Key Stage 4 Worksheet

Earth LIVE Lessons: Why Sharks Matter?

What is it about?

In this video, marine conservation biologist and researcher Dr David Shiffman from Arizona State University talks about:

- Shark biology
- Shark ecology
- Threats to shark survival

Watch the video here:
www.youtube.com/watch?v=REkG27DJ1_Y

Open the file in your web browser to click on the links.

Some key facts:

- There are more than 1000 species of sharks and rays and more are discovered all the time.
- Shark fossils date back more than 400 Million years, sharks have outlived dinosaurs and many other species.
- Sharks weigh up to 11 tons and species exist that are just 8 inches long and up to 40 feet long.
- 143 species of shark are under threat, listed by the International Union for Conservation of Nature (the group who monitor extinction and threats to wildlife) from 'vulnerable' to 'critically endangered'. Read more about it **here.**
- Most sharks are cold-blooded but Great White's are partially warm-blooded
- The basking shark is Britain's largest fish (and the second largest in the world). It can grow up to 11 metres long and weigh up to 7 tonnes - about the size and weight of a double-decker bus. Read more about it **here.**
- Sharks have a sensory organ on their nose tip that senses electrical fields emitted by animals nearby – they use it for hunting and it is called the 'Amupllae of Lorenzini'. Read more about it **here.**
- Something to watch? Check out biologist Lizzie Daly diving with Sharks **here** and discussing shark sanctuaries and the positive impact they have on numbers.

What is this about?

In this video, marine conservation biologist and researcher Dr David Shiffman from Arizona State University talks about shark biology and ecology, and threats to sharks' survival.

Sharks, along with skates, chimaeras and rays, are cartilaginous fish, with a skeleton made from cartilage rather than bone. Cartilage is less dense, more flexible and heals faster than bone.

Sharks are able to sense electric fields (electroreception) and magnetic fields (magnetoreception). Electroreception enables sharks to detect animals hidden in the sand, as they can detect the electric field emitted by their prey. Magnetoreception helps sharks to navigate using the Earth's magnetic field, an advantage in the ocean where there are few landmarks by which to navigate.

Most fish reproduce by spawning, whereby the female lays eggs and the offspring develop outside of her body. This is less energetically expensive for the mother than the young developing inside of her, so most fish have a large number of offspring, but most do not survive.

Sharks, however, have multiple different modes of reproduction. Although some sharks do lay eggs, others are viviparous (give birth to live young), and in some species, the young develop inside eggs within the mother's body – a phenomenon only observed in sharks. Some species can also undergo parthenogenesis, a process by which the mother shark produces young genetically identical to herself (clones).

Compared to other fishes, sharks have relatively few young at a time, relatively infrequently and late in life, which means their populations recover more slowly from overfishing than other fish species do. The most severe threat to shark populations is unsustainable fishing (overfishing) for their meat and fins, and bycatch, i.e. accidental capture in fishing nets. Sharks may also, to a lesser extent, be affected by climate change and plastic pollution.

Sharks are an important part of a healthy ocean ecosystem, with ocean predators helping to maintain the balance in the food web by controlling the numbers of their prey.

This lesson also explores some lesser-known of the 551 species of shark, including their key morphological and behavioural adaptations. These include critically endangered river sharks; thresher sharks, which use their long tail as a whip to stun their prey; filter-feeding basking sharks, which can be found off the coast of the UK; and the megamouth shark, which lives in the dark depths of the ocean and possesses glow-in-the-dark outer gums to attract its prey to swim into its mouth.

Find out more about it

- Dr Shiffman is available to respond to questions on social media (@WhySharksMatter).
- Discover more **behavioural adaptations** of sharks.
- **Find out more** about how sharks help to create a healthy ocean ecosystem and maintain a stable marine **food web.**
- Explore which fish and other seafood sold in the UK comes from sustainable and unsustainable fisheries in the **Marine Conservation Society's Good Fish Guide.**
- Explore which sharks, and other species, are critically endangered on the **IUCN Red List.**
- Investigate how fisheries are managed sustainably in Wales, using a whole ecosystem approach **here.**

Questions

Interactive: Click on box to start typing

What does a fishery need to do to operate in a sustainable way?

If more fish are caught than are replaced through reproduction, the population size will decrease and eventually there won't be any left.

What effect does removal of sharks have on other species in ocean food webs, and why?

Sharks are predators and help to limit the numbers of their prey. Removing them disrupts the balance in the food web and will increase the numbers of their prey.

As well as the five standard senses, what additional senses do sharks possess and how do they use them?

Electroreception - to detect electric fields allowing sharks to find prey hidden in the sand.
Magnetoreception - to detect magnetic fields, allowing them to navigate using the Earth's magnetic field.

What are the advantages and disadvantages of giving birth to live young rather than laying eggs?

Giving birth to live young uses more energy and fewer young can be produced. However, young developing inside the mother's body are better protected. Relatively few of the young produced by laying eggs survive.

What behavioural and physical adaptations do the sharks described in the video possess, and how do they use them?

The megamouth shark lives in the depths of the ocean and has glow-in-the-dark gums to be able to see. Thresher sharks have long tails, which they use to whip and stun their prey. The mouths of basking sharks are adapted for filter-feeding at the surface of the water.

Exercise

Research at least three shark species that were not covered in the video (for example the whale shark, hammerhead shark and great white shark) and for each of them describe their specific physical and behavioural adaptations.

Whale shark - Whale sharks are very large, and swim along with their mouths open, causing prey to be trapped inside. They can then close their mouths and expel the water, trapping the prey. They have small teeth, helping them to feed on plankton. Whale sharks have a mottled pattern, helping to camouflage them. They also pump water over their gills when resting on the sea bed to ensure they get enough oxygen.

Hammerhead shark - Hammerhead sharks have their eyes set widely apart, which gives them a much bigger field of vision than most sharks, making it easier for them to spot their prey. They have enhanced electroreception compared with some other sharks, as their favourite prey is rays, which are well-camouflaged and tend to be buried in the sand.

Great white shark - The great white shark has a streamlined, torpedo-shaped body, reducing drag and allowing it to swim very quickly in order to catch its prey. These sharks are large, with powerful muscles and tails, and possess sharp teeth. All of these adaptations enable the great white shark to be a successful predator of large prey.

For teachers and home schoolers

Links to Science in the National curriculum for Wales (KS4)

AS Biology: Basic Biochemistry and Cell Organisation: Genetic information is copied and passed on to daughter cells [(e) the differences between mitosis and meiosis, including that mitosis produces genetically identical daughter cells whereas meiosis produces non-identical daughter cells] – the role of mitosis and meiosis in the different reproductive strategies of sharks (egg formation and parthenogenesis).

AS Biology: Biodiversity and Physiology of Body Systems: All organisms are related through their evolutionary history [(a) the classification of organisms into groups based on their evolutionary relationships and that classification places organisms into discrete and hierarchical groups with other closely related species] – the classification of sharks and the morphological differences between cartilaginous fish and bony fish.

AS Biology: Biodiversity and Physiology of Body Systems: All organisms are related through their evolutionary history [(n) the different types of adaptations of organisms to their environment including anatomical, physiological and behavioural adaptations] – the adaptations of sharks in general (e.g. electroreception and magnetoreception), and the adaptations of different species to catch prey in different parts of the ocean (e.g. in the dark depths).

A2 Biology: Energy, Homeostasis and The Environment: Population size and ecosystems [(a) populations and the way in which they grow - a simple quantitative treatment including immigration, emigration, birth and death rates; (h) the transfer of biomass from plants to animals including trophic levels, efficiency of transfer; gross and net production and pyramids of biomass] – the importance of sharks as predators in maintaining functioning ocean food webs, and the factors affecting shark population recovery.

A2 Biology: Energy, Homeostasis and The Environment: Human impact on the environment [(a) the reasons for species becoming endangered and causes of extinction; (d) the increased human pressures on the environment including the need to achieve sustainability by changes in human attitudes and making informed choices] – the threats to sharks and the ocean more widely (including climate change and plastic pollution), and the differences between the management of sustainable and unsustainable fisheries.

A2 Biology: Energy, Homeostasis and The Environment: The nervous system – how the electrical activity within prey animals enables sharks to detect them via electroreception, and how this sense works.

hwb.gov.wales/storage/779c7300-574d-4a12-a518-c873557d6a7a/science-in-the-national-curriculum.pdf

Swansea University Science for Schools Scheme

Swansea University Prifysgol Abertawe

EARTH LIVE LESSONS

UNDEB EWROPEAIDD EUROPEAN UNION

Llywodraeth Cymru Welsh Government

Cronfa Gymdeithasol Ewrop European Social Fund

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