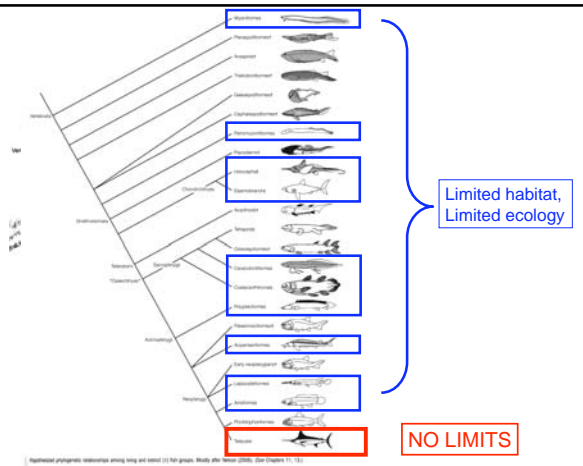


TELEOSTS... part 1



Division Teleostei (“perfect bone”)

- 26,840 species (96% of all fishes)
- 40 orders
- 448 families



No limits for Teleosts!



Division Teleostei (perfect bone)

- >95% living species = 400+ families
- arose 200 mya
- common genera of today existed 40-70 MYA
- evolved from several lines
- 4 subdivisions

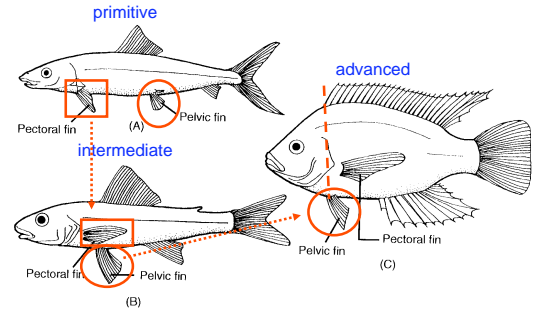
Division Teleostei (perfect bone)

- Subdivision **Osteoglossomorpha** (bony tongues)
- Subdivision **Elopomorpha** (tarpons and true eels)
- Subdivision **Ostarioclupeomorpha** (herrings, minnows, catfish)
- Subdivision **Euteleostei** (the main event)

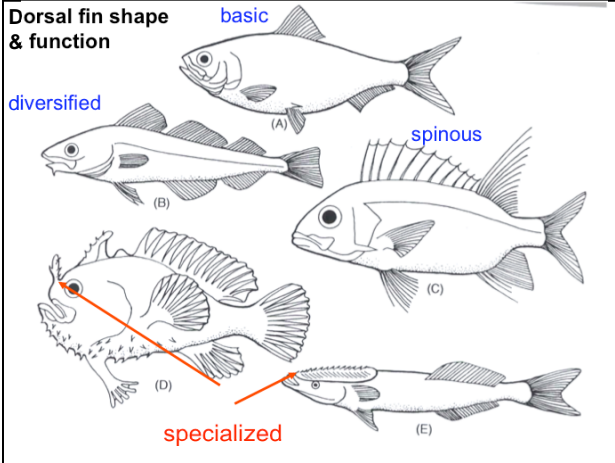
Major trends in Teleosts:

- reduction in bony elements
 - fewer vertebrae
 - fewer bones in skull
 - fin ray reduction in C, P₁, P₂
- dorsal fin function and position changes
- pectorals and pelvics change body position
- caudal fin modifications
- swimbladder modifications
- improvements in feeding apparatus

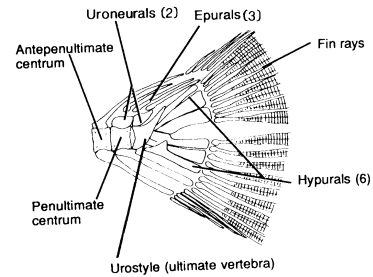
Evolution of paired fin location in teleosts



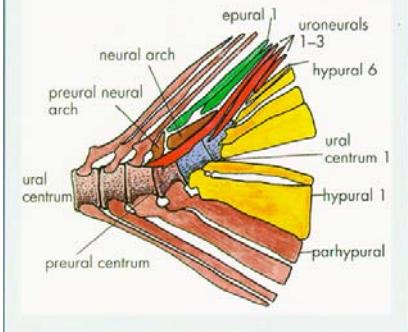
Dorsal fin shape & function



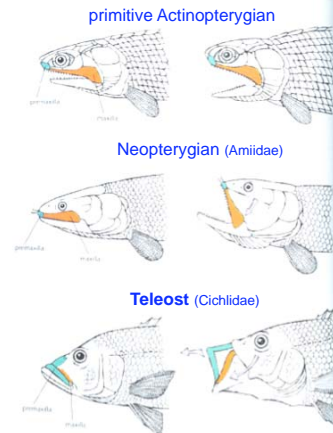
Caudal fin reinforced by hypurals, uroneurals, and epurals



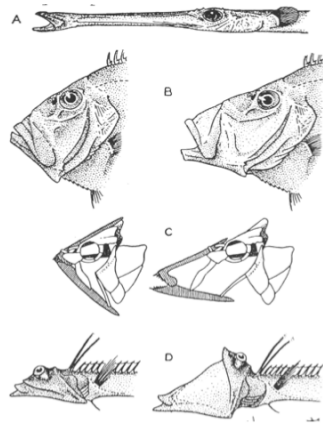
The tail skeleton of *Brannerion* shows the specialised uroneural bones that gave teleosts a powerful swimming ability.



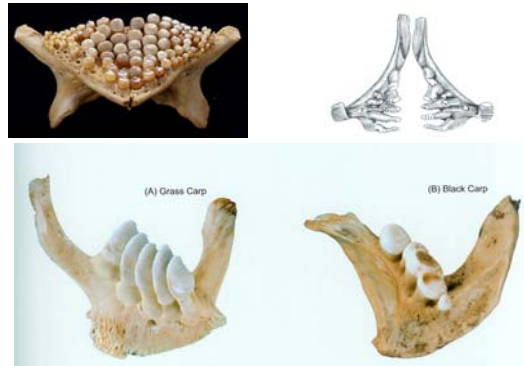
Evolution of protrusible jaw:



Protrusible mouths



Pharyngeal Teeth



End results of Teleost trends:

- fast and highly maneuverable
- reduced armor but quick and spiny
- efficient prey capture mechanisms
- efficient and diverse prey processing

Characters of Teleosts

- operculum has 4 bones
- homocercal tail, partly supported by *uroneurals*
- cycloid / ctenoid scales
- vertebrae are ossified, but lightweight
- swimbladder is a buoyancy organ
- maxilla and premaxilla are moveable, premaxilla is principal bone of upper jaw
- fins are highly maneuverable with rays and spines
- body shape is highly variable

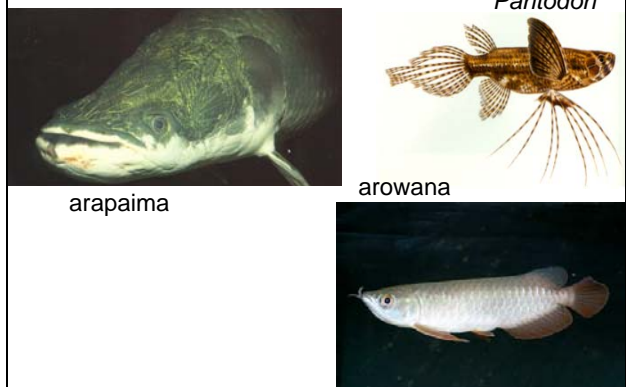
Subdivision **Osteoglossomorpha** (2 orders)
 Order **Osteoglossiformes** (bonytongues)
 (4 families, 218 spp.)

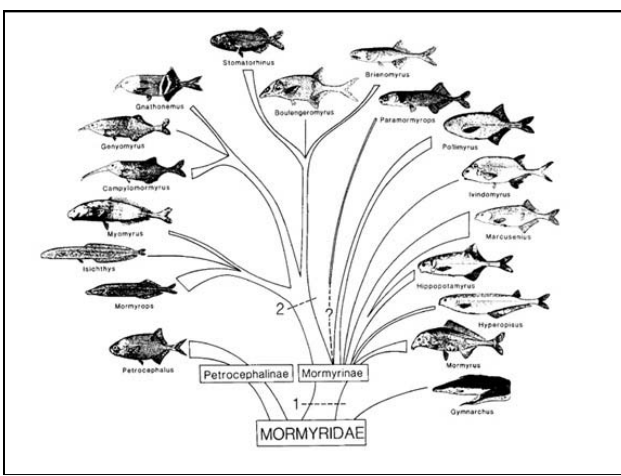
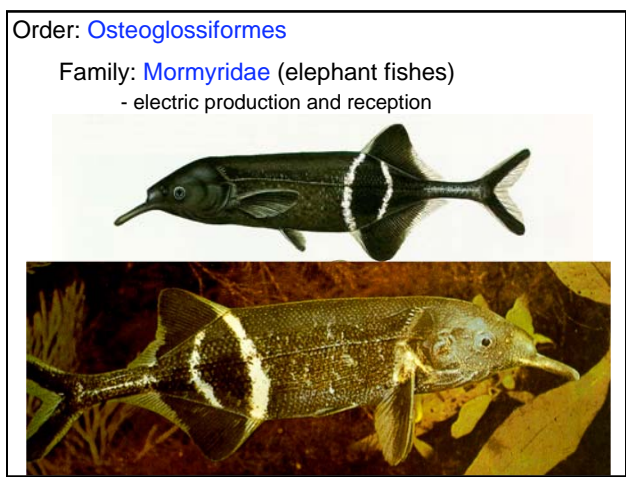


- most teeth are on tongue or roof of mouth
- premaxilla small & fixed to skull (no supramaxilla)
- huge scales in some
- fresh water, usually tropical
- some are electric, production and receptive

Examples: arowana, arapaima, mormyrid elephant fish

Order: **Osteoglossiformes**
 Family: **Osteoglossidae** (bonytongues)





Subdivision **Osteoglossomorpha**
 Order **Hiodontiformes** (mooneyes)
 (1 families, 2 spp.)

- small
- freshwater
- eastern US



Subdivision **Elopomorpha**

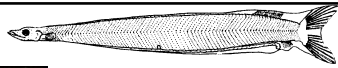


- Order **Elopiiformes** (tarpon)
- Order **Albuliformes** (bonefish)
- Order **Anguilliformes** (true eels: e.g., moray, snake-eels, conger)
- Order **Saccopharyngiformes** (deep-sea gulper eels)

Characters:

- leptocephalus larvae: very thin, leaflike
- snake-like bodies (often)

Leptocephalus larvae



Order: **Elopiiformes**
 (2 families, 8 spp.)

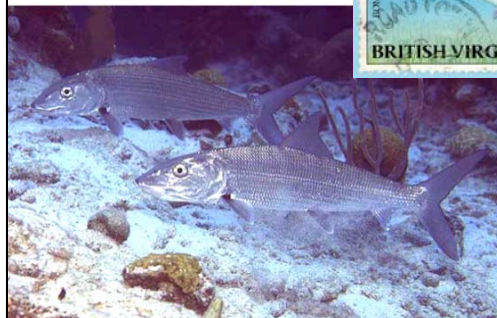
Elops: ladyfish or tenpounder

Family: **Elopidae** (tarpon)

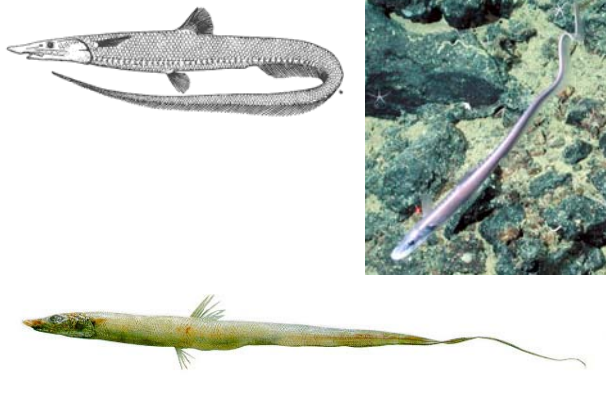


Order: **Albuliformes**
 (3 families, 30 spp.)

Family: **Albulidae** (bonefish)



Order **Albuliformes** - halosaurs



Order:

Anguilliformes (eels)

(14 families, 791 spp.) -- in all major habitats

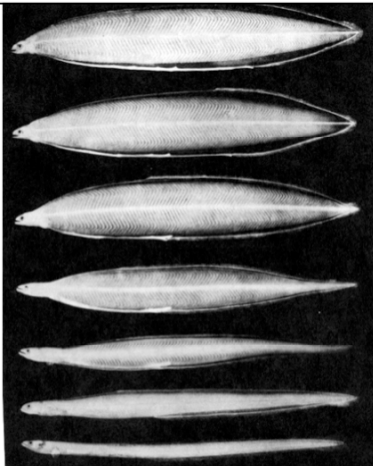
characters:

- no pelvic fins
- no scales (usually)
- opercular series reduced
- premaxilla fused to vomer & ethmoid
- gill opening narrow
- no gill rakers

American eel



progression from
leptocephalus larva to
adult eel body plan

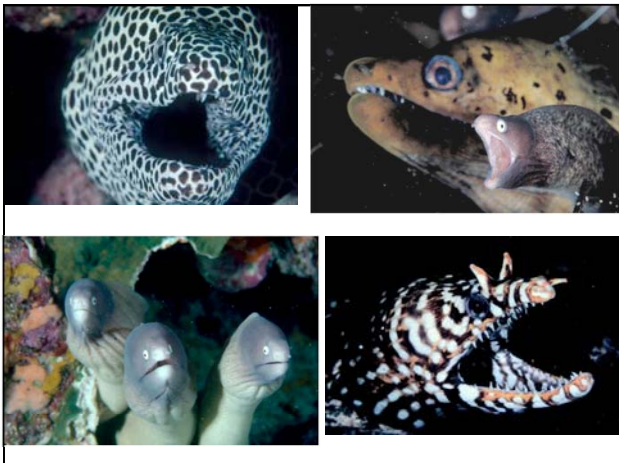


Order: **Anguilliformes**

Family: **Muraenidae** (moray eels)



goldspot moray

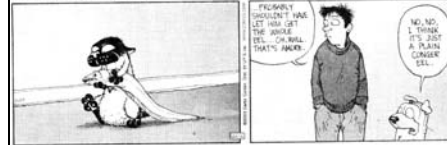


Order: **Anguilliformes**

Family: **Congridae**



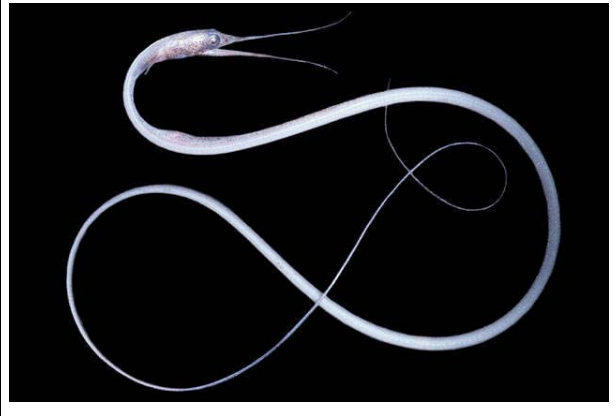
GET FUZZY By Darby Conley



Order: **Anguilliformes** Family: **Congridae**

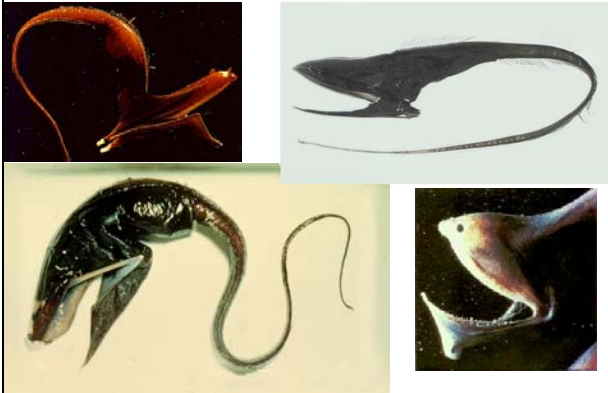


snipe eels (Nemichthyidae)



Order: **Saccopharyngiformes** (gulper eel)

(4 families, 26 spp.)



Subdivision: **Ostarioclupeomorpha**

Superorder: **Clupeomorpha**

Order: **Clupeiformes**

Superorder: **Ostariophysii**

Order: **Gonorynchiformes**

Order: **Cypriniformes**

Order: **Characiformes**

Order: **Siluriformes**

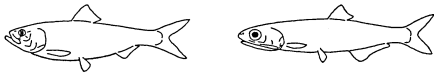
Order: **Gymnotiformes**

Characters:

-- connection of swimbladder to inner ear

Order: **Clupeiformes**

(5 families, 364 spp.)



- open water, silvery, compressed bodies
- planktivorous: flexible mouth and fine gill rakers
- swimbladder touches the inner ear: otophysic connection for increased sensitivity to low frequency sounds
- major commercial importance

Examples: herring, shad, anchovy

Order: **Clupeiformes**

Family: **Clupeidae** (herrings)

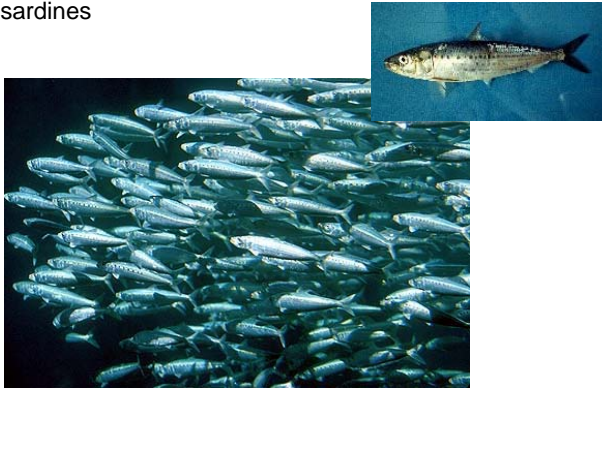
American shad



herring



sardines



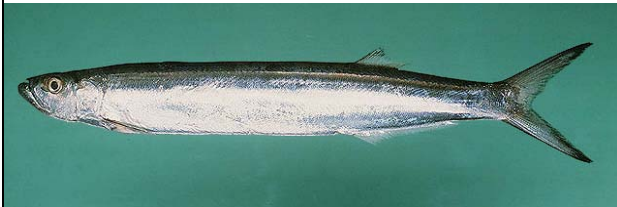
Order: **Clupeiformes**

Family: **Engraulidae** (anchovies)



wolf herring (Chirocentridae):

carnivorous & up to 1 m long



Superorder **Ostariophysii**:

Order **Gonorrhynchiformes** (milkfishes)



Order **Cypriniformes** (carps)



Order **Characiformes** (tetras & others)



Order **Siluriformes** (catfishes)



Order **Gymnotiformes** (S. American knifefishes)



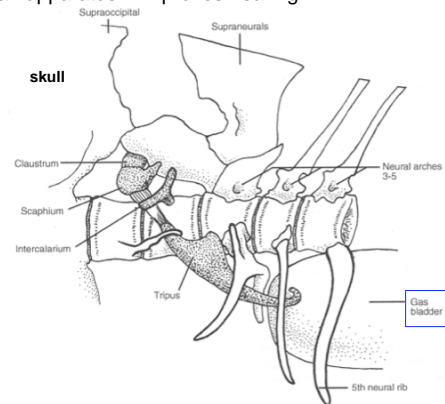
- 64% of all fresh water fishes!
- widespread, but absent from Australia and Antarctica
- great diversity of form: large predators to small herbivores

Superorder **Ostariophysii**

Characteristics

- **Weberian Apparatus** - first 4 vertebrae fused -- connects inner ear to gas bladder (low frequency hearing)
- fright substance - "Shreckstoff"
- trend toward reduction of jaw teeth - even absence
- well developed lower pharyngeal bones
- pelvic fins abdominal, adipose fins in some, pungent spines often present

Weberian apparatus – improves hearing



Order:

Gonorhynchiformes (milkfishes)

(4 families, 37 spp.)


- small mouth
- toothless



Chanos chanos

Order:

Cypriniformes (carps)

(6 families, 3270 spp.!) 

common carp



goldfish

Order: **Cypriniformes**

Family: **Cyprinidae** (minnows, carp, barbs)

world's smallest fish:
Paedocypris progenetica



bluenose shiner



giant barb



bluehead chub

Order: **Cypriniformes**

Family: **Catostomidae** (suckers)

- fleshy lips



sicklefin redhorse


Order: **Cypriniformes**

loaches (Cobitidae)



Order:

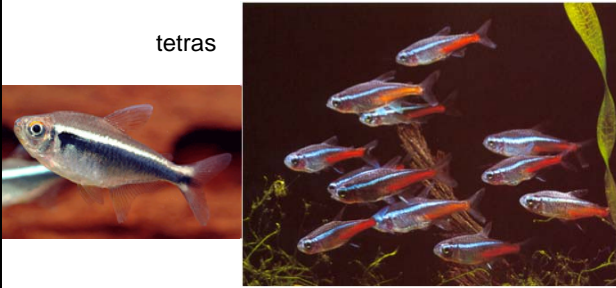
Characiformes (tetras & others)

(18 families, 1675 spp.) 



Order: **Characiformes**
 Family: **Characidae** (tetras, piranhas, & others)

tetras



Order: **Characiformes**
 Family: **Characidae** (tetras, piranhas, & others)

black pacu



Order: **Characiformes**
 Family: **Characidae** (tetras, piranhas, & others)

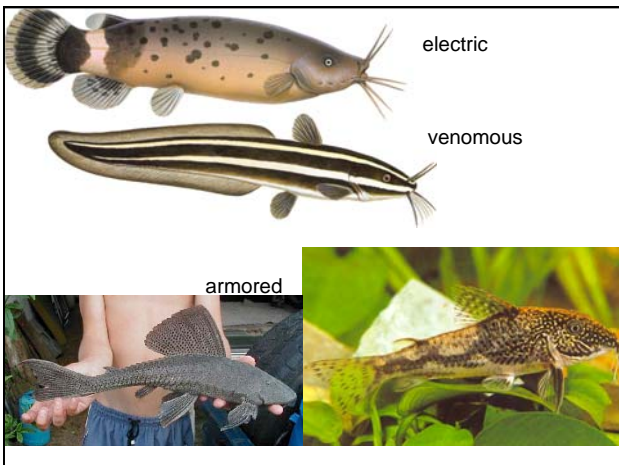
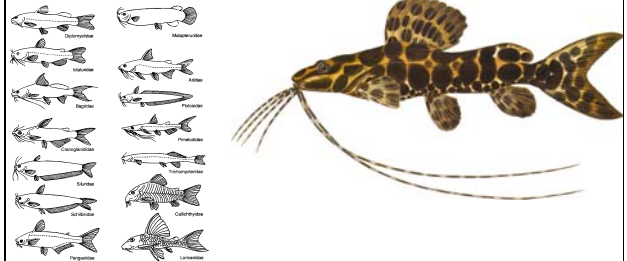


piranha

Order:
Siluriformes (catfishes) (34 families, 2870 spp.)

characters:

- barbels ("wiskers")
- adipose fin
- scaleless or armored



electric

venomous

armored

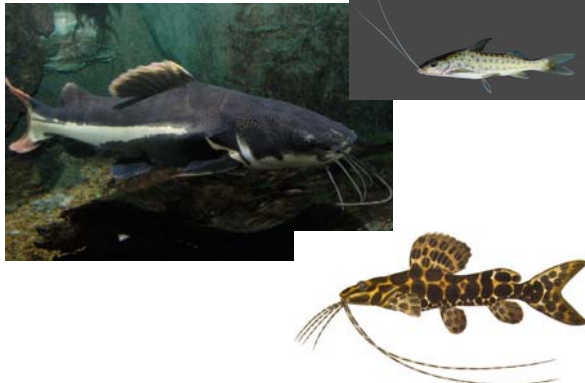
Order: **Siluriformes**
 Family: **Ictaluridae**
 channel catfish



blue catfish

<http://www.youtube.com/watch?v=biL-QcviQGk>

Order: **Siluriformes**
 Family: **Pimelodidae**



Mekong giant catfish



captured in the Mekong river in 2005: 9 ft long, 645 lb.

wels catfish



goonch



Candiru – your worst nightmare



<http://www.youtube.com/watch?v=QQWgUht-Obl>



"PHYSICIAN EXTRACTS CANDIRU FROM PATIENT IN MANAUS

Registered as an unprecedented case of urethrorraxy (hemorrhage of urethral origin), a first of a kind surgery was performed on patient FBC, 23, last week in Manaus, by urologist Anoar Samad, and will be presented at the American Meeting of Urology this year in the US.

The urologist extracted a 12 cm long by 1 cm thick candiru from FBC's urethral canal.

According to the victim the event started during a river bath in Itacoatiara, 175 km east of Manaus. The lad was injured when he decided to urinate while bathing, and lowered his bathing suit to do so. The fish entered the urethra through the penis. The victim stated that he realized immediately what had happened to him, yet he did not feel pain immediately, only a noticeable discomfort. The pain comes later he said. Before the surgery, the urologist performed an ultrasound scanning to locate the fish and to document the event. The physician used endoscopy equipment to reach the fish. The physician used micro scissors to cut off the fins and opercular spines, and then retrieved the fish."



Order: **Gymnotiformes** (S. American knifefishes)

(5 families, 62 spp.)

Family: **Gymnotidae**

-- produce and receive electrical impulses



Banded knifefish (*Gymnotus carapo*)
 about 1 ft (30 cm)

Electric eel (*Electrophorus electricus*)
 up to 8 ft (244 cm)



500 volts!

Subdivision **Euteleostei** (>300 families & >17,000 spp!)

9 Superorders:

- Protacanthopterygii** (pikes, salmonids, smelts, argentines)
- Stenopterygii** (marine hatchetfishes, bristlemouths)
- Ateleopodomorpha** (jellynose fishes)
- Cyclosquamata** (pearleyes, lizardfishes)
- Scopelomorpha** (lanternfishes)
- Lampridiomorpha** (oarfish, opah)
- Polymixiomorpha** (beardfishes)
- Paracanthopterygii** (cusk-eels, cods, frogfishes)
- Acanthopterygii** (mullet, silversides, whalefishes, squirrelfishes, John dories, sticklebacks, swamp eels, scorpionfishes, flatfishes, pufferfishes, **and all perchlike fishes**)

Subdivision **Euteleostei**

Superorder **Protacanthopterygii**

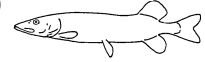


Order **Argentiformes** (argentines)

Order **Osmeriformes** (smelts)

Order **Salmoniformes** (salmon & trouts)

Order **Esociformes** (pike)



Characters:

- no fin spines
- most have adipose fin
- hypural plates consolidated to the urostyle (strong swimmers)
- slender predatory fish with many specializations
- cycloid scales
- physostomous connection (passageway) between swimbladder and pharynx
- pectoral and pelvic fins usually in ancestral position

Order:

Argentiformes (argentines or herring smelts)

(6 families, 202 spp.)

- all deep sea
- crumena organ (branchial)



Family: **Microstomatidae** (pencilsmelts)

-- includes former Bathylagidae (deepsea smelts)



Order:

Osmeriformes (smelts)

(3 families, 88 spp.)



Order:

Salmoniformes (salmonids: salmon, trouts, charrs, graylings, charrs)

(1 Family, 66 spp.)

Family: **Salmonidae**



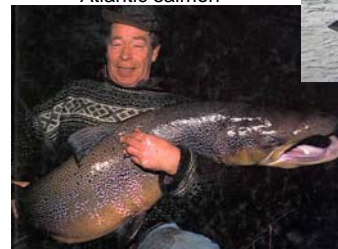
rainbow trout



chinook salmon

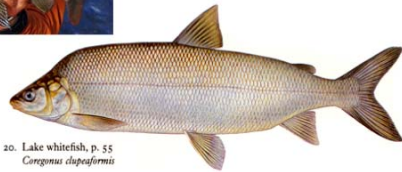


Atlantic salmon

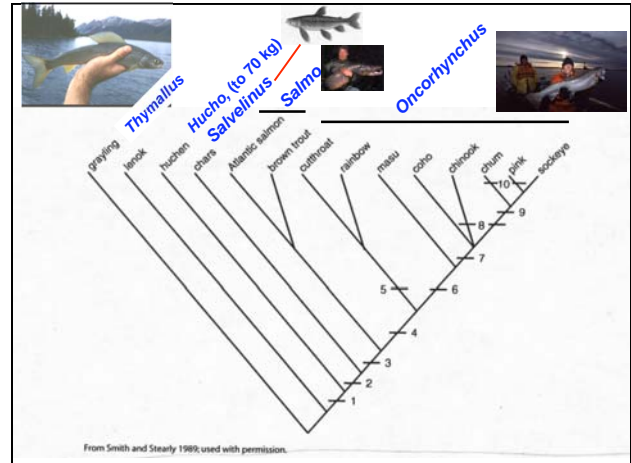


Order: **Salmoniformes**

Arctic grayling



20. Lake whitefish, p. 55
Coregonus clupeaformis



Order: **Esociformes** (pikes & pickerels) (2 families, 10 spp.)

Family: **Esocidae**



northern pike



redfin pickerel

From here on the **Neoteleosts**

based on 4 skull and jaw characteristics

- trend toward P₂ more anterior and P₁ more lateral

Superorders:

Stenopterygii
Cyclosquamata
Scopelomorpha

Acanthomorpha (true spines)
Lampridiomorpha
Polymixiomorpha

Paracanthopterygii
Acanthopterygii

specialized deep-sea
and pelagic forms

Superorder **Stenopterygii**



Order **Stomiiformes** (5 families, 391 spp.)

(bristlemouths, marine hatchetfish, lightfish, viperfish)

- deepsea, worldwide
- photophores – light emitting organs
- big gape
- one genus, *Cyclothone*, considered to be most abundant fish in world

Order **Ateleopodiformes** (jellynoses) (1 family, 12 spp.)

- skeleton largely cartilaginous, deep water, on the bottom
- bulbous-headed fish

Order: **Stomiiformes**

Family: **Gonostomatidae** (bristlemouths)

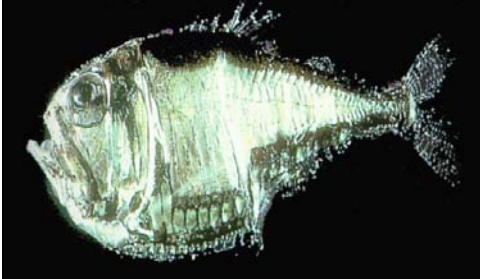
Cyclothone



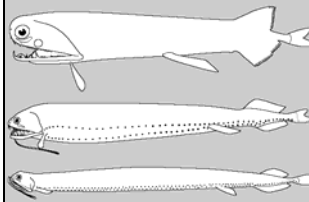
Order: **Stomiiformes**
Family: **Sternoptychidae**
(hatchetfishes)



hatchetfish



Order: **Stomiiformes**
Family: **Stomiidae** (barbeled dragonfishes)



Order:
Ateleopodiformes (jellynoses)
(1 family, 12 spp.)



Superorder **Cyclosquamata** (cycloid scaled)

Order **Aulopiformes**
(7 families, 236 spp.)

- mostly deep-sea
- major exception: lizardfishes (common on coral reefs)

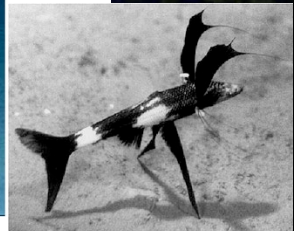
longnose lancetfish



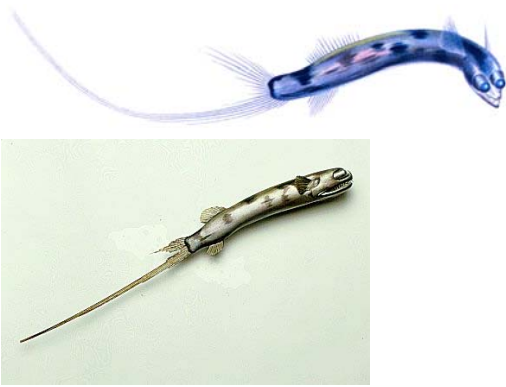
Order: **Aulopiformes**
Family: **Synodontidae** (lizardfish)



Order Aulopiformes
tripod fish



Order Aulopiformes, telescopefish

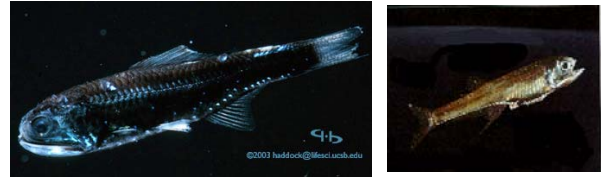


Superorder: **Scopelomorpha**

Order: **Myctophiformes** (lanternfishes)
(2 families, 246 spp.)

- large fraction of the “deep-scattering layer”

Family: **Myctophidae** (lanternfishes)



Next lecture: **Acanthomorpha**, the spiny teleosts

