Kansas Master Naturalist Training

Ichthyology

1

- Chapter Goals

Demonstrate an appreciation for fishes and an interest in ichthyology.

Discuss the diversity of fishes in Kansas and demonstrate familiarity with the different groups of fishes.

Understand the relationships among various groups of fishes.

Demonstrate knowledge about the general characteristics of the major groups of fishes.

Discuss basic principles of fish behavior, physiology, and ecology and relate these principles to environmental adaptations.

2

Fishes are the most numerous vertebrates on the planet.

Estimates between 25,000 and 40,000 species

Kansas is home to 135 species of fish, 116 which are native.

19 fish species have been introduced.

No species of fish lives only in Kansas.

There are more kinds of fish that occur naturally here than in any other state farther west or directly north of Kansas.

3

Superclass Agnatha

- "without jaws"
- Lack paired appendages
- Most primitive of living fishes

Lampreys

Round mouth with rasping tongue; feed on tissue and blood of prey

Most, but not all, live as larvae in freshwater streams and migrate to sea as adults

Only one species in Kansas--Chestnut lamprey—is believed extirpated.

Hagfishes

Mainly scavengers; lack rasping mouthparts; eyespots only

Lack a larval stage and live entirely in salt water.

4

Class Chondrichthyes

Includes sharks, rays, and their relatives

Jaws and paired fins are well developed

Skeleton made of cartilage

Most are marine. There are about 1,000 living species and none live in Kansas.

Fossil shark teeth are quite common in Kansas

5

Class Osteichthyes

Bony Fishes

Lobe-finned Fishes

Lobe-finned Fishes are the ancestors of amphibians and all tetrapods

Modern lobe-finned fishes include lungfishes and coelacanths

All are freshwater. Lungfishes are found in Africa, South America, and Australia

6

Class Osteichthyes

Ray-finned Fishes

Fins are supported mainly by long, flexible rays. Modified for maneuvering, defense, and other functions.

Include the fish most familiar to Kansans. Bass, trout, perch, catfish, tuna, herring, etc.

Most numerous of all vertebrate classes. Number about 24,000 species

Occur in all habitats where fishes occur. Range from approximately 3 miles above sea level to 7 miles beneath it.

7

Bony Fish Characteristics

Endoskeleton made of bone

Skin covered by scales

Glands in the skin secrete mucus that reduces drag during swimming

Possess a lateral line system

Breathe by drawing water across gills

Swim bladder controls buoyancy of fish

8

Parts of a Fish and Their Function

EXTERNAL ANATOMY

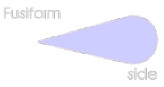
Fins: Fins move, stabilize and sometimes protect the fish. A fish may have paired fins (pectoral and pelvic fins), and unpaired fins (anal, caudal, and dorsal fins). Some fish do not have all of these fins, and their placement shows great variability.

The pelvic and pectoral fins are like the arms and legs of mammals. When they extend outward like oars (sunfish), the fish uses them for small maneuvers and in offsetting the propulsion effects of water going over the gills. When they extend outward like stubby wings, they may be used to prop the fish on the bottom or to hold on in strong currents

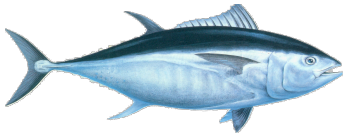
The position of the pectoral and pelvic fins provides an important means of identifying major groups of fish.

9

Fish Shapes



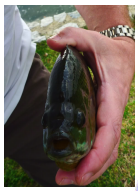
Ideal shape is torpedo-shaped or fusiform. Best shape to overcome the thickness and stickiness of water—a much denser medium than air.



The fastest fish are this shape like tuna, mackerels, and white sharks.

10

Fish that range through all depths in calm pools or lakes have compressed bodies.



Bluegill

Compressed (flattened- side to side)

Depressed (flattened-dorso ventrally)

Catfish

Fish that are flattened from top to bottom are held against stream bottoms by the force of water flowing over their backs.

11

Attenuated

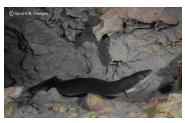
Fish that live near the surface have a slender, cigar-like form.

Gar

Walleye

Fish that occupy strong currents are narrowly spindle-shaped to allow water to slip by them with least resistance

Long, limp bodies of eels or madtoms allow them to avoid currents by wriggling into crevices between rocks



Eel

12

The most extreme shape probably goes to the flatfishes like flounders, halibuts, and soles. This group has become compressed and then lies on its side to approximate a depressed shape. One of their eyes even migrates to the other side of the head to complete their bottom lifestyle. These fishes are truly unique among vertebrates in being asymmetrical.

Notice two eyes on same side of the head

Bottom-dwelling shape

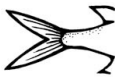
The ultimate shape of a fish is a compromise among many factors concerned with locomotion, feeding, and staying alive. Keep in mind that it is possible to examine the shape of a fish and predict where it lives.

13

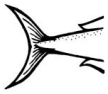
The caudal, or tail, fin is responsible for propulsion in most bony fish.

Fish with **continuous** caudal fins (dorsal, caudal, and anal fins attached) are able to swim in and around cracks and crevices.

Many continuously swimming fish have **forked** caudal fins.



Fish with **lunate** caudal fins tend to be the fastest fishes and maintain a rapid speed for long durations.



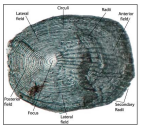
Fish with **truncate** caudal fins are usually strong, but slow, swimmers.

Fish with **rounded** caudal fins are usually strong, but slow, swimmers.

14

Scales and Skin

The skin of most bony fish is covered with bony scales that look like shingles on a roof.



It is interesting to note the annual growth rings on the scales which allow biologists to age the fish by counting the rings.

There are several types of scales in fish. Some are thick and hard like armor but most are small and overlapping. A few fish like catfish and paddlefish lack scales on the body.

15

Glands in the skin in which the scales are embedded secrete a layer of mucus that covers the entire body. Mucus helps protect fish from infection by maintaining a higher salt content than in the surrounding water. Color cells are also located in the skin.

Handling fish removes this mucus coating and can be harmful to the fish so always wet your hands before handling a fish.

16

Jaws and Teeth

Teeth may be present on the roof of the mouth and the tongue as well as on the jaws.

Some fish that "inhale" their food like minnows and suckers, lack teeth in the jaw but have "throat " teeth behind the gills that tear or crush the food as it is swallowed.

Pharyngeal teeth of a goldfish

A few kinds of fish are filter feeders like paddlefish, shad, and bigmouth buffalo. These fish have weak jaws and teeth but their gills are equipped with hair-like structures that strain food from water pumped through the mouth during respiration.

17

The mouth is an important clue to food source for bony fish.

Large
For eating whole fish or chunks of fish

Anterior
For eating in the water column

Small
For nibbling on plants and small animals

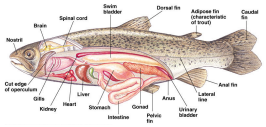
Ventral
For eating on the bottom

Dorsal
For eating near the surface

18

Internal Organs

Most fish have the same recognizable organs we are familiar with—heart, stomach, intestines, liver, spleen, kidneys, and gonads.



The sex of most fish can only be determined by looking at the gonads.

Carnivorous fish usually have a short gut with a white or silvery lining to the body cavity.

Few fish are strictly herbivores but those that feed on plants have a long, coiled intestine and a black lining in the body cavity.

19

And one organ that is not seen in other vertebrates….

is the air bladder or swim bladder

Air bladders are an outgrowth of the intestinal tract and are only found in ray-finned fishes. They can function like lungs in some fish (gars, bowfin) and can produce sounds like in drum.

Air bladders help the fish control its density. In order for fish to stay afloat in water, they must be the same density as the water.

Sharks are denser than water and sink if they stop swimming, however, they gain additional buoyancy by storing large amounts of oil in their huge livers.

20

Fish Senses

Fish possess the five major senses like all other animals.

Hearing: Sound travels better in water than in air so fish have good hearing, accomplished through the inner ear and sometimes aided by the air bladder.

Smell: The sense of smell is highly developed in many fish and some experiments have shown that some fish may recognize their home by its smell. Fish detect odors through the nares located between the eyes and in front of the snout.

Taste: Taste is an important sense for fish. It is less important, however, to those fish that locate food by sight. Unlike other vertebrates, fish can have taste buds outside the mouth. Fish that feed in darkness tend to have taste buds generously distributed over the entire head. The whiskers (barbels) of catfish are covered by taste buds.

21

Sight: Fish are near-sighted due to the optical qualities of water. This is usually no great hardship since turbidity and other factors can greatly reduce the amount of light available for distance vision. Walleye have a chyrstalline substance in the eye that aids the fish in seeing in low light conditions.

Touch and the Lateral Line System: Fish possess a sense to which humans have no comparison—that is the lateral line system. This sense has been called "distant touch". Any motion in water causes vibrations of very low frequencies and causes pressures on different parts of the surface of the fish. These pressures are detected by the lateral line, a series of tubular canals mostly under the scales.

Electricity: Some bony fish and sharks have special pores on the head that allow them to detect electrical currents. This sense aids them in navigating or finding prey in dark or muddy water.

22

Reproduction

As varied as the types of fishes.

Most fish are single sexed –either male or female– and most employ external fertilization.

The majority of fish use the broadcast method of reproduction where millions of eggs are laid , sperm is released in the water to find the eggs, and eggs float off on their own with no care.

23

Fish as Consumers

Fish fill all the consumer niches of aquatic ecosystems

Some are herbivores, some are carnivores, some are omnivores, and some are parasitic.

Some of the largest fish eat some of the smallest food.

Some fish can eat fish larger than themselves by dislocating their jaws.

A few fish eat terrestrial insects by dislodging them from plants above the surface of the water by spitting water. (Archerfish)

24

Lampreys **(Family Petromyzontidae)**

Lampreys are remnants of a group of jawless fishes that lived more than 350 million years ago. The mouth is a sucking disc since the adults are parasitic on other fishes. The chestnut lamprey is found in Kansas only in the Missouri and Kansas Rivers and it is believed to be essentially extirpated from the state.

25

Shovelnose Sturgeon **(Family Acipenseridae)**

These fish somewhat resemble sharks in their appearance esp. due to their large upper tail fin. The eggs of sturgeon are known as caviar. Sturgeon occur in rivers with broad, sandy channels like the Missouri, Kansas, and Republican rivers. The current status in Kansas is not well-known as it has disappeared from some former areas and rivers have changed substantially.

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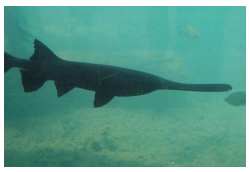

Paddlefish **(Family Polyodontidae)**

One of the most unusual fish to grace Kansas waters. A distinctive feature of this fish is its long, paddle-shaped snout whose function is still not known. Even though it is one of the largest freshwater fishes, reaching weights over 100 lbs, it feeds only on microscopic organisms that it strains from the water. Paddlefish live in large rivers and lakes but must migrate upstream to spawn. It also has no internal bones or scales which makes it easily prepared for eating.

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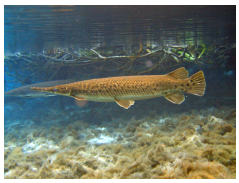


Gars **(Family Lepisosteidae)**

Gars are easily recognized by their slender, cylindrical bodies and long beaks heavily fortified with teeth. In gars, the air bladder can function as a lung allowing the gar to survive out of the water for more than an hour. These are the only fish in Kansas having toxic parts --their eggs are poisonous. Kansas is home to three species of gar.

28

Goldeyes **(Family Hiodontidae)**

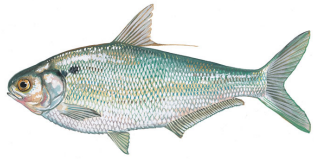
Goldeyes generally occur in large rivers and get their name from a reflective layer of tissue behind the visual cells that produces an "eye shine". Although this species is apparently stable in Milford Reservoir, it is considered scarce throughout much of its former documented range.

29

American Eel **(Family Anguillidae)**

Many kinds of eels are found in the seas, but only one species occurs in the freshwaters of North America. Eels are a brownish-colored fish with a slender, snakelike body. No eels ever begin life in Kansas--they are born more than 3000 miles away in the Atlantic Ocean (called catadromous). American Eels will disappear from the state unless the Missouri and Mississippi rivers remain free of high dams between Kansas and the Gulf.

30



Herrings **(Family Clupeidae)**

Gizzard shad is the best known member of this family in Kansas. They are important food for most of the game fish in reservoirs and can be considered the most abundant Kansas fish. Gizzard shad occupy most large streams and lakes throughout the state.

31

Minnows **(Family Cyprinidae)**

More than a third of all the different kinds of fish is Kansas are minnows and minnows are easily the most successful group of fishes in Kansas and most of the freshwaters of the world. Being small does not make a fish a "minnow"--the carp is a minnow that grows to be more than three feet. Other fish species that belong to this group include the chubs, goldfish, shiners, stonerollers, and grass carp. Minnows are the main food of most predatory fish in Kansas streams. Some characteristics of minnows are specialized throat teeth behind the gills, lack of scales on the head, presence of a lateral line, and short, triangular or squared dorsal and anal fins that lack bony spines.

32

Suckers **(Family Castostomidae)**

Suckers, as the name implies, usually have mouths located on the underside of the head with which they suck up material from the bottom. Some suckers can grow to be very large like the bigmouth buffalo which may weigh over 80 pounds.

33

Channel Catfish
Flathead Catfish
Blue Catfish
Yellow Bullhead
Black Bullhead
Brown Bullhead*
Slender Madtom
Neosho Madtom
Brindled Madtom
Stonecat
Freckled Madtom
Tadpole Madtom

Catfish **(Family Ictaluridae)**

Twelve kinds of catfish occur in Kansas and six of these are so small and secretive that they are never seen by most people. The barbels (whiskers) of the catfish are covered with hundreds of tastebuds which lets the catfish taste its food before it is in the mouth! Consequently, catfish can survive well in muddy water since they don't rely on their eyesight to find food. The sharp spines on the pectoral and dorsal fins of the catfish can cause pain like a bee sting if handled improperly.

34

Pikes **(Family Esocidae)**
Northern pike were introduced into Kansas starting in 1962 to help stabilize reservoir fish populations. Walleye, of the perch family, are sometimes mistakenly called "walleyed pike."

Trout **(Family Salmonidae)**
There are no self-sustaining populations of trout in Kansas, however, at least six species have been introduced here in the past. Stockings in some waters occur in the winter months.

Codfishes **(Family Gadidae)**
The burbot is the only codfish that occurs widely in freshwater and only extends into the northeast corner of Kansas.

35

Topminnows **(Family Fundulidae)**
The topminnows are a small group of fish that resemble the minnows. Their mouths are tilted upwards to feed just beneath the surface of the water.

Mosquitofish **(Family Poeciliidae)**
This fish was introduced into Kansas in the 1940's and it is the only Kansas fish that gives birth to young rather than lay eggs--just like pet store guppies. As the name suggests, they eat mosquito larvae.

Silversides **(Family Atherinidae)**
The brook silversides is the only widespread freshwater species in a family that is mainly marine.

Sculpins **(Family Cottidae)**
The banded sculpin is the only sculpin found in Kansas and it is found only in the Ozarkian streams of the southeast corner of the state.

36

Sea Basses or Temperate Basses **(Family Moronidae)**

This group includes the striped bass, white bass, and a hybrid of both called the "wiper". The white bass may have occurred naturally in eastern Kansas but its present abundance, along with the striped bass and wiper, are due to stocking by man.

37

Sunfishes **(Family Centrarchidae)**

There are twelve members of this well-known family in Kansas. They can be divided into three major groups: black basses (largemouth, smallmouth, and spotted bass), crappies (black and white), and the panfish like bluegill, redear, green sunfish, or orange-spotted sunfish. Sunfishes are most active in daytime. They feed on various living animals that they locate mainly by sight, so sunfishes do best in clear water.

38

Perches **(Family Percidae)**

The name perch is often misapplied to many different fish, especially the small sunfish. Members of this family are the yellow perch, walleye, sauger, and darters. Darters are small, often colorful fish, that dart from place to place. They are usually found in the riffles and runs of clear streams. True perch have two dorsal fins (the first with stiff spines and the second with soft rays) completely separated near the middle of the back, unlike sunfish where the dorsal fin is joined by membranes into a single dorsal fin and pikes and salmon have a short dorsal fin without spines.

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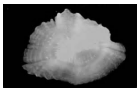

Drums **(Family Sciaenidae)**

Most of the species in this family are also marine. Drum get their name from a peculiar booming sound the fish produces by muscular action against the air bladder. Drum also contain large otoliths, sometimes called lucky stones, in the head which have been used in the making of jewelry.

40

Test Your Fish IQ

Which fish in Kansas has poisonous parts?

Which fish is the most abundant Kansas fish?

What is a madtom?

What is a wiper?

41

1. Gar—their eggs are poisonous
2. Gizzard Shad
3. Type of small catfish found in streams
4. Hybrid fish between a striped bass and a white bass

42