OHSU-EP-1536

How can a dichotomous key help identify Lake Erie fish?

Lake Erie is home to one of the world's largest freshwater commercial fisheries. Its fish populations are the most abundant of all the Great Lakes. In a normal year more fish are harvested for human consumption from Lake Erie than the other four Great Lakes combined. There are more than 100 different species of fish in Lake Erie that can be grouped into more than 20 families. Dichotomous keys, a classification tool consisting of a series of paired statements, use observable characteristics or features to identify organisms.

In this lesson students will learn to use a dichotomous key to identify Lake Erie fish.

Objectives

Upon completion of this activity, students should be able to:

- Recognize external characteristics of fish.
- Describe ways fish differ from each other in appearance.
- Use a dichotomous key to identify fish.
- Explain why Lake Erie has high levels of biological productivity and the impact on fish diversity.

Grade Levels

4 - 8 Life Science

Time Required

Approximately 1-2 class periods

Materials

- Ichthyology: Fish Trawl Sample (ohioseagrant.osu.edu/p/1lfh0) video presentation of a live fish trawl
- *A Dichotomous Key of Great Lakes Fish*, *External Characteristics of Bony Fish* and *Common Fish Families of Lake Erie* reference sheets
- *How does a dichotomous key help identify Lake Erie fish?* student page
- *Fish Characteristics*, *Identifying Lake Erie Fish* and *Finding Lake Erie Fish* slide decks

Alignment

Stone Lab Field Trip Experience

Science Cruise, Fish Dissection and Identification

Ohio's Learning Standards and Model Science Curriculum for Science

Scientific Inquiry, Practice and Applications - Develop and communicate descriptions, models, explanations and predictions.

Great Lakes Literacy Principles

Principle 5: The Great Lakes support a broad diversity of life and ecosystems.

Next Generation Science Standards (NGSS)

DCI: LS1.A: Structure and Function - Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

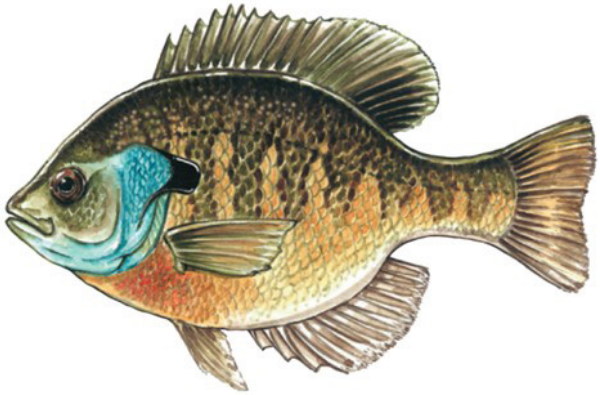
CC: Patterns - Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

SEP: Constructing Explanations - Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. Identify the evidence that supports particular points in an explanation.

Prior to the Lesson

Provide students with print or digital copies (if using an online learning management system) of:

- *Fish Characteristics* slide deck
- *How can a dichotomous key help identify Lake Erie fish?* student page
- *A Dichotomous Key of Great Lakes Fish* reference sheet
- *External Characteristics of Bony Fish* reference sheet
- *Common Fish Families of Lake Erie* reference sheet
- *Identifying Lake Erie Fish* slide deck
- *Finding Lake Erie Fish* slide deck



Lesson

Engage

Display the picture of a fish that Stone Laboratory field scientists caught during a bottom trawl in Lake Erie's Western Basin. The following questions can be used to generate discussion.

- Can you identify the external features of fish?
- What are some ways fish differ in appearance? How are they similar?
- Do all fish have the same external features?
- Are some features more helpful than others when identifying fish?

Use these questions (particularly the last one) as a segue to introduce the driving question - How does a dichotomous key help to identify Lake Erie fish?

Explore & Explain

1. Guide students through a discussion on how dichotomous keys are an important scientific tool used to identify different organisms. Use the slide deck, *Identifying Lake Erie Fish*, to provide students with background information on Lake Erie fish and biological classification systems.
2. Have students watch Ichthyology: Fish Trawl Sample (ohioseagrant.osu.edu/p/1lfh0) showing a live fish trawl aboard a Stone Lab research vessel (approximately 10 minutes). Students should pay close attention to external features and observable characteristics used to identify the fish. There are three opportunities for students to practice identifying Lake Erie fish; students should use the *External Characteristics of Bony Fish* and *A Dichotomous Key of Great Lakes Fish* reference sheets to determine the common names of fish.

3. Students then use the dichotomous key to identify four Lake Erie fish and the families to which they belong.
   Correctly identified fish:

Fish #1	*Common Name: Yellow perch*	*Family Name: Perch*
Fish #2	*Common Name: Channel catfish*	*Family Name: Catfish*
Fish #3	*Common Name: Round goby*	*Family Name: Goby*
Fish #4	*Common Name: Trout-perch*	*Family Name: Trout-perch*

4. Lastly use the slide deck, Finding Lake Erie Fish, to provide students with background information on why Lake Erie is one of the world's largest freshwater commercial fisheries.
5. Students can then answer the questions on the student page.

Answers to the questions on the student page:

1. *A Sea lamprey has a snake-like shape which none of the other fish here have.*
2. *Smallmouth bass, Bluegill*
3. *Gizzard shad*
4. *As the southernmost and shallowest of the Great Lakes, Lake Erie water temperatures are the warmest of the Great Lakes. This results in an abundance of plankton which serve as the base of the food web in the lake.*
5. *Round goby, Steelhead trout, Sea lamprey*
6. *(a) Larisa did not start at line 1 in the dichotomous key, but rather she started in the middle of the key. (b) The fish is a White sucker.*
7. *ichthyologist*
8.

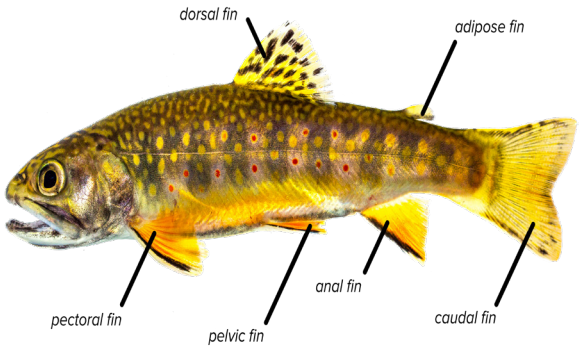


Image Credit: Todd Amacker

Elaborate & Evaluate

The following questions can be used to extend students' thinking, integrated into teacher-created assessments, or given to students as an exit slip (provided).

1. Ahmed and Saari were fishing when Saari caught her first fish. "What kind of fish is it?" she exclaimed. "It's a Bluegill," said Ahmed as he looked at a dichotomous key. "How do you know?" asked Saari. Use the dichotomous key to list the characteristics Ahmed used to identify the fish.

   Answer: Working backwards up the key from line a Bluegill has two joined dorsal fins, does not have a forked caudal (tail) fin, no barbels, and a fish-shaped body.

2. Melia was fishing with friends when she caught the fish shown here. "Look, I caught a Freshwater drum." "Are you sure?" asked Sam. "It looks like a White bass to me." Who made the correct identification? What characteristics led you to that conclusion?

3. Using the dichotomous key below, identify with a quick drawing what a phytoplankton known as Volvox might look like. Circle the correct description in each of your steps. Do not do your drawing until you have completed the key.

Step 1. Is its shape spherical or tubular?

spherical	go to Step 2
tubular	The plankton is *Spirogyra*.

Step 2. Is its outside edge smooth or jagged?

Smooth	go to 3
Jagged	The plankton is *Pediastrum*.

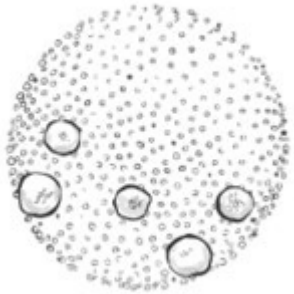
Step 3. Is the body divided into 2 halves?

2 halves	The plankton is *Gymnodinium*.
no division	go to 4

Step 4. Is its surface dotted with visible cells?

visible dotted cells on the surface	The plankton is *Volvox*.
no visible dotted cells on the surface	The plankton is *Cryptomonas*.

Drawing Representation



Volvox

How can a dichotomous key help identify Lake Erie fish?

Name_____

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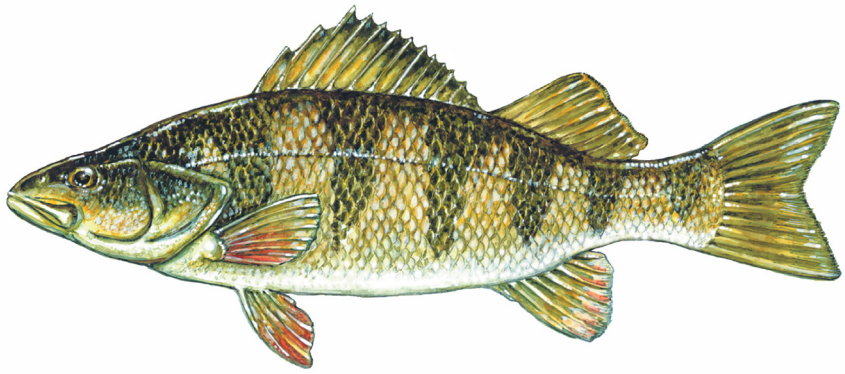
Procedure

1. Read and Review: Identifying Lake Erie Fish
2. Watch: Ichthyology: Fish Trawl Sample (ohioseagrant.osu.edu/p/1lfh0)
3. Practice:
   a. Use the dichotomous key to identify the common names of four species of Lake Erie fish.
   b. Next determine the family of fish to which each species belongs.
4. Read and Review: Finding Lake Erie Fish
5. Complete: Use the dichotomous key information found in the slide decks to answer the questions.

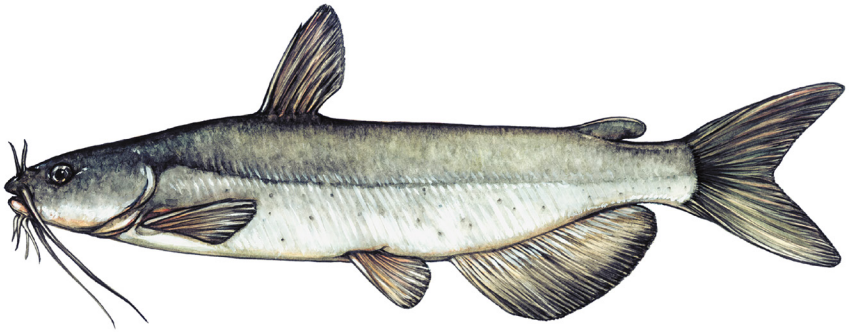
Fish 1



Common Name_____

Family Name_____

Fish 2



Common Name_____

Family Name_____

Fish 3

Common Name_____

Family Name_____

Fish 4

Common Name_____

Family Name_____

Questions

1. How does a sea lamprey differ from all the other fish in this activity?

2. Which two of the following fish are in the same family?

Spotfin shiner Smallmouth bass White bass Bluegill

3. Which of the following fish does not have a visible lateral line?

Steelhead trout Channel catfish White bass White Sucker Gizzard shad

4. What characteristics make Lake Erie a great place to go fishing?

5. Which three of the following fish are not native to Lake Erie?

Channel catfish Round goby Steelhead trout Sea lamprey Freshwater drum

6. Larisa caught the fish seen here. When using the dichotomous key to identify the fish, she began at line 5 because she saw the fish had a forked tail. She incorrectly identified the fish as a Trout-perch.

a. What was Larisa's mistake?

b. What is the correct identification of the fish?

7. What do you call a person who studies fish? Taxonomist Ichthyologist

8. Label the adipose, anal, caudal, dorsal, pectoral, and pelvic fins on the fish diagram.

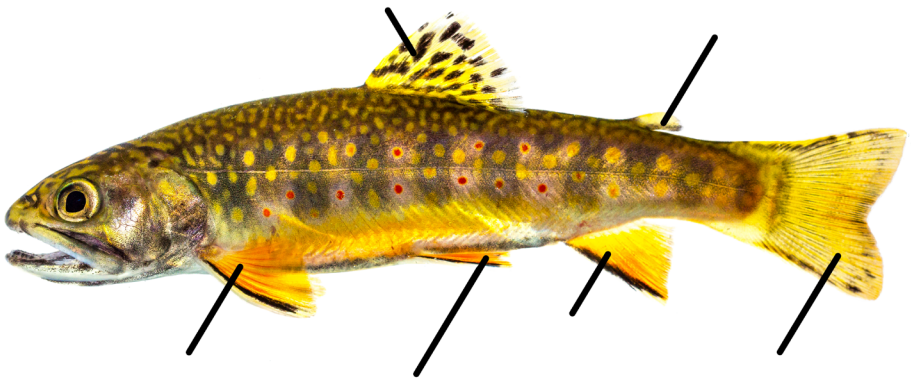


Image Credit:
Todd Amacker

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Name_____

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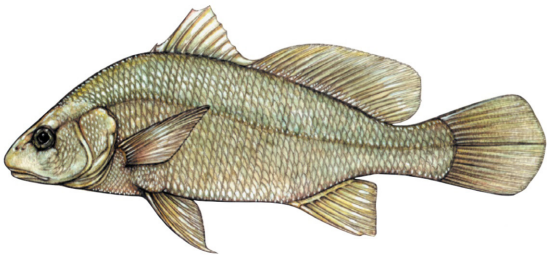

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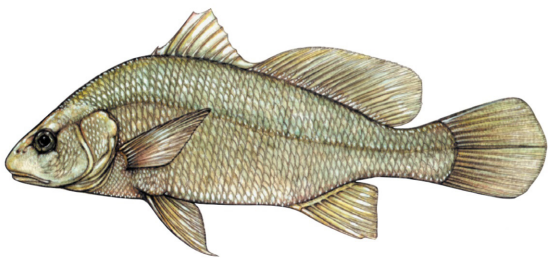

3. Using the dichotomous key below, identify with a quick drawing what a plankton known as Volvox might look like. Circle the correct description in each of your steps, THEN make a drawing of the plankton in the box.

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Drawing Representation

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Drawing Representation

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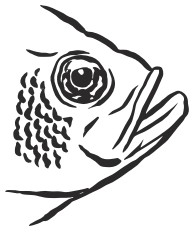
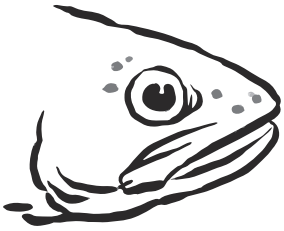
External Characteristics of Bony Fish

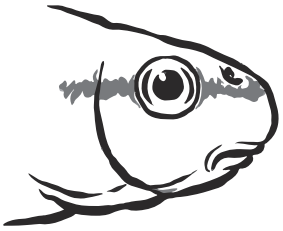
Mouth Positions



Superior



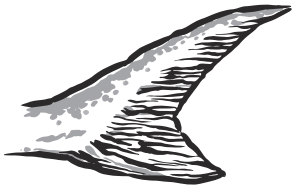
Terminal



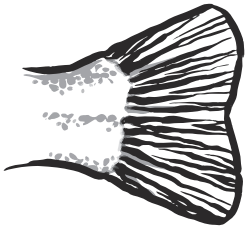
Subterminal

Inferior

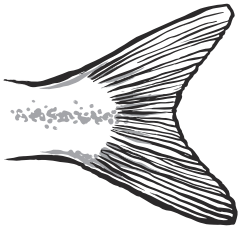
Tail Types



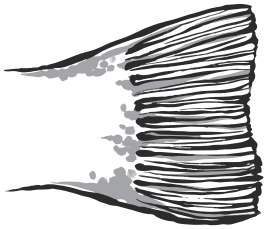
Heterocercal



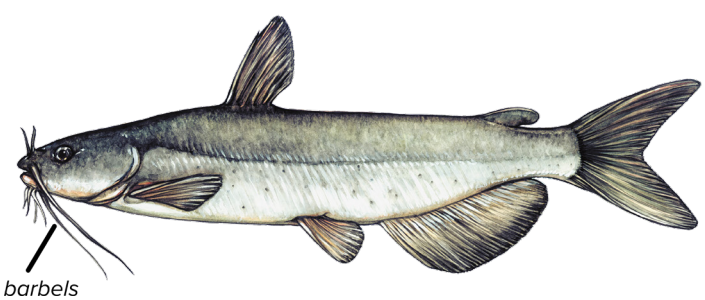
Homocercal



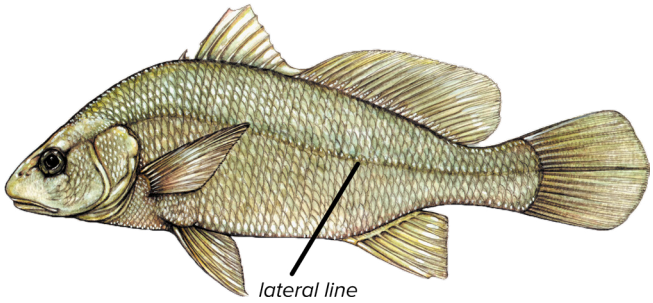
Homocercal: Forked



Homocercal: Square



Barbels



Lateral line

Stone Lab Lake Erie Field Trip Workbook, Page 25 (ohioseagrant.osu.edu/products/nf57h)

Common Fish Families of Lake Erie

There are more than 20 families of fish in Lake Erie.
Here are some of the more common fish families you will see in the trawl or in the lab.

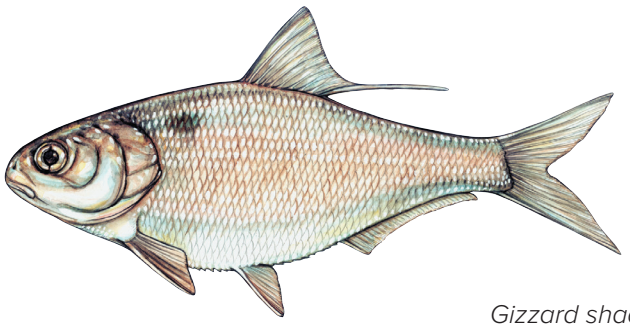
Lamprey family (Petromyzontidae)

These are primitive fish that have no jaws or calcified bones. Their mouths are toothy, sucker-like discs. Many species, like the non-native sea lamprey, are parasitic on other fishes. Native lampreys should not be considered a threat to other fishes.

Sea lamprey

Herring family (Clupeidae)

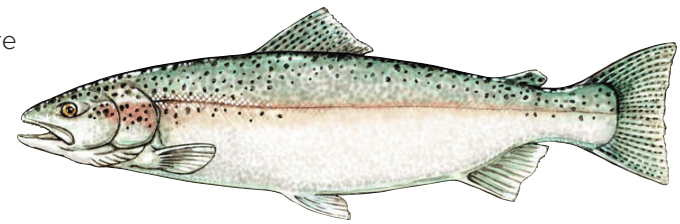
Herrings include the gizzard shad and alewife, also known as “sawbellies” for their jagged undersides. They feed on plankton and are an important prey of larger fish such as walleyes. They may die off in large numbers as water temperatures change with the seasons.



Gizzard shad

Trout, salmon and whitefish family (Salmonidae)

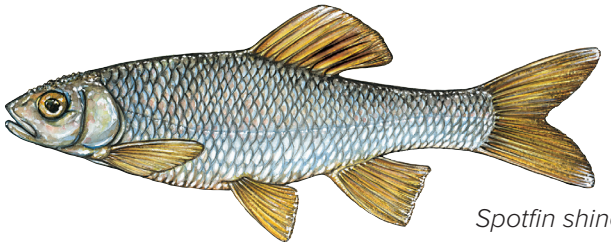
All of these fish have an extra fatty fin called the adipose fin. Steelhead trout are not native to Lake Erie and are stocked for anglers to catch.



Steelhead trout

Minnow family (Cyprinidae)

Minnows, shiners and chubs are important as food for many larger fish, and they are widely used as bait. The family also includes carp and goldfish!

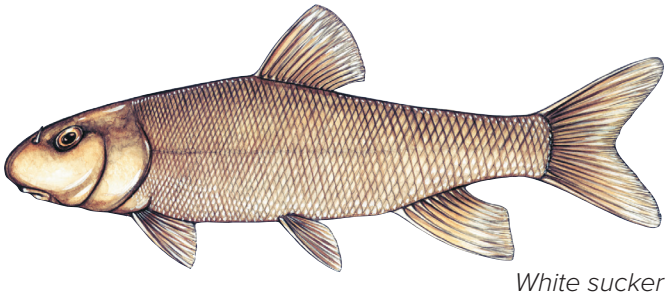


Spotfin shiner

Common Fish Families of Lake Erie

Sucker family (Catostomidae)

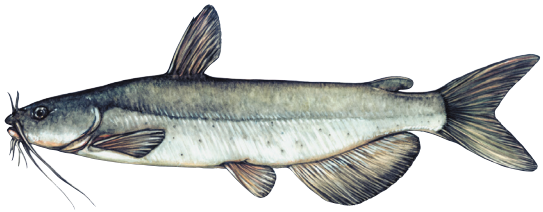
Suckers are a lot like minnows, but most have a strongly subterminal, downward-pointed mouth and fleshy “sucker” lips. Some suckers, like the quillback and buffalofishes, can get 2-3 feet long.



White sucker

Catfish family (Ictaluridae)

Catfishes have no scales, and their barbels are like feelers to help them find food. Catfishes eat both plants and animals that they find on or in the bottom of lakes and streams.



Channel catfish

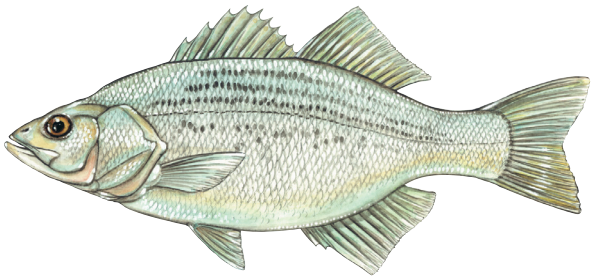
Trout-perch family (Percopsidae)

Trout-perch have rough scales. They also have an adipose fin like trout and a general shape like a perch. Many other fish eat trout-perch.

Trout-perch

Temperate basses (Moronidae)

The white bass and white perch live over sand and gravel bottoms or around reefs in open water. They feed on smaller fish, including their own young.

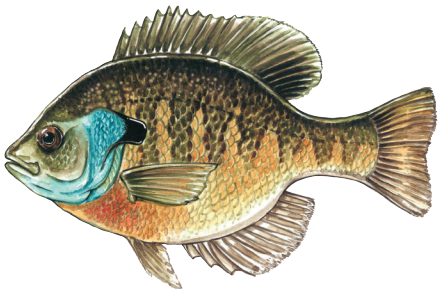


White bass

Common Fish Families of Lake Erie

Sunfish family (Centrarchidae)

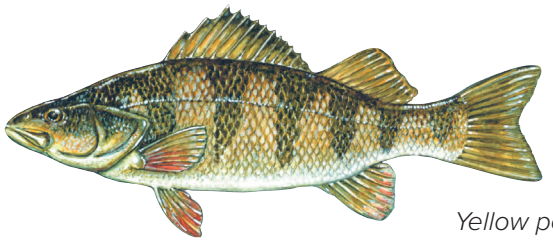
Many types of fish are in this family, from largemouth and smallmouth bass to bluegill. They eat smaller fish, frogs, and macroinvertebrates such as crayfish and insects.



Bluegill

Perch family (Percidae)

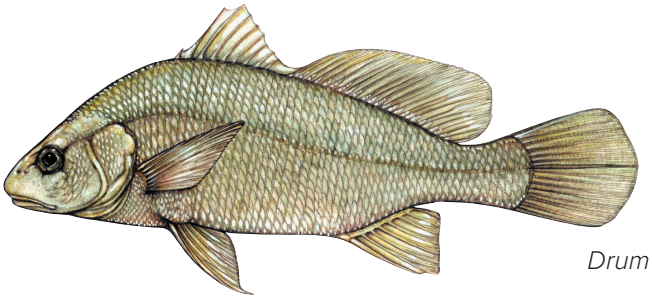
This group includes the walleye, yellow perch and darters. Walleye live in cold, clear water, but perch can live in warmer water.



Yellow perch

Drum family (Sciaenidae)

These fish get their name from the drumming sound they make. Some people call this fish “sheepshead.” They eat crayfish, aquatic insects and small fish.



Drum

Goby family (Gobiidae)

The round and tube-nose gobies are accidental imports, presumably from the ballast tanks of ships coming from overseas. They have a unique fused pelvic fin which acts as a suction cup to attach to rocks.

Round goby

OHSU-EP-1536

A Dichotomous Key of Great Lakes Fish

Remember to always start with step 1 when identifying a fish!

Characteristics	Next Step or Common Fish Name
1. A. Is snake-shaped	Sea lamprey
1. B. Is shaped like a fish	go to 2
2. A. Has barbels	Channel catfish
2. B. Does not have barbels	go to 3
3. A. Has one dorsal fin	go to 4
3. B. Has two dorsal fins	go to 8
4. A. Has an adipose fin	go to 5
4. B. Does not have an adipose fin	go to 6
5. A. Has a forked caudal fin	Trout-perch
5. B. Does not have a forked caudal fin	Steelhead trout
6. A. Has an inferior mouth	White sucker
6. B. Has a terminal mouth	go to 7
7. A. Has a spine on the dorsal fin	Gizzard shad
7. B. Does not have a spine on the dorsal fin	Spotfin shiner
8. A. Has a forked caudal fin	go to 9
8. B. Does not have a forked caudal fin	go to 10
9. A. Has vertical stripes	Yellow perch
9. B. Has horizontal stripes	White bass
10. A. Dorsal fins are joined	Bluegill
10. B. Dorsal fins separated	go to 11
11. A. Has a visible lateral line	Drum
11. B. Does not have a visible lateral line	Round goby

OHIO SEA GRANT AND STONE LABORATORY

Fish Characteristics

Ichthyology Field Trip

Sea Grant
Ohio Sea Grant College Program

The Ohio State University
College of Food, Agricultural, and Environmental Sciences

NOAA

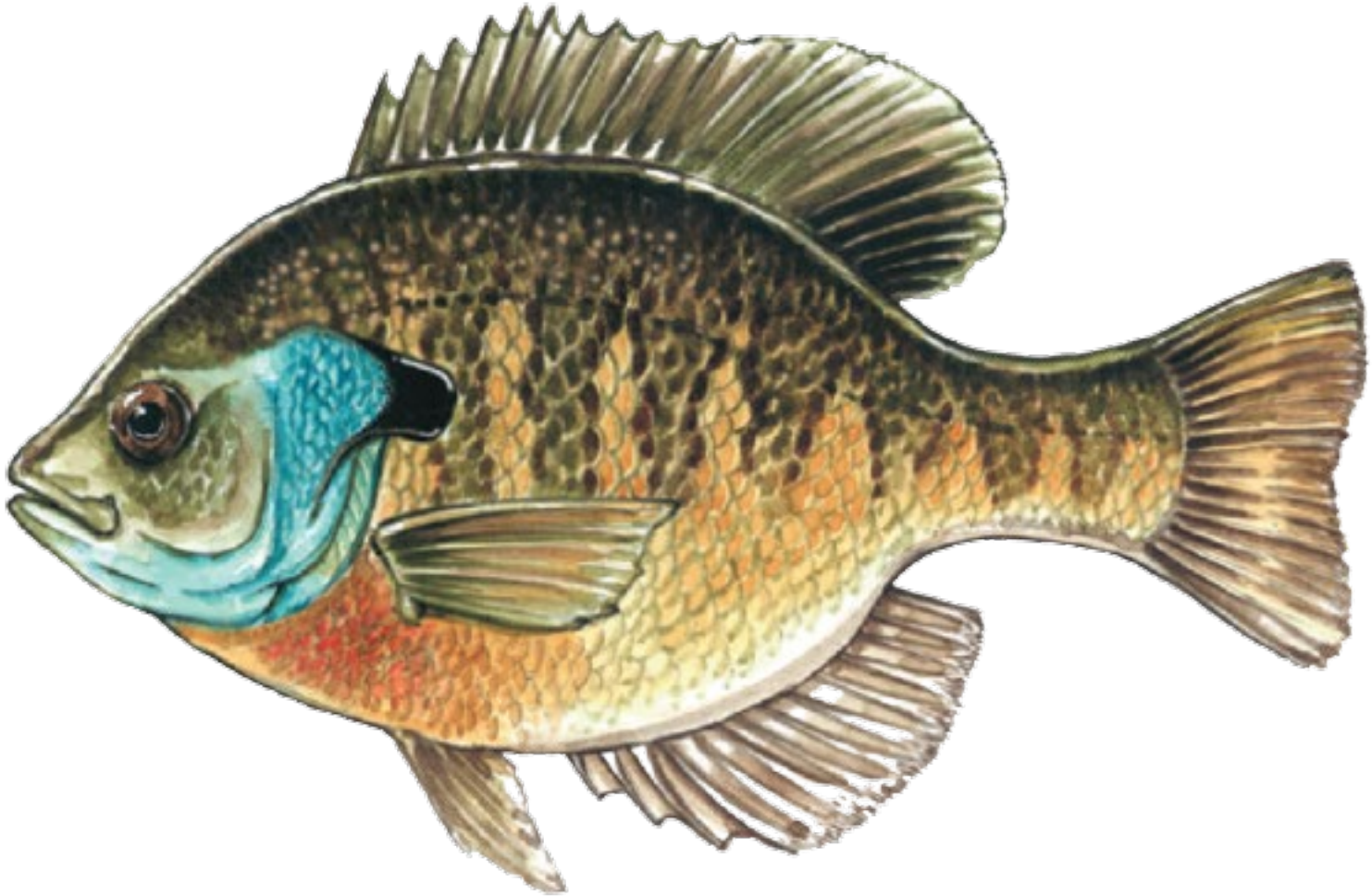


Image Credit: Ted Walke, PA Fish & Boat Commission

Sea Grant
Ohio Sea Grant College Program
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
NOAA

Driving Question

How can a dichotomous key help identify Lake Erie fish?

OHIO SEA GRANT AND STONE LABORATORY

Finding Lake Erie Fish

Ichthyology Field Trip

Sea Grant
Ohio Sea Grant College Program

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

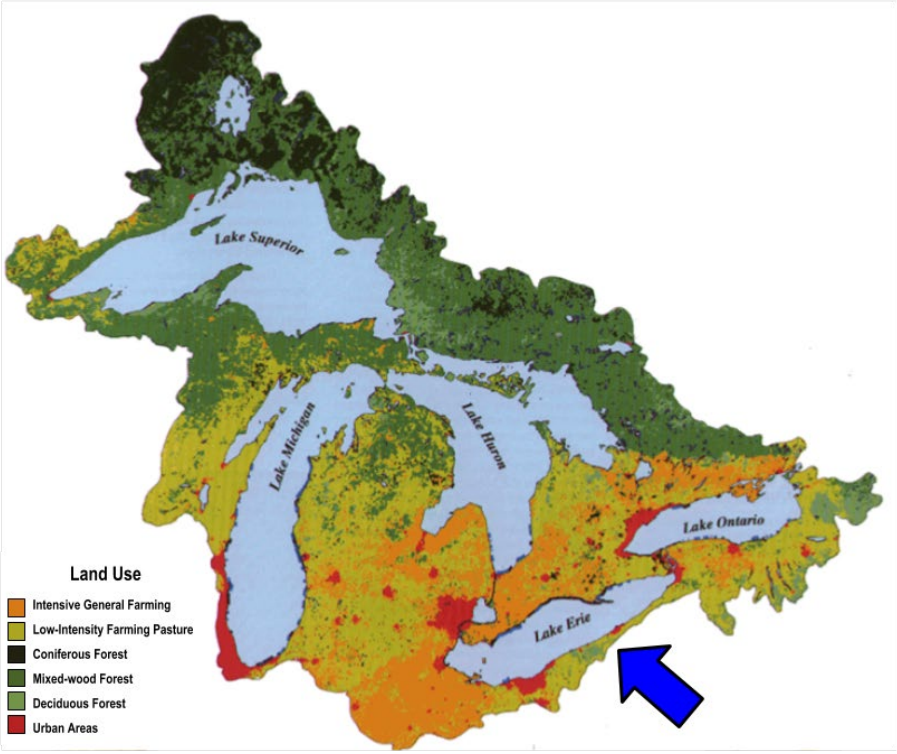
NOAA

Lake Erie: Where the Fish Are

- Lake Erie is one of the world's **largest** freshwater commercial fisheries.
- Lake Erie's fish populations are the **most abundant** of all the Great Lakes.
- In a normal year, Lake Erie produces **more** fish for human consumption than all the other Great Lakes put together.

Why is this?

Location, Size and Temperature



- Lake Erie is the **southernmost** of all the Great Lakes.
- Considering volume of water, Lake Erie is the **shallowest** and **smallest** of all the Great Lakes.
- The geographic location and the shallow waters allow Lake Erie to heat quickly and be the **warmest** of the Great Lakes.
- This results in an **abundant supply of plankton**.
- Plankton, the microscopic plant and animal life drifting with the movement of the water, are the building block of the fish food chain.

OHIO SEA GRANT AND STONE LABORATORY

Identifying Lake Erie Fish

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Ichthyology

- **Ichthyology** is the scientific study of fish.
- There are more than 100 **species** of fish in Lake Erie.
- Lake Erie fish can be grouped together according to external **characteristics**.
- There are more than 20 **families** (groups) of fishes that live in Lake Erie.

Taxonomy

- **Taxonomy** is the science of naming, describing and classifying living things.
- **Taxonomists** use shared characteristics to identify and arrange organisms into classification systems.
- A **classification system** is a way to categorize living things based on shared characteristics.
- Taxonomic work is far from complete. Scientists have named about 1.78 million organisms, yet the total number of species is likely between 5 and 30 million.

Dichotomous Keys

- **Dichotomous keys** are taxonomic tools used by scientists to identify specific organisms based on defining characteristics.
- Dichotomous keys are progressive series of statements providing two choices in each step that assist in correctly identifying an organism.
- While dichotomous keys are still universally used, the internet provides the opportunity to design and use keys with far more complexity.
- Dichotomous keys are used by **ichthyologists** to identify fish based on external features such as tail shape and scale type.

Binomial Nomenclature

- Living organisms are given two names: a scientific name and a common name.
- The scientific name of an organism is formed by combining the genus and species names. This two-word naming system is referred to as **binomial nomenclature.**
- Genus and species names are part of the widely used **Linnaean** classification system.
- A fish with the common name largemouth bass has the genus name *Micropterus* and the species name *salmoides*. Therefore, the scientific name for largemouth bass is *Micropterus salmoides*.