

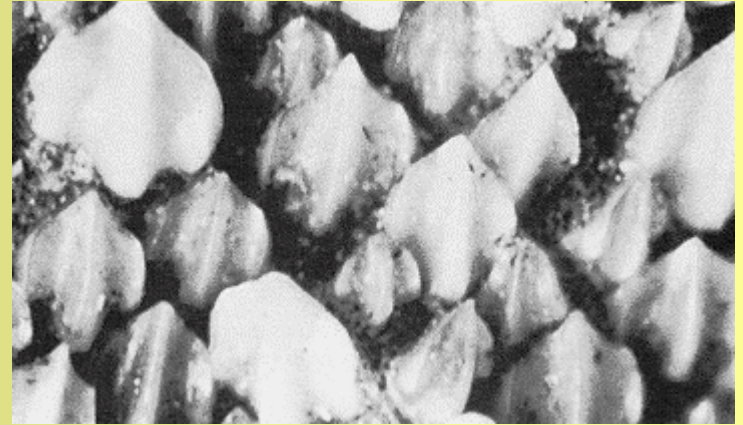
# Osteichthyes Continued

# Differences Between Osteichthyes and Chondrichthyes

	<b>Chondrychthyes</b>	<b>Bony Fish</b>
<b>Skeleton</b>	Cartilage only	Cartilage and bones
<b>Swimming</b>	Forward only	Forward and backward
<b>Buoyancy</b>	Large, oily liver	Gas-filled swim bladder
<b>Gills</b>	Slits but no gill cover	Covered gill slits
<b>Reproduction</b>	Internal fertilization	Eggs usually fertilized externally
<b>Scales</b>	Rough, sand-paper like placoid scalse	Smooth, overlapping scales

# Scale Types of Bony Fishes

- Placoid
  - not found on bony fishes;  
Chondrichthyes only
- Ganoid
  - covered by enamel-like substance called ganoin
  - diamond-shaped
  - thick
  - non-overlapping
  - fit together like tiles
  - found in primitive bony fishes such as gars



Placoid Scales



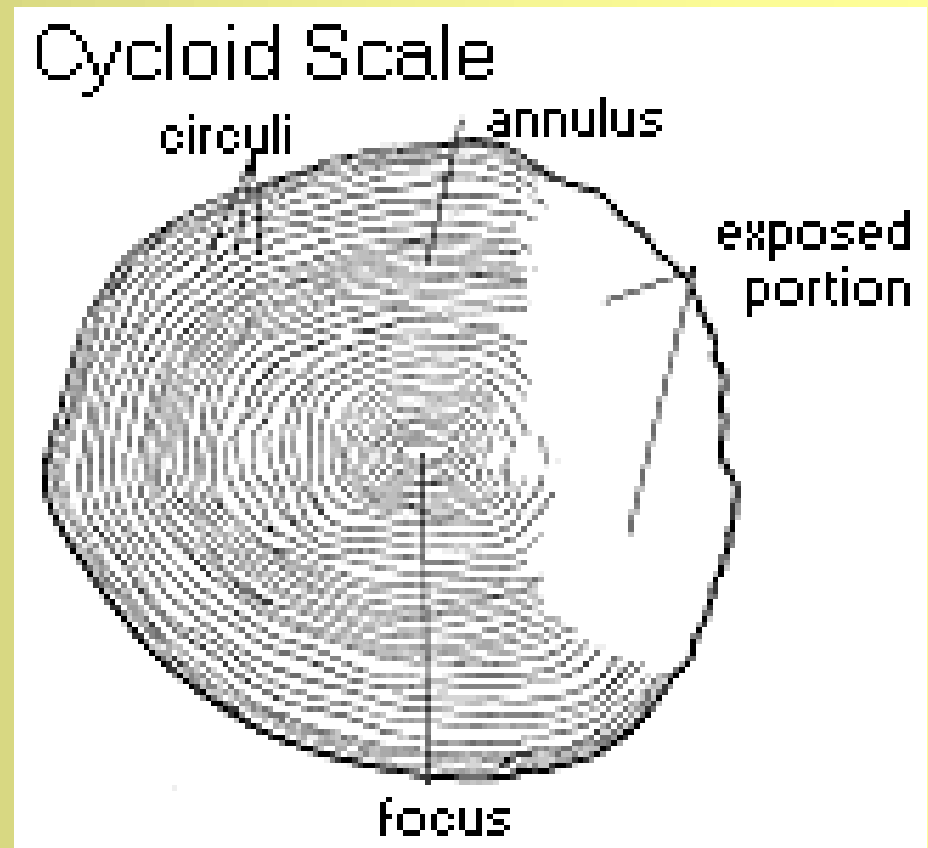
Ganoid Scales

# What does it mean when we say a trait is *primitive*?

- Primitive is a relative term that refers to the time of appearance of the character/structure in the history of the taxon under consideration
- Similar to ancestral condition
- e.g. ganoid scales found on fossils as old as 300 - 400 million years, while thin, overlapping scales appeared only about 200 million years ago

# Scale Types of Bony Fishes

- Cycloid
  - thin, flexible, and overlapping
  - grow as fish grows
  - in some species scales show growth rings, with spring and summer rings well-separated, little growth in winter
  - can use rings to determine age, growth rate



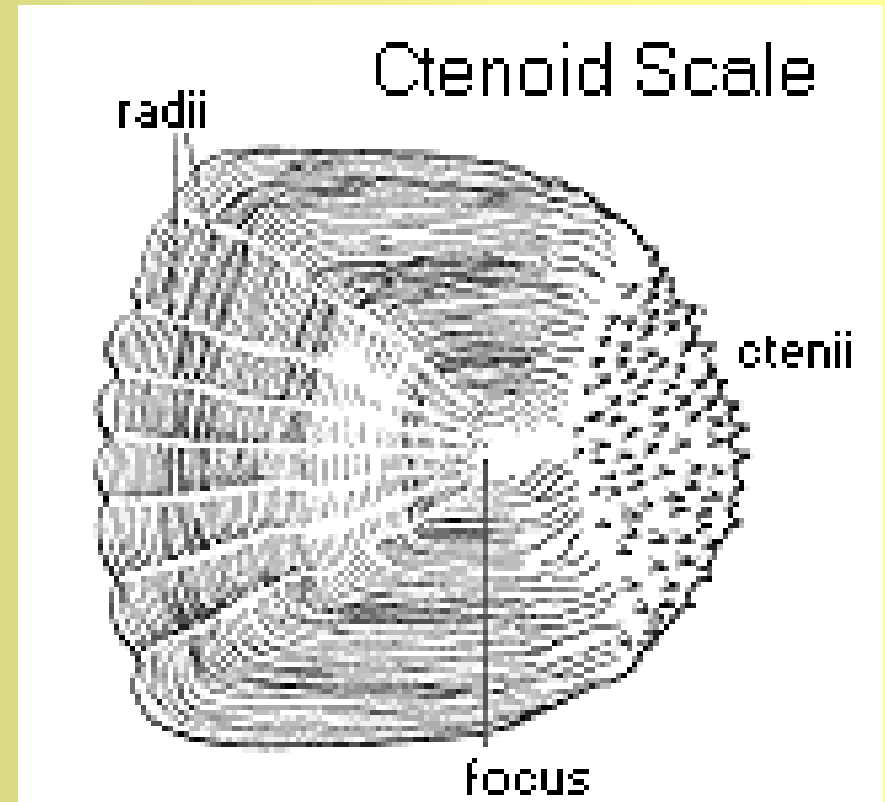
# Scale Types of Bony Fishes

- Ctenoid

- thin, flexible, and overlapping
- posterior edge has comb-like teeth
- believed to reduce drag during swimming

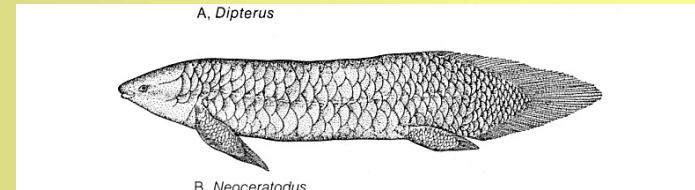
- Scaleless Fish

- some fishes sacrifice the protection of scales, presumably for added flexibility
- some catfishes, sculpin, eels

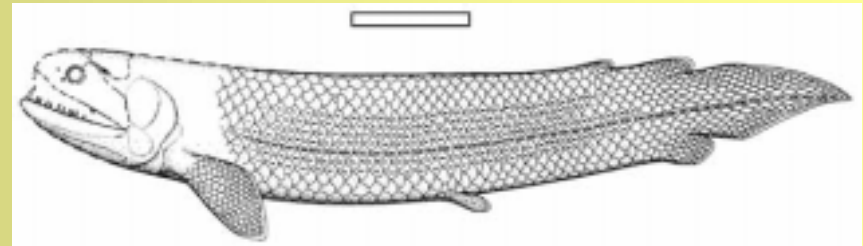


# Two Subclasses of Osteichthyes

- Subclass Sarcopterygii - fleshy finned fishes
  - Superorder Dipnoi - lungfishes
  - Superorder Crossopterygii - lobe-finned fish
    - Order Rhipidistia - extinct; rhizodonts may have been amphibian ancestors
    - Order Actinista - Coelocanth



Lungfish



Rhizodont



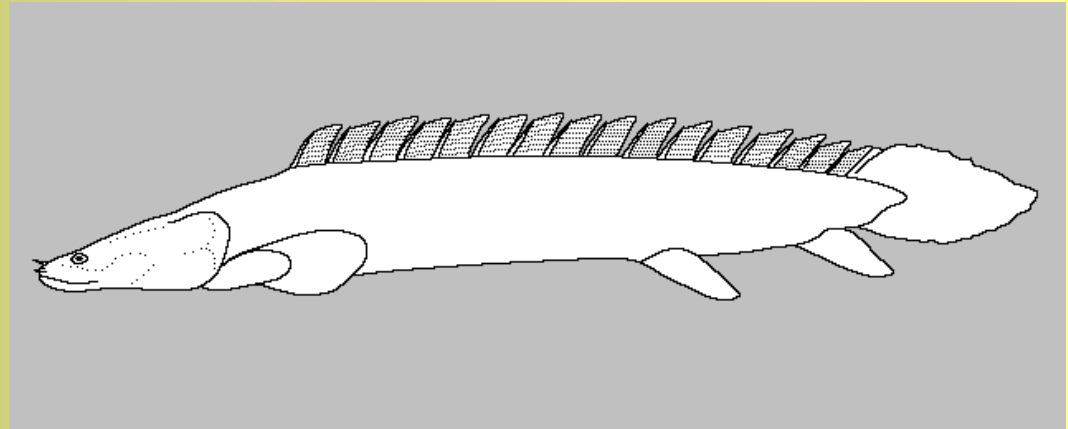
Coelocanth

# Subclass Actinopterygii

- Ray finned fish
- Considered more “advanced” than Sarcopterygii
  - increased caudal symmetry - trend toward homocercal tail
  - fin membranes with fewer rays
  - reduction in dermal armor
  - loosening of maxillary and premaxillary bones, leading to a rounded mouth
- Contains 3 Infraclasses
  - Infraclass Chondrostei
  - Infraclass Holostei
  - Infraclass Teleostei

# Infraclass Chondrostei

- Means cartilage-bone
  - same root as Chondrichthyes
- Mostly bottom dwellers that scavenge or strain food from water
- Considered the most primitive infraclass within Actinopterygii
- Something of a link between sharks and bony fish:
  - Skeleton more cartilaginous, like sharks
  - Tail heterocercal, like sharks
  - Ventral mouth
  - But... have operculum and some bone

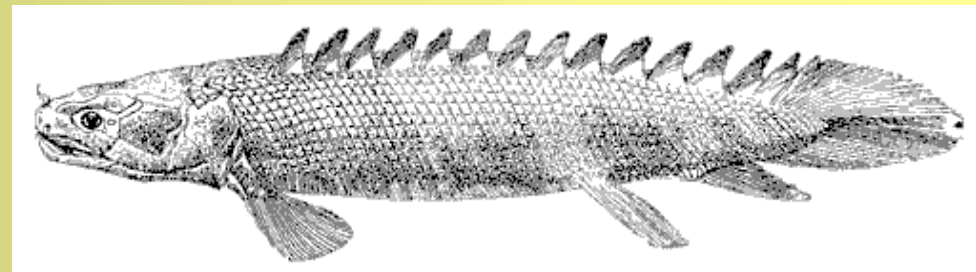


# 2 Living Orders within Infraclass Chondrostei

- Order Polypteriformes
  - the bichirs
- All live in Africa
- Note multiple dorsal finlets
- Ganoid scales
- Fins are intermediate between ray fins and fleshy fins
- Can live in stagnant water with low O<sub>2</sub>



Bichir



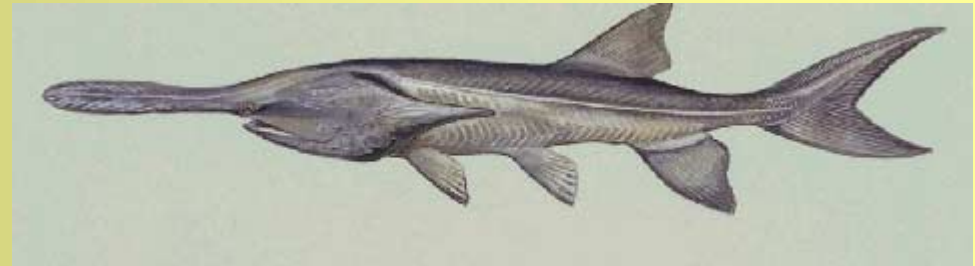
Bichir

# 2 Living Orders within Infraclass Chondrostei

- Order

## Acipenseriformes

- Family Acipenseridae
  - sturgeons
  - many are migratory
  - generally large, up to 600 kg and 6 m long
  - some live up to 60 yr
  - worms, mollusks, crustaceans, fish are common foods
  - valued for caviar
  - several endangered sp
- Family Polyodontidae
  - Paddlefish
  - freshwater sp. up to 70 kg, 2 m
  - valuable caviar



# Infraclass Holostei

- As a group, considered more primitive than Teleostei, but less primitive than Chondrostei
  - skeleton mostly bony
  - tail still somewhat heterocercal, but less so than Chondrostei
- Holostei means complete bone
- 2 Orders
  - Semionotiformes - gars
  - Amiiformes - bowfins

Note tail



Gars



Bowfins

# Order Semionotiformes

- Family Lepisosteidae

- gars
- ganoid scales
- fresh or brackish water
- some sp. Reach 2.6 m in length, 100 kg
- 7 sp, 2 in WV; longnose and shortnose
- predatory
- sluggish, except when capturing prey
- bony snout with many teeth



Longnose Gar



Alligator Gar

# Order Amiiformes

- Family Amiidae
  - Bowfins, 1 species
  - shallow, weedy waters
  - voracious predator
  - single layer of bone
  - thin scales
  - can breathe by gulping air
  - thin layer of bone covers cartilaginous skull; rest of skeleton primarily cartilaginous
  - Note long dorsal fin



# Where We Are

- Class Osteichthyes
  - Subclass Sarcopterygii
    - lungfish, coelocanth
  - Subclass Actinopterygii
    - Infraclass Chondrostei
      - Order Polypteriformes -- bichirs
      - Order Acipenseriformes -- sturgeons and paddlefish
    - Infraclass Holostei
      - Order Semionotiformes -- gars
      - Order Amiiformes -- bowfin
    - Infraclass Teleostei

# Infraclass Teleostei

- Modern ray finned fish
- Fins usually composed of bony rays with skin in between rays
- Contains most species in Osteichthyes
- Appeared 208 million years ago and out-competed most Holostean fish soon afterward
- Many orders



# Characteristics of Teleosts

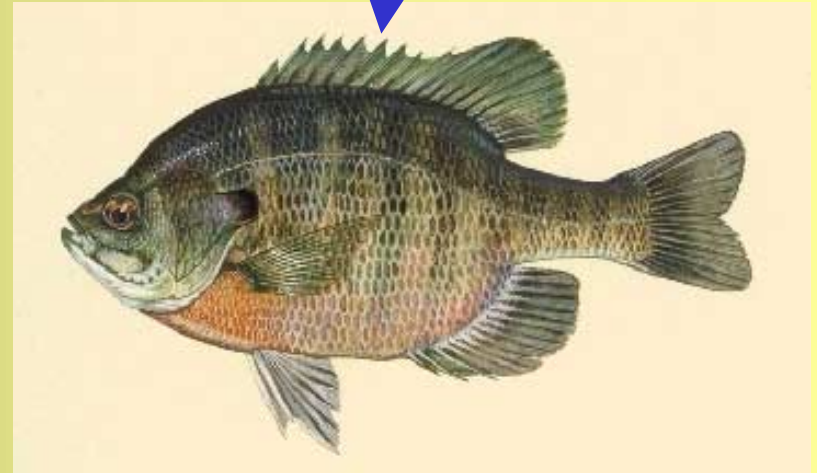
- Most have homocercal (symmetrical) tail
  - caudal fin external to muscle mass of body
- Skeleton almost completely bony
- Have either thin (ctenoid or cycloid) scales or no scales
- Well-developed air bladder system
  - bladder used for buoyancy rather than respiration



# Characteristics of Teleosts

- Usually divided into 2 groups
  - the spiny rayed (rough) fish

Spiny rayed



- soft rayed (smooth) fish

Soft rayed



# Locomotion in Water: Swimming

- Usually results from sequential contractions of muscles along one side of body and simultaneous relaxation of muscles on the opposite side
- 3 classes of undulatory (back and forth) swimming motions
  - anguilliform: typical of eels and other highly flexible fishes; most of body involved in bending
  - carangiform: undulations limited mostly to tail region; trout, cod, etc.
  - ostraciform: body inflexible; undulation of caudal fin only; tuna
  - some fish swim without flexing tail or body, use fins

# Digestive System of Teleosts:

A list of features encountered by a morsel of food moving through the digestive tract

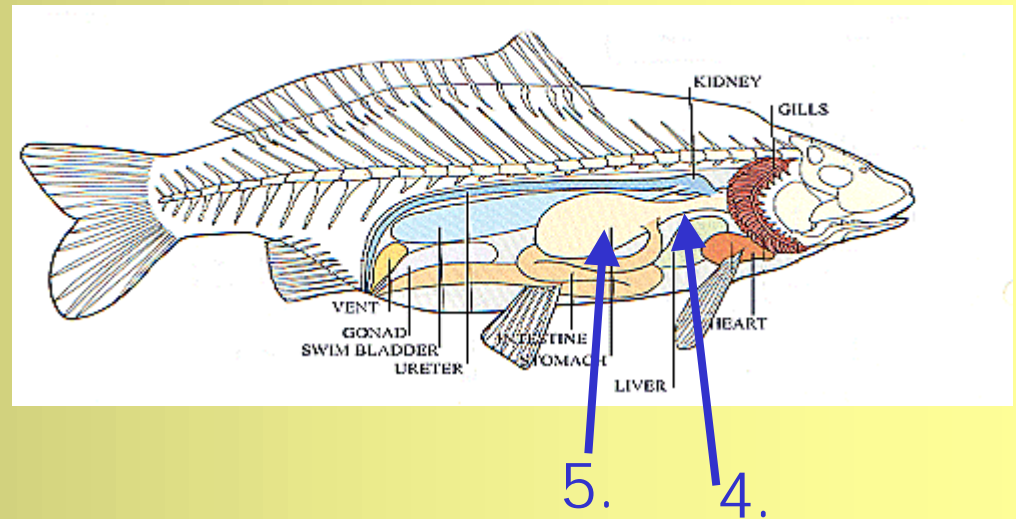
- 1. Mouth
  - toothed jaws rimmed internally with oral valves
- 2. Oral Cavity
  - may have accessory teeth in the roof (vomerine and palatine) and tongue



# Digestive System of Teleosts:

A list of features encountered by a morsel of food moving through the digestive tract

- 3. Pharynx
  - with gill rakers and/or pharyngeal teeth
- 4. Esophagus
  - highly distensible
- 5. Stomach
  - muscular, sac-like;
  - typically secretes digestive acids



# Digestive System of Teleosts:

A list of features encountered by a morsel of food moving through the digestive tract

- 6. Pylorus
  - valve followed by caeca
  - may secrete enzymes and/or provide absorption surfaces
- 7. Small Intestine
  - ducts that bring in bile and pancreatic secretions
- 8. Large Intestine
  - longer in herbivorous (plant-eating) species, many folds
- 9. Anus
  - anterior to anal fin