

Macroinvertebrate and Mudsnaails

Macroinvertebrate and Mudsnaails activities are directly tied to the fifth spread - pages 9 and 10 of "Our Wetland Project".

Exploring a local stream gives students the opportunity to determine its relative health, physical attributes and plant/animal populations. During the investigation students collect and classify aquatic insects and learn how they are adapted to stream life.

Levels

All Grades

Subjects

Language Arts, Science, Mathematics

Skills

Analyzing, Identifying, Investigating, Observing, Qualifying

Concepts

Structure and functions of living things

Observation, Inquiry process

Ecosystem balance

Objectives: Students will be able to:

Define the term macroinvertebrate

Illustrate how tolerance of water quality conditions varies among macroinvertebrate organisms

Explain how population diversity provides insight into the health of an ecosystem

Use a dichotomous key to identify an aquatic insect

Identify three aquatic insects

Explain the difference between complete and incomplete metamorphosis

Materials (20 student class-size)

What is a Stream? Mudsnaail Invasion

white board or butcher paper for brainstorming

macroinvertebrate samples

Time Considerations

Preparation - 30 minutes

Activity - 80 minutes

Lesson Overview

- **What is a Stream? Mudsnaail Invasion** (15 minutes)

- **Dichotomous Keys** (20 minutes)

- **Stream Exploration** (45 minutes)

Background

Explain that a macroinvertebrate is an animal without a backbone living in one stage of its life cycle, usually the nymph or larval stage. Visible without a microscope, macroinvertebrates can spend a few years living in a freshwater habitat. Many are benthic (oceanic or deep sea) organisms, or bottom dwellers.

New Zealand Mudsnaails are tiny INVASIVE snails that can be found in many Western States.

They may be small, but don't be fooled! In large numbers, these small snails can completely cover a stream bed and wreak havoc on local stream ecosystems. Introduced from New Zealand to the western United States in the 1980s, New Zealand Mudsnaails have already invaded many Western rivers in California, Idaho, Montana, and Wyoming including Yellowstone National Park.

What is a Stream? Mudsnap Invasion Lesson Details - 15 minutes

STEP ONE. Introduce streams. Ask students *What is a stream?*, or better yet,

Why do streams exist?

Where do streams come from?

Why do they exist?

(stream sources: direct runoff, snowmelt, glaciers, springs, lakes, and marshes)

How does water get to altitudes? (precipitation, usually)

Brainstorm living and non-living things in a stream (verbally or list on white board or butcher paper). Ask students to think of a stream(s) they have seen. Ask students

What living and non-living things have you (would you find) found in a stream?

Create a list as a group of living and non-living things (divided into these two categories).

Explain to students that out of all things they found in a stream, the next exercise will focus on the aquatic insects/macroinvertebrates. Show examples of macroinvertebrates to students and ask them to think about what they are. Break down the word macroinvertebrate.

- **macro** (*large, inclusive*)
- **in** (*lacking*)
- **vertebrate** (*backbone, spine*)

Explain to students how population diversity provides insight into the health of an ecosystem. Discuss what would happen to the diversity of a stream ecosystem following the invasion of a single Mudsnap. Or you can describe how Quagga and zebra mussels are invasive species capable of plugging water delivery systems and reducing diversity.

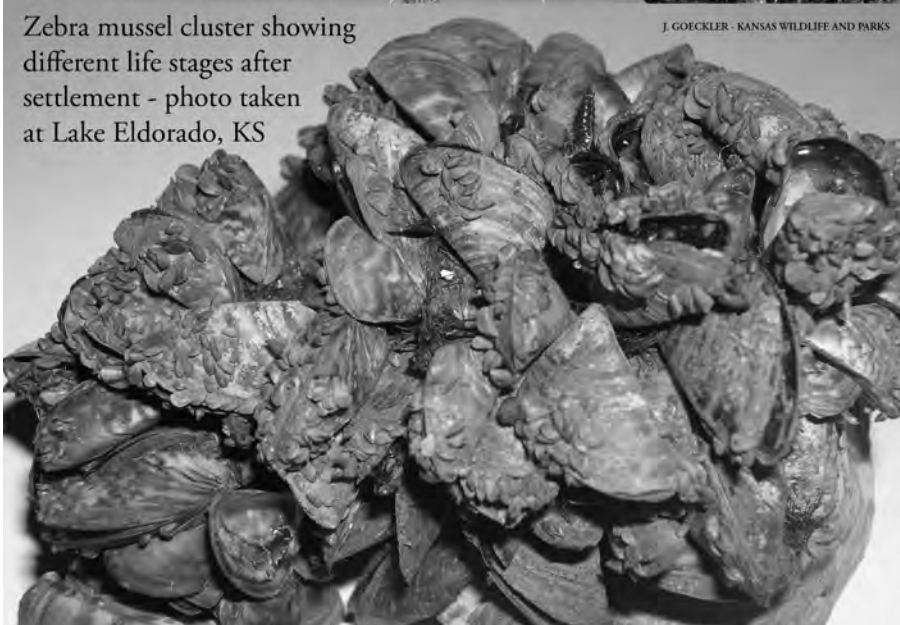


Fishing rod recovered
from Lake Eldorado, KS
zebra mussel settlement

M. MURRELL

Zebra mussel cluster showing
different life stages after
settlement - photo taken
at Lake Eldorado, KS

J. GOECKLER - KANSAS WILDLIFE AND PARKS



Dichotomous Key Lesson Details - 20 minutes

Materials

- white board or butcher paper (or flip chart) and markers
- Dichotomous Key Candy Kit
- Aquatic Insect dichotomous keys (1 per student, to be reused)
- 6 species of aquatic insects, already collected
- private eyes/magnifying glasses (or hand lens from activity kit)

STEP ONE. Introduce the concept of classification.

Why do we do classification? (It helps us make sense of the world we live in, and it helps us recognize and identify the things in our world. It is a tool to identify objects on their characteristics.)

STEP TWO. Explain the rules of a dichotomous key.

Make a YES or NO decision about whether or not something fits a category.
For example, Living or Non-Living; Boy or Girl; Light Hair or Dark Hair; and Soft or Hard.

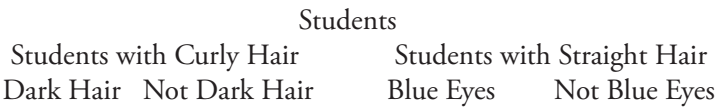
STEP THREE. Key out the class--make a dichotomous People Key.

Pick a starting point, such as boy/girl, and work down until each person is identified with a unique description. Once all of the students have been sorted, ask them what characteristics you used to divide them. Diagram on the blackboard how a scientist would begin to record this sorting process to form a dichotomous identification key.



If the students seem to have grasped this sorting process, let them make the next division. Ask each group to decide on one trait that will further divide their group into two smaller groups. Then have each group physically separate themselves into two distinct groups. Now there are four (4) groups.

Ask students to determine the characteristics that were used by other groups to make the last division. Continue to record the sorting process on the board.



Each of these four groups then works to divide again, for a total of eight groups. Once again have the students determine the traits that were used to further subdivide the groups. Explain to the class that they will continue this sorting process until everyone has been singled out by a unique set of characteristics. Be sure to record the characteristics for each division.

Explain to students that this resulting dichotomous People Key can now be used by anyone to name or identify any student in the class. Given time, you can invite another teacher or principal to use the key by selecting a student specimen and using the key characteristics to identify the specimen.

STEP FOUR. Using the Dichotomous Key Kit, key out a bag of candy. Observe the candy to decide on distinguishing characteristics. Pick a starting point and work out the key to find each piece of candy's 'Latin name'. Students should share as a group the 'new' Latin name of their candy and then they can eat it if they want! Make sure everyone understands the concept at this point.

Stream Exploration Lesson Details - 45 minutes

Materials

Macroinvertebrate Identification Key (available from UWEX Environmental Resources Center - 608-262-2634 - reproduced in this section for educational purposes)

hand lens (6-7)

large shallow tubs/trays

waders (2-4 pair)

plastic spoon (98)

sorting trays (for example, ice cube tray)

D-net and rinse container (for example, cup or water bottle)

STEP ONE. Select a sampling site. Try to find a small, fairly shallow, slow-moving stream or pond. Be alert to student safety. Advise students in advance to dress for the setting. Brief students on habitat courtesies. Alert them to ways to minimize potential damage to the habitat, and encourage care in their collecting techniques. Emphasize that all the wildlife is to be returned to its habitat unharmed. You may choose whether or not to take some of the organisms back to school for further study.

STEP TWO. Begin the collection process. Students should take a strainer, identification key, specimen jar, and hand lens with them. Let students discover techniques for uncovering insects in the stream. Thirty to 45 minutes should be ample time to find enough insects to get the aquarium well stocked. After this leads to direct observation of the food chain.

When students have completed the search and discovery portion of the lesson, have them each investigate and draw an insect larva or nymph they found.

What features do you think help this animal to survive in its habitat?

What does this aquatic insect indicate relative to the water quality?

Modifications for Older Students (advanced collection techniques and identification processes may be used).

STEP ONE. Choose a location that is not too deep (do not go above your knees) and does not have a strong current. *Note. Depending on water conditions, instructors/teachers may be required to enter the water for collection of macroinvertebrates and students will observe.

Choose a riffle area (a shallow, gravelly area with some current) for your sample location. Approach the sampling location from downstream. Do not disturb the sampling area by walking in it or upstream of it before you are ready to collect.

Place the collection net (D-net) in front of you and facing upstream, so the opening faces into the flow. Hold the net perpendicular to the flow, but tilted slightly down into the water. The bag of the net should be resting on the bottom of the stream.

Use your feet to gently agitate (by shuffling your feet on the bottom) and disturb the substrate (bottom material of the stream) walking diagonally up the stream (back and forth on small streams) traveling **20 feet and for one minute**. The Recorder will act as a timekeeper and call out "15 seconds", "30 seconds", "45 seconds", and "stop". Make sure the kicking lasts one minute for consistency. For safety reasons, **DO NOT** sample where the stream is deeper than 20 inches. Keep your sampling in the shallow areas.

Stream Exploration Lesson Details - 45 minutes *(continued)*

Carefully lift the net, from the bottom, out of the water and carry it to the river bank. Turn it inside out in a bucket/tray, half full of cool stream water. Gently transfer the invertebrates and debris into the bucket by carefully rinsing or shaking the net.

Gently pick off organisms that cling to the net. Handle them carefully to avoid injuring them. Make sure the entire sample is in the bucket and is kept in the shade. Check larger pieces of debris in the bucket for insects, and then carefully put the debris back into the river.

Handle the invertebrates gently with spoons. Many will be active. Sort the invertebrates by major groups into smaller containers/sorting trays/ice cube trays. Each container or “cube” should have insects that look the same; the next cube will be filled with insects that look different from the first cube, and so on.

Use hand lenses and other equipment that may be provided to examine each invertebrate in the sample closely.

Use the Macroinvertebrate Identification Key to identify each type of invertebrate present in the sample. Most simple field charts identify only major taxa or groups (classes, orders, families), not species. There are thousands of species and many are difficult to identify to that level of detail.

On the Data Sheet, check off each type of taxa that is present in the sample.

Once the identification is complete return all macroinvertebrates and debris/rocks that were collected back to the exact spot where they were collected.

Calculate the results of the Pollution Tolerance Index and assess the stream quality using the Data Sheet.

Recommended Roles Within the Group.

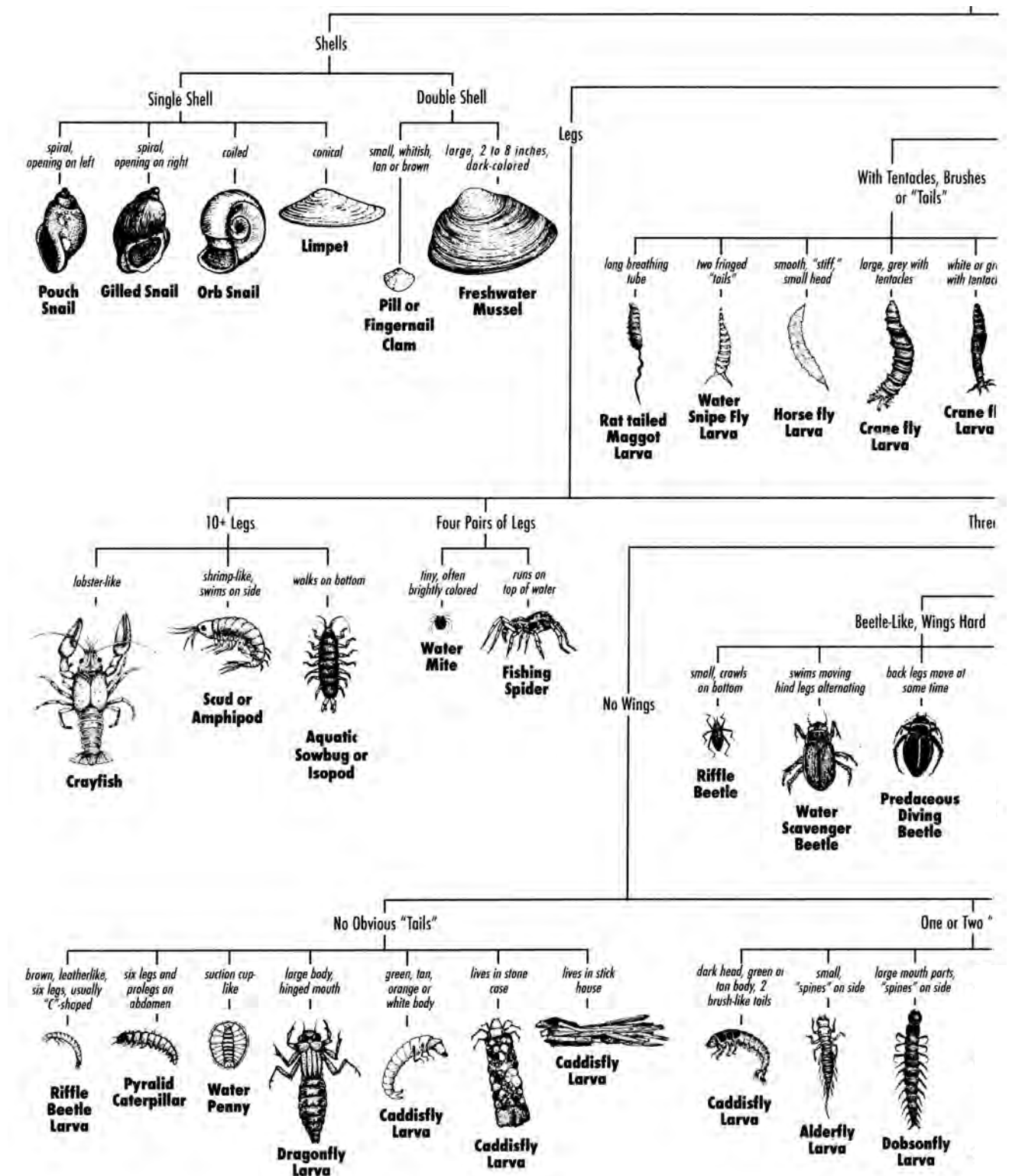
Sample Collector/Identification (*) - Responsible for going into the water and gathering a sample for observation; later assists in the identification of macroinvertebrates

Recorder/Assistant Collector (*) - Responsible for timing one minute for the Sample Collector; responsible for collecting information from others in group in order to record observations on Data Sheet; may assist the Sample Collector if equipment is available

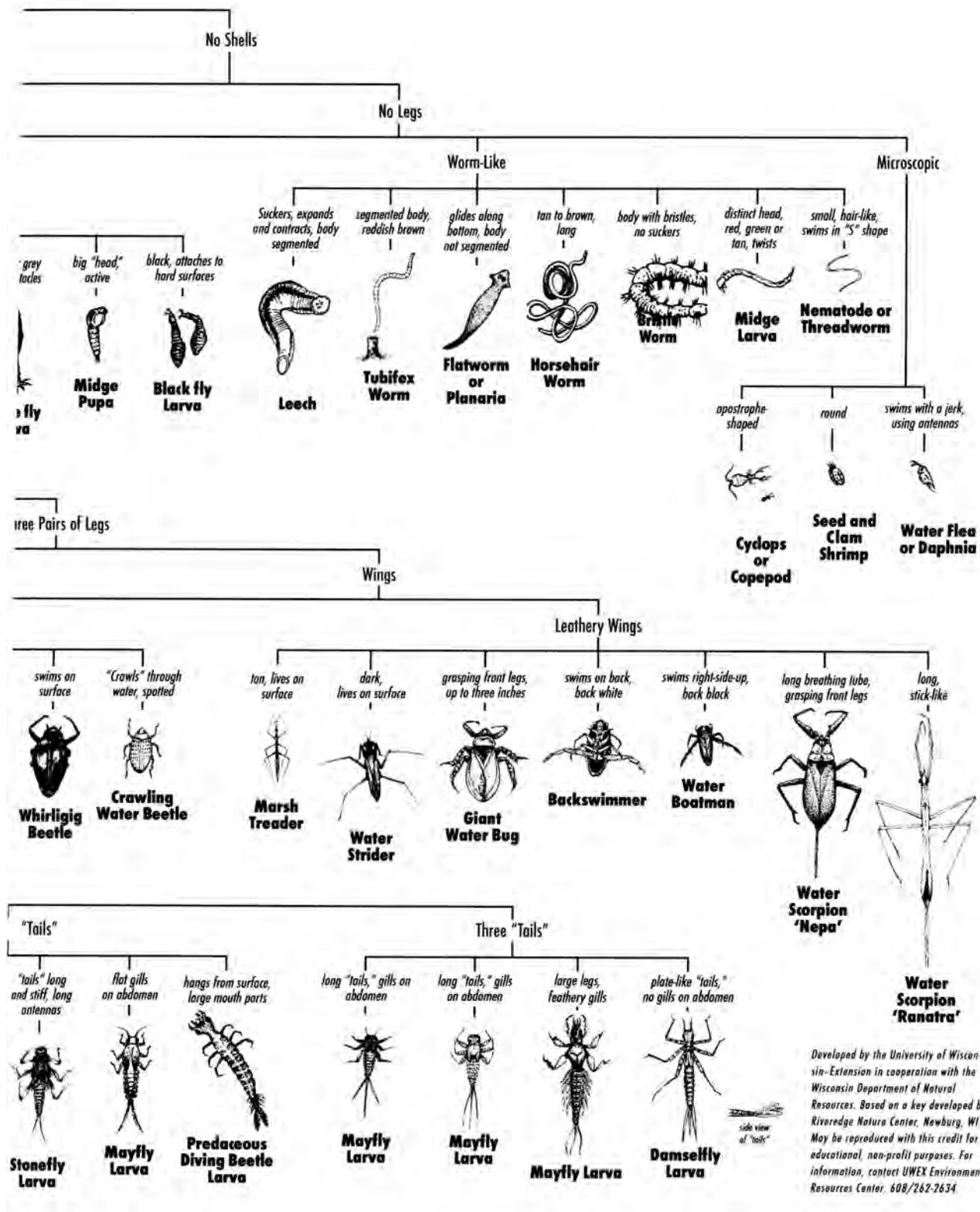
Identification (x2) - Responsible for the identification of the macroinvertebrates using the identification keys that are provided and reporting findings to the Recorder

*Note. Depending on river conditions, instructors/teachers may be in the water as the collectors and students will observe collection techniques and then identify collected samples.

Key to Macroinvertebrate

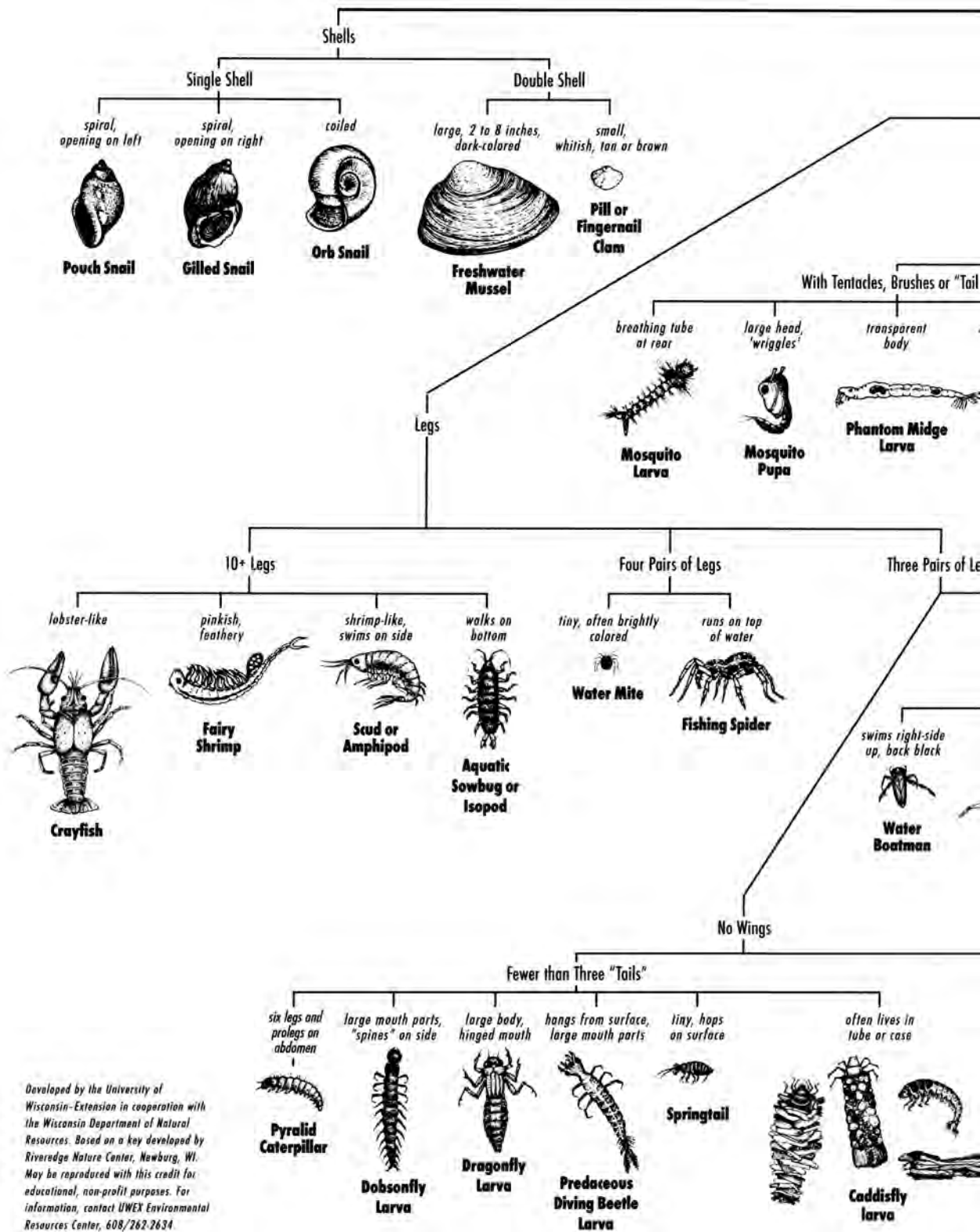


Life in the River



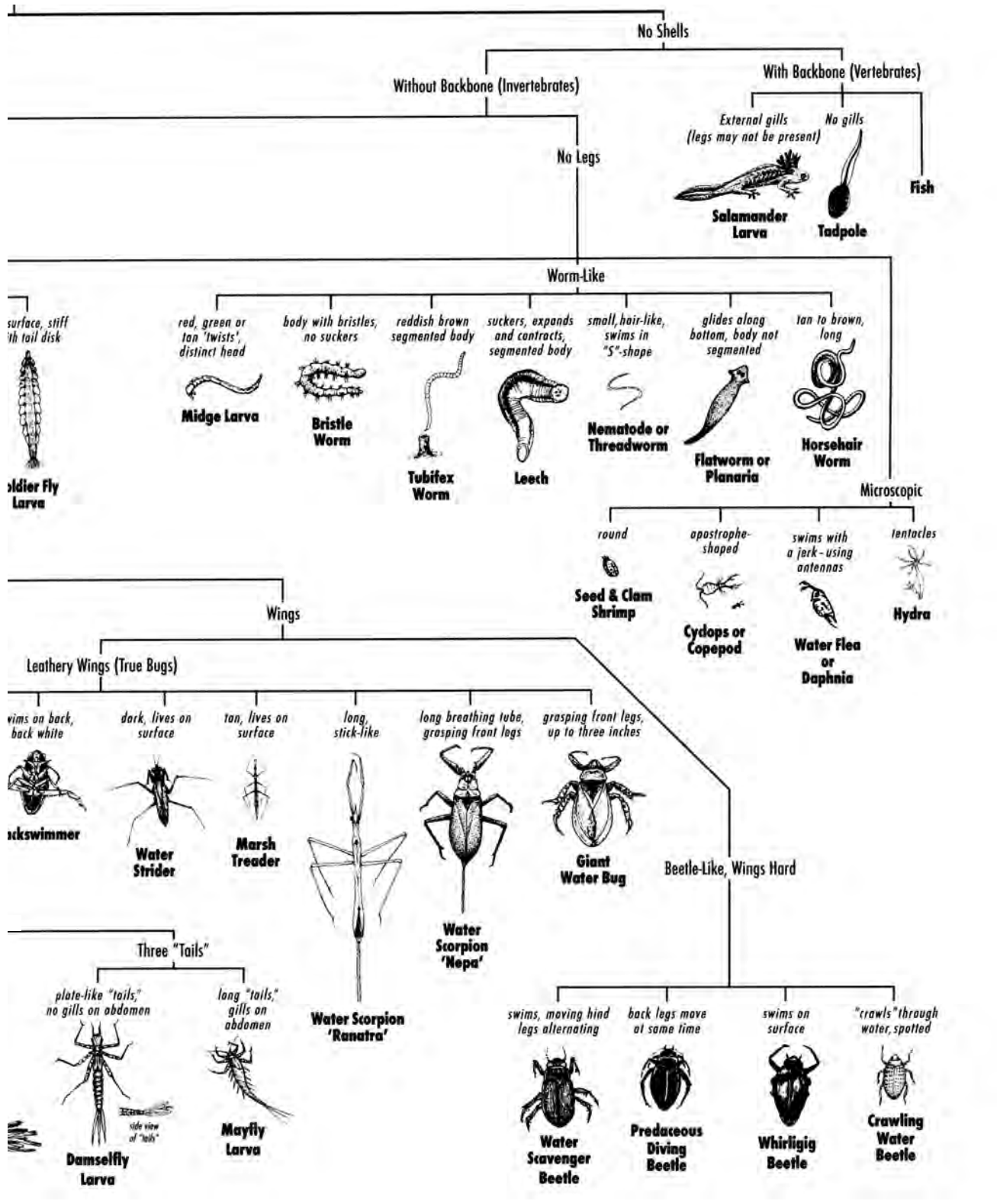
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Key to Life



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in the Pond



CANDY KEY - Stream Exploration Lesson Details - 45 minutes (continued)

CANDY KEY

*Note Smarties start on #2.

FAMILY: *Candius*

1a.	Candy is chewy	2	
1b.	Candy is hard	7	
2a.	Candy is wrapped	3	
2b.	Candy is not wrapped		<i>Ursa gummus</i>
3a.	Candy is rounded	4	
3b.	Candy is not rounded	5	
4a.	Wrapper is all white		<i>Saltus taffinia</i>
4b.	Wrapper is not white	5	
5a.	Wrapper is clear and candy is colorful		<i>Smartis rollus</i>
5b.	Wrapper is not brown and white	5	
6a.	Wrapper is silver		<i>Chocolatus cyssan</i>
6b.	Wrapper varies in color		<i>Steorra explodes</i>
7a.	Candy is spherical (ball-shaped)	8	
7b.	Candy is not spherical	9	
8a.	Candy is wrapped	11	
8b.	Candy is unwrapped		<i>Mandiblus tartis</i>
9a.	Wrapper is transparent	10	
9b.	Wrapper tells the flavor		<i>Joyous rancheria</i>
10a.	Wrapper is clear		<i>Mintus stripus</i>
11.	Candy is on a stick		<i>Moronus moronus</i>

CANDY LETTER	PATHWAY	LATIN NAME	COMMON NAME