Water Habitat Site Study

Meet the water dwellers in your local pond, stream, or lake. What are the special features that help them survive in the water?
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Chapter 1 • Lesson 4

Water Habitat Site Study

Minnesota Academic Standards

Lesson introduces this Benchmark.
Lesson partially addresses this Benchmark.
Lesson fully addresses this Benchmark.

Language Arts

Grade 3
I. Reading and Literature
A. Word Recognition, Analysis, and Fluency:
Benchmark 1—The student will read unfamiliar complex and multi-syllabic words using advanced phonetic and structural analysis.

B. Vocabulary Expansion:
Benchmark 1—The student will acquire, understand and use new vocabulary through explicit instruction and independent reading.

C. Comprehension:
Benchmark 1—The student will read aloud grade-appropriate text (that has not been previewed) with accuracy and comprehension.
Benchmark 2—The student will recall and use prior learning and preview text to prepare for reading.
Benchmark 7—The student will follow three-step written directions.

II. Writing
D. Research:
Benchmark 1—The student will use grade-level appropriate reference materials to obtain information from dictionaries, glossaries, encyclopedias, and the Internet.

III. Speaking, Listening, and Viewing
B. Media Literacy:
Benchmark 1—The student will participate in and follow agreed-upon rules for conversation and formal discussions in large and small groups.
Benchmark 2—The student will demonstrate active listening and comprehension.

Grade 4
I. Reading and Literature
A. Word Recognition, Analysis, and Fluency:
Benchmark 1—The student will read unfamiliar complex and multi-syllabic words using advanced phonetic and structural analysis in grade-appropriate text.

B. Vocabulary Expansion:
Benchmark 1—The student will acquire, understand and use new vocabulary through explicit instruction and independent reading.

C. Comprehension:
Benchmark 1—The student will read aloud grade-appropriate text (that has not been previewed) with accuracy and comprehension.
Benchmark 2—The student will recall and use prior learning and preview text to prepare for reading.
Benchmark 9—The student will follow multiple-step written instructions.

II. Writing
B. Elements of Composition:
Benchmark 4—The student will create informative reports, including gathering material, formulating ideas based on gathered material, organizing information, and editing for logical progression.

D. Research:
Benchmark 1—The student will locate information in various reference materials including dictionaries, online dictionaries, glossaries, encyclopedias, and the Internet.

III. Speaking, Listening, and Viewing
B. Media Literacy:
Benchmark 1—The student will read print, view pictures and video images and listen to audio files and identify distinctions in how information is presented in print and non-print materials.
Benchmark 3—The student will use print, pictures, audio and video to express ideas and knowledge gleaned from these sources.
Grade 5

I. Reading and Literature

A. Word Recognition, Analysis, and Fluency:

Benchmark 1—The student will read familiar, complex and multi-syllabic words using advanced phonetic and structural analysis.

B. Vocabulary Expansion:

Benchmark 1—The student will acquire, understand and use new vocabulary through explicit instruction as well as independent reading.

Benchmark 4—The student will analyze word structure and use context clues in order to understand new words.

C. Comprehension:

Benchmark 1—The student will read aloud grade-appropriate text (that has not been previewed) with accuracy and comprehension.

Benchmark 13—The student will follow multiple-step written directions.

D. Literature:

Benchmark 1—The student will read a variety of high quality, traditional, classical and contemporary literary works specific to America, as well as significant works from other countries.

Science

Grade 3

I. History and Nature of Science

A. Scientific World View:

Benchmark 1—The student will explore the use of science as a tool that can help investigate and answer questions about the environment.

B. Scientific Inquiry:

Benchmark 2—The student will participate in a scientific investigation using appropriate tools.

Grade 4

IV. Life Science

B. Diversity of Organisms:

Benchmark 1—The student will classify plants and animals according to their physical characteristics.

Benchmark 2—The student will learn that the characteristics used for grouping depend on the purpose of the grouping.

Environmental Literacy Scope and Sequence

Benchmarks

- Social and natural systems are made of parts. (PreK-2)
- Social and natural systems may not continue to function if some of their parts are missing. (PreK-2)
- When the parts of social and natural systems are put together, they can do things they couldn't do by themselves. (PreK-2)
- In social and natural systems that consist of many parts, the parts usually influence one another. (3-5)
- Social and natural systems may not function as well if parts are missing, damaged, mismatched or misconnected. (3-5)

For the full Environmental Literacy Scope and Sequence, see:

www.seek.state.mn.us/eemn_c.cfm
Chapter 1 • Lesson 4

Water Habitat Site Study

Grade Level: 3-5  
Preparation Time: 15 minutes  
Activity Duration: Part 1: 60 minutes for field trip  
Part 2: 30 minutes for food web activity  
Group Size: 1-30  
Subject Areas: Expressive Arts, Language Arts, Science  
Academic Skills: classification, comparison, drawing, observation  
Setting: outdoors, at a body of water  
(Lesson can be done indoors if specimens are collected within three hours prior to class starting time of class. Fall and spring collections yield primarily macroinvertebrates. Summer and early fall collections yield primarily plants.)

Vocabulary: aquatic, aquatic ecosystem, benthic organisms, emergent plants, floating-leaf plants, free-floating plants, habitat, identification key, littoral zone, macroinvertebrate, metamorphosis, pollution, runoff, submerged plants, vertebrate  
Internet Search Words: aquatic macroinvertebrates, aquatic plants, pond life

Instructor’s Background Information

Aquatic refers to water. Scoop some water from a stream or pond, look closely, and you’ll find some fascinating living organisms. These small aquatic plants and animals are crucial components of an aquatic ecosystem. They’re extremely important for healthy aquatic food chains and food webs. (See Lesson 1:2—Food Chain Tag for more information on aquatic food chains.) An aquatic ecosystem is any body of water (such as a stream, river, or lake) and all of its organisms and nonliving components that, together, function as a natural system. A habitat is an area that provides food, water, cover, and space to adequately meet an organism’s survival needs. The ability to identify each organism in an aquatic ecosystem is, for young children, less crucial than having the opportunity to discover the diversity of life in a pond or stream—and spending some time contemplating how fish rely on these many aquatic organisms for survival.

Aquatic Plants

Minnesota streams, rivers, ponds, lakes, and wetlands are home to approximately 150 species of aquatic plants and macroscopic (visible to the unaided eye) algae categorized into four groups. Aquatic plants that are not attached to the bottom and float on the surface are free-floating plants. Examples include duckweed, planktonic algae, and watershield. Plants that are attached to the bottom, and have true

Summary

In this activity, students explore a local water ecosystem and discover organisms living in various habitats. Many of these organisms provide food and cover for fish. Each student collects aquatic invertebrates using a dip net and sorts through muck scooped from the lake bottom. Students also use a rake to collect aquatic plant specimens. They’ll have the opportunity to sketch the specimens, and to use field guides and identification keys to study and identify the plants and animals. From these sketches, they’ll make a pond, stream, or lake discovery book.

Student Objectives

The students will:
1. Collect specimens of aquatic plants, macroinvertebrates, and other animals from a variety of habitat types in a local water ecosystem using a dip net, rake, and bottomsifting sampling methods.
2. Observe features or adaptations of aquatic organisms.
3. Draw and describe examples of organisms collected with each sampling method.
4. Use field guides or identification keys to identify aquatic plants and animals.
5. Group illustrations of organisms into types or categories and create and illustrate a pond, stream, or lake discovery book.
stems, roots, and leaves with more than half of their vegetative parts projecting from the water are **emergent plants**. Examples include wild rice, cattails, and bulrush. Rooted plants with leaves that float on the surface are called **floating-leaf plants**. Examples include water lilies and lotus. Plants that grow completely underwater or with more than half of their parts growing beneath the surface are **submerged plants**. Submerged plants include wild celery, coontail, and water milfoil. Non rooted plants that float on the surface and can drift, such as duckweed, are called **free-floating plants**.

The zone in which emergent, floating-leaf, and submerged plants grow is known as the **littoral zone**. In many Minnesota lakes, the littoral zone extends to a depth of approximately fifteen feet.

Aquatic plants are important to fish and to other organisms in the ecosystem. Plants make their own food through photosynthesis, a process that uses the energy from the sun. Oxygen, a by-product of photosynthesis, is dissolved in water and respired by fish and other aquatic animals. Plants also provide food, cover, and spawning habitat for many types of fish and other animals. Many submerged plants provide food for waterfowl, as well as habitat for the insects they eat.

Aquatic plants further benefit water bodies and aquatic animals by absorbing excess nutrients, such as phosphorus and nitrogen, from runoff. **Runoff** is the water that “runs off” the land into lakes, streams, wetlands, and rivers.

Emergent plants also protect shorelines and bottoms by dampening wave action, stabilizing sediments, and preventing erosion.
Sheltering vegetation in or along the water provides food and cover for macroinvertebrates, fish, turtles, frogs, muskrats, snakes, birds, and many other types of wildlife. The loss of this vegetation can result in the loss of animals, too.

Aquatic Macroinvertebrates

Aquatic macroinvertebrates are animals without backbones (invertebrates) that are large enough to be seen with the unaided eye (macro) and spend most or all of their life cycles in water (aquatic). Examples include mosquitoes, mayfly larvae, pouch snails, blackfly larvae, crayfish, whirligig beetles, water striders, dragonfly larvae, and fingernail clams.

Aquatic macroinvertebrates are found swimming freely, or attached to things like rocks, docks, plants, or fallen logs, or buried in the bottom sediments of lakes or streams. A good way to find macroinvertebrates is to pick up a rock or log in a stream or along the lakeshore and watch the rock or log’s surface for movement.

Macroinvertebrates can be herbivores, carnivores, or omnivores. Herbivorous invertebrates consume plants and algae. The macroinvertebrates that eat small fish, small amphibians, and other invertebrates are carnivores. Omnivores eat both plant and animal material. Aquatic macroinvertebrates are consumers, and they also provide food for other organisms such as fish, birds, frogs, and turtles. They’re critical to a healthy aquatic ecosystem.

Organisms at various stages of their species’ life cycle can be collected in a single water sample. At each life stage, members of the same species can look quite different from one another and display different characteristics. This is clearly illustrated by aquatic insects. You can collect dragonfly larvae from the water while the adults of the same species fly in the air around you.

Aquatic insects are a group of macroinvertebrates that have three-part bodies (with a head, thorax, and abdomen), and, in the adult stage, six legs. Aquatic insects live all or parts of their life cycles in the water.

Materials (continued)

Basic Safety Equipment for Field Activities
- Waterproof shoes, rubber boots, or waders
- Walking stick (with measurements) for balance, probing, and measuring
- Insect repellent and sunscreen
- First aid kit
- Tarps, for gathering areas, sitting, and setting trays
- Towels, in case someone gets wet
- Whistle to summon help in emergencies, and to signal the beginning and end of activities
- Refreshments and drinking water
A dragonfly larva spends most of its life cycle in the water before emerging to the air as an adult.
Macroinvertebrates, such as whirligig beetles, snails, aquatic sowbugs, and leeches, emerge from eggs, grow, and become adults without leaving the water. Most aquatic insects, however, spend at least a few days of their lives as winged adults in the air. Dragonflies, after as long as two years of development in the water, emerge to the air as adults to feed and to mate. Mayfly larvae and adults also have different features. The larvae have mouths, but the adults don’t. Adults are too short-lived and occupied with mating to even need mouths—they die within seven days of emergence and mating. Although they’re referred to as mayflies, various species from this group emerge all year long—some even in the dead of winter.

Many aquatic insects undergo numerous dramatic physical changes during their life cycles. The series of stages that the young undergo on the way to maturity is known as **metamorphosis**. There are two basic types of metamorphosis.

**Complete metamorphosis** involves a series of four stages. An egg matures, becoming a larva, a pupa, and finally, an adult. The pupa is non-feeding, typically in a cocoon or hardened case. The appearance of insects that undergo complete metamorphosis changes dramatically as they pass from one stage to the next. Examples of insects that undergo complete metamorphosis include mosquitoes, caddisflies, and blackflies.

During the process of complete metamorphosis, the mosquito matures from egg to larva to pupa to adult.
Incomplete metamorphosis, a more primitive type of development, doesn’t include a pupa stage. After hatching from its egg, the young insect undergoes a series of instar stages (or molts), shedding its exoskeletons and growing ever larger until it emerges directly from its exoskeleton as a winged adult. Examples of insects that undergo incomplete metamorphosis include dragonflies, stoneflies, and damselflies.

During incomplete metamorphosis, the dragonfly matures from egg to larva to adult.

Aquatic Vertebrates
Vertebrates are animals with backbones or spines. Aquatic vertebrates include fish, turtles, salamanders and frogs. Vertebrate organisms (such as minnows or other small fish or tadpoles) might also be collected in your samples.

Aquatic Plants and Macroinvertebrates Are Indicators of Water Quality
Biologists often monitor aquatic plant and macroinvertebrate populations to determine habitat diversity and to measure water quality. The proportion of rooted aquatic plants versus algae is a good indicator of water quality. The absence of rooted aquatic plants and a high concentration of algae indicates excessive nutrient input from the surrounding watershed.

Macroinvertebrates are excellent indicators of water quality because they usually live most or all of their life cycles in the same area of a...
stream or lake, so changes in their populations can be directly related to changes in their water habitats.

**Pollution** is any substance or condition that makes water less useful or desirable. Pollution impairs water quality. Some species of macroinvertebrates are more tolerant of pollution and low water oxygen levels than others. For example, leeches, pouch snails, and aquatic sowbugs are relatively tolerant of pollutants. Stonefly larvae, alderfly larvae, and Dobsonfly larvae (sometimes referred to as hellgrammites) are very sensitive to pollutants in the water. Crayfish, dragonfly larva, and clams are aquatic macroinvertebrates usually found in water of moderate (or better) quality. Identifying the macroinvertebrates that appear in a sample can give clues to the water quality of the lake or stream. For example, if most of the macroinvertebrates sampled are pollution-tolerant species, the lake or stream may be polluted. Or, if many of the macroinvertebrates sampled are pollution-sensitive species, the lake or stream may be healthy.

If aquatic macroinvertebrate monitoring indicates a possible water quality problem, definitive chemical analyses are needed to determine which pollutants or other water quality issues are impacting the health of the organisms. See *Lesson 3:6—Macroinvertebrate Mayhem* for more information on macroinvertebrates as water quality indicators.

**Identification and Observation of Diversity Build Understanding**

**Identification keys**, field guides, and careful observations can unlock the identity of the plants and animals that the students collect. The varied features of the specimens also highlight the diversity exhibited in aquatic habitats. The more students observe aquatic plants and animals and their interactions, the better they’ll understand the importance of these organisms and their roles in aquatic ecosystems.

**Sampling Techniques**
Collecting plants and animals from a stream is a fun and exciting activity for students. They’ll be surprised and amazed by the whole new water world they discover. Plants can be collected using common kitchen strainers and a rake.

Macroinvertebrates and other animals are collected in various ways. One common technique is to place a collection net in a stream and then use a stick, hands, or feet to stir the gravel *upstream* from the net. Dislodged animals will be then wash into the net. Empty the contents of the net into a specimen bucket for observation and identification.

**Kick Nets**
Kick nets are used in streambeds and are useful for rapid coverage of bottom dwelling organisms from large sections of water. One type of kick net has two rods or handles with a mesh net between them. The
net is stretched across fast-moving water and placed on the bottom to trap organisms. One person holds the net and another kicks the rocks in front of the net, dislodging animals on the rocks. The animals flow downstream and the net captures them. The net can be folded for carrying. The bottom of the net is weighted to keep it from floating during sampling.

A mesh kick net with two handles.

Make your own kick net by stapling a section of screen to two four-foot long dowels.

Dip Nets
These nets are designed for sweeping over light vegetation or for use in shallow ponds and streams.
D-frame Dip Net
A D-frame dip net ring is made of steel and is D-shaped with a flat bottom. It’s wrapped in heavy, durable muslin, with rope reinforcement at the net ring. The bottom of the net has mesh screening that allows water to flow through, catching organisms, plants, sediment, and other debris. The ring is attached to a long wooden handle that’s usually about five feet long.

![A D-frame dip net.](image)

Triangle Dip Net
A triangle aquatic dip net is designed to take samples in heavy weeds. The steel ring is triangle-shaped, with heavy muslin and rope reinforcement at the net ring. Like the D-frame dip net, the bottom side is flat, but the top side comes to a narrow point with an attached handle.

![A triangle dip net.](image)
How to Make a Simple Dip Net

1. Collect enough coat hangers, pantyhose, and plastic bottles for each net that you plan to make. Prepare bottles and pantyhose as illustrated. The bottoms of the bottles can be saved and used as study trays for the collected specimens.

2. Insert the middle section of the plastic bottle into the top of the panty hose and attach it with waterproof glue.

3. Make a handle by bending the wire coat hanger to fit around the bottle. Secure the hanger to the bottle by with a few wraps of duct tape.

4. The top portion of the bottle can be used to scoop or dredge bottom sediments to look for benthic (bottom dwelling) invertebrates. Attach a piece of mesh screening to the screw-top opening of the bottle top by twisting a wire (or wrapping a rubber band) tightly around the screening and cap threads. Scoop a thin layer of bottom sediments, allow the water to filter through the screening, and look for invertebrates wiggling in the remaining sediments.

A Hester-Dendy sampler

A Hester-Dendy sampler is a commonly recommended device for aquatic macroinvertebrate sampling. It’s compact, lightweight and inexpensive. It can be suspended, floated, or attached to underwater objects (such as large rocks, or a post) and left in the water for as long as two weeks. When it’s retrieved from the water, the aquatic macroinvertebrates can be collected from the plates, put in trays, observed, and identified.

Benthic Dredges

Aquatic macroinvertebrates can also be found inhabiting the muck and sediment in the bottoms of lakes and streams. Organisms that inhabit the bottom substrates of water bodies are benthic organisms. Benthic bottom dredges, also known as “grabs,” are devices usually used to sample macroinvertebrates from the top few centimeters of sediments on lake, reservoir, or pond bottoms. They’re essentially metal scoops attached to a rope or cable. The scoops resemble miniature construction shovels. Four sizes of dredges—the Peterson dredge, the Ponar Dredge, the LaMotte Dredge, and the Eckman Dredge—are used to collect samples from different types of terrain. The small and lightweight Eckman Dredge is typically used to collect samples from finer silt and sand bottoms. A dredge is usually lowered to the bottom of a body of water from a boat with a winch or by hand. The end of the rope or cable is secured to reduce the risk of losing the dredge. The dredge is “tripped” to grab and hold a sample of sediment, and retrieved from the water. A bucket is placed under the dredge just before the dredge is lifted above the surface, so that none of the sample drips away.
An Eckman dredge.

Making Your Own Dredges
You can make a dredge or “muck scooper” for collecting benthic organisms. Use an empty soup can for the scoop, and attach it to a handle with three screws, nuts, and washers. For the handle, use a long, sturdy dowel (or a one-by-two board) at least three feet long.

A homemade dredge, also known as the muck scooper.

Macroinvertebrates can also be obtained by collecting a few submerged rocks from a lake, pond, or stream. Place them in a bucket, take them back to the classroom, then very gently scrub the bottoms of the rocks with a soft dishwashing brush to dislodge the macroinvertebrates into the water.
Procedure

Preparation

1. Before the class trip, visit the site. Survey the entire area you plan to study. Look for possible safety concerns such as steep banks, fast-moving water, loose footing, thick brush, and poison ivy. Become familiar with the plants and animals that live in and near the body of water.

2. Choose collection sites. Your areas for collecting specimens should be shallow, accessible, and safe. Beach areas provide little habitat for aquatic plants and animals. Docks, fishing piers, and areas with vegetation, rocks, and fallen logs will provide a wider diversity of species.

3. Obtain permission to use the site if it is located on private land.

4. Discuss with your students what they should wear for the field trip to the pond.

Protect Minnesota’s Aquatic Resources and Native Species

For additional information, see A Field Guide to Aquatic Exotic Plants and Animals, a brochure available from the Minnesota DNR.

- The law prohibits removing aquatic vegetation within areas posted by the Minnesota DNR as Infested Waters, Scientific and Natural Areas, or Fish Spawning Areas. Obtain all required permits, refer to the current Minnesota fishing regulations booklet, or check with MinnAqua staff, your local conservation officer, or a DNR resource biologist for proper procedures concerning transportation, collection, and disposal of water and aquatic organisms. You can refer to Minnesota Rules Chapter 6280 Item G, and the Minnesota Exotic Species statutes Chapter 84D. These rules and guidelines will also help prevent the spread of invasive species and diseases to native aquatic organisms.

- Never put water, plants, animals, or sediment from one aquatic system into another.

- All sample-collecting equipment should be dried or frozen after use to prevent the spread of aquatic diseases and invasive species. Or, if it is to be used again in an infested area, mark that equipment and only use it in the same infested waters. Your Minnesota fishing regulations booklet may not include the most recently infested waters. For more information on aquatic invasive species and infested waters see: www.mndnr.gov/eco/invasives.html

If you can’t take the students to a body of water, you can go out beforehand and collect a sample large enough to evenly divide between groups in the classroom. Students can then pick through the water and debris to locate, observe, draw, and identify organisms.
• This activity will disrupt the pond bottom or streambed, which can stir up any contaminants that may have settled in the water body. Avoid areas of major contaminant spills, as well as areas near discharge sites.
• Do not repeatedly use a single area for habitat site study visits. Give each area time to recover by rotating to another spot—this way, you’ll limit harm to a good study area.

Activity

Warm-up
1. Prior to going outdoors, ask the students which living things they expect to find in different places or different habitats of the pond or stream. After making a list, ask the students why it might be important to identify these organisms.
2. Explain how to use an identification key. Define ecosystem.
3. Explain that different organisms can be found in different types of aquatic habitats.
4. You may wish to show a video program on pond life to the class. There are many excellent video programs on freshwater life available (such as Eyewitness Nature Pond and River and Animal Discovery Fun for Kids! Pond Life, available through SVE & Churchill Video).
5. Discuss the life cycles of aquatic insects and explain that students may find macroinvertebrates in different life stages. Hand out copies of the Aquatic Insect Life Cycle Sheet or project it in the classroom.

6. Review the basic safety rules (or guide the class in creating their own list of safety rules).
   • Ask students to stay dry and remain within set boundaries.
   • Discuss the importance of minimizing impact on the sample area by treading lightly, taking only small amounts of samples, and placing rocks, water organisms, and other materials back in their original positions at the conclusion of the activity.

7. Tell the students how to use the equipment at each station. They’ll use different kinds of equipment to collect organisms from different habitats in the lake or pond.
   • At Station 1, use strainers and dip nets for scooping into the water from shore or a dock. Place strained items into a bucket of water on shore. Students on shore can sift through the bucket and place organisms on shallow white trays (with water) for easy viewing.
   • At Station 2, from shore, use a shovel or homemade dredge to collect loose material and substrate from the bottom and put it in a bucket. The students can sift through the material with spoons, tweezers, or small cups. Use the shovel with care. Small scoops will yield many organisms that live in the bottom muck.

Do not transport water, plants or animals from areas known to be infested with harmful invasive plants or animals. Look for signs or postings indicating the presence of invasive species. Be careful not to fragment plants or leave organisms along the shore. Check the Minnesota DNR website for a current list of infested waters.
To save time, you may have each group bring their sample trays, after one rotation, to a central location where all students can identify and draw the organisms. At the completion of the activity, carefully return all specimens to the water body.

You may wish to divide the students into six groups so the groups are smaller and more manageable. In that case, you’ll need to set up two of each of the stations at the site.

- At Station 3, use the rake from shore to collect small amounts of submerged aquatic plants from the water into a bucket. Students can separate different types into shallow trays. Do not disturb or remove emergent plants that can be easily observed from shore (such as cattails, water lilies, and bulrushes). Instead, point them out to students to identify using identification keys or field guides.
- At each station, use half of the time for collecting specimens and placing them into white trays for observation. Use the second half of your time to examine the organisms closely. Use magnifying lenses. Notice the special features of the different plants and animals. Use identification keys to identify the organisms. Make a detailed drawing of each different type of specimen in your tray.
- At the instructor’s signal, carefully empty trays and return specimens to the water. Leave sampling equipment at the station for the next group. Rotate to the next station.

8 Divide the students into three working groups. Assign one or two adult supervisors to each group. If you have two adult volunteers per group, one volunteer can help students with the collection equipment while the other helps students identify organisms.

9 Determine locations for the three stations and set the necessary equipment at each station.

Lesson
Part 1: Sampling and Identification
1 Begin with a site survey. Pause with your students—away from the water’s edge—and take in the site. Be observant! Look, listen, and note the sights and sounds. Note the weather conditions, amount of vegetation, and the most prominent signs of living things in the area. What evidence of human activity do you observe?
2 Distribute sampling equipment to each student group: buckets, white trays, strainers, dip nets, and small rakes or shovels. Each student should have a clipboard or other firm writing surface, paper or a journal, a pencil, and a Water Habitat Site Study Check-Off Sheet. Each instructor and adult leader should have copies of the identification keys:
   - Water Habitat Site Study Identification Sheets and Keys in this lesson
   - A Guide to Aquatic Plants, Minnesota DNR
   - Through the Looking Glass: A Guide to Aquatic Plants, University of Wisconsin-Extension
3 Signal the groups to rotate to each of the three stations. Each group should have time to collect, draw, and identify several plants or animals at each station. Students should also check off the organisms that they find on the Water Habitat Site Study Check-Off Sheet.
4 Carefully return the animals and plants to the exact locations from which they were collected.
Station 1
- Use the dip nets to collect organisms on or below the water’s surface. This should be done from a gentle sloping bank or from a fishing pier. Set your net firmly against the bottom of the pond or stream, and sweep to dislodge animals that live on or under rocks, allowing them to float into the net.
- Students should place their specimens in the white trays. The white of the trays allows details to be seen in the organisms collected. Keep about an inch of water in the tray and place it in a cool, shady spot. Change the water as often as needed to keep the animals cool.
- Have each student study and draw one or two different animal or insect specimens. Use the key to help identify the animals and label the drawings.

Station 2
- Sift through the mud and muck from the bottom that an adult leader has collected using a small shovel or homemade dredge. A small scoop of substrate is adequate, just enough to place on a tray. (The students may use their bare hands, spoons, tweezers, and cups for sifting.) This group could also try stirring up the bottom muck and silt, then scooping up organisms with a net or strainer.
- Place about one inch of water in a tray and empty the contents of the shovel onto it. Sift through the debris to look for small animals that might be hiding. Consider why these tiny animals are more abundant than larger creatures like fish and crayfish in your sample.
- Have each student study and draw three different animals on separate sheets of paper. Use the key to help identify the animals and label the drawings.

Station 3
- Sort through the plant samples collected with the rake and a strainer. Remember to make the least possible impact and take only what is needed. Place small pieces of the collected plants in the white tray.
- Have each student study and draw three different plants on separate sheets of paper. Use the key to help identify the plants and label the drawings.

Part 2: Use the Drawings to Create a Pond, Stream, or Lake Discovery Book
1. Bring your budding biologists back together to share their discoveries.
2. Collect the students’ drawings and view them with the class.
3. Ask the students to group the drawings according to types of organisms. Keep track of the groups on the whiteboard. Group names might include shore plants, submerged plants, emergent plants, floating plants, macroinvertebrates, and vertebrates. Or students may wish to group the organisms according to the various habitats in which they were collected. Plants and animals can also be grouped according to physical characteristics or behaviors. Characteristics used for grouping depend on the purpose of the
grouping.
4 Divide the class into as many groups as the groups of organisms. Give the corresponding set of drawings to each group of students.
5 Each group can then use their set of drawings to create and write a chapter about that type of organism. These chapters can then be incorporated into a class book on the aquatic life found at the lake, pond, or stream ecosystem that the class visited.
6 Have each student create a cover page and title for the book. Students can vote to determine which will be the cover for the class book.
7 Collect and compile the chapters into a book and attach the winning cover. The book can be kept in the classroom or school library and posted on the school website as a reference and guidebook to life in the local water body.
8 You may wish to make a copy of the book for each student, using each student’s own cover design for their personal copy.

Wrap-up
1 Review with your students the four basic habitat needs of aquatic animals: food, water, shelter, and space. Ask students to name some examples of food, water, shelter, and space that they might have observed during the water habitat site survey. What role do aquatic macroinvertebrates play in the aquatic ecosystem?
2 Discuss what might happen if one member of the aquatic community disappeared. How might people be affected? Remind students that all the organisms in an ecosystem are connected in a food web.
Assessment Options

1. Observe students working in groups at the site and as they create the book chapters. Assess each group’s chapter, group participation, and contributions to class discussion.

2. Have students make a poster or graphic organizer that describes the various sampling methods they used to collect plants and animals at the site. They should also describe the types of organisms found using each method.

3. Have each student choose an organism from one of their drawings and describe the adaptations that help it survive in its watery habitat.

4. Write an article for the school newspaper or website about the field trip and the discovery book created by the class.

5. Assessment options include the Checklist and Rubric on the following pages.

Graphic organizers can take the form of a concept map, tree, star or web showing definitions, attributes, examples, classifications, structures, examples, relationships, and brainstorming. Charts and tables show attributes, characteristics, comparison, and organization. A chain or timeline illustrates processes, sequences, cause and effect, and chronology. Diagrams, charts, and drawings show physical structures, spatial relationships, and concrete objects. Cut and folded paper can be fashioned into flaps that, when lifted, reveal details, definitions, descriptions, or explanations.
Checklists are tools for students and instructors. Checklists involve students in managing their own learning. They help students understand and set learning goals before the lesson begins, and help them monitor their progress during the lesson, ensuring that they meet learning goals and objectives by the end of the lesson. Students can also use checklists to discover areas that may need improvement. Checklists help instructors monitor each student’s progress throughout the lesson, facilitating appropriate adjustment of instruction to ensure learning by the end of the lesson. The instructor may wish to have students add several of their own learning goals to the checklist to personalize it, and to accommodate varied learning needs and styles.

**Grade**

**29-32 points = A**
Excellent. Work is above expectations.

**26-28 points = B**
Good. Work meets expectations.

**21-25 points = C**
Work is generally good. Some areas are better developed than others.

**17-20 points = D**
Work doesn't meet expectations; it's not clear that student understands objectives.

**0-16 points = F**
Work is unacceptable.

---

**Water Habitat Site Study Checklist**

<table>
<thead>
<tr>
<th>Possible Points</th>
<th>Points Earned</th>
<th>Points Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student</strong></td>
<td><strong>Instructor</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Student describes three types of sampling equipment: dip nets, bottom sampler (spade, dredge, or shovel), and rake.</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Student describes how to use the three types of sampling equipment.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Student describes types of organisms collected with all three types of sampling equipment.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Poster is attractive, legible, and easily seen from a distance.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Student can define aquatic macroinvertebrate.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Student collects aquatic plants, macroinvertebrates, and other animal specimens from a variety of habitat types in a local water ecosystem using a dip net, rake, and bottom-sifting sampling methods.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Student draws and describes examples of organisms collected using each sampling method.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Student identifies the plants and animals collected with each sampling method using field guides or identification keys.</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Student groups organism illustrations into different types or categories of organisms and creates and illustrates materials for the discovery book.</td>
</tr>
</tbody>
</table>

**Total Points**

32      |      | Score ______
### Water Habitat Site Study Scoring Rubric

<table>
<thead>
<tr>
<th>Sampling Methods Poster Criteria</th>
<th>4 Excellent</th>
<th>3 Good</th>
<th>2 Fair</th>
<th>1 Poor</th>
<th>0 Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sampling equipment and use</strong></td>
<td>Illustrations show at least three types of equipment: dip nets, bottom sampler, and rake. Text states how equipment is used.</td>
<td>Illustrations show two types of sampling equipment. Text states how equipment is used.</td>
<td>Illustrations show two types of sampling equipment. Inaccurate description of equipment use.</td>
<td>Illustrations show one type of sampling equipment. Inaccurate description of equipment use.</td>
<td>Doesn't complete illustrations.</td>
</tr>
<tr>
<td><strong>Types of organisms collected, by equipment type</strong></td>
<td>Illustrations describe or visually show types of organisms collected with all three types of sampling equipment</td>
<td>Illustrations describe or visually show types of organisms collected with at least two types of sampling equipment.</td>
<td>Illustrations describe or visually show types of organisms collected with at least one type of sampling equipment.</td>
<td>Illustrations lack description of types of organisms collected with sampling equipment.</td>
<td>Doesn't complete illustrations.</td>
</tr>
<tr>
<td><strong>Materials and design</strong></td>
<td>Illustration attractive, legible, and easily seen from a distance.</td>
<td>Illustration attractive and easy to view.</td>
<td>Illustration hard to read and lacks visual appeal.</td>
<td>Illustration illegible.</td>
<td>Doesn't complete illustrations.</td>
</tr>
</tbody>
</table>

Score _____ (Calculate score by dividing total points by number of criteria.)
Diving Deeper

Extensions

1. Create an aquatic food web using the plants and animals in the pond, stream, or lake discovery book the students created, as well as those organisms from the list of living things students expected to see at the site. Include producers, primary consumers, secondary consumers, herbivores, and carnivores. Refer to Lesson 1:2—Food Chain Tag. Remind the students that all living things are interconnected. Have all of the students create a food web by arranging the drawings in the center of the room—if an organism eats another organism, position the two drawings so that one corner of one drawing touches the corner of the other drawing. Connect as many of the organisms as possible! Could people be a part of this food web? What does a food web illustrate? Tape the food web together to display in the classroom, or on a wall in the school where everyone can see what lives in the local pond or stream, and how these organisms are connected.

2. Bring some of the pond water and macroinvertebrates that you collect into the classroom and look at the water and organisms with a microscope. Observe and draw the features of the macroinvertebrates in detail. See if students can find the extremely small and microscopic organisms listed on the Water Habitat Site Study Check-off Sheet. Determine which adaptations these organisms have that allow them to eat, and note how they move around in the water. Add a microscopic organisms chapter to the pond, stream, or lake discovery book.

3. Ask students to research and write a one-page paper on the adaptations to life in the water developed by pond or stream macroinvertebrates. (Examples include gills, breathing tubes, suction cups, streamlined or flat body shapes, and the ability to walk on the water.)

4. Investigate the camouflage capabilities and building skills of caddisflies, which use silk to glue small sticks and pieces of rock together to make “armored” case structures for themselves.

5. Have students investigate the differences between the complete metamorphosis that mosquitoes undergo and the incomplete metamorphosis of dragonflies and mayflies.

6. Have your students participate in a local volunteer stream monitoring effort. They'll learn more about how some types of aquatic macroinvertebrates are more sensitive to water pollution, and that others are more tolerant of pollution or degraded conditions (including turbidity and silt, low oxygen levels, and toxins).
For the Small Fry


Instead of making drawings and creating a pond, stream, or lake discovery book, have the student groups play Water Habitat Bingo as they rotate through each station at the site. To play Bingo, ask each group to mark a Water Habitat Bingo Sheet, placing an X in each box that names an organism that they find at a station. Four Xs in a row indicate a bingo! Allow students to rotate through the stations until one team gets a bingo and wins the game.
Aquatic Insect Life Cycle Sheet

**Dragonfly Life Cycle: Incomplete Metamorphosis**

1. Adult laying eggs
2. Egg
3. Larva
4. Pupa
5. Adult emerging

**Mosquito Life Cycle: Complete Metamorphosis**

1. Egg
2. Larva
3. Pupa
4. Adult
## Water Habitat Bingo Sheet (for K-2)

<table>
<thead>
<tr>
<th>Mayfly larva</th>
<th>Crayfish</th>
<th>Snail shell</th>
<th>Water strider</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Mayfly larva](©MN DNR)</td>
<td>![Crayfish](©MN DNR)</td>
<td><img src="%C2%A9MN" alt="Snail shell" /></td>
<td>![Water strider](©MN DNR)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arrowhead</th>
<th>Lily pad</th>
<th>Cattail</th>
<th>Small fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Arrowhead](©MN DNR)</td>
<td>![Lily pad](©MN DNR)</td>
<td><img src="%C2%A9MN" alt="Cattail" /></td>
<td>![Small fish](©MN DNR)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adult damselfly</th>
<th>Sun</th>
<th>Water</th>
<th>Dragonfly larva</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Adult damselfly](©MN DNR)</td>
<td>![Sun](©MN DNR)</td>
<td>![Water](©MN DNR)</td>
<td>![Dragonfly larva](©MN DNR)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tadpole</th>
<th>Duckweed</th>
<th>Mussel</th>
<th>Algae</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Tadpole](©MN DNR)</td>
<td>![Duckweed](©MN DNR)</td>
<td><img src="%C2%A9MN" alt="Mussel" /></td>
<td>![Algae](©MN DNR)</td>
</tr>
</tbody>
</table>
### Water Habitat Site Study Check-off Sheet

<table>
<thead>
<tr>
<th>Macroinvertebrates</th>
<th>Vertebrates: Reptiles and Amphibians</th>
</tr>
</thead>
<tbody>
<tr>
<td>____ Dragonfly</td>
<td>____ American Toad</td>
</tr>
<tr>
<td>____ Damselfly</td>
<td>____ Bullfrog</td>
</tr>
<tr>
<td>____ Caddisfly</td>
<td>____ Chorus Frog</td>
</tr>
<tr>
<td>____ Mayfly</td>
<td>____ Green Frog</td>
</tr>
<tr>
<td>____ Stonefly</td>
<td>____ Leopard Frog</td>
</tr>
<tr>
<td>____ Scud</td>
<td>____ Newt</td>
</tr>
<tr>
<td>____ Fairy Shrimp</td>
<td>____ Painted Turtle</td>
</tr>
<tr>
<td>____ Water Boatman</td>
<td>____ Tiger Salamander larva</td>
</tr>
<tr>
<td>____ Backswimmer</td>
<td>____ Spring Peeper</td>
</tr>
<tr>
<td>____ Predaceous Diving Beetle</td>
<td>____ Tadpole</td>
</tr>
<tr>
<td>____ Whirligig Beetle</td>
<td></td>
</tr>
<tr>
<td>____ Water Strider</td>
<td></td>
</tr>
<tr>
<td>____ Mussel shell</td>
<td>____ Fathead Minnow</td>
</tr>
<tr>
<td>____ Snail shell</td>
<td>____ Creek Chub</td>
</tr>
<tr>
<td>____ Crayfish</td>
<td>____ Northern Redbelly Dace</td>
</tr>
<tr>
<td>____ Water Scorpion</td>
<td>____ Bluntnose Minnow</td>
</tr>
<tr>
<td>____ Giant Water Bug</td>
<td>____ Darter</td>
</tr>
<tr>
<td>____ Leech</td>
<td>____ Brook Stickleback</td>
</tr>
<tr>
<td>____ Leech</td>
<td>____ Mudminnow</td>
</tr>
<tr>
<td>____ Mussel shell</td>
<td>____ Killifish</td>
</tr>
<tr>
<td>____ Snail shell</td>
<td>____ Sunfish</td>
</tr>
<tr>
<td>____ Crayfish</td>
<td>____ Black Bullhead</td>
</tr>
<tr>
<td>____ Water Scorpion</td>
<td>____ Golden Shiner</td>
</tr>
</tbody>
</table>

© 2010 Minnesota DNR  •  MinnAqua  •  USFWS Sport Fish Restoration
<table>
<thead>
<tr>
<th>Aquatic Plants</th>
<th>Other Aquatic Plants or Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>____ Wild Celery</td>
<td></td>
</tr>
<tr>
<td>____ Common Waterweed</td>
<td></td>
</tr>
<tr>
<td>____ Large-leaf Pondweed</td>
<td></td>
</tr>
<tr>
<td>____ Northern Watermilfoil</td>
<td></td>
</tr>
<tr>
<td>____ Eurasian Watermilfoil</td>
<td></td>
</tr>
<tr>
<td>(invasive species)</td>
<td></td>
</tr>
<tr>
<td>____ Coontail</td>
<td></td>
</tr>
<tr>
<td>____ Curlyleaf Pondweed</td>
<td></td>
</tr>
<tr>
<td>(invasive species)</td>
<td></td>
</tr>
<tr>
<td>____ Small Duckweed</td>
<td></td>
</tr>
<tr>
<td>____ Large Duckweed</td>
<td></td>
</tr>
<tr>
<td>____ White Water Lily</td>
<td></td>
</tr>
<tr>
<td>____ Yellow Water Lily</td>
<td></td>
</tr>
<tr>
<td>____ Yellow Lotus</td>
<td></td>
</tr>
<tr>
<td>____ Arrowhead</td>
<td></td>
</tr>
<tr>
<td>____ Soft-stem or Hard-stem Bulrush</td>
<td></td>
</tr>
<tr>
<td>____ Common Rush</td>
<td></td>
</tr>
<tr>
<td>____ Cattail</td>
<td></td>
</tr>
<tr>
<td>____ Northern Blue Flag Iris</td>
<td></td>
</tr>
<tr>
<td>____ Wild Rice</td>
<td></td>
</tr>
<tr>
<td>____ Purple Loosestrife</td>
<td></td>
</tr>
<tr>
<td>(invasive species)</td>
<td></td>
</tr>
</tbody>
</table>
### Water Habitat Site Study Check-off Sheet

<table>
<thead>
<tr>
<th>X</th>
<th>Microscopic Organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clam or Seed Shrimp</td>
</tr>
<tr>
<td></td>
<td>Diatom</td>
</tr>
<tr>
<td></td>
<td>Volvox</td>
</tr>
<tr>
<td></td>
<td>Euglena</td>
</tr>
<tr>
<td></td>
<td>Spirogyra</td>
</tr>
<tr>
<td></td>
<td>Rotifer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Microscopic Organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hydra</td>
</tr>
<tr>
<td></td>
<td>Cyclops/Copepod</td>
</tr>
<tr>
<td></td>
<td>Daphnia</td>
</tr>
<tr>
<td></td>
<td>Paramecium</td>
</tr>
<tr>
<td></td>
<td>Amoeba</td>
</tr>
</tbody>
</table>
Submerged Plants

Entire leaves: opposite or whorled

Common Waterweed
*Elodea Canadensis*

Curly-leaf Pondweed
*Potamogeton crispus*
(Invasive Species)

Finely-divided leaves

Entire leaves: alternate or basal

Northern Water Milfoil
*Myriophyllum sibiricum*

Wild Celery
*Vallisneria Americana*

Eurasian Water Milfoil
*Myriophyllum spicatum*
(Invasive Species)

Large-leaf Pondweed
*Potamogeton amplifolius*
Submerged Plants

Finely-divided leaves

Coontail
*Ceratophyllum demersum*

Floating-leaf Plants

Watershield
*Brasenia schreberi*

Free-floating Plants

White Water Lily
*Nymphaea odorata*

Yellow Pond Lily
*Nuphar advena*

Large Duckweed
*Spirodela polyrhiza*

Small Duckweed
*Lemma minor*
Emergent Plants

Narrow leaves

Sweetflag
_Acorus calamus_

Northern Blue Flag Iris
_Iris versicolor_

Hardstem Bulrush
_Scirpus acutus_

Water Horsetail
_Equisetum fluviatile_

Common Rush
_Juncus effusus_

Broad-leaved Cattail
_Typha latifolia_

Cross-section of leaf
Cross-section of flower stalk
Spadix
Sepals
Petals
Spikelet
Floral leaf
Rhizome
Male flowers
Female flowers
Spore-producing strobil
Primitive leaves
Rhizome
Emergent Plants

Narrow leaves

Common Bur-reed
*Sparganium eurycarpum*

Common Reed
*Phragmites australis*

Wild Rice
*Zizania spp.*

Softstem Bulrush
*Scirpus validus*
Emergent Plants

Broad leaves

Common Arrowhead
*Sagittaria latifolia*

Pickerelweed
*Pontederia cordata*

Purple Loosestrife
*Lythrum salicaria* (Invasive Species)

Water Hemlock
*Cicuta maculata*

Wild Calla
*Calla palustris*
Frogs

- Bullfrog
  *Rana catesbeiana*
- Bullfrog Tadpole
  *Rana catesbeiana*
- Chorus Frog
  *Pseudacris triseriata*
- Green Frog
  *Rana clamitans*

*S* Note: native only to southeast Minnesota.

Toads

- American Toad
  *Bufo americanus*

Turtles

- Painted Turtle
  *Chrysemys picta bellii*

Salamanders

- Leopard Frog
  *Rana pipiens*
- Eastern Tiger Salamander
  *Ambystoma tigrinum*
- Spring Peeper
  *Pseudacris crucifer*
- Eastern Tiger Salamander Larva
  *Ambystoma tigrinum tigrinum*
Minnow Family

- Fathead Minnow
  *Pimephales promelas*

- Creek Chub
  *Semotilus atromaculatus*

- Northern Redbelly Dace
  *Phoxinus eos*

- Bluntnose Minnow
  *Pimephales notatus*

- Golden Shiner
  *Notemigonus crysoleucas*

Perch Family

- Johnny Darter
  *Etheostoma nigrum*

Stickleback Family

- Brook Stickleback
  *Culaea inconstans*

Mudminnow Family

- Central Mudminnow
  *Umbra limi*

Killifish Family

- Banded Killifish
  *Fundulus diaphanus*

Sunfish Family

- Bluegill
  *Lepomis macrochirus*

Catfish Family

- Black Bullhead
  *Ameiurus melas*
**Zooplankton**

- **Amoeba**
- **Clam Shrimp** (Conchostraca)
- **Cyclops / copepod**
- **Daphnia / water flea** (Cladocerans)
- **Euglena** (Mastigophora; motile unicellular algae)
- **Hydra**
- **Paramecium** (Ciliophora)
- **Rotifer**
- **Seed Shrimp** (Ostracoda)
- **Stentor** (Ciliophora)
Phytoplankton

- Anabaena (planktonic blue-green algae)
- Chara (plant-like algae)
- Diatom (hard-sided phytoplankton)
- Spirogyra (filamentous green algae)
- Volvox (Mastigophora; colonial algae)
Identification Key #1

**Shells**

- **Single Shell**
  - spiral, opening on left
  - spiral, opening on right

- **Double Shell**
  - coiled

- **Pouch Snail**
- **Gilled Snail**

- **Orb Snail**

- **Pill or Fingernail Clam** (Actual Size: 10mm)

- **Freshwater Mussel**

**Without Backbone (Invertebrates)**

- **Legs**
  - No Legs
  - Go to Key 2

- **Ten or More Legs**
  - lobster-like
  - rust-colored spots; invasive species
  - pinkish, feathery
  - shrimp-like, swims on side
  - walks on bottom

- **Crayfish**
- **Fairy Shrimp** (Actual Size: 15mm)
- **Scud or Amphipod** (Actual Size: 15mm)
- **Aquatic Sowbug or Isopod**

**Four Pairs of Legs**

- runs on top of water

- **Fishing Spider**

**Three Pairs of Legs**

- **No Wings**
  - Go to Key 3

- **Wings**
  - Go to Key 4

**No Shells**

- **With Backbones (Vertebrates)**

  - Go to Fish ID Sheet and to Reptiles and Amphibians ID Sheet

Macroinvertebrate keys based on the work of University of Wisconsin-Extension, the Wisconsin Department of Natural Resources, and the Riveredge Nature Center, Newburg Wisconsin

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Identification Key #3

No Wings (Wing Pads May Be Present)

No Obvious Tails

- brown, featherlike, usually six legs, C-shaped
- six legs and prolegs on abdomen
- suction cup-like
- large body, hinged mouth
- lives in stone or stick case; green, tan, orange, or white body
- moves slowly; abdomen blunt, round on end; thick jaws
- long tails, gills on abdomen
- plate-like tails, no gills on abdomen

One or Two Tails

- brown, featherlike, usually six legs, C-shaped
- six legs and prolegs on abdomen
- suction cup-like
- large body, hinged mouth
- lives in stone or stick case; green, tan, orange, or white body
- moves slowly; abdomen blunt, round on end; thick jaws
- long tails, gills on abdomen
- plate-like tails, no gills on abdomen

Three Tails

- brown, featherlike, usually six legs, C-shaped
- six legs and prolegs on abdomen
- suction cup-like
- large body, hinged mouth
- lives in stone or stick case; green, tan, orange, or white body
- moves slowly; abdomen blunt, round on end; thick jaws
- long tails, gills on abdomen
- plate-like tails, no gills on abdomen

Riffle Beetle Larva

(Actual Size: 8mm)

Pyrrallid Caterpillar

(Actual Size: 10mm)

Water Penny

Dragonfly Larva

Caddisfly Larva

Water Scavenger Beetle Larva

Alderfly Larva

Dobsonfly Larva

Stonefly Larva

Predaceous Diving Beetle Larva

Whirligig Beetle Larva

Springtail

(Actual Size: 2mm)

Three Tails

- brown, featherlike, usually six legs, C-shaped
- six legs and prolegs on abdomen
- suction cup-like
- large body, hinged mouth
- lives in stone or stick case; green, tan, orange, or white body
- moves slowly; abdomen blunt, round on end; thick jaws
- long tails, gills on abdomen
- plate-like tails, no gills on abdomen

One or Two Tails

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No Obvious Tails

- brown, featherlike, usually six legs, C-shaped
- six legs and prolegs on abdomen
- suction cup-like
- large body, hinged mouth
- lives in stone or stick case; green, tan, orange, or white body
- moves slowly; abdomen blunt, round on end; thick jaws
- long tails, gills on abdomen
- plate-like tails, no gills on abdomen

No Wings (Wing Pads May Be Present)
Identification Key #4

**Wings**

**Leathery Wings**
- Tan, lives on surface
  - Marsh Treader
  - Water Strider
- Dark, lives on surface
  - Backswimmer
  - Water Boatman
- Grasping front legs, up to three inches
  - Giant Water Bug
- Swims on back, back white
  - Water Scorpion (Nepa)
- Swims right-side up, black back
  - Water Boatman

**Paper-like Wings**
- Long breathing tube, grasping front legs
  - Water Scorpion (Ranatra)
- Long, stick-like
  - Riffle Beetle (Actual Size: 8mm)
- Small, crawls on bottom
  - Water Scavenger Beetle
- Swims moving hind legs alternating
  - Predaceous Diving Beetle
- Back legs move at same time
  - Water Scavenger Beetle
- Swims on surface
  - Whirligig Beetle
- "Crawls" through water, spotted
  - Crawling Water Beetle (Actual Size: 6mm)

**Hard Shell Wings**
- Elongate wing extends past abdomen
  - Alderfly Adult
- Moth-like; wings tent body
  - Caddisfly Adult
- Looks like giant mosquito
  - Cranefly Adult
- Wings extend above body
  - Damselfly Adult
- Elongate wing extends past abdomen
  - Dobsonfly Adult Female
- Abdomen long and stout
  - Dobsonfly Adult Male (head)
- Three long, thin tails
  - Dragonfly Adult
- Large feathery antennae
  - Mayfly Adult
- Two thin tails
  - Midge Adult (Actual Size: 14mm)
- Stonefly Adult

Macroinvertebrate keys based on the work of University of Wisconsin-Extension, the Wisconsin Department of Natural Resources, and the Riveredge Nature Center, Newburg Wisconsin.