



Sharks





Introduction

At first glance, the sea might seem like a big, monotonous chunk of water, spreading out into the distance until it reaches the horizon. However, if we take a look under the surface of this blue yonder, we are astonished by its depth and fullness of colours. The richness of different forms of life can be compared with the most colourful carnival, exposing the treasures of nature. Actually, nowhere else on Earth can we find so many different animal and plant species interacting and sharing their environment, with humans present only as occasional guests. Looking at the sea and all the life it supports, we can learn about its inhabitants, admire its harmony and compare ourselves to it. We might be tempted to try and learn how to swim like a dolphin or use sound to orient ourselves in the environment. In order to swim faster, we construct swimming suits resembling shark skin. We would like to hold our breath as long as sea turtles. We learn about ways sponges and starfish regenerate parts of their body or how planktonic sea algae create oxygen. People can learn a great deal from the sea, which is why we have to appreciate it and take care of it. Let's dive into the secrets of its inhabitants as real researchers of the marine world! Read the book, and have fun learning and playing!

experiment



Play and learn!

In every chapter you'll find a section called "Play and learn!", with many interesting assignments to complete. These experiments make learning and understanding facts about sharks much easier and more amusing.

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fish called sharks

Sharks belong to a group of fish called cartilaginous fish, with skeletons made out of flexible material called cartilage. Unlike bony fish with swim bladders, they have to move constantly or they will sink to the sea bottom. Their big, fatty liver helps them balance in the water column, but is not as effective as a swim bladder. Gill slits allow for water circulation over the gills, which differs from the operculum of bony fish. Both sharks and rays are cartilaginous fish.

Scientists have described 370 species of sharks, and only four have been known to attack humans. Despite that, sharks have a bad reputation of being dangerous man-eaters. This misrepresentation of sharks is the result of negative commercials, movies and novels depicting sharks far more deadly than they really are.

The Adriatic is home to about thirty shark species, none of which are dangerous to people.

exercise 1

Find four shark species in the crossword!

Nazivi:

- BLUESHARK
- GREATWHITE
- TIGERSHARK
- WHALESHARK

W	V	Y	J	V	R	H	B	Y	B
C	H	Y	U	J	V	B	W	X	W
I	Q	A	U	R	T	L	G	Q	C
Q	F	B	L	E	P	U	D	F	E
I	U	T	Z	E	M	E	B	T	X
U	H	A	D	H	S	S	I	R	N
T	I	G	E	R	S	H	A	R	K
B	L	N	J	O	W	A	A	W	T
J	R	L	Q	T	J	R	D	R	B
E	U	X	A	U	A	K	J	E	K
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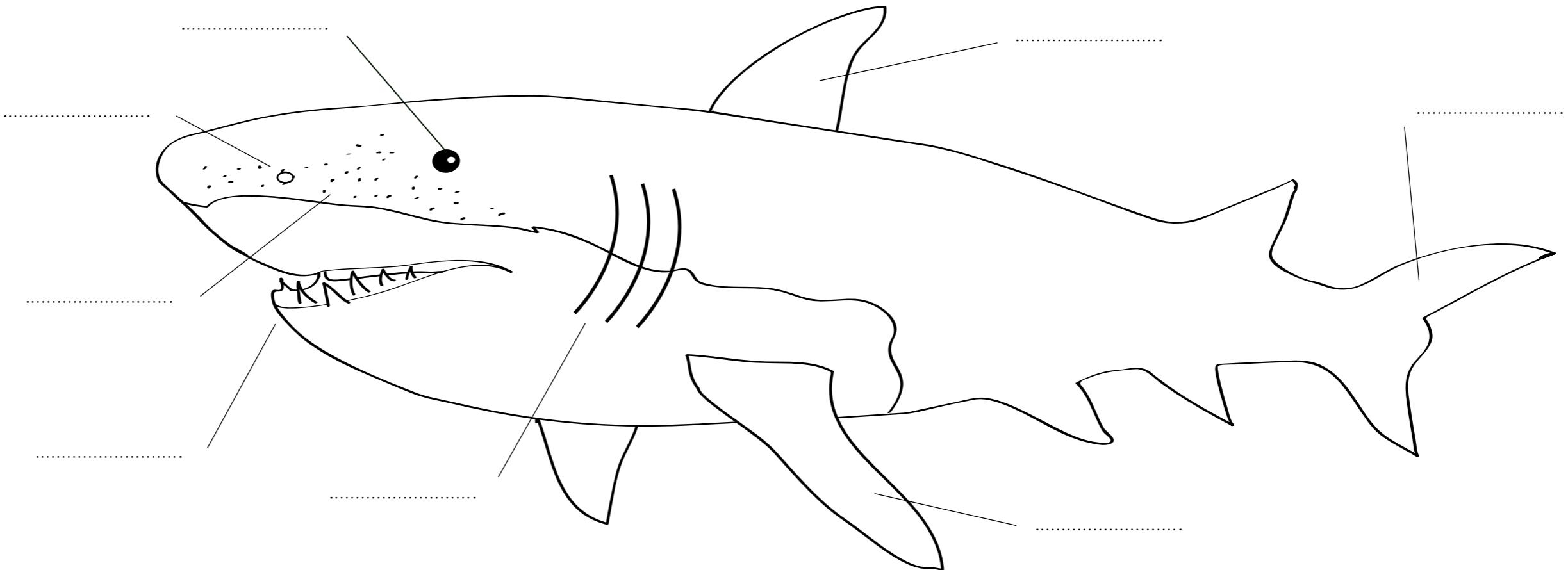




Body structure

exercise 2

Connect the body parts with their appropriate descriptions and place them on the picture!



- a) Nostrils
- b) Mouth
- c) Eyes
- d) Ampullae Lorenzini
- e) Gill slits
- f) Pectoral fins
- g) Lateral line
- h) Dorsal fin
- i) Caudal fin

The body shape of most sharks resembles a torpedo. They have a long, pointed snout, a horizontal mouth, big pectoral fins, a pointed dorsal fin and a tail with an elongated upper part. Their skin is covered with small teeth-like scales, making it as rough as sandpaper.

Nostrils - sharks have an extremely well developed sense of smell.
 Mouth - most of the species have sharp teeth set up in rows; when one falls out, the one from the row behind is there to replace it.
 Eyes - sharks have really good vision.
 Ampullae of Lorenzini - small pores with sensory cells enable the shark to detect electrical impulses.

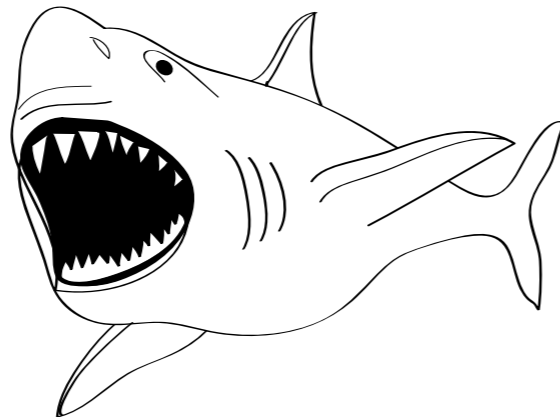
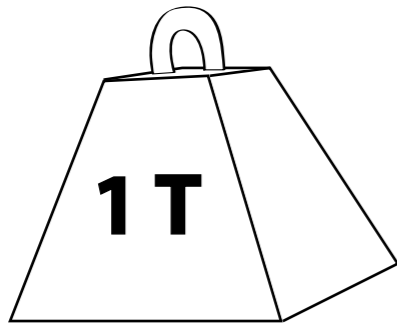
Gill slits - they enable seawater to flow over the gills where oxygen is taken up. Sharks have 5-7 gill slits.
 Pectoral fins - by appropriate positioning of these fins, sharks generate lift, allowing them to swim in the water column.
 Lateral line - a sensory organ they use to detect water currents.
 Dorsal fin - causes fear among swimmers because of the common misconception that sharks swim near the surface with the fin sticking out. In reality, this is not very common.
 Caudal fin - the upper part of this fin is longer than the lower part and helps in maintaining their balance.

The megalodon story

The first sharks probably appeared 450 million years ago, making them one of the oldest groups of vertebrates alive. Some species were around even before the dinosaurs. In the meantime, many of them evolved, and some have gone extinct at different points in time. There was one particular species so large and powerful that it is considered one of the largest predators of all time - the megalodon.

Megalodon appeared 17 million years ago and became extinct 2 million years ago. Fossils were found all around the world indicating the sea level was once much higher than today. Megalodon was the biggest shark that ever lived, and could grow up to 18 metres long. Unfortunately, shark skeletons are made out of cartilage, so a complete skeleton was never recovered. Their length was calculated using the size of their teeth.

The shape of their teeth reveals that megalodon was an apex predator, probably feeding on large marine mammals. Its diet consisted of other sharks, large fish, dolphins and even small whales. It is estimated that they consumed around a ton of meat every day! Megalodon played an important role in the stability of the marine ecosystems. The megalodon example shows that even the largest predators can be very vulnerable and become extinct.



exercise 3

Using the map, mark countries where megalodon fossils were found. Try to draw a line, indicating where the border between land and sea once was.

Fossil records:

- Argentina
- Chile
- Cuba
- France
- Italy
- Japan
- Malta
- New Caledonia
- Peru
- USA (California, Florida, Georgia, Maryland, New Jersey, South Carolina)

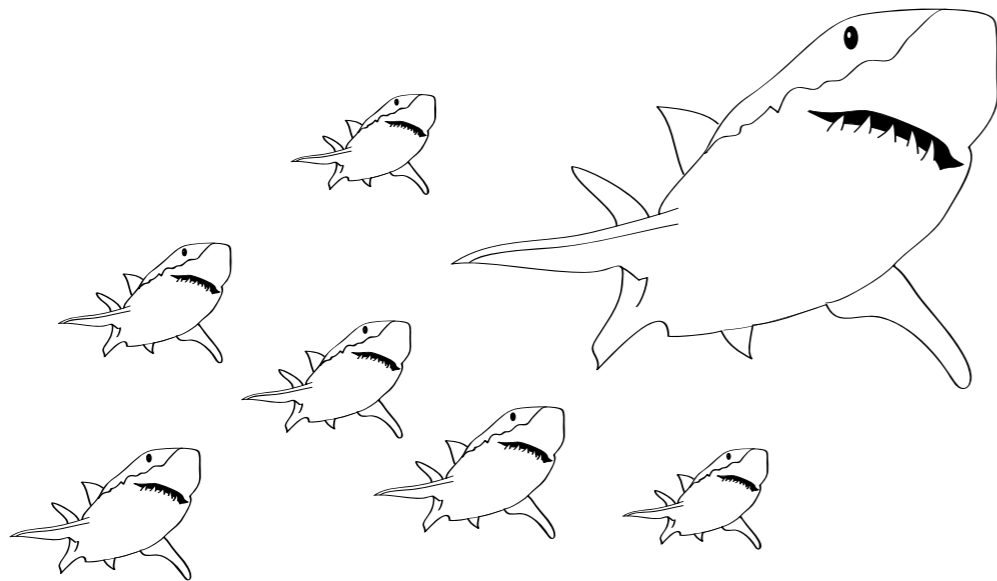


Shark life span

Most shark species give birth to live young. The eggs are fertilized inside the female and continue to develop. When they are born, baby sharks are completely formed and look like miniature copies of their parents.

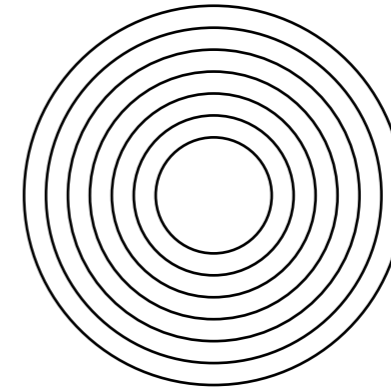
Some species, including the small spotted catshark, deposit egg-cases, so the baby sharks develop externally. They have long, curly filaments for attaching to seagrass or algae. Small catsharks emerge six to nine months later. Empty cases called "mermaid's purses" stay on the sea bottom, and are sometimes washed up on the shore.

Sharks are cold-blooded animals and their body temperature depends on the sea temperature. This means they grow at different rates throughout the year, which is reflected on their cartilaginous spine where you can spot growth rings. Similar to tree rings, the darker areas are the result of slower growth rate during winter period, while lighter rings form during fast growth in the summer. Counting the number of rings can give us an estimate of the age of an animal.



exercise 4

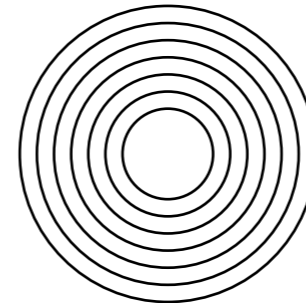
Considering you know that darker rings on the spine represent winters and lighter rings represent summer growth, determine how old were the sharks, whose spine cross sections are shown in the picture.



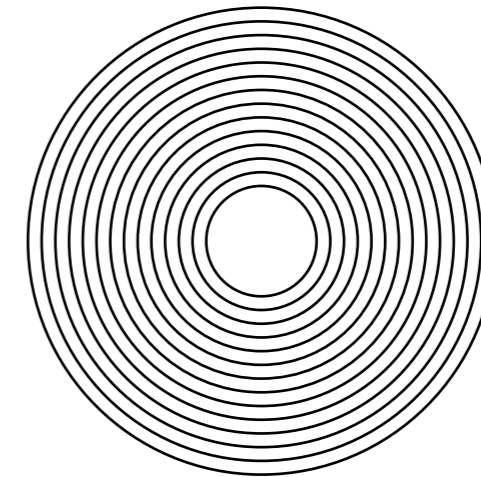
This shark was ___ years old.



This shark was ___ years old.



This shark was ___ years old.

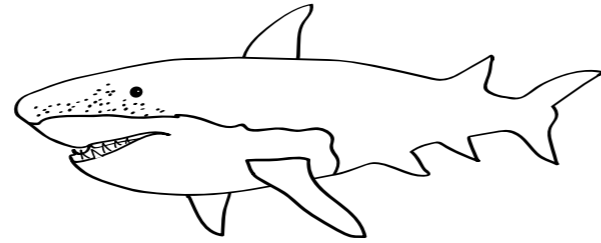


This shark was ___ years old.



Shark profiles

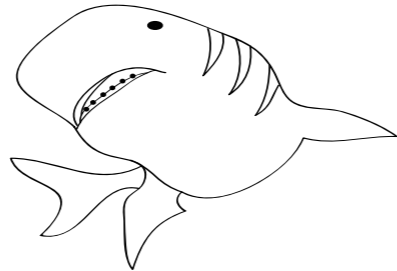
great white shark



This is probably the most famous shark species and can grow up to seven meters. Even though it is widely known as a large, fearless predator that is able to attacks humans, it actually prefers eating seals and sea lions. It is equiped with as many as 3000 sharp teeth placed in a few rows. When one tooth gets worn or falls off, the one from the back is there to replace it, which is true for other species as well. Many people are afraid they are going to see its dorsal fin on the sea surface.

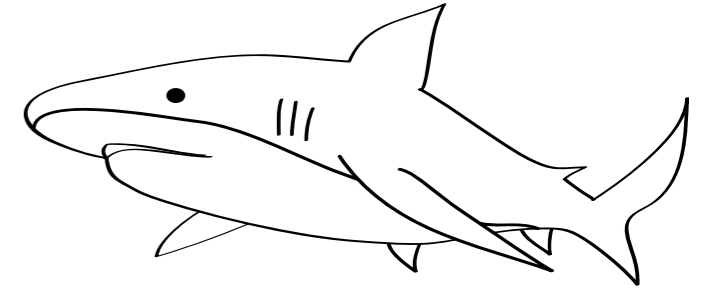
Great white sharks live in warm costal waters, and are most numerous near the coast of south Australia, South Africa and California. They are not permanent residents in the Adratic Sea but can sometimes wander to these waters as well.

tiger shark



This shark was named after tigers due to the stripes on its body. Tiger sharks are known for their voracious behavior. It will eat whatever gets in its way. Researchers have found sharks with cans, bottles, bicycle parts, sea turtle shells and other animal parts in their stomach. Like the great white, it can grow up to seven metres, but it lives in tropical waters, especially around islands in the central Pacific Ocean.

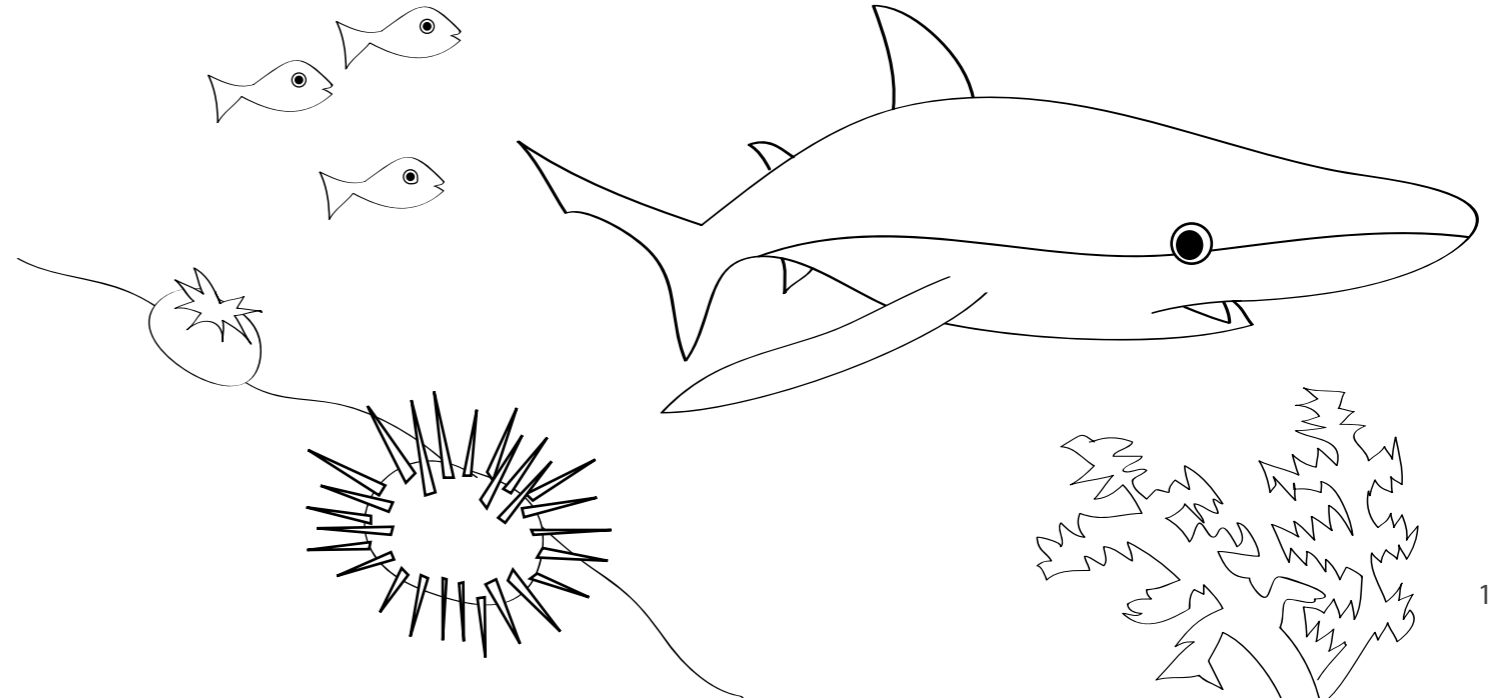
bull shark



The bull shark is one of the most dangerous shark species, with a potential for attacking humans quickly and suddenly. They grow to about 3.5 meters in length and inhabit tropical and subtropical waters across the world. This species often lives in rivers, swimming upstream. In the Amazon River it can sometimes be found a few thousand kilometers from the river mouth.

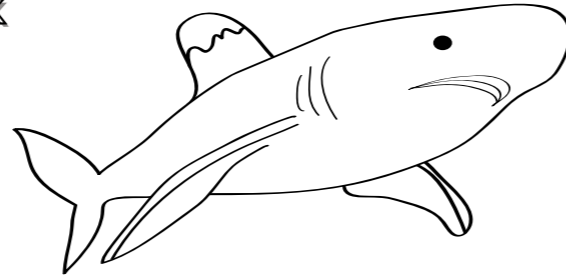
exercise 5

Colour the picture!





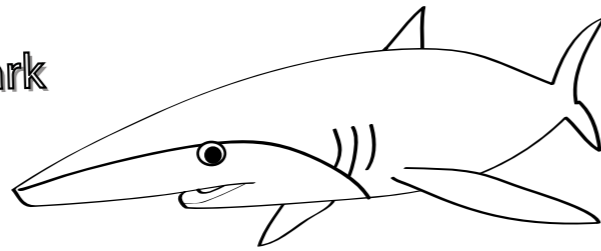
whitetip shark



This species can attack humans but is most famous for its long, oval pectoral and dorsal fins with white tips. It can grow up to 4 meters long, and is usually moving in groups in deep ocean waters of temperate climate.

Its fins are the main ingredient for the highly sought after soup in Asian countries, and are in high demand. Whitetip sharks are considered to be extremely threatened, with a high risk of extinction.

blue shark

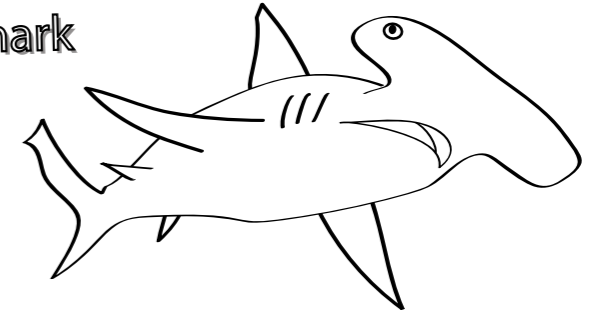


The blue shark is the only potentially dangerous shark permanently inhabiting the Adriatic. Attacks are rare because they live out in the open sea, where there are very few swimmers. People present a much greater threat to this shark than they do to us. They are frequently caught in fishing nets.

Blue sharks were named after their dark blue colour and can grow up to 4 metres long. They are fast swimmers and migrate to warmer water each season. This species is considered the most widely distributed shark in the world.



hammerhead shark

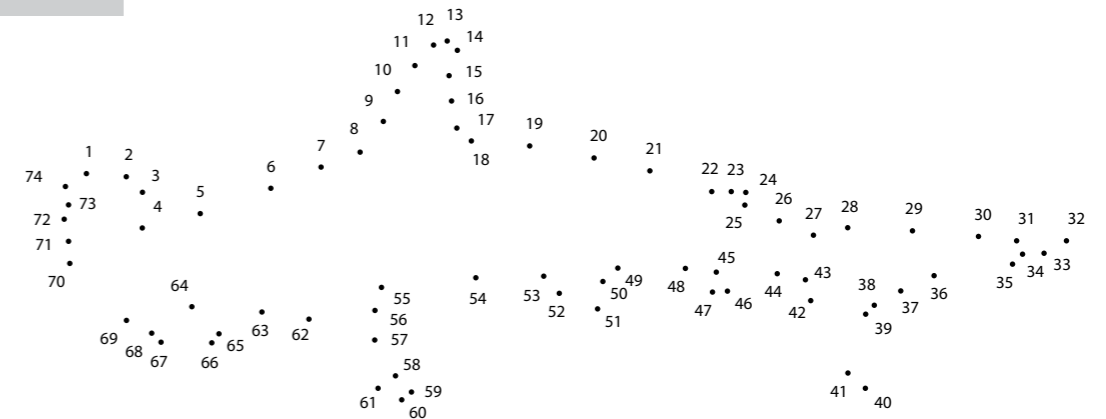


Hammerheads were named after the specific hammer-shaped head with eyes set on each end. Scientists believe this shape is well suited for easy movement through water and it enhances the sense of smell while broadening the field of view. It grows to around 4 meters in length, and has a characteristic big, pointy dorsal fin.

Hammerheads live in coastal waters of temperate and tropical climates, and are sometimes found in the Adriatic as well.

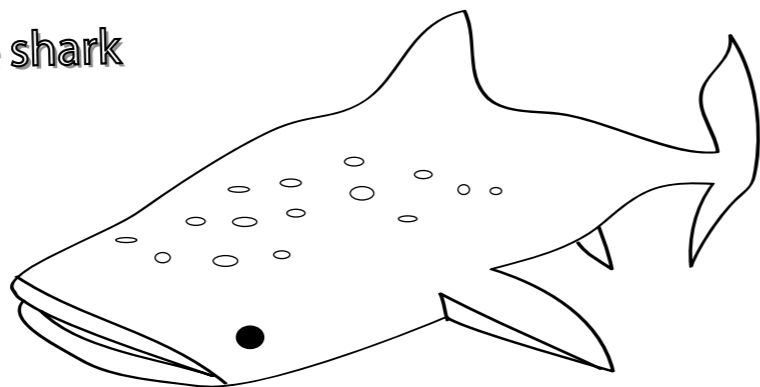
exercise 6

Connect the dots and discover what is hiding on the picture!



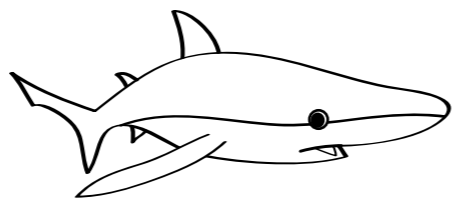


whale shark



The whale shark is 12 to 14 metres long and weighs up to 12 tons. It is the largest fish in the world. Due to its enormous size, whale sharks appear dangerous, but are totally harmless. It feeds on plankton by filtering seawater through its gills. It moves slowly just beneath the surface in tropical and temperate waters around the world, so it comes into the Adriatic from time to time.

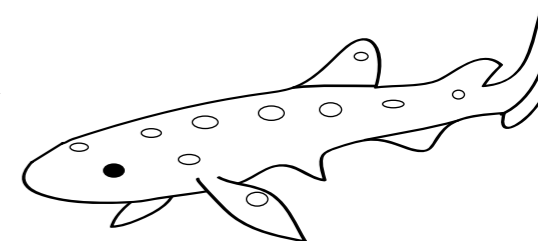
common
smoothhound



The smoothhound is one of the most common shark species in the Adriatic. It has plate-shaped teeth which enable it to crush its favourite food - molluscs, crustaceans and other invertebrates. It inhabits coastal areas in eastern Atlantic and the Mediterranean, where it is often caught in fishing nets and used for food.



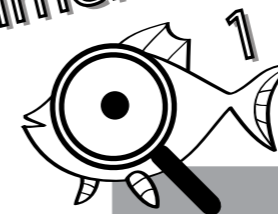
small spotted
catshark



Catsharks form a separate family of sharks, with the small-spotted catshark as the most common species inhabiting the Adriatic. It is one meter long and spends most of its time in shallow waters, next to the sea bottom. It is used in cuisine and considered the most frequently caught cartilaginous fish in the Adriatic.

Play and learn:

experiment



You need to prepare: a long ball of rope (100 meters), ruler, chalk

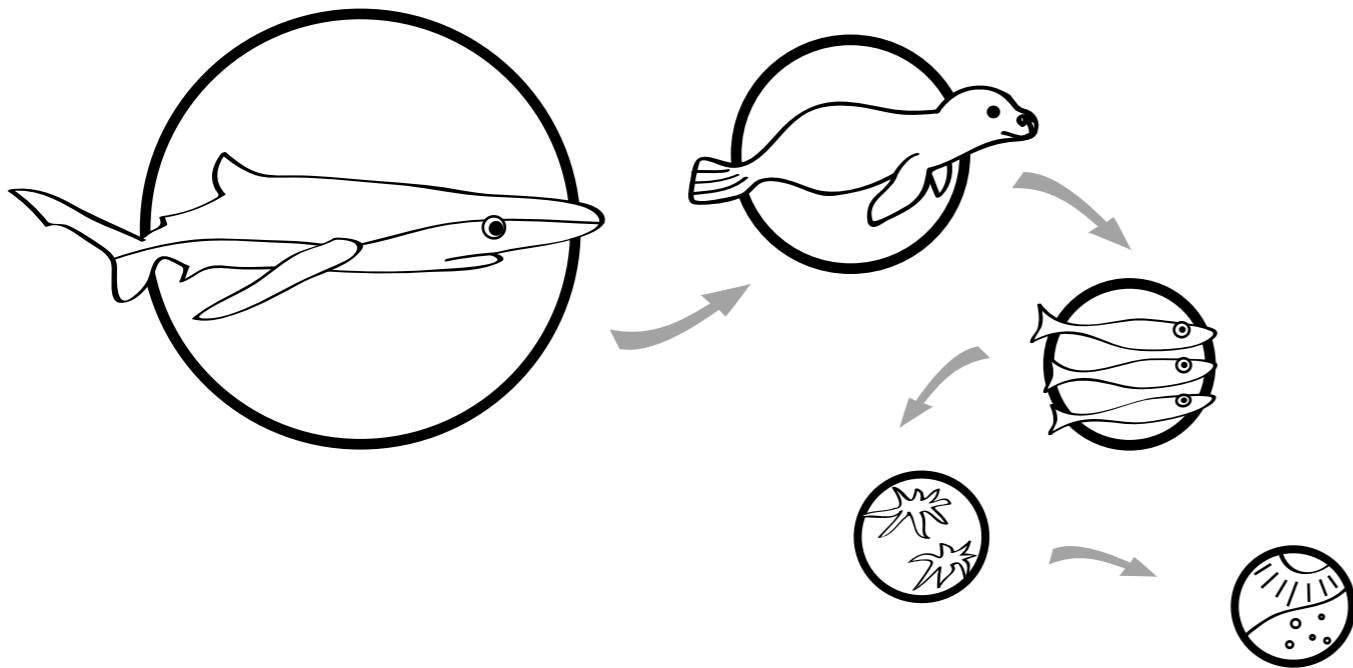
How big is a whale shark?

- 1 Bring all the necessary material and the guidelines. Go to an open space area like a playground or an empty parking lot.
- 2 Using the ruler, spread out the same length of rope a whale shark would occupy if it were laying across the playground (15 meters).
- 3 Using chalk, mark the beginning and the end of the rope. Try to draw a whale shark using the picture in the workbook (the mouth is about 1.2 meters wide).
- 4 Imagine how many whale sharks could fit in the playground/parking lot.
- 5 Calculate how many times a whale shark is bigger than any one of you!

Why are sharks important?

Despite sharks having a bad reputation as merciless predators, they play a key role in the natural balance in seas and oceans. They attack old, injured or sick animals, leaving healthy ones to survive and reproduce. In this way, only the best attributes are transferred to their offspring. They are also scavengers, even removing the waste people leave behind.

Like all living things, sharks occupy a significant position in food webs. Their importance is even greater considering the vast diversity of prey they feed on. By eating other predators they are directly impacting the survivorship of species preyed upon by these animals. Decreasing the number of sharks in the oceans changes the abundance of their prey, causing an imbalance in nature.



Play and learn: experiment 2



You need to prepare: a long ball of rope or wool (100 meters), paper, pencils and paper clips

Who is eating whom?

- 1 Use small papers to write down names of plant and animal species (as many as there are people in your class or group).
- 2 Place the pieces of paper in a box and have everyone pick one to pin to their shirt. Everyone is now representing a single organism.
- 3 Stand in the middle of a room or playground, and let the person who represents the biggest predator take the ball of rope and hold the end of it.
- 4 This player should choose another person or "find his prey", throwing the ball to them while still holding the end of the rope. For example, the player representing the great white shark can find a "seal" and throw the ball, "eating" him in the process.
- 5 The ball is now in the hands of the player representing a seal. He should hold on to the rope and throw the ball to his chosen prey and so on.
- 6 When the ball ends up in the hands of a player representing a plant-producer, they should find another big predator to throw the ball to. This is how the game continues and why the same people can be chosen several times.
- 7 All players should hold the rope throughout the game, so a food web is formed in the middle, connecting all organisms in the sea.
- 8 The game ends when everyone has a rope in their hands or there is none left. Find out how many food chains you created.





Threats

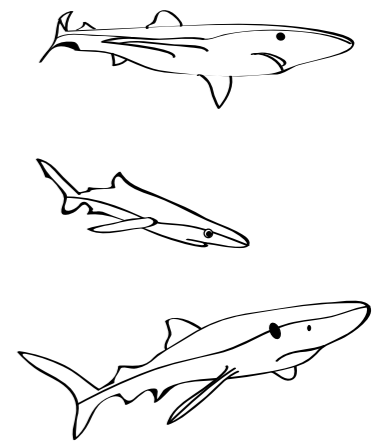
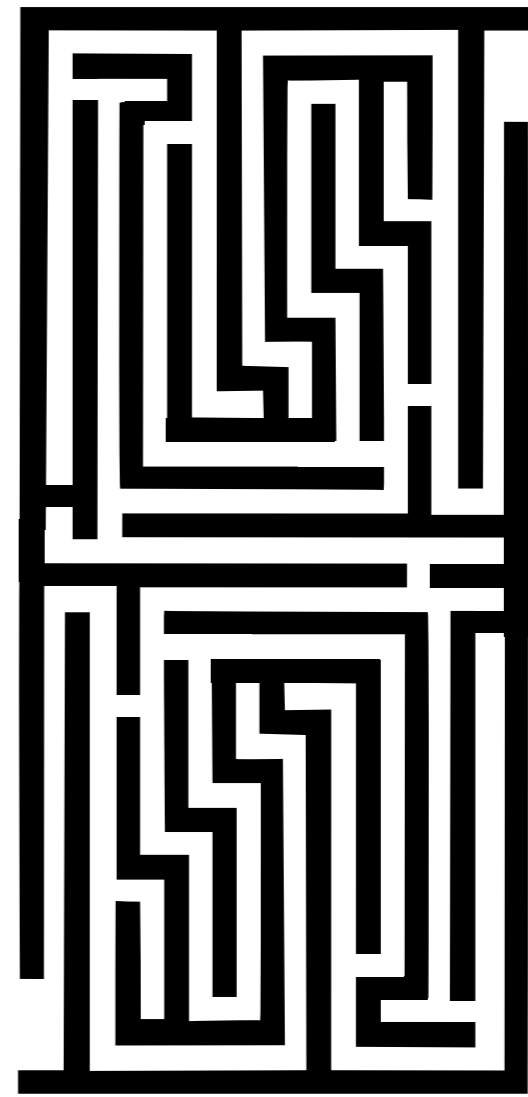
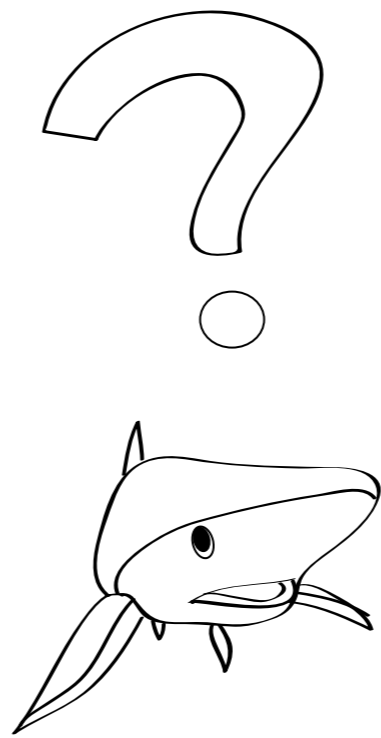
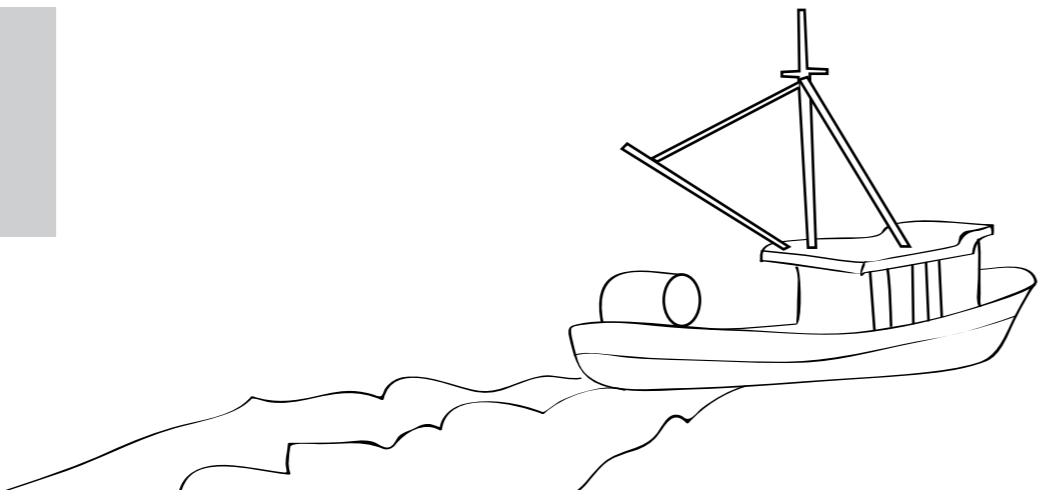
People present the biggest threat to sharks. Contrary to popular belief, sharks are the ones that should be afraid of people, not the other way around. Terrifying horror films and books, presenting these animals as bloodthirsty man-eaters, cause unnecessary fear and hatred among many people. These astonishing rulers of the sea are frowned upon even though most people have never seen one. As we have become aware of the importance of each species in nature, most of the sharks are now considered critically endangered and under threat of extinction.

Sharks are among the most endangered species due to overfishing. Millions of sharks get caught on longlines. There is high demand for sharkfin soup, especially in east Asia, so many of them will have their fins cut off and will be thrown back into the sea, where they will bleed to death.

Pollution and habitat loss have a big influence on sharks as well. They sometimes get hurt eating floating debris, but are mostly affected by the disappearance of other prey species, forcing them to change their diet and behaviour. Since there is less prey, sharks are more likely to mistakenly attack people instead of seals or other animals.

exercise 7

Help the little blue shark escape the fishing boat and join his group!



Protection

Many shark species are endangered and protected by laws around the world. There are also attempts at creating protected areas for sharks, even though sharks migrate and travel great distances. This makes it very difficult to confine them to certain areas where effective protection can be implemented.

Shark protection starts with educating people that they are more than just notorious predators. Sharks are beautiful marine animals and their absence would cause a huge change in marine ecosystems. Without them, many other species would disappear as well. This negative perception is slowly changing. Sharks are now depicted in comic books and are well known cartoon heroes, so there is hope modern generations will acknowledge their importance and forget the hostility.

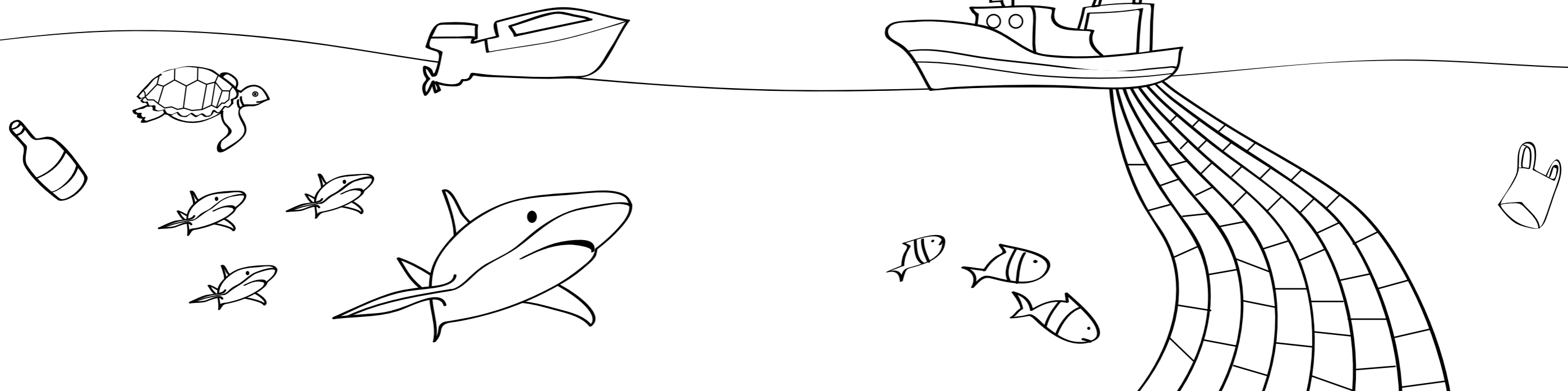
exercise 8

Look at the picture and find all threats to sharks!

Avoid buying souvenirs made out of endangered marine animal body parts such as products made out of sea turtle shells, shark teeth, noble pen shells, etc. In addition to being illegal, buying these encourages further poaching of these animals. It has been proven that the popular fin soup has no special health or other effects. Sharks are caught in a cruel way and we should aim to ban such fishing activities.

Act in ways that decrease unnecessary consumption of water and energy! Use public transport, turn off the tap while you are brushing your teeth, turn off the lights when exiting a room and buy domestic products that need not be transported from other parts of the world, etc. Think about the environment that is all around us!

Participate in programs taking care of the environment and support the organisations involved!





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