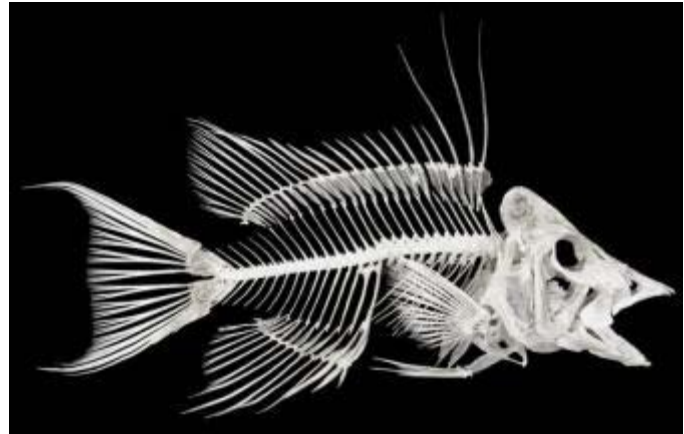


Lecture 3 – The axial and appendicular skeleton

- The vertebral column, cranium, jaw, ribs, and intramuscular bones comprise the skeleton.
- Jaws and cranium will be covered later in the course

SKELETON:

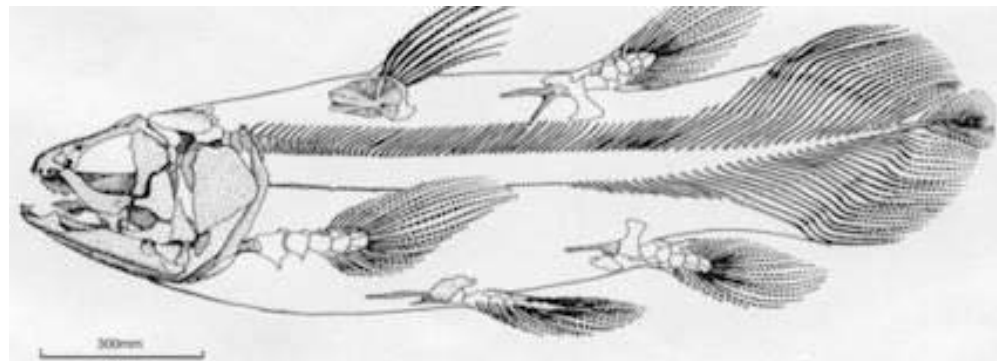
- gives structure
- provides protection
- assists in leverage
- site of red blood cell production.



So, what are the differences between bony fishes (the CLASSES Actinopterygii and Sarcopterygii) and the cartilaginous fishes (the CLASS Chondrichthytes).

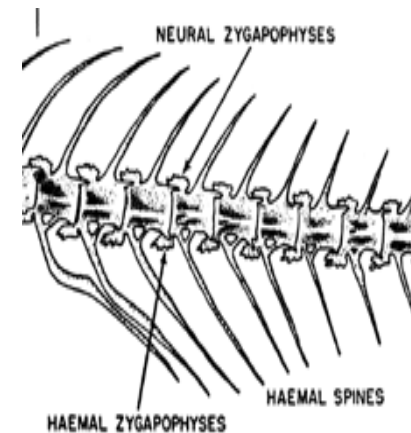
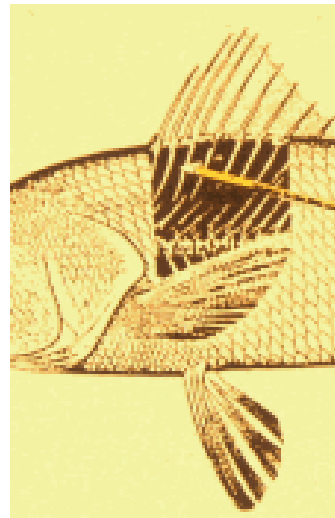
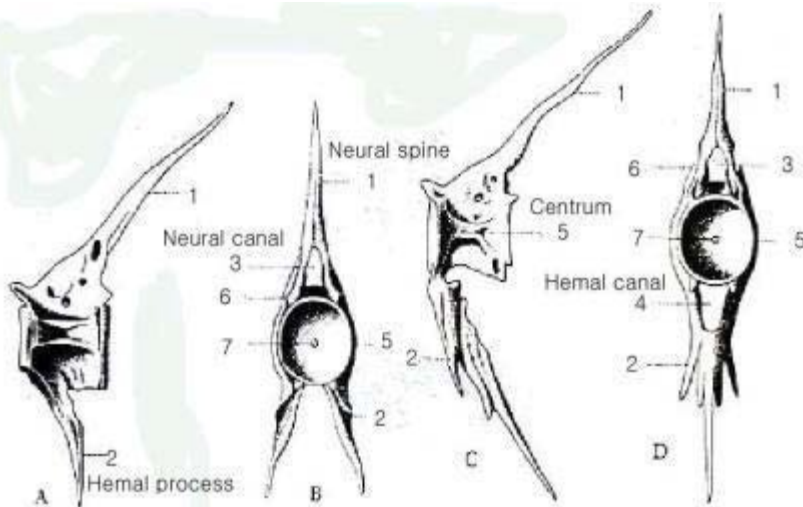
Axial skeleton (protects body organs)

- Also known as vertebral column
- Either cartilage (Chondrichthytes and coelacanths) or bone (Actinopterygii + other Sarcopterygii)
- Coelacanth – *Latimeria* has an unsegmented oil-filled hollow tube (hence coelom=cavity (a)canth=spine)



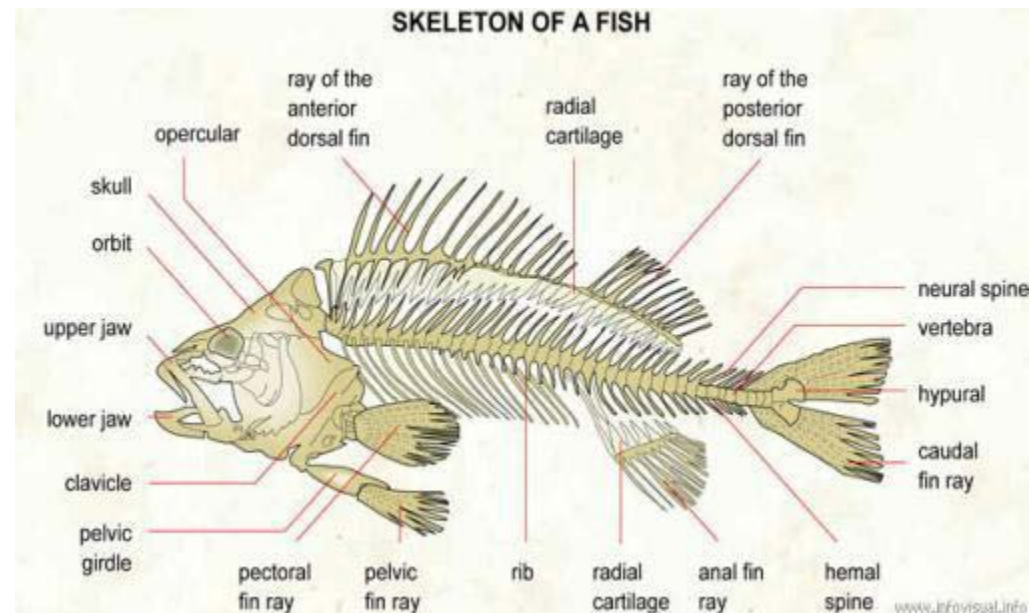
Vertebrae usually have at least one spine and one arch

- Neural spine and arch – dorsal with spinal cord
- Haemal spine and arch – ventral with caudal blood vessels
- Restriction of movement in vertical plane from zygapophyses and interlocking pterygiophores
- Pleural ribs attach onto thoracic vertebrae (no haemal spine) and protect the visceral cavity
- Intramuscular ribs are found in thoracic region



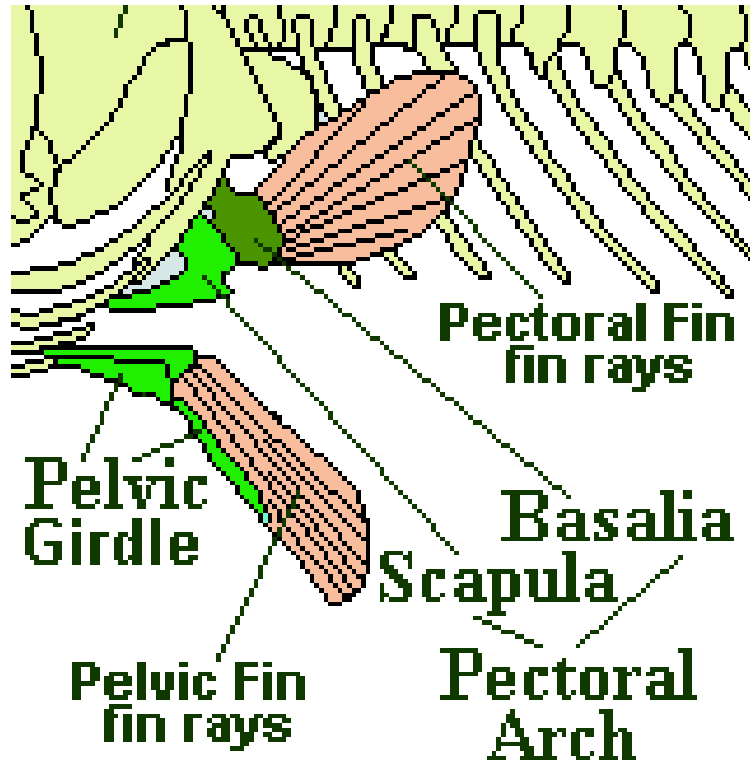
Appendicular skeleton (primarily associated with locomotion)

- These are the fins and are conspicuous. Two groups – paired and unpaired (median)
- Supported and stiffened by:
 - - lepidotrichia in bony fishes (originally from scales)
 - - ceratotrichia in cartilaginous fishes
- Rays- rays are soft and segmented constructed by elements one on top of each other- catfishes and carps have hardened modified rays that are spine-like.
- Spines – are derived from rays and are solid.



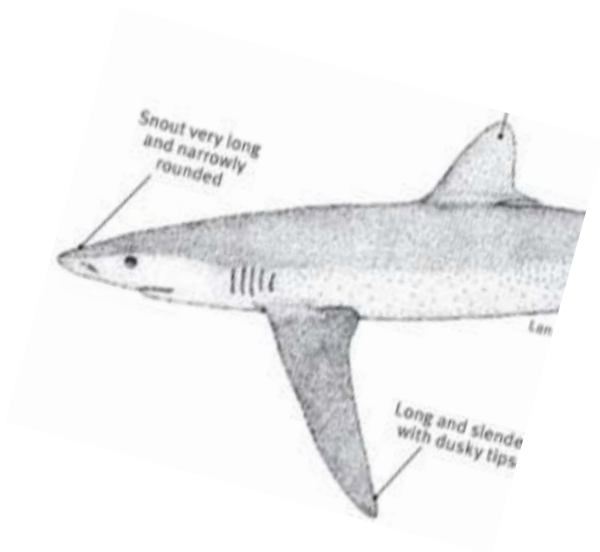
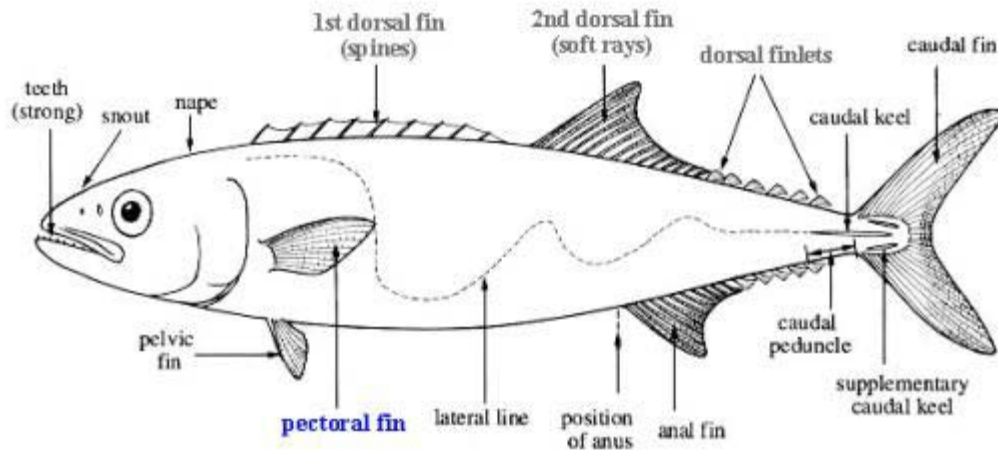
Paired fins

Each supported by a girdle (arms and legs analogy)



Pectoral fins

- Almost all fish have them
- Plesiomorphic (ancestral) forms are situated low on the body (eg sharks, catfishes)
- Apomorphic (derived) forms are high on body (eg cichlids)



- Derived fish have lost the mesocoracoid bone that holds the fins in a low oblique position and the pectoral girdle is formed from the cleithrum and scapula and coracoid which join ventrally
- fins attached to scapula via radials

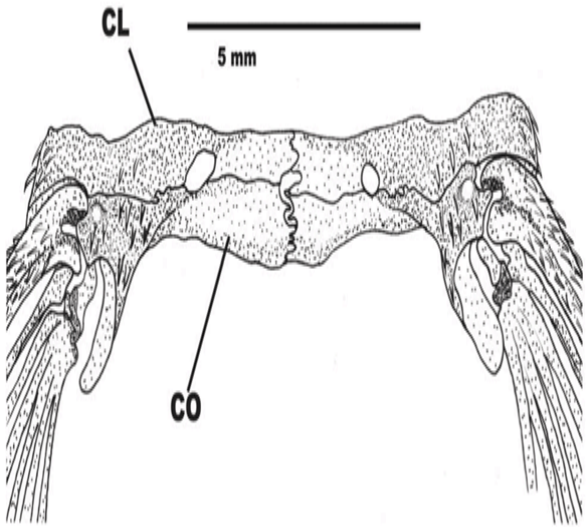
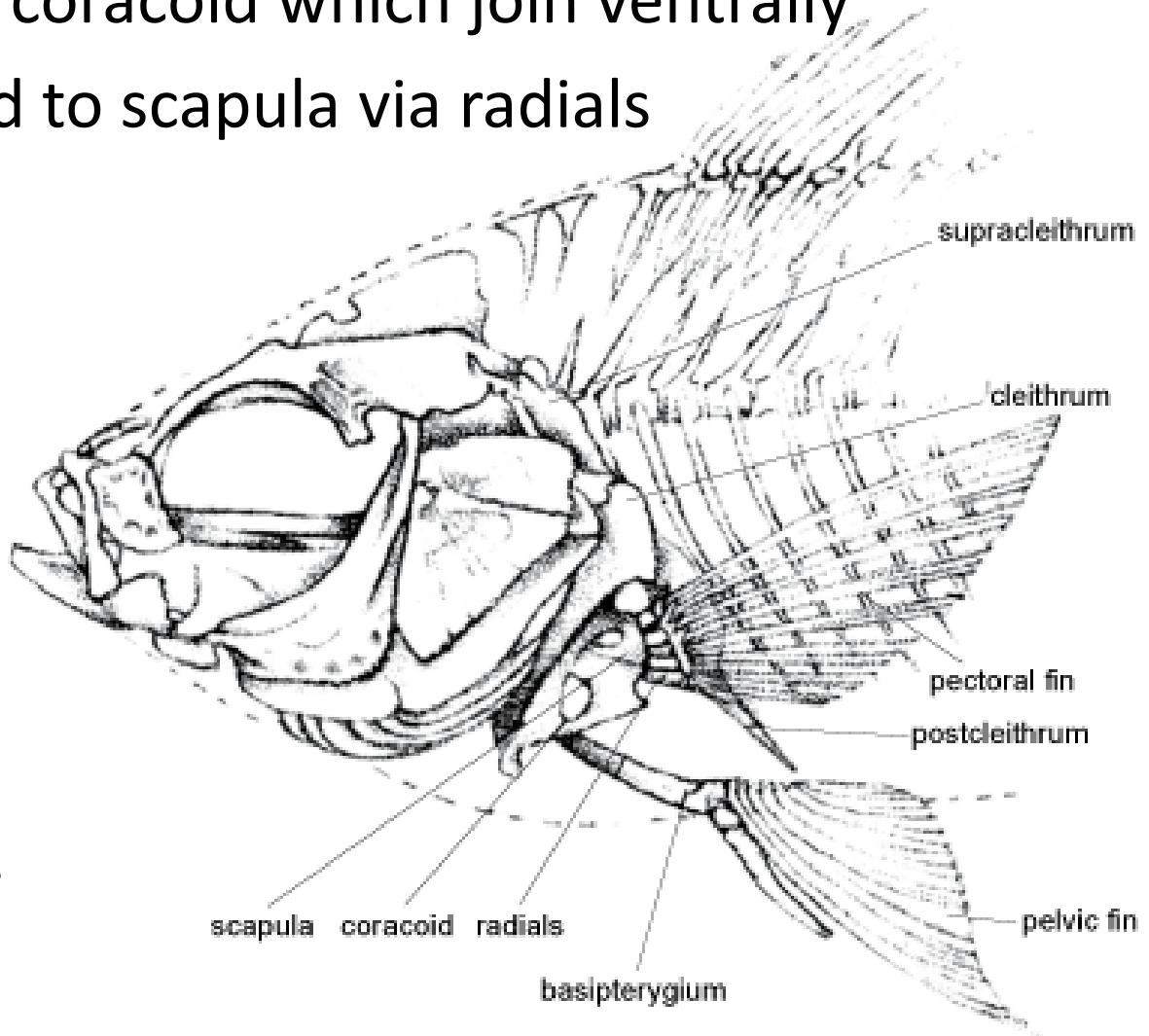


Fig. 6. Pectoral girdle in ventral view of *Gymnotocinclus anosteos*, MCP 41726, paratype, male, 40.5 mm.



Other types of pectoral fins

- birchirs (SUBCLASS Chondrostei) have a lobate base called a bracypterygium



- The CLASS Sarcopterygii have lobate fins of a completely different structure and are simply modified pectorals without radials



Pectoral Fin modifications

- Modified: clinging in hillstream loaches – Gyrinocheilidae
- Modified: flying in flying fish – Exocoetidae, Gastropolecinidae and *Pantodon*

overhead



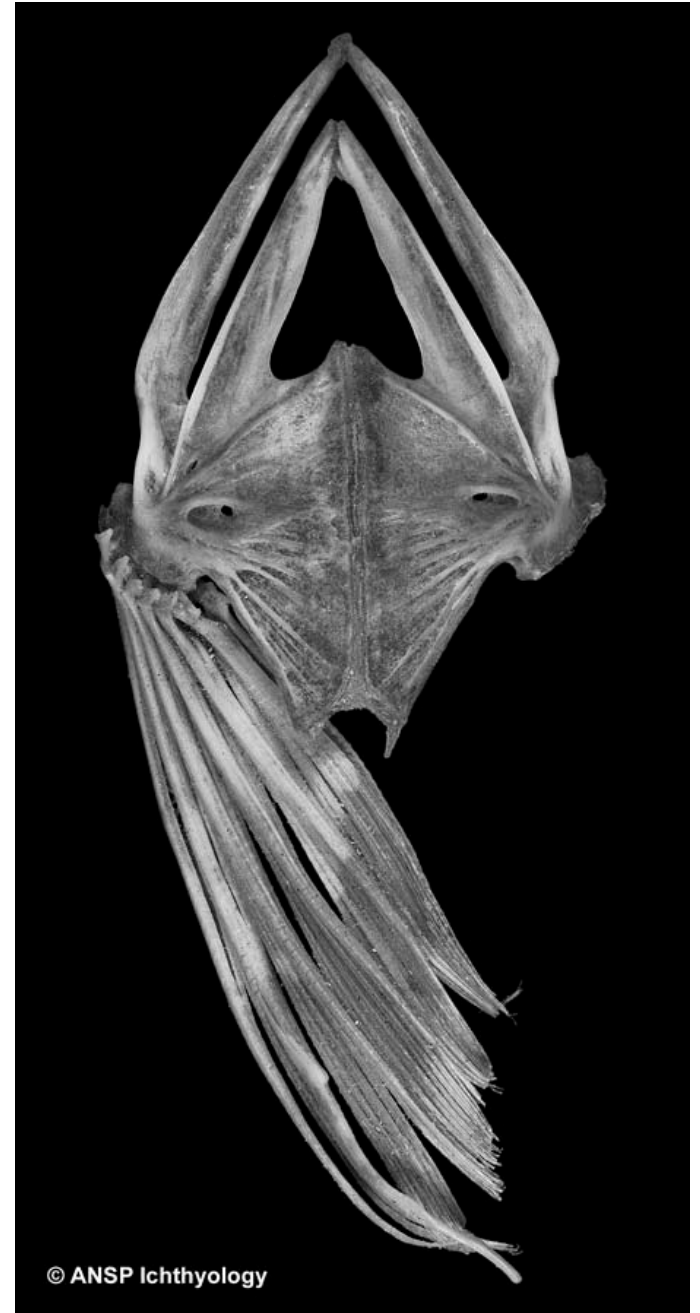
Pelvic fins (overheads)

- also known as ventrals
- smaller than pectorals
- restricted in function
- Plesiomorphic forms are situated posteriorly on body (eg sharks, catfishes)
- Apomorphic forms are anteriorly situated on body (eg cichlids)



Pelvic fins

- Thoracic, abdominal and jugular in position
- Girdle is comprised of basipterygium and then radials and fins



Pelvic fin modifications

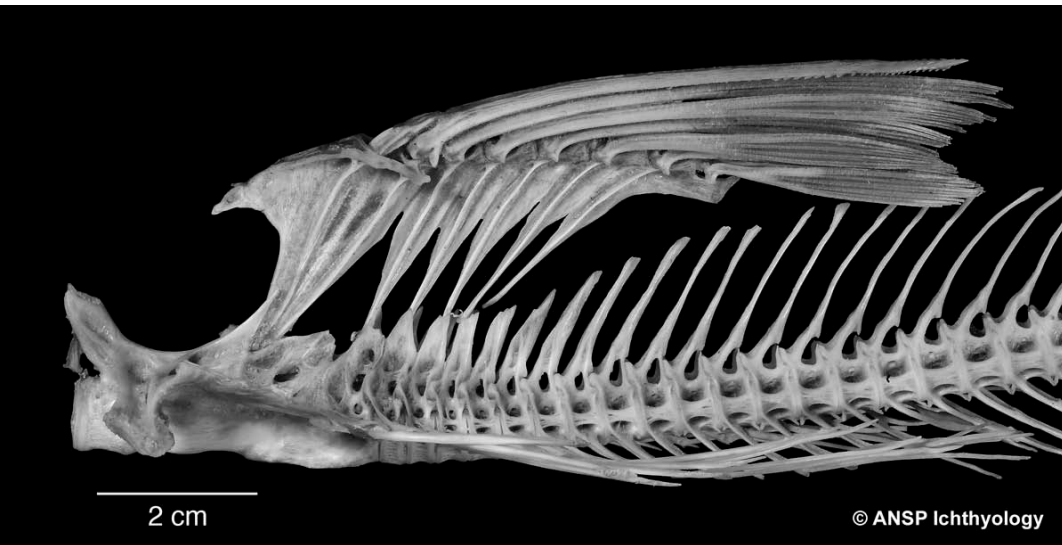
- Modified: sucking in clingfish (Gobiesocidae) and gobies (Gobiidae)
- Modified: claspers in Chondrichthyes

overhead



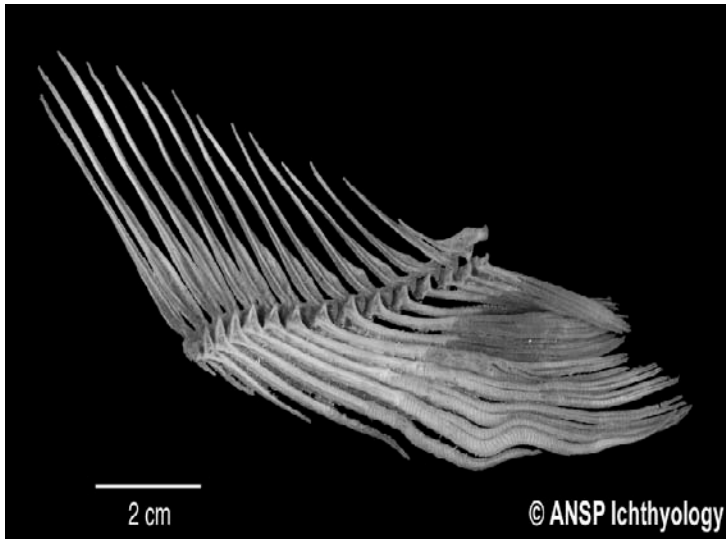
2. Median fins

- Dorsal or ventral and include “tail fin” – can be continuous in eels
- Dorsal and anal – spines and rays
- ***a. Dorsal fin(s)***
 - Supported by pterygiophores
 - Modified: sucking in remoras (overhead)



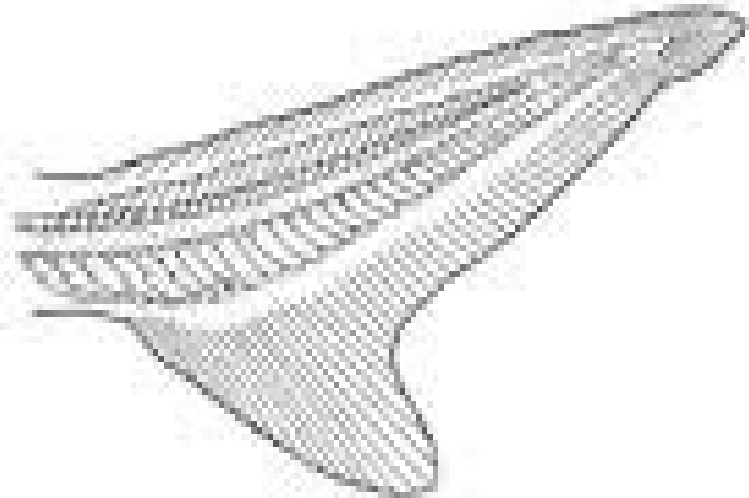
b. Anal fin(s)

- Lacking in most chondrichthyans
- Normally found just posterior to the anus
- Supported by pterygiophores
- Modified: gonopodia in Cyprinodontidae

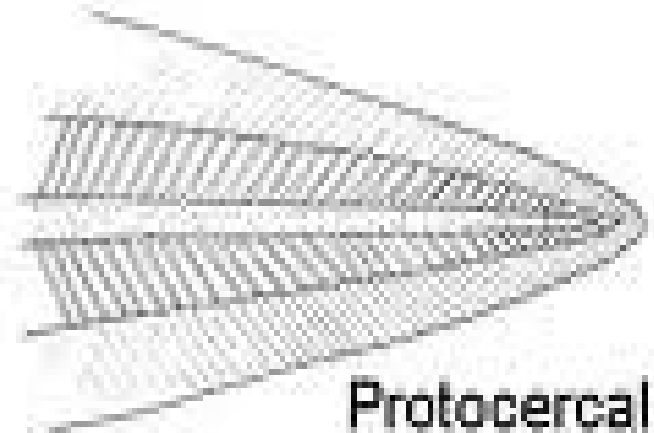


c. Caudal fin

- Four main types : heterocercal, protocercal, diphyccercal and homocercal

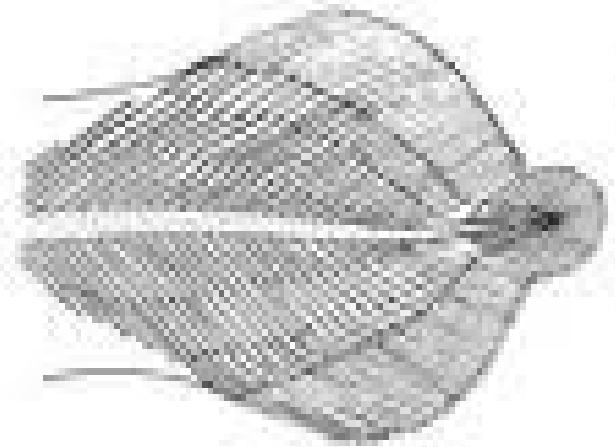


Heterocercal

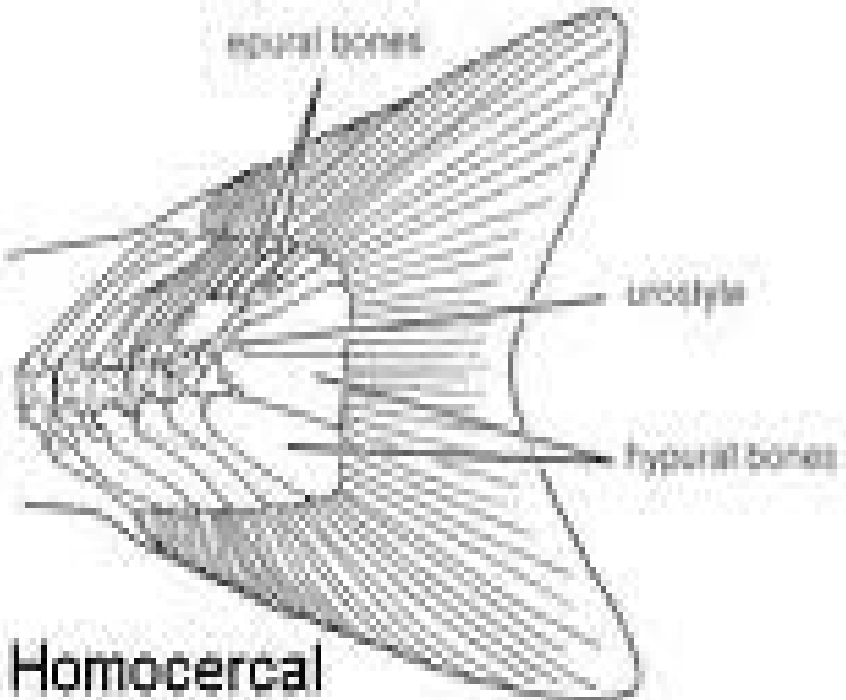


Protocercal

caudal bones



Diphyccercal

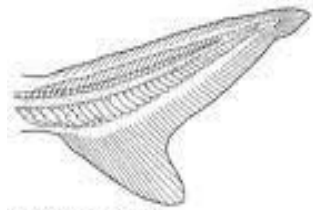


Homocercal

urostyle

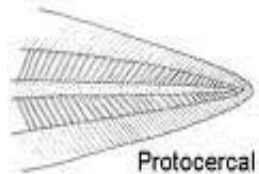
hypural bones

c. Caudal Fins (overhead)



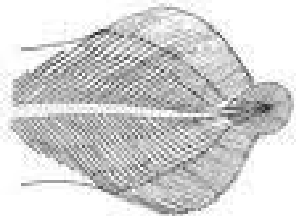
Heterocercal

- Heterocercal – vertebral column extends into the upper lobe of the tail. Eg. Bowfins – Amiidae have an intermediate abbreviate heterocercal caudal fin.



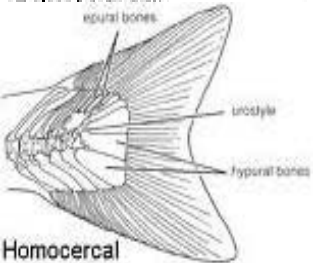
Protocercal

- Protocercal – undifferentiated caudal fin, vertebrae extends to the posterior end of the fish.



Diphyrcercal

- Diphyrcercal – similar to protocercal, dorsal and anal fins joined with caudal fin at the posterior part of the fish. This is thought to be a derived character



Homocercal

- Homocercal – hypural bones support most of the branched fin rays. Epural bones turn upward and support the upper procurrent rays .



- Gephyrocercal – caudal fin can be 2° lost – sunfishes (Molidae)

c. Caudal fins

- Variety of sizes and shapes
- Swimming habits can be deduced from shape (fast = forked/lunate)

