# APPENDIX A

# Significant Others

### Additional Recommended Great Lakes Activities in Brief

| Category | Activity | Grade/Subject | Source |
|---|---|---|---|
| Life in the Water | | | |
| | Web of Life Game | 3-8 S | Zebra Mussel Mania |
| | Mussel to Mussel | 3-8 S, SS, LA | Zebra Mussel Mania |
| | Food Chains | 4-8 S | GLEP |
| | What Factors Affect the Size of a Natural Population? | 6-12 S | ES-EAGLS Life in the Great Lakes, pp 75-86 |
| | Something's Fishy | 3-6 S, A | Paddle-to-the-Sea |
| | Family Reunion | 3-8 S, M | Zebra Mussel Mania |
| | Where Have All the Lake Trout Gone? | 4-12 S, M | The Life of the Lakes |
| Habitat | | | |
| | Fish Habitat | 4-8 S | Project FLOW |
| Climate & Weather | | | |
| | Studying Thermal Stratification | 7-12 S | Water on the Web |
| Hydrology | | | |
| | Aerial Photographs | 6-12 S | Watershed Science for Educators |
| | What Makes Water Healthy? | 4-8 S | Project FLOW |
| Coastal Processes | | | |
| | What Causes the Shoreline to Erode? | 4-8 S | ES-EAGLS Land & Water Interactions |
| Issues | | | |
| | Great Lakes Grief | 5-8 S, LA | ESCAPE |
| | All Clogged Up | 3-8 S, M | Zebra Mussel Mania |
| | What Do Scientists Know About Invader Species and the Effects that Global Climate Change Will Have on Them? | 4-6 S | GLIMCES |
| | Invader Species of the Great Lakes | 4-8 S | ESCAPE |
| | We've Gotta Survive Rap | 4-7 S, A | ESCAPE |

Subject Key: S = Science, SS = Social Science, M = Math, A = Art, LA = Language Arts

# *Activity Summaries*

**Web of Life Game**
A native river habitat is a fluid yet fragile community. Introduced species have altered, permanently in some cases, the natural food chain. The *Web of Life Game* actively demonstrates to students the impact zebra mussels have in a native river environment and on its food web. This activity engages students in important science and critical thinking skills including inferring, predicting, and drawing conclusions.

**Mussel to Mussel**
Almost 300 different species of native mussels have been identified from streams, rivers, lakes, and ponds of North America. They are important, both economically and ecologically. Zebra mussels compete with native mussels for food, space, oxygen, and other necessities, and may eliminate native mussels completely from many rivers and lakes. To preserve our native mussels and control or eliminate zebra mussels, we need to be able to tell the good guys (the native mussels) from the bad guys (the zebra mussels). This activity incorporates a dichotomous key to teach students how to classify species based on physical characteristics using zebra mussel and native mussel shells.

**Food Chains**
Knowledge of the complex interactions between organisms is crucial to developing an understanding of eco-systems and how they work. This activity uses paper cutouts to teach students about the parts of a food chain, specifically herbivores, carnivores, and producers, and their interdependence. Students construct their own food chains, and learn how human interference and other disasters can impact the food chain as a whole.

**What Factors Affect the Size of a Natural Population?**
Each spring hundreds of thousands of yellow perch deposit their eggs over vegetation in the shallow waters of the Great Lakes shoreline. A female perch can lay jelly-like ribbons of up to 50,000 eggs at one time. This board game helps students explore the life cycle of the yellow perch and the natural and human-caused factors that affect fish populations at each stage of their life cycle.

**Something's Fishy**
Using pictures, puzzles, and descriptions of fish anatomy, *Something's Fishy* teaches students the basic parts of a fish's body, both structure and function. In addition to a matching game, students construct a puzzle and play "Pin the Fin on the Fish." A worksheet is provided, and as an extension, students are asked to design their own fish.

**Family Reunion**
Zebra mussels attach to hard surfaces in lakes and rivers. They attach to rocks, docks, boats, and even to each other. This activity will engage the students in a sampling technique currently being used by scientists to esti-mate the number of zebra mussels in rivers and lakes. The students simulate this sampling technique by taking samples of gravel (representing zebra mussels) from a cookie sheet (simulating a lake/river bottom), and use this information to calculate the number of "zebra mussels" in the entire pan. In addition to learning how to sample, this activity engages students in the critical thinking skills of predicting and inferring.

**Where Have All the Lake Trout Gone?**
As sea lampreys invaded Lake Michigan in the 1950s, the lake's lake trout population declined sharply. In this activity students use real data from 1929-1970 to graph and examine the relationship between the lake trout and sea lamprey populations, discuss and analyze the relationship, and explain the effects of these population chang-es on the economics of the region.

**Fish Habitat**

A healthy environment supports a variety of native species. This is especially true for Great Lakes fish. Different species of fish require specific habitats, and loss or alteration of fish habitat can lead to population declines. This lesson explains some of the characteristics of fish habitats and some of the changes that have taken place over time, including pollution, invasive species, and urban development. Students listen to an online interview with a fisheries researcher who studies Great Lakes fish and their habitats.

**Studying Thermal Stratification**

This activity utilizes a model and a laboratory investigation to answer basic questions about thermal stratification: What does stratification look like in a lake? What evidence supports thermal stratification? Why does stratification occur? And what factors might relate to thermal stratification? Students collect, graph and analyze real Great Lakes temperature data through Water on the Web.

**Aerial Photographs**

Aerial photographs are a convenient source of information about your watershed. In most areas of the U.S. they are available dating back to the 1930s, and can help you identify land use patterns, management practices, drainage patterns, and potential sources of soil and water contamination. This activity teaches students how to interpret aerial photographs, find landmarks, use them for watershed monitoring, and find historical trends. Several reliable sources of aerial photographs are provided for the educator's convenience.

**What Makes Water Healthy?**

Water quality is one of the most important factors in a healthy ecosystem. Clean water supports a diversity of plants and wildlife. In turn, our actions on land affect the quality of our water. Pollutants, excessive nutrients from fertilizers, and sediment frequently get carried into local lakes and rivers via run-off from urban areas or agricultural fields. By observing, testing, and evaluating several water samples from local lakes, rivers or streams, students begin to consider the factors that influence water quality.

**What Causes the Shoreline to Erode?**

Erosion is a serious issue affecting the Great Lakes region, and has the potential for large economic impacts. In this activity, students create models of a shoreline to help them understand the processes and major causes of shoreline erosion, as well as the differences in how various kinds of soil are affected.

**Great Lakes Grief**

The balance of nature is delicate; each organism has its own special niche, its own specific tolerance levels to many different environmental and human-imposed factors. Nonindigenous species invading the Great Lakes is only one of many factors that determine which species will survive in a freshwater ecosystem. In this activity, students take on the role of reporters writing newspaper articles to inform the public about the impact of one invasive species on the environment. This activity has a strong stewardship component, as the finished articles are distributed in local supermarkets.

**All Clogged Up**

Zebra mussels are gathering on water intake lines of power companies and water treatment plants along rivers and lakes. The resulting economic impact to these companies is very serious and costs thousands of dollars for clean-up and repairs. In this activity students examine a model of the problem, learn to predict and calculate rates of flow, and brainstorm the effects this problem might have on utility services.

**What Do Scientists Know About Invader Species and the Effects that Global Climate Change Will Have on Them?**
A significant number of fish species in the Great Lakes are invaders. This activity uses a matching game to familiarize students with some of the most threatening invaders, their origins, how they were introduced into the Great Lakes, the impacts they have on Great Lakes ecosystems, and the impacts global climate change will have on invasive species. Once familiar with these species, students select one to study and, as experts, they give a presentation to their class.

**Invader Species of the Great Lakes**
Since the early 1800s, over 140 species of aquatic plants and animals have been introduced into the Great Lakes. A few of these invaders have had very substantial impacts. In this activity, students play a matching game to learn about introduced species that have had the greatest impact on Great Lakes ecosystems. They create posters and fact sheets in groups, and play a game of charades as a class, acting out methods of preventing exotic species spread.

**We've Gotta Survive Rap**
The topic of food chains and natural environment destruction are salient to the lives of students for many reasons. This activity effectively engages students with these topics as students research them, construct their own rap song, and perform it for classmates.

**Which Fish Can We Eat?**
Bioaccumulation, the process by which toxins are collected in an organism's body, is a serious issue that affects every species in the Great Lakes region, including humans. In this activity, students examine and analyze graphs and data tables to determine which factors affect the amount of toxins that accumulate in a species, and which species of fish might be safer to eat than others.