

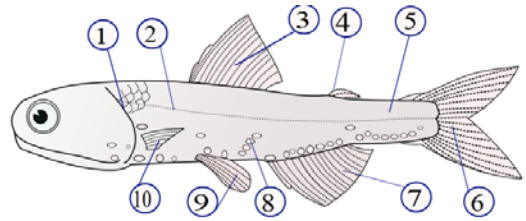
ZOOLOGY

FISHES - in practice



Miloslav Petrtyl
petrtyl@af.czu.cz

GENERAL ANATOMY

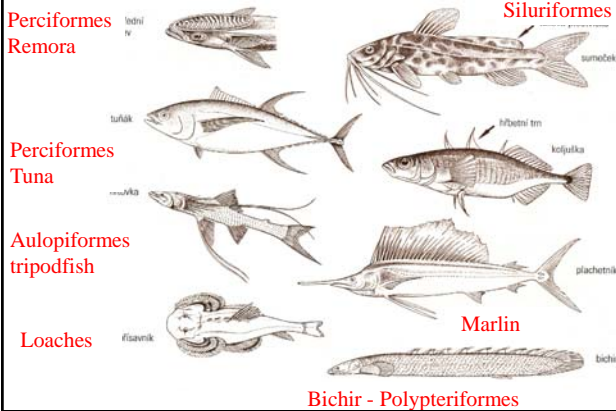


The anatomy of *Lampanyctodes hectoris*

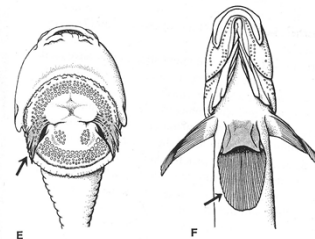
- (1) – operculum (gill cover), (2) – lateral line, (3) – dorsal fin
- (4) – fat fin, (5) – caudal peduncle, (6) – caudal fin, (7) – anal fin
- (8) – photophores, (9) – pelvic fins (paired)
- (10) – pectoral fins (paired)

source: Wikipedia

ADAPTATION & MODIFICATION OF FINS



FIN MODIFICATIONS



E – gobiesocidae

F - Goby

12-11

<http://kzr.agrobiologic.cz/>

4

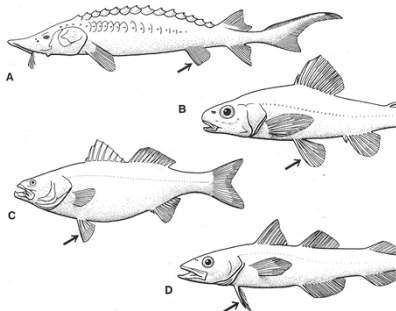
POSITION OF PELVIC FINS

A – abdominal

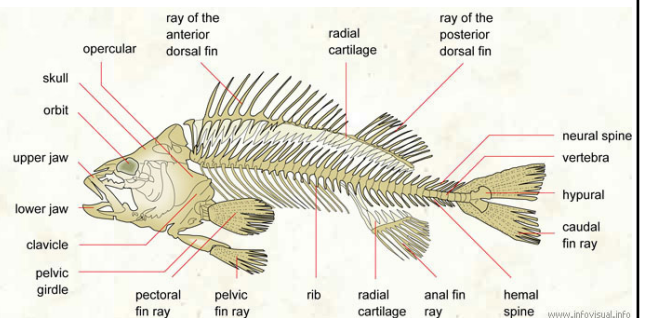
B – subabdominal

C – thoracic

D – jugular



FISH SKELETON



TYPES OF CAUDAL FIN

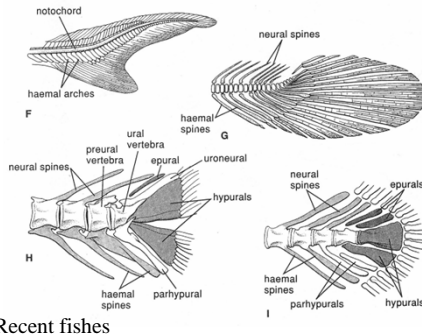
Based on a/symetry Primitive fishes

F - heterocercal
sturgeon

G - heterocercal
bowfin

H - homocercal
Sea bass

I - isocercal
Cod



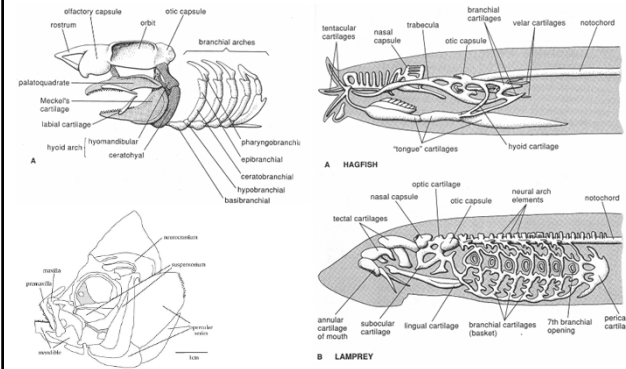
Recent fishes

12-11

<http://kzr.agrobiologic.cz/>

7

„SKULL“

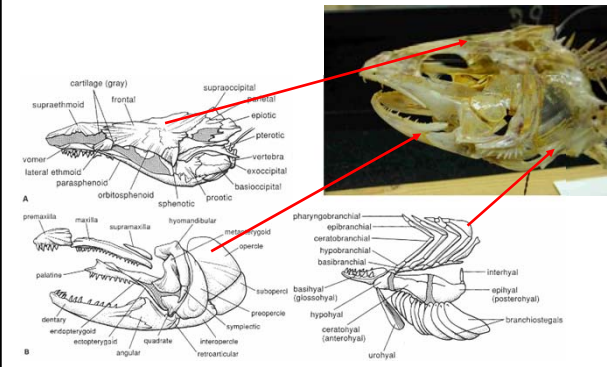


12-11

<http://kzr.agrobiologic.cz/>

8

SKULL OF BONY FISH

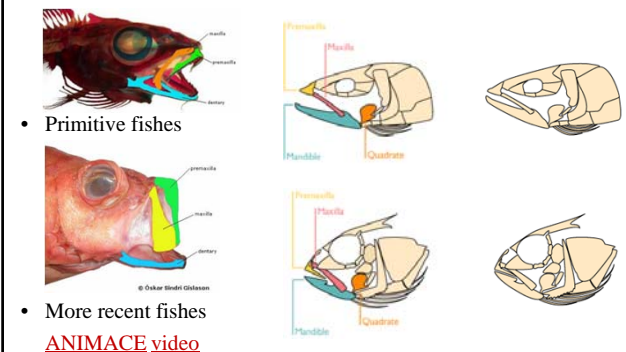


12-11

<http://kzr.agrobiologic.cz/>

9

SKULL AND FEEDING



• Primitive fishes

• More recent fishes

[ANIMACE video](#)

12-11

<http://kzr.agrobiologic.cz/>

10

DIFFERENT FEEDING

• *Epibulus insidiator* – extreme protrusion



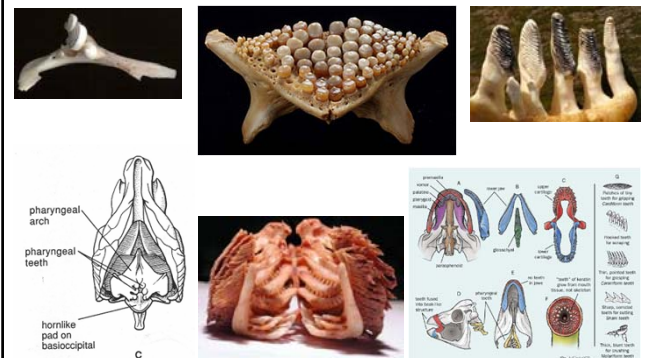
• [video](#)

12-11

<http://kzr.agrobiologic.cz/>

11

PHARYNGEAL TEETH



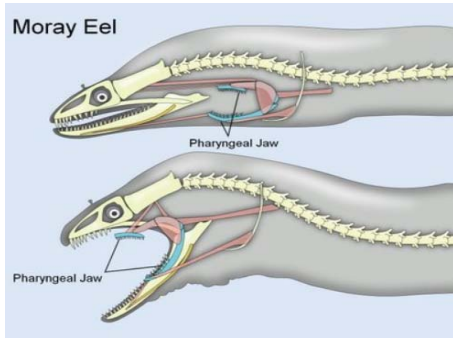
12-11

<http://kzr.agrobiologic.cz/>

12

PHARYNGEAL TEETH

- Structure of the Moray's pharyngeal jaws



12-11

<http://kzr.agrobiologie.cz/>

13

FOOD AND FEEDING



12-11

13

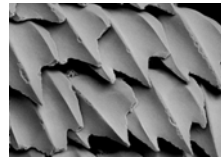
SKIN & COLORATION

- **Chromatophores** – pigment-containing cells
- **Melanophores** – black, dark brown
- **Xanthophores** – yellow and orange
- **Erythrophores** – red
- **Iridocyt** – guanin - silvery
- Xanthophore pigmentation – ornamental fish, golden fish
- Albinism - absence pigmentů - světlé zbarvení

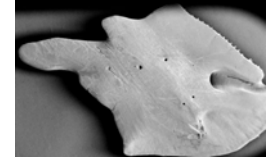


SCALES

1. Placoid - sharks



3. Ganoid - bichir, sturgeon



2. Cosmoid - lungfish



4. Cycloid + Ctenoid - teleostei



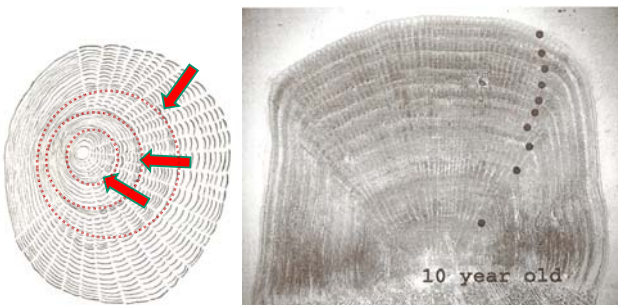
12-11

<http://kzr.agrobiologie.cz/>

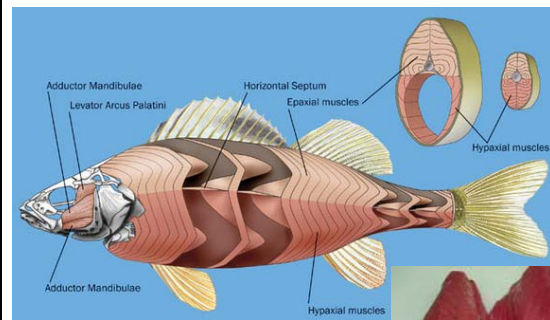
16

SCALES & AGE

Scales, otoliths, vertebra...



MUSCULAR SYSTEM



White muscle versus red muscle (tuna)

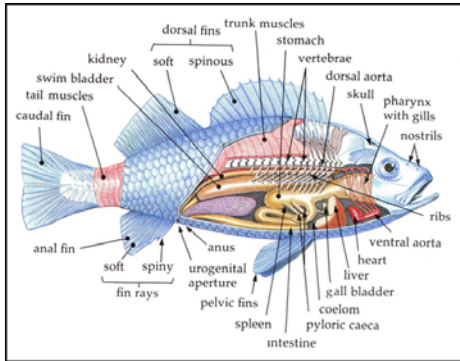


12-11

<http://kzr.agrobiologie.cz/>

18

GENERAL ANATOMY - ORGANS

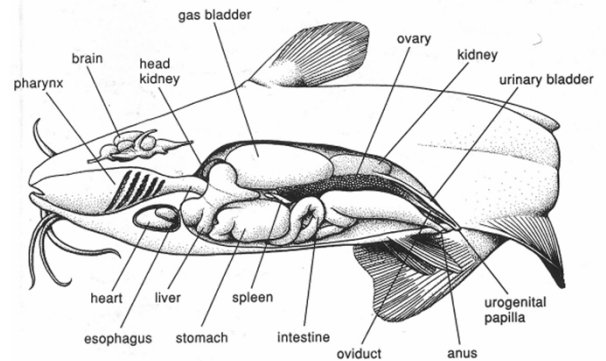


12-11

<http://kzr.agrobiologie.cz/>

19

DIGESTIVE SYSTEM

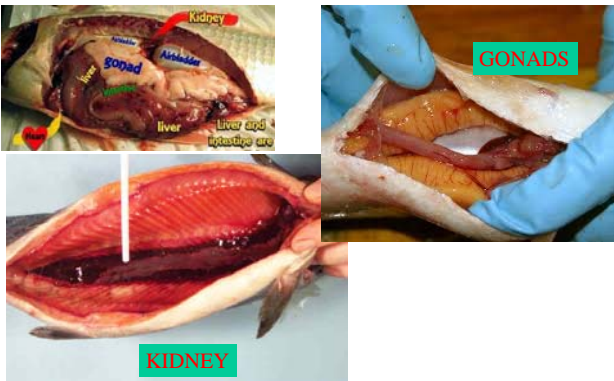


12-11

<http://kzr.agrobiologie.cz/>

20

INTERANAL ORGANS



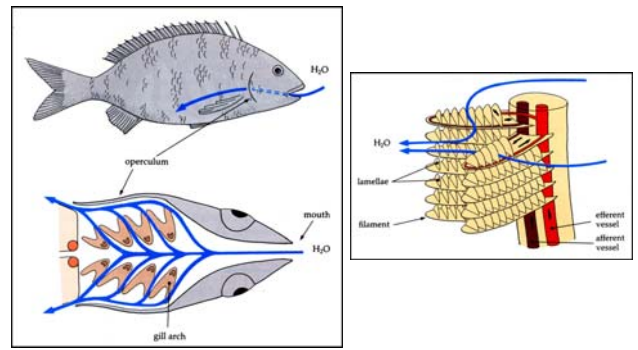
12-11

<http://kzr.agrobiologie.cz/>

21

BREATHING - GILLS

Water - high density and viscosity, low oxygen content.

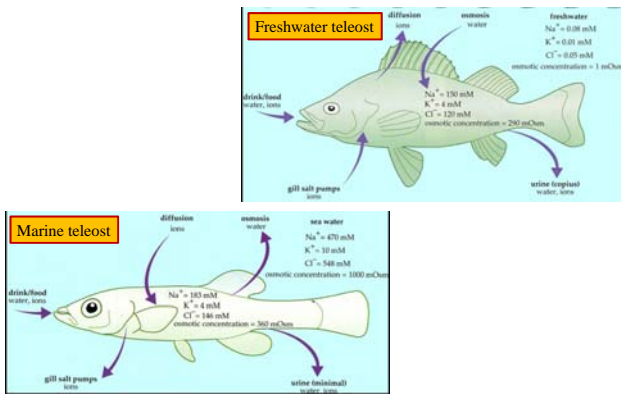


12-11

<http://kzr.agrobiologie.cz/>

22

ARE THEY DRINKING WATER?

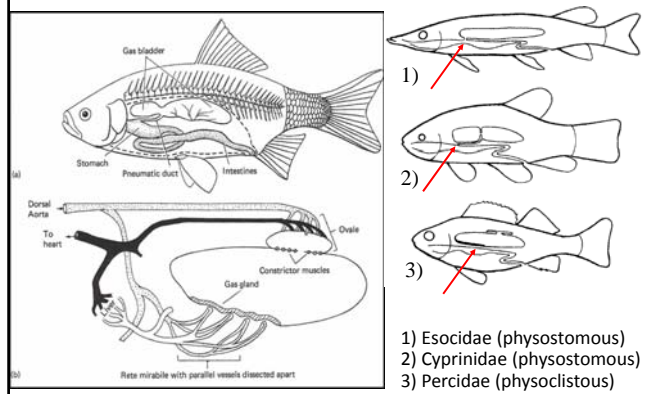


12-11

<http://kzr.agrobiologie.cz/>

23

BUOYANCY



12-11

<http://kzr.agrobiologie.cz/>

24

SENSES - SIGHT

Lens of fish is spherical

Lens has variable optical density

12-11 <http://kzr.agrobiologie.cz/> 25

SENSES - SIGHT

- Anableps anableps

12-11 <http://kzr.agrobiologie.cz/> 26

SENSES - SIGHT

- Deep sea adaption of *Macropinna microstoma*, transparent head

12-11 <http://kzr.agrobiologie.cz/> 27

SENSES - SIGHT

- Deep sea adaption of *Dolichopteryx longipes* – mirror organ.

12-11 <http://kzr.agrobiologie.cz/> 28

MIRROR ORGAN -

<http://en.wikipedia.org/wiki/File:Spookeye.svg>

12-11 <http://kzr.agrobiologie.cz/> 29

SENSES - HEARING

- Weber's organ – connected with gass bladder

12-11 <http://kzr.agrobiologie.cz/> 30

SENSES - TASTE

- Sensors in the mouth, pharynx, on the operculum, barbels

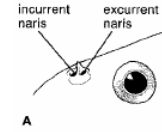


12-11

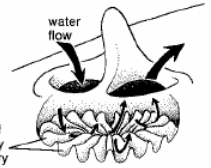
<http://kzr.agrobiologie.cz/>

31

SENSES - SMELL



A



folde of sensory olfactory epithelium

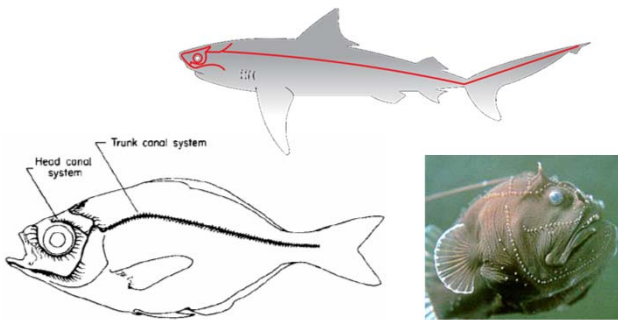
12-11

<http://kzr.agrobiologie.cz/>

32

SENSES - TOUCH

- Neuromasts on the body – head, lateral line

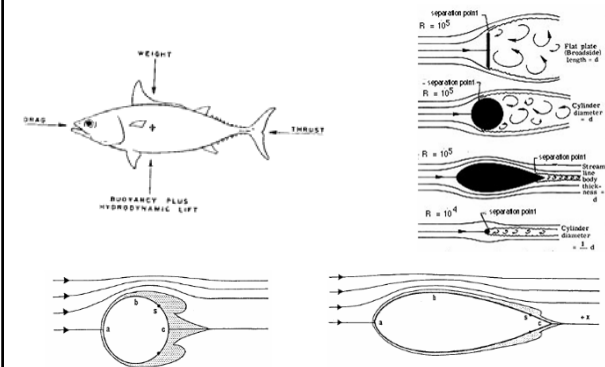


12-11

<http://kzr.agrobiologie.cz/>

33

BODY SHAPE



12-11

<http://kzr.agrobiologie.cz/>

34

MOTION

- Swimming of individual



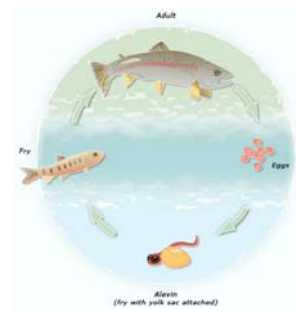
- Swimming in school

12-11

<http://kzr.agrobiologie.cz/>

35

LIFE CYCLE



12-11

<http://kzr.agrobiologie.cz/>

36

LIFE CYCLE

Egg: Trout eggs have black eyes and a central line that show healthy development. Egg hatching depends on the water temperature in an aquarium or in a natural habitat.

Alevin: Once hatched, the trout have a large yolk sac used as a food source. Each alevin slowly begins to develop adult trout Characteristics.

Fry: Buttoning-up occurs when alevin absorb the yolk sac and begin to feed on aquatic insects.

Fingerling and Parr: When a fry grows To 2-5 inches, it becomes a fingerling. When it develops large dark markings, it then becomes a parr.

Juvenile: In the natural habitat, a trout avoids predators, including wading birds and larger fish, by hiding in underwater roots and brush.

Adult: In the adult stage, female and male Tasmanian Rainbow Trout spawn in autumn. Trout turn vibrant in color during spawning and then lay eggs in fish nests, or redds, in the gravel.

12-11

<http://kzr.agrobiologic.cz/>

37

SEXUAL DIMORPHISM

- *Haplophryne mollis*

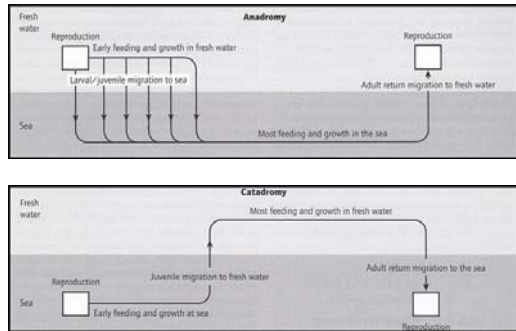


12-11

<http://kzr.agrobiologic.cz/>

38

MIGRATION



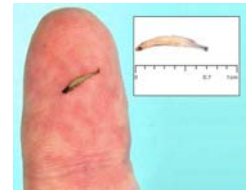
12-11

<http://kzr.agrobiologic.cz/>

39

SIZES OF FISHES

- *Schindleria brevipinguis*
7 – 8 mm, 1 mg



- *Rhincodon typus*
8 – 12 (18)m, 20 - 30t



12-11

<http://kzr.agrobiologic.cz/>

40

TAXONOMY

VERTEBRATA

AGNATHA

GNATHOSTOMATA

OSTEICHTHYES

CHODRICHTHYES

MIXINI

CEPHALASPIDO-
MORPHI

SARCOPTERYGII

ACTINOPTERYGII



12-11

<http://kzr.agrobiologic.cz/>

41

AGNATHA – JAWLESS FISH

- MIXINI - Hagfish – manipulation - [video](#)



- CEPHALASPIDOMORPHI – Lampreys - [specimen + skeleton](#)



12-11

<http://kzr.agrobiologic.cz/>

42

GNATHOSTOMA – JAWED VERTEBRATES

Chondrichthyes - cartilaginous fishes

Holocephali - chimaeras

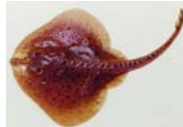


Elasmobranchii

Sharks



rays



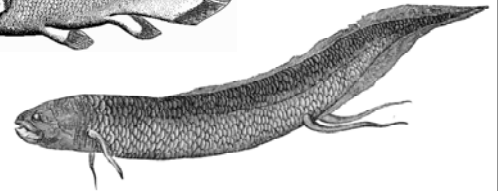
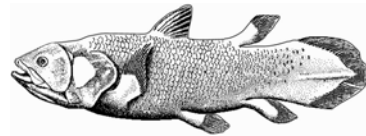
12-11

<http://kzr.agrobiologie.cz/>

43

OSTEICHTHYES BONY FISH

Sarcopterygii – lobe finned



Actinopterygii – ray finned – next

12-11

<http://kzr.agrobiologie.cz/>

44

OSTEICHTHYES BONY FISH

Actinopterygii – ray finned

1) Chondrostei – Chondrosteans

[specimen + skeleton](#)

Sturgeon



Paddlefish



Bichir



2) Holostei - Holosteans - next

3) Teleostei - Teleosts - next

12-11

<http://kzr.agrobiologie.cz/>

45

OSTEICHTHYES BONY FISH

2) Holostei – Holosteans

– Bowfin



– Gar



12-11

<http://kzr.agrobiologie.cz/>

46

OSTEICHTHYES BONY FISH

3) Teleostei – Teleosts - **THE MOST IMPORTANT FOR US!!**

PRACTICAL DEMONSTRATION OF SPECIMENS AND SAMPLES

- *Osteoglossiformes*: arowana, arapaima, ...
- *Elopomorpha*: eel, moray eel, ...
- *Clupeomorpha*: herring, anchovies, ...
- *Ostariophysii*: cypriniformes, characiformes, siluriformes, ...
- *Protacanthopterygii*: salmoniformes, esociformes, ...
- *Paracanthopterygii*: Lophiiformes, gadiformes, ...
- *Acanthopterygii*: mugiliformes, beloniformes, gobiesociformes, sygnathiformes, tetraodontiformes, pleuronectiformes, scorpaeniformes, perciformes (40% of all fish)

12-11

<http://kzr.agrobiologie.cz/>

47

EXAMPLE OF SALMONIDS FROM CR



12-11

<http://kzr.agrobiologie.cz/>

48

EXAMPLE OF FISH DIVERSITY

- Practical observing of preserved fishes
- Fish collection of Department of Zoology and Fisheries