Movement

TEACHER'S NOTES

What this topic is about

Fish are the dominant free-swimming animals of the seas. The structure of a fish body is designed for ease of movement. This ability to move about easily, without relying on water currents to carry them about, has enabled fishes to exploit most parts of the world's oceans, and this is reflected in an extraordinary variety of sizes and shapes.

What will pupils learn?

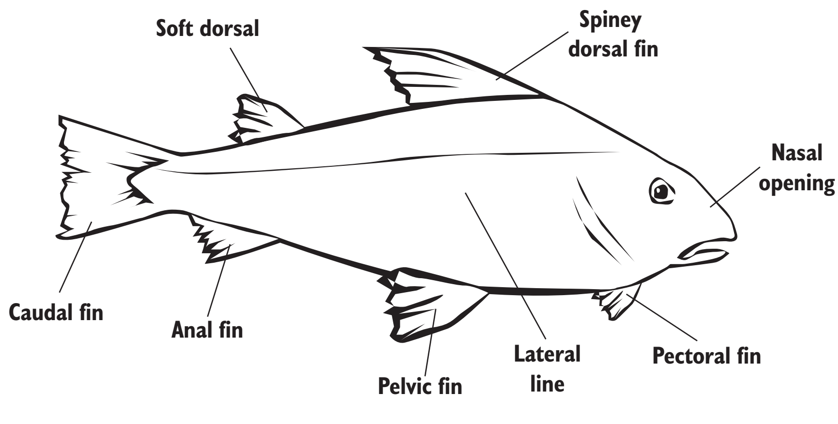
- How Fish Swim
- How the structure of a fish's body is designed for swimming
- The different ways in which different fish move

Essential information

How Fish Swim: The density of water makes it very difficult to move in, but fish can move very smoothly and quickly.

A swimming fish is relying on its skeleton for framework, its muscles for power, and its fins for thrust and direction.

The skeleton of a fish is the most complex in all vertebrates. The skull acts as a fulcrum, the relatively stable part of the fish. The vertebral column acts as levers that operate for the movement of the fish.



The muscles provide the power for swimming and constitute up to 80% of the fish itself. The muscles are arranged in multiple directions that allow the fish to move in any direction. A sinusoidal wave passes down from the head to the tail. The fins provide a platform to exert the thrust from the muscles onto the water.

TEACHER'S NOTES

Two swimming types in fishes

Defined by their method of living, and reflected in their physiology.

- Cruisers: These are the fish that swim almost continuously in search for food, such as the tuna.
- Burst Swimmers: These fish usually stay relatively in the same place such as most reef fish.

Variations in body form

Fish shape has a great bearing on ability to move through the water.

- A tuna fish which has a form similar to a torpedo can cruise through the water at very high speeds
- The attenuated shape of the eel allows it to wiggle into small crevices where it hunts prey
- The depressed shape of the angler fish is advantageous for its "sit and wait" strategy of hunting
- The compressed shape found on many reef fishes such as the butter fish gives the fish great agility for movement around the reef and can support sudden bursts of acceleration.

Fish Thermal Strategies

In general, fishes are cold blooded. They derive their body heat from their environment and conform to its temperature. As water has a high heat capacity, it is able to easily suck any excess heat out of a fish and into the environment. Ectothermic fish derive their heat from the environment Poikilothermic fish conform to the heat in the environment.

Some large, fast-swimming fish are not ectothermic. The tunas and mackeral sharks can actually have core body temperatures ten to twenty degrees higher that the surrounding water. They are endothermic and derive their body heat from their metabolism, but they are still ploikiothermic; their body temperature may be higher than the surrounding water, but they still conform to the temperature of the water, just 10-20 degrees above it.

The higher a fish's body temperature, the greater the muscular power and speed. Thirty degrees is the optimum temperature for muscular speed. With increased speed, the tuna can capture the slower, cold blooded fish it prey upon. Tuna have been clocked at record speed of 70-90 kph!

Swim Bladders

Bony fish have swim bladders to help them maintain buoyancy in the water. The swim bladder is a sac inside the abdomen that contains gas. This sac may be open or closed to the gut. If you have ever caught a fish and wondered why its eyes are bulging out of its head, it is because the air in the swim bladder has expanded and is pushing against the back of the eye. Oxygen is the largest percentage of gas in the bladder; nitrogen and carbon dioxide also fill in passively.

- Fish that migrate vertically tend to have high oxygen levels in their bladders because it fills in faster and leaves faster.
- Fish that maintain a stable depth tend to have more nitrogen because it is inert, enters slowly, and exits slowly.

Movement (continued 2)

TEACHER'S NOTES

Things your pupils can do:

- ***Before their visit***

Use books, magazines, CD-ROMs and the internet to find out all they can about the way different fish move.

- ***During their visit***

Key Stage 1

Ask your pupils to draw some very different fish (say, a pike, a shark, a ray, a John Dory and an eel) and try to capture the way each fish moves.

Key Stage 2

Fins give a fish control over its movements by directing thrust, supplying lift and even acting as brakes. Each fin is designed to perform a specific function. Ask your pupils to look carefully at a "typical" fish and decide what the general functions of its different fins are. This exercise can be as complicated or simple as you choose to make it.

Dorsal fin. Lends stability in swimming.

Ventral fin. Serves to provide stability in swimming.

In most fish, the Caudal or tail fin is the main propelling fin and controls the fish's direction.

Anal fin. Also lends stability in swimming.

Pelvic fins. Mostly control pitch

Pectoral fins. Locomotion and side to side movement. Also act as very important brakes by causing drag.

Adipose fin. Stability.

- ***After their visit***

After summing up what your pupils have learned about the way different fish move, ask them to design the ideal tank or other environment for five or six different kinds of movers.

Answers to Pupil Work Sheet activity

How far do you think these fish can swim in an hour?

A barracuda can swim	– 40 km
A blue fin tuna can swim	– 100 km
A blue shark can swim	– 70 km
A flying fish can swim	– 60 km
A mackerel can swim	– 30 km
A swordfish can swim	– 90 km
A sailfish can swim	- 115 km