FISHERIES LEARNING ON THE WEB

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Fisheries Learning on the Web (FLOW) is an online curriculum that explores the Great Lakes ecosystem through 15 standards-based lessons. Developed in 2005, the FLOW curriculum complements Michigan Sea Grant’s efforts to increase aquatic science literacy and Great Lakes awareness. Each lesson features a content summary and background for educators, and interactive projects and activities geared toward upper elementary and middle school students. The curriculum is organized into the following three units:

1. **Food Web:** Lessons demonstrate that all living organisms in an ecosystem are connected and address the problem of invasive species.

2. **Water:** Lessons introduce the concepts of watersheds and wetlands, discuss the availability of freshwater and encourage students to make decisions about water quality and land use.

3. **Fish:** Lessons address distinguishing characteristics of Great Lakes fish, important aspects of fish habitat and life cycles, and discuss some of the ways scientists monitor the movement of fish populations.

One objective of FLOW is to broaden access to existing, high-quality Great Lakes education materials. Many of the FLOW lessons are based on teacher-reviewed content and hands-on activities used in Michigan Sea Grant’s successful Great Lakes Education Program. Since it began in 1991, this popular program has introduced approximately 70,000 fourth-grade students in Wayne and Macomb counties to the unique aspects of the Great Lakes through classroom and shipboard components. Other FLOW lessons are based on the award-winning materials contained in *The Life of the Lakes: A Guide to the Great Lakes Fishery*. First published by Michigan Sea Grant in 1993, *The Life of the Lakes* covers the biology, history and management of the Great Lakes fishery.

The FLOW development team, with assistance from education specialists and fisheries scientists at the University of Michigan and Michigan State University, transformed this core content into a three-unit curriculum. The initial work was funded in part by the Great Lakes Fishery Trust. In 2007, Michigan Sea Grant revised and enhanced the fisheries content contained in unit three.

All FLOW lessons are aligned with State of Michigan and National education standards and benchmarks for science and social studies. Main features of each lesson include learning objectives, summary, content background, materials, step-by-step procedures describing each activity, and an assessment chart based on learning objectives. Many of the lessons contain downloadable materials, including worksheets, diagrams, educational fact sheets and game cards for use in conducting the activities. Lessons also provide links to supplemental materials (e.g., posters, fact sheets) and information about the Great Lakes.

The following pages feature the first lesson from the revised fish unit. The lesson,* Fins, Tails and Scales: Identifying Great Lakes Fish*, includes a set of fish cards, a dichotomous key, and a Fish Characteristics fact sheet. Note: The online version of the lesson also includes a Teacher Master with full-page fish illustrations, species, family, and habitat information.
Conclusion

Supported by Michigan Sea Grant, the Fisheries Learning on the Web (FLOW) curriculum is designed to be an engaging, cost-effective tool for educators. Fins, Tails and Scales is one of 15 lessons online at www.projectflow.us that has been accessed by educators worldwide. Please help us continue to improve the curriculum by submitting your comments online via the FLOW feedback form.

Michigan Sea Grant, a joint program of the University of Michigan and Michigan State University, is part of the NOAA-National Sea Grant network of 30 university-based programs. Michigan Sea Grant promotes knowledge of the Great Lakes through education, research and outreach. See: www.miseagrant.umich.edu

Michigan Sea Grant FLOW Development Team

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FINS, TAILS AND SCALES: IDENTIFYING GREAT LAKES FISH

Activity: Working with a set of Great Lakes fish cards, students identify distinguishing characteristics of fish and use a dichotomous key to identify 10 common fish families.

Grade level: 4-8
Subjects: Science, social studies
Setting: Classroom
Duration: 30-60 minutes

Objectives

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

- Name several distinguishing characteristics of Great Lakes fish.
- Describe how these characteristics help fish survive in their environment.
- Organize Great Lakes fish (cards) based on similarities and differences.
- Use a dichotomous key to identify 10 Great Lakes fish families.

Summary

Each family of fishes in the Great Lakes region has physical traits that set it apart from others, called distinguishing characteristics. These characteristics help fish survive in their environment. By observing and comparing these features, students learn that fish, like other living organisms, can be organized and classified into meaningful groups for identification and further study.

Background

The Great Lakes region is home to an impressive variety of fish, numbering more than 160 separate species. A species consists of individuals that share the same gene pool. These species belong to 28 major fish families. A family is a taxonomic group that includes similar species.

Students may be most familiar with fish in the sunfish and bass family, cold-water species in the salmon and trout family, or some of the 62 species that make up the minnow family. Ancient fish, such as lake sturgeon and longnose gar, also inhabit waters of the Great Lakes region and possess unique attributes that have helped them to survive for millions of years.
With the exception of some primitive species, most fish have common characteristics that include gills, scales, fins, and bony skeletons. Some characteristics that differentiate fish include head shape and mouth orientation, fin type and location, as well as average adult size. Color markings, such as vertical stripes or fin spots, may also help differentiate fish when used in combination with other factors, including geographic range.

Distinguishing characteristics can provide clues about where a species typically lives and what it eats. For example, fish in the sturgeon and sucker families have downward-oriented mouths (ventral) that enable them to find food along a lake or stream bottom. Other traits, such as fin shape and location can provide clues about whether a fish is generally a fast swimmer or a slow swimmer.

Dichotomous Keys

To correctly identify fish and classify newly discovered species, fisheries scientists use a dichotomous key based on distinguishing characteristics. A dichotomous key is a classification tool used to sort, organize and identify a collection of objects or living organisms.

A dichotomous key is made up of a series of questions with two choices. Each choice leads to another question. The key can appear in narrative form (as numbered questions), graphically (resembling a flow chart), or a combination of graphics and narrative. By making choices and progressing logically through the key, users follow a path that ends with the correct identification of the organism.

Dichotomous keys vary in their degree of specificity. In this lesson, a simplified key has been created that distinguishes 10 Great Lakes fish families. By using their knowledge of distinguishing characteristics, students use illustrations of fish to work through the key and make identifications.

Materials

- Great Lakes Fish Cards
- Dichotomous key: Great Lakes fish families
- Fish Characteristics fact sheet

Procedure

Part 1

1. Discuss the importance of observing distinguishing characteristics of living organisms in order to classify and identify them.

2. Hold up the generic fish illustration. Explain that this is not a real fish, but rather a composite showing a variety of physical traits. Point out the location and names of the various fins and other special features such as barbels (a scientific term for the “whiskers” used by bottom-feeding fish to sense food), and adipose fin (a fleshy fin located behind the dorsal fin).

3. Arrange the students in small working groups. Provide each group with the generic fish illustration and a set of fish family cards. Explain that the species on the 12 cards belong to 10 Great Lakes fish families.

4. Ask the groups to sort the fish cards based on any set of physical characteristics they choose or for which they have some prior knowledge. Note: This is an important step in drawing out students’ previous knowledge and creates motivation for students to learn more.

5. Discuss the results. Ask students: How did you sort the fish? What features did you look at? Was it easy or hard? As the discussion progresses, ask students: Did anyone sort by tail shape, by presence of a barbel, by mouth shape, or fin rays? This way, the discussion becomes informative to students about what features scientists consider important, and informative to the teacher with regard to gauging students’ current knowledge.
6. Explain that in Part II, students will use a dichotomous key to sort and identify fish based on the characteristics that ichthyologists or fish scientists, view as important.

**Procedure**

**Part 2**

1. Divide the class into small groups. Explain the need to use classification systems to organize living organisms. Introduce the concept of a dichotomous key. Emphasize that this system uses a set of logical steps based on distinguishing characteristics and results in the correct classification or identification of an organism.

2. Pass out a set of fish family cards and a dichotomous key to each group. Note: The *Fish Characteristics* fact sheet may be helpful for reference. Remind students that the species on the 12 cards belong to 10 Great Lakes fish families. Explain that each group will use the dichotomous key to identify the correct families. Families include Trout and Salmon, Pike, Sturgeon, Lamprey, Sunfish and Bass, Perch, Sucker, Goby (invasive), Catfish, and Freshwater Cod.

3. Using the set of fish family 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.

4. Review the results. Hold up the enlarged fish illustrations, labeled *Teacher Master*, and tell about each species, pointing out distinguishing characteristics and family. Ask: Did everyone correctly identify all fish families? Was it difficult to distinguish some of the characteristics? How else might some of the characteristics be described? Remind students that these variations, or adaptations, help fish survive in their environment.

5. Explain that 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. Fisheries scientists often use many additional physical characteristics, such as scale counts, fin location, and body depth, in combination with factors, such as geographic distribution, to correctly identify fish.

**Additional Information Online**

See: [www.projectflow.us](http://www.projectflow.us), Unit 3, Lesson 1, Fins Tails and Scales, for the following additional information:

- Standards
- Assessment
- Glossary
- Lesson Extension

**Source**

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**References**


Dichotomous key: Great Lakes Fish Families

Unit 3, Lesson 1

Use this dichotomous key to organize distinguishing characteristics and identify 10 common fish families. Note: Key is designed for use with Project FLOW Great Lakes Fish Cards.

Start: Pick a fish card

One fin

Does the fish have an adipose fin?

Yes

Family: Catfish

No

Does the fish have barbels?

Yes

Family: Trout, Salmon and Whitefish

No

Is the tail asymmetrical?

Yes

Family: Sturgeon

No

Does the fish have a large, elongated mouth or small ventral mouth?

LARGE MOUTH

YES

Family: Pike

NO

SMALL MOUTH

Are the scales small or large?

Small

Subfamily: Trout and Salmon

Large

Family: Whitefish

How many dorsal fins does the fish have?

NO

YES
This graphic is a composite illustration that shows a variety of distinguishing characteristics. Scientists use these and many other characteristics to correctly classify and identify fish.

Is one dorsal fin spiny and one smooth?

- **YES**
  - Are the two fins connected?
    - **YES**
      - Family: Sunfish & Bass
    - **NO**
      - Is the caudal (tail) fin rounded or forked?
        - **FORKED**
          - Family: Perch
        - **ROUNDED**
          - Family: Goby

- **NO**
  - Does the fish have a round mouth?
    - **YES**
      - Family: Lamprey
    - **NO**
      - Determine the species: Does the fish have vertical stripes?
        - **YES**
          - Species: Yellow Perch
        - **NO**
          - Species: Walleye

Family: Freshwater Cod
DISTINGUISHING CHARACTERISTICS OF FISH

Distinguishing characteristics 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), mouth position and shape of snout, tail shape, and presence or absence of unusual traits such as barbels (whiskers). Other traits used to identify fish include structure and location of pectoral fins, pelvic fins and anal fin, body depth, standard length, and scale counts.

Adipose fin: Small, fleshy fin located between the dorsal fin and caudal fin. Unlike other fins, the adipose fin does not have rays or spines. Its purpose is unclear.

Anal fin: Fin located on a fish’s underside behind pelvic fins.

Barbels: These “whiskers” near the mouth are used by bottom-feeding fish to sense food.

Caudal fin: The caudal fin (tail fin) is used for propulsion. It varies in shape and this affects a fish’s speed and buoyancy. Fish with forked caudal fins, such as lake trout, are generally fast swimmers. Fish with rounder caudal fins, such as round goby, are slower.

Dorsal fin: Large fin on a fish’s back that varies in shape, size and position. Some fish have single, soft-rayed dorsal fins. Others, like sunfish and bass, have split dorsal fins that are part spiny and part soft. The dorsal fin stabilizes fish against rolling and assists with maneuverability.

Pectoral fin: Side fins mainly used for direction or “steering,” and sometimes for slow swimming.

Pelvic fin: Paired fins located on the belly or under pectoral fins.

Mouth: The size and position of the mouth indicates what a fish eats. A ventral, or downward-oriented mouth, indicates a fish that feeds on insects and snails along the lake or stream bottom.* A forward or upward-directed mouth indicates a fish that feeds within the water column.

*Lampeyes are an exception. Some lampeyes are parasites and feed on other fish.