



Section 1: Characteristics Of Fish

• How do fish regulate their body temperature?

Most fish are ectothermic, meaning their body temperature varies with their external environment. However, some species are able to keep their body temperature slightly warmer than their surroundings using a counter-current exchange system, in which warm blood flows over cooler blood, transferring heat and keeping it inside the body rather than losing it to the environment. Being slightly warmer allows these fish to swim faster and for longer, though it also means they have to eat more food to provide their body with energy. Great white sharks, tuna and swordfish all have this ability.

• Suggested Film

– What is a Fish?

Extension Question

Q1. How do fish survive in extremely cold waters?

In most species of fish, body temperature is equal to the temperature of the surrounding water. Around the north and south poles, this can be just a few degrees above freezing. At these temperatures, ice crystals can form inside body tissues and quickly result in death. To prevent this, some fish, such as herring and northern cod, make their own antifreeze chemicals, which bind to the ice crystals as they form and stop them from growing. This protects the fish from damage, allowing it to survive the extreme cold.

• Why aren't jellyfish classified as fish?

Jellyfish are marine animals but, despite their name, they aren't classified as fish. True fish are aquatic vertebrates, which means they have a backbone. They have an internal skeleton consisting of cartilage or bone, which gives structure and shape to their bodies. Jellyfish are invertebrates. They have entirely soft bodies, meaning they cannot support their own shape and so rely on the water to provide structure. The difference between fish and jellyfish is most obvious when both are out of water – a fish retains its shape, while a jellyfish collapses into a shapeless pile.

• Suggested Films

- What is a Fish?
- Humphead Parrotfish
- Splash Tetra
- How Did Fish Evolve?



Fish are cold-blooded, which means their temperature is controlled by their external environment.

• How do fish breathe underwater?

Like mammals, fish must respire to stay alive. Respiration requires oxygen, which fish absorb from water, rather than breathing in from the air. Whales are often mistaken for fish but are actually mammals, and so need to regularly return to the surface to breathe air.

Fish have gills rather than lungs. These structures are composed of stacks of flat plates, filled with densely packed blood vessels. Water flows over these plates and gases are exchanged. By stacking plates very close together, fish can create a huge surface area for gas exchange, which allows them to absorb oxygen and get rid of waste carbon dioxide efficiently.

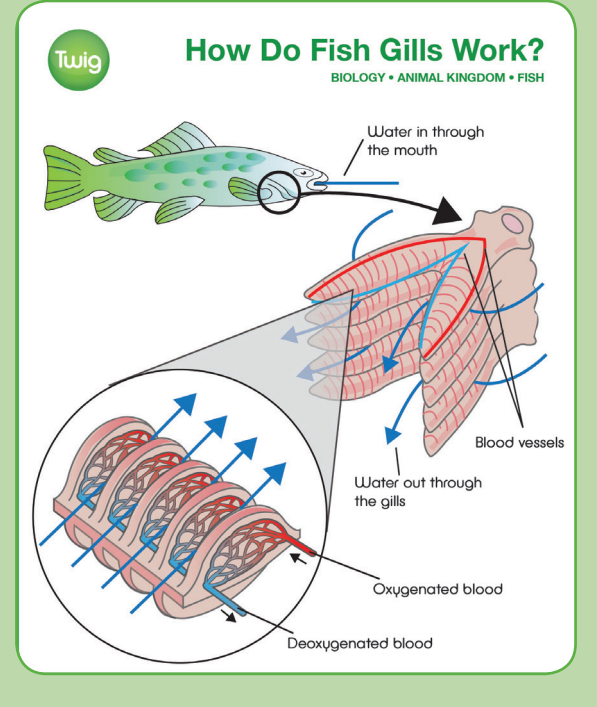
- Suggested Film
 - What is a Fish?

Extension Question

Q2. What do humans and fish have in common?

The human backbone can be traced all the way back to the very first vertebrate – an ancient fish that evolved over 500 million years ago. Fish were the first animals to evolve a backbone, and all modern-day mammals, birds, reptiles and amphibians owe this feature to their shared ancestor.

DIAGRAM 01:



Section 2: Catching Prey

• How do fish catch their prey?

Fish that eat other fish must either catch their prey or scavenge. Some fish primarily use their sense of sight to locate prey, while others can detect electrical impulses and vibrations created by other fish. Most have streamlined bodies that enable them to swim at great speeds to catch prey.

Barracudas are large predatory fish that live mainly in tropical waters. They hunt using bursts of speed of up to 43 kilometres per hour, capturing their fleeing prey with fang-like teeth. Their bodies have evolved to be long and thin, with smooth scales and powerful muscles to help them dart through the water.

- Suggested Film
 - Barracuda

Extension Questions

Q3. Which is the fastest fish in the ocean?

Sailfish live in warm and temperate waters around the world, and they can grow to over 3 metres in length. Their upper jaw forms a protruding spear, which cuts through the water as they chase prey such as sardines and anchovies. Sailfish have been recorded leaping out of the ocean at more than 109 kilometres per hour, making them the fastest known fish.

• How do sharks locate their prey?

Sharks are very effective predators because they have an incredibly sensitive sense of smell. Their nostrils are designed to allow water to continually flow through them and over skin filled with sensory cells. Some sharks are able to detect a single drop of blood mixed with 1 million drops of seawater, and can use this super sense to identify potential meals at long distances. They are able to calculate the direction of a scent by comparing its arrival time at each of their nostrils.

• Suggested Films

- Great White Shark
- Basking Shark

Extension Questions

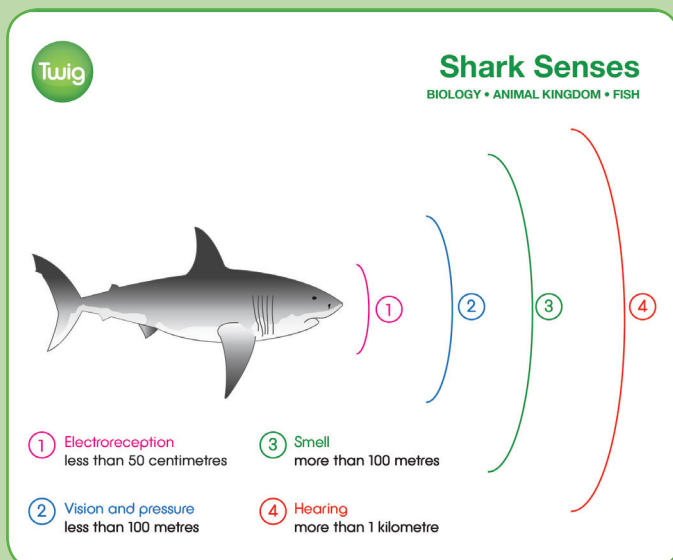
Q4. Why can some sharks never stop swimming?

Some species of shark have lost the ability to actively pump water through their gills. Since gas exchange can only take place when there is a constant flow of water across the gills, these sharks must keep swimming at all times or they will suffocate. They will keep moving for their entire life, never staying still even when asleep.

Q5. How are shark teeth different from human teeth?

A shark's teeth are designed to slice through the flesh of its prey. Each tooth has a razor-sharp edge and a very sharp point. Rather than sitting in sockets, like human teeth, shark teeth are attached loosely and are designed to fall out regularly and be replaced by fresh teeth. Some large sharks, like the great white shark, have several rows of teeth inside their jaws, which move forward into position when the tooth in front is lost.

DIAGRAM 02:



The great white shark is the largest predatory fish in the ocean.

• How do deep sea angler fish entice their prey?

Deep sea angler fish live at very low depths, in almost complete darkness. In order to catch food they have evolved a special lure that protrudes from their head. At the end of this flexible rod is a small pocket containing bioluminescent bacteria that are capable of making light on demand. The deep sea angler fish has a symbiotic relationship with the bioluminescent bacteria: it supplies nutrients and protection to the bacteria, and in return uses their light to catch prey. The deep sea angler fish uses the glowing lure to attract inquisitive prey towards its waiting jaws, before devouring them.

• Suggested Film

– Deep Sea Angler Fish

Extension Questions

Q6. How do other species use bioluminescence?

Many species of fish make use of bioluminescence. The cookiecutter shark has light-producing “photophores” across the majority of its underside, except for a small patch near its throat, which creates a dark shape against a background of light. It’s thought that this dark patch resembles the shadow of a small fish to other marine life that are swimming below the shark. This shadow lures them into striking range for the predator.



Deep sea angler fish have glowing rods that protrude from their bodies, which are used to entice prey.

Section 3: Protection from Predators and Parasites

• How have fish adapted to avoid predators?

Fish have adapted to avoid predators in lots of different ways. Some swim in large groups called schools, which provides “safety in numbers” by confusing predators into thinking the school is one large fish. Others use camouflage to help them blend in with their surrounding environment, in the hope they will remain undetected by predators.

Mudskippers are amphibious fish, which means they can survive out of the water for fairly long periods at a time. This enables them to avoid marine predators by walking on land using specially adapted pectoral fins. Mudskippers can seal their gills when on land, and instead obtain oxygen by absorbing it through their skin. They use low tide as a chance to hunt for food in the mud, and will vigorously defend their territory from any rival fish. When high tide returns, they bury themselves in the mud, safely away from hungry predators.

• Suggested Film

– How Did Fish Evolve?

Extension Questions

Q7. How do scales provide protection for fish?

Like reptiles, fish are covered in a layer of hard scales that helps protect them from their environment and predators. These scales grow out from their skin to provide a tough, interlocking covering, which makes it hard for parasites to latch onto. Most fish also have a protective layer of mucus coating their scales. In the case of clownfish, this mucus protects them from the stinging tentacles of sea anemones, allowing the clownfish to shelter amongst the anemones, safe from predators.

• How do fish deal with parasites?

Some fish rid themselves of parasites by forming symbiotic relationships with other, smaller fish. Remora fish attach themselves to their larger hosts using a special suction cup, and then find and eat parasites living on the host's skin. As well as providing the remora fish with a convenient meal, the remora can conserve energy by hitching a ride. In return, it helps to keep the host healthy.

Similarly, pilot fish pick parasites off sharks, and young pilot fish will even swim inside a shark's jaws to clean away food particles stuck between their teeth.

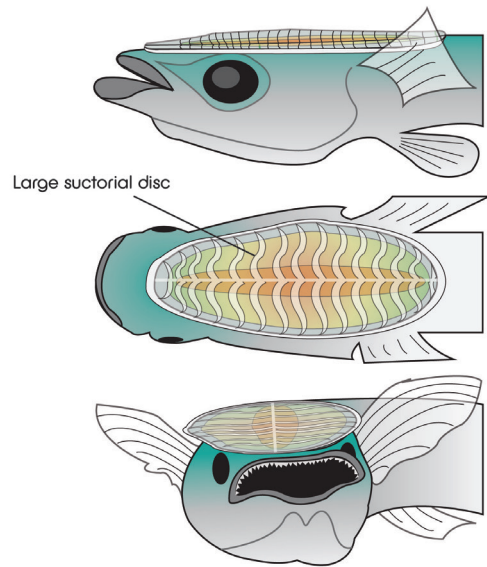
- **Suggested Film**
– Remora Fish

DIAGRAM 03:



Remora Suction Cup

BIOLOGY • ANIMAL KINGDOM • FISH



• How do fish use camouflage for protection?

Some species of fish hide from predators by blending into their environment. Seahorses, for example, live in sheltered marine environments, including seagrass lawns and coral reefs. They swim upright using small fins, which makes moving around pretty slow. To avoid predators they have evolved to be masters of camouflage, changing the colour and pattern of their skin in order to mimic their surrounding environment. Some species have even grown special extensions on their bodies that resemble the shape of nearby marine plants, making them almost invisible to predators.



Seahorses use body armour and camouflage as a defence mechanism.

- **Suggested Film**
– Seahorse

Extension Questions

Q8. What makes seahorse reproduction so unusual?

Unlike the majority of animals, where the female carries the offspring, it is the male seahorse that incubates the fertilised eggs. Males have a pouch located on their front, into which a female deposits up to 1500 eggs. Once the eggs have fully developed, the male gives birth to their young.

• Quizzes

What is a Fish?

Basic

• How many species of fish are there in the world?

- A – over 5000
- B – over 10,000
- C – over 30,000
- D – over 50,000

• Which of the following statements best describes fish?

- A – they live only on land
- B – they live only in the air
- C – they live on land and in water
- D – they live only in water

• Which of the following is NOT a type of fish?

- A – whale
- B – seahorse
- C – goldfish
- D – butterflyfish

• What do fins do?

- A – help the fish swim
- B – help the fish breathe
- C – protect the fish
- D – help the fish reproduce

Advanced

• Which of the following is a characteristic of fish?

- A – vertebrate
- B – invertebrate
- C – warm-blooded
- D – live on water and land

• Which one of the following is a type of fish?

- A – jellyfish
- B – starfish
- C – shellfish
- D – shark

• What do gills do?

- A – help the fish swim
- B – help the fish breathe
- C – help the fish reproduce
- D – protect the fish

• Which one of these words means cold-blooded?

- A – ectothermic
- B – exothermic
- C – endothermic
- D – indothermic

How Did Fish Evolve?

Basic

• A primitive backbone made early fish the first...

- A – carnivores
- B – invertebrates
- C – vertebrates
- D – thermophiles

• Which type of fish was the first to move on to land?

- A – lampreys
- B – lobe-finned fish
- C – cartilaginous fish
- D – jawless fish

• What are shark skeletons made of?

- A – calcium carbonate
- B – silicate
- C – calcified bone
- D – cartilage

• How did jaws give fish an evolutionary advantage?

- A – they improved feeding and defence
- B – they improved swimming and navigation
- C – they improved fertility
- D – they improved camouflage

Advanced

• How long was the very first fish, haikouichthys?

- A – 2 centimetres
- B – 20 centimetres
- C – 2 metres
- D – 20 metres

• Which organ do bony fish use to control their buoyancy?

- A – liver
- B – alveoli
- C – swim bladder
- D – gall bladder

• Which of these is a type of jawless fish?

- A – lungfish
- B – lamprey
- C – pike
- D – salmon

• The first fish evolved 550 million years ago. How long after that did the first jawed fish appear?

- A – 10 million years
- B – 50 million years
- C – 200 million years
- D – 100 million years

• Answers

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