

**EUTELEOSTEI = OSTARIOPHYSI +
PROTACANTHOPPTERYGII +
NEOTELEOSTS**

NEOTELEOSTS = Stenopterygii + Cyclosquamata
+ Scopelomorpha + ACANTHOMORPHA

ACANTHOMORPHA = Lampridiomorpha +
Polymixiomorpha + Paracanthopterygii +
ACANTHOPTERYGII

ACANTHOPTERYGII = Mugilomorpha (mullet) +
Atherinomorpha (silversides) + Percomorpha

- *Neoteleostei* --
- **Superorder Stenopterygii**
 - **Order Stomiiformes**: (dragonfish, hatchetfish); 321 spp, including lightfishes, marine hatchetfishes. Mostly weird, deep-sea forms.
 - **Order Ateleopodiformes**: Jellynosefishes
- **Superorder Cyclosquamata**
 - **Order Aulopiformes**: deep sea dwellers – 220+ species lizardfish, telescopefish
- **Superorder Scopelomorpha**
 - **Order Myctophiformes**: Blackchins & Lanternfishes (65% all mesopelagic fish)
- **Acanthomorpha** --
- **Superorder Lampridiomorpha**
 - **Order Lampridiformes**: opahs, crestfish, ribbonfish, oarfish, Deep-sea fishes.
- **Superorder Polymixiomorpha**
 - **Order Polymixiiformes**: = Beardfish
- **Superorder Paracanthopterygii**
 - **Order Percopsiformes**: Troutperch, pirate perch (anus below head), cavefishes
 - **Order Ophidiiformes**: Cuskeels
 - **Order Gadiformes**: Codfishes
 - **Order Batrachoidiformes**: Toadfishes
 - **Order Lophiiformes**: Anglerfishes, Frogfishes, Batfishes, Goosefishes
- **Superorder Acanthopterygii**

- **Superorder Acanthopterygii**
- **Mugilomorpha**
 - **Order Mugiliformes**: Mullet
- **Atherinomorpha**
 - **Order Atheriniformes**: Silversides and rainbowfishes
 - **Order Beloniformes**: Needlefish, Halfbeaks, and Flyingfishes
 - **Order Cyprinodontiformes**: Killifishes, plays, swordtails + ricefishes (Medaka)
- **Series Percomorpha**
 - **Order Stephanoberciformes**: Pricklefish, whalefish
 - **Order Bercyiformes**: Squirrelfishes, redfishes, Pineapple fishes, flashlight fishes, Roughies, Spinyfins, Fangtooths
 - **Order Zelformes**: Dories, Oreos, .
 - **Order Gasterosteiformes**: Pipefish and seahorses, sticklebacks
 - **Order Synbranchiformes**: Swampeels
 - **Order Scorpaeniformes**: *Scorpanifish*
 - **Order Perciformes**: Many many
 - **Order Pleuronectiformes**: Flounders and soles
 - **Order Tetraodontiformes**: Triggers and puffers etc

Neoteleosts

Neoteleosts: Emergence of a Pharyngeal Retractor Muscle - seven super orders are recognized.

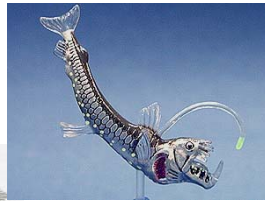
Anterior end = Dorsal gill arch elements (pharyngobranchials) and posterior end (first to sixteenth elements). Connects pharyngeal jaws w/ vertebral column.

Also changed way vertebral column connects to skull – three bones (basi and two exoccipitals) versus basioccipital only (primitive).

Other characters include (a) medial rostral cartilage between premaxillae and neurocrania & some muscles I will not bore you with.

Seven “Super Orders”

- Super order groups
- #1) **Stenopterygii** = Stomiiforms and Ateleopodidae (jellynose fish = weird deep water – swim just above bottom).



Seven “Super Orders”

- Stomiiformes = deep-sea, mesopelagic and bathypelagic w/ luminescent organs (photophores) present; include the lightfishes or bristlemouths including - Cyclothone = greatest abundance of individuals of any fish genus in the world); Marine Hatchetfish; Viper fishes; dragon fishes; snaggletooths



Stomiiformes

- 4 families w/ 321 species: [Gonostomatidae](#) (bristlemouths), [Phosichthyidae](#) (lightfishes), Sternoptychidae (marine hatchetfishes), and [Stomiidae](#) (dragonfishes and relatives). 1985 – Bill Fink combined 230 or so species of "barbeled stomiiforms," previously recognized in six families, into one large family, the Stomiidae.

Seven “Super Orders”

- #2) AULOPIFORMES = Cyclosquamata = pelagic & bathypelagic; many synchronous hermaphrodites;
- 4 Suborders; 12 families, 42 genera w/ about 200 species; greeneyes; pearleyes; waryfishes; Lizard fishes; Tripod fishes – elongate pectoral, pelvic and caudal rays to sit on bottom
- All fishes above Cyclosquamata - lost fifth pharyngeal tooth plate



Seven “Super Orders”

- #3) Myctophiformes (Scopelomorpha) - with 2 families; 35 genera & about 241 species; lanternfishes – lost tooth plate but still have cycloid scales (versus ctenoid)



Bathypterois quadrifilis



Lepidophanes guentheri

Seven “Super Orders”

- Super order groups
- Now we get the = ACANTHOMORPHA = True fin spines (rather than hardened rays) = in dorsal, anal and pelvic fins; = Spiny rayed teleosts (other changes include the maxilla, pharyngeal teeth diversified, etc

Seven “Super Orders”

- ACANTHOMORPHA
- 4) Lampridiomorpha = open water oceanic include opahs and oarfish = one can enlarge its mouth volume 40 fold during feeding; no true spines, maxilla helps premax - has no teeth



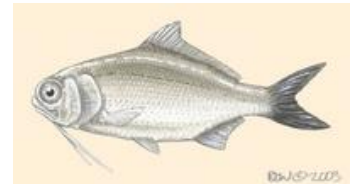
Opah - *Lampris guttatus*



Oarfish - *Regalecus glesne*

Seven “Super Orders”

- ACANTHOMORPHA
- 5) Polymixiomorpha = beardfishes – unsure of exact phylogenetic position- mixed combination of characteristics



Seven “Super Orders”

- 6) Paracanthopterygii – major side branch; Marine, benthic and nocturnal fishes; Defined - caudal skeleton and holes in skull. About 1200 species – only 20 primitive are freshwater
- Percopsiformes - Troutperch (most advanced w/ adipose fin) and blind scaleless cave fish (amblyopsid),



Seven “Super Orders”

- 6) Paracanthopterygii
- Ophidiiformes - Pearlfish and cusk eels – some live inside body cavities and are parasitic; two distinct larval stages.



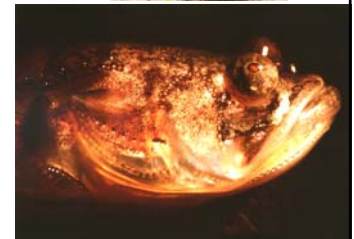
Seven “Super Orders”

- 6) Paracanthopterygii
- Gadiformes - Cods, hake etc – some of most important commercial fishes in the world – largest food fishery in world is for Pacific walleye Pollock > 6 million tons in 1989



Seven “Super Orders”

- 6) Paracanthopterygii
- Batrachoidiformes - Toadfish – some venomous - convergent with scorpionfish.
- Lots of acoustics and midshipmen (lateral photophores and very vocal during breeding – houseboats complain) – auditory scene analysis



Seven "Super Orders"

- 6) Paracanthopterygii
- Lophiiformes = anglerfishes; Goosefish & frogfish (esca or lure used to mimic small fish) and batfish – very strange morphologically, 150 plus species and males small and are parasitic on females.



Seven "Super Orders"

- 7) Superorder Acanthopterygii – 13,500 species in 251 families.
 - a) Ascending process of premaxilla
 - b) Pharyngeal dentition and action great – retractor dorsalis now inserts on 3rd pharyngobranchial arch and upper pharyngeal jaws supported by 2nd and 3rd epibranchials
- Typically - ctenoid scales, physoclistous gas bladder, no maxilla in gape; two distinct dorsal fins (spiny and soft); pelvic and anal fins with spines; externally symmetric tail

Seven "Super Orders"

- 7) Superorder Acanthopterygii
- 'Three 'Series'
- 1) Mugilomorpha – mullets – 66 species, economically important; leap from water.??



Seven "Super Orders"

- 7) Superorder Acanthopterygii - 3 'Series'
- 2) Atherinomorpha – Surface of water.
 - a) Atheriniformes - silversides, rainbow fish, 285 spp.;
 - b) Beloniformes = needlefishes, flying fishes, include Medakas (ricefish *Oryzias* - used in labs; first to have sex in space); and
 - c) Cyprinodontiformes = Poeciliids – mollies, guppies, swordtails; Killifish, pupfish etc. – highly salt tolerant and extreme environments; Annual aplocheilid rivulines. *Rivulus marmoratus* only self fertilizing fish; Anablepid – four eye fish. Species flock of *Orestias* in Lake Titicaca (4570 m).



Seven “Super Orders”

- 7) Superorder Acanthopterygii – 13,500 species in 251 families.
- 3) Percomorpha 12,000 species with anteriorly placed pelvic girdle that is connected to the pectoral girdle directly or by a ligament; pelvic fin w/ anterior spine and usually five soft rays

Percomorpha

- Defined - Anteriorly placed pelvic girdle connected to pectoral directly or by ligament; not well defined group

Basal Orders

- Stephanoberyciforms (gibberfishes & whalefish)
- Bericiformes - orange roughy & squirrelfishes
- Zeiforms – John dories
- Gasterosteiforms – dermal armour plates, small mouths; sticklebacks, Syngnathoidei = sea horses. Sea moths, pipefish, sea dragons, - only verts where males become pregnant, also trumpetfish & cornet fish and shrimpfish – head down in urchins.
- Synbranchiforms – Swamp Eels - palatoquadrate attaches at two points on skull = amphystylic suspension.
- Scorpaniformes – scorpionfish and rockfish; only freshwater = sculpins

Percomorpha

- Order Perciformes – 148 families and 9300 species
- Suborder Percoidae (many families) – 71 families with 2860 species
 - Centropomids – snooks, barramundi, Nile Perch etc
 - Serranidae – sea basses, 450+ species – 3 spines on opercle; 3 subfamilies inc. mamelets, groupers, soapfish, etc. Many are hermaphrodites – start female become male = PROTOGYNY
 - Centrarchidae – 29 spp. Sunfishes, crappies, rockbasses and basses
 - Grammatidae – basslets
 - Percidae – yellow perch and walleye and darters (162+ species)
 - Cardinal fish (Apogonids) – 320+ spp. Nocturnal reef fish w/ big eyes
 - Tilefishes (Malacanthids) – marine burroughs, move shells, rocks w/ mouth
 - Nematistidae – remoras – first dorsal fin modified as sucking organ; - sometimes combined w/ next four as carangoids

PERCOMORPHA

- Cobia – monotypic – looks like ramora but no disk often w/ manta rays
- Dolphin fishes (dorado) - - 2pp. – sexual dimorphism in skulls
- Jacks – Carangids – 140 + species of predators – good swimmers – carangiform locomotion.
- Lutjanids – snappers 125+ spp.
- Lobotid triptetals – dorsal anal and caudal fins
- Gerreidae – mojarras – common inshore
- Haemulidae (grunts) – coral reef – pork fish
- Sparidae (Porgies)
- Polynemid threadfins
- Sciaenid Croakers – 270+ species inc. Inc. Totoaba – sound production & large otoliths and extensive lateral lines.
- Mullid (goatfishes) –
- Monodactylid fingerfishes
- Toxotid Archerfishes – shoot water eyes submerged
- Chaetodontidae – butterfly fishes – 114 species
- Pomacanthidae – Angelfishes
- Kyphosids – sea chubs 42 sp.
- Nanid Leaf fish
- Cirrhitid hawkfishes

PERCOMORPHA

- Suborder - Elasmobranchs – shark and ray
- Suborder - Labroidae – species flocks and explosive speciation
Cichlidae, Pomacentridae, Labridae, Scaridae, Embiotocidae & Odacids
- Suborder - Zoarcoidei – eelpouts, wolffishes, wolf eels, gunnels
- Suborder - Notothenioidei – icefishes, glycoprotein antifreeze
- Suborder - Trachinoidei – stargazers, sand divers, sand lances, weeverfishes (venomous w/ stargazers)
- Suborder - Icosteioidei, Gobiesocoidei, Callionymoidei – ragfish, clingfish, Dragonet (popular aquarium)
- Suborder - Blennioidei – Blennies
- Suborder - Gobioidae – Gobies

PERCOMORPHA

- Suborder Kurtidae – Kurtids, males care eggs w/ attachment to supraoccipital crest
- Suborder Acanthuroidei – Acanthurids (72 spp), rabbitfishes, spadefishes, Louvar (female w/ 50 million eggs), Moorish Idol
- Suborder Scombroidei – weird gas bladder that has projections, monotypic
- Suborder Scombroidei – Mackerels, tunas, Barracudas, cutlass fishes, Xiphiid swordfish and istiophorid sailfish, spearfish and marlins
- Suborder Stromateoidei – medusafishes, squaretails, driftfishes, butterfishes
- Suborder Anabantoidei – labyrinth fishes – auxiliary breathing structure
- Suborder Channoidei – snakeheads

PERCOMORPHA

- Order – Pleuronectiformes – pelagic symmetric larvae, metamorphose into adults that lie on bottom, Soles (usually right eyed), flounders, halibut (righteye flounder), tonguefishes.
- Order - Tetradontiformes – triggerfish, filefishes, boxfishes, puffers, Mola Ocean Sunfishes lots of cartilage in skull, up to 1000 lbs.