

Stream Microhabitats

Teacher Background and Lesson Plan

Engagement:

Have students watch this Vimeo “Aquatic Insect” video:

<http://vimeo.com/album/2629118/video/10549040>

These insects also live in your local stream, but not all insects live in all parts of the stream.

What are these stream dwellers and how would you find out? What questions would a scientist ask?

How would you conduct an investigation? What pieces of information do you need to know?

Exploration: Have students walk along the banks of their stream. Use your own judgment on how far the students should walk making sure they are following good safety rules. As they walk, point out different stream features to them. Have them draw a map of their stream and explore the habitats they see as they walk along. Use the worksheet provided.

Background Information:

Stream Features

Adapted from Henry Kanemoto’s “Reading The Water, or Where The Trout Are.”

<http://www.uky.edu/~agrdanny/flyfish/faq/FAQ-5.HTM>

There are four major types of water in a small stream system – riffles, runs, pools and flats. These types are the result of three physical characteristics of the river system: (1) the gradient of the river bed (the slope or difference in height from one part of the stream to others along its length), which determines how fast the water flows; (2) the bottom ground surface which determines how turbulent the flow will be; and (3) the depth of the water which determines whether the turbulence reaches the surface.

The combination of these physical factors is what causes different parts of the stream to look and behave differently, i.e., they are characterized as riffles, runs, pools or flats, described below. In general, these areas range from those with steeper gradients and faster, narrower flows, to those with flatter gradients and slower, wider flows. The steeper gradients cause faster and generally deeper water flows. These faster flows can suspend more solid particles and cut a narrower channel into the underlying bedrock. As the gradient lessens, the stream tends to gradually widen, meander, and flows more slowly.

The makeup of these types of water creates specific habitats where we find aquatic life that is suited to living in these conditions – sometimes referred to as **microhabitats** (small habitats within the overall stream habitat). Familiarity with the microhabitats as well as the feeding habits and physical characteristics of organisms in the stream can help predict where these animals will be found – in other words, match animals’ requirements with the microhabitats.

- **Riffles** are the food factories of a stream. They are the result of moderate to shallow depths, with faster flows over a rocky bottom. This results in small irregular waves on the surface, good oxygenation of the water, and light penetration to the stream bottom. The light penetration allows for growth of vegetation and small phytoplankton which form the basis of the aquatic food chain. The rocky stream bed increases the surface area upon which the vegetation and

aquatic insects can live. This combination results in riffle water being a prime area for macroinvertebrates.

- **Runs** are deeper than riffles and have a smoother surface to the flowing water. The speed of the water through here tends to be less than a riffle. This is the result of the greater depth and the smoother bottom. Runs also support aquatic insect life but usually less than a riffle.
- **Pools** are the deep water areas of a river. Because of their depth, the flow can be quite slow in the larger pools. The hallmark of a pool is its depth, often too deep to see the bottom. The water depth limits light penetration and the slower flow can lead to less oxygen in the water. This can lead to less insect life than in riffles or runs.
- **Flats** are the still-water areas of a stream. They are often found in a wider section of the river off the main channel. Because flats are defined by the glasslike nature of their surface, they have a smooth bottom and most have only a slight gradient. They tend to be fairly shallow in depth.

Explanation: Students doing background reading/research and investigating their streams will learn that different types of water features are evidence of differences in how the water flows and what kind of ground surface lies under the water. Different animals have different adaptations that allow them to live more easily in some habitats than others. Ask students to read the macroinvertebrates resource page titled “Who lives in your stream?” and fill out the graphic organizer provided. Students can use the information about each animal as a clue as to where each might be found most often.

Exploration and Evaluation: Ask students to use the graphic organizer they just completed to design an investigation. Ask them to choose an animal and make a prediction about where they might find that animal most frequently. For example: A student might believe, after reading the resource guide, that they will find water pennies only in riffles or runs. Guide students through the scientific method asking them to write a hypothesis based on the prediction they have developed, create a materials list, data table, and procedure. Ask students to carry out the investigation to see if their prediction was accurate and graph their conclusions.

Extension: Ask students to do a more extensive background research project on the animal they chose. When students have a more thorough understanding of the animal they chose, ask them to refine their prediction. Perhaps the season of the year impacts when they will find more animals. Perhaps the occurrence of a higher or lower water volume in the stream makes a difference. After students have refined their predictions, ask them to repeat their experiment and then compare the data sets. Was there a difference in how accurate their predictions were based on how thorough their background information was? Did their results change if they did one trial versus three?

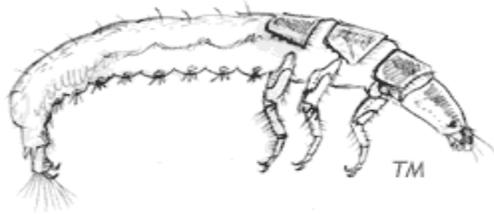
Lesson developed by Amanda Sullivan, Education Specialist, Maryland Department of Natural Resources.



Who lives in your Stream?

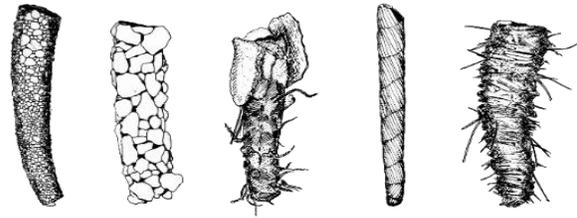
Student Reading

Caddisflies



http://naturalhistory.crowspath.org/wp-content/uploads/2012/12/inv-caddisfly_larvae.gif

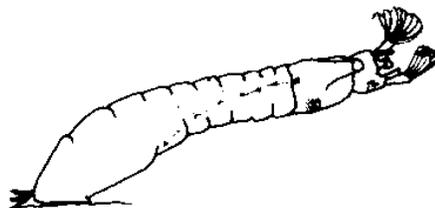
Examples of Caddisfly Cases



<http://www.cals.ncsu.edu/course/ent425/images/compendium/trichoptera/caddis1c.gif>

Caddisflies can live in many different kinds of habitats. They can live in small, cool and fast streams and in larger, warmer slow streams. There are many different families of caddisflies but all of them have complete metamorphosis and live in the water while they are larvae and pupae. Caddisflies spend their adulthood on land. Caddisflies are a very successful type of macroinvertebrate because the larvae can spin a silken thread. They use this thread to build shelters for themselves by gluing small bits of leaves, twigs, or rocks together to form a case. Some caddisflies also use this silk to attach themselves to objects in the stream so they don't get carried downstream by the current. Caddisflies use the cases they build for camouflage, protection from predators, and making a current for themselves inside their tubes to breathe dissolved oxygen. Finally, when it is time to metamorphose, caddisflies use their cases as a cocoon.

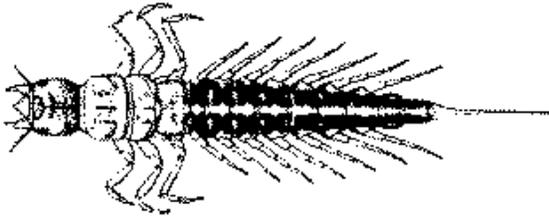
Black fly



<http://www.state.nj.us/dep/wms/bfbm/GenExecSum.html>

Black fly larvae can only live in flowing waters, but they can live in all kinds of different flows from tiny springs to large rivers. Black fly larvae attach to rocks, pieces of plants and wood, and any other stable, solid object in the water. These larvae produce a silk thread from their mouth and put a pad of this sticky material on things they want to attach to. They then attach themselves to the silk pad by a ring of hooks on their abdomens. If there is too much algae, bacteria, or fungi this attachment won't work. Black flies eat by extending fan-like brushes into the water from their mouths to collect food that is floating by. They mostly eat algae and bacteria. Adult female black flies are terrible pests and feed on the blood of humans and animals.

Alderfly

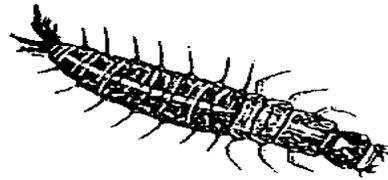


http://raven.islandwood.org/kids/stream_health/macros/Alderfly_nymph.htm

Alderfly larvae are most commonly found in mud and silt where a lot of dead leaves have built up. These larvae prefer to live in still water. Alderflies live in little burrows that they dig into the soft stream bed. They are predators but not very good swimmers so they search for their prey in the mud and on the bottom of the stream bed.

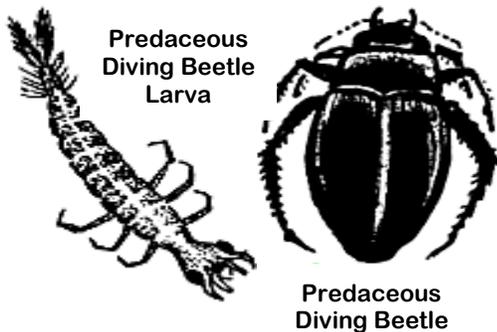
Dobsonfly

Dobsonflies prefer to live in running water in habitats from woodland streams to large rivers. These animals like the fastest current in the habitat. They live in sheltered spaces underneath rocks or logs and crawl around the spaces between the rocks. They hold onto the rock or wood with strong claws on their legs. If they get caught by the current, they can swim backwards for a short distance. These larvae are predators and they actively search for their prey between the rocks or sticks and prefer to eat the larvae of other macroinvertebrates.



<http://life.bio.sunysb.edu/marinebio/fc.4.fauna.html>

Predaceous Diving Beetle



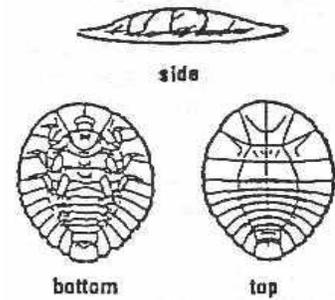
<http://dnr.wi.gov/org/caer/ce/ee/critter/watercritter/divingbeetle.htm>

These animals, both larvae and adults, can be mostly found in shallow, weedy areas in still water, like the edges of ponds and slow streams. The larvae are good climbers and spend most of their time climbing about on plants and other objects in the water, but they can swim if they need to. The adults are fast swimmers and rest by hanging upside down under the surface of the water. They also catch an air bubble as they hang upside down. They carry this bubble under their front wings and use it to breathe from. Both the larvae and the adults are predators but they kill their prey in

different ways. The larvae are called water tigers and they stick their mouthparts into their prey and inject a liquid that kills their prey and dissolves its insides. Then the water tiger sucks the fluid out leaving only the empty skin of their prey. Adults have normal chewing mouthparts and feed by catching and holding their prey with their legs while they tear their prey into pieces. Both the larvae and adults eat worms, leeches, other macroinvertebrates, and even tadpoles, salamanders, and small fish.

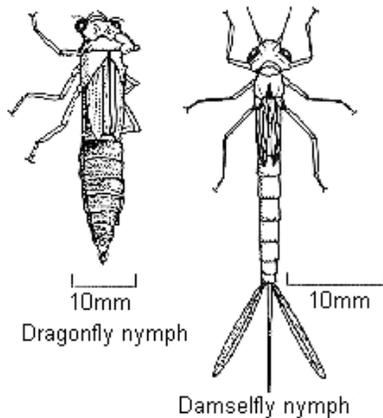
Water Penny

Water pennies live on stones in medium to fast flowing water. They especially like rocks that stick out of the water and splashing water. Water pennies are very good at holding onto rocks because their thin bodies mold to the rock they are attached to. They often hold on so tightly that tweezers are needed to peel them off. Water pennies scrape larvae off of the rocks they cling to. Their body extends outward like an umbrella to protect the food they are eating so it doesn't get washed away. If, however, there are too many nutrients in the water, the algae can grow too thickly and prevent water pennies from attaching to rocks. If this happens, water pennies can no longer live in the stream.



http://www.amrclearinghouse.org/Sub/WATER_monitoring/Macro%20pics/waterpenny.jpg

Dragonfly and Damselfly



<http://www.lagrande.k12.or.us/peers/streamwatch/bug6.gif>

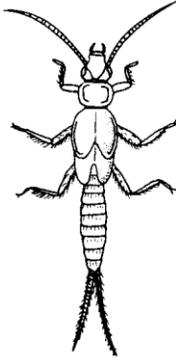
Dragon and damselfly larvae like to live in still water. There are many different types of these animals and some can live in rocky habitats while others like soft bottoms. They can move by either climbing, crawling, or digging into the ground. Some of these animals can build up pressure inside their body and then shoot water out to jet propel themselves forward. Usually they do this only as an emergency escape from predators like fish. All dragonfly and damselfly larvae are predators themselves. They catch their prey with a special lower lip. This lower lip has an "elbow", or hinge in the middle of it which allows it to bend. The lower lip also has two "finger like" parts that they can move and are covered in sharp teeth and spines (pictured below). As the larvae grows bigger, they eat larger animals including a lot of mosquitoes. They are also an important food source for some migratory birds.



http://www.illustratedwildlife.com/files/thumbs/Dragonfly_Nymph_mouthparts_01.jpg

Continued, next page

Stonefly



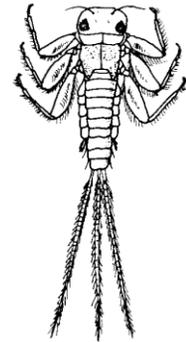
<http://naturalhistory.crowspath.org/wp-content/uploads/2012/12/stonefly2.gif>

Stonefly larvae like to live in cool, moving water with rocks and leaves lining the bottom. Most of these animals are crawlers and move around on the bottom of the stream bed to find food and places to hide. They usually hide in small spaces between the rocks in riffles. Not all stoneflies are predators but those that crawl around in these spaces at night in search of prey. Stoneflies that are not predators eat and shred leaves. These animals will often stay put in a safe place where there is a lot of food like the inside of a leaf pack. Some stonefly larvae use their long tails to defend themselves by hitting other macroinvertebrates that get too close. Some of them will also act like they are dead when

they are approached by predators. Stoneflies are helpful animals that play a big role in a stream's ecosystem by breaking down leaves and twigs or eating other more harmful macroinvertebrates such as black fly larvae.

Mayfly

Mayfly larvae live successfully in many different types of habitat but most live in habitats with firm ground. They can live in fast or slow moving water, and can live in a rocky or sandy habitat. Different mayflies also move in different ways. Some can swim, some cling, some climb, crawl, or burrow. Many of them seek out their food or scrape it off rocks. Very few of them are predators. Mayflies shed their skin more times than any other aquatic insect – between 12 and 27 times before they are adults. Some of them may molt as many as 45 times while they are larvae. When mayflies are finally adults they live for only about 24 hours. This is a much shorter time than the adult stage of any other insect because adult mayflies do not have any mouthparts and so do not feed. Their only role is to find a mate and reproduce. Because they live for so short a time, many mayflies hatch at the same time in swarms.



<http://www.state.nj.us/dep/wms/bfbm/mayfly.gif>

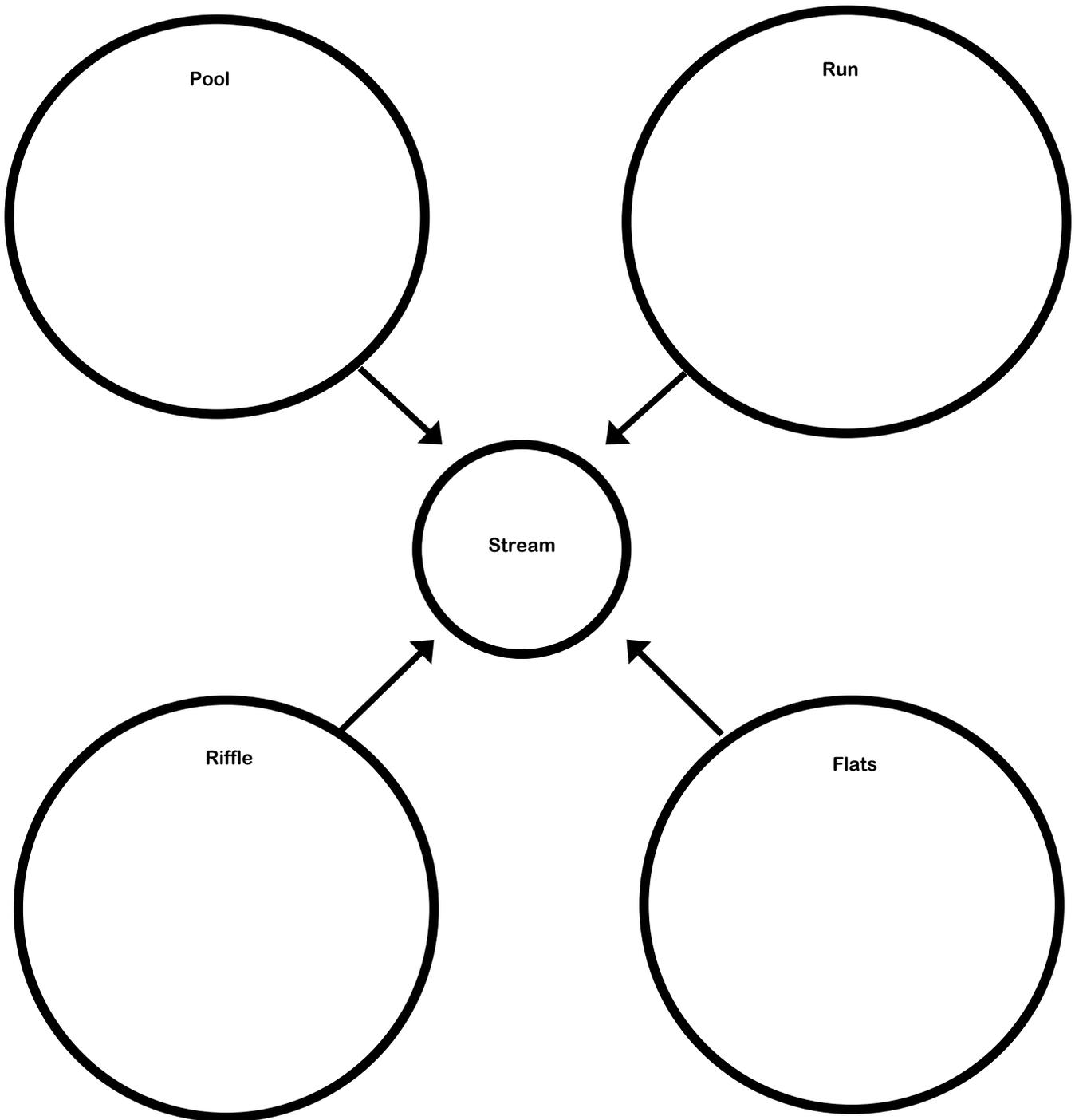
Information adapted from "A Guide to Common Freshwater Invertebrates of North America," by J. Reese Voshell, Jr., Ph.D., McDonald & Woodward Publishing Co., Blacksburg, VA 2002.

Name _____

Date _____

Macroinvertebrate Microhabitat Organizer

In which habitats do you think you will find these macroinvertebrates?
Hint: Some animals may be found in more than one type of habitat.



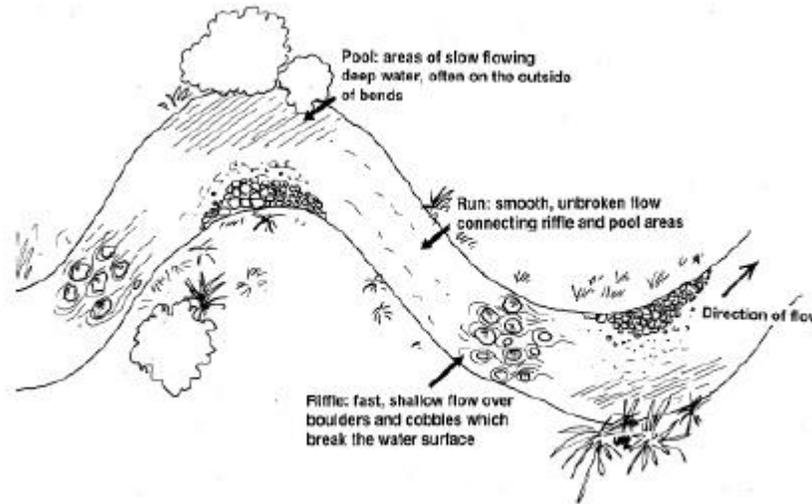
Name _____

Date _____

Microhabitats Worksheet

1. Please draw a section of your stream here: Label **Pools**, **Runs**, **Riffles**, and **Flats**. Include other details like the width of the water, features of the bank, and the type of ground surface underneath the water.

Example:



<http://www.dep.wv.gov/WWE/getinvolved/sos/PublishingImages/Reach.jpg>

2. Explore one of each type of habitat and record your findings:

Habitat type	Width of water in the stream (note the unit of measurement used)	Stream bottom - draw or describe the average grain or rock size	Depth of water in the middle of the feature (note the unit of measurement used)	Surface of the water - draw or describe
Riffles				
Run				
Flat				
Pool				