Oxley Nature Center – Middle School
Title: The Amazing Structures of Macroinvertebrates at Tulsa's Oxley Nature Center
Video Title on SDE Website: Amazing Structures MS
Length: 0:05:26

Description of the Bellringer:

Ms. Donna Horton, senior staff naturalist at Tulsa's Oxley Nature Center, helps 7th grade students of Madison Middle School of Tulsa Public Schools, examine some of the specialized structures of macroinvertebrates. The students observed the gills and wings of dragonfly nymphs, as well as the breathing tubes of mosquito larvae. Tubifex worms and adult mosquito fish were also examined by the students.

In addition to serving as an example of specialized structures, this bellringer might also be used to introduce the following topics:

1) discuss the adaptations of organisms (aquatic insects) that live part of their life cycle (ex. egg and nymph) in one habitat (water) and their adult stage out of the water;
2) the dependence of these macroinvertebrates on living (plant and other animals as sources of food) and nonliving components (water, oxygen, solar energy, etc.) of their environment.

Curriculum Application

Life Science Inquiry Standards

Grade 7	Standard 2.2	Specialized structures perform specific functions.
Grade 8	Standard 3.1	Biologists use internal and external structures to classify organisms.
	Standard 3.2	Organisms have a great variety of internal and external structures that enable them to survive in specific habitats.

Additional Resources

The following website offers photo images of macroinvertebrates:
www.bgsd.k12.wa.us/hml/jr_cam/macros/amc/index.html

Additional information about aquatic organisms can be obtained through the Oklahoma Conservation Commission's **Project WET (WOW! The Wonders of Wetlands) and the Blue Thumb Program**
http://www.ok.gov/conservation/Agency_Divisions/Conservation_Programs_Division/Conservation_Education/Project_WET.html
http://www.ok.gov/conservation/Agency_Divisions/Water_Quality_Division/Blue_Thumb/

Oxley Nature Center – Middle School
Title: Animal Adaptation
Video Title on SDE Website: Bird Adaptations MS
Length: 0:08:07

Teacher Tool – Primary Focus: Grades 7 and 8

Description of the Bellringer:
The bellringer uses birds as an example of how animal adaptation helps an animal to survive in its environment. The bellringer highlights some of the internal and external structures of birds to demonstrate animal adaptation. Oklahoma's birds offer a fun and fascinating way to study animal adaptation.

Curriculum Application

Life Science Inquiry Standards

Grade 7	Standard 2.2 Specialized structures perform specific functions.
Grade 8	Standard 3.2 Organisms have a great variety of internal and external structures that enable them to survive in specific habitats.

Attachment
The attachment provides additional information about bird adaptation.

Examples of Bird Adaptation

Seed-eating Birds
Seed-eating birds often have short, cone-shaped, beaks. These strong beaks can crack open tough seeds. A few examples of seed-eating birds are the cardinal, goldfinch and species of sparrows.

Nectar-sipping Birds
Through adaptation of their wings and tongue, tiny hummingbirds are able to sip nectar from flowers while hovering over a plant. Their long, slender, tongue extends deep into a flower to reach the sugary nectar. Hummingbirds also sip sugar water in bird feeders.

Insect-eating Birds
Most birds, at some time in their life, are insect eaters. Some birds, like our state bird the scissor-tailed flycatcher, are able to catch insects in mid-air. To nab flying insects these birds must be agile flyers.

Because flying insects are not a reliable food source during Oklahoma's winter season, most insect-eating birds must migrate to a warm climate to find insects. Birds, like the scissor-tailed flycatcher and purple martin, migrate to Central and South America during the winter. Birds that spend part of the year in North America and part of the year in tropical climates are called neo-tropical birds.

Woodpeckers are another kind of insect-eating bird. Woodpeckers use their strong, pointed beaks and long, sticky, tongues to find insects in the wood of a tree. Woodpeckers have a thick skull which cushions their head as they hammer through the bark of a tree. The feet of woodpeckers are also different from most birds. Woodpeckers have two toes that are positioned forward and two back. This enables these birds to climb up and down trees as they hunt for insects.

Many insect-eating birds have fairly long, slender, legs which allow them to hop on the ground. Robins and mockingbirds eat insects that are on the ground. They also use their sharp beaks to grab earthworms.

Shorebirds are another group of birds that feed on insects and other small animals. Many species of shorebirds find snails, crustaceans, worms and aquatic insects along the shoreline of an ocean or lake, as well as in the muddy soils of a pond or marsh. Many species of shorebirds migrate great distances between their winter and summer habitats.

Birds of Prey
Hawks, eagles and owls are called birds of prey because they hunt and eat other animals. Through adaptation, these birds have keen eyesight, as well as powerful wings, legs and feet. Nighttime hunters, owls have also developed exceptional hearing so that they can locate their prey in almost total darkness. An owl's feathers have adapted so that these birds can fly without making a sound.

Fish-eating Birds

Some fish-eating birds, like egrets and herons, are called wading birds. Their long legs help them to stalk fish, frogs and crayfish in the shallow water of a marsh, pond or lake. Wading birds also have sharp bills and long necks so that they can plunge into the water to grab their prey.

Other fish-eating birds, like the American white pelican, have a large pouch that is attached to their long, slender, bill. As the pelican pokes its head into the water, the pouch opens wide, like a balloon. When the pelican closes its bill, it traps any fish that swam into the pouch.

Some birds, like loons, kingfishers, cormorants and certain species of ducks, dive into the water as they chase and catch fish. Diving ducks include mergansers, buffleheads, goldeneye, redhead and canvasback.

With its keen eyes, bald eagles are able to locate fish that are swimming near to the water's surface. Powerful wings make the eagle a swift hunter. It's sharp and strong talons are just the right tools to nab a fish from the water.

Dabbling Ducks

Some duck species, like mallard, pintail, shoveler, and teal, are called dabbling ducks. These ducks turn their bottoms-up as they feed on vegetation and aquatic animals that are in the water and mud of a pond or marsh. Dabbling ducks have bristles along the edge of their bills. They use these bristles to separate food from the water and mud that fill the duck's beak as it feeds.

Plant-eating Birds

While geese, wild turkey, and cranes will eat small animals, their primary source of food comes from plants. Many birds have a digestive system that contains a chamber called a gizzard. Inside the gizzard are small bits of sand and gravel which the bird has intentionally swallowed. Called grit, these bits of gravel help the gizzard to mash the shells and seeds that a bird has eaten. For example, a wild turkey uses its gizzard to crack open acorns, which they gobble up whole. Humans don't need a gizzard because we use our molar teeth to grind our food before swallowing.

Scavengers

Vultures are nature's sanitation department for they help to remove dead and decaying animal remains, also called carrion. Vultures have strong wings that allow them to soar great distances with little expenditure of energy. Keen eyesight allow them to spot carrion from high in the sky. While most birds do not have a developed sense of smell, turkey vultures have an excellent sense of smell which helps them to find carrion. Vultures don't have feathers on their head. This adaptation helps these birds to keep decaying material off of their heads while they are feeding. Vultures have a specialized digestive system that allows them to eat carrion without getting sick. Carrion is filled with toxins and bacteria, things that can kill other animals.

Oxley Nature Center – Middle School
Title: Birding at Oxley Nature Center
Video Title on SDE Website: Birding at Oxley MS
Length: 0:04:18

Teacher Tool – Primary Focus: Grades 6 through 8

Description of the Bellringer:

With instruction from Ms. Donna Horton, senior staff naturalist at Tulsa's Oxley Nature Center, 7th grade students of Madison Middle School of Tulsa Public Schools, learn how to adjust the eyepieces (oculars) of binoculars in order to observe birds. Ms. Horton then leads the students on a springtime bird walk. She notes that sometimes bird watchers have to look to the tops of tall trees in order to spot a bird. Ms. Horton also suggests that when a bird is seen, it's fun to try and tell what the bird is doing. The bellringer concludes with the invitation to everyone to look for birds in city and state parks, as well as in our neighborhoods. For many, bird watching is the spark that prompts a desire to explore Nature.

Curriculum Application

Science Process Standards

Grades 6 through 8	Standard 1	Observe organisms
	Standard 4.1	Report data using data tables and/or graphs
	Standard 4.3	Evaluate data to develop explanations for the some of the reasons why the number of birds of particular species may have greatly varied from one year to another (i.e. Tulsa's weather conditions on the days of the Bird Counts).

Life Science Inquiry Standards

Grade 6	Standard 4.1	Organisms within an ecosystem are dependent on one another and on nonliving components of the environment.
Grade 7	Standard 4.2	Living organisms have physical responses to external stimuli (migration).

Birding at Oxley Cont'd.

Resource for Classroom Discussion and Graphing
Attached is an abbreviated summary of Christmas Bird Counts that were conducted by members of the Tulsa Audubon Society at Mohawk Park, which contains Oxley Nature Center. The complete Christmas Bird Count can be found on the Tulsa Audubon Society's website. These bird counts might be used for a classroom activity involving the **graphing of this data** (counts by bird species over time). These bird counts were conducted in much the same manner as the Madison Middle School's bird walk.

These Christmas Bird Counts might also be used to discuss the fact that many birds are not permanent residents of Oklahoma. Classroom discussion might focus on the reasons why many species of birds migrate during certain seasons of the year (ex. birds seek those habitats that have needed food, shelter, etc.).

The following websites provide information about bird population surveys and bird migration.

Bird Population Surveys

Tulsa Audubon Society: www.tulsaaudubon.org/birding.htm

Oklahoma Department of Wildlife Conservation – Non-Game Program
www.wildlifedepartment.com/amateurbiologists.htm

North American Breeding Bird Survey
http://www.pwrc.usgs.gov/bbs

Audubon – Christmas Bird Count
www.audubon.org/bird/cbc/getinvolved.html

Great Backyard Bird Count
http://birdsource.org/gbbc/

Project Feeder Watch
www.birds.cornell.edu/pfw

Bird Migration Information

Shorebird Migration: www.whsrn.org/western-hemisphere-shorebird-reserve-network, Migration Maps.

The Cornell University Lab of Ornithology, http://www.birds.cornell.edu

Audubon Society – Conservation Programs http://conservation.audubon.org

U.S. Fish and Wildlife Service – Endangered Species Program http://www.fws.gov/endangered

Partial Results of the Christmas Bird Count at Tulsa's Mohawk Park
As Reported By Members of the Tulsa Audubon Society

Bird Species	Year				
	2004	2005	2007	2008	2009
Canada Goose	157	254	382	112	345
Mallard Duck	217	172	373	142	386
Hooded Merganser	10	55	37	8	9
Great Blue Heron	0	14	4	7	5
Red-shouldered Hawk	6	11	1	0	6
Red-tailed Hawk	6	4	2	2	1
Ring-billed Gull	45	73	224	147	25
Red-headed Woodpecker	23	2	5	0	4
Downy Woodpecker	2	41	2	14	9
Red-bellied Woodpecker	0	28	7	5	7
Blue Jay	51	13	12	2	8
American Crow	84	54	21	15	14
Carolina Wren	2	38	3	6	4
American Robin	23	329	34	0	0
Swamp Sparrow	15	25	20	0	5
Dark-eyed Junco	86	132	186	84	55
Northern Cardinal	65	60	26	0	34
American Goldfinch	35	7	5	12	12
Eastern Bluebird	0	19	7	4	12
Northern Mockingbird	4	6	3	7	2

Oxley Nature Center – Middle School
Title: Use of Controlled Fire to Help a Prairie Habitat at Oxley Nature Center
Video Title on SDE Website: Use of Fire MS
Length: 0:02:29

Description of the Bellringer:
This bellringer talks about the difference between wildfire which can be deadly and cause great damage, and controlled fires, which are intentionally set by biologists and others.

Ms. Donna Horton, senior staff naturalist at Tulsa's Oxley Nature Center, discusses the use and benefits of controlled fire with 7th grade students of Madison Middle School of Tulsa Public Schools.

This bellringer might be used to introduce the idea that plants with similar needs are in competition with each other. For example, not only are prairie plants competing with each other for nutrients, water, soil, space and sunlight, as well, they are in competition with forest plants, such as trees and shrubs. Without occasional prairie fire, trees and shrubs will eventually crowd-out prairie plants (ex. as trees get taller their shade covers prairie plants. Prairie plants need lots of sunlight to survive.) Prairie plants have specialized structures, such as deep roots, which aren't harmed by most prairie fires. A final point might be made that as prairie plants are crowded out by trees and shrubs, certain animals that only live in prairies lose their habitat/home. These animals must then either re-locate to another prairie habitat, or die. These animals are dependent upon a prairie habitat. Prior to pioneer settlement much of present-day Oklahoma was a prairie ecosystem. Today most of this prairie ecosystem has been changed to farmland, towns and cities, roads and highways. As well, with the control of prairie fire, forests of redcedar and other trees now grow where there was once prairie grass. The final, and most important point of this bellringer, is that controlled fire **is not** wildfire. Controlled fires are set by biologists and others who are knowledgeable about how to manage such a fire so that it doesn't harm the environment or become a deadly wildfire. Only these trained people should start a controlled fire; the rest of us should never, ever, start a fire.

Curriculum Application

Life Science Inquiry Standards

Grade 6	Standard 4.1	Organisms within an ecosystem are dependent upon another.
	Standard 4.2	Organisms compete with similar needs compete with one another for food, space, water, air, sunlight.
Grade 7	Standard 2.2	Organisms have specialized structures that perform specific functions.
Grade 8	Standard 3.2	Organisms have a great variety of structures that enable them to survive in specific habitats.

Additional Information on the Use of Controlled Fire:
www.forestry.ok.gov

Oxley Nature Center – Middle School
Title: Using Observation to Study Macroinvertebrates at Tulsa's Oxley Nature Center
Video Title on SDE Website: Using Observation MS
Length: 0:05:11

Teacher Tools – Primary Focus: Grades 6 through 8

Description of the Bellringer:
Led by Ms. Donna Horton, senior staff naturalist at Tulsa's Oxley Nature Center, 7th grade students of Madison Middle School of Tulsa Public Schools learn how to use some tools in studying macroinvertebrates. With the help of Ms. Horton, the student's teacher, Mr. Martinez, and Ms. Adrienne Elder, Science Curriculum Specialist for Tulsa Public Schools, the students learn to use pipettes and eye droppers to transfer the macroinvertebrates to discovery scopes and magnification boxes.

Ms. Horton introduces the idea of using a dichotomous key to identify organisms that appear very much alike.

Curriculum Application

Science Process Standards

Grades 6 through 8	Standard 1	Use tools to observe organisms.
	Standard 2.1	Use dichotomous keys to classify organisms.

Life Science Inquiry Standards

Grade 7	Standard 2.2	Organisms have specialized structures (aquatic animals that have gills or breathing tubes; flying insects have wings).
Grade 8	Standard 3.1	Organisms are classified based upon internal and external structures (ex. macro-invertebrates don't have a backbone.)

Attachment:
Attached is a copy of the dichotomous key that was used by the Madison Middle School students during this activity. This key can be reproduced for classroom use.

It should be noted that there are many kinds of dichotomous keys. Such specific keys are useful in identifying wildlife and plant species.

Using Observation to Study Macroinvertebrates Cont'd.

Additional Classroom Activities in Studying Macroinvertebrates

Use of Metric Measurement
As students observe and classify macroinvertebrates, they might also use a metric ruler to measure the size of these aquatic animals. Attached is a data sheet that could be used for recording this data.

Tolerant and Intolerant Aquatic Species
Students might be reminded that certain aquatic species are very **intolerant** of poor quality water, while other species are **tolerant** of polluted water conditions. Thus the presence, or absence, of particular aquatic species can be an indicator of water quality.

The attached sheet provides a listing of aquatic species, based upon their level of tolerance of poor quality water.

Recording and Analyzing Data
Using the recorded data of the observed macroinvertebrates, students might organize this information into tables and/or graphs. The data might be organized so that students can identify the most and least common macroinvertebrate species that were collected. If the water samples came from different locations, the findings of each aquatic habitat can be compared. If samples were taken from the same aquatic habitat, but on different days, this could offer another way to compare the results of the findings.

In evaluating these results, students might be asked to develop a reasonable explanation for their findings. They may also be asked if there is sufficient evidence on which to base a conclusion about the water quality of the aquatic habitat(s) that were studied. If the findings aren't conclusive, students might be asked to design an appropriate experiment to obtain needed data.

Use of Outdoor Resources in Studying Macroinvertebrates

City parks, Oklahoma State Parks, national wildlife refuges, and national parks, Quartz Mountain Nature Park, educational facilities of the Okla. Dept. of Wildlife Conservation, and nature preserves like Tulsa's Oxley Nature Center, Rogers County Conservation Education Reserve in Claremore and Oklahoma City's Martin Park are all great places for student field trips. If your school isn't able to travel to such places, you might see if there is a creek or pond near to your school. If so, a short trip to such an aquatic habitat might be a good way to introduce your students to examples of aquatic life that can be found in even the smallest water body. If a student field trip isn't possible, before class the educator might collect a small amount of water from one of these aquatic habitats for classroom use. The best time to collect macroinvertebrates is during the springtime, late summer or early fall when the water is warm.

While a small dip net is a good way to catch macroinvertebrates, there are also some other techniques that work. One way is to simply dip a small tupperware container into shallow water of a creek where some aquatic vegetation is present. Macroinvertebrates are often found near aquatic vegetation which provides them with food and cover. Pour this creek water into a larger, clear, container that has a lid. If macroinvertebrates are in the water sample you will be able to see them moving around.

You may be astounded at how many examples of aquatic life you capture by obtaining a liter or so of creek water. In the classroom use such inexpensive magnification tools as acrylic bug boxes or hand lenses for students to observe these fascinating creatures. Once the classroom activity is completed, be sure to promptly return these organisms back to their original aquatic habitat. All creatures that are used for study are to be treated with care and respect.

Additional Resources

Blue Thumb www.ok.gov/conservation/Agency_Divisions/Water_Quality_Division/Blue_Thumb/

Project WET (WOW! The Wonders of Wetlands)
http://www.ok.gov/conservation/Agency_Divisions/Conservation_Programs_Division/Conservation_Education/Project_WET.html

Project WILD Aquatic okprojectwild@fullnet.net

Images of Benthic Macroinvertebrates
www.bgsd.k12.wa.us/hml/jr_cam/macros/amc/index.html

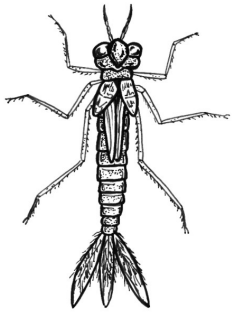
Dichotomous Key

Thorax (body part that is behind the head) has easily observable segmented legs;
(the insect has 3 pairs of legs) and no shell.
Possibilities: larva of mayfly, damselfly, dragonfly, dobsonfly, caddisfly, cranefly, or whirligig beetle

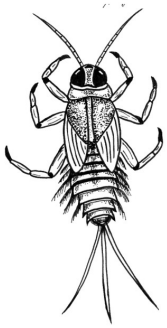
Abdomen (body part that is behind the thorax)

1. **has 3 tail-like structures** (mayfly or damselfly larva) **OR** 2. **has 1,2 or no tail-like structures** (dragonfly, dobsonfly, caddisfly, cranefly or whirligig beetle larva)

1.A **has feathery tails** (gills) and round eyes **OR** 1.B **has hair-like tails** and **gills** on the **sides of its abdomen**



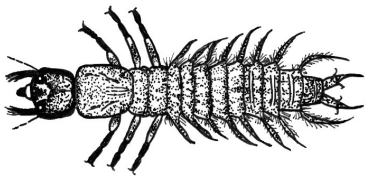
Damselfly larva



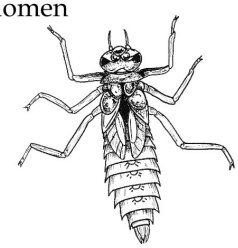
Mayfly larva

2.A **has** a large head **OR** 2.B **doesn't have** a large head

2.A.i **has** 8 pairs of spurs along the sides of its abdomen **OR** 2.A.ii **doesn't have** spurs along its abdomen



Dobsonfly larva



Dragonfly larva

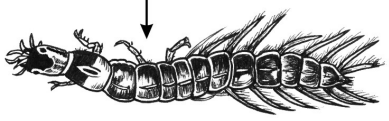
2.B **doesn't** have a large head

2.B.i head is **small,** but viewable **OR** 2.B.ii head **isn't easily viewable** (retracted into the thorax)

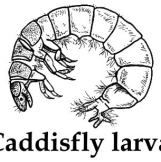
Cranefly larva

2.B.i.a has **feathery projections** along its abdomen

2.B.i.b **doesn't have** projections along its abdomen



Whirligig beetle larva



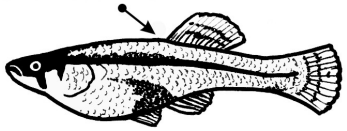
Caddisfly larva

Aquatic Animals that don't have easily observable segmented legs. None of them have a shell.

1. **Swims** in the water. **OR** 2. **Doesn't swim** in the water.

1.A **Whips tail** to move **OR** 1.B **Doesn't whip** tail to move

1.A.i **Has fins** **OR** 1.A.ii **Doesn't have** fins

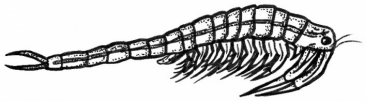


Mosquito fish

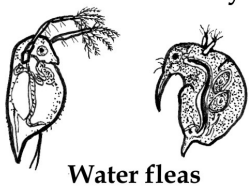
Tadpole

1.B **Swims, has tiny, feathery legs**

1.B.i **Has slender body** 1.B.ii **Has rounded body**



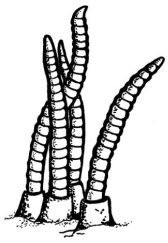
Fairy shrimp



Water fleas

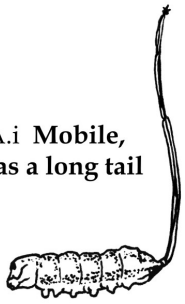
2. **Doesn't swim, shaped like a worm**

2.A **Mobile** **OR** 2.B **isn't mobile**



Tubifex worms

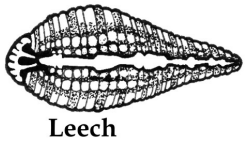
2.A.i **Mobile, has a long tail** **OR** 2.A.ii **Mobile, no tail or short tail**



Rat-tail maggot

Mobile, no tail or short tail

2.A.ii.a **Flattened body** **OR** 2.A.ii.b **Cylindrical shaped body**



Leech

Cylindrical body

2.A.ii.b* **No** breathing tube, tiny legs **OR** 2.A.ii.b** **Has** a breathing tube at end of body

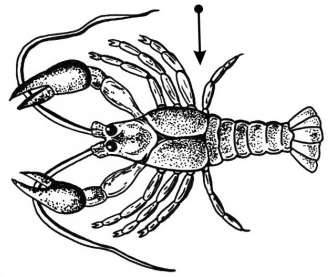
Midgefly larva

Mosquito larva

Animals That Have Shells or Carapace

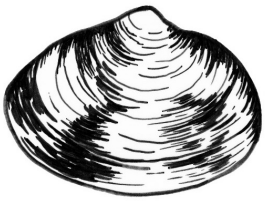
1. **Shell covers entire body**

2. **Shell doesn't cover entire body**



Crayfish

1.A Shell is **oval-shaped**



Fingernail clam

1.B Shell is **peanut-shaped.**

Lung snail

Aquatic Animals That Can Serve As Indicators of Water Quality

Group One: Organisms that are sensitive, or intolerant, to pollution. Only found in good quality water.
Nymphs/Larva of: Mayfly, Dobsonfly, Caddisfly, Stonefly, Hellgrammites
Gilled snail (with the shell opening facing you, the shell opens to the right; this snail obtains oxygen that is dissolved in the water.)
Freshwater Clam (bivalves)

Group Two: Organisms that are tolerant of good or fair quality water.
Crayfish
Aquatic Sow bug
Nymphs/Larva of: Dragonfly, Damselfly, Cranefly
Scud

Group Three: Organisms that are tolerant, or aren't sensitive, to pollution and can be found in poor quality water.
Larva of: mosquito, midgefly, blackfly, horsefly
Rat tail maggot
Aquatic worm, bloodworm
Pond snail (with the shell opening facing you, the shell opens to the left; this snail obtains oxygen from the air.)
Leech

Importance of a Diversity of Aquatic Species as Water Quality Indicator

A creek or pond that has good quality water will often have many different species of aquatic animals.

Water that is polluted generally has just a few species of aquatic animals.

Species diversity is an indicator of good quality water.

Data Sheet for Aquatic Organisms

Date that Sample was Collected _____

Location Where Sample was Taken (name of creek, town)

_____

Name of Collector _____

Species Information (separate entry for each organism)

Name of Organism (Species)	Length of the Aquatic Organism (mm)