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Carolina Biological Supply Company
2700 York Rd Burlington NC 27215
336.584.0381
www.carolina.com
Editor: Phil Owens, PhD
(phil.owens@carolina.com)
Managing Editor: Karen Earles
Advertising Director: Harry Shoffner
Art Director: Jo Boykin
Photography: Harry F. Holloway, CPP; Jeff McAdams; and William R. West, FBPA
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Crayfish, Curriculum, and Classrooms

TRISH PATRICK
Environmental Science Teacher
Ragsdale High School
Jamestown, NC

The goal of science education reforms has been to improve approaches to learning and to provide teachers with curriculum standards. These reforms tell us that students should be able to build their education, like beads on a string, threaded upon the ability to use problem-solving skills. Hands-on, guided activities and open inquiry can be the needle we use to pull the problem-solving thread through each bead of education. Using both living and preserved crayfish in the classroom is a great way to answer the call of current science reforms.

During project-based instruction employing crayfish, students are active participants in science research. Crayfish provide the potential for scientific data collection, both quantitative and qualitative. By participating in an inquiry-based introduction to living crayfish and then dissecting a preserved specimen, students can begin to understand how the body's structures function together to maintain life. Such activities not only cultivate the student's natural interest in observing and learning but also cover the majority of Content Standard C in the *National Science Education Standards*.

Crayfish Biology

The crayfish, also known as the crawdad or crawfish, is a crustacean in the class Crustacea of phylum Arthropoda of kingdom Animalia. The typical length is about 3″, with the smallest full-grown crayfish being less than 1″ and the largest being about 16″. The average life span is about 2 years. Crayfish live throughout the world in freshwater streams beneath sticks and stones or within caves (Fig. 1). They are most active at night when feeding on snails, algae, detritus, insect larvae, minnows, and worms. Crayfish are eaten by fish, raccoons, turtles, birds, alligators, and humans.

Because of its very specialized, diverse yet similar appendages, the crayfish is the perfect specimen to convey to students the relationships between structure, function, and environment. You can easily demonstrate these relationships by allowing students to observe live crayfish through open inquiry. Then they can perform a hands-on, guided, follow-up dissection, which reiterates the specific functions of the crayfish's body parts and appendages.

Live Crayfish

Crayfish are very easy to maintain in the classroom. Place 1 to 2″ of mud in the bottom of a 10-gal aquarium. Mud from a pond or stream is most suitable. Then fill the aquarium with 3 to 4″ of water. Water from a pond or stream works best, but if you don't have access to either of these, use tap water. Let the water sit for about 24 hours to allow the mud from the pond or stream water to settle or the chemicals in the tap water to evaporate. Place rocks or bricks in the

Figure 1 Crayfish serve as decomposers by feeding on carrion, debris, and vegetation.

aquarium, making sure their tops are nearly level with the water's surface. Crayfish like to hide, so you may want to give them extra cover by laying small clay pots on their sides in the bottom of the tank. Your crayfish will be much happier if you add some pond plants, algae, duckweed, or elodea (for oxygen). If you are not able to obtain plants, use an aerator. Then place your tank in a sunny area of your room.

Live Specimen Activities

Using live crayfish in the classroom lends itself to inquiry-based learning with cross-curricular strategies. The following activities are suggestions meant to get you started. At this point, students are not expected to know the names or functions of crayfish body parts; these definitions and concepts develop as you move through the activities and culminate with the dissection.

To make your students feel like "real scientists," give them small notebooks. An option is to have them fold sheets of paper in half and staple them together. On the outside of their notebooks have them write "Crayfish Data" or "Crayfish Observations." They should use these to record all of their data.

Allow students to observe the crayfish in the habitat you have designed. Ask them write down their observations in their notebooks.

Divide students into small groups (I usually don't divide them into groups larger than 3). Give each group of students a plastic container. Clear, plastic shoeboxes work great for this. Ask your students to add about 3″ of water to the container and then place a crayfish in each. The crayfish will begin to lift itself up on the side of the container, which allows the students to see its underside and mouthparts. They can make many observations without hand lenses, but you may want to give students the option of using them. Students can record their observations in their notebooks. **Note**: *Crayfish have chelipeds (claws), which can pinch. Caution students to keep their fingers away from the chelipeds*.

Have students draw pictures of their crayfish from the side and from the top. A great way to get students to pay attention to detail is to have them pick one appendage or section of the body and draw it. Ask them questions about the crayfish or have them develop their own questions.

How many legs does it have? How many sections does it have in its abdomen? How many appendages are found on its head? Describe the differences between these appendages. How does the crayfish swim? How does it move? What does it do if you approach it? Is the tail hinged? Does the tail curl under or over the body? What do you think a crayfish uses its big claws (chelipeds) for?

Also consider questions that cannot be answered without research or further study. For example, how does a crayfish grow? Have students find this answer in their science book or do research online (some useful resources are listed in Further Resources). Begin by probing students with a few questions and then allow them to develop their own. Encourage them to develop questions they can test. For example, do crayfish prefer light or dark? Then have students design experiments to test their questions.

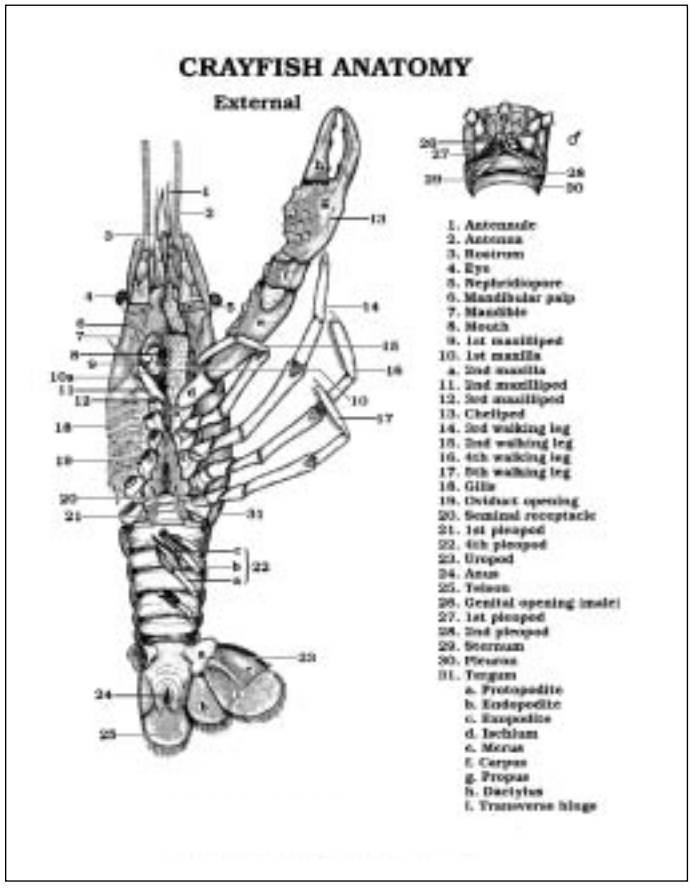

Figure 2 Crayfish External Anatomy Bioreview® Sheet (teacher version) from Carolina's Bioreview® Classroom CD-ROM (CT-39-7082).

Have students plot the movement of their crayfish on graph paper. Then give each group a small flowerpot or some other sinkable item that's large enough for the crayfish to get in. Have students plot the movement of the crayfish once again. For a third trial have students move the flowerpot from place to place in the container and record their observations. If graph paper is unavailable, students can use a plain sheet of paper to make a map of the bottom of the container. They can then chart the crayfish's movements on the map.

Allow students to feed the crayfish. Watching crayfish eat minnows is exciting for students, but there are other options. Place pieces of hotdog or crayfish food pellets in the container once every other day. Crayfish eat plants, too. Students may want to place some clover stems in with the crayfish and observe; sometimes a crayfish will seize a clover stem and feed the stem into its mouth like spaghetti. Remove any uneaten food. Students may use forceps to hold food for their crayfish to eat. However, a crayfish is very shy and is more likely to eat if the food is left undisturbed in the container. Students should always record and draw pictures of their observations.

Before setting up the following activity to study crayfish behavior, remind students again to keep their hands away from the chelipeds. Crayfish will not chase the students' hands, so they are safe from pinching as long as they keep their hands away from the chelipeds. Students should pick up the crayfish from the thorax, which is just behind the head.

Give your students 3 crayfish in separate containers and 2 small flowerpots. Before placing the crayfish together in one container, students should observe the crayfish and determine which they think will be dominant. You might have them hypothesize about what they think will happen before they introduce each successive crayfish.

Then tell students to place 2 flowerpots in the bottom of a container. They should introduce the 3 crayfish into the container one at a time, waiting one to 2 minutes before placing the next crayfish, then record their observations. Next they should remove one of the flowerpots and observe the crayfish for about 5 to 7 minutes, then record their observations.

Place the flowerpot back in the container. Have students hypothesize about what they think will happen when food is introduced into the container. Then add food, and ask students to write their observations. They should explain each of the behaviors they have seen and compare their observations with those of another group.

Crayfish Dissection

Many of you may already use crayfish in your classroom, but that interest may not carry over to dissection. However, dissection is a natural, wonderful way to allow your students to get their hands on a crayfish and see how its body parts function. Dissection is perhaps the only systematic, practical way to gain this personal, first-hand knowledge. Some teachers worry about the safety of dissection because of the use of scalpels, but this dissection is performed with scissors and does not require a dissection pan.

Getting Ready: Before students come to class, have your materials ready. For each pair of

students you will need 3 paper towels (2 if you have dissecting pans), clear adhesive tape, 2 pairs of scissors, and a preserved crayfish. Each student needs one piece of clear tape for each appendage removed. This activity suggests that students remove 9 appendages; therefore, each will need 9 pieces of tape.

The Lab Sheet: It is easy to design your own lab sheet for this activity. (See the Carolina Web site at http://www.carolina.com/life_science/crayfish.asp for a sample lab sheet and for other crayfish information.) At the top of the sheet, tell students exactly what they must do and how to remove a walking leg (covered in the next section). Then draw blocks and label them for each of the appendages: antennule, antenna, cheliped, walking leg with gill, swimmerets, compound eye, mandible, maxilla, and maxilliped. When students remove an appendage, they tape it in its labeled block. Since the crayfish has 2 or more of every appendage, each student should be able to remove the required appendages and place them on his or her own lab sheet. The last section of your lab sheet should consist of a picture of crayfish parts to label and a list of terms to define.

The Dissection: Give each pair of students one preserved crayfish and 2 lab sheets. Allow time for them to look at their crayfish and examine its external anatomy. Ask students to draw what they observe in their lab books. Drawing and labeling a picture of the ventral side of the head is a great exercise to have students observe the crayfish's mouthparts, and it also allows you to determine their understanding of what they saw. They should determine if the crayfish is male or female by observing the first 2 pairs of swimmerets. The male's swimmerets are hard and the female's are soft.

Once students have had time to observe the external anatomy, they should begin to remove the appendages. Unless you instruct them to exercise care, students tend to cut off only the tip of each appendage. As they identify and remove each appendage, remind them to carefully place the tip of their scissors as close to the crayfish's body as possible, then cut. This allows them to study the entire appendage. They then tape each part in the appropriate block on the lab sheets. Another option is to have students tape their appendages in their lab notebook and label them.

The most difficult appendages to remove are the mandible and the walking leg. The mandible can be difficult to identify and even harder to remove. Tell students to look for a very hard mouthpart that looks like sideways teeth. They should place their scissors under the mandible and carefully but forcefully pry it out.

To remove the walking leg with a gill they should first remove the carapace (the hard case or shell). On the dorsal side of the crayfish, the carapace appears to have a seam that holds it together. Students should place their scissors under the carapace and cut up the seam through the rostrum (the anterior median prolongation of the carapace). They then can lift the side of the carapace off with some effort. The pink, feathery tissues underneath are the gills. At this point I like to have students move one walking leg so they can see the movement of the gills.

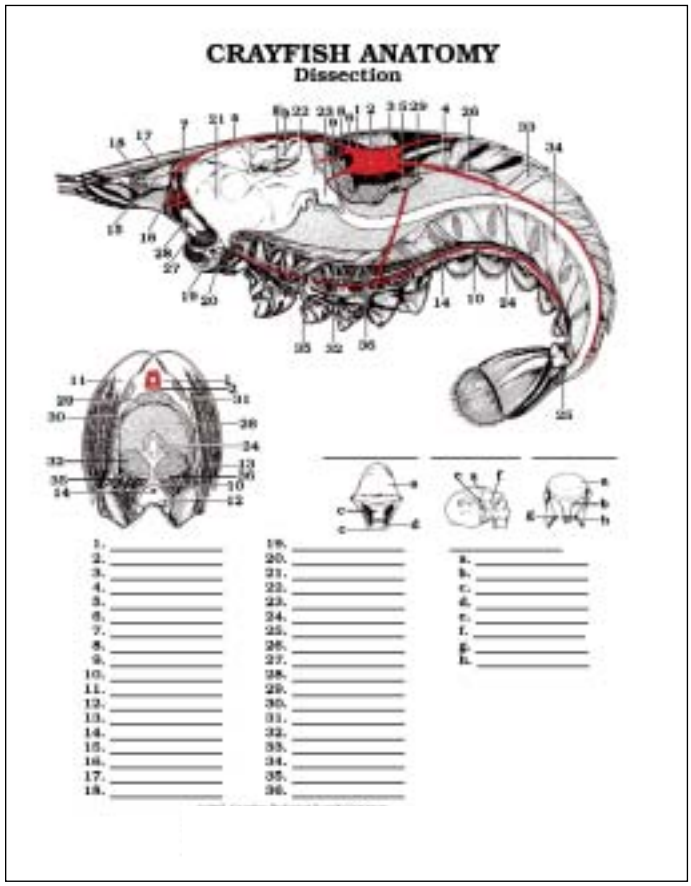

Figure 3 Crayfish Anatomy Dissection Bioreview® Sheet (student version) from Carolina's Bioreview® Classroom CD-ROM (CT-39-7082).

They should remove a walking leg with a gill attached. (I tell them they have 8 chances to get a walking leg with a gill, so they shouldn't get worried. It does require some practice, though.) As previously stated, students should tape the appendages to the lab sheet, which is a good way to determine if they correctly identified the appendages.

Other Activities

Prior to dissection, ask students to measure their crayfish. Put the data on the board and have students do stem-and-leaf plots of the class data. Send students online to find the cultural and economic importance of crayfish and then write about a particular aspect that interests them.

For younger students, a wonderful series of books that teach about crayfish and other organisms is the *Clovis Crawfish Series* by Mary Alice Fontenot. Since there are several books in the series, you may assign each group of students a different title. In each of the books, Clovis meets a new organism. Have students do research about the organism in their book and present their information to the class. Another book students may find interesting is *Crawdad Creek*, a story about the adventures of 2 children who visit a stream.

Let students have a "Crayfish Dish Day." They can prepare crayfish dishes for each other to enjoy. A good recipe book is *Jambalaya, Crawfish Pie, Filé Gumbo: Cajun and Creole Cuisine* by Todd-Michael St. Pierre. Measuring ingredients and portions allow students to practice their math skills.

Bring music into your classroom. When crayfish are mentioned, many people think of Cajun country, New Orleans. Many musicians try to capture the feel of New Orleans in their music. A great CD to use in the classroom is *Whatever Boils Your Crawfish* by Jimmy Newman.

Whatever exercises you try, your students are sure to enjoy learning about the crayfish. While helping to satisfy your students' curiosity and the National Science Education Standards, you'll have fun, too. ❖

Further Resources

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Web Sites

http://www.carolina.com/life_science/crayfish.asp

http://inbio.byu.edu/faculty/kac/crandall_lab/crayfish/crayhome.htm