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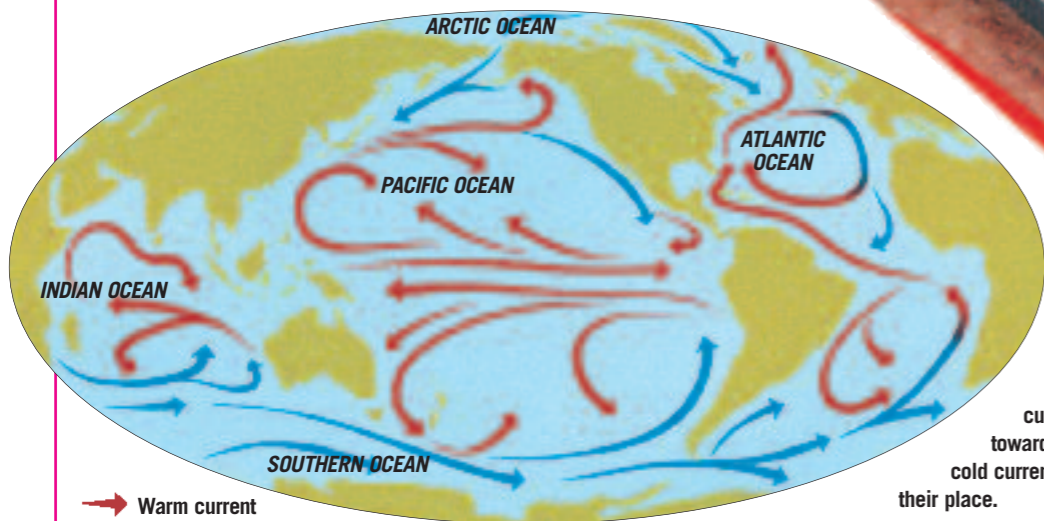
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# OCEANS

THE OCEANS cover more than 360 million square kilometres of the Earth's surface, approximately 71% of its total area. More than 1350 million cubic kilometres of water is contained within it, representing nearly 97% of the Earth's entire supply. The oceans hold enough salt in them to cover Europe to a depth of five kilometres. There are four great oceans: in order of size, the Pacific, Atlantic, Indian and Arctic Oceans (some would add a fifth, the Southern Ocean, surrounding Antarctica).

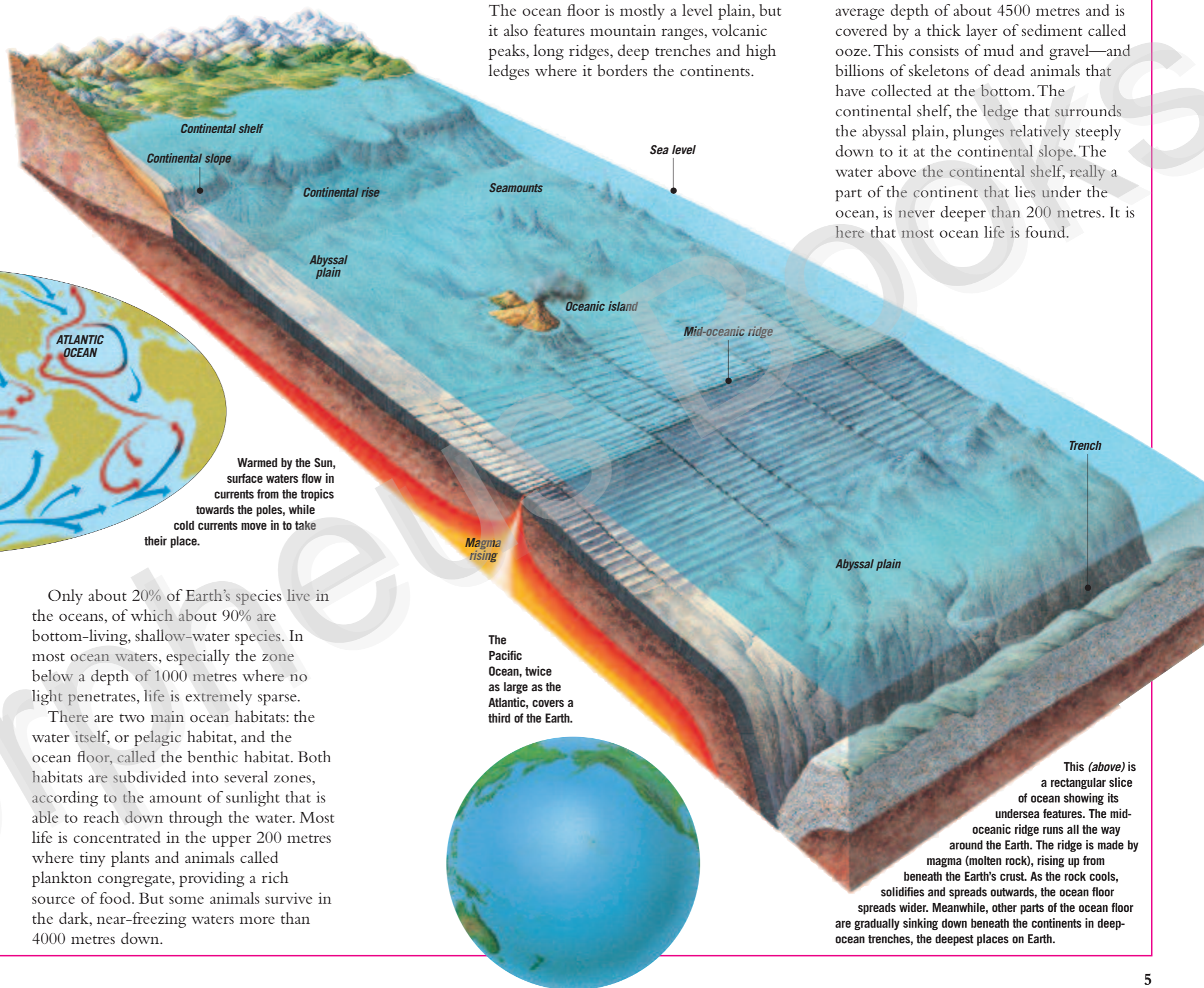


→ Warm current  
→ Cold current

The ocean waters are not still, but move in tides and currents. Tides shift the water daily under the gravitational pull of the Moon (see page 19). Currents, great flowing bands of water, swirl around the globe.

There are two kinds: surface currents, which are swept along by the wind, and deepwater currents, which are generated by differences in density (the colder and saltier the water is, the greater its density).

In the open oceans, currents flow clockwise in the northern hemisphere, anticlockwise in the southern. This is the Coriolis effect, caused by the direction of rotation of the planet. Ocean currents have a great influence on climate. The warm Gulf Stream, for example, brings relatively mild winters to northwestern Europe.



# THE OCEAN FLOOR

The ocean floor is mostly a level plain, but it also features mountain ranges, volcanic peaks, long ridges, deep trenches and high ledges where it borders the continents.

The flat plain that forms most of the ocean is called the abyssal plain. It lies at an average depth of about 4500 metres and is covered by a thick layer of sediment called ooze. This consists of mud and gravel—and billions of skeletons of dead animals that have collected at the bottom. The continental shelf, the ledge that surrounds the abyssal plain, plunges relatively steeply down to it at the continental slope. The water above the continental shelf, really a part of the continent that lies under the ocean, is never deeper than 200 metres. It is here that most ocean life is found.

Warmed by the Sun, surface waters flow in currents towards the poles, while cold currents move in to take their place.

Only about 20% of Earth's species live in the oceans, of which about 90% are bottom-living, shallow-water species. In most ocean waters, especially the zone below a depth of 1000 metres where no light penetrates, life is extremely sparse.

There are two main ocean habitats: the water itself, or pelagic habitat, and the ocean floor, called the benthic habitat. Both habitats are subdivided into several zones, according to the amount of sunlight that is able to reach down through the water. Most life is concentrated in the upper 200 metres where tiny plants and animals called plankton congregate, providing a rich source of food. But some animals survive in the dark, near-freezing waters more than 4000 metres down.

The Pacific Ocean, twice as large as the Atlantic, covers a third of the Earth.

This (above) is a rectangular slice of ocean showing its undersea features. The mid-oceanic ridge runs all the way around the Earth. The ridge is made by magma (molten rock), rising up from beneath the Earth's crust. As the rock cools, solidifies and spreads outwards, the ocean floor spreads wider. Meanwhile, other parts of the ocean floor are gradually sinking down beneath the continents in deep-ocean trenches, the deepest places on Earth.

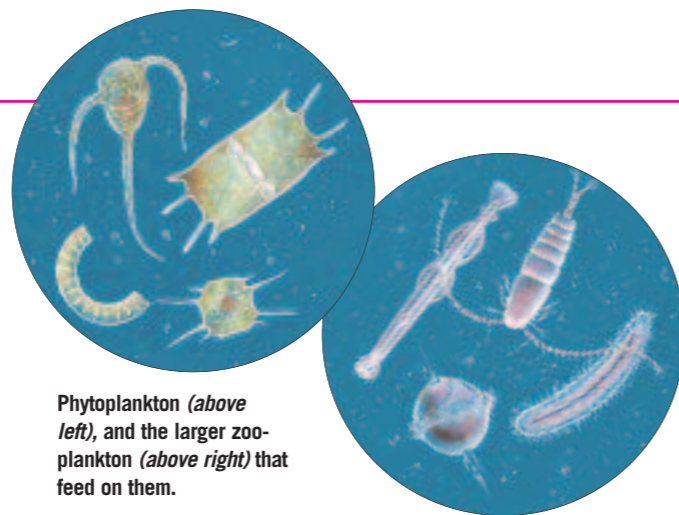
## SURFACE WATERS

THE RICHEST VARIETY of life in the oceans is found in the surface waters. Here, light from the sun penetrates the water, allowing plants to grow. Unlike land plants, oceanic plants cannot put down roots into the ground. Instead, they drift through the water in the form of tiny, usually single-celled organisms, known as phytoplankton. They use sunlight and nutrients dissolved in the water to make food by the process of photosynthesis.

Phytoplankton comprise most of the plant material found in the oceans (a small amount also comes from seaweeds and shallow-water marine grasses). Able to grow very quickly, they are the first and vital stage in the food web of the oceans.

Phytoplankton are fed upon by tiny animals called zooplankton. These include the larvae (young) of fish, as well as tiny relatives of crabs and shrimps, known as copepods. They rise and fall through the water, using the surface currents to carry them along to new grazing areas. Plankton is richest in those parts of the ocean where nutrients are stirred up from the ocean floor

by currents or winds, such as

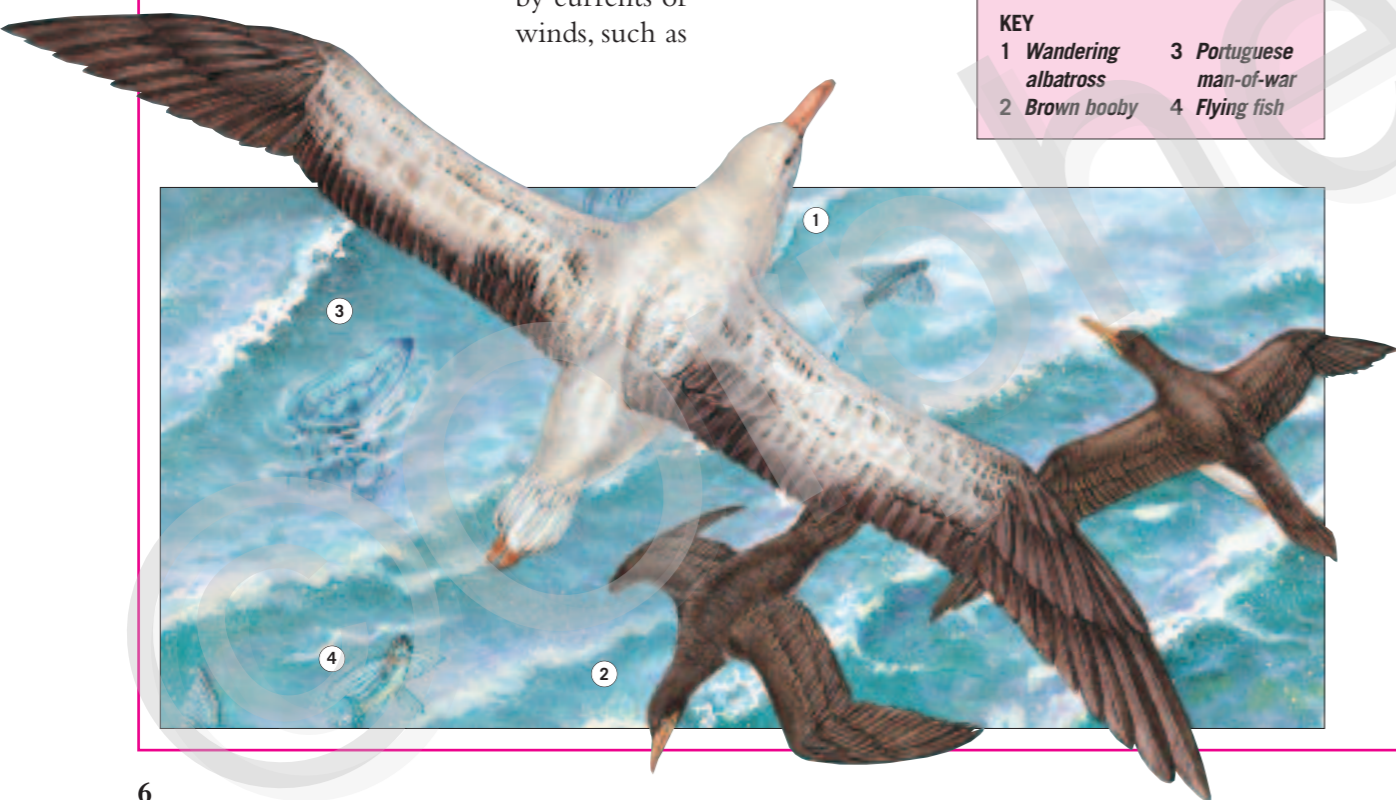


Phytoplankton (above left), and the larger zooplankton (above right) that feed on them.

on the continental shelf (see page 4). In some oceans, the amount of plankton in the water peaks in the spring and autumn. Many plankton-eating animals breed or migrate to coincide with these peaks.

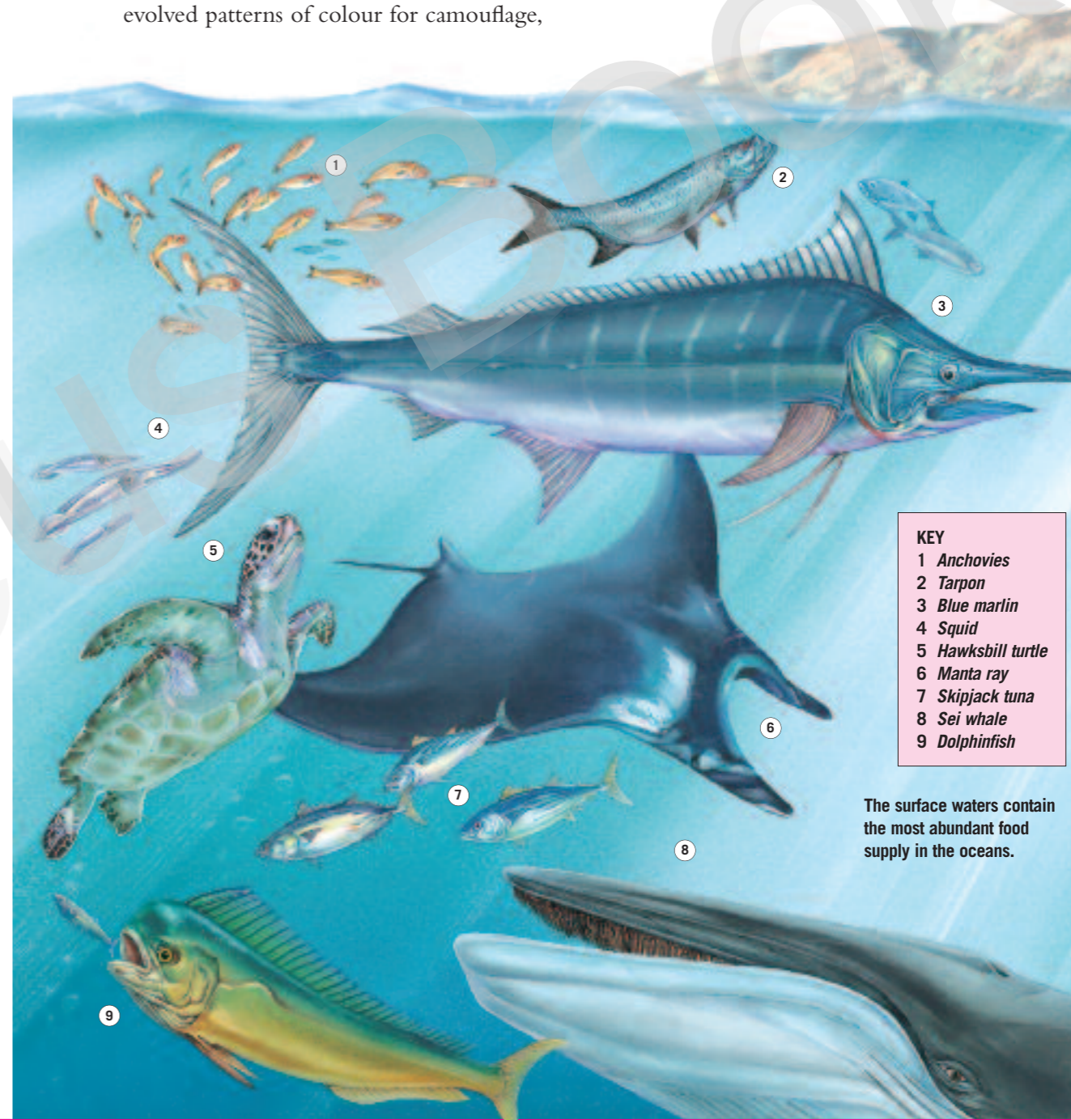
Zooplankton provide food for a wide range of ocean animals. In an attempt to escape attention, many zooplankton have confusing colour patterns, and some are even transparent. Fish and squid are major predators of zooplankton, and shoals of small fish throng the surface waters. They in turn attract larger predators. The Portuguese man-of-war floats on the surface, trailing its stinging tentacles down to catch small fish.

KEY	
1 Wandering albatross	3 Portuguese man-of-war
2 Brown booby	4 Flying fish



Sea birds (see illustration, opposite) glide over the ocean waves, looking out for fish. Some birds scoop up fish from the surface with their beaks or feet, while others, such as the booby, dive right into the water to grab their prey. Below the surface, small fish are preyed upon by larger, fast-moving predatory fish, such as tuna or sharks. They also fall prey to sea turtles, and mammals such as seals, dolphins and whales. With so many different predators, many fish have evolved patterns of colour for camouflage,

or spiny or armoured skin, for protection. The surface waters are home to some of the largest animals in the world. Many of these, however, feed on the smallest creatures of all, zooplankton. Baleen whales, such as the blue whale or the sei whale, as well as some sharks like the basking shark, take in great mouthfuls of water and filter out vast quantities of a shrimp-like zooplankton called krill.



KEY	
1 Anchovies	2 Tarpon
3 Blue marlin	4 Squid
5 Hawksbill turtle	6 Manta ray
7 Skipjack tuna	8 Sei whale
9 Dolphin	

The surface waters contain the most abundant food supply in the oceans.