FISH BIOLOGY/ MORPHOLOGY

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INTRODUCTION

Largest Group of vertebrates

☐Four major subdivisions or classes

I.Agnathaor Cyclostomata

II.Placodermi

III.Condrichthyes (Cartilaginous fishes)

IV.Osteichthyes (bony fishes)

☐**Osteichthyesis most diverse group with approx. 21,000 species and form 97% of total fishes**

☐Modern bony fishes are represented by two groups

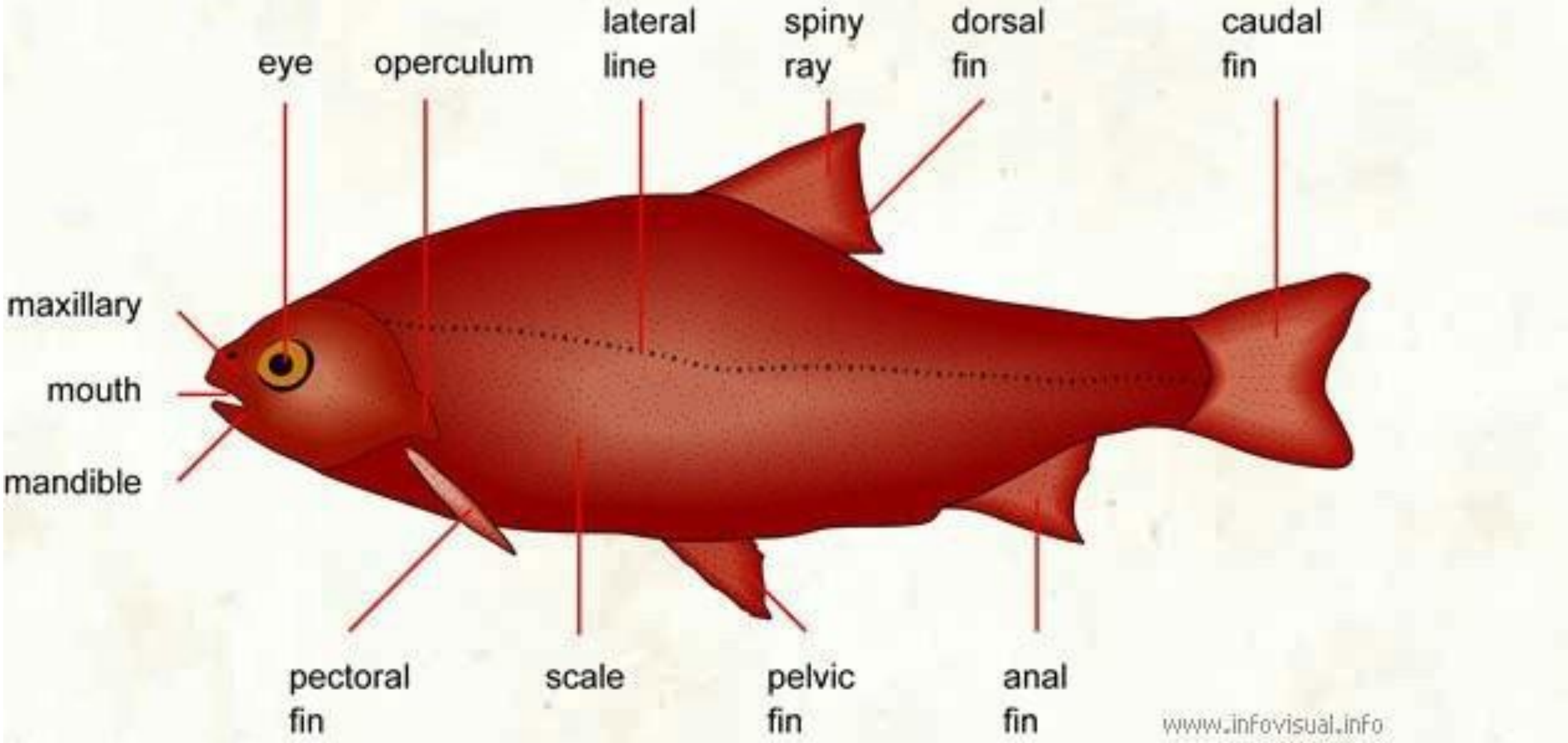
I.Sarcopterygii (flesh or lobed-finned fishes)

II.Actinopterygii (ray-finned fishes) 99% of living bony fishes

☐**Teleostei with 20,000 species most diverse vertebrate group living**

☐**Teleosts have 27 orders and 390 families**

MORPHOLOGY OF A BONY FISH



BODY DIVISIONS

Fish body is divide into:

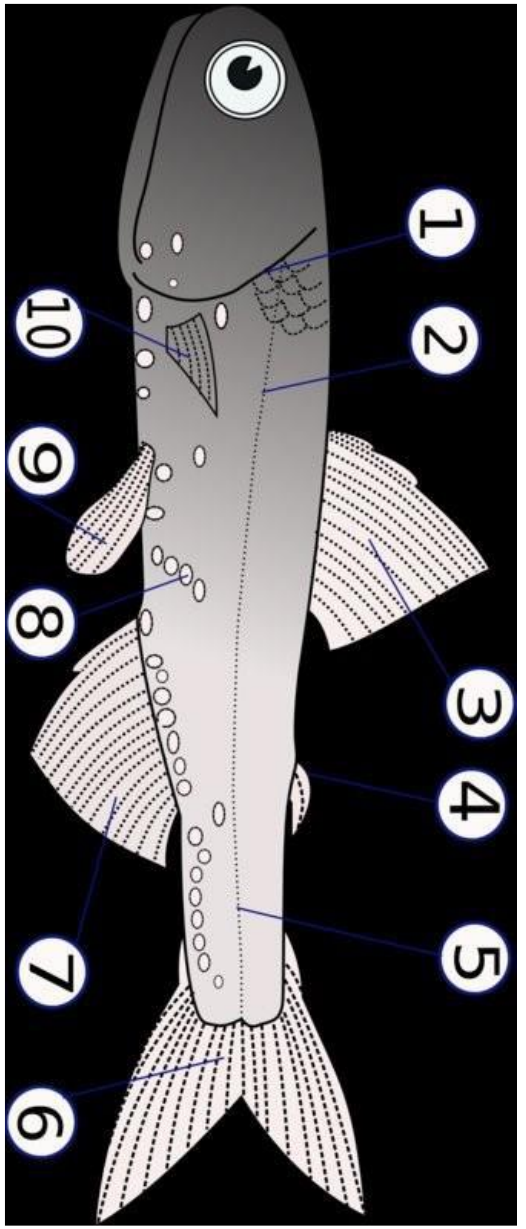
head

Trunk

caudal

The divisions are not always externally visible.

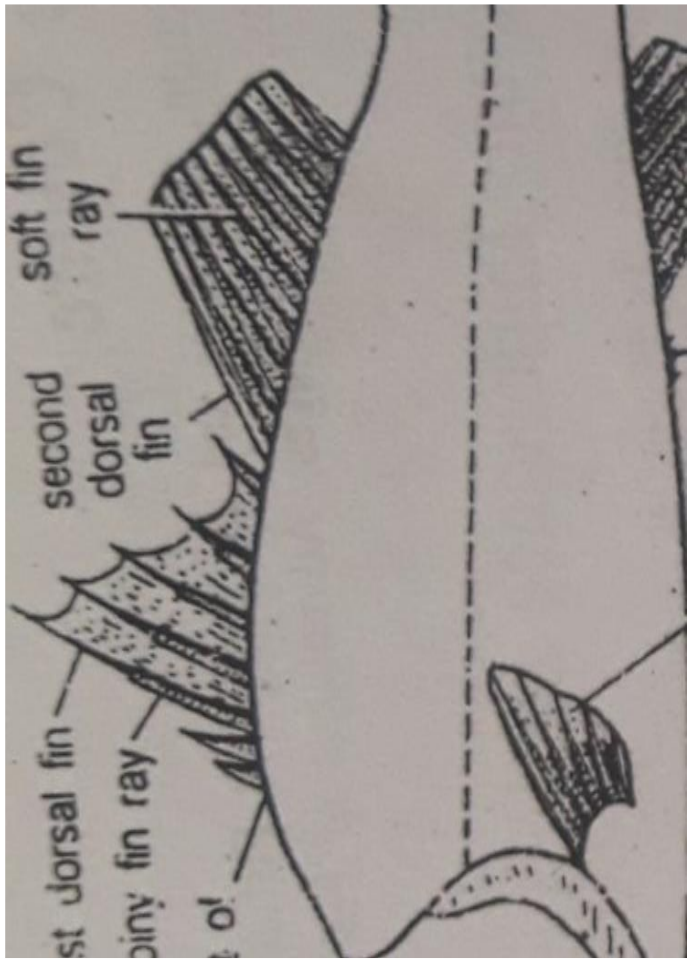
Neck is absent the region behind the “nape”



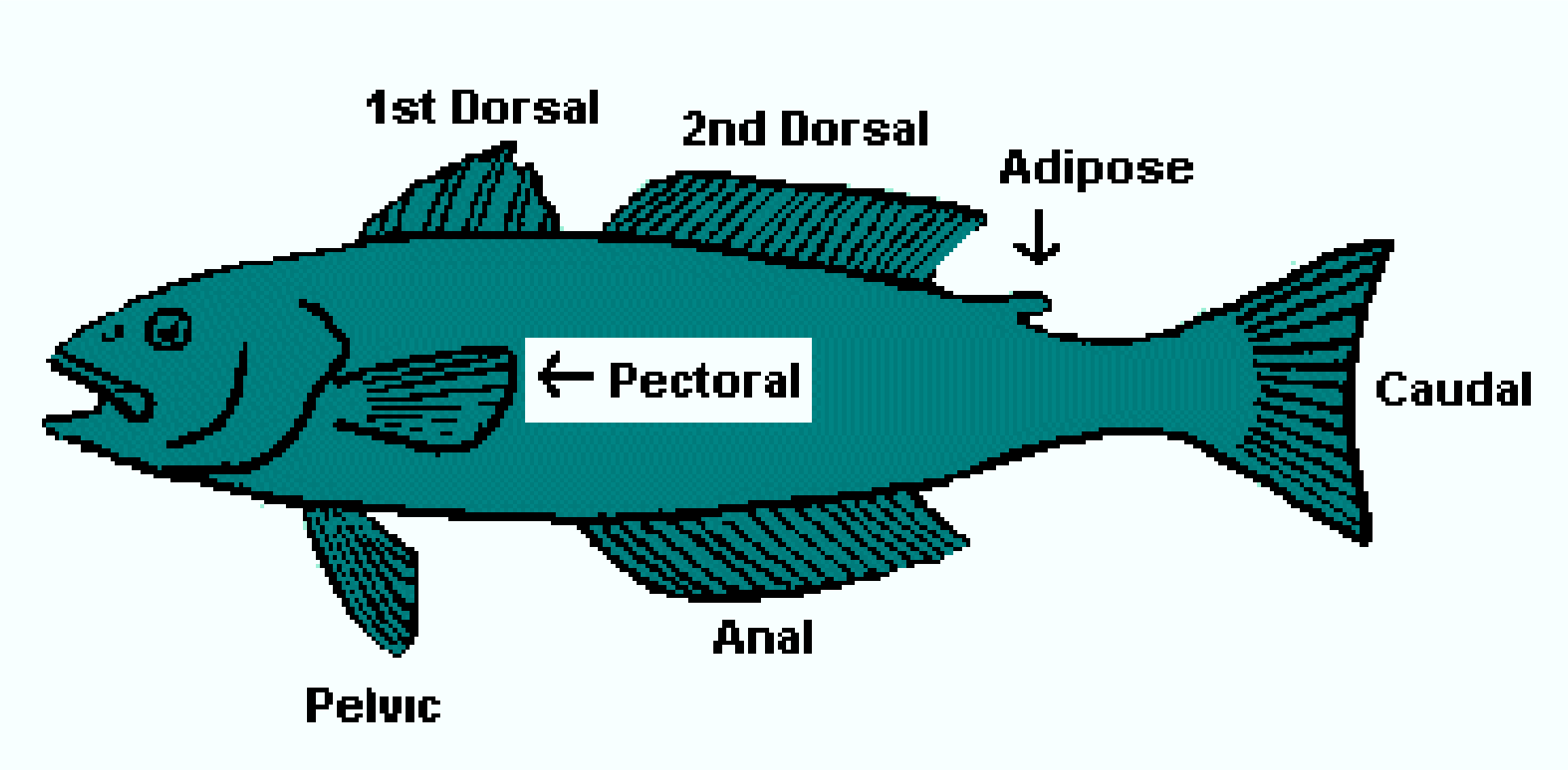
FIN TYPES

Integumentary Extension of body with no coelom

- Supported by muscles and rays or spines
- Rays are modified into soft and hard rays
- **Soft rays: slender flexible structures composed of many bony joints**
- Present usually at front of fin and short
- **In some fishes (catfishes and carps) soft rays may fused to form stiff spine like structure called hard rays**
- **True spines are stiff rays ending in sharp points and do not show joints**



FIN TYPES



CAUDAL FIN SHAPE

from Latin caudameaning tail

☐Tail terminates into caudal fin

☐The caudal fin may be

A.The *homocercal*: It is symmetrical.

It appears in verity of shapes like

a.Round

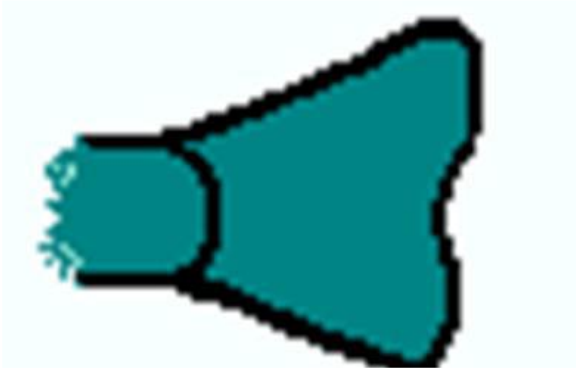
b.Truncateor square

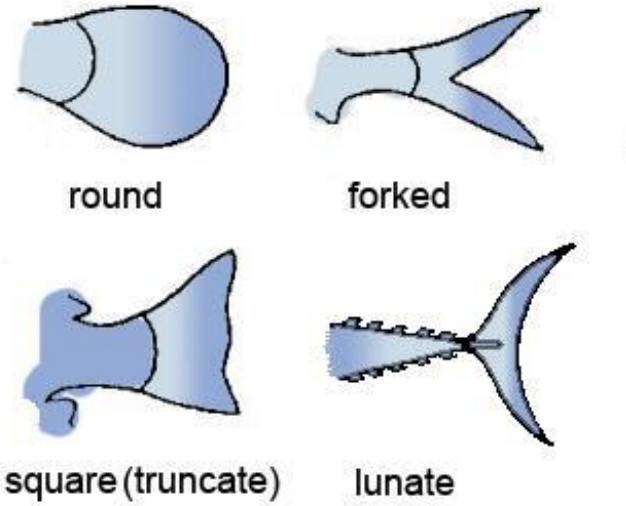
c.slightly forked

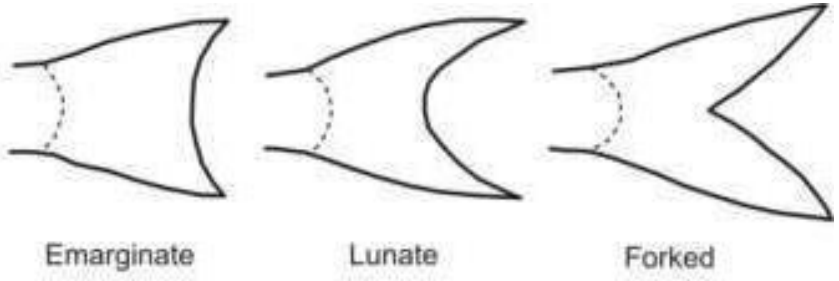
d.and deeply forked

e.Emarginate

f.lunate



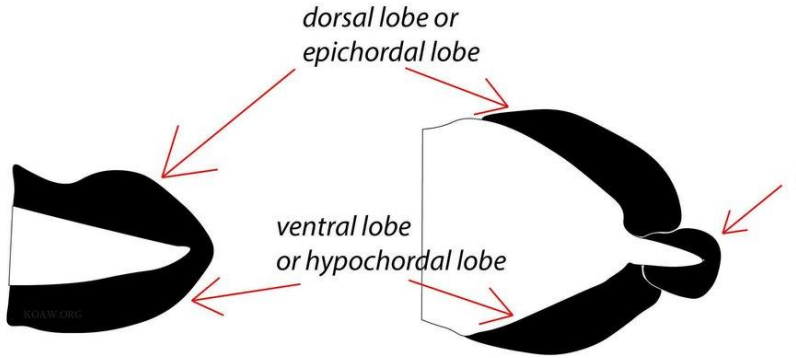




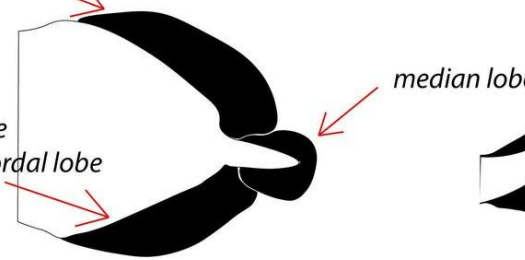
Caudal Fin (Tail Fin) Types

(The Quick Reference for Fishes – Simplified Version)

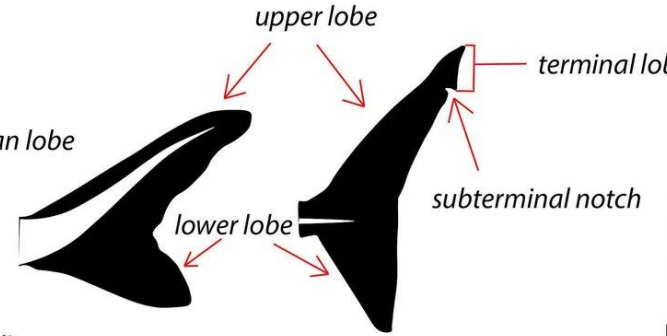
Koaw.org



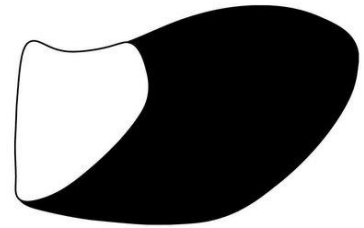
Protocercal (diphycercal)
Primitive and undifferentiated; vertebrae extend to tip of tail symmetrically.
(Lampreys, hagfishes, larvae of advanced teleosts).



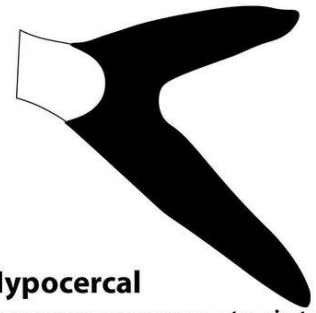
Leptocercal (modified diphycercal)
Vertebrae extend symmetrically to tip of an expanded tail.
(Convergently evolved in coelacanth, lungfishes, ratfishes and many eel-like fishes).



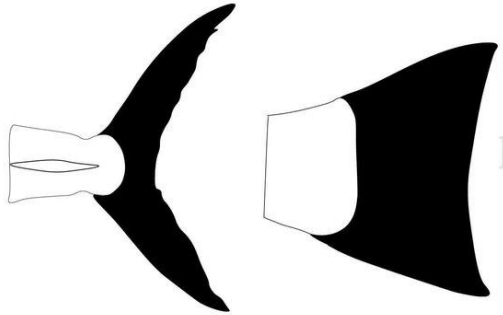
Heterocercal (unequal-lobed)
Vertebrae extend into upper lobe.
(Modern sharks and primitive bony fishes like sturgeon).



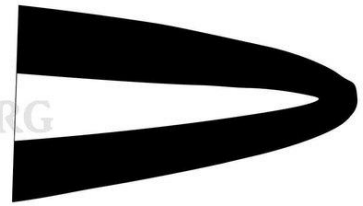
Hemihomocercal (abbreviated homocercal)
An intermediate between heterocercal and homocercal.
(*Amia calva* - bowfin; also in gar)



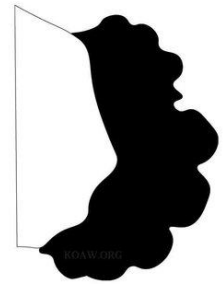
Hypocercal
Expresses asymmetry internally and externally; ventral lobe longer (Cypselurus, flying fishes).
Different than **reversed heterocercal** where vertebrae extend into ventral lobe.



Homocercal (equal-lobed)
Exists in most advanced teleosts; expresses asymmetry internally but symmetry externally; so can be considered abbreviated heterocercal.



Isocercal
Resembles protocercal tails but retains asymmetrical internal structure of homocercal tails.
(Gadidae, Notopteridae, Gymnarchidae, Macruridae, Anguilliformes)



Gephyrcercal
The clavus is the hardened bridge between anal and dorsal fins. Highly advanced; found in molids (molas/ocean sunfishes); no caudal bones.

B.THE HETEROCERCAL

If both ends of tail is not of equal length

☐**an ancient formof caudal fin**

☐**Present in only afewprimitive fishes sharks, sturgeon, and paddlefish.**

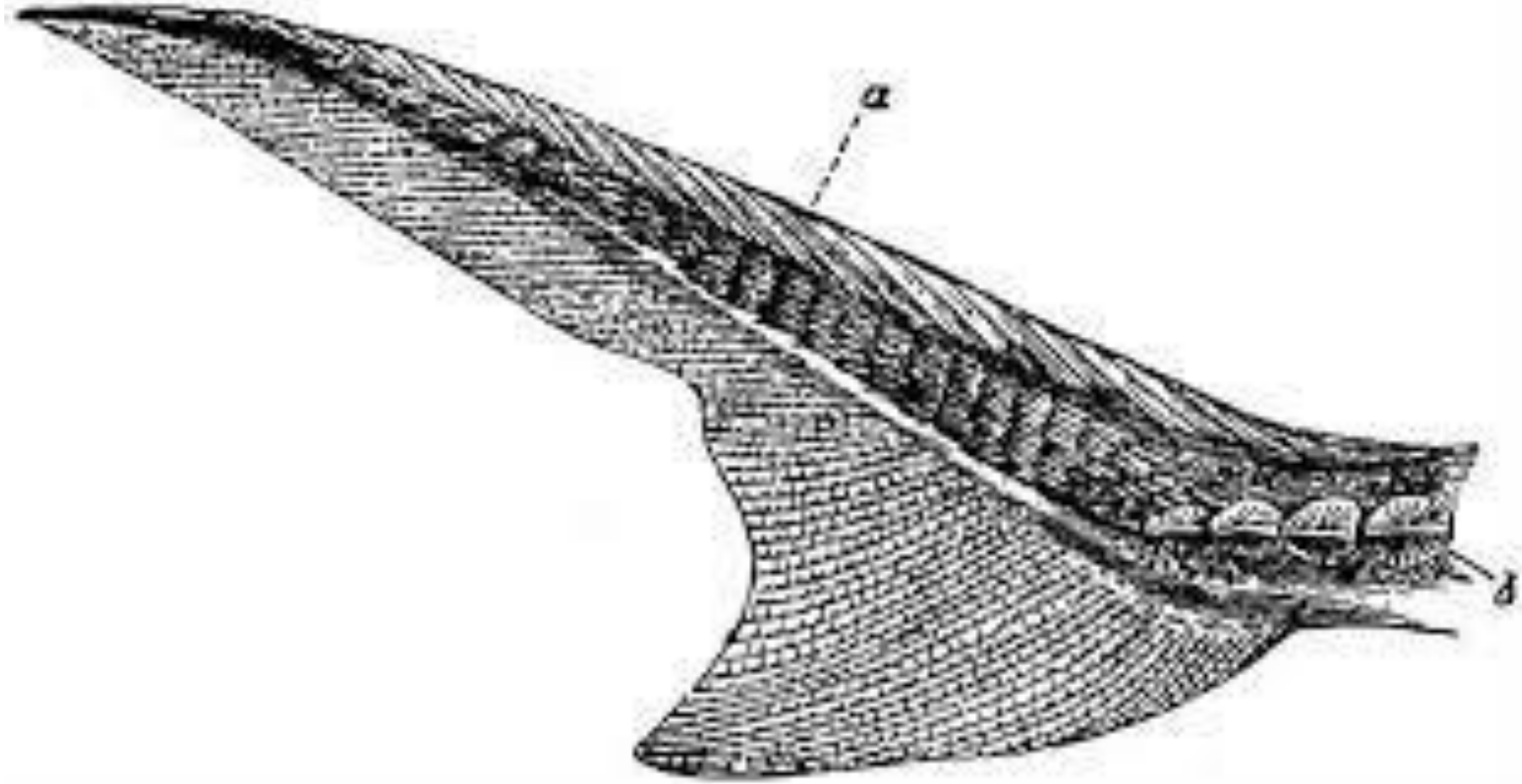
☐It wasanecessary tail shape when

a.fisheshad no swimbladders

b.and were heavy in the front

☐**if the fish use a symmetrical tail, it would have plungedtoward the bottom.**

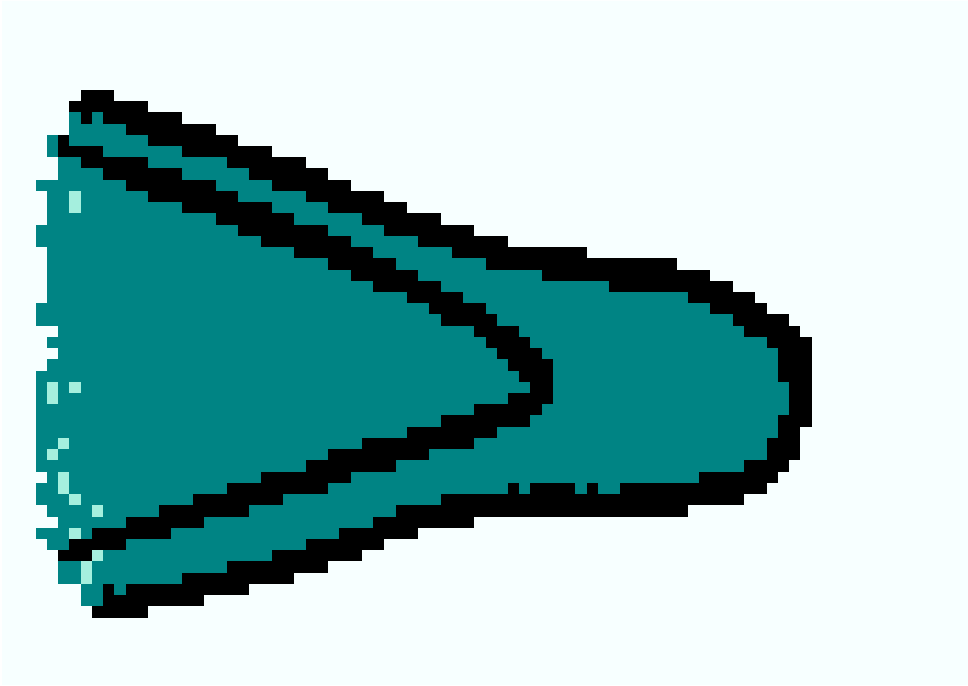
☐**Instead, it developedatail with downward-driving design and supplemented it withhorizontal, plane-like pectoral finsthat transformed that downward force into ahorizontal, forward-driving force.**


a
d

NON-DIFFERENTIATED CAUDAL FIN

This fin is not differentiated

- may be found in
- eels of all sorts
- lampreys.



PECTORAL FINS

The paired pectoral fins are located on each side, usually just behind the operculum

☐homologous to the forelimbs of tetrapods

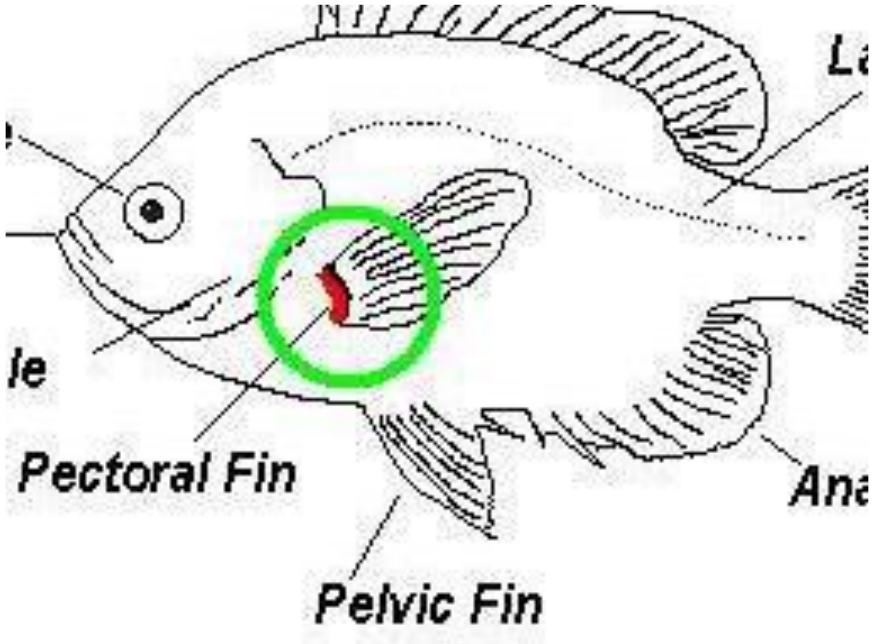
☐salmon, trout, shark, or sturgeonmainly for gliding.

☐These may also often used for

a.swimming

b.holding position

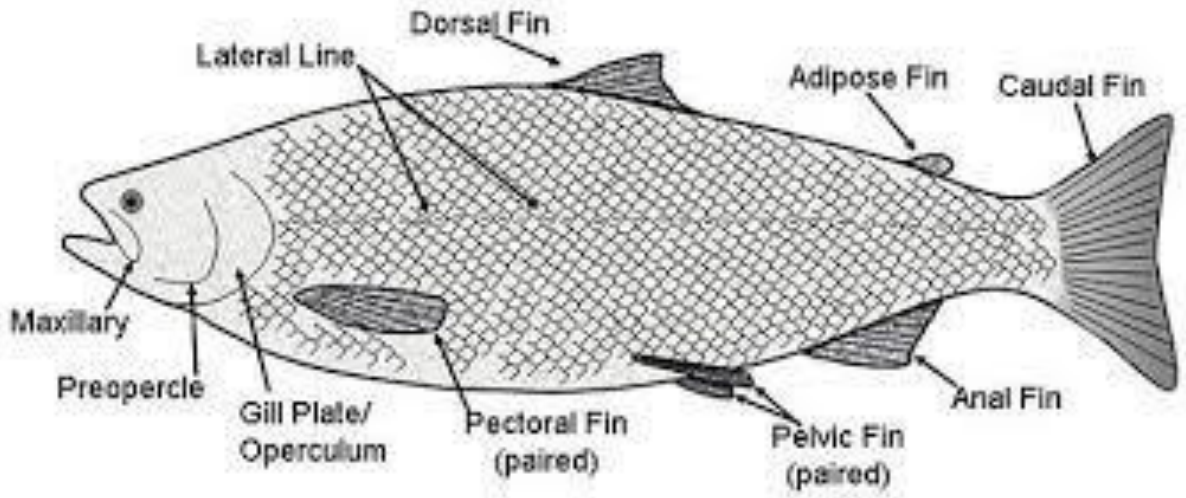
c.changing directions quickly.



ANAL FIN

Median ventral fin

- Just posterior to the anus
- Composed of both spines and soft rays
- stabilize the fish while swimming



PELVIC FINS

Anterior to anus but move forward in many fishes

- **homologous to the hindlimbsof tetrapods**
- assists the fish in going up or down through the water
- turning sharply
- and stopping quickly

a.When near anus it is **abdominal pelvic fin** meaning thatthey are attached midway down the belly

b.When pelvicfinsnear or under pectorals it is ***thoracic*pelvicfin**

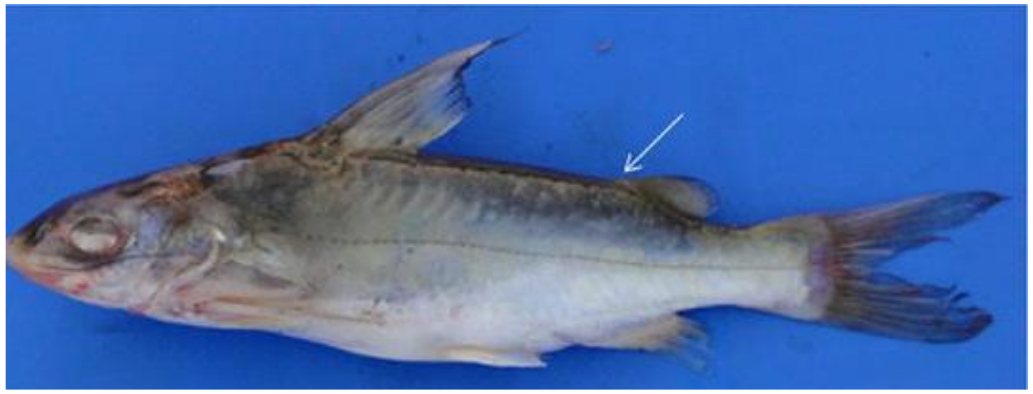
c.In some anterior to pectorals it is **jugular fin**

d.and if under the chin or eye, mental fin

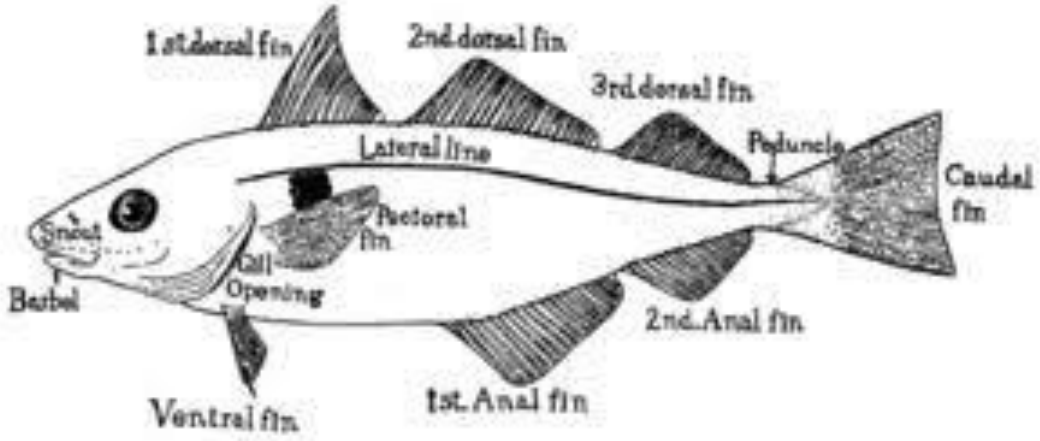
ADIPOSE FIN

Small median fin behind the dorsal fin

- and just forward of the caudal fin
- Soft flashy structure without spines or rays
- The function of the adipose fin is something of a mystery
- may be vital for the detection and response to stimuli such as touch, sound and changes in pressure



DORSAL FIN

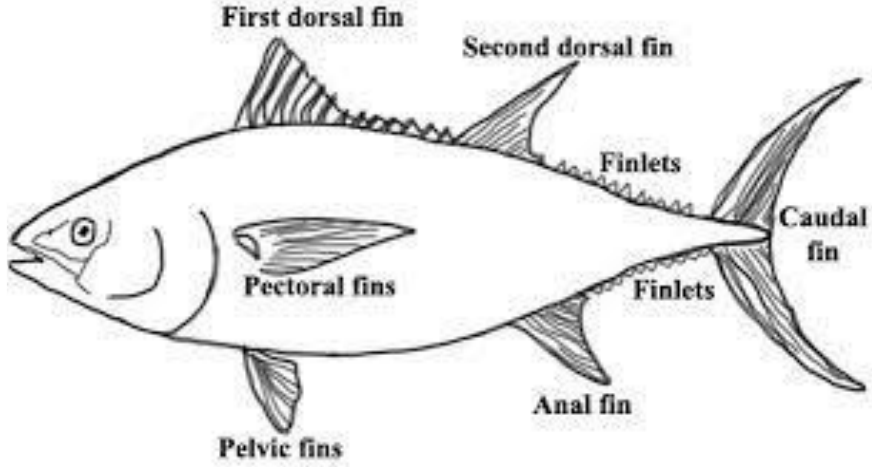


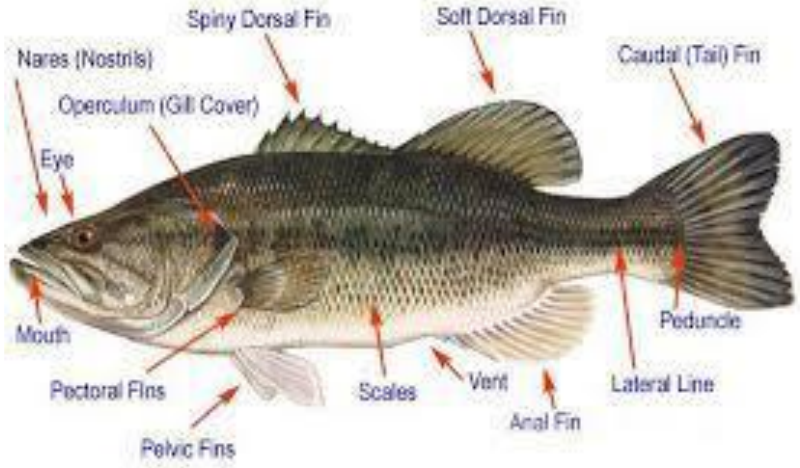
Dorsal fins are located on the back.

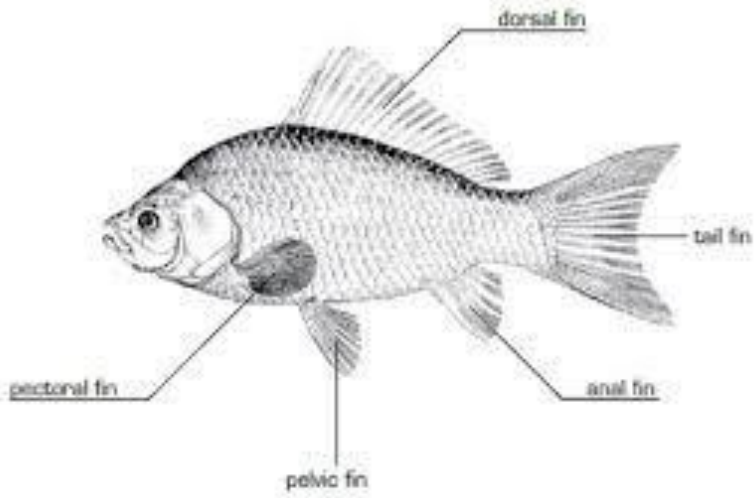
☐A fish can have up to three dorsal fins.

☐The dorsal fins serve to protect the fish against rolling

☐and assist it in sudden turns and stops.







MORPHOLOGY: SCALE TYPE

The skin of most fishes is covered with scales

- **Scales vary in size, shape, structure**
- **Fish scales are part of the fish's integumentary system**
- produced from the mesoderm layer of the dermis
- **Most scales are deeply buried in the fish's *epidermis*, or outer skin layer, with only part of them showing.**

GANOIDSCALE

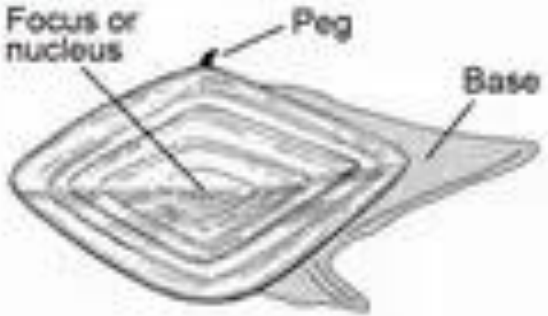
Primitivekindofscalereminder of the time

when fishes used armor plating to protect themselves

- **Ganoid scales are found in the sturgeons, paddlefishes, gars, bowfin**
- **Ganoids cales are hard and smooth, and may take the form of only a few scales**
- **Most are diamond-shaped and connected by peg-and-socketjoints**
- **They are usually thick**

Ganoid scales - found on the gars, sturgeons and paddlefishes

(1)



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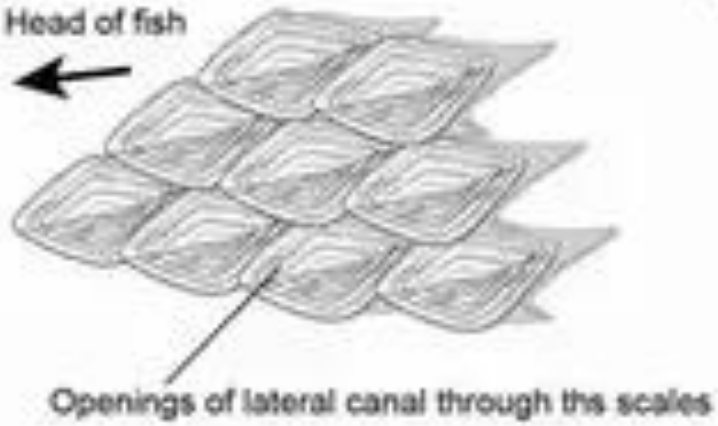

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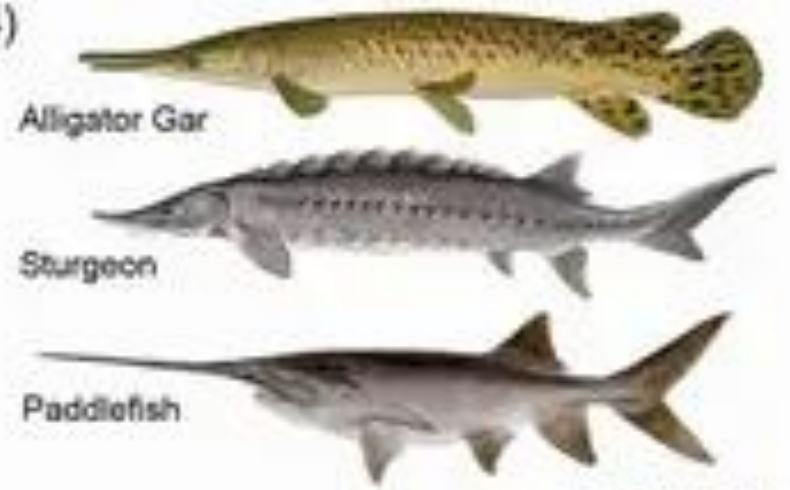

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PLACOID SCALE

Cartilaginous fishes: sharks, rayshave placoid

- **(PLAK-oyd) scales**
- **Tiny, tooth-like structuresthat are partiallyembedded in the skin.**
- **They are also called dermal denticles**
- **Structurally homologous with vertebrate teeth (denticulussmall tooth")**
- **The skin of sharks is entirely covered by placoidscales**
- **These scales giveskin sandpaperlike texture**

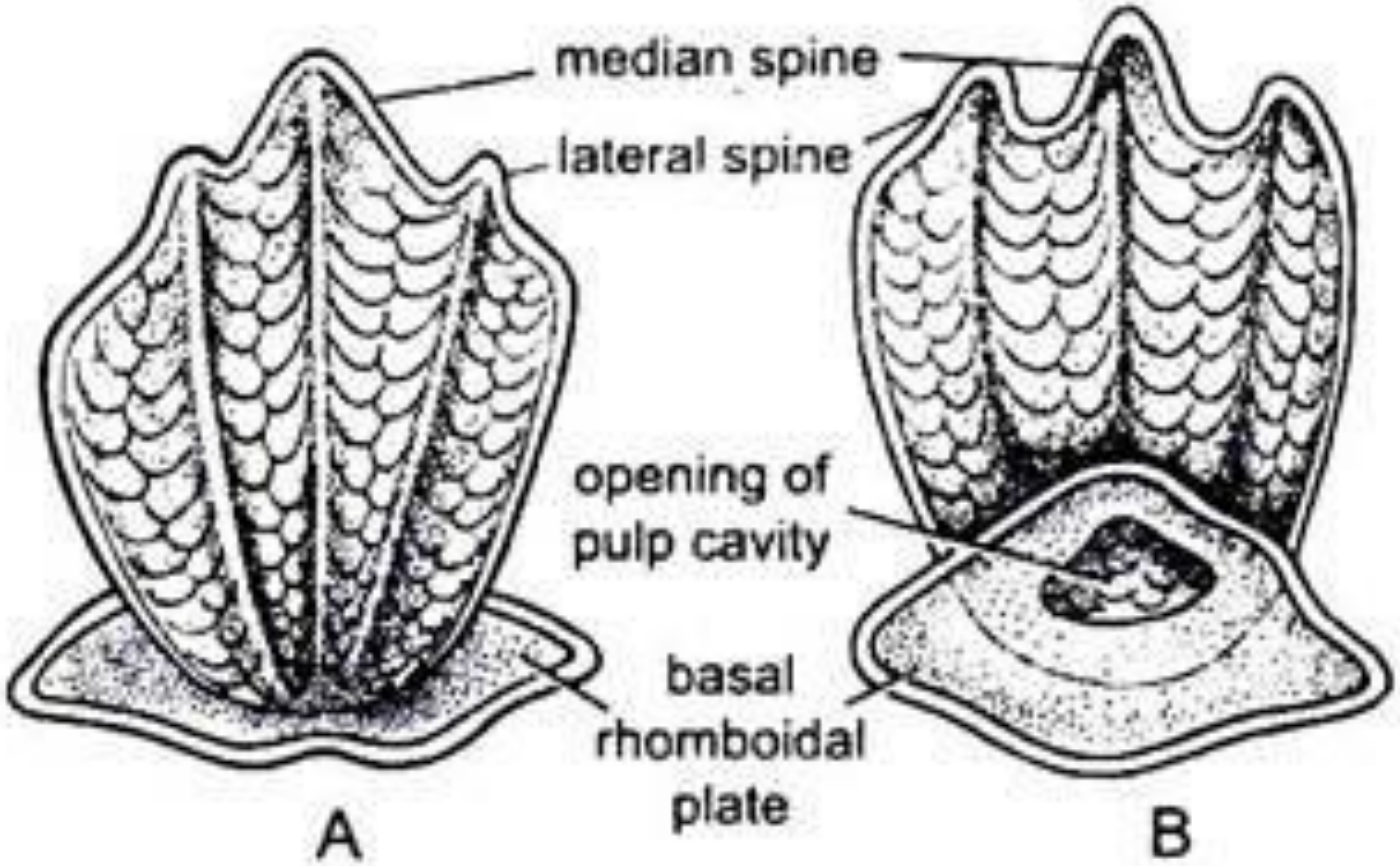
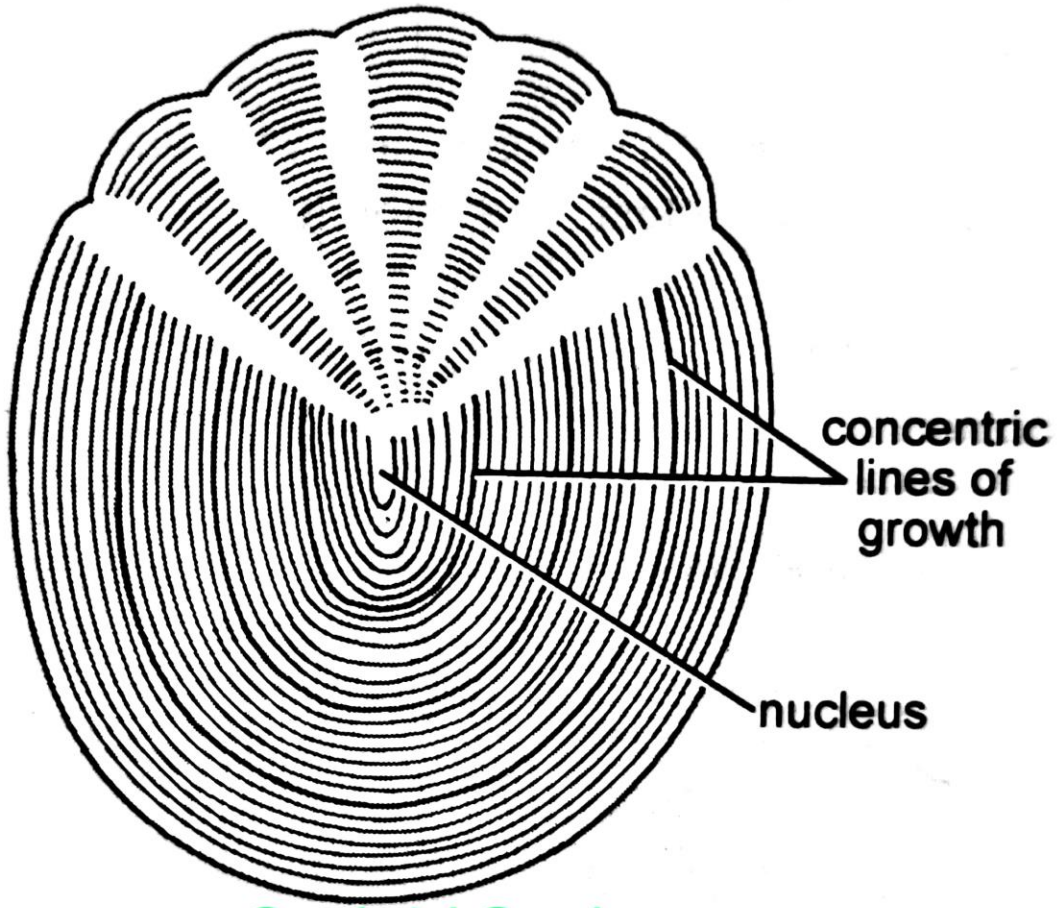


Fig. 14.4. *Scoliodon*. Placoid scales. A–Dorsal view; B–Ventral view.

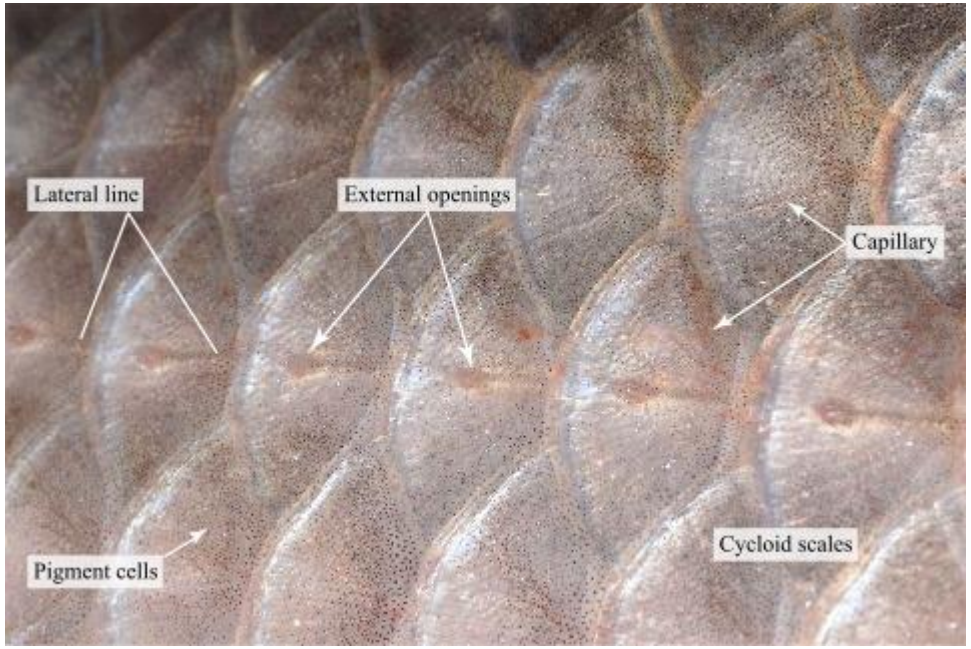
CYCLOID SCALE

Many fishes which are most familiar have cycloid scales

- **thin, round, almost transparent scales**
- **These scalesare mostly buried in the epidermis, only the small posterior margin to show.**
- **They are also circular scales with smooth texture, uniformand smooth outer edge or margin.**
- **Most common on fish with soft fin rays, such as salmon and carp.**



Cycloid Scale



CTENOID SCALE

Much likecycloid scales with small teeth along their outer edges

☐Difference include that they have tiny,comb-like projections

☐These projection are with a toothed outer or posterior edge featuring tiny teeth called cteniiand give rough texture

☐They are usually found on fishes with spiny fin rays, such as the perch-like fishes.

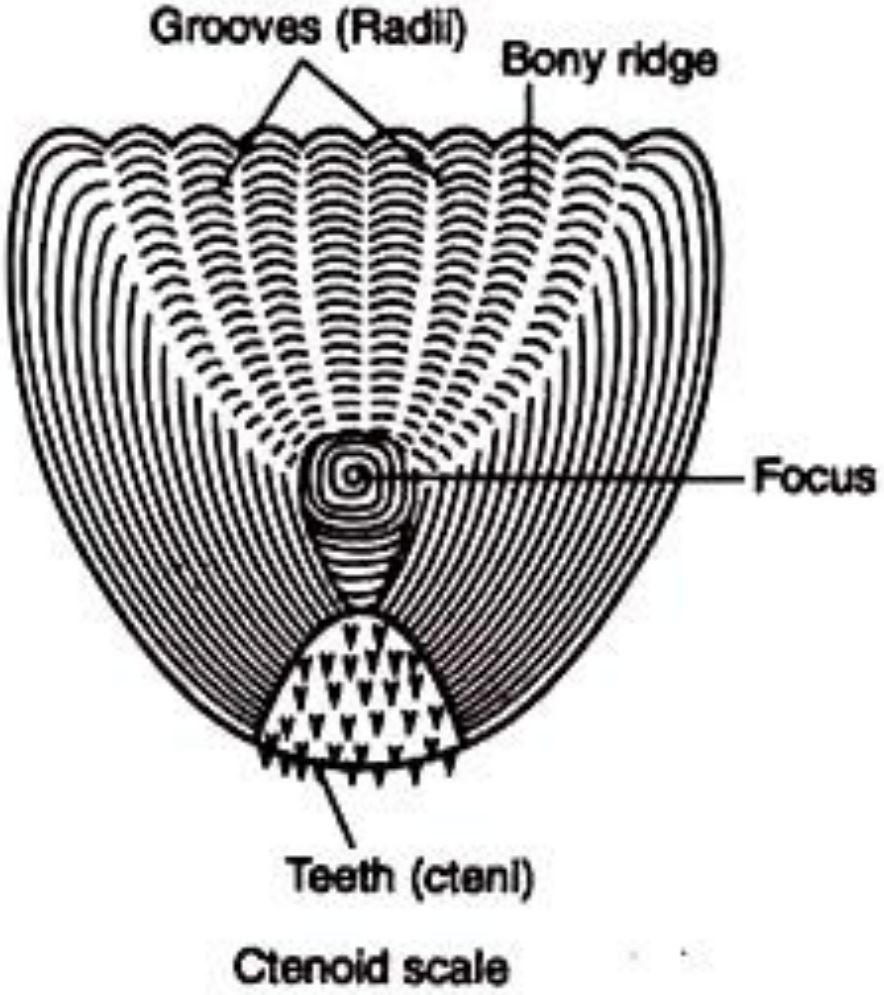
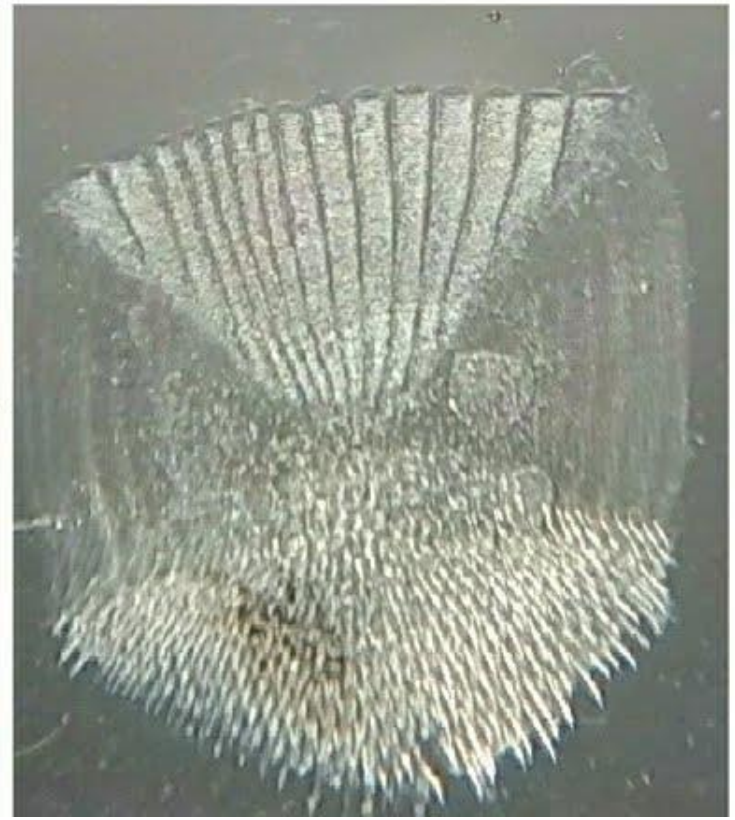
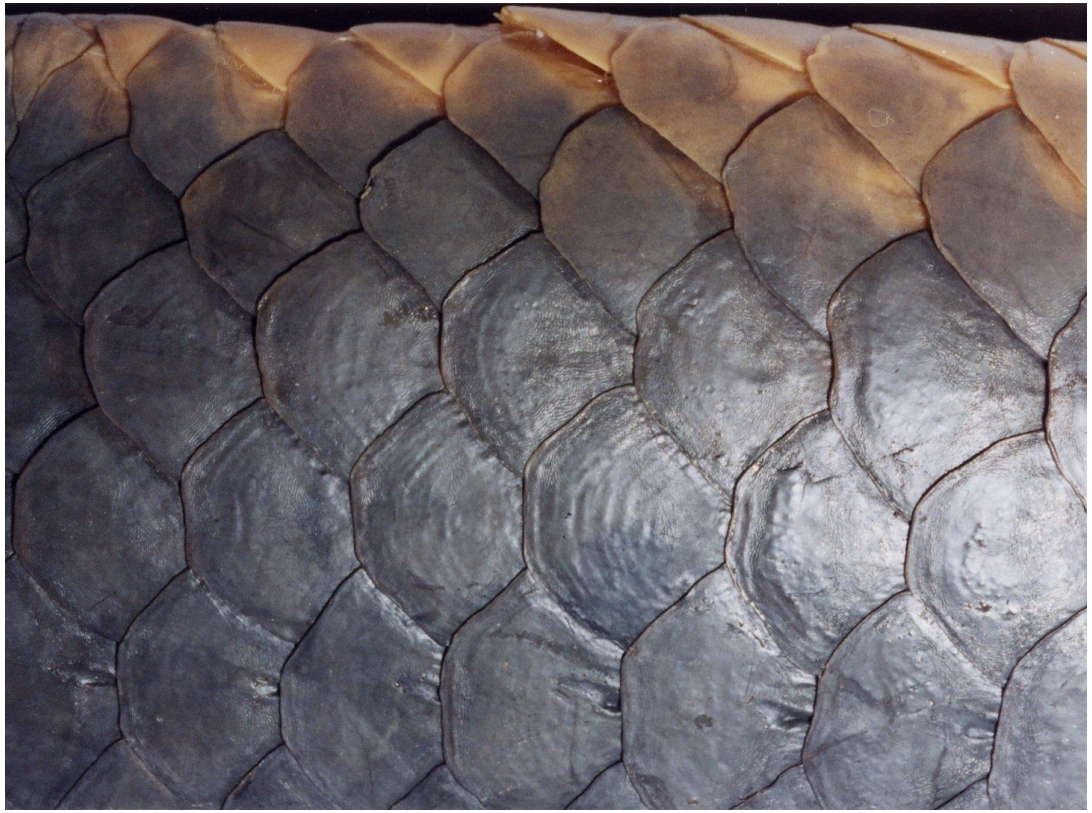


Fig. 3.3(d) : Ctenoid scale

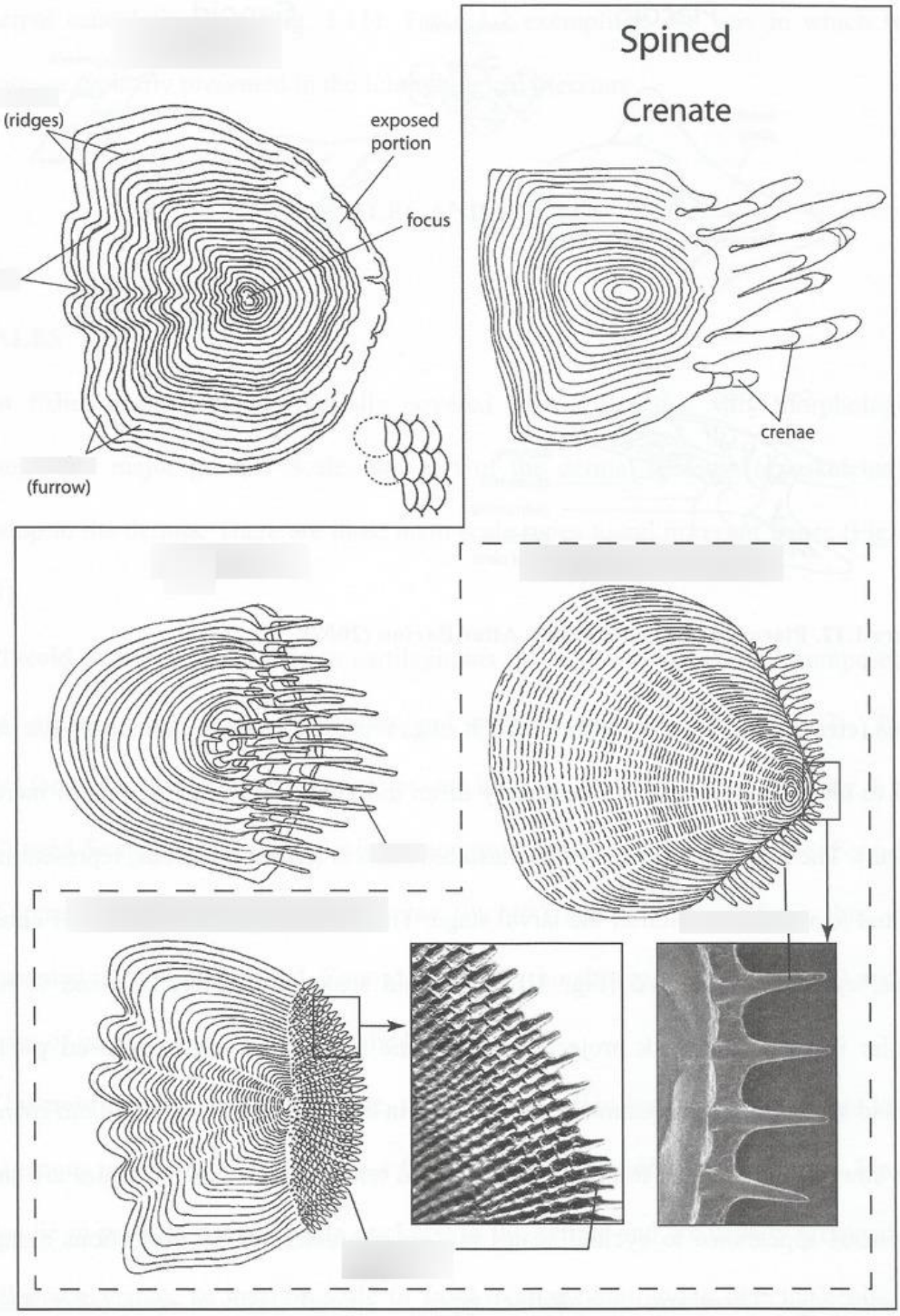


Besides the scale types, there are also cosmoid and Elasmoid scales

- Some fishes are scale less
- **many catfish, some eels, and swordfish),**
- **and fishes which have scales so deeply buried that they look scale less(many tunas and anguillid eels).**



Cosmoid scales


Spined
Crenate
(ridges)
exposed portion
focus
(furrow)
crenae

BODY SHAPE

is a good indicator of how a fish moves and where it lives.

1.flator Depressiform

- **They normally live on the bottom of the sea floor**
- **flap their fins up and down to swim through the water in the same way a bird flaps its wings.**
- **Example: skates and Stingray**

Oban Skates

Stingray

FILIFORM

Long and Skinny

slither through thewater like a snake, e.g.eel

Snake eel

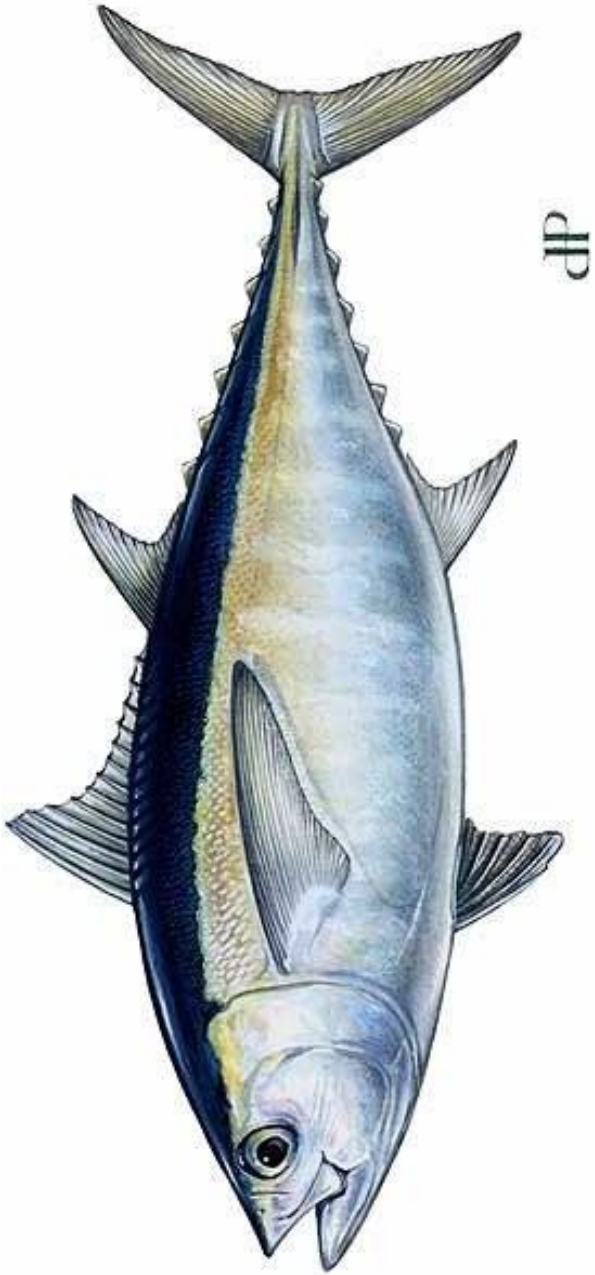
American Eel

OVAL OR FUSIFORM

Section like a tuna or stripedbass are fast swimmers

☐Usually live in open water

Large mouth bass



Black fin tuna

COMPRESSIFORM

Compressed body

- **Thinwhen viewed fromthe front.**
- **Thisbody shape iswell designed for making quick turnsand quick burstsof speed over short distances.**
- **Compressiformfish commonly live where there are many places to take refuge such asponds, lakes, or coral reefs, or**
- **They school together in shallow open waters.**

Angelfish

Holacanthus bermudensis

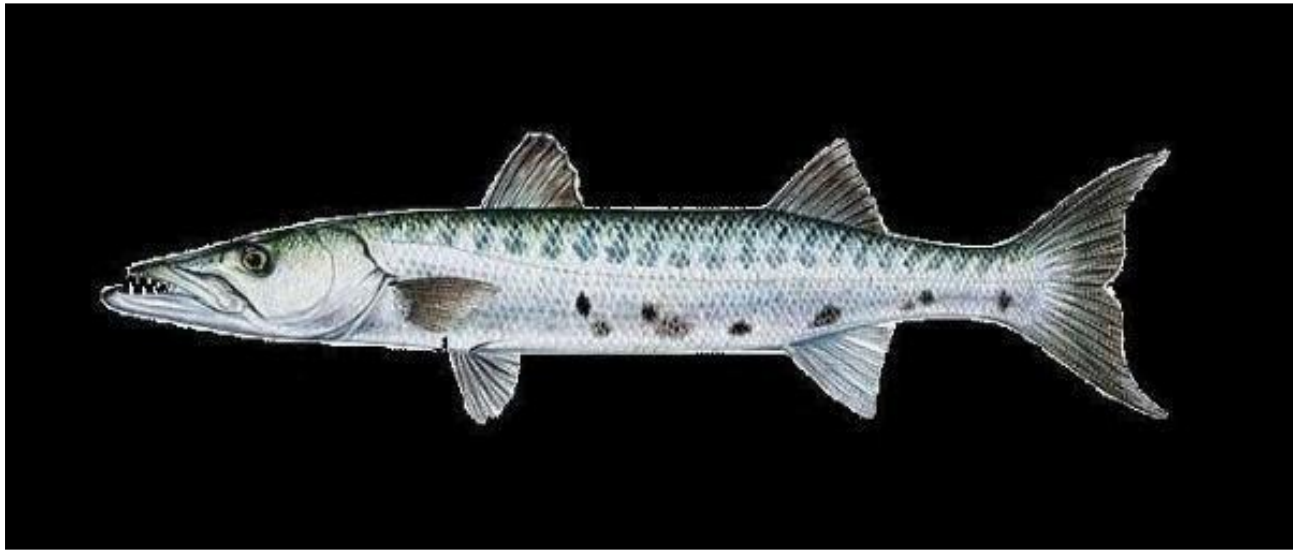
Yellow-facedAngelfish

SAGITTIFORM

These body shapesare good for roverpredators, which depend on an ability to strike quickly--often froma hiding place.

- **"Arrow-like." Example shown isagrass pickerel.**
- **Other fish with thisbody type include pikes, gars, topminnows, killifish, needlefish, and barracuda.**

Spotted gar



barracuda

TAENIFORM

Ribbon-like

- **Thisshape is good for hiding cracksandcrevices,**
- **but fishes like this do not move very fast.**

ANGUILLI FORM

"Eel-like"

☐Many eels, have this shape.

☐Shown is abrooklamprey

☐**This shape allows a fish to enter and hide in very narrow openings, andalso helps the fish resist the force of current.**