

GREAT LAKES NEWS FROM
MICHIGAN SEA GRANT COLLEGE PROGRAM

upwellings

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Learning
on the
Lakes




Sea Grant
Michigan

upwellings

An upwelling occurs in a lake or ocean when strong, steady winds push warm in-shore surface water away from shore causing colder, nutrient-rich water to rise.

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MICHU-06-802

COVER PHOTOS: MARSEE, STEWART, COSEE-GREAT LAKES

Fish Tales

On a recent visit to Ludington State Park, I found myself standing on a footbridge spanning the Big Sable River, looking down on a group of large, motionless fish.

Probably salmon, guessed several park visitors. Others identified the fish as common carp. For my part, I wasn't sure. I needed to see a profile, to look at the shape of the dorsal fin and whether or not the fish had that funny adipose fin. (I now know it's a trait shared by all fish in the salmon and trout family.)

A year ago, I wouldn't have known. That was before our Sea Grant communications and education team began work on two curriculum lessons introducing students to Great Lakes fish and their distinguishing characteristics. As we worked on the lessons, we soon found ourselves immersed in fish anatomy. With the help of several experts, we learned to distinguish some common fish families and use a dichotomous key for identification. Yes, you might say, we were hooked. Not long afterward, team leader Elizabeth LaPorte suggested the information belonged on a poster. As it turned out, the process was more complex than we had imagined.

We met first with scientific illustrator Emily Damstra and retired University of Michigan (UM) professor Gerald Smith, editor of *Fishes of the Great Lakes Region*. Together, they helped us decide which fish species to feature, given space constraints, and gave us a crash course in significant anatomical traits. We also talked with UM fish biologist Paul Webb, who encouraged us to think about the organization of our 21 fish illustrations. Did we intend to show an evolutionary pattern or simply a

representative sample of Great Lakes fish? We chose the latter. As we revised text and moved illustrations, we also listened to feedback from Sea Grant education specialists Brandon Schroeder, Rochelle Sturtevant and Steve Stewart.

The end result—*Fins, Tails and Scales: Learning about Great Lakes Fishes*—is an eye-catching poster that provides an intriguing glimpse into the world of fish identification. Shown on the back cover of this issue, the poster complements two curriculum lessons from *Fisheries Learning on the Web*. We've reprinted a combination of the lessons on pages 4 and 5 along with a set of eight fish cards representing eight common families. We hope these educational materials will not only complement classroom learning but also inspire amateur naturalists of all ages to learn about and appreciate the diversity of fish that inhabit our Great Lakes.

Over the course of the summer, these activities formed a backdrop to active, hands-on learning events taking place around the region. Notable among them were the first COSEE-Great Lakes educator workshops on Lake Erie and Lake Superior, summer discovery cruises on the Detroit River and Lake St. Clair, and the Great Lakes Sea Grant network meeting on the shores of northern Lake Huron. These and other summer events are highlighted in this issue of *upwellings*.



Joyce Daniels
Editor



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COSEE-GREAT LAKES

Educators, scientists and crew aboard the R/V Lake Guardian use a rosette to collect water samples at varying depths in Lake Erie. On cover, Michigan educators Margaret Holtschlag of Haslett, Matt Lefler of Reese and Mary Lindow of Battle Creek are shown aboard the R/V Lake Guardian.

COSEE Workshop Immerses Educators in Great Lakes Science

As the new school year begins, Haslett educator Margaret Holtschlag is eager to tell her students what she did over summer vacation.

Studying Lake Erie aboard a 180-foot research vessel ranks high on the list. Holtschlag was one of 16 educators, three from Michigan, who set sail on Lake Erie in June for the first annual Center for Ocean Sciences Education Excellence (COSEE) Great Lakes shipboard and shoreline science workshop, sponsored by the National Science Foundation and the National Oceanic and Atmospheric Administration.

Their ship was the U.S. EPA Great Lakes National Program Office research vessel, the R/V Lake Guardian, contributed for the workshop and staffed by EPA scientists. The weeklong workshop allowed educators from around the Great Lakes Basin to work shoulder to shoulder with scientists and Sea Grant educators, picking up great teaching ideas along the way.

"I'm excited to see what my students will make of it," says Holtschlag, who teaches technology to students in grades 2 through 5. "Every time I bring something new back, they find layers of interest and enthusiasm that I haven't thought of. I'm excited to see where it takes them."

The shipboard and shoreline science workshop began in Cleveland, with stops

at ports throughout Ohio's Lake Erie coastline. The voyage took its eager crew of learners through critical science areas of Lake Erie. Wearing hard hats, work vests and steel-toed boots, the educators collected information about the water quality, physical conditions of the lake, and living things in and below the water.

Learning with scientists and other educators – what a great way to learn about the Great Lakes.

— Margaret Holtschlag

When the samples came on board, the work gear was traded for lab coats as the educators learned how to interpret new information and identify lake plankton and benthic invertebrates. Their data will be contributed to the EPA's log of the changing Lake Erie system.

Shoreline activities included stops at Stone Laboratory in Put-in-Bay, a visit in Toledo from representatives of the Maumee River Remedial Action Plan Committee, exploration of Old Woman Creek National Estuarine Research Reserve in Huron, Ohio, and a tour of the Tom Ridge Environmental Research Center in Erie, Pennsylvania.

The combination of activities was unforgettable, says Michigan educator Mary Lindow of Battle Creek. "The COSEE Lake Guardian workshop on Lake Erie was by far the best professional development experience that I've ever been involved in. I would highly recommend that any Michigan teacher interested in a hands-on/minds-on approach to learning more about the Great Lakes apply for this program as it moves to the other Great Lakes."

The cruise was one of the first major events of COSEE Great Lakes, a consortium of educators and scientists assembled to promote science literacy through the study of the Great Lakes, America's inland seas, and the ocean. COSEE Great Lakes, supported by grants from the National Science Foundation and NOAA-National Sea Grant, is the tenth center in a nationwide network.

To read more about participants' experiences on Lake Erie, see: www.coseegreatlakes.net

LAKE HURON EXPLORATION WORKSHOP

Michigan Sea Grant will host a one-week Lake Huron exploration workshop for educators in 2007. Scholarships are available. For more information, see the COSEE Great Lakes website at www.coseegreatlakes.net

Contact: Steve Stewart at stew@msu.edu, (586) 469-7431.

FIN TAILS & SCALES

Identifying Great Lakes Fish

Project
FLOW
FISHERIES LEARNING ON THE WEB

Activity: Students use a simple classification system to identify eight common Great Lakes fish families.

Grade level: 4-8

Subjects: Science, social studies

Setting: Classroom

Duration: 30-60 minutes

Standards and Benchmarks: Select *Standards* for Lesson 2 of the FISH curriculum unit on the FLOW website.

An impressive variety of freshwater fish inhabit the waters of the Great Lakes region. Scientists have documented more than 160 distinct fish species belonging to some 29 families.*

While some Great Lakes fish may look similar in size, shape and color, each family shares similar traits. These distinguishing features, combined with information on geographic range, help scientists, anglers and amateur naturalists observe and identify fish.

Some fish characteristics that can be easily compared include structure and location of dorsal fin(s) on the fish's back, mouth position and shape of snout, tail shape, and presence or absence of unusual traits such as barbels (whiskers).

By observing and comparing distinguishing characteristics, students learn to organize fish species into meaningful groups for identification and further study.

Objectives

After participating in this activity, students will be able to:

- Name several species of Great Lakes fishes.
- Use a dichotomous key to identify 10 common fish belonging to eight families.
- Describe some distinguishing traits that separate fish families.

Summary

Scientists use classification systems to organize living organisms into groups based on similarities, distinguishing characteristics and other attributes or

behaviors. This lesson introduces students to a simple dichotomous key that can be used to identify several common families of Great Lakes fish.

Background

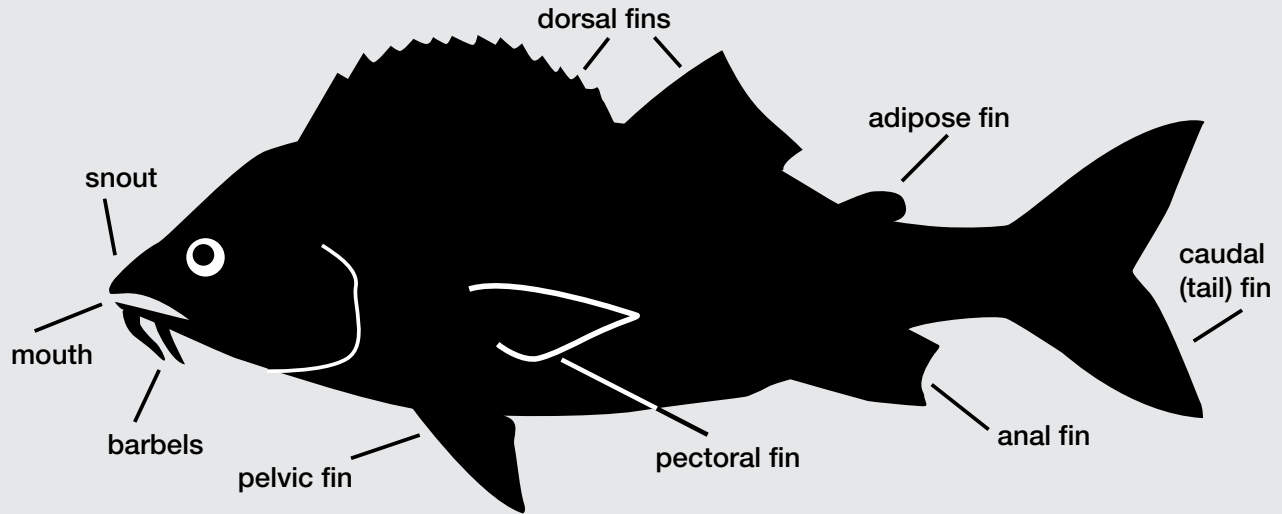
Fish scientists, or ichthyologists, often use a dichotomous key to correctly identify fish. A dichotomous key is a classification "tool" used to sort, organize and identify a collection of objects or living organisms.

This type of key is made up of a series of questions with two choices; it can appear in narrative form, graphically, or a combination of the two. By starting at one common point and progressing through the key, making choices based on observed traits, the user is led through a path that ends with a correct identification of the object or organism.

A dichotomous key can be complex—incorporating all families and species of a particular animal—or simple. In this lesson, a simplified key has been developed that distinguishes eight Great Lakes fish families. By using their knowledge of distinguishing characteristics, students use

*Source: Carl Hubbs and Karl Lagler, Revised by Gerald Smith. *Fishes of the Great Lakes Region*, 2004.

FISH ANATOMY



illustrations of fish to work through the key and make identifications.

Materials and Preparation

- Set of 8 Great Lakes Fish cards (opposite page)
- Post-it notes
- Fish anatomy diagram and Dichotomous key. To print the diagram and key, select Downloads for Lesson 3.2 on the FLOW web site.

Procedure

1. Divide the class into small groups. Explain the need to use classification systems to organize living organisms. Describe a dichotomous key, emphasizing that this type of key uses a series of questions based on distinguishing characteristics. For example, a key to identify fish might ask: Does the fish have barbels (whiskers)? or Is the dorsal fin spiny?
2. Explain that each group will use a dichotomous key to identify the fish pictured on the Great Lakes fish cards. The cards represent 8 common families: Trout and Salmon, Pike, Sturgeon,

Burbot, Sunfish and Bass, Perch, Goby, and Catfish.

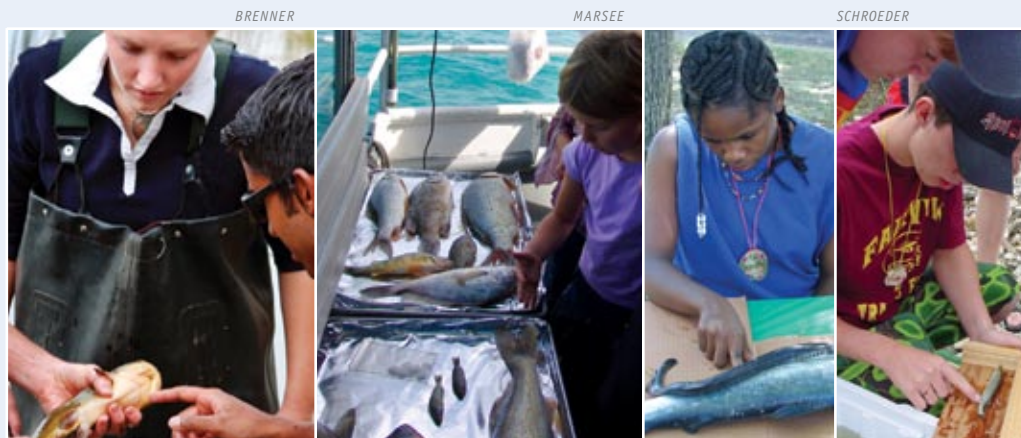
3. Pass out the generic fish diagram and remind students of some of the distinguishing characteristics of fish covered in Lesson 3.1.
4. Using the set of 8 Great Lakes fish cards, have students begin by selecting one fish and “keying it out” by answering the questions and following the arrows as indicated on the key. For each fish, they should identify the correct fish family. As they identify each illustration, have them write the name of the family on a post-it note and label each card. Note that there are Bonus Questions on the key that ask students to identify 4 fish at the species level. Additional cards are available online.
5. Discuss the results. Did everyone correctly identify all fish? Was it

difficult to distinguish some of the characteristics, such as a rounded or forked tail? How else might some of the characteristics be described?

One limitation of a dichotomous key is that all fish of a given family or species do not look exactly alike, as with humans. There will always be individual differences. Still, the process of using a dichotomous key is valuable in many disciplines. Also, by learning to observe important fish characteristics, students will become more competent in identifying common Great Lakes fish families—a useful skill whether they enjoy fishing or simply want to know what lives in their local lake or river.

Source: Anna Switzer, Brandon Schroeder and Joyce Daniels, Michigan Sea Grant

Funding for Fisheries Learning on the Web (FLOW) was provided by the Great Lakes Fishery Trust



FISH FAMILY CARDS

Unit 3, Lesson 1



Round goby

Neogobius melanostomus

- Invasive, bottom-dwelling fish
- Discovered in St. Clair River in 1990
- Mottled coloring with frog-like raised eyes

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra

Chinook salmon

Oncorhynchus kisutch

- Native to Pacific Ocean from southern California to Alaska
- Introduced to Great Lakes in 1967
- Largest of the salmon species; also called king salmon

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra

Northern pike

Esox lucius

- Large predator with bladelike teeth
- Habitat: cool to moderately warm, weedy lakes, ponds and sluggish rivers
- Long, slender body with duck-billed snout

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra

Burbot

Lota lota

- Belongs to freshwater cod family
- Habitat: medium to large streams and cold, deep lakes
- Long dorsal and anal fins; single barbel on chin

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra

Walleye

Sander vitreus

- Popular sport fish in the Great Lakes
- Habitat: moderately fertile lakes with primarily sandy basins
- Slender body, pointed snout, forked caudal fin

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra

Lake sturgeon

Acipenser fulvescens

- Primitive, long-lived fish native to Great Lakes
- Habitat: nearshore in water depths of 15 to 30 feet
- Asymmetric, shark-like tail

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra

Black Bullhead

Ameiurus melas

- Scaleless, bottom-dwelling fish
- Habitat: Deep pools in small to large rivers; lakes
- Long barbels (whiskers) around mouth

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra

Smallmouth bass

Micropterus dolomieu

- Popular sport fish in Canadian and U.S. waters
- Habitat: Clear, gravel-bottom runs in flowing rivers; shallow rocky areas of lakes
- Large mouth; upper jaw extends under eye

Michigan Sea Grant, www.miseagrant.umich.edu Illustration: E. Damstra



MARSEE

David Sadler and Erica Clark of Central Michigan University assist microbiologist Elizabeth Alm in collecting and testing samples of Great Lakes shoreline sand.

Researchers Test Shoreline Sand for Genetic Pollution

A brisk June breeze cooled the public beach in East Tawas as Central Michigan University (CMU) student David Sadler twisted a sterile plastic tube into the wet Lake Huron sand. After removing the core, Sadler held it steady as fellow student Erica Clark divided five sections of sand into sterile plastic bags.

The students, led by CMU microbiologist Elizabeth Alm, are analyzing sand at four other Great Lakes recreational beaches in 2006 as part of Michigan Sea Grant funded research investigating the bacterial environment of shoreline sand. Alm has studied microorganisms contained in shoreline sand since 2001.

“When we first started, we had the idea that some beaches would be better than others,” says Alm. “But we’re finding that they’re all the same. Fecal bacteria is present everywhere.” In most cases, she adds, bacteria contained in shoreline sand persists in higher quantities than bacteria measured in the water.

While bacteria are part of the natural environment, Alm is investigating

the potential for this rich bacterial environment to promote the exchange of genetic material, creating what amounts to “genetic pollution.” At issue are three specific genes that could be transferred among bacteria that inhabit the sand. The genes, if present, would indicate the presence of bacteria with the potential to cause disease.

In tests conducted in 2005, Alm reports that while two of the genes are rare, one of the genes was detected in 80 percent of beach sand samples analyzed (69 percent of sand samples from the Michigan beaches of Lake Huron, and 92 percent of sand samples from the metro Detroit beaches

of Lake St. Clair). Sand was collected from public beaches in Iosco County, St. Clair County and Macomb County.

James Herrick, Alm’s colleague at James Madison University, also confirmed the presence of genetic material called plasmids from bacterial populations in a sample of sand collected from Metro Beach on Lake St. Clair in July 2005. The plasmids are capable of conferring resistance to the antibiotic tetracycline. Herrick will test resistance to additional antibiotics on new samples being collected this summer.

Contact: [Elizabeth Alm](mailto:Elizabeth.Alm@cmich.edu)
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WHAT IS E. COLI?

E. coli bacteria live in the digestive systems of humans and other warm-blooded animals, as well as in soils and water. Most strains of the *E. coli* bacteria are not dangerous, but certain strains can cause illness in humans. The presence of *E. coli* in water is a strong indication of recent sewage or animal waste contamination. Water is monitored for *E. coli* because it can indicate the presence of other disease-causing bacteria.

Source: NOAA Center of Excellence for Great Lakes and Human Health

Science Night Out

More than 70 young people and their parents turned out in July for Science Night Out, an evening of songs, music, and science celebrating the Great Lakes.

Held at the Ann Arbor Public Library, the evening event began with music by Mustard's Retreat, a short Great Lakes slide show, and several science activities for preschool through eighth grade.

Activities included a video microscope with microscopic animals on slides, a coloring station, a collection of small fish, insects and mud samples on display, as well as a live lamprey tank in the library lobby.

Participants also heard from several Great Lakes scientists who spoke on topics ranging from Great Lakes research and education to coastal land use issues, recreation, water quality, invasive species, fisheries and public safety.

A second event scheduled in August featured a panel presentation and discussion by three Great Lakes scientists



MARSEE



LAPORTE

Communications director Elizabeth LaPorte of Michigan Sea Grant discusses the Great Lakes ecosystem with a young visitor at the Ann Arbor Public Library.

addressing the health of the Great Lakes. Speakers included Bruce Manny, Research Fishery Biologist at the USGS Great Lakes Science Center; Jaci Savino, Branch Chief at the Great Lakes Science Center; and Tom Nalepa, Aquatic Biologist with the Great Lakes Environmental Research Laboratory of the National Oceanic and Atmospheric Administration.

Both events were held in conjunction with the exhibit *Revolutions in Great Lakes Science*, which ran from July 17 - August 16.

The display featured three dimensional maps of the Great Lakes, photography, scientific instruments, and an array of educational posters and materials.

The events and display were sponsored by Michigan Sea Grant, NOAA Great Lakes Environmental Research Laboratory, U.S. Geological Survey Great Lakes Science Center, the Great Lakes Fishery Commission and the Great Lakes Commission in collaboration with the Ann Arbor Public Library.

Great Lakes Sea Grant Network Conference

Sea Grant colleagues from around the region convened in Alpena, Michigan in June for the biennial Great Lakes Sea Grant Network Conference, hosted by Michigan Sea Grant.

A maritime heritage theme guided the conference, which was held in the new Great Lakes Maritime Heritage Visitors Center at the NOAA Thunder Bay National

Marine Sanctuary. Located on a former industrial site, the re-fitted facility opened to the public in 2005.

Sea Grant programs from New York, Pennsylvania, Ohio, Illinois-Indiana, Wisconsin, Minnesota and Michigan participated in the three-day meeting. Featured topics included network theme updates on fisheries, education, aquatic

MARSEE

invasive species, coastal community development, and Great Lakes restoration, in addition to program updates.

Guest speakers included Dr. Tom Coon, Director of Michigan State University Extension, and Dr. Marco Yzer of the University of Minnesota School of Journalism, as well as representatives from National Sea Grant, the International Joint Commission, the Michigan Department of Environmental Quality, the Great Lakes Environmental Research Laboratory, and the Great Lakes Commission.

Conference presentations are now available online. See: www.miseagrant.umich.edu/greatlakes06

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RESOURCES FOR GREAT LAKES EDUCATION AND RESEARCH

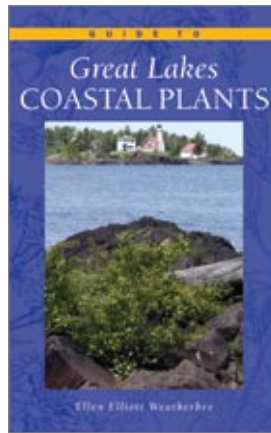


Fins, Tails and Scales: Learning about Great Lakes Fishes

Get to know your Great Lakes fish!

From the distinctive lake sturgeon to popular fish like walleye and smallmouth bass, Michigan Sea Grant's new *Fins, Tails and Scales* poster features 21 full color fish illustrations. Additional photos and text highlight some of the distinctive traits that separate Great Lakes fish families. Poster size: 37 x 26 inches.

MICHU-06-702



Guide to Great Lakes Coastal Plants

Ellen Elliott Weatherbee


The definitive book for identifying the rich diversity of both flowering and non-flowering plants of Great Lakes coastal areas

Coastal areas are some of the most outstanding features of the northern Great Lakes region. These delicate ecosystems support a rich diversity of unique and protected plants, some

of which grow nowhere else on Earth. *Guide to Great Lakes Coastal Plants* features 75 of the most common plants found on the U.S. and Canadian shores of the Great Lakes. Each plant is described in simple, authoritative language and illustrated with photographs and line drawings. Distribution maps included. Perfect for naturalists, weekend botanists and travelers alike—anyone with an interest in learning about coastal plants and the fragile ecosystems that support them. 180 pages; 68 line drawings; 112 photographs.

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