in direct sunlight or unusually bright artificial light. Remember, frogs are coldblooded animals. An aquarium in direct sunlight may have

a temperature as much as 5° C above the temperature of the room. At night such an aquarium cools rapidly, stressing the frogs and leaving them vulnerable to disease.

Acclimating and holding dwarf African frogs: IMPORTANT! IMMEDIATELY ACCLIMATE FROGS TO HOLDING PAILS OR HABITATS—DO NOT LEAVE THEM IN THE SHIPPING BAGS! Refer to Appendix A in the *Animal Studies Teacher's Guide*. Prepare 2 holding pails according to the instructions in Appendix A. Acclimate frogs to temperature and pH by removing one cup of shipping water and replacing it with one cup conditioned, room temperature tap water. Repeat this step after 15 minutes; allow the shipping container to sit undisturbed for 15 additional minutes. Gently transfer frogs from shipping water to 2 holding pails using an aquarium net. Hold your hand over the net to prevent the frogs from jumping out.

Elodea, a water plant, is shipped with the frogs. Put half the plants into each holding pail. Punch air holes in the holding pail lids and cover the pails. Feed the frogs according to instructions in Appendix A. DO NOT OVERFEED! Keep them at room temperature and in indirect light. Do not further disturb the frogs until you are ready to use them for lessons.

FAQs:

The shipping bags are cold and the frogs aren't moving. Are they dead?

The frogs are cold-blooded and become less active when they are cold. Allow time for them to warm to room temperature. Never apply heat or add warm water to hasten this process. A rapid change of temperature can do much more damage to the frogs than chilling them can.

The frogs are probably hungry, so I should feed them, right?

The frogs need time to recover and become familiar with their new environment. Wait a day before feeding them.

What should I feed the frogs?

Use the brine shrimp flakes as recommended in your Teacher's Guide. We do not recommend other foods.

All the frogs died soon after we put them in the aquaria. What went wrong?

Did you properly acclimate the frogs? Did you use the water conditioner? Some city water systems now use chlorinators that are not removed by aging the tap water. In those cities, the water conditioner must be used to dechlorinate the water. If you acclimated the frogs properly and used the water conditioner, your tap water may contain metal ions that are toxic to frogs. This is especially likely if the water pipes at your school are less than 3 years old or if there have been recent, major repairs to the plumbing. You may have to use water from another source or bottled water. Finally, the frogs may have been overstressed during shipping. Request a replacement from Carolina Biological Supply Company.

Amphipods (Environments Kit, Grade 5)



Although they are not familiar to most people, amphipods are common in aquatic ecosystems. They are crustaceans and are related to lobsters, crayfish, crabs, and shrimp. *Gammarus* is the most common freshwater genus, and amphipods are sometimes called *Gammarus* shrimp or freshwater shrimp.

Amphipod means “2 legs” and refers to the presence of 2 different types of thoracic legs. There are 2 pairs of shorter legs toward the front, and 3 pairs of longer legs to the rear. Amphipods are usually flattened from side to side and have large compound eyes on the sides of the head. They often swim on their sides, which gives them the common name of “sideswimmer.”

They are primarily scavengers of plant and animal material, although they may attack injured or stressed animals. They avoid light and usually hide when not swimming about or mating.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND INSPECT YOUR SHIPMENT. Remove the lid from the shipping jar and allow it to just sit on the jar, but DO NOT AERATE THE CULTURE WITH A PIPETTE OR ANY OTHER DEVICE. Keep the jar in a cool area (21° C, 69° F) out of direct sunlight. Amphipods are best maintained in a glass or plastic container (e.g., 20-liter or larger aquarium) filled with spring water or bottled water. Do not use city tap water or distilled water because the organisms are sensitive to metal ions, which are usually present in at least trace amounts. Amphipods feed on algae, as well as on bacteria and yeast.

FAQs

How can I tell male from female amphipods?

During breeding season, this is easy. Female amphipods have a dark brood pouch on the underside of their abdomens.

Can I keep amphipods in an aquarium with fish?

The fish will eat them. In fact, many aquarium hobbyists culture amphipods to feed their fish.

Can I refrigerate amphipods?

We do not recommend refrigeration of these organisms. Plan on using the culture as soon as possible after its arrival.

Brine Shrimp Eggs (Environments Kit, Grade 5)

Brine shrimp (*Artemia salina*) are small crustaceans found in salt lakes and brine pools. Under ideal conditions, female brine shrimp can produce eggs that hatch soon after emerging from their ovisacs to produce live young. When environmental conditions become less than ideal, such as during periods of high salinity or food shortage, the female responds by producing dormant cysts, which are encased embryos that cease development until conditions are again favorable. The dormant cysts can remain viable for years if kept in a dry, oxygen-free environment. Thus the widely sold brine shrimp “eggs” are actually brine shrimp cysts. Once the cysts are incubated in saltwater, the embryos quickly resume their development and young hatch from the cysts.

Hatching brine shrimp eggs: *Two-liter soft drink bottles* with their tops cut off are good for hatching brine shrimp. Use aged conditioned tap water throughout. In one liter of water, dissolve 2 tablespoonfuls of *noniodized salt*. The exact amount is not critical. Synthetic sea salt is best, but rock salt also works. This is enough saltwater for hatching 1/4 tablespoon to one level tablespoon of brine shrimp eggs.

Constant light is needed for hatching, so you need a *lamp*. Drop in a *coarse-bubbling air stone* or other bubbler to provide needed circulation and oxygen. Under these conditions and at temperatures of 26° to 28° C (80° to 82° F), the eggs hatch in 24 hours. Lower temperatures result in longer hatching times. Do not exceed 30° C (86° F), or the young may be damaged.

When hatching is complete (not all cysts hatch), remove the air stone and direct the light to the middle of the bottle. The shells of the old cysts float, unhatched cysts settle to the bottom, and the young shrimp (nauplii) concentrate in the light. You can skim off most of the old shells and discard them.

To feed, crush 3 to 4 grains of dry baker’s yeast on clean paper and dust this on the surface of the brine shrimp culture. Avoid overfeeding. The water in the culture should not become clouded. Each week draw off and discard about 1/4 of the culture water and replace it with new saltwater.

FAQs:

I had many cysts that didn’t hatch. What should I do with them?

Most of these cysts are slow hatchers. Mix up a new bottle of saltwater and add them to it. They should hatch on the second try.

How long does it take brine shrimp to reach adulthood?

Under good conditions, nauplii (newly hatched brine shrimp) grow rapidly, reaching adulthood in 8 days. The adults average about 8 mm in body length, but can be double that length.

How can I tell if my brine shrimp are healthy?

Shine a flashlight into the bottle. If they do not concentrate in the light, they are not healthy. If you have a microscope, examine the digestive tract, which is a straight tube running the length of the shrimp's body. It should be full of food.

Can I refrigerate brine shrimp?

They can be refrigerated (not frozen) for several days. Feed them several hours before refrigeration.

INTERNET RESOURCES

There are thousands of good Internet sites about plants and animals. Here are a few to get you started:

Carolina Biological Supply Company

(www.carolina.com)

Carolina offers online care guides for a number of living organisms. To view these, click on the "Care for living organisms" tab in the gray bar near the top of the Carolina homepage. See also back issues of the *STC® Update* newsletter

(www.carolina.com/carolina_curriculum/stc/publications_STC_update.asp)

, the STC living materials section

(www.carolina.com/carolina_curriculum/stc/living_materials.asp), and

revised instructions for the *STC® Animal Studies* unit, which now uses millipedes instead of land snails

(www.carolina.com/carolina_curriculum/stc/animal_studies_change.asp).

Look around a bit—new information is constantly being added.

Special thanks to:

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Delta Education, LLC

Carolina Biological Supply Company