THE new FUNK & WAGNALLS ILLUSTRATED WILDLIFE ENCYCLOPEDIA

VOLUME 24

WIL-ZOR & INDEX

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Cover Photo: Puffins
Gunter Ziesler—Bruce Coleman Ltd.

Frontispiece: Burchell's Zebra
Eric Hosking

ISBN 0-8343-0035-4
Library of Congress Catalog Card Number 80-66926

Printed in the United States of America

Volume 24

Wild cat

André Fatras

Wild cat

The wild cat of Europe and Asia resembles the domesticated tabby but is more heavily built. The average length is about 2 ft 9 in. of which 11 in. is tail, but there is a record from Scotland of one that reached 3 ft 9 in. total length and there is an unconfirmed report of one shot in Scotland that measured 4¼ ft. The weight of a male averages 11 lb but may be as much as 15 lb and that of the female 8½ lb with a maximum of 10 lb; one wild cat from the Carpathians weighed nearly 33 lb. The wild cat has a squarish, robust head and a stouter and longer body than the normal domestic cat. The thick bushy tail is relatively shorter than in the domestic cat and is ringed, ending in a long black tip. The limbs, too, are longer than those of the tame cat.

The fur is long, soft and thick, and is mainly yellowish-grey but there is a good deal of variation. Individuals differ in their dark brown markings, some having vertical stripes running down the sides, while in others these are broken up to form spots. Since there seems to have been considerable cross-breeding with feral domestic cats some of the variations in the pattern of the coat may be due to this.

In Europe the wild cat is now confined chiefly to the mountains, especially in the Balkans, and in the British Isles it is restricted mainly to the Scottish Highlands north of the Great Glen, where its numbers are said to be increasing. It also extends into Asia Minor with related species in central Asia.

Wild and inaccessible home

The wild cat lives on very lonely and inaccessible mountainsides or in wooded places, hiding during the day among rocks and prowling far and wide at night in search of prey. It hunts alone or in pairs, being most active at dawn and at dusk, although in the autumn there is a tendency to hunt by day. The home range covers an area of 150–175 acres which is defended by the male, who may wander well outside this in search of food in winter or in the breeding season. Like the domestic cat, the wild cat will shelter from the rain but loves to bask in the sun, on a bough or a rocky ledge.

The wild cat is one of the fiercest and most destructive of the cat family and when hard pressed its strength and ferocity are remarkable. Some so-called wild cats are feral domesticated cats and although these do not attack human beings they will fight capture as furiously as the true wild cat.

Geoffrey Kinns: AFA

◁ *Feline ferocity: a Scottish wild cat at bay.*

The voice of the wild cat ranges from a meeow, a growl when angry and a purr when pleased, to the typical small cat scream or caterwaul on occasion. C St John writing in 1845 says: 'I have heard their wild and unearthly cry echo far into the quiet night as they answer and call to each other. I do not know a more harsh and unpleasant cry than that of the wild cat.'

Poultry and lambs in peril

The wild cat's main food is mountain hares, grouse and rabbits but it will eat any small mammal or bird it can catch as well as fish and insects. It can kill a roe fawn and create havoc among poultry or lambs, this being the main reason why it has been wiped out in much of its former range.

Fierce mother

There are two breeding seasons, in early March and again in late May or early June, the litters of 4–5 kittens being born in May and August respectively. Very occasionally there is a third litter in December or January, but it is suspected that these may have been from a domestic-wild cat cross. The gestation is 63 days. The kittens are born in a nest made by the female in some remote rock cleft or hollow tree, well away from the male, who may kill his own young. The kittens' fur is a light ground colour with greyish-brown tabby markings. The female is very fierce while she has her kittens in the nest and will attack any animal, no matter what its size, that dares to intrude. Even the kittens will spit and fight if handled. Very few have been taken alive and all are said to have proved untameable. They leave the nest at 4–5 weeks old but do not go hunting with the mother until 10–12 weeks old and they are not weaned until they are 4 months. They leave the mother to fend for themselves when 5 months old.

Persecuted by man

Although the wild cat now has few natural enemies as most of the large predators in its range have been wiped out, it nevertheless has always had man's hand against it because of its destructiveness to poultry and lambs. Many years ago, when it was widespread over England, the wild cat was hunted for sport.

Unsolved problems

We can be fairly certain that the domestic cat is not descended from the European wild cat. As suggested on p. 522 we cannot be sure whether the domestic cat came from the jungle cat or the African bush cat. Moreover, we cannot be sure that the jungle cat and even less the bush cat does not belong to the same species as the European wild cat. In any case they look very much alike and they behave in much the same way, and above all, the kittens of all three species are said to be virtually untameable.

To say that the wild cat kittens are untameable, even if taken into captivity before their eyes are open and hand-reared, is to risk the challenge from one or more people who claim to have hand-reared and tamed a kitten from a wild cat mother. The probability is that the remark is acceptable as a generalisation, but to all generalisations there are exceptions. With all wild mammal babies we know that the chance of successful taming is increased the earlier they are taken from the mother and hand-fed before the eyes open. Moreover, in every litter there will be one that is more tameable than the others. Possibly therefore the domestication of the cat from its wild ancestor depended on selecting the more tameable kittens and hand-rearing them almost from birth. However, there is evidence from the personal stories of a few who have tried this which suggests that when a wild cat kitten has been tamed, it can be handled by the person who hand-reared it, and by nobody else. So it is indeed remarkable that the cat was domesticated in the first place, although some insight is gained into the independent nature of the domestic cat.

class	**Mammalia**
order	**Carnivora**
family	**Felidae**
genus & species	***Felis sylvestris***

Wildlife Parks and Reserves

In an ideal world, wildlife parks and nature reserves would not exist. However, it has been necessary to set up such sanctuaries all over the world to protect habitats, animals and plants from the activities of man. The main causes of the disappearance of wildlife and the extinction of certain species are hunting, habitat destruction (to make way for building or agriculture), over exploitation and pollution.

Today there are over 600 parks, reserves and refuges. In most cases, people are welcome to go and enjoy the beauty and fascination of these natural wild areas and to observe the animals and plants living there. These are there for interested tourists, nature lovers, conservationists and research scientists. The many endangered species that survive only in these parks include the tiger in the parks of Asia, the Indian lion in the Gir Forest, the koala bear in Australia, the osprey in Scotland, the whooping crane in America, to name but a few. Various bodies help finance the reserves and sanctuaries. For example, in the USA the National Audubon Society runs the Big Cypress reserve, the Rainey Sanctuary and the Pacific Grove Butterfly Sanctuary in California. The World Wildlife Fund US National Appeal has helped save other important habitats including the Texas habitat of the prairie chicken and the marshlands in southern New Jersey.

Space allows only a handful of the wildlife refuges and parks to be discussed but each one does offer the required sanctuary in order that many species of animals and plants will not disappear for ever from the face of the earth. Conservationists all over the world are striving daily to establish more reserves in order that certain habitats are saved from man's encroachment of the land.

AFRICA

Etosha National Park, South-West Africa
16 250 000 acres, 4000 ft above sea level. A flat, semi-arid stretch flooded by heavy rains to a depth of about 3 ft annually. The water seeps away within weeks and reappears in one or other of the waterholes that support thousands of animals. Mammals include springbok, Burchell's zebra, brindled gnu, kudu, hartebeest, giraffe, elephant, bat-eared fox, lion, cheetah, leopard, aardwolf. Birds include ostrich, giant bustard, crane, secretary bird, hornbill, eagle and all kinds of waterfowl.

Kalahari Gemsbok National Park, South Africa
3700 square miles. Arid sand dunes and sparse vegetation, crossed by two watercourses, the Auob and the Nossob, which flow only once or twice a century. These watercourses provide the only roads across the park. Mammals include gemsbok, springbok, gnu, eland, lion, hyaena, camel (imported and escaped to become feral), kudu, leopard, cheetah and jackal. Birds include secretary bird, giant bustard, namaqua dove, lammergeier, vulture and eagle.

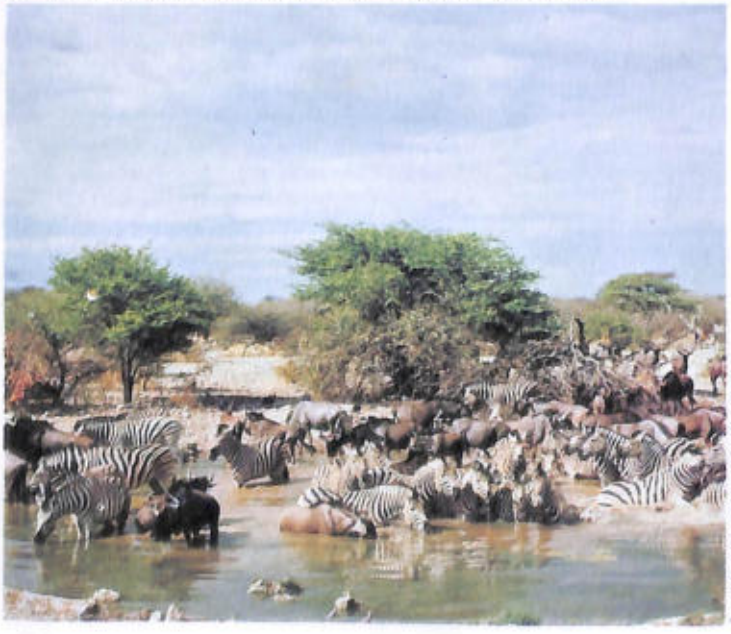
Kruger National Park, South Africa
8000 square miles. South Africa's greatest park and one of the finest of the world's accessible wildlife areas, with excellent facilities for tourists throughout the park. In the south are wide, grassy plains crossed by meandering rivers, these habitats slowly merging with the more rugged bush of the centre and north. The main rivers, the Sabie in the south and the Olifants in the north, cross the park from the east, with deep gorges being formed in some areas. In parts there are densely wooded slopes, but most of the landscape is open and ideal for watching the varied wildlife.

Lake Manyara National Park, Tanzania
123 square miles. This large salt lake lies in the northern part of the rift valley, between the Arusha National Park (famous for the Ngorongoro crater) and the Serengeti. Water accounts for 64 000 acres of the park, and some 21 120 acres are land. As the ground rises up the western escarpment of the Rift, five zones of vegetation are met, beginning with a groundwater forest of soaring mahogany and fig with plenty of open spaces, then extensive reed marshes fringed by open grassland, this giving way to park-like groves of acacia before rising to the scrub and scree of the escarpment. Mammals include elephant, buffalo, black rhinoceros, zebra, lion (this is one of the few areas where these cats can be seen reclining in trees), leopard (also in trees), hippo, impala, monkey, baboon and giraffe. Birds on and near water include flamingo, pelican, various waterfowl, jacana, egret and stork. Birds on land include plover, courser, lark, kingfisher and wagtail.

Lake Nakuru National Park, Kenya
11 650 acres. Famous as a sanctuary for the vast population of flamingoes that inhabit it, also for the nearby sodium lakes. As well as the 1½ to 2 million flamingoes some 400 other species of birds occur in the park. The big congregations of lesser and greater flamingoes are on the west side of the 8-mile-long lake, where the margins are firm and the water only inches deep.

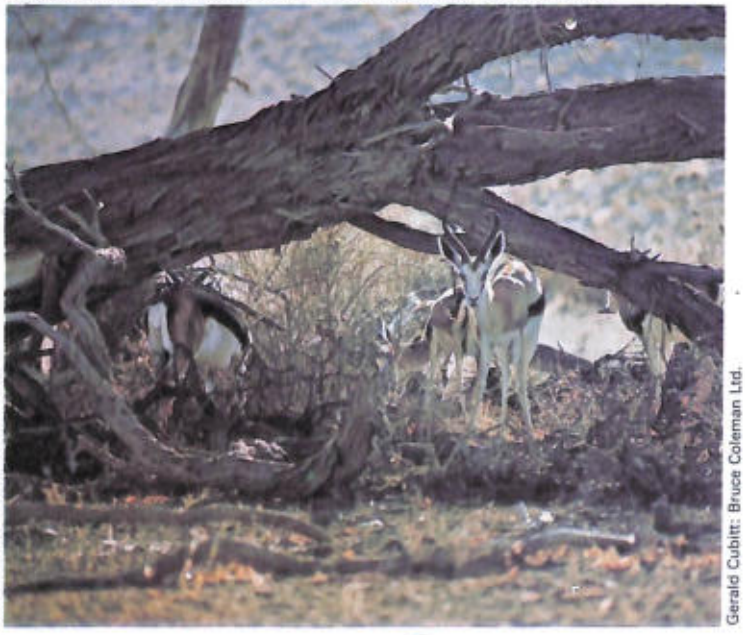
Nairobi National Park, Kenya
44 square miles. The boundary of the park is just 5 miles from the centre of Nairobi so that it is very popular (about ¼ million people visit it each year) and it is more like a huge open zoo than an African wildlife park. Mammals include lion, leopard, black rhino, buffalo, zebra, impala, Thompson's gazelle,

Burchell's zebra and wildebeest (gnu) at a waterhole in Etosha National Park. Waterholes are the best places to find animals in such dry conditions.



Carol Hughes: Bruce Coleman Ltd.

Springbok in the Kalahari Gemsbok National Park. They are the most numerous animals in the park and can be seen in herds of up to 1500.



Gerald Cubitt: Bruce Coleman Ltd.

Grant's gazelle and giraffe. Birds include Masai ostrich, secretary bird, crowned crane, marabou stork and Kori bustard.

Ngorongoro Conservation Area, Tanzania

102 square miles. The caldera or cavity of the extinct volcano is one of the wonders of the world. It averages between 10 and 12 miles across and its rim soars to 2000 feet above the floor, which is 5500 feet above sea level. A lake is at the centre of the crater, and from this bamboo and tropical humid forest spread out, giving way to dry plain and bush. Wild animals and Masai grazing flocks co-exist in this area, as well as in the total area of the caldera (3200 square miles). Mammals include black rhinoceros, buffalo, elephant, lion, leopard, gnu, zebra, cheetah, hunting dog, jackal, gazelle, various antelope, vervet monkey and genet. The most spectacular birds are the birds of prey, such as Verreaux's eagle, steppe eagle, tawny eagle and vultures, that range the high cliffs of the crater.

Serengeti National Park, Tanzania

5700 square miles plus. This park is famous for the large and spectacular concentration of plains animals that can be seen. Around 1¼ million plains animals inhabit the region, over 300 000 of these being gnu. For most of the year the animals roam the vast, treeless plain, but in late May or early June, as the dry season begins, they begin to congregate and make their famous migrations to the western corridor of the park, searching for fresh grass and water. Prides of black maned lions can be seen hunting along the processions of animals. Mammals include gnu, Thompson's and Grant's gazelle, lion, leopard, hyaena, hunting dog, cheetah, black rhino, giraffe, buffalo and Coke's hartebeest. Over 300 species of birds can also be seen.

ASIA

Gir Wildlife Sanctuary, India

500 square miles. The last stronghold of the Indian lion which is rigidly protected and watched over by rangers. Apart from the lion, other mammals that inhabit the forested sanctuary include the wild pig (the lion's main prey), serow, nilgai, sambar and axis deer, chital, bear and hyaena.

Jaldapara Game Reserve, India

36 square miles. Set up in 1961 specifically for the conservation of the Indian rhino, of which there are now over 60 living in the riverine forests along the banks of the river Torsa in northern Bengal. Other mammals include a few wild elephants, tigers, various deer and wild pigs. Peafowl and junglefowl are among the numerous birds.

Manas Wildlife Sanctuary, India

105 square miles. Famous for its wild buffaloes, this attractive area stands at the foot of the Himalayas where the river Manas tumbles through a magnificent forested gorge and spills out onto a plain. Rhino, wild elephant and tigers can also be seen, as well as a wealth of bird life.

Mount Apo National Park, Phillipines

190 000 acres. Mount Apo is the highest peak in the islands and soars above this park. The area is famous for being the home of the monkey-eating eagle, but deer, wild pigs, as well as monkeys, can be seen in this attractive area with its hot spring, dense forests and rushing waterfalls.

Eric Hosking

A small colony of hippopotamuses inhabits the eastern swamps of the Ngorongoro Conservation Area.

Sariska Wildlife Sanctuary, India

80 square miles. Set in a most beautiful part of Rajasthan and of special interest as tigers can be watched (and photographed) on a tethered kill in a floodlit clearing from special observation towers, and birds that are normally wary, such as partridge, quail and sand grouse, wander around at ease. Other mammals include leopard, wild boar, samba, nilgai and four-horned antelope.

AUSTRALIA

Atherton Tablelands, North Queensland

Several national parks are dotted throughout this tropical area which rises over 2000 ft in a great escarpment from the coastal plains south of Cairns. The soil is volcanic red and the tropical rain forests are among the most scenic in Australia. Several species of possums and the Lumholtz's tree kangaroo are found in the rain forest, but one is likely to see them only at night with the help of powerful flashlights. Flocks of white cockatoos, fruit bats (hanging from trees), king parrots, golden bowerbirds, scrub turkeys and cassowaries are among the animals that can be seen during the day. Orchids, vines and creepers are found in the rain forests.

Ayers Rock/Mount Olga National Park, Alice Springs

487 square miles. The great sandstone bulk of Ayers Rock makes this one of the most bizarre landscapes of Australia and the world. Thousands of people fly in or drive the 300 miles from Alice to see the spectacle. Kangaroos, dingos, snakes, lizards and various parrots, including budgerigars, are among the wildlife to be seen.

The dense, tropical rain forest of Mount Apo National Park provides a home for many species.

G. Ziesler: Bruce Coleman Ltd.

Green Island, Great Barrier Reef, off Cairns, Queensland
30 acre coral atoll. Two hours by boat from Cairns, this white coral-sanded island offers a hotel and underwater observatory. At low tide the coral reef is exposed and the visitors can inspect the coral for starfish, small fish, brittlestars, sea urchins and numerous shells–alive and dead. The inland vegetation is dense jungle of mangrove palms, pandanus and white cedar, with reef herons nesting there. Green turtles and bat rays as well as puffers, surgeon fish, clown fish and giant groupers can be seen swimming in the clear, warm waters.

Heron Island, Great Barrier Reef, Queensland
A half mile long by 300 yards wide. Beautiful resort off Gladstone town with the centre of the island a jungle of brittle pisonia trees growing up to 60 ft. Pandanus and wild poinsettias grow here as well. A famous feature of this coral cay are the extensive burrows of the mutton birds (wedge-tailed shearwaters) that breed here during October. An ornithologist's paradise, with white-breasted seagulls (nesting), cormorants, sea curlews, terns, various gulls and, of course, herons.

Lamington National Park, Brisbane, Queensland
48 870 acres. Best known of Queensland's national parks. An area of mountain peaks and escarpments, scored by deep, winding river gorges. It is mostly rain forest with giant trees, vines, ferns and orchids. Marsupials are not easily seen, koalas being rare, wallabies sparsely distributed and most of the others such as possums, sugar gliders, bandicoots and mammalian rodents being nocturnal. The egg-laying monotremes–platypus and echidna–are also rare. Birds are numerous and great variety is found, from whipbirds, catbirds and mountain parrots to Albert lyrebirds and rufous scrubbirds.

Bill Wood: Bruce Coleman Ltd.

Heron Island, off the Great Barrier Reef, is a coral island famous for its muttonbirds.

CANADA

Wood Buffalo National Park, Alberta
17 300 square miles. The continent's largest national park, but it is more of a huge reserve than an accessible vacation area, as it lies in the untamed lands of northern Alberta, overlapping into the Northwest Territories. With enormous forests, broad grasslands, large and small lakes, few inhabitants are found in the immense park. Initially this park was established to protect the few remaining wood bison. In 1947 plains bison were introduced from the south and the subspecies have interbred. The largest herd in North America now lives here with over 15 000 head inhabiting the region. Other mammalian species include moose, elk, deer, black and brown grizzly bears, wolf, lynx and wolverine and numerous rodents such as squirrel, beaver and porcupine. Migrant fowl such as Canada, white-fronted and snow geese abound on the numerous lakes as do all kinds of wild ducks and coots. Ptarmigan and grouse are also among the birdlife.

Glacier National Park, British Columbia
330 000 acres. This mountainous region takes its name from the gigantic Illecillewaet Glacier, a 10 miles square block of ice that descends 3500 ft from its head. Black and grizzly bear live here, as well as mountain goat, mule, white-tailed deer, moose, elk, caribou and several other smaller mountain mammals. Many species of small colourful songbirds can be seen, as well as golden eagles, hawks and owls.

Banff National Park, Alberta
1 600 000 acres. Established in 1887, this is Canada's oldest national park and includes a remarkable hot spring at Sulphur Mountain. Like Jasper National Park to its north it contains an enormous stretch of the eastern slopes of the Rockies. Now a famous resort centre. Very beautiful lake-strewn landscapes can be seen and the countryside is teeming with wildlife. Most of the Canadian mountain-dwelling mammals can be seen and over 180 species of birds.

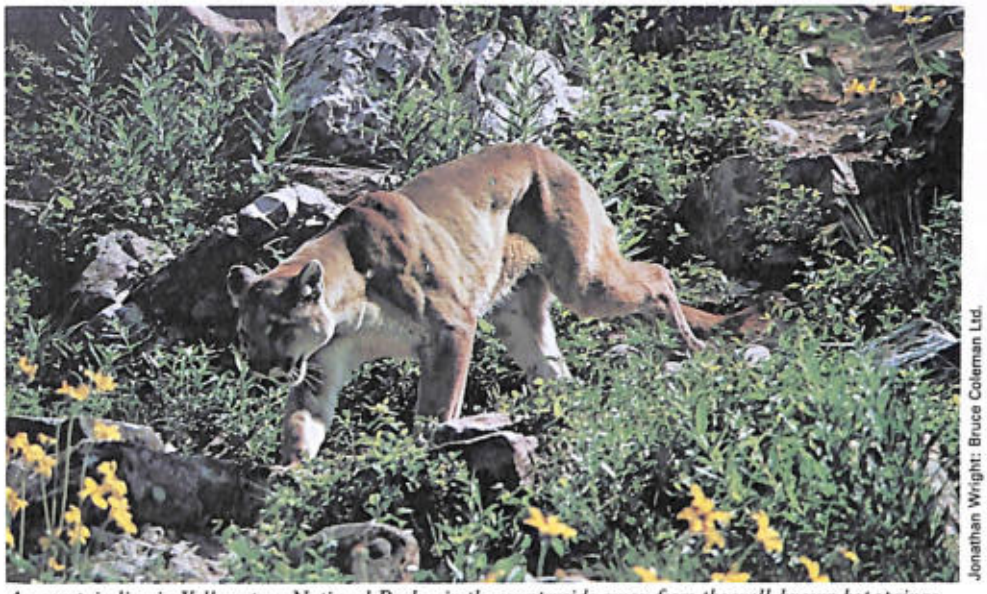
Sure-footed ibex moving up a narrow path on a cliff face in the Gran Paradiso National Park.

Peter Jackson: Bruce Coleman Ltd.

EUROPE

Bialowiecz National Park, Poland
12 683 acres. The area was protected in 1919 and became a park only in 1947 with the principle aim of protecting and ensuring the survival of the European bison or wisent. It is a unique stretch of virgin lowland forest which ranges from marshland borders to mixed stretches of pine, spruce and hornbeam with a thick undergrowth of various shrub species. Elk, lynx, brown bear, beaver and small forest mammals can be seen, as well as numerous European forest birds.

Cairngorms National Nature Reserve, Scotland
64 118 acres. Britain's largest national nature reserve covering the central mass of the Cairngorm mountains. Reindeer were



Jonathan Wright: Bruce Coleman Ltd.

A mountain lion in Yellowstone National Park – in the countryside away from the well-known hot springs.

imported to the area in 1950 and now a large breeding herd is established. The native red deer can be seen in large herds as well as roe deer. Other mammals include the wild cat, fox, badger, otter, red squirrel and mountain hare. Birds include the golden eagle, osprey, peregrine falcon, snow bunting, capercaillie, black grouse, buzzard, ring ouzel and siskin. Above 2000 ft the ptarmigan can be found.

Camargue, France

One of the finest wildlife viewing areas of the world and perhaps Europe's greatest natural treasure. There are a number of distinct zones, each one having a particular animal population. The marshes and reedbeds contain marsh and Montagu's harriers, heron, little bittern, various warblers, crakes and the whiskered tern. The saltwater lagoons which make up most of the area are the home of the world-famous flamingo population, as well as large breeding colonies of terns. The sand dunes are wooded with stone pine in places and here are found night and squacco herons and little egrets.

Coto Doñana Reserve, Spain

33 000 acres. Bird-watchers' paradise in the marshy, many-branched delta of the Guadalquivir river. There are several habitats in this area: including the sandy beach (Caspian and Kentish plover), dunes and slacks (stone curlew and theckla lark), woods of stone pine and juniper (wild boar and mongoose, rich bird life), the plain (golden oriole) and the marismas (Montagu's harrier and sandgrouse).

Gran Paradiso National Park, Italy

140 000 acres. An alpine zone park at the centre of the great arc formed by the Graian Alps, where over 3700 ibex and around 8000 chamois live. Various other European mountain mammals and birds can be spotted.

NORTH AMERICA

Everglades National Park, Florida

1 400 533 acres of islands, sea, mangrove swamp, and sawgrass, at or near sea level. This area is the most southerly point of the US mainland and contains animal communities unique to the country, such as the wood stork, Everglades kite and swallowtail kite, which is very rare. Another rare sight is the saltwater crocodile, and manatee, alligator and otter can be seen in the waters. Among the major species of birds are wood ibis, white ibis, roseate spoonbill, pelican and laughing gull.

Glacier National Park, Montana

1600 square miles. Although in places the terrain is open and park-like, most of the region is mountainous with some 40 glaciers and many wide valleys, some of them with lakes. The fauna is typical of north American mountains and includes mountain goat, bighorn, black and grizzly bear, as well as many rodent species. Over 200 bird species can be seen including Lewis's woodpecker, finch, pipit, hawk, eagle and nuthatch.

Grand Canyon National Park, Arizona

310 square miles. A most spectacular gorge with near-equatorial desert at the bottom (2000 ft) and blue-spruce landscapes at its northern rim (9000 ft). The animal life also varies from one climatic zone to another. On the gorge floor can be found desert spiny lizards, rattlesnakes and chuckwallas. The gorge is accessible only on foot or mule and only by well marked trails. The 217-mile chasm is not navigable in the ordinary sense, although several expeditions have gone down the awesome rapids.

Mount McKinley National Park, Alaska

3030 square miles. Most of the park is above the timberline, a refuge for dall sheep, barren caribou, grizzly bear, moose and red fox, as well as numerous rodents and lagomorphs. Over 130 bird species can be seen.

Yellowstone National Park, Wyoming

3472 square miles. America's oldest, largest and most famous national park, with volcanic and glacier-carved countryside. The famous geyser Old Faithful is a regular tourist attraction, although 200 others exist. Away from the thermal areas the park is forested and undeveloped, offering a home for black bear, mule deer, moose, pronghorn, bison and over 200 bird species. Among the birds are bald eagle, osprey, white pelican, mallard, trumpeter, western tanager, mountain bluebird, Canadian jay and water ouzel.

SOUTH AMERICA

As yet only a dozen or so national parks exist on this continent, and although there is a prolific animal life of unique species their habitats are difficult to reach as large areas of the continent are barely modified by human influence. However, many species, such as the jaguar and the golden lion marmoset, do need protection due to animal trading.

Mount McKinley National Park is worth a visit not only for its animals but also for its scenery.

Charlie Ott: Bruce Coleman Ltd.

Wobbegong

Wobbegongs, or carpet sharks, are most unusual sharks. Unlike most sharks the wobbegong uses cunning instead of speed to obtain its food. Resting on the sea bottom it looks like a rock overgrown with seaweed, a perfect camouflage to enable it to pounce on unsuspecting victims. Most wobbegongs are small but some of the larger species grow to a length of 6—8 ft; the largest of all is ***Orectolobus maculatus****, which ranges from Queensland to South and West Australia and Tasmania, reaching 10½ ft.*

The wobbegong is quite unlike the usual shark in shape. It has a stout, thick-set, flattened body with a very broad head and a blunt rounded snout ending in a wide straight mouth. Its teeth are slender and pointed, those in the centre of the mouth being the largest. Its eyes are small with folds of skin below them, and the wide, oblique slits of the spiracles are situated behind the eyes and lower down on the head. The last three or four external gill-clefts on each side open above the bases of the pectoral fins, which are broad and sometimes rounded. The two dorsal fins are comparatively small. The anal fin either reaches to or is actually joined at its base to the lower lobe of the tailfin which is long and asymmetrical with a notch in the end. The skin is covered with small rough denticles. The colour of wobbegongs varies with different species and individuals but the ground colour is usually brown, yellowish or grey with distinctive mottled or striped markings of a lighter or darker colour. What distinguishes the wobbegong from any other shark is the fringe of fleshy lobes or flaps of skin around the sides of the head and mouth which resemble fronds of seaweed when the shark is at rest.

There are about five species of wobbegong living in the seas around China, Japan and east and south Australia.

Sluggish existence

The wobbegong lives an inactive life spending most of its time lying hidden on the sea bottom among the rocks and weeds, only coming to life when a fish passes by for it to snap up. It is further concealed by waving its flaps of skin so they look even more like seaweed. Its heavy body is not built for speed like most other sharks that hunt their prey, but its perfect camouflage gives it an equally effective means of obtaining food. Wobbegongs do not need to keep moving, as do typical sharks, in order to breathe. They draw water into the gill chamber through the spiracles, in much the same way as skates and rays.

Wobbegongs are not aggressive and under normal circumstances are not considered very dangerous to humans. Nevertheless, cases have been known of their attacking people wading in shallow water. Their long pointed teeth are said to be perfectly capable of biting off a man's foot but they very seldom attack unless stepped on or provoked in some other way.

The wobbegong has little or no value as food but its colourful variegated skin makes it valuable in the shark-leather industry.

Snapping up fish

The wobbegong feeds on any fish or crustacean which comes within reach of its jaws as it lies hidden on the sea bottom. It has even been known to snap fish from the spears of underwater fishermen.

Little-known breeding

Very little is known about the breeding habits of the wobbegong. Like the nurse sharks it is ovoviviparous and produces large numbers of young at each birth.

A fisherman attacked

Despite the fact that the wobbegong is not considered a very dangerous shark an instance has been recorded in New South Wales, Australia, of one attacking a spear-fisherman who was fishing in Shellharbour in 1953. He was using a snorkel and wearing an underwater mask with a bright metal band. He was trying to spear a dying grouper and running out of shafts he surfaced and borrowed another gun. As he shot a spear into the fish it came out of its cave followed by a large, brown wobbegong shark with three or four tentacles hanging from its lip. The spear-fisherman swam quickly for about 15 yards but the shark rushed at him to attack. It is well known that bright objects and metal attract sharks and the wobbegong was obviously going for the mask with its bright metal band. It tore away the face piece and snapped off the snorkel. The rush of the attack was so great that both the shark and the fisherman were hurled from the water, enabling the fisherman to escape with injuries only under his chin and to his face and nose.

class	**Chondrichthyes**
order	**Lamniformes**
family	**Orectolobidae**
genus & species	***Orectolobus maculatus*** *others*

Ben Cropp

◁ *Wobbegong* ***Orectolobus ogilbyi*** *lurks, nearly perfectly camouflaged, in its Barrier Reef niche. Unique among sharks, the seaweed-like fringe which breaks the outline of the mouth is clearly visible in this shot.*

Pierre Montoya : Jacana

Wolf

Thought by many to be at least one of the possible ancestors of the domestic dog, the wolf was once widespread over Europe, most of Asia and North America and had a range probably greater than any other land mammal. Today, there are two distinct species of wolf, the grey or timber wolf which is still found in the wilder parts of northern Europe, Asia and North America and the red wolf which is restricted to the south-central United States. There are numerous local races, however, differing in size and colour.

The grey wolf is the larger of the two, with a head and body length averaging 42–54 in. and a tail of 11½–22 in. The height at the shoulders is up to 38 in. The weight varies from about 60–150 lb. The grey wolf tends to be heavier in the more northern parts of its range—one shot in east-central Alaska weighed 175 lb. The red wolf is more slender, weighing on average 33 lb, occasionally 70–80 lb.

Both species are dog-like in appearance. They have large heads with erect rounded ears and long muzzles with strong jaws which contain 6–7 cheek teeth on each side, including a well-developed carnassial. The limbs are long and slender with four toes on the hindfoot and five on the forefoot, each bearing non-retractile claws. When angry, wolves erect the long hair on the nape of the neck, so that it looks like a mane. There is a scent gland on the upper side of the tail near its base which is used for recognition.

The colour of the grey wolf varies considerably over its range but it is usually grey, sprinkled with black apart from the legs and underparts which are yellowish-white. Black and light-coloured phases occur quite commonly. On the Arctic coast of Alaska and in western Canada, wolves are sometimes white throughout the year but more usually they are a mixture of white and grey tinged with brown. The red wolf is more tawny and sometimes small ones look like coyotes.

△ Wolves travel a great deal, and although a grey or timber wolf does not attain great speeds, its stamina enables it to keep a steady pace and journey for miles at a time.
▷ Overleaf. Both intelligence and a high degree of co-operation are required for animals to hunt in groups; only the mammals have these qualifications, and of them the wolves are among the most efficient. Here a pack manoeuvres in an attempt to make a strong adult moose panic, bolt, and thus expose its vulnerable flanks to the combined jaws of the pack. They are not always successful; a 16-strong pack studied on Isle Royale in Lake Superior, Canada, where this picture was taken, harassed an average of 16 moose for every one they killed. The wolves attack adult moose only in the winter, when deep snow gives the hunters the advantage.

Savage and intelligent

The wolf is a ruthless and ferocious carnivore. It is also very courageous and has great fighting ability, intelligence and endurance. It lives in open country and forests, hunting by day and hiding at night among rocks, under fallen trees or in holes dug in the ground. Wolves sometimes hunt singly or in pairs but more often they move in a family party or pack of from three to two dozen individuals. A single large wolf can bring down and kill a large steer but a pack can tackle much larger animals such as moose or elk. Although a wolf runs at an average speed of only 22–24 mph, reaching a maximum of 28 mph for short distances, it has remarkable powers of endurance and can keep up a loping run for mile after mile, running right through the night if necessary. It has greater powers of endurance than most large game animals and so it can usually outrun its prey. It travels widely and there is a record of a red wolf in Oklahoma which covered 125 miles in two weeks, crossing four mountain ranges. The wolf is


L. David Mech

Tom McHugh: Photo Res

△ *That lean and hungry look: timber wolf in alert pose. The wolf would seem, at first sight, the most probable ancestral dog, but some scientists have favoured an extinct wild dog.*

a good swimmer when necessary, sometimes pursuing deer into the water.

The wolves make use of pathways through the territory, which is usually in open country, often incorporating game trails and cattle tracks in these hunting routes which sometimes cover more than 100 miles and have numerous 'latrines' which also function as scent posts and vantage points on high ground for observation.

Large feeder

The wolf is an enormous feeder. It can eat ¼ of its body weight at one meal and then go without food for a considerable time, rather like a snake. Although it will kill large animals such as caribou, musk-oxen, deer, moose and horses, much of its food is made up of small animals such as mice, rabbits and squirrels. Fish and crabs are sometimes taken, as well as carrion. When natural food is short the wolf will take to killing any domestic livestock and poultry within its range. However, stories of attacks on humans have not been authenticated.

A large family

The breeding season is usually from January to March with a gestation of 60–63 days. There are 5–14 cubs in a litter, usually 7, born in a den prepared by the female. At birth the cubs are blind with a sooty brown fur, except in the Arctic where the white colour phase predominates and the cubs' fur is light blue or dull slate. The eyes open 5–9 days after birth and at 18 months the cubs are well-grown. Both parents teach the cubs to hunt and kill prey and the family may keep together for some time. The males are fully mature in 3 years and females in 2. They are thought to mate for life.

Slaughtered by man

Over many centuries the wolf's chief enemy has been man. Constant efforts have been made to exterminate it because of its destructiveness to domestic stock and even to human life. Numerous methods have been used to kill it, including poison, steel traps, shooting and hunting by dogs. In the USA the wolf has been deliberately exterminated from 99 per cent of its former range. And human settlement has deprived it of much territory. It says a lot for the wolf's cunning and endurance that it has survived at all.

The wolf in legend

From earliest times the wolf has been depicted in literature and legend as a symbol of savagery, courage and endurance. Beowulf, the legendary Teutonic hero, and many Anglo-Saxon kings and nobles incorporated 'wolf' into their names as an indication of their fighting prowess and in North America the Indians used the name for their most powerful warriors. Yet, strangely enough, there have been many stories, from way back in history, of wolves that have raised human children from infancy, lovingly looking after them and protecting them from other predators. The most famous story is that of Romulus, the legendary founder of Rome and his twin brother Remus. In more recent times there is a story from India of a child raised by a wolf until she was about 9 years old. However, such stories are almost certainly untrue.

class	**Mammalia**
order	**Carnivora**
family	**Canidae**
genus & species	***Canis lupus*** *grey or timber wolf* ***C. rufus*** *red wolf*

JAL Cooke

△ *Beloved burden: the female wolf spider – this one is* ***Pisaura mirabilis*** *– is very attached to her cocoon and will substitute some other similar object if it is removed from her care.*

Wolf spider

Wolf spiders, like the carnivores after which they are named, run their prey down instead of making a silken snare like so many other spiders. There are, however, a few species that use silk to line their burrows or make silk tubes from which to pounce on their prey.

They are small to medium-sized spiders, the largest being less than 1 in. long in the body with legs also 1 in. long. They are dark or drab in colour, and their bodies are covered with a pile of short bristles. They have strong jaws. Their most characteristic feature is the three rows of eyes on the head; four small eyes in front, just above the base of the jaws, then two larger eyes in each of the two succeeding rows, all simple, as in other arachnids.

Wolf spiders are widespread across all the continents except Antarctica. The total number of species is hard to estimate: there are about 125 in North America, and 50 in Europe. The tarantula of southern Europe ***Lycosa*** *is a wolf spider.*

Wolf-like in many ways

Wolf spiders are often numerous, especially among leaf litter. They tend to be more active at night or under overcast conditions, but they can sometimes be seen in large numbers by day, running over dead leaves, probably because they were disturbed by someone walking over the litter. They shelter by day in small burrows dug in soft earth. Some species line the burrow with silk, while others also have a silken tube running out a short way from the mouth of the burrow. The silk is never used as a snare, but more as an ambush. The food, as with most spiders, is small insects, which the wolf spiders pursue and grab with their strong jaws. They then chew their prey to a pulp and suck the juices through a very small mouth, too small to admit any but the smallest particles.

Wooing by waving

Wolf spiders have relatively keen sight and courtship is conducted by visual signals. A male ready to breed sets out in search of a female. He stations himself in front of her and begins to wave his long palps up and down like semaphore arms. These are usually black and are conspicuous against the drab body. In some species, parts of the front pair of legs are also black and these are also held up and waved. The males of many species vibrate this front pair of legs; in other species the male may tremble in the legs and the abdomen. If the female is not receptive at first she may be induced to respond later by the sight of these movements in the male. She may then face the male and signal back in like manner. Finally the two mate by the male placing his sperm, previously deposited in the pedipalp, into the female's genital pore.

The female lays her eggs in a spherical or lens-shaped silk cocoon, specially spun for the purpose. She attaches this cocoon to the rear end of her abdomen and carries it around with her wherever she goes. Should the cocoon become detached she turns and retrieves it, fastening it again to her abdomen. In experiments, designed to test her devotion to the cocoon, it was found that if the cocoon is taken away and a small white object such as a pith ball, or a pellet of screwed up blotting paper, placed on the ground near the spider she will retrieve this.

PH Ward

△ *About hatching time, in June or July, the female* ***Pisaura mirabilis*** *detaches her cocoon and spins a tent over it, by which she stands guard. Clustered together inside, the young complete the final stages of development, including two moults, and then disperse.*

Family bus

When the eggs hatch the spiderlings remain for a short while in the cocoon until it splits, under favourable weather conditions. They then climb onto the mother's back and are transported by her. In some species the brood is so numerous the spiderlings cover the mother's back several layers deep. So far as we know the spiderlings do not feed during this time. Should one fall off the mother does not halt for it to regain its position on her back, or do anything to assist it. The spiderling must either quickly climb up one of her legs, to reach her back, or be left behind to perish. This is in sharp contrast to the solicitude she shows for the eggs in the cocoon. She will seek shelter when it is raining, to preserve the cocoon, and should it get wet she will, at the earliest opportunity, tilt her head and body downwards to hold the cocoon up to the sun to dry it. 'Solicitude' is probably the wrong word because there is nothing intelligent or deliberate about these acts. They are all automatic responses to circumstances.

Two deadly enemies

The drab colouring of wolf spiders, their mainly nocturnal habits and their use of burrows into which they can retire gives them a fair degree of immunity from enemies. There are, however, two important enemies. The first is the mantisfly, which preys on the eggs while they are still in the cocoon. Hunting wasps are the second danger. They paralyse the spiders and use them to feed their larvae. These hunting wasps fly low over the ground on a zigzag course, searching for prey. When a wasp is over the burrow of a wolf spider it lands and starts to dig. Once the wasp is inside the burrow the spider becomes easy prey.

WS Bristowe has described how he touched a wolf spider *Arctosa perita* sitting at the mouth of its burrow with the tip of a fine grass stem. The spider grabbed the silk on one side of the opening and pulled it across, like a curtain, until only a small slit was left, which it then closed by spinning silk criss-cross over it. We can suppose this is what it would do to keep out a wasp.

Mother's clear vision

The eyes are more important to wolf spiders than to web-spinning spiders. When a female is loaded with her brood of spiderlings they spread in a solid layer, or layers, across her back and onto her head. Yet you never see any of the babies covering the mother's eyes. This seems like some remarkable instinct which makes the spiderlings draw back when in danger of covering their mother's eyes. When we watch carefully, however, we see that every now and then one or more spiderlings are pressed forward by the mob, so almost blindfolding the mother. The moment this happens the mother passes one of her palps over her head, like someone brushing back their hair, and casually pushes the erring spiderlings away from her eyes.

phylum	**Arthropoda**
class	**Arachnida**
order	**Araneida**
families	**Lycosidae** **Pisauridae**

Wolverine

The wolverine, or glutton, is the largest of the weasel family. It has been aptly referred to by one writer as the super-weasel; yet its appearance is not that of a weasel, marten or stoat, but rather of a bear or badger. A full-grown male may be up to 4 ft long, including nearly a foot of tail, stand 14—17 in. at the shoulder and weigh 30—60 lb. The females are smaller and lighter. The wolverine is powerfully built, thick-bodied with short legs set widely apart and ending in broad powerful paws armed with long sharp claws. It has a shaggy coat of thick dense fur, very dark brown above, with a pale brown band on the sides and dark brown below.

The wolverine ranges across the Arctic and sub-Arctic regions of Europe and Asia and in North America from the Arctic to the northern United States.

Ferocity and courage

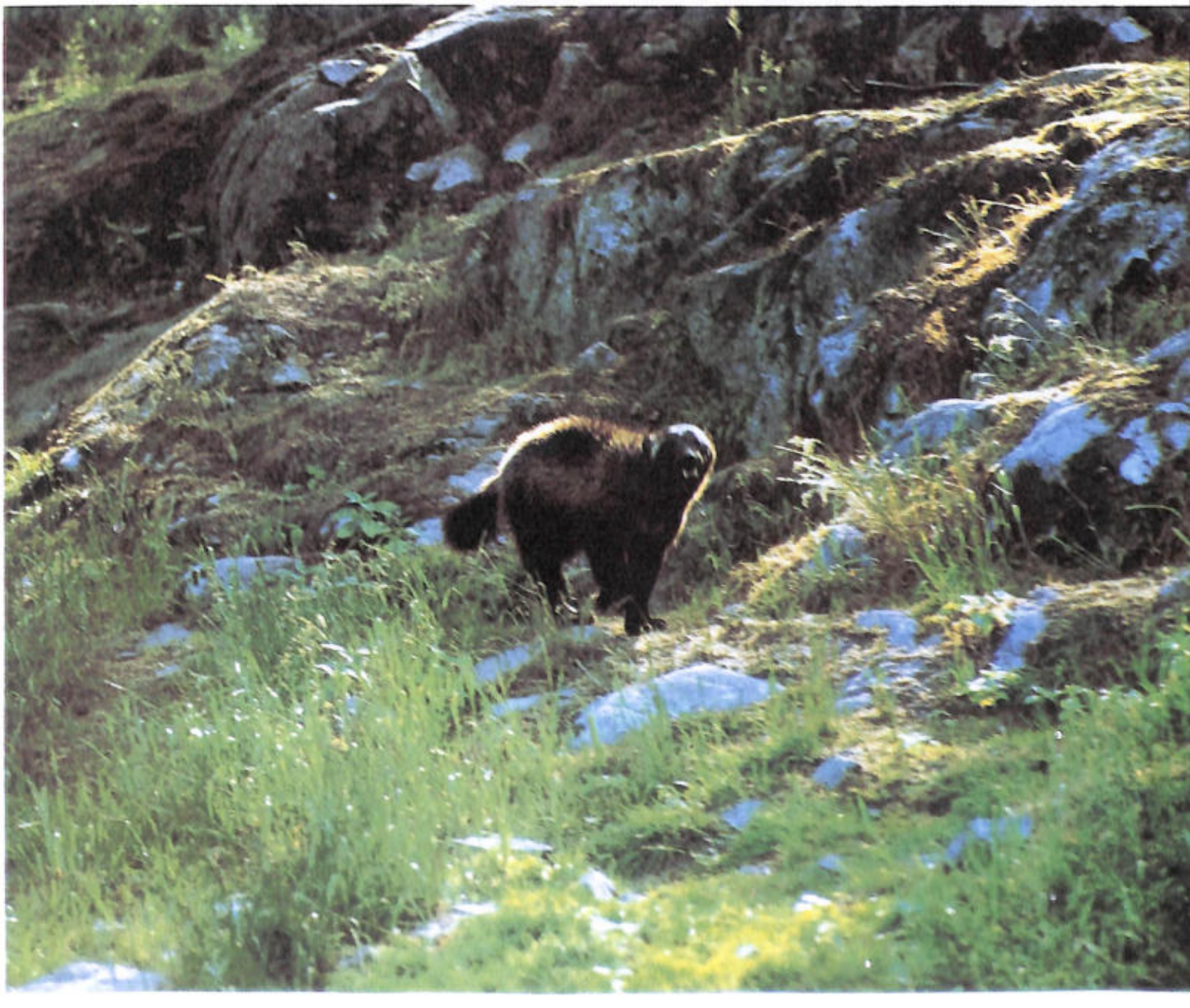
Wolverines live in the cold evergreen forests from 800 to 13 000 ft above sea-level. They are solitary except during the breeding season, inhabiting very large but definite territories. They hunt mainly at night although they tend to have a 3- or 4-hourly rhythm of alternate activity and rest. They do not burrow or make any permanent home but use whatever shelter is available in the particular locality they are hunting. Where they use man-made shelters in this way they may tear down the timbers of a cabin to effect an entry and also wreck the contents, consuming what food they need and carrying other articles away. This has given them a false reputation for wanton destructiveness.

The wolverine cannot move with speed and, unlike the smaller members of its family, has little skill in stalking. At most, it may hide behind a rock in a kind of ambush or drop from a branch of a tree onto a victim's back. Mainly, it depends for survival on its unusual courage in driving other predators from their food. The wolverine bares its teeth, raises the hair on its back, erects its bushy tail and emits a low growl. Even bears have been driven from a carcase by such a display. It has remarkably strong teeth and jaws and is said to crack large bones to powder, to snap branches up to 2 in. diameter with ease and to have bitten a lump out of a rifle butt. The more reliable reports suggest, unless disturbed with young, that it is not aggressive towards man.

Trappers' tales

Among the exaggerated stories about the wolverine is its alleged high skill not only in avoiding the traps of the fur trapper but in robbing those in which marten and fox have been caught. When satiated it is said to exude its musk on the remaining carcases to prevent any other beast taking them. It has even been said that parent wolverines teach their young how to spring traps. The truth seems to be that it does

▽ *Casual encounter: powerful enough to fear nothing in its Swedish National Park home, a wolverine pauses to size up the photographer.*



Russ Kinne : Photo Res

sometimes rob traps and there may have been occasions when a whole line of traps has been cleared but, as a rule, the depredations are not as wholesale as most accounts suggest. As for skill in avoiding traps, this seems to be explained by the small size of the traps used. Wolverines are usually caught by the toes in marten traps and often escape leaving a toe or two behind. There seems to be no evidence that they can avoid, or escape, the larger traps set deliberately for them.

A libellous name

Its diet is a wide one. Mice, rats, small mammals of many kinds, eggs, ground-nesting birds, ducks and even snails are included. Above all, carrion, especially the kills of other carnivores, is eaten. It is reputed to be powerful enough to kill a reindeer or even a moose or elk and to drag a carcase three times its own weight for some distance over rough ground. Uneaten food is cached, either covered with soil or snow or wedged in the fork of a tree. A wolverine has a reputation for eating more than any other carnivore—hence its name of glutton—but probably the many stories about its excessive feeding habits are also exaggerations. Indeed, some of them take no account of the size of the animal's stomach.

Possible delayed implantation

The young, usually 2 or 3, occasionally 5, are born from February to May. The gestation period seems to be uncertain, the records varying from 60–120, or even 183 days, suggesting that delayed implantation occurs. The young are born in a hollow tree, among rocks or even in a snow drift. They have thick woolly fur at birth and are weaned at 8–10 weeks. They stay with their mother for as long as 2 years, then she drives them away to find their own territories and fend for themselves. They are sexually mature at 4 years of age and in captivity have been known to live for 16 years.

Persecuted by man

Being so powerful the wolverine has little to fear from natural enemies. It has, however, been persecuted by man for its destructiveness and also because of its reputation for killing reindeer. For over 100 years attempts have been made in Norway to stamp out the wolverine and premiums have been paid for each one destroyed. The eskimos hunt it for its fur as this does not hold moisture and then freeze, so it is invaluable for trimming the hoods of their parkas. Although its numbers have been reduced everywhere by persecution it is still not uncommon in parts of its range.

Exaggerated beliefs

One of the many stories of the wolverine concerns its stratagem for catching deer, or other large prey. The animal is said to climb into a tree carrying a quantity of moss in its mouth. When a deer approached the wolverine would let the moss fall. Should the deer stop to eat it the wolverine would then drop onto its back, fix itself firmly between the antlers and tear out its victim's eyes. Following this, either from pain or to rid itself of its tormentor, the deer would bang its head against a tree until it fell dead.

As alleged proof of their amazing strength we have the 18th century account from Churchill on Hudson Bay, of some provisions hidden by several of the Hudson Bay Company's servants in the top of a wood-pile. On their return from Christmas festivities, the wood-pile, over 70 yd round, had been thrown down and scattered about. And this 'notwithstanding some of the trees with which it was constructed were as much as two men could carry.' The large quantity of provisions had been consumed, or carried away, except for the sacks of flour and cereals, which had been ripped to shreds.

class	**Mammalia**
order	**Carnivora**
family	**Mustelidae**
genus & species	***Gulo gulo***

▽ *Profile of a powerful predator: a wolverine shows its strong head and claws as it looks out from a snowy vantage point.*

William W Bacon III

F. Collet

Okapia

Wombat

Like its nearest relative, the koala, the wombat looks like a bear, but it is more like a badger in its habits so it is often called 'badger' in Australia. Its head and body length varies from 27 to 47 in. and its weight from 33 to 80 lb. It is thickset with little or no tail, its legs are short and strong and its toes are armed with stout claws used in digging. The wombat's teeth are unlike those of other marsupials, being more similar to those of rodents. The 24 teeth are rootless and there are two incisors in both upper and lower jaws, like those of a beaver. There are traces of cheek pouches.

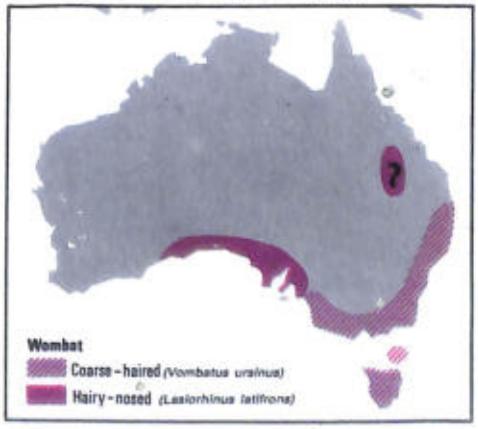
The two genera of wombats each contain a single species. The common or coarse-haired wombat lives in the hilly or mountainous coastal regions of south-eastern Australia and on Tasmania and Flinders Island in the Bass Strait. It is the larger of the two and has a naked muzzle, rounded ears and coarse fur ranging from a yellowish buff to dark brown or black.

The soft-furred or hairy-nosed wombat lives in the sandy or limestone coastal country and drier inland areas in the southern half of South Australia. It was once plentiful in the hilly parts of inland southern Queensland but it is probably nearing extinction in this area. It is distinguished from the common wombat by its smaller size and larger skull bones, and by having a haired nose and relatively pointed ears. The fur is soft and silky, the upperparts a grizzled-grey and the underparts white or grey.

Shy and nocturnal

Both species of wombats are nocturnal and shy and therefore difficult to observe in the wild. They sleep by day in burrows dug.out with the powerful claws of their forefeet, the soil being thrust back with the hindfeet. The burrows are large, usually 10–15 ft long or as much as 100 ft at times, and one series of burrows is reported to have been ½ mile long and 60 yd across. There is a sleeping chamber at the end of the burrow which contains a nest of bark. The entrance

◁ *Rounded ears, a naked muzzle and larger size are the hallmarks of this coarse-haired wombat, in contrast with its smaller relation, the hairy-nosed wombat (previous page).*



Photographic Library of Australia

△ *Greedy nibbler: the wombat tears up grass roots with its clawed forefeet to expose the tasty bases of grass stems and other roots.*

to the burrow is large and arched and a few yards away there is usually a shallow depression scraped in the surface of the ground, at the base of a tree, where the wombat goes to bask in the morning sun. Wombats are solitary except in the breeding season and quite inoffensive to man unless interfered with, although a female has been reported to attack someone in defence of her young. Although heavily built they are quick in their movements and can run swiftly for short distances. The only sound heard from a wombat is a hoarse grunting cough, rather like that made by a large kangaroo.

Wombats are easily kept in captivity and make affectionate and amusing pets. One is recorded as living for 26 years in captivity.

Diet of grass

There are often well-defined paths leading from the wombats' burrows to feeding areas in open country. Their food is mainly grass and roots and occasionally the inner bark of certain trees and fungi. They tear out and grasp the grass stems with their forefeet and they sometimes damage pasture and crops near settled areas.

One young in the pouch

During May to July the female gives birth to one young which is carried at first in the pouch, in the usual way of marsupials. Later it runs free, but stays with the mother until the end of the year. During this time she feeds it on sword grass, pulling out the stems singly and dropping them on the ground so that the youngster can feed on the tender bases.

Man the chief enemy

The wombat has few natural enemies but it has suffered severely at the hands of man. In many areas it has disappeared entirely. Although its skin is not used commercially the aborigines make string out of the fur of the hairy-nosed wombat, coiling it round their hair. Wombats have been ruthlessly banished from settlements from early days because of their habit of tearing down fences to reach the grass in sheep pastures or cultivated crops of various kinds. Another similarity with badgers is that they have been killed for their hams. Their burrows have been eradicated because of the danger to horse riders and because rabbits sheltering in them could not easily be destroyed.

Resembling a badger

The first account of the common wombat in New South Wales was supplied by a former convict, James Wilson, in the 18th century, while on a journey into the southern highlands across the Nepean River. His account was written down by one of his companions, a young servant to Governor Hunter. When evidently near the present town of Bargo on January 26, 1798: 'We saw several sorts of dung of different animals, one of which Wilson called Whom-batt, which is an animal about 20 inches high, with short legs and a thick body with a large head, round ears, and very small eyes, is very fat, and has much the appearance of a badger.'

As has been said before in previous articles many marsupials resemble closely in appearance and habits well-known animals in other parts of the world. The wombat is no exception with its marked resemblance to the badger. Although the wombat shows some characters of the koala and possums it is so unlike them in other features, particularly in feeding, that it has been classed in a family on its own. In the past wombats have not excited much interest and have therefore received little attention but they are quite as interesting zoologically as the koala and other marsupials, and it would be a pity if their remaining numbers were allowed to diminish any further. In view of the very great similarity to the badgers of the northern hemisphere, it would be of unusual interest for a complete study to be made of the wombat.

class	**Mammalia**
order	**Marsupialia**
family	**Vombatidae**
genera & species	***Lasiorhinus latifrons*** *soft-furred or hairy-nosed wombat* ***Vombatus ursinus*** *common or coarse-haired wombat*

Stephen Dalton: NHPA

△ *Collected by the carnivorous wood ants, a battered brimstone butterfly is borne back to the nest by a team of workers.*

Wood ant

The wood ant is noted for the huge mounds it builds over its underground nest, transporting quantities of pine needles and twigs to do so. It lives in Europe in open woodlands or on heaths with clumps of trees. Wood ants are red with a black abdomen and they have a large scale on the 'waist'. The workers are $\frac{1}{8}$—$\frac{2}{5}$ in. long, and the queens are $\frac{1}{2}$ in. or more long, the males being only slightly smaller than the queens. The meadow ant or hairy wood ant, sometimes regarded as a distinct species, and sometimes as a subspecies of the wood ant, is darker in colour than the wood ant, and more bristly. It nests in more open country. The habits of only the common wood ant are described here.

A spreading city

The nest is usually built around a tree stump, but as nests may persist for many years the stump often disappears due to decay. The part of the nest above ground is made of small twigs and leaf stalks or pine needles and is really the roof or thatch of the nest, the greater part of which is underground. The thatch keeps out rain and it also keeps the temperature of the nest equable in very hot or cold weather. In an old colony it may be 5 ft high and 10 ft in diameter. Below the mound there is a large rounded pit filled with a mixture of leaf mould and earth. Below this excavated channels slant downwards. In winter the ants retire to these channels, hibernating in clusters of several thousand individuals, each cluster having two or three queens at its centre. During summer the whole nest is occupied and open galleries are maintained throughout the mound as well as in the underground part of the nest.

The openings to the exterior are closed with twigs at night and guarded by sentinel ants by day. The worker ants stream in and out, carrying food, and materials for the thatch which is constantly being added to. Visible tracks, from which leaves and other obstacles have been cleared, run out from the nest and can sometimes be followed for over 50 yd. They lead to foraging grounds, trees on which large numbers of aphids are living, and to other nests. The wood ant nests in an area of woodland are usually interconnected like towns. Some are small and are obviously satellites of a large nest nearby; others have an independent existence, but the ants are not hostile to the ants from other nests in the vicinity.

Durable dynasties

Inside the nest the workers are concerned with feeding the queens and the larvae, taking over eggs from the queens and carrying larvae and pupae about to parts where the temperature and humidity are best for them. The pupae are contained in whitish oval cocoons about as large as the ants. These are the so-called 'ants' eggs' sometimes used as food for cage birds and fish in aquaria. The real eggs of the ants are microscopic in size. When a pupa is due to hatch workers tear open the cocoon and help the occupant out. If undisturbed a wood ants' nest may go on indefinitely: new queens are constantly recruited.

Founding new nests

Wood ant males and queens are winged, but there is no marriage flight as in many smaller kinds of ants. Mating takes place on the surface of the nest or on the ground nearby, usually in June or July. After mating the queen breaks off her wings and then may do one of three things. Her most usual course is simply to go back into the nest where she lived as a larva and add her eggs to those of her mother, sisters and 'aunts'. On the other hand, she may set out from her home after mating, accompanied by a number of workers, and find a site in which to found a new nest. Thirdly, if she wanders off alone, she may enter a nest of a related but smaller species, the large black ant *Formica fusca*, displace the single queen and lay her own eggs, which are tended by the *fusca* workers. For a while there are both *fusca* and *rufa* workers in the nest, until the former die out, as there is no longer a *fusca* queen, and so a well-established wood ants' nest is founded.

John Markham

Below: this neat mound of dry stalks, twigs and pine needles is the product of much hard labour by thousands of common wood ants. The workers (above) are constantly collecting more thatch material, so that the nest mound may reach several feet in height and, as here, it is often constructed at the base of a tree. Underneath, snug and dry, are the galleries and chambers of the nest proper, connected to the exterior by channels closed at night.

Ant farms

Wood ants are fierce carnivores and bring great numbers of insects, especially caterpillars, back to the nest. Small victims are carried by single ants, large ones are dragged along by teams. The prey is devoured by the workers, who then feed the larvae from their mouths with liquid nourishment. Wood ants also tend and 'milk' aphids on trees and bushes, especially oak and birch. A tree supporting a large number of these aphids is treated as a 'farm' by the ants of a particular nest and is jealously guarded, and a column of ants can be seen running up and down its trunk. To obtain a meal of honeydew the ant solicits an aphid by stroking it with its antennae. The aphid responds by giving out a drop of its sugary excreta which the ant eagerly licks up. This sugar is the main energy-producing food of the ants, and a Swedish entomologist has calculated that the occupants of a single large wood ant nest may collect the equivalent of 20 lb of dry sugar in a season.

Chemical warfare

Wood ants are well armed for chemical warfare and their active enemies have been said to be limited to woodpeckers and man. When threatened the ant curls its abdomen forward between its legs and squirts a spray of formic acid at its enemy. In actual fighting it bites with its sharp jaws and then ejects acid into the bite. The strength of the formic acid can be tested by leaning closely over a nest and smelling the sharp tang of the acid or feeling it sting the eyes.

The green woodpecker disregards the biting and acid spray and may sometimes be seen head-down and half buried in a nest, licking up the outraged inhabitants with its long sticky tongue.

At one time wood ants' nests were regularly raided by animal dealers for the 'ants' eggs', which were sold to feed cage birds and aquarium fish. As long ago as 1880 the German forestry authorities, recognising the great service that these ants do in destroying insect pests among the trees, had a law passed forbidding interference with the nests under penalty of a fine or imprisonment. Today, pet shop dealers are less energetic in collecting ant eggs and there are also fewer woodpeckers, but already there is a noticeable decline in the number of wood ant nests, for the ant now has a far more dangerous enemy: the bulldozer, which destroys the woods and heaths on which it lives.

phylum	**Arthropoda**
class	**Insecta**
order	**Hymenoptera**
family	**Formicidae**
genus & species	***Formica pratensis*** *meadow ant* ***F. rufa*** *common wood ant*

Heinz Schrempp

Woodchuck

The woodchuck, also known as a whistle-pig and popularly called a 'chuck', is a common rodent with a reputation for forecasting the weather in most of Canada and the eastern United States. Its body is thickset and 18–27 in. long. It has a 6in. hairy tail. Its weight varies from a little over 5 lb when the animal emerges from hibernation in the spring to 10 lb in September. The largest woodchucks may weigh as much as 14 lb at this time. The head is flattened with small ears, and the four toes have long claws used for digging. The colour of the fur varies from yellow to reddish-brown.

The woodchuck's range extends from Labrador and Nova Scotia, south to Virginia and Alabama, west to Kansas and north through Minnesota and Central Canada to the northern Rocky Mountains.

True hibernation

The woodchuck frequents woods and farmland and digs its burrow on a rocky hillside or in a gully, but preferably in bushy woods at the edge of meadowland. The burrow has several exits and the entrance has a large pile of freshly removed earth around it. The burrows vary in depth according to the soil; in soft earth a tunnel may be as much as 6½ ft below the surface. The burrow consists of several compartments for sleeping, hibernating and for toilets. The toilets are cleaned regularly and the waste taken up and buried in the entrance mound. The woodchuck is solitary and diurnal, feeding in the morning and again in late afternoon or evening. It never wanders far from its burrow, its home range being only about 100 yd. It can swim well and unlike most large rodents will climb for food.

In autumn the woodchuck hibernates, starting earlier in the northern parts of its range. It settles down in one of the chambers in its burrow, sealing it off with earth. It then rolls up in a ball and goes into a deep sleep. Its breathing slows down until it almost stops: 14 breaths per minute against the normal of 262. Its temperature gradually drops to 4–14°C/40–57°F, as against the normal of 37–40°C/94.8–104°F. When the woodchuck emerges in the spring it looks very thin and hungry and has lost as much as half its weight.

A pest to farm crops

The woodchuck is mainly vegetarian, feeding on grass, leaves and flowers, particularly clover, and sometimes acorns. It will eat bark from trees and also takes fruits such as blackberries, raspberries, cherries and windfall apples. It will occasionally eat snails, insects and small birds. In some farmland areas the woodchuck has become a pest, eating all kinds of farm produce and cereal crops. In addition to feeding voraciously it spoils the crops by trampling, and in some parts of the United States the woodchuck's numbers have had to be controlled by gassing it in its burrow.

▷ *Favourite stance for a curious woodchuck.*

Leonard Lee Rue: Photo Res

William Vandivert

Looking for a mate

As soon as the male woodchuck comes out of hibernation in the spring it goes to look for a mate. Fights often break out between two males and considerable damage may be inflicted before the weaker animal retreats, leaving the victor in possession of the female. Mating takes place in March and April and, after a gestation period of 28–32 days, 2–8, on average 4, babies are born in the burrow. The young 'chuck is pink, naked and blind, less than 4 in. long and weighing only 1–1½ oz. The female feeds her babies sitting on her haunches or standing on all fours. At the end of a month the youngsters' eyes open and they make their first trip out of the burrow. They are weaned in 35 days, and by midsummer have been driven out of the home burrow but continue to live in one nearby. The mother still watches over the youngsters and at the first sign of danger warns them with an alarm whistle. The young are sexually mature at one year.

Many enemies

The woodchuck has many natural enemies. It is preyed upon by bears, coyotes, wolves, mountain lions, as well as by eagles and hawks, and is often attacked by farm dogs. In addition, man hunts it for sport and for its flesh which, except when old, makes very good eating. The hunters, however, have to be very quick and sharp-eyed as 'chucks are very wary and bolt for cover at the slightest hint of danger.

Weather forecaster

The woodchuck is a legendary weather forecaster in America. It is said that if it emerges from hibernation on Candlemas Day, February 2nd, and sees its shadow, it returns to sleep for another six weeks and there will be another six weeks of winter. If, however, it does not see its shadow then winter is over and spring has come. According to Will Barker, in *Familiar Animals of America*, this legend dates back to early Colonial times. He states that in European folklore it was the badger that was supposed to look for its shadow on Candlemas Day, and early European settlers in America transferred the myth to the woodchuck. It is, however, hard to find confirmation of this belief regarding the badger.

class	**Mammalia**
order	**Rodentia**
family	**Sciuridae**
genus & species	***Marmota monax***

◁ *A young woodchuck on a cautious outing from the safety of mother's burrow. When the 4 young, born in spring, are a month old their eyes open and they take their first tentative steps outside. They are weaned at 35 days and are driven from the burrow by the mother within a month or two. The young woodchuck take up residence nearby where she can keep an eye on them and warn them when danger threatens.*

Woodcock

Woodcock belong to the sandpiper family and are most closely related to snipe (p. 2306). They are larger than snipe, about 13 in. long, with brown plumage mottled and barred with black. The bill is straight and 3 in. long and the eye is set well back on the head giving the woodcock a distinctive expression. The eye socket is very large and the opening of the ear lies below the socket rather than behind it. Compared with the snipe the head is large, the neck short and the wings are rounded.

There are two species of woodcock. The Eurasian woodcock breeds in much of Europe, including the British Isles, except the extreme north and south, and across Asia to Japan. It is also found in the Azores, Canaries and Madeira, Asia Minor, the Himalayas, Indonesia and New Guinea, though in the latter two regions it may be a related species. Its plumage is very like an owl's and makes a perfect camouflage among dead leaves. The back and wings are dark brown, mottled with black and buff and the crown of the head is dark with light transverse bars. The underparts are light brown with dark brown bars. The American woodcock is confined to the eastern half of North America as far north as the Great Lakes and the St Lawrence. It is lighter in colour than the Eurasian woodcock and is buff underneath with no barring.

▽ *Roding flight: each evening at sunset a male European woodcock wings his way in slow ritual flight around his territory.*

Arthur Christiansen

Regular habits

Unlike most waders woodcock are solitary and it is most unusual to see more than two together. They live in coniferous and deciduous woodlands, especially where there is bramble or some other type of undergrowth. More open ground, such as heaths with scattered trees or the edges of moors, is also frequented and there is a preference for damp places such as wet hollows in woodlands and marshy areas.

During the day woodcock lie up in dry places, among bracken, heather or brambles. They sit very still, relying on their plumage to conceal them, only flying up when almost stepped on. Then they rise swiftly with a great whirr of wings, which has been described as sounding like the ripping of stiff paper. The flight is strong and rapid as the woodcock manoeuvres between the trees, but it soon settles again. Feeding and courtship flights take place at dawn and dusk. Woodcock fly just above the treetops or along woodland rides and with their unmistakable outline it is easy to identify them as they make their regular flights along the same route each evening.

In the British Isles most woodcock are sedentary but in the northern parts of their range they regularly migrate southwards in winter, into North Africa and southern Asia. The American woodcock migrates into the southern United States.

Nimble bills

The food of woodcock is largely earthworms; a diet of 86% earthworms has been reported for the American woodcock. They also eat ground-living insects and their larvae, including earwigs, caterpillars and beetles. Centipedes and spiders are also eaten and occasionally freshwater molluscs. Woodcock usually feed at twilight, on damp ground, but in bad weather they may forage in leaf litter and along the shore.

Earthworms and other animals are sought by probing the soil with the long bill. The tip of the bill is well supplied with nerves and it is thought that the woodcock locates its food by touch. The bill is thrust into the soil with the mandibles closed but the tip of each mandible can be twisted outwards to seize an earthworm or other animal so the whole bill does not have to be forced open against the pressure of the earth. Thus earthworms can be swallowed without the bill being withdrawn from the soil.

The roding of woodcock

At dusk and dawn during the breeding season male woodcock make special flights around their territories. In Britain this flight is known as 'roding'. The woodcock flies at about 20–30 ft with slow, owl-like wingbeats and follows a regular course for up to an hour, starting at sunset. Two sounds can be heard as a roding woodcock flies past. One is a thin, far-carrying whistle, the other a low croak which is heard as the woodcock checks in its flight. It has been suggested that the croak is made by air rushing past three, narrow, stiff primary flight feathers but there is also evidence that this is a vocal sound. When two roding males meet they chase each other and females are also chased. Clearly, roding has the function of song in proclaiming ownership of a territory. The male courts the female by strutting around her with his feathers fluffed out and wings drooping.

Although his plumage is as well camouflaged as the female's the male woodcock takes no part in incubation and rearing his chicks. After mating the female makes a depression in the ground, lined with leaves and usually at the foot of a tree. She lays 3 or 4 well camouflaged eggs and incubates them for 20–21 days. The chicks fly in three weeks and there may be two broods in a season. If the brood is disturbed the adult 'feigns injury' by flying with tail spread and legs lowered or else it runs about with the tail fanned and the wings drooped or thrashing.

Rides for babies

Woodcock are among the few birds that carry their young. Jacanus (p. 1305) carry their chicks under their wings and swans carry their broods on their backs. Both the American and Eurasian woodcock have been reported to carry chicks but, not surprisingly, reliable evidence is not easy to obtain because of the difficulty of being certain that a woodcock is carrying something as it speeds away. In a survey carried out in Britain 142 cases of carrying chicks were reported, and in 97 of them the chicks were carried between the legs. The rest were carried between the feet or on the back. Occasionally a woodcock has been seen to return and pick up another chick until the whole brood has been removed.

class	**Aves**
order	**Charadriiformes**
family	**Scolopacidae**
genera & species	***Scolopax rusticola*** *Eurasian woodcock* ***Philohela minor*** *American woodcock*

▽ *Sitting tight on her eggs a female woodcock will lie low until almost trodden on.*

© Middleton: Photo Res

Constance P Warner

Its beak adapted as a probe, the strong-billed woodcreeper ***Xiphocolaptes promeropirhynchus.***

Woodcreeper

The woodcreepers or woodhewers are fairly small, slender-bodied, dull coloured birds related to the ovenbirds. They are 5—18 in. long and they look rather like creepers (p. 701), the resemblance being due to convergent evolution as the two groups of birds have similar habits. Both climb agilely on tree trunks and the woodcreepers have sharp, curved claws and stiff, woodpecker-like tail feathers for gripping vertical trunks.

There are about 50 species of woodcreepers, many being difficult to distinguish in the field because of the uniformity of their drab plumage and the difficulty of observing them among foliage. The plumage is mainly dull brown with reddish wings and tail and light stripes on the head, nape and underparts. There is considerable variation in the size and shape of the bill. It is usually stout, sometimes flattened and chisel-like or down-curved. The most extreme bill is found in the scythebill or sicklebill, which has a 3in. down-curved bill making up about a third of the total length of the bird. The barred woodcreeper has an almost straight bill with a hook at the tip, the allied woodhewer has a slender pointed bill.

Woodcreepers live in tropical America, from Sonora in north-west Mexico to northern Argentina, and in Trinidad and Tobago.

Solitary with simple songs

Woodcreepers are woodland and forest birds. They are solitary and little is known of the habits of most species. None migrate, with the possible exception of the narrow-billed woodcreeper, and they have poor songs consisting of repetitive trills, whistles and harsh notes. The allied woodhewer lives in forests where the trees are covered in mosses and epiphytic flowers but it also comes into clearings where there are only scattered trees. Like most other woodcreepers it can be seen hopping up and around tree-trunks then flying to another tree and repeating the process. A few woodcreepers, however, feed on the ground, such as the great rufous woodcreeper of Argentina.

Probing for food

The bill is not used as a chisel, like the woodpecker's, but as a probe, like the creeper's, for searching in crevices in bark or among the plants growing on the tree trunks. Grubs are pulled out of their burrows and loose bark is sometimes prised off to reveal other animals. In addition to insects and their larvae, spiders, small snails and frogs are also eaten.

Borrowed nests

As far as is known woodcreepers nest in cavities in trees, from ground level up to about 30 ft, sometimes in earth banks or fallen logs or between the leaves of epiphytes. They are unable to excavate their own holes but use natural holes or those of barbets and woodpeckers, particularly if they are well concealed by moss and have narrow entrances. Sometimes no material is added to form a nest but at other times pieces of wood and bark from dead trees are deposited in the nest hole, particularly if it is very deep. There is one record of a buff-throated woodcreeper carrying some 7 000 pieces of material to its nest. They add material throughout the incubation period.

The clutch is of 2, sometimes 3, glossy white eggs. The incubation period of the streak-headed woodcreeper is 15 days and in the allied woodhewer the chicks spend 19 days in the nest. Both parents care for the brood, incubating the eggs then brooding and feeding the chicks, which are fed for a few weeks after they leave the nest.

Second-class diner

The range of the woodcreepers is very similar to that of the antbirds and both have the habit of following advancing hordes of army ants (p. 180), feeding on the small animals that they flush. The plain-brown woodcreeper, for instance, flies from perch to perch just above the army ants and swoops out to catch the fleeing animals. In some parts of its range it comes into conflict with the ocellated ant-thrush which has similar habits and drives the woodcreeper from the lower levels of the undergrowth, where it is easier to catch fugitives from the army ants. As an ant-thrush approaches, the woodcreeper hops up the tree, returning once the ant-thrush has passed. The woodcreepers also have to keep to the edges of the ant swarm whereas the ant-thrushes can forage in the centre. Such competition between unrelated species will only have an adverse effect on the dominated species if there is a shortage of food. It appears, however, that the ants flush so many animals that the woodcreepers can find sufficient food even when driven from the best pitches.

class	**Aves**
order	**Passeriformes**
family	**Dendrocolaptidae**
genera & species	***Campylorhamphus falcularius*** *scythebill* ***Dendrocolaptes certhia*** *barred* ***Dendrocincla fuliginosa*** *plain-brown* ***Lepidocolaptes affinis*** *allied woodhewer* ***L. angustirostris*** *narrow-billed* ***L. souleyetii*** *streak-headed* ***Xiphocolaptes major*** *great rufous* ***Xiphorhynchus guttatus*** *buff-throated* *others*

Wood duck

The wood or Carolina duck, sometimes called the tree duck, is one of the most ornately-plumaged ducks, probably attaining second place after its close relative, the mandarin duck. It is 20 in. long, rather smaller than an eider, with a large head, short neck and a long square tail. The bill is short and the toes bear sharp claws. The breeding plumage of the male almost defies description; the feathers of the back have metallic, iridescent colours, mainly green with blue on the trailing edges of the wings. The upper breast is reddish-brown and the flanks orange-brown with white margins. The belly is whitish. The head bears a trailing crest, purple and green with white markings. The eye is red and the bill mainly white with red and yellow at the base. In its eclipse plumage the male resembles the female but has more white under the chin. The female has a small crest and is mainly grey above with blue on the wings, and brown with white spots underneath.

The wood duck is confined to the United States and the southern parts of Canada. Its close relative, the mandarin duck, lives in eastern Asia and Japan and has almost identical habits. Its plumage is even more gaudy than that of the wood duck, having a larger crest and upswept 'fins' on the back. The females of the two species are, however, virtually indistinguishable. Despite their close relationship the two species never interbreed. Indeed, the mandarin does not interbreed with any species, although the wood duck has bred in captivity with several species of ***Anas*** *ducks.*

The maned goose or wood duck of Australia belongs to the same group of perching ducks as the wood duck of North America. It is found over most of Australia and often nests in trees.

▽ *Celebrated aristocrat, the Carolina duck.*

Toni Angermayer

Zool Soc London

◁ *Like its close relative the Carolina duck, the mandarin duck is a familiar sight on ornamental ponds, but its real home is China, where pairs were formerly given as wedding presents to symbolise marital fidelity.*

◁▽ *A graceful pair of wood duck at home. These birds were once brought to the verge of extinction in the wild by indiscriminate hunting, but numbers are now recovering.*

▷ *A harassed wood duck sees an intruder off the premises. In her nest in a hollow tree she will be kept busy incubating a clutch of 6—15 eggs with no help from her mate.*

Cyr Color Agency

An individual duck

The wood duck is sometimes called the summer duck because it nests in the southern states whereas other ducks merely stay for the winter, migrating north in spring for nesting. The wood duck has only a limited migration, a few individuals staying in the northern part of the range for the winter and a few migrating south of the United States. Migrating wood duck travel in small parties, not mixing with other ducks. Their only calls are whistles.

The wood duck is exclusively a freshwater duck, living on ponds, streams and swampy woodland. It roosts on small ponds and flies out in the early morning to its feeding grounds. Unlike many ducks it is extremely agile in the air and darts through thick forests with remarkable ease, turning and dodging between branches, even at dusk. Wood ducks walk well and climb agilely along branches.

Surface feeder

Wood duck feed mainly on plants floating on the surface or growing just above the water, although they do upend in shallow water to feed on the bottom. The seeds and leaves of many water plants are taken, including those of grasses, docks, wild celery and wild rice, and underwater bulbs and tubers are uprooted. Wood duck also forage for acorns and chestnuts on the forest floor. In the summer a considerable proportion of the diet is made up of animal food taken from around the surface of the water. Two thirds of this is insects, such as beetles, dragonflies and damselflies and their larvae, and the rest is snails, crustaceans, small amphibians, and small fish such as minnows.

Sharing nests

Apart from occasional nests in rock crevices, wood duck always nest in holes in trees, either natural cavities formed where a branch has broken off or in the abandoned nests of woodpeckers, flickers and fox squirrels. The ducks are able to squeeze through surprisingly small holes. The hole may be as much as 50 ft up or as low as 5 ft and is usually near water, but if there are no suitable sites, the ducks may be forced to nest a mile from the nearest stretch of water. In these circumstances there is often competition with the hooded merganser which sometimes results in a duck of each species laying eggs in one nest hole.

Apart from the remains of the previous tenant's nest, the nest consists of only a layer of down plucked from the duck's breast. The clutch consists of 6—15 eggs which are incubated for 28—30 days by the female while the male waits nearby. Although there are descriptions of newly hatched wood ducks being carried down from the nest by the mother, it is usual for them to jump down, encouraged by her calls. Shortly after they are hatched, the chicks scramble up the sides of the nest hole with the aid of their sharp claws and drop to the ground. The parents then escort them to the water.

Help for the wood duck

At one time the wood duck was one of the most widespread and commonest ducks in the United States but by the early years of the 20th century its numbers had been so reduced that there were fears for its survival in the wild. Although a fast and agile flier it had been shot in vast numbers, while the clearing of trees, especially of dead trees, robbed it of nesting places. Luckily the wood duck, like the mandarin, was highly prized by aviculturalists and by the First World War there were probably more wood duck in captivity than in the wild. At this point Alain White set up a sanctuary to breed wood duck. By 1939, when the project was ended, more than 9 000 wood duck had been successfully reared and then released to spread either locally or in other states.

class	**Aves**
order	**Anseriformes**
family	**Anatidae**
genera & species	***Aix galericulata*** *mandarin duck* ***A. sponsa*** *wood duck* ***Chenonetta jubata*** *maned goose*

Wolfgang Lummer

Woodlouse

Woodlice, or sow-bugs as they are called in America, are particularly interesting as they are the only crustaceans that have become completely adapted to spending their whole life on land. They are small, never reaching more than $\frac{3}{4}$ in. long, with oval bodies, convex above and flat or hollow beneath. The head and abdomen are small but the thorax is comparatively large, composed of seven hard, individual overlapping plates. There are seven pairs of legs, the last pair appearing only after the first moult.

Two of the commonest European woodlice are ***Oniscus asellus*** *which has a brownish body and two rows of yellowish spots on the back and* ***Porcellio scaber*** *which is bluish-grey. These two are rather flat and do not roll up into a ball when touched. The pill woodlouse,* ***Armadillidium vulgare,*** *on the other hand, has a more convex dorsal surface and readily rolls up into a ball when handled, which makes it look like a small grey pill—indeed it was formerly used as a popular medicine. A small, blind, colourless woodlouse,* ***Platyarthrus hoffmannseggi*** *is occasionally found in the nests of ants in southern England. In fact it is never found apart from ants, who seem to tolerate its presence without aggression.*

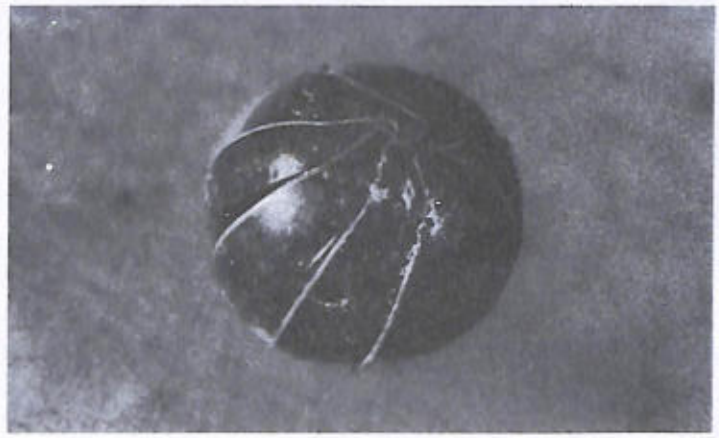
Woodlice are found in all temperate and tropical parts of the world.

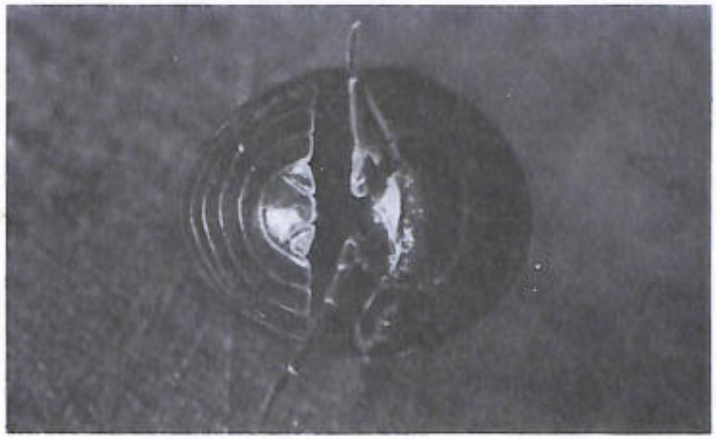
Damp, dark places necessary

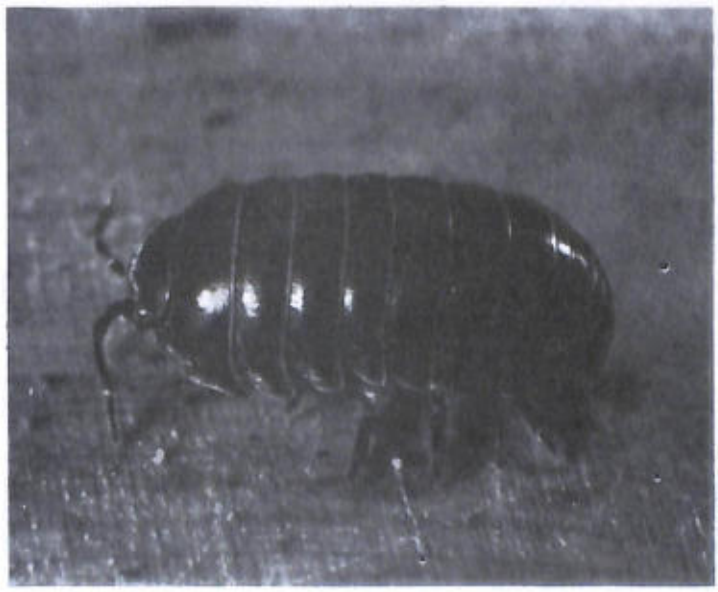
All woodlice are scavengers, hiding by day in dark, damp places under bark, stones, piles of leaves or in cracks in the ground, and only coming out into the open at night. Dampness is essential to the woodlouse and in dry air it will die in about 2 hours. It is noticeable that a woodlouse walks much more quickly in dry places and slows down in damp situations. Similarly it tends to aggregate with other woodlice when the air is dry probably because, when bunched together, they lose water much less rapidly, so their chances of survival increase. The pill woodlouse is much more resistant to drying up and can often be seen walking about in strong sunlight.

About nine or ten times in its life a woodlouse retires into a quiet, sheltered corner to moult its shell and grow a new one. This is necessary as the shell is rigid and does not grow with the animal. The rear segments of its shell fall off first and after about three days the front segments are moulted. This leaves the woodlouse more or less defenceless—vulnerable even to members of its own kind which will eat it without any hesitation.

Heather Angel







Series by Heinz Schrempp

How they breathe

If the underside of a woodlouse such as *Porcellio scaber* is examined with a lens, a white spot can be seen on the outer plates of each of the first two pairs of abdominal appendages. These white spots are the tufts of fine branching tubes in the interior of the appendages. The tubes are filled with air and open to the outside by a minute pore. They represent, in fact, the beginnings of a tracheal system like the respiratory systems of insects and certain other air-breathing arthropods. It is impossible to suppose, however, that woodlice are in any way closely related to insects, and their tracheae must have evolved independently from those of insects.

Small but independent

The breeding habits of *Porcellio scaber* have been observed but little is known about the habits of other species. After fertilisation by the male a brood pouch appears as a white

Above: Grouped on the underside of bark, adult and young ***Porcellio scaber*** *and (bottom right)* ***Oniscus asellus.*** *Right: When disturbed a pill woodlouse rolls itself up into an armour-plated ball. The thick carapace prevents water loss from the body and serves as protection against predators. The antennae are the first to show as the wood-louse uncurls, in this case it lies on its back, flailing its legs to right itself. Finally – ready for action.*

MWF Tweedie: NHPA

triangular patch between the female's forelegs. About 20 or more eggs are laid in the pouch, which becomes slightly distended. The pouch is transparent, so the eggs can be seen clearly through a hand lens. They grow larger and larger until they burst and the embryo young emerge. About 6 weeks after fertilisation a split appears in the pouch through which the young escape, one at a time, over a period of 2 or 3 days. Although only about $\frac{1}{16}$ in. long they are pearly white with large black eye spots and six pairs of stumpy legs. They are completely independent. After all the young have emerged the brood pouch becomes flat again and is sloughed off at the next moult, when a new one grows.

Repelling spiders

Spiders are the most serious enemies of woodlice, which defend themselves by secretions from their lobed glands that make them distasteful. These secretions are also used by *Platyarthrus hoffmannseggi* to repel ants, centipedes and other predators.

Dry society

Although woodlice look like insects there are many differences between them. For example, in the outer layers of an insect cuticle is a wax which prevents evaporation of moisture. Insects also have other ways of conserving water, such as eliminating dry faeces. Woodlice have none of these and readily lose moisture in a dry atmosphere. They are therefore very dependent on moisture and they have special sense-organs in the tough outer skin for detecting it. Woodlice also have an urge to move away from light, but if one is in a dark place that dries out it will tend to move towards the light. Therefore, if a woodlouse is in a moist, dark place it stays there, but in a dry, light situation it is compelled to wander, until it reaches a dark, damp place. When woodlice bunch together they reduce the amount of evaporation from their bodies, and when one woodlouse smells another it automatically walks towards it. This is what brings them together in a bunch. There is, however, an exception to this. When a woodlouse has been kept for a day in moist surroundings it is more likely than not to be quite unmoved by the odour of its fellow woodlice. Finally, since a woodlouse is so attracted to dark damp places what makes it come out at night to feed? When it has been in the dark for 10 hours or more it becomes restless and must wander.

phylum	**Arthropoda**
class	**Crustacea**
order	**Isopoda**
genera	***Armadillidium, Kogmania, Ligia, Oniscus, Platyarthrus, Porcellio, Schoblia, Trichoniscus, Tylos***

Top: ***Platyarthrus hoffmannseggi*** *with its newly born young. They shed their skins immediately after birth making their first meal of them. Centre and bottom: An adult of the same species also sheds its skin and eats it.*

Woodpecker

No birds are better adapted for a life on the branches and trunks of trees than the woodpeckers. Two of the true woodpeckers are described under the separate headings of flicker (p. 933) and sapsucker (p. 2143). There are about 200 species of true woodpecker which are spread over the wooded parts of the world, except Malagasy, Australia and oceanic islands. They are up to nearly 2 ft long and are usually brightly-coloured with patterns of black, white, green or red. A few woodpeckers have crests. The bill is straight and pointed, the legs short with two toes forward and two backwards and the tail is made up of pointed feathers with stiff shafts.

The 15 species of green woodpeckers inhabit the woods and forests of Europe and Asia from the British Isles to Borneo and Java. The familiar green woodpecker of Europe is 12 in. long, and has a green plumage, which is brighter below, a bright yellowish rump and a red crown. The male has a red and black stripe under the eye, while the female has a plain black stripe. The pied or spotted woodpeckers form a widespread group, the 30-odd species being distributed across North America, Europe and Asia. They are black or grey with white patches, bars or mottling. The males often have red crowns. The three-toed woodpeckers are unusual in having one toe missing from each foot. They too have a circumpolar distribution. The ivorybills of America are the largest woodpeckers and inhabit forests of large trees. As a result of these forests being cut down these species are in danger of extinction. The ivory-billed woodpecker of North America and Cuba was thought to be extinct but in 1966 a few pairs were found in Texas.

Expert tree climbers

Woodpeckers are usually seen as just a flash of colour disappearing through the trees. They live solitarily in woods and can be identified by their characteristic undulating flight: 3–4 rapid wingbeats carrying them up, followed by a downward glide. They are more likely to be given away by their harsh or ringing calls, such as the loud laugh of the green woodpecker, or by their drumming, a rapid tattoo which they make with their bills on dead branches, or even on metal roofs.

Woodpeckers spend most of their time hopping up tree trunks in spirals, searching for insects. When a woodpecker has searched one tree it flies to the base of the next and repeats the operation. In climbing vertical trunks, woodpeckers are assisted by having two backward-facing toes, sharp claws, and stiff tail feathers, which are used as a prop while climbing, rather like a shooting stick.

Peter Johnson

Albert Visage: Jacana

Which nest hole is the best hole? Upper: Female African ***Campethera abingoni.*** *Below: Great spotted woodpecker* ***Dendrocopos major.***

Boring for insects

The woodpecker's food is largely insects and their larvae. The green woodpeckers often hunt on the ground for ants and sometimes attack bee hives. The red-headed woodpecker of North America catches insects on the wing. Otherwise woodpeckers feed on insects which are prised out of crevices in the bark or drilled out of the wood. The pointed bill is an excellent chisel and the skull is toughened to withstand the shock of hammering. When drilling, a woodpecker aims its blows alternately from one side then the other, like a woodman felling a tree. Insects are removed from the hole by using the woodpecker's second useful tool—an extremely long tongue; it can protrude up to 6 in. from the tip of the bill in the green woodpecker. The tongue is protruded by the same mechanism as that of the piculet (p. 1887). It is often tipped with barbs or bristles or coated with mucus for brushing up the insects.

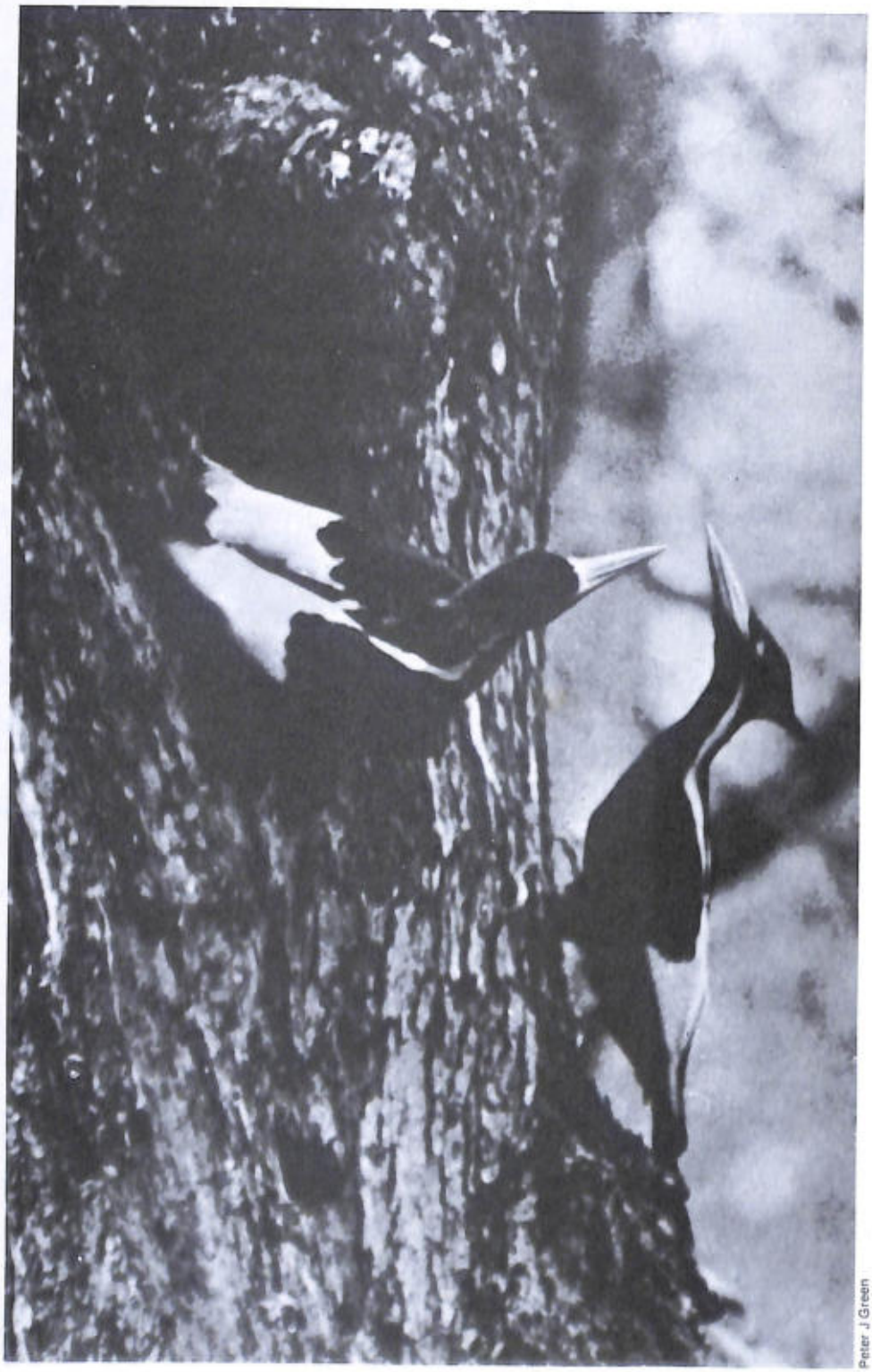
Some woodpeckers eat fruit and seeds or drink sap. Red-headed woodpeckers and acorn woodpeckers store acorns, drilling separate holes in trees for each acorn or else using a natural cavity. There is a story of an acorn woodpecker that spent an autumn feeding acorns into a knothole in the wall of a cabin. As the hole never filled, the woodpecker 'posted' several hundred acorns in it.

Nesting in holes

With the exception of the African ground woodpecker, which burrows in the ground, woodpeckers nest in holes that they excavate in trees. They drill into a trunk then tunnel downwards to make a cavity up to 1 ft deep. There is no nest lining and the 2–8 white eggs rest on the bottom of the cavity. The eggs hatch in 11–17 days and the chicks fledge in 2–3 weeks, depending on the size of the woodpecker. Both sexes bore the nest hole, and take turns at incubating and feeding the chicks.

Evacuating the home

Boring a nest hole several inches across does considerable damage to a tree and may weaken it sufficiently for it to fall. This happened at a nest of a pileated woodpecker observed by FK Truslow in the Everglades National Park. The tree split off at the level of the entrance to the nest, revealing that the trunk had been hollowed to leave a shell only ¼–½ in. thick. Truslow stayed in his hide hoping to watch the reactions of the woodpeckers—the female was incubating at the time. About 10 minutes later the female woodpecker did a most remarkable thing. She returned to the tree, disappeared into the nest cavity and reappeared with an egg in her bill. She then flew off with it and did not drop it for the 75 yd she was in sight. All three eggs were removed in this manner. Unfortunately this extraordinary story has no satisfactory ending as he never found out what became of the eggs. It is, however, one of the few positive records we have of birds rescuing their eggs by carrying them away.



Peter J Green

class	**Aves**
order	**Piciformes**
family	**Picidae**
genera & species	***Campephilus principalis*** *ivory-billed woodpecker*
	Dendrocopos major *great spotted woodpecker*
	D. minor *lesser spotted woodpecker*
	Phloeceastes pileatus *pileated woodpecker*
	Geocolaptes olivaceus *ground woodpecker*
	Melanerpes erythrocephalus *red-headed woodpecker*
	M. formicivorus *acorn woodpecker*
	Picoides tridactylus *three-toed woodpecker*
	Picus viridis *green woodpecker*

◁ *Rare photograph of a pair of ivory-billed woodpeckers. The former distribution of this striking bird was the once heavily wooded bottomlands of the Mississippi basin. With the felling of giant cypresses, water oaks and black gums, the birds' habitat was destroyed. Today a few pairs live in the near-virgin forests of Texas and Louisiana—their last refuge.*

▷ *In complete contrast: the lesser spotted woodpecker is widespread in the woods of Europe; but, although numerous, it is seldom seen.*

André Fatras

Albert Visage: Jacana

◁ *Just beginning to lose their sparse yellow down, a pair of large young wood pigeons wait for the arrival of one or other of their parents with some food. After their first three days, when they are fed with pigeon's milk, their main diet is ripe cereal grain.*

▷ *Two greedy young wood pigeons eagerly reach out of the nest trying to get more food from their ever-patient parent. They remain in the nest for about 22 days, but for at least another week afterwards they are fed by one or both parents.*

▽ *One of the greatest enemies of farmers in Europe, the gentle-looking wood pigeon is easily distinguishable from other doves by the white patch on the sides of its neck. In order to reduce their numbers, the most effective method has proved to be nest destruction.*

Heinz Schrempp

Wood pigeon

From being a harmless rarity up to the end of the 18th century, the wood pigeon, or ring dove, has become one of the most common and most destructive pests of agricultural land, especially in certain parts of Europe. It is a handsome, rather heavily built bird, about 16 in. long with a wing span of about 18 in. The upper parts are bluish-grey with darker grey on the upper wings and black on the upper tail and wing quills. The breast is vinous shading to pale grey or lavender on the belly, flanks and under the tail. The rump and head are a bluer grey than the rest and the sides of the neck are a metallic purple and green. The base of the bill is pink, the rest yellow shading to pale brown on the tip. The base of the bill expands into a soft fleshy lump over the nostrils. The legs and feet are pink with a mauve tinge. The straw colour of the eye and its unusual pear-shaped iris give the bird a very alert expression. The wood pigeon can always be distinguished from other doves by the white patch on the sides of the neck, which is absent in young birds, and the broad white band across the wing. The male and female are alike except that the males tend to be slightly larger and their plumage brighter.

The typical race of the wood pigeon is found throughout Europe, except in the extreme north. It ranges eastwards to Russia and in the south extends to the north coast of the Mediterranean and to the various Mediterranean islands from the Balearics to Cyprus, and around the Black Sea. It is replaced by allied races in northwest Africa, the Azores, Madeira, Turkestan and Transcapia to Iran, Baluchistan, Kashmir and Sikkim.

Wary in the country

The wood pigeon is primarily a bird of the woods but since the spread of agriculture it has taken to feeding on cultivated land. It is also a familiar bird in town parks and suburban gardens and is often found on downs and on coasts, some way from woods.

Albert Visage: Jacana

From autumn to spring and sometimes also in summer it congregates in large flocks to feed, although single birds and small groups may also be seen. In the towns and parks it may become quite tame but in the open country it is wary of humans and will take off with a loud clatter of wings at the slightest disturbance. Its normal flight is fast and strong with quick regular wingbeats and occasional glides. On the ground it struts about, restlessly moving its head to and fro. It roosts in trees, sometimes in large numbers.

The wood pigeon's voice, which is heard at all times of the year but more frequently in March and April, is often said to be a series of coos but the phrase 'two coos, Taffy take' repeated several times gives a better idea. The alarm note is a short, sharp 'roo' sound.

Agricultural menace

Originally the wood pigeon fed on acorns and beech mast as well as seeds, nuts, berries and the young leaves of many trees. Since the spread of agriculture and the disappearance of many woods it has turned, to a large extent, in many areas to cultivated crops and found them just as palatable and in greater abundance. Cereal grains are the most important food for both adults and young in late summer and autumn and in some areas peas and beans are taken in large quantities. In winter the birds depend mainly on clover, turnip tops and young greens. The pronounced hook at the end of the bill makes it easy for the pigeon to tear off the leaves of these plants. Some animal food is taken including caterpillars, earthworms, slugs, snails and insects.

The wood pigeon needs quite a large quantity of water and drinks greedily, not in sips like most other birds.

Billing and cooing

The courtship of a pair of wood pigeons begins while they are still in flocks. A pair separate from the main body and on the ground or a perch in a tree they bow to each other, their breasts touching the ground or perch, with their tails raised and spread, all the time cooing to each other. This bowing and cooing is often interrupted by a nuptial display flight in which the bird rises steeply with strong wingbeats then glides down and rises again with stiff set wings in an undulating course. At the top of its rising flight it usually makes several claps with its wings, caused by a strong downbeat of the wings and not, as so often supposed, by the wings clapping together. Also at this time pairs of birds start to establish territories in the trees, the males driving away any intruders with aggressive posturing or actual attacks.

Young fed on milk

The breeding season is long, usually from April to September, but there are records of nests in every month of the year for the southern parts of the wood pigeon's range. The peak of breeding activity seems to be July, August and September in the British Isles when there is plenty of ripe corn for feeding the young. There are usually three broods a year. The nest is built in almost any kind of tree or in tall hedgerows, sometimes on top of the old nest of crows or sparrowhawks or on a squirrel's drey. Very occasionally it is built close to the ground or on ledges of rocks. In towns, buildings are used. The nest is a flimsy structure of intertwined sticks, often used for several years in succession. The male brings the material but only the female builds. Usually two, occasionally one or three, white, fairly glossy eggs are laid and are incubated for about 18 days, by both parents.

When the young birds hatch they are covered in sparse yellow down and for the first three days are fed at frequent intervals on a fluid from the parents' crops known as 'pigeon's milk'. After this, ripe cereal grain is the main food with some green food and weed seeds supplemented with animal foods. They stay in the nest for about 22 days, and afterwards are still fed by one or both parents for at least another week.

The average age attained by a wood pigeon in the wild in the British Isles is only 38 months but the oldest one recorded was in its 14th year.

Large numbers shot

Apart from man the adult wood pigeon has few enemies, but many of their eggs are taken by jays and magpies. The losses among young birds are due mainly to starvation, especially when they leave the nests and compete for food with the adult birds. In really severe winters the mortality among wood pigeons is very high but their numbers soon seem to increase again.

Owing to the widespread destruction of crops by wood pigeons a great deal of research has been done into methods of keeping down their numbers. Shooting the birds is still the most widely used method although some sportsmen contend that wood pigeons are difficult to shoot as the shot glances off their feathers. There is no evidence to show that widescale shooting makes any impression on their numbers.

Migrant or not?

The subject of migration of wood pigeons to and from the British Isles has provided a constant source of argument amongst countrymen, sportsmen and bird-watchers for many years. Apparently the wood pigeons in the British Isles are mainly sedentary but with a tendency to move south in the winter. Only a small proportion of the population undertakes long flights and these are usually young birds. There is probably a latent urge, inherited from migratory ancestors, which shows itself in only a few individuals. The only birds recovered abroad reached no farther than France. In continental Europe the migratory behaviour is rather different. Wood pigeons in Scandinavia and the Baltic are forced to migrate south in winter to escape the snow and some of these do arrive on the east coast of Britain, but the numbers vary considerably from year to year. Observers have told of hordes of wood pigeons arriving from the Continent and although large numbers may arrive in some years, confusion very often arises because of the flocks of wood pigeons that seem to fly out to sea from the British Isles and then fly back again!

class	**Aves**
order	**Columbiformes**
family	**Columbidae**
genus & species	***Columba palumbus***

Loke Wan Tho: WWF

Loke Wan Tho: WWF

Constance P Warner

Wood-swallow

The wood-swallows, or swallow-shrikes, are an unusual group of birds. They are superficially like the swallows, but resemble miniature vultures in their habit of soaring. There are about 10 species of wood-swallow making up a family which is not related to the true swallows. They are 5—8 in. long, with stout bodies, long pointed wings and short tails. The plumage is soft and wood-swallows are the only songbirds with powder-down feathers which break up into powder for cleaning the plumage. Other birds with powder-down include the herons, parrots, and tinamous. The legs are short and strong and the bill stout and curved.

The white-breasted wood-swallow of southeast Asia and Australia is dark brown above with a white bar on the rump. The underparts are white except for a dark brown throat and upper breast. The bill is blue with a black tip. The masked wood-swallow is grey above and greyish-white underneath. The face and throat are black with a white border. The smallest wood-swallow is the little wood-swallow, also of Australia, which is sooty-brown with black wings and black tail with a white tip.

Six of the ten wood-swallows live in Australia but others range from India, where the ashy swallow-shrike is found, to Fiji, with its white-breasted species.

Dense huddles

Despite their name, wood-swallows are found not in forests but in open country where they are easily recognised as they soar in flocks, emitting loud, harsh twittering calls. Apart from ravens and choughs, wood-swallows are the only passerine or perching birds that habitually glide or soar for extended periods. They soar in thermals like vultures (p. 2645), sometimes climbing so high that they are lost to sight.

Another unusual feature of the wood-swallows' habits is their extreme gregariousness. The flock usually forages from a particular vantage point such as a tree or, when possible, telephone wires. Unlike true swallows, which perch neatly spaced out, wood-swallows huddle together. Some species, such as the dusky wood-swallow, roost in clumps numbering up to 200, piled on top of each other, looking like a swarm of enormous bees.

Scourge of insects

Wood-swallows feed on insects, mainly flying ones, which they catch rather like fly-catchers. Individual wood-swallows fly out from the perch and snap up insects with their widely-opening bills and circle around for some time before returning to the perch. They feed mainly in the early morning and late evening. Wood-swallows are particularly beneficial to man because they descend in large flocks, sometimes of thousands, onto swarms of locusts and cutworms, the destructive caterpillars of owlet moths. The masked wood-swallow is sometimes a nuisance because it feeds on honey bees.

Father to the rescue

The nests of wood-swallows are usually very loosely constructed saucers of twigs, roots and grass. They are usually placed on a branch, among the bases of palm leaves or in a hole up to 50 ft above the ground. The little wood-swallow nests in colonies among rocks or on cave ledges and the white-rumped wood-swallow sometimes uses the solid nests of mudlarks, which it relines. The clutch is of 2–4 eggs and in the species for which information is available, incubation takes 12 days and is shared by the parents. The chicks fly in another 12 days. There is one record of a brood of young Papuan wood-swallows being fed by four or five adults. In such a gregarious bird this behaviour is not surprising and may be quite widespread.

There is also a remarkable story of two young white-browed wood-swallows fluttering to the ground and being rescued by the male parent who carried them, one at a time in his feet, to a branch. There is a report of a sand martin behaving in a similar manner in England.

Mean tricks

The rescue of the chicks is a remarkable story, but in *Bird Wonders of Australia* AH Chisholm recounts another anecdote that shows a meaner side to the wood-swallow's character. Chisholm was watching a newly-fledged cuckoo-shrike calling for food when a white-browed wood-swallow landed nearby. When the parent cuckoo-shrike appeared with food the wood-swallow swept past, grabbed the food from its bill and sped away with the cuckoo-shrike in pursuit. One must presume that the wood-swallow had somehow learned to associate the begging calls of the young cuckoo-shrike with the arrival of the parent bearing food in the bill. Thieving of this sort seems to be a very individual matter even in species which employ it fairly regularly, such as sheathbills (p. 2225) and skuas (p. 2275). In the article Chisholm recounts how silver gulls in a particular part of Tasmania have formed the habit of riding on the backs of pelicans and grabbing the fish they catch.

◁ *Papuan wood-swallows nest on the top of a projecting stump or branch; parental duties are often shared—young birds have been seen being fed by four or five adults.*

△ *Masked wood-swallows congregate on a vine in a spacious captive enclosure. Wood-swallows are extremely sociable birds, they even roost in a compact huddle.*

class	**Aves**
order	**Passeriformes**
family	**Artamidae**
genus & species	***Artamus cyanopterus*** *dusky wood-swallow* ***A. fuscus*** *ashy swallow shrike* ***A. leucorhynchus*** *white-breasted wood-swallow* ***A. maximus*** *Papuan wood-swallow* ***A. minor*** *little wood-swallow* ***A. personatus*** *masked wood-swallow* ***A. superciliosus*** *white-browed wood-swallow* *others*

Eric Hosking

Well hidden in the woodland undergrowth, the wood-warbler ***Phylloscopus sibilatrix*** *guards its young*

Wood-warbler

The wood-warblers form a large family of small birds confined to the Americas. There are at present 113 species, but it has recently been suggested that the honeycreepers (p. 1225) belong to the same family and differ only in their adaptations for drinking nectar. They range in size from 4 to 7 in. long and have narrow, straight bills. The plumage is sometimes dull grey or brown but in many species it is bright, usually yellow, orange or black and white. In tropical America both male and female are brightly coloured but in temperate latitudes the female is sombre and the male brightly coloured only in the breeding season. The large number of species makes identification difficult; the songs, call notes and the male plumage are the most diagnostic features. In Britain the wood-warbler ***Phylloscopus sibilatrix*** *is a true warbler (p. 2660).*

A widespread wood-warbler is the yellow warbler ***Dendroica petechia*** *in which the sexes are very similarly coloured: buff above, yellow underneath, yellow and black on the wings and tail, the male having rusty streaks on the breast. Many other wood-warblers have more right to the name 'yellow warbler', particularly the yellow-breasted chat* ***Icteria virens,*** *the largest wood-warbler, which is olive-green above and bright yellow below with white around the eyes. Kirtland's warbler* ***D. kirtlandii,*** *with a yellow breast and black-streaked flanks, is unusual in being confined to an area of 60 by 80 miles in Michigan, where there are dense growths of jack pines 3–18 ft high. Two wood-warblers have blue in the plumage; the black-throated blue warbler* ***D. caerulescens*** *is most striking with blue-grey upper parts, black cheeks and throat and white underparts. Two other wood-warblers, the golden-winged—* ***Vermivora chysoptera*** *—and blue-winged —* ***V. pinus*** *—warblers, which are rather different in appearance, interbreed where their ranges overlap. The hybrids, which are fertile, were once considered separate species and were called Brewster's and Lawrence's warblers respectively.*

Wood-warblers breed from Alaska to southern South America, about half of which are found in North America and the West Indies. Like the vireos (p. 2638) wood-warblers occasionally migrate across the Atlantic to Europe.

Impressive migrations

Wood-warblers are found mainly in woodland and scrub country but they have colonised a wide variety of habitats. The northern waterthrush lives in bogs and others are found in deserts and in tropical rain forests. The chestnut-sided warbler prefers scrub country and has benefited from the clearing of forests. Most northern wood-warblers are migratory, travelling in flocks to Central and northern South America, sometimes to Brazil and Chile. These flocks, in which several species of wood-warblers fly in company with tits, are one of the most spectacular sights of North American bird-watching. In the spring, migration is rapid, the blackpoll warbler taking a month to travel from Florida to Alaska, and 'waves' of warblers, many in brightly-coloured breeding plumage, pass through North America.

The songs of wood-warblers are simple when compared with the varied calls of Old World warblers but the yellow-breasted chat is a good mimic.

Mainly insect-eaters

Almost all wood-warblers eat insects and the majority feed among the foliage. The ovenbird and waterthrushes feed on the ground and some wood-warblers, like flycatchers, hawk for flying insects. The latter have flattened bills surrounded by bristles for sweeping up their prey. The black and white warbler searches for insects among crevices in bark and has short legs and long claws which enable it to run up trunks like a creeper (p. 701). It is able to stay north in the autumn after other wood-warblers have migrated because insects hiding in crevices survive longer than those in exposed places. As it eats fruit and berries, the myrtle warbler also survives colder weather and can live in areas where there is snow in winter.

Varied nest sites

The nests of wood-warblers are cup-shaped or domed, some being built 50 ft or more up in the tops of trees and others on the ground. The parula warbler builds its nests in hanging skeins of Spanish moss. The nest of the ovenbird, not to be confused with the ovenbirds of the family Furnariidae (p. 1789), is a dome-shaped nest of leaves built on the ground. The prothonotary warbler sometimes builds in holes or nest boxes. It is named after the papal secretary who wears orange-yellow robes. In tropical America the clutch is 2 or 3 eggs but in temperate latitudes it is 3–5. The female alone incubates but both parents feed the chicks. Incubation ranges from 10 to 16 days and fledging from 8 to 14 days. The periods are shorter in tropical than in the northern migratory species.

Saving Kirtland's warbler

The story of Kirtland's warbler has been told by HF Mayfield in *The Kirtland's Warbler*. Its nesting place was discovered in Michigan in 1903 and it was later found that it wintered only in the Bahamas. It is not evenly distributed through the jack pine forests as it has a definite preference for young trees, moving into areas about 6 years after felling or burning when saplings have reached a height of 6 ft. There is now a programme of controlled burning to ensure that a suitable habitat is always available. In 1951 a painstaking census revealed 432 singing males and 10 years later 502 were found. In 1971 and 1974 numbers had fallen, only 200 pairs were counted, a woefully small number to ensure survival. The warbler is, however, protected by law and, more important, by public sentiment in both its summer and its winter homes. Disaster could, however, befall it while migrating and its numbers seem to be severely limited by cowbirds which parasitise half the nests each year.

class	**Aves**
order	**Passeriformes**
family	**Parulidae**
genera & species	***Dendroica coronata*** *myrtle warbler* ***D. striata*** *blackpoll warbler* ***Geothlypis trichas*** *yellowthroat* ***Icteria virens*** *yellow-breasted chat* ***Mniotilta varia*** *black and white warbler* ***Parula americana*** *parula warbler* ***Protonotaria citrea*** *prothonotary warbler* ***Seiurus aurocapillus*** *ovenbird* ***S. noveboracensis*** *northern waterthrush, others*

James Carr

Woolly monkey

The woolly monkey is one of the commonest monkeys kept in captivity, yet very little is known about it in the wild. It is fairly large and is closely related to the spider monkey. Although only 16–22 in. long in head and body, with a tail of 22–28 in. long, it weighs 7½–20 lb, and is much fatter than the spider monkey. Like the spider monkey, however, it always seems to be pot-bellied. The woolly monkey has close, woolly fur and a black face which, in spite of the widely spaced nostrils, as in all New World monkeys, can look strikingly human, with a high and rounded forehead. The tail is prehensile, with a naked undersurface at the tip, covered with ridges and creases like fingerprints. This specialised skin is called volar skin.

Woolly monkeys live in the forests of South America. The common species is Humboldt's woolly monkey, which varies in colour in different areas from grey to pale brown or nearly black; often the head is black and the body pale. The very rare Hendee's woolly monkey, known from only a few specimens, is confined to a small area on the eastern flanks of the Andes. It is a deep mahogany colour with a yellow band underneath the end half of the tail, and a buff nose patch. It has never been seen alive by a European.

Mealtime acrobats

Humboldt's woolly monkey lives high in the trees, often in the emergent crowns which reach above the general forest canopy. In spite of its somewhat clumsy-looking build it is agile, and has the advantage of a 'fifth limb' in its tail, which is prehensile. With the help of this versatile appendage it can move among very thin branches, hanging underneath them, feeding with its hands while grasping with its tail only, or with its tail and one foot. It does not leap, but when it comes to an open space goes around it, or simply drops into a lower layer of branches. It does not seem to come to the ground at all in the wild. In captivity it generally flexes its hands on the ground, and walks in a somewhat ape-like manner. When resting, it sits upright, grasping with its tail. It sleeps curled up, with the tail wrapped around the body, or holding on to a branch.

Woolly monkeys have been seen in troops of 15–25, but they apparently do not hold territories. As in troops of spider monkeys, membership of a troop is probably not permanent. The troops of woolly monkeys often mix while feeding with troops of other monkeys, such as howlers or capuchins. The different species do not compete for food, but they do provide extra protection from predators, such as birds of prey or large snakes, because there are more eyes to keep a lookout for them.

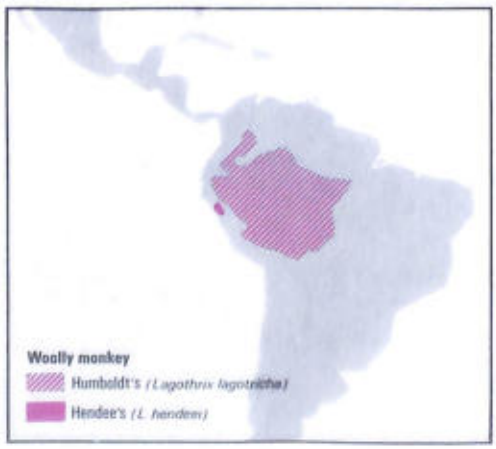
Woolly monkeys feed on leaves and fruit. The signs of hard wear on their teeth seem to indicate that they eat a good deal of hard-shelled fruit.

Leonard Williams

△ *The agile acrobatics of woolly monkeys make them popular zoo animals. Their prehensile tail is in constant use as a 'fifth limb'.*

H Schifter

△ *Baby takes a ride as mother snacks nonchalantly. The young monkey stays aboard by gripping its parents short, thick fur.*



Year-long infancy

As far as is known, there is no fixed breeding season although there may be a 'birth peak'. The gestation period is 7½ months, after which a single young is born. This is nursed for at least a year. Puberty is reached at four years, and the lifespan may be as much as 20 years.

Forgotten monkeys

Woolly monkeys are gentle and placid creatures, which makes them good pets. Some individuals, however, may become dangerous when they are older, but they are not as irritable as the Old World monkeys, and do not become bad-tempered with the same regularity. They have been submitted to intelligence tests, but not on a very wide scale. From what has been done they appear to be highly intelligent, like capuchins, and more so than an Old World monkey, although less so than an ape. They are so familiar in zoos and through Leonard Williams's books, that it is surprising that so little is known of their behaviour in the wild. All the more surprising is that so little is known of the 'forgotten' second species, Hendee's woolly monkey.

This was described as *Simia flavicauda* by Baron von Humboldt as long ago as 1812, at the same time as he described the more familiar species which is now named after him. Humboldt in fact saw only the trimmed, flat skins of the first species which were used as saddle covers by muleteers in Peru. Of the monkey itself he saw nothing, although its Peruvian name was given as *choro*. Pöppig mentioned reports of it in the same area near Yurimaguas, Maynas district, Peru, in 1832. Nothing more was heard of the species until Oldfield Thomas, of the British Museum (Natural History), obtained a skin from the same general area and described it as *Lagothrix hendèei*. He knew of Humboldt's description, but because of its somewhat sketchy nature and the worn nature of the skins Humboldt saw, Thomas considered it was not the same animal. The matter was not seriously considered again until 1963, when Jack Fooden pointed out that, in spite of the apparent discrepancies in the descriptions, the two forms must be the same animal, and that moreover it has an exceedingly restricted range in the San Martin and La Lejia areas of the Andes, about 5 000 feet above sea level. It is certainly the least known of all South American monkeys.

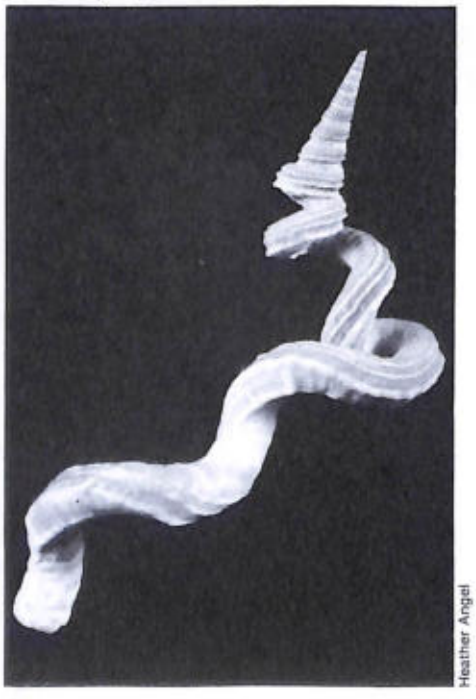
class	**Mammalia**
order	**Primates**
family	**Cebidae**
genus & species	***Lagothrix hendeei*** *Hendee's woolly monkey* ***L. lagotricha*** *Humboldt's woolly monkey*

▷ *The woolly monkey's furry skin was used as a saddle-cloth by the Peruvians 200 years ago.*
◁ *Overleaf: a wistful woolly monkey shows clearly the widely spaced and outward-facing nostrils of New World monkeys, or platyrrhines.*

Photo Library Inc

Worm shell

Worm shells are a remarkable group of molluscs whose shells have come to resemble worm tubes. Because they are so odd nobody is quite sure what common name to give them—their various common names include tube molluscs, tube snails, worm shells and vermetids. They start life as quite ordinary little creeping snails with typical coiled shells, but soon they settle in one place and cement themselves to a rock or embed themselves in a sponge. Their shells, which may be various shades of cream, grey, pink or brown, then continue to grow either as long irregular tubes or in loose coils. Tube snails are limited to tropical and warm-temperate seas. They are now divided into two families, the Siliquariidae and the Vermetidae, which may possibly have evolved separately from more typical snails, since they differ in a number of important ways.



Heather Angel

△ *The tortuous unravelled look of a worm shell.*
▷ *Fixed for life:* ***Aletes squamigerus.***

Feeding like barnacles

In the first family, the Siliquariidae, the shell becomes a loose spiral, like a corkscrew, embedded in the substratum. The first whorls form a narrow, tight spiral like the turret shells Turritellidae, from which the group may have evolved. The siliquariids feed by drawing water in over their single gills by the action of the cilia on them, a method also used by the sessile, but not closely related, slipper limpets. Diatoms and other particles become entangled in mucus and are propelled by cilia to the mouth. In *Siliquaria*, water leaves the body from a slit running the length of the shell. Another method of feeding has been observed in one member of the family, *Stephopoma*, which is unique among molluscs but reminiscent of the feeding of barnacles. The gill filaments are extended out of the tube and, like the legs of barnacles, are swept through the water to trap small organisms.

Passive breeding

Since worm shells cannot move about, their eggs have to be fertilised by sperms carried in water currents into the mantle cavity of the female. The eggs of siliquariids are laid in separate capsules and are usually retained, lying free, in the mantle cavity, although in *Pyxipoma* there is a special brood pouch. The veliger stage is passed through in the egg and the young emerge as crawling snails and not as the free-swimming larvae we should expect as appropriate for the distribution of these otherwise sedentary animals. Like many other snails, the siliquariids have an operculum, that is, a horny lid that can be pulled into place to close the aperture of the shell; this cover can be unusually elaborate and decorated with branched bristles. When the operculum is half closed, the bristles form a filter keeping out excessively large particles during feeding. The operculum can be put to another use by the embryo when ready to hatch. Its sharp edge may be used to cut through the wall of the egg capsule.

Slimy line-fishing

The members of the other family, the Vermetidae, have generally similar breeding habits except that several eggs are laid in one capsule and the capsules are attached inside the aperture of the mother's shell. The irregular tube-like shells of some of this family may be entwined together into

DP Wilson

masses, sometimes forming large reefs or banks. Together with the tubeworms of the family Serpulidae and the stony corals or madreporarians, they form the main constituents of the miniature atolls or 'boilers' in the Bermudas. The main points of interest in this family centre around the different methods of feeding. The evolution of this habit is best illustrated by a comparison of two contrasting species. *Serpulorbis novaehollandiae* lives on the outermost reefs of the Great Barrier Reef and is one of the few snails to stand the powerful battering of the waves. Its shell, which can grow to a length of 10½ in., is thick and cemented all along its length to the dead coral rock. The mouth, sometimes 1½ in. across, can be closed by a horny operculum. It feeds by collecting particles from the incoming stream of water on the long, ciliated gill filaments. These particles become trapped in mucus which is propelled to the mouth. The bulk of the mucus is augmented by additional mucus balls from a gland below the mouth.

Serpulorbis gigas forms thinner-walled, twisted shells reaching about 8 in. in length and with an internal diameter up to ⅝ in. Most of the tube is not cemented to the rock but is raised up and often intertwined with others. *S. gigas* lives only in still water and feeds in a way that could not work in rough water but which is made easier by the raising of the shell aperture. The gland that in *S. novaehollandiae* merely supplements the mucus passing to the mouth is much better developed in *S. gigas* and produces long threads of slime, up to a foot long, that float in the water. After floating for a while, the threads are devoured as the many little grappling-hook teeth of the radula haul them into the mouth together with any captured prey or other particles.

Larger prey may be taken directly if it passes near the mouth. Strong feeding or respiratory currents would disturb the 'fishing lines' so it is understandable that the gills should be reduced. Likewise an operculum would be in the way, and this, also, is not present in the adult.

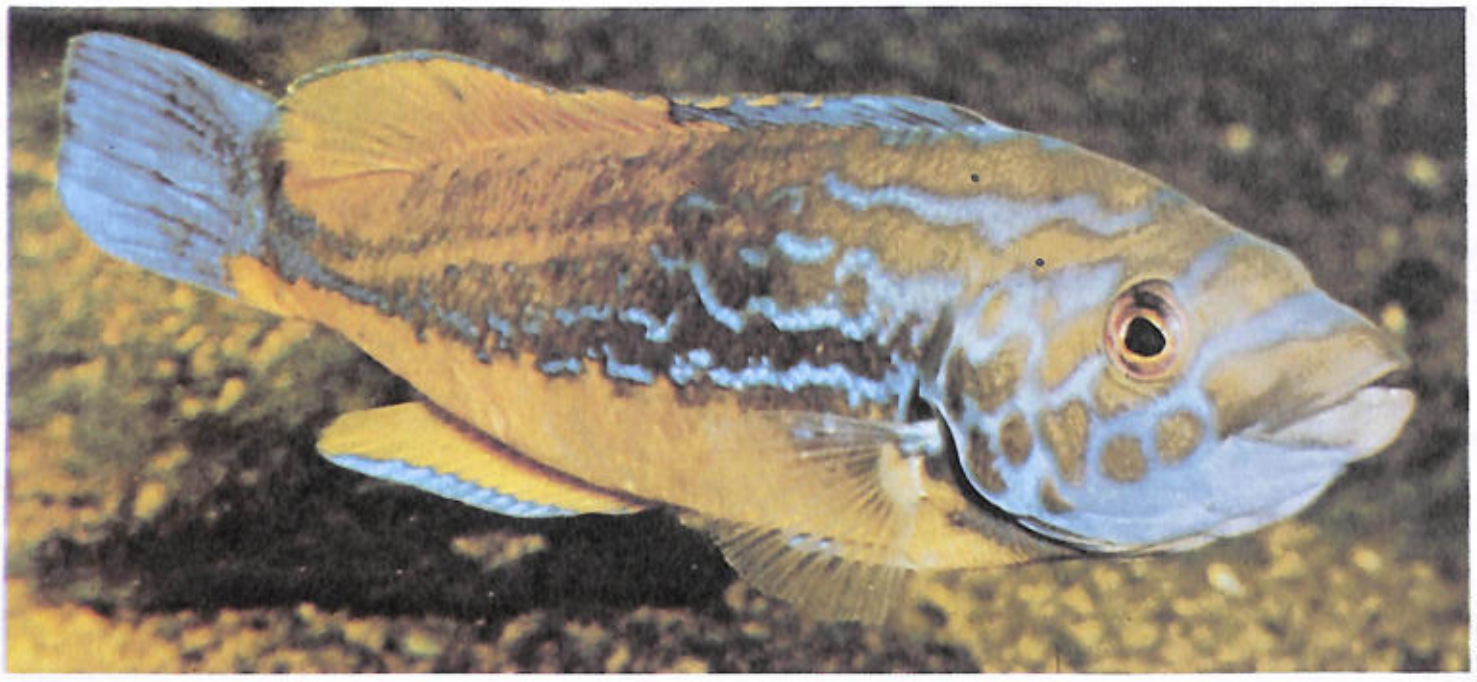
Evolution gone berserk

With these two species in mind, it is possible to speculate on their evolution from grazing ancestors, whose gills bore cilia just to create respiratory currents and sweep away sediment, to creeping snails using their gills for feeding, and so to fixed tube snails feeding in the same way and producing an excess of mucus that was eventually put to good use as a snare, while the gills reverted to their purely respiratory role. If this supposition is correct, then the production of mucus has gone almost to the point of madness in the scaled worm shell *S. squamigerus* of the American Pacific coast. In this species sheets of mucus up to 6 in. long are secreted, instead of strings, and those of neighbouring individuals tend to merge into one. So, when one worm shell starts to eat, all the others do so too.

Chris Howell-Jones

△ ***Serpulorbis*** *feeding: mucous strands up to a foot long trail on the surface, trapping food.*

phylum	**Mollusca**
class	**Gastropoda**
order	**Mesogastropoda**
families	**Siliquariidae** **Vermetidae**



DP Wilson

Wrasse

Wrasses are noted for their brilliant colours and for the way their colours and patterns vary with sex and age. Their belligerence, too, is exceptional.

A typical wrasse, and one whose behaviour is best known, is the cuckoo wrasse of the western Atlantic seaboard and the Mediterranean. It is long bodied, compressed laterally, with a long head and jaws. The lips are thick, the teeth in the front of the mouth well-developed and the angle of the jaw goes back nearly to the level of the large eye. The single dorsal fin is long, its front half spiny, the rear half soft-rayed. The anal fin is long, the tailfin square-ended, and the pelvics are forward on a level with the base of the pectorals. There are marked colour differences between the sexes. The male is yellow or orange with a vivid blue head and back with blue lines running over the gill-covers and along the flanks. Females and young fishes vary in colour from orange to red, with three spots on the rear half of the back.

The 600 species range from 3in. slender fishes to 10ft giants which weigh several hundred pounds, and are most numerous in tropical seas. Some of the small wrasses are cleaner fishes. One of the most colourful of the larger wrasses is the Atlantic bluehead. The males are blue with black bands in the front half and green in the rear half including the crescentic tail. The females and immatures range from yellow to green. Other Atlantic species are the corkwing or sea pheasant, rainbow wrasse and the ballan wrasse, on the European side, and the pudding wife, tautog, razorfish and hogfish on the American side.

Home-loving fishes

Wrasses are solitary fishes that live, at the most in pairs or trios, seldom in schools, in shallow seas, around rocky coasts and coral reefs. Some species live between tidemarks and shelter in rock pools when the tide is out. Another marked feature of their behaviour is the tendency for each fish to keep to one place from which it makes feeding sorties. This is most marked in the species that have become cleaner fishes, but with other wrasses, also, observers have commented how they could rely on seeing the same fish in the same place. They are rock-haunters which swim by twisting movements of the rear part of the dorsal fin and the anal fin helped by backward beats of the pectorals. When speed is needed this is supplemented by movements of the whole body, but the fin swimming allows them to manoeuvre nimbly in confined spaces, as in rock crevices.

The strict territorial behaviour of wrasses is linked with their habitual aggressiveness. Their attacks take the form of biting off each other's fins or gouging out the eyes, and the extent and effectiveness of them can be judged from the reduction of numbers in one large tank, which originally contained 70 Hawaiian saddle wrasses; only a dozen remained after three months.

Armed with fangs

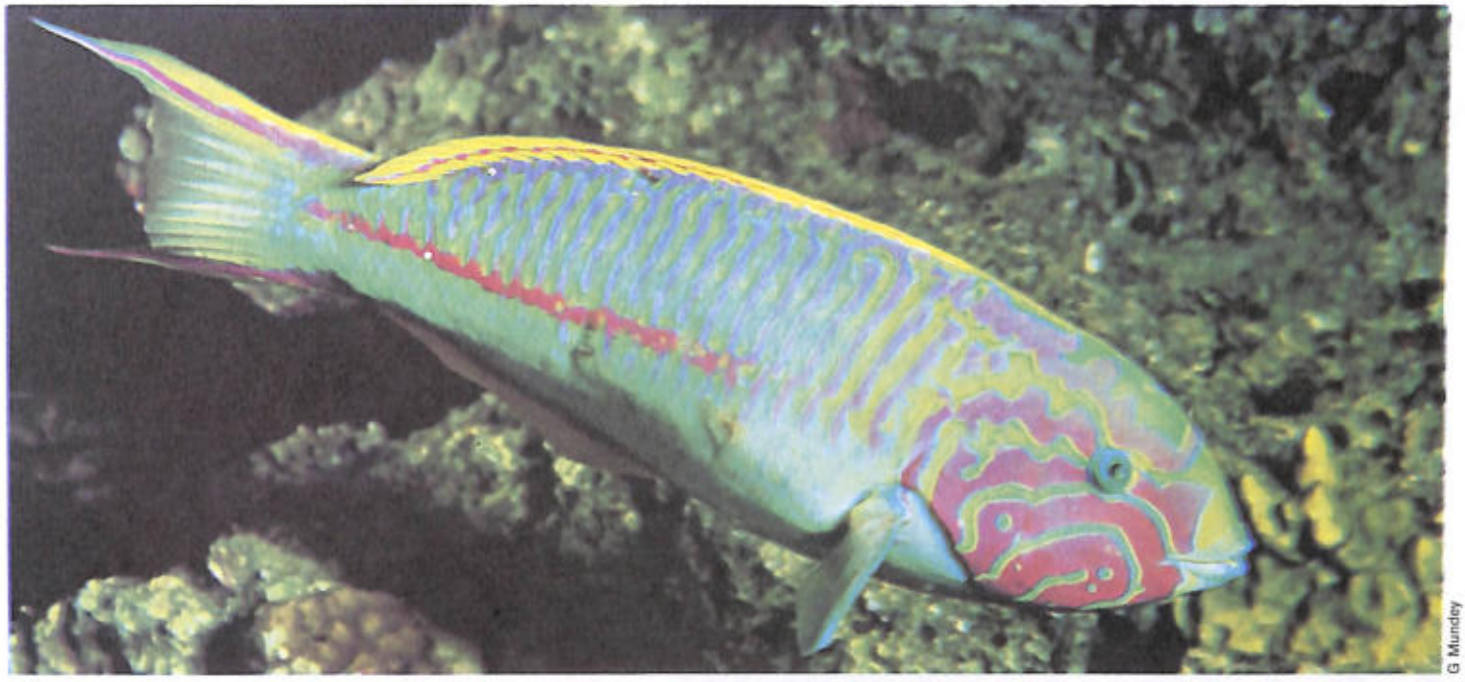
The strong and prominent front teeth which create such havoc include the one or more fang-like teeth in the side of each jaw. They are normally used to feed on crabs and sea snails as well as smaller fishes. Wrasses eat probably any animal food, including carrion, since they are often caught in crab and lobster pots which they seem to have entered to feed on the bait.

Rough courtship

Some wrasses construct their nests of seaweed and corallines wedged in a rock crevice, both sexes helping in the work. The eggs are laid in the middle of this tangled mass but there is no evidence that the parents guard the eggs. In others a shallow trough is dug in the sand in which the eggs are laid. Spawning seems to be preceded by a courtship, judging from the observations set forth by Douglas P Wilson in 1956. During one night in May, in the Plymouth Laboratory aquarium, Wilson watched a male cuckoo wrasse dig a nest in the sand by turning on his side and flapping vigorously with his tail. After that he attacked all the females around him, charging at them and nibbling them until he at last induced one to follow him to the nest. During this excited behaviour the male went white over a large area of the head and back, which may have acted as a visual stimulus to the female. The eggs, $\frac{1}{25}$ in. in diameter, hatch in 21 days, the baby fishes becoming planktonic. Cuckoo wrasse are believed to live up to 17 years.

Problems of colour

The bright colours of wrasses have more than artistic merit—they pose problems worthy of further thought. To start with wrasses are one of the few groups of fishes in which females and males differ markedly in colour. The next point is that while it is not unusual for fishes living around gaudily coloured coral reefs to be brightly coloured, presumably being camouflaged against their background, it is unusual for their relatives in temperate seas to be equally brightly coloured. Presumably wrasses have few enemies, so can be brightly coloured with impunity. This idea is supported by those wrasses that act as cleaners, a trade they could not carry out without an unusual immunity from attack. There are even species, of blennies for example, that mimic their shape and colours, a sure sign that these are protective. By contrast, there are a number of wrasses in the South Pacific that look like lumps of floating weed. They are a translucent green with dark brown lines and white blotches. Moreover, they hold themselves limp so they are carried back and forth in the surf, as seaweed would be: an effective camouflage.



G Mundey

E S Hobson

Fishes abed

Those who say we can rely on seeing the same wrasse in the same place each day are supported by the findings of those who have studied wrasses in marine aquaria. These find that wrasses spend much time resting on rock ledges or in crevices during the day, and that the fishes go to these same places at night to sleep—and they lie on their sides to do so. More remarkable are the findings of WA Gosline and V Brock that the wrasses around Hawaii bury themselves in the sand at night to sleep. When these wrasses are kept in an aquarium they swim about all day and at night the aquaria look empty. All the fishes seem to disappear. Of the 48 species studied only one does not go into the sand to sleep. This is *Labroides phthirophagus*, which surrounds itself with a mucous envelope, a sort of nightdress, like the parrotfish, mentioned on page 1847.

class	**Osteichthyes**
order	**Perciformes**
family	**Labridae**
genera & species	***Coris julis*** *rainbow wrasse* ***Crenilabrus melops*** *corkwing* ***Halichoeres radiatus*** *pudding wife* ***Labrus bergylta*** *ballan wrasse* ***L. mixtus*** *cuckoo wrasse* ***Lachnolaimus maximus*** *hogfish* ***Tautoga onitis*** *tautog* ***Thalassoma bifasciatum*** *Atlantic bluehead* ***Xyriclithys psittacus*** *razorfish* *others*

△ *Purples and greens:* ***Thalassoma ruppelli*** *exhibits a wide range of subtle hues.*
◁△ *Blues and yellows: male cuckoo wrasse in breeding colour—a northern species which ranges from Norway to the Mediterranean.*
◁ *Spawning aggregation of* ***Thalassoma lucasanum*** *in the Gulf of California.*

P Hinchliffe: Photo Res

A cosy nest in a damp situation: a European wren feeds its young with a tasty morsel.

Wren

In Europe the wren is a widespread and well-known bird of woodland and gardens. In Britain it is known affectionately as the Jenny wren; but it is the only European representative of a family that is otherwise confined to the New World. In Australia and New Zealand there is a large group of birds known as wrens or warblers which includes, among others, the thornbills, emu-wrens and blue-wrens. In New Zealand, a third group of 'wrens' consists of the bush wren, rock wren and rifleman.

The true wrens of the family Troglodytidae are mainly small, drab-coloured birds, but the cactus wren of the south-western United States and Mexico is 8 in. long. There are about 60 species, the most widespread being the wren of Europe, Asia and North Africa, which is also found in North America where it is known as the winter wren. It is 3¾ in. long and although it is popularly thought to be the smallest British bird, this honour is held by the goldcrest (p. 1058). In appearance it has the typical characters of other wrens: dumpy body, short, upturned tail, rounded wings, slender bill and brown plumage, lighter underneath with black bars on wings and tail.

A very widespread American wren is the house wren which ranges from southern Canada to Cape Horn and is one of three wrens found on the Falkland Islands. It is very similar in appearance to the winter wren. Bewick's wren has a white eyestripe and white underparts, and the cactus wren has a white breast densely spotted with black. The zapata wren was discovered only in 1926 and is restricted to a single swamp on the coast of Cuba.

Preference for undergrowth

The typical habitat of wrens is low, fairly dense undergrowth but the cactus wren and the rock wren—not to be confused with the New Zealand rock wren—are found in rocky desert country with sparse vegetation, the short-billed marsh wren and the zapata wren live in marshes, and several tropical wrens live on the floor of rain forests. Few wrens, except those living in the far north, migrate. The European wren suffers in hard winters when the ground below the undergrowth is covered by snow and after the severe winter of 1963 when their numbers in Britain were severely reduced, it was possible to determine their preference for different habitats. By means of a painstaking survey over several years it was shown that the surviving wrens set up territories in woodland and in well-covered banks of streams. As their numbers recovered they spread first into orchards and gardens and then into hedges.

Varied, delightful songs

As they usually live among undergrowth wrens are more often heard than seen. They have a variety of calls and rich songs which are surprisingly loud for such small birds. Some tropical wrens sing antiphonally, the pair keeping in contact in dense cover by singing in turn. The song of the winter wren is a shrill warble ending with a trill. It can be heard all the year round and is used for a variety of purposes apart from advertising the territory. EA Armstrong has, in his monograph *The Wren*, classified the variety of the wren's song. The loudest songs are territorial, defying males and attracting females, then there is a harsher song heard when a wren is challenging another bird. Softer, quieter songs are used in courtship and for inviting the female to inspect a nest while the softest song is heard from females as they sit on the nest. A fairly loud song is also heard when wrens are gathering at a communal roost.

A fishing wren

Wrens feed mainly on insects, particularly caterpillars, fly larvae, beetles, bugs and so on, which they find in crevices and on foliage. Cactus wrens turn over stones in their search for insects and European wrens have been known to catch small fish.

A wife in each nest

Most wrens build domed nests but some, such as the house wrens which often use nest-boxes, build cup-shaped nests in holes and crevices. In monogamous species both sexes build the nest but in polygamous species such as the European wrens and the marsh wrens the male builds the nest and the female lines it. These wrens may build several nests in their territories, some of which are ignored, or are used only for roosting.

Polygamy is related to an abundant food supply but in all cases the female alone incubates the eggs, although she may be fed by the male. The clutch ranges from 2 or 3 in the tropics to 8—10 in temperate regions and incubation takes about two weeks. The chicks fly in another two weeks and the male helps feed them. There is more than one brood in a year and in the house wren the young of one brood may help feed the young of the next.

Wrens in dormitories

Wrens frequently roost under cover, working their way into crevices, holes in trees, old nests, even into pockets of clothes hanging out to dry, and some tropical wrens build special roosting nests. Wrens are usually solitary but they may gather to roost communally; 61 European wrens were once counted roosting in a nest box. Communal roosting occurs most frequently in hard weather and it appears that wrens remember suitable roosting sites for future use. As dusk gathers the wrens gather and it seems that they follow a leader who calls or sings to them in a particular way. As more wrens fly in to join the group they chase from perch to perch until they finally enter their roost arranging themselves tier upon tier with heads directed inwards.

class	**Aves**
order	**Passeriformes**
family	**Troglodytidae**
genera & species	***Campylorhynchus brunneicapillus*** *cactus wren* ***Cistothorus platensis*** *short-billed marsh wren* ***Ferminia cerverai*** *zapata wren* ***Salpinctes obsoletus*** *rock wren* ***Thryomanes bewickii*** *Bewick's wren* ***Troglodytes aedon*** *house wren* ***T. troglodytes*** *winter or European wren*

Wryneck

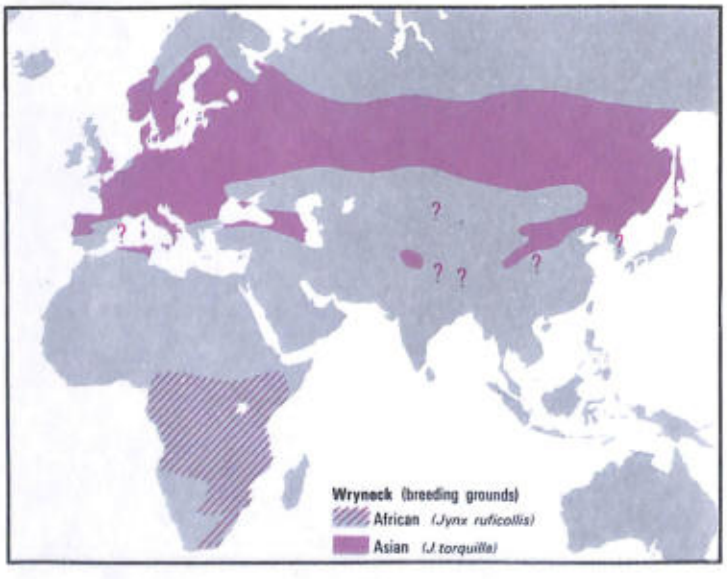
The wryneck is a relative of the woodpeckers but resembles the nightjars in appearance and at a distance can be mistaken for a thrush, especially when it feeds on the ground. It is about 6½ in. long, a little larger than a house sparrow, of slight build and mottled grey-brown plumage. The wryneck is thought to be the most primitive of the woodpecker family as it lacks the stiff tail feathers which woodpeckers use as a prop when climbing and its bill is weak and incapable of chiselling into trees. However, wrynecks have one toe facing sideways to assist climbing and have long hyoid bones supporting the tongue which run back under the skull and over the top of the cranium, features typical of woodpeckers.

The common wryneck ranges across Europe and Asia from southern England to Japan, being widely distributed in Europe except for the extreme north and the extreme southwest and southeast. It is also found in parts of North Africa. The plumage is brown, delicately mottled and streaked with grey and black and the underparts are barred. The chestnut-breasted wryneck of tropical Africa is similar to the Eurasian species except that the throat and breast are rich chestnut and the belly is pale with brown streaks.

▽ *Contortionist: balanced precariously a wryneck twists its head right round to see what is happening behind it. Wrynecks perform this extraordinary trick especially when they are frightened. This species is the African chestnut-breasted wryneck, so called because of its distinctively coloured feather collar.*

Peter Johnson

Eric Hosking



△ *Flying away with a faecal pellet, a common wryneck dutifully cleans its nest.*
▽ *A juicy beakful: a common wryneck brings ant pupae for its young. Note the wryneck's third eyelid, known as a nictitating membrane. It lies underneath the eyelid on the nasal side, and can be drawn horizontally across the eye. It is usually transparent in diurnal birds like the wryneck, and can be drawn across the eye to moisten or clean it without shutting out the light.*

Cuckoo's mate

The wryneck gets its strange name from its habit of twisting its head round over its back when frightened; an old name for it was snakebird because of the resemblance of this action to a snake waving its neck. A third name for the wryneck was 'cuckoo's mate', because it arrives from its winter quarters in Africa and India at the same time as the cuckoo. Like the cuckoo it is more often heard than seen, its call of 'quee-quee-quee-quee—' sounding like the shrill notes of a kestrel. Wrynecks spend most of their time in the trees but also feed on the ground, as do some true woodpeckers. Although they lack the spiny tail feathers of a true woodpecker, they sometimes use the tail as a prop. They climb very easily on tree trunks and hide by running to the other side of the trunk. When disturbed they fly fairly slowly on an undulating course.

Arthur Christiansen

Dependent on ants

Wrynecks feed on insects, particularly ants and their pupae, and beetles, butterflies, moths and their larvae. Nestling wrynecks are often fed entirely on the pupae and workers of the common black and yellow ants. During dry weather, when the pupae are carried farther below ground, the nestlings may go short of food. Wrynecks occasionally chase flying insects but usually pick up insects from crevices in bark or in the ground or wipe insects off the surface of leaves with their long tongues.

Brought up on ants

During courtship the pair 'gape' at each other, displaying their pink mouths and writhing and wriggling their necks in the manner that earned them their name. They have occasionally been reported as drumming like woodpeckers.

The usual nest site of wrynecks is a hole in a tree. They are unable to bore their own holes, and have to rely on natural ones. They also use nest-boxes and holes in banks or in walls. The 5—12, usually 7—10, dull white eggs are laid on the unlined floor of the hole. Both parents incubate the eggs until they hatch after 12 days. The chicks are fed by both parents on insects, nearly always ants, brought in the bill.

Vanishing wrynecks

At one time the wryneck was common enough in Britain to have over a score of local names. At present, the wryneck is one of Britain's rarest breeding birds—only about 50 pairs are reported each year, mainly in the southeast. A decline in wryneck population has also occurred in many European countries, but the British wrynecks have suffered worse, perhaps because Britain is at the extreme end of their range.

It is difficult to give a reason for the decline in wrynecks. Like other hole-nesting birds they may be short of nesting sites because of land clearance and increased ploughing may have severely affected ant populations. There is, however, no conclusive evidence for this. Whatever the reason, the wryneck and some European birds are showing a decrease, while others, such as the collared dove (p. 614), are increasing. Often the causes of the changes are unknown or improperly known, and this makes it very difficult to assess the effects of man's activities on animals; a decline in numbers of a species is not necessarily evidence of pollution or over-hunting.

class	**Aves**
order	**Piciformes**
family	**Picidae**
genus & species	***Jynx ruficollis*** *Chestnut-breasted wryneck* ***J. torquilla*** *Common wryneck*

Gene Wolfsheimer

△ *X-ray fish quartet; males escort a female (top).*

X-ray fish

Many small tropical freshwater fishes are semi-transparent, but one particular species has been called the X-ray fish because it is almost totally transparent. The swimbladder and much of the skeleton can be seen but the stomach and intestine are opaque and the hind part of the body is semi-opaque.

X-ray fishes are up to 2 in. long. The body is fairly deep and ends in a forked tailfin. The first dorsal fin is high and so is the long-based anal fin. The second dorsal is very small and the pectoral and pelvic fins are of only moderate size. Although the body is usually described as transparent it sometimes appears silvery in reflected light. At other times it has a faint yellowish or a greenish tinge and there is a black shoulder spot. The first dorsal and the anal fins are lemon yellow with a prominent black blotch or band and they are white at the tips. The tailfin is reddish. The combination of red, black and yellow in the fins recalls the more prominent colours of the goldfinch and another common name used for this species is water goldfinch.

The X-ray fish lives in the rivers of northeastern South America, from the Amazon Basin to the Orinoco River and the Guianas.

Jerky swimmers

These small fishes live mostly in shoals that swim rapidly backwards and forwards. When in smaller groups they are rather shy and tend to hide among water plants or in shaded places. They swim in a jerky manner, letting the tail drop slowly then flicking the fins to bring it up and to let it drop again.

Early in this century the X-ray fish became a favourite aquarium fish, popular not only for its semi-transparency – which was something of a curiosity – but also for its colours and its sprightly movements.

Small but thorough carnivore

The generic name of this fish *Pristella* means 'little saw'. The fish's specific name *riddlei* is in honour of Oscar Riddle who first collected it. Saw-like teeth and an upward-sloping mouth are a clear indication of a carnivorous diet. The X-ray fish is, in fact, closely related to the piranha (p. 1915), which has such a bad reputation for savagery. The X-ray fish, being so much smaller, feeds on smaller prey, mainly animal plankton and insect larvae, but it will take anything living of appropriate size, and also small worms. Even when young it feeds on animals such as rotifers, the nauplius larvae of crustaceans, small insect larvae, very small worms and the hosts of microscopic protozoans, which used to be known as infusorians, living in the freshwater plankton.

Small fry keep to cover

The female is the more robust, the male being markedly slimmer. The sexes can be told apart by viewing them against the light: the hind end of the body cavity of the female is rounded, while that of the male tapers to a point. In spawning the eggs and milt are shed into the water, fertilisation being external. Each female lays 70–150 eggs at a time. As a rule, spawning takes place in full sunlight, in the morning, among water plants. The eggs hatch in 20–28 hours, the larvae hanging like minute glass rods on the leaves of the water plants for a day or two, before starting to swim. They keep to the cover of vegetation, however, for the first two weeks. They grow rapidly and develop their full colours in about six weeks.

Fear of infanticide

There is little precise information on the natural enemies of the X-ray fish, but we can be fairly sure, from the relatively small number of eggs laid, that the number of enemies is small. Indeed, from what is known by keeping these fishes in aquaria the likelihood is that the main dangers are in early infancy and from being eaten by adults of their own kind. Care has to be taken to remove the parents to another tank after they have spawned.

Popular curiosities

It is always of interest to speculate about the reasons why this or that aquarium fish is popular. X-ray fish are colourful and lively but when they were first displayed in the Aquarium of the London Zoo, in the early years of this century, the comments made by visitors suggested it was first and foremost their transparency that captured attention. This may have been because people could see inside a fish – see its internal works – which is not possible with more familiar fishes. There is, however, another possibility – that what they could see was aesthetically pleasing. An X-ray picture of quite an ordinary small fish can be most pleasing to look at. So is a fossil fish in which the skeleton is whole and laid out as an etching in a rock, showing the orderly arrangement of the vertebrae and the ribs.

class	**Osteichthyes**
order	**Cypriniformes**
family	**Characidae**
genus & species	***Pristella riddlei***

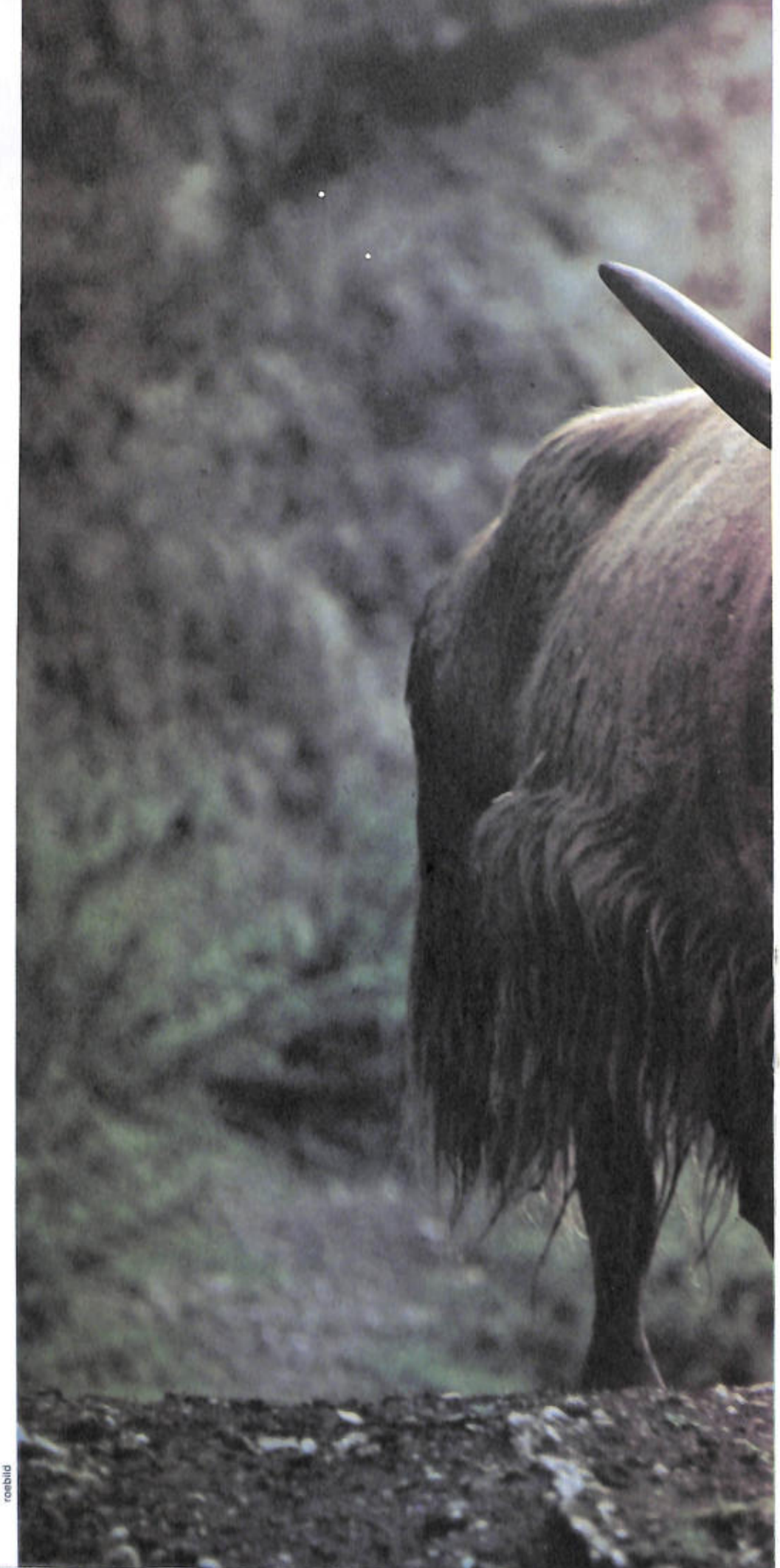
Yak

The yak is the wild and also the domestic ox of the Tibetan plateau, and of all large animals it lives in probably the most inhospitable region in the world. The wonder is it can subsist on such scant vegetation. A wild yak is possibly the largest of the cattle tribe; bulls are said to stand 6 ft 8 in. high and to weigh ¾ ton. Domestic yak are very much smaller. The shoulders are humped, and there is a long fringe of hair on the shoulders, flanks, thighs and tail, almost sweeping the ground. The coat is black in wild yaks. In the domestic form it varies from black to piebald or white, and the hair is usually longer. Yak have long, thin angular horns, which point straight out sideways, then turn up, and at the tips turn back and inwards. In some domestic yak they turn outwards. The horns sometimes reach over 3 ft in length.

Domestic yak are found all over the highlands of central Asia, from the Rupshu plateau in Ladakh across Tibet to Szechwan, in the Pamir, Tienshan and Altai ranges. Sometimes they are crossed with domestic oxen to give a creature called the zo which is bred mainly in Ladakh and at lower altitudes and is difficult to distinguish from the true yak. Polled yak have been bred in places and zo, too, may be hornless. Wild yak are confined to the highest altitude zones in Tibet and Szechwan, going up to 20 000 ft, which is as high as any mammal in the world lives. They may have been displaced from some areas by domestic yak which compete for the same food, but herdsmen regard them as useful for improving the domestic stock from time to time.

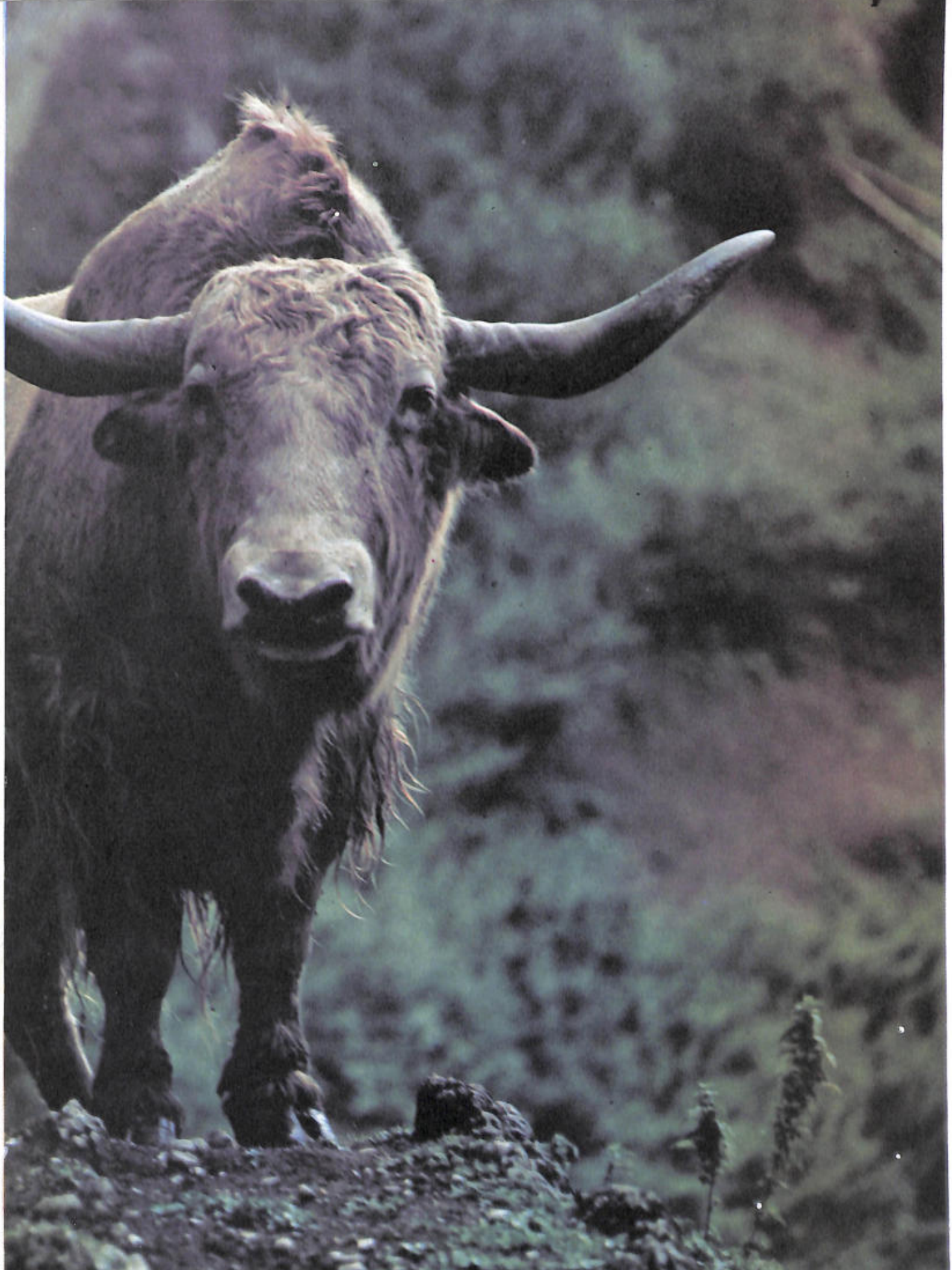
Swinging kilts

The cows and calves of wild yak live for most of the year in herds of 20–200. The adult bulls are solitary, or live in herds of up to five. The herds increase in size in the spring, when the freshly sprouting grass attracts large aggregations. In the summer they move higher up the mountains, returning to the lower plateaux in the autumn, where they wade through waterlogged valleys in search of moorland grasses. When the snow comes, around September in Szechwan, they make their way once more to the high ground, and here they wander along the snowy upland moors, on the Roof of the World, in temperatures that may be as low as −40°C/−40°F. The herd moves through the snow in single file, each animal placing its feet in the tracks of the one in front. When disturbed, the herd flees at a gallop, their long flank-fringes swaying from side to side, like kilts. Their only predators are wolves and bears, and only an unprotected calf will fall victim even to these.



roebild

▷ *Despite its cumbersome appearance, the domestic yak is very sure-footed and an expert climber, sometimes going as high as 20 000 ft.*



From one extreme to another

Although yak are one of the most cold-adapted animals in the world, they have been kept successfully in the subtropical environment of the Rio de Janeiro zoo, with its summer temperatures of 40°C/104°F. In this climate, the yak grow shorter coats, and their respiratory rate increases.

Clash of foreheads

Yak herds begin to split up in the rut, which takes place in July in Szechwan, but rather earlier in Ladakh. The big bulls fight for possession of cows, pushing against each other with their foreheads but doing no real damage. Gestation lasts for 280 days, so the young are born in April or May.

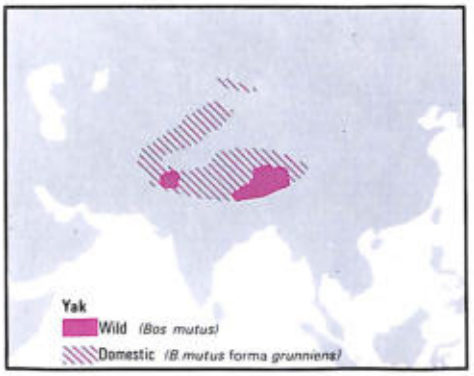
Economical yak

The economy of the peoples of the Central Asian mountains depends on the domesticated yak, both as a beast of burden and as a milk-producer. The strict lamaistic form of Buddhism practised in Tibet forbade their killing under normal circumstances, although sick yak may be slaughtered humanely. Yak skins are used as cloaks and for tents and rancid yak butter is made into ghee, an oil-like butter. The main use of the yak, however, is as a pack animal. Pure yak are used in the highlands, but at lower altitudes zo are used to carry trade goods, between Ladakh and Kashmir, for example.

Wild yak compete with domestic yak for grazing, but with man on their side the domestic animals always win and wild yak have been driven into the highest and most inaccessible places. In the 14th century wild yak occurred in the Tuva chain. In the 17th, they were known in Kusnezk; in 1739 there were 'not a few' in the Altai and Dauriya, as well as in the Semipalantinsk area. The northern yak—probably ancestral to the domestic yak still used in the southern Altai—have been described as a separate species, *Bos baicalensis*, now believed to be extinct.

Herwart Bohlken has made a special study of wild and domestic cattle. He has pointed out that domestic animals are so variable that to call them by any scientific species name is meaningless. Thus, although Linnaeus in 1758 called the yak *Bos grunniens* (because it grunts rather than moos), domestic yak are so variable that they cannot be classified into a subspecies or race—they have been bred by man and 'sheltered from the environment'—and Bohlken prefers to call the yak *Bos mutus* (a name first given to the wild form), distinguishing the domesticated form just as *Bos mutus* forma domestica *grunniens* to show from what wild species the domestic yak was derived. He applies similar rules to other wild and domestic cattle, and his point of view is gaining ground.

class	**Mammalia**
order	**Artiodactyla**
family	**Bovidae**
genus & species	***Bos mutus*** *wild* ***B. mutus (grunniens)*** *domestic*



At a height of 16 000 ft in Nepal, these yaks are indispensable to the mountain people as beasts of burden and providers of meat, milk and wool.

Detleg Hecker: Bavaria

Yellow-eyed penguin

The yellow-eyed or grand penguin provides a contrast in many respects to the other penguins in this encyclopedia. Of the 17 penguin species only six breed in the Antarctic and only the Adélie (p. 19) and the emperor (p. 857) are completely confined to the Antarctic, while the king penguin (p. 1363) reaches only the fringes. Although the Antarctic is usually thought of as the 'home' of penguins, the remaining 11 species breed around the shores of Africa, Australia and South America reaching as far north as the Galapagos Islands on the equator. The yellow-eyed penguin breeds on the coast of South Island, New Zealand and on Stewart, Auckland and Campbell Islands. In marked contrast to the Antarctic penguins its nests are well scattered among thick vegetation.

The yellow-eyed penguin is medium-sized, about 30 in. long and, like many penguins, has yellow plumes on the head. The plumes of the yellow-eyed penguin are only moderately elongated, unlike the flowing head-dresses of the macaroni and royal penguins. The crown and nape are yellowish gold with black flecks and there is a yellow band running around the head from each yellow eye. The rest of the body is slate grey with white underparts and white edges to the flippers.

MF Soper

Bathing belle, penguin style: a yellow-eyed penguin poses on one of its cliffside haunts.

Studied for 18 years

The yellow-eyed penguin is distinguished by being the first seabird to have its breeding habits intensively studied. Long-term studies have now been made on many birds but few cover as long a period as that of the yellow-eyed penguin, which was started in 1936 and finished in 1953. Furthermore, it was carried out by an amateur ornithologist, LE Richdale, who worked alone in his spare time. His study was made on a small colony, averaging about 40 nests, in which all the penguins were marked with individually numbered metal rings so that their breeding success, marital faithfulness, and many other aspects of their social life could be studied.

Unlike the Antarctic penguins but like many of those living in warmer waters, yellow-eyed penguins do not migrate. They stay in shallow coastal waters near the breeding places all the year round, coming on shore to roost. They also moult ashore just after the breeding season, the non-breeding penguins doing so first. The former have to build up reserves of fat after the breeding period to survive the 3-week moulting period, during which they lose 40% of their body weight.

Like other penguins, yellow-eyed penguins feed on small fish and squid.

Nests in holes

We usually think of penguins nesting in dense colonies on bare rocky cliffs and shores but some nest in burrows or crevices. The yellow-eyed penguin nests in holes, among rocks or under fallen logs in thick scrub or forests, up to half a mile from the sea. The nests are well spaced out and one nest may be 100 yd or more from its neighbours. This is in marked contrast to the colonies of the Adélie penguin where it has been found that more chicks are reared in the middle of large colonies where the nests are packed closely together. The advantage of having nests more spaced out is that there is less fighting between neighbours. Nevertheless, there is still some fighting in a colony of yellow-eyed penguins, particularly among young birds establishing nest sites.

The clutch of two white eggs is laid on a nest of sticks and grasses. Most clutches are started in the third week of September and are incubated by both parents for 6–7 weeks. The chicks are then fed at the nest for another 14–16 weeks until they have fledged. This is a long period compared with the 9-week fledging period of the similar-sized Adélie penguin. When they leave their nests, the young penguins, which can be distinguished only by the yellow bands on the sides of the head, gather on pathways leading down to the sea, and take to the water together.

Some yellow-eyed penguins breed when two years old, others wait until they are three. In Richdale's colony 5 out of the 36 penguins lived for more than 18 years.

Low divorce rate

Richdale's study on the yellow-eyed penguin was one of the first to show that some birds return to the same nest site and partner year after year. This is particularly marked in seabirds which are generally long-lived. The 'divorce rate' each year among the yellow-eyed penguins was about 14%, excluding pairs which dissolved through the death of one member, and one pair remained faithful for 13 seasons. A similar divorce rate exists in Adélie penguins and it has been found that two birds are less likely to remate if they were unsuccessful in breeding in the previous season. In other birds the divorce rate may be lower: 2–3%, for instance, in skuas.

In the Adélie penguin it has been shown that there is more to faithfulness to a mate than just two birds returning to their old nest site. Individuals can definitely recognise each other by voice, if not by sight.

class	**Aves**
order	**Sphenisciformes**
family	**Spheniscidae**
genus & species	***Megadyptes antipodes***

Yucca moth

There is a genus of small American moths which pollinate the flowers of yucca plants and whose larvae feed on their seeds. The mutually dependent relationship between moth and plant is unusually intricate and precise. It is, in fact, one of the most wonderful cases known of balanced symbiosis, an association of two wholly distinct organisms for their mutual advantage. The larvae of the moth can feed only on developing seeds of yucca and the plant is pollinated only by this particular moth. The moth provides for the needs of both the plant and her offspring by what appears to be a deliberate and calculated course of action on her part.

The yucca plants themselves are peculiar. They grow in Mexico and the southwest United States and are sometimes called Spanish bayonets, from the cluster of dark green sword-like leaves that spring from the rootstock. A tall stem bearing the flowers rises from out of the centre of the clump of leaves. The yucca is a popular plant in ornamental gardens in Europe as well as North America.

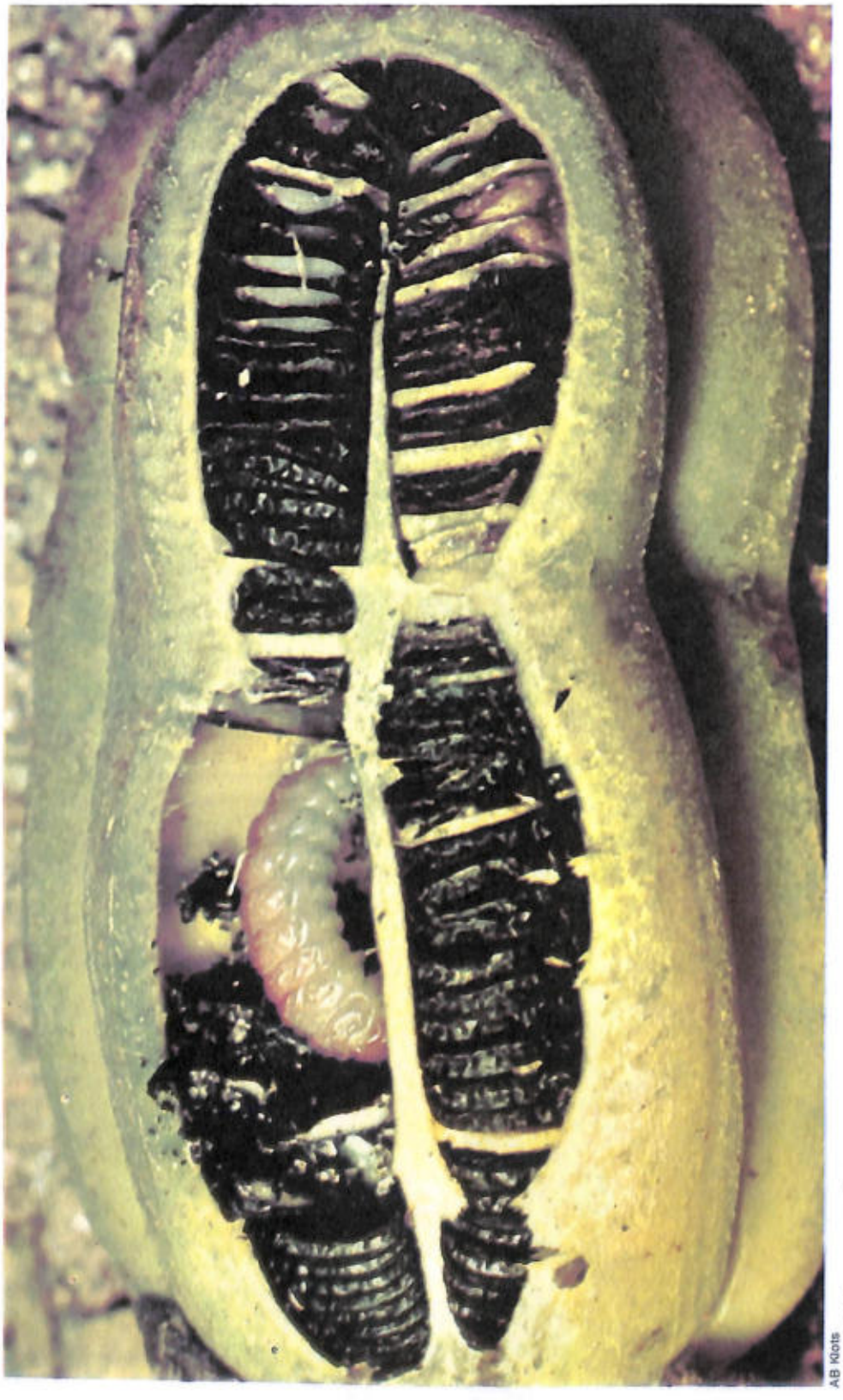
The moths belong to the genus ***Tegeticula*** *(formerly called* ***Pronuba****) and are known as yucca moths. They are small white moths, just under ½ in. long and about 1 in. across the spread wings. The best known species is* ***Tegeticula yuccasella****. Each of the different species is attached to one particular kind of yucca plant. Thus,* ***T. yuccasella*** *pollinates and feeds on* ***Yucca filamentos,*** *while* ***Yucca brevifolia*** *and* ***Y. whipplei*** *are associated with* ***Tegeticula synthetica*** *and* ***T. maculata*** *respectively. The association was first discovered and described by the American entomologist CV Riley in 1872.*

AB Klots

◁ *A mutual dependence: the yucca moth,* ***Tegeticula yuccasella****, depends on the plant for food; the yucca flower depends on the insect for pollination.*

Precision pollination

The yucca moth becomes active after dark and when she has mated the female seeks out yucca flowers to collect pollen from them. To do this she uses a pair of curved tentacles which are formed from the modified right and left halves of the proboscis; the adult moth never feeds and has no use for a proboscis of the normal type. The pollen is sticky and the moth gathers it from open anthers and works it into a ball, which may be larger than her own head. Holding the ball with her tentacles, head and forelegs, she flies to another flower of the same species and presses the ball of pollen down onto the receptive end or stigma of the female part of the flower. The moth then lays one or two eggs in the ovary, at the base of the style. She may repeat this half-a-dozen times in a single flower. Then she flies off to repeat the process with other flowers. The pollen fertilises the ovules, which develop into seeds on which the larvae feed. As more seeds are produced than the larvae need, some ripen and grow into new yucca plants.



AB Klots

The moth is able to carry out this remarkable operation because of two unusual structural features. One is the modification of the mouth parts already mentioned. The other is the possession by the female of a piercing ovipositor, a most unusual thing among moths.

Insects and flowers

Flowering plants and insects have been evolving side by side since the Cretaceous period, about 100 million years ago, when dinosaurs still walked the earth. We admire the beautiful forms and colours of flowers, and their sweet scent, but they were not evolved for our appreciation. They are for the insects, as is the pollen. Probing into the flowers and flying from one to another the insects become dusted with pollen, so promoting the cross-fertilisation of one plant by another. This is insect pollination at its simplest level, but precise and peculiar adaptations of flowers to secure pollination with greater certainty are quite frequent. Adaptations on the part of the insect, as with the transformation of the yucca moth's proboscis, are more rare. Usually it is no more than a simple lengthening of the proboscis to reach into tubular flowers, best seen in some of the hawk moths.

Orchids show some of the remarkable instances of insects and flowers linked for survival. The pollen of many orchids is concentrated on small club-shaped organs called pollinia. When an insect visits a flower and pokes its head inside, these become detached and stick firmly to the insect's head or proboscis in such a way that when the insect goes to the next flower the pollen on them is applied accurately to the stigma and the flower is fertilised. A few kinds of orchid have, moreover, abandoned the traditional lure of an offer of nectar and they appeal to the insect in another way. In certain small wasps, for example, the males hatch some time before the females, so they hunt in vain for a mate during the earlier period of their adult life. The flower of the orchid concerned in the association has come to resemble the female wasp so closely that the frustrated males actually try to mate with the flowers and so carry pollen from one to the other. The European fly orchis, *Ophrys insectifera*, is pollinated in this way, but there are other examples of this kind of close relationship between a particular species of orchid and a particular species of wasp. If anything, the association between the yucca moth and the yucca plant is even closer, so if the moth became extinct the yucca plant would be doomed, and vice versa.

phylum	**Arthropoda**
class	**Insecta**
order	**Lepidoptera**
family	**Prodoxidae**

◁ *Inside the ovary of the yucca flower a yucca moth larva* ***Tegeticula yuccasella*** *feeds on the flat seeds. As the moth lays only one or two eggs in each seed pod the developing larvae do not eat all the seeds but leave some untouched to start new yucca plants.*

Zambezi shark

This is a shark with many aliases, remarkable for living in fresh water temporarily or permanently. In South Africa it is the Zambezi, shovelnose grey, slipway grey or van Rooyen's shark. In Australia the same species is called the whaler shark. In Central America we meet it again as the Lake Nicaragua shark. In the United States it is the bull, cub or ground shark.

The Zambezi shark has a broad head with a short rounded snout and small eyes. The body is heavy with a prominent triangular first dorsal fin and a small second dorsal fin set well back towards the tail fin with its long upper lobe. The pectoral fins are relatively large. The teeth are triangular with saw edges. The back and flanks are light to dark grey, the underside white. The Zambezi shark is up to 10 ft long and over 400 lb weight. Its distribution is probably worldwide in tropical and subtropical waters.

Attacks on bathers and canoes

This shark normally moves fairly slowly but can suddenly put on speed to attack. It frequents inshore waters and enters estuaries and rivers. Individuals have been caught 300 miles up the Zambezi. In America, as the bull or cub shark, it is also known to go more than 100 miles up rivers. In Central America, Lake Nicaragua, 96 miles long by 30 miles across and 106 ft above sea-level, has a permanent freshwater population. Wherever they are they have a reputation for being aggressive, attacking large fish including other sharks, human bathers and even attacking boats. There are several records of canoes being persistently bumped in the Limpopo River and of one shark biting through the fabric of a canoe so that it eventually sank. There seems to be a connection between the shark's attacks and the presence of fresh water. Off the Natal coast it has been noticed that when floodwaters from rivers are pouring into the sea, bathers in the less salt water have been attacked. There seems to be a greater incidence of attack on bathers in the freshwater Lake Nicaragua than in coastal waters.

In the United States, this shark has the additional common name of 'ground shark'. It has, however, been found in saltwater aquaria, such as the one at Durban, that unless it is injured or diseased, the Zambezi shark does not lie on the bottom. If it does it soon dies from lack of oxygen. Normally the shark swims continuously round and round the tank, night and day. Sharks cannot pump water across the gills, as bony fishes do, but must keep on the move to maintain the flow of water.

Cat-like vision

Sharks traditionally find their human victims by smell, especially following blood trails in the water. They must use sight as well, and this is emphasized by the accounts of persistent and seemingly deliberate attacks on boats. Although the eyes of the Zambezi shark are small we can assess its sight by studies made on related species in the same family. These show the eye to be well adapted for vision in bright and dim light. The retina is rich in rods but poor in cones, indicating a high degree of visual sensitivity, poor colour vision and poor discrimination of detail. A canoe would, therefore, be merely a fish-like shape, and one to be attacked. Another feature of the shark's eye is the tapetum lucidum, a layer of silvered, mirror-like plates which reflects light rays back through the retina so that the shark, like the cat on land, can make full use of light of low intensity. As with cats, the pupil is a vertical slit in bright light but round and well open in subdued light.

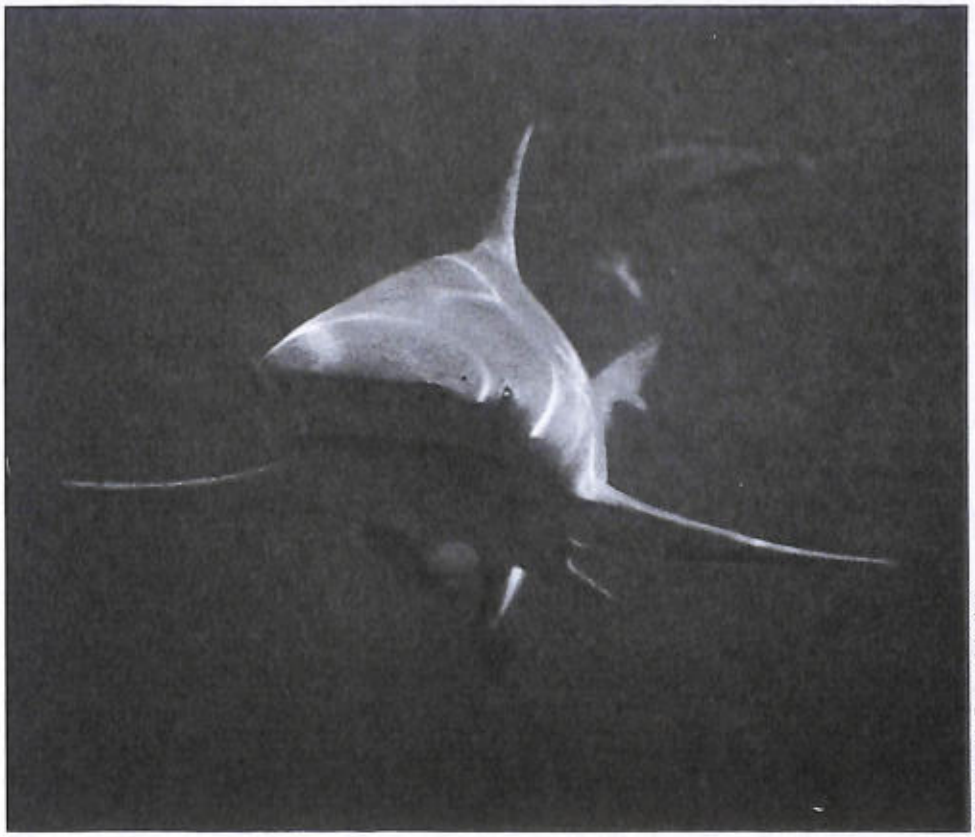
Although it attacks other objects, including bathers, the real food of the Zambezi shark is other fishes, especially rays and other sharks.

Breeds in fresh water?

It is noticeable that the Zambezi shark enters the St Lucia estuary in Natal in large numbers during November and December. It is assumed they go into brackish or fresh water to give birth to their live young. The small immature sharks are the ones found farthest upstream leaping from the water in estuaries. It is even possible that, for the shark, fresh water is linked with breeding, which is a time when many animals are at their most aggressive.

Killer whales the enemy

Tests on several sharks, including the Zambezi shark have shown that they respond to sounds over a wide frequency and are able to determine the direction of the sounds. The sharks were conditioned, in the time honoured way, to associate sounds with food. Then an interesting experiment was carried out with a tape recording of the sounds made by a group of killer whales 600 yd away. When these high pitched sounds were transmitted into the Shark Research Tank at Durban all the sharks in the tank were unmoved by them except for a large Zambezi shark. This seemed to be agitated and swam rapidly round and round the tank. The killer whale is the most powerful predator in the sea and this experiment could be taken to mean that the Zambezi shark is one of its habitual victims.



Oceanographic Research Institute

△ *Dappled by sunlight, a Zambezi shark and attached remora in a research tank at Durban.*

Prosecutor's evidence

In the last 20 years or so several books have been written on the clinical side of shark attack. It is clear from these that all too often the identity of the shark that has lacerated a human bather is in doubt. The attack is sudden, the attacker is underwater with at most a small part of the fin showing, and usually competent observers are not present who might name the shark with certainty. The teeth of the Zambezi shark have been described as flattened blades with saw edges made on the same principle as a steak knife. They are, however, liable to break on contact with bone and the victim takes with him fragments of teeth in his wounds, usually embedded in the bones, that effectively name the villain of the piece.

class	**Chondrichthyes**
order	**Lamniformes**
family	**Carcharhinidae**
genus & species	***Carcharhinus leucas***

Zebra

Zebras are distinguished from horses and asses by the stripes on their bodies. Their mane is neat and upright. The tail is tufted as in asses, but the hard wart-like knobs known as 'chestnuts', are found on the forelegs only, and not on the hindlegs as in horses. There are differences from both the horse and the ass in the skull and teeth. Three species of zebra live in Africa today. The commonest and best-known is Burchell's zebra, which extends from Zululand in the southeast, and from Etosha Pan in southwest Africa, north as far as southern Somalia and southern Sudan. In this species the stripes reach under the belly, and on the flanks they broaden and bend backwards towards the rump, forming a Y-shaped 'saddle' pattern. Although the races in the southern and northern parts of the range look quite different, the differences are only clinal. That is, there are gradual changes from south to north, but they all belong to one species. In the southernmost race, the 'true' Burchell's zebra, now extinct but once living in the Orange Free State and neighbouring areas, the ground colour was yellowish rather than white; the legs were white and unstriped; the stripes often did not reach under the belly; and between the broad main stripes of the hindquarters and neck were lighter, smudge-grey alternating stripes commonly known as 'shadow-stripes'.

Further north a race known as Chapman's zebra is still found. It has a lighter ground colour than the true Burchell's, the stripes reach farther down the legs—usually to below the knees—and the shadow-stripes are still present. All zebras still living from Zululand north to the Zambezi are referred to as members of this race; but at Etosha Pan there are some zebras that have almost no leg stripes and closely resemble 'true' Burchell's.

North of the Zambezi is the East African race, known as Grant's zebra. Its ground colour is white, the stripes continue all the way down to the hoofs and there are rarely any shadow-stripes. Grant's zebra is smaller than the southern races, about 50 in. high, weighs 500—600 lb, and has a smaller

mane. In the northern districts the mane has disappeared altogether. Maneless zebras occur in southern Sudan, the Karamoja district of Uganda and the Juba valley of Somalia.

South and southwest of the Burchell's zebras' range lives the mountain zebra, about the same size as Burchell's but with a prominent dewlap halfway between the jaw angle and the forelegs. Its stripes always stop short of the white belly. Its ground colour is whitish and, although the stripes on the flanks bend back to the rump, as in Burchell's, the vertical bands continue as well, giving a 'grid iron' effect. The southern race, the stockily built, broad-banded Cape mountain zebra, is nearly extinct, preserved only on a few private properties. The race in southwest Africa, Hartmann's zebra, is still fairly common. It is larger and longer-limbed than the Cape mountain zebra, with narrower stripes and a buff ground colour.

The third species is Grévy's zebra, from Somalia, eastern Ethiopia and northern Kenya, a very striking, tall zebra. The belly is white and unstriped, and there are no stripes on the hindquarters, except the dorsal stripe which bisects it. On the haunches the stripes from the flanks, rump and hindlegs seem to bend towards each other and join up.

▽ *At the waterhole: a herd of southeast African Burchell's zebra. This race generally has striped legs and a paler ground colour than the now extinct true Burchell's zebra.*

Belligerent stallions

Burchell's zebras are strongly gregarious. Groups of 1–6 mares with their foals keep together under the leadership of a stallion, who protects them and also wards off other stallions. Sometimes, for no apparent reason, the male simply disappears and another one takes his place. The surplus stallions live singly, or in bachelor groups of up to 15 members. Burchell's zebras are rather tame, not showing as much fear of man as the gnu with which they associate. When alarmed they utter their barking alarm call, a hoarse 'kwa-ha, kwa-ha', ending with a whinny. Then the herd wheels off, following the gnu. When cornered, however, the herd stallion puts up a stiff resistance, kicking and biting.

Mountain zebras, said to be more savage than Burchell's, live in herds of up to six, although sometimes they assemble in large numbers where food is plentiful. They seem to have regular paths over the rugged hills and move along them in single file. The call of the mountain zebra has been described as a low, snuffling whinny, quite different from that of the Burchell's.

Although in Grevy's zebra there are family groups as well as bachelor herds, the biggest and strongest stallions, weighing up to 1 000 lb, are solitary, each occupying a territory of about a mile in diameter.

Slow breeding rate

A newborn foal has brown stripes and is short-bodied and high-legged like the foal of a domestic horse. It is born after a gestation of 370 days. It weighs 66–77 lb and stands about 33 in. high. The mares come into season again a few days after foaling, but only 15% are fertilised a second time; usually a mare has one foal every three years. Mares reach sexual maturity at a little over 1 year, but do not seem to be fertile before about 2 years. Young males leave the herd between 1 and 3 years and join the bachelor herd. At 5 or 6 years many of them attempt to kidnap young females and if successful a new one-male herd is formed. The unsuccessful ones remain in the bachelor herd, or become solitary. Zebras live as long as horses, 29 years being the record.

Lions beware

Man still hunts the zebra for meat but in protected areas, at least, very little of this continues. The zebra, with the gnu, is the lion's favourite prey. Because zebras are potentially dangerous, the lion must make a swift kill and young lions have been routed by zebra stallions that turned on them. Astley Maberley tells the story of an African poacher who was killed and fearfully mangled by an irate troop of Burchell's zebras after he had killed a foal.

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H Klingel

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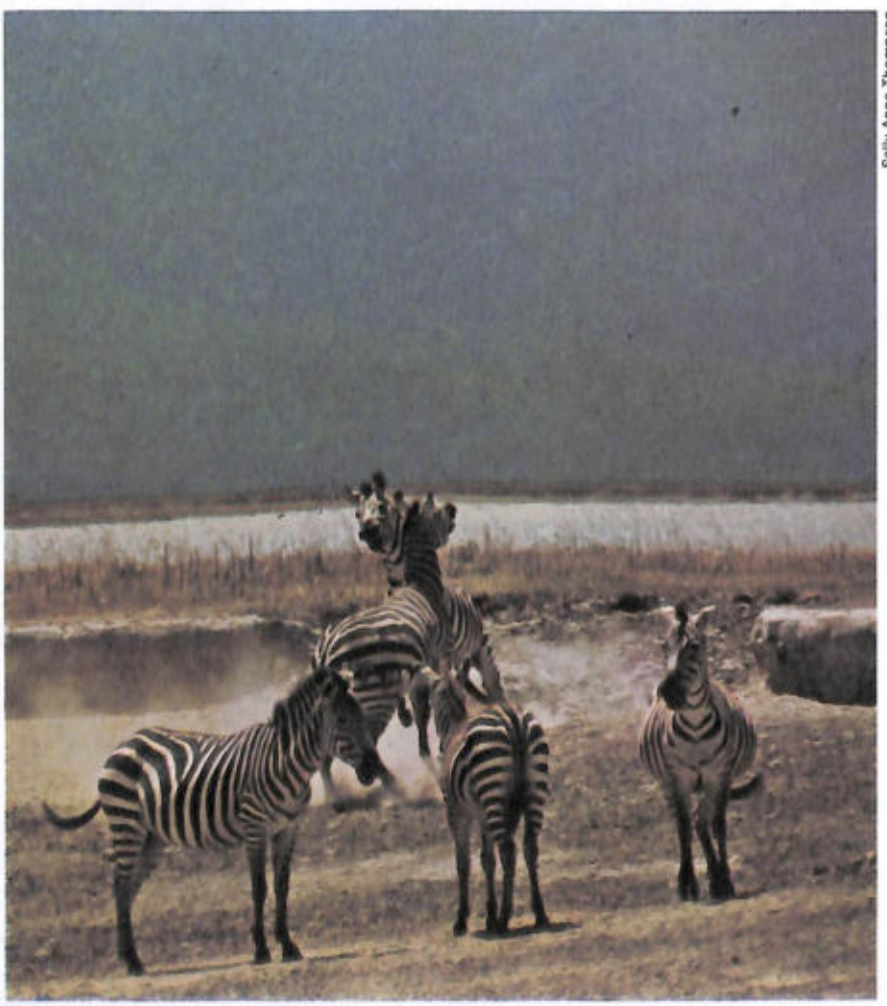

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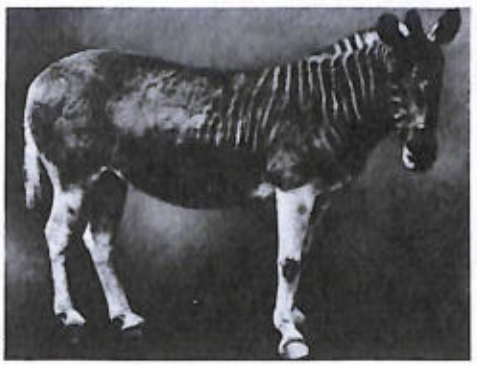
Sally Anne Thompson

5

(1) Linear line-up: a row of Grévy's zebra, large, handsomely-marked animals recognised by the huge ears and narrowly-spaced stripes. (2) Topi antelope and Grant's zebra—a subspecies having stripes that reach below the knees. The odd-looking animal on the left is a rare melanistic form of Grant's zebra. (3) Grant's zebra spar in the dust of Ngorongoro crater. Zebra stallions are aggressive not only to males of the same species but also to predators, including man.

N Myers: Photo Res

H Klingel



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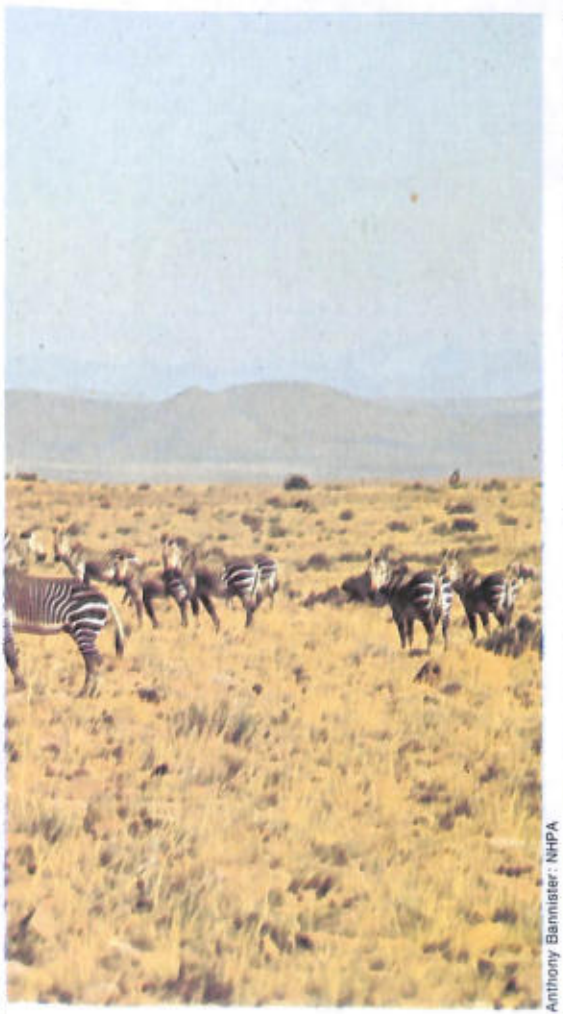
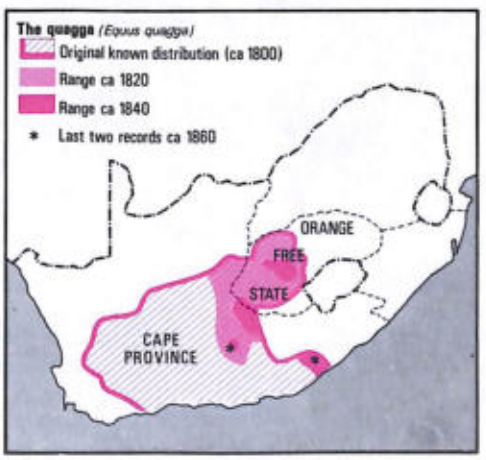
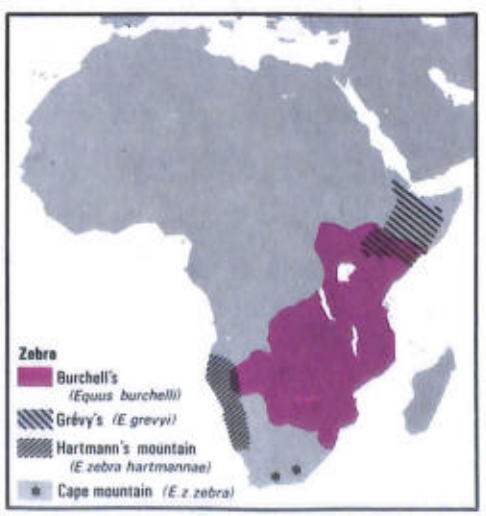


Anthony Bannister: NHPA





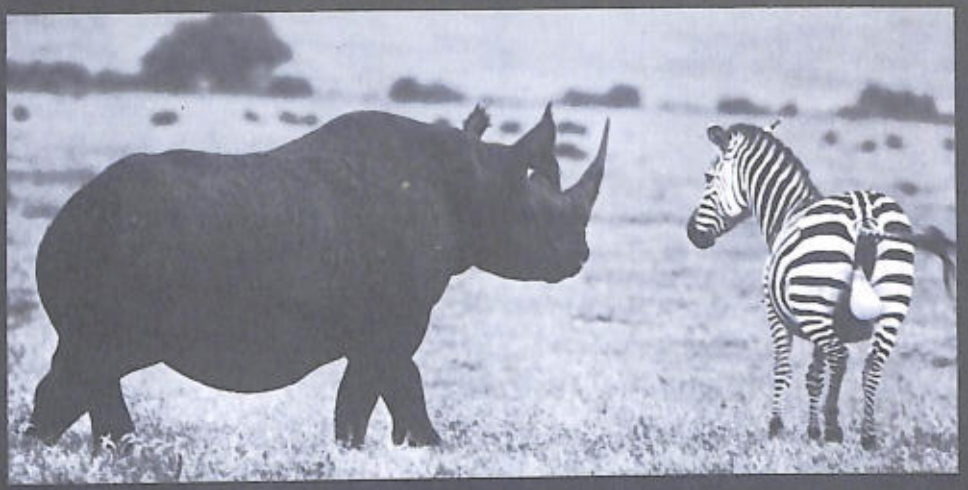
The lost quagga

A fourth species of zebra, the quagga, was extremely common in South Africa 150 years ago. It has since been completely exterminated. Most closely resembling Burchell's zebra, the quagga was distinctly striped brown and off-white on the head and neck only. Along the flanks the stripes gradually faded out to a plain brown, sometimes extending to just behind the shoulders, sometimes reaching the haunches. The legs and belly were white. Its barking, high-pitched cry, after which it was named, was rather like that of the Burchell's zebra.

The early explorers, around 1750–1800, met quaggas as far southwest as the Swellendam and Ceres districts, a short way inland from Cape Town. The Boer farmers did not appreciate quaggas except as food for their Hottentot servants. Their method of hunting was to take a train of wagons out onto the veldt and blaze away at everything within sight. Then large numbers of carcases would be loaded onto the wagons, and the rest of the dead and dying animals were simply left to rot. It is no wonder that today Cape Province is virtually denuded of wild game. When Cape Province was emptied, the trekkers to the Orange Free State repeated the process there. By 1820 the quaggas' range was already severely curtailed; they were almost gone even from the broad plains of the Great Fish River, which had been named 'Quagga's Flats' from the vast numbers of them roaming there. A few lingered for another 20 years or so in the far east of Cape Province and in the Orange Free State, the last wild ones being shot near Aberdeen, CP, in 1858, and near Kingwilliamstown in 1861. Strange to say, no one realised that they were even endangered. Zoos looking for replacements for their quaggas that had died were quite shocked to be told, 'But there aren't any more'.

class	**Mammalia**
order	**Perissodactyla**
family	**Equidae**
genus & species	***Equus burchelli burchelli*** *true Burchell's zebra or bontequagga* ***E. b. antiquorum*** *Chapman's or southeast African Burchell's* ***E. b. boehmi*** *Grant's or East African Burchell's* ***E. b. borensis*** *maneless zebra* ***E. grevyi*** *Grévy's zebra* ***E. quagga*** *quagga* ***E. zebra zebra*** *Cape mountain zebra* ***E. z. hartmannae*** *Hartmann's mountain zebra*

(4) '. . . along a mountain track'—Hartmann's mountain zebra, a race of the Cape mountain zebra described in 1898, has a large dewlap between chin and forelegs and stripes that end short of the belly. The stripes form a 'gridiron' effect on the rump.
(5) Nearly extinct: less than 200 Cape mountain zebra live in specially protected areas of high tableland in western Cape province.
(6) Extinct: the quagga was hunted in large numbers by early white settlers to South Africa.



1 *Birth of a Grant's zebra: disturbed by a rhinoceros, a female zebra in labour canters off to find a more private place.*

2 *More of the birth sac exposed: the mare rears her head at the emergence of the foal's front legs—the head appears minutes later.*

3 *The foal's birth is completed after only 7 minutes. The mare, exhausted after the ordeal, lies back in the grass to rest.*

4 *The foal is the first to move: after only a few seconds in the outside world, it shakes its head and tries to free itself from the sac.*

5 *The foal twists and turns to break the umbilical cord, then in a surge of movement, struggles hard to stand up on shaky legs.*

6 *Mother proudly watches foal's progress: like a skier's first trip on the slopes, the foal discovers that standing is no easy matter.*

7 *After its energetic antics the foal needs nourishment; maternal instinct tells the zebra her foal is hungry and she gets up to feed it.*

Photos N Myers

8 *A guarded escort: the young foal stays close to its mother's flanks as they trot off to rejoin the herd in safer pastures.*

Zebra finch

In the wild the zebra finch is found only in Australia but it has become very well-known in many countries as a favourite cage bird. It is small, compact and like most finches, is about 3½—4½ in. long. The male is more brightly coloured than the female. His back and wings are a light brownish-grey, the crown a dark grey and the sides of the neck and throat are grey finely barred with black, with a black area on the crop. There are distinctive orange or chestnut cheek patches separated from the white feathers round the base of the beak by a black stripe. The flanks are light chestnut spotted with white and the underparts are white. The tail is black with broad white bars and the strong beak and legs are a bright orange-red. The female lacks the male's bright cheek patches and white-spotted chestnut sides as well as his black mark and barrings on the throat. Her underparts have a buffish tinge. A number of colour variations or mutations have, however, been bred in the cage bird.

The zebra is the most common of the Australian finches being found throughout the continent except for the wet coastal forest areas.

Flocking together

The wild zebra finch lives in the grasslands and savannah woodlands. It is an active and hardy little bird that lives in flocks which wander about from place to place in search of food. It is remarkably unafraid of man. Although zebra finches have a variety of calls they are not singing birds. They call to each other with a soft low *tet-tet* which can be heard all the time the flock is moving about. The identity call is louder and sounds rather like the note from a small toy trumpet. When aggressive or chasing another bird zebra finches have a special attacking call which resembles the sound of the sudden tearing of a piece of cloth.

A zebra finch will never roost on the branch of a tree if it can find some sort of nest. Sometimes simple untidy nests are made for roosting, often without a roof, or else old breeding nests are renovated.

Mainly seed-eater

The zebra finch feeds on or near the ground chiefly on grass seeds which are either picked up from the ground or pulled from the stem. During the breeding season it supplements its diet with small insects taken from the ground or caught in flight.

Prolific breeder

The zebra finch is stimulated to breed by rainfall: no rain, no breeding, usually. It may build its own nest in a thick prickly bush or in a tree as high as 30 ft from the ground, or it may use holes of various kinds, old nests of other birds or even a rabbit burrow. It may even lay its eggs under the large stick-nests of birds of prey. If it builds its own nest, it constructs an untidy affair of grasses or small twigs and roots, lined with feathers, plant down and wool. Both male and female build the nest, incubate the eggs and feed the nestlings. From 3 to 7 usually 4 or 5, white eggs are laid. Occasionally more than one hen will lay in the same nest and 23 eggs have been recorded in one nest at Marble Bar. The young birds hatch out in 12½—14 days and are fed in the nest for 9—12 days on half-ripe and ripe grass seeds regurgitated from the parents' crops. They leave the nest on about the 14th day but the parents continue to feed them for another two weeks, and during this time they usually spend the night in the nest. The fledglings resemble the female in colouring but the bill is black until 8—11 weeks of age when it changes to the adult's orange-red. Sexual maturity is reached when they are about three months old.

Favourite cage bird

The zebra finch is one of the commonest of all cage and aviary birds and one of the easiest to keep and breed in captivity. Although there is now a ban on the export of these birds from Australia most breeders had already established reliable strains before the ban was imposed so it is of little disadvantage. A number of colour variations have been bred in which the normal grey of the body and wings is replaced by another colour as for example in the silver zebra finch and the fawn zebra finch. The white zebra finch is white except for the beak and legs and the sexes look almost identical.

A number of these hardy and gregarious birds can be kept together in an outdoor aviary all the year round so long as dry, draught-proof sleeping quarters are provided with perhaps a little heat in the winter months. Breeding birds are, however, best housed in an indoor aviary. Feeding is no problem as the birds will thrive on millet and canary seeds with some fresh green food. Water and grit and some form of shell-forming substance are also needed.

The zebra finch is the easiest and most prolific breeder in captivity of any of the finches and given the opportunity would breed nonstop throughout the year. Too many clutches, however, weaken the hen and produce less healthy chicks. Whether it is the result of the easy living conditions of being kept in captivity, or because of a natural urge to break records, some zebra finches have a misguided habit of laying one clutch of eggs, covering it with nesting material and then laying another clutch on top. The effort is wasted, however, because none of the eggs hatches.

▽ *Ruling the roost: a male zebra finch is put firmly in his place by his mate—the top bird.*

Barnaby's

class	**Aves**
order	**Passeriformes**
family	**Estrildidae**
genus & species	***Poephila guttata***

Zebra fish

There are several fishes with a common name that includes the word 'zebra'. The most noticeable of these is a small freshwater fish of Bengal and eastern India. Less than 2 in. long, it is called the zebra fish or zebra danio and is a member of the large carp family. It is an extremely popular fish with aquarists.

It is a slim fish with the body only slightly compressed. The single dorsal fin and the anal fins are fairly large, and it has a relatively large tailfin and small pelvic and pectoral fins. There are two pairs of barbels. The back is brownish-olive, the belly yellowish-white and the flanks are Prussian blue with four golden stripes from the gill cover to the base of the tail. The dorsal fin is also blue with yellow at its base and a white tip. The anal fin is again blue-gold barred, and so is the tailfin. The effect of the stripes is to make the fish look even more streamlined than it is, and to give an impression of movement even when the fish is stationary.

Beauty in repetition

As so often happens with a fish of outstanding colour, subsequently popular with aquarists, there is little that is zoologically striking in zebra fishes. They swim among water plants or in schools—it is when they are all aligned, swimming in formation, evenly spaced, and all travelling in the same direction that they most catch the eye. Almost certainly their attraction owes much to the repetition of their stripes—termed the 'beauty in repetition' by Dr Dilwyn John in 1947. In 1935, William T Innes came very near to saying this in his comprehensive book *Exotic Aquarium Fishes* when he described it as a fish 'to show to advantage moving in schools, it scarcely has an equal, for its beautiful horizontal stripes, repeated in each fish, give a streamline effect that might well be the envy of our best automobile designers'.

Thwarting the egg-eaters

Zebra fishes are carnivorous, feeding on any small animals they can swallow, which usually means small insect larvae, crustaceans and worms. After their colour, their strongly carnivorous tendencies provide one of their more interesting features. They are egg-eaters, and those who breed zebra fish in aquaria need to take special precautions to achieve success.

There is little difference between the sexes except that the female, especially just before spawning, is more plump than the male, and her stripes are more silver and yellow than the golden stripes of the male. In the pre-spawning behaviour the male leads the female in among the water plants and the two take up position side by side, she to shed her ova, he to shed his milt over them to fertilise them. As the eggs slowly sink there is a tendency for the two to snap up the eggs. The first precaution for the aquarist is therefore to provide a breeding aquarium with water so shallow that the fish have no chance to catch the eggs before they sink to safety in the spaces between the gravel on the bottom. The correct size of gravel pebbles must be used or the adults may become trapped between them. Marbles have been used, or else some sort of trap. An early trap used was a series of slender glass rods held together at the ends with soft wire and raised just off the bottom of the aquarium. This was later superseded by fine metal mesh or nylon.

Each female lays about 200 eggs which hatch in two days. The larvae are at first fairly helpless and inactive, but two days later they can swim and start to feed on microscopic plankton animals. They begin to breed at a year old. At two years they are old-aged, and a zebra fish of three or more years old is an extreme rarity.

Question of stripes

The name 'zebra' is from an Amharic or Ethiopian word and first gained currency in Europe in 1600. By the early years of the 19th century its use had been extended not only to cover all manner of striped animals but also materials showing stripes, and especially to striped shawls and scarves. In the world of fishes there is the zebra shark of the Indian Ocean, with black or brown bars on the body, more like the stripes of a tiger. So we have the anomaly of the common name being zebra shark and the scientific name *Stegostoma tigrinum*. In the extreme south of South America is the zebra salmon *Haplochiton zebra*. In pisciculture there is a hybrid of the trout *Salmo trutta* and the American brook trout *Salvelinus fontinalis*, which is called the zebra hybrid. A foot-long marine fish of the Indo-Pacific *Therapon jarbua* is sometimes called the zebra or tiger fish. It is, however, among the aquarium fishes that the name is most used—the striped or zebra barb *Barbus fasciatus* of Malaya and the East Indies is an example. The common killifish *Fundulus heteroclitus*, of North America, is also called the zebra killie, while the zebra cichlid *Cichlasoma nigrofasciatum* is also—and more appropriately—called the convict fish. Some of these fish have horizontal stripes and others vertical, and there has been some disagreement over which are more correctly termed 'zebra'. However, since a glance at a photograph of a zebra shows that the stripes run in different directions on the different areas of the body, there seems no reason why the name should not be applied to all.

class	**Osteichthyes**
order	**Cypriniformes**
family	**Cyprinidae**
genus & species	***Brachydanio rerio***

▽ *On the right lines: the popular zebra fish proves that parallel stripes never meet.*

Klaus Paysan

Jane Burton: Photo Hes

Zebra mouse

The zebra mouse, also known as the striped field mouse or four-striped grass mouse, is found only in Africa. It is slightly larger than a house mouse, with a head and body length of 3½—5 in. and a long tail of 3—5¼ in. The fur is coarse, the upper parts of the body varying in colour from yellowish-grey to light greyish brown with lighter underparts. There are three light stripes down the middle of the back from the back of the neck to the base of the tail with dark stripes on either side of them. Sometimes there is only one light stripe with one dark stripe on each side. The light stripes vary from pale yellowish grey to buff while the dark stripes may be anything from a golden brown or clay colour to a dark brown or almost black. The tail is scaly, thickly covered with short hairs.

There is only one species of zebra mouse, which ranges from Tanzania, Kenya and Uganda southward to the extreme southern tip of Africa. A second species of similar size, range and habits is sometimes called a zebra rat, but is more often known as the striped grass mouse or single striped field mouse, although it mostly has half a dozen lines of light coloured spots on each side of the body.

Alert and active

Zebra mice are fairly common throughout their range, living in grassy or cultivated areas up to 9 000 ft or more above sea level. Unlike most rats and mice they are active during the day, sheltering during the night in underground burrows, in weed-covered banks or old termite mounds. They are very alert and active, with good eyesight, and although they stay mostly on or under the ground they have occasionally been seen climbing about the low branches of shrubs. When the sun is not too hot they come out and bask.

When taken young these mice make attractive and lively pets, especially as, unlike many rodent pets, they are active in the daytime. Given the right conditions they will readily breed in captivity.

Variety of foods

The main food of the zebra mouse consists of grass, bark, roots, seeds, berries and cultivated grain of various kinds. Zebra mice will also take snails, insects and eggs. In captivity they flourish on a wide variety of food, taking sunflower, canary and millet seeds and fresh melon pips and almost any sort of fruit, including apple, banana, grape and even holly berries.

Born under or above ground

It is thought that the breeding season in the wild is from September to April, with possibly 4 litters a year. The litters are usually small, with 4 or 5 young but there may be up to 7 young and as many as 12 to a litter have been recorded. The babies are usually born in a nest in a burrow but occasionally the female makes the nest above ground in a dense shrub or in a thick tuft of grass. The nest is made of grass, leaves and moss. Like all baby mice they are born naked, blind and helpless, only about 1 in. long, but they are clearly striped at birth, the stripes being marked by dark pigment in the otherwise pink skin. The babies when very young make plaintive, bat-like squeaks. By the third day the eyes open and they begin to groom themselves and a few days later they can stagger about and try to feed on any food left around. By a fortnight old they are lively and active. They are sexually mature at 3 months. Sometimes family groups of 12—30 have been seen living in the same nest.

Many enemies

Like all small rodents, zebra mice have many enemies. These include the smaller carnivores such as mongooses, and the medium-sized jackals, but surprisingly also the large predators like the secretary bird, even the cheetah. Hawks will also take them as well as pythons and cobras. The young ones born in nests above ground are especially vulnerable.

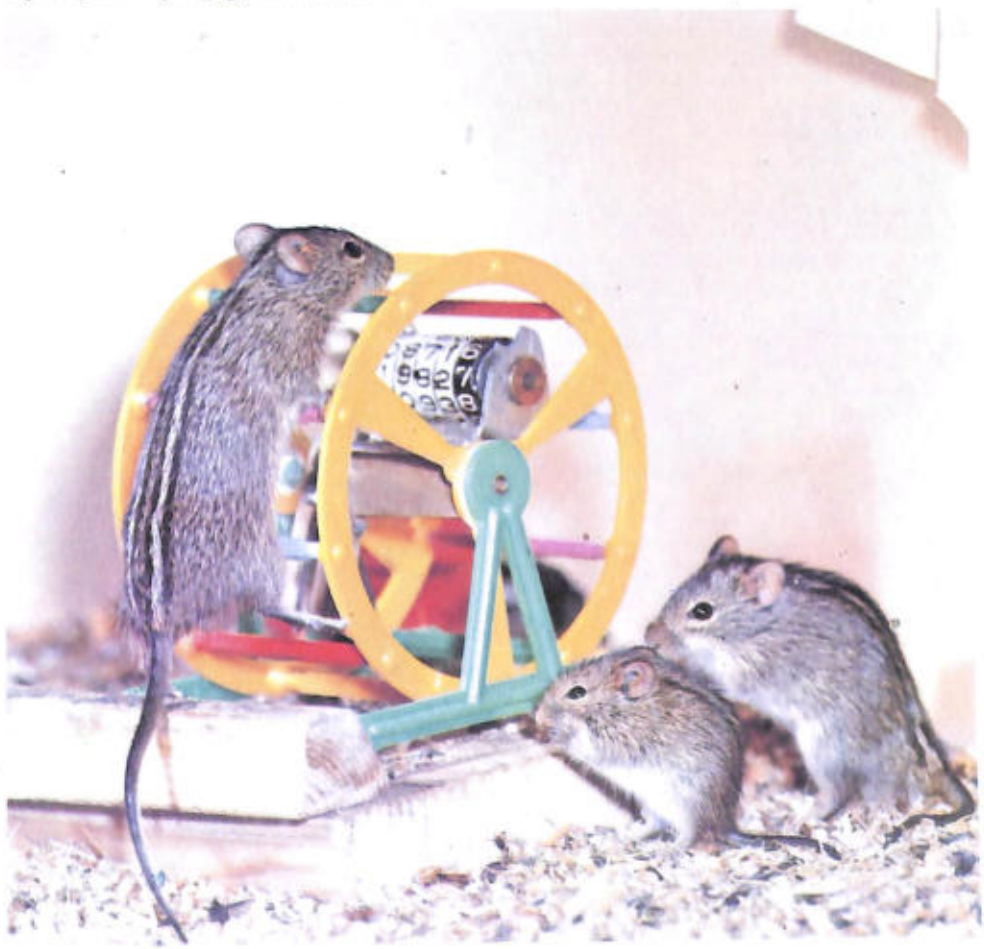
Nine miles a week!

Some years ago Mr and Mrs Kim Taylor carried out an interesting experiment with a pair which were housed in a cage large enough to give them plenty of room to run around. A wheel was placed in the cage for the mice to play with. After preliminary hesitations both male and female took to this sort of treadmill and soon were turning it, either separately or together, when the two would stand side by side spinning it in a concerted effort. A meter was then fixed to the wheel to register the number of times the wheel was turned by the mice in a given time. From this it was calculated that in the first ten weeks the mice had turned the wheel a million times, and that this was the equivalent of the pair running, between them, 180 miles. Assuming they shared the wheel equally, this gives the equivalent of 90 miles per mouse in ten weeks, or nine miles a week, which is just about the sort of distance a mouse in the wild would be expected to cover in its search for food.

The interest of the experiment lies in the fact that the pair of mice using the wheel produced two healthy litters totalling nine babies, whereas a pair of zebra mice kept under exactly the same conditions but with no wheel to play on, did not breed at all during the same period of time. It is, perhaps, reasonable to assume that the provision of a wheel in their cage gave the mice not only a greater zest for living, by providing them with recreation, but in doing so contributed something essential to their mental and physical well-being, which a life in captivity otherwise lacks.

class	**Mammalia**
order	**Rodentia**
family	**Muridae**
genus & species	***Rhabdomys pumilio***

Left: inquisitive group of juvenile zebra mice. Below: marathon mouse clocks up another mile.



Jane Burton. Photo Res

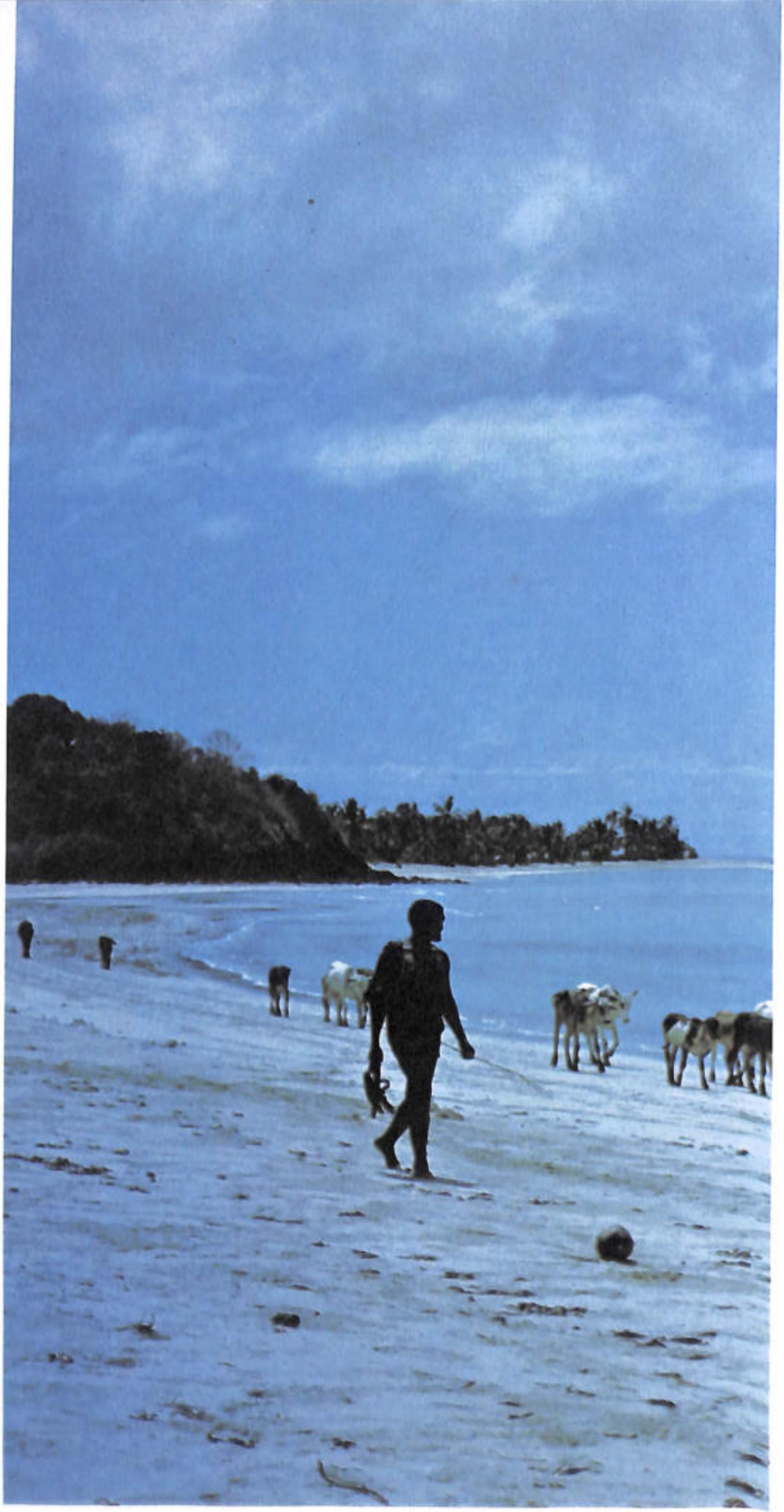
Zebu

The zebu or Brahman cattle originated in southern Asia, possibly in India, but their wild ancestor is unknown. The zebu has a prominent hump on the shoulders, which is an enlarged muscle rather than a store of fat as is usually claimed. Its coat is grey but may be white or black, its legs are slender, and its horns are more upright than those of the aurochs, the wild ancestor of European cattle (p. 530). It has a marked dewlap and drooping ears. Some scientists claim it was domesticated from the wild gaur or the banteng of south-east Asia, but it differs from these in its long slender face and in other features.

Domestication of the zebu may have been earlier than that of western cattle. The first record was made in 4500 BC, *but on seals from West Pakistan, dated 2500* BC, *there are representations of both zebu and western cattle. The two kinds readily hybridise and offspring from such crosses have produced some of the breeds found in Africa, where the zebu is better adapted to the hot climate.*

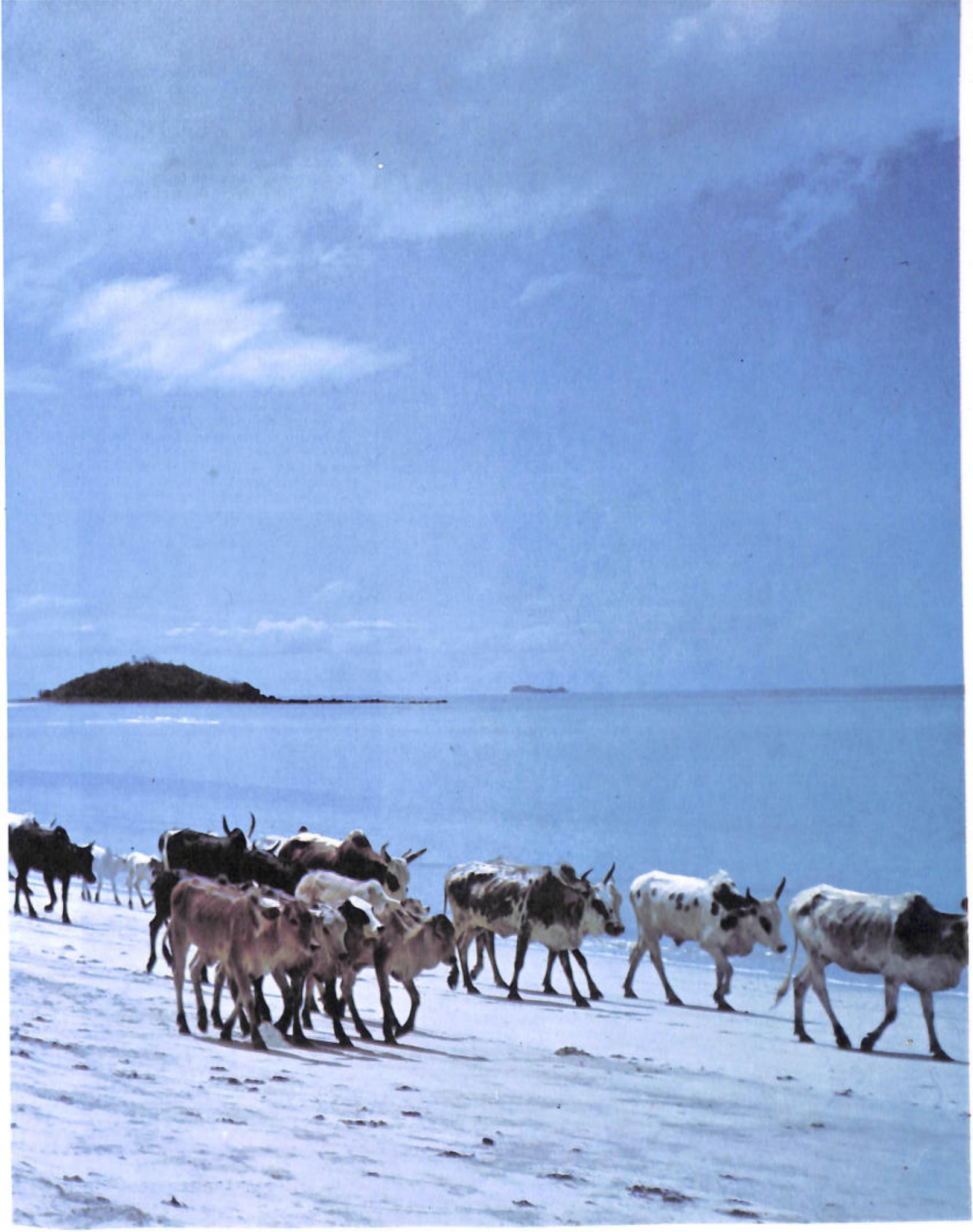
Less sweat, more milk

Of recent years much research has been directed towards making more use of such crosses. The western cattle are better for milk production, but this and meat production declines in animals taken from temperate to tropical countries. Zebu are usually better for meat production. The zebu has larger ears than western cattle, and these and its dewlap offer a large surface for loss of body heat by radiation. In other words, zebu can, because of their build, keep cooler than western cattle which, taken to the tropics, spend less time grazing and more time lying in the shade. So they tend to suffer from permanent malnutrition. This is enhanced by their woolly coat, which also inhibits heat loss, so they lose more water through their breathing which, among other things, lowers their milk yield. Modern research is aimed at producing hybrids that combine the most advantageous characters from the two species for giving maximum milk or meat production, or both. The research is intensive, and includes a close study of the sweat-glands of the two species, on the assumption that sweating and milk-production are mutually exclusive. But hybridizing the two has been carried out repeatedly, in different places, in the course of history. The Sanga cattle, widespread in Africa, originated probably in Egypt from crossing Hamitic longhorn cattle with zebu.



Gerald Cubitt

▷ *In complete harmony with the scene, a herdsman and his placid zebu cattle amble along a peaceful beach on Nossi Bé, off Malagasy. The economic value of the zebu in Malagasy has been acknowledged on her postage stamps.*



Okapia

△ *Tolerant zebus plod round a never-ending circle, pumping water to irrigate the surrounding land.*
▽ *Infant inspection; an adult zebu washes a newly-born young while another watches closely.*

Gentle and docile

There is a distinct difference in temperament between the two species of cattle. The zebu is more tractable and docile yet is more lively than western cattle and grunts rather than moos. In walking it swings its hindlegs in a straight line, like a horse, instead of using the sideways movement of the dairy cow. It has endurance and speed, and zebu are recorded as carrying a soldier on their back for 16 hours a day at a speed of 6 mph. Zebus were frequently used for drawing vehicles, from state carriages to heavy farm wagons or ploughs, and are still used today for transporting heavy loads.

W Youatt, writing in 1832, described the zebu as 'very fond of being noticed; and often, when he is lying down, if anyone to whom he is accustomed goes and sits down on him and strokes him over the face, he will turn round and put his head on their lap, and lie there contentedly so long as they please.' Professor John Francis, in *Nature*, 1965, comments that this 'perfectly portrays the temperament of the Brahman'.

Zebu are said to clear a five-barred gate with ease. Youatt tells of a calf which would leap over an iron fence to reach water, and when it had drunk its fill it would leap back again with ease.

Toni Angermayer

Tick- and heat-resistant

The zebu has been taken across the tropical and sub-tropical regions of the Old World, from China to Africa. It was taken to the United States a century ago and also to Australia, especially to Queensland. Its popularity, and that of hybrids with western cattle, in the United States rests not only on its ability to stand up to heat but also on its immunity to ticks that carry Texas fever. The hybrids share this immunity at the same time producing a better meat than the pure zebu.

The size of zebu ranges from that of a small donkey to animals larger than any western cattle. Their horns also show a wide range, from hornless and small-horned, with horns shorter than the ears, to the Ankole cattle of Uganda. The Ankole has enormous swept-back horns, stout and up to 5 feet long.

class	**Mammalia**
order	**Artiodactyla**
family	**Bovidae**
genus & species	***Bos indicus***

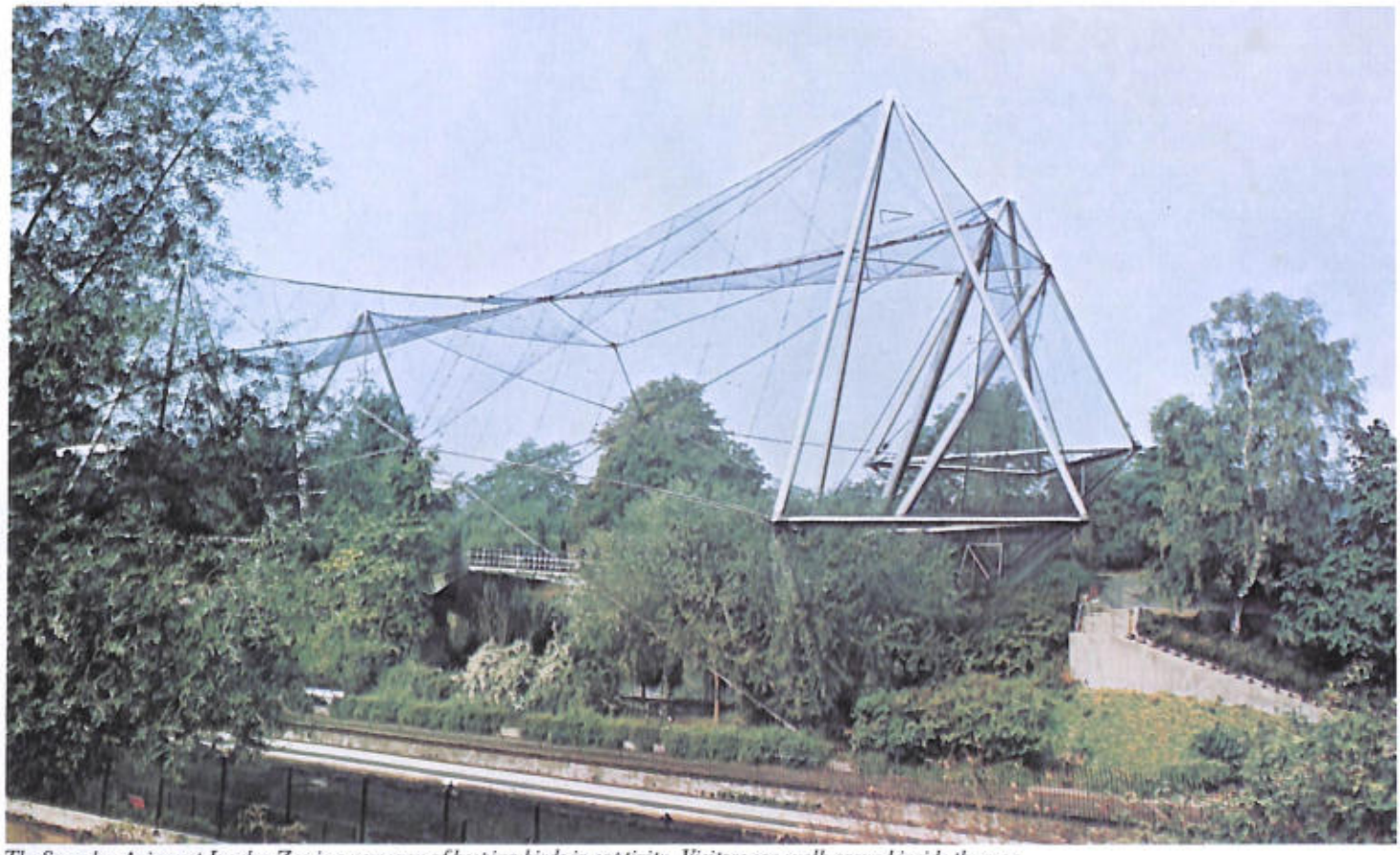
Okapia

△ *In practice, Indian cow-worship is restricted to one species: the Indian humped zebu.*

Heather Angel

▽ *Reliable zebus with their load dawdle on while the sleeping drivers take advantage.*

Zoos



The Snowdon Aviary at London Zoo is a new way of keeping birds in captivity. Visitors can walk around inside the cage.

Wild animals have been displayed in a garden setting for thousands of years. There were great temple gardens in China and Egypt. The word 'zoo' was first used for the Zoological Gardens of London in a popular music hall song in 1877, which went 'Walking in the zoo is the OK thing to do'. London Zoo is the oldest surviving example of a proper zoological garden, as opposed to groups of animals being exhibited in a menagerie.

When zoos were first built, the main reason for their existence was to allow people to see strange creatures from far off countries. Until these times such animals could only be described and illustrated. For example, there was a great furore in 1835 at London Zoo when they received their first chimpanzee, as indeed there was in 1850 when the first hippopotamus arrived. All London flocked to see these amazing animals. Similarly, in more recent times people have trekked to those zoos that have very famous or rare animals, such as giant pandas.

Today, many people believe zoological gardens should not exist because the animals can be seen on the marvellous nature and animal television programmes and films, their lives being covered in their natural wild habitat. Why enclose animals just for the pleasure of the public? However, the aims of most modern zoological gardens are much wider than just entertaining the public. Rather than entertain, zoos seek to instruct and educate their visitors. An important function is to carry out zoological research, with the aim of helping to protect wild animal life. To conserve animal species in a zoo may seem strange, but with the disappearance of many of the animals' wild habitats, many species are endangered. Keeping them in zoos and breeding them ensures their survival. In some cases where the animal has become extinct in the wild, captive specimens have been bred so successfully that some of their numbers can be reintroduced into the wild once more.

Over the last 150 years zoological gardens have learned how to keep animals happy and healthy. Today, animals are rarely kept in closed and stuffy conditions, but instead are given large amounts of space with as much summer sunshine and fresh air as possible. The majority of medium to large mammals and many birds are housed in cages that give them indoor sleeping and resting quarters as well as outdoor areas, often with natural vegetation planted to make them feel more at home. Most zoos, when designing new buildings or replacing old existing ones, select those that although functional provide a healthy, comfortable and easily managed environment for the animal, as well as displaying them to the public to their best advantage both inside and outside the building. The use of iron bars to keep animals in has declined recently and modern barriers are as invisible or unobtrusive as possible. Water-filled moats are very popular for animals that cannot swim, although precautions must be taken to prevent the animal drowning if it does enter the water. Chimpanzees, gibbons, giraffes and camels are a few of the animals that are enclosed by moats in most zoos today.

Aviaries have also changed in design, the thick mesh often being replaced with fine vertical steel wires that are almost invisible to the human viewer. One of the most famous large aviaries is the Snowdon Aviary at London Zoo which was opened in 1965. This was most successful as it not only provided a very natural environment for its inmates, but was a most striking structure. Visitors enter the spacious cage and walk over a cantilevered bridge, getting a bird's eye view of herons, ducks and other birds moving about beneath them.

It is a fact that most animals in captivity are far healthier and better fed than those in the wild, and also they have a longer average life. Many years ago feeding captive animals was taken to mean giving them either a herbivorous or carnivorous diet. As a result many animals died within a short time. In fact most wild animals need to eat a varied diet and animal nutritionalists have altered the ideas about diet for wild animals in captivity. Adequate minerals must be provided, especially for larger animals, such as elephant, zebra, rhinoceros, kangaroo and

giraffe. These animals make periodic visits in the wild to special spots where salt licks exist in order to obtain the various minerals they need.

Food is usually prepared by the keepers in special kitchens within the particular animal section. Each keeper knows his own animals and prepares a dish worthy of a first class restaurant. The timing of when the animals are fed is also considered. Most birds are adapted to seek food by daylight, while most mammals prefer to feed by twilight or by night. Large cats such as the lion and leopard rarely eat every day in the wild and it is normal and quite natural for zoos to 'starve' their carnivores one or two days a week. Snakes are usually fed only once a week and many take food only after they have sloughed their skins. For humane reasons small animals are not given to snakes alive and snakes therefore have to learn to take freshly killed animals rather than the live ones they would catch in their natural habitats.

In the wild an animal finds a partner, mates and produces young, thus ensuring the survival of its kind. In captivity an animal that is not happy and does not have the right environment will rarely breed. Even a happy animal will sometimes not breed due to becoming too humanized. The classic example here is that of Chi-Chi, London Zoo's female giant panda, who in the mid-1960s refused and spurned her intended mate, An-An, who had come all the way from Moscow Zoo. Unfortunately, she was more 'in love" with her zoo curator, Desmond Morris. One of the main aims of zoos today is to establish breeding pairs, so that endangered species will not become extinct and no further specimens need be captured from the wild–thus conserving the wild populations. China has succeded in breeding giant pandas in captivity, but as yet no baby panda has been born in a western zoo. One of the ways in which successful breeding is achieved is by a kind of international 'marriage bureau'; when zoos only have one specimen of a certain species they may arrange a 'wedding' with a specimen from another zoo. Bronx Zoo began this idea when they sent their only female gerenuk to San Diego Zoo to meet up with a male for breeding. Such conservation practices are becoming one of the main reasons to keep good zoological gardens in existence.

Space allows only a few of the numerous zoological collections around the world to be covered. In Britain before World War II there was a handful of zoos, whereas today there are well over 100 zoological collections of various sorts, including Safari Parks and specialist collections such as the Otter Trust.

Antwerp, Belgium
Although near the centre of the town, hemmed in by city buildings and the railway station, the 24 acres of zoological gardens are enhanced by the excellent use of growing plants which are squeezed in everywhere. Within the zoo is housed the city's Natural History Museum, the collection being an integral part of the garden. The zoo takes on a considerable responsibility for education and all pupils in Antwerp schools have zoo visits as part of their syllabus. They have an excellent collection of birds of prey, a good colony of gorillas and a good record for breeding animals such as marmosets, ring-tail and other lemurs, and kangaroos.

Barcelona, Spain
Among the 500 species exhibited at this city zoo, the most famous animal was the white gorilla, an albino that came to them as a youngster in the late 1960s from Africa. Called Snowflake, this ape was provided with another young gorilla as a playmate and attracted huge crowds.

Basle, Switzerland
This excellent zoo announced in 1961 the first lowland gorilla to be reared in captivity by its mother. Since this wonderful achievement many other births have taken place due to hard work and devoted care by all the members concerned in the zoo. The zoological gardens achieve a marvellous feeling of being in a natural environment with the clever planting of trees, shrubs and flowers. The architectural structures here are exciting in form and space, and they are softened by the luxuriant greenery.

Bristol, England
Although in only 12 acres, this collection is an excellent botanical as well as an animal one. It is famous for its white tigers, obtained from India, which breed successfuly. The practice of exhibiting nocturnal animals (as opposed to merely keeping them in captivity) was due largely to the efforts of this zoo. They carried out the first successful experiments in reversing the animals' daily cycle, using blue fluorescent lighting so that the nocturnal animals could be viewed during their most active periods.

Snowflake, the albino gorilla that was a major attraction at Barcelona Zoo.

David Hosking

A 'graveyard' at the Bronx Zoo records the extinction of many species.

Norman Tomalin: Bruce Coleman Ltd.

Bronx, New York, USA
The New York Zoological Park is known to the public as 'The Bronx Zoo , so that it is not confused with the Central Park Zoo, a small establishment in the middle of Manhattan. Covering some 250 acres it is known as one of the outstanding zoos of the world. It attracts well over 2 million visitors each year. Opened in 1899 the society has always worked to acquire rare animals as long as they could provide the necessary care and attention. As early as 1912 the zoo was the first in America to obtain a pygmy hippopotamus and other notable 'firsts' include the platypus, vampire bat, gorilla, bongo, okapi, king penguin and Komodo dragon. Research, study and observation is also of utmost importance here. Education and conservation are also well dealt with, the Society being on good terms with city schools and having a children's zoo and farm-in-the-zoo where children can see and handle domesticated and tame animals. The Bronx was the first zoo to have a closely-barred cage, with large padlocks and a notice above: 'The most dangerous animal in the world'. On peering through the bars the human onlooker finds only his own reflection in a mirror.

Chester, England
Another zoo famous for its wonderful flower displays as well as its animal exhibitions. To many it is the prettiest zoo, not only because of the plants but the way the paddocks, elephant house, and other buildings fit in so well. Also there are moats protecting some of the displays which can be travelled along by water-bus. The tropical house is a unique establishment, with streams, tropical orchids and other blossoms hiding sunbirds, parrots and hummingbirds as well as hippopotamuses, crocodiles, snakes and lizards. The ape house is another excellent building.

Frankfurt, West Germany
Director of this zoo is Bernhard Grzimek, famous for his efforts in the area of conservation and wildlife filming and writing, as well as for educating the public through the Frankfurt Zoo. Close relations exist between the zoo and the city's schools. Zoo keepers spend some weeks in East Africa observing wild animals in their natural habitats. Among many excellent exhibits is an 'Exotarium' with all sorts of rather exotic animals that require special conditions for survival. It contains penguins in a refrigerated room, a Komodo dragon, Galapagos land iguanas and so on. Among the good collection of apes are dwarf chimpanzees or bonobos. The zoo first succeeded in breeding these chimps in 1963.

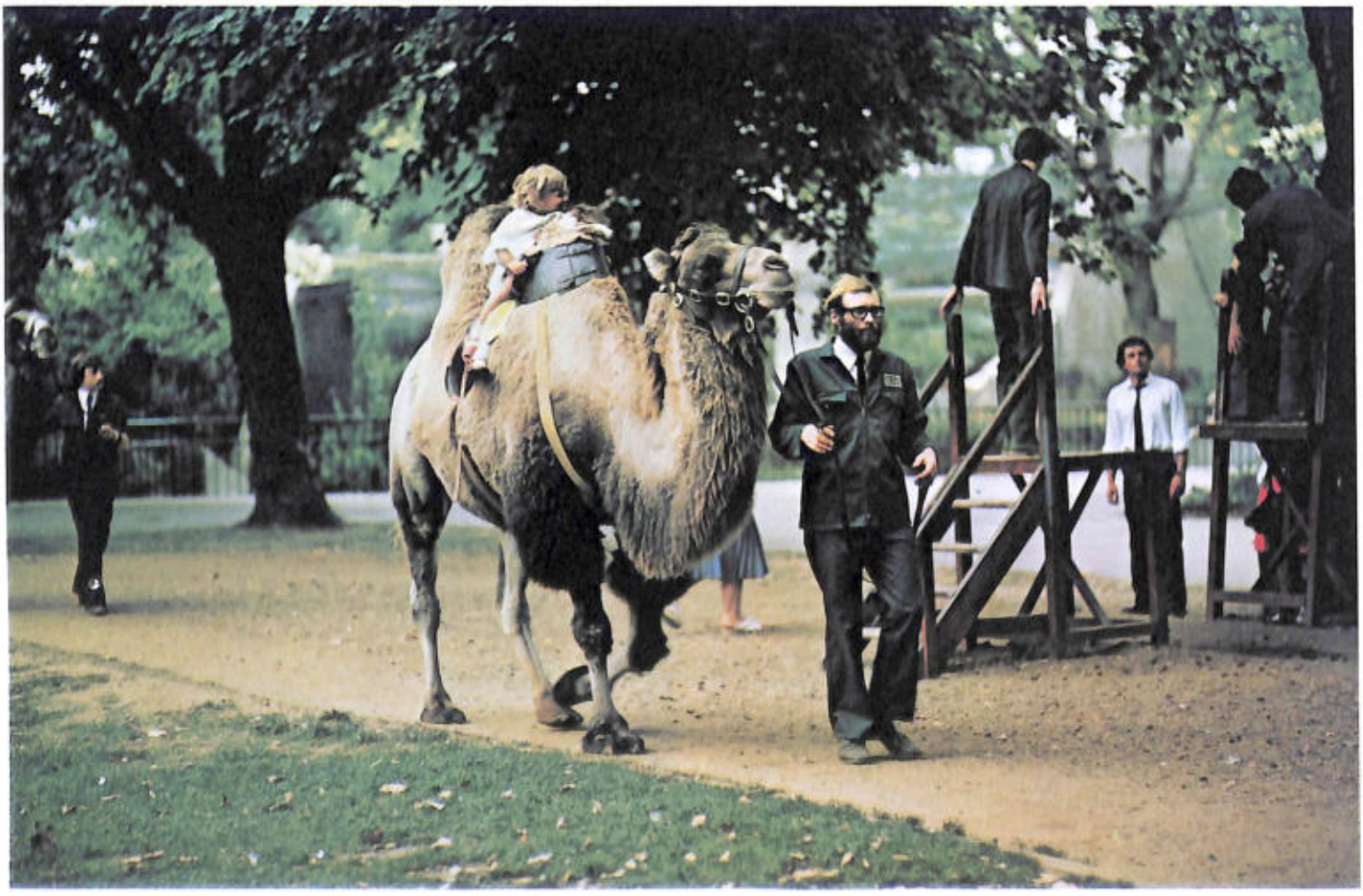
Hagenbeck's Zoo, Hamburg, West Germany
Carl Hagenbeck is famous for his 'open zoo' which he designed and had constructed to give the animals maximum freedom and a cage as much like their natural habitat as possible. He employed engineers, architects and sculptors to realize his ambitious ideas, producing mountain landscape for African animals, a Polar panorama for those from the Arctic and Antarctic, and large glens for carnivores. The park opened in 1907 and was an immediate success. Although much was destroyed in World War II the original ideas are still in evidence, the family still being in charge of the park. The zoo is geographically divided to show the animals of a particular continent together–African animals, South American, Australian and so forth.

Jersey Zoological Park, St. Helier, Channel Islands
Gerald Durrell started this zoo to house his private animal collection, most of which came from his collecting trips to foreign countries, especially South America. Now a preservation trust, although Durrell is director, its main aim is to breed animals in captivity, and in this it has succeeded. Examples include douc langurs (the baby is bright orange) and other primates.

London Zoo, England
A tremendous number of species (about 1500) are crowded into the 36 acre gardens within Regent's Park. Gradually, as money becomes available, the old buildings are replaced with modern animal houses. A new education centre and an open, landscaped large cat collection are among the latest accomplishments in their modernization plan. Lord Snowdon's aviary, a Moonlit World (nocturnal exhibits) and elephant house are among the other famous sections of the zoo.

Paris Zoo, Vincennes Woods, France
The pleasant landscaped zoo outside Paris, was established in 1934 when the central Paris collection in the Jardin des Plantes was

Where else but in a zoo would most children get the chance to ride on a camel?

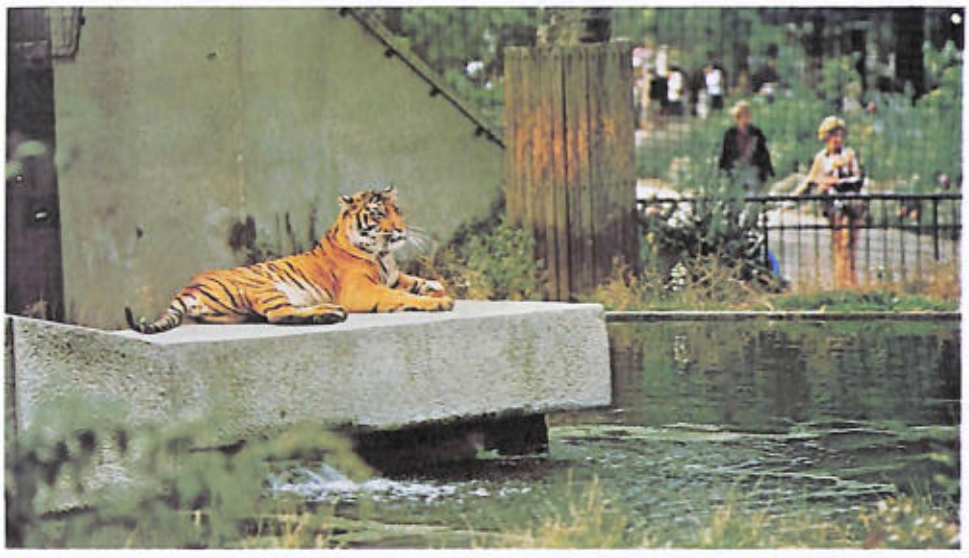


Eric Crichton: Bruce Coleman Ltd.

becoming far too crowded. An artificial mountain is at its centre, housing mountain goats on its heights and various penguin species at its base. The top can be reached by an elevator and provides a panoramic view of the entire zoo. Paris can be seen on the horizon.

Peking Zoo, China
Famous for its giant pandas which it breeds with great success. Mainly Oriental species are exhibited. As relations with the West improve a more varied fauna will be exhibited as zoos trade animals. A good collection of various huge goldfish breeds is another attraction.

San Diego Zoo, USA
Renowned as one of the best zoos in the world with one of the largest and rarest collections of animals in the world. Due to the climate, which is good most of the year, the exhibits of animals can be outdoors nearly all the year round. Rainfall averages some 10 in. a year with 330 out of 365 days being sunny. The 128 acres of land is divided by three steep canyons which can be travelled around by bus. Among the wonderful exhibits is a breeding colony of koalas, which–conveniently–feed on 4 or 5 of the 27 varieties of eucalyptus grown by the zoo. A dazzling display of hummingbirds, numerous parrot species, breeding primates and splendid cat exhibits are among some of the other attractions. Conservation is the underlying theme of the zoo's extensive education programme, which includes classes for handicapped children. San Diego is one of the principal zoos to carry out research on subjects such as the contents of seal's milk or diseases of hoofed mammals.



Eric Crichton: Bruce Coleman Ltd.

The landscaped terraces outside the new cat house in London Zoo show the modern approach to zoo design.

Washington DC, USA
The National Zoological Park, a sub-division of the Smithsonian Institution, is located in Rock Creek Park, A sharply-cut ravine gives the park an extremely hilly terrain. The zoo has had many breeding successes and was the first zoo to breed and raise kookaburras in captivity. The zoo also has great success with hippopotamuses, including the pygmy species.

Whipsnade Park, Bedfordshire, England
Bought by the London Zoo as a country home where large groups and herds of animals could be built up and established in surroundings as natural as possible. The park setting enables the animals to be easily seen. Recent additions include a modern ape-house, a dolphinarium and a train which runs through a herd of breeding white rhinos. Bennett's wallabies, peacocks and prairie dogs all live free within the park and breed successfully. Breeding successes include polar bears, cheetahs, hippos, pygmy hippos and Thompson's gazelles.

The old part of San Diego Zoo has outdoor enclosures for its animals, many of which are landscaped to appear natural.

Bruce Coleman: Bruce Coleman Ltd.

Zool Soc London

△ *Although it looks like a skunk, the zorille is more closely related to the weasels and polecats.*
▷ *Playful and innocent though he seems, the malodorous zorille is shunned by potential predators.*

Zorille

The zorille, sometimes spelt zorilla, or striped polecat of Africa, bears a strong resemblance to the American striped skunks, although it is only distantly related to them. It is a small slender animal with a head and body length of 11–15 in. and a tail 8–12 in. long. Its long fur is strikingly marked in black and white. The body is black with broad white stripes down the back, the face is black with three large white spots and the bushy tail is mainly white. Like the skunks, when disturbed, the zorille ejects a strong evil-smelling fluid from its anal glands.

The zorille is one of the most common mammals of Africa, ranging from Senegal, northern Nigeria, the Sudan and Ethiopia to southern Africa. Although there is only one species many local races have been described. Two slightly smaller relatives of the zorille in Africa resemble it in having black and white markings. They are the Libyan striped weasel ***Poecilictis libyca*** *from North Africa and the white-naped weasel* ***Poecilogale albinucha*** *from central South Africa. They are known as snake-weasels either because they kill snakes or because their low flat head is like the head of a puff-adder.*

Evil-smelling defence

The zorille is found in a variety of habitats but it seems to favour dry areas. It is nocturnal and usually solitary except in the breeding season. During the day it shelters in rock crevices or in burrows dug with its long, strong claws. Sometimes it uses the burrows of other animals or even shelters under farm buildings or outhouses. It hunts during the night usually on the ground but if necessary can climb and swim after its prey. It trots slowly along on its short legs with its back slightly hunched, waving its long bushy tail.

At the sight of an enemy the zorille erects the hair on its body and turning its back towards the intruder it stiffly raises its tail. If actually attacked it ejects the fluid from its anal glands and is said to do so with deadly accuracy, usually into the face of the enemy. The fluid is said to be so potent that it is able to blind another animal almost instantly. Sometimes, if its enemy still persists, the zorille will feign death, so often escaping being mauled or killed. There seems to be a difference of opinion about the fluid—some people say it is less pungent than that of the American skunks while others claim its odour is worse than that of any other animal. It is possible that its odour may vary with the age of the individual or perhaps even with the time of year. The people of the Sudan, however, are in no doubt about this for they have named the zorille the 'Father of Stinks'.

Good rodent catcher

The zorille's food consists mainly of mice and other rodents, small reptiles, birds and large insects. It will follow the burrowing mole rats underground to catch and eat them. It will also sometimes take eggs and snakes. Although it may occasionally kill poultry it does more good than harm around farms in keeping down rodents. The food is bolted in lumps rather than chewed, and as with cats it is not held with the paws before being eaten. A habit the zorille shares with other small members of the weasel family is of cacheing surplus food. It will kill more than it needs for immediate consumption and will pile the carcases in a neat heap.

Gentle pet

Not much is known of the breeding habits of the zorille. The litter size is usually two or three, the young being born in a burrow. If taken young the zorille can make a friendly and gentle pet, seldom emitting its fluid except when frightened or angry. This is common experience with other mustelids, such as the European polecat, that can give out a noxious fluid. A fully tamed individual will discharge the fluid only if suddenly shocked. Zorilles have in the past occasionally been kept in zoos; one lived for over five years in the London Zoo.

Given a wide berth

Although the zorille may occasionally be attacked by dogs or larger predators, most animals, warned by its striking black and white colouring, give it a wide berth to avoid being sprayed by its evil-smelling fluid.

A matter of size

Ivan T Sanderson, in his *Living Mammals of the World*, quotes a famous game warden for the story of how nine fully grown lions were warded off around a freshly killed zebra by a zorille. The zorille had taken possession and for several hours sniffed around the carcase, occasionally nibbling at it, even taking a nap with its back to the zebra. Whenever a lion made an attempt to approach the carcase the zorille raised its tail in warning and the big cats retired, frightened of the stream of amber-coloured liquid that might follow.

This contrasts with the behaviour of the tame white-naped weasel kept by Anne J Alexander and RF Ewer as reported in *African Wild Life* for 1959. These two observers found that their weasels would kill and eat mice. They would also eat the bodies of dead mice. When offered the carcases of a freshly killed pigeon, rabbit or domestic cat, the weasels 'merely sniffed towards the potential prey, then ran away'. The only conclusion they could come to was that it was a question of size.

class	**Mammalia**
order	**Carnivora**
family	**Mustelidae**
genus & species	***Ictonyx striatus***

Zool Soc London

Zool Soc London

Chicago Zoological Society

Mixture: with the size and shape of a dog, the grace of a cat and the name of a fox, the zorro is one of the many South American mystery animals.

Zorro

Zorro, the Spanish word for fox, has been applied to several of the South American dogs which are not strictly foxes but are fox-like members of the dog family. The name is best given to the small-eared zorro which does not seem to be closely related to any other member of the dog family. This, together with other aspects, makes it an intriguing animal, even more so because nothing has been recorded of its behaviour and habits in the wild and as yet only a few individuals have been kept in captivity.

The small-eared zorro is so called because its ears are shorter than those of any other dog, domestic breeds excepted. They are 1¼–2 in. long, the body being 28–39 in. with a 10–14in. tail. The head is large, and the legs short. Apart from the maned wolf (p. 1534), the zorro is the largest of the South American dogs, standing about 14 in. at the shoulder. The hair is dark grey to black above and rufous mixed with grey and black underneath. The tail is long and bushy and is carried curled forward with the tip turned up to prevent it sweeping the ground. A peculiar feature of the zorro is the long upper canine teeth which project ¼ in. when the mouth is closed.

The range of the zorro, so far as is known, is in tropical America, in the Amazon basin in Brazil, Colombia, Ecuador and Peru, in the Orinoco basin in Colombia and probably Venezuela, and in the Rio Parana basin in Brazil.

Graceful cat-like movement

The zorro's existence was made known to science in 1882 when a live specimen arrived at London Zoo, and knowledge of its habits is virtually limited to observations on a pair kept at Brookfield Zoo, Chicago. When a zorro is excited the hairs of its tail are raised, giving rise to the name of flag-tailed dog. The male at Brookfield became extremely tame, and would wag its tail feebly and roll over on its back, squealing, when petted by people it knew. The female, on the other hand, was unfriendly.

One of the most noticeable features of the zorro's behaviour is the cat-like grace of its movements, quite unlike the plodding, stiff gait of most dogs. It would be interesting to know whether it is cat-like in its behaviour, approaching its prey by stealth rather than by running it down, for instance. The coat is very sleek and it has been suggested that this is related either to a life where there is frequent rain or to a partly aquatic life. With regard to the latter it is of interest that the zorro looks most like a bush dog (p. 463), which is said to swim well.

Both the zorro and bush dog have very small ears which is surprising in view of the general rule that extremities become smaller as one goes towards the polar regions; compare, for instance, the ears of the tropical fennec fox and the polar Arctic fox. The reduction in ear size is related to the need to conserve heat by cutting down on the surface area of the body. It may be that the zorro and bush dog, living in humid forests, have less need for 'radiators' than does the fennec of the deserts.

Small male dominant

The male zorro at Brookfield Zoo was always surrounded by a musky aroma from its anal glands, but there was hardly any noticeable aroma from the female. The male was one third smaller than the female with a smaller head and more slender muzzle but he did dominate her, taking precedence at feeding times and not allowing her to feed until he was replete.

Obscure relations

Apart from its superficial resemblance to the bush dog, the short-eared zorro seems to be unrelated to any of the fox- or wolf-like dogs. With its short ears, the pattern of the coat, the proportions of the skull and its cat-like gait, it appears to be unique. This makes it noteworthy and the absence of any observations on its behaviour make speculation worthwhile, as in the false killer whale (p. 885) whose habits have largely been pieced together from observations of stranded animals. Even the relationships of well-known dogs have presented difficulties because, apart from size, there is very little variation in their skeletons, all of them being unspecialised, long-distance runners. The relationships of the dog family have now been investigated by comparisons of their social behaviour and the true position of the zorro will probably not be known until more zorros can be found and studied. So we end this encyclopedia, if not with a mystery animal then with one about which further study may reveal many interesting features.

class	**Mammalia**
order	**Carnivora**
family	**Canidae**
genus & species	***Atelocynus microtis***

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Page 2834 – SYSTEMATIC INDEX, animals identified by their classification. Names in italic type indicate a subdivision.

Key to Index

Common names and numbers in bold type indicate that there is a complete article on that animal.
Numbers in italic type indicate an illustration.
Numbers in bold italic type indicate a complete, illustrated article.
A star (★) indicates a distribution map.

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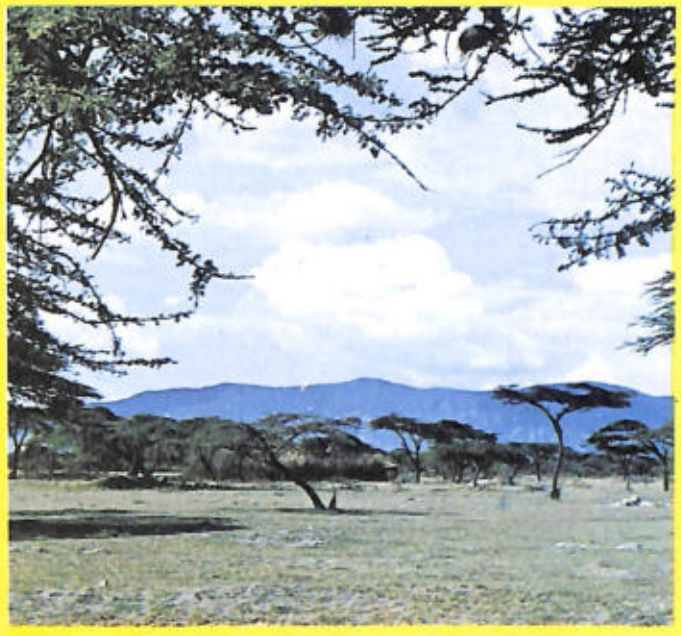

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