

APPENDIX 9. TAXONOMIC OUTLINE OF MARINE ORGANISMS

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Introduction

This appendix is intended as a brief outline of the taxonomic categories of marine organisms, providing a classification and description of groups that are mentioned elsewhere in the Encyclopedia. It is presented at the level of Phylum (or equivalent) in most cases, but to the level of Class in large groups with many marine species. The few categories that contain no known marine species are not included in this list.

The outline is intended as a list rather than any kind of phylogenetic tree. The three Domains listed are now considered, on genetic evidence, to be the three primary categories of living organisms on Earth. The definitions and relationships of many higher taxonomic groups are currently in flux owing to the advent of new molecular genetic data. This is particularly true for the Archaea, Bacteria, and Protista (also called Protozoa or Protoctista), in which numerous phylogenetic lineages have been identified in recent years that are neither consistent with classical categories based on morphological characters nor arranged in a comparable hierarchy. The accepted systematics of the Protista will probably change in the near future, reflecting this new genetic information. However, as these new categories are still being defined, and have not yet come into common usage in ocean sciences, this outline retains a more classical and widely known system for protists (Margulis and Schwartz, 1988), with names that will more likely be familiar to marine scientists. Where possible, the approximate number of known (named) species is given, with an indication of how many of these are marine. For many groups the described species may be only a small fraction of the probable true number of species.

It should be apparent from perusal of the list that the ocean environment is home to the vast majority of the biological diversity on Earth. Notwithstanding the large numbers of insect species and flowering plants on land, the remarkable diversity of different body plans defining the higher taxonomic levels occurs almost entirely in the sea.

Readers interested in recent work on the phylogeny and classification of any of these organisms are directed to the Further Reading list. Often the most up-to-date information will be found on the Web sites listed.

DOMAIN ARCHAEA

Prokaryotic cells having particular cell lipids and genetic sequences that distinguish them from all other organisms. Many are extremophiles living at high temperatures or under unusual chemical conditions. Few have been cultured. "Species" are defined and classification is based mainly on molecular evidence. Increasing numbers of Archaea are being detected in marine environments.

Korarchaeota

A poorly-known group of hyperthermophilic organisms thought to be near the evolutionary base of the Archaea, and perhaps the most primitive organisms known.

Crenarchaeota

Primarily hyperthermophilic forms, including many sulfur-reducing species, but also species living at very low temperatures in the ocean.

Euryarchaeota

A group containing methane-producing forms and others that live in extremely saline conditions.

DOMAIN BACTERIA

A tremendously diverse domain of prokaryotic cells with particular genetic sequences and cell constituents. All photosynthetic and pathogenic forms are in this domain. A dozen major phylogenetic groups can be identified on genetic evidence, of which all but one include marine forms. Numbers of species are almost impossible to specify.

Aquificales

Primitive hyperthermophiles with a chemoautotrophic metabolism. Known from hydrothermal environments.

Green non-sulfur bacteria

A group including some photosynthetic and multicellular filamentous forms. Related forms may have produced ancient stromatolite structures in shallow seas.

Proteobacteria

Purple bacteria; a large, metabolically and morphologically diverse group including some photosynthetic, chemoautotrophic, and nitrogen-fixing forms that occur in the ocean. There are also many pathogenic species.

Gram-positive bacteria

Common soil-dwelling forms, but some also marine. Many form resting stages called endospores enabling survival under harsh conditions.

Cyanobacteria

An ancient and diverse lineage of photosynthetic bacteria that include some of the most abundant and important primary producers in the ocean.

***Bacteroides*, *Flavobacterium* and related forms**

Gram-negative microbes occurring in freshwater and marine environments, as well as soils and deep-sea sediments.

Green sulfur bacteria

Anaerobic forms that oxidize sulfur compounds to elemental sulfur and occupy a variety of marine environments.

Deinococci

Highly radiation-resistant cells, which include forms found in terrestrial and marine thermal springs.

Planctomyces

One of only two groups having cell walls that lack the component peptoglycan; found in freshwater and marine environments.

Thermotoga

A group of anaerobic microbes found at shallow and deep-sea hydrothermal vents, and which includes some of the most thermophilic bacteria known.

Spirochaetes

Flagellated cells with a unique helical morphology; most are parasites and some inhabit marine animals.

DOMAIN EUKARYA

Single-celled or multicelled organisms with membrane-bounded nuclei containing the genetic material, and other specialized cellular organelles. Cell division is by some form of mitosis, and metabolism is usually aerobic. All protists, plants and animals are eukaryotes.

PROTISTA (also **Protocista**, **Protozoa**)

Single-celled (and some multicellular) organisms that are neither animals nor true plants. It is a diverse and polyphyletic group that includes protozoans, algae, seaweeds and slime molds. These categories are defined mostly by morphology.

Phylum Dinoflagellata

Marine protozoans having unusual organization of their DNA, two locomotory flagella, and frequently encased in a rigid test. Dinoflagellates can be photosynthetic or heterotrophic; some live symbiotically in the tissues of other organisms. Approximately 3000 species, mostly marine.

Phylum Rhizopoda (also **Amoebozoa)**

Amoebas; single-celled organisms lacking flagella or cilia and moving by pseudopodia. Some are encased in a test. There are several thousand species in terrestrial, freshwater and marine environments, as well as parasitic and pathogenic forms.

Phylum Chrysophyta

A large group of unicellular algae that lack sexual stages and reproduce only by asexual division and formation of “swarmer” cells for dispersal. Most live in fresh water; the silicoflagellates are the only marine representatives.

Phylum Haptophyta

Marine photosynthetic cells that alternate between a flagellated free-swimming stage and a resting coccolithophorid stage covered with calcareous plates. These stages were previously thought to be distinct species. Several hundred species.

Phylum Euglenophyta

Flagellated protozoa that may be photosynthetic or heterotrophic, solitary, or colonial. They have flexible cell walls made of protein, and complex internal organelles. About 800 species including some marine.

Phylum Cryptophyta

Also called cryptomonads, these cells are widely distributed in fresh and salt water, and as internal parasites. They lack sexual reproduction and swim with two flagella.

Phylum Zoomastigina

Nonphotosynthetic cells with one to many flagella, including free-living, symbiotic, and parasitic species, with both sexual and asexual reproduction. The group is probably polyphyletic and includes hundreds of described species, with probably thousands more unknown; many are marine.

Phylum Bacillariophyta

The diatoms; photosynthetic cells enclosed in elaborate siliceous tests consisting of two halves or valves. Diatoms are important components of the food chain in marine and fresh water, with about 12 000 species.

Phylum Phaeophyta

The brown algae and seaweeds; macroscopic, photosynthetic, multicellular plantlike forms inhabiting intertidal, subtidal, or pelagic marine environments. About 1500 species, all marine.

Phylum Rhodophyta

Red algae; complex multicellular seaweeds inhabiting intertidal and subtidal environments worldwide. All contain particular photosynthetic pigments that give them a reddish color. About 4000 species, mainly marine.

Phylum Chlorophyta

Green algae, including single-celled forms and some multicellular seaweeds. They are important primary producers in all aquatic environments. There are about 7000 species, including many marine forms.

Phylum Actinopoda

Heterotrophic protozoa having long filamentous cytoplasmic extensions called axopods, supported by silica-based or strontium-based skeletal elements. Important marine forms are the radiolarians and acantharians. Some harbor algal symbionts or form macroscopic colonies. About 4000 species, mostly marine.

Phylum Foraminifera

Amoeboid protozoans with internally chambered, calcified, or agglutinated shells or tests. All are marine, living in benthic and pelagic habitats. About 4000, mainly benthic, extant species, but 30 000 fossil species.

Phylum Ciliophora

The ciliates; single-celled organisms covered with short cilia that are used for locomotion and/or food gathering. Ciliate cells have two nuclei and reproduce by fission. The 8000 species live in freshwater and marine environments.

Phylum Cnidosporidia

A diverse, polyphyletic group of heterotrophic microbes that are parasites and pathogens of animals, including many marine invertebrates and fish. About 850 species.

Phylum Labyrinthulomycota

Slime nets; colonial protozoans that construct networks of slime pathways on the surface of various substrates. The osmotrophic cells move along the slimeways toward food sources. Only about 10 described species, including marine forms.

PLANTAE

Plants are multicellular, photosynthetic organisms that develop from an embryo that is produced by sexual fusion. Plant cells have rigid cell walls and contain chloroplasts where photosynthesis occurs. Most of the 235 000 described species are terrestrial, with a few secondarily adapted to shallow marine environments.

Phylum Angiospermophyta

Flowering plants; virtually all the familiar grasses, flowers, vegetables, shrubs, and trees on Earth belong in this group, comprising about 230 000 species. A few grasses live in salt marsh and shallow subtidal marine environments.

FUNGI

Multicellular organisms that are neither motile nor photosynthetic, and form spores for reproduction. The basic structural elements of fungi are threadlike hyphae, which are partially divided into separate cells. Fungi range from microscopic yeasts and molds to large mushrooms and shelf fungi, and include some pathogenic forms. The vast majority of the 100 000 species are terrestrial.

Phylum Ascomycota

A diverse group including yeasts, molds, and truffles. In the marine environment filamentous ascomycotes grow and feed on decomposing plant material. A few of the 30 000 species are found in marine environments.

Phylum Basidiomycota

Complex, mainly terrestrial fungi including rusts, smuts, and mushrooms. Of some 25 000 species, only a handful are known from the marine environment, where they grow on marine grasses.

ANIMALIA

Animals are motile, heterotrophic, multicellular organisms, all of which develop from a ball of cells called a blastula, which originates by fusion of gametes. Most animals have complex tissues, organs, and organ systems, and higher animals have well-developed nervous and sensory capabilities.

Phylum Placozoa

A simple, tiny multicellular marine organism resembling a large amoeba, lacking tissues or organs. Only one species known.

Phylum Porifera

There are about 10 000 species of sponges, animals with skeletons composed of spicules, but which lack tissues, organs, or definite symmetry. Sponges have free-swimming larvae and sessile adults that filter-feed. All but a few hundred species are marine.

Class Calcarea

Sponges with skeletons made up of calcareous spicules. About 500 species, all marine.

Class Demospongia

Sponges with skeletons of spongy protein and/or silica, mainly marine. About 9500 species.

Class Hexactinellida

Glass sponges, with skeletons of six-rayed silica spicules. About 50 deep-sea species.

Phylum Cnidaria

Radially symmetric animals with distinct tissues, including the jellyfishes, corals, anemones, and hydroids. All cnidarians are predators, using cnidocytes (nematocytes) to sting prey. Body forms include the polyp and medusa. Over 10 000 described species, nearly all marine. The group Myxozoa, previously considered protozoans or degenerate metazoans, are now thought to belong with the Cnidaria.

Class Anthozoa

Corals and sea anemones, having the polyp form only. About 6200 benthic marine species.

Class Hydrozoa

Most hydrozoans have a life cycle that alternates between an asexual polyp (hydroid) stage and a free-swimming, sexual medusa. Hydroid stages are usually colonial. Some coastal hydroid species lack the medusa and some oceanic species lack the hydroid. About 3000 species, nearly all marine.

Class Scyphozoa

More complex, larger jellyfish with simpler or absent polyp stages. About 200 marine species.

Class Cubozoa

Medusae with cuboidal body shape, well-developed nervous system and eyes, and highly toxic nematocytes. About 30 mainly tropical species.

Phylum Ctenophora

Comb jellies; transparent gelatinous animals that use fused plates of cilia (comb plates) for locomotion and sticky tentacles to capture prey. They have biradial symmetry and a more complex digestive system than Cnidarians. All 100 species are marine, mainly planktonic.

Phylum Rhombozoa

Simple, microscopic organisms that live as internal parasites in the kidneys of cephalopods. They have complex life cycles, and the group is sometimes considered a class of the phylum Mesozoa, along with the Orthonectida. About 65 species.

Phylum Orthonectida

About 20 species of simple, small organisms that are internal parasites of various marine worms, mollusks, and echinoderms.

Phylum Platyhelminthes

The flatworms, bilaterally symmetrical worms with three cell layers and distinct tissues, but no body cavity (coelom) and guts with only one opening. Most of the approximately 18 000 species are parasites in a wide range of hosts, but there are many free-living forms in all environments.

Class Turbellaria

Free-living flatworms that are mainly predators or scavengers of other small organisms. Most are hermaphroditic. About 4500 species, including many marine forms.

Class Monogenea

Ectoparasitic flatworms, mainly on skin or gills of marine fishes. Although previously included in the Trematoda, this group now appears to be evolutionarily distinct. About 1100 described species, but possibly many more.

Class Trematoda

Parasitic flatworms or flukes, having digestive systems and complex life cycles, often among alternating hosts. There are about 8000 species of flukes, which infect both invertebrate and vertebrate hosts and cause some human diseases.

Class Cestoda

Tapeworms; parasitic, segmented flatworms that lack digestive systems and live in the alimentary tracts of vertebrate hosts, including humans. About 5000 species, some in marine fishes or turtles.

Phylum Nemertea

Ribbon worms; long unsegmented worms with a complete digestive tract and a large cavity containing a proboscis that can be extended to sample the environment or capture prey. There are about 900 species, mainly benthic marine forms, but some freshwater or terrestrial.

Phylum Gnathostomulida

Minute, wormlike animals that live interstitially in marine sands and sediments. They feed on bacteria and protozoa using a specialized jaw, and are hermaphroditic. About 100 described species, but probably many more undiscovered.

Phylum Gastrotricha

Small wormlike organisms in freshwater and marine environments, living in sediments or on plants or animals. They feed on bacteria, protozoa, and detritus, using cilia to collect particles. About 500 species, half of them marine.

Phylum Rotifera

Small aquatic organisms with ciliated structures and complex jaws at the head. They have internal organs and complete guts, and feed either on particles or on small animals. Reproduction is sexual, but males are rare or unknown in many species. Of the 2000 species only about 50 are marine.

Phylum Kinorhyncha

Small, segmented animals with external spines that live interstitially in marine sediments or on the surfaces of seaweeds or sponges. There are about 150 species known.

Phylum Loricifera

Microscopic marine animals encased in a covering of spiny plates called a lorica, into which the head and neck can retract. Described only in 1983, the 10 known species of loriciferans live between and clinging to sand grains.

Phylum Acanthocephala

Parasitic worms in the guts of vertebrates, where they anchor to the intestine wall by spines on their head. About 1100 species., some living in marine fishes, turtles, and mammals.

Phylum Cycliophora

Described in 1995, this phylum comprises one known species, a microscopic animal that lives attached to the mouthparts of lobsters and collects particulate food. The life cycle is unusual and complex, with sexual and asexual stages.

Phylum Entoprocta

Small filter-feeding animals on stalks that live attached to various substrates either as single organisms or as colonies. A ring of ciliated tentacles surrounds the mouth and anus and creates water currents to collect food. About 150 species, all but one marine.

Phylum Nematoda

Roundworms; unsegmented worms with a layered cuticle, which molts during growth. Nematodes are among the most ubiquitous and numerous animals on Earth. They live in all environments and as parasites of most plants and animals. Of the 16 000 described species, a few thousand are marine. It is likely that many times more species exist.

Phylum Nematomorpha

Long, wiry, unsegmented worms, sometimes called horsehair worms. The gut is reduced or absent. Larval stages are internal parasites in arthropods and adults do not feed at all. A few of the 325 species are marine.

Phylum Bryozoa

Also called the Ectoprocta, a group of small colonial organisms that filter-feed using a tentaculate structure called the lophophore. Individual bryozoans are encased in tubular or boxlike housings and reproduce asexually to produce encrusting or plumose colonies attached to hard substrates. About 5000 species, all but 50 are marine.

Phylum Phoronida

Phoronids are tube-dwelling marine worms that also use a lophophore to collect particulate food. They are common in mud or sand, or attached to rocks or pilings. About a dozen widely distributed species are known.

Phylum Brachiopoda

Brachiopods are lophophorate, filter-feeding animals whose bodies are enclosed in bivalve shells. Most live secured by a stalk to hard substrates or in sediments, at depths from intertidal to 4000 m. Only about 335 living species, but over 30 000 fossil ones known. The living genus *Lingula* dates back over 400 million years.

Phylum Mollusca

A large and diverse phylum containing the familiar clams, snails, squid, and octopus. Mollusks possess mantle tissue that secretes a carbonate shell around the body, a belt of teeth called the radula for feeding, and a muscular foot variously modified for digging, crawling, or swimming. A diverse, widespread, and economically important group, mollusks have a long and complex taxonomic history, with between 50 000 and 100 000 described species. Most mollusks are marine but there are many freshwater and terrestrial snails

Class Monoplacophora

Small, single-shelled animals living on hard surfaces, usually in the deep sea. Primitive in structure and thought to be similar to ancestral forms. Only 11 known species.

Class Aplacophora

Small wormlike animals with calcareous spicules but no true shell. They lack the typical molluscan foot, but creep with cilia. About 250 species are known from various benthic marine environments.

Class Caudofoveata

Shell-less wormlike animals that live in burrows in deep-sea sediments. Little is known of the ecology of the 70 known species.

Class Polyplacophora

The chitons; mollusks having a shell of eight overlapping, articulating plates. All are marine and most live on intertidal or subtidal rocks, where they feed by scraping algae with their radulas. About 600 species.

Class Gastropoda

The largest and most diverse class of mollusks, gastropods include aquatic and terrestrial snails, slugs, limpets, and nudibranchs. In most, the body sits on a muscular foot used for locomotion, and is enclosed in a conical or coiled shell. Gastropods may be filter feeders, grazers, or predators. By various counts there are 40 000 to 80 000 species, about half of them marine.

Class Bivalvia

Bivalves or Pelecypods, mollusks with the body enclosed between two valves or shells hinged together, and closed by an adductor muscle. Most are filter feeders, drawing water into the shell cavity and filtering particles from it. Some bivalves attach to surfaces; others burrow into sediments. Most of the 8000 species are marine.

Class Scaphopoda

Mollusks with a conical, tusk-shaped shell that is open at both ends. Scaphopods burrow into marine sediments and collect small food organisms with specialized tentacles. About 350 species.

Class Cephalopoda

Squid, octopus, and *Nautilus*; in cephalopods the molluscan foot is modified into tentacles surrounding the mouth. Cephalopods are actively swimming predators with highly developed nervous and sensory systems. *Nautilus* and most extinct cephalopods have external chambered shells, while squid have reduced internal skeletons and octopus have none. All 650 species are marine.

Phylum Priapulida

Marine worms that burrow into sediments with only their mouths exposed at the surface. They are predatory on other small worms. The 10 known species live from estuarine to abyssal environments.

Phylum Sipuncula

About 320 species of unsegmented marine worms, with a retractable proboscis called the introvert. They are benthic, often living in sediments or among other animals. Tentacles around the mouth collect detritus and other particulate food.

Phylum Echiura

Unsegmented, benthic marine worms having an extensible proboscis that is used to collect detrital food. They live mainly within burrows in sediments. Considered by some to be a class of the Annelida. About 140 species.

Phylum Annelida

Segmented worms, a large group of diverse species, most having bodies divided into segments by internal septa, and with chitinous setae on the exterior body. There are about 12 000 species of annelids, in all aquatic and terrestrial environments.

Class Polychaeta

Worms usually with distinct head region, numerous setae and paddle- or leg-like parapodia for locomotion. The group includes mobile, burrowing, attached, and symbiotic forms, feeding as predators, scavengers, filter or deposit feeders. About 8000 species, almost all marine.

Class Oligochaeta

Worms lacking parapodia and with few setae; terrestrial forms include earthworms. Most of the 3100 species are freshwater or terrestrial.

Class Hirudinea

Leeches; the body is not segmented internally and lacks setae on the exterior. Most are ectoparasites, feeding on blood of other animals, but some are predators. About 500 species, many marine.

Phylum Tardigrada

Water bears; minute animals with eight short legs that live in aquatic or moist terrestrial environments and suck juices from plants or animals. They are able to remain in a dried state for long periods, returning to active metabolism on rehydration. About 550 species, a few of them marine.

Phylum Arthropoda

The arthropods, or jointed-leg animals, are one of the most successful and widespread metazoan groups. All possess segmented bodies and articulated exoskeletons, which are molted during growth. Insects and arachnids are the dominant arthropods on land, but almost entirely absent from the sea, where crustaceans predominate. About 1 million described species, mostly insects, but many more probably exist.

Class Merostomata

An ancient group of chelicerates now containing only 4 species of horseshoe crabs. They live in subtidal environments, and feed as predators and scavengers.

Class Pycnogonida

Sea spiders; lacking the well-developed head, thorax, and abdomen of other arthropods. About 1000 species, entirely marine, which feed on body fluids of other animals and plants.

Class Crustacea

Largely aquatic arthropods including copepods, amphipods, shrimp, barnacles, crabs, and lobster. Often with a calcified carapace covering the segmented body. All forms have a nauplius larva as the first of many molt stages. About 35 000 species, almost entirely marine, in all habitats.

Phylum Pogonophora

Thin, wormlike animals that live in tubes in sediment or attached to benthic surfaces. Pogonophorans lack digestive systems and obtain nutrition by absorption of dissolved organic nutrients. Pogonophorans are thought by some to be aberrant annelids. About 100 species, mostly in deep water.

Phylum Vestimentifera

Closely related to pogonophorans, these larger marine worms rely on symbiotic bacteria in their tissues to generate nutrition from the metabolism of inorganic chemical compounds. They are best known from deep-sea hydrothermal vents, where they can be over 2 m long. About a dozen species have been described.

Phylum Echinodermata

An entirely marine phylum including the sea stars, urchins, and brittle stars. All have a five-part radial symmetry, a water-vascular system, tube feet used for locomotion, respiration and feeding, and a skeleton made of minute calcareous ossicles or spicules. Over 6000 species.

Class Crinoidea

Most ancient of the living echinoderms, crinoids have multiple pinnate arms used for filtering food particles from the water. Some are attached to the bottom by a stalk, others swim by movement of the arms. About 600 subtidal and deep-sea species.

Class Asteroidea

The seastars, most with five radial arms, are slow-moving predators in intertidal and subtidal environments. About 1500 species.

Class Ophiuroidea

Brittle stars, having five slender and flexible arms radiating from a central disk. Some are deposit or filter feeders, others predatory. About 2000 species, including many deep-sea forms.

Class Concentricycloidea

Small discoidal organisms known only from submerged wood in the deep sea. They lack five-part symmetry and arms, and the body is covered by overlapping calcareous plates. Two known species.

Class Echinoidea

Sea urchins; with a rigid, globular or flattened test made of calcareous ossicles and a complex mouth structure for grazing and chewing. Most are free-living in subtidal environments, but some burrow in sediments or rock. Approximately 950 species.

Class Holothuroidea

Sea cucumbers; with an elongate, flexible body, bilateral symmetry and no arms. Most of the 1500 species are benthic deposit or filter feeders.

Phylum Chaetognatha

Arrow worms; planktonic marine organisms that are predatory on small zooplankton, using chitinous spines around the mouth to catch prey. The 100 species are mainly planktonic with a few benthic forms.

Phylum Hemichordata

Wormlike marine organisms that burrow in sediments or form colonies on hard substrates. Most are deposit or suspension feeders. About 100 species from shallow tropics to deep sea.

Phylum Chordata

A large and diverse phylum including the familiar vertebrates. All have a dorsal nerve cord that can form a brain, a notochord that becomes the vertebral column in vertebrates, and gill slits in the throat at some stage of development. Chordates live in all environments and are one of the most successful and widespread groups. Perhaps 45 000 species, about half marine forms (mainly fish).

Subphylum Urochordata

The tunicates; sessile or motile animals with the body enclosed in a tough, flexible tunic. Most are filter feeders. The notochord and dorsal nerve are seen only in larval stages, and sessile adults may be asymmetrical in form. About 3000 species, all marine.

Class Ascidiacea

Sea squirts; sessile, filter-feeding tunicates that live mainly on hard benthic substrates. About 2700 species.

Class Sorberacea

A small group of solitary, deep-sea tunicates that appear to prey on live organisms instead of filter-feeding.

Class Larvacea

Minute planktonic tunicates (also called appendicularians) with small bodies and long tails. They filter feed using an external mucous structure that concentrates small particulate material for ingestion by the larvacean. About 200 species.

Class Thaliacea

Pelagic tunicates with gelatinous, transparent bodies. They filter feed by creating a water current through their bodies. All have complex life-cycles with sexual and asexual, solitary, and colonial stages. About 100 species.

Subphylum Cephalochordata

Lancelets or “Amphioxus”; small fish-shaped animals with notochords extending the length of the body. They burrow into substrates with the head end exposed and filter particulate food. About 20 species.

Subphylum Vertebrata

Chordates with a backbone replacing the notochord, and a distinct head region with brain. Approximately 42 000 species in all environments.

Class Agnatha

Lampreys and hagfish; eel-like jawless fishes without scales, bones or fins. Most are scavengers or parasites on other fish. About 60 marine and freshwater species.

Class Chondrichthyes

Sharks and rays; fish with cartilaginous bones and small denticle scales embedded in the skin. The 850 species are virtually all marine.

Class Osteichthyes

The bony fishes; having bone skeletons, scales and often air bladders for buoyancy. Highly diverse and widely distributed in all marine and freshwater habitats, with about 25 000 species.

Class Reptilia

Turtles, snakes and lizards. Most of the 6000 species are terrestrial except for a few marine turtles, crocodiles, and snakes.

Class Aves

Birds; about 9000 species in all terrestrial habitats and many marine forms including penguins, albatrosses, gulls, etc.

Class Mammalia

Four legged, endothermic animals usually with fur or hair, which mainly give live birth and suckle the young. Most of the 4500 species are terrestrial; marine forms include whales, dolphins, seals, and otters.

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