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Grade Level
Middle School (6-8)

Duration
Six to eight weeks, if species
are raised simultaneously,
longer, if raised separately

Subject Area
Inquiry
Life Science
Environmental Science

Materials List

Mosquito –

- Mosquito kit
- Hand lens
- Microscope
- Deep-well slides
- Hand lens
- Metric ruler

Earthworms –

- Earthworm bin with
earthworms
- Hand lens
- Metric ruler
- Petri dish or lid
- Paper towels
- Toothpick

Paddlefish –

- Video – *The Paddlefish:
An American Treasure*
- Paddlefish eggs
- Paddlefish aquarium
- Incubation jar
- Petri dish or clear container
- Hand lens
- Microscope
- Metric ruler

Note: Only classrooms engaged
in the Native Fish in the Classroom
project will have access to
paddlefish eggs.

**Grade/Benchmark/GLE
Science**

7/LS-M-A3/5,6

SE-M-A7

6,7,8/SI-M-A2/4

6,7,8/SI-M-A3/7,8

6,7,8/SI-M-A4/10,12,13

6,7,8/SI-M-B2/28

9/SI-H-A4/7

LS-H-C6

BM = Blackline Master

Life Cycles of the Wet and Wiggly



1 of 8

Focus/Overview:

Three different species of living things will be raised in the classroom. Students will observe and compare the life cycles of each while seeing first-hand the development from egg to adult.

Background Information:

Real-life experiences in the classroom provide students with unique and interesting learning situations. One way to make these experiences available is to raise organisms in the classroom so students can observe the different stages in the life cycle of the organism.

Three organisms that have different developmental stages and can be raised in the classroom are mosquitoes, earthworms and paddlefish.

Mosquitoes:

Mosquitoes complete their life cycle relatively quickly. It takes about a month to complete, depending on the availability of water, the temperature and the species of mosquito.

Egg – When the weather is warm, mosquito eggs will hatch and develop into larvae within two to three days. Some species can hatch within hours, while others can take up to a week. If the eggs are not exposed to water, they can remain in a dormant state for several years.

Larvae – Live immersed in water for seven to 14 days – as few as four days.

Pupa – Live near the surface of water for two to three days.

Adult – Varies depending on species – at least one month.

Different species go through the life cycle at different rates, depending on the temperature. Some complete the cycle within a week, and some take as long as a month. The adults of some species die within a month while other species can survive through the winter and breed when the temperature turns warmer.

The mosquito life cycle includes a complete metamorphosis from egg to larva to pupa to adult. Eggs can be laid individually or in rafts and are usually laid directly on the water's surface or on a solid structure that is close to water. The eggs are whitish or yellowish when laid and will later turn brown.



Larvae that hatch from eggs must live in water and breathe air through a tube on their bodies extended above the surface of the water. Because of their constant activity in the water, they are sometimes called wigglers. Larvae are filter feeders, eating bits of algae, organic matter or each other.

The pupae, also called tumblers, are comma-shaped with large heads. They live near the surface of the water and breathe through tubes on their backs called siphons.

After a few days, the skin on the pupa splits and the adult mosquito emerges. Female adult mosquitos need blood to reproduce and are the only ones that bite.

Earthworms:

Earthworms are ready to reproduce when they are about 6 weeks old. Each worm has both male and female reproductive organs. When worms are ready to mate, two worms join together by mucus from the clitella, and sperm is passed from one worm to the other and stored in sacs. Then a cocoon forms on each clitella and the worms back out of the cocoons as they harden. Eggs and sperm are deposited in each cocoon, and the cocoon closes at both ends.

Cocoons are smaller than a grain of rice and are lemon-shaped. As the worms develop inside, the cocoon changes color from pearly white to almost yellow and then to light brown. When the worms are ready to hatch, the cocoon will be reddish in color. Cocoons can stay dormant for years if the physical conditions are not right for hatching, but, under normal conditions, it will hatch in two to three weeks. The hatchlings that emerge are whitish in color and are about 1.25 to 2.5 cm (0.5 to 1 in).

Paddlefish:

Compared to most fish, paddlefish mature late in life. Males usually reach sexual maturity in seven to nine years, and females usually mature in 10 to 12 years. Males can spawn every year after reaching sexual maturity, but females need two or more years to produce more eggs. A large female can produce approximately 1 million eggs. These eggs are not contained in an ovary, but instead are enclosed in a thin membrane within the body cavity.

Paddlefish are broadcast spawners and require specific conditions for spawning. Eggs must be laid in a body of water with a good current and water temperatures near 13°C (60°F). Females usually release their eggs and males release their milt (sperm) over a clean gravel bar or other hard substrate. When fertilization occurs, the eggs become sticky so they will adhere to the gravel bars. The current keeps the eggs oxygenated and prevents them from being covered with silt and debris.

Egg (embryo) – After fertilization, the development of the notochord can be seen in about 24 hours, bringing the embryo into the larval stage. A notochord is a longitudinal flexible rod which provides internal support and is located between the gut and nerve cord in chordate (backboned) embryos. The notochord is visible on the developing paddlefish embryo. Eggs will usually take five to seven days to hatch.



Larval fry – When hatchlings emerge from the egg, they are called fry or sac fry. The young have a yolk sac — a round sac on the belly — which supplies food. After a few days, the yolk sac is absorbed and the fry feed first on small insects and later on zooplankton. The rostrum begins growing shortly after birth and will make up approximately one-third of the fish’s total length.

Fingerlings – Fry become fingerlings when they reach about 2.5 to 5 cm (1 to 2 in) in length.

Adult – Mature adults can grow in excess of 91 kg (200 lbs) and over 2 m (7ft) in length. Paddlefish have been known to live 30+ years or longer.

Learning Objectives:

Students will:

- Observe and describe the life cycle of three different species —mosquitoes, earthworms and paddlefish.
- Identify the stages of metamorphosis.
- Compare and contrast the life cycles of mosquitoes, earthworms and paddlefish.

Procedure:

Follow mosquito life cycle

Mosquito kits can be obtained from East Baton Rouge Parish Mosquito Abatement and Rodent Control District No. 1. (See resources for ordering details.)

1. Students observe mosquito eggs using a hand lens or a microscope. Students draw the mosquito egg and write their observations in a journal.
2. Read and follow mosquito kit directions. Speed up the process of hatching the eggs by placing some of the eggs into a test tube, sealing it and placing it into your pocket for a few minutes. The heat from your body will cause the eggs to hatch more quickly. After viewing, the newly hatched larvae can be added to the container.
3. Discuss the four stages of metamorphosis in the life cycle of a mosquito. Explain that mosquitoes go through a complete metamorphosis: egg, larva, pupa and adult.
4. Once the eggs have hatched, place mosquito larvae on a deep-well slide and cover with a coverslip. Place the slide in a refrigerator for a few minutes to slow down the movement of the larvae. This will allow for easier observation.
5. Place the slide under a microscope. If equipment is available, the microscope can be connected to a TV for entire class viewing.
6. Students should draw the larvae and make observations in a journal. Using a centimeter ruler, measure the length of the larvae. Include data in the observations.
7. Repeat these procedures until mosquitoes have completed the life cycle and students have observed all stages during metamorphosis.
8. Using the data, determine the length of time for each stage of metamorphosis.

Assessment:

- Students name and draw the four stages of mosquito metamorphosis.
- Student journals may also be used for assessment.



Extension:

- Students can compare and contrast the stages of mosquito metamorphosis with the metamorphic stages of other insects.

Follow earthworm life cycle

Safety Note: Students should wash hands before and after working around worm bins.

1. Set up an earthworm bin in the classroom. There are many Web sites and books available with information on different types of bins that are easy to set up for a relatively low cost. (See resources.) Choose a bin that is right for your classroom situation.
2. Students investigate the life cycle of the earthworm using the Web site *The Adventures of Herman* (<http://www.urbanext.uiuc.edu/worms/>).
Students should use the information to complete the Earthworm Life Cycle Sequence.
3. Once the bin has been set up, students observe the worms using a hand lens. Worms can be carefully placed on a damp paper towel for viewing. A toothpick can be used as a tool to gently move and guide the worm. Students draw the earthworm and make observations in a journal. Using a centimeter ruler, students measure the length of the worm. Include data in the observations.
4. Continue to make frequent observations of the worm bin. When cocoons are found, they can be removed from the bin to hatch. Cocoons are about the size of a small grain of rice lid, which has been lined with moistened paper toweling. Cover the cocoons with more container to block light and keep in the moisture.
5. Students can make daily observations using a hand lens. The cocoons will change in color from pearly white to light brown as the baby worms develop. Before hatchlings emerge, the cocoons turn reddish in color. After the worms hatch, measure the length of each baby worm and record data in a journal. After hatching, carefully return hatchlings and cocoons to the bin.

Assessment:

- Students name and draw the steps of the earthworm life cycle in sequence.
- Student journals may also be used for assessment.



Follow paddlefish life cycle

Safety Note: Students should wash hands before and after working around paddlefish eggs and fry.

Classrooms that are involved in the Native Fish in the Classroom program are able to obtain paddlefish eggs. Teachers are trained and given the necessary equipment to hatch eggs and raise paddlefish in the classroom.

1. View the video *The Paddlefish: An American Treasure* (or another similar video containing information about the life cycle of the paddlefish). Discuss the stages in the life cycle of a paddlefish: egg (embryo to larva), fry (larval paddlefish, also called sac fry), fingerling and adult.
2. Carefully place a few paddlefish eggs and some water from the incubation jar in a container, such as a petri dish. Allow students to observe the eggs using a hand lens. Have students draw the egg and write their observations in a dated journal. Eggs can also be placed under a microscope for a short amount of time for viewing. Be careful that the eggs do not become overheated. If equipment is available, the microscope can be connected to a TV for entire class viewing. After viewing, return eggs to the incubation jar.
3. Continue to make daily observations of the paddlefish eggs. Eggs should hatch in five to seven days. As the baby paddlefish develops in the egg, movement can be detected, and students may be able to observe the fish turning “flips” inside of the egg. Have students continue to draw the changes they observe and write their observations in a journal.
4. After the eggs have hatched, carefully transfer a few fry and some water from the aquarium to a container, such as a petri dish. Smaller containers are best, as the fry are very active. Allow students to observe the fry using a hand lens. Have students draw the fry and write their observations in a journal. Fry can also be placed under a flex cam for a short amount of time for viewing.
5. Measure the length of fry by placing a centimeter ruler under the container. Measurements can be made when the fry swim over the ruler. Include data in the observations. After viewing, return fry to the aquarium.
6. Continue to make frequent observations of the fry. Record changes in the fry as they grow and develop into fingerlings.

Assessment:

- Students draw and label the stages in the paddlefish life cycle.
- Student journals may also be used for assessment.



Bringing it all together

1. After students have observed the development of mosquitoes, earthworms and paddlefish, discuss the differences and similarities in the life cycles. Students complete a Venn diagram showing the comparisons. (See resources.)
2. Students calculate the length of time from egg to adult for each species. Graph the results. Discuss possible reasons for differences in the length of time for development for each species.
3. Students calculate the length of time to grow for eggs to hatch for each species. Graph results. Discuss possible reasons for differences in the length of time.
4. Students use their journal drawings to compare and contrast the developmental differences of each species as the organisms go through each developmental stage. Discuss the following:
 - Which species changed the most, and which species changed the least in appearance?
 - Which species grew the most, and which species grew the least from egg to adult?
 - Which species most resembles the adult after hatching?

Extensions:

- Students can compare and contrast the life cycle stages of the paddlefish with other species of fish.
- Students can research and compare the life spans of each species.
- Students can research and compare the survival rate of the hatchling for each species.



TEACHER REFERENCES:

Publications

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Helpful book on how to set up and maintain a worm composting system.
- Camacho, C.S., L.C. Edwards and M.L. Nabors. 2002. "The Dirt on Worms," *Science & Children*, (40:42-46).
Article about a classroom's earthworm study.
- Dickerson, George. 1999, *Vermicomposting*. College of Agriculture and Home Economics, New Mexico State University: guide H-164. Available at http://www.cahe.nmsu.edu/pubs/_h/h-164.pdf or http://www.cahe.nmsu.edu/pubs/_h/h-164.html.
PDF of information on setting up worm bins and bedding types.
- Integrated Waste Management Board. November 5, 2003. *The Worm Guide: A Vermicomposting Guide for Teachers*. Available at <http://www.ciwmb.ca.gov/schools/Curriculum/Worms/default.htm>.
PDF files with classroom activities on how to make a worm bin and bedding types.
- Mims, Steven.D., William L. Shelton, Forrest S. Wynne and Richard J. Onders. 1999. *Production of Paddlefish*. Southern Regional Aquaculture Center Publication # 437.
Good information about the production of paddlefish.
- Sutherland, Donald J. and Wayne J. Crans. *Mosquitoes in Your Life*. New Jersey Agriculture Experiment Station publication # SA220-5M-86.
Available at <http://www-rci.rutgers.edu/~insects/moslif.htm>.
Life stage of three different species of mosquitoes – Anopheles, Aede and Culex.
- Vaughan, R. 2000. *Mosquitoes: Their Place On the Planet*. SeaScope Aquatic Activities. Louisiana Sea Grant College Program: Baton Rouge, LA.
Mosquito unit designed for use with Scope-on-a-Rope. To order, call (225) 578-6448, or email jsche15@lsu.edu.

Internet sources

- Enchanted Learning. *Mosquito Life Cycle*.
<http://www.enchantedlearning.com/subjects/insects/mosquito/lifecycle.shtml>.
Accessed July 14, 2004.
Visuals showing the life cycle of the mosquito.
- Louisiana Mosquito Control Association. <http://www.lmca.us/education/education.htm>.
Accessed July 14, 2004.
Education page with activities and games using information about mosquitoes. Includes a slide show with photographs and information about the stages in the mosquito life cycle.
- Schools of California Online Resources for Education. *Venn Diagram*.
<http://www.sdcoe.k12.ca.us/score/actbank/tvenn.htm>. Accessed June 14, 2004.
Describes a Venn diagram and how to use one.
- Upper Midwest Environmental Sciences Center. *Paddlefish Study Project*.
<http://www.umesc.usgs.gov/aquatic/fish/paddlefish/main.html>. Accessed June 14, 2004.
Information for restoring depleted paddlefish populations. Also has a paddlefish video that can be downloaded for viewing.



Urban Programs Resource Network. *The Adventures of Herman*. <http://www.urbanext.uiuc.edu/worms/>.
Accessed June 14, 2004.
Site designed to introduce students to worms.

Mosquito kits can be obtained from:

East Baton Rouge Parish Mosquito Abatement and Rodent Control District No. 1
2829 Gen. Ben Davis Jr. Ave.
Metro Airport
Baton Rouge, LA 70807
Phone (225) 356-3297