Invertebrates

- Invertebrates are the heterotrophs or animals that lack the vertebral column.
- Zooplanktons, the microscopic to submicroscopic and unicellular marine Protozoans like calcareous foraminifers and siliceous radiolarians, are the ocean’s primary consumers.

Simple Marine Invertebrates:

(a) PROTOZOA (unicellular, often parasitic: foraminifera, radiolaria, amoebas),
(b) PORIFERA (porous, attached, most primitive of the animals: sponges)
(c) CNIDARIA or COELENTERATA (carnivorous and mostly marine stinging animals, e.g., jellyfish, sea anemones, corals).

Worms: (a) PLATYHELMinthes (flatworms, flukes, tapeworms),
(b) Nematoda (roundworm, with a flow-through digestive tract: mostly free-living or nonparasitic microscopic burrowers)
(c) ANnelida (ringworms).

Advanced Invertebrates: (a) MOLLUSCA (soft-bodied and hard-shelled mollusks like clams, snails and squids),
(b) ANTHROPODA (footed animals like lobsters, shrimp, crab, krill) and
(c) CORDATA (i.e., with spinal chord): Amphioxus, a transitional species.

Marine Vertebrates

- Fish:
  - Class Agnatha or the “Jawless” Fish are primitive vertebrates with cartilaginous skeleton, no jaws and no scales and evolved ~500 Ma ago (Lamprey and hagfish are their living examples).
  - Class Chondrichthyes or the “Boneless” Fish, like sharks (largest living vertebrates after whales), skates, rays etc., with cartilaginous skeletons (but no true bones), jaws and teeth, paired fins, evolved 350-400 Ma (sharks) to ~180 Ma (rays) ago.
  - Class Osteichthyes are the bony fishes with cycloid scales and covered grill openings (e.g., tuna, halibut, sea horse) that first evolved ~300 Ma ago but radiated ~100 Ma ago.
- Class Amphibia: Frogs, toads, salamanders. Asian mud flat frogs are the only amphibians accustomed to seawater. First appeared 350-400 Ma ago. These cold blooded vertebrates use grills in the early stages but lungs as adults.
- Class Reptilia: Snakes, turtles, lizards and alligators, the first two of which are the major marine groups, evolved from the amphibians ~300 Ma ago.
- Class Aves: Birds; mainly live on and in the ocean but must return to land to breed. Tubenoses (e.g., albatross), pelicans, gulls and penguins are common marine birds. Evolved ~135 Ma ago.
- Class Mammalia: Warm blooded; hair, mammary glands; bear live young. Marine representatives found in the orders Sirenia (sea cows), Cetacea (whales) and Carnivora (sea otters, seals, walruses).