TELEOSTEI (1) Osteoglossiformes through Lophiiformes

Division Teleostei
Subdivision Osteoglossomorpha

Order Osteoglossiformes: Intestine passes posteriorly to the left of esophagus and stomach (in most gnathostome fishes it passes to the right; exceptions include cyprinids and some atherinids). Parasphenoid and tongue bones usually with well-developed teeth; premaxilla small and fixed to the skull; no supramaxilla. One or two pyloric caeca.

Osteoglossidae (bony tongues) Distribution: freshwater, circumtropical. Small family of archaic fishes in Africa (1 spp.), South America (3 spp.), and southeastern Asia to Australia (3 spp.). Pelvic fins well behind base of pectoral fins. Most with very large scales. Some with suprabranchial organ and capable of air-breathing. Vertebræ 60-100. Most are omnivores or carnivores inhabiting quiet waters. Bony tongues are commonly exhibited in public aquaria and the arawana is a popular aquarium fish in Asia.


Notopteridae (African knifefishes) Chiefly freshwater; sometimes in brackish water. Distribution: Africa (2) and Southeast Asia (2). Small quill-like dorsal fin (absent in Xenomyslus) and long-based anal fin confluent with small caudal fin. Combined anal and caudal rays 100 or more. Scutes along ventral 25-45. Maximum length 80 cm. Small specimens are popular with home aquarists and large adults are exhibited in public aquaria. Most are used for food in their native ranges.

Mormyridae (Elephantnose fishes) Distribution: freshwater, tropical Africa and Nile. Paired and vertical fins all present; narrow caudal peduncle and deeply forked caudal fin. Parasphenoid and tongue with teeth. Dorsal and anal fins usually opposite each other on posterior part of body. Mouth of highly variable form, often trunklike. Maximum length 1.5 m, usually 9-50 cm. Mormyrids are noted for their large cerebellums and their use of electricity and sound.

Subdivision Elopomorpha: Leptocephalus larvae; swim bladder is not connected to the ear; no recessus lateralis. Leptocephalus larvae commonly to 10 cm and may be as long as 2 m. During metamorphosis from the larval to the adult form the fish shrinks greatly in length.
Subdivision Elopomorpha:

**Order Anguilliformes:** Pelvic fins and skeletal elements absent; dorsal and anal fins confluent with caudal fin; scales usually absent, or if present, cycloid and embedded; leptocephali larva of anguilliforms differs from that of notocanthiforms and elopiforms (but not saccopharyngiforms) in having the caudal fin small and rounded, continuous with the dorsal and anal fins.

*Anguillidae (freshwater eels)* Usually **catadromous** fishes in tropical and temperate waters, except eastern Pacific and south Atlantic. Eel-like body with minute or embedded scales. Well developed pectorals but no pelvic fins; dorsal and caudal fin confluent with anal fin. All species are important food fishes and are sold fresh, smoked, or canned. Important aquaculture species based on captured juveniles (elvers); widely introduced. All spend their juvenile and adult live in freshwater, returning to the ocean to spawn and die. The leptocephalus larvae are marine. There is some doubt as to the validity of some of the fifteen species currently recognized. Single genus, *Anguilla*, containing 15 species.

*Muraenidae (moray eels)* Worldwide in tropical and temperate seas; marine, some species in or occasionally visiting freshwater. Diverse group of eels with large mouths with numerous teeth; often with fanglike (canine) teeth. Dorsal fin origin usually before the gill openings; median fins confluent with caudal fin; no pelvic and pectoral fins. Gill openings as small roundish lateral openings. Head with 1-3 lateral line pores; absent on body. Scaleless. Recorded maximum length 3.0 m. Some morays cause ciguatera fish poisoning. A skin toxin was noted in an Indo-Pacific moray eel. Adults benthic, generally in shallow water among rocks and coral heads; many species are more active at night and hide in holes and crevices during the day. Vicious reputation is undeserved, although some species will bite if provoked. Feed mainly on crustaceans and small fishes. Larvae (leptocephali) epipelagic; widespread and abundant.

*Ophichthiidae (snake eels and worm eels)* Large family (250 spp.) Marine; coastal, estuaries and entering rivers. Distribution: tropical to warm temperate waters. Body serpentine. Snout subconic to pointed. Mouth subterminal to inferior. Nostrils well separated, posterior usually lying within or piercing the upper lip, opening into mouth. Tongue attached. Branchial opening small, slit or round. Branchiostegal rays 15-49 pairs, overlapping midventrally along the throat to form a jugostegalia. Neural spines poorly developed, when present. Hyomandibulae usually vertical, but may be inclined backward or forward. Lateral lines meeting dorsally at head level. Dorsal and anal, when present, confluent with or ending before caudal extremity (naked and hardened). Supraorbital pore on middle line. With or without pectoral fins. Pelvics absent. Vertebrae 110-270.

*Congridae (conger eels)* Distribution: Marine, tropical to temperate, Atlantic, Indian and Pacific Oceans. Body without scales. Usually with pectoral fins. Branchiostegal rays 8-22. Lateral line complete. Includes garden eels which have the interesting habit of hovering vertically above their burrows in large groups giving the appearance of a garden.

**Order Saccopharyngiformes:** Highly aberrant fishes lacking symplectic bone, opercular bones, branchiostegal rays, scales, pelvic fins, ribs, pyloric caeca, and swim bladder. Jaws and hyomandibular greatly elongate. Leptocephalus larvae deep-bodied with V-shaped (vs. W-shaped) myomeres.

*Eurypharyngididae (gulpers or pelican eels)* Distribution: Atlantic, Indian and Pacific Oceans, depth range 500 - 7500 m. Gill openings small, farther from snout tip than from anus. Gill arches 5. Visceral clefts 6. Minute pectoral fins. All temperate and tropical seas. Mouth greatly enlarged by a backward extension of jaws, gape comprising half or more
of preanal length; buccal cavity greatly distensible. Tail attenuated and ending in an expanded, luminous caudal organ. Caudal fin absent; scales absent; lateral line without pores, instead with groups of elevated tubules. Feed mainly on crustaceans, but also take fishes, cephalopods, and other invertebrates. Oviparous, planktonic eggs hatch into planktonic leptocephalus larvae. Max. size: 100.0 cm TL.

**Order Elopiformes:** Pelvic fins abdominal; gular plate well developed (median); leptocephalus larvae small (max. length 5 cm) with a well-developed, forked, caudal fin.


**Subdivision Clupeomorpha:** *Otophysic (ear-swim bladder) connection* comprising a pair of anterior extensions of the swim bladder that enter the skull through the exoccipital and extend into the prootic and often into the pterotics within the lateral wall of the braincase to connect with the utricle of the inner ear.

*Clupeid skull: Swim-bladder extensions enter through the auditory foramen.*
Order Clupeiformes: *Recessus lateralis* present (part of the otophysic connection in which various sensory canals merge within a chamber in the otic region of the neurocranium – not known in any other groups of fishes); parasphenoid teeth absent.

**Clupeidae (herrings)** Distribution: global (mostly tropical) from 70° N to about 60° S. Chiefly marine coastal and schooling fishes; some freshwater and anadromous. Body usually fusiform, round to strongly compressed. Head without scales; jaw teeth, when present, are small or minute. A single dorsal fin, small and near midpoint of body; pelvic fins more or less below dorsal fin base; dorsal and pelvic fins absent in some species; soft rays only. Lateral line spanning a few scales behind the head in some species, missing in others; scales cycloid (smooth to touch); abdominal scutes usually present (a single pelvic scute in the Dussumieriinae). Branchiostegal rays usually 5-10. Most feed on small planktonic animals. Size range (adults): from 2 to 75 cm. A very important fish family, both economically and ecologically. They are the primary forage fish for larger predators in both freshwater (e.g. Georgia reservoirs, Great Lakes) and in marine systems. They support large fisheries for such delights as pickled herring, sardines, cat food, and fish meal. Look at the fossils, and notice how similar they look to the modern fish. These fishes appeared early in the teleost record.

**Engraulidae (anchovies)** Distribution: Atlantic, Indian and Pacific Oceans. Schooling fishes, mostly of shallow coastal waters and estuaries in tropical and temperate regions. Some species enter or live in freshwater. Mouth inferior. Upper jaw produced. Jaw teeth well developed to absent. Gill rakers on lower limb of first arch 10-50 or more. Branchiostegal rays 7-19. A silvery stripe down flanks. Body translucent. Abdominal scutes present in most Old World anchovies; absent in New World anchovies; except for one pelvic scute. Luminescent organs noted in one species. Mostly filter feeding on zooplankton; a few piscivorous. About 50 cm maximum length; most species below 15 cm. Commercially important for food and fish meal; also used as bait.

Superorder Ostariophysi:

*Weberian apparatus*: anterior vertebrae and ribs modified to connect gas bladder to inner ear

**Order Cypriniformes**: pharyngeal teeth on 5th gill arch; pharyngeal teeth opposite posterior process (covered by a pad) of basioccipital bone (which encloses dorsal aorta), rather than to upper pharyngeal elements; three branchiostegal rays; head usually scaleless

**Cyprinidae (minnows)** Distribution: northern Canada to Mexico, Africa, and Eurasia. Pharynx with 1-3 rows of teeth, each row with a maximum of 8 teeth. Maximum length at least 2.5 m to probably 3 m in *Catlocarpio siamensis*; many species less than 3 cm. The family includes herbivores and predators. An important freshwater family with ~2,000 spp. Notice the diversity of forms within this family (although within some genera the species look extremely similar, e.g. *Notropis*). The species within this family are best told apart by their pharyngeal teeth.
**Catostomidae (suckers)** Distribution: China, northeast Siberia, North America. Pharyngeal teeth a single row with at least 16 teeth. Lips usually thick and fleshy with plicae or papillae. Premaxilla and maxilla usually bordering upper jaw. Exhibits tetraploidy. About 1-m maximum length, usually below 60 cm. Important fishes in freshwaters of North America-- (historically) abundant in rivers.


**Order Characiformes:** teeth usually well developed (most are carnivores); adipose fin usually present; pharyngeal teeth usually present, but not as specialized as in cypriniformes; barbels absent; branchiostegal rays 3 - 5; 19 principal caudal fin rays.

**Characidae (characins)** Distribution: southwestern Texas, Mexico, Central and South America. Characids are a large and diversified family, characterized by an adipose fin. Many genera are poorly defined and numerous changes in both generic and specific names are anticipated. Hundreds of species are sold in the aquarium trade, based either on breeding or on collection from wild populations. The potentially dangerous Amazon piranhas (*Serrasalmus*) belong to this group as well as the popular neon tetra. Eyes are absent in cave forms and the adipose fin is missing in some species.


**Order Siluriformes:** Sympletic, subopercular, basihyal and intermuscular bones absent; parietals fused to supraoccipital; mesopterygoid reduced. Many other reduced or fused bones; vomer usually toothed; spinelike rays often present at the front of dorsal (often two spines present, one acts as locking mechanisms for second spine) and pectoral fins; body either naked or covered in bony plates; normally up to four pairs of barbels on head (one nasal, one maxillary and two on chin); most with 17 caudal fin rays


**Aspredinidae (banjo catfish)** Freshwater; occasionally brackish. Distribution: tropical South America. Anterior part of body depressed. Body naked except for large tubercles. Adipose fin absent. About 42 cm; maximum length; most below 15 cm.

**Clariidae (air-breathing catfishes)** Distribution: Africa. Syria and southern and western Asia. Dorsal fin extending over much of body length. Dorsal fin rays usually over 30 without a leading spine. Dorsal fin discontinuous or united to caudal fin. Rounded caudal fin. Wide gill openings. Barbels 4 pairs. Air-breathing is accomplished with a labyrinthine organ arising from the gill arches (‘labyrinth catfishes’). Some are capable of traveling over short distances on land (‘walking catfishes’). Some are burrowers with small eyes and the pectoral and pelvic fins small or lacking. Introduced in the U.S.
**Ictaluridae** (North American catfishes) Distribution: North America from southern Canada to Guatemala. Head with eight barbels: 2 nasal, 2 maxillary and 4 chin. Scaleless. A spine on anterior edge of dorsal (except in *Prietella*) and pectoral fins. Dorsal soft rays usually 6. No palatine teeth. About 1.6 m maximum length. Large, important family. Includes such familiar fishes as bullheads, and channel catfishes as well as unfamiliar fishes such as madtoms (*Noturus*). All have adipose fins, however fishes within *Noturus* have adnate adipose fins (continuous with caudal fin). Farming of channel cats is big business in the U.S.

**Loricariidae** (armored catfishes) One of the largest families. Chiefly freshwater. Distribution: tropical and subtropical waters. Forked caudal fin. Adipose fin absent or, when present, with a spine at anterior border. Barbels usually 3 pairs. Nasal barbels absent. Bony plates present on head and near dorsal fin. A leading spine in both pectoral and dorsal fins. Popular aquarium fishes (e.g. *Plecostomus* spp.).


**Trichomycteridae** (pencil catfishes) Northern South America: Orinoco and Amazon river basins. Import to parts of USA prohibited. Parasitic, feeding on scales or mucus or enters the gill cavity of larger fish to suck blood; burrows in sandy bottoms. One species (*Vandellia cirrhosa*) known to enter the urethra of humans urinating under water; presumably it mistakes the urea for water exhausted from gills. The incorporation of this species in fish-based house security systems has been suggested.

**Order Gymnotiformes** (electric knifefishes and eels): Body eel-like (compressed or rounded; pelvic girdle and fins absent; dorsal fin absent; anal fin extremely long; caudal fin absent or greatly reduced; restricted gill openings; anal pore under head or pectorals; electric organs present;

**Gymnotidae** (South American knife fishes) Distribution: Restricted to freshwaters of Central and South America. Body eel-like (compressed or rounded); dorsal fin absent; anal fin extremely long from near pectorals to near tip of body. Electric organs present. Nocturnal fishes, mostly occurring in quiet waters from deep rivers to swamps. Some bury themselves in the substrate in strongly flowing waters. Note upside-down convergence with African knife fishes.

**Superorder Protacanthopterygii**

**Order Esociformes:** Maxilla toothless; maxilla in gape of mouth; no adipose fin; dorsal and anal fins posteriorly located; no breeding tubercules; no pyloric caecae;

**Esocidae** (pikes and pickerels) Distribution: Northern Hemisphere, colder parts of Eurasia and North America. Duckbill-like snout. Forked caudal fin; caudal rays 40-50, usually 17 branched rays; no spines. Many small cycloid scales. Complete lateral line. With at least 8 pores in infraorbital canal. Branchiostegal rays 9-20. Nasals present. With 43-67 vertebrae. To 1.8 m maximum length. Pikes are voracious predators, feeding on a wide variety of fishes and other vertebrates. Important sport fishes. 50 lb. Muskelunge have been caught. Learn the names of the North American pickerels and be able to distinguish between the chain and grass pickerel. One genus, *Esox*, with 5 species. Four are North American:

- *E. masquinongy* (muskellunge),
- *E. lucius* (northern pike)
**E. niger** (chain pickerel)—snout to eye distance longer than eye to opercle distance; suborbital bar nearly vertical

**E. americanus** (grass and redfin pickerel)—snout to eye distance less than eye to opercle distance; suborbital bar angled slightly to rear

**Order Salmoniformes:**

**Salmonidae** (*trout, chars, salmons, and whitefishes*) Distribution: Northern Hemisphere, but widely introduced in cold waters for sports and aquaculture. Many are anadromous, spending part of their life at sea, but returning to freshwater where all species spawn in a gravel bed in rivers or streams; most fish die after spawning. Small cycloid scales. Gill membranes reaching far forward, detached from isthmus. Axillary process on pelvic. Last three vertebrae directed upward. No spines. Adipose fin present. Attains 1.5 m (maybe 2 m) maximum length. Highly valuable in sport and commercial fisheries. There is disagreement about the status of some species and genera.

**Superorder Stenopterygii**

**Order Stomiiformes:** Luminescent organs (photophores) present; chin barbel in some; premaxilla and maxilla in gape of mouth—both with teeth; mouth extending past eye in most; scales if present, cycloid and easily lost; pectoral, dorsal and adipose fins absent in some; ventral adipose fin present in some; branchiostegals 5-24;

**Sternopychidae** (*hatchetfishes*) Distribution: Atlantic, Indian, and Pacific Oceans. Branchiostegal rays 10, except *Sternopyx* with 6; 3 on epihyal. Branchiostegal photophores 3-7 (mode 6). Branchiostegal pseudobranch present. Photophores are thought to camouflage the fish from predators below by scattering light of similar intensity as that of downwelling light in the ocean, thus eliminating the silhouette of the fish.


**Superorder Cyclosquamata**

**Order Aulopiformes** (*grinners*): gill arch specialization—second pharyngobranchial arch greatly elongated posterolaterally—unique among teleosts


Superorder Paracanthopterygii

Paracanthopterygians are chiefly benthic marine fishes (< 2% live in freshwater), active nocturnally or living in dark waters (e.g. bathypelagic region of deep sea; caves) Many have sonic muscles on their gas bladders used to produce sounds.

**Order Percopsiformes:** pelvic fins, if present, behind pectorals and with 3-8 soft rays; spines usually present in dorsal fin; many with ctenoid scales; premaxilla nonprotractile.


Aphredoderidae (pirate perch) Distribution: eastern United States. Scales ctenoid. Head scaly on sides. Normal eyes. Dorsal fin spines 3 or 4; soft rays 10 or 11. Anal fin spines 2 or 3; soft rays 5-7. Pelvic fin insertion subthoracic; pelvic rays 7. Anus in juveniles immediately preceding anal fin, moving anteriorly with growth. That young individuals have less anal fin spines (2) but more soft rays (5) while adults have 3 and 7, respectively, seems to result from a transformation of the third soft ray into a spine. About 13 cm maximum length. One species, *Aphredoderus sayanus*, also referred to as the asshole perch, shithead perch, or the politician fish.

**Order Ophidiiformes:** Pectoral fins high up on body with vertical orientation. Pelvic fins, when present, inserted at level of preopercle or farther anterior, and occasionally with a spine; base of dorsal and anal fins long, extending to and usually joining caudal fin; nostrils paired on each side;

Ophidiidae (cusk-eels) Chiefly marine (rarely freshwater). Distribution: Atlantic, Indian, and Pacific Oceans. Anus and anal fin origin usually posterior to pectoral fin tip. Anal fin rays usually of the same length or shorter than opposing dorsal fin rays. Scales present. One or more opercular spines in some. Supramaxillary present. Vexillum lacking in larvae. Pelvics usually present. About 1.5 m maximum length.

**Order Batrachoidiformes:** Body usually scaleless; head large with eyes more dorsal than lateral; mouth large and bordered by premaxilla and maxilla; pelvic fins in front of pectorals, with one spine; three pairs of gills; branchiostegals 6; swim bladder; no pyloric caeca. Fishes in this order are often quite vocal, producing a variety of sounds with their gas bladders.


**Order Gadiformes:** Pelvic fins, when present, inserted below or in front of pectorals; no true spines in fins; most with long dorsal and anal fins; scales usually cycloid; premaxilla forms entire margin of upper jaw, protractile in some

Gadidae (cods, haddocks, pollocks) and other fishes that are good deep fried with onion rings) Marine: Arctic, Atlantic, and Pacific. Three dorsal fins and two anal fins, the first dorsal behind head. No spines. Pelvics before pectorals. Teeth present on vomer. Usually with barbel. No otophysic connection between swim bladder and auditory capsules. Egg without globule. Up to about 2 m maximum length in *Gadus morhua*. Members of the family are found in circumpolar and temperate waters, mainly of the northern hemisphere. Most species are demersal or benthiopelagic, feeding on fish and invertebrates. Schooling and long-distance migrations are known for several gadid species. The family is second only to the Clupeidae in terms of the global volume of marine fish landings.
Order Lophiiformes: First ray of spinous dorsal, if present, on head and transformed into illicium (line) and esca (bait), a device for attracting prey to mouth; pelvic fins, if present, in front of pectorals; gill opening small, tubelike at or behind pectoral fin base;

Antennariidae (frogfishes) Distribution: all tropical seas except the Mediterranean. Body short, spherical, and laterally compressed with lateral eyes; mouth large with 2-4 more or less irregular rows of small, villiform teeth on upper and lower jaws; tube-like gill opening under pectoral base, used for jet-propelling. Three dorsal spines on head, the anterior-most (illicium) free and modified as a lure, usually with a distinct fleshy bait (esca). Cutaneous filaments or appendages nearly always present; color and color pattern highly variable from white, yellow, red to dark brown and black. Juveniles and adults benthic in 0-300 m, with the single exception of Histrio, which is pelagic in floating sargassum weed. Voracious carnivores feeding on smaller fishes or crustaceans attracted by wriggling the bait. To 33 cm SL in Antennarius avalonis.

Ogcocephalidae (batfishes) Distribution: all major tropical and many subtropical seas. Body usually considerably depressed and flattened ventrally; more or less box-shaped in some. Illicium relatively short; no other dorsal spines. The illicial cavity, with its anterior opening, encloses the esca upon retraction of the illicium. Mouth nearly horizontal. Gill opening located in or above base of pectoral fin. Gills 2 or 2.5; first gill arch reduced and without filaments. Scales well-developed and tubercle-like. The lateral line organs with modified type of scale. Capable of walking on the bottom using their large arm-like pectorals and smaller pelvic fins. Swims awkwardly. Maximum length 40 cm, usually 20 cm.

Melanocetidae (angler fish) Distribution: Atlantic, Indian and Pacific Oceans. Caruncles present before soft dorsal fin in females as a modification of 2 or 3 fin rays. Females are host to the parasitic mature males. Soft rays usually 4 (rarely 5) in dorsal and anal fins.