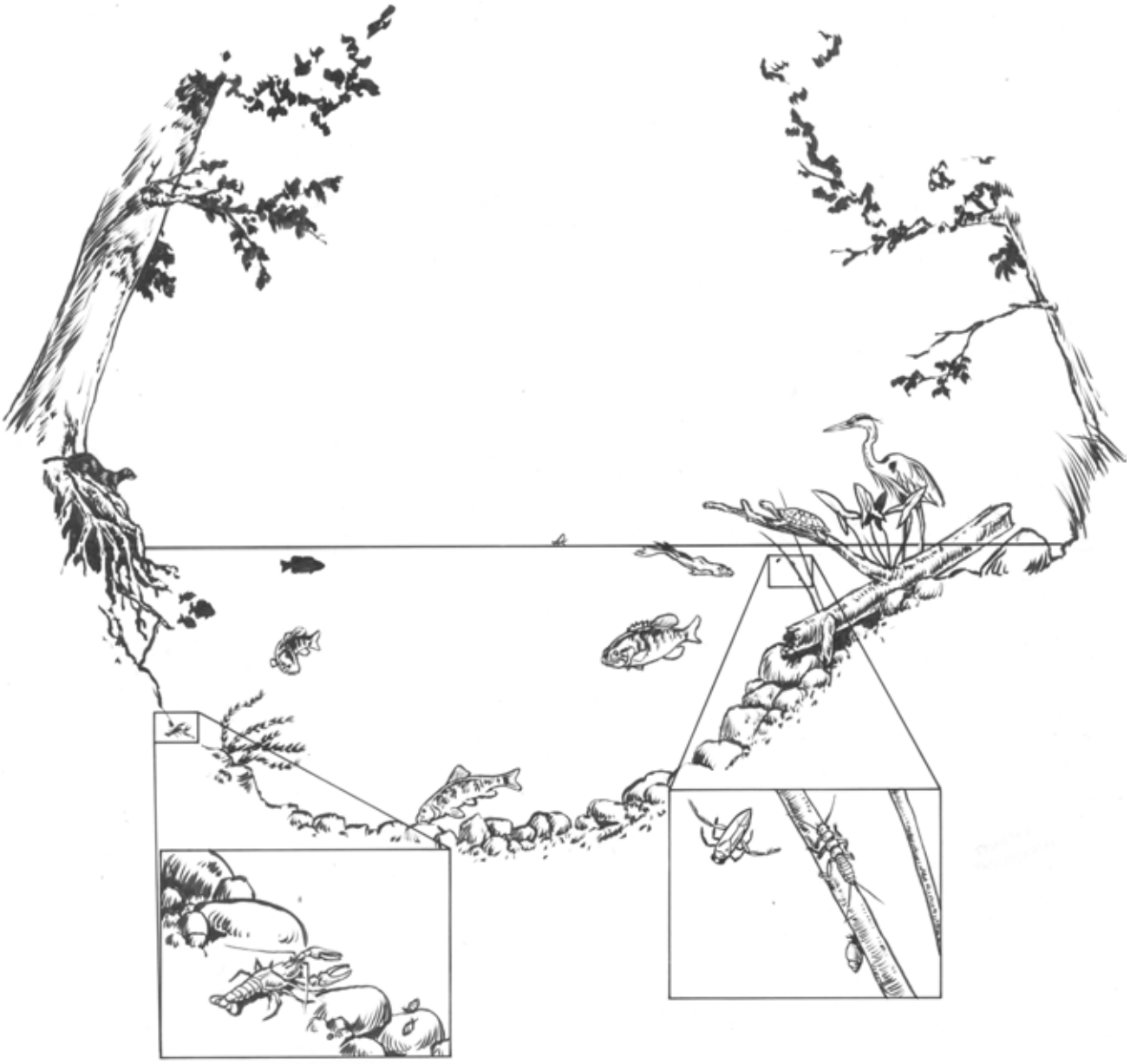
Aquatic Habitat Module

The quality of the fisheries and the diversity of aquatic life depend upon the watershed conditions of the stream channel, banks, riparian zone, and flood plain. Healthy aquatic habitats are an important component in all ecosystems. In addition, aquatic habitat health can affect human health and recreation.



Introduction

All life forms in and around the stream are dependent upon specific habitats for their existence. Each habitat determines the amount and types of food, shelter, and spawning areas available for fish and wildlife.

In a stream, the aquatic life is a function of the types of food, shelter, and conditions of the riparian corridor, stream channel, and overall watershed conditions. Land use conditions in a watershed determine runoff water quality and quantity. The riparian corridor conditions either buffer a stream or leave it unprotected (see Introduction on Riparian Corridors). In turn, human activities that take place directly in the stream channel (improper gravel or sand dredging, inappropriate ATV use in stream beds, channelization, dam construction, and water diversions or withdrawals of water flow) can degrade a stream's aquatic wildlife. Many of Missouri's rare and endangered species have their life cycles tied to stream beds or riparian corridors. For example, the wood frog and assortments of birds, fish, fungi, insects, mammals, and reptiles that are rare or endangered are dependent directly or indirectly on streams. Forty Missouri endangered species are aquatic. (Check the Missouri Department of Conservation booklet on *Rare and Endangered Species.)*

Four primary factors determine a stream's habitat quality: pools and riffles, stream flow, structures, and stability of the stream bottom. Each of these factors reflects the land use conditions of a stream's channel, riparian corridor, flood plain, and watershed.

Pools and riffles are the dominant habitat in a stream's ecosystem. The deep, slower moving waters of a pool provide cover and quiet resting areas for fish. Riffles are shallow and fast moving as water flows over rocks. The riffles put oxygen in the water, which is used by invertebrates that live among the rocks in a riffle. These invertebrates provide a food source for fish. Water quality in a stream can be determined by analyzing the types of macro invertebrates that live in a riffle.

As a stream gradient drops, pools and riffles work together to provide habitat and balance to a stream's equilibrium. Pools can fill up with sediment, a process known as channel filling. Riffles are destroyed by improper use of heavy equipment and ATVs in a stream bed. When a pool is exposed to excessive sedimentation two events take place, sunlight is absorbed by the suspended darker sediment particles raising the water temperature. This results in a decrease in the waters ability to hold oxygen. Additionally, photosynthesis is reduced as sunlight is blocked from aquatic plants therefore reducing the production of dissolved oxygen. A decrease of oxygen has a negative impact on sensitive macro invertebrates that are a food source for fish.

Stream flow is the speed and amount of water traveling in a stream channel. Stream flow is affected by precipitation, topography, and geology. Missouri receives approximately 20-40 inches of precipitation in a year. Due to the karst geology of the Ozarks, water is funneled underground in sinkholes and losing streams, reappearing as springs. As precipitation decreases in the dry summer months, aquatic life is stressed as stream flow decreases and temperatures increase with standing waters. Slower waters decrease the opportunity to add oxygen to a stream. Human activities such as

channelization, dredging, damming, discharging effluents, and withdrawing water in larger rivers increase or decrease stream flow.

Structures such as root wads, logs, boulders, and vegetation in a stream are important, they provide shelter for all forms of aquatic life. These structures provide cover for fish, attachment areas for insects, and homes for reptiles, amphibians, and mammals. A stream without of these structures will be void of a diversity of aquatic life. Dredging, channeling, and improper gravel or sand removal in streams disturb these structures and threaten aquatic wildlife.

The stability of a stream bed affects aquatic wildlife. A stable stream bottom does not shift excessively with changes in the stream flow. A stable stream bottom provides habitats for insects, crayfish, and essential spawning grounds for fish. The stability of a stream channel is reflected by human activities within the stream channel, riparian corridor, flood plain, and watershed. These factors are interdependent as a stream seeks equilibrium. The quality of aquatic life is determined by land use management in a watershed.

Aquatic Stream Habitats

Lesson Abstract

Summary:	This lesson consists of both in class and on stream site activities providing students with an opportunity to combine their present knowledge of stream environments with first-hand observations as an individual, team, or class. Students make connections between their expanding knowledge of aquatic habitats and watershed conditions.
GLE:	4.1.A.6, 4.1.B.6,4.1.D.6, 4.3.C.6, 5.3.A.6
Subject Areas:	Science, Communication Arts, Fine Arts
Show-Me Standards:	Goals – 1.1, 1.3, 2.1, 4.6 Strands – SC 1, 2, 4, 5, 7, 8; CA 4, 6; FA 1
Skills:	Observation, record keeping, illustration
Duration:	2 to 3 class periods (50 minutes)
Setting:	Classroom and stream site
Key Vocabulary:	Aquatic, macroinvertebrates, watershed, land use, riparian zone, sediment, pool, riffle, root wad, erosion

Rationale:

- All wildlife is dependent on aquatic habitats for their source of water.
- The quality of the water in an aquatic habitat partly determines the types and abundance of both aquatic and terrestrial organisms.
- Wildlife is a vital component of outdoor recreation and ecosystem stability.
- Wildlife is dependent on the quality of water the same as humans are.
- The diversity of aquatic organisms living within a stream channel reflect the overall health of a stream's watershed conditions and the riparian corridor adjacent to the stream.
- Aquatic organisms vary in their sensitivity to pollution and disruptions in their aquatic ecosystems and adjacent riparian corridors.
- A close examination of a stream's aquatic habitat provides the observers with information regarding land use practices and other human activities.

Student relevance:

- Students directly observe a stream's aquatic habitat.
- Students apply content knowledge directly to the aquatic habitat chosen for the activity.
- Students make direct observations to speculate on watershed conditions surrounding the given stream.

Learning Objectives:

Upon completion, students will be able to . . .

- Observe the physical conditions of the given area.
- Record observations.
- Make connections between observations and aquatic habitat conditions.
- Identify, compare, and contrast components of an aquatic ecosystem, both natural and human.
- Identify, compare, and contrast components of an aquatic ecosystem, both natural and human.
- Identify aquatic habitat components that function as food, shelter, water, and space.

Students Need to Know:

- How to define, explain and identify plant and/or animal habitats.
- How to identify wildlife.
- How to identify and describe human-made structures in a stream channel.
- How to observe and record findings.
- The connection between aquatic life and the conditions of a stream channel, riparian corridor, flood plain, and watershed.

Teachers Need to Know:

- General aquatic organisms in the area chosen for the activity (if possible, contact a local or regional MDC aquatic specialist to assist your activity.)
- The aquatic functions of pools, riffles, riparian corridors, stream bottom materials, root wads, erosions, and general fish feeding behaviors.

Resources:

The following materials area available from the Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102-0180, (573)751-4115.

Aquatic Field and Classroom Activities
Fishing for Answers: The Challenge of Conserving Aquatic Resources, 1991
Fishing for Answers: Teacher's Edition, 1991 (Under revision)
Missouri Fishes (poster with 18 species)
Life Within the Water, 1992

Missouri Crayfish
Water Plants for Missouri Ponds (Ask for pricing)

Sewall, Susan Beyer. *Hooked on Science: Ready to Use Discovery Activities for Grades 4-8.* Center for Applied Research in Education, 1990.

Materials Needed for Lesson:

Handouts
Aquatic Habitat Observations for Streams
Stream Insects & Crustaceans (Blue Bug Card)

Other Materials
Stream Team Macro Invertebrates ID card set (New)
Note cards or equivalent cut paper
Poster board or equivalent sized paper (one for every four students)
Markers
Notebooks with writing instruments
Color Pencils
Underwater view bottles (one for every two to three students)

Construction of bottles (see *Hooked on Science* by Susan B. Sewall):

1) Cut the top portions off of clear two-liter plastic soda bottles.
2) Apply masking tape around the cut edges of the bottles to prevent the plastic from cutting students.

Optional materials
Clipboards
Camera and film
Trash bags
Bottom dredges (buckets or cans with ropes tied on and holes on the bottom)—see MDC publication *Aquatic Field and Classroom Activities* (one for every three to four students)
Kick nets or seining nets (contact local or regional MDC office)

Procedure:

Part One: Circulating Current Knowledge (classroom activity)

- Provide each student with 3 to 5 note cards and a marker.
- Ask students to write down (using marker) one term or phrase on each card that reflects their knowledge of stream environments. (This segment is done independently and silently.)
- Ask students to group their like cards with another student, then ask them to team up with another pair and group their cards.
- Repeat this process until all the cards from the class are grouped together.
- Go over each group of cards with the class and make connections, corrections, and clarifications as needed.

- Construct a concept map from the card piles (example: water, fish, rocks, currents, bugs) showing the "current" knowledge the class just "circulated" and "pooled."
- Sum up the concept map and explain to students that they are going to visit a stream aquatic habitat and observe these components.
- Go over the handout *Aquatic Habitat Observations for Streams* with students for the field trip activity.
- Introduce and model the procedure for using aquatic wildlife sampling and observation equipment (underwater view bottles, bottom dredges, kick nets, and/or seining nets).
- Instruct students on appropriate dress for the trip (old clothes, shorts, river shoes, old tennis shoes, or rubber boots) and provide permission slips.

Part Two: Stream Aquatic Habitat Observations (field trip activity)

- Transport students and supplies to the site (if needed, arrange for an MDC resource person, STREAM TEAM staff person or active volunteer, or parent volunteers to attend).
- Go over safety precautions and appropriate conduct before allowing students off the bus (require that all students stay within a designated area at all times and not enter the stream without permission).
- Instruct students to complete the *Aquatic Habitat Observations* handout in pairs.
- Combine pairs into teams of four and ask everyone to share and compare their observations.
- Instruct students to add additional observations of their new team members to their handouts.
- Call on each team to discuss their observations and to note same, similar, and different observations.
- Tell students to add and clarify observations on their own handout.
- Explain to the class that they have "circulated" their "current" observations and discuss how these observations differ from the activity conducted in class.
- Demonstrate how to use an underwater viewing bottle (place the base of the bottle in the water and look directly down into the top of the bottle).
- Provide one underwater viewing bottle to each team of students.
- Allow students to observe shallow (knee high or less) underwater environments.
- Ask students to record their observations on their handout.
- Have students rotate to different areas of the stream as time and appropriate conditions exist, note additional observations.
- Have students collect and identify water critters with provided resources.
- Optional – Have a designated student or adult take pictures of collected critters, the stream channel, the riparian corridor, and other observations for extension activities in class at a later date.
- Demonstrate how to use the bottom dredge by pulling the dredge along the bottom of a shallow area to collect sediments and organisms.
- Have each team use the dredge and observation and record their collections.
- Demonstrate, use, and record observations from other sampling devices.
- Sum up the class findings and collect materials before returning to school.

- Ask students to note the land use practices that they see in the watershed as they travel back to school.
- Optional – Pick up trash before leaving.

Part Three: Connecting Current Knowledge (classroom activity)

- Ask students to read over their *Aquatic Habitat Observations* handout that they completed in the field.
- Review the class's combined observations through questioning.
- Have each team reconstruct their direct observations by drawing on poster board or large paper a picture of the entire habitat they observed.
- At the bottom of their drawing have students write a statement about the health of the aquatic habitat.
- Ask each team to share their posters with the rest of the class.
- Ask students to draw, chart, or list the land use activities from the trip. Have students include point and nonpoint sources pollution.
- Ask teams to share their observations and inferences.
- During discussion, ask questions to make connections between the aquatic habitat ecosystem health of surrounding land use practices.
- Optional – Repeat this process for another stream site with a significantly different health.

Evaluation Strategies:

- Have students keep a journal of their observations.
- Have students write a story, newspaper article, poem, song, or skit about their findings.
- Have students create a concept map of their findings which connects their current knowledge.

Extension Activities:

- Have students use a topographic map of the stream site and outline the stream's watershed.
- Have students make an inventory of the watershed (use the *STREAM TEAM Inventory Guide available on line)*. www.mostreamteam.org
- Have students repeat the lesson for areas in a stream that are above and below a known point source pollution.
- Train students in biomonitoring of macroinvertebrates.
- Devise a set of interview questions for anglers. Conduct the interviews and compile the results.
- Compare and contrast the flowing aquatic habitat to other freshwater aquatic habitats such as larger rivers, ponds, lakes, and wetlands.

Suggested Scoring Guide:

Aquatic Stream Habitats

Teacher Name: _____

Student Name: _____

CATEGORY	4	3	2	1
Contributions	Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in the group and classroom discussion. A strong group member who tries hard!	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.
Focus on the task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Problem Solving	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions, but is willing to try out solutions suggested by others.	Does not try to solve problems or help others solve problems. Lets others do the work.
Monitors Group Effectiveness	Routinely monitors the effectiveness of the group and makes suggestions to make it more effective.	Routinely monitors the effectiveness of the group and works to make the group more effective.	Occassionally monitors the effectiveness of the group and works to make the group more effective.	Rarely monitors the effectiveness of the group and does not work to make it more effective.
Preparedness	Brings needed materials to class and is always ready to work.	Almost always brings needed materials to class and is ready to work.	Almost always brings needed materials but sometimes needs to settle down and get to work .	Often forgets needed materials or is rarely ready to get to work.
Working with Others	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.

Rubric Made Using: **RubiStar** (http://rubistar.4teachers.org)

Aquatic Habitat Observations for Streams

Directions: Make observations about the following items located in or near the stream environment. Record these observations in the provided areas. Use all of your senses to make observations.

Riparian Corridor

Land use -

Vegetation -

Wildlife signs –

Signs of human use -

Ground cover -

Soil –

Stream Channel

Bottom sediments - (type & approximate sizes)

Erosion signs -

Gravel bars –

Channel width -

Channel path -

General depths –

Pools -

Riffles -

Currents –

Root wads -

Logs -

Boulders –

Fish feeding behaviors –

Food, Water, Shelter, and Space

Identify each item above as either food, water, shelter, or space for stream aquatic habitats. Use these symbols: food *, water +, shelter ^, and space #. Note: Some items may serve more than one function.

Aquatic Habitat Worksheet (continued)

Underwater Viewing Bottle

Describe and illustrate what you observed (use any provided resources for identification of organisms). Be as specific as time permits.

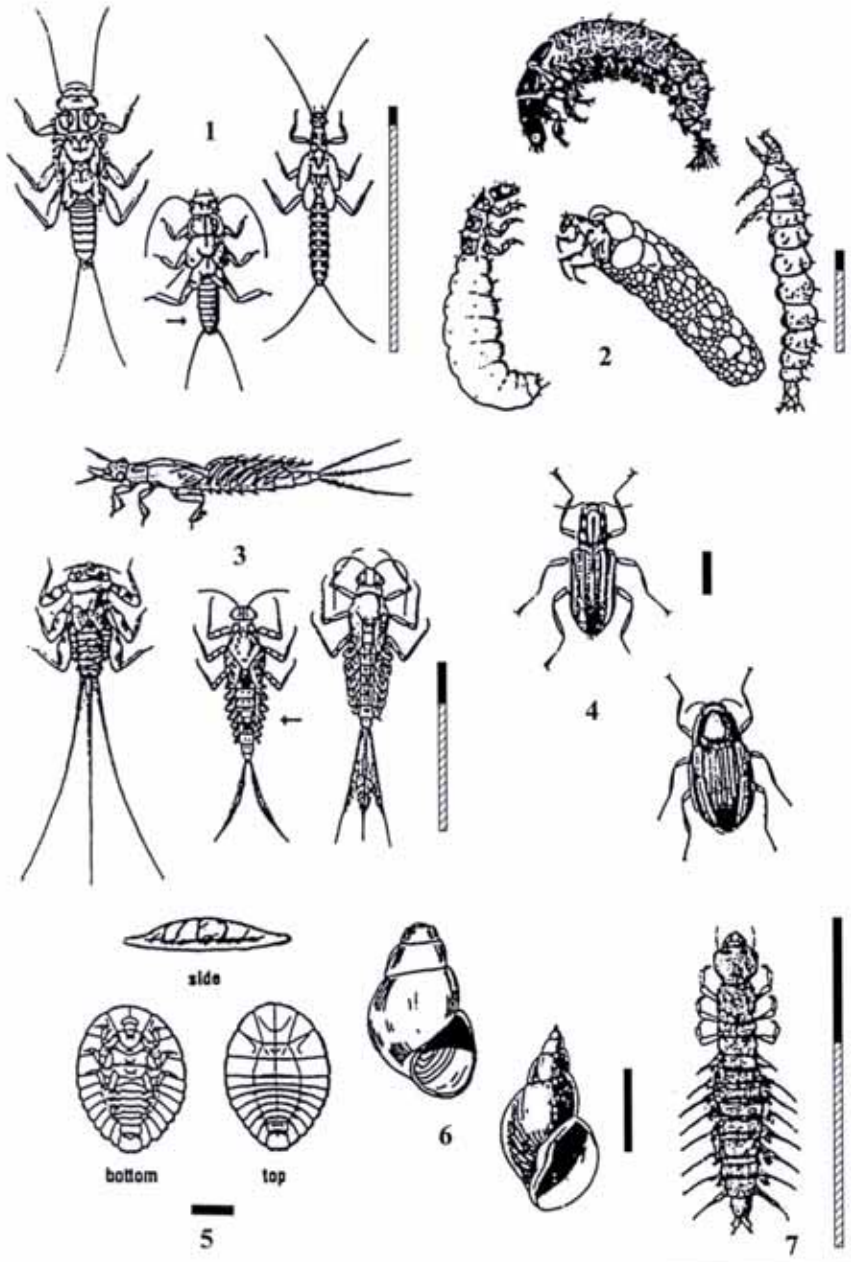
Bottom Dredge

Describe and illustrate the living and nonliving times that you dredged from the stream's bottom (use any provided resources for identification of organisms). Be as specific as time permits.

Other Sampling Devices

On the back of this sheet record observations from other devices used in this activity.

Stream Insects & Crustaceans



GROUP ONE TAXA

Pollution sensitive organisms found in good quality water.

1 Stonefly nymph: *Order Plecoptera.* 1/8" - 1 1/2"; 6 legs with hooked tips; 2 hairlike tails. Smooth (no gills) on abdomen (see arrow). May have gills on thorax under the legs.

2 Caddisfly larva: *Order Trichoptera.* Up to 1"; 6 legs on thorax; 2 hooks at end of abdomen. May be in a stick, rock, or leaf case with its head sticking out. May have fluffy gill tufts on lower half.

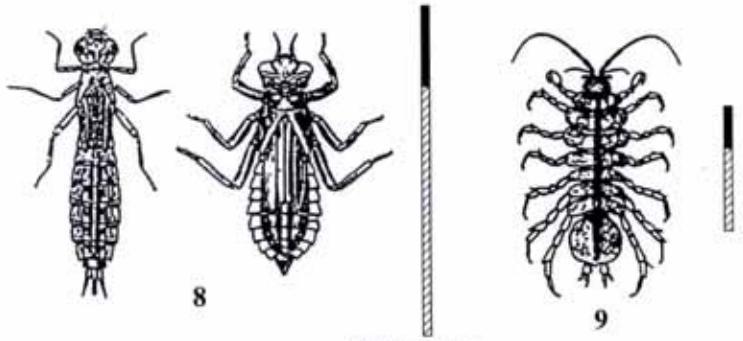
3 Mayfly nymph: *Order Ephemeroptera.* 1/4" - 1"; brown, moving, platelike, or feathery gills on abdomen (see arrow); 6 large hooked legs; antennae; 2 or 3 long, hairlike tails. Tails may be webbed together.

4 Riffle Beetle: *Order Coleoptera.* Adult: Tiny, 6 legged beetle; crawls slowly on the bottom. Larva: Entire length of body covered with hard plates; 6 legs on thorax; uniform brown color. Combine number of adults & larva when reporting total counts.

5 Water Penny larva: *Order Coleoptera.* 1/4"; flat saucer-shaped body, like a penny; segmented with 6 tiny legs underneath. Immature beetle.

6 Gilled Snail: *Class Gastropoda.* Shell opening covered by thin plate called operculum. When pointed up and opening facing you, the shell opens to right. Do not count empty shells.

7 Dobsonfly larva (hellgrammite): *Family Corydalidae.* 3/4" - 4"; dark-colored; 6 legs, large pinching jaws; eight pairs feelers on lower half of body with paired cottonlike gill tufts along underside of lateral filaments; short antennae; 2 tails and 2 pairs of hooks at back end.



GROUP TWO TAXA

Somewhat pollution tolerant organisms can be in good or fair quality water.

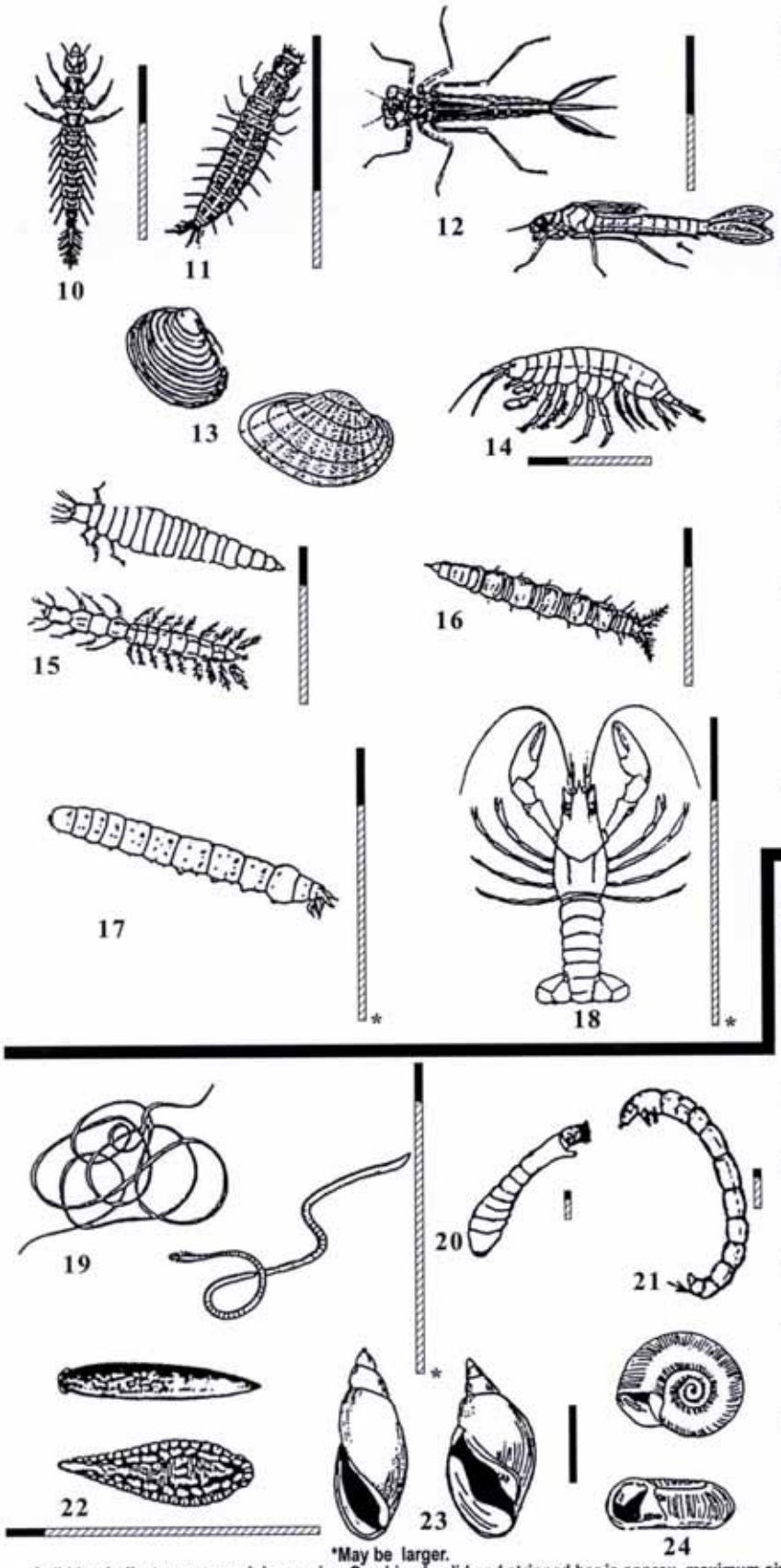
8 Dragonfly nymph: *Suborder Anisoptera.* 1/2" - 2"; large eyes, 6 hooked legs. Wide oval to round abdomen, masklike lower lip.

9 Sowbug: *Order Isopoda.* 1/4" - 3/4"; gray oblong body wider than it is high, more than 6 legs, long antennae, looks like a 'roly poly.'

Save Our Streams

*May be larger.

~Solid bar indicates aprox. minimum size. Combined solid and stripped bar is approx. maximum size.~



GROUP TWO TAXA continued

10 Alderfly larva: *Family Sialidae.* 3/8"- 1"; looks like small hellgrammite but has 1 long, thin, branched tail at end of abdomen (no hooks). No gill tufts underneath the lateral filaments on abdomen.

11 Fishfly larva: *Family Corydalidae.* Up to 1 1/2"; lateral filaments on abdomen. Looks like small hellgrammite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

12 Damselfly nymph: *Suborder Zygoptera.* 1/2"- 1"; large eyes; 6 thin hooked legs; 3 broad oar-shaped tails; body positioned like a tripod. Smooth (no gills) on sides of lower half of body (see arrow).

13 Clam/Mussel: *Class Bivalvia.* Do not count empty shells.

14 Scud: *Order Amphipoda.* 1/4"- 3/4"; white to gray, body higher than it is wide; swims sideways; more than 6 legs; resembles small shrimp.

15 Other Beetle larva: *Order Coleoptera.* 1/4" - 1"; light-colored; 6 legs on upper half of body; feelers; antennae; obvious mouthparts. Diverse group.

16 Watersnipe Fly larva: *Family Athericidae (Atherix).* 1/4" - 1"; pale to green; tapered body; many caterpillarlike legs; conical head; two feathery 'horns' at back end.

17 Crane Fly larva: *Suborder Nematocera.* 1/3" - 4"; milky, green, or light brown; plump caterpillarlike segmented body. May have enlarged lobe or fleshy fingerlike extensions at the end of the abdomen.

18 Crayfish: *Order Decapoda.* Up to 6"; 2 large claws, 8 legs, resembles small lobster.

GROUP THREE TAXA

Pollution tolerant organisms can be in any quality of water.

19 Aquatic Worm/Horsehair Worm: *Class Oligochaeta/ Phylum Nematomorpha.* Aquatic worm: 1/4"- 2"; can be very tiny, thin wormlike body. Horsehair Worm: 4"-27"; slender, can be tangled.

20 Black Fly larva: *Family Simulidae.* 1/8"- 3/8"; one end of body wider. Black head, suction pad on end.

21 Midge Fly larva: *Suborder Nematocera.* Less than 1/4"; distinct head; wormlike segmented body; pair of tiny pro-legs under head and tip of abdomen.

22 Leech: *Order Hirudinea.* 1/4" - 2"; flattened muscular body, ends with suction pads.

23 Pouch Snail and Pond Snails: *Class Gastropoda.* No operculum. Breathe air. Shell usually opens on left. Do not count empty shells.

24 Other snails: *Class Gastropoda.* No operculum. Breathe air. Snail shell coils in one plane. Do not count empty shells.

*May be larger.

~Solid bar indicates aprox. minimum size. Combined solid and stripped bar is approx. maximum size.~

09/05
STR 250

Stream Substrate Habitat

Lesson Abstract

Summary:	Students conduct random sampling of habitat material found in a stream to determine benthic invertebrate fauna diversity.
GLE:	SC7.1.A.6, 7.1.B.6, 7.1.C.6, 7.1.D.6, 7.1.E.6,
Subject Areas:	Science, Mathematics
Show-Me Standards:	Goals – 1.3, 1.4, 1.8 Strands – SC 3, 4, 5, 7, 8; MA 1, 2, 3
Skills:	Measuring, random sampling
Duration:	1 class period (50 minutes)
Setting:	Site on a shallow, gravel or sand bottom stream
Key Vocabulary:	Random sampling, habitat, substrate, cobble, bow caliper, interstitial spaces, Dependant Variable, Independent Variable

Rationale:

- There is a diversity of insects that live in and around water.
- Stream bottom material influences the type of organisms in a stream.
- Substrate is a function of stream stability reflecting the conditions of a stream channel, riparian corridor, flood plain, and watershed.
- Benthic invertebrates living in running water show preference to various bottom types.
- Benthic invertebrates not only need specific chemical water quality parameters, but they need substrate habitat providing adequate living space.
- Habitat is important in animal survival.

Student relevance:

- Substrate habitat is one component that helps determine benthic diversity.

Learning Objectives:

Upon completion, students will be able to . . .

- Determine the average size substrate material in a cross-section of a riffle or other part of a stream.
- Identify that some species prefer a particular substrate.

- Use a random number table.

Students Need to Know:

- Insects live around bodies of water.
- Insects and other animals live in water and are dependent on a wide variety of variables, including substrate composition.

Teachers Need to Know:

- Most benthic invertebrates living in water show preference to various bottom types.
- Some species prefer a particular substrate; thus, as the stream bottom changes from place to place so does the benthic invertebrate fauna.
- The more diversity in stone size within a stream provides more variety of space available for colonization by benthic invertebrates.
- Sandy bottoms often have the fewest kinds of benthic invertebrates.
- Silt reduces the fauna among stones because it fills in interstitial spaces.
    - Interstitial spaces are the gaps between different sized stones where macroinvertebrates colonize.
- The benthic invertebrate in clean, stony riffles are greater in species diversity than those in silty riffles and pools.
- Often the upstream end of a riffle has a more diverse and abundant benthic fauna because organic matter used as food reaches this area first.
- This system should be used to compare streams whose geographical, geological, and watershed characteristics are similar.
- Muddy or sand bottom streams in northern Missouri are difficult to measure using this system.

Resources:

The following materials are available from the Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102-0180, (573)751-4115.

Aquatic Field and Classroom Activities
Life within the Water

A Monitor's Guide to Aquatic Macroinvertebrates - Available form the Izaak Walton League of America (IWLA), 707 Conservation Lane, Gaithersburg, MD 20878, 1-800-284-4952. ($5 each with 10% discount for ordering 10 or more)

Materials Needed for Lesson:

Transparency of *Stream Cross Section of Riffle* (provided)
Random Number Chart (provided)
Tape measure that will stretch across a stream (one per team)
Bow caliper—measures external diameter, obtain at an office supply store (one per team)

Two clipboards (optional)
Graph paper
Pencils

Procedure:

- Prior to field trip, show transparency of *Stream Cross Section* and discuss where aquatic life live.
- Divide students into at least two teams.
- Have each team select a stretch of river channel where the water is less than knee deep.
- Stretch a measuring tape across the selected sites.
- Remove 100 rock samples from the stream bed in a riffle. Remove one rock from the stream for each random number on the chart where that number is found on the tape measure.
- Have each team align their rocks from smallest to largest based upon the axis as it would be found in the stream.
- Measure and record all stones using a bow caliper. Have students take turns.
- Measure to the nearest centimeter along the horizontal or longest axis.
- Graph in groupings of five centimeters along the X axis (Dependent Variable) and number of stones along the Y axis.(Independent Variable)
- The graph is interpreted as the greater number of points along the Y axis, the greater the interstitial spaces, the greater the potential for habitat diversity.

Evaluation Strategies:

- Check measurements done by students and observe students' sampling techniques.
- Have students write a paragraph explaining which site has greater substrate diversity and why.

Extension Activities:

- Detailed water quality monitoring.
- Attend Stream Team Volunteer Water Quality Monitoring Workshops

Scoring Guide:

Substrate Habitat

Teacher Name: _____

Student Name: _____

CATEGORY	4	3	2	1
Accuracy of Plot	All points are plotted correctly and are easy to see. A ruler is used to neatly connect the points or make the bars, if not using a computerized graphing program.	All points are plotted correctly and are easy to see.	All points are plotted correctly.	Points are not plotted correctly OR extra points were included.
Neatness and Attractiveness	Exceptionally well designed, neat, and attractive. Colors that go well together are used to make the graph more readable. A ruler and graph paper (or graphing computer program) are used.	Neat and relatively attractive. A ruler and graph paper (or graphing computer program) are used to make the graph more readable.	Lines are neatly drawn but the graph appears quite plain.	Appears messy and "thrown together" in a hurry. Lines are visibly crooked.
Title	Title is creative and clearly relates to the problem being graphed (includes dependent and independent variable) and s printed at the top of the graph.	Title clearly relates to the problem being graphed (includes Dependent and Independent Variable) and is printed at the top of the graph.	A title is present at the top of the graph.	A title is not present.
Labeling of X axis	The X axis has a clear, neat label that describes the units used for the Independent Variable (e.g.: days, months, participants' names).	The X axis has a clear label that describes the units used for the Independent Variable.	The X axis has a label.	The X axis is not labeled.
Labeling of Y axis	The Y axis has a clear, neat label that describes the units and the Dependent Variable (e.g.: % of dog food eaten; degree of satisfaction).	The Y axis has a clear label that describes the units and the dependent variable (e.g.: % of dog food eaten; degree of satisfaction).	The Y axis has a label.	The Y axis is not labeled.

Rubric Made Using: **RubiStar** (http://rubistar.4teachers.org)

Random Number* Chart

53	49	99	111
18	182	31	51
72	281	41	71
128	94	29	82
36	133	33	213
212	206	77	242
45	25	28	144
10	52	150	170
65	66	147	210
125	35	175	55
42	81	88	28
89	27	13	84
95	63	101	179
200	122	222	110
16	54	145	68
214	251	19	233
108	56	103	263
67	24	280	155
250	98	177	11
39	59	15	202
130	20	17	267
14	61	239	129
298	142	180	198
13	76	166	140
300	93	86	260

*Random numbers based on a 25-foot tape measure being used.

Stream Cross Section of Riffle