



Nature's Aquatic Engineers: Encased Caddisfly Larvae

Teacher Sheet

Lesson: Nature's Aquatic Engineers: Encased Caddisfly Larvae

Grade Levels: Advanced 4-5, 6-7, 8-10

Time Frame: 60-80 minutes or 2 class periods

SOL Focus: 4.2, 4.3, 4.8, 6.9, LS.3, LS.5, LS.6, LS.7, LS.8, LS.9; STEAM

Essential Standards: Ecosystems

Driving Question: Why do encased caddisflies build their cases out of different materials?

Objectives: Students are introduced to macroinvertebrates that reside in the local rivers and streams, specifically the encased caddisfly larvae, learn about their importance to the river ecosystem in which they are found, and their importance to water quality. Students will then investigate why caddisflies choose different mediums to construct their homes.

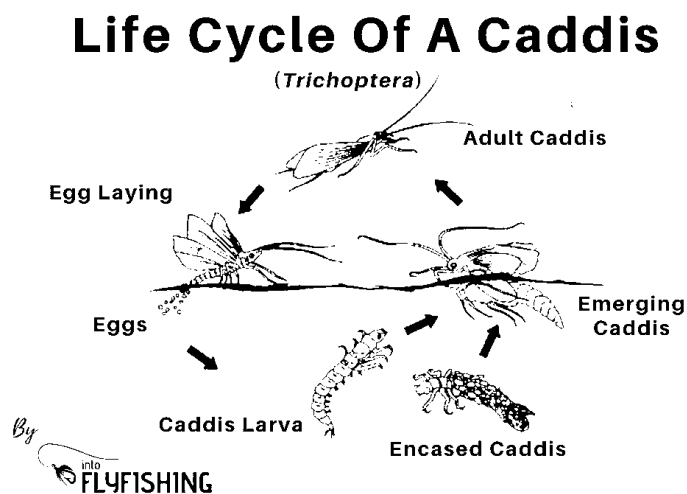
Student Connection: Students may be inspired to investigate streams on their own for macroinvertebrate species using simple items such as an aquarium net and cup, or leaf pack.

Materials:

- Small river or aquarium pebbles 1/4"
- Small tree sticks 10cm, available in 100 pack
- Small decorative tumbled stone chips/crystal quartz pieces
- Small craft leaves in autumn colors, available in 100 pack
- 6 or more hot glue guns and glue sticks or Elmer's glue (may not dry quickly enough)
- Toilet paper tubes for each student
- Plastic tweezers for each student
- Cut out and distribute caddisfly larvae to each student.

Procedure:

1. It may work best to introduce students to macroinvertebrates in a separate lesson, prior to beginning this lesson. We have videos and lessons available at <https://www.danriver.org/resources/in-classroom-presentation-w-activity/tub-of-bugs>.
2. Show students a video(s) of encased caddisflies such as the examples below.
<https://www.pbs.org/video/deep-look-amazing-underwater-tape-caddisfly/>
https://youtu.be/5_03QuVfjMw?si=PCLvmfrFyPocBR8k The Underwater Life of the Caddisfly
3. Study and discuss why caddisflies choose different types of materials found in the stream to build their home. Print pages 7-10 DOUBLE SIDED for students. "Deep Dive" section may be reviewed as a class, in groups or by individual students, but will be needed to answer questions on pages 9-10.
4. Cut and distribute stream scenarios, one for each student, and have each student sketch their stream. They can be as detailed as they like, or as time allows. Allow about 5-10 minutes for this part.
5. Distribute craft supplies or leave in a craft cart/workspace and have each student build their encased caddisfly from their stream scenario. Allow 45-60 minutes for this part. Prep all materials beforehand.



Developed by Krista Hodges, Director of Environmental Education

For questions, comments or suggestions, please email at khodges@danriver.org.



1. Sandy bottom stream

Leaves & sticks present
Low flow pool area
Low presence of predators
Young larvae

2. Rock & stick bottom stream

High flow
Trout & dragonfly larvae present
Mature larvae

3. Leaf & stick bottom stream

Medium flow
Trout & dragonfly larvae
Mature larvae

4. Leaf & rock bottom stream

Low/medium flow
Low presence of predators
Young larvae

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What are Encased Caddisflies?

Kingdom: Animalia Phylum: Arthropoda
Class: Insecta Order: Trichoptera

Macroinvertebrates are aquatic insects, crustaceans and mollusks found in rivers and streams. They are large enough to see with the eye and do not have a backbone. Within the macroinvertebrates, are nature's aquatic engineers, the encased caddisflies. **Encased caddisflies** are an ecologically diverse and important group of freshwater insects that construct cases, or protective homes, out of materials found in rivers and streams. The larva spends **up to two years** of their lives in streams before they turn into an adult as a flying, air-breathing terrestrial insect. Once an adult, caddisflies live less **than a month** and spend their time reproducing. The larvae are extremely sensitive to pollution and are used as **indicators of excellent water quality**. Dissolved oxygen levels, water velocity and chemical parameters are all important to the survival of the caddisflies.

What do they do?

Encased caddisflies are very creative when it comes to protecting themselves from predators in a river ecosystem. With their own **silk** created under their mouth, they construct cases, or homes, built from rocks, leaves, sticks and/or sand. The cases provide **camouflage** for the larva along the stream bottom and protection from predators. Caddisfly larva are known to be very choosy about what they use to construct their homes, and have even been known to select decorative items. Some even choose to build their homes completely out of quartz. Every constructed case is unique to each caddisfly - each piece has to fit just right, or it is not used, and they will choose another piece. It takes **up to 24 hours** for a caddisfly larva to construct a case.



Examples of Caddisfly Cases

KEY POINTS - A Look at Caddisflies Behavior and Survival from Research Studies

- The constructed case can determine resistance to the current of the water. Some caddisflies have been found to build cases out of straight sticks to assist with **navigation** in the stream - the current will run along the stick helping keep the larva pointed upstream or the caddisfly may turn sideways to be carried downstream to a “safer area” from predators.
- Rock cases are often built by **mature larva**. **Rock cases** take more energy to create and tend to be the sturdiest against crushing, such as during times of flooding and rock movement in the stream, and against predatory attacks.
- Young larvae often build homes of **leaves or sticks**. They take less energy to build, reserving energy for growth.
- In some studies, cases built of **leaves** were determined to be eaten **more often** by predators such as trout. In another study, it was determined that **stick** cases experienced **fewer attacks** from predatory dragonflies. However, all cased caddisflies show a higher chance of survival than those with no cases.
- Mineral (rock) cases are more likely to be found under larger rocks in streams.
- Leaf and stick caddisflies tend to be in the current or along slower/calmer areas of the sides of the stream, in leaf-congested areas.
- Cases may even assist with providing higher oxygen levels (**respiration**) for caddisflies as the caddis can move up and down in the case to create oxygen. This may allow some caddisflies to stay in pool areas of streams over high current areas.

Sources:

Dodds, G. S., & Hisaw, F. L. (1925). Ecological Studies on Aquatic Insects. III. Adaptations of Caddisfly Larvae to Swift Streams. *Ecology*, 6(2), 123–137. <https://doi.org/10.2307/1929367>

Emily E. Ferry, Gareth R. Hopkins, Amber N. Stokes, Shabnam Mohammadi, Edmund D. Brodie, Brian G. Gall, Do all portable cases constructed by caddisfly larvae function in defense? *Journal of Insect Science*, Volume 13, Issue 1, 2013, 5, <https://doi.org/10.1673/031.013.0501>

Ferry EE, Hopkins GR, Stokes AN, Mohammadi S, Brodie Jr ED, Gall BG. 2013. Do all portable cases constructed by caddisfly larvae function in defense. *Journal of Insect Science* 13:5. <http://www.insectscience.org/13.5>

Name _____ Date _____



Driving Question: Why do encased caddisflies build their cases out of different materials?

Answer the following questions:

1. Encased caddisflies are important freshwater insects that are used as indicators of _____.
2. Caddisflies construct their cases out of what materials found in the stream?

3. How long does it take caddisflies to construct their cases? _____
4. What do they use to construct their cases and bind them together? _____
5. What two advantages does it give caddisflies to construct cases?

6. How long do caddisflies spend in streams before they become adults? _____
7. How long do caddisflies typically live once they become an adult? _____
8. What type of case may provide the best resistance to breakage? _____

Follow these steps to construct your own caddisfly case:

1. Using your stream scenario, sketch a drawing on the back of this sheet of what your stream may look like.
2. Once your sketch is completed, determine which type of case your caddisfly would build.
3. Construct your own caddisfly case using provided materials.
4. Once your case is completed, answer the following questions:
 - a. **What materials did you use to construct your case?** _____
 - b. **Does your caddisfly have a high or low chance of survival?** **Yes** **or** **No**
Why?

c. Why do encased caddisflies build their cases out of different materials?

Sketch Your Stream Scenario