

Versatile Vertebrates

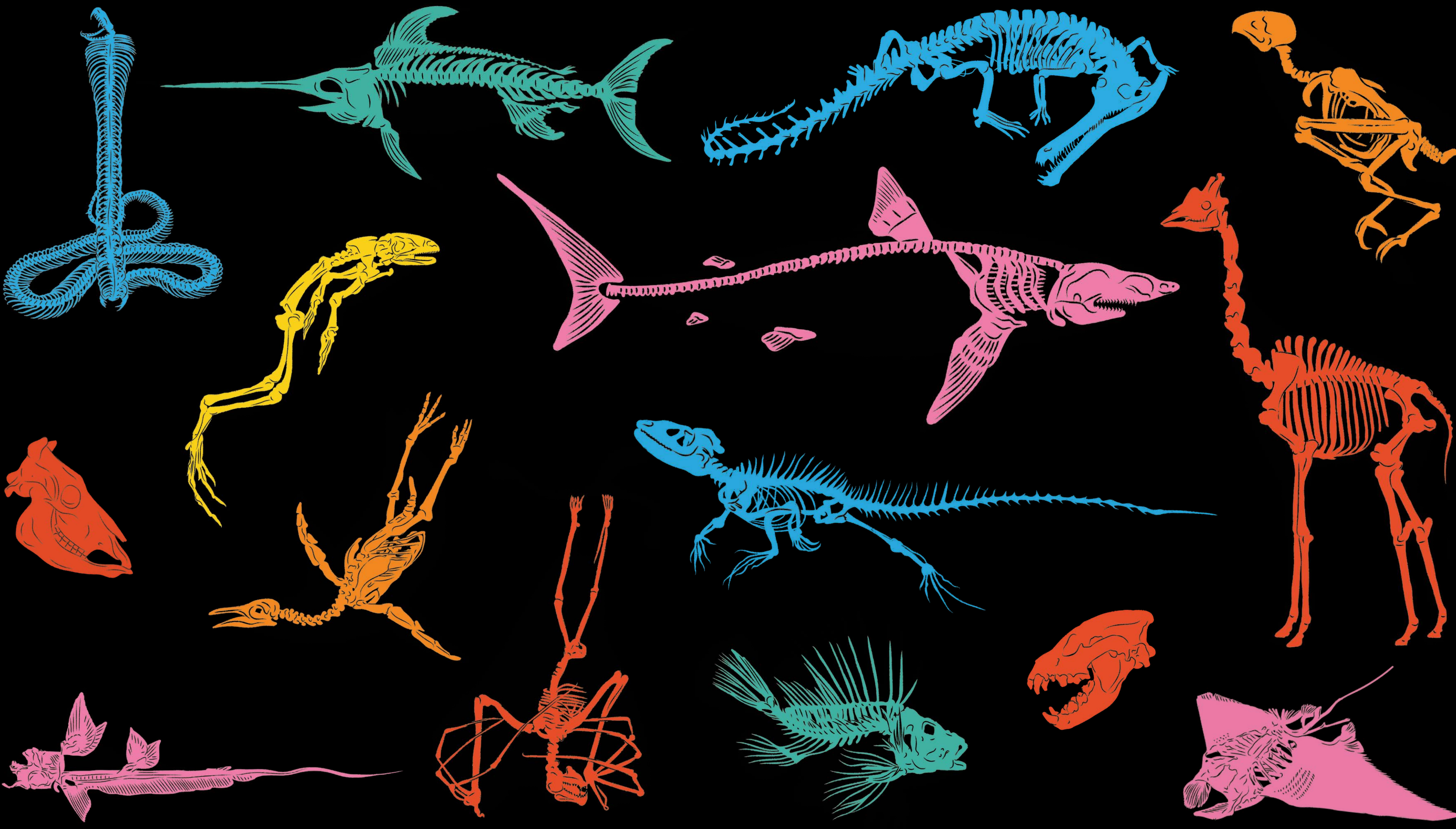
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Versatile Vertebrates



Albatros





Versatile Vertebrates

Albatros



There are many animal species in the world. Counting just the ones we can find, there are about two million of them. Some are still hidden from us, waiting to be discovered. Sadly, others have already been lost forever.

Clever scientists have ordered these animals into groups to help us understand them better. Vertebrates comprise the biggest group. To be a vertebrate, you need a skeleton, and this skeleton must have a skull and a backbone.

Many different animals are vertebrates, including us humans. If you knock on your own head, the sound you hear is made by your skull. When you see someone with a sore neck or back, the ache is coming from the backbone. The backbone is composed of vertebrae, which cause pain if moved in the wrong way. *Vertebrates* take their name from the *vertebrae*.

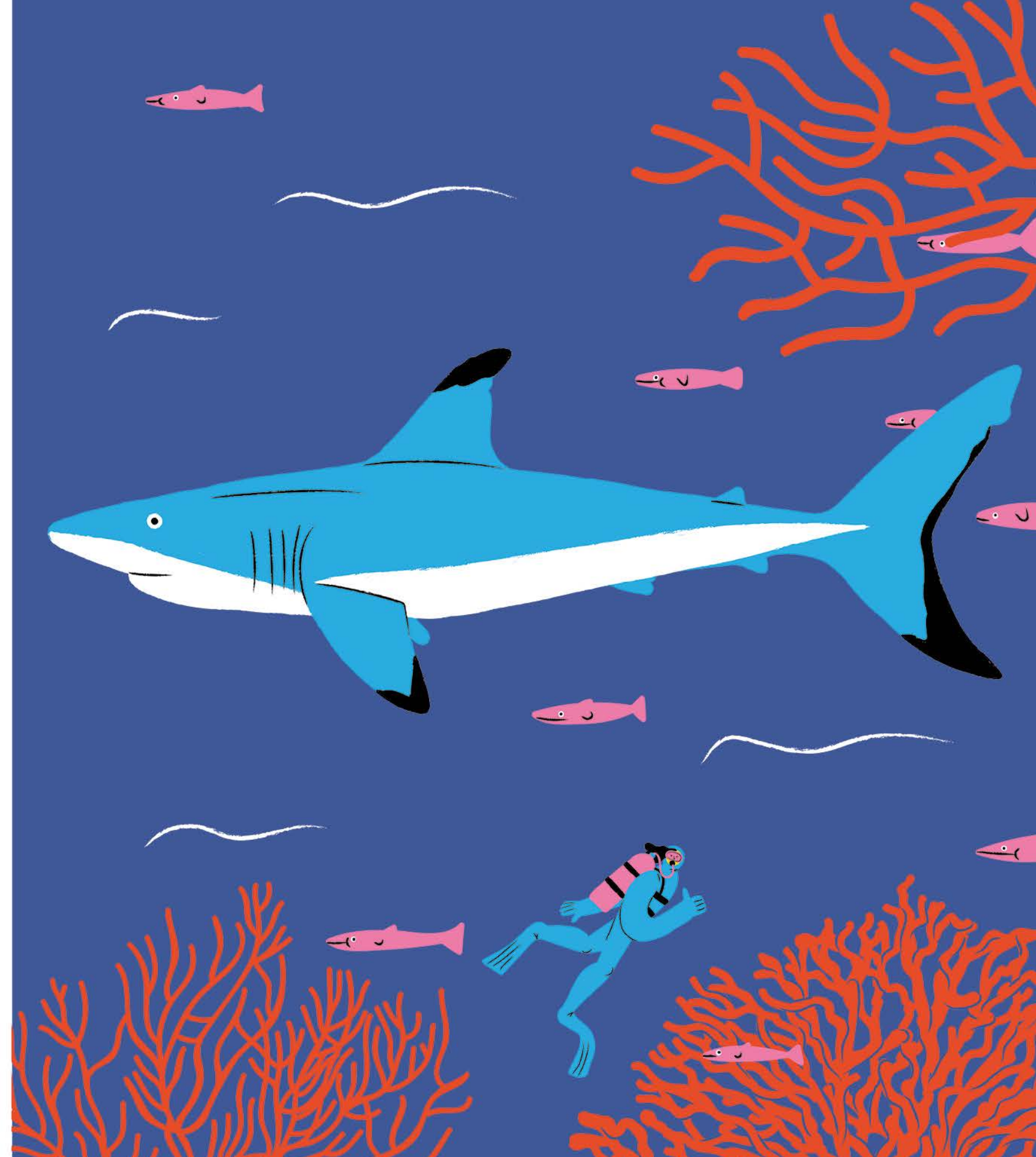
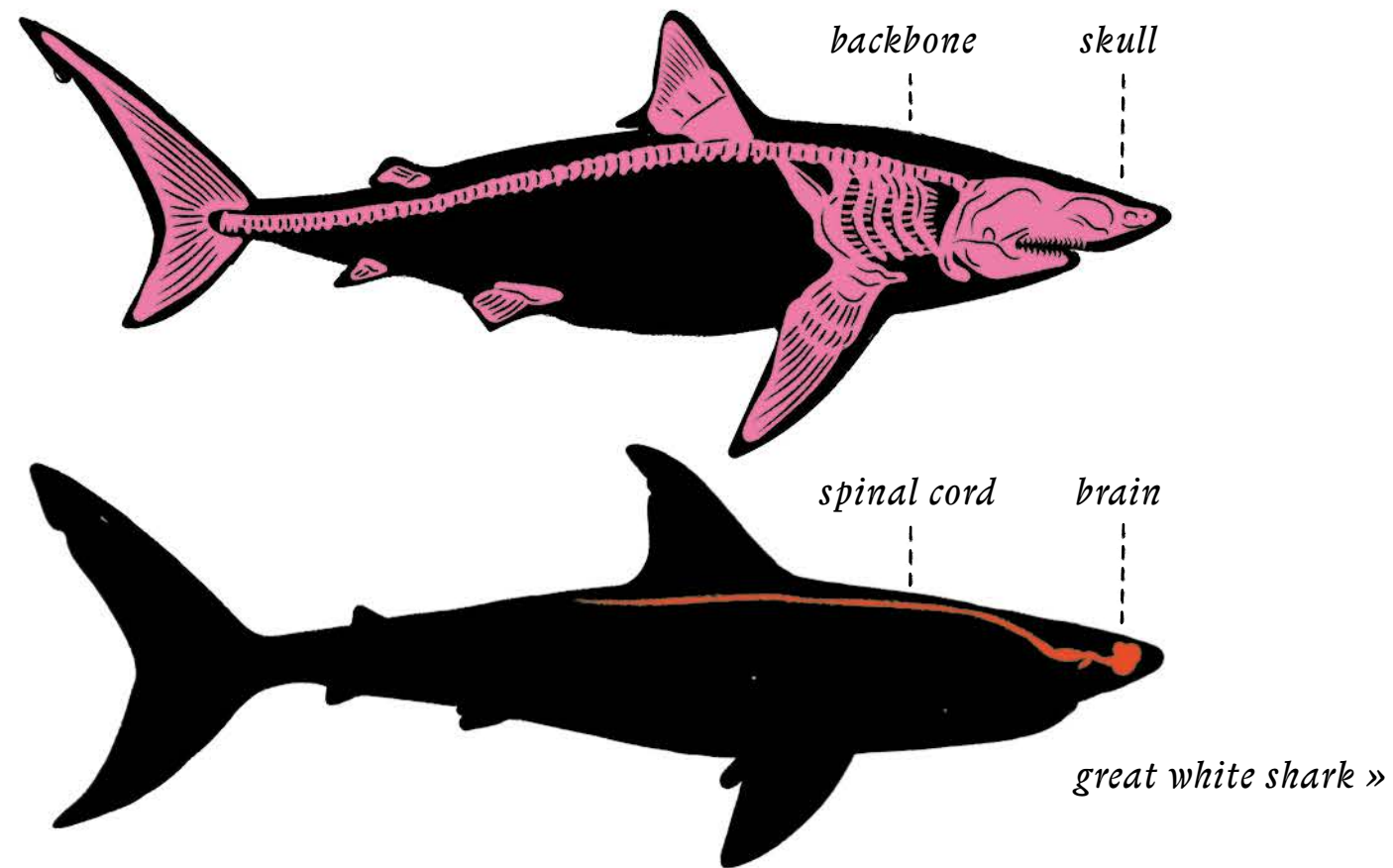
We humans are also mammals. Mammalian young are suckled by the mother. All other mammals are vertebrates too. As well as mammals, vertebrates include birds, reptiles, amphibians, fish, and cartilaginous fish. Even though their skeletons are mainly composed of cartilage, cartilaginous fish are vertebrates. We can forgive them this, as they have been in the world for over 500 million years! When fish and cartilaginous fish were first around, Earth was one big ocean. Hard to imagine, isn't it?

While fish and cartilaginous fish have remained in the oceans, they now also swim in lakes, rivers, streams, and ponds too. Some even live in aquariums. Amphibians are happy in water, on land, and underground. Reptiles too. Birds and mammals do as they please in all kinds of places: on land, underground, in the water, and in the air. What all these creatures have in common is their breathing—they need oxygen to live. They also need food. And as they can't be left alone, they must reproduce regularly.

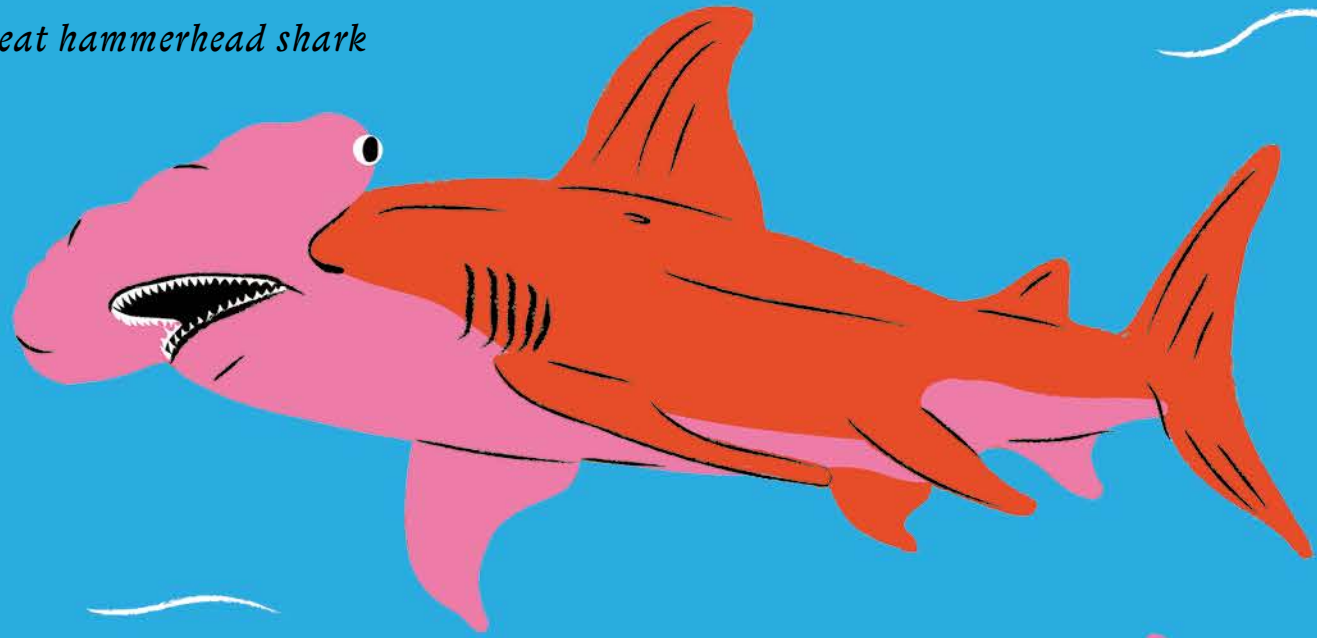
This book doesn't explain what makes humans happiest and what is most important for human life—which is as it should be, because we humans know these things very well already. Instead, this book explains what other vertebrates do and don't enjoy, and it tells us about all the things they can manage. If there's anything you wish to know about vertebrates but fail to find here, go ask a vertebrate—specifically a zookeeper!

Cartilaginous fish

Cartilaginous fish live mainly in the seas and oceans, leaving salt water for fresh water very rarely. A cartilaginous fish has a head, a trunk, and fins. A regular fish has these too, although most fish have skeletons made of bone, whereas cartilaginous fish have skeletons made of—you guessed it—cartilage. This difference may not be apparent at first sight.



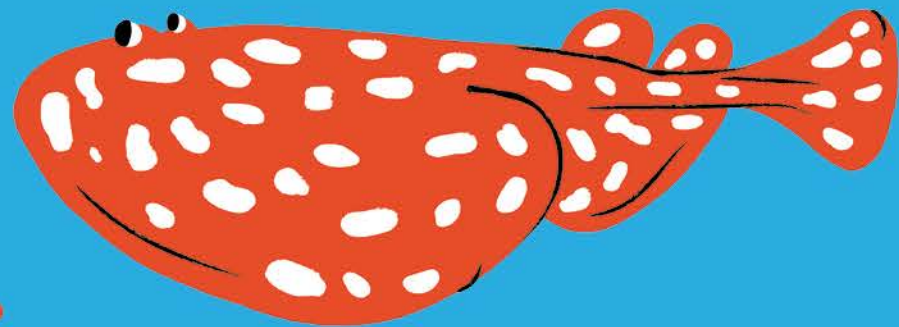
great hammerhead shark



rabbit fish

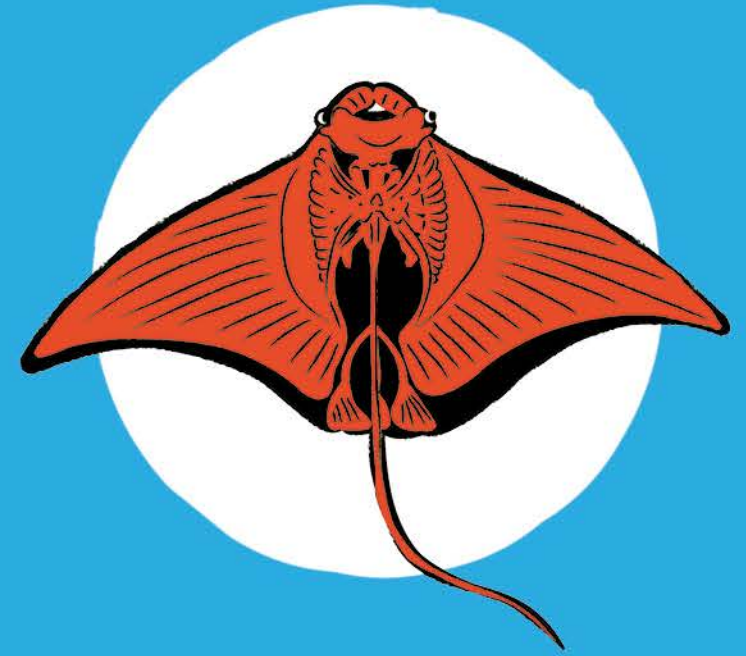


marbled electric ray

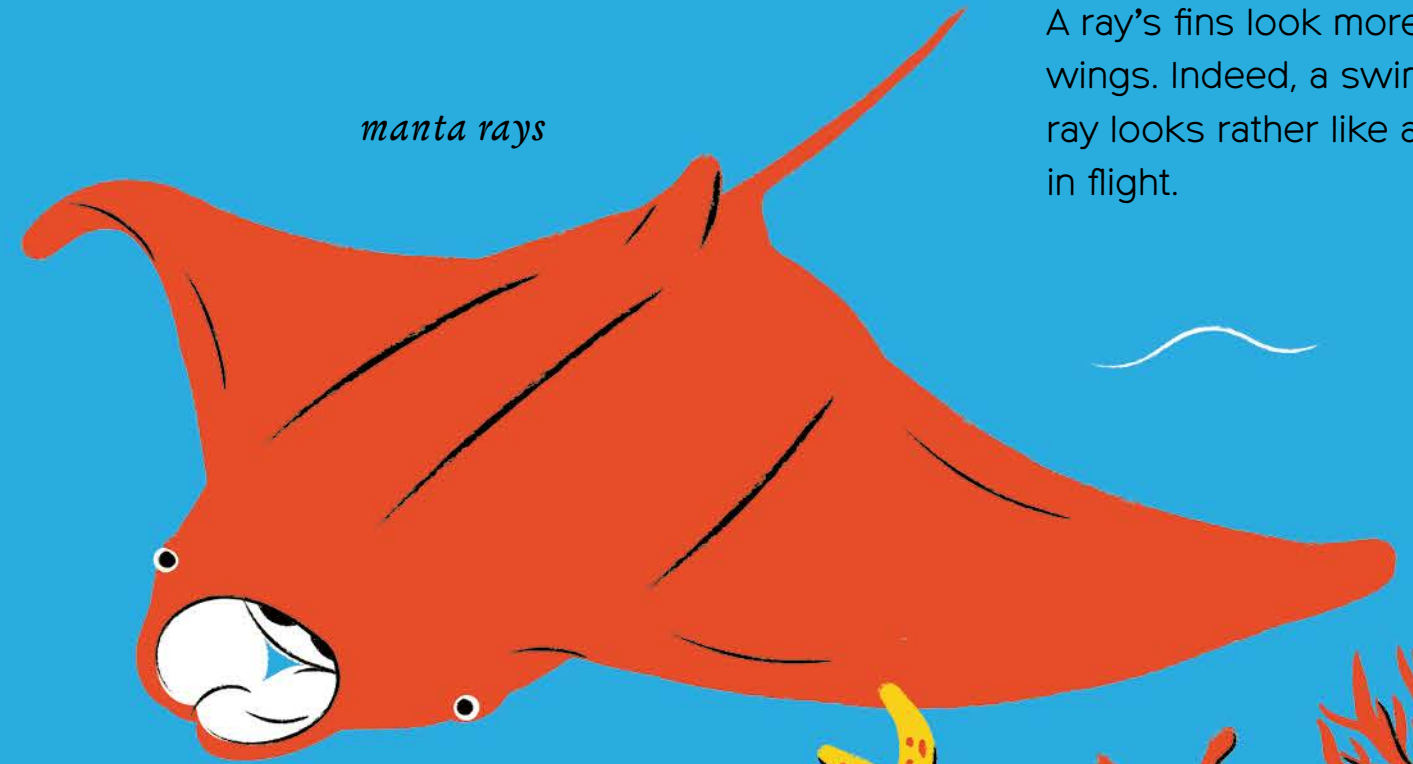


Cartilaginous fish come in three basic shapes: fish-shape (e.g., the shark), flat (e.g., the ray), and chimaera shape.

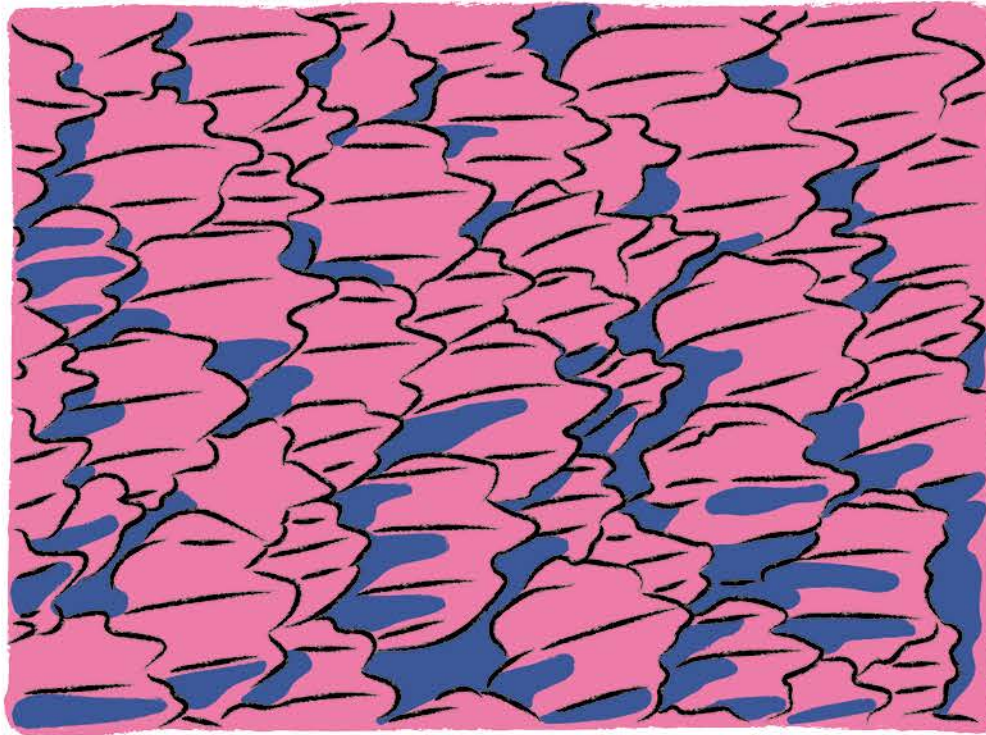
manta ray skeleton



manta rays

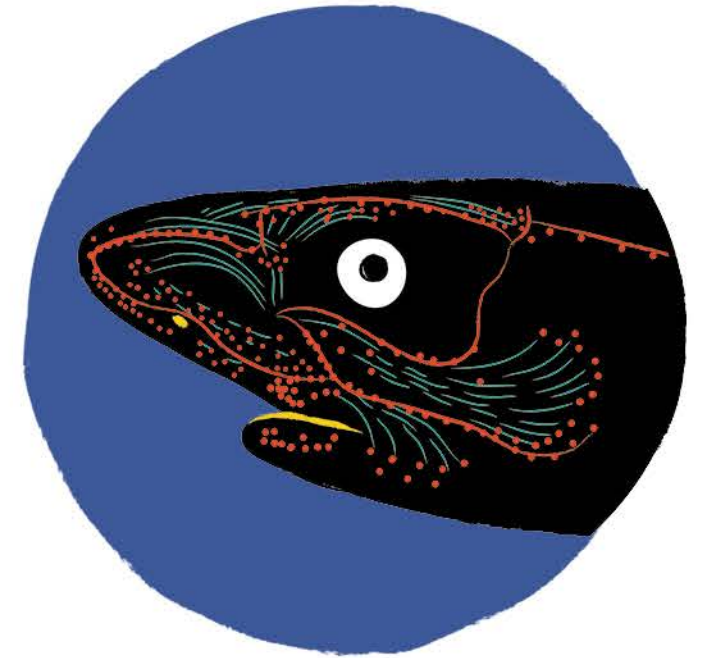


A ray's fins look more like wings. Indeed, a swimming ray looks rather like a bird in flight.

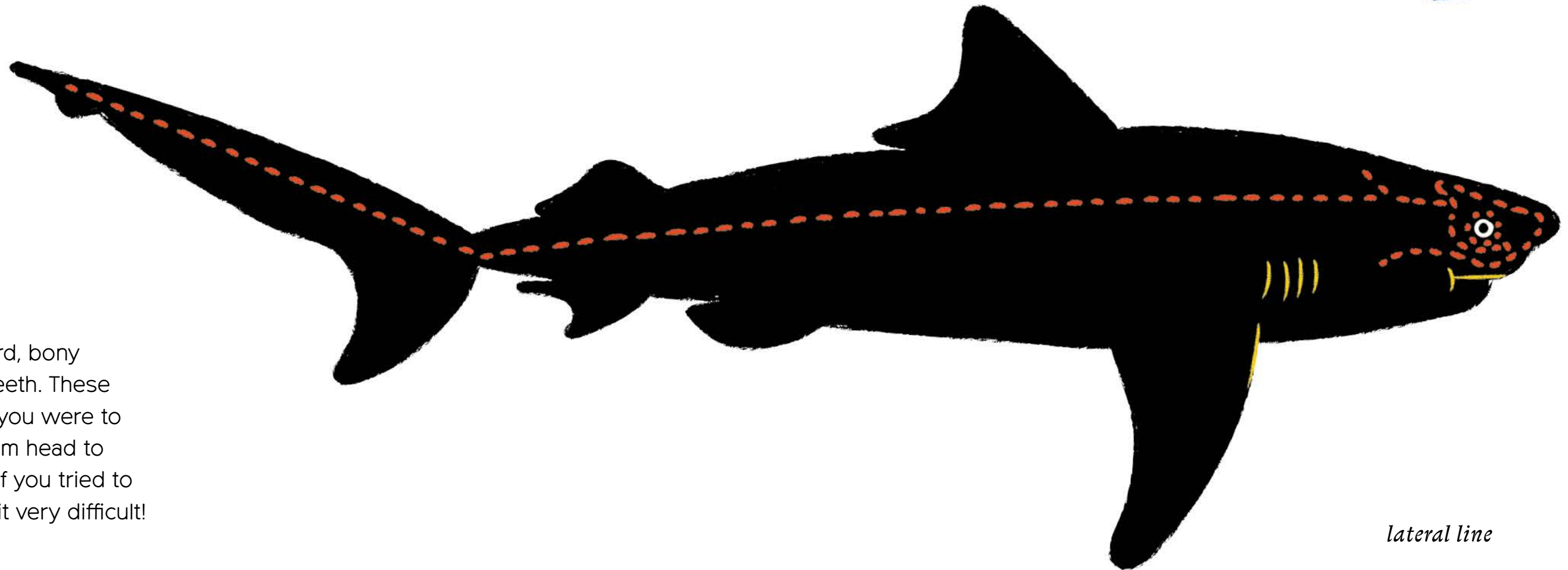


*shark's scales
under a microscope*

Sharks are amazing hunters. Although their sight is poor, they have very good hearing and excellent smell. They sense the presence of lunch from some miles away. Their impressive ampullae of Lorenzini (right) pick up the faintest electric signals given out by their prey. The icing on the cake is the lateral line on their bodies, which tells them how deep they are and how much salt water they are surrounded by.



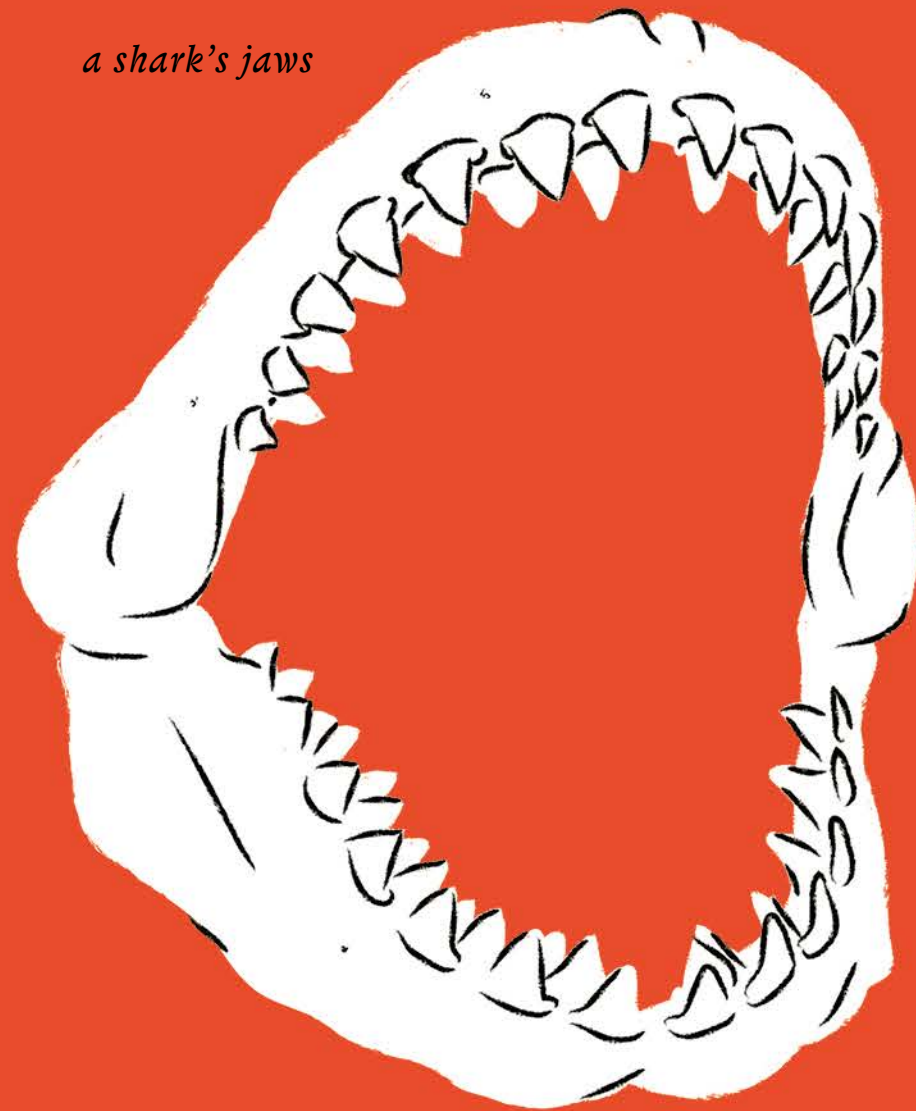
ampullae of Lorenzini



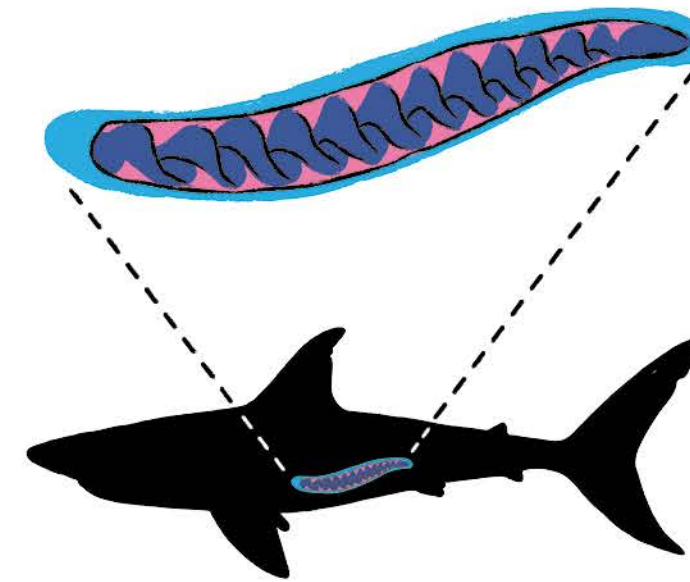
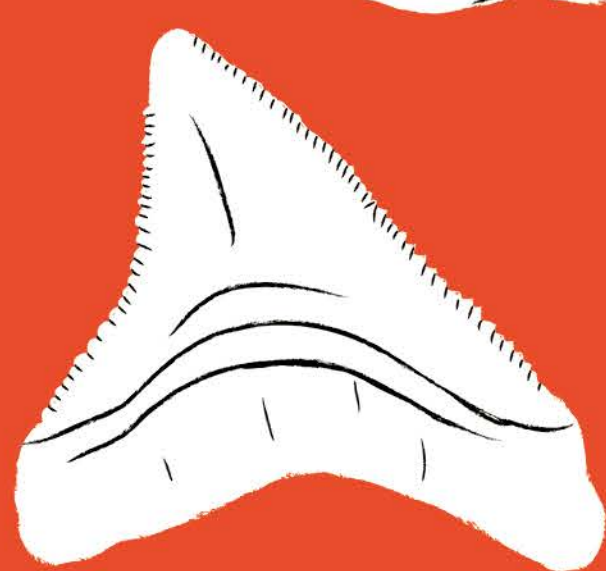
lateral line

Cartilaginous fish have hard, bony scales that remind us of teeth. These scales protect the skin. If you were to pet a cartilaginous fish from head to tail, it would feel smooth. If you tried to scratch it, you would find it very difficult!

a shark's jaws

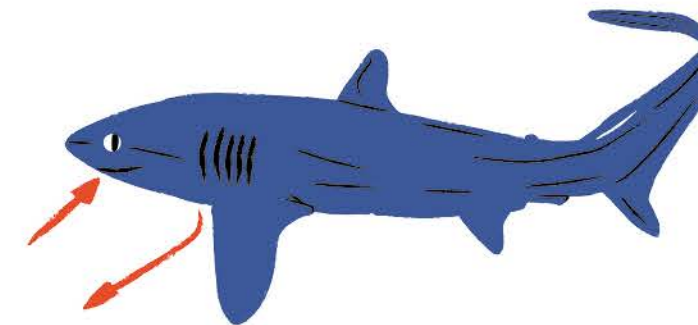


Apart from the chimaeras, all cartilaginous fish constantly grow teeth. What a pity that we humans can't do the same! Plus, unlike humans, cartilaginous fish grow teeth in several rows.



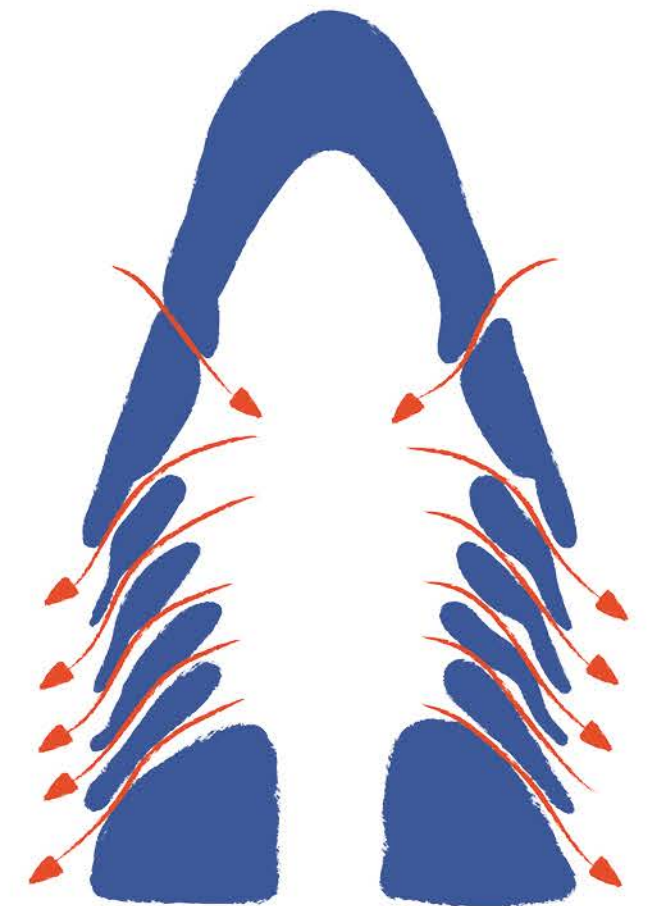
a shark's spiral valve

A shark has a special spiral valve in its stomach, which helps it digest. As its intestines are much shorter than ours, its digestion is slow. In its behind, a shark has a special gland to filter the salt it swallows along with seawater.



Gills look like this.

Cartilaginous fish take oxygen from the water through their gills. In order to breathe, they must swim a lot, as their gills work like a sieve to collect oxygen from the water.

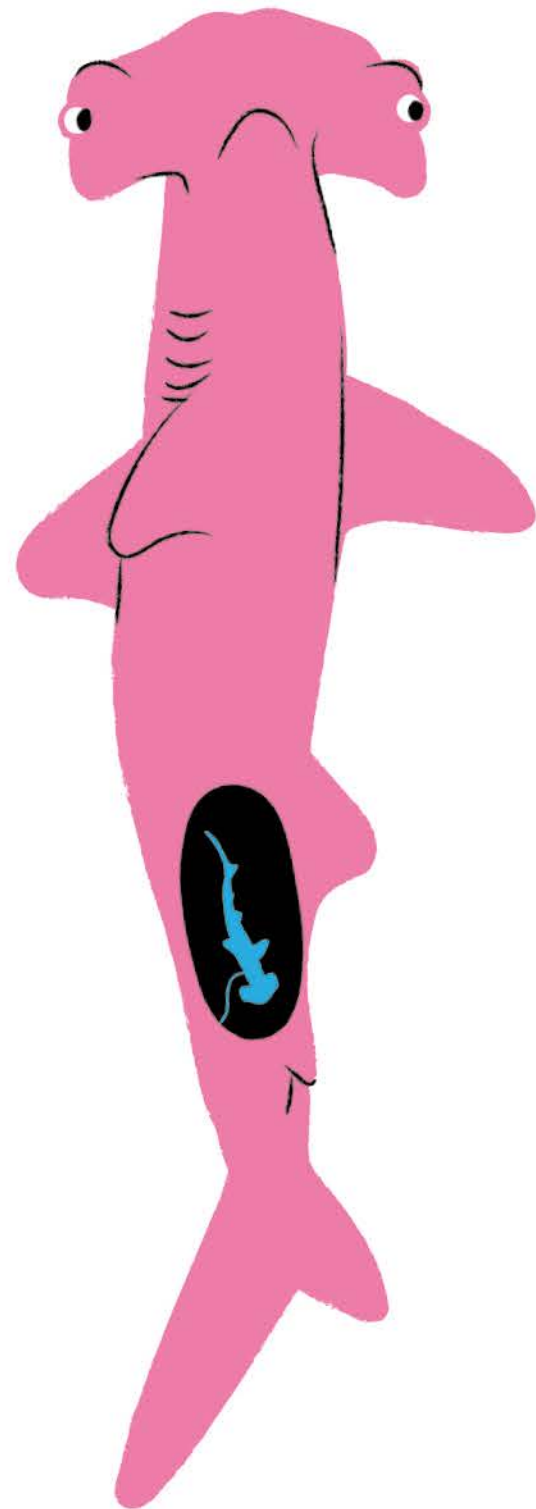


Gills work like this.



shark eggs

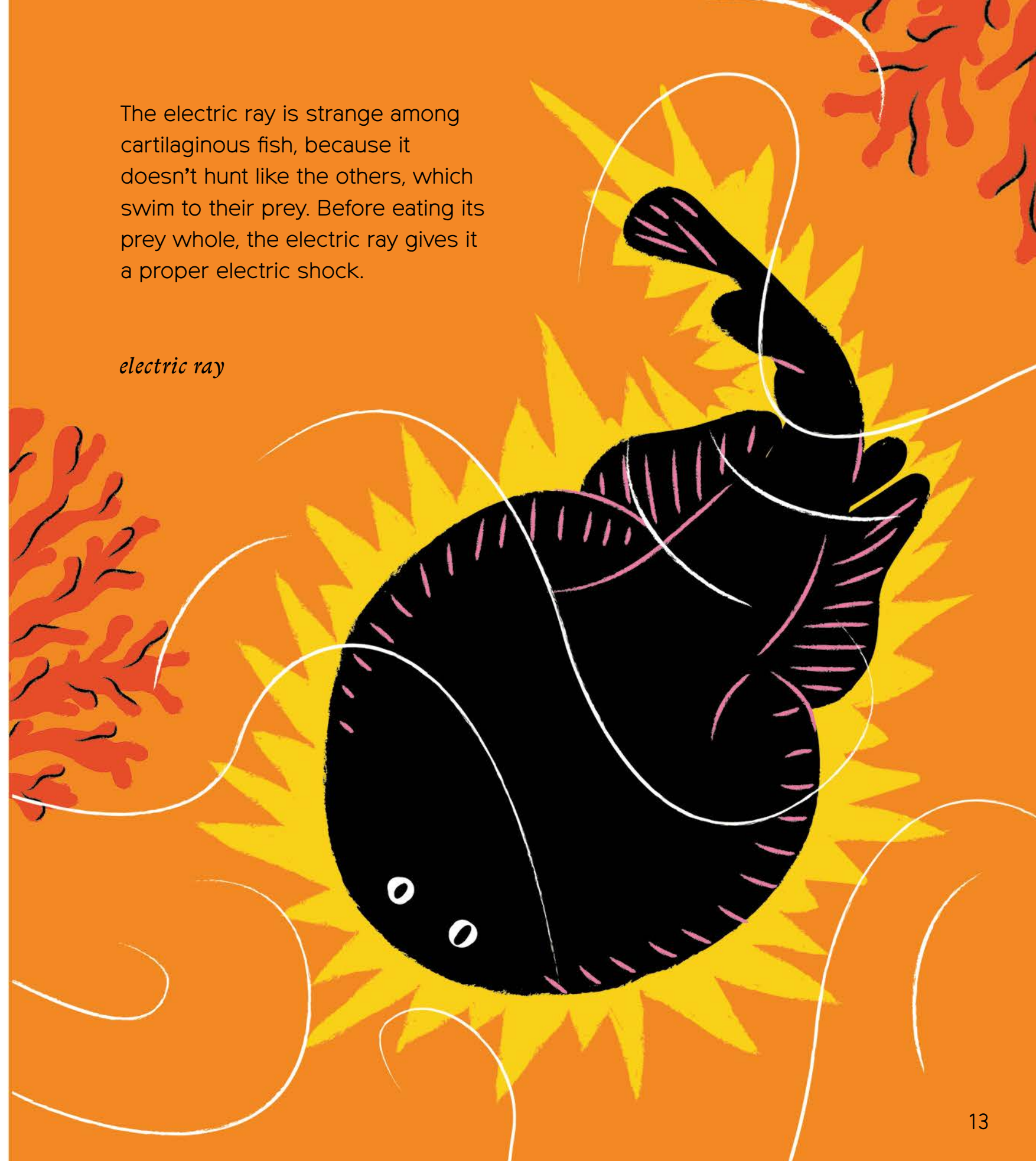
Cartilaginous fish hatch in different ways—some from eggs outside the mother's body, others from eggs inside it.



great hammerhead shark (female)

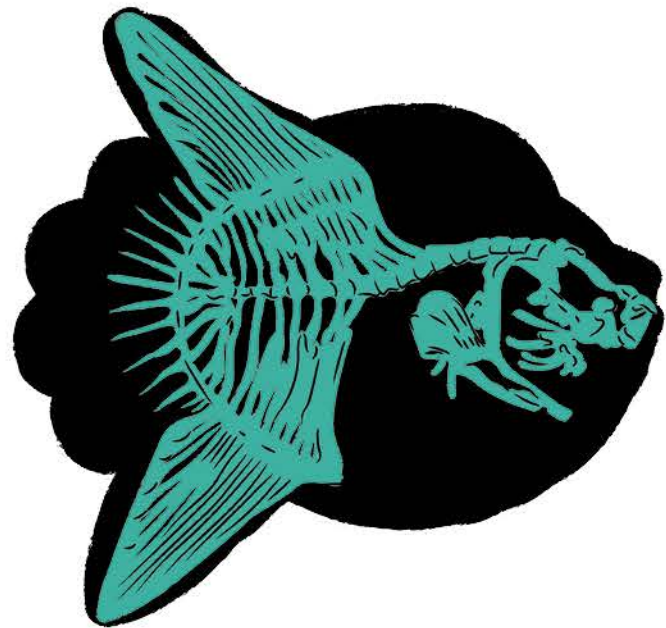
The electric ray is strange among cartilaginous fish, because it doesn't hunt like the others, which swim to their prey. Before eating its prey whole, the electric ray gives it a proper electric shock.

electric ray



Fish

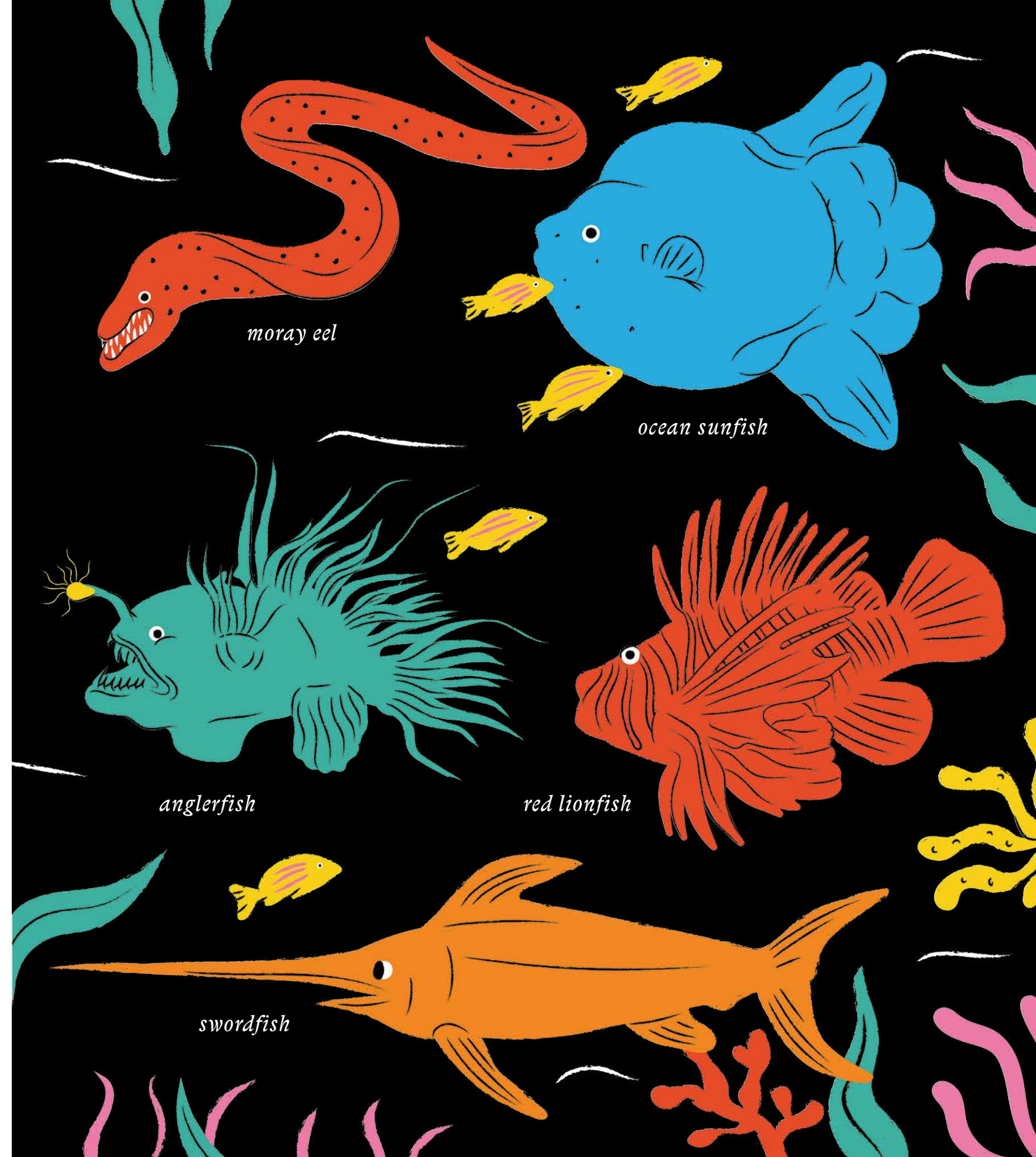
Not all fish live in the salt water of the sea (like the ones on the next page). We also find them in the fresh water of ponds and rivers. Like cartilaginous fish, they have a head, a trunk, and fins. Unlike cartilaginous fish, they can't be categorized by shape, because they come in all kinds. A sunfish looks nothing like an eel, for instance.



ocean sunfish (skeleton)



moray eel (skeleton)



moray eel

ocean sunfish

anglerfish

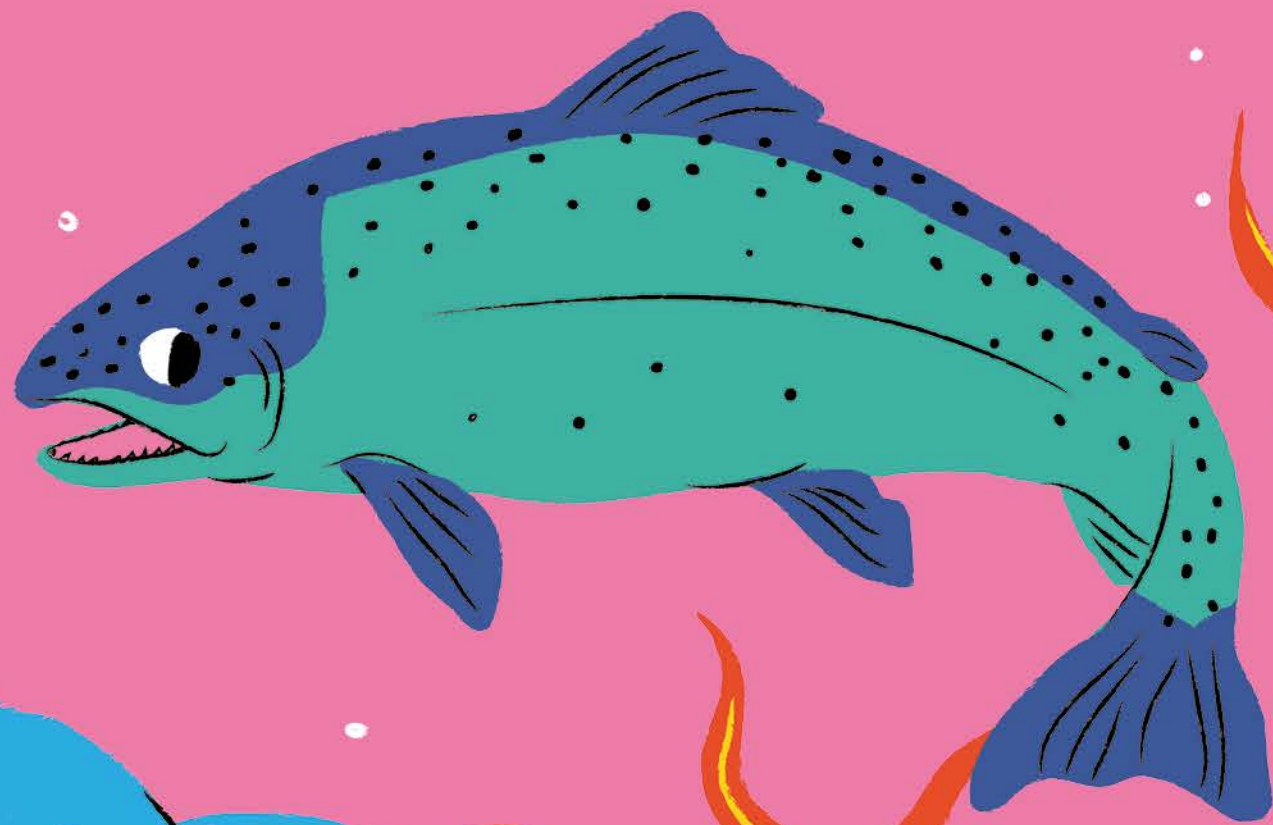
red lionfish

swordfish

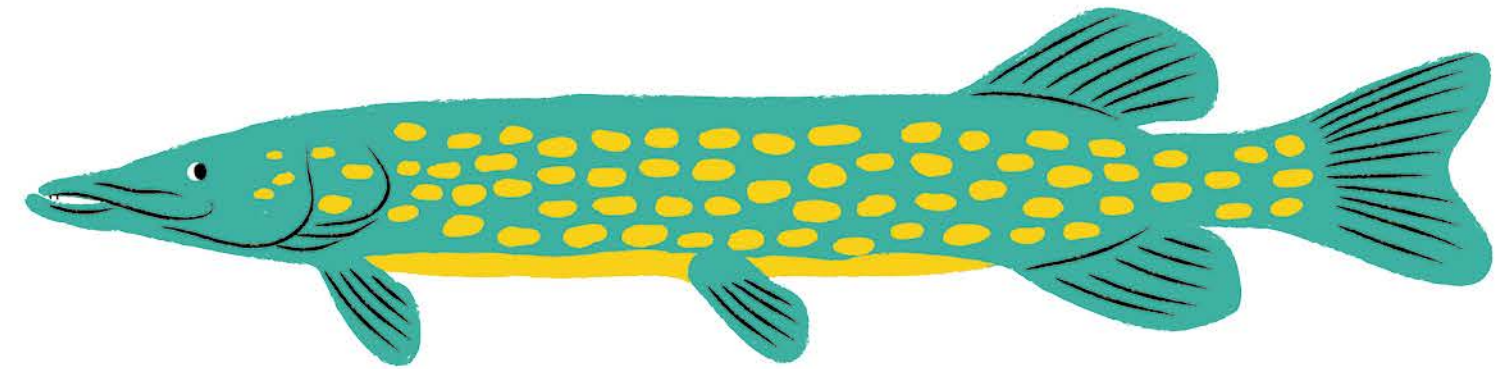


Fish, too, use their gills to sort oxygen from the water, although their gills are on the inside. To breathe in, a fish fills its mouth with water. To breathe out, it pushes this water through its gills.

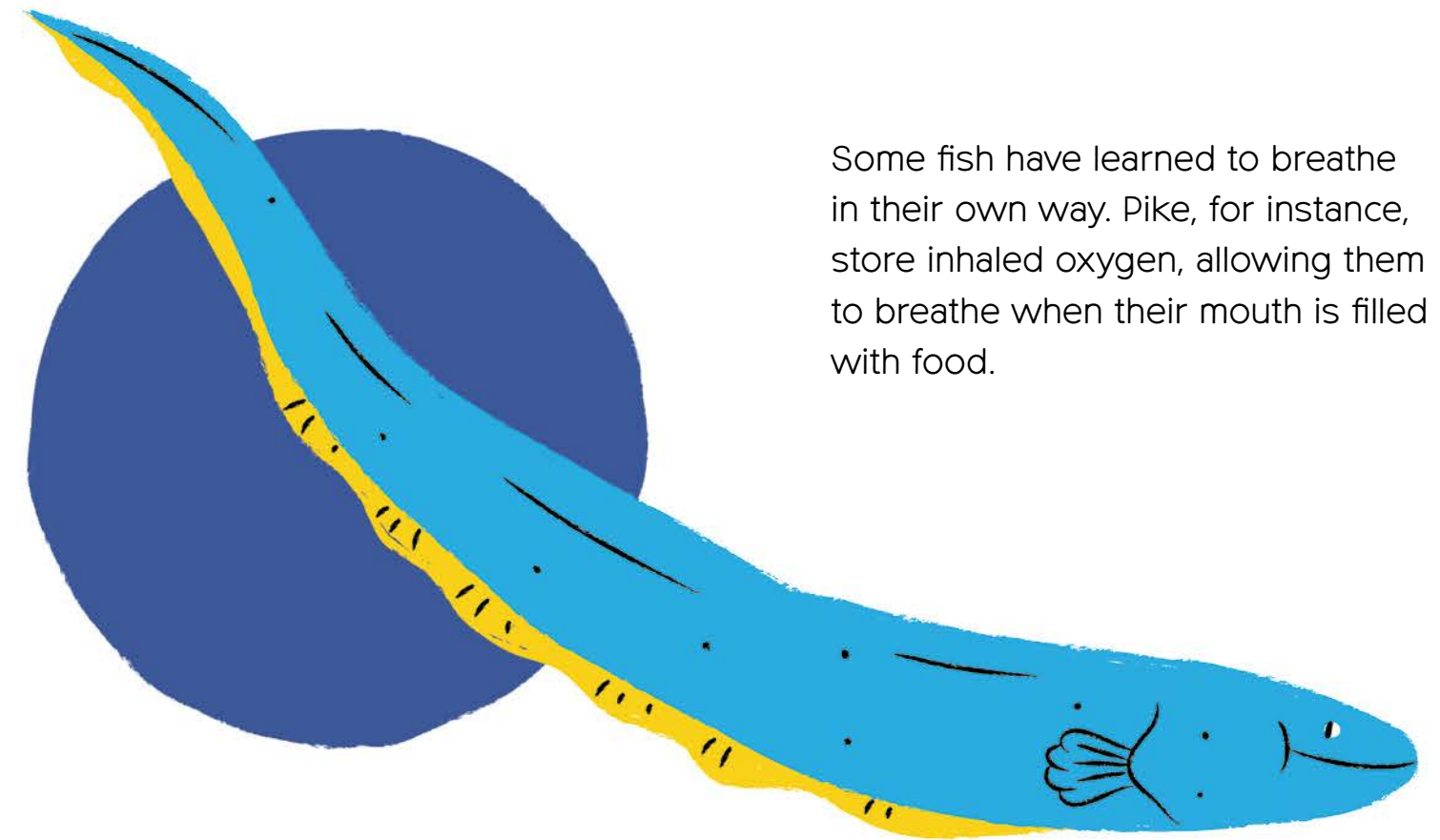
salmon breathing through its gills



pike (breathing)



Some fish have learned to breathe in their own way. Pike, for instance, store inhaled oxygen, allowing them to breathe when their mouth is filled with food.



The eel can breathe through its skin—an achievement that allows it to stay on land for hours at a time. Eventually, of course, it must return to the water to keep from drying out.

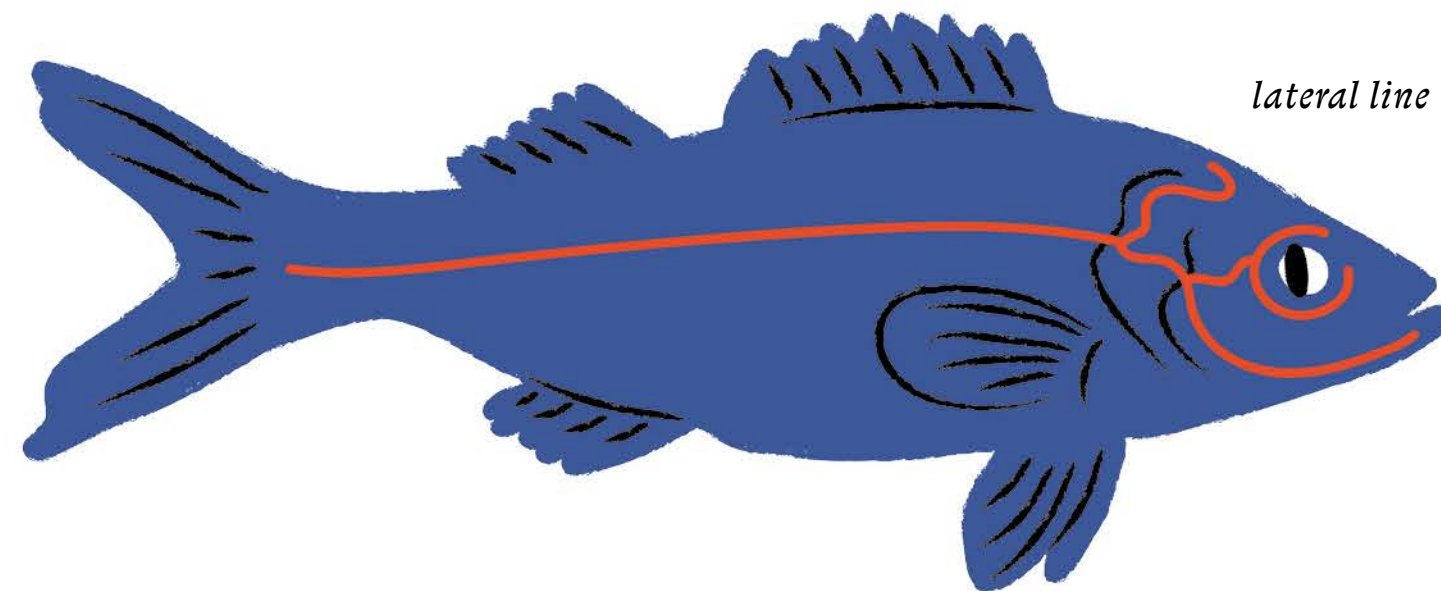
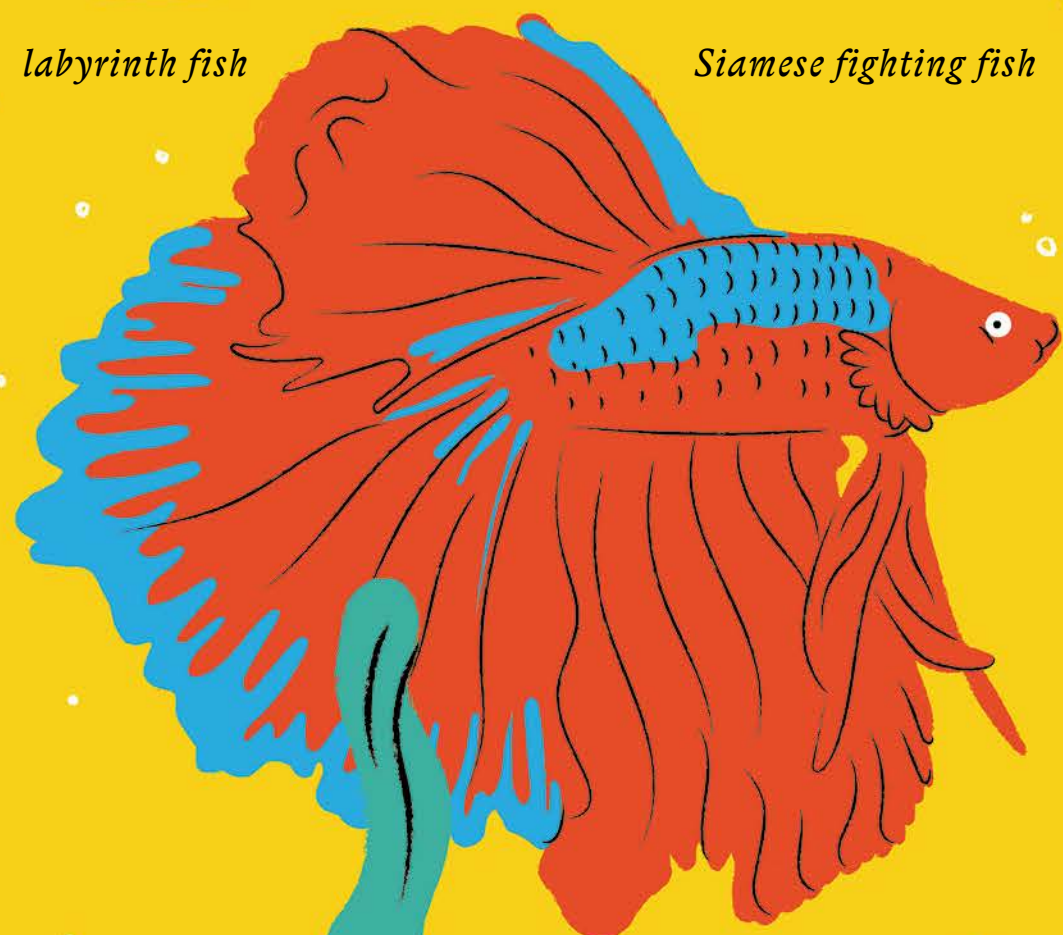
European eel



This little chap is called the labyrinth fish because of its extra breathing organ, which looks like a maze, also called a labyrinth. This organ allows it to inhale oxygen directly from the air.

labyrinth fish

Siamese fighting fish

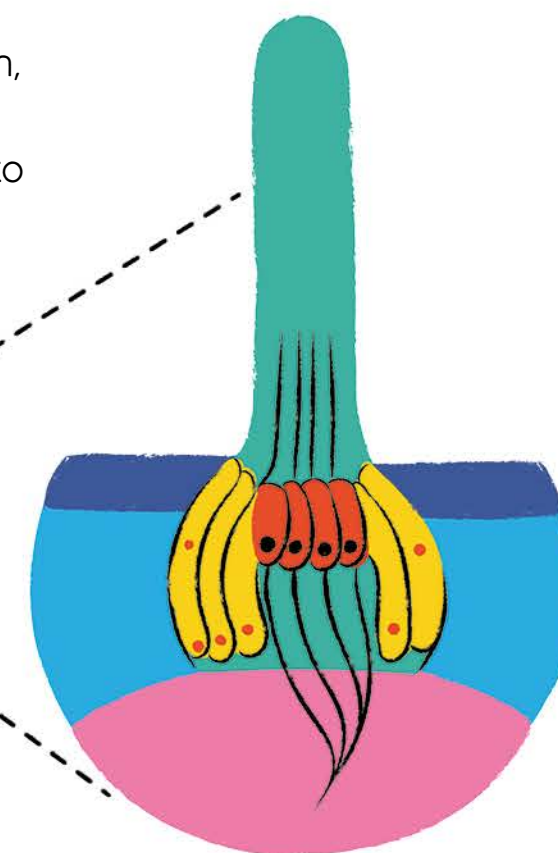


lateral line

Fish have sensitive whiskers. These allow them to taste the water around them and to gauge the temperature. Like cartilaginous fish, they have a lateral line by which they tell the strength of the water current. Although their ears are hidden, fish can hear, and they see in color. A fish's eyes contain a water-like liquid, which allows it to see underwater—like humans do, when we go diving with goggles on.



sensitive places on a fish's face



tactile hair



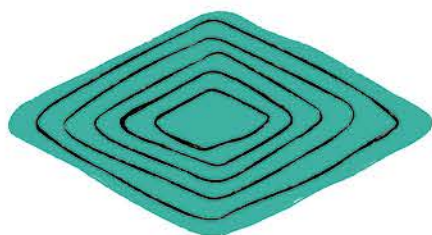
fish skin under a microscope

We shouldn't touch fish. Not because they are slippery and slimy, but because we would harm them. This slipperiness is concealed in glands in the fish's skin. Fish need this slime, which protects their sensitive skin from damage and bacteria, as well as from rascals who would like to catch them in their bare hands.

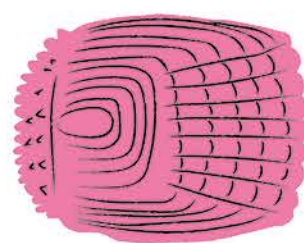
Their bony scales have a similarly protective purpose. As you can see in the picture below, fish scales vary from species to species. You will also notice that scales have different grooves on them. Like the annual rings of trees, these grooves increase in number with age, thereby allowing us to tell the age of the fish.



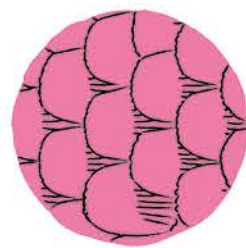
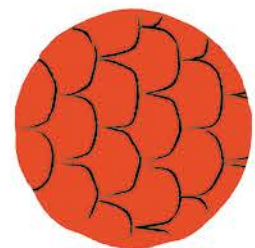
round scales of smooth-skinned fish



rhomboid scales of more-evolved fish

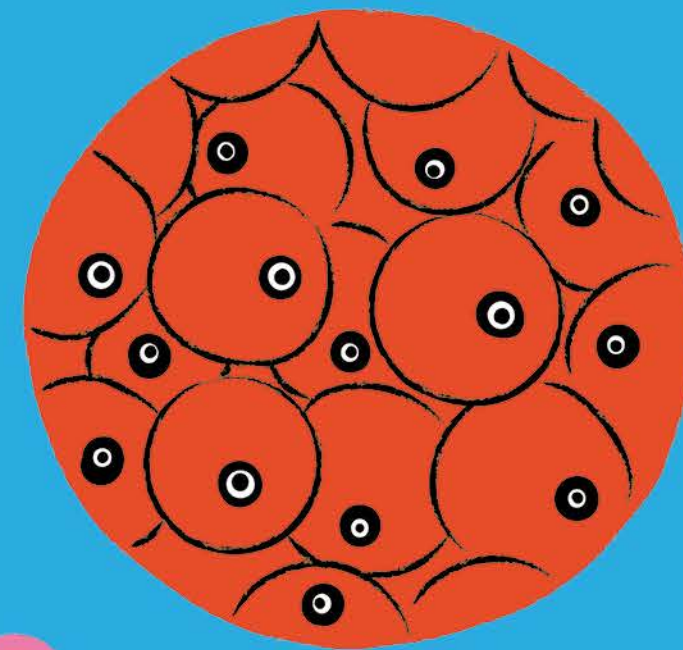


placoid scales of fish with sharp dorsal fin



Fish eggs, too, vary from species to species. Some fish simply spray their eggs into the water. Others might stick them to a rock or plant, and it is from here that the young fish—known as fry—emerge.

fry

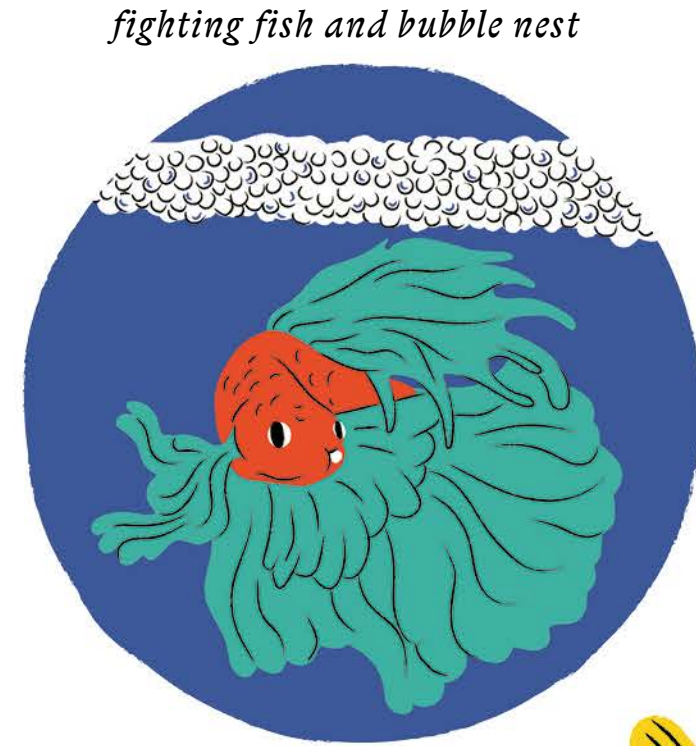


eggs on a rock



Some fish eggs are carried in the mother's belly. In the case of the seahorse, though, the eggs are the father's concern. The mother places them in a pouch on the belly, where they are cared for by the father until they are grown and shoot out of the pouch.

seahorse (male)



fighting fish and bubble nest

That it breathes oxygen from the air isn't the only strange thing about the labyrinth fish. Its newly laid eggs are stuck together so that they look like a floating nest.








The bitterling is so afraid for its eggs that it keeps them safe by hiding them in a shell. To place their eggs, they use a tubular organ called an ovipositor.

bitterling with ovipositor

Who am I? Where did I come from?
What am I doing here? Questions all of us
probably ask at some point. This book doesn't
answer these questions, but it does answer
similar ones. I imagine you shaking your
head in confusion, thinking I'm just trying
to fill the space on this book's back cover.
But shaking your head is a sign that you are
a vertebrate. And vertebrates are what this
book is about. That's right—all the vertebrates
in this book are relatives of yours and mine.
So now you get my point. And if you don't,
this book will explain it all to you. Well, now I'm
out of space. So take a look and read on!



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