MARINE ANIMALS

ACS DISTANCE EDUCATION
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INTRODUCTION

Ocean environments cover more than 70% of the earth’s surface; therefore it is no wonder that they also contain almost 50% of all species on earth. The exact number of marine species in existence is not known as there are many areas of the ocean that remain unexplored. Scientists believe there are over 2.2 million species in our oceans. Over one million of these are marine animals. Marine animals can range significantly in size from microscopic krill through to the Blue Whale which is the largest animal to ever live on earth. The ocean environments they occupy can also vary from the intertidal zones along our coastlines through to the deepest depths of the oceans.

Marine species are extremely sensitive to changes in their environment. There are many human activities that have lead to the endangerment of marine animals. These include overfishing, bottom trawling, whaling, pollution, habitat degradation and climate change.

Climate change associated with human activities over the past one hundred years has impacted greatly on marine ecosystems. The temperature of sea water in many tropical areas has been rising over time which has lead to the increased occurrence of coral bleaching worldwide. This is a stress reaction in coral in which corals expel microscopic algae which provides their food resource.
The bleached coral can recover, but only if cooler water temperatures return and the algae are able to grow again. This is an incredibly slow process however, and the rate of destruction of the reefs is far quicker than the recovery rate.

We need to ensure the human impact on marine animals is reduced to ensure that future generations can also enjoy these fascinating creatures.
CHAPTER 1: CLASSIFICATION

TAXONOMY: GROUPING BIOLOGICAL ORGANISMS

In the scientific system, living organisms are classified by dividing them into groups, which have similar characteristics. These groups are then divided into smaller groups with similar characteristics. These are divided again and so the division of group to sub group and sub group to further sub groups goes on, until you finally have only one type of organism in each group.

There are many different levels of division, although the main ones which we use are at the bottom end of the scale (i.e. family, genus, species and variety).

The main levels of division are as follows:

- all living organisms are divided into KINGDOMS
- all animals are divided into PHYLA (singular: Phylum)
- phyla are divided into DIVISIONS
- divisions are divided into CLASSES
- classes are divided into ORDERS
- orders are divided into FAMILIES
- families are divided into GENERA (singular: Genus)
- genera are divided into SPECIES
- species are sometimes divided into SUBSPECIES
In addition to these levels of division new divisions have been introduced over time. For example, infraclass and superorder, among others, are now considered taxonomic divisions. Due to new species being discovered there are increasing numbers of new species belonging to the same number of divisions. The increase in the number of described species has led to the growth of the divisions of classification.

Also, as the techniques for identification have advanced species which may have once belonged to one division may have been reclassified into another division. Genetic markers have brought taxonomic classification a long way to grouping species. There are always exceptions and the classifications shown in one text book or resource may differ slightly to another. It is important to check the classification from various reliable resources. Lastly, statistics given may also change over time. For example there may be more than 30,000 fish species but not all are described and it is not always easy to create an exact figure.

CLASSIFICATION

The 5 Kingdoms of organisms:

- **Kingdom Monera** – include bacteria, defined by their simple cell structure and lack of a nucleus.

- **Kingdom Protista** – unicellular and colonial organisms with more complex eukaryotic cells. This Kingdom includes the diatoms, dinoflagellates, algae and protozoa.

- **Kingdom Metazoa** – the animal kingdom. This includes over 1 million described species in 30 different phyla

- **Kingdom Plantae** – multicellular, photosynthesising eukaryotes. Underrepresented in ocean environments as many flowering plants cannot complete their lifecycle submerged in salt water.

- **Kingdom Fungi** – eukaryotes that do not photosynthesise. These organisms are unique because of they reproduce by spores.

In this book our focus will be on Kingdom Metazoa. Kingdom Metazoa contains 29 phyla. Some of the more common phyla are described below.

PHYLUM CHORDATA

The subphylum Vertebrata is placed within the phylum Chordata. Most chordates are bilaterally symmetrical animals with differentiation into head, trunk, and tail.

As a rule, chordates are active animals. The most distinctive anatomical features of chordates are a notochord and nerve cord. The notochord is an exceptionally
important characteristic of chordates. It is like a stiffened rod that does not compress. This allows the body muscles to act against the notochord and thus allows the animal to move.

The phylum Chordata includes three subphyla:

1. Subphylum Acrania includes about 30-35 contemporary species placed in one class and three families. All are marine animals. Look like small (approximately 10 cm or smaller) semi-transparent fish.

2. Subphylum Urochordata (Tunicata) consists of three classes of exclusively marine animals.
   - **Class Ascidia** includes about 1,000 contemporary **sessile** filter-feeding animals also called Sea Squirts. Order Synacidae includes species living in colonies, while order Monoscidiae includes solitary animals.
   - **Class Thaliacea** (Salpae) includes about 70 contemporary pelagic filter-feeder species shaped like a barrel, and is divided into three orders. Order Pyrosomidae consists of species living in colonies: orders Salpidae and Doliolidae consist of solitary species.
   - **Class Appendiculariae** includes about 60 small (several millimeters) pelagic species.

3. Subphylum Vertebrata includes animals with a distinct internal skeleton. They are multicellular animals derived from embryos that have three cellular layers: endoderm (endo- internal), mesoderm (meso- medium) and ectoderm (ecto- external). They have bilateral symmetric bodies, and internal gut with two openings, mouth and anus.

Only vertebrates have a true brain with several different areas and a skeletal structure that protects the brain, the cranium. They have developed sensory organs (eyes, ears, olfactory organs).

They possess a more complex digestive system, with several accessory digestive glands. The heart is chambered. They have developed more complex respiratory and muscular systems as well.

Classes within Vertebrata include:

- **Cyclostomata** (Lampreys and Hagfish)
- **Chondrichthytes** (Sharks, Skates and Rays, Elephant Fishes)
- **Osteichthytes** (Bony Fishes) (Choanichthytes (Lungfish) separated from this class by some researchers)
- **Amphibia** (Amphibians – Frogs and Toads, Newts and Salamanders, Caecilians). Not associated with marine environments due to permeable skin. One exception is the crab-eating frog *Fejervarya cancrivora* living in mangrove estuaries of Southeast Asia.
- **Reptilia** (Sea Turtles, Crocodilians and Sea Snakes)
- **Aves** (Sea Birds)
- **Mammalia** (Sea mammals such as sea otters, whales, dolphins, seals and walruses).
OTHER PHYLA IN KINGDOM METAZOA

Below is a list of phyla represented in marine environments.

- **Phylum Acanthocephala** – These are spiny-headed worms. They are all parasitic worms characterised by a spine-covered proboscis that can extend outwards. The larvae is consumed by insects which are then eaten by fish. They are abundant in deep sea fish and Antarctic fish.

- **Phylum Annelida** – This is a phylum of segmented worms found in marine environments. They can be in the ocean or in tidal zones. It includes tube worms, bristle worms and sand worms.

- **Phylum Arthropoda** – Invertebrate crustaceans with segmented bodies and jointed limbs. Includes sea spiders, lobsters, crabs, barnacles and krill.

- **Phylum Brachiopoda** – These are bivalve molluscs commonly referred to as lamp shells. They are sessile, filter feeders living on the ocean floor.

- **Phylum Chaetognatha** – These species are known as arrow or “glass” worms. They are a major component of plankton and are found in various marine environments ranging from ocean floors to coastal lagoons.

- **Phylum Cnidaria** – This encompasses a diverse range of species that can be either sessile, swimming or hydrozoa. These include the jellyfish, anemone and coral species. They have no organs but have an internal cavity for respiration and digestion. All have stinging cells called nematocysts.

- **Phylum Ctenophora** – These are the comb jellies or sea walnuts. They have eight comb rows of fused cilia running laterally. The cilia beat synchronously to propel the comb jelly through the water. Vary from Cnidaria as they do not possess stinging cells.

- **Phylum Ectoprocta** – These are bryozoans or moss animals that resemble corals. They are filter-feeding invertebrate animals that use cilia to sieve food particles.

- **Phylum Echinodermata** – There are around 13,000 species of echinoderm known from fossils. These include sea stars, sea cucumbers and sea urchins. They are characterised by radial symmetry and the body is covered by calcereous plates that can be moveable or fixed. They have no head and respiration is through skin gills.

- **Phylum Entoprocta** – These are sessile goblet-shaped aquatic animals known as goblet worms. The term “entoprocta” refers to internal anus. They are sedentary and can exist in colonies or lead solitary lives in coastal marine environments.

- **Phylum Gnathostomulida** – This is a relatively new phylum of around 100 microscopic marine animals known as ciliated jaw worms. They live in the sand and organic detritus of shallow coastal waters. They propel themselves by beating their cilia.
- **Phylum Hemichordata** – These are worm-shaped marine animals referred to as acorn worms. The body is divided into three sections, the proboscis, collar and trunk. They have a circulatory system and a rudimentary digestive system. They are believed to be closely related to the echinoderms.

- **Phylum Echiura** – This is a small phylum of 150 known species. They were once considered part of the annelid phylum. Members of this phylum are called spoon worms. They have a free-swimming larval stage and a sessile adult stage similar to a tubeworm.

- **Phylum Kinorhyncha** – These are microscopic invertebrates that live in mud or sand. They are segmented with a head, neck and trunk and a spiny proboscis. They can be distinguished from other invertebrate species by the absence of cilia.

- **Phylum Loricifera** – These are sediment-dwelling microscopic marine animal. They have a head, mouth and digestive system enclosed in a protective outer casing. They are unique from all other animals because they do not have mitochondria and do not require oxygen to survive.

- **Phylum Mollusca** – This is the most diverse group of animals on earth. It includes sea snails, clams, octopus and squid. They are characterised by a soft body and generally distinguishable head and foot regions. Some molluscs have an exoskeleton and use its muscular foot to move.

- **Phylum Nemertea** – This phylum includes the ribbon or proboscis worms. The term proboscis is used to describe their ability to extend a proboscis to capture food. They can grow extremely long; one species has been recorded at a length of 30 metres, however, this is uncommon.

- **Phylum Placozoa** – This phylum simple structured multicellular animals. They have a flattened body that is about 1mm across. Cells of the body have flagella which help it move along the sea floor.

- **Phylum Platyhelminthes** – Members of this phylum are known as flatworms. They are bilaterally symmetrical, unsegmented, soft-bodied invertebrates. The body cavities other than the gut are absent in these animals. Nutrients and oxygen pass through their body via diffusion.

- **Phylum Porifera** – This phylum includes the simple invertebrate sponges. There are up to 10,000 species of sponge in marine environments occupying a variety of niches. They vary greatly in size and shape from cup-shaped to tree-like sponges. Most exist anchored to hard surfaces, but some can attach themselves to softer sediments.

- **Phylum Priapulida** – These are marine worms sometimes referred to as penis worms with an extendible spiny proboscis. They live in mud in shallow waters on which they feed. They can range greatly in size from 0.5 to 20 cms.
- **Phylum Phoronida** – These are marine worms known as horseshoe worms. It is one of the smallest phyla with around 20 species. These species differ from worms as the gut loops and ends close to the mouth instead of nutrients moving straight through the body.

- **Phylum Sipuncula** – This phylum contains over 300 species. Members are characterised by being bilaterally symmetrical, unsegmented worm-like animals. They are referred to as peanut worms because their shape resembles a shelled peanut.

- **Phylum Tardigrada** – These are microscopic, aquatic, segmented animals. All members have four pairs of legs. There are 1000 recognised species within this phylum; however, biologists believe there may be 10 times this amount. Members of this phylum are often referred to as water bears. They can survive in extreme environments, being able to dry-out or freeze.

Sea Cucumber *Stichopus variegatus* of Phylum *Echinodermata*
THE WHALE SHARK (RHINCODON TYPUS)

The Whale Shark is the largest fish species in existence today. The largest recorded species was just over 12.5m in length and weighed over 21.5 tonnes. They are found in warm-temperate seas, migrating to the west coast of Australia in spring.

Whale Sharks are mainly pelagic, their feeding patterns vary with seasons. Whale sharks do not need to be near the surface of the water and can dive to great depths up to 700m. They are one of only three filter-feeding sharks, closely related to the bottom-dwelling sharks. They use “gill rakers” to feed on microscopic organisms including krill, jellyfish and crab larvae.

Whale sharks are viviparous. Males do not reach sexual maturity until they are at least 8m in length. There is not enough information at present on breeding habits and locations as the data relating to only one pregnant whale shark has ever been recorded.

SUBCLASS HOLOCEPHALI – CHIMAERAS

Unlike other cartilaginous fishes, chimaeras have a gill cover that covers four pairs of gill slits. Teeth are in the form of tooth plates that are slowly replaced. The first dorsal spine is erectile. The skin is naked. Males have a claspers organ on their head. They can grow to 1.5m. Most chimaeras are deep-water fish.

Subclass Holocephali contains only one order – Chimaeriformes – with three families and about 25 species.

- Family Chimaeridae (chimaeras, or short nose chimaeras, or ratfishes). The snout is bluntly rounded. Large eyes, small mouth. Two genera living at different depths in all oceans.


Dusky Whaler *Carcharhinus obscurus*

Claspers of a male Wobegong of the Family *Orectolobidae*
Port Jackson Shark egg *Heterodontus portusjacksoni*

Ray Locomotion
Sting Ray Order *Myliobatiformes*

Bluespotted Stingray *Neotrygon kuhlii*
Blacktip Reef Shark markings

White-Spotted Eagle Ray Aetobatus *narinari* of Class *Chondrichthyes*