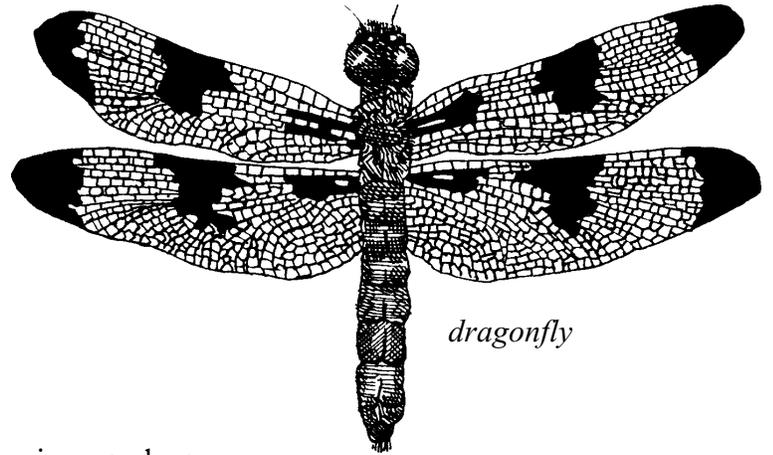


# The Rivers Are Alive

## Theme:

The St. Croix River is a complex system of interconnected habitats that support many forms of plant and animal life. The river is affected by human activities.



*dragonfly*

## Participants:

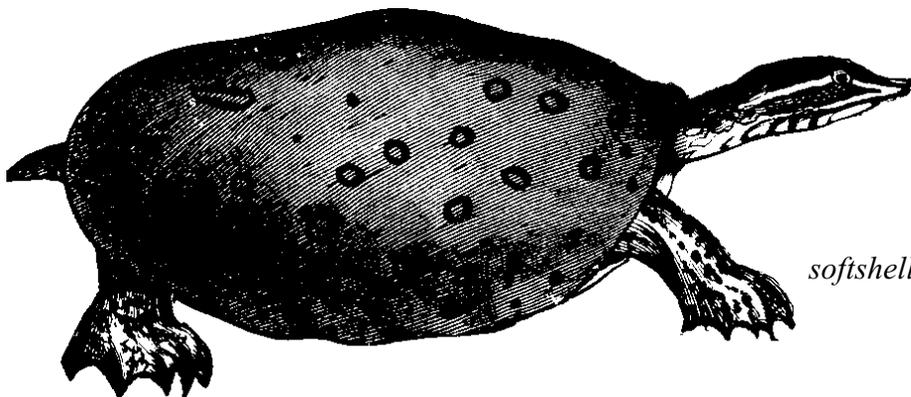
Fourth Grade classes.

## Program Goals:

1. By gaining a greater respect for the river students will develop stewardship that includes actively protecting the Riverway.
2. Students will gain an understanding of the interrelationships contained in the river system.

## Background: ST. CROIX NATIONAL SCENIC RIVERWAY

In 1968 Congress passed the Wild and Scenic Rivers Act to protect streams and rivers that were still relatively free flowing and possessing unique scenic beauty or ecological significance. Eight rivers were included in the original act. One was the St. Croix River with its main tributary, the Namekagon River. They are among the cleanest and most pristine river systems in the Midwest. The Riverway embraces significant resources centered around the free-flowing, high quality waters and their riparian environments. Diverse habitats explain the variety of plants and animals. The rivers are nurseries for many common flying insects such as dragonflies and mosquitoes, as well as homes for many aquatic insects. The variety of fish ranges from minnows to muskies. The rivers also contain the greatest diversity of mussels in the Upper Mississippi River system.



*softshell turtle*

## Pre-visit Preparation Activity Behavioral Goals:

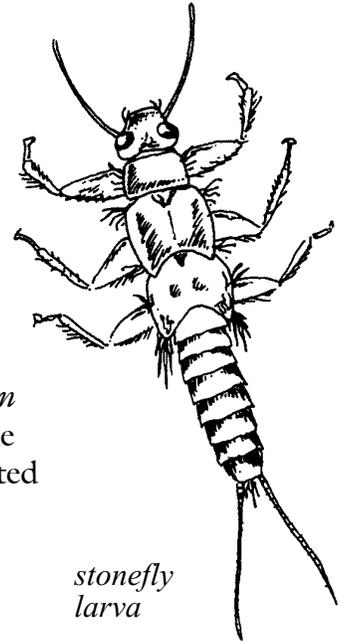
1. Students will become excited and curious about the Riverway visit.
2. Students will conduct themselves with respect for the resource.
3. Students will understand how to participate safely.

### **HABITAT NEWS (mini-magazine)**

*Habitat News*, an eight-page booklet, should be duplicated and distributed to the students *before* the pre-visit activity. The stories and activities focus on the Riverway habitats, wildlife and the National Park Service.

### **OBSERVATIONS (Rivers Are Alive Reference Guide and Identification Sheet)**

The *Rivers Are Alive Reference Guide*, and *Key to Macroinvertebrate Life in the St. Croix River* is provided as background reference for teachers. The *Identification Sheet* is used in the on-site activity and should be duplicated and reviewed prior to the pre-visit activity "The Web of Life".



## Pre-visit activity: "The Web of Life"

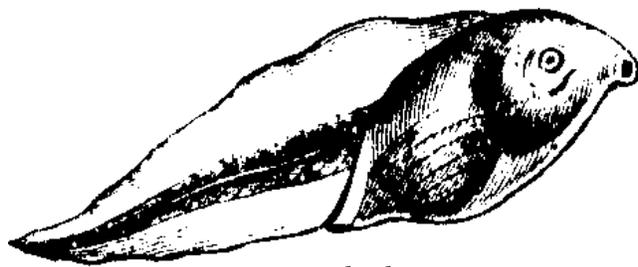
The focus of the "Web of Life" is the inter-dependent nature of all living things, plant or animal, and their place in the natural pyramid of life in various communities (forest, river, meadow, etc.). It will also highlight changes that occur, natural and human caused, and the affects they have on the environment. A Park Ranger will present this activity at the school prior to the trip to the river. The presentation should be in an open area such as a gymnasium or outdoors.

### **Objective:**

Students will learn how all life and everything around it is connected, either directly or indirectly.

### **Materials (provided by Park Ranger):**

- ball of yarn.
- cards with pictures of the plants, elements and animals found in and along the Riverway (on string to be worn around the neck).



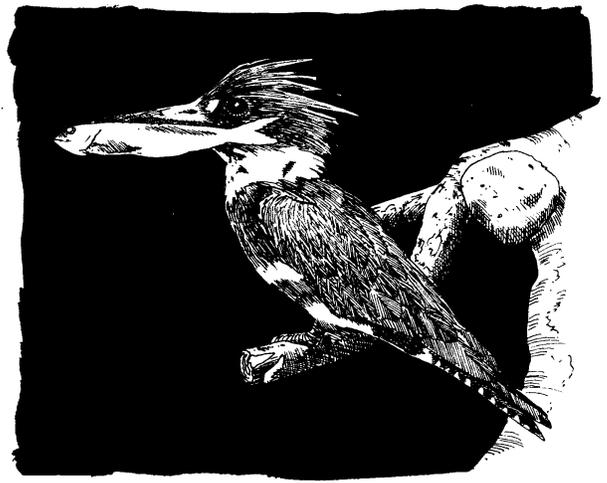
tadpole

### **Program Description:**

The Park Ranger will introduce herself and the National Park Service. Then she/he will discuss "**Habitat News**, Mini-Magazine" and ask the class to define habitat and give examples of habitat. Then we will play the "Web of Life" game.

## Methods:

The students stand in a circle. Each player wears a "Web of Life" card around their neck. The player becomes the animal, element or plant that s/he is wearing. The activity begins by one person stating who they are and one way in which s/he is connected to one of the other players in the circle. Example: I am a DRAGONFLY and I eat MOSQUITOES. The DRAGONFLY would then toss the ball of yarn to the MOSQUITO. The MOSQUITO would then select another player with whom they have a connection. Each player holding the yarn will state the relationship between themselves and the person s/he throws it to next.



*kingfisher*

When the web is completed and each player is connected to someone else, find out what would happen if one of the players in the circle is lost through pollution, habitat loss, over population, etc. That player holds up his/her string. Find out how many other players are affected by holding up just one string. (As soon as the students feel their string move they should hold it up). This illustrates that everyone in the web is affected, directly or indirectly, by the loss of one member. After all members have been affected, reverse the process. Ask students how the damage can be healed.

Total time: 30 to 45 minutes.



*"When we try to pick out anything by itself we find it hitched to everything else in the universe." —John Muir*



## On-site activity: "Let's Go Mucking"

### Objectives:

After exploring the river and its five habitats (stream bottom, open water, water surface, stream edges and the forest canopy), the students will be able to:

1. List three of the habitats that make up the river.
2. List one plant or animal from each of three habitats.
3. List two plants or animals that have a predator/prey relationship.
4. Describe one way that citizens can help protect the river.
5. Identify the National Park Service as managers of the St. Croix Riverway.

### Materials: (provided by Park Ranger)

Golden Guide "Pond Life" and other field guides  
laminated wildlife "Identification Sheet"  
small dipper nets and small seining nets  
bug boxes  
buckets  
whiteboard

### Location:

A pre-designated landing on the St. Croix or Namekagon Rivers. The students, teachers and chaperones will arrive by bus at the river landing where they will be met by a ranger. The ranger will gather the group and begin the program by asking the students if anyone can describe what a habitat is. The definition will be written on a whiteboard. The ranger will ask the students to look around the area and describe as many habitats as they can see. The ranger will list the habitats they have found on the whiteboard and will ask the students to give an example of a plant or animal they would expect to find in that habitat.

At this point the ranger will divide the group into pairs and give each pair a dipper net and a laminated "Identification Sheet" which will have illustrations of common animals found in the water. Prior to entering the water the students will be reminded of safety rules and they will be instructed to use their nets to catch animals that are found in the water or along the riverbank. Students should attempt to identify the animal using their "Identification Sheet. All finds will be brought to a central location and placed in several large buckets. After about twenty to thirty minutes the ranger will call the students from the river.

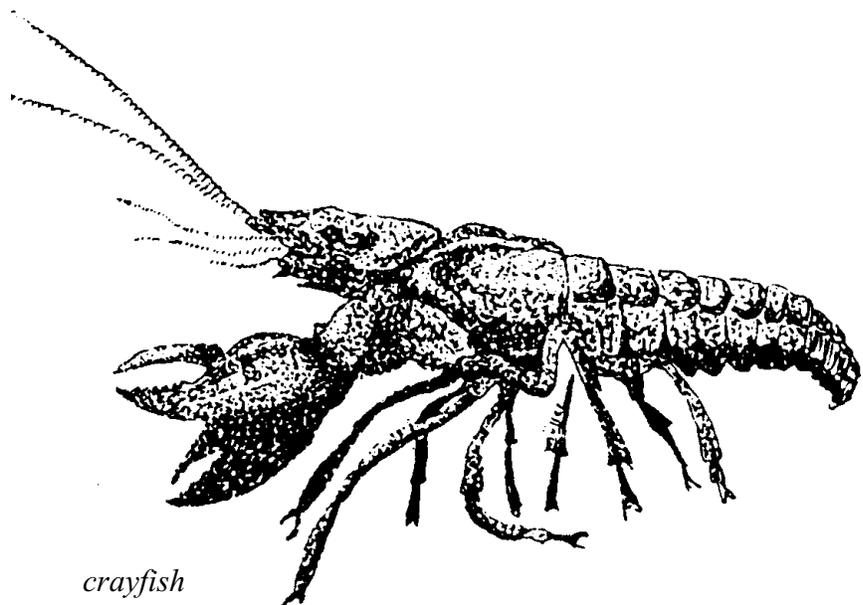
The ranger, teacher and/or parent will gather the buckets and place one individual of each species into a bug box or other container. With the students seated in a circle, the ranger will discuss the species found and pass the boxes around. Each student will have a chance to closely examine each species.

### **On-site wrap-up:**

With the students gathered together, the ranger will take a couple of minutes to review the wealth of life found in just one small section of the river and discuss how this diversity reflects the water quality of the river. Referring back to the "Web of Life" activity, the ranger will ask the students to identify some connections between the plants and animals that they found, and the students connections to the river. Then the ranger will ask the students if they can list some of the ways that they can help to protect all the plants and animals living in the river. After discussing these ideas the ranger and children will release the animals back into the river. The ranger will then thank the children for visiting the Riverway and refer the class to the teacher for departure.

Total time: 1 to 1 1/2 hours

(Note: If more than one class comes to the river at one time, the classes will be separated and a concurrent activity such as a hike, Turtle Hurdles or water quality testing would be scheduled.)



*crayfish*

# Identification Sheet (Small Animals)



**whirligig  
beetle**



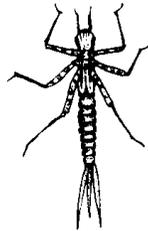
**water  
strider**



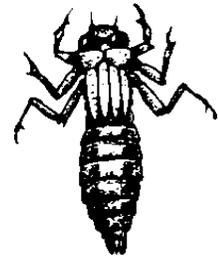
**backswimmer**



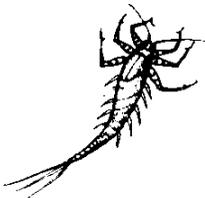
**water  
boatman**



**damselfly  
nymph**



**dragonfly  
nymph**



**mayfly  
nymph**



**stonefly  
nymph**



**scud**



**leech**



**caddisfly  
larva**

# Identification Sheet (Larger Animals)



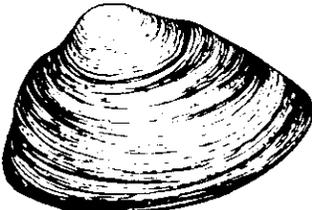
**dobsonfly  
larva**



**predacious  
diving beetle**



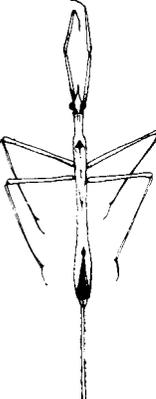
**giant  
water bug**



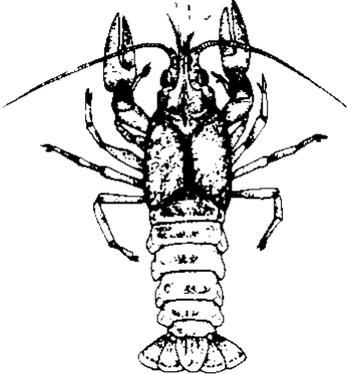
**freshwater  
mussel**



**snail**



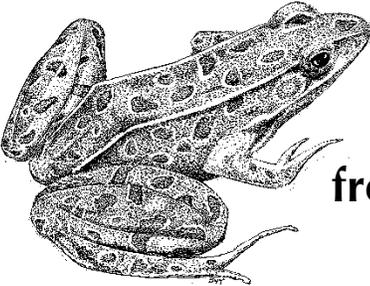
**marsh  
treader**



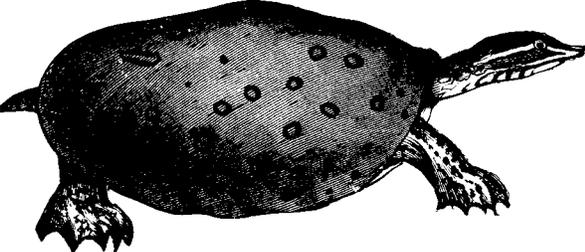
**crayfish**



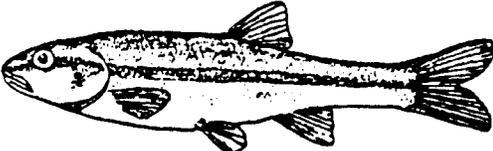
**tadpole**



**frog**



**softshell  
turtle**

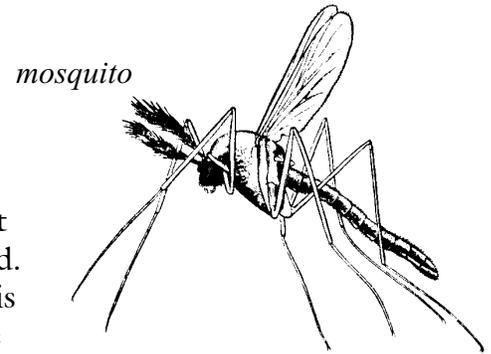


**creek chub**

## Post-visit Activities:

### Activity 1. Are You Me?

**Background:** Many aquatic insects look significantly different in their earliest stages of development, compared to adulthood. Many aquatic insects undergo metamorphosis. Metamorphosis means change during growth. Some insects experience simple metamorphosis while others undergo complete metamorphosis. In simple metamorphosis, the insect egg hatches to produce a nymph. Insect nymphs have essentially all the features of adults. As they grow, they are visibly similar at each stage. Examples of insects with incomplete metamorphosis are dragonflies, damselflies and mayflies.



Insects that experience complete metamorphosis are characterized by eggs that hatch into larvae. The larva grows through several stages and then changes into a pupa. From the pupae emerge soft-bodied, often pale-colored insects. Gradually the soft pale body develops firmness and color. In complete metamorphosis, there is little resemblance between the adult and earlier forms. Examples of aquatic insects with complete metamorphosis are caddisflies, mosquitoes and dobsonflies.

**Materials:** insect image sheet (included)  
scissors

**Method:** Using picture cards, students match pairs of juvenile and adult aquatic insects.

Cut the sheet with insect images into individual cards. Individual cards can be laminated. Divide the class into two groups. Designate one half of each group as adults and one half of each group as juvenile insects. Give each student in the adult group an adult insect card and give each student in the juvenile group a juvenile insect card. Make sure that each juvenile card has a corresponding adult card. Instruct the students to look for their “match”--pairing the appropriate adult and juvenile forms. When all the students have made their choices and think they have a match, you may show the students the matched images on the master. Have all the students look at all of the correctly matched pairs. Look at similarities and differences in adults and juveniles.

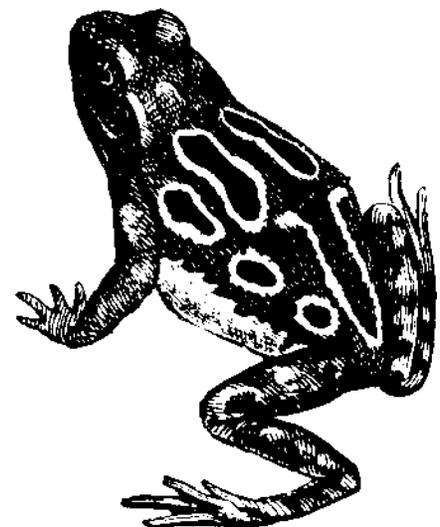
**Extension:** Dragonfly emergence. Read the "Dragonfly Life Cycle" story and have the students act it out.

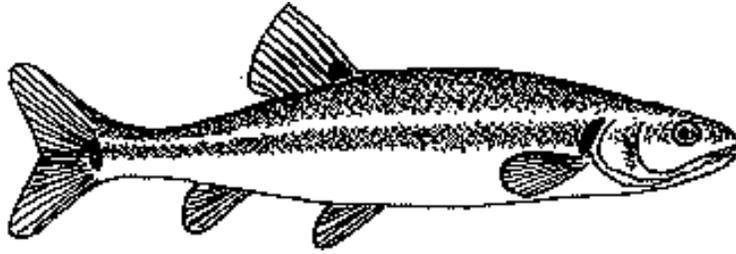
**Extension:** St. Croix Snaketail Dragonfly. Read the "Real Science" story to the class.

**Background:** A river contains many types of habitats--riffles, quiet pools, deep water, shallow water, and different substrates. Aquatic animals adapt in many ways to survive in their water habitat.

**Materials:** snorkel  
grappling hook or other hook  
toilet plunger  
snowshoe  
scuba tank  
bifocals  
turkey baster  
swim fin  
(or photographs of above items)  
worksheet with illustrations of aquatic insects (included)

**Method:** Students will match common items to insects as metaphors of habitat adaptations. Set out objects or photographs of objects on a central table. Pass out worksheets. Have students walk past central table and write name of object under the insect whose adaptation it represents. When all the students are finished, teacher gives the correct answer and describes the adaptation for each insect. (Adaptation descriptions included.)





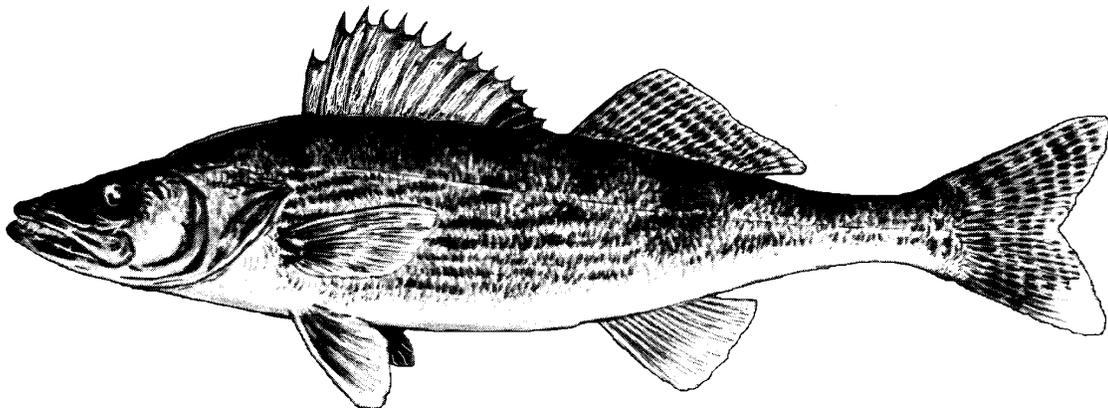
### Activity 3. Bio-indicators and Water Quality

**Background:** Some species of plants and animals are more sensitive to disturbances or poor quality in an environment. These species can be used to give a rough indication of the quality of their habitat. When used in this manner, we refer to these species as bio-indicators. Several of the insects that we find during the “Rivers Are Alive” field trip are bio-indicators. The species that your class found can give an estimate of the water quality in your section of the Riverway.

**Materials:** Bio-indicator Chart (included)

**Method:** Assign one student to make a list of the insect species that were found in the river mucking activity. The easiest time to do this is while the insects are being discussed and passed around in the bug boxes. You may wish to make a quantity assessment also with terms such as “few, several, abundant, etc.” Back in the classroom, refer to the bio-indicator chart and determine whether the insects are tolerant of pollution, somewhat tolerant, or intolerant. With this information, determine the status of water at your site.

**Extension:** If your school had more than one class participating in the field trip, compare your species list with theirs. Are there differences? What factors may have contributed to this? Some possibilities are: time of day, temperature, cloudy v.s. clear skies, disturbance from an earlier group and many others. Comparing the data from year to year would also enable discussion of factors affecting rivers. *If you would like to compare your results with a school from another part of the river, the rangers will help you contact another teacher.* In this case, notes of any other animals species seen would also be useful.



## Activity 4. Aquatic Times

*adapted from Aquatic Wild*

**Background:** In any classroom there is a wide range of learning styles and skills among students. The production of a newspaper requires an array of skills that include art ability, graphic sense, design capabilities, creative writing, composition, research and decision making. This means that such an effort has a high likelihood of addressing many of the diverse skills possessed by various classmembers.



This activity provides an opportunity for the students to coordinate newspaper production with information, issues, and recommendations about aquatic organisms and their habitats with others. The major purpose of this activity is to familiarize students with a range of aquatic-related topics and issues.

**Materials:** library resources  
current nature magazines  
writing materials  
field trip notes  
optional: cameras, tape recorders, computers

**Method:** Students investigate, write and produce a newspaper that features aquatic information and issues.

Using an actual newspaper as a model, discuss the various parts of a newspaper. Help the students recognize that in addition to news articles, many special interest departments exist in most newspapers. Comics, sports reports, editorials, commentary, home making articles, want ads, political cartoons, food and nutrition features, entertainment information, business columns, weather predictions, daily horoscopes, obituaries and many other sections are available. Also draw attention to advertisements. Ask each student or team of students to choose one section to plan and write.

Begin the research phase, asking the students to gather information and ideas for their chosen section. Tell them that whatever they compile has to relate to aquatic animals and plants, aquatic habitats, or aquatic-related issues. Show the students how to properly acknowledge and credit any sources they use. Each section should include a combination of information and the students' opinions, based on what they learn through their research. Try to set the stage for both playful and serious reporting. For example:

- water strider upends at soap spill in stream
- crayfish die in silt avalanche
- three million mosquito larvae died suddenly last night
- walleye recipes
- an interview with three grandparents about how the rivers used to be

- local educator found knee-deep in the St. Croix Riverway
- new species of dragonfly discovered on the St. Croix River
- habitats for sale (students write ads attracting specific aquatic insects to their habitat)



Once the information accumulates and writing begins, encourage the students to share their work with each other. In this way, interests can merge and different talents can be called upon. Keep the students on track, making sure their writing is accurate even though they may have chosen humor as their approach.

When enough work is completed, begin the production phase of the paper. At this point artwork can be done to accompany the stories. The artwork can be in color or black and white and can involve computer graphics. If possible, the stories should be typed or written neatly in a specified column format (3 1/2 or 4 inches wide works well).

The next step is the layout and design. A small group should be assigned the responsibility, but with input from everyone.

Once the newspaper is complete, you may investigate the possibility of having copies made for each child. Most communities now have fast copy facilities that can print oversize papers.

Culminate the activity with a discussion of each article or feature, emphasizing what can be learned about aquatic life and habitat from its content. Circulate the finished newspaper--for example, by posting copies on school bulletin boards.

**Extension:** Send copies of the finished newspaper to local newspapers, offer them use of any of the students' articles for their use. Send copies of the finished newspaper to other area schools. Send copies of the finished newspaper to St. Croix National Scenic Riverway for use in their visitor centers.

## Activity 5. To Dam or Not to Dam

*adapted from Aquatic Wild*

**Background:** Hypothetical situation: The town of Rocksburg, population 900, is located along the scenic Jones River approximately 60 miles from the closest big city. The mayor and city council of the big city have proposed that a dam be constructed two miles upriver of Rocksburg. In the Environmental Impact Statement written by the city engineers, the following information was identified.

The dam would meet the area's electrical power demand for ten or more years in the future. It would provide some water for irrigation and would help with flood control problems downriver.

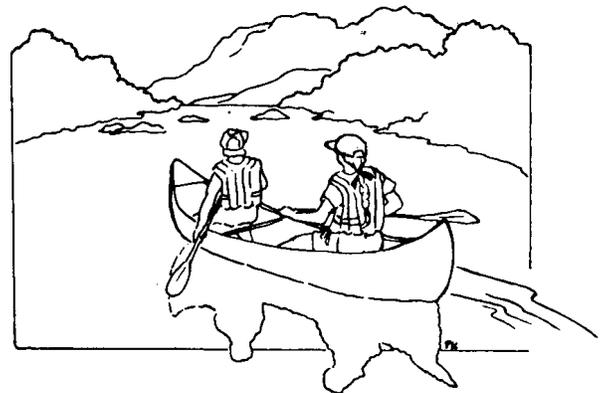
Construction would be of rock-earth fill, 75 feet high and 300 feet across. Seven miles of river would be turned into a lake.

The dam construction would take five years to complete and would employ over 2,000 workers. After the dam was finished, approximately 150 workers would be required to keep the plant running. The dam construction would cost over 20 million dollars.

Wildlife would be affected in the following ways:

- 20% loss to the deer herd that browses the lands alongside the river due to lost forage
- 20% loss to small mammals living in the river valley due to loss of habitat
- 20% loss to the area's songbird population due to lost riverbank nesting sites
- blockage of the upstream and downstream movement of fish that live in the river due to the creation of the lake and dam
- freshwater mussels depend on fish for part of their life cycle; restricted fish movement would alter their availability to the mussels. Mussels would also be directly affected by dam construction
- increase in bald eagle wintering habitat due to the ice-free open water available to them below the dam
- development of suitable habitat for bass, carp and other spiny-ray warm water fish due to the creation of the lake; the lake water tends to be warmer than the flowing river water
- loss of 10,000 acres of prime timber growing land and wildlife habitat

The people in Rocksburg are concerned about the problems and benefits from the number of people that would come to their town during and after the construction of the dam. For example, they project the arrival of 2,000 workers plus their families during construction for five years and that 150 permanent workers plus their families would stay after the dam was finished. They are concerned about effects on schools, sewage disposal, roads, homesites, property values, and the rural atmosphere, as well as police, fire, and hospital emergency capacities. They



see some potential benefits from the development, such as new recreation opportunities for the people of Rocksborg and the city which is only about an hour away (water skiing, sailboarding, motorboating, swimming, fishing, camping, picnicking, and other lake-related sports).

Other impacts could include:

- loss of drinking water quality locally and in the metropolitan area
- flooding of Native American archeological sites
- cultural changes for local Native American tribal people who have fished the river for generations.
- water for irrigation at a lower monetary cost
- potentially less (monetarily) expensive power when compared to other forms of power production, e.g. nuclear, coal, oil, fossil fuels
- potentially more (monetarily) total power bills that may be necessary to pay for construction of the dam
- loss of seven miles of prime whitewater; private and commercial raft, kayak, and canoe trips would be gone

**Materials:** role playing cards

**Method:** Provide students with the background information. Generate an initial discussion with them about some of the possible costs and benefits from the construction of this dam, considering it from a variety of perspectives.

Ask each student to choose the role of an individual to become or represent for the purpose of this activity--or assign roles randomly. Examples of roles are included. Establish a balanced variety of roles with people having conflicting values and concerns relating to the potential impacts of this dam construction. NOTE: Teachers have copied the role descriptions and cut them apart to pass out to students.

Ask students to prepare for their role, developing a short position paper for use as background for the dramatization of their role.

Arrange the classroom to represent a meeting room for the county council in the area in which the town of Rocksborg is located. Students will role-play their position and make a presentation to the five-member Rocksborg County Council. This council will ultimately make a recommendation to the F.E.R.C. (Federal Energy Regulatory Commission) on a siting permit for the dam.

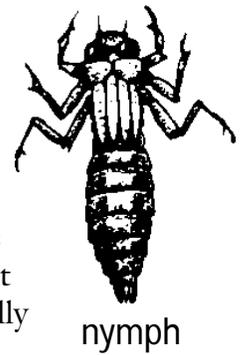
After all the students have made their presentations, ask the county council to render a decision.

Following the council's decision, have a brief class discussion to summarize the "pros" and "cons" that emerged from the students' presentations. Identify and list the benefits, if any, and costs or liabilities, if any, as a result of building the dam. Include effects on people, plants, and animals. The list of "pros" and "cons," and effects can be listed visually on a chalkboard.

After the role play and class discussion, ask each of the students to write a brief essay describing his or her own personal recommendation for whether or not to build this dam. The students might expand their position papers, or "start from scratch" in writing their essays.

# Dragonfly Life Cycle

A dragonfly's life begins underwater as an egg. The egg hatches into a nymph. The nymph lies just beneath the sand or near water plants to wait for prey. Dragonfly nymphs eat other aquatic insects, tadpoles and small fish. They have a lower jaw that unhinges and extends out very rapidly to catch their prey. The nymphs have large eyes to watch for food and to watch for predators that might eat them. To escape from predators, dragonfly nymphs can shoot water forcefully out of their abdomens which propels them quickly away from danger. Some dragonflies live as nymphs for three years underwater, hibernating in the winter.

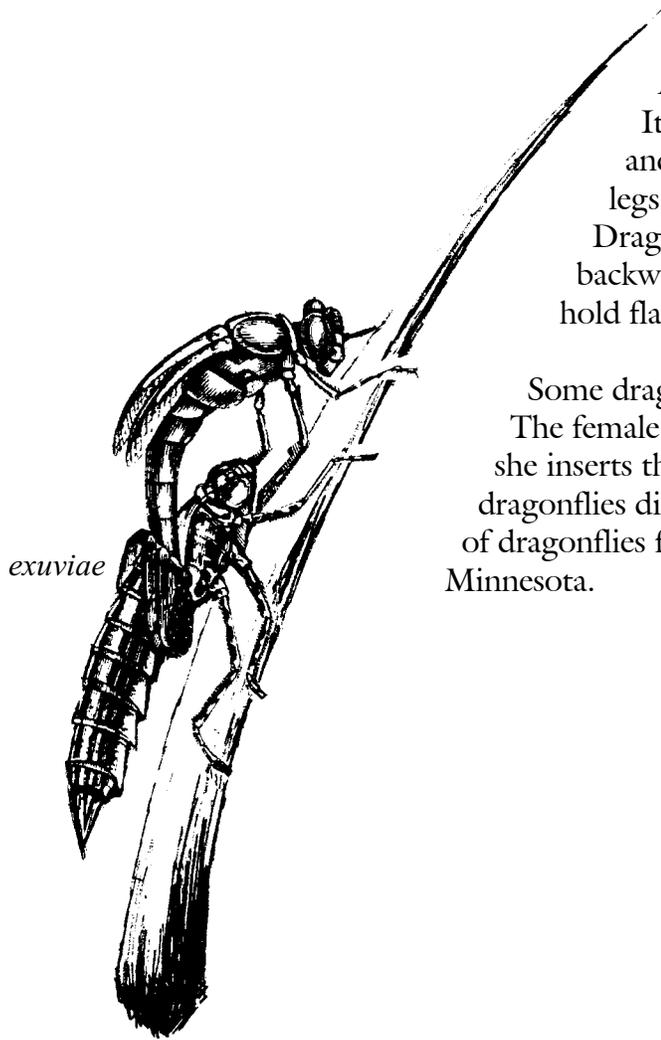


nymph

The dragonfly nymph molts its outer skin as it grows, just like a snake. About a week before the nymph is ready to emerge, it stops eating. Then it crawls out of the water and grabs onto a stick, plant or rock. The outer skin then splits down the back. The dragonfly gulps air to pump up and expand its' body. Slowly, the adult dragonfly emerges from the split skin. The empty skin is called an exuvia. The adult must dry its wings before it can fly.

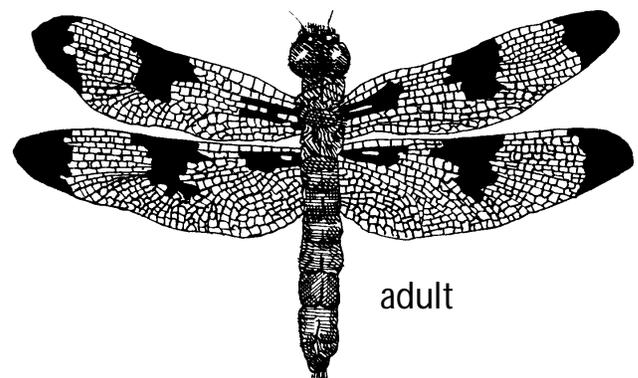
As an adult, a dragonfly usually lives 4 to 10 weeks. It hunts flying insects such as mosquitoes, black flies and gnats by scooping them up with its long hairy legs that they hold to form a kind of basket. Dragonflies can fly 35 miles per hour and go forwards, backwards and can hover. They have four wings that they hold flat when they land.

Some dragonflies mate in flight while others require a perch. The female lays eggs directly into the water, into soft mud or she inserts them in plant stems depending on her species. Adult dragonflies die soon after they have mated. There are 108 species of dragonflies found in Wisconsin and 86 species known in Minnesota.

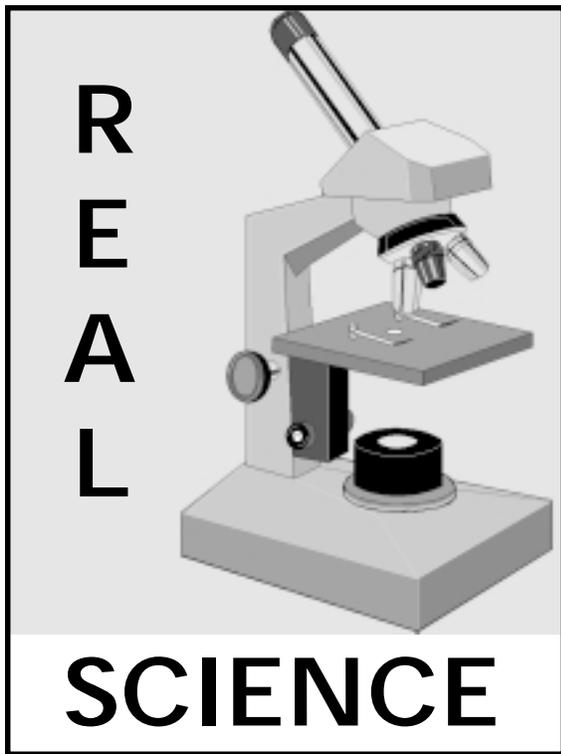


exuvia

emerging dragonfly



adult



## Scientists Find a New Dragonfly Species Along the St. Croix

Two Wisconsin Department of Natural Resources biologists, William Smith and Timothy Vogt, had grant money to survey streams for dragonflies. They chose the St. Croix River as one place to survey because the river is large and relatively clean. Many species of dragonflies need clean water to survive.

On June 18, 1989, William Smith collected exuviae--the skins left once the adult dragonfly emerges from the water--at County Road O Landing on the St. Croix. He noticed that some of the exuviae looked different from the other exuviae that he collected. He took them back to the laboratory and looked at them under a microscope.

The biologists returned to County Road O Landing later that year and collected live dragonfly nymphs. The nymphs were raised to adults in the laboratory. As the adults emerged, it was clear to the biologists that they were looking at an unknown species of dragonfly. Mr. Smith and Mr. Vogt returned to the St. Croix River the following spring and collected wild adults from several locations.

Meanwhile, the two biologists carefully reviewed scientific descriptions of known dragonflies. They compared their dragonflies to the descriptions. Then, they wrote a description of their dragonflies and sent the description to be published in a scientific journal. Other dragonfly experts agreed that the biologists did find a new species.

Mr. Smith and Mr. Vogt named the new species *Ophiogomphus susbehcha*, the St. Croix Snaketail Dragonfly.

## Roles

1. Five people chosen as members of the County Council.

2. **A.G. "Rick" Ulture:** a representative of the local farmers' coalition interested in the irrigation potential of the dam.

3. **Lotta Power:** a lobbyist for the municipal electrical power company interested in developing the dam.

4. **Rob or Marta Kanu:** kayaker concerned with the loss of the whitewater stretch for canoeing and kayaking.

5. **Sam N. Fish:** a local sporting goods store owner and avid fisherman concerned with the loss of migration routes of the fish on the river.

6. **Dan D. Lion:** the president of the "Save Our Native Plants and Wild Animals" organization.

7. **Pat "Pottery" Brusher:** an archeology professor from the local university who has done extensive research on the archeological sites of Indian fishing camps along the river.

8. **Lynn Dripper:** the director of the municipal water quality authority responsible for providing quality drinking water for the city, and attracted to the dam's potential for providing a reservoir of high quality water useable during long hot summers.

9. **H.M. Owner:** a representative for all homeowners in the river valley below the dam who would like to see more flood control.

10. **Bobbie Lawkeeper:** the local Rocksborg sheriff concerned about maintaining police protection, peace, health and safety with only a one person staff as the sole legal authority in the region.

11. **T.M. Burr:** the owner of a lumber company whose land would be inundated by the dam.

12. **I.M. Floaten:** an owner of a whitewater rafting company who uses the river for commercial rafting. Concerned about loss of the "best seven miles of river," I.M. argues that the best rapids would be submerged by the lake.

13. **"Sky" Soarer:** president of the local bird club who has organized eagle-watching trips to the river every winter for the last 15 years.

14. **Sam Slalom:** an avid water skier who sees the new lake as a real boon to skiing interests.

15. **Velma or Virgil Vigil:** a local representative of the gray panthers, a group of retired people who are concerned about any rise in power bills.

16. **"Boater" Cartop:** an older fisherperson who enjoys throwing the boat on the top of the car and putting in at the closest float spot--especially lakes!

17. **Marshal or May Flyfisher:** a long-time resident who champions the purity of fly fishing and insists on pristine habitat, noting the necessity of white water riffles.

18. **Col. "Bull" Winkle:** the president of "More Moose Now" who believes that with the lake behind the dam, more moose habitat will be created.

19. **Lap Larson:** the president of W.O.W. (Watch Our Waves).

20. **Cy or Sy N. Tist:** a respected biologist who is prepared to testify about potential effects on wildlife from building of the dam.

21. **O.L. Slick:** a saleperson for motor boats, water skis, and other recreational equipment.

22. **Forest or Park Site:** a trained forester who has worked in the woods of the area for more than 50 years.

23. **Running Waters:** a tribal leader who is concerned about loss of native heritage from flooding the region for the dam.

24. **E. Conomy:** a local businessperson who is concerned about the long-range business potential of the area.

25. **C.D. Minium:** a wealthy land developer who has architects working on designs for lakeside condominiums and resort homes.

And so on! Create any additional roles which serve to illustrate a variety of major perspectives and interests. NOTE: Some students have dressed for their roles to heighten the dramatic quality of the experience.

# Bio-indicator Chart

Biologists can use abundance of an animal and the number of different species present in an area to get an idea of how clean a river is. The abundance of an animal refers to how many individuals of one type of animal are present. For example, there are 15 crayfish in the sample tub, so crayfish are common. The number of different species refers to how many different species of one type. For example, there are 2 species of dragonflies in the tub. Use this chart to determine if the river is clean and healthy or impaired.

River Name and Landing \_\_\_\_\_  
 Date \_\_\_\_\_ Time \_\_\_\_\_  
 Investigators (students names or class) \_\_\_\_\_  
 Site Description (include weather) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Record abundance and number of species present here.  
 (Abundance codes are: N = none, R = rare, C = common)

| Example:    | abundance | # of species |
|-------------|-----------|--------------|
| GROUP X     |           |              |
| mayflies    | <u>C</u>  | <u>2</u>     |
| stoneflies  | <u>R</u>  | <u>1</u>     |
| dobsonflies | <u>N</u>  | <u>0</u>     |

|             | abundance | # of species |
|-------------|-----------|--------------|
| GROUP I     |           |              |
| mayflies    | _____     | _____        |
| stoneflies  | _____     | _____        |
| dobsonflies | _____     | _____        |

|             | abundance | # of species |
|-------------|-----------|--------------|
| GROUP II    |           |              |
| dragonflies | _____     | _____        |
| damselies   | _____     | _____        |
| caddisflies | _____     | _____        |

|           | abundance | # of species |
|-----------|-----------|--------------|
| GROUP III |           |              |
| snails    | _____     | _____        |
| scuds     | _____     | _____        |
| crayfish  | _____     | _____        |
| leeches   | _____     | _____        |

How clean is the river? Group I animals are pollution intolerant, they cannot tolerate pollution. Group II animals are somewhat tolerate of pollution. Group III animals are pollution tolerant. Circle the results below that match those in the section above.

Abundance  
 GROUP I   N    
 and  
 GROUP III   C  

Abundance  
 GROUP I   C or R    
 and  
 GROUP II   C or R  

Total number of species is < 8

**River is impaired**

Total number of species is > 8

**River is clean or slightly impaired**

# Animal Adaptation Descriptions

Name: Marsh treader

Habitat: River edge and relatively quiet waters.

**Adaptation: Snorkel**

Marsh treaders have a breathing tube on their posterior. They suspend themselves in a head-down position with their breathing tube at the surface and wait for prey.

Name: Stonefly

Habitat: Faster moving water.

**Adaptation: Grappling hook**

Stoneflies have anal hooks that they use to hold their position in fast currents.

Name: Tadpole

Habitat: Slow moving water or quiet pools.

**Adaptation: Toilet plunger**

Tadpoles use their mouths as suction cups to maintain their position in currents and to gather food.

Name: Water strider

Habitat: Water surface.

**Adaptation: Snowshoe**

Water striders have wide spread legs with hairs on the ends that distribute their weight and allow them to “walk” on the water without breaking the surface tension.

Name: Backswimmer

Habitat: Water column.

**Adaptation: Scuba tank**

Backswimmers trap air in fringed pockets on their abdomens before they dive. Some species can remain underwater for 6 hours, using the air they trap to breathe.

Name: Whirligig beetle

Habitat: Water surface.

**Adaptation: Bifocals**

Whirligig beetles have compound eyes. Half of the compound eye sees clearly in air while the other half sees clearly in water.

Name: Dragonfly

Habitat: River bottom.

**Adaptation: Turkey baster**

Dragonflies can propel themselves very rapidly by expelling water out of their bottoms which pushes them forward.

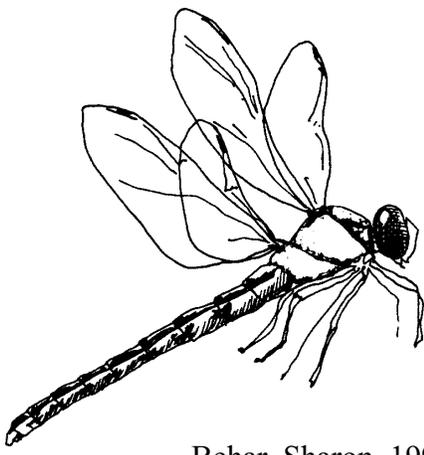
Name: Crayfish

Habitat: River bottom.

**Adaptation: Swim fin**

Crayfish use the segments at the end of their tails and the shape of their tails to push water enabling them to move quickly backwards.





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|         |                         |
|---------|-------------------------|
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| Flowers | Mammals                 |
| Insects | Butterflies and Moths   |
| Trees   | Fishes                  |
| Spiders | Pond Life               |

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