# Chapter 4, Stream Life

Use with fishing skills **FLY TYING** or **READING THE WATER.**

## New Ideas

- **Trout Food**
- **Metamorphosis**
- **Adaptation**

## Activities

**Activity #7: Insect Life Stages Fill-In, p. 33**
- Handout: Insect Life Stages, p. 33

**Activity #8: Stream Safari, p. 35**
- Handout: Make Your Own Kick Net, p. 37

**Activity #9: Water Quality Bioassessment, p. 39**
- Handout: Bioassessment Worksheet, p. 41

## Review and Related Ideas

- Habitat and Niche (Ch. 2, p. 3-4)
- Food Webs and Energy Pyramids (Ch. 2, p. 4-5)
- Pollution (Ch. 7, p. 63-67)

**Introduction**

Most anglers have some idea of what trout feed on, and have, at the very least, used caddis, mayfly, or stonefly imitations. Still, many anglers who have fished elk hair imitations might not recognize a live caddisfly. Knowledge of small aquatic animals, and insects in particular, is the core of fly fishing. They are also widely recognized as a sort of biological litmus paper: biologists, hydrologists, and environmental scientists all inventory aquatic invertebrates (insects, molluscs, worms, and crustaceans) to measure stream health. Techniques these scientists use are easy for students to imitate, can be used with little or no specialized equipment, and are a lot of fun. The following is a guide to the invertebrates that are most important to trout, and most commonly used to assess water quality, with suggestions for your own "bug safari." It is a great chance to teach fishing skills and biology in a single fun lesson that will make kids better, more conscientious fishermen. This is fun because it feels like discovery. An act as simple as turning over a rock to find something new can deepen one's appreciation of a stream forever.

While the heart of this lesson is the on-stream exploring, a little preparation beforehand will make the scientific exploration much richer. If you're running a short program, the most important thing to do is to give students a taste of the excitement and wonder of discovery. If your program is stretched out over a much longer period of time, several classes before the actual stream trip can be devoted to the basics of bugs.

**Teaching Tips**

Much of this can come out as discovery learning on the stream, after insects have been collected. Students will probably come up with a lot of questions as they observe the organisms they have collected, but it is helpful to have a number of questions in mind to ask them.

The **Trout Food** section below will not be terribly interesting to students unless you can collect pictures or specimens of the different groups you talk about. Find out if your local university or extension station has an insect collection. The head curator, a graduate student, or a volunteer will likely be willing to give your class a tour, or bring some specimens in and give a short lecture.

Another way to make the biology in this section more accessible is to relate it directly to fishing gear and techniques. Use artificial flies to illustrate the different body forms of nymphs and adults, aquatics and terrestrials.

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**Trout Food**

To catch fish, we present lures that look like the things wild trout eat. For most trout, even very large ones, most of the diet is made up of small **invertebrates**, or animals without backbones. Some of the invertebrates that are important parts of the trout diet are:

- **Arthropods**, which have segmented bodies and hard exoskeletons. The most common arthropods are **insects**, the six-legged arthropods. Most of the flies we fish with imitate insects. Some are **aquatic**, or have aquatic stages, like mayflies. Others are **terrestrial**, or land insects, like beetles and grasshoppers. Trout eat these when they accidentally fall into the water.
- **Crustaceans**, like crayfish and scuds (brine shrimp), are another class of arthropods that trout eat.
- **Molluscs** have soft bodies, and some have hard shells. Clams, mussels, and slugs are common molluscs, but did you know that octopi and squid are molluscs, too?
- **Nematodes** are the **roundworms**. Trout eat some of these. Many flatworms, like planarians, are aquatic.
- **Annelids** are very advanced worms with segmented bodies. Leeches and the common earthworms that people use for bait are annelids.

Some trout, especially lake trout, will eat microscopic **zooplankton**, but trout will also eat **vertebrates** (animals with backbones), like frogs or other fish. Some fish are cannibalistic, and will eat smaller members of their own species! Predators that eat many different kinds of food, as trout do, are called **generalists**. The opposite kind of predator is a **specialist**, which "specializes" in catching one kind of prey.

Some trout populations have reputations for being very selective about what they feed on. Anglers sometimes refer to the need to "match the hatch," or use flies that imitate the native insects. In fact, trout aren't "crafty" so much as they are creatures of habit. Trout are selective in order to maximize their efficiency when feeding. If they can recognize the common foods or hatches on their home waters, they don't need to waste energy investigating strange new foods. Lunker trout on the San Juan River drive anglers crazy because they often won't respond to anything but midges. From the trout

**Discussion Questions**

- **A good question to start the discussion with is, *why bother with metamorphosis*? Why might it be advantageous to spend part of a life cycle in water and part on land?** If adults and juveniles of the same species live in different habitats, they won't compete with each other. Aquatic juveniles that feed on leaf litter and organic matter are taking advantage of a niche where there isn't much competition. Adults do not need to eat as much, and the ability to fly lets them disperse to find mates and mix their genes with those of other populations.
- **Why is it often easier to catch fish on nymphs than on dry flies?** Insects usually spend a much longer period in the nymph or larval stage than they do as adults. Trout naturally get to feed on nymphs more than they do on adults, so they usually search for food under water. In addition, trout feeding under water are less exposed to predation than those feeding on top.

**Adaptation**

The concept of **adaptation** follows naturally from a discussion of metamorphosis. Insects that have aquatic larvae or nymphs and terrestrial adults are adapted for different habitats at each life stage. Sometimes they have entirely different body parts at different stages. For example, the stonefly nymph pictured above uses gills to breathe. By the time they are adults, they lack gills and breathe through tiny tubes in their skin. Other features just look and function a bit differently in nymphs and adults. The nymph's legs are thicker, stronger, and flatter than the adult's, so that it can hold on tight to rocks in the fast riffles it inhabits. The adult has thinner legs with less pronounced claws on its feet. It moves around by flying, and big legs would hinder its movement more than they would help.

Adaptations can be behavioral, as well as physical. For example, mayfly adults emerge at dusk. One advantage of emerging at night is that their predators, fish and birds, locate their prey primarily by sight. Emerging when light is low makes it more likely that they will survive long enough to break free of the water's surface tension, mate, and lay their own eggs.

Give a simple homework assignment: have students go home and observe their own house pets and note a few different physical and behavioral adaptations. One might give a starter assignment like, "Domestic cats are often quite active at night. Which of their features seem to be adaptations for navigating and hunting in the dark?" (big pupils, whiskers, strong senses of smell and hearing)

On your class's field trip, use **Activity #8, Stream Safari (p. 35)** to draw out ideas about adaptation. Ask students to ponder how different body shapes, sizes, and appendages might be adaptive.

**References**

McCafferty, 1983
Merritt & Cummins, 1996
Pobst, 1990