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Watch for more "Stream Team Academy Fact Sheets" coming your way soon. Plan to collect the entire educational series for future reference! Contact us at 1-800-781-1989 if you'd like a copy of previous Fact Sheets or a binder for storing them.

# LIFE CYCLES & NATURAL HISTORY OF AQUATIC INSECTS

## Part 4 – The Caddisflies (Trichoptera)

### An Educational Series For Stream Teams To Learn and Collect

*By Paul Calvert*

The Trichoptera (caddisflies) are an Order of insects that are primarily adapted to life in the water as immature stages with only a few exceptions in the world and none in North America. Their closest insect relatives are the Lepidoptera (butterflies and moths), an Order of insects that are primarily terrestrial with only a few species worldwide adapted to aquatic life. Caddisflies can be divided into three groups based on case-building behavior. These are free living forms, net spinners/retreat builders, and case makers (saddle case makers, purse case makers, and tube case makers).

Like mayflies (Ephemeroptera) and stoneflies (Plecoptera), caddisflies most likely evolved in cold, fast flowing streams. It is theorized that as they developed their case building abilities, they were able to diversify ecologically due to a respiratory mechanism that replenishes oxygen by allowing a continuous flow of water through the case. This, in turn, enabled them to survive in warmer, slower moving systems.

### LIFE CYCLE

Caddisflies are holometabolous, meaning that they have a complete life cycle which includes a pupal stage. They typically lay their eggs in gelatinous masses, either in or out of the water. This mass helps minimize water loss and maximize respiratory exchange. In some families it allows for continued development of the eggs in completely dry habitats. Eggs are deposited in several different modes. Some species drop eggs in the water during flyovers. Others descend under the water and attach eggs to the substrate. Species that inhabit ephemeral pools lay eggs in the basins when the pools are dry. The eggs develop in the gelatinous matrix while waiting for the pools to fill.

Most caddisfly species are univoltine (having one generation per year), although a few are multi-voltine (having multiple generations in a year). Others are semi-voltine, taking two years to complete a generation. Larvae generally undergo five instars before pupating. After completing larval development, case makers and retreat builders seal off the ends of their cases or retreats and attach them to the substrate while free living forms spin silken cocoons. The pupal stage usually lasts two to three weeks, although some species overwinter as pupae.

Caddisfly pupae have mandibles that they use to chew through their case or cocoon when adults are ready to emerge. Once emerged, adults are commonly active during the evening or nighttime hours. They can live from a few weeks to as long as several months.

Depending on the species, caddisfly mating can occur in flight, on the ground, or on vegetation near aquatic habitats.



*Some caddisfly larvae build cases out of materials like sand, twigs, leaves, and other debris. (Photo by Chris Riggert, Missouri Department of Conservation.)*

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### FEEDING

Caddisfly larvae occupy every functional feeding group. They are shredders, grazers, filter feeders, or predators. It was once thought that the net spinners collected food indiscriminately, eating anything captured in the net. Recent evidence, however, suggests that they are capable of selecting the food that is most nutritious and cleaning the net of the rest of the material. Grazers similarly feed preferentially. They select feeding territories and defend these beds fiercely, often out-competing other grazers. All free living and some tube case making caddisfly larvae are predatory on other aquatic macroinvertebrates, sometimes even including other caddisflies. Adult caddisflies feed on nectar or do not feed at all.

### RESPIRATION

Caddisflies breathe in three primary ways. Many case makers and some retreat builders maintain spacing between their bodies and the case with small bumps (tubercles) located on the first abdominal segment. The larva then maintains a current through the case and over its gills by undulating its abdomen, continuously replenishing its oxygen supply. Non-case-bearing forms either have numerous branched abdominal gills or depend on cuticular respiration (uptake of oxygen through the exoskeleton). These forms are typically more sensitive to changes in dissolved oxygen levels.

### CONCLUSION

Caddisflies can vary widely in their forms and behaviors. From their case building habits, to their feeding groups and even their habitats, which can consist of both cold and warm water, lotic and lentic systems, caddisflies are incredibly diverse.

Our next fact sheet will cover the aquatic beetles, our largest and most diverse group of insects. Don't forget to send your questions to [streamteam@mdc.mo.gov](mailto:streamteam@mdc.mo.gov) or call 1-800-781-1989.

Caddisflies are important in water quality monitoring, but temperature and oxygen levels aren't always the limiting factors for these insects. Caddisflies are sensitive to a variety of pollutants and, while case builders are more tolerant of low oxygen levels, free living forms and net spinners require cool, flowing, highly oxygenated water. No matter what the particulars of the species, when we find caddisflies in our streams, with or without stoneflies and mayflies, we are excited!



*Hydropsyche orris, a common net spinning form of caddisfly. (Photo by Amy Meier, Missouri Department of Conservation.)*



*Adult caddisflies feed on nectar or not at all. (Photo by Amy Meier, Missouri Department of Conservation.)*

### Sources:

Freshwater Macroinvertebrates of Northeastern North America. Barbara L. Peckarsky et al. 1990.

Aquatic Entomology—the Fishermen's and Ecologists' Illustrated Guide to Insects and Their Relatives. W. Patrick McCafferty. 1998.