Using a Key for Fish ID

With the right key, you can unlock the identity of a fish.

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Please note: Academic Standards are updated regularly and our alignments will be updated on the DNR Academic Standards Website at: www.mndnr.gov/education/teachers/edstandards_intro.html

Using a Key for Fish ID

Minnesota Academic Standards

◒ Lesson *introduces* this Benchmark.
◍ Lesson *partially* addresses this Benchmark.
● Lesson *fully* addresses this Benchmark.

Language Arts

Grades 3, 4, 5
I. Reading and Literature
B. Vocabulary Expansion:
Benchmark 1—The student will acquire, understand and use new vocabulary through explicit instruction and independent reading. ◍
III. Speaking Listening, and Viewing
A. Speaking and Listening:
Benchmark 1—The student will participate in and follow agreed—upon rules for conversation and formal discussions in large and small groups. ◍
Benchmark 2—The student will demonstrate active listening and comprehension. ◍

Science

Grade 3
I. History and Nature of Science
A. Scientific World View:
Benchmark 1—The student will explore the use of science as a tool that can help investigate and answer questions about the environment. ◍

Grade 4
I. History and Nature of Science
A. Scientific World View:
Benchmark 1—The student will explore the uses and effects of science in our interaction with the natural world. ◍
IV. Life Science
B. Diversity of Organisms:
Benchmark 1—The student will classify plants and animals according to their physical characteristics. ◒
Benchmark 2—The student will learn that the characteristics for grouping depend on the purpose of the grouping. ◍

Grade 5
I. History and Nature of Science
C. Scientific Enterprise:
Benchmark 1—The student will describe the different kinds of work done in science and technology. ◒

Environmental Literacy Scope and Sequence

Benchmarks

- Social and natural systems are made of parts. (PreK-2)
- Social and natural systems may not continue to function if some of their parts are missing. (PreK-2)
- When the parts of social and natural systems are put together, they can do things they couldn't do by themselves. (PreK-2)
- In social and natural systems that consist of many parts, the parts usually influence one another. (3-5)
- Social and natural systems may not function as well if parts are missing, damaged, mismatched or misconnected. (3-5)

For the full Environmental Literacy Scope and Sequence, see:
www.seek.state.mn.us/eemn_c.cfm

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Chapter 2 • Lesson 4

Using a Key for Fish ID

Grade Level: 3-5
Preparation Time: 25 minutes
Activity Duration: 40 minutes
Group Size: any
Subject Areas: Language Arts, Science
Academic Skills: communication, comparison, description, drawing conclusions, identification, inquiry, matching, observation, ordering, problem solving, recognition, small group skills
Setting: indoor or outdoor gathering area with tables
Vocabulary: adipose fin, anal fin, barbel, caudal fin, dichotomous key, dorsal, dorsal fin, forked tail, gill chamber, gill opening, lateral line, lengthwise stripe, pectoral fin, pelvic fin, ray, rounded tail, spine, vent, ventral, vertical stripe
Internet Key Words: dichotomous key, Minnesota fish identification

Instructor's Background Information

Fish that are related or share similar characteristics are grouped into families. Minnesota currently has 160 fish species grouped into 27 families. Scientists use physical characteristics to identify and classify fish into family groups. Identifying and naming fish species provides a reference point for study and discussion. Fish identification is important to anglers, too. It helps them determine if their catch has broken a state record. It also helps them follow fishing regulations, tell good fish stories after fishing trips, and find the appropriate recipe for cooking their catch.

It's important to understand the difference between classification and identification. To **classify** (biologically or otherwise) is to place items in groups according to some articulated system of characteristics. To **identify** is to discover the group to which an individual has previously been assigned.

Identification Keys
Identification keys, illustrations, and descriptions based on external and internal characteristics are useful tools for identifying plants, animals, and other objects. Dichotomous keys can unlock an object's identity by presenting choices based on characteristics. Dichotomous keys are often included in field guides or reference books. They help users identify, to the species level, a specific object or organism.

Summary

Identification keys are useful tools. They identify an organism according to its physical characteristics. Using an identification key requires detailed observations of features and characteristics as well as comparing and contrasting these characteristics with those of similar organisms. Students will learn how to identify Minnesota fish species using a dichotomous key.

Although dichotomous keys are usually taught to students in grade 7, the purpose of this lesson is to develop observation skills and introduce students to a scientific tool that will help them identify organisms according to physical characteristics.

Student Objectives

The students will:
1. Identify five basic characteristics used to identify fish.
2. Use a dichotomous key to identify fish, and understand that an identification key is a tool for identifying organisms according to physical characteristics.
3. Identify similarities and differences between the physical characteristics of different species of fish using descriptions of characteristics as noted in a dichotomous key.

Materials

- **Dichotomous Key Warm-up Sheet**, one per student
- Book (any book will do)
- Pencil
- Sheet of paper
- Roll of masking tape
- Marker (with removable cap)
- **Definitions of the Parts of a Fish Sheet**, one per student (can be copied on back of **The Parts of a Fish Sheet**)
- **Caudal Fin Shapes Sheet** (or projection overhead)
- **Mouth Positions Sheet** (or projection overhead)
- **Minnesota Fishes Dichotomous Key**, one set per pair of students
- **The Parts of a Fish Sheet** (optional)
- **Fish Identification Cards**, one card for each pair of students
- **Fish Identification Cards Answer Sheet**
- Various dichotomous keys and identification guides (optional)

See **The Parts of a Fish Sheet** and the **Definitions for the Parts of a Fish Sheet** in this lesson.

The dichotomous key in this lesson is intended to familiarize students with a key using selected Minnesota fish. It's not a comprehensive key for identifying all Minnesota fish.

A **dichotomous key** is one type of identification tool used to identify something (such as a particular butterfly, plant, fish, lichen, or rock) by leading the user through a series of questions about physical characteristics. The key provides two possible answers to each question. The question series eventually leads to the correct name or classification group for the object. The key continuously divides a larger group of organisms into two smaller groups until only one choice remains. A dichotomous key used to identify fish families first lists the specific observable traits or characteristics of many fish species. For each trait, the key poses a question with two possible answers. Both responses lead to another question. By matching the option or answer to each question to the fish's features, the user can eventually identify the family to which the fish belongs. (This is similar to a game of Twenty Questions.)

> Dichotomous means separation of different or contradictory things: a separation into two divisions that widely differ or contradict one another. The term comes from the Greek words *dikho* (meaning apart, in two) and *temnein* (to cut). A dichotomous key provides two possible answers to a question.

Physical Characteristics Used to Identify and Group Fish

A dichotomous key for fish identification lists numerous observable traits of many fish species. Fish identification becomes much easier when you're familiar with the physical characteristics—the "keys" that unlock fish identities. These are the key characteristics to look for when identifying fish:

- body shape
- position of body parts, such as the mouth
- relative size and shape of body parts, such as dorsal and tail fins
- presence or absence of certain structures, such as barbels or an adipose fin
- number of scales, fin rays, or spines

In most cases, you can identify fish using only external features. Sometimes two fish species so closely resemble one another that internal structures must be examined as well.

Color and size aren't often used to identify fish. One reason for this is that color and size can vary among individuals of the same fish species, depending on age, sex, and season. Color can also vary, depending on the mineral content and water quality of a lake, river, or stream.

When students learn to use a key, they'll be able to identify many of the fish they encounter—as long as the fish species is included in the key, and the fish exhibits the characteristics listed in the key. (Some fish may not meet these criteria.)

Procedure

Preparation

1. Copy one **Dichotomous Key Warm-up Sheet** for each student.
2. Collect a book, pencil, sheet of paper, roll of masking tape, and marker.
3. Copy one **The Parts of a Fish Sheet** and one **Definitions of the Parts of a Fish Sheet** for each student.
4. Copy and cut out one or two **Fish Identification Cards**. (Make one card for each pair of students.) You may wish to have students help with the cutting. You can laminate the cards to preserve them for future use.
5. Copy one **Minnesota Fishes Dichotomous Key** for each pair of students.

Activity

Warm-up

1. Before using a key to identify fish, have the students distinguish several common classroom objects by using a simple dichotomous key. Distribute the **Dichotomous Key Warm-up Sheets** to the students. As a class, use the key to identify the book, pencil, sheet of paper, roll of masking tape, and marker. Guide them through the steps of using a dichotomous key. For each step, have them decide which of the two characteristic descriptions best fits the actual object, then move on to another pair of choices. Eventually they'll reach a point where the description fits the object and there are no more choices. Work step-by-step to reach the correct identification.
2. What if you wanted to identify objects that share many features, but are not as easily identified? An identification key is a tool that can direct its users, step by step, to observe characteristics, make comparisons, and eventually identify the object in a systematic way.
3. There are 160 fish species in Minnesota. Fishes share many physical features. How can you tell them apart and identify a particular species of fish? With the class, review ways of distinguishing one fish from another. Distribute **The Parts of a Fish Sheet** and the **Definitions of the Parts of a Fish Sheet** to each student. Go over the parts (characteristics) and their definitions. You can also use pictures of fish to point out differences so the class can better visualize these characteristics. It's especially important to cover these characteristics:
   - names and locations of fins
   - definition of barbels ("whiskers")
   - the difference between sharp spines and soft rays
   - location of lateral line
   - definition of vent
   - differences between forked, square, and rounded caudal (tail) fins
   - mouth position

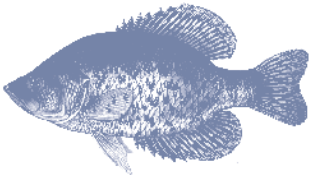
You may want to do Lesson **2:2—Fins: Form and Function.**

Lesson

1. Divide class into pairs of students. Give each pair of students a **Minnesota Fishes Dichotomous Key** and a **Fish Identification Card.** Using the dichotomous key, have the students work on identifying the fish on the cards. If answers are incorrect, have them try again.
2. If time and interest allow, rotate the fish cards so that each group can identify each fish.
3. Give students a group of fish cards and have them create their own dichotomous key for identifying the fish. Have them write or explain to the class how their dichotomous key works, and how dichotomous keys are tools that help identify objects—including fish—according to physical characteristics.

Wrap-up

1. Ask the students about their experiences with the key. Was it easy to follow? Did they ever get lost and have to return to the beginning of the process?
2. After using a key to identify several fish, students will begin to remember the distinguishing characteristics of various fishes, such as body shape, mouth position, dorsal fin, tail fin, and special features. Ask each pair of students to summarize some of the most useful distinguishing features of the fish they identified, and to present those features to the class. (Include examples of kinds of fishes that share and don't share that characteristic.)
3. Ask the students to name other types of animals, plants, or other things that a dichotomous key could be used to identify, such as insects, birds, trees, flowers, or almost anything!



Assessment Options

1. Ask students to describe five physical characteristics they used to identify fishes. Observe all students as they use the dichotomous key and note their ability to realize and correct mistakes as they follow the steps in the key.
2. Have students create their own dichotomous key to identify the fish, or a group of organisms of their own choosing. Ask students to write or to explain to the class how their dichotomous key works, and how dichotomous keys are tools that help users identify things, including fish.
3. Give students a dichotomous key created by another student group. Ask students to use the key to identify the fish, and then evaluate how well that key worked. Ask them to write their evaluation, including any suggestions that would improve the key.
4. Assessment options include the Checklist and Rubric on the following pages.

Using a Key for Fish ID Checklist

Possible Points	Points Earned Student	Points Earned Instructor	
4	_____	_____	Student identifies differences among fish species using at least five key characteristics of fish that are used for identification.
4	_____	_____	Student lists five key traits used to identify fish, such as body shape, mouth position, location of fins, and shape of tail.
4	_____	_____	Student creates an identification key and includes at least five key traits used to identify fish.
3	_____	_____	Student creates an identification key and designs a step-by-step method for determining differences in the key traits used to identify fish.
2	_____	_____	Student understands two reasons why scientists would use an identification key to identify an organism.
Total Points			
17	_____	_____	**Score** _____

Checklists are tools for students and instructors. Checklists involve students in managing their own learning. They help students understand and set learning goals before the lesson begins, and help them monitor their progress during the lesson, ensuring that they meet learning goals and objectives by the end of the lesson. Students can also use checklists to discover areas that may need improvement. Checklists help instructors monitor each student's progress throughout the lesson, facilitating appropriate adjustment of instruction to ensure learning by the end of the lesson. The instructor may wish to have students add several of their own learning goals to the checklist to personalize it, and to accommodate varied learning needs and styles.

Grade

16-17 points = A
Excellent. Work is above expectations.

14-15 points = B
Good. Work meets expectations.

11-13 points = C
Work is generally good. Some areas are better developed than others.

8-10 points = D
Work does not meet expectations; it's not clear that student understands objectives.

0-7 points = F
Work is unacceptable.

Using a Key for Fish ID Scoring Rubric

Key Use Criteria	3 Excellent	2 Good	1 Fair	0 Unacceptable
Differences in fish characteristics	Can identify differences among fish species in at least five key characteristics used to identify fish.	Can identify differences in three different key characteristics used to identify fish.	Can identify differences in two different key characteristics used to identify fish.	Can identify differences in one or fewer key characteristics used to identify fish.
Fish traits	Can list five key traits used to identify fish, such as body shape, mouth position, location of fins, and shape of tail.	Can list three key traits used to identify fish.	Can list two key traits used to identify fish.	Can list one key trait used to identity fish.
Creating an identification key	Includes at least five key traits used to identify fish. Designs a method for determining differences in key traits for identifying fish.	Includes at least three key traits used to identify fish. Designs a method for determining differences in key traits for identifying fish.	Includes at least two key traits used to identify fish.	Doesn't include key traits as a means of identifying fish.

Score _____ (Calculate score by dividing total points by number of criteria.)

Diving Deeper

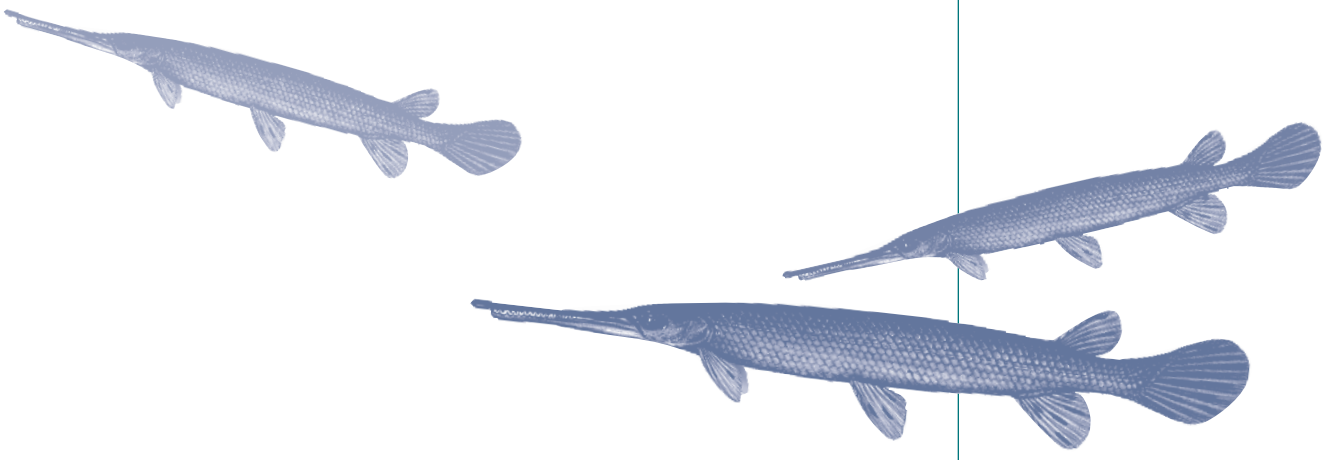
Extensions

1. Some identification keys are detailed and complex. Use a more complex key to identify some uncommon fish species. Try the key in *Fishes of the Minnesota Region,* by Gary L. Phillips, James C. Underhill, and William D. Schmid, published by the University of Minnesota Press.
2. Use dichotomous keys to identify other organisms such as insects, birds, trees, or flowers.
3. Have students create an identification key for plant species growing in the schoolyard, or for aquatic macroinvertebrates collected from a local stream.

For the Small Fry

K-2 Option

This lesson may not be appropriate for these younger students. Instead, you may wish to play a matching game (such as Concentration) with two sets of the **Fish Identification Cards.** Ask students to look closely at the fish characteristics as they make their matches. You might want to have them draw a fish before playing the game, and to draw another fish after playing the matching game with the fish cards. Ask students to compare their two drawings. Are they different? How? What could explain differences in the drawings?



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Dichotomous Key Warm-up Sheet

1a

Object has a square or rectangular shape with corners.

Go to 2

1b

Object does not have a square or rectangular shape with corners—it's cylindrical or round.

Go to 3

2a

Object can be opened and has several paper sheets between thicker covers.

Book

2b

Object cannot be opened.

Sheet of paper

3a

Object has a removable cover.

Marker

3b

Object does not have a removable cover.

Go to 4

4a

Object comes to a point on one end; has a central core of dark material.

Pencil

4b

Object has a hole in the middle.

Roll of masking tape

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Definitions of the Parts of a Fish Sheet

These words describe the parts, or characteristics, of a fish.

Dorsal: near the fish's back (top half)

Ventral: near the fish's belly (bottom half)

Dorsal fin: on dorsal side of fish; may be a single fin (one part dorsal fin) or two connected or unconnected parts (two-part dorsal fin) (Note: Some fish species that aren't native to Minnesota may have three-part dorsal fins.)

Spines: hard and often sharp; made of bone (otolithic); give structure and help support the fins

Rays: soft and usually flexible; made of a connective tissue core surrounded by scale-like bony plates (called lipidotrichia); give structure to fins

One-part dorsal fin: *single fin structure* located on the fish's back (top) side and supported by spines or rays

Two-part dorsal fin: *two-part fin structure* located on the fish's back (top) side, with one part supported by spines and a second part supported by rays; the two parts of the fin may be connected or unconnected, appearing as two separate fin structures along the back of the fish

Anal fin: fin on ventral side of fish in front of the caudal peduncle just behind the anal vent

Caudal fin: tail fin

Pelvic fins: usually paired, on the fish's ventral side, between the anal and pectoral fins

Pectoral fins: usually paired, located on the fish's ventral side, between the pelvic fin and the gill area

Adipose fin: a fleshy fin behind the fish's dorsal fin and near the tail; no supporting rays or spines

Rounded tail: no notch or fork in the caudal fin

Forked tail: notch in caudal fin

Barbels: sensory organs located on or near the mouth; sometimes called whiskers

Lateral line: a series of pores that contain nerves and run along each side of a fish; they sense movement or vibrations in the water

Vent: an opening to eliminate waste; sometimes referred to as anus

Vertical stripes: stripes that run up and down—from the dorsal to the ventral side of a fish

Lengthwise stripes: stripes that run from nose to tail

Gill chamber: where the gills are located inside the fish underneath the gill cover

Gill opening: an opening at the rear of head leading from the gill chamber to the outside; fish usually have one on each side

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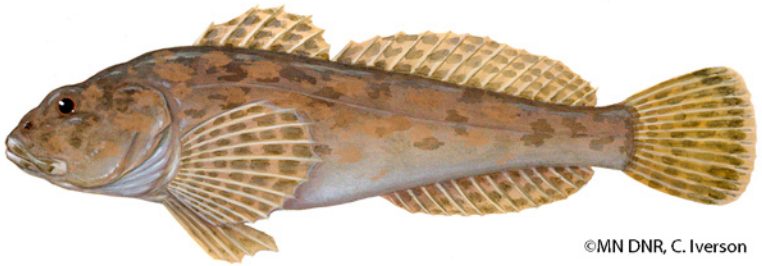
Caudal Fin Shapes Sheet

Forked Caudal Fin Shape

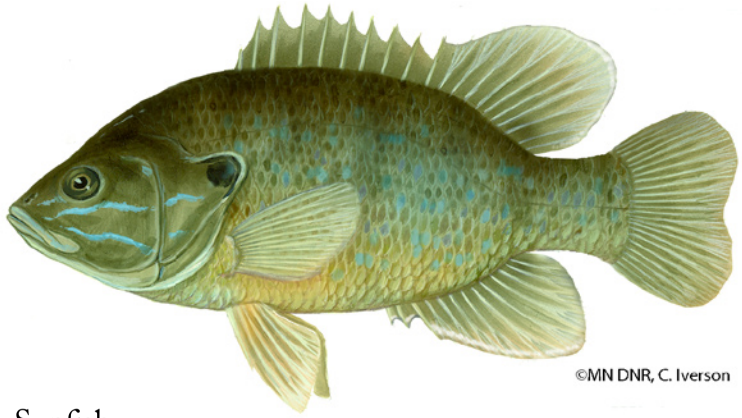
Channel Catfish
Ictalurus punctatus

Rounded Caudal Fin Shape



Mottled Sculpin
Cottus bairdi

Heart-shaped Caudal Fin Shape



Green Sunfish
Lepomis cyanellus

Square Caudal Fin Shape

Brown Trout
Salmo trutta

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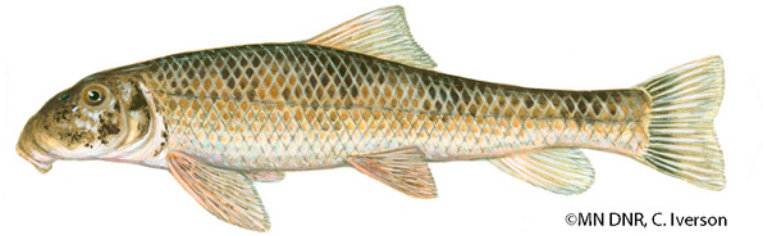
Mouth Positions Sheet

Bottom-facing Mouth Position

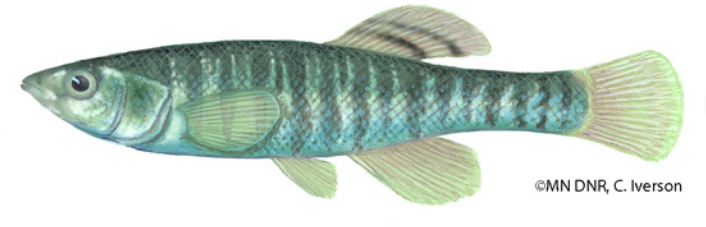


Northern Hogsucker
Hypentelium nigricans

Forward-facing Mouth Position

Muskellunge
Esox masquinongy

Upward-facing Mouth Position



Banded Killifish
Fundulus diaphanus

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Minnesota Fishes Dichotomous Key

Starting with the first pair of terms, choose the statement that best describes the characteristics of the fish you're trying to identify. If the statement you choose ends with a number, go to that number, read the pair of statements, and continue until you reach a statement that refers you to a fish name. Does the fish listed in the key have the same characteristics as this fish on your fish card? If so, you've identified your specimen properly. If not, you've made a wrong choice at some point, and you must start over.

1a Dorsal fin has one part ..... Go to 2
1b Dorsal fin has two parts ..... Go to 5

2a Mouth pointed down or on underside ..... Go to 3
2b Mouth pointing forward ..... Go to 10

3a Tail fin longer at the top portion than bottom part ..... Go to 4
3b Tail fin not longer at the top portion than bottom part ..... **White Sucker**

4a Body with bony plates ..... **Lake Sturgeon**
4b Body without bony plates ..... **Paddlefish**

5a Two-part dorsal fin is well-connected (no space between the two parts) ..... Go to 6
5b Two-part dorsal fin is not well-connected (space between the two parts) ..... Go to 9

6a Lateral line goes through tail ..... **Freshwater Drum**
6b Lateral line stops at tail ..... Go to 7

7a At least one horizontal (lengthwise) stripe ..... **Largemouth Bass**
7b No horizontal (lengthwise) stripes ..... Go to 8

8a Sides with black specks ..... **Black Crappie**
8b Sides without black specks ..... **Bluegill**

9a Three or more anal spines ..... **White Bass**
9b Two or fewer anal spines ..... Go to 14

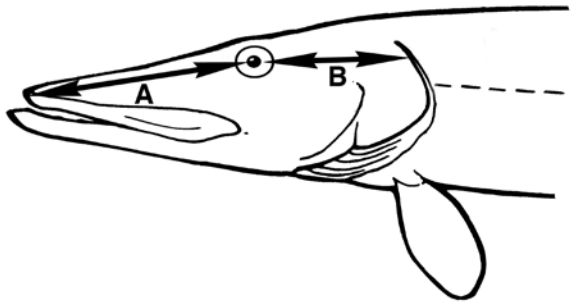
10a Snout measured from tip to center of eye **longer** than length measured from center of eye to gill opening (see illustration) ..... Go to 11
10b Snout measured from tip to center of eye **shorter** than length measured from center of eye to gill opening (see illustration) ..... Go to 12

11a Tail forked ..... **Northern Pike**
11b Tail rounded ..... **Longnose Gar**

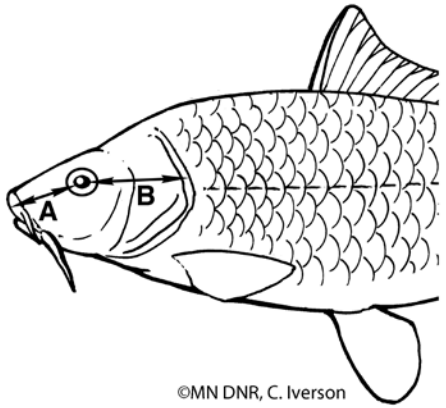
12a Scales large and easily seen ..... **Common Carp**
12b Scales not large and not easily seen ..... Go to 13

13a Barbels present ..... **Channel Catfish**
13b Barbels absent ..... **Brook Trout**

14a Six or seven vertical stripes ..... **Yellow Perch**
14b No vertical stripes ..... **Walleye**



A is longer than B



A is shorter than B

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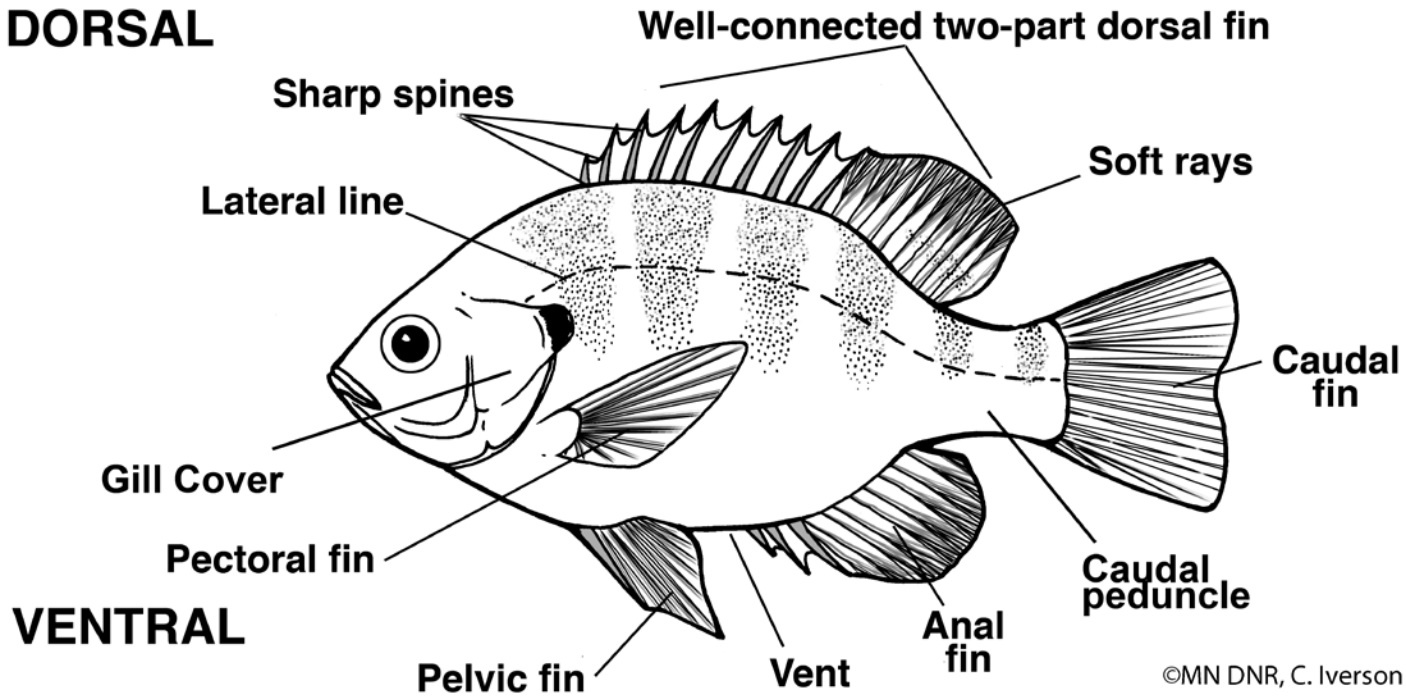
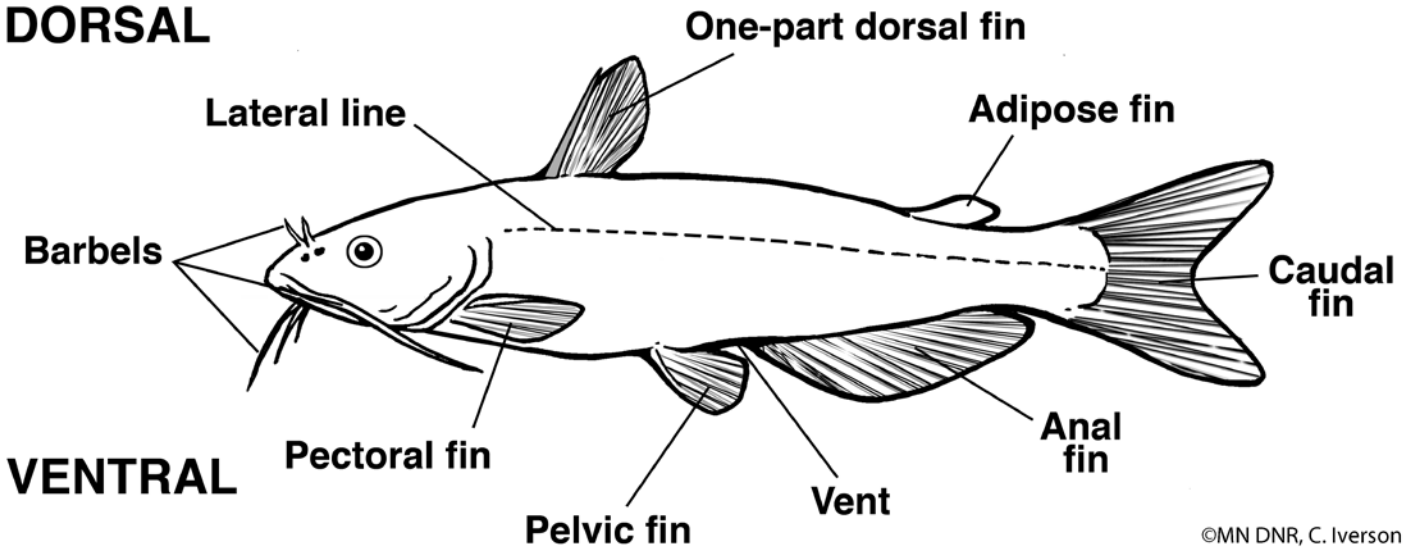
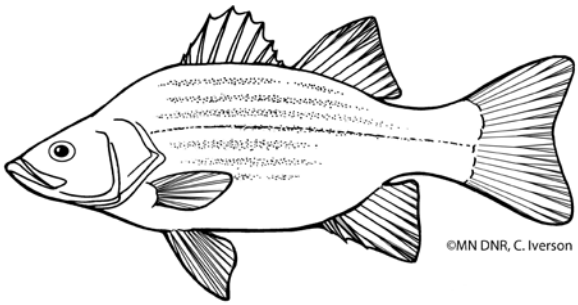
The Parts of a Fish Sheet





Fish Identification Cards

Copy these cards and cut them out.



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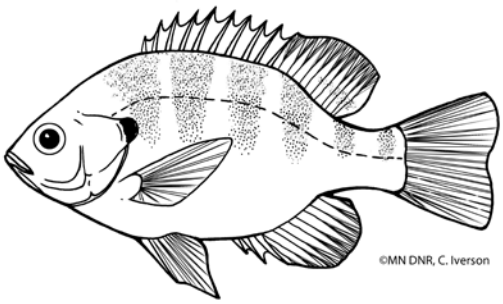

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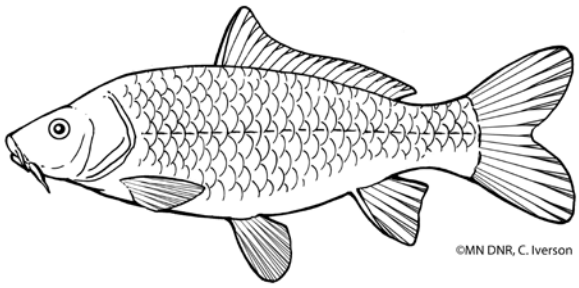

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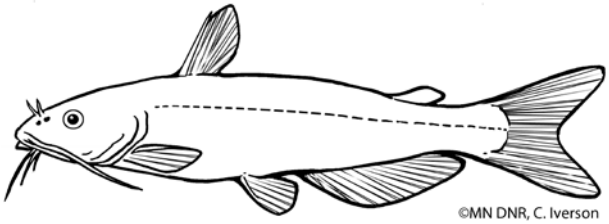

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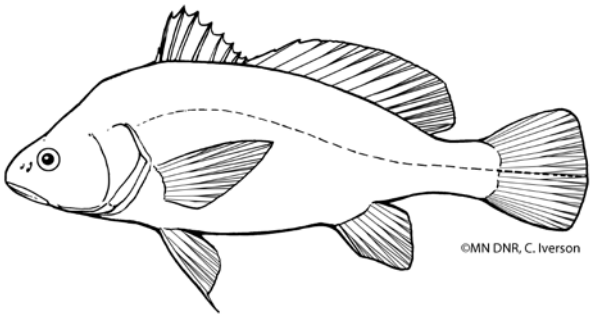

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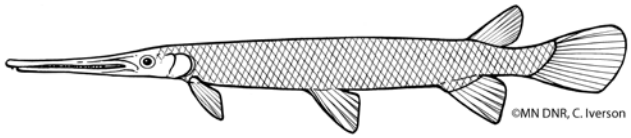

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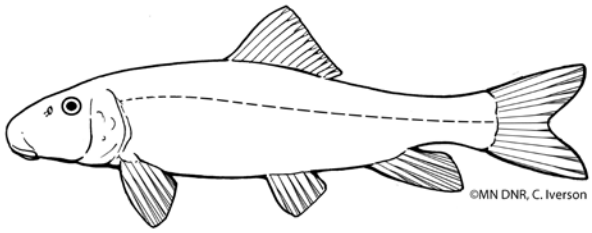

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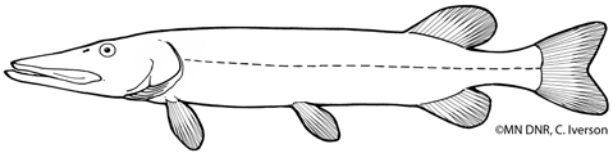
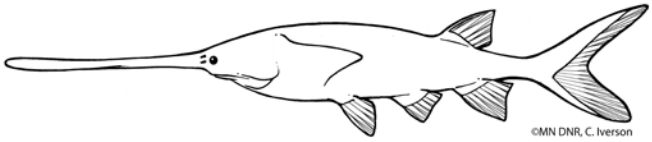


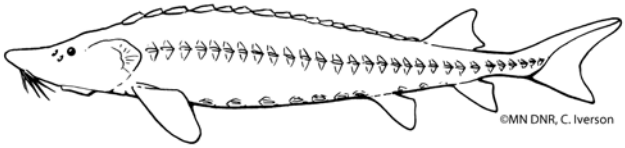
H

Fish Identification Cards

Copy these cards and cut them out.



I



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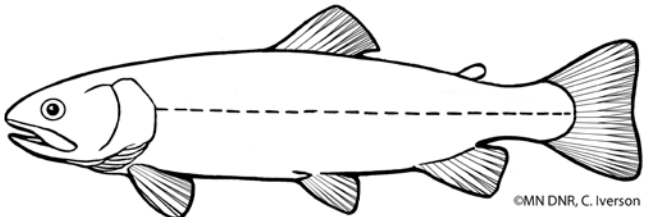

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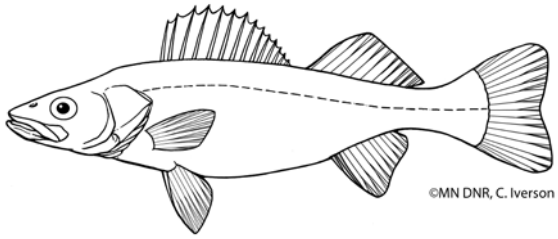

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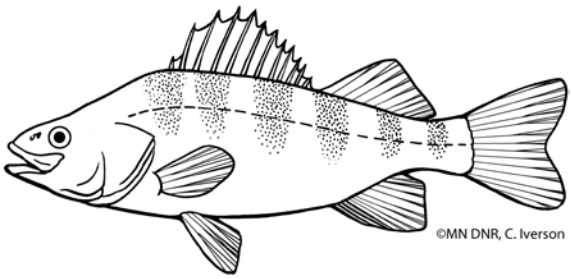

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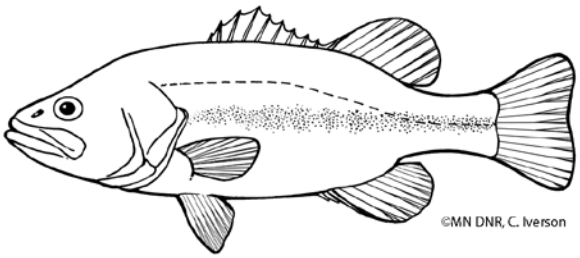

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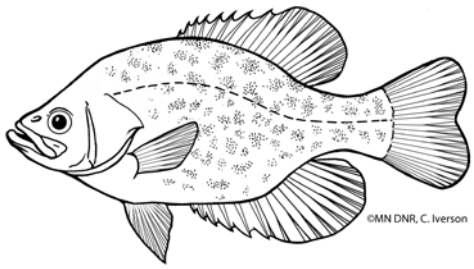

O

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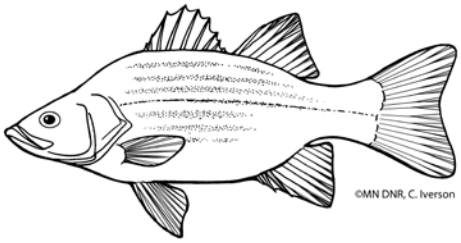
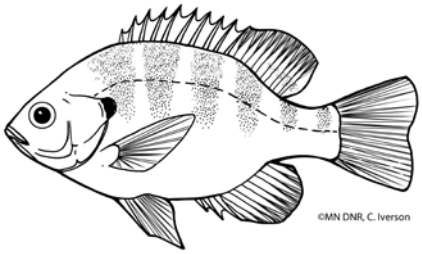
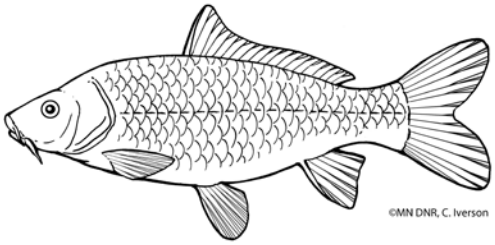
Fish Identification Cards Answer Sheet



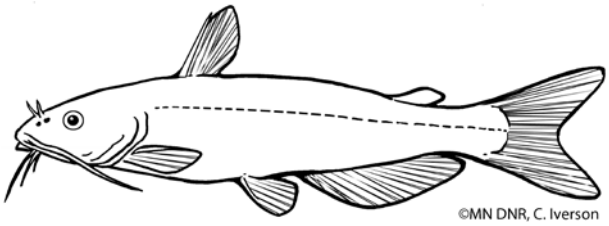
A
White Bass *Morone chrysops*
Temperate Bass Family Moronidae



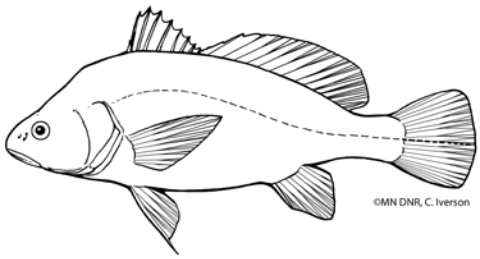
B
Bluegill *Lepomis macrochirus*
Sunfish Family Centrarchidae



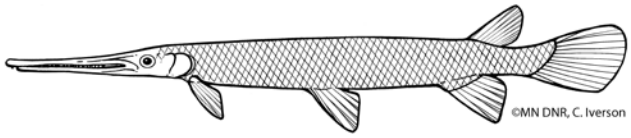
C
Common Carp *Cyprinus carpio*
Minnow Family Cyprinidae



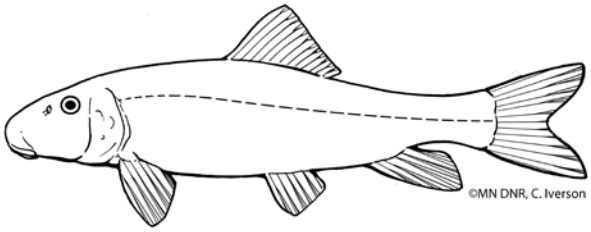
D
Channel Catfish *Ictalurus punctatus*
Catfish Family Ictaluridae



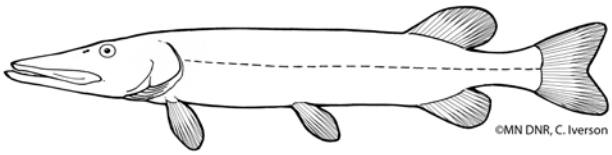
E
Freshwater Drum *Aplodinotus grunniens*
Drum Family Sciaenidae



F
Longnosed Gar *Lepisosteus osseus*
Gar Family Lepisosteidae



G
White Sucker *Catostomus commersoni*
Sucker Family Catostomidae



H
Northern Pike *Esox lucius*
Pike Family Esocidae

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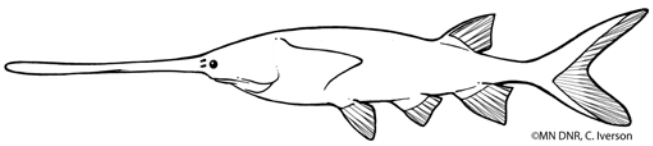
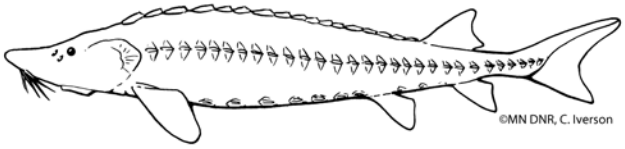
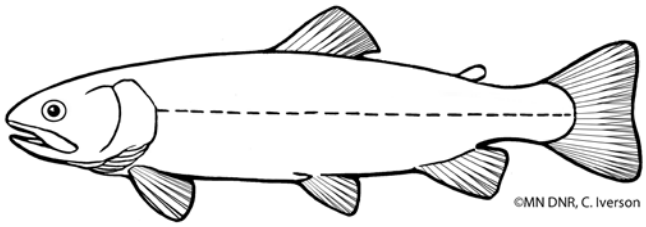
Fish Identification Cards Answer Sheet



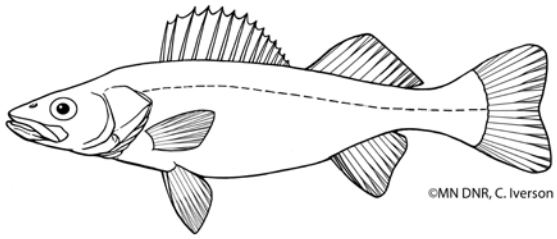
I
Paddlefish *Polyodon spathula*
Paddlefish Family Polyodontidae



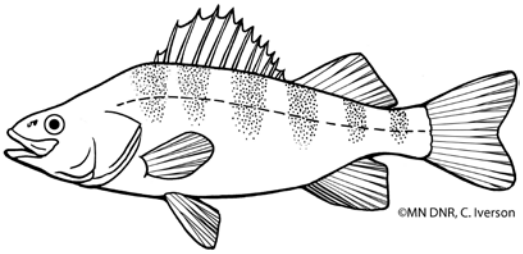
J
Lake Sturgeon *Acipenser fulvescens*
Sturgeon Family Acipenseridae



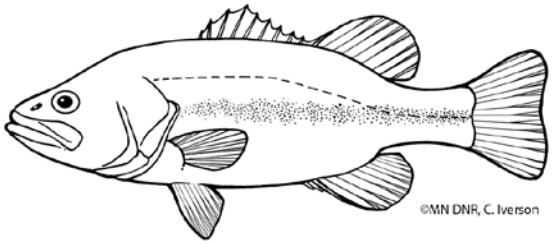
K
Brook Trout *Salvelinus fontinalis*
Salmon Family Salmonidae



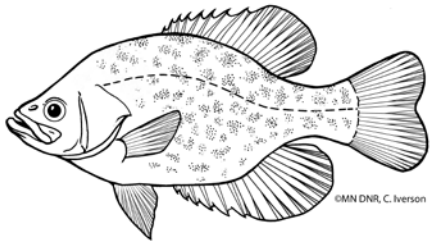
L
Walleye *Sander vitreum*
Perch Family Percidae



M
Yellow Perch *Perca flavescens*
Perch Family Percidae



N
Largemouth Bass *Micropterus salmoides*
Sunfish Family Centrarchidae



O
Black Crappie *Pomoxis nigromaculatus*
Sunfish Family Centrarchidae