

Aquatic Insect Life Cycles

Adapted from: An original Creek Connections activity.
Creek Connections, Box 10, Allegheny College, Meadville, Pennsylvania 16335.

Grade Level: Basic or intermediate.

Duration: 50 minutes

Setting: classroom

Summary: Student will conduct background academic research on different aquatic insects.

Objectives: Discover that there is a great diversity of aquatic insects each with unique identification characteristics, behaviors, habitat needs, and ecosystem roles.

Vocabulary: metamorphosis, complete metamorphosis, incomplete metamorphosis

Related Module Resources:

- Book resources

Materials (Included in Module):

- Aquatic Insect Life Cycle Photo Quiz transparencies
- Life Cycle Fact Sheets and transparency
- Dragonfly Life Cycle Plastomount
- Mosquito Life Cycle Plastomount
- Connect Four or Three Game Board
- Life Cycle Stages Game Pieces
- Aquatic Insect Fact Sheets for individual bugs
- Aquatic Insect Life Cycle Worksheet
- Mosquito Life Cycle transparency

Additional Materials (NOT Included in Module):

- Toddler picture of teacher
- Overhead projector
- Internet (optional)

ACADEMIC STANDARDS (ENVIRONMENT AND ECOLOGY)

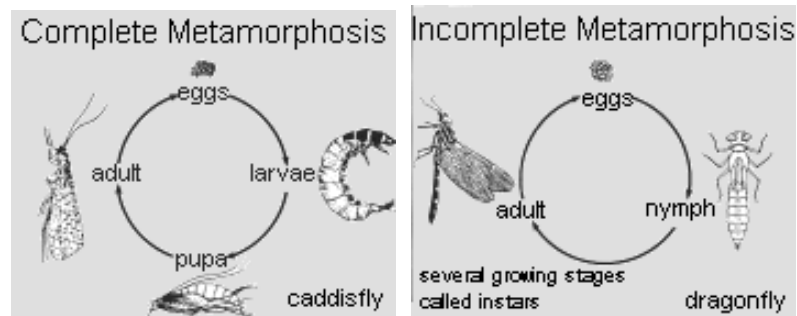
7th Grade

- 4.1.7.C. Explain the effects of water on the life of organisms in a watershed.
- Describe the life cycle of organisms that depend on water.
 - Identify organisms that have aquatic stages of life and describe those stages.
- 4.6.7.B. Explain the concepts of cycles.
- Identify and explain cycles within an ecosystem.
 - Analyze the role of different cycles within an ecosystem.

BACKGROUND:

It is estimated that 7% of the 91,000+ North American insects are aquatic or semi-aquatic. In every part and type of waterway, these organisms can be found. Aquatic insects are a varied group, but they all have one thing in common – at one stage during their life cycle, they rely on water.

The majority of aquatic macroinvertebrates that inhabit waterways are simply the juvenile form of an adult, land-dwelling insect. Many aquatic insects start life off underwater. Because their immature aquatic bodies are specially suited for life underwater, they often do not resemble their land-dwelling, adult body. Before the juvenile aquatic insect can leave its original aquatic home, it must undergo several physical changes to prepare itself for life on land. This change in physical appearance is called **metamorphosis**. The extent of change that the aquatic organism undergoes varies from organism to organism. There are two types of metamorphosis: *complete* metamorphosis and *incomplete* metamorphosis.



Almost 90% of the insects that undergo metamorphosis undergo **complete metamorphosis**. Complete metamorphosis consists of four stages. The organism begins as an *egg*, then is hatched a *larvae*, (often resembles little of mature adult), which gradually matures into a *pupa*, which then enwraps itself into a cocoon, where it finally transforms into the adult land-dwelling insect. Larvae usually do not look anything like the adult form of the insect. Many larvae are shaped like worms and have soft bodies. Some don't even have their 3 pair of legs. But all will eventually become different looking adults with wings that fly away, reproduce and lay eggs to start the life cycle all over again. Examples of aquatic insects that undergo complete metamorphosis include a caddisfly, dobsonfly, crane fly, mosquito, midge, and many beetles.

Incomplete metamorphosis has only three main stages of development. The insect again begins as an egg, which is hatched producing a nymph. Nymphs are a miniature version of the adult form, often looking somewhat similar to the adult. You can even see wing pads or the beginning of wings on their backs usually. They are sexually immature, and grow larger through a series of molts until they reach full size and develop wings from their wing pads. With full size and wings, they emerge from the waterways as adults. Examples of aquatic insects that undergo incomplete metamorphosis include a mayfly, stonefly, dragonfly, and damselfly.

The ecological requirements and associated body and behavioral adaptations of different stages of aquatic insects are quite varied. Even the location of where these stages take place, whether in the water or on land or on a plant right above the water, can differ between insects. Therefore, knowledge of life cycles and stages is important when studying aquatic life.

OVERVIEW:

Students will participate in a hands-on game about aquatic insect life cycles, learning the stages of both incomplete and complete metamorphosis.

PROCEDURE: Warm Up Activity: Changes Through Time

Teacher Preparation:

1. Find pictures of yourself as a toddler that you will share with your students.
2. Find the aquatic insect life cycle photos quiz (on transparency) and obtain an overhead projector.

Student Activity:

1. Show students the pictures. Ask them who they think it is? Reveal that it is you and ask the students to quit laughing.
2. Ask the students if you look any different today as compared to the picture? Have you CHANGED any? Indicate that you looked different in as a juvenile as compared to adult. Do most people look different between adult and juvenile? Do some animals look different between juvenile and adult phase? Do insects?

3. Now show only the adult on one of the aquatic insect adult/juvenile photos quiz overhead. Then reveal the four choices of this insect's juvenile phase and ask students to guess which is the correct juvenile of the shown adult. Provide answer. Do this with some of the other aquatic insect adult/juvenile photo sheets. A few preserved specimens of the same aquatic insect larva could be handed out and the students guess which adult choices shown on a transparency goes with the larva.
4. Do the juveniles look anything like the adult? Not in most cases. The insects go through changes in their body and body function prior to becoming an adult. These changes are called **metamorphosis**. Some students might have learned about metamorphosis before, maybe learning about some land-dwelling insects, like butterflies. This is the same thing. That butterfly went through changes in their body - metamorphosis.
5. [DISTRIBUTE LIFE CYCLE HANDOUT] Indicate to students that 7% of the 91,000+ North American insects are aquatic or semi-aquatic, found in all types of waterways. Aquatic insects vary but have one commonality - at least 1 stage of life cycle relies on being in the water.
6. Many aquatic insects found in our waterways are juvenile form of an adult, land-dwelling insect. Often, their body does not resemble land-dwelling or flying adult. Before juvenile leaves the aquatic home, it must undergo several physical changes to prepare for life on land. This change in physical appearance (shape, size, form) is called **metamorphosis**.
7. The extent of change varies from organism to organism. But there are two types of metamorphosis - complete and incomplete. [TRANSPARENCY of HANDOUT]
8. 90% of insects that undergo metamorphosis undergo complete. **Complete metamorphosis**: Four stages. Egg - Larva - Pupa - Adult. The larvae usually do not look anything like the adult form. Many larva worm-like, soft bodies. Some lack legs. All will eventually become adults with wings that fly away, reproduce and lay eggs to start the life cycle all over again. Examples: caddisfly, dobsonfly, crane fly, mosquito, midge, and many beetles. [Pass around mosquito plastomount]
9. **Incomplete metamorphosis**: Three main stages. Egg - nymph - adult. Nymphs are found in the water and are miniature versions of adult, often looking somewhat similar to the adult. Even see wing pads. Nymphs undergo a series of molts (sometimes referred to as instars) to reach full size and develop wings. Emerge as adults. Examples: mayfly, stonefly, dragonfly, and damselfly. [Pass around dragonfly plastomount]

PROCEDURE: Connect Four or Three

Teacher Preparation:

1. Locate the small envelopes of the pre-cut aquatic insect life cycle stage cards or make photocopies of these cards (originals are included in this activity write-up). Make enough so each student has at least 12 of each stage.
2. Also locate the copies of aquatic insect life cycle stages game board (11x17 sheet of empty squares) or make enough copies of the enclosed original for ½ the class.

Student Activity:

1. We will play a short game to review the stages of complete and incomplete metamorphosis. Ask students what the stages were again?
2. Ask students to find a partner (assign /rearrange if necessary). Pass out the envelopes of aquatic insect life cycle stage cards (1 to each student) and game boards (one to each group of two). Hands off until further instruction.
3. Tell students they will play a game that is similar to Connect Four (the game that you place red or black tokens vertically into slots and tried to get four of your color in a row). Instead, this game will use cards with various aquatic insect life cycle stages. The goal of the game is to play an opponent and try to be the first to place both a set of complete and incomplete metamorphosis in the correct order either vertically or horizontally (forward or back) or diagonally.
4. Taking turns, place cards down anywhere on the game board. You will try to put your cards in a correct order to form a complete metamorphosis and an incomplete metamorphosis, but your opponent can block your progression by placing one of their life cycle stage cards. However, their card stage they choose has to be out of order from your progression and not complete your life cycle progression or else the card is forfeited and removed and their turn is lost.
5. Continue the game of placing and blocking until there is a winner - the first to complete both a complete and incomplete life cycle. If a group finishes early, they can begin a new game.
6. Set a time limit if necessary to end the game. Have students clean up game contents and pass them forward.
7. Find out how students did at the game. Which was easier to get down on the board - the 3 stage or 4 stage cycle? What is the 3 stage cycle called again? 4 stage one?

PROCEDURE: Research Aquatic Insect Life Cycles

Teacher Preparation:

1. Locate and photocopy the Aquatic Insect fact sheets for individual insect specimens. There is a corner of the fact sheet that covers life cycles. You will only need a few copies of each sheet for the class for the following insects:

Dobsonfly, whirligig, stonefly, dragonfly, crane fly, mosquito

Student Activity:

1. Distribute Aquatic Insect Life Cycle Worksheet and Aquatic Insect Fact sheets.
2. Ask students to complete the questions on the worksheets (this could be done in teacher-established groups perhaps) using information already provided in class, their notes, and the provided Aquatic Insect Fact Sheets. Place the mosquito life cycle TRANSPARENCY on the overhead to help with question #3. Students should be prepared to discuss the answers upon completion.
3. Review of the worksheet answers will be part of the closure. There are questions on the worksheet that review the main facts/concepts to be learned:
 - a. Definition of metamorphosis
 - b. Stages of both complete and incomplete metamorphosis
 - c. Examples of insects for complete and incomplete metamorphosis.
 - d. Water can play a role in different life cycle stages, but it varies for each insect.

There are also questions that show application of life cycle knowledge to real world scenarios.

DISCUSSION:

What is the difference between complete metamorphosis and incomplete metamorphosis? *Complete has 4 stages (egg, larva, pupa, adult) and incomplete has only 3 stages (egg, nymph, adult).*

Why do stream ecologists and aquatic entomologists care so much about insect life cycles? *Many insects have some stages of their life cycle that take place in the water. It is estimated that 7% of the 91,000+ North American insects are aquatic or semi-aquatic. Many aquatic insects start life off underwater. Because their immature aquatic bodies are specially suited for life underwater, they often do not resemble their land-dwelling, adult body. Before the juvenile aquatic insect can leave its original aquatic home, it must undergo several physical changes to prepare itself for life on land. These changes are metamorphosis.*

EVALUATION:

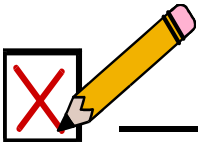
- Discussion questions above.
- Correctly filled out worksheet.

EXTENSIONS AND MODIFICATIONS:

- Investigate the following websites about aquatic insect life cycles:
<http://www.epa.gov/OWOW/NPS/kids/MOVIE.HTM>
http://www.uen.org/utahlink/activities/view_activity.cgi?activity_id=2024
<http://www.enchantedlearning.com/subjects/insects/mosquito/>
<http://www.usask.ca/biology/skabugs/lifecycle/insectlifecycle.html>
<http://www.earthlife.net/insects/lifecycles.html>

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):

Activity Version: June 2003



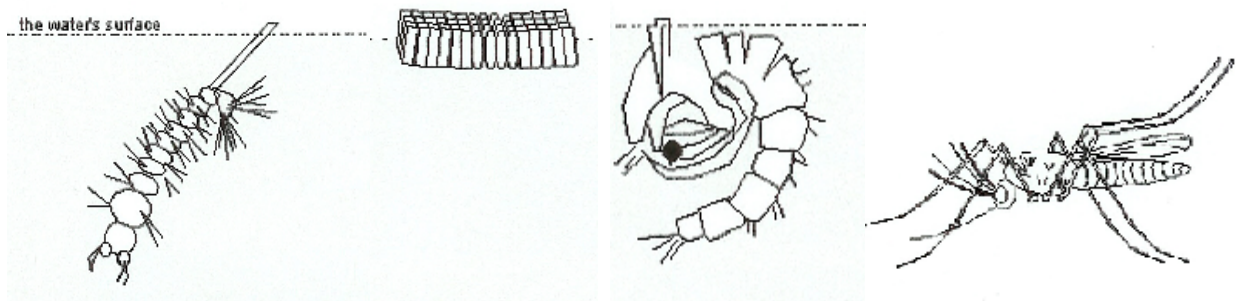
WORKSHEET : AQUATIC INSECT LIFE CYCLES

Name: _____ Class: _____

1. Define metamorphosis? _____

1. How does incomplete metamorphosis differ from complete metamorphosis?

2. Below each illustration of a mosquito's life cycle, indicate the correct order for the following life cycle using 1 for the first stage and 4 as the last stage. Also, label the names of each stage below the illustration.



Is the above an example of incomplete or complete metamorphosis? (Circle which)

How many stages rely on water? _____

3. An aquatic entomologist approaches you and shows you a mayfly nymph. Based on this information alone and not having to look up any additional information, you are able to impress him and tell him what type of life cycle a mayfly has. What type of metamorphosis does it have? How did you know this?

4. Review the dobsonfly larva fact sheet. How long does the dobsonfly larva stay in the water? How long does a dobsonfly survive as an adult? What do you think is the main purpose/responsibility of the dobsonfly adult? Do you think this is the main purpose of other adult aquatic insects?

5. Using the aquatic insect fact sheets, determine if the following insects undergo complete or incomplete metamorphosis. For each, write down what stages of their life cycle take place in water?

Whirligig beetle _____

Dragonfly _____

Stonefly _____

Cranefly _____

Of the larva or nymph stages of these insects listed above, which two look the most dissimilar from their adult stage?

7. Why do fly fisherman care so much about aquatic insect life cycles?

8. The Pennsylvania Department of Environmental Protection (DEP) is the agency in charge of protecting and monitoring the air, land and water of the Commonwealth. The DEP is in charge of investigating and monitoring the West Nile Virus within the state. This virus is being carried by adult mosquitoes in many parts of the country and may pose a threat to humans and other mammals that are bitten. The DEP is trying to minimize the spread of this disease. One thing they tell people to do is to make sure that you do not have stagnant water collecting in old tires, barrels, pots, drainage ditches, or abandoned bird baths on your property. Get rid of this stagnant water. If the West Nile Virus is transmitted by adult mosquitoes that fly around in the sky, why is the DEP making sure people get rid of standing, stagnant water on their property?

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