THE new FUNK & WAGNALLS ILLUSTRATED WILDLIFE ENCYCLOPEDIA

VOLUME 23
TUN-WHY

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Portions of this work have also been published as The International Wildlife Encyclopedia, Encyclopedia of Animal Life, and Funk & Wagnalls Wildlife Encyclopedia.

Funk & Wagnalls
a company of
The Dun & Bradstreet Corporation

Cover Photo: Harp Seal
Bruce Coleman Ltd.

Frontispiece: Common Vampire Bat
Ron Williams—Bruce Coleman Ltd.

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

Printed in the United States of America

Volume 23

Tuna

Although the name 'tunny' was first used in England—from the Latin ***thunnus*** *—at least as early as the 15th century, and the Spanish word tuna did not come into general use until the beginning of this century, tuna is rapidly becoming the accepted name for this large fish.*

The tunny or bluefin tuna of the Atlantic is said to reach 14 ft long and weigh 1 800 lb, but few exceed 8 ft in length. It has a sleek streamlined shape with a large head and mouth, and large eyes. The first dorsal fin is spiny and close behind it is a smaller soft-rayed second dorsal fin. The anal fin is of similar shape and size as the second dorsal, and behind these two, reaching to the crescentically forked tail, are finlets, nine on the upper and eight on the lower surface of the tail. The pectoral fins are medium sized, as are the pelvic fins, which are level with the pectorals. The back is dark blue, the flanks white with silvery spots and the belly white. The fins are dark blue to black except for the reddish brown second dorsal and the yellowish anal fin and finlets. There are three keels on each side at the base of the tailfin.

The bluefin is found on both sides of the North Atlantic as far north as Iceland.

Time Life Inc.

Follow the leader: a shoal of bluefin tuna migrate northward through the Florida-Bermuda channel.

Segregated by size

Tuna are oceanic fishes that sometimes come inshore but apparently never enter rivers. They move about in shoals in which individual fishes are all about the same size. The smaller tuna make up the largest shoals; the larger the tuna the smaller the shoal, and the really large individuals are more or less solitary. They swim near the surface in summer but are found between 100 and 600 ft in winter. Tuna are strongly migratory, their movements being linked with those of the fishes on which they feed and also on the temperature of the water. They are intolerant of temperatures below 10–12°C/ 50–54°F, so although they move into northern waters in summer they migrate back to warmer seas in autumn. A cold summer will limit the northward migrations. There also seem to be movements across the Atlantic. Tuna tagged off Martha's Vineyard, Massachusetts in July 1954 were caught in the Bay of Biscay five years later and occasionally individuals from American waters turn up off the coasts of Norway. Two tagged off Florida in September and October 1951 were caught off Bergen, Norway 120 days later, having travelled 4 500 miles.

Tuna, like their relative the mackerel, swim with the mouth slightly open so that their forward movement forces water across the gills. Their oxygen requirements are high because of their great muscular activity which depends on a correspondingly abundant supply of relatively warm blood. Because of this high oxygen requirement they swim more or less continuously. Tuna are believed to reach speeds of up to 50 mph.

Feeding frenzy

Very young tuna feed largely on crustaceans especially euphausians but later they eat mainly shoaling fishes such as herring, mackerel, sprats, whiting, flying fishes and sand eels. They also eat some squid and cuttlefish. When a tunny shoal meets a shoal of food fishes it is seized with what has been called a feeding frenzy. It charges through, the tunny twisting and turning, often breaking the surface, and sometimes leaping clear of the water. The commotion usually attracts flocks of seabirds to feed on the smaller fishes that are driven to the surface.

Soon put on weight

Spawning takes place in the Mediterranean and to the southwest of Spain in June and July and off Florida and the Bahamas in May and June. The eggs are small and float near the surface. They hatch in about 2 days, the newly hatched larvae being less than ¼ in. long. The baby fishes grow quickly reaching a weight of 1 lb in 3 months. At a year old they weigh 10 lb, at 2 years 21 lb, 35 lb at 3 years and 56 lb at 4 years of age. At 13 years of age they reach a length of 8 ft and weigh 440 lb. The two tagged at Martha's Vineyard were 18 lb and nearly two years old, and they had reached 150 lb when captured later in the Bay of Biscay, at the age of 7 years.

Ancient fisheries

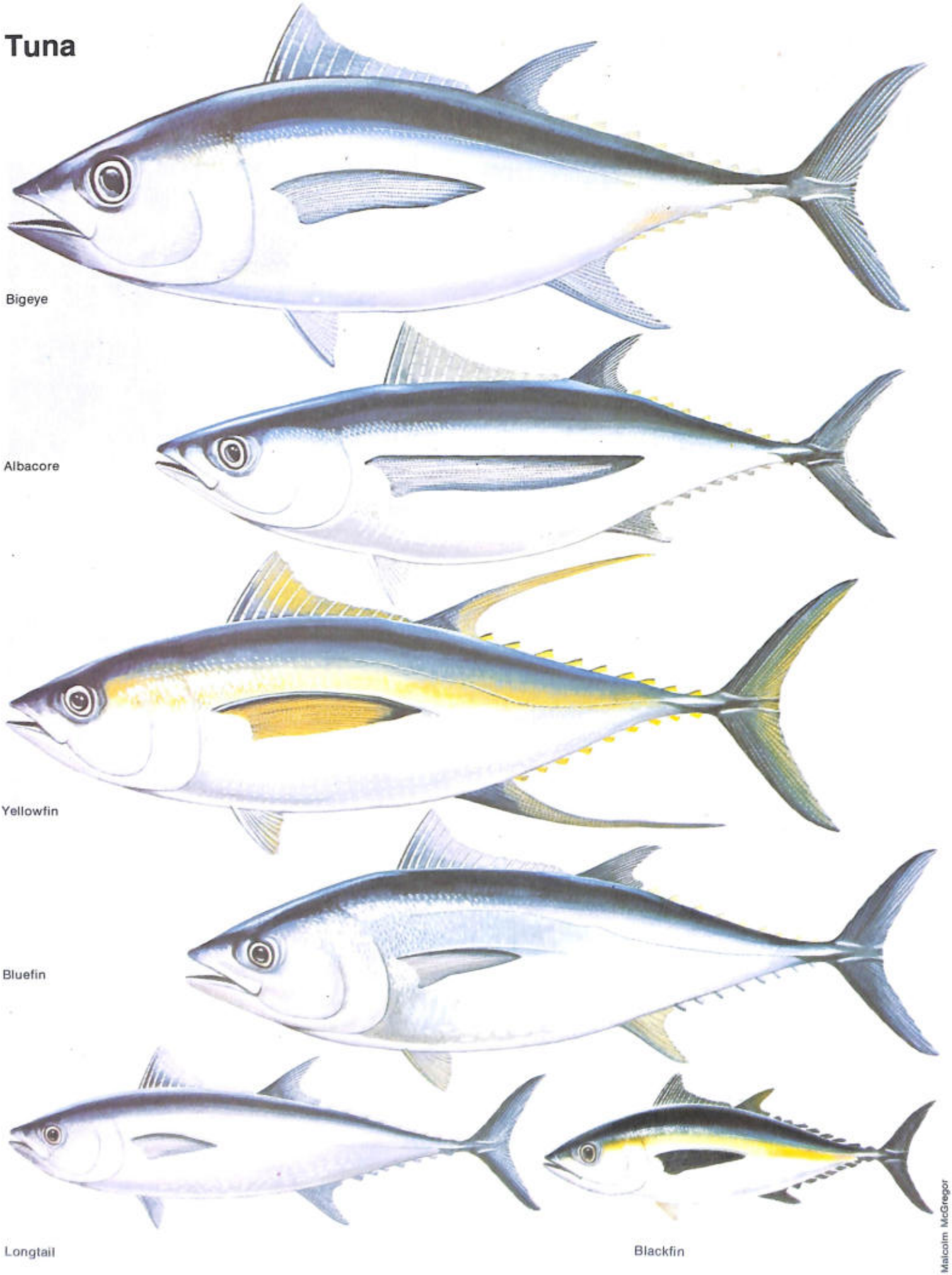
The many references to the tunny in classical literature show it to have been as important to the Mediterranean peoples as the herring was to the people of northwest Europe. The fisheries have continued through the centuries. Many methods have been used for catching the fish, such as harpoons, baited hooks and nets. The most spectacular are the net fisheries; very long nets are used to intercept migrating shoals and guide them into a final compartment or 'death chamber'. When this is filled with jostling fish the net floor is raised, the surrounding boats close in and the massed fish are clubbed, speared and dragged into the boats. Tuna fishing, or tunny fishing, according to whether it is carried out in American or British waters, has become a popular sport during the last half century. A large fish has been described as 'the tiger of the seas' and 'a living meteor' that strikes like a whirlwind and, played with a rod, will give a man the contest of his life, perhaps towing his boat for hours over a distance of several miles before becoming exhausted. The chief natural enemy is the killer whale.

Wide ranging tunas

There has long been some doubt whether the tuna of the American Atlantic is the same species as the tunny of the European side. They differ slightly in details of anatomy and in the time of the breeding season. Nevertheless, the tendency now is to treat them as separate populations of a single species. Other related species have similar wide distributions. A near relative, the Atlantic albacore, up to 4 ft long and 65 lb weight, with long scythe-like pectoral fins, has its counterpart in the Pacific albacore which ranges from the Pacific coast of North America to Japan and Hawaii. In the yellow-finned albacores or yellow-finned tunas, up to 9 ft long and 400 lb weight, the second dorsal and anal fins are also long and scythe-like. One species ranges across the tropical and subtropical Atlantic and another ranges across the Pacific and into the Indian Ocean.

class	**Osteichthyes**
order	**Perciformes**
family	**Scombridae**
genus & species	***Thunnus alalunga*** *albacore* ***T. albacares*** *yellowfin* ***T. atlanticus*** *blackfin* ***T. obesus*** *bigeye* ***T. thynnus*** *bluefin* ***T. tonggol*** *longtail*

Tuna



Bigeye

Albacore

Yellowfin

Bluefin

Longtail

Blackfin

Malcolm McGregor

Turaco

The turacos, or touracos, some of which are known as louries, go-away birds or plantain-eaters, are lively, fruit-eating birds. Their nearest relatives appear to be non-parasitic cuckoos, such as the couas of Malagasy. There are about 18 species, most of them about 18 in. long, the size of a wood pigeon, but the giant or great blue turaco is 2½ ft long, about the size of a pheasant. The wings are short and rounded and the tail is rather long. The bill is strong and curved. The plumage is usually grey or brown, as in the go-away birds, but some species have considerable amounts of green with red patches on the wings and red, white or other colours on the head. All turacos have crests except for the violet plantain eater which has short, hair-like feathers on the head.

Turacos are confined to Africa south of the Sahara. Some are widely distributed such as the giant turaco of West Africa, Zaire and Malawi but a few are very restricted, including the Prince Ruspoli's turaco which lives in a small area of Ethiopia.

Reversible toes for agility

Turacos are found only where there are trees, from the thick evergreen forests, where the giant and blue-crested turacos live, to the dry savannahs of the eastern coast of Africa. The Ruwenzori turaco lives up to 12 000 ft above sea level. The forest-dwelling species have the most green in their plumage while those living in thorn scrub may have none. Thus the forest turacos are well camouflaged, their red wing patches showing only in flight. When disturbed they freeze, becoming completely inconspicuous, then quietly run through the branches, making their way up into the safety of the canopy.

Branches and foliage present no obstacles to turacos because of the peculiar form of their feet. When two toes face forward and two backwards, as in owls and woodpeckers, birds' feet are called zygodactylous. The feet of turacos are semi-zygodactylous; they have a special joint on the outer toe. At rest this toe sticks out sideways but it can be moved either forwards or backwards. This special joint makes it easy for turacos to walk to the tips of the smaller branches, among the leaves and twigs where they hunt for their food.

Turacos are solitary and gather in small groups only where food is abundant. The black-tipped crested turaco roosts huddled in small groups. Turacos are inquisitive and readily approach men or snakes. Their calls are harsh and the go-away birds are named after their cries of 'go-waa'.

▷ *Not a feather out of place: an immaculate* ***Tauraco livingstonii*** *shines with metallic colour. The coloration of turacos is due to unique pigments; the green comes from turacoverdin, the red from turacin, both pigments being named after these birds.*

Wolfgang Lummer

Eating poison

The main food of turacos is fruit, which they eat very wastefully, dropping more than they consume. The waste is, however, probably only relative as the fallen fruits are sure to be eaten by other animals. Turacos show definite preferences for certain kinds of fruit. The Knysna lourie is remarkable for eating the poisonous red fruits of a shrub called 'bushman poison'. Shoots and leaves are also eaten and small invertebrates are taken by some turacos. The black-billed or Congo turaco feeds on small snails and the black-tipped crested turaco feeds on invertebrates flushed by driver ants on the forest floor.

Precocious young

The nests of turacos are like those of pigeons: flat platforms of loosely-woven twigs built in dense foliage, usually quite low in the tree. Most of their nesting habits have not been well documented but VGL Van Someren has studied the blue-crested plantain-eater in detail. It has two breeding seasons in each year: April–July and September–January. It appears, however, that each individual nests only once a year. Turacos living near the equator nest all the year round, but elsewhere they generally do so just after the rainy season. The floor of the nest is so thin that the two white eggs can be seen through it. The incubating parent holds its head in such a way as to break the silhouette and so appear less conspicuous. The incubation period is thought to be around 18 days and the fledgling period about a month. The latter is difficult to record because the chicks, which hatch with a covering of black down, leave the nest before they can fly and clamber about using wing claws like those on young hoatzins (p. 1211) or mousebirds. The chicks are fed on regurgitated fruit.

Unique pigments

The red and green colours in the plumage of turacos are unusual. In most birds green is either produced by the structure of the feather (see fairy bluebird, p. 878) or by a mixture of two pigments: brown melanin and a yellow carotenoid. In turacos the green is due to a single green pigment, turacoverdin. The red pigment of the wings and head is called turacin and is found nowhere else in the Animal Kingdom.

For a long time it has been said that the red pigment runs easily and that the red plumage of turacos fades in the rain. To dispel this belief JP Chapin wore a red turaco feather in his hat for 18 months. If anything the colour became darker because turacin is slowly oxidised in the air. Similarly, in museum specimens the red plumage darkens rather than fades.

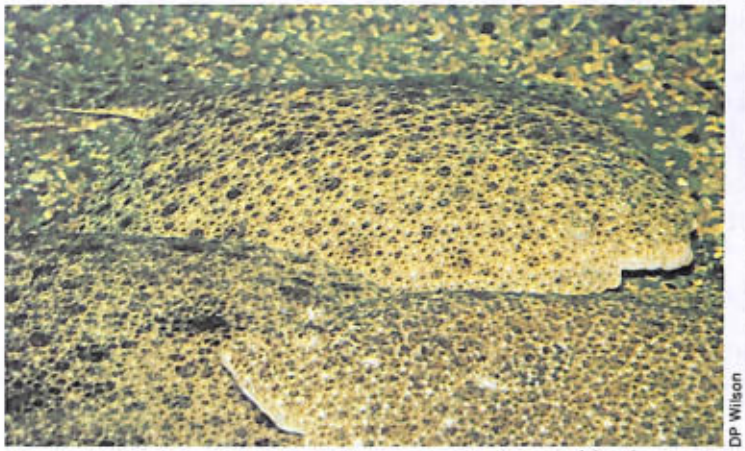
This darkening with exposure is unusual. Red pigments tend to run, as is well known in laundries, or fade, as can be seen on posters where red letters disappear even when protected from rain. Perhaps the turacos have the answer the dye manufacturers are seeking.

Jane Burton: Photo Res

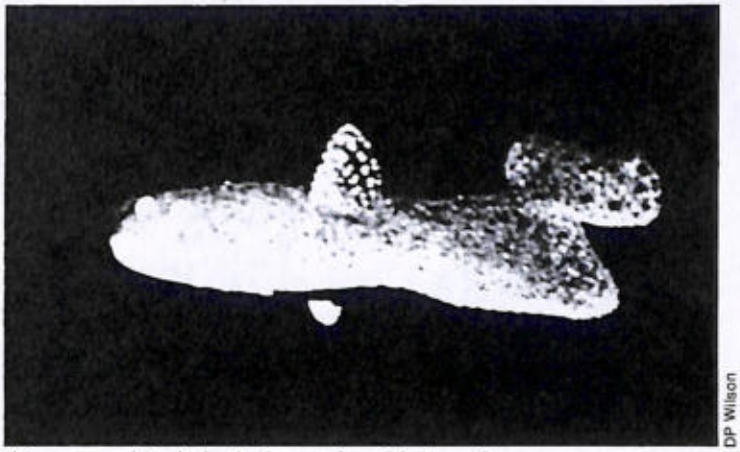
class	**Aves**
order	**Cuculiformes**
family	**Musophagidae**
genera & species	***Corythaeola cristata*** *giant turaco* ***Musophaga violacea*** *violet plantain eater* ***Ruwenzorornis johnstoni*** *Ruwenzori turaco* ***Tauraco corythaix*** *Knysna lourie* ***T. hartlaubi*** *blue-crested turaco* ***T. macrorhynchus*** *black-tipped crested turaco* ***T. ruspolii*** *Prince Ruspoli's turaco* ***T. schuttii*** *Congo turaco* *others*

▽ *Poised for takeoff: a startled Donaldson's turaco* ***Tauraco leucotis.*** △ *Ross's turaco* ***Musophaga rossae*** *raising its smart crest.*

John Markham


DP Wilson

Head to tail turbot, showing both sides of the typical crooked head.


DP Wilson

After a propulsive body-ripple, a turbot glides in mid-water.

Turbot

The turbot has the reputation among many people of being the finest flavoured of all sea fishes. Ever since a fisherman presented a very large one to the Emperor Nero, it has had the reputation of growing to a considerable size. It was said there was no dish large enough to take it, and that Nero summoned his senators to gaze on this marvel.

In fact, the turbot grows up to 31 in. long, very rarely reaching 39 in. Its average weight is 25–32 lb with a maximum of 55 lb. Its body is broad and diamond shaped, the length being only 1½ times its width. Both eyes are on the left side, so the fish rests on the sea bottom on its right side. The large mouth is situated to the left of the eyes, the teeth and jaws are equal on both sides. The dorsal fin starts at the snout and, like the anal fin, does not join with the tail fin. The pelvic fins are broad at the base, that on the eyed side being slightly longer than that on the blind side. The turbot is scaleless but its upper side is covered with small, scattered bony knobs or tubercles. These are much smaller and closer together on the head. The colour varies according to that of the seabed on which it is lying, ranging from a dull grey when on mud or muddy sand to a pale yellow on sand. The underside is white but may bear patches of colour. A few turbot are ambicoloured—coloured on both sides.

The brill is closely related to the turbot and is similar in form and habits but it is relatively unimportant as a food fish. The Black Sea turbot is another related form with much larger tubercles on both the lower and upper surfaces.

The turbot ranges from the Mediterranean to the North Sea as far north as Bergen on the Norwegian coast, sometimes wandering north of the Arctic Circle as far as Lofoten Islands. It is found all round the coasts of the British Isles but is rarely caught as far north as the Orkneys and Shetlands.

Rippling sprinter

The turbot lives in shallow water, rarely being caught in depths of more than 250 ft. Locally it is sometimes found so close to the shore that it can be fished off the beach at low water, but it has not been known to enter estuaries. It normally lies on shell gravel or gravel bottoms but may also be found on sand or mud. Like all flatfishes the turbot swims by rippling undulations of the whole body but each spurt does not carry it very far.

A wide diet

The food of turbot is mainly other fish such as sand eels, sprats, pilchards and members of the cod family. Soles, dabs, dragonets, sea bream and boarfish, a relative of the John Dory, are sometimes taken; invertebrates such as bivalve molluscs and worms have been recorded, but rarely. The larvae of the turbot feed on animal plankton, including the larvae of barnacles and molluscs.

One of the most prolific seafish

In the North and Irish Seas spawning takes place from April to August, in the western Channel and off the Welsh coast from May to September. The turbot is one of the most prolific of seafishes, the female laying 5–10 million eggs, each $\frac{1}{25}$ in. diameter, over gravelly ground in shallow water. Turbot eggs and larvae are pelagic, floating near the surface of the sea. The egg has a pale yellow oil droplet in it that gives buoyancy. After 7–9 days the eggs hatch. At first the fry are very small, $\frac{1}{10}$ in. long, and helpless. They then have a normal shape with an eye on each side of the head. They also have a distinct airbladder which they do not lose until they have changed into little flatfishes. During this change the right eye migrates to the left side of the head to a position next to the left eye. The left side of the body becomes pigmented and the right side becomes white. The change is slow and does not begin until the young turbot is $\frac{1}{2}$ in. long and is sometimes not completed until it is 1 in. long, and 4–6 months old. During this time the baby turbots are widely spread. They do not assume a bottom-living life until after their metamorphosis is complete.

Turbot grow fairly rapidly, the females faster than the males. At 3 years old the males are about 12½ in. long and the females 14¼ in. and at 5 years old the males are 16½ in. long and the females 17½ in. The maximum age recorded is about 15 years, when the average length of males is 21 in. and the females 27 in.

Hazardous beginnings

As the eggs and larvae float near the surface of the sea they are subject to many hazards. They are at the mercy of wind and current and may be carried into waters where they cannot survive, or they may be snapped up by a wide variety of fishes. Changes of temperature may kill them or they may be cast up on the shore to perish. Out of each brood of 10 million eggs, very few turbot reach adulthood. Once fully grown the fish's ability to assume the colour of the sea bottom where it is resting is an effective camouflage concealing it from its enemies.

Ancient fishery

Its fine flavour makes the turbot an important food fish in both the Mediterranean and northern European waters. The chief fishery is in the central area of the North Sea where 88% of the northern European catch is obtained. Fishing is now usually by trawl although some are taken by long lines or even caught in seine nets off the beach in some localities. The turbot is also a favourite fish of anglers; the record fish taken on rod and line in British waters weighed 29 lb. Fishing for turbot with long lines has been going on for centuries in the North Sea. An 18th century account tells how Yorkshire fishermen went out in 20ft boats manned by three men who each had three lines furnished with 280 hooks set 6 ft 2 in. apart. Once on the fishing ground the nine lines were joined, making one long line nearly three miles long and carrying over 2 500 baited hooks.

class	**Osteichthyes**
order	**Pleuronectiformes**
family	**Bothidae**
genus & species	***Scophthalmus maeoticus*** *Black Sea turbot* ***S. maximus*** *turbot* ***S. rhombus*** *brill*

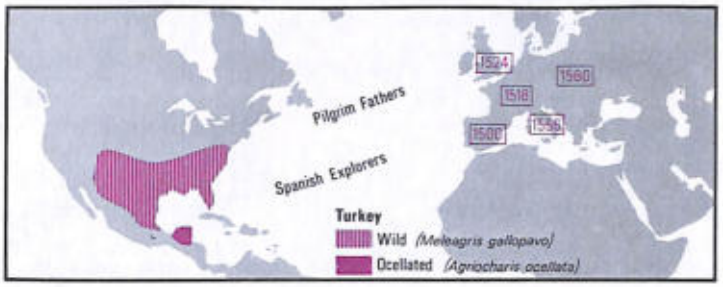
Why 'turkey'?

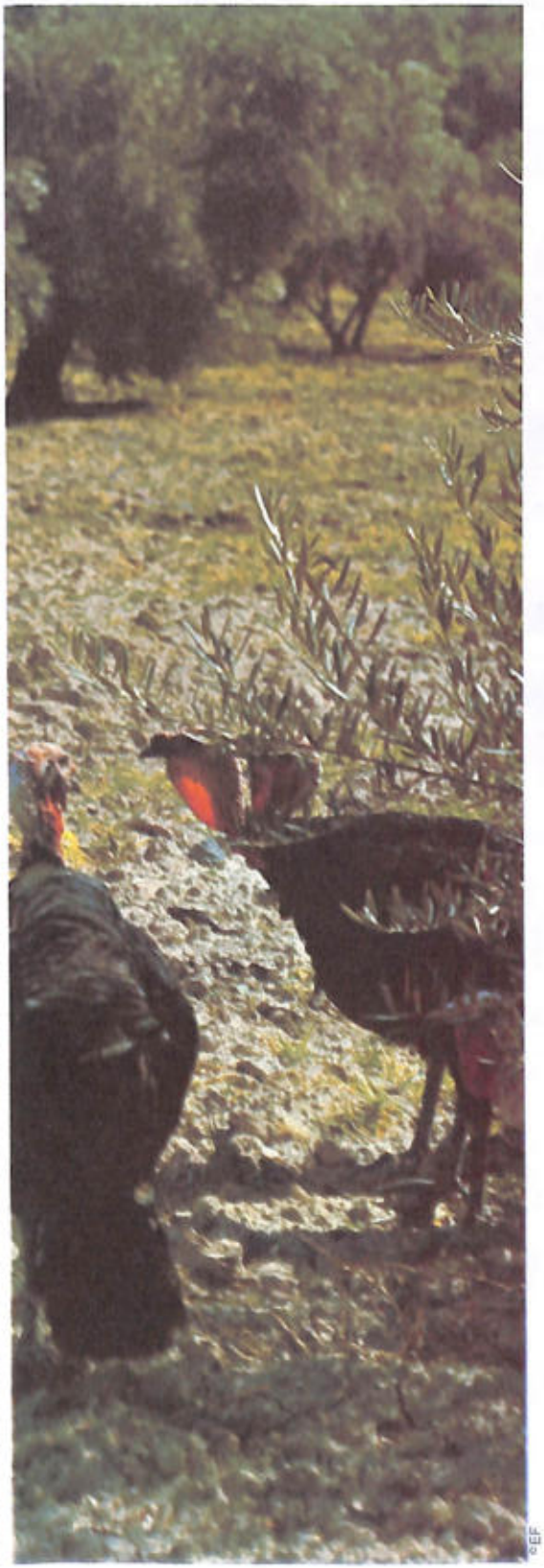
The earliest record we have for the domesticated turkey in Europe tells us that Pedro Nino brought some to Spain in 1500, having bought them in Venezuela for four glass beads each. The turkey is known to have reached England by 1524, and by 1558 at least it was becoming popular at banquets. In Spain the new bird was often referred to as the Indian fowl, an allusion which is repeated in the French *dindon*, formed from *d'Inde*. The origin of the name turkey is less obvious. One view is that it is from the bird's call *turk-turk-turk*. A more likely explanation is that in the 16th century merchants trading along the seaboards of the Mediterranean and eastern Atlantic were known as Turks. They probably included the birds in their merchandise and these then became known as turkey fowls.

The domesticated breeds today range from the Norfolk, known in the United States as the black, through the bronze to several breeds of white, including the small white. Whereas formerly size in a turkey was desirable, with the small ovens today the small white has gained popularity.

class	**Aves**
order	**Galliformes**
family	**Meleagrididae**
genera & species	***Agriocharis ocellata*** *ocellated* ***Meleagris gallopavo***

▷ *Distribution of the wild turkey in the New World and dates of its arrival as a domestic breed in different parts of Europe. Ancestors of present-day domestic turkeys were drawn from the* **Meleagris** *population.*
▽ *A 'gobbling' gathering. During the day, small flocks of wild turkeys spend their time roaming over the ground, searching for seeds and insects —a large part of their diet. At night they roost in trees, making them particularly vulnerable to hunters as they are silhouetted against the sky.*
▽▷ *Puffed up with importance; a 51lb male domesticated turkey, one of the many breeds of the wild turkey, dwarfs a small plump hen.*
▽▽ *Polygamous domesticated male turkey mates with one of his harem. Turkey rearing is an important and successful part of the poultry industry today, table birds being available for most festive seasons.*





Joe Munroe: Photo Res.

Heather Angel

Turkey vulture

The turkey vulture is one of the 'New World vultures', a family of birds of prey very similar in habits and appearance to the true vultures of the Old World. The family includes the two condors (p. 644), the yellow-headed vulture ***Cathartes burrovianus,*** *the greater yellow-headed vulture* ***C. melambrotus,*** *the black vulture* ***Coragyps atratus,*** *and the king vulture* ***Sarcorhamphus papa****. The turkey vulture, also known as the buzzard, is about 29 in. long, weighs about 3 lb and has a 6ft wingspan. The plumage is blackish-brown with a greenish gloss on the body. The head is naked and red, or brownish in young birds. In flight the turkey vulture is distinguished by its long wings and red head.*

Turkey vultures range from southern Canada to Tierra del Fuego, including the West Indies and the Falkland Islands.

Grounded by weather

The turkey vulture's distinctive outline in flight is a common and unwelcome sight in many parts of its range, where tales of its killing livestock and spreading disease are widespread. It is found in many types of country, from forests to deserts and the high plateaux of the Andes. In most regions, including the northern and southern parts of its range, the turkey vulture does not migrate, but the Andean population moves to lower levels and turkey vultures in the dry areas of the western United States fly south in winter.

The turkey vulture is an excellent flier, gliding for long distances without a beat of its large wings, or soaring in thermals. It has been calculated that they travel at 40 mph when on migration, following the lie of the land. Turkey vultures roost in trees, sometimes in groups that crouch on their perches like chickens. They leave the roost only when the ground has warmed and there are rising air currents to help them take off. When it rains they may remain perched all day.

The riper the better

As with their relatives of both Old and New Worlds, the food of turkey vultures is mainly carrion, which may be freshly dead or in very advanced stages of decomposition. Compared with other vultures the turkey vulture has a small bill, so it prefers rotten carcases or those already opened.

▽ *Turkey vultures investigate a sandy beach. In the Peruvian guano islands they are considered pests, as they take the eggs and young of seabirds.*

Wolfgang Lumm

◁ *Grotesque monarch: with earflaps, warts and wattles, the king vulture is the most distinguished of the New World vultures. It lives in the forested areas of Central and South America, and can sometimes be seen in groups of 25 or more, flying with all the grace of an albatross. The protuberances on the beak may have a sensory function.*

The animals killed by motor traffic now provide an abundant source of food. They also catch small live animals, such as mice, and they occasionally take eggs and nestlings of herons and of seabirds on the Peruvian guano islands. Other foods include rotten pumpkins and the fruit of oil palms.

A circle dance

Small groups of turkey vultures have been seen to perform a strange dance during the early part of the breeding season. About six birds gather in a clearing and hop after each other with wings outstretched. One bird hops after a second, who chases a third and so on until they are moving in a circle. This dance apparently precedes mating. Two white eggs are laid on the floor of a cave, in a cranny, in a hollow tree or on the ground in a thicket. Both parents incubate the eggs, which hatch in 38–41 days. The young are able to fly when about 11 weeks old.

Unjustified persecution

Turkey vultures' great enemy is man, either through deliberate hunting or by accident. Ironically, they are hit by cars while feeding on animal carcases from previous collisions. The reason for shooting turkey vultures is that they attack the nests of guano-producing seabirds or kill young livestock. Their predations have no significant effect on the former and instances of the latter must be most unusual as the turkey vulture is too small and its bill too weak to harm a large living animal unless it is very weak or trapped. Another reason for killing turkey vultures, especially in the United States, is that they can spread diseases such as anthrax, which they pick up on their feet and heads from carcases. They are, however, unlikely to transfer the germs to living animals. It is of interest that turkey vultures are immune to the deadly botulinus toxin which must be a hazard to most carrion eaters.

Follow that smell

For over a century there has been controversy about the way in which turkey vultures, and other birds of prey, have been able to spot prey or carrion from great distances. Many experiments have been made to show that turkey vultures have a very limited sense of smell and find their food by sight. Audubon, for instance, covered a carcase with canvas and found that they were not attracted to it but they would come to a canvas with a picture of a dissected sheep on it. A Mr Bachman also covered a putrid carcase with canvas, and then, by scattering meat on it, attracted turkey vultures onto it. They ate the meat but did not detect the decaying meat only a few inches from their nostrils.

Despite the apparent proof of these experiments a number of instances have been recorded of turkey vultures gathering at hidden carcases. The turkey vulture also has relatively large centres of smell in the brain and recent experiments have now proved that turkey vultures find their food at least partly by smell. Furthermore, maintenance engineers recognise that turkey vultures sometimes gather over leaks in gas pipes, where they are apparently attracted by the nasty smell.

class	**Aves**
order	**Falconiformes**
family	**Cathartidae**
genus & species	***Cathartes aura*** *turkey vulture*

▽ *Full stretch: a turkey vulture exposes the full 6 feet of its wingspan. It is, however, small compared with its relatives. With wings spread like this the vulture prevents overheating by exposing a massive surface area to any cooling breezes.*

Ron Austing

Turnstone

Turnstones are small waders that turn stones over when searching for food. They are about 9 in. long, a little larger than ringed plovers. With the surfbird, the two species of turnstones form a subfamily usually classed with the sandpipers (p. 2141), but sometimes with the plovers (p. 1933). The bill is fairly short and stout; the legs are also rather short. The turnstone, known in North America as the ruddy turnstone, has a very distinctive summer plumage. The upperparts are 'tortoiseshell' with rusty red on the back. The head, neck and underparts are white but there is a very conspicuous pattern of black lines over the head and across the breast. The legs are orange. In winter the head, breast and back become dark brown, except for the throat, which remains white. The pattern of the summer plumage breaks up the outline of the turnstone and makes it extremely difficult to see when it is feeding among the pebbles on a beach. In flight, however, the piebald pattern shows up very well. The ruddy turnstone is found around the globe in Arctic regions, around the coasts of Alaska, northern Canada, Greenland, Scandinavia and Siberia. At one time it nested on the northern coast of Germany but it has now disappeared, probably because of the warmer weather during this century.

The black turnstone breeds only in Alaska, where it nests inland. Its plumage is more uniform than that of the ruddy turnstone. It lacks the rusty colour on the back, and the head and breast are mainly black with white speckles on the side of the breast. These disappear in winter. The surfbird also breeds only in Alaska, nesting in mountains above the tree line. It is mottled black and white over most of the body, becoming uniformly darker in winter.

Speedy migration

Turnstones migrate long distances between their breeding and wintering grounds. The ruddy turnstone travels south to the Cape Province of South Africa, Chile and even Australia and New Zealand. Some, presumably juveniles, stay there while the remainder fly north to breed. The black turnstone and the surfbird spread down the Pacific coast of America. One turnstone gave a good indication of the speed at which birds migrate. It was ringed in Germany at 11 am one day, and was recovered on the northwest coast of France at 12 am the following day, having travelled just over 500 miles at an average of 38 mph.

While on migration turnstones fly in large flocks at a considerable height but when not travelling they fly low and in small parties, circling over the sea and returning quickly to the shore when disturbed. Turnstones often associate with other waders and fight them when competing for food.

Heinz Schremmp

△ *Although turnstones feed along the water's edge like other waders, their favourite haunt is around stones and pebbles on the shore—as shown by this ruddy turnstone. The stones are turned and flicked over with the strong bill. They also eat birds' eggs and in Alaska they have been seen feeding on seal carcases.*

Turnstones by name and nature

When feeding along the shore turnstones eat small animals such as winkles, worms and crustaceans, as well as the eggs of other birds and carrion. Inland on the breeding grounds they feed mainly on insects and their larvae, such as beetles and caterpillars. Their name is derived from the way they flick over stones, clods of earth or seaweed, to expose the small animals underneath. They bend their legs, then insert the slightly upcurved bill under the object and flick it over, sometimes pushing with the breast if it gets stuck halfway. Stones up to ½ lb can be shifted in this way, flat ones being more difficult to move than round ones. It sometimes appears as though turnstones co-operate with each other to turn heavy stones but they are just as likely to work against each other as to lever in the same direction. Sandhoppers are found by flicking over seaweed, while small molluscs and worms are exposed by digging into the sand. The stone-turning habit, however, is not so common as the name suggests as turnstones spend much of their time feeding along the water's edge like perfectly normal waders.

Inland nest sites

Ruddy turnstones usually nest near the shore but sometimes they choose islands some distance up rivers. The black turnstone and the surfbird regularly nest inland, the former on the banks of pools in the tundra and the latter in rocky outcrops in mountainous regions. It has been said that the breeding grounds of the surfbird are identical to those of mountain sheep.

The nest is a scantily lined scrape in the ground in which four eggs are laid. Both parents incubate the eggs and feed the chicks. Turnstones defend their broods vigorously, harassing any enemies, especially skuas and Arctic foxes.

Grisly diet

Turning over stones and clods is not the only unusual feeding habit of turnstones. Alexander Wetmore describes how migrating turnstones feed on terns' eggs on Laysan Island. Whenever the terns were disturbed and flew off their nests, parties of turnstones would alight and peck holes in the eggs. They also tried to attack the eggs of boobies and frigate birds but these were too tough. Two turnstones even dragged an egg from under a sitting tern and ate it there and then. Another surprising habit is that of carrion-eating. In Alaska turnstones seem to feed on the carcases of slaughtered fur seals, although it may be merely that they are feeding on the maggots in them. However, in *British Birds* for 1966 AJ Mercer records seeing turnstones definitely feeding on the flesh of a human corpse washed up on the beach. Turnstones also exploit humans by feeding on edible refuse such as potato peelings.

class	**Aves**
order	**Charadriiformes**
family	**Scolopacidae**
genera & species	***Aphriza virgata*** *surfbird*
	Arenaria interpres *ruddy turnstone*
	A. melanocephala *black turnstone*

André Fatras

Turtle dove

The turtle dove is one of the smaller members of the pigeon family, and one of the least harmful to agriculture. It is of special interest because its habits, especially its migrations, are particularly closely linked with its food supply.

It is about 10 in. long, red-brown on the upper parts, grey on the head, the throat and breast being vinous shading to white on the underparts. The centres of the wing feathers are black. The eye is deep red. The bill is relatively weak. There are patches of black and white feathers on the sides of the neck, used in display. The tail has long graduated black feathers, all white-tipped, except the central one.

The turtle dove winters in tropical Africa, south of the Sahara but north of the Equator, and migrates north to breed in north Africa, southwest Asia, and Europe.

▷ *The turtle dove is a summer visitor over most of Europe and some parts of North Africa and Asia.*
◁ *On its nest among the brambles, a parent turtle dove feeds its hungry family. Their food is 'pigeon's milk' regurgitated from the crop of the adult bird. The young insert their bills into that of the parent and stimulate production of this nutritious, curdlike liquid. A pair of doves will raise 2 or 3 broods a season in this way, sharing the incubation and feeding.*

A peaceful chorus

In contrast to the wood pigeon, with which it shares much the same range in summer, the turtle dove frequents open woodlands, parkland and shrubberies. It is seldom found on buildings, and prefers to perch on low or medium sized trees and bushes near cultivated ground. There are few more restful or pleasant sounds than the call of the turtle dove in the stillness following the dawn chorus. The Latin name for the dove was *turtur*, from its call. Originally called 'dove' in Old English, it later became the turtur dove and finally turtle dove. In *The Song of Solomon* there is mention of the belief that the cooing of the turtle dove heralded the approaching spring.

Feeds on weed seeds

The summer diet of turtle doves has been very fully analysed, particularly by RK Murton. From the end of April or the beginning of May, when the doves reach their summer grounds, to the end of June, they feed mainly in hayfields. From July to September they feed mainly among cereal and other crops. Their food is 95% seeds of weeds, with about 3% animal food, mainly small snails. The weed seeds include those of grasses but are predominantly the fruits of fumitory *Fumaria* spp. A recent report shows that the seeds of millet, a commercial crop in the USSR, are particularly suitable for the turtle dove, so there the bird is a potential pest especially in spring when the ground is newly sown. Nevertheless, the report concludes: 'as they mainly pick up seeds that are badly embedded in the earth or lying on the surface, and whose germination is improbable, the harm that the doves cause should be reckoned as inconsiderable'.

Elsewhere the distribution of turtle doves is closely linked with that of the fumitory. In Britain, for example, the fumitory, a weed of cultivated ground, is common over much of England, rarer in Wales and absent from most of Scotland, and the distribution of the turtle dove follows these limits.

Early families in peril

The territorial display of the turtle dove consists of launching out from a perch, then climbing steeply before gliding down and circling back to the perch again. During courtship the male displays to the female by puffing out his chest and bobbing up and down in front of her with lowered bill.

The nest is a frail platform of thin twigs, sometimes lined with roots, hair or plant stems. Two white, oval or elliptical eggs are laid, and usually each pair of doves has 2 or 3 clutches in a season. The parents share the incubation for 14 days and feed the nestlings on 'pigeon's milk', a secretion from their crop, for 18 days. Egg-laying reaches its peak in the second half of May and early June then declines during July, to end abruptly in September. The supply of seeds improves as the summer wears on and there is a higher rate of survival among young born in the second half of the breeding season. This is because the parents need to spend less time looking for food so the losses from nest-robbing predators are fewer. Even so, there are heavy losses over the season as a whole. Nest-robbers take 34% of the eggs, only 47% hatch and only 39% produce fledged young. The nest robbers are other birds, the magpie and the jay being very active thieves, especially during the early part of the breeding season.

Learning the hard way

Towards the end of August there is a decline in the breeding impulse and the parents tend to desert their eggs and young. Even if they continue to feed the nestlings their waning parental instinct means the young may not get sufficient food to lay in the stores of fat needed on migration. This leads to further deaths on migration, already hazardous for young doves. It has been found that on the journey south in September through western Europe the young and inexperienced birds take a more westerly route than the old birds, flying down the coast of Portugal. There is danger on this route of their being blown out to sea by the prevalent easterly winds. Moreover, young birds tend to migrate under unfavourable weather conditions, so instead of being able to fly high they must come down, within range of the shotgun.

Hawks and egg-robbers

The predators of turtle doves are mainly hawks, such as sparrowhawks, and the nest robbers including the magpie and jay. The latter are always on the lookout for unguarded nests so their impact is greatest during the early part of the season, when food is less plentiful and the parents must absent themselves more from the nest. From all causes, there is a 50% mortality among adult turtle doves made good each year by surviving young ones.

Unusual moult

In summer, turtle doves work to a tight schedule as breeding continues late into the year, leaving little time before migration to go through a moult. This may be because they do not have sufficient energy to spare for this exacting process without depriving the body of fat reserves needed for the migration journey. As a result they start the moult and then migrate with an arrested moult, which is not completed before they reach their winter quarters.

Standing weeds needed

The question then arises why, in the face of normal hazards and other dangers, turtle doves should migrate at all. Climate seems not to be the determining factor since turtle doves can be kept in outdoor aviaries throughout the winter in England, provided they are well fed. In the wild there should be no shortage of weed seeds on the ground. The need to migrate may well be linked with the pattern of the turtle dove's feeding behaviour. They take mainly the seeds from standing vegetation. The fumitory, and other wild plants supplying their food, die down at the end of summer, and turtle doves have little skill in taking seeds from the ground.

class	**Aves**
order	**Columbiformes**
family	**Columbidae**
genus & species	***Streptopelia turtur***

Tyrant-flycatcher

The tyrant-flycatchers are a vast group of birds, with over 300 species including birds with the common names of kingbird, kiskadee, phoebe and pewee. They are similar but not related to the true flycatchers (p. 943). Confined to the New World, they have taken up many ways of life and are so widely varied in appearance that generalisation is nearly impossible. Many have a short crest and a bright patch of colour on the crown. The wings may be rounded or pointed and the bills also vary greatly. Tyrant-flycatchers range in length from 3 to 9 in.

Some of the tyrant-flycatchers are brightly coloured. The vermilion flycatcher has a red head and underparts with a brown back. The many-coloured tyrant has feathers of black, blue, green, orange, scarlet and white. The 15in. scissor-tailed flycatcher has a black and white forked tail making up over half its total length and the northern royal flycatcher has a fan-shaped crest of orange and violet. Most tyrant-flycatchers are, however, rather inconspicuously coloured with shades of brown and grey.

Tyrant-flycatchers range from the treeline in Canada to the tip of South America, including the Galapagos and Falkland Islands, but most are found in the tropics.

Variety of lives

The habitats of tyrant-flycatchers are extremely varied and this is correlated with their variability in body form. Long-winged species are migratory, while those with short rounded wings live in forests, and in open country there are tyrant-flycatchers with strong legs, like pipits. Tyrant-flycatchers range from sea-level to 12000 ft in the Andes and live in grassland, dense forests and swamps. Not surprisingly their feeding and nesting habits are also very varied. Their songs are poor and not particularly pleasant; the kiskadees and pewees are named after their calls.

Many feeding habits

In their feeding the tyrant-flycatchers show many of the habits of familiar Old World flycatchers. Most feed on insects but their diet is often supplemented with fruit and larger animals. Like the Old World flycatchers, they wait on a favoured perch and fly out to catch passing insects with an audible snap of the bill. Their ability to catch flying insects is assisted by the rictal bristles around the base of the bill which act as a net. Rictal bristles are best developed in the 'fly-catching' species and are much reduced in those that catch larger prey or eat fruit. Instead of catching flying insects, some tyrant-flycatchers, such as the grey pepoaza, pounce on terrestrial insects as shrikes do, and those with strong legs chase them on the ground or fly up to snap a low-flying insect, like [illegible]. Others hunt insects among foliage [illegible] warblers.

The larger species, such as the boat-billed flycatcher, feed on small birds, lizards, frogs and mice, battering their victims before tearing them apart. The black phoebe catches fish, and to complete this example of contrasts, the fire-crowned tyrant searches the backs of cattle for insects and ticks, like an oxpecker.

Snakeskin decorations

Tyrant-flycatchers are almost as varied in their nesting habits as in their feeding habits. The nests may be open cups or domed nests, on the ground or in the fork of a tree, camouflaged or conspicuous. Some take over the holes of woodpeckers, others usurp the mud nests of oven birds and a few nest near wasps, sheltering under the protection of these aggressive neighbours. The majority of species, however, build cup-shaped nests of grass and twigs in the branches of trees. Many tropical species build purse-like domed nests with tubular entrances.

The great-crested flycatcher, a hole-nester using woodpecker holes, bird-boxes and so on, sometimes decorates its nest with cast-off snakeskins. It is often said that this habit is a protective device to scare away predators. About 15 other species of birds are known to do this, including the riflebird and a bird of paradise, but it is difficult to see that predators would be scared by a snakeskin if the nest builder was not scared to pick it up in the first place. Presumably the snakeskins are merely one of the many odd objects that have been found in birds' nests merely because they are convenient materials.

The eggs vary from pure white to white with spots and streaks and the clutch number varies from two in the tropics to four in higher latitudes. Both parents build the nest but only the female incubates. The incubation and fledging periods also vary. They are usually 14–18 and 13–14 days respectively, but incubation may last 19–23 days and the fledging period may be 21–25 days. Both parents feed the young and there may be two or more broods a year, especially in the tropics.

Little tyrants

The kingbirds of the genus *Tyrannus* are aptly named because of the way they harass other birds that come into their territories. The eastern kingbird of North America was known as the 'Little Chief' from the way it attacked humans who ventured near its nest and did not hesitate to attack crows or hawks much larger than itself. Even if the intruders show no interest in the kingbird and its brood they are pursued until well away from the nest. Kingbirds are not the only aggressive flycatchers. RE Mumford describes how the acadian flycatcher attacks cowbirds, which may try to lay their eggs in its nest, squirrels, chipmunks and even inoffensive nuthatches.

◁ *Vermilion flycatcher* ***Pyrocephalus rubinus***.

class	Aves
order	Passeriformes
family	Tyrannidae
genera & species	***Empidonax virescens*** *acadian* · ***Machetornis rixosa*** *fire-crowned* · ***Megarhynchus pitangua*** *boat-billed* · ***Muscivora forficata*** *scissor-tailed* · ***Myiarchus crinitus*** *great-crested* · ***Onychorhynchus mexicanus*** *northern royal* · ***Pyrocephalus rubinus*** *vermilion* · ***Sayornis nigricans*** *black phoebe* · ***Tachuris rubrigastra*** *many-coloured* · ***Tyrannus tyrannus*** *eastern kingbird* · ***Xolmis cinerea*** *grey pepoaza* · *others*


Uakari

Uakari

The uakari (pronounced wakari) is a little-known monkey of South America, closely related to the saki (p. 2131) but differing from it in a number of features, especially the short tail. It is the only South American monkey whose tail is actually shorter than the head and body, which measure 16–18 in., the tail being only 6–7 in. The body is covered with shaggy hair, variable in colour, but underneath it the uakari is a skinny, spidery animal. The head is naked, with only very short, sparse hair or none at all. This utter baldness is accentuated by an almost complete lack of fat under the skin, making the face incredibly lean and bony. In the adult male the jaw muscles become big and bulky, and can be seen clearly beneath the bare skin, bulging out on the top of the skull. The bare face pokes out from a mass of shaggy hair which begins behind the ears and on the neck and the back of the head, so the uakari looks rather like a bald monk with a cape.

There are two species of uakari, found around the Amazon on both sides of its upper course. On the north side, between the rivers Branco, and its tributary the Rio Negro, and Japurá, lives the black-headed uakari, which is chestnut-brown in colour with black hands and feet, and a naked black face. To the southwest, on the other side of the Rio Japurá, lives the bald uakari, which differs in its skull characteristics, and has a longer coat and a pink or red face. The face turns pale if the animal is kept from sunlight and becomes bright crimson if it is allowed to live in the full sun. The bald uakari is divided into two very distinct races: the white one, in which the coat is white or silvery, and the red one, with a coat that is red like the face. The first ranges from the Rio Japurá to the Rio Içá. The second extends south from the Içá to about 7° S, its range bounded on the west and east by the rivers Ucayali and Juruá.

Active in the treetops

Uakaris have rarely been observed in the wild. Their superficial thickness of body has led people to suspect they are clumsy and lethargic, but on seeing how thin a shaved uakari really is, it is not at all surprising to learn that they are in fact agile and active. In the wild they have been seen making leaps of 20 ft or so, launching themselves into the air with arms stretched forwards. On the ground they are somewhat ill at ease, walking with the hands partly flexed, and turned out sideways, but in captivity they invent games for themselves, sliding along the cage floor or turning back somersaults. When feeding they are very dexterous. They hold the food in the whole flexed hand, the thumb not being divergent, or between the index and middle fingers, or even

Alan Band Associates

▷ *Sweet dreams for a relaxed bald uakari.*

Alan Band Associates

between the hand and wrist. They have projecting lower incisors like their relatives the sakis, and these are probably used for spearing the fruits which form part of their diet along with buds, leaves and seeds.

Uakaris have been seen both in small troops and in large gatherings of about 100. They may go right up to the treetops but they come down to the lower branches when travelling through the forest.

Breeding is a closed book

It is a pity that these remarkable animals seem neither to have been bred in captivity, nor to have been observed in the wild to any great extent. So nothing is known of their breeding habits. Even the length of the gestation period is unknown, which is the one thing that is usually known about a mammal even when other details of its breeding remain obscure.

Sedation an old trick

The only thing we possess that approaches an adequate record of uakaris in their natural habitat was written over a century ago. Bates, in 1855, wrote that the bald uakari is captured alive by shooting it with arrows and blowpipes. The curare poison always used with these arrows was, however, diluted in order to capture the monkeys alive. The uakari, when shot, would run quite a long way, and it took a really expert hunter to track one and be underneath it when, weak with the poison, it fell from the branches. As soon as the animal fell a pinch of salt would be put into its mouth, which, so the story ran, acted as an antidote to the poison and revived the monkey. Animals caught in this way were kept as pets, often being traded far from their native haunts. They seem to have developed a great devotion to their owners and they were fairly easy to keep, although the initial death rate was high. Nowadays they are not too uncommon in zoos, but have not yet bred there. Some have lived as much as eight years in captivity. Their weird appearance, especially in the case of the bald species, and their off-beat antics, performed in silence, have made them popular zoo inmates from Bates's time to the present day.

Perhaps the most interesting feature in this story of how the South American Indians caught the uakari alive is that the method anticipated modern usage. Today we are familiar with the way animals that are marked for study purposes, or for transport to wildlife parks, are first immobilized with a drug in a dart shot from a crossbow. There is no substantial difference between this and the blow-pipe darts used long ago by the South American Indians.

class	**Mammalia**
order	**Primates**
family	**Cebidae**
genus & species	***Cacajao calvus*** *bald uakari* ***C. melanocephalus*** *black-headed uakari*

◁ *'Old monk' of the forest: the bald uakari seems to be scarlet with rage.*

Urania moth

In 1781 Sir William Herschel gave the name of the ancient Greek god Uranus to his newly-discovered planet. The scientist who called a genus of moths ***Urania*** *was almost certainly moved by the thought that he was dealing with a heavenly being living on earth. The name was first given to New World moths but it has been extended to include all the moths of the family Uraniidae. They are almost entirely limited to the tropics. Some are large, conspicuous day-flying moths, brilliantly coloured and bearing 'tails' on the hindwings like those of the swallowtail butterflies (p. 2442), which the urania moths greatly resemble in appearance.*

The genus ***Urania*** *is centred on tropical America. The South American* ***U. leilus,*** *like most of the moths of this genus, is brilliantly coloured iridescent green and blue with a long tail and broad white fringes. It has a slender body and a wingspan of 3 in. The largest and most brilliant member of the family is* ***Chrysiridia madagascarensis*** *of Malagasy which has been called the most magnificently coloured of all animals. Its wings are black, banded with metallic green which changes to blue and gold according to the angle of the light and the hindwings have a patch of glowing copper and purple, and long white fringes around their tailed and deeply scalloped margins. As well as being so spectacular this moth is a classic mystery: why is it in Malagasy when its nearest relatives seem to be the South American uranias rather than any African or Asian moths?*

In the Indo-Australian region the species of ***Nyctalemon*** *and* ***Alcides*** *are similarly 'swallow-tailed' and some are beautifully coloured with bands of pale blue, green and yellow. The common* ***Nyctalemon patroclus*** *of India is banded with brown and white and may be seen sitting on trees and buildings with its wings outspread, as if the whole group of moths were spread out in a display cabinet.*

Dazzled into ignorance

It seems almost as if the very brilliance of these moths has taken the collectors' minds off their habits and life histories. Except that the caterpillars feed on leaves and the moths fly by day, little more seems to be known. The females tend to lay eggs on shrubs and bushes of the *Euphorbia* type.

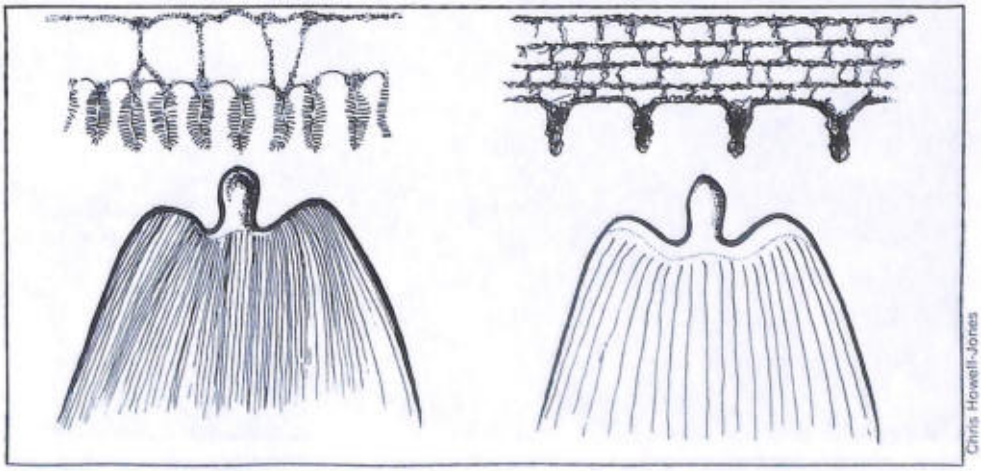
The caterpillars are very diverse in shape and appearance. That of *Chrysiridia* has black spatulate spines and in the northern Indian species *Epicopeia polydora* the caterpillar is covered with white cottony filaments. When the caterpillars pupate they spin a loosely woven silken cocoon. Possibly another reason why so little can be said about the life histories of these moths is that study has been concentrated on the colours of their wings.

PH Ward

△ *Upper surface of a pinned specimen of* ***Chrysiridia madagascarensis,*** *a brilliant urania moth.*
▽ *Magnificent from all aspects: the underside shows similar colouring—an unusual moth feature.*

PH Ward

▽ *Production of iridescent colours in moth and butterfly scales through interference by thin plates. The detail shows sections across the scales; 'morpho type' left, 'urania type' right.*



Chris Howell-Jones

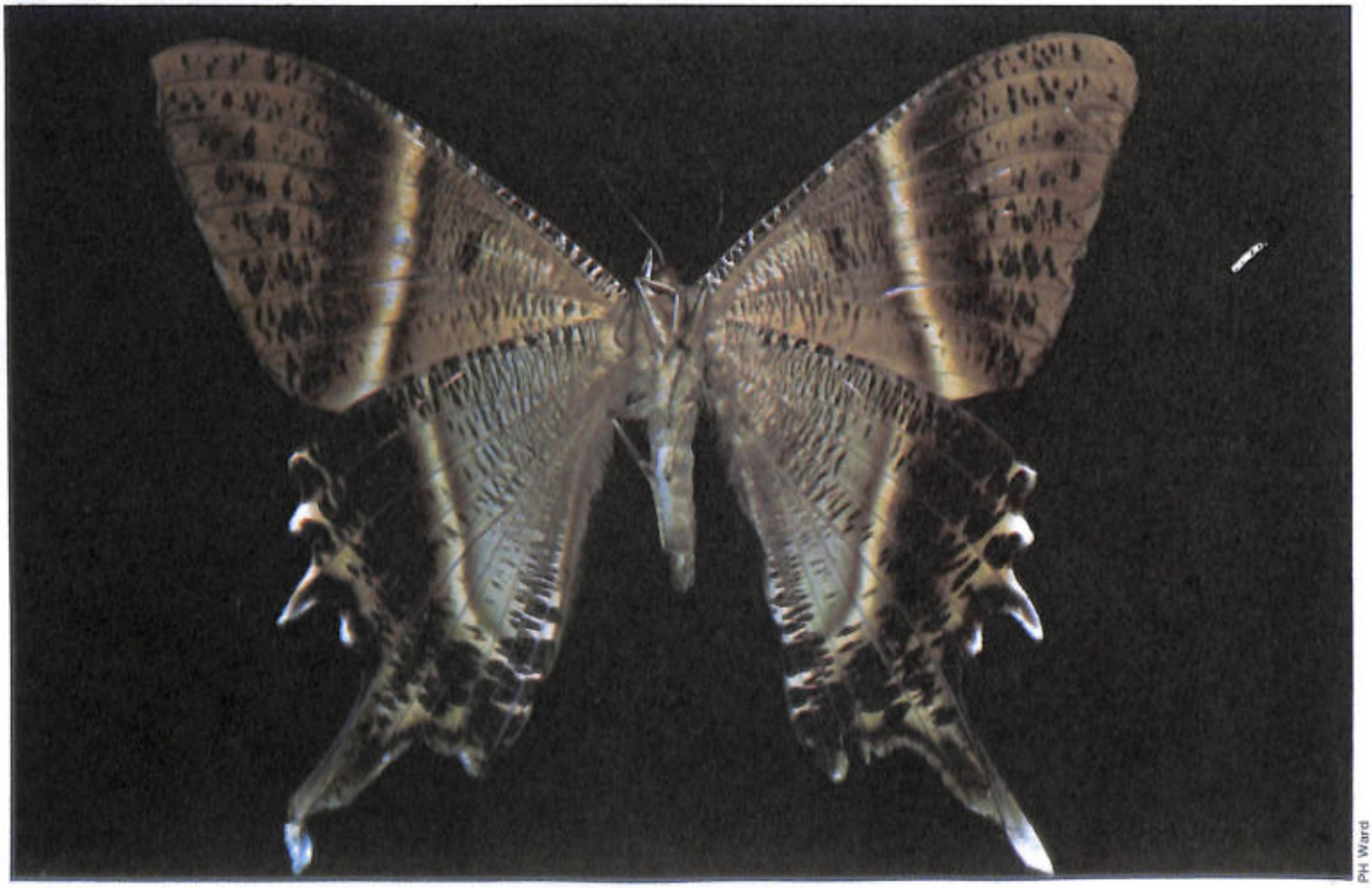
Structural coloration

Iridescent or metallic colours that in nature change with the angle of the light are always known as structural colours. This implies that they are not due to pigments which absorb certain wavelengths and reflect others, but to very minute structures which refract and reflect the different wavelengths in different directions. In the wings of butterflies and moths two types of structural coloration are recognised, both depending on 'interference'. This is the physicist's term for colour effects produced when two or more very thin layers or films of a substance are separated by a medium of different refractive index. The 'rainbow colours' shown by a film of oil on water afford an instance of this. The brilliant metallic colours on the wings of some butterflies and moths are produced by interference structures in the scales, and two types are recognised, the 'morpho type' and the 'urania type'. In the former the longitudinal ridges on the scales have extremely minute plates or lamellae projecting from their surfaces (p. 1654). In the urania type, named after the moths under discussion, either the upper or the lower part of the scale is thickened by a number of superimposed layers actually lying in the thickness of the scale and not on ridges standing up out from it. Although the morpho type is named after a butterfly and the urania type after a moth the two types are not characteristic of butterflies and moths respectively, for the glorious birdwing swallowtail butterflies, for example, have the urania type of coloration.

PH Ward

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

△ *Specimen of* ***Urania leilus****, a day-moving species that flies faster and is more brilliantly coloured than most butterflies.*
▽ *In complete contrast,* ***Nyctalemon patroclus*** *from New Guinea exhibits the sombre colouring more associated with moths.*



PH Ward

Vampire bat

The vampire bat of fact is totally unlike the vampire of fiction except that it feeds on blood. In one way it is worse than the fictional vampire—it is a carrier of rabies, a disease feared the world over. True vampires, of tropical and subtropical America, feed only on the fresh blood of mammals and birds. Unlike the man-sized vampires of fable, they are only 2½—3½ in. long with a forearm of 2—2½ in. The weight of an adult varies in the different species from ½ to 1¾ oz. Their fur is various shades of brown. They have no tail. The ears are small and the muzzle short and conical without a true noseleaf. Instead there are naked pads on the snout with U-shaped grooves at the tip, which may be sensory. The upper incisor teeth are large and razor-edged, well adapted for gently opening a small wound to take blood. The grooved, muscular tongue fits over a V-shaped notch in the lower lip, so forming a tube through which the blood is sucked. The stomach is also adapted for liquid feeding, the forward end being drawn out into a long tube. The saliva contains substances that prevent the blood from clotting.

There are three genera, each with a single species. The common vampire bat, the most numerous and widespread of the three, is distinguished by its pointed ears, longer thumb with a basal pad and its naked interfemoral membrane. It has only 20 teeth. It ranges from northern Mexico southward to central Chile, central Argentina and Uruguay. It is now one of the most common and widespread mammals in eastern Mexico.

The second species, the white-winged vampire, is much less numerous. The edges of its wings and part of the wing membrane are white. It has a peculiar short thumb about ⅛th as long as the third finger, and has a single pad underneath. It is the only bat known to have 22 permanent teeth. The white-winged vampire is mainly confined to the tropical regions of South America from Venezuela and the Guianas to Peru and Brazil, but it has also been found on Trinidad and in Mexico.

The hairy-legged vampire, smaller than the common species, is not well known. It has shorter, rounded ears, a short thumb without a basal pad and softer fur. Its interfemoral membrane is well-furred. It has 26 teeth and is unique among bats in having a fan-shaped, seven-lobed outer lower incisor tooth which resembles the lower incisor in the order Dermoptera, the gliding lemurs. This species is found in eastern and southern Mexico, Central America, and southwards to Brazil.

▽ *Cutting closeup: the bloodstained mouth and shear-like teeth of a common vampire.*

Bruce Hayward

Victims attacked while asleep

During the day vampire bats roost in caves, old mines, hollow trees, crevices in rocks and in old buildings. Colonies of the common vampire may number as many as 2000 but the average is about 100. The sexes roost together and they may share the caves with other species of bats. They are very agile and can walk rapidly on their feet and thumbs either on the ground or up the vertical sides of caves. Shortly after dark the bats leave their roosts with a slow noiseless flight, usually only 3 ft above the ground. The bats attack their victims while they sleep, sometimes alighting near them, crawling up to them, looking rather like large spiders. They make a quick shallow bite with their sharp teeth in a place where there is no hair or feathers. They cut away only a very small piece of skin, making a shallow wound from which they suck the blood without a sound, so the victim does not wake. Unlike other bats they do not cling with their claws but rest lightly on their thumbs and small foot pads, so lightly that even a man is unlikely to be wakened by the visit of a vampire. The common vampire bat in particular can drink such large quantities of blood that it is barely able to fly for some time afterwards.

The common vampire attacks only large mammals such as horses, cattle and occasionally man. Cattle are generally bitten on the neck or leg and a human on the big toe. The white-winged vampire attacks mainly birds, biting the neck or ankle, and occasionally mammals, and the hairy-legged vampire appears to prey mainly on birds such as chickens, but it is possible it may also attack some mammals.

In captivity vampire bats have been kept alive on blood defibrinated to prevent clotting. One survived for 13 years in a laboratory in Panama.

Echolocation in vampires

Like all bats, vampires find their way about and detect their prey by echolocation. Since their source of food is large and relatively stationary they do not have the same difficulty in finding their prey as bats that feed on fast-moving insects, or even those that catch fish. Like the fruit-eating bats, which also feed on stationary food, their echolocation is by pulses having only $\frac{1}{1000}$th of the sound energy of those used by bats feeding on insects or fish. It is noteworthy that vampires very seldom attack dogs, presumably because they have more sensitive hearing than larger mammals such as cattle and are able to detect the bat's higher sound frequencies.

Babies left at home

Little or nothing is known of the breeding habits of the white-winged and hairy-legged vampire bats. The common vampire gives birth to a single young after a gestation of 90–120 days. They breed throughout the year and it is possible there is more than one birth a year. The young are not carried about by the mother, as in most other bats, but are left in the roost while she is out foraging.

◁ *Disturbed while sleeping: common vampires prefer retreats of almost complete darkness.*

Desperate measures

The real danger of vampire bats lies not so much in their feeding on the blood of domestic animals and man, although this is bad enough, but in the transmission of disease resulting from the bites and risk of secondary infections. Vampires can transmit rabies which may be fatal in cattle or even in man. They may also transmit the disease to other species of bats and they may die of it themselves. In Mexico alone it is necessary to inoculate thousands of head of cattle each year against the disease. The disease is always fatal to uninoculated cattle.

Various control methods have been tried in the past, including dynamiting the caves where the bats roost and the use of flame-throwers and poison gas. These have been found to be largely ineffective and also highly destructive to other harmless species of bats. The only solution to the problem seems to lie in biological control, including sterilisation, habitat management and the use of selective chemical attractants and repellents. A research centre has now been set up in Mexico City for the ecological study of vampire bats and for research into biological methods of control.

class	**Mammalia**
order	**Chiroptera**
family	**Desmodontidae**
genera & species	***Desmodus rotundus*** *common vampire bat* ***Diaemus youngi*** *white-winged vampire bat* ***Diphylla ecaudata*** *hairy-legged vampire bat*

AN Warren

△ *Fresh bites on a pig's neck are grisly evidence of a common vampire's feeding methods. It only feeds on large animals, and because horses and cattle provide such a large supply of easily accessible blood, stockrearing in many tropical areas has proved uneconomical.* ▽ *The culprit on all fours.*

Bruce Hayward

Vanessa

The vanessas include some of the most colourful butterflies in the northern hemisphere, and some of these have a worldwide distribution. The name is from the tribe Vanessidi, a 'tribe' being a taxonomic division of lesser value than a family, the family in this instance being the Nymphalidae. Vanessas have the front pair of legs reduced in size, only the rear two pairs being used for walking. They are fairly large butterflies, with a powerful flight. Most of the species resident in northern Europe pass the winter hibernating as butterflies, others are continuously brooded in the subtropics and migrate northwards in summer. Their caterpillars bear an armature of branched spines and the pupae, or chrysalises, which are suspended by the tail, are ornamented with shining metallic spots. It was the ornamentation of these pupae which led the early butterfly collectors to call themselves 'aurelians', from the Latin ***aureus,*** *golden. 'Chrysalis' has a similar derivation from the Greek* ***chrysos*** *also meaning golden.*

Seven of the dozen European species are found in Britain and some of these occur in America as well. Eight vanessas are especially interesting in their habits, distribution or life history and the best way to deal with them is to describe each one separately.

Peacock

This beautiful butterfly ranges from Britain eastwards to Japan. It is resident in Britain and spends the winter hibernating in dark sheltered places, often in attics and outhouses. It is quite easy to breed peacock butterflies, by keeping them in a cage in a cool, dark room for the winter. They can then be 'tamed' before releasing them in the spring, so they will remain in the garden and will come to be fed on sugar-water. They have only one generation a year, and the habit of hibernation results in the butterfly having an unusually long life in the winged state. A peacock butterfly in captivity lived for 11 months. Its food plant is nettles.

Red Admiral

The red admiral is the popular name for a butterfly which has several subspecies. One found in Europe, Asia and the Canaries, is the familiar European one. Formerly it was believed to occur in the United States but a distinct subspecies occurs there. This is found from Canada to Mexico and on some West Indian Islands and has been introduced to Hawaii. There is even one distinct species of Red Admiral which is known only from Hawaii. Other species of Red Admiral are found in India and the Far East.

Camberwell Beauty

This butterfly is known as the mourning cloak in North America. It is, like the red admiral, distributed all over the northern hemisphere, and it also goes down the Andes, in South America. In spite of its wide distribution it is a great rarity in Britain. It appears to need the severe continental type of winter to induce proper hibernation. There is some evidence that the few Camberwell beauties seen in Britain are not true migrants, but stowaways on Scandinavian timber ships. Its food plants are willow, poplar and birch.

Hermann Eisenbeiss

PH Ward

Map butterfly

This little vanessid is widespread in France and elsewhere in Europe. Attempts to introduce it to Britain have failed. It is remarkable in being represented by two distinct seasonal forms. Unlike most vanessids it overwinters as a pupa, and the butterflies which hatch in May are chequered tawny and black and look rather like fritillaries. The larvae from the eggs of these spring butterflies feed and grow rapidly, pupate and produce in July a generation of black-and-white butterflies totally unlike their parents. The length of day during the larval stage determines which form the mature butterfly shall assume. By exposing the caterpillars to long or short 'days', using artificial light, successive generations of either form can be bred. Its food plant is entirely nettles.

Yves Lanceau

Small tortoiseshell

This gay little butterfly ranges right across the Eurasian continent to Japan. It is one of the commonest species in Britain and can be seen in gardens throughout most of the spring and summer as it goes through two generations in a year. The butterflies of the second generation hibernate and reappear in spring. Its food plant is nettles.

Large tortoiseshell

Up to the first two decades of this century this butterfly was not uncommon in southern England, but it has suffered a decline and is now by far the rarest of the resident vanessids in Britain. It is still occasionally seen in Essex and Suffolk and is common in central and southern Europe. Its food consists of elm foliage.

Toni Angermayer

◁ *The rich-hued vanessid of European summer—each year the red admiral flies north from the Mediterranean to lay its eggs.*
▽◁ *Peacock butterflies on a spray of* ***Buddleia****, a favourite food plant of adult butterflies.*
△ *Mourning cloak—a vanessid that hibernates as an adult, feeding on the sugar-rich sap from trees when it emerges in early spring.*
△▷ *Bird's eye view of a small tortoiseshell.*
▷ *The most widespread butterfly in the world—the painted lady. In the spring it migrates in vast numbers from North Africa to Europe.*
▽ *The tattered look of the comma provides excellent camouflage when the wings are folded.*

PH Ward

Hermann Eisenbeiss

They taste with their toes

As already mentioned, all the nymphalid butterflies (vanessas, fritillaries, emperors and others) are 'quadrupeds', the forelegs being stunted and not used for walking. Those of the males have only two terminal joints and are brush-like. In the females these legs are more slender with four terminal joints and are only sparsely haired. They are used as sense organs, the end joints serving as organs of taste. A red admiral can distinguish, by touching with its forefeet, between pure water and a sugar solution $\frac{1}{200}$ of the strength required to be detected by the human tongue.

Spare the nettles

Farmers and people obsessed with the idea of 'tidiness' wage a relentless war on nettles, spraying them ruthlessly wherever they grow. But nettles should be allowed to grow in places that are not needed for cultivation or pasture. Five of the vanessid butterflies described here depend on nettles for their larval food. If those who aim to exterminate this plant had their way we should see much fewer gaily coloured butterflies in the gardens of Europe.

Comma butterfly

The recent history in Britain of this very attractive butterfly is in curious contrast to that of the large tortoiseshell. Up to about 1920 it was confined to a small area in South Wales, but about that time it began to spread over southern England and the Midlands and has maintained this wider distribution. Like the other resident British vanessids it hibernates as a butterfly, but remains in the open in woods and hedges, sheltering under leaves instead of seeking shelter in natural hollows or buildings. When its wings are closed the coloration and irregular outline make the butterfly look like a withered leaf. Without this the butterfly would never survive the hunting of winter-hungry birds. It goes through two generations in the summer and the larva feeds on nettles and elm.

Painted Lady

This is known as the thistle butterfly in North America. It has the distinction of being the only butterfly with a world-wide distribution, without the formation of any well defined races or subspecies. The reason for this is that the urge to migrate is so powerful and persistent in this butterfly that its populations are subject to constant mixing, which of course prevents the formation of local races. In Britain and northern Europe the painted lady is a summer migrant of the same type as the red admiral. The main breeding ground of the European painted ladies is North Africa, and travellers there have witnessed the hatching of thousands of pupae among the sand dunes and the start of the butterflies' massed flight towards the Mediterranean. Its food plant is thistles.

phylum	**Arthropoda**
class	**Insecta**
order	**Lepidoptera**
family	**Nymphalidae**
genera & species	***Aglais urticae*** *small tortoiseshell* ***Araschnia levana*** *map butterfly* ***Nymphalis antiopa*** *Camberwell beauty, or mourning cloak* ***N. io*** *peacock butterfly* ***N. polychloros*** *large tortoiseshell* ***Polygonia c-album*** *comma* ***Vanessa atalanta*** *red admiral* ***V. cardui*** *painted lady or thistle butterfly, others*

Vanga

The 12 vangas or vanga-shrikes form a family of birds confined to Malagasy. They are shrike-like in appearance but owing to the isolation of Malagasy they have evolved quite separately, so it is difficult to trace their relationships with other birds. The vangas have been compared with the wood hoopoes, wood swallows and the shrikes, but as the least specialised vangas, like Chabert's vanga, look like the bush-shrikes of the African mainland, it seems most likely that the vangas are derived from bush-shrikes that crossed to Malagasy.

Vangas are 5–12 in. long, usually black above and white below, but some have brighter colours. The blue vanga, for instance, is bright blue on the head, back, wings and tail, with some black on the flight feathers and white underneath. The rufous vanga has a black head, white underparts and a rufous brown back. The red-tailed vanga resembles a finch and is predominantly greyish brown above and white underneath. The face is black with white eye rings and the male has a black crescent on the breast. In some species the sexes are similar but the male Bernier's vanga is all black while the female is mainly rufous. As with other passerine families such as the Hawaiian honeycreepers (p. 1225) and Darwin's finches (p. 751) which have evolved in the isolation of islands, the greatest variation of form lies in the bill. Some vangas have relatively simple finchlike or shrikelike bills, others have strangely shaped bills, like the helmetbird, which resembles a miniature toucan with its exaggerated blue bill that is deeper than the skull, and the sicklebill, once thought to be a starling, with a long curved bill.

Peter J Green

△ *A painting by Keulemans of a male – grasping an insect – and female vanga,* ***Cyanolanius bicolor****. The sexes do not differ to this extent in all vangas.*

Childish chatter

There are three families of birds found only in Malagasy, the asities or false sunbirds, the mesites (p. 1591) and the vangas, and they must be the least known of all bird families. There are very few published records of the habits of the vangas and even these have been compiled incidently by ornithologists making a general survey of Malagasian birds, so that they are little more than the results of observations made while other birds were being studied.

All vangas live in trees, mostly in the now fast-disappearing forest, but also in scrubland, mangrove swamps and savannah with scattered trees. Most forage together in small parties of about a dozen, sometimes several species flocking together, but the hook-billed vanga is more solitary. They are usually seen in the treetops, where they travel through the foliage with great agility, calling to each other with a variety of whistles and chattering calls. Sicklebills sometimes utter a bedlam of groans, cries and laughs. Their local name is *voronzaza* or 'bird baby' because of their childlike calls.

Acrobatic feeders

The food of vangas is, as far as is known, insects and other small animals up to the size of chameleons. Most vangas feed in the foliage or along twigs and branches, picking off small and medium-sized insects or probing for them in crevices. When foraging, some vangas behave remarkably like the familiar tits, agilely flitting among the foliage and hanging upside down to reach awkward places. Some of the larger vangas hunt like shrikes, waiting on a perch then dropping on their prey. The white-headed vanga and the hook-billed vanga, among others, include a large proportion of vertebrate animals such as tree frogs, chameleons and lizards in their diets.

Nesting habits unknown

Virtually nothing is known of the nesting habits of vangas and even the nests of many species have yet to be discovered. The sicklebill, however, has been watched while building its cup-shaped nest of dead twigs about 30 ft up in a tree. The female collected and carried the twigs while the male accompanied her. The clutch consists of 3 or 4 white or green spotted eggs.

Why the variety?

Darwin's finches (p. 751) are a classic example of adaptive radiation. A single ancestral finch species apparently reached the Galapagos Islands where, through lack of competition, it evolved into a large number of species, each occupying a certain habitat or having a particular feeding habit. The differences between the many Darwin's finches lie mainly in the shape of the bill which has been adapted for these various feeding habits. It seems that the vangas also provide an example of adaptive radiation, some ancestor having arrived in Malagasy where there was also little competition from other kinds of birds. The vangas have also evolved different shaped bills, as has already been described, but with the present state of knowledge of the family it has not been possible to relate the different vangas to different habitats or feeding habits.

class	**Aves**
order	**Passeriformes**
family	**Vangidae**
genera & species	***Euryceros prevostii*** *helmetbird* ***Calicalicus madagascariensis*** *red-tailed vanga* ***Falculea palliata*** *sicklebill* ***Leptopterus chabert*** *Chabert's vanga* ***L. madagascarinus*** *blue vanga* ***L. viridis*** *white-headed vanga* ***Oriolia bernieri*** *Bernier's vanga* ***Schetba rufa*** *rufous vanga* ***Vanga curvirostris*** *hook-billed vanga*

Velvet ant

Velvet ants are some of the biggest frauds in the animal kingdom. Although called ants they are, in fact, solitary wasps. Their common name is due to the marked difference between the male and female. The female is wingless and is therefore forced to run about over the ground, looking like a big hairy ant. The male is winged and so attracts little attention among other wasps that fly around.

The bodies of velvet ants are covered with a pile of short velvet-like bristles, often patterned in black, bright orange and scarlet. Even the antennae are covered with these short hairs. The 3 000 species are all much alike in colour, and most of them live in the hotter, drier parts of the world, and especially in America. A few live in temperate latitudes, including Europe, and two live in Britain. All velvet ants are parasitic on the larvae and pupae of other insects, including bees and wasps. There are even velvet ants that parasitize other solitary wasps, the hunting wasps, that themselves prey on other insects. Some of the desert species have a thick covering of long whitish hairs. The smallest velvet ant ***Mutilla lilliputiana*** *is ¼ in. long and the largest,* ***Dasymutilla occidentalis,*** *of the southeastern United States, is 1 in. or more long and is known as the cow-killer or mule-killer. The so-called large velvet ant of Britain* ***Mutilla europaea*** *is only about ½ in. long. In many species the male is nearly twice the size of the female, but in the three for which sizes are given here the females are only slightly smaller than the males.*

▽ *Wasp parasitizes wasp: a South African velvet ant lays her eggs in the nest of a mud-dauber wasp; on hatching the larvae will eat the host's eggs. (Approx × 15.)*

Anthony Bannister: NHPA

Vesper bat

There are 980 species of bats in 17 families. Nearly one-third of the species are in one family, the Vespertilionidae. They are usually referred to by those studying bats as the vespertilionids but it is not surprising that people with no special knowledge of them have simplified this to vesper bats. Since most of the 980 species of bats are seen in the evening, this simplified name is hardly specific; yet it is a convenient name for the small, commonplace, insectivorous bats seen especially in temperate latitudes, but found all over the world except at the poles.

Vesper bats are mainly small. They range from 1¼—4 in. head and body length, with wingspans of about 5—15 in. Most of them are various shades of brown, sometimes grey or black, and a few are yellow, orange or red. Some, like the spotted or pinto bat of the United States and Mexico, have white patches. Vesper bats typically lack nose leaves but have an earlet. The ears, as in the barbastelle and the long-eared bat, may be up to 1½ in., half the length of head and body.

Leisler's bat **Nyctalus leisleri** *hunting.*

SC Bisserot

Photos by SC Bisserot

Sleeping quarters

Most vesper bats spend the daylight hours in caves or cavities in hollow trees, under loose bark, among foliage, or, more especially, in rock crevices, buildings, tunnels, mine shafts and natural caves. They usually hang by their hindfeet and prefer to sleep on a vertical face rather than hanging free by the toes. Some are solitary but most roost in small groups or in colonies. The sexes often roost separately, especially when the females are giving birth or have young. Roosting places are often traditional, with the same colony using a particular place year after year. Some species move from a summer feeding ground to winter quarters, which may be several miles away. The red and hoary bats make long migrations southwards at the end of summer, returning the following spring.

Highly manoeuvrable wings

A bat's skeleton is light. The arm, which carries the wing membrane, consists of a short upper arm and a long forearm with a single bone, the radius, and a compact wrist with several of the bones fused together. The finger bones are greatly elongated, especially the third and fourth, which support most of the wing membrane. The thumb is short and bears a claw, used in climbing or walking. The wing membrane runs from shoulder to wrist, over the fingers and backwards along the side of the body to the ankle. It is made up of a double layer of skin between which are such slender elastic strands and fine muscle fibres that the wing collapses and folds up easily when not in use. While on the wing, however, a bat has full control through the tendons, which are worked by the arm muscles, controlling all the joints; it is, in fact, the most manoeuvrable of all flying animals. Among vesper bats there are the long-eared bats that fly through foliage and hover to pick insects off leaves and, at the other extreme, the slender winged noctule that often hawks high-flying insects.

While the bat is flying its wing acts as a ventilator; the network of fine blood vessels allows the blood to be cooled so the bat does not become overheated from the exertion of flying. When the bat lands and folds its wings the flow of blood to the wings is cut down, so the heat is retained in the bat's body as the surface area is reduced.

Feeding on the wing

Nearly all vesper bats are insect-eaters. They have sharp teeth, the molars having a W-shaped pattern of cusps for chewing. One species, the fishing bat of California, eats fish and small crustaceans, and a few other species are suspected of catching fish. The desert bats of North America catch insects near the ground and also capture scorpions and lizards. Most vesper bats eat only insects, which they catch in flight. Small insects are chewed and swallowed straight away. Larger prey such as moths and beetles is usually pouched in the interfemoral membrane, between the tail and the hindlegs, where the bat, being able to bend its head back under its body, can chew it while in flight.

Members of the Vespertilionidae come out at varying times in the evening, from just before sundown to almost dark. Some are still seen on the wing just before dawn, but

the night is divided into alternating spells of hunting and resting to digest their food. Some species, like the noctule, have only two periods of hunting, of an hour each.

Delayed fertilisation

Most of our information about the breeding of vesper bats is from species in temperate regions, where the bats hibernate. There, mating usually takes place between August and October, the sperms being stored in the female, and it may also occur again in spring. All fertilisation is in spring and after a gestation of 40–70 days, or even 100, according to the species, the babies are born from late May to July. In the tropics fertilisation follows immediately after mating. The number of babies at a birth is usually one or two, but there may be four.

Accidents in the dark

Because they fly by night bats probably have few enemies. Hawks have occasionally been seen to take them, well before nightfall. Owls have taken others, after dark. Domestic cats have on occasion been seen leaping up to capture a bat venturing too near the ground, so presumably wildcats sometimes take them. Despite the efficient echo-location system by which they find their prey and locate obstacles in pitch dark, there are records of bats seen flying into walls breaking their necks. Such accidents may be more frequent than we suspect.

Rip van Winkle bats

As a result of banding hibernating whiskered bats in the caves in Holland we know that 40% die in the first six months of life and beyond this the average expectation of life is about 4½ years, but some of the bats have lived to 20 years or more. This is a remarkably long time compared with other small mammals of similar size, such as shrews and mice, which live only a few years, about five years in the longest-lived. The bat's effective life is, however, very brief. A noctule, for example, spends about six months of the year hibernating. In the remaining six months it is on the wing for about two hours in every 24.

◁△ *Reconnaissance: a noctule bat* ***Nyctalus noctula*** *looks, listens and sniffs before takeoff. The sharp teeth crush beetles, a favourite item in the noctule's diet.*
△ *European longeared bat, showing the skin 'bag' between the legs, which acts as both net and aerial larder in which to pouch large or hard insects on the wing.*

class	**Mammalia**
order	**Chiroptera**
family	**Vespertilionidae**
genera & species	***Antrozous pallidus*** *desert bat* ***Barbastella barbastellus*** *barbastelle* ***Lasiurus borealis*** *red bat* ***L. cinereus*** *hoary bat* ***Myotis mystacinus*** *whiskered bat* ***Nyctalus noctula*** *noctule* ***Pizonyx vivesi*** *fishing bat* ***Plecotus auritus*** *longeared (European)* ***P. macrotis*** *longeared (American), others*

Vine pest

When Columbus discovered America he started a chain of events that nearly ruined the vineyards of France. Native to North America, the vine pest is a tiny insect related to the well-known aphides, also known as plant lice, greenfly and blackfly. The vine pest is called the vine phylloxera, sometimes referred to as the graperoot louse, although it also feeds on a wide range of other plants.

Except that the vine pest threatened to wipe out the vine-growing industry in France and elsewhere towards the end of the last century, there is little that is remarkable about it, other than its complicated life history. The vine pest was introduced into Europe between 1858 and 1863, when vine growers were experimenting with species of vines imported from America. By 1885 it had reached Algeria, Australia and South Africa. It also reached California about the same time, probably taken there on vines from other parts of the United States east of the Rocky Mountains that had been imported from Europe.

▽ *Ugly galls on the lower surface of a dried vine leaf, destructive work of the vine pest.*
▽▷ *The culprits, wingless and winged females.*
▽▽ *Healthy looking grape vines in Yugoslavia.*

Nearly vineyards' doomsday

From time immemorial only one species of vine has ever been used for wine-making in Europe. This is *Vitis vinifera*, a native of the region bordering the Caspian Sea, and it has proved extremely susceptible to attacks of the introduced vine pest. The presence of the aphid on a vine is shown first by the stunting of the plant itself and then in the reduction in the size and number of the leaves. In some cases the leaves become discoloured and galls form on their lower surfaces. At the same time knot-like swellings are found on the smaller roots. These turn from yellow to black and cause the roots to die and decay. The growth of the grapes is arrested and the fruits become wrinkled. When at its worst this pest ruined 2½ million acres of vineyards in France.

A complicated life history

After mating the female vine pest aphid lays her egg on the bark of the vine. Each egg passes the winter on the bark and in spring hatches, producing a wingless female called a fundatrix, or foundress. This female crawls into a leaf bud where she causes a gall to develop on the young leaf. Inside the gall she lays a number of eggs which develop into further wingless females called gallicolae, or gall-dwellers. These multiply during the summer, giving further gall-forming generations that in turn infest other leaves. Later in the season they produce another kind of wingless female, the radicicolae, or root-dwellers, which go down to the roots. After producing several generations of their own kind these radicicolae give rise to winged females which, in late summer, fly to other vines where they lay two kinds of eggs: small ones which produce males and large ones which produce females, both sexes being again wingless. The mouth-parts and digestive systems of this latest batch are not developed so they do not feed, but they mate and each female lays a single egg. These are the eggs which overwinter and which form the start of a new generation of fundatrix females which start the whole complex series again.

This is the typical, complete life history of a vine pest on its natural and native American host plants. When transferred to European vines the radicicolae are the principal form and they seem to be able to hibernate through the winter and reproduce their own kind indefinitely.

How it is controlled

The French vineyards are, happily, still productive. They were saved by intensive entomological research. There are many species of vine native to North America and these have varying degrees of resistance to the vine phylloxera. If European vines are grafted onto stocks of these resistant American plants the radicicolae are unable to thrive on their roots and the *Vitis vinifera* scions escape the effects of the pest. *V. riparia*, *V. rupestris* and *V. berlandieri* are American species of vine that are suitable for grafting, and hybrids between them and *V. vinifera* are also extensively used.

In the American grape-growing industry *V. vinifera* is cultivated on resistant stocks, as in Europe, and some resistant species of vines, producing fruit of different kinds and flavours, are also grown, including *V. labrusca* and *V. rotundifolia*.

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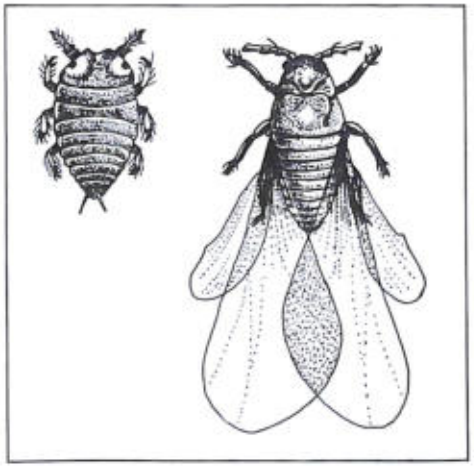


Chris Howell-Jones

Picturepoint

Dangers of easy living

Aphides in general, and the vine pest in particular, have specialized mainly in the simple life. As insects go they are simple in structure, having few specializations other than the general features of the Hemiptera, the order to which they belong. Their food is simple and so is their method of feeding: they simply push their proboscis into the skin of a plant and suck. So, apart from enemies, life would be idyllic. By contrast, their methods of reproduction are highly complicated. Some pests have even more complicated life histories. The oak phylloxera, *Phylloxera quercus*, has no fewer than 21 different forms in its life history.

Complicated life histories, coupled with a high rate of multiplication, tend to be the rule for parasites. This can mean only one thing: that a complex reproductive cycle is needed for the species to survive. It is an indication that parasitism may bring an easy living but it is a precarious way of life.

phylum	**Arthropoda**
class	**Insecta**
order	**Hemiptera**
family	**Phylloxeridae**
genus & species	***Phylloxera vitifoliae*** *vine pest*

Viperfish

The deepsea viperfishes are a fearsome sight because of their long fanglike teeth, which are slightly barbed at their tips. The teeth project on either side of the jaws.

The body of a viperfish ranges from 6–10 in. long, but its slender build makes it appear longer and it is only slightly thicker behind the head than in the tail. The head is small but has a strong lower jaw. The fins, including the tailfin, are also small, the pectorals being smaller than the pelvics. There is a small adipose fin, just in front of the tailfin, and opposite this on the underside are two small anal fins set close together. The most prominent fin is the first dorsal, set just behind the level of the rear end of the pectoral fins and it has a long whiplike spine formed from the first ray of the fin. The spine is about half the length of the fish and carries a small light organ at its tip. A double row of light organs runs all along either side of the lower body edge.

They live from 1 500–9 000 ft in oceans between latitudes 60° N and 40° S.

Viper or pike of the deep seas?

Usually, deepsea animals can be studied only from their dead bodies brought to the surface in nets. We are a little better off with viperfishes because we have the brief sightings by William Beebe who made the first descent into the ocean and saw one through the window of his bathysphere in 1934. In his book *Half Mile Down* he spoke of seeing a fine red prawn that was pounced upon by a 'really fearsome' viperfish which shook it for a moment then swallowed it. He also spoke of the viperfish's stomach that can stretch enormously as if it were made of rubber. The long body of a viperfish, with the second dorsal and the anal fins set far back, recalls the pike in fresh waters, which lunges swiftly at its prey, seizing it in a wide mouth armed with fearsome teeth. On the other hand a viperfish also has a lure—the light organ at the end of its whiplike dorsal spine—presumably used for tempting prey within reach. It also has 350 tiny light organs in the roof of its mouth and on the lower surface of the eyeball. Presumably these attract crustaceans and small fish near enough so when it opens its mouth to take in water for breathing they are drawn in. Thus a viperfish feeds as it breathes—at least so far as small prey is concerned.

Opening its throat

In the early 1950's Dr VV Tchernavin completed his brilliant anatomical studies of the viperfishes. He showed that the first vertebra behind the head is large and has broad surfaces for the attachment of strong muscles. The backbone, immediately behind this, is supple. The heart is well forward and lies between the bones of the lower jaw, as do the gills. In swallowing prey the muscles attached to the first vertebra pull the head up and, with the mouth opening at the same time, the lower jaw is shot forward, so the head seems almost to part company with the body as the throat opens at the sides. The effect is to give a wide and clear passage into the gullet. At the same time the heart is carried forward and the delicate gills outward, so they are not damaged by prey, even large prey, entering the throat. When the prey has been swallowed the head, jaws, heart and gills all return to their normal position. It is reasonable to suppose that with so much derangement of the vital organs, the swallowing action must be rapid. Digestion also seems to be very quick since most of these fishes have empty stomachs when caught.

Competition in depth

There are 300 million cubic miles of water in the oceans, room enough for the deepsea animals to be well spaced out. The study of many viperfishes suggests that in spite of all this space the various species are in competition with each other. There are three species of viperfishes. They are *Chauliodus danae, C. barbatus* and *C. sloani*, and the last of these is divided into 5 subspecies, two of which are *C. sloani sloani* and *C. sloani schmidti*. These two and *C. danae* live in the Atlantic, but each has its definite range which can be marked out on a map. In places their ranges are contiguous or even overlapping and where this happens it affects their vertical distribution. For example, in areas where *C. sloani sloani* is on its own it lives between 1 500 and 9 000 ft during the day—all viperfishes migrate into the surface layers at night. Where this is in the same area as *C. danae* it occupies only the depth from 3 000 to 5 400 ft, and *C. danae* occupies the rest.

Popperfoto

class	**Osteichthyes**
order	**Salmoniformes**
family	**Chauliodontidae**

◁ *A weird appearance is given by viperfishes because of their long fanglike teeth. This appearance has often led to them being used as illustrations of deepsea fishes although there are only three species of viperfishes and they certainly do not represent all the varied and numerous deepsea animal forms. The photophores or light organs can be clearly seen running along the side of the body as a double row and extending nearly to the tail. The three species of viperfishes occur in all oceans between latitudes 60° N and 40° S from tropical to very cold water and between 1 500 and 9 000 ft. Species:* ***Chauliodus sloani***

Jack Dermid: Photo Res

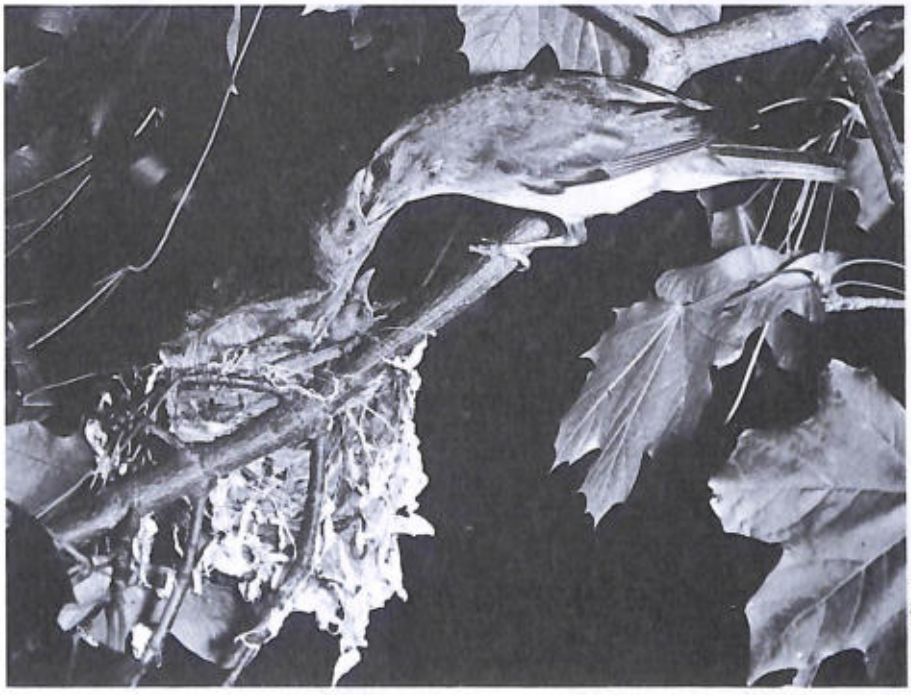
Vireo

Vireos are small, drably plumaged songbirds of the New World. The 42 species, together with the little-known shrike-vireos and peppershrikes, make up the family Vireonidae. In the 19th century they were known as greenlets but this name is now used for only tropical vireos of the genus ***Hylophilus.*** *Vireos range from 4 to 7 in. long and are usually olive-green or grey above and whitish or yellowish underneath. The bill is slender and sometimes bears a hook.*

The best known is the red-eyed vireo, 6 in. long, olive-green above and whitish underneath. The top of the head is slate-grey and there is a white line with a black border running over the red eye. It breeds from central Canada to the shores of the Gulf of Mexico but is missing from most of the western half of the United States. One of the brightest vireos is the yellow-throated vireo of the eastern United States. It is olive-green above with two white wing bars, a yellow eye-stripe and yellow on the chin, throat and breast. The greenlets are among the smallest vireos. The grey-headed greenlet is 4 in. long with a grey head and a white ring around the eye. The body is olive-green above and white and yellow underneath.

The vireos range from central Canada to northern Argentina, including the West Indies and the Bahamas and the slender-billed vireo is confined to the tiny island of Fernando de Noronha, 250 miles off the Brazilian coastline.

PJK Burton



Lynwood Chace

◁◁ *Devoted to incubation, this red-eyed vireo will not easily be persuaded to leave its nest—vireos have very strong parental urges. The nest is a deep cup of grass and strips of bark in which 3 or 4 spotted eggs are laid.*
◁ *The white-eyed vireo* ***Vireo griseus*** *has drab plumage typical of most of the family.*
◁▽ *An adult red-eyed vireo tries to satisfy the insatiable. The nestlings are fed mainly on insects and the parents share the task of food-collecting, although usually, as here, it is the female who works the harder.*

Monotonous songs

Except for some, like the red-eyed vireo, which lives in trees, most vireos live in undergrowth or thickets. They are not easy to see as they flit through the foliage, their drab colours making them 'just another small brown bird' to all but bird watchers, who often find it easier to identify them by their voice or habits.

A few vireos have pleasant songs, such as that of the warbling vireo of North America and the brown-capped vireo of tropical America. The songs of these two birds are continuous warblings. The other vireos are also persistent songsters but there is little that is musical about them. The red-eyed vireo was once known as 'the preacher' from its boring, rambling utterances. Each phrase consists of a variety of half a dozen notes, and one indefatigable ornithologist counted 22 917 phrases from one red-eyed vireo in one day. This was an average of over 1 000 an hour. The white-eyed vireo varies its collection of clicks and mews with mimicked notes of other birds.

Many of the North American vireos are migratory, spending the winter in Central America. The red-eyed vireo migrates across the Gulf of Mexico, down Central America and into South America as far as southern Brazil.

Foliage searchers

Vireos feed mainly on insects, their larvae, spiders and a few small fruits. The insects and spiders are sought among the foliage which the vireos move through with agility, sometimes hanging upside down to search the undersides of leaves. Large insects are held down with one foot and attacked by thrusting and tearing with the bill. Only rarely do vireos search for food on the ground. Red-eyed vireos sometimes descend to feed on small snails.

Singing on the nest

The nest is built in a tree or bush, sometimes near the ground but never on it. It is a deep cup of grass, leaves, strips of bark and other materials and is slung in a horizontal fork by cobwebs. The female does most of the building and lays a clutch of 3 or 4 eggs in temperate regions or 2 or 3 eggs in the tropics. They are white or cream with brown or lilac spots. Incubation lasts 12–14 days and the male helps, although he sits for a shorter time than the female. The males are such dedicated singers that they even sing while sitting on the nest. Not all males incubate, however, and in those species in which males do not share incubation they do not brood the young either. Otherwise, the urge to incubate is very strong and vireos sometimes have to be lifted off the nest in order to count their eggs. They may even peck at the offending hand. The chicks are fed by both parents, the female bringing most of the food, and they start to fly when about 2 weeks old.

Trans-Atlantic immigrants

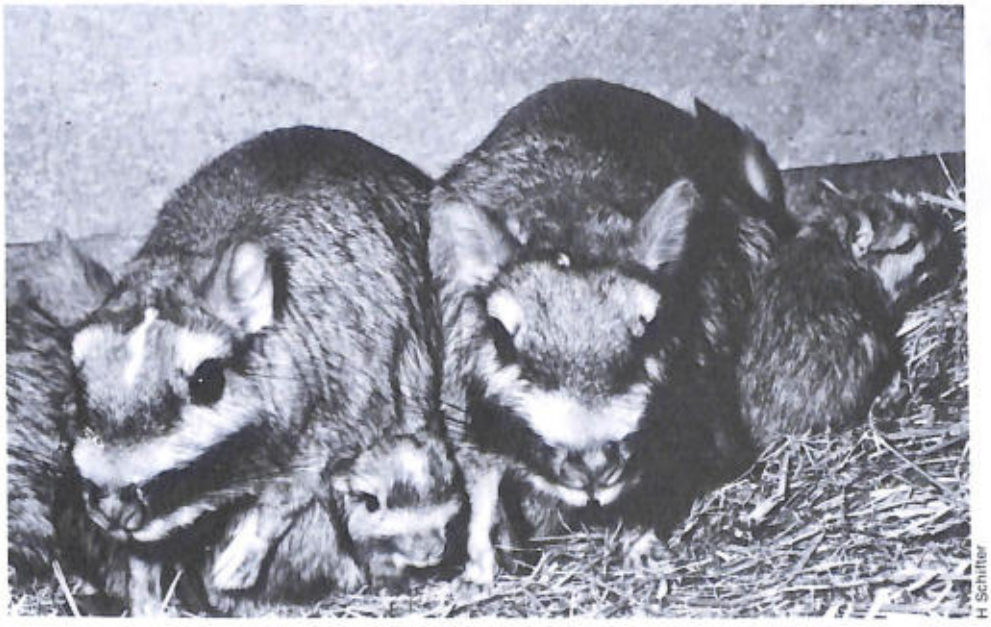
Although their distribution is American, red-eyed vireos occasionally turn up in the British Isles, especially on the western coast of Ireland and on the Scilly Isles, off the southwestern tip of England. The red-eyed vireo is one of a growing band of American birds that have been seen in the British Isles. These new migrants include the pectoral sandpiper *Calidris melanotos*, various ducks and cuckoos, the American robin, the bobolink *Dolichonyx oryzivorus* and the Baltimore oriole *Icterus galbula*. Shore birds and water birds might be expected to make the crossing but many trans-Atlantic migrants are small passerines. Some may have escaped from local aviaries but others definitely have not. It has been suggested that, having been blown out to sea, these small birds hitch lifts on ships for the rest of the way. However, they could not survive so long without food, many being insect-eaters, and if hitch-hiking were the answer, there should be as many records of European birds reaching North America. In fact, there seems to be a very good reason for thinking that the vireos and others are swept high across the Atlantic by the jet-streams in a few hours. Probably whole flocks are caught up but few birds make a landfall.

class	**Aves**
order	**Passeriformes**
family	**Vireonidae**
genera & species	***Hylophilus decurtatus*** *grey-headed greenlet* ***Vireo gilvus*** *warbling vireo* ***V. flavifrons*** *yellow-throated vireo* ***V. gracilirostris*** *slender-billed vireo* ***V. olivaceus*** *red-eyed vireo* *others*

Zool Soc London

Viscacha

Okapia



H Schrifter

The plains viscacha and mountain viscacha are South American rodents closely related to the chinchilla (p. 562). They are different in both form and habitat. The plains viscacha is heavily-built; an adult male may weigh as much as 15 lb. The body is up to 2 ft long with a short 6–8in. tail. The head is large and blunt with prominent black whiskers. The tail, which is fully furred, is short and stiff and helps the animal to sit upright. The four fingers on the forefeet are well-developed for burrowing and the three toes on the hindfeet have very sharp claws. The fur is coarse and fairly long, dark grey above with white underparts and black and white stripes on the face. The female is smaller with somewhat lighter fur.

The mountain viscacha, sometimes called the mountain chinchilla, looks more like a chinchilla or a long-tailed rabbit. It is smaller than its plains relative, $12\frac{1}{2}$–$15\frac{3}{4}$ in. long in head and body with a long tail, up to $12\frac{1}{2}$ in. It is a much slighter animal, weighing up to only $3\frac{1}{2}$ lb. It has large, erect ears and unlike the plains viscacha the claws on the fore- and hindfeet are blunt and weak. The fur is short, thick and soft. The upper parts vary from fawn to dark grey and the underparts are whitish, yellow or light grey. There is a crest of stiff hairs on the tail, which is black to reddish brown, and it often has a black stripe down the back.

Today there is only one species of plains viscacha, found over most of Argentina, and spreading into southern Brazil. Another species ***Lagostomus crassus*** *is now almost certainly extinct. The four species of mountain viscacha are found in the Andes and its foothills, up to a height of 17 000 ft, from Peru and Bolivia southward to the Argentine.*

Social animals

Both the plains and mountain viscacha live in colonies, the former on the pampas and scrubland and the latter in rugged, mountainous country wherever water and food are available. The plains viscacha digs extensive burrows, with long tunnels and numerous entrances, known as viscacheras. Some have been in continual use for centuries and sometimes cover as much as 200 sq ft. Colonies of 15–30 individuals are usually formed, ruled over by a single adult male. They are very clean rodents, carrying all their refuse up to pile on the excavated earth at the entrance to the burrow. The entire surrounding area is cleared and they seem to have a passion for collecting objects and adorning the earth mounds with them. Stones, bones, cow-dung, branches and even objects accidentally dropped by man are dragged to the burrows and placed on top of the mounds.

The plains viscacha is nocturnal, coming out to feed in the evening. It shares its

▷ *The range of the mountain viscacha extends over mountainous country high in the Andes, and is quite separate from that of the pampas-dwelling plains viscacha.*
△△ *The two kinds of viscacha differ in appearance as well as in habitat. A big head with short ears and distinctive facial stripes are the most noticeable features of the portly plains viscacha, in contrast with its smaller mountain cousin (overleaf). Plains viscachas construct large mounds over their warrens, which were once scattered over the pampas in such numbers as to create a serious hazard to horsemen. Objects of all kinds are collected by the viscachas and displayed on the mounds.*
△ *Unlike the mountain viscacha, the plains viscacha produces only one litter a year, and the two offspring are slower to mature.*
◁ *Portrait of an inveterate collector.*

Zool Soc London

△ *The chinchilla-like mountain viscacha is less houseproud than the plains viscacha. It does not excavate warrens, but lives in rock crevices high in the mountains.*

burrows with many other creatures; owls, snakes, lizards and even skunks. It is also friendly with its own kind and occupants of neighbouring colonies visit each other during the night. It has a variety of calls from grunts and squeals to a wire-twanging sound. The warning note is a peculiar swishing noise followed by a liquid note which sounds like a drop of water falling into a pool.

The mountain viscachas have a very different way of life. Although living in colonies of up to 80 individuals they do not burrow but shelter in rock crevices or among piles of boulders. Unlike their relatives on the plains they are diurnal and spend most of the day basking in the sun. They feed in the evenings but always return to shelter before dark. They are very agile, running among the rocks and leaping up the mountainside with their long hindlegs.

Devastation of grassland

The plains viscachas feed on a wide variety of grasses, roots, stems and seeds. They are voracious feeders, often laying bare large areas of grassland. In captivity they will also take carrot and potato. The mountain viscachas feed on plants – grasses, moss and lichens found near their colonies.

Slow breeding

The plains viscacha is a slow breeder. After a gestation of slightly less than 5 months, two young are born in September. There is only one litter a year and the young do not reach maturity for 2 years. The mountain viscacha mates in October and November and usually only a single young is born after a gestation of about 3 months, but there may be 2 or 3 litters a year. The young are able to nibble plants an hour after birth and males become sexually mature in 7 months.

Plains viscacha on the blacklist

Now that the puma has disappeared from its range the plains viscacha has virtually no enemy except man. Owing to the wide devastation of areas by the rodent's burrowing and its voracious appetite for grass it is now regarded as a serious pest and in the past few years it has been cleared from many areas of Argentina, especially where grazing animals are kept. It is not eaten by the local people nor is its fur valuable but a few years ago canned viscacha began to be exported to Italy where it proved to be very popular.

The mountain viscacha on the other hand is hunted by the local people for food and for its hair which is mixed with wool and made into a yarn. It also has a natural enemy in the Andean fox. All species are now sparsely distributed throughout their range and the mountain viscacha, in particular, seems in some danger of extinction.

Live trapping

Various methods of exterminating the plains viscacha have been tried out, including stopping up the entrances to starve the animals out and flooding. In a fairly recent expedition to obtain live animals for study, because so little is known about them, several methods of catching live viscachas were tried out, including digging out and vibration. The only methods that met with any success were flooding and trapping. Some were caught as they fled from their viscachera after it had been flooded but the majority were caught by trapping. All the holes to the viscachera were stopped up and wire-mesh treadle traps set at the most-frequented holes. The traps were examined at dawn and dusk and re-set in fresh holes if no animals had been caught after two visits. This method caught two or three viscachas every day until a total of 151 animals had been captured.

class	**Mammalia**
order	**Rodentia**
family	**Chinchillidae**
genera & species	***Lagidium peruanum*** *mountain viscacha* ***Lagostomus maximus*** *plains viscacha, others*

W Rohdich: Bavaria

△ *Vantage point: a viviparous lizard seeks the warmest point on a rock. Although they enjoy basking in the sun, these reptiles cannot tolerate excessive heat.*

Viviparous lizard

The viviparous or common lizard could be said to be a typical lizard. It has a slender body with a long tapering tail and well-developed limbs, a short, flat tongue, not deeply forked, external ear openings and the two halves of the lower jaw are firmly connected. The teeth are very small and conical, unfitted to deal with hard substances. It averages 5 in. in length, the female being slightly longer, with a maximum of about 7 in. The female is more heavily built, the male being the more graceful, his tail tapering gradually to a very fine tip. Although the tail is equal in length to the head and body in both sexes, that of the female appears shorter, owing to its sudden tapering beyond the thick basal portion.

It varies from yellow-grey to purple-brown above, with dark spots forming more or less broken longitudinal lines. There is sometimes a blackish line following the backbone to just behind the hips and a dark band edged with yellow along the sides. On the underside the males are orange or red, spotted with black. The females are orange, yellow or pale greenish, with or without black spots, or sometimes with only a few small grey dots. All-black, melanistic individuals occasionally occur.

The viviparous lizard lives farther north than any other European reptile. It ranges over most of Europe and Asia, except for southern and southeast Asia. It is found over the whole of the British Isles, including the Isle of Man, and is the only reptile found in Ireland.

Variety of habitat

The viviparous lizard, found in a wide variety of climates and habitats, is one of the hardiest reptiles. It lives as high as 8 000 ft in the Balkans and extends north of the Arctic Circle in Lapland. Elsewhere it is common on heaths, in open woods, in hedgerows, gardens and on sand dunes. It frequently basks in the sun and individuals have favourite spots such as a patch of sand or on an old wall. Sometimes as many as 50 have been seen lying together, basking, with their bodies flattened and limbs extended to catch as much sun as possible. Yet the viviparous lizard is intolerant of excessive heat. Indeed, in southern Europe it is found only in the mountain districts where it can keep cool.

The lizard is agile and graceful. Its movements are almost too quick for the eye to follow; and it is even more difficult to catch. It runs with a nimble glide, shooting forward in short dashes from one tuft of herbage to the next, the body and tail scarcely lifted from the ground. It can also run easily over the tops of heather shoots, spreading its toes out to cover the gaps between the foliage. The claws are used to ascend vertical walls or even posts with smooth surfaces. The lizard can also swim well and will pursue prey in water. It has good hearing and is said to respond to some musical sounds. A few people have claimed they can attract it from its hiding place by a particular whistle. In the British Isles hibernation begins in October, the adults going before the young ones which, in a warm autumn, have been seen out in the south of England as late as November. It is one of the first reptiles to reappear in the spring. In the southern parts of its range this may be as early as February but usually it is in March, the males and young coming out first, the females some weeks later.

Fond of spiders

Viviparous lizards feed mainly on insects, including flies, beetles and moths, as well as ants and their larvae, and they are particularly fond of spiders. Small caterpillars are swallowed whole, large ones chewed, the insides swallowed and the skin rejected.

They locate insects by sound and will spend several minutes looking for one after hearing the rustle of the insect among grass or dry leaves. In captivity the viviparous lizard has been seen to enter a large bowl of water to seize an insect that had fallen onto the surface of the water. On rare occasions it has been seen in the wild swimming, apparently for the same purpose.

Living young

Mating takes place in April and May with no obvious courtship but with some fighting between the males. Gestation is about 3 months. As the name *vivipara* implies, the female retains her eggs until they are fully developed and ready to hatch. Thus the young are born free from the egg-membrane or else the membrane is broken either during or immediately after leaving her body. When kept in captivity the mother makes no attempt at a nest or concealment and seems to take no interest in her young. In the wild, however, she digs a shallow pit, preferably well concealed in moist soil, into which she deposits her young, in July or August. There are 5–8 in a litter, exceptionally 4 or 10. The baby lizards are $1\frac{1}{2}$–2 in. long at birth. Most of them are bronze-brown but a few are born black and change to bronze-brown within a week. The underparts are greyish-brown and the back and sides are often speckled with gold. Within a few hours they begin to feed, hunting small soft-bodied insects such as aphides. From the first they are agile and skilful in the search for food. Males reach sexual maturity at 21 months.

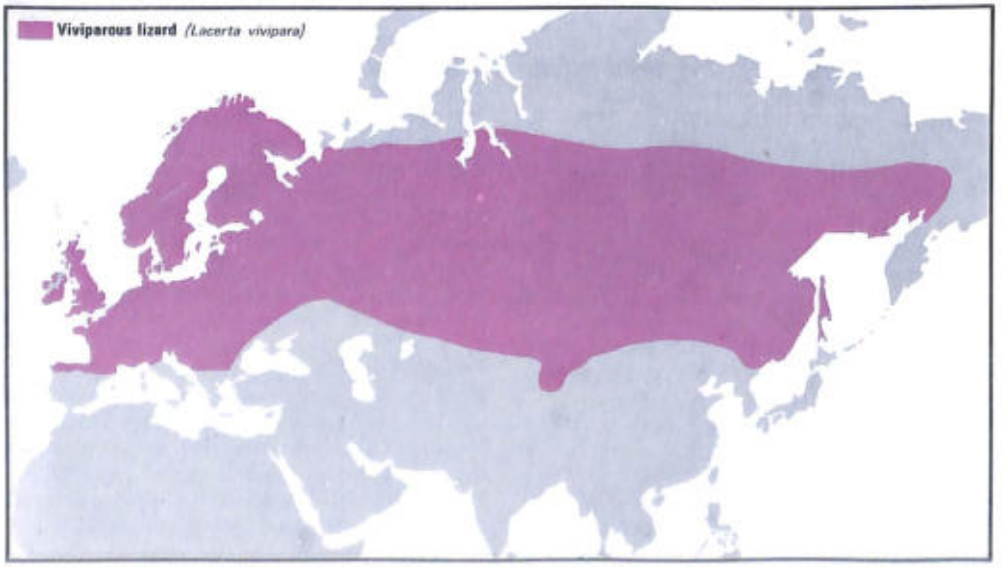
Self-mutilation for safety

Large numbers of viviparous lizards fall victim to snakes, birds and other predators. Like many other species of lizards they are able to cast off the tail in order to elude an enemy and then grow a new one.

When attempting to catch a lizard, it is best to grasp it by the shoulders. If the tail is held instead, it will probably come away in the hand, snapping readily at a joint near the base. Another tail will grow from the stump if the lizard lives long enough, but it is always a poor, ungraceful affair compared with the original. General opinion is that the tail snaps off as a result of the mechanical pressure exerted in grasping it. In fact, the lizard actually throws off its tail. For example, it can happen that you grab the lizard by the body, yet the tail comes away, nevertheless. Conversely, tame lizards accustomed to being handled will not lose their tails even when held by them. The autotomy (self-cutting), as the operation is called, is governed by a nervous reflex and a special breaking point in the tail. At that point, there is a line of weakness through one of the vertebrae, almost cutting it in two. Opposite this point each blood vessel and nerve is narrowed as in the waist of an hour-glass. So everything is ready for the tail to be thrown off by muscular contraction with the least damage and shock to the animal itself. The narrow neck in each blood vessel at this point serves as a natural ligature and keeps bleeding to a minimum when the break comes.

When cast off, the tail continues to lash violently, so it twists and bounces in a truly startling manner. The predator's eye is held by this unusual spectacle, while the former owner glides like lightning into the nearest cover. It is easy to imagine how successfully the antics of the severed tail can divert attention from the escaping lizard.

J Blossom: NHPA



class	**Reptilia**
order	**Squamata**
suborder	**Sauria**
family	**Lacertidae**
genus & species	***Lacerta vivipara***

◁△ *The first steps of a live-born viviparous lizard watched by its parent. The egg-membranes of the other young have not yet ruptured, and the remains of the yolk may be seen inside them as well as the dark curved forms of the baby lizards.*

◁ *The viviparous lizard is quite widely distributed in northern and central Europe and temperate Asia. In the Alpine and northern Balkan countries it occurs mainly as a mountain dweller, ascending to 9 000 ft. It is the only reptile found in Ireland.*

Vulture

The name 'vulture' was originally applied to only the large, scavenging birds of prey of the Old World, but after the discovery of America the term was extended to the condors, turkey vultures and other members of the New World family of birds of prey. They resemble the Old World vultures in appearance, presumably through convergent evolution, both groups having similar habits.

Vultures have naked or nearly naked heads, and sometimes naked necks, which is an asset to birds that regularly thrust their heads into carcases. Unlike other birds of prey, which kill their food, they have relatively weak feet which are adapted for running rather than holding prey. Both groups of vultures have heavy bodies but they soar effortlessly for hours on their long, broad wings.

There are 15 species of Old World vultures, with dark brown or black plumage, except in a few cases. The bare skin of the head and neck may, however, be orange, pink or white. The European black vulture is one of the largest flying birds in the Old World. It has a wingspan of over 8 ft and weighs over 15 lb. The plumage is almost wholly dark brown or black, with pale skin on the head and neck. It ranges from Spain to Korea and Japan. At the other end of the scale there is the lammergeier, or bearded vulture (p. 1404), and the Egyptian vulture. The latter has a wingspan of over 5 ft and is almost pure white except for black on the wings. The Egyptian vulture ranges through Africa, southern Europe, the Middle East and India. Only a little larger is the hooded vulture which is dark brown with a pinkish head and neck. It is very common in Africa south of the Sahara. The seven species of griffon and white-backed vultures are, perhaps, the 'typical' vultures. They are found throughout southern Europe, Africa and Asia, often in large groups, and they nest in colonies. They are medium-sized and have a ruff of long feathers around the naked neck. The remaining vultures are the palm-nut vulture, which has a feathered neck and black and white plumage, the white-headed vulture with blue at the base of the bill and the lappet-faced vulture. All of these live in Africa and have wattle-like folds of skin on the head and neck. There is also the Asian black vulture, which has a bright red head and neck.

▽ *White-backed vultures:* ***Gyps africanus.***

KB Newman

Okapia

Ripe food only

Vultures hunt by sight, detecting carrion from vast distances by watching the behaviour of other vultures and other carrion-eating animals. Large carcases may attract large flocks of vultures but despite their heavy bills most vultures have difficulty in breaking through the skins of large animals. Therefore they have to wait for the carcase to decompose or for another animal to attack it. The large vultures, such as the lappet-faced vulture, are powerful enough to rip through hide and, although solitary in habits, they take precedence over the gregarious griffon and white-backed vultures at a carcase. These, in turn, keep away the small vultures which have to be content with scraps.

The rasp-like tongues of vultures enable them to pull flesh into the mouth and their long necks allow them to probe deep into a large carcase, while the lack of feathers means that they have no problems about preening blood-stained feathers. Vultures do not feed on carrion exclusively, however. The largest vultures sometimes prey on the chicks of flamingos or on small rodents and the palm-nut vulture feeds on oil-palm nuts as well as shellfish from the seashore and sometimes hunts in shallow water for small fish.

Huge nests

Unlike the condors and many other birds of prey, the Old World vultures build their own nests instead of laying their eggs on the ground or in the abandoned nests of other birds. The lammergeier and the Egyptian vulture nest in caves or rock crevices, as do the griffon vultures which nest in colonies of over 100 on cliffs. The Indian griffon and the white-backed vultures often nest in trees, with up to a dozen nests in one large tree. The large vultures, the hooded vulture and the palm-nut vulture, nest singly in trees. The nests are huge cups of sticks and twigs lined with leaves, pieces of hide and refuse.

There is usually a single egg, two in smaller species, which is incubated by the female. Incubation ranges from 46 to 53 days, depending on the size of the vulture, and the chicks stay in the nest for up to 4½ months. The male feeds the female while she is incubating, then both parents feed the chicks by regurgitation.

Decreasing scavengers

Vulture numbers are decreasing wherever modern agricultural methods and methods of hygiene are being introduced; there are fewer carcases left lying about, and those that remain have often been poisoned. Although the vultures are not so useful nowadays as scavengers around human settlements they still help to clear up the carcases of stock, which are a potential source of infection. Unfortunately they are not always seen in this light and are persecuted for allegedly killing livestock, although only the largest vultures could possibly attempt to do so.

◁ *Gregarious griffons. Cape vultures gorge on a common zebra carcase. Most vultures are not strong enough to rip the hide so have to wait for it to decompose.*

Riding the thermals

Vultures are most common in dry, open country where they can soar effortlessly in ascending air currents. They are also found in mountain country, up to 20 000 feet. Apart from supplying the air currents necessary for flight, these areas are also those where there is likely to be an abundance of carcases of large animals easily visible from the air. Vultures are rarely found in forests, except for the hooded vulture. This is the most widespread, although not the commonest vulture in Africa. It regularly scavenges around towns and villages, providing a valuable garbage disposal service, and even follows people as they till the soil, to feed on insects that are turned up. Because of its exploitation of man it is able to penetrate forests where there are human settlements.

To be able to soar at great heights, the heavy-bodied vultures make use of thermals, the 'bubbles' of hot air that rise from the ground as it heats up. A thermal is like a smoke-ring with a stream of air rising through the centre of the ring, which is spinning rapidly. The vultures glide around inside the ring, using the rising air to hold them aloft. This is the same principle as is used by glider pilots. The dependence of vultures on thermals is shown by their daily habits. They do not take off in the morning until the ground has warmed up and thermals begin to form. The lighter species of vulture take off before the heavier vultures, which need more lift.

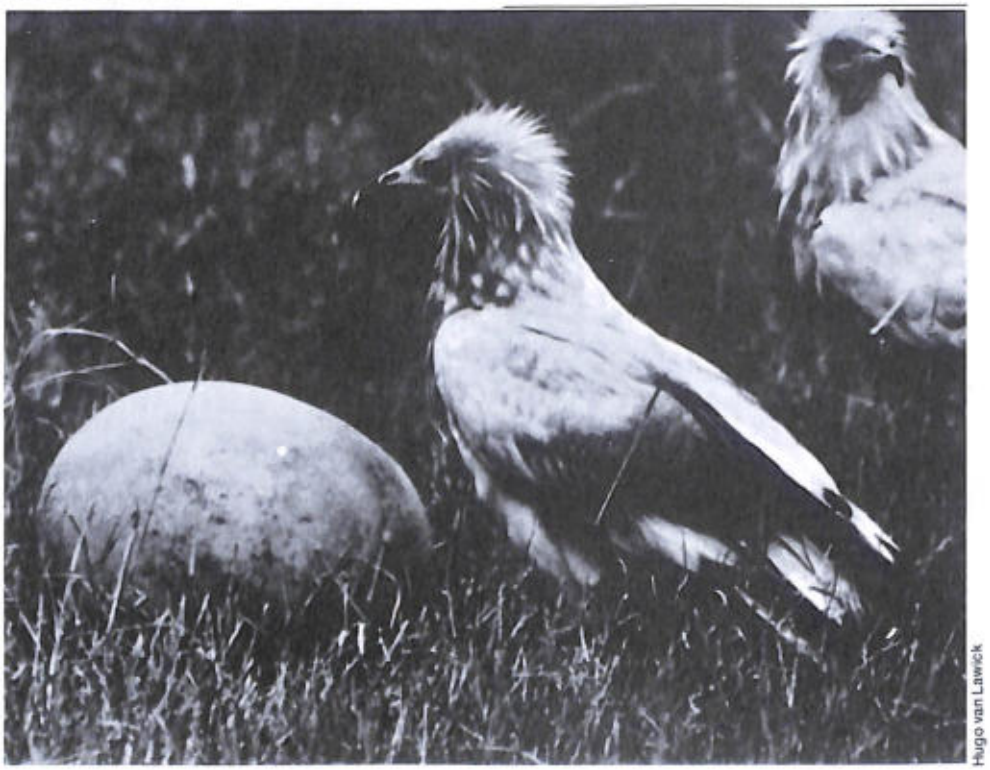
▷ *With appetite obviously far in excess of stomach capacity, an Egyptian vulture attempts to break an outsize fake egg placed as part of a study into the stimuli initiating this species' extraordinary use of stones as tools. The stimulus was shape; a cube of the same size and colour as an ostrich egg was completely ignored. The vultures were very persistent; in this case a pair bombarded the fibreglass giant – its volume was equal to that of six ostrich eggs – for 1½ hours.*

▽ *Soaring in thermals. The thermal current begins as a rising column of warm air (1) undercut by cold air (2). Like a warm-air bubble (3 and 4) the thermal rises so strongly that a vulture circling in it will also rise.*

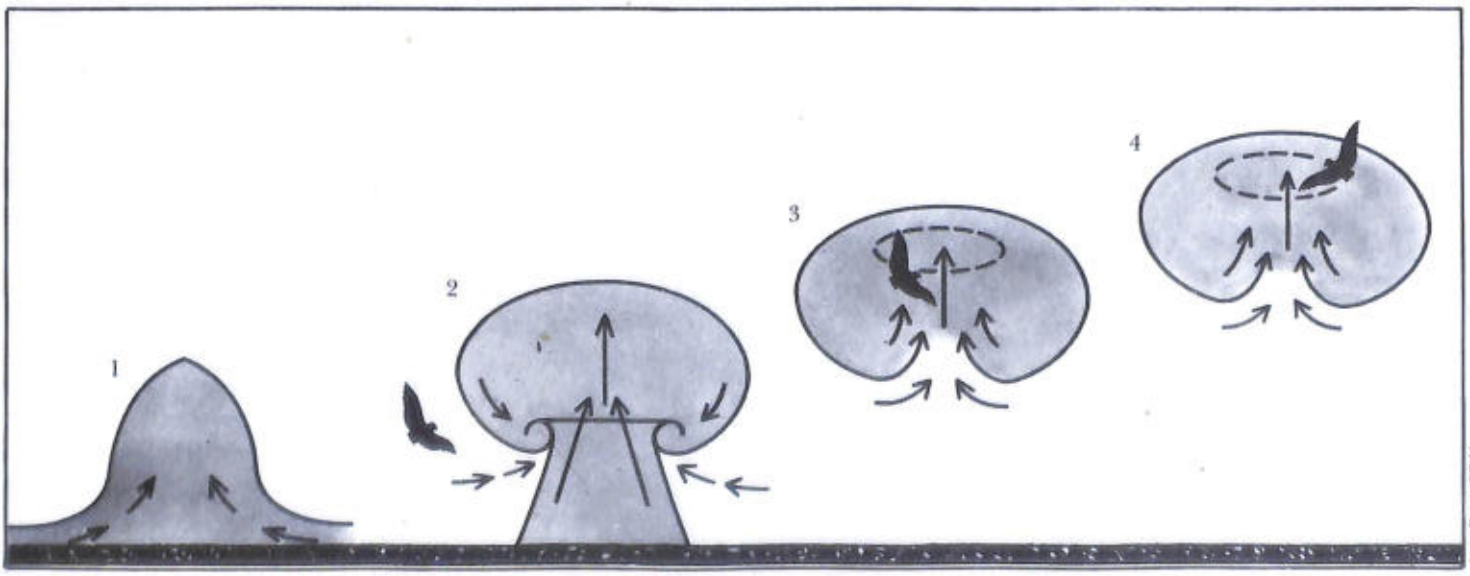
Tool-users

There are very few animals that use tools – the Galapagos woodpecker finch (p. 751), the chimpanzee (p. 559) and the sea otter (p. 2192) are the best known – but in 1966 another was added to the list. This is the Egyptian vulture, which throws stones at eggs. The habit is so well developed in a population in Tanzania studied by Jane Goodall that it is surprising that there are no previous records. These vultures smash the tough shells of ostrich eggs either by throwing them against a rock or another egg, or by throwing a stone at them. If there is no stone nearby a vulture may search for one up to 50 yards away, fly back with it in its bill then sling it with a violent downward movement of the head. The action is repeated until the shell cracks. One vulture managed to throw a 2lb rock, and continued to do so for some time, no mean feat for a raven-sized bird.

class	**Aves**
order	**Falconiformes**
family	**Accipitridae**
genera & species	***Aegypius monachus*** *European black vulture* ***Gypohierax angolensis*** *palm-nut vulture* ***Gyps africanus*** *white-backed vulture* ***G. coprotheres*** *Cape vulture* ***G. indicus*** *Indian griffon* ***Necrosyrtes monachus*** *hooded vulture* ***Neophron percnopterus*** *Egyptian vulture* ***Sarcogyps calvus*** *Indian black vulture* ***Torgos tracheliotus*** *lappet-faced vulture* ***Trigonoceps occipitalis*** *white-headed vulture, others*



Hugo van Lawick



Alan Rees: PDAI

Wagtail

Wagtails are small birds closely related to pipits but with brighter plumage and characteristic long tails which continually 'wag' up and down. The bill is needlelike, typical of insect-eaters, and the feet are well developed with long toes. The tail is nearly as long as the head and body, making a total length of 6–7 in.

There are about eight species of wagtail, some of which are divided into races with separate common names. The race of the yellow wagtail that lives in Britain and on the nearest parts of the Continent has more yellow in its plumage than the race which breeds farther east and is known as the blue-headed wagtail. Both races are greenish brown above and yellow underneath with white outer tail feathers. The male of the British yellow wagtail has a bright yellow crown and eyestripe while the male of the continental race has a slate-blue crown, white eyestripe and white chin. The females are similar to each other but have the same eyestripes as the males of their race. The grey wagtail could easily be mistaken for a yellow wagtail as its underparts are yellow but it can be distinguished by blue-grey upperparts. The male has a black 'bib' in summer. Closely related to the grey wagtail is the mountain wagtail of Africa and the Madagascar wagtail. The pied wagtail also has two races which are easily confused. Both have distinctive black and white plumage but in summer the continental race, called the white wagtail, has a light grey back. The Cape wagtail of southern Africa is a close relative.

Wagtails live in the Old World, but are not found in Australia. The yellow wagtail has, however, crossed the Bering Straits and breeds in western Alaska and the white wagtail has bred in Greenland. The forest wagtail is rather different from the others and lives in Manchuria and Korea. The willie wagtail ***Rhipidura leucophrys*** *of Australia is one of the fantails (family Muscicapidae) which also has the habit of wagging the tail.*

Nod heads and wag tails

Wagtails usually live in open country, particularly in grasslands, but the pied wagtail is sometimes found in trees and often lives on farms and around houses. The forest wagtail of eastern Asia is found in woods. The pied and grey wagtails, particularly the latter, are often found near water, sometimes wading into it. Many wagtails migrate, especially the yellow wagtail, the European population of which winters in Africa and occasionally reaches Australia from Asia. In winter many wagtails roost communally among dense vegetation or in trees. The pied wagtail may roost in the roof spaces of buildings, which may contain hundreds of birds.

The flight of wagtails consists of a series of 'bounds' as they alternately beat and close their wings. The glides between each burst of beating are longer than those in the flight of finches, and as a result the flight of wagtails is much more undulating. Their gait is also very characteristic. They run swiftly after insects on their strong legs with head, body and tail parallel to the ground, then stop suddenly and bob their tails rapidly. When walking normally the tail is bobbed and the head is nodded in time to the step.

Racing for food

Wagtails eat mainly small insects, particularly flies and insects living on the surface of the ground. Wagtails living near water feed on water insects such as small dragonflies and water beetles, small snails, and even minnows. The rapid, and seemingly pointless, dash of a pied wagtail across a lawn actually is the pursuit of a small insect which the wagtail's keen eyesight has detected. Most of the food is caught either on the ground or just above it, but wagtails can also be seen fluttering up to catch a higher-flying insect then dropping back to the ground. Yellow wagtails are found with cattle or sheep, feeding on the insects that they disturb.

Sitting on their tails

In his book *The Yellow Wagtail,* Stuart Smith has given vivid descriptions of the rivalry between male yellow wagtails at the beginning of the breeding season. Each male stakes out a territory and defends it against neighbours or other males which try to take it over. The owner advertises his possession by a warbling song and displays to rivals by throwing his head back, puffing out his breast feathers and leaning back on his

DN Dalton: NHPA

▷ *Pied wagtail – often seen dashing across a lawn on a seemingly pointless journey but really after a small insect seen with keen eyesight.*

tail so it is flattened against the ground. Occasionally fights break out on the ground or in the air and rivals peck and claw each other.

Once territorial ownership has been settled and mating has taken place the female builds a nest, the male not assisting but merely escorting her. The nest of grass lined with hair is usually built among long grass or undergrowth. Pied and grey wagtails often nest in cavities in walls, banks or trees and sometimes use old birds' nests, such as those of blackbirds or dippers.

The clutch generally consists of 4–6 eggs, which are incubated for 2 weeks almost entirely by the female. The young are fed by both parents. They leave the nest after 2 weeks and continue to be fed, staying together as a family party for some time. The pied wagtail raises 2 or 3 broods a year, the male caring for one brood, while the female incubates the next clutch.

Why wagtail?

The Saxon name for the wagtail was *wagstyrt, styrt* meaning tail and its name in other languages also refers to the habit of bobbing the tail. In Dutch, the wagtail is *Kwikstaart* and in Danish *Vipstjert*. Tail-wagging is not confined to wagtails. It is well developed, but not so obvious, in the related pipits, and many other birds can sometimes be seen to bob their tails. The reason for tail-wagging remains obscure. It is probably related to their habit of suddenly dashing and fluttering after insects. The long tail acts as a counterpoise to the body and makes balancing easy as the wagtail stops dead or changes direction. Other birds can be seen to twitch their tails after landing. This movement, of which the wagtails' bobbing may be an extreme development, probably balances the bird, as we might wave our arms when unbalanced.

class	**Aves**
order	**Passeriformes**
family	**Motacillidae**
genera & species	***Dendronanthus indicus*** *forest wagtail* ***Motacilla alba alba*** *white wagtail* ***M. a. yarrellii*** *pied wagtail* ***M. cinerea*** *grey wagtail* ***M. clara*** *mountain wagtail* ***M. flava flava*** *blue-headed wagtail* ***M. f. flavissima*** *yellow wagtail* ***M. flaviventris*** *Madagascar wagtail* *others*

▽ *Grey wagtail female with brood. It is easily mistaken for a yellow wagtail but can be distinguished by blue-grey upperparts.*

D. Zingel

Wallaby

There are more than a score of wallabies. Some have been dealt with elsewhere: the pademelon (p. 1811), quokka (p. 2027) and the rock wallaby (p. 2106). The way of life of the wallabies described here brings out other interesting aspects. In Australia itself the wallabies' story is largely one of persecution or extinction. There are also wallabies in New Guinea and one species of wallaby has become acclimatized to living wild in parts of Europe.

Most wallabies are the size of a hare or slightly larger, but the brush or scrub wallabies are up to 3 ft long in head and body, with a tail 2½ ft long and a weight of up to 50 lb. There are three species of hare wallaby, which are greyish brown with some red in places. The single species of banded hare wallaby is greyish with many dark bands across the back, from the nape to the base of the tail. The three species of nail-tailed wallabies are mainly grey with white stripes, but the eleven species of scrub wallaby are sandy to reddish brown. The five New Guinea forest wallabies are grey-brown to black-brown.

Hares and organ grinders

Hare wallabies are so named not only for their size but for their habit of lying in a 'form', a shallow trench scratched in the ground, under a bush or grass clump. They also run fast and will double back on their tracks like hares. They are solitary, nocturnal and make a whistling call when pursued. Nail-tailed wallabies have similar habits except that when bounding along they hold their small forelegs out to the sides and swing them with a rotary movement, which has earned them the nickname 'organ grinders'. The purpose of the spur or nail at the tip of the tail is not clear. The scrub wallabies spend much of the day in cover but often come out to feed—although they never stray far from cover. They may be solitary or live in pairs, or in large groups. The New Guinea forest wallabies live in the rain forest from sea level to 10 000 ft, but apart from this there is little information on them, and it is assumed that they live much as other wallabies do.

Generalized diets

All wallabies are vegetarian, most of them eating grass, although the nail-tails eat mainly the roots of coarse grasses and the scrub wallabies take succulent roots and eat leaves as well. Probably, as with other herbivores, the diets as given here are oversimplified. Some wallabies, normally grass eaters, have been seen to eat bark and fruits, as well as leaves. There is also a lack of detail on the life history except that they probably carry one young in the pouch at a time.

Unfortunate wallabies

Piecing together such information as is available in Britain, it seems the wallabies dealt with here are among the 'unfortunates'. They are small enough to be at the mercy of introduced foxes and dogs; the fur of some of them is valued for export; their speed makes them targets for sport; and their flesh is agreeable as human food. The aborigines of Australia and New Guinea have hunted them for food, some species, such as hare wallabies, being persecuted more than others. The banded hare wallaby, now confined to a few islands in Sharks Bay, southwest Australia, was once numerous on the mainland. The aborigines used to burn the undergrowth to drive out the game, and this particular hare wallaby suffered badly as a result. The larger scrub wallabies have suffered from the general accusation that they are outgrazing the sheep (see p. 2226) and cattle. The most recent research in Australia suggests this may have been exaggerated for all wallabies and kangaroos. Already it had been noted that the reverse was true for the banded hare wallaby—it was displaced by grazing sheep.

Some species of wallabies have become extinct, others are much reduced in numbers and range, and the only hope of ultimate survival for all seems to lie in creating suitable reserves and sanctuaries for them, and generally improving the climate of opinion in Australia.

Harry & Claudy Frauca

Sunning itself: a swamp wallaby ***Wallabia bicolor****. This position is adopted when the ground is cool.*

Fate of immigrants

Australia is not the only part of the world where wallabies have had their ups and downs. Bernard Grzimek has summarised, in his *Four-legged Australians*, what has happened to Bennett's wallabies brought over to Europe. In 1887 Baron Philipp von Böselager released two males and three females in 250 acres of forest near Heimerzheim, in western Germany. In spite of one hard winter they multiplied to 35—40 in six years, but were later exterminated by poachers. At the beginning of this century Count Witzleben successfully bred Bennett's wallaby on his estate near Frankfurt-on-Oder—then shot them all because, he said, they frightened the deer. Prince Gerhard Blücher von Wahlstatt released wallabies on the island of Herm, Channel Islands, where they did well until British troops occupied the island and 'the entire herd found its way into their cookhouse'. Today feral wallabies live on the moors in Derbyshire.

One danger peculiar to temperate climates comes from ice on lakes, which tends to break, with fatal consequences, under the strain of a wallaby's heavy, rhythmical leaps.


G Thomson

Pepperfoto

Pretty-face wallabies

△ *Relief! A contented wallaby closes its eyes as it sits down to scratch itself.*

▷ *Meal time. Incredibly this large young wallaby fits comfortably into mother's pouch.*

◁ *Heavyweight at home: the young wallaby causes an enormous bulge inside the pouch.*

G Thomson

class	**Mammalia**
order	**Marsupialia**
family	**Macropodidae**
genera & species	***Dorcopsis veterum*** *New Guinea forest wallaby* ***Lagorchestes leporides*** *hare wallaby* ***Lagostrophus fasciatus*** *banded hare wallaby* ***Onychogalea fraenata*** *nail-tail* ***Macropus rufogriseus fruticus*** *Bennett's wallaby* *others*

Wall lizard

The wall lizard got its name originally from its habit of living in the walls separating fields. The adult male grows to a length of 8 in. including a tail of up to 5½ in. The female is slightly shorter. It has an elegant appearance, with a slender body and tail, a narrow, pointed head, and well-developed limbs with long, slender toes. The numerous small scales on the back are granular and there are six rows of larger scales on the abdomen. As in nearly all lizards, the tail is very brittle and readily shed, but can be regenerated. The wall lizard presents such an amazing variation in colour that it is almost impossible to give anything but the most general description. The ground colour varies from grey to red-brown or black, sometimes with a bronze or greenish tinge and with lines or a series of white, yellow or green spots along each flank. The lower flanks are spotted with blue, green or white. The underparts vary from a milky white to copper-red, often spotted with black. The male's throat is usually cream, bordered with reddish-brown or blue. In addition, the brightness and variety of their colours change as the sunlight flashes on them.

Up to 14 subspecies or local races of the wall lizard have been described, usually distinguished only by their colours. The wall lizard is found in central and southern Europe from Holland, Germany and Poland to the countries bordering on both sides of the Mediterranean as far east as Asia Minor. It is also found in the Channel Islands. Some 200 wall lizards were liberated in southwest England in 1937, where the climate is very similar to that of the Channel Islands. Although they were seen for some years they did not flourish and are now thought to be extinct.

Eric Hosking

Special sun spot? Both male (left) and female wall lizards have their own regular basking places.

Lively and agile

The wall lizard lives in dry regions among rocks, walls and old buildings and can sometimes be found in gardens, especially in rockeries. It is very lively and active, running so fast that it comes and goes in a flash. It is an expert climber, even up perpendicular walls. It sees and hears well and is very inquisitive, investigating anything out of the ordinary. Although it will swim if necessary it will drown if it does not reach the bank quickly. Like all lizards, the wall lizards love to bask in the sun but will retire to crannies or holes in the rocks in cloudy or rainy weather. Each has its favourite spot on a rock or wall where it may be found regularly. In southern Europe wall lizards can be seen in large numbers lying in the sun on almost every wall, rock or ruined building and at times they can become quite tame.

In the northern part of its range the wall lizard hibernates from October to March among stones or rocks or in holes in the ground. In the south the period of hibernation is much shorter.

Opportunist feeders

Wall lizards feed mainly on flies and other small insects or their larvae as well as on other small invertebrates. They will occasionally feed on fruit and soft plants. Like the European robin and other small birds, they will sometimes follow anyone working in the fields or garden to pick up the insects disturbed by the digging, and they have even been known to scramble about at the feet of picnickers, picking up any scraps of food.

Two or three clutches

In the wild the wall lizard mates usually in April, the female laying 3–9 oval white eggs in a hole dug in the soil. These hatch after about 2 months. There may be 2 or 3 clutches in one season. On hatching the young wall lizards are 1½–2 in. long. In captivity wall lizards live up to 3 years.

Attractive pet

With their beautiful colours and lively inquisitive ways wall lizards make charming pets. They are among the most popular of vivarium animals and every year thousands are exported from southern Europe. If kept in a vivarium it should be large and able to contain as many lizards as possible as wall lizards seem to like each other's company, running around seemingly playing with each other. The bottom of the vivarium should be covered in sand and there should be rocks and stones for the lizards to climb over and crevices where they can hide. There should also be some small plants and always a dish of water. They thrive on small earthworms, mealworms and other small soft insects and their larvae.

Colour preferences

Lizards will search for prey that eludes them and disappears from sight, making what look like purposive attempts to find it. They are helped by having keen eyesight and by an acute sense of hearing. A wall lizard living in a vivarium with a floor of dead leaves will search for a mealworm that crawls under the leaves, standing and turning its head from one side to the other, as if listening to the very slight, almost inaudible rustling. Then it will scrape over the leaves with its forefeet and pounce on the mealworm the moment it sees it.

Most lizards seem to show a preference for green, the commonest colour in their environment. Wall lizards living among rocks seem to be conditioned to preferring yellow, as well as orange and red, which may also be linked with their liking for fruit. They seem especially fond of the flesh of oranges, yellow plums and strawberries. When the lizard is in a vivarium, separated experimentally by glass from these fruits – the whole being so arranged that the lizard cannot receive the odour from them – it will make deliberate movements to reach the fruit, such as scratching the glass with its front feet.

class	**Reptilia**
order	**Squamata**
suborder	**Sauria**
family	**Lacertidae**
genus & species	***Lacerta muralis***

Walrus

Although hunted since the time of the Vikings, almost to the point of extinction, the walrus has survived and today, with strict conservation measures, some herds are very slowly recovering their numbers. The two subspecies, the Pacific walrus and the Atlantic walrus, differ in only minor details. The Pacific bulls average 11—11½ ft long and weigh a little over 2 000 lb but they can reach 13¾ ft and weigh up to 3 700 lb when carrying maximum blubber. The Atlantic bulls average 10 ft long and up to 1 650 lb in weight but may reach 12 ft and weigh 2 800 lb. The cows of both subspecies are smaller, 8½—9½ ft and 1 250 lb, but large Pacific cows may reach almost 12½ ft and a weight of 1 750 lb.

The walrus is heavily built, adult bulls carrying sometimes 900 lb of blubber in winter. The head and muzzle are broad and the neck short, the muzzle being deeper in the Pacific walrus. The cheek teeth are few and of simple structure but the upper canines are elongated to form large ivory tusks, which may reach 3 ft in length and are even longer in the Pacific subspecies. The nostrils in the Pacific subspecies are placed higher on the head. The moustachial bristles are very conspicuous, especially at the corners of the mouth where they may reach a length of 4 or 5 in. The foreflippers are strong and oar-like, being about a quarter the length of the body. The hindflippers are about 6 in. shorter, very broad, but with little real power in them.

The walrus's skin is tough, wrinkled and covered with short hair, reddish-brown or pink in bulls and brown in the cows. The hair becomes scanty after middle age and old males may be almost hairless, with their hide thrown into deep folds.

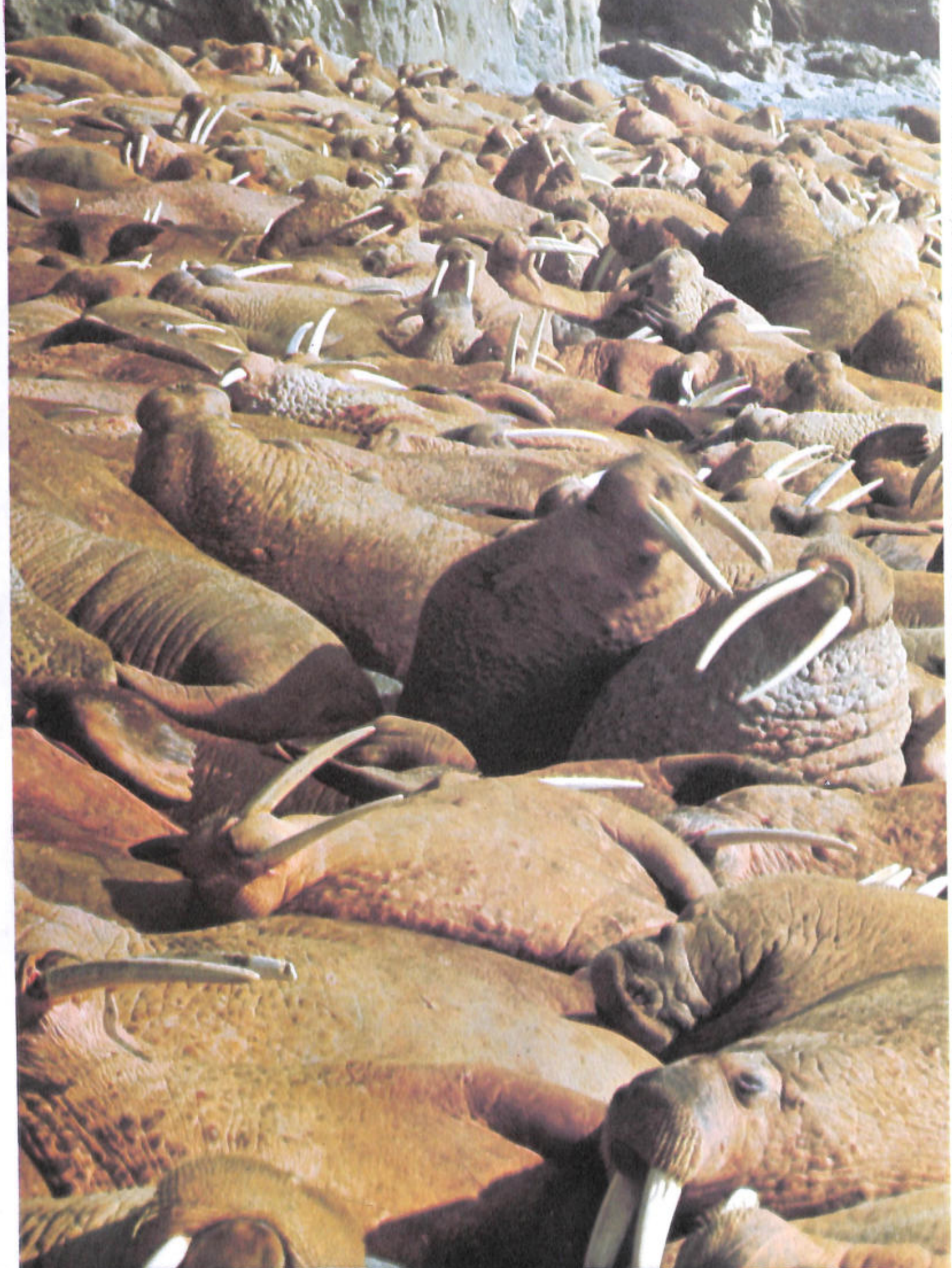
The Pacific walrus lives mainly in the waters adjacent to Alaska and the Chukchi Sea in the USSR. The Alaskan herds migrate south in the autumn into the Bering Sea and Bristol Bay to escape the encroaching Arctic ice, moving northwards again in spring when it breaks up.

The Atlantic walrus is sparsely distributed from northern Arctic Canada eastward to western Greenland, with small isolated groups on the east Greenland coast, Spitzbergen, Franz Josef Land and the Barents and Kara Seas. They migrate southward for the winter.

Walruses also inhabit the Laptev Sea near Russia and do not migrate in the winter. It is thought that this herd may be a race midway between the Atlantic and Pacific subspecies.

Steve McGutcheon

▷ *A long-in-the-tooth bull walrus of the Pacific subspecies. The elongated upper canine teeth are put to a variety of uses, among them defence and digging for clams.*




L.Lee Rue Photo Res.

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◁ *Overleaf. Standing room only: the walrus is a sociable animal and crowded gatherings like this one used to be commonplace on some remote beaches. Persistent persecution by unscrupulous hunters has, however, reduced numbers and driven the walrus to new behaviour; the herds now tend to haul out onto the relatively inaccessible security of ice floes.*

◁ *Playful pups: young walruses nuzzle each other with their sensitive moustaches.*

Tooth-walking bulls

Walruses associate in family herds of cows, calves and young bulls of up to 100 individuals. Except in the breeding season the adult bulls usually form separate herds. They live mainly in shallow coastal waters, sheltering on isolated rocky coasts and islands or congregating on ice floes. Since their persecution by man, however, walruses have learnt to avoid land as much as possible and to keep to the ice floes, sometimes far out to sea. They are normally timid but are readily aroused to belligerence in the face of danger. There seems to be intense devotion to the young, and the killing of a young one will rouse the mother to a fighting fury, quickly joined by the rest.

Walruses can move overland as fast as a man can run and because of their formidable tusks hunters, having roused a herd, have often been hard put to it to keep them at bay. Walruses have even been known to spear the sides of a boat with their tusks or to hook them over the gunwales.

As well as using them as weapons of offence and defence the walrus makes good use of its large tusks for digging food out of the mud and for keeping breathing holes open in the ice. It also uses them as grapnels for hauling itself out onto the ice, heaving up to bring the foreflippers onto the ice. The horny casing of bare hard skin on the palms of the flippers prevents the walrus from slipping. The walrus also uses its tusks for hauling itself along on the ice—indeed the family name Odobenidae means 'those that walk with their teeth'.

Walruses sunbathe and sleep packed close together on the ice floes with their tusks resting on each other's bodies. If the water is not too rough, adult walruses can also sleep vertically in the water by inflating the airsacs under their throats.

Clam grubbers

The walrus's diet consists principally of clams, which it grubs out of the mud with its tusks, and sea snails. It will also take mussels and cockles. The snout bristles help in detecting the shellfish. Clams are thought to be swallowed whole but no shells have ever been found in the stomach. In captivity a walrus was seen to suck out clams and discard the shells. A walrus also swallows a quantity of pebbles and stones, possibly for helping to crush the food in its stomach. Walruses usually dive for their food in shallow water of about 180 ft or less but occasionally they go down to 300 ft. It is not known how they deal with pressure problems at this depth, but they must have special physiological adaptations.

Occasionally a walrus, usually an adult bull, will turn carnivorous and feed on whale carcases or it may kill small ringed or bearded seals. Having sampled flesh it may continue to eat it in preference to shellfish.

Hitch-hiking pup

Most matings take place from late April to early June and after a gestation of just over a year one pup is born, every alternate year. Birth takes place on an ice floe. The new-born pup is 4 ft long with a coat of short silver grey hair and weighs 100–150 lb. It is able to swim immediately, although not very expertly, and follows its mother in the water. After a week or two it can swim and dive well. Even so, it usually rides on its mother's back for some time after birth, gripping with its flippers. After a month or two the silver grey hair is replaced by a sparser dark brown coat of stiff hairs. The cow nurses the pup for 18 months to two years but they remain together for several months after weaning. Males become sexually mature at about 5–6 years, the females at about 4–5 years.

Killed in the rush

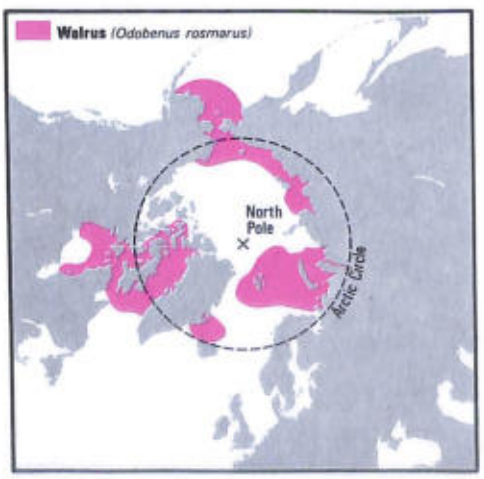
Killer whales and polar bears attack walruses but not often, the polar bear particularly being wary of attacking an adult bull even when he is ashore and therefore more vulnerable. Panic when killer whales are near may, however, cause high mortality. In 1936 a large herd was attacked by killer whales and driven ashore on St Lawrence Island. They hauled out onto the beach in such panic that they piled up on each other and 200 of them are said to have been smothered or crushed to death.

Slaughter by man

Walruses have been hunted by man from early times. The Eskimo and Chukchee have always depended on the annual kill to supply all their major needs, including meat, blubber, oil, clothing, boat coverings and sled harnesses. Even today they are largely dependent on it. The annual killings by the local people, however, had no very marked effect on the numbers of the herds. It was the coming of commercially-minded Europeans to the Arctic that started the real extermination. From the 15th century onwards they used the walrus's habit of hauling out on the beaches in massed herds to massacre large numbers in the space of a few hours. After 1861, when whales had become scarce, whalers from New England started harpooning walruses. Then they started using rifles and the Eskimos followed suit. More walruses could be killed but large numbers of carcases fell into the water and could not be recovered. An even greater wastage has been that caused by ivory hunters, who kill for the tusks and discard the rest of the carcase.

By the 1930's the world population of walruses had been reduced to less than 100 000 and only recently have strict conservation measures been enforced. The Pacific walrus now seems safe from extinction and the Atlantic walrus is still holding its own.

class	**Mammalia**
order	**Pinnipedia**
family	**Odobenidae**
genus	***Odobenus rosmarus divergens*** *Pacific walrus* ***O. r. rosmarus*** *Atlantic walrus*



J Simon: Photo Res

△ *Wildlife refuges, such as this one beneath the snow-covered Teton Range, harbour most of the American population of wapiti.*

Wapiti

The wapiti of North America is often referred to as cousin to the red deer (p. 2058); the closeness of the relationship remains open to question. In the 17th century the wapiti—the name given by the Shawnee Indians—was an abundant and widely distributed deer in North America. Its range fell just short of the Pacific coast in the west across almost to the Atlantic coast in the east, and from British Columbia in the north to New Mexico and Arizona in the south. Its numbers then were about 10 million. The total today is half a million.

The wapiti is larger than a red deer, up to 9 ft long in head and body, 5 ft high at the shoulder and weighing up to 1 000 lb, the hinds being smaller than the stags, as in red deer. It resembles the red deer in colour except that it is less reddish in summer and it has a more prominent light rump patch. Wapiti means 'white deer' and probably refers to this light patch. The antlers of red deer go up to 43 in.; those of wapiti may reach 66 in.

There are four forms of wapiti living in widely differing environments. The largest, living towards the Pacific coast, was named after Theodore Roosevelt in 1897. The smallest, the dwarf or Tule wapiti, lives on the hot, dry plains of southern California. Its coat is much paler than in the other three.

Incompatible neighbours

In spite of the tremendous reductions in its numbers, the wapiti gets in man's way. Most of the half-million survivors are in national parks or other wildlife refuges, mainly in the western states. Two small herds were introduced into the Virginian Jefferson National Forest in the eastern United States, and there have been reintroductions elsewhere. Where they invade arable or other settled land they tend to damage crops or compete with domestic livestock for browse and grazing. They also bark trees, especially the aspen, and wapiti introduced into Australia barked the pokaka. They present the same problem as the red deer in wildlife refuges in Britain; their natural ability to build up numbers under protection is apt to lead to the destruction of their habitat and the need to control them. Regrettably, the hand of man must always be to some extent against the deer in his vicinity.

Musical wapiti

The breeding habits of wapiti are very like those of red deer. There is, however, a marked difference in the stag's calls at the beginning of the rut. Instead of a roar, the wapiti stag makes an undulating bugling which starts in a low key, rises to a high pitch in a prolonged note which abruptly drops to a harsh scream, and ends in a few grunts. Otherwise the details are much the same, with the mature bulls rounding up the hinds into harems in September and October, to the accompaniment of a clatter of antlers and a clashing of foreheads from furious fighting, as the subordinate stags challenge the bulls. In May or June of the following year the hinds leave the herds and go into thickets to drop their dappled calves. There is usually one at a birth, rarely twins and exceptionally triplets, after a gestation of 249–262 days. The calf is up to 30 lb at birth, stands within minutes of being dropped and can run after a few hours. It starts to feed itself at three months, and is weaned and loses its spots in September or October.

Lion-hearted deer

The enemies of wapiti, a prey species itself, are much reduced in numbers at the hands of man. They include wolf, coyote, puma and bear, which prey especially on the calves. Adults can use speed to escape or can turn and defend themselves, striking down with the front hoofs. A big wapiti stag is credited with breaking the back of a wolf with one kick. One wapiti stag reduced a bear to a lacerated carcase with the tines of its antlers, then trampled it furiously until only a battered pulp remained. Such behaviour seems to be unusual until we recall that in the 18th century the Duke of Cumberland, so we are told, had a stag and a tiger brought together in an enclosure and that the stag made 'so bold and furious a defence, that the tiger was at last obliged to give up the contest'.

Dance of the deer

Contemporary accounts tell how the North American Indians sometimes hunted the wapiti in parties, forming a wide crescent around a stag, with the horns of the crescent half a mile apart. As they closed in the stag dashed first one way, then the other until, with the circle closed, the exhausted stag could be taken alive. Nevertheless, unless the animal was completely worn out, he would stand at bay, and usually one or more of the hunters was hurt before the stag was secured. Apparently this 'dance of the deer', as it was called, was for sport. The wapiti stag was also killed by Indians for his upper canine teeth, which were worn as charms. Surprisingly, the carcase was not used but left to rot. Later, some Americans of European origin formed a fraternal order or brotherhood named after this deer, not after its Indian name but after the one wrongly given it by early white settlers, which was 'elk'. Members of the order, it seems, used the canine teeth as emblems, for which a stag was killed, its canines extracted—and the carcase left to rot.

class	**Mammalia**
order	**Artiodactyla**
family	**Cervidae**
genus & species	***Cervus canadensis***

Warbler

There are about 300 warblers, named after the melodious song that is characteristic of many species. They are small, generally 4–5 in. long, with fine-pointed bills, and usually drably coloured, green, brown or grey. Identification is, therefore, not an easy task and many warblers can be identified, even by experienced bird-watchers, only when held in the hand and even then identification can be difficult. Many warblers migrate and because they get blown off course some species turn up in odd places. The appearance of such rarities, together with the difficulties of identification, make the warblers particularly interesting to bird-watchers.

The warblers are sometimes called the Old World warblers to distinguish them from the New World warblers also known as the wood-warblers or American warblers. The two groups are placed in separate families, the Old World warblers having 10 primary flight feathers on each wing and the wood-warblers having only nine. The Old World warblers are very uniform in form and colour, although some tropical warblers are brightly coloured. The sexes usually have similar plumage but they differ in a few cases. For example, the blackcap is an appropriate name only for the male which has a black crown contrasting with the pale grey of the rest of his plumage. The female has a brown cap. Similarly, the Rüppell's warbler has a black head and throat with a white moustache. The female retains the moustache but the head and throat are grey and white.

Warblers are restricted to the Old World except for the Arctic warbler which has crossed the Bering Straits from Siberia to Alaska. The rest are found all over the Old World from western Europe to Australia, with about half in Africa.

RK Morton: Photo Res

Eric Hosking

Peter Hinchcliffe Photo Res

◁△ *Male Dartford warbler with his hungry young. He is identified by his slate-grey head, dark brown upper-parts and purplish-brown underparts. This 5in. warbler is constantly cocking and fanning his tail and has rather skulking behaviour. It usually lives on open commons with heather and gorse or on cistus-covered hillsides or dwarf oak trees.*

△ *Chiffchaff fledglings at their nest of moss and dry grass, lined with feathers. They are fed by the female alone and after about 13 days they are able to fly. When adult they look very like willow warblers but their voices clearly identify them; the chiffchaff's song is a monotonous, high-pitched 'chiff-chaff' whereas the willow warbler has a fluent, wistful song.*

◁ *Blackcap family. Its cap – glossy black in the male and red-brown in the female – makes it one of the easiest warblers to identify. Its rich and melodious song has named it 'the northern nightingale'. The frail nest is built in coarse vegetation such as brambles or evergreen shrubs and is attached to the surrounding plants with 'basket handles'.*

Mixed-up migrators

Many warblers spend their lives in one area, while others are migratory, especially those that live in places where the winters are cold. Only 3 of the 13 species breeding in the British Isles spend the winter there. These are the blackcap, chiffchaff and Dartford warbler. Some of the migratory species travel vast distances on their twice yearly journeys: the willow warbler flies up to 7 000 miles, from eastern Siberia to east Africa and the Arctic warbler may travel even farther: from northwest Europe to southeast Asia. The Alaskan population of the Arctic warbler returns to the Old World in the winter, crossing the Bering Straits and flying down to southeast Asia. Sometimes reversed migration takes place and part of a warbler population flies in the opposite direction to the others. This results, for instance, in some warblers arriving in the British Isles in autumn when the others have left. Some Arctic warblers arrive in the British Isles from northern Europe having flown southwest when they should have flown southeast.

Warblers have the typical thin, pointed bills of insect eaters and most of them feed entirely on insects, spiders, and the eggs and larvae of insects and other invertebrates, which they find in the bark of trees, in reeds and other plants, and sometimes on the ground. Berries are eaten by some migrating warblers and blackcaps feed at bird-tables during the winter.

Songs gay and dull

Many warblers advertise their presence by elaborate songs that compete in quality with that of the European blackbird, while others have dull songs like that of the grasshopper warbler which can be easily mistaken for the stridulation of a grasshopper. The breeding habits of warblers are fairly uniform. Each pair usually holds a territory and nests in isolation although reed warblers build nests quite close together.

The nests are built near the ground, among bushes, reeds or grasses, and are built of grass or reeds which is woven to form a bowl, ball or even a bottle-shaped nest. The males sometimes build several 'cock nests'. The white, spotted eggs, 3 – 10 in number, are incubated by the female alone or by both sexes, but both parents usually feed the chicks.

Almost identical twins

Some species of warblers are so similar that it is almost impossible to distinguish them by their plumage. Such species are called sibling or cryptic species and, in the case of warblers, the chiffchaff and willow warbler, among others, are distinguished by their song. The chiffchaff's irregular, high-pitched 'chiff-chaff-chaff-chiff-chaff' is a common sound in the woods during spring whereas the willow warbler has a faint, liquid and regular song repeated at intervals. The breeding range of these two species overlaps in most of Europe but where the willow warbler does not occur, as in Spain and Portugal, the chiffchaff resembles the willow warbler more closely than it does elsewhere. Its legs which are usually noticeably darker than the willow warbler's are lighter in the Iberian peninsula and its song is made up of a pattern of notes rather than the two notes of other chiffchaffs. Presumably the chiffchaff and the willow warbler arose from populations of a common ancestor which became isolated from each other. Now their ranges overlap these differences are sufficient to prevent interbreeding.

class	**Aves**
order	**Passeriformes**
family	**Muscicapidae**
genera & species	***Locustella naevia*** *grasshopper warbler* ***Phylloscopus collybita*** *chiffchaff* ***P. trochilus*** *willow warbler* ***Sylvia atricapilla*** *blackcap* ***S. undata*** *Dartford warbler* *others*

N Myers: Photo Res

Warthog

The warthog is thought by some to have the most grotesque face of all mammals. This is partly because its face is badly proportioned, and partly because of the excrescences or 'warts', strengthened with gristle, on either side of the face. These are prominent in the males only and do not appear to have any function. The male warthog is up to 5 ft long, exclusive of its 18in. tail, stands up to 28 in. at the shoulder and weighs up to 200 lb. The female is somewhat smaller. The skin of both is slate or clay-coloured, with a few bristly hairs over the body and a conspicuous mane of long bristles running from the head down the midline of the back. The most striking feature is, however, the very long head, armed with tusks and ornamented with warts, with the small eyes set well back, only just in front of the ears. The long legs and long head with the stout thick neck make the warthog, when seen standing on all fours and from side view, look like a caricature of a horse. The long thin tail hangs down when the animal moves slowly but is carried stiffly erect with the tufted tip hanging over when it is running.

The curled upper pair of tusks, 12 in. or more in length—the record is 27 in.—are longer than the lower because these bite against only the lower surface of the upper tusks, instead of wearing them away at the points. The upper tusks have enamel at the tips and even this is soon worn away, while the lower tusks are coated with enamel throughout their length. The young warthog has 34 teeth but in the mature adult there may be only eight because the three pairs of lower incisors and one pair of the upper are lost, as well as all the cheek-teeth, except for the last pair of molars. Each of this last pair is large and complex, consisting of a number of long narrow cylindrical denticles, packed closely together.

The warthog is found in most open country in Africa, from Ethiopia to Senegal in the north, southwards to the Orange Free State.

◁ *Face to face with ugliness. A male warthog clearly shows its four large and functionless warts—only prominent in males. Despite its ferocious appearance the warthog is basically inoffensive, but when cornered is quite capable of defending itself and its family from the attack of all but the largest and most formidable of predators. Its long upper tusks, with an average length of 1 ft, can inflict severe wounds on the unfortunate enemy.*

Likes to wallow in mud

Warthogs prefer open thorn bush, thin forest or plains. They feed mainly by day, travelling about singly, in pairs or in family parties of one or two sows with their offspring. The boars are usually solitary. At night they lie up in a den, which may be a cave, a hollow under rocks or a depression they dig in the ground under the shelter of a dense thicket. They wallow in mud, caking their bodies with it, but their dens are kept scrupulously clean. They sometimes use abandoned aardvark burrows for sleeping or as temporary retreats when disturbed. They enter the burrow backwards, presenting their formidable tusks to the entrance, ready to inflict severe wounds on any enemy foolish enough to intrude.

Selective grazer

The warthog is principally a grazer preferring short grass and tender growing tips. The small incisors are used as tweezers to pluck out the selected food. The warthog's neck is too short for comfortable feeding so it goes down on its knees to graze, sometimes shuffling forward in this position. Where water is not available or grass is scarce the warthog may dig up roots. Fruit and berries are also taken and it will very

Sally Anne Thompson

H Klingel

△ *A disinterested Thomson's gazelle passes a family of rooting warthogs. As they have such short necks warthogs drop to their padded knees for more comfortable feeding; they often grunt while rooting but are otherwise rather silent.*

◁ *Warthogs erect their tails only when running.*

occasionally take animal food. During a drought in the Nairobi National Park in 1961 warthogs were frequently seen feeding on the carcases of wildebeest and other animals that had died of hunger or thirst.

The warthog is usually silent but will grunt when feeding. It has a good sense of smell and acute hearing, but poor eyesight.

Rationed piglets

Usually 2–4 young are born from October to November after a gestation of 171–175 days. The warthog sow has only four teats, and recently it has been learned that a litter may number 6. How the meals are arranged is not known. Sows seen suckling their young have been standing, although they may lie down to do so in the burrow when the piglets are first born. The young warthogs are a reddish brown colour.

It is not known how long warthogs live in the wild but one lived in the London Zoo for 12½ years.

Hunted with jeeps

The lion is the warthog's chief enemy in the wild but leopards, cheetahs and wild dogs may take the young ones. Several observers have testified that the warthog is virtually fearless; warthogs have turned and charged pursuing leopards or elephants, which turned tail and fled. The sow with young is particularly fearless in the defence of her piglets.

Local people hunt the warthog because the flesh is said to be very tasty and today it is hunted with jeeps for sport against which its normal methods of defence and 30 mph maximum speed are of little use.

Bob Campbell: Photo Res

△ *Meal time: two young warthogs satisfy their appetites while mother feeds on grass. There are usually 2—4 young, sometimes 6. The sow has only four teats, but it is not known how they manage.*
▽ *Quenching their thirst in muddy water; warthogs will often wallow, caking their bodies in mud.*

Odd or misunderstood?

In general each part of an animal's body contributes in some positive way to the welfare of the whole. In most animals there are one or more parts that we speak of as vestigial; they were formerly larger and more vigorous or contributed more to the general economy of the body but are now smaller and are, so to speak, wasting away. Occasionally we find parts that are better labelled rudimentary. These are at their beginning and have not yet developed to the point of playing their full part. Over and above these there are, not infrequently, animal parts, structures and tricks of behaviour which seem to be neither functional, vestigial nor rudimentary. Until we know more about them they may best be described as oddities.

The warthog is one of the oddest of the quadrupeds. Its flat, almost shovel-shaped head, combined with the stout, thick neck, may be useful now, or it may have been useful in the past in perhaps a different kind of habitat, for rooting in the earth or for turning over logs or stones. The warts may possibly serve for additional strength in such exercises. It may be that the warts serve as weapons additional to the tusks, for powerful thrusts at the enemy. If either of these has any truth, there may also be a very good reason why the eyes should be set so far back in the head. This position may keep them out of harm's way when rooting for food. Perhaps this extraordinarily grotesque head would prove, were we better informed on the habits and behaviour of the warthog, to be the result of a combination of remarkable adaptations to a specialised way of life, and oddities only because of our ignorance.

class	**Mammalia**
order	**Artiodactyla**
family	**Suidae**
genus & species	***Phacochoerus aethiopicus***

South African Tourist Corporation

Wasp

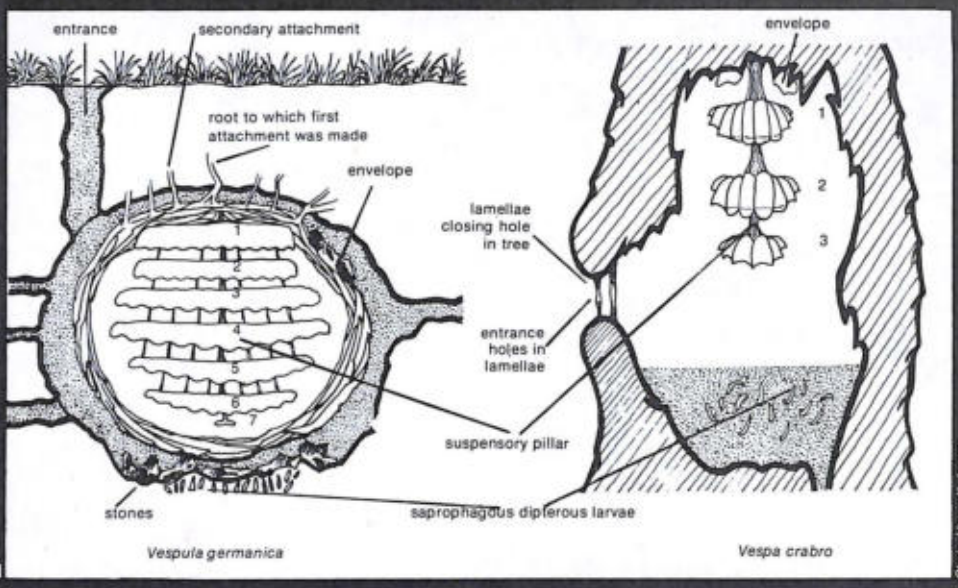
To most people a wasp recalls the black-and-yellow insect often abundant enough in summer to be a nuisance, but in its broader sense the term 'wasp' includes any of the stinging Hymenoptera that is not a bee or an ant.

The common wasp ***Vespula vulgaris*** *and the German wasp* ***V. germanica*** *are equally common in Europe, and so alike that the workers are difficult to distinguish, though the queens can be separated by the pattern of their yellow and black markings. Except to entomologists these two are just 'wasps', without any thought of there being more than one species. Almost all that is said here jointly concerns both.*

Their nearest European relative is the hornet ***Vespa crabro*** *(p. 1241), and they are more distantly related to the paper wasps* ***Polistes*** *(p. 1832). Their American equivalents, with similar habits, are known colloquially as 'yellowjackets'.*

Four other species of ***Vespula*** *are found in Britain, all very similar in appearance to the two common kinds. The red wasp* ***Vespula rufa*** *also nests underground, but the tree wasp* ***V. sylvestris*** *and the Norwegian wasp* ***V. norvegica*** *hang their nests in trees and bushes. Finally there is the cuckoo wasp* ***V. austriaca*** *whose queen enters the nest of a red wasp, kills some of the workers and supplants the queen. The parasitic invader's brood is reared by the red wasp workers, the offspring of the parasite consisting entirely of fertile males and females.*

▽ *Lover of liquids—a wasp feeding. Adult wasps feed on nectar, fruit and tree sap.*



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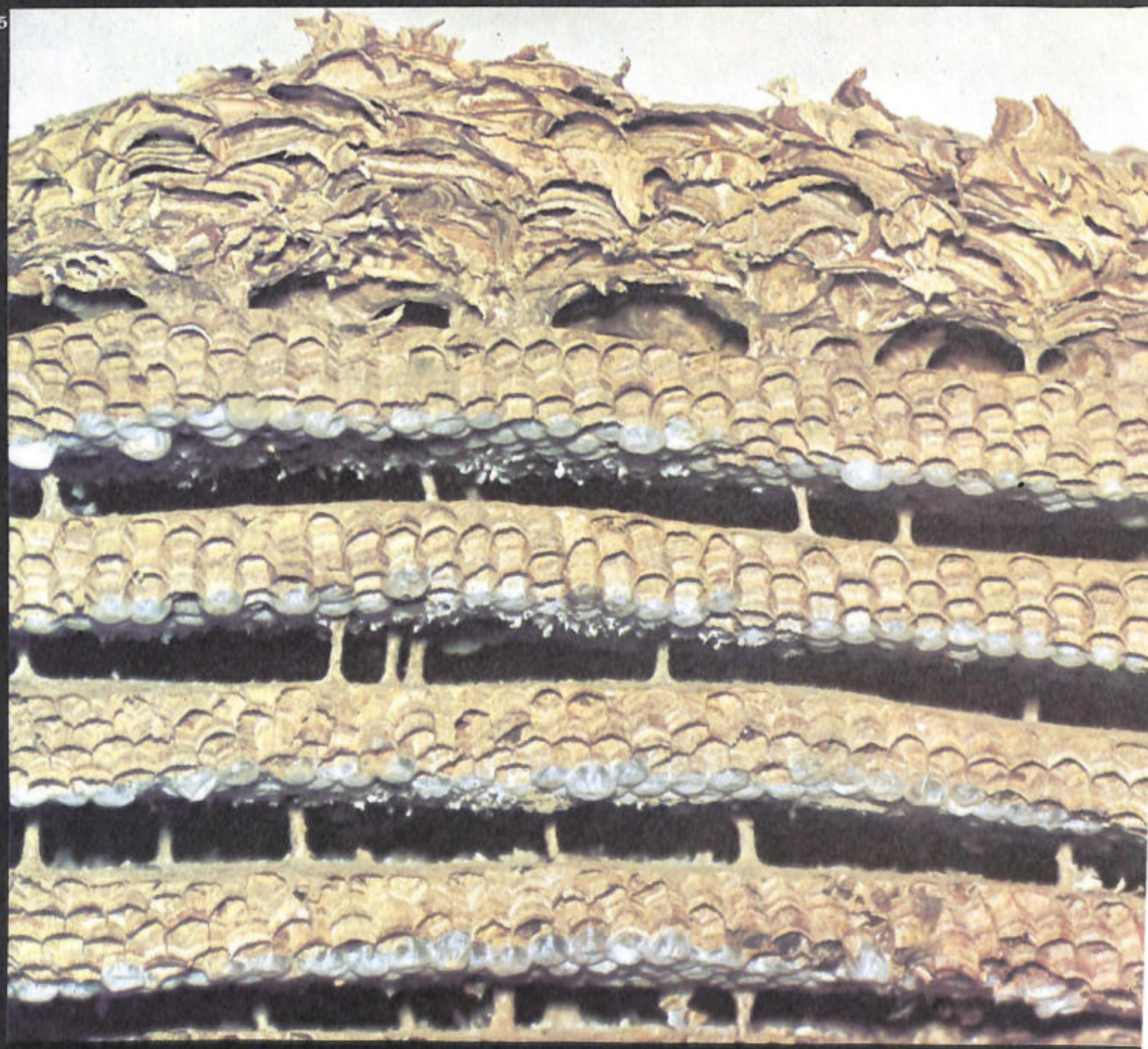
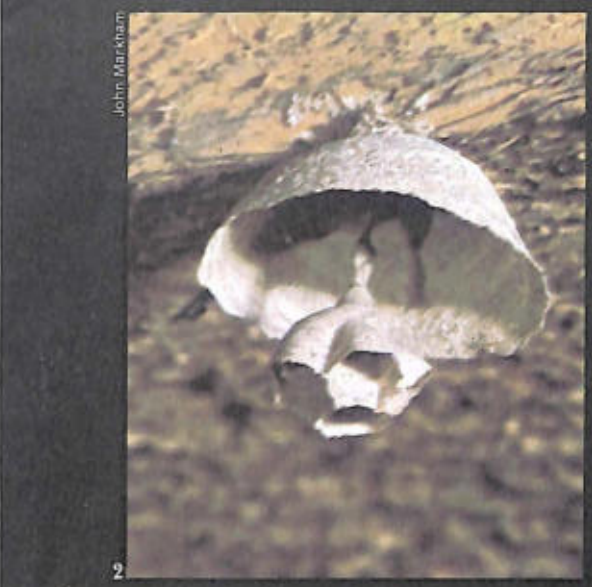
The inside story

1. Section through the subterranean nest of the German wasp and a section of a hornets' nest in a tree hollow. The numerals refer to layers of comb in order of construction.
2. Built by a queen: the finely sculptured first cells of the common wasp are suspended by a stalk from a delicate paper canopy.
3. The underside of a layer of cells from the upper storey of a common wasps' nest. The white cells contain larvae which prior to pupation spin a cocoon and seal off the mouth of the cell with a layer of tough silk.
4. Whorled and circular design: detail of the outside of a wasps' nest formed by the laborious efforts of the queen. Pieces of wood are rasped with the mandibles, worked up with saliva and masticated to form a substance which when dry has a paper-like consistency.
5. Stratified: section through a common wasps' nest shows the different layers of comb supported by tiny props.

Chris Howell-Jones

5

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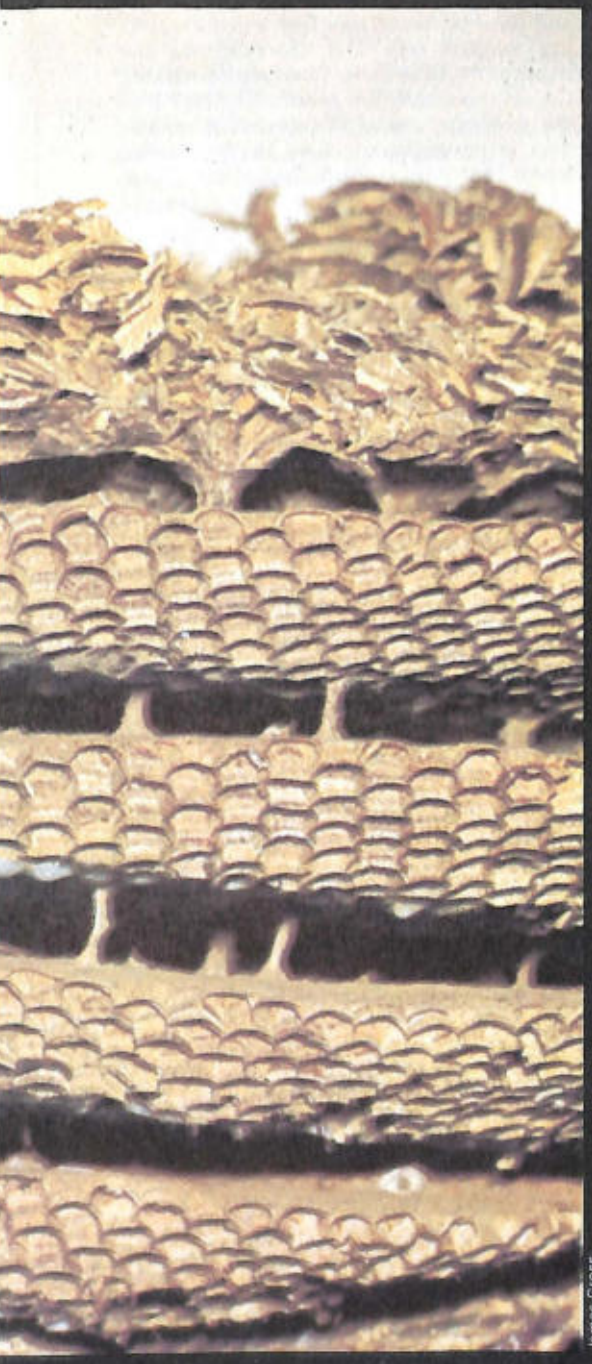

James Cross


4
Heather Angel

SG Giacomelli

Fear-inflicting German wasp. Wasps usually sting only when annoyed or if their nest is approached.

Elaborate paper building

The history of a wasps' nest really begins in the autumn of the year previous to its construction, when the big queen wasps leave the nests where they were hatched, mate and then hide themselves, to pass the winter in hollow trees, sheds and attics. The queen finds a rough beam or piece of sacking, clamps her jaws onto a fibre and hangs unconscious for six or seven months. She emerges in late spring and seeks a crack in the ground or an old mouse's hole running under a tree root. Just below this she digs out a chamber, removing the earth in her jaws. Then she flies repeatedly to and from a fence post or dead tree, each time bringing home a little pellet of paste made by rasping away the wood and moistening the resultant material with saliva. This substance is plastered on to the underside of the root, where it hardens to form a kind of cardboard or paper. A little curved canopy is fixed onto this foundation and a paper stalk is made, pointing down from the centre of the canopy. A cluster of hexagonal cells, also of paper, is then made round the stalk, with their open ends downward. The queen lays an egg in each then encloses this first comb in a bag of paper about as big as a golf ball, with a hole at its lower end.

Building a city

All this time the queen has been feeding on nectar. When the eggs hatch into small white larvae she divides her time between feeding them on the juices of chewed-up insects—they are growing and so require a protein diet—and adding more cells to the comb, enlarging the enclosing bag as she does so. By the time the larvae from the earliest eggs have passed through the pupal stage to produce the first workers, she may have added a storey to her house, built below the first and hanging by little stalks of paper. To make room for the growing nest the queen may have to excavate more earth and carry it away.

When the worker wasps, which are non-reproductive females, appear in quantity, they take over from the queen the job of extending and enlarging their home. New storeys are added, one below the other, increasing to the maximum diameter of the nest and then decreasing again to give it a roughly spherical shape. Quantities of earth are removed by the workers and wood pulp is brought back for construction. The anchorage to the root is strengthened as the bulk and weight of the nest increases, and struts and stays are made between it and the surrounding earth. The queen stays at home, fed by her sexless daughters, who must also bring home animal food for all the growing larvae. As each cell is completed she places an egg in it until a population of as many as 5 000 wasps, or more in very big nests, is built up and maintained. The total number of the queen's offspring that hatch, live and die in the service of the nest throughout a summer may be five times this number.

Make do and mend

When complete the nest is a hollow sphere 8–9 in. wide, containing 6–10 horizontal combs which extend more or less right across it. The nest is comparable to a house built of bricks and mortar, yet there is a difference: although the nest has a basic external form, the inside is continually being nibbled away and repulped to be added, together with fresh pulp, to the outside and to the expanding combs, so the whole structure is constantly changing.

At the end of the summer a generation of males and functional females is produced. The latter are the queen wasps, similar to workers but larger; the males are about the same size as the workers but have much longer antennae. Eggs which produce workers and queens are always fertilised by spermatozoa from the store which the queen acquired at mating and keeps in her body. Males are produced from unfertilised eggs, from which the queen withholds sperm as she lays them. After mating the males soon die and the queens hibernate. At the end of the summer the workers become lazy and cease to maintain the economy of the nest, and they and the old queen die with the first frosts of autumn.

The workers feed on nectar and fruit juices and also accept drops of liquid exuded by the larvae. The larvae and queen are fed by the workers on the juices of captured insects; wasps destroy great numbers of bluebottle flies.

The larva is a white legless grub and it maintains its position in the upside-down cell by pressing its body against the sides. When fully grown it closes the cell by spinning a papery cover across the mouth. During its life its excrement accumulates at the end of the intestine and is voided all at once in the last larval skin when it changes into a soft white pupa. The wasp emerges 3–4 weeks after the eggs were laid.

Guests and parasites

A hoverfly *Volucella* enters wasps' nests and lays its eggs without any interference from the wasps. Its curious prickly larvae play a useful part in the nest as scavangers, living in the midden below the nest, where dirt and dead bodies accumulate, and also entering vacated cells and cleaning out the deposits of excrement. This helps in making the cells available for re-use. The larvae of the moth *Aphomia sociella* also live as scavengers in wasps' nests. Late in the season, when the nest is 'running down', these invade the combs and devour the grubs and pupae. The larva of a rare beetle *Metoecus paradoxus* lives parasitically on the grubs of wasps in underground nests. It is at first an internal parasite (like the larva of an ichneumon (p. 1294) or a tachina (p. 2465) fly), but later emerges and devours its host. It is a remarkable fact that *Metoecus* apparently invades the nests of only the common wasp, never those of the German wasp, although to our eyes the two species look exactly the same.

The wasp's sting

This formidable weapon is really an ovipositor or egg-laying organ that has become transformed into a tiny hypodermic needle connected with a poison gland. The eggs are extruded from an opening at the base of it. Wasps sting if they are squeezed or restrained, as when they accidentally crawl inside someone's clothing. They also attack and sting if the nest is interfered with or even simply approached. The inhabitants of large, well-populated nests are more aggressive than those of small ones. The two main constituents of the venom are histamine and apitoxin. Old-fashioned remedies such as washing soda and ammonia were based on the mistaken idea that the venom is an acid of some kind, and they are ineffective except in giving reassurance. Genuine relief is given by the application of antihistamine to the site of the sting and by taking antihistamine tablets.

phylum	**Arthropoda**
class	**Insecta**
order	**Hymenoptera**
family	**Vespidae**

Water beetle

Fresh water would not remain fresh for long if it were not for scavengers like the water beetles that feed on decaying vegetation. There are 2 000 species in the worldwide family, most numerous in the tropics, known as water beetles, or sometimes as water scavenger beetles, to avoid confusion with another family, the diving beetles (p. 777). The name is not wholly appropriate because not all species live in water, some living in damp places among vegetable rubbish, others in dung.

Many water beetles look very like the diving beetles because both are dark brown or black and oval in outline. The former are, however, stouter, less flat, and differ in their habits, especially in the way they swim and breathe. The silver water beetle is one of the best known and largest. It is nearly 2 in. long, black and smooth above. Under water it appears bright silvery underneath due to a covering of very fine short hairs which trap a thin layer of air. Usually hidden under the head, the antennae are short and clubbed, and are used in breathing. There are much-elongated palps on the maxillae which look like a second pair of antennae, and in many species these function as such.

Awkward swimmers

Water beetles live in shallow weedy ponds, in pools in marshes, some mainly on damp land, a few live in brackish water or in running water where there are plenty of algae. They swim awkwardly with alternate strokes of the legs, very different from the efficient rowing action of more truly aquatic beetles such as the great diving beetles. The first pair of legs are not adapted to swimming and the beetle uses first the middle and hindlegs of one side, then those of the other. These are flattened and fringed. When the silver water beetle submerges it carries a silvery film of air on the underside and a bubble between the body and wing-cases. The beetle replenishes its store in a peculiar way, coming to the surface headfirst, not tail first like the diving beetles, turning on one side and piercing the surface film with one of the antennae. This forms a funnel which puts the outside air in continuity with the two stores of air the beetle carries. This species, like other members of the family, also flies at night and is attracted to artificial light.

The adult beetle feeds on water plants, including algae, or on decaying matter, seldom on living animal prey, although the larvae are more often predatory. Where the larvae live in dung they are maggot-like, feeding on fly maggots found there. In some parts of the Far East water beetles are used to combat the larvae of other beetles which damage sugar cane and banana stems.

Carnivorous larvae

The female silver water beetle spins a large silken cocoon and attaches it to the underside of a leaf of floating vegetation. A vertical 'chimney' projects above the water surface, allowing air to reach the 50–100 eggs laid inside. Sometimes the cocoons are spun independently of any support and they float like small brown balloons at the surface, with the chimney looking like a mast. In a few species the female carries the cocoon about with her, held between her hindlegs. When these hatch the larvae swallow some air and then bite their way out of the cocoon. The object of swallowing the air seems to be to make the larvae buoyant so they can rise to the surface to breathe. Unlike the adults they are carnivorous, but confine their attentions mainly to water snails. The jaws are asymmetrical and are apparently designed for holding and cutting through the shell of a snail. Well-grown larvae also prey on tadpoles. The soft body of the prey is eaten normally, not externally digested as in the case of the diving beetle larva.

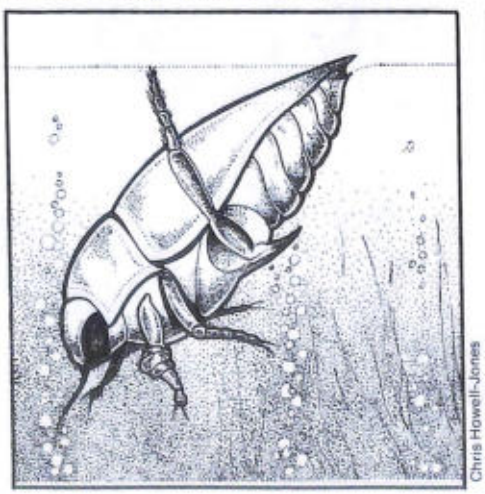
The larva is nearly 3 in. long when fully grown. At this time it leaves the water to pupate in an earthen cell.

An aquarium favourite

It is not surprising that such a large, handsome and well-behaved insect as the silver water beetle should be a favourite with aquarium keepers. It is rather rare and in Britain is mainly confined to the south. At one time it was thought that over-collecting for aquaria was a threat to its existence. This is probably no longer the case, but it is now in far greater danger than before from modern agricultural operations involving filling up ponds and the mechanical dredging of drainage ditches in country that was formerly marshland. This, added to the way the beetles or their larvae serve as food for birds, fish, frogs and toads, may be too much for the water beetles.

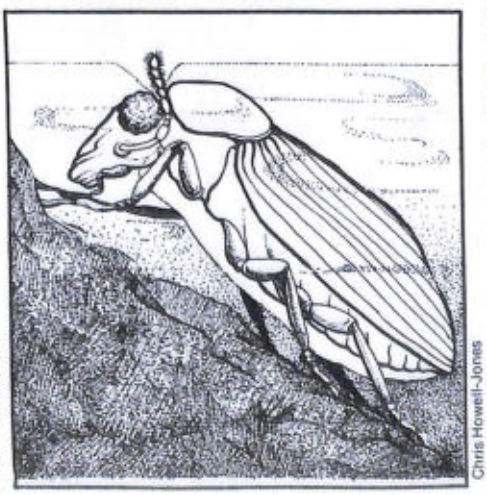
John Clegg

△ *The silver water beetle, so-called because of the shiny layer of air on its underside.*



Chris Howell-Jones

▽ *Bottom up: diving beetle* ***Dysticus*** *fills the air reservoir trapped behind its wing cases.*



Chris Howell-Jones

▽ *Antennae raised, water beetle* ***Octhebius*** *renews the air store under its body.*

phylum	**Arthropoda**
class	**Insecta**
order	**Coleoptera**
family	**Hydrophilidae**
genus & species	***Hydrous (=Hydrophilus) piceus*** *others*

Waterbuck

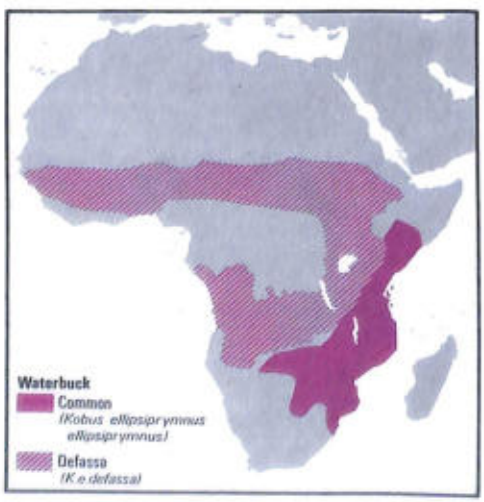
The waterbuck is a large antelope which is always found near rivers but which, in spite of its name, lives on drier ground than the closely related kob (p. 1384) and lechwe (p. 1425). It is 48–53 in. high and may weigh 450—500 lb. It has a coarse, rough, brownish coat, blackish feet and white on the midline of the underparts round the muzzle and round the eyes. There is also an indistinct white band round the neck behind the ears, and either a white ring round the rump or a white patch in that region. The neck and haunches of adult males are thick, and some have a shaggy mane down the throat. Only the males have horns and these are long and slender, ribbed all the way up, and make a smooth crescentic path out and back, then in and forward. They do not have an 'elbow' halfway up the horn like a kob or a lechwe.

Waterbuck are found over most of Africa south of the Sahara. One type with a white rump-patch is known as the defassa or singsing and is found in the more westerly parts of the range. The second type with the white ring known as the common waterbuck, is found more to the east. At one time the two were considered different species but it is now known that they interbreed where their ranges meet. Thus, in parts of East Africa such as the Nairobi National Park, the herds cannot be definitely classed as one species or the other, but show all intermediates between the white patch and the white ring forms. South of the East African parts of their range they are separated by geographical barriers; in Zambia, their ranges are divided by the Muchinga escarpment, and further south by desert. Moreover, each type shows geographic variation, and there are altogether about seven subspecies of waterbuck: three of the common and four defassa, differing among themselves in colour, the amount of white round the eye, length of ear and other details.

H Klingel

△ *A horned male common waterbuck will try to keep a female which strays into his territory.*

▽ *Females and young move about in groups during the day, grazing their home ranges.*



Protection in darkness

Waterbuck live in the savannah zone, even in somewhat arid country, but always near water. Thus they are found in the savannahs of southern Gabon, which they have invaded across the Zaire river from the south – not by penetrating the forest belt from the north. In the arid country of Somalia they are restricted to the major river valleys. The thick cover by the rivers gives them protection. They come out to graze in the grassland beyond, returning again to rest. They are basically diurnal, and where they have not been hunted, as in the Nairobi Park, they stay in the grasslands all day and return to cover at dusk. Where they have been constantly shot at and disturbed, as in Zaire and Somalia, they come out at night and lie up during the day. This is an interesting example of the way an animal's habits may change under human pressure.

Territorial status

A male waterbuck holds a territory covering between ¼ and 1 square mile, extending along the river and back into the grazing areas. He moves about daily to and from the riverine thickets within the territory, the boundaries of which are clearly defined by the owner's behaviour, at least along the river, although less clearly farther inland. The length of its river frontage is an indication of the rank of the male holding it.

The male tries to attract females into his territory. Should a group of females wander through it he tries to keep them, while his neighbours move up to the boundary ready to herd the females the moment they move out. The male herds the females by running in front of them and standing with his head up and forefeet together, thus blocking their path, and while they are moving he will give chase, running alongside and butting them.

The females have their own home ranges, which are used for grazing. They are similar in extent to a male's territory, but are not defended. A group of females may therefore move unchallenged into a neighbouring group's home range, and out again as occasion demands. The home ranges, moreover, cut across the males' territories, so the females are constantly harassed as they wander to graze. They spend the night with their young in the riverside bush in groups of three or four. During the day they move about the home ranges in larger groups of up to 30. A few subadult males move along with the females, but those past puberty are usually evicted by the territory-owners, and they join a peripheral herd until each can set up a territory of his own.

Greeting ceremonies

When a male greets a female he sniffs and licks her vulva and tail or else he adopts the *flehmen* pose – head raised, lips drawn back, nose wrinkled – and then he uses the *laufschlag*, stroking between the female's leg or under her belly with his foreleg. He then mounts the female without necessarily mating. A male will graze alongside females he has attracted into his territory and occasionally perform a greeting ceremony with them. A female in season will move a greater distance and graze for a longer time each day than one who is not. She therefore passes through the territories of a greater number of males and the greeting ceremony is more complex than usual. The male may, for example, rub against the female with his face and the base of his horns, where there is a depression, richly supplied with nerves. He will often put his horns on either side of her rump and push slightly.

Gestation takes 240 days, the single young being born in riverside cover. At first the mother leaves the thicket later in the day and returns earlier than the females without young, leaving her young for as short a time as possible. Later, after 3–4 weeks, the young begins to come into the open. Although the sex ratio is thought to be about equal at birth, only 30% of the adult population are males.

Harmonious feeding

Waterbuck and the related kob and lechwe occupy the same terrain in the National Park on the borders of Botswana and Southwest Africa, but they do not compete for food. To begin with, the three species differ in their food preferences at different times of year. Lechwe prefer young grasses, eating the newly emergent perennials in May and the grasses sprouting after the burnings in December. Kob – in this case the subspecies known as puku – prefer somewhat more matured grasses, and so although they eat the same foods as lechwe it is in different proportions, and somewhat later in the year. Waterbuck like matured grasses, and during the floods may often be seen standing up to their bellies in water, having left the dry ridges to feed on the exposed portions of mature plants. Annuals which sprout in January are grazed to a great extent only by lechwe. In this way three large species of very closely related antelope can share the same habitat.

class	**Mammalia**
order	**Artiodactyla**
family	**Bovidae**
genus & species	***Kobus ellipsiprymnus defassa*** *defassa* ***K. e. ellipsiprymnus*** *common waterbuck*

Nolly Zaloumis

Water-holding frog

Any frog or toad is likely to discharge a fluid from its bladder when gently squeezed, and this fluid is mainly water. Frogs and toads living in deserts hold more water in their bladders and are therefore termed water-carrying or water-holding. One more especially has been singled out for this name: the water-holding frog of the deserts of Australia.

It is squat-bodied, 2½ in. long, with fairly short, stout front legs and plump hindlegs with webbed toes. It is greenish-grey, often with a dark line down the middle of the back, and its skin is warty. The head seems small for the bloated body; the animal looks more like the European common toad than the common frog. This may be why this and other similar species in Australia have at times been called water-holding or water-carrying toads.

The range of the water-holding frog covers the dry areas of New South Wales and Queensland, northern South Australia and Central Australia.

John Moore

△ *Fat frog:* ***Cyclorana australis*** *is adapted to living in the more arid regions of Australia.*

Tanker frogs

Frogs and toads can lose water rapidly through their skin, but they can also rapidly absorb water through it, which is why they never drink. Most of this water is stored in the lymph spaces under the skin and between the muscles. Much of it is stored in the bladder and can be taken back into the rest of the body if needed. What this means can best be appreciated by comparing the clawed frog (p. 583) of Africa with the water-holding frog. The clawed frog continually lives in water and has a small bladder capable of holding only 1% of its body weight. The bladder of the water-holding frog can hold up to 50% of its body weight of water.

Cocooned for the dry spell

The climate map of Australia shows that over half the surface of the continent has 10 in. or less of rain each year. The driest places are in the heart of the continent, where the annual rainfall is less than 5 in. a year. In this area, however, the rain falls as heavy but infrequent showers, and in a given district there may be a lapse of several years between one rainstorm and the next. During periods of drought the water-holding frog lies buried, as much as 3 ft down in the ground, where the soil is permanently moist. It also lays down a skin-bag or 'cocoon' around itself, by casting off the cell-deep outer layer of its skin. This is separated from it except at the nostrils, and water accumulates between the skin and the skin-bag, which inhibits evaporation. The frog remains so, in a torpid state, eating nothing, until the next rainstorm. Then it casts off the skin-bag and comes to the surface to feed rapidly on insects that become abundant during the wet spell. At the same time the frog replenishes its water supply and breeds.

Brief infancy

The frogs breed in the temporary pools caused by the heavy rains, in the same way as pond-breeding frogs and toads everywhere (see p. 630). The main difference is that the eggs hatch in much less than the usual time and the tadpoles develop much more quickly. They become froglets in less than a fortnight, compared with, for example, the 10 weeks taken by the European common frog to reach the same stage. The young frogs feed heavily and rapidly and also fill up with water, then they bury themselves in the ground before the hot sun dispels the moisture remaining from the heavy rainfall.

Speed kills

It is hardly surprising that little precise information is available on many aspects of the biology of animals living under such rigorous conditions. It is only within recent years that a few of the animals in deserts near the more densely populated regions of the world, where biologists are more numerous, have been subjected to close scrutiny. It seems reasonable to suppose, however, that the main hazards in the life of water-holding frogs are connected with the very brief period of infancy. When so much development, feeding and water storage must be carried through in so short a space of time there must be many tadpoles and froglets that fail to make the grade. It may also be shown in due course that there is predation, by birds and reptiles principally, while the frogs are above ground. That such enemies are few may, however, be inferred from the large populations of this and other desert amphibians known to exist, not only in Australia but in other deserts, as in the southwest United States.

Food and drink in one

In fact, some water-holding frogs and toads occur outside Australia but these have received less notice than their Australian relatives. This is partly because their adaptations are less extreme, but it is due more to the link between the amphibians and the Aborigines of Australia. We are told that when the Aborigine feels thirsty he digs a water-holding amphibian out of the ground, holds it over his open mouth and squeezes it to quench his thirst. This is, it seems, an over-simplification. Harry Frauca, in his *Book of Australian Wild Life*, tells us that water-holding frogs are 'said to be found in large numbers in the claypans of Centralia and to provide some aborigines with food and drink. There are reports to the effect that some tribes will dig up Water-holding Frogs from the claypans, squash them and drink the liquid contained inside the bodies and later on throw the frogs into the cookpot'.

Amphibians re-defined

Frogs and toads belong to the class Amphibia, the name meaning loosely 'animals leading double lives'. We tend, therefore, to think of them as spending half their time in water and half on land. In fact, some like the clawed toad spend all their time in water. At the other extreme there are many which never go into water, including the Stephens Island frog of New Zealand, 80 different kinds in New Guinea and adjacent islands and four in Australia. All of them, when not in water, must live in moist places, where evaporation from the skin can be counterbalanced by intake of water through the skin, or else must take their water supply around with them. Amphibians are therefore not so much animals spending half their time in water and half out, but animals adapted to ensuring to themselves a supply of water whether they are immersed in it or outside it. When outside it, however, the desert-living amphibians can lose water equal to a third of their body weight without necessarily dying.

class	**Amphibia**
order	**Salientia**
family	**Leptodactylidae**
genus & species	***Cyclorana platycephalus*** *others*

Heather Angel

△ *Predacious pair: water scorpions in weeds.*

A. Klots

△ *Diagonally placed: water stick insect with legs and breathing siphon extended is about 2 in. long.*

Water scorpion

Water scorpions are bugs and therefore have nothing to do with the more familiar land scorpions, and they are far less dangerous to people. They are water insects, called scorpions because of the shape of their front legs, which are modified for grasping prey, and the presence of a long, slender 'tail', which resembles to a very slight degree a scorpion's tail. The larger kinds of water scorpion can pierce the human skin with their beaks with painful but not serious effects. In Australia people are attacked often enough to have earned for the insects the name 'toe-biter' or 'needle bug'.

Water scorpions are flat, blackish-brown insects, the largest being no more than 1—2 in. long. They live on the bottom around the edges of muddy ponds and ditches and are difficult to see on account of their resemblance to water-logged dead leaves. The more or less oval outline of the body is made more leaf-like because the 'tail' looks so like a leaf-stalk. They are poor swimmers and seldom venture into open water, but may climb about on water weeds to get to the surface to breathe air. For this they use the tail, which consists of two half-tubes closely applied to each other and held together by interlocking bristles to form a 'snorkel', the tip of which is pushed above the surface.

The family which includes the water scorpions is a small one, with only about 150 species, but these are well distributed over the world. The water stick insect is in the same family.

Wings hide evolutionary secrets

When the wing-cases of a water scorpion are raised a pair of very delicate hind-wings are revealed. These are never used, however, as the insect has lost some of the principal wing muscles and cannot fly. The wings are pink with bright red veins and the part of the hind body over which they lie is brick-red with black bands. This permanently concealed splendour must have had a function at some time, so it must be supposed that this loss of the use of the wings has occurred rather recently in its evolutionary history. Another feature that is revealed when the wings are lifted is a group of three pairs of false spiracles on the surface of the abdomen below the wings. The spiracles of insects are primarily breathing pores, but in the water scorpion only those at the base of the breathing tube are used for this. The three pairs on the upper surface of the abdomen are balancing organs. Experiments have shown that these spiracles are extremely sensitive to water pressure, which will be very slightly greater on the side of the insect which is tilted downwards from the horizontal position.

Predacious bugs

Water scorpions are predatory, seizing small tadpoles, insects and other animals with their forelegs, each of which is hinged like a clasp knife, so the end portion can fold back into a groove along the basal part. The piercing beak, a feature characteristic of the whole order Hemiptera—bugs— is plunged into the victim, which is killed and consumed by external digestion. In this type of feeding digestive juice is pumped down the beak and into the victim, thus dissolving the tissues, which are then sucked back in liquid form. As well as being digestive the injected juice is also poisonous and quickly paralyses and kills the prey—even large victims, like young fish, are quickly subdued.

Chains of eggs

Water scorpions lay their eggs in spring, among aquatic plants near the surface. At one end of each egg is a bunch of seven long filaments. These become entangled and the eggs cling to each other in chains. The newly-hatched young are like their parents, except in size.

Means to an end

Water stick insects are larger than most water scorpions. They are long and slender with long legs, rather like the familiar stick insects on land for which they are named. The breathing siphon is nearly as long again as the rest of the body, which is light ochreous in colour, and the mode of feeding is similar to that of the water scorpion. Water stick insects live in still waters among water weeds and standing reeds. Unlike water scorpions they have functional wings and will fly in search of a new habitat if their pond or ditch dries up. Their eggs are most peculiar. They are inserted into floating leaves, such as those of water lilies, the female having a saw-like ovipositor for cutting the leaves and fixing the eggs in position.

Perhaps the most remarkable thing about this unusual family is that the two types of insects have come to look like vegetation. One has come to look like leaves, the other like stems, and all within the one family.

phylum	**Arthropoda**
class	**Insecta**
order	**Hemiptera**
suborder	**Heteroptera**
family	**Nepidae**
genera & species	***Nepa cinerea*** *water scorpion* ***Ranatra linearis*** *water stick insect*

Water shrew

A water shrew swimming underwater has been likened to an 'animated air-bubble' due to the air trapped in its fur, which gives the submerged body a silvery appearance. It is larger than the common shrew (p. 2245), the head and body being 3—3¾ in. and the tail about 3 in. long. The body looks bulky but an adult weighs no more than ½ oz, even less in winter. The upper parts vary from a slaty black to dark brown and the light ash-grey or dirty white of the underparts, sharply separated from the upper, appear pure white by contrast. The water shrew's snout is short and broad and its eyes small and blue. The ears, each bearing a tuft of white hairs, are entirely hidden beneath the fur. The feet are brown and broad, the hindfeet—usually more than ¾ in.—being the longer. The toes are bordered with stiff hairs which make them efficient paddles. They are also used in grooming the fur. The tapering tail of the adult water shrew, flattened from side to side, has a double fringe of strong silvery-grey hairs along its underside, constituting a keel and making the guiding tail more efficient as a rudder.

F Greenaway: NHPA

It is mainly the difference in dentition that has caused the water shrew to be placed in a separate genus from the other shrews. Although the teeth have coloured tips like the others, the points of the incisors are more hooked and there are two less teeth than in other species.

The water shrew is found through most of Europe and southwest and northern Asia. In southern Europe and Asia Minor it is replaced by the closely-related Mediterranean water shrew, which is slightly smaller with the upperparts a slightly paler brown, and it lacks the keel of hairs on the underside of the tail. In the British Isles it is widely distributed throughout England, Wales and Scotland but is not found in Ireland, the Isle of Man, the Outer Hebrides, Orkneys or Shetlands.

Two species in North America, the northern water shrew and the Pacific water shrew, are very similar to the European water shrew. They range from Alaska south to California and eastwards to southeast Canada and northeastern United States.

P Morris

Jane Burton: Photo Res

Jane Burton: Photo Res

△ *Rudder and keel: the water shrew* ***Neomys fodiens*** *is well equipped for aquatic hunting. It can swim and dive well, using its fringed toes as paddles, sometimes walking on the bottom of streams. The long tapering tail, flattened from side to side, is an effective rudder and its silver-grey fringe on the underside acts as a keel.*
◁△ *Hungry hunter: a water shrew devours a stickleback with all possible speed.*
◁ *A water shrew without food for 2-3 hours will die of starvation.*

Walking on the bottom

Water shrews live on the banks of streams, rivers or lakes. They are more active by day than by night, with alternating periods of feeding and rest slightly longer than those of the common shrew. They seldom venture more than a couple of yards from the bank, swimming buoyantly with the head slightly above the surface and the body flattened. Water shrews appear to be able to walk for a time along the bottom of a stream, and at other times they make distinct leaps out of the water, presumably after flying insects. Their range of vision is limited, so a water shrew is readily alarmed only by sudden noises.

They make shallow burrows in a bank for sleeping quarters but there is no hibernation; in winter shrews may even be seen chasing their prey beneath the ice.

It always comes as a surprise to people to find a water shrew miles from the nearest river or lake, and it is not yet settled whether these are resident in such places or whether their presence there is transitory. Normally the water shrew has a home range of up to 60 yd, but live-trapping experiments made within the last few years have shown that some mammal species include residents, the majority, which keep to a home range, and transients, that seem to be more nomadic. It may be that water shrews found far from water are transients, or merely wanderers.

The water shrew has a cricket-like chirp, near the upper limit of the human ear, audible to young persons but inaudible to the elderly, as with the squeaks of bats.

A poisonous bite

Whirligig beetles and water gnats on the surface are chased by water shrews and at the bottom the shrews search for caddis worms and other insect larvae. They eat a variety of other aquatic animals such as snails, worms, small crustaceans, frogs and small fishes. They are not averse to carrion. Water shrews have also been caught in traps baited with cheese. Their bite is poisonous, and tests have shown that a secretion from their submaxillary glands can be lethal even to small rodents.

Short life span

The breeding season in the British Isles is from mid-April to September with a peak in May or June. The female burrows farther into the bank than for the sleeping quarters and the nursery is a small chamber lined with moss and fine roots, or there may be a round nest of woven grass or leaves. After a gestation of 24 days, 5–8 blind and naked young are born, each weighing just over $\frac{1}{10}$ oz. They develop rapidly, are weaned in 27 days and are independent at 5–6 weeks old. There is probably a second litter in September. The water shrew's life span is only about 15 months and most of them die well before this.

Many enemies

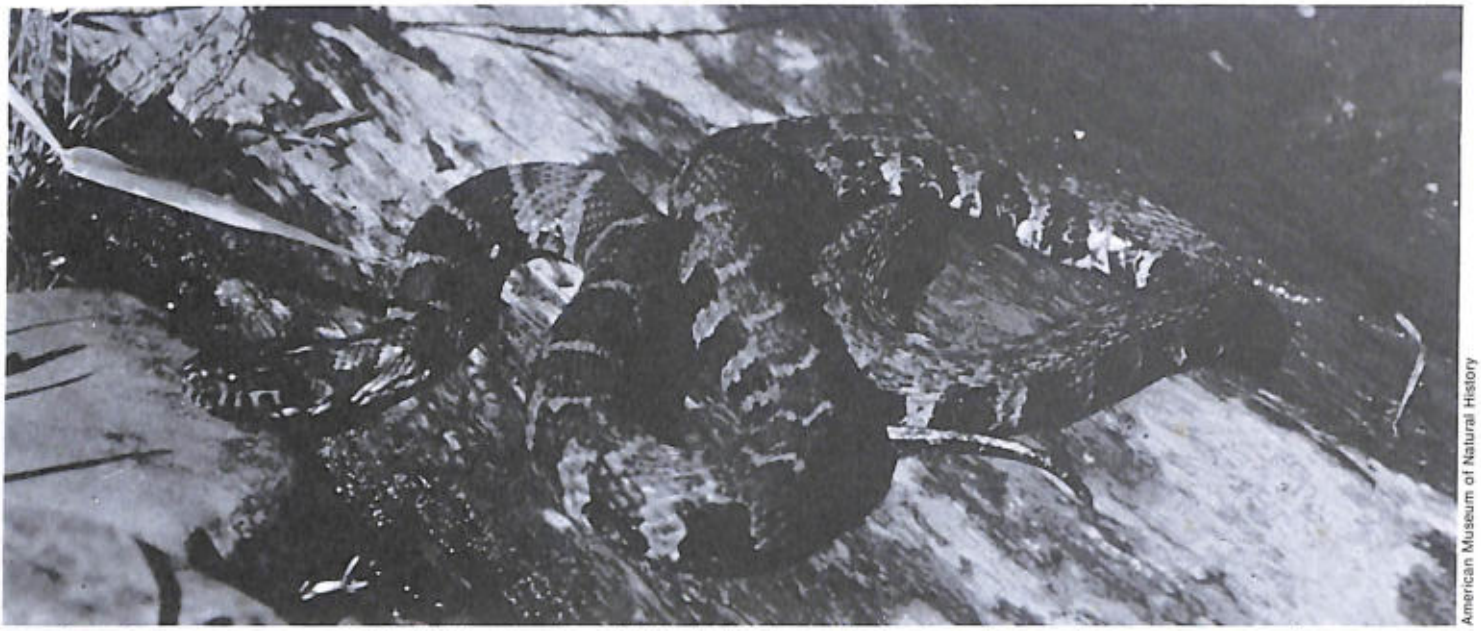
The chief enemies of the water shrew are owls, but they are probably taken by stoats, weasels, vipers and smooth snakes. Many more fall victim to the larger predatory fishes such as pike, eels and large trout.

Grooming over breakfast

As has already been said, water shrews have alternating periods of feeding and resting; a shrew without food for 2–3 hours will certainly die of starvation.

The water shrew is even worse off than other shrews in that, although it is an aquatic animal, it cannot stay long in water because it cannot stand long periods of exposure to cold. As soon as it has grabbed some food in the water it comes out onto the bank. It runs through the tunnel it has made in the bank to squeeze the water out of its fur, then it combs the fur to get rid of any water left, using its hindfeet, which are fringed with bristles and act as combs. If it did not immediately do this the waterlogged fur would cause it to lose heat even more rapidly and it would quickly die of cold. Not only does a water shrew eat its own weight of food in 24 hours, but it does what probably no other animal needs to do: it continues to eat while grooming its fur. Most animals have a meal and then groom themselves but a water shrew cannot afford to waste time in this way.

class	**Mammalia**
order	**Insectivora**
family	**Soricidae**
genera & species	***Neomys fodiens*** *water shrew* ***N. anomalus*** *Mediterranean water shrew* ***Sorex bendirii*** *Pacific water shrew* ***S. palustris*** *northern water shrew* *others*



American Museum of Natural History

Looped on a log—a common water snake. This handsomely marked North American snake is a close relative of the European grass snake.

Water snake

The name water snake is likely to be given to any snake that spends most of its life in or near water feeding on aquatic animals. Most water snakes belong to the family Colubridae, but those that have the best claim to the name have recently been given a family of their own, the Acrochordidae. They live on the coasts from India to the Solomon Islands and are nearly as well adapted to aquatic life as the sea snakes. The largest, ***Acrochordus javanicus,*** *sometimes known as the elephant's trunk snake, grows up to 6 ft in the largest females. The nostrils are on the top of the snout and can be tightly closed by muscular valves. The body is streamlined, as the scales are placed edge to edge rather than overlapping. For this reason these Oriental water snakes are used as snakeskin leather for shoes and handbags.*

A very widespread group of water snakes belong to the genus ***Natrix,*** *including the grass snake (p. 1082) of Europe. These water snakes are found in North America, Europe, North Africa and Asia as far east as the East Indies and can be regarded as one of the most successful and abundant of the non-poisonous snakes. There are about 75 species, most living in the Orient, 10 in North America and three in Europe, two of which have spread into North Africa. In appearance these water snakes are 'typical snakes', with fairly slender heads. The scales are ridged and rarely brightly coloured. The common water snake of North America* ***Natrix sipedon,*** *however, has red-brown bands or spots on its back with a white or yellow belly with bright red dots. This snake is also called the northern banded water snake or moccasin, but it should not be confused with the deadly water moccasin* ***Agkistrodon piscivorus,*** *a pit viper.*

In Africa south of the Sahara there are several water snakes, including the olive-brown water snake ***Lycodonomorphus rufulus*** *and the olive water snake* ***Natriciteres olivacea,*** *which rarely exceed a length of 1 ft, and the black-bellied water snake* ***Hydraethiops melanogaster*** *of the rain forests. In the Orient there are also the mountain water snakes* ***Opisthotropis,*** *and in the Orient, Australian and Pacific regions there are the rear-fanged water snakes of the sub-family Homalopsinae.*

Evil defensive odours

Water snakes are either non-poisonous or, as in the rear-fanged water snakes, only mildly so, When disturbed they escape by diving into water, but if cornered the water snakes of the genus *Natrix* will turn and attack. The common American water snake, which may grow up to 4 ft, flattens its body and strikes, sometimes drawing blood. No venom is injected but there is a danger of blood poisoning if the wound is not cleaned. The final line of defence is to emit an evil-smelling liquid.

The common American water snake lives in marshes, streams and lakes but, like other water snakes, spends much of its time sunning itself draped over branches overhanging water. Other *Natrix* water snakes are less attracted to the water and may often be found on land some distance from water. The Oriental water snakes, on the other hand, are extremely specialised. They are almost helpless on land and live exclusively in rivers and estuaries, sometimes swimming along the coast.

Fishes and frogs

The diet of water snakes is largely fishes or amphibians. The *Natrix* water snakes, in particular, feed largely on frogs, but the chequered water snake *Natrix tessellata* of Central Europe feeds mainly on fishes and is more aquatic in its habits than its frog-eating relatives. The black-bellied water snake of Africa is also a fish-eater and the dog-faced snake *Cerberus rhynchops* pursues mudskippers (p. 1670) overland. It is sometimes caught by anglers.

Varied breeding

There is a wide variety in the breeding habits of water snakes. The wholly aquatic Oriental water snakes bear their young alive. About 30 are born in each brood without the mother's having to come ashore. The American *Natrix* water snakes are also ovoviviparous which may, again, be related to their aquatic habits; the European water snakes, which are less aquatic, lay eggs.

Defences foiled

The olive-brown water snake of Africa feeds mainly on frogs, their tadpoles and occasional small fishes. Frogs have an admirable escape mechanism in their ability to jump 10—15 ft, and no doubt many a water snake has missed its meal through a timely jump by a frog. On the other hand, frogs are undoubtedly caught by water snakes. Dr Vincent Wager, an authority on African reptiles, has suggested that water snakes catch frogs as they come ashore into dense vegetation where only short jumps are possible. The snake chases the frog, grabs it by one leg then quickly throws a number of coils around its body. When the frog is properly trussed up, the snake manoeuvres its mouth over the frog's head.

Another water snake that overcomes its prey's defensive equipment is the common water snake of North America which eats catfish, ignoring the fin spines, although they may sometimes pierce the gut wall.

class	**Reptilia**
order	**Squamata**
suborder	**Serpentes**
families	**Acrochordidae** **Colubridae**

Water spider

Although many spiders can live temporarily underwater, or even voluntarily enter water, there is only one species that lives more or less permanently below the surface. It does so by constructing a diving bell.

There is nothing unusual about the appearance of the water spider. It is small-bodied and long-legged, the front part of the body light brown with faint dark markings, the chelicerae reddish brown and the abdomen greyish and covered with rather short hairs. An unusual feature is that the females are usually smaller than the males, the size range being 8—15 mm although females of up to 28 mm long—just over an inch—have been recorded.

The water spider ranges across temperate Europe and Asia.

▽ A male water spider, usually larger than a female, crawls over some water vegetation. Only the ***Argyroneta*** *species of spiders spend their entire life in the water.*

Jane Burton Photo Res

Stocking up with air

Although it lives permanently in water, the water spider is dependent on air for breathing. It rises to the surface and hangs head-down from the surface film with the end of its abdomen pushed up into the air. With a sudden jerk of the abdomen and the hind pair of legs a bubble of air is trapped on the spider's underside. The spider then descends, swimming down or climbing down the stems of water plants, to its thimble-shaped bell of silk, holding the bubble of air between its hindlegs. It enters and, with its head directed towards the top of the bell, the bubble of air slides forward under the spider and the front part of it is released, to rise to the top of the bell. The spider then turns round, directing the tip of the abdomen upwards, and releases the rest of the air, stroking the abdomen with the rear legs if necessary to brush it off. The spider then goes to the surface and swims down with another silver bubble, this being repeated until the bell is filled with air.

Building the bell

The bell is made by first spinning a platform of silk between the stems or leaves of water plants, with strands running out from the spider to the vegetation around. Wherever the spider goes it lays down a guide line of silk and this may serve other purposes than guiding the spider back to its home. The thread accumulation probably helps to secure the silken bell, and insects bumping into them probably alert the spider to the approach of prey. Once the platform of silk has been spun the spider releases air beneath it, making the silk web bulge upwards. As more and more air is added the web takes on the shape of a bell or thimble.

Lying in ambush

During the day the spider remains inside the bell, with the front legs pushed beyond the mouth of the bell, into the water. Any small animal, particularly an insect or its larva, passing near will make the spider dash out, seize it and return to the bell to eat it. An insect falling on the surface of the water will also set up vibrations to which the spider is sensitive, sending it to the surface to seize the insect and take it down to the bell to be eaten. By night the spider leaves its bell to hunt, but it will always return to the bell with its prey.

Aviating submariners

Mating begins in spring or early summer with the male loading his palps with sperm and setting out to visit a female in her bell. If she is ready to mate only a brief courtship ensues, otherwise she lunges at him, making him retire. Having mated with her he may remain in her bell for a while and even mate a second time. The female lays 50–100 eggs in a silken bag that takes up the upper half of the cavity of the bell. The eggs hatch in 3–4 weeks, the spiderlings biting their way through the bag into the bell where they stay for a few weeks, moulting twice during that time. Some of the brood stay in the same pond, but many go to the surface, climb out, spin threads of silk onto the wind and float away—to find a new pond or die.

Predators preyed upon

There is probably a heavy mortality as the young spiders disperse. Even after this stage of the life cycle has been safely passed, enemies are numerous. They include dragonfly larvae, backswimmers, water stick insects, beetles and their larvae, frogs, fish and possibly larger members of their own species. Whether cannibalism occurs in the wild or is, as so often has been demonstrated, the result of being in captivity, would be hard to say.

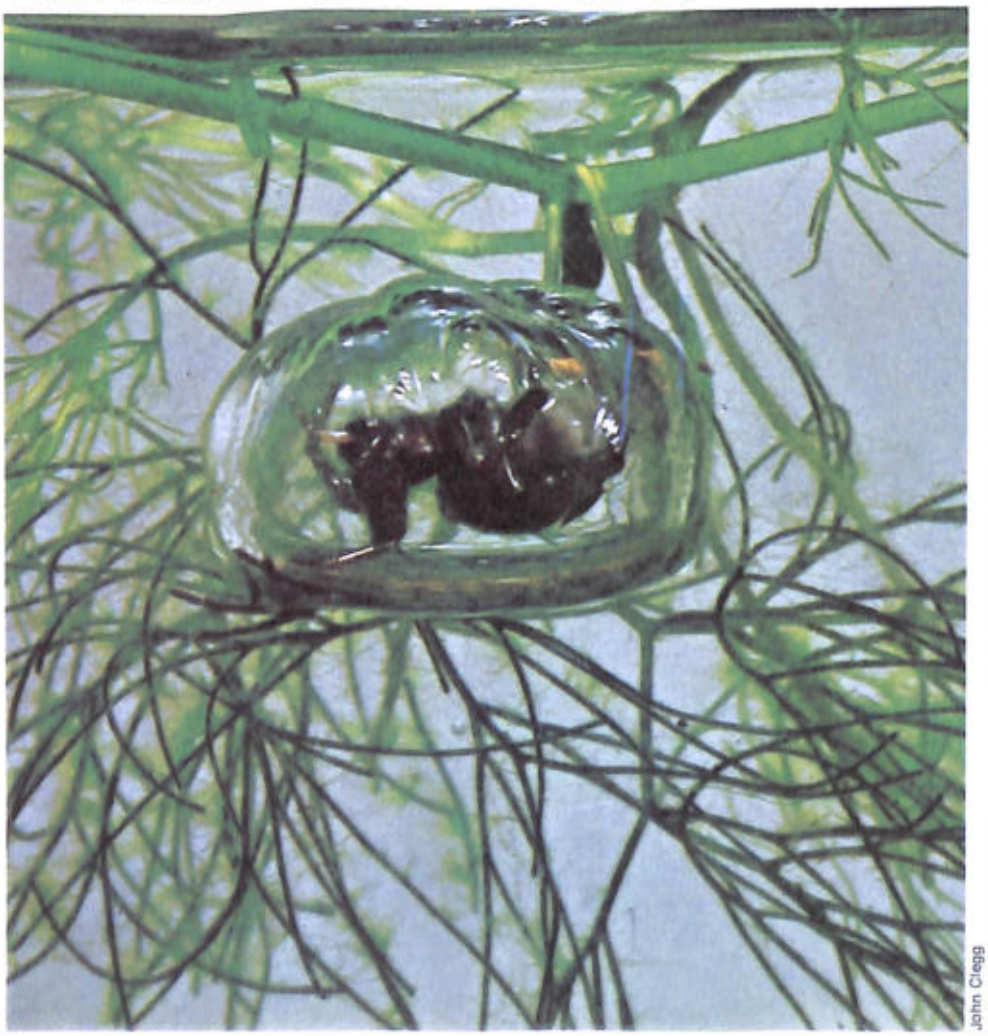
As winter approaches, water spiders go to a lower level in the pond and spin a winter bell, stocking it with air. Some will use an empty water snail shell lying on the bottom. The one bubble of air will last 4–5 months, since the spider is completely immobile and using almost no energy while in its submerged winter quarters.

Ten minutes' grace

Among other spiders that voluntarily submerge in water, one species has been tested experimentally. It is unrelated to the water spider, belonging to the family Pisauridae, and is named *Dolomedes triton*. WH McAlister, of the University of Texas, found that this spider requires a solid surface to push itself into and out of the surface film, and while submerged needs a solid support to cling to as an anchor. So it is fair to say that the spider deliberately enters water. In addition it was found to remain submerged voluntarily for 4–9 minutes, exceptionally up to 30 minutes. While being tested it was found to survive sustained immersion for up to 180 minutes, which is 10 times as long as most terrestrial spiders.

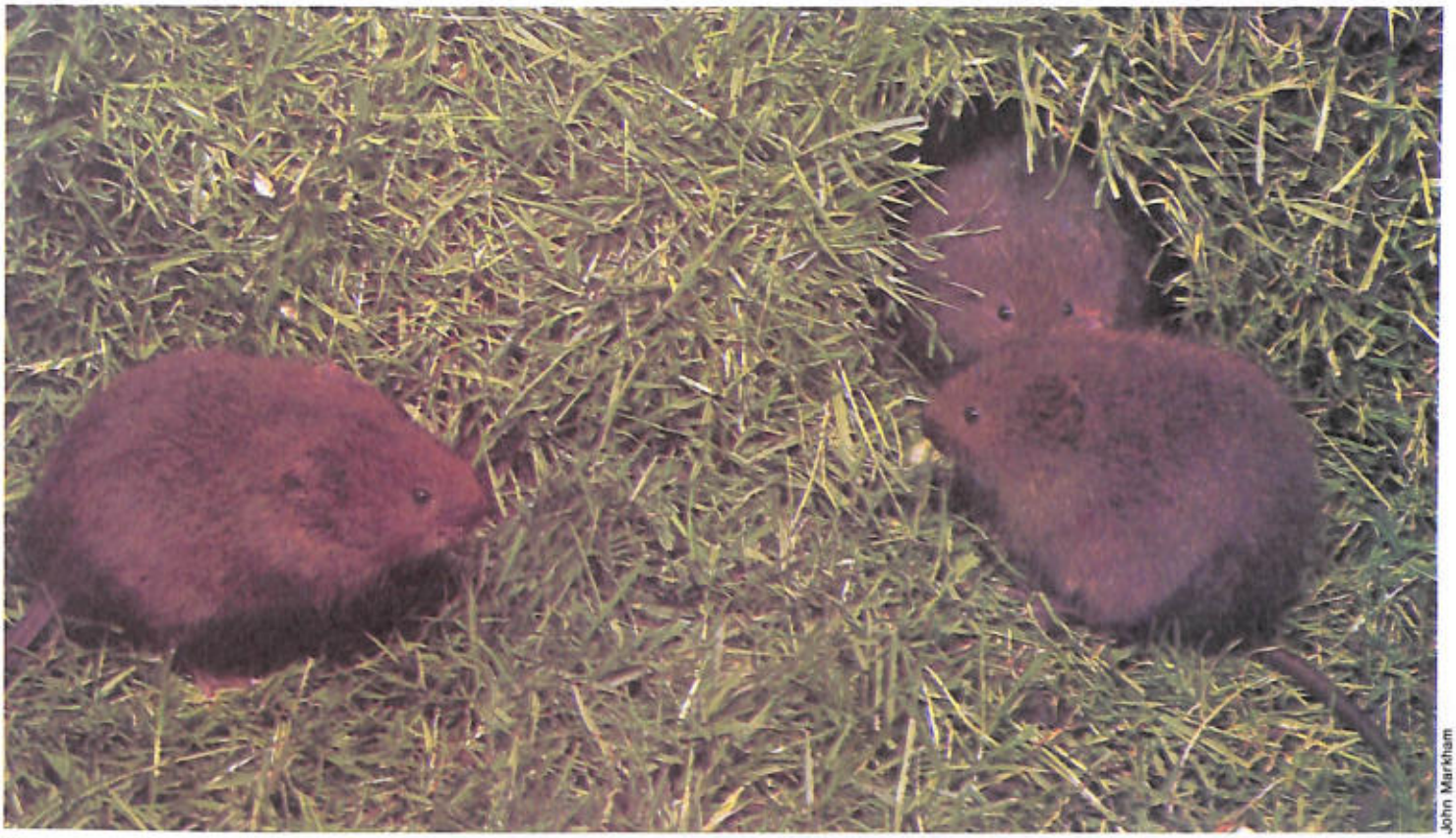
People often find a spider in the bath. Many are strongly averse to spiders yet are equally averse to killing one, so solve the problem by washing it down the wastepipe. They often ask—having perpetrated the foul deed—whether the spider dies from this. Most spiders tend to trap some air among the hairs on their bodies when immersed, and from McAlister's experiments it would seem that most spiders can stand up to 10 minutes' immersion, some can stand more than this, which should give them time to get out of the water to safety—provided the water used to wash them away is not hot.

▽ *A water spider inside its bell of air, which is still in the early stage of construction.*



John Clegg

phylum	**Arthropoda**
class	**Arachnida**
order	**Araneida**
family	**Agelenidae**
genus & species	***Argyroneta aquatica***



John Markham

Terra cotta trio: a family of water voles around the entrance to their burrow — made up of sleeping and food-storage chambers connected by tunnels.

Water vole

The water vole is apt to suffer from its folkname of 'water rat'. It is about the size of the common rat and can be easily mistaken for it, yet generally speaking cannot even be called a nuisance. Head and body total 7½—8½ in, and the tapering and hairy ringed tail is about 4½ in long. Its weight varies from 3¾—5¾ oz in winter to almost double this in summer. The females are slightly smaller than the males. The head is short and thick with a broad and rounded muzzle. The eyes are small and extremely short-sighted, and the small round ears scarcely project beyond the surrounding fur. The limbs are relatively short and the feet, which are not webbed, are naked, pale pink on the underside with five rounded pads, and clothed with stiff hairs on the upper surface. All the toes are well clawed. The long, thick, glossy fur varies from a blackish-grey to a warm reddish-brown above, sprinkled with grey, and the underparts are yellowish-grey. The female's fur is more chestnut. A few black melanistic forms are found, as are albino strains.

The water vole is found over most of Europe, parts of Russia and Siberia, Asia Minor, northern Syria, Israel and Iran. It is generally distributed throughout Britain, but does not occur in Ireland or on the Scottish islands. In many parts of its range outside Britain it lives entirely on land, burrowing rather like a mole.

Diving to safety

The water vole is found on the banks of streams, rivers and canals. It is thought to have a four-hourly rhythm of activity throughout the day and night, with feeding periods of about half an hour alternating with periods of rest or random movement. There is, however, disagreement among those who have studied the water vole; some describe it as mainly nocturnal. If the latter is correct then it can only be said that the rhythm of daily activity must vary from place to place.

Near a stream or canal the sudden 'plop' as a water vole drops into the water is the observer's first intimation of its presence. Occasionally its course can be tracked under water, but as a rule it disappears at once, to surface some distance away or retreat into a burrow in the bank, sometimes by an underwater entrance. It may regain the bank by an upper exit. It is a steady swimmer, its rate of progress being an even 2½—3 mph, but it is less skilful in swimming than in diving.

Bedrooms and larders

The burrows made by water voles have long winding passages with chambers for sleeping, lined with grass and hay, and chambers for storing food. The vole digs them at great speed with the forefeet, the earth being thrown out with the hindfeet. Stones are removed with the teeth and any roots that impede progress are eaten. The burrows sometimes cause considerable damage to the banks of dykes and canals. The water vole also does much good in helping to keep waterways clear of weeds and rotting vegetation.

The water vole does not hibernate, but it has been reported to lay up considerable stores for when food is scarce. Although it is aquatic, steady rain will keep it in its burrow or cause it to gather food from near the mouth of the burrow and eat it inside. Like the water shrew (p. 2676) it is sometimes found in fields far from water. It marks its home range with a scent from glands on the flanks conveyed to the ground by the hindfeet.

Vegetable eater

The water vole's diet consists mainly of succulent grasses, flags, loosestrife, sedges and other plants growing along river margins. They enjoy grain such as wheat, oats and millet, and apples are an especial favourite. It is thought that they sometimes eat freshwater snails and mussels, as well as caddis-worms and other insects, but this is not certain. Food stored in the burrow consists usually of different types of nuts, beech mast, acorns and the creeping underground stems of horsetails.

Bad weather curtails breeding

The breeding season is from early April to October. There may be fierce fighting among the males, but whether for possession of a female or for a territory is not clear. After mating, the female makes a thick-walled globular nest of reeds and grasses in a chamber under the bank, in a hollow willow, or even in a disused bird's nest. Sometimes the male helps her make the nest. After a gestation of 3—4 weeks, 2—7, usually 5, naked and blind young are born. At 10 days old their eyes are fully open and they are covered with thick, golden-red, smooth hair and at 15 days they come out into the open but do not take easily to water. By

Stephen Dalton: NHPA

△ *Water vole makes a meal of willow leaves.* ▽ *Swimming water vole leaves a wake of ripples.*

the third week they can feed themselves, swim fearlessly and are independent of the parents. It is thought that there may be as many as 3 or 4 litters a year, as the young of early litters mature so quickly and breed before the winter. There are fewer litters if the summer is cold and wet.

The life span is little more than a year in the wild because the older individuals are driven out of their territories by the younger voles and more readily fall prey to their numerous enemies. Herons, owls, otters, stoats, weasels, rats, pike, eels and large trout all prey on the water vole.

United in battle

A predator does not always get all its own way when attacking a water vole, for sometimes a whole family will unite to do battle against it. As soon as any male member of a family is aware of an intruder approaching it 'points' with its snout upwards and stands motionless, followed by all the other males. The females in the family and the babies retreat to the water's edge. One male then engages the enemy, scuffling, squeaking and biting. If the enemy is too strong for it the water vole will run and join the females and another male takes over the fight. At each engagement the females and babies dive into the water but usually return to the bank after a short while to watch the next round. The father is usually the last to enter the battle but quite often by this time the enemy is exhausted and makes its escape.

class	**Mammalia**
order	**Rodentia**
family	**Cricetidae**
genus & species	***Arvicola terrestris***

P. Morris

Wattlebird

The name wattlebird was originally applied to some Australian honeyeaters (p. 1227), but it has since been given to a small family of New Zealand birds. Of the three species one is extinct and two are very rare but efforts are being made to preserve them. It is uncertain which are the closest relatives of the wattlebirds, but they have been linked with the Australian apostlebirds, the birds-of-paradise and the bower birds. No doubt some ancestor must have crossed to New Zealand where the three forms evolved. Wattlebirds have rounded wings, long tails, strong legs, long hindclaws and wattles, usually orange, at the corner of the mouth. The huia, an extinct wattlebird, was most unusual; male and female had bills of different shapes. Their plumage was, however, alike, being glossy black with a white band across the top of the tail.

The kokako or wattled crow is jaylike with a stout, curved bill, and is 17–18 in. long, a little smaller than the huia. The plumage is bluish-grey with a velvet-black strip in front of the eyes and above the bill. There are two subspecies; that on North Island has bright blue wattles while that on South Island has orange wattles with blue at the root. The tieke or saddleback is thrush-sized, 10 in. long, with glossy black plumage, except for a chestnut 'saddle' over the back.

The huia was known to Europeans from only the southern part of North Island. The other wattlebirds were once widespread in both islands but the tieke is now restricted to Hen Island in the north, the South Cape Islands in the south and a few other islands where it has been introduced in recent years in an attempt to preserve it. The kokako is still widely distributed but is rare.

▽ *Claimed to be New Zealand's most versatile and beautiful singers: Kokakos or wattled crows. The South Island race* ***Callaeas cinerea cinerea*** *– the kokako with orange and blue wattles – is now very rare, living only in the dense mountain forests and bushes. The North Island subspecies* ***C. c. wilsoni*** *is still found locally in forests. Incapable of sustained flight, it moves by rapid bounding from one leg to the other. It feeds on leaves, berries and buds, often using one foot to hold its food, the other foot for tearing.*

Malcolm McGregor

Waxbill

The waxbills are a group of small, colourful, seed-eating birds, that are popular cage birds. Waxbills are related to the sparrows and weavers and the waxbill subfamily includes the mannikins, munias, cordon-bleus, silvereyes and many others well known to bird fanciers. Unfortunately, several have different common names which makes the term waxbill open to confusion. The cordon-bleus, for instance, are also called blue waxbills. The waxbills proper belong to the genus ***Estrilda*** *which also includes the striking avadavat (p. 258).*

Waxbills are small, usually about 4 in. long and many have finely barred upperparts. The species, known as the waxbill, the common waxbill or sometimes the St Helena waxbill, is brown with fine barring. There is a scarlet patch around the eye, the cheeks and throat are white and in the male there is a pink tinge to the underparts. It is found in many parts of Africa and has been introduced to St Helena and Brazil. Other waxbills have a similar confusion of names. The grey or red-eared waxbill is also called the common waxbill. The upperparts are grey-brown with a pink tinge and the underparts light grey with a pink tinge turning to crimson on the belly. There is a crimson stripe through the eye and the rump is black. The grey waxbill has recently become established in Portugal from aviary escapes. One of the smallest is the 3½in. locust finch that flies in dense swarms. Its plumage is almost black with red on the face and throat. The smallest waxbill of all is the zebra or orange-breasted waxbill with a crimson streak through the eye and a crimson rump. The throat is yellow becoming scarlet underneath and the sides are barred with yellow. Waxbills live in Africa south of the Sahara apart from the avadavat in Asia and the Sydney waxbill that lives in eastern Australia.

Grain eaters

Outside the breeding season waxbills are gregarious, living in parties, sometimes of only a few birds, but others, such as the locust bird, in large flocks. The members of a party continually call to each other with shrill or soft monosyllables designed to inform each waxbill of its fellow's position and to keep the party together. Waxbills are mainly found near rivers or in swampy country where they feed on seeds, particularly those of grasses, and are particularly abundant in grassland and in crops of cereals, in association with other seedeaters such as mannikins and whydahs. In Sierra Leone the flocks are followed by rats which feed on the seeds they spill. In general, waxbills occur in too few numbers to be pests. They also eat some insects and catch flying termites.

Jacana

△ *The distinctive southern grey waxbill.*
◁ *Overleaf: A small and prettily coloured bird, the orange-cheeked waxbill.*

Husband's annexe or decoy?

The typical waxbills differ from their near relatives by building nests with tubular entrances projecting from a ball of grass that are very much like the nests of sparrows and weavers. The nest is built of grass stems or flowering heads woven into an untidy mass and fastened to vertical stems or placed on the ground among grass or herbage. Some waxbills decorate the nest with paper, damp earth, feathers and other materials and a peculiar feature of the nests of true waxbills is that there is a so-called 'cock nest' incorporated into the top or side of the nest or built a short distance away. It has been said that the cock nest is used as a roost by the member of the pair that is not incubating the eggs. There is, however, no proof of this and Derek Goodwin has suggested that the cock nests may mislead predatory birds into overlooking the real nest.

The nest is built by the female waxbill but the male helps with the decoration and with lining the nest with feathers. Both sexes incubate the 4–6 white eggs, which hatch in 2 weeks. One species feeds the chicks by regurgitating seeds. The chicks solicit by gripping their parents' bills. The young waxbills fly in 16-17 days.

Getting their own back?

Many waxbills are parasitised by some of the related whydahs, also known as widow birds. The whydahs lay their eggs in the waxbills' nests and their young are brought up with the young waxbills. Not all the whydahs are, however, parasites and one waxbill, the zebra waxbill, has to a certain extent reversed the situation: it lays its eggs in the nests of whydahs and bishops, but only when they have been abandoned. Bishops and whydahs finish nesting in March and the waxbills then start their nesting season taking over the nests of the bishops and whydahs and relining them.

class	**Aves**
order	**Passeriformes**
family	**Estrildidae**
genus & species	***Estrilda astrild*** *common waxbill* ***E. locustella*** *locust finch* ***E. melpoda*** *orange cheeked waxbill* ***E. perreini*** *southern grey waxbill* ***E. temporalis*** *Sydney waxbill* ***E. troglodytes*** *northern grey waxbill* ***Amandava subflava*** *zebra waxbill* *others*

Waxwing

The three waxwings are named after the red tips of their secondary flight feathers which look like blobs of sealing wax. Similar but smaller blobs are also found on the tail feathers. Waxwings are starling-sized, 6—7 in. long, with prominent pointed crests, fairly long wings and slightly rounded tails. The bill is short and slightly hooked. The nearest relatives of the waxwings are the silky flycatchers of America, such as the crested phainopepla ***Phainopepla nitens.***

The waxwing that breeds from northern Scandinavia to Kamchatka also breeds in western Canada and Alaska, where it is known as the Bohemian waxwing. The plumage is soft pink or grey-brown, shading to grey on the rump. There is black around the eyes and chin and the flight feathers are black with yellow and white. The black tail is tipped with yellow. The cedar waxwing of southern Canada and the northern United States is very similar but the plumage is generally paler and it lacks the yellow and white on the wings. The Japanese waxwing is like the cedar waxwing but has a red tip to the tail and red bars on the wings but no wax droplets. It lives in eastern Siberia and migrates to China and Japan.

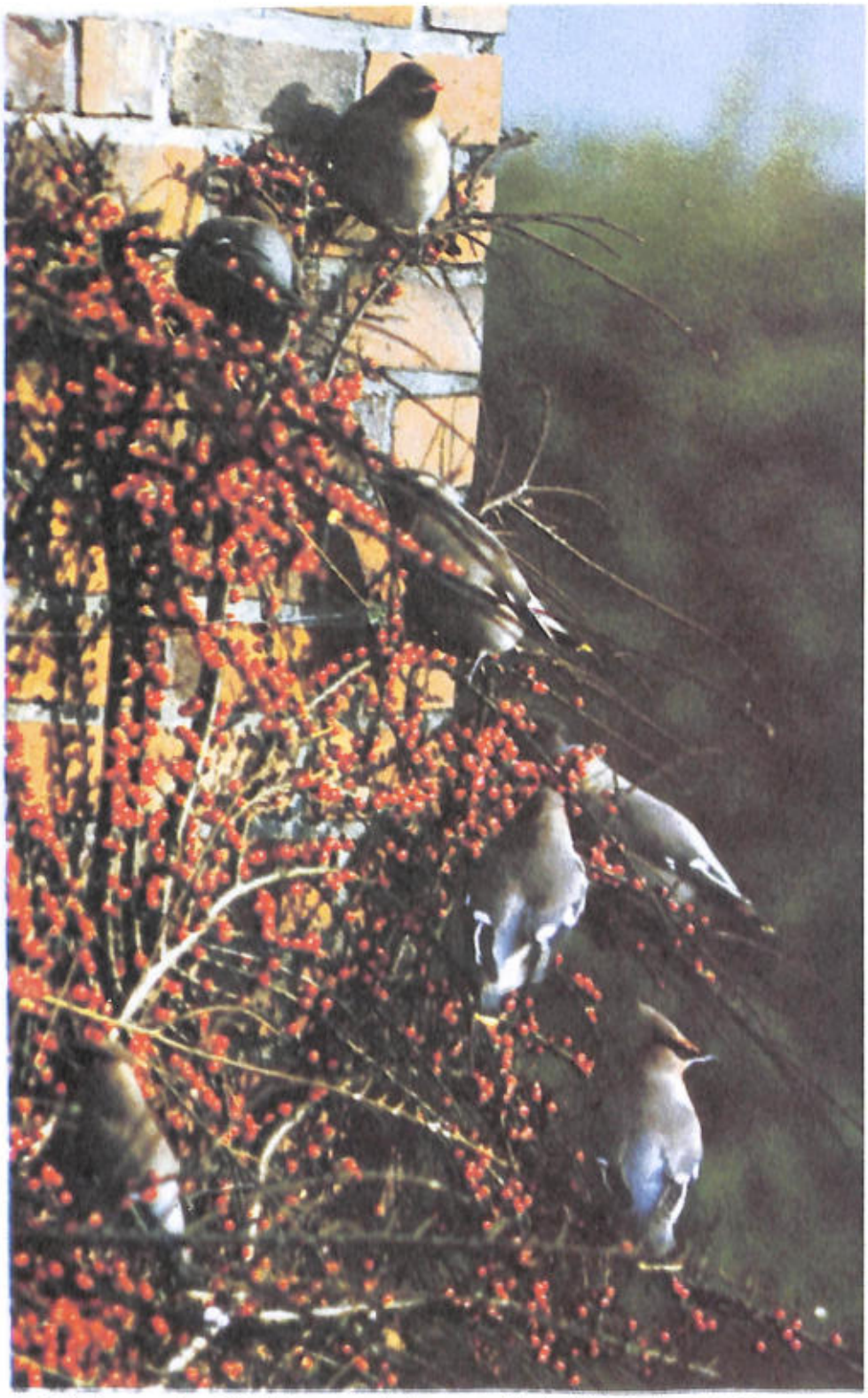
Playing with berries

Apart from their pretty appearance waxwings are noted for their irregular migrations and wanderings. Small numbers usually migrate south in the winter but there are occasional mass movements of large numbers when waxwings can be seen in flocks which, on rare occasions, reach Central America and the Mediterranean. It has often been noticed that the waxwings in these winter flocks are sluggish, perching motionless for long periods and allowing themselves to be approached quite closely. When perching the members of a flock often huddle closely together, sometimes touching each other but usually keeping an inch or so apart. Even in winter waxwings sometimes feed each other like they do during courtship, when the food, or even an inedible object, is passed to and fro between two birds. Cedar waxwings have been seen to pass food from one to another along a line and K Parkes recounts seeing a house sparrow join the line of waxwings and swallow the berries as they reached the end.

The nomadic habits of the waxwings extend even to their breeding. Nesting takes place in the coniferous and birch forests of northern Europe, Asia and America but the waxwings shift their breeding grounds from year to year, depending partly on the local abundance of food. Perhaps related to this is the general lack of territorial behaviour. Nesting waxwings defend no territory other than the nest itself and the song is very poor, being no more than a thin trill.

KH Hümmler

▷ *Family circle. It is quite common for cedar waxwings to pass food from one to another.*



Fritz Siedel

△ *Bohemian waxwings. The birds were probably attracted by the bright berries of the* ***Cotoneaster****.*

Berry eaters

In the summer waxwings eat mainly insects, catching flies in the air or foraging on the ground. Flower petals and oozing sap are also eaten but the main food throughout the year is berries such as those of juniper, yew, rowan and elder. Blackberries, hawthorn, holly, cherries and many other berries have also been taken.

Little aggression

Waxwings' nests are usually solitary but, as there is no defended territory, nests are sometimes placed close to each other. The nest is a cup of twigs lined with moss and grass and built in a pine or birch tree.

Even at the start of the nesting season waxwings are fairly sociable and there is only a limited amount of rivalry between the males. During courtship the feeding of the female by the male is accompanied by a display in which both birds puff out their feathers, particularly those on the rump.

The male waxwing also feeds the female while she incubates the 3–7 eggs for 2 weeks. The male also plays a small part in incubation and both parents feed the chicks.

Starvation exodus

Providing there is plenty of food many waxwings spend the winter in the northern parts of their range, even north of the Arctic Circle. Others migrate southwards and every few years there is a mass exodus known as an irruption. In winters when an irruption has taken place waxwings are seen in large flocks and stragglers appear far to the south of their usual limit of winter migration. In the winter of 1965/66 there was an irruption of waxwings from northern Scandinavia, Finland and northwest Russia and waxwings appeared as far south as Portugal, Sicily and Greece.

Irruptions of waxwings, crossbills (p. 715), lemmings (p. 1431) and other animals are usually caused by a season of plentiful food, when the population expands, followed by a failure of the food supply which then forces the large population to travel in search of food. The waxwing irruption of 1965/66 was predicted in advance by Kai Curry-Lindahl because these conditions had been fulfilled. The winter of 1964/65 had been unusually mild and there had been a good crop of rowan berries in northeast Europe. As a result the waxwings survived the winter well and large numbers nested in 1965. Rowans, like other plants, cannot fruit well two years running, and in the autumn of 1965 the large population of waxwings was faced with a food shortage and they were forced to move, leaving the White Sea region in late September, and arriving in southern England in mid-November with stragglers reaching Portugal and Sicily in January.

class	**Aves**
order	**Passeriformes**
family	**Bombycillidae**
genus & species	***Bombycilla cedrorum*** *cedar waxwing* ***B. garrulus*** *Bohemian waxwing* ***B. japonica*** *Japanese waxwing*

Weasel

Although similar in form to its near relative the stoat (p. 2400), the weasel is smaller and lacks the black tip to the tail. The average length of the head and body of the adult male is 8½ in., plus a tail of 2¾ in. The female is 1 in. or so less in total length than the male, and weighs on average 2 oz against his 4 oz. Because of this smaller size, the females are known in some districts of Britain as cane weasels and were formerly believed to represent a distinct species. The long slender body, short limbs, long neck and small head give the weasel a snake-like appearance which is heightened by its active gliding movements. The fur is a reddish brown with white on the throat and underparts, but the line of demarcation between the colours is less pronounced than in the stoat. It has been said that a weasel is small enough to pass through a wedding ring. It is hard to persuade a living weasel to perform this trick but it has been proved that a weasel's skull can be passed through a wedding ring.

The weasel is found throughout Europe, across Asia to Japan and from Siberia in the north, southwards into China and Afghanistan. Its range also extends into North Africa.

The least weasel which is widespread in North America is smaller than the Old World species as is the pygmy weasel which is said to occur in some parts of Europe. It is now fairly widely agreed that both of these should be considered as subspecies of the Old World weasel.

Jane Burton: Photo Res

△ *A versatile hunter and obviously able seaman, the weasel will often swim after water voles.*

Ferocious killer

The weasel is found in almost every type of habitat including woods, scrubland, hedgerows, rocky country, barns and even at times in large towns. Although it is mainly nocturnal, it is sometimes active by day and it is possible that it has alternating spells of activity with periods of rest. It is swift and agile in movement, a good climber and swimmer and a relentless killer, hunting mainly by scent. Like other members of its family the weasel is courageous and ferocious out of all proportion to its size, and will attack animals larger than itself. It has been seen struggling to haul along a nearly full-grown rat, two or three times its own weight, killed by a bite through the base of the skull. Sometimes weasels hunt in pairs or in family parties. The normal method of hunting is to stalk or trail the prey and then to pounce swiftly and kill with a bite on the back of the victim's head. 'Charming', however, is sometimes used and this has been fully described under the red fox (p. 2063).

Weasels occupy territories which they probably mark with musk from the glands under the tail. This musk is also released when an animal is severely disturbed and it may also be used to bring the males and females together in the breeding season.

Like stoats, weasels undergo a change to a white coat in autumn in the more northerly parts of their range although as a rule there is no seasonal change in their fur in more southerly parts; an occasional individual may, however, be white or partially

▽ *On the attack: a rabbit jumps into the air to escape the weasel.*

▽ *Snared: the weasel wraps itself around the rabbit for the final kill.*

Photos by Pamela Harrison

Jane Burton: Photo Res

white in winter. The causes of the change appear to be the same as those discussed under stoat.

The voice is a guttural hiss when alarmed and a short screaming bark when disturbed, but neither is heard very often.

Staple diet of voles and mice

The weasel's food includes rats, mice, voles, moles, frogs, small birds and their eggs and an occasional fish. It will swim in pursuit of the water vole and climb trees and bushes to rob birds' nests of eggs or young. Voles and mice are, however, the principal victims, a weasel's small size enabling it to pursue these rodents in their underground runs. When very hungry it will eat freshly killed shrews or very rarely carrion, and it does some damage in poultry runs.

Two litters in a season

The female weasel builds her nest of dry leaves, grass or moss in a hole in a bank or low down in a hollow tree. Pregnancy may occur in any month from March to August, but is most frequent in April and May. There is no delayed implantation and the gestation period is about 6 weeks. There are usually 2 litters in a season consisting of 3–8, usually 5, kittens. They are weaned at 4–5 weeks and are taught to hunt and kill by their mother. Young males of the first litter grow rapidly and are sexually mature by August, as are some of the females. Second litters grow more slowly and do not mature until their second year. A weasel has been known to live up to 6 years old.

Natural enemies

The weasel's natural enemies are the larger hawks, owls, foxes, wild and domestic cats and sometimes even stoats. The numbers taken, however, are not large and the effect on the weasel population is negligible.

Man still its enemy

In former times the hand of every gamekeeper and farmer was raised against the weasel for its alleged raids on game birds and poultry. It was shot and trapped and every gamekeeper's 'gibbet' had its weasel corpses hanging on it. The accusations of poultry and game killing were undoubtedly justified to some extent but today many people have realised that the weasel does more good than harm by keeping down the numbers of small rodents in the countryside. It has been estimated that a male weasel probably kills at least 500 small rodents a year and a female 300. This, and the fact that there has been a steady decline of widespread game preserves in recent years, is reducing the number of weasels killed each year.

class	**Mammalia**
order	**Carnivora**
family	**Mustelidae**
genus & species	***Mustela nivalis*** *weasel*

◁ *Usually an active hunter, the weasel seldom eats carrion. Here the exception is a bream.*

Weaver

Weavers are small, mainly seed-eating birds which live in Africa and Asia, but there is some confusion as to precisely which birds the term weaver refers to. Sometimes it includes the family Estrildidae which contains the avadavat, waxbills, mannikins and others, some of which have the common name of weaver. Nowadays this family is often referred to as the weaver-finches and only the members of the family Ploceidae are called weavers, or 'ploceid weavers' to avoid confusion. The Ploceidae contains the buffalo-weavers, the sparrows (p. 2335), and the true weavers. The true weavers are further divided into two groups, one of which contains the bishopbirds (p. 351), the fodis and the queleas (p. 2024). This account will consider the other group alone, mainly because most of the other groups of 'ploceid weavers' have been treated separately. This is also the simplest method because the habits and appearances of this vast mass of birds are very similar, hence the confusion in classification.

There are about 70 species of weaver, most living in Africa south of the Sahara but a few live in southern Asia and the village weaver has been introduced to Haiti. They are sparrow-sized birds, about 6 in. long, and have the conical, seed-eating bills of the house sparrows. The males of many weavers have bright plumage during the breeding season but revert to the same drab, streaky plumage as the females outside the breeding season. The males of the 10 species of ***Malimbus,*** *sometimes known as malimbes, have red in their plumage. The red-headed weaver, or red-headed malimbe, is black all over with a red 'cap' on the crown and nape. The males of the species of* ***Ploceus*** *have yellow plumage. One of the best known is the village or black-headed weaver. It is golden-yellow with a black head and black streaks on the back and wings. The five Asian species of* ***Ploceus*** *are much alike. The baya weaver, which ranges from Pakistan and Ceylon to Sumatra, is mainly black above and pale brown underneath with yellow on the head and neck above the eye and black under it.*

Peter Ward

Varied habitat

Weavers are found, often in large flocks, in a variety of habitats, but always where there are trees where they can roost and nest. The malimbes are found in evergreen forest while the *Ploceus* weavers are found in a variety of wooded country. The masked weaver, for instance, prefers watercourses and often nests on branches that overhang water. Others are found in dry savannahs or in marshes. As a general rule weavers in which the males are brightly coloured in the breeding season live in drier areas. The

Arboreal architecture

◁ *Nests of the village weaver bird hang like pendulous fruits from the branches of a palm tree in equatorial Africa. The weavers strip so much leaf material from the palm fronds to construct their nests that eventually the palm will probably be killed.*

▷ *Yet another nest completed, the male village weaver builds nests compulsively. After each construction he 'advertises' it to the females by hanging upside down at the entrance, at the bottom of the nest, flapping his wings and chattering.*

▽ *In contrast to the rather carelessly woven nest of the village weaver is the neatly built home of the baya weaver bird. The tubular entrance, which can be as long as 2 ft, is a good deterrent against predators, coupled with the fact that the nest is suspended.*

▽ ▷ *The early stages. This male red-headed weaver* ***Malimbus rubricollis*** *has a long way to go before his nest is complete. The end product will be a rough but elaborate home made of tendrils and leaf midribs. The entrance will be at the end of a downward funnel.*

KB Newman

Peter Jackson: Photo Res

Peter Johnson

dull eclipse plumage is associated with the formation of large flocks that wander about the country in the dry season to search for food. Some, like the spectacled weaver, are not so gregarious.

Grain, seeds and insect food

The majority of weavers feed on seeds, particularly grass seed, and several species have become pests of grain crops, although not to the same extent as the quelea. Insects are also eaten particularly by three species of *Ploceus*, which have slender bills, and the malimbes. These weavers hunt among the foliage or along branches and tree trunks, agilely hopping up or down like nuthatches.

Nest-building runs riot

Weavers are named after the elaborate flask-shaped nests which they make from strands of grass or palm fronds. Each nest is separate but a single large tree may contain hundreds of the nests of the village weaver. The nest is built by the male who cuts a notch in a palm frond or grass stem, then strips a 2ft thread from it, making himself a pest in palm plantations. The strips are first woven into a loop which acts as a foundation for a hollow ball, with an entrance tunnel up to 2 ft long suspended from it. When the main structure is completed the weaver displays at the entrance to attract a female. If she accepts both male and nest, mating takes place and the female lines the nest and lays her eggs. In the village weaver, the baya weaver and many others, particularly those in which the male has bright breeding plumage, the male builds several nests, courting and installing a female in each. When they run out of partners, the males continue to build nests which remain unused and usually half-finished. Some species of weaver are monogamous and the insect eaters are territorial.

The clutch consists of 2 or 3 eggs which are incubated by the female.

Belt-braces security

It must be extremely difficult for any predator to invade the nest of a weaver. The nest is not only suspended from a twig, it is protected by a vertical tunnel up to 2 ft long. One cannot, for instance, imagine a snake or a mongoose managing to climb down the outside then turn up through the entrance. Yet weavers very often employ a second line of defence by building their nests near aggressive animals that may dissuade other predators. The village weaver, for instance, often nests near human habitations or near the nests of large birds of prey and in Malaya the baya weaver nests in trees swarming with ants.

Weaver nests are not, however, immune to cuckoos, such as the South African cuckoo *Chrysococcyx caprius*. Many cuckoos, including the European cuckoo, mimic the eggs of their hosts, choosing the right host for their eggs. Parasites of the weaver, however, have an additional problem because weaver eggs are very variable, those of the masked weaver having different patterns in different localities. Yet the South African cuckoo follows suit, and has an astonishing ability to mimic local patterns, laying eggs that match the different weaver eggs.

class	**Aves**
order	**Passeriformes**
family	**Ploceidae**
genera & species	***Malimbus rubricollis*** *red-headed weaver* ***Ploceus cucullatus*** *village weaver* ***P. ocularis*** *spectacled weaver* ***P. philippinus*** *baya weaver* ***P. velatus*** *masked weaver* *others*

▽ *Patiently waiting for their turn to feed, golden weavers* ***P. bojeri.***

JP Varin: Jacana

DG Bone

Weddell seal

Of the four Antarctic seals—crabeater, leopard, Ross and Weddell—we know most about the Weddell seal. Unlike the others it breeds around the coastline and because it lives under the sea-ice near land it is possible to walk out over its home and to study it with comparative ease. When first discovered this seal was called Weddell's sea-leopard, after its discoverer and its spotted coat. The Weddell seal could, indeed, be mistaken for a leopard seal but for its small head and distinctly tubby body. Adult males grow to just over 9 ft and females grow a little longer, the record being 10 ft 9½ in. The colour of the coat varies, being usually dark or light grey with white streaks and spots. In summer the fur fades to a dirty brown. The seal has a dog-like face with a benign expression that is accentuated by the rolls of fat around the neck and the long, often curling whiskers.

Weddell seals are found all around the coasts of Antarctica and its neighbouring islands. The most northerly breeding colony is on South Georgia but they are sometimes seen around the Falkland Islands, New Zealand and southern Australia.

Living icebreaker

The Weddell seal is the most southerly living mammal, being found in considerable numbers along the coasts of the Weddell and Ross Seas. They are usually found in sight of land and only infrequently seen on pack ice. They spend most of their time in the water, where the temperature is usually higher than the air temperature, but on fine days in particular, Weddell seals haul themselves out of the water to bask. They prefer to lie on the ice but if this is not available they will choose the smoothest rocks they can find. They probably haul out to digest after feeding, for while they are diving their blood is diverted from the intestine to the essential organs, for example the brain.

Throughout the winter in most parts of the Weddell seal's range, and over the whole year in some parts, the sea is frozen to a depth of 4 ft or more. To breathe the seals have to either find a crack or lead in the ice or to carve a special breathing hole. These breathing holes are opened, and kept open, by vigorous sawing actions of the mouth. As a result the teeth of Weddell seals are blunted and the loss of the teeth may be a prime cause of death in old seals. It is known that Weddell seals travel long distances from one breathing hole to another but these animals are not migratory. How the seals locate their breathing holes is certainly a mystery.

△ *Roly-poly female seal will lose about 300 lb in the 6–7 weeks before her pup is weaned.*

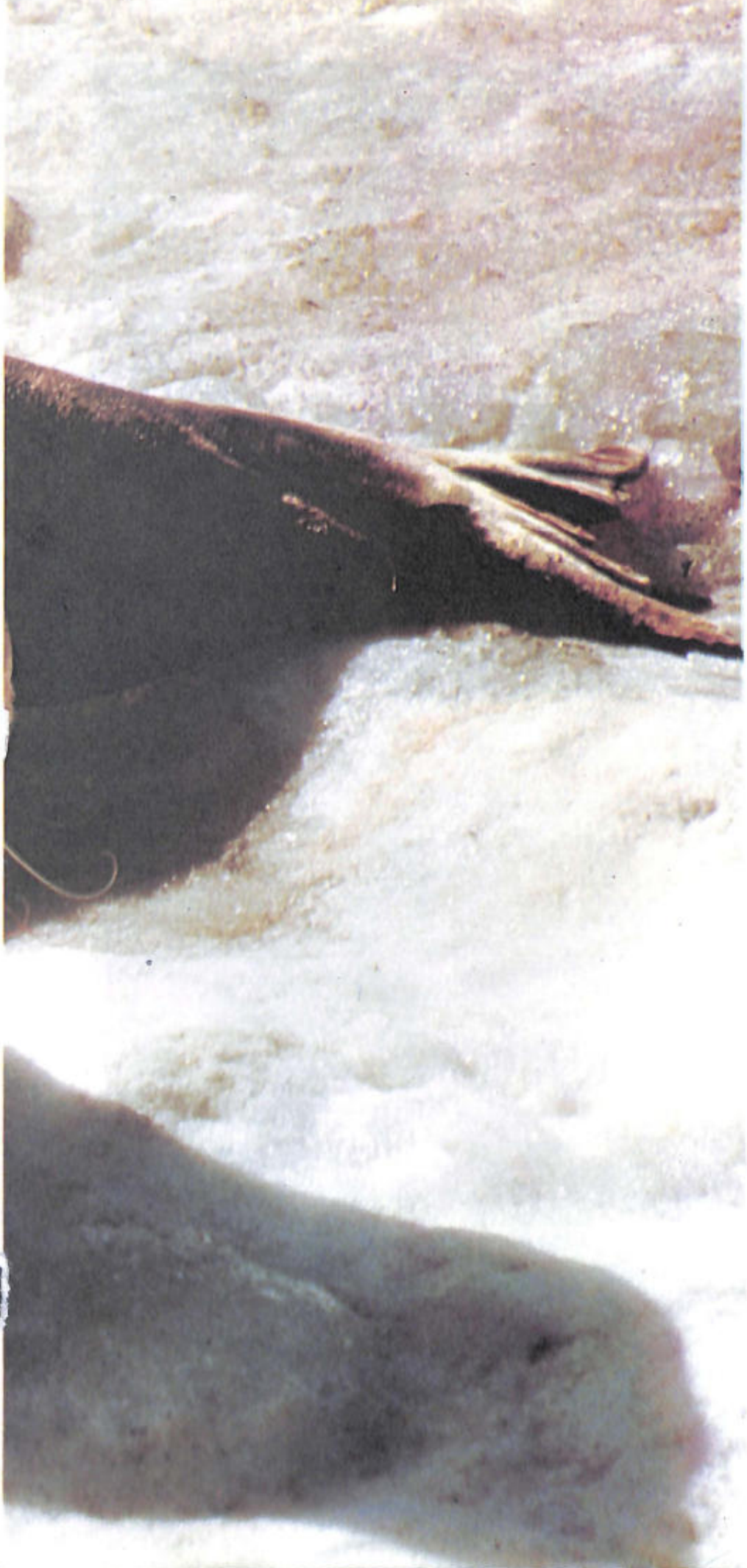
Babies learn to fish

The food of Weddell seals is mainly fish, such as Antarctic cod and icefish, which they find on the sea bed and in midwater. Fish of up to 45 lb have been found in their stomachs. They also eat squid and octopus and many kinds of planktonic crustaceans. Krill are usually eaten only when the seals are hunting in the pack ice. Like other seals, young Weddell seals start by eating only crustaceans, learning to catch fish later.

Chilly reception

For most of the year Weddell seals are solitary but in early spring, from late August onwards, female seals haul out of cracks and holes in the ice to give birth to their pups. They may gather in groups of 20 or more at this time, but these concentrations are mainly the result of the seals taking advantage of the available openings in the ice. The pregnant seals do not emerge more than about 100 yd from the shore unless there is a suitable rock or islet offshore. In the northern parts of their range they sometimes give birth on land.

The single pup, which is just under 5 ft long, is born a few days after the mother has hauled out on the ice. It is born during the coldest part of the Antarctic year, yet it has no protective layer of blubber and may



British Antarctic Survey

suffer a drop in temperature of over 100° F as it leaves its mother's body and hits the ice.

The cow stays with her pup until it is weaned 6–7 weeks later. During this time she does not feed and changes from a plump animal hardly able to heave herself over the ice to a skinny creature whose bones are showing. She loses about 300 lb, much of which is passed to the pup as milk and converted into fat, so that by the time it is weaned the pup can hardly move. The pup may first enter the water when only a few days old. The mother is very solicitous, and even helps it out of the water. There is hardly a more charming sight than a female Weddell seal and her pup leisurely swimming underwater or floating nose to nose in the waves while the pup utters its plaintive cries.

The males have nothing to do with rearing the pup. During the pupping period they establish territories and occasionally they fight. These fights have sometimes been seen on the ice. The seals appear to be very ferocious but the tough hide and thick blubber, together with their blunt teeth, prevent much serious damage being done, although male Weddell seals are often found with one eye blinded or their flippers mutilated. Mating takes place after the pups leave the mothers. As it has never been seen it presumably takes place underwater.

Champion divers

Although Weddell seals live in an inhospitable part of the world, they are remarkably good animals to study. They are fearless of man and it is sometimes possible to place a tag on a hindflipper while the seal just looks on placidly. As they live in frozen seas one can walk out over their home and in recent years American scientists have entered the Weddell seal's home using aqualungs or underwater observation chambers. Here they recorded the strange bird-like trills and whistles that can be heard from above the ice. These calls are connected with the holding of territories but it seems that these territories are not as exclusive as those of song birds, for the dominant Weddell seal will allow other seals into the territory provided they behave respectfully.

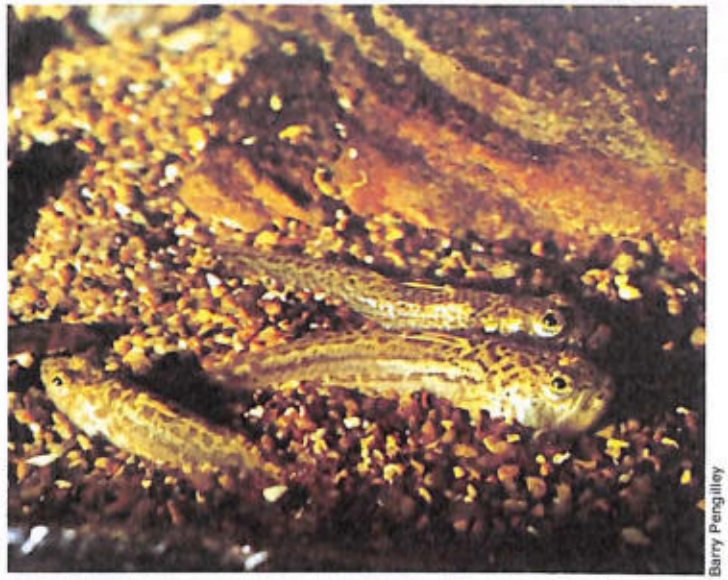
The scientists have also studied the diving abilities of Weddell seals by attaching a depth recorder to a seal then retrieving it when the animal surfaces at the breathing hole. Weddell seals appear to be the champion divers among seals. They have been recorded as diving to 2 000 ft and as staying submerged for up to 43 minutes, 20 seconds.

class	**Mammalia**
order	**Pinnipedia**
family	**Phocidae**
genus & species	***Leptonychotes weddelli***

◁ *A nonchalant wave of the flipper and a benign look for the cameraman—Weddell seals are not afraid of man and are easy to approach. Scientists have been able to attach tags to a hind flipper while the seal looked placidly on.*

Barry Pengilley

On the move: a greater weever in active and therefore relatively harmless mood. When at rest, half buried, its dorsal fin is a constant danger.



Barry Pengilley

Eyes on the top of the head and upward-tilting mouths—adaptations shown by this greater weever trio to a life in sand and gravel beds.

Weever

There are only four species of the small weevers or weeverfishes but these are so notorious they probably have more local common names than any other fish. Their name seems to be from the Latin ***vipera*** *for a snake. Two of their other common names are stingfish and sea dragon.*

The fish itself has a long body with a fairly small head, a wide mouth directed upwards and large eyes well up on the head. The first dorsal fin is short and supported by a few spines. The second dorsal fin and the anal fin are long and low, the tail fin is relatively large. The pelvic fins are small and lie forward of the largish pectorals. Each gill cover bears a stout poison spine. The body is greyish-brown to yellow, with spots and blotches of these colours, and the first dorsal fin is black or mainly black. The scales are arranged in oblique rows on the body. The greater weever, the largest of the weevers, is 1½ ft in length, but most weevers are only a few inches long.

Weevers range from the coasts of Norway to West Africa and also into the Mediterranean, mainly from low-water mark to 300 ft.

Hidden danger

They live on sandy bottoms, lying for much of their time buried in the sand with little more than the eyes and dorsal fin exposed. Weevers tend to be local in distribution, numerous in some places, sparse in others. Since they are often taken in nets at night they are probably more active then. In the Mediterranean the greater weever is numerous and is caught for food. In other places it may be used as fish meal. The importance of weevers is the danger they present to the unwary. When lying buried they erect the dorsal fin at the slightest disturbance and the unwary bather may easily tread on one. Shrimp fishermen working inshore often take them in their nets and must be careful how they handle them. Even when they have died in the nets, the spines of the dorsal fin, which are connected to poison glands at their bases, and the poison spine on each gill cover, can cause excruciating pain. The poison is said to be sometimes fatal but reliable records of this are hard to find. The venom is a nerve poison which has distressing psychological side effects. There is reputed to have been a case of a fisherman, maddened by pain, who cut off his own finger to get rid of the poison.

Attractive eyes

The food of weevers is mainly bottom living animals, including crustaceans such as shrimps and small crabs, and small fish such as gobies, sand eels and small flatfishes. Small bivalve molluscs and marine bristleworms are also eaten. The greater weever has a similar diet but feeds more especially on fishes, particularly sand eels. The weever, although apparently mainly active by night, feeds also by day, pouncing on passing prey or snapping it up as it passes close overhead. It has been suggested that its bright eyes looking up from the sandy sea bed lure fishes to it.

Spines are defensive only

The greater weever spawns from June to August: a slightly more extended season is found in the lesser weever. The eggs are $\frac{1}{25}$ in. diameter and float in the sea. They hatch in 5–10 days. The rest of their life history has not yet been studied, understandably, so, perhaps, in view of the poison equipment of the fish. The dorsal spines have poison glands at their bases. The spine on the gill cover is ensheathed in skin with only its tip projecting, and there is a deep groove along both its upper and lower margins. There are no ducts to carry the poison to the spines and it is released into a wound only when the cells of the poison tissue are ruptured. This suggests that the poison is purely defensive, which is supported by observations showing that a weever does not poison its prey. A fish attacking the weever is, however, soon killed. A goby attacking a weever dies within 90 seconds, after threshing about violently and then turning on its back, but it continues to twitch for another minute after death. A blenny twice the size of a weever, attempting to swallow it, died within 2 minutes.

Human guinea pig

Another reason for supposing the poison spines of weevers are purely defensive is the black colour of the dorsal fin, which becomes very prominent when the fin is erected. Against the yellows and pale browns of the weever's skin, or against the yellow sand when the weever is buried, the effect could be like the black and yellow of a wasp's body—a warning to predators not to touch. To be an effective defence against a predator a poison need not necessarily be lethal but it must produce a painful sensation instantly, before the predator's jaws have had time to do damage. This aspect of weever biology was investigated in 1961 by Dr DB Carlisle, at the Plymouth Marine Laboratory. He held a piece of sponge—with forceps—to the poison spines of a weever, to collect the poison, then he injected small doses into his own arm. The pain was immediate and this was followed by a rise in his pulse rate and respiratory distress—even with much diluted doses. Carlisle describes the immediate pain as 'more severe than that of any other venomous sting'. The poison is due to 5-hydroxytriptamine, 'one of the most potent of pain-producing substances'. So rope-soled shoes for bathers can be a wise precaution.

class	**Osteichthyes**
order	**Perciformes**
family	**Trachinidae**
genus & species	***Trachinus draco*** *greater weever* ***T. vipera*** *lesser weever* *others*

Weevil

Insects form the most numerous and diverse class in the animal kingdom, and the beetles, which include the weevils, are the largest insect group. Entomologists have already described and named about 40 000 species of weevils and every year several hundred new ones are discovered—and no doubt there are hundreds still unknown to science.

Most weevils are small, ⅛ in. or so long. A few attain ½ in. and there are tropical weevils of up to 3 in. They are generally very compact, with the head drawn out into a snout, called the rostrum. In some species the rostrum is long, slender and downward curving, and it is longest in the females; in other species it is quite short. The jaws are at the end of the rostrum. Often the antennae arise from a point halfway along the rostrum and are elbowed at the end of the first joint so that they can be folded back into a groove on each side of the rostrum. Many weevils are wingless and few of them fly much.

Trials of motherhood

All weevils are plant feeders, both as larvae and adults. The female uses her snout, with its terminal jaws, to drill a hole in a stem, bud or fruit. She then turns round and extends a long egg-laying tube or ovipositor from inside her body and deposits an egg at the end of the tunnel. Sometimes a female weevil can come to grief doing this. As she is boring into a nut or acorn her feet may slip and she is then left poised on her embedded nose, her legs waving helplessly in the air. She has no means of extricating herself from this situation and remains there until she dies. The larvae, little white legless grubs, usually live inside the plant tissues. Some pupate within their larval habitat, while others gnaw their way out and turn to pupae in the soil.

Old World weevils

The majority of weevils feed on some particular species or genus of plant, and often on a special part of the plant, and there are few plants without their associated weevils. This accounts to a great extent for the remarkable diversity of this family of beetles. The following are examples of weevils attached to particular plants.

The female nut weevil, of the Old World, bores into hazel nuts while they are still green and lays an egg in each one. The larva feeds on the growing kernel until the nut falls in the autumn, when the mature larva gnaws its way out and pupates in the soil. The proverbial 'bad nut' is a hazel nut either containing or vacated by a little white legless grub.

▽ *Glossy black weevil:* ***Liparus coronatus*** *a European species that feeds on carrots shows the downward-pointing head rostrum and clubbed antennae typical of weevils. This group of the Coleoptera contains more species than any other animal group: many are notorious as pests on fruit and vegetables.*

MT Tanton

The figwort weevil is a small brown beetle with a black dorsal spot. The larvae are unusual in feeding openly on the leaves. They are covered with slime and pupate attached to the plant in cocoons formed of hardened slime. These very closely resemble the seed capsules of the figwort and no doubt derive protection thereby from insectivorous birds.

The eggs of the gorse weevil are laid in batches of a dozen or so in the seed pods of the gorse plant. The larvae feed on the seeds and pupate inside the pods, hatching on dry days in summer when the gorse seed is ripe and the pods are splitting. In this plant the pods split or dehisce suddenly with a cracking sound and the seeds are scattered quite widely. Infested pods dehisce in just the same way, but in this case it is beetles instead of the seeds that are hurled around. So the weevils are spread as far as the gorse seeds on which they feed. This weevil has been introduced to New Zealand to control the spread of introduced gorse.

One of the largest European weevils is the large pine weevil, about ½ in. long, blackish with patches of short yellow hair. It lives on coniferous trees, especially pine, and the adult beetles do serious harm to young pines by feeding on the tender bark of the shoots and on the buds. The larvae are comparatively harmless boring into the old stumps and roots of felled trees.

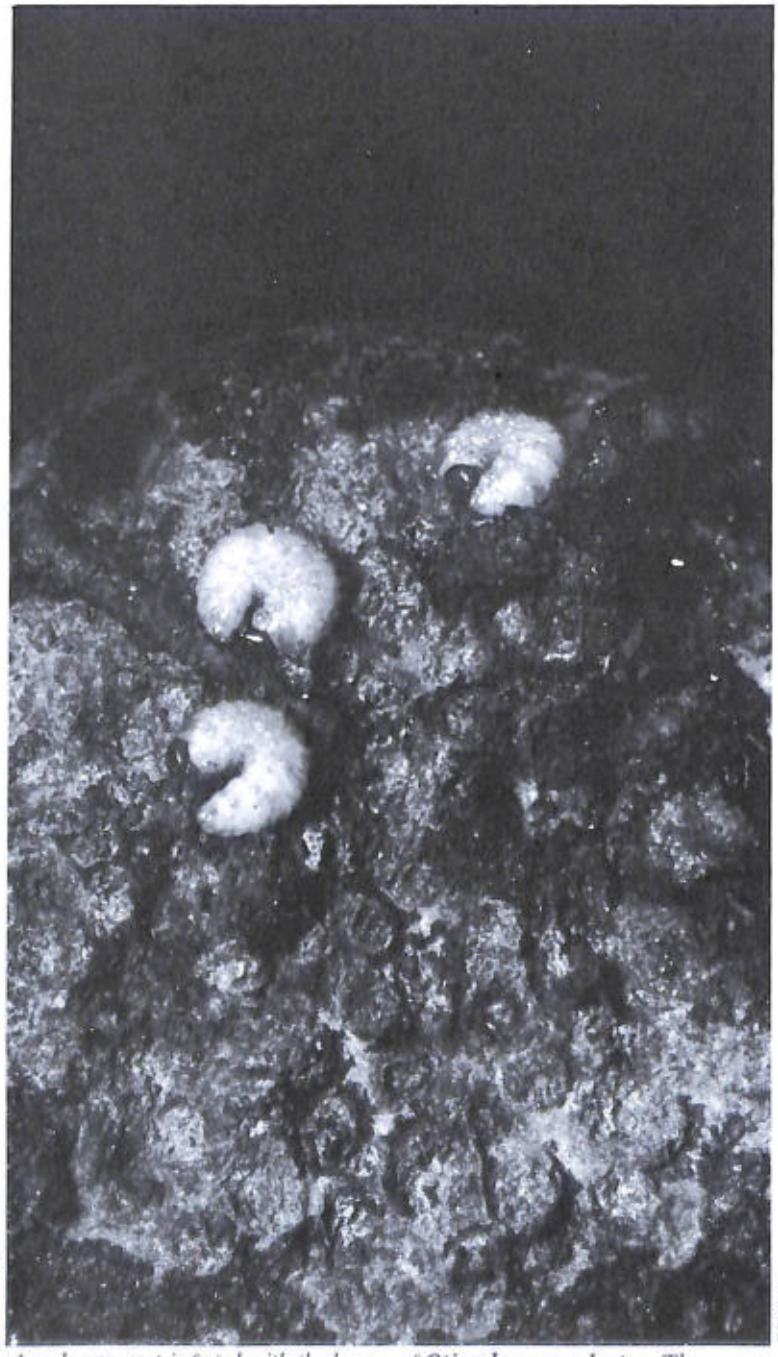
Curse on cotton

The close attachment of particular weevils to particular plants has of course led to some of these beetles becoming agricultural pests. A weevil feeding on a wild plant that is brought into cultivation will almost certainly multiply enormously when its food plant, normally scattered among many other kinds of wild flowers, extends, uninterrupted, for hundreds of square miles. The pine weevil is a pest in forestry plantations of young pine, but for a weevil whose depredations are economically really impressive we must turn to the southern United States, where the cotton boll weevil costs the American cotton industry between one and two million dollars a year.

This notorious insect first invaded southern Texas from Mexico in 1892 and rapidly spread to all the cotton-growing regions. It is a typical weevil, compact, brown in colour, ¼ in. long, and it has a stout, down-curved rostrum. Its eggs are laid in the buds or, later in the season, in the fruits of the plant, one in each, and a single female may lay 100–300 eggs. The life cycle

Shell Photo

Cosmopolitan pest: ***Sitophilus oryzae*** *attacks stored grain products. In a rice grain only one larva develops but a maize seed may contain several.*



GE Hyde

A cyclamen root infected with the larvae of ***Otiorrhyncus sulcatus****. The larvae damage the roots of many garden plants, the adults attack foliage.*

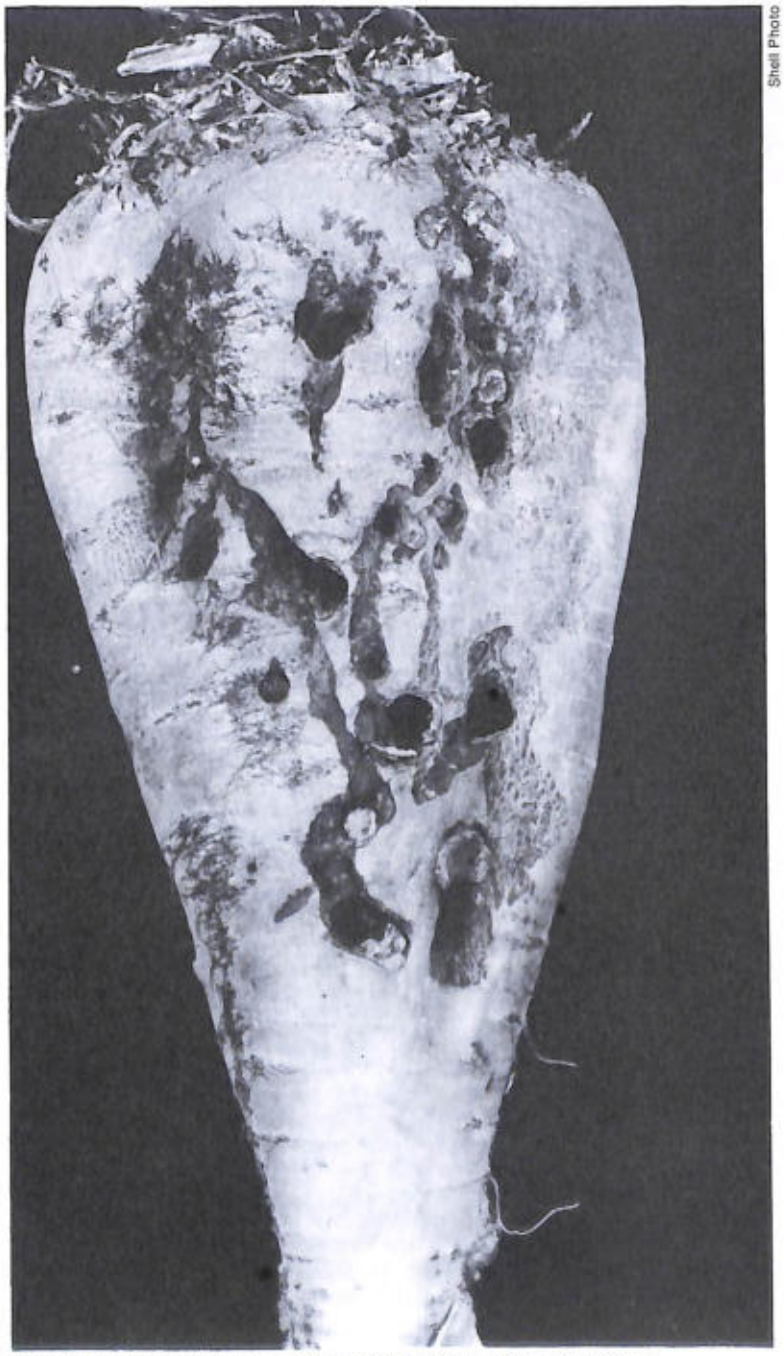
takes only 3 weeks and in some localities there may be ten generations in a year. The bolls that are infested are rendered useless, and once inside the bud or fruit the larva is largely protected from sprayed or dusted pesticides. Carefully timed applications of insecticides are partly effective, and burning debris, in which the adults overwinter, is an important control measure.

From one point of view the boll weevil can be regarded as a benefactor of the southern United States. Before it invaded the area agriculture was concentrated on two crops, cotton and tobacco, and so was very vulnerable to price fluctuations. The weevil forced the farmers to diversify their agriculture and the economy of the American South has undoubtedly benefited from this. One city has acknowledged indebtedness to the boll weevil by erecting a statue to it.

Sailor's hard-tack

The Anglo-Saxon word *wifel*, from which weevil is derived, referred to the grain weevil which has infested stored grain since prehistoric times. The egg is laid, and the larva lives inside cereal grains of all kinds, hollowing them out and causing serious damage if uncontrolled. It can be destroyed by fumigation in suitably constructed stores. It also infests any foodstuffs prepared from flour, and is the weevil that we read about in the stories of sailing ship days. The staple food on board was a sort of thick, hard biscuit in which the grain weevil thrived. Fastidious sailors broke their biscuits and tapped them on the table to dislodge the little grubs and beetles; others ate them as they were and were possibly better nourished as a result.

phylum	**Arthropoda**
class	**Insecta**
order	**Coleoptera**
family	**Curculionidae**
genera & species	***Anthonomus grandis*** *cotton boll weevil* ***Apion ulicis*** *gorse weevil* ***Cionus scrophulariae*** *figwort weevil* ***Curculio nucum*** *nut weevil* ***Hylobius abietis*** *large pine weevil* ***Sitophilus granarius*** *grain weevil* *others*

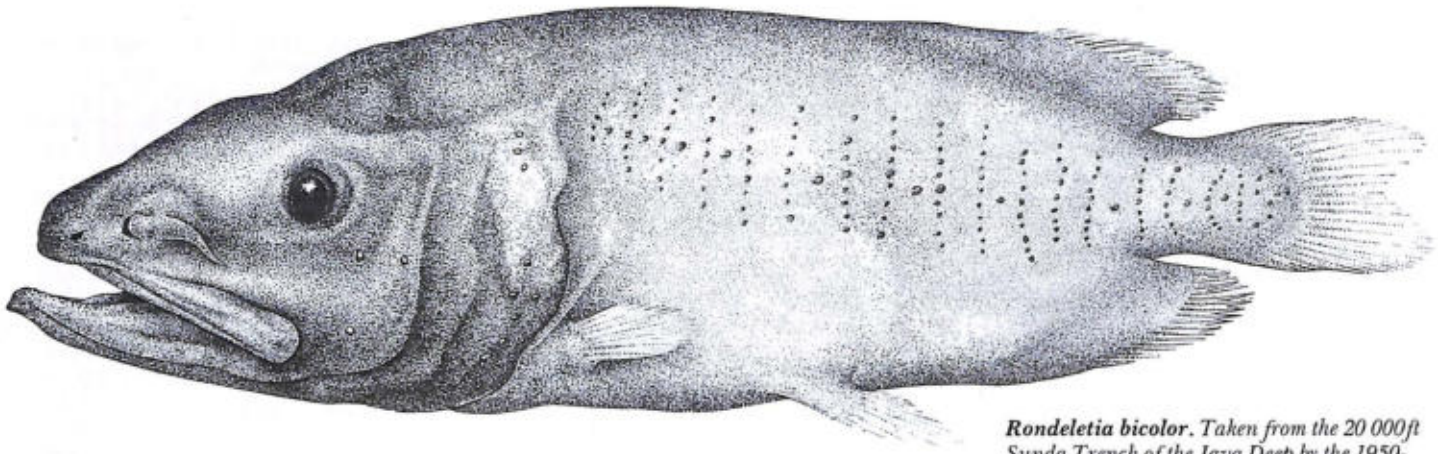


Shell Photo

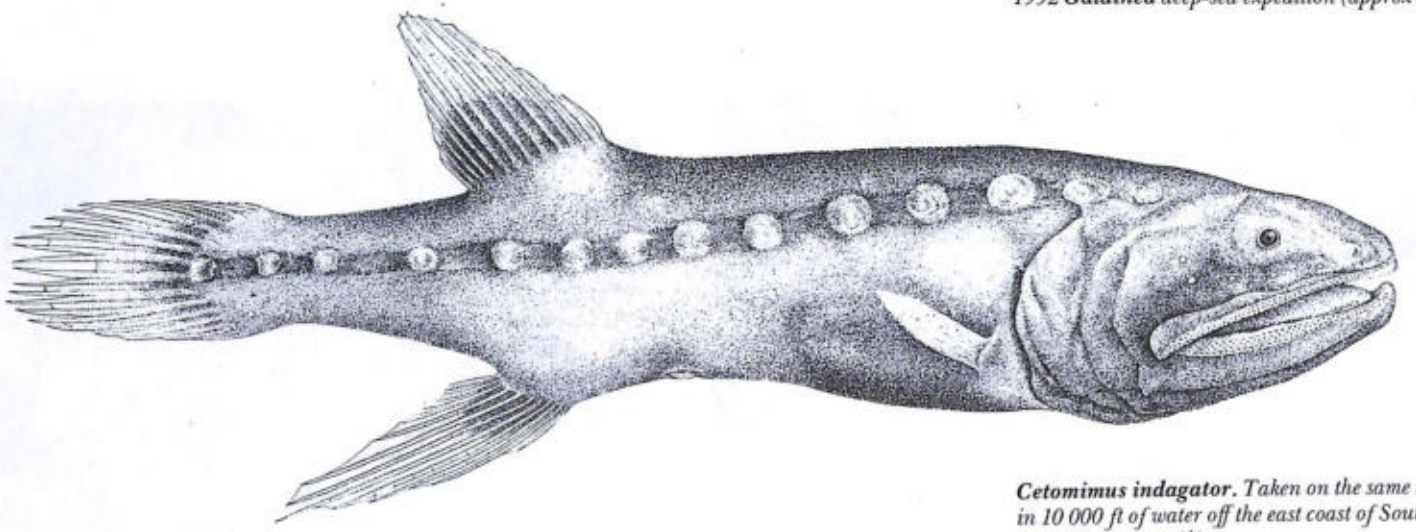
Tunnels bored by the larvae of the sugar beet weevil ***Temnorrhinus mendicus*** *make this vegetable useless for marketing.*

Klaus Paysan

A major pest of apple: ***Anthonomus pomorum*** *is found especially when orchards adjoin woods, providing favourable hibernation conditions.*



Rondeletia bicolor. *Taken from the 20 000 ft Sunda Trench of the Java Deep by the 1950-1952* ***Galathea*** *deep-sea expedition (approx × 2).*



Cetomimus indagator. *Taken on the same trip, in 10 000 ft of water off the east coast of South Africa (approx × 1½).*

Galathea Report

Whalefish

Whalefishes are not named for their size. They are small deep-sea fishes, the largest being 9 in. long, and most of them are 4 in. or less. They resemble the leviathans of the sea in their shape, especially in the head and relatively huge mouth, which are also similar to the head and mouth of the large whalebone whales. Whalefishes are either blind or have degenerate eyes; when eyes are present they are only about $\frac{1}{25}$ *in. diameter. Like so many deep-sea fishes whalefishes are black, but in contrast with other deep-sea fishes they have brilliant patches of orange and red around the mouth and fins. The body is plump but delicate and tapers in the rear third to a relatively small tail fin. The dorsal fin is fairly large and soft-rayed and so is the anal fin that lies opposite on the underside of the tail. Both these fins have luminous patches believed to be due to a secretion from glandular patches at the bases of the fins. There are usually no pelvic fins and the pectoral fins are small.*

The relationships of whalefishes are obscure. They were at one time placed in a separate order Cetunculi, then they were placed in a suborder near the squirrelfishes (p. 2373). Now they are placed in the order Cetomimiformes, near the salmon-like fishes, order Salmoniformes. The 30 species of whalefishes live at depths of 6–18 000 ft in tropical seas, from the Gulf of Mexico to West Africa and in the Indian Ocean to the western Pacific.

Touch at a distance

Blind or poor sighted fishes in order to find their way about have a highly sensitive lateral line. Whalefishes have a lateral line made up of a relatively enormous hollow tube communicating with the exterior by a series of large pores, which suggests they have a highly developed distant touch and are able to detect the slightest vibrations in the water. They lack a swimbladder so the question arises as to how they maintain a position in mid-water without sinking. The answer probably lies in 'flotation appendages', typically cone-shaped, which lie between the pores of the lateral line.

Homing on vibrations

The stomach is highly distensible, so a whalefish is able to swallow fishes as large as itself. The position of the single dorsal and anal fins, set far back on the body, recalls the pikes, which capture their food by a quick dart forward. In view of what we know of the poor eyesight of whalefishes, we can only suppose they detect their prey from the vibrations the prey set up in the water. If a whalefish then darts at its prey its lateral line organs must detect the vibrations and give accurate direction-finding as well.

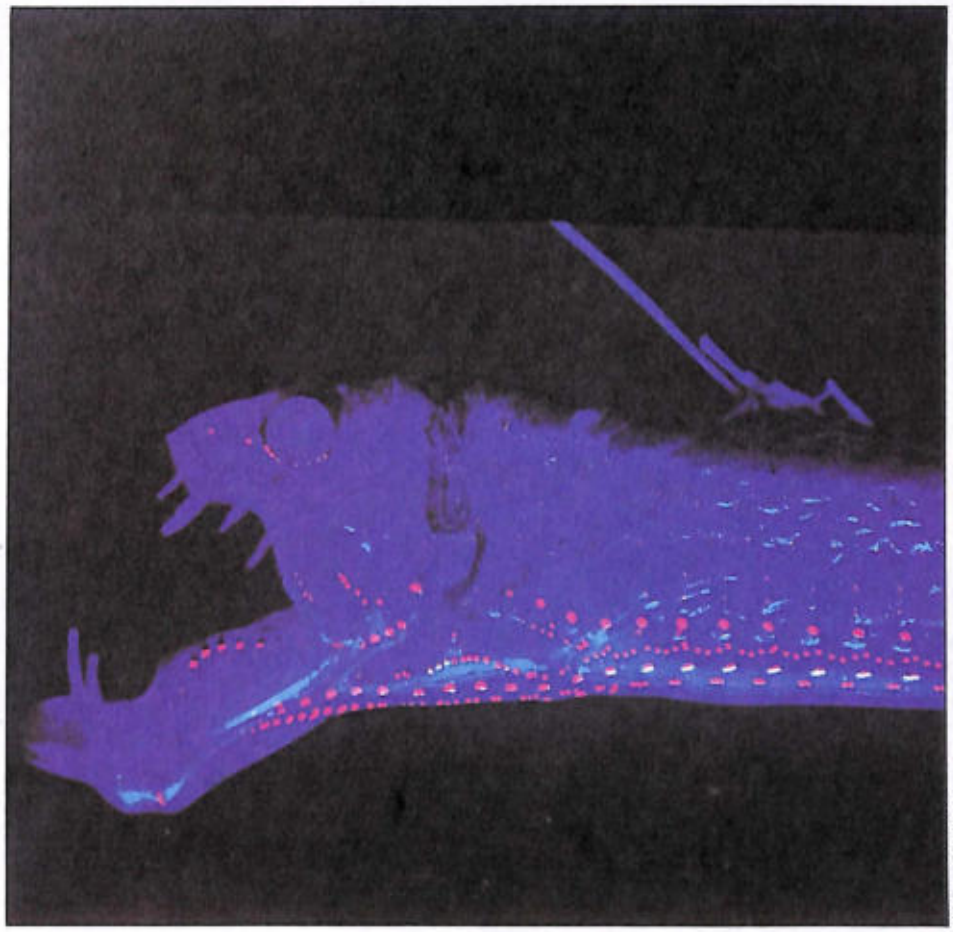
Going blind with age

Practically everything that is written about the way of life of deep-sea fishes must be based on speculation, or deduction from what can be studied of the structure in a dead specimen. Nothing is known of the life histories of whalefishes, yet there is reason to suppose that the larvae live in the surface layers of the ocean. This supposition springs from a detailed examination of the eyes of two species of whalefishes. In one, *Gyronomimus*, the tiny degenerate eye is covered by a small transparent area of pigmented skin. It has no remains of a lens, no iris and no eye muscles. The retina consists of a single instead of a double layer and little is left of the optic nerve. The other, *Ditropichthys storeri*, was previously thought to have lost its eye entirely but it was realized it has an optic nerve branching out to the region where the eye would normally lie. Close examination with the microscope has since shown that there are, in the adult of this species, the remains of a retina and lens, mere vestiges, as if the eye were slowly degenerating. All things considered it seems reasonable to suggest, therefore, that the larval whalefishes have eyes and live in the surface layers where light penetrates, and that the eyes degenerate as the fish grows up and sinks down to the depths of the ocean.

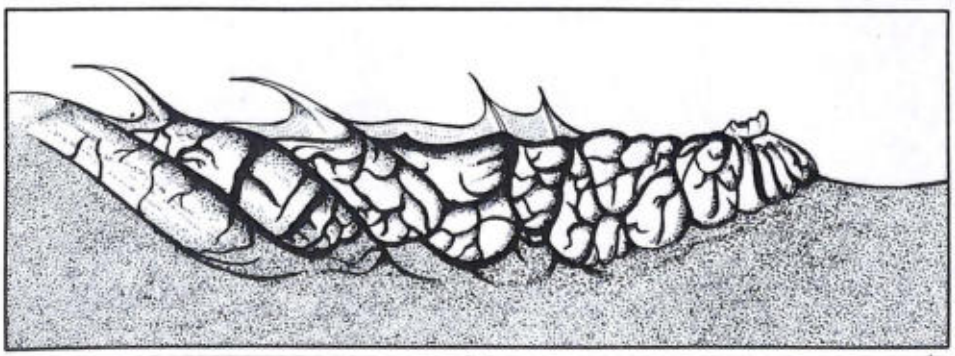
Eyes and no eyes

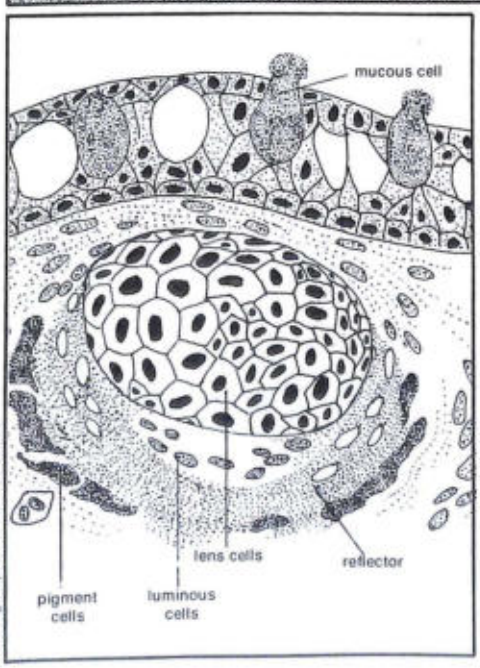
Daylight does not penetrate to more than 3 000 ft in the sea. The human eye can detect light down to 1 500 ft, and sensitive photographic plates lowered into the sea can register faint traces of light down to 3 000 ft. Beyond this all is in absolute darkness except for flashes and sparks from luminescent animals or from animals with light organs. In depths down to 3 000 ft fishes have more or less normal eyes. Below this depth they are blind or have degenerate eyes, or else they have extra large eyes. Those with large eyes are probably the fishes that come up into the surface layers at night. At other times they use their eyes either to recognize the signals from the light-organs of members of their own species or of the species they prey upon. All fishes so far examined that live permanently in the black depths of the ocean, and have degenerate eyes, have no light-organs. The luminous patches on the fins of whalefishes are not light-organs in the strict sense, and the only other fishes with luminescent glandular secretions of this kind are the deep-sea gulper eels. Their presence in whalefishes is something of a puzzle, and so are the red and orange patches on the fins and mouths of these nearly blind fishes.

class	**Osteichthyes**
order	**Cetomimiformes**
family	**Cetomimidae, Rondeletiidae**

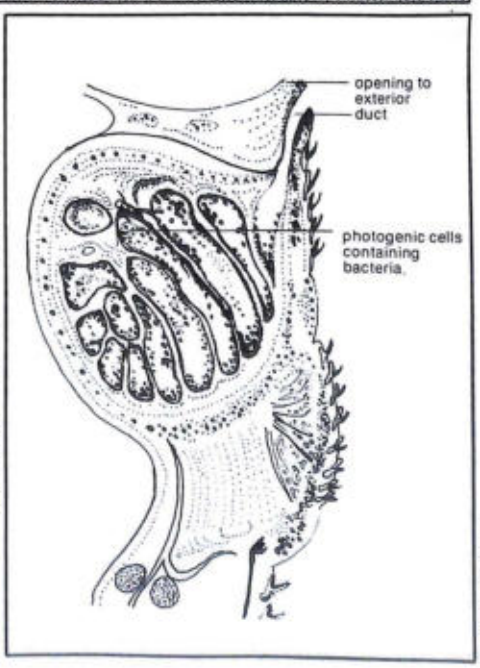


JM Bossot: Jacana





Drawings by Chris Howell-Jones



Chris Howell-Jones

Glimmers in the gloom

No sunlight penetrates the sea to more than 3 000 ft; only sparks and flashes from the luminous organs of fish interrupt the darkness. Whether these serve as sex- or species-recognition signals, shock predator deterrents or baits to attract smaller fishes is not known completely, but the fact remains that 95% of fishes caught from depths of 600 or more feet possess luminous organs.

There is an almost infinite variety of form, quantity and situation of these organs on the fishes' bodies, but most have them on the sides and belly—putting some whalefishes, with their dorsal glands, in the minority.

Any classification of luminous fishes must have a primary division between those which glow directly and those which have glands containing symbiotic luminous bacteria. The spectacular viperfish ***Chauliodus sloani*** *(above) produces its own light, through organs similar to the one illustrated at bottom left, which is from the toadfish* ***Porichthys notatus*** *(see p. 2539). It is, in fact, a highly elaborated mucous gland.*

In the other form of light production luminous bacteria are squeezed from a cell specialised to store them. This is illustrated at bottom right by the pre-anal gland of the deep sea rat-tail ***Malacocephalus laevis.***

Whether or not whalefishes have symbiotic bacteria is unknown, but their light is produced by the secretion of a luminous mucus into the cavernous tissue at the fin bases. The gland of ***Cetomimus gillii*** *is illustrated at centre: mucous from the glands of this whalefish may spread over large portions of the head and body.*

Whale shark

The largest of all sharks, yet perfectly harmless, the whale shark grows to a length of 50 ft, although large specimens of 65 ft and even 70 ft have been reported. Exact weights are not known but it has been estimated that a 70ft-whale shark would weigh about 70 tons. It is readily distinguished from any other fish by its striking colour pattern, very dark grey or brownish with white underparts, the head and body covered in white or yellow spots which are smaller and closer together on the head. The spots on the back are separated by white vertical lines. The whale shark has a long cylindrical body with longitudinal ridges along its back, one down the middle and two or three on each side. Like all sharks it has a very tough skin, that of a 50 ft whale shark being 6 in. thick. The powerful tail is keeled and has an almost symmetrical fin. The head is broad and blunt and the huge terminal mouth contains hundreds of very small teeth which form a sort of rasp. The gape of the mouth is so large, 5 ft across in even a medium-sized specimen, that it is said to be wide enough to allow two men to crouch inside. The eyes are small with small spiracles placed just behind them. The pectoral fins are large and sickle-shaped and there are two dorsal fins, the second one lying above the anal fin.

An unusual feature of the whale shark, which is shared by only one other shark, the basking shark (p. 299), is the presence of gill-rakers. The external gill-openings above the base of the pectoral fins are very wide and internally they are covered within the throat by closely-set rows of sieve-like gill-rakers, each 4–5 in. long, growing out from the gill-arches. They look like miniatures of the baleen plates of the whalebone whales and have the same function of straining off plankton and small fishes. This may be one reason for their common name of whale shark.

Whale sharks are found in all the tropical waters of the world. Occasionally individuals have been reported as far north as New York and as far south as Brazil and in Australian waters.

▽ *A 35ft whale shark gives a ride to small remoras clustered on the underside of its jaw.*
▷ *The same whale shark with an extra load.*

Photos by Ben Cropp

Docile and sluggish

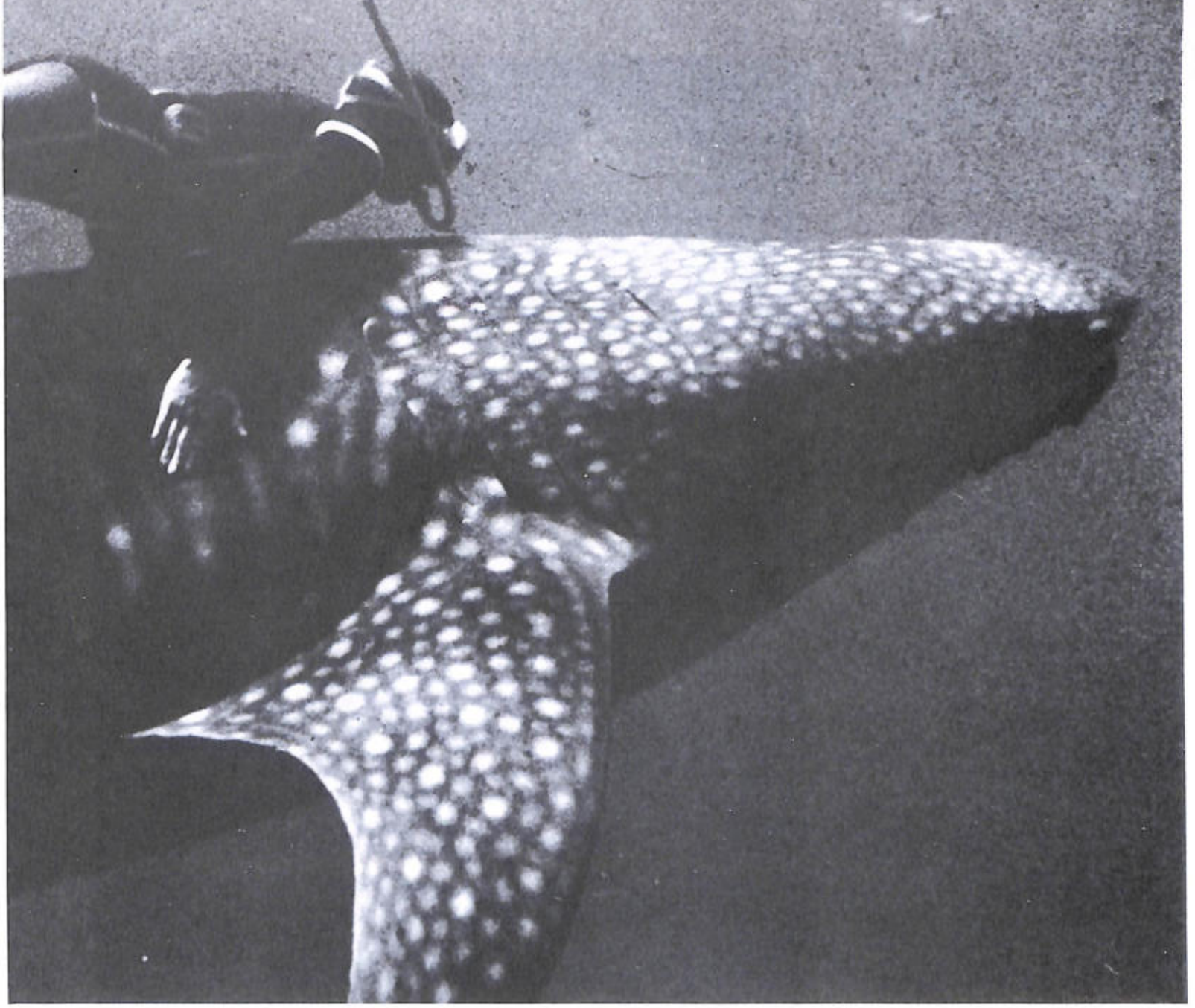
The whale shark lives near the surface of the open sea, swimming sluggishly at a leisurely pace of 2–3 knots. It is very docile and one underwater photographer has described how he swam holding onto a whale shark's tail without it taking any apparent notice. It is quite harmless, the only danger from it would be from its bumping against the side of a small boat and perhaps capsizing it. Whale sharks are known to rub themselves deliberately against boats, possibly to get rid of external parasites. This has been observed by the tunny fishermen of California and Thor Heyerdahl on the *Kon-Tiki* also describes one that rubbed itself on the raft, swimming around for about an hour.

Very few whale sharks have been caught and they are not often seen except perhaps when basking at the surface. When wounded by a harpoon the shark will dive straight down or streak away at speed, dragging the boat with it. It has very great powers of endurance and does not give in easily. It is said that if harpooned the whale shark can contract the muscles of its back to prevent the entrance of another spear. While swimming the whale shark gives out a sort of croaking sound which is possibly a form of echo-location used in navigation.

Plankton feeder

The whale shark, like the basking shark, feeds on plankton and small schooling fishes such as sardines and anchovies, by opening its huge mouth. Water rushes out over the gills leaving the fish sticking to the inner walls of the throat and to the gill-rakers. Because of this type of diet one might expect the whale shark to be lacking in teeth. Its numerous small teeth are arranged in some 310 rows in each jaw, but only about 10 or 15 rows can function at any one time. Sometimes much larger articles, such as shoes, leather belts and even large poles, are taken into the mouth.

Stewart Springer of the US Fishery Vessel *Oregon* has described seeing 30 or 40 sharks standing vertically, head up and tail down,



during a spell of calm weather in the Gulf of Mexico. They were pumping up and down in the water feeding on small fishes and accompanied by small black-fin tuna that had stirred up the sea all around with their darting and leaping. 'The whale sharks looked like black oil drums slowly rising and sinking in a long swell; only there was no swell, just a choppy sea to a hundred yards in diameter, stirred up by the tuna.'

Breeding unknown

Nothing is known of the breeding habits of the whale shark. It was formerly thought to be viviparous but a specimen caught off Sri Lanka contained 16 eggs.

No economic value

The whale shark has few natural enemies. Owing to its large size only the sea's largest carnivores would attempt to attack it and a blow from its powerful tail would probably be enough to drive even the largest enemy away. It is not hunted commercially – even its liver oil does not contain vitamin A.

Gentle giant

The whale shark could truly be called a giant that does not know its own strength, and this is illustrated more specially by three incidents that took place in the last half century. In 1919 one of these sharks became wedged in a bamboo stake-trap set in water 50 ft deep in the Gulf of Siam. It appeared to have made no attempt to break its way out. In the same area, in 1950, another one was captured and beached by the local fishermen, and while details of its capture are not to hand, it would seem that the giant fish offered little or no resistance. Prince Chumbhot, reporting this incident, says it was 'towed out to deep water and released by fishermen as a matter of luck, with a piece of red rag tied round its tail'.

In 1935 a 35ft whale shark was caught almost on the doorstep of New York City, having blundered into a huge fish trap on the southern shore of Long Island. Fishermen passed ropes around the fish's tail and pectoral fins, and hoisted it aboard a lighter with the aid of a petrol engine. Dr EW Gudger described the sight of the whale shark when landed, in the following words: 'The huge body, as large as a great oak in a primeval forest, stretched back and back to a vast tail within the spread of which a tall man could stand with room to spare. The whole thing was unbelievably enormous. For the first time in my life I beheld a whale shark in the flesh, the hugest thing that I ever saw come out of the sea. I looked at it head on, I walked around it, I climbed on its broad head, and I walked down its great back. It was the most enormous, the most colossal, the most gigantic sea animal I had or have ever seen.'

class	**Chondrichthyes**
order	**Lamniformes**
family	**Rhincodontidae**
genus & species	***Rhincodon typus***

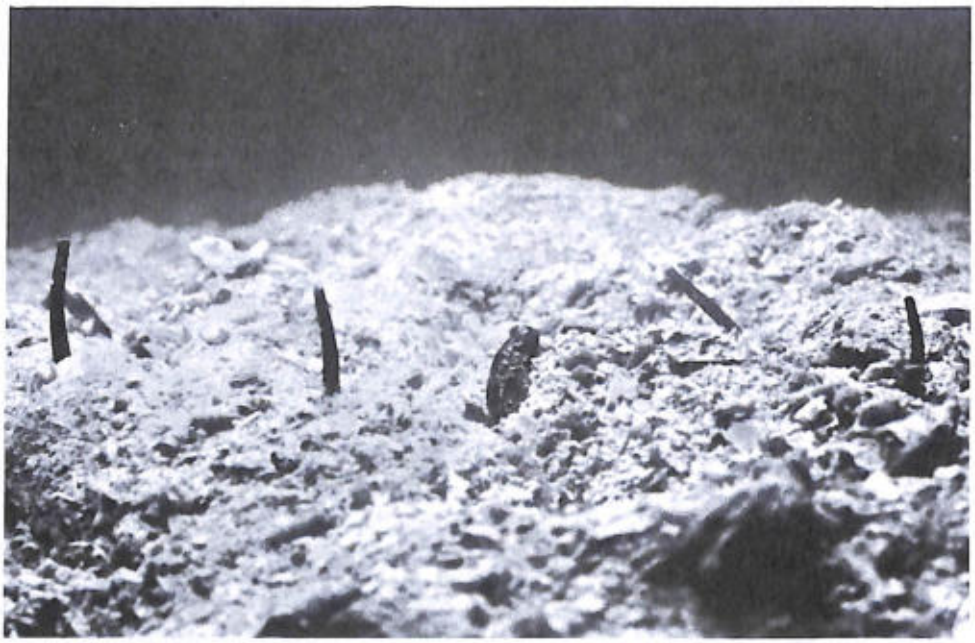
Whelk

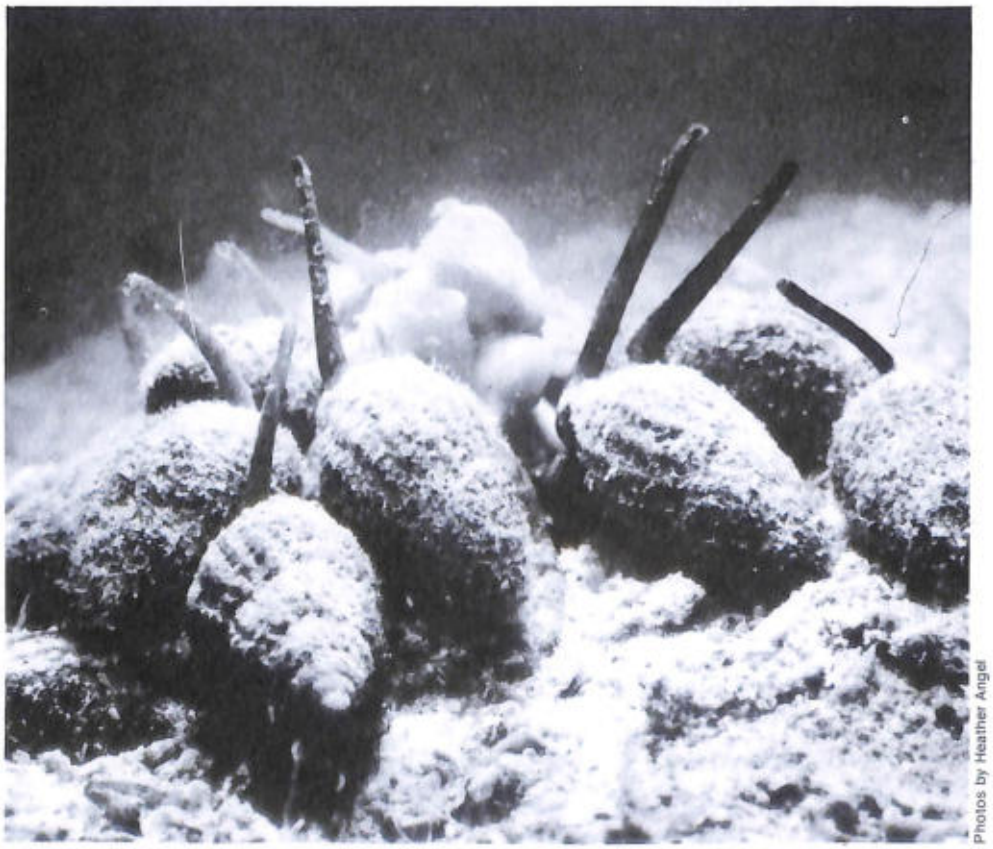
The name 'whelk' was originally used for one particular sea snail, the common or white whelk ***Buccinum undatum*** *of Europe, also known as buccinum in North America where it occurs along the coast from the Arctic to New Jersey. In Scotland it is known as the buckie. The name is derived from the Latin* ***buccina*** *meaning a twisted trumpet. It was originally applied to almost any shell with a trumpet shape, and the name 'whelk' is still sometimes loosely used in this way.*

The common whelk has a thick, chalky-grey to yellowish shell up to 6 in. long, and it is only one of the large family Buccinidae, which contains up to 50 genera and several hundred species. The common whelk shell has figured in many text books during the past century because of the way a sea anemone is often carried about on one. Another European species is the red whelk, or almond whelk, ***Neptunea antiqua.*** *Its shell is usually 4½ in. long but it may be as much as 8 in. There is a red whelk* ***Charonia rubicunda****, unrelated to true whelks, that lives in Australian seas.*

One of the best known American whelks is the channelled whelk ***Busycon canaliculatum*** *found from Cape Cod to Florida. Its shell is 5—7½ in. long. Related to the Buccinidae, but forming a separate family, Nassariidae, are the dog-whelks or mud snails, often attracted to lobster pots in the course of their scavenging. These dog-whelks are distinct from the European dog-whelk,* ***Nucella lapillus,*** *which belongs to the family Muricidae. Its shell, which is 1—1½ in. long, may be yellow, white, mauve or brown, and is often banded. The members of the family Muricidae bore holes through the shells of other molluscs then insert their long proboscises and eat the flesh, or else they prise open bivalve shells using a special tooth on the lip of their own shell aperture. The American whelk-tingle, rough whelk or oyster drill* ***Urosalpinx cinerea,*** *is another of the same family and a serious pest of oysters. It was introduced into British waters with American oysters in 1920. Whelks of this family yield a dye that was once highly valued: the Tyrian purple. Among other 'whelks' are the heavy whelks of the Vasidae family of Australia and the distantly related needle whelks belonging to the family Cerithiidae.*

◁ *A common or white whelk searches for food with its long siphon, which may be extended for 2 in., or even twice the length of its shell.*
▽ *Top: Periscopic breathing. All that can be seen of netted dog whelks* ***Nassarius reticulatus*** *is their siphons protruding through the sand, which are used for breathing.*
Bottom: A dead common whelk is placed on the sand and within minutes the whelks surge forward to feed.
▷ *Top: A rusted bucketful of marine life; a mass of common whelk's spawn, sea squirts, contracted sea anemones and sponges.*
▷ *Bottom: An assortment of European dog whelks. Their shells are 1–1½ in. long, all varying greatly in colour and often with bands.*





Photos by Heather Angel

Cannot live on the shore

The common whelk is found on every kind of sea bottom from near low water to great depths and its abundance has in the past made it important as food. Though large empty shells are familiar objects on the shore, the larger living individuals normally live offshore and it is only the small ones

that occur between tide marks, usually in well-sheltered places where there is mud between large stones. The common whelk is not suited to life on shore. When uncovered by the tide it may cling to a rock until the tide returns, but on mud or sand, instead of retreating into its shell and using the operculum to seal the aperture as would a winkle, it continues to crawl about. Thus the water drains from the gill cavity and the tissues gradually dry out. In the Bay of Fundy, on the east coast of Canada, where the tidal range is the greatest in the world, many of these whelks are left exposed on the shore during the great ebb of the spring tides and so die.

Long probing feeding-tube

The common whelk feeds by means of a long proboscis which may be extended for about 2 in. or even twice the length of the shell. At its tip is the mouth with its rasping, file-like radula. The whelk's food consists of fresh carrion, crabs, worms and bivalve molluscs which it finds with a long siphon which sways about sampling the taste of the water. The siphon also brings clean water into the gill cavity while the whelk is buried or feeding on rotten flesh. Plaice caught in nets are sometimes attacked by whelks; the proboscis is inserted directly into the flesh of the fish, and 10–20 whelks may 'gang up' on a single fish. Whelks also insert the outer lips of their shells into the valves of cockles, scallops, mussels and oysters, thus preventing them from closing and allowing the proboscises to rasp away inside. The American *Busycon* also feeds on bivalves, but if the valves cannot be wedged apart this whelk chips away at their edges with its own shell until the proboscis can enter.

DP Wilson

DP Wilson

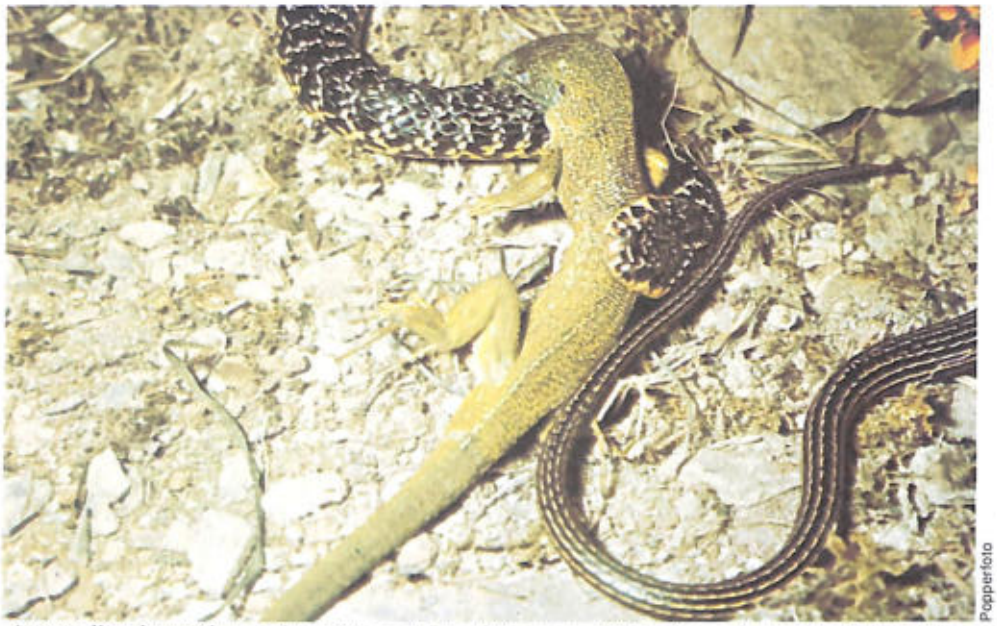
Young whelks feed on eggs

As familiar as whelks themselves, are the masses of usually empty egg cases that are so often cast ashore. Sometimes called 'sea wash balls', they are said to have been used by sailors as sponges, which they closely resemble. Before their real nature was realized, they were named by John Ellis as a species of coralline *Alcyonium*. The female whelk lays her eggs between October and May, turning herself around as she deposits them in a mass of capsules. Though the lower egg cases in the mass are usually fastened to some hard object, the mass often breaks free and many empty egg cases are eventually washed up on the shore. A single female produces up to 2 000 capsules, each about 1 in. across and joined to its neighbour by projections around the edge. However, several females may together produce a mass over 1 ft across made up of as many as 15 000 capsules. Smaller capsules are usually produced by smaller whelks. Each egg capsule contains several hundred eggs, occasionally more than 3 000, each about $\frac{1}{80}$ in. across; from these only 10–30 young snails emerge. The reason for this is that the remaining eggs, though fertilised, serve to nourish those few embryos that are destined to become small whelks. They are known as nurse cells or food eggs. The snails that finally emerge after about two months are about $\frac{1}{8}$ in. long. However, some of the unhealthy, developing young may be devoured by their healthier companions before hatching.

Easy to catch

The whelk's habit of eating dead or dying animals has been exploited by fishermen as a means of catching whelks for food or for bait. They have been considered delicacies at least since the days of Ancient Rome. Whelk 'pots', made of withy and twine on an iron frame, are lowered to the sea floor with freshly dead crab or fish inside. Another method of catching whelks is to tie the crabs or fish in a bunch and lower this into shallow water just offshore. Whelks are attracted to the carrion from a considerable distance. Whelks themselves are preyed upon by bottom-feeding fish, such as rays and dogfishes, and a single cod may have 30–40 whelks in its stomach at one time. Some idea of how numerous they are can be seen by the record of over 10 tons being caught in one small area in 7 months.

phylum	**Mollusca**
class	**Gastropoda**
subclass	**Prosobranchea**
order	**Neogastropoda**
family	**Buccinidae**



Popperfoto

A green lizard provides a substantial meal for a dark green whip snake—a large yet agile hunter.

Whip snake

The whip snakes are, as their name suggests, extremely slender with long tapering tails. The name has been applied to very close relatives of the racers (p. 2038) of North America and Eurasia, to other snakes of the family Colubridae that live in the Orient and to Australian members of the family Elapidae. The name is most commonly used for the European or dark green whip snake and its relatives. They are found mainly around the Mediterranean from the Atlantic coast of France to the Persian Gulf and through North Africa. One species can be found as far north as Poland.

The dark green whip snake is the largest European snake, growing to over 6 ft and occasionally up to 8 ft, one third of this length being tail. The head is fairly prominent and the eyes are large. The colour is, typically, yellowish-brown or pale olive with black bars and spots at the front end and yellowish-white underparts. One of the commonest snakes around the Adriatic, it ranges from southern France and northern Spain through Switzerland and Italy to Asia Minor. Close relatives of the dark green whip snake are Dahl's whip snake and the brown whip snake, both ranging from the Balkans into western Asia.

Of the Oriental whip snakes, the pencil-slim common green whip snake may grow to 6 ft or more but is usually 3—4 ft. The tail is long, the eyes large with horizontal pupils and the snout is long and pointed. The body is bright green, but the green is made up of minute spots of yellow on a blue background. It lives in India and Southeast Asia. The brown speckled whip snake is very similar in appearance except that it is brown. It lives in southern India and Ceylon.

The Australian whip snakes belong to the family Elapidae and are venomous. The yellow-faced whip snake of all states except Tasmania may be 3—4 ft long and its bite has an effect similar to that of a bad wasp sting. The black whip snake grows to 6 ft or more and has a more severe, sometimes dangerous, bite.

Difficult to capture

The common characteristic of the three kinds of whip snake, apart from their slender bodies, is their ability to move fast, although this may be more apparent than real, as in the racers (p. 2038). They can, however, disappear into undergrowth or under stones with remarkable speed and are very difficult to capture. The French authority on snakes, Lataste, tells how he saw a certain whip snake at a particular spot many times over a period of two years but was never able to catch it.

The whip snakes of the Mediterranean region usually live on the ground in dry places among shrubs and stones, although they sometimes climb among bushes. The Oriental whip snakes, however, spend most of their time in trees and are sometimes called tree snakes. Because of their colour and shape they are easily mistaken for hanging vines or twigs. The Australian whip snakes live on the ground in dry areas.

Good vision

Whip snakes feed mainly on small reptiles especially skinks and other lizards which they chase and swallow alive, instead of enveloping them in their coils. Voles, mice and large insects such as locusts are also eaten. Tree-living whip snakes take large numbers of tree frogs and also catch birds up to the size of a dove. The horseshoe whip snake enters houses in Spain and Algeria where it preys on mice and robs the nests of sparrows.

The Oriental whip snakes are unusual in having horizontal pupils that appear as long slits. There is also a groove running along the snout to each eye which probably allows each eye to see objects in front of the head and allows stereoscopic vision, as the eyes' field of vision overlaps. The Oriental whip snakes are among the few snakes which can detect motionless prey.

Eggs or live young

Mediterranean whip snakes lay their eggs in holes or crevices in the ground or under stones. The eggs vary in number from 3 in the horseshoe whip snake to about 15 in the dark green whip snake. The Australian whip snakes also lay eggs, varying from 3 to 6 in number, but the Oriental whip snakes give birth to 3—22 live young.

St Paul's viper

Most descriptions of Mediterranean and Oriental whip snakes emphasise their ferocity. At one time the Mediterranean species had the generic name of *Zamenis*, alluding to its aggressiveness, while the green whip snake of India and Ceylon is popularly believed to strike at the eyes and in Singhalese is called the 'eye plucker'. The name is well earned for, although whip snakes do not necessarily aim at the eyes, they strike aggressively with the mouth open, even attempting to strike through the window of a cage. They inflict painful bites, but no venom is injected although the saliva of the green whip snake can cause a local swelling. It has been suggested that the dark green whip snake, which is common on many of the Mediterranean islands from Corsica and Sardinia eastwards, was the 'viper' that bit and clung to St Paul's hand after he had been shipwrecked on Malta. According to the story in the Acts of the Apostles the Maltese were surprised that St Paul came to no harm and 'said that he was a god'. One might expect that the local people would know which animals were dangerous but in several parts of the world snakes, geckos and various insects are supposed to be deadly when they are in fact harmless.

class	**Reptilia**
order	**Squamata**
suborder	**Serpentes**
family	**Colubridae**
genera & species	***Coluber hippocrepis*** *horseshoe whip snake* ***C. jugularis*** *brown whip snake* ***C. najadum*** *Dahl's whip snake* ***C. viridiflavus*** *dark green whip snake* ***Ahaetulla mycterizans*** *green whip snake* ***A. pulverulentus*** *brown speckled whip snake*
family	**Elapidae**
genus & species	***Demansia olivacea*** *black whip snake* ***D. psammophis*** *yellow-faced whip snake, others*

Whirligig beetle

The small beetles that gyrate rapidly on the surface of the water on ponds and canals are called whirligig beetles. The name dates from the 15th century and originally a whirligig was a toy that spun. Most of them belong to the genus ***Gyrinus*** *and are shiny blue-black or dark bronze in colour. They swim with the second and third pairs of legs only. These legs have their segments flattened and fringed with hairs, making them effective oars. The first pair of legs are slender and quite normal, and they take little or no part in swimming. The antennae are short and clubbed and the eyes are remarkable in being divided into separate upper and lower compound eyes on each side of the head. Whirligig beetles have wings and fly readily and will quickly escape from an open aquarium.*

Ten species of ***Gyrinus,*** *all very similar in appearance, are found in Europe and some species of whirligig beetle are almost cosmopolitan. In one member of another genus,* ***Orectochilus,*** *the upper surface, instead of being shiny, is clothed with thick yellowish-grey hair. It is known as the hairy whirligig and lives in running water, gyrating on the surface only at night. By day it hides under the bank. It is the only species of its genus found in Europe: one other kind of hairy whirligig is known from Africa and a number from Asia. The Gyrinidae is a relatively small beetle family, containing a total of about 400 species, as compared, for example, with the 40 000 species of weevils.*

Surface swimmers—whirligigs ***Gyrinus natator.***

F. Greenaway: NHPA

F Greenaway: NHPA

Ripples on a pond: ***Gyrinus natator*** *whirl around on their specially flattened mid- and hind-legs.*

Semi-submerged skaters

Their capacity for scooting about like tiny speed boats, weaving around in dense crowds but never colliding, is the whirligigs' most characteristic feature. They do not float on the surface film like pond skaters. The undersurface and legs are wettable and are immersed in the water but the shiny or hairy upper surface repels the water and remains dry. The antennae are held actually in the surface film and are believed to be sensitive to changes in its curvature, thus enabling the beetles to avoid collision with each other. Each beetle makes a dimple in the film around it and throws up little bow waves in front. The two pairs of swimming legs do not rely only on their fringe of hairs for propulsion, as do those of most other water insects. The flattened joints fold up like a fan on the forward movement and then open up for the backward propulsive stroke.

Maintaining position

A group of whirligigs can be seen to maintain its position on a pond, or even in slowly flowing water, without simply scattering, as would perhaps be expected from the maze-like movements of the individuals. The two separate pairs of eyes are so positioned that one is under the water and the other above, and there is little doubt that their facets or ommatidia are adapted respectively for aquatic and aerial vision. There seems to be only one possible means by which the beetles can maintain their position when swimming. They must keep a constant pattern of objects on the bank in view. The fact that they can do this while weaving about in elaborate convolutions implies a remarkable degree of co-ordination of movement and vision.

Whirligigs can swim well under water and dive readily when alarmed. They always carry a bubble of air attached to the hind end; this bubble is probably used for respiration when the beetles rest clinging to underwater plants.

They make no attempt to hide themselves at any time and seem to be an easy prey for birds and fishes, for all their active movement. They are probably protected by their power to exude a milky fluid when molested. This is variously described as smelling 'disagreeable', or, in one American whirligig, *Dineütes americanus*, 'like apples', but it is likely to function as a repellent in all cases.

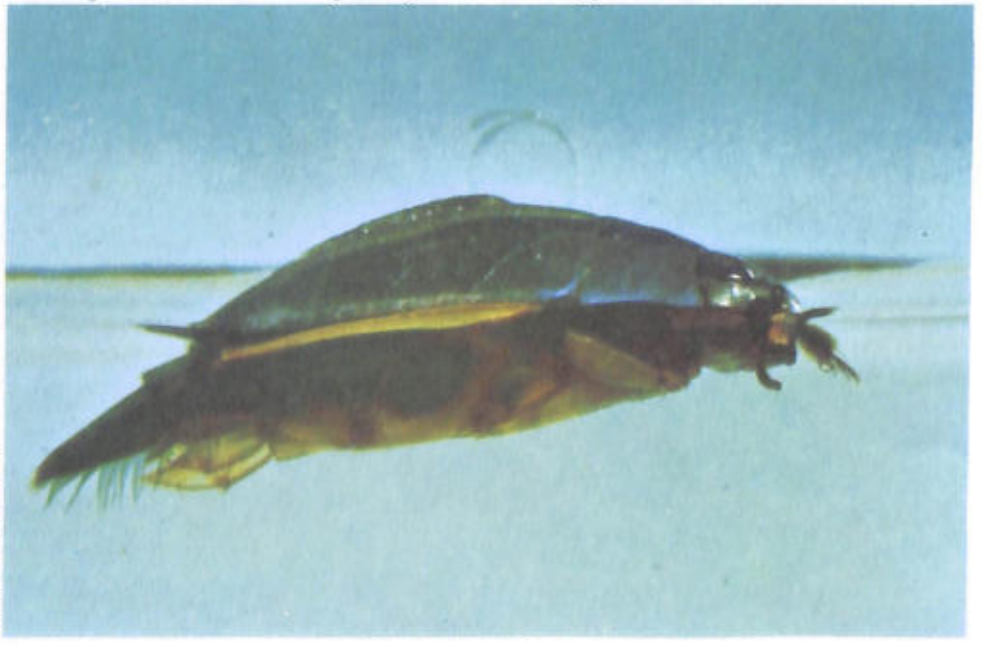
So far as is known whirligigs feed on small insects that fall onto the water surface, which they seize with their long, mobile front legs.

Aquatic larvae

Whirligigs over-winter as adults and the females lay their eggs in spring, end to end in rows on submerged water plants. The larvae hatch and grow rapidly. They swim in a wriggling manner or creep about the bottom feeding on other insects and to some extent on vegetable matter. Their pointed jaws are hollow for sucking the juices of their prey. When fully grown the larva is very slender and over $\frac{1}{2}$ in. long. The joints between the segments are deeply indented and there is a row of feathery gills along each side of the body, one pair on each abdominal segment except the last, which has two pairs. The last segment also has two pairs of hooks which are said to be used for climbing about on water plants. About the end of July the larvae climb up the stems of emergent water plants and spin cocoons above the surface. The adults appear a month or so later and it is at this time, in late summer, that whirligigs are extremely abundant.

The larva of the hairy whirligig is found among gravel in shallow flowing water, and keeps out of sight, like the adult.

The best of both worlds: divided compound eyes allow a whirligig to see both above and below water.



Anthony Bannister: NHPA

Aquatic all-rounder

A whirligig beetle is unusual in enjoying the best of three worlds. Although it spends much of its time sculling about on the surface it can easily take off and fly, skimming over the surface to look for a fresh feeding ground. Then it noses over into a steep dive, using its wing cases as a parachute, and lands gently on the water. It can then, if necessary, shut its wing-cases, trapping a bubble of air under them, and submerge like a submarine or, better still, a skin-diver.

phylum	**Arthropoda**
class	**Insecta**
order	**Coleoptera**
family	**Gyrinidae**
genera & species	***Gyrinus natator*** *whirligig* ***G. marinus*** *whirligig* ***Orectochilus villosus*** *hairy whirligig, others*

Whistler

The whistlers, or thickheads, are small birds with melodious, often whistling songs. They are related to the flycatchers. They are found in Australia, New Guinea, Malaysia, the Philippines and islands of the South Pacific. In Australia some whistlers have alternative names such as robin, shrike-thrush or tit-shrike. As the alternative names suggest they have large heads and rather shrike-like bills. Some have crests and a few have wattles or bare patches of skin. They vary in size from 6 to 13 in. The plumage usually contains yellow or green and black and the throat is usually white.

The golden whistler, like most other whistlers, is sexually dimorphic, the male having a bright plumage that contrasts with the dull female. The male has a white throat which is separated from the yellow breast and abdomen by a narrow black band that joins the black on the head. The back is bright olive green, the wing tips and tail grey and black. The female has no yellow plumage and is grey except for buff on the breast. The golden whistler is found from Malaya to Australia and in the Fiji Islands. Another Australian whistler is the rufous whistler, the male being chestnut where the golden whistler is yellow. The black band across the chest continues along each side of the throat to the bill. The female, in contrast, is streaked with white on the abdomen.

R Craven

Almost-fledged rufous whistler awaits a meal from its mother. The male, too, helps feed the chicks.

Birds of ground cover

Whistlers are found mainly in forest and scrub; the golden whistler is found in the open green forests and in wattle scrub but the white-breasted whistler of Australia is found in the mangrove swamps of the northern coast. In general, they are found where there is good cover and they spend their time on or near the ground. Outside the breeding season they gather in flocks, often with other birds. They are usually shy birds and their habits are not known in detail but the golden whistler often goes into suburban gardens and may become quite tame.

Mainly insect eaters

Most whistlers feed on insects, such as beetles and grasshoppers, which they glean among foliage or on the ground. The whistling shrike-thrush peels bark with its bill to disclose insects and their larvae underneath. A few whistlers eat berries and some of these lack the rictal bristles around the base of the bill which are generally an adaptation for sweeping up insects and are probably a disadvantage in berry eating.

Wistful songs

The songs of the whistlers are among the finest of any Australian bird and early European settlers called the golden and rufous whistlers 'thunderbirds' because they were stimulated to sing by loud noises. The rufous whistler sometimes sings to defend its territory all the year round. It has a number of phrases in its song including sounds like a whip-crack. Other whistlers, such as the olive whistler, have strangely wistful calls. The golden whistler sounds like a man calling a dog, the notes usually being represented as 'wi-wi-wi-wi-*wit*'. Male whistlers defend their territories by singing and performing bowing displays and the female rufous whistler assists in the defence. In this species both sexes sing during courtship, the female answering the male's whip-crack calls.

The cup- or saucer-shaped nest is constructed of dead leaves and dry grass and is lined with feathers or fibres. It is placed in a fork of a tree, usually in an upright rather than a horizontal fork. There are 2–4 white or brownish eggs which are incubated by both parents or by the female alone for about 15 days. Both parents care for the young which stay in the nest for about a fortnight. They sometimes perform distraction displays to lure away predators.

Record varieties

There are about 80 subspecies of golden whistler—a record among birds. The reason for this is probably that its range from Malaysia to the Fijis includes a vast number of islands, including the Indonesian archipelago and the Solomon Islands. In the latter group there is a separate subspecies on each major island. On Malaita, for instance, the male lacks the black band across the breast, on Rendova the wings are black rather than olive and on Rennell Island the male is drab and indistinguishable from the female.

Here, it seems, we have another example of birds evolving in isolation, but at the subspecies level instead of between species as in Darwin's finches. As far as is known, there seems to be no adaptive function in plumage changes as there is in the bill shapes of Darwin's finches. The subspecies of golden whistlers appear to have just evolved in isolation, but if they met they probably would not interbreed; other females, for instance, would not recognize the Rennell Island male as a possible mate.

class	**Aves**
order	**Passeriformes**
family	**Muscicapidae**
genera & species	***Colluricincla rectirostris*** *whistling shrike-thrush* ***Pachycephala olivacea*** *olive whistler* ***P. pectoralis*** *golden whistler* ***P. rufiventris*** *rufous whistler* *others*

White butterflies

The term 'white butterflies' is sometimes used to cover the whole of the great butterfly family Pieridae, but many pierids, especially tropical species, are brilliantly coloured yellow, orange and red, so this usage is rather misleading. The European white butterflies comprise the members of the subfamily Pierinae, exclusive of the 'orange-tips' and those of the Dismorphiinae, one of which is the wood white. The pierine whites are the familiar cabbage white butterflies. In the New World one species, accidentally introduced from Europe, is a serious pest of cultivated plants of the cabbage family. This is ***Pieris rapae,*** *the small white or (in America) the European cabbage butterfly. There are also a number of indigenous American species of* ***Pieris****. Another North American pierine is the pine white, the larva of which feeds on pine, an unusual diet for a member of this family of butterflies. It is sometimes abundant enough to do considerable damage in pine woods and plantations. Some species of whites range up to 18 000 feet or more, the highest habitat known for any butterflies. These include species of* ***Phulia*** *and* ***Piercolias*** *in the Andes and* ***Baltia*** *of central Asia.*

The whites, and all other members of the Pieridae, pupate like the swallowtails. The pupa is attached by the tail, usually to a vertical surface, and has an anchoring girdle of silk surrounding it at mid-body. It is thus suspended rather like telephone linesman at work. The eggs are bottle-shaped and ribbed and stand upright on the leaves when laid. The larvae are often elongate and green but show considerable diversity of form.

▽ *Marbled mating of a pair of meadow whites* ***Pontia helice****. Close relatives of the Bath white, they live throughout South Africa.*

Anthony Bannister NHPA

Crop pests

The large white and the small white are notorious pests of cabbage and other brassica crops, on which their larvae feed. The large white is generally less numerous but it sometimes migrates in huge swarms, which occasionally cross the Channel to southern England. Its bristly larva is dull green and yellow with blackish mottling. It has an unpleasant smell and is distasteful to birds, although they eagerly search for and eat the pupae during the winter. The larva is heavily parasitised by the small ichneumon wasp *Apanteles glomeratus*. It is often found feeding on 'nasturtium' *Tropolaeum* as well as on cabbage.

The very abundant small white also migrates in swarms, but less frequently. Its larva is not protected by any distasteful properties, but is well camouflaged by its green colour. It also suffers heavily from parasites. In both species the sexes are distinct, the black markings of the females being heavier and always including a pair of black spots on the forewing. Both have a spring and a summer brood, of which the latter is more strongly marked with black in both sexes.

The small white has spread widely over the world, probably by accidental conveyance of pupae. It reached Quebec about 1860 and in the next 25 years spread all over temperate North America. It appeared in New Zealand in 1929 and in southern Australia some years later, reaching Tasmania about 1940. In these regions biological control has met with some success. The agent used is a chalcid wasp (p 544) *Pteromalus puparum* which lays its eggs in the newly formed pupa.

Harmless white butterflies

The third common European white butterfly, the green-veined white, is similar in size and appearance to the small white, but differs in having the veins of the wings bordered with greenish-grey scales on the underside. The sexes and the spring and summer generations differ in much the same ways as the large and small whites. The larva feeds on various wild Cruciferae, such as hedge mustard and cuckoo flower, and does not attack cultivated crops. This is one of the butterflies in which a distinct race or subspecies has evolved in Ireland. It is more strongly marked than even second brood butterflies from Great Britain. The black-veined white has no distinct markings except an outlining in black of the wing veins. It is common in continental Europe and was widely spread in southern England during the last century. By 1900 it had become confined to Kent and it became extinct in the 1920's. Recent attempts to re-establish it have not succeeded, and it seems most probable that a climatic change, away from hot summers and severe winters, led to its dying out in Britain. The larva feeds on sloe, hawthorn and plum, hibernating through the winter in a communal web.

Historic butterflies

The Bath white is distinctively marked, having areas of both wings dappled with greenish-black. Its English name is a piece of whimsy derived from the circumstance that at some time during the 18th century

Klaus Paysan

SG Giacometti

△ *Small white butterflies congregate around a patch of mud to drink.*
◁ *Pupae of the large white overwinter on a tree trunk. The pupal stage involves a great amount of internal rearrangement from the caterpillar to the adult butterfly. Metamorphosis of insects into different forms is controlled by hormones produced in the brain – the pupa develops when the epidermal cells are exposed to a relatively large amount of moulting hormone and a small amount of juvenile hormone. The adult butterfly develops when no more juvenile hormone is produced. To complicate matters the whole sequence of events is genetically controlled. The pupa, common to many insects, represents a protective transitional stage, and must have had selective value in the course of evolution.*

Hille Kleinstra

Anthony Bannister: NHPA

a young lady of Bath executed a piece of needlework in which the butterfly was depicted. It is also interesting to note that a specimen of it, collected and preserved in 1702, shortly after Queen Anne came to the English throne, is preserved in the Hope Department of Entomology at Oxford. It is common in continental Europe but a rare summer visitor to Britain.

The wood white and two other related species are remarkable in being the only Old World representatives of the subfamily Dismorphiinae, which is otherwise entirely confined to South and Central America. In that region about 100 species are known, many of them brightly patterned.

Butterfly pigments

In many of the most brilliant butterflies the colours are produced by the effect known as 'structural coloration' (p. 1654). In the Pieridae, of which the 'whites' are a sober coloured minority, we find bright colours, red, orange and yellow as well as white, which are due to chemical pigments produced by the insect and deposited in the scales of its wings during development. These pigments are known as pterines; the white substance in the scales of the common white butterflies is a particular pterine called leucopterine, which chemically resembles uric acid and was formerly confused with it. The marbled white butterfly has wings checkered with white and black, but is a relative of the meadow brown (p. 1581) not of the true whites. If a preserved specimen of a pierid, say a large white, and one of a marbled white are exposed together to ammonia vapour the large white will remain unchanged but the colour of the marbled white will deepen to a yellow tint. This is because its white pigment is of a wholly different nature; it is a flavone or anthoxanthin, a type of pigment derived from the food plant. The fact that the scales of the wood white also contain flavone pigment does not mean that it is related to the marbled white, but it does underline its quite remote relationship with the other more typical pierid butterflies.

phylum	**Arthropoda**
class	**Insecta**
order	**Lepidoptera**
family	**Pieridae**
genera & species	***Aporia crataegi*** *black-veined white* ***Leptidea sinapis*** *wood white* ***Neophasia menapia*** *pine white* ***Pieris brassicae*** *large white* ***P. napi*** *green-veined white* ***P. rapae*** *small white* ***Pontia daplidice*** *Bath white* *others*

◁ △ *Large white – close up: the coiled proboscis is formed by the highly modified maxillae held together by interlocking spines.*
◁ *A colourful white – the purple tip* ***Colotis danae****, a butterfly of the low African veld.*

White-eye

The white-eyes, also known as silver-eyes, particularly in Australia, are small birds, about 4–5 in. long, that are found in most of the Old World tropics from West Africa to the Pacific Islands, and from Japan in the north to Macquarie Island in the south. Within this vast range they show a wide variation in plumage, particularly among the species living on islands. White-eyes are also popular cagebirds. Several of the pochard group of ducks are also called white-eyes.

Most of the 85-odd species of white-eye are classed in the genus ***Zosterops****, which is sometimes used as a common name for white-eyes. The bill is usually slender and curved, the wings rounded and the tail square. As their name suggests a principal feature is the white ring of minute feathers around the eye. In some African species the ring becomes a large patch and in others it is missing. The yellow-spectacled white-eye of the Lesser Sunda Islands has a yellow eye ring. Both sexes of white-eyes are similar, and are usually green or yellowish above and grey or yellow below. Those living on islands often lack yellow in the plumage.*

Among the best-known of the white-eyes is ***Zosterops senegalensis*** *that ranges from Senegal to South Africa. It exists in several different forms and is known as the green or the yellow white-eye depending on the brilliance of its plumage. The common eastern white-eye, known as the coast white-eye in Malaya, ranges from Afghanistan to Indonesia. It is greenish yellow above and yellow and grey underneath with a black tail. The commonest Australian white-eye is the western silver-eye, or greenie, often a pest in orchards and suburban gardens. It is olive-green above, grey underneath.*

WT Miller

△ *Fig eater: the Cape white-eye* ***Zosterops virens*** *pierces the skin of fruit with its sharp beak to extract pulp with its brush-like tongue.*

Variation with climate

White-eyes have a very wide range of habitats. They live in flocks of up to 100 in wooded country, ranging from dense forests, where they are found only on the borders, to scrub. They are found in the Australian coastal mangrove swamps and in the wooded highlands up to the tree line.

Often a species is confined to a single type of habitat; one finds different white-eyes living close together but not overlapping as one travels up a mountain side or from dry to wet forest. RE Moreau has shown that the white-eyes in Africa vary from one environment to another in accordance with several biological rules. Bergmann's rule, for instance, states that the body-size of an animal becomes larger towards the cooler part of its range, an adaptation to the conservation of heat. This happens in the African white-eyes. Their wing-lengths also increase with altitude and their plumage gets darker in areas of increasing humidity.

Flocks of white-eyes keep in touch with quiet calls as they forage among bushes and trees in a straggling procession. As one flies from a tree, calling, others follow in a stream. Most do not migrate but the grey-backed white-eyes of Tasmania migrate across the Bass Strait to New South Wales.

Pests of soft fruit

White-eyes eat insects, fruit and nectar. The insects are found among the trees and include aphids, caterpillars and flying termites. Like the honeyeaters (p. 1227), white-eyes have tongues that have brushes at their tips which are used for mopping up nectar or fruit pulp. The common white-eye of the Orient, for instance, pierces the base of hibiscus and other flowers with its pointed bill then licks out the nectar with its tongue. Soft fruit such as paw-paw, figs and grapes are treated in much the same way, by piercing the skin and extracting the juice and pulp. Thus the damage to a crop is out of all proportion to the amount they actually eat as they remove only a small part of each fruit. The flocking habits of white-eyes increase the amount of the damage and there is an Australian record of 1 200 white-eyes being shot in one orchard in one day.

A family similarity

For all their variety in plumage white-eyes have very similar nesting habits. At the beginning of the breeding season the flocks split up and the males sing a pleasant, far-carrying trill. The nest is a deep cup, about 2 in. across, slung between two twigs. It is made of lichen or grasses, bound with cobweb and lined with finer grasses, kapok or sheep's wool. Both parents incubate the 2 or 3 eggs for 10–12 days. The chicks stay in the nest for 9–13 days and are fed on caterpillars, pulped by passage through the parents' bills. After they have fledged, the chicks stay with their parents for another 2–3 weeks.

Successful colonists

The white-eyes have been extremely successful at colonising islands. They were introduced to one place in the Hawaiian Islands and have since spread around the islands by themselves. About 1856 Tasmanian grey-breasted white-eyes arrived in large numbers on the west coast of North Island, New Zealand. From there they rapidly colonised the whole of New Zealand. It is very unlikely that these white-eyes were assisted by a ship-borne passage because they arrived in such large numbers. This journey was 1 200 miles long, but perhaps more astonishing is their colonisation of the sub-Antarctic island of Macquarie about 700 miles south of New Zealand.

The white-eyes' success in colonisation probably lies in their gregarious habits. By travelling in flocks there is a good chance of sufficient numbers arriving, even though many die on the way, and then by keeping together they form the basis of a colony.

class	**Aves**
order	**Passeriformes**
family	**Zosteropidae**
genus & species	***Zosterops australasiae*** *western silver-eye* ***Z. lateralis*** *grey-breasted white-eye* ***Z. palpebrosa*** *coast white-eye* ***Z. senegalensis*** *yellow or green white-eye* ***Z. wallacei*** *yellow-spectacled white-eye* *others*

Anthony Bannister: NHPA

△ *A congregation of whitefly of the family Aleyrodidae. They are not, in fact, flies, but hemipteran, sap-sucking bugs.*

Whitefly

Whitefly are not flies at all but extremely small bugs very closely related to the aphids (p. 167) and scale insects (p. 2154) They are seldom more than ¼ in. long and many are less than this. The adults look like minute white moths as they fly actively around. Their colour is due to a fine waxy powder which covers the body and wings. This is given out from the anus, which lies in a cavity overlaid by a tongue-shaped flap, or lingula, the cavity itself being covered by a lid, or operculum. Originally, the wax was probably given out as a waste substance, as in some other bugs, but in whiteflies this 'waste' is put to use, possibly as a protective covering. The majority of known whiteflies are tropical and they would largely escape notice but for the fact that some are serious pests of crops. Indeed, it is highly likely that the majority of whiteflies living today have yet to be discovered. The cabbage whitefly infects cabbages in Britain and other temperate countries, and the greenhouse whitefly is a tropical insect which establishes itself in glasshouses, attacking tomatoes, cucumbers and many other plants. It is believed to have come originally from Brazil. A third species, the citrus whitefly, is a pest of citrus fruits in the southern United States.

Harmful sapsucker

The cabbage whitefly congregates when young on the undersides of cabbage leaves where it breeds throughout the summer. In autumn the adults rise in clouds when disturbed and settle again like tiny snowflakes. Both the greenhouse and citrus species discolour and weaken the plants they infest by sucking their sap, in the same way as aphids, and like the aphids they cover the plants with sticky honeydew. On citrus fruit the honeydew promotes the growth of a fungus, the sooty mould *Meliola camelliae*, which so discolours the fruit that, even if it is not spoiled altogether, it has to be expensively washed for marketing. The reason why whiteflies and other bugs take in so much sap, in excess of their need for carbohydrates, is that they need other nutrients such as amino-acids, which are less concentrated in the sap.

Eggs laid in circles

The eggs are laid on the undersides of leaves, sometimes in a double layer, and are usually arranged in an arc or a circle, because when laying the female keeps her head in one place and moves her body round it. Each egg has a stalk and is laid upright, a batch of eggs looking rather like a group of minute pegs. The larvae are tiny and scale-like. They move about, feeding on the sap and excreting honeydew. They cast their skins three times and after the third moult the larva develops rods or filaments of wax all around itself. Then it stops feeding and settles down in a condition resembling that of the pupa of a higher insect. After a longer or shorter period of rest, varying with the species, the winged insect emerges fully developed.

The stalks of the eggs actually pierce the outer layer of cells of a leaf and, as they are hollow, they draw moisture from the leaf by capillary action. So long as the plant is well supplied with water, development of the eggs proceeds normally. If the leaf withers, however, the development of the egg is arrested; and if the plant wilts during a drought the egg goes into a resting stage until more sap is available. Sometimes whitefly eggs go into a resting stage for no obvious reason. All these are almost certainly adaptations to life in the tropics.

The characteristic way in which all bugs develop is by a series of instars, or stages separated by skin changes. In the course of these the insect gradually takes on the characters of the adult and continues to feed and move about throughout its life without a break, contrasting with, for example, the pupa of a moth. The false pupa of the whiteflies is an interesting departure from the normal way in which bugs develop, and it closely parallels the true pupa of such insects as butterflies, bees and beetles. The differences are that the false pupa has much the same shape as the previous larval stage and it keeps feeding. It is also decorated with wax rods.

Imported killers

The greenhouse whitefly can be effectively controlled by the use of another exotic insect, the minute chalcid wasp *Encarsia formosa*, which probably also came from the tropics, although nobody is sure of its precise point of origin. This wasp is a parasite of the whitefly and was first noticed in a greenhouse at Elstree, in Hertfordshire, England, in 1926. A stock of it was bred up and was found to be effective in wiping out whitefly in greenhouses. Consignments of it were sent out all over Britain and also to Canada and Australia.

The parasite reproduces by parthenogenesis, that is, by the development of unfertilised eggs. The males are rare and apparently do not mate even when they occur. The female wasps lay their eggs in the larvae or 'scales' of the whitefly, and those that are parasitised turn black; this is useful as an indication that the parasite is being effective. To introduce the wasp, bunches of tomato leaves bearing parasitised scales are obtained and hung up in the greenhouse. Blackening of the scales is generally noticed 2–3 weeks after the introduction of the parasitised material. A night temperature of about 13°C/55°F is needed to maintain the wasps: good evidence that they are from warmer climates.

phylum	**Arthropoda**
class	**Insecta**
order	**Hemiptera**
suborder	**Homoptera**
family	**Aleyrodidae**
genera & species	***Aleyrodes proletella*** *cabbage whitefly* ***Dialeurodes citri*** *citrus whitefly* ***Trialeurodes vaporariorum*** *greenhouse whitefly* *others*

DP Wilson

Whiting

A member of the cod family, the whiting is an important food fish and forms a considerable part of the catch of the North Sea trawlers. It reaches a length of 28 in., the females being slightly larger than the males. The whiting is easily distinguished by its silvery sides, the black spot at the base of each pectoral fin and by having only a very small inconspicuous barbel or none at all in most of the larger individuals. The snout is long and rather pointed with the longer upper jaw extending back to the front edge of the pupil. There are three soft-rayed dorsal fins and two anal. The colour varies on the back and the head from sandy to dark blue or green, but all whiting have the silvery sides and belly.

The whiting ranges from the North Sea off Iceland and Norway through the Irish Sea and the English Channel to the Mediterranean. In the Black Sea it is replaced by a subspecies.

Abundant in shallow waters

The whiting is very common throughout its range, being particularly abundant in the North and Irish Seas. Unlike most members of the cod family it lives mainly in shallow waters: it is most common at 36–330 ft and exceptionally goes below 4 000 ft. Sometimes whiting come close inshore and are caught in a few feet of water. Like all members of the cod family, whiting make considerable seasonal migrations within their range. Being a good fighter for its size it makes a good sporting fish for anglers. The record for one caught on rod and line off the British coast is 6 lb.

Eat anything small enough

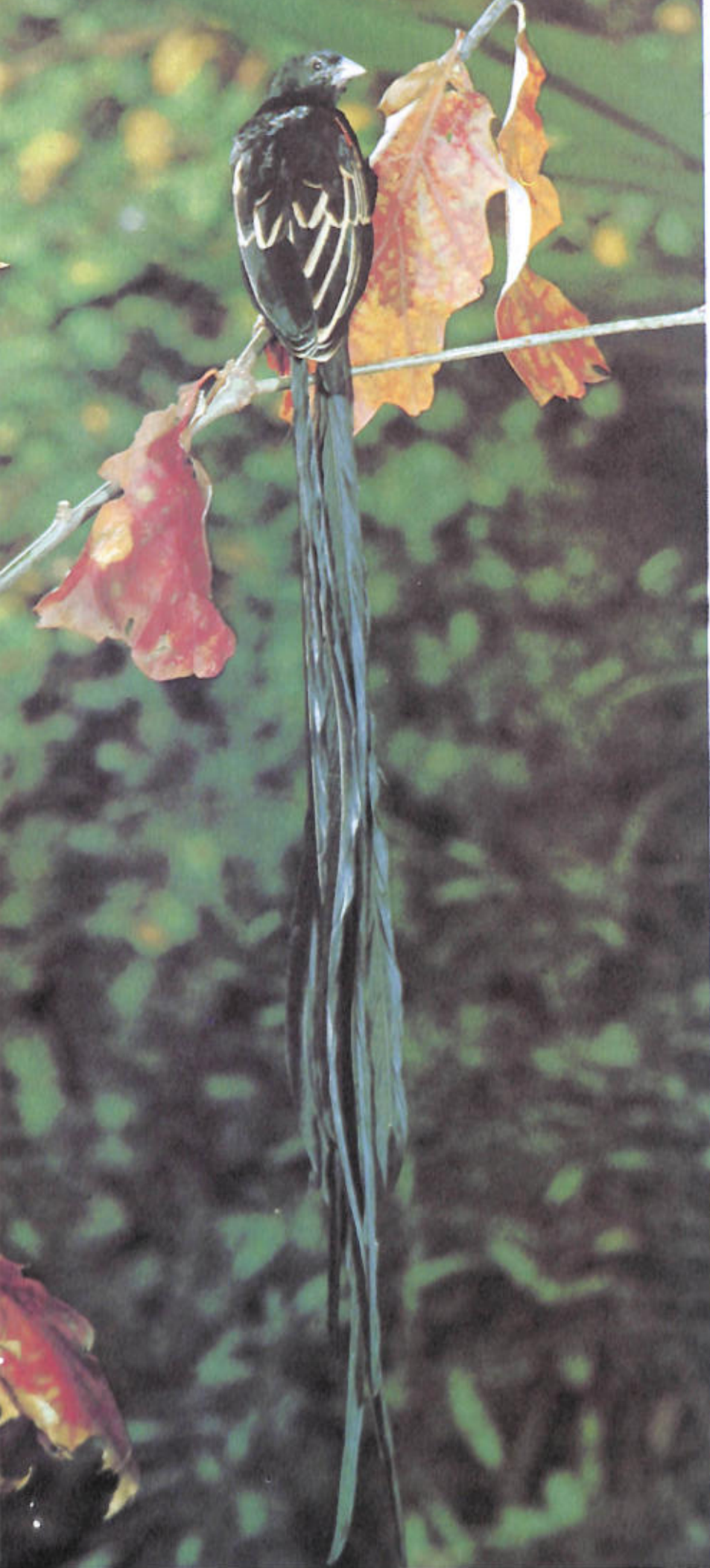
Whiting feed principally in the daytime, mostly in midwater or just off the bottom. Their food consists mainly of smaller fish such as sprats, younger whiting, herring and sand eels but they will also take large quantities of crustaceans such as shrimps, prawns and crabs and occasionally cuttlefish, small squids and worms. Young whiting, which live mainly close to the shore, feed on shrimps, young shore crabs, amphipods, small gobies and sand eels.

△ *Mixed shoal of pout—with the deeper fins—and whiting. Both are eminently edible and provide consistent sport for the angler.*

A deadly shelter

In northern areas whiting spawn principally in April and May but they may begin as early as January in the south and continue into July in the north. Spawning takes place mainly in depths of 300 ft or less and sometimes in only 60 ft of water. This is in much shallower waters than either the cod or the haddock. The eggs resemble those of the cod and haddock but are smaller, averaging $\frac{1}{20}$ in. diameter. They are laid in great numbers and float at the surface. When hatched the young larva is about $\frac{1}{10}$ in. long. It drifts at the surface feeding on plankton. This is the most critical stage of its life, at the mercy of its numerous enemies. If it survives it grows fairly quickly and in its first year averages about 6 in., increasing to about 9 in. in its second year when it matures and to 12 in. in the third year. The females live for 7–8 years, reaching a length of 19½–21 in. at this age.

Very young whiting, once they have reached a length of about $\frac{3}{4}$ in., sometimes



Constance P. Warner

one egg is laid in each nest and the host's eggs are not destroyed, but if a second whydah lays in a nest where there is already one whydah egg she will destroy one of the weaver finch eggs. Both the host's and parasite's eggs are white, yet the whydah can recognise, and destroy, the host's eggs.

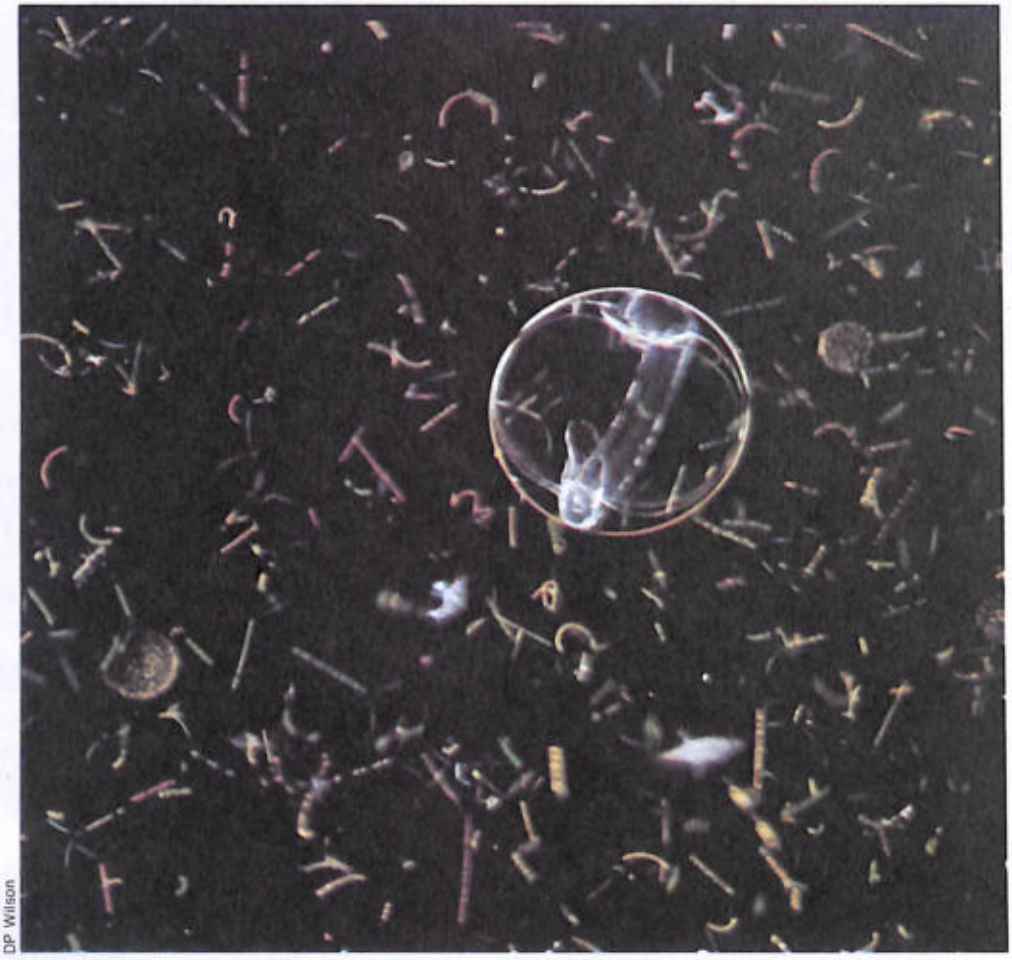
The perfect mimic

The whydahs possess a remarkable mechanism to ensure that their offspring are successfully brought up by the foster parents. This is necessary because of the manner in which the young weaver finches are reared. They are fed by the parents thrusting their bills into the chicks' mouths and regurgitating semi-digested food. To guide the parents each chick has a pattern of black markings in the mouth and bright spots around the bill. They also have special begging calls. The markings and calls vary between the species and a weaver finch only feeds chicks with the correct markings and calls. It is therefore essential that the whydah chicks should mimic the recognition signals of their foster parents' chicks. Each whydah species has evolved the mouth markings and begging calls of its particular host and the fledglings even have plumage resembling that of the host fledgling.

Because of the need of the whydah chick to resemble the host chick it is essential that the female whydah lays her eggs in the nests of the correct weaver finches. This happens in cuckoos in which the egg markings mimic those of the host species (see weaver, p. 2692) and it seems that the female cuckoo is somehow able to recognise nests of the species in which she herself was raised. In the whydahs, it seems that the male also plays a part in ensuring that the eggs are laid in the right nest. There are several very similar races of paradise whydah, some of which live in the same areas. Each race parasitises a different weaver finch, so it is essential for female paradise whydahs to mate with the right race of male, otherwise the hybrid offspring will not mimic the host. Recognition is based on song. Incredibly, male paradise whydahs mimic the songs of their hosts, so that, for example, a male narrow-tailed paradise whydah sings a song almost indistinguishable from that of the melba finch *Pytilia melba* which reared it. The song attracts female paradise whydahs which were also reared by melba finches and are conditioned to laying their eggs in melba finch nests.

class	**Aves**
order	**Passeriformes**
family	**Ploceidae**
genera & species	***Vidua chalybeata*** *Senegal combassou* ***V. macroura*** *pin-tailed whydah* ***V. paradisaea*** *paradise whydah* *others*

◁ *One of the genus* ***Euplectes****, a link between the 'ploceid weavers' and the whydahs—* ***E. progne*** *the giant whydah, or sakabula.*



DP Wilson

DP Wilson

associate with jellyfish, particularly *Cyanea*, sheltering under the bell in small shoals and swimming among the stinging tentacles, enjoying the protection without apparently coming to any harm themselves. After reaching 2½ in. in length they sink to the bottom and are found in great numbers close to the shore, especially in sandy bays and estuaries.

Many enemies when young

The most perilous stage of the whiting's life is when it is first hatched and drifting at the surface. It is helpless against seabirds, predatory fish and adverse tides and currents. Although thousands of eggs are produced at a single spawning very few reach adulthood. In the British Isles, particularly during July and August, young whiting frequent the shrimping grounds off the Lancashire coast where thousands of them are destroyed each year through the operations of the shrimpers.

Fishery

There seems to be no evidence of overfishing of the whiting and particularly in the North Sea catches have been increasing in recent years. In 1952 the total European catch amounted to 73 000 tons and in 1963 to 185 000 tons. Most whiting are caught by trawl, by far the most effective and widely used of all fishing methods. It is very ancient, having been used in Britain as early as the reign of Edward III, when its use was prohibited because it destroyed too many small fish. Even today, although it has been greatly improved upon, the trawl is a very destructive means of fishing because in addition to taking in so many unmarketable small fish it ploughs up the sea-bed, killing the small bottom-living creatures on which so many fishes feed. The trawlers themselves have been greatly improved in recent years. Steam has given place to diesel engines enabling the ships to spend longer at sea and travel greater distances. Echo-sounding and underwater equipment, similar to that used in the Second World War to detect submarines, is now widely used to detect shoals of fish and the nets are constantly being improved in efficiency, strength and ease of handling.

class	**Osteichthyes**
order	**Gadiformes**
family	**Gadidae**
genus & species	***Merlangius merlangus***
	M. merlangus euxinus
	Black Sea whiting

◁ △ *Egg of whiting suspended in a mass of plant plankton, chain-form diatoms, and a golf-ball-like aggregation of the microscopic flagellate* **Phaeocystis** *(approx × 40).*
◁ *Minute early larva of a whiting. At this stage it drifts with the surface plankton, at the mercy of wind, tide and predators (× 40).*

Whydah

The whydahs or widow-birds form a group of sparrow-like birds sometimes classed with the weaver finches, and sometimes with the large family of 'ploceid weavers' (see weaver, p. 2692). The name is also, confusingly, given to the genus ***Euplectes*** *which is related to the bishops, fodis and queleas in the 'ploceid weaver' family. Whatever the true relations of the whydahs, they form a distinct group of African, seed-eating birds that lay their eggs in the nests of weaver finches.*

There are about 11 species of whydah. The females are drab and sparrow-like throughout the year but in the breeding season the males have a special plumage which is usually shiny black, sometimes with very long tail feathers. The Senegal combassou or indigo finch is an example of a whydah without a long tail. In the breeding season the male of this species looks like a small blackbird, but the feathers have a bluish gloss and the bill is white. The male of the pin-tailed whydah, which is found throughout most of Africa south of the Sahara, measures 15 in. of which 9—10 in. is made up by the four central tail feathers. The breeding plumage is black and white, the tail, back and head being glossy black. The bill is pink. Another distinctive and widespread whydah is the paradise whydah which also has a 10in. tail but the two outer feathers are only half the length of the inner two. The plumage is black with pale brown underparts and neck but this description hardly conveys the appearance of the bird. JD Macdonald writes that 'one is astonished on first seeing a fully plumaged male in flight . . . for momentarily it is difficult to register the fact that it is a bird.'

Birds of open spaces

Whydahs live in the savannahs and plains of Africa rather than in wooded regions frequented by the weavers. Like the weavers, however, they form large flocks outside the breeding season, sometimes mixing with flocks of weavers and weaver finches. Some species are also found around towns and villages. Whydahs are predominantly seed eaters but they also take insects. They feed mainly on the ground, searching for small seeds by scratching with their feet.

Cuckoos in paradise dress

For a long time the breeding habits of the whydahs were unknown and only a very few nests were ever described. It was suspected that these descriptions were based on mistaken identifications, and quite rightly so, because it was later shown that whydahs do not build nests. They are parasites, like cuckoos, and lay their eggs in the nests of their near relatives the weaver finches.

In the whydahs there is no bond between male and female, which is not surprising as once mating is completed the male's role is ended. The males are polygamous and are aggressive towards each other. Many have elaborate courtship displays, so rivalling the birds of paradise in their behaviour as well as in plumage. The male paradise whydah clears a patch of ground about 4 ft across and prances about on it to attract females. Others, such as the pin-tailed whydah, perform display flights, ascending 100—200 ft then fluttering slowly down with the long tail waving.

Each species of whydah usually lays its eggs in the nests of a particular species of weaver finch. In normal circumstances only

▽ *Elongated glory: a male pin-tailed whydah from Africa. His 9—10in. tail comes into its own during courtship flights.*

JS Wightman

FEATURED IN THIS VOLUM

Tuna
Turkey
Vampire Bat
Walrus
Warthog
Wasp
Weasel
Whale Shark