BIOLOGY AND ECOLOGY OF THE MOST COMMON MARINE VERTEBRATES

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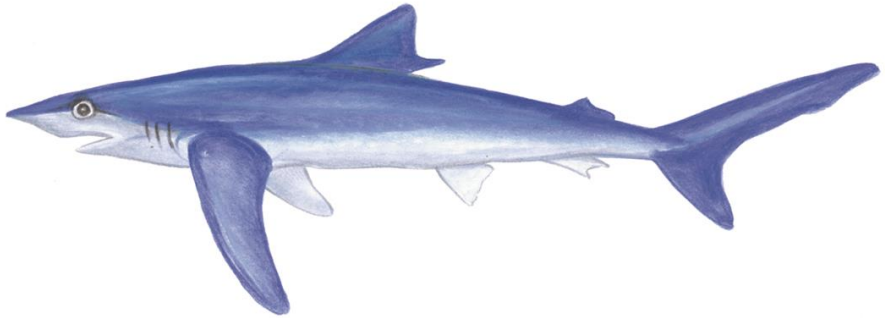
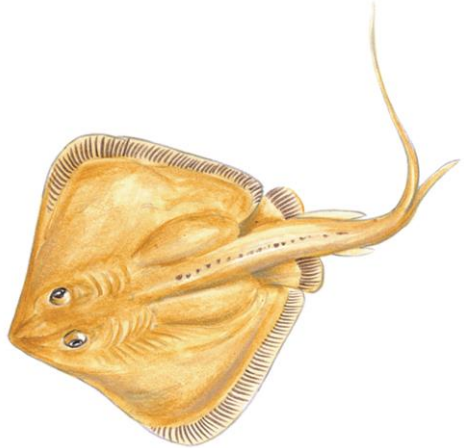
FISH

The term 'fish' describes **vertebrates** that are **equipped with gills even in the adult stage** and that move by means of **fins**.
Present-day fish evolved from ancestors that became extinct many millions of years ago, the Placoderms, so called because they have a shell consisting of individual bone plates.

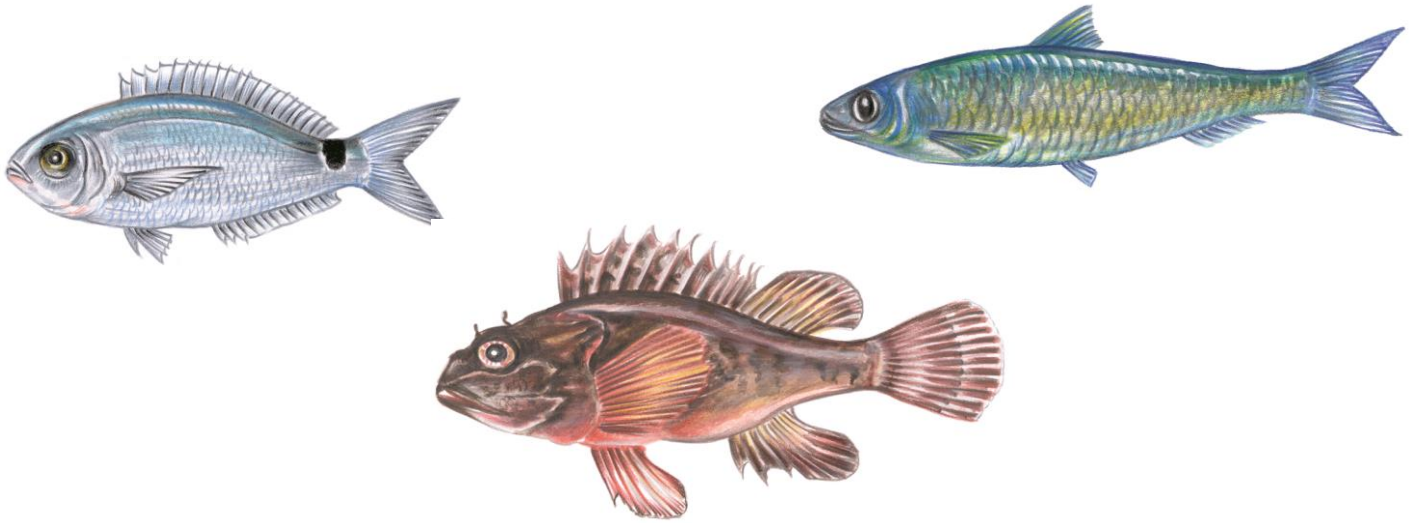
Fish are divided into two large groups:

- **Cartilaginous fishes** (sharks, rays and stingrays) - with a **cartilaginous skeleton**, calcified but not ossified.





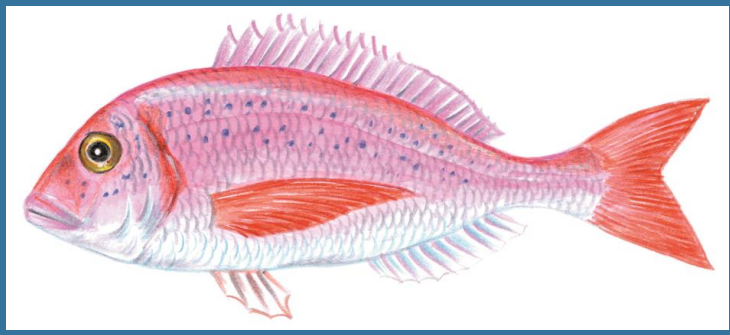
- **Bony fishes** – with a skeleton consisting of cartilage and bone in varying proportions.



The **skin** of the **bony fishes** is generally **covered** with **scales** (thin bony plates) and a layer of mucus, while that of the **cartilaginous fishes** is covered with the **dermal denticles** of the placoid scales, which give many species a rough texture.

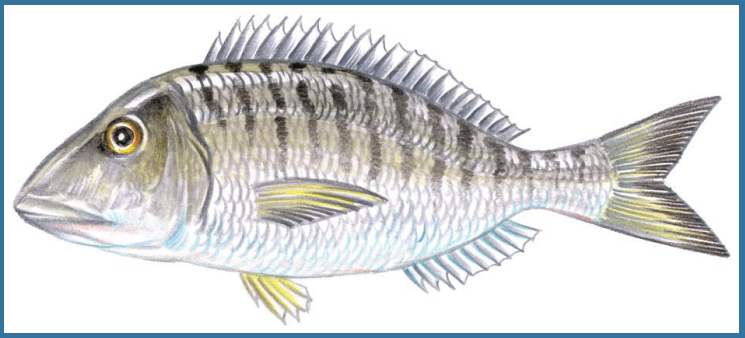
As far as the breathing apparatus is concerned, **bony fishes** have **gills protected by an operculum**, while **cartilaginous fishes** have **simple gill slits** that open on the sides, behind the head.

Another important difference is how these animals maintain their **hydrostatic buoyancy**, or ability to remain stable at a given depth. Most bony fishes use the **swim bladder**, an organ that can inflate and deflate thanks to its ability to extract or return gases dissolved in the animal's blood.
Cartilaginous fishes, which do not have this organ, maintain their hydrostatic buoyancy by means of a **complex system of thrusts** provided by their fins, snout, cartilaginous skeleton (lighter than bone) and liver.
The latter is highly developed in the cartilaginous fishes (up to 20% of the animal's total weight) and provides effective positive drive due to its high content of oils and other fatty substances, which are much less dense than water and therefore lighter.



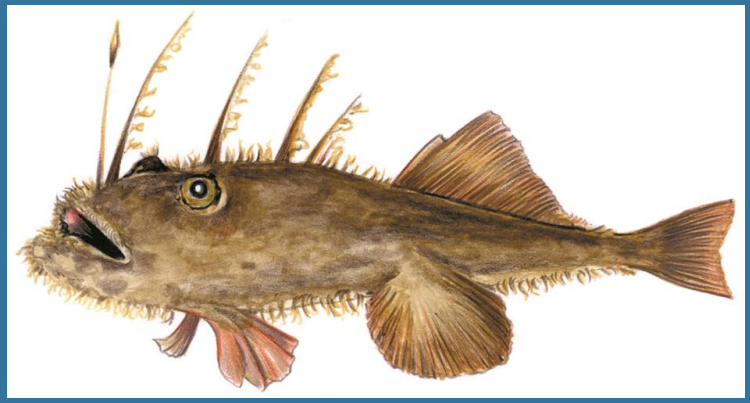
The fish move by means of a forward wave that runs through all or part of the body, alternately affecting the right and left sectors of the musculature.

The main **propulsive organ** is the **caudal fin**, supported by all the other fins.
These can have different functions in different groups: the pectoral fins of sharks, for example, are used to 'support' the body, while in many bony fishes they act as a brake.
A rigid and fixed **dorsal fin**, such as that of pelagic sharks, has the main function of preventing the animal from rolling at speed; in bony fishes, on the other hand, the dorsal fins are made up of rays that are articulated together, which can be soft or rigid and have different functions.
The morphological and anatomical characteristics of fish differ depending on the environment in which they live.



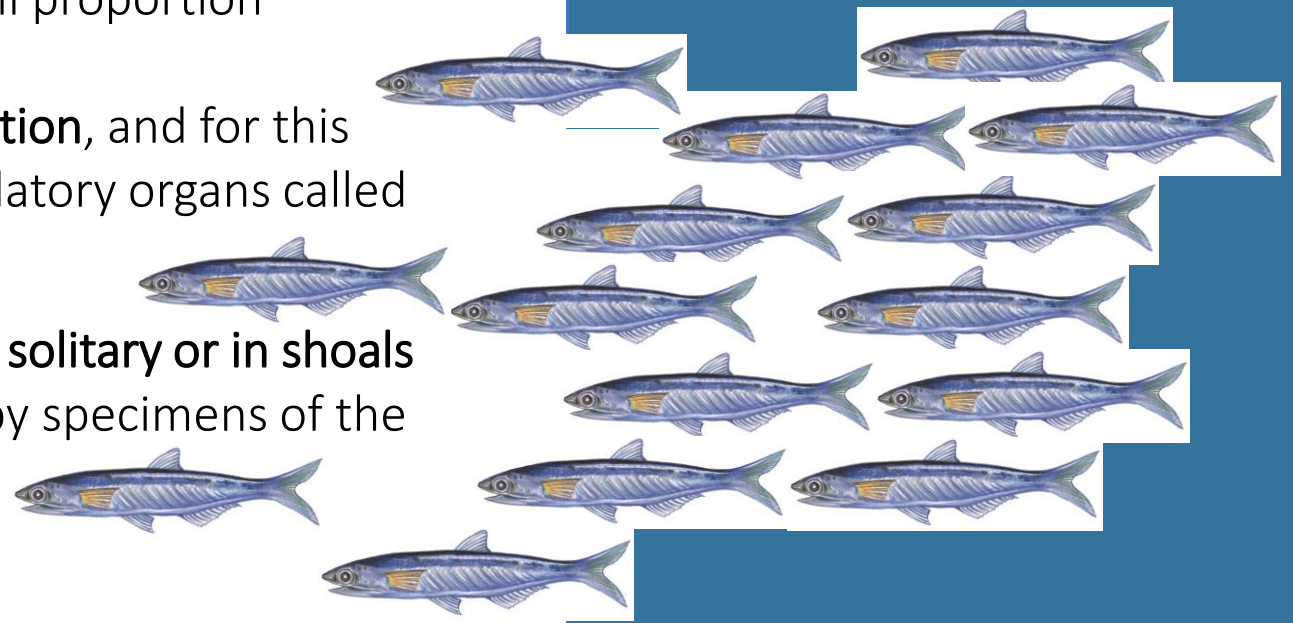
Species that live in the **open sea** (pelagic) have, for example, hydrodynamic shapes with **powerful caudal fins**, while those that live **on the seabed** (benthic) have a shape suitable for 'blending in', and **fins capable of rapid movements**.
Fish that forage near the bottom have a flattened ventral part and a downward-facing mouth, while those that feed near the surface have a flattened back and an upward-facing mouth.

Normally, **bony fishes** have **separate sexes**, but it is not uncommon in some groups (e.g. Sparidae, Labridae and Serranidae) for sexual inversion to occur during an individual's lifetime: a female specimen may become male and vice versa.
Fertilisation is external: the eggs are usually released and fertilised in water and the young are not cared for by the parents.
In species with parental care, it is often the father who takes care of the eggs and newly hatched young.



Many species produce hundreds of thousands or even millions of eggs each breeding season, but only a very small proportion survive and develop into adults.
Cartilaginous fishes always have **internal fertilisation**, and for this purpose the males are equipped with two copulatory organs called pterygopods.

The fish have very different habits: they **can live solitary or in shoals** that can reach **enormous sizes**, usually formed by specimens of the same size.



MARINE MAMMALS

Mammals are distinguished from other vertebrates by some exclusive characteristics: they have **skin covered with fur** (except for Cetaceans) and **have mammary glands**.
Other important, non-exclusive characteristics are the presence of lungs, homeothermy and, for the more evolved forms, the presence of placenta.

Pinnipeds

Three groups belong to the Pinnipeds:

the **Odobenidae**, represented only by the walrus, the **Otaridae**, with several species of sea lions, and the **Focidae**, which include seals.
The term Pinniped (fin foot) refers to the modification of the limbs that have adapted to aquatic life by turning into fins.

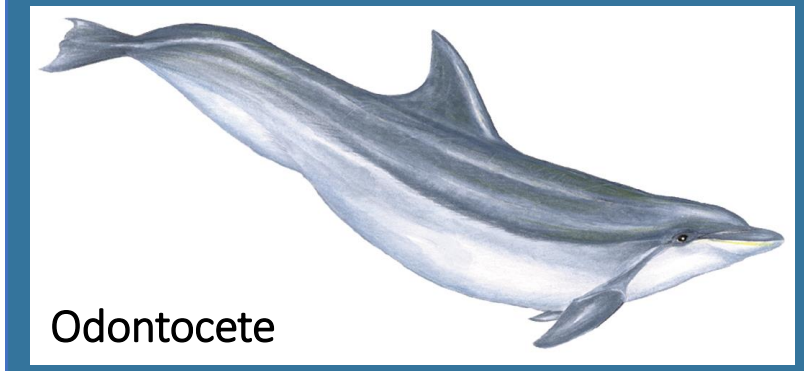
The body of Pinnipeds is adapted to lead a **semi-aquatic life**: the body is elongated; the head is small and under the fur there is a thick layer of fat that has the function of reducing heat loss in the water.
To prevent water from entering their lungs, Pinnipeds are able to **close their nostrils** with special muscles before diving.
They can perform **long apneas**, the duration of which varies depending on the species.
They have **vibrissae**, long whiskers near the nostrils, which are supposedly used to detect vibrations in the water.
Walruses and all seal species lack ear flaps, which are present in sea lions.

They are carnivorous animals; if the prey is not large, it is swallowed whole. Births generally take place on land, in isolated places.

The Mediterranean Sea is home to the **monk seal**, currently considered one of the most **endangered marine mammals**. The number of specimens of this once abundant species has drastically decreased due to hunting and the cementing of coastlines.

Cetaceans

Cetaceans are the 'most marine' of all Mammals.
According to current knowledge, **they descended** from a **land mammal**, the same one that millions of years ago gave rise to the Artiodactyls, the order to which deer, hippos and pigs also belong. These ancient Cetaceans, now extinct, left land and adapted to aquatic life over millions of years.
Present-day Cetaceans are divided into:
Odontocetes (or Cetaceans with teeth: dolphins, porpoises and sperm whale) and **Mysticetes** (or Cetaceans with baleen: whales and minke whales).

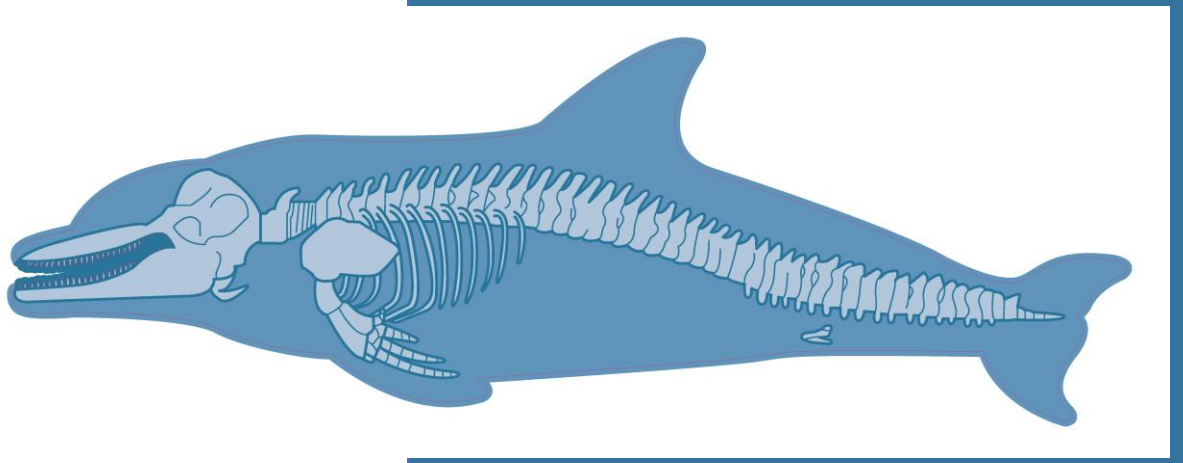

Odontocete


Mysticete

The body of Cetaceans, over millions of years of evolution, has undergone profound changes related to their new environment.

- The **hind limbs** have disappeared and only the rudiments of the pelvic girdle can be found.
- The **forelimbs** have changed into fins and the body in general takes on a fusiform appearance.
- The **tail** becomes the main propulsive organ, thanks to the development of two robust lateral lobes.
- A **dorsal fin** with a stabilising function appears in the faster species.
- The **cervical vertebrae** all fuse together, improving the animal's hydrodynamics.
- The **fur disappears**, making way for a thick layer of subcutaneous fat, which reduces heat loss.

A dolphin skeleton

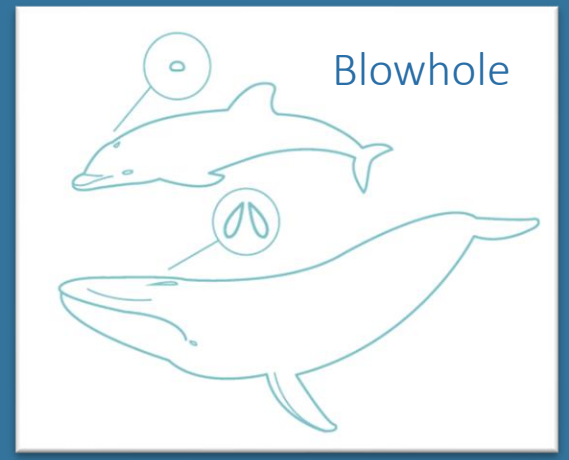


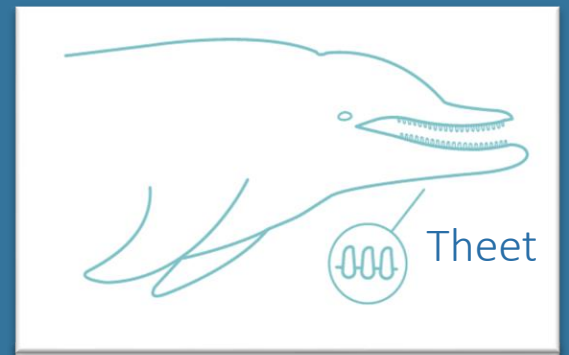
- The **nostrils** have turned into blowholes, 'migrating' to the top of the head, allowing the animal to remain almost completely submerged during respiration. In Mysticetes the blowhole consists of two orifices, while in Odontocetes the opening is only one.

- The **teeth** are undifferentiated in almost all Odontocetes, whereas in Misticetes the teeth are replaced by **baleen**, present only in the upper jaw.

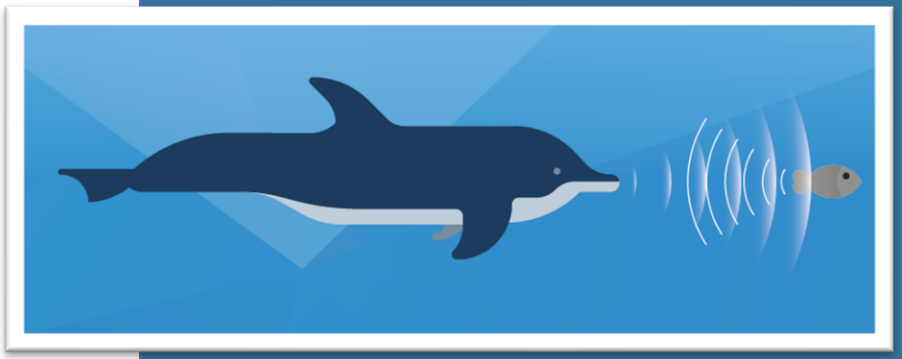
Cetaceans include the **largest living forms** that have ever existed on Earth: the blue whale, for example, reaches 30 metres in length and can weigh over 100 tonnes.

All Cetaceans are **predators**, but great differences can be observed in their hunting strategies. **Mysticetes** catch prey by means of baleen, filtering water and retaining **krill** and **small fish**. Different families use different strategies, in which individuals may or may not participate in catching prey.





Odontocetes, on the other hand, are more active predators; many species frequently co-operate in the capture of prey, consisting mainly of fish and squid, which they are able to locate through the use of **biosonar**.



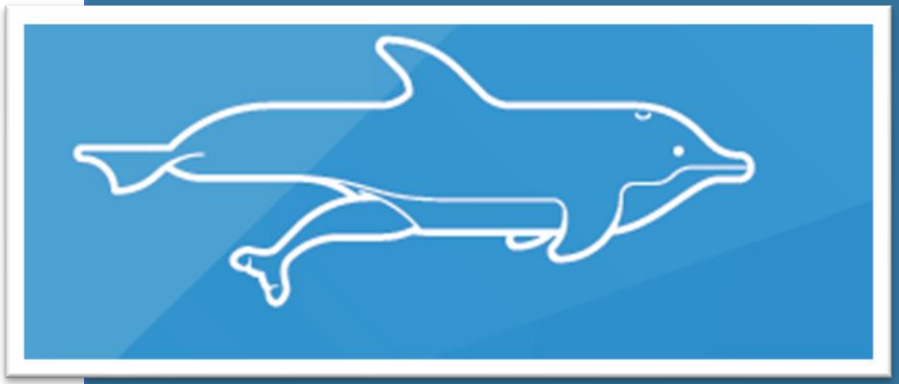
Like all mammals, Cetaceans have **aerial respiration**; they must therefore prolong their apnea to the maximum in order to catch their prey.
Sperm whales can dive over 2,000 metres and remain underwater for more than 90 minutes.

Cetaceans' **senses** are generally **well developed,** with the exception of the sense of smell. Hearing is the most important sense, as it is linked to the ability to produce sounds.
Mysticetes generally produce low-pitched sounds, which are probably intended to keep distant specimens in contact.

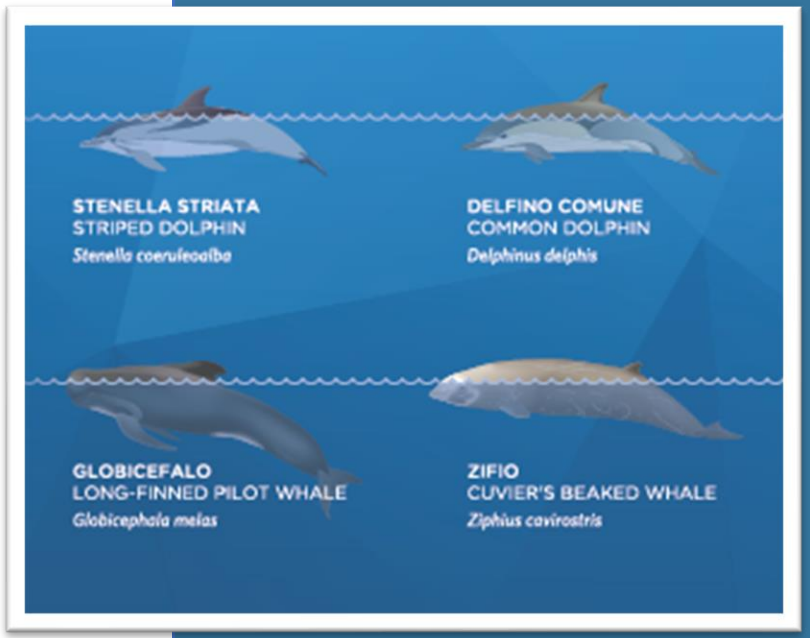
An exception is the humpback whale, which is capable of emitting a wide range of sounds of varying intensity.
Odontocetes produce **different types of sounds**. We can distinguish **clicks**, used for e**cho-localisation** (biosonar), from whistles and squeaks, used for social interactions, to the development of true languages and, perhaps, intraspecific 'dialects'.

All Cetaceans generally **give birth to one young** at a time. The breeding season is not always well defined and gestation times are extremely variable, ranging from 8 months for porpoises to 19 months for sperm whales.

Birth always takes place with **posterior presentation**, to allow the pup to spread its tail lobes and be able to swim freely. The mother is often assisted by other females who help the pup up to breathe. The pup is suckled as in all Mammals: the **milk is very rich** in fat and protein to ensure rapid growth.



Cetaceans that are regularly encountered in the Mediterranean Sea are the following: fin whale, sperm whale, Cuvier's beaked whale, long-finned pilot whale, Risso's dolphin, bottlenose dolphin, striped dolphin and common dolphin.



REPTILES

Sea turtles

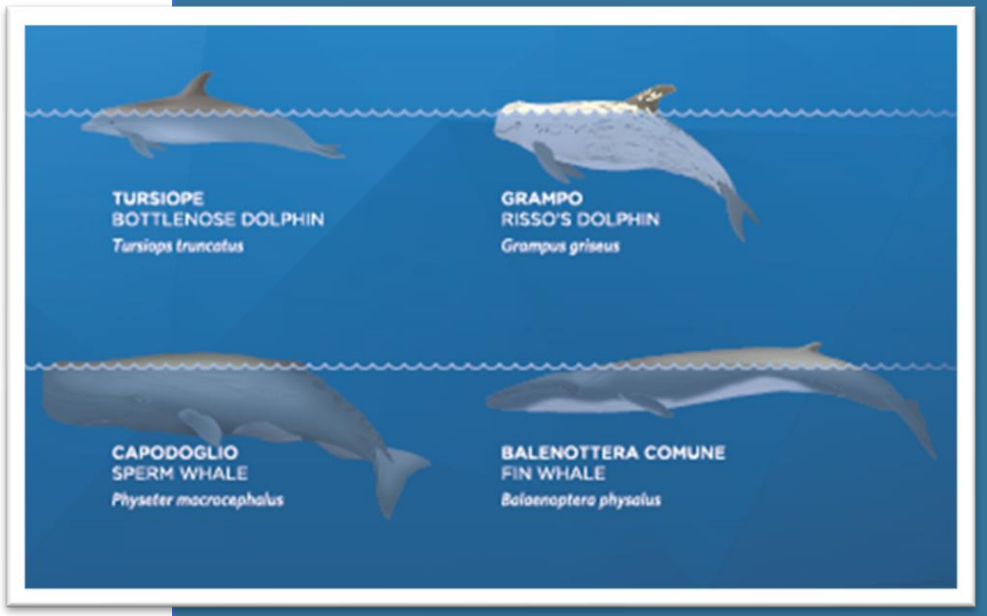
Sea turtles are Reptiles perfectly **adapted to marine life**, but dependent on the terrestrial environment for laying and incubating their eggs.

Their body, protected by a robust armour, is elongated and their **legs** are **modified into flippers**. They breathe through their lungs and can remain apnea for about 20 minutes.

They live in all the world's oceans except polar waters.

The different species have an **omnivorous diet** and feed mainly on fish, algae, molluscs, crustaceans and jellyfish.

Turtles mate at sea; however, **egg-laying** takes place **on land**, on sandy beaches.



When the **female** is ready, she **reaches the beach** and digs a few **holes** in which she **lays numerous eggs**, covering them with sand to protect them from the sun and predators.
Incubation lasts about two months, and hatching usually takes place at night.
The newly hatched young emerge from the nests and move towards the sea.
The **sex** of the newborns **depends** on the **incubation temperature**: higher temperatures will produce females; lower temperatures will result in males.
They make **long migrations** to reach their breeding sites; in some cases, females return to nest in the place where they were born.

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