



### Stream Team Academy Fact Sheet Series

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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 3 – The Stoneflies (Plecoptera)

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

By Paul Calvert

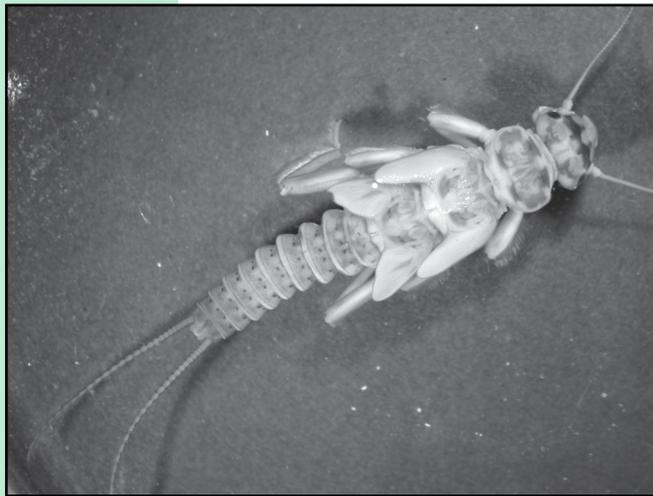
The Plecoptera (Stoneflies) are an order of insects that are poorly understood because many immature stages have not been associated to a particular adult form, making it difficult for taxonomists to organize this order. The North American stoneflies are generally divided into two groups: **Euholognatha**, those with mouth parts adapted for herbivory (scrapers, grazers, collector–gatherers, shredders, gougers, and detritivores) and **Systellognatha**, those who have mouthparts mainly adapted for predation, including sharp-cusped mandibles and toothed lacinia (the inner portion of the maxilla) for grasping and holding prey. There are 9 families in the United States and 8 are found in Missouri.

### LIFE CYCLE

Stoneflies have an incomplete life cycle, or are hemimetabolous. When

they lay their eggs, the females generally dip their abdomen into the water as they fly over the surface. Others deposit eggs while submerged, and one flightless species actually runs across the surface and deposits them as she travels. The eggs settle to the bottom where their gelatinous covering enables them to attach to the bottom substrate. In most stonefly species, the first nymphal instar develops in the egg, so, when the egg hatches it is actually the second instar. The nymphs go through 12 to 36 molts depending on the species and the water temperature. Water temperature plays an interesting role in the development of the nymphs. Most wait out the warmer temperatures of summer by burrowing deeper into the substrate. Others actually exhibit a summer diapause or aestivation where their metabolism is slowed dramatically as they wait for cooler water temperatures. Most species actually develop more in the winter months. Life cycles are from 1 to 4 years. This is why we may see two or three different sizes when we sample. Most are univoltine, meaning that there is only one hatch that occurs each year, or one flight season. This flight season is when we see the adults mating and depositing their eggs.

The last instar crawls out of the water and rests on objects on the ground like rocks or leaves before emerging as an adult. These nymphs are highly vulnerable during this time and many are lost to predation. After emerging, the adults live from 1 to 4 weeks while they look for mates and reproduce. Stonefly males have the ability to communicate by



*Hydroperla fugitans*. Photo by Amy Meier, Missouri Department of Conservation.

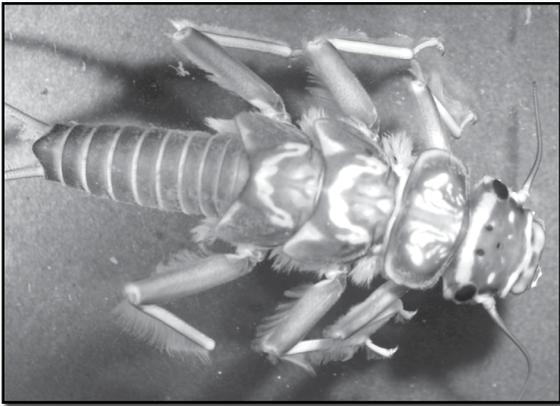
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vibrating their abdomens on the substrate, or vibrating fast enough to emit high frequency sounds. This is known as drumming, is species-specific, and is used by males to attract females.

### FEEDING

Stonefly nymphs are generally shredders (i.e. they shred detritus materials for consumption) or predators. Some groups demonstrate both forms with early nymphs being shredders and later nymphs becoming predacious. Predators are engulferers; they swallow their prey whole or bite off chunks and swallow them. They are either active search or pursuit predators (hunters) that feed as opportunists (feeding on anything that moves), or selective hunters (feeding on a specific size and type of prey). In the adult forms, some species feed and others do not, living only long enough to mate and lay eggs.



Above is *Acroneuria abnormis* from the Missouri River. Photo by Amy Meier, Missouri Department of Conservation.

### RESPIRATION

Nymphs of many stonefly species breathe through tufts of filamentous tracheal gills. These are affectionately known as “hairy armpits.” A few that are restricted to cold, swift flowing streams rely entirely on oxygen exchange through the cuticle; in other words, they absorb oxygen through their exoskeleton.

### CONCLUSION

Stoneflies are very sensitive to changes in water quality. When you are monitoring, and you find stoneflies in your net sets, remember that they are great indicators of good water quality.



An adult stonefly rests on vegetation near the Maries River in Osage County. Photo by Chris Riggert, Missouri Department of Conservation.



Our next fact sheet will cover the caddisflies, another group of our sensitive aquatic insects. Don't forget to send any questions you may have to [streamteam@mdc.mo.gov](mailto:streamteam@mdc.mo.gov) or call 1-800-781-1989.

### 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.