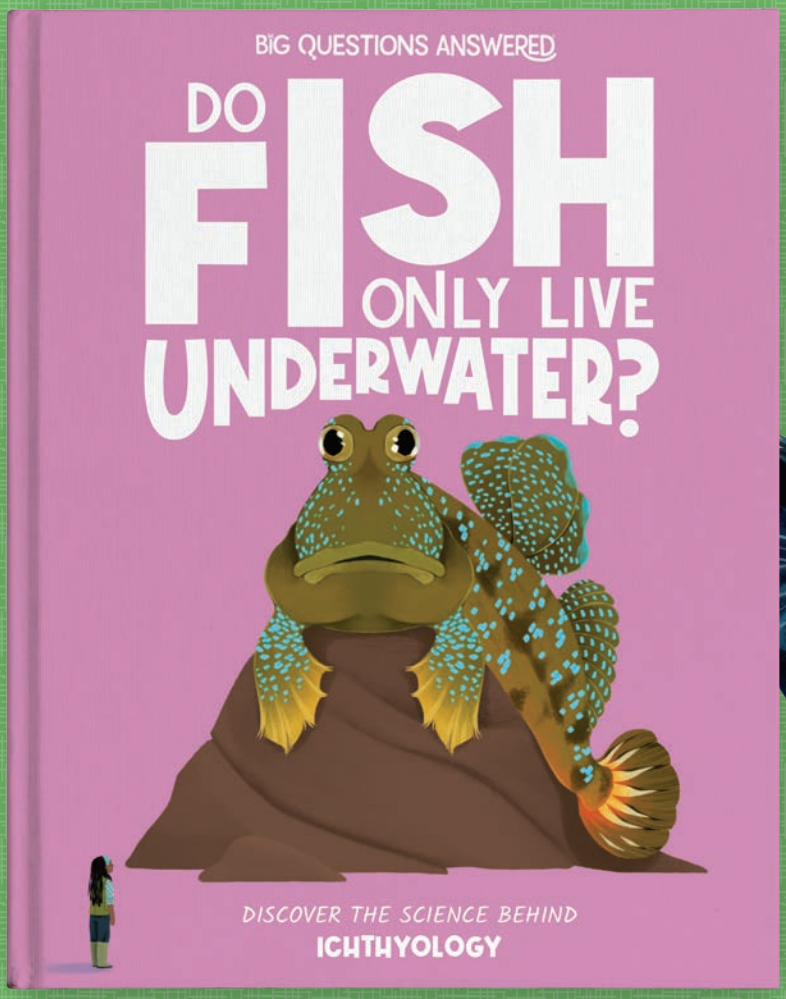
BIG QUESTIONS ANSWERED

TEACHERS' & PARENTS' RESOURCES

Full of thought-provoking questions and fascinating extra information to accompany this book!



CONTENTS:

INTRODUCTION

NOTES FOR TEACHERS, HOME EDUCATORS AND PARENTS

Inspire children's natural curiosity, improve literacy, and have fun learning about different sciences with The Big Questions Answered. Each book in the series is accompanied by a selection of fantastic, **FREE** downloadable resources.

Our **Teachers' and Parents' Resources** booklets are full of ideas for discussions, extra facts, and links to hands-on activities – all great ways to help children explore each field of science and the key topics surrounding them.

Our **Young Scientists' Activity Packs** are a real bonus. They're full of soft-learning, fun activities, all subtly linked to the field of science, that will encourage independent learning. Visit the 'Kids' Zone' to find out more.

Don't forget, on the website you can also download our **'Meet the Scientist' pages** – there's one to accompany each book – and sign up to our newsletter to follow what's coming up next for The Big Questions Answered. Download all these and more at: **www.thebigquestionsanswered.com**

Do Fish Only Live Underwater? book

Young Ichthyologists' Activity Pack

KEY CURRICULUM TOPICS

The resources related to *'Do Fish Only Live Underwater?'* tie in with key curriculum topics including:

- Animals, including humans
- Earth and space
- History
- Human and physical geography
- Living things and their habitats
- Working scientifically

The most relevant topics are indicated throughout this guide.

DO FISH ONLY LIVE UNDERWATER?

This book explores the extraordinary world of ichthyology. As well as covering key facts about the habitats fish live in, the book also explores different, fascinating species that have lived on Earth, their impressive adaptations, and what they can teach us about the natural world. Diving into how and why scientists study fish, this book explores what makes fish special as well as why we should all care about protecting them.

PRE-READING QUESTIONS

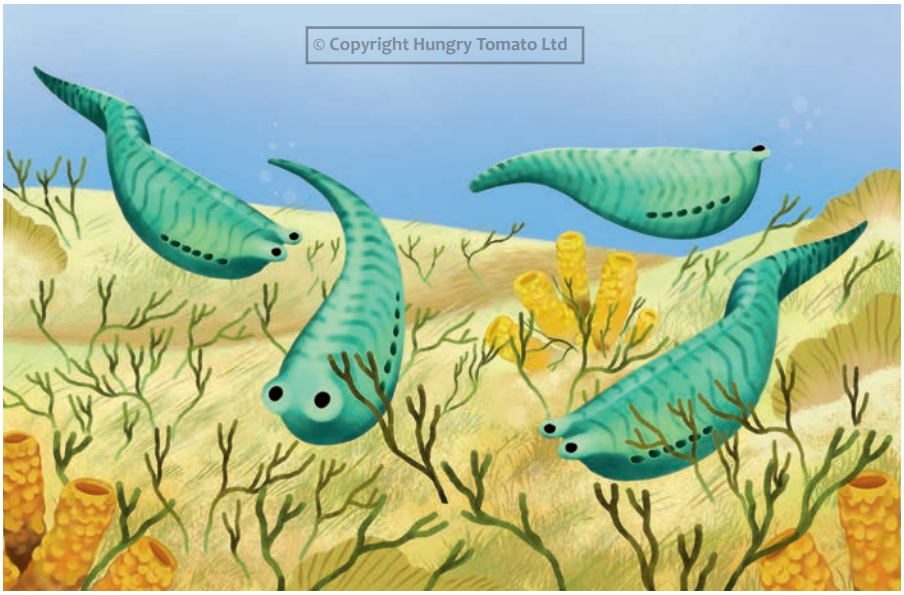
Engage in discussion about the general topic of ichthyology with the suggested questions below.

- What do you know about fish already?
- How many different types of fish can you think of?
- Do you think fish can live out of water? Why or why not?

PREHISTORIC FISH: SCENE 1

The material for this scene can be linked to curriculum topics, including: animals, including humans; living things and their habitats; working scientifically.

Dive into the world of fish with this scene that shows some of the first fish that swam on Earth! Compare these prehistoric creatures, their features, and their habitat with the fish that swim on Earth today.



DISCUSSION PROMPTS

- **What are fish?**

Information overleaf

- **How do you think scientists learned about the fish in this scene?**

Information overleaf

- **What similarities and differences can you see between these fish and the fish that swim on Earth today?**

Encourage children to point out features such as eyes, gills, tail, and so on.

- **What similarities and differences can you see between this ocean habitat and the ocean habitats on Earth today?**

Encourage children to point out features such as sea sponges, seaweed, and so on.

ACTIVITY

Corresponding activity on page 3 of the activity pack: 'Fantastic World of Fish' is a classic word search activity, using lots of great words related to fish and their habitats to get children familiar with the language of ichthyology.

PREHISTORIC FISH: SCENE 1

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

WHAT ARE FISH?

Fish are a type of animal that live in water and breathe **oxygen** underwater through their **gills**. Most fish have **scales** all over their bodies as well as **fins** to help them swim. Many of them are also **cold-blooded**.

Fish can be found in **freshwater** sources, like ponds and streams, or **saltwater** sources, like oceans and seas.

Fish are **vertebrates**, which means they have a backbone inside their body. Other groups of vertebrates include **amphibians**, **birds**, **mammals**, and **reptiles**. Animals that don't have a backbone inside their bodies are called **invertebrates**. Examples of invertebrates include **crustaceans** and **insects**.

FISH IN THE SCENE

The fish in this scene are metaspriggina walcotti. Many scientists think they were the first fish that ever lived. These **prehistoric** fish lived in the ocean more than 500 million years ago! That's long before the dinosaurs walked the Earth.

Metaspriggina walcotti were small fish that had seven pairs of gills and eyes that stuck out from the front of their bodies. They may share these features with modern fish, but they look very different from any fish that lives on Earth today.

These ancient fish are thought to have become **extinct** about 485 million years ago. This means they died out way before humans were first around! So, how do we know they existed? Scientists have clever ways of learning about animals that lived long ago...

LEARNING ABOUT ANICENT FISH

Scientists learned about metaspriggina walcotti from **fossils** of the fish which were found in Australia in 1993. From their fossils, scientists were able to learn when these fish lived, how their bodies were shaped, and what this meant for the development of fish on the whole!

Fossils have helped scientists learn about lots of different animals and plants that lived long ago, as well as what world's **climate** and **habitats** were like!

TEAMWORK IN NATURE: SCENE 2

The material for this scene can be linked to curriculum topics, including: animals, including humans; living things and their habitats; working scientifically.

Jump forward in time with this modern scene showing different fish interacting with their ecosystem. Introduce the role of ichthyologists and discuss the way these scientists conduct their studies.

DISCUSSION PROMPTS

- **Can you name any of the animals in this scene?**

There are five types of animals in this scene for children to try and name. Their names are also overleaf.

- **What is a group of fish called?**

Information overleaf

- **Why do you think the little fish are swimming in a sphere like that?**

Information overleaf

- **Can you think of any other times when animals work together like this?**

Information overleaf

ACTIVITY

Corresponding activity on page 4 of the activity pack: 'Fishy Facts' is a mixture of research and creativity. Children choose a fish, research it, fill in the fact file, and draw it. This activity can be printed multiple times to generate a fact booklet!

TEAMWORK IN NATURE: SCENE 2

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

ANIMALS IN THE SCENE

There are many different animals within this scene:

- Frigate birds
- Sardines
- Sailfish
- Shark
- Humboldt squid

SHOAL VS SCHOOL

A 'shoal' is a group of fish that swim together in a loose group.

A 'school' is a group of the same sort of fish who swim closely together and follow each other's exact movements, turning and twisting the same way at the same time.

BAIT BALLS

In the scene, the sardines are swimming in a bait ball. Fish sometimes form into this tightly packed sphere when they feel **threatened** by **predators**. It's much harder for attacking animals to catch individual fish this way.

WORKING TOGETHER

Bait balls keep most of the small fish inside safe and are an example of animals working together to stay safe.

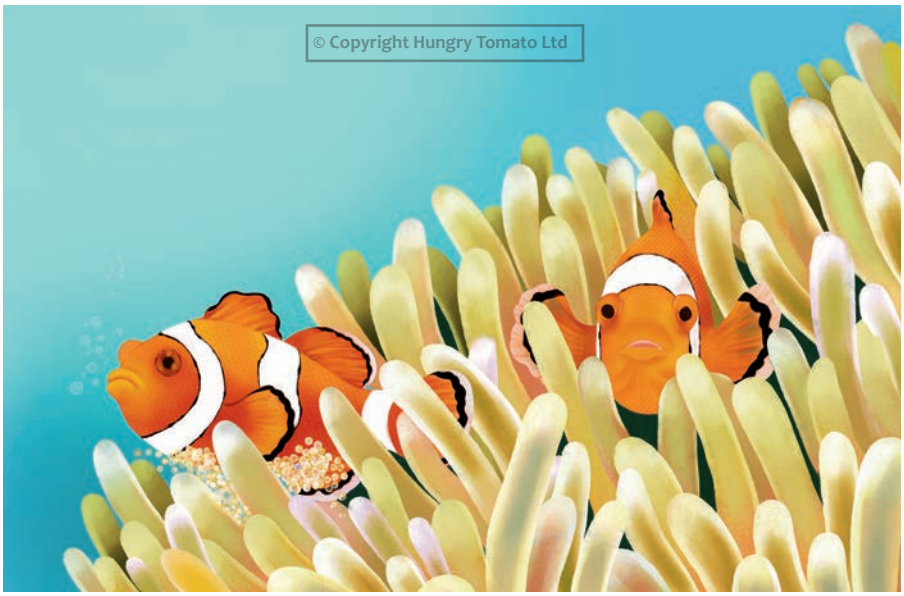
Unfortunately for small fish, some predators work together too, using teamwork to catch **prey**! Dolphins and whales have been known to surround fish, trapping them with 'bubble nets' that confuse the fish and make them easier to catch.

As we see in the scene, sometimes animals of different **species** can feed at the same time too. While sailfish, frigate birds, and sharks don't **intentionally** work together to catch sardines, they often turn up at the same time, feeding on the same group of prey. Scientists call this 'co-feeding' or 'opportunistic feeding', as the predators make the most of each other attacking from different angles, making success more likely!

HIDING FROM PREDATORS: SCENE 3

The material for this scene can be linked to curriculum topics, including: animals, including humans; living things and their habitats; working scientifically.

Explore the different ways fish keep themselves safe from predators, using clownfish as a key example. Engage in discussion about coral reefs more generally, asking children to name other animals that make their homes in the reef.



DISCUSSION PROMPTS

- **Do you know any other ways fish keep themselves safe from predators?**
Encourage children to think about things like sharp teeth, venom, camouflage, and so on. There is also information overleaf.

- **Do you know what the little bubbles are under the clownfish on the left of the scene?**
Information overleaf

- **What are coral reefs?**
Information overleaf

- **Can you name any other animals that live in coral reefs?**
Information overleaf

ACTIVITY

Corresponding activity on page 5 of the activity pack: 'Swim to Safety' is a fun maze activity for children to help the clownfish find its way back to the safety of its anemone home.

HIDING FROM PREDATORS: SCENE 3

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

STAYING SAFE IN THE WILD

Clownfish stay safe from **predators** by hiding in anemones that other fish can't get close to. This is just one survival technique. Others include:

- **Living and swimming in a big group**.
- Growing big **teeth**, **spikes**, **pincers**, or **shells** on their bodies.
- **Creating venom** that harms attacking animals.
- **Becoming camouflaged** (when an animal's skin blends in with its surroundings).
- **Becoming nocturnal** (sleeping in the day and waking up at night when fewer animals are around).

LAYING EGGS

In the scene, there are little bubble-like things under one of the clownfish. These are **eggs**. While animals like **mammals** give birth to **live young**, almost all fish lay eggs that their babies eventually hatch from. The fish must keep their eggs very safe because lots of predators like to eat them!

Very few fish give birth to live young. These include guppies, platys, and swordtails.

CORAL REEFS

Coral reefs are **habitats** made up of tiny animals called polyps. The polyps create hard shapes that build up over time to form large, vibrant structures.

Coral reefs are found in warm, **shallow** ocean waters. The biggest and most famous coral reef system in the world is The Great Barrier Reef, found off the coast of Australia. It's made up of more than 2,900 individual reefs and 900 islands!

ANIMALS OF THE CORAL REEF

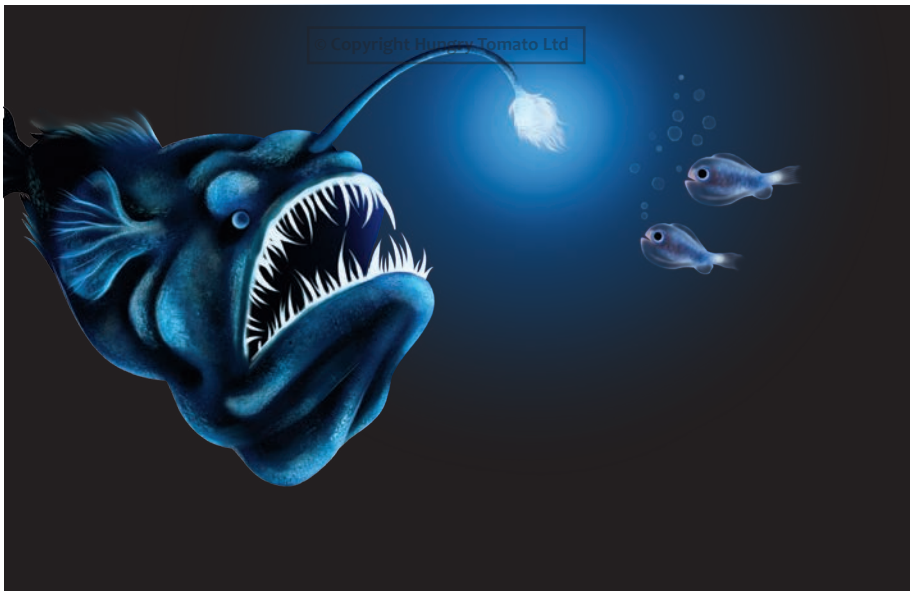
Coral reefs provide homes and food for many marine animals, including:

- Fish like parrotfish, angelfish, butterflyfish, and reef sharks.
- **Reptiles** like sea turtles and sea snakes.
- **Crustaceans** like hermit crabs, spiny lobsters, and mantis shrimp.
- Mammals like bottlenose dolphins and manatees.

ATTRACTING PREY: SCENE 4

The material for this scene can be linked to curriculum topics, including:
animals, including humans; living things and their habitats; working scientifically.

Discover spooky fish living in the ocean's depths with this scene which showcases the anglerfish. Introduce children to the ocean's layers, including its most extreme depths, and how scientists study the deepest-dwelling animals.



DISCUSSION PROMPTS

- **How deep in the ocean do you think the anglerfish lives?**
  Information overleaf

- **Do you know the names of any of the layers of the ocean?**
  Information overleaf

- **Do you think anything lives at the very bottom of the ocean?**
  Information overleaf

- **How do you think scientists learn about animals that live really deep down?**
  Information overleaf

ACTIVITY

Corresponding activity on page 6 of the activity pack: 'Draw Your Own Deep-Sea Discovery' is a creative drawing activity where children imagine they have discovered something new in the ocean, and draw a scene to show off their discovery.

ATTRACTING PREY: SCENE 4

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

ANGLERFISH

There are several hundred **species** of anglerfish, and most of them live really deep in the ocean. Some of the deepest dwellers live at depths of 5 kilometres (16,400 feet)! These species rely on their headlights for seeing through the dark and catching food.

OCEAN LAYERS

The ocean is divided into several layers:

- **Sunlight zone** – this is the top layer, where the ocean is at its brightest and warmest, and where most **marine** life lives.
- **Twilight zone** – this layer is dim and cooler.
- **Midnight zone** – this is the largest layer. There is no light at all and the water is icy cold. The **pressure** there is so strong that only some animals can cope.
- **Abyss** – the water hardly moves in this layer. It's freezing, very dark, and home to some unusual creatures.
- **Trenches** – the deepest parts of the ocean. The trenches are pitch black and experience extreme levels of pressure. Even so, some animals are able to survive here!

LEARNING ABOUT THE OCEAN

Earth's oceans are so vast that huge sections remain unexplored! The biggest challenges of ocean exploration, especially in the deeper layers, include poor **visibility**, extreme cold, and extreme pressure. To cope with these factors, scientists need high-tech machines.

In shallow, safer waters, scientists sometimes explore the ocean from inside **submersible** vehicles like submarines. For more dangerous locations or deeper depths, it's safer for them to use **robotic** vehicles that can be controlled from the surface. These vehicles can be equipped with cameras, sensors, arms for collecting samples, and scientific **instruments** that can record data. This clever technology keeps scientists safe while studying the ocean and its wildlife.

IMPOSSIBLY COLD HABITATS: SCENE 5

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats.

Jump into discussions about what life is like in some of the world's coldest habitats with this frozen scene set in the Antarctic. Get children engaged in discussion about how animals adapt to this extreme environment.

DISCUSSION PROMPTS

- **What temperature does water freeze at?**
Information overleaf

- **Do you think it's easy or hard to live in the North or South poles? Why do you think that?**
Encourage children to discuss their opinions. There is also information overleaf.

- **Can you think of any other animals that live in the North or South poles? How do you think they cope living there?**
Encourage children to name animals such as penguins, polar bears, narwhals, and so on, and discuss the features that let them thrive in extreme environments. There is also information overleaf.

ACTIVITY

Corresponding activity on page 7 of the activity pack: 'Where Do I Live?' is a task where children match the fish with its habitat! With handy hints and visual clues, this is a fun task that reinforces the difference places fish live.

IMPOSSIBLY COLD HABITATS: SCENE 5

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

FREEZING POINT

Freshwater (water that's not naturally salty) freezes into ice at 0 °C (32 °F). In scientific settings, this is sometimes called the 'freezing point' or 'freezing temperature'. But ice can get even colder than that!

However, because of all the salt, ocean water can be colder than 0 °C (32 °F). Its own freezing point is -2 °C (28.4 °F)!

LIFE AT THE POLES

The **North Pole** is the most northern point on Earth. It is located within the **Arctic**.

The **South Pole** is the most southern point on Earth. It is located within the **Antarctic**.

Both of these areas are **harsh** places for animals to live. They are incredibly **isolated** and are cold all the time, staying covered in **ice** throughout the year. Because of their extreme location, the poles experience 6 months of non-stop light followed by 6 months of non-stop dark.

This unusual **cycle** and harsh **climate** means that very few plants can grow there and very few animals can cope too!

ANIMALS LIVING AT THE POLES

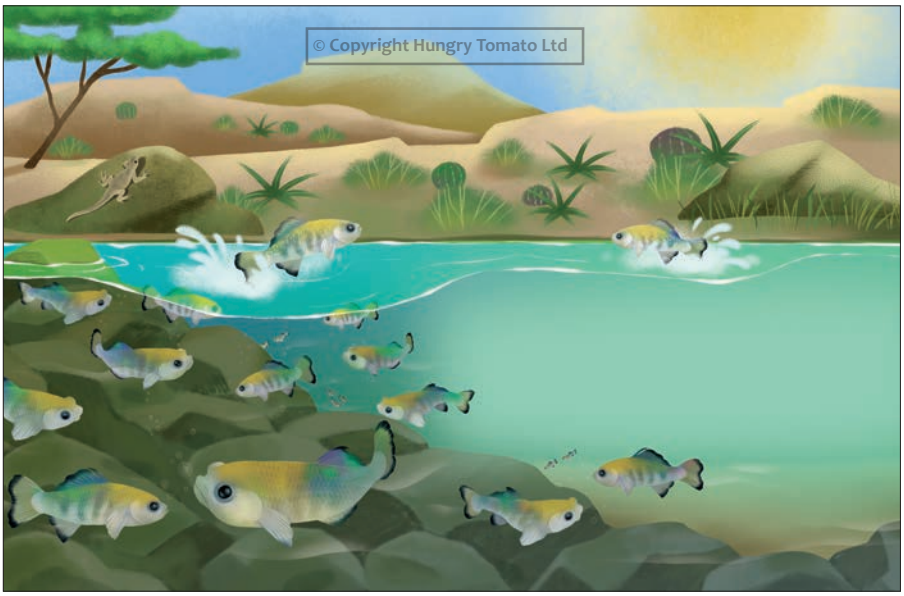
Animals that live at the poles must **adapt** – change their features or habits to better cope with their surroundings. Some examples of animals that live in these extreme **habitats** (and the adaptations which make this possible) include:

- Polar bears – thick, white **fur** for **staying warm** and **camouflaged**, large **paws** for **walking on snow**
- Emperor penguins – **huddle together** for warmth, can go for a **long time without eating**
- Harp seals – thick **blubber** for staying warm and having an **energy reserve**, large **eyes** help with **spotting prey**
- Beluga whales – **migrate** to warmer waters in summer to give birth

IMPOSSIBLY HOT HABITATS: SCENE 6

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats.

Consider what the world's hottest habitats are like with this desert scene. Get children engaged in discussion about how animals adapt to this extreme environment and open up a conversation about other habitats around the world.



DISCUSSION PROMPTS

- **What's it like in the desert?**

Encourage children to use the scene for hints about things like the climate, the type of plants that grow, and so on. There is also information overleaf.

- **Can you think of any other animals that live in the desert? How have they adapted to this habitat?**

Information overleaf

- **Besides deserts, can you think of any other types of habitats from different parts of the world?**

Information overleaf

ACTIVITY

Corresponding activity on page 8 of the activity pack: 'Slippery Fish' is a spot the difference activity where children have to spot 10 differences between two versions of this scene.

IMPOSSIBLY HOT HABITATS: SCENE 6

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

DESERTS

Deserts are very dry places that get less than 25 cm (10 inches) of rainfall every year. Deserts can be boiling hot, for example the Sahara Desert in Africa, or freezing cold, for example the Antarctic Desert in Antarctica.

It is difficult for animals and plants to live in the desert because there is so little water. All plants and animals on Earth need water to **survive**. Those that live in the desert have to **adapt** – change themselves – to survive.

Examples of animals that live in hot deserts include camels, roadrunners, meerkats, tarantulas, ostriches, scorpions, and snakes.

Examples of plants that live in hot deserts include cacti (plural of cactus), tumbleweed, and elephant trees.

ANIMALS LIVING IN THE DESERT

Some examples of animals that live in the desert (and the adaptations which make this possible) include:

- Camels – **large, flat feet** for **walking across sand**, long **eyelashes** to protect their eyes from **sandstorms**, **conserve fat** in their humps to **last a long time without food**
- Roadrunners – varied, **omnivorous diet** to allow **opportunistic feeding**
- Meerkats – have **thin fur** and **burrow** underground to help **stay a safe temperature**
- Tarantulas – being **nocturnal** helps with **hunting** and coping with desert temperatures
- Scorpions – slow down **metabolism** or **hibernate** to last a long time without food

HABITATS OF THE WORLD

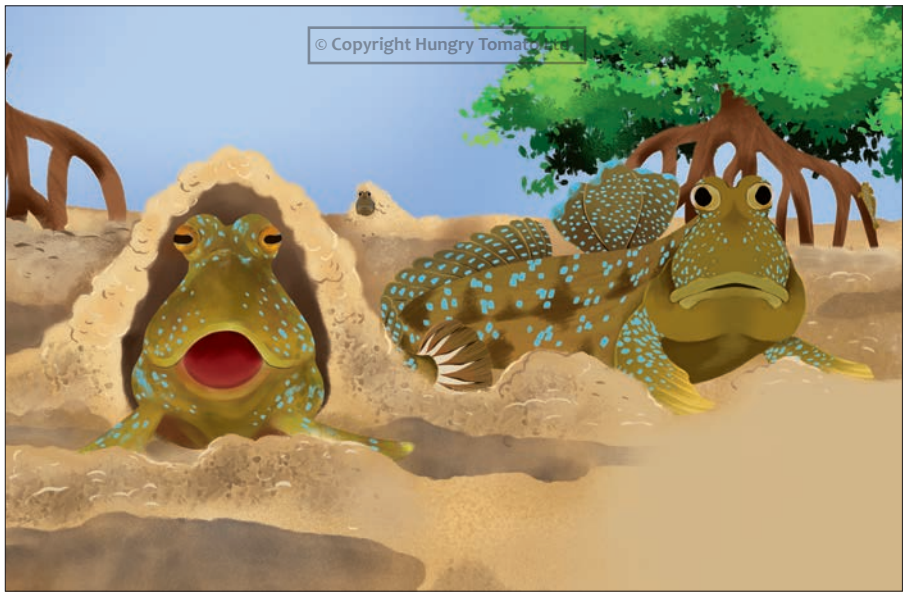
Deserts are examples of **habitats**. Some examples of other habitats include rainforests, temperate forests, grasslands, and swamps.

Each type of habitat has different **weather** and **climate** conditions, and physical features, as well as different types of plants and animals living there.

OUT OF WATER: MUDSKIPPERS: SCENE 7

The material for this scene can be linked to curriculum topics, including: animals, including humans; living things and their habitats; working scientifically.

Explore the secret to some fish surviving out of water with this scene that focuses on mudskippers. Discuss the similarities and differences between mudskippers and other animals, as well as what this discovery means for science.



DISCUSSION PROMPTS

- **Have you ever seen mudskippers before? Do you think they look like fish or do they remind you of any other animals?**
Encourage children to point out features such as fins, tails, and big eyes, as well as things like the way they're burrowing or lying on the mud.

- **How long do you think mudskippers can stay out of water for?**
Information overleaf

- **Can you think of other animals that create underground burrows?**
Information overleaf

- **Why do you think this discovery is important?**
Information overleaf

ACTIVITY

Corresponding activity on page 9 of the activity pack: 'Mirror the Mudskipper' is a 'finish the drawing' activity where children are given an image of a mudskipper split down the middle to complete and colour in.

OUT OF WATER: MUDSKIPPERS: SCENE 7

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

MUDSKIPPERS

Scientists have discovered more than 20 **species** of mudskipper! They live in many places around the world including in Africa, South Asia, and South America, usually in **habitats** that experience **tides**, like **mudflats**, **swamps**, and **mangrove forests**.

These unusual-looking fish can survive out of water for up to two days (but only if their **gills** stay wet).

BURROWING ANIMALS

Lots of animals **burrow** underground to create **homes** and safe places to **hide**, **hibernate**, or **lay their eggs**.

Other fish that burrow include loaches, sandfish, and swamp eels.

Other animals that burrow include badgers, moles, rabbits, wombats, and meerkats.

MUDSKIPPERS AND SCIENCE

Learning about mudskippers and their ability to survive out of water has been important for scientists for many reasons:

- Mudskipper help scientists understand land animals – surviving out of water is just one of their skills. Mudskippers are also the only fish that blink, which may help scientists understand how blinking developed in land animals. Studying how they walk and breathe could also shed light on how these skills arose in land animals.

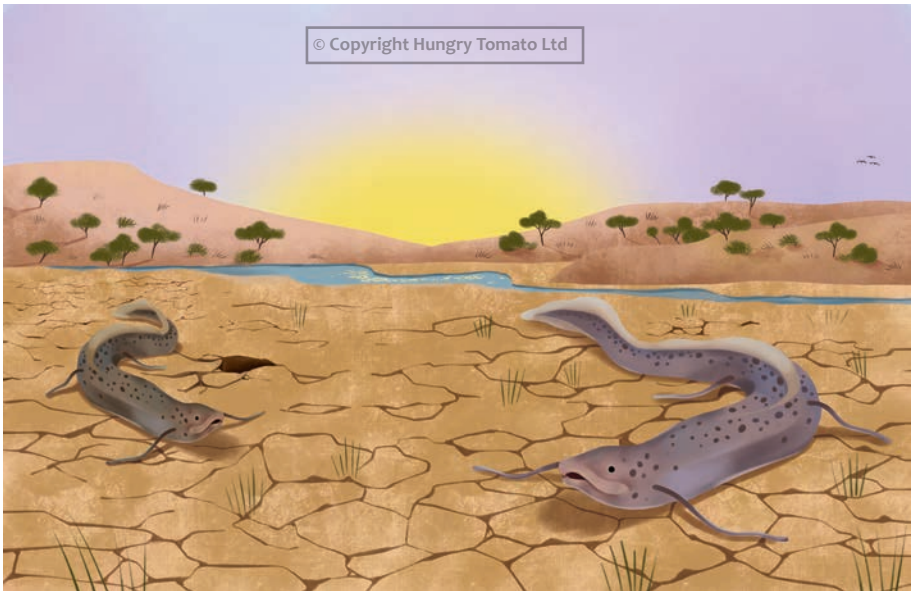
- Mudskippers have **unique genes** that help them cope with high-stress **environments**. This could help us better understand the importance of genes and could help bioscientists improve **stress resistance** in humans or other animals.

- Mudskippers cope with **habitats** which are constantly changing (due to incoming and outgoing water and changing food sources), showing the adaptability of life. This could impact scientists searching for **alien life** in outer space, as it shows that life may be able to exist in places that were once considered too extreme.

OUT OF WATER: LUNGFISH: SCENE 8

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats.

Discover another strange-looking fish, the African lungfish, that can survive out of water. Use this scene to discuss a range of relevant topics including floodplain habitats, the location and role of lungs in humans, and the concept of hibernation.



DISCUSSION PROMPTS

- **Can you name any other animals that live in floodplains like the one in this scene?**
  Information overleaf

- **Where in the human body are the lungs found? How do they work?**
  Information overleaf

- **Can you think of any other animals that hibernate?**
  Information overleaf

ACTIVITY

Corresponding activity on page 10 of the activity pack: 'Know Your Fish!' is a crossword activity where children use clues to name the different body parts that all fish have, no how they look. They can then fill in the crossword with the answers.

OUT OF WATER: LUNGFISH: SCENE 8

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

FLOODPLAINS

A **floodplain** is a flat area of land right next to a river or water source that floods when levels gets really high. Floodplains can be very wide or very narrow. Their size depends on the **shape of the land** around them and how **weather**, like heavy rain, affects the area.

The animals that live on, or near, floodplains vary around the world. As well as the African lungfish, other animals that live on, or near, the Congo floodplain include Nile crocodiles, herons, kingfishers, pythons, and red river hogs.

THE LUNGS

The human **lungs** are found in the chest and are protected by the **ribcage**. They are the pair of **organs** that allow you to breathe. They take in **oxygen** and push out **carbon dioxide**. This process is called **respiration**.

When a person breathes in, oxygen is transferred into their blood. Their heart then pumps the oxygenated blood around their body, giving energy to their other organs (like the brain) and muscles.

Breathing is so important that our bodies keep doing it even when we're asleep!

HIBERNATION

Hibernation is when animals go into a deep sleep for a long time. During hibernation, the animal's **heartbeat** and **breathing** slow down. It also uses less **energy** and its **body temperature** cools down. These things help the animal survive long periods of time without much food or water.

Lots of animals hibernate to get through the cold winter months, when it's harder to find food and stay warm. To prepare for hibernation, animals often eat lots in summer and autumn. This helps them build up lots of fat their bodies can use up during hibernation.

Not all animals hibernate, but examples of those that do include chipmunks, badgers, hedgehogs, bears, and bats.

Sadly, **climate change** is bad news for hibernation. It affects when animals hibernate and when food is ready, making it harder for animals to survive!

OUT OF WATER: WALKING CATFISH: SCENE 9

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats.

Discover the walking catfish, another fish that can survive out of water. Explore why it moves from water to land, the pressures that affect fish today, and what different species eat.

DISCUSSION PROMPTS

- **Where do you think the walking catfish lives in the world?**
  Information overleaf

- **Can you think of any other challenges facing fish?**
  Information overleaf

- **Do you know what the walking catfish eats? Do you know of any fish that eat different things to this?**
  Information overleaf

ACTIVITY

Corresponding activity on page 11 of the activity pack: 'Back to the Pond' is a classic maze activity where children have to complete the maze to help the walking catfish find its way back to its pond home.

OUT OF WATER: WALKING CATFISH: SCENE 9

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

THE WALKING CATFISH

The walking catfish is a **species** of catfish. There are more than 3,000 different species of catfish in the world in total!

The walking catfish is **native** to Southeast Asia, however it has been **introduced** to parts of the United States, so it can be found there too.

This **freshwater** fish can be found in ponds, canals, and rivers. It usually prefers **shallow** water that has lots of plants and **vegetation** in it.

CHALLENGES FACING FISH

In this scene, we mention some of the challenges that fish face, including **finding a mate**, **finding food**, and **escaping from predators**. Some other challenges include:

- **Pollution** hurting the fish, their **habitats**, and food sources
- **Overfishing** reducing the numbers of fish and their food sources
- **Habitat destruction** leaving fish with fewer safer places to live
- **Climate change** harming fish and their habitats, and making changes to the **ecosystem** on a whole
- **Diseases** harming fish and their numbers

FISH DIETS

The walking catfish is an **omnivore**. This means it eats a range of food, including small fish, insects, and small plants.

Not all fish are omnivores though! Some are **carnivores**, which only eat meat, while others are **herbivores**, which only eat plants.

Examples of **carnivorous** fish include sharks, piranhas, barracudas, and tuna.

Examples of **herbivorous** fish include parrotfish, surgeonfish, and mullets.

OUT OF WATER: SNAKEHEADS: SCENE 10

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats.

Discover the role of ichthyologists with this scene which focuses on scientists' studies of fish populations. Discuss the different ways that scientists track fish and how this research impacts different types of science.

DISCUSSION PROMPTS

- **How do you think scientists track fish populations?**
  Information overleaf

- **What else do you think scientists can learn from tracking fish?**
  Information overleaf

- **Do you think this information is useful for different types of scientists? Which type of scientists do you think would benefit from this information?**
  Information overleaf

ACTIVITY

Corresponding activity on page 12 of the activity pack: 'Catch the Word!' is an activity where children have to unscramble the letters to spell out fish-related words. In a linked activity, they have to see how many words they can create out of set letters.

OUT OF WATER: SNAKEHEADS: SCENE 10

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

TRACKING FISH POPULATIONS

Scientists have different ways of tracking fish populations. These include:

- **Tagging** – attaching little tags to fish that send signals to scientists' machines to show where the fish are. Some people say this is not very nice for the fish, but scientists only do it when it's necessary to help save the fish in the long run.
- **Sonar** – sending signals from a boat down into the water below. How fast and strong the signals come back shows scientists where fish are and what the **habitat** is like.
- **Visual surveys** – counting fish or observing their movements when visible in shallow water is an easy way for scientists to track fish as it doesn't require special machines.
- **Studying data from fisheries**.

WHAT CAN SCIENTISTS LEARN?

Tracking fish can help scientists learn lots of things. In this scene, we mention some examples, including **changes to the food chain**, **water quality**, or **climate**. Some other examples include:

- How fish **interact with each other** in an area, as well as with other animals and plants in their environment.
- New information about **breeding patterns**, **migration**, and **life cycles**.
- The **impact of human activity** – for example pollution and fishing – on fish and their habitats.
- **Which fish may be at risk** and when scientists need to help with **conservation efforts**.

IMPACT ON OTHER SCIENCES

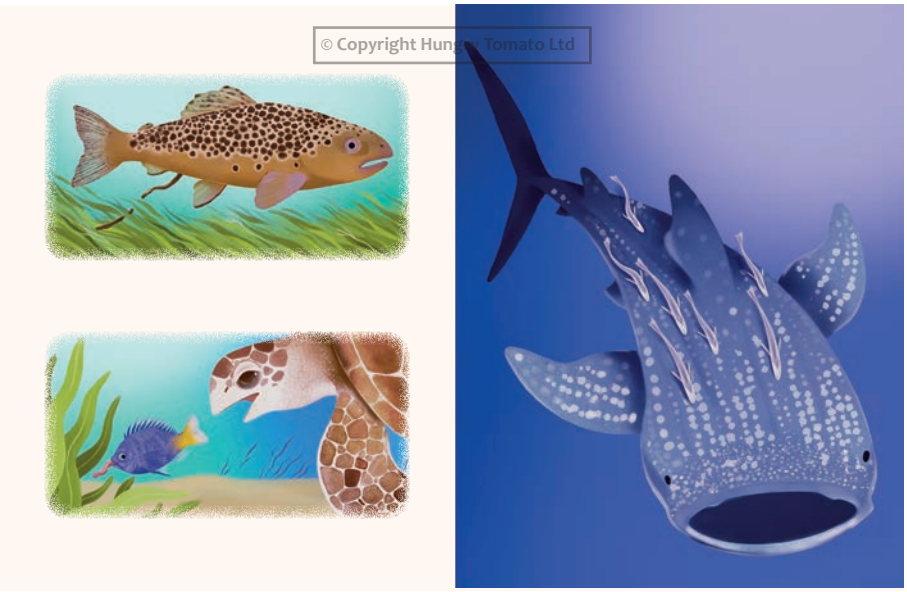
These findings don't just help ichthyologists learn about fish – they have an impact on many other sciences and research disciplines, including:

- **Climatologists** – scientists who study climate and global temperatures.
- **Oceanographers** and **hydrologists** – scientists who study the ocean and other water sources.
- **Conservation biologists** – scientists who help threatened **species** and habitats.
- **Social scientists** – scientists who study how changes in the natural world affect humans.

ECOSYSTEM-SAVING FISH: SCENE 11

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats.

Explore the many ways that fish help the natural world with this scene showing three key examples. Engage in discussion about other ways fish help the world around them and ways that animals help each other out too.



DISCUSSION PROMPTS

- **Can you name any of the animals in these scenes?**
  Information overleaf

- **Can you think of any other ways that fish help the natural world?**
  Information overleaf

- **In the scene, the small fish and the shark are working together. Can you think of any other animals that work together like this?**
  Information overleaf

ACTIVITY

Corresponding activity on page 13 of the activity pack: 'Fascinating Fish Abilities' is a classic activity where children fill in the blanks in a series of sentences and facts about fish and the ways they help out the natural world.

ECOSYSTEM-SAVING FISH: SCENE 11

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

ANIMALS IN THE SCENE

There are six different animals in these scenes:

- **Trout**
- **Hawksbill sea turtle** trying to catch a **damselfish** that has caught a **worm**
- **Remora fish** swimming on top of a **whale shark**

HELPING THE NATURAL WORLD

In this scene, we mention some of the ways that fish help the natural world, including **releasing important nutrients into the water, keeping the food chain balanced,** and **keeping bigger animals clean and healthy**. Some other examples include:

- **Keeping ecosystems diverse**, which helps the overall health of **habitats**
- **Spreading plant seeds** across ecosystems, which helps new plants grow
- Helping to **create and look after habitats** like coral reefs
- Helping to **remove carbon from the atmosphere**, which helps keep **global warming** and **climate change** in check
- **Providing scientists with information about the environment** so they know when **conservation** efforts are needed

ANIMALS WORKING TOGETHER

When two things in nature help each other out, scientists say they have a **mutualistic relationship**. The remora fish and whale shark in this scene are an example of this. Other examples include:

- Oxpecker birds are often found sitting on the back of **mammals**, like rhinos or zebras. The birds eat the **parasites** off the mammal's body. This helps the mammal stay healthy and gives the birds an easy meal.

- Clownfish live inside **anemones** – plant-like animals in the sea. Clownfish are safe inside anemones because most animals get stung by the tentacles. In return for their safety, clownfish keep anemones free from parasites and provide them with **nutrients** from their poop and leftover food.

THE DANGER OF EXTINCTION: SCENE 12

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats.

Explore the ways we can all help to protect fish by making small changes in our own lives. Engage children in discussion about what it means for something to become extinct as well as which type of living things this can affect.

DISCUSSION PROMPTS

- **Can you think of any things we can do to help protect fish?**
  Information overleaf

- **What does it mean if an animal becomes extinct?**
  Information overleaf

- **Does extinction only affect animals?**
  Information overleaf

- **Can you think of any animals that have become extinct?**

Encourage children to name examples they have heard about in books or movies, such as dinosaurs, mammoths, dodos, and so on. There is also information overleaf.

ACTIVITY

Corresponding activity on page 14 of the activity pack: 'Reflecting on Fish' is a reflective writing task where children answer questions about their opinions on a number of fish-related questions.

THE DANGER OF EXTINCTION: SCENE 12

RELEVANT INFORMATION

Keywords that you may want to pull out and explain have been put into bold.

PROTECTING FISH

We can all help to protect fish and their ecosystems by helping the **environment**. Here are just a few ways to help:

- Using less water.
- Turning lights and **appliances** off when not in use.
- **Reusing** and **recycling** items.
- Walking, cycling, or using public transport instead of cars.
- Planting more trees and plants.
- Talking about **climate change** to encourage other people to help.

If we all made a few of these changes, it could make a big difference!

EXTINCTION

When a **species** dies out and no more of that type of animal exist, we say that the species has become **extinct**. It's not only animals that become extinct – plants can too.

There are lots of reasons why extinction happens. Some examples include **diseases**, **natural disaster** (like a massive volcanic eruption or a **meteor** strike), **loss of habitat**, and **loss of food sources**.

Scientists learn about extinct species by studying their **fossils**. They also track plants and animals that are living today to see which ones might be in danger of becoming extinct. If they notice a problem, they can try to help. They might help by protecting the places those plants or animals live, making sure they have enough food, or creating rules (like banning hunting). Doing things to help save plants and animals is called **conservation**.

EXTINCT ANIMALS

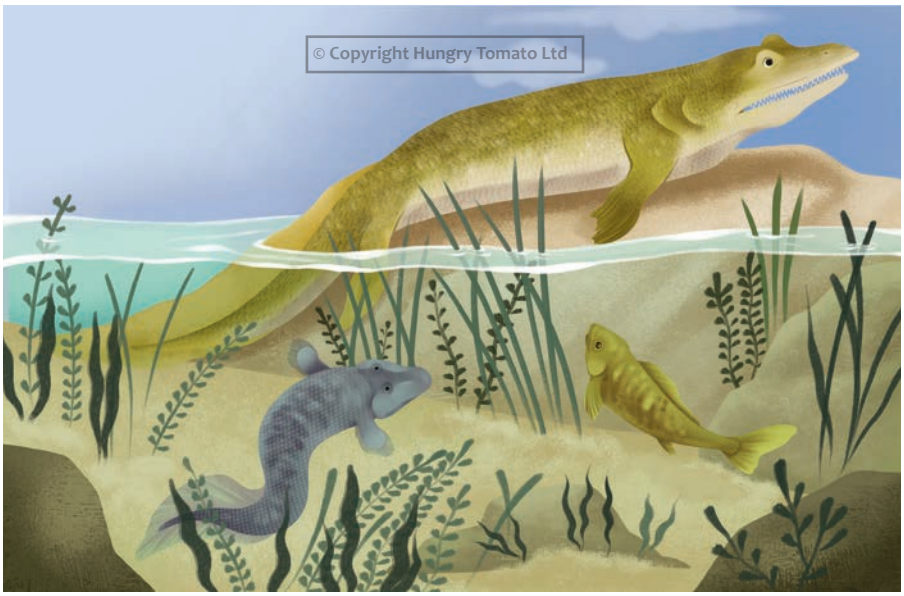
Sadly, scientists estimate that over 99% of all the species that have ever lived on our planet are now extinct! That's billions of species.

Examples of extinct animals include dinosaurs, plesiosaurs, megalodons, mammoths, dodos, and saber-toothed cats.

ANCIENT RELATIVES: SCENE 13

The material for this scene can be linked to curriculum topics, including: animals, including humans; climate change; living things and their habitats; working scientifically.

Discover the true importance of ichthyologists' discovery that some fish can survive out of water with this final scene covering how some ancient fish developed into amphibians!



DISCUSSION PROMPTS

- **What are amphibians? Can you name any examples of amphibians?**
Information overleaf

- **Does the animal on the rock remind you of any animals that live today? What features does it share?**
Encourage children to point out features such as the long snout, rows of teeth, gills, and so on.

- **What is unusual about the smaller, grey animal on the left? What similarities and differences does it share with the more familiar fish on the right?**
Encourage children to point out features such as the scales, fin shape, and so on. There is also information overleaf.

ACTIVITY

Corresponding activity on page 15 of the activity pack: 'Fact or Fishy?' is true or false quiz. Children use what they have learnt from reading the main book, as well as their intuition, to fill in the answers.

Ancient Relatives: Scene 13

Relevant Information

Keywords that you may want to pull out and explain have been put into bold.

Amphibians

Amphibians are a group of animals that live both **in water and on land** during different stages of their lives.

They are **cold-blooded**, which means that their body temperature changes with their surroundings, and they have **permeable skin**, which means that water and **gases** pass through them easily.

Examples of amphibians include frogs, toads, salamanders, axolotls, and newts.

Animals in the Scene

There are three different animals in this scene. They show how fish changed slowly over time and developed into amphibians that could live on land:

- **Tetrapod** (on the rock) – early tetrapods were **vertebrates** that developed from **lobe-finned fish**. They had four **limbs** instead of **fins** and began to spend time on land. Once fully **adapted** to life on land, tetrapods developed into many other types of animals. Scientists think they are related to reptiles, birds, and mammals!

- **Half-tetrapod and half-fish** (grey) – this animal looks a bit like a lobe-finned fish, which had sturdy fins that it used to 'walk' along the bottom of the water. It's a step between fish and land animals.

- **Fish** – the fish represents modern-day fish. Its iconic body shape and features are like those of many fish that live in oceans, lakes, and rivers on Earth today.

POST-READING QUESTIONS

Engage in discussion about the journey taken throughout the book and the facts that were uncovered, with the suggested questions below.

- **Were you surprised to learn that fish can live out of the water?**
- **Did anything else in the book surprise you?**
- **What's the coolest thing you've learnt from this book?**

ACTIVITY

Corresponding activity on page 16 of the activity pack: 'Write Your Own Ichthyology Story' is a creative writing activity which encourages children to write a story about ichthyology, using three key prompt words.

DISCLAIMER:

Every effort has been made to ensure the information in this booklet is correct as of the time of publication, Autumn 2025.

THE BIG QUESTIONS ANSWERED

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