



Before You Get Started...

The goal at the heart of the State-Fish Art Program is creating the future stewards of our lakes, rivers, streams and oceans ... our precious aquatic resources.

We believe that **EDUCATION** through Fish On! Leads to the **ACTION** of entering the Contest which is a key to **CREATING STEWARDSHIP!**

The Fish On! Lesson Plan is written for educators teaching grades four through twelve. It can easily be modified to include K-3. You can pick & choose which exercises you want to offer your students. On average it takes 2-4 class periods.

THEN, TAKE ACTION

After learning all about fish, their habitat and conservation needs you are ready to enter the State-Fish Art Contest.

REMEMBER THE ENTRY DEADLINE IS MARCH 31

Fish On!

using art as a springboard into the fascinating world of fish



The Wildlife Forever® State-Fish Art™ Project Lesson Plan

Open to Grades 4-12

INTERDISCIPLINARY ~ MULTIMEDIA ENVIRONMENTAL EDUCATION

-  Bringing aquatic conservation into classrooms
-  Learn about **fish** species, their **habitat** and **conservation** needs
-  Draw, paint, and sketch your way to free prizes, fishing gear, and national recognition!



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www.statefishart.com

Fish On!

Subjects

- Language Arts
- Art

Skills

- Identify
- Research
- Write
- Illustrate

Time

- 2 to 4 class periods

Objectives

Students will:

- 1) Label the parts of a fish and describe their function.
- 2) Outline a simple aquatic food chain.
- 3) Explain several characteristics associated with fish adaptation including gills, fins, and scales.
- 4) Describe specific examples of fish behavior including feeding and spawning.
- 5) Identify their state-fish, its physical appearance, and its habitat requirements.

Vocabulary

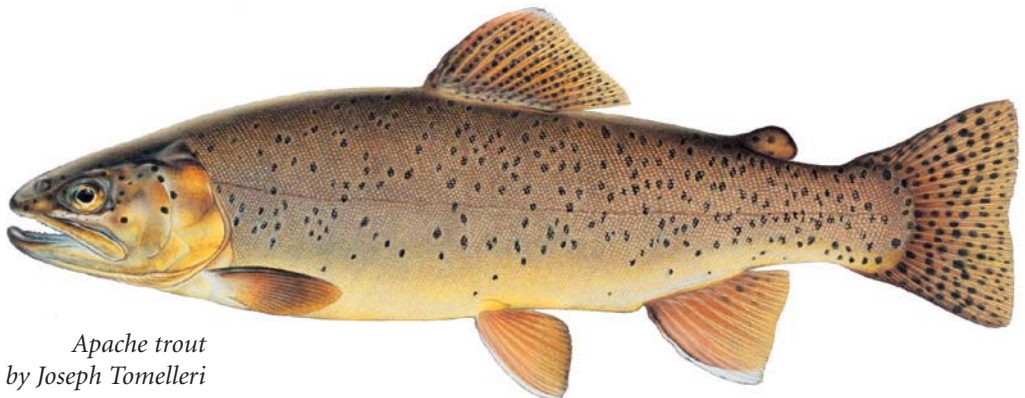
Anadromous	Lateral line	Prey
Camouflage	Milt	Redd
Carnivore	Omnivore	Salt water
Cold-blooded	Plankton	Vertebrate
Fresh water	Predatory	

Background

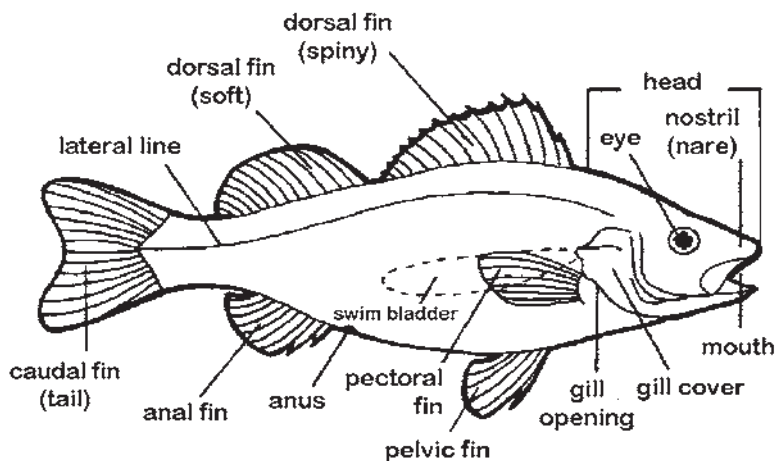
How many different species of fish are there? How are fish adapted to life under water? How do fish reproduce? How can you determine the age of a fish? What do fish eat? What kind of defense mechanisms do fish have? What is a group of fish called?

(Note: the answers to these questions are found throughout the text. However, for quick reference turn to the procedure section.)

There are over 25,000 different species of fish in the world and roughly 2,000 in North America. In fact, fish represent more



Apache trout
Illustration by Joseph Tomelleri



than half of all **vertebrate** animals. There are flat fish, skinny fish, and fish that crawl on land. There are flying fish, electric fish, and fish that live in schools.

Fish vary greatly in size and color. Some are tiny, measuring only two inches in length like the Naked Goby. Others are giants. The Whale Shark measures some 50 feet. That's longer than a school bus! Some fish are drab and mottled. Some are patterned with stripes, bars, and spots. While others are aglow with brilliant color: red, yellow, orange, green, pink, silver, and blue. The tremendous diversity among fish is a result of 400 million years of evolution and unique environmental conditions associated with life in the water.

Adapting to life in the water: Gills, fins, scales

The oldest group of vertebrates, fish can be found wherever there's water. Three quarters of the Earth's surface is covered by water, including **salt water** (oceans, tidal pools, and coral reefs) and **fresh water** (lakes, cold mountain streams, and slow-moving rivers). Fish are specially adapted to life in the water, they have permanent gills, and most have fins and scales.

GILLS

Gills are thin, feathery-like membranes located inside slit-shaped openings behind the head. Fish get oxygen from the water by passing it through their mouths and over their gills. Oxygen is absorbed through the gill membranes and carbon dioxide is removed.

FINS

Fins aid in maneuverability. Each fin has a particular function.

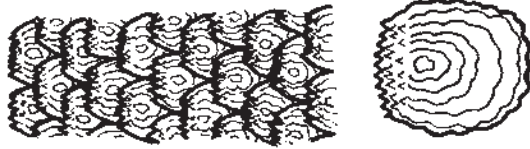
- The pectoral fin is found at the side behind the gills. It helps with diving, swimming to the surface, and remaining stationary.
- The dorsal fin is vertical from the back. It helps keep the fish from rolling.
- The pelvic fin is a stabilizer. It helps with balance.
- The caudal fin or tail helps to propel and steer. A forked tail allows for increased speed, whereas a broad tail allows for increased maneuverability.
- The anal fin is located near the rear of the belly. It helps with balance.



Placoid scale (shark)



Ganoid scale (gar)



Ctenoid scale (perch)



Cycloid scale (salmon)

SCALES

Most fish have a flexible armor of protective scales covering their bodies. There are four kinds of scales: placoid, ganoid, ctenoid, and cycloid. Placoid are tooth-like. Ganoid are diamond shaped. Ctenoid are comb-like, and cycloid have a rounded appearance. Ctenoid and cycloid are the two most common scale types.

Scales vary in size from one species to another and may be as large as a silver dollar. Scales do not increase in number but grow as an animal grows. Scales grow faster during the summer months when food is abundant. Each year, an “annual ring” is laid down within each scale. Counting the consecutive annual rings will provide an estimate of the age of the animal. The scales are coated with a slimy layer of mucous that has antiseptic properties, which protect the animal against disease and parasites.

GAS BLADDER OR SWIM BLADDER

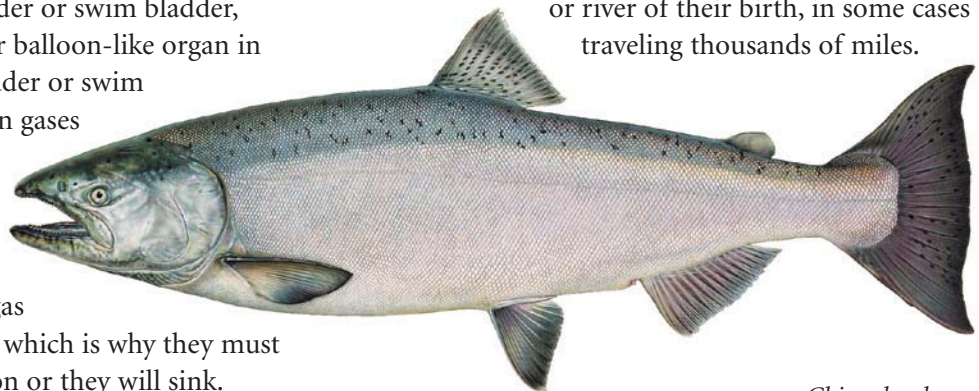
Most fish have a gas bladder or swim bladder, which is an airtight sac or balloon-like organ in the gut area. The gas bladder or swim bladder selectively takes in gases from the bloodstream to regulate floatation and buoyancy. Some fish, including the shark and tuna, do not have a gas bladder or swim bladder, which is why they must remain in constant motion or they will sink.

SIGHTS, SMELLS, AND SOUNDS

The underwater world is often murky or cloudy, which limits visibility to about 100 feet or less. Although fish have good peripheral vision due to the position of their eyes and many scientists believe that they can see color, they rely predominantly on their senses of smell and sound. In fact, most fish use smell to find food, locate a spawning site, and avoid danger. Nostrils, called “nares,” are prominently located on the snout.

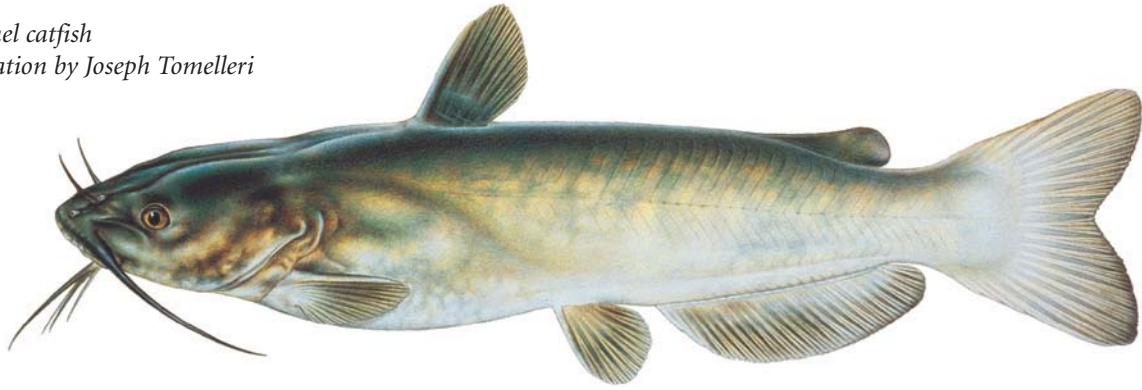
Many fish are carnivores and use smell to locate their prey. They feed on other fish, marine invertebrates such as squid, amphibians such as frogs, and zooplankton, which are tiny, microscopic animals.

Some fish use smell to locate a preferred spawning site. **Anadromous** species such as salmon begin their lives in fresh water but migrate to salt water where they live until they reach maturity. At spawning time, they use their sense of smell to guide them back to the freshwater stream or river of their birth, in some cases traveling thousands of miles.



Chinook salmon
Illustration by Joseph Tomelleri

Channel catfish
Illustration by Joseph Tomelleri



Fish also use smell to communicate, secreting chemical scents called “pheromones,” which serve as a means of communication between members of the same species. For example, some species, such as tuna, live together in a large protective group called a “school.” When a member of the school is attacked by a predator, it secretes a pheromone to warn the others of danger.

Fish have ear-like openings on either side of their head, which provide for excellent hearing. And some fish, such as catfish, have whisker-like appendages with taste buds called “barbels,” which provide added sensory capability as they probe the bottom for food.

LATERAL LINE: “A SIXTH SENSE”

Fish have a unique system of sensory nerves located in the skin called the **lateral line**, which in many ways serves as their sense of touch. The lateral line extends from just behind the head along to the tail on either side of the fish. The lateral line detects the slightest movement of water, which helps a fish to avoid danger or to capture food in otherwise dark or cloudy water.

CAMOUFLAGE: PROTECTIVE COLORING

Most fish have some kind of protective coloring called **camouflage**. Camouflage is an adaptation that enables fish to disguise themselves or to blend-in with their surroundings. Camouflage can take many forms. It can be a color that allows an animal to blend in with its environment or an appearance that allows an animal’s shape to mimic its environment. Muskellunge and northern pike are mottled and greenish in color, allowing them

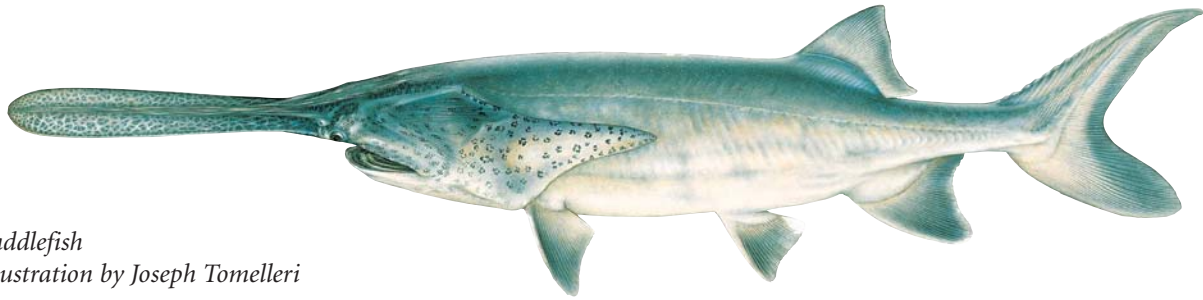
to blend in with their weedy environment. Sole are flatfish with coloration that resembles pebbles or sand allowing them to virtually mimic their environment. Further, most fish are patterned with bars, stripes, or spots, which provide additional camouflage by breaking up an otherwise distinctive silhouette.

Some fish can actually change color during the spawning season (breeding season) or as they age. Color can also vary according to water temperature, sex, and even location. Generally, brightly colored fish are found in the tropics, fish that live near the surface are bluish-green, and fish that live near the bottom are brownish.

Counter shading, also called “obliterative camouflage,” is a very common type of protective coloring. Counter shading refers to fish that have darker-colored backs and lighter-colored undersides such as sharks, rays, billfish, trout, and cod. Counter shading provides a certain amount of protection and concealment from predators above such as bald eagles and osprey and predators below such as other fish and otters.

COLD-BLOODED

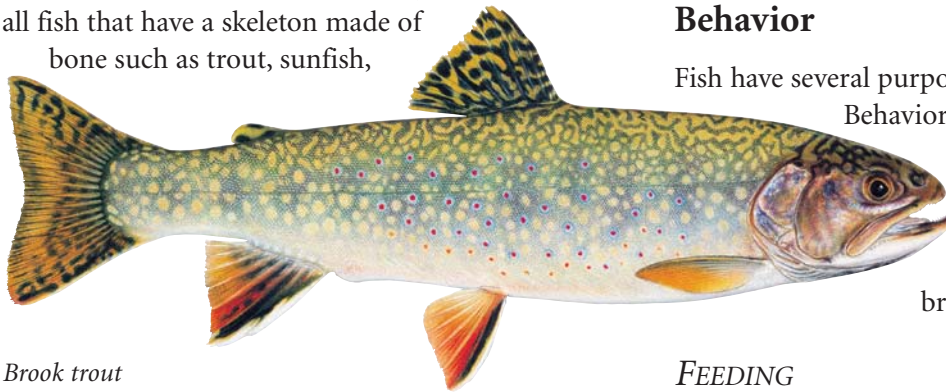
Fish are cold-blooded or ectothermic animals, which means their body temperature depends on their environment. As such, water temperature greatly affects distribution. Most fish are found in temperate areas. Amphibians and reptiles are also cold-blooded animals. In contrast, warm-blooded or endothermic animals such as mammals and birds are able to maintain a constant body temperature even when the temperature around them changes.



Paddlefish
Illustration by Joseph Tomelleri

Types of fish

There are paddlefish, porcupine fish, sunfish, parrot fish, dogfish, goat fish, and even butterfly fish. Generally, fish are divided into two groups: those that have a skeleton made of cartilage (*Chondrichthyes*) and those that have a skeleton made of bone (*Osteichthyes*). *Chondrichthyes* consist primarily of marine species and include sharks, skates, and rays. *Chondrichthyes* have a skeleton made of cartilage rather than bone, and their mouths and gill openings are on the underside of their bodies. *Osteichthyes* include all fish that have a skeleton made of bone such as trout, sunfish,



Brook trout
Illustration by Joseph Tomelleri

perch, salmon, tuna, cod, walleye, bass, flounder, halibut, and sole. By far the most dominant group, *Osteichthyes* are characterized by two sets of paired fins, a set of vertical fins, and a swim bladder. Scientists recognize another group of fish called "*Agnatha*" to classify a few primitive species including the lamprey. *Agnatha* have poorly developed skeletons. They lack jawbones and paired fins.

The name game

Although fish have many distinguishing characteristics such as shape, size, and color, species identification can be tricky, especially since species identification can vary from region to region. For example, "largemouth bass," "bigmouth bass," "black bass," "green bass," and "bayou bass" are all names used to identify one species of fish, the *Micropterus salmoides*. As such, all fish have one scientific name, which is always italicized.

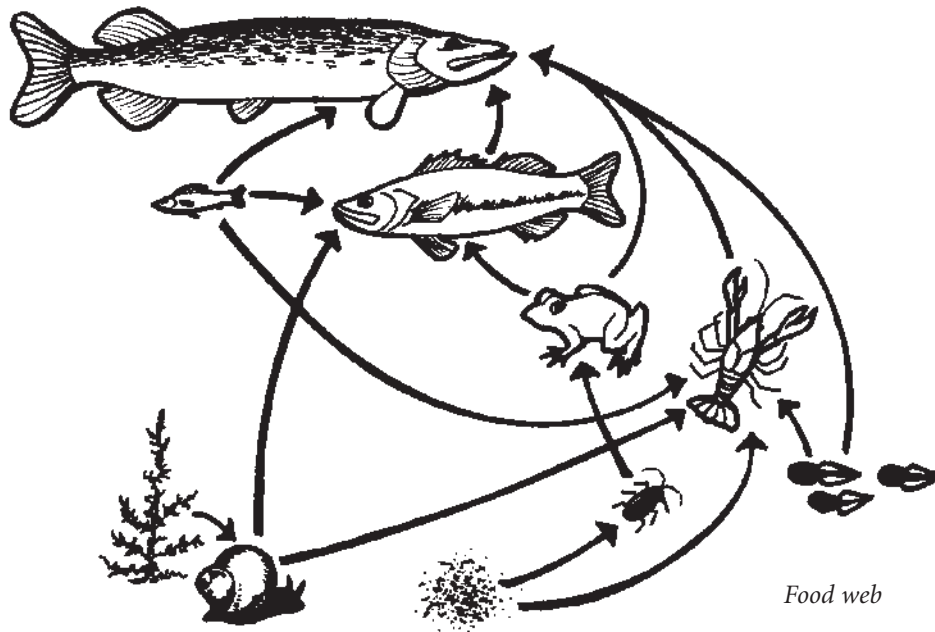
Behavior

Fish have several purposeful patterns of behavior. Behavior refers to the way in which an animal responds to its environment. Behavior takes many forms including feeding and breeding.

FEEDING

Fish spend much of their time feeding. They are most active at dawn and dusk. Many fish are meat eaters, called **carnivores**. Others, called **omnivores**, eat both plants and animals.

Predatory fish such as trout feed on insects, crayfish, fish eggs, and small fish. Northern pike eat mostly fish, but also eat frogs, crayfish, mice, muskrats, and ducklings. Predators usually swallow their prey whole. Humuhumunukunukuapua'a feed on seaweed and insects, and bluegill feed on aquatic plants, insects, and small fish. Fish equipped with sieve-like gill rakers feed on



plankton, which is the generic term used for microscopic plants and animals.

All fish are members of a food chain, which is a group of plants and animals linked together as sources and consumers of food. Food chains linked together form a larger, more complex food web.

Fish distribution, health, and population size is largely due to the quality and quantity of available food. Increased variety in available food leads to increased diversification among species of fish in a given area.

SPAWNING

In most fish, fertilization is external. The female produces an amazing number of eggs that usually appear as a long, jelly-like strand or blob. Eggs vary in size depending on species from one-fifth

of an inch to seven-eighths of an inch. Some eggs attach to rocks or plants, others free-float. Several species of fish, including the largemouth bass, construct a nest-like depression called a **redd** where the eggs are deposited. The male's **milt** later fertilizes the eggs. In most cases the fertilized eggs are left unprotected, and the majority do not survive as fry (young fish).

As previously mentioned, some species migrate to distant spawning grounds. Anadromous species including salmon begin their lives in fresh water but migrate to salt water where they live until they reach maturity. At spawning time, they use their sense of smell to guide them back to the freshwater stream or river of their birth, in some cases traveling thousands of miles. The Pacific salmon, Atlantic salmon, king salmon, and sockeye salmon die after spawning.

Species	Number of eggs	Hatching time
Largemouth Bass	2,000 to 7,000	8 to 10 days
Bluegill	12,000 to 15,000	2 to 5 days
Salmon	2,000 to 10,000	3 months



Striped Bass

The Striped Bass is South Carolina's state fish. The Striped Bass is silvery blue with seven horizontal black stripes. You mostly find the Striped Bass in fresh water like Lake Murray. The Striped Bass swims in schools of 20 fish to a school. The Striped Bass spawns in spring. The Striped Bass lays up to 25,000 eggs at each spawn. Only 50% of the fry lives. The average weight of the adult Striped Bass is 15 to 35 pounds.

Originally the Striped Bass was only found in the Santee Cooper Lakes. The South Carolina Wildlife and Marine Resources Department has stocked every public reservoir and lake with Striped Bass. In Lake Murray, the SCWMRD has made fish attractors out of red cedars and discarded Christmas trees. Most of the sports fishermen that have fished these spots have reported good fishing.

Striped Bass like to live in shallow water near vegetation. They prefer lakes better than fast moving rivers. Striped Bass are found in fast moving water and also found in deep holes or near the edge of the water.

Example from Grades 4–6
South Carolina winner

Procedure Options

1) Anticipatory setting questions or pre-test

Approximate time: 15 minutes

- 1) *How many different species of fish are there?*
- 2) *How are fish adapted to life under water?*
- 3) *How do fish reproduce?*
- 4) *How can you determine the age of a fish?*
- 5) *What do fish eat?*
- 6) *What kind of defense mechanisms do fish have?*
- 7) *What is a group of fish called?*

ANSWERS

1. *How many different species of fish are there?*

There are approximately 25,000 different species of fish in the world and roughly 2,000 in North America.

2. *How are fish adapted to life under water?*

Fish are well adapted to life under water. They have gills, fins, scales, and a gas bladder.

3. *How do fish reproduce?*

In most fish, fertilization is external. The female deposits the eggs, and the male fertilizes them later with its milt.

4. *How can you determine the age of a fish?*

One way to determine the age of a fish is by counting the annual rings on its scales.

5. *What do fish eat?*

Different species of fish eat different things. Many fish are carnivorous, meaning that they eat meat including other fish and insects. Others eat plant material as well.

6. *What kind of defense mechanisms do fish have?*

Different species of fish have different defense mechanisms. Some live in large groups called schools. Some have protective coloring called camouflage, which allows them to blend in with their surroundings.

7. *What is a group of fish called?*

A group of fish is called a “school.”

2) Composition

Approximate time: 2 to 3 class periods

Assign a composition or theme paper as part of *The Wildlife Forever State-Fish Art Contest*. Compositions should not to exceed one page in length. Students should research their state fish including its physical description, habitat, behavior, and anything else they find interesting. For more information on contest rules and regulations, see page 62.

3) Illustration

Approximate time: 1 to 2 class periods

Assign an art project as part of *The Wildlife Forever State-Fish Art Contest*. Art techniques may include scratchboard, pointillism, chalk, charcoal, dry brush, watercolor, crosshatch, lead, collage, linoleum printing, or crayon. All entries must be horizontal, on an 8½” x 11” standard piece of paper without a mat, frame, cover sheet, or border. Photographs and computer-generated artwork will not be accepted. (Please note: if the students use chalk or lead they will have to seal it with an adhesive.) For more information on contest rules and regulations, see page 62.

Reflection opportunity or post-test

- Revisit anticipatory setting questions.
- Identify several examples of how fish are adapted to life under water.
- Ask students what they will remember most from the procedure-related activity.

Extension Activities

SHARE AND SHARE ALIKE

Ask students to share their artwork with their classmates in the form of a brief presentation. Students could also be encouraged to share one or two nuggets of information about their state fish that they found especially interesting.

WORD WEB

Write the word “fish” on the chalkboard or whiteboard. Ask students to brainstorm all the words they can think of related to fish. Record their responses. Then draw lines to connect related words and ideas.

AGING

Divide students up into small groups. Provide each of them with a microscope and a scale from a fish. Ask students to determine the age of the fish by counting the number of annual rings in the scale.

GUEST SPEAKER

Invite a fisheries biologist in for the day.

POETRY

Ask students to write a poem about fish. They could use diamanti or picture poetry.

Diamanti poetry

Noun

Adjective, adjective

Participle, participle, participle

Noun, noun, noun, noun

Participle, participle, participle

Adjective, adjective

Noun

FIELD TRIP

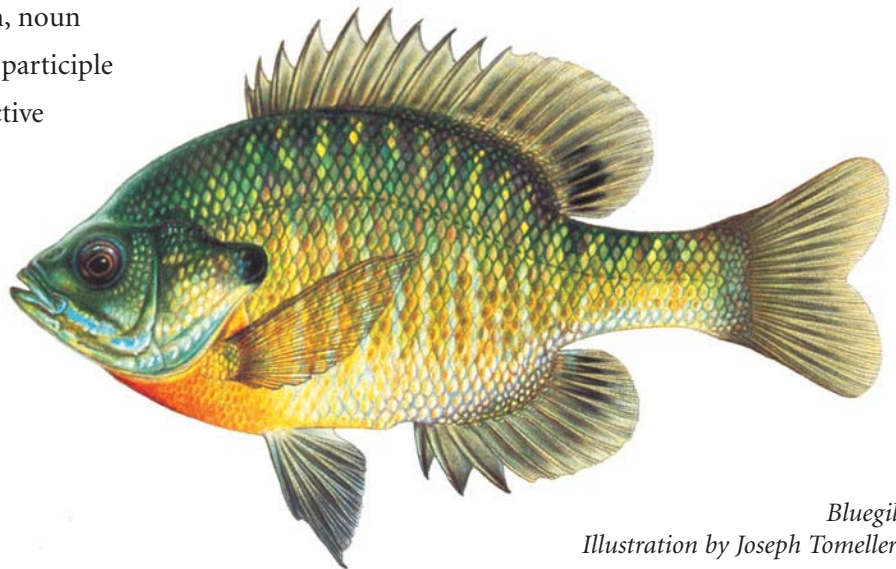
Visit an aquarium or fish hatchery in your area.

GET INVOLVED

Organize a lakeshore or stream-bank clean-up effort.

Assessment Options

- Assign student workbook pages.
- Observe and assess student participation in procedure(s).
- Observe and assess student participation in selected extension activities.
- Select appropriate questions from quiz provided.



Bluegill
Illustration by Joseph Tomelleri

À la Carte Quiz

NAME _____

Select the appropriate questions for grade levels 4-12.

SHORT ANSWER

1) Define vertebrate.

TRUE OR FALSE

- 1) There are approximately 2,000 different species of fish in North America. T or F
- 2) Fish represent more than ½ of all vertebrates. T or F
- 3) Most fertilized fish eggs do not live to maturity. T or F

2) Define plankton.

FILL IN THE BLANK

1) _____ fin serves as a propeller and helps to steer.

2) _____ fin is vertical or upright from the back and helps fish to avoid rolling.

ESSAY

Draw an aquatic food chain.

3) _____ fins are found on either side of the fish just behind the head.

4) _____ is an internal balloon-like organ that helps to regulate floatation.

5) _____ serve as a flexible, protective armor.

6) _____ is a unique system of sensory nerves located in the skin that senses movement.

Briefly describe how gills function.

7) _____ is an adaptation that enables fish to disguise themselves.

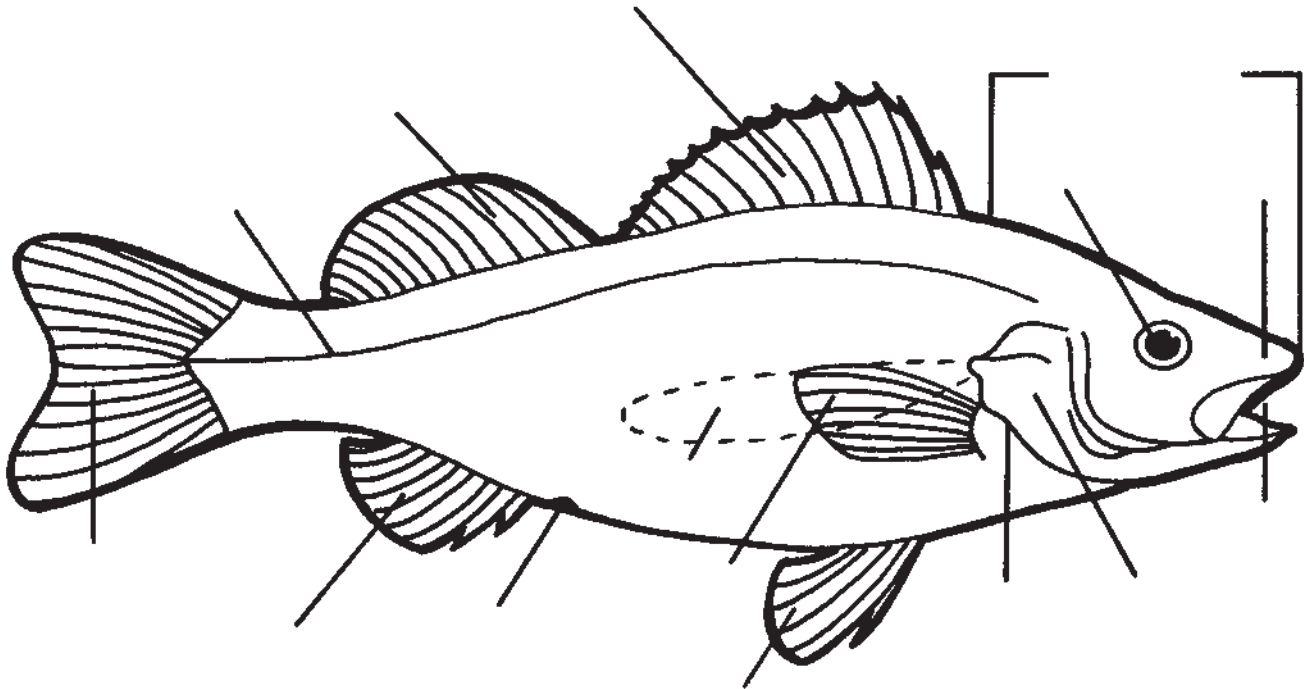
8) _____ are chemical scents used to communicate.

STUDENT WORKSHEET

Fill in the Blanks

NAME _____

Directions: Label the parts of the fish and briefly describe their function.



STUDENT WORKSHEET

Word Search

NAME _____

N X C H A N N E L C A T F I S H P R T P D D I W E
D Q O W P H T B W E A K F I S H A X F X P V S Y Q
R R C Z A W G Q P V E W H I T E C R A P P I E U X
A S R Z C P R N G H X C F U J E J O V W K L T A P
L G X B H O K B O K B L O M E Z G Q C W L X Y H Z
A O O L E X P E X R I R A I N B O W D A R T E R O
R L C U T T H R O A T T R O U T N S W N G G U L M
G D X E R X K Z S D T H M A X O A Y A A R I B Q P
E E E G O F P C A P B L E W P Y S H P H D C O K B
M N W I U Q I E H R A Y A R X H I W J L E H X C H
O T Z L T T H T W S C H A N N E L B A S S T L C P
U R G L N L S X K K T T B Z T P Y B G P F R Y S P
T O T A E B R O O K T R O U T I I A Y O L A S H A
H U L E H C O N I A K M I N L R C K J T T A K M R
B T T Z Z N G A E L P E F P A J L C E T B J R N K
A S A G I K L X J S M E P G E M A G O E G M O V P
S C X H H C C V C I Z J S W N D N V T D Q M E T O
S J C R I S E I C K E U R W D U B I T B L E P F I
U A L Q E K X L B X E L D T L X H A H A Y E A Q Z
L K S A A D E L O P Z X R L Q W N Y S S Y O G W E
P W N U H E X Z H P K E E M Q E P G K S T N R N Z
V A P K M S M N H S C K Z M J V N H A Z S K L P N
S G Y B N P Z X A L S D R C O I G C M H X M T F P
Q F L C S X S Q C U W U U C K V P C X U N A O L D
U S V P A G K B M X E N O L F G H U A Z L Q H U X

Apache Trout
Atlantic Cod
Atlantic Sailfish
Bluegill
Brook Trout
Channel Bass

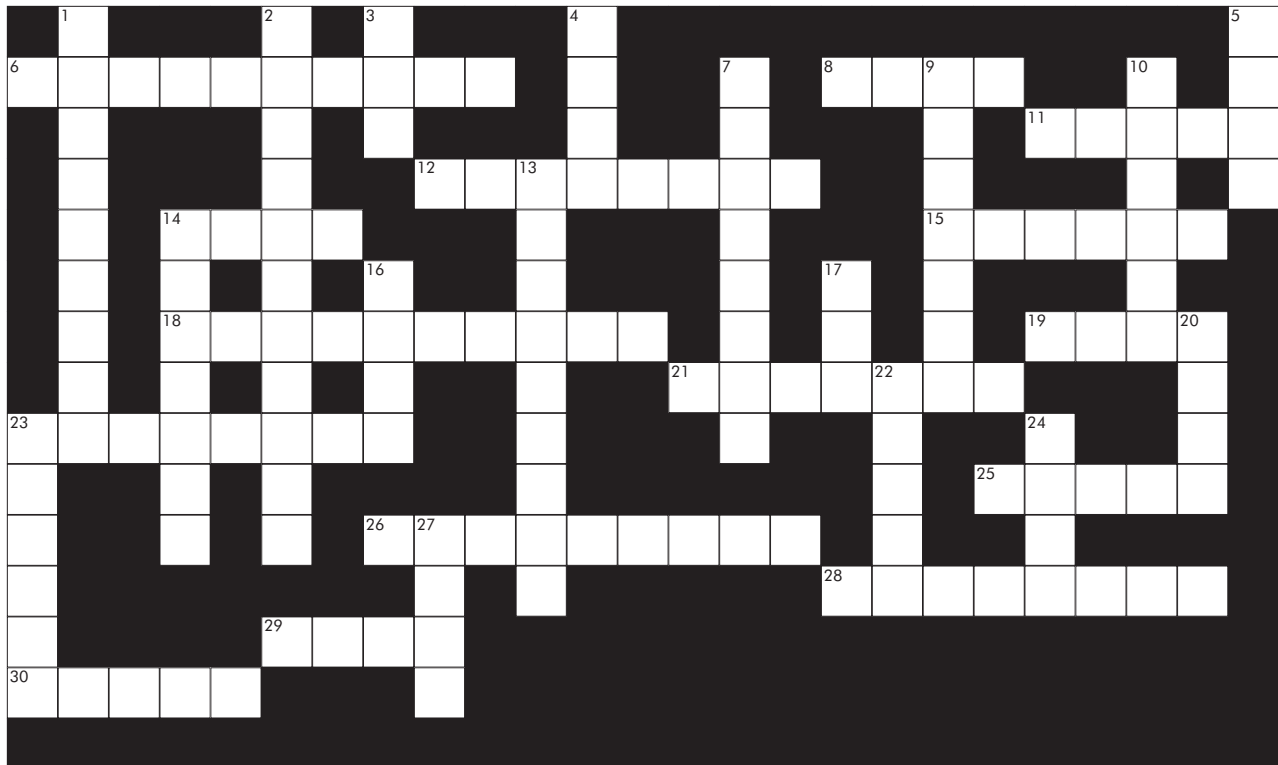
Channel Catfish
Chinook Salmon
Cutthroat Trout
Garibaldi
Golden Trout
King Salmon

Largemouth Bass
Muskellunge
Northern Pike
Rainbow Darter
Spotted Bass
Steelhead Trout

Striped Bass
Tarpon
Walleye
Weakfish
White Bass
White Crappie

Crossword

NAME _____



Across

6. Name for an immature fish
8. Fish and reptiles are _____-blooded
11. Thin plate on fish
12. Fins on side of a fish
14. Fish deposit these into a redd
15. A foreign species introduced to an area from another region
18. Fish species whose population is in great decline
19. Walleyes are named for their milky _____
21. A brook trout that migrates up to the Great Lakes
23. The way a fish or animal responds to its environment
25. The number of fish legally allowed to be taken
26. Area a fish will defend during breeding season
28. Nickname for steelhead trout
29. Nest-like depression made by fish to contain eggs
30. Cutthroat trout do not successfully spawn in _____

Down

1. Southernmost species of cutthroat trout
2. Another name for humuhumunukunua'ā
3. Dorsal _____
4. A redd is a _____-like depression where fish deposit eggs
5. A fish hunted by other fish for food
7. Microscopic plants and animals eaten by fish
9. State permit that allows a person to fish
10. Naturally occurring species of fish
13. Fish that eats other animals
14. Area where fresh water and salt water meet
16. Name for dark oval marks on fish
17. A _____ bladder affects flotation of fish
20. Oceans have a high concentration of it
22. Cutthroat _____
23. Whisker-like appendage
24. Breathing organ of fish
27. Place where two streams come together

STUDENT WORKSHEET

Mystery Math

NAME _____

Directions: Solve these math problems and then use the code to get a message about conservation.

Code
1 = B
2 = V
3 = P
4 = E
5 = I
6 = K
7 = R
8 = C
9 = A
10 = S
11 = M
12 = G
13 = Y
14 = F
15 = L
16 = J
17 = D
18 = Q
19 = W
20 = T
21 = N
22 = Z
23 = H
24 = O
25 = U
26 = X

$\frac{57}{\div 3}$	$\frac{92}{\div 23}$	$\frac{121}{\div 11}$	$\frac{500}{\div 20}$	$\frac{91}{\div 7}$	$\frac{246}{\div 82}$
				$\frac{-3}{-3}$	$\frac{+17}{+17}$

$\frac{192}{\div 24}$	$\frac{7}{\times 4}$	$\frac{147}{\div 7}$	$\frac{85}{\div 5}$	$\frac{42}{\div 7}$	$\frac{126}{\div 18}$	$\frac{96}{\div 6}$	$\frac{76}{\div 19}$
	$\frac{-4}{-4}$		$\frac{-7}{-7}$	$\frac{-2}{-2}$		$\frac{-14}{-14}$	

$\frac{288}{\div 12}$	$\frac{1025}{\div 41}$	$\frac{98}{\div 14}$
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$\frac{115}{\div 5}$	$\frac{324}{\div 18}$	$\frac{216}{\div 8}$	$\frac{54}{\div 6}$	$\frac{133}{\div 7}$	$\frac{465}{\div 93}$	$\frac{728}{\div 91}$
$\frac{-14}{-14}$		$\frac{-2}{-2}$		$\frac{+1}{+1}$		

$\frac{427}{\div 61}$	$\frac{126}{\div 42}$	$\frac{182}{\div 14}$	$\frac{9}{\times 8}$	$\frac{203}{\div 7}$	$\frac{255}{\div 15}$	$\frac{648}{\div 81}$	$\frac{819}{\div 91}$	$\frac{209}{\div 11}$
	$\frac{+1}{+1}$	$\frac{-3}{-3}$	$\frac{-48}{-48}$	$\frac{-4}{-4}$	$\frac{-10}{-10}$		$\frac{-5}{-5}$	$\frac{-9}{-9}$

Answer: _____

à la Carte Quiz

TRUE OR FALSE

- 1) There are approximately 2,000 different species of fish in North America. T or F
- 2) Fish represent more than ½ of all vertebrates. T or F
- 3) Most fertilized fish eggs do not live to maturity. T or F

FILL IN THE BLANK

- 1) Caudal or tail fin serves as a propeller and helps to steer.
- 2) Dorsal fin is vertical or upright from the back and helps fish to avoid rolling.
- 3) Pectoral fins are found on either side of the fish just behind the head.
- 4) Gas bladder or swim bladder is an internal balloon-like organ that helps to regulate floatation.
- 5) Scales serve as a flexible, protective armor.
- 6) Lateral line is a unique system of sensory nerves located in the skin that senses movement.
- 7) Camouflage is an adaptation that enables fish to disguise themselves.
- 8) Pheromones are chemical scents used to communicate.

SHORT ANSWER

- 1) *Define vertebrate.*
An animal with a backbone.
- 2) *Define plankton.*
Microscopic plants and animals.

ESSAY

Draw an aquatic food chain.
See illustration on page 12.

Briefly describe how gills function.
Gills are thin, feathery-like membranes located inside slit-shaped openings behind the head. Fish get oxygen from the water by passing it through their mouths and over their gills. Oxygen is absorbed through the gill membranes and carbon dioxide is removed.

Fill In the Blanks

Answers can be found on page 8.

Word Search

See page 22 for answers.

Crossword

See page 22 for answers.

Mystery Math

19-4 11-25-10-20
8-24-21-10-4-7-2-4 24-25-7
9-18-25-9-20-5-8 7-4-10-24-25-7-8-4-10
We must conserve our aquatic resources.

Glossary of Terms

A

Adaptation: a particular characteristic of a plant or animal that makes it better suited to its environment.

Amphibians: cold-blooded, smooth skinned, vertebrate wildlife species including frogs, toads, newts, and salamanders. Amphibians spend part of their life on land and part of in water.

Amphidromous: migrating between freshwater and saltwater for reasons other than spawning (breeding).

Anadromous: migrating from an ocean into a freshwater river to spawn.

Arthropod: an animal without an internal backbone, including insects and crayfish.

B

Barbels: whisker-like appendages with sensory capabilities.

Behavior: the way an animal responds to its environment.

C

Camouflage: a protective adaptation that enables a fish to disguise itself or blend with its surroundings.

Carnivore: a fish that eats other animals, a meat eater.

Carrion: the body of a dead animal in the natural state of decay, which serves as a food source for some animals.

Cold-blooded (ectothermic): an animal whose body temperature is dependent upon and varies with the temperature of its environment, i.e. fish, amphibians, and reptiles.

Communication: any sound, scent, or behavior recognized by members of the same species.

Competition: the result of different species of animals that use the same source for food or shelter.

Conservation: the care, wise-use, and management of a resource.

Consumer: a fish that gets its food from producers (plants).

Courtship: behavior that attracts a mate in the state of reproductive readiness.

Cover: naturally occurring sheltered areas, which provide concealment shelter, i.e. a submerged tree, log, or rock outcroppings.

E

Ecosystem: an interacting system of plants, animals, soil, and climactic conditions in a self-contained environment, i.e. pond, marsh, swamp, lake, or stream.

Endangered: a species in danger of becoming extinct due to declining population numbers.

Environment: the entire surroundings of an organism (plant or animal) or group of organisms.

Estuary: area where fresh water and salt water meet.

Extinct: a species that no longer exists or has died out.

F

Fingerling: an immature fish.

Food chain: a group of plants and animals linked together as sources and consumers of food.

Food web: the many possible feeding relationships found within a given ecosystem.

Fresh water: a body of water that contains little salt in it, i.e. pond, lake, or stream.

Fry: an immature fish.

G

Gas bladder or swim bladder: an internal balloon-like organ, which affects floatation by selectively taking in gases from the blood stream.

H

Habitat: the local environment in which an animal lives. Components of habitat include an arrangement of food, water, cover (shelter), and space.

Herbivore: a fish that eats only plant material.

I

Invertebrates: animals without backbones, including insects (*Arthropoda*), earthworms (*Annelida*), and jellyfish (*Coelenterata*).

L

Lateral line: a system of sensory nerves in the skin, which detects the movement of water and other fish. The lateral line extends from head to tail on either side of the fish.

M

Migration: the seasonal movements of fish and wildlife from one area to another; usually triggered by the length of daylight hours.

Milt: the semen of a male fish.

O

Obliterative camouflage: a protective color pattern of dark on top and light underneath.

Omnivore: an animal that eats both plants and animals (meat).

P

Pheromone: a chemical scent secreted as a means of communication between members of the same species.

Photosynthesis: a series of chemical changes in which plants combine sunlight, gasses, and water to form sugar or food.

Plankton: microscopic plants and animals that are eaten by fish and other aquatic life.

Predator: an animal that hunts and feeds on other animals.

Prey: an animal hunted or killed for food by other animals (predators).

Producer: plant that obtains energy from the sun and produces food through the process of photosynthesis.

R

Redd: a nest-like depression made by a male or female fish to contain eggs.

S

Salt water: a body of water with a high concentration of salt in it, i.e. oceans and seas.

School: a group of fish.

T

Territory: the area a fish will defend, usually during breeding season, against intruders of its own species.

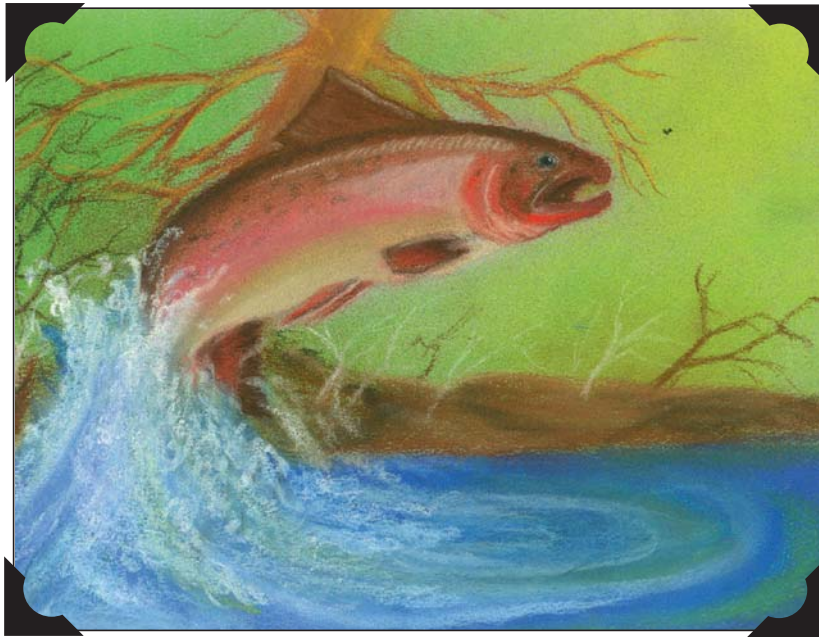
Threatened: a classification used to describe a species whose population is in great decline and approaching the “endangered” classification.

V

Vertebrate: an animal with a backbone; includes fish, birds, mammals, and reptiles.

W

Warm-blooded (endothermic): an animal whose body temperature is unrelated to its environment, i.e. mammals and birds.



Montana's Pride

On February 10, 1977, Governor Thomas Judge signed the law designating the Black Spotted Cutthroat Trout as Montana's state fish. The cutthroat trout has a scientific name, *salmo clarkii*, also known as *oncorhynchus clarkii*. It bears the name because it was first identified by William Clark, of the Lewis and Clark expedition, at the Great Falls of the Missouri in 1805.

The State Fish bill was introduced in the 45th Montana Legislature and passed by wide margins in both houses. The other main competitor for the honor was the Montana Grayling. Both of these fish were on the Threatened Species List. It was hoped that by this increased attention both fish would benefit.

The people in favor of designating a state fish set six criteria. These were: 1) native to Montana, 2) not already adopted by another state, 3) well accepted by the people, 4) a game fish, 5) distinctive in appearance, and 6) found in more than one area of the state. The cutthroat met these criteria and was also claimed to be a "fighting, good-eating, and beautiful fish." Montana has taken steps to preserve this special fish and its residents are proud to have the cutthroat represent our state.

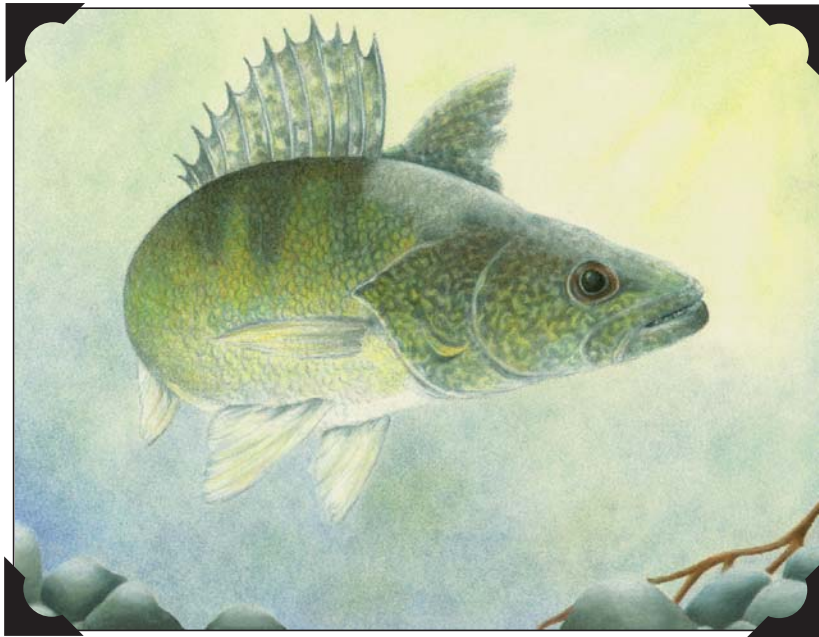
Example from Grades 7-9
Montana winner

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**This state does not have an official state fish, but its state department of natural resources chose this fish for the contest.*



Future Walleye Fishing

The fishing line was lying limp in the water. A little nibble occurs now and then that keeps you on the edge of your seat waiting and anticipating the big catch. All of a sudden you give a good jerk and you have a good-sized walleye fighting against you on the other end of the line. All fishermen and women love the thrill of a good-sized catch. The question is, can we keep the fish numbers up and the fish habitats clean for future fishing enjoyment?

South Dakota is one of the best walleye producing states in the nation. The milk-eyed walleye is the most popular and sought after fish by anglers in my area. The walleye is known to have a white tip on the bottom of the caudal fin and a black blotch on the end of the dorsal fin. It likes darker fresh water to live in and feeds on insects, invertebrates, and other small fish. The lake levels have risen in eastern South Dakota where I live, which improves the fish habitat and benefits the fish production.

We can preserve the future of fishing by choosing to conserve and protect the fish and their environment so later generations of children and families have as much fishing enjoyment as we do now.

Example from Grades 10–12
South Dakota winner

Apache Trout

Oncorhynchus apache



Illustration by Joseph Tomelleri

Common Name

Arizona trout

Identifying Features

Apache trout have rich, olive-green sides and a golden-yellow belly and darken to brass or copper on their head. They have orange-red “cutthroat” marks below their lower jaw.

TYPICAL ADULT

Length

Up to 18 inches in lakes and 6 inches in streams

Weight

Up to 3 pounds

Life span

Unknown

Habitat

Apache trout inhabit clear lakes and forested streams of the White Mountain area in east central Arizona.

Feeding Behavior

Apache trout feed on smaller fish and insects.

Reproductive Behavior

WHEN: Spring or early summer

HOW: The female constructs a nest-like depression called a “redd” over loosely covered gravel and lays about 200-600 eggs while males swim by and fertilize them.

Did you know?

The Apache trout is one of only two trout native to Arizona. The White Mountain Apache Tribe is actively helping the U.S. Fish and Wildlife Service to improve the population numbers of the Apache trout, which is listed as a “threatened species” by the U.S. Fish and Wildlife Service.

Atlantic Cod

Gadus morhua

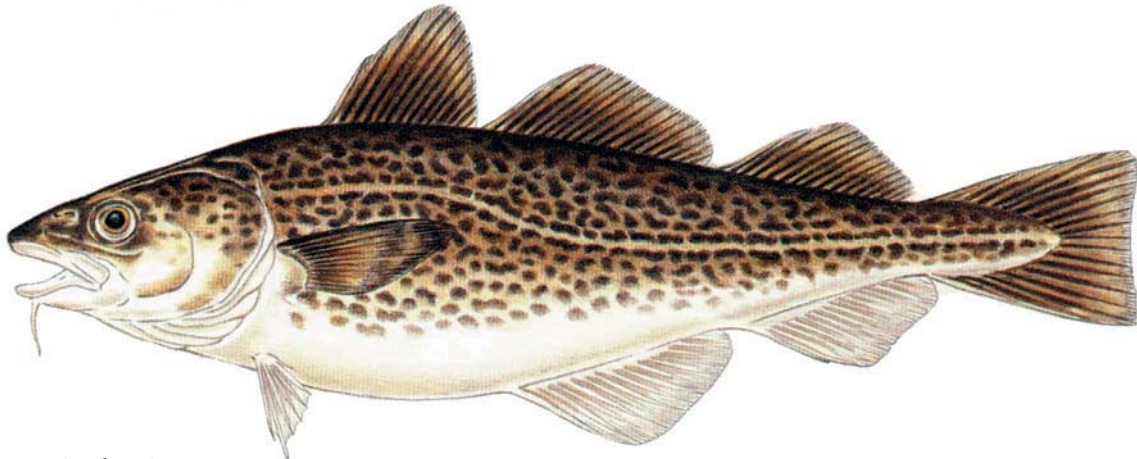


Illustration by Victor Young

Common Name

cod

Identifying Features

Atlantic cod have one barbel (whisker) on the chin. Their coloration is variable depending on their surroundings. The back may be brown or green, yellow or red, or a combination of these colors. Atlantic cod have a light-colored belly and a long, light, lateral band along their body.

TYPICAL ADULT

Length

Up to 72 inches

Weight

Up to 12 pounds

Life span

Up to 20 or more years

Habitat

Atlantic cod are found in coastal waters, usually on or near the bottom of the continental Atlantic shelf, from New England to the Mid-Atlantic states. The preferred water temperature is cold.

Feeding Behavior

Atlantic cod feed on crustaceans, mollusks, sea squirts, worms, and other fish.

Reproductive Behavior

WHEN: Winter or spring

PREFERRED WATER TEMPERATURE: 28-34°F

HOW: The female cod lays more than 9 million fertilized eggs into the sea, where the eggs will float and are vulnerable to wind and predators.

Did you know?

The Atlantic cod has two color phases: red and gray. It can survive at depths of 1,500 feet.

Atlantic Sailfish

Istiophorus platypterus

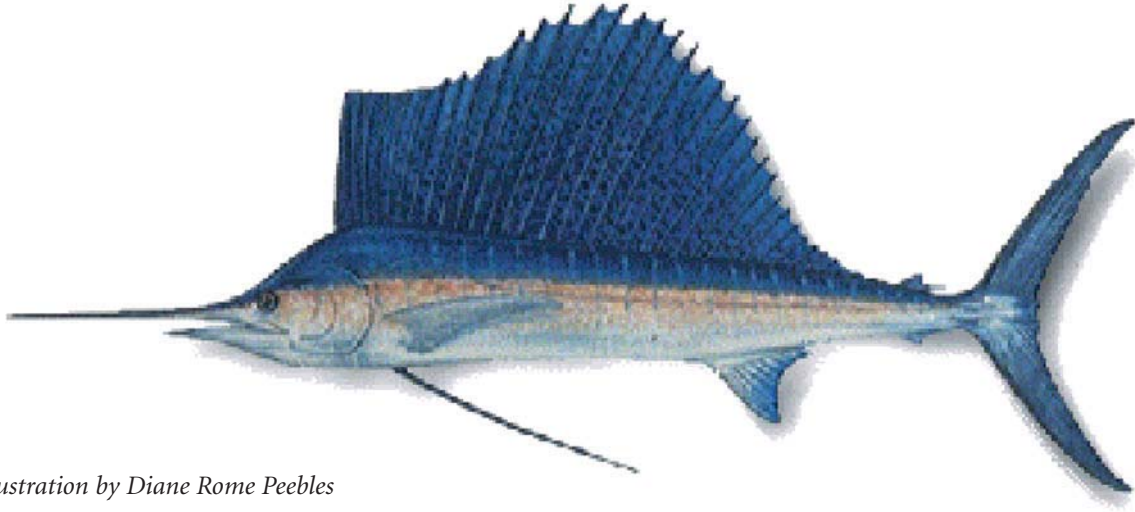


Illustration by Diane Rome Peebles

Common Names

sailfish, sail, spikefish, spindlebeak, spindlesnoot, mylmeen

Identifying Features

Atlantic sailfish have a long bill and a long, slender body of dark blue with silvery flanks and belly. Their blue dorsal fin has dark spots and is two times the height of the fish itself.

TYPICAL ADULT

Length

Up to 84 inches (may reach 100 inches)

Weight

Up to 37 pounds

Life span

Up to 10 years

Habitat

Sailfish inhabit warm (above 70°F) Atlantic and Pacific waters.

Feeding Behavior

Atlantic sailfish feed on smaller fish, squid, and crustaceans.

Reproductive Behavior

WHEN: Summer

HOW: The female swims near the surface of the water with one or more males and releases over 4 million eggs each year. The male fertilizes them, and the eggs hatch within two days.

Did you know?

The Atlantic sailfish can swim up to 60 miles per hour over short distances. Also, Atlantic sailfish grow very quickly. In its first year, an Atlantic sailfish can grow up to five feet!

Bluegill

Lepomis macrochirus



Illustration by Joseph Tomelleri

Common Names

sun perch, bream, brim, blue sunfish, copperbelly, roach

Identifying Features

Bluegills have an olive to bronze back, with blue and orange sides. Two to five bluish bars extend from the mouth.

TYPICAL ADULT

Length

Up to 10 inches (sometimes up to 15 inches)

Weight

Up to 1 pound (sometimes over 4 pounds)

Life span

Up to 11 years

Habitat

Bluegills inhabit quiet and moderately weedy lakes, ponds, bays, and slow-moving streams.

Feeding Behavior

Bluegills feed on larval and adult insects, plankton, snails, fish fry (young), and sometimes aquatic plants.

Reproductive Behavior

WHEN: Spring

PREFERRED WATER TEMPERATURE: 68-70°F

HOW: The male builds a nest on a sand or gravel bottom near other bluegill nests. The female lays eggs in the nest. The male guards the nest and the fry.

Did you know?

Larger bluegills are found in deeper waters than small ones. Also, male northern bluegills become darker and more orange in color during the spawning season.

Bonneville Cutthroat Trout

Oncorhynchus clarki utah

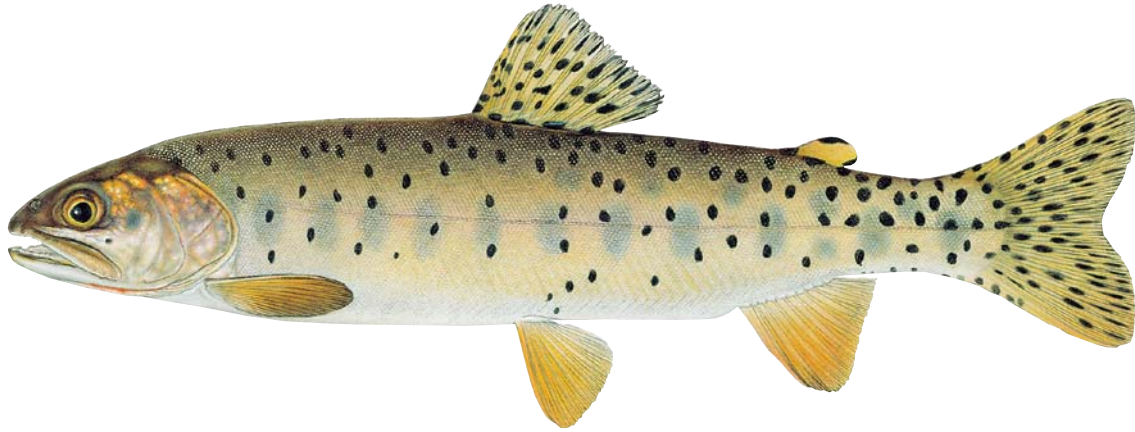


Illustration by Joseph Tomelleri

Common Names	native trout, Utah trout, blueheads
Identifying Features	Bonneville cutthroat trout have a yellowish body with uniform spotting. Larger spots are found on the back half of the fish. They also have orange fins and red-orange “slash” marks on their throat.

TYPICAL ADULT

Length	Up to 18 inches in streams and 30 inches in lakes
Weight	Up to 4 pounds in streams and 18 pounds in lakes
Life span	Up to 20 or more years
Habitat	Bonneville cutthroat trout inhabit mountain streams and lakes in the Bonneville Basin of Utah, Wyoming, Nevada, and Idaho.
Feeding Behavior	Bonneville cutthroat trout eat plankton (passively floating, minute animal and plant life), insects, and fish.
Reproductive Behavior	WHEN: Spring or summer, depending on elevation HOW: The female digs nest-like depressions called “redds” in gravelly riffles in streams. Adults do not guard the nest.

Did you know?

Legend has it that the early pioneers were saved from starvation many times by catching this native trout. Today, the Bonneville cutthroat is listed as a “sensitive species” by the U.S. Fish and Wildlife Service.

Brook Trout

Salvelinus fontinalis



Illustration by Joseph Tomelleri

Common Names eastern brook trout, brookie, speckled trout, native trout, squaretail
Identifying Features Brook trout have a dark olive body with a brownish to greenish back and light worm-like markings. The sides are pale with several small red spots with blue borders. The lower fins have dark and light edges.

TYPICAL ADULT

Length Up to 18 inches (sometimes up to 34 inches)
Weight Up to 3 pounds (may reach 14 pounds)
Life span Up to 15 years
Habitat Brook trout inhabit clear and cold streams, lakes, and ponds, often with access to sea, but are mostly found in the headwaters of spring-fed streams.
Feeding Behavior Brook trout feed on tiny larval insects, small fish, and occasionally, field mice and snakes.
Reproductive Behavior WHEN: Late summer and fall
PREFERRED WATER TEMPERATURE: 40-49°F
HOW: The female digs several redds (depressions) in a gravel bed in the headwaters of a small stream. Adults do not guard the nest.

Did you know?

A sea-run brook trout is known as a "salter" or "sea trout." A brook trout in the Great Lakes that migrates up its tributaries to spawn is known as a "coaster."

Channel Bass

Sciaenops ocellatus

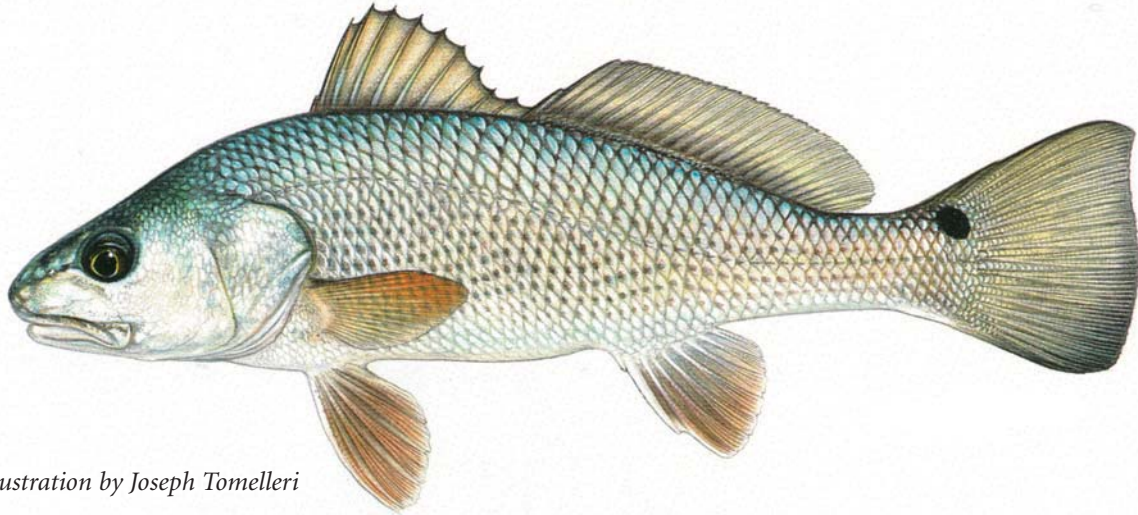


Illustration by Joseph Tomelleri

Common Names	red drum, redfish, spot-tail bass, red bass, red dorse, school drum, puppy drum
Identifying Features	Channel bass have a copper-red body with one or more black spots on the tail.

TYPICAL ADULT

Length	Up to 27 inches
Weight	Up to 40 pounds (sometimes as big as 95 pounds)
Life span	Up to 20 or more years
Habitat	Juvenile channel bass are found inshore, in bays and channels off the Atlantic and Gulf coasts. As the juvenile grows to adult, around age 4, it prefers colder temperatures and moves back to the oceans.
Feeding Behavior	Channel bass feed on crustaceans, fish, and mollusks.
Reproductive Behavior	WHEN: Summer or fall PREFERRED WATER TEMPERATURE: About 75°F HOW: The channel bass migrate out of estuaries (water where a river meets the sea) and lagoons into deeper water near the mouths of bays and inlets. The female broadcasts eggs randomly and the male fertilizes them.

Did you know?

Female channel bass can lay over a million eggs when they spawn.

Channel Catfish

Ictalurus punctatus



Illustration by Joseph Tomelleri

Common Names spotted cat, blue channel cat, Great Lakes catfish, lady cat
Identifying Features Channel catfish have eight barbels (whiskers), an olive-green to bluish body with dark spots, and a deeply forked tail.

TYPICAL ADULT

Length Up to 24 inches
Weight Up to 20 pounds
Life span Up to 11 years
Habitat Channel catfish inhabit deep streams, rivers, and lakes in eastern and central U.S., especially in deep stretches of sand, gravel, or rubble bottom. They also inhabit lakes, reservoirs, and ponds.
Feeding Behavior Channel catfish feed on insect larvae, clams, snails, crayfish, crabs, and aquatic plants. They locate food by probing the bottom with their barbels.
Reproductive Behavior WHEN: Late Spring-Summer
PREFERRED WATER TEMPERATURE: 70-75° F
HOW: The male builds the nest in dark secluded spots under logs, the shade of boulders, holes in riverbanks, or barrels. The female scatters the eggs in the nest. The male guards the nest.

Did you know?

Young channel catfish are called "fiddlers." During the 1950s, commercial fisherman harvested nearly 270,000 pounds of channel catfish each year from the Mississippi River.

Chinook Salmon

Oncorhynchus tshawytscha

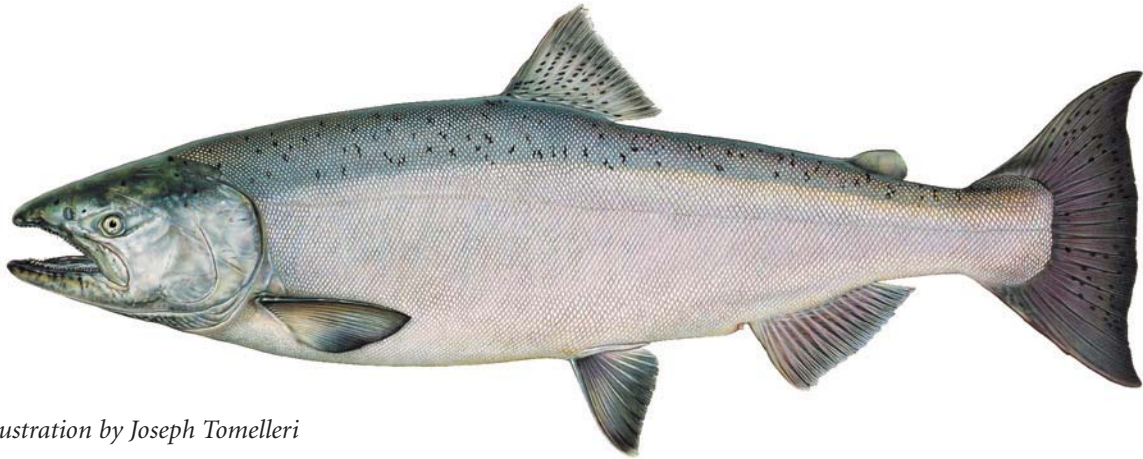


Illustration by Joseph Tomelleri

Common Names king salmon, spring salmon, tye, quinnat, blackmouth, blackjaw
Identifying Features Chinook salmon have a silver body with dark spots on the back and tail. They also have black gums.

TYPICAL ADULT

Length Up to 46 inches (sometimes up to 58 inches)
Weight Up to 43 pounds (sometimes up to 125 pounds)
Life span Up to 9 years
Habitat An anadromous (entering a river from the sea to breed) fish, the Chinook salmon lives in the northern Pacific Ocean but enters large Pacific coastal streams to spawn.
Feeding Behavior Chinook salmon feed on other fish, as well as squid, shrimp, crab larvae, and other crustaceans.
Reproductive Behavior **WHEN:** Fall, but may have separate runs in the spring
PREFERRED WATER TEMPERATURE: 40-55°F
HOW: The female digs a large nest-like depression called a “redd” in a deep gravel riffle of main stream channels. She is accompanied by one dominant male and several smaller ones called “jacks.” The female guards the nest.

Did you know?

After spawning, the female Chinook salmon guards the nest for up to two weeks and then dies. The redd is sometimes 12 feet long and 1 foot deep. Some Chinook salmon swim as far as 1,500 miles upstream to spawn.

Cutthroat Trout

Oncorhynchus clarki

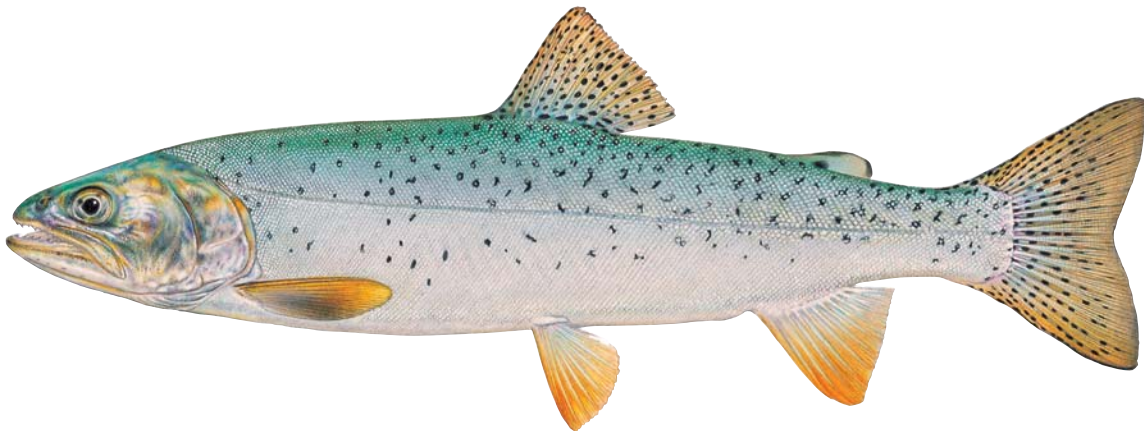


Illustration by Joseph Tomelleri

Common Name native trout, cut, red throat, mountain trout, black-spotted trout
Identifying Features Cutthroat trout have a greenish back with black spots. Their sides are olive to silver in color. They have a red “cut-throat” mark on their lower jaw.

TYPICAL ADULT

Length Up to 19 inches
Weight Up to 5 pounds (may reach 40 pounds)
Life span Up to 7 years
Habitat Cutthroat trout inhabit cold streams and mountain lakes in the western U.S.
Feeding Behavior Cutthroat trout feed on insects, small fish, and occasionally trout eggs, crustaceans, frogs, and earthworms.
Reproductive Behavior WHEN: Spring
PREFERRED WATER TEMPERATURE: 55-62°F.
HOW: The female constructs nest-like depressions called “redds” by brushing aside gravel in small streams. The adults do not guard the nest.

Did you know?

There are 14 different recognized subspecies of cutthroat trout. Cutthroat trout do not successfully spawn in lakes.

Florida Largemouth Bass

Micropterus salmoides floridanus

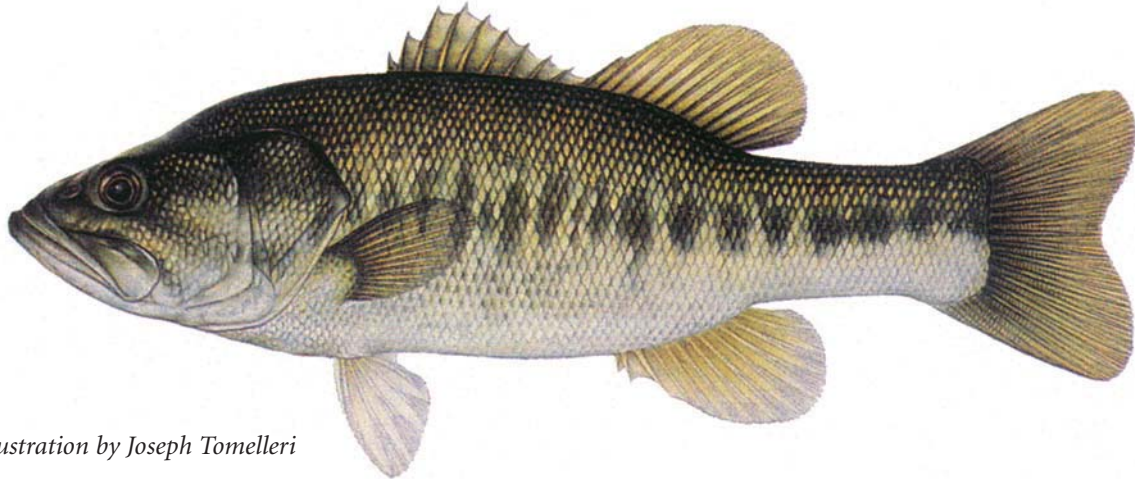


Illustration by Joseph Tomelleri

Common Name Florida bass
Identifying Features Florida largemouth bass have a greenish back and a cream-colored belly. They have diamond-shaped vertical bars on their sides and a fin along the back that has a notch almost down to the back.

TYPICAL ADULT

Length Up to 25 inches
Weight Up to 10 pounds
Life span Up to 10 years
Habitat The Florida largemouth bass inhabits weedy lakes and ponds with firm, sandy bottoms.
Feeding Behavior Florida largemouth bass eat other fish, insects, and invertebrates. The young feed on zooplankton.
Reproductive Behavior WHEN: Spring
PREFERRED WATER TEMPERATURE: 63-68°F
HOW: The male digs a circular-shaped nest with its tail. The female lays eggs and the male fertilizes them. The male primarily guards the nest and the fry (young), although the female may help.

Did you know?

Each Florida largemouth bass nest may contain as many as 43,000 eggs.

Garibaldi

Hypsypops rubicunda



Photograph
by National
Audubon
Society

Common Name

orange-colored sunfish

Identifying Features

Garibaldi have a brilliant orange body with large body scales and a deeply forked tail fin. Juveniles have bright, iridescent blue spots on their body.

TYPICAL ADULT

Length

Up to 14 inches

Weight

Unknown

Life span

Up to 17 or more years

Habitat

Garibaldi inhabit swirling waters along rocky reefs in the Pacific Ocean, off the California coast from Monterey Bay to Baja.

Feeding Behavior

Garibaldi eat sponges, small anemones, and occasionally worms and crabs.

Reproductive Behavior

WHEN: Spring or summer

PREFERRED WATER TEMPERATURE: 59°F

HOW: The male builds a 1-1/2 foot nest on a reef, clearing away all the growth except for red algae. The male defends the nest against intruders, and when the female swims by, the male entices her through clicking sounds and dashing to and from the nest. After the female lays the eggs, she leaves while the male spends 2-3 weeks guarding the nest.

Did you know?

Garibaldi can live in ocean depths of up to 95 feet. Garibaldi are extremely territorial and defend their homes and nests through aggression rather than camouflage.

Golden Trout

Oncorhynchus aguabonita

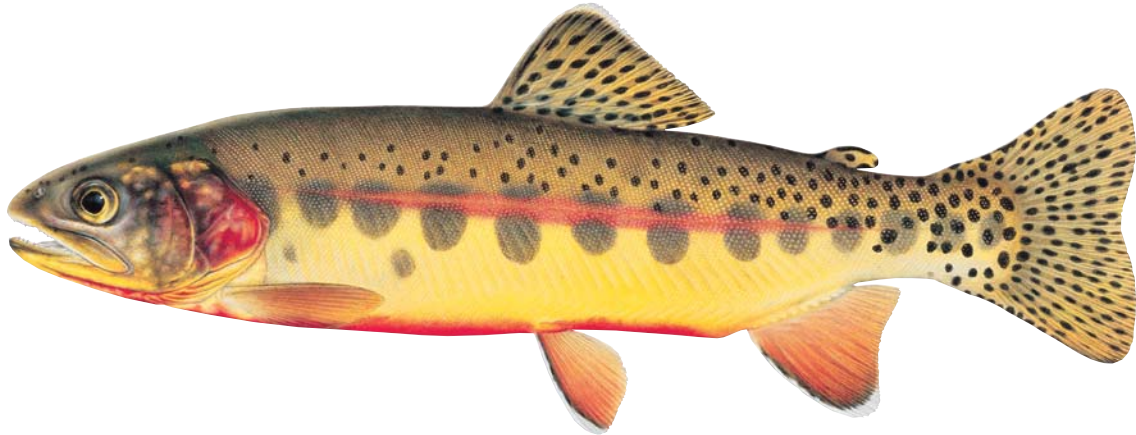


Illustration by Joseph Tomelleri

Common Name Kern River trout, mountain trout, goldie
Identifying Features Golden trout have brilliant, gold sides with a red horizontal band and 10 dark oval marks called “parr marks.” Their fins have white edges.

TYPICAL ADULT

Length Up to 14 inches
Weight Up to 1 pound in streams (up to 11 pounds in lakes)
Life span Up to 7 years
Habitat Golden trout inhabit cold mountain lakes and streams at altitudes above 6,000 feet. They have been stocked at lower elevations with moderate success.
Feeding Behavior Golden trout feed on insects, especially caddis flies and midges, and also eat small crustaceans.
Reproductive Behavior WHEN: Early to mid summer
PREFERRED WATER TEMPERATURE: 48-52°F
HOW: The female digs several redds (depressions) at the tail of a pool and deposits eggs. Adults abandon the nest.

Did you know?

The brilliant colors of the golden trout disappear if they are stocked at altitudes lower than 6,000 feet. Unlike other trout, the golden trout’s parr marks persist throughout their adult life.

Greenback Cutthroat Trout

Oncorhynchus clarki stomias



Illustration by Joseph Tomelleri

Common Names greenback trout, black-spotted trout
Identifying Features Greenback cutthroat trout have a few large spots on their body called “parr marks.” These are usually concentrated near the tail. They also have red “slash” markings on their gill covering.

TYPICAL ADULT

Length Up to 18 inches
Weight Unknown
Life span Up to 7 years
Habitat The greenback cutthroat trout inhabit the South Platte River, the Arkansas River, and the Colorado River.
Feeding Behavior Greenback cutthroat trout feed on aquatic insects and other fish.
Reproductive Behavior **WHEN:** Spring
HOW: The adults display courtship-like behavior and then the female digs a large nest-like depression called a “redd” in gravelly riffles. The adults defend the egg for a period of time.

Did you know?

Habitat loss and the introductions of non-native trout, such as the rainbow, brook, and brown trout, led to the decline of greenback cutthroat numbers.

Guadalupe Bass

Micropterus treculi

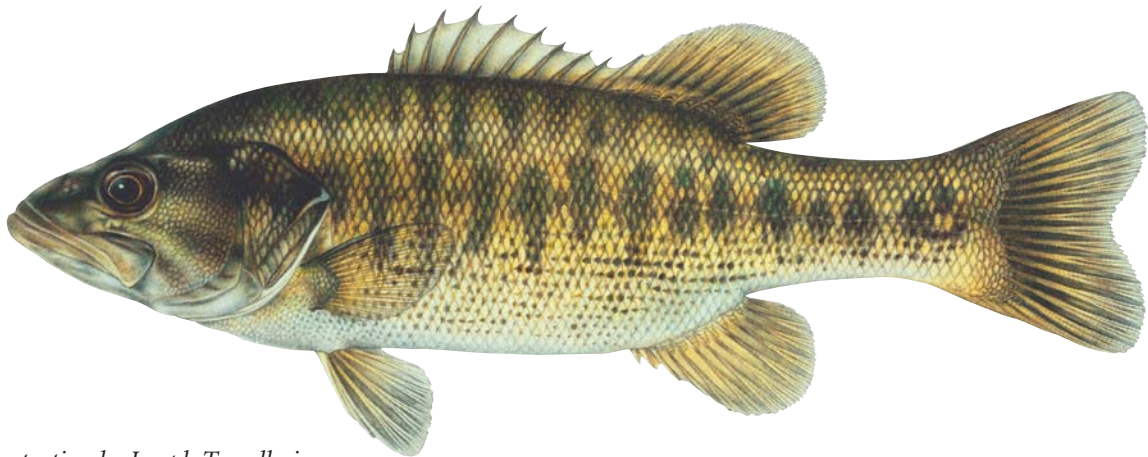


Illustration by Joseph Tomelleri

Common Names black bass, Guadalupe spotted bass
Identifying Features Guadalupe bass have a greenish body with 10-12 dark bars along the side (similar to a smallmouth bass).

TYPICAL ADULT

Length Up to 12 inches
Weight Up to 1 pound
Life span Up to 7 years
Habitat Guadalupe bass are found only in Texas. Guadalupe bass typically inhabit flowing water, including the headwaters of the San Antonio River, the Guadalupe River, the Colorado River, and portions of the Brazos River.
Feeding Behavior Guadalupe bass feed on invertebrates and other fish.
Reproductive Behavior **WHEN:** Spring or summer
PREFERRED WATER TEMPERATURE: 60-65°F
HOW: The male builds a gravel nest in flowing water. After the female lays up to 9,000 eggs, she is chased away and the male stands guard over the eggs until they are hatched.

Did you know?

Guadalupe bass may spawn a second time in the summer.

Humuhumunukunukuapua'a (Hawaiian Triggerfish)

Rhinecanthus rectanglus



Photograph by Keoki Stender

Common Names

Picasso triggerfish, reef triggerfish

Identifying Features

Humuhumunukunukuapua'a have a diamond-shaped body with armor-like scales. A dark stripe crosses their silver sides and belly. Their fins are pale blue. They are called a triggerfish because of their sharp, spike-like dorsal fin.

TYPICAL ADULT

Length

Up to 18 inches

Weight

Unknown

Life span

Unknown

Habitat

Humuhumunukunukuapua'a inhabit the tropical coral reefs of the Pacific Ocean.

Feeding Behavior

Humuhumunukunukuapua'a feed on bottom-dwelling invertebrates and seaweed.

Reproductive Behavior

HOW: The female builds a nest and the male fertilizes her eggs. The female defends the nest vigorously until the eggs are hatched.

Did you know?

Humuhumunukunukuapua'a means "fish with a pig's nose" in Hawaiian. The Humuhumunukunukuapua'a sleeps on its side at night.

King Salmon

Oncorhynchus tshawytscha

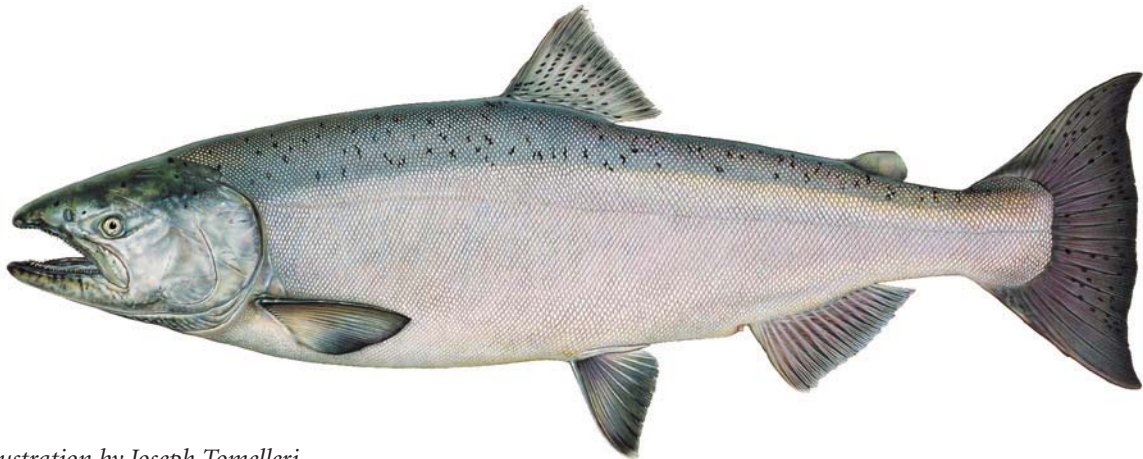


Illustration by Joseph Tomelleri

Common Name Chinook salmon, spring salmon, tye, quinnat, blackmouth, blackjaw
Identifying Features King salmon have a silver body with dark spots on the back and tail. They also have black gums.

TYPICAL ADULT

Length Up to 46 inches (sometimes up to 58 inches)
Weight Up to 43 pounds (sometimes up to 125 pounds)
Life span Up to 9 years
Habitat An anadromous (entering a river from the sea to breed) fish, the king salmon lives in the Northern Pacific Ocean but enters large Pacific coastal streams to spawn.
Feeding Behavior King salmon feed on other fish, as well as squid, shrimp, crab larvae, and other crustaceans.
Reproductive Behavior **WHEN:** Fall, but may have separate runs in the spring
PREFERRED WATER TEMPERATURE: 40-55°F
HOW: The female digs a large nest-like depression called a “redd” in a deep gravel riffle of main stream channels. She is accompanied by one dominant male and several smaller ones called “jacks.” The female guards the nest.

Did you know?

After spawning, the female king salmon guards the nest for up to two weeks and then dies. The redd is sometimes 12 feet long and 1 foot deep. Some king salmon swim as far as 1,500 miles upstream to spawn.

Lahontan Cutthroat Trout

Oncorhynchus clarki henshawi

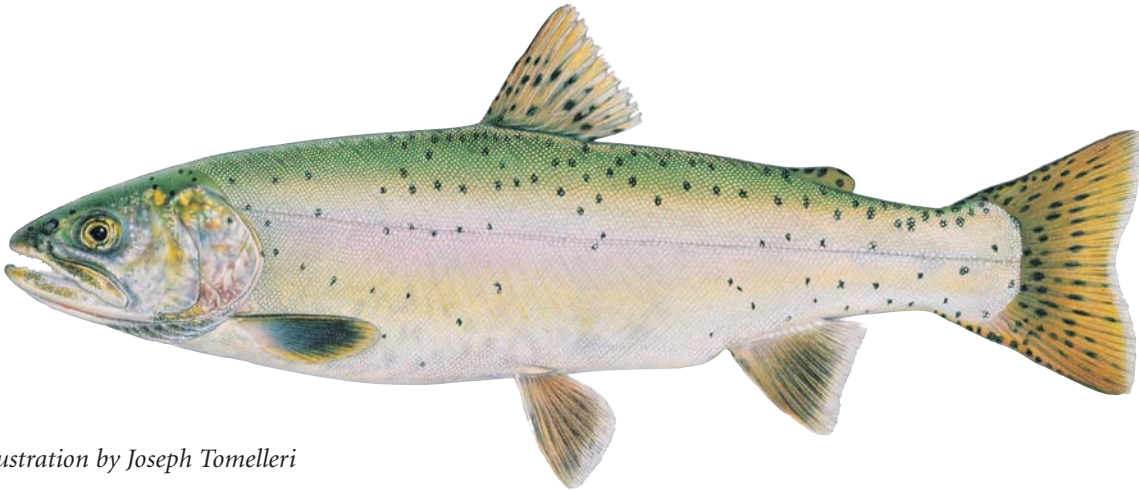


Illustration by Joseph Tomelleri

Common Name	native trout
Identifying Features	Lahontan cutthroat trout have a golden-brown to olive back with black spots. They have red-orange slash marks around their throat.
TYPICAL ADULT	
Length	Up to 25 inches
Weight	Up to 5 pounds
Life span	Unknown
Habitat	Lahontan cutthroat trout inhabit lakes, streams, and rivers in the Lahontan sub-basin of the American Great Basin in west-central Nevada.
Feeding Behavior	Unknown
Reproductive Behavior	WHEN: Spring or summer HOW: The adults display a courtship ritual, and then the female digs a large nest-like depression called a “redd” in gravelly riffles. The adults defend the egg for a period of time.

Did you know?

Previously unregulated fishing and the introduction of non-native species have reduced the Lahontan cutthroat populations to 11% of their original stream population and one-half of 1% of their original lake population. The U.S. Fish and Wildlife Service has placed the Lahontan cutthroat trout on its Threatened Species List.

Landlocked Salmon

Salmo salar

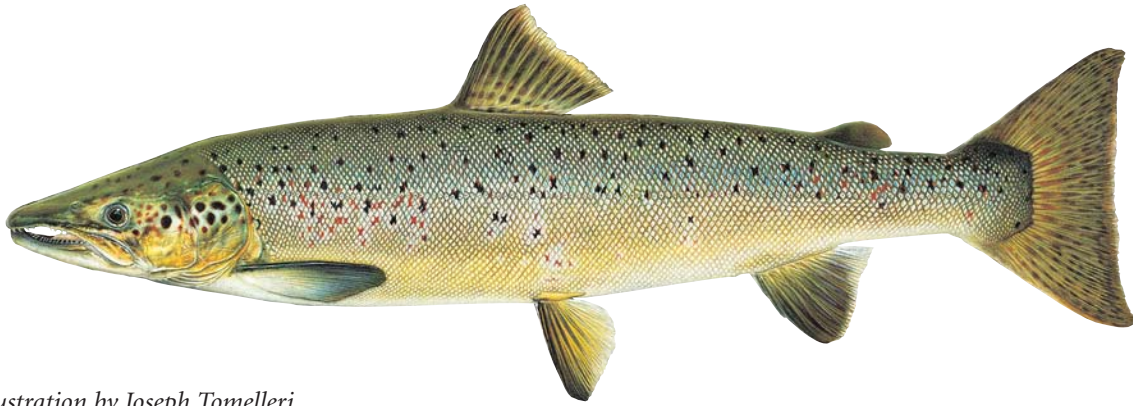


Illustration by Joseph Tomelleri

Common Names	Atlantic salmon, ounaniche, Sebago salmon
Identifying Features	Landlocked salmon have a gray-green back with a silver head and silver sides and a white belly. It has a series of black spots in a lateral line on its body.

TYPICAL ADULT

Length	Up to 36 inches (may reach 60 inches)
Weight	Up to 5 pounds
Life span	6 years
Habitat	Landlocked salmon inhabit clear, cold lakes (with gravelly inlets for spawning) on the Atlantic coast.
Feeding Behavior	Landlocked salmon eat crustaceans, insects, and small fish including herring and sardines.
Reproductive Behavior	WHEN: Fall PREFERRED WATER TEMPERATURE: 42-50°F HOW: The female digs a nest-like depression called a “redd” by brushing aside small gravel. The female deposits her eggs in the redd and then abandons the nest to return to the lakes.

Did you know?

When landlocked salmon spawn, they can swim far upstream, negotiating nearly impassable falls.

Largemouth Bass

Micropeterus salmoides

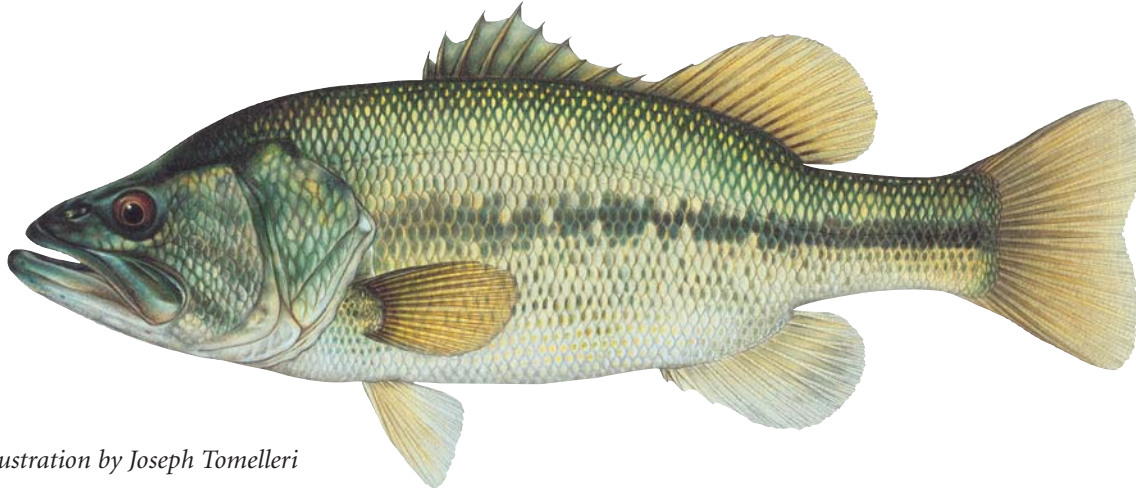


Illustration by Joseph Tomelleri

Common Names black bass, green bass, bigmouth, linesides, bucketmouth
Identifying Features Largemouth bass have a black to green back with lighter sides and a pale belly. They have a dark wavy band running the length of their sides. Their mouth extends beyond their eyes.

TYPICAL ADULT

Length Up to 21 inches
Weight Up to 10 pounds
Life span Up to 15 years
Habitat Largemouth bass inhabit weedy lakes and ponds and slow-moving rivers and streams throughout U.S. They prefer areas with lots of cover (brush, sunken logs, and rocks).
Feeding Behavior Largemouth bass feed on whatever is available, including small fish, leeches, salamanders, frogs, snakes, and turtles. They also feed more heavily as the water temperature rises.
Reproductive Behavior **WHEN:** Spring
PREFERRED WATER TEMPERATURE: 63-68°F
HOW: The male constructs a 2-3 foot nest by sweeping away debris with its head and tail. It will usually nest near heavy cover such as brush and logs. The male guards the eggs and fry for about a month.

Did you know?

Largemouth bass have a sensor along their lateral line that picks up underwater vibrations as subtle as small fish swimming nearby. The eyes of largemouth bass absorb more light than human eyes. In shallow waters, largemouth bass can detect colors, especially red.

Longear Sunfish

Lepomis megalotis



Illustration by Joseph Tomelleri

Common Names	sun perch, pumpkinseed, creek perch, red-belly bream, red perch, blackear and red bream
Identifying Features	Longear sunfish have a blue-green back and sides speckled with yellow and emerald with an orange and yellow belly. They are named for having a long earflap that is typically bordered with white. Emerald blue wavy lines run from the mouth to the earflap.

TYPICAL ADULT

Length	Less than six inches
Weight	Less than one pound
Life span	Up to 4 years
Habitat	Longear sunfish prefer shallow, weedy waters of lakes and ponds; also found in quiet streams. They are frequently found in the same streams as spotted bass.
Feeding Behavior	Longear sunfish eat mainly aquatic insects, as well as mites, small crustaceans, fish eggs, mollusks, filamentous algae, and small fish.
Reproductive Behavior	WHEN: Spring-to-summer PREFERRED WATER TEMPERATURE: 75-80°F HOW: The male prepares the nest, of pebbles, gravel and sand, in shallow waters along the shoreline using its fins to clear a circular depression and fan silt away. It then locates a female who lays sticky eggs in the nest. The male aggressively guards these eggs and within two weeks of hatching herds the larvae into dense schools to more safely search for food and mature.

Did you know?

Longear sunfish feed more extensively at the surface of the water than some other sunfish. They are well known to most young anglers as being the first "perch" they ever caught on a cane pole with a dangling worm for bait.

Muskellunge

Esox masquinogy



Illustration by Joseph Tomelleri

Common Names muskie, lunge, maskinonge, great pike
Identifying Features Muskellunge have a light green back and a pale belly. Their sides are marked with dark diamond-shapes.

TYPICAL ADULT

Length Up to 52 inches (sometimes up to 60 inches)
Weight Up to 46 pounds
Life span 30 or more years
Habitat In the summer, muskellunge inhabit the deep water of ponds, lakes, streams, and slow-moving rivers. In the fall, they live in shallow weedy areas.
Feeding Behavior Muskellunge are carnivores (meat eaters) and feed on fish, frogs, crayfish, and occasionally, young mice, muskrats, and ducklings.
Reproductive Behavior **WHEN:** Mid to late spring
PREFERRED WATER TEMPERATURE: 49-59°F
HOW: Adults pair off at spawning. The female sometimes swims along shoreline with 1-2 smaller males nearby. The eggs are scattered at random over lake or river vegetation. Adults do not guard the nest.

Did you know?

Muskellunge have three distinct color phases: spotted, clear, and barred.

Northern Pike

Esox lucius



Illustration by Joseph Tomelleri

Common Names great northern pike, jack, jackfish, pickerel, snake, gator
Identifying Features Northern pike have light bars on an olive-green back. Their fins have dark spots with a reddish tinge.

TYPICAL ADULT

Length Up to 39 inches
Weight Up to 24 pounds (sometimes up to 40 pounds)
Life span Up to 25 years
Habitat Northern pike inhabit large, weedy bays of natural lakes in the northern U.S. and slow, meandering rivers with heavy weed growth. They can also be found in ponds, lakes, and streams. Northern pike live in shallow water in the summer and deep water in the winter. As the fish grow larger, they prefer colder water temperatures.
Feeding Behavior Northern pike eat mostly fish, but also frogs, crayfish, mice, muskrats, and ducklings.
Reproductive Behavior **WHEN:** Early spring, just after ice-out
PREFERRED WATER TEMPERATURE: 40-70°F
HOW: Eggs are scattered at random in small tributary streams, marshes adjacent to lakes, or shallow, weedy bays. Adults do not guard the eggs.

Did you know?

Female northern pike grow faster and live longer than males. The northern pike is one of two freshwater fish known to live on three continents: North America, Europe, and Asia.

Paddlefish

Polyodon spathula

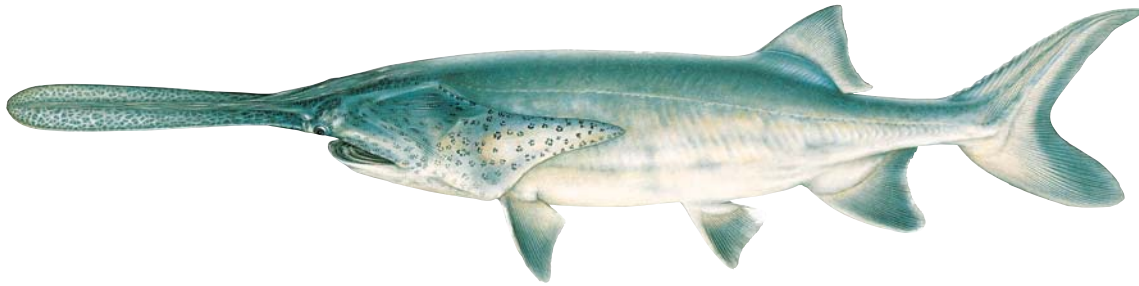


Illustration by Joseph Tomelleri

Common Names

spoonbill, spoonbill cat, shovelnose cat, spadefish

Identifying features

Paddlefish are gray to dark blue with white sides and a white belly. They also have a long, paddle-shaped snout and a pointed gill cover that extends to the middle of the body.

TYPICAL ADULT

Length

Up to 68 inches

Weight

Up to 67 pounds (sometimes over 100 pounds)

Life span

Up to 30 years or more

Habitat

Paddlefish inhabit slow-moving stretches of large rivers and adjoining backwaters, especially where bottoms are muddy.

Feeding Behavior

Paddlefish swim with bills wide open, swaying slowly from side to side to feel for concentrations of plankton. They filter plankton with gill rakers (strainer-like teeth). Paddlefish also eat small crustaceans, algae, and mayflies.

Reproductive Behavior

WHEN: Spring

PREFERRED WATER TEMPERATURE: 50-60°F

HOW: As the water level rises, female paddlefish deposit eggs at random on silt-free gravel, either exposed to the air or barely submerged. Adults do not guard the eggs.

Did you know?

There are only two living species of paddlefish in the world—one in North America and the other in China. Paddlefish eggs are a delicacy and are often used to make caviar. They can grow to be 1 foot long in their first year.

Rio Grande Cutthroat Trout

Oncorhynchus clarki viginalis



Illustration by Joseph Tomelleri

Common Names New Mexico cutthroat trout
Identifying Features Rio Grande cutthroat trout have a yellowish-green to gray-brown body with scattered black spots. They have a densely spotted tail.

TYPICAL ADULT

Length Up to 10 inches
Weight Up to 1 pound
Life span Up to 8 years
Habitat Rio Grande cutthroat trout inhabit mountain streams and rivers.
Feeding Behavior Rio Grande cutthroat trout feed on insects, zooplankton, and crustaceans.
Reproductive Behavior WHEN: Spring or summer
PREFERRED WATER TEMPERATURE: 48-52° F
HOW: The female lays between 200 to 4,500 eggs on a gravel nest in flowing water where high levels of dissolved oxygen exist.

Did you know?

The Rio Grande cutthroat trout is the southernmost species of cutthroats. The introduction of the rainbow trout led a decline in the populations of Rio Grande cutthroat trout, combined with early logging, grazing, and hunting practices.

Spotted Bass

Micropterus punctulatus

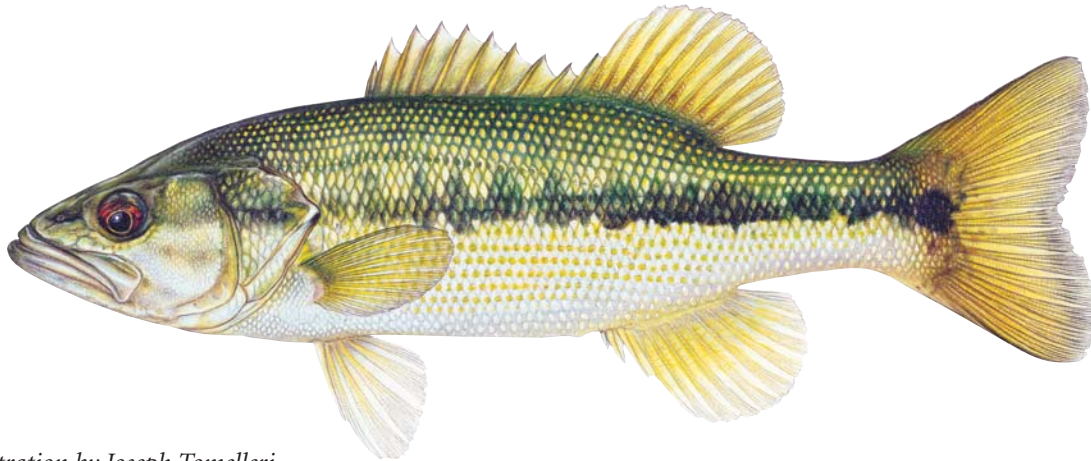


Illustration by Joseph Tomelleri

Common Names

Kentucky bass, spot, Alabama spotted bass

Identifying Features

Spotted bass have an olive green back with dark, diamond shaped blotches above a white belly

TYPICAL ADULT

Length

Up to 18 inches

Weight

Up to 3 pounds

Life span

Up to 7 years

Habitat

Spotted bass inhabit clear, slow-moving, small to medium-sized streams and deep reservoirs.

Reproductive Behavior

Spotted bass feed on crayfish, small fish, and larval and adult insects.

WHEN: Spring

REFERRED WATER TEMPERATURE: 63-68°F

HOW: The male sweeps silt from the rock bottom near heavy cover, such as brush or logs, to make a nest. After the female lays eggs on the nest, the male fertilizes them and guards the eggs and the fry (young) for about a month.

Did you know?

Spotted bass become lighter in color when the water becomes murkier. They are seldom found in natural lakes. A spotted bass subspecies known as the "Wichita spotted bass" is thought to be extinct.

Steelhead Trout

Oncorhynchus mykiss irideus



Illustration by Joseph Tomelleri

Common Names coastal rainbow trout, steelies
Identifying Features Steelhead trout have a glowing steel-blue body with spots on the upper body. Their tail has radiating rows of black spots.

TYPICAL ADULT

Length Up to 34 inches
Weight Up to 8 pounds (may reach 24 pounds)
Life span Up to 11 years
Habitat Steelhead trout are anadromous fish, which means they inhabit the Pacific Ocean and Great Lakes area except during spawning season, when they move to rivers and streams.
Feeding Behavior Steelhead trout feed on immature and adult insects, plankton, crustaceans, fish eggs, and small fish.
Reproductive Behavior WHEN: Spring
PREFERRED TEMPERATURE: 50-60°F
WHERE: Steelhead trout spawn in large, swift, boulder-filled streams at the gravelly tail of a pool or a riffle at the head of a pool.
HOW: The female digs several nest-like depressions called “redds” and deposits eggs in each one. The adults do not guard the eggs.

Did you know?

A steelhead tagged in the Aleutian Islands was caught six months later in Washington, 2,400 miles from the tagging site.

Striped Bass

Morone saxatilis

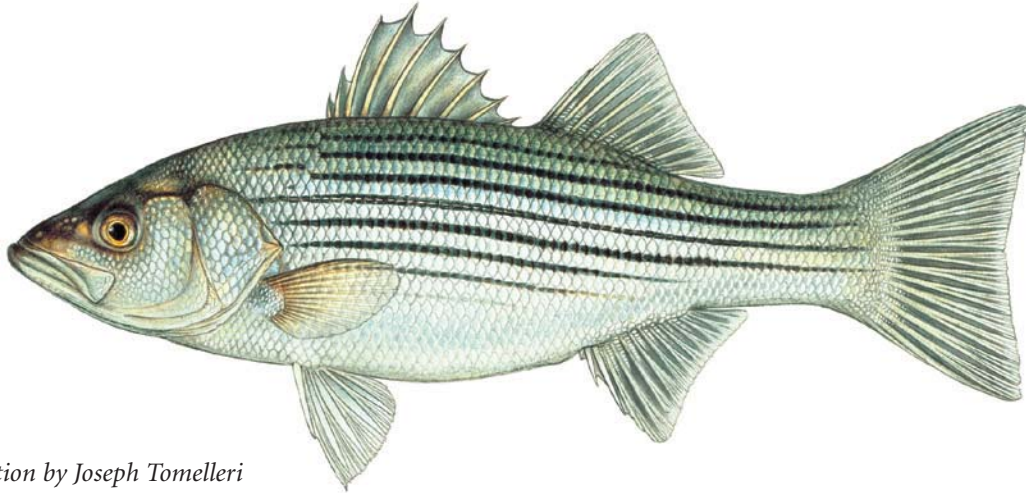


Illustration by Joseph Tomelleri

Common Names

striper, rockfish, linesides

Identifying Features

Striped bass have a dark, olive-green to bluish-black back and silvery-white sides and belly. There are 7 to 8 black, unbroken, horizontal stripes along the side.

TYPICAL ADULT

Length

Up to 35 inches (sometimes up to 48 inches)

Weight

Up to 37 pounds (sometimes up to 100 pounds)

Life span

Up to 9 years

Habitat

Striped bass are an anadromous species of fish, inhabiting both fresh water and salt water, depending on the time of year. Striped bass live in the Atlantic and Pacific coastal waters and the Gulf of Mexico but enter freshwater streams to spawn.

Feeding Behavior

Striped bass feed on threadfin, gizzard shad, crustaceans, insects, and bottom organisms. The heaviest feeding times are at dawn and dusk.

Reproductive Behavior

WHEN: Spring

PREFERRED WATER TEMPERATURE: 55-60°F

HOW: Adults swim up tributary streams and spawn below dams or natural obstructions such as rock formations. The female deposits eggs in light to moderate current. The moving water keeps the eggs afloat until they hatch. Adults do not guard the eggs.

Did you know?

Striped bass move in packs or schools to feed, with all the members tending to feed at the same time. Up to 50 striped bass may spawn together.

Tarpon

Megalops atlanticus



Illustration by Joseph Tomelleri

Common Names

silver king, silverfish, tarpum

Identifying Features

Tarpon have a narrow band of dark blue-green on their back and a single dorsal fin with an elongated ray. They also have a prominent upturned lower jaw and silver sides with large scales.

TYPICAL ADULT

Length

Up to 96 inches

Weight

Up to 80 pounds

Life span

Up to 16 years

Habitat

Tarpon inhabit shallow, warm Atlantic and Gulf coastal waters and estuaries (water where a river meets the sea), including lagoons, mangrove swamps, and rivers.

Feeding Behavior

Tarpon feed on sardines, anchovies, and crustaceans.

Reproductive Behavior

WHEN: Spring or summer

PREFERRED WATER TEMPERATURE: 72-82°F

HOW: Along the ocean floor, the female tarpon lays more than 12 million eggs.

Did you know?

Adult tarpon swallow their food whole. Tarpon need to swallow air and are often seen "rolling" on the surface gulping for air.

Walleye

Stizostedion vitreum vitreum

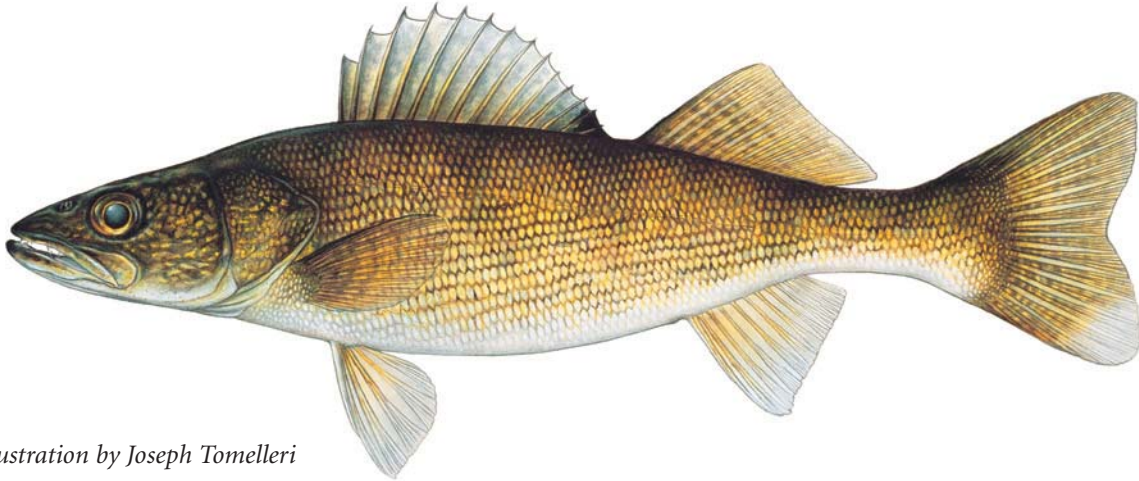


Illustration by Joseph Tomelleri

Common Names

walleyed pike, pickerel, jackfish, dorè

Identifying Features

Walleye have a milky cast to their eyes. They have a long, round, olive body that has gold flecks on the sides with a white tip to the lower fork of the tail. There is a distinct black blotch on the rear end of the first dorsal fin.

TYPICAL ADULT

Length

Up to 30 inches

Weight

Up to 10 pounds

Life span

Up to 26 years

Habitat

Walleye are most numerous in large, cool, windswept lakes with low to moderate clarity. They also live in large rivers.

Feeding Behavior

Walleye most prefer other fish, but also eat aquatic insects, leeches, crayfish, snails, and larval salamanders. They normally feed in dim light.

Reproductive Behavior

WHEN: Spring

PREFERRED WATER TEMPERATURE: 45-50° F

HOW: No nests are built. The female scatters eggs randomly along a shallow, windswept shoreline with rubble bottom. Adults do not guard the eggs or fry (young).

Did you know?

Walleye are named for their prominent, milky eyes. Blue walleye were once common in Lake Erie and Lake Ontario but are now thought to be extinct.

Weakfish

Cynoscion regalis

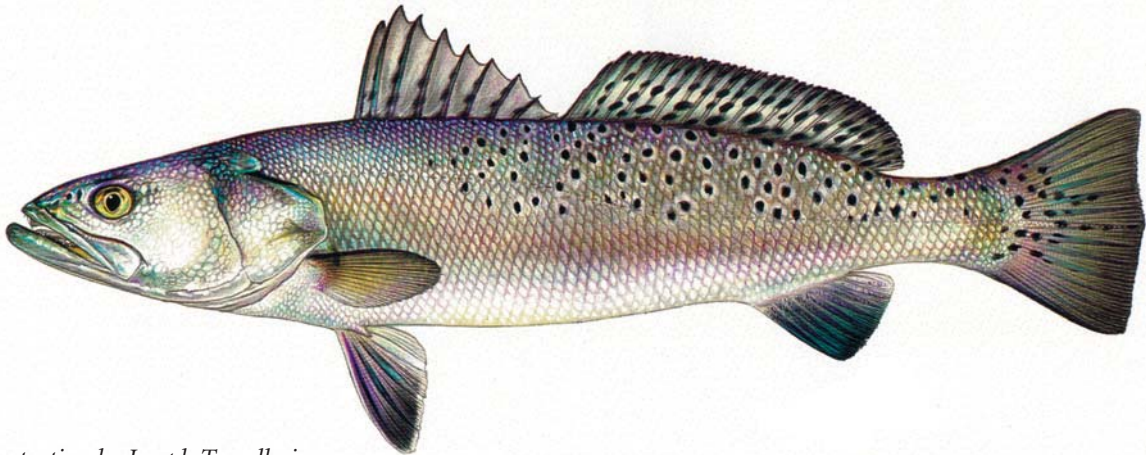


Illustration by Joseph Tomelleri

Common Names tide runner, sea trout, yellow fin trout, yellow mouth, squeteague, gray trout, gray weakfish

Identifying Features Weakfish have a projecting lower jaw with a soft mouth. They have an olive-green back with dark spots above copper sides. Their fins have a yellow tinge.

TYPICAL ADULT

Length Up to 36 inches

Weight Up to 18 pounds

Life span Up to 12 years

Habitat While not spawning, weakfish live in sandy, shallow waters of the temperate seas off the North Atlantic coast, especially around the mid-Atlantic states.

Feeding Behavior Weakfish eat other fish and crustaceans, especially crab and shrimp.

Reproductive Behavior WHEN: Spring or summer

PREFERRED WATER TEMPERATURE: 56-68° F

HOW: During spawning season, weakfish migrate north and inshore, entering sounds, bays, and estuaries (water where a river meets the sea).

The male makes a croaking or drumming sound to attract females. The female broadcasts eggs randomly. The eggs hatch within 48 hours.

Did you know?

Weakfish have a delicate mouth structure. Often, hooks from fishing poles will pull out their jaws. This is how weakfish got their name.

White Bass

Morone chrysops

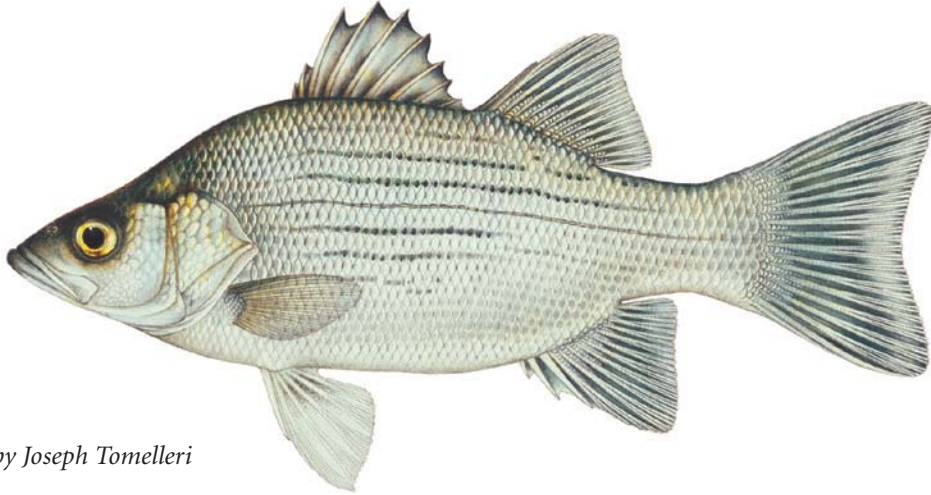


Illustration by Joseph Tomelleri

Common Names

silver bass, striper, sand bass, whitey, dwarf striper

Identifying Features

White bass have a blue-gray back with silver sides that have about 5 to 7 bold, horizontal stripes above the lateral line. White bass have separated dorsal fins and a protruding lower jaw.

TYPICAL ADULT

Length

Up to 15 inches

Weight

Up to 3 pounds

Life span

Up to 6 years

Habitat

White bass inhabit large lakes connected to major river systems or big rivers with moderate current and are found throughout the Midwest, including the Great Lakes and St. Lawrence River, as well as some southern and southwestern states down to the Gulf of Mexico. The preferred water temperature is 65-75°F.

Feeding Behavior

White bass prefer shad and emerald shiners but will eat any fish available, as well as insect larvae and crayfish. Their heaviest feeding times are at dawn and dusk.

Reproductive Behavior

WHEN: Spring

PREFERRED WATER TEMPERATURE: 58-64°F

HOW: The white bass swim upstream in rivers or shoal lakes to a barrier, such as a dam, and drop eggs in light current, over weeds, debris, and rock. The adults abandon the eggs. Up to a million eggs are spawned.

Did you know?

The white bass is one of only three members of the bass family found in Oklahoma.

White Crappie

Pomoxis annularis



Illustration by Joseph Tomelleri

Common Names Identifying Features

papermouth, speckled perch, bachelor perch, silver bass, calico bass
White crappies have an iridescent, olive-green back with spots arranged in 7-9 vertical bars. Their sides are silvery with emerald and purple reflections.

TYPICAL ADULT

Length	Up to 15 inches
Weight	Up to 2 pounds (sometimes up to 5 pounds)
Life span	Up to 8 years
Habitat	White crappies inhabit natural and man-made lakes and slow-moving, silt-laden rivers, as well as weedy ponds and lakes.
Feeding Behavior	White crappies feed on suspended plankton (passively floating, minute animal and plant life), small fish, fish eggs, and larval aquatic insects.
Reproductive Behavior	WHEN: Spring PREFERRED WATER TEMPERATURE: 62-65°F HOW: White crappies nest in colonies. The male guards the nest and fry (young).

Did you know?

White crappies can survive in very warm water temperatures, sometimes approaching 85°F.