

RECORD BREAKERS

The Living World



by David Lambert

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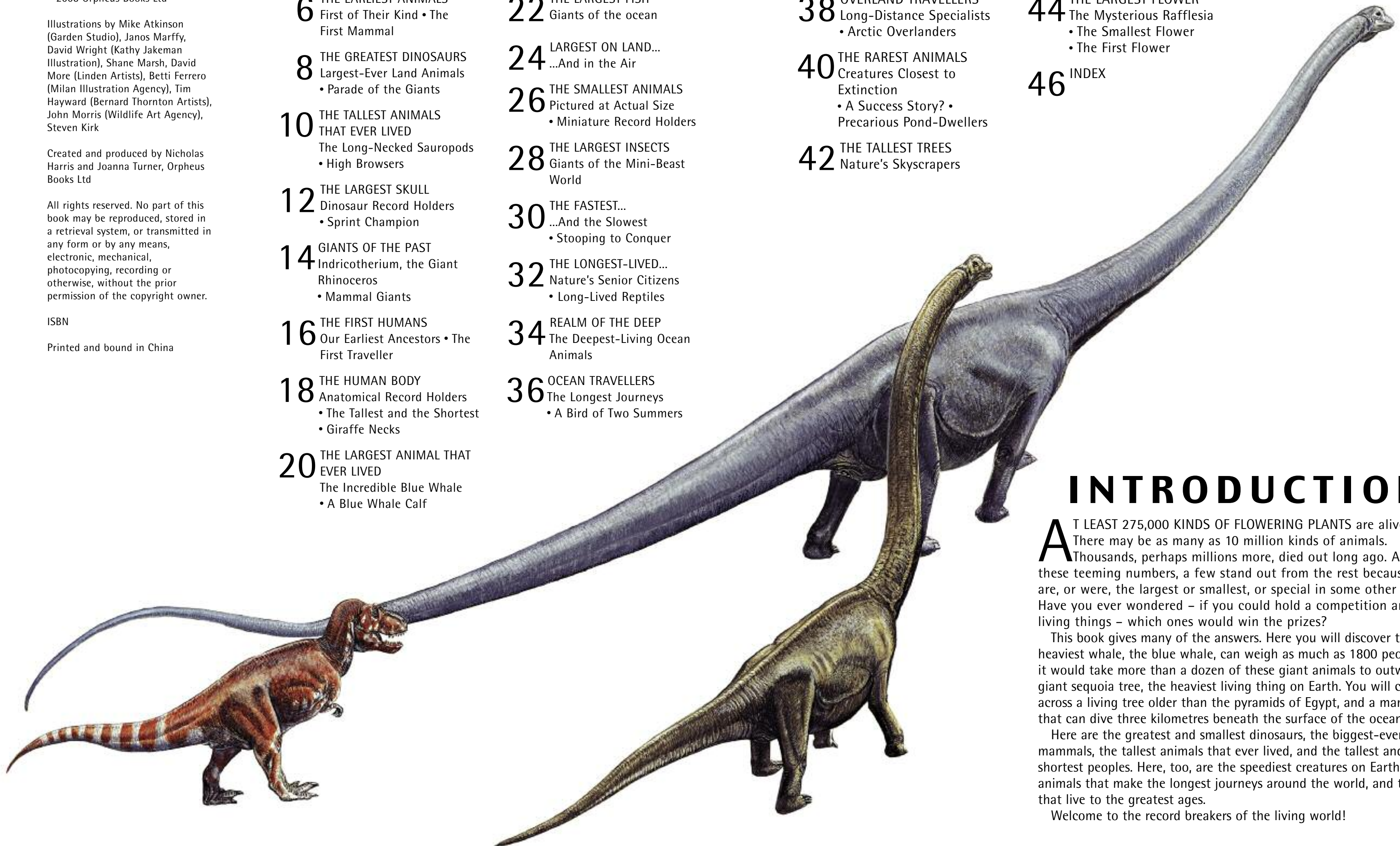
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INTRODUCTION

AT LEAST 275,000 KINDS OF FLOWERING PLANTS are alive today. There may be as many as 10 million kinds of animals. Thousands, perhaps millions more, died out long ago. Among these teeming numbers, a few stand out from the rest because they are, or were, the largest or smallest, or special in some other way. Have you ever wondered – if you could hold a competition among all living things – which ones would win the prizes?

This book gives many of the answers. Here you will discover that the heaviest whale, the blue whale, can weigh as much as 1800 people, yet it would take more than a dozen of these giant animals to outweigh a giant sequoia tree, the heaviest living thing on Earth. You will come across a living tree older than the pyramids of Egypt, and a mammal that can dive three kilometres beneath the surface of the ocean.

Here are the greatest and smallest dinosaurs, the biggest-ever land mammals, the tallest animals that ever lived, and the tallest and shortest peoples. Here, too, are the speediest creatures on Earth, the animals that make the longest journeys around the world, and those that live to the greatest ages.

Welcome to the record breakers of the living world!

THE EARLIEST ANIMALS

First of their kind

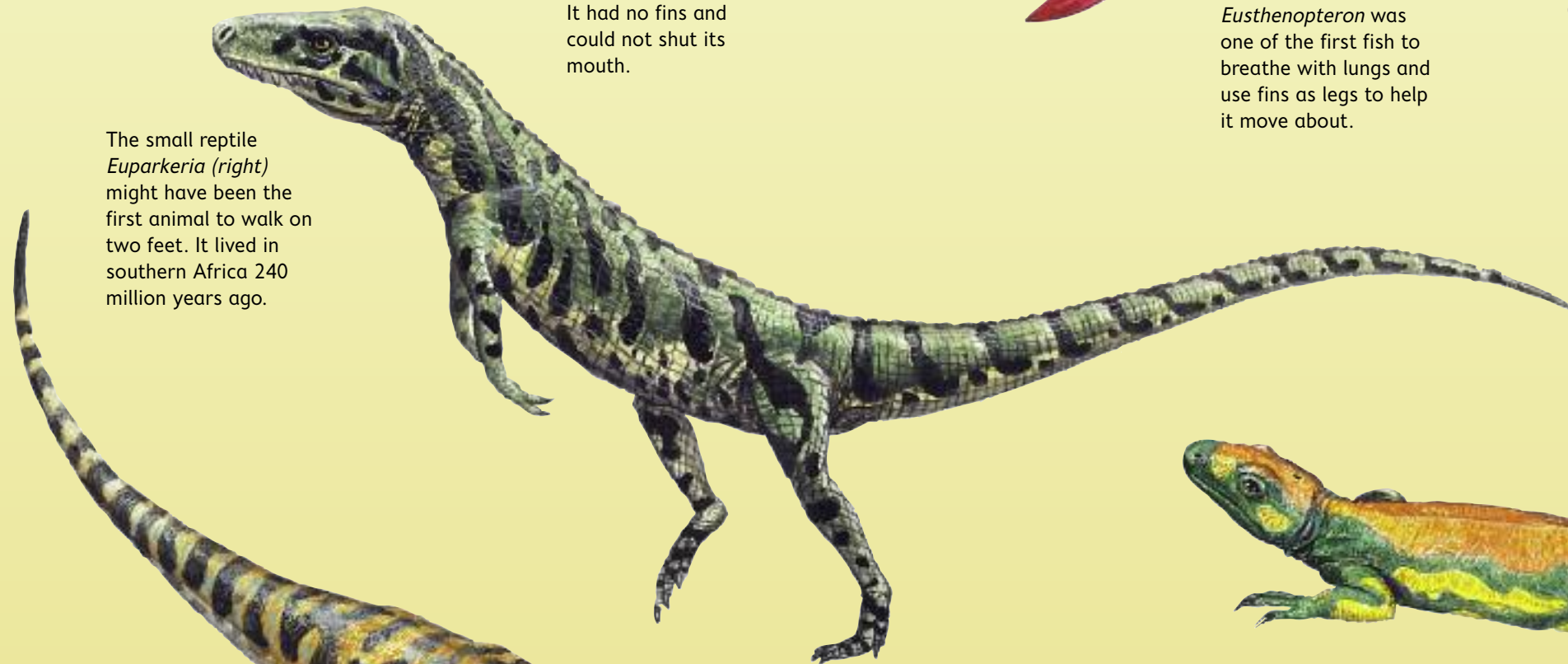


Arandaspis, one of the first known fish, lived 480 million years ago. It had no fins and could not shut its mouth.

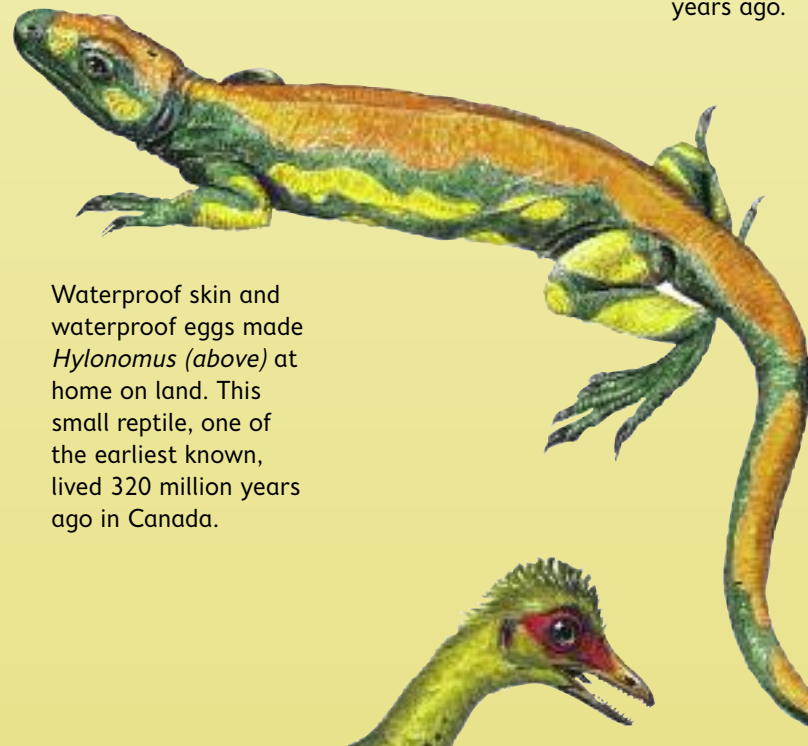


Eusthenopteron was one of the first fish to breathe with lungs and use fins as legs to help it move about.

The small reptile *Euparkeria* (right) might have been the first animal to walk on two feet. It lived in southern Africa 240 million years ago.



Ichthyostega (right) was one of the earliest four-legged animals. This amphibian crawled through warm, swampy forests that existed in Greenland about 360 million years ago.



Waterproof skin and waterproof eggs made *Hylonomus* (above) at home on land. This small reptile, one of the earliest known, lived 320 million years ago in Canada.

Eoraptor was one of the first dinosaurs, a two-legged flesh-eating beast no bigger than a large dog. *Eoraptor* hunted small reptiles. It lived 228 million years ago in Argentina.



One of the earliest-known birds was *Archaeopteryx*. This crow-sized creature had feathered wings and was probably able to fly. But its teeth, claws and bony tail were like those of a small flesh-eating dinosaur. *Archaeopteryx* lived in Germany about 150 million years ago.



ALL ANIMALS have prehistoric ancestors whose fossil remains are found in ancient rocks. Scientists studying these fossils can work out when each living group of animals appeared. Over the thousands of millions of years since life began, the fossil history tells us, animals have – very gradually – changed: for example, they have grown a fin or a tail, developed wings or lost teeth. We call this process *evolution*. When a new kind of animal has evolved, an older one may die out, or become extinct.

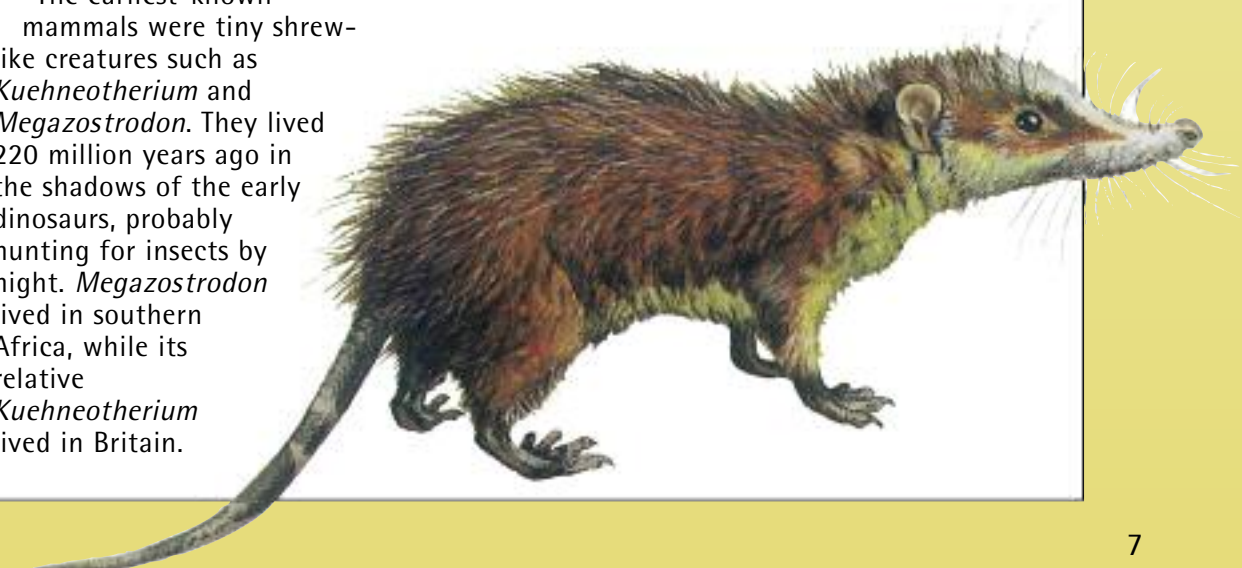
Jellyfish-like creatures, among the very earliest fossils, appeared about 600 million years ago. Fifty million years later, the seas teemed with shellfish, worms and animals with jointed legs. Later still, eel-like beasts with bony teeth appeared. These were probably the ancestors of fishes, the earliest-known backboned animals.

By about 400 million years ago, fishes with lungs and fleshy fins began to move around on land. Forty million years on, these animals had evolved into the first four-legged backboned creatures, the amphibians. These animals could live on land but they returned to the water to lay their eggs. It took a further 80 million years for the first backboned animals to live and breed on land – the reptiles – to evolve.

The illustrations are not drawn to scale

A mammal is an animal whose females produce milk to feed their young. The earliest-known mammals were tiny shrew-like creatures such as *Kuehneotherium* and *Megazostrodon*. They lived 220 million years ago in the shadows of the early dinosaurs, probably hunting for insects by night. *Megazostrodon* lived in southern Africa, while its relative *Kuehneotherium* lived in Britain.

THE FIRST MAMMAL



THE GREATEST DINOSAURS

Largest-ever land animals

Most dinosaurs are known only from a few bones, so experts have had to guess just how big these creatures were. It depends on whether the measure is height, length or weight. The only fact upon which everyone is agreed is that the dinosaurs were certainly the largest land animals that ever lived.

The heaviest and tallest dinosaur known from a complete skeleton was Brachiosaurus ('arm lizard'). It might have weighed as much as eight African elephants. From just a few pieces of bone, scientists have now been able to identify an even larger kind, called Argentinosaurus. This giant plant-eater lived in South America about 100 million years ago.

The longest dinosaur was Supersaurus ('super lizard'). With its snaky neck, whip-like tail and hollowed-out bones, it was probably lighter than some shorter, but more heavily built, dinosaurs.

The illustrations are approximately to scale

PARADE OF THE GIANTS

If all the reptile record holders were gathered together, this (below) is how they would compare in size. All those shown here, pterosaurs, crocodiles and dinosaurs, belonged to the same group, called archosaurs ('ruling reptiles').

Quetzalcoatlus ('feathered serpent') was a skin-winged flying reptile, a pterosaur with the wingspan of a microlight aeroplane.

QUETZALCOATLUS
Wingspan 12 m
Largest-ever flying creature

ARGENTINOSAURUS
36 m long 21 m tall
Largest dinosaur

DIPLODOCUS
27 m long
Longest dinosaur known from complete skeleton

SUPERSAURUS
40 m long
Longest-ever dinosaur

STEGOSAURUS
9 m long
Largest plated dinosaur

SPINOSAURUS
Length: 18 m
Weight: up to 9 tonnes

TYRANNOSAURUS REX
Length: 12 m
Weight: up to 6.4 tonnes

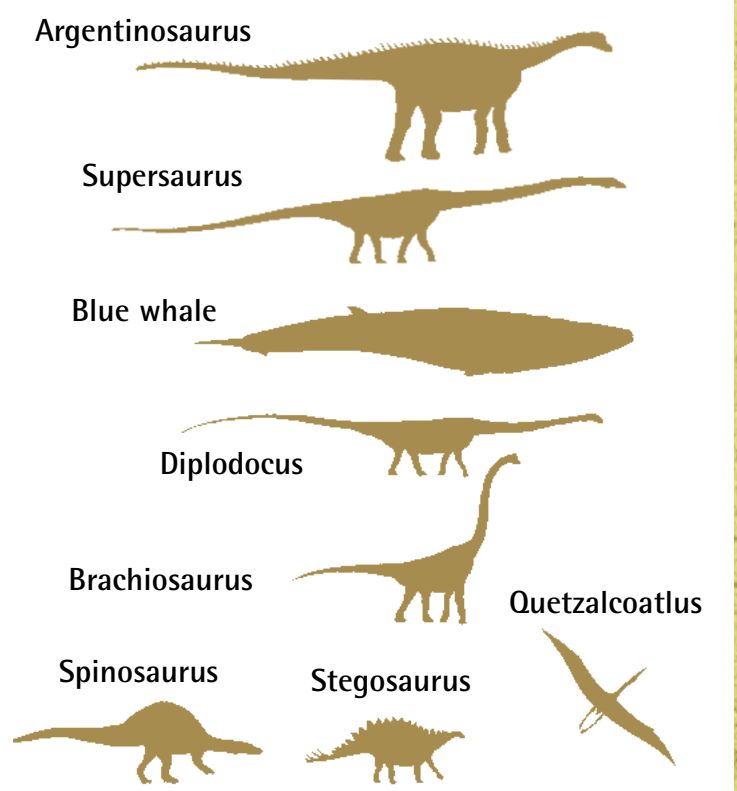
DEINOSUCHUS
15 m long
Longest-known crocodile

Recently discovered fossil bones of Spinosaurus suggest that it was the largest of all the flesh-eating dinosaurs, larger even than Tyrannosaurus rex. The long spines on its back probably had a skin covering, forming a kind of sail.

Deinosuchus ('terrible crocodile') was a crocodile more than twice as long as the largest kind of crocodile alive today.

BRACHIOSAURUS
22 m long 14 m tall
Largest dinosaur known from complete skeleton

SIZE COMPARISONS



THE TALLEST ANIMALS

The long-necked sauropods

HIGH BROWSERS

If the tallest creatures the world has ever seen came together, which animal could reach the highest? (Compare them with the human being and the giraffe, the tallest animal alive today.)

Indricotherium (see page 56), an Asian rhinoceros, was the tallest prehistoric mammal. *Dinornis* ('terrible bird') may have been the tallest-ever bird. It died out in New Zealand only about 400 years ago. Both these animals, if they had lived in the age of the dinosaurs, would have walked in the shadows of the giant sauropods, *Brachiosaurus* and *Mamenchisaurus*.

BRACHIOSAURUS
14 m
Tallest animal known from a complete skeleton

SUPERSAURUS
12 m
Longest dinosaur

INDRICOTHERIUM
7.3 m
Tallest-ever mammal

GIRAFFE 5.5 m
Tallest living animal

DINORNIS MAXIMUS
3.7 m
Tallest-ever bird

MAMENCHISAURUS
More than 15 m rearing
Longest-necked animal

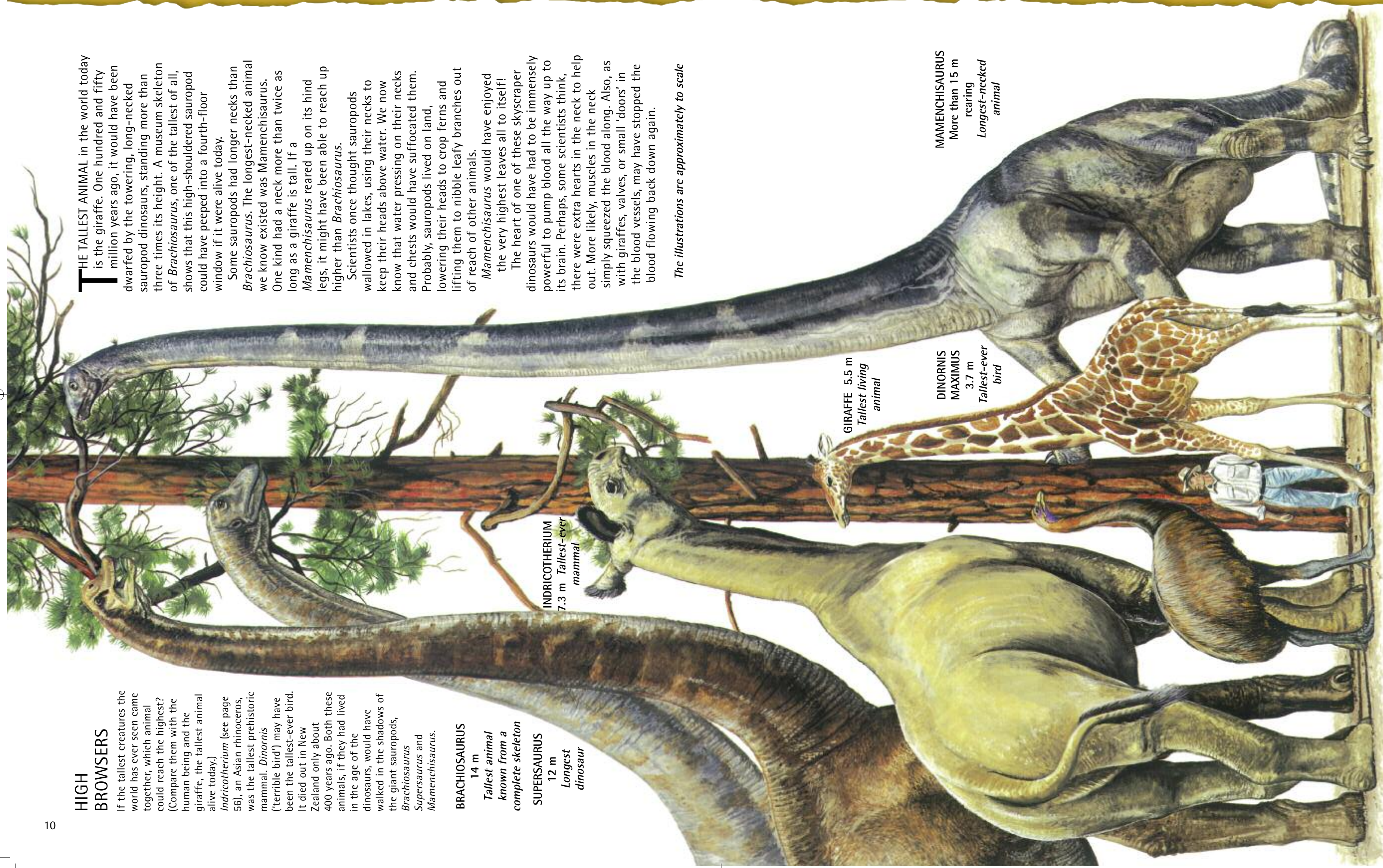
THE TALLEST ANIMAL in the world today is the giraffe. One hundred and fifty million years ago, it would have been dwarfed by the towering, long-necked sauropod dinosaurs, standing more than three times its height. A museum skeleton of *Brachiosaurus*, one of the tallest of all, shows that this high-shouldered sauropod could have peeped into a fourth-floor window if it were alive today.

Some sauropods had longer necks than *Brachiosaurus*. The longest-necked animal we know existed was *Mamenchisaurus*. One kind had a neck more than twice as long as a giraffe is tall. If a *Mamenchisaurus* reared up on its hind legs, it might have been able to reach up higher than *Brachiosaurus*.

Scientists once thought sauropods wallowed in lakes, using their necks to keep their heads above water. We now know that water pressing on their necks and chests would have suffocated them. Probably, sauropods lived on land, lowering their heads to crop ferns and lifting them to nibble leafy branches out of reach of other animals.

Mamenchisaurus would have enjoyed the very highest leaves all to itself! The heart of one of these skyscraper dinosaurs would have had to be immensely powerful to pump blood all the way up to its brain. Perhaps, some scientists think, there were extra hearts in the neck to help out. More likely, muscles in the neck simply squeezed the blood along. Also, as with giraffes, valves, or small 'doors' in the blood vessels, may have stopped the blood flowing back down again.

The illustrations are approximately to scale



THE LARGEST SKULL

Dinosaur record holders

SPRINT CHAMPION

Dromiceiomimus ('emu mimic') was a bird-like dinosaur, built on similar lines to an ostrich. With its long shins it could have taken very long, fast strides. If it were alive today this dinosaur might have outrun an ostrich, which sprints at up to 65 km/h (see page 72). *Dromiceiomimus* lived in south-west Canada 75 million years ago.

Troodon ('wounding tooth', bottom left) had a bigger brain for its body size than perhaps any other dinosaur. This agile hunter was as intelligent as birds and even some mammals – an opossum, for example. It lived in the same time and place as *Dromiceiomimus*.

Therizinosaurus ('scythe lizard') was named after its three huge finger claws (left). The longest claw's curved outer edge was just under 1 m long. *Therizinosaurus*, a plant-eater measuring up to 12 m long, lived in Mongolia 70 million years ago. It was probably covered with feathers.

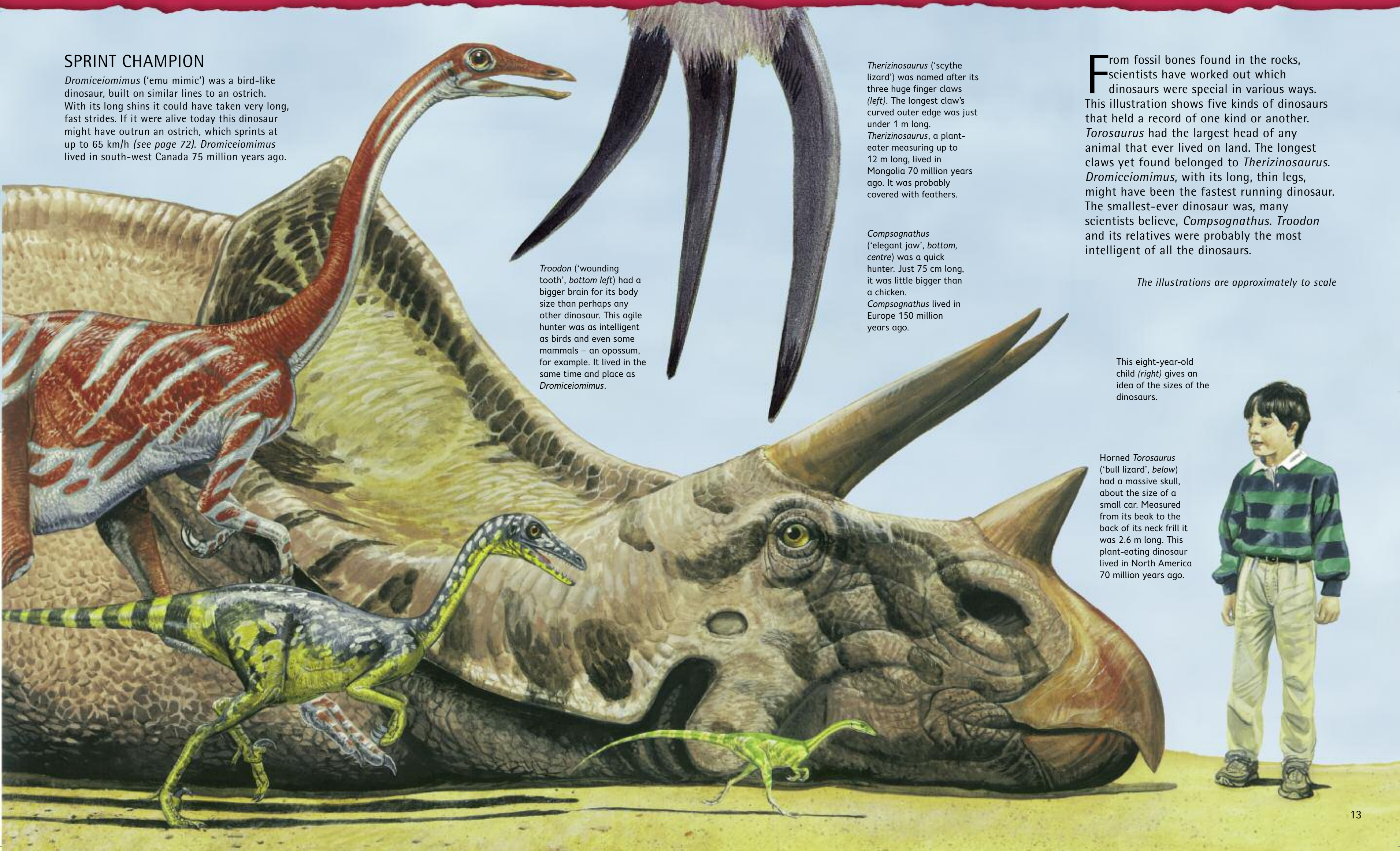
Compsognathus ('elegant jaw', bottom, centre) was a quick hunter. Just 75 cm long, it was little bigger than a chicken. *Compsognathus* lived in Europe 150 million years ago.

From fossil bones found in the rocks, scientists have worked out which dinosaurs were special in various ways. This illustration shows five kinds of dinosaurs that held a record of one kind or another. *Torosaurus* had the largest head of any animal that ever lived on land. The longest claws yet found belonged to *Therizinosaurus*. *Dromiceiomimus*, with its long, thin legs, might have been the fastest running dinosaur. The smallest-ever dinosaur was, many scientists believe, *Compsognathus*. *Troodon* and its relatives were probably the most intelligent of all the dinosaurs.

The illustrations are approximately to scale

This eight-year-old child (right) gives an idea of the sizes of the dinosaurs.

Horned *Torosaurus* ('bull lizard', below) had a massive skull, about the size of a small car. Measured from its beak to the back of its neck frill it was 2.6 m long. This plant-eating dinosaur lived in North America 70 million years ago.



GIANTS OF THE PAST

Indricotherium, the giant rhinoceros

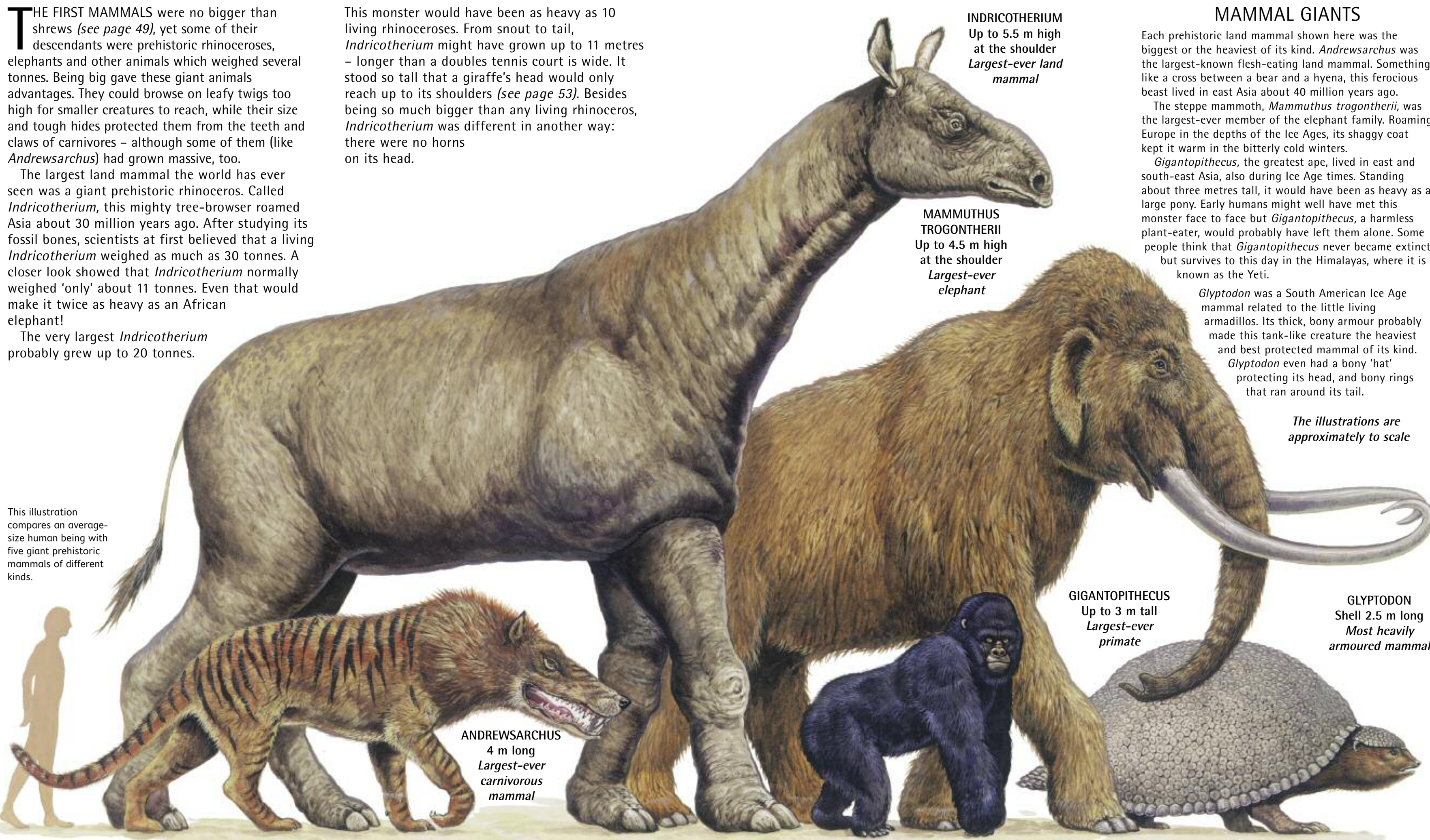
THE FIRST MAMMALS were no bigger than shrews (see page 49), yet some of their descendants were prehistoric rhinoceroses, elephants and other animals which weighed several tonnes. Being big gave these giant animals advantages. They could browse on leafy twigs too high for smaller creatures to reach, while their size and tough hides protected them from the teeth and claws of carnivores – although some of them (like *Andrewsarchus*) had grown massive, too.

The largest land mammal the world has ever seen was a giant prehistoric rhinoceros. Called *Indricotherium*, this mighty tree-browser roamed Asia about 30 million years ago. After studying its fossil bones, scientists at first believed that a living *Indricotherium* weighed as much as 30 tonnes. A closer look showed that *Indricotherium* normally weighed 'only' about 11 tonnes. Even that would make it twice as heavy as an African elephant!

The very largest *Indricotherium* probably grew up to 20 tonnes.

This monster would have been as heavy as 10 living rhinoceroses. From snout to tail, *Indricotherium* might have grown up to 11 metres – longer than a doubles tennis court is wide. It stood so tall that a giraffe's head would only reach up to its shoulders (see page 53). Besides being so much bigger than any living rhinoceros, *Indricotherium* was different in another way: there were no horns on its head.

This illustration compares an average-size human being with five giant prehistoric mammals of different kinds.



INDRICOOTHERIUM
Up to 5.5 m high
at the shoulder
*Largest-ever land
mammal*

**MAMMUTHUS
TROGONThERII**
Up to 4.5 m high
at the shoulder
*Largest-ever
elephant*

ANDREWSARCHUS
4 m long
*Largest-ever
carnivorous
mammal*

GIGANTOPITHECUS
Up to 3 m tall
*Largest-ever
primate*

GLYPTODON
Shell 2.5 m long
*Most heavily
armoured mammal*

MAMMAL GIANTS

Each prehistoric land mammal shown here was the biggest or the heaviest of its kind. *Andrewsarchus* was the largest-known flesh-eating land mammal. Something like a cross between a bear and a hyena, this ferocious beast lived in east Asia about 40 million years ago.

The steppe mammoth, *Mammuthus trogontherii*, was the largest-ever member of the elephant family. Roaming Europe in the depths of the Ice Ages, its shaggy coat kept it warm in the bitterly cold winters.

Gigantopithecus, the greatest ape, lived in east and south-east Asia, also during Ice Age times. Standing about three metres tall, it would have been as heavy as a large pony. Early humans might well have met this monster face to face but *Gigantopithecus*, a harmless plant-eater, would probably have left them alone. Some people think that *Gigantopithecus* never became extinct, but survives to this day in the Himalayas, where it is known as the Yeti.

Glyptodon was a South American Ice Age mammal related to the little living armadillos. Its thick, bony armour probably made this tank-like creature the heaviest and best protected mammal of its kind. *Glyptodon* even had a bony 'hat' protecting its head, and bony rings that ran around its tail.

The illustrations are approximately to scale

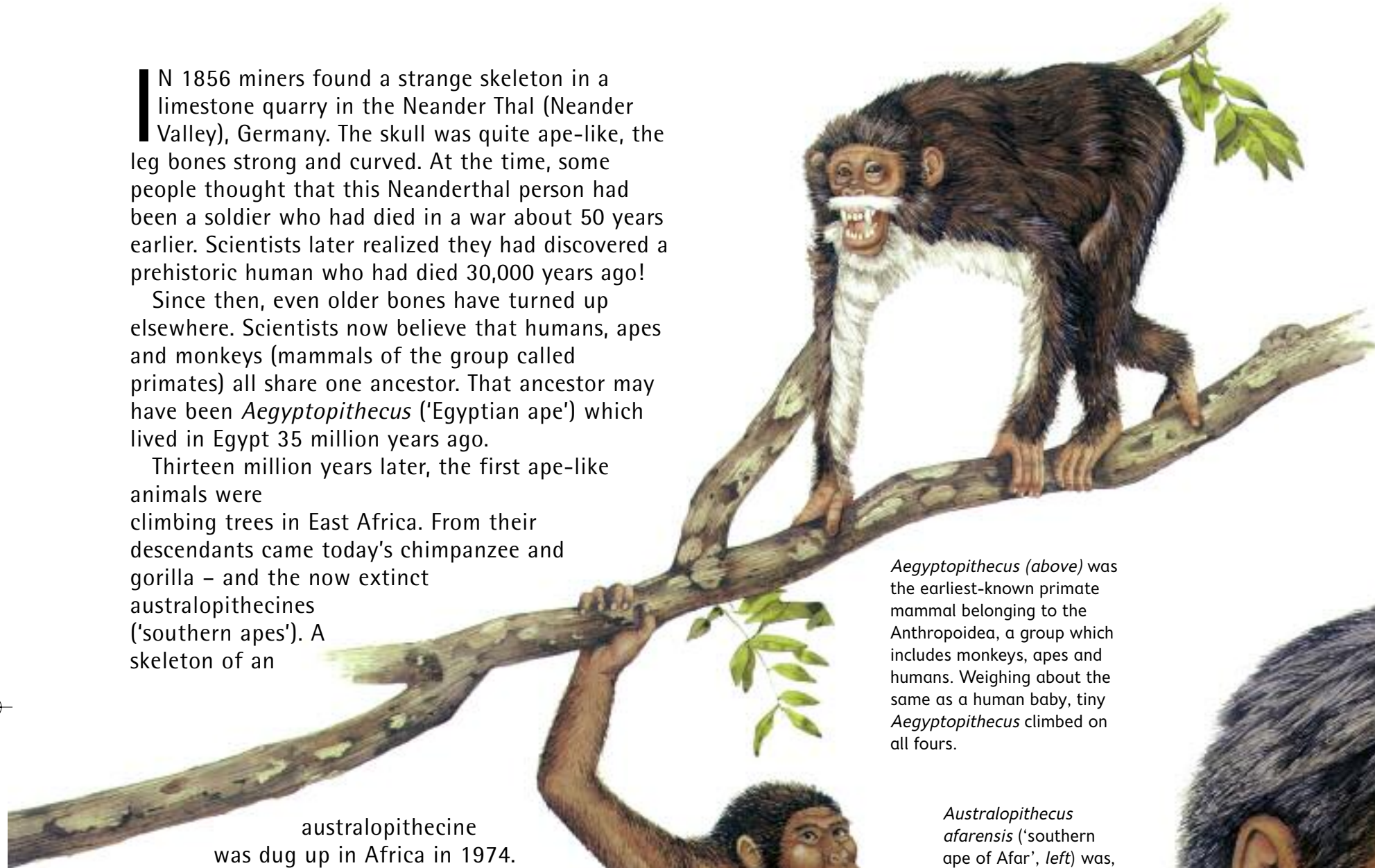
THE FIRST HUMANS

Our earliest ancestors

IN 1856 miners found a strange skeleton in a limestone quarry in the Neander Thal (Neander Valley), Germany. The skull was quite ape-like, the leg bones strong and curved. At the time, some people thought that this Neanderthal person had been a soldier who had died in a war about 50 years earlier. Scientists later realized they had discovered a prehistoric human who had died 30,000 years ago!

Since then, even older bones have turned up elsewhere. Scientists now believe that humans, apes and monkeys (mammals of the group called primates) all share one ancestor. That ancestor may have been *Aegyptopithecus* ('Egyptian ape') which lived in Egypt 35 million years ago.

Thirteen million years later, the first ape-like animals were climbing trees in East Africa. From their descendants came today's chimpanzee and gorilla – and the now extinct australopithecines ('southern apes'). A skeleton of an

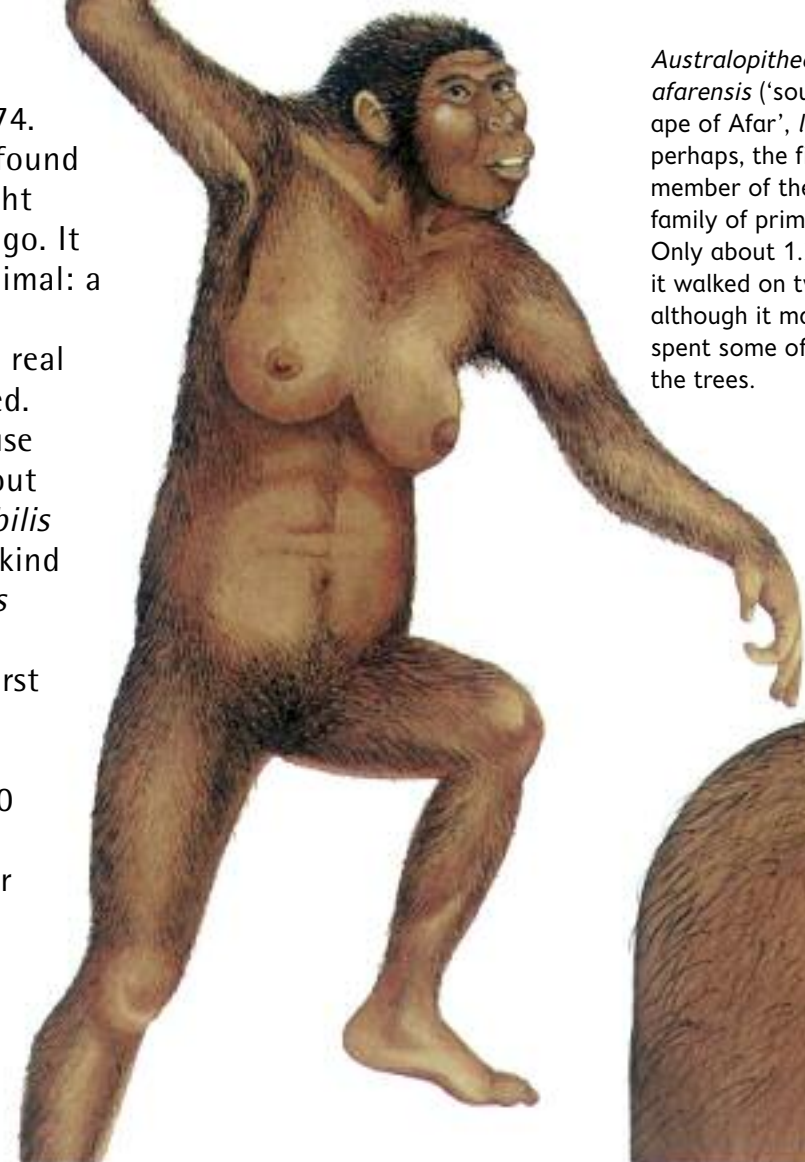


Aegyptopithecus (above) was the earliest-known primate mammal belonging to the Anthroidea, a group which includes monkeys, apes and humans. Weighing about the same as a human baby, tiny *Aegyptopithecus* climbed on all fours.

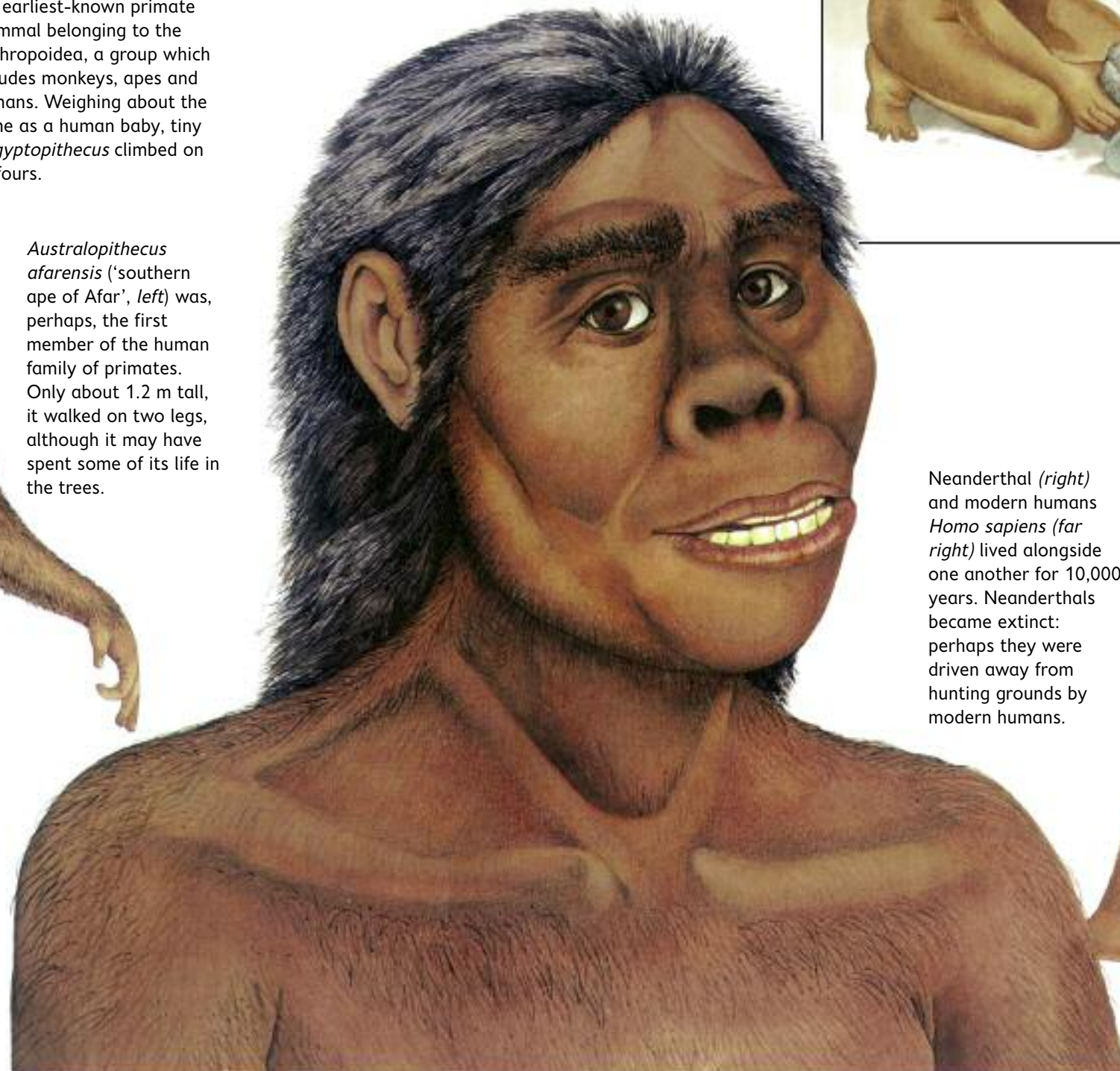
australopithecine was dug up in Africa in 1974. Called 'Lucy' by the scientists who found her bones, it probably walked upright between 3.9 and 2.9 million years ago. It was the first known, human-like animal: a hominid.

By 2.5 million years ago, the first real humans, *Homo habilis*, had appeared. *Homo habilis* ('handy man') could use tools and, perhaps, talk a little. About 500,000 years later, little *Homo habilis* had given rise to a bigger, brainier kind of prehistoric person: *Homo erectus* ('upright man').

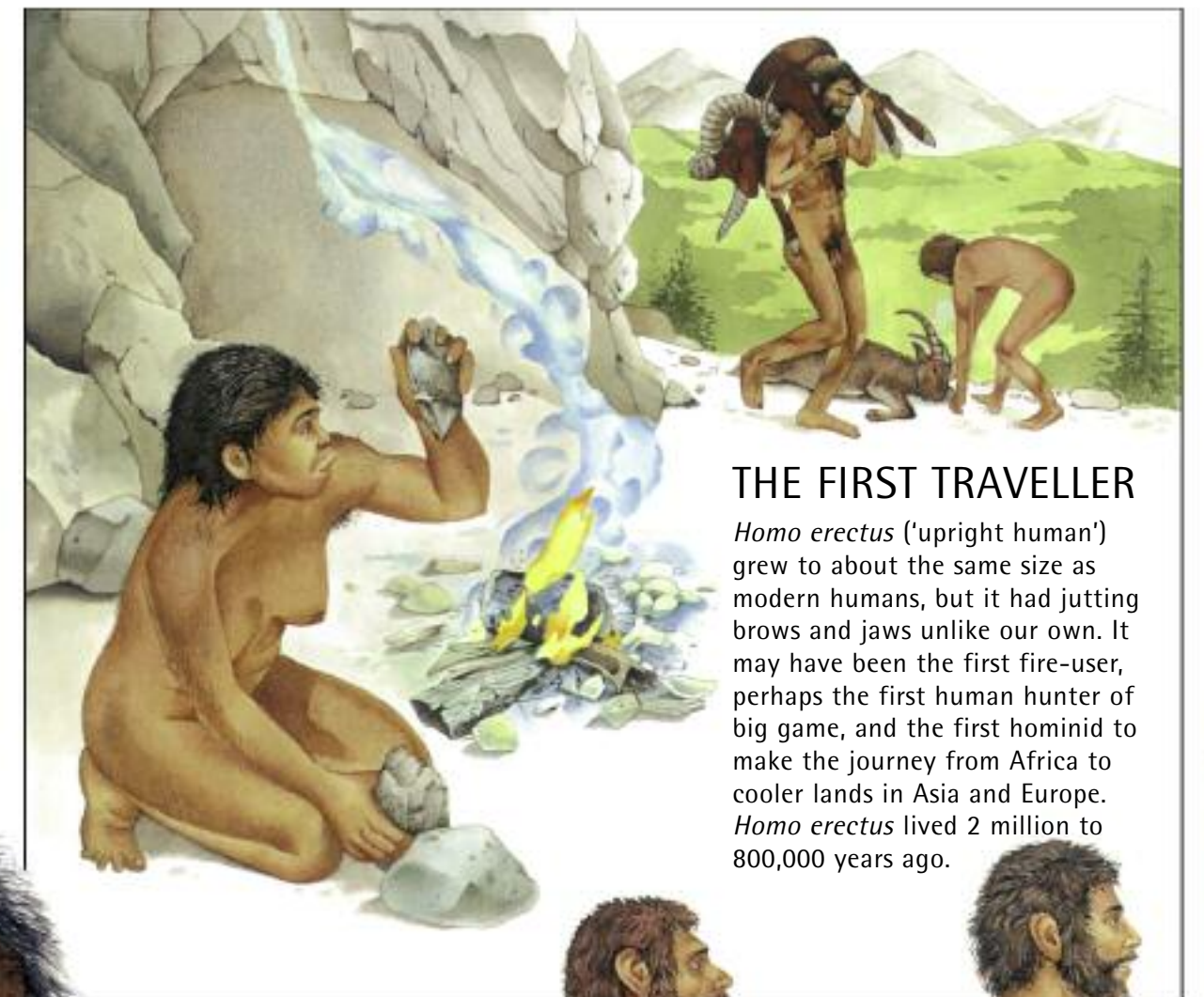
Homo sapiens ('wise man'), the first modern human, appeared, it is thought, about 200,000 years ago. They arrived in Europe about 40,000 years ago and, for a time, lived alongside the Neanderthals, another species of humans, who died out about 30,000 years ago



Australopithecus afarensis ('southern ape of Afar', left) was, perhaps, the first member of the human family of primates. Only about 1.2 m tall, it walked on two legs, although it may have spent some of its life in the trees.



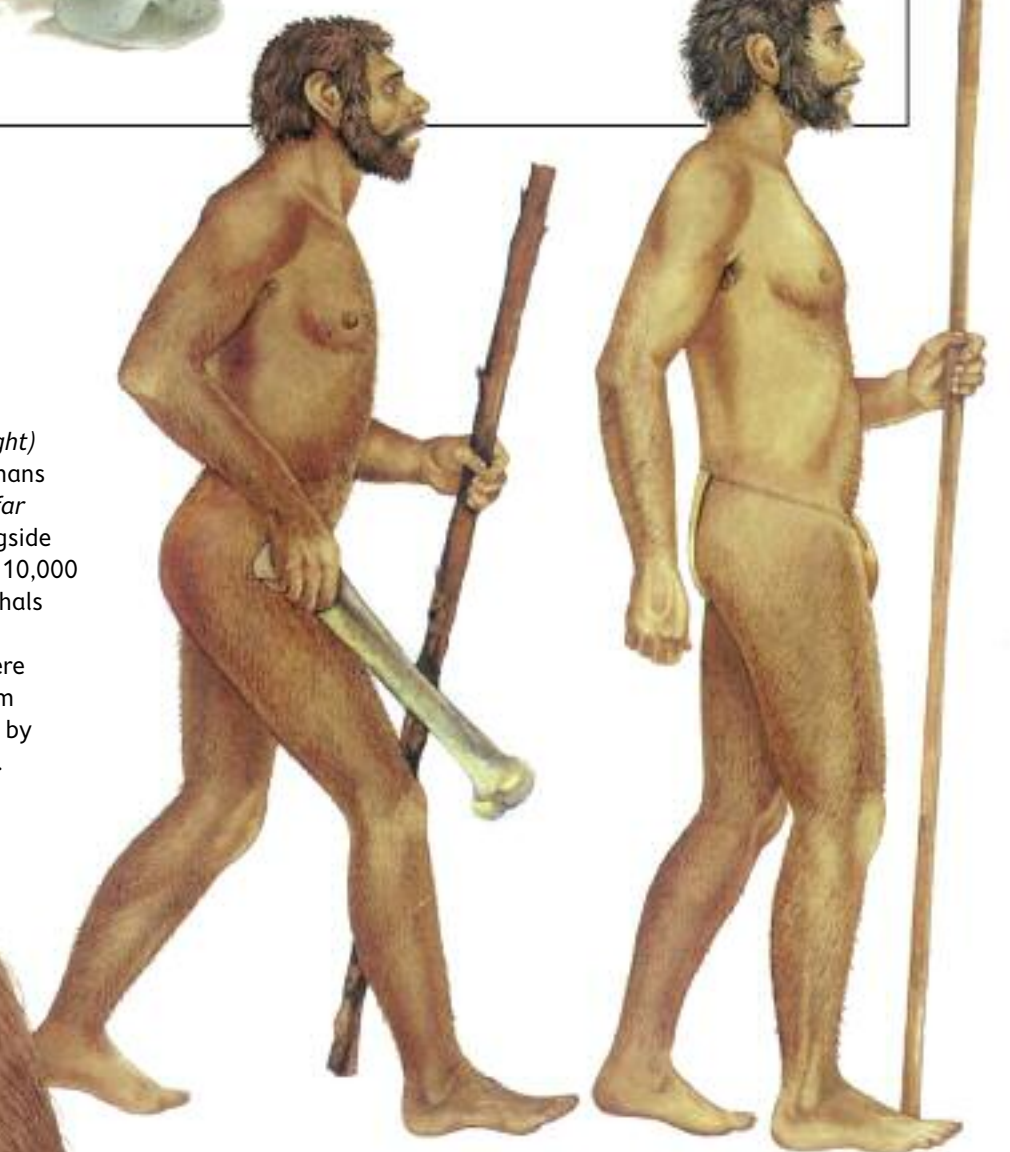
Homo habilis, (below) the first creature that could be described as 'human', lived in Africa about 2,500,000 years ago. Standing about the same height as *Australopithecus afarensis*, it had a bigger brain. It made rough stone tools, and, maybe, simple shelters.



THE FIRST TRAVELLER

Homo erectus ('upright human') grew to about the same size as modern humans, but it had jutting brows and jaws unlike our own. It may have been the first fire-user, perhaps the first human hunter of big game, and the first hominid to make the journey from Africa to cooler lands in Asia and Europe. *Homo erectus* lived 2 million to 800,000 years ago.

Neanderthal (right) and modern humans *Homo sapiens* (far right) lived alongside one another for 10,000 years. Neanderthals became extinct: perhaps they were driven away from hunting grounds by modern humans.



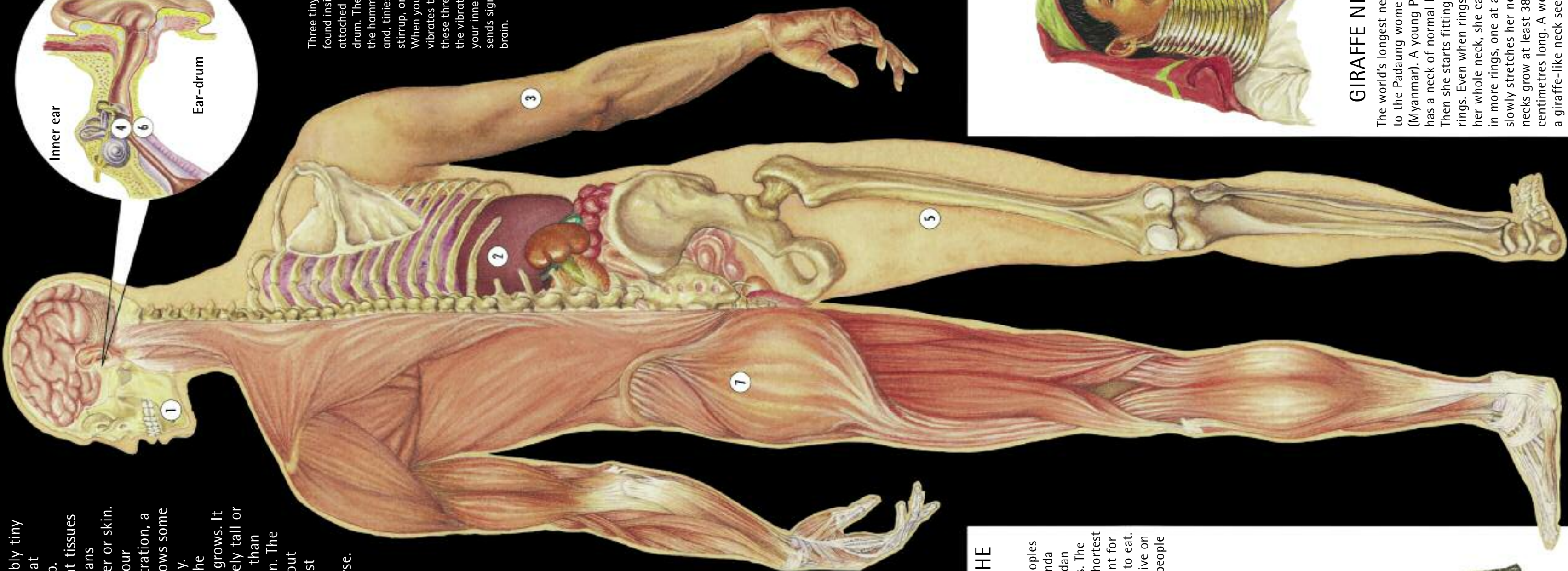
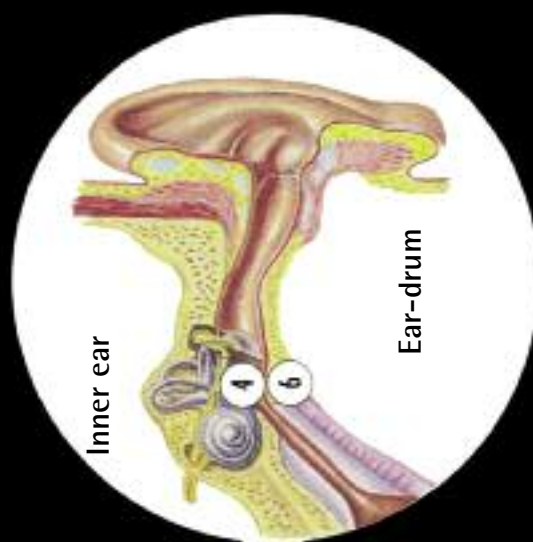
THE HUMAN BODY

YOUR BODY is made of billions of invisibly tiny building-bricks, living cells so small that hundreds would fit inside one full stop. Different kinds of cell make up the different tissues which build the bones, the muscles and organs (working parts) such as the heart, brain, liver or skin. Organs that produce chemicals which help our bodies work are known as glands. This illustration, a diagram showing the inside of the body, shows some of the largest and smallest parts of the body. Sometimes something goes wrong with the chemicals controlling how someone's body grows. It may grow scarcely at all or become extremely tall or fat. The shortest-known adult is a man less than 58 centimetres high, shorter than a penguin. The tallest man stood about 2.7 metres tall, about the height of an Asian elephant. The lightest woman weighed no more than a little dog. The heaviest-known man outweighed a horse.

KEY

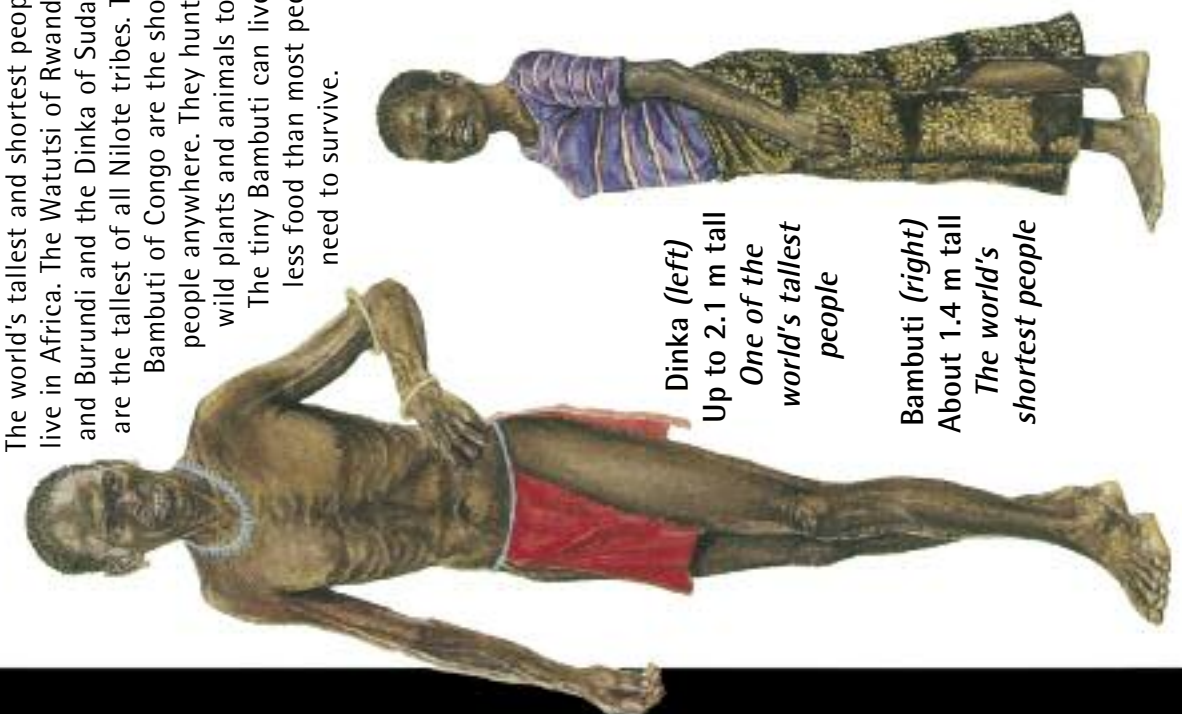
- 1 Tooth enamel *Hardest tissue*
- 2 Liver *Largest gland* Average weight 1.4 kg
- 3 Skin *Largest organ* Average size 1.9 sq m
- 4 Stapes in the middle ear *Smallest bone* 3 mm
- 5 Femur (thigh bone) *Largest bone* More than a quarter of total body length
- 6 Stapedius (moves the stapes) *Smallest muscle*
- 7 Gluteus maximus (buttock muscle) *Largest muscle*

Three tiny bones are found inside your ear, attached to the ear-drum. They are called the hammer, the anvil and, tiniest of all, the stirrup, or stapes. When your ear-drum vibrates to sounds, these three bones pass the vibrations on to your inner ear, which sends signals to the brain.



THE TALLEST AND THE SHORTEST

The world's tallest and shortest peoples live in Africa. The Watutsi of Rwanda and Burundi and the Dinka of Sudan are the tallest of all Nilote tribes. The Bambuti of Congo are the shortest people anywhere. They hunt for wild plants and animals to eat. The tiny Bambuti can live on less food than most people need to survive.



Dinka (left)
Up to 2.1 m tall
One of the world's tallest people

Bambuti (right)
About 1.4 m tall
The world's shortest people

Anatomical record holders

GIRAFFE NECKS

The world's longest necks belong to the Padaung women of Burma (Myanmar). A young Padaung girl has a neck of normal length. Then she starts fitting brass neck rings. Even when rings surround her whole neck, she can squeeze in more rings, one at a time. This slowly stretches her neck. Some necks grow at least 38 centimetres long. A woman with a giraffe-like neck seems bizarre but to the Padaung it is a sign of beauty.



THE LARGEST ANIMAL

The incredible blue whale

THE BLUE WHALE is probably the biggest creature of all time. The longest reliably recorded specimen measured more than 32 metres, nearly one-third the length of a football field (in this illustration, it runs over six pages!). The heaviest ever caught weighed more than 190 tonnes. Even an 'ordinary' blue whale is as heavy as more than 1800 people!

Blue whales can grow to this size because water supports their colossal bodies. On dry land they would collapse under their own weight, even if they had legs instead of flippers. But although blue whales can never leave the sea, they must come up to the surface to breathe in air like any other mammal.

The world's largest animal feeds on a tiny, shrimp-like creature called krill. One blue whale eats about four tonnes of krill every day. It swims open-mouthed, trapping krill on the whalebone 'comb' which hangs down inside its huge mouth instead of teeth.

While blue whales are the largest whalebone, or baleen, whales, sperm whales are the biggest whales which have teeth. A

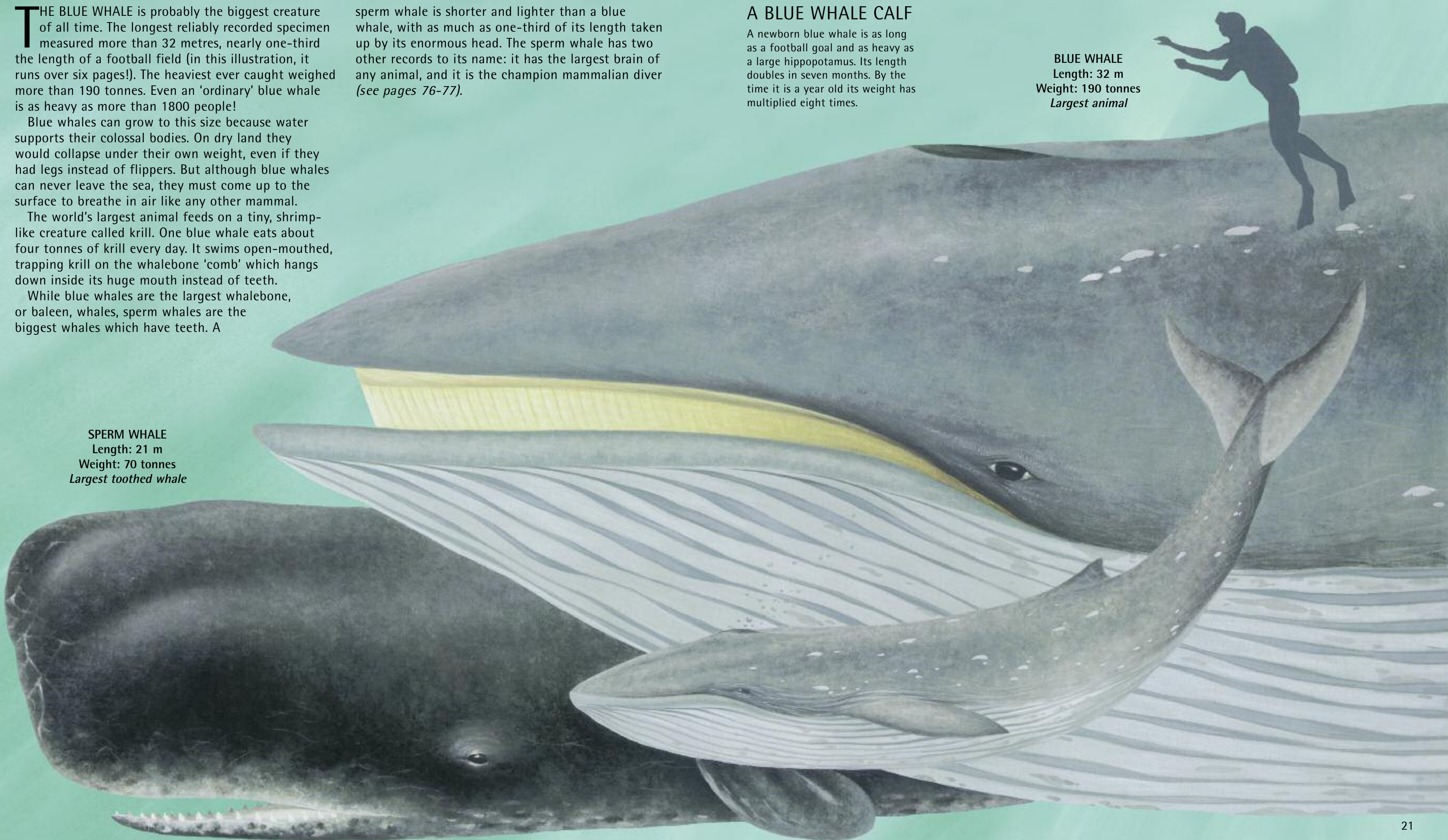
sperm whale is shorter and lighter than a blue whale, with as much as one-third of its length taken up by its enormous head. The sperm whale has two other records to its name: it has the largest brain of any animal, and it is the champion mammalian diver (see pages 76-77).

A BLUE WHALE CALF

A newborn blue whale is as long as a football goal and as heavy as a large hippopotamus. Its length doubles in seven months. By the time it is a year old its weight has multiplied eight times.

BLUE WHALE
Length: 32 m
Weight: 190 tonnes
Largest animal

SPERM WHALE
Length: 21 m
Weight: 70 tonnes
Largest toothed whale



THE LARGEST FISH

Giants of the ocean



COLOSSAL SQUID
 12-14 m long
Longest invertebrate

WHALE SHARK
 Length: 10-15 m
 Weight: 17 tonnes
Largest fish

SOUTHERN ELEPHANT SEAL
 Length: 6.7 m
 Weight: 3.63 tonnes
Largest seal

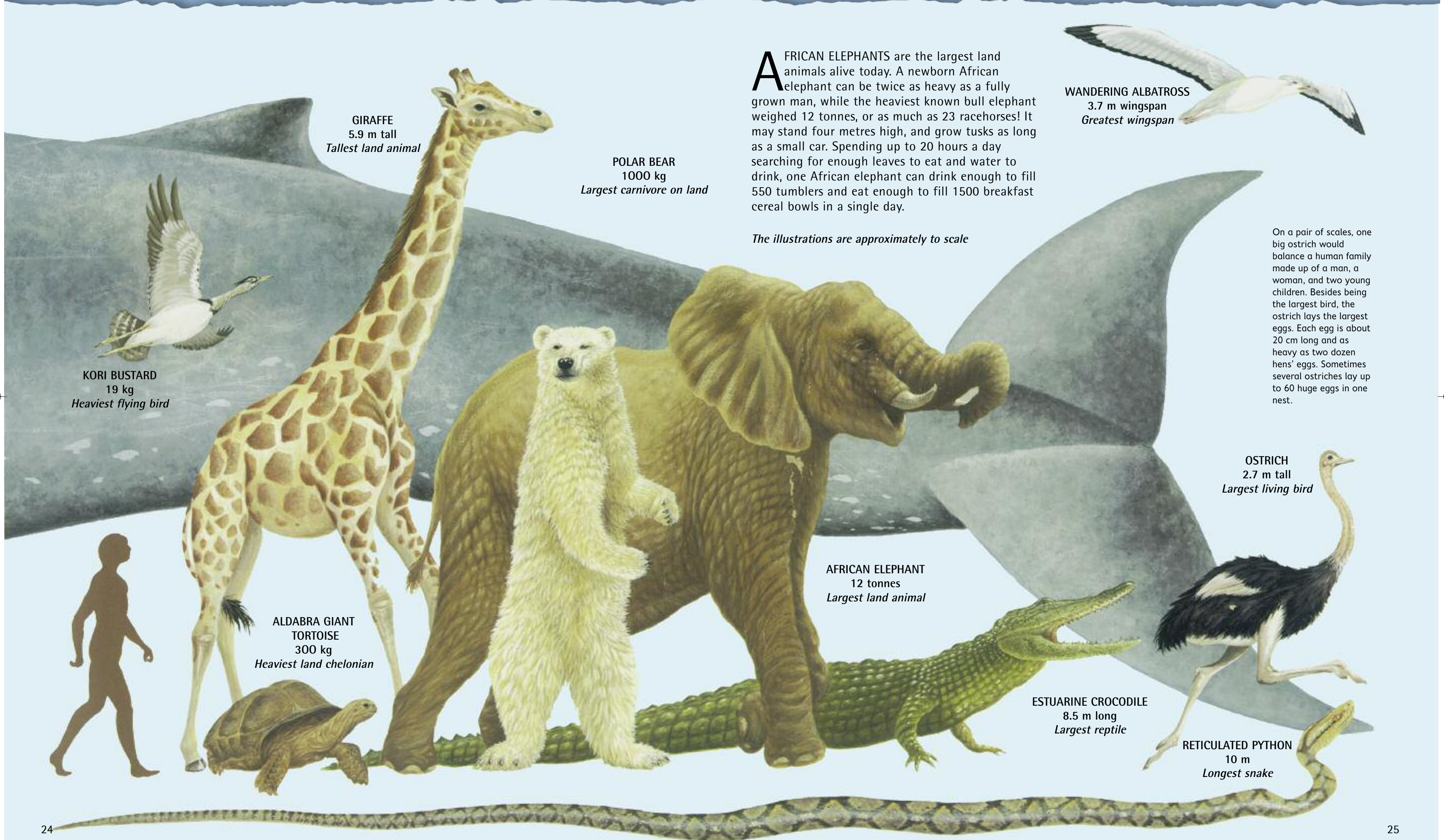
**LEATHERBACK
 TURTLE**
 More than 960 kg
Largest chelonian

Little is known about whale sharks, the largest fish in the world. They swim, always alone, in tropical waters, and sightings of them are quite rare. The very largest whale sharks can grow to 15 metres long and weigh as much as three African elephants. Their broad mouths could engulf two divers at a time but, happily, these are peaceful giants, harmless to humans: their tiny teeth are six millimetres long. Whale sharks are content to swim along with their mouths open ready to swallow up hundreds of small fish and shrimps. In fact, they travel so slowly that sometimes they collide with boats. Usually, it is the boat that comes off worst!

The illustrations are approximately to scale

LARGEST ON LAND

...and in the air



GIRAFFE
5.9 m tall
Tallest land animal

POLAR BEAR
1000 kg
Largest carnivore on land

AFRICAN ELEPHANTS are the largest land animals alive today. A newborn African elephant can be twice as heavy as a fully grown man, while the heaviest known bull elephant weighed 12 tonnes, or as much as 23 racehorses! It may stand four metres high, and grow tusks as long as a small car. Spending up to 20 hours a day searching for enough leaves to eat and water to drink, one African elephant can drink enough to fill 550 tumblers and eat enough to fill 1500 breakfast cereal bowls in a single day.

The illustrations are approximately to scale

WANDERING ALBATROSS
3.7 m wingspan
Greatest wingspan

KORI BUSTARD
19 kg
Heaviest flying bird

On a pair of scales, one big ostrich would balance a human family made up of a man, a woman, and two young children. Besides being the largest bird, the ostrich lays the largest eggs. Each egg is about 20 cm long and as heavy as two dozen hens' eggs. Sometimes several ostriches lay up to 60 huge eggs in one nest.

ALDABRA GIANT TORTOISE
300 kg
Heaviest land chelonian

AFRICAN ELEPHANT
12 tonnes
Largest land animal

OSTRICH
2.7 m tall
Largest living bird

ESTUARINE CROCODILE
8.5 m long
Largest reptile

RETICULATED PYTHON
10 m
Longest snake

THE SMALLEST ANIMALS

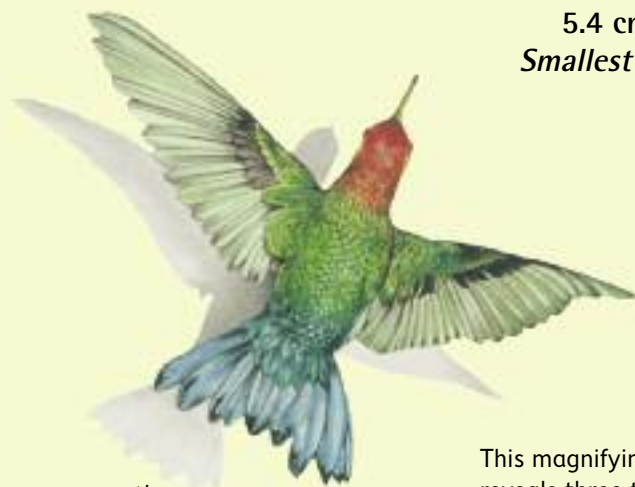
Miniature record holders

SMALL ANIMALS always live in danger of being gobbled up by larger ones, yet being small does have its advantages. The fairy fly can lay its invisibly tiny eggs on top of the eggs of little insects larger than itself. These become food for the fairy fly's grubs when they hatch out. A least weasel is slim enough to chase mice down their holes. The tiniest fishes, lizards, mice and shrews can hide in holes or cracks too narrow for their enemies to enter. The lightweight pygmy mouse lemur can climb about on twigs that would not bear a monkey's weight. Agile flyers, tiny bats dart here and there in pursuit of small moths, while bee-sized hummingbirds can hover in mid-air to suck nectar from a flower.

Some animal-like creatures are so small they are invisible. You cannot see them even under a powerful magnifying glass. These mini-beasts are called protozoans, a name meaning 'first animals'. Most animals are made of millions of tiny building blocks called cells, but a protozoan consists of just a single cell. Some protozoans are so small that thousands could live on your thumbnail.

One organism, called a mycoplasma, is the smallest form of life capable of living by itself. You would have to magnify it 10,000 times for it to appear the size of a full-stop on this page!

BEE HUMMINGBIRD
5.4 cm
Smallest bird



Even some moths grow larger than a male bee hummingbird, the smallest bird. In flight, its tiny whirring wings hum like a bee's. Bee hummingbirds live in Cuba and on the nearby Isle of Pines.

This magnifying glass reveals three tiny creatures magnified to twice actual size. Dwarf gobies are the lightest of all the backboneed animals.

Fairy flies (magnified 1400 times, right) are wasps small enough to walk through a needle's eye.

DWARF GECKO
2 cm
Smallest reptile



BRAZILIAN SHORT-HEADED FROG
1 cm
Smallest amphibian



DWARF GOBY
0.8 cm
Smallest fish



FAIRY FLY
0.02 mm
Smallest insect



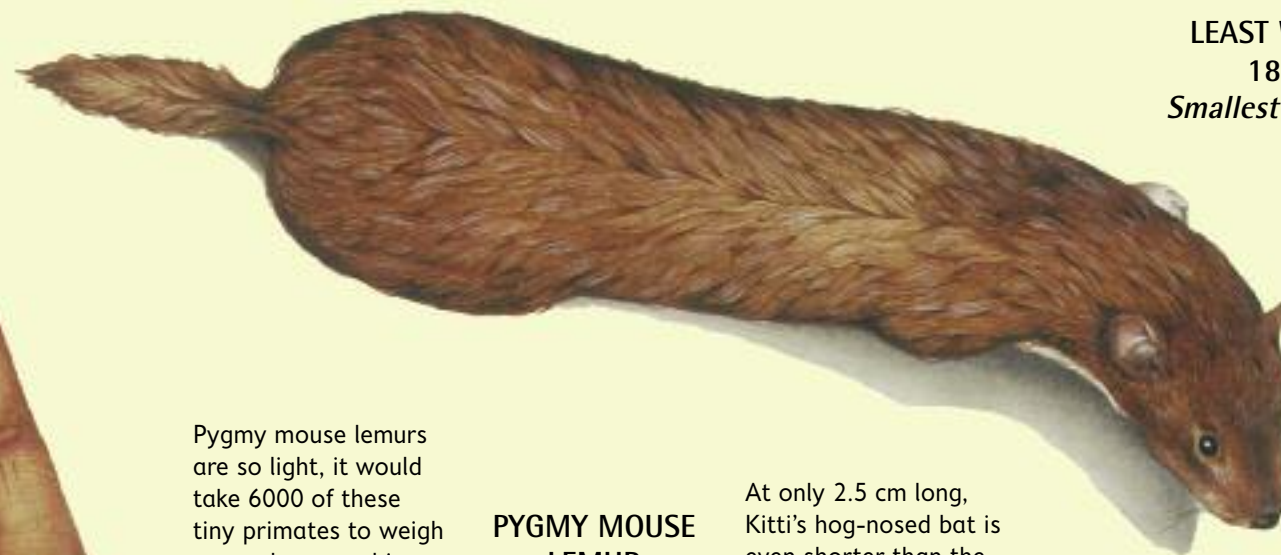
Pygmy mouse lemurs are so light, it would take 6000 of these tiny primates to weigh as much as one big gorilla, the heaviest primate of all.

PYGMY MOUSE LEMUR
20 cm
Smallest primate



At only 2.5 cm long, Kitti's hog-nosed bat is even shorter than the pygmy white-toothed shrew without its tail. A pygmy shrew is little larger than a big bee, but eats up to four times its own weight in insects every day.

LEAST WEASEL
18 cm
Smallest carnivore

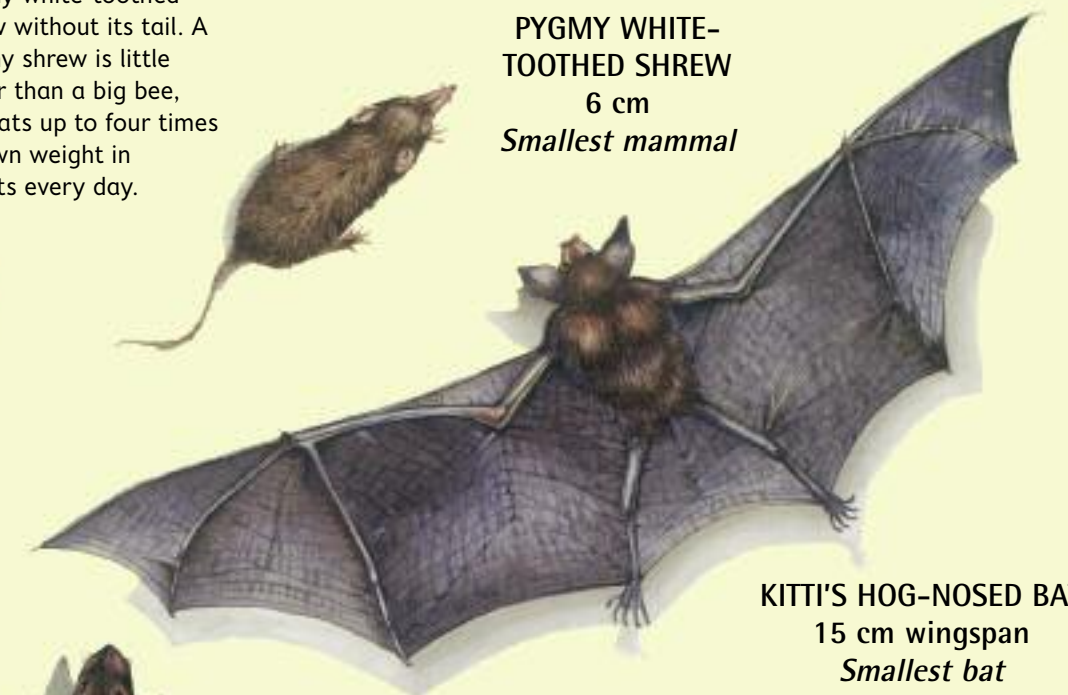


Least weasels are the smallest of all meat-eating mammals. Despite their tiny size, these sharp-toothed carnivores are every bit as fierce as tigers. Many females are only half the weight of males but they also eat mice and voles. Least weasels live in North America, and have close relatives in Asia and Europe.

PYGMY WHITE-TOOTHED SHREW
6 cm
Smallest mammal



KITTI'S HOG-NOSED BAT
15 cm wingspan
Smallest bat



PYGMY MOUSE
7.3 cm
Smallest rodent



At 7.3 cm long, pygmy mice are the smallest rodents. It would take 7000 of them together to match the weight of one capybara, the biggest rodent.

MINIATURE RECORD HOLDERS

Smallest sea mammal: Heaviside's dolphin (right)
Weight: 40 kg Length: 1.2 m

Smallest marsupial (pouched mammal):
Kimberley planigale Weight: 4 g
Length: 5.7 cm

Smallest breed of horse: Falabella
Weight: 40 kg
Shoulder height: 76 cm

Smallest bear: Sun bear Weight: 27 kg
Shoulder height: 70 cm

Smallest wild cat: Rusty-spotted cat
Weight: 1.4 kg Length: 48 cm

Smallest ungulate (hoofed mammal):
Lesser mouse deer (left) Weight: 2 kg
Shoulder height: 20 cm

THE LARGEST INSECTS

Giants of the mini-beast world



The longest stick insect (*right*) is as thick as a human finger and longer than a man's foot.

The largest living dragonfly (*below*) measures 19 cm across its wings. The largest-ever dragonfly had a wingspan more than three times that size.

The largest flea, the beaver flea is tiny, but even smaller fleas jump 33 cm, equivalent to humans leaping 210 m.

The world's heaviest insects are the goliath beetles from West Africa (*right*). One big male goliath beetle is as heavy as 50 pygmy shrews, the lightest land mammals (*see page 69*). Elephant beetles from Central America are bigger than goliaths but weigh less.

The insects are pictured at actual size

There are more different kinds of insect than any other animal. Insects come in a huge variety of sizes: some are bigger than some small mammals (*see page 69*) while some are so tiny it is impossible to see them without a magnifying glass. The biggest butterfly is 1000 times larger than the smallest fairy fly.

Most insects are small, partly because of the way they breathe. Unlike humans, they do not have lungs to force air in and out. Instead, air drifts in and out of their bodies through little tubes in their sides. This simple breathing system would not let enough fresh air reach deep inside the body of too large an animal.

Some insects must be light enough to fly. An insect lives inside a hard outer skeleton, like a suit of armour. As the insect grows, this armour must split open and fall off to allow a bigger suit to grow in its place. If beetles or butterflies grew as large and plump as pigeons their armour would have to be so heavy that they could not fly. Some prehistoric insects were much bigger (although no heavier) than the largest insects now alive. One prehistoric dragonfly even had the wingspan of a crow!

The male Queen Alexandra's birdwing (*below*) is smaller than the female. His bright colours warn hungry birds that he is poisonous to eat.

The world's largest butterfly, the Queen Alexandra's birdwing, is also probably the rarest. Females (*above*) can grow to 28 cm across the wings. They fly so high they are difficult to net. The first specimen collected was shot down instead!

The largest cockroach (*left*) has a body nearly 10 cm long. Its antennae (feelers) are even longer.

THE FASTEST...

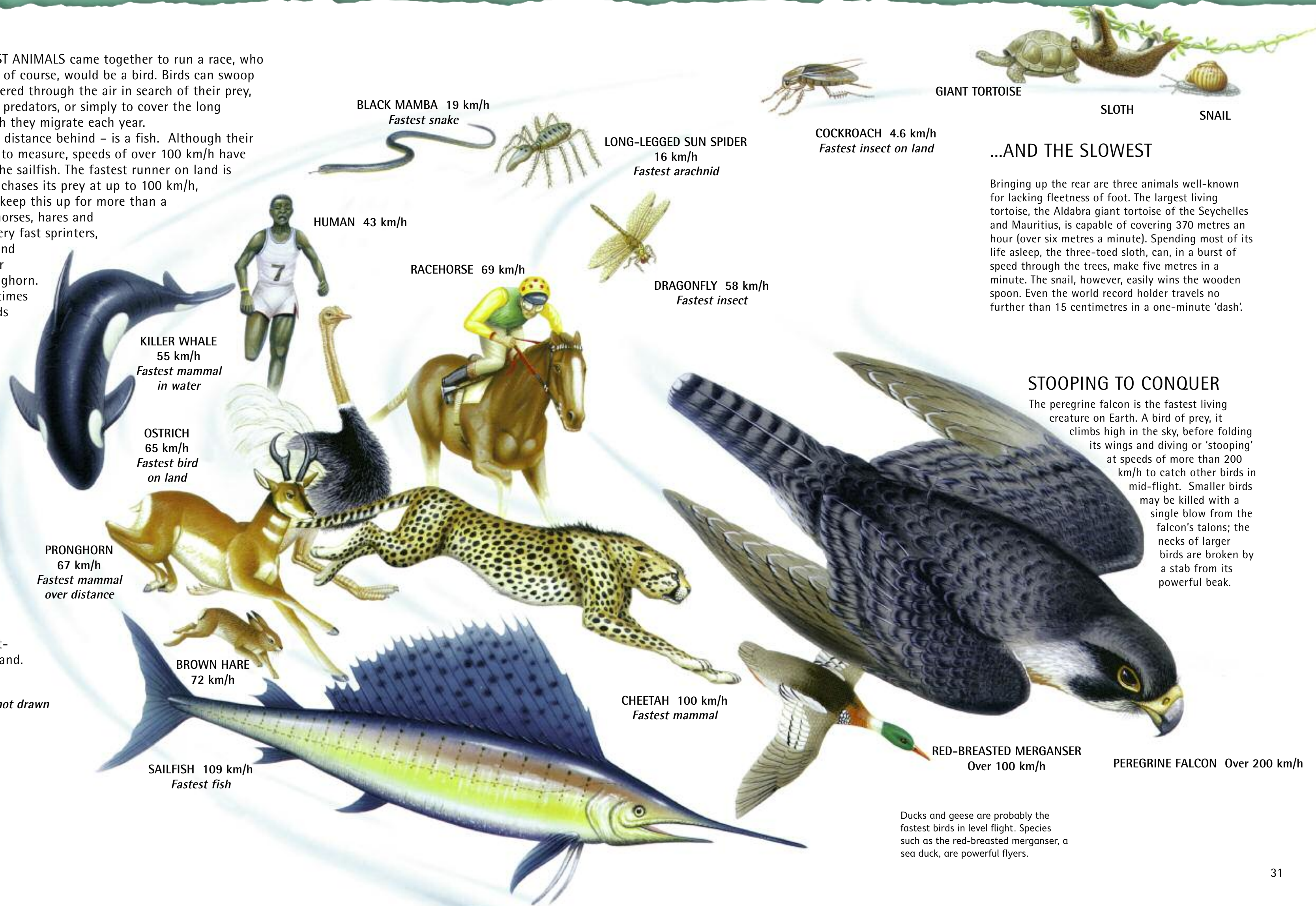
...and the slowest

IF ALL THE FASTEST ANIMALS came together to run a race, who would win? First, of course, would be a bird. Birds can swoop and glide unhindered through the air in search of their prey, escaping from their predators, or simply to cover the long distances over which they migrate each year.

Following – some distance behind – is a fish. Although their speeds are difficult to measure, speeds of over 100 km/h have been recorded for the sailfish. The fastest runner on land is the cheetah, which chases its prey at up to 100 km/h, although it cannot keep this up for more than a minute or so. Racehorses, hares and ostriches are also very fast sprinters, but the speediest land animal running over distance is the pronghorn. Athletes recording times of under ten seconds for a race of a 100 metres may reach peak speeds of around 43 km/h during the course of their sprint.

Speed records for spiders and insects are very difficult to time. Dragonflies may be the fastest flying insects over short bursts, while tropical cockroaches are probably the fastest-moving insects on land.

The illustrations are not drawn to scale



...AND THE SLOWEST

Bringing up the rear are three animals well-known for lacking fleetness of foot. The largest living tortoise, the Aldabra giant tortoise of the Seychelles and Mauritius, is capable of covering 370 metres an hour (over six metres a minute). Spending most of its life asleep, the three-toed sloth, can, in a burst of speed through the trees, make five metres in a minute. The snail, however, easily wins the wooden spoon. Even the world record holder travels no further than 15 centimetres in a one-minute 'dash'.

STOOPING TO CONQUER

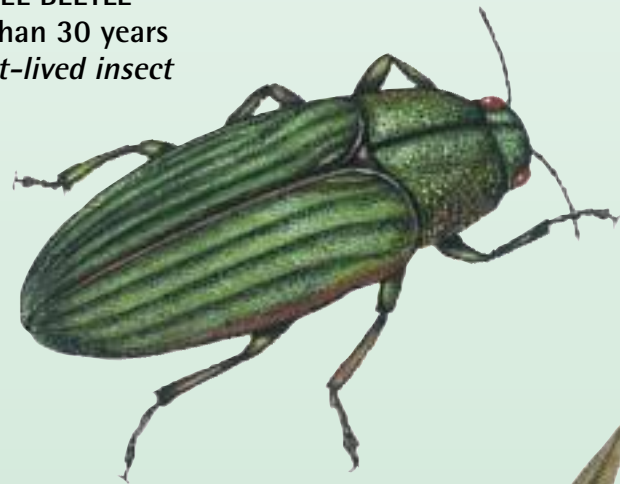
The peregrine falcon is the fastest living creature on Earth. A bird of prey, it climbs high in the sky, before folding its wings and diving or 'stooping' at speeds of more than 200 km/h to catch other birds in mid-flight. Smaller birds may be killed with a single blow from the falcon's talons; the necks of larger birds are broken by a stab from its powerful beak.

Ducks and geese are probably the fastest birds in level flight. Species such as the red-breasted merganser, a sea duck, are powerful flyers.

THE LONGEST-LIVED...

Nature's senior citizens

JEWEL BEETLE
More than 30 years
Longest-lived insect



JAPANESE GIANT SALAMANDER
More than 50 years
Longest-lived amphibian



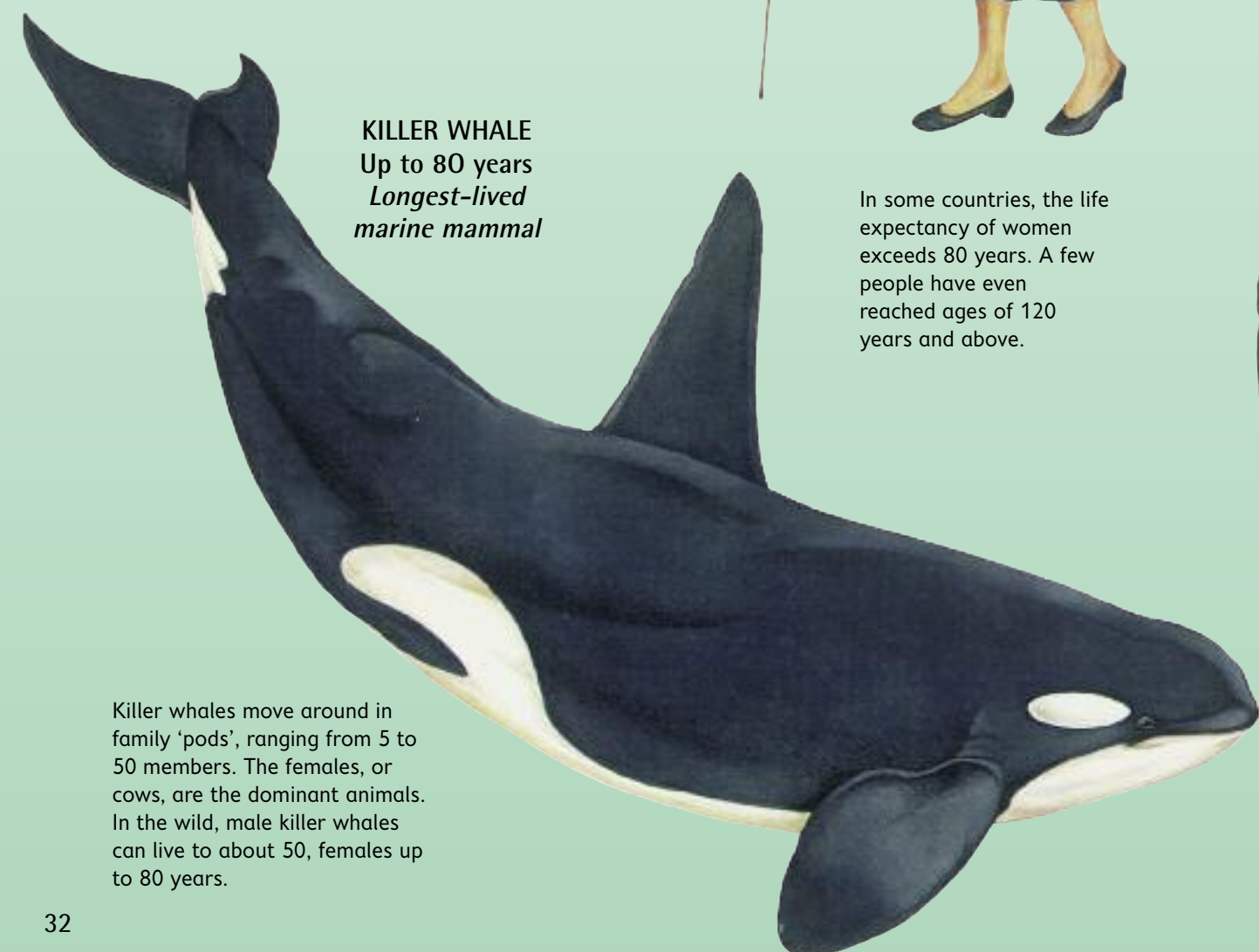
LAKE STURGEON
More than 80 years
Longest-lived fish



WANDERING ALBATROSS
More than 70 years
Longest-lived bird

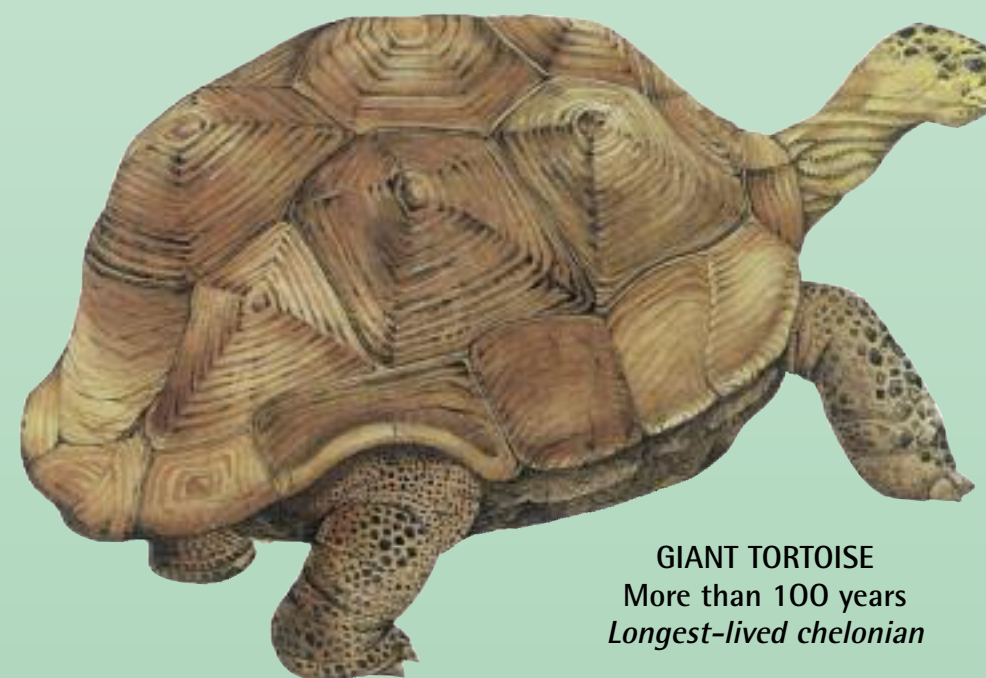


ASIAN ELEPHANT
More than 60 years
Longest-lived land mammal (after humans)



KILLER WHALE
Up to 80 years
Longest-lived marine mammal

In some countries, the life expectancy of women exceeds 80 years. A few people have even reached ages of 120 years and above.



GIANT TORTOISE
More than 100 years
Longest-lived chelonian



LONG-LIVED REPTILES

Tuataras and tortoises live longer than any other land animals. Tuataras (*above*) are lizard-like creatures found only on small islands off New Zealand. In chilly weather, a tuatara breathes no more than once an hour. Scientists think that creatures which lead such slow-motion lives are capable of living 120 years or more.

Several kinds of tortoises normally live for more than 100 years. One giant tortoise, collected by the French explorer Marion de Fresne from the Seychelles in 1766, died (from a fall) in 1918, 152 years later. Known as 'Marion's' tortoise, it was probably an adult when captured and so could have been more than 200 years old when it died!

NO ANIMAL lives for ever. Accidents, diseases or enemies kill many of them while they are still young. Only one Atlantic mackerel in every 100,000 is likely to survive more than 90 days. But creatures that escape an early end may live on until their bodies wear out. Animals that live protected lives in zoos often live to greater ages than they would do in the wild.

Tiny animals tend to have the shortest lives. A mayfly, for example, once it gets its wings, usually lives no more than a single day. An albatross or an elephant, on the other hand, can go on for many years. After an elephant turns 60, however, its teeth begin to wear out; it cannot chew so it starves to death.

The longest-lived vertebrate animal is the giant tortoise, but some marine animals may live much longer. In 2007, a type of clam called the quahog clam dredged from Icelandic waters was found to have lived for between 405 and 410 years!

The illustrations are not drawn to scale

REALM OF THE DEEP

The deepest-living ocean animals

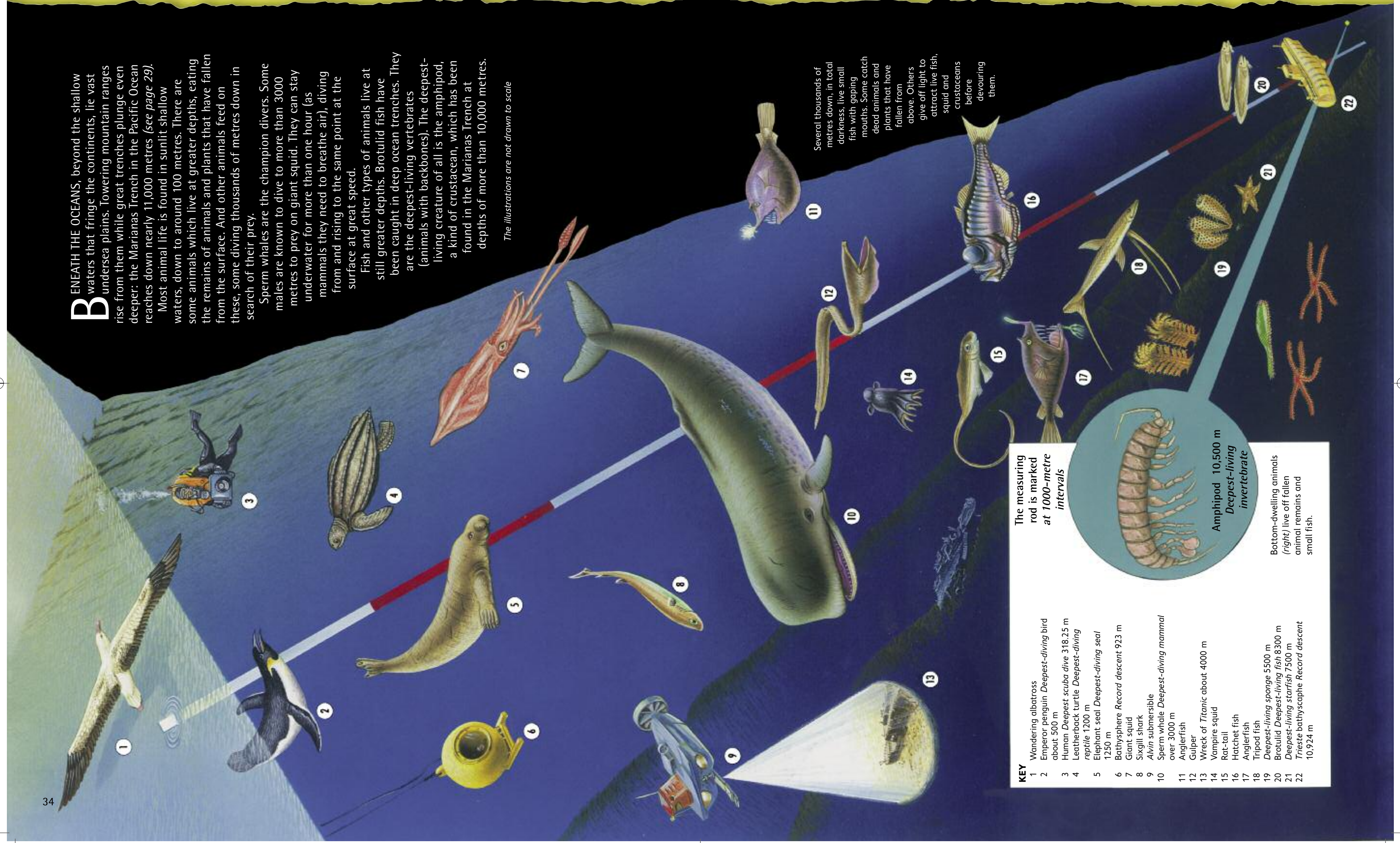
BENEATH THE OCEANS, beyond the shallow waters that fringe the continents, lie vast undersea plains. Towering mountain ranges rise from them while great trenches plunge even deeper: the Marianas Trench in the Pacific Ocean reaches down nearly 11,000 metres (see page 29).

Most animal life is found in sunlit shallow waters, down to around 100 metres. There are some animals which live at greater depths, eating the remains of animals and plants that have fallen from the surface. And other animals feed on these, some diving thousands of metres down in search of their prey.

Sperm whales are the champion divers. Some males are known to dive to more than 3000 metres to prey on giant squid. They can stay underwater for more than one hour (as mammals they need to breathe air), diving from and rising to the same point at the surface at great speed.

Fish and other types of animals live at still greater depths. Brotulid fish have been caught in deep ocean trenches. They are the deepest-living vertebrates (animals with backbones). The deepest-living creature of all is the amphipod, a kind of crustacean, which has been found in the Marianas Trench at depths of more than 10,000 metres.

The illustrations are not drawn to scale



Several thousands of metres down, in total darkness, live small fish with gaping mouths. Some catch dead animals and plants that have fallen from above. Others give off light to attract live fish, squid and crustaceans before devouring them.

The measuring rod is marked at 1000-metre intervals

- KEY**
- 1 Wandering albatross
 - 2 Emperor penguin *Deepest-diving bird* about 500 m
 - 3 Human *Deepest scuba dive* 318.25 m
 - 4 Leatherback turtle *Deepest-diving reptile* 1200 m
 - 5 Elephant seal *Deepest-diving seal* 1250 m
 - 6 Bathysphere *Record descent* 923 m
 - 7 Giant squid
 - 8 Sixgill shark
 - 9 Alvin submersible
 - 10 Sperm whale *Deepest-diving mammal* over 3000 m
 - 11 Anglerfish
 - 12 Gulper
 - 13 Wreck of Titanic about 4000 m
 - 14 Vampire squid
 - 15 Rat-tail
 - 16 Hatchet fish
 - 17 Anglerfish
 - 18 Tripod fish
 - 19 *Deepest-living sponge* 5500 m
 - 20 Brotulid *Deepest-living fish* 8300 m
 - 21 *Deepest-living starfish* 7500 m
 - 22 Trieste bathyscaphe *Record descent* 10,924 m



Amphipod 10,500 m *Deepest-living invertebrate*

Bottom-dwelling animals (right) live off fallen animal remains and small fish.

OCEAN TRAVELLERS

The longest journeys

ANIMALS ARE ALWAYS ON THE MOVE in search of fresh sources of food. Some travel at the same time each year to places where the new season brings a more favourable climate for feeding or breeding. Called migration, these journeys are sometimes made to distant parts of the world. The most ambitious travellers fly or swim incredible distances across oceans and back again to the same places each year.

The champion long-distance specialist is the Arctic tern. In one year, this small bird flies from the Arctic to the Antarctic and back again – almost all the way around the world. The wandering albatross does circle the world, but near the South Pole where the distance is shorter.

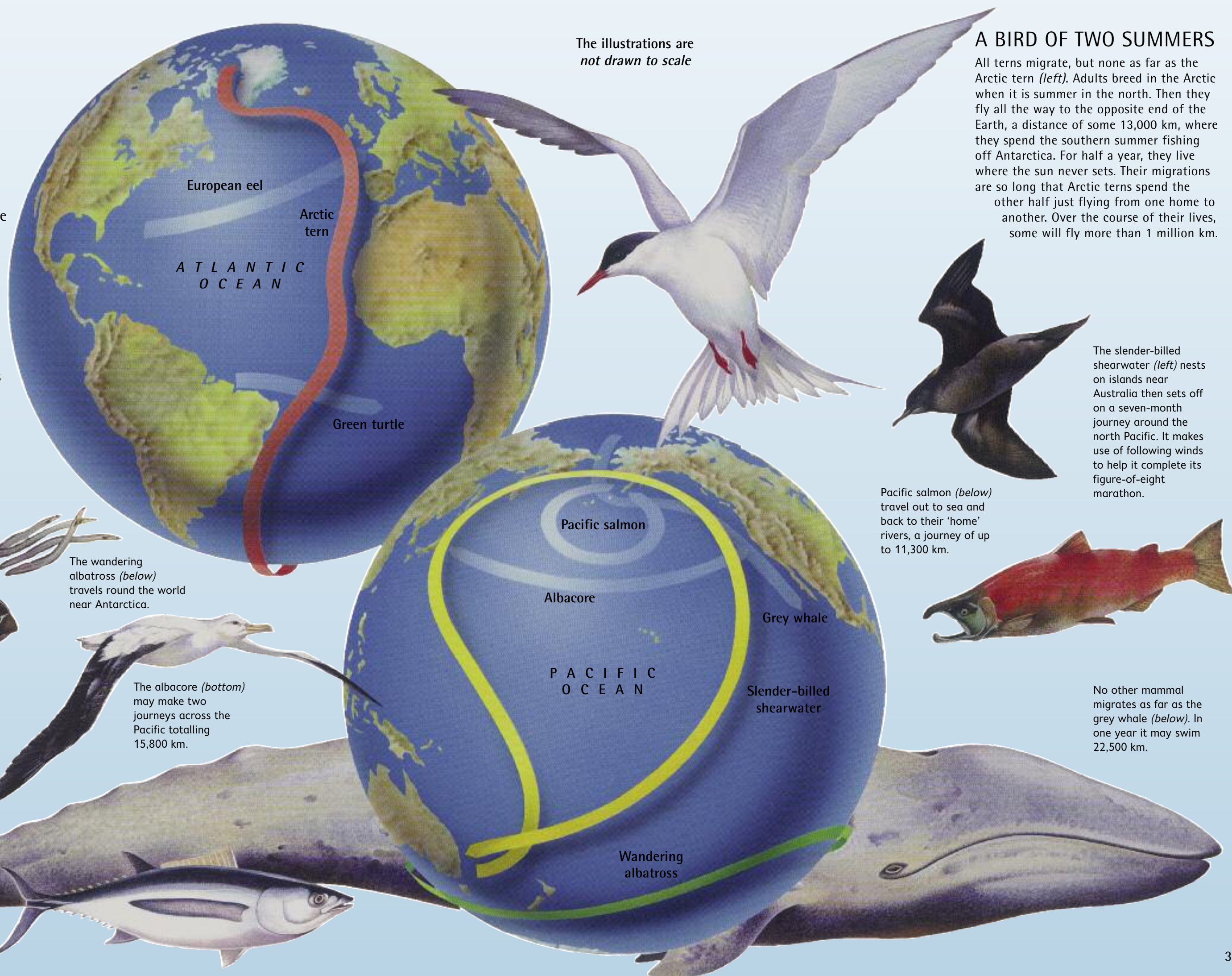
Animal swimmers can also make amazingly long sea trips. Green turtles feed off Brazil but swim far out into the Atlantic Ocean to breed on lonely Ascension Island. Grey whales make the longest journeys of any mammal. They feed in Arctic waters in summer, before swimming south in winter to breed off Mexico.

The young of the European eel (*right*) are born in the Sargasso Sea east of Florida. They spend the next few years drifting 10,000 km across to Europe. They swim up rivers to grow into adults.

The wandering albatross (*below*) travels round the world near Antarctica.

The albacore (*bottom*) may make two journeys across the Pacific totalling 15,800 km.

Probably the farthest-travelled reptile, the green turtle (*above*) swims up to 2250 km to its breeding grounds on Ascension Island then back again.



The illustrations are not drawn to scale

A BIRD OF TWO SUMMERS

All terns migrate, but none as far as the Arctic tern (*left*). Adults breed in the Arctic when it is summer in the north. Then they fly all the way to the opposite end of the Earth, a distance of some 13,000 km, where they spend the southern summer fishing off Antarctica. For half a year, they live where the sun never sets. Their migrations are so long that Arctic terns spend the other half just flying from one home to another. Over the course of their lives, some will fly more than 1 million km.

The slender-billed shearwater (*left*) nests on islands near Australia then sets off on a seven-month journey around the north Pacific. It makes use of following winds to help it complete its figure-of-eight marathon.

Pacific salmon (*below*) travel out to sea and back to their 'home' rivers, a journey of up to 11,300 km.

No other mammal migrates as far as the grey whale (*below*). In one year it may swim 22,500 km.

OVERLAND TRAVELLERS

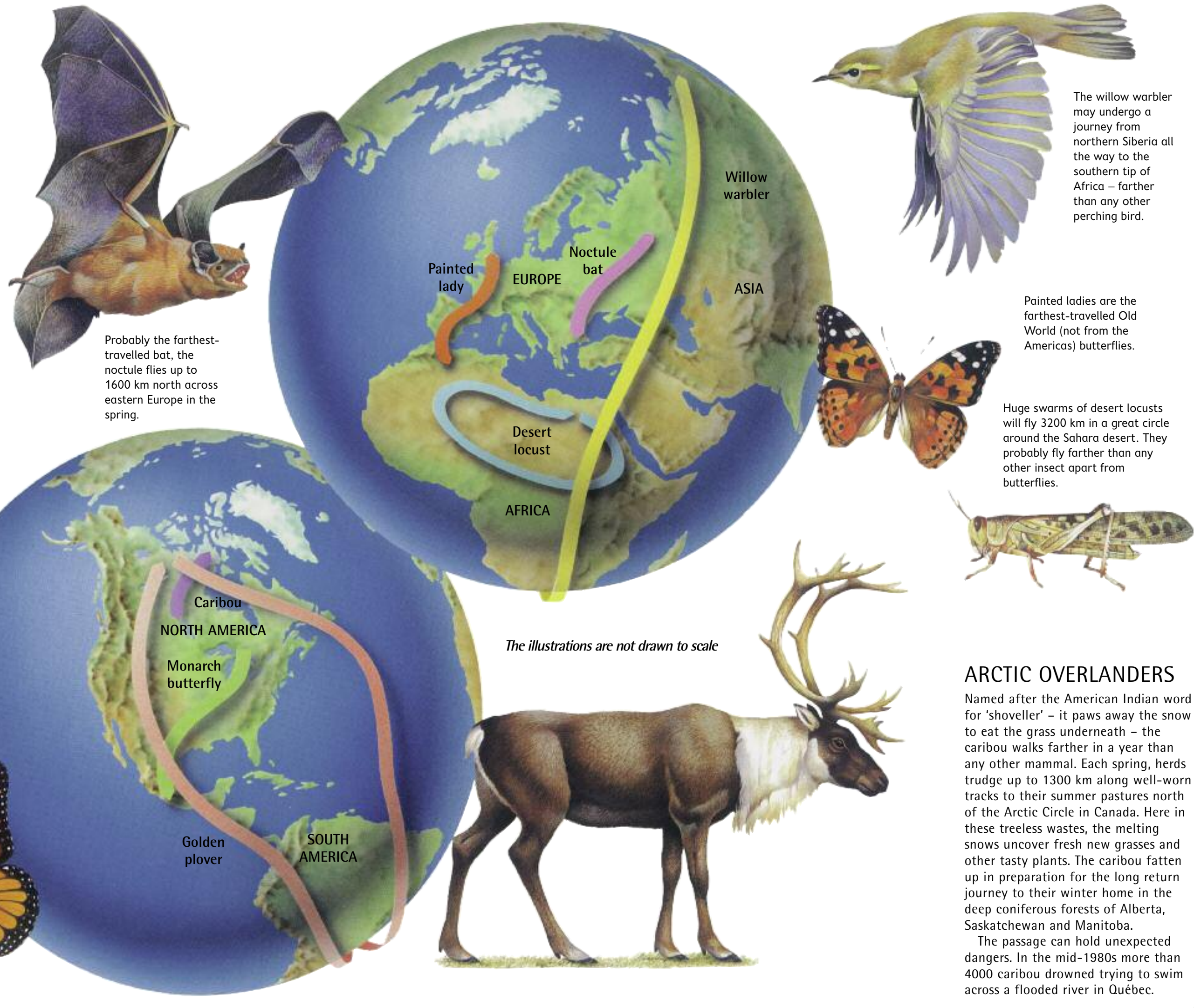
Long-distance specialists

MANY ANIMAL MIGRANTS that go by air – birds, bats and insects – prefer to avoid travelling over the sea. They may be unable to find their usual sources of food, or to rest from long periods of flight. If they do need to cross the sea on their journey, they will cross where there are narrow straits or island 'stepping-stones'.

In the Northern Hemisphere spring, millions of birds flock thousands of kilometres northwards. Warblers, plovers and others will rear their young during the long northern summer days when food is plentiful. Bats and butterflies join in the great airborne migration. There are even some animals that go by foot: herds of caribou, a kind of deer, wander hundreds of kilometres across the far north of Canada.

Sometimes, the travellers must cross deserts. To many, these are just as forbidding as the open seas. Warblers feed well before they overfly a desert. A plump willow warbler's body holds enough energy to enable it to fly 60 hours non-stop.

As summer ends, the long-distance travellers, or their young, head back south to spend winter in warmer climates.



The willow warbler may undergo a journey from northern Siberia all the way to the southern tip of Africa – farther than any other perching bird.

Painted ladies are the farthest-travelled Old World (not from the Americas) butterflies.

Huge swarms of desert locusts will fly 3200 km in a great circle around the Sahara desert. They probably fly farther than any other insect apart from butterflies.

Probably the farthest-travelled bat, the noctule flies up to 1600 km north across eastern Europe in the spring.

The illustrations are not drawn to scale

Golden plovers fly overland from Brazil to northern Canada, then back across the Atlantic Ocean, a flight of 19,000 km each year.

Every autumn, clouds of monarch butterflies flutter a record 3200 km south from Canada to Mexico. Billions of these insects spend winter clustered together on tall evergreen trees. In spring they fly back north, laying eggs as they go. Most adults die, but their young complete the journey begun by their parents.

ARCTIC OVERLANDERS

Named after the American Indian word for 'shoveller' – it paws away the snow to eat the grass underneath – the caribou walks farther in a year than any other mammal. Each spring, herds trudge up to 1300 km along well-worn tracks to their summer pastures north of the Arctic Circle in Canada. Here in these treeless wastes, the melting snows uncover fresh new grasses and other tasty plants. The caribou fatten up in preparation for the long return journey to their winter home in the deep coniferous forests of Alberta, Saskatchewan and Manitoba.

The passage can hold unexpected dangers. In the mid-1980s more than 4000 caribou drowned trying to swim across a flooded river in Québec.

THE RAREST ANIMALS

Creatures close to extinction

SOME ANIMALS ARE VERY RARE, numbering perhaps only a few hundred in the wild. They include some very well-known animals, like the giant panda or the blue whale. Some are getting even scarcer and could soon disappear.

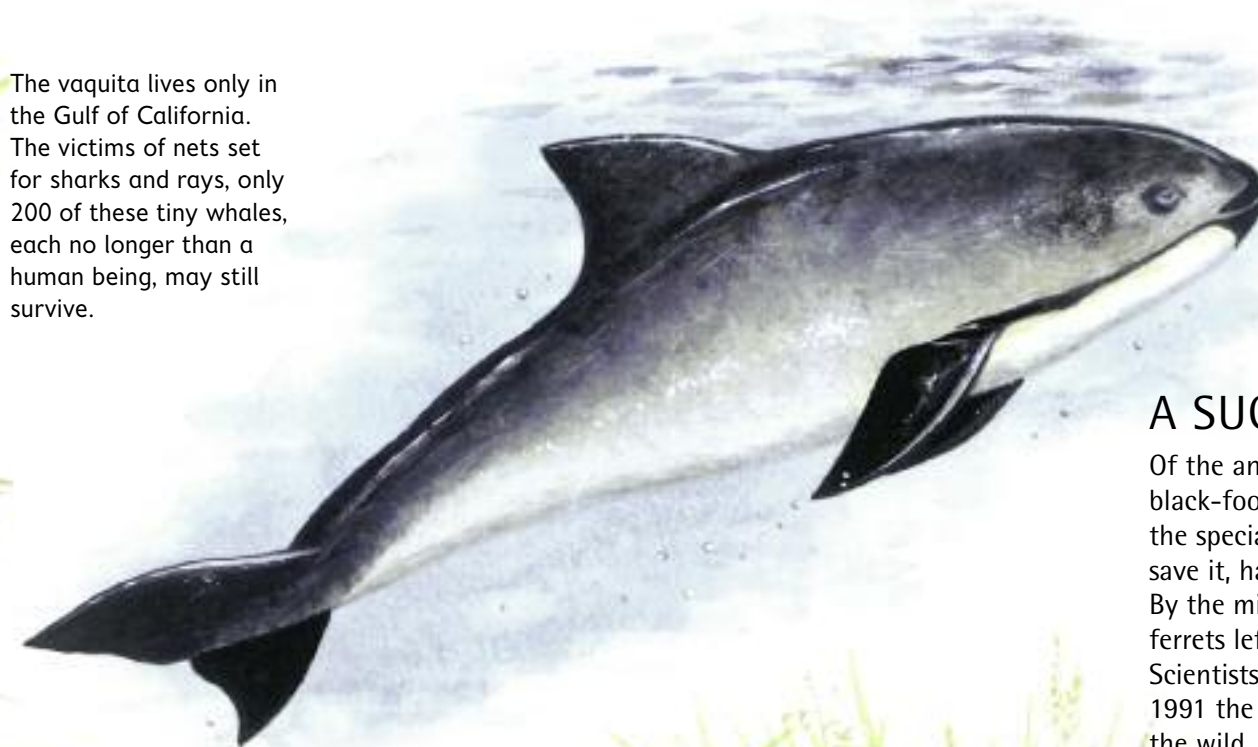
In the course of evolution (*see page 49*), every kind of animal eventually dies out, but we humans are speeding up the rate at which many become extinct. In the past, hunters were the worst culprits, wiping out some animals for food or sport, and others because they threatened people or livestock. Now wild creatures die out when farms and cities gobble up the forests, prairies and marshes where they live.

The Red List of Threatened Species for 2007, issued by the World Conservation Union (IUCN) lists 16,306 species threatened with extinction. One in three amphibians, one in four mammals, one in eight birds and more than two-thirds of plants are thought to be at risk. Human alteration of habitats and climate change are the biggest causes. Besides all these, millions of unknown kinds of insects could vanish for ever even before we have discovered them!

Fewer than 200 Tonkin snub-nosed monkeys live in the wild, in four small patches of bamboo forest in Vietnam.



The vaquita lives only in the Gulf of California. The victims of nets set for sharks and rays, only 200 of these tiny whales, each no longer than a human being, may still survive.



A SUCCESS STORY?

Of the animals pictured here, only the black-footed ferret, which is enjoying the special care of people determined to save it, has a good chance of survival. By the mid 1980s, there were just 18 ferrets left, all living in Wyoming, USA. Scientists caught and bred them, and in 1991 the first ferrets were returned to the wild. Today, numbers are up to more than 600 individuals.

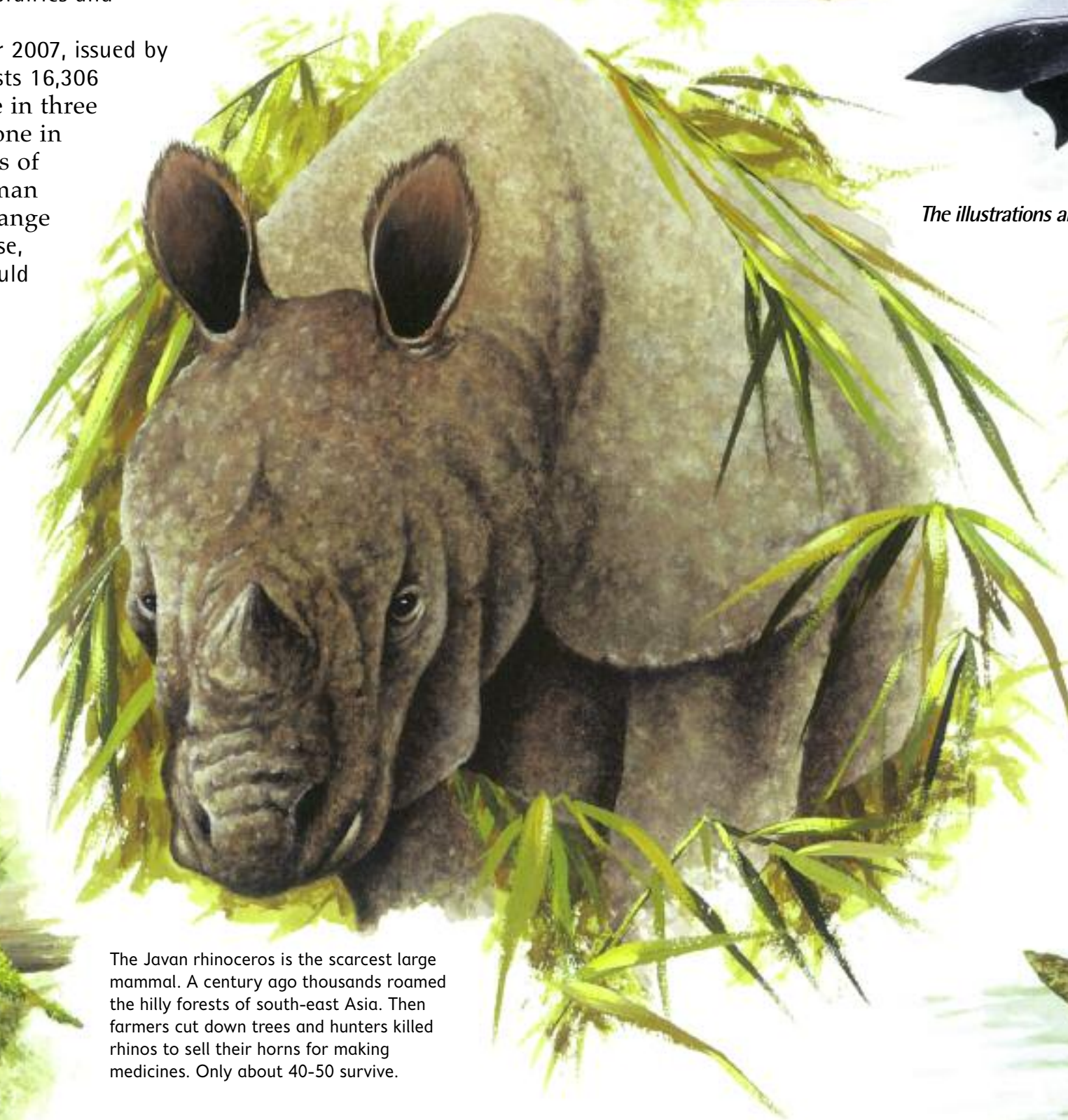
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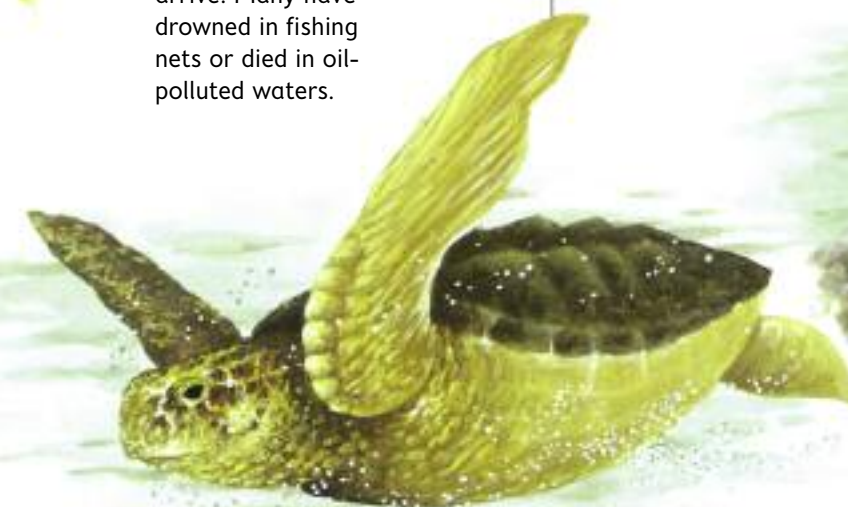
Spix's macaw is now believed to be extinct in the wild. About 70 are kept as pets. Breeding captive birds is now the only hope of keeping this species alive.



The Javan rhinoceros is the scarcest large mammal. A century ago thousands roamed the hilly forests of south-east Asia. Then farmers cut down trees and hunters killed rhinos to sell their horns for making medicines. Only about 40-50 survive.



Kemp's ridley sea turtle breeds mainly on one beach in Mexico. Once tens of thousands came; now only a few hundred arrive. Many have drowned in fishing nets or died in oil-polluted waters.



PRECARIOUS POND-DWELLERS

Changes in the weather can put some animals at risk. Golden toads live only in Costa Rica's moist, misty mountain forests. In 1988 little rain fell and the toads' breeding ponds dried up. By 1990 no toads could be found at all.

The Devil's Hole pupfish lives only in a flooded Californian cave. Between 38 and 42 individuals were counted in 2007.



DOUGLAS FIR
128 m tall
Believed to be
tallest known tree

COAST REDWOOD
115.5 m tall
Tallest living tree

**EUCALYPTUS
(MOUNTAIN ASH)**
97 m tall
Tallest broadleaf tree

TREES CAN GROW far higher and heavier than any other living thing. The tallest known tree may have been a Douglas Fir: one felled on Vancouver Island, British Columbia 100 years ago was said to be 128 metres tall, although this was never verified. The tallest trees alive today are coast redwoods growing on the slopes of north California's Coast Ranges.

The heaviest living tree and the most massive living thing of all is one of another kind of redwood from California. Called 'General Sherman', this giant sequoia, perhaps more than 3000 years old, is thirteen times heavier than a blue whale, the largest animal. Its trunk is 25 metres wide just above the ground. You can punch its thick, spongy bark without hurting your hand!

Trees can live longer than almost any other kind of plant. One of the longest-living trees in the world, the bristlecone pine can live to be more than 5000 years old. The oldest bristlecone pines would have begun life around the same time as the dawn of the ancient Egyptian civilization. Probably the oldest kind of living tree is the maidenhair, or ginkgo. Its fan-shaped leaves look almost exactly like fossil leaves preserved in rocks known to be more than 160 million years old.

GIANT SEQUOIA
2500 tonnes
Heaviest living tree

The ginkgo (*below*) is a living fossil, probably the oldest kind of tree alive today. Ginkgoes existed in the age of the dinosaurs.

One of the oldest-living trees is the bristlecone pine (*below*). Bristlecones grow very slowly on the high, windswept slopes of the Rocky Mountains.

BANYAN TREE
600 m around
*Greatest canopy
(spread of branches)*

The banyan tree, a kind of fig, is a holy tree in India. Its roots grow downwards from its branches and support them like pillars. This allows the tree to keep growing outwards.

A fat baobab tree (*below*) can measure more than 50 m around its trunk. Its huge, bottle-shaped trunk is for storing water during the dry season in Africa. In long droughts, some baobabs may actually shrink in size.

GIRAFFE
5.5 m
Tallest animal



The illustrations are approximately to scale

THE TALLEST TREES

Nature's skyscrapers



THE LARGEST FLOWER

The mysterious *Rafflesia*

WALKING THROUGH a south-east Asian forest, you might sniff a disgusting smell like rotting meat. This stench would lead you to one of the strangest plants on Earth. A scientist named it *Rafflesia* after Sir Thomas Stamford Raffles, the British colonial governor who founded Singapore. People also call it the stinking corpse lily. But *Rafflesia* is not a lily, nor is it like any other ordinary flowering plant.

You will see no stem, and there are no leaves or roots. The whole plant consists of long, thin threads hidden from sight – and one huge flower up to 90 centimetres across, the largest flower in the world. With five reddish 'petals' resembling slices of raw meat, the flower is very heavy, too. A large specimen may weigh more than a one-year-old child.

Rafflesia has a flower almost as big as a bus wheel but no roots, stem or leaves for making food. This parasite steals ready-made nourishment from another plant. From the sticky seeds produced by female flowers sprout the threads that form a new *Rafflesia* plant. The threads burrow through the rough bark of a jungle vine. Nine months later, a new flower bud bursts open.



THE FIRST FLOWER

No one knows when the world's first flowering plant bloomed, or what it was. But fossil leaves and pollen found in rocks do show that flowering plants existed more than 125 million years ago. The earliest kinds (*left*) may have looked like today's magnolias. Scientists believe that the magnolias' ancestors were related to cone-bearing pines and fir trees. Unlike these kinds of plants, flowering plants carry seeds covered with a special outer coat. These well-protected seeds helped flowering plants to multiply and spread around the world.

THE SMALLEST FLOWER

This picture shows *Wolffia*, the world's tiniest flowering plant, hugely magnified and cut open from one side. Its flowers grow inside a special hollow. About the size of a comma on this page, *Wolffia* is so small that you cannot see it properly without a magnifying glass. Millions of these floating plants mass together to form green scum on ponds. There are about a dozen sorts of *Wolffia* in different parts of the world. The smallest kind, *Wolffia arrhiza*, lives in Australia.



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