

BIODIVERSITY IV: LAMPRIOMORPHS, PARACANTHOPTERYGII, AND BASAL ACANTHOPTERYGII

Subclass **Actinopterygii**

Division **Teleostei**

Subdivision **Euteleostei**

Superorder **Lampriomorpha**

Order **Lampriformes** (opahs, ribbonfish, oarfish)

Superorder **Paracanthopterygii**

Order **Percopsiformes** (trout-perches, pirate perch)

Order **Ophidiiformes** (cusk eels, brotulas)

Order **Gadiformes** (cod, grenadier, hake)

Order **Batrachoidiformes** (toadfishes, midshipmen)

Order **Lophiiformes** (anglerfish)

Superorder **Acanthopterygii** (higher spiny-rayed fishes)

Series **Mugilomorpha**

Order **Mugiliformes** (mulletts)

Series **Atherinomorpha**

Order **Atheriniformes** (silversides)

Order **Beloniformes** (flying fishes, half-beaks, needlefish, sauries)

Order **Cyprinodontiformes** (pupfishes, killifishes, guppies)

Series **Percomorpha**

Order **Beryciformes** (fangtooths, flashlight fish, pinecone fish, squirrelfish)

Order **Gasterosteiformes** (sticklebacks, sea horses, pipefish, trumpetfish)

Order **Synbranchiformes** (swamp eels)

Superorder **Lampriomorpha**

Order **Lampriformes**

- Well-defined order of marine fishes united by:
 - Unique musculature with pectoral fins (they swim with them).
 - Modification of the upper jaw that allows for protrusion of both premaxilla and maxilla together, the maxilla is not ligamentously attached to the ethmoid and palatine, rather it slides in and out with the highly protractile premaxilla.
 - Lack true spines.
- The order consists of seven families, 12 genera, and ~21 species: Veliferidae (velifers, 2 species), Stylephoridae (tube-eye or thread-tails, one species), Lophotidae (crestfishes, ~3 species), Radiicephalidae (tapertails, one species), Trachipteridae (ribbonfishes, 10 species), Regalecidae (oarfishes, 2 species).
- All species are marine, one near-shore family, others pelagic or deep-sea, order with world-wide distribution.

Superorder **Paracanthopterygii**

- This group represents a euteleost lineage that evolved parallel to acanthopterygians. Its monophyletic status is still being debated, with resulting changes in membership, although most recent examinations have supported it as a true assemblage.

- All presently recognized paracanthopterygians are carnivorous fishes characterized by the unique evolutionary pathway their caudal fin has followed. They tend to have a reduced number of caudal fin rays and jugular/thoracic pelvic fin attachment.

Order **Percopsiformes**

- Order united by:
 - Nonprotractile premaxilla
 - Pelvic fins (if present) just behind pectoral fins, with soft rays only
 - Ctenoid scales
 - Weak spines in dorsal fin
- This order consists of three families, seven genera, and nine species: Percopsidae (trout-perches, 2 species), Aphredoderidae (pirate perch, 1 species), Amblyopsidae (cavefishes, 6 species).
- Freshwater fishes restricted to eastern North America.

Order **Gadiformes**

- Order united by:
 - Thoracic or jugular pelvics.
 - No true spines.
 - Long dorsal and anal fins.
 - Scales usually cycloid (rarely ctenoid).
 - Premaxilla forms entire margin of upper jaw (i.e. excludes maxilla from gape).
 - Swimbladder without pneumatic duct.
 - Often subterminal mouths.
- This order consists of nine families, 75 genera, and ~555 species: Muraenolepididae (eel cods, 4 spp.), Bregmacerotidae (codlets, 15 spp.), Euclichthyidae (eucla cod, 1 sp.), Macrouridae (grenadiers/rattails, 350 spp.), Moridae (deepsea cods, 105 spp.), Melanonidae (pelagic cods, 2 spp.), Merlucciidae (merluccid hakes, 13 spp.), Phycidae (physid hakes, 10 spp.), Gadidae (cods, 31 spp.).
- Where found.

Order **Batrachoidiformes**

- Order united by:
 - Body usually scaleless (small cycloid in some).
 - Large head with somewhat dorsally-directed eyes.
 - Large mouth, bordered by premaxilla *and* maxilla.
 - Pelvic fins jugular, and with one spine.
 - Some species can produce audible sounds.
- The order consists of one family, three subfamilies, 22 genera, and 78 species: Batrachoidinae (toadfishes, 52 spp.), Porichthyinae (midshipmen, 15 spp.), Thalassophryninae (venomous toadfish, 11 spp.).
- All toadfishes are contained in the family Batrachoididae. These fishes usually have scaleless bodies and large, dorsally oriented eyes.
- Batrachoidiforms are predominantly marine, coastal, benthic fishes. They are found in the Atlantic, Indian, and Pacific Oceans.

- Members of the subfamily Thalassophryinae possess venom glands associated with two hollow dorsal spines and a hollow opercular spine.
- Species in the genus *Porichthys* (midshipmen) are some of the few shallow-water fishes with photophores.

Order **Lophiiformes**

- Among other groups, Lophiiformes includes the families Lophiidae (monkfish, goosefish), Antennariidae (frogfishes), Ogocephalidae (batfishes), and the suborder Ceratioidei (deep-sea ceratioid anglerfishes).
- All lophiiforms are marine fishes with a worldwide distribution. Most of these fishes are characterized by modifications of the first dorsal spine used for attracting prey to the vicinity of the mouth.
- Many ceratioid families exhibit an unusual reproductive adaptation known as sexual parasitism whereby male(s) attach to the female and remain attached for life.

Superorder **Acanthopterygii**

- Acanthopterygians are characterized by adaptations of the muscles and articulations involved in pharyngeal teeth movement (e.g., the attachment of the retractor dorsalis muscle) and a well-developed ascending process allowing improved upper jaw mobility.
- Acanthopterygians are a very diverse group (containing 11,000+ species), found throughout the world.
- Examine specimens from representative acanthopterygian orders (there are more to come in the next lab):

Series **Mugilomorpha**

Order **Mugiliformes**

- Order united by:
 - Two distinct spiny-rayed (4 spines) and soft-rayed (8-10 rays) dorsal fins.
 - Anal fin with two or three spines.
 - Pectoral fins high on body.
 - Pelvic fins subabdominal, with one spine.
 - Ctenoid scales.
- The order consists of one family, 17 genera, and ~72 species: Mugilidae (mulletts).
- Coastal marine and brackish water, all tropical and temperate seas.

Series **Atherinomorpha** – An assemblage of fishes within Acanthopterygii lacking a ball and socket joint between palatine and maxilla.

Order **Atheriniformes**

- Order united by:
 - Two distinct dorsal fins.
 - Anal fin usually preceded by a spine.
 - Lateral line absent or very weak.
 - Pectoral fins inserted high on body.
 - Pelvic fins abdominal or thoracic.

- The order consists of 6 families, 48 genera, and 312 species: Atherinopsidae (New World silversides, 108 spp.), Notocheiridae (surf sardines, 6 spp.), Melanotaeniidae (rainbowfishes and blue eyes, 113 spp.), Atherionidae (pricklenose silversides, 3 spp.), Phallostethidae (tusked silversides, penisheads, and priapiumfishes, 22 spp.), Atherinidae (Old World silversides, 60 spp.).
- Freshwater and marine fishes, circumglobal distribution in tropical, subtropical, and temperate waters.

Order **Beloniformes**

- Order united by:
 - Fixed or nonprotrusible upper jaw.
 - Largely dorsally directed mouths and eyes.
- The order consists of 5 families, 36 genera, and 227 species: Adrianichthyidae (adrianichthyids, 28 spp.), Exocetidae (flying fishes, 52 spp.), Hemiramphidae (half beaks, 109 spp.), Belonidae (needlefishes, 34 spp.), Scomberesocidae (sauries, 4 spp.).
- Freshwater and marine fishes. The majority of species are epipelagic in tropical to temperate waters of the world.

Order **Cyprinodontiformes**

- Order united by:
 - Truncate or rounded caudal fin.
 - Pectoral fin inserted ventrolaterally.
 - Lateral line canal and pores on head.
 - Upper jaw bordered by premaxilla only.
- The order consists of ten families, 109 genera, and 1,013 species: Aplocheilidae (Asian rivulines, 7 spp.), Nothobranchiidae (African rivulines, 250+ spp.), Rivulidae (New World rivulines, 4 spp.), Goodeidae (goodeids, 2 spp.), Fundulidae (topminnows, 50 spp.), Valenciidae (Valencia toothcarps, 2 spp.), Cyprinodontidae (pupfishes, 104 spp.), Anablepidae (four-eyed fishes, 14 spp.), Poeciliidae (livebearer/guppies, 304 spp.).
- Largely freshwater fishes, although many species also occupy brackish water, and even fewer coastal marine waters. Found in tropical, subtropical, and temperate regions.

Series **Percomorpha**

- Most derived euteleostean clade.
- ~12,000 species of largely marine fishes.
- United by:
 - Thoracic placed pelvic girdle that is connected to the pectoral girdle directly or via a ligament.
 - Pelvic fin typically consists of one spine and five rays.

Order **Beryciformes**

- *A poorly defined*, diverse group, most fish in this order possess very large eyes.
- The order (or two depending on who you talk to) consists of 16 families, 57 genera, and 219 species: Melamphidae (bigscale fishes, 36 spp.), Stephanoberycidae (pricklefishes, 3 spp.), Hispidoberycidae (hispidoberycids, 1 sp.), Gibberichthyidae (gibberfishes, 2 spp.), Rondeletiidae (redmouth

whalefishes, 2 spp.), Barbourisiidae (red whalefishes, 1 sp.), Cetomimidae (flabby whalefishes, ~35 spp.), Mirapinnidae (tapertails, 5 spp.), Megalomyceteridae (largenose fishes, 8 spp.), Anopogasteridae (fangtooths, 2 spp.), Diretmidae (spinyfins, 4 spp.), Anomalopidae (flashlight fishes, 8 spp.), Monocentridae (pinecone fishes, 4 spp.), Trachichthyidae (roughies and slimeheads, 39 spp.), Berycidae (alfonsinos, 9 spp.), Holocentridae (squirrelfishes, 78 spp.).

- All marine fishes with many meso- and bathypelagic species.

Order **Gasterosteiformes**

- Order united by:
 - Body often with armor of dermal plates.
 - Small mouth.
- The order consists of 11 families, 71 genera, and 278 species: Hypoptychidae (sand eels, 1 sp.), Aulorhynchidae (tubesnouts, 2 spp.), Gasterosteidae (sticklebacks, 8 spp.), Indostomidae (armored sticklebacks, 3 spp.), Pegasidae (seamoths, 5 spp.), Solenostomidae (ghost pipefishes, 5 spp.), Syngnathidae (pipefishes and seahorses, 232 spp.), Aulostomidae (trumpetfishes, 3 spp.), Fistularidae (cornetfishes, 4 spp.), Macroramphosidae (snipefishes, 11 spp.), Centriscidae (shrimpfishes, 4 spp.).
- Marine, brackish, and freshwater fishes found circumglobally.

Order **Synbranchiformes**

- Order united by:
 - Elongate body.
 - Pelvic fins absent.
 - *Single, continuous gill opening confined to lower half of body (i.e. a cutthroat appearance).*
 - Premaxilla without ascending process.
 - Only freshwater examples of protogynous hermaphrodites.
- The order consists of three families, 15 genera, and 99 species: Synbranchidae (swamp eels, 17 spp.), Chaudhuriidae (earthworm eels, 9 spp.), Mastacembelidae (spiny eels, 73 spp.).
- Freshwater fishes confined to circum-tropical and subtropical waters (except for 3 spp. which are marine).