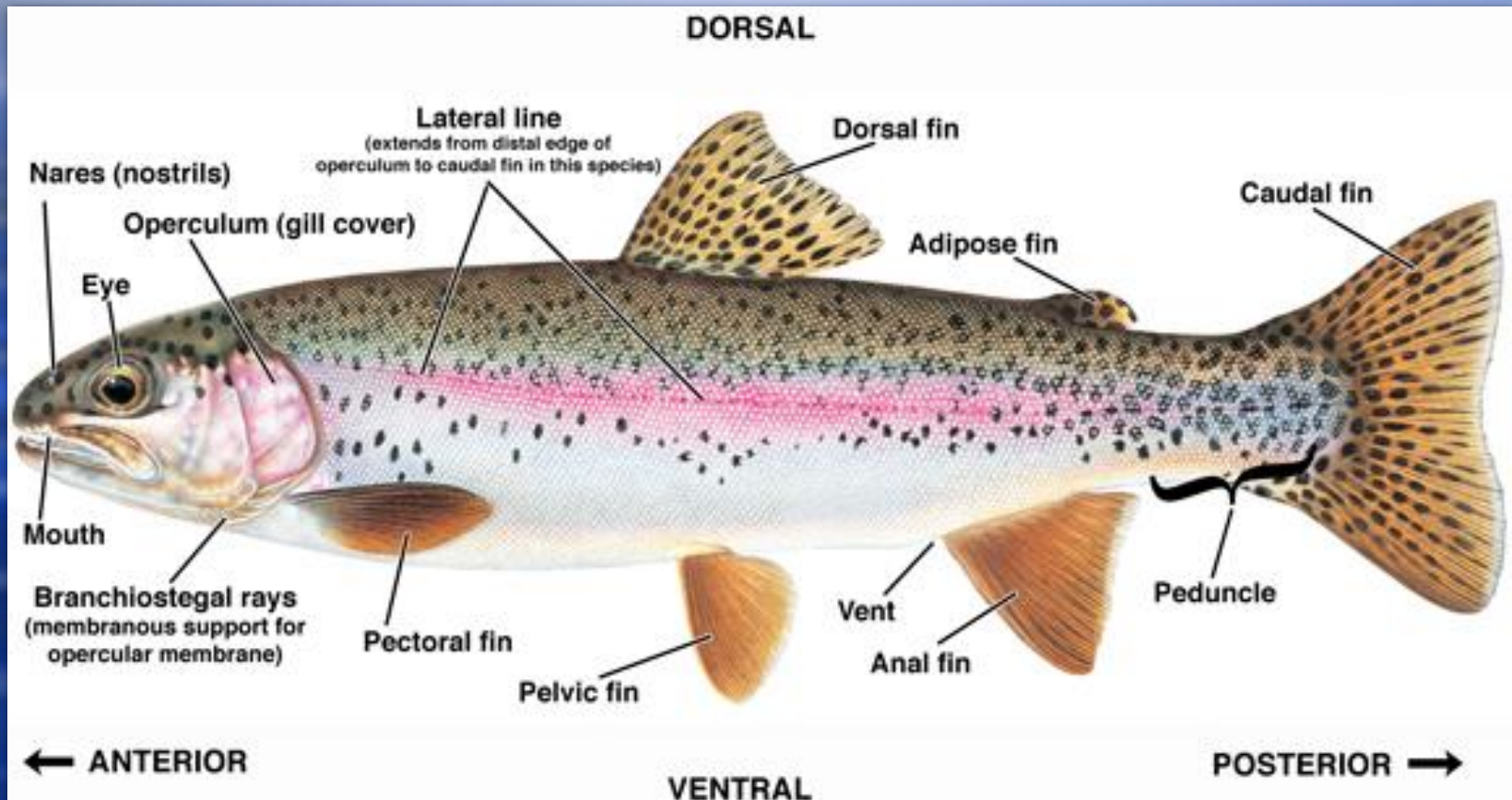
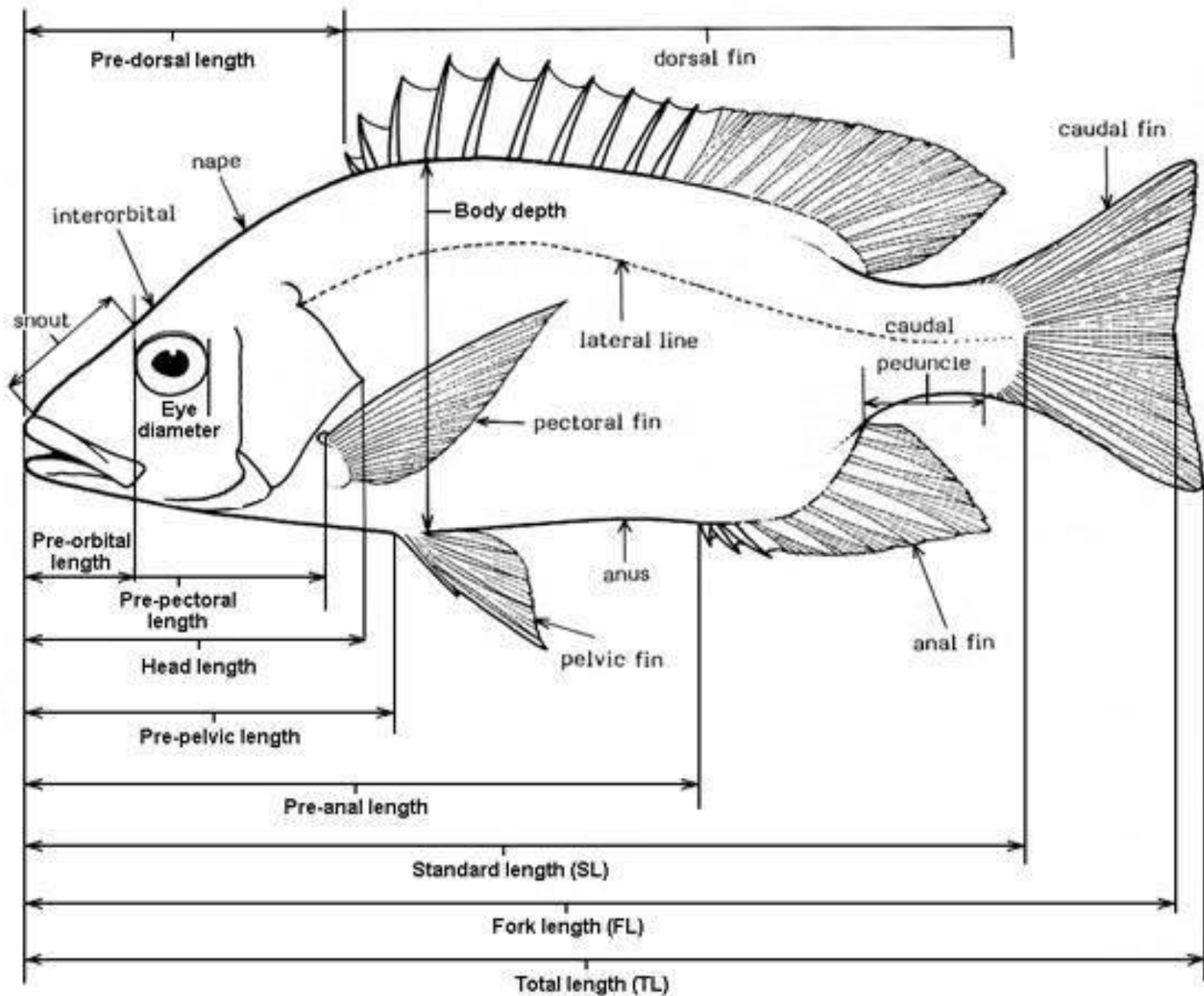


# General External Morphology





# Variations are many

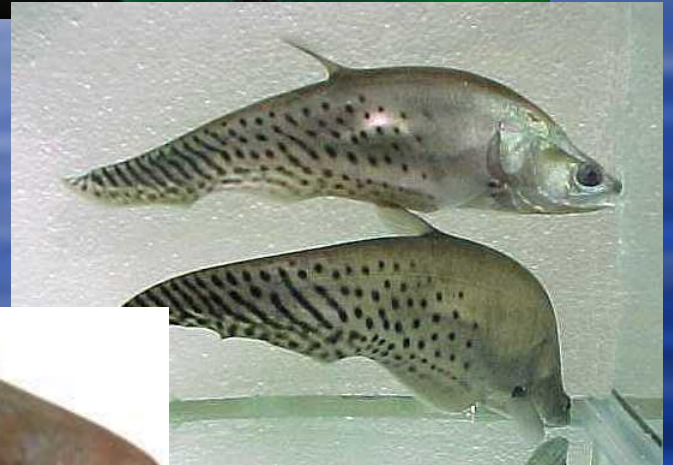
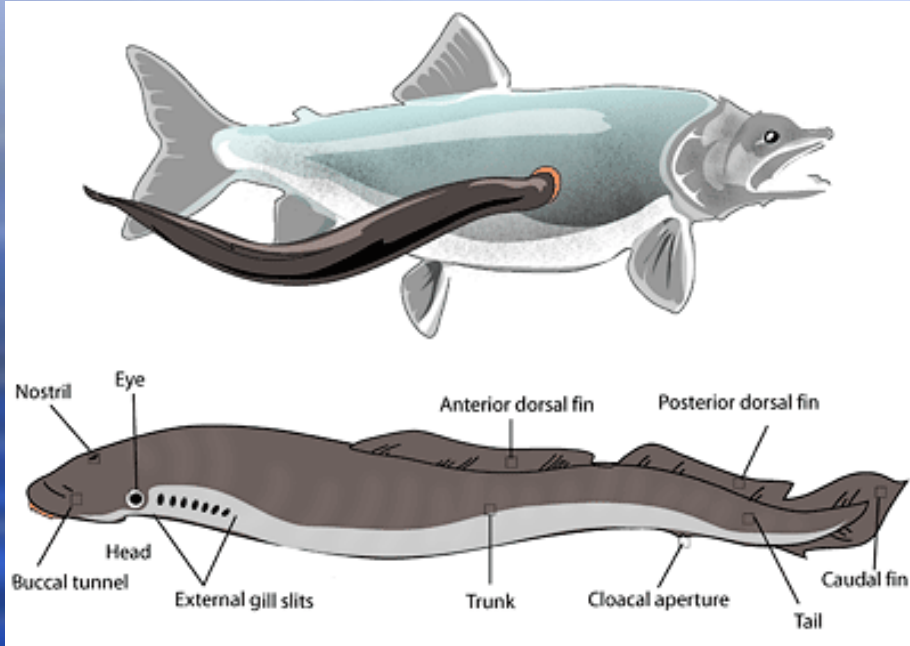
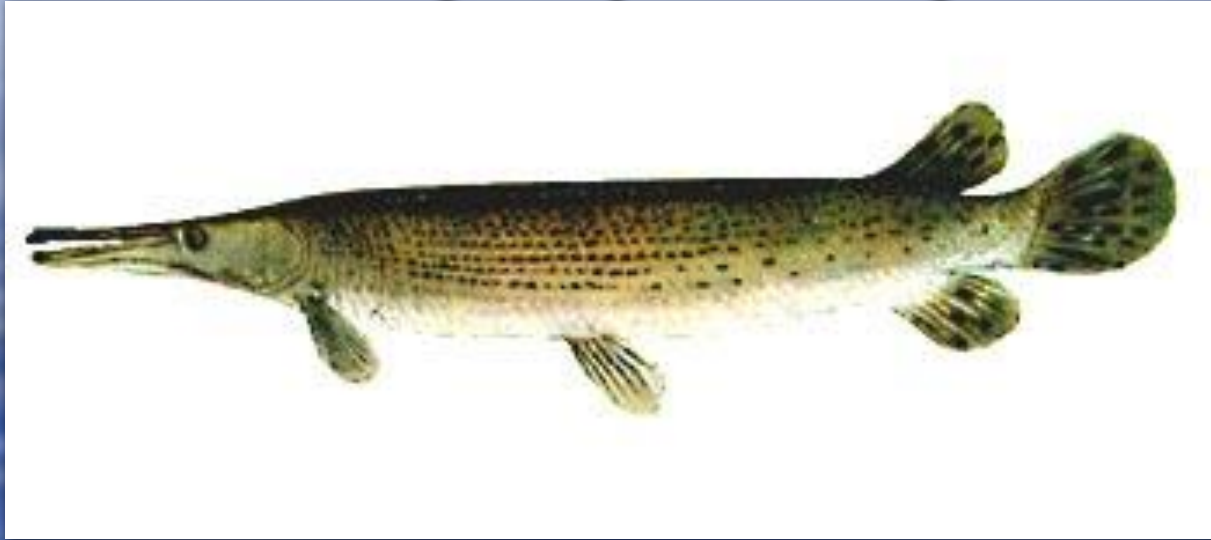


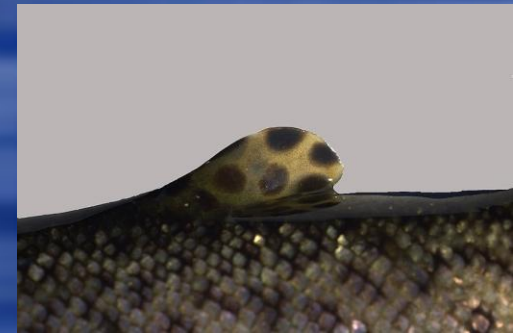
illustration by Ted Walker



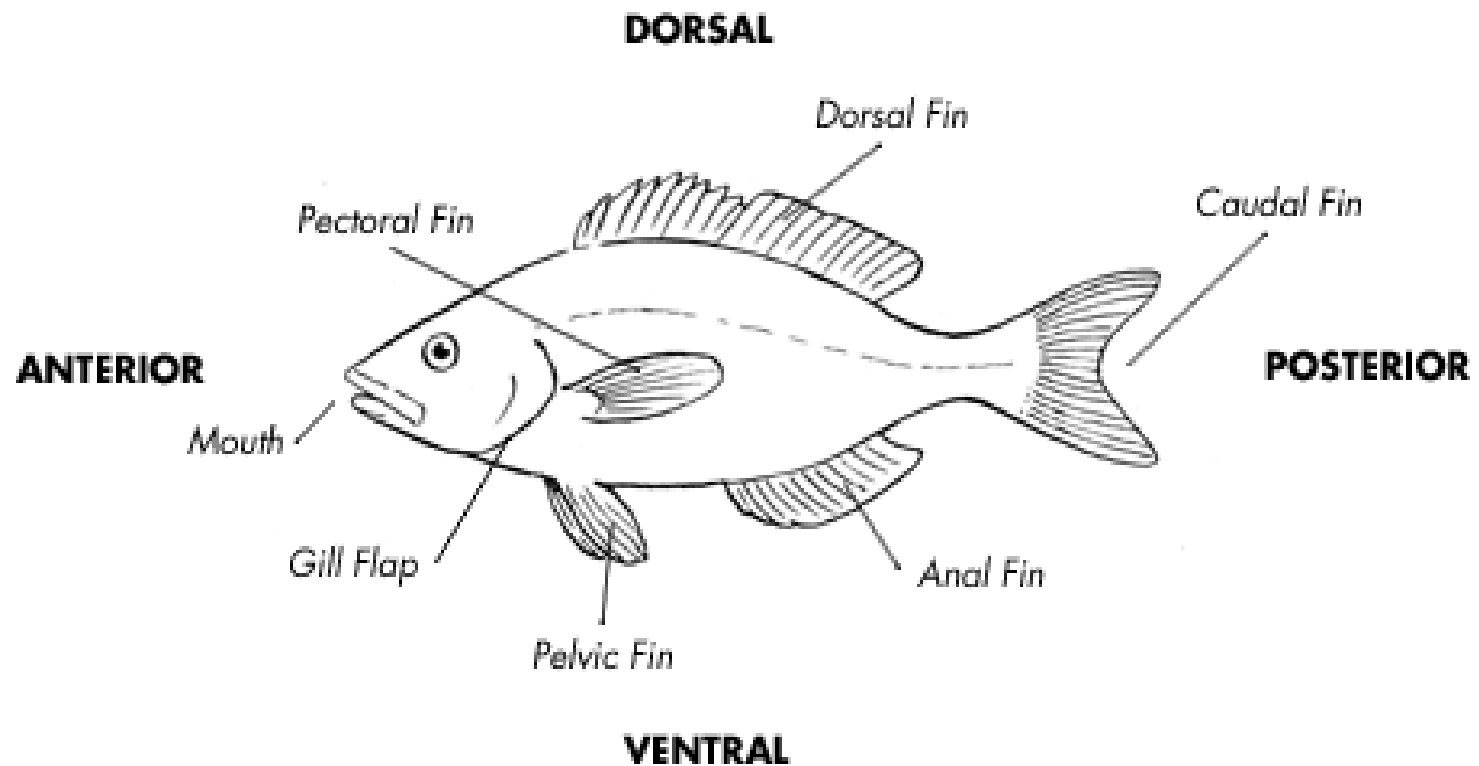
# Medial (Unpaired) Fins



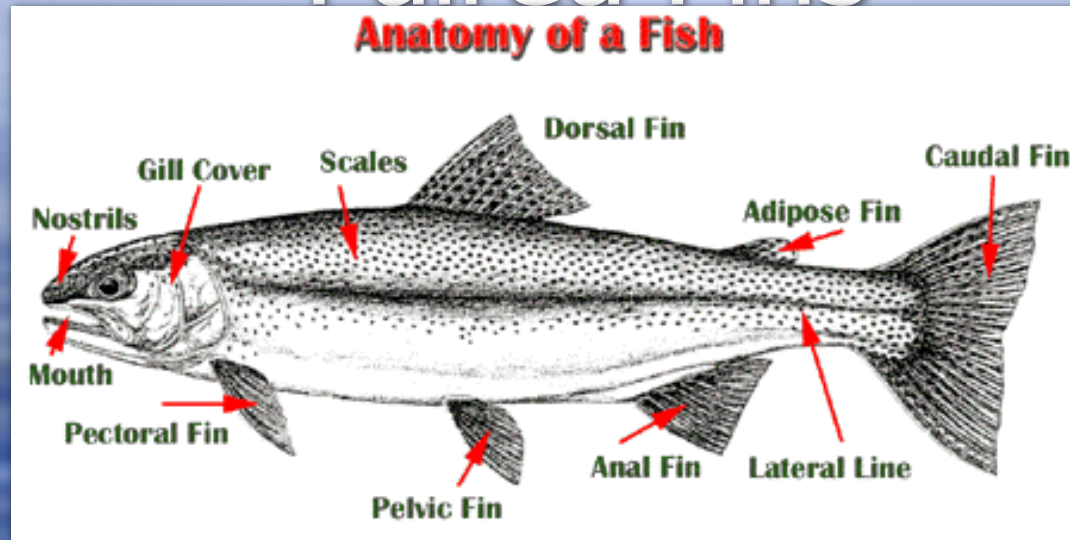
- ◆ Unpaired fins with fin rays of bone or cartilage
- ◆ Dorsal (one or more), caudal, anal
- ◆ Some have adipose (no rays) –  
Salmonidae, Ictaluridae, Osmeridae



# Paired Fins

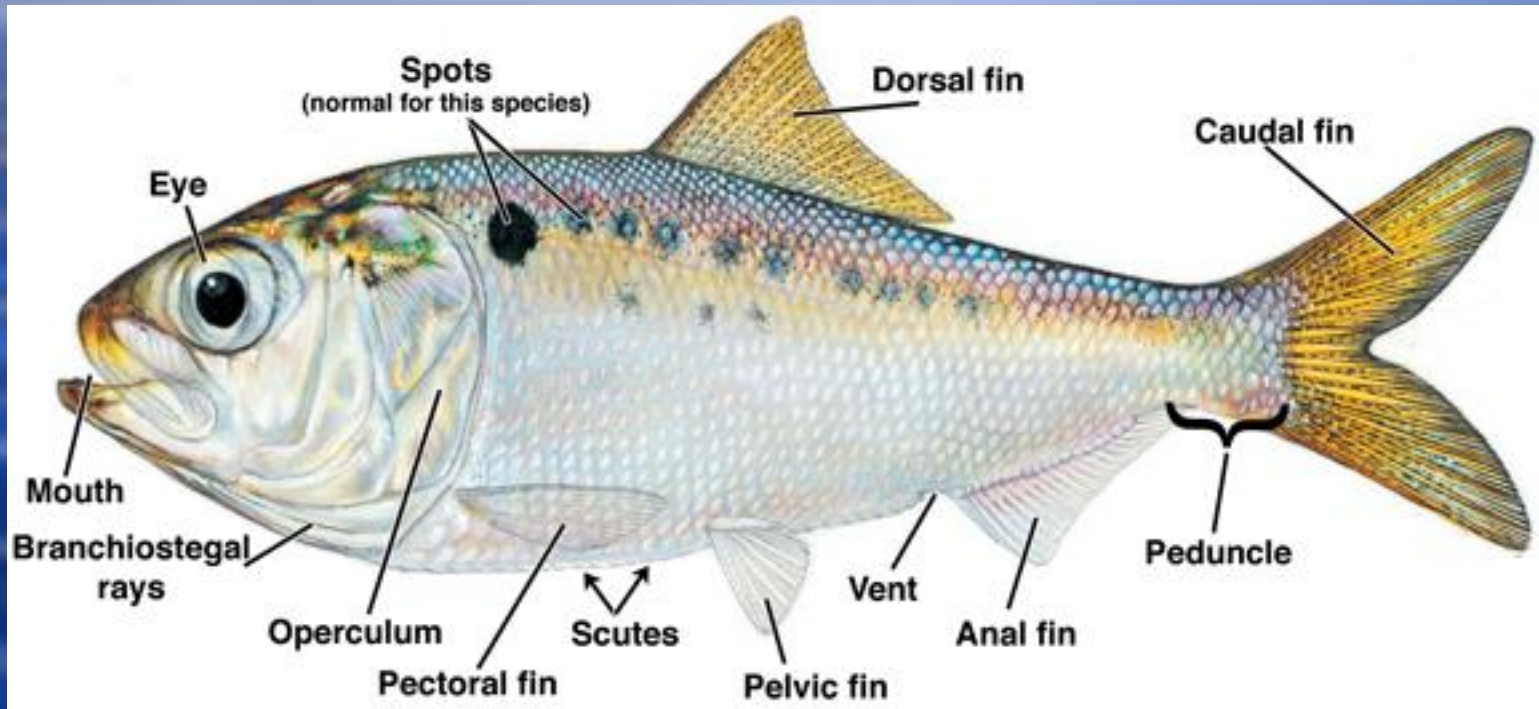


# Paired Fins

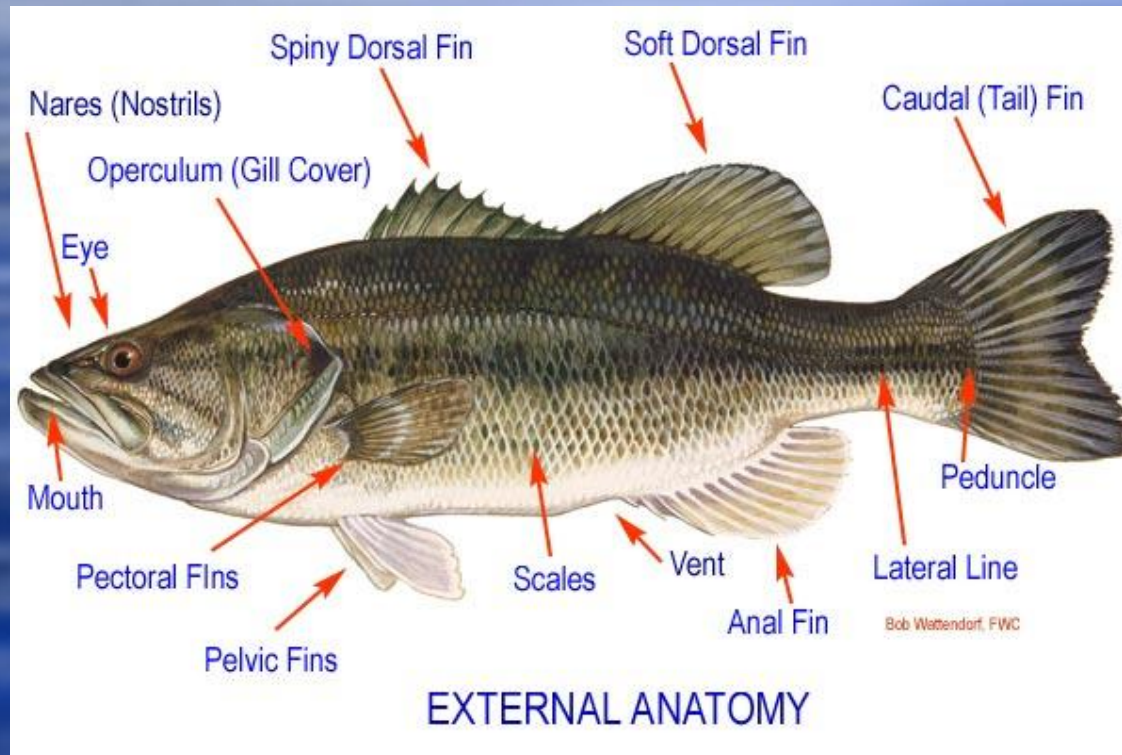


- ◆ Pectoral fins - homologous to front legs
- ◆ Pelvic fins - homologous to hind legs
  - ◆ Abdominal in position in more primitive fishes
  - ◆ Thoracic in position in more advanced fishes

# Abdominal pelvics

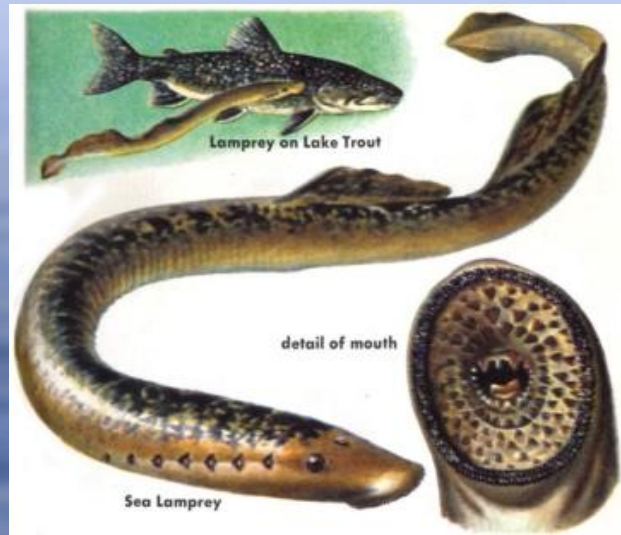


# Thoracic pelvics



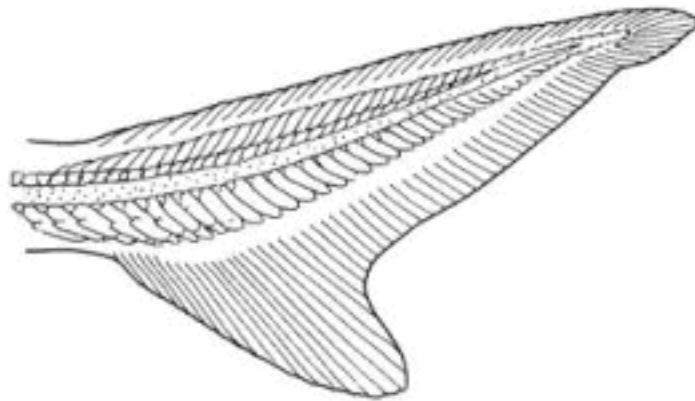


# Missing pelvics

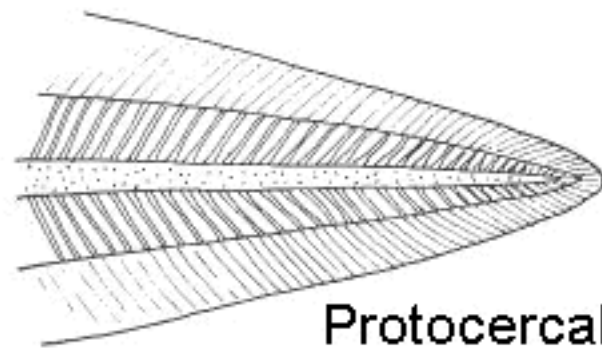


- ◆ Eels, ocean sunfish lack pelvics
- ◆ Lampreys, hagfish lack pelvics, pectorals

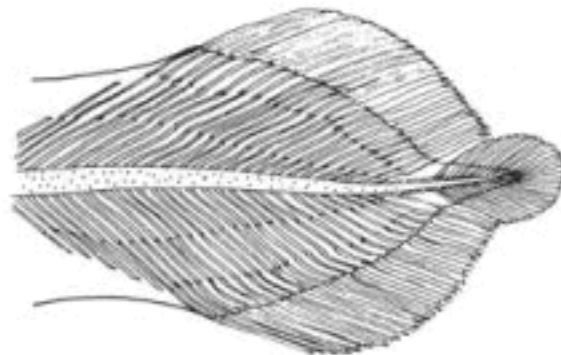
# Caudal fins



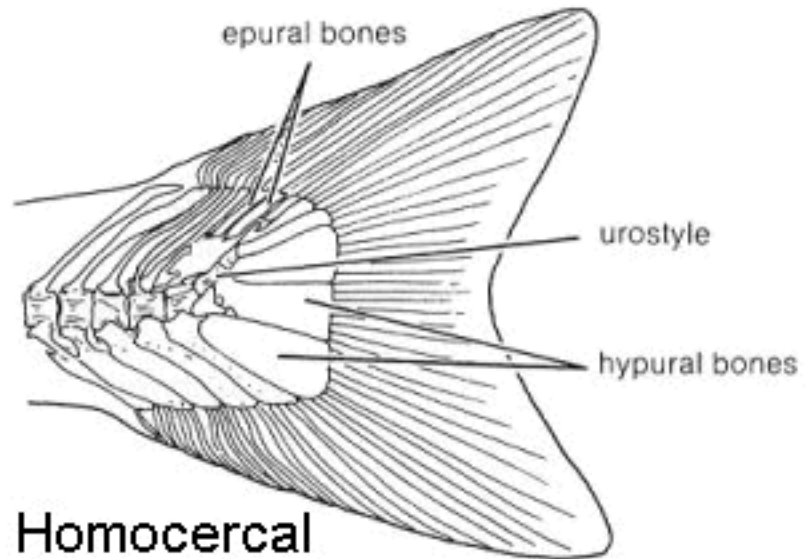
Heterocercal



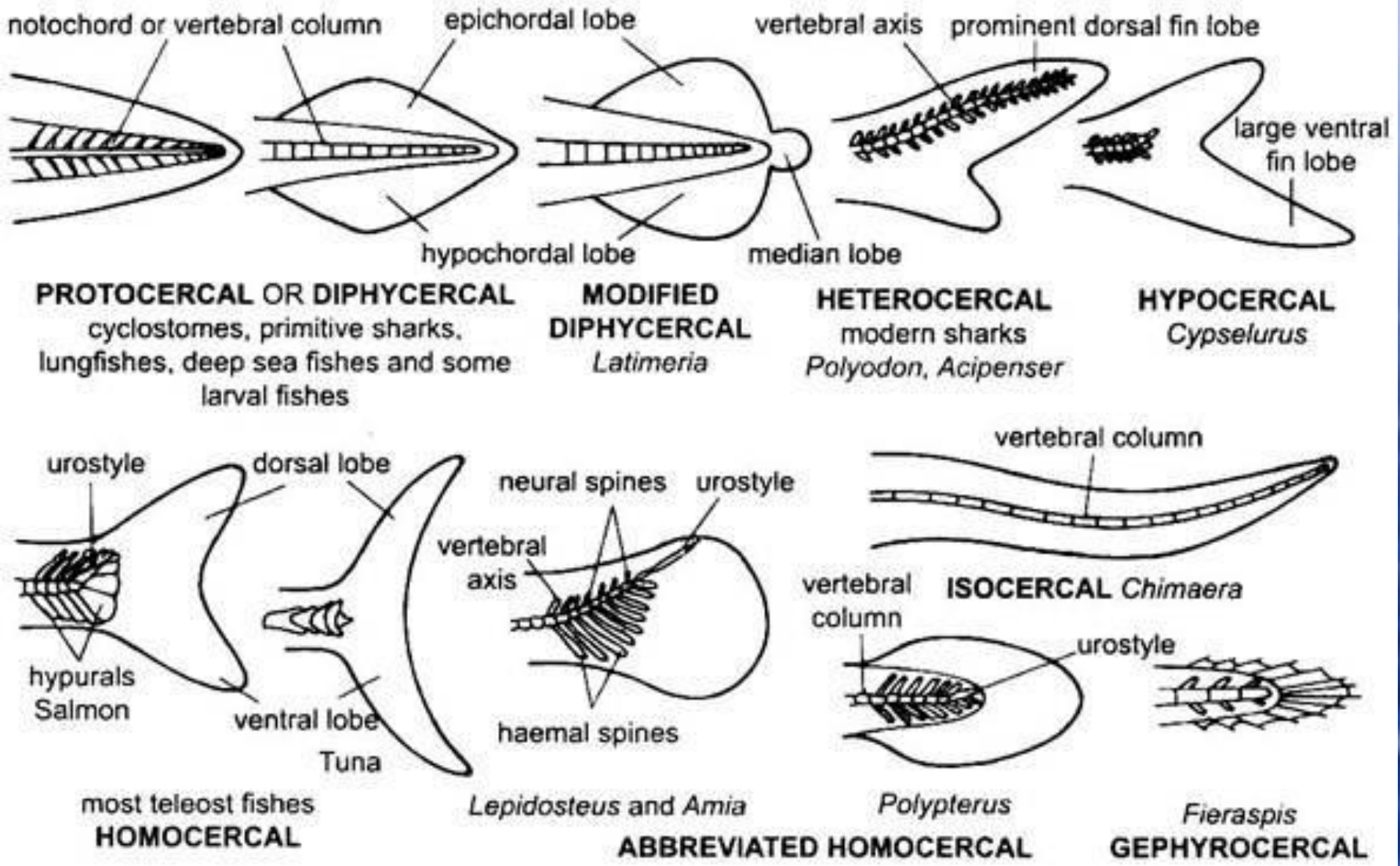
Protocercal



Diphyccercal



Homocercal



**Fig. 17.4.** Different types of caudal fins or tails in fishes.

# Heterocercal

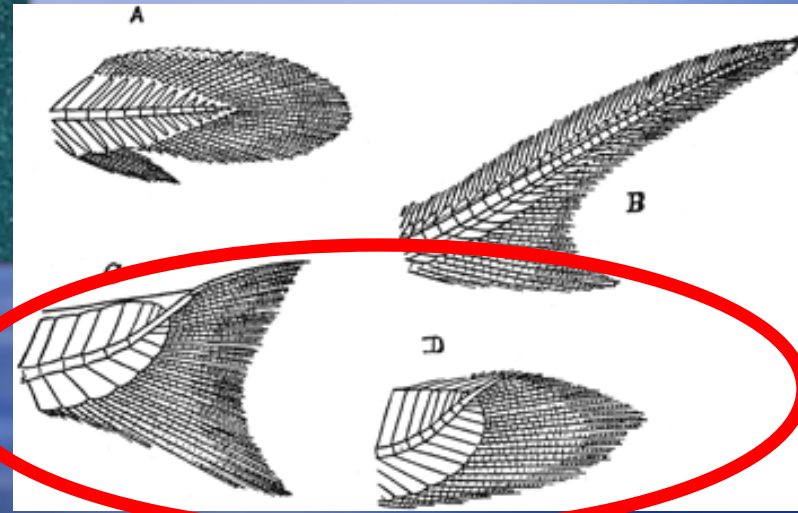
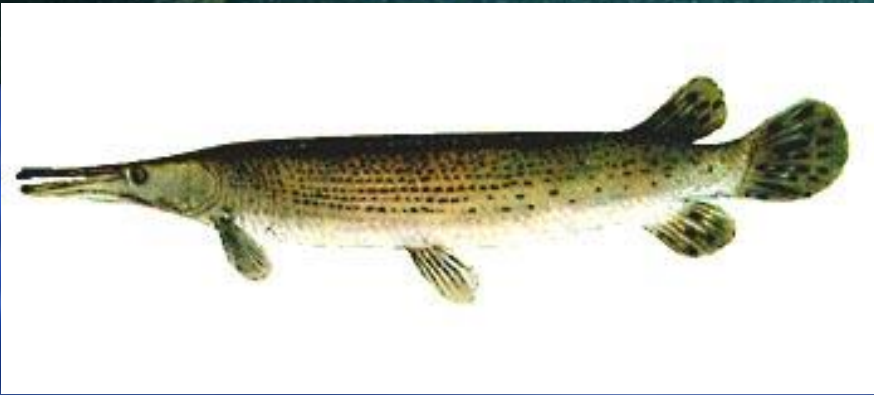


Lake Sturgeon (*Acipenser fulvescens*)



- ◆ Heterocercal - primitive fish like sturgeons, paddlefish, plus cartilaginous fishes
- ◆ Superorder Chondrostei and Class Chondrichthyes

# Modified heterocercal



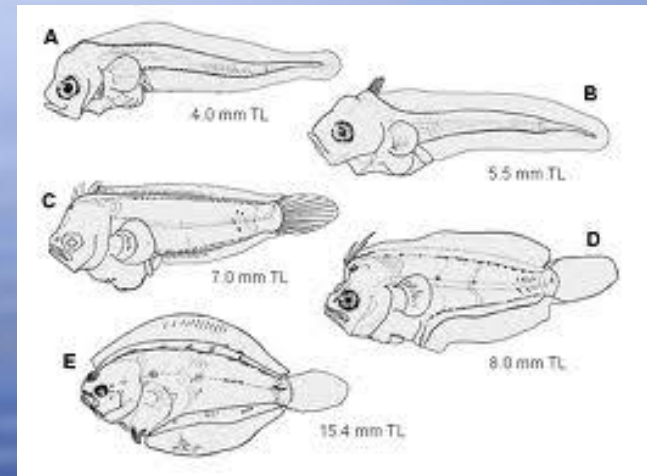
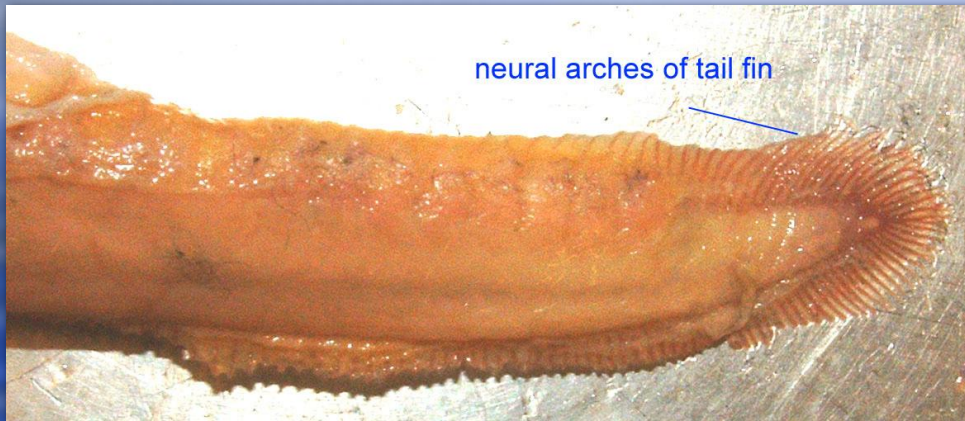
- ◆ Modified heterocercal - bowfin and gars
- ◆ Superorder Holostei (bony ganoids)

# Diphycercal



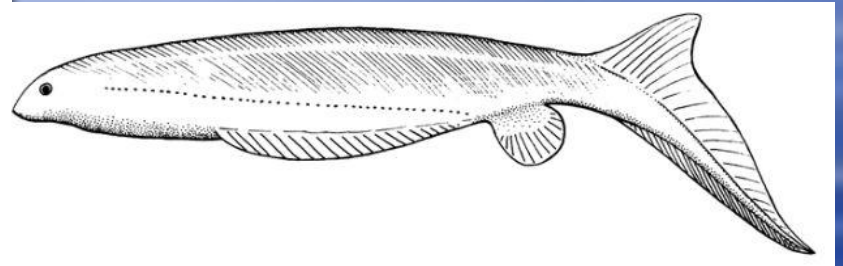
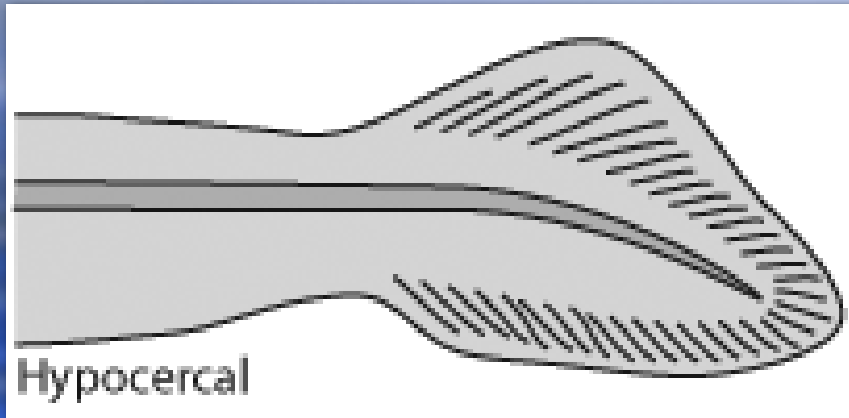
- ◆ Diphycercal - lungfish and crossopterygians
- ◆ Subclass Sarcopterygii (fleshy-finned)

# Protocercal



- ◆ caudal fin extends around the vertebral column
- ◆ present in embryonic fish and hagfish

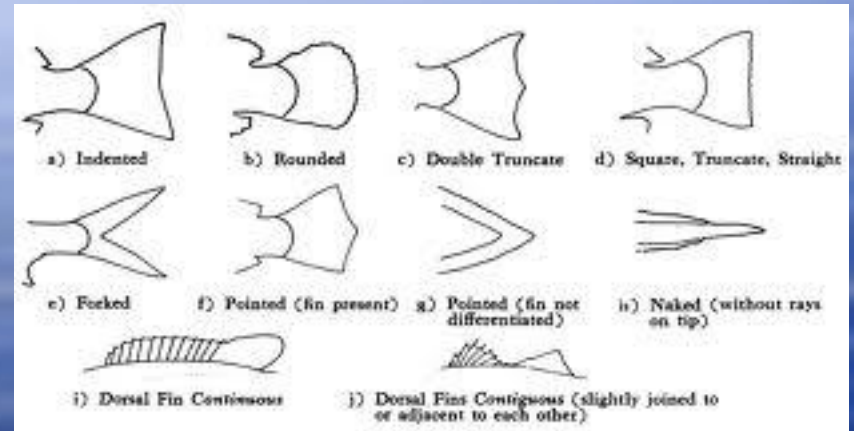
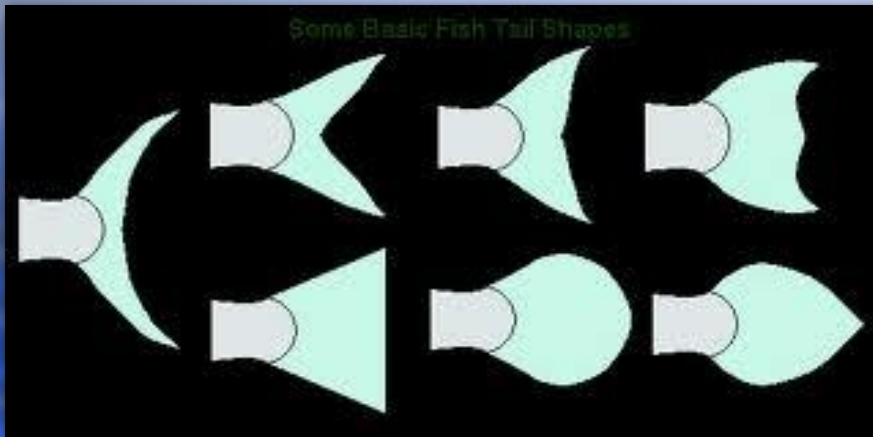
# Hypocercal



- ◆ Vertebral column extends into lower lobe
- ◆ Fossilized ostracoderms (anapsids)



# Homocercal



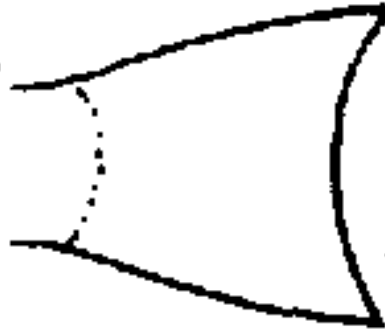
- ◆ Vertebrae do not extend into a tail lobe
- ◆ Fin more or less symmetrical
- ◆ Pointed, rounded, truncate (squared), emarginate, forked, lunate



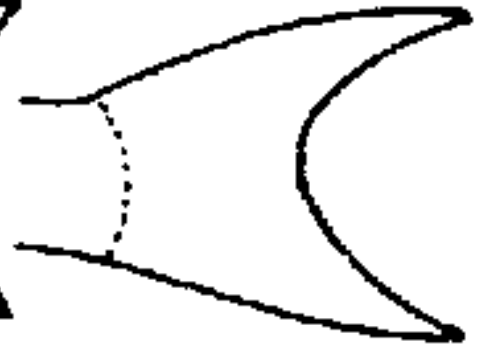
Rounded



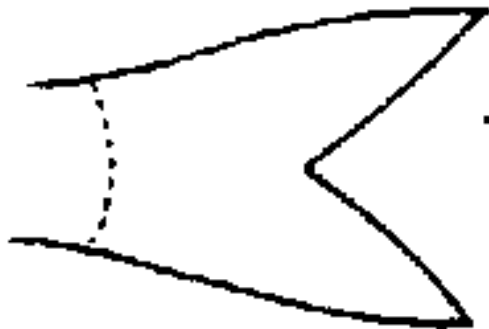
Truncate



Emarginate



Lunate



Forked



Pointed

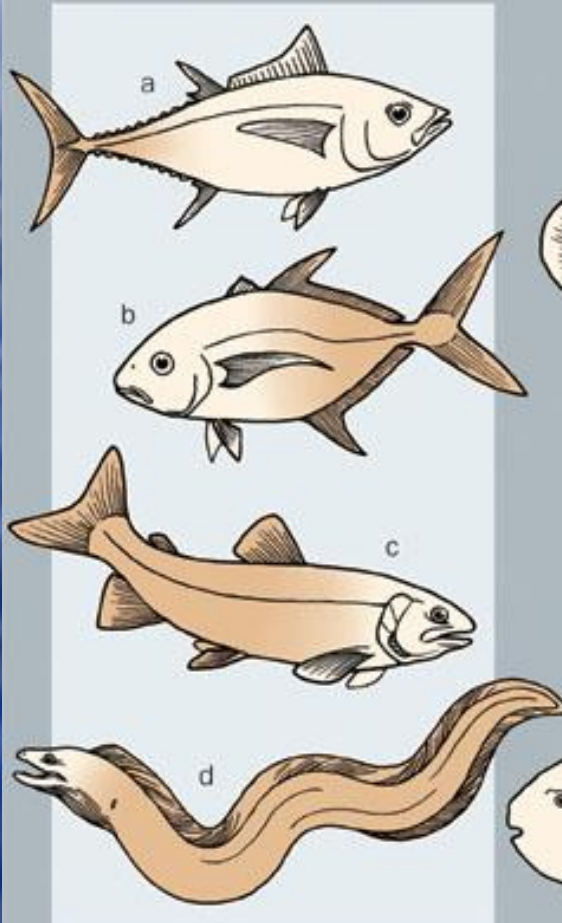


Rhomboid

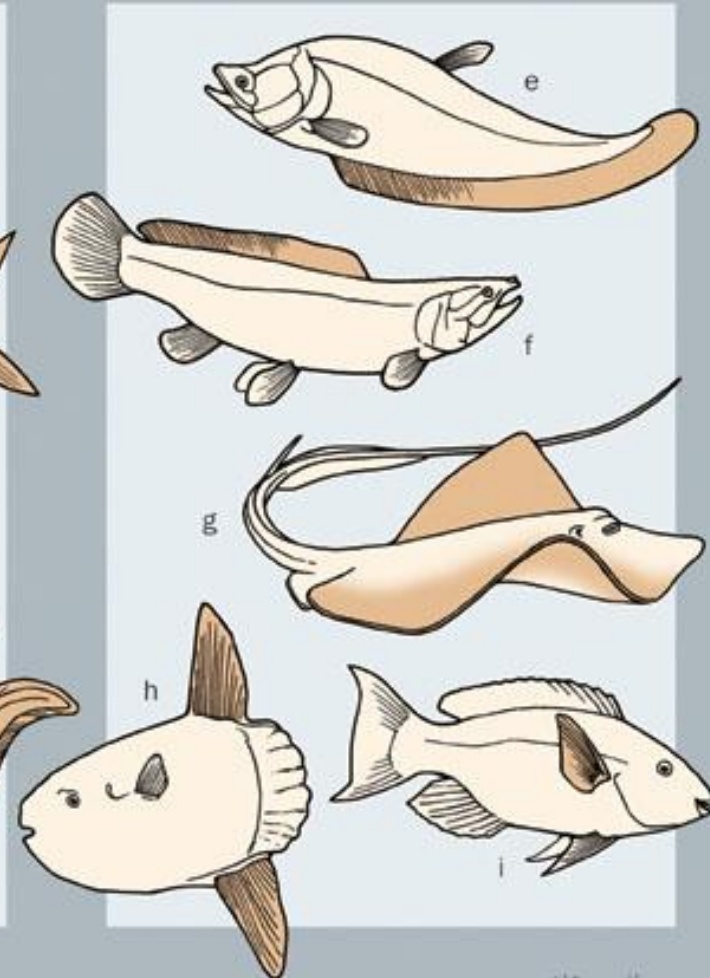
## Common caudal fin shapes

# Body Shape

Swims with trunk and tail



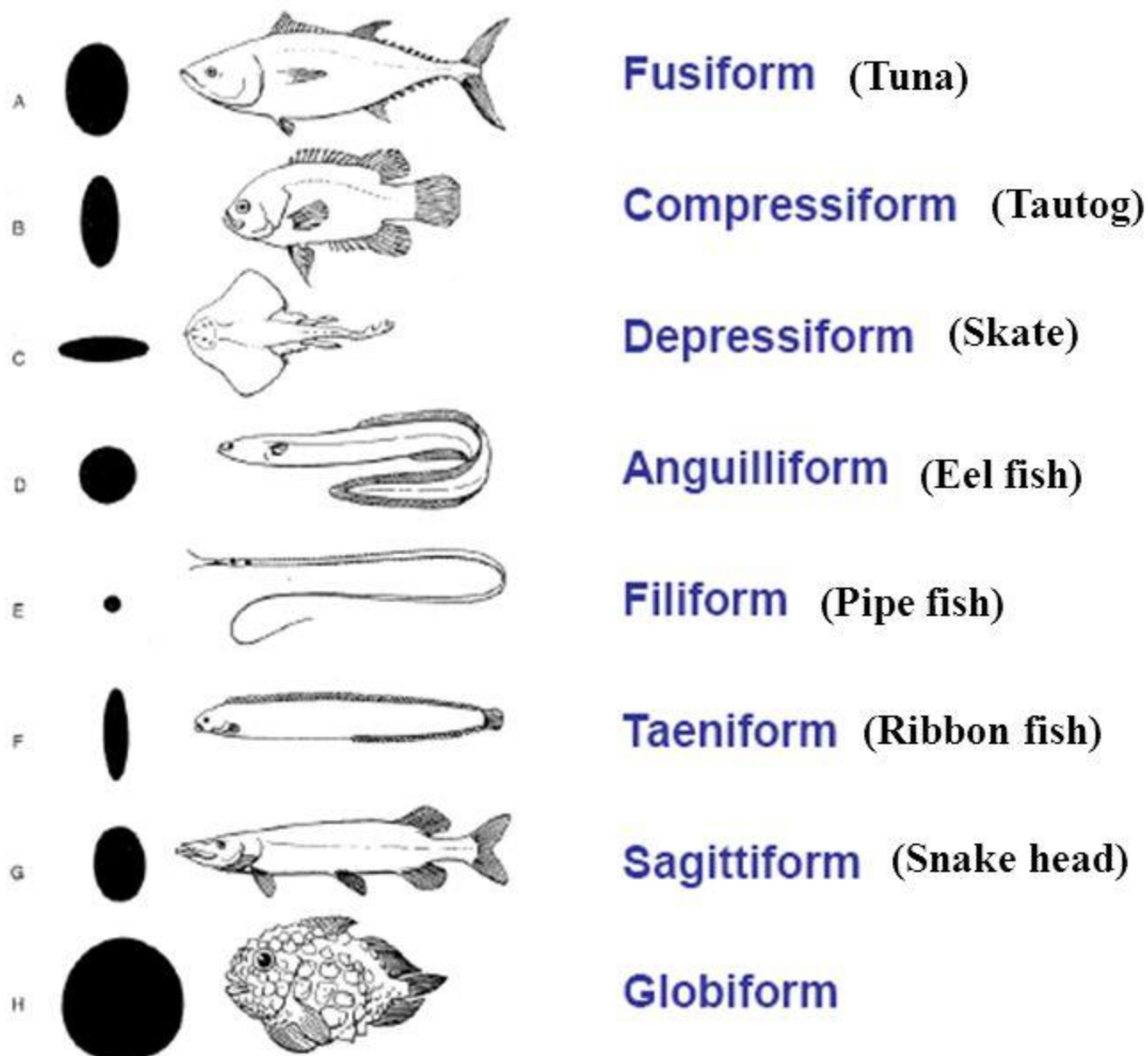
Swims with fins



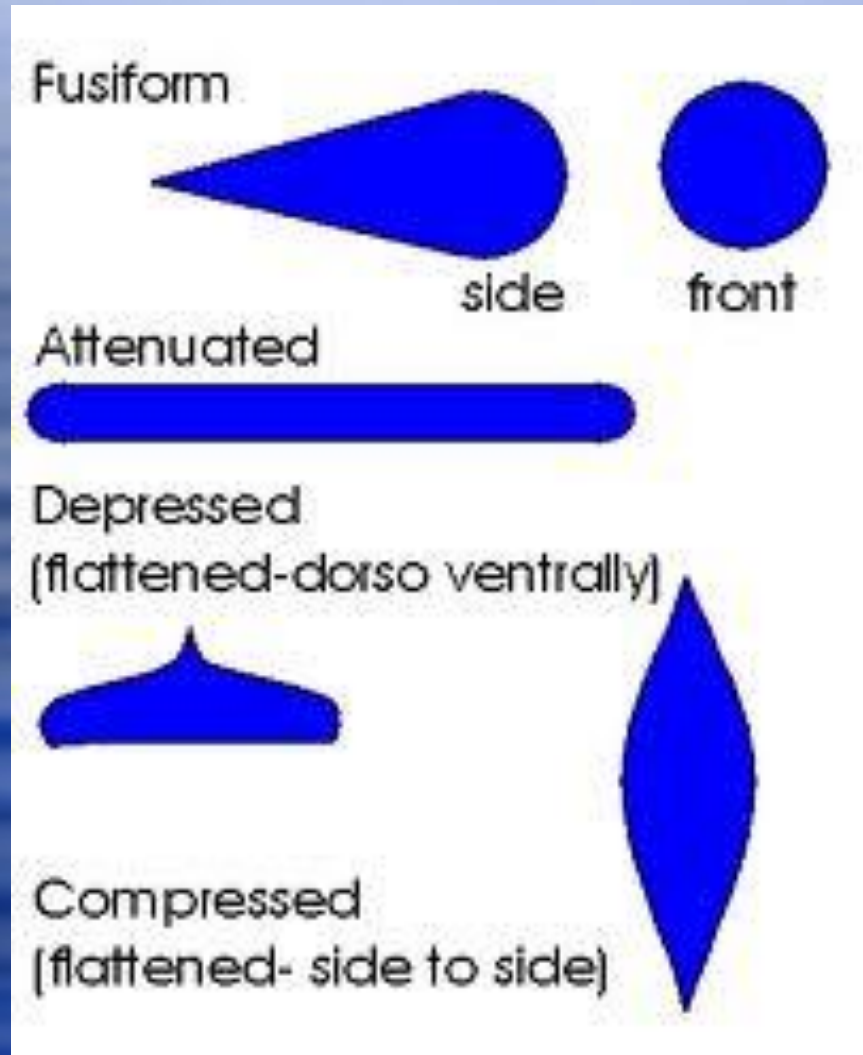
Shading represents primary body region that is used during propulsion.

©2002 M. Donaghy

## Fish Morphology/ Fish Shape



# General Patterns



# Rover-Predator



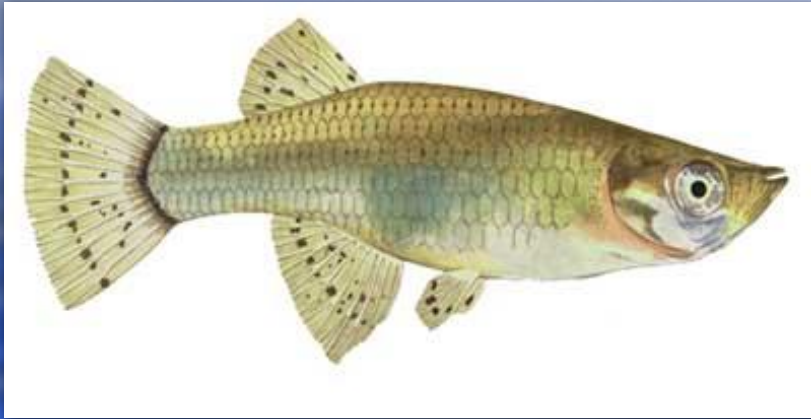
- ◆ Streamlined (fusiform), stability and maneuverability produced by even fin distribution

# Lie-in-wait Predator



- ◆ Elongate, torpedo-like
- ◆ Pointy head with teeth
- ◆ Thrust generated by large caudal, posteriorly-located dorsal, anal fins

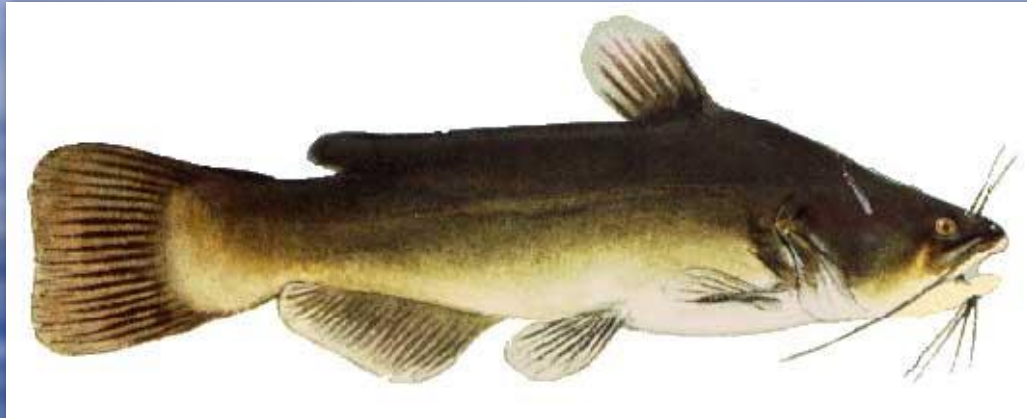
# Surface-oriented Fish



- ◆ Small, with upward-directed mouth and DV flattened head
- ◆ Tend to have dorsal fin posterior
- ◆ E.g., mosquitofish



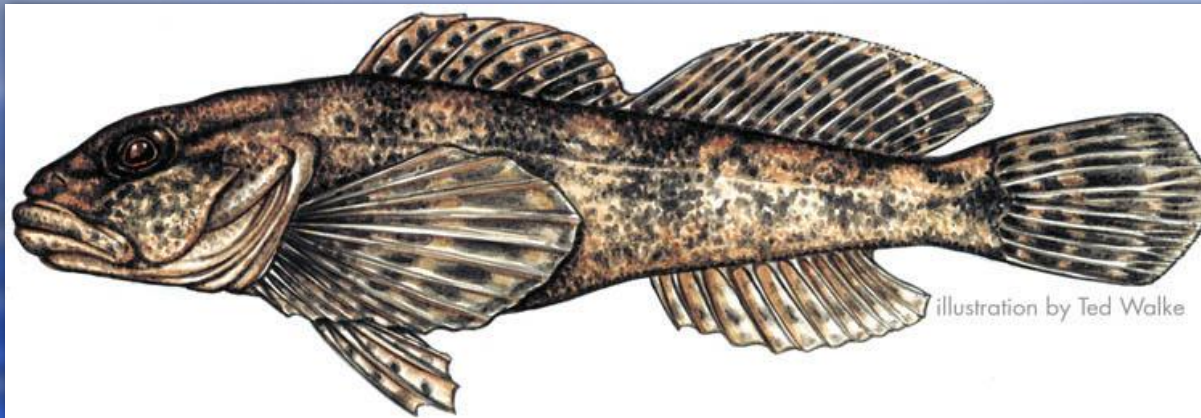
# Bottom Rover



- ◆ Flattened heads, fusiform to humped backs, enlarged pectorals, mouths terminal to inferior, barbels
- ◆ Catfishes, sturgeons



# Bottom Clinger



- ◆ Small, with flattened heads, large pectorals, structures to hold to bottom in strong currents
- ◆ Sculpin, gobies, clingfishes

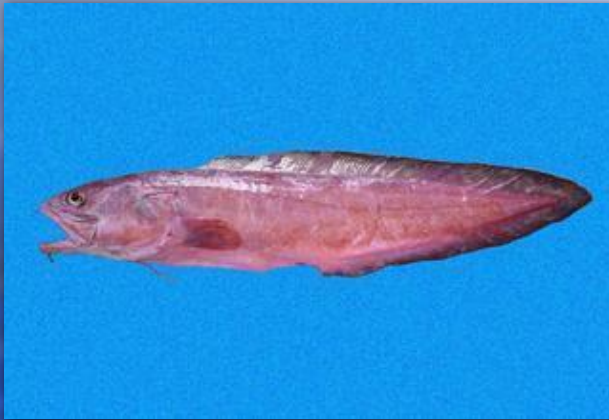


# Flatfish



- ◆ Extreme flattening for life on bottom
- ◆ Lateral – live on side – flounders, halibut
- ◆ Dorsoventral – skates, rays

# Rattail Fish



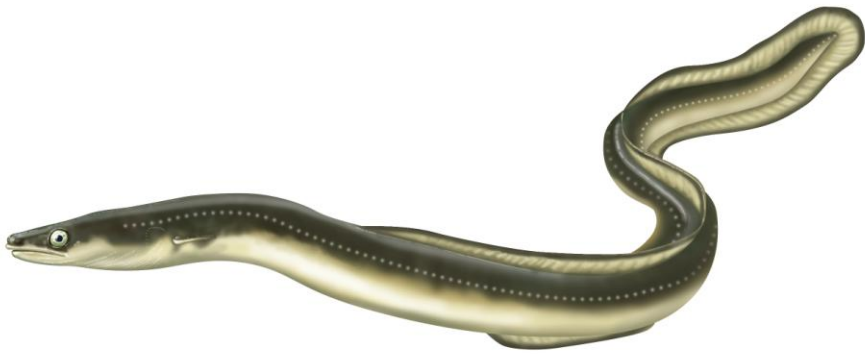
- ◆ Large heads, pointy snouts, large pectorals, rat-like tails
- ◆ Benthic deepsea dwellers
- ◆ Genadiers, brotulas, chimaeras

# Deep-bodied Fish



- ◆ Laterally flattened, small mouth, short snout
- ◆ Body depth  $\geq 1/3$  standard length
- ◆ Adapted for maneuverability

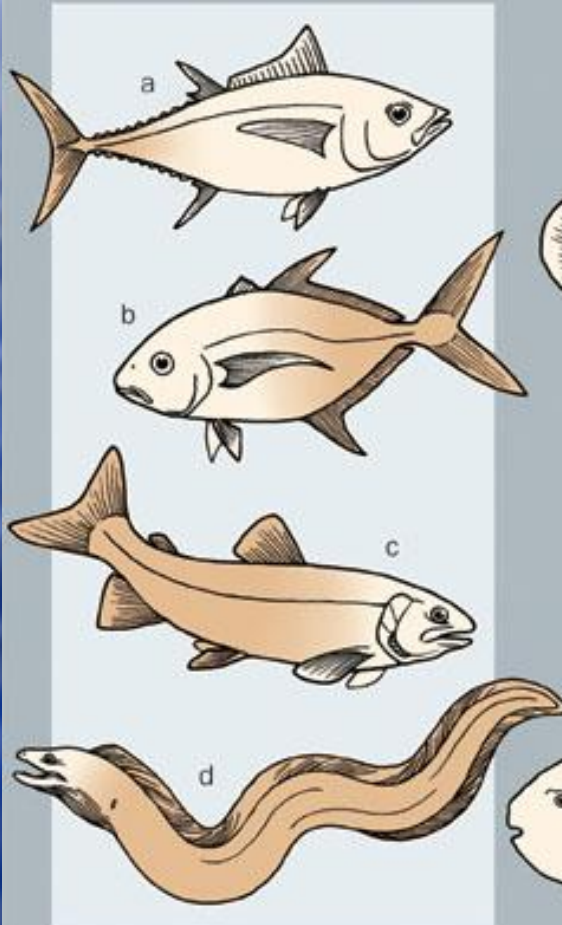
# Eel-like Fish



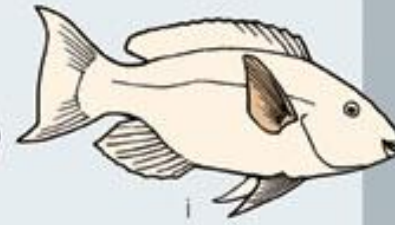
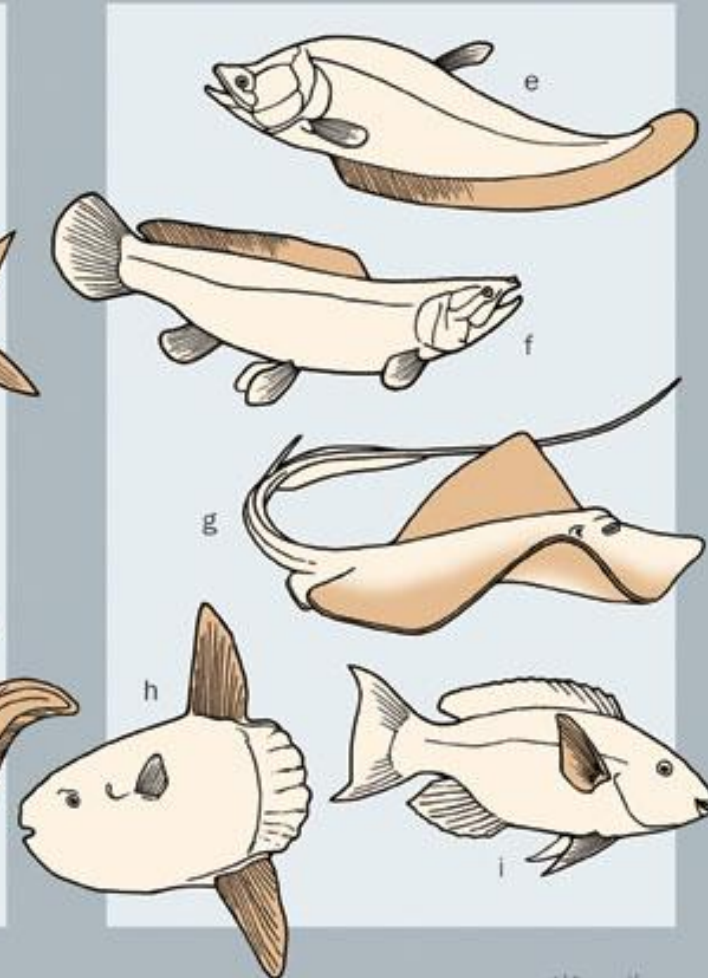
- ◆ Elongate bodies adapted for entering holes, crevices
- ◆ May be missing paired fins
- ◆ Eels, loaches

# Body Shape

Swims with trunk and tail



Swims with fins



Shading represents primary body region that is used during propulsion.

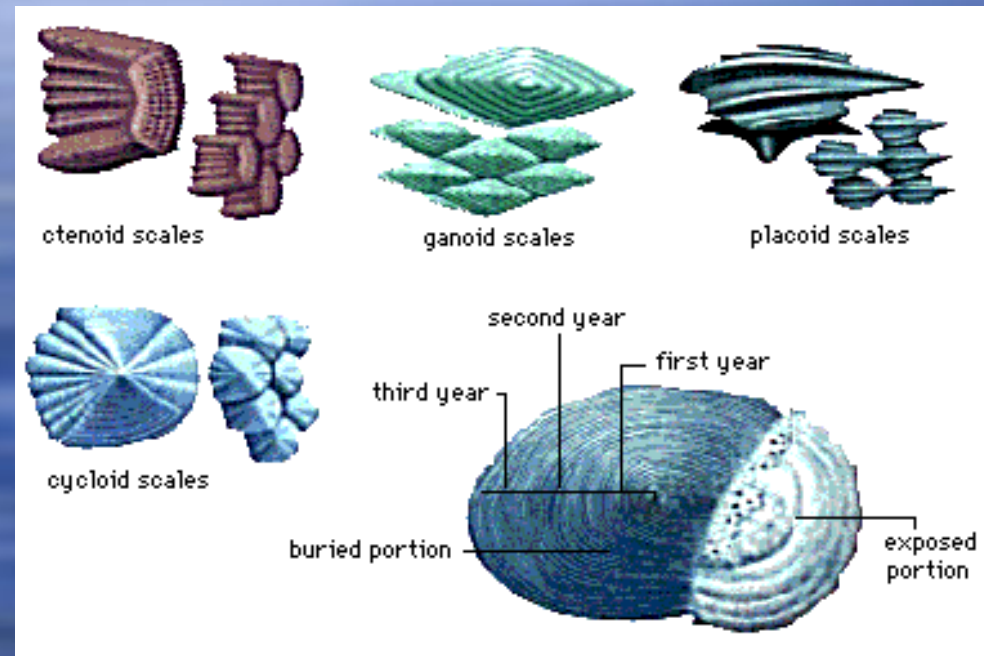
# Scales



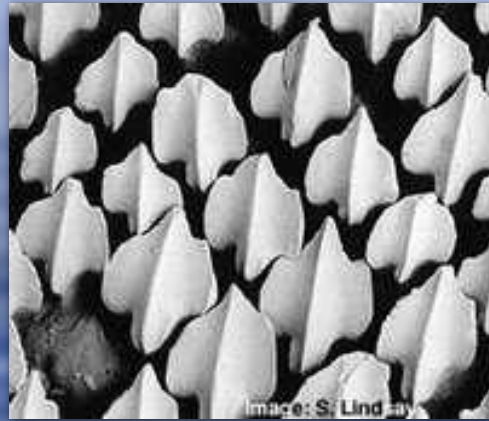


# Types of scales

- ◆ Placoid
- ◆ Ganoid
- ◆ Elasmoid (bony ridge)
  - ◆ Cycloid
  - ◆ Ctenoid



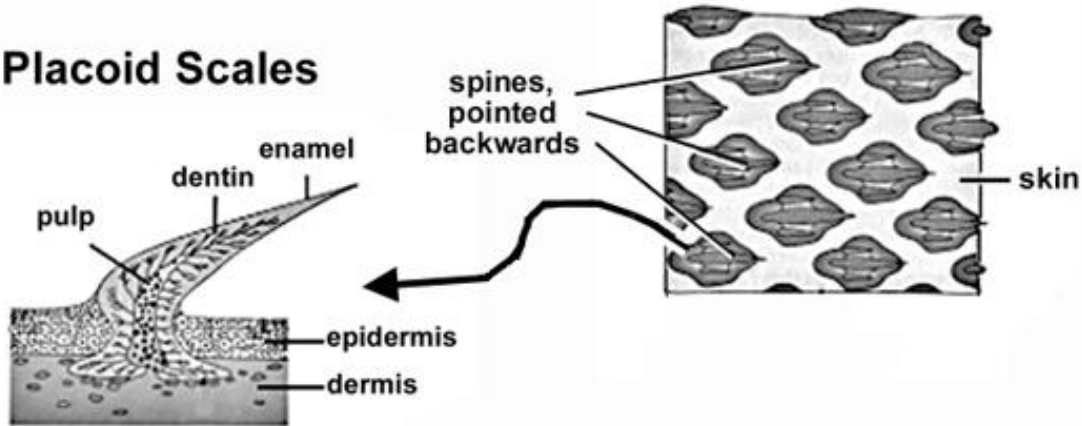
# Class Chondrichthyes



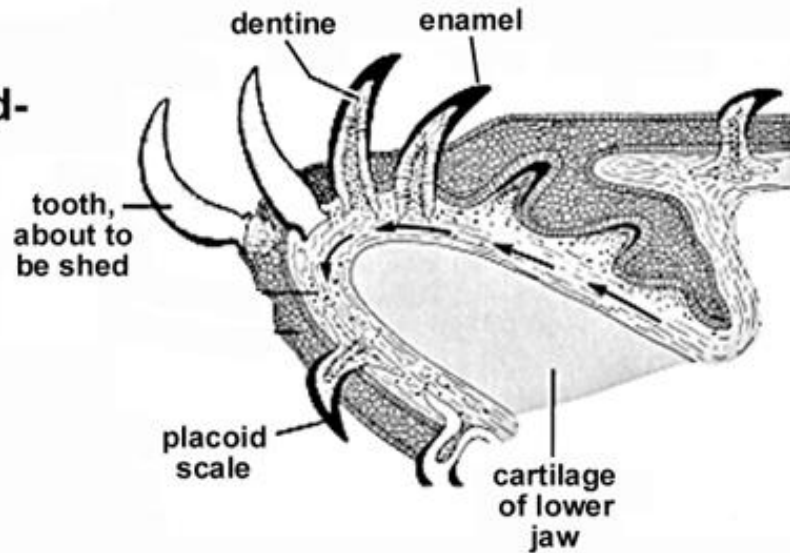
- ◆ Skin contains placoid scales
- ◆ Similar in structure to teeth
- ◆ Dentine-like core surrounded by enamel-like covering

# Class Chondrichthyes

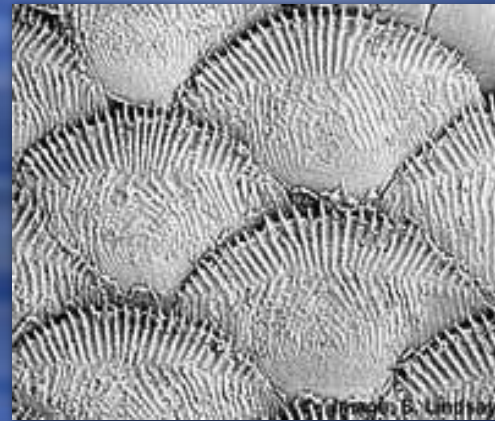
## Placoid Scales

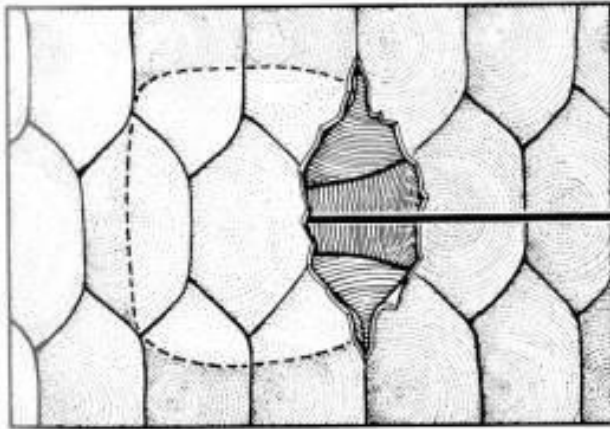


## Jaw Longitudinal Section, With Teeth

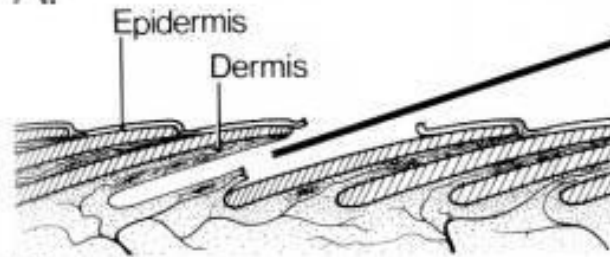


- ◆ Skin of most bony fishes is covered with mucous glands and embedded dermal scales

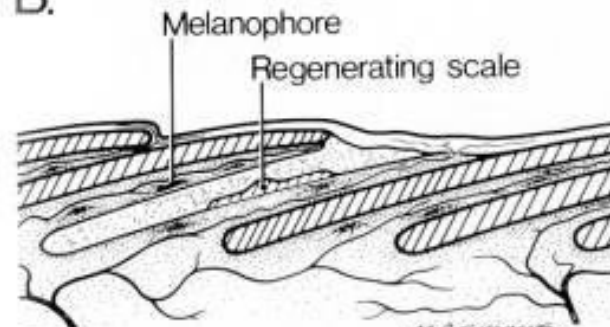




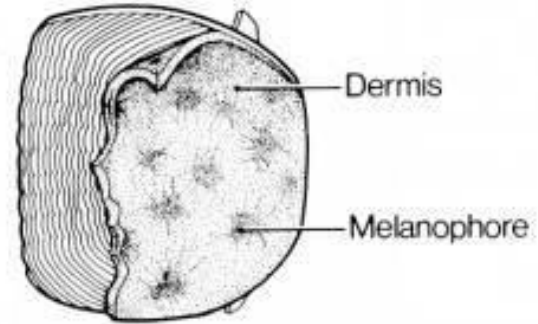
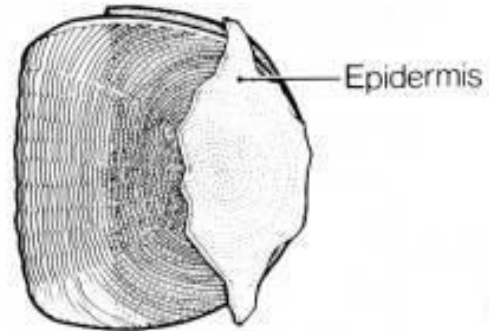
A.



B.

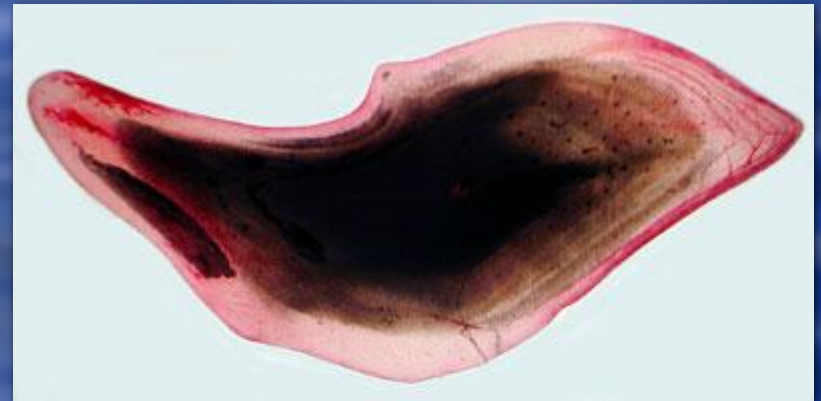


C.



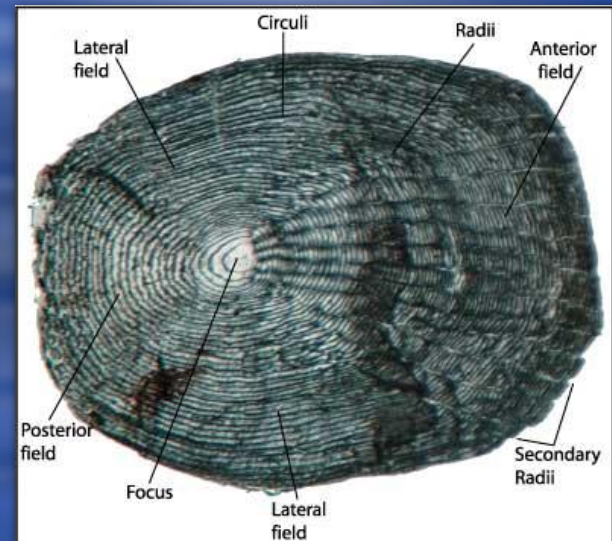
# Class Osteichthyes

- ◆ Ganoid or rhomboid scales (ganoin)
- ◆ Heavy, diamond-shaped, non-overlapping
- ◆ Primitive fish like gars



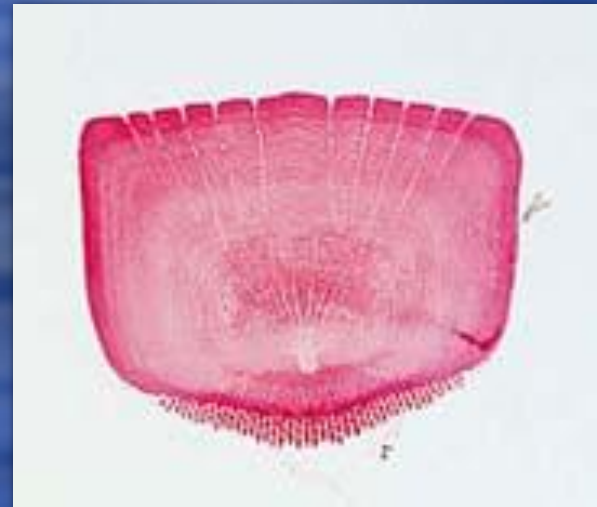
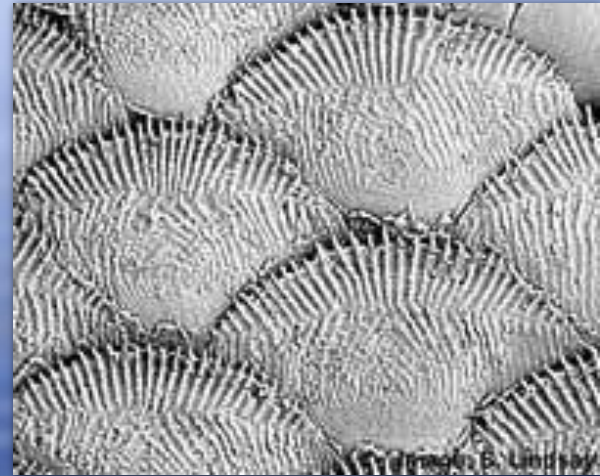
# Class Osteichthyes

- ◆ Cycloid scales - roughly circular
- ◆ Thin, flexible, overlapping
- ◆ Modern bony fishes such as minnows, suckers, trout



# Class Osteichthyes

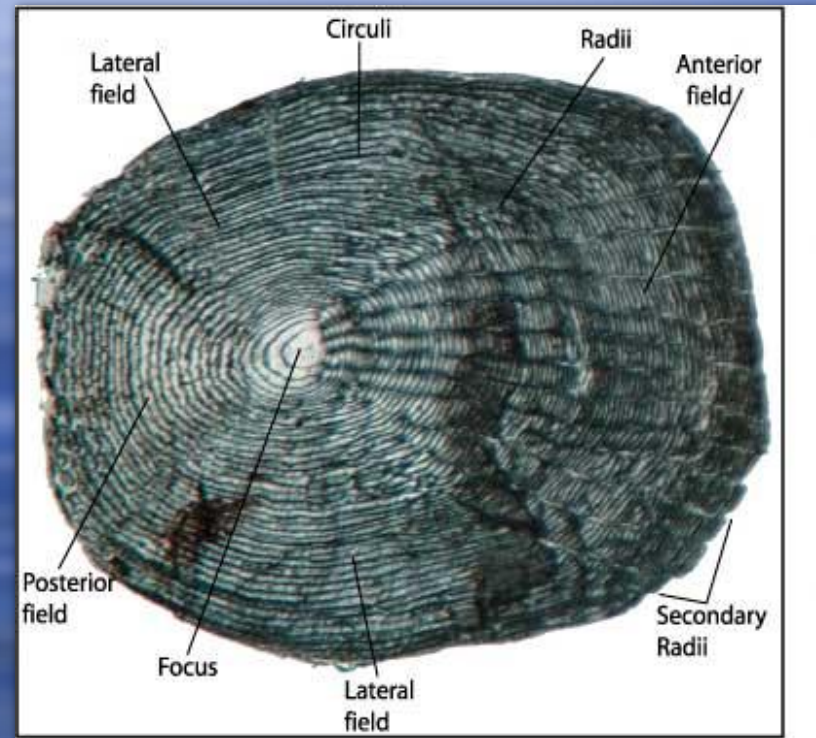
- ◆ Ctenoid scales - with minute ctenae or teeth - roughly rectangular
- ◆ Thin, flexible, overlapping
- ◆ Modern bony fishes such as sunfishes, perches





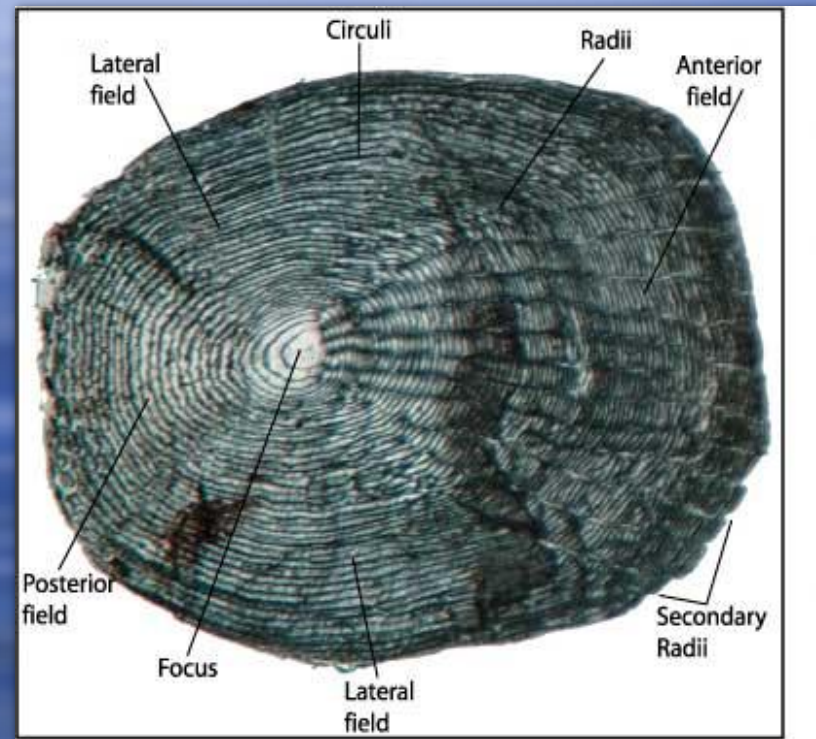
# Class Osteichthyes

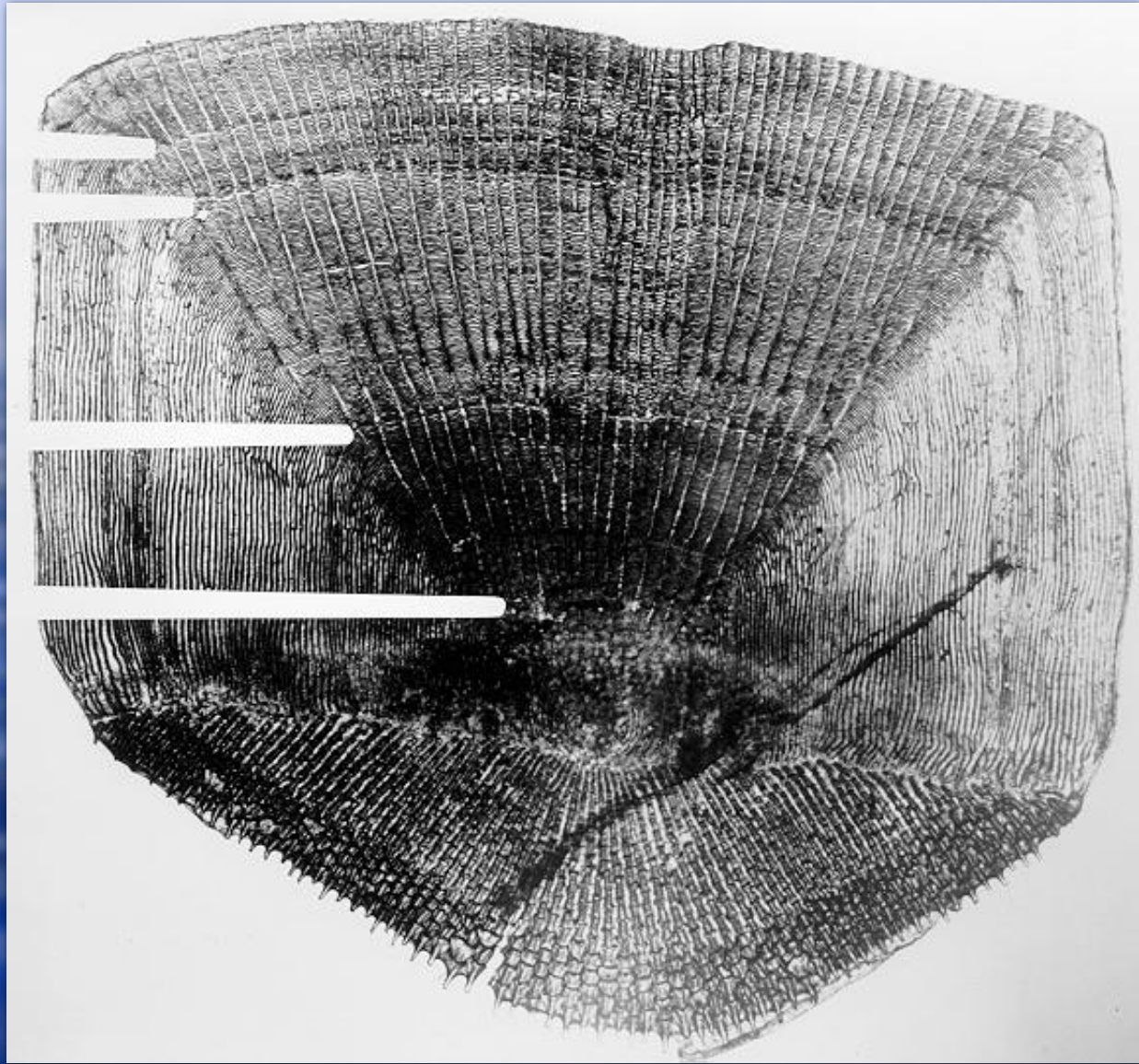
- ◆ Fish growth is reflected in scale growth
- ◆ Larger fish have larger scales
- ◆ Scales continually growing - temperature dependent

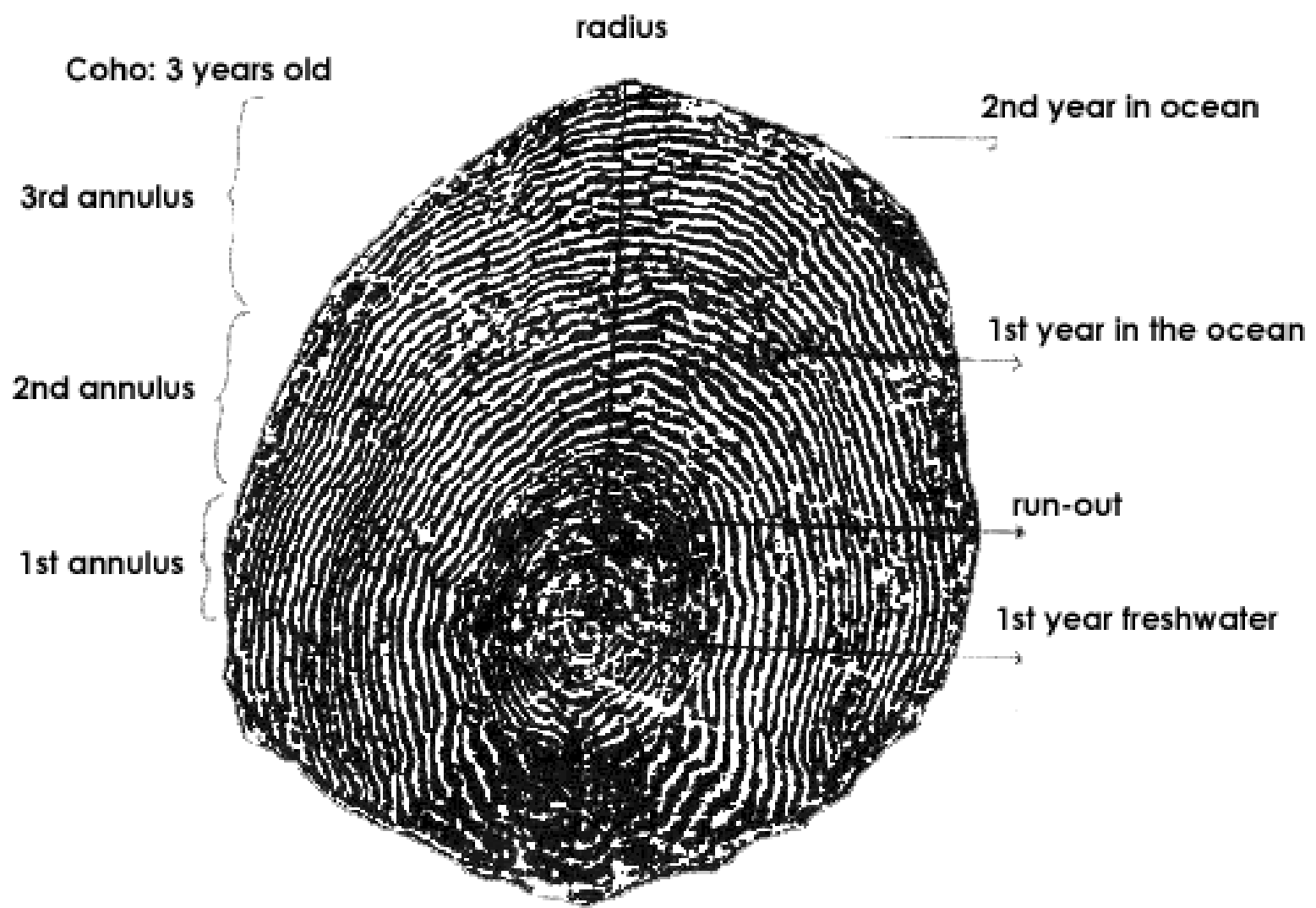


# Class Osteichthyes

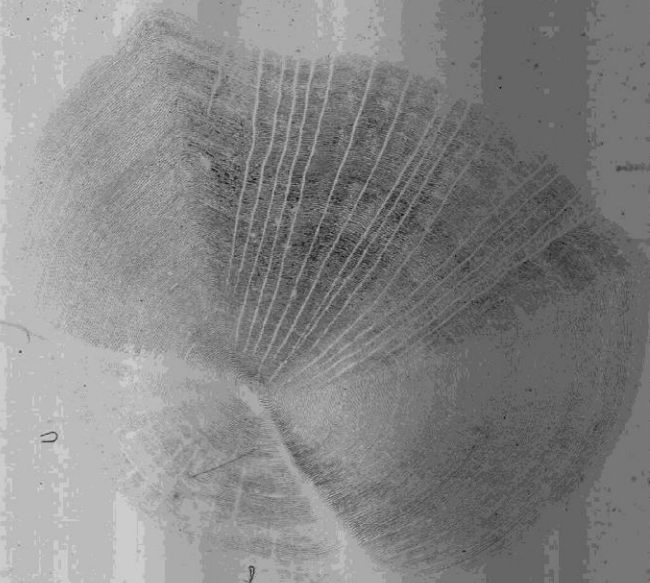
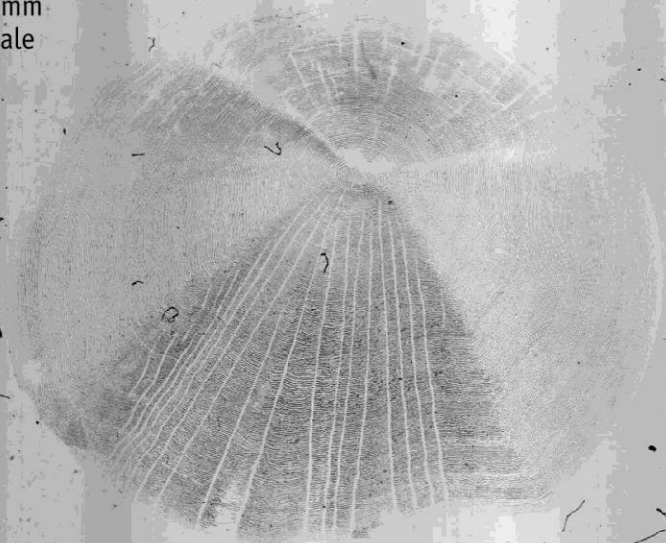
- ◆ Able to determine age of fish in areas with winter - greatly reduced growth
- ◆ “Rings” get closer together and form bands







*Hiodon tergisus*  
300mm  
female  
7+





# Barbels



# Barbels



- ◆ Found in fishes in many groups
- ◆ Catfishes
- ◆ Loaches
- ◆ Sturgeons
- ◆ Minnows
- ◆ Others



# Catfishes



# Loaches



# Sturgeons



© Pat Morris / [www.ardea.com](http://www.ardea.com)

# Minnows



# Hagfishes



# Cod

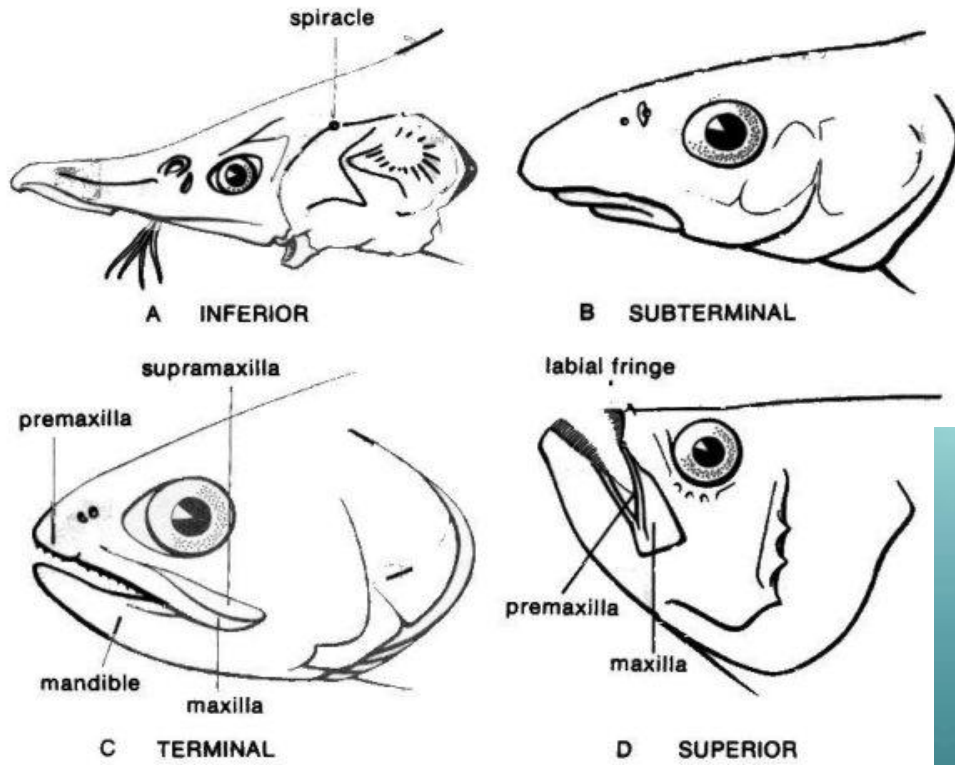


# Barbels

- ◆ Slender tactile organs near the mouth
- ◆ Taste buds – used to search for food in murky water
- ◆ Maxillary, nasal, mandibular or mental (chin)

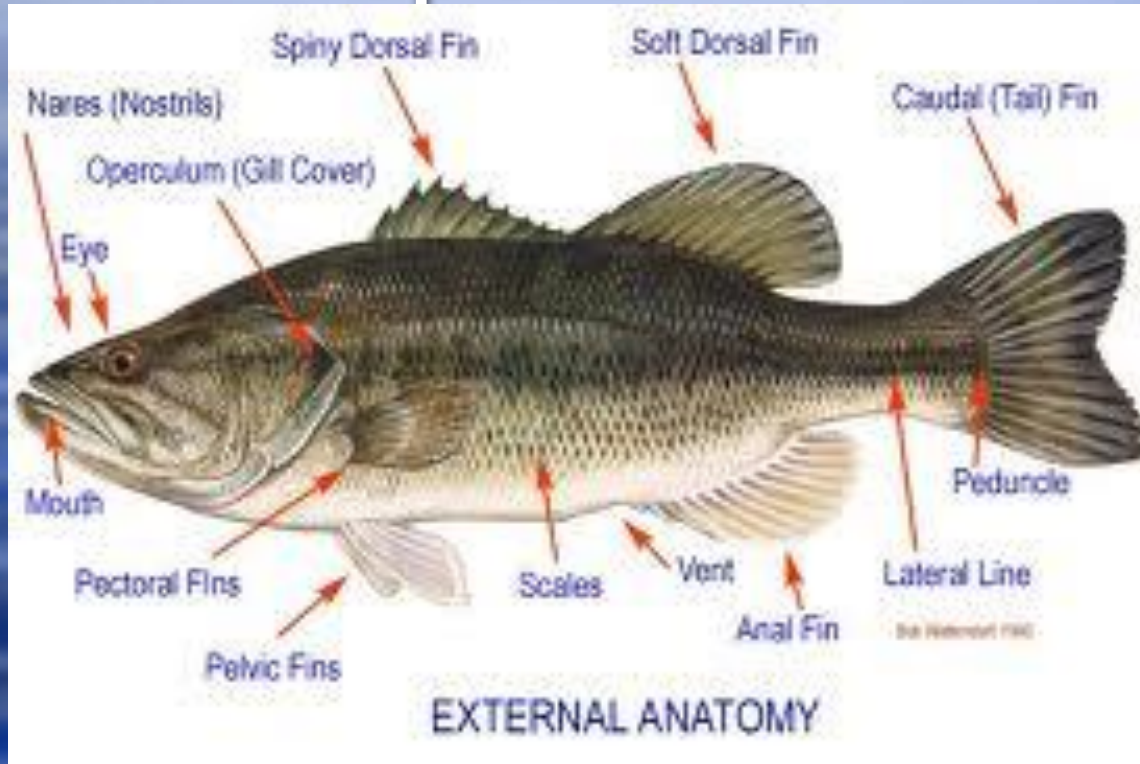


# Mouths





# Gill Openings – single operculum



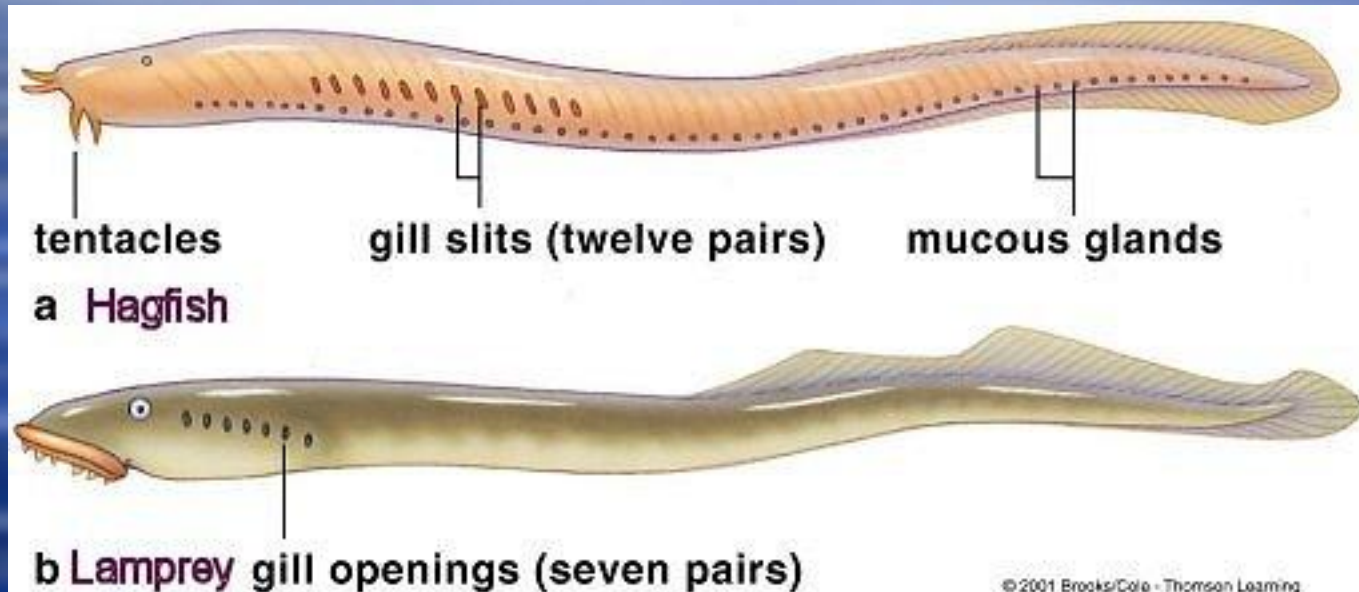
# Gill Openings - 5-7 slits



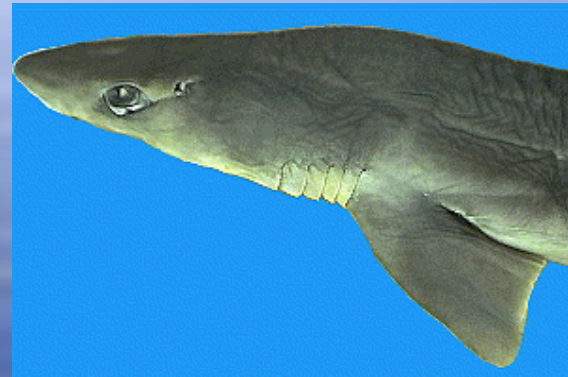
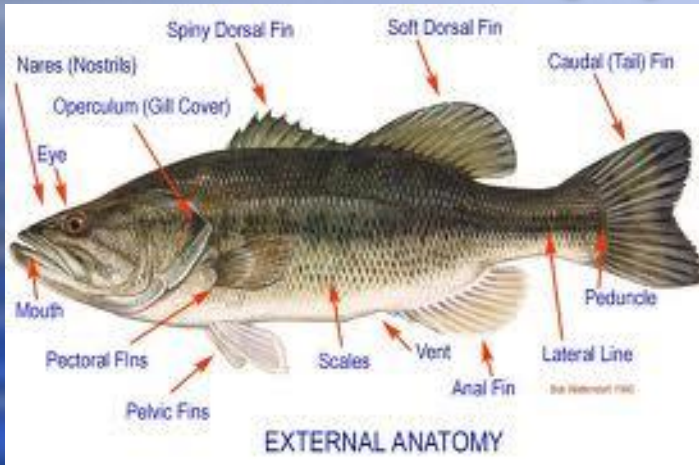
# Gill Openings - 7 pores



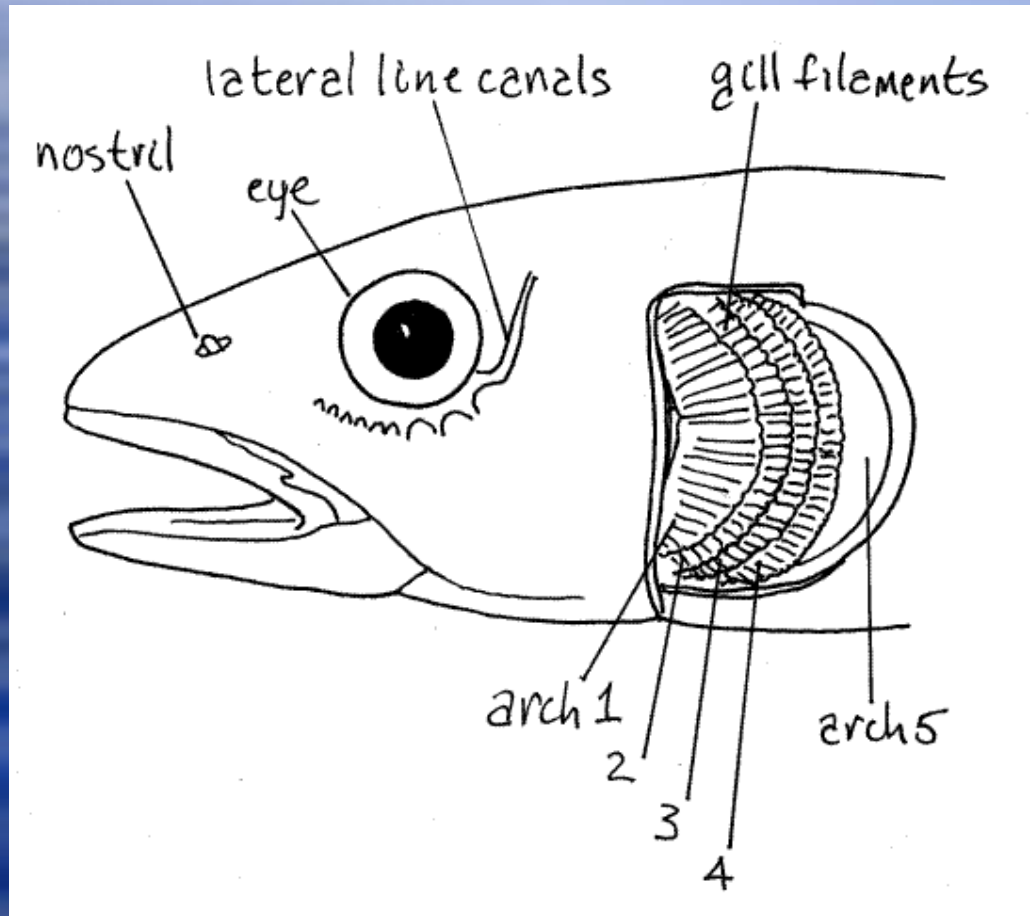
# Gill Openings



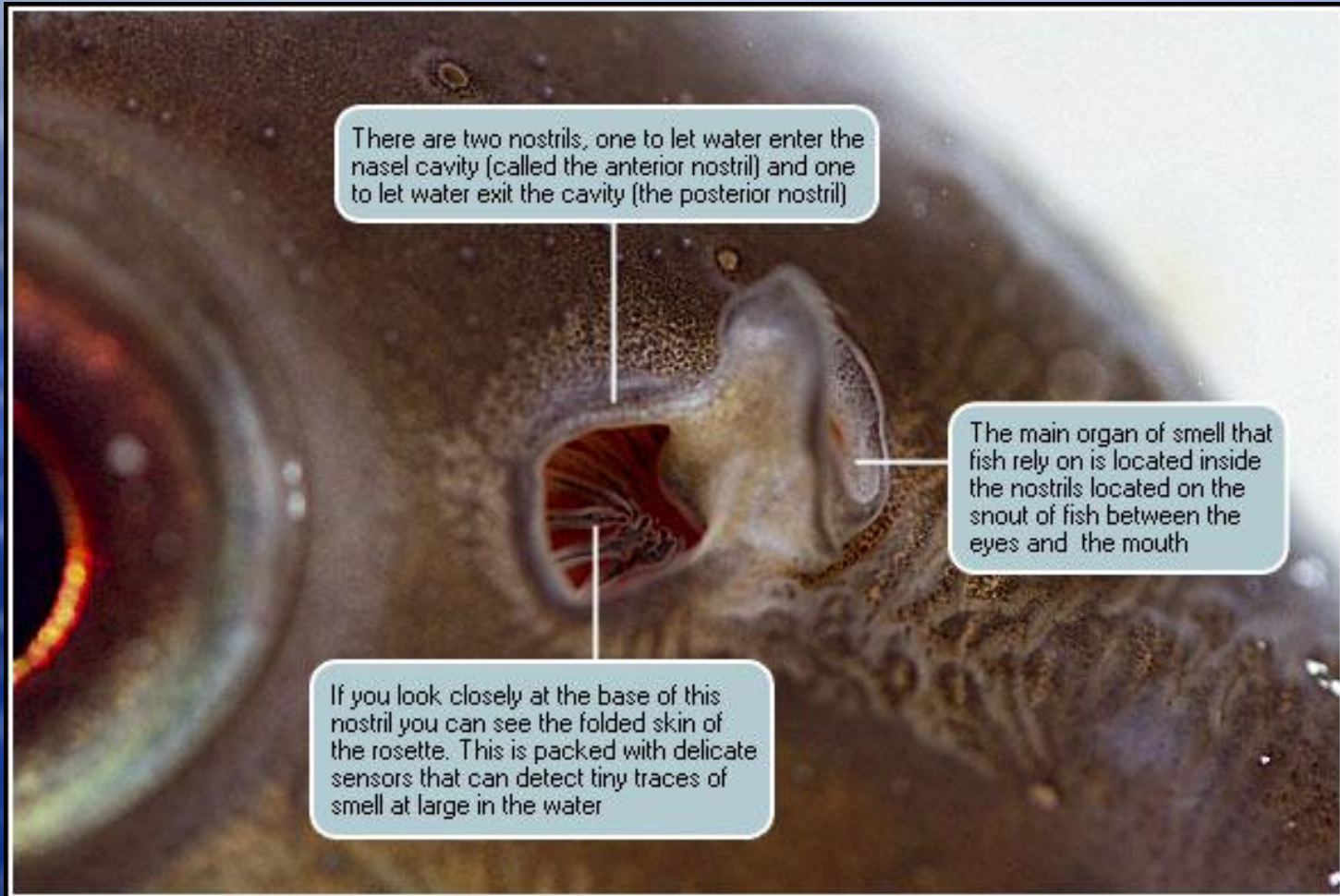
# Oxygenated H<sub>2</sub>O Intake (spiracles)



# Nostrils



# Nostrils



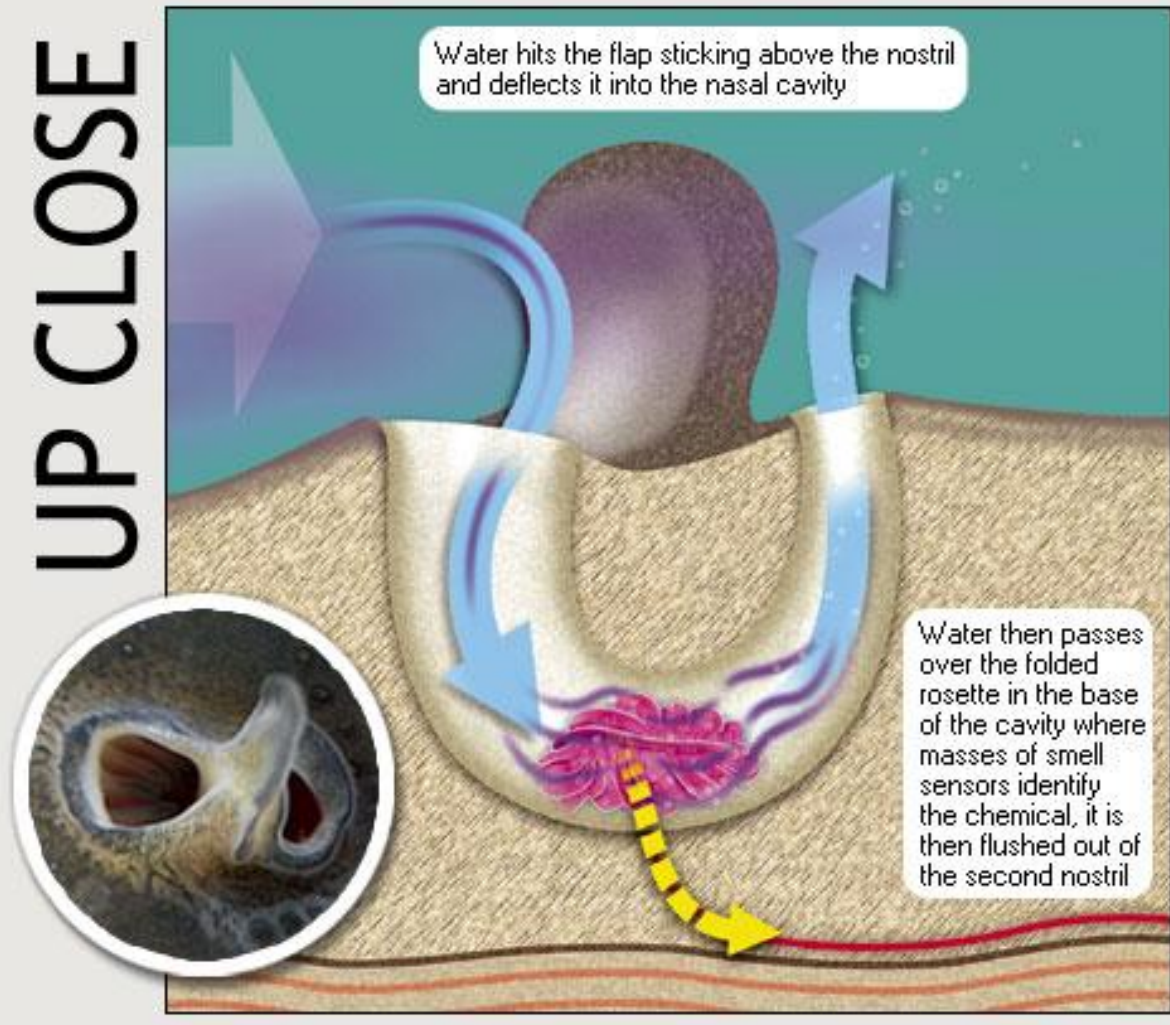
There are two nostrils, one to let water enter the nasal cavity (called the anterior nostril) and one to let water exit the cavity (the posterior nostril)

The main organ of smell that fish rely on is located inside the nostrils located on the snout of fish between the eyes and the mouth

If you look closely at the base of this nostril you can see the folded skin of the rosette. This is packed with delicate sensors that can detect tiny traces of smell at large in the water

# Nostrils

UP CLOSE





# Lateral Line

