

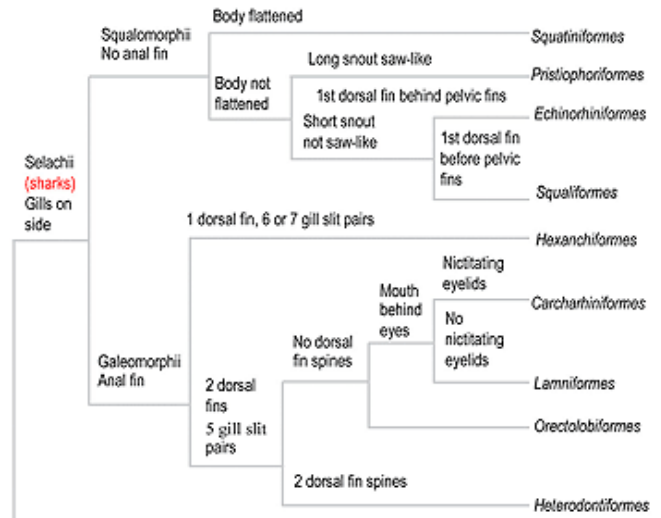
Student Information Sheet 2

The Diversity of Sharks, Rays and Chimaeras

Background

All sharks and rays belong to the class of animals called the **Chondrichthyes**. These animals all have skeletons made of **cartilage**, which is softer than bone and as a result do not preserve as well as the bony and dermal structures of other fishes in the fossil record.

Palaeontologists have to rely on fossilised teeth, small **dermal** scales and **calcified** vertebrae, rather than complete skeletons, to piece together the evolutionary history of these animals. For this reason some of the early relationships and origins of the chondrichthyan fishes remain uncertain.



Key for classification of sharks
For the fully key for classifying sharks, rays and chimaeras see page 5.

We know now that all living species of sharks and rays have a cartilaginous skeleton. However, it appears that the first sharks ever to have lived did originate from fish with bone in their skeleton. Bone was probably lost during the early evolution of sharks to reduce body weight and improve **buoyancy**.

It is thought that the earliest sharks appeared on Earth more than 400 million years ago. About 340 million years ago, the group of chimaeras appeared and the earliest rays appeared about 200 million years after the first sharks. These days there are nearly 400 living species of sharks, nearly 600 living ray species and 33 described living species of chimaeras worldwide. More species are likely to be discovered as the deep waters of the world's oceans are better explored.

Cartilaginous fish occur in a range of habitats. They are present from near shore to the deep **abyss**, from the equator to the poles, and a few species are found in freshwater and **hypersaline** waters. They are most abundant in **tropical** and **temperate** marine waters.

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Sharks

Sharks are mostly **fusiform** (bullet-shaped) in shape, but some have a flattened ray-like shape. They have mostly five pairs of gill openings, but some have six or seven. Most have two **dorsal fins**, but a few species have only one. The dorsal fins of some groups of sharks have spines on the leading edges. Sharks have a well-developed **caudal fin** (tail) for swimming.

Sharks form two broad groups that can be divided into nine orders and thirty different families. Those in the group called Galeomorphii possess an **anal fin** and form four orders, and those in the group called Squalimorphii lack an anal fin and form five orders.



Australian angle shark (© Ken Hoppen, oceannotions@primus.com.au)



Piked spurdog (© Ken Hoppen, oceannotions@primus.com.au)



Crested Port Jackson shark (© Ken Hoppen, oceannotions@primus.com.au)



Grey spotted catshark (© Ken Hoppen, oceannotions@primus.com.au)



Juvenile brown-banded bamboo shark (© Ken Hoppen, oceannotions@primus.com.au)



Frisled shark (© Ken Hoppen, oceannotions@primus.com.au)

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Rays

Rays have five or six pairs of gill openings underneath their flattened body. The **pectoral fins** are attached to the back of the skull and body, which are greatly enlarged to form a body disc. Most ray species have small dorsal and caudal fins and many species lack them completely. The dorsal fins lack spines. Rays have a thin, often whip-like tail, and lack an anal fin.

The eyes and **spiracles** are usually on top of the head. The eyes are covered with skin and are indistinct in a few blind electric rays.



Coffin ray
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Eastern fiddler ray
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Southern eagle ray
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More than half the living species of rays have maximum sizes exceeding 50 cm in length. The smallest ray is a shortnose electric ray with a maximum length of 10 cm. The largest ray recorded – the wide sawfish – is 7.6 metres total length, and the largest manta ray recorded is 6.7 metres.

Most ray species prey on **invertebrates** and small fish, but some are **plankton** feeders, such as manta rays. Most rays are bottom dwellers and feed by trapping prey with their disc against the **substrate**.

Features used for identifying species of rays are colour, disc and tail shape, nasal and mouth structure, distribution, and shape of **dermal** thorns and denticles. Taxonomically, rays form a single broad group called Batoidea, within which there are 16 families of living rays.

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Chimaeras

Chimaeras are different from sharks and rays in a number of ways:

- The upper jaw is fused to the underside of the skull;
- There is only one gill opening;
- The skin is smooth and lacks **denticles**;
- The teeth are fused into plates that are often beak-shaped;
- The tail is long and narrow.

They range in size from 50 cm to 2 metres total length. All chimaeras lay eggs and feed on invertebrates. They are found mainly on the **continental slopes** in deep water.

Chimaeras can be identified from colour, head shape, position and shape of the fins, dorsal spines and tooth plate structure. Living chimaeras are classified into three families



Juvenile elephant shark
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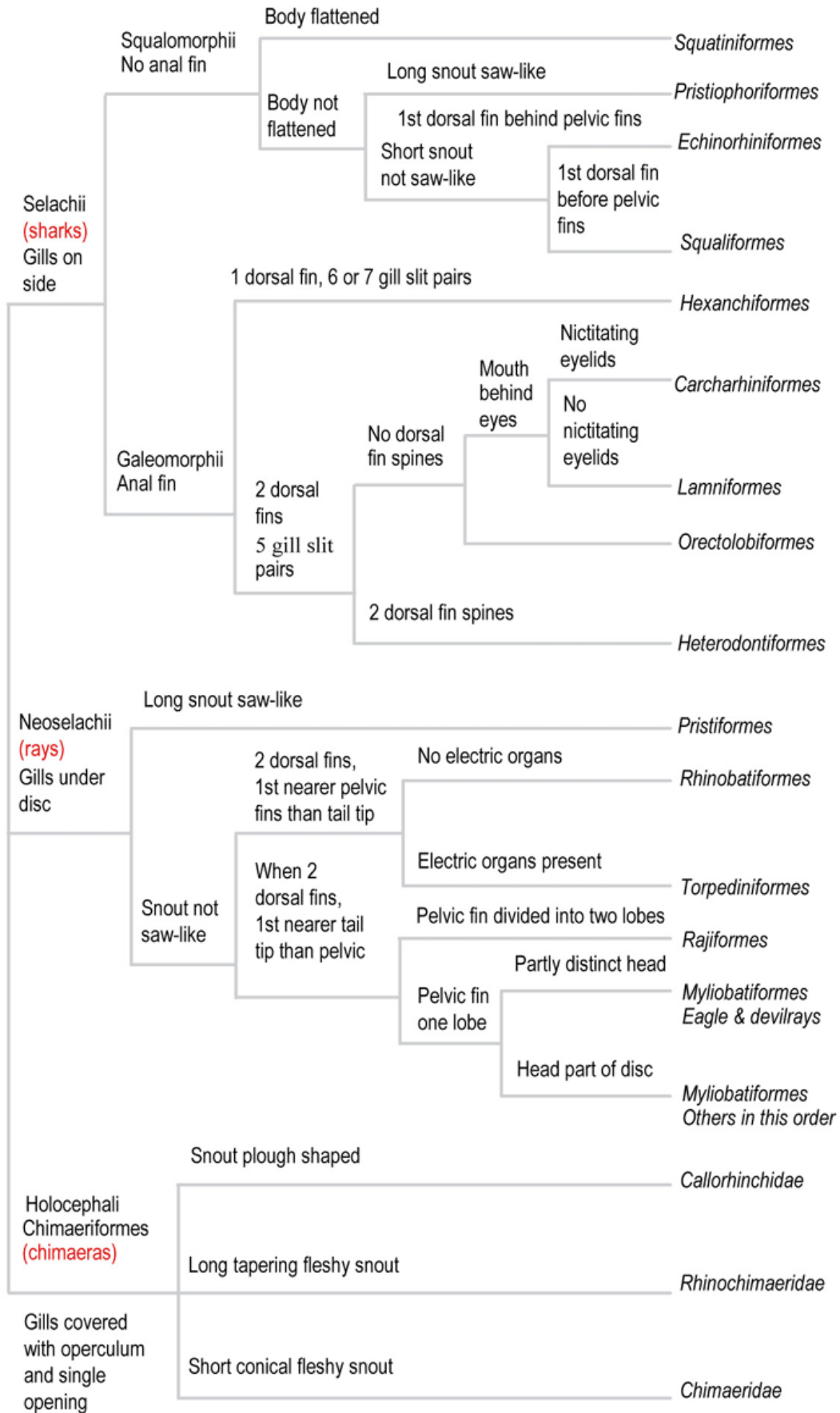


Southern chimaera
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Kate Sputore (Rottneest Island Authority) and Alex Gaut (MESA) adapted this information sheet for children (which is suitable for primary school students) from the information sheet compiled for the general public by © Terence Walker (Terry.Walker@dpi.vic.gov.au).

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Key for classifying sharks, rays and chimaeras