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Versatile Vertebrates



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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 been lost forever.

Clever scientists have ordered these animals in 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.

Very many different animals are vertebrates, including humans. When you tap someone on the head, the sound you hear is made by their 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.

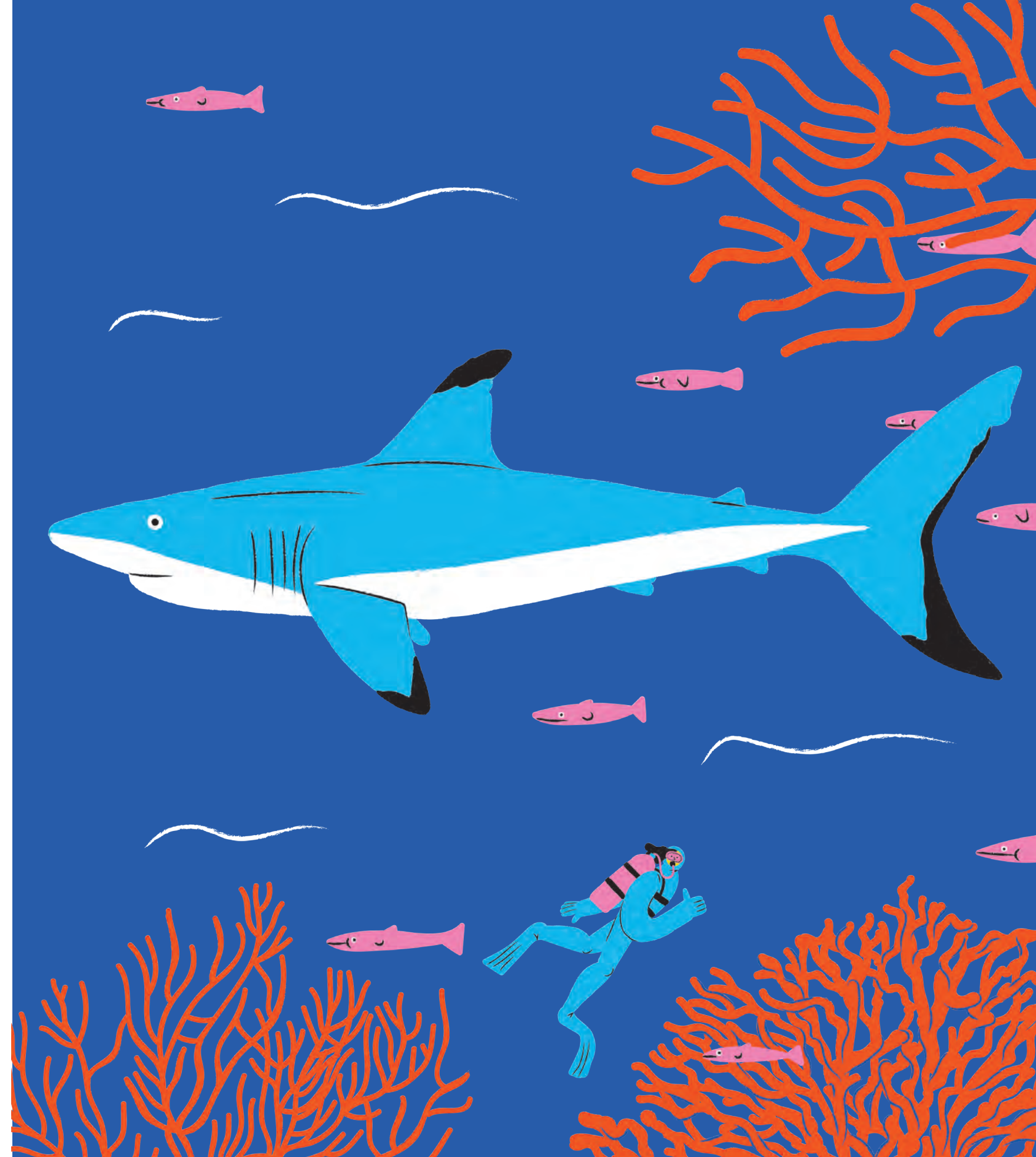
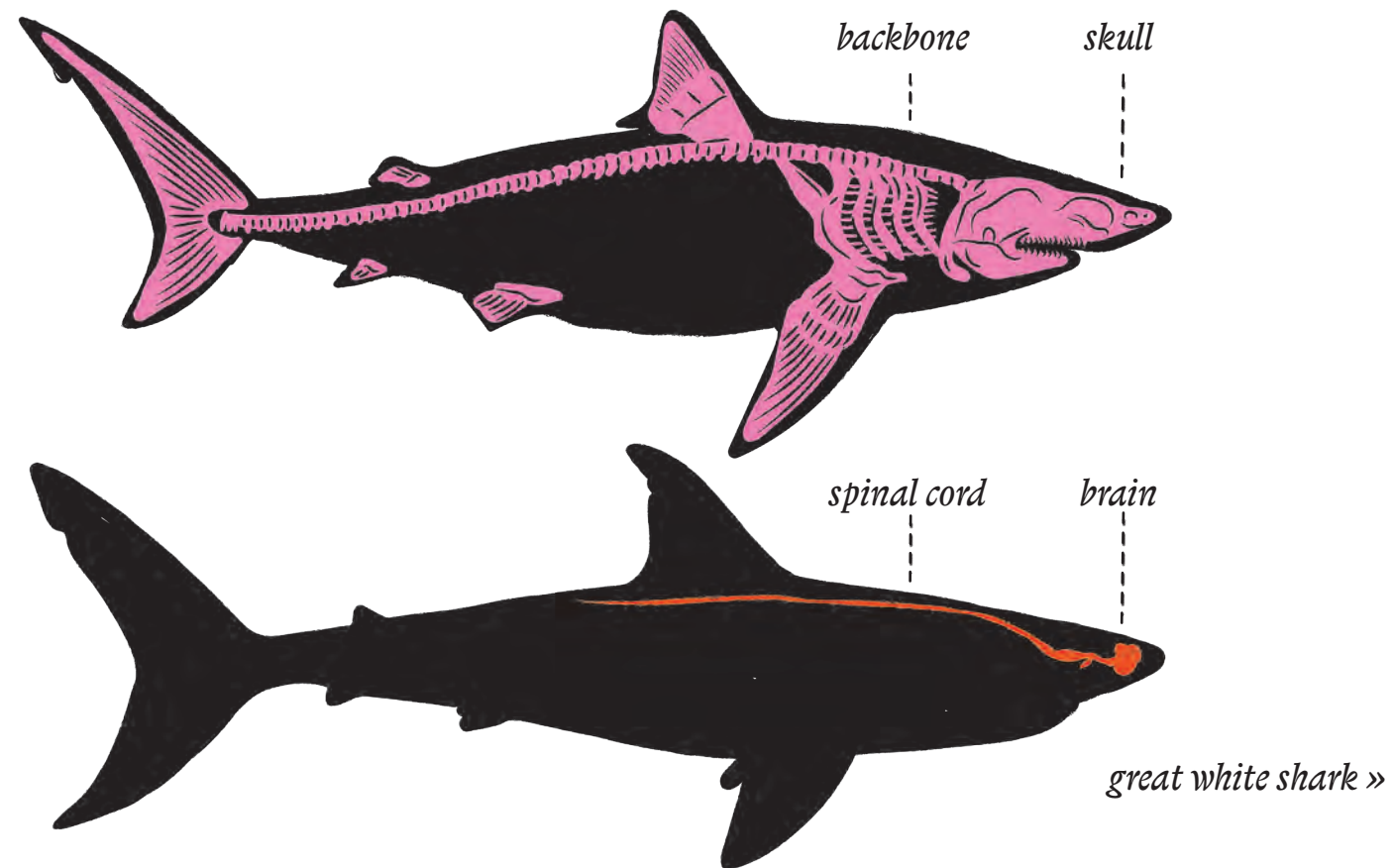
We humans are also mammals. Mammal young are suckled by the mother. All other mammals are vertebrates, too. As well as mammals, vertebrates include birds, reptiles, amphibians, fishes and cartilaginous fishes. Cartilaginous fishes are in there even though their skeletons are mainly composed of cartilage.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

While fishes and cartilaginous fishes have remained in the oceans, they now swim in lakes, rivers, streams and ponds, too. Some even live in aquariums. Amphibians are happy in water, on land and underground. Reptiles are similar in this regard. Birds and mammals do as they choose 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. Nor can they manage without food. And as they can't be left alone, they must reproduce regularly.

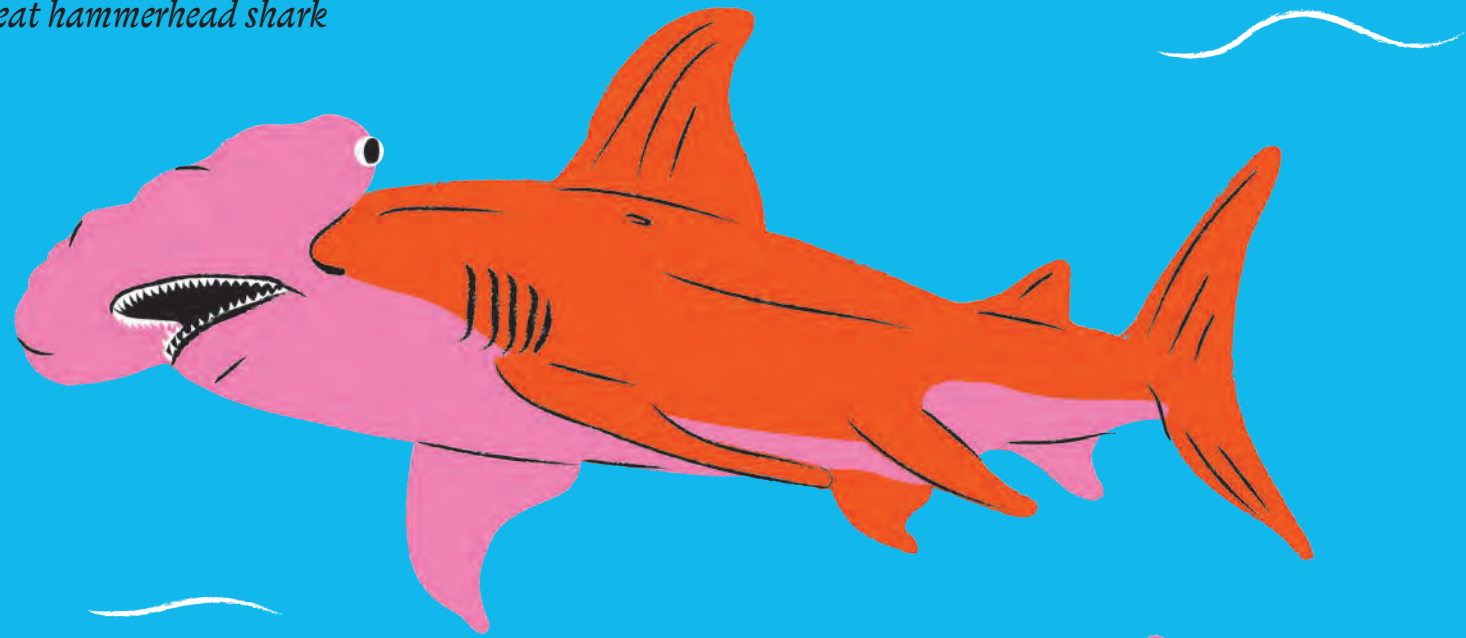
This book doesn't explain what makes humans happiest and what is most important for human life – which is as it should be, because we humans know these things very well already. Instead, it explains what other vertebrates do and don't enjoy, and it tells us about all the things they can manage. If there's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

Cartilaginous fishes

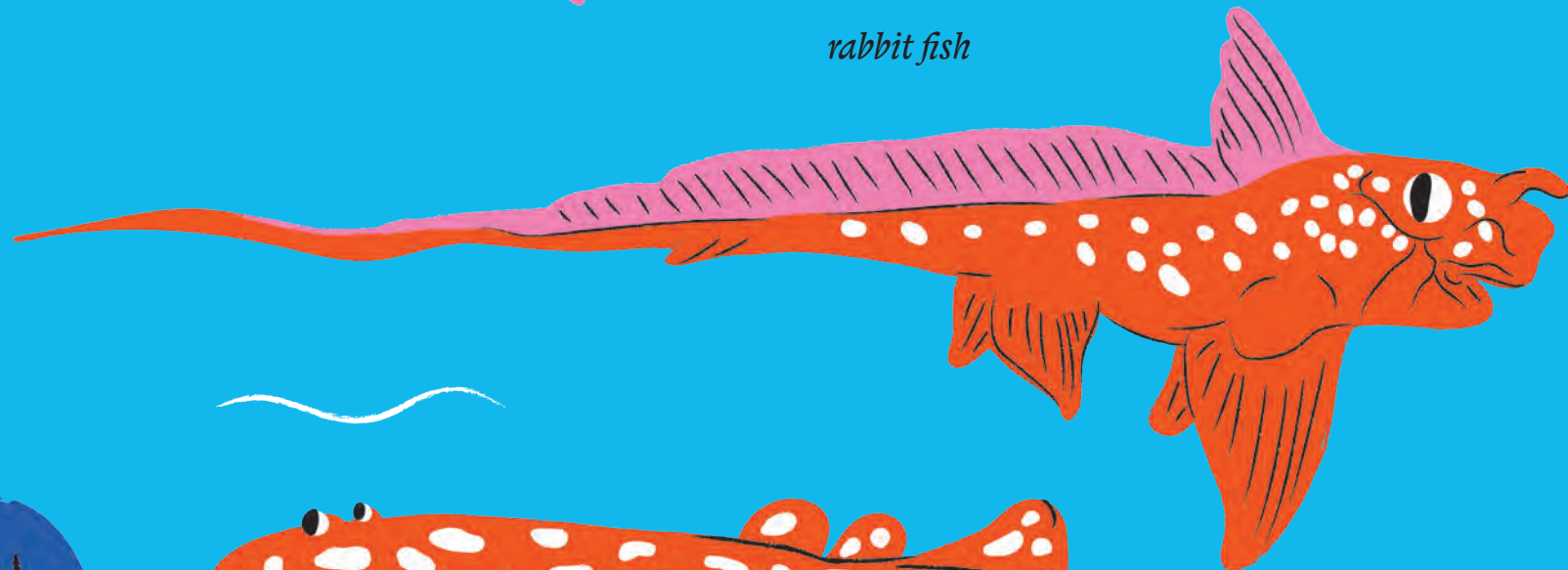
Cartilaginous fishes live mainly in the seas and oceans, leaving salt water for fresh water very rarely. A cartilaginous fish has a head, a trunk and fins. A fish has these too, although most fishes have a skeleton of bone, whereas cartilaginous fishes have a skeleton of cartilage. This difference may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



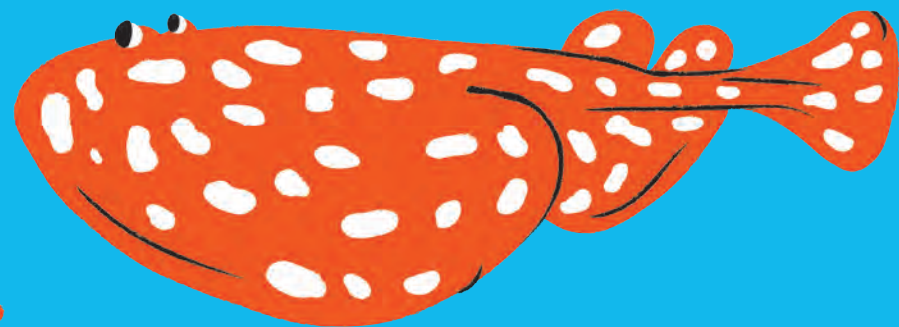
great hammerhead shark



rabbit fish

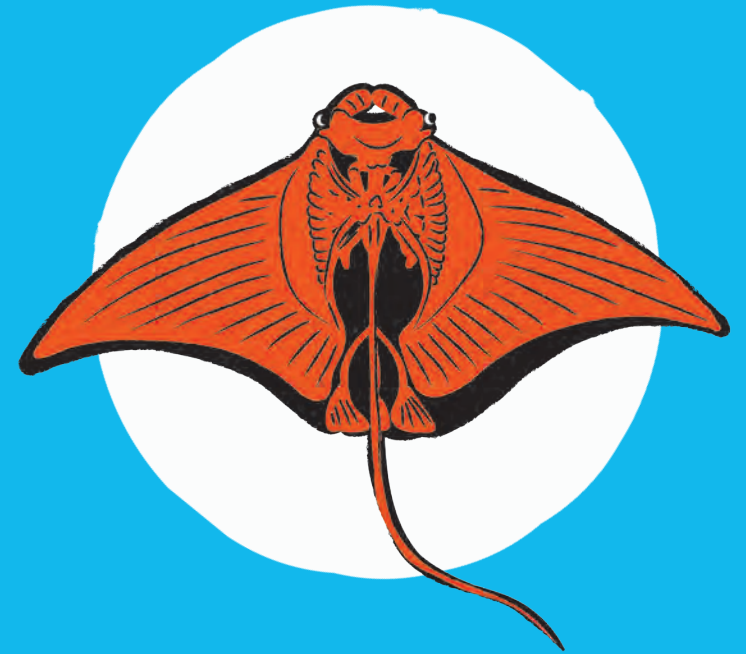


marbled electric ray

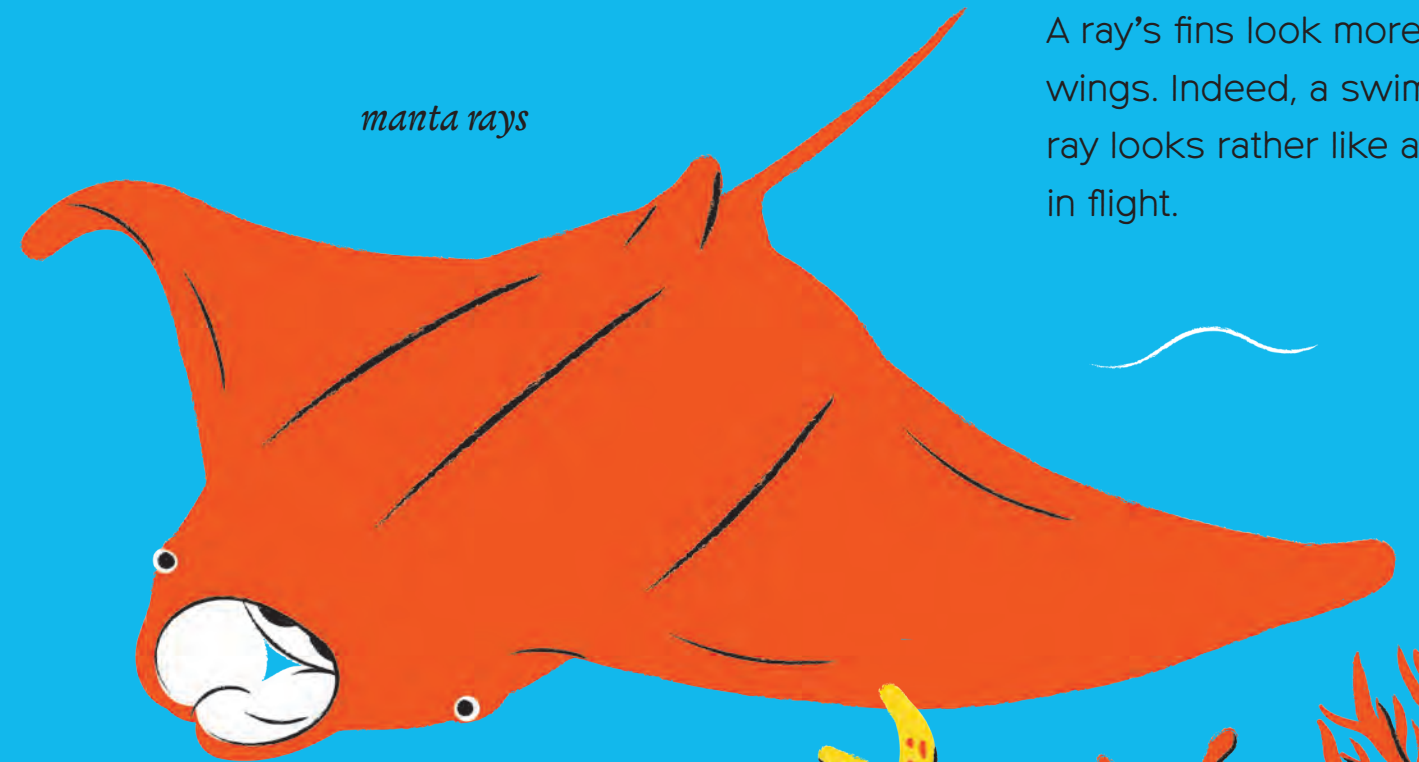


We can say that cartilaginous fishes come in three basic shapes: fish-shape (e.g. the shark), flat (e.g. the ray), and chimaera-shape.

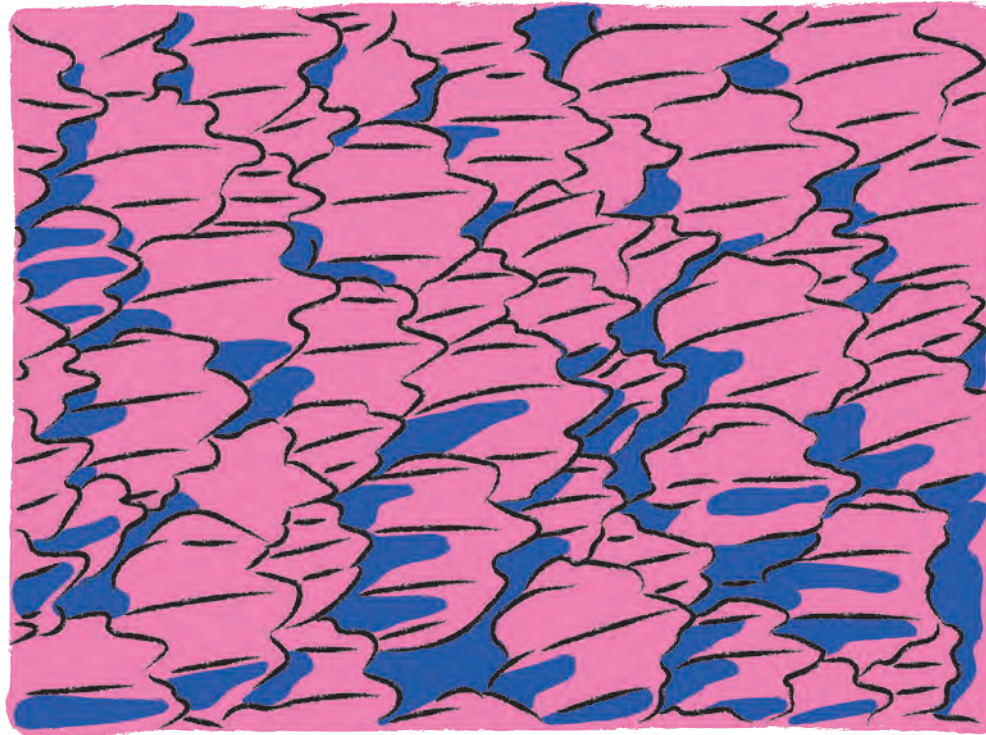
manta ray skeleton



manta rays



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



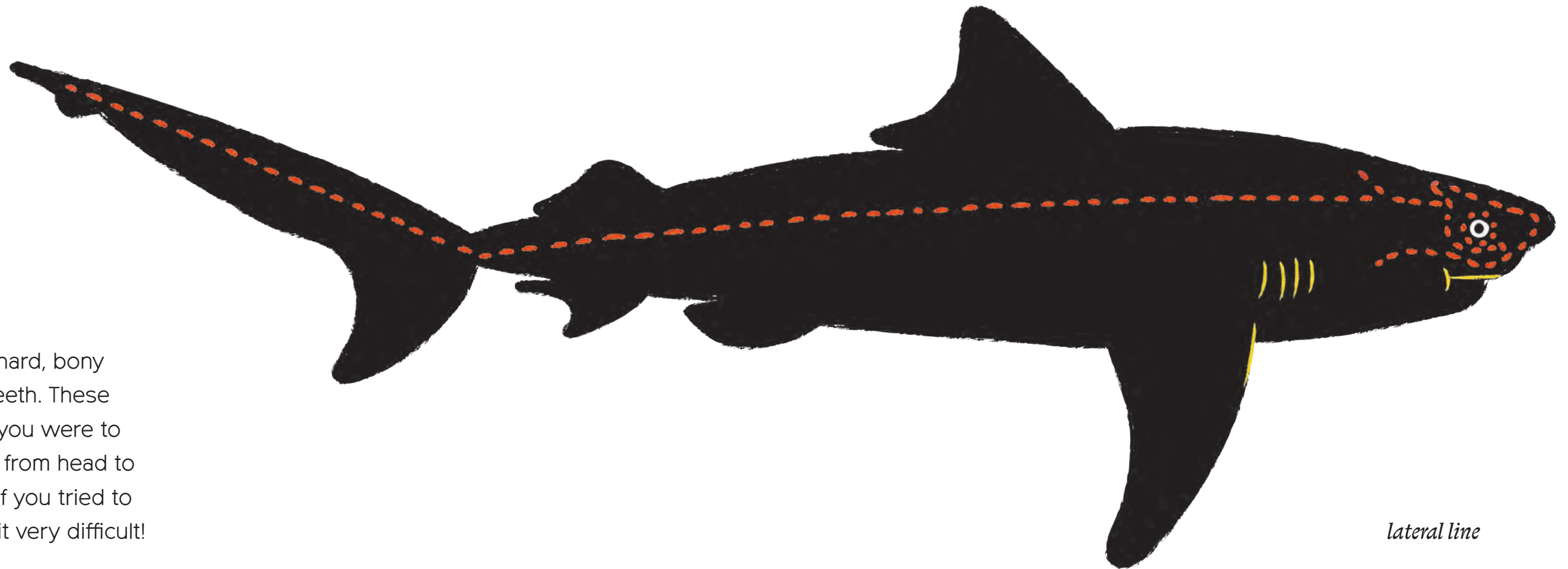
*shark's scales
under a microscope*

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 kilometres 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 that tells them how deep they are and how much salt water they are surrounded by.



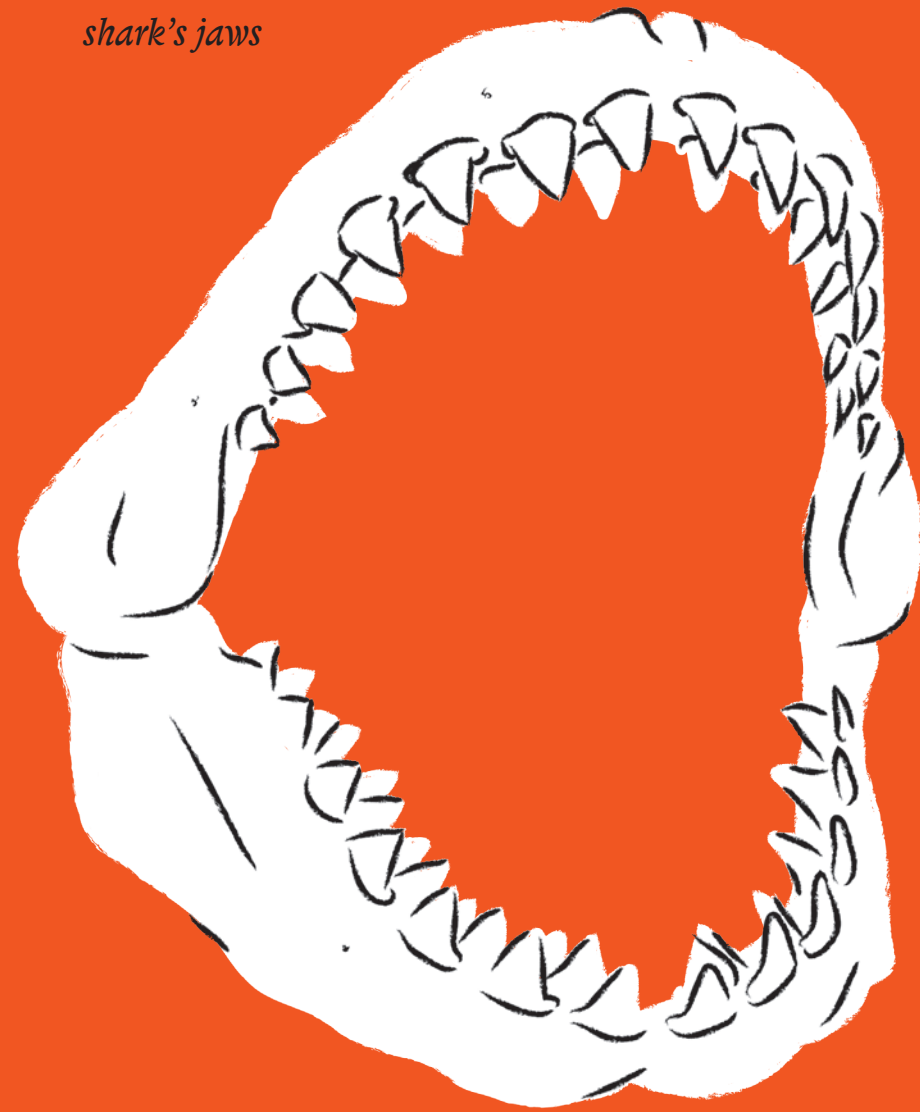
ampullae of Lorenzini

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

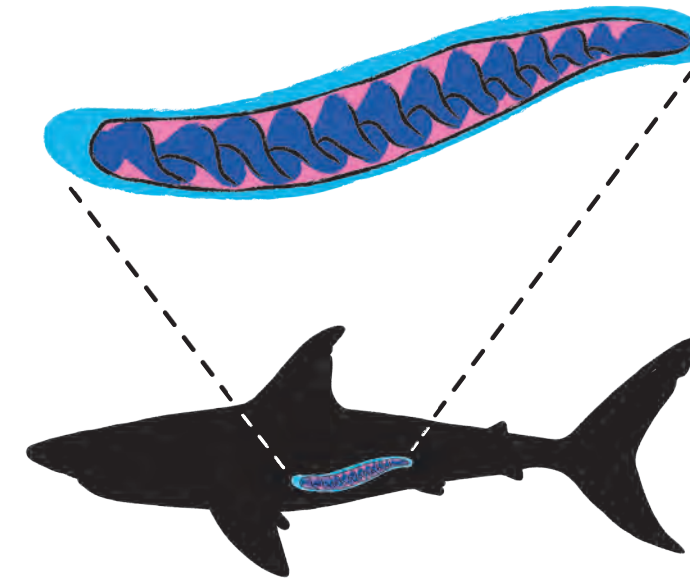


lateral line

shark's jaws

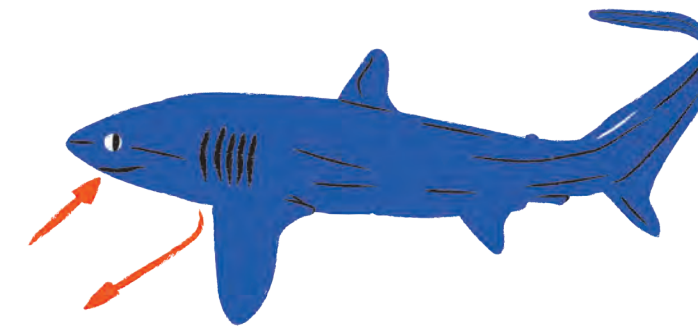


Apart from the chimaeras, all cartilaginous fishes constantly grow teeth. What a pity that humans can't do the same! Plus, unlike humans, cartilaginous fishes grow teeth in several rows.



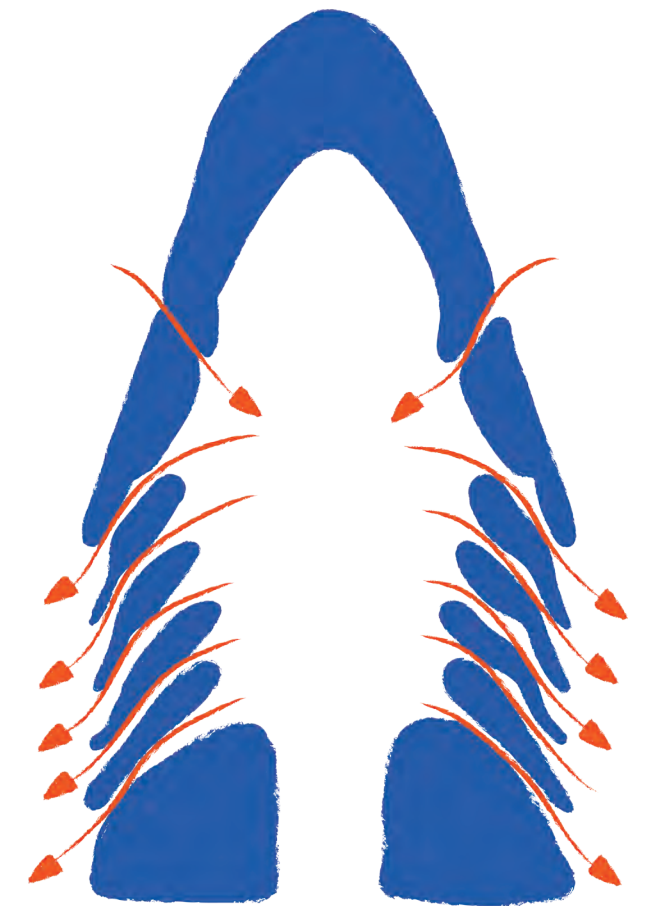
shark's spiral valve

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 for filtration of the salt it swallows along with sea water.



Gills look like this.

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

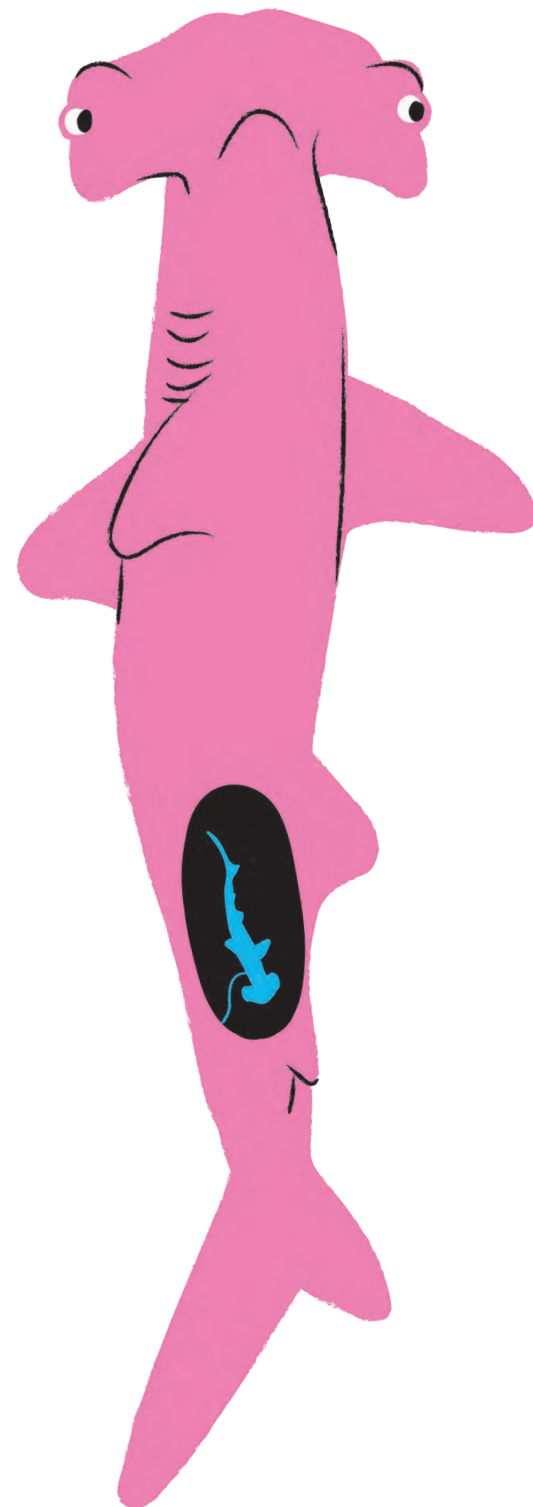


Gills work like this.



shark eggs

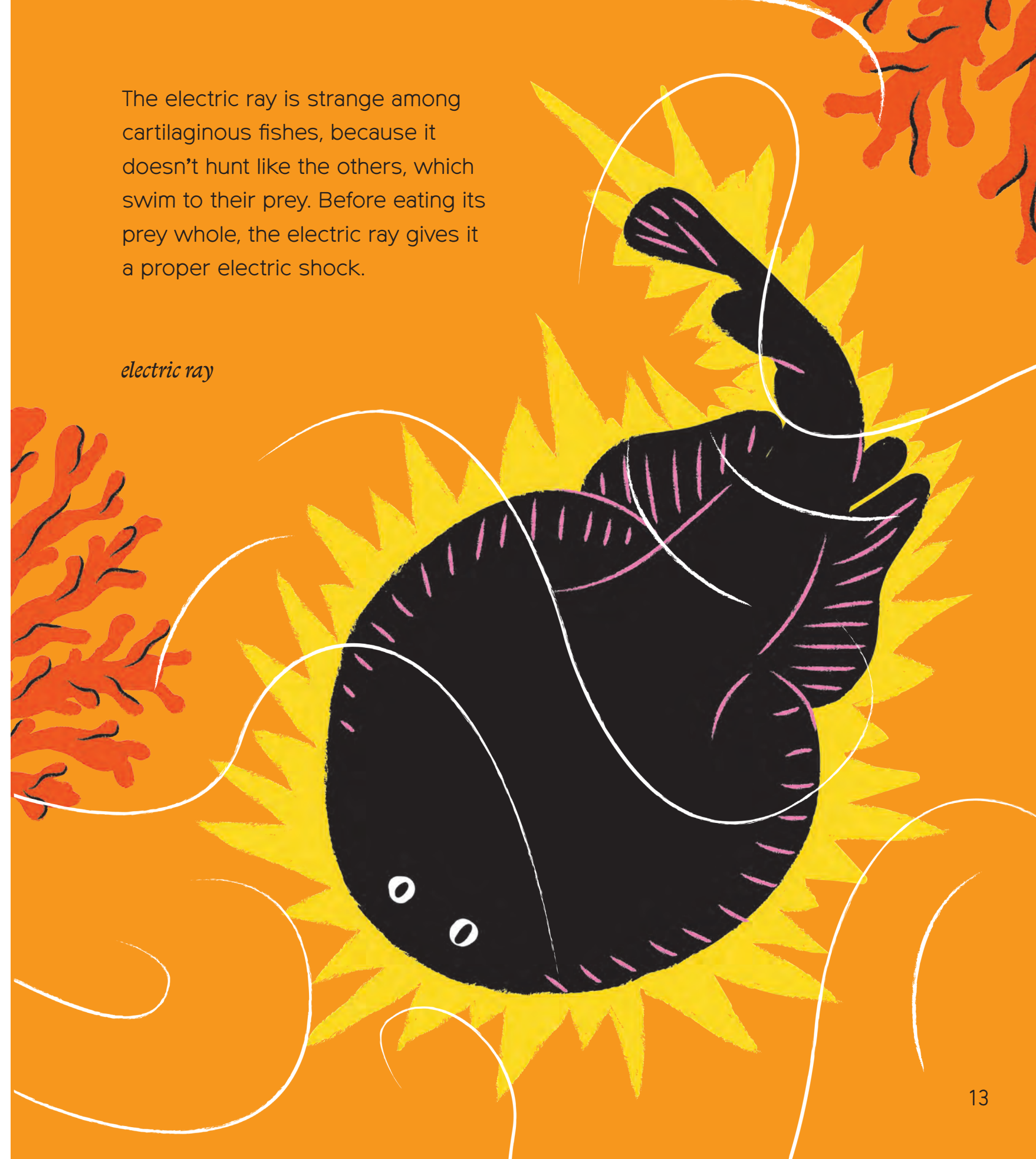
Cartilaginous fishes hatch in different ways – some from eggs outside the mother’s body, others inside it.



great hammerhead shark (female)

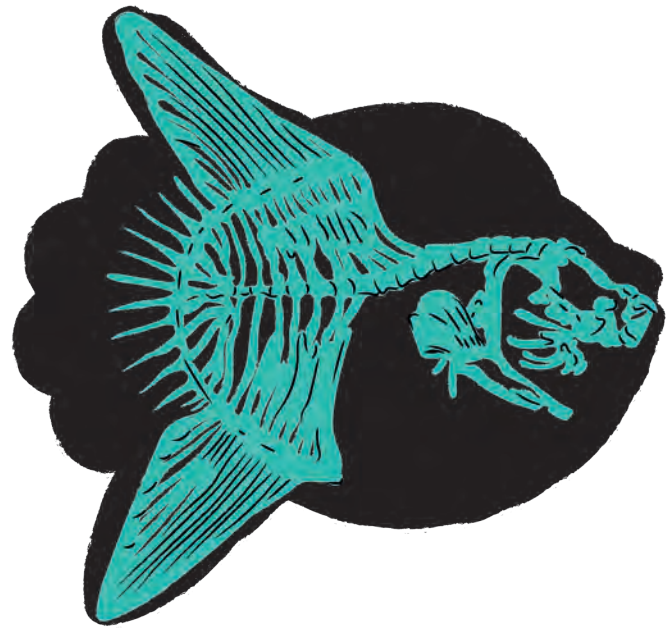
The electric ray is strange among cartilaginous fishes, because it doesn’t hunt like the others, which swim to their prey. Before eating its prey whole, the electric ray gives it a proper electric shock.

electric ray



Fishes

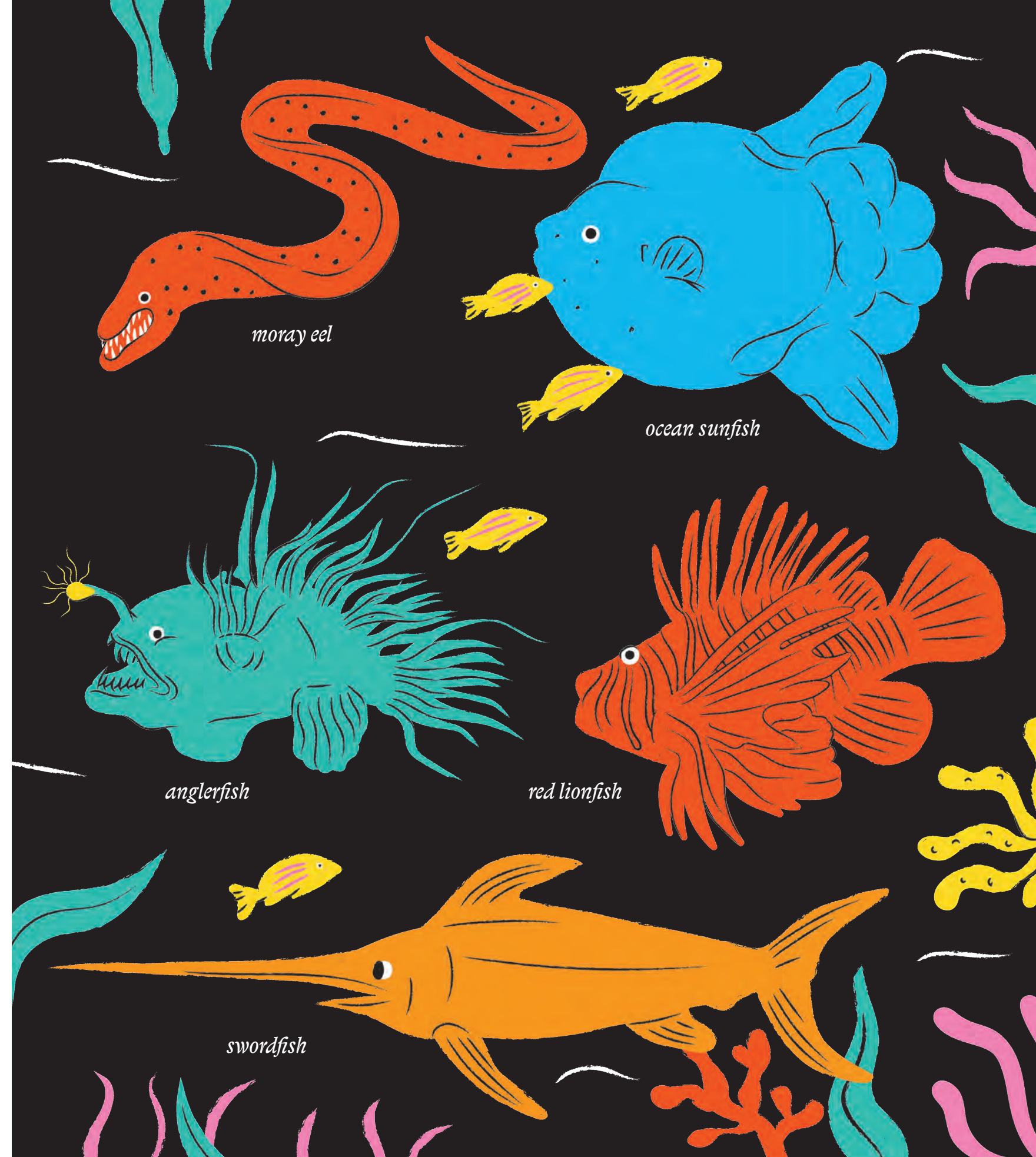
Not all fishes live in the salt water of the sea (like the ones on the next page). We find them in the fresh water of ponds and rivers, too. Like cartilaginous fishes, they have a head, a trunk and fins. Unlike cartilaginous fishes, they can't be categorized by shape, because they come in all kinds.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



ocean sunfish (skeleton)



moray eel (skeleton)



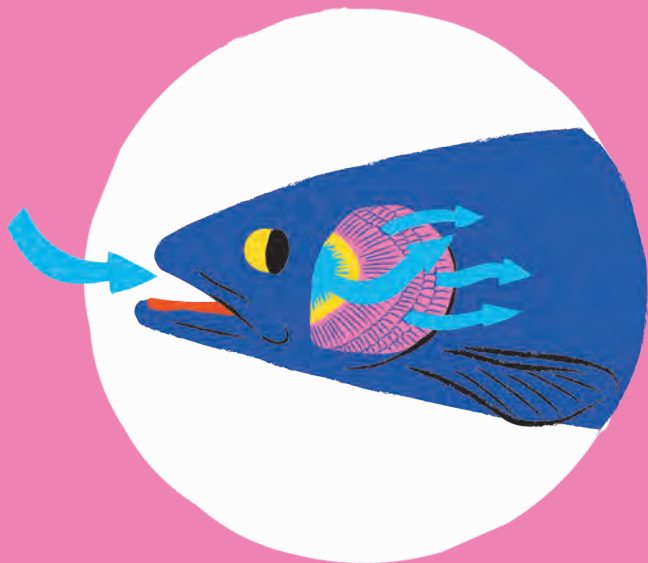
moray eel

ocean sunfish

anglerfish

red lionfish

swordfish

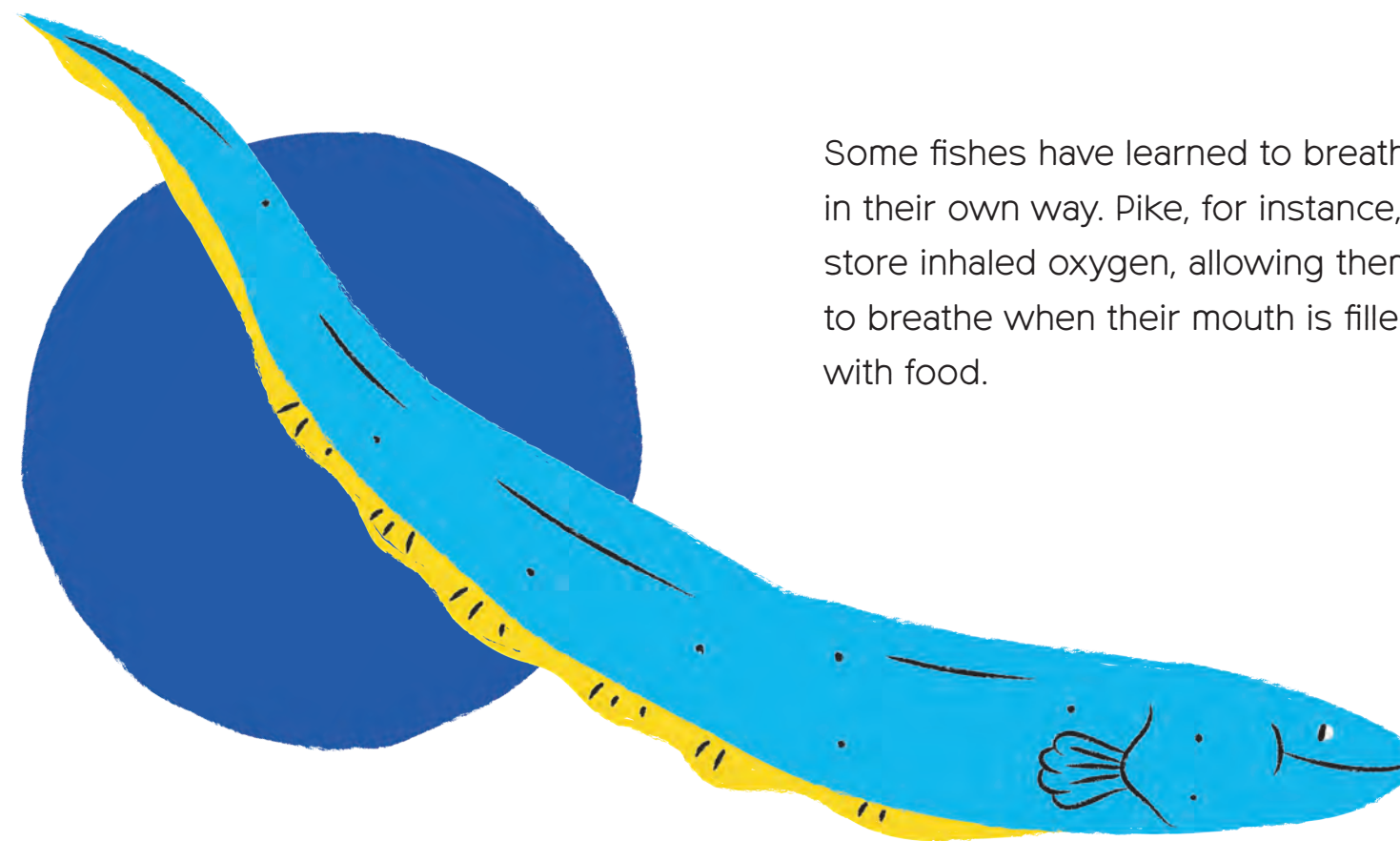
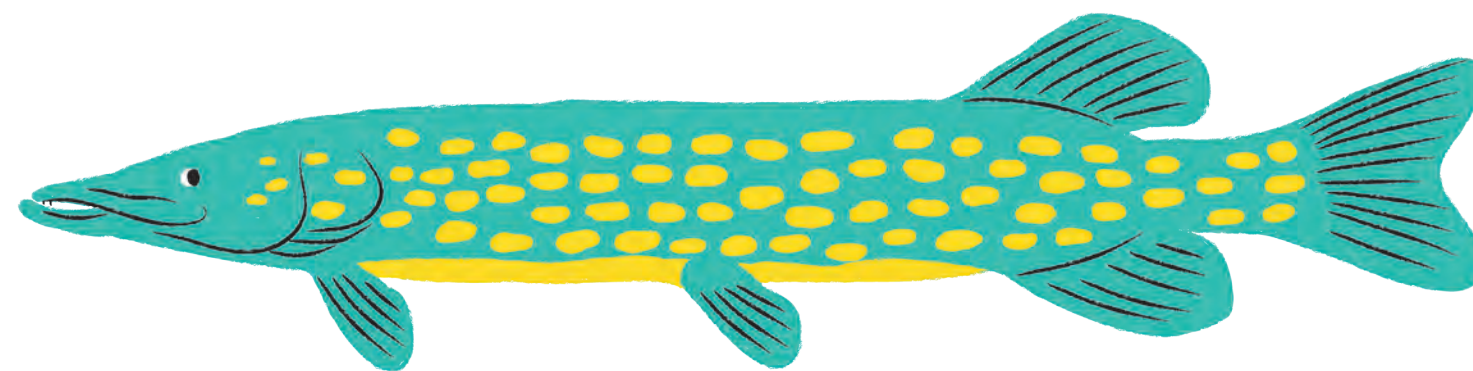


Fishes, too, use their gills to sort oxygen from the water, although these gills are on the inside. To breathe in, a fish fills its mouth with water. To breathe out, it pushes this water through the gills.

salmon breathing through the gills



pike (breathing)



Some fishes 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.

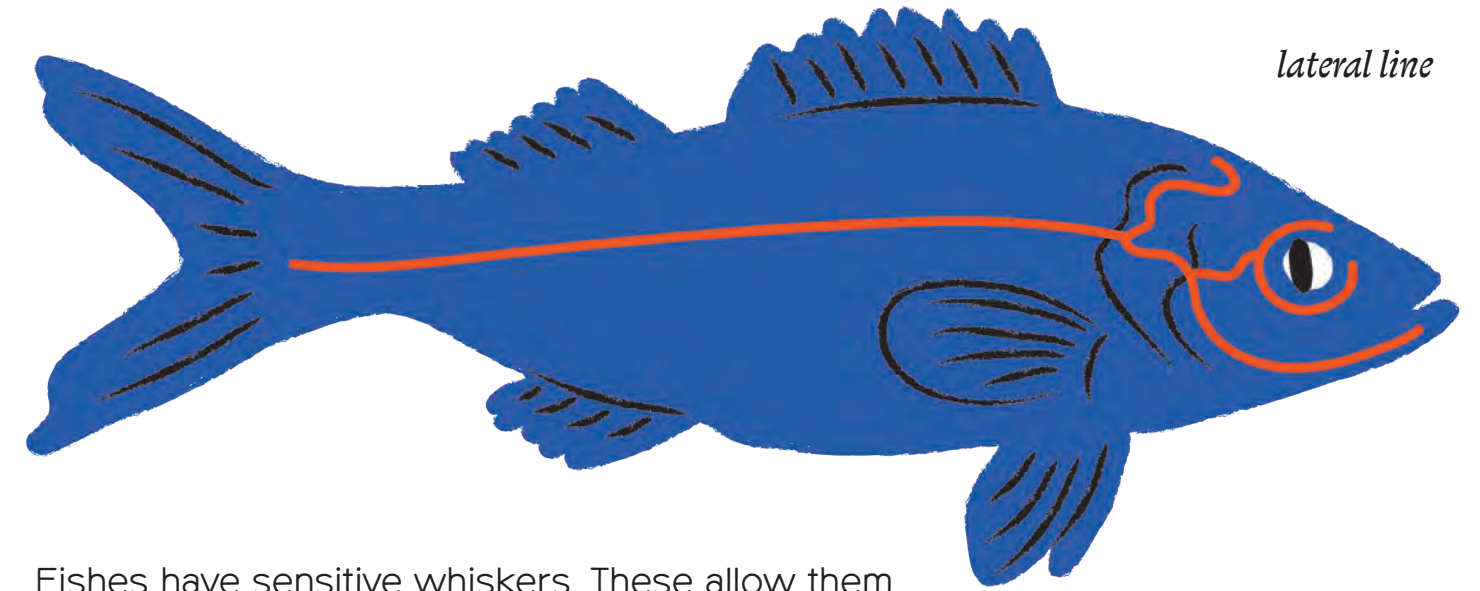
European eel



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

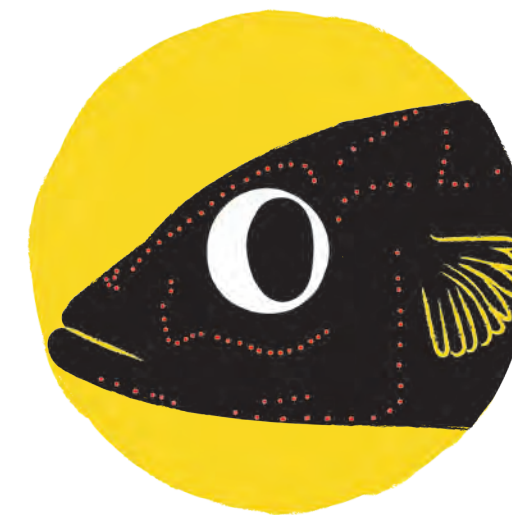
labyrinth

Siamese fighting fish

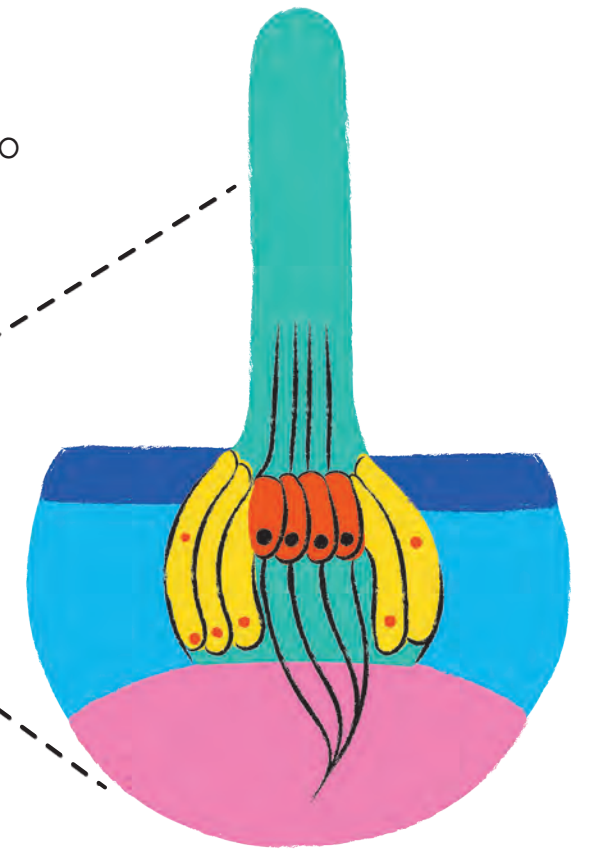


lateral line

Fishes have sensitive whiskers. These allow them to taste the water around them and to gauge its temperature. Like cartilaginous fishes, they have a lateral line by which they tell the strength of the water current. Although their ears are hidden, fishes can hear, and they see in colour. 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



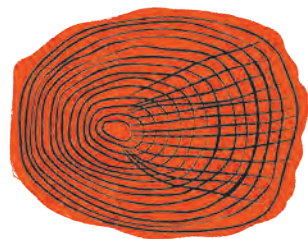
tactile hair



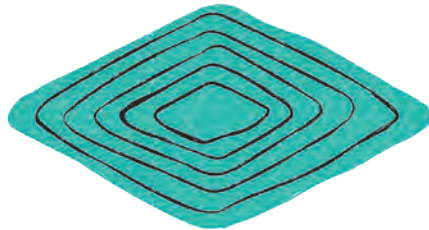
fish skin under a microscope

We shouldn't touch fishes. Not because they are slippery and slimy, but because we would harm them. This slipperiness is concealed in glands in fish skin. Fishes are glad of this slime, because it protects the sensitive skin from damage and bacteria, as well as from rascals who would like to catch them in their

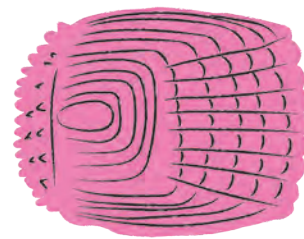
bare hands. Their bony scales have a similarly protective purpose. As you will see in the picture below, fish scales vary from species to species. You will also notice that scales have different grooves on them. Like the annual rings of trees, these grooves increase in number with age, so allowing us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



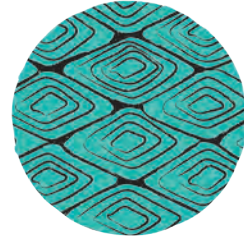
round scales of smooth-skinned fish



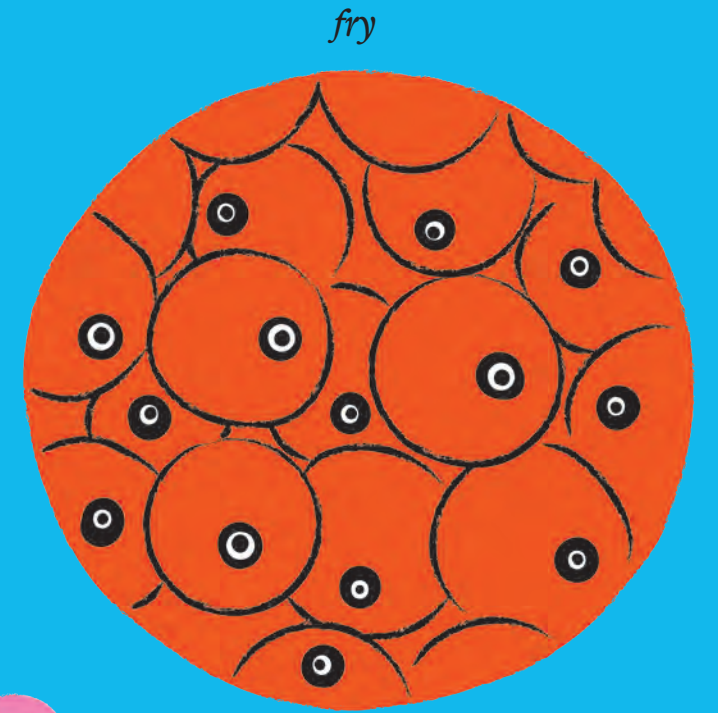
rhomboid scales of more evolved fish



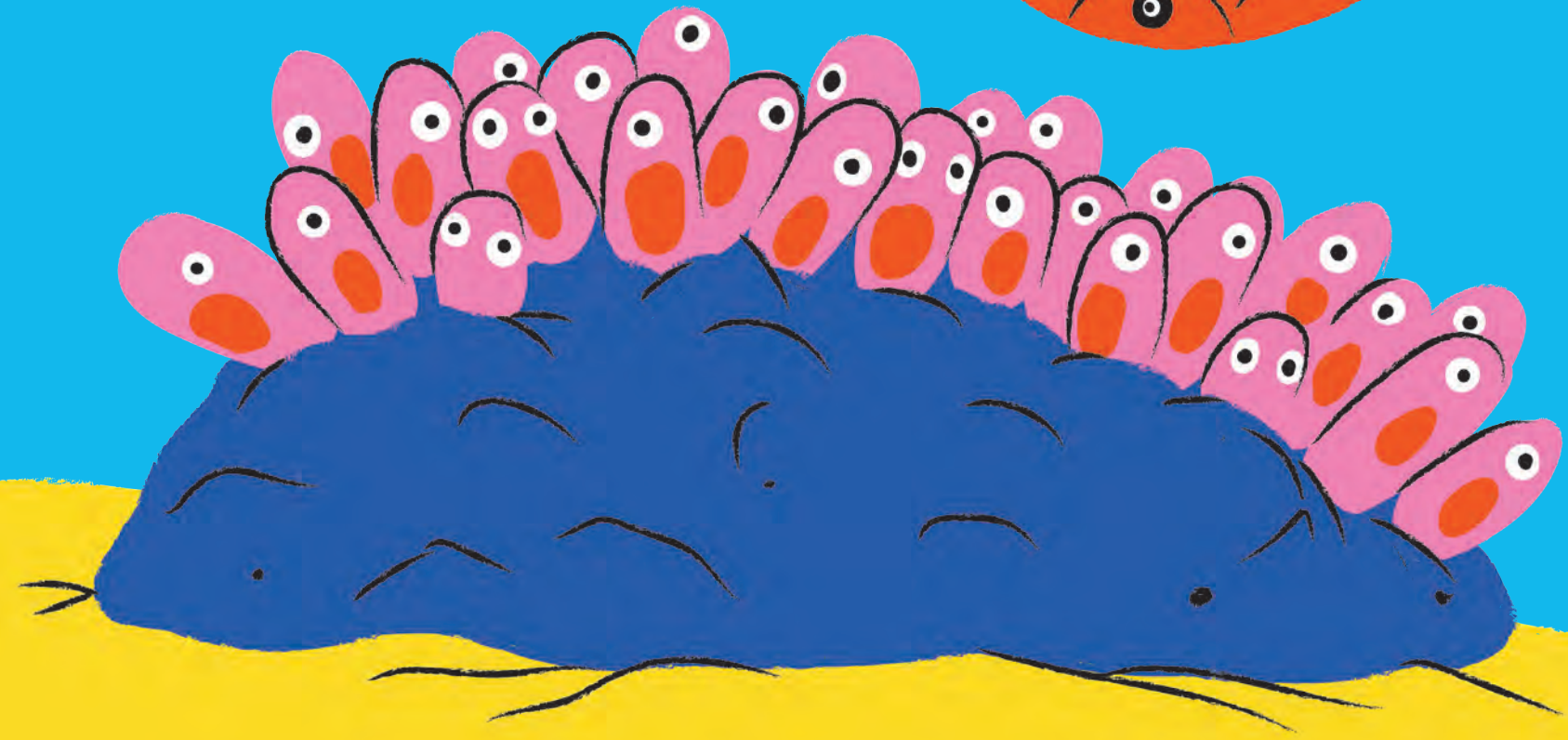
placoid scales of fish with sharp dorsal fin



Fish eggs, too, vary from species to species. Some fishes 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



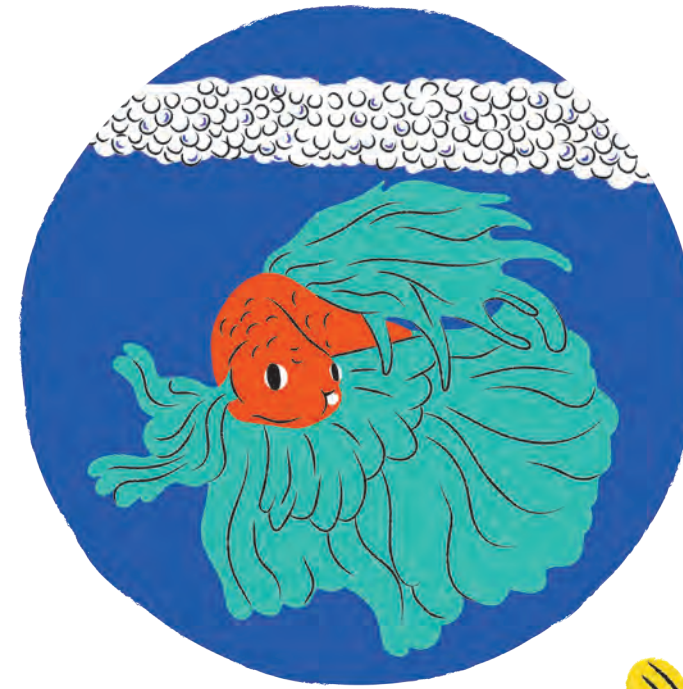
eggs on rock



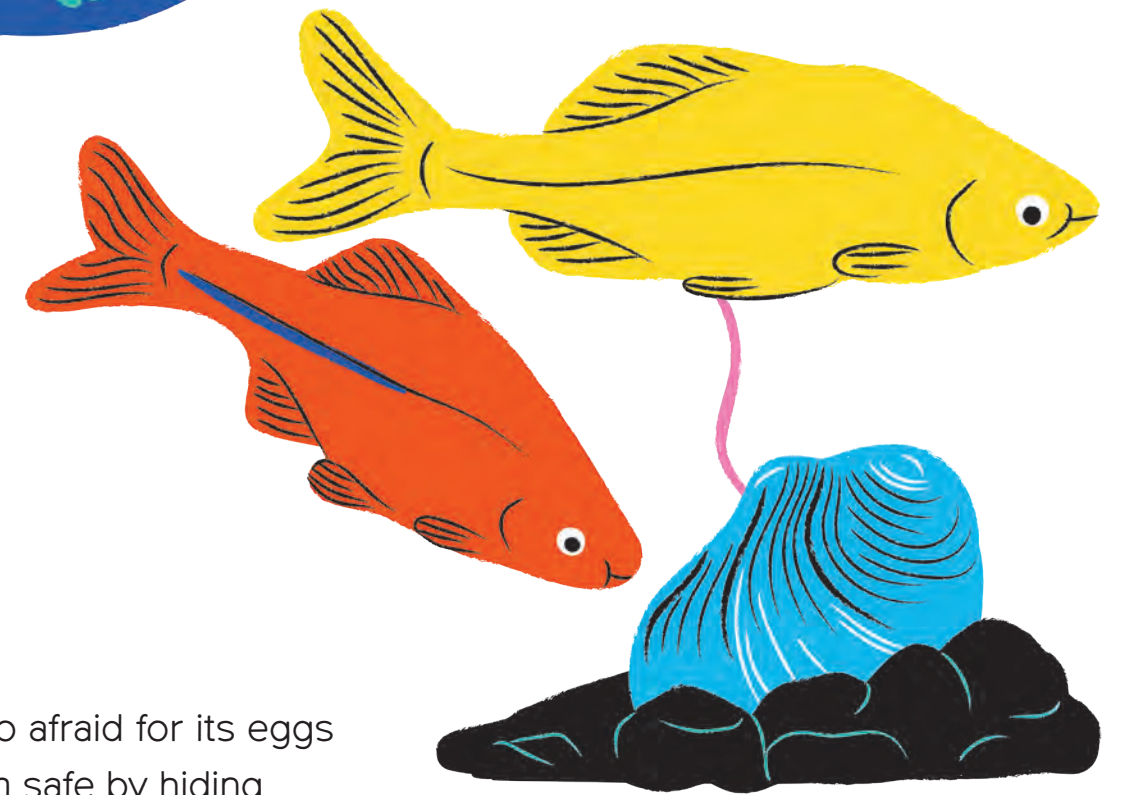
Some mother fishes carry their eggs in their belly. In the case of the seahorse, the eggs are the father's concern; the mother places them in a pouch on the belly, where they are cared for by the father till they are grown and shoot out of the pouch.

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 new-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 ovipositor.

bitterling with ovipositor



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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 very questions, but it does answer similar ones. I imagine you shaking your head in confusion, telling yourself that 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. And now I'm out of space. So open the book and read on!

