RSNO
SCOTLAND'S NATIONAL ORCHESTRA

Sounds of the Deep

Learning Resource:

Sharks aren't scary

MARINE CONSERVATION SOCIETY

Sharks aren't scary

Subject links:
Science, English, Design and technology

Ages 7-11

Curriculum links:
UK wildlife, Adaptations, Anatomy, Life cycles, Food webs, Human impact, Reading, Presentation, Design innovation

Ocean Literacy Principles:
5. The ocean supports a great diversity of life and ecosystems
6. The ocean and humans are inextricably interconnected

Learning Objectives:
- To explore the basic biology of sharks
- To discover how sharks are adapted to be apex predators
- To learn how shark populations are affected by human activity

Sustainability Goals:

Resources provided:
Sharks Fact File
Shark Image Reel
Shark Outline
Shark Anatomy
Lifecycle of a Shark
Hydrodynamics of shark skin video
Studying sharks case study
Whose teeth are these?

Extra resources required:
Mini whiteboards
Poster paper, pens, scissors, glue
Tablets and books

Step 1 Background

Sharks have been around for millions of years, but today they're in serious decline with many shark species under threat of extinction. Sharks are at the top of the food chain in virtually every location they're found. Their body shape and structure, scales and teeth are all perfectly adapted to being apex predators. We're lucky to have 40 species of shark visiting UK seas. For more information, see the *fact file.*

Step 2 Set the Scene

5 minutes - Shark association

Write the word 'shark' on the board. Hand out mini whiteboards to students and give them 1 minute to write down the first words that spring to mind. After 2 minutes, students should feedback their words. Write them on the board, and for each one have a show of hands for how many other people wrote the same word and record the totals on the board. Find out what the most common words associated with sharks were, and use this to discuss today's topic. Introduce some of the top facts on the *fact file*. Take a photo of your board and save it for the Reflect activity.

Step 3 Activities

Activity 1: 15 minutes - Sharks in the UK

Ask students where sharks live. Do we have sharks in the UK? Display the *image reel* to reveal some of the key UK shark species. Use information in the *fact file* to study each species further. Show the image of six sharks and discuss similarities and differences. Use this to discuss how a shark's features are adapted to its environment. For example, the Angel shark lives on the seafloor and is camouflaged in colour.

Activity 2: 10 minutes - Shark anatomy

Display the blank *shark outline* on the whiteboard, or you could also print these out for students to write on. Through questioning and discussion, name the body parts of the shark. Ask students if they think sharks are mammals, fish, reptiles or amphibians. Explain that sharks are fish, and discuss the characteristics of fish. All information is provided on the Sharks Trust *shark anatomy* poster.

Activity 3: 15 minutes - Lifecycle of a shark

Hand out the *lifecycle of a shark* worksheets. Students should cut out and stick images in the correct order to reveal the full lifecycle.

Activity 4: 5 minutes- How do sharks swim?

Point out the pectoral fins on the *shark outline* and explain that these act like aeroplane wings, helping guide the shark up and down in the water. The pectoral fins are solid unlike other fish, and therefore don't have much movement. This means sharks can't stop or swim backwards. To move forward, sharks pump blood into their powerful tails and swing these from side-to-side which propels them forward. Watch the video, *hydrodynamics of shark skin,* to discover how their teeth-like scales, called dermal denticles, help them swim fast.

Activity 4 (extension): 30 minutes - Studying swimming sharks

Biomimicry is the design and production of materials and structures that are modelled on biological processes. Many industries have been studying shark skin to see how they could use dermal denticles technology to improve their products. Split the class into 4 or 8 groups and hand out an industry *case study card* to each group. Students should study how the industry has used the technology of sharks' scales in their product. Groups should work together to create a 2-minute Newsround-style presentation using information learnt in Activity 4, as well as information on their cards. Each group should then deliver their news snippet to the rest of the class.

Activity 5: 10 minutes - How do fish breathe underwater?

Ask students if humans can breathe underwater. Discuss why this isn't possible and pose the question, how do fish breathe underwater? Split class into groups and hand out ground coffee, coffee filter paper, small jar, jug of water and elastic band to each group. Note: this investigation also works with a fine sieve and pretty much anything small to put in the water! Students should cut the filter paper into a fish shape, and write 'gills' in the middle. Place this middle section over the jar and

tie with elastic band. Mix the ground coffee into water. Explain what each material represents (coffee = oxygen, filter paper = fish gills, water = the ocean). Students should slowly pour the coffee mixture over the filter paper. Ask students what's happened, and explain how the dissolved oxygen 'coffee' has been sucked out of the water by the gills. This will then be pumped around the rest of the fish. The water wasn't trapped by the gills, but moved through them and back into the 'ocean'.

Activity 6: 15-20 minutes - What do sharks eat?

Explain that sharks are very varied, and different species feed on different prey. Hand out the *whose teeth are these?* sheets. Students should try to match the shark teeth with the prey. Check answers and reveal shark's name, with children adding this to their sheets. Discuss feeding techniques using the notes in the *fact file*. Students should add notes for each shark to describe how their teeth are suited to their diet.

Activity 6 (extension): 15 minutes - Filter feeders

To explain the filter-feeding mechanism of a basking shark, split the class into groups of 3-4. Hand each group trays with water and peas in, a small sieve, tweezers, a stop watch and two small pots. One student will keep time (20 seconds per round). One student will use tweezers (normal jaws) to pick up one pea (plankton) at a time and place in their small container (stomach). Another student will use the sieve (gills) and 'swim' around the tray (ocean) trying to filter the peas (plankton), and placing in their container (stomach). After 20 seconds, count the peas in each container and record the total. Repeat this activity several times to see how consistent the results are and allow all children to have a go at different tasks. From the results, determine which was the best method for fishing plankton. Relate the activity to how basking sharks filter the water like the sieve - an effective way of eating small plankton.

Step 4 Extend

10 minutes - A threatened species

Using notes in the *fact file* along with the *image reel*, explain that numbers of sharks have declined dramatically, and highlight some of the reasons for this. Have a class discussion around how the children feel about this, and whether they think there's a way to protect sharks.

Step 5 Reflect

10 minutes

Can you name any sharks that live in the UK? Show the blank outline and see if students can name different sections of a shark. What three things do sharks use to help them swim? What adaptation do all fish have to breathe underwater? What types of food do sharks eat? Why are sharks in trouble?

Return to the activity in Set the Scene and repeat the exercise. Analyse the results and compare these to the initial words to see how they have changed.

Step 6 Follow up

To learn more about predators and food chains, complete our lesson, *Create a food web*.

For more information on destructive fishing – including techniques that may harm sharks – see our lesson, *Let's go fishing*.

For more on threats to the ocean, have a look at *How do we use the sea?*

Sharks Fact File

Top facts

- You are more likely to die from a lawnmower, vending machine or coconut than a shark attack.
- Sharks have been around for around 455 million years.
- Some sharks lay eggs and some sharks give birth to live young.
- Sharks don't have bones but instead have cartilaginous skeletons.
- There are 1,107 described Chondrichthyan species around the world - these include sharks, rays, skates and chimaeras. Of those species, there are 432 species of sharks.

Sharks in the UK

Over 40 different species of shark have been observed in UK waters, and 21 of those species live in the UK throughout the year.

Basking sharks can reach lengths of up to 12 metres, making them the second largest shark. These gentle giants are filter feeders, mostly dining on plankton. Their huge mouths can open up to one metre wide!

The basking shark is a seasonal visitor to the UK, so the best time to spot one is between May and October. Across the UK, people can record basking shark sightings on the Shark Trust's *online database.*

Basking shark © 12019/10259 images via Pixabay

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Sharks Fact File

Blue sharks are migratory; each year they make huge trans-Atlantic migrations and can travel 5000 miles in one trip. They visit the UK in the summer. They migrate in a 'school' or larger group.

Blue shark © Adam Searcy via Flickr

Angel sharks are nocturnal. They inhabit sandy or muddy areas of the seabed, and bury themselves during the daytime. They are critically endangered. Their numbers have declined dramatically during the last 50 years, to the point where they have been declared extinct in the North Sea.

Angel shark © Luis Miguel Estevez via Shutterstock

Small spotted catsharks are also known as lesser-spotted dogfish. This is the most common shark in the UK. They live in shallow waters spending their time close to the seabed. They are small sharks approx. 75cm in length. Their egg cases, commonly known as mermaid purses, can often be found washed up on beaches.

Small-spotted catshark © David Ceballos via Flickr

Greenland sharks are the second largest species of carnivorous shark after the great white. They are found in very deep waters and sometimes referred to as the world's most mysterious shark. Footage of Greenland sharks swimming in their natural environment was not captured until 2003. Many Greenland sharks have a small parasite attached to their eyes, which slowly causes the shark to go blind.

Greenland shark © Dotted Yeti via Shutterstock

Research has shown that these fascinating creatures could live to around 400 years old, making them the longest-lived vertebrates on the planet!

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Sharks Fact File

Feeding and diet

Sharks' teeth are adapted to their diet. Some have sharp teeth for piercing and slicing prey, others have blunt teeth for crushing, and some are filter feeders with very small teeth that they don't actually use for feeding. All sharks regularly lose and replace their teeth. Sharks can have on average 12-13 rows of teeth – the bull shark has a whopping 50 rows of teeth!

White shark teeth © Karen Zhang via Unsplash

White sharks (commonly known as Great White Shark) eat large prey like seals, dolphins and large fish like tuna, rays and even other sharks. Their jaws can move forward as well as down to help capture prey. Their teeth are serrated like a knife. The teeth on the bottom jaw are pointed for piercing and holding onto their prey, while their serrated upper teeth act like a saw.

Shortfin mako shark © Alessandro De Maddalena via Shutterstock

Mako eat small slippery fish. They have very sharp, pointy, non-serrated teeth to grasp onto small fish. A mako's teeth are so large they can't fully close their mouth. They are also the fastest shark in the ocean - reaching up to 45mph - making them fierce predators.

Basking shark © jidanchaomian via Flickr

Basking sharks eat plankton, which are tiny animals and algae in the water column. They filter the water through their gills to capture plankton, and can filter 2000 tons of seawater per hour. Though they don't use teeth for feeding, they do have hundreds of tiny hooked teeth.

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Sharks Fact File

Horn sharks are bottom feeders, feeding on crabs and shellfish that have sharp outer shells. Their front teeth are pointed to pierce with and their back teeth are flat and molar-like for crushing their prey.

Horn shark © Ed Bierman via Flickr

Cookie cutter sharks eat squid and small fish but also feed on large prey such as tuna, dolphins and other sharks. They bite small chunks out of their prey without killing it. Cookie cutter sharks use their top teeth to attach on to prey, and then use their razor sharp bottom teeth to slice, twisting their body to create a circular cut. This round mark left on their prey is why they are referred to as the cookie cutter.

Cookie cutter shark teeth © JSUBiology via Flickr

Threats to sharks

Sharks have been around for millions of years, but today they are in serious decline, with many shark species under threat of extinction. Sharks are slow-growing species, with some sharks like hammerheads producing very few young, making them more susceptible to threats.

Sharks are at the top of the food chain in virtually every location they're found. Their presence indicates a healthy marine ecosystem. If we lose sharks, something will have gone seriously wrong with our seas.

It's estimated that a staggering 100 million sharks are killed every year worldwide because of unsustainable fishing practices, shark finning, overfishing, pollution and habitat destruction. If this continues, we are in danger of losing many of our iconic shark species forever.

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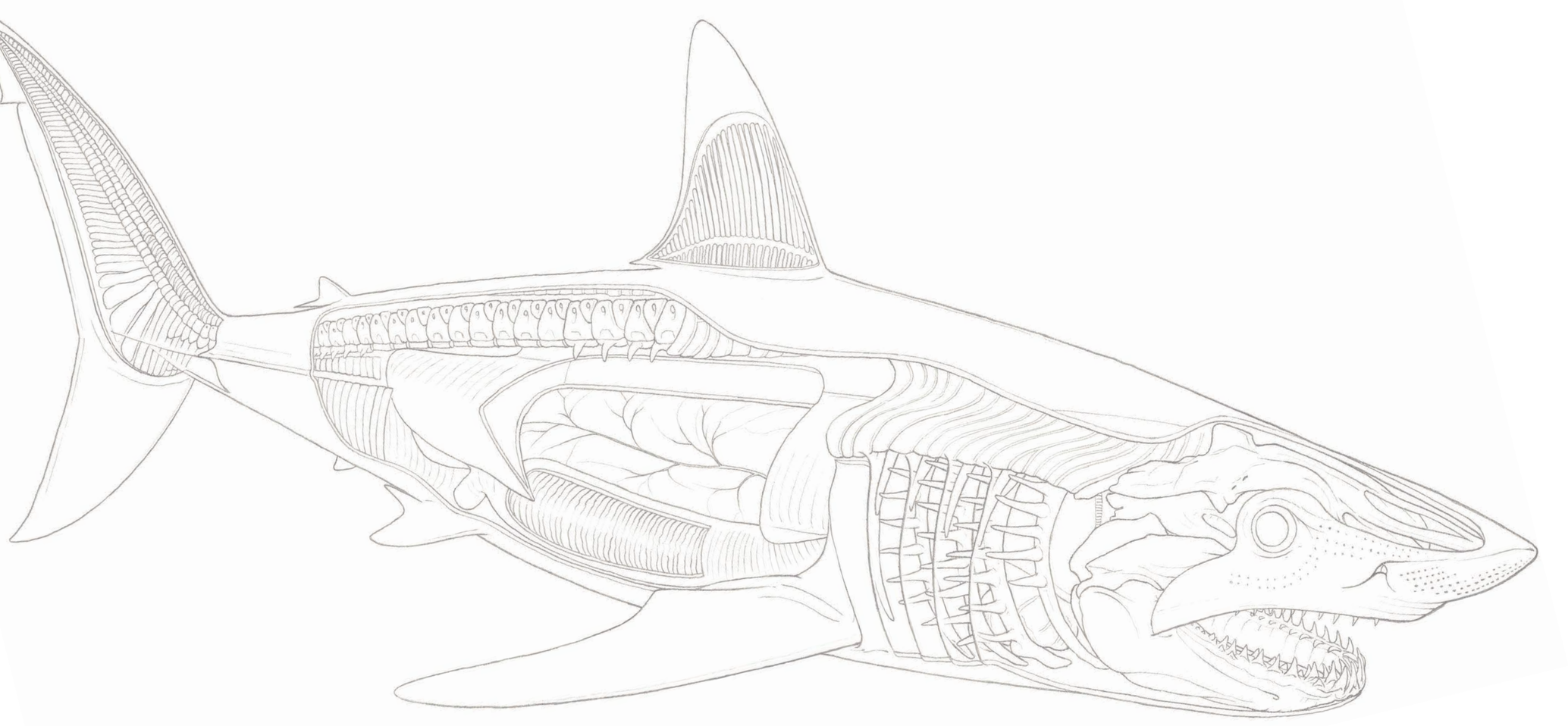
SHARK ANATOMY



SHARK ANATOMY

Skeleton

This is made of cartilage – just like human ears and noses. Cartilage is flexible and enables a shark to move quickly through the water. It is also light so keeps the shark buoyant.

Muscle

Sharks have two types of muscles that move the skeleton. Red muscle breaks down fat providing energy for long distance swimming. White muscle breaks down sugars, enabling the shark to make short fast sprints when catching prey or escaping danger.

Liver

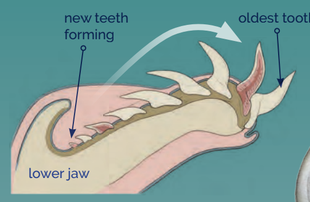
A large oily liver provides a shark with neutral buoyancy, so it doesn't sink or float.

Dorsal Fin

This keeps the shark steady and upright.

Jaws

The jaws are not attached to the skull, so a shark is able to quickly shoot its jaws forward to catch prey.



Teeth

Most sharks have several rows of teeth - as the front row wears down a new row moves in from behind to replace them, like a conveyor belt. Some sharks can lose 30,000 teeth in their lifetime!

Caudal Fin

The tail is used to propel the shark forward through the water.

Pelvic Fin

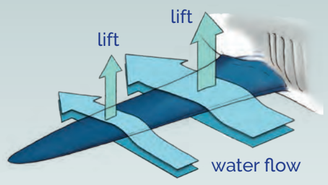
Spiral Valve

The spiral valve is part of the small intestine, its shape provides a greater surface area for digestion of food.

Stomach

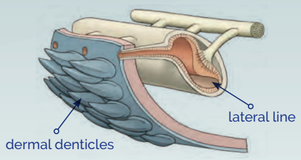
Pectoral Fin

Pectoral fins provide balance and are used to steer. They act like aeroplane wings, as water flows beneath them the shark is lifted up.



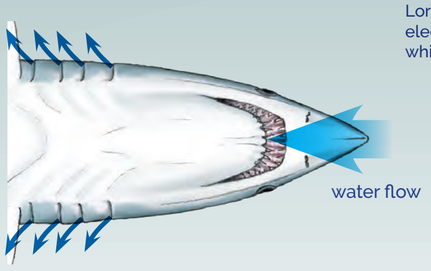
Lateral Line

Sharks are very sensitive to touch and can even feel pressure differences in the water. This is due to the lateral line, which is made up of nerve endings under the skin that run from the head down along the body.



Gills

As a shark swims forward water enters its mouth and passes out through the gills. Oxygen in the water is absorbed into tiny blood vessels near the gills, which is then carried around the body.

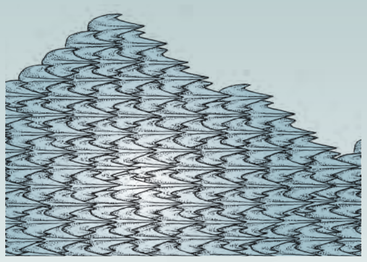


Ampullae of Lorenzini

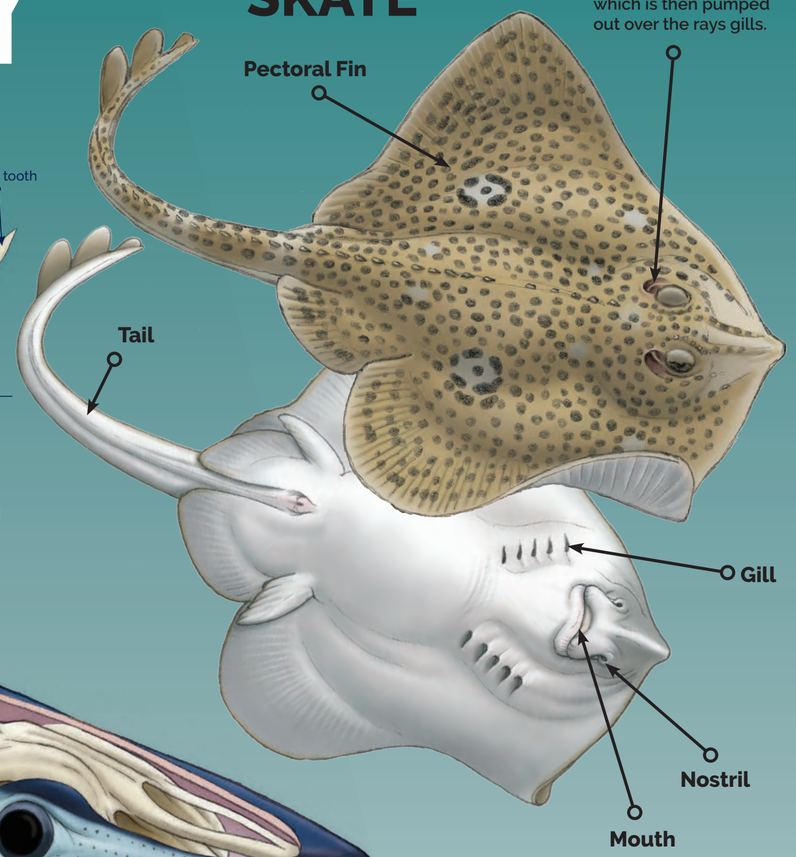
A shark's snout is covered in small pores called 'ampullae of Lorenzini', these can detect tiny electrical currents in the water, which are given off by prey.

Skin

A sharks' skin feels like sandpaper. It's covered with millions of tiny teeth-like scales called denticles, which point backwards, helping the shark to swim faster by reducing water resistance.



SKATE

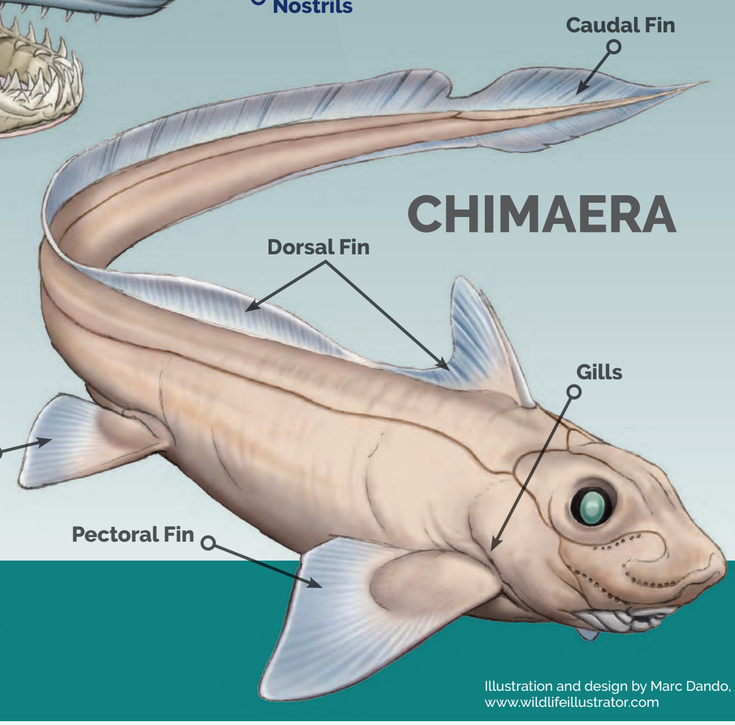


Spiracles

Spiracles behind the eyes draw water in, which is then pumped out over the rays gills.

Nostrils

CHIMAERA



SHARK TRUST

www.sharktrust.org

The Shark Trust works to advance the worldwide conservation of sharks, skates, rays and chimaeras, collectively known as Chondrichthyans.

Illustration and design by Marc Dando, www.wildlifeillustrator.com

Catshark life cycle

Adult shark

1

Egg

2

(commonly known as '**mermaids purse**')

Young

3

Not all sharks lay eggs

There are three ways sharks can reproduce:

1. Oviparity

Some sharks lay eggs. Another example is a horn shark, which creates a corkscrew shaped egg.

2. Ovoviviparity

Eggs hatch inside mother and then baby sharks are born fully developed. This is how Hammerhead sharks reproduce.

3. Viviparity

Baby sharks grow inside mother and are born fully developed. This is how Mako's reproduce.

Swimsuit technology

A shark's scales look like teeth and are called dermal denticles.

These make the shark really aerodynamic.

Swimsuit companies, like speedo, have designed swimsuits inspired by shark scales.

These shark skin suits aim to reduce drag in the water and make the swimmer more aerodynamic so they can swim faster.

Full body swimsuits are so good they were banned from the Olympics, because it was seen as cheating.

Aeroplane technology

A shark's scales look like teeth and are called dermal denticles.

These make the shark really aerodynamic.

Airbus and Lufthansa are two aeroplane companies that have been using this incredible shark adaptation as inspiration for their aeroplanes.

When aeroplanes fly fast there is natural resistance from the air causing drag.

By putting a textured surface on the aeroplanes which is similar to shark scales, the aeroplanes have been able to reduce resistance from airflow, making the aeroplane more aerodynamic.

Being more aerodynamic helps to save fuel.

Using less fuel will save the aeroplane companies lots of money and is much better for the environment.

Shipping technology

A shark's scales look like teeth and are called dermal denticles.

These make the shark really aerodynamic.

Shark skin is very rough because of these teeth-like scales.

This rough skin stops animals like barnacles from growing on their skin.

Boats have problems with animals growing on the hull (bottom) of the boat. This is a problem because it can slow the boats down.

Normally boats try to stop animals growing on the hull by using special paint but this paint can cause chemical pollution.

The US Navy have been studying shark skin to use the same design on the hull of their boats.

They hope the new design will reduce the number of animals growing on the boats and help the boats go faster.

Boats that are more aerodynamic will also save fuel.

Using less fuel will save money and be better for the environment.

Hospitals

A shark's scales look like teeth and are called dermal denticles.

Shark skin is very rough because of these teeth-like scales.

This rough skin reduces the number of bacteria growing on its surface, because bacteria prefer smooth surfaces.

Bacteria don't have the energy to colonize (grow) on rough surfaces and therefore die.

In hospitals it is really important to kill bacteria to stop diseases spreading.

The company Sharklet make products for hospitals that have a textured surface similar to rough shark scales to reduce bacteria.

Whose teeth are these?

Name: _____

_____

What shark is this? _____

What shark is this? _____

What shark is this? _____

What shark is this? _____

What shark is this? _____

Small fish

Tuna

Ray

Plankton

Other sharks

Squid

Dolphin

Crab

Shells

Can you match the sharks teeth with the food they eat?

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Sounds of the Deep

Sharks aren't scary:

Experiences and Outcomes

Science

I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. **SCN 2-0**

I can use my knowledge of the interactions and energy flow between plants and animals in ecosystems, food chains and webs. **SCN 2-02a**

By investigating the lifecycles of plants and animals, I can recognise the different stages of their development. **SCN 2-14a**

Through research and discussion I have an appreciation of the contribution that individuals are making to scientific discovery and invention and the impact this has made on society. **SCN 2-20a**

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. **SCN 2-20b**

Technologies

I can recognise basic properties and uses for a variety of materials and can discuss which ones are most suitable for a given task. **TCH 2-10a**

English and Literacy

I can select ideas and relevant information, organise these in an appropriate way for my purpose and use suitable vocabulary for my audience. **LIT 2-06a**

I regularly select subject, purpose, format and resources to create texts of my choice. **LIT 2-01a**

I am developing confidence when engaging with others within and beyond my place of learning. I can communicate in a clear, expressive way and I am learning to select and organise resources independently. **LIT 2-10a**

I consider the impact that layout and presentation will have and can combine lettering, graphics and other features to engage my reader. **LIT 2-24a**

I am learning to use language and style in a way which engages and/or influences my reader. **ENG 2-27a**

I can persuade, argue, explore issues, or express an opinion using relevant supporting detail and/or evidence. **LIT 2-29a**

With thanks to our partners

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