

Biodiversity

Birds & Mammals

Ocean Explorer



Bayworld Centre for Research & Education





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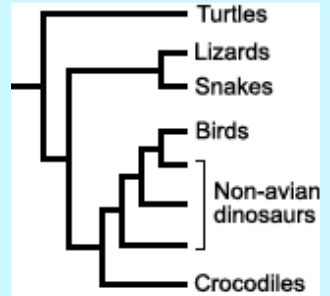
1 - Marine birds

Birds are one of the most diverse vertebrate group on Earth, with more than 10 000 different species spread all over the world !

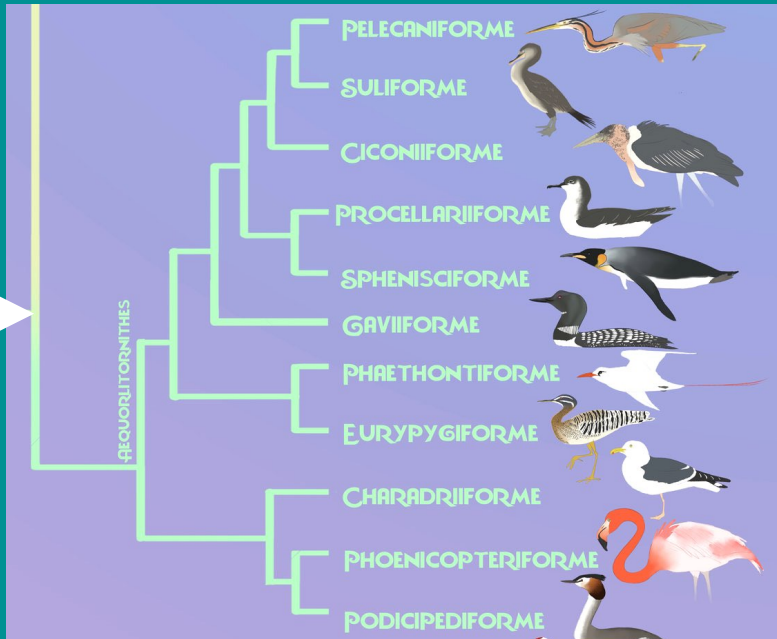
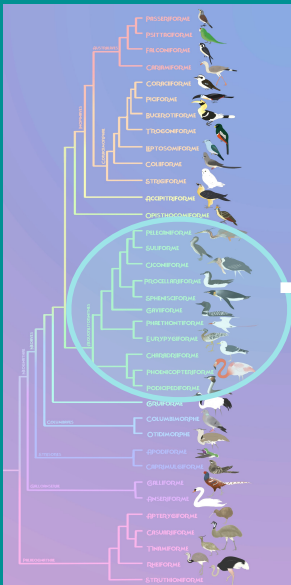
Their special characteristics include :

- Endothermy (organisms with a constant internal body temperature)
- Feathers
- Wings (not always for flying)
- Beaks without teeth
- Lay eggs with a hard shell

Birds are part of the reptile phylum ! They originated from the avian dinosaur family which also included velociraptors. This is the reason why most scientists think that the dinosaurs from this group also had feathers !



The bird tree of life is absolutely gigantic ! Marine birds are only a part of it and are classified under the name **Aequorlitorithes** (from the greek "aqua" = water).



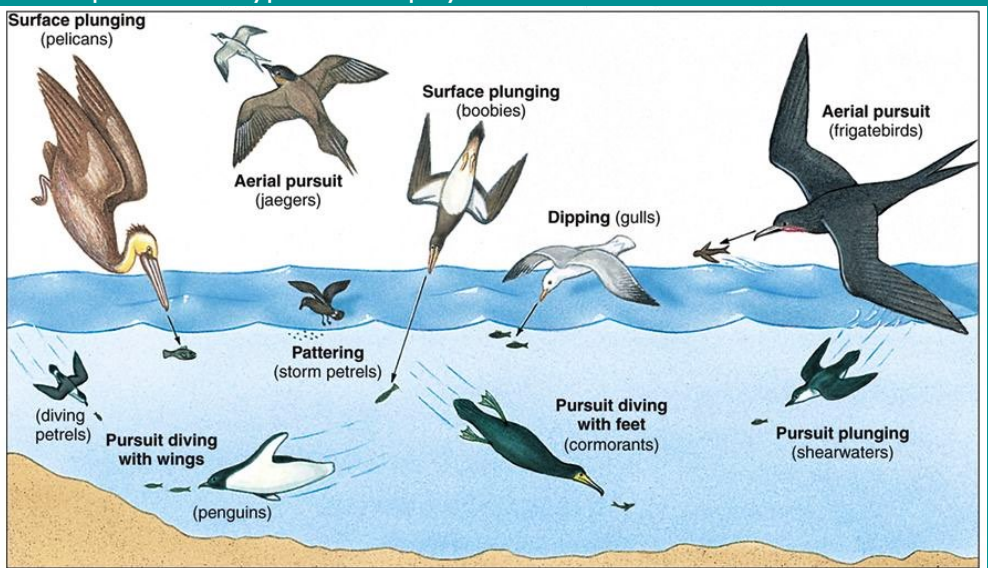
Flying under water

Not all birds can fly : penguins for example are unable to do so. Thanks to the fossil record, we now know that their ancestors could fly. So why didn't they keep this ability ?

The reason is simple : they don't need it. Their food is water based, and a bird's wings are useless under water. Most marine birds simply dive from the sky onto a fish located just under the water surface, but if they miss they are unable to pursue their prey further under water. Penguins don't have that problem. They have totally modified their wings to fish where other birds cannot. It gives them an crucial advantage because they are one of the few birds species capable to access this food source.

In order to do this, one of their adaptations is their wing structure. Instead of keeping the long flight feathers that bend, unable to keep their shape under water, they have these short waterproof feathers, covering a profiled wing especially designed to gain speed while swimming !

Marine birds are all very different in morphology but also in behaviour. This is especially visible when watching their fishing strategies. Each species has its own way of doing things, that will depend on the type of fish it preys on !



Multitool beak

The beak is a bird's multitool. The bird uses it predominantly to feed but also to preen, to communicate, to build its nest... Depending on the type of beak, one can determine which type of prey item this species is eating.

Below are a few types of beak and their use compared to a human tool.

Pursuit fishing



Aerial fishing



Dip netting



Filter feeding



Gripping



Surface skimming



*Cormorants
Boobies
Guillemots*

*Kingfishers
Terns
Skimmers*

Pelicans

*Flamingoes
Spoonbills*

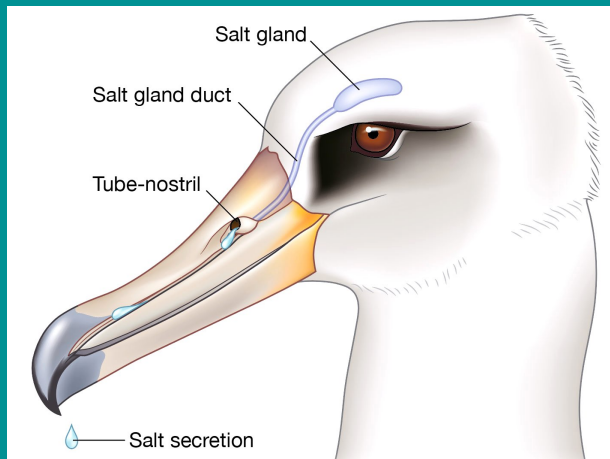
*Ducks
Teals*

*Herons
Snipes
Jacanas*

Salt glands

Most of the freshwater a marine bird requires comes from its diet, but, unlike us, it can also drink salt water if needed. They have a special organ to remove salt : a salt gland.

Have you ever noticed a seabird with a "runny nose", liquid dripping from the tip of its beak ? That's its salt gland at work !





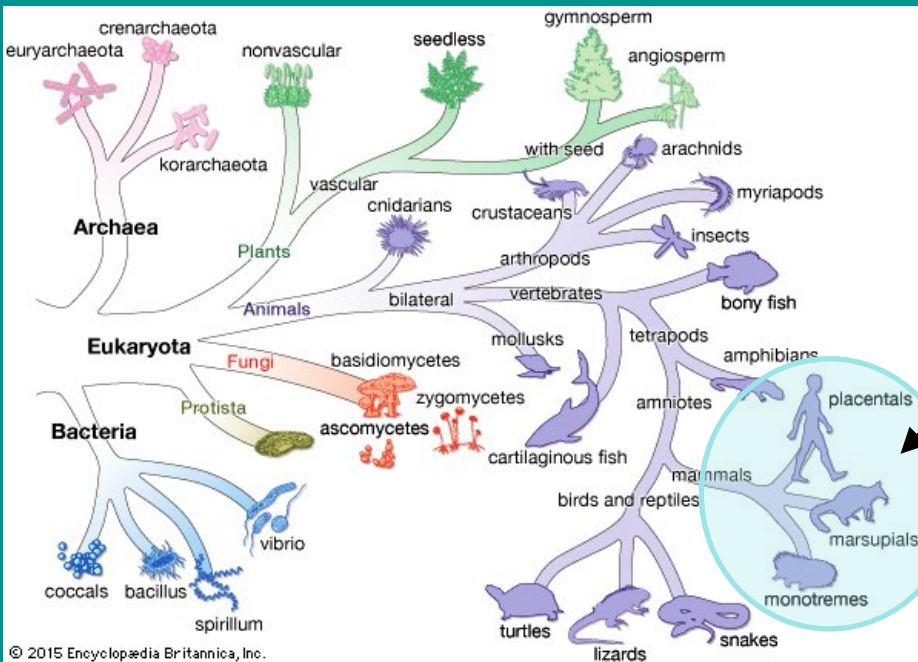
2 - Mammal classification

Unlike birds, mammals have not evolved from dinosaurs. We are not closely related. We have evolved from what are called pre-mammalian reptiles that existed even before the apparition of dinosaurs on Earth !

All mammals share the following characteristics :

- Females produce milk for their young through mammary glands
- Young are born live, not in an egg
- Hairs / fur
- Endothermy (organisms with a constant internal body temperature)
- 7 vertebrae in the neck (cervical vertebrae) - even in girafes !

Because mammals are the biggest species, the ones that we see without having to look through a microscope, we think they are the most abundant life forms on Earth. But this is far from being true ! Mammals are only a very small part of life on Earth. In fact, our planet is dominated by invertebrates !



Mammals only !

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3 different lineages

Mammals can be separated into 3 groups : Monotremes, Marsupials and Placentals.

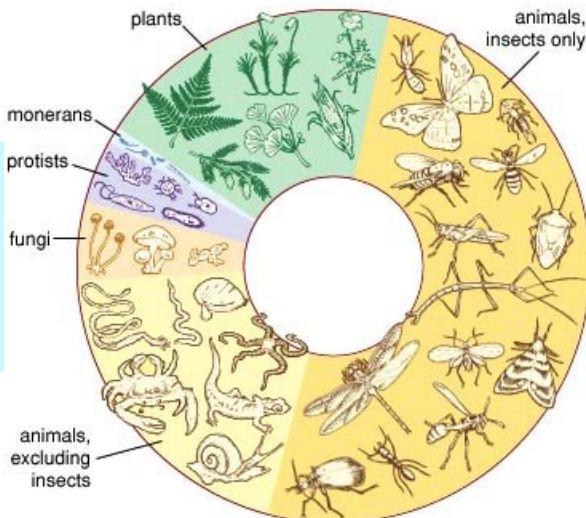
- **Monotremes** : they lay eggs, just like birds ! There are only 5 species of Monotremes, the platypus and 4 species of echidnas.
- **Marsupials** : partly developed young live in a pouch. These includes kangaroos, koala bears and opossums.
- **Placentals** : young develops inside the mother's body. For example cats, dogs, rats, elephants and humans.



Platypus



Kangaroo with young (joey)
inside the pouch



Info +

Invertebrates are more numerous on Earth than mammals ! About 80% of life forms are invertebrates, of which 60% are insects only !



3 - Marine mammals

Marine mammals are all Placental mammals. But inside the placentals, all marine mammals do not belong to the same group ! Here we will concentrate on 4 phyla that contain most of them : Cetacea, Pinnipedia, Lutrinidea and Sirenia.

Cetacea (Whales, Dolphins, Porpoises)

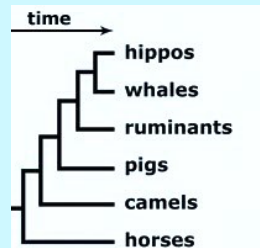
The word cetacean is used to describe all whales, dolphins and porpoises in the order Cetacea. There are about 90 different species of Cetacea.

The order Cetacea is divided into two sub-orders, the **Mysticetes** (baleen whales) and the **Odontocetes** (toothed whales).

- **Mysticetes** are the "true" whales. These animals have hundreds of comb-like plates of baleen hanging from their upper jaw. They feed by gulping large amounts of water containing thousands of small fish or plankton, then forcing the water out in between the baleen plates, leaving the prey trapped inside the mouth.
- **Odontocetes** include the sperm whale, orca (killer whale), and all of the dolphins and porpoises. They have cone-shaped or spade-shaped teeth and usually capture only one animal at a time. Odontocetes feed mostly on fish and squid, although orcas prey on other marine mammals.

Info +

Whales and dolphins are more closely related to hippos and cows than to sharks ! It is because sharks are not mammals but fishes.

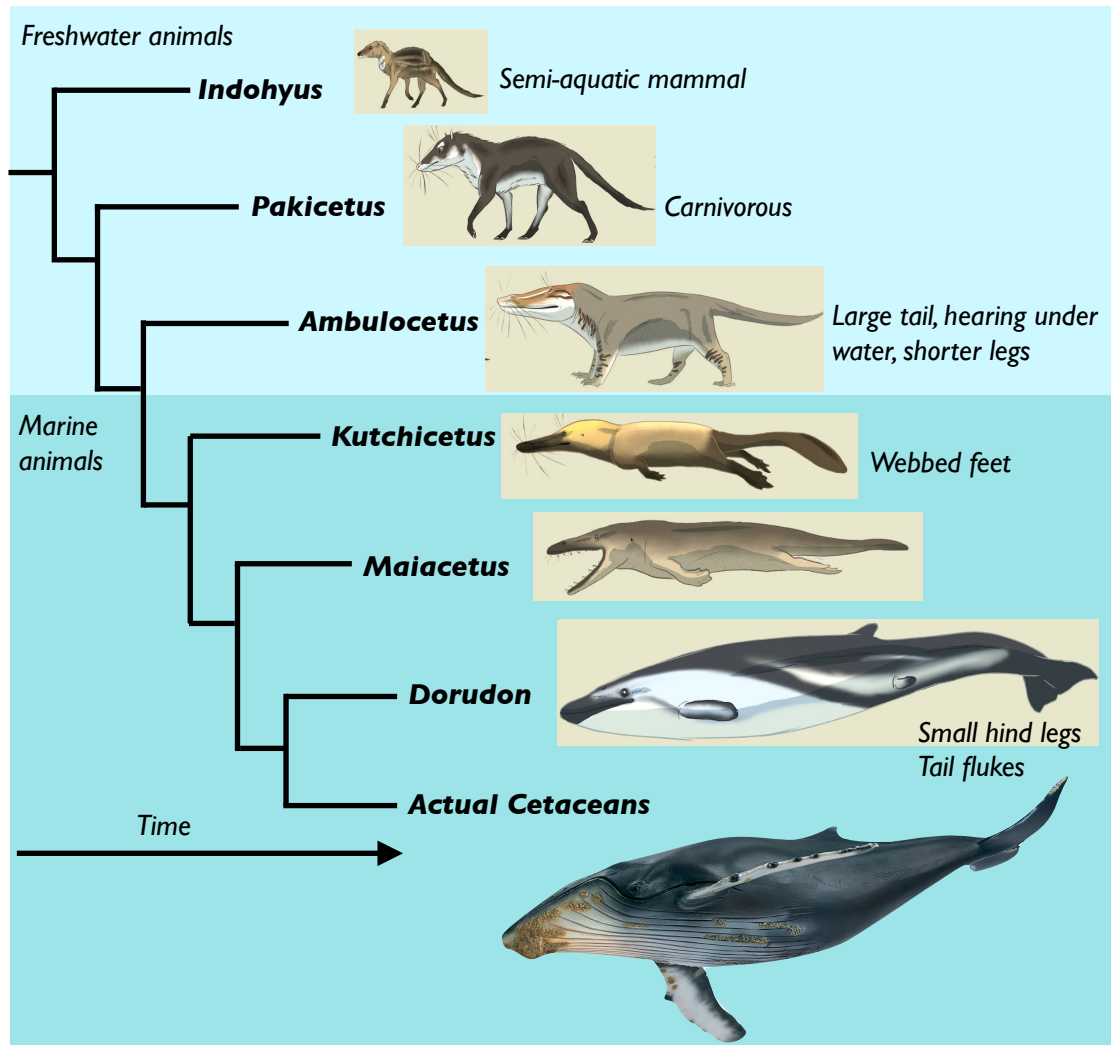


Cetaceans are very diverse. The biggest one is the blue whale which weighs 150-200 tons for 30 metres long and the smallest is the vaquita, only 1.4 metres long for about 60kg !



Cetacean evolution

Cetaceans are not fishes but mammals, and as such they have evolved from a terrestrial mammal, not from a fish ! Fossils have been found that show the slow evolution form a small mammal called *Indohyus*, not bigger than a dog, to our actual whales and dolphins.

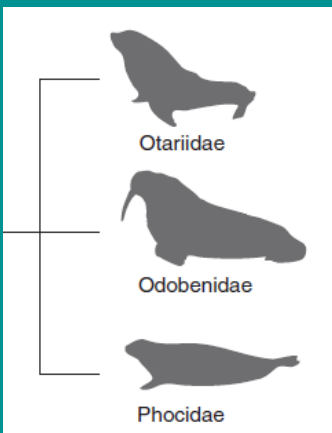


Pinnipedia (Seals, Sea Lions, Walrus)

Their limbs are highly modified for aquatic locomotion with flattened, elongated and webbed digits. The name pinniped actually means "feather-footed". Other aquatic adaptations include streamlined body, external ears reduced or absent, slit-like nostrils that close completely and flexible spines that allow for impact from waves and hauling out onto land. Otariidae and Odobenidae use their front flippers in an up and down motion for primary locomotion, whereas Phocidae use their hind flippers in a side to side motion.

All of the Pinnipedia are carnivorous and dependant upon the aquatic environment for food. No matter how aquatic each species' lifestyle may be, they all must return to the land to breed, give birth and rear their young.

Pinnipeds are part of the Carnivora order, very close to the Mustelidae (weasels, badgers, otters...) and Ursidae (bears). They are not closely related to the cetaceans.



Otaries Small ear flaps visible. Use their front flippers to swim. Family of the South African fur seal.

Walrus Very large tusks. Only species : the Walrus.

True seals No ear flap. Swim by using their hind flippers. Very clumsy on land.

Lutrinae (Otters)

There are 13 species of otters found mostly around freshwater but also in marine environments. Otters are semi-aquatic mammals that are specialized for chasing and capturing fish and other aquatic prey underwater. Otters are social and are often found in family groups.

Info +

The Sea otter has an exceptionally thick coat of fur, the densest in the animal kingdom ! It protects the animal while at sea.

Compared to other otters, the Sea otter is the most adapted to water. It can spend its entire life at sea, without having to leave the water. To sleep, Sea otters float on their backs, holding paws with other otters to prevent drifting ! It is the only mammal that catches fish with its front paws instead of its teeth, which is the reason why its claws are well developed.

Another otter is marine : the Marine otter, found around the coast of South America. However it is not as well adapted to life in water as the Sea otter.



Using tools

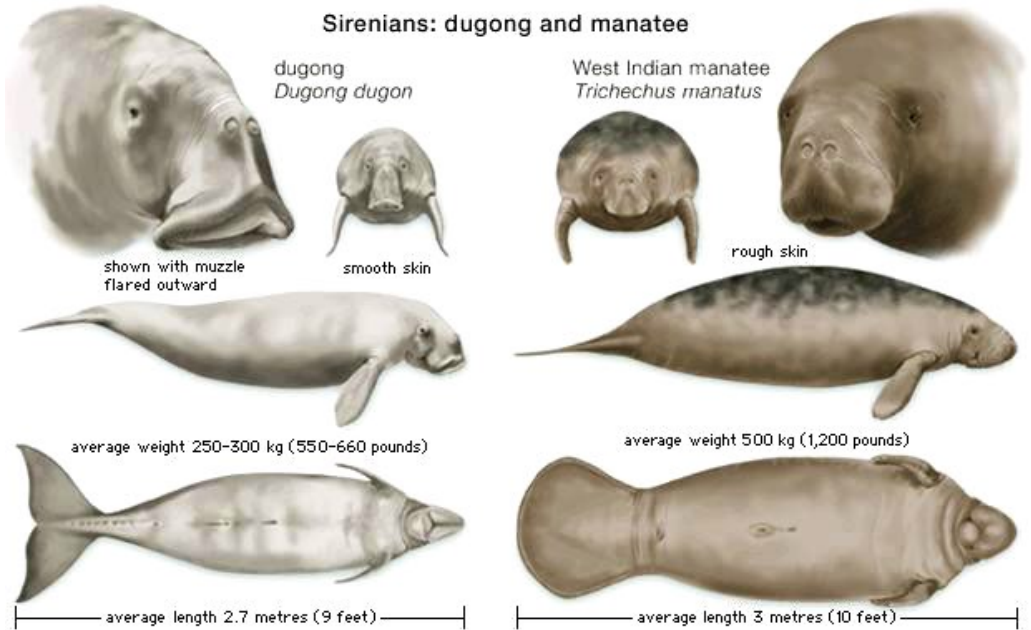
Sea otters are one of the few mammals capable of using tools !

In the case of a Sea otter, it is a rock that an animal places on its belly while floating at sea. It uses it to open clams and sea urchins by tapping the shell against the rock numerous times in a row !

Sirenia (Dugong, Manatee)

There are 4 living species of sirenians, 3 **manatees** and the **dugong**. A fifth species, **Steller's sea cow**, of the North Pacific and Bering Sea, was exterminated by overhunting in the 1700s. Sirenians, like cetaceans, are totally aquatic, however they are the only herbivorous marine mammals. As a consequence, they tend to be less marine than members of other marine mammal groups. In fact, manatees spend almost all of their lives in fresh or brackish water. All 4 living species are restricted to a tropical and subtropical habitat. Steller's sea cow was unique : it inhabited cold temperate to subarctic waters.

Sirenians: dugong and manatee



Classification

Sirenians are Afrotherians, which means they are closely related to elephants, dassies and golden moles. These mammals have evolved together on the African continent, away from the other mammal groups.





4 - Activity : Whales' "fingerprints"

How can we study whales when they are living under water ?

Questions

1 - Imagine you are a scientist trying to study whales. You need a method to be able to identify each individual in order to recognise them. What would you do ? List a few methods you could use.

2 - You decide to go for a visual identification. Which part of the body could you use ?

3 - Scientists usually build a database based on whale's fins to identify each individual. In the case of orcas or killer whales, it is the dorsal fin that is used. Take a look at the pictures below. They are all from different animals. How can you differentiate between these animals ?





5



6



7



8

4 - Look at the picture below. It shows the differences between male and female orcas. Using this method, determine the sex of each whale in the previous question.

Male



Female

