

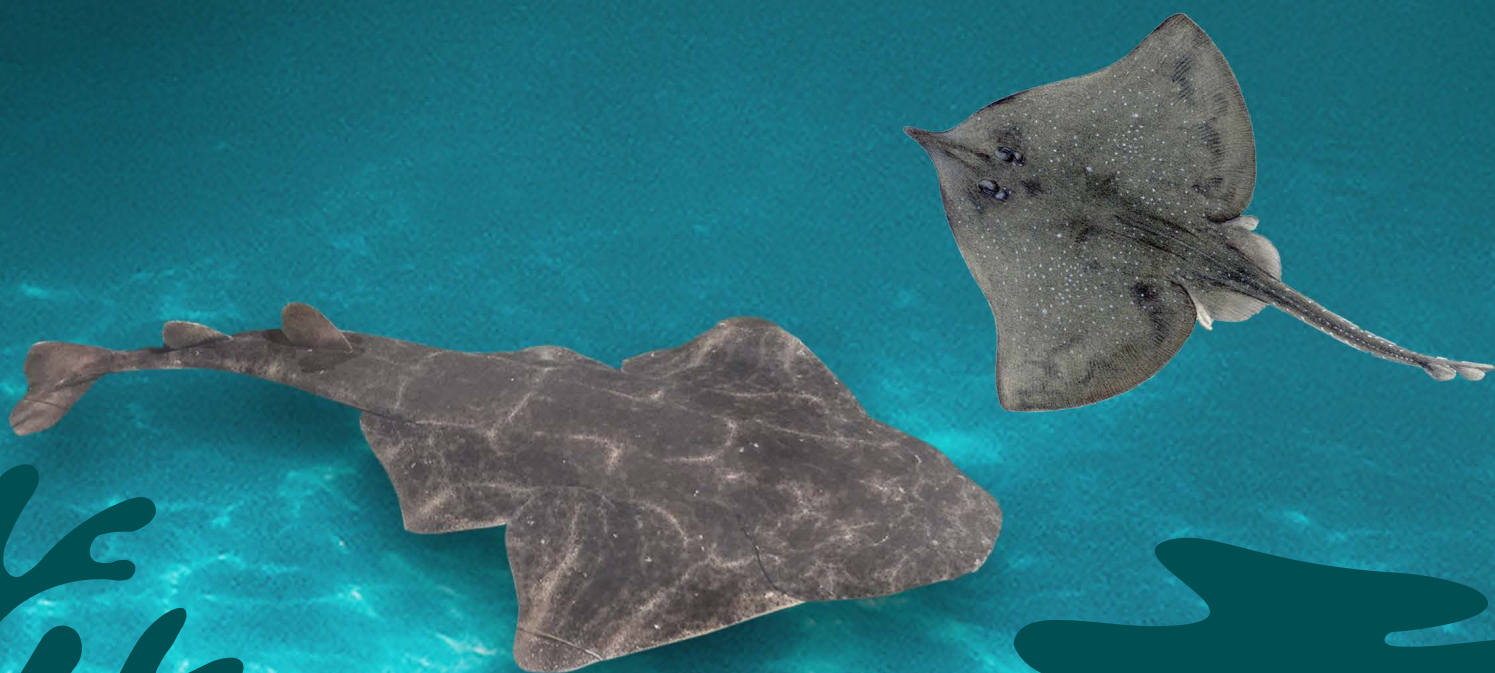


# EXPLORERS FIN-TASTIC SHARKS +



## An Introduction to Elasmobranchs for Children

By Cushla Dromgool-Regan, Danielle Crowley  
and Mona McCrea



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**Authors:** Cushla Dromgool-Regan & Danielle Crowley, Camden Education;  
Mona McCrea, SEASHOREKIDS

**Contributions:** Eimear Manning & Atalya Peritz, Camden Education

**Editors:** Gillian Mills, Camden Education; Catherine McCann, The Sea Collective

**Designers:** Design concept - Cushla Dromgool-Regan, Camden Education;  
Graphics - Designetc; Book design - Design West.

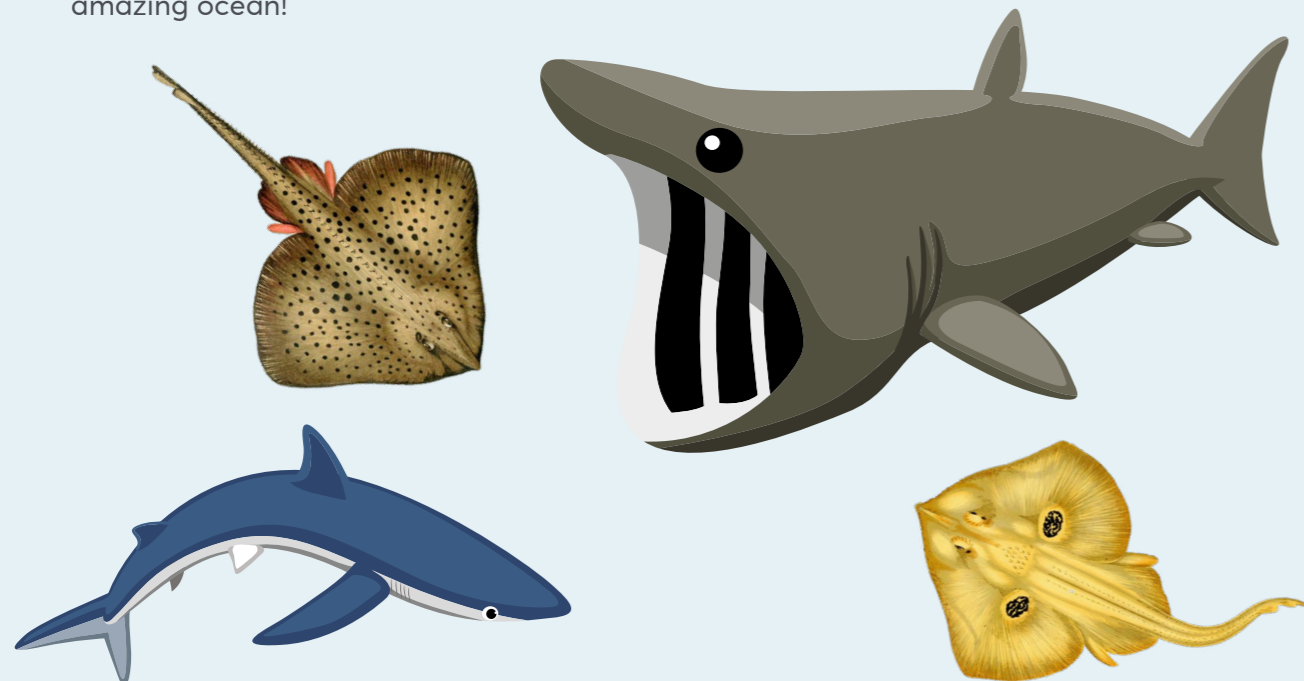
## Explorers Education Programme

The Explorers Education Programme team engages with primary schools, teachers and children, creating marine leaders and ocean champions. We love to create activities and resources for teachers, children and the education network, to help deliver ocean literacy to primary schools.

We aim to inspire children and educators to learn about our marine and maritime identity and heritage, and to make informed and responsible decisions regarding the ocean and its resources.

We also love to communicate about the ocean in a meaningful way, increasing the awareness and understanding of our marine biodiversity, the environment, as well as the opportunities and social benefits of our ocean wealth.

Check out our website and social media for lots of fun facts and information about our amazing ocean!



**Keep Exploring!**



## EXPLORERS FIN-TASTIC SHARKS +

Suitable for  
Teachers &  
Children  
**10-12** Years

Sharks+ sharks, skates &  
rays belong to a subclass  
of vertebrates known as  
Elasmobranchs

## An Introduction to Elasmobranchs for Children

By Cushla Dromgool-Regan, Danielle Crowley and Mona McCrea



Published by the  
Marine Institute

 *Foras na Mara*  
*Marine Institute*

# Thank You

The Explorers Education Programme team is extremely lucky to have friends who are leaders in shark advocacy, ocean literacy 'awareness' campaigns, and citizen science projects, all of whom have contributed to this book.

Dr Sarah Varian from Marine Dimensions was a leader in the citizen science project Purse Search Ireland. For many years Sarah inspired us where she was at the forefront of guiding the hunt for mermaid's purse on the seashore. Beach combing on an Explorers seashore safari would not be complete without finding a purse or two – and recording it.

We are indebted to Sarah for her work, for teaching and engaging us all over many years.

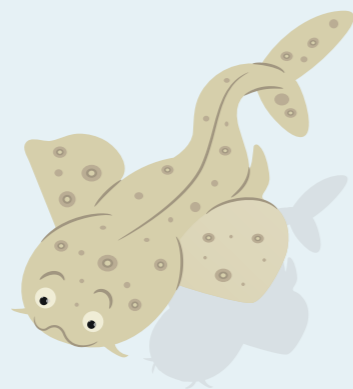
We would like to thank the marine scientists and the fisheries team from the Marine Institute and Trinity College Dublin, for their photos and information provided about sharks, skates and rays in Irish waters. We would also like to particularly thank Graham Johnston for his expertise and guidance. His scientific knowledge of sharks, skates and rays and the research carried out in Ireland has been an amazing source of inspiration to us, as well as lots of children he has presented to over the years.

We also want to thank two 'junior' scientists, Hugo Johnston and MacDara Flavin, who also love sharks. Their enthusiasm to learn and share their projects, fun shark facts and stories, and for helping out at events, has been a big influence on creating this book.

For many years, Galway Atlantaquaria has provided significant insight into the variety and different shark, skate and ray species in Irish waters. Galway Atlantiquaria plays a significant role in raising awareness about these species alongside the Explorers team in schools and at events.

We would like to thank our team Eimear Manning and Atalya Peritz for their great job gathering content about our favourite shark species in Ireland and sourcing some of favourite fin-tastic SHARKS + facts! We also want to thank Mona McCrea, SEASHOREKIDS, for reviewing the resources with teachers and children taking part in the Explorers Education Project modules in Dublin and Wicklow. Mona also worked with Cushla, producing the Explorers Fin-tastic Workbooks, Activity Sheet, Presentations for Teachers and Mermaid's Purses Identification key.

We want to thank the Explorers Education outreach team for their feedback on content development – especially for sharing their favourite facts and ideas for the complimentary Explorers workbook and activities sheet. This includes Dr Nóirín Burke, Rory McAvinney, Padraic Creedon, Natasha Howard, Paul Tuohy, Sorsha Kennedy, William McElhinney, Edmond Aylward, Jacintha Mullins, David and Catherine McCann, Tara Noonan, Jai Tuohy, Mervyn Horgan, Shazia Waheed, Sibeal Regan, Shona O'Dowd, Friederike Eimer, Claire Kelly, Jane Sharp, Eoin McMahon, Francesca Aaskov, Fergal Keogh and Gavin Beetlestone.



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# Introduction

Welcome to the Explorers Fin-tastic Sharks +. This book introduces some of our favourite shark, skates and ray species in Irish waters and around the world.

## 1,200+ SPECIES

There are currently over 1,250 shark, skate and ray species around the world. This number however is changing every year! In 1984, scientists had only discovered 342 shark species. With better technology, research ships, remotely operated vehicles and equipment, marine scientists are now finding new shark species - nearly every two weeks!

Some shark species are among the largest animals on the planet. The female whale shark can grow to 20 metres long. The oceanic manta ray can measure up to 7 metres across the width of its wings (disc).

Despite sharks being famous for their size, 80 per cent are smaller than a male adult human. In fact, 50 per cent of sharks reach less than one metre in length.

The smallest shark is the dwarf lantern shark. It is only about 20 centimetres long. You could hold it in your hand!

## Sharks+ from around the World

Sharks, skates and rays come in many sizes and are found in all five oceans of the planet - in the cold waters of the poles to the warm reefs in the tropics. They live in habitats near coastal shores and in deep seas, down to the abyssal depths of 3,000 metres.

They also come in lots of different colours: blacks, grays, to blues, and browns, oranges and yellows, to name a few.

Some sharks have stripes like tigers, and others have spots. Skates and rays can have a multitude of patterns too.

### Did you know...

A lot of adult female sharks grow to be larger than male sharks of the same species.

Many sharks, skates and rays have distinguishing features that also influence their names.

Check out the picture showing some of our favourite sharks. Can you guess why they were given their names...



**HUMAN - IRISH**  
1.78m | 69.9kg | 89yrs

There are a lot of sharks bigger than humans and also some as small as a human hand.



## SHARKS FROM AROUND THE WORLD

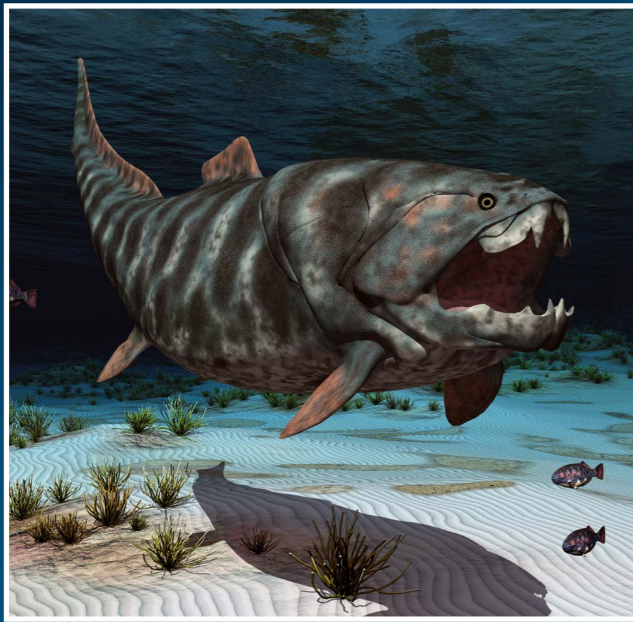
There are over 550 shark species in the ocean around the world.

<p><b>BASKING SHARK</b> (<i>Cetorhinus maximus</i>) 9.8m (female)   7.5m (male)   3,628kg (est)   50yrs (est)   0 - 2000m (depth)   IUCN Status: Endangered</p> <p><i>Basking sharks have been reported measuring up to 15m long!</i></p>	<p><b>MEGAMOUTH SHARK</b> (<i>Megachasma pelagios</i>) 7.09m (female)   5.49m (male)   weight &amp; lifespan unknown   150 - 600m (depth)   IUCN Status: Least Concern</p>	<p><b>WHALE SHARK</b> (<i>Rhincodon typus</i>) 20m (female)   17m (male)   34 tonnes (est)   80.4yrs   0 - 1,928m (depth)   IUCN Status: Endangered</p>	<p><b>TIGER SHARK</b> (<i>Galeocerdo cuvier</i>) 7.5m   807.4kg   50yrs   0 - 800m (depth)   IUCN Status: Near Threatened</p>
<p><b>GREAT WHITE SHARK</b> (<i>Carcharodon carcharias</i>) 5.94m (female)   5.5m (male)   1,100kg (est)   36 yrs   0 - 1,200m (depth)   IUCN Status: Vulnerable</p> <p><i>Great white sharks have been reported measuring up to 6.4m long!</i></p>	<p><b>GOBLIN SHARK</b> (<i>Mitsukurina owstoni</i>) 6.17m   30 - 1,300m (depth)   IUCN Status: Least Concern</p>	<p><b>BLUNTNOSE SIXGILL SHARK</b> (<i>Hexanchus griseus</i>) 6m   590kg   1 - 2,500m (depth)   IUCN Status: Near Threatened</p>	
<p><b>COMMON THRESHER SHARK</b> (<i>Alopias vulpinus</i>) 5.49m (female)   5.73m (male)   348kg   38yrs   0 - 650m (depth)   IUCN Status: Vulnerable</p>	<p><b>GREAT HAMMERHEAD SHARK</b> (<i>Sphyma mokarran</i>) 6.10m   449.5kg   30yrs   0 - 300m (depth)   IUCN Status: Critically Endangered</p>	<p><b>GREENLAND SHARK</b> (<i>Somniosus microcephalus</i>) 4.6m (female)   4.27m (male)   1 tonnes   392 - 500yrs (est)   0 - 2,992m (depth)   IUCN Status: Vulnerable</p>	
<p><b>LEMON SHARK</b> (<i>Negaprion brevirostris</i>) 3.4m   183.7kg   25yrs   0 - 92m (depth)   IUCN Status: Vulnerable</p>	<p><b>BLUE SHARK</b> (<i>Prionace glauca</i>) 4m   205.9kg   20yrs   0 - 1,082m (depth)   IUCN Status: Near Threatened</p>	<p><b>SHORTFIN MAKO SHARK</b> (<i>Isurus oxyrinchus</i>) 4.45m   505.8kg   32yrs   0 - 888m (depth)   IUCN Status: Endangered</p>	<p><b>NURSE SHARK</b> (<i>Ginglymostoma cirratum</i>) 4.3m   109.6kg   25yrs   0 - 130m (depth)   IUCN Status: Vulnerable</p>
<p><b>COMMON SAWSHARK</b> (<i>Pristiophorus cirratus</i>) 1.37m   8.2 kg   15yrs   37 - 310m (depth)   IUCN Status: Least Concern</p>	<p><b>SAND TIGER SHARK</b> (<i>Carcharias taurus</i>) 3.3m   158.8kg   35yrs   1 - 190m (depth)   IUCN Status: Critically Endangered</p>	<p><b>ZEBRA SHARK</b> (<i>Stegostoma tigrinum</i>) 3.54m   20kg   30yrs   0 - 90m (depth)   IUCN Status: Endangered</p>	<p><b>BLACKTIP SHARK</b> (<i>Carcharhinus limbatus</i>) 2.86m   122.8kg   12yrs   0 - 140m (depth)   IUCN Status: Vulnerable</p>
<p><b>DWARF LANTERN SHARK</b> (<i>Etmopterus perryi</i>) 20cm (female)   17cm (male)   0.9kg   30yrs (est)   230 - 530m (depth)   IUCN Status: Least Concern</p>	<p><b>BONNET HEAD SHARK</b> (<i>Sphyrna tiburo</i>) 1.5m   10.8kg   12yrs   10 - 80m (depth)   IUCN Status: Endangered</p>	<p><b>SMALL-SPOTTED CATSHARK</b> (<i>Scyliorhinus canicula</i>) 1m   3.7kg   12yrs   10 - 780m (depth)   IUCN Status: Least Concern</p>	

**KEY**  
Size (m) = metres. Unless specified, the length of the shark refers to the male species / or the gender has not been provided. | Weight (kg) = Maximum weight in kilograms | tonne = 1 tonne is equal to 1000kg  
Lifespan (yrs) = Maximum years sharks are reported to live for | Depth (m) = The depth range in which the shark species is found | International Union for Conservation of Nature (IUCN) Red List - showing the status of sharks risk of extinction.

Information about different shark species may vary, as new discoveries and research is carried out by scientists. Most data used for this graphic has been sourced from Fishbase.org

# Sharks from the Past



Sharks, skates and rays have been through many changes – and certainly don't resemble the animals of today!

Scientists divide the evolutionary history of sharks and their relatives into three major periods:

Shark-like creatures first appeared in fossil records dating back about 450 million years, long before the dinosaurs! Around this time, during the **Palaeozoic** era, fish were evolving and diversifying.

Many animals didn't have backbones, and some sharks shared the seas with weird fish such as the **Dunkleosteus** – an enormous placoderm (armour-plated fish) with jaws like shears.

After the placoderms disappeared, the shark-like species that lived during the **Devonian** to the **Carboniferous** period, (between 419 million and 358 million years ago), took on some very unusual shapes.

## Stethacanthus – The 'Ironing Board' Shark

**STETHACANTHUS** was a small shark, only 1.5 metres long and looked like a modern-day shark except for the bizarre feature on its back. Some scientists think this looks like an ironing board iron and so nicknamed Stethacanthus – the 'ironing-board' shark!

The 'iron' was covered in dermal denticles, giving it a bristly appearance. It was possibly used for display when mating.

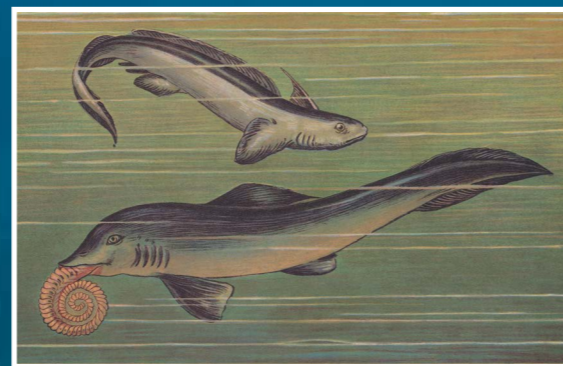


## Helicoprion – 'Buzz Saw Shark'

**HELICOPRION** is an extinct shark-like fish, closely related to the chimaera species.

Like sharks, helicoprion had teeth growing in a continuous, conveyor belt like manner. However, unlike sharks, the helicoprions' teeth grew in a unique whorl-like pattern!

Scientists have worked out that the teeth grew inside the helicoprion's bottom jaw – where the tongue would normally be. It could then extend its jaw out of its mouth and looked like a whirling spiral saw.



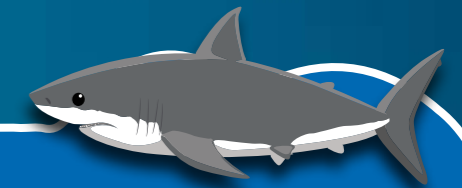
During the **Jurassic and Cretaceous period** (between 250 million and 65 million years ago), dinosaurs ruled the land. Shark species that we know today started to evolve during this period. Megalodons then began to roam the oceans. The earliest megalodon fossils date back 20 million years.

*Otodus megalodon* is more commonly known as **MEGALODON** – the largest predatory shark that ever lived. This mega shark is thought to be a close relative of the mako shark, but much bigger.

The largest females were thought to reach 18 metres long! The largest great white sharks reach a tiny 6.4 metres in comparison!

Megalodon teeth are triangular and are the size of an adult's hand whereas the teeth of the great white shark although similar in shape, are only 6 centimetres in size.

Megalodon was so big it was able to feed on large whales. As the climate changed however, and its prey and competitor species disappeared, it became extinct.



### Did you know...

Palaeontologists rely on teeth, vertebrae, and coprolites to help unravel the mystery of the animals that lived a long time ago.

**Coprolite** is the scientific term for fossilised poop!

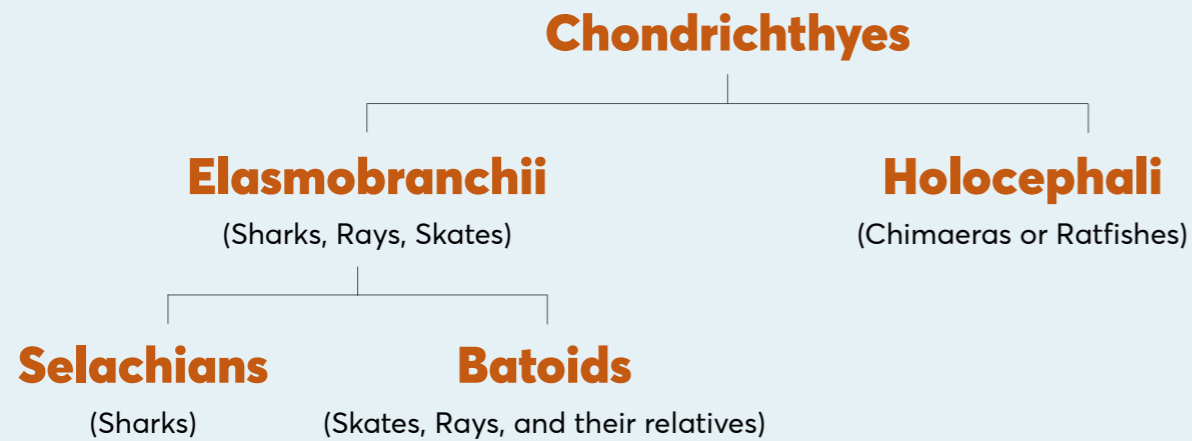


# What are Sharks, Skates & Rays?

Sharks, skates, rays and chimaeras are **vertebrates** and belong to a **class of fish** called **CHONDRICHTHYES** [Pronounced: cond-rick-these].

They differ from other fish as they have skeletons made of a light flexible material called cartilage – not hard bones. This is the same material that humans have in their noses and ears.

Scientists have split the sharks, skates and rays into different groups to help sort and classify them. This is called **TAXANOMY**.

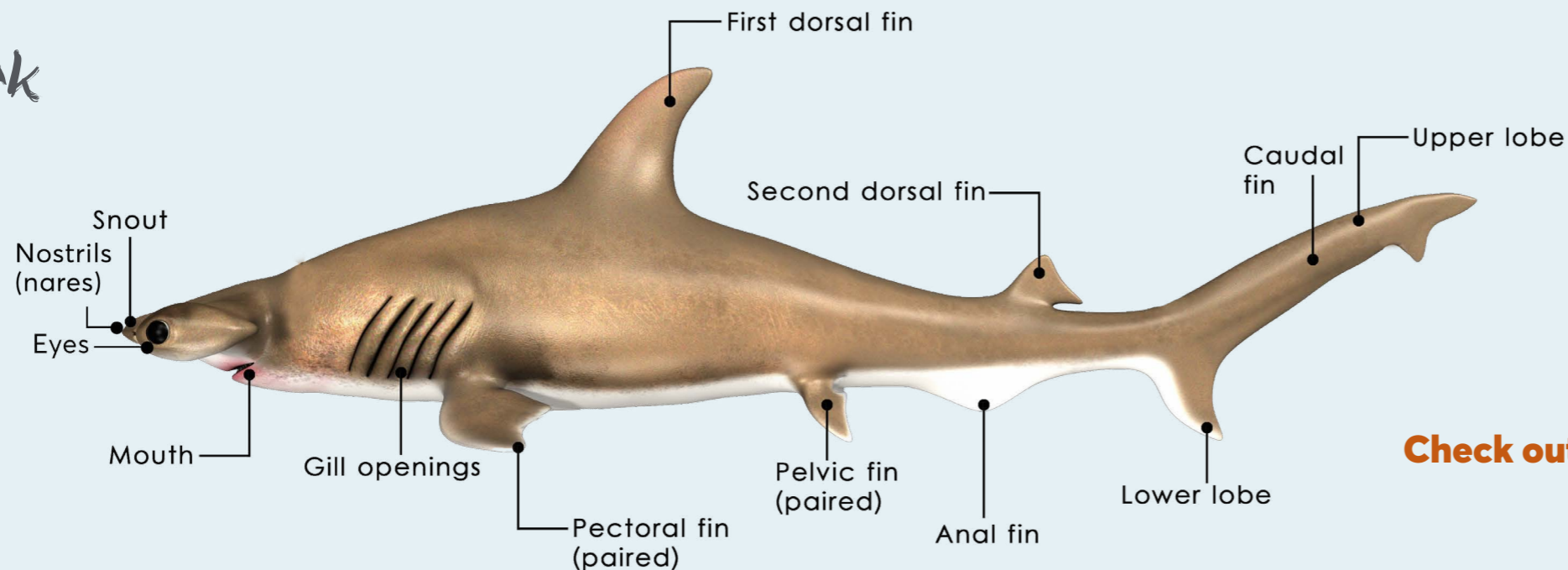


The class called Chondrichthyes is split into two subclasses: **Elasmobranchii** and **Holocephali**.

**ELASMOBRANCHS** are characterised by their body shape, gill openings, rigid dorsal fins, as well as their small placoid 'tooth-like' scales on their skin.

**SELACHIANS** include sharks. Most sharks have a rounded body, shaped like a long cylinder tapered at both ends. The most recognised part of a shark is the dorsal fin, which is often represented as slicing through the surface of the water. All sharks have 5-7 gill slits on the side of their body, near their head.

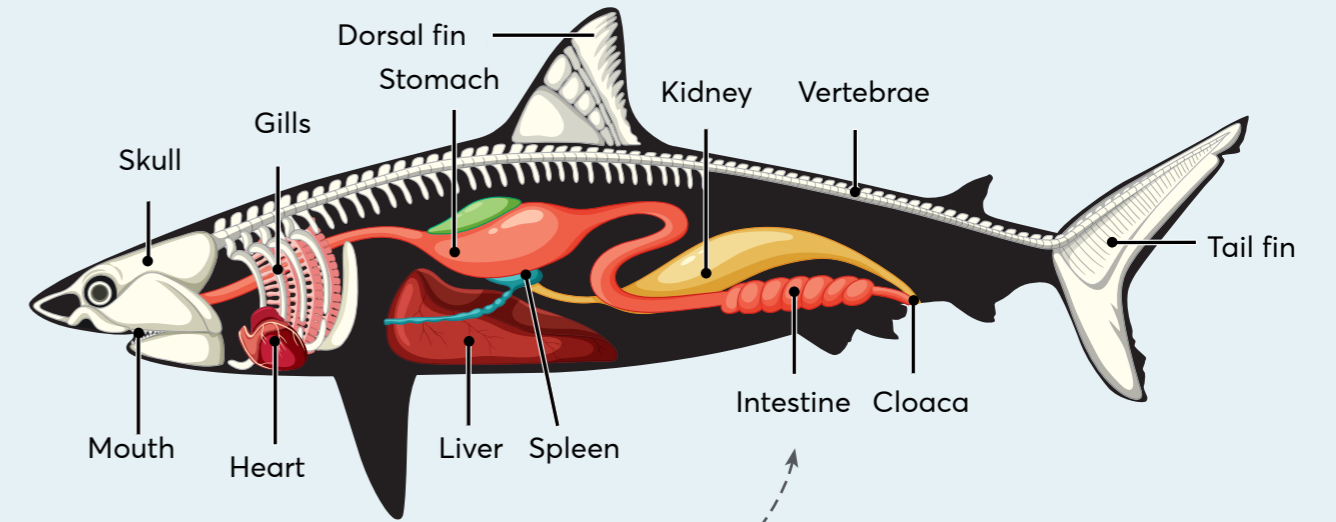
## Shark



Another key difference between a shark and a fish is that sharks do not have swim bladders. They instead rely on their oily livers and large pectoral fins to maintain buoyancy when swimming.

A shark's fins are rigid and are also fleshy. They also have cartilaginous rods in their fins. This gives the shark's fins the strength and flexibility to help them move through the water with precision and stability. Shark fins also consist of collagen. This is a protein that is also found in human skin and bones.

## General anatomy of a shark



A shark's intestines are also very short compared to a bony fish. It is a spiral shape that looks like a cork-screw. This allows sharks to absorb more nutrients.

### Did you know...

Shark fins are used in traditional Chinese medicine and soup. Because of the detrimental impact that the shark fin trade has had on sharks, many countries have stopped the sale of their fins.

**Check out the skates and rays on the next page...**

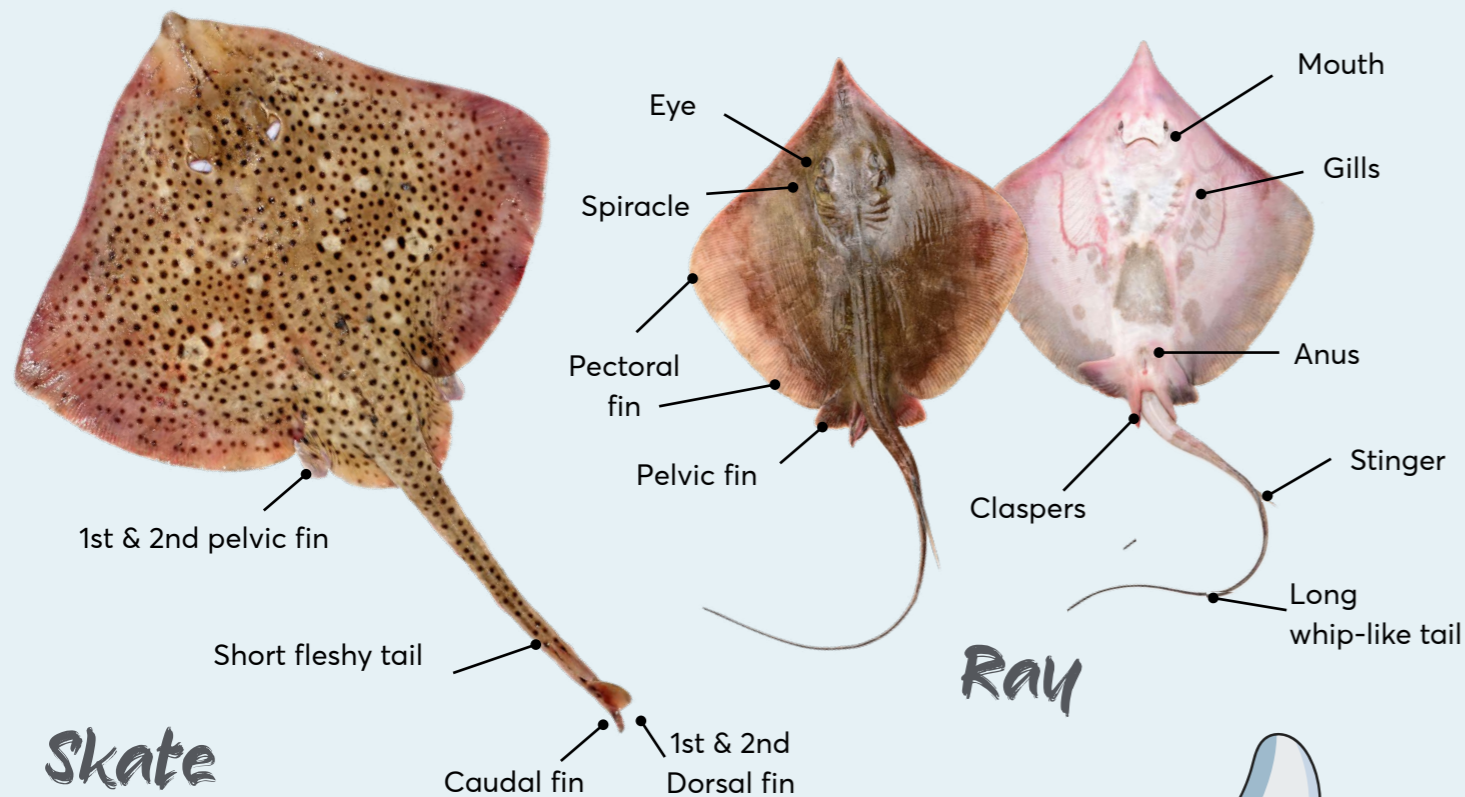
**BATOIDS** include skate and ray **species** – which are basically flat sharks.

Although some skates and rays look very similar, they are divided into **four scientific orders**. This is like being put into different groups where you have more things in common than the other: • Myliobatiformes – stingrays, manta rays, and eagle rays • Torpediniformes – electric rays • Pristiformes – sawfish • Rajiformes – skates, rays and guitarfish.

The main difference that skates and rays have to sharks is that their gills are located on the underside of their bodies. They have flattened kite-shaped bodies with large pectoral fins that look like wings, or a large disc. They do not have anal fins, and although most species have two dorsal fins, some have only one, and others none at all!

Skates and rays are however not the same. Rays generally have slender, whip-like tails, whereas skates have shorter fleshier tails. Some rays have a stinging spine on the tail, which skates do not have.

**Another key difference is that skates reproduce by laying eggs, whereas rays give birth to live young.**



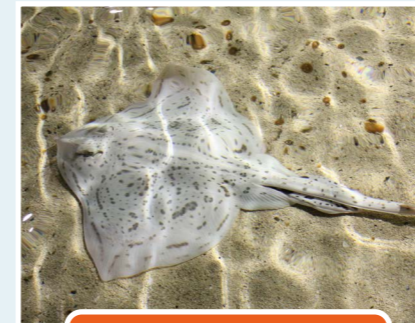
**WOULD YOU LIKE TO CHANGE YOUR NAME?**

## AM I A SKATE OR A RAY?

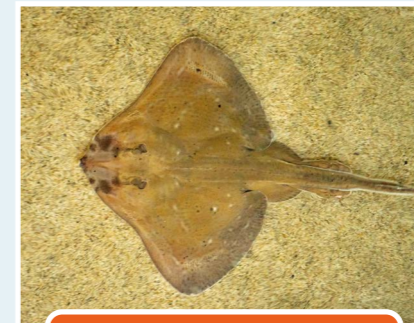
The **classification** of skates and rays has changed over the past few years. In fact, some skate and ray species have changed their **order, family and genus**. This means that some species that were called rays are actually **SKATES!**

**In fact, in Europe most skates are still labelled as rays!**

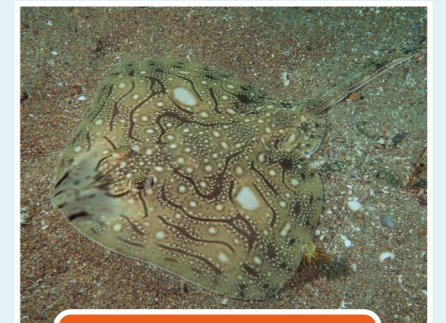
**These are some examples of skates that are known by their common 'ray' names!**



Scientific Name  
*Raja brachyura*  
Common name  
**Blonde Ray**



Scientific name:  
*Raja microcellata*  
Common name:  
**Small-eyed Ray**



Scientific Name  
*Raja undulata*  
Common name  
**Undulate Ray**

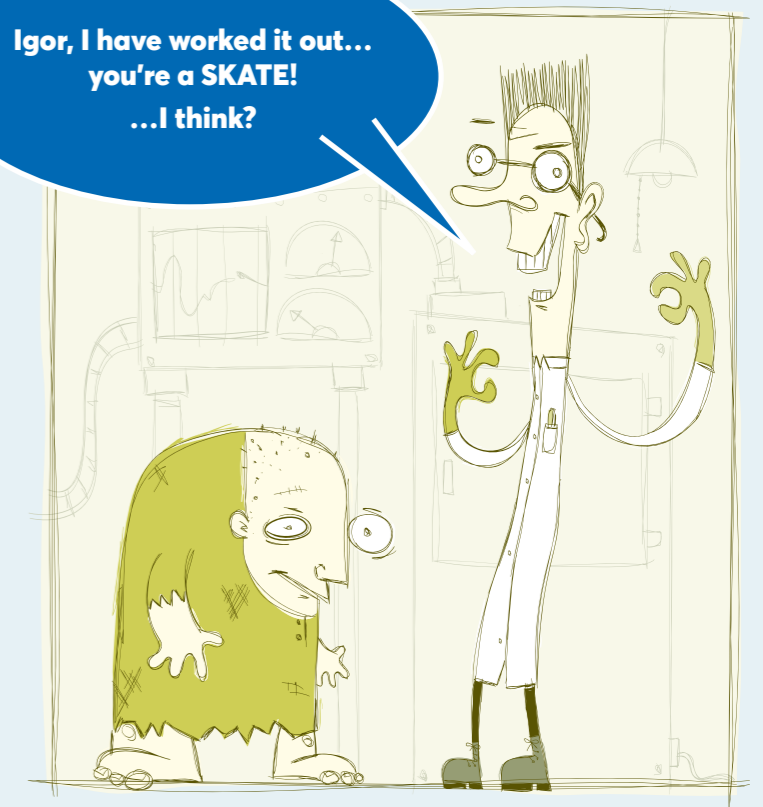
## Why the confusion?

In the past, 'rays' became a word that was used to describe batoid species that included both skates and rays. Some people still call skates 'rays' as a generic term. They then refer to rays that are actual rays as 'real rays'!

With new technology and DNA testing, scientists are now better able to work out the differences between the species that look very similar. So they can name actual skates as skates and rays as rays.

Some skate species that had ray names have been given new names to help avoid the confusion. For example, the spotted ray, which is actually a skate, is now also referred to as a spotted skate. However, for many their common 'ray' names have stuck!

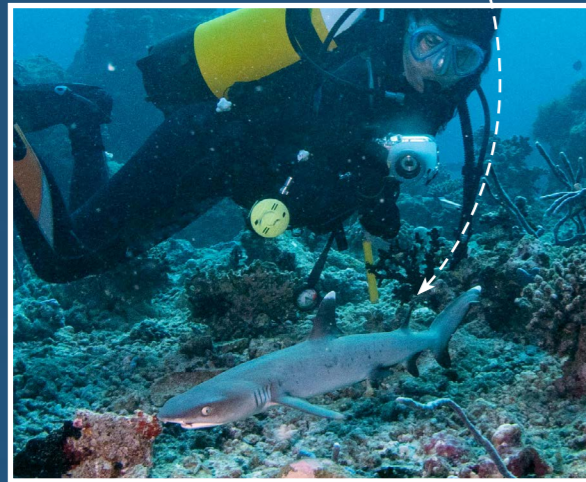
Igor, I have worked it out...  
you're a SKATE!  
...I think?



# Pups & Mermaid's Purses

The majority of **SHARKS** and all **RAYs** give birth to live young called **PUPS**. Some **SHARKS** and all **SKATES** lay egg cases. The egg cases are called **MERMAID'S PURSES**.

When born, baby sharks all look like miniature versions of the adults. They are the same shape and colour – just a lot smaller.



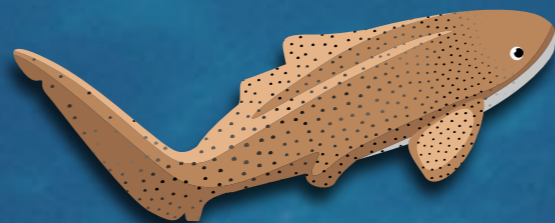
## PUPS

Sixty per cent of **SHARKS** are **viviparous** [say it like this: vuh.vi.puh.rus]. Viviparous animals develop inside the body of the mother shark. Mammals such as whales, dolphins, seals and even cats and dogs are viviparous. Viviparous sharks include mako, bull sharks and hammerheads, to name a few!

Some **SHARK** and **RAY** species are **ovoviviparous** [say it like this: ow.vow.vai.vi.puh.rus]. This means the mother produces eggs that are hatched inside the body. Examples of ovoviviparous sharks and rays are the whale shark, basking shark, angel shark, as well as the stingray, manta ray, and the spotted eagle ray.

In 2017 in an aquarium in Australia, a **ZEBRA SHARK** produced three baby clones of herself.

Scientists tested the genetics of the baby sharks that had hatched from cases and found that they carried the DNA of **ONLY** their mother. This indicates that the babies were created through a process called **parthenogenesis**.



## Did you know...

Some baby sharks take nutrition to the next level by eating unfertilised eggs in their mother's womb. This is called **oophagy** [say it like this: oo.fa.gee] and is a trait of great white sharks and makos. The sand tiger shark takes this even further: **They eat their siblings!**

## MERMAID'S PURSES

Some **SHARKS** and all **SKATES** are **oviparous** [say it like this: O.vip.puh.rus]. Oviparous animals reproduce by laying eggs – just like a chicken. This is how fish, amphibians, reptiles, and insects reproduce.

The 'leathery' egg cases are made out of keratin and collagen. This is also what makes up our hair and nails! By looking at the size and shape of an egg case, you can determine the different species.

The egg cases, depending on the species, have special features. The **SMALL-SPOTTED CATSHARK** egg cases have **curled tendrils** at each end of the **capsule**. These are wrapped around seaweeds to stop them from floating. The egg cases are long and tubular in shape. They measure 4 to 6 centimetres in length excluding tendrils.

Skates attach their egg cases to the seabed, reef and corals using **horns** or a sticky mucus at each end of the casing.

The **FLAPPER SKATE** has a very large egg case measuring 13 to 24 centimetres long. That's almost the size of a child's foot. When found washed up on the shore, they can look like a small piece of fibrous wood.

The **THORNBACK SKATE** cases are 5 to 9 centimetres long and are square to rectangular in shape. They have a keel that runs along the outer edge of the case. The case also has four 'horns' at each corner. They look like Batman's ears!

Thornback Skate



Size: 1.3m in length

Small-spotted catshark

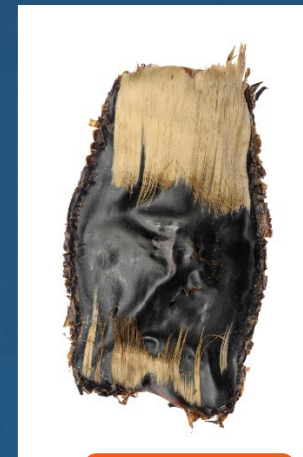


Size: 1m in length



Length of case: 4-6cm

Flapper skate



Length of case: 13-24cm

Size: 2.5m in length



Length of case: 5-9cm

# Superpowers and Adaptations

**Sharks, skates and rays** have many amazing adaptations that allow them to survive and thrive – just like having superpowers! They have five senses in common with humans: sight, hearing, touch, smell, and taste. They also have a sixth sense: electroreception! Among these super powers, they also have lots of other adaptations that help them swim faster, use camouflage, and swim at different depths of the ocean.

## 1. EYES FOR SPYING

Sharks can open and close their **pupils** in response to changing light. In fact, the thick round **lens** of a **LEMON SHARK** is seven times more powerful than the human lens! This means that these sharks can focus and hunt by night and use the starlight to see their prey.

The eyes of skates and rays are located on the top of the head and are suited for being partially buried in the sand. Recent research also indicates that **STINGRAYS** may be able to tell the difference between some colours.

## 2. EARS FOR DRUMMING

Although sharks, rays and skates don't appear to have obvious ears like humans, they do have well developed **inner ears**. Sharks and rays are attracted to irregular pulses of low frequency sounds – similar to how we hear a low sound of a bass or a drum. They tune into the 'sound scape' to navigate and listen for prey swimming erratically – such as fish swimming in sudden movements, in different directions in the water.

## 3. 'TOOTHY' SCALES

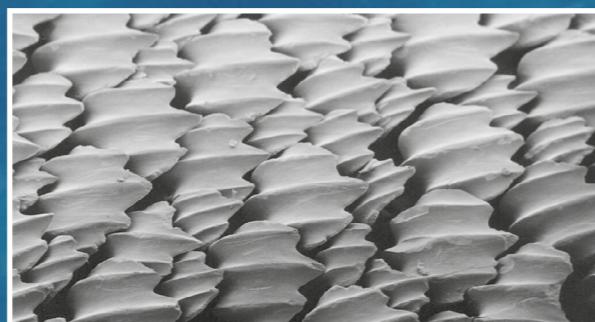
A shark's skin is covered in tiny tooth-like scales called **placoid scales**, also known as **dermal denticles**.

These toothy scales point towards the tail and feel smooth. They streamline the body, helping the shark swim with less resistance, making it more hydrodynamic.



### Did you know...

Sharks have eyelids! However, they don't blink. They close their eyelids to protect their eyes from damage when fighting or feeding.



## 4. SUPER 'SENSORY' SNOUTS

**SAWSHARKS** have a long nose, studded with teeth like a chainsaw that they use for detecting and attacking their prey.

**SAWFISH** belongs to the ray family. They look very similar to the sawshark, with a long **rostrum** and teeth. It however, has gill openings under its body.

The broad head of **HAMMERHEADS** and elongated snouts of the **SAWSHARKS** are thought to be used like a metal detector, allowing the animals to enhance their ability to sense electric fields.

Sharks have an excellent sense of smell, so excellent it's famous! Fishermen have used 'chum' – a bloody blend of fish parts – to attract sharks.

### Myth Buster

Sharks can detect a single drop of blood in the ocean – **FALSE!**

Scientists have carried out experiments to test how sensitive sharks are to chemicals in the water. They have shown that **BLACKTIP** and **GREY REEF SHARKS** can detect fish blood at one part per 10 billion parts of seawater. That's equivalent to one drop of fishy blood in an Olympic-sized swimming pool – not the whole ocean!

**SHARKS** have nostrils called **nares** under their snout. These are not for breathing but solely for smelling. The sharks use their sensory cells to work out the direction a smell is coming from, and to navigate.

## 5. TESTER TASTE BUDS

Sharks like to taste their food before feasting. Their throat is lined with **papillae**, which contains taste buds. After the first bite, the shark can change its mind and reject the food if it doesn't like it!



## 6. SUPER ELECTROCEPTORS

Sharks, skates and rays all have a 'sixth sense' to detect their prey. Located around their snouts and the underside of their body, they have a unique electrosensitive sensory organ called the '**Ampullae of Lorenzini**'.

These are like the pores we have on our face, but with a difference: they are full of a jelly-like substance that enables the animals to pick up the electrical signals that all living things produce.

## 7. SHOCKING & STRANGE HEADS

Some sharks have strange-shaped heads; the strangest of all are the **HAMMERHEADS** – shaped like a hammer – called a **cephalofoil**.

This unusually shaped head helps the shark catch its favourite meal (stingrays and octopus) by pinning them to the seafloor.

Scientists think that the shape of the head may also give extra lift to their bodies as they swim. It may even allow them to better detect from which direction an electrical signal is coming, using a more effective electroreception.

As their eyes are at the tips of the 'hammers', this strange head helps to give the sharks a great view as they swing their head from side to side.

Electric rays, such as the **TORPEDO RAYS**, don't have dermal denticles or thorns. Instead they have an electric organ on each side of their head. These organs produce electric shocks, used for defence and to subdue and capture prey.

Australia's **COFFIN RAY** can pack a shock of 200 volts and can emit up to 50 shocks in 10 minutes. This is certainly strong enough to cause a human a lot of pain!



### Did you know...

In ancient Greece and Rome, shocks from the **ELECTRIC RAY** were used as a treatment for headaches and other illnesses.

## 8. SHORT, LONG & WHIPPIN' TAILS

All other rays that lack electric organs generally have rough skin and a long slender tail that looks like a whip with one or two spines. A skate's tail tends to be shorter and stockier.

For most sharks, the **caudal fin** or tail is **heterocercal**. This means that the upper lobe of the tail is larger and longer than the lower lobe.

A shark swims by moving its tail in a wave-like, side-to-side manner that propels the body forward. The movement forward pushes water around the fins – like an airplane's wings creates lift in the air.

When both halves and lobes are the same size, the shark is speedy like the **MAKO SHARK**.

A **THRESHER SHARK** has a tail that is as long as its body! It uses it like a whip to stun prey.

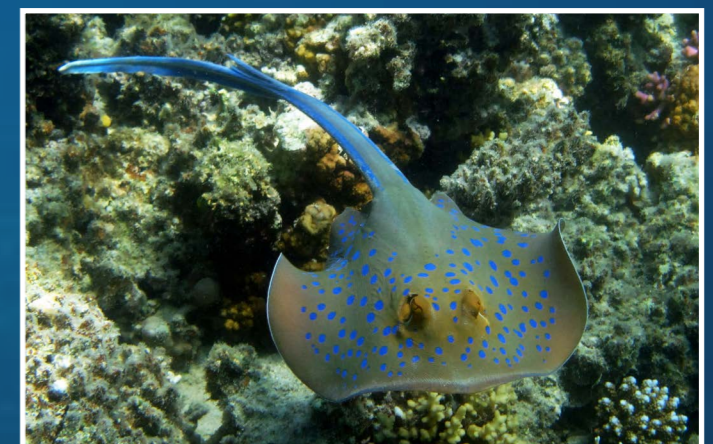


## 9. BARBS & STINGERS

A skate's tail is lined with blunt, **thorny barbs** that look like spines. The barbs are not venomous like a stingray's spines, but are used as a dangerous weapon and can inflict serious wounds when the tail is lashed.

Several of the rays, such as **STINGRAY** and **BLUESPOTTED RIBBONTAIL RAY**, have a venomous barb that they use as a defence tool. They may look pretty – but you wouldn't want to disturb them!

The **MANTA RAY** has no barbs, stinger, or teeth. It has large pectoral fins that give it the ability to swim and to move in bursts of speed – escaping its predators!



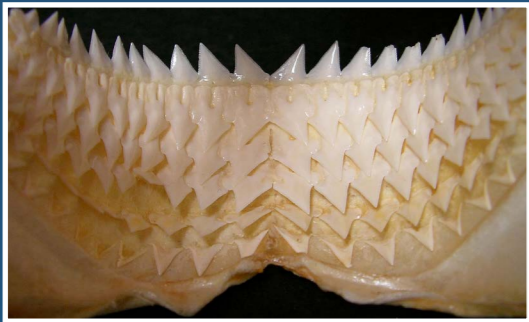
## 10. TEETH & JAWS

Almost all sharks are **carnivores** - this means they like to eat meat!

The teeth of sharks, skates and rays come in lots of different shapes and sizes, depending on what they eat. There are four main types including: **needle-like** or **pointed lower teeth** are for gripping. **Dense flattened teeth** are used for crushing. The teeth of plankton-feeders are small and **non-functional**.

The **GREAT WHITE SHARK**, also known as the white pointer, is probably the shark most people think of when they think sharks, jaws and teeth! It has **pointed lower teeth** with triangular upper teeth that have a serrated edge.

Their young eat fish and rays, and as they get older they eat seals and other marine mammals. Despite their size, they can make spectacular leaps out of the water to catch their prey.

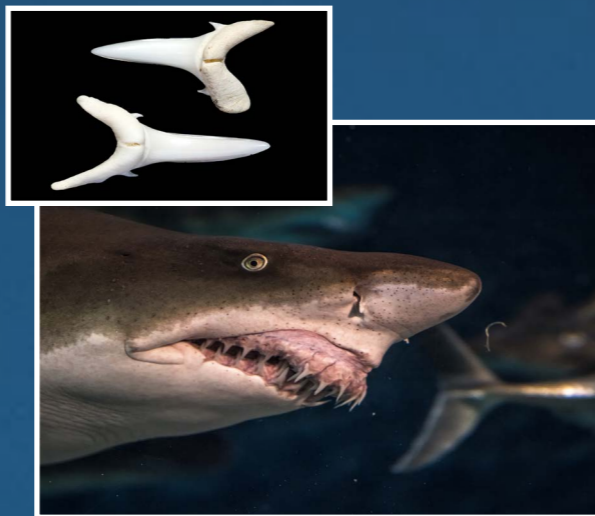


Baby sharks are born with a set of teeth and they can instantly set off to find their own food. Although sharks are famous for their teeth, they are constantly losing them! Fortunately they have multiple rows of growing teeth. Like a conveyor belt, when one falls out or is lost, another from behind moves forward to replace it. Some sharks can go through up to 30,000 teeth in a lifetime.

The **PORT JACKSON SHARK** has **dense flattened teeth**. The frontal teeth are used for grasping. The teeth at the back are used to crush crustaceans such as crabs and sea urchins, which have a hard shell.



The **SAND TIGER SHARKS** have long, narrow, **needle-like teeth** that are perfect for snaring small fish, squid, and even other small sharks.



The **TIGERSHARK** has **multipurpose sharp serrated teeth** that are powerful enough to bite a turtle shell in half. The pointed tips grip the prey and the serrated bottom edges are used for cutting.

They are famous for eating anything and are often called the garbage shark. This is because car tyres, number plates and drink cans have been found in their stomachs!

**BONNETHEAD SHARKS**, a small member of the hammerhead family, also eat seagrass! This means they are **omnivores**. They have small sharp teeth at the front and **flattened teeth** at the back. These are perfect for eating both plants and animals.



Many skates and rays glide closely over the bottom of the seafloor in search of food. Skates have small pointy teeth while rays have plate-like teeth adapted for crushing its prey.

Their mouths are located on the underside, which enables them to feed on benthic animals that live on the bottom of the ocean, such as shrimps, crabs, oysters, clams and other invertebrates and fish.



The **COOKIECUTTER SHARK'S** **pointed teeth** latch onto larger animals and twists to pull off chunks of flesh! The circular scars left on marine mammals by the little shark give it its name! Cookiecutter teeth marks have also been found on submarines! They will bite anything!

### Did you know...

A bull shark has 50 rows of teeth!  
The goblin shark can extend its jaw and teeth outside of its mouth to catch its food!



## 11. BRISTLES - GILL RAKERS

Whale sharks, basking sharks, and megamouth sharks are considered harmless giants and have what are considered **non-functional** teeth! Although these sharks have tiny teeth, they are not used for 'hunting'. Instead, these sharks are filter feeders.

They eat tiny plants and animals called plankton. They filter their food by swimming with their mouths wide open, allowing the seawater to pass through their **gill rakers** to catch their food like a sieve.

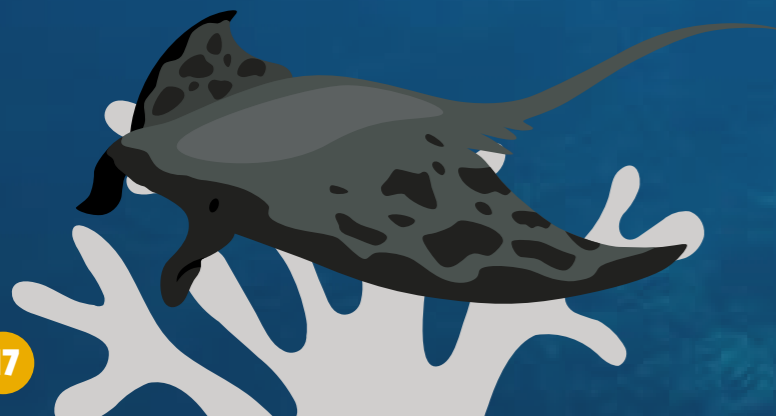
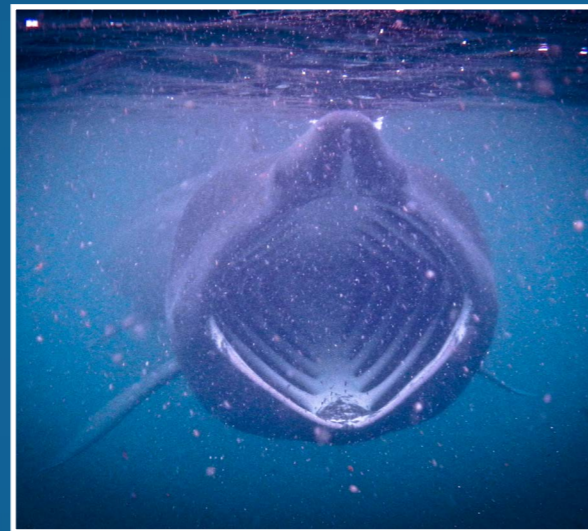
Manta rays are also very large and have a forward-facing mouth. Like the whale shark and basking shark, they also glide along the water with their large mouths wide open, filter feeding on tiny plankton and other small food particles in the water.

## 12. BIG BRAINS

Sharks are super intelligent. Instead of associating sharks with jaws, we should be thinking brains! The idea of sharks being ruthless man-eating predators is not correct! Instead, many sharks are social and curious.

The **MANTA RAY** has the largest brain of any fish and has more **glial cells** in its brain than a domestic cat! The glial cells are associated with intelligence. These ocean geniuses use their smarts to socialise and navigate around the ocean. They are also very curious and will approach divers to play with the bubbles released by SCUBA equipment.

There is also anecdotal evidence of mantas approaching divers to get them to remove things they have got entangled in, such as fishing nets. This requires awareness and intelligence.



## 13. GILLS & SPIRACLES FOR BREATHING

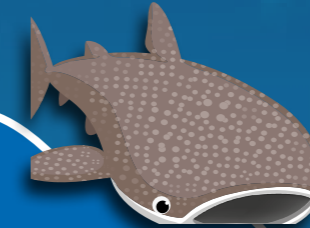
Sharks, skates and rays generally have five to seven pairs of **gill openings** on each side of their body and no gill cover.

Skates and rays have their mouths and gills on the underside of their bodies, and have **spiracles** behind their eyes for breathing.



### Did you know...

The word Elasmobranch comes from Greek and Latin, meaning 'plate' (Elasmos) and 'gill' (branchus)



## 14. SUPER LIVERS & NO SWIM BLADDERS

Sharks have **no swim bladder** – unlike bony fish that have a bladder full of air to help them with buoyancy. Instead, sharks have large oily livers that are used to help them with controlling their **buoyancy**.

Some sharks must swim constantly to keep oxygen-rich water moving over their gills. Others, however, can pass water through their breathing system. This allows them to move easily between different depths in the water, and even to take a breather on the seabed!





# Super Sharks from around the World

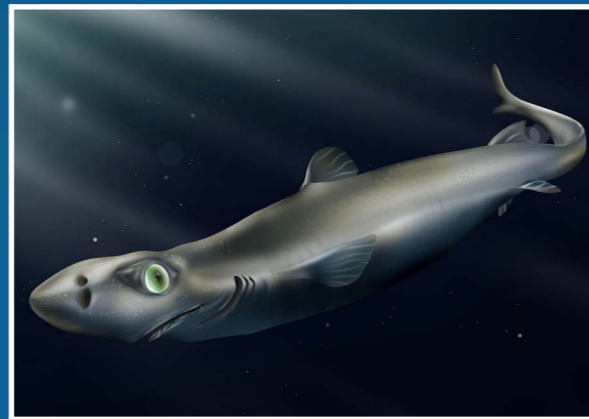
It was once thought that sharks were not very intelligent and were just mindless eating machines. Now we know this is not true! Check out some of our favourite super sharks.

## GREATEST MIGRATORS

Scientists have tracked different shark species using satellite tracking.

**GREAT WHITE SHARKS** migrate and congregate en masse annually. In the winter, males travel to remote locations in the Pacific between the California and Baja coasts, and to Hawaii in the mid-Pacific. This area of the ocean has been dubbed the 'White Shark Café'.

At the 'café', they dive down to feed on deep sea fish and squid, feeding at depths of 350-500 metres during the day. At night they return to the upper parts of the ocean at 200 metres to feast.



## SMALLEST

The **DWARF LANTERN SHARK** from the deep ocean in the Caribbean is smaller than a human hand and glows in the dark. It grows to only 20 centimetres long and has big bulging eyes to help it see in the deepest parts of the ocean.

The **VELVET BELLY LANTERN SHARK**, slightly bigger at 60 centimetres, has a black belly, making it seem invisible from below. It has glowing spots called photophores on its belly, and glowing dorsal spines that look like little 'lightsabres' – making it a 'Jedi' shark and a match for any Star Wars storm trooper.

## BIGGEST

The **WHALE SHARK** is the biggest fish on the planet, reaching up to 20 metres long, with a mouth 1.5 metres wide!

This gentle giant is found in tropical waters, feeding solely on plankton that they filter through their huge mouth.

Their beautiful spotty pattern is unique, like fingerprints, and helps scientists to tell different sharks apart.



## FASTEST

The **SHORTFIN MAKO SHARK** is found in tropical and warm temperate waters, including Irish waters!

Capable of short bursts of speed up to 100 kilometres per hour. This means it can target speedy prey such as tuna.

## FLYING SHARKS

The **SHORTFIN MAKO SHARK** is also the highest jumping shark on the planet, reaching heights of 9 metres out of the water. The **GREAT WHITE** leaps only 3 metres. Surprisingly **BASKING SHARKS** are also known to breach the water, reaching up to 1.2 metres, which they can do several times in a row. Other shark species that have been observed naturally breaching the water include the spinner, blacktip, and thresher sharks.



## SLOWEST & OLDEST

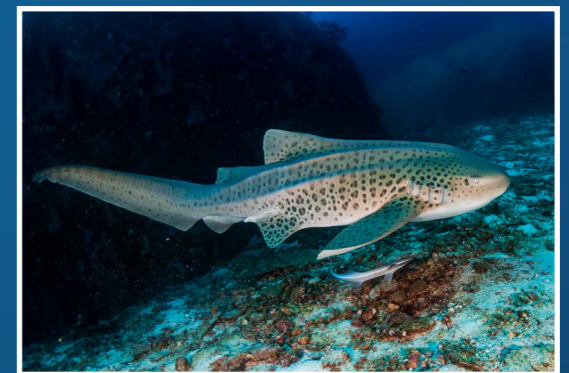
**GREENLAND SHARKS** are slow-moving and are found around the Arctic Circle. They are also found in Irish waters at some times of the year. They are one of the oldest animals on Earth, estimated to live up to 500 years!

Despite their sluggish behaviour, cruising at less than half a metre per second, they can catch fish, birds, and seals. Some have even been found with the remains of polar bears and reindeer in their stomach, but this was probably scavenged!



## PRETTIEST

The **ZEBRA SHARK** is a beauty. It is born with strong white stripes over a dark brown background. As the shark gets older and grows, its stripes change to brownish spots over a palish background.



## BEST FRIENDS

**LEMON SHARKS** are born in mangroves. While growing up and learning how to be a shark, they often have a 'best friend' and stay together for the seven or eight years it takes to grow up.





# Our Favourite Sharks, Skates & Rays in Irish Waters...

## 71 SPECIES

In Irish waters there are **36 SHARK SPECIES, 28 SKATE** and **RAY SPECIES**, and **7 CHIMAERAS**, also known as the rat fish. This includes over half the number of all sharks, ray and skate species in Europe.

### THE BIGGEST SUNBATHER

**BASKING SHARKS** get their name because they 'bask' - or spend time - in the sun. Even the Irish name for the basking shark comes from the phrase '**liamhán gréine**', which means 'great fish of the sun'.

The basking shark is one of the largest species of the shark family, reaching up to 9.8 metres long. The largest basking shark species recorded is 15.2 metres. That's longer than a coach bus! It is one of three plankton-eating shark species, along with the whale shark and the megamouth shark.

The basking shark is listed as 'Endangered' on the IUCN Red List and runs the risk of becoming extinct. We are lucky to still see them in Irish waters, where they are listed as an Endangered Species and are protected under Ireland's Wildlife Act.



#### Extra Fact

**Basking sharks like to come together and swim in circles, when they are looking for a potential mate.**

### THE LARGEST MERMAID'S PURSE NURSERY

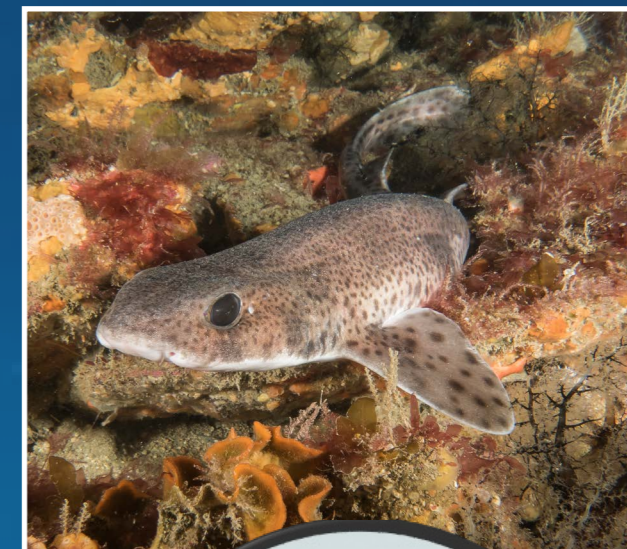
In 2018, the **SeaRover exhibition**, which used the Marine Institute's remotely operated vehicle **ROV Holland I**, discovered the largest shark nursery ever found in Irish waters!

The nursery was discovered 200 nautical miles off the west coast of Ireland at a depth of 750 metres. It was a **BLACKMOUTH CATSHARK** nursery containing dozens of sharks and thousands of egg cases.



### IS IT A CAT, DOG OR SHARK?

The **SMALL-SPOTTED CATSHARK** is also known as the **DOGFISH** - but it is a shark. In fact, it is the most common shark found in Irish waters, on the seabed in depths between one and 800 metres. Sometimes it can be found caught in rockpools when the tide goes out. It lives up to 12 years. When swimming, its length is about the same as a 4 year old child's height, measuring up to 1 metre long. When threatened however it can curl into a ball, to look like a shark doughnut! This makes it hard for a predator to eat it!



### THE BEST CAMOUFLAGE

**BLUE SHARKS** live to 20 years. They are remarkable at camouflage. Like all sharks, they use a technique known as **countershading** - meaning the colour of their backs and bellies are different for a reason.

Viewed from above, their deep blue back helps it blend into the blue colour of the ocean below.

Viewed from below, the white underside helps the shark to blend in with the bright light of the sun shining through the water's surface. This makes it very easy for the blue shark to sneak up on its prey!

#### Extra Fact

**Most blue sharks will grow 3-4 metres in length. The largest ever caught was a whopping 239.49kg. The largest caught in Irish waters is 93.5kg!**

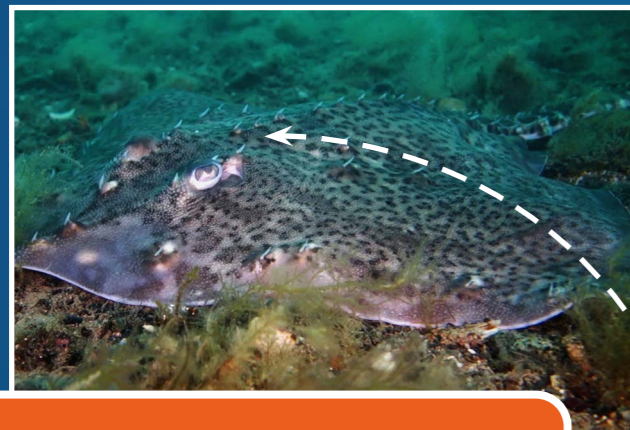


## PATIENT PREDATOR

**ANGEL SHARKS** are ambush predators. They can wait for days lying in the sand and then strike passing prey within a tenth of a second.

Male angel sharks found in Irish waters can grow up to 1.32 metres long. In fact, the females generally grow larger than the males, reaching up to 2.44 metres long.

The angel shark family is the second rarest of all the shark and ray families. Sawfish are the rarest. Sadly, over the past 30 years, the angel shark population in Irish waters has declined by 90 per cent. It is now Critically Endangered.



### Extra Fact

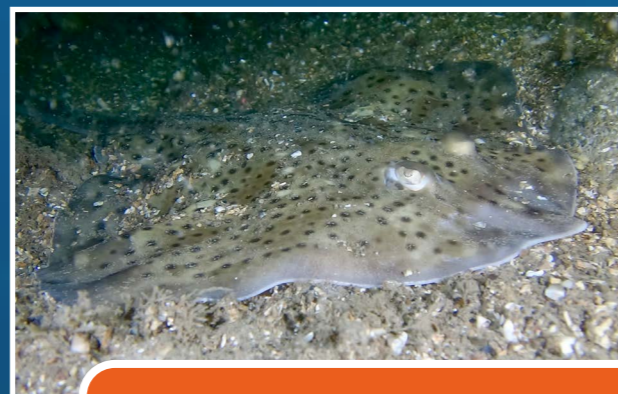
A thornback female can lay up to 170 egg cases in a year - although most produce between 48-74 cases.

## NOCTURNAL HUNTERS

The **THORNBACK RAY** is a skate. It is also referred to as a **THORNBACK SKATE**. It is mostly nocturnal, preferring to hunt from dusk till dawn. It is the most commonly found skate around the Irish coast.

The thornback skate comes in lots of variations of colour, and its tail has a banding pattern on it. Its body is kite-shaped and it can grow up to 1.3 metres long.

Look closely and you can see the thorns running down its spine from the front to the tail. It can live up to 15 years.



### Extra Fact

Juvenile spotted skates are smooth. The adults however are very prickly. It has a row of thorns running down its back that keep predators away!

## COMMON STINGRAY

**COMMON STINGRAYS** are found from the North East Atlantic Ocean to the Mediterranean and Black Seas. It is a coastal species that likes sheltered bays. It is listed as an Endangered species in Ireland.

The common stingray is known for its short snout and its long whip-like tail. It can grow to 60 centimetres in length. Its tail can be up to 1.5 times the disc length.

Ancient Greeks and Romans greatly feared the stingray, believing its venom could dissolve stone!

## WHEN COMMON IS NOT SO COMMON

The common skate, thought to be one species for hundreds of years, was reclassified as TWO different species in 2009.

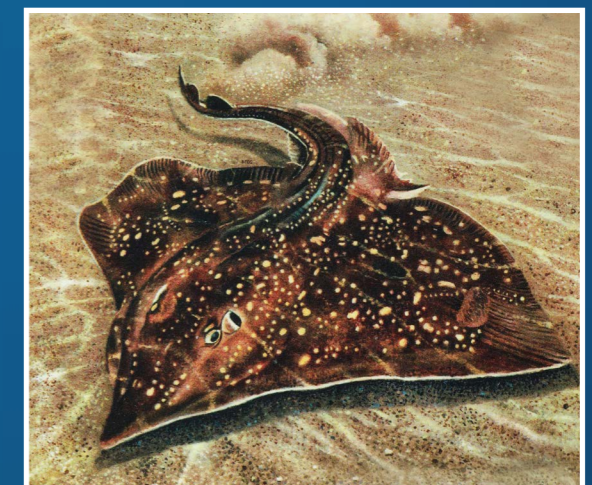
Thanks to genetic research the species was reclassified as the **FLAPPER SKATE** (*Dipturus intermedius*) and **BLUE SKATE** (*Dipturus batis*)!

The flapper skate is larger in size and can measure up to 2.5 metres. The blue skate can measure up to 1.45 metres.

It was once a very common fish species in the North East Atlantic - but it is not so common now! Both species cannot be targeted by EU fishing vessels in certain sea areas.

### Extra Fact

There is an isolated common stingray population that returns to Tralee Bay in Co Kerry each season.



### Extra Fact

The flapper skate is rarer than a snow leopard. Listed as Critically Endangered in Ireland and on the IUCN Red List, only small localised populations now remain in Ireland and in North West Scotland.

# Threats to Elasmobranchs around the World

Sharks, skates and rays are some of the most threatened animals in the world. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species provides scientifically-based information on the status of species. This Red List helps to guide actions to conserve animals under threat. The Red List finds one-third of the world's sharks, rays and chimaeras are threatened with extinction. Many are **Critically Endangered**, **Endangered**, or **Vulnerable**.

The main causes:

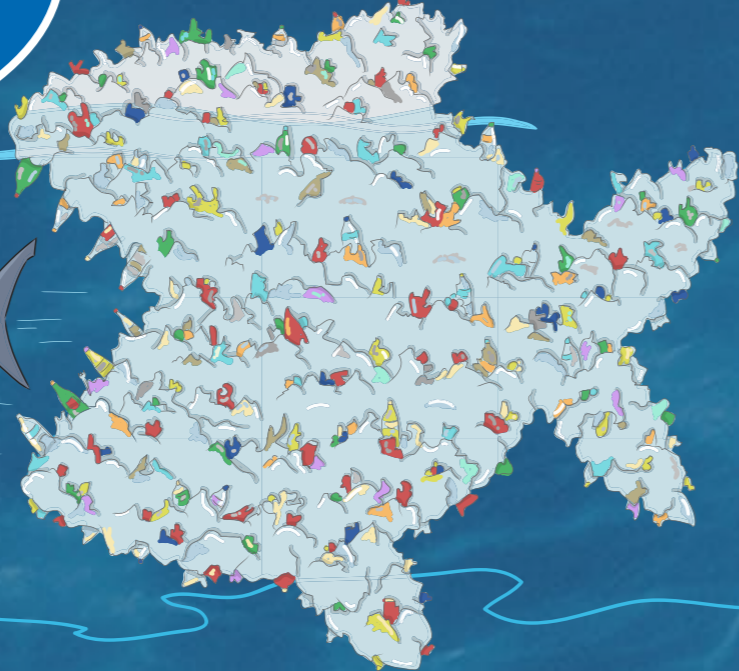
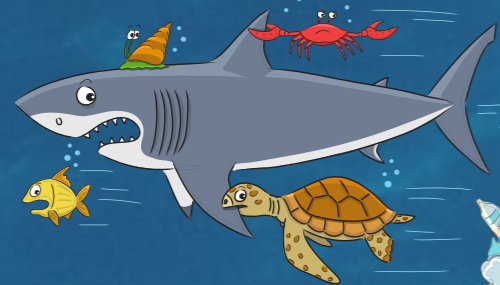
- **SLOW GROWING**
- **LATE TO MATURE**
- **PRODUCE FEW YOUNG**
- **OVERFISHING (WORLDWIDE), BYCATCH & FIN INDUSTRY**
- **HABITAT & PREY LOSS**
- **POLLUTION & CLIMATE CHANGE**
- **HUMAN DISTURBANCE**

## Did you know...

Irish waters are a perfect refuge for shark, skate and ray species, such as the **BASKING SHARK** and the **COMMON STINGRAY**. The **ANGEL SHARK** and **WHITE SKATE** can also be found in Irish waters - particularly near sheltered areas such as Galway Bay and Tralee Bay.

## Did you know...

In 2020, scientists reported finding microplastics and synthetic microfibres from clothing in the stomachs of sharks living off the UK coast in the North-East Atlantic.

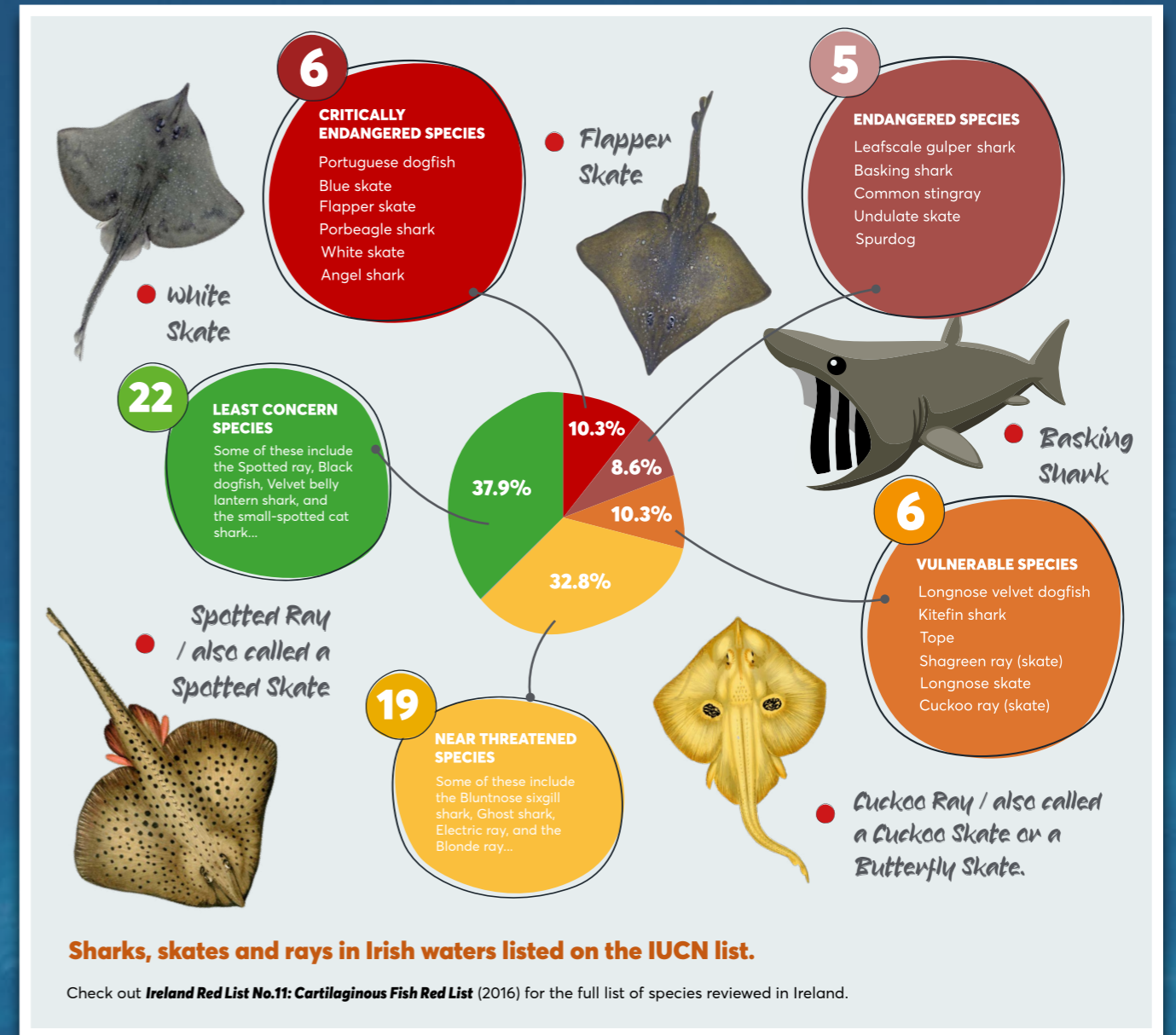
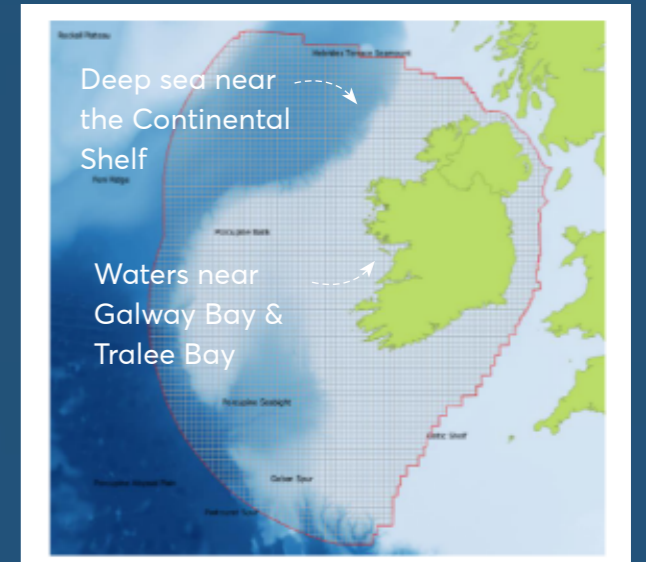


Scientists in Ireland are keen to protect cartilaginous fish including sharks, skates, rays and chimaeras in Irish waters.

They have specifically studied 58 species that live in the waters near the Irish coastline to as far out as the continental shelf area of Ireland's marine territory.

The information gathered has helped to establish the status of these species in Ireland.

Many of them are listed on the International Union for Conservation of Nature (IUCN) Red List as **Critically Endangered to Near Threatened**.





# Conservation in Irish Waters

Scientists at the Marine Institute have been working with fishers to learn more about the sharks, skates and rays found in Irish waters.

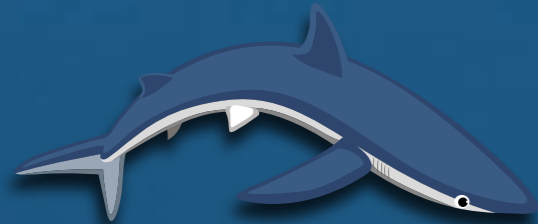
Scientists carry out annual surveys from Irish research vessels to get an idea of the health status of the fish populations. During these surveys they also collect information about sharks, skates and rays. This is done by measuring their length and weight before returning them to the water. These samples should represent a good mix of young and old fish.

During the annual groundfish survey in November 2023, two young **WHITE SKATES** were caught in Galway Bay, and re-released, by scientists on the *RV Celtic Explorer*.

## TAGGING SHARK SPECIES

Scientists study sharks by tagging and releasing them back into the water. In Ireland, about 60 charter boats are part of a catch-and-release scheme for sharks and skates.

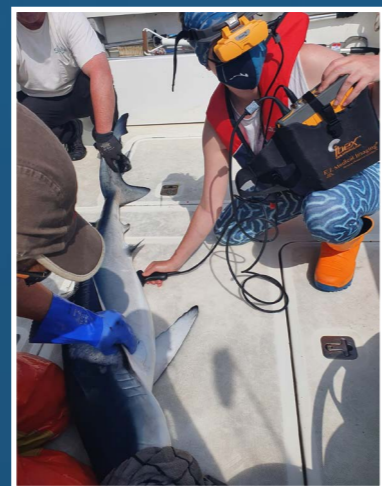
Marine scientists from Trinity College Dublin tagged and released a **BLUE SHARK** in 2021. The scientists also conducted an ultrasound to determine if the shark was carrying pups.



While tagging sharks, scientists can also take a DNA sample through a small fin clip or mucus sample. Scientists can then study the DNA sample to help work out a shark's genes and how different sharks are related. This also means they can gather valuable information about where species live in different locations, and how they use Irish waters.

Tagging and taking photos of **BASKING SHARKS** helps scientists learn more about their behaviour. For example, recording basking sharks that travel across the Atlantic Ocean show that these sharks don't stay in Irish waters all the time!

This provides people with information about how to help protect the species that are under threat.



Spot the tag

## PLASTIC TAGS

In Ireland, the tags mostly used on sharks are the exact same type as ear tags used on cattle! They have a serial number that easily identifies them if recaptured.

The tags are put on the shark's dorsal fin or the skate's wing, much like an earring! The species mainly tagged include blue shark, porbeagle, tope, and different skate species.



## SATELLITE TAGS

In some cases, however, satellite tags are used. These are much more expensive and are not used as often. They can tell scientists all sorts of exciting information about the animal, such as its location and the temperature and depth of the water of where it travels.

Some tags transmit their data regularly, giving scientists an idea of where the sharks are in real time. Others collect their data for a certain amount of time. The tags then pop off the animal and float to the surface. At the surface, they send a signal telling the scientists to come and pick up the tag.

Satellite tags can give us fascinating insights into shark behaviour and reveal surprising findings, such as how far they can travel in short periods of time.



### Did you know...

A **TOPE SHARK** was tagged off the Donegal coast and was recaptured in the exact same spot 24 years later. It's the longest known time before recapture in Irish waters!

### Did you know...

A **PORBEAGLE SHARK**, which is a smaller relative of the white shark, was caught in Irish waters and measured 2.44 metres long. It was tagged, and swam from Ireland to the Arctic waters, and down to the Canary Islands, before heading back to Ireland, in just 12 months.





# People Helping Sharks, Skates & Rays

## CITIZEN SCIENCE PROJECTS

Citizen science projects are projects where anyone can take part by collecting and recording data and giving it to scientists to use.

Purse Search Ireland asks people to send photos of any **MERMAID'S PURSES** they find on the seashore, along with information such as the location, size and date the egg case was found. Children taking part in the EXPLORERS seashore safaris often collect mermaid's purses and learn how to record the data.

This enables a picture to be built up of where sharks and skates are breeding around the coast of Ireland.



### Did you know...

Folklore stories tell us the shark egg cases are the 'lost handbags' of the mythical ocean creatures called mermaids - hence the name mermaid's purse.

### Did you know...

Almost all recent records of the rare **WHITE SKATE** in northern Europe waters comes from records of its mermaid's purse sent to Purse Search Ireland!

The **WHITE SKATE**, also known as the **BOTTLENOSE SKATE**, is over 2 metres long and has a long nose, like a bottle. It is listed in Irish waters as **Critically Endangered**. To find its egg case on the shore is a rare find. The cases can measure up to 19 centimetres long.



Length: 15-19cm



Size: 2.4m long

## COMMUNITIES & SCIENTISTS HELPING BASKING SHARKS

All around the world, scientists, fishers, surfers, and people involved in community projects are doing different things to help save the sharks that are at risk.



Over 200 years ago, **BASKING SHARKS** were hunted for their meat and oil, which was used to light street lamps in Dublin. Many other countries did the same, and fishing for basking sharks continued into last century. Due to serious decline in the species from overfishing, the fishery was eventually closed worldwide in 2006.

Today, thanks to marine research and community projects, basking sharks are starting to return to Irish waters.

The **Irish Basking Shark Group**, established by the Irish Whale and Dolphin Group, work with scientists from Ireland, UK and the USA to find out more about these animals numbers, movement and behaviour.

The basking shark information centre in Achill, Co Mayo, as well as scientists and the wider community, work together to inform tourists about protecting these gentle giants.

Swimmers, boaters and kayakers are encouraged to follow the **Basking Shark Code of Conduct**, so as not to disrupt the sharks' natural behaviour. Remember, for every shark that is basking at the surface, there are likely to be at least ten more of these mighty giants swimming beneath!

**Jennifer Whitmore TD** is an Irish politician who works on climate action. In 2022, she helped bring legislation to the Dáil that would protect basking sharks in Irish waters.

This is a very important achievement because basking sharks are the first and only fish to be protected under Irish law, and Ireland is a very important feeding and courting habitat for these animals.



### Did you know...

Worldwide, some scientists estimate there are only 10,000 basking shark breeding females alive.



## MEDIA HELPING SHARKS

The media, filmmakers, storytellers and photographers are also helping to save sharks by telling their stories.

There are many stories worldwide about sharks interacting with humans. Sharks can be friendly or fierce depending on the storyteller.

Sharks are often used to represent strength, regularly seen painted on military vehicles and airplanes. Surfers and sailors often wear shark tooth necklaces for good luck and protection.

With the development of technology and filming capabilities, filmmakers are working with scientists to create an insight into the lives of sharks and rays, their environment and their behaviour.

## SHARK HORROR STORIES

The most persistent myth that experts try to dispel is that sharks love to attack and eat humans.

The anti-sharks stories grew when Captain Jack Cousteau, famous for his marine documentaries, widely shared his dislike for sharks.

By the 1970's, the ultimate phenomenon of demonising sharks evolved with the book and later film called *Jaws*, which painted the great white shark as a terrifying monster.

## SHARK MYTH BUSTER

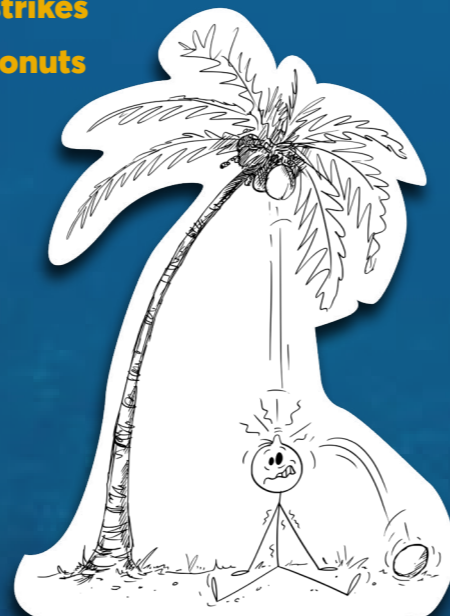
Shark attacks are rarer than people think. In 2022, only 57 unprovoked attacks were reported, of which five were fatal. This is despite millions of people using the oceans to swim, dive, surf and for many other reasons.

Most shark attacks are a case of mistaken identity as scientists who study shark behaviour believe that humans can be mistaken for a seal or a turtle.

According to the International Shark Attack File, you're far more likely to be stung by a jellyfish than ever see a shark!

### Some things far more likely to harm you than a shark:

- Cars
- Vending machines
- Lightning strikes
- Falling coconuts
- Dogs



## SHARK ATTACK SURVIVORS

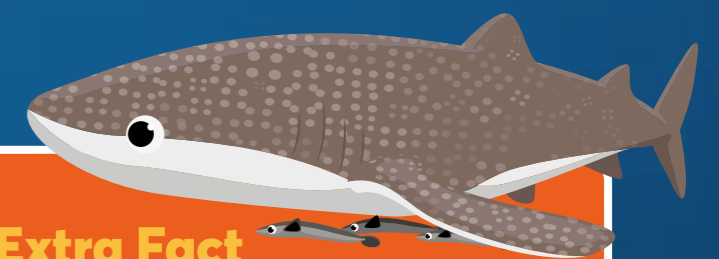
Shark Attack Survivors for Shark Conservation is a community of people from around the world who want to educate others and to save sharks – even though they themselves have had a bad encounter.

One member is Achmat Hassiem, who after losing his leg to a great white shark, won a bronze Paralympic medal and now gives talks on how sharks are so important to our ecosystems.

These 'survivors' highlight how shark culls or net protection on beaches rarely have the desired effect. Instead, they result in the nets snaring other animals such as dolphins and fish.

## SHARK SONGS

The song "**Baby Shark**" became extremely popular with children when it was released as a YouTube music video in 2016. It went viral across social media, on television and on the radio reaching over **13 BILLION** views in 2023. Thanks to this catchy song many see sharks in a new light.



### Extra Fact

Sharks don't have vocal cords that can make sounds like humans. So, unfortunately the whale shark can't sing like a whale or dolphin.

However, the Draughtsboard shark can 'bark' like a dog. When threatened, they suck in and expel water, making a 'barking' noise!



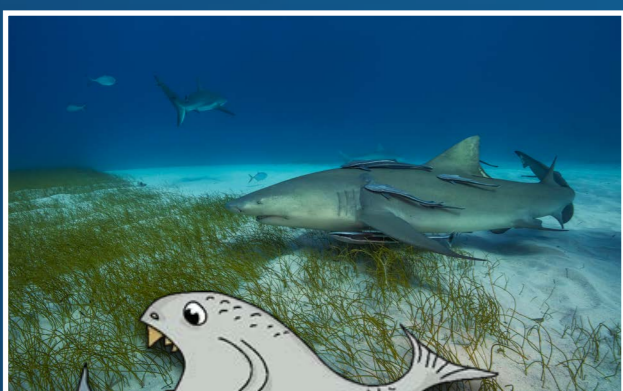
# Wow... Sharks, Skates & Rays are really important for humans and the ocean!

Sharks and their relatives are extremely important for making sure the ocean stays healthy. They are also really important for humans too. Check out the top six reasons why...

## 1. FOOD CHAIN KEPT IN CHECK

Many sharks are **apex predators**. This means as they are at the top of the **food chain**, they feed on species that are most numerous.

Sharks feed on a variety of animals - this may mean munching on crustaceans or tucking into larger species, such as seals. By doing so, they keep the population of other marine animals in check, so that the ecosystem remains in balance. Sharks also rely on other species to help them keep clean. **Remoras** clear the waters of scraps around the shark, as well as parasites. As a result, these **symbiotic relationships** all help keep the ocean healthy too, allowing for a wide variety of marine life and diverse **marine biodiversity to thrive**.



## 2. FOOD SOURCE

Sharks are important to many coastal communities around the world, where they are a source of food. Shark meat is popular to in Japan. In Ireland, ray wings and dogfish meat are sold in fish shops.

## 3. SHARK ECO-TOURISM

The fascination of sharks has grown in recent years, generating a thriving **eco-tourism** industry in places like the Bahamas, South Africa, Galápagos Islands – as well as Ireland. It allows people to dive and observe these species in their natural environment.

Sharks, skates and rays kept in large **aquariums** can also provide opportunities for people of all age groups to observe the different species. Seeing them up close, encourages people to develop a positive connection with them!



## 4. SHARK-INSPIRED DESIGN

Inspired by sharks, inventors, scientists, designers and engineers have come up with innovative ways to help humans.

Nearly 20 years ago, the **Fastskin LZR Racer swim suit** was inspired by shark skin. The high-tech suits were designed to help swimmers swim faster. These super all-length body suits have now been banned in major swimming competitions.

Surfers have also benefitted from shark inspired designs: **'Shark-repellent wetsuits'**. Black and white striped suits and blue and white suits were designed to act like a camouflage, where the colours would break the silhouette of the swimmer in the water. It is likely that the shark will think of the surfer or swimmer as a 'blob' – instead of a seal!



Sharks have inspired lots of other designs too. Designers have also created the coolest cars where their shape is inspired by the mako shark. Designed over 80 years ago, the **Mako Shark Corvette** cars are now classics!

## 5. INSPIRATION FOR HEALTH

Scientists are also puzzled why sharks rarely get sick. By looking at the texture of shark skin, a scientist that researches materials, worked out that the denticles of a shark's skin helps prevent barnacles and other tiny organisms from growing on their body. Inspired by this, the **Sharklet surface coating** was invented. The coating can be used on surfaces in hospitals to prevent the growth of bacteria and superbugs!

## 6. SHARKS RECYCLE CARBON

When ocean plants and animals die, their remains sink to the seabed. When they decompose, they release carbon dioxide and nutrients back into the water. Deep-sea sharks help remove carbon by scavenging dead animals on the ocean floor.





# Top Tips to Help Save the Sharks!

This is a critical time for our oceans, so we hope this book will inspire you to look out for sharks, skates and rays. We hope you can do your bit with your friends and family to help protect these wonderful animals in Irish waters and around the world.

## Here are our top tips:

**1**

**SHARKS ARE NOT VILLAINS!** Because many people are afraid of sharks, they don't want to protect them. Use your new knowledge to wow your friends and family with shark facts and encourage them to see how amazing these animals really are!

**2**

We all love fish and they are a great food source for humans. When eating fish and chips, or your family is buying fish for dinner, check that the fish is from a sustainable fishery.

**3**

If you go to watch sharks in the wild, always follow the guidelines to keep yourself and the sharks safe.

Never touch them, don't get within four metres of them, and don't chase them in boats, kayaks or on paddleboards.

**4**

With the help of your family, teacher, or class, ask local politicians to support measures to encourage sustainable fisheries and Marine Protected Areas.

**5**

Reducing your plastic use and making climate-friendly decisions will help sharks and other marine life.

**6**

Eggcases come in all shapes and sizes. Don't forget to collect and record the shark and skate egg cases on Purse Search Ireland citizen science project. You can also record your data at [Sharktrust.org](http://Sharktrust.org) as part of the Great Eggcase Hunt.



**Keep Exploring!**

# Further Resources & References

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- British Sea Fishing: <https://britishseafishing.co.uk/skates-and-rays/>
- FishBase – The Global encyclopedia about fish: <https://www.fishbase.se>
- Florida Museum – Fish Species Profiles: <https://www.floridamuseum.ufl.edu/discover-fish/species-profiles>
- Irish Elasmobranch Group: <https://irishelasmobranchgroup.com/irishelasmobranchs/>
- Ireland's Wildlife – Basking Shark: <https://irelandswildlife.com/basking-shark-cetorhinus-maximus/>
- Purse Search Ireland: <https://marinedimensions.ie/purse-search-ireland/>
- SeaWiFS Project NASA Goddard Space Flight Center – Research Article: Shark Senses and Ecology: [https://seawifs.gsfc.nasa.gov/jason/HTML/CURRICULUM\\_JASON\\_7\\_RESEARCH\\_ARTICLE\\_SHARKS.html](https://seawifs.gsfc.nasa.gov/jason/HTML/CURRICULUM_JASON_7_RESEARCH_ARTICLE_SHARKS.html)

- The Deep: [www.thedeep.co.uk](http://www.thedeep.co.uk)
- The International Shark Attack File: <https://www.floridamuseum.ufl.edu/sharkattacks/>
- The Irish Basking Shark Group: <https://www.baskingshark.ie/>
- The IUCN Red List of Threatened Species: <https://www.iucnredlist.org/>
- The Ray Project: <https://www.therayproject.org/>
- The Shark Trust: <https://www.sharktrust.org/>
- The Shark Trust Guide to mermaids' purses: <https://www.sharktrust.org/Pages/FAQs/Category/eggcases-of-british-isles-nw-europe>

## Videos & Documentaries:

- BBC Shark: <https://www.bbc.co.uk/programmes/p02n7s0d>
- Secrets of the Basking Shark: <https://vimeo.com/720024025>

## Photos:

A big thank you to all of the photographers and film makers who have dived into the ocean waters to take photos of sharks, skates and rays. These images have opened up a new world for many of us who are landlubbers. They have also provided us with a new appreciation of the diversity of sharks, skates and rays around Ireland and the rest of the world.

Photos in this book are courtesy of: Jonathan White, Graham Johnston, Robert Bunn Colin O'Loan – Galway Bay Sailing Club Kyakers, Nicholas Payne, Cushla Dromgool-Regan, Mona McCrea and Sarah Varian.

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