

Reader's Guide

Grzimek's Student Animal Life Resource: Fishes offers readers comprehensive and easy-to-use information on Earth's fishes. Entries are arranged by taxonomy, the science through which living things are classified into related groups. Each entry includes sections on physical characteristics; geographic range; habitat; diet; behavior and reproduction; fishes and people; and conservation status. All entries are followed by one or more species accounts with the same information as well as a range map and photo or illustration for each species. Entries conclude with a list of books, periodicals, and Web sites that may be used for further research.

ADDITIONAL FEATURES

Grzimek's Student Animal Life Resource: Fishes includes a pronunciation guide for scientific names, a glossary, an overview of fishes, a list of species in the volume by biome, a list of species by geographic range, and an index. The volume has 225 full-color maps, photos, and illustrations to enliven the text, and sidebars provide additional facts and related information.

NOTE

Grzimek's Student Animal Life Resource: Fishes has standardized information in the Conservation Status section. The IUCN Red List provides the world's most comprehensive inventory of the global conservation status of plants and animals. Using a set of criteria to evaluate extinction risk, the IUCN recognizes the following categories: Extinct, Extinct in the Wild, Critically En-

dangered, Endangered, Vulnerable, Conservation Dependent, Near Threatened, Least Concern, and Data Deficient. These terms are defined where they are used in the text, but for a complete explanation of each category, visit the IUCN web page at <http://www.iucn.org/themes/ssc/redlists/RLcats2001booklet.html>.

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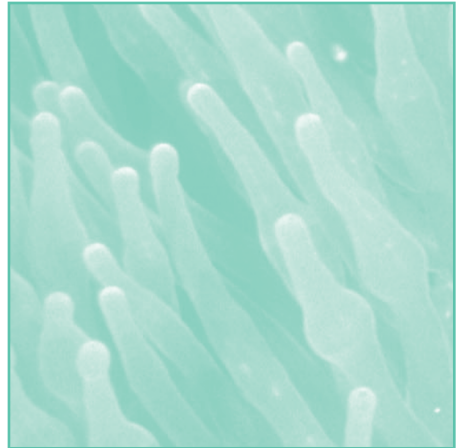
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COMMENTS AND SUGGESTIONS

We welcome your comments on *Grzimek's Student Animal Life Resource: Fishes* and suggestions for future editions of this work. Please write: Editors, *Grzimek's Student Animal Life Resource: Fishes*, U•X•L, 27500 Drake Rd., Farmington Hills, Michigan 48331-3535; call toll free: 1-800-877-4253; fax: 248-699-8097; or send e-mail via www.gale.com.

Pronunciation Guide for Scientific Names



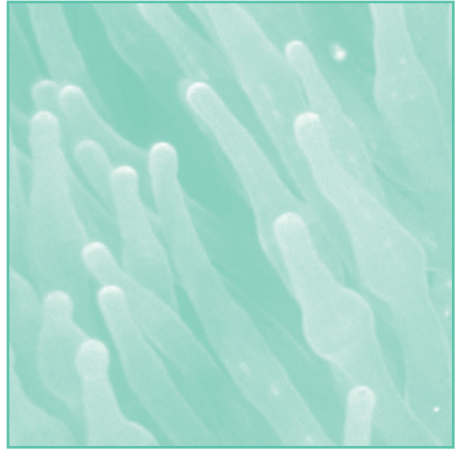
Acanthuroidei uh-KAN-thuh-ROY-dee-EYE
Acanthurus lineatus uh-KAN-thuh-ruhs LIH-nee-ah-tuhs
Acipenseriformes AS-uh-pen-SER-uh-FOR-meez
Albula vulpes ALB-yuh-luh VUL-peeZ
Albuliformes ALB-yuh-luh-FOR-meez
Alepisaurus ferox ay-LEP-uh-SOR-uhs FAIR-awks
Amia calva uh-MEE-uh KAL-vuh
Amiiformes uh-MY-uh-FOR-meez
Ammodytes americanus AM-uh-DY-deez uh-MAIR-uh-KAN-uhs
Anabantoidei AN-uh-BAN-toy-dee-EYE
Anabas testudineus AN-uh-buhs TEST-yoo-DIH-nee-uhs
Anableps anableps AN-uh-BLEPS AN-uh-BLEPS
Anchoa mitchilli AN-koh-uh MITCH-uh-ly
Anguilla rostrata ang-GWIL-uh RAH-struh-duh
Anguilliformes ang-GWIL-uh-FOR-meez
Annarrichthys ocellatus AN-ner-RIK-theez os-uh-LAH-tuhs
Anomalops katoptron uh-NOM-uh-LOPS kuh-TOP-truhn
Aphredoderus sayanus AF-ruh-DOD-uh-ruhs say-AN-uhs
Arothon hispidus AR-uh-thon HIH-spuh-duhs
Astroscopus guttatus AS-troh-SKAH-puhs guh-TAH-tuhs
Atheriniformes ATH-uh-RIN-uh-FOR-meez
Atigonia rubescens AD-uh-GAH-nee-uh ROO-buh-sinz
Aulopiformes all-OP-uh-FOR-meez
Austrolebias nigripinnis AH-stroh-LEE-bee-uhs nih-GRIP-ih-nis
Balistoides conspicillum BAH-luh-STOY-deez kon-SPIS-uh-lum
Bathypterois quardrifilis buh-THIP-tuh-roy kwah-DRIF-uh-lis

Batrachoidiformes BAT-truh-KOY-duh-FOR-meez
 Beloniformes BEL-uh-nuh-FOR-meez
Benthoosema pterotum ben-THOS-uh-muh tair-AH-dum
 Beryciformes BY-ris-uh-FOR-meez
Betta splendens BED-uh SPLEN-dunz
 Blennioidei BLEH-nee-OY-dee-EYE
Bothus lunatus BAH-thuhs LOO-nah-tuhs
Botia macracanthus boh-TEE-uh MAK-ruh-KAN-thuhs
 Callionymoidei kuh-LON-ee-MOY-dee-EYE
Campostoma anomalum KAM-puh-STOH-muh uh-NOM-uh-lum
Canthigaster solandri KAN-thih-GUH-ster SOH-lan-dry
Carapus bermudensis KAR-uh-puhs BER-myoo-DEN-sis
Carcharodon carcharias kar-KAR-uh-don kar-KAR-ee-uhs
 Cephalaspidomorphi SEF-uh-lah-SPIH-duh-mor-fee
Chaca chaca KAH-suh KAH-suh
Channa striata KON-nuh STRY-ah-tuh
 Channoidei kan-NOY-dee-EYE
Chanos chanos KAH-nohs KAH-nohs
 Characiformes kuh-RAS-uh-FOR-meez
Chauliodus sloani koh-LEE-uh-duhs SLOH-ny
Cheilopogon pinnatibarbatus californicus ky-LOP-uh-gon pih-NAT-uh-BAR-buh-tuhs kal-uh-FORN-uh-kuhs
 Chondrichthyes kon-DRIK-thee-EEZ
 Clupeiformes KLOO-pee-uh-FOR-meez
Coryphaena hippurus KOR-uh-FEE-nuh hih-PER-uhs
 Cypriniformes sy-PRIN-uh-FOR-meez
 Cyprinodontiformes sy-PRIN-uh-DON-tuh-FOR-meez
Dactyloptena orientalis DAK-tuh-LOP-tuh-nuh or-ee-EN-tuh-lis
Eigenmannia lineata EYE-gun-muh-NEE-uh lin-EE-ah-tuh
Electrophorus electricus uh-LEK-TROF-uh-ruhs uh-LEK-truh-cuhs
 Elopiformes uh-LOP-ih-FOR-meez
Enneapterygius mirabilis EN-ee-OP-tuh-RIH-jee-uhs- MER-ah-buh-lis
Epinephelus striatus EP-uh-NEF-uh-luhs stry-AH-tuhs
 Esociformes uh-SOS-uh-FOR-meez
Esox masquinongy EE-sawks mas-KWIH-nun-jee
 Gadiformes GAD-uh-FOR-meez

Gadus morhua GAD-uhs mor-HOO-uh
Galeocerdo cuvier GAL-ee-oh-SAIR-duh koo-VEE-air
Gasteropelecus sternicla GAS-ter-RAH-puh-LEE-suhs STER-
nik-luh
Gasterosteiformes GAS-ter-RAH-stee-uh-FOR-meez
Gasterosteus aculeatus GAS-ter-RAH-stee-uhs ak-kyoo-LEE-
ah-tuhs
Gobiesocodei goh-BY-uh-SOS-uh-dee-EYE
Gobioidei GOH-bee-OY-dee-EYE
Gonorynchiformes GON-uh-RIN-kuh-FOR-meez
Gymnothorax funebris JIM-nuh-THOR-aks FYOO-neh-bruhs
Gymnotiformes jim-NOD-uh-FOR-meez
Hippocampus erectus HIP-uh-KAM-puhs EE-rek-tuhs
Hippoglossus stenolepsis HIP-uh-GLOS-uhs STEN-uh-LEP-sis
Histrio histrio HIS-tree-oh HIS-tree-oh
Huso Huso HYOO-soh HYOO-soh
Hydrocynus goliath hy-DRAH-sih-nuhs guh-LY-uth
Hydrolagus colliei hy-DRALL-uh-guhs kuh-LEE-eye
Hypophthalmichthys molitrix hy-POP-thal-MIK-theez MOL-
uh-triks
Icosteoides EYE-kah-STEE-uh-dee-EYE
Icosteus aenigmaticus eye-KAH-stee-uhs ee-nig-MAH-tuh-
cuh
Ictalurus punctatus IK-tuh-LOOR-uhs PUNK-tah-tuhs
Labroidei LAB-roy-DEE-eye
Labroides dimidiatus LAB-roy-DEEZ dih-MID-ee-AH-tuhs
Lampridiformes lam-PRID-uh-FOR-meez
Latimeria chalumnae LAD-uh-MAIR-ee-uh kuh-LUM-nee
Lepidosiren paradoxa LEP-uh-dah-SUH-rin PAIR-uh-DOK-
suh
Lepisosteiformes LEP-uh-SOS-tee-uh-FOR-meez
Lepisosteus oculatus LEP-uh-SOS-tee-uhs ah-KYOO-lah-tuhs
Leuresthes tenuis LOOR-es-teez teh-NYOO-is
Lophiiformes LAH-fee-uh-FOR-meez
Lophius americanus LAH-fee-uhs uh-MAIR-uh-KAN-uhs
Macquaria ambigua muh-KWAR-ee-uh am-BIG-yoo-uh
Makaira nigricans muh-KY-ruh nih-GRIH-sunz
Malacosteus niger MAL-uh-KOS-tee-uhs NY-ger
Manta birostris MAN-tuh BY-ros-truhs
Megalops atlanticus MEG-uh-lops at-LAN-tuh-kuhs

Meiacanthus grammistes MAY-uh-KAN-thus GRAM-uh-steez
Melanogrammus aeglefinus MEL-uh-NAH-gruh-muhs ee-
gluh-FIN-uhs
Micropterus salmoides my-KROP-tuh-ruhs sal-MOY-deez
Mirapinna esau muh-ROP-uh-nuh EE-sou
Mugil cephalus MYOO-jil SEF-uh-luhs
Mugiliformes myoo-JIL-uh-FOR-meez
Myctophiformes mik-TOF-uh-FOR-meez
Myripristis jacobus mir-ih-PRIS-tuhs juh-KOH-buhs
Myxine glutinosa MIK-suh-nee gloo-tuh-NOH-suh
Myxini MIK-suh-ny
Nemateleotris magnifica NEM-uh-TEL-ee-OH-truhs mag-
NIH-fuh-kuh
Notothenioidei NOH-duh-thuh-NOY-dee-EYE
Oncorhynchus tshawytscha ON-koh-RIN-kuhs chuh-WIH-
chuh
Ophidiiformes OFF-uh-DEE-uh-FOR-meez
Ophiodon elongatus off-FEE-oh-don ee-lon-GAH-tuhs
Opsanus tau op-SAH-nuhs TOU
Osmeriformes oz-MER-uh-FOR-meez
Osteoglossiformes OS-tee-oh-GLOS-uh-FOR-meez
Oxyeleotris marmorata AWK-see-uh-LEE-oh-truhs mar-
MOH-rah-tuh
Pantodon buchholzi PAN-tuh-don byoo-KOHL-zy
Paradiplogrammus bairdi PAIR-uh-dip-LOG-ruh-muhs BAIR-dy
Peprilus triacanthus PEP-rih-luhs TRY-uh-KAN-thuhs
Perciformes PER-suh-FOR-meez
Percoidei per-KOY-dee-EYE
Percopsiformes per-KOP-suh-FOR-meez
Periophthalmus barbarus PAIR-ee-op-THAL-muhs BAR-buh-
ruhs
Petromyzon marinus PEH-troh-MY-zun muh-REE-nuhs
Phycodurus eques fy-KOH-der-uhs EK-weez
Plecoglossus altivelis PLEH-koh-GLOS-uhs al-TIV-uh-lis
Pleuronectiformes PLER-oh-NEK-tuh-FOR-meez
Polymixia nobilis PALL-ee-MIK-see-uh NOH-buh-luhs
Polymixiiformes PALL-ee-MIK-see-uh-FOR-meez
Polypteriformes PALL-up-TER-uh-FOR-meez
Polypterus ornatipinnis PALL-up-TER-uhs OR-nuh-TIP-ih-nihs
Pterois volitans TAIR-oy VALL-uh-tunz

Pterophyllum scalare TAIR-oh-FY-lum skuh-LAR-ee
Pygocentrus nattereri PY-goh-SEN-truhs nad-uh-RAIR-eye
Raja eglanteria RAH-juh eg-LON-tuh-REE-uh
Regalecus glesne ruh-GAL-uh-kuhs GLEZ-nee
Retropinna semoni ruh-TROP-ih-nuh SEH-muh-ny
Saccopharyngiformes SAK-oh-fuh-RIN-juh-FOR-meez
Saccopharynx ampullaceus SAK-oh-FAR-inks amp-yoo-LAY-see-uhs
Salmo salar SAL-moh SUH-lar
Salmoniformes sal-MON-uh-FOR-meez
Salvelinus fontinalis sal-vuh-LIN-uhs fon-tih-NALL-lis
Sarcopterygii sar-KOP-tuh-RIJ-ee-EYE
Scarus iseri SKAR-uhs EYE-suh-ry
Scombroidei skam-BROY-dee-EYE
Scorpaeniformes skor-PEEN-uh-FOR-meez
Siluriformes sih-LOOR-uh-FOR-meez
Solea solea soh-LEE-uh soh-LEE-uh
Sphyræna barracuda sfer-EE-nuh BAIR-uh-KOO-duh
Stephanoberyciformes stuh-FON-uh-BAIR-ris-uh-FOR-meez
Stomiiformes STOH-mee-uh-FOR-meez
Stromateoidei STROH-muh-tee-OY-dee-EYE
Strongylura exilis stron-juh-LOOR-uh ek-SIH-luhs
Strophidon sathete STROF-uh-don SATH-uh-dee
Synbranchiformes sin-BRAN-kuh-FOR-meez
Synbranchus marmoratus sin-BRAN-kuhs MAR-muh-RAH-tuhs
Tetraodontiformes TEH-truh-oh-DON-tuh-FOR-meez
Thunnus thynnus THUH-nuhs THY-nuhs
Tomicodon humeralis toh-MIK-uh-don HYOO-muh-RAL-is
Toxotes jaculatrix TAWK-suh-teez juh-KYOO-luh-triks
Trachinoidei TRAK-uh-NOY-dee-EYE
Trematomus bernacchii treh-muh-TOH-muhs ber-NOTCH-ee-EYE
Vandellia cirrhosa van-duh-LEE-uh ser-OH-suh
Xiphophorus hellerii ZIF-uh-FOR-uhs huh-LOOR-ee-EYE
Zanclus cornutus ZAN-kluhs kor-NUH-tuhs
Zebrosoma flavescens ZEE-bruh-SOH-muh fluh-VES-unz
Zeiformes ZEE-uh-FOR-meez
Zoarcés americanus zoh-AR-seez uh-MAIR-uh-KAN-uhs
Zoarchoidei zoh-ar-KOY-dee-EYE



Words to Know

A

Adipose fin: Small fleshy rayless fin located behind the dorsal fin and in front of the caudal fin.

Algae: Tiny plantlike growths that live in water and have no true roots, stems, or leaves.

Amphibian: An animal that spends part of its life in water and part on land and has an internal skeleton, such as frogs and salamanders.

Anal fin: The unpaired fin that runs along the bottom of the body on the belly toward the rear.

Aquatic: Living in water.

B

Barbels: Long, thin feelers used for the senses of taste, touch, and smell, depending on the animal.

Buoyant: Capable of floating.

C

Canal: A tube-shaped passage or channel.

Cartilage: Tough, bendable tissue that forms part or all of the skeleton, depending on the animal.

Caudal fin: The fin at the end of the body; also called the tail fin; generates much of the thrust in swimming.

Caviar: Salted, unfertilized sturgeon eggs, eaten as a delicacy.

Clutch: A group of eggs.

Contract: Make smaller by drawing together; shrink.

Critically Endangered: Facing an extremely high risk of extinction in the wild.

Crustacean: An animal that lives in water and has a soft, segmented body covered by a hard shell, such as hermit crabs and shrimps.

D

Digestive tract: Part of the body that changes food into energy.

Dorsal fin: The unpaired fin that runs along the top of the body along the center and toward the back.

E

Eggs: The reproductive cells that are made by female animals and that are fertilized by the sperm, or reproductive cells, of male animals.

Endangered: Facing a very high risk of extinction in the wild.

Estivation: A period of inactivity during dry spells or during the summer.

Estuary: The wide part at the lower end of a river, where the river meets the sea.

Extinct: No longer living.

Extinct in the Wild: Known only to survive in cultivation, in captivity, or as a naturalized population well outside the past range.

F

Fan: To move water over eggs or newly hatched young animals to clean them and give them oxygen.

Fertilization: The joining of egg and sperm to start development.

Forage: To search for food.

Fossils: The remains, or parts, of animals that lived long ago, usually found set into rock or earth.

G

Genital: An external reproductive organ.

Gestation: Development of young inside a female animal.

Gill rakers: Comblike structures that sift plankton from water.

Gills: Organs for obtaining oxygen from water.

I

Incisors: Front cutting and chewing teeth in mammals.

Ingest: Swallow or take in as food.

Invertebrate: An animal that lacks a backbone, such as an insect, spider, or earthworm.

L

Larva: The early, or young, form of an animal, which must go through metamorphosis, or certain changes in form, before becoming an adult.

Lateral line: A series of pores and tiny tubes along each side of the body, used for sensing vibrations.

Least Concern: Does not qualify for a threatened category.

M

Metamorphosis: The changes in form that some animals make to become adults, such as tadpole to frog.

Microscopic: Too small to be seen with the eye.

Migrate: To move from one area or climate to another to breed or feed.

Mollusk: An animal with a soft, unsegmented body usually covered by a shell, such as a snail or a clam.

Mottled: Spotted with varying colors.

N

Navigation: Act of setting a course for ship or aircraft.

Near Threatened: Likely to qualify for a threatened category in the near future.

Nocturnal: Active at night.

Nomadic: Moving from place to place without a fixed home.

O

Obstacles: Things that block the way.

Opportunistic: Taking advantage of what is available.

Ovary: Organ that produces eggs.

P

Parasite: An animal or plant that lives on another animal or plant without helping it and often harming it.

Pectoral fins: The front pair of fins, corresponding to the front legs of four-footed animals; used to turn and maneuver while swimming.

Pelvic fins: The rear pair of fins, corresponding to the rear legs of four-footed animals.

Plankton: Microscopic plants and animals that drift in bodies of water.

Predator: An animal that hunts and kills other animals for food.

Prey: An animal that is hunted and caught for food.

R

Ray: One of the series of supporting rods inside a fin.

S

Scales: Flat, rigid plates that act as part of a body covering.

Scavenger: Animal that feeds on dead or dying animals.

Snout: Nose area.

Solitary: Alone.

Spawn: To produce or release eggs.

Species: A group of animals that share many traits and can mate and produce young with one another.

Sperm: The reproductive cells that are made by male animals and that fertilize the eggs of female animals.

Stagnant: Still and stale.

Subtropical: Referring to a climate with an average annual temperature 55°F to 68°F (13°C to 20°C).

Swim bladder: An internal sac that fishes use to control their position in the water; also called the gas bladder.

T

Taper: To grow narrower toward one end.

Transparent: See-through, clear.

Trawler: Fishing boat that drags nets to make a catch.

Tropical: Referring to a climate with an average annual temperature more than 68°F (20°C).

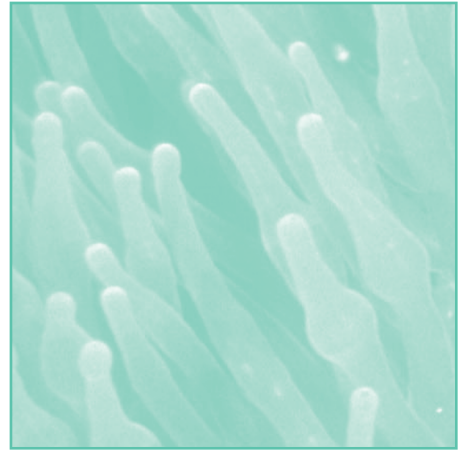
V

Vertebrae: The bones that make up the spinal column.

Vertebrate: An animal that has a backbone.

Vulnerable: Facing a high risk of extinction in the wild.

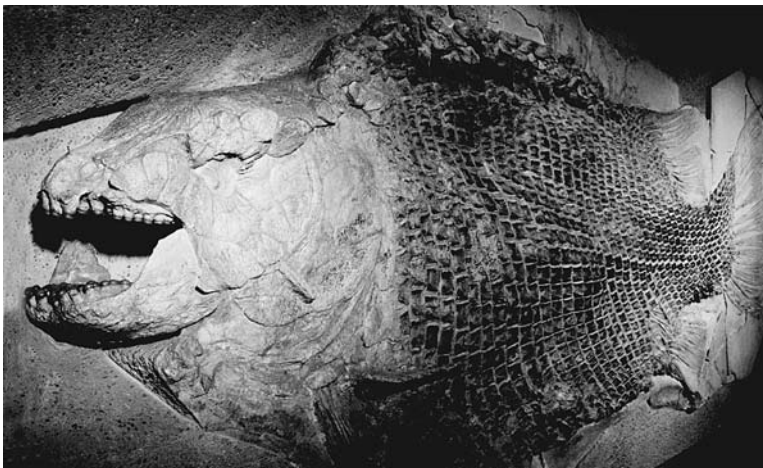
Getting to Know Fishes



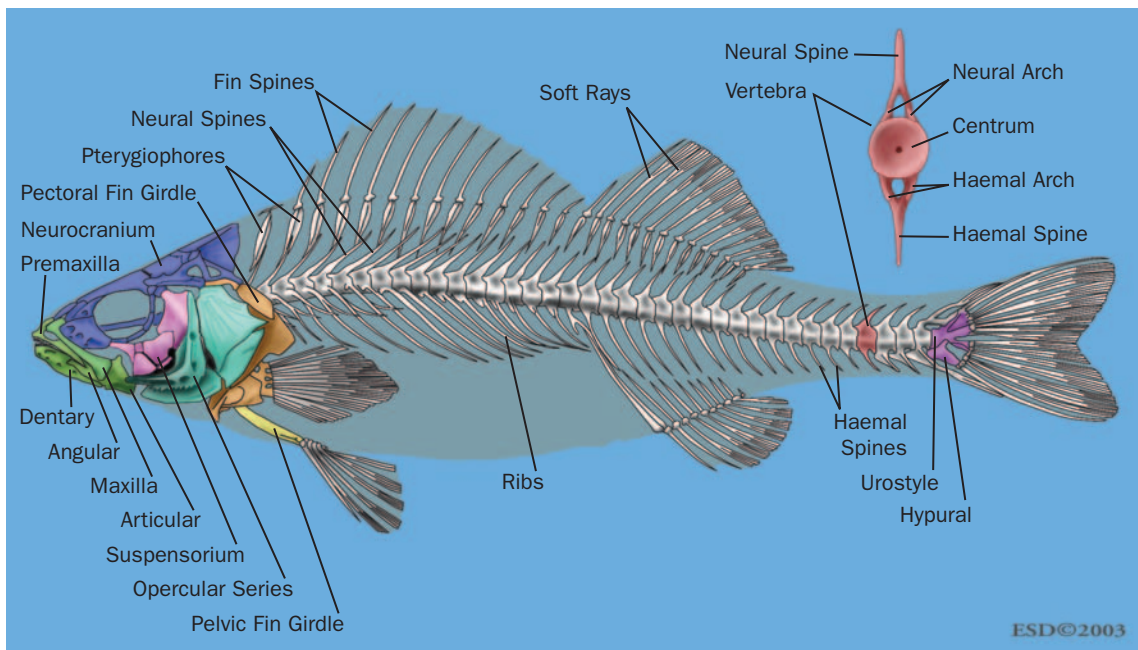
PHYSICAL CHARACTERISTICS

Fossil records show that fishes have been in existence for 438 million years. They were the first vertebrates (VER-teh-brehts), or animal with a backbone. A fish is a cold-blooded vertebrate that lives primarily in water and has a skull, gills, and fins. Cold-blooded means the animal's internal temperature changes with its surroundings.

There are two types of vertebrates: those with jaws and those without jaws. The only jawless vertebrates are fishes: lampreys (LAM-prees) and hagfishes. Among the many vertebrates with jaws, two types are fishes. One type has a skeleton made of cartilage (KAR-teh-lej), a tough but bendable tissue. The other type, 95 percent of fishes, has a skeleton made of bone.



Fossil records show that fishes have been in existence for 438 million years. (Jonathan Blair/Corbis. Reproduced by permission.)



Side view of the skeleton of a yellow perch. Ninety-five percent of fishes have a skeleton made of bone. (Illustration by Emily Damstra. Reproduced by permission.)

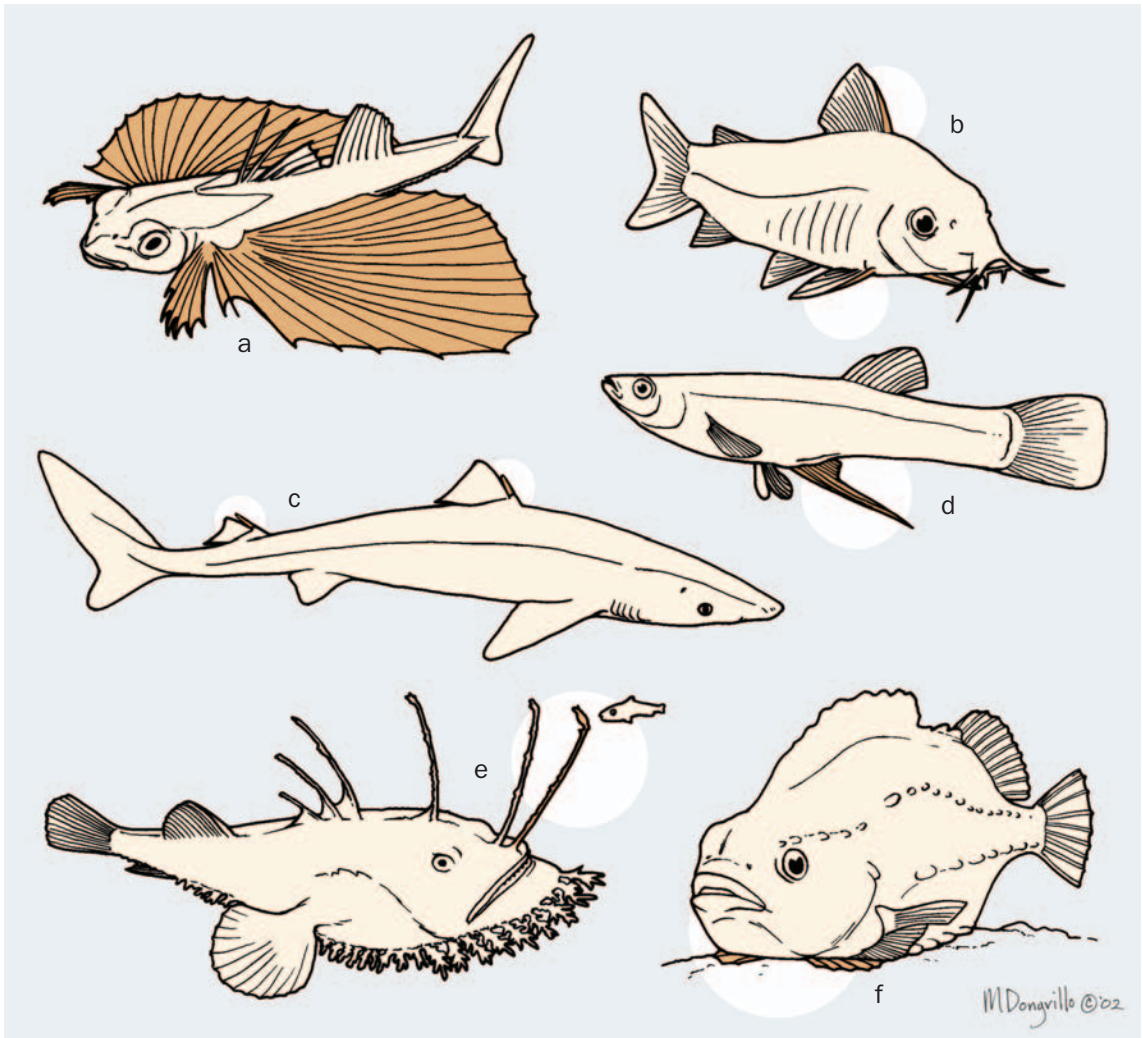
Fishes vary in length from about one-eighth inch (a few millimeters) to more than 59 feet (18 meters). Fishes can be ribbon shaped like eels, pointed at the ends like salmons, flat from top to bottom like stingrays, or flat from side to side like flounders.

Most fins consist of spines or rays connected by a thin film. Some fins do not contain rays. Fishes have two sets of paired fins, several fins on the body midline, and a tail fin.

Scales protect the skin and deeper tissues from the environment. In some fishes, scales are bony plates that form armor over the surface of the body but do not overlap. Most fishes, however, have thinner, lighter scales that do overlap. The exposed edge of overlapping scales can be smooth or rough. Some fishes do not have scales at all.

The lateral (LAT-uhr-uhl) line runs along each side of a fish's body from head to tail. This line is a series of pores and tiny tubes that sense low vibrations, or sound waves, that cannot be heard. This structure helps fishes avoid obstacles, or things that block the way, and predators, or animals that kill and eat other animals, and find food. The lateral line canals can be seen in most fishes, and in many species are open grooves.

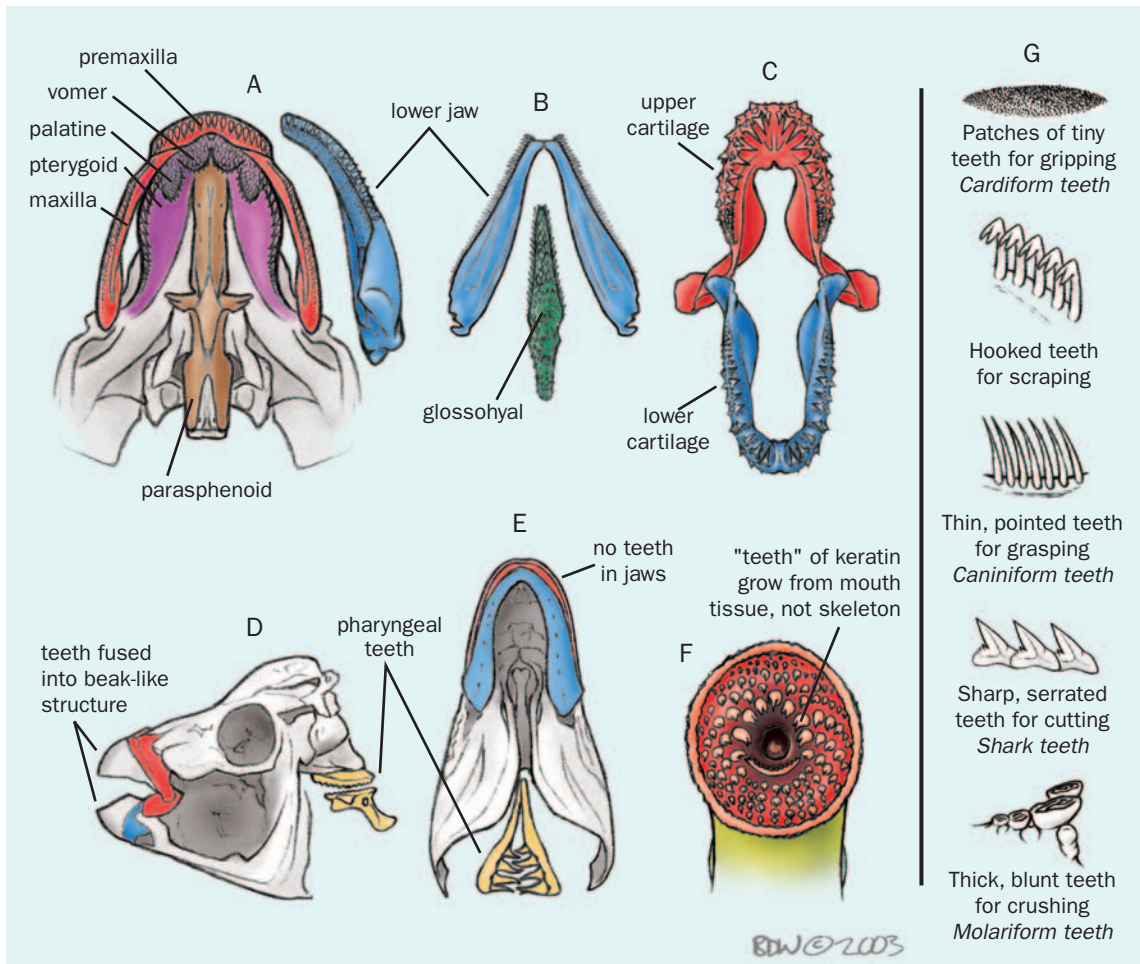
Fishes are unique in that they can move their upper jaw and their lower jaw, a feature that helps them eat large foods. The



teeth of many fish predators are triangular and sawlike for cutting through prey, or the animals hunted and caught for food. Predators that swallow prey whole have long backward-pointing teeth that grasp the prey and prevent it from struggling out of the mouth. Many fishes have teeth adapted for biting and crushing hard material, such as shells and coral.

Gills are the organs that fishes use to breathe in water. The gills are behind the head on both sides of the body. Water flows through the mouth, over the gills, and back to the outside. While water flows over the tiny threads that make up the gills, oxygen in it passes into the blood. Some fishes gulp air at the

Different fishes have developed different shaped fins: a. Sea robin; b. Catfish; c. Dogfish; d. Mosquitofish; e. Anglerfish; f. Lumpfish. (Illustration by Marguette Dongville. Reproduced by permission.)



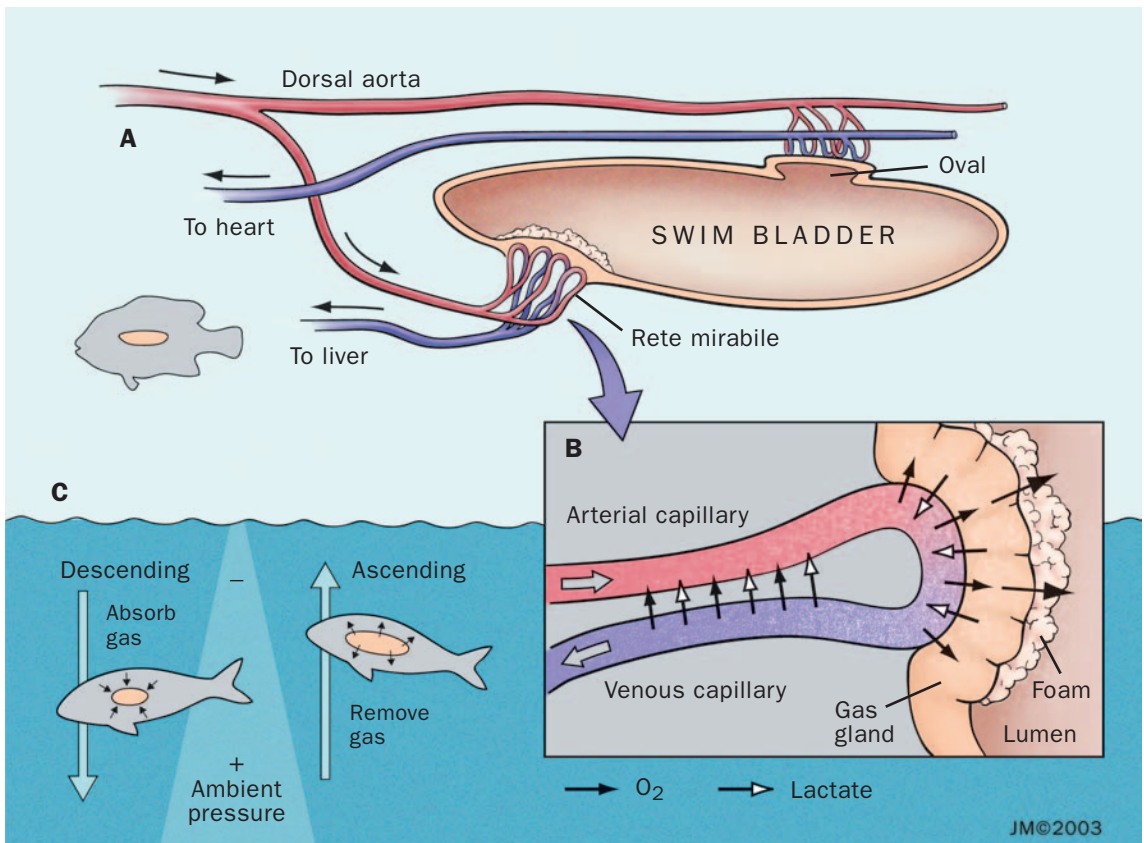
Tooth morphology and tooth-bearing structures typical of fishes: A. Bowfin; B. Mooneye; C. Sand shark; D. Parrotfish; E. Pike minnow; F. Sea lamprey; G. Tooth form and functions. (Illustration by Bruce Worden. Reproduced by permission.)

surface of the water and store it in lunglike organs. Other fishes use the swim bladder for breathing.

The swim bladder is a sac of gases in the body that helps a fish hold its position in the water. The fish rises as gas moves from the bloodstream into the swim bladder and moves down as gas leaves the swim bladder. Some fishes do not have a swim bladder. In these fishes oil in the liver keeps the fish steady. This system works because oil is lighter than water.

GEOGRAPHIC RANGE

Freshwater in lakes and rivers makes up less than 0.01 percent of the total amount of water on Earth, yet 42 percent of all fish species live there. The other 58 percent live in the oceans



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that make up 97 percent of Earth's water. (The other 2.99 percent of water is in ice, the ground, and the atmosphere.) Most ocean fishes live in the tropical and temperate zones, that is, in water 50°F (10°C) or warmer.

HABITAT

Most freshwater fishes live in streams, rivers, and lakes. Other freshwater habitats are wetlands such as marshes and swamps. Saltwater fishes live in oceans and seas near the shore, in coral reefs, on the deep ocean floor, and in open water.

DIET

Many fishes eat plankton, or microscopic (MAI-kro-SKA-pihk) plants and animals drifting in the water. The plankton is too small to be seen with the eye. Some fishes pluck the plankton particles from the water. Others take in plankton with the

The swim bladder is a sac of gases in the body that helps a fish hold its position in the water. The fish rises as gas moves from the bloodstream into the swim bladder and moves down as gas leaves the swim bladder. (Illustration by Jacqueline Mahannah. Reproduced by permission.)



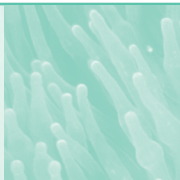
Fishes eat many different things, from microscopic plankton to sea birds, reptiles, and mammals. Here a wolf eel makes a meal of a sea urchin. (Brandon D. Cole/Corbis. Reproduced by permission.)

water that flows over their gills. Comblike structures called gill rakers strain out the plankton before it gets to the gills and divert it to the digestive tract where it is changed into food energy. Some fishes eat bottom-dwelling algae (AL-jee), which are tiny plantlike growths that live in water but have no true roots, stems, or leaves; grasses, or even seeds and fruits from plants on the shore or river bank. Other fishes feed on invertebrates, or animals without a backbone, such as insects, spiders, or earthworms, and on other fishes. Invertebrate prey may be bottom dwelling, such as clams, or be in open water, such as squids. Fish eaters actively hunt, chase, herd, grasp, stun, club, shock, ambush, bite, or engulf other fishes. Large fishes may feed on floating sea birds, reptiles, and mammals in addition to fishes. Scavengers (SKAV-ihn-jerz) feed on dead or dying animals.

Fishes swim by contracting or drawing together muscles at the bases of their fins to move the fins and by contracting their body muscles in a wave from head to tail to move the backbone. Fishes use chemical signals for navigation. For example, salmon use this sense to set a course and direction to find the stream in which they were born and to which they will return to reproduce and die. Some fishes, especially sharks, can sense barely detectable electrical currents discharged by prey. Electric signals are received in pit organs on the surface of the body.

BEHAVIOR AND REPRODUCTION

Some fishes form shoals or schools for protection from predators, finding food, migration (MY-gray-shun), and reproduction. Shoals are unorganized, often temporary groups. They may consist of different species with a changing membership and may break up and form again quickly. Schools are organized groups that form permanently or temporarily. They usually are made up of only one species.



NOT FISHES

The “shellfish” found in restaurants and fish markets is not fish at all but crustaceans (krus-TAY-shuns), such as crabs, and bivalve mollusks (MAH-lusks), such as clams. Bivalve mollusks are invertebrates with a one-part body, a muscular foot but no legs, and a shell made of calcium carbonate. Crustaceans are invertebrates with jointed legs, a shell made of chitin, and a body that has several parts.



Salmons use chemical signals to return to the stream in which they were born. (Ralph A. Clevenger/Corbis. Reproduced by permission.)

Fishes reproduce by spawning, that is, producing or releasing eggs that are then fertilized (FUR-teh-lyezd), or united with the male's sperm, outside the female's body; by laying eggs that have been fertilized inside the female's body; or by giving birth to fully developed young that have grown inside the female after the eggs have been fertilized inside her.

Some fishes emerge from the egg as larvae (LAR-vee) and must undergo many changes before becoming adults. During this phase the larvae eat plankton and are plankton. The larval



Some fishes care for their eggs and offspring. Here a male lumpfish is guarding its eggs. (Andrew J. Martinez/Photo Researchers, Inc. Reproduced by permission.)

stage ends when the skeleton, organ systems, skin color, arrangement of scales, and fins become fully developed, and the young fishes look like adults. The transition can take minutes to years.

Some fishes care for their eggs and offspring by behaviors such as nest building before spawning; mouth brooding, or keeping the eggs in a parent's mouth until hatching; nest guarding; and fanning, or using the fins to move water over eggs or hatchlings to clean them and give them oxygen.

FISHES AND PEOPLE

Fishes have been important in human life since ancient times. Fish themes appear in mythology, religion, literature, and art. Fishes are important to humans for food, employment, and income. Many people enjoy the sport of fishing and the hobby of keeping fishes in aquariums.

CONSERVATION

Fish populations are threatened by habitat alteration, such as by dam building, water pollution, overfishing, and introduction of competing species. Many people are trying to pro-



Shark fins, hanging to dry on a fishing vessel, are used for such delicacies as shark's fin soup. Federal regulators are trying to determine the impact of fishing on shark populations. (AP/Wide World Photos. Reproduced by permission.)

tect habitats and develop regulations to reduce overfishing and pollution.

FOR MORE INFORMATION

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