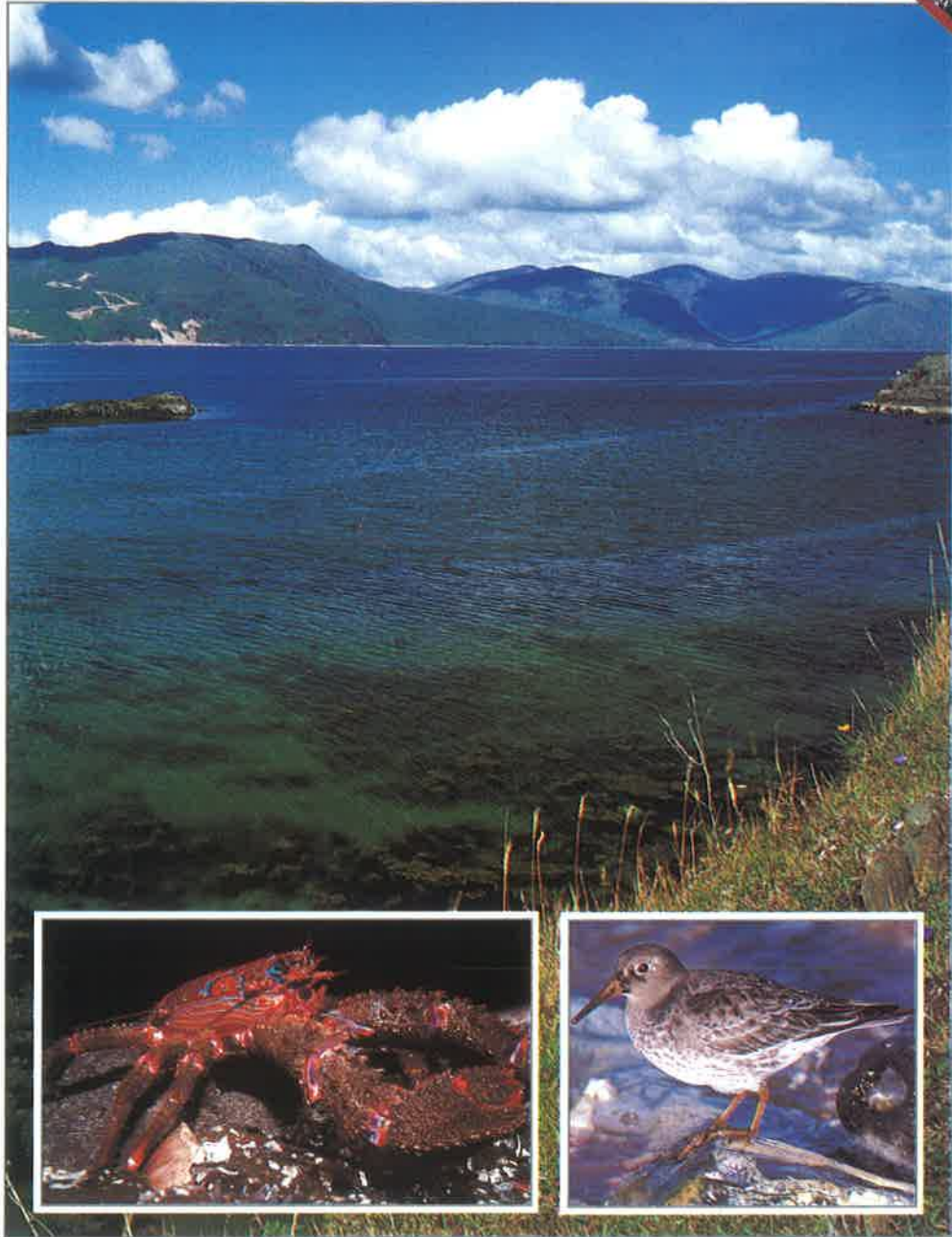


THE SCOTTISH SEA LOCHS AND THEIR WILDLIFE

CARD 37

GROUP 10: WORLD HABITATS



Scotland's sea lochs are marine habitats that are protected from severe weather and waves. These sheltered environments are havens for the plants and animals of the rocky shores.

KEY FACTS

HOW SEA LOCHS WERE FORMED

Unlike freshwater lochs, which are surrounded by land, sea lochs open into the ocean and are salty. They occur around the north and northwest coasts of Scotland, and some run inland for miles.

Sea lochs were formed at the end of the last Ice Age, some 10,000 years ago. Glaciers gouged deep U-shaped valleys through the mountains to the coast. As the ice melted and sea level rose, the valleys were flooded by the sea.

The water is even in depth up to the seaward end of the loch, where it becomes shallower. The reason is that the glacier spread out when it reached the coast and bit less deeply into the earth.



The sea loch is home to a range of wildlife also found on the rocky coast. But its inhabitants benefit from being more sheltered. Waves in the loch are not as rough, and the tide does not rise and fall as much.

Above: Salt marshes sometimes occur at the head, or landward end, of a sea loch.

Although rivers may run into the loch, the waters—as well as the wildlife—are predominantly marine.

THREATS TO SEA LOCHS

Most sea lochs are isolated and undisturbed. Ships have always anchored in their sheltered waters. But real threats to sea lochs and their wildlife are more recent.

OIL POLLUTION

Oil spills are a serious threat. A tanker going aground near the mouth of a loch would threaten its wildlife. Because the loch is enclosed, the oil

would be trapped. It would coat the shores and in time sink to the bottom and kill marine life. Seabirds that winter on the loch are very vulnerable to oil slicks.



FISH FARMING

Fish farming is becoming common. Tanks and cages detract from the beauty of the loch. More seriously, the excrement from thousands of fish and the concentrated food that is fed to them can pollute the water. In addition, disease can spread from stock fish to wild populations.

Left: Salmon fisheries are not only unsightly—they threaten the loch and its wildlife as well.

Carved out by glaciers, sea lochs tend to be long and straight. At the seaward end, the habitat resembles the adjacent coast. Farther inland, the loch supports a greater variety of wildlife, which benefits from the gentle tides.

SHELLFISH

Shellfish are found on shore below the high-water mark or underwater but near the surface. They are food for a number of seabirds.

On the upper shore, rough periwinkles graze on seaweed such as channeled wrack. Lower down, flat periwinkles cling to fronds of knotted

wrack. Also lower down, on seaweed or clinging to the rocks, the common limpet, edible winkle, and clusters of barnacles can be found.

At or below the low tide-mark, dogwinkles, gray topshells, and mussels cling to the rocks. Mussels are plucked off and eaten by eiders.

LOBSTERS & CRABS

The small squat-lobster has a body less than two inches long and front claws that are about the same length. Its body is red with bright blue bands. It is found under rocks on the shore, as is its cousin, the spiny squat-lobster, which is three times its size. The spiny squat-lobster hides in underwater rock crevices and emerges at night to feed.

The long-clawed porcelain crab has a small body (less than an inch long) but long claws. It lurks under stones on the shore or in shallow water. The larger green crab hides in seaweed and feeds on mussels. It is in turn a favorite food of coastal otters.

BIRDS

In summer common eiders and Eurasian oystercatchers breed on the loch shore. The black scoter may also nest here. The red-breasted merganser brings its ducklings to the loch from its nest by a river. The red-throated loon often fishes in the loch. Great cormorants and shags may nest on the cliffs.

In winter two waders arrive—the ruddy turnstone and purple sandpiper. Old squaws and common loons fly in from their Arctic breeding grounds. Storms drive flocks of scoters and other sea ducks to the loch. They are joined by razorbills, common murre, and black guillemots.

SEAWEEDS

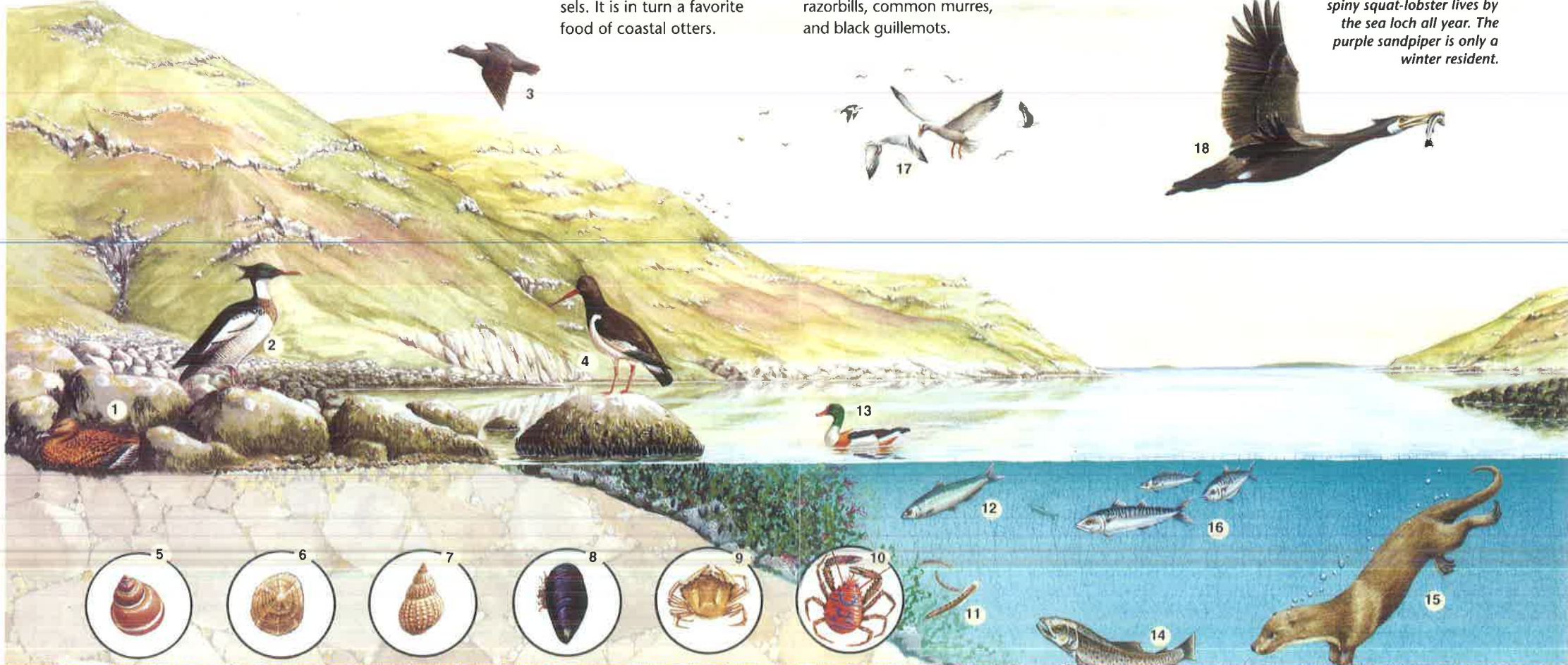
Seaweeds grow on each level of the shore. Channeled wrack grows near the high-water mark. Spiral rockweed grows a little lower, and beneath this are ropes of knotted wrack as long as 13 feet.

Serrated rockweed grows on shore that is exposed only at low tide. This shore area is also home to Irish moss and pepper dulse. Sea belt and sea oak grow on the lowest level of the shore and under the water.

KEY TO SPECIES

- | | |
|--------------------------|------------------------|
| 1 Common eider | 10 Spiny squat-lobster |
| 2 Red-breasted merganser | 11 Butterfish |
| 3 Black scoter | 12 Herring |
| 4 Eurasian oystercatcher | 13 Common shelduck |
| 5 Periwinkle | 14 Sea trout |
| 6 Common limpet | 15 Otter |
| 7 Dogwinkle | 16 Mackerel |
| 8 Mussel | 17 Herring gull |
| 9 Green crab | 18 Great cormorant |

Front cover insets: The spiny squat-lobster lives by the sea loch all year. The purple sandpiper is only a winter resident.



THE RUSSIAN STEPPES AND THEIR WILDLIFE

CARD 36

GROUP 10: WORLD HABITATS

KEY FACTS

A VARYING CLIMATE

Climatic conditions on the Russian steppes can reach great extremes. In the drier regions, summer temperatures can top 100° F, while winter temperatures fall well below freezing. Rainfall is low throughout the steppes, with an average of only 10 to 30 inches a year. But in the wet months, the rainfall can be three or four times greater than in other months.

Strong winds sweep across the central and the southern



Above: Once common on the steppes, today the European bison lives only on reserves.

steppes. These winds, combined with the low rainfall, create conditions that encourage the growth of grass but inhibit the growth of trees. High winds speed the evaporation of moisture, removing the humidity trees need. The winds also dislodge the roots of saplings. Grass can grow more easily: it needs less moisture, and it is anchored in the soil by deep roots and underground runners called *rhizomes*.



Left: Because the bobak marmot relies on grass and other plants for most of its diet, the grassy steppes are an ideal home.



Left: The varied soils of the steppes determine what kind of vegetation can grow there. The fertile loam of the grassy plains is widely used for farming. Steppe conditions occur elsewhere in the world, including the western U.S.



The Russian steppes extend from the Ukraine to southwestern Siberia. The changing landscape includes woodlands, grassy plains, and an arid belt, each with its own varied wildlife.

The Russian steppes are part of a wider belt of grassland that stretches nearly 5,000 miles across Europe and into Asia. Birds and mammals—both residents and migrants—have adapted to the extreme climates. Some species take advantage of the areas where the three distinct steppe regions meet and blend.

THE STEPPE LANDSCAPE

The northern steppe is wooded. The central belt is a grassy plain with hardly any trees. For centuries this land was used as pasture for domestic animals. Today much of it is used for growing crops.

Front insets: *The stone marten (left) lives on wooded steppe. The edible frog (right) prefers ponds on the grassy plains.*

Farther south, the grasslands are drier and the soil is sandy. The poor soil, hot, rainless summers, and cold winters make the area unsuitable for farming. Vast expanses of yellowish ground stretch for miles, unbroken by natural landmarks. A steppe of this type turns into semidesert in the arid southern region.



ANIMALS OF THE GRASSY PLAINS

The grassy plains can support ground-dwelling birds such as the demoiselle crane, which arrives in March to breed. Great and little bustards were once common, but today they are becoming rare.

Birds of prey include the imperial eagle and long-legged buzzard. They range for miles over the grasslands, dropping down to snatch small mammals. Montagu's harrier and the pallid harrier arrive on the steppe in spring and summer but return to Africa in winter when their rodent prey retreats below ground.

The spotted suslik is a squirrel that is probably the most widespread rodent on the grassy

steppe. It lives in large underground colonies. Other small animals include the common hamster (larger than the pet golden hamster) and the bobak marmot. The green toad and the edible frog live wherever there are ponds or lakes.

The saiga is an antelope that once roamed the grasslands in large herds and migrated to the dry steppes in winter. It almost died out in the 1930s, when hunting and several severe winters cut its population from several million to a few hundred. Today the saiga is found mainly in Asia, but a thriving population lives on the steppes between the Volga and Ural rivers.

Left top: *The demoiselle crane arrives on the grassy steppe in spring to breed.*

Left center: *The moose has moved from its forest habitat to the more open wooded steppe.*



Above: *The suslik is a common species of ground squirrel on the steppes.*



Right: *The saiga faced extinction in the 1930s, but today it thrives on the steppes.*

WILDLIFE OF THE WOODED STEPPE

The wooded steppe is lush, grassy, and dotted with groups of trees. It is home to mammals like the stone marten, badger, and European hare. Moose and roe deer have taken refuge on the wooded steppe because their forest habitats are threatened. Species like the aurochs (a large wild ox) and the European bison once moved sea-

sonally from wooded to grassy areas. The aurochs is now extinct. The bison survives only on reserves in eastern Europe.

Songbirds of the wooded steppe include the linnet, goldfinch, and thrush nightingale. The hoopoe, bee-eater, and roller visit the steppe for part of the year, but they migrate in winter to Africa.

ANIMALS OF THE DRY STEPPE

Rodents are abundant on the dry steppe. Many are related to rodents of the grassy plains. For example, where the habitat is too hot for the spotted suslik, the pygmy and yellow susliks take over. They survive the cold winter by nesting underground. Jumping rodents such as the Si-

berian jerboa are also common. The rodents attract predators. The steppe or tawny eagle returns to the dry steppe to breed each year. The marbled polecat catches rodents in their burrows. The steppe and European polecats live on the dry steppe as well as the grassy plains.



Above: *The long-legged buzzard is a bird of prey of the grassy plains.*



Left: *The common hamster is trapped for its soft fur and is now rare in some places.*

DEEP OCEAN TRENCHES AND THEIR WILDLIFE

CARD 33

GROUP 10: WORLD HABITATS



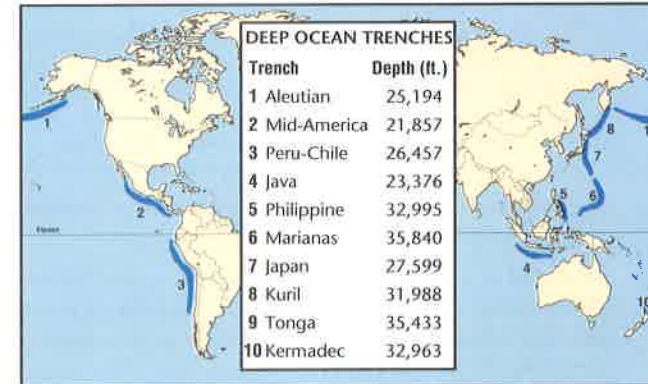
Trenches in the deep ocean can reach depths of seven miles. At these depths, survival is very difficult for the small number of inhabitants that must eat bacteria—or each other—in order to survive.

KEY FACTS

FORMATION OF THE TRENCHES

Trenches in the deep ocean occur in a ring around the perimeter of the Pacific Ocean. Several trenches also border the Atlantic and Indian oceans.

Some scientists believe that the trenches were formed by the continuous movement of the earth's crust. According to this theory, the world's continents sit on huge plates of land that float on the earth's molten core. These plates are continually moving away from the core, splitting the earth's crust at various places under the sea. Lava wells up at these points to form volcanic mountain chains known as *mid-ocean ridges*. As the plates



expand, they push together at their outer edges, forcing one plate to move beneath another. This movement forms a trench on the ocean floor. The earth's crust melts along the line where the plates meet.

Above: Deep ocean trenches occur where plate movement is common in the Pacific.

This movement and melting are happening in the Peru-Chile Trench, which runs alongside the Andes mountain range.

HOT SPRINGS UNDER THE OCEAN

Volcanic action on the ocean floor causes temperatures to reach 212° F (the boiling point of water) and huge amounts of hydrogen sulfide gas to be produced, creating hot springs, known as *hydrothermal vents*.

Bacteria thrive in these conditions, getting chemical energy from the hydrogen

Right: An ecosystem relies on hot gases from the Galápagos vent.

Below: The flashlight fish has light-producing organs that illuminate its body.



sulfide gas instead of from sunlight. Their presence allows an entire food web to develop. Ten-foot-long vestimentiferan worms, for example, get energy from the waste products of the bacteria that live inside them. These worms are part of a unique ecosystem that does not get its energy from light.

It has been said that we know more about the dark side of the moon than about the deepest parts of the ocean. But scientists are now beginning to find evidence of many unusual sea creatures that have developed their own unique methods for survival in the extreme cold and darkness of the deep ocean trenches.

ADAPTING TO THE TRENCH

Smell and touch are important senses in the trench. Many deep sea species are blind and have adaptations that allow them to detect prey in the dark. The rattail fish has a long tail with sensors that detect movement. The tripod fish uses its three long fins to prop itself up above the muddy sediment so it can smell prey in the clearer water.

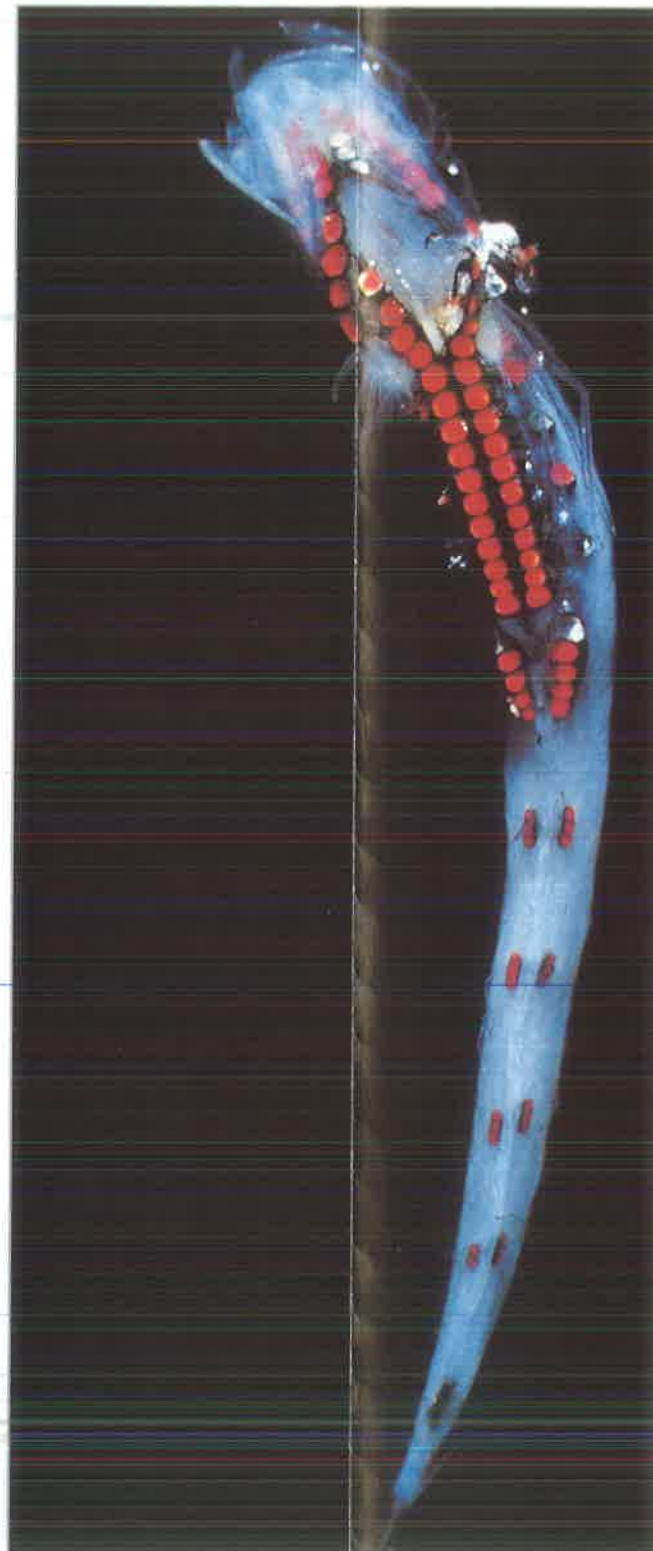
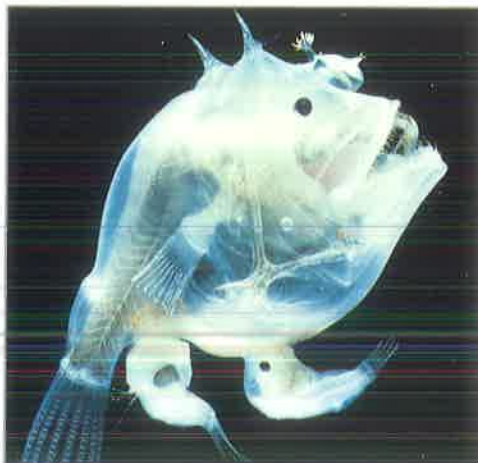
Because there is little life in the trench, animals need to catch as much food as possible to survive. Some fish swim with their huge mouths open, swallowing everything in their path. These fish have elastic stomachs to hold large

amounts of food. Other fish can unhinge their jaws to swallow prey larger than themselves. Their teeth are angled inward to prevent prey from escaping.

Some deep sea animals produce light by a chemical reaction. The anglerfish, for example, dangles a luminous line from its body to attract food. This fish also has an unusual solution to the problem of mating in the sparsely populated trench. The male is much smaller than the female and attaches himself to her, becoming completely dependent and even sharing her blood and skin.

Right: The male deep sea anglerfish attaches himself to his much larger mate.

Front insets: To survive darkness and cold, trench animals have made adaptations that give them a bizarre look when seen in the light.



CONDITIONS IN THE DEPTHS

Conditions in the deep ocean trenches are unique. Visible light penetrates only 650 feet below sea level, and by 3,000 feet it is totally dark.

Pressure is one reason so little is known about this realm. At seven miles below the water surface, the pressure is 1,100 times greater than at sea level.

Movement becomes slow in the dense, salty water, which may be below freezing (32° F). Divers cannot survive at such depths, and even pressurized submersible vessels can stay down for only a few days. In 1960 a submersible first took two men seven miles down into the Marianas Trench.



Left: Some deep sea fish can unhinge their jaws to engulf large prey.



Below: The rattail fish uses its tail to find prey in the dark.

FEEDING IN THE TRENCH

Plants cannot live in the dark trenches because they need light for *photosynthesis* (converting light into energy). In the absence of plant life, the only available food for the trench animals is *detritus*—the remains of dead material—that has sunk down from above. The detritus forms a soft, oozy

deposit containing vast numbers of bacteria. These bacteria provide food for deep sea species such as fish, sea cucumbers, bivalves, worms, and crustaceans.

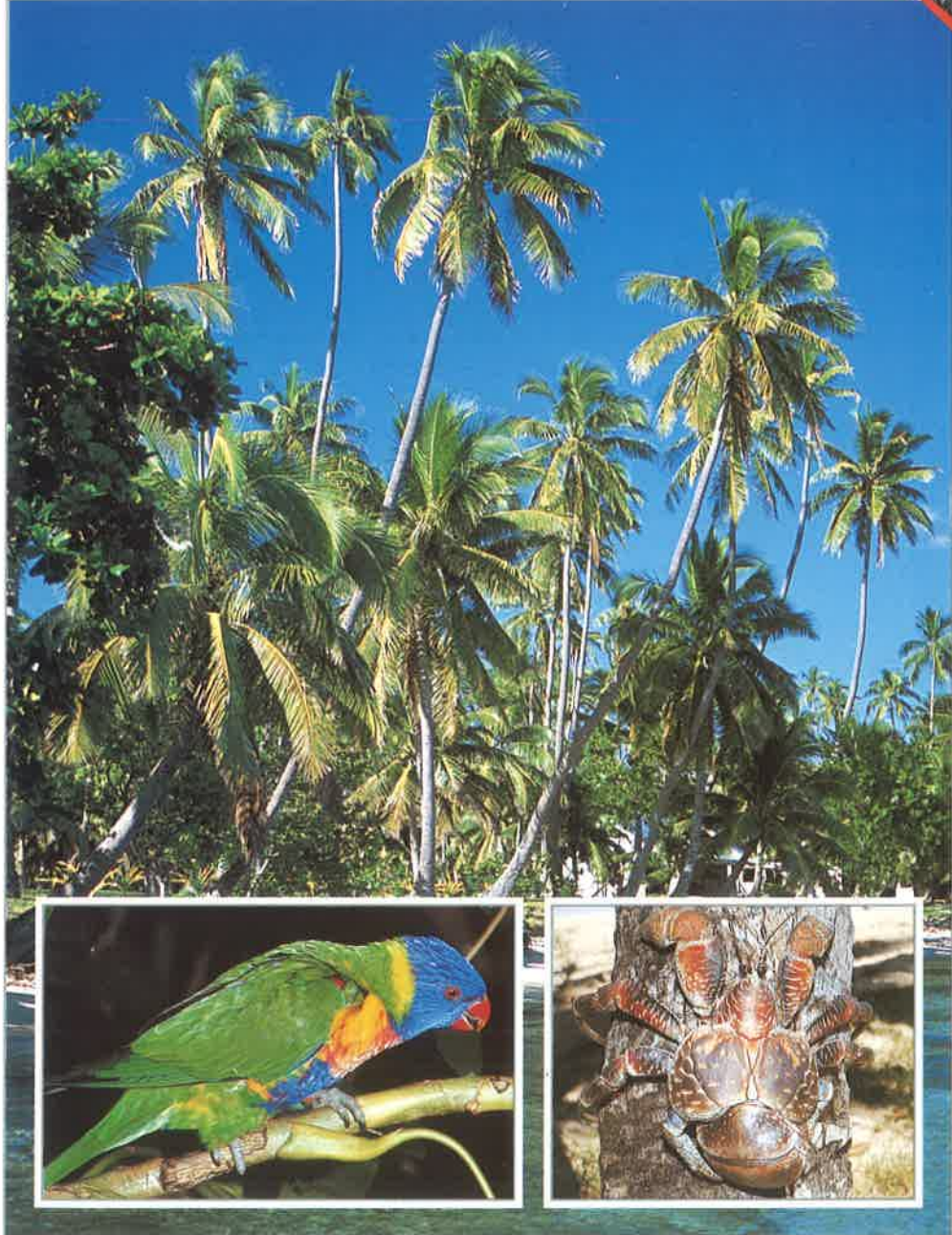
The animals living in the trenches have only two options for food: They can feed on detritus or on each other. As a result of the limited food supply, few trench inhabitants live long.

Left: Chemicals in the bodies of trench animals like this deep sea fish produce light.

THE SOUTH SEA ISLANDS AND THEIR WILDLIFE

CARD 30

GROUP 10: WORLD HABITATS



The South Sea Islands are scattered throughout the Pacific Ocean. These tropical islands have blue lagoons, lush shores, and diverse, colorful wildlife.

KEY FACTS

FEATURES OF THE SOUTH SEA ISLANDS

The three major groups of islands in the Pacific Ocean are Polynesia, Melanesia, and Micronesia. Polynesia is the largest group, stretching between Hawaii and New Zealand. It contains 17 smaller clusters, including Tonga, Samoa, and the Society Islands (where Tahiti is located).

Melanesia includes Papua New Guinea, Fiji, and the Solomon Islands. Micronesia consists of the Caroline, Gilbert, and Marshall islands. Many Polynesian and Melanesian islands are well populated; some Micronesian islands are uninhabited.

Except for New Guinea, the Pacific islands were formed by a



Above: Much of the dramatic landscape in the South Seas was formed by volcanic activity.

band of volcanic activity called the "ring of fire." The Hawaiian volcanoes are at the center of the ring. Several Pacific volcanoes are still active today.



Left: Some of the Pacific islands are so densely covered by vegetation that it is difficult for humans to live there or to study the wildlife.

New Guinea is connected to Australia by a continental shelf under the sea. This shelf was once dry land so animals and plants could move between the two land masses. As a result the two areas have similar wildlife today.

Many islands in the western Pacific are *atolls*—low islands formed when a coral reef encircles a submerged volcano and encloses a shallow lagoon.

HOW WILDLIFE IS BROUGHT TO THE ISLANDS

Seabirds bring wildlife from one area to another. Birds often transport seeds by eating them in one area and eliminating them in their waste matter elsewhere.

Other seeds and fruit have hooks, barbs, or spines that attach to birds' feathers and feet. Because of its barbed

seeds, the plant species *Bidens* has been transported throughout the Pacific by birds. The *Olearia* plant has seeds with fluffy tops that stay airborne for long distances. Some seeds, such as mangroves, float on water and are carried to new areas by ocean currents.

Many reptile, insect, and

snail species have been carried across the Pacific on logs or branches. Seabirds also transport invertebrate or fish eggs that get attached to their feet. Some young spiders travel great distances on the long silk threads they produce. The threads are lifted up and carried by the wind.

Polynesia, Melanesia, and Micronesia

make up the South Sea Islands. These islands were created by volcanic activity many centuries ago, and a few volcanoes are still active today. The landscape ranges from low-lying coral reefs to more mountainous terrain, and it supports a variety of tropical wildlife.

WILDLIFE OF THE CORAL REEF

Atolls (low, circular islands made of coral) and coral reefs are formed by *polyps* (marine animals that secrete a rigid external skeleton of limestone). Coral builds up from these skeletons over many centuries. Above the water's surface, coral backs down firmly and forms rock that is bound together by grasses, palms, and a variety of trees and shrubs.

Living coral is usually found at the outer edge of a reef. Many coral polyps form into columns or treelike colonies that can reach almost to the water's surface.

Individual coral polyps are equipped with tentacles with which they trap their own food. In many species, however, they are connected to one another and can share nutrients. Polyps can also communicate with one another by releasing chemicals into the water. If one polyp releases a chemical in response to a disturbance, all the surrounding polyps may quickly contract. Although marine biologists note this close cooperation between

polyps, they hesitate to consider corals "social" animals in the sense that bees, ants, and termites are.

The outer edge of the reef, the flat reef top, and the island shore all support a rich marine life, which varies with the temperature, light, currents, and oxygen content of the water. In particular, the stony skeleton of a coral reef provides hiding places for a number of brightly colored fish such as the clownfish, squirrelfish, and soldierfish. Boldly patterned sea cucumbers, sponges, sea hares, starfish, crabs, and shrimp also conceal themselves in coral reefs. The variety of animals living on a reef almost rivals that of the tropical rainforest.

Healthy populations of the six giant clam species exist on some reefs, but on others people collect them for food and they are becoming extinct. Clams have become very rare on Guam, an island in the Marianas group in Micronesia. In a conservation project there the clam larvae are hatched, grown in tanks, and put back on the reef.

BIRDS

The South Sea Islands are rich in bird life. Inhabitants include plovers, terns, shearwaters, and sandpipers. The frigatebird from the Marshall Islands in Micronesia has a 10-foot wingspan. The male bird has a brilliant red throat pouch, which he inflates during his courtship display.

New Caledonia in Melanesia is home to over 70 bird species. One of these birds is the colorful rainbow lorikeet, which is common on other Pacific islands. In contrast, Stephen's lory is an endangered species found only on Henderson Island in the Pitcairn archipelago.



Front inset left: The rainbow lorikeet is appropriately named.

Front inset right: The coconut crab climbs coconut trees to get its favorite food, the coconut.



Left: The fruit bat, or flying fox, is one of the few common mammals in the South Sea Islands. These fruit eaters are vital to the lifecycle of some of the plants they feed on because they disperse the plants' seeds.



Left: The rainbow lorikeet is most common on New Caledonia. This sociable bird pollinates coconut flowers, whose pollen forms part of its diet.

ANIMALS

Few mammals live on the Pacific islands, except in New Guinea. But there are about 50 species of the flying fox, or fruit bat, throughout the Pacific. Other mammals include descendants of the domestic animals brought by early settlers as well as descendants of the rats that traveled on settlers' ships.

Because New Guinea was once connected by land with Australia, it is home to some of the same species. The wallaby, tree kangaroo, striped possum, cassowary (a large flightless bird), and several

species of flying fox can all be found both in Australia and in New Guinea.

Reptiles in the South Sea Islands include skinks (a family of long-bodied lizards) and geckos. The most common land animals are snails and crustaceans—especially the coconut crab and the land hermit crab. The coconut crab uses its huge, powerful claws to climb palm trees and to cut down coconuts. When the nuts fall to the ground, the hard shells crack and the crab tears them apart to get at the coconut meat inside.

Left: The flightless cassowary can be easily identified by its horned head crest.

Below: The crocodile skink belongs to a long-lived family of lizards.



WILDLIFE IN SUBURBAN GARDENS

CARD 29

GROUP 10: WORLD HABITATS



North American and European urban areas often include the green oases of suburban gardens. These gardens provide a haven for wildlife driven from the countryside.

KEY FACTS

HOUSEGUESTS

Many wild animals make their homes in or near suburban houses. Deprived of woods or caves, bats have found that modern houses with shingle roofs and ventilated eaves provide a perfect substitute. At dusk on warm nights they may come into the garden to feed on insects drawn to the house and streetlights.

Swallows and house martins also like the suburban house.

With a potter's skill they mold their clay nests tightly into the eaves, leaving just the tiniest gap through which they can leave and enter.

Garden sheds full of seeds and vegetables attract rats and mice that may create a home base by burrowing beneath a shed's shallow foundations. Larger holes may be the work of foxes digging a den in which to raise their young.



Below: A pipistrelle bat leaves its roost soon after dusk to hunt nocturnal insects.

Right: The European robin is renowned for aggressively defending its territory.



Above: The common toad is easy to recognize with its warty skin and short legs.

GARDENING FOR WILDLIFE

Gardeners can make their gardens inviting to wildlife. A pond filled by rainwater provides a home for insects and minnows and a breeding ground for frogs and smooth newts. Some water and mud brought in from a natural pond will introduce all kinds of invertebrates, such as dragonfly larvae. As the insects hatch, birds are drawn

to the water and adult dragonflies can be seen hunting over its surface.

Below: Newts feed on worms, insects, leeches, and even frog eggs.



The growth of large cities has created increasing demand for housing in surrounding areas.

As people settle in suburbs, many animals lose their natural habitat. But suburbs usually contain gardens that provide food and shelter for a variety of wildlife.



GARDEN HABITATS

Exotic plants are often popular among gardeners, but they may offer little to native wildlife. There are, however, exceptions. In Great Britain, for example, *leylandii* are planted to provide privacy. These imported conifers offer perches as well as protective cover for chaffinches and house sparrows. Blackbirds may hide their nests inside these trees.

Front: Foxes and moles (inset) can be found in suburbs.

Buddleia, another exotic plant, is known as the butterfly bush. Its nectar is irresistible to small tortoiseshell, peacock, and red admiral butterflies. Border flowers like lavender and roses also attract butterflies and bees—as well as troublesome sap-sucking aphids. But aphids attract colorful insect eaters such as ladybugs.

Some gardens have vegetable plots. Their visitors include various butterflies, snails, and birds.

VISITING MAMMALS

Many of the mammals that visit gardens are nocturnal and shy. Some of these creatures are welcome guests. In Europe, the hedgehog is often enticed into a garden with a saucer of bread and milk so that it will eat garden pests such as slugs.

Another nighttime visitor is the red fox. Although it preys on worms and small mammals in the wild, this *carnivore*, or meat eater, has become accustomed to living off human handouts. Foxes often develop routines, visiting gardens at the same time every night. During the day they may at times be seen dozing in a quiet corner or in the sun.

More visible and far less welcome is the mole. But it is possible to live at peace with this velvet-coated insect eater. Once a mole has dug its tunnels, the mounds of soil can be brushed away or used for potting.

Mice, voles, and even rats may live in large gardens. Generally nocturnal, their presence may be discovered only when a domestic cat captures one.

Still other garden visitors in North America include cottontail rabbits, white-tailed deer, and raccoons.

Above: The peacock butterfly is one of many visitors drawn to the bright and sweet-smelling flowers that are found in suburban gardens.



Below: The common shrew often makes its home in the burrows of other animals. It prefers damp or overgrown sites and feeds on worms and insects.



Above: A pile of leaves serves as a convenient nest for hedgehogs and their young.



Left: Blue tits are a common garden bird in Great Britain.

Below: Fruit and nuts attract gray squirrels and birds.

CREATURES OF QUIET CORNERS

In the farthest, most difficult to reach parts of the garden, amphibians such as toads and reptiles, including a variety of lizards, may be found. If the area is damp, a garter or a grass snake may slither by. A stream or a pond introduces a variety of other animals, including frogs, salamanders, and turtles.

