



Big River Journey Classroom Activity: River Ecosystems

Web of Life Game *

Objective: The students will learn how animals compete for resources and the impacts an exotic species can have on a natural ecosystem.

Time requirement: 20-30 minutes

Materials:

- identity tag* for each student – for a class of 30, the tags should be made as follows:
- 10 small fish * use copies of photos from Native Fish and Mussels
- 10 native mussels
- 10 larger "predator" fish
- write "ZEBRA MUSSEL" on the back of each identity tag
- 150 Blue game pieces (these pieces represent dissolved oxygen)
- 150 Red game pieces (these pieces represent zooplankton)
- cones or flags for game area boundaries
- pencil and paper to record the results of each round for later discussion

For the game pieces, you can use colored popsicle or craft sticks, colored plastic spoons, colored paper, poker chips, or anything that will not blow away (if played outdoors) and can be easily picked up after the game is over.

Introduction: Zebra mussels are just one of many exotic species that have "stowed away" in ships from Europe and Asia and now live in the Great Lakes and the Mississippi river. (See the enclosed, "A Field Guide to Aquatic Exotic Plants and Animals" for more information). Like many exotic species, zebra mussels have an ecological impact on the areas they inhabit, out-competing native species for food and oxygen. In the "Web of Life Game", students will take the roles of the species most directly impacted by the zebra mussel to discover the delicate balance in a river ecosystem.

* This activity is adapted from "Zebra Mussel Mania Teacher's Guide", Illinois-Indiana Sea Grant Program.



Web of Life Game

Setting up the game: the following instructions are based on 30 students.
Adjust the numbers as needed using a starting ratio of 1:1:1.

Object of the game: to survive as long as possible.

Directions for students:

Round One:

1. Students put on the nametags with the fish or mussel picture facing out and the teacher scatters the food and oxygen pieces in the playing area. Record the starting numbers of each species.
2. At a signal from the teacher, all fish and mussels scramble to get as many game pieces as possible.
3. When all of the game pieces have been gathered up, regroup to determine who has survived based on the following chart.

	<u>Dissolved Oxygen</u>	<u>Zooplankton</u>
small fish	4	4
native mussels	4	4
larger "predator" fish	8	8
ZEBRA MUSSEL	2	2

4. Species must have at least the required number of each game pieces to survive. Survivors remain in the game for the next round. Record the numbers of survivors. Species who did not have the required number of game pieces die and are "recycled" into Zebra Mussels for the next round. . . they should turn their species tag over to display **Zebra Mussel**.

Round Two:

5. Collect and rescatter the game pieces. Again, at a signal from the teacher, have students collect as many game pieces as they can.
6. Repeat the counting process to determine who survived, recording the numbers of survivors after each round. If many animals besides **Zebra Mussels** survive, repeat another round or two.
7. The results may be different each time the game is played. If you choose, play the game again in the same manner or using different starting numbers of species for different results.



River Ecosystems Vocabulary

Basic Vocabulary:

habitat - the place where a plant or animal lives and finds the resources it needs

predator - an animal who eats other animals

prey - an animal that is eaten by another animal

niche - the role or function a plant or animal has in a community

population - all of one kind of plants or animals in a specified area

native species - a species originally living or growing in a certain place

exotic species - a plant or animal introduced from a different area that competes with the native species

endangered species - a species in danger of extinction (dying out)

food chain - a series of plants and animals within an environment of which each kind serves as a source of nourishment (food) for the next in the series

food web - a complex, interlocking series of individual food chains

Intermediate Vocabulary:

ecosystem - a group of plants and animals that interact and adapt to a physical environment, including climate, water, air, and soil (desert, tundra, rain forest, etc.)

competition - the struggle between individual organisms for food, water, space, etc., when the available supply is limited

watershed - all the land that water flows over or under on its way to a stream, river or lake

floodplain - the flat area of land adjacent to a stream or river that is created by erosion and deposition of sediments during regular flooding

flood pulse - the seasonal rise and fall of the water level, which controls plant and animal life in the river's channel, backwaters and floodplain



River Ecosystems

Pre-trip activity ideas:

Play the " Web of Life Game" and then answer the following questions.

Who is at the top of the food chain?

Who is at the bottom of the food chain?

What happens when one species is removed?

Which populations increase or decrease? Could any populations go extinct?

Are all the parts of a food chain important?

What can happen when an exotic species is introduced into an ecosystem? What exotic species are present in the Mississippi River?

Have the students research which plants and animals would have lived in and along the Mississippi River 200 years ago.

Which plants and animals live here today?

How have the land and the river changed?

List some ways that people can use and change rivers.

How might these uses or changes effect the ecosystem?

Have the groups research two or more Ecosystems (examples: desert, grassland, forest, marsh, rainforest, tundra)

Draw pictures of the different ecosystems and their plant and animal communities

Compare and contrast the different ecosystems.

How are the plants and animals the same? How are they different?

Which plants or animals occupy the same niche?

Which plants or animals are found in more than one ecosystem?

Which plants or animals are unique to an ecosystem?

Which ecosystems are native to Minnesota?

Use the article [The flood pulse: Heartbeat of a River](#), by Dean Rebuffoni from the April 16, 1997 Minneapolis Star Tribune to discuss seasonal cycles and how they can affect ecosystems along a river.



River Ecosystems

Post-trip activity ideas:

Compare the Observations made by the three Ecosystems groups during the trip.

What different ecosystems were observed?

What species of plants and animals were observed?

How high was the water? Was there evidence of how high the river has been in the past?

What evidence was there of flooding?

What are some of the adaptations that plants and animals have for living in a floodplain?

How are people changing the floodplain ecosystem? How do people have an impact on flood levels or the frequency of floods?

Have the students research the natural history of a plant or animal found in a river ecosystem and answer the following questions about their species.

What does it look like? (Draw a picture)

Where does it live? (habitat and community or ecosystem)

What does the species do that makes it different from others? (its niche)

Is it a producer, consumer, or decomposer?

Where does it get its energy from?

Is it an herbivore (plant eater), a carnivore (animal eater), or an omnivore (both)?

What eats it? (who does its energy go to)

Have the students draw pictures to construct a 4-5 link food chain using their species.

Discuss how these food chains are just a small part of the whole system called the food web. Use the pictures each student made of their species to construct a food web bulletin board. Use arrows or pieces of yarn to show the species that are connected in the food web.

Notice that some plants and animals are eaten by more than one species.

Why is it important to have many pathways of energy flow in an ecosystem?

Which species are eaten by more than one other species, those at the top or those at the bottom of the food chain?

What does this suggest about the population sizes of species at the top and bottom of the food chain?

Which plants and animals occupy the same niche?

What happens when a species is eliminated from the ecosystem?

Suggested Resources: Minnesota's St. Croix Valley and Anoka Sandplain: A Guide to Native Habitats, from the Minnesota DNR; animal and plant fact sheets from the DNR or Minnesota Valley National Wildlife Refuge

Native Fishes and Mussels of the Mississippi River

Shovelnose Sturgeon -to 34"; bottom of main channels

Paddlefish - to 87"; plankton eater; slow moving water of large rivers

Bowfin – to 43"; swamps, sloughs, pools and backwaters near vegetation

Mooneye – to 18 $\frac{3}{4}$ "; eats aquatic invertebrates and small fish

Sucker family: vacuum up invertebrates from river bottoms

Bigmouth Buffalo – to 40"; main channels, pools and backwaters

Quillback – to 26"; pools, backwaters and main channels

Shorthead Redhorse – to 29 $\frac{1}{2}$ "; rocky pools, runs and riffles

Channel Catfish – to 50"; deep pools and runs over sand or rocks

Shortnose Gar – to 33"; predator; quiet pools, backwaters and swamps near submerged logs and vegetation

Drum family: males make drumming noise under water

Freshwater Drum – to 35"; bottom of rivers: eggs and larvae float at surface of water; eat zebra mussels

Sunfish family: males build nests and guard eggs and young

Rock Bass – to 17"; predator; pools in rivers and near brushy stream banks

Smallmouth Bass – to 27 $\frac{1}{4}$ "; predator; live in flowing pools

Perch family: eat insects, crustaceans, and fish

Walleye – to 36"; backwaters and runs of rivers, usually in clear water near brush

Mussels:

The larval stage (called glochidia) live in the gills of specific host fish for a short time

Fragile Papershell – host is the freshwater drum

Pink Heelsplitter – host is the freshwater drum; decreasing in numbers

Higgins' Eye – hosts are saugers and freshwater drums; endangered species

Hickorynut – host is the shovelnose sturgeon; healthy population

Deertoe – hosts are saugers and freshwater drums; healthy populations

Native Fishes and Mussels of the Mississippi River



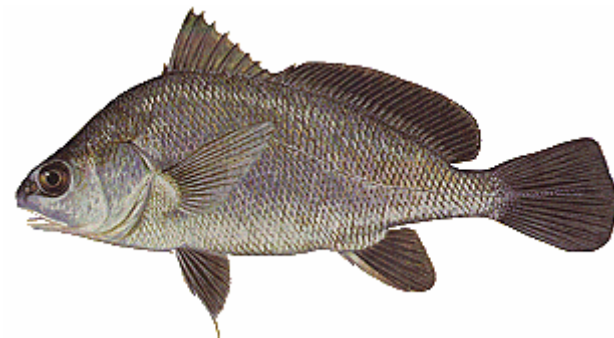
Channel Catfish



Smallmouth Bass



Walleye



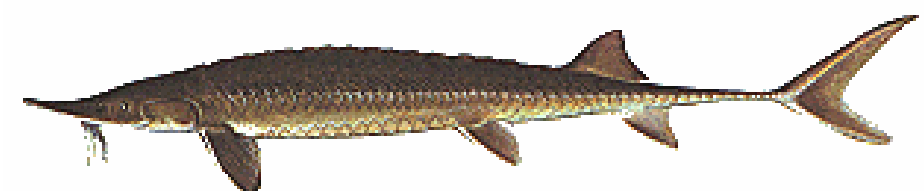
Freshwater Drum



Bowfin



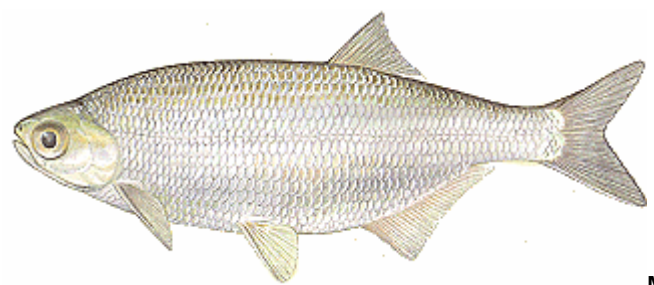
Shortnose Gar



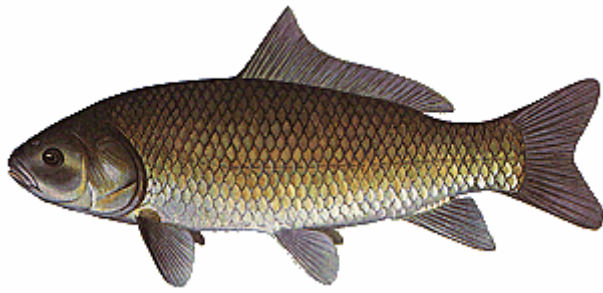
Shovelnose Sturgeon



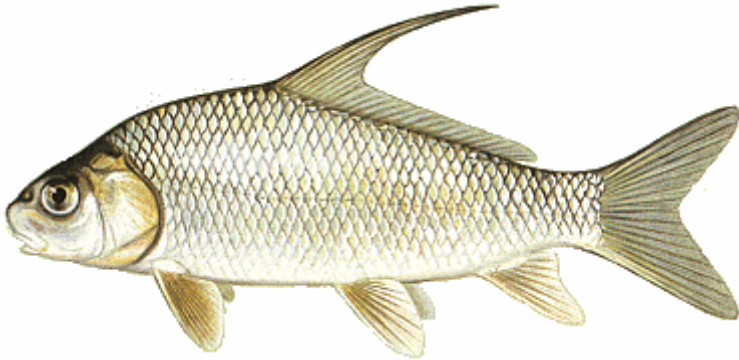
Paddlefish



Mooneye



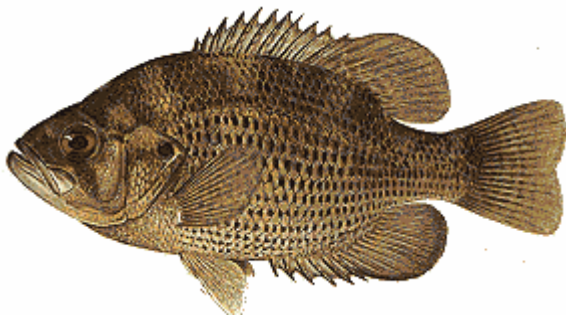
Bigmouth Buffalo



Quillback



Shorthead Redhorse



Rock bass

Mussels of the Mississippi River



Fragile Papershell



Pink Heelsplitter



Higgins Eye

Mussel photos courtesy of the Illinois National History Survey,
K.S. Cummings and C.A. Mayer



Hickorynut



Deertoe

zebra mussel

zebra mussel

zebra mussel

zebra mussel

zebra mussel

zebra mussel