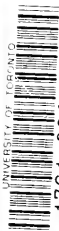


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WILD LIFE
OF THE WORLD



W. Kuhnert

WILD LIFE OF THE WORLD

A DESCRIPTIVE SURVEY OF THE
GEOGRAPHICAL DISTRIBUTION
OF ANIMALS

BY
R. LYDEKKER, F.R.S.

ILLUSTRATED WITH
OVER SIX HUNDRED ENGRAVINGS FROM ORIGINAL DRAWINGS
AND
ONE HUNDRED AND TWENTY STUDIES IN COLOUR



VOL. I

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P R E F A C E

MR. RICHARD LYDEKKER, who came of a well-known family of Dutch descent that settled in Bedfordshire more than a century ago, died on the 15th of April 1915, aged 66, while this work was in the press. It had been long in preparation, and the sheets had received his final revision, so that it remains as he left it, with the exception of this preface.

It is a general natural history in which the animals are described according to their geographical distribution, and the treatment of the subject on these lines was not new to him; in fact, his *Geographical History of Mammals*, published in 1896, is held by many to be his most original and important contribution to scientific literature. These volumes, however, have a wider scope. They are on a more popular basis, and deal with animal life of every kind, vertebrate and invertebrate, in all aspects throughout the world; and, of necessity, prominence is given to those groups which are of most importance in denoting the changes in the lands and seas during comparatively recent geological epochs.

No writer was more competent to discuss these matters from all points of view. His university studies in natural science, his experiences during the eight years he was on the Geological Survey of India, his work in South America, his many volumes of descriptive catalogues of the fossil vertebrates in the Indian, British, and Dublin museums, and his contributions to the proceedings of learned societies, made him eminent as an authority on extinct animals of the higher orders.

No man had better opportunities of familiarising himself with the existing fauna of every region, owing to his work at the Natural History Museum, where for twenty years he was arranging the collections of mammals and reptiles. He spent his life among animals living and dead, and gave the world the results of his studies in quite a long array of

publications. His *Deer of all Lands*, his *Wild Oxen, Sheep, and Goats*, his *Game Animals of Africa*, his *Game Animals of India*, his *Great and Small Game of Europe, Asia, and America*, and his *Sportsman's British Bird Book* are all of good repute. *The Horse and its Relatives*, *The Ox and its Kindred*, and *The Sheep and its Cousins* are as well and widely known. His Handbooks to the Carnivora, the Marsupials, and the British Mammals are in every naturalist's library, as are most of his collections of miscellaneous papers. His graphic essays on the various animals in *Animal Portraiture* are models of clear writing and compact expression, and, like the rest of his work, not mere repetitions of what he learnt in his youth, for he learnt all along and was always abreast of his time. He contributed many articles to the new edition of the *Encyclopædia Britannica* and to other books of reference, and last, but by no means least, he edited, and wrote by far the greater part of, *The Royal Natural History*, in which the animals are described in the order of their relationships, while in this companion work they are dealt with from the point of view of their homes and range.

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WILD LIFE OF THE WORLD



INTRODUCTION

LAND animals, and in a more limited degree marine animals also, may be regarded from two entirely different points of view. In the one case they are dealt with according to their mutual relationships and affinities (so far as these can be understood); in the other, they are considered in connection with their geographical distribution on the surface of the globe. The former method of treatment constitutes SYSTEMATIC ZOOLOGY, the second is called ZOOLOGICAL GEOGRAPHY, DISTRIBUTIONAL ZOOLOGY, or, shortly, DISTRIBUTION, and forms the subject of the present work.

Nowadays it is a well-known fact that while the assemblages of animals of different countries differ more or less markedly from one another, the amount of differences between these assemblages (or faunas, as they are technically called) in many cases does not accord with the distance between the countries in question. The animals of Japan, for instance, are not very unlike those of northern Europe and the mainland of western Asia, while those of Madagascar differ entirely from those of the adjacent continent of Africa. Again, in many respects, the fauna of North America is much more nearly akin to that of northern Asia and Europe than it is to that of South America. And from the study of geology and the remains of extinct animals it has been ascertained that the difference or resemblance between any two faunas depends, not upon the number of miles separating the two areas they respectively inhabit, but upon the presence or absence of uninterrupted land-communication between them during a long period. A connection existed, for instance, at no very remote date between eastern Asia and North America, which doubtless included Japan. On the other hand,

Madagascar has long been an island; and there is evidence that at one time South America was separated by sea from the land to the north.

Studies of this nature have rendered it possible to parcel out the land surface of the globe, according to the distribution of mammalian life, into three primary divisions or realms. Of these, the first, or *Notogæa*, includes Australia, New Guinea, and the adjacent islands; the second, or *Neogæa*, is formed by Central and South America; while the third, or *Arctogæa*, embraces the rest of the world.

These "realms" are divisible into a number of "regions." Thus in *Arctogæa* we have a *Malagasy Region*, formed by the island of Madagascar; an *Ethiopian Region*, including all Africa south of the northern tropic, together with southern Arabia; an *Oriental Region*, embracing India, Burma, southern China, the Malay Peninsula and the islands as far east as Celebes; a *Sonoran Region*, comprising Mexico and some adjacent territories; and an *Holarctic Region*, embracing the remainder of the realm. This *Holarctic Region* may be divided into an *Eastern and Western Division* (the latter containing such part of North America as is included in the region); but from the former of these divisions some authorities would cut off a *Mediterranean Region*, embracing the Mediterranean countries and a strip of country continued in a north-easterly direction through Kashmir.

In technical treatises on Distribution the faunas of the globe are usually dealt with according to these divisions or some of their modifications; but the method does not readily lend itself to a work on thoroughly popular lines, especially since some mention of extinct types is in the former case almost essential. Accordingly, in the present work, the ordinary geographical divisions of the land-surface of the globe have been followed to a great extent, and the faunas of the continents described in that order. Commencing with Europe, both that continent and western Asia have, however, been divided into a number of zoological provinces according to a scheme formulated by Dr. P. Matschie, who takes central Europe, including Germany, Belgium, and parts of France and Austria, as the typical area for the European fauna. But practically the whole of western central Europe, inclusive of the British Isles, has much the same fauna, so that the greater part of the Continent north of the Alps, west of Russia, and south of Scandinavia is included under that heading.

In addition to the ordinary geographical divisions, what is technically known as "station" has to be taken into consideration. By station is meant whether an animal is a denizen of the woods, the plains, the water, or the mountains. As an example of the method followed, we have the animals of central Europe divided into groups according to their "station." It might be thought that the Alps are entitled to no higher rank than a "station" of central Europe; but as their fauna has been very generally treated as a separate unit, the Alpine fauna has been allowed to occupy a position equivalent to that of central Europe on the one hand, and those of southern and eastern Europe on the other.

Asia follows naturally after Europe; and since the fauna of north-eastern Asia is intimately allied to that of North America, the New World comes in order. North and South America are thus treated in sequence; and although, as already

mentioned, their faunas were originally very distinct, they have now been to some extent mingled, so that this method of treatment is not altogether disadvantageous.

Next in order comes Africa and then Australasia; notices of the animal life of the shores and seas being intercalated between the accounts of the faunas of Asia and America, the animals of the southern and eastern oceans being dealt with in the concluding section.

It should be added that species are regarded, as a rule, in a wide sense, so that many of those named by modern naturalists on the evidence of slight distinctions are ignored.

The appearance or habits of the great majority of the animals mentioned are described more or less briefly, but differences in the mode of treatment of the various species have been considered advisable. Many of the better known representatives receive, for instance, a very much greater share of space than is allotted to those calculated to arrest the attention of the naturalist rather than of the general reader; and vertebrates are treated more fully than invertebrates. But even with regard to what may be called animals of general interest the treatment is mainly dependent upon the importance of the animal from a distributional point of view. The fallow deer, for example, is generally considered to be an immigrant into central Europe from the south, and consequently receives less full notice than the indigenous red deer and roe, which may be regarded as typical and characteristic members of the central European fauna. A similar remark will apply to the rabbit, which likewise appears to have been originally a Mediterranean animal. Again, the red grouse, although an important member of the British fauna, is but an insular representative of the Scandinavian willow-grouse, and is therefore only incidentally referred to in connection with the species of greater interest from a geographical standpoint.

Whatever divisions of the land surface of the globe are adopted in a work of this nature, a certain amount of repetition is inevitable, but this has been reduced as much as possible. In the case of Europe it will be noticed that certain animals, such as the brown bear, which formerly ranged over the greater part of the Continent, are not mentioned among the fauna of the central area; the reason for this being that it seemed preferable to refer to them in the localities where they still survive in the greatest numbers, or where they are alone found at the present day.



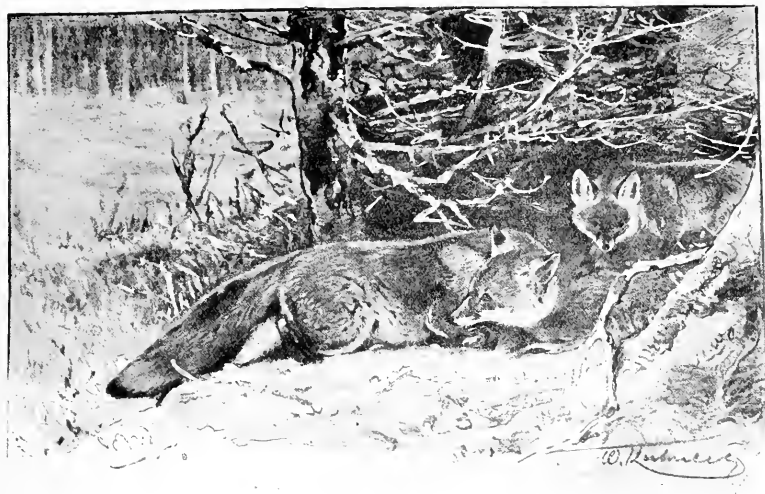
FERRET.

EUROPE



(CENTRAL)





FOXES AT HOME.

CHAPTER I

THE MAMMALS OF THE WOODS

So recently as the beginning of the Christian era Europe was to a great extent covered with primeval forest, and to the denizens of the woods may most fittingly be given the first place in the description of its present fauna. At that period the distribution of life differed greatly from what it is now, when carefully tended woodlands separated by tracts of open country, parks, orchards, and plantations, have so changed the face of the land that it is difficult to distinguish between the animals of the forest and those of the fields. Those, however, which depend upon trees and bushes for their subsistence, frequent the underwood, and are met with on the outskirts and in the outliers of the wooded regions, may safely be classed among the forest-dwellers, of which mammals are treated first.

Of the general characters of the vertebrates it will suffice to say that between the central nervous system, which extends the whole length of the body on the back, and the alimentary canal extending also along the body but not throughout the entire length on the abdominal side, is interposed the principal part of the skeleton, that is, the backbone or spine, which may be bony, or more or less cartilaginous in its composition. Among the vertebrates, the most highly developed are the mammals.

The chief characteristics of mammals are their warm, red blood, their respiration by lungs, and their habit of suckling their young. The body is generally covered with hair, which is renewed once or twice a year, and varies in

colour, according to species, age, time of year, and climate. Some of them, the ungulates, for instance, have only one kind of hair; others, on the contrary, such as the beaver and the marten, have two kinds—the upper or contour hair, which is long and wiry, and the under-fur, which is short, soft, and sometimes shows a tendency to felt. In certain species, or on certain parts, stiff wiry hairs are distinguished by their peculiar colour, length and thickness, and are called bristles; in others there is no hair at all, or only on certain parts of the body, where it may be thicker and of a different texture in one place than in another. A few are provided with scales or horny plates, and some again, such as rhinoceroses, are characterised by one or more horns of a peculiar type. The nails with which the tips of the toes are provided are of a horny substance, and vary according to the group. They may be flat, broad, and rounded in front, or long, narrow, blunt, and arched; they are called claws when they cover the whole toe-tip and are curved, and compressed, long, and pointed, and hoofs when they are blunt and short and invest the toe like a shoe. The number of toes is frequently correlated with the shape of the nails; many mammals have five fingers or toes on the fore and hind limbs, whilst the horse, for instance, has only one toe on each foot.

The number and shape of the toes are of great importance in the classification of mammals, but the number and conformation of the teeth are more important still. The teeth, implanted in the jaws, differ greatly in form, size, number, and position, according to the food and general habits of the various species. Sometimes they are wanting, but in most cases they are arranged in distinct groups, and named according to their function; their structure and arrangement proving how very different is the mode of life in the various families. Scarcely less varied is the manner in which the mammals are distributed over the face of the earth. Although whales are to be found in all seas, and bats in all countries, other representatives of the class are confined to a remarkably limited range—as, for instance, the egg-laying, or oviparous, mammals of Australia and New Guinea.

Mammalia are commonly divided into three subclasses—placentals, marsupials, and egg-layers. The first alone is represented in Europe; its chief characteristic being the existence of a complete placenta, by means of which the blood of the mother circulates through the fœtus in the uterus, though a more or less well-developed placenta exists in certain marsupials. The group is more numerously represented than the other two, and comprises the great majority of the class, among them being the ungulates, or hoofed mammals.

As the name indicates, the typical ungulates have the tips of the toes encased in hoofs; in some cases they may have broad blunt nails, but never claws. Exceptionally five toes may exist on one foot, but there are more commonly four, of which, however, two are often rudimentary or even wanting. The typical ungulates have a very wide range, being represented all over the world, except Australia. They are subdivided into two suborders, those with an even number of toes, and those with an odd number. To the first (*Artiodactyla*) belong such as have no first toe, and the other toes formed in such a manner as to present, in their fullest development, a middle pair, of which the two components are of equal size and symmetrical to one another, and an outer smaller pair, also of equal size, so that the line between the middle pair divides the foot into halves.

Artiodactyles, in most cases, walk on the tips of the two large middle toes, while the other two, when present, often scarcely touch the ground. The suborder is divided into four groups, namely, true ruminants; camels; chevrotains; and pigs, peccaries, and hippopotamuses. One of the chief characteristics of true ruminants, to which belong deer, the prongbuck, the giraffe and okapi, and oxen, sheep, and antelopes, is that the upper jaw is entirely without front teeth, while upper tusks, or canines, if they exist at all, are generally small; in the lower jaw the canines are placed close beside the incisors, and are of similar shape, so that the three pairs of incisors and the pair of canines form a row of four pairs of chisel-like teeth. The cheek-teeth or molars, form a compact series, placed at some distance from the canines. The ruminants owe their name to their peculiar habit of chewing the cud, this habit being correlated with the conformation of the stomach, which is composed of four distinct compartments. Of these, the first receives the food temporarily, but does not digest it; consequently it is brought up to be thoroughly chewed by the cheek-teeth; this process accomplished, the food descends into the second division of the stomach, and thence successively into the other two, where it undergoes complete digestion.

Roebuck. Of the four families of ruminants, two only—the deer and the hollow-horned group—include a large number of species. The different members of the deer family differ from most of the hollow-horned group (oxen, sheep, antelopes, etc.) in having no gall-bladder, and, in common with the antlerless species, in possessing, unlike the antelopes and oxen, canine teeth in the upper jaw. Their pointed slender feet are provided with well-developed, small, narrow, outer hoofs, different from those of the giraffe and prongbuck, in which the outer pair is absent. All deer have the tip of the nose bare; many of them have on the outer side of the lower part of the hind-leg a thick gland, conspicuous by its tuft of bristly hairs, and the males of most carry the characteristic antlers. The antlers grow from frontal prominences covered with the hairy skin of the head; these appendages being generally shed yearly, and replaced by new ones, developed on the same pedicles. When the new antlers begin to sprout, they present a round uniform mass of hard calcareous substance, furrowed by numerous arteries, and entirely covered with skin and hair, the so-called "velvet." As they become larger they mostly fork into several branches, although in some cases they remain simple. When the antlers have attained their full development, the circulation in the arteries ceases, and the velvet, having lost its vitality, dries up, detaches itself, and is finally peeled off by the animal rubbing against a tree.

Deer, among which the reindeer is the only species in which the female normally has antlers, are widely spread all over the world, except Australasia and that part of Africa lying south of the Sahara. They are generally timid by nature, and live hidden in the forest; and although sometimes found in fertile plains, never haunt the desert.

The roebuck (*Capreolus caprea*) is the smallest European deer, and at once distinguishable by its short three-branched horns. The coat of the new-born fawn is reddish brown, marked on both sides with three rows of white spots. At the age of eighteen months the roebuck, whose withers are still somewhat lower

than the hind-quarters, is about 40 inches long, and $29\frac{1}{2}$ inches high. The head is short: the neck is slender—longer and thinner in the female, shorter and thicker in the male: and the fore-legs are 18, and the hind ones 19 inches in length. The delicate feet end in small pointed black hoofs. The eyes are large and dark; the ears are covered inside and out with hair; and there is no apparent tail. The weight varies with age and food, but may reach 66 lbs. The coat changes in colour, according to season—in summer it is uniformly bright chestnut: in winter, brownish grey, with a white rump-patch. The under-parts of the body are lighter



ROEBUCK AND DOE.

than the upper. The chin, lower jaw, and a spot on either side of the upper jaw, as also the aforesaid patch round the root of the tail, are white. The chief characteristic of the rump-patch is the mobility of its hairs, which can be drawn together or expanded at will. When danger threatens, the patch is greatly enlarged, and thereby serves as an alarm-signal. White, black, and mottled roebuck are frequently met with. White individuals, which generally have white hoofs and red eyes, and are thus real albinos, are not only produced by similar albinos, but also by those of the normal colour; they are of frequent occurrence on both sides of the Bohemian Forest. In winter so-called black roebuck are stated to be found most frequently in Westphalia, in the Bückeburg,



ROE DEER.

and several other parts of Germany; their colour being generally grey in winter and brownish black in summer, with a lighter shade beneath and on the inner side of the legs.



ROEBUCK WITH THE ANTLERS IN VELVET.

When black roebuck change their coat in spring, they are at first light in colour, so that they are only recognisable by their heads as of that variety. Of the same character are the so-called "black-humps," which in summer are red; but in winter, on the neck and back, and sometimes even down to the centre of the

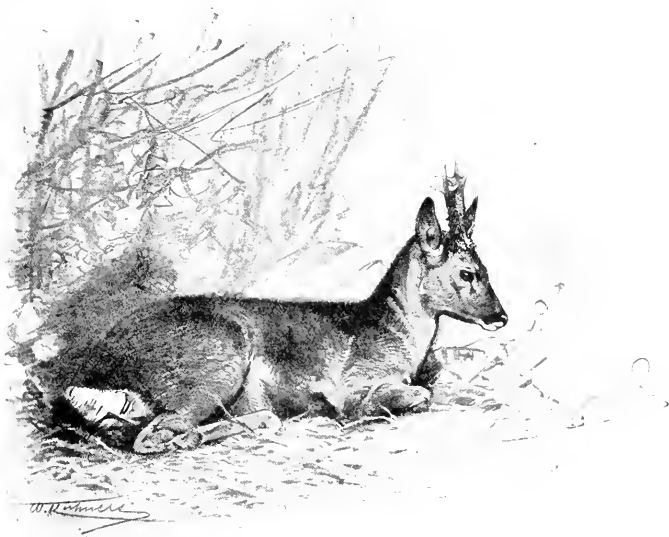
abdomen, are deep black, while during the rest of the year they resemble ordinary roes. The black phase seems to occur mainly on marsh and moorland, and is apparently more constant than the white, for, wherever a black roe appears, there are sure after a few years to be several more, so that the variation could probably be perpetuated.

The lifetime of this deer seems to be from fifteen to sixteen years, or more. When fully developed, the mouth contains thirty-two teeth; but in some cases there are also two canine teeth in the upper jaw resembling small points; these occurring more frequently in the young than in the adult, are more common in does than in bucks. As the changing of the teeth is a slow process, restricted to a certain period, the age of the roe up to a certain time may be ascertained by its dentition; but in the absence of the skull the age is difficult to estimate, owing to the size and development of the different parts of the body depending on the nature of the food, the antlers affording no real guide.

Growth of Antlers in Roebuck. Four weeks after shedding the old ones, namely, between the middle and end of January, the shape of the new antlers is already recognisable. As a rule, each antler of the full-grown buck has only three points, the pair having six; this six-pointed stage is quickly reached, and from that time onwards the possibility of telling the age of the roe by its antlers almost ceases. Four stages may, however, be distinguished in the formation of the antlers. In the fourth month after birth, about September, the frontal bones of the young buck become elevated, and in October or the beginning of November there arise two small protuberances capped by a pair of hair-tufts. By the middle of December the skin of the head rises on these, and two bases for the antlers are formed, which incline towards each other in a backward direction. During the next two or three months are developed the "spikes," which are cleared of velvet in February or March, and are cast in the following December. After these "head-spikes" come the "narrow spikes," which are developed by April of the following year, and are distinguished by having no point and no real burr. These are shed in December, when the buck is two and a half years old. When the "narrow spikes" are fully grown the forking begins, and then the antlers become effective weapons. When the six tines are formed the antlers are complete: but in addition to these there may appear a point growing backwards. If the development of the antlers goes on regularly, the buck is four years old when he first gets his six points. The height of the beam of the antler is the same as the distance from point to point, and for average bucks we may assume the medium height of 8 inches, but specially fine heads have antlers of 12 inches. Very tall antlers seldom have so many "pearls," or bead-like knobs, as short, thick ones. The distance of the two shafts from each other may exceed 8 inches—the average distance being about 4 inches,—but there are bucks whose antler-points touch. The shade of their colouring depends, it is said, to a great extent on the food and health of the buck, and also on the kind of wood against which he rubs his antlers. The tannin in the bark of the oak is reported to give the antlers a dark colouring; and darker antlers are certainly more frequent in woods of deciduous trees than in those of pine, partly on account of the food obtained there being of a more nourishing nature. Aged barren does generally show only slight pro-

tuberances, but sometimes develop properly formed antlers. The antlers of the does are never shed; those of the bucks are shed about the middle of December. After four months, by the middle of April, the new antlers are generally clear of velvet, and complete.

Distribution and Habits of Roebuck. Roebuck are not found in the extreme north, but with that exception are distributed over the whole of Europe and the greater part of Asia north of the Himalaya. At the present day they survive in England, Scotland, Germany, Italy, Spain, Portugal, France, Belgium, Holland, Hungary, Galicia, Transylvania, in the plains of the Danube, in Denmark, southern



A FOUR-YEAR-OLD ROEBUCK.

Sweden, Poland, Lithuania, and the Baltic provinces. In Switzerland the roe is nearly exterminated, and in Turkey and Greece it is very rare. In northern and central Russia it is not to be found at all, but in the Ukraine and Crimea it reappears. In Asia roe are met with in Armenia, Asia Minor, Syria, and Persia. They are also found in central and southern Siberia, eastward to the countries at the mouth of the Amur, and southward to the Manchurian mountains; but the Siberian roebuck is a larger species than the European one, from which the Manchurian roebuck is likewise distinct. In barren high ground they are rare; and in Europe they are not met with far up on the mountains. In the Tyrol roe range up to 5000 feet, in the Caucasus to 6500 feet, and in southern Siberia to 10,000 feet. In

many parts of the Continent they were originally inhabitants of the plains, but incessant persecution and the progress of agriculture have driven them from the low ground to the nearest hills. Roebuck prefer stretches of woodland among the fields to the large forests; their favourite haunts being where trees of all sorts and sizes grow, and where the dense upper foliage does not check the growth of the underwood and grasses and herbaceous plants beneath. They feed much under oak, beech, elder, mountain-ash, wild pear, horse-chestnut, and other trees yielding edible seeds or fruit; and it is said that brushwood and even pine-leaves afford them excellent food. Raspberry and blackberry, heather, bilberry, and broom, complete the bill of fare of the roe, and also yield it convenient resting-places.

During winter roebuck are generally silent in the forest, but in spring they begin calling. In some cases such a call merely means that a roebuck sees something suspicious, to which it desires to call attention, but more often it is a challenge to the rival that the buck scents in the neighbourhood. In the first case it is a long-drawn sound; in the latter, short and abrupt. While at the warning signal the grazing roes raise their heads at once, they hardly notice the challenging voice, and continue feeding quietly without taking any part in the proceedings of the combatants. The call of the buck may be easily distinguished from that of the doe, not by the pitch of the sound, but by the longer or shorter manner in which it is uttered.

The bigger bucks have finished cleaning their antlers towards the middle of April, at which time the younger ones begin; in the woods at this season may be found traces of their fore-hoofs near the trees they choose for this purpose. When the cleaning is over, the bark of these young trees often hangs down in long strings, and the branches are mostly broken. From the size of the branches broken, from their height, from the cuts on them caused by the "pearls" of the antlers, and from the length of the footprints, the sportsman draws his conclusions as to the size and age of the buck. Roebuck leave such traces not only when they are cleaning their antlers, but also when they are in a fit of anger or excitement, or when seeking food in the ground, for they are fond of half-grown mushrooms and truffles. They have the habit of trampling the ground in a peculiar way when preparing their lairs; but where they find dry leaves, or plenty of grass, they lie down without any such preparations.

In the middle of May, and sometimes earlier, they commence changing their coat, and the grey hairs may then be found by the bushel in their resorts; the animals at this period, instead of being sleek and smooth, looking bristly and ragged, with, in many instances, a conspicuous reddish patch on their neck and sides. At first this change goes on very slowly, for the deer has to recover from the hardships of winter by means of nourishing food, and the forming of new hair demands an abundance of nutritive material, which can only be gradually assimilated. This is the chief reason why the young turn red first, for they have neither to suckle a calf, nor to grow antlers. At this season they browse on the young green sprigs of ash, beech, elder, and hazel, but they also feed on grass, clover, and young corn, especially rye. They seem to drink only when sick, or when the leaves are dry; their thirst being so slight that the dew on plants and grasses is sufficient to provide the fluid required. When they are thus living on their natural food, they

avoid the marshy spots in the meadows, and sour and reedy grasses. Indeed, they are at all times very particular in their choice of food, and pick out everywhere only the best, seldom grazing long at the same place. If there is food in the forest, they remain there the whole day, and only come out in the evening to graze during the night in the neighbouring fields and meadows.



A FEMALE ROE AND HER FAWN.

The old doe comes out first, as she has to provide for her fawn left in the bushes: she never goes far from the edge of the forest, and is most watchful. If an intruder, creeping quietly through the forest, touches with his foot a roe-fawn hidden in the grass, causing it to utter a loud scream, the doe rushes back as if possessed, uttering loud, long-drawn cries, and running round and round the enemy in wide circles. At times she moves further away, and then returns with drooping head stretched out, and eyes betraying the greatest anxiety. Meanwhile the fawn has risen on its long, awkward legs, and follows its dam.

by whom it is licked all over, and suckled continually to appease its hunger. If a fox attack the fawn, the mother drives him off with her fore-legs. Having done so, she runs quickly back to her young one, which she finds lying with its head stretched forward and its legs pressed close to the ground, as is the habit of the young when in danger during the first weeks of life. They also assume the same position when the mother utters the danger-signal, or when they hear a human voice in the forest. When the fawns are from four to six weeks old, they follow their mother to the grazing-places; nibbling occasionally at the clover, though their taste for this has not then been acquired. As a pastime they soon take to frisking about, when their stiff and awkward movements are very noticeable.

During the night roe-deer remain in the meadows and fields; with the dawn they are on their legs again for the morning feed, after which they return slowly to the forest. On sultry days they are restless, and it is then useless to try and stalk them at their usual grazing-places. If it rains, roes do not remain among bushes, but retire into those portions of the forest where there is nothing but trees, and stay there till the weather improves, when they go back to the meadows and fields.

The changing of the coat continues till the middle of June; solitary grey hairs being sometimes found later on. The thin summer coat shows the graceful form of the animal best; but the tormenting mosquitoes and flies make life in the woods almost unendurable, and in order to escape these pests, roe-deer then live in the fields, or in meadows where the grass is high. Even in June the young bucks seem to begin rutting, for now and then one will drive a doe, uttering a long, sharp *prauh*, several times in succession. In the plains the pairing-time is at its height towards the end of July, and in the lower mountain districts about a week or so later: but pairing-roes are still to be found in the middle of August, and in the Tyrol the bucks may be seen driving the does so late as the end of that month.

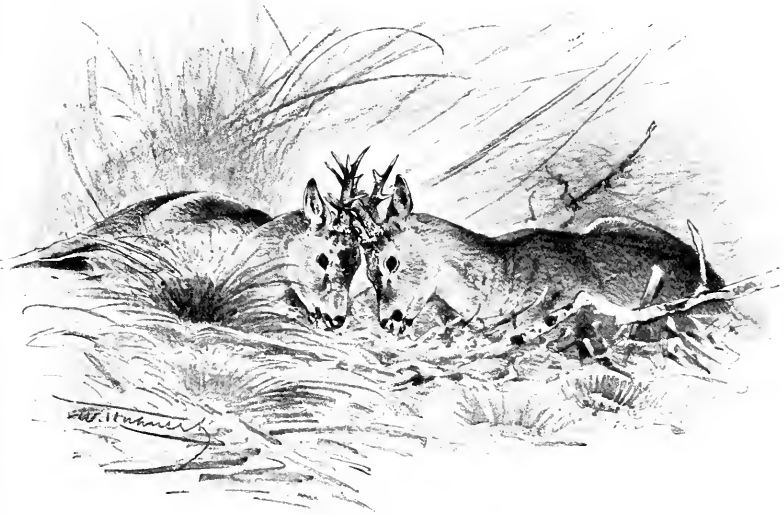
One buck generally has two or three does, but if there are not many, he is content with one. When the pairing-time begins the bucks search for the does either straight ahead or in large circles; later on the circles grow smaller and smaller, and in this way they make beaten paths with a diameter of 6 feet or thereabouts, called pairing-circles or pairing-rings. In the forest a tree or a dead stem generally forms the centre, but the paths are only found in the grass, or in cornfields. The pugnacity of the bucks is greater than ever at this season, and their dead bodies frequently show the way in which these combats end.

Forty weeks after pairing, *i.e.* in May, the doe brings forth one or two fawns in some sequestered spot; and, after a few hours, these are able to follow their mother. In rare cases there may be three or even four fawns. During pairing-time the mother separates from her fawns, but when this is over they rejoin her: later on those of two years of age join the band, and by September they are all together, generally in troops of from eight to ten.

The changing of the coat now commences again, and by the middle of October scarcely any red-haired roe are to be found. At this time some of the bigger bucks begin to cast their antlers, but most of them do not shed these before

November; and in many countries, and in many seasons, six-pointers are to be found with antlers even in December and January.

In autumn clover-fields are particularly attractive to roe-deer, a favourite food of theirs being the seed-vessels of certain species of trefoil; but they are equally fond of peas and vetches intermixed, and also of beetroot, lupin, and serradilla. In warm and damp autumns roe-deer greedily browse on the young shoots of trees, and when changing their coats delight in licking such rock-salt as may have been provided. In sporting districts, where roe are regularly fed, they invariably return to the feeding-places. If the forest begins to grow bare, they take refuge in pine-plantations, or under the drooping branches of fir-trees. When frost and



AFTER THE BATTLE: ROEBUCK WITH ANTLERS INTERLOCKED.

snow set in, the time of their need begins. At this time they walk slowly one after the other, and soon tread well-marked paths to their feeding-places. They resort to places where wood-cutters have been working, and feed on the buds of the branches lying about, often following the track of the snow-plough. In sheltered spots they find blackberry and raspberry bushes still with green leaves, as well as heather, bilberry, and broom: and they can break through the snow with their fore-hoofs to reach the grass, which furnishes scanty but still grateful nourishment for the time of year. Plantations of ash, sycamore, oak, beech, pine, and fir also afford welcome food. For a change, they eat the budding twigs of the willow and branches of the spruce-fir, cut down for that purpose, and especially young corn, and the leaves of rape. So long as the snow lies loosely, the roe

can reach the ground with their feet; but if, after thawing, it begins to freeze again, they cannot reach the ground, the twigs are covered with a crust of ice, and the feeding-places are their only refuge. During the winter months roe-deer are silent; but if the cold be severe, and the snow deep, the call of the young which cannot follow the others will now and then be heard.

Among the enemies of the roe-deer on the Continent, the bear, the wolf, and the lynx are the most dangerous; but in many districts the fox is their worst enemy, slinking about day and night in the forest, watching for a favourable moment for seizing some unprotected fawn. If the fawn be strong enough to escape, the fox chases it as a dog would in order to snap at its legs, and throw it down. Foxes will also follow the old or sick, especially in winter in deep snow, and when the snow is frozen on top. By breaking through the icy crust, roebuck often cut their legs, and leave a track of blood; nor can they then move so fast as usual. The snow will, however, bear the fox, which, in most cases, can only bring down the younger ones, as the old bucks and does are able to defend themselves with their hoofs. A fox will often follow a wounded roe, and if it be alive but dying, will finish it off by tearing open the arteries of the neck; but, if already dead, the fox commences to devour it at once, beginning where the bullet has entered.

The wild cat, which is still not uncommon in some parts of the Continent, where it lives among rocky caverns and clefts in the cliffs, as well as in rugged hills and forests abounding in deer, is another dangerous enemy to roe-fawns. Cunning, clever, and extremely daring, the cat knows much better than the fox how to take advantage of the country. So soon as the mother starts feeding a short distance away, the wild cat pounces on the fawn, snatches it up, and, before the doe returns, is far away with its prey; seizing and killing the little fawn so quickly as to give it no time to cry for help. The pine-marten, the polecat, and even the stoat are also enemies of these fawns. Of the birds-of-prey of central Europe, only the owl is dangerous to these deer, but in the high mountains, and in Asia and elsewhere, eagles are formidable foes.

An enemy against which the roe is powerless are certain flies which attack it so severely that death not unfrequently results. The larvæ of these flies are parasitic either in the mucous membrane of the nose or under the skin on the back. In the mucous membrane lives also the pupa of another fly, *Estrus stimulator*, and under the skin that of a gad-fly, *Hypoderma diana*. Another parasite is the stag-louse, *Lipoptera cervi*, while another tick, *Ixodes reticulatus*, penetrates the skin and sucks the blood. Among the internal parasites is *Tenia cœnurus*, one of the tape-worms, which establishes itself in the brain, in the same manner as in a sheep's brain, where it generally causes an attack of "gid." The thread-shaped palisade-worm, *Strongylus filaria*, attacks their lungs, and the liver-fluke, *Distoma hepaticum*, the liver. Among the ailments caused by microbes, the most frequent are tubercle and rinderpest, and there have been a few instances of disease of the spleen.

On account of their graceful and dainty ways, roe-deer have been kept as pets since very ancient times. A young roe-fawn, when caught, soon gets accustomed to its surroundings, to people, and to other animals. It plays with the

dog as if it were its like, and seems to enjoy the numerous attentions that it receives from all sides, continually showing its inborn curiosity. It climbs on benches and tables, is thankful for dainty bits, and thrives exceedingly when fed on bread, sweetmeats, turnips, cabbage, sprouts, hay, oats, wheat, etc. The doe remains even in old age a pleasing pet, but it is advisable to watch her during the rutting-time should there be a forest close by in which there are bucks, although, if she is prevented from escaping to the forest, she remains faithful to her home. The buck, on the contrary, becomes dangerous, especially after cleaning his first antlers; and not only children, but also grown-up people, and especially women, have to beware of its presence. In Germany about 200,000 of these deer are shot every year. They represent some 2700 tons of meat, and are worth from fifteen shillings to one pound each. The flesh of the roe-deer is very short in, the fibre, and therefore tender when roasted. The melted fat is a remedy for external inflammation, and will preserve the smoothness of the skin, while it is also used in the manufacture of soap. The marrow from the bones of the lower part of the legs is used for oiling gun-barrels. The antlers afford good material for fine carving. From the skin in summer is made excellent leather, and the hide in winter furnishes foot and sledge rugs; while the variegated skins of the fawn are used for small bags, and skins in the winter coat for lining saddles.

On the Continent roe-deer fall to the sportsman in many ways; they are killed from hiding-places or by stalking, or driving, or hunting with dogs, or by the gunner taking a leaf in his mouth, and blowing through it, imitating the call of the rutting-doe to allure the buck. Dogs are sometimes so confused by the antics of these deer that they completely lose their heads. The behaviour of a roe towards dogs depends on their size and activity; it plays with the awkward dachshund, sometimes escaping at a run, and sometimes stopping until the dog approaches again, when it springs to one side, till at last, after all sorts of capricious turnings and windings, it works back to the starting-point. With ordinary dogs, however, its behaviour is different, and its swiftness increases with its fears. Frequent disturbance by dogs running wild is most injurious to these deer, and will drive them completely away from a district.

Red Deer. The red deer (*Cervus elaphus*) may be recognised by the rounded antlers, as well as by the presence of upper canine teeth when advanced in years. This deer is the typical representative of the genus *Cervus*, and is strongly built, with rather slender long legs, a short, pointed tail and a yellow rump-patch. It is red in summer, and in winter greyish brown, though the hue varies according to age, sex, and locality; until the first shedding of the coat, which takes place in October, it is spotted with white. The young, of which the hind brings forth one or two at a time, are called fawns when male, and calves when female. In the first autumn the female calf is called a young deer, in the following year a hearst, and then a hind; while the fawn is called a brocket during the first and second winter, a spire during the third, a staggard during the fourth, a stag during the fifth, and then a warrantable stag, and afterwards a hart. Several local races of red deer are now recognised in western Europe.

Antlers of Red Deer. The antlers of red deer display much greater annual differences than those of the roe. First of all the bases undergo a change; the burrs becoming larger from year to year, and thereby approaching each other in the middle of the forehead. In the same way as the space between the burrs, the space between burr and skull diminishes. Still more striking is the change in the shape of the antlers and the number of their points. Although the number of the tines changes irregularly, there is a strict regularity in the development of the beam; and it is, therefore, of more importance when determining a stag's age to examine the shape of the antlers than to count their points.



A YOUNG RED DEER STAG OR "BROCKET."

The arrangement of the tines is more important than their number, only those that grow immediately out of the principal beam of the antlers being essential; the branching of the tines is an unimportant variation from the regular plan. The lowest of the regular tines, or "brow-tine," is at first some distance from the burr, and rather high on the beam. In the course of time it approaches the burr, until at last it becomes close to it: the position and direction changing simultaneously. At first the brow-tine forms with the beam from which it rises an acute angle, which widens every year, until it becomes a right angle, while in a ten-pointer the angle is so large that it becomes obtuse. Similar variations may be observed in the trez-tine, which in a normal six-pointer immediately

follows the brow-tine, and, under all circumstances, originates from the first bend of the main beam. The trez-tine remains invariably in the principal direction, which is at the base turned forwards and to the outer side in a curved line,



RED DEER ANTLERS AT VARIOUS STAGES OF DEVELOPMENT.
(The lower figure shows a tuberosity indicating the position of the bez-tine.)

rising at the point, and turning towards the inner side. Between the trez-tine and the brow-tine, a little closer to the latter on a sharp edge, is the second brow-tine, or bez-tine. This is at first only very slightly developed, being sometimes indicated merely by a swelling or tuberosity on the sharp and smooth edge of the main stem, and it never reaches the size of the brow and trez tines, midway

between which its direction is always kept. A branching of the main beam at its summit occurs, without exception, above the trez-tine. At the place where this starts a side stem branches off from the main beam, which rises in a curved line, turning outwards and forwards at the same time. Thus arises a fork,



ABNORMAL RED DEER ANTLERS.

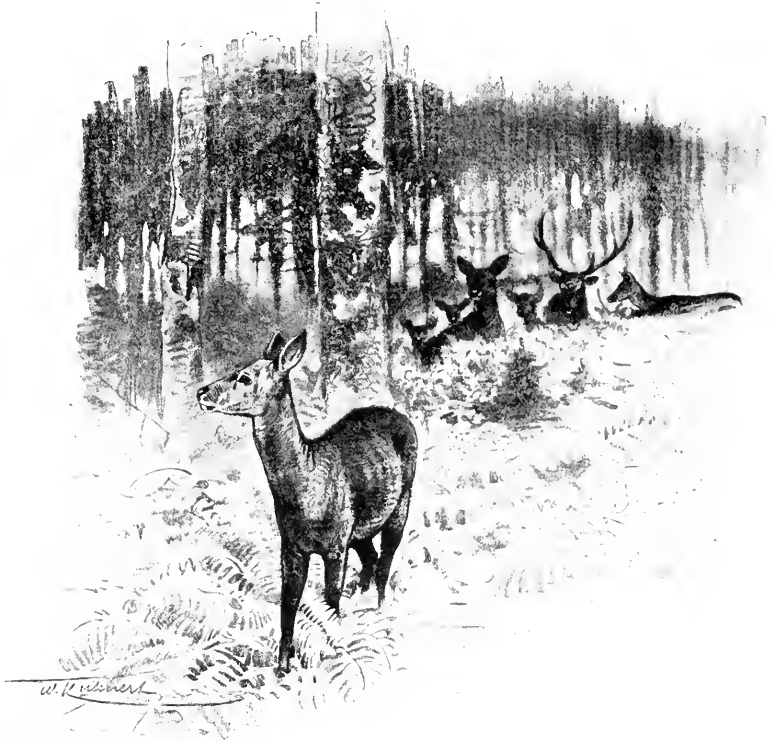
which appears first in the eight-pointer. By means of their increasing complexity, the stages of development of the antlers may be defined. The brocket bears slender, undivided beams with smooth outward curves that have no angle, and no inwardly inclined tips. A stag with its second antlers carries on the main beam, which is not very different from that of the brocket, a weak,

upright brow-tine not far from the centre of the forehead. With the six-pointer begins, however, a new type of antler, inasmuch as the principal beam, which in the main is much like that of the second pair, forms at about half its length a sudden, knee-like bend. At this knee the slender trez-tine appears for the first time; but at this stage of development the bez-tine may sometimes still be wanting, its place being only indicated by the angle of the main beam. The eight-pointer adds a new part to the antler, namely, the terminal fork which is often wanting on one side. If it be wanting on both sides, the head would seem a six-pointer, and yet would be regarded as an eight-pointer. It frequently happens that besides the side-tine of the fork the trez-tine also disappears, so that, judged by the number of their tines, the antlers would seem to be at a much lower stage of development than is really the case. The ten-pointer, whose main beam, like that of the eight-pointer, has a fork at the summit, shows for the first time the bez-tine branching off almost at right angles from the main stem. By this bez-tine the ten-pointer is easily recognised, as it is by the inclination of the brow-tine, which forms an obtuse angle with the main stem. If the bez-tine disappear, the stag would be regarded as an eight-pointer, although, by the shape of the antlers, a ten-pointer. At this stage, again, the side-branch of the terminal fork may have disappeared, making the head look like an eight-pointer; but, if brow-tine and side-branch of the terminal fork disappear together, the head seems to be a six-pointer.

The cup or crown first appears in the twelve-pointer: in such antlers the main stem forms the second knee, and the tines change their direction. The upper half of the main stem now has three tines, which start from the same point to form a sort of reversed pyramid, and, by ending the main beam, become the "crown." If the bez-tine be wanting, such stags, although really twelve-pointers, might be regarded as ten-pointers. In all regularly developed specimens of the fourteen-pointer we find a fork at the top of the main beam. The eight-pointed main beam of the sixteen-pointer shows a third knee, and has at its extremity again three tines shooting forth at the same place: the main beam of the eighteen-pointer is forked again at the end, and the twenty-pointer's main beam has a fourth knee, from which again arise three tines.

Range and Habits of Red Deer. The nature of the forest in which deer live has great influence on the condition of the antlers, deer from alder-woods, for instance, having antlers of a dark colour; and not only colour, but shape, size, and other peculiarities are affected by local conditions. The developing antlers are often damaged externally or checked in their growth by internal diseases. They first appear at the age of seven months; and the deer lives to about twelve, or sometimes twenty, but never, as was formerly assumed, forty years. Originally the whole of Europe was the home of the red deer, which was found in Scandinavia up to latitude 65° N., and towards the south inhabited the countries round the Caucasus. At the present day red deer are found in Ireland, very locally in England, and much more widely in Scotland. In the Hebrides deer are smaller than on the mainland of Scotland, and in Norway they are also of proportionally small size. In Sweden they are rare; they have been driven from European Russia, except the Crimea and the Caucasus, but in all the other countries of Europe

they are still to be found. In Sardinia and Corsica they are distinguished by their inferior size, and in Morocco and Algiers they often lack the bez-tine; each of these deer forming a separate race, as does the red deer of the Caucasus. In Siberia the place of the red deer is taken by local races of the wapiti of America. The favourite resorts of red deer are extensive forest, although they do not



RED DEER IN THE FOREST.

everywhere keep to the forest. In Scotland they live in the mountains, where they find shelter in the valleys and ravines. A stag changes its abode only during the rutting-season, or when shifting its coat, or when it cannot get sufficient food. In winter deer are often driven by the snow from the mountains to the lower hills and plains, where they seek safe and sheltered places, to return to their old haunts in spring. So long as the antlers are soft, stags prefer staying among

soft-wooded trees or low bushes; but in summer, when the forest is not so quiet, they often leave it, and, like roe deer, take to the cornfields. For the stag is a cautious animal, which if disturbed invariably runs up-wind, and grows particularly shy and restless if it thinks it scents a hidden enemy in its vicinity. When red deer, as in Scotland, live in open country, they detect intruders at enormous distances, and, once they have sighted them, keep them steadily under observation. On the Continent, where they are exclusively animals



A ROYAL HART WALLOWING IN A MORASS.

of the forest, during the greater part of the year they never venture out of their hiding-places in the thickets by daylight. At sunset they come out at a short trot to their grazing-grounds, that is the fields and other open places, where they remain during the night, and at dawn slowly stride back to their forest-home.

Gregarious, like most of their kindred, wild red deer generally live in large herds, the majority of which consists of hinds and fawns; the stags collecting in isolated groups, and, unlike the hinds and young ones, frequenting the higher ground. During rutting-time the old stags very frequently separate from

the herd and wander for miles and miles, driving the hinds to convenient places and chasing the weaker stags away from them. While the stags have to keep their own look-out, the hinds generally do the warning and watching in the mixed herds. Such a herd is always headed by a leader—a hind—on whom its movements depend, so long as it is not being driven by the stags. The master-stags always come last as the herd issues from the forest; and if a herd is seen during the rutting-time accompanied by several big stags, it may safely be expected that about three hundred yards behind the rest a still finer stag will follow. At this period, which is in September and October, the harts separate from their companions earlier than the young stags, in order to find the hinds. Having taken the troop to the sheltering thicket the hart will bathe for hours, and restlessly wallow in pools and morasses, till the mud makes him look quite black. Sometimes, when he has just assembled his troop of hinds, there comes a rival to fight him for his harem. If he is beaten, and is unwilling to give in, he continues to linger round the herd. The conqueror pursues him, and occasionally the combat is renewed. Often it is given up at once. Generally the first fight is a long one, fortune sometimes favouring one, sometimes the other: and so much is each bent on his purpose that the excited animals notice the approach of man much less than at other times.

In the beginning of the rutting-season the stag brings his troop to the thickets every morning, where they remain during the day, while he keeps aloof, but later on he remains with them all day long. At first he calls only now and then, afterwards beginning early in the afternoon, and continuing until morning. From the power, depth, and hoarseness of his voice, his size may be estimated. When the whole forest rings with his cry, the driving is at its highest point. The young stags do not call because they are afraid of the older and stronger ones. At the end of rutting-time, which commences after the completion of the antlers and summer coat, the stags again live peacefully together. Then the winter coat begins to grow, and by February the old stags drop their antlers, although the younger ones do not shed theirs before May. In the former the antlers are fully grown in June, in the latter not before August. After the shedding of the antlers the summer coat grows, and when this is fully developed the hind, which has been pregnant eight months and a half, drops her fawn. The fawn is born in May or the beginning of June, and after some days follows its mother, from whom it does not separate, except during the rutting-season. The new-born fawn lies hidden amidst tall heather or other covert. By day it is left to itself, but in the evening the mother returns to her offspring. Before leaving it she presses it down with her nose to its couch, and there it remains the whole day, without even raising its head, keeping its nose close to its tail like a dog. The hind never goes far away, and is always on the alert for its safety, selecting a spot where the wind blows from the direction of its hiding-place. Wild cats, foxes, and other enemies are driven away by her at once.

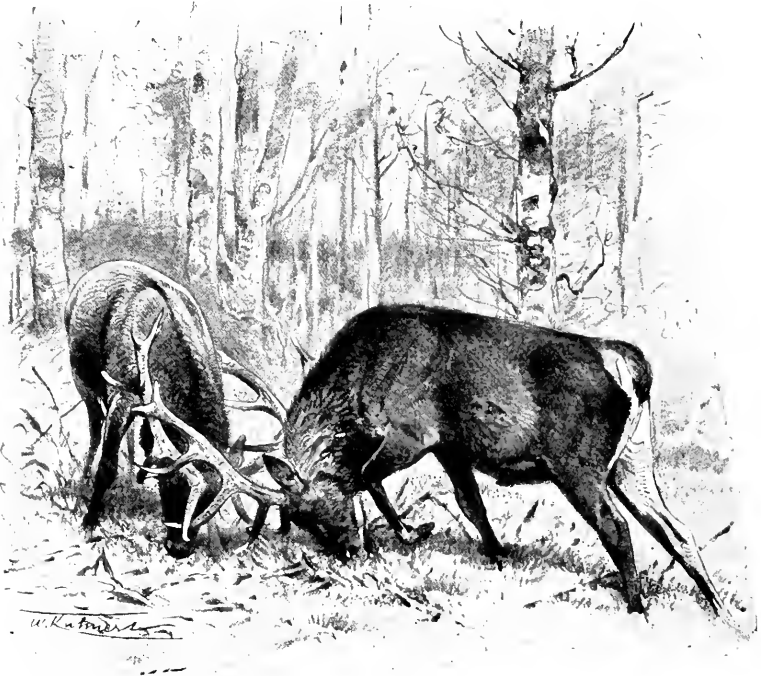
Red deer change their food according to the season. In autumn they feed on beech-mast and acorns; in winter on the bark of trees, twigs, heather, and moss. In some districts they seem to have accustomed themselves to what they disdained before; in northern Germany, for instance, deer have taken to eating potatoes for the



RED DEER HIND AND FAWN.

last seventy years, though in former times they ignored them, as they do the bark of pine-trees. During rutting-time the harts eat very little; often only mushrooms, and sometimes even poisonous funguses will be found in the stomach, but later on they take all the more food. In Scotland the deer during rutting-time eat the light green and grey reindeer-moss which grows on the mountains. Like roe-deer they will regularly return to blocks of rock-salt when placed for them to lick. Red deer furnish fairly good venison, which is, however, unfit for food during the rutting-time, on account of the unpleasant taste it has: the hide affords good leather; and the antlers, which may be boiled to jelly, furnish material for many articles. Red deer are easily tamed, and can be trained for riding and driving, and even for circus performances. On the Continent the red deer is shot from a concealed position, or hunted on horseback, or in carriages and sledges, and

may be allured during rutting-time by imitating its call on a conch-shell, or by an artificial call. When hunted by hounds, red deer make for the water. When they are wounded in mountainous countries, and closely pursued, they climb to the higher mountain-streams where the hounds cannot easily follow them. Reaching a mass of rock in the water, the stag will then place himself,



A FIGHT FOR MASTERY.

if possible, in such a position that the hounds can only attack him in front. Such an attack is fruitless, as he is able with the help of his antlers to defend himself against a whole pack; but if he takes to flight good hounds are able to overtake and pull him down. In 1819 there were shot at a deer-drive in Prussia 672 stags, 614 staggards, and 179 calves, among which there was one of twenty points weighing more than 800 lbs. Nowadays the weight is much less, red deer of 350 to 450 lbs. being considered large. Corsican and Norwegian deer barely reach 230 lbs.

The third European representative of the deer tribe is the fallow deer (*Cervus dama*), distinguished by its antlers being cylindrical at the lower end of the shaft, and palmated in the upper part. As it is not properly a member of the central European fauna, its real home being apparently the Mediterranean countries, it may accordingly be treated more briefly than the two preceding species. It is reputed to occur wild in the forests of Tunis, as well as in those of Spain, Sardinia, the Taurus, and some of the islands between Greece and Asia Minor; and has apparently been introduced into central and northern Europe, as well as into Italy, where it had become extinct. This introduction must have been a long time ago, for fallow deer bones have been found in an English cave. At present we find fallow deer in many parts of Germany, France, and England, and they have been acclimatised in southern Sweden and Norway. In 1465 there were dark-coloured fallow deer in Windsor Park; and under the Great Elector these were introduced into Brandenburg, and under Frederick William I. into Pomerania. In these and other districts from the Alps northward the fallow deer, provided it is taken care of during the winter, thrives well; but it has almost degenerated into a domesticated animal, and its colour is subject to much variation. Generally it is yellowish brown, or tan-coloured, a little darker on the head and upper part of the neck, and marked on the back with a dark line running from the neck to the end of the tail. On the sides of the body and on the haunches it is more or less spotted with white in summer, but underneath the tail and inside the legs it is white. There are also spotless, or indistinctly spotted fallow deer, and entirely black ones, as well as all sorts of variations between the black, white, and spotted phases. In summer the fallow deer is of a more reddish colour, and the spots are more distinct; in winter it is greyer, and nearly spotless. It has neither a mane nor longer hair at the neck, and all over its body the hair is comparatively short and fine. It is, however, much more easily distinguished by the shape of the antlers. The shaft, when fully grown, is, as already said, cylindrical below, and palmate at the top, and has a brow-tine, forming an obtuse angle, but there is no bez-tine, although beneath the palmation there is a trez-tine. The palmation bears at its back three or more sharp snags, the lowest of which is separated from the others, and a little longer. The spotted coat of summer harmonises with the splashes of light and shade thrown by the leaves of the trees beneath which these deer repose. In winter such a type of colouring would be useless.

In the fallow deer of Epping Forest there are none of the true fallow colour, that is yellowish dun, nor are there any that are spotted with white, and no spotted fawns have been noticed by the keepers, though spots on old and young are distinguishable after death. Another peculiarity is the unusual narrowness of the antlers, which are seldom more than 2 inches in width, the degeneration being probably due to prolonged isolation and continued interbreeding.

In habits of life the fallow deer closely resembles the red deer. It is, however, much less shy and cautious, fearlessly running about in open places in the daytime, and not changing its haunts either so regularly or so often. It is gregarious, and lives in large or small herds, which only during rutting-time, from September to the beginning of winter, are accompanied by the bucks.

Rutting-time begins in September, and is at its height in November, or about a month later than that of the red deer. The doe, which is pregnant for eight



FALLOW DEER AT HOME

months, bears one or two (never three) fawns, these being suckled till next rutting-time. If bucks, the fawns assume in the second year cylindrical antlers, which are renewed every spring, and gradually expand. First the brow-tine appears then the trez-tine, and at last the shovel-shaped summit which carries tines on

the back. The age of fallow bucks may be estimated by the size of the antlers and the breadth and division of their palmations. The food of fallow deer is much the same as that of red deer, but they seem to prefer horse-chestnuts, which the bucks often shake off the branches with their antlers. They yield better venison than red deer, and a softer and more elastic but thinner leather.



A SOUNDER OF WILD SWINE.

They are hunted exactly like their larger relative, and furnish similar materials for commercial purposes.

Wild Boar. In addition to the true ruminants, the ungulates are represented in the central European forests by one member of the swine group. This group includes pigs, peccaries, and hippopotamuses, none of which ruminate. All of them have simple stomachs; and they are distinguished from the camels and the true ruminants by the structure of their feet, as well as by their teeth. Unlike those of the true ruminants, the upper bones of the feet are not fused into a cannon-bone, in which respect they resemble the African water-chevrotain. The pigs are distinguished by a long head, and the prolongation

of the nose into a movable snout, which has a disc with the nostrils at its end. The narrow feet of the swine have four completely developed toes, the outer pair of which do not touch the ground, while the inner ones are flattened. Their tusks grow throughout life, and the upper ones are usually directed upwards instead of downwards. The ears are large and drooping; the rather long, round tail has a tuft at its end; the body is covered with sparse bristles; the neck is short and thin; and the head is carried low.

All the more typical swine are restricted to the Old World, and include animals that like damp and marshy situations, and enjoy walking in mud. In Europe there is only one genus, that of the true swine (*Sus*). These are distinguished by forty-four teeth; the upper tusk having a smooth terminal surface, produced by rubbing against the lower canine. Owing to this, both the upper and lower canines are kept from growing long, but, if one of these teeth be broken, its fellow in the opposite jaw grows to an inordinate length. Besides their bristles, pigs have more or less developed under-fur; and the wild race has a long and narrow face. They are very prolific, and the young, especially those of the wild species, are striped all along the body with light or dark lines. Before the wild boar was so persistently hunted, wild swine were spread all over Europe and North Africa, as well as southern and central Asia, Japan, and the Malay Isles.

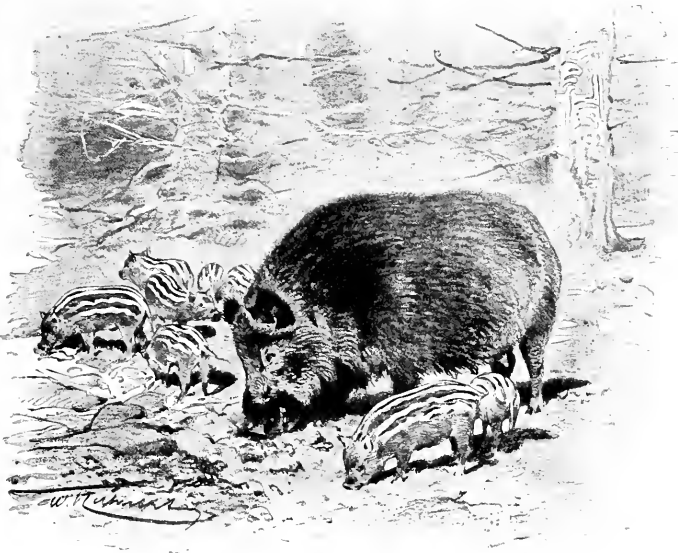
The wild boar (*Sus scrofa*), the only representative of the family in Europe, is blackish brown, in winter sometimes blackish grey, in summer dark brown or foxy red. Although resembling the domestic pig in form, the wild boar differs considerably in the shape of the head, which occupies nearly a third of the entire length of the animal, exclusive of the tail. The snout consists of cartilage, thickening to a protruding edge at the nose, and is worked by strong muscles. The chief weapons of the boar are its tusks, especially those of the lower jaw. In the upper jaw the tusks are comparatively short and club-shaped, but those of the lower jaw stand up vertically, and even at the age of two years form spear-like weapons, projecting a little above the edge of the muzzle. These tusks are more formidable in a boar of three years old, owing to their increase in length and their vertical position. The lower tusks at that age are indeed particularly dangerous, since they enable the animal to strike with its full strength; but in the fourth year they begin to curve backwards, thus rendering the boar less dangerous as he grows older. During this time the upper canines gradually curve over the muzzle, the lower pair, in old age, becoming much worn, if not broken and entirely lost. Unlike the boar, the sow has only small tusks, which are practically incapable of inflicting harm; and her means of defence are limited to biting and trampling with her feet, for which reason she is often more dangerous than a big boar, especially as she persists in her attack to the last, trampling on her adversary with her hoofs, and biting until the encounter ends.

The eyes of wild swine are scarcely visible externally, being deeply sunk and protected by bristles, thus enabling the animal to rush through the densest brushwood without closing the eyelids. The ears stand erect, although sometimes laid back a little. The front of the body is much more developed than the hind part, being joined to the powerful head by a thick-set neck, and supported on



WILD SWINE

short, stumpy legs. The animal thus stands higher at the withers than at the rump. Between the skin and the flesh covering the shoulder-blade lies a sort of shield consisting of white, horny matter, sometimes as much as 2 inches thick, which even at reasonable distances cannot be pierced by shot. A kind of warty crust, formed on the skin by rubbing against the trunks of pine-trees, and consisting of a hardened resinous layer, also serves as a shield. The thin and whip-like tail is carried upright or curled upwards while running, but hangs downwards when the animal is engaged in turning up the ground. The prints left by the feet of wild swine resemble those of the red deer, but may generally be distinguished



A WILD SOW AND HER STRIPED YOUNG.

by the lateral hoofs of the hind-feet making an impression on the ground, which those of the deer seldom do. The weight of the European wild boar in the first year ranges from 60 to 90 lbs. ; in the second year, from 110 to 155 lbs. ; in the third year, from 175 to 220 lbs. ; and in the fourth year, from 220 to 275 lbs. Afterwards the weight depends on food and other conditions. Formerly the weights were said to have been greater ; but nowadays the maximum weight varies between 330 and 440 lbs.

Wild swine begin to breed before they are fully grown, and are capable of doing so at the age of eighteen months. The general pairing-time begins either early or late in November and lasts till February. As a rule, the boar leads a

solitary life, but during the pairing-time there are often fierce combats between the more powerful rivals.

Wild swine are not entirely forest animals like red deer. In north Africa they live among swamps and pasture lands, and in upper Egypt among sugar-cane plantations; in parts of Asia they leave the forest, temporarily at least, to live for a time among tall grass near water. On the Continent they favour undisturbed forests with numerous thickets, which afford a safe retreat during the day. The old boar makes his lair under some pine-tree with drooping branches, or in a dense mass of thorn-bushes. In such a situation the boar digs up the ground and excavates a deep hole, which, after being lined with moss and ferns, is used again and again, and in which he is barely visible. Sows sometimes make their lairs in small copses amid the open fields, even when large forests are near. This may be due to the weather, since it is supposed that sows prefer sunny shelters in winter, while in the warmer months they select cooler situations exposed to the north. With the twilight they rise from their lairs and set off at a trot, now and then stopping to dig up the ground. They frequently sniff in the air when they do not feel quite safe, especially when they have to cross a road or fence in emerging from the forest into the open. If anything suspicious attracts their notice, they utter a snuffing, hissing sound, and then disappear so noiselessly that it might be thought they had sunk into the ground. The slightest thing will rouse their suspicion; an object lighter in colour than the surroundings, or even a softly creaking bough, is sufficient to drive away these shy animals, for, while their sight is imperfect, their hearing and scent are excellent. Indeed, they always recognise their pursuer by scent, not by sight. If compelled by necessity, the wild boar does not hesitate to swim across the strongest and most rapid streams.

Winter is the worst time for wild swine. In the colder districts of the Continent the icy crust so often formed wounds their fore-feet, which frequently turn gangrenous, and thus cause death. Man, moreover, takes a large share in their destruction, and many are shot from covert, and especially from the boar-pulpit, as it is called in Germany—that is to say, an artificial stand, ascended by means of a ladder, where they are waited for until they come within range. They are occasionally hunted by hounds, and when abundant, are caught in traps.

The only other mammalian order of vegetable-eaters represented in central Europe is the Rodentia. The mammals of this great group, as their name implies, gnaw their food, and have their teeth specially adapted for a diet of this nature, being thus easily distinguished from other members of the class. In each jaw they have one pair of long, chisel-like incisors which grow continuously, and, except in the case of the hare family, are their only incisors. Since the rodents have no canines in either jaw, and never more than four cheek-teeth on each side, there is always a long gap between the incisors and the molars. These features alone would be sufficient to distinguish them from all other mammals, with the exception of the aye-aye of Madagascar. As a rule, their feet have four or five toes, furnished with sharp claws or large nails, and they walk either on the whole or a part of the sole.

Squirrel.

Their mouth is remarkable for a peculiarity found in no other mammal—the hairy skin extending into it, behind the upper incisors, so as to cover its inner side, and thereby dividing it into two chambers, which communicate by a small aperture. The first chamber encloses the incisors, and the second the molars; and by this arrangement the splinters of wood and other objects of too large a size are prevented from entering the mouth-chamber. Most rodents have dark, uniformly coloured coats, although many are more vividly coloured. In some, for instance, the body is spotted or striped, but in none is the tail marked with lighter and darker rings.

Of all mammalian orders the rodents are the most numerous in species, and the rapidity of increase of the majority is very remarkable. The group is absent only from the coldest polar countries; while, with the exception of bats and the native dog, rodents are the only mammals in Australia besides marsupials and the egg-laying species. A very large number of rodents are indigenous to South America, where the largest representatives of the group are found. All are purely vegetable-eaters, and masticate their food to a great extent by gnawing it with their incisors. Timid creatures, they take to flight whenever danger threatens, and attack their enemy only in cases of the utmost need; when they do so, they fight with desperate courage, often inflicting serious wounds with their powerful incisors. Many yield useful, though not as a rule valuable, furs: but of a few the pelts are very costly.

In considering the European representatives of the group, we may commence with the common squirrel (*Sciurus vulgaris*), which is the sole representative of its genus in western and central Europe, where it lives only in trees. The numerous other species of the group are, however, widely spread; they are all distinguished by their long, bushy tails, long and sharp claws, and, generally, rather large ears, which in some cases may have tufts of long hair at the tips. The European squirrel is, as a rule, of a uniform brownish red, but many of the species from hot countries are of much brighter colours, some being orange-yellow, and others, like the little Indian palm-squirrel, being marked with longitudinal light stripes on a dark ground, while certain North American species show a different colouring for different seasons. Squirrels vary much in size, and are found in all the temperate and tropical countries, except Madagascar and Australia. They are represented by a very large number of species, many of which are indigenous to the Malay Archipelago.

The continental form of the European squirrel in summer is brownish red above, mixed with grey on the head and sides, and white below from the chin downwards; but in winter the hair of the upper-parts of the body becomes mixed with grey, and sometimes the whole coat is whitish grey or black, and less frequently white or piebald. The species inhabits the forests of Europe and northern Asia, from the shores of the Atlantic in the west to north-eastern Siberia and eastern Asia; and from the Mediterranean, the Caucasus and the Altai in the south to Lapland in the north. The British squirrel forms a very distinct local race of the species distinguished by the colour of the tail. Black squirrels are frequent in mountain districts—for instance, in the Alps, in the Silesian and Hartz Mountains, and there is a blackish race in Greece,

while in Russia this is replaced by a grey one. In the Alps, as well as in northern Europe generally, the squirrel lives mostly in trees, although it is said to have been found wandering in troops through Lapland and Norway, and even swimming the rivers; but in the main it seldom leaves the wooded area, and never wanders far from its home. Where the trees are sufficiently close it will climb, run, and jump from one to the other without touching the ground; but, when frightened, it will not hesitate to drop to the ground from the highest tree, alighting without hurt, and immediately climbing the next.



THE SQUIRREL-TAILED DORMOUSE.

The forest-trees are not only its home, but also furnish its food, consisting of seeds, nuts, acorns, pine-seeds, fruit-pips, and, in times of scarcity, even buds and bark. When on the ground, the squirrel will also eat mushrooms; and it not unfrequently attacks birds, destroys their nests,

and devours their eggs and young. It eats its food in a dainty way, sitting up on its hind-legs, and thrusting it into its mouth with its fore-paws. In the autumn squirrels gather large quantities of food, which they store for winter use in hollow trees. The species undergoes no real winter sleep, although in bad weather it may not leave its nest for days. The drey, as the nest is called, is round, closed at the top, softly lined in the interior, and with only one entrance; and generally there are several of them close together. The pairing-season lasts from the end of February until April, and during this time many and fierce are the

combats between rival males. Some weeks later the female brings forth three to four young ones, which at first are blind. At the slightest disturbance these are carried by their parents to another drey.

Squirrel-Tailed The dormice, or *Gliridae*, are much like squirrels in habits as well as in appearance. They are small creatures with narrow heads, rather large eyes, nearly naked ears, and short bodies; their fore-feet carry four toes, the thumb being short with a small flat nail; but the hind-feet have the usual five toes. The bushy tail is about as long as the body, and the upper lip is cleft. Their fore-legs are short, and have short nails to the toes, although



THE GARDEN-DORMOUSE.

dormice live in trees. Dormice are found in Europe, Africa, and Asia. The largest of the European species is the squirrel-tailed dormouse (*Glis esculentus*), which gives its name to the family. In this species the ears are one-third longer than the head; the colour is ashy grey above, sometimes with a brown hue, and white below. Round each eye is a dark brown ring. The fore-feet are greyish white, the hind-feet whitish with dark brown stripes on the upper side. The tail is light brownish grey above, and a little lighter below.

Garden-Dormouse. The garden-dormouse represents a type distinguished from the last by the nature of the hair of the tail, which is short near the root, but long and bushy at the tip; the ears are also larger, and the upper and lower surfaces of the body are differently coloured. In the central European

species (*G. nitida*) the ears are half as long as the head, the colour is reddish grey above, lighter at the sides, white below, and round the eyes there are black rings which extend beneath the ear to the side of the neck. On each shoulder there is a similar spot, and in front and behind the ears are other white spots; the tail is reddish grey at the root, black at the tip, and white below. This dormouse is found in gardens and orchards in the warmer parts of western and southern Europe. It is fond of meat, and builds its nest and rears its young



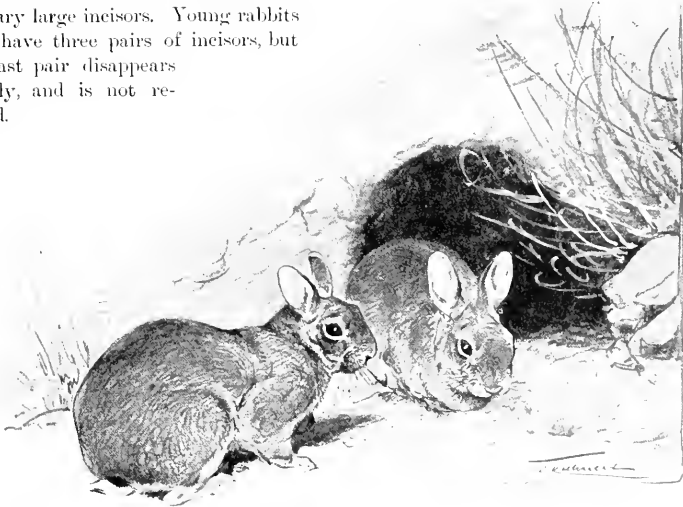
THE COMMON DORMOUSE.

sometimes in the hollows of trees, but often in unprotected spots between small branches, or even in the abandoned nest of a thrush.

Common Dormouse. The common dormouse, which represents another genus (*Muscivora* *cardinus ardeanarius*), is pale yellow both above and beneath; its throat and breast being white, a circle round the ears and eyes light red, the upper side of the tail brownish red, and the feet red with the toes whitish. The species seems to be confined to Europe, ranging from the British Isles and

Sweden in the west and north to Hungary, Transylvania, Galicia, Italy, and Turkey in the east and south. Its home is in thickets and hedges: it lives on hazel-nuts, beech-mast, corn, and berries, holding its food between its fore-paws, which are used like hands, and are provided with thick, fleshy palms, as are also the hind-feet. This pretty little dormouse is nocturnal, sleeping in its nest or in the hollow of a tree by day, with its body coiled up into a ball.

Rabbit. The other European rodents, although found in the forests, do not live in trees. With the exception of the hares, which prefer the fields, the rabbit is the largest. Together with the hares, this species is distinguished from other rodents by the four incisors in its upper jaw, as it possesses a pair of smaller ones at the back of the ordinary large incisors. Young rabbits even have three pairs of incisors, but the last pair disappears quickly, and is not replaced.



RABBITS AND THEIR BURROW.

Rabbits are often grouped in the same genus as the European hares, but are sometimes separated as *Oryctolagus*. Both hares and rabbits have five toes on the fore-feet and four on the hind-feet; they are further distinguished by the short hair on their soles and inside the cheeks. In colour they are grey mixed with reddish brown, or red, or grey on the upper side; and, except with certain Indo-Malay and African species, the lower side of the tail is pure white, in order that they may recognise each other from a distance when in rapid flight. The common rabbit and the Assam rough-haired rabbit have shorter legs and ears than hares, and, unlike the latter, live in holes in the ground, so that they have no need to hear so well or to run so quickly. Their young are born naked and blind, while those of the hares are partially furred and have their eyes open when they make

their first appearance in the world. The rabbit (*Lepus cuniculus*) is a less agile but more sociable animal than the hare, and, as already mentioned, generally burrows, although sometimes it establishes its household in the hollow of a tree, which it will climb to a considerable height if the trunk be not too straight. Although it leads mainly a nocturnal life, it may often be seen in quiet places at any hour of the day, its principal feeding-times being the morning and evening. Its fecundity is extraordinary; several times a year, in winter and summer, it has five to eight young ones, which are born in a hole with only one entrance, whereas the usual burrow is open at both ends. So far as can be determined, the rabbit is not properly a denizen of central Europe, its true home being the countries bordering the western end of the Mediterranean basin; but it is a hardy species, and has now made itself at home over the greater part of the Continent, while it has likewise flourished to such a degree in many parts of Greater Britain, where it has been incautiously introduced, as to become a perfect pest. We shall have to mention the rabbit again, but it may be said here that black rabbits, as well as white ones, are frequently met with in warrens where there seems to have been no admixture of domesticated blood; and that compared with the hare, great differences are observable in the length of the bones of the various segments of the limbs.

Long-Tailed Field-Mouse. Rats and mice are spread all over the globe, but are only represented by a few species in the forests of central Europe. As a family (*Muridæ*) the group includes rodents with naked, scale-covered tails and undeveloped first toes. The more typical members of the family may always be distinguished by their long, naked, scale-covered tails, large ears, bright eyes, pointed noses, and graceful little bodies. They are represented in central Europe by one genus only, the true rats and mice, for which there exists no collective popular name.

The long-tailed field-mouse (*Mus sylvaticus*) scarcely deserves its name, since it is occasionally caught in houses. It is easily distinguished from the house-mouse by its colour, its larger size, and the number of rings of scales round its tail; the ears being equal to half the length of the head. Its fur is of two colours, yellowish brown and grey above, and white below, the feet and toes being also white. It has a wide distributional area in Europe and western Asia, and is represented by several local races, even the west of England having one peculiar form of the species. Living in forests, gardens, hedges, and cornfields, it digs holes in the earth, and stores up provisions for the winter in such quantities that corn, nuts, or seeds may be taken out of its nest by handfuls.

Continental Field-Mouse. The field-mouse of eastern Europe (*M. agrarius*) is in many ways like the last, being brownish above and white below, with white feet, and on the back a black line from head to tail. Its ear measures the third part of its head; and, if laid flat, does not reach the eye. In autumn this mouse is found in great numbers in stubble-fields, but it is not half so active in climbing and jumping as the last species. In winter it chooses barns and stables for its habitations. It eats grain and other seeds, and also roots, insects, and

worms: it stores winter-provisions, and in summer brings forth from four to eight young ones, three or four times during the season, who do not assume their brownish red coats until the following spring.

Short-Tailed Field-Mouse. The water-rat and the short-tailed field-mice (*Microtus*), often miscalled voles, may be distinguished from the true rats and mice by their rather short hairy tails. They are nearly related to the hamsters, from



THE LONG-TAILED FIELD-MOUSE.

which they differ by the structure of their molar teeth, which are either rootless or nearly so; these teeth in both genera differing widely in character from the simpler molars of the true rats and mice. In the red-backed field-mouse (*M. glareolus*) the body is 4 inches long, and the tail about half that length: the coat is brownish red above and greyish at the sides: the feet are white: and each ear has a stripe of long hair. There are many varieties of this mouse which differ greatly in colour and dimensions. The species is found in the plains and lower mountain-ranges of Europe, occurring in England, France, Germany,

Denmark, Hungary, Croatia, Moldavia, and central and southern Russia to the Ural Mountains. The forest, the skirts of the forest, and plantations and parks, are its usual haunts. It makes its nest, in holes in the ground, of soft grass, hair, and wool, and often prefers animal food to any other; insects and worms, as well as young birds, and butcher's meat, being among its favourite fare. But it by no means disdains vegetable food, such as corn, seeds, and roots; and in hard winters will live on the bark of young trees. It will climb trees to a considerable height, but does not run very quickly. Solitary individuals may be seen at any time of the day, although these field-mice do not appear in large numbers before the afternoon or towards evening. Three or four times a year the females have a litter of from five to eight naked and blind young ones, which in six weeks are half the size of their parents.

Wild Cat. The beasts of prey (Carnivora), like the hoofed mammals and rodents, are not well represented in the forests of Europe. To this order belong cats, civets, hyenas, bears, dogs, martens, and likewise seals and walruses. The order consists mainly, although not exclusively, of flesh-eating animals and comprises proportionally more of these than does any other mammalian group except the marsupials.

If the walruses and seals, as well as certain extinct Carnivora, be included, it is not easy to find distinctive marks in common for the order. In all cases, however, the toes of these animals are armed with claws, which are generally sharp and bent, without any near resemblance to human nails. There are never less than four completely developed toes on each foot, and in no case can the first toe, otherwise the thumb, be placed opposite the others for grasping purposes. The teeth of the Carnivora are generally well developed, as their food would indicate. Their canine teeth are large and adapted for seizing and tearing their prey, and among the cheek-teeth there is generally a pair in each jaw, adapted for cutting the food to pieces like a pair of scissors. The lower jaw can only be moved up and down, and not sideways as in most other mammals, so that the teeth cannot crush and grind the food but only tear or cut it into fragments which are swallowed whole. While some families are indigenous to all parts of the world, others are confined within very small limits. The land Carnivora (Fissipedia) are best distinguished from the marine Carnivora by the structure of their feet. There are, indeed, some species among the former which spend more or less of their time in the water, and have their feet united by a membrane, but they are never fin-footed like the seals and walruses. The teeth, however, are more important for the purpose of distinction. Instead of the uniform and sharply cusped cheek-teeth of the marine forms, those of the land Carnivora have usually the above-mentioned flesh-teeth on each side of the upper and lower jaw.

The family of the cats (*Felidae*) contains the two genera *Felis* and *Cynalurus*. In all there is obviously a relationship to the domesticated cat, so that, whoever knows that familiar animal will recognise any other representative of the group. The long slender body of the cats combines strength and suppleness in perfection, and their strength is so considerable that the larger kinds can kill and carry away animals of greater bulk than themselves. Their distinctive points are the



short jaws, the fewness of the teeth, the perfect development of the canines and flesh-teeth, the strong and retractile claws, and the great mobility of the fore-limbs.

Over the greater part of western and central Europe the wild cat (*Felis catus*) is the only representative of its genus and family. In colour it is brownish



WILD CAT AND DYING FAWN.

grey with black stripes above and white on the inner side of the loins and underparts; on the crown of the head there are black stripes, and on the throat is a spot of yellowish white; the tail being marked with black rings, and having a blunt, black tip. The home of the species is Europe, where it is found sparingly in Scotland, France, Germany, Poland, Hungary, Russia, Spain, Italy, Dalmatia, Greece, Turkey, and the Caucasus: but towards the east it does not seem to extend beyond the Ural Mountains, though it has been met with a little to the south-

ward of the Caucasus. It is found rather frequently in the Hartz Mountains, as well as in the Alps, but is most numerous in the wild forests of the Carpathians. It prefers mountain forests, especially those where pines predominate, and does not mind crossing extensive plains to reach a larger forest than the one it has left, even if it takes it several days to do so. It hides in hollow trees, crevices of rocks, abandoned fox and badger holes, or in thickets near marshes. Climbing the highest trees, it leaps from bough to bough, or even down to the ground from a great height. It attacks man only when it is wounded, or in self-defence, but preys on all warm-blooded animals it can kill, especially young roe-deer, young chamois, hares, rabbits, mice and other small rodents, and game of all kinds, as well as small birds. When seeking its prey, it follows it more by sight and hearing than by scent. In May or April the female brings forth six or more blind kittens, which she hides in hollow trees, rock-clefts, or such-like hiding-places, or, when afraid of any danger, carries in her mouth to some other spot. In its ways it resembles the domestic cat; it purrs when pleased, opens its mouth and hisses when in a passion, walks with arched back, and expresses its feelings by various movements with the tip of its tail. In many countries it seems to have interbred with domestic cats which have run wild, so that in some districts it is doubtful whether it is to be found in its original purity.

Fox.

If we except the wolf, the dog family (*Canidæ*) has also but one representative in the woodlands of western and central Europe, namely, the much more familiar fox. Apart from several extinct species, the family includes a rather large assemblage of animals, distinguished by the formation of the teeth, the long and pointed head, pointed ears, and the fairly long tail; and also, as in the case of most animals of a thoroughly carnivorous nature, by the blunt, almost straight, non-retractile claws. All the representatives of the family, with the exception of the African hunting-dog, have only four toes behind and five in front. Foxes, although associated by many naturalists with the dog in one genus, are in certain respects distinct. Their bodies are of lighter build than that of the dog—the tail is longer, the nose more pointed, the body proportionally longer, and the limbs shorter. The tail, which is always covered with long hair, is a little longer than the half of the body; the ears are large; and the pupil of the eyes, when exposed to a great glare of light, forms a perpendicular ellipse. Foxes are generally nocturnal, and live a solitary life, seldom or never associating in packs, like wolves and jackals, and feeding, like all their kind, not only on flesh, but more or less on insects and fruit.

The fox (*Canis vulpes*) lives in the daytime by preference in dense woods, on steep river-banks among shrubs, but also in thickets near water, or in undisturbed cornfields. The head is pointed, the ears are triangular and a little longer than the head, and the legs rather short. The long, bushy tail touches the ground with its tip as the fox sneaks along: when trotting, it is lowered, but when in full flight is stretched out horizontally, and when excited is carried vertically. The close hair of the soft fur is mostly of a light rust-colour; the forehead, shoulders, and back being of a whitish hue, the cheeks and throat

white, the breast and abdomen grey, the outer side of the ears black, and the tip of the tail white or whitish.

Evidence has been gradually accumulating that in the ancestors of several groups of mammals the skin was protected by a bony or horny armour. One of the animals retaining vestiges of such an armour is the fox, in whose skin has been detected a structure indicating the presence of the ancestral forms of an imbricating panoply of scales arranged like the tiles on a roof. Under the microscope the skin displays very clearly a pattern representing the implantation of such a scaly covering; while the mode of arrangement of the hairs lends further support to the evidence afforded by the structure of the skin. If these inductions be well established—and there seems little doubt that they are so—the fox carries about with him indisputable evidence of his descent from mail-clad ancestors, who in turn must seemingly have inherited their panoply direct from still earlier reptilian progenitors. Such progenitors were in all probability the mammal-like reptiles of the Trias of South Africa, from which the primitive, or creodont, carnivora of the Eocene Tertiary are almost certainly descended.

It would seem, however, that in other cases there was a fresh development of armour among early mammals long after their complete emancipation from the reptilian type. The primitive whales, or zeuglodonts, appear, for instance, to have been heavily armoured, probably to protect them from the breakers as they gradually adapted themselves to a pelagic life. Since, however, these primitive whales are now known to be the descendants of the primitive carnivora, they probably derived the rudiments of their armour from the latter, instead of, as has been supposed, developing it entirely *de novo*.

In many parts of Europe there are two differently coloured varieties of foxes, one of which is called the birch-fox, or red fox, and the other the black or coal fox. Both phases live in the same districts and pair with each other, although they are distinctly different in their colouring. The red fox, whose prevailing colour is a yellowish grey, has a white stripe along the upper lip and round the corners of his mouth, which runs up the cheeks in the shape of a sickle, becomes a little wider at the lower jaw across the chin and throat, and ends in a point at the fore-legs. The black fox has the same marking, but is of a blackish grey. The close, thick brown hair of the red fox is very short just above the nose, but higher up it becomes gradually longer, and is marked with little white lines. The black fox, on the other hand, has ashy grey hair without any white. The red fox has yellowish red hair on the upper part of the neck, on a portion of the back, and on the shoulders, while the lower parts of the loins are brownish yellow, the sides of the abdomen light yellow or whitish, and the rest of the hair on the back grey or brown. Close above the tail is a red-brown stripe with a light yellow edge. The black fox is here of a darker colour, and the loins are an ashy grey. As in other members of the family, the tail of the fox has on its upper surface, about $2\frac{1}{2}$ inches from the root, a small scent-gland, overgrown with bristly hair of a brown-red colour. In the red fox the tail has a pure white tip, in the black fox a dark grey one. The fore-feet of the red fox are yellow, those of the black fox brownish red; those of the red fox are marked with a whitish stripe, those of the black fox with a

blackish grey streak. The hind-legs of both are of much the same colour. Both sexes are of the same shade and marking, but vary with the two varieties. Besides these two differently coloured phases of the typical race, there are also black, fawn, grey, white, and piebald foxes, while now and then we meet with the so-called cross-fox, which has a yellowish brown or sometimes almost black stripe along its nose, head, and back, to the end of the tail, which is crossed by one of the same colour and width running across the shoulder.

The usual yelp of the fox, not unlike the bark of a small dog, is uttered five or six times in rapid succession, and generally ends in a wailing, croaking howl. In winter it is mostly heard at night, when it is commonly believed to foretell cold and stormy weather; the yelp is also heard during pairing-time, but is then accompanied by a sound resembling the cry of a peacock. Much more tender are the cries with which the female fox calls to her offspring, or teaches them how to seize their prey; and equally low are the voices of the whelps while still in the burrow crying for food. When defending himself against hounds, the fox utters a fierce growl or a hoarse scream; while very rarely he emits a plaintive sound difficult to be described. A fox is exceedingly hard to kill, and often runs off as if nothing had happened when wounded even to death. Sometimes he seems to collapse suddenly; violent convulsions contract his body, his gleaming white teeth are shown, and he soon lies motionless as though dead; yet all the time there is a crafty twinkle in his eyes, and, at the moment when he is believed to be dead, he draws a long breath, jumps up, and gallops off at full speed. Some naturalists consider that the fox shares the hole of the badger, but this can happen but very seldom, and only if the dimensions of the burrow are unusually large. If the burrow has been dug by the fox itself, it consists of several tunnels opening in all directions, and containing one or more chambers connected by tunnels with the outer world. Sometimes in front of the principal chamber there is a large oblong space nearly a yard long, which is used as a larder. Occasionally foxes take refuge in holes formed of two tunnels of from 24 to 30 inches in length, which run deep into the ground, have two outlets, and are a little wider at the bottom than at the top. The burrow or "earth" is by no means so sweet as that of the badger, on account of the disgusting smell of the decaying food which the fox brings in for its young. This smell is noticeable a long way off, and attracts an immense number of insects, which remain in the deserted burrow long after the original owner has departed.

The fox is generally described as a greedy, cruel murderer, who rejoices in slaughter even when his hunger is appeased, but in times of plenty he is very particular. He chooses for his robberies a spot from which he is able to overlook his whole surroundings, and can pounce unhindered on his prey. When he has captured an animal he first bites off and then eats its head. He leaves what he cannot eat on the scene of slaughter, sometimes covering it up with dry leaves. His favourite food consists of the flesh of animals with a strong scent of their own, such as the shrew-mouse and the hedgehog. It is not known how a fox manages to tackle a hedgehog; possibly he is to a certain degree insensible to its pricks, for he does not seem to mind the stings of wasps, bees,

or hornets, whose nests he routs up with great avidity. In exceptional cases he will even devour his own kind, especially when he finds one caught in a trap, and will do the same to other animals captured in the same way. He is contemptuous of owls and most birds-of-prey, but not of crows and magpies, which, when they espy a fox sneaking about, generally follow him with a loud croaking, and so betray his whereabouts. It is scarcely necessary to say that, when he has the opportunity, the fox is a dangerous enemy to domestic fowls. He is an expert mouser, but seems to carry on the sport more for his own pleasure than because he is hungry; for he has often been seen to catch a mouse, let it go again, catch it once more, throw it up with his muzzle, then stand and watch it, and go on repeating this game for hours.

His usual and characteristic gait is a sort of mixture between a run and a trot. Avoiding everything that might in any way betray him, from time to time he stops and listens, or seems to reflect, and then, quick as lightning, will catch the field-mouse that has been stirring the dry leaves. Then he will sit down on his hind-legs, like a dog, to devour his prey, greedily licking up the last drop of blood. Yet all the while he remains watchful and observant, and for safety will often lie huddled up, hiding his nose, dog-like, beneath the tip of his tail.

In most parts of Europe the fox has not many enemies, but in other countries he is pursued by the lynx and the wolf, and, in districts where owls and eagles abound his adversaries are by no means few. The diseases to which he is subject generally end fatally. The most dangerous is the mange, which is infectious in the highest degree, and generally comes on in warm weather. Females, or vixens, are more troubled with this complaint than dog foxes. The second disease is tubercle, which is shown by the rapid wasting away; and the third is rabies, which attacks both sexes. But except in countries where he is preserved for sport the most dangerous enemy of the fox is man, who has invented innumerable devices for catching and killing him. In England the fox is hunted solely with hounds, but in Germany dachshunds are used as terriers to drive him from his hole. If a fox-earth be noiselessly approached and a dachshund sent in, the fox will bolt after a few minutes at the other end, and run headlong into the net placed ready. But if the trapper make a noise in approaching the hole, the occupant will remain below, no matter how strong the dachshund may be, and must be dug out. If a fox be driven from covert, he avoids making for his hole, especially when chased by hounds: but, at the slightest sound behind him seeks to escape in the direction which offers the best chance of safety. In many cases, and particularly if his pursuers make much noise, he will ensconce himself in a tree, and quietly wait there till all have passed. At other times, as when allured by an imitation of the cry of a mouse, he will readily follow the sound, and be led into danger. Baits laid for foxes are taken with the greatest caution, and if the trap be set in such a way that it can be seen, they will never be deceived by the lure. If one of his fore-feet gets caught, a fox will unhesitatingly bite through the sinews or fleshy parts held in the trap, in order to save his life.

The fox is found in most parts of the Northern Hemisphere, from northern

Africa and the southern slope of the Himalaya in the south to beyond the limit of trees in the north, and from the British Isles in the west to the far east of Asia, as well as in the corresponding latitudes of North America. Local races of the species are, however, peculiar to many districts. The Egyptian and Arabian, or Nile foxes, for instance, are greyish red, with grey sides, and the lower part of the neck, breast, and abdomen brownish black, the tip of the tail being white. In Poland, Sicily, and Sardinia the foxes are black beneath. There are also several varieties in North America; one being golden-red, with white legs and a black tail; another is exactly like the European fox; while the third is the black or silver-fox, whose fur is very valuable. This is either of a brown-black or totally black colour, with a sort of shimmering of hoar-frost. Foxes coloured like this variety are occasionally found in Europe; their fur is much more valuable than that of the ordinary fox, and is especially appreciated in Russia.

Badger. The weasel family (*Mustelidæ*) is represented in western and central Europe by the martens, weasels, badgers, and otters. Most members of the group are characterised by their long tails, slender bodies, and short legs; and they are small or of medium size, none of them being very large. They vary considerably in the marking and colouring of their coats, and several of the northern species are dark-haired during the summer and light-haired during the winter; being thereby distinguished from all other beasts-of-prey, except the Arctic fox. Many have fur of a uniform colour; but in some cases the fur shows strongly contrasted light and dark colours, thus making their owners seem the most conspicuous of all mammals, as, contrary to the general rule, they are light above and dark below. They are occasionally spotted or striped, but seldom have light and dark rings round the tail, although they are sometimes marked with one dark or light band along their whole length. They are met with in every continent except Australia, but are found mainly in the temperate zones.

The badgers are distinguished from the other members of the family by their strong claws for digging up the ground. The one representative of the group in Europe is the true badger (*Meles taxus*); but the group ranges over the whole of Asia as well. Badgers are of short, compact build, with a pointed nose and short ears and tail. Their coat is long and coarse, and they have a scent-gland beneath the tail. The European badger is marked with a dark stripe on each side of the head, running from the muzzle across the eyes and the white-haired ears; the rest of the head being white. The back is whitish grey mixed with black; on the sides of the body, and the tail, the coat is red, while the under-parts and feet are blackish brown. A badger's skin, which is covered with long and coarse hair, hangs very loosely on his body, so that, when attacked, the creature can always turn round somehow to bite. The species is found all over Europe, except northern Scandinavia and Sardinia, and in northern Asia extends to the river Lena. Possibly it may also inhabit Syria, but it is not quite known where its range ends and that of the Persian badger (a smaller species) begins.

In many parts of the Continent the badger is still common, and sometimes does much damage to vineyards: it lives in the depths of the forest, or in thickets on rocks and quarries. Its home is a spacious hole in which it remains all day



BADGER.

wandering abroad only in the evening in order to hunt its prey, either alone or with several companions. In cold countries the badger lies torpid all the winter. In Sweden it takes to earth towards the middle of November, and does not come out again until the middle of March, unless the snow disappears before that time. On retiring to its habitation, which it keeps scrupulously clean, a badger carefully stops up the entrance. The burrow is generally lined with ferns and other plants; at the approach of winter the old leaves are replaced by new ones, which are gathered with the sharp claws of the animal, but these are never used until properly dried. Badgers eat all kinds of roots and fruits, but their chief food is small mammals, frogs, insects, and birds' eggs. The burrow often forks off into



YOUNG BADGERS.

two side-holes, and here the female gives birth to three or four blind young ones, which open their eyes on the tenth day of their life, but do not appear outside the hole before the end of June. In Germany the badger is generally driven out of its hole by dachshunds, that is "badger-hounds," and latterly fox-terriers have been employed, which, if they do not succeed in driving him out, at least keep him prisoner until he can be dug out.

Pine-Marten. The martens are mainly confined to the northern parts of Europe, Asia, and North America: the two largest of the European species being the pine-marten and the beech- or stone-marten. The pine-marten (*Mustela martes*) is distinguished from the stone-marten by the form of its lower flesh-tooth, the outer edge of which is as long as the upper one is wide, while the outer edge of the upper flesh-tooth is rounded, and not curved. This marten extends

over Italy, and the whole of central Europe, also all over Britain, Scandinavia, the temperate parts of European Russia and the Ural countries, and in certain districts of Siberia; and is also found in the Caucasus, and in some of the vast tracts which lie between that district, the southern Ural, and the Altai Mountains. It generally lives a long way from human habitations in large forests, and makes its home in hollow trees, rocky clefts, or abandoned nests of birds-of-prey or squirrels, but it has always several haunts, so that, when disturbed, it can shift

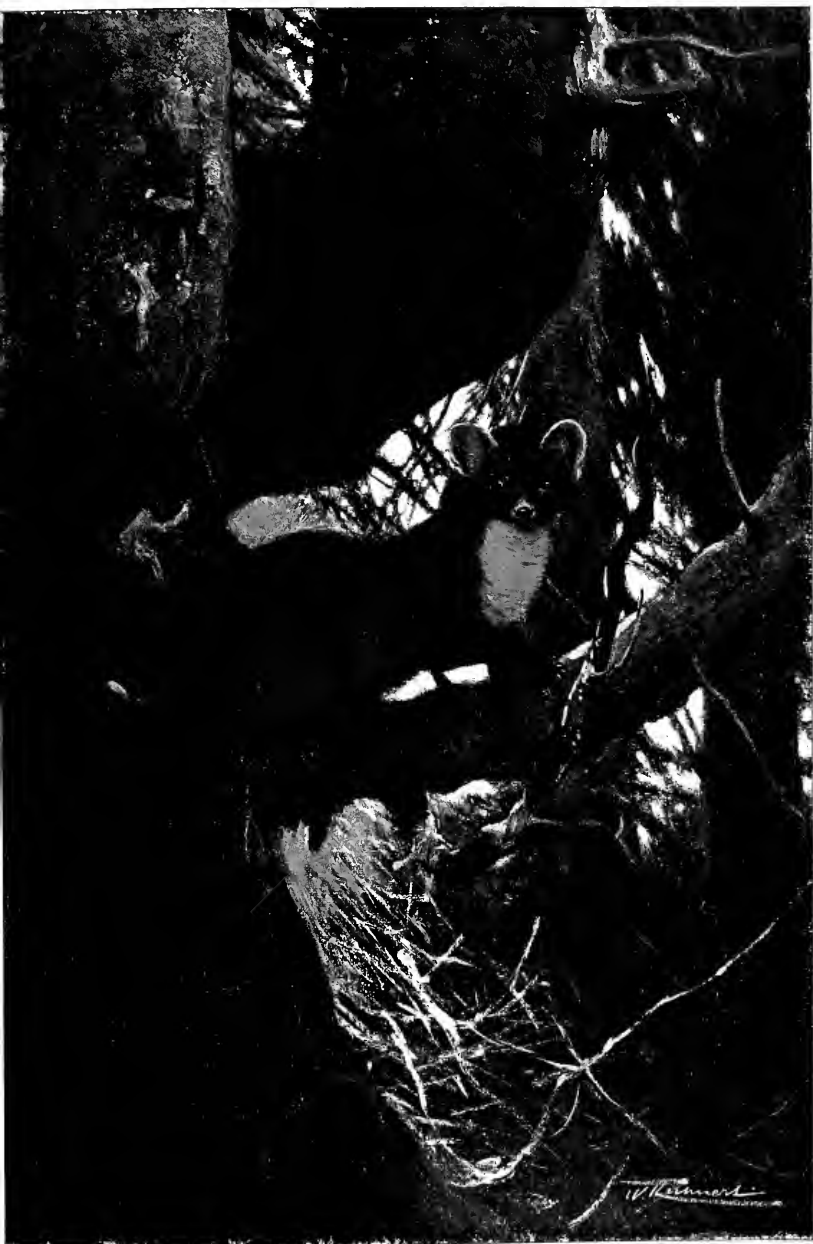
from one to another.

When assured of safety, it will seek its prey in the daytime, but, as a rule, prefers doing so at night. Its food consists of ducks, pigeons, and various small birds, and also hares, rabbits, hamsters, mice, and squirrels; nor does it disdain large insects, birds' eggs, juicy fruits, and honey. A marten will not only eat any bird it finds caught in a trap, but also the berries with which the trap has been baited. In agility in climbing it is not inferior to the cat. When creeping from branch to branch in stealthy pursuit of its prey, the long, sharp claws afford a firm hold of the bark, while the strong bushy tail aids in keeping the balance among the dark foliage in which, whenever possible,



THE PINE-MARTEN.

this marten conceals itself during the silent approach. It sneaks round its living prey with the utmost caution, follows it among the trees as well as on the ground, and finally grips it by the hinder part of the head or the throat. A marten will always leave fish, lizards, and small insects, untouched, but will kill even after its hunger has been appeased. January or February is the pairing-time of the pine-marten, and in April or May the female gives birth to from three to five young ones, which are blind for the first fortnight. At the age of six or eight weeks they can climb about by themselves on the trees, though they are still accompanied by their parents. The fur is worth



much more than that of the beech-marten, and, in fact, is nearly equal to sable in value.

Beech-Marten. The beech-marten (*M. foina*) has a white breast instead of a yellowish one like the pine-marten, which it resembles in habits, and its under-fur varies but slightly from pure white to light grey and is without any yellow tips. In general colour it is brown, varying from greyish to blackish, being darkest on the limbs and tail, and is occasionally known as the white-breasted marten, the pine-marten being the yellow-breasted one; on the Continent it bears the name of stone-marten from its frequently living among inland cliffs and in other stony places. Being more southerly in distribution than the pine-marten it is not found in England, Norway, Sweden, and northern Denmark, but its range extends from the coast of the Atlantic to Turkestan and the Himalaya as far east as Sikhim. It is known all over central Europe and throughout Italy, as well as in eastern Europe up to the Urals; and though unknown as yet in Persia, it inhabits the Crimea and Caucasus, Asia Minor and Syria. It preys on mice, rats, rabbits and squirrels, birds, frogs, and lizards, and has been observed to eat cherries, plums, and other fruit. As it is frequently found nearer the habitations of man than its relative, it does more damage to poultry and pigeons. During the pairing-season, which begins about three weeks later than that of the pine-marten, the beech-marten mews like a cat, though at other times it rarely makes a sound. In the hollow of a tree or some rocky cleft or other suitable place it makes a carefully arranged nest of hay, straw, or similar material, in which are born in April the four or five young, which are blind for the first fortnight.



THE BEECH-MARTEN.

Polecat and Ferret. The polecat (*M. putorius*), which is less exclusively an arboreal animal than the pine-marten, is much better known than its larger relative. Its colour is a uniform blackish brown, lighter above and on the sides than below: the under-fur being yellowish, the tip of the nose black, the lips and chin white, the sides of the head whitish, and the tail black. This species is found over the greater part of Europe as far north as the south of Sweden and the White Sea, but is unknown in the Mediterranean countries. In habits the polecat is nocturnal: it sleeps by day in the woods, lying hidden in fox or rabbit holes, in wood-piles, or among stones. In the evening it leaves its haunt in search



A POLECAT AND ITS PREY.

of hares and rabbits, lizards and snakes, frogs and other small animals—as well as poultry, such as pigeons, domestic fowls, and even turkeys, and all kinds of birds' eggs. In a hen-house a polecat will kill, if possible, all the inhabitants, sucking their blood without eating their bodies. These animals are very fond of wild rabbits, and are so eager in their pursuit that a single family of polecats will greatly diminish the number in a warren in a very short time. The polecat is not so common now as it used to be, and is becoming more and more restricted to dense woods, though in the Alps it is found in summer above the tree-line. The well-known ferret is an albino variety of the polecat, which has been domesticated—if ferrets can be said to be domesticated—in southern Europe ever since the days when a polecat was kept as a substitute for the domestic cat in hunting

for mice. Though the ferret is usually white, and has pink eyes, there are ferrets which, as the result of interbreeding, are similar in colour to the polecat, from which they differ in their extreme sensitiveness to cold and in being, like many other domesticated animals, more reproductive than the original stock. They usually have from five to ten young at a birth and often a second litter in the year.

Ermine or Stoat. The ermine or stoat (*M. erminea*), the nearest relation of the polecat inhabiting Europe, is yellowish below, and in summer brownish red above. In winter its fur turns white, except the tip of the tail, which even then remains black. This is the case in Germany and in the Scottish Highlands; in the northern counties of England it sometimes, although not always, changes, and in the southern counties the change takes



ERMINE AND HARE.

place but seldom. The same thing has been observed in North America. Ermines caught in New England during the winter are nearly always white; those taken in Virginia are partly white, while those found in South Carolina are never white.

In its habits the ermine resembles the polecat; and as it is powerful enough to overcome hares, rabbits, and fowls, it attacks them frequently. Even large hares succumb to it, and in hen-houses it has been known to kill as many as

forty full-grown fowls in a night. It usually hunts in pairs, but sometimes in threes, by day and by night; it climbs tolerably well; and, although not a water animal, swims excellently, and never hesitates to do so when circumstances render this advisable. Its favourite haunts are thickets and stony places, which afford sufficient shelter from its enemies. When driven to bay it emits a most disagreeable penetrating smell. In April or May, two, five, or six, sometimes even a dozen, young stoats may be found in the nest, which is made in a hole in the ground.

Weasel.

The smallest European member of the family is the weasel (*M. vulgaris*), which is white below and brownish red above; its tail, which is of the same length as the head, being of the same colour. The weasel is found all over Europe, northern and central Asia, and the greater part of North America. In high northern countries it becomes white in winter, with the exception of the end of its tail, which, although much paler, remains brownish red. Weasels feed chiefly on small animals—such as mice, moles, harvest-mice, small birds, and insects; but they have been known to attack sleeping partridges, and to harry hen-houses and hunt rabbits. They generally run along the ground in little leaps, interrupting them now and then to have a good look round, sitting erect that they may have the better view. The weasel is an agile climber, and will surprise brooding-birds in their nests and eat both them and their young. Although travelling more by night than by day, it cannot be regarded as quite nocturnal. It makes its snug nest in a hole in the ground, a hollow tree, or some such place, and lines it with dry leaves and other materials. Twice a year the female brings forth four or five young ones, and the parents, especially the mother, defend their young with desperate fury, at the risk of their own lives, and after the danger is past carry them to another place.

Hedgehog.

The insect-eating mammals (Insectivora), like the true beasts-of-prey, fully justify their name. The majority have five toes on each foot, which are armed with sharp claws: and all walk on the whole sole of the foot, or at least on the greater part of it, and are distinguished from other mammals by their cheek-teeth, the crowns of which carry, in the upper jaw, cusps, arranged either like a W or a V. They are further distinguished by the long, pointed head, and especially by the muzzle, which extends beyond the lower jaw. They are found all over the world, except South America and Australia, but there are not many species of the group, which is probably now waning. The hedgehog is the largest insectivore in Europe. The family to which it belongs comprises only four genera, the members of which differ greatly in appearance, and live in widely sundered countries. The hedgehogs are spread widely over Europe, Asia, and Africa, but in southern Asia are not found eastward of the Bay of Bengal.

The European species (*Erinaceus europæus*) is distinguished by its short neck, pig-like muzzle, and short limbs. It lives on insects, field-mice, shrew-mice, and other small animals, and, to a certain extent, on roots and fruits. Although a nocturnal animal, it will sometimes venture out in the daytime, but probably only when it has to provide food for its young. The young are born in July or August, or, when there are two litters in a year, late in the autumn. They never exceed four in number, and are at first blind, and



WEASEL

incapable of rolling up their bodies. When born they are almost naked, and their spines are quite soft but harden in the course of a few days. The nest is carefully made, and always in a place well sheltered from rain. Hedgehogs, though silent as a rule, will occasionally utter a low shrill growl. They take a long winter sleep, rolling themselves up in a ball, in a nest of moss and leaves.

The shrew-mice (*Soricida*) form the second European family of the insect-eaters. The family may be identified by the form of the two middle incisors, which in the upper jaw have a cusp on their hinder border, while those in the lower jaw are directed horizontally except at the tip. The members of the typical genus *Sorex* are mouse-like creatures, with slender bodies, long heads, and pointed muzzles; short-haired, soft, velvet-like fur; large ears directed backwards, and partly covered with hair on either side; claws on all their



THE HEDGEHOG.

toes; and a tail as long as the body, and clothed with hair up to the tip. Two species inhabit western and central Europe.

The common shrew-mouse (*S. araneus*), whose tail is rather shorter than its body, is widely distributed in England, as well as in Europe, Asia, and North America, although by many naturalists some of its local races are regarded as distinct species. It lives chiefly on insects, worms, slugs, and snails; and is characterised by a strong, unpleasant odour, which may deter other animals from attacking it; many are, however, killed and swallowed by owls. In the autumn shrew-mice are often found dead in gardens, probably because at that time of year they can find but little food. The common shrew-mouse hibernates in central Europe and other countries of similar climate.

The lesser shrew-mouse, otherwise known as the pigmy shrew-mouse (*S. minutus*) is the smallest European mammal, having a total length of only $3\frac{1}{4}$ inches, including the tail, which is $1\frac{3}{8}$ inches in length. In colour it is brown

above and greyish white below. It is widely distributed in North Africa, northern Asia, and nearly every country in Europe, living in wooded districts, either among forests or copses, being in many respects like the common shrew-mouse, though not so frequently found in the open.

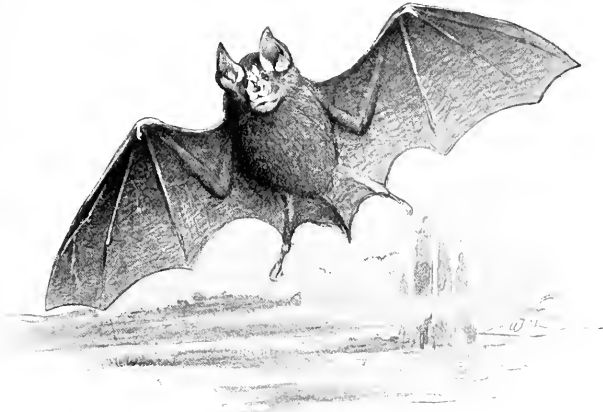
Horseshoe-Bats. Bats, forming the order of Chiroptera, are the only mammals endowed with the power of true flight. Unlike nearly all other mammals, the arms are much longer than the hind-limbs, and between the much elongated fingers (with the exception of the thumb, which has a crooked claw for climbing) a delicate bare web is spread, extending from the arm and sides to the leg, which is frequently connected by another web with the tail. The knee-joint, instead of turning forward as in other mammals, is directed backwards; this being the reason why bats get along so awkwardly on level ground. So specially fitted are they for movement in the air that, as a rule, they rarely move about on the ground, and most of them leave it as soon as possible by climbing up a tree, rock, or wall, with the object either of suspending themselves head-downwards from some convenient position or of starting on their flight. During flight most bats both eat and drink, the female also carrying her young. They are entirely nocturnal, or at least twilight, animals, though, unlike other nocturnal creatures, they have comparatively small eyes. Fruit-eating bats are confined to the warmer parts of the Old World, and vampires and their allies are exclusively tropical American; but several of the European insect-eating kinds are met with over a large part of the globe.

Bats are represented by an enormous number of species, and are grouped into several families. The whole group may be divided into two suborders, namely, the insect-eaters and the fruit-eaters. The suborder Microchiroptera includes the blood-suckers, and a few fruit-eating species, but consists principally of those that live only on insects, and is formed entirely of such species as are distinguished from those of the other group by their sharply cusped teeth, so admirably adapted for the mastication of insects; and they may also be recognised at a glance by the form of the ear, which is never, as in the case of the fruit-eating group, closed at the base, so as to form a complete ring. To make up for the comparatively weak vision of their small eyes, bats have an exceptionally acute sense of touch, which in the greater number of species is probably situated in the wing-membrane and in the soft ears. In others, however, there is little doubt that this sense has its seat in the leaf-like expansions of membrane on the nose, which may be either small and simple or large and mask-like, and always bear long fine hairs, that may represent the whiskers of the cat tribe. All ordinary bats have a shrill squeak, so shrill that it cannot be heard by many persons. Bats living in temperate regions must either sleep in the winter or go to a warmer climate. Probably all European bats hibernate, but in Canada at least two species are known which, in order to avoid the cold, migrate regularly to southern districts, and there is one North American species which does not appear to visit the northern parts of its haunts at all until August. As some North American bats have been found to migrate, we have good grounds for supposing that other bats journey to and from their winter-haunts, and this at any rate holds good for those living near the north

polar regions, though not for all, as the majority belong to the tropics or the warmer regions of the temperate zone.

The horseshoe-bats, of which there are two species in Europe, are distinguished by a well-developed nose-leaf, which completely encircles the low-lying nostrils, and by large ears that do not touch at the base, and have no earlet, or "tragus." The greater horseshoe-bat (*Rhinolophus ferrum-equinum*) sleeps during the day in caves and old buildings, which it only leaves in the evening to fly about until complete darkness sets in. The males are ashy grey above, and pale grey beneath; the females light reddish brown above, and reddish grey beneath.

The lesser horseshoe-bat (*R. hipposiderus*), which is met with over the greater part of Europe as far north as the Baltic, as far west as Ireland, in Africa



GREATER HORSESHOE-BAT.

north of the Sahara, and in Asia to the northern districts of western India, has whitish grey fur, rather darker above, with the web extending beyond the heel, and the curved rim on the nose-leaf wider than that of the preceding species.

With the exception of the two horseshoe-bats, all the European members of the group belong to the family Vespertilionidae, the distribution of which is world-wide. Its members have no nose-leaf, but are furnished with a long tail, reaching to the edge of the membrane between the hind limbs, and their ears have a tragus, or earlet. The long-eared bat (*Plecotus auritus*), which is greyish brown above and lighter in colour underneath, occurs in most parts of Europe, in north Africa, and probably also in the temperate regions of Asia, its distribution practically reaching from Ireland to the Himalaya. Not until late in the evening does this bat leave its resting-place, and it flies all through the night, emitting at all hours a sharp, shrill chirp that is never very loud.

Barbastelle,
etc.

Like the long-eared species, the barbastelle (*Barbastella barbastellus*) is the only representative of its genus met with in Europe, where its range extends from England and Scandinavia across central and northern Europe to the temperate parts of Asia north of the Himalaya: it also occurs in north Africa. The genus *Pipistrellus*, on the other hand, includes three European species, the most familiar being the little pipistrelle (*P. pygmaeus*), which is the common British bat. This is a mouse-coloured species; but the great noctule, first recognised as British by White of Selborne, is a large chestnut-coloured species, which flies at a great altitude; its title being *P. noctula*. A third British species is the hairy-armed bat (*P. leisleri*), taking its name from the presence of hair on the under side of the main bone of the wing. The mouse-



NATTERER'S BAT.

coloured bat (*Vespertilio murinus*), on the other hand, is unknown in the British Isles, and is representative of another genus. It ranges from France and Italy to Siberia. Seldom found in treeless plains, in mountain regions and wooded localities it is rarely absent. In Siberia it appears generally to leave the plains in spring, betaking itself to higher ground, which is probably its habitat in other districts. To the same genus belongs the serotine (*V. serotinus*), which is more widely distributed than any other bat, being the only one common to both the Western and Eastern Hemispheres.

With Bechstein's bat (*Myotis bechsteini*), a species of extreme rarity in Britain, we come to yet another genus of the Vespertilionidae, of which four species occur in England. Bechstein's bat on the Continent is generally found in hollow trees, which are dry inside and provided with a narrow ascending entrance. Such shelter this bat leaves only at a late hour in the evening, when it flies low and rather slowly and awkwardly. As it flies, its long ears distinguish it easily from

other bats. In its choice of habitation and mode of life, Natterer's bat (*M. nattereri*) agrees with the last, especially as regards its solitary habits. It prefers wooded districts and orchards, flies rather low and slowly, appears late in the evening, and is found sleeping singly or in small parties in hollow trees, or in buildings. It is sometimes called the fringed bat, on account of the fringed edge of the membrane connecting the hind-legs with the tail. Nearly allied is the ciliated bat (*M. emarginatus*), a continental species, easily recognised by the cilia or fine hairs on the hind margin of the membrane between the legs. There are two other representatives of this genus met with in Britain, namely, Daubenton's bat (*M. daubentoni*), and the whiskered bat (*M. mystacinus*), but both are rare.

From observations made in copper-mines at Alderley Edge, it appears that the winter-sleep of the long-eared bat is interrupted, the bats probably feeding at intervals on the insects which abound in the tunnels in winter, even if they do not venture forth into the open. The same is probably true of Daubenton's bat, the whiskered bat, and the lesser horseshoe-bat. When at rest, the latter species hangs head downwards, with the wings folded, after the manner of flying foxes. The posture of ordinary bats is quite different; and it is curious that while the lesser horseshoe-bat alights from the air in an inverted position, other bats, on first coming to rest, do so with the head upwards, and then reverse their position. In regard to the length of time that bats remain on the wing after emerging from their places of retreat, in the case of the noctule, several observers having noted its return to its hiding-place before the end of twilight, it was inferred that the duration of its evening flight was only about an hour; but this has been negated by other observers who have watched these large bats on the wing from dusk until it became too dark to see them any longer. The long-eared bat maintains its flight throughout the night; and the same holds good for the pipistrelle and Daubenton's bat. On the other hand, the hairy-armed bat restricts its flight to two short periods, one in the evening and the other in the morning twilight; and it is possible that the noctule has similar habits, since it has been observed abroad on one or two occasions in the early morning. Of the whiskered bat and Natterer's bat nothing is known with regard to the duration of their flight, but, as they are allied to the hairy-armed species, it may be inferred that their habits in this respect are similar. July is the great month for breeding among British bats; and in the pipistrelle the period of gestation is not less than forty-one days, and probably about six weeks. At birth the young pipistrelle is flesh-coloured, blind, and naked except for a few hairs on the muzzle. Fur begins to show in about a week, and soon after imparts a golden tinge to the back and a more silvery tint to the under-parts. When only a few days old young bats hang apart from their parents, but at least up to the thirty-first day they do not attempt flight on their own account. In certain habits Natterer's bat is intermediate between other members of the Vespertilionidæ and the horseshoe-bats. It has, for instance, the habit of turning in the air, characteristic of the latter; and, whereas in the horseshoe-bats the short tail is carried bent over the back, while in most British Vespertilionidæ it is usually carried beneath the body, in Natterer's bat, despite the fact of its being used as a pouch to contain the insect-food, it is borne extended in the line of the body.



THE NIGHTJAR.

CHAPTER II

THE BIRDS OF THE WOODS

BIRDS form a class of warm-blooded, feathered vertebrates, which lay hard-shelled eggs: they are in most cases endowed with the power of flight, and thus have a certain similarity in their mode of life, and a great general sameness of form which renders their systematic classification difficult. Any classification of birds is indeed almost entirely based on the formation of the foot, the beak, and the wings, if external features alone are dealt with; and frequently the length and number of certain feathers have to serve as distinguishing marks.

A few words are necessary with regard to the different types of feathers met with among birds. The pinions or feathers of the wing are the flight-feathers, or *remiges*: those of the tail the steering-feathers, or *rectrices*. Over the remiges come the wing-coverts, and over these the lesser coverts: between the wing and the back are the scapulars; and at the base of the back come the upper tail-coverts. The wing of a bird, like the fore-limb of a mammal, consists of the shoulder, the upper and lower divisions of the arm, the hand with a thumb and some of the fingers. On the thumb is the small so-called bastard wing, coming just where the wing bends downwards. On the hand are situated the *primaries*, mostly ten in number, which, when the wings are folded, are covered by the shorter feathers of the lower part of the wing known as the *secondaries*.

As regards other external features in a bird, above the beak is the fore-

head, then the crown; next in order come the occiput or poll, the nape, the neck, the back, and—at the lower end—the rump from which the tail feathers arise. On the under side follow the chin, the throat, the breast, and the abdomen, ending with the under tail-coverts. In order to keep the contour-feathers in proper condition, a bird lubricates them with the secretion of the oil-gland placed at the root of the tail. This is a fatty substance, with which the bird first anoints its beak, and then its feathers by passing its beak along them one at a time; this is more frequently the case with water-birds which have a well-developed oil-gland, but many species, especially such as can only walk, are without this gland. All birds moult at least once a year; a few, like quail, ducks, and certain others, twice in the year, in autumn and in spring. Generally the wing and tail feathers fall off gradually, but ducks and geese sometimes cast them so quickly that they cannot fly at all for a short time.

Besides the feathers and beak, the length and feathering of the legs and the formation of the feet are of great importance in classifying birds. The hind-limb consists, as in mammals, of the thigh, of the lower half of the leg, and the foot. The short thigh is close to the body, and so well covered with feathers that the knee hardly ever appears; the lower half of the leg, as in the case of the horse, being often mistaken for the thigh, and the joint of the heel for the knee. The long segment between the heel and the toes is the tarsus, or, properly speaking, tarsometatarsus. Birds walk only on their toes, and the number and position of these are important. Most birds have three toes in front, corresponding to the second, third, and fourth toes of man and other mammals, which are also denominated in the same way as second, third, and fourth toe, and a hind or first toe, corresponding to the great toe of mammals. Inferences may be drawn regarding the life-history of a bird rather from the formation of its feet than from the nature of its wings, for, with comparatively few exceptions, all birds are good flyers.

The food of birds varies greatly; everything produced by a plant, save wood, may serve them for nutriment, while animals of nearly all kinds form the prey of some groups of birds. On the nature of the food depends the habitat of the bird; hence a vast number are dwellers in the woods, while others frequent treeless plains, and others marshes, or the water. The nesting, again, depends on the stations birds occupy. The eggs of some species, although very few, are not incubated at all, but heated by decaying plants; the eggs of others, such as the ostrich, are incubated by the males alone. In some cases male and female sit alternately; in others the male provides the female with food during incubation, and in others again the male leaves all the family cares to the female. The females of the cuckoo and many of its relatives seem to live with several males, a circumstance apparently connected with their parasitical nesting-habits. Many cuckoos, indeed, make no nest at all, but deposit their eggs in other nests. Generally the nest is made by the female, sometimes with the assistance of the male; and nests are usually found singly, sometimes in great numbers, and in a few cases contain the eggs of several females.

Young birds that leave the egg almost blind or naked, and are fed by their parents until they are partly feathered, remain in the nest a considerable time, but those that are hatched with their eyes open, and covered with down or feathers,

remain but a short period in the nest, and are not fed by the old birds, but merely taught to find their own food. Birds which remain the whole year in the neighbourhood of the nest are called resident species; those which, except during breeding-time, wander into the neighbouring districts, are called inland migrants; while those that leave their breeding-haunts to visit countries where they find better food at other times of the year, are called migrants, or birds of passage.

In spite of their distant migration, most of the birds of passage return regularly to their breeding-places, and the majority of birds do not migrate so far as might be expected, considering their powers of flight. Many European birds are spread, not only over the whole of northern Asia, but also over North America, owing to their finding suitable conditions in both hemispheres. And as most countries are suitable for birds of all ways of life, we find everywhere birds-of-pry, perching-birds, wading-birds, and swimming-birds. Many groups of birds are, however, confined to certain districts. Humming-birds, for instance, are peculiarly American; penguins are practically restricted to the Southern Hemisphere, although one species is found in the Galapagos Islands, which lie on the Equator; and there are no woodpeckers in Australasia, which is the home of the birds-of-paradise. What is essential for the larger groups of birds is repeated in the smaller, so that the physical features of a country are apparent from its birds as well as from its other animals.

Woodcock. In dealing with the birds of the central European woods we give first place to the plovers and their allies, forming the group *Limicolæ*. These are distinguished by a fairly long tail, and long and pointed wings which extend to the tip of the tail or beyond it, and by their having either a very short hind-toe, or none at all. Among these the most important family is that of the *Charadriidæ*, the typical section of which includes the plovers themselves. A long, thin, soft, and rounded, but not sharp-edged beak distinguishes the snipe group (*Scolopacinae*) from the plovers. Woodcock and snipe are also characterised by the eyes being placed well back in the hind part of the head; the true snipe having a very long beak, the upper half of which is a little longer than the lower half, while the tip is either flattened or soft and button-like. They are birds of compact build, with proportionally short and thick necks; among them the woodcock (*Scolopax rusticola*) is distinguished by the complete feathering of its legs, and the shortness of its toes. Only in large woods does the woodcock breed; but it makes no difference whether the trees be deciduous or evergreen. Swampy or damp situations are generally chosen, although the bird never lives in actual swamps or morasses. Where mossy spots with plenty of shrubs vary the monotony of forests that are not too dry, where alder-groves and marshy patches are found in leafy woods, there the woodcock makes its haunt, choosing the darkest and most sequestered spots. Only in the twilight is it to be seen in the clearings and woodland paths, on pastures near the forest, or on marshy fields near the edge of the wood. In exceptional cases woodcock may indeed be found among high trees, willow groves, gardens, fields, or even, but only for a short rest, on barren sand-dunes. Their method of feeding necessitates damp, soft ground with little grass and moss, but covered with decaying leaves. Woodcock are said to be able to live on bilberries and service berries, but they chiefly

feed on worms, insects, beetles, slugs, etc.; in short, such animals as they can extract from the ground with their long beaks. In order to get at the worms and



A WOODCOCK ON THE WING.

larvæ, a woodcock turns up patches of leaves, into which it thrusts its sensitive beak right up to the nostrils, but never deeper; and in damp, soft ground, or fresh manure, it bores holes alongside each other. It can, without withdrawing

the beak from the ground, raise the upper half, to seize and swallow food. This movement may be shown in the dead bird by squeezing the cheeks between the beak and ear with two fingers: and the same extraordinary movement may be observed if the woodcock be very much frightened, when it will raise about a third of the upper half of the beak, while the other two-thirds remain closely applied



THE WOODCOCK.

to their fellow. A woodcock seldom carries its beak horizontally, but more or less directed towards the ground, and in this way it not only walks but flies, and it can run so fast as frequently to escape. A woodcock, when wounded, or if blown into the sea by a storm, or if it fall into the water from fatigue while migrating, can swim for some time. The flight is generally slower than that of the snipe, but it can be varied at will, and no bird-of-prey surpasses a woodcock in quickness

of movement. It flies low, never higher than about 50 feet, which naturally corresponds with its habit of flying among thickets; and although in escaping it flies more quickly than at other times, it prefers disappearing at the earliest opportunity into some bush or grove, or flying round in a circle, to crossing any open space. When a woodcock is alarmed, the movements of its wings, which then produce a sort of "whirr," are particularly rapid and vigorous.

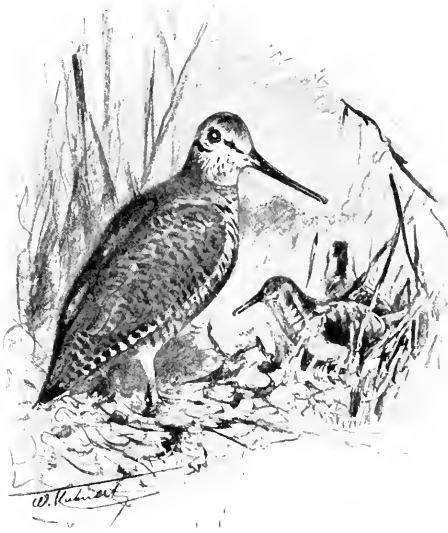
Quite different is the "rôding" flight on the pairing-grounds, the male then flying up and down in an altogether peculiar manner. Should two males happen to meet they fly against each other in curves, wound each other with their beaks, fight in the air, and occasionally drop to the ground while thus engaged. If a female arrives three or four males follow her, so closely that one of them touches her tail



A WOODCOCK FEEDING.

with his beak. The "rôding" flight is performed within a height of 50 feet, and lasts no longer than a quarter of an hour in the twilight. It is repeated at dawn, and on warm, calm, rainy evenings. Before a woodcock leaves the country, it begins this performance, which is continued on and after its journey. This flight has also been observed in June or even later, and not only during the spring migration. Woodcocks on migration are most numerous after a warm night's rain, for the south-westerly wind that brings rain also brings these birds, as they fly down wind. Cold and snowy springs, however, delay the spring-migration, which is due at the beginning of March, is at its height in the middle of the month, and lasts until the middle of April and sometimes longer. The autumn migration begins at the end of September, lasts through the whole of October, and ends in November. The birds fly singly or in pairs, and never in flocks, and travel between the evening twilight and the first streak of dawn.

An enormous number of woodcock are destroyed almost every year during the autumn migration, and yet they return again and again. It is supposed that their principal breeding-grounds are the lonely woods of northern Russia and the wastes of Siberia, but they also nest in considerable numbers in the Carpathians. In France, where there are few forests, they breed but very seldom, and the same is true of England, where the woodcock is essentially a bird of passage. In Denmark, Spain, Italy, and Greece, Switzerland, the Tyrol, and Germany it is also a bird of passage, but may occasionally breed. It is extremely rare in Iceland, but, on the other hand, quite common in Sweden. In the latter part of April or



WOODCOCK AND YOUNG.

in May, seldom earlier, one may find a woodcock's nest in some quiet, solitary, moist woodland spot, among moss or grass, behind old stumps or small bushes, but never in dense undergrowth. It is a tiny hollow, lined with moss and dead leaves, and in it lie four or occasionally only three eggs of a buff colour, irregularly marked with light red and yellowish brown spots and specks, which are generally more numerous towards the larger end. After eighteen days the young are hatched; they begin to struggle out of the nest as soon as they are dry, their whereabouts being betrayed by the parents which flutter around them, but throw themselves on the ground, as if hurt, when their young

are in any way disturbed. After four or five weeks the young can fly, and they then leave the parent-birds entirely. They are taken in search of food by the female, the cock also helping to guide them. The female is sometimes bold enough to carry off her young in her claws out of danger, though observers may be standing only a few yards away.

If, on being disturbed, a woodcock lie flat on the ground, it is easy to pass by without seeing it, since its plumage is the same colour as the dead leaves and sticks, its presence being only revealed by its large, black, glittering eyes. The eyes are placed high and far back, and this, together with the flattened and peculiar shape of the head, the short thick legs, the large body, and abbreviated tail, gives the bird so strange an appearance that during its irregular flight it has

often been mistaken for an owl. It can, however, always be distinguished when on the wing by the shrill note uttered by both sexes; the low note, a sort of grunt, being uttered only by the male. When flying in pairs, the one pursuing the other, a quick *slit-slit-slit* is heard, the cry perhaps of the male alone, possibly also of the female. Similar to this is the cry of pain uttered by a woodcock when shot and crippled, as it flutters with tail spread and erect. In the evening the woodcock prepares for flight with a low *etsch*; as it soars upwards there is heard a dull, hoarse *dack*; and as it flutters about trying to deceive intruders as to the whereabouts of its young, it utters a note of anxious fear which sounds like *dack-dack*. Danger is notified by a croaking *tshatscha*. The woodcock measures almost a foot in length, and is easily recognised by the mixture of rusty brown, black, and brownish white on the back, the dark mark between the eyes and the base of the beak, and the brownish white striped appearance of the under side of the body.

Passing on to the game-birds of the forest, we come to the members of the *Tetraonidae*, or grouse tribe, all characterised by having feathers on their legs, and often also on their toes. Another noteworthy feature of the group is the shedding and renewal of the beak and claws, which has been observed in several species, and probably occurs in all. While this process takes place among other birds in such a manner as to wear out or peel off only so much of the tip of the horny sheath as is compensated by fresh growth at the base, those of this group undergo a complete renewal of beak and claws once a year, when the horny sheaths are shed whole or in large pieces, owing to the newly formed structure beneath.

The capercaillie (*Tetrao urogallus*) is the largest European representative of the family, and is characterised by its black rounded tail, which is only half covered by the lower feathers, and is often spotted with white, and also by the beard on the chin, consisting of long stiff feathers, and by the dark-green metallic shield on the breast. As a contrast to this, the hen is adorned with a cinnamon breast, and a chestnut tail with the feathers tipped with white and barred with black. The body is well rounded in form, and the short, strong legs are covered to the joints of the toes with close, hair-like feathers. The capercaillie is a true woodland bird, which, with the destruction of the old forests, has been driven from the plains into the mountains. Preferring pine-trees to all others, it lives only in extensive woodland abounding in shrubs of different kinds, or in clumps of small trees, or stretches covered with berry-bearing plants, with here and there a brook, or a sandy, gravelly patch. In such forests it lives on the ground during the moulting-season, but at other times mostly in the trees, not at the tops, but among the middle and lower branches.

The pairing-season begins towards the end of March, though in January and February the males may betake themselves, one at a time, to the breeding-grounds. If possible, capercaillie return to the place they occupied the year before, and generally choose an elevated situation which affords them a wide view to the east, west, and south, and has only a few trees. Here the old cock, before the arrival of the hens, perches among the pines and rehearses his chant. During

the breeding-season, after searching in the vicinity for food and taking a due share of rest during the day, he returns to the pairing-place with the evening twilight, and either then or next morning repeats his chant some two or three hundred times. As he grows agitated, he struts slowly to and fro on the branch, spreading out his tail in turkey-like fashion, and at each note resembling in attitude an ordinary barn-door fowl when crowing, the only difference being that the breast, neck, and head are stretched forward. In Germany, the chant, or *spel*, is generally uttered on a tree, or is at least commenced there, although sometimes



HEN CAPERCAILLIE AND YOUNG.

on the ground, as is always the case in Transylvania. A curious phenomenon, unknown among any other birds, is the deafness of the cock capercaillie during the *spel*, especially towards the end. During this time the ears are practically shut, so that the bird can hear absolutely nothing but its own voice.

The love-call of the capercaillie begins like the clapping together of two hard sticks, accompanied by a bell-like note, audible only when quite close. This is uttered at first at short intervals, then more and more quickly, till it blends into a gentle tremolo, followed by sounds like the uncorking of a bottle; the finish being like the whetting of a scythe. The cock is answered by the hen with a long-drawn *gack-gack*, which is her note throughout. The alarm-note of the

cock is a short *hoch-hoch*, that of the hen a sharp *gokgokgoilk*, several times repeated. The hen calls her young with a soft *chuck*, and they answer with a low chirping. When enraged, the cock hisses like a goose, or utters a monotonous *tack-tack-tack*; when in pain, he gives vent to a peculiar gurgling in the throat, like the squeak of an unoiled wheel; and he makes another sound, a sort of rattle, by airing his wings or shaking them, or striking with them at some hard object.

The hens, six, or sometimes even ten, of which are included in a "harem," are not always present at the *spel* trees, although they keep near them, and seem to mimic the attitudes of their mate as he chants. They lay seven, or (but this is exceptional) even eighteen light brown eggs, freckled with reddish brown, which are deposited in a slight hollow scratched in the ground. The hens leave the nest only at midday in warm, dry weather, and even then but for a short time. So soon as they are hatched the young birds are led about by the mother, who calls them coaxingly, and feeds them from her beak with ant-pupæ and other insects and larvæ. In winter, and also in March and April, the male capercaillie will live on pine-needles, but his principal food is berries and seeds, when he can get them. The hen wants more variety in her bill of fare and prefers more animal food, so that she is oftener found on the ground.

Amongst the enemies of the capercaillie the principal are the fox and the marten, but in northern and eastern Europe the wolf, lynx, bear, and glutton also prey upon these birds, as do the larger kinds of eagles, hawks, and owls. The nests are attacked by squirrels, hedgehogs, badgers, and wild boars, as well as by magpies and other birds of the crow family. The weaker young birds are sometimes destroyed by large ants, and in northern Europe by swarms of mosquitoes and gadflies. The capercaillie is sharp of hearing and of sight, escaping quickly, and being most ingenious in finding hiding-places. The cock is always suspicious, but the hen is generally more confiding. If disturbed on the nest, she either remains quietly on the eggs, or sneaks away, and pretends to be lame or ill, in the hope that by drawing attention to herself the eggs may escape detection. If the young can run, the whole party escapes on foot and disperses over a considerable area, the young birds concluding their run by pressing their bodies close to the ground. This happens, however, only so long as they cannot fly; when older, they follow their mother to the nearest tree. During the pairing-time the hen informs her mate of danger by a sharp *gock*, and flies against him or touches him with the point of her wings. If he hears the warning calls of other animals in the forest, he knows how to take advantage of them for his own safety; and he always hides if another cock calling near by suddenly stops and disappears. It is said that he can be deceived by tripping steps or jumps, in imitation of the noises caused by deer. Like other animals a capercaillie is much more easily frightened by a repeated crackling than by one crack as of breaking wood, and will take alarm at a sudden silence, as the halting or turning back of an approaching man.

Capercaillie are found in the mountains of all the peninsulas of southern Europe, in the Jura, the Alps, and the Carpathians, in Germany, in Russia up to the Arctic Ocean, and in Siberia eastward to Kamchatka. They are most numerous in Asia, and after that in Russia, Scandinavia, the Baltic provinces,

and the island of Solovetski in the White Sea. They are rare in Italy and western Europe, Prussia, and Pomerania, and are absent altogether from the Caucasus, the south of Russia, Denmark, Holland, England, and Ireland. In Scotland they have been acclimatised, after they had died out, by putting eggs under greyhens, thereby giving the young ones good mothers. According to some authors there are several species instead of one. Europe with Siberia, the southern Ural, south-eastern Siberia, eastern Siberia, Kamchatka, the isle of Saghalien, and central Asia are said to have each its own peculiar species—seven in all. Most naturalists, however, do not recognise more than two species, the common *T. urogallus*, and *T. parvirostris* of north-eastern Siberia; each of these having two local races.

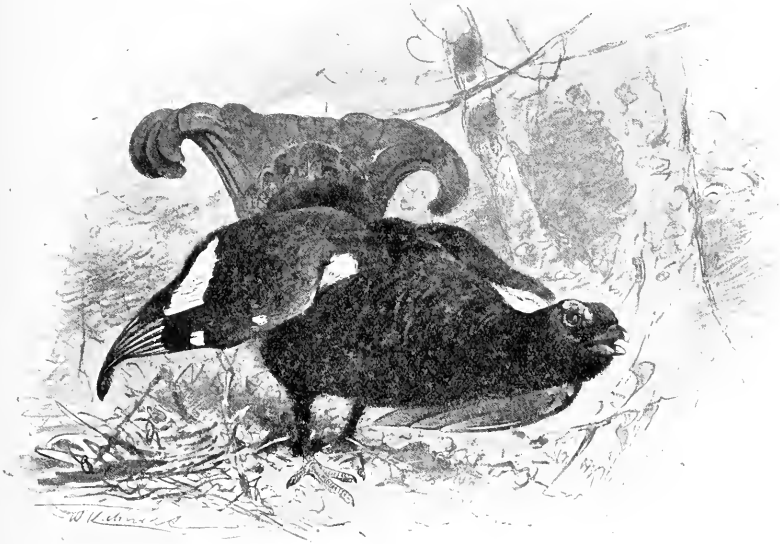
Blackcock. The black grouse, otherwise black-game (*Lyrurus tetrix*), of which the male is blackcock and the female greyhen, is the largest European relative of the capercaillie, but its haunts are different. Woods of all kinds, amid meadows and fields, and open spaces dotted with trees and bushes growing at random, and plenty of underwood, together with rippling brooks, moors, and sandy stretches with solitary trees, and the apparently indispensable heather, form the favourite haunts of the blackcock. In Germany the species is called the birchcock, on account of its preferring the birch to all other trees. The slightest disturbance will cause this shy bird to shift its quarters, as will likewise bad weather, which makes it move lower down the mountains, and in winter drives it to the sunny side of the valleys. It will often exchange the leafy woods, which at other times it prefers on account of the buds, for the pine-forests, as they afford it warmer and safer hiding-places.

The pairing-season of the blackcock depends on the climate, but generally begins in the middle of March and lasts till the middle or end of May. Unlike the capercaillie, the cock calls almost exclusively on the ground, and much more frequently and at different times of the day. Blackbirds and ring-ousels generally announce his arrival at the early dawn. First of all the cock stretches its head forward to see that all is safe, then extending its body, and giving a violent jerk, hisses a challenge to any rival that may happen to be near, and follows on with the wonderful crow that makes every feather of the plumage quiver. As the bird trills this forth, its thin-skinned throat is distended as if it were a soap-bubble lighted up by the sun. Many gestures accompany the vocal effort. The bird rises and spreads his tail, his drooping wings beat the ground, his neck-feathers stand up, he stoops and rises, dances, flutters, jumps, and bows continually. Unlike the capercaillie, he is not, however, deaf; nor do his duels with his rivals ever terminate fatally. His crow is answered by a soft, nasal *dakdak* from the hen, which, when uttered in a short, sharp way, becomes a warning call. At the end of April or the beginning of May the hen lays her six or ten eggs, sometimes more; and, like the ptarmigan, deposits them on the ground in what can hardly be called a nest. In colour the eggs are a little darker than those of the capercaillie, and they are also smaller.

The blackcock is a livelier and more audacious bird than its larger relative, but in all other respects the two are much alike. Blackcock have good hearing

and sharp sight, are much better able to hide themselves than the capercaillie, on account of their smaller size, and are oftener seen on open plains, even when these are frequented by man, as they fly so swiftly as to be able to escape in time. They are alert to the alarm-calls of other birds, and are very shy of approach.

The more negligently a forest is kept, the more likely is it to contain blackcock. In Germany the species is met with almost everywhere, provided the place affords it suitable food, but is not now found in the Black Forest, where, a hundred years ago, it was resident; nor in the Palatinate, the Vosges, the Taunus,

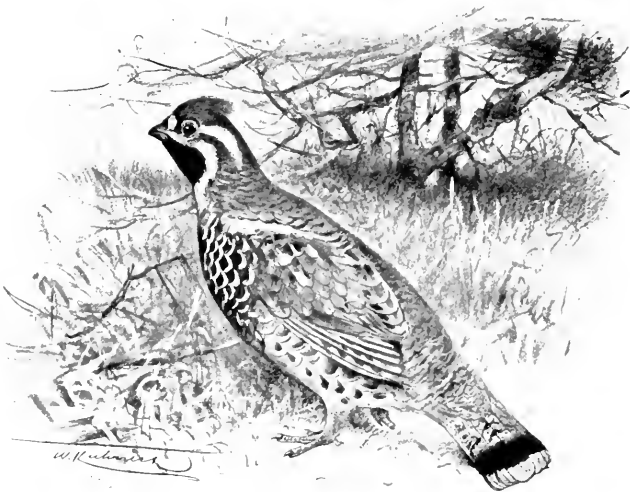


BLACKCOCK CROWING.

or southern Transylvania. It occurs, however, in Scotland, Holland, Denmark, the southern Jura, the whole of the Alps, the Ardennes, the Balkans, Bohemia, Moravia, Galicia, and the Carpathians. It is also found in great numbers in the Baltic provinces, the Urals, Finland, northern and central Russia, Siberia, and as far east as Kamchatka. In Russia it is spreading more and more to the north, often occupying the places from which capercaillie have been driven by timber-felling.

Hazel-Hen. The hazel-hen (*Tetrastes bonasia*), disliking high grasses on account of their dampness and the impediment they offer to rapid movement, takes up its abode in woods, where there is a mixture of pines and

deciduous trees. It requires shelter alike from great heat and excessive cold, sufficient vegetable and animal food—especially an abundance of berries and buds—good hiding-places and quiet surroundings. All these it still finds in the mountain woodlands of Germany as well as in the sylvan regions of the Alps, though originally, as still in Poland, it was more a bird of the plains than of the hills. In parts of the Continent the spread of pine-forests and the absence of underwood has caused a decrease in the numbers of these birds, by depriving them of a sufficient supply of the berries on which they feed. Hazel-hens devour cranberries, bilberries, wild strawberries, raspberries, service-berries, blackberries, elder-berries, juniper-berries, snow-berries, hips and haws, and medlars and other



THE HAZEL-HEN.

fruits; and, in addition to these, the seeds of vetches and peas, beech-mast and acorns, as well as buds and catkins, the young sprigs of heather and such undershrubs, and leaves and grass; and in summer many insects, and spiders and worms.

The food of the hazel-hen, as well as its fondness for sand and dust baths, keep it, at least in summer, on the ground. Except in the far north or in stormy weather it sleeps in trees, in which in winter most of its time is spent, for the sake of the buds and fruit. When bathing in the dust, it behaves in the same manner as a domestic fowl, which it also resembles in its walk. It runs quickly, and, when escaping from danger, stretches the body forward, presses the wings close, jumps into the air, and then flies off, although not to any great distance. Its hiding-places are among the underwood, and when in fear it keeps as low on the ground as possible. If again disturbed it will fly into a tree, generally to one of the lower branches,

when it will lie flat, or creep stealthily to the side away from danger, or suddenly drop and hide among the bushes. In addition to the enemies of blackcock, hazel-hens are the prey of ravens, crows, jays, falcons, sparrow-hawks, buzzards, owls, hedgehogs, squirrels, and other animals. The young are sometimes devoured by snakes, and brooding-hens are often driven from the nest by ants and gadflies. The eggs are laid in a hollow, beside a rock or the trunk of a tree, among heather and ferns, in reeds, or under bushes; the nest not being easy to discover, owing to its having a sort of cover of the same colour as the ground. Sometimes the eggs are laid in a forsaken pigeon's nest, or some other elevated spot, but this occurs only in certain districts. Each nest contains from eight to twelve reddish yellow eggs, dotted with brownish red spots. If more are in the nest, they have been laid by two hens.

As a rule, these birds pair for life, probably in their first spring; but, while the hen is on the nest, her mate often wanders about in the same district with some other female, and does not return to his family until the young are about eight days old, when he accompanies and protects them. The young leave the nest so soon as they are dry, and run about with their mother to look for food, which consists of small insects and their pupæ, and later on of berries, tender herbs, and leaves, and at last of larger insects, buds, etc. The chicks glide very carefully through the shrubs on the ground, and at the warning call of the mother disperse and skulk in the covert. When the danger is past they are called together by the chirping of the old bird, which they answer with their shrill pipings, and at night they all creep beneath her wings, where they are sure of a bold defence against all comers. The young, which are reddish brown, yellowish, or white in colour, are at eight days old so well fledged that they can fly to the branches for their night's rest, for food, or at the approach of danger. If in September any are seen half-grown they belong to a second brood, the first having probably been destroyed. In late autumn the members of the family disperse into the forest, in order to pair off soon afterwards. The hazel-hen is more or less numerous throughout Germany, the wooded districts of Switzerland, and the mountains of northern Italy, and is abundant in the Alps, the Carpathians, and especially so in Styria. It is still more plentiful in Russia, where it serves both as an article of food and of export, particularly in the Baltic provinces, Finland, and the northern and central districts, as well as in Siberia, the countries of the Amur, and the island of Saghalien. It is frequently seen in Manchuria, and is well known as a resident in Japan. In the colder regions, where it is not met with at a greater elevation than 3000 feet, its nesting-grounds extend to the 68th degree of north latitude. The hazel-hen is larger than the partridge but smaller than the blackcock, and has greyish or rufous plumage, which, on the upper parts of the body, is barred with black and brown, and occasionally spotted with white: the throat of the male being black with a white ring. There is a white spot behind the eye, and another on the wing, and the tail is whitish, with dark brown markings, and a black band at the rounded edge. The hen is mostly white on the chin and throat.

Of the birds-of-prey inhabiting the woods and forests of central

Peregrine.

Europe one of the most noticeable is the peregrine or blue falcon (*Falco peregrinus*), which ranges from the far north to the tropics. In hot

countries, however, it chooses mountain ranges for its home, while in the north it is also found on the Siberian tundra. In many parts of the Continent it lives in the forest, but being more successful in the open country as regards its prey,



THE PEREGRINE FALCON.

it journeys miles away among cultivated fields in its pursuit. The nest may be found either among rocks or in high trees, but on the moors and the Siberian tundra is of necessity placed on the ground; and the peregrine will sometimes build in populous cities, a nest having been found in 1880 on the steeple of St.

Peter's Church, in the centre of Berlin. Often it will use the abandoned nest of some other bird-of-prey, or of a heron or raven; while, if it take a fancy to an occupied nest, it will force the owners to leave.

Birds from the size of a lark to that of a duck, or even a wild goose, are the prey of the peregrine, but its favourite victim is the partridge. It can only catch birds as they fly, and swoops on its prey with such force that it sometimes injures itself on the ground. Its flight is exceedingly swift, and mostly at a moderate height; and, on rising, it flies at first with outspread tail, going a long distance, but keeping low. The sweeping, circling flight, the slender body, long, narrow, pointed wings and thin tail distinguish it from other birds-of-prey. As a nesting-bird, the peregrine is increasing in numbers in the British Isles but becoming rare in Germany, though when once it has established its nest in a ruined tower, or in the forest or its outskirts, it is not to be driven away, even by robbing its eggs or young. Most of those nesting in central Europe migrate in autumn; and are replaced by visitors from the north, while throughout the winter they are met with on their passage, though their numbers are greatest in March and September.

Hobby. The hobby (*Fulco subbuteo*) is a much smaller bird, which may sometimes build in high trees, but in Britain generally takes possession of the deserted nest of a crow or a magpie. Never building in the hollow of a tree, although it may occasionally do so in a rocky crevice, on the Russian steppes it generally nests on the ground. Rarely attacking birds in the forest, this falcon preys on those frequenting the fields, the speediest of which are unable to escape its clutches when on the wing, for the hobby is one of the swiftest of European birds-of-prey. Bold and resolute, the hobby never tries to strike birds on the ground, but swoops on them as they fly with such rapidity that it can hardly be recognised. It will feed on flying insects as well as birds, but will never touch carrion. Larks and swallows are its favourite victims; larks being so terrified at its approach, that they often fall to the ground, where they may be caught in the hand. If they notice their enemy in time they fly high in the air, where it never follows them. Later on—when the larks are able to hide in the corn—the hobby turns his attention to swallows, which, although they mob every other bird-of-prey, dare not attempt this with him, and escape either by flying to a great height, or by dashing into a patch of reeds, or other hiding-place. Should a swallow separate from the rest, it is pursued, and if young and unable to fly well, is invariably caught. Sometimes the hobby begins the chase with a series of seemingly capricious curves. Occasionally male and female hunt together, and generally quarrel over the prey; but should the cock offer his booty to his partner, it is received with screams of pleasure. The hobby feeds its young while flying in the air, as do swallows; later on the parents drop their capture to the young birds, which fly a little lower and catch it in their claws; sometimes they miss it, whereupon the old ones swoop down and seize it before reaching the ground. Later still the young birds will fly up close to the old ones, snatch the food from them with their beaks, and dash off with it in their claws to devour it on some lofty tree. Young hobbies awake rather late in the morning, but immediately fly round above the forest, and after sunrise begin hunting in the

fields. They will sometimes follow a man out shooting, and swoop down on the small birds which have been flushed by the dog before the very eyes of its master. When settling themselves for the night, the old birds fly all round their own part of the forest with a peculiar cry, as though to make sure that everything is safe before retiring to rest.

The hobby, which may be distinguished from the peregrine by its smaller proportions and rufous thighs, leaves the central districts of the Continent in September or October, and returns in April; in Germany it is never found in large numbers, owing to the country being so poor in small birds; but it is said to be common in the lower parts and steppes of the Urals and in the Dobrudscha. It ranges from Lapland, within the Arctic circle, to Cape Colony, and from the Atlantic to Kamchatka; and, on migration, to the Canaries. To India it is a well-known winter visitor.

Spotted Eagle. The commonest eagle of central Europe is the small screaming or spotted species (*Aquila navia*), which prefers forests of deciduous trees to pine-woods, and generally builds in a beech-tree; its favourite haunts being extensive marshes, large lakes, and wooded meadows, although it sometimes appears in treeless districts, but never far from water. The nest is always in lofty trees, occasionally in a birch, alder, or oak, and quite exceptionally in a pine; it is always placed where a gap in the trees gives an easy way of escape; and the same nest is often used for many years, though it may sometimes be left for another made close by. Like that of some other birds-of-prey, it is lined with green twigs—in this case generally sprigs of beech—and is always built in hilly situations. Often it contains but one egg, sometimes two, and rarely three.

In habits the spotted eagle is like most of its tribe, although it lacks their swift and powerful flight. It preys on frogs, lizards, and snakes, occasionally on fish, and on small mammals and birds, especially when they have young. Breeding in the north German plains and the Baltic provinces, it is also found in Poland, Hungary, western Russia, the Dobrudscha, and Turkey, as well as now and then in Greece. It is but seldom seen in Italy, Switzerland, or France; neither is it often met with in western Asia, the river Don being apparently the boundary of its eastward range. From north Germany, where it is never seen in winter, this species migrates south in the middle of September, and returns at the beginning of April, its migration taking it down the Nile Valley to Abyssinia, if not further.

Buzzard. The buzzards, which are spread all over Europe, Asia, and North America, are represented by about twenty different species, and have the tail about half the length of the wings. They live principally on mice, but not unfrequently kill larger mammals; they rob the falcon of its prey, while to catch a mole they will wait for hours near its hill, and now and then will even scratch it up with their claws. They also eat insects and frogs, and poisonous snakes and other reptiles.

The typical species is the common buzzard (*Buteo vulgaris*), which lives in the woods of both the plains and the hills, especially in the neighbourhood of corn-fields. In spring its haunt is within the forests, but in autumn it is found on



their outskirts, or in fields and isolated woods. It nests, as a rule, in pines, oaks, or beeches, and invariably selects the highest trees, although it does not always go to the top of these, choosing by preference a branch at a medium height. At the end of April or in May the nest usually contains three eggs, one of which is generally darker than the other two, the second being much lighter, and the third almost devoid of spots. The buzzard is very quiet and shy while near its nest; and at the least suspicion of danger will carry its young to some other nest it has in readiness. It feeds them with mice, birds, reptiles, frogs, and other small animals; its chief food being at all times field-mice, although it will also prey on moles and rats, and, less frequently, on snakes and slow-worms and snails, as well as on beetles and other insects. While nesting, a buzzard will take forest and field birds, domestic fowls, young and old crows, leverets, and, it is said, very young calves; nor does it disdain a meal of birds' eggs. A buzzard usually perches quietly on some tree or hillock, waiting for its prey; when it sees anything living, it quickly and silently steals up to it, makes one snap, and devours it at once. Sometimes it hovers for a little above its victim, and then swoops down in a curve, with wings close to its body, till it reaches the spot, when it opens its wings and beats the unfortunate creature to death. The buzzard may be known from a distance by its short and somewhat clumsy body, and its gentle, swaying flight. During nesting-time, as well as when migrating, it flies high, and in spirals. Arriving on the Continent in March or April, it leaves in September or October in flocks of from twenty to fifty birds. In Britain the buzzard is resident but rare; it is occasionally met with in France and the Netherlands, and is one of the best known birds-of-prey in Denmark, Germany, Austria, Hungary, central Russia, and the Balkans. The species is more or less nearly confined to Europe, its distributional area extending from the south of Sweden to the Mediterranean, although it extends as far east as Asia Minor.

Honey-Buzzard. The honey-buzzard (*Pernis apivorus*) is but seldom found among the pine-forests, as it prefers to dwell among the woodlands and orchards, where wasps and bees abound, since its food consists principally of those insects. To obtain these the honey-buzzard scratches up the ground like a hen, regardless of their stings, being protected by the hardness of its feet and the tufts of feathers in front of its eyes. When a wasp or bee is captured, it is held crosswise in the beak of the buzzard till with one snap the sting-bearing abdomen is nipped off. Besides bees, the honey-buzzard eats beetles, caterpillars, and other insects, as well as worms, frogs, lizards, birds, and mice, hamsters, and such other small mammals as it may capture in the fields. The young are fed chiefly with ants, wasps, bees, and their grubs. The nest is full of the remains of these insects which have been chewed up by the old birds to prepare them for their young; and it may always be recognised by fragments of the honeycomb lying around. The nest is always in a tree, generally a beech, and is often the deserted and repaired nursery of a raven or other large bird. Long before the eggs are laid the male and his mate amuse themselves by pursuing each other high in the air, rising and falling, and describing large circles—the males always flying faster than the females. Their usual flight is quiet and slow; they move on the ground like ravens, carrying

their neck high, and bristling up their feathers; but they walk fast, in fact faster than any other birds-of-prey.

The eggs of the honey-buzzard are not laid before the end of May or the beginning of June. The young birds sit in the nest with head erect like eagles from the very first, remaining quiet, but knowing no fear, and not even defending themselves against man. They do not leave the nest for a considerable time, and even use it as a resting-place after they are fully grown, when they are still fed by the old birds. Unlike other rapacious birds, the family keeps together



HONEY-BUZZARD.

until they migrate and start on their journey. Honey-buzzards migrate in flocks of from thirty to fifty, which in some districts succeed each other so quickly that often in the course of a few hours a thousand birds may pass. Sometimes they migrate in a straight line, flying no higher from the ground

than the tree-tops: but at other times they move along in continuous curves, or they may fly in such a way that those behind can overtake the leaders; and all the while they do not forget to look for food. The migration occurs in August and September, and the birds return in April and May to their nesting-places, which are spread all over Europe. The honey-buzzard is most abundant in the east of Russia, and is also very numerous in the plains of Norway; but in other countries generally appears in pairs, and in Germany is one of the rarer birds-of-prey.

Kite.

The kite (*Milvus iclinus*) ranges over almost the whole of the Eastern Hemisphere, living by day in fields and meadows, over which it wanders for miles, and in the evening repairing to the forest for shelter. It nests high up on some large deciduous tree or pine, mostly close to the trunk,

and lines its nest with rags and paper gathered in the neighbouring fields or rubbish-heaps. Kites often play in the air above their nests, flying against each other, then soaring for a while together, and raising their heads in a sportive manner. At other times they fly in a quiet and incomparably graceful style, soaring without any perceptible movement of their wings to heights so great that they can hardly be followed by human eyes. They often fly low above the ground, and only when swooping on their prey is there much energy in their movements. The kite is, however, essentially a coward, and greatly afraid of other birds-of-prey. It is a crafty robber, stealing goslings, fowls, and ducks; and in quest of these venturing close to villages, and coming back day after day at the same hour, if it has once been successful. Kites will also kill and eat moles, mice, and other small mammals, and in times of need, even insects, worms, and fruit; while carrion appears to be regarded as their daintiest food. A few solitary kites may remain in central Europe during mild winters, but most of the tribe leave for the south in September and October, generally in flights of from fifty to one hundred, when they cross open plains in large circles, flying slowly and not far above the ground. In the beginning of March they return to their nesting-haunts, the area of which extends from southern Sweden to the Mediterranean, and in the east to the Volga and the Urals. In Britain the kite is practically exterminated, and it is rare in Germany. In France it is also rare, and in Greece is merely a bird of passage; but in north-west Africa, in the Canaries, and in lower Egypt, it is quite common. On the shores of the Danube it is not seen so frequently as its relative the black kite, but in Bulgaria, Rumania, and the Dobrudscha it appears in considerable numbers.



THE KITE.

Goshawk.

The typical hawks are birds which catch and kill their own prey, building in the most secluded part of the forest near the trunk of some old lofty tree, or on the lower branches, but always in a dense thicket,

and never, like falcons and buzzards, on the tops of trees where the nest would be visible from a distance.

The common hawk of central Europe is the goshawk (*Astur palumbarius*), a species which flies over the plains and hilly country, and takes its rest in the woodland patches around fields and meadows. The nest of this hawk, which is more often placed in the spruce-fir than in the pine or oak, is sometimes a yard in width, and has a basement of sticks an inch thick, with thinner twigs above. The young are grey above, and of a pure downy white beneath. At first they rest on their shanks, with the toes placed close together, but after some weeks



THE GOSHAWK.

they learn to stand up, and in a couple of months are fledged enough to leave the nest. The mother takes such care of her young that she is heedless of any danger where they are concerned, and attacks not only men and children, but even horses, if she thinks they mean mischief. So long as the young are in it, the nest is quite a larder of slaughtered birds and small mammals. The goshawk preys on pigeons, ducks, partridges and other game-birds, crows, rooks, magpies, jays, and many smaller birds, as well as on field-mice, hamsters, squirrels, weasels, hares and rabbits. It steals young rooks from their nest, killing the old birds after a short struggle, and although a mob of rooks may sometimes try to punish the robber, it is rarely without one falling a victim to the desire of revenge.

Small birds are almost paralysed by the sudden appearance of a hawk, so that they are struck down before they regain their senses. If there is no prey to be found in the fields, the goshawk invades farm-yards and village gardens, and even follows pigeons into their cotes, sometimes even breaking window-panes in order to gain an entrance to take tame birds in their cages. When a hawk has dispersed a flock of pigeons, it follows one particular bird which soon falls a victim. Even the swiftest birds cannot escape into the bushes, for the hawk follows and drags them from among the densest thickets and the sharpest thorns. Like the sparrow-hawk, the goshawk dashes along the skirt of the forest, along fences and walls, over low roofs and between buildings, and seizes its prey so suddenly that the frightened animal is in its claws before there is time to scream. It catches birds, whether on the wing or otherwise, with the utmost dexterity, dashing on them at all angles, and turning over in the air with incredible swiftness in order that it may seize its quarry from below. So much does its form blend with the atmosphere in its terrific speed, that it is scarcely more visible than an arrow. A goshawk usually kills its prey with its claws, which are stronger and sharper than those of any other rapacious bird. Either it strikes its victim with both claws simultaneously, or, as in the case of smaller birds, with one claw alone. The larger birds are borne to the ground and wounded and torn by its claws before they are carried away. During the nesting-season everything it catches goes to the nest, but at other times it tears its victim with its claws, never with its beak, and carries it to some hiding-place where it can feast in peace. When all is eaten, the hawk sits down, arches its back and puts its head between its shoulders; yet even then only the experienced shot can succeed in bagging it, for the goshawk has an innate fear of man, and never perches where it can be seen from a distance.

The goshawk can only be caught by traps and snares, the bait tempting its voracity. Old birds never recover from the loss of their freedom, even if they are caught by means of their young, of which they are first robbed, and then taken and put into the same cage. When thus captured they behave as if mad, devouring their young first, and then fighting with one another, when the female always gets the better of her partner. In central Europe the goshawk is resident and partly migratory, arriving in March and April, and leaving in September and October, on its way to Africa. Its range extends over the temperate and northern countries of Europe and northern Asia as far as Japan, although in some countries within those limits the species is unknown. The goshawk is distinguished from the peregrine by its short, rounded wings, and its mode of flying with its bill erect and its neck between its shoulders; its tail also seems much more pointed than that of the peregrine, although this is not really the case.

Sparrow-Hawk. The sparrow-hawk (*Accipiter nisus*) is a small edition of the goshawk, quite as bold and dexterous in catching its prey, although being smaller and weaker, it hunts smaller birds, which regard it as their most formidable foe. This species nests in lonely and secluded spots, where it lays from four to five white eggs marked with reddish brown blotches. The haunt of the sparrow-hawk is in stretches of forest, or in patches of woodland adjoining meadows and arable land, near some village. It builds on pine-trees, choosing

those that stand on the edge of the wood, providing they are fairly large. The nest is generally close to the main trunk, and in shape more oblong than round. Occasionally it is built up on an old crow's nest, and it is always so large that the long tail of the brooding female is well within it. It is lined with rootlets, and occasionally has a little moss. The young sleep with their heads resting on their



THE SPARROW-HAWK.

backs, and their beaks hidden in their plumage. They are so amply provided with food by their parents, that eight or ten slaughtered birds may be found at a time in the nest: and this slaughter goes on long after they are fully fledged. All this time they are being guided and taught by the old birds, but so soon as they are strong enough to hunt on their own account, they have to find hunting-grounds for themselves.

The sparrow-hawk catches birds when they are perching or on the wing, and

flies with extraordinary swiftness, gliding through the air for miles without a visible movement of the wings. It slips through foliage with wings held closely together, and generally flies close to the ground; while it will turn any corner with wonderful quickness, and surprise small birds at their feeding and roosting places like a flash of lightning. When compelled, it will eat mice or insects, but it prefers birds, from the size of a linnet to that of a pigeon, hunting and catching them in the same way as the goshawk. Sparrows seem to be its favourite prey, for it will follow them even into rooms. The female can kill and carry off pigeons and crows, although she is inferior in size; and she has even been seen to attack a heron. If the sparrow-hawk is not hungry, it flies with its prey in its claws in graceful curves and circles, but never hovers. In perching it moves its tail up and down like a wagtail, and draws its head in between its shoulders. Sparrow-hawks do not all remain in central Europe to winter, most of them going south in September and October, and returning in March and April. They nest throughout Europe, north-west Africa, and the Canaries, as well as in Persia and Asia Minor. Many sparrow-hawks winter in southern Europe, others cross to Africa, where they are found as far south as Kordofan.

Horned Owl. All the owls have short, plump bodies, broad heads, scarcely to be distinguished from the equally broad neck, and very large, staring eyes. Most of them have also a disc of radiating feathers round the eyes; the whole face being, in fact, taken up by the two large eyes and these discs, which are often surrounded by several rows of very stiff feathers, bent at the tip. In some species the whole face is surrounded by these feathers, but in others they occur only round the outer and lower part of the face, or round their ears: a few are without them altogether.

Owls are also distinguished by the flexibility of the fourth toe, which may be turned backwards or forwards at will, or at least so much to the side that, while clasping twigs, they are able to put two toes on one side and two on the other, like parrots. The beak lies within the stiff feathers of the eye-discs, and thereby seems shorter than is really the case. The body-plumage is beautifully soft, and as the wing-feathers are also soft the flight is nearly noiseless. The outer feathers of the upper wing-coverts have small hooks at their ends, with points bent outwards, the object of which is not as yet known. The group comprises about one hundred and fifty species, which are spread over all countries; one of them being peculiar to the Arctic regions. They are nearly all nocturnal, sleeping during the day, and hunting at dusk and during the night. Their food consists of small nocturnal rodents and shrew-mice, as well as of bats and sleeping birds and mammals. Owls are guided by their acute sense of hearing more than by sight, being able to hear the low cry of a mouse from a long distance; and by the imitation of such sounds they may be lured to destruction. It is an error to suppose that owls can see only imperfectly or not at all by day, for not only are there several species which hunt during daylight, but all of them can see approaching danger by day as well as by night. They are therefore no less difficult to catch than ordinary birds, and, when frightened in the daytime, fly through foliage just as quickly as at night. Their eggs are pure white and usually almost

spherical. Owls build in various places, most of them choosing hollows of trees, rocky clefts or holes, and hiding-places in walls of buildings, while some take possession of the abandoned nests of crows and birds-of-prey. Others nest on the ground, others again in cavities under the ground which they share with certain rodents. Owls are feared by nearly all other birds, and as soon as they appear by day are mobbed and driven off by the smaller species.

The horned owl, or, as it is generally called in England, the eagle-owl (*Bubo ignavus*), is the largest European member of the group. It ranges



THE LONG-EARED OWL.

through Europe from northern Africa to within the Arctic Circle, is rather common in Prussia and Pomerania, far from rare in the old ruined castles of southern Germany, and numerous in Lithuania and Poland. It is found frequently in western Russia, Turkey, and the Greek mountains, but seldom in Italy and Spain. Really a resident bird, it is only in winter when food is getting scarce, that it is occasionally compelled to go on long journeys. Young birds fly about alone, because the old ones will not suffer them in their own preserves, and they lead a single life for years, until they pair and choose a permanent residence.

Eagle-owls feed on frogs, lizards and snakes, on mice and small mammals, including hares and occasionally young fawns, and very largely on birds. Their favourite food seems indeed to be crows. If they catch a large animal, they first of all tear the skin off the abdomen, and devour the intestines, storing away what they cannot eat for future meals. Before devouring small birds, these owls break the skull with their beaks. They nest in rocky clefts, cavities in the ground, old quarries, ruins, hollows of trees, and pollard stumps, and rarely on tall trees. The nest contains in March or April two, rarely three, and very occasionally four eggs, but it is only exceptionally that more than two hatch. The nest is bravely defended



HORNED OWL.

by the courageous parent-birds, even foxes being driven away by them and the largest birds-of-prey put to flight. If, when on the nest, sitting in her calm way with bristled feathers, depressed ear-tufts, and half-closed eyes like a shapeless mass of feathers, the hen be disturbed, she opens her eyes wide, raises her feathers so that she looks double her size, moves her head and body from one side to the other, lifts her feet alternately, turning the outer toes forward and backward, slowly closes and opens her eyes, trembles and hisses, snaps her beak, and suddenly rushes on her enemy, which if once clutched she does not readily release. The eagle-owl is always on the alert, and is much livelier by day than others of its kind, nothing which happens within range escaping its attention. When alarmed, it flies through the bushes to some other hiding-place, the flight being mostly low and irregular, as well as light and silent.

Long-Eared Owl. The long-eared owl (*Asio otus*) dwells in the gloomy pine-forests, where, with its body pressed close to the trunk of the tree, it sleeps during the day on some strong branch. These owls are gregarious in habit, and during migration may often be seen in flocks of a hundred or so at a time. They also sleep by eights and tens on a tree, and sometimes in the open field, where, at the approach of man, they stand like stones, and then slowly move off, but not before the enemy is close to them. On migration they follow a route along which mice are abundant, for the smaller rodents form their favourite food. They never hunt in couples, being so careful of their young that one of the parents always remains at the nest. The male provides the brooding female with a good supply of food, but, by his cries and the clapping of his wings, often betrays the nest, which is generally the deserted nursery of some crow, pigeon, or bird-of-prey. In most parts of the Continent the long-eared owl is met with wherever there are forests. Its range extends from Sweden to northern Africa, and from the Azores, Madeira, and the Canaries, through Europe and Asia, to China and Japan.

Tawny Owl. The wood-owls are easily recognised by the absence of ear-tufts and their short bodies. The best known species is the tawny wood-owl (*Syrnium aluco*), which lives as a rule among trees, and keeps clear of lonely buildings, and particularly ruins and uninhabited houses. So long as there are leaves it will sleep on one of the main boughs, but in autumn and winter it retires to some hole in the trunk, from which it is not easily driven out. The eggs are sometimes found in a sort of rudimentary nest, but generally on the bare bottom of the nesting-hole. This species shuns the daylight more than other owls, but is very active by night in search of field-mice, moles, frogs, large insects, caterpillars, and birds up to the size of ring-doves. Unlike other owls, it always ejects the pellets of indigestible materials which form in its stomach in some particular place. In other respects this courageous bird, which will attack and chase even the buzzard, especially at night in the vicinity of the nest or roosting-tree, has the same habit as other owls; it hisses, bristles up its plumage, blinks its eyelids, clicks with its beak, and moves its large head to and fro when disturbed. During the nesting-time its call of *tu-whit, tu-whoo! oh-h-h-h!* is frequently heard at night, and by the cry the tawny owl is well known to the people of most continental countries. This owl is found beyond the boundaries of Europe only in Asia Minor, Syria, and Palestine. It ranges as far north as there are forests, but in the extreme

south appears but seldom and then only singly. In central Italy, in the forests of the lower Danube, and in Austria and Hungary, it is still comparatively common.

Little Owl.

The so-called little owl (*Carine noctua*), the bird of Minerva, chooses its abode on the edge of the forest, in woodlands among fields, in gardens with trees, and in ravines, rocky places, ruins, and buildings, especially wherever there are many hollow fruit-trees and plantations of white willows. It lays its eggs in May, generally in holes or hollow trees, and sometimes between the beams in a roof. During the day it will sit in its hiding-place, and occasionally enjoy the sun; when frightened, it immediately flies away, softly and lightly, moving with many a curve and undulation, as if uncertain where to go; while at night its movements are singularly graceful and decided. Beginning in the twilight to hunt for mice, birds up to the size of sparrows, and creeping things generally, including cockroaches and other insects, it will continue the pursuit on a moonlight night until dawn. Sometimes it will sit, as is the habit of the family, on some perch a few feet from the ground, in order to dash quickly down on its prey, and carry it home. It will also fly over the fields, and during the night approach any light there may be in a window, making its presence known by



THE TAWNY OWL.

its cry; the cry, together with the circumstance that in the country many of the rooms lighted late at night are sick-rooms, has caused this owl to be regarded by the peasantry of many countries as the messenger of death. The little owl is over 9 inches long; it has a brown back speckled with white, and is white below with broad, brown stripes, the legs being white and the tail brown with whitish bars.

Pigmy Owl. The pigmy owl, or sparrow-owl (*Glaucidium passerinum*), ranges over Europe from the Alps as far north as trees can thrive. It occurs around the lower slopes of the hills as well as in the most elevated forests, but does not often venture out into the open. In Germany it is rare, and its nest seldom found. The latter is built in tall trees, especially beeches, often in a deserted hole of the green woodpecker, at a height of about 30 feet from the ground. This species, which is the smallest of the European owls, being under 7 inches long, has a small head, with a white and brown face, white-spotted crown



THE FIGMY OWL.

and wings, the upper-parts darkish brown fading off into white beneath, the flanks marked by brown streaks, and the tail by white bars. It flies swiftly and gracefully by day as well as by night; and lives chiefly on field-mice, small birds, and moths and other large insects which it catches mostly in the twilight.

Ring-Dove. From the owls we pass to the pigeons, of which the wood-pigeon, or ring-dove (*Columba palumbus*), is the largest European representative. By preference it dwells in the pine-forests, where it feeds on the seeds of any species of conifer; and if these seeds do not afford sufficient food it betakes

itself to woods, but rarely those from which pines are absent. The nest is usually built on some bough from 10 to 100 feet above the ground, and is flat and round or oblong, and so roughly made that the eggs can frequently be seen in it from underneath. In the middle of April, or even so late as July, the hen lays a couple of white eggs, which in due course hatch out; but at the slightest disturbance she is apt to abandon both nest and eggs, and sometimes even a nest containing the young, which will invariably be found to be looking in opposite directions. In some parts of Europe, as, for instance on the North Frisian Islands and in Schleswig-Holstein, where the ring-dove chiefly lives in gardens, the bird has lost much of its shyness; as it has in the Dutch cities, where it builds in the old trees bordering the canals, and in London. Besides pine-seeds, the ring-dove eats peas and many other seeds, mainly of wild plants. It is a shy, brisk bird, alive to every danger in time, with a swift and strong flight.

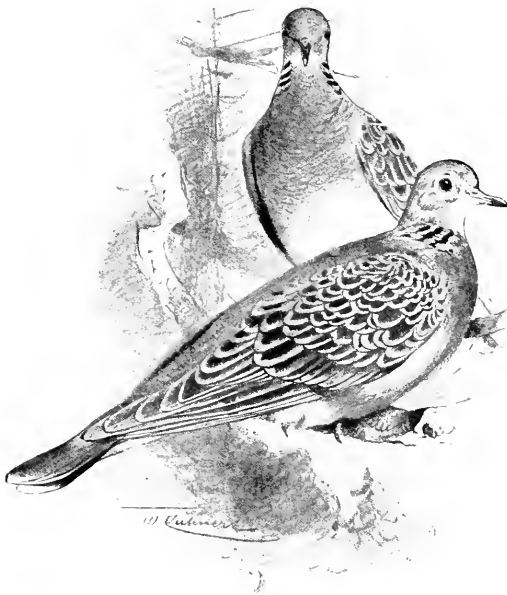
The wood-pigeon always pairs for life. Early in the morning the cock begins to coo his song to his mate; then both preen themselves, and fly off to their feeding-places, where they remain cooing a little from time to time till about ten o'clock, when they fly back to the trees, and an hour later visit their drinking-place. After a noontide slumber, which lasts till about three or a little after, they repair once more to their feeding-grounds, returning between five and seven to the trees, whence, before their night's rest, they once more fly off to drink. This handsome bird, which is about 16 inches long, and generally grey in colour, with a white patch on the side of its neck, ranges from western France and Spain to northern Persia. It is found in Sweden, where it ranges up to the 65th degree of latitude, in the British Isles, where it remains during the winter, and is abundant in many parts of Germany, Switzerland, Austria, and Russia. In Greece it winters, as it also does in Turkey and Asia Minor, and the same latitudes farther west, while on the autumn migration it crosses the Mediterranean to Morocco and Algiers.

Stock-Dove.

Hollow trees in patches of woodland bordering fields and meadows are the favourite abode of the stock-dove (*C. œnas*). On the lower Danube, where there are extensive forests of willows, this species lives in large numbers. Its nest is merely a twig or two dropped into a hole or on the bole of a tree, and generally there is nothing but the bare wood on which the eggs are laid. Not only hollows in trees, but rabbit-burrows, clefts in cliffs, and corners in church-towers, and old nests of other birds are taken possession of by the stock-dove for the purpose of raising its brood. It has three broods a year—the first in early April, the second in July, and the third in August, each in a different place, probably because the young make the nest so foul, though in some places the old birds are said to return to the same nests in succession every year. The stock-dove is distinguished from the ring-dove by the bill being white at the tip instead of yellow, and by the patch on the neck having no white. In Britain it is never found in flocks, as it frequently is on the Continent. Its food is similar to that of the ring-dove, except that this bird seems to have no special liking for mustard-seed, and is rather more addicted to acorns and beech-mast. A good many stock-doves migrate south, and are met with in northern Africa; but if the weather be mild they return north as early as February or March. This species

breeds as far north as Christiania and the Gulf of Finland, and ranges as far east as Afghanistan and Lob Nor, though it is in the main confined to Europe.

Turtle Dove. Unlike other doves, the turtle-dove has no shiny feathers on its wings, and may generally be recognised by the presence of a more or less dark collar on the neck, or a chequered patch on each side. This patch is particularly noticeable in the common turtle-dove (*Turtur communis*), which frequents pine-woods, interspersed with deciduous trees, as well as plantations and clumps of high trees close to running water. It also lives in oak, beech,



A PAIR OF TURTLE-DOVES.

and birch forests, especially those with a good many pines in them, and but rarely resorts to woods of purely deciduous trees. The nest is built in dense underwood, such as a thick, high hedge: it is seldom, under any circumstances, over 20 feet from the ground, and is generally near water, not only fresh but brackish. So lightly is it built of slender twigs, that, from below, the eggs and even the sitting dove may easily be seen, her position being often indicated by the cooing of the male and the sound of his wings: his habit being to fly in a circle over his mate, clapping his wings together above his back, and dropping down with uplifted wings to perch close by her. There are two eggs at a time and two broods, the first

in the middle of May, the second in July, the young leaving the nest unusually early. On the Continent the turtle-dove's principal food consists of pine and other seeds, and nearly every sort of grain. On the ground it walks very quickly, bobbing and turning its head in all directions, and it is also fast on the wing. The monotonous *tur-tur*, from which this dove takes its name, is uttered in various modulations and frequent repetitions from the tree-tops, the bird inflating its throat and lowering its head and neck somewhat as it coos.

The turtle-dove is a true migrant, and does not arrive in northern latitudes before the middle of April. In north Germany it is rare, but in the province of East Prussia, where it does not arrive before the beginning of May, it is much more frequent. Its range extends over southern and central Europe as well as central Asia up to the 58th parallel of north latitude. In Persia it is common, in northern Africa it is met with as far north as Abyssinia, and in the Canaries it is found in flocks. The bird is nearly a foot in length, and may be easily recognised by its tail-feathers, which, with the exception of the middle pair, end in a white point.

Cuckoo.

A bird that reminds us somewhat of the doves, and still more so of the sparrow-hawk, is the cuckoo. As a family, cuckoos are lively, restless birds, which wander in search of food daily through considerable tracts of country, and seldom remain in one spot for more than a short period. They prefer, with few exceptions, animal food; and their call, only uttered during the pairing-time, but then with almost wearisome frequency, consists of short, far-carrying sounds. These birds either make open nests in bushes and on branches of trees, or smuggle their eggs into the nests of other species to whom they entrust the bringing up of their young. Those that construct their own nests lay eggs of a uniform colour, either pure white or bluish, sometimes covered with a thin incrustation of lime, but the others lay eggs of a great variety of colours. While Europe and northern Asia have but one species of cuckoo, and North America only two, which, although of a different genus, resemble their European and Asiatic relatives in travelling south in winter, all the other cuckoos (some four hundred in number) are resident in the tropics. The ordinary cuckoo (*Cuculus canorus*), during the pairing-time, is to be found almost all over Europe, where there are trees and underwood, and where insects abound. Even districts where there is a scarcity of insects, for instance the isle of Sylt in the North Sea, are visited by this bird, which also inhabits by far the greater part of the northern half of the Old World, and breeds anywhere between the sea-level and the snow-line from the northern shores of the Mediterranean to Siberia and Japan. It traverses the north of Africa twice in its yearly migration, and in Asia its winter refuge is southern India, the Malay Archipelago and the Philippines, and even northern Australia.

Perhaps the most remarkable fact about the cuckoo is the wonderful variety in the colouring and marking of its eggs. There are cuckoos' eggs of one uniform colour; there are others with a few fine reddish clay-coloured spots: and again others with white, yellowish, green, blue, brown, reddish, red, grey, violet-grey, or yet other ground-colours, marked with black, violet, rusty brown, greyish brown,

greenish brown, reddish or rust-coloured blotches, spots, lines, or freckles. Many cuckoos' eggs are like those of the redstarts, others like those of the whinchat, reed-warbler, redbreast, skylark, woodlark, and wagtails. Others resemble those of the chaffinch, brambling, ortolan, yellow bunting, reed-bunting, blackcap, or barred warbler; and some are like those of the marsh-warbler and garden-warbler. Some cuckoo's eggs are, however, unlike those of any other bird.

The birds in whose nests cuckoos' eggs have been found are as different as the colouring of the eggs. They include the nightingale, the redstart and blue-throat, the redbreast, stonechat, whinchat, and wheatear; the rock-thrush, blackbird, song-thrush, fieldfare, and ring-ousel; the goldcrest, firecrest, willow-wren, wood-wren, garden-warbler, grasshopper-warbler, reed-warbler, sedge-warbler, marsh-warbler, blackcap, chiffchaff, whitethroat, barred warbler, hedge-sparrow, and Alpine accentor; the wren, the tree-creeper, the coal tit and blue-tit; the skylark and woodlark; the blue-headed, grey, and white wagtails; the meadow, tree, tawny, and water pipits; the reed, ortolan, and other buntings; the bullfinch, serin, twite, greenfinch, siskin, chaffinch, brambling, and other finches; the tree and house sparrows; the swallow, starling, jay, and magpie; the shrikes, flycatchers, green woodpecker, and little grebe; in short, more than a hundred species of birds, but these are by no means all. Among the birds in whose nests cuckoos' eggs have been found, there are some in which the female takes refuge only in her direst need, such as those of doves, rooks, finches, shrikes, flycatchers, starling, rock-thrush, blackbird, song-thrush, nightingale, tree-creeper, chaffinch, sparrow, swallow, green woodpecker, and little grebe. To a greater or less degree the egg of the cuckoo resembles that of the foster-parents in whose nest it is deposited, this being especially the case in regard to the wagtails and warblers; and it is generally supposed that the majority of cuckoos' eggs resemble those of the most favoured foster-mothers. As, however, they are not always placed with apparently similar eggs, the resemblance at first sight seems much greater than is really the case; and when we analyse and tabulate the points of resemblance we find that this opinion is not borne out by the facts. For instance, among 597 cuckoos' eggs 30·2 per cent. resembled the eggs of the foster-parents, 27·5 per cent. the eggs of other birds, and only 7·4 in a hundred had no resemblance whatever to the eggs of other birds, while 35 in a hundred combined the markings of other kinds of eggs. In the nests of the chiffchaff, garden-warbler, reed-warbler, and sedge-warbler, cases of resemblance were numerous, and among the eggs found with the redstart as many as 85 in a hundred were like those of that bird; but out of the 597 there were only 14·3 in a hundred—and omitting the eggs from the redstart's nests, only 3·6 in a hundred—that closely resembled the eggs of the foster-parents.

The cuckoo is much attached to its birthplace, and most of these birds always deposit their eggs in the district; but in the wider range over which the cuckoo is spread, there is sufficient space for a large number of varieties, distinguished from each other by a difference in their eggs. The cuckoo, it seems, always deposits her eggs, when possible, in the nest of that kind of bird to which her own foster-parents belonged, and at a time before cultivation had modified wide stretches of country, every cuckoo used to smuggle her eggs into the nest of one particular

species of bird. Now that cultivation has had its effect on the physical features many birds have been driven from their native haunts and compelled to seek new



A CUCKOO IN FLIGHT.

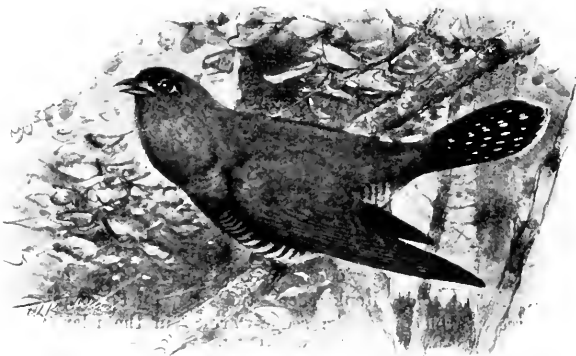
ones, whence it results that the female cuckoo has to make use of a wider selection of foster-parents for her young. Different species of birds in the same district behave in different ways towards the intruder's eggs. Sometimes the cuckoo

finds amiable hosts, sometimes unwilling ones, and in most cases a partly willing, partly unwilling reception for her egg. Moreover, it was rare for the eggs of the same race of cuckoo to resemble the eggs of all of the birds that were induced to hatch them, although such a resemblance existed in certain cases. Consequently the cuckoo not only found birds that would not accept her egg without demur (although they would not refuse it) when it was like their own, but also others that willingly lent themselves for foster-parents, even when the egg was quite different from their own. Thus the fact that many cuckoos' eggs resemble those of other birds is explained by the circumstance that birds are naturally averse to them; while the fact that the egg is very often unlike the other eggs in the same nest may be explained by the sudden change of habit of many birds, owing to cultivation, and also by the different degree of sensitiveness of the species of birds to which the cuckoo entrusts the care of her young. The circumstance that cuckoos' eggs are frequently marked with the markings of those of other birds seems to indicate that the habitats of different races of cuckoo whose eggs differ from one another have also been changed, so that members of different races have come in contact with each other, paired and produced females which in turn laid eggs with the colouring a mixture of that peculiar to each. In many parts of the Continent there are, however, districts where individual cuckoos are not easily to be distinguished by their eggs; a sure sign that in such districts more or less pure-bred local varieties of the cuckoo are still to be met with. For instance, during a period of seven years there were found in Pomerania only cuckoos' eggs with the same type of markings, and these in large numbers. In some countries, as Dessau and Finland, the cuckoo's egg is almost exactly like that of the redstart, while in Lapland it resembles that of the brambling.

In different districts the cuckoo chooses different nurses, such as the redbreast in Cassel, Naumburg, and Altenkirchen; the wren in Pomerania; the marsh-warbler, the reed-warbler, and the sedge-warbler, in the islands of the lower Elbe and those of the lower Rhine, at Wesel on the middle Elbe, at the junction of the Saale and the Elbe, and on the lower Theiss and Danube; the pied wagtail, the hedge-sparrow, and the pipits in England; the tree-pipit in Pomerania, the redstart in Steiermark, the blue-throat in Norway, the brambling in north Finland, and the redstart in other parts of that country. The resemblance of the cuckoo's egg to the eggs of its foster-parents is a means of protection, besides which it is provided with other means for other cases, amongst which one of the chief is its proportionately small size. Another protective feature is the hardness of the shell, which prevents the egg from being pecked to pieces by unwilling foster-parents and from being broken by the cuckoo herself when carrying it in her gullet or beak. In addition to these peculiarities of the egg, there are certain instincts in the cuckoo which also serve for the preservation of the race. The hen deposits, for instance, only one egg in each nest; and the survival of the species is dependent on the different hatching-times of the birds to which the egg is entrusted. In the case of birds which breed twice a year the cuckoo seems to deposit two series of eggs. When in search of a suitable nest, the female flies almost noiselessly through low copses or reeds, across open spaces in the forest, meadows, and fields, and if she find the owners close to one adapted for her

purpose she passes on seemingly indifferent, only to return so soon as the builders are absent. Generally she avoids their attacks, though sometimes furious fights take place. In a nest where she is able to settle down without hurting the other eggs, she lays her egg at once: but when the selected nest is not accessible, being perhaps in the hollow of a tree, or if it is courageously defended by its owners, she deposits her egg on the ground, subsequently picking it up in her mouth and dropping it into the nest, so soon as this can be done without attracting attention. Sometimes a mistake is made, as in the case of the entrance of the hole being too small, when the young cuckoo is unable to leave the nest, where it must perish miserably.

A short time after the young cuckoo is hatched, it is generally found by itself in the nest, owing to its habit of pushing the other fledglings out so soon as it is strong enough to do so. At any rate it is always hatched a day or so earlier than



THE CUCKOO.

its step brothers and sisters. Some naturalists think that the parasitical habit is connected with the food of the cuckoo: for the cuckoo lives at certain seasons on the hairy larvæ of the tiger-moth, whose hairs pierce the protecting skin of its stomach, sometimes in such large numbers that this skin is as hairy as fur, and this food is said to be injurious to the young birds. At other times the cuckoo eats other caterpillars as well, for instance those of the white cabbage-butterfly, which, strange to say, are avoided by most other birds.

At one time there was supposed to be another cause for the parasitical nesting, this being the long interval between the laying of each egg. It used to be said that if she hatched them herself she would have young birds and eggs together in her nest, but this was a mistake, as these birds lay one egg every day, and not every sixth or seventh day, as was then considered to be the case. Just as mistaken is the theory of making the structure of the sexual organs responsible for the parasitical habit. On the contrary, it is probably the great number of their eggs that is connected with this habit, but only as a consequence of, not as a reason for, the

parasitic habit itself. Another factor connected with this habit may be the relations of the sexes to one another. By some it has been asserted that a male cuckoo associates with several females, while others, on the contrary, believe that the female mates with several males. The latter is the more probable view, for the males seem to wander less than the females, and these again appear to be less numerous than the males, so that in the resorts of one female there would be several males which are said to be visited one after the other by the females. If this were so their parasitism might be excused, for the female would want a considerable extent of ground, on account of the necessity of depositing her eggs in suitable nests; she would not be able to remain continually with the same male and, as the males apparently do not like to move about, each would be obliged to associate with several females. The males drive away other males, and the females other females from their haunts; but the females when wandering about and traversing the feeding-grounds of several males, are well received and accompanied by them through their respective territories.

Quarrels between females are much more violent than those between males. The former attack each other furiously, wound each other with their beaks and claws, and often fall fighting to the ground. Males as well as females perch during their wanderings regularly in certain trees, and always on the thickest branches, for the cuckoo flies quickly enough, but is awkward on the ground, and cannot perch on slender twigs. The cuckoo, notwithstanding its climbing toes, cannot climb a tree, although it may sometimes cling to the trunk in pursuit of small insects, and it therefore prefers to seek its food on arable lands and meadows with short grass. Owing to its flight resembling that of a falcon, and its plumage that of the sparrow-hawk, the cuckoo is often mistaken for one of these, not only by man, but perhaps also by the small birds, which, when they have an opportunity, tease and mob it almost as they do an owl.

The male repeats his *cuck-oo* always several times in succession, in the daytime not more than twenty or thirty times; after midnight, however, and at dawn, he repeats his call for several minutes, often a hundred times in succession. Later on he is not heard, but at sunrise he begins again, and after that he enters on his daily round. Sometimes he grows hoarse from calling too much; sometimes between the *cuck-oo* may be heard a sound like the hoarse laughter of a human being; sometimes a preliminary cough, as if clearing the throat, but this is only audible when quite close to the bird. It is well known that the froth produced on stems of grass by the cuckoo-spit insect, one of the frog-hoppers, a family of the Rhynchota, is popularly supposed to be the cuckoo's saliva. When calling, the cuckoo generally sits amid the thickest foliage of a tree, or on a dry bough, but it also calls when rising, or flying with the female to a distant place. The male accompanies his song with gestures peculiar to himself; nodding his head to and fro, lowering his wings and turning up his tail, and all the time calling out in every direction his *cuck-oo*, which may be heard at a distance of half a mile. Sometimes he grows agitated, when he depresses his wings though they still move, wags his fan-like tail up and down, turns it to either side, clears his throat, and bows at every call. If rain be imminent he calls a great deal in the morning, but after

rain has begun, he almost ceases to do so. During the pairing-season the cock calls almost all day, except about noon.

From the time of its arrival in April till the middle of July the cuckoo calls apparently so long as the female is laying; but in the beginning of July it becomes less noisy, and is only heard in the morning and evening, and then not so continually as before. Early in that month the half-grown young cuckoos begin to depart. They have, as nestlings, a shrill, piercing voice, and they are by no means wanting in courage, and frighten their enemies by opening their large mouths. After leaving the nest they are accompanied and fed by their foster-parents. On the Continent it is not until August or September that the adult cuckoos begin to move southwards. The cuckoo is about 12 inches long, has yellow feet and claws, the tail tipped and spotted with white, and the wing-feathers with white notches on their inner webs. The white breast is crossed by black bars, and the upper part of the body is of a delicate grey. There are also, especially in warm countries, reddish brown cuckoos, which in Europe are generally young females. The nestlings are of a light or dark dust-colour above, sometimes slaty grey, sometimes brownish black, marked with white or grey mottlings, and have grey eyes, pale, reddish yellow beaks, orange red throats, and sulphur-coloured feet and claws. Their breast is white, with a tinge of pale brown or yellow, and crossed by black wavy stripes.

Woodpeckers. The woodpeckers are climbing birds in the true sense, for in climbing the bark of a tree they make full use of their feet, which have two toes behind and two in front. Instead of moving about in a tree in the manner of other climbing birds, they run along the branches, or ascend its vertical trunk, which they are able to do by the help of their elastic tails, which, when firmly pressed against the tree, can not only assist the hold obtained by the claws, but support the whole weight of the body. The tail is generally used when the woodpecker is obliged to let go its hold on the bark, to move its feet higher up, so that the bird can go up a tree but not down one. Woodpeckers appear to make great use of the fourth toe, which, in the majority of cases, is longer than the third; a peculiarity which distinguishes a woodpecker from the other Picarian birds; the green woodpecker, which is an awkward climber, being the only exception. Woodpeckers seem very rarely to use the first toe, which is very short; and in fact some species are without it altogether. These birds have a straight, sometimes slightly bent, mostly wedge-like beak, which serves for splitting the bark when seeking food, or for shaping the nesting-holes. In the tail there are from four to six spiny feathers with wedge-like points, which, by constant pressing against the trunk, get worn down, and are therefore shorter than the other tail-feathers. Woodpeckers are mostly inhabitants of hot countries, and when they live in temperate climates are generally resident. They feed principally on insects and their larvæ, which they obtain by hammering with their beak on the trunks and branches, and pulling their victims out from beneath the bark or from the decaying wood by means of their long, barbed tongues. They have a peculiar call, consisting of short, loud notes, which in the green woodpecker is rather like a laugh, and in the great spotted woodpecker is accompanied by a sort of rattle or drumming.

This is caused by the rapid hammering of the beak on a dry branch, and not, as was formerly believed, by the trembling of the branch. The eggs of these birds are of a pure brilliant white, and are laid in a hole made by the parents, which is too small for any larger bird to enter, and is perhaps a foot deep, the only lining being a few of the chips that have not been cleared out.

Great Black Woodpecker. The great black woodpecker (*Picus martius*), the largest of the European species, generally frequents forests of considerable extent, whether pine or otherwise, provided they contain old trees with stout stems and are not disturbed by man. It makes little difference to the black woodpecker whether the forest be on the mountain or in the plain. In Germany this species is rather scarce, it very seldom appears in Schleswig-Holstein and Denmark, and never in Holland or the north of France. In England it has been incorrectly reported as a visitor, but in East Prussia, as well as in many districts of Pomerania and the Mark, it is by no means rare. The range of the species extends from the Vosges to the northern slopes of the Himalaya, the east of Siberia, and the forests near Pekin. The female makes her nest in smooth-stemmed beech-trees and pines, and always chooses a tree in some stage of decay. The eggs are laid in the second half of April, and after eighteen days the young are hatched. The old birds feed these from their crop with the larvæ of ants and other insects; and they remain in the nest until fledged, when they disperse in all directions, for the old birds do not suffer their young to remain very long in their vicinity. Black woodpeckers are solitary, and very shy and suspicious. Their favourite food is the large forest-ant, in search of which they turn up its habitations with their beak, and then pick out the insects with their long, sticky tongues.

Spotted Woodpeckers. The spotted woodpeckers, as their name implies, are mostly black and white. Their best known continental representative is the greater spotted woodpecker (*Dendrocopus major*), a species rare in forests from which pines are absent. In autumn it seeks its food outside the forest, and then visits copses, orchards, and gardens near villages, being generally accompanied by tits and goldcrests. Its favourite trees are poplars and willows, but its nest may be found in a pine or fir tree, especially if a soft-wooded deciduous tree be not at hand. Besides insects and their larvæ, the greater spotted woodpecker eats seeds, beech-mast and hazel-nuts, which it squeezes into a crevice and then hammers till they break. It ranges from Lapland to Italy, and from Spain to Corea.

The white-backed woodpecker (*D. leuconotus*) is a much rarer bird, living chiefly on the mountains among pines and beeches, only occasionally on the lower hills, and hardly ever in the plains. Partly resident, partly a bird of passage, to Germany it is a rare visitor, and only in Silesia and the Mark is it said to nest; it is found over Scandinavia, Poland, Galicia, the Carpathians, the Alps at Salzburg, the mountains of Dalmatia, the Balkans, Russia, and eastward across Siberia to the valley of the Amur. In its habits it is more or less like the other woodpeckers, but is not so noisy, and much less shy than many of them, and differs from some in eating oily seeds, in addition to insects and their larvæ. It is about 10 inches in length, being slightly larger than the great spotted woodpecker, and may be easily recognised by the pure white colour of the lower part of the

back and tail, the male being distinguished by a red, and the female by a black crown.

The middle-sized spotted woodpecker (*D. medius*) is found only in deciduous woods, especially those near streams, its favourite trees being oaks and beeches, and is almost entirely confined

to the temperate countries of Europe. During migration it has been met with in copses, willow-plantations, and gardens in the vicinity of houses; and it nests in deciduous trees, mostly at a man's height from the ground. By this it may more easily be distinguished from the great spotted woodpecker, than by the slight difference in size, colour, and marking. The eggs are laid in April, and at that time the males may be heard screaming as they sit on some high tree, repeating their call of *kerk* with great and accelerating rapidity. When excited by jealousy, the males chase each other from tree to tree, till they are tired out, and then hang

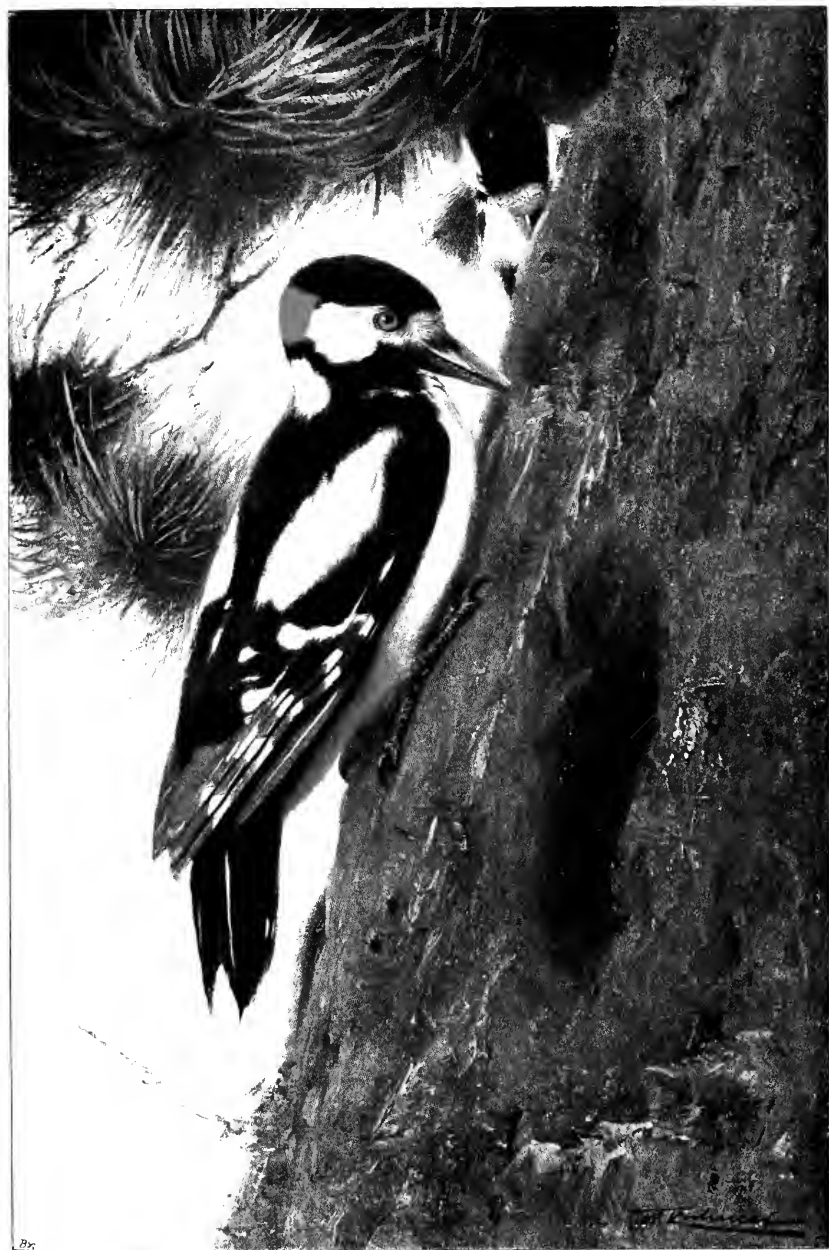
side by side, screaming at and clutching at each other so fiercely that they often fall to the ground. Like other woodpeckers, this species hammers most in spring, and, like the rest, it lives principally on insects, though it is not averse to seeds, hazel-nuts, berries, and cherries. In length it measures about 8 inches. Both sexes have a crimson crown with a white border, the males having a rosy tint in certain parts of the plumage; but this is absent in the females, which have also less black on the breast.

The lesser spotted woodpecker (*D. minor*) is often found among evergreen trees, but oftener still in woods of oak, willow, beech, poplar, as well as in underwood near streams and in orchards. It also frequents the ash and the elm, and in Lapland and Siberia makes its home in the birch-forests. High ground or low ground makes no difference to it; it is met with in the



THE GREAT BLACK WOODPECKER.

Alps, and though not particularly common anywhere, is the ordinary woodpecker of the Thames district, being well known in the gardens bordering that river. This cheery, active climber, which haunts the highest trees, though occasionally seen on slender stems close by, shows but little fear of man, and is noticeably jealous of



SPOTTED WOODPECKER

its fellows. It eats all kinds of insects, fruits, and seeds, but, unlike the green woodpecker, is never seen ant-hunting on the ground; and it makes its nesting-hole at the end of April, generally at a height of about 30 feet, in some decaying bough. The cocks of this beautiful species may be compared in size to a sparrow, and are distinguished by their scarlet crowns from the more soberly coloured females which have no red.

Green Woodpecker. The green woodpecker (*Gecinus viridis*) is the best known of the three species of its genus inhabiting Europe. The deciduous trees of the forests of the temperate zone are the favourite haunt of this woodpecker, which avoids the gloomy evergreen mountain-forests, and takes up its abode in sunny open spaces amid such woods as have orchards in their vicinity. Under stress of cold and snow it may, however, seek food and shelter in the wilder upland forests; but in mild winters it stays near its nest. Never crossing the Mediterranean, it is known to nest in Norway in 63° N. latitude; while westwards it is found in France and the British Isles, and eastwards as far as Persia. In the east it is rarer than in the west, its place there being taken by the grey woodpecker (*G. canus*); and it is unknown in Spain, where it is represented by Sharpe's woodpecker (*G. sharpei*). The green woodpecker nests in some hollow tree, at a height of from 7 to 40 feet or thereabouts; the absolutely circular hole going horizontally into the tree, and then curving downwards as a tube-like passage with smooth sides, narrower at the top than at the bottom. In the beginning of May from six to eight gleaming white eggs are laid in the nest, which, like those of other woodpeckers, has only a few chips and splinters for its lining. The green woodpecker will not only climb timber, but also walls, such as those of churches and houses; and its movements are quicker than those of any other of the group. Its principal food consists of ants, which in winter it chisels out with its beak from the frozen ground; but it also eats other insects, which it seeks on trees, as well as nuts and acorns. As its name implies, this woodpecker is principally green, with a red and grey crown, the male being distinguished by a red and black moustache, which in the female is black. In the grey woodpecker the crown is red only in front, the grey extending from the back of the head down the nape of the neck. In other respects these birds are generally similar, as they also are in their habits and haunts. The grey species, as already mentioned, is however found more in the east of Europe, and ranges as far as China and Japan as a nesting-bird.

Wryneck. Some naturalists include the wrynecks in the same family as the woodpeckers; others constitute them a family to themselves; while, owing to the shape of their beaks, wings, and tails, they are by others classed with the African honey-guides, from which they are distinguished by the soft feathers and straight, sharp, conical beaks. Their long extensile tongues, which can be thrust some distance out of the beak, are very like those of woodpeckers, but the hairy tip is shorter, and not furnished with hooks.

The European representative of the wrynecks (*Iynx torquilla*)—the iynx, from "iñξω," to cry out—may be found in almost any kind of woods near grass and orchards, except such as consist entirely of evergreen trees. Its favourite food is ants, in search of which it will go almost anywhere, not even fearing to enter inhabited

houses in which such delicacies are attainable. During its autumnal migration, which begins in August, this bird will visit fields planted with vegetables, and is quite content to rest in a solitary tree, or even in some low bush. It returns about the middle or in the second half of April from the south of Europe or the north of Africa, and lays its eggs about the middle

of May in the hole of a tree which it finds suitable to its purpose, or even in a box hung up for the purpose of attracting birds to nest. Frequently a layer of moss or hair is placed by the parent bird in the hole as a cushion for the eggs.

This interesting bird not only creeps up trees like a woodpecker, but clings to their bark in a manner peculiarly its own, as it runs up and down in search of insects. If another bird approach, the wryneck drives it away by bristling up the feathers of its head, stretching out and drawing back its neck, writhing its head like a snake, and darting its beak backwards and forwards, at the same time spreading out its tail like a fan, bowing and swaying and rolling its eyes, and accompanying these gestures, which might almost be taken for convulsions, with a peculiar sound in its inflated throat. When two male wrynecks fight, they gesticulate in the same peculiar manner. The wryneck



THE WRYNECK.

ranges as far north as the middle of Sweden, and eastwards through northern Asia to Japan. In Europe it is found on the heaths of central and south Russia, though it has there to content itself with the few trees along the river valleys.

A very different type of bird are the nightjars, or goatsuckers, which may be readily recognised by their soft and loose plumage, large flat heads, great staring eyes, long pointed wings, long tails, wide gapes, and very short beaks, which are almost entirely concealed by feathers.

Two species of these birds occur in Europe, both of which have the mottled black, brown, and grey plumage characteristic of the group. In general appearance they are much alike, but one is larger than the other, and has a rufous neck. Both lay their two eggs, which are white marbled with grey and brown, on the bare ground, without any pretence at a nest. The typical nightjar (*Caprimulgus europæus*), the smaller species, frequents open and often heathy localities with solitary old trees and wide woodland paths. Its partiality for fern has gained it the name of fern-owl, its name of nightjar being a corruption of *night-churr* from its call, while its name of goatsucker is derived from an erroneous popular belief. It is found all over central and southern Europe and western Asia, ranging northward to central Sweden and southward into Africa. It goes south in August and September, to return in the middle of April. The eggs are laid in the beginning of June in some shady place among fern or heather or under a gorse-bush. Both parents defend the young; if the sitting hen be alarmed, she flutters along the ground as if lame, and when young are in the nest both old birds will fly right at the enemy, the male making curious movements of its tail.

Nightjars appear to feed their young in the same way as pigeons, taking the nestling's head into their wide jaws and pushing down the food with their tongues. They are birds of the twilight, living during the day on the ground, on some low tree, or on a large bough; their coloration being such that they are not easily distinguished. In hopping they stretch out their necks and hold their bodies quite straight, and they always sit lengthwise on a branch. Their flight is rapid, like that of the swifts, to which they are distantly related. Their call, a sort of vibrating *cherr-churr*, is uttered at nightfall, and in the morning for perhaps five minutes in succession; the first part of it being apparently caused by inhaling the air, the second part by exhaling it. If two begin uttering this sound at the same time, one will stop till the other has finished, and then continue to be followed in turn by the other.

Blue Roller. One of the most brilliant of European birds is the blue roller (*Coracias garrula*), which lives in birch-woods and among hollow oaks or beeches, frequenting the outskirts and not the depths of the wood; in fact, wherever there are fields near high trees. In harvest-time this bird perches on the corn sheaves, on the look-out for insects, small frogs, and mice. On sighting its prey the roller flies straight at it, and, before devouring it, will often throw fragments on the ground. It will eat figs in the countries where they grow. The blue roller is a shy bird which must be seen through a glass if its habits are to be watched closely. It flies quickly from tree to tree, but always chooses the tops of the trees, so that, in spite of its shyness, its whereabouts are easy to discover. The flight of the roller when out in the open is varied with gambols and somersaults, like those of a tumbler pigeon, but it is more graceful and the action is quicker. The male flies high in the air in the neighbourhood of the nest, calling *rak, rak, rak*, throwing himself over, and rolling from one side to another, and then suddenly drops with a sharp *raa-raa-raa*, generally to its last resting-place, or some other spot from which its flight may be repeated. When sitting quietly, his cry is not only *rak* many times repeated, but a noise like the chatter of a

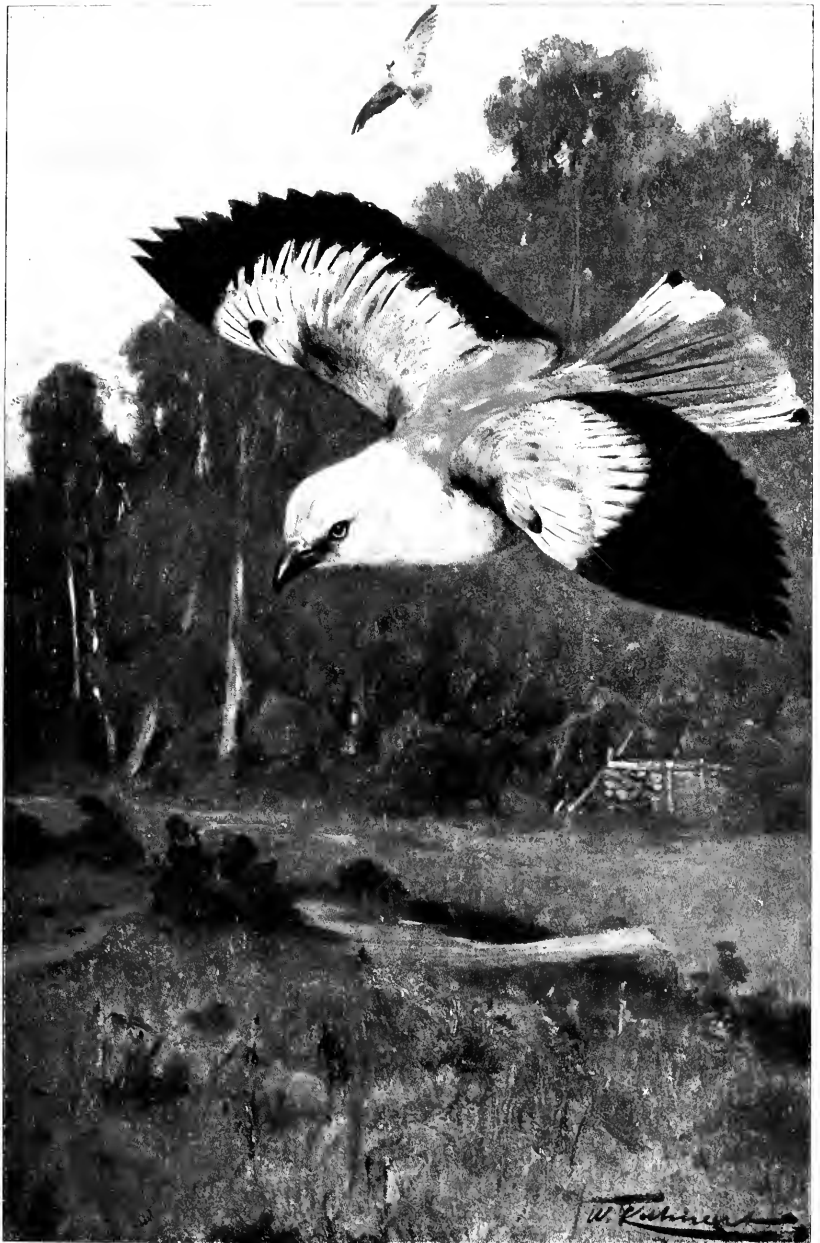
magpie. The blue roller is very quarrelsome with birds of its own kind, fighting with and biting them, and, while fighting, falling to the ground: yet several couples will nest not far from each other, and, though not gregarious, an instance is



THE HOOPOE.

recorded in which a whole colony nested in holes they had themselves made in a bank. The nest is usually in a hollow tree, at a man's height from the ground, and often much higher; but in countries poorly timbered, such as Greece, the eggs are laid in the deserted nests of magpies, or in holes in walls or on roofs.

In central Europe the roller starts for the south in August, to reappear



BLUE ROLLER

about the end of April; but in southern Europe it goes away later and comes back earlier. Avoiding marshy places and high mountains, it ranges as far north as Sweden, as far east as the Altai Mountains, and southwards to South Africa and Madagascar. It is frequently found in the south of France and in Spain, as also in Hungary, Rumania, south Russia, and Turkey, but is only a rare straggler to Britain. In eastern Europe it is known as the Polish parrot.

Hoopoe.

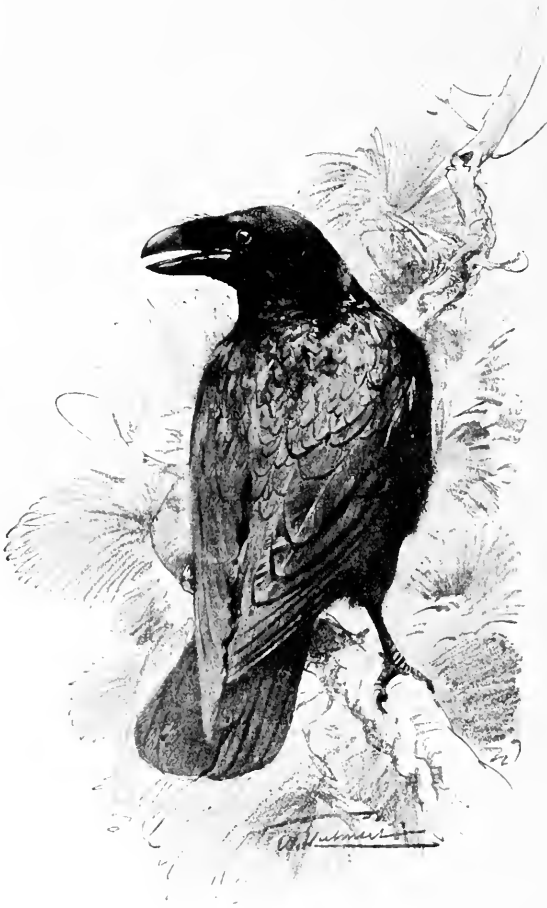
The hoopoe (*Upupa epops*), conspicuous on account of its erectile crest, and making its presence known by its monotonous cry, is as much a bird of the fields as of the woodlands, and has its home on the skirts of the forest or in some copse or plantation amid meadows and farms. It rarely goes far afield in search of its food, which consists mainly of insects and worms. These it either picks up on the ground, drags from their holes, or pulls from their hiding-places in manure-heaps and then indulges in a curious habit of throwing up its victim into the air and catching it as it falls.

When searching for food, a hoopoe either leans its head back, or raises its crest like a fan and spreads up its tail; but should a bird-of-prey or a crow appear in sight, it lies flat down, stretches out its tail and wings, lays its head on its back and puts up its beak, thus making itself look not unlike a piece of old rag. In walking, the hoopoe slowly and solemnly makes an incessant nodding movement. When sheltering in trees, it perches on some strong branch near the top. Hoopoes go about in pairs, never in flocks; they are not quarrelsome, and are easily distinguished on the wing by the habit of raising the crest, stretching out the neck, and holding the beak downwards. They take their name from the characteristic cry of *hoop-hoo*, repeated two, three, or four times. In pairing-time they will perch in trees, with the crest spread out like a fan, and the beak resting on the distended throat. The hoopoe nests but once a year, and goes south in August and September, returning in April a few days before the cuckoo. It has been found nesting from the Mediterranean to about 60° N. latitude, and from western Europe to China and Japan. In England it is rare. It winters in Africa, north-western India, and southern China.

Raven.

Passing on to the perching birds, the first of the European woodland species for consideration is the raven (*Corvus corax*), which is an inhabitant of large woods bordering fields and water. In the north where there are no trees it inhabits rocky and other solitary places and lofty ruins. It is more a resident than a migratory bird, yet in winter it wanders a considerable distance. Its eggs are laid so early as the end of February or the beginning of March; and the young remain in the nest until the end of May, when they are chased away by the parents, who have, however, taken the greatest care of them while they were helpless. The raven cannot bear any other member of the crow tribe in the neighbourhood of its nest; and is always a rather quarrelsome and a very cautious bird, seeming to know no fear in its combats with other species. Ravens prey on partridges in preference to anything else, but are practically omnivorous, and in the north may frequently be found feeding on shellfish by the seashore. The smaller birds and mammals on which the raven

preys are seized in its beak, the larger in its powerful claws. In attacking birds it swoops down on them after the manner of a hawk; and it walks with stately



THE RAVEN.

measured steps, but hops much more quickly, and flies easily and leisurely as a rule, but can move fast with long, laboured strokes. In fine weather it flies so high as to be almost out of sight. The raven is characterised by its large size, boldly curved beak, and the deep black, with shiny blue-green reflections, of its

plumage. It thrives on any soil and in all climates, and ranges over the whole of Europe and Asia, from the latitude of the Mediterranean to the Arctic Ocean, and in America as far south as Mexico and Guatemala. It is frequently seen in southern Europe, and is common near the Danube, but in Germany is now rare, chiefly on account of the numbers destroyed; the same being the case in many other countries, especially England.

Carrion-Crow. The carrion-crow (*C. corone*) resorts to woods and large ever-green forests, copses with underwood, single trees in fields near streams, bushes adjoining fields or meadows, and marshes. It prefers plains to mountains, and is particularly fond of the shore, even where it is rocky. Unlike the rook, the carrion-crow leads a solitary existence, frequenting the fork of some isolated tree, or some rocky ledge, where never more than one nest is to be found. Exceptionally it may nest on the ground. If a good spot has been selected, this is generally used for many years, fresh material being annually added, till at last the nest becomes of enormous bulk. Sometimes the eggs are not laid before the end of April. In autumn the young migrate with other crows, to return from the south at the end of February or beginning of March. Many of the old birds stay on the Continent during the winter, and often come into the smaller towns and villages for food. Cautious and courageous in disposition, the crow will not only drive off all birds-of-prey, but will actually attack the larger ones; while on the small kinds it swoops down from a height, so that even falcons and hawks find it a difficult bird to deal with. Occasionally, but rarely, carrion-crows assemble in flocks as if they were rooks. There is scarcely anything a crow will not eat, although it lives principally on animal substances. Crows frequently resort to the seashore and the estuaries, and the banks of rivers where the waters are tidal. Here they feed upon the refuse and shellfish, being frequently seen to fly up with the larger shells, and drop them from a height in order to break them.

Hooded Crow. Next in order comes the hooded crow (*C. cornix*), which differs from the last species in being grey, except on the head, throat, wings, tail, and legs, which are black. In other respects—as in its manner of living, etc.—there is no difference between the two birds. The hooded crow has a very extensive geographical distribution, but in many countries the carrion-crow will be in one district, while in another its place is taken by the hooded crow, though in some places both are present. In Germany the Elbe may be said to form a line between the nesting-haunts of these two crows; but in Brunswick, Anhalt, and Mecklenburg, both live together, although here as also in Schleswig-Holstein the carrion-crow predominates. Hybrids are often met with. The hooded crow is always local and generally resident, its numbers being swelled every year by flocks migrating, the headquarters of the species being Russia, and its migrating line east and west.

Rook. No bird is better known than the rook (*C. frugilegus*), and no colony of nests more familiar than a rookery. On the Continent, as in England, the rook builds in parks and large gardens in the neighbourhood

of fields and habitations, and also in small groups of trees in level country, and on the banks of rivers, for these birds are never met with in mountains unless they are there on a short expedition in quest of food. The nests are built in the tops of trees near inhabited places, and are composed of sticks and twigs, occasionally lined with a little turf, and plastered with mud. They contain a few scraps of moss and wool, and are so loosely put together that, when thrown down from a tree they fall to pieces, which is not the case with most nests that from a distance appear to be of similar construction. While the nests are building, many quarrels take place, but so soon as incubation begins the rooks live in peace together. When the young are able to take care of themselves, they go off with the old birds, and only come back to the rookery at night. In July longer excursions are made, and other sleeping-places chosen, till at last the young birds travel together to the south to pass the winter. In some rookeries, however, the birds remain all the year round, and it is only the young ones that are sent on their journeys. Those that migrate to southern Europe and northern Africa divide up into smaller parties after their arrival. In February and March such of these birds as have migrated return to breed. Rooks are found, locally, all over Europe and western Asia, but in the south of Europe they are only seen when migrating to Africa. They are much like the carrion-crow in character and habits, but more timid, and will, if they can, avoid attack, even from the magpie. At all seasons they congregate in large flocks, frequently associating with jackdaws and starlings. They are practically omnivorous, although they subsist largely on worms and insect larvæ, in search of which they probe and bore deep into the ground with their pointed beaks. To this proceeding was formerly attributed the absence in the adult of feathers at the base of the beak, but there seems to be no doubt that the feathers really drop off by themselves so soon as the bird reaches a certain age, and are not worn away. The rook is easily recognised by this featherless beak, and also by the grey bases of its body-feathers, as compared with the white bases of those of the carrion-crow.

Magpie. The magpie (*Pica rustica*) lives among trees, although not in extensive forests, and never on high mountains. On the Continent, as well as in England, it is never met with in uninhabited places, but always where there are parks or gardens. In winter the magpie will travel long distances, but at other times it is a resident bird, and does not leave its home for more than a few miles. It seeks its food on the skirts of the woods, among the underwood on the banks of rivers, and on marshes, in meadows and fields, and also on the shore, if it lives near the sea. Even from a distance it cannot be mistaken for any other bird, on account of its colour, shape, style of flight—and, above all, its voice. Much slower on the wing than the crows, it has a habit of flying round a gap, from one tree to another, as if to avoid the risk of crossing. It can also be easily identified by its movements on the ground, where it walks slowly, with an occasional hop and a tilt of its tail. The magpie, like all its family, is attracted by glittering objects, which it hides in its nest. It robs other birds' nests, attacking the owners unexpectedly, and chasing the young about till they are tired and fall an easy prey. It also feeds on insects, worms, and fruits. Its well-known cry is



shack-shack, or *shackerackackack*, and it has a chattering and by no means agreeable voice, in which, when in captivity, it may be taught to speak a few

words, and it may also be taught to whistle. The nest is built of twigs, and generally domed, so that it is nearly spherical, the entrance being guarded with thorns. It is often, but not always, built well up a tree in a sheltered spot, and it is always clearly distinguishable, though it might be mistaken



THE MAGPIE.

for a roundish bundle of loose faggot-wood if it were not for its position. Sometimes a nest will be made among the thicker boughs of a tall hedge, though oftener in a leafy tree just within a wood or on the skirt of a clearing. Throughout Europe the choice of the site of a nest appears as capricious

as in England, and there are more nests than magpies, for, like the wren, the magpie builds nests that are left unfinished but can be quickly completed when required. There are in fact several nests, which it uses alternately,

so that the one in use can only be known by the presence of the young birds. The magpie is a handsome bird with a long tail and short rounded wings; its breast and both shoulders being pure white, and the rest black, its plumage glistening with iridescent hues. It is found all over Europe, from Spain to the Urals and the Caspian, and from the North Cape to Greece. In many districts it is rare, in others it is abundant, while in a few it has been exterminated.

The Jay. The gaudily plumaged jay (*Garrulus glandarius*) is a bird of the woodland, but never of the pine-forest, and only of the woodlands where oak-trees grow. It is the bird of the oak, or rather of the acorn, as indicated by its specific name; and, notwithstanding its varied bill of fare, the acorn is its favourite food. The jay is a restless, impudent bird, having many enemies and few friends, in spite of its handsome plumage. It is seldom seen on the ground, as it can only move about there with difficulty, and instead of walking like a crow, hops like a sparrow; it has an irregular, laboured flight, with many sudden undulations and frequent rests, even when another jay is in pursuit. The jay is one of the worst enemies with which smaller birds have to contend, owing to its robbing their nests and eating their eggs and young. It will also feed on insects and worms and nuts and fruits of most kinds; it is particularly destructive to peas, and will occasionally take a fancy to unripe grain when cornfields are skirted by woods. In self-assurance it is never wanting, and it will even stand up to the sparrow-hawk, whose astonishment at such audacity is quickly followed by the jay's summary execution.

The jay's call is a *rahrahk*, *rake*, *rake*, half screech, half croak, but the bird seems to have the gift of imitating most sounds, natural and mechanical, except the human voice. The nest is a rather large cup of twigs and roots in a tall bush, or on the lower branches of a tree, and the eggs, which may be as many as seven in number, are of various shades of green, grey, and brown, generally with a band of olive speckles at one end. Though it migrates in considerable flocks, the jay is confined to Europe, where it ranges from Britain and France to the valley of the Volga, and from the Mediterranean to the Arctic Circle in Sweden, and to latitude 63° in Russia. Its colour is chiefly grey and vinaceous brown, the tail being blackish barred with blue, and the blue, white, and black chequers on the wing-coverts are characteristic.

Nutcracker. The nutcrackers are distinguished from the jays by a more compact shape and a thinner bill; the European representative of the genus being *Nucifraga caryocatactes*, whose favourite haunts are woods of fir and larch in the sparsely populated parts of Asia, although it is also found here and there in the mountainous districts of Europe. When on migration, the nutcracker resorts to forests of deciduous trees, which it searches for acorns, beech-mast, and hazel-nuts. Hazel-nuts and, more especially, pine-seeds are its favourite food, and wherever pine-trees abound, as is generally the case in northern Asia, these birds have thinner and more slender beaks than in localities where their food has a harder husk, and therefore requires more force to crack. From this character



we may divide the nutcrackers into two races—the thin-beaked form indigenous to northern and north-eastern Asia, and the thick-beaked variety breeding in Europe. Regarding these two forms as local phases of a single species, we may say that the nutcracker ranges over temperate and northern Europe and Asia to the middle of Scandinavia and Kamchatka. It is an occasional visitor to England, and not unknown in Japan. It is frequently seen in the Apennines and the



THE NUTCRACKER.

Alps, but has become rare in the Black Forest, where it is found only in the old pine-woods near Wildbad. Very rare in most parts of Germany, it nests in East Prussia, where, if pine-cones are not abundant in any particular season, the nutcracker promptly migrates to southern Germany, Switzerland, the south of France, and the countries watered by the Danube, or to southern Russia and central Asia. Sometimes it appears only after an interval of two or three years, but in Siberia and the Tyrol it may frequently be seen in thousands which seek these pine-seeds wherever they are to be found, and even high up on the mountains

where the trees are no larger than shrubs. A bold bird, even when facing man, the nutcracker is strong and impetuous, and an active climber, although not so restless as the jay, which it resembles in being a notorious nest-robber, attacking young fledglings, seizing them with its beak, trampling on them and pecking out their brains. It also eats large insects—even wasps and bees—as well as small snails, and besides these is very partial to acorns and hazel-nuts. If the nuts are fresh, the bird cracks them in its beak with a noise that can be heard at some distance. When, however, the nuts are old and hard it takes them between its claws, as do the tits, and hammers them till they crack. It also resembles the tits in its habit of clinging to pine-cones to break up their scales and peck out the seeds. The nutcracker begins to nest early in the year, about the middle of March, and generally chooses groups of pines in large forests in which to build. The nest is usually placed on some slender bough of a large fir or pine, at a height of from 17 to 25 feet from the ground. The bird is conspicuous owing to its dark brown plumage being ornamented with white spots, and a distinctive feature is its tail, which is tipped with white.

Starling. Little in the way of description need be said concerning such a familiar bird as the starling (*Sturnus vulgaris*), which on the Continent, especially if water be close at hand, lives in deciduous forests, particularly where oaks abound, and in the neighbourhood of pastures, although it may be found in places that are almost devoid of trees, as for instance in the Alps, on the seashore, and in towns. Barren districts are only visited by the starling on its migration, from which it arrives in central Europe sometimes as early as January if the weather be warm, though it often disappears for a time if cold weather return. It arrives in greater numbers in February and March; the young leave in June, and from that month the migration goes on throughout September, October, and November. All starlings, however, do not migrate; and, in England, Germany, and other countries there are always some that stay throughout the winter. The starling nests in a hole at some distance from the ground, and cares not if it be in a tree, a cliff, a wall, a roof, or a chimney; and it will also use the nesting-boxes hung up for its use, wherever it is possible to fix them at the needful height. In the northern parts of its breeding area—as, for instance, Schleswig-Holstein—there is only one brood a year, and in many parts of northern and central Germany it is rare to find two broods, although this is the rule in southern Germany. The nest usually contains eggs in the latter half of April, the second clutch being laid in June; and it is worth noting that for this second brood the starling often covers its nest with green leaves, and occasionally builds it on trees. When the young have left the nest, they do not remain long in the neighbourhood but migrate in large flocks to the south; the old birds not starting until a month or two later. Just before they go, the cocks return to the nest during the day, and step in and out, while they sing with drooping wings as if taking leave.

Worms and insects, the latter particularly as larvæ, are the favourite food of the starling; but it also eats snails and slugs and other farm and garden pests, and at times does much damage to orchard produce. It hunts for vermin on the backs

of grazing animals. When searching for insects on meadow plants, it carefully

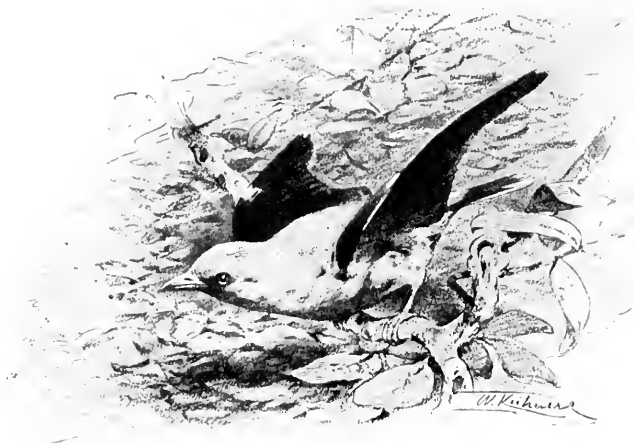


THE STARLING.

passes each stem through its beak. A brisk and busy bird, often associating in flocks with rooks and jackdaws, and distinguishable from them as easily by its

behaviour as by its size, it has a jerky sort of walk and a singularly straight flight which ends in a hover or a glide.

Towards the end of August, starlings begin flying about in considerable flocks, which increase in numbers until October when they are thousands strong. These large flocks move every evening from their feeding-places to their roosting-haunts, which are often several hours' journey away, and are mostly situated in dense reeds. Here flock after flock alights, the members of each of which scream and sing, and give a noisy welcome to every newly arriving party, till, as the daylight fails, all grow silent and fall asleep, many perching on the same reed, which is thus bent nearly to the ground by their weight. At dawn they commence their noisy chatter again, and, so soon as the sun is up, they rise together, to settle



GOLDEN ORIOLE.

again at a little distance; and, after repeating this two or three times, disperse in small parties, and in the evening return to the same sleeping-place. During the winter, in southern Europe and northern Africa starlings behave in a similar way. They are easily tamed, and learn to whistle tunes, and to say several words distinctly, but soon forget what they have learnt and imitate something new.

The golden oriole (*Oriolus galbula*), which lives in leafy woods but not far in them, where it can find safe hiding-places in the upper foliage of tall trees, is one of the most striking of the birds of the European woodland. In its proper haunts, despite its black and yellow livery, it is a bird by no means easily discovered, even if it be heard whistling close by, since it seldom

comes down into the underwood, and is only seen on the ground when engaged in insect-hunting. The oriole is very quarrelsome with its fellows as well as with other birds, and has often been found fighting them in and about cherry-trees; cherries being its favourite, though by no means its only fruit. It also feeds largely on insects, hunting some of them in hawk-fashion, and often hovering before striking down on them. The nest is mostly placed on a forked horizontal bough, under 50 feet from the ground, from which it hangs on long bark-fibres, wound round the twigs and hardened by the saliva of the bird. The eggs are laid in the latter half of May or beginning of June. The oriole courageously defends its young against jays, magpies, and other robbers. The cock sings most and loudest in sultry weather when a thunderstorm is imminent, and then generally from dense foliage in which he hides himself. From time to time he utters a sort of croak as an alarm-note, which is repeated several times; his call-note during the pairing-season being a rapid "Who are you?" as if sounded on a flute. The oriole is a bird-of-passage, which makes a particularly short stay; generally arriving in the beginning of May, seldom earlier, and leaving towards the end of July or beginning of August. Stragglers may pass over Europe, however, during the whole of August and even in September. The male birds traverse Africa, to Damaraland, the Transvaal, Natal, and Madagascar; but the females and young do not travel so far. The oriole breeds in temperate and southern Europe, and Asia as far as Turkestan; rare in Scandinavia, Great Britain, and the south of Sweden, it is often met with in France, Italy, and Austria, though in Germany it is not common.

Blackbird. A much more familiar bird than the oriole is that well-known songster the blackbird (*Turdus merula*), which has to a great extent left the forests and invaded the gardens, where it sings its song in the upper branches of the trees, and even from the house-tops, as is frequently the case in many parts of the Continent. When blackbirds dwell in the woods, they generally keep to dense bushes near water; but in parks and gardens and along the country roads, the nest may be found almost anywhere, no matter how exposed may be the position. And yet the blackbird is by nature cautious and rarely ventures to fly far away from cover. Its flight is low and straight, but somewhat fitful, and invariably ends with a raising of the tail on alighting. The tail is also raised and spread when anything suspicious is noticed, and at any alarm there is a dash for the nearest bushes, accompanied by a peculiarly noisy chatter which acts as a warning to the whole neighbourhood. The blackbird not only hops but walks, particularly when hunting for worms in wet weather. Besides worms, its food consists of slugs and snails, insects in all stages, and fruits of most kinds, though the damage it does in orchards is more than compensated for by the enormous number of garden-pests it removes. The blackbird ranges from the Outer Hebrides to the Volga, and from the south coast of the Mediterranean to the Arctic Circle in Norway, but it does not visit northern Russia. During the summer months in northern countries, it lives in the mountains, but in autumn comes down to the plains in large numbers. In Great Britain and central Europe many remain throughout the winter, but young birds and females

start south on their migration towards the middle of September or beginning of October, and return in February.

Thrush. The thrush (*T. musicus*) is found over all northern and central Europe, Siberia, and eastward to the borders of China. In September many individuals migrate to warmer countries, to southern Europe, northern Africa, and the Persian Gulf, and return in March or the beginning of April. Thrushes are met with, not only in the woodlands, but wherever there is a clump of trees with a little underwood, and the nest is easily recognised by being, as a rule, plastered inside with cow-dung, mud, clay, and fragments of rotten



THE THRUSH.

wood. It is generally found at less than 20 feet from the ground in dense bushes, or on small deciduous trees. The eggs, which are greenish blue spotted with dark brown, are laid in the middle of April and in June, and the male takes his turn in sitting upon them, but leaves the nest and drives the female back when he considers that his time is up. The food of the thrush, like that of the blackbird, consists chiefly of worms and snails. When startled, these birds raise the wings and tail, and when alarmed fly to the nearest tree, through which they continue their flight. The familiar and exceedingly pretty song of the thrush, which sometimes seems to contain many dissyllabic words, resounds from the upper boughs of the highest trees. In colour the thrush is olive-brown above, and yellowish white below, with triangular and

oval brownish black spots and streaks. The axillary feathers are pale yellow, and the wing-coverts tipped with the same colour, the tail being of uniform darkish brown.

Missel-Thrush. The missel-thrush (*T. viscivorus*) flourishes wherever there is woodland near pastures, but prefers woods of pine to those of deciduous trees. Seldom perching in low bushes, it frequents the higher trees, and spends much of its time on the ground. The nest may be distinguished from that of the thrush by being lined with grass. Normally the missel-thrush builds near brooks, in pines, some distance from the ground; but in England it usually avoids evergreens, and frequently chooses some old fruit tree or thorn that is amongst other trees and not in a hedge. It breeds early, the eggs being laid in March or the beginning of April. A wary bird, it has a characteristic habit of giving a start every now and then, and looking all around as does a deer. On the ground it takes long hops, raising its tail, and spreading its wings, and is much greyer when on the wing than the true thrush. It lives aloof from its fellows, and, when the young are hatched, the family parties keep distinct, and never recognise each other except to quarrel as they pass. Its food consists of worms, snails, insects, berries, and other fruits, especially mistletoe-berries, the sticky seeds of which it ejects. When these seeds fall into crevices on the bark of a tree, some of them germinate, and thus the missel-thrush spreads the plant from which it takes its name. The song of this bird is composed of short and long notes, not so sweet or so sustained as those of the thrush, but louder and ending with a sort of scream. Singing early in the year, and loudest and most persistently in stormy weather, it is known in many parts of the country as the storm-cock. The missel-thrush, which measures about 11 inches in length, is the largest of the European thrushes. It is at first sight very like the true thrush, but is ashy brown above, and buff below, marked with dark triangular spots on the throat, and with oval spots on the breast; the axillary feathers being white. The wing-coverts are tipped or edged with pale buff, the tail-feathers are lighter than the wings, the inner webs of the outer ones being tipped with white spots which are largest on the outermost pair, while the edges of all are grey. The range of the missel-thrush extends all over northern Europe and Asia, from the Orkneys to Lake Baikal. In the more northerly parts it is a bird-of-passage; in Great Britain, northern France, and Germany it is both migratory and resident, the migration extending to Africa north of the Sahara, Persia, and northern India. It has been known to nest so far south as northern Africa and as far north as Bodö in Norway, within the Arctic Circle.

Fieldfare. The fieldfare (*T. pilaris*) nests in but few localities in the heart of Europe, and is a true denizen of the woods, ranging over northern Europe and Asia, and finding among the forests of Germany and the adjacent countries a wider choice of abode than in the far north, where it never goes beyond the limits of tree-growth, although it has to content itself with bush-like birches and stunted pines. In November, after the local fieldfares leave, the northern birds arrive in central Europe, and in mild winters remain there, continuing their migration to northern Africa should the cold be great. Farther east fieldfares are found in winter in Asia Minor, Persia, and Turkestan, and even

in Kashmir. In the north these birds nest in large colonies in the birch-forests, but where there are few trees, or they have to nest on the ground, they lose their gregarious habits. The nest is formed of twigs and grass, plastered inside and out with mud, lined with grass, and coated externally with grass, lichens, reindeer-moss, or whatever may be found near that will make it inconspicuous. The eggs are laid in May, but later in the north; they vary greatly in their markings, though the greenish blue ground-colour is rarely quite concealed.

The fieldfare derives its name of juniper-thrush from its partiality for juniper-berries, which it prefers to other food, though, like other thrushes, it feeds, as a rule, on fruits of all kinds, as well as on worms and insects. Nearly as large as the missel-thrush, it is distinguished by the ashy grey head and lower part of the back, its chestnut-brown shoulders, and the blackish tail, the feathers of which are edged with grey, the outer ones being fringed with white at the tips of their inner webs.

Nightingale. The nightingale (*Daulias luscinia*) has its home on the skirts of such woods as contain oaks, birches, elms, aspens, and other leafy trees, not too close together, and adjoin a tall hedge or other strip of underwood. Only exceptionally does it resort to dark pine-forests, since it seems to avoid places in which there are no dry leaves, those of the oak being specially favoured. The dry leaves among which it loves to skulk prevent the bird from being easily perceptible by affording a background of the same general colour as its body, and, by the rustling sound made by persons stepping on them, give warning of the approach of an enemy. The nest is generally made of dead oak-leaves and grass, with rootlets and usually a little horsehair, and is placed on or near the ground, in which position it is also protected by the fallen leaves. It contains from four to six eggs, which are of a pale olive-grey or olive-brown, the grey variety being clouded or ringed with brown. The young birds are also protected by their colour, and when they crouch in the leaves can scarcely be seen. They are dark brownish grey above, mottled with dull yellow, and below are pale buff with greyish brown bars; their large wing- and tail-feathers are slightly darker than those of the old birds, and the wing-coverts are tipped with buff. They leave the nest before they are fully fledged to hop about on the ground, where they are fed by their parents for a considerable time. If the sitting bird be frightened off, she flutters slowly along on the dry leaves, thereby drawing the attention of the intruder away from the nest; but, notwithstanding all these protections and precautions, the old birds often betray the whereabouts of their young by incessant cries of alarm at the approach of an intruder.

The nightingale eats various grubs and pupæ, small butterflies, beetles, flies, and other insects, and worms; also fruit and berries, particularly those of the elder, and is said to feed its young on small green caterpillars, ants, and spiders. It has somewhat solemn ways, and moves with a certain consciousness, carrying its wings loosely, and advancing in long hops over the ground, stopping every now and then, raising its tail and looking thoughtfully around. Should it spy some insect, it closely watches it for a few moments before pecking. Fluttering from

bush to bush, it flies buoyantly and smoothly when fairly on the wing; and in spring, when the males quarrel over their nests, their flight is quick and straight as an arrow.

By many persons the song of the nightingale is considered of incomparable beauty; and the suppleness of throat of this songster, its power and flexibility of voice, the rapidity of its trills and rolls, and the beauty and expression of its concluding notes are proverbial. Slowly and with silvery clearness the song begins, then it rises, gradually increasing in power, changing into a phrase of lament or complaint, closing in a rapid succession of similar notes, the clear, bell-like sounds ending in a shake of thrilling vehemence. When singing, the bird dwells between one bar and another, but never really pauses, since it unites the bars by a few soft and almost inaudible notes. The richness and variety of the melody, sung with such extraordinary power, show the exceedingly strong construction of a nightingale's throat; in fact the muscles are much more developed in the throat of this species and its relatives than in any other singing bird. A good nightingale will sing from twenty to twenty-four times in succession. When singing, it generally perches on the top of a bush or branch of a tree, with throat distended, beak wide open, and tail drooping, and is so little afraid of man that it often allows a passer-by to stand and watch for a long time. The immigration opens with the arrival of some of the male birds and continues during the whole of spring, the males that arrive start singing at once, by day as well as by night, as a call to the females as they pass. Except in pairing-time, nightingales are only to be heard singing at certain times, beginning during the hour before sunrise. After breakfast they sing for the second time at irregular intervals up to about three o'clock in the afternoon, and in the twilight and evening they commence again, but not with such zest as in the morning. Some nightingales sing only during the night, but these are not heard before the end of April or in May, and even then only when the nights are warm.

The song-time of the nightingale is from the middle of April, when it arrives, until the middle of June, when there are young birds in the nest, and the feeding of the brood leaves no time for singing. Between the end of June and the beginning of September nightingales leave Europe, to pass the winter in Africa. On their return in spring, fierce battles often take place between these birds and their neighbours. The cocks arrive from four to eight days earlier than the females, and generally take up their abode in the same locality as the previous season. Where nightingales find everything they require in the way of food and shelter, they often nest in small colonies. In some parts of the Continent they are common enough, but in other districts, where the conditions seem just as favourable, they may never be seen. The range includes central and southern Europe generally, but the species is more common in the west, the limit to the north-east being the valley of the Vistula. Nightingales visit Greece, Turkey, the south of Russia, Asia Minor and Palestine, and frequently the south of Denmark and England south of York. Recently nightingales have been heard in Devonshire, where they were supposed to be unknown. In Denmark they nest very often close to the northern nightingale. In the south of Sweden the latter bird (*D. philomela*) begins to be the more numerous. In Germany the river Peene, flowing into the Baltic

through Mecklenburg and Pomerania, used to form a sort of boundary between the territories of the two species. In Switzerland the true nightingale is restricted to the southern and western cantons, but in Spain it is abundant.

It winters in Africa and, has been found as far south as the Gold Coast.

The red-
breast (*Eri-*

thacus rubecula) is also a forest-bird, although known in perhaps every garden in Europe; and in the forest it is still to be found where the shadow of dense underwood prevents the grass from growing, and where water is close at hand, while on migration it always shelters among low bushes. Redbreasts are not solely resident birds, many of them moving about a district according to the season, and the majority being migrants in the true sense; the migration taking place every March and September, and always at night. In autumn they go to southern Europe and northern Africa, and in the east to Asia Minor, but they never nest farther east than the Urals and the Caspian. They are found in every part of the British Islands, many



THE REDBREAST.

remaining in the south of England, some even in Germany; those that stay during the winter find sufficient food around the houses and farms to eke out the berries, worms, and insects on which they chiefly live. Redbreasts will build almost anywhere and in anything close to the ground, and, if it is not sheltered from above, they sometimes give the nest a cover. It may generally be recognised at a glance by the cup not being in the centre of the mass of dead leaves, grass, and moss; the lining being rootlets, hair, and feathers, and occasionally a little wool.

In its habits the redbreast resembles the nightingale and the thrush, and like these, has spotted young. It is, however, much more lively, and moves about more briskly, on its rather long legs, often raising its tail and drooping its wings, and bowing continually. Its flight, though never long-continued in the daytime, is swift and straight. With other small birds the redbreast is very quarrelsome, as it is with members of its own kind, especially when one male meets another, although its cheery, trilling song, would hardly lead one to expect this. Even the females sing, although very softly, in a gentle, twittering sort of way, till late in the evening, for the redbreast is one of the last birds to go to roost and one of the earliest of risers.

The redstart, redtail, or firetail (*Ruticilla phæniceus*), ranges

Redstart. over the whole of Europe as far north as the Arctic Circle and as far east as the Yenesei and Persia. Taking its name from the bright chestnut colour of its tail, which has two dark brown middle feathers, the redstart has the dark wing-feathers edged with light brown, while the axillaries are nearly of the same chestnut hue as the tail; the male birds having a black throat and red breast, and the females being grey above and buff beneath, with the breast sandy brown. In Africa the colours of this bird are brighter. The redstart is almost always found where there are trees, not only in the depths of a forest, but in villages, fields, gardens, and on river-banks. In Switzerland, however, even when trees are near, it seems to prefer living amongst rocks. On migration, it flies at night, and appears in its breeding-haunts from about the end of March to the middle of April, or even sometimes later, seemingly in no way particular as to where it builds its nest; though it generally selects situations not raised much above the ground. The eggs are laid in May or June. Redstarts are restless birds, continually on the move, jerking and fanning their tail about, and hopping and bobbing and bowing as if they could never keep still. They live on insects, flying and otherwise; the young, which often betray the whereabouts of the nest by their loud screams, being fed mostly on caterpillars. The song, which is heard in the morning and evening, consists of about four bars, now and then interrupted by whistling notes or snatches of the songs of other birds; and it has many admirers.

Hedge-sparrow. The familiar hedge-sparrow (*Accentor modularis*), which belongs to a different group, is found all over Europe so far north as Norway and Archangel. It is resident throughout England, Scotland, and Ireland, in Germany and France, as well as southern Europe; and during migration, which in autumn lasts from the middle of September till October, and in spring from the middle of March till April, it visits Arabia and north-east Africa. In Asia Minor and Palestine it is said to be found all through the year. Although living in the open air, the hedge-sparrow does not expose itself to view more than it can help; and it is by no means exclusively a forest-bird. In the Hebrides it builds on the open moor; in many districts it lives amongst gardens and in the vicinity of houses, the nest being placed low down in thick bushes or evergreen shrubs, and the eggs laid about the end of April or beginning of May and in June. The beautiful blue colour of the eggs is familiar to all; and the nest itself is a model of neatness, being chiefly made of green moss, harmonising well with the newly unfolded leaves among which it is usually situated. During much of the

year the hedge-sparrow lives mainly on spiders, and beetles and other insects, but in autumn and spring almost entirely on small seeds. The song much resembles that of the wren, but is not so powerful: it is uttered when the bird is perching on the top of a bush or small tree; the hedge-sparrow being hardly ever seen on large trees.

Blackcap. With the blackcap (*Sylvia atricapilla*) we come to a regular bird-of-passage, which travels by night like its relatives, and arrives in Europe during April, to leave again in September. It prefers thick bushes and



THE BLACKCAP.

the tops of fairly large trees, and is found in forests where there is plenty of underwood, in plantations, and gardens with trees, as well as in hedges with trees close by. In such places it nests in the end of April or beginning of May, and for the second time at the end of June. The young birds are much attached to one another, and keep in company in covert for a long time after being fledged, waiting to be fed by their parents, and anxiously fluttering into the bushes when frightened. With head bent the blackcap hops through the bushes, and, when its attention is attracted by anything, it bristles its head-feathers and wags its tail. It is continually looking for food, suns itself in the morning, lives in harmony with other

birds, and is by no means shy with man. Its food includes all kinds of insects and berries, particularly raspberries and red currants: and its song rivals that of the nightingale, and is longer and more varied, but not so characteristic, as it includes many turns and trills that seem to be imitated from other birds. The blackcap is resident in the warmer parts of England, and in certain districts of the Continent, and is known all over Europe up to Lapland, and in Asia Minor and the Caucasus, as well as in western Asia generally, as far as 70° E. longitude, the winter being spent in northern Africa, ranging down to Senegambia on the west coast.

Whitethroat. The whitethroat (*S. rufa*) is one of the best known summer migrants to the British Isles, owing to its nesting in every county south of the Caledonian Canal, and being so easily identified. Ranging right across the Continent up to the latitude of the Vigten Islands in Scandinavia and to about 60° N. in the Urals, in the south of Europe it is rather rare, and in the Mediterranean countries is mostly known as a winter-visitor. It winters also in Arabia and in the Nile Valley down to Abyssinia. Eastwards its range extends to Turkestan, where it begins to be replaced by the larger and darker *S. fuscapilla*, which winters in north-western India. As a rule, it is a bird of the hedgerow, though it also builds in isolated thickets and in strips of bushes, or the outskirts of the smaller forests. Along the hedges it is generally conspicuous on the top, brisk and alert to all that is going on, fluttering after flying insects, singing merrily, and soaring straight up to sing on the way down. The song is monotonous but pleasing, and is often heard at night. When singing from a bush the bird raises the feathers of his crown.

The whitethroat is almost as fearless as the redbreast, and will follow an intruder passing the nest, and scold as if driving off a trespasser. The nest is made of grass with a few scraps of galium, or some other flowering plant, and lined with rootlets and hair. It is lightly built in thick herbage or brambles, or on the lower branches of a thorn bush, and contains from four to six eggs, which vary much in the green ground-colour, but always have violet-grey markings and brown speckles. The bird will eat berries and other fruits by way of a change, but feeds chiefly on insects, spiders, and aphides, and is busiest when the daddy longlegs are in season, as they form its particular prey. The throat and under-parts are white; the outer pair of tail-feathers are mostly white, the next pair having only white tips; the head is greyish, like the upper tail-coverts. The whitethroat has a brown back and brown legs, the lesser whitethroat being distinguished by a grey back and bluish legs, and its rather smaller size.

Lesser Whitethroat. The lesser whitethroat (*S. curruca*), which is about 5¼ inches long, has almost ceased to be a bird of the forest, preferring gardens or hedges in the neighbourhood of towns and villages, particularly where there are wild gooseberry-bushes; its favourite haunt being a thicket near a lane, or a sunny little grove amid underwood. This warbler breeds throughout Europe and most of northern Asia, even beyond the Arctic Circle, and is found in north-eastern China. Its autumn migration takes it down to Africa, Arabia, and Russia, though some of the birds do not cross the Mediterranean. The nest is distinguished from that of other warblers by its small dimensions, being shallowly built of grass and rootlets, bound together with cobwebs and cocoons. It is perhaps oftener than otherwise built in a hazel-bush, whence the bird is known in some districts as the hazel-linnet. In many parts of Germany it is called the little miller, from its monotonous song, which ends in a long series of sounds like the clacking of a mill.

Garden-Warbler. The garden-warbler (*S. hortensis*) is a small plain-coloured bird, with blue legs, and a pale eye-stripe; its general colour being olive-brown above, and greyish white below, with the wings and tail dark brown,

and the margins of the feathers greenish. This warbler never dwells in large forests, preferring small woods, gardens, etc., especially where there are brambles and thorns in which it can hide its nest. This is built about a foot or more from the ground, and towards the end of May or the beginning of June contains from four to six reddish white eggs, with dark brown spots. The nest itself is built of bedstraw, grass, and rootlets, bound together with cobwebs and lined with horse-hair. The young leave the nest as soon as they are tolerably well fledged. The garden-warbler is an active bird, searching incessantly for its food of insects, peas, berries, and other fruits, and while thus occupied has a habit of looking cautiously around as it glides in a skulking sort of way through the bushes. The song, which is almost equal to that of the blackcap, and is frequently mistaken for that of the nightingale, is composed of long, loud, rich flute-like notes. The bird generally sings from the underwood, and while singing moves restlessly to and fro. Although seldom going further northward than central Sweden, nor beyond Tomsk in Siberia to the east, the garden warbler has been found on the shores of the Arctic Ocean; but its principal home is central Europe, and more in the west than in the south. It breeds in Portugal, Spain, and Italy, but not in Greece; and migrates at night, arriving in the north in April and May, and returning to its winter-quarters, which extend from Egypt to the Gold Coast and even Cape Colony, from August to October.

Barred Warbler. The barred warbler (*S. nisoria*) is one of the largest members of the group, and distinguished by its pale yellow eyes, and its plumage of brownish grey above, and greyish white below, with brown bars on the throat, breast, and sides. Preferring low-lying leafy forests on the banks of rivers, and generally taking up its abode amid thorn-bushes and shrubs, this species arrives in central Europe from the south in the beginning of May, and breeds as far north as Denmark and Sweden, as far west as the Rhine, and as far east as Turkestan, or beyond. It is an occasional visitor to England, and in Germany is met with rarely in Brandenburg, Mecklenburg, Silesia, and Prussia. Leaving Europe in the middle of September, it spends the winter in north-eastern and central Africa. It is a timid, energetic bird, of much the same habits as the garden-warbler, which it resembles in the way it moves along the ground through underwood; it is unsociable with its fellows and other birds, and lives on berries and other fruits, but chiefly on insects, which it never catches when they are on the wing. The nest is a large one, neat and round within, but rather rough and loose outside, and is always near the ground. The eggs are buff, spotted with light grey, and more faintly marked than those of any other European warbler. The song resembles that of the whitethroat, with selections from the melodies of other birds; and while singing the bird is continually fluttering, now and then taking short flights into the air, hopping among the bushes, and singing as it slowly descends.

River-Warbler. The river-warbler (*Locustella fluviatilis*) is not happily named, as it lives principally in the forest, and seldom near running water. It may be found amongst beeches and alders, its favourite haunts being beech-woods with clearings overgrown with grass and umbelliferous plants, blackberries, and wild raspberries, or willows,—in short any rather marshy place, not necessarily near a stream. Its food consists exclusively of winged

insects, and its nest is always placed close to the ground. The river-warbler has a two-syllabled song of great sweetness, which is poured forth from the dense underwood both early and late, but chiefly early, the bird being to a certain extent a ventriloquist, its notes appearing to issue from a spot at some distance from the singer. It is heard all over eastern Europe, as far as Lake Ladoga, although but rarely to the west of the valley of the Danube. Farther eastward the river-warbler is found in western Asia; and southward its range includes northern Africa. Its annual visit to Europe extends from May to August.

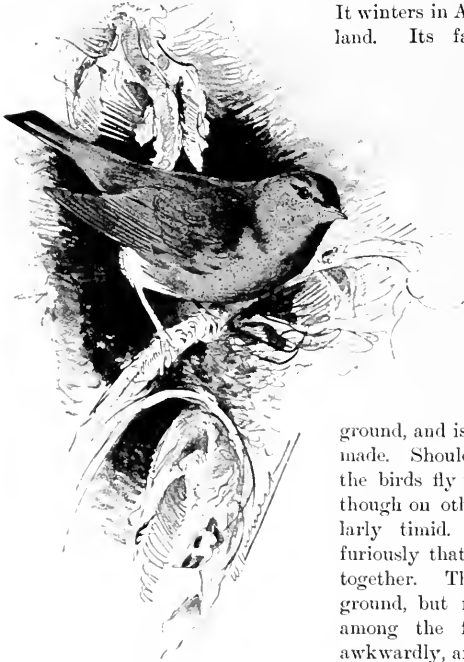
The grasshopper-warbler (*L. naevia*) is as much a bird of the fields as of the forest, frequenting forests with much underwood and not too many high trees, but also found in woods broken up by clearings, covered with grass and sedges and brambles, in clumps of willows, in pastures and arable fields, often at a great distance from any considerable body of water. This warbler arrives in Europe about the end of May, nests in the middle of July, and leaves in the first half of September. Although on migration it is often found in and near reeds close to willows, it never breeds in such situations. Keeping more carefully out of sight than any of its kind, it is one of the most restless of birds, creeping in a curiously mouse-like manner along the ground and climbing up and down the slender stems of plants in search of larvæ. Insects form its principal food, and it is said to have a preference for dragon-flies, which it takes on the wing. Its name is derived from its song, which is like the chirping of some unusually persistent grasshopper. The grasshopper-warbler is just 6 inches long, and may be distinguished by its greenish brown colour and striped back, its want of an eye-stripe, and its barred and rounded tail. The throat is brownish white, and the under tail-coverts are buffish white with dark middles. It nests in central Europe and ranges farther west than any other warbler. Rare in Italy, Switzerland, and the south of France, in England and Wales it is widely distributed but not abundant; in Holland, Denmark, and Holstein, in short throughout the north German lowlands, it is common, as it also is in the east of Germany and eastern Europe generally. In Asia it is found so far east as the Altai Mountains. It winters in southern Europe, southern Asia, and north-east Africa. The nest is compact.



GRASSHOPPER-WARBLER.

and deep and generally has galium in it together with grass and moss ; it is placed, as a rule, under a gorse-bush or in a clump of grass or clover.

Tree-Warbler. Another species, the tree-warbler (*Hypodais philomela*), ranges throughout central Europe to Denmark and central Sweden, but is not found farther east than Asia Minor. It occurs in England only as an accidental visitor, and is unknown in Spain, where it is represented by an allied species. It winters in Africa as far south as Damara-



WILLOW-WREN.

land. Its favourite haunts are small stretches of woodland, and it is often found near human habitations, especially if these are surrounded by hedges and bushes, and the trees near them are not too high ; but such conditions are not always essential, for a nest was built on an acacia tree in a noisy street in Berlin. The nest is generally situated at a man's height above the

ground, and is well hidden and beautifully made. Should an enemy approach the nest, the birds fly round with plaintive shrieks, though on other occasions they are singularly timid. These warblers fight so furiously that both combatants drop down together. They seldom fly close to the ground, but move from bush to bush, or among the foliage of trees ; they hop awkwardly, and when startled have a habit of bristling up their head-feathers. Their food consists of insects and snails, and in the

late summer and autumn of berries and other fruits. The song, which has been much praised, and indeed over-praised, is loud and long, with some notes that are flute-like, and others of quite a different type, interspersed every now and then with a burst of mocking laughter. This will go on for hours ; and even if the songster be pelted with stones, he will still persist.

Wood-Wren. With the wood-wren (*Phylloscopus sibilator*) we come to a true bird of the woodlands, and one almost always found nesting among beech-trees in England and many other countries. This familiar bird arrives from the south towards the end of April or beginning of May, and leaves again in August or the early part of September ; its range extending from the mountains of Italy to

the highlands of Scotland and the forests of Sweden. In some parts of England it is fairly abundant, in Sweden it is rare, in Norway and Holland it is never seen. It straggles to Archangel, ranges as far east as Kazan, passes through Greece, Asia Minor, and Palestine on migration, and winters in Abyssinia and the Gold Coast. In colour it is yellowish green above, with a bright yellow eye-stripe, and a dark streak through the eyes to the ear-coverts. Below it is white, the sides of the breast as well as the front part of the neck being yellowish. The wings are greyish brown edged with yellow, the secondaries having whitish tips. The nest of the wood-wren is situated on the ground, and half-domed, as in the warblers generally, but may be identified by not containing feathers. This warbler is a brisk and cheery bird, although cautious and easily alarmed. It feeds on flies caught on the wing, small caterpillars, and other insects; in the late summer adding berries and similar fruits to its diet. Its favourite haunt is among boughs of medium height, whence it dashes out at its prey like a flycatcher, or flutters to a neighbouring bush to search both surfaces of the leaves. The song is a jarring trill, ending in a sweet flute-like tremolo, which seems to require considerable effort, if we may judge by the way the throat is distended, the wings hung down, and the crest raised. Sometimes the song is begun on the wing and finished on a tree, but it is invariably delightful.

Willow-wren. While the wood-wren is a bird of the beeches, the willow-wren (*P. trochilus*) is a denizen of the birches, and it is distributed over Europe and the greater part of western Asia, so far as the valley of the Yenesei. Arriving in the middle of April, it begins to leave for the south in August, and visiting on migration Persia, Asia Minor, and Greece, it winters in Africa on the west coast and as far south as Cape Colony. It is not quite such a forest-bird as the wood-warbler, but is generally found where there is plenty of underwood, large and small, either in the forest, or in parks and shrubberies, suburban and otherwise. Its name of willow-wren seems to have been given, not from its nesting among willows, but from its frequently seeking on these trees the flies and other insects, etc., upon which it feeds. It is about 5 inches long, or a quarter of an inch shorter than the wood-wren, from which it is distinguished by having its five outer primaries notched, by its darker green back, and its greenish eye-stripe. The pointed wings distinguish it readily from the chiff-chaff. The nest is placed amid the densest shrubs on the ground, and is therefore difficult to find; a projecting tuft of grass often forms the roof, and the entrance is so small that the eggs are not visible from outside. The nest is always lined with feathers, frequently those of the partridge. The willow-wren is a bolder bird than the last, quite as cheery and more restless, with a characteristic habit of jerking its tail up and down. As a rule, it is by no means shy, but when nesting it is easily frightened by an approaching intruder. It is a persistent songster, and repeats the sweet descending scale of its simple melody from morning till night.

Chiff-chaff. The chiff-chaff (*P. rufus*) generally nests in hedges at no great distance above the ground, in the "balks" dividing ploughed fields, or in solitary bushes, where these are thick and thorny: it rears two broods a year, and feeds on insects and their larvæ and berries. In disposition it is a livelier and

more restless bird than all its kindred, though rarely venturing out of the bushes, and in most localities never singing in the open.

Its southern migration takes it to Africa, along the valley of the Nile on the east and the Senegal on the west, as well as to Arabia and Persia. It is a more or less resident species in Greece, Italy, and Spain; and from these countries it spreads northward over a great part of Europe to close on the Arctic Circle. To the east its range ends in Perm, where it is replaced by *P. tristis*; to the west it was believed to extend to the Canaries until the birds resident there were found to belong to another species, *P. fortunatus*. In Britain it is the earliest spring migrant, and is found right up to Caithness. In certain parts of the south of England it is resident, as it is all through central and southern Europe, where its numbers are increased by migration. The chiff-chaff is a trifle under 5 inches long. The full-grown males are olive-green above and whitish below, with the wing-coverts dusky brown, like the primaries, and the six outer ones notched; the tail is the same colour as the wings but edged with olive. There is a faint greyish white eye-stripe, which is buff in the autumn when the whole plumage becomes greyer. The plumage of both sexes is alike. The chiff-chaff generally sings from near the top of a tree, the short song ending in the syllables from which it gets its popular name. It is apparently untiring in the repetition of its melody, and sings all day except when the female is on the eggs, at which period the song is heard only in the evening and in the morning, especially at sunrise. The nest is domed, placed within a foot of the ground, and is made of grass, leaves, and moss lined with feathers. The eggs are very small, and cream-coloured, spotted with purplish brown. The food consists of insects and their larvæ.

Goldcrest.

The tiny goldcrests are in many respects not unlike the warblers, from which they are distinguished by the coloured crown, the single feather on the nostril, and their beautiful nests of green moss, cobwebs, hair, and wool. The goldcrest (*Regulus cristatus*) is a bird of the pine-woods, and has a bright orange crown, bordered with black and fronted with yellow, with no stripe through or below the eye. It is one of the smallest of European birds; its total length being about $3\frac{1}{2}$ inches, and its weight only 5 grammes. On the autumn migration it is much oftener seen than in summer, especially in gardens and plantations, but even then it is generally found among conifers and other evergreens. In March and April it returns to its nesting-places amongst the firs and yews. The nest, as a rule, is hung like a hammock from a branch, and so placed that the sun may reach it, the tiny entrance-hole being at the top. The goldcrest is generally found in parties of four or more, and associates with tits and creepers. When on the move, it flutters busily from twig to twig, sometimes hanging upside-down on the branches, in search of the insects which form its food. During pairing-time its song is audible at a distance of about a hundred yards, but at other seasons is very low, although always melodious; it consists of a frequent repetition of *if-he, if-he, if-he*, the call being a much more powerful *zit, zit*. In the mountains the goldcrest is found as high as pine-trees grow, although in southern Europe it seldom breeds there. In Europe its range extends as far north as the limit of pines, and in Asia from the north of Siberia to the farthest east. Though usually classed as resident, considerable

numbers of goldcrests visit Malta in spring and autumn on their journey to and from northern Africa.

Firecrest. Closely allied to the last is the firecrest (*R. ignicapillus*), which is more of a bird-of-passage, arriving in central Europe in March and April, and leaving in September and October for milder climates. It is resident in southern Europe, and breeds in France, Germany, Austria-Hungary, Turkey, and south Russia. In England it is known as a winter visitor, and is not found so far north as the goldcrest, from which it is distinguished by two more dark streaks through and below the eye, the goldcrest having one and the firecrest three streaks. A trifle larger than the goldcrest, it breeds twice



THE GOLDCREST.

a year, once between the end of April and the end of May, and again in the beginning of July. It nests in pine-trees and yews, the nest being similar to that of the goldcrest, and hung in the same way. The eggs are smaller than those of any European bird except the goldcrest: the goldcrest's eggs are white mottled with red, those of the firecrest are greyish or pale chocolate dotted with reddish brown.

Wren. The wrens are distinguished from the warblers by their upper wing-coverts, which are mostly longer than the lower ones, and their rounded concave wings. Their plumage is soft and long, especially on the tail, which is carried nearly upright. Their food consists chiefly of insects and worms, but also includes soft fruits and berries. Wrens are distributed all over the world, but are more numerous in tropical than in temperate climates, the

majority belonging to the Eastern Hemisphere. They are birds of the woods, or rather of the underwood, through which they creep like mice. They fly reluctantly, and their flight is short, straight, and whirring. The males have a rather melodious song, consisting of only one bar, of which they never tire all through the year. The nests are built mostly of moss, but also of leaves and grass, so as to be inconspicuous among the surroundings, and are placed in the fork of

two branches, never far from the ground. They are round as a ball and have the entrance at the side.

The common wren of Europe (*Troglodytes vulgaris*), which is nearly or quite as small as the goldcrest, and of the same weight, is distributed over the whole of the Continent to Finland and beyond the Arctic Circle, but is not met with farther east than the Urals, the Caucasus, and northern Persia. It is easily recognised by its brown plumage, barred on the body and tail with

darker brown. Though a bird of the forest, but not of the pine-forest, it seems to prefer a hedge to any other place, and is seldom seen on high trees, as it likes to be near the ground. It is most familiar in its ways, and is often seen in sheds, on wood-piles and heaps of dry branches, and among the climbing plants on cottage walls. In most countries it is resident, but in others it is a migrant, appearing in March and April and again in October. The

breeding-nest usually contains eggs in the second half of April, and in June; but the bird has other nests, made to draw off attention from the real one, these being generally occupied by males only, which sleep in them, mostly several together, during winter. These sleeping-nests are seldom, if ever, lined, while the breeding-nests are always neatly lined with leaves. The wren inhabiting the island of St. Kilda has been described as a distinct species, but can scarcely be regarded as more than a local race of the ordinary wren. It has been nearly exterminated by egg-collectors.



THE WREN.

Great Titmouse. Passing on to the group of titmice, we find that the greater number of European species belong to the genus *Parus*, most of whose representatives are indigenous to the temperate and northern latitudes of

Europe, Asia, and North America, although a few inhabit Africa and India. The great titmouse (*P. major*) is by no means particular in choosing its residence; taking up its abode in forests, plantations,



GREAT TITMOUSE.

parks, or gardens, or, in fact, wherever trees and bushes grow. Generally keeping to the trees and bushes, it is only in the winter that it looks for its food on the ground. Insects, seeds, and all sorts of

fruit constitute its ordinary diet, but in the winter it will eat scraps of meat or fat, preferring those hung in a tree. In October the great tit migrates in large flocks to the south-west; the females and young birds going first, and the males

following soon after, although a few remain all through the year. These are soon joined by others, which come down from the north to spend the winter in temperate Europe. Holes in trees and walls, and elsewhere, even pumps and cupboards, form the nesting and sleeping places of the great tit. In April the nest contains from five to nine or more eggs, white, with small rusty yellow spots and faint underlying greyish markings. The nest itself is a felted mass of grass, moss, rootlets, wool, hair, and feathers. The bird is a regular little busybody—inquisitive, dainty-mouthed, and so daring that one may be caught three or four times in succession at the same spot. Although fond of company, it will attack birds larger than itself, and kill them if possible, splitting their skulls to get at their brains. Great tits never seem anxious to cross a wide plain, and often perch for a long time in large parties on the last tree of the forest before they make up their minds to take to the open country. Always hungry, they search the smallest corners for food; and after seizing their food, press it with one foot against a twig, and by this means are enabled to peck out the inside of an insect or the soft part of a seed or fruit, after which they swallow it a little at a time.

The great tit, which is 6 inches long, is green above and yellowish below, its head, the sides of its cheeks, and an apron from the throat downwards being glossy black; while the cheeks are white and the tail bluish grey with the feathers black along the inner webs, and the outer ones white along the outer webs and at the tips. The species ranges over Europe from Lapland to Spain, from Scotland to the Urals, and over western and central Asia north of the Himalaya, but does not occur in India, China, or Japan. It is also found in north-western Africa and in the Canaries, and is particularly abundant in Palestine.

Coal Titmouse. The coal titmouse (*P. ater*) has a distribution very similar to the last; its place in the far east being taken by *P. pekinensis*, as is that of *P. major* by *P. minor*. In the British Isles it is known only as a migrant, the resident coal tit having its back brown instead of blue, being a distinct race (*P. a. britannicus*). In the north it is not resident; during migration it keeps to the line of trees and bushes, and is then often found in forests, parks, and gardens, almost always accompanied by goldcrests, crested tits, and allied birds. It always nests in a hole, which may be placed anywhere, though usually in a tree or a wall. This sprightly and courageous tit has a short, fluttering flight, and may sometimes be seen bristling up its crown into a crest as it hunts among the pine-trees, and clings to the cones, looking for insects and seeds, which when in plenty it stores in the crevices of the bark. The bird, however, is more often heard than seen; its note being a shrill twitter or a double "clink" easily recognisable. There is some white on the cheeks and nape of the neck, the head and throat are glossy black, but the throat-patch does not extend over the whitish breast.

Marsh Titmouse. The marsh titmouse (*P. palustris*) should be sought among the willows and alders of the marshes, but is as often seen elsewhere. During summer on the Continent it keeps mostly to leafy woods with plenty of underwood, and not too many high trees, although, curiously enough, in Transylvania it prefers beech-woods to other places. In all countries it is found in orchards and gardens, which may or may not be near water. Subsisting chiefly on insects, berries, and seeds, this tit is as much attracted by the seeds of the

sunflower in autumn as by a meaty bone in winter. It nests in holes, either in decayed trees or in hedge-banks; the hole being occasionally of the bird's own making. The marsh tit is a very lively bird, quick and versatile in its movements, and also in variations of note. The song is neither loud nor noteworthy, although so varied; but the two calls are more audible, especially the sharp *tse-yerrel*, which has given the bird its name of *ziaerl* among the country-people of Germany. The marsh tit is more of a resident than a migrant; many individuals not leaving their birthplace in winter, although others wander about, particularly during October, in pairs or small families. There are several local races of this bird, which by some naturalists are treated as separate species; the British marsh tit, for instance, which breeds as far north as Perthshire, being known as *P. palustris dresseri*. In northern Scandinavia the species is represented by *P. palustris borealis*; in the Alps and the Tyrol we have the somewhat similar Alpine marsh tit, *P. palustris alpestris*; while in south-eastern Europe this is replaced by *P. palustris lugubris*. The typical race is found all over central Europe, and northern and western Siberia. The total length is about $4\frac{1}{2}$ inches; the head is black with a bluish metallic glitter, the chin and throat have a small black spot, and the body is a greyish brown above and buff below; the British birds being of a warmer brown above, and redder on the flanks.

Blue Titmouse. The blue titmouse (*P. caeruleus*) dwells in leafy woods, especially those in plains, or river-valleys, and is also common in orchards and gardens. Although on migration it may pass through pine-forests, it never chooses these for its summer residence. This pretty bird is the same size as the marsh tit, from which it is at once distinguished by its blue wings, tail, and head; although in young birds the tint is greenish. Ranging almost all over Europe south of 64° N. latitude, it is a resident species whose numbers are increased by migrants from the north. It lives in pairs or families; those that migrate leaving for the south in the middle of September, to return in March. In some places it is an inland migrant, and its southerly journeys are often interrupted by the open plains, which it hesitates to cross. The nest is built in a hole in a tree, a wall, or elsewhere, and is loosely made of moss and grass with wool, hair, and feathers, but not with rabbit's fur, like that of the marsh tit. The blue tit feeds chiefly on beetles and other insects and their larvæ, on spiders, and aphides and other garden pests, in pursuit of which it peeks out the buds it is supposed to destroy, whereas it is simply slaying the destroyer. It is a bright, restless little bird, brisk in all its movements, and flying hurriedly with many sudden dips and rises. Like other tits, it clings to the thinnest twigs that will bear its weight; and when it sees a bird-of-prey, utters a peculiar call, warning every bird in the neighbourhood. The courting of the cock is a remarkable performance; on such occasions the bird hops among the twigs, chirping and twittering with many strange antics, and then returns to the female with outspread wings, hovering between the trees like a bird-of-prey. Indeed, owing to the bristling of the feathers, it is scarcely recognisable on these occasions.

Crested Titmouse. The crested titmouse (*P. cristatus*), by preference a dweller in pine-woods, although also found where there are oaks or birches, is restricted to Europe, ranging from southern Sweden to the Alps, and from Spain

to the Caucasus, being unknown beyond the Volga and the Urals. Although it keeps, as a rule, to the upper boughs of high trees, it is also seen in low bushes, and in the spring even on the ground. Except at nesting-time, it is seldom alone, being generally in company with other tits and goldcrests; the various species forming large parties, the leaders of which seem to be the crested tits. Although mainly a resident species, in spring and autumn it may wander about, often at



THE CRESTED TITMOUSE.

some distance from stretches of woodland, but always sheltering in firs and bushes. The nest is in a hole in a decayed tree, which the bird often makes itself, or in the abandoned habitation of a magpie or squirrel; the materials being moss and wool roughly felted together. During nesting-time this tit eats insects and their larvæ, but in autumn and spring its food consists of pine and other seeds and berries. The song is neither loud nor varied, resembling somewhat that of the goldcrest. The white-tipped crest sufficiently distinguishes this bird from the other members of the group.

Long-Tailed Titmouse. Widely different is the long-tailed titmouse (*Acredula caudata*), which frequents woods of all kinds, except those consisting of pines, but prefers such as contain stretches of water. It is met with in willow plantations,



LONG-TAILED TITMICE AND THEIR NEST.

and gardens and parks, and, particularly in winter, close to human dwellings. This bird is represented by two distinct races in Europe and northern Asia as far eastward as Japan. These races are frequently considered to be separate species; the one with a black edge to the white crown being resident in the British Isles. The continental bird, which has no black in the crown, is well known in Germany

and Switzerland, where it assembles in flocks among the river-banks, forest outskirts, and gardens. It is resident in Greece, but rare in southern Europe generally. Some winter in central Europe, and associate with other tits; others migrate from September to November to return in March and April. The nest of the long-tailed tit is frequently built in a tree about 10 feet from the ground, with one side resting against the main trunk to which it is fastened, while the bottom is supported on a mossy branch or in the fork of two branches. It is neatly and skilfully made of moss and cobwebs, oval and domed, with a small entrance-hole high up on the side carefully concealed by feathers; the outer surface being covered with lichens, and the interior lined with small feathers, of which so many as two thousand have been counted in a single nest. This tit lives exclusively on small insects and their larvæ; and in not holding its food between its toes, as well as in several other respects, differs in habits from all other tits. Untiring in activity, the male tit never remains long on the same tree, but wanders through its beat several times a day, followed in autumn by its wife and family in single file. The somewhat insignificant song of this bird consists of a short series of monotonous chirps, ending with a rather melodious note. Although, including its tail, it is $5\frac{1}{2}$ inches in length, the body is really no longer than that of a wren. The loosely growing feathers are principally black and white; the tail being black, with the exception of the three outer feathers, which are white along their outer webs and also tipped with white.

Nuthatch. Resembling the tits in some ways, and the woodpeckers in others, the nuthatches include two European species; namely, *Sitta cæsia*, ranging across central Europe from the British Isles to Palestine, and *S. europæa*, which replaces it in Scandinavia and Siberia, and ranges eastwards to Japan. The nuthatch dwells in woods of all kinds, both small and large, as well as in parks and gardens, but is most at home in a forest of deciduous trees. Clumsy as it looks, it is really a singularly quick and active bird, which will ascend to the very top of the highest trees, and descend with restless activity all round the branches as if it were a mouse, its head now downwards, now upwards, and often hanging on twigs like a tit and running along their under side. The nuthatch can be occasionally observed resting by perching across a bough like any other singing bird as it gives its loud call-note, which resembles *fetch-it* quickly echoed. In colour the male is of a slaty-blue above with a black eye-stripe passing from the base of the beak to the nape; the wings are slaty-blue like the back and so is the tail, but the outer tail-feathers are edged with white which only shows when the tail is spread; the under-parts are very pale buff, and the flanks are chestnut. Beech-mast is its favourite food, but it also eats sunflower and other seeds, and lives largely on insects, for which it taps the trees as if it were a woodpecker, and also seeks them on the ground. It takes its name from its habit of fixing hazelnuts into a crack in a tree, and then hammering them open with its beak; and it establishes little stores of these nuts. Its way of nesting is remarkable: it appropriates a hole in a wall, or in a decayed tree, and, if in a tree, sticks so much clay round the mouth that only a very small aperture, just

big enough to slip in and out of, remains. The nest scarcely deserves the name, since it consists only of a few dead leaves, and thin strips of pine or other bark thrown loosely on top of each other.



A PAIR OF NUTHATCHES.

Another bird resembling in some ways the tits is the tree-creeper (*Certhia familiaris*), a woodland species which is often seen in gardens and orchards. It is distributed throughout Europe,

and Asia north of the Himalaya to the far east; and during migration visits north-west Africa, but is resident over a wide area, including the British Isles

and most of Germany. It is a quiet, confiding bird, often observed as it dexterously climbs the trunks or larger branches of trees. It never tries the twigs, and always selects such trees as have rough bark: these it commences to search at the roots for insects and their larvæ, and continues its hunt to the top, working up in spirals, and, unlike the nuthatch, never with its head downwards. In

climbing, this bird uses its stiff, pointed tail, and, when it reaches the top, flies down to the bottom of the next tree, up which it works in similar fashion. Insects are its chief food, seeds being eaten only in case of necessity. Although generally seen alone or in pairs, the creeper usually sleeps with several of its fellows in the same hole. The nest is built in a hole beneath the bark of a tree, and, if the cavity be very deep, the bird reduces it to a suitable size with a woven mass of fine twigs, the nest itself being made of strips of inner bark, together with grass, moss, rootlets, and occasionally feathers. The eggs are laid in the beginning of April and again in June. As the young do not leave the nest till the shafts of their tail-feathers are stiff, they are able to climb forthwith, although the tail is still only half-fledged. The plumage is brown above, streaked and spotted with whitish grey, the under surface being silvery white. The tail-feathers are brown and long, with chestnut shafts and stiff points.



A TREE-CREEPER AT WORK.

Great Grey Shrike. The shrikes may be regarded as the birds-of-prey among the great

assemblage of perching birds. Their largest representative in Europe, the great grey shrike (*Lanius excubitor*), is found in small isolated patches of woodland and the outer ring of a forest, from which it can generally reach the fields. Also met with in tall hedges in open plains, it is never seen where there is marsh. It is distributed all over central and northern Europe, up to the Arctic Circle, but not beyond the Asiatic border. North of Germany it is known only

as a summer-visitor; in England it is only a winter-visitor, but over the rest of Europe is resident throughout the year with its numbers increased by the winter migration from its breeding-grounds in Sweden and northern Russia, where it meets the Siberian bird, which may rather be considered as a variety than a distinct species. Although widely distributed, this shrike is by no means a common bird on the Continent, except in some districts, and especially the valley of the Rhine at Trier. In September, October, and November, when wandering in search of food, it leaves the wilder parts for the vicinity of the villages to return to the former in February when the pairing-season begins. The nest is in most cases conspicuously placed on low trees, especially oaks and fruit-trees, seldom firs, although not unfrequently on the top of a thorn-bush, the eggs being laid towards the end of April or the beginning of May. The great grey shrike is no coward, and will fight even with large birds-of-prey, greeting them with loud screams, and thereby giving a danger-signal to all the birds in the neighbourhood. For this reason the bird is often called the sentinel on the Continent, although there is really no more dangerous enemy to smaller birds than this shrike, which watches for them from the highest trees and bushes, and will attack even thrushes, quails, and partridges, although by no means always with success. Shrikes will also feed on the nestlings of other birds, grasshoppers, and other insects, both large and small, as well as blindworms, lizards, and field-mice. Before eating its prey a shrike sticks it on some long thorn, either for the purpose of tearing off the flesh at leisure without much trouble, or, in case of abundance, to let it decay. The flight is remarkable, the bird dropping downwards at first, then continuing horizontally, and rising again in a curve. Sometimes it hovers like a hawk, and may occasionally be seen shaking its prey in the air. Its song is a series of screeches, mingled with the calls of many other birds.

Lesser Grey Shrike. The lesser grey shrike (*L. minor*) also resorts to small leafy woods near fields and meadows, or to large plantations amid stretches of grass. Rare in Denmark and Scandinavia, it is only an accidental straggler to Britain, but is fairly numerous in the east of Belgium, the south of Holland and north Germany, nesting principally in the eastern countries of Europe, and being scarce in southern Bavaria, Württemberg, Baden, and Switzerland. It is also rare in the north of France, as well as in Spain, although more common in the south of France. In Sardinia it breeds, but it seldom appears in the Italian peninsula. Perhaps southern Russia may be regarded as the centre of its distributional area; it is unknown in eastern Siberia and China. As a bird-of-passage it wanders through Africa as far south as Damaraland and the Transvaal. The eggs are not laid before the latter part of May. The lesser grey shrike is a handsome bird, and by no means shy, perching conspicuously on the tops of bushes and trees. Its food consists mainly of beetles, but includes mole-crickets, grasshoppers, and other insects: these it detects from some elevated spot, to which it carries them back before eating them; and it often hovers a long time over its prey. Although it does not attack small birds, it will occasionally fight with rooks and magpies. Its song consists partly of the calls and melodies of other birds, partly of screeches and twitters. Like some of the other shrikes, this bird makes much use of aromatic plants in the construction of its nest; a nest

taken in Greece was mostly composed of *Antennaria dioica*, one of the everlasting flowers.

Woodchat.

The woodchat (*L. pomeranus*) should be looked for either in the heart of the forest, or in leafy woods near fields and pastures. In central Europe it is not common, but from Spain, through southern Europe to Asia Minor, is the best known of all the shrikes; while in Denmark and north of the Vistula it is occasionally met with. In England it is known only as a rare visitor, though it is recorded to have nested in the Isle of Wight. It winters in Africa, and appears on the south coast of the Mediterranean in March as it comes northward. Arriving in central Europe in April and May, it leaves for the south in August or September. The nest is compactly built of twigs and grass and the stems and flowers of cudweed, or some other aromatic plant; and though placed conspicuously in the fork of a tree, its owner takes great care of the young, defending them bravely against other birds and even man. This shrike subsists on insects, principally beetles and grasshoppers, but also preys on young birds, mice, and other small animals. Resembling other shrikes in its harsh call, its song is rather soft and pleasing, being composed of imitations of the notes of other birds, many of them larger than itself, with a few notes of its own.

**Red-Backed
Shrike.**

The red-backed shrike (*L. collurio*), the last we have to deal with here, feeds mainly on beetles and bees, and is found in places where these insects abound, in wooded dells where wild flowers grow, as well as in parks and enclosures, in thorny hedges near fields and meadows, and on bushy commons. It is a bold, active bird, perching among trees or on telegraph-wires when singing or on the look-out for its victims, which it rarely pursues should it fail to secure them at the first dash. Like other shrikes, it jerks its tail when excited, and flies from one place to another in a series of undulations, with much poising and hovering. Its powers of vision seem to be unusually keen, since it can apparently distinguish at a distance wasps and bees from the large flies which they resemble, and avoids their stings by biting off their heads, and then squeezing out the soft-parts by rubbing the body against a twig. This shrike is likewise an enemy to all kinds of small birds, which it bites in the wing so as to cripple them; and it also attacks other small animals, such as mice, lizards, and frogs. When, in shrike-fashion, it impales its prey on a thorn, it hangs it up by the mouth if the body is large enough; and in eating birds it begins with the brain. While the female is sitting, the male hangs food on the thorns round the nest as a convenient larder. The nest is generally placed on a forking branch in a thorn-bush, about a man's height from the ground; and is a slovenly structure, about 7 inches across, made of plant-stems and twigs lined with grass, wool, and hair, rarely without a little moss and a few flowers. It contains from four to six eggs by the end of May or beginning of June. The red-backed shrike is found throughout Europe, but is rare in Spain and Portugal; it occurs both in Britain and Scandinavia, and breeds in the mountainous parts of Greece, Asia Minor, and central Asia. On migration the western race travels down the Nile Valley to South Africa, and is common in East Africa, while the Asiatic type goes south to the Persian Gulf.

This shrike does not appear in central Europe before the end of April or May, and retires to its winter-quarters as early as August or, at the latest, the beginning of September. It is the smallest but one of the European shrikes, being only $7\frac{1}{2}$ inches in length, and is also the handsomest. The male has a greyish



RED-BACKED SHRIKE.

blue head, a chestnut back marked off from the black and white tail by an area of grey, and he has a white chin and buff breast. The central tail-feathers are black, the others white at their bases and tips, and the outer pair nearly all white. The females and young have a pale instead of a black stripe above the eye, and are brownish instead of chestnut and of a much more sombre grey. This shrike is almost as good a vocalist as the woodchat, and certainly a better mimic.

The flycatchers are not unlike the shrikes in the way they capture their prey, and show a resemblance to the thrushes in the mottled plumage of the young. The spotted flycatcher (*Muscicapa grisola*), which is the central European representative of a mainly African genus, resorts to the outskirts of woods and spinneys, to trees and bushes near ponds and other water,

to large gardens in the country, and to parks in the towns. Arriving in pairs at the end of April or beginning of May, it leaves in parties at the end of August or in September. It makes its nest about 10 feet from the ground on a tree or elsewhere, frequently in the climbing plants on a wall, occasionally on a beam in an outhouse, but always under shelter. The nest is neatly built of moss and grass bound together with cobwebs, lined with rootlets and hair, and crossed with fragments of the immediate surroundings so as to render it as inconspicuous as possible.



WHITE-COLLARED FLYCATCHER.

The spotted flycatcher, which feeds on flies, gnats, moths, and other winged insects, is seldom seen on the ground, except for a few moments, preferring to perch on a dead bough or a fence, or some spot higher than the flight of its prey. From this it dashes down at its victim, occasionally pursuing it with many a curve and turn, and generally taking it back to the perch to eat. Should the capture be a butterfly or moth, the bird rubs it against some object, to break off the wings. The old birds have often been observed teaching the young ones to capture their own food, invariably near bushes, over a strip of damp ground where small insects are numerous. In the autumn, when insects are scarce, flycatchers will feed on

berries, particularly those of the mountain-ash. The song is hardly noticeable, and the call merely a sort of click. This flycatcher ranges through Europe, from the White Sea to the Mediterranean, from the British Isles to the Urals, and beyond to Turkestan, and on its migration to Africa reaches the Gold Coast on the west and Natal on the east.

Pied Flycatcher. The pied flycatcher (*M. atricapilla*) is a less familiar bird, frequenting, from the middle of April until October, much the same localities as the spotted species, but keeping more in the woods away from human dwellings. Its call, an incessant *bit, bit, bit*, betrays its presence at the extreme end of some overhanging branch, from which it can drop down on the insects passing through the grass below. In Germany and the adjacent parts of the Continent this flycatcher is comparatively scarce, but its range includes the whole of Europe, not excepting Scandinavia and Finland; while in Siberia it wanders a little beyond the eastern slopes of the Urals. It is found in Spain and Palestine, and is resident in Algeria; its winter-quarters are northern Africa down to the Gambia on one side and southern Egypt on the other. In the British Isles it is known from Devonshire to the Orkneys, but seldom goes north of Inverness, and is throughout very local in its distribution. In Norway it breeds as far north as Tromsø, within the Arctic Circle.

White-Collared Flycatcher. Resembling at first glance the last, the white-collared flycatcher (*M. collaris*) is sometimes mistaken for that species: although often seen shortly after its arrival, it soon retires to the forest to make its nest in holes in trees, or on branches among dense foliage, and is not again noticed until on its southward journey. Inhabiting central and southern Europe and western Asia, it is rare in Germany, and only occasionally found so far north as southern Sweden. In Italy and Greece it is better known as a migrant than a resident; its winter-quarters being northern Africa. While journeying through Italy it may be seen among the gardens and vineyards, searching the nests of other birds for insects, and having so much the appearance of looking after the young birds that the Italians have named it the nurse.

Red-Breasted Flycatcher. The red-breasted flycatcher (*Siphia parva*) is the smallest and least known of the European species of the group, whose favourite haunts are beech-woods in which the trees are of different heights. Although smaller, it presents considerable resemblance to the redbreast, but lives among the dense foliage, at a height of from 30 to 60 feet, only coming down to the ground for water. During migration it is not unfrequently seen in gardens. Its nest is like that of the chaffinch, but smaller, and contains from five to seven eggs. The song, which is simple and pleasing, is limited to a few notes, repeated two or three times from one tree, and then from another. On the Continent this flycatcher is most abundant in Mecklenburg, Pomerania, west Prussia, Moravia, Galicia, and Hungary, and thence ranges through eastern Europe as far as Turkestan. Westward of the Rhine and in south-west Germany it is one of the rarest birds. In the south of Europe it is known as a winter visitor, and it straggles to Great Britain, Denmark, and the south of Sweden.

Chaffinch.

The central European representative of the great group of finches is the familiar chaffinch (*Fringilla coelebs*), which may be met with almost wherever there are trees, its favourite resort being, perhaps, beech-woods. Well-built, handsome, bold, and active, very quarrelsome with its fellows, particularly during the pairing-season, it has a habit of bristling up its head-feathers as a crest every now and then, while it is also brisk and sprightly



A COCK CHAFFINCH.

in its movements at all times. Though a finch, and therefore a seed-eater, the chaffinch feeds largely on insects: the seeds it prefers being those of the weeds that the farmer and the gardener do their best to destroy. Although sheltering during the winter in the upper foliage of fir-trees, it rarely chooses a fir as a nesting-place. The nest is usually built in a bush or among the lower branches of a deciduous tree, far out from the trunk, where two or three twigs fork. Cup-like in form, it is by no means easy of discovery, since it is decorated on the outside with green and grey moss and lichen, so as to harmonise with the colouring of the branch or stem against which it rests. The ringing song of the chaffinch resounds

in the woods from the beginning of March, sometimes even earlier: and later on in the year it is heard the whole day through, even during the hot hours of noon. The note of the chaffinch is carefully defined as "a perfect and complete *toll-loll-loll-chickweedo*" in the rules of the singing matches which used to be so frequent in certain parts of London and still take place; the prize being won by the bird which delivers the greatest number of these notes in a quarter of an hour, no note with a syllable short being counted. The matches are sung in heats of two

birds at a time, each in its own cage; there being generally three or four rounds. An umpire and scorer are appointed, the umpire ruling out any bird of distinct inferiority in tone; ties in the number of notes have to be sung off, and the decision in the final heat depends on quality when the numbers are equal. The chaffinch winters in northern Africa. It is found in western Siberia, in Syria, and the forest-region of Persia, and is distributed over Europe to within the Arctic Circle, but ranges no higher than 62° N. in the Urals. In the south it nests in the mountains, and in winter comes down to the plains in small parties. It is one of the commonest birds of Germany; but only a few males and no females winter in the eastern and north-eastern districts, though some remain the whole winter in the west and south-west. A small minority of chaffinches are local migrants; they begin wandering about in small parties in September, and go on doing so until November, when they are joined by others coming from the north. From the end of February till the beginning of April the wanderers return to their nesting-sites. Although their migratory instinct tends to keep them in company, they quarrel much with each other, especially when feeding, the local birds generally consorting together apart from the rest. The cocks arrive a fortnight before the hens at the nesting-haunts, hence the name of *cœlebs* (bachelor) given to the species by Linnæus.

Hawfinch. The hawfinch group includes more strongly built finches, with very stout beaks, large heads, and comparatively short tails. The hawfinch (*Coccothraustes vulgaris*) is a denizen of forests where oaks and beeches are plentiful, although it does not by any means limit its residence to such trees, being often found among hawthorns or pines. Gardens and orchards likewise often afford shelter to this bird. Everywhere local on the Continent, the hawfinch in Germany is only found in certain districts, being abundant, for instance, in Brandenburg. In the British Isles it is also very local, though of late years it has greatly increased in numbers, and is by no means rare in the neighbourhood of London. It has been found as far north as Banff in Scotland, and ranges to about the same latitude in Sweden, while eastward it wanders as far as Lake Baikal. It is resident in Greece and Asia Minor, and on migration passes into northern Africa, returning to Europe in the middle of March. On the Continent, as in Britain, it is a resident species, reinforced in winter by migrants from the north.

The nest is flat and shallow with a wide fringe of twigs, always containing grey lichen, and lined with fine rootlets and hair. It is built, as a rule, in an old tree within 25 feet of the ground. Although the hawfinch feeds its young on caterpillars, the old birds eat the kernels of stone-fruit, and all sorts of seeds and berries, being particularly fond of green peas. The hawfinch does considerable damage to plum and cherry orchards, eating only the stones and spoiling the fleshy part of the fruit. With its powerful beak, which is proportionately stronger than that of most birds, it cracks the stones quite easily. When a flock of hawfinches are plundering a cherry-tree, they are quite silent about their work, nothing being heard save the cracking of the stones. In spring and summer these birds eat flying insects, and visit ploughed fields to pick up larvæ for their young, but, as a rule, they keep out of sight in the thickest foliage of the trees, being easily frightened by man.

Though rather awkward on the ground, they are quick and graceful in their movements among the branches. The hawfinch is distinguished by the remarkable shape of its middle primaries, which from the fifth to the ninth have a distinct prominent angle, opposite which are deep notches on the inner web.



THE HAWFINCH.

Tree Sparrow. The sparrows may likewise be regarded as members of the finch tribe, although their nests differ in construction from those of the more typical species. A sparrow's nest is never placed on open branches, neither is it ever of a perfect basin-shape, being generally built in some convenient hole,

or on any projection above the ground, and in no wise neat or attractive in appearance. In all these respects it is, indeed, the very opposite of the compact structure built by the chaffinch. Of the European kinds, the tree-sparrow (*Passer montanus*) is a bird of the open country, most at home among wooded hills, and choosing, as a rule, leafy woods near pastures, and ploughed fields containing plenty of hollow trees, especially willows, although also resorting to orchards and hedgerow-trees. At all seasons it may be seen in the fields in pairs, or larger parties, and in winter generally associating with other finches and yellow buntings in searching for seeds in farmyards and villages. The tree-sparrow is more of a migratory bird than the house-sparrow, from which it is distinguished by living principally on insects, in hunting for which it clings to the trees and examines the bark. It nests in the hollows of trees, especially willows, oaks, and alders, and shelters in rocky clefts, and, in autumn, among reeds. Sometimes it selects for a nesting-place the deserted abode of a vulture, eagle, or stork, as is often the case on the Danube between Pressburg and Orsova. The nests of both tree-sparrows and house-sparrows are placed at a considerable height, and both are built of the same material, and in the same disorderly way. They contain eggs two or three times a year, the first clutch being laid at the beginning of April. The tree-sparrow is a lively, good-looking bird, always on the move, wagging its head and its tail every now and then; quarrelling one minute with its fellows and making peace the next. Generally this bird is on good terms with buntings, larks, greenfinches, linnets, and others, although not with its cousin the house-sparrow. When arriving in flocks at a reed-bed, for a night's rest, tree-sparrows are in every way as noisy as house-sparrows in an avenue. The tree-sparrow ranges from Portugal in the south all over central and northern Europe, as well as the greater part of Asia as far as Japan, the Malay Peninsula, and Java. In the north it flourishes in higher latitudes than the house-sparrow, and in southern Europe is rarer than its relative, although in Germany the two are equally numerous. In China it replaces the house-sparrow in villages and towns, and the same may be said in Bulgaria and Servia. Abundant in Germany and Austria, it is not uncommon, though local, in the British Isles, where it is resident in the east of Ireland, along the whole eastern coast of Scotland up to Sutherlandshire, and in the eastern and midland counties of England.

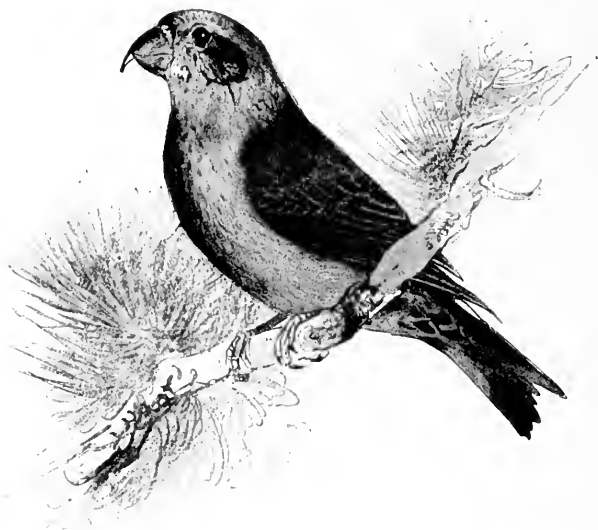
Crossbill.

In the crossbills the tips of the beak cross one another so as to form a most effectual instrument for opening the scales of pine-cones, and extracting the seeds which constitute the principal food of these curious birds. Crossbills are distributed over Europe, Asia, and North America, and everywhere simulate parrots in their movements, climbing about the trees and on the pine-cones with the help of their beaks, in the manner characteristic of those birds.

The crossbill (*Loxia curvirostra*) is found in all pine-forests, especially those abounding in Scots pines, the seeds of which are its principal food; and it always chooses for its residence localities where the pine seeds are particularly large; and in search of these it is continually moving about the country. Early in June and July these birds begin their wanderings in parties of from twenty to twenty-five;

large flocks being sometimes met with in forests where crossbills have not been seen for years. Crossbills migrate to southern Europe and the Atlas Range of northern Africa; and are distributed over northern and central Europe generally, from the stunted firs of the far north to the luxuriant pine-forests of France, Switzerland, and Greece, while they are also found over the greater part of northern Asia.

Although the parrot-crossbill (*L. pityopsittacus*) has the beak stronger, longer, and more arched, in other respects it so closely resembles *L. curvirostris* that it is generally treated as a variety and not as a distinct species. Its distribution is



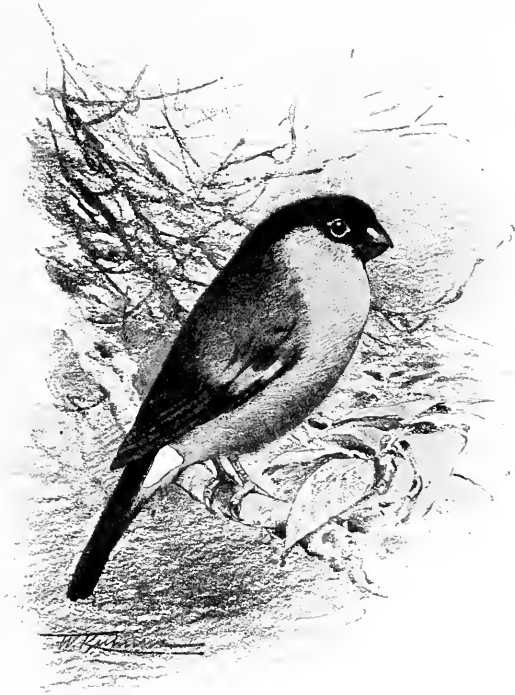
THE CROSSBILL.

much the same, but it is most numerous in northern Europe. In food and habits it is exactly similar.

Bullfinch.

The handsome bullfinch (*Pyrrhula europaea*) during summer is almost exclusively an inhabitant of the woods, either in the mountains or in the plains, and indeed never leaves trees and bushes except in case of need. On the Continent it is mostly found in dense mountain-forests, especially those containing a few pine-trees, but, above all, those abounding in beeches with clearings and grassy paths, or such as adjoin meadows and ploughed fields. Only when on migration does it frequent isolated trees. In England, gardens, especially those where there are plantations of gooseberries, are favourite haunts of the bullfinch, which is a quiet, peaceable bird, seldom fighting with its fellows, and

never with other species. It always appears to be in a good humour, hopping gracefully about amongst the branches, and sometimes hanging upside-down while seeking its food, which consists of nuts, seeds, berries, and insects. The cock accompanies his song, which is very simple and undeveloped, though rich and flute-like, by many singular antics. Both males and females sing, but the song of the male is much the louder. As is well known, bullfinches



A COCK BULLFINCH.

are trained to pipe certain tunes, and those that do this well are very valuable. They pair for life and are much attached to each other, and take great care of their young. Bullfinches generally nest in woods, although hardly ever where the trees are firs. The nest is built about 20 feet from the ground, and is excellently constructed and recognisable everywhere by its outer margin of interlaced twigs. The first clutch, which is laid in the beginning of May, contains five, rarely six, eggs, but the second, in the middle of June, not more than four. In autumn the bullfinch leaves its summer quarters to wander through the fields and woods,

always keeping to the same route. The bullfinches of the north travel long distances, their southward migration lasting from October until December, and the return to their nesting-haunts taking place in February and March. They travel in flocks of six to twelve, sometimes of twenty or thirty, consisting, strangely enough, sometimes of only male birds, and sometimes chiefly of females. The species has been divided into several races, among which is the large *P. vulgaris major*, inhabiting the east and north of Europe and central Asia, but often breeding in Pomerania and east Russia, and the typical western form, which nests in



SERIN FINCH AND NEST.

France, Switzerland, south-west and central Germany, and Austria-Hungary, but in most of those countries is never very abundant.

Serin Finch. Generally at home in the outskirts of a wood near fields and meadows, or in parks and enclosures near villages where there are plenty of trees, such as willows and alders, in the neighbourhood of rivers or any piece of water, the serin finch (*Serinus hortulanus*) ranges all over southern Europe, and is common in Algeria and Tunis. It appeared in south-western Germany, from its southern home, in the beginning of the last century, for in 1818 it was found, not only on the Rhine, but at Frankfort-on-the-Main. Seventeen

years later it appeared in Hanau, and in 1883 it was first seen in Würzburg. It is supposed to have arrived in Lorraine about 1830, then, following the course of the Moselle, it was recorded at Neuwied on the Rhine as a nesting-bird in 1857. From Hungary, where it was frequent, and from Vienna, where it has been abundant since 1879, it has migrated to Bavaria. In 1859 it appeared at Bensen on the Moldau; more than five years later it had advanced sixteen miles farther on to Budweis. In 1870 it was seen occasionally at Schandau in Saxon Switzerland, and also in the Bielagrunde. Eighteen years earlier it had been observed near Dresden, and in 1859 it had unsuccessfully tried to settle in the valley of the Elster. In 1871 a pair succeeded in nesting there; these were followed by another the next year, and in 1873 seven pairs were established near Gera. The serin entered upper Silesia along the line of the Danube, March, and Oder. At Breslau it was frequently seen in 1866, although twenty years earlier it was unknown there. In the Lausitz, solitary birds were seen in 1850; but from year to year they increased and invaded the adjoining parts of Saxony, and towards 1880 the serin reached Frankfort-on-the-Oder and Berlin.

The serin is a lively, merry bird, spending most of its time in trees, but hopping about on the ground with equal briskness, hunting for its food, which consists mainly of seeds, especially those of an oily or mealy nature. It nests in low fruit-trees, high bushes, and even in rose-bushes. The artistically interwoven nest is lined with hair, sometimes with feathers, occasionally only with willow catkins, and is generally built in the upper branches. At the beginning of May it contains four or five eggs, marked with red spots and blotches on a greenish grey or dirty white ground. After the second hatching several families associate together, and fly about the feeding-places until the time for migration. When nesting begins the male birds do everything possible to demonstrate their affection for their mates. They are most active on fine spring days, when they amuse themselves by a curious playful fluttering; and, when near the nest, sing in their peculiarly rapid and almost chirping manner, resembling the playing of a zither as well as the song of the grasshopper-warbler, although far merrier and less monotonous. When singing they stretch themselves almost flat on a branch, trill most energetically, bristle their neck-feathers, spread out the tail as much as possible, sway from side to side, flutter suddenly into the air, and then return to the same perch to continue their song. In Germany, if the winter be mild, many of these birds remain on the Rhine and Main, and in the south, where they inhabit the highest mountain-forests, they cannot be regarded as real birds-of-passage, since they only descend from the mountains to the warmer plains. From central Germany, however, they depart in families in the autumn, to return in spring, when they at once become noticeable by their lively chirping.

Goldfinch.

The haunts of the serin are usually also those of the goldfinch (*Carduelis elegans*), a handsomer bird of similar habits, with an inordinate preference for thistles, and distinguishable from its ally, apart from coloration, by the beak being nearly conical but slightly compressed with a sharp and slender point. The goldfinch's familiar haunt is the outer strip of a wide, open wood, in which the deciduous trees are of many kinds, and not particularly close

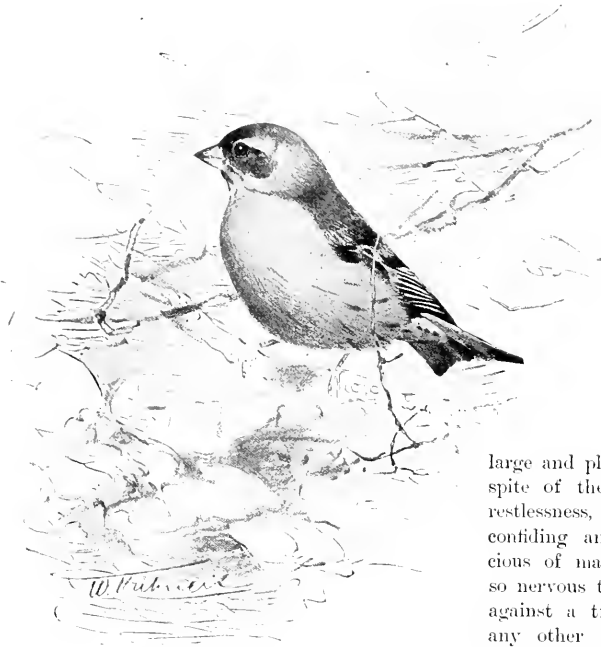
together; but the bird also frequents parks, avenues, and orchards, although it is never found in pine-forests. In England goldfinches often select commons for their haunts. Not unfrequently they resort to the neighbourhood of villages and towns, especially where there are plum-trees, from which they can visit the meadows and wastes, particularly those where thistles, burdock, and such-like plants thrive. The goldfinch, which towards the close of the winter is oftenest seen in poplars, aspens, alders, birches, and elms, always perches either on the outermost twigs of the tops of the trees, or on the summits of bushes and smaller plants. Brisk and restless, it climbs as easily as a tit, even head-downwards, about the branches, never remaining in one position for any length of time, and, when perching, spreading and turning its tail from side to side in a characteristic manner. It is somewhat awkward on the ground, and instead of hopping prefers to fly even for short distances. Its food consists chiefly of the seeds of thistles, but knap-weeds, groundsels, and docks are also laid under contribution. Since its food is mostly taken from the plant, and rarely sought on the ground, there is hardly any doubt as to the seeds on which this bird feeds.

The goldfinch sings nearly the whole year, diligently warbling its loud, sweet melody, which is not unlike that of the canary, from morn till eve. Whilst singing, the bird is almost incessantly on the move, turning now to the right now to the left, and continuing to sing as it flies from tree to tree, occasionally in a garden or among evergreens, and frequently on the fork of a fruit-tree. The song is valued by fanciers, in proportion to the number of times the syllable *fin*k is repeated. Goldfinches build at a moderate height on most kinds of trees. The nest, which is difficult to find, almost equals in beauty that of the chaffinch, but has no lichens on the outer surface, the materials being fine soft grass, moss and wool, interwoven with willow down. The eggs can hardly be distinguished from those of the linnet and greenfinch, except by their smaller size, and are distinguishable from those of the serin and siskin only when found in the nest. There are two broods in a year. At first the goldfinch feeds its young with the larvæ of insects but afterwards with seeds, which are softened in its own throat. A bird-of-passage, a partial migrant or a resident, it moves on to a warmer climate only when its food-plants are covered with snow, and, as a rule, keeps within a small area. Towards winter goldfinches fly about in small flocks of from ten to twenty, after forming themselves into large flocks at the beginning of autumn. In the south of Europe they are found in very large numbers. The distributional area extends throughout Europe, from central Sweden to the Mediterranean, and northern Africa, including the Canary Islands and Madeira, Algeria, Tunis, and Egypt, thence through Syria to Persia. The goldfinch has been introduced into Japan, North America, and New Zealand, and east of the Urals is represented by the larger and whiter *C. major*, and in southern Siberia by *C. caniceps*, which is whiter on the wing, but without any black on the crown and nape. The goldfinch is 4 inches long, ruddy brown above and white below; the wings are black, barred with gold and tipped with white; the tail is black tipped with white; the forehead scarlet and on the throat and cheek is a scarlet patch with a broad black edging. The sexes are alike, except that there is less red on the female's face.



GOLDFINCH.

Siskin. The siskin (*Chrysomitris spinus*), although closely related to the goldfinch, may be distinguished by its yellowish green plumage and black forehead. The feathers lie close to the body, the back part of which is swung to and fro as the bird calls and sings and climbs like a tit, sometimes with the body downwards, on the thinnest twigs of the trees, even on those of the weeping birch. Sometimes seen in mixed forests, it chiefly keeps to pine-woods, specially frequenting those situations where the seeds of the cones are



THE SISKIN.

large and plentiful. In spite of their extreme restlessness, siskins are confiding and unsuspecting of man, although so nervous that a blow against a tree-stem or any other unsuspected noise will disperse a small flock, which thereupon, with a continuous

cry, flies near to the ground, and then makes a wide curve in its ascent. Siskins always remain in company during the nesting-time, and are rarely seen alone, generally associating in large parties, or even in very large flocks. In addition to their favourite pine-seeds, they subsist largely on the seeds of other trees, while in summer they consume the larvae of insects, and in winter the seeds of the alder, birch, and elm. When picking out the seeds from conifers, they may be observed to frequently whet their beaks, owing to the resin with which they become coated. In the pairing-season, their lively, chirping song,

which towards the finish sounds like a stocking-frame at work, is sung on the wing during the curious, bat-like flight. Breeding begins in April, the nest being built on some tall conifer; firs are preferred to pines, and those are chosen that grow near water, the nest being generally placed at the end of a long lateral branch, rarely less than 30 feet from the ground, and often twice or thrice as high. Unless its position is betrayed by the courting flight of the male bird, the nest is very difficult to find. There are two broods in the year; the young are fed at first with a pasty matter obtained from small, soft insects, and afterwards with seeds which the parents soften in their throats and then disgorge. Later on they are taken to the woods and taught to catch insects for themselves. The siskin generally breeds in the northern districts of its range, which extends over the whole of Europe and northern Asia to the far east. In Europe it breeds up to the limit of the fir-forests, and in winter migrates to the Mediterranean countries, including even the Grecian Archipelago. In France these birds appear at the time of vintage, and leave again when the trees bud. Never remaining long in any place where there is want of food, the siskin commences to migrate in August, and in March and April settles down again in its nesting-place. It is about $4\frac{1}{2}$ inches long, and may be recognised by the yellow bases of the five outermost tail-feathers, as well as by the blackish streaks on the flanks, and the two irregular yellow wing-bars due to the yellow-tipped wing-coverts, and likewise by all the primaries being yellow on the inner webs, those from the fourth to the last but one having yellow bases.

Linnet.

The linnet (*Linota cannabina*) avoids the shady depths of the forest, preferring the borders, and particularly those places where young conifers abound, but also resorting to thorn-bushes bordering cornfields and meadows, tree-plantations with underwood and hedges, as well as enclosures with a few trees, and currant and gooseberry bushes. On the Continent it is found in Württemberg in hilly districts; in Holland often on islands in the sea, on which a few bushes grow, and sometimes also in quarries, provided there are at least a few trees and bushes; while in England it occurs everywhere among gorse, and during autumn and winter near the sea, and wherever there are stubble-fields. From their nesting-places, which are screened more or less by trees and bushes, linnets journey to the open fields to feed, sometimes to a great distance, and in autumn flock with others of their kind arriving from their migrations. The linnet is an active, companionable bird, which in the daytime perches openly on the tops of bushes and trees or in conspicuous positions; it hops about on the ground in rapid jumps, carrying its breast very high, and is always on good terms with its kindred.

Linnets feed on soft seeds, especially flax and hemp and other small kinds containing oil, but do not despise berries and the tender shoots of young plants. The song, which is strong, characteristic, and continuous, and may be heard almost throughout the year, even in winter when there is a little sunshine, frequently contains selections from the melodies of other birds, which make the linnet so popular in captivity. Linnets pair for life, seeking in March a nesting-place, if possible the same they occupied the previous year. The nest may be in a variety of situations, such as at the edge of a mountain-forest, among

firs, pines, junipers, hawthorns, blackthorn, gorse, or currant and gooseberry bushes, in hedges, among climbing plants and vines, or on low lime-trees, dwarf chestnuts, or beeches, in quickset hedges, and even in peat-stacks. In Holland sandy situations, such as the sandhills of Ameland, are selected. The nest may sometimes contain eggs so early as the end of March, and is always full in April, and a second time at the end of May or in June. The young are fed from the parental



THE LINNET.

gullet, in which the food, which has often to be brought from the fields at a great distance, is softened. When the young birds are a little older, the parents leave the nest, but perch alongside, the cock first flying to the young and feeding them one after another, after which he is relieved by his partner in this duty. For a time the two parent birds sit quiet on their perches, after which they hurry forth again to the fields to obtain food. The young in no way betray their presence in the nest, and the old birds, when suspicious that they are being watched, remain away for a long time, but occasionally call to their offspring in

a soft and almost plaintive manner. From October to March linnets travel in large numbers from one feeding-district to another, and migrating flocks are sometimes seen in cold, snowy seasons. In winter they sometimes journey to Egypt and Abyssinia, but more frequently visit north-west Africa, where flocks of these birds pass through Tunis and Algeria. In the Canaries the species is a nesting



THE GREENFINCH.

and resident bird; and it also nests throughout Europe as far north as central Sweden, and eastwards to Asia Minor and the Caspian. On the Continent linnets are well known in Germany and Switzerland, and in certain parts are even frequent nesting-birds. In Denmark they often live in districts similar to those they frequent in Holland, but in the south of France, Italy, and Greece they choose wooded heights and headlands. In length the linnet measures nearly 6 inches. During the breeding-season the cocks display conspicuous patches of red feathers on the breast and head. The primary quills have white outer edges which

form a long wing-bar, and the tail-feathers are edged with white on both webs, broadly so on the inner web.

Greenfinch.

The familiar greenfinch (*Ligurinus chloris*) approximates to the hawfinch in the form and stoutness of its beak, although this is not so large as in the latter. Unlike the hawfinch, its plumage is green, and it has neither notches nor hooks to the wing-feathers. The favourite tree of the greenfinch seems to be the pollard willow, if we may judge by the frequency with which it is found among the strips of woodland along the banks of rivers: and it always shuns large gloomy forests, especially pine and fir woods. When perching in trees, this bird rarely ascends high, keeping to the middle branches; and it is at all times remarkably quiet.

Living, as a rule, in quiet and concealment, the cock greenfinch, as the pairing-season approaches, becomes noticeable on account of his incessant singing and remarkable courting flight. With wings raised high, he flies upwards in a sloping direction, describing several circles in the air before returning to his perch. As he rises he sings; the twittering song consisting of a few original notes and several imitations. Greenfinches often nest in company; they are almost as gregarious as sparrows, and do not quarrel with others of their kind on account of their nesting-places. The nest, which is built in all sorts of bushes and trees at a height of from 5 to 20 feet from the ground, sometimes contains eggs so early as the first half of April. In some districts a second brood follows in July. The young are at first fed on insects and their larvæ, and later on have a course of berries before taking to their full diet of seeds. Seeds, berries, and buds constitute, with other substances, the food of the greenfinch, which is picked from the ground as well as from the plants themselves; the favourite seed being that of the hemp. Although in Germany and certain other parts of the Continent the greenfinch is mainly a bird-of-passage, departing in autumn to warmer climes, yet some individuals may be seen throughout the year, while in winter others probably arrive from the north. Large flocks migrate to the coasts of the Mediterranean and north-west Africa. The range of the greenfinch includes the whole of Europe, Asia Minor, Persia, Turkestan, and Siberia to about long. 70° E. In Scandinavia it nests up to about 65° N. It is found in all the British Isles, even in the Orkneys, the residents being reinforced from the east every autumn, and from the south every autumn and spring: the migrants are invariably of a brighter colour than the native birds.

Yellow Bunting. Less familiar than the finches are many members of the bunting group, all of which are characterised by the peculiar gap in the beak. For the most part denizens of the temperate and colder regions of the Eastern Hemisphere, buntings spend most of their time on the ground, and build their nests in low bushes, laying therein faintly scribbled eggs. The species best known in Europe, the yellow bunting (*Emberiza citrinella*), is found in wooded and bushy districts near water, in enclosures and gardens, woods on headlands, willow-plantations, river-banks and tall hedges, especially in the proximity of cornfields, and particularly fields of oats. It ranges all over Europe, up to the Arctic Circle and beyond, and as high as the tree-line in the Alps, everywhere avoiding bare heaths, old timber-forests, and reedy ponds. In the autumn these birds are met with in flocks on ploughed fields; and during snow they will come into the villages, to leave them as soon as a thaw sets in. Except in breeding-time, they are often seen in the company of other buntings, sparrows, hawfinches, crested larks, crows, and jackdaws; and at all times they have a remarkable attachment to the fieldfare. In summer, insects and their larvæ, in winter, berries and seeds, form the food of the yellow bunting. The nest, the situation of which the cock-bird reveals by his perpetual singing, is made on the ground, in a shrub, in long grass, underneath clods, stones, or in some such shelter. In April and June, and sometimes even as late as August, the eggs may be found. Except in southern Italy, the yellow bunting nests all over Europe. The song of this species is not

unlike that of the other buntings, and has been written down as "a little bit of bread and no cheese," with an accent and drawl on the two last words: in every European language it has been rendered by some phrase having the same number of syllables and the same arrangement of emphasis. Characteristic also are the strange dances of the cocks, during which they bristle up the head-feathers into a crest, inflate and writhe the throat, raise their wings, and move about in a circle, hopping, jumping, and stepping.

Ortolan. The ortolan (*E. hortulana*), a quiet, unobtrusive, and plaintive-voiced bird, inhabits woodland borders, low bushes, and hedges in meadows and fields, overgrown gardens, thick forests with thin brushwood, often even sandy fields that are not absolutely bare of trees, but by preference localities near water, although never the actual marsh or swamp. Ranging over Europe up to the Arctic Circle and all over central Asia, it migrates to north Africa, appearing in Germany only in certain districts, such as the lower Elbe, the Luneburg heath, the plains of Silesia, and Westphalia. It nests in shallow holes, and well-hidden places covered by coarse herbage, and often in cornfields, after the manner of larks. The yellow ring round the eye, the cinnamon breast, and the outer pair of tail-feathers with a long, white, wedge-shaped spot reaching to the middle of the inner web, afford characters by which this bunting may be identified at a glance.

Tree-Pipit. To recognise the members of the widely extended group of pipits it may be noticed that the hind-claw is more or less elongated, and the plumage plain in colour, the upper-parts having dark streaks or spots on an olive or yellowish brown ground, while the lower-parts are white or cream-colour with black lines; the throat being occasionally reddish brown. Our first representative is the tree-pipit (*Anthus trivialis*), which is essentially a bird of the forest, particularly of neglected woods with few trees and undergrowth and sunny glades. Here it perches on trees, even the highest, although more often found on the ground, where it shelters at night. Instead of hopping when in the trees, this pipit flutters from bough to bough, or runs along them. Using trees chiefly as a resting-place and a refuge in case of danger, it hurries to them when surprised, even though they be at a distance, making its way carefully through the high grass or other plants so as to keep out of sight as long as possible. In place of seeds, the tree-pipit lives entirely on insects; and its nest which, if not artistically, is at least carefully built, is hidden away in grass, heath, or herbage, and contains eggs in the first half of May. The tree-pipit is a summer-migrant, arriving in the beginning of April, and leaving in August or September. As a nesting-bird it is found in Europe for some distance beyond the Arctic Circle, and in Asia up to 62° N. in the valley of the Yenesei. It winters in Africa, the Canaries, and western and north-western India, but is not found in Asia east of the Yenesei, where it is replaced by *A. maculatus*, which winters in India and Burma. It is distinguished from the other pipits, not only by its plumage but by the claw of the hind-toe being much curved and shorter than the toe itself.

Woodlark. The larks are at first sight not unlike the pipits, from which they may be distinguished by the presence of large shield-like plates on both the back and front aspects of the lower segment of the leg. Their



YELLOW BUNTING

wings are generally large and pointed, with the first primary, when this is present, always short. The general colour of their plumage is brown above and lighter and whiter below, with darker lines and spots which in some cases are black; one species being entirely black. They are ground-birds, keeping mostly to dry fields, and walking instead of hopping. The cocks may be distinguished by the fact that when singing they soar almost perpendicularly in the air, and then, with folded wings, drop to the earth. Insects, green plants, and seeds form the food; and the nest is placed on the ground.

Among the numerous representatives of this mainly Old World group is the woodlark (*Lullula arborea*), whose home is in forests and heathy districts, with a dry, sandy soil and but few plants, and barren hills and slopes and uncultivated fields. It prefers evergreen to deciduous trees, and is never found in river-side woodlands. Although called the woodlark, and appropriately so in many countries, in some parts of central Europe this bird keeps mostly to the ground, and only rarely visits trees, into the leafy tops of which it never ascends. The nest is on the ground generally in a hole amid low bushes, especially in a forest-glade or on the outskirts of a wood; and may contain eggs in the first half of April and a second time in June. The woodlark lives on insects, seeds, and tender herbage; and although difficult to detect when on the ground, is easily recognised in the air on account of the shortness of its tail. Its slow, trilling, and soothing song consists of uneven, fragmentary bars, following quickly one on the other, and each containing an equal number of syllables. On account of its peculiar charms, many fanciers consider the song of the woodlark superior to that of any other song-bird. The song may be uttered from the top of a tree or in the air: in the latter case, the bird only commences to sing when at a considerable height, and, throwing itself from side to side, continues its upward flight without intermission, sometimes swaying in the air, its tail outspread and its wings motionless; then, having finished its song, it closes its wings and falls like a stone to the ground. Arriving in central Europe in March, or, if the weather be favourable, a little earlier, the woodlark leaves at the end of September or in October. It ranges as far north in Europe as central Sweden, but eastwards only so far as Persia, although in the east, and even in the Lebanon, it is often found in great numbers. In England it is resident and a local migrant, in Ireland resident, in Scotland a migrant only. In Greece it is partly resident and partly a winter bird, as it is along the northern coasts of the Mediterranean, though a few cross over to Africa.



CONVOLVULUS HAWK MOTH.

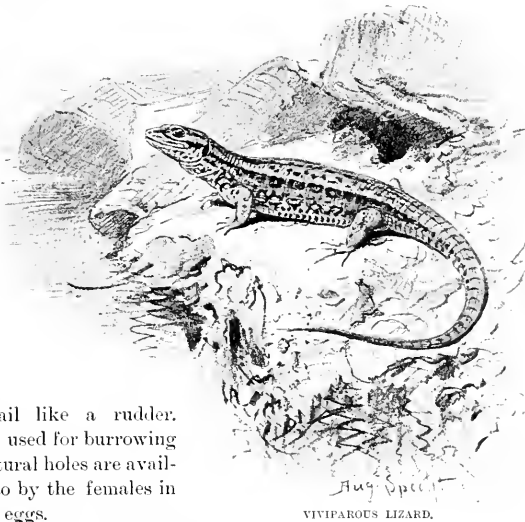
CHAPTER III

OTHER DENIZENS OF THE WOODS

CENTRAL Europe is badly off for reptiles, but of these few species, some at least may be found at times among bushes, and often dwell, though never exclusively, in forests. As the distinctive features of both reptiles and amphibians are given in works devoted more exclusively to the classification of animals, they need not be referred to on this occasion. Neither need we stay to consider the groups into which these cold-blooded creatures are divided. It is perhaps also superfluous to refer to the characteristics of lizards, although it may be well to mention that these reptiles have long cylindrical bodies, with scales on the back and sides, and rows of cross-scales along the under-parts. The head is distinct from the throat, with larger scales on the upper side; and the tail is generally longer than the rest of the body, but becomes thinner towards the tip, and has scales arranged in a distinctive manner. Lizards typically possess five toes to each limb, while the hind-limbs have a line of pores on the under side of the upper part of the thigh.

The habits of the European species of lizards are in many respects very similar. Every lizard seems to have its special hole; and for the winter sleep, which commences at the end of September or beginning of October, each withdraws to its own hiding-place. At this time they lose their activity, which they recover when awakened by the warmth of spring. Soon after they awaken, the pairing-season commences, concurrently with the fights of the males, which are as jealous as they are quarrelsome. Not quite two months later the female produces her young, or else lays eggs which are whitish and have shells that are soft when

fresh, but soon harden and whiten in the air. Generally she chooses a spot where moisture as well as the sun's warmth can reach the eggs, which are always covered, although never incubated. In summer these lizards seek shelter from the sun, and in many cases are seldom seen again until towards the autumn. Nevertheless, warmth and sunshine are necessary to their well-being, and when the morning sun has absorbed the dew, they come forth as if to gather its rays: as the sun moves they follow the sweep of its rays so as to keep out of the shade, and only when the heat becomes too great do they change their places. After basking in the sun, they go in search of food. On land, they use legs, tail, and abdominal muscles; when swimming, the body moves like that of a snake, the limbs acting like



VIVIPAROUS LIZARD.

oars, the tail like a rudder. The legs are used for burrowing when no natural holes are available, and also by the females in hiding their eggs.

Of the senses of the lizard, sight comes first, although hearing is also good. If one of these reptiles desire to examine its immediate surroundings, the sense of touch is resorted to by means of the tongue. Taste is more developed than smell. Lizards apparently know how to benefit by experience, and accommodate themselves to circumstances; and their sense of locality seems to be well developed. Their proper food consists of insects and worms. They will follow the movements of a caterpillar for some time before pouncing upon it, but steal up to grasshoppers, which they capture with a sudden jump. In spring and summer they are always ready for food, and they also require a daily drink and bath.

Viviparous Lizards. The species most frequently found in the forests, as well as elsewhere, is the viviparous lizard (*Lacerta vivipara*), which has a slender, delicately built body, a fine somewhat flattened head, and a tail of about the length of the body, and rather thick up to the middle, whence it tapers to the

tip. The range of this species extends from Lapland to north Italy, and from Ireland to the borders of the Pacific: it is also found in the central and southern districts of Russia but does not seem to go south of the Pyrenees. On the Continent it is not so well known as the sand-lizard, since it keeps to certain localities and situations, as, for instance, the higher mountain-ranges, and marshy spots in woods and meadows. It likes the wilderness, where it seeks shelter beneath low bushes, moss, roots, the bark of tree-stumps, fallen cones, or stones. In the mountains of central Germany it ranges to the crests, while in the Alps it ascends to the highest forests, and sometimes even beyond the snow-line. In the Bavarian and Tyrolean Alps, this lizard has been found at a height of 6500 to 7250 feet, on Mont Blanc as high as 9000 feet, and once, near the Wormser, at an elevation which is covered with snow during nine months, and where an insect rarely strays. Indeed, of all European reptiles this species ranges farthest north, and ascends highest up the mountains. It appears as soon as sunshine follows rain; in captivity it shows its liking for water by sitting for hours in a bath, and when at liberty crosses pools and ditches, and takes to the water when in danger. In small streams it has been observed to dive suddenly, and swim or crawl to a familiar hole beneath the surface, through which it tries to reach dry ground. In spring it leaves its winter haunt sooner than the sand-lizard, but nevertheless cannot exist without sunshine, and not only keeps among moss and shrubs out of the shade, but in autumn and spring climbs up tree-trunks to get all the sun it can. In general habits it is quiet and inoffensive, making no attempt to defend itself when caught, but trying to escape as soon as possible. It is by no means difficult to catch, although it finds good covert in tall grass, and adroitly slips along between the stems. The earth-coloured skin preserves it from its enemies, at least when it is among dark-coloured leaves and fir-cones. It is a voracious feeder, disposing in a surprisingly rapid manner of worms of any size, which, with millipedes and insect larvæ, for which it will go into the water, form its principal food.

This lizard is distinguished from its kindred by bringing forth living young which are enclosed in an egg-shell for a few seconds only. The young are born sometimes at the end of June, sometimes not till September. They are described as charming pets, some kept alive by a collector being fed on aphides, of which they seemed very fond.

Sand Lizard.

Perhaps the best known species is the sand-lizard (*Lacerta agilis*), which is found throughout the greater part of the Continent its range extending from the north German lowlands northwards to Denmark, westwards to the Netherlands, and eastwards to the Russian plains. In England it occurs only in the southern counties, and it is never seen in Scotland or Ireland. It is seldom found in Belgium, although frequent in Luxemburg; and, with the exception of a few southern districts, inhabits the whole of France, but is not found south of the Pyrenees or the central Alps. In the Tyrol it is confined to the northern districts, and in Switzerland it has not yet been detected in the south Grisons, nor in the cantons of Ticino or Valais; in the countries south of the Danube it has only been noticed in Bosnia. Frequenting all the Russian coasts of the Black Sea, this species also ranges from European Russia into western Siberia.

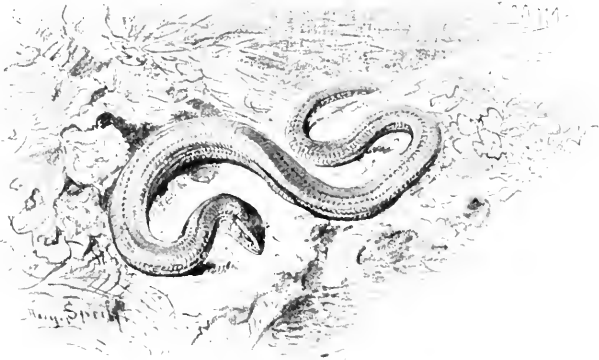
Although the sand-lizard is found alike in plains, hilly districts, and mountains, it seems to prefer low-lying ground, but avoids damp places; and it is also absent from dense forests, marshy meadows with tall grass, and peaty moors, as well as bare, stony hillsides, and cliffs—in fact, all hard ground. The sunny slopes, with scattered stone-heaps, or the rugged country roads, are as much its home as the skirts of the forest, the open woods, the upper part of river-valleys, sandy and sunny heaths, and forest-glades. Moreover, among its haunts may be mentioned sand-hills covered with sheep's-bit, fleabane and other sand-plants, the walls of vineyards and other enclosures, hedges, and dunes overgrown with sand-grass.

The sand-lizard is by no means fond of climbing, its limbs being mainly adapted for running on flat ground, and slipping through dry grass and herbage, and among hedges, bushes, and stones. If by chance it gets into the water, it swims well, in a serpentine way, but does not keep long afloat. When pursued, it can move quickly, but if caught, or in immediate danger, turns to defend itself, either opening its mouth threateningly, or actually biting, sometimes with so firm a grip as to remain hanging to its assailant. The males fight with exceptional courage against their greatest enemy, the viper, although they generally have to succumb.

During its winter-sleep the sand-lizard hides in holes in the ground, and hollows beneath stumps of trees. According to the locality, and the mildness or otherwise of the weather, it awakes from its winter-sleep between the middle of March and the middle of April. In June or July it lays from five to fourteen eggs, which are about $\frac{1}{2}$ inch long and $\frac{3}{8}$ inch broad. The young appear eight weeks later, in August or September, and live at first on aphides, flies, and other small insects.

So far as its haunts are concerned, the blindworm (*Anguis fragilis*) is intermediate between the viviparous and the sand-lizard. It ranges over a greater area than any other European lizard, occurring not only in Europe but in Algeria and Palestine. So far as is known at present, it ranges west to the Atlantic, east to Tehran, south to the Sahara, and north nearly to the Arctic Circle. It lives on rich vegetable soil as well as on poor slopes, on heavy moorland, and on light sandy ground: it is found alike in open fertile valleys, on mountain-ridges and bushy hillsides, on grassy meadows, on dry land, and near water, above and beneath the moss-covered ground of the woodlands, on the roadways of sandy, light fir-woods, on waste lands, and in the gardens of outlying villages, or even in cemeteries. But it prefers grass-grown and bushy or wooded spots, where holes, roots, large stones, and possibly ant-heaps afford shelter, as it generally hides when the weather is very hot or windy. Disliking excessive dryness, it is fond of warm, humid air, and also—though not in so great a degree as the viviparous lizard—of damp haunts and hiding-places, but avoids arid slopes and hillsides that have no shade. In the summer it appears early in the morning and towards evening, and when heat is followed by rain goes about during the day. The actual active life of the blindworm commences between the 10th and 15th April, and ceases in the first half of October. During the winter

this reptile lives in holes, which it burrows in the ground; it requires less sun than other lizards, although fond of sunning itself from time to time, and often coming to the surface before rain. When resting outside its hole, it remains motionless, and this habit, in conjunction with its brown, earthy colour, renders it difficult of detection, except by a practised eye, especially if only the head peeps out of the hiding-place. If an attempt be made to drag it out, it pushes itself with surprising force against the sides of its hole: and would sooner be torn to pieces than yield. In other ways it proves to be remarkably strong. When in the grip of a viper, for instance, if it succeed in attaching its tail to a plant or other object, it often gives the snake trouble for hours. Blindworms are also inclined to intertwine with one another. When alone, of course, they lie flat on the ground, while the comparatively small eyes keep a sharp lookout on what goes on in the vicinity, for blindworms are undeservedly so called; next to hearing, sight being one of



THE BLINDWORM.

their best developed senses. When an enemy approaches, blindworms withdraw to their hiding-places. Tame ones do not, however, thus withdraw, but occasionally will even come out of their holes when a slight noise indicates the time for feeding.

They behave in many ways quite differently from the true lizards, their movements being somewhat slow, and rather awkward and stiff, although this is probably due in some measure to the character of their scaly coat. Blindworms can only move in wide curves, thus rendering their progress on flat ground so slow that they can easily be followed at a moderate pace. But if they get into water, which, by the way, they endeavour to avoid, they swim rather fast, with their heads above the surface. Although not hard to catch, they must not be taken by the tail, which easily breaks off, and frequently gets lost through the violent struggles of the animal: it is an exception for them to bite the hand, but, when they do, they do not readily let go. Naturally, they cannot do much damage with their feeble teeth: blindworms, in fact, are very harmless, and feed on comparatively sluggish animals, such as worms, smooth caterpillars, and slugs. On sighting a

worm, they approach it slowly, so as to consider it attentively by turning their head to one side. The head is then slightly raised, the jaws lazily distended, and the prey borne down upon with moderate rapidity. The worm is next seized about the middle, pressed to the ground so as to grip it securely, after which it is swallowed. This process—occupying a space of from five to twenty minutes—accomplished, the blindworm wipes the edges of the jaws on moss or other suitable substance and seeks repose.

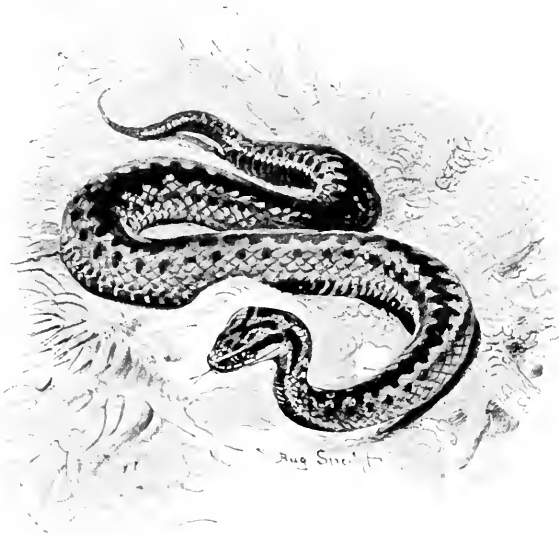
Viper. To their elongated body and the great suppleness of their vertebral column and their ribs, the serpents owe their remarkable activity and the security of their movements on the ground, on branches, and in the water. The working of the numerous muscles finds external expression in the horizontal winding curves in which the body moves. At the same time the ribs execute movements, which are perhaps best compared with those of the legs of the millipedes. Nevertheless, a snake has to advance in a serpentine way, and cannot move forward very rapidly. No snake can jump, properly speaking; on the other hand, some are excellent climbers, and others very good swimmers, while many can burrow into the ground.

European snakes, as is the case with most members of the group, take no particular care of their eggs, which are deposited under moss, stones, and manure-heaps, and in hollows in the ground, or elsewhere, and are from the first left to themselves. Their food consists of small living vertebrates, the mode of capture depending on the species of the snake. When the prey is near enough to be attacked, it receives its death-wound by a sudden forward thrust of the serpent's head, and a single rapid incision of the venomous fangs, but it is not gripped, and is not eaten until dead. In other cases the serpent strikes rapidly and unexpectedly with its fangs, releasing its hold again almost immediately as it winds itself round the body, and devouring it after a shorter or longer interval. While the glands secrete large quantities of saliva, which assist the snake to swallow its food, the teeth, moving with the sides of the head alternately forward, advance further and further, so that to a certain extent the jaws and throat gradually extend over the victim. Once the prey passes the entrance to the throat, it is crushed, elongated, and drawn down into the stomach by the movements of the muscular alimentary canal, where it is slowly and almost completely digested, even the bones, although not the feathers, hair, and the like, being consumed. Under normal conditions snakes partake of large quantities at a meal, and fast for a considerable period afterwards; they can also do without water for a long time. When drinking, they dip the front of the head up to the eyes in water, which they draw in without a stop. Most snakes also require water for promoting the action of the skin, especially before it is changed.

In addition to being able to do without food and water for a considerable time, snakes generally seem to have a strong hold on life, for which reason they often succumb to wounds and injuries only after a long interval; but they are subject to fatal diseases, especially when in captivity. Some also suffer through parasites, but their chief enemies are birds and mammals, the worst foe being man himself who often credits them with greater powers than they really possess. Towards their

enemies snakes are cautious and timorous; a suspicious noise drives them into their hiding-places. If they have not time to reach these, they will often endeavour to frighten their would-be captors by curling themselves up, swelling, and hissing loudly. Wherever climate permits, snakes are to be found all the world over. On the whole, however, they like warmth, and in colder districts hibernate. Most are fond of the daylight, and withdraw to their haunts at sunset, only to appear again the next morning; some, however, are by no means partial to the rays of the mid-day sun.

Of the snakes of central Europe two agree with the two most familiar



THE VIPER.

European lizards in regard to the situations where they are found. In this respect the viper (*Vipera berus*), the only real European venomous serpent, is very like the viviparous lizard. This species is distinguished by having from twenty-one to thirty-seven rows of strongly keeled scales along its body, two cross-rows of scales on the under side of the tail, and either one or two rows of small scales lengthwise between its eye and the scales of the upper lip. The body is strongly developed in the centre, and the tail rapidly tapers towards the point, being, like the thick-set trunk, very short. In length the viper has been known to reach $27\frac{1}{2}$ inches, but on the Continent rarely exceeds 20, the size of the females being shorter by one quarter. It has twenty-one rows of scales along the body,

and the ground-colour of the upper-parts is light yellowish brown, with or without a tinge of green, varying through every gradation of shade to very dark brown. A darker zig-zag band, which may occasionally change into spots, commences at the back of the head, and runs down the centre of the back, while there is a line of dark spots on each side. The upper side of the head generally shows eight dark spots; the ground-colour of the under side is dark grey, rarely black, or very light brownish yellow, and marked as a rule by several yellow spots on each shield. The lighter coloured vipers are sometimes known as copper-adders: some are quite black, when they are termed devil's adders. Of all land snakes the viper has by far the widest range, being found from the coasts of the Atlantic to those of the Pacific, and from the 41st or 42nd parallel of north latitude in the south to the Arctic Circle in the north, although in certain districts within this area it does not occur at all, and in others is but rarely seen. In Germany, for instance, it is absent from the Odenwald and the southern portion of the Grand Duchy of Hesse, as well as from Alsace, the Palatinate, Upper Hesse, Birkenfeld, and Rhenish Prussia; it is likewise not met with in parts of Hesse-Nassau and Westphalia, nor in several districts of Thuringia; while, among other places in the Hartz, it is unknown on the Brocken; and in Brandenburg, apart from the environs of Berlin, it occurs only in a few isolated spots. In the Saxon plains it is fairly numerous, though absent from some localities; it is more evenly distributed over Hanover, although there, as in Schleswig-Holstein, it is not found on the moors; and it is similarly distributed in the neighbourhood of Bremen as well as in the Grand Duchy of Oldenburg.

In the same manner that the viper follows the viviparous lizard farthest north, it also ascends next highest on the mountains; in the mountains of central Germany reaching to the crests, while in several Swiss localities it ranges up to about 9000 feet, and in the Tyrol to almost 8000 feet. In such situations the viper pays little regard to the nature of the ground, whereas in the plains it prefers marsh and peat to bare sand and clay. Nevertheless, even in the plains, it will leave its favourite marshy and peaty haunts, alternating here and there with hills overgrown with low bilberry and cranberry bushes and moss, and wooded, at least on the borders, with alder, birch, and other trees, to visit sandy situations among meadows and fir-trees. It is also found in the grassy steppes of Russia. As a rule, it avoids districts where the smooth maple grows, and often appears in places to which it was previously a stranger, while at times it disappears from many districts only to reappear again.

When a solitary viper appears in a district in which it has previously been unknown to exist, the cause may often be found in an inadvertent transportation in brushwood, etc., from woods, as this snake often crawls beneath piles of wood and bark, moss and heath, hay-stacks and corn-sheaves, although mouse-holes and mole-burrows, stone-heaps, or rotten tree-stumps, clefts in rocks, or hollows beneath the undergrowth are its actual haunts. In such hiding-places these snakes sleep through the winter; the general duration of their slumber being from the end of September or the beginning of October, till the end of March or early part of April. The slumber does not appear, however, to be very sound,

as a few sunny days in December or January will often entice the vipers out of their hiding-places. The food of the viper consists chiefly of field-mice, which, as well as their young, are often sought in their holes. The viper also eats shrew-mice, young moles, nestlings, especially the young of ground-birds, such as yellow buntings and pipits, and occasionally frogs, blindworms, lizards, and even weasels and salamanders. In warm weather it feeds at dusk, and occasionally during the night, but at other seasons in the daytime; in the mountains always in the daylight. It is thus to a great extent diurnal in the hills, and more of a crepuscular or nocturnal animal in the plains. Everywhere it enjoys the rays of the sun, in search of which it will mount low bushes. For this reason it is necessary to be prepared, where vipers abound, to meet them on and beneath brushwood, in moss and grass, or by the sides of walks and footpaths. The viper does not always disclose its presence by hissing, nor does it always crawl away. If any one approach too near, it draws its head back in order to thrust it swiftly forward and bite, sometimes, according to circumstances, rapidly repeating the operation. The bite of the viper is justly regarded as dangerous, although in most cases it is not fatal. Apart from blood-serum, the best antidote seems to be copious, even excessive, drinking of alcohol, combined with uninterrupted movement, maintained, if necessary, with the help of others.

The pairing-time of the viper is generally in April and the beginning of May. In the daytime (and sometimes also at night) single couples may be found on sunny spots, which are sometimes joined by others, until they form a heap or tangled mass. About four months later—generally in August or September—the female brings forth from five to twelve, rarely thirteen to sixteen, but sometimes only three to four young. These are from $5\frac{1}{2}$ to $8\frac{1}{2}$ inches long, and at once break through their covering, cast their skins, and immediately make use of their dangerous fangs. Among mammals, the hedgehog is one of the chief natural enemies of the viper, but it is as little secure against poison as the others, being in reality, like other enemies of snakes, protected only by its covering and dexterity.

Smooth Snake. The smooth snake (*Coronella austriaca*), which represents quite a different family, has no poison-fangs and only nineteen rows of scales, and may, exceptionally, be as much as 30 inches long. It includes many varieties, and is one of the most common and widely distributed of the European species, being found, like the viper, not only in Britain, where it is rare, but over most of the Continent. Besides Germany, it is met with in Holland, Belgium, France, Switzerland, Austria-Hungary, Bosnia, Servia, northern Greece, and probably in other parts of the Balkan Peninsula; in Denmark, Sweden, Norway, and Russia; as well as in lower Egypt, Syria, Palestine, and apparently still farther east.

On the Continent it is the snake of the lower mountains and hills; being as much at home in their open, bushy, boulder-covered heights and declivities, as on river-banks, hill-slopes, sand-hills, and in gardens and other enclosures. It is found in similar haunts on the plains, but, as in the mountains, is absent from bare, cold plateaus, gloomy fir-woods, moors covered with moss and marsh-plants, and shady glens and watery hollows. It therefore avoids just such places as the

viper likes, and as a rule the two species keep apart when they live in the same districts. In the mountains the smooth snake prefers the lower levels to the rocky heights and peaks and is, therefore, absent from the Hartz and the barren parts of other mountains. In the Raube Alp it ascends to a height of 2500 feet, in Baden to 3300 feet, in central Switzerland to 2600 feet, in the Tyrol and Swiss Alps to 4200 feet (sometimes even to 6600 feet), and in the Caucasus to a similar height. In the choice of its haunts it resembles the sand-lizard, while the viper shares the domain of the viviparous lizard.

The smooth snake keeps to its dwelling-place, and enters on few distant migrations or excursions; its progress, retreat, and defence being alike slow. If its refuge—a hole in the ground or a stone-heap—be not at hand, it takes no trouble to endeavour to escape, but prepares to defend itself, coiling up flat or in spirals, puffing out threateningly, and biting furiously right and left. As a matter of fact, this snake seeks concealment from its numerous enemies, as well as from its victims; and only when it lights upon its prey, or is seized, does it develop greater vivacity. When taken from the ground, it curls around the hand as quickly and as often as possible, in order to fasten its teeth into the nearest object. The warmer the air, the more excited, angry, and violent is the snake. In fits of ill-temper it will sometimes bite other members of its own kind, while occasionally in excitement or blind fury it even bites itself. The bite of the feeble teeth inflicts, however, little or no hurt on either man or beast, unless it be in gripping the animals that serve as food; its food proper consisting of small lizards and blindworms, and exceptionally of field-mice, shrew-mice, and small snakes.

This snake usually seizes its prey with the jaws, winding its body round the victim in three coils as quick as lightning, so as to crush it, or, if it be a quadruped, to prevent its using its legs. Soon, although at times only after some minutes, the snake, keeping free at least a third of its body, dashes suddenly down on the head of the victim protruding from the coils, stretches its open mouth around it, and gradually swallows the crushed mass. Besides food it requires water, which is either sucked up from moss or the ground, or gulped down after the manner of the viper. This species also takes readily to water, in which its movements are quick and graceful.

Quitting in April its winter-refuge, which it often only enters in October, and having successfully cast its skin during the spring and become strong again after that somewhat trying operation, the smooth snake enters upon its pairing-season, during which the males are very jealous and quarrelsome. At the end of August, or, in most cases, not till September or even October, the young emerge from their shells almost as soon as the eggs are laid. If not driven into winter-quarters by the inclemency of the weather, they at once seek their food, consisting of young lizards and blindworms; but they themselves are not infrequently devoured by adult snakes of their own kind. With the exception of a few that for a long while will refuse to take food, these snakes readily accustom themselves to captivity in a dry and sunny cage, and in some days or weeks lose their ill-temper and uncertain humours, and often feed from the hand.

Most of the European amphibians belong to the tailless group, of which the smallest representative found on the Continent is the tree-frog (*Hyla arborea*), which is a widely disseminated species, whose distributional area may roughly be taken as extending between latitude 28° and 58° N., and thus including the whole of Europe, with the exception of the British Isles, Norway, northern Sweden, and northern Russia. The species is, however, also found in Madeira and the Canaries, as well as in northern Africa and central Asia, China, and Japan. Its local variations are somewhat numerous, one of these races inhabiting Germany, Piedmont, and Tuscany, while a second occurs



THE TREE-FROG.

in northern Italy and Sicily, and presumably therefore the whole of Italy; and a third is met with in Elba, Corsica, Sardinia, Egypt, Asia Minor, Cyprus, Palestine, Syria, Mesopotamia, northern Persia, and Hainan. A fourth has been found near Coimbra in Portugal, a fifth near Charkow in south Russia and also near the mouth of the Danube, and a sixth occurs in Japan. Within its habitat the tree-frog is by no means met with everywhere, being absent from the higher mountains, deserts, sandy steppes, and many other situations. In Germany it is fairly general, and although avoiding the crests and bleak heights of the mountains, is found in the Hartz and the Alps, ranging in the Tyrol as high as 5000 feet above sea-level. In the lowlands it avoids the wilder districts

and is unknown in the treeless marshes of the north German plains, or at any rate in those of Schleswig-Holstein and Oldenburg.

In summer tree-frogs are to be found in meadows and fields traversed by ditches and watercourses interspersed with stagnant water, in swamps and the outskirts of woods, in gardens and parks, where, according to the nature of the vegetation, they frequent trees, bushes, high reeds, grass, growing corn, and beds of cabbages, or other garden plants. During rough winds, or in unfavourable weather they seek refuge, however, under stones, in holes in walls, or in hollows of trees. In summer they will take to the water, although only occasionally. On the other hand, when spawning-time is over, they linger for a few weeks in the neighbourhood of water, which they enter in the evening, when their voice may be heard from among the sedges. Tree-frogs are not day-sleepers; on the contrary, they come out into the sunshine, and are awake, even when apparently sitting most listlessly, to any flying or creeping insect, but only at dusk do they become really lively. Then they hop and climb about cheerfully, and at that time may be heard their astonishingly loud croaking, issuing from the widely distended throat. It is audible half a mile off, resounding most vigorously and loudly on fine evenings in spring and early summer during the mating-time, when frequently hundreds of these frogs assemble in one pond. The croak is a piercing, shrill monotone, clear and abrupt, which may be represented by the syllables, *epp, epp, epp*. In jumping after their prey, tree-frogs display great dexterity and sureness of purpose. If they miss their footing when jumping, any leaf or branch suffices to save them from falling; for as soon as they press anything with the balls of their toe-tips the sucking-discs immediately afford a secure hold. These tiny frogs can even climb up and down or across perpendicular panes of glass without perceptible effort; and they excel not only in climbing and jumping, but also in swimming. On the approach of a real or supposed enemy they remain quiet and motionless squatting on a leaf of like colour to themselves. When they decide on flight, they do so unexpectedly, and remain quiet in another place after one or two immense jumps, thus rendering useless further search. Tree-frogs, which in genial springs appear as early as March, usually mate in May, croak sometimes in September, and soon after retire to their winter-quarters in crevices of walls, hollows in the ground, and the like. They make favourite pets, but are apparently not the safe weather-prophets they were formerly considered. They may be fed with flies and other insects, but are more accustomed to weevils. Very soon and easily they become tame and confiding, take food from the hand, learn to know when they are called, and also show some sense of locality in looking for their cage, whether they have left it of their own accord or otherwise. They also notice the place where the pot from which they are fed is kept, and with careful attention will live not only for years, but even for decades, in captivity.

Spotted Salamander. Among the tailed amphibians of Europe the largest and most conspicuous are the salamanders, which, however, are very local in distribution. The spotted salamander (*Salamandra maculosa*), which is represented in Corsica, Algeria, and Portugal respectively by local races, is found in central Europe and the Mediterranean countries; in Morocco, Portugal, and Spain; on several

of the Mediterranean islands, as well as in France, Belgium, Germany, Switzerland, Italy, Sicily, Austria-Hungary, Turkey, Greece, Asia Minor, and Syria. Its domain is, therefore, somewhat limited, and it is absent, with few exceptions, from the low-lying plains of the far north and east of Europe, in the Asiatic extensions of which, namely in western Transcaucasia, it is represented by a smaller species with a longer tail. The most northerly points of its habitat are Oldenburg, near Bremen, Luneburg, and Lauenburg, whence its northern limit rapidly deflects to the Neisse near Görlitz, and towards the western boundary of the Oder valley in central Silesia, and farther on to the forest-region of the Tatra and Carpathian Mountains. The eastern boundary, speaking generally, is formed in north-west Germany by the Elbe, farther south and east by the Oder, and in Galicia and Siebenburgen by the upper reaches of the Dniester and the Pruth. Farther south the species has not yet been definitely recognised. In west and north Germany



SPOTTED SALAMANDER.

the spotted salamander is unknown, as also in the British Isles, the greater part of Holland, the Belgian plains, and Scandinavia.

Salamanders require shade and moisture, and thus dwell in wooded valleys, bushy ravines and overgrown slopes, in hill and upland where shelter is found against sunshine and drought, beneath roots and stones, on mossy banks and ferny patches, in holes and eaves, and old tree-trunks. They range up the lower mountains to a height of from 2000 to 3000 feet, while in the Swiss and Tyrolese Alps they reach as high as 7000 feet. In the evening and at night—in the daytime only after a warm shower—they issue from their hiding-places to seek their prey, which consists of worms, grubs, slugs, wood-lice, and other creeping animals, and occasionally also of spiders and various insects. If they find enough food in their hiding-places, they sometimes do not show themselves at all for long periods. In holes and similar places of refuge they hibernate in company, reappearing at the end of March or commencement of April. At that time, although often not

until May, the females retire to cool forest-brooks, or springs, or other supplies of water to bring forth their young, which are sometimes more than thirty in number. The eggs in the ovary, which begin to mature after the birth of the young, are fertilised by milt previously taken up by the females and preserved in special receptacles. By the autumn they have developed into fairly large tadpoles, which are not born till the following spring. The pregnancy of the female salamander, therefore, lasts nearly a whole year; the female, for instance, which in the spring of 1910 fertilises her eggs with the milt collected in 1909, and preserved in her receptacle for nearly a twelvemonth, then takes up fresh milt, gives birth in the spring of 1911 to the young sprung from these eggs, and fertilises the eggs maturing meanwhile with the milt taken in during the spring of 1910.

The young tadpoles, endowed with lightning-like rapidity of movement, live on small crustaceans at first, and then on worms: they develop into lung-breathers in the water, which they leave between June and August, but, earlier or later, according to the time of their birth, requiring at least two years to become mature. Salamanders are the most lethargic of European amphibians. Their movement is a laboured crawl, by slowly shifting their four heavy feet forward and sideways, and by a lateral bending of the body and tail. Their progress in water, in which their motive power lies almost entirely in the tail, is more walking or water-treading than swimming, properly so called. Nor is the serenity of the salamander disturbed when in search of food. Slowly it drags itself nearer to the prey it has espied, and only a slight forward thrust of the head betrays its intentions. These sluggish animals are not, however, without some gleams of intelligence; in captivity they gradually come to know the regular feeding-place, and go there in the evening; but if no food has been forthcoming for a few days in succession, they do not repeat the visit. They also respond to a rap on the glass of their case and when captive have been heard to make a sound like *ükük* and a kind of twitter.

Insects. Among the inhabitants of the European woodland, the insects are by far the most numerous. Indeed, no class of the animal kingdom is represented by so many species, while scarcely any is so easily identified. Their structure is so well known that it will be enough to mention that in all adult insects the body consists of three principal parts—head, thorax, and abdomen; but in the young and undeveloped state they differ considerably from the perfect animal, into which they develop either by complete metamorphosis—larva, pupa, and imago—or by a less complex transformation. The head is always freely movable, and has, first of all, two antennæ, and also, in most cases, two immovable so-called compound eyes placed near together, their surfaces consisting of numerous hexagonal facets, every one of which is really a separate eye. Besides these, many insects have on their forehead, or in the middle of their head, two or three small simple eyes, not placed together, and not consisting of a series of adjacent facets. In the classification of insects, it is of particular importance to consider the nature of the feeding-organs. Insects may either have a mouth adapted for biting, or one specially modified for sucking; the former consisting of freely movable, that is to say distinct, parts, while in the sucking apparatus these struc-

tures are more or less welded together, aborted, or otherwise modified. The thorax adjoins the head, and consists of three segments—prothorax, mesothorax, and metathorax. Most insects have one or two pairs of wings attached to the thorax, the mesothorax carrying the first pair, and the metathorax the second or hind pair, which are so small in the case of the flies as to be represented only by two knobs known as balancers. Wings play an important part in the classification of insects, as they differ so greatly in shape, size, and formation. Like the wings, the six legs of insects are attached to the thorax, namely, one pair to each segment. These are also of importance in classification; and, when fully developed, consist of five segments, generally terminating in a couple of claws. The legs are often wanting in the larvæ, although some larvæ have thick, fleshy, rudimentary abdominal legs. The division of the body into three principal parts is rarely so clearly discernible in the larva as in the mature insect, the hinder portion of which is always formed by a limbless abdomen, consisting of from four to nine, mostly nine, more or less closely connected segments.

Insects are of separate sexes, and mostly lay eggs, although some give birth to living larvæ, and a few even to pupæ. Moreover, in addition to fertile males and females, between which there may be structural differences, neuters, or imperfectly developed males and females, also occur; and many insects are reproduced by the process known as parthenogenesis, while some are capable of propagating even as larvæ. Most insects multiply very rapidly; many take particular care of their offspring.

As a rule, the increase of insects is only slightly controlled by their many enemies, among which birds hold perhaps the first place. Still most kinds seldom, if ever, attain such numbers as to disturb the balance of life. Of course, where a number of certain kinds of plants are grown that are exposed to the attacks of insects, as, for example, in woods, fields, and gardens, insects find suitable food in great quantities and often multiply to such an extent as to do serious damage. In many cases, however, the enormous increase of certain species of insects is succeeded by a similarly extensive multiplication or aggregation of their enemies, and disease often kills off many of the insects that appear in great numbers. Whilst there is a considerable number of the so-called noxious and troublesome insects, among which may be classed many parasites of man and domesticated animals, the insects usually classed as useful are much less numerous. It must not be overlooked, however, that most flowering plants bear seed only when insects convey the pollen from flower to flower. There is no insect which has not some clearly allotted place in the economy of nature; many serve as food to other animals, in the larvæ of many those of others live, many kinds destroy putrefying matter, and not a few devour sickly and therefore useless plants.

Among the various orders of insects the beetles, or Coleoptera, are distinguished by possessing fore-wings and hind-wings of different structure, the horny fore-wings, called elytra, covering, when at rest, the hind-wings by which the flight is performed, these hind-wings being wanting in certain so-called wingless beetles, whose wing-covers are for the most part aborted. Beetles are seldom many-eyed, and nearly always have mouths adapted for biting. According to the number of

joints in the feet, beetles may be divided into four suborders, the first being the five-jointed group (Pentamera).

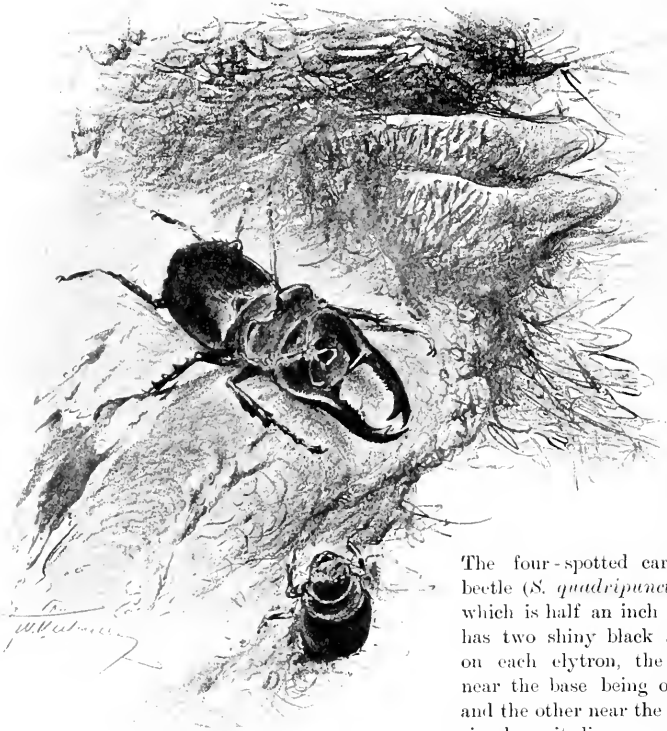
Carnivorous Ground-Beetles. Among the families of this group, that of the carnivorous ground-beetles (*Carabidae*) is one of the most important. The representatives of this family are mostly long-legged, swift runners, whose larvæ live in droppings or putrid animal-matter, while the full-grown beetles dwell under stones, moss, or bark, and feed on insects or their larvæ. These beetles winter in their haunts, and, when seized, not infrequently emit an evil-smelling fluid. The largest European species, *Procrustes coriaceus*, the leather-beetle, generally found in the woods, is about $1\frac{1}{2}$ inches long, and dull black in colour, wrinkled in such a way as to look like leather. Another characteristic genus is *Calosoma*, which is almost world-wide in distribution, and is distinguished by



THE LEATHER-BEETLE.

the rectangular form of the wing-covers. In the fir-woods *C. sycophanta* may frequently be found climbing the trees in search of larvæ and pupæ. It is from 1 to $1\frac{1}{8}$ inches in length, and blue-black, with a triple row of impressions on each of the closely dotted, striped, greenish gold elytra. In oak-forests, a companion species (*C. inquisitor*) is as easily discoverable: this is about $\frac{5}{8}$ inch in length, copper-coloured above, darkish green beneath, the elytra being edged with green, and striped, and obliquely furrowed with three rows of impressed dots on each side. The bombardier-beetles live gregariously under stones or at the roots of trees; and are so called from their habit, when in danger, of spurting out from behind, three or four times with a loud puff, a corrosive, volatile, odorous liquid. The common bombardier-beetle (*Brachinus crepitans*) is a third of an inch long, and of a ferruginous red colour, the mouth and third and fourth joints of the antennæ being pitchy black, and the elytra black with a bluish and greenish tinge and indistinct stripes.

Carrion-Beetles. Like the running beetles the carrion-beetles (*Silphidæ*) have five-jointed feet. In the typical genus *Silpha* the males are distinguished by wide joints on the feet of the first and second pair of legs. These beetles usually live in carrion or under stones, and when touched emit an offensive secretion: they feed on carrion, as well as on living insects and plants.



MALE AND FEMALE STAG-BEETLES.

beetles, the red-breasted carrion-beetle (*S. thoracica*), which is a trifle longer, and has black elytra and a red thorax, is frequently noticeable.

Stag Beetle. The stag-beetles include some of the largest species of the order: among them being the largest European beetle, the common stag-beetle or horned beetle (*Lucanus cervus*). Of these the males have very long jaws, recalling the antlers of a deer; they are brown in colour, and vary in size from 1

The four-spotted carrion-beetle (*S. quadripunctata*), which is half an inch long, has two shiny black spots on each elytron, the one near the base being ovate, and the other near the apex circular: it lives on oaks and other trees on which it destroys the caterpillars.

Among the forest ground-

to 3 inches in length. The larva, considered by some to have been the cossus delicacy so highly prized by the ancient Romans, is only found in wood, mostly in decayed stems, and requires several years to develop into the beetle, which flies by night in May and June, and during the day sucks the sap from injured oaks.

Rhinoceros-

Beetle.

The Lamellicorn beetles include a considerable number of species which are found in the forest, and many that live on trees and bushes amid other surroundings. These beetles, the terminal joints of whose antennæ, numbering from three to seven, are laminate or leaf-shaped, and form a diagonally placed club, which, in most of the species, can be spread out like a fan, live as eyeless, long-legged grubs in manure, decaying wood, and other vegetable-matter, and as adult beetles partly in similar places, and partly on plants, eating the leaves, or sucking the sap. Like the larva of the stag-beetle, the adult insect and larva of the rhinoceros-beetle (*Oryctes nasicornis*), which is not now common on the Continent, live in decayed oaks, and especially in oak-bark. This beetle is from 1 to 1½ inches long, chestnut-brown in colour, with rows of five spots on the elytra, while the head carries a curved horn, long in the males and short in the females.

Cockchafer.

Unlike the rhinoceros-beetle and stag-beetle, the cockchafer (*Melolontha vulgaris*) frequents many kinds of foliage. This well-known species is an inch or rather more in length, long-haired on the thorax, elsewhere short-haired, with brown elytra shorter than the abdomen which are dotted with whitish scales and ornamented with four or five smooth ridges. The antennæ are ten-jointed, the club in those of the male having seven joints, in those of the female only six: they are rusty brown in colour, as are the legs, but the head, thorax, and scutellum are generally black. The larva—familiar to country-people as the cockchafer-grub, and often unearthed when potato-digging—is most injurious to the roots of trees and field-plants. The mature insect is also mischievous, stripping the foliage off oaks, fruit-trees, and vines, sparing only the leaves of the pear which are as tough as leather. The females of this beetle, which flies from April or May for about a month or six weeks, deposit their eggs in the ground, from which in some four to six weeks issue the larvæ. These latter do not, however, develop into pupæ until the third or fourth summer,



COCKCHAFFERS.

when they are fully grown. In many parts of the Continent where cockchafer particularly abound in certain years, such abundance recurs only after a period of four years, although on the Rhine and in Switzerland the recurrences take place at intervals of three years. With the enemies of the cockchafer, which is preyed upon underground by moles and shrew-mice and above by crows and bats, may be associated man, who not only destroys them because of the damage they inflict, but who has discovered in both beetles and larvæ a valuable food for pigs and poultry. Moreover, these beetles yield, for those who like it, a nourishing soup, very like that prepared from crabs. A relation of the cockchafer (*Polyphylla fullo*), 1 to 1 $\frac{3}{4}$ inches long, blackish brown in colour, and speckled with numerous pale spots, does great damage in the sand-hill districts of Germany and France in its larval stage, especially to the roots of sand-grass. In some districts it is occasionally, in others more frequently, injurious to trees.

The golden chafer or rose-chafer (*Cetonia aurata*) is found on roses and other



MALE AND FEMALE GLOW-WORMS.

flowers, and frequently also in bushes on the fringe of woods, and in gardens. It is just under an inch in length, golden green or black in colour above, and bright coppery below, the head and throat being punctured, but the scutellum smooth; the elytra being sinuated on the sides and marked by chalky waved cross-lines. The larva dwells in ant-hills, in hollow trees, or in tan.

Another group belonging to the section with five-jointed feet are the so-called soft beetles (Malacodermata), typified by the continental glow-worm (*Lampyrus splendidula*), a flat brown beetle, about half an inch in length, having on each side of the thorax a transparent crescent, and the female showing a good deal of ashy white on her body. The glow-worm common in Britain is *L. noctiluca*, which is fuscous in colour in both sexes the elytra of the male having three elevated lines with the interstices roughly punctured, and the terminal segment of the abdomen being yellowish below, while the abdomen of the female has a dorsal ridge. Both species are distinguished by the phosphorescent shining of the three terminal segments. Like their larvæ.

glow-worms are nocturnal, some being able to shine at will; the males shine as they fly, especially about midsummer, while the wingless females crawl on the ground, where they emit a light to attract their partners. Very similar to the females are the larvæ with their flat, broad segments, the hind edges of which are faintly spotted. Like the mature insect, they emit their light from the last three segments of the abdomen.

Among the Heteromorous beetles, which take their name from **Meal-Worms.** having a dissimilar number of joints on the fore and the hind feet, there being four in front and five behind, the most important forest-types are the members of the family *Tenebrionide*. A familiar example of this family in its larval state is the meal-worm. Although these beetles thrive best in dark, wet, or musty places, some are often met with among forests and underwood. In the common tree-fungus, for instance, there lives *Diaperis boleti*, a bright, black beetle, about one-third of an inch long, convex and ovate, with two waved yellow cross-bands on the elytra, and a yellow spot at the apex, and with pitchy red tarsi. Its larvæ eat large pieces out of the funguses in which they live, and develop into complete insects in the holes they make. Not infrequently the larva of another species (*Orchesia micans*) hibernates and lives in touchwood. This beetle is about a quarter of an inch in length, and is pitchy brown in colour, with silken hairs, finely wrinkled and punctate, the legs and the under-side being a dull red, and the elytra a paler brown. It appears in May, and like its fellows is a good jumper with its hind-legs.

Spanish Fly or Blister-Beetle. Better known is the so-called Spanish fly (*Cantharis vesicatoria*), which appears chiefly on the ash, and often strips the very young trees of all their leaves. It occurs in the south of England, as well as in Sweden and Russia, and is not infrequent in June throughout Germany, though mainly known from the south of Europe. In colour it is golden green, or coppery, with black antennæ and bluish tarsi, the breast being densely pubescent, the head and thorax having a longitudinal channel, the elytra showing two slightly raised lines, and the length varying from half an inch to an inch. The females of the blister-beetle, as the species is better called, lay their eggs in the ground, where the larvæ attach themselves, presumably as parasites, to wasps and bees. The mature beetles are collected in Spain, the south of France, Russia, Sicily, and Hungary for the drug-trade, the gatherers always using gloves, as the mere touch of the beetle will raise blisters on the bare hands. They are used in the manufacture of the various vesicant preparations, and are the basis of most of the lotions for increasing the growth of the hair. Their blister-raising and other medicinal properties are due to the active principle cantharidin, which is deposited mainly in the ovary. Cantharidin is also found in other species, and in a lesser degree in the lady-birds; it is so powerful in its effect that a hundredth of a grain will raise a blister on the lip.

Weevils. A third section of beetles, the Tetramera, comprises those in which the tarsi have apparently four, but in reality five joints, one being very small and hidden, while the anterior tarsi have sometimes only three joints. The members of one family of the group, the weevils (*Curculionide*), which are extremely numerous and very injurious insects, are distinguished by the head being

prolonged into a beak with the mouth at the extremity, into grooves in the sides of which the antennæ can be neatly folded away. Weevil-larvæ have an indistinct head, devoid of feelers and eyes, and are almost without feet: they live on plants, particularly on fruit. The large pine-weevil (*Hyllobius abietis*) is a fairly common species, living especially on pines, but also on other coniferous and some deciduous trees, though it deposits its eggs only in coniferous wood. It is dull blackish brown in colour, with yellowish hairs, the thorax being narrowed in front, the elytra striped with large square specks, with the intervals roughly wrinkled and marked with two curved yellow bands, while the legs are pitchy black. As a larva it does little damage, but as a beetle it is one of the most destructive insects of the forest, eating the buds and bark of firs and pines, and thereby attracting the bark-beetle, which is the worst enemy of such trees. *H. pinastri*, also found in



LARGE PINE-WEEVIL.

fir-plantations, has red legs; the thorax being rounded at the sides, and the markings not yellow but ashy white. It is half an inch long, while *H. abietis* ranges from one half to three-quarters of an inch. Another species destructive to pines is the white-spotted trunk-beetle (*Pissodes notatus*), somewhat smaller than the last, and entirely covered with greyish white scales: the thorax is spotted with white and there is a whitish scutellum, while the elytra are spotted and

striped with a pair of greyish white bands. Its larva, which apparently differs from the larva of the pine-weevil only in its slightly smaller size, lives under the bark and in the wood of young firs, while the beetles bore into the trees themselves and deposit their eggs in the holes. In autumn they bury themselves in larger holes, which they make in the tree right down to the sapwood. The blue vine-weevil (*Rhyuchites betuleti*) destroys the leaves, not only of vines, but of birch, pear, and other trees. This weevil, which in 1756 destroyed near Roth in Baden almost nine-tenths of the vintage, often appears in May and June on birches, and later, when their leaves are too hard, betakes itself to the vines. On the latter it bites through the young shoots about a finger-length from the tips, so that the upper-part hangs down and withers. It also devours the upper layer of the leaves in strips, so that they become transparent at such places. From May to July this weevil rolls up the leaves of the plants on which it lives into the shape of a cone,

and bores into this a hole in which it deposits an egg, so that the larva emerges amid shelter and food. The larva eats grooves into the inner layers of the roll, and is full-grown in about five weeks, when it abandons the roll, and changes into a pupa in the ground, where in autumn may be found the young generation hibernating, to commence their ravages in the following spring. The mature insect is of all the intermediate tints between silky green and blue, with golden green legs and beak, and deeply punctured elytra, and is about one-third of an inch in length.

Another species of this leaf-rolling group is the branch-weevil (*R. conicus*), which lives on pear, plum, cherry, apricot, and other fruit-trees, as well as on the service-tree and the hawthorn, infesting them from the first unfolding of the blossoms and leaf-buds. A little over one-eighth of an inch long, it is steel-blue in colour, with long hairs; it is much punctured on the scutellum, and has on the elytra stripes of spots alternating with faint dotted lines. Boring into those blossoms and stalks that are an inch or two in length, in such a way that they droop and wither, it lays its eggs in the leaves it rolls; and the larvæ, about five weeks after the eggs are laid, drop to the ground to pass into the pupa-stage, and appear next spring to begin their ravages, which sometimes extend to every tree in an orchard. Another member of this family, the apple-blossom weevil (*Anthonomus pomorum*), lives chiefly on apple-trees, although it is also found on the hawthorn and the pear. It is blackish brown in colour with ashy grey down, showing on the red elytra an oblique, whitish, black-bordered posterior band, the thighs being dusky in the middle, and the scutellum small and white. Passing the winter beneath stones and tree-bark, this pest bores into the young flower-buds of apples, depositing a single egg in each. The injured bloom, if it develop quickly, often exposes the larva, which in that case perishes, but, if it develop slowly, it dries up and looks as if browned by cold or the sun. The destructiveness of the larvæ is therefore checked by quick development of the flowers, and increased by cold weather retarding such development. In years when blossoms are plentiful, a moderate number of these weevils may even be useful in destroying the superabundance of bloom, and thus preventing the development of too many, and consequently the production of inferior fruit.

Quite as injurious to trees as any of the weevils are some of the **Bark-Beetles.** bark-beetles (*Bostrichidæ*), which are very widely distributed, being found on high mountains apparently up to the limit of the forest-zone. All have clubbed antennæ and a globular, imbricated thorax. As a rule, they attack such trees as have begun to decay, whether standing or fallen, but they will often devote their attention to healthy trunks, though they will never touch a tree that is thoroughly dry of sap. In the first warm days of spring these beetles come out of their winter-quarters to pair, and by preference attack single trees standing in sunny places; into these some of the bark-beetles drive their bore only through the bark, while in others they go right into the wood, the holes differing in form, disposition, and length, according to the species by which they are drilled. When pierced by the females for the purpose of depositing their eggs, they are called "mother-galleries"; but the galleries bored by the larvæ have at their ends an enlargement called the cradle, in which each larva instals itself as it is on the point

of turning into a pupa. Among the most destructive bark-beetles living in and under the bark or in the wood itself of coniferous trees, is the "typographer" beetle (*Bostrichus typographus*), which is about one-quarter of an inch long, and has four teeth on the impression at the end of the elytra. This is a very injurious species to fir-trees; the trees attacked dying off from the crown downwards, the cones becoming red, and the wood losing its resin, and thus being of little use to the carpenter. It has been computed that a tree of moderate size may hold as many as about eighty thousand of these tiny beetles. In 1783 bark-beetles caused the withering of over two million fir-trees in the Hartz. They swarm in April or the beginning of May, require regularly from eight to ten weeks before they fly and have usually only one brood a year.

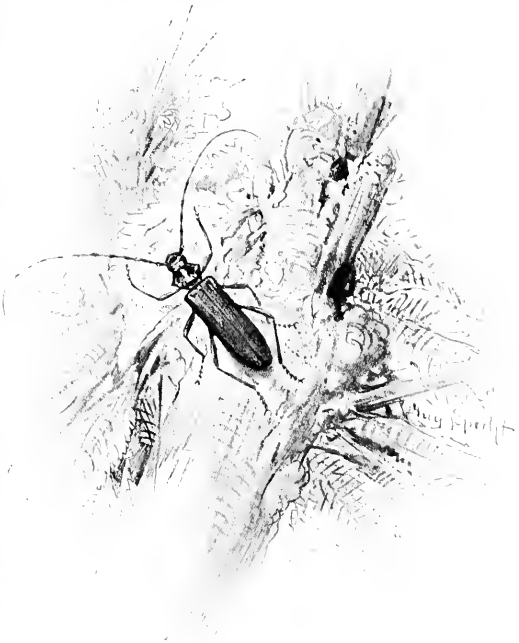
The large typographer (*B. stenographus*) is also very injurious to fir-trees; it has six teeth on each side of the impression at the end of the elytra, and is about $\frac{5}{8}$ of an inch long. The destructive larch-beetle (*B. laricis*) is not only very injurious to the conifer from which it takes its name, but to all coniferous trees, appearing in old stems as well as in saplings. It is about one-eighth of an inch long, and distinguished by the bordering of each side of the impression at the back of the elytra by from three to six small, straight teeth, showing one or two larger teeth on the inside of the second and third. Very like the larch-beetle is the crooked-toothed bark-beetle (*B. curvidens*), the principal destroyer of the white pine. The small back-teeth on the elytra of this species are more pointed than in the last, and bent in the males, whilst the female has three or four blunt teeth and a tuft of golden yellow hair on the forehead. This beetle, which is not quite so long as the preceding, bores double-channelled horizontal mother-grooves, like a single or double bracket sign ($\neg\text{---}\neg$). A trifle smaller is the long copper typographer (*B. chalcographus*), a species nearly always associated with *B. typographus*. The male has three long, pointed, bent teeth, and the female three short little humps on the border of the impression at the end of the elytra: it is the only beetle which gnaws star-like grooves on pines. On the other hand, the two-toothed bark-beetle (*B. bidens*), which is about the same size, is the one which makes star-like grooves in firs, and also bears on the circular impression at the end of the elytra of the males on each side a long backwardly bent hook, and generally a small hump above this. The females instead of the impression, hook, and hump, have a small groove on the elytra. Another dweller on firs is the mischievous bast-beetle (*Hylurgus piniperda*), all whose European relatives, except two, live on coniferous woods, although not in the outer bark, nor deep in the timber, but merely in the bast-layer. They are usually more or less brown, rarely straw-colour, but sometimes pitchy black, with short hairs, brick-red antennæ and tarsi, and dotted lines on the elytra, with wrinkled spaces between these lines, and on each a series of protuberances. This species is distinguished by these protuberances extending no farther than the end of the horizontal part of the elytra, as well as by a deep and widely dotted shield. This beetle, $\frac{3}{16}$ of an inch in length, bores slightly curved holes about twice its own length, which injure the tree by causing it to wither at the ends of its branches, thereby producing some resemblance to the trees and shrubs trimmed into the formal skapes that used to be so much admired in gardens; it has hence received the name of the forest-gardener.

Another injurious insect is the oak bast-beetle (*Scolytus intricatus*), which lives under the bark of deciduous trees; its tunnels being mostly horizontal. This beetle is reddish brown, lustreless, with dotted stripes on the elytra, between which is a series of heavy dots and many crossing wrinkles. In 1836 the larvæ attacked the trees of an oak-forest in France so severely, that no less than fifteen thousand had to be felled. This species is especially distinguished by its strong and stoit shield, which is much dotted and almost wrinkled on the sides.

Musk-Beetles.

The longicorns (*Cerambycidae*), a family of so-called four-jointed beetles allied to the bast-beetles, are distinguished by an elongated

body, more cylindrical than flat, and mostly rather large, as well as by the thread-shaped antennæ, which are generally as long as or even longer than the body, and recall the stag's antlers in their position on the head. The white and yellow, legless, or short-legged larvæ develop in the inside of woody plants, rarely in herbaceous or grassy stems, and change into easily recognisable pupæ. One species, the musk-beetle (*Aromia moschata*), is frequently found on splitting willow-logs, and is very injurious to those trees: it is nearly an inch long, and has a slender body, metallic green colouring, often shading into copper-red, an irregularly tuberculated thorax, and thickly roughened elytra, especially at the base. On



THE MUSK-BEETLE.

account of its colour, it is sometimes wrongly called the Spanish fly: but it derives its name from the strong odour it emits, and also produces a distinct stridulating sound. In oak-forests the large oak musk-beetle (*Cerambyx cerdo*) is somewhat injurious; it lays its eggs only on broken surfaces of living oaks, and its larvæ bore the wood through in all directions. This oblong blackish brown beetle has very rough and almost thorny elytra, and a warty wrinkled scutellum. In the males the antennæ are almost twice as long as the body, which measures from 1 to 1½ inches in length.

Leaf-Beetles. The leaf-beetles (*Chrysomelidæ*) are met with in larger numbers than the longicorns. The long, dark, or bright-coloured larvæ, which is mostly lancet-shaped, lives, like the beetle itself, on foliage, and is particularly fond of buds and young plants. These beetles are found more frequently on herbs than on trees, and some are highly injurious to agriculture. They are characterised by their widely separated, thread-like, and sometimes serrated antennæ, which are tapering, and generally less than half the length of the body. Their legs are equal in size, the palpi are short, and the body is generally hemispherical or ovate and strongly built. The blue alder leaf-beetle (*Agelastica alni*), which is a quarter of an inch long, is a destroyer whose larvæ reduce leaves to skeletons, but the species is abundant only in certain years. The body contains a juice smelling of bitter almonds, which is popularly supposed to drive away toothache. The poplar leaf-beetle (*Chrysomela populi*), under half an inch in length, appears on poplars and aspens, but only on the young sprigs, and is a frequent and destructive pest, which in its larval form effectually skeletonises the leaves it attacks. It is dark blue or dark golden green in colour, with a black tip to the red elytra. Nearly allied is the aspen leaf-beetle (*C. tremulæ*), which is perhaps still more injurious; it is similar to the last, but somewhat smaller, and without the black tips to the elytra.

Lady-Birds. Among the fourth and last section of the order, the so-called three-jointed beetles (*Trimera*), in which the apparently three-jointed hind-feet have a very small penultimate segment, the lady-birds must be specially mentioned. These have a more or less arched, and generally semi-globose body, flat underneath, a head retractile beneath the shield of the thorax, short and usually club-shaped antennæ (not exceeding half the length of the body), short legs that can be drawn close up to the body, and elytra completely covering the abdomen. Where plant-lice abound, there will generally be found both the adult beetles and the larvæ of the lady-birds, which pass the winter beneath foliage, bark, moss, or in other shelter, and reappear in summer. Two of the best known species are the seven-spotted and the five-spotted lady-birds (*Coccinella septempunctata* and *C. quinquepunctata*), respectively named from the number of black spots on the red elytra.

Honey-Bee. Like the beetles, the wasps, and their allies, collectively forming the order Hymenoptera, are numerous represented in the forests and thickets of Europe. The most familiar members of this order constitute the group Aculeata, which includes bees, wasps, and ants, insects well known to all. The more typical, or honey-bees, are specially characterised by the formation of the central segment of the hind-legs, which serves as a receptacle for the pollen, and is more or less of the shape of a spoon, and very often so thickly haired as to resemble a brush. The larvæ of the bees of this group are nourished on a paste consisting of pollen and honey, each living in a separate cell, in which it is fed by the neuters or imperfectly developed females known as workers. By no means all bees are, however, sociable; many, for instance, nest separately, live in pairs, have no workers, lay a single egg in each cell constructed by the female, and alongside deposit a paste of pollen and honey, to serve as a food-supply for the

larva when hatched. The parasitic bees are likewise without workers, and do not build combs; they also lack brushes of hair for collecting, and do not gather pollen but lay their eggs in the cells of other bees, where their larvæ, coming out before those of the bees they visit, consume the paste destined for these, and thus bring about their starvation. The apparatus with which the pollen is collected consists in the sociable bees, such as the honey-bee and the humble-bee, of the spoon in the tibia of the hind-leg, and of bristles on the hind-tarsi. The solitary bees, on the other hand, may be classified as those which collect with the tibia, the femur, or the abdomen. In the tibia-collectors, the entire outer side of the tibia



HONEY-BEES AT WORK

and tarsus of the hind-legs is densely haired; the femur-collectors, in addition to similar hairs, have also long collecting-hairs on the under side of the femur, and even on the sides of the mesothorax; while the abdomen-collectors lack hairs on the legs, but are provided with collecting-bristles over the entire lower surface of the abdomen.

The honey-bees are easily distinguished by the square, bristle-bearing first segment of the tarsus of the workers being lined inside with hairs placed obliquely; the best known species being the common honey-bee (*Apis mellifica*). In this familiar insect the brown-black coloration is more or less relieved by longer or shorter reddish yellow, grey, or brownish hairs. A swarm of this species consists of from six hundred to eight hundred males or drones, one

fertile female known as the queen, and from ten thousand to thirty thousand workers. These latter, the smallest denizens of the hive, bear on their hind-legs the distinctive small receptacles for collecting the pollen, and ear-shaped prolongations for the purpose of removing the wax secreted between the abdominal rings, the wax being formed in four pairs of glands known as wax-pockets. From the wax the working bees, the only labourers in the hive, construct the honeycombs, composed of many upright hexagonal cells, placed in two series, back to back, and fastened together with a mucilage, the crude wax, a sticky substance which exudes from the buds of several trees, particularly poplars. Like the queen, the working bees are provided with stings, which commonly remain in the wound they cause, and by so doing occasion the death of the insect. Of the wax-cells, some are filled with the honey sucked by the bees from flowers and regurgitated. In others the queen lays her eggs at the rate of about two a minute for several weeks. From these develop drones, queens, and workers. When the young queens are ready to assume their duties, the old queen leads off a party of the workers, and goes away to start another home, the emigration being known as swarming. The young queens are then liberated from their cells, and, should they not lead off fresh swarms, remain to fight for the vacancy, and not until the survivor has killed all her rivals does she take her nuptial flight. The stingless drones, which are larger and more compact than the working bees, do not appear until spring: they fly out rarely and only in warm weather; and though they feed on honey do not bring any to the hive. They are useless except for reproductive purposes, and after once mating are killed or turned out to die. Thus the hive, up to the development of the female larvæ, consists only of workers. The vast majority of eggs laid by the queen are female, her drone-eggs being comparatively few. Queens that have never mated also lay eggs, the eggs being invariably those of drones. The difference between the drones on the one hand, and the queens and workers on the other, is thus dependent on the eggs, but the difference between the queens and the workers is entirely due to the way in which the female larvæ are nursed. In the ordinary course the larva becomes a worker, but it may be developed into a queen by means of better and more plentiful food, and for the same reason workers which have been brought up with special care may occasionally be capable of reproducing their kind.

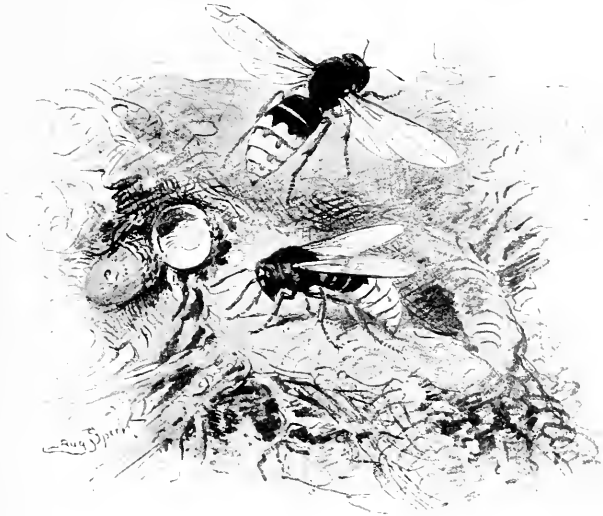
Besides silkworms and cochineal insects, bees are the only insects which, in a certain degree, have become domesticated animals, and their culture for honey and wax is an industry of some value. Bee-keeping was practised by the Egyptians, Greeks, and Romans, as a source of wealth; but in more modern times the introduction of sugar and its substitutes have reduced the importance of honey to a considerable extent. Nevertheless, the attention given to apiculture has resulted in great improvements in hives and other appliances, and the contrast is great between bee-farming, as practised in most civilised countries, and the system still in vogue in Russia and Poland, where the bees are kept in forests as in pre-Egyptian days.

The leaf-cutter bees which, unlike honey-bees, live solitary lives, construct their nests in old tree-stumps or in the ground, making thimble-shaped cells from pieces bitten out of leaves, and in these

Leaf-Cutter Bees.

depositing their eggs. A well-known species is the rose-cutter (*Megachile centuncularis*), which is black with ashy-coloured hairs, the abdomen of the female being almost heart-shaped, with reddish brown hairs beneath and almost white above, while that of the male is nearly spherical, with the hindmost portion bent. This bee cuts pieces out of leaves with great neatness, especially rose-leaves, the leaf so treated being distinguishable by the perfection of the curve.

Social Wasps. Like honey-bees, the social wasps (*Vespidæ*) develop males, fertile females or queens, and also workers, which, like the females, gnaw wood, and work it up with their sticky saliva into the consistency of blotting-paper for use in building the nests. Of the inmates of these nests only the fertile



HORNETS.

females hibernate, and these in sheltered places. In the spring, by way of founding the nest, they build a few cells and lay an egg in each; the workers hatched from these eggs immediately resume the building, and provide the larvæ from subsequent eggs with food, whilst the female simply devotes herself to reproductive functions, although she lays no eggs from which males develop until the autumn. The longer the summer lasts, the larger the nest becomes; but unfavourable weather soon checks its enlargement, although to protect it from rain the entrance is always underneath. Wasps prey on insects; and when hurrying off with a fly, and impeded by the wind, set matters right by biting off its wings. They also feed on flesh and fruit, and are fond of jam and other sweets. They only use the poisoned sting in the warm season, and never against man unless provoked. Only the queen and workers have a sting, the males being defenceless.

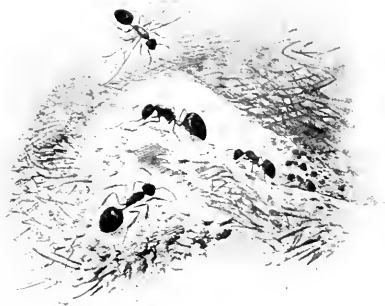
Where oak-trees flourish, the hornet (*Vespa crabro*), dreaded on account of its painful sting, may generally be found. The largest species of the social wasps inhabiting Europe, it kills bees for the purpose of sucking their honey, licks the sap of trees, and is very fond of sweet things generally. Mainly brownish red or blackish with bright yellow rings, hornets are conspicuous by their contrast of colour, and by their size. The queens are an inch and an eighth in length, the workers a quarter of an inch less, and the males measure a trifle less than an inch.

Another family of the aculeated Hymenoptera are the ants (*Formicidæ*), distinguishable in many ways from the bees and wasps, and chiefly characterised by the first, and sometimes the second ring of the abdomen being modified into a stalk. As with bees, the community of ants includes a multitude of workers, with a few males, and still fewer females, to carry on the race; but in this case the workers are not winged, although the males are always so, and the breeding-females, at least at pairing-time, have also wings, which, especially the front pair, are very large, and easily fall off. They are, in fact, cast off by their owners, so soon as the nuptial dance is over. The males are much inferior in size to the females, with smaller heads and larger eyes, and one more antennal segment and abdominal ring. Like the breeding-females, they have behind the mesothorax an almost triangular, arched surface, represented in the workers by one of narrower and strip-like form. The workers may also be distinguished by the relatively large size of the front of the thorax; whereas in the males and females this portion is small, and often hidden between the head and the very large mesothorax. The workers either have no lateral eyes, or but very small ones, and larger heads than the males or females. Like the latter, they may possess a protrusile sting, or may be furnished only with a gland secreting formic acid. It is this acid which causes the strong odour that remains when the hand is brought into close contact with an ant-hill. At pairing-time the breeding-females fly into the air to a height of from 100 to 200 feet, in large, cloud-like swarms, usually in summer, although some kinds swarm so early as April or May, while others wait till the autumn. While in the air, the females meet the males, with whom they fall down in pairs, to lose their wings, or break them off themselves, and return, borne by the workers, to the nest, whilst the males disperse, and soon perish or fall a prey to other animals. It is, indeed, only the fertile females and the workers which hibernate; although the eggs, if laid before the spring (when new ant-colonies are founded), may also remain dormant through the winter. Ants live together in large colonies, which may be situated in hollow trees, under stones, beneath the ground, under moss, in walls and rafters, or may be constructed by the ants themselves. In these colonies the decomposition of the vegetable and animal matter accumulated by the workers produces a higher temperature than that of the outside air.

In the construction of their dwellings the workers, which far exceed the fertile females and males in number, do all the work; they repair the dwelling, feed the larvæ, and carry the pupæ (erroneously termed "ants-eggs") to the sun, and bring them back to the nest, while the fertile females exist only for the purpose of laying eggs. Many ants have defined roads or paths of their own construction, along which they go forth in quest of building material or food. Their

food consists of sweet vegetable and animal matter, honey, and the honey-like juice which exudes from aphides, or plant-lice. It is for the sake of this secretion that the latter insects are often found in ants' nests, where they are kept by their owners, who use them as milch-cows. Ants also devour cochineal insects, caterpillars, worms, and the flesh of small vertebrates, as well as fruit, although they only attack the latter when the skin is broken. Many ants steal the larvæ or pupæ of the workers of other species, in order to procure their so-called slaves. There are certain insects found only occasionally and not exclusively in ant-hills, while others simply inhabit them when fully developed, and a third category are completely dependent on ants, and occur only in their nests.

The commonest kind of ant in forests, especially when coniferous, is the wood-ant (*Formica rufa*), which varies from $\frac{1}{8}$ to $\frac{5}{16}$ of an inch in length, and has a blackish spot on the back of the brownish red thorax; the males, however, being wholly brownish black, with a slight shimmer of ashy grey. In forests and by the wayside, nesting mostly under stones and moss, sometimes also in hollow stumps, is not infrequently found the red ant (*F. sanguinea*), which is from $\frac{1}{4}$ inch to $\frac{3}{8}$ of an inch in length, with a red head and thorax, and black abdomen, the whole suffused with shimmering grey on account of the coat of hairs, and the head sometimes showing blackish brown spots. In their nests are usually found workers of the dark brown ant, developed from stolen pupæ. The aforesaid brown ant (*F. fusca*), which furnishes the slaves, inhabits similar situations, is of the same size as the last, and is everywhere abundant: it has more or less brown legs and antennæ, but is otherwise entirely brownish black.



FOREST-ANTS.

Old stumps of oaks and willows, as well as beneath stones and moss, are the usual situations for the nests of the wood-ant (*Lasius fuliginosus*), a common species, the males, females, and workers of which are almost equal in size and of a uniform glossy black colour, excepting the antennæ, legs, and the pedicle connecting the abdomen with the thorax, which are more or less reddish brown; the head being broader than the thorax, very stout, and indented at the back. The black ant (*L. niger*) may be met with everywhere in woods and fields, by the wayside and in the meadows, in the ground among stones, or above it in stumps. In colour it is dark brown, often quite black, the thorax being reddish and somewhat transparent, the abdomen covered with close and short hairs, and the legs brown like the antennæ, but with more red on them. The males and workers measure rather over one-eighth of an inch long, the fertile females being

about double as large. In similar situations is also found the common yellow ant (*L. flavus*), a species very like the black ant, which it resembles in size, being one of the smallest species of the group. Covered with long thin hairs, it is light or dark yellow in colour; the females having a darker head and similarly coloured thorax, with the base, tip, and edges of the wings of the abdomen reddish yellow. In the nest of this ant may be found, although rarely, a small beetle (*Claviger testaceus*) belonging to the section with three-jointed feet, distinguished by an eyeless head, and simple clawed feet: both in the larval and adult condition this beetle is carefully tended and fed by the ants, in order that they may suck from the hair-tufts on its elytra a juice that is secreted there.

As its name implies, the tree-ant (*Camponotus ligniperdus*) generally lives on the trunks of trees, although more rarely it may be found under stones, or in the ground in forests and gardens. The workers are distinguished by the brilliant black head and abdomen, the dark red thorax and basal portion of the abdomen, the absence of any deflection between the three rings of the thorax, and the presence of two rows of bristles to every abdominal ring: on the other hand, the males are black throughout. Besides this species, the horse-ant (*C. herculeanus*) may be met with in decayed trees. Its fertile females measure $\frac{5}{8}$ inch long, its workers about $\frac{3}{8}$ inch long, and its males about $\frac{1}{2}$ inch. In colour this ant is almost wholly black, brownish only on the legs and part of the thorax; the abdomen being shimmering greyish white, on account of the grey hairs with which it is covered, while the males are dull in hue except for the brilliant abdominal rings.

The red ant (*Myrmica levinodeis*), which abounds in woods and gardens under stones, turf, and stumps, is brownish red in colour, with the middle of the first abdominal ring marked by a broad streak of dark brown. While the workers carry rather long pointed spines on their wrinkled thorax, the fertile females have shorter and broader spines, and the males a pair of protuberances at the reddish brown tip of the abdomen. Under similar conditions is frequently found the turf-ant (*Tetramerium cæspitum*), a species of very diverse colouring, often mostly brown, although the males are black. The body and legs of this ant are fringed with yellow bristles, and the thorax is longitudinally striped. The workers have the head equal in length to the thorax, but much broader, while the thorax carries serrated, stunted, and upright spines; in the fertile females the head is shorter and narrower than the thorax, and its spines are almost horizontal.

To quite another family belong the ichneumon-flies, or ichneumon-wasps (*Ichneumonidae*), comprising to a great extent comparatively large insects, characterised by their slender antennæ, which are long, many-jointed, and often multicoloured, and nearly always maintain a quivering or vibrating motion. The larva of the common ichneumon-fly (*Ichneumon pisorius*), which is legless, and without antennæ or eyes, lives only on animal-matter, and is produced from eggs that have been either fastened, or loosely stuck by the female to other insects, especially caterpillars, or which have been placed within the bodies of such insects by means of the ovipositor; the unwilling hosts being caterpillars, maggots, spiders, plant-lice, and other insects. The larvæ that issue from the eggs devour their host either inside or out, sometimes singly, and

in other cases as gregarious parasites. At first the host appears but little injured, hibernates, goes on feeding, and even enters the pupa-stage, so that at times the pupa of the parasite may develop within the pupa of its host. Two-thirds of the insects stung perish, however, before the pupa-stage is reached. Another of the parasitic ichneumons is *Bassus sulcator*, a species frequently found under the bark on trunks of trees, where it hibernates. These flies are black, with the middle of the abdomen red, and the legs reddish brown, the males having yellow faces, and the females yellow mouths.

Allied to the ichneumon-flies are the members of the family *Braconidae*, characterised by their almost or entirely veinless wings. They comprise small Hymenoptera, often not much more than one-tenth of an inch in length, many of which are parasitic on beetles, while others, such as *Microgaster unorum*, affect Lepidoptera. This last-named species is black, shiny, and smooth, with pale reddish yellow legs, and light-coloured hips; it is one of the most important enemies of the pine-lappet moth, depositing its eggs in the caterpillar in the autumn. The maggots proceeding from these eggs hibernate with the half-grown caterpillar, and in spring, when fully grown, bore their way out of the likewise full-grown caterpillar, which they envelop with their snow-white pupa-coverings like a garment of fur.



OAK GALL-FLY.

Next come the Gall-Flies. gall-flies (*Cynipidae*), distinguished by their sparsely veined wings (like the *Braconidae*), and straight, slender, many-jointed antennæ, the small compressed body, and the concealed ovipositor. Their larvæ live on plants, either in galls of their own production, or as so-called tenants of other galls. The females lay in spring, mostly before the sprouting of the leaves, depositing their eggs in various tender parts of the plants they affect, particularly those of slow growth. Where the egg is placed a gall grows, the nature of which depends, not only on the plant, but on the insect. The larva becomes a pupa in the gall: and some fifty kinds of galls are known on oak-trees alone. In due course the pupa develops into the perfect insect, which gradually eats its way out, to pass the winter beneath leaves in erevices of bark and such-like shelters. On the lower side of oak-leaves are often found galls as large as cherries—green, frequently red-checked, soft, juicy, and containing a larva in a central cavity. The most common galls are produced by the oak gall-fly (*Cynips folii*), which is a little over one-eighth of an inch long, and striped with red on the back of the mesothorax, and brilliant black on the abdomen. The rose gall-fly

(*Rhodites rosæ*) is black, with red and black legs; the males having the abdomen entirely black, but the females with red at the base: it is this species which produces on roses, especially the wild rose, the well-known hairy galls, in whose interior, when cut in half, the larva is seen. In winter woodpeckers and tits destroy numbers of these larvæ by pecking open the galls. Another rose gall-fly is *Aulax brandti*, which is black, with reddish brown thighs and claws.

Saw-Flies.

Among the other families of Hymenoptera, the saw-flies (*Tenthredinidæ*) feed on both vegetable and animal matter. They have two spines on the fore-legs, and the ovipositor of the females, which is not always present, does not project beyond the body, and when at rest is hidden in a sheath. At times they are predaceous and carnivorous, often attacking other insects. As larvæ, they resemble caterpillars, and, since they generally live on leaves, they are green in colour. These larvæ spin for themselves a paper-like wrap, which they wear during a period of from ten days to three years. The only care they bestow on their young is to make an incision in the plants by means of the serrated teeth of their ovipositor, in which incision they lay their eggs. Incisions are made in rose-leaves in May by the rose saw-fly (*Hylotoma rosæ*), which is about $\frac{3}{8}$ of an inch in length, and of a deep yellow colour, with a black head and antennæ, and black on the thorax, as well as at the edges of the fore-wings, and at the tips of the tibiæ and tarsi. The females lay their eggs, some fifty in number, in the incision, and the larvæ in August and September eat the leaves of cultivated roses, starting at the edges in such a way that only the principal ribs remain. The larvæ of the pine saw-fly (*Lophyrus pini*), on the other hand, live only on pine-needles. This insect is a little over one-quarter of an inch long; the females being pale yellow, with a blackish head, a black centre to the abdomen, and three black spots on the thorax, while the males are black with yellow and black legs.

Tailed Wasps.

Finally, the tailed wasps (*Siricidæ*) have a single spine on the fore-leg, whilst the ovipositor projects beyond the abdomen. Their larvæ are eyeless and colourless, with short thick legs, and live in the wood of trees and bushes, in which the females deposit their eggs. The larvæ are large, and often perforate and destroy the wood in which they live for nearly two years; the giant tailed-wasp (*Sirex gigas*) not unfrequently issuing from the wood which has already been in the hands of the carpenter. This insect, which is occasionally $1\frac{1}{2}$ inches long, is black, with a large yellow spot on the head behind the eyes, the males having a red abdomen with a black point, and the females a black abdomen with a red centre.

Butterflies.

The most generally attractive, perhaps, of all insects are the butterflies and moths, collectively forming the order Lepidoptera. It is almost unnecessary to say that these insects are provided with two pairs of uniform wings, entirely, or for the greater part, covered with minute scales; they have a proboscis arranged for sucking, confluent thoracic rings, and they undergo a complete metamorphosis. The butterflies are generally distinguished from the moths by their thread-like antennæ being knobbed or club-shaped at the tips, and by their comparatively broad and large wings, coloured often on both sides, which, when at rest, are held vertically, or nearly so. The genera

are so numerous that it would be hopeless to attempt dealing with them all in such a work as this.

In the woodlands of central Europe one of the conspicuous species is representative of the swallow-tails, the larvæ of all of which have a retractile head and a protrusile fleshy fork. This species, *Papilio podalirius*, appears first in April and May and a second time in August, and is occasionally over 3 inches in wing-spread; the wings are pale yellow, marked by broad black streaks extending from their front edge, the hind-pair being dentated and tailed, with a blue eye-spot, edged at the top with orange. The larva is yellowish green in colour, with red dots and yellow stripes, and feeds on fruit and forest trees, such as plum, pear, apple, and oak, and particularly the sloe, in July and August. Another well-known species is the black-veined white (*Aporia crataegi*), which is representative of a second family in which the larvæ are without the forked tentacle. The wings are white with black veins and edges, and have a spread of about 2½ inches. The larvæ are black at first and then become dull yellow, with short hairs and reddish brown stripes; they live on pear and apple, hawthorn, sloe, cherry, and plum, and are found from April to June. This species is among the most injurious of orchard-butterflies. On leaving the pupa it drops a few spots, staining the leaves red, and is thus responsible for the belief in blood-rain. On the under side of leaves it deposits from thirty to a hundred gold-coloured eggs, and covers them with a weather-proof varnish. The caterpillars which soon creep out of these hibernate in a leaf drawn together by a web, and begin their depredations at the commencement of April, dispersing later after devouring the buds and tender foliage. The larvæ of the brimstone-butterfly (*Gonepteryx rhamni*) are found in April and May, on oak and buckthorn. In colour they are grass-green, with a paler line on each side, and small black dots on the back. This butterfly is about 2 inches across, all the wings being angular; those of the male are sulphur-yellow, and those of the female whitish yellow, with, in both sexes, a small orange spot. This colouring, which is that of butter, is unknown in any other British species, and it has been suggested, in consequence, that the species is the typical "butter-fly" from which the group derives its name.

Representing another family we have the Camberwell beauty (*Vanessa antiopa*), known all over Europe from May to September, and also in northern and western Asia, north Africa, and North America. This handsome species is about 3 inches across, and in colour dark purple, with a broad outer margin of white, buff, or yellow, and an inner margin of black, on which is a single row of oval spots of blue. The larva is black with a row of large red spots on the back, intersected by a black line; the legs are red, and there are seven rows of black spines. It feeds on the poplars and willows and the white birch, and is common from June to September. The peacock-butterfly (*P. io*) lives in its larval stage on hops, and oftener on stinging nettles, and as the latter are widely distributed, this may account for its wide range, extending across Europe and Asia from Britain to Japan. The larva is black with reddish fore-legs, and a transverse series of white spots and six rows of black spines. The butterfly is about 2¼ inches across, and has brownish red wings, the hinder-pair having each an eye-spot like that on a peacock's feather. Another abundant species,

about the same size, is the large tortoiseshell (*V. polychloros*), which is tawny in colour, marked on the front edge of the fore-wing by three large black blotches, with yellow between them, and having no white spot. The caterpillar is brownish grey or greyish blue, marked with yellow stripes on the back and sides, with knotted yellow spines. It is abundant from April till June throughout Europe and northern Asia, and is a hibernating butterfly, the individuals that have passed through the winter appearing in April, while those of the year emerge in May and continue till August. The caterpillar feeds on willow, elm, cherry, pear, and apple trees. Another butterfly whose larva feeds on the willow is the splendid purple emperor (*Apatura iris*), which has a wing-spread of about 2½ inches and upwards, the wings of the male being black and shimmering blue, those of the females having no shimmer, but both sexes having a broad white band across the wings and a small red-ringed eye-spot on the hind-pair. The caterpillar, which is green marked with yellow, and has two yellow tentacles, is found on the poplar, aspen, and willow in May and June.

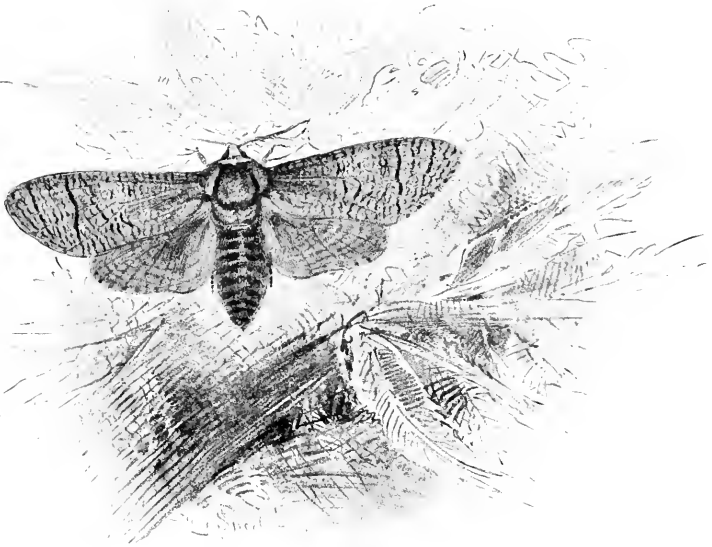
Unlike the butterflies, the hawk-moths have stout bodies, short antennæ, which are thickest in the middle, long fore-wings, and short narrow hind-wings, and, when at rest, hold their wings flat or ridged like a roof. A well-known representative of this family is the privet hawk-moth (*Sphinx ligustri*), the larva of which is more than 3 inches long, and light green in colour, marked on each side with seven oblique white and violet stripes and having orange spiracles and a dark brown horn on the last segment. When in repose, the attitude of this larva resembles that of the Egyptian sphinx, and from this it takes its name. From the larva the name was naturally transferred to the moth; from *S. ligustri* the name was adopted for the other species of the genus, and from the genus it became that of the group. This larva feeds from June till September on privet, lilac, and elder, and develops into a moth nearly 5 inches in wing-spread. The moth is common from May to July throughout Europe, northern Asia, and South Africa, and recognisable at once by its abdomen being ringed with black and rose. The fore-wings are brown with ashy edges and black streaks, while the hind-pair have alternate bands of black and rose, the rose being occasionally replaced by buff. Larger is the convolvulus hawk-moth (*S. convolvuli*), notable for its invasions of England at irregular intervals.

The clear-wings, with their transparent wings and long abdomens, are more like wasps and bees than other moths. A characteristic representative of this group is the hornet-clearwing (*Trochilium apiforme*), whose larva lives in the stems of poplars, aspens, and willows, which are somewhat damaged by its presence, from May to July. The moth, which bears a close resemblance to a large wasp, has a wing-spread of over 1½ inches, the transparent wings showing rusty brown edges and veins, while the long abdomen is ringed with black and yellow, and the head yellow with a brown collar. The larva is hairy and pale yellow, with a dark line down the back and a dark brown head.

As representing another family mention may be made of the goat moth (formerly *Cossus ligniperda*, now *Trypanus cossus*), the larva of which feeds in the stems of willow, poplar, oak, lime, walnut, elm, and horse-

chestnut, and occasionally fruit-trees. Flesh-coloured, with a blackish head and a dark red back, it bores through the stem in all directions, taking two or three years, or more, to develop into the greyish brown adult moth, which is nearly 4 inches across.

Pine Lappet Moth One of the wood-dwelling moths found on firs and other conifers, is the pine lappet (*Gastropacha pini*), a species more injurious than any other to those trees, and the largest moth feeding on them. It is over 2½ inches in breadth, dark reddish brown in colour, dusted with whitish grey on

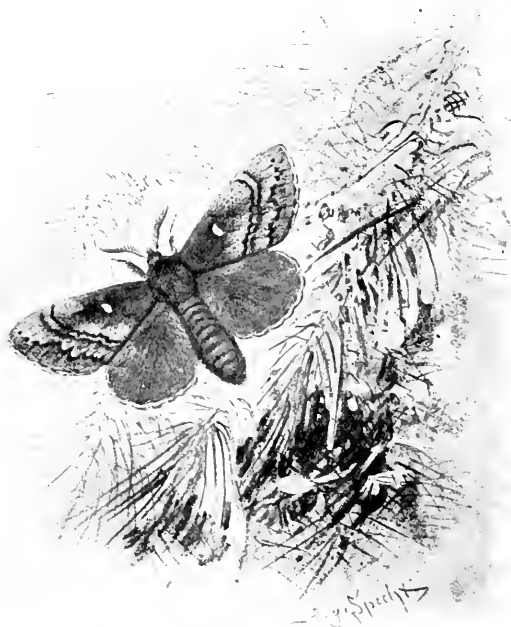


THE GOAT MOTH.

the fore-wings, which are broadly striped with brown and marked with a white crescent. This moth appears in June and July over almost the whole of Europe, but is abundant only in fir-woods. Its grey larvæ attain a length of over 3 inches, and are ornamented with spots and stripes, the distinguishing marks being two blue transverse notches on the third and fourth segments. The moths pair at the end of July, the larvæ resulting from their eggs feeding until frost, and then hibernating, to recommence feeding in April. At the end of June they enter the pupa-stage in a wadded, plum-shaped cocoon, terminating at both ends in stiff bristles, which is placed sometimes at the foot of the trees, and sometimes among the branches. The larvæ are frequently devoured by beetles and birds, particu-

larly the nutcracker and the cuckoo; and the pupæ in many cases become the habitation of ichneumon-flies.

Lackey Moth. Among the companion species of the pine lappet is the lackey moth (*Clisiocampa neustria*), whose presence is revealed by its eggs and cocoons. The hairy, bluish caterpillar, striped with white and red down the back, lives on almost all foliage and fruit trees. The moth measures $1\frac{1}{2}$ inches across, and is brown in colour, the fore-wings having a dark cross-stripe with a light border. In July its eggs are fastened in a ring round the shoots of the



PINE LAPPET MOTH.

trees, and so securely fixed that they do not wash off either in rain or snow. They remain through the winter, and at the end of April the caterpillars emerge; these are gregarious and live at first under a web, which they place in the angle of a branch.

Pale Tussock Moth. The pale tussock moth (*Dasychira pudibunda*) is found principally on the beech, but also feeds on the oak, hazel, and many other deciduous trees. The larva is green with velvety black patches, four yellow tufts on the central rings, and a rose-coloured tuft above the tail. In spring this moth is distributed over Europe, mainly in the beech-woods of the

north, where in the larval stage it first reduces the leaves to skeletons as a preliminary to destroying them utterly, and finally descends to enter the pupa-stage and hibernate.

Black Arches Another forest-pest is the black-arches moth (*Oenocera monacha*),
Moth. whose caterpillar, from July to September, infests not only deciduous trees but conifers. It may be distinguished by its blue and red warts, the black spot on the second segment, and the dark line down the back. The moth has white front-wings with black zigzag lines, grey hind-wings with a white edging, and a reddish abdomen. It measures about 2 inches across: the males being smaller than the females, which are distinguished by the long ovipositor. The caterpillar emerges



BLACK-ARCHES MOTHS IN FLIGHT AND IN REPOSE.

from the winter-eggs in April, and begins to eat only the centres of the leaves. At the end of June, just before becoming a pupa, it is extraordinarily ravenous, and by no means particular as to the sort of tree it attacks.

Procession The grey-haired caterpillar of the procession moth (*Cathocampa*
Moths. *processionata*), which frequents deciduous trees, particularly oaks, in May and June, is unknown in Britain and on the Continent east of the Oder. The moth, which has a wing-spread of just over an inch, is distinguished by a very hairy forehead, and clouded ashy fore-wings, marked with two oblique grey lines, often having black specks between them. The females are paler and less distinctly marked: the tip of the abdomen being brownish yellow. This moth is remarkable for the singular habits of its larvæ, which advance in a solid phalanx upon the tender foliage, one caterpillar always leading, closely

followed by two together, then by three in a rank, then by four in a rank, and so on. When changing into pupæ, the whole company spins for itself a mass of cocoons, from which the moths emerge in August. The hairs of the larvæ have barbed hooks, and can apparently be shaken off at will, to adhere to other objects, and inflame the skin of men and animals by causing a burning irritation. Another species of procession moth (*C. pinivora*) is restricted to firs. The larvæ are sharply keeled across the forehead and have triangular black spots on the back. They move only in single file, one after another, often assembling on the sand, in which they form regular tracks.

The puss moth (*Cerura vinula*) is remarkable for the form of its larva, which at first is blackish, then green, with a dark brown saddle on the white-bordered back, two long tail-points, and a red-edged, dark-eyed face. The moth, which is 3 inches across, and found practically all over Europe, derives its name from its delicately white-furred body, and is distinguished by greyish white black-veined fore-wings, with dentated lines and spotted edges, but mainly by its abdomen, which is striped at the sides, with a chain line down the middle.

From July to September, on oaks, birches, limes, alders, and hazels, is found the caterpillar of the lobster moth (*Stauropus fagi*), resembling at first glance a crumpled beech-leaf and strangely unlike that of any other species. It has fourteen legs, of which the first six are very long; the three middle segments carry humps, and there are two anal projections, which, with the lobster-shaped head, are raised up whenever this strange larva is alarmed or attacked. The larva eventually develops into a rather widely distributed moth, inhabiting all parts of Europe, although seldom in large numbers, in June and July. The fore-wings are brownish grey, reddish towards the inner margin, with a black dot at the base, and a wavy dentated yellowish stripe; the wing-spread being 2½ inches.

The next group of moths we have to mention are the *Geometra*, frequently called spanners and loopers, from the peculiar mode of locomotion affected by their caterpillars. The moths have small heads and slender bodies, while their larvæ are usually provided with only ten, rarely twelve to fourteen, legs. The larvæ "measure the earth" (*geo-metra*) as they progress in a series of loops due to the want of legs in the middle. These larvæ are often coloured like their surroundings, and when frightened hold on only by the hind-part, stretching the body at an oblique angle from the branch on which they happen to be crawling so as to resemble the butt-end of a broken twig.

One of the commonest of this group is the magpie moth (*Abraxas grossulariata*), which ranges over most of Europe and northern Asia. The larva is whitish with an orange stripe along the spiracles, and rows of black spots on the sides and back, and feeds on currant and gooseberry bushes, sloes, thorns, and plum-trees, and of late years has betaken itself largely to the now common evergreen *Euonymus japonicus*. The moth is white, spotted with black, the front wings having a yellow base and a narrow yellow bar between the black blotches near the tip, and the body being yellow and black.

Another voracious species, the mottled umber moth (*Hibernia defoliaria*), occurs in nearly the whole of Europe with great frequency. Its caterpillar is reddish brown, with sulphur-coloured sides, and a small brown

streak on each segment; it feeds, often in hundreds at a time, on fruit and other trees, though in agricultural districts every effort is made to destroy it. The moth is one of those in which the female, which is yellow and black in colour, and short and stout in shape, has no wings. The male has a wing-spread of over $1\frac{1}{2}$ inches, the fore-wings being yellowish brown with a central spot and a broad brown bar edged with black.

Bordered White Moth. In another of the group, the bordered white moth (*Bupalus piniarius*), the caterpillar in October lets itself down to the ground to enter the pupa-stage. This caterpillar dwells on firs, especially those with tall thin stems, and has ten legs; it is green in colour, with a white dorsal stripe, a yellowish white subdorsal line, and a yellow line along the spiracles, so that at a little distance it is scarcely noticeable among the fir-needles. The adult moth is $1\frac{1}{4}$ inches in breadth, the males having comb-like antennæ, while those of the female are thread-like. The fore-wings of the males are yellowish, with the inner margin brown, the tip brownish black, and the veins brown: those of the females are yellowish brown, darker at the tip, and frequently have a brown transverse band in the middle.

Tawny-Barred Angle Moth. The larva of the tawny-barred angle moth (*Macaria liturata*) lives on the Scots fir from July to October, and is green in colour, with a brown head and whitish lines. It is often abundant and does much damage. The moth, which is met with from May to July, is just over an inch across, the fore-wings being grey, bordered and barred with tawny.

Winter Moth. In the winter moth (*Cheimatobia brumata*) the female has only rudimentary wings; while the larva, which is green with three white lines along each side, lives from March to May on trees of nearly all kinds, particularly orchard trees. The male moth measures $1\frac{1}{4}$ inches across, and is brownish grey with broad brown bands on the fore-wings, the hind-wings being paler with three faint streaks. The female's wings are only a quarter the length of the body, and brownish grey crossed with two brown stripes. Although the larva begins to feed in May, the moth does not appear until October, and is met with up to Christmas. The eggs are fastened high up in trees, chiefly in the buds. The larvæ creep out when the buds open, bore into and destroy them, and later on eat their way down the tree, stripping off the leaves as they go, so as to render the trees absolutely bare. About the middle of June, when they have cleared the tree to its lowest branch, they let themselves down to the earth by threads, and there enter their pupa-stage. The winter moth is one of the most injurious insects known; none has been more discussed by agricultural societies, and against none are so many remedies tried. Tree-trunks are wrapped with sticky bandages and greased haybands, or daubed with grease, and painted with tar, London purple, Paris green, kerosene, and patent compounds—in some cases a hundred and twenty thousand trees at a time; the object in all these cases being to prevent the ascent of this female to the top of the tree to deposit her eggs.

Codlin Moth. Another species for whose destruction great efforts are made is the codlin moth (*Carpocapsa pomonella*), which is one of the tortrix group, and common from May to July. In breadth it measures three-quarters of an inch, the fore-wings being ashy grey, with darker transverse lines, and having on the

hind-border a large ringed velvet-black spot, with an inner lining of rusty red. It deposits its eggs in the eyes of young apples, one only in each, by inserting its long ovipositor between the divisions of the calyx; and, on emerging from the egg, the larva bores into the crown of the apple where the rind is always thinnest. The flesh of the apple is first attacked, then the pips, until the fruit falls, when the larva creeps out by the hole it made on entering, and, climbing a tree, chooses a crevice in the bark, which it gnaws and smoothes, and, weaving in it a white silken case, goes to sleep there for the winter, not becoming a pupa until the following May. In short, the larva of the codlin moth is the "fruit-maggot," which causes "worm-eaten" fruit, and brings about at least as many "windfalls" as the wind.

Midges.

The great group of flies (Diptera) are characterised—in so far as they are not entirely wingless—by possessing only one pair of membranous wings, behind which are the club-like organs known as balancers or "halteres," representing the hind-pair of wings in the Hymenoptera and other orders. The larvæ—mostly known as maggots—have no legs, and, as a rule, are cylindrical or thread-like, and long and flexible, though differing in details of structure. The pupæ are generally barrel-shaped, being longish oval in form, and permitting the escape of the fully developed insect, either by the fore-part of the envelope springing open like a lid, or by splitting longitudinally. Most flies require but a short time to develop, and hence, as they find food the whole summer, produce several generations in a year. Their numbers, and their taste for blood make them the most troublesome of all insects; while many of them, in one way or another, are the propagators of various diseases.

Among the Orthorrhapha, or section with straight-seamed wings, perhaps the most important group is that of the gall-midges (*Cecidomyiidae*), small insects, restricted as larvæ to certain plants, on which they produce singular malformations, while as adults they lay their eggs on certain parts of the same plant, often far away from the malformation caused by the larvæ: indeed, no part of the plant may remain free from attack.

Another group of importance is that of the fungus-midges, among which are the army-worm, the yellow-fever fly, and the pear-midges. The small pear-midge (*Sciara pyri*), like its larger namesake, deposits its eggs in the blossom of the pear as soon as it opens, and the larva eats its way into the core of the growing fruit, drops with it to the ground, and gnaws its way out when the time arrives to bury itself in the earth, and pass into the pupa-stage. These pupæ develop into fine-haired gnats only $\frac{1}{16}$ of an inch in length, with black head, thorax, and antennæ, white stems to their balancers, and black rings round the lead-coloured abdomen.

Hover-Flies.

The brilliantly coloured hover-flies are to be met with in the haunts of plant-lice. Like buzzards, they hover for a long time at the same height, and then in a series of short jerks dart off and deposit their eggs on some leaf or twig. Here the emerging larvæ, like leeches, fasten on the plant-lice, which may often be observed creeping carelessly about as their enemies suck their comrades dry. Among the commonest species of the family is the gooseberry hover-fly (*Syrphus ribesii*), living as a larva on currant and gooseberry bushes. It is over a quarter of an inch long, and has a greenish thorax, yellow shield, reddish

yellow legs, and a black abdomen with one interrupted yellow stripe and three curved yellow stripes.

Grub Flies. Another group belonging to the typical flies live within insects or their larvæ, and likewise in dead pupæ. These flies deposit their eggs on the outside of their host, for the larvæ to eat their way in, the maggots tearing the soft-parts of their hosts to pieces, unlike those of the ichneumon-flies, which only suck the juices. As grown larvæ they bore their way out, and change in the ground into barrel-shaped pupæ. Not uncommon among the numerous species is the grub-fly (*Tachina larvaram*), which is about $\frac{3}{8}$ of an inch long and whitish grey, with four stripes on the thorax, the longish abdomen being striped with black. A noteworthy insect, injurious to stone-fruit, also belongs to this



A PAIR OF PLANT-BUGS (*Pyrrhocoris apterus*).

group, namely, the cherry-fly (*Spilographia cerasi*), which is $\frac{1}{2}$ of an inch long, and glossy black with a yellow shield and similar lateral stripes, and black and yellow legs; the glossy wings having four brown stripes and a brown border. The female deposits one or two eggs near the stalk of the white cherry. From these develop larvæ which live in the cherry, whence they may be expelled by gentle pressure.

Plant-Bugs. The members of the Rhynchota differ from the flies in many ways, having four wings and developing without a complete metamorphosis. Among them, forming a fairly large group, are the plant-bugs (*Geocoris*), which suck other insects dry, and probably live mostly on animal-matter, but, according to place and season, also attack plants. At the foot of lime-trees, and also on the tree itself, as well as on thistles and walls, is

found *Pyrrhocoris apterus*, which feeds on dead insects and the young leaves and fruit of the lime. This common insect, found all over Europe, is about $\frac{3}{8}$ of an inch long, and in colour black and red. On the stems of trees, especially birches, where it crawls about in search of caterpillars, may often be seen the red-legged tree-bug (*Tropicoris rufipes*), which is rather larger, and yellow and red in colour. Such raspberries, cherries, and other small fruit as have an unpleasant taste, owing to a bad odour about them, have probably been infected by the berry-bug (*Pentatoma baccarum*), which is about the same size, and brown and white in colour.

Cicadas. To another section of the Rhynchota belong the cicadas (*Cicadidae*), which are mainly confined to subtropical and tropical countries, and in Europe are seldom found beyond the vine-growing districts. In many parts of the Continent one species (*Cicada concinna*) is, however, heard on sunny days and warm nights till late in the autumn, notably at Erlangen, Heidelberg, in Franconian Switzerland, and other south German localities, and also on the Drachenfels near Bonn, where it often occurs in such multitudes that the chorus it produces affords some idea of the noise made by the large cicadas of the south. These insects bore twigs with their beaks to suck the sap, which continues to run after tapping, and dries, and in many districts is collected as manna. Manna-sugar is present in many plants, such as beet, asparagus, onions, celery, and the ash; it is used commercially as a drug, being mainly obtained from the manna-ash (*Fraxinus ornus*) in Sicily and Calabria, by means of horizontal incisions in the bark. The cicada inhabiting the manna-ash (*C. orni*) is $1\frac{1}{2}$ inches in length, yellowish, and spotted with brown; in central Europe it is unknown farther north than the Thuringian Forest. Leaving the higher trees of the forest, we frequently find on hazel-bushes the species known as *Centrotus cornutus*, an insect about half an inch long, dark brown with yellowish wings and a hooked thorn on the back; and on rose-bushes that active jumper *Typhlociba roseæ*, about a quarter as long, yellow, with white wings striped at the tips.

Plant-Lice. Especially rich in species and individuals is the family of bugs commonly known as plant-lice, or aphides. The males and females of these insects are distinct in size and colour, and change their hue according to season and food: they emit a honey-like juice of which ants are particularly fond. This juice flows from trees, in consequence of the bite of the aphids, covering the leaves and stalks, especially in July, with a shiny coat like varnish, commonly called honey-dew, and, when mixed with the discarded skins of the insects, known as meal-dew. The belief that honey-dew and meal-dew—names that are also applied to certain funguses which live on leaves—fell from the air during thunder-showers is presumably based on the fact that plant-lice multiply in the greatest degree when the weather is damp and warm. It has, however, been recorded on several occasions that plant-lice have fallen from the air in large numbers. They are extremely prolific, owing to their being capable of reproduction when only a few days old. Each female brings about ninety young into existence at a time, and can, after five generations, have a progeny of more than five millions. For this increase no males are required during the greater part of the summer; and the extremely

rare males do not appear till the autumn, and are mostly much smaller than the females, at times attaining only a fifth of their size. After their appearance the females deposit the eggs, which remain in the bark through the winter, from which the young emerge in the spring. These latter cast their skins several times, and grow up, either depositing eggs, or bringing forth live young, and that to the tenth generation and more without males. The earlier generations invariably consist of wingless insects, and not till the end of summer are there any capable of flying and settling on other plants. In consequence of their rapid increase, these insects often become highly injurious. In spring they collect round the opening buds, later on attacking the young shoots, which they frequently cover in such numbers that the leaves curl and wither. Many kinds by their bite cause plants to twist, and turn up the leaves and stalks, and thereby bring about other changes, perhaps for the protection of the young. Although no indigenous tree is entirely free from them, and many, such as willows, harbour from eight to ten species, these pests exercise but little influence on forest-trees. They are much more harmful to fruit-trees, and also to herbaceous plants, peas, beans, and corn, especially where their propagation is assisted by dry oppressive air or by manuring, which forces the young shoots too fast. In hothouses defective ventilation similarly assists in their increase.

Among those living on rose-bushes, is the rose-aphis (*Aphis rosæ*), which is green on green shoots, though red on red ones, the males being distinguished by a double row of black dots on each side. It migrates from roses to the scabious and thistle, and frequently harbours the pupæ of an ichneumon-fly. On the under side of the leaves of plum-trees *A. pruni* is often found in such numbers that the leaves, overspread with honey-dew, are blackish; and trees so overrun bear no fruit. This insect is light green, powdered with white all over, and, if winged, has three green longitudinal stripes on the abdomen. Beneath the bark of apple-trees, and there only, flourishes the blood-aphis (*Schizoneura lanigera*), which leaves a blood-red spot when crushed. The insect is yellow, covered all over with whitish flakes, and is the most injurious of all species: it is found in the injured parts of young trees, as well as in the cankers and fractures of old trees. The females appearing late in the autumn deposit their eggs at the foot of the apple-tree stems, whence the young ascend the trunk and damage it, by preventing the healing of wounds due to pruning and accident, so that the trees die off in consequence. On young fir-shoots are often found plug-shaped galls, in which are the larvæ of *Chermes abietis*. This species is reddish brown powdered with white, lighter on the antennæ and legs, and white-winged. In hollows at the roots of firs, whence they come to the surface over-night, live the larvæ of *Rhizobius pini*, which are brown, with a white woolly covering. The larva returns to its haunt in the morning, and often leaves its skin as meal-dew on the leaves.

Coccidæ.

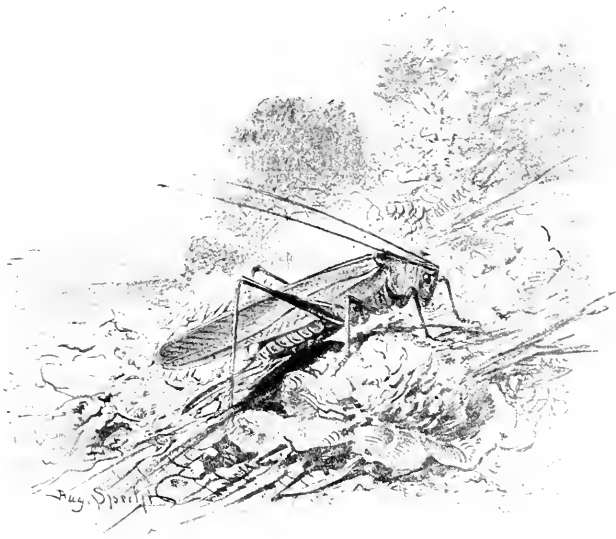
In another family, the *Coccidæ*, there is a great difference between the males and females. The males have two or four wings with only a double vein, and are without a beak, and they undergo complete metamorphosis, occasionally even sheltering in a cocoon; whereas the females are without wings, but have beaks, and undergo no metamorphosis. The beak serves to attach them by suction to the bark, leaves, and other parts of the plant, so that they can deposit

their eggs beneath their bodies, remain immovably upon them, as if hatching them, and die whilst they shelter them as with a roof. The young, which creep out from under the mother's dead body, disperse on the plant in quest of a convenient sucking-place where they live as permanent parasites, either singly or in a crowd. By extracting the sap they inflict great damage in hothouses. Besides these, there are some useful species, which produce pigments, manna, and shellac. Young shoots, blossoms, and twigs, especially of garden roses, are often entirely covered with the white shields of *Aspidiotus rosæ*, the males of which are pale red and finely powdered, whilst the flat, oval females are yellow, with three rows of dots and a white shield on their backs. Another species is *Lecanium racemosum*, the males of which are yellowish brown, with pale pink wings almost as long as the body, and the legs brownish yellow. The females are pouch-shaped, and have been known to attack pines in such a way that all the afflicted trees died. Curiously enough, the females have a parasite feeding on their eggs, the larva of a trunk-beetle (*Brachytarsus varius*), an oval, black insect, chequered with whitish tufts of hair. Another species (*B. scabiosus*) frequents white beeches and cherry-trees, where its larvæ are also parasitic on shield-lice.

The insects constituting the order Neuroptera are distinguished by their two pairs of membranous net-veined wings, and their complete metamorphosis. Among these, the flat-winged group, or Planipennia, have particularly well-developed organs for biting, and are specially characterised by their upper and lower wings being of equal length. When at rest, they lay their wings flat over the body, both the upper and lower pair being kept unfolded. In the lace-wing flies the larvæ are about $\frac{3}{8}$ of an inch long, lancet-shaped, and generally variegated: they live on plant-lice. The fully developed insects, as a rule, lay their eggs on the leaves of plants, and on account of their long stalks they were formerly mistaken for a kind of mould. The larvæ developing from these suck plant-lice, and throw the skins on their backs, where they become mixed with their excreta, which are also placed in the same place, and form a kind of bag. Perhaps the best known species of lace-wing is the golden-eyed fly (*Chrysopa vulgaris*), often seen in autumn in houses. It is $\frac{3}{8}$ of an inch long, and of a grassy green, flesh-red or yellow colour, with a flesh-coloured stripe under the eyes, and black hairs on its green or red veined wings. Common all over Europe, except Spain and Sardinia, it is found in Germany the whole year round. The scorpion-fly (*Panorpa communis*), which also belongs to the flat-wings, is distinguished by having a pair of claws on the abdomen, like those of scorpions, only bent forward, but it is not provided with a sting. An allied species (*Boreus hiemalis*), which is less than a quarter of an inch in length, and of a dark colour, lives in bushes during spring and autumn, and may often be seen hopping about on the snow in winter, while it is found even on glaciers.

With the exception of such grasshoppers as are restricted to animal food and live on insects, most of the members of the order Orthoptera are vegetable-feeders. The leaf-grasshopper, however, is partly an insect-eater, and is found in forests on bushes and trees, where it creeps instead

of jumping. It feeds partly on plants, but also to a large extent on flies, and above all on larvæ, and is particularly skilful in catching flying insects with its fore-legs. The females of these grasshoppers have the ovipositor curved. The common green grasshopper (*Locusta viridissima*) is the largest and best known representative of its genus, and is found all over Europe and northern Africa. In this species the auditory organs are placed in the tibiae of the fore-legs, and the male is distinguished by its power of producing the well-known chirping sound by rubbing the wing-covers over one another. These wing-covers are green in colour and double the length of the abdomen, the right one having a mirror at its base, while in the left one the veins are so modified in the corresponding part as to scrape the margin of the mirror and set it vibrating. The females have the ovipositor straight.



THE GREEN GRASSHOPPER.

In the locusts and short-horned grasshoppers (*Acridiidae*) the auditory organs are situated in the first ring of the abdomen; the females have no prominent ovipositor, and both males and females chirp by rubbing their hind-legs against their elytra, the sound being rather feeble in the female. One of these, *Psophus stridulus*, mostly resorts to pine-forests, but also frequents mountain-meadows and treeless heaths. It is about an inch in length, with two depressions and a keel on the chest. The hind-legs are red, with broad black edges at the ends.

Spring-Tails. The minute insects grouped as Thysanura are wingless and covered with beautifully coloured scales or hairs, but are not subject to a metamorphosis. Their scientific name is derived from certain bristle-like appen-

dages to the abdomen, which are found in nearly all the members of the group. Among them, the spring-tails take their name from the fact that their forked tail acts as a spring, which is kept bent when at rest, and suddenly released when they jump. They have thread-like antennæ with from four to eight joints, which are generally shorter than the hairy abdomen. Many species live in large numbers, among fallen leaves, under the bark of trees, in pits in the snow and other damp situations. One of the prettiest, the hairy spring-tail (*Podura villosa*), frequents bushes. It is an eighth of an inch long, yellowish red with black bands, and hairy, particularly on the breast and antennæ. The tree spring-tail (*P. arborea*), which is not a third as long as this, and lives under the bark of trees, is black, with white legs and tail. Groups of blackish brown, glistening spring-tails (*Sminthurus fuscus*), only $\frac{1}{2}$ of an inch long, are often found on decaying wood. Another spring-tail (*S. signatus*), about $\frac{1}{8}$ of an inch long, lives among dead leaves, and is of a pale green colour dotted with brown.

Spiders.

With the Thysanura we complete our brief survey of the insects of the woodlands, and with the spiders we enter on another class, that of the Arachnida. Spiders differ from insects in having eight in place of six legs, and also in lacking a distinct head, the head and thorax being welded to form the so-called cephalothorax. Most of them have eight eyes (some only six), which are brightest at night. When full grown, each of the eight legs has seven joints, varying in length, and the inner side of the claws is usually provided with bristles or combs for the management of the thread during the act of spinning. Spiders lay eggs, from which the young hatch out in the fully adult shape, although they moult several times before they are mature. During moulting-time they replace broken limbs and repair damages generally. Most spiders live on land, although a few are aquatic. All prey upon living insects, especially those with wings, biting them first with their jaws, then killing them with the poison which flows from a fang in the second segment of the mandibles, and finally chewing and sucking the bodies. They are able to fast for long periods, but at other times eat a great deal, and do not even spare their fellows when shut up with them. Spiders dwelling in the open air generally die at the beginning of winter, but individual members of some large species may live for years, and pair several times, although this holds good only for the females. Young spiders are often found underneath the bark of trees in a cocoon, the material of which is furnished by silk-glands occupying the greater part of the spider's abdomen. The silk consists of a tough sticky matter, which instantly hardens in the air, and is drawn out of six or eight spinning mammillæ, open at the back, and perforated at the tip like sieves. Each of these contains from a hundred to four hundred tubes, from which issue the threads, which are so fine that several thousands are necessary to make up the thickness of one human hair. Of these threads the spiders make their webs and cocoons. In September and October the threads are often noticed drifting with a spider attached to them, their flights often extending for some distance, so that they have even been met with at sea many miles from shore. They end these flights at will by twisting up the thread until it has not sufficient buoyancy to support its weight. When placed on the palm of the hand, spiders raise their

abdomens, and emit threads of many feet in length in all directions into the air, in order to pass along them and so escape; and they do the same when perched on the top of a stick standing in water. By emitting threads spiders are also enabled to construct bridges between two distant objects, as, for instance, between two trees, the web being suspended from the connecting threads.

All European spiders belong to the group with two lungs and breathing-tubes, or tracheæ (Dipneumones), the other group (Tetrapneumones) having four lungs and no tracheæ. Many of them (*Orbitulariæ*) make a wheel-shaped web, slide down on a thread from their web when in danger, wrap up their prey before carrying it away, and surround their eggs with a round or half-round cocoon.

The common cross-spider (*Epeira diadema*), which sits lurking for its prey in a vertical web, is found in bushes, gardens, and houses all over Europe; it is brownish red or blackish in colour, and on the back of the abdomen has white or yellow spots of different sizes, arranged in the form of a cross, from which its name is derived. The legs are marked with black rings. The male is $\frac{3}{8}$ of an inch in length and the female half as long again. The horned cross-spider (*E. cornuta*), inhabiting forests and gardens, is rather smaller, black or grey in colour, with pale yellow rings on the legs. Its leaf-shaped back has white spots and edges, and on each side of the abdomen is a conical protuberance from which

the species takes its name. In making the web the first thread that is fixed and strengthened is more or less horizontal. From this a short distance from one of the ends the spider drops another which is fastened to some object below; climbing up this the spider fixes a third thread in a similar manner, and the fourth thread is run along across the two vertical threads so as to form what is practically a rectangle, from the sides of which the rest of the straight threads radiate and are continued. Then the spiral is made which forms a scaffolding, the threads of which are eaten up as they are replaced by the viscid spiral on which the insects are caught.

The spiders of the group *Retitulariæ* construct either a horizontal web between



THE CROSS-SPIDER.

grasses and bushes, or emit threads in all directions, to form a loose kind of tissue; some drawing threads after them when they run. These spiders live in gardens and vineyards, where the web is said to protect the grapes from insects. One is the useful weaver-spider (*Theridium benignum*), distinguished by having on the front part of its reddish yellow and brown abdomen a large brown square spot, and at the end a black line; the legs being yellow, and the total length one-third of an inch. The crab-spiders (*Laterigradæ*) are so-called on account of being able to run backwards, forwards, or sideways with equal rapidity. They make no webs, and are inveterate thieves. One of these is a well-known forest-species, the emerald-spider (*Micrommata smaragdula*), which is about $\frac{3}{8}$ of an inch long, and grass-green in colour. On the upper part of the abdomen it has a triangular green spot; and the abdomen of the male is generally edged with a reddish line. The running-spiders (*Citigradæ*), another subdivision, likewise weave no web; the females sitting on their cocoons, or carrying them about attached to their spinning mammillæ. The well-known hunting-spider (*Ocyale mirabilis*) is a member of this group; it is about half an inch long, and in colour yellowish brown, with a white tip to the cephalothorax, and a white festoon with black edges round the abdomen. The male has four white lines running along the cephalothorax and abdomen, and two waved lines which are not so long. The false scorpions, which may be distinguished from spiders by the absence of a distinct constriction between the thorax and the abdomen, differ from the true scorpions in lacking a tailed abdomen, although resembling them in the presence of similar pincer-like appendages. The moss-scorpion (*Obisium muscorum*), often found under moss and bushes, is of a glistening blackish brown, with the legs whitish, the pincers reddish brown, and the total length about an eighth of an inch.

Mites.

The mites and ticks constitute another order of the arachnid class, characterised by the head, thorax, and abdomen being blended together. Some dwell in the water, where they feed on small water-animals, others weave tiny tissues on the ground, while others again live by feeding upon the food in our houses. Some are permanent parasites, while others, as for instance the ticks, are parasitic only for a portion of their existence. These live on bushes; the body being covered with a leathery, elastic skin, and the beak with a horny shield. They are sluggish animals, boring their proboscis deep into the skin of their hosts to suck their blood, increasing a hundredfold in size on such nutritious diet, and looking not unlike beans. Only the females, however, are blood-suckers, the males being much smaller than their partners, to whose bodies they cling. A familiar representative of the group is the dog or sheep tick (*Ixodes ricinus*), which is oval in shape, and yellowish red in colour. The shield on the back is a little darker than the rest of the body, and the abdomen has an elevated edge, and is clothed with fine hair. When empty, this tick is only an eighth of an inch long, but when full of blood it swells to the size of a hazel-nut.

The velvet-mites (*Trombididae*), which are mostly of a brilliant red or yellow colour, take their name from their velvet-like skin. They creep about under earth and moss, and their six-legged larvæ are generally parasitic on insects. The spinning-mites (*Tetranychida*) spin a silky tissue underneath the leaves of limes, oaks, roses, beans, and other plants, from which they suck the juices. The common

Tetranychus telarius, which is scarcely recognisable without a microscope, is covered with fine hairs, and of a pale yellow colour, with a darker spot on each side of its oval-shaped abdomen. Its larva is probably the so-called autumn grass-mite (*Leptus autumnalis*), a six-legged creature, which appears in two phases during July and August, on grasses, corn, elder, and gooseberry bushes, and produces small itching sores on the human skin. One of these phases is slow in its movements and of a light honey colour; the other runs quickly and is bright red.

Centipedes. The centipedes (Chilopoda) are without wings, and breathe through tracheæ, but the head is distinctly marked off from the body, which is composed of many successive segments of similar shape, to almost every one of which is a pair of legs. The mouth is provided with toothed cutting jaws, and the head with a pair of many-jointed antennæ. Centipedes are nocturnal, shunning the light, and living on insects which they kill instantaneously by means of a poisonous fluid secreted at the base of a long fang. Their commonest European representative is the worm-like centipede (*Geophilus electricus*), which is of a pale yellow colour, has about seventy-one pairs of legs, and is about $1\frac{1}{2}$ inches long, but only $\frac{1}{15}$ of an inch broad. This species is noteworthy as being luminous. In an allied group we may mention, as the best known, the brown stone-creeper, *Lithopius forficatus*, nearly an inch long, and an eighth of an inch broad, with from thirty-eight to forty-eight joints in its antennæ and fourteen pairs of legs. It is of a greyish brown colour, and lives under the bark of trees and in the mould in gardens, and is noticeable for the way in which flies are instantly killed by its bite.

The pigmy centipedes (Symphyla) form a group by themselves; they are small, delicate creatures, with a pair of legs only on the larger segments of the body, and live in cool and damp places in forests, gardens, and fields under leaves, stones, and loose ground, their food probably consisting of small insects.

Another allied group is the Pauropoda, so called on account of their having comparatively few (eighteen) legs. These small arthropods avoid the light and dwell in damp, muddy places; among them may be mentioned *Pauropus huxleyi*, which is probably found all over Europe. It is $\frac{1}{10}$ of an inch long, or a little more, with a smooth, snow-white, glistening body.

Millipedes. The millipedes (Diplopoda), which are better known and more numerous represented than either of the preceding groups, are sluggish animals which shun the light and live principally on decaying plants. They have cylindrical bodies, and bear on some of their segments two pairs of legs. The common millipede (*Iulus terrestris*), often called a centipede, which is the best known species, lives under moss and stones, and has a narrow but extraordinarily long body, black and grey in colour, with two yellowish lines along the back. In another species (*Polydesmus complanatus*), which lives under dead leaves, the body is also long and narrow, but flattish and sharp-edged. It is of a brownish grey colour, and the numerous segments are uneven in the middle, the last being pointed. Yet another species (*Glomeris pustulata*), often found in forests beneath stones, is blackish grey, with yellow edges to the body-segments, each of the first four segments having four small yellowish red spots, but the others only two.

A somewhat similar, although smaller species (*G. marginata*), which also lives under stones, is brilliant black, with yellow edges round the segments. All the species of *Glomeris* have the power of rolling up their bodies into a ball, and are hence known as pill-millipedes.

Wood Lice. The pill wood-lice, or garden armadillos, which have a similar habit, belong to the Isopoda, a group of crustaceans. All isopods

have a somewhat flat body, with the thorax distinctly separated from the head, and consisting of seven or at least six segments. On each segment of the thorax there are two, and on the abdomen twelve pairs of legs, which are all of the same shape, and serve for walking as well as for swimming. Isopods carry their eggs beneath the thorax, and live, as a rule, in water. The wood-lice (*Oniscidae*), on the other hand, live on land in damp situations, and wander out at night to seek for food, which consists of decaying or soft vegetable and animal matter.

The common wood-louse is known as *Armadillidium vulgare*.



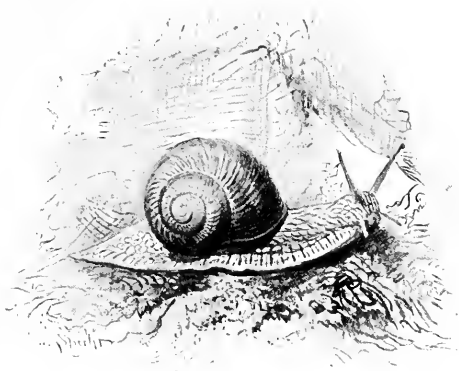
THE BLACK SLUG.

The slugs and snails of the forest all belong to that group of molluscs in which the eyes are perched on the summits of long retractile tentacles. On the Continent the

best known slug is the large *Arion ater*, a species living in warm, damp places, usually on plants, and more especially among mushrooms. This slug, so common in forests and gardens, is provided with a granulated shield, a striped band on the foot, and irregular wrinkles on the upper part of the body. In length it is from 5 to 6 inches, and in colour black or reddish yellow. The common garden-slug (*A. hortensis*) is from 1½ to 2 inches long, and either uniform black or grey, or marked longitudinally with grey lines along the back. The large garden-slug (*Limax maximus*), inhabiting both forests and cellars, is ashy grey, spotted or striped with black, slightly keeled towards the tail, and has the foot bordered with white. The length is from 3 to 6 inches, and the breathing-hole lies behind the middle of the shield. In *Limax* and *Arion* what is left of the shell is internal. In *Limax* it is traceable as a thin, flat elliptical plate, in which the sudden thickening at one end is the nucleus representing the apex of the cone. In *Arion* still less is left, the shell being present only in the form of a few independent granules, which in some species have disappeared entirely.

Snails.

The slugs and snails form the family *Helicidae* of lung-breathing molluscs, many of which live in forests, or at least in and under bushes. They have a rather thin, spirally coiled, conical, globose, or discoidal shell, and dwell in shady places in hedges, among leaves, etc. More than a thousand different species are known, and the group is found all over the world. The largest central European representative of the group is the great Roman or apple snail (*Helix pomatia*), which has a thick globose shell of $1\frac{3}{4}$ inches in height, of a very pale brown colour with indistinct reddish brown bands. This snail, which ascends mountains up to 5000 feet, lays from thirty to forty eggs of the size of a pea, which develop in twenty-six days; the young taking a whole year to grow to their full size. In autumn these snails close the aperture of the shell for hibernation with a door of calcified mucus; and in this state, after they have been kept fasting for some time, they are frequently used as food, although in summer they are too slimy to be eaten. They form in many continental countries, in the south of Germany for instance, an important article of trade, especially during Lent; and in some districts the peasants breed them in special gardens and fatten them with cabbage-leaves. They are believed to have been introduced by man into many countries where they are not indigenous,



THE APPLE-SNAIL.

as Great Britain and Livonia. The monks seem to have brought them to many parts of northern Germany, but to the Romans is generally given the credit of acclimatising them in Britain.

The tree-snail (*H. arbustorum*), which is also found in hedges and gardens, and inhabits the Alps up to 7000 feet, is brown in colour, dappled and streaked with a dark band along the middle of each whorl. The wood-snail (*H. nemoralis*) is frequent in many localities, but varies much in coloration. It is about an inch in diameter, and may be distinguished from the garden-snail (*H. hortensis*) by having the lip of the shell brown instead of white. The group of *Bulimi*, although rare in central Europe, is represented by numerous types in South America. One European species (*Buliminus obscurus*) lives beneath leaves and moss, on rocks and walls, and on the trunks of trees, where it is never conspicuous owing to its coating itself with mud, and thus acquiring the appearance of an excrescence on the bark. When the mud is cleared off, the shell is found to

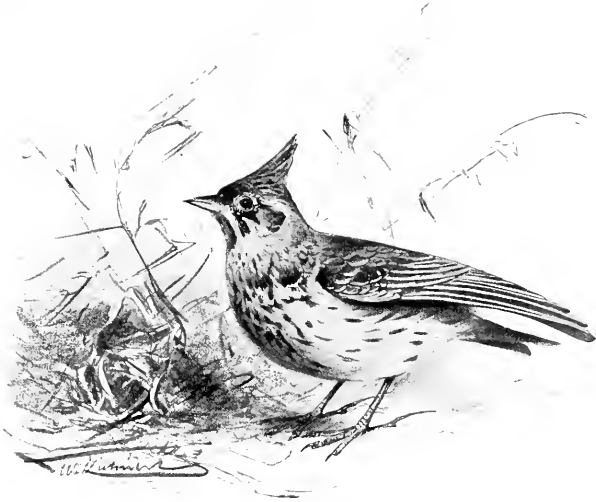
be golden-brown, thin and translucent, and about $\frac{1}{3}$ of an inch long and $\frac{5}{16}$ of an inch wide.

The agate-snails are also very rare in Europe: one species, however, the needle-snail (*Achatina acicula*), is occasionally found beneath decaying roots. It is very small, the shell being only $\frac{1}{20}$ of an inch in diameter and $\frac{1}{3}$ of an inch long and very much compressed and drawn out. Another interesting genus is *Clausilia*, in which the shell is left-handed and spindle-shaped, with the mouth constricted by numerous teeth-like projections. These snails live in damp places, under old stumps and moss, or on walls, and are very common in southern Europe, especially Dalmatia. Simpler in construction, and as a rule rarer, are the glass-snails (*Vitrina*), which are about $\frac{1}{4}$ of an inch in diameter, and have flat, greenish shells with a large semilunar mouth.

The pigmy horn-snail (*Carychium minimum*) lives under damp moss in the woods. Its transparent shell, consisting of five and a half whorls, has an obliquely oval mouth, and is only $\frac{1}{5}$ of an inch long. Unlike the preceding genera, *Carychium* has the eyes at the base of the tentacles instead of at their tips. Like the former, however, it is a lung-breather, which our last example, *Pomatias elegans*, although a land-shell, is not. In the family to which it belongs, the breathing-organ is a special gill-chamber modified for breathing air. Another peculiarity is that it has a stony operculum, or door, to the mouth of the shell. The shell, which is about half an inch long, pale brown in colour with a more or less purple tinge, is of graceful shape, much marked by striations, with a twisted hollow up the middle of the spire, and four and a half whorls, the mouth being circular or nearly so. It is most numerous in limestone districts, and not so much an inhabitant of the forest as of the field.



THE ROSE-CHAFER.



CRESTED LARK.

CHAPTER IV

THE OPEN COUNTRY

THE fields, meadows, and heaths are far less rich in animal life than are the woodlands; and the few mammals inhabiting such localities belong exclusively to the rodent and the insect-eating groups. Among the former, we

Hare. have first of all the hare (*Lepus europæus*), which is sometimes met with in the forest, and is therefore not exclusively an animal of the field. Unlike the rabbit and mountain-hare, its ears are longer than the head, and, if bent forwards, project beyond the nose. Several local varieties of hares are distinguishable by their colour, the length and thickness of their fur, and the relative length of their ears. The hare of southern Europe has, for instance, a short, loose coat, slender, thinly haired ears, and is of a dark rusty colour; while that of central Europe has a close, long coat, long and thickly haired ears, a distinct whitish hue on the sides of its body and the thighs, and in winter a grey back and greyish white sides and thighs. There are some slight differences between the hares in the different parts of Europe, and a distinction is sometimes made between those of the uplands and those of the plains. In the Hartz Mountains the hares have thicker hair and more white in their coats than those which live in the lowlands; but the difference between them is slight, whereas the German hare differs greatly from that of northern Russia. The British hare has now been distinguished as *L. europæus occidentalis*, while the Spanish and Corsican hares

have been made the types of distinct species, under the respective names of *L. lilfordi* and *L. corsicanus*.

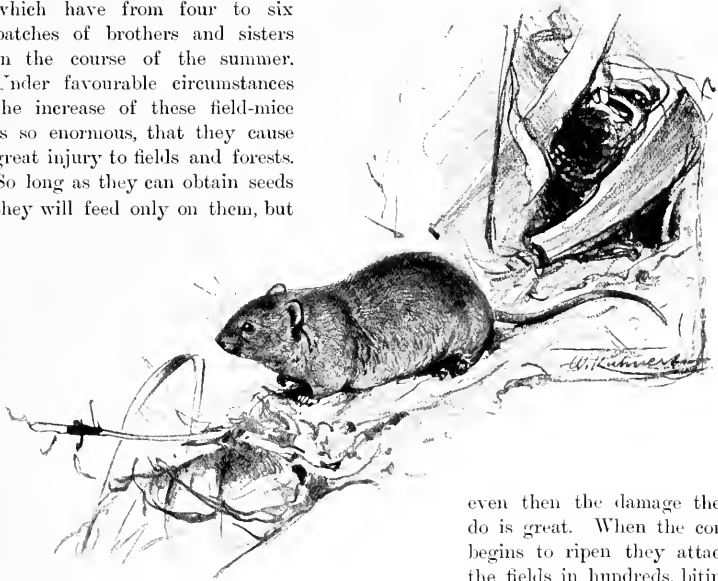
The brown hare, as the species is often called, is found in most European countries, from the Ural Mountains westwards, its northern limits being Scotland, southern Sweden, and the countries on the White Sea, its southern boundaries being the Mediterranean, the Black Sea, and the Caucasus. It also appears round the Caspian, but is unknown in Siberia. Its favourite haunts are wide, fertile plains and clearings along the outskirts of a forest. In the Alps it is found as high as 5000 feet, and in the Caucasus up to 6500 feet. The hare feeds on grass, young corn, and various kinds of herbs to which it may obtain access: in the daytime it lies hidden among clods of earth and bushes, where it relies more on hearing than on sight to escape its many foes. The statement that hares sleep with their eyes open is untrue. When suddenly frightened, a hare trusts to its legs, although it does not run far in a straight line, but soon doubles and returns by a roundabout way. If not quite sure that danger is near, it will sit up, shaping itself almost into a cone, and sometimes standing up on its hind-legs to look and listen; if reassured, it will lie as flat as possible on the ground, while, when danger is real, it races off with ears laid well back on the neck, keeping if possible to level ground, or going up-hill, because down-hill, on account of its short fore-legs, it runs the risk of stumbling. Hares increase very rapidly; in mild winters they begin pairing in January, and have several litters during the year. About a month after pairing, the female brings forth from three to five leverets, which are born with their eyes open, and are suckled for three weeks when they leave their parents, although remaining in the neighbourhood. Hares may live to eight or ten years, but rarely if ever attain that age on account of the persistent pursuit they suffer from foxes and smaller Carnivora, as well as from birds-of-prey and man.

Continental Field-Mouse. The mouse-tribe is much more numerously represented in the fields than the hare, although only a single species of true mice can be considered a field-animal. This is the harvest-mouse (*Mus minutus*), the smallest found in Europe. Much more harmful is the continental field-mouse (*Microtus arvalis*), easily distinguished by the naked inside of the ears, which are one-third the length of the head. In colour this field-mouse is yellowish grey above, and dirty rusty white below; its feet being whitish, and the soles of the hind pair having six pads. According to the different countries it inhabits it varies greatly: its range extending from the Atlantic to the Urals in western Siberia and the central Asiatic steppes, and from north Germany and the Baltic to northern Italy, Dalmatia, Turkey, and south Russia. It is not found in Great Britain, where its place is occupied by the short-tailed field-mouse (*M. agrestis*), nor in Iceland, Corsica, Sardinia, or Sicily, neither has it been observed in Sweden. Ranging as high as 5500 feet up the mountains, it also lives in fields and meadows, as well as the forest clearings and outskirts. It not only lives in dry places, but also in marshes, where it makes its nest on some elevation. Sometimes it migrates in large colonies, often to quite another part of the country, crossing rivers on its way. The continental field-mouse runs quickly and swims



HARE.

well, but is a bad climber, and is easily discoverable owing to the numerous narrow paths or "runs" in the grass leading to the nest. An expert in tunnelling its galleries beneath the ground, in winter it burrows under the snow. Its store is seldom without provisions either in summer or winter, and, as a rule, is well filled with grain, seeds, nuts, roots of plants, ears of corn, and even the bark and buds of young trees. In its softly lined nest, which is placed just beneath the surface of the ground, or sheltered by thick grasses on the ground itself, this field-mouse brings forth from four to eight young in the month of April, which have from four to six batches of brothers and sisters in the course of the summer. Under favourable circumstances the increase of these field-mice is so enormous, that they cause great injury to fields and forests. So long as they can obtain seeds they will feed only on them, but



THE HARVEST-MOUSE.

even then the damage they do is great. When the corn begins to ripen they attack the fields in hundreds, biting through the stalks at the base till they fall over, then gnawing them through above and dragging the ears into their burrows. Often they follow the reapers from one crop to another devouring the corn that has dropped among the stubble, gathering the ears which have fallen in binding up the sheaves, and finding their way to the stackyard to carry off enough to supply themselves during the winter. The harvest over a wide area has been destroyed by their hordes, and extensive plantations of beech-trees have died in consequence of their biting off the buds. The species, indeed, often appears in such numbers that the fields are practically riddled by their subterranean retreats, and even in the daytime the tiny rodents may be seen scuttling in fours or sixes to the same hole. Buzzards usually herald the arrival of these pests, and are much more successful in destroying

them than cats or dogs; but buzzards would not be sufficient in themselves to materially diminish the multitude, and it is thus fortunate that the field-mice themselves are subject to epidemics which destroy them by thousands.

In 1843 a field-mouse was found in Brunswick in a ploughed field near the edge of a forest and described as *Microtus campestris*. It is of a dark brownish grey above, and white with a rusty hue below, the feet being rusty white, with six small pads on the soles of the hind pair. The total length is 4 inches; the tail measuring $1\frac{3}{8}$ inches, and the ears being one-third the length of the head. Later on this field-mouse was discovered in other places, but it is still the rarest of the European species, and its habits are unknown, although it appears by its behaviour in captivity to be much more active than the common field-mouse, especially when searching for food.

Other Short-Tailed Field-Mice. The ordinary British short-tailed field-mouse (*M. agrestis*) is one of the most abundant species. The total length is $4\frac{1}{2}$ inches; the tail measuring $1\frac{3}{4}$ inches, and the ears being one-third as long as the head. This species is spread over the greater part of Europe from northern Italy in the south to Finland in the north, and from Spain, France, and Great Britain in the west to Russia in the east. It lives chiefly in meadows and marshy ground, and in habits resembles *M. arvalis*, feeding on seeds, roots, and all sorts of herbage. In gardens it does great harm to crocus-bulbs and newly sown peas and beans; in winter, when food is scarce, it climbs trees and gnaws the bark, and does not even disdain insects and meat.

Another species inhabiting central Europe is *M. subterraneus*, which in colour is rusty grey above, and white below, with the feet whitish grey, and the ears one-third the length of the head, and hidden in the fur. On the soles of the hind-feet there are five pads, and the total length is $3\frac{1}{4}$ inches, the tail length being $1\frac{1}{4}$ inches. This species is represented by several local varieties, and seems to be generally spread over Belgium, France, and western and central Germany, although not found beyond the Alps and the Pyrenees, nor to the north of Germany. Living in marshy meadows and orchards, it prefers the neighbourhood of rivers, and often appears in cultivated fields as well as in mountain-pastures. It does much harm in gardens, feeding on roots, such as parsnips, carrots, and artichokes, and storing up a supply of provisions in galleries under ground. Like all its relatives, it eats worms and insects, and in captivity does not even spare its fellows. This field-mouse, on account of its small ears and eyes, is evidently not fitted to live above ground, and by burrowing numerous and extensive passages makes a considerable area for itself beneath the surface. While the continental field-mouse allows other field-mice to enter its realm, the present species keeps its numerous dwellings to itself.

Hamster. The hamsters are near relatives of the voles, with which they form a large group of almost universal distribution. The common hamster (*Cricetus frumentarius*) is one of the most richly coloured animals of Europe, and ranges from the Rhine to the Obi in Siberia, although rare in some localities, and absent entirely from others, the nature of the soil having much to do with its distribution. It is unknown in the British Isles; and is remarkable not only on account of the presence of a gland in the middle of the back but for its social habits and complex underground dwellings.



HAMSTER.

Mole. Besides the rodents only the insect-eaters are represented among the European mammals of the field, and of these the most important is the mole (*Talpa europaea*), which inhabits most of the northern and temperate countries of Europe, and extends across Asia to Japan, preferring plains to mountains, although found up to the farthest limits of agriculture—for instance, in the Scottish highlands up to 1000 feet, and in the Alps almost up to 5500 feet. In south Europe there is a distinct species, Savi's mole (*T. caeca*); while the neighbourhood of Rome is the home of the third species (*T. romana*), distinguished by its large teeth, as well as by certain peculiarities in the form of the skull.



THE MOLE.

Of all the subterranean animals of Europe the mole is the most skilful in constructing its habitation, which is generally situated in a place almost inaccessible from the outside, under roots of trees or alongside walls, and generally at a long distance from the hunting-ground, which is crossed by numerous and far-reaching passages, connected with it by a long, tolerably straight gallery, and recognisable from outside merely by the large heap of loose earth thrown up during excavation. The dwelling-place was formerly considered to be a very complicated structure, but is now known to be much simpler. It comprises a large central chamber, provided with an entrance-tunnel, and at least one "emergency exit." The burrow of the mole generally lies from 1 to 2½ inches below the ground, and its walls, as well as those of the passages leading to it, are closely and solidly pressed together. The principal chamber, lined with soft grass, young corn,

dead leaves, moss, and other material, offers the greatest security to the animal when asleep or resting.

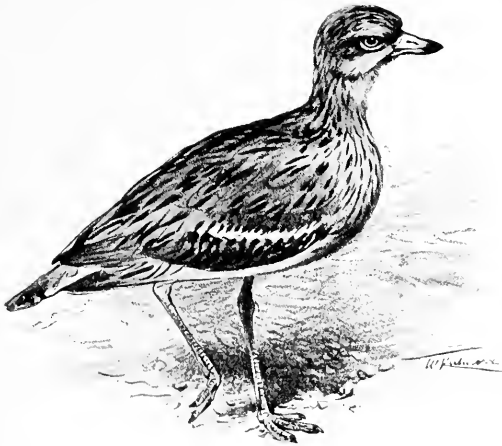
Moles generally live in rich, loose soil which, although not absolutely wet, is damp enough to contain a sufficient number of worms. They hunt in the morning, at noon, and in the evening, and thus pass through the principal gallery six times a day. They eat insects and their larvæ, and also snails, but prefer field-mice, shrew-mice, lizards, and frogs, and above all worms, which are especially abundant in winter, great quantities of which are said to be sometimes found immured in the walls of the passages by frost, with their heads bitten off but the rest of their body still alive. To appease its hunger, the mole requires every day an amount of food equivalent in weight to itself, and if this is not procurable it dies within twenty-four hours. As soon as it has eaten its fill it lies down to rest, but, after six hours, hunger causes it to wake again, and urges it to the hunting-ground, the tunnelling of which requires a considerable amount of muscular force. In finding its food the mole relies on its exceedingly keen sense of smell, but its hearing, in spite of the very small apertures of the ears, is equally acute. Although they are very minute, the mole is also said to use its eyes, which are covered with hairs all over; when the animal is compelled to swim, these hairs separate like rays, and the power of vision thus appears to be of considerable use when crossing rivers or leaving flooded lands.

In spite of the position of its fore-feet, the mole runs quickly, and in its principal gallery moves almost with the speed of a trotting horse. On meeting another mole, a field-mouse, or a shrew-mouse in its tunnels, it fights with the intruder; the surviving mole generally devouring the slaughtered enemy. Each mole keeps its habitation, with the surrounding passages, entirely to itself, except during pairing-time, when these animals live in couples. During this season fatal duels often take place between the males for the possession of the females, which are much fewer in number. When a mole discovers a rival, he shuts up the female in one of the passages, returns to the intruder and enlarges the passages for a fighting arena at the spot where they meet, and a battle takes place, which generally ends only in death or escape. During the combat the imprisoned female, instead of remaining inactive, tries to escape by digging new tunnels, until the conqueror follows and takes her back. After these preliminaries, when the male and female have grown accustomed to each other's society, they both work at the galleries. The female prepares a nest for her young, which is generally situated at the junction of three or more tunnels, in order to facilitate escape, and is lined with leaves and other soft parts of plants, bitten into short pieces. Between the middle of April and the end of June, sometimes also in August, the female produces from three to five (rarely six or seven) naked young, which have both eyes and ears closed. In about five weeks these attain to half the size of the parents, although they do not even then leave the nest unless impelled by hunger to seek their parent, who may perhaps have been captured. Both the young and her partner seem to feel the loss of the female, as the bodies of dead males have often been found alongside those of their captured mates.

Musk-Shrew.

The list of the European mammals of the fields concludes with the musk-shrews, which are unknown in the British Isles. Their most familiar continental representative is *Crocidura suaveolens*, which is dark brown

above and white below, and ranges over a great extent of Europe, from France in the west to southern Russia in the east and Italy in the south, as well as in the Alps up to about 4000 feet. Living by preference in fields and gardens, dry ditches, hedges, under stone-heaps and roots of trees, and occasionally in large forests and wooded districts, the musk-shrew, except during pairing-time, dwells alone in its burrow; its food consisting of insects and their larvæ, worms, field-mice, and young birds, the favourite hunting-time being mostly after a short and sudden rain. The musk-shrew leaves its hole at dawn, and in the evening a little later than the common shrew-mouse, in winter coming into barns, although seldom entering human habitations. It makes at the beginning of winter a soft, snug nest but never hibernates.



THE THICKNEE OR STONE-CURLEW.

Thicknee. Of birds characteristic of the open country one of the most interesting is the thicknee or stone-curlew (*Eliotnemus scolopax*), which frequents heaths, extensive plains, and desert-like steppes with a sandy soil where grass and other plants are scarce. In such situations this bird seeks the most solitary places, especially those where scattered pines adjoin the open country. In spite of its preference for barren spots, the thicknee cannot exist without water, and therefore lives, when possible, not too far removed from some pool or stream, though often obliged to travel long distances in search of drink. Although its flight is heavy by day, by night it is speedy and energetic. By day the thicknee is indeed a slow and inactive bird, but in the morning and at dusk and on moonlight nights it is remarkable for its activity, running quickly for long distances. When not in a hurry, it walks in measured strides, with straight legs, horizontal body, and neck almost upright: this attitude, together with the large owl-like eyes, giving the bird a somewhat strange appearance. By nature timid and distrustful, at

the approach of an enemy it presses its body close to the ground, when its grey plumage makes it look like a stone, and prevents its being discovered. If this ruse fail to prove effectual, the bird tries to escape, first by running and then by flying. When sitting on her nest it is said that the hen will not flee from a flock of sheep, but remains quietly on the eggs, staring with her large yellow eyes at the sheep till they grow shy and turn aside. The food consists of worms, snails, and insects, particularly beetles; also of frogs, field-mice, small lizards, and snakes. Small vertebrates are killed with the beak, after which they are kicked about on the ground till all their bones are broken. The thicknee's nest is made in a shallow depression in stony ground, has no lining, and in May contains two pale-coloured eggs, with ashy grey spots and streaks and numerous brown marks, which closely assimilate to their surroundings. In the beginning of September the thicknee begins migrating to the south; and in October large parties, flying in the form of an acute angle, may be met with on migration. In Germany this bird is found only in certain localities, for instance, in the Mark, in Pomerania, and in the Lausitz; in the south it seldom breeds, but it is common on the sandy and willow-covered islands of the Danube, from Vienna to the Dobrudscha. The Mediterranean countries and northern Africa harbour flocks of these birds, and from there the species is spread over the warm and temperate countries of Europe, including Great Britain and the corresponding latitudes of Asia.

Bustard.

Like the thicknees, the bustards lack the hind-toe: their front-toes are short and connected by a membrane, the legs are bare above the tarsal joint, the tail is fairly long, and the beak short, straight, and fowl-like. The group is spread over the four continents of the Eastern Hemisphere. All of them lead more or less the same life as the European species, and lay olive-green or olive-brown double-spotted eggs. The ordinary bustard (*Otis tarda*) inhabits wide, bushy, or treeless plains, and prefers fertile soil to sandy and barren country. Feeding in cultivated fields, it generally passes the night on isolated patches of ploughed ground, and in the early morning leisurely extends and flaps its wings before starting on long excursions in search of food. In winter these excursions generally commence before sunrise, but in summer not until the sun appears above the horizon. Except during pairing-time, bustards live in communities of from six to ten, while in winter the flock may often number from fifty to a hundred or more. In some parts the bustard is a resident, in others a migratory bird. In February, but often not before March, bustards begin to be much more lively and restless, wandering from one feeding-place to another, while the males commence to fight for the females, and fly much more boldly than at other times. They often come quite close up to villages to strut beside their hens with extended fan-like tail and drooping wings, puffing up their throats, pressing the head back on the neck, and lowering the fore part of the body. In this position the rivals stand opposite one another, then suddenly rush forward and try to wound each other with beaks and legs, the battle ending with one final blow from the beak of the victor. During these fights they perform all sorts of strange antics, which would hardly be expected from such a heavy bird. If all the full-grown bustards are paired by April, the males, which generally have



GREAT BUSTARD.

but one female each (although sometimes a second, while the first one is sitting), resume their ordinary condition.

In the second half of May, when she can hide herself in the young crop, the hen makes her nest, that is to say, scratches a hole, which is sometimes covered with dry stalks. The nest is generally placed in large fields, among growing corn, where the female can slip in and out unperceived, and is hard to discover. Occasionally the nest may contain as many as three (never more) fertilised eggs. Should the hen perceive an intruder, she raises her head a little above the surrounding herbage, and never removes her eyes from him as she skulks off without being detected. If thoroughly frightened, she leaves her eggs for good. After an incubation of thirty days the chicks, which are at first awkward and do not learn to run for some time, are hatched. They hide with their mother in the corn, and live at first on insects and their larvæ, to which later on they add green herbage. The mother defends them bravely against enemies of strength equal to her own, while the cock watches and protects them: should the hen discover an enemy of superior strength, she flutters off as if injured, and so draws away attention from her young. In spring and summer such bustards as are too young for breeding form separate flocks with about five in each. In autumn both young and old birds of the same family associate with others in smaller or larger flocks, and graze and rest in company, the stronger birds placing the younger and weaker in the middle of the party.

In summer the full-grown bustard feeds principally on the larger insects, but also on green plants, such as dandelion, valerian, hawkweed, young grasses, corn, clover, cabbage, carrots, turnips, and rape. Although a large, stately, and somewhat heavy bird, it is not clumsy, and unites great caution and alertness with keen sight and hearing. Its power of smell is, however, by no means good, and it often raises its head to look round. When undisturbed, it walks in a slow and measured manner, but when pursued runs so fast that it can scarcely be overtaken even by a swift dog. When about to fly, it rises, after a few quick leaps, and then flies slowly and apparently without effort. While flying, a bustard stretches out its neck and legs, and lowers the heavy hind part of its body, thereby being distinguishable from a goose, which it otherwise much resembles in flight. The bustard has many enemies, among them being the golden and sea eagles, while the young are the prey of hawks and falcons, as well as of foxes, martens, weasels, and cats. Its great shyness and vigilance protect the bustard from most of its bird-enemies. In western Europe the bustard is rare, but in Italy and Hungary, as well as in the warmer districts of Russia, it is still comparatively common. Its range, which formerly included England, extends northwards to southern Sweden, southwards into Africa, and eastwards to central Asia.

Crane. Cranes differ from the bustards by the presence of the hind-toe, and from the game-birds by the comparative shortness of the front-toes. The European representative of the group (*Grus cinerea*) is a bird of the fields or of the marshes, according to its food, which may consist of grain, green seeds, and small plants, or insects, worms, lizards, and small mammals. It prefers plains with not too many trees but abundance of reeds and grasses, as

well as marshes with alders from which a wide view of the surrounding country may be obtained. The nest, generally situated in a marsh among rushes and sedges, is built of dry twigs and reeds roughly put together. Since a crane never flies right up to it, but approaches it from some distance, always going and returning the same way so as to make a well-marked path, the nest is easy to find. Cranes lay their eggs in May, and in a month the young birds are hatched. These remain in the nest but a few days, and are at first fed from the beaks of the old birds, by



THE CRANE.

whom they are hidden in dense bushes, or among field-crops, until fully fledged. They reach maturity when two years old, and until then associate only with other young cranes, and start with them on their migration. They also pass their second summer by themselves, although on the breeding-grounds of the old birds. Towards the end of September cranes begin to leave for the south, the migration being at its height in October and the early part of November. In central Europe the flight is from east to west; and before the autumn migration cranes assemble in large flocks at certain spots whence they all fly off together with loud screams. They often migrate in flocks of many thousands, divided up into smaller parties, each of which flies in good order, either in a serpentine line, or in two lines of fifty or sixty birds, forming an acute angle. Generally they fly so high as to be almost invisible, but on dark nights they take a lower level; should they sight anything suspicious they fly round in circles. In

most cases they fly down wind, particularly when on migration, and they may be noticed at different heights, as they are able to fly with the wind in a higher current when the lower current is blowing in the opposite direction. Migrating cranes are often accompanied by small birds, especially larks. When surprised by a late winter in Europe, cranes return, if the migratory instinct be still strong enough in them, to milder climates. The spring migration begins in March; towards the close of the month it is at its height, and it ends with April.

A stately, well-shaped, and active bird, a crane generally walks with long measured steps, although this dignified manner is given up when, in sport, the bird performs various quaint bows and leaps, spreading at the same time its graceful wings to the wind. Even then, however, its attitudes and movements are more graceful than those of the stork, for which it is often mistaken, especially when on the wing. Although one of the shyest of the central European birds, when kept in domestication a crane soon grows very tame, and will live to the age of forty years. In the farmyard a crane is a useful bird, as it will separate quarrelling poultry by kicks and loud cries, and lead geese to the pasture, keeping them together, and also growing so tame that it will allow itself to be handled, and will follow its master like a dog, entering even the house and eating out of a special dish. It is, however, a somewhat dangerous companion, on account of its habit of pecking at the face and eyes.



THE CORNCRAKE OR LANDRAIL.

Corncrake or Landrail. Between the cranes and the rails, in spite of a marked difference in habit, there seems to be an evident although distant relationship. The rails are very thin in the body and short in the wing, with an abbreviated tail. Their powers of flight are not remarkable, and they are seldom seen in the open except when driven out of the covert in which they spend most of their lives, favoured by their slimness in making their way among the closely growing stems of grasses and reeds.

The familiar cornerake or landrail (*Crex pratensis*) frequents fertile meadows abounding in flowers, green corn-fields, clover, and pea-fields or other fairly dry places, including hilly and mountainous districts. Arriving in central Europe in the second half of May, it makes its presence known by the peculiar pairing-call, a ventriloquial *crake-crake* not easy to locate, particularly as the bird keeps carefully out of sight. The nest, which is built either

on the edge or in the middle of a meadow, but always in some dry spot is difficult to find, as it is nothing but a small depression in the ground, lined with moss and grass. At the end of June it contains from seven to twelve greyish eggs, marked with violet-grey and reddish brown spots and streaks. The hen is so reluctant to leave her eggs that, in former days, she used frequently to be slain by the scythe of the mower. The young birds, which are covered with black down, leave the nest at an early period, to seek their food under the instruction of the hen, to whom they resort at times in order to warm themselves beneath her plumage. When frightened, the young birds disperse so quickly, and find such excellent hiding-places, that they are but seldom caught. The landrail leaves central Europe in August, and continues to migrate until October, travelling at night to its winter-quarters in Africa. A common bird in many parts of Britain and the Continent, the landrail is spread all over Europe as far as Lapland, and over western Siberia to the Lena River; while it also appears in Greenland and the Bermudas. The landrail is 10 inches long; the feathers of the upper part of the back are light brown, each with a dark brown spot in the middle, the throat and breast are white and the wings and sides are rusty brown, the axillaries being chestnut, and the beak and legs flesh-coloured. In France there is a curious idea that each bevy of migrating quails is headed by a landrail, which is accordingly known as the "king of the quails."

Partridge. The typical game-birds live principally in the fields and are almost exclusively denizens of the ground, although the partridge (*Perdix cinerea*) may be found among bushes and underwood, especially if these adjoin fields under cultivation, and offer convenient hiding-places. It never, however, perches on trees, and never passes the night in bushes during the pairing-time. In spring partridges may be seen in such corn and other fields as they may later on use for nesting purposes. In autumn they may be met with in these same fields, as well as in others, and even in meadows and on moors, providing good hiding-places are near at hand. In winter they associate in coveys; in spring they separate into couples, but there generally remain a few bachelor cocks, on account of the excessive number of that sex in localities where they are not purposely shot down.

The call of the cock is heard morning and evening, and is answered by the female, who is received with drooping wings, outspread tail, a nodding of the head, and a soft *kur-kur*. As a rule, this courting lasts from ten to twelve days only, but some cocks wander about for a much longer period, and by their attentions grow so troublesome to the sitting hens that the latter cannot properly brood their eggs, which they are consequently compelled to remove to the nests of others of their kind. The nest is often found among growing corn, clover, or lucerne, as well as in tall meadow-grass and low shrubs close to thick underwood, or in vineyards and grassy orchards. Partridges never nest in woods, and enter the forest only in case of need. The well-hidden nest is nothing but a small hollow lined with dry plants and stalks, which the hen generally excavates or at least enlarges.

Towards the end of April, or in most cases not before May, the nest contains from ten to fifteen olive or yellowish brown eggs. If often disturbed, the hen will

desert her eggs, but towards the end of incubation she sits very close. The number of eggs varies according to the age of the hen, young birds laying fewer than older ones. If there are nine eggs in the nest, these are laid by a bird whose first clutch has met with an accident; if the nest contains seventeen or more eggs they have been laid by two birds.

So soon as their feathers have been dried by the warmth of the mother, the young birds leave the nest for ever. The whole family are much attached to one another. First of all, the mother teaches the chicks to find their food, during which time she creeps about cautiously in situations where she is not easily seen. The

cock informs his family of every danger, courageously meeting all enemies, and often trying to divert attention from the young by pretending to be lame, in which endeavour he is supported by the hen. The latter always escapes in an opposite direction to the cock but returns as soon as possible in secret to the chicks, which have hidden among grass and leaves.

While attention is monopolised by the male bird, the mother leads her chicks away. As soon as all is safe, the cock calls to the hen, and when she answers returns to his family; and by means of different calls, and the general acuteness of their senses, the two find each other very quickly. So long as the chicks are small the hen shelters them under her wings, not only at night, but also in bad weather and after meals. If they grow too big for all of them to be covered by the hen's wings, the cock takes some of the little ones beneath his own. When the chicks are grown up, they escape from their enemy by flight, and, if chased a second time, by dispersing in all directions. When in fear, they press their bodies close to the ground and await the intruder's approach without taking to



A COVEY OF PARTRIDGES.

flight; and, when everything is again quiet, the old birds begin calling until the fugitives are collected. The cock especially takes great trouble in doing this—and in short, for a long time, looks after his offspring, in whom he seems to take great pride. Towards the broods of others of their kind, partridges behave most unsociably, strangers being at once driven away; while a pair of old birds which have lost their young ones are not readily accepted by another family. Young partridges, as well as solitary old birds, meet however with a better reception, although even in their case quarrels will arise. In the twilight partridges collect in parties, and after flying round for a short time suddenly alight, fly about once or twice perhaps, then quickly scratch little holes in the ground, and go to rest with their heads towards each other. In the morning they separate until the old birds call them together, when they again disperse, to be once more assembled in a similar way. At the third call they remain on the spot awaiting the rising of the sun, when they stretch their necks and fly off in search of food.

The partridge walks quickly if undisturbed, but runs with its head erect and so rapidly that it can scarcely be followed by a man. When running, it hides its short and rounded wings beneath its side-feathers. The tail, which is generally drooping, is erected when anything unexpected is encountered; this being a sign that the bird contemplates escaping. The flight is quick and whirring, and, when once started, the bird glides through the air without any visible movement of the wings for a long distance. The pairing-call of the cock, generally called "crowing," is also the call for the rest of the family; it sounds like *girhick*, and is answered by the hen with a softer *girret*. The young birds chirp, their call sounding at the beginning like *girik*. When full-grown partridges are undisturbed, they utter a subdued *kurruk-kurruk*, and the old ones a soft *kur-kur* which also serves as a danger-signal. When frightened, the cry sounds like an agitated *rip-rip-rip-rip*.

The partridge is not a naturally timid bird, for in districts where it is not disturbed it will allow intruders to come close; but wherever the country is much shot over it becomes very difficult of approach. Among its numerous enemies hawks are the most dreaded, since they seize their victims alike when flying, sitting, or running. Dense brushwood, or the habit partridges have of pressing themselves close to the ground, may often be the only thing to save them from the destroyer. The hawk's victims are generally the cocks, which are more numerous than the hens; and on this account the inequality in the number of the sexes is not without advantage.

The food of the partridge consists of insects, especially ants and their pupæ, in search of which it scratches up the ground like a domestic fowl; but corn and other seeds, as well as green plants, are also eaten. Each covey seeks its food within its own particular area; and in winter food can be easily obtained so long as the snow is not too deep; but when the snow is frozen the partridge starves, the feeding-places becoming deep in dust on account of the continual scraping and scratching in the ground. In districts where there are many junipers, partridges find shelter under the branches and sufficient food in the berries. Sometimes partridges hide away during the whole winter to reappear when the snow melts. As a rule, they sleep in the open field.

The partridge is about 12½ inches long; the largest birds being found on

rich arable fields. The general colour above is brownish grey, finely marked with black, the grey being darker in the birds of northern Europe. The head is brown at the top, the rest of it being chestnut, like the throat and neck. There are buff cross-bars on the wing-coverts and scapulars of the female but none on those of the male, this being the only marking by which the sexes can be distinguished, although in many cases the cock has a horseshoe-spot on the breast, which may be obscure or wanting, or even more distinct, in the hen. The middle tail-feathers are coloured like the back, the others being chestnut, and the underparts are greyish on the breast, fading into whitish on the abdomen. In old birds the first flight-feather is rounded at the tip; in birds of the year this feather is pointed. Young birds have yellowish brown feet, which turn to bluish grey as soon as hard weather sets in and remain that colour. The partridge inhabits Europe from southern Scandinavia to the shores of the Mediterranean, from Spain to the Caucasus, and is found in Asia as far east as the Altai Mountains.

The sex of the partridge cannot always be distinguished by the horseshoe, but that of the quail is invariably shown by the anchor on the chin and throat, which is never borne by the females. Quails are comparatively small birds with pointed wings, long white axillaries, and a short tail of ten or twelve soft



THE QUAIL.

feathers. The migratory species (*Coturnix communis*) spends the greater part of its life on grassy plains and meadows, or arable lands; ranging over the milder countries of Europe, from southern Italy to central Sweden, and vast stretches of Africa, but especially the plains of Asia to the far east. In the Caucasus it is found up to a height of 8000 feet; and it is most abundant in Hungary and the plains of south Russia. In Germany it has greatly decreased in numbers, especially in the south, where it is only a bird-of-passage. Many quails remain in the south of Europe during the winter, but most migrate to South Africa. They start south towards the end of August; by the middle of September their migration is at its height, and in October the last stragglers disappear. They fly easily, but prefer a light wind; if the wind is against them they remain on shore, or on cliffs and downs, and when tired often settle on the decks of ships at sea; they are even said to rest sometimes on the waves, when many perish. In southern Europe and

northern Africa they are often seen migrating in huge flocks. In both countries they are used as food, and a large business is carried on in these birds, especially in Capri, where a part of the episcopal revenue is derived from the results of the quail trade.

Africa is the principal winter-quarters of the European quails; the Asiatic birds crossing the Himalaya into India. Appearing in great crowds, they separate soon after their arrival into smaller parties and return rather later than other birds-of-passage. A quail's nest is seldom seen before midsummer, and most of them are found towards the middle or even the end of July. The nest is always well hidden, generally among field-plants, occasionally in meadow-grass or standing corn. It is nothing but a slight hollow with little or no lining, and contains from eight to twelve eggs which are buff or light brown blotched with blackish brown. On leaving the eggs, the young run about at once. From the first they are carefully taught by the old birds to find their own food, which consists of the larvæ and pupæ of ants and other small insects. The old bird scratches up ant-hills, feeds, and takes under her wings the young ones, which grow so quickly that in the second week they begin to fly, and after eighteen days are thoroughly fledged and full grown. Then the affection of the mother suddenly cools, and they disperse and start on their journey south.

Besides insects, the quail is fond of seeds and green plants, which it seeks on the ground. It leaves its hiding-place at noonday to dust in the sand and bask in the sun, and is most active at dawn and in the twilight, flying only in case of necessity, and hiding rather than attempting to escape by flight; or, when surprised in the open field, pressing its body flat to the ground. Once on the wing a quail flies swiftly enough, though not very far at a time, with a quick, whirring flight about a yard from the ground, either straight on or in curves. In its walk every step is accompanied by a nod of the head, and it has a peculiar habit of jumping up into the air, when it usually draws its feet close to the body and looks almost like a tiny ball. When agitated, it stands erect on the tips of its toes, stretching out its neck to see what is going on; and it will sometimes even walk in this attitude. The male is quarrelsome, especially in spring, when he will fight till death with a rival. In spring the well-known call, *put-put-put*, is often heard; and, on account of this curious call, quails are often kept in houses as pets. The total length of the quail does not exceed 7 inches; it is sandy brown above, with dark brown bars and buff shaft-stripes, the throat and breast, with the exception of the black anchor in the males, being white, as is the eye-stripe.

Hen-Harrier. In the open fields of central Europe the birds-of-prey are represented only by two species of harriers. Of these, the hen-harrier (*Circus cyaneus*) constructs its nest on the ground, on heather and waste lands, in standing corn, or among reeds and shrubs in large meadows, young underwood and in the willows bordering a swamp. Dry twigs, potato-stalks, heather, or wool, with a layer of long grass, may compose the nest, which is about 2 feet wide and 5 inches high, and in May contains from four to six eggs. The young, which in case of danger lie flat on the ground and make no sound, grow up into unsocial birds which feed on insects, lizards, small mammals birds, and eggs.

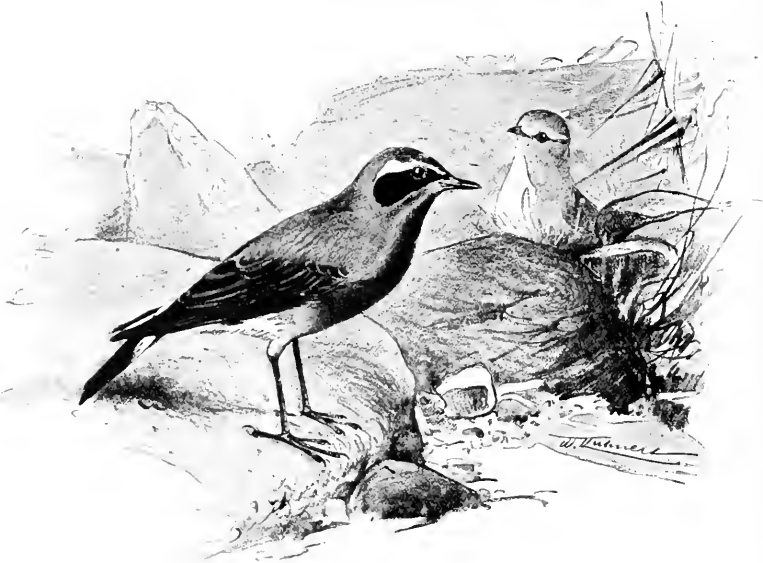
The hen-harrier flies low across the fields in search of prey, frequently pausing to hover, sometimes turning in a circle, sometimes dropping to the ground as if to seize some object, then rising again, and, as soon as it espies a victim, suddenly



HEN-HARRIER.

swooping down, and seldom without success. Avoiding trees, it shelters for the night in some cornfield or bush, and flies over its haunts for certain hours daily. Both in Germany and Hungary the hen-harrier is now rare, although it is common in Rumania and the Dobrudscha, as well as in Holland. It migrates south in September and returns in March, but in mild winters a few solitary birds remain; its nesting-area extends over central Europe across Asia to Corea and Japan. In the north it is found in Lapland as a visitor, and in the south of Europe as a migrant: in Africa it has been traced down to the Equator.

Montagu's Harrier. Montagu's harrier (*C. pygargus*) frequents extensive plains, where there is water, and fields, meadows, and low-lying ground with isolated willows and bushes. The nest, of which there are sometimes large colonies, is generally found amid high grass, bushes, and reeds, but always on the ground. It is about 9 inches across and 3 inches deep, and made of dry twigs, and plant-stems lined with grass. In the middle of May are deposited from four to six eggs, the colour of which is chalky white blending into bluish green; they are not usually spotted, and only in some cases are marked in a manner similar to those of other



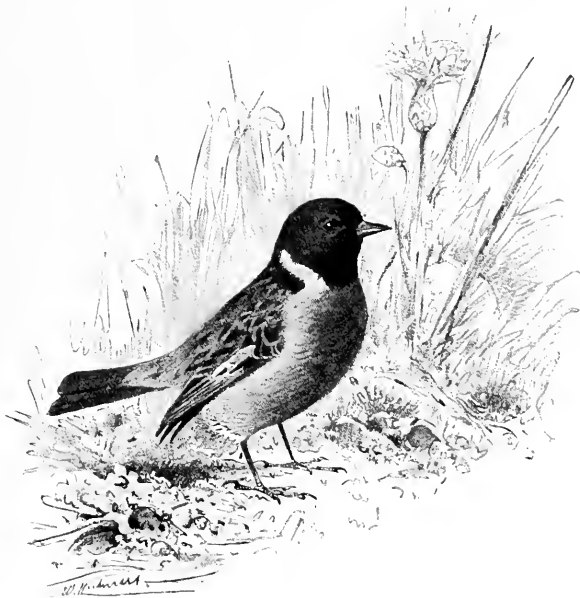
A PAIR OF WHEATEARS.

harriers. The nest is not easily found, as the birds, while they have young, only remain in its neighbourhood in the evening.

Although Montagu's harrier is rare in the west and north of Europe, it is frequently seen in the east, as well as in western and central Asia, but is most numerous in the valley of the Danube, from Vienna to the Dobrudscha, and in the Russian steppes. In Germany it is rare, especially in the Mark, but it is found on the north German plain in districts similar to those it visits in Holland. It leaves for the south in October and migrates down the Nile Valley to Cape Colony, although in mild winters a few remain on their nesting-grounds.

Wheatear. The perching birds are so numerously represented in the fields that it is quite impossible to include them all in our survey. Beginning with the thrush-tribe, the first noteworthy species is the wheatear (*Saxicola*

œnanthe), a bird not only of the fields but of the moor and the seashore, and also of the mountains, where it ranges higher than the tree-line in southern Europe. It is found all over Europe, and northern Asia and north-east America, being nearly circumpolar in its distribution. From Europe it migrates to Senegambia and Abyssinia, and in Asia its winter-quarters are in the north-western Himalaya and Persia. The wheatear is strong, active, and wary, and by no means a lover of a quiet life with its fellows; it has a rolling, jerky sort of gait, nods as it sits on stones or any small elevation, and escapes from every bird-of-prey into the nearest



A COCK STONECHAT.

hiding-place. Its song is a twittering, varied with a few specimens of mimicry of the shorter trills of other birds, and its call *chuck-chuck*. It sings on the wing as well as when perching, and the low dipping flight rarely rises higher than forty feet. It lives on insects, worms, and snails, and nests in rocky clefts and stone-heaps, even in holes in the ground, in peat-stacks, holes in walls, and other hiding-places.

Stonechat.

The handsome stonechat (*Pratincola rubicola*), which lives on or near the ground, and is seldom seen on trees larger than a hawthorn, is distributed somewhat locally over central and southern Europe, being found in Spain and Portugal, and ranging from the British Isles to the Petchora Valley, where its place is taken by *P. maura*, distinguished by its black axillaries. In the beginning of April it arrives in northern Europe from its winter-quarters in

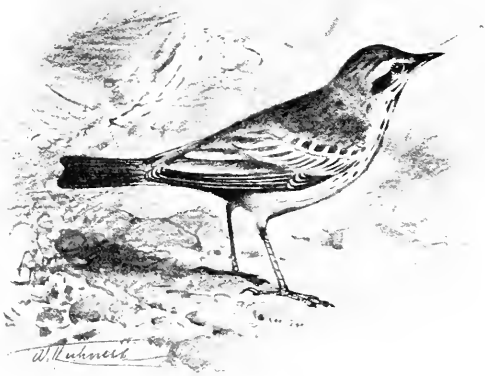
northern Africa, and in September leaves for the south, its wanderings taking it at least as far as Senegal.

Whinchat. In Germany, especially from the Elbe eastwards, the stonechat is a resident bird, and is less common than its relative the whinchat (*P. rubetra*), which generally arrives in the second half of April or at the beginning of May. Found in most parts of Europe up to the Arctic Circle, and eastward as far as the Urals, its southerly range extends into Africa and Arabia. The whinchat is 5 inches long; its chin, cheeks, and eye-stripe are white, the throat is light reddish brown, as are the flanks, the centre of the breast being sandy; all the tail-feathers except two brown ones in the middle are white, with long brown tips, and the primaries have white bases. The nest, composed of moss and dry grass lined with grass and hair, is always on or near the ground and approached by a winding run. At the end of May, or beginning of June, from four to six eggs are laid. The nest is difficult to discover, but its position is often indicated by the old birds if they have young, as when an intruder approaches they become very noisy in their anxiety. The whinchat is vivacious in all its movements, and one of the prettiest and most engaging of the minor songsters. It sings on the wing, and its call of *oo-tack oo-tack* is like that of the stonechat, but the two birds are readily distinguished by the male stonechat having a black breast and but little white in his tail, whereas the whinchat has a brown breast and much white in the tail, the hen also having white in her tail, while the hen stonechat has none.

Bunting. A common inhabitant of the open country, the bunting (*Emberiza miliaria*) is widely distributed wherever there is arable land. It is a heavily built, leisurely bird, walking in measured fashion, and on account of its earthy-grey colour is scarcely perceptible, its plumage being not unlike that of a lark, which it resembles in sleeping on the ground. Its nest is always on or near the ground, and generally in the centre of a field among coarse grass or young corn, being a loose structure of grasses lined with finer grass and hair. The eggs, four to six in number, are of the colour of slate, beautifully blotched with dark purple. The song bears a curious resemblance to the sound produced by a creaking machine, but it has its admirers. When singing, the cock perches on a tree or telegraph-wire, or on a little height near the ground, with feathers ruffled up, head erect, wings drooping, and throat distended. He often repeats the song in the same place for a quarter of an hour or so, sometimes running from one place to another, or flying in a whirring manner with dangling feet, to a more distant spot, singing as he goes. The bunting ranges nearly all over Europe south of Norway; its easterly limits extending to the Persian Gulf. It is met with right across northern Africa, and is frequent in Hungary, south Germany, and Switzerland. In October, November, and March, buntings wander about in large flocks, and in cold winters migrate south. It is the largest of the European buntings, being in some cases over 7 inches long.

The pipits are represented in the open country by two species, of which the tawny pipit (*Anthus campestris*) lives on waste lands, plains, and sandy stretches. It is peculiarly a ground-bird, perching on bushes, stones, or posts, but never on trees, and running about in chase of insects, with an occasional flight to a large stone or paling and thence at once to the ground again

with a run on alighting. Now and then it soars and sings, but never for long, and soon comes softly down, or with closed wings falls like a stone. At night it sleeps behind a clod or in the furrows, and shelters in similar places from birds-of-prey. Its song is like that of the lark, but neither so rich nor so sweet. The tawny pipit arrives in Europe in the middle of April, breeds towards the end of May, and leaves about the end of August. In south-west Germany and Switzerland it is rare and always found in pairs; in Germany it is nowhere very common, and in Great Britain is known only as an occasional autumnal visitor. It ranges over the temperate countries of Europe up to central Sweden, and is also found in central Asia, north-western India, and in Africa down to Senegal. It is 7 inches long; the upper-parts are sandy grey with indistinct dark spots, the lower-parts being



TAWNY PIPIT.

whitish, and the outer tail-feathers nearly all white; the flanks are without streaks, and the wing-coverts are edged with sandy buff, as are the feathers of the tail. The hind claw, which is slightly curved, is never shorter than the hind toe.

Meadow Pipit The meadow pipit (*A. pratensis*) is a restless, gregarious bird, which seldom perches on a tree, owing to its hind toe being too short to clasp the twigs and the straight hind claw being so inconveniently long. It lives in meadows and marshes, on moors, near water, in large pastures with few trees and bushes, and on the seashore, preferring everywhere open ground with short grass. Feeding on insects, worms, and snails, it rarely eats grain or other seeds. When singing its melodious song of many repetitions, the meadow pipit flutters up into the air, remaining there for a little time, and then descending to finish on the ground. The autumn migration begins in the middle of September, is at its height in October, and lasts through November. The birds return in the

beginning of March or earlier, and breed in the middle of April and in the middle of June. The meadow pipit is not quite 6 inches long, and has a good deal of white in its plumage, though in the main its upper-parts are olive, and the breast buff, both being spotted and streaked with black. The eye-stripe is narrow and whitish, the axillaries are brown and yellow; the upper wing-coverts edged with white, and there is white in the outer



BLUE-HEADED WAGTAIL.

tail-feathers. Ranging over northern and central Europe, the species extends to Iceland and Norway; in Asia it is found in the north and west; and it is also met with in southern Europe, along the African coast of the Mediterranean, and up the Nile Valley so far as Abyssinia.

Blue-Headed Wagtail. The wagtails, being near akin to the pipits, next claim attention, and we take as an example the blue-headed species (*Motacilla flava*), which is one of the yellow group, and extends all the way from the British Isles to Alaska by way of Kamchatka. This wagtail frequents marshy places, and fields and pastures near running water, avoiding hilly country, and only crossing mountain-ranges when on migration. Essentially a bird of the plains and of the stream, it is distributed over the greater portion of Europe and Asia, departing in September from central Europe to South Africa. At the beginning of April it returns and makes its well-hidden nest among tufts of grass, frequently under the shelter of a spurge. It feeds on insects, particularly small flies, which it catches on the ground as well as in the air, seeking and pursuing them round the muzzles of grazing cattle.

Although the larks, as a rule, are birds of the open country, they prefer fields under cultivation. The crested lark (*Galerita cristata*) frequents high-roads and lanes, and dry, sandy barren ground, especially at high elevations. It avoids meadows, cornfields, and woods; never perches on trees, and is a silent, confiding bird, which allows approach within a short distance, until it endeavours to escape by running a little way or by a longer flight.

The gradual occupation of Germany by the crested lark in modern times has been carefully recorded. The bird has always been a common resident in the lower

districts of the Altai, and one of its varieties ranges from Turkestan to southern Russia, whence several varieties have spread over Bulgaria and the Mediterranean countries and from Greece to Spain, these varying not only in colour and size but also in song and habits. The few crested larks found in Switzerland and Styria are probably descended from these Mediterranean birds. One variety is indigenous to Portugal, where it perches on trees, which the typical form never does. Other crested larks came westward through the Iron Gate and slowly made their way up the valley of the Danube. In 1864 they had reached Arnsdorf, where six years later they had considerably increased in numbers, but they did not appear in the environs of Vienna before 1879. Another line of advance was along the valley of the Oder, turning to the west on reaching the Baltic. Near St. Petersburg the crested lark has not even yet been seen, and to Sweden and England it is only an occasional visitor. In Schleswig it is only seen in winter, but then very frequently; in 1850 it was found nesting in Holstein, and in 1856 on the island of Sylt. In Oldenburg it appeared first in 1820, but had considerably increased by 1853; and in 1848 it became more numerous near Berlin, and seven years later appeared at Seppenrade in Westphalia. In southern Thuringia it is



THE SKYLARK.

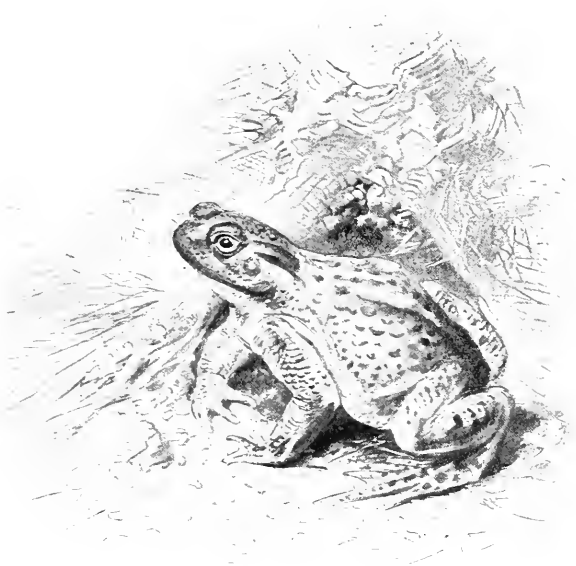
even now a rare winter bird, while in north-western Thuringia it was found nesting at Schlottheim, near Mulhausen, in 1854. At Neuwied on the Rhine it nested first in 1840, and in 1878 reached Saarbrücken. A remarkable feature of its progress is its having kept to the high-roads, near which its nests are generally found. These wide roads, it may be noticed, are not unlike the barren Chinese and Mongolian steppes, and the crested lark is essentially a bird of the steppe, much more so indeed than any of the other birds migrating into central Europe from the south-east. By following these roads, the crested lark at once attracted the attention of man, who was thus able to watch its gradual advance.

In Thuringia it is believed to have made its first appearance in 1813 with the Russians, to whom also the introduction of cockroaches is ascribed. Southwards of the line, from Metz to Leipzig, the crested lark does not appear in Germany as a breeding-bird, but it has on a few occasions been found nesting near Darmstadt, Ulm, and a few other places.

Skylark. The familiar skylark (*Alauda arvensis*) is to be found almost everywhere, on arable plains, barren heaths, sandy stretches, rocks, pastures, the highest mountain meadows, and the seashore; and it is always recognisable by the flight and song. When rising, and singing as it rises, the lark first flies at an angle, and then mounts almost vertically until it suddenly starts on a wide spiral curve, in which it soars higher and higher. At last it ceases to rise, and, supported by the expanded tail, hovers in the air, trilling forth its melody for sometimes a quarter of an hour at a stretch. Towards the end of its song it falls gradually for a time, and then suddenly drops, singing all the while until close to the ground. It begins to sing from the time of its arrival and continues till the end of July, the song being at first tender and low, as if proceeding from afar or from beneath a rock. The skylark makes its nest on the ground, in a slight depression scratched out for the purpose, the nest being difficult to find, owing to its colour being the same as that of the surroundings; it is made of grass or herbaceous plants with a little moss and rootlets. The eggs are sometimes laid in March, although oftener in April, and are of a whitish earthy brown, blotched with brown and grey. The male is 7 inches long, the female being similar in plumage to the male but of smaller size. The species may be distinguished from the other larks by the faint yellowish eye-stripe, by the throat and head being more spotted than streaked, and the outer tail-feathers mostly white. It ranges over Europe up to the Arctic Circle, but is rare in the south except as a winter-visitor, its place being taken in the Mediterranean countries by *A. cantarella*.

Toad. Of the central European reptiles none are properly inhabitants of the fields, but among the amphibians the toads and a few of the frogs may be so regarded. The most familiar of these is the toad (*Bufo vulgaris*), which is more widely distributed than any of the others. With the exception of the extreme north of Ireland, and some of the Mediterranean islands, it is found all through Europe, western and central Asia, Japan, Morocco, and Algeria, and dwells in the mountains as well as in the plains and uplands. During spawning-time the toad keeps close to water, but after that season lives almost exclusively on land, although always in shady and moist places. Nocturnal in its habits, it hides by day in crevices and beneath roots, bushes, tree-stumps, and stones, in old walls or in grottoes, or even in cellars and stables. For its hibernation it seeks shelter in mud, holes in the earth, rock-clefts, etc., retiring towards the end of September or the beginning of October, and not reappearing till March, when pairing begins. Toads remain in the water until they have spawned, after which they emerge in search of food on land. They live on worms, spiders, slugs, caterpillars, and insects. From its behaviour in securing its prey, its power of finding its old holes after nocturnal wanderings, and its endeavours to drive away rivals

during pairing-time, the toad seems to be endowed with a considerable amount of intelligence. It also knows how to accommodate itself to circumstances. When in captivity and fed regularly, it forsakes its nocturnal habits and soon learns to know and distinguish its keeper from other persons, while in time it will follow when called by name. It may even be touched and caressed without its making use of the acrid secretion from the skin; and seems to remember bad treatment, since it is obviously alarmed at the reappearance of any person by whom it has been teased. On account, however, of its clumsy body, phlegmatic habits, and sluggish, awkward movements, it has earned an ill-deserved



THE TOAD.

reputation for stupidity. Its walk is a laborious crawl, which becomes a sort of hobble when in pursuit of food; but when young it can leap, although it does so but seldom. A toad is very quick in digging a hole in loose soil, although generally it makes one only big enough to hide the lower half of its body: it also swims in a masterly fashion, if the current be not too strong. During pairing-time the female utters a sort of squeak, and the male a high-toned, soft, short croak.

Natterjack Toad. The natterjack toad (*B. calamita*) is a far less generally distributed species, although found locally, from Portugal and Ireland in the west to the Vistula in the east, and from the south of Scotland, Denmark, and the south of Sweden in the north to Gibraltar in the south. It is, however, unknown

in Italy and the islands of the Levant, as it also is in Austria-Hungary; in fact, it is confined to western Europe.

Throughout the whole year it may be found on sandy river banks and in marshy meadows, and also in gardens and parks, tool-houses and cellars, and even on dry heaths and mountain-slopes. It is by no means entirely confined to the vicinity of water, as in the Alps it is met with as high as 4000 feet. In September or October it retires to a deep hole in sand or mould, and sleeps there, as a rule, till the middle of April, when it leaves its winter-quarters and takes to the water, where the males make a noise resembling the croaking of the frog until spawning-time.



MALE MIDWIFE TOAD WITH THE EGGS.

Midwife Toad. The curious midwife toad (*Alytes obstetricans*) is also confined to western Europe, but has a more restricted distributional area than the natterjack, being found only in Germany, Belgium, France, Spain, and Portugal; while in Germany it has been met with beyond Hesse in the north and Thuringia in the east. Far from being confined to the plains, this toad in the Teutoberg Forest ranges up to a height of 1200 feet, in the Hartz Mountains up to 1500 feet, and in the Alps as high as 5000 feet. This species may live near the water, and never leaves its lurking-places in rainy weather. It hides in stone-heaps, or rocky clefts, small cavities beneath the roots of trees, and if a suitable hole is not to hand digs one itself, but this happens very rarely, for these toads are not, as a rule, given to burrowing, although they excavate their own winter-holes. In the dusk and at night they hop about in leaps of a foot in length, which quickly succeed one another; and

they are quite equal to the natterjack in climbing. An excellent diver, the midwife toad can remain for a long period under water. At night and dawn it searches for worms, and insects and their larvæ; the male at such times uttering a series of bell-like sounds which blend together into a sort of chime, and have given rise to its name of bell-frog. When imprisoned it shows by its actions a good memory of localities and persons, and grows very tame. The most remarkable circumstance in its life is its breeding, which commences sometimes in March, in other cases in August, and occasionally in September. It is the only central European toad which spawns on land, and the male helps the female to bring forth



THE GARLIC TOAD.

her two chains of eggs, which form a double cord, by expanding and contracting his hind-legs and winding the cords round his legs and body; and he carries them about until the young are ready to creep out, when he enters the water, where, after a few hours, the young leave him.

Garlic Toad. The garlic toad (*Pelobates caltripes*), which is the only continental representative of the toad-frogs, inhabits the vast plains of central, north-eastern, and eastern Europe, from the lower Rhine to the Volga; the plains round the Elbe, Oder, and Vistula forming the centre of its area. As soon as this frog has finished spawning (during which season it remains near the water, from the end of March to the end of April or May, according to the weather), it starts

its summer-life. In spite of the large webs to the toes, it is a land animal, and except during spawning-time lives on dry ground. The young hop about the ploughed fields in the sunshine, but the adults are so exclusively nocturnal that they do not leave their lurking-places until nightfall. By day they sleep in holes under the ground, which have no visible entrance, and are therefore difficult of discovery. During their nocturnal hunting excursions these toads cover a great deal of ground, and they hop in a much quicker and more agile way than the ordinary toad. Their hiding-places are many and various, for every morning a new place of refuge is added to the old ones, this being, so to speak, the work of a moment. With incredible dexterity and rapidity one of these toads, when digging, pushes the earth away with its hind-legs, placing the hind part of its body in the hole, and turning it to the right and left to enlarge the aperture. In a few seconds the earth surrounds it as a wall, and in less than two minutes the animal has entirely disappeared underground. This capacity for digging is principally due to the spur with which each of the hind feet is furnished, this being as sharp as a knife, and capable of being turned outwards like a shovel, so that it may be considered an important means of protection. But the animal possesses another means of protection in the sharp, repulsive, garlic-like odour, which it emits when touched. This odour is, however, very weak during spawning-time, so that many naturalists think that it proceeds only from such individuals as have been in contact with garlic or onions. In the main the garlic toad is a harmless, peaceable, rather stupid, and gluttonous creature, but in the capture of its food, which consists of various kinds of worms and insects, it displays considerable energy. Its voice varies according to sex and age; the spawning female now and then uttering a low, sonorous grunting, while the male is recognisable by a loud powerful note, uttered three times in succession, interrupted by longer intervals, and deep in tone. Uneasiness is expressed by a short, feeble croak, quickly repeated. If in pain, the creature cries in a pitiful way, very much like a kitten whose tail has been trodden on. Even the young of the garlic toad, at least the four-legged ones, utter a monosyllabic squeaking sound. In September this toad retires to its hole for a solitary hibernation, which is ended in March or, in favourable weather, at the end of February, and at the end of March or the beginning of April spawning-time begins.

One of the most familiar representatives of the whole group is the frog (*Rana temporaria*), which spends less time in the water than any other member of its tribe. In this species the back is brown, greyish brown, or yellowish brown, while the thighs are never marked with light or dark marbled cross-bands but with plain brown bars. The ear has a distinct black, or blackish brown spot, and the webs of the toes are not so developed as in water-frogs. The frog may be readily distinguished from its relatives by the circumstance that the heel-joint does not reach the tip of the nose when the leg is stretched in that direction. The abdomen is grey with red and yellow spots, and the total length from 2 to 3 inches. The distributional area of this species extends from the Atlantic to the Pacific coast, and from Transylvania in the north to northern Italy in the south, and includes the north-western corner of Spain as well as Japan. The species was introduced into Ireland during the seventeenth

century, but has existed in England from prehistoric times. On the Continent it ascends the mountains up to 9000 feet. In the plains this frog is the first of its kindred to awake from hibernation, when it immediately enters the water for pairing and spawning, leaving it in April for the land, on which it spends the greater part of its life. In autumn it again enters the water, to bury itself in the mud for the winter. On land it progresses in long leaps, on the look-out all the time for the creeping and flying-creatures on which it feeds, and for its numerous enemies. The frog is not a noisy creature, its croak being a sort of grunt, generally uttered singly at long intervals, and then only in the pairing-season. During its summer-life on land it remains silent unless it be suddenly caught by the hind-legs, when it utters a long, plaintive wail.

Golden Ground-Beetle, etc. Passing on to the insects, we find numerous species more or less exclusively inhabitants of the fields, foremost among them being many beetles, especially those of the five-jointed section. The ground-beetles of



THE GREEN TIGER-BEETLE.

the family *Carabidae*, which live mostly on clay-soil, are represented in central Europe by the golden ground-beetle (*Carabus auratus*), a very common species with gold-green wing-covers, blue-black abdomen, and red legs. It feeds exclusively on living animals. Another representative of the same group is the corn-runner (*Zabrus gibbus*), which is about half an inch long, with a black cylindrical body, pitchy red legs and antennae, and wing-covers marked by small spots and striations. This beetle does much damage in cornfields, its larva eating the leaves, and the full-grown beetle feeding on the grain.

Tiger-Beetle, etc. The beautiful and swift tiger-beetles (*Cicindelida*), which frequent dry sandy places, shine like metal on the lower side of their bodies. They fly in jerks and feed on living insects. Their larvæ, which dig deep holes in the ground, are as voracious as their parents, and do not even spare their fellows.

The green tiger-beetle (*Cicindela campestris*), so often found in sandy fields, is about half an inch long, and bright silky green above, with a brown-edged white spot in the middle of each wing-cover and three white spots on their edges. The German tiger-beetle (*C. germanica*), on the other hand, lives in fields or grassy hills, and is under half an inch in length, of almost cylindrical shape, and greenish, violet, or black above. On the edge of each wing-cover are two white spots, and on their tips is a crescent of the same colour, but the colouring varies greatly in different individuals.

The short-winged rove-beetles of the family *Staphylinidae* derive their name from the six or seven uncovered rings of the abdomen, which are horny all round. They are very rapid runners, and their long-legged wingless larvæ are also very quick on their feet and curl up the ringed abdomen like earwigs. They have much the same habits as the adults, feeding on living insects and living in decaying matter. Many of this group emit a peculiar smell, while some have no



RED-WINGED ROVE-BEETLE.

mouth, but only a thin slit at the bottom of the jaws, with which they suck their victims. One of the commonest species of this family is the red-winged rove-beetle (*Staphylinus erythropterus*), which is from half to three-quarters of an inch long. It is black and hairy, with reddish bars on the antennæ, elytra, and legs, and has golden spots on each side of the head, the posterior margin of the thorax, and the sides of each abdominal segment. Another family is represented by *Hister quadrinotatus*, which is much like other carnivorous species in its habits, and eats beetles living in manure. It is broad and rounded, glossy black in colour, with a square red spot on each shoulder, and an oblique one on the disc, and is a quarter of an inch long.

Burying-Beetle, The carrion-beetles (*Silphidae*) are represented by the German etc. burying-beetle (*Necrophorus germanicus*), which also feeds on dung-beetles, as well as on other insects. It is black, with black clubs to the antennæ, and a triangular yellow spot on the forehead, the wing-covers having red edges, and its total length being from an inch to $1\frac{1}{4}$ inches. Like many of its relatives, it lives on manure and carcasses, which it scents from a distance: by undermining the ground beneath them, it inters small dead animals and deposits in

their bodies its eggs, which later on serve as food for the larvæ. The common burying-beetle (*N. vespillo*), which is the best known of this family, is generally entirely covered with red mites, and emits, if touched, a brown juice with a most objectionable odour. The wing-covers are ornamented with two yellowish red cross-bands, while the clubs of the antennæ are yellowish red, and the thorax is clothed in front with yellow down. The larva of another burying-beetle (*Silpha obscura*), which is injurious to fields of sugar-beet by eating the blossoms, is brilliant black in colour, with the upper rings of the body marked with yellow. The adult beetle is uniform black, nearly three-quarters of an inch long, with small dots between the



BURYING-BEEETLES.

three slightly raised lines of each wing-cover. The dusky burying-beetle (*S. opaca*) is a rather flat insect under half an inch in length, with the upper part of the body grey, in consequence of being covered with down. The larva of this species likewise destroys sugar-beet, as does that of the black burying-beetle (*S. atrata*). The latter species is oval in shape, and has uniformly black wing-covers, with three slightly raised lines, and is about half an inch long.

In the family *Nitidulidæ* we have the rape-seed beetle (*Meligethes aeneus*), a species found on blossoms of all kinds, but especially on rape, from the beginning of spring until the autumn. It is oval-shaped, and rather convex, with fine spots and hairs on its metallic wing-covers, and is black or violet above. The legs are pitch-black or dark brown, and its total length about an eighth of an inch.

Summer-Chafer. Among the beetles with complex antennæ furnished with fan-like leaves at the extremities, we may first mention, as a typical insect of the fields, the summer-chafer (*Rhizotrogus solstitialis*), which feeds on the buds of young poplar-plantations. In length it is about three-quarters of an inch, pale rufous in colour, and covered with down; along the yellowish elytra there are pure whitish lines, while the thorax and abdomen are more or less black. This chafer is common in hedges and on elms, and, like others of its kind, flies about in the evening on meadows and sandy grass-plots. The dor-beetle (*Geotrupes stercorarius*) lives on droppings, beneath which it bores holes in the ground for the reception of its eggs. It is oblong-oval in shape, of a brilliant violet-black or steel-blue colour, with a smooth thorax and little furrows and dots on the elytra. This species, which is about an inch long, is generally covered with reddish parasites, and is a common insect of the meadows as well as of the fields.

As a well-known member of another family (*Buprestidae*), mention may be



DOR-BEETLES AT HOME.

made of the small *Trachys minuta*, which is not above an eighth of an inch long, and short, flat, and very broad in the body. It is black with blue reflections, downy, striated on each side of the thorax and elytra, and marked with four narrow waved whitish bands. This beetle deposits its eggs in May, and can live through the winter.

Click-Beetles and Wireworms. The click-beetles (*Elateridae*), many of whose larvæ are known as wireworms, are recognised by the spiny protuberance at the hinder angles of the shield on the thorax. Their six-legged, thread-like, hard-skinned larvæ live principally on vegetable matter or on other larvæ. A common species of this group (*Laeon murinus*), found in spring in meadows and gardens, is brownish black, covered with white and light brown down, and having reddish brown antennæ and feet: its length is half an inch. The larva feeds on chicory, bites off the stems of rosebuds close to the bud, and bores through lettuces below the ground. Another wireworm-beetle (*Agriotes lineatus*) is found almost everywhere, especially in spring. It is about a third of an inch long, and of a greyish brown

colour with greyish down, the thorax and alternate striae of the elytra being rather darker, and the antennae and legs dusky red. The long wire-like larva does much damage to corn, especially oats, by feeding on the roots; it also lives on the roots of grasses, and bores into lettuces, turnips, carrots, and cabbages. Another beetle doing great damage to lettuces and other plants is *A. sputator*, which resembles the preceding species in many respects, but has no dark stripes on its brown elytra.

The soft-beetles are also represented in the fields; among them being the snow-worm beetle (*Rhagonycha melanura*), which lives in cornfields and elsewhere: it is yellowish red in colour, with the antennae, tarsi, and the tips of the elytra black. In length it measures about a third of an inch, and is very common on herbaceous plants and trees, living, like its relatives, on insects. The larva is long, flat, and clothed with down, leaving only the front half of the head uncovered. These beetles, which live under stones and on the ground, often appear before the beginning of spring in great numbers on the snow.



A CLICK-BEETLE.

The repulsive oil-beetles (*Meloe*), the females of which deposit more than two thousand eggs in spring, at intervals of two or three weeks, in holes in the ground dug in places warmed by the sun, are familiar insects on lawns and meadows. After four or five weeks the yellow, flea-like larvae hatch out and make their way to flowers, in order to cling to the legs of the bees and wasps of all kinds that visit them, and be carried away to the hives and nests where they develop into beetles. If the adult beetles be touched, they emit a yellow liquid from certain joints of their legs which raises blisters on the skin, owing to its containing cantharidin, like the fluid emitted by the blister-beetle; and in some parts of Spain these insects are actually used instead of the latter, or are mixed with them by druggists. The common oil-beetle (*M. proscarabaeus*) ranges from about an inch to $1\frac{1}{4}$ inches in length, the male being distinguishable by a hook-like bending of the antennae. In colour this beetle is bluish black, with a violet hue, the thorax having a notch behind, the elytra being rough, and the abdomen dark with a rough violet spot on each segment.

The Tetramera are represented by the pea-beetles, which live mostly on leguminous plants; one of them (*Bruchus granarius*) feeding as a larva in peas, beans, and other pods, and, in the tropics, on mimosas and acacias, as well as in cocoa-nuts and cocoa-beans. This beetle is of oval shape and black colour, with white dots on the thorax, and measures about half an inch in length. Another

species (*B. pisi*), a little larger and longer and much more injurious, is black in colour, mottled with white, and has two round black spots on the white hinder part of the body. In many places this beetle is so numerous that the cultivation of peas has been entirely given up. The eggs are deposited while the plants are in bloom, just as the pod begins to shape, generally one egg in each pea or bean.

Asparagus also has a destroyer, in the form of a small beetle (*Crioceris asparagi*), under a quarter of an inch long, with a red thorax, and marked on its yellow elytra with black spots and a black cross. The larvæ of this beetle eat the asparagus sprouts as they come out of the ground. Another species (*C. meridigera*) feeds on lilies and hollyhocks. Chiefly black in colour, it is red

on the thorax and elytra, and is about the same size as the preceding species: it produces a chirping sound by rubbing its wings against its thorax, from which habit it has been named "the musician." The minute beetles typified by the so-called turnip-fly (*Haltica*) are represented by a large number of species, all of which are injurious to plants; one



THE OIL-BEETLE.

of the most common being *H. oleacea*, which is blue or metallic green in colour, with small irregular spots, and bluish legs with a groove under the thighs of the hind-legs, strong enough to enable the beetle to jump readily. Like most of the associated species, these beetles remain the whole winter under the leaves and bark of trees, and in similar hiding-places, to appear in the first days of spring and eat into the seeds and early leaves of young plants. In doing this they pierce small holes, which grow larger in the same degree as the leaves develop, and are therefore often erroneously ascribed to larger insects. The beetles deposit their eggs on the leaves, which later on serve for the food of the larvæ.

The great group of Hymenoptera is well represented in the fields by the humble-bees, which make their nests on the ground, and cover them with moss. They live in communities like honey-bees, each community being composed of males, females, and workers. Not only the workers, however, but the fertile females are provided with baskets, brushes, and hooks on the legs to remove the wax from their abdomen. Among the many species which on account of the variability of their colour, and the facility with which their hair may be rubbed off, are difficult to distinguish from one another, the best known are the common humble-bee, the garden humble-bee, the moss humble-bee, and the stone humble-bee. The ordinary humble-bee (*Bombus terrestris*) is nearly one inch long, and principally black in colour with white markings on the breast, and yellow

on the second ring of the abdomen. The garden humble-bee (*B. hortorum*) is just as large and of the same colour, but the first ring of the abdomen and not the second is yellow, as is also the hind part of the breast. The moss humble-bee (*B. muscorum*) is red on the breast and at the base of the abdomen; the abdomen itself being light yellow, the rest of the body black. The male of the stone humble-bee (*B. lapidarius*), on the other hand, is yellow on the head, breast, and thorax, and has a red hinder part.

The parasitic humble-bees (*Psithyrinae*), which have no workers, and are



HUMBLE-BEES AT WORK.

without baskets and hooks on their hind-legs, do not make nests for themselves but deposit their eggs in those of other humble-bees. In the species known as *Psithyrus rupestris* there is a great difference between the males and females. The female is black, with the end of her abdomen marked with red in the same way as the females of the stone humble-bee, though she has blackish brown wings, and is double their size; while the male is covered with grey hairs on the black breast and has the four last rings of the abdomen red, with the edges of the two first grey on each side.

In the digging wasps (*Crabronidæ*), which live in the ground, **Sieve-Wasp, etc.** both males and females are winged. They are solitary, and have no workers. These wasps bore holes for themselves, or utilise those made by beetles; and they seize upon plant-lice and other insects, cripple them with their stings, and carry them to their nests as food for their young. The sieve-wasp (*Crabro cribarius*), often found in flowers and on old wooden beams, is black, with five or six yellow bands on the lower edge of the breast, while its thorax and legs are yellow; the total length being half an inch. The male of this insect may be distinguished by having a white spotted disc on the fore-legs, with which it clings to the flowers. The roving-wasp (*C. sagus*), so frequent in worm-eaten wood, is black in colour, with yellow markings like those of the sieve-wasp, but has only three bands on the abdomen, and is yellow at the bases of the antennæ. The smooth field-wasp (*Mellinus arvensis*) is five-eighths of an inch long, black in the main, but with the inner eye-circle, the bases of the antennæ, the thorax, the lower edge of the breast, the legs, and three bands round the abdomen yellow. It generally feeds its young with dead flies, while *Dinetus pictus* feeds them on honey-bees. The latter insect, which is very common on sandy beaches, is about half the size of the former, and is also mostly black and yellow. The voracious wasps, which provide each of their cells with one large caterpillar, are best represented by the black and slender hairy sand-wasp (*Ammophila sabulosa*), which is about three-quarters of an inch long, with the second and third rings of the abdomen yellow; being also distinguished by a two-jointed elongation of the abdomen.

The minute parasitic insects of the family *Mutillidæ* are represented in the fields by the bee-ant (*Mutilla europæa*), the males of **Bee-Ant, etc.** which live in flowers, while the females dwell in the ground, and the larvæ in the nests of humble-bees, where they feed on the grubs, but do not touch the provisions stored up by the bees. The female is wingless and black in colour with a red breast-piece; while the male, which measures three-eighths of an inch in length, is bluish black, with red only on the lower part of the breast: both sexes have white bands round the neck, but those of the female are incomplete.

The ichneumon-flies and their relatives are well represented in the fields by the familiar *Bracon variator*, which varies much in colouring and lives in the larvæ of weevils. About an eighth of an inch long, and in colour principally black, it has a shining and generally red abdomen, dark wings with a lighter edging, and the ovipositor as long as the body. The members of another parasitic family, the *Chalcididæ*, live in hundreds as larvæ in the pupæ of the white cabbage-butterfly, as well as in those of other butterflies which, in consequence, become dirty brown.

The butterflies of the fields are very numerous, one of the finest **Butterflies.** being the swallow-tail (*Papilio machaon*), whose caterpillars feed on carrots, cow-parsley, and other umbelliferous plants. Far more common and familiar is the large white cabbage butterfly (*Pieris brassicæ*), whose caterpillars do so much mischief to cabbages, pelargoniums, and many other field and garden plants. In general colour the caterpillar is bluish green with black spots, the back and sides being striped with yellow, while the head, which is devoid of spots, is marked with a forked line. Developing in a fortnight, and producing several

broods, this butterfly is very common all through the summer and autumn. The beautiful orange-tip butterfly (*Euchloë cardamines*), found all over Europe, and northern and western Asia, is double-brooded. The greenish blue caterpillar, marked with a white streak along the line of breathing-pores, feeds mainly on cruciferous plants, especially on their seed-pods. Wrapped in a leaf whose edges are brought together by silk, the caterpillar of the red admiral butterfly (*Vanessa atalanta*) feeds on the nettle. In colour this caterpillar is blackish grey with seven rows of yellow spines; the adult insect is as easily



SMALL TORTOISESHELL BUTTERFLY.

distinguished by its black hind-wings with their red borders as is the orange-tip by the patch of colour on the otherwise white wings of the male.

The caterpillars of the small tortoiseshell butterfly (*V. urticae*) also feed on nettles, but instead of each individual living in a shelter alone, a number are found in company. Blackish is the general colour, with seven rows of dark green spines. The caterpillar of the painted lady (*V. cardui*), which is spotted with yellow, and has seven rows of yellow or grey spines, lives not only on thistles but also on the nettle, the viper's bugloss, the mallow, and other plants. This brownish red butterfly, which is so spotted with black as to give the appearance of a mask, and has four black "eyes" with blue centres on the hind-wings, is almost world-wide in its

distribution, though it does not occur in South America. Swarms of this species have occasionally been observed so numerous as to take from eight to ten hours in passing a given spot.

The elegant little blue butterflies, as well as the copper butterflies, are represented in the open country of Europe by several species, among them the rare Clifden blue (*Lycana ulonis*), the caterpillar of which lives on clover, lupin, hawkweed, etc., in limestone-districts, and is green in colour with black hairs; the male butterfly being of a brilliant sky-blue, with a black border and black and



CLIFDEN BLUE BUTTERFLY.

white fringe, while the female is brown, with orange spots on the edges of the hind-wings.

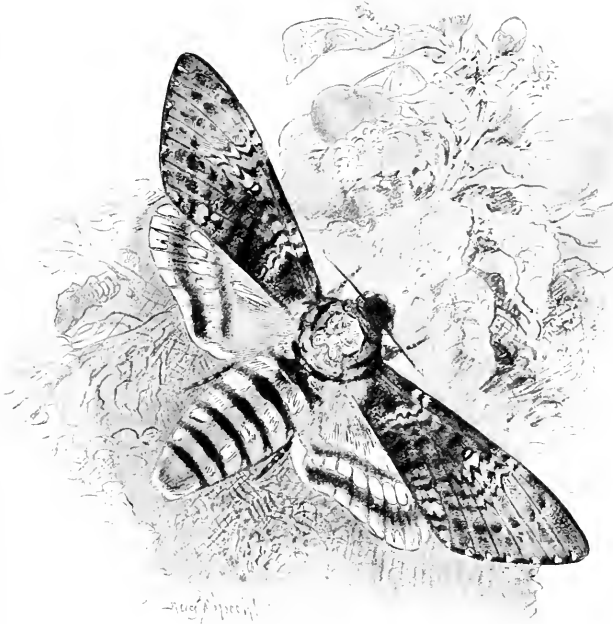
Moths.

Passing on to moths, the largest of the European hawk-moths is the well-known death's head (*Acherontia atropos*), whose caterpillar generally feeds on potatoes and other solanaceous plants, although it is sometimes taken on jasmine and buckthorn. The moth, which is distributed almost all over Europe as far north as Sweden, is always solitary, and utters, when caught or touched, a peculiar sound, probably caused by the passage of air through its proboscis.

The caterpillar of the six-spotted burnet-moth (*Zygna filipendule*) frequents places similar to those in which lives that of the death's head. Similar to it in appearance is the caterpillar of the five-spotted burnet-moth (*Z. lonicere*), which

may be seen from May to July on lupin, vetches, and clover. The red hind-wings of this species are marked with black edges; the front-wings of the male being dark brown, while those of the female are greenish, both marked with five distinct round red spots, two of which, namely, those at the root of the wing, are often blended in one, while the other two, unlike those of the last species, are never confluent.

As representing another family of moths (*Noctuidæ*), mention may be made of



DEATH'S HEAD MOTH.

the antler moth (*Charaxas graminis*), a species indigenous to northern Europe, whose wrinkled caterpillar is brownish or greenish, marked with five pale lateral stripes, as well as by smooth crests round the first and last rings of its abdomen. The moth has the fore-wings brown, with a whitish vein and blackish triangles near the hind-margin, and several ochreous and fuscous spots: the hind-wings being grey with a round spot in the centre and various dusky bars. The caterpillar feeds on grasses, apparently of every kind but the foxtails, and has often destroyed whole fields, which have been left bare and dry as if a fire had passed over them. In Sweden and Norway the price of hay has occasionally risen to five times the

normal on account of the damage done by these larvæ, which in 1759 and 1802 swarmed in the sheep-farms of Tweeddale, devouring grass to the root over patches more than a mile square; again, in 1884, larvæ was such a pest in Glamorgan that the surface herbage was burnt to destroy them. Equally injurious is the caterpillar of the turnip moth (*Agrotis segetum*), which feeds on cabbages, turnips, swedes, lettuces, and other vegetables, and hibernates, to begin its career of destruction early in the spring. When touched, it rolls itself up: by day it hides under stones or in the ground, creeping out at night to feed. It is striped brown and grey, sometimes tinged with pink, with three dark lines on the back, the middle one double. The



SIX-SPOTTED BURNET MOTH

moth, which should be looked for from May to July, inhabits all the countries of Europe, and is very common in Germany; it is $1\frac{3}{4}$ inches in wing-spread, the front-wings being brownish grey, dark at the hind-margin, with three toothed cross-lines and two black-edged spots, while the hind-wings are whitish with brownish nervures, those of the female bearing a grey dust. Another injurious species is the silver gamma moth (*Plusia gamma*), which, like the last, flies in the sunshine and is $1\frac{3}{4}$ inches across. Nearly in the middle of its violet wings it has a silver mark, resembling the Greek letter γ or the ordinary Y, and is thus easily distinguishable. The caterpillar lives from April to September on nettles, dead-nettles, turnips, mangold, clover, or other plants, including oats and especially hemp, to

which it is most destructive. In colour it is green, with whitish lines on the back and sides and the breathing-pores or spiracles yellowish. In many seasons the moth migrates in great swarms, which in 1879 swept across Europe from North Africa in millions, the invasion extending into England, where it was fortunately checked by heavy rain.

Flies.

Flies, of course, are well represented among the field-life of Europe, one of the most common and most mischievous being the great gadfly (*Tabanus bovinus*), readily distinguishable by its blackish brown colour, the



A PAIR OF GREAT GADFLIES.

black stripes on the breast, the white triangular spots and yellow edges of the segments of the abdomen, and the yellow legs. The grubs are marked with blackish cross-lines, and live underground. The grubs of another group of flies likewise change into pupæ underground, where they are bold and industrious insect-feeders, one of the most important being the hornet robber-fly (*Asilus crabroniformis*), which is reddish yellow in colour, with the three first segments of the abdomen deep black.

The gadflies and bot-flies of the family *Æstrida* are remarkable on account of their habits; their larvæ, which are covered with a rough shiny skin, living beneath the skin of grass-eating animals, where they cause large abscesses. Among them may be mentioned *Æstrus ovis*, the sheep bot-fly, the thorax of which is covered

with many single-haired warts, while the white abdomen is marked with deep black glistening spots. This pest, which is only too frequently to be met with in July and August near flocks of sheep and goats, quietly sitting on stones or tree-trunks, lays its eggs on the nostrils of those ruminants, whence the grubs pass upwards into the brain, where they undergo their development. Yet another pest is the ox-warble fly (*Hypoderma bovis*), which is principally black in colour with reddish yellow and black hairs, except on the abdomen, where they are grey and yellow. The eggs are deposited on cattle in whose skin the larvæ produce abscesses of the size of a pigeon's egg, where they remain for some nine months. According to one view, the larvæ so soon as hatched from the eggs laid in the hair of the infected beast, at once proceed to bore their way through the skin of the back, and then eventually form the warbles. On the other view, they are licked off from the hair by the tongue of the animal, swallowed, and carried into the stomach and intestine, whence they bore their way through the intervening tissues till they reach the muscular layer beneath the skin of the back. The latest observations confirm the general correctness of the second view. The eggs, instead of being hatched externally, are, however, licked off from the hair by the infected cattle, and do not develop into larvæ till they have entered the first compartment of the stomach. Here they may be found soon after the swarming period of the flies, but later on the greater number of them migrate to the throat, where they wander for several months (July to November, or even February) in the tissues underlying the mucous membrane, which they have previously penetrated. Their next migration is more extensive, and they gradually make their way from the submucous tissues of the throat or entrance of the stomach right through the body till they reach the spinal canal, this migration taking place, as a rule, between December and March.

After a residence of three months in the spinal canal, the larvæ again shift their quarters—usually between January and June—this time reaching their final station beneath the skin of the back, where they form the "warbles," subsequently piercing the skin to fall to the ground and undergo the pupa stage, and ultimately to develop into adult flies. A single female of this fly is capable of laying eggs enough to infect an entire herd: and so much are these flies dreaded by cattle, that even the imitation of their buzzing will cause a herd to stampede. The horse bot-fly (*Gastrophilus equi*), which somewhat resembles a bee in general appearance, is about half an inch in length, with a brown cross-band on its whitish wings, and two spots of the same colour at their tips. The eggs are laid on the hair of the horse's fore-legs, and being licked up from there, enter as larvæ into the alimentary canal, along which they slowly pass until they pass out with the droppings, when they turn into pupæ underground.

To the family of the typical flies belong the flesh-flies, whose larvæ dwell in decaying flesh. Among these may be mentioned the carcase-fly (*Sarcophaga mortuorum*), which develops from the ill-famed carcase-worm, and has a reddish yellow head, a steel-blue abdomen, and yellow antennæ. This noisome fly deposits its eggs in bodies buried a short distance below ground, but is fortunately rare. Better known is the grey flesh-fly (*S. carnaria*), which is common everywhere in summer and autumn, and, in place of laying eggs, brings forth living maggots. These grubs, which have sometimes been observed in abscesses of the human ear,

number from fifty to eighty in a swarm, and change to pupæ after five or eight days' feeding, developing into flies eighteen to twenty days later.

Frog-Hoppers. The frog-hoppers, which form a group of the Rhynchota, infest the shoots and twigs of various plants. The well-known white froth so often seen in meadows is emitted by the "nymphs" of the common frog-hopper or cuckoo-spit (*Apherophora spumaria*), which live in it, and are thereby protected against their enemies, especially birds, until full-grown. From these nymphs develop yellowish grey insects, a quarter of an inch long, whose wing-covers are generally crossed with two crooked whitish bands. The females deposit their eggs in autumn in the bark of trees, especially willows, and the grass-green larvæ creep out in April to fasten on meadow-sweet and other plants. Ever since the time when it was seriously regarded as an emanation from the stars, or as the saliva of the bird from which it takes its name, there have been constant discussions as to the origin of the froth enveloping these nymphs, which, together, of course, with the full-grown insects, are members of the family *Cercopidae*.

Naturalists have tried to solve the problem, but, according to Mr. Braxton Guilbeau, of Cornell University, in an article contributed to the *American Naturalist*, none of them has been successful. To test the matter thoroughly, this gentleman inaugurated a very careful series of experiments and observations, in which the first process was to cleanse specimens of the nymphs from all traces of the investing froth by means of a camel-hair pencil, and then watch their actions when placed on twigs. When thus situated, the first action of the insect is to dig its beak firmly into the bark, soon after which its body will be observed to swell, while a little drop of clear liquid will be observed to issue from the vent. After a quantity of this fluid has accumulated about its body, the last, and sometimes also the second, pair of legs are moved to the region of the seventh and eighth abdominal segments, and rubbed against the body, as if in the action of mixing substances. After the fluid had been thus mixed so as to completely cover the body, the creature moved the tip of its abdomen out of the liquid, opening up the pair of lateral appendages of the ninth segment, which were again immediately closed. Then, with a downward movement, these parts were reimmersed in the liquid, when the appendages were opened and released a bubble of air in the liquid; and by the repetition of this process the insect soon became involved in a mass of the characteristic froth. Bubbles of different sizes can be made by regulating the size of the air-grasping pocket of the appendages. To complete the production of the envelope of froth, a mucilaginous substance is added from certain abdominal organs known as the glands of Batelli, this rendering the liquid viscous, and therefore better adapted for retaining the air-bubbles. The problem thus appears at last to have been completely and satisfactorily solved.

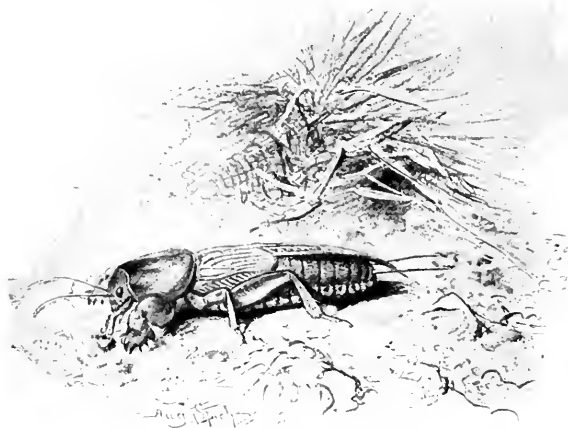
**Fan-Winged
Insects.**

A brief notice must suffice for the fan-winged insects (*Stylopidæ*), whose females are wingless and legless, while in the males the front wings are stump-shaped and rolled up at the tips, and the hind-wings large and capable of being opened and closed like fans. These curious insects undergo a complete metamorphosis, and their larvæ are parasitic in the abdomens of Hymenoptera, out of which they creep between two of the abdominal segments

before changing into pupæ. On emerging from the pupa-stage, the females remain in the pupa-case, where they are fertilised by the males, which can fly but live only for a few hours. Here are produced living larvæ, which crawl out of the cases by means of their legs and tail-bristles, and settle on wasps or bees by which they are carried to their nests. In the nest they make their way into the young larvæ of their hosts, and change into footless grubs.

Crickets.

The field-cricket (*Gryllus campestris*), which is more heard than seen, is one of the noisiest of the Orthoptera: its monotonous chirp is produced by the friction of the bases of the clytra, when rubbed one over the other. It lives in dry fields in holes of its own making, before which, except in pairing-time,



THE MOLE-CRICKET.

it sits alone. With head thrust well forward and apparently motionless, it chirps incessantly, as if deaf to everything else: but at the slightest unusual sound the chirp ceases, the cricket momentarily hesitates, and the next instant disappears into the ground. In colour it is blackish with the wings greyish at their bases, and the hind-legs red above. In length about three-quarters of an inch, it feeds on roots and seeds, and does much damage to plants. Its development takes a whole year; the insect being full-grown in May or June. Far more remarkable is the mole-cricket (*Gryllotalpa vulgaris*), which is brown above and brownish yellow below, with black-veined wings: its length ranging from an inch to $1\frac{1}{2}$ inches. This insect, which is silent, and without an ovipositor, inhabits the greater part of Europe and western Asia, and dwells in holes in any kind of soil, feeding on roots and snails and worms. Occasionally it is found in forests, and then generally on young oaks and

beeches. These crickets, which betray their presence by biting off the grass in strips about a foot wide, pair in the beginning of July. Curiously enough, most of the larvæ are devoured by the female parent, but the survivors lie dormant during the winter, wake up in April, and after five changes of the skin become fully developed in May. The mole-cricket has many enemies, among them being moles, crows, and jackdaws; but it suffers most from wet weather.

Thrips. The group of the Thysanoptera is represented in the European open country by the tiny corn-thrips (*Thrips cerealium*), which lives on grasses, particularly the cereals. In these insects the males have no wings, and are about a sixteenth of an inch long. In colour they are reddish brown, with pale yellow antennæ and legs. Other members of this family suck flowers, or perforate the outer layers of leaves. Their larvæ are exactly like the full-grown insects, with the exception that they have undeveloped wings. Some kinds are often found



SAND-CENTIPEDE.

in hundreds on the blossoms of plants, but others live, with their red or yellow larvæ, beneath the bark of trees.

Crab-Spider. The crab-spider (*Xysticus viaticus*), so often met with in fields and gardens, is distinguishable by its dark brown body, with a paler edge, the three-toothed band along the abdomen, and the brown-spotted legs, which in the male are black half-way up.

Passing on to another group, mention may be made of the sand-centipede (*Iulus sabulosus*), which lives under stones, and is blackish brown in colour, marked on the back with two reddish yellow stripes. It occasionally reaches 2 inches in length, though never more than an eighth of an inch in width, the body being a long narrow cylinder, which can be rolled up at will, and consists of from forty-four to fifty-five segments, the last but one having a horny tip.

Earth-Worms. Earth-worms are of the highest importance in the life of the fields, which derive much of their fertility from the silent exertions of these lowly invertebrates. The familiar representative of the group is the common earth-worm (*Lumbricus terrestris*), whose general appearance is known to all. Like other worms, its body is divided into a number of ring-like segments, and the head is indistinct. In all earth-worms the body tapers at both ends, and on the abdomen carries from two to four rows of hooked bristles, which act as legs. Earth-worms bore almost vertical holes into the ground, and live on mould and decaying vegetable-matter, contributing to the formation of fertile soil by filling up their holes with green or dead leaves. They swallow large quantities of earth, which, after passing through them, is deposited in front of their holes, thereby covering in time whatever may be there, and in this way in the course of years a floor of paving-stones may be lowered a foot deep. Earth-worms generally come to the surface in great haste when the ground in which they dwell is disturbed or smartly trampled upon; and it is generally supposed that they do this in consequence of mistaking the disturbance for the approach of their dreaded enemy, the mole. As a result of this mistake, they frequently perish miserably, if they happen to come out on to dry and parched ground in full sunshine. Worms are most frequently seen above ground on lawns or meadows in spring or autumn when the dew is still on the grass.

Molluscs. As regards the numerous slugs and snails of the field, it must suffice to mention the common grey slug (*Limax agrestis*), which is $1\frac{1}{2}$ inches in length, and grey in colour, with the keel set obliquely on the back, and the shield marked with concentric lines, and the heath-snail (*Helix ericetorum*), which has a greyish, depressed shell with brown bands, a large umbilicus, that is to say, the conical cavity occupying the centre of the spire, and a nearly circular mouth.



THE BLACK RAT.

CHAPTER V

FARM AND GARDEN

Rats and Mice. IN Europe many creatures find the necessary conditions of life in human dwellings; this being particularly the case with the rats and mice. The largest and at the same time one of the most familiar of these is the brown rat (*Mus norvegicus*), which is generally brownish grey above and greyish white below, with the middle line of the back in most cases a little darker than the sides. In this species the length of the tail is less than that of the head and body, whereas in the black rat the tail is considerably longer than the body. In addition to this, the ears of the brown rat are one-third the length of the head, while the ears of the black rat are half that length. Moreover, the brown rat has only two hundred and ten rows of scales round the tail, while in the black rat there are from two hundred and fifty to two hundred and sixty such rings. Unlike the brown species, the black rat (*M. rattus*) is generally of uniform colour, namely, dark brown and black above, and only a little lighter below, while its feet are greyish brown. Although somewhat uncommon, the black rat is still found in some parts of the Continent together with the brown rat, the latter generally living in the lower parts of buildings, while the black rat prefers the upper floors. Ship-rats are stated to be almost invariably of the black species. In the much smaller house-mouse (*M. musculus*) the tail is of the same length as the body, and bears about one hundred and eighty rows of scales, while the ears

are half the length of the head, so that when bent forwards their points just touch the eyes.

Musk-Shrew. One continental member of the insect-eating mammals, the musk-shrew (*Crocidura suaveolens*), is perhaps entitled to a place here, since it is occasionally met with in houses, probably because it there finds shelter and food. This species is distinguished by its twenty-eight teeth, and its thin tail, which exceeds half the length of the body. In colour this shrew is brownish grey above and grey below, the colours gradually blending; its total length is $4\frac{1}{2}$ inches, of which the tail occupies $1\frac{3}{4}$ inches.

Mouse-Coloured Bat. Among the bats there are a few species, which, though living principally in woods, occasionally resort to buildings. The best known of these is the mouse-coloured bat (*Myotis murinus*), which is greyish or reddish brown above and brownish white below; its total length being about $4\frac{1}{2}$ inches, including the tail which measures $2\frac{1}{8}$ inches, while the wing-spread is 15 inches. This bat ranges throughout central and southern Europe, northern Africa, and central Asia; the northern limits of its area being France, north Germany, Scandinavia, and central Russia. It appears, however, not only in inhabited towns and villages, but in the Alps up to 5000 feet, and in other mountainous districts. Issuing forth late in the evening, or at night-fall, it flies low and slowly, and never sleeps in hollows of trees. By day it hides away in buildings, among roofs and steeples, or in vaults and caves, where it is often found by hundreds, and in such places it hibernates. These bats sleep during the winter, close together, hanging by their hind-legs, in large numbers. If the season be mild, they wake up and move about; but do not venture into the open air, and in summer they do not fly in cold and unseasonable weather. The female has only one young one at a time, and may be seen flying from the end of May till July with its offspring, which is then old enough to take care of itself.

Pipistrelle. The pipistrelle (*Pipistrellus pygmaeus*), which is more frequently seen in England than any other bat, has a high and rapid flight with many sudden dips, curves, and turns. It often sleeps in old buildings and among roofs, but sometimes chooses trees, either as a winter habitation or as a hiding-place, and shelters in uninhabited districts in caves and rocky clefts. It appears earlier than other bats in spring, and does not repair to winter-quarters before the beginning of cold weather; while it may at times be seen abroad in mid-winter.

Rough Skinned Bat. A relative of the pipistrelle is the rough-skinned bat (*P. nathusii*), which is dark smoky grey or yellowish above, and has the upper part of its wing-membrane down to the middle, as well as the lower portion of the leg, covered with hair. The total length over all of this species is $3\frac{1}{2}$ inches, the wing-spread being 9 inches. Apparently distributed through Europe, from the Rhine to Russia and from north Germany to the Mediterranean, this bat ranges into Sweden, and occurs on the southern slope of the Urals, and on the Alps as far up as the St. Gothard.

Kestrel. A few species of birds seem to have taken up their abode among buildings owing to the distant resemblance these bear to their native rocks. One such is the kestrel (*Falco tinnunculus*), and another the



barn-owl (*Strix flammea*). The kestrel frequents churches, castles, towers, high old walls, ruins, and rocks, but where it does not find these is content to dwell in forests and their outskirts, especially when they contain many pine-trees. It occasionally makes its nest in isolated trees, but, when it chooses a hole in a cliff, there is no nest worth mentioning, and, as a rule, it captures a nest ready-made by driving away the crows, magpies, or pigeons to whom it may belong, or by taking possession of it when deserted. Sometimes the nest is found among those of jackclaws, rock-doves, rooks, herons, or sea-gulls. In the Würtemberg and Baden districts of the Black Forest the kestrel nests in the baskets hung up on the gables of their roofs by the peasants, who think that by the presence of the kestrel they may keep off the goshawk. This falcon lays from four to seven eggs, blotched and clouded with several shades of chestnut: the young, if hatched on trees, leave the nest before they are able to fly properly, but they remain there longer when it is on a wall or in a hole. The kestrel feeds on beetles, grasshoppers, and other insects, as well as on frogs, moles, lizards, and particularly mice and field-mice: only exceptionally does it prey on birds. Flying quickly and easily, it often stops suddenly in its flight, and sometimes hovers for a while at



BARN-OWL.

a considerable height, looking down for its prey. When going far it flies with quick movements of its wings, interrupted by short hovering pauses: and, when looking keenly at any object, moves its head quickly up and down like an owl.

Barn-Owl. The barn-owl is abundant in most parts of the Continent, where it never dwells in forests and mountains, but prefers steeples, old ruined walls, barns, and deserted dove-cots. In South Africa it is said to live among rocks, and in America partly in the hollows of trees. It is a resident bird,

breeding from April until October, and making no regular nest. This owl sleeps by day, but is disturbed by the slightest noise, although it bears with indifference the ringing of church bells and the striking of clocks, even when sitting close to them. When alarmed, it sits up erect, and wags its head slowly to and fro, and if driven out, it flies, even in the daylight, with great composure to some other shelter, its flight being soft and noiseless, slow, hovering, and generally low. Although nesting in dove-cots, the barn-owl does not harm the proper inhabitants, preferring mice, field-mice, young rats, bats, small birds, beetles, and moths. Few people have an idea of the numbers of mice and other field-vermin destroyed by these owls. It has been found that a pair bring a mouse to their young every quarter of an hour at the least, and in one nest over forty-nine mice were discovered, representing what remained of one night's catch. Owing probably to infection with the luminous bacteria in decaying wood, the plumage of barn-owls is itself not unfrequently luminous.

Swift. Another bird frequently taking up its abode in and near human habitations is the swift. The swifts somewhat resemble swallows in appearance when seen at a distance, but their tails consist of only ten feathers, while that of the swallow has twelve, and in their wings there are ten primaries and eight secondaries, while the swallows have but nine of each; and their front-toes are all much of the same length, whereas in swallows the middle toe is longer than the rest. Their claws are strong, and their wings very long, and of proportions quite different from those of swallows. Except for a midday rest, swifts are in the air from sunrise to nightfall, driving themselves with a few quick beatings of the wings, and then gliding with the wings almost at a right angle so that the bird looks like a cross-bow. They eat insects, especially beetles, as they fly, and on account of their short, weak legs, seldom alight on the ground of their own will, but even snatch up most of their building material in the air, or from the twigs of trees. The true swifts glue their nests together with their saliva, and generally place them in the holes of trees, walls, and rocks. Their nests are often found in colonies, where violent disputes frequently occur, as they are very quarrelsome birds, and seriously wound one another with their sharp claws. The ordinary swift (*Cypselus apus*) was originally an inhabitant of the mountains, where it used to nest in the clefts of rocks; but it has moved thence to breed on high buildings, in steeples, crevices of ruined walls, under roofs, and in other situations. The nest is a flat dish made of straw, feathers, wool, rags, etc., untidily cemented together and covered with sticky saliva, and contains from two to four long white eggs. The swift's call is a short, shrill scream, uttered as the bird returns to the nest, but never while hunting for insects, and is most frequently heard when the young are flown. Soon after the young are able to fly, they start with their parents on their long journey to South Africa, beginning towards the end of July and continuing on to September or even later. The swift is found as far north as Lapland, where it arrives in June: it is known as a visitor in the Faeroes and the Shetlands, and at Archangel, but does not range very far east of the Urals, where its place is taken by the light-coloured Chinese species. In Africa it has been reported from the Gold Coast, and it winters in Madagascar

and Cape Colony. Its length is about 7 inches, and the wings are nearly as long; the plumage is blackish brown with a greenish hue, but the chin and upper part of the throat are white.



THE SWIFT.

Jackdaw. A much more familiar bird in every sense is the jackdaw (*Corvus monedula*), which, though living mainly amongst clumps of trees, is equally at home wherever there are church-towers or other high buildings. Jackdaws' nests are often found in great numbers close to each other, for the jackdaw is sociable and frequently consorts with crows in large flocks. The nest is a mere heap of odds and ends, lined with some soft substance, and contains

from three to six eggs in the middle or end of April. When there are young in the nests, the parents fly continually to and fro, and should a bird-of-prey startle the colony, it is mobbed by the whole flock and driven away for some distance. When the young are half-fledged they leave the nest, although they remain in the



A PARTY OF JACKDAWS.

neighbourhood and every evening return to its shelter. They develop into bold sprightly birds, which fly more quickly than any other crows and indulge in many curious antics in the air. After the nesting-season jackdaws seek out high trees and buildings in which to sleep, flying in large circles round them until dusk and then settling down to rest. They are resident in most European countries, but in

very hard winters some migrate to northern Africa and the Canaries. They are found all over Europe up to the Arctic Circle, and in Asia as far east as the valley of the Yenesei. The jackdaw feeds on worms, insects, and the parasites infesting domesticated animals, being often seen on the backs of sheep hunting for ticks; and it will occasionally follow the plough, seeking its food in the freshly turned furrows.

Black Redstart. The black redstart (*Ruticilla titys*) is another bird frequenting buildings, probably on account of the rocky nature of its original home. It is met with in mountainous districts higher than the tree-limit, and also lower down in the forests and especially on high buildings in towns and villages. From its home in the mountains, it seems to have followed the habitations of man until it became distributed over the lowlands. In Ireland the black redstart was first noticed in 1818, and about ten years later in England, whence it has spread as a winter-visitor to Scotland. For some years it has been known as a straggler to the Faeroes and Iceland, southern Sweden, and Denmark. It is common in central and southern Europe, and Asia Minor, but is not found east of the Urals. In winter it migrates to the mountains of northern Africa, and down the valley of the Nile to Nubia. Partly a resident bird, at least in the south of the Continent, it leaves central Europe at the end of October, or a little later, and returns in March, when it is soon noticed by its peculiar song, often heard at night, which consists of three or four bars, varied by a few croaks, and has little resemblance to that of the common redstart, though the calls of both birds are alike, and the young of both scream in the same way. The nest of the black redstart is rather large for the size of the bird, and is built in clefts and in holes in rocks and walls, under the eaves of buildings, and in sheds and outhouses. It contains, in the middle of April, six or seven white eggs, and in June four or five; within thirteen days the young are hatched, which leave their birth-place when scarcely fledged. The black redstart feeds on flying insects, caterpillars, and the small crustaceans it finds on heaps of seaweed when in the neighbourhood of the coast. In habits it is not unlike the redbreast, and its flight is quicker and easier than that of the common redstart.

House Sparrow. By far the commonest bird among human habitations is the house-sparrow (*Passer domesticus*), which seems to have settled in towns for the sake of the corn and seeds it finds in the streets, when it can get none in the fields—a view supported by the fact that a great migration of sparrows takes place from the towns to the country as soon as the crops begin to ripen. The house-sparrow is found wherever grain grows, and its distribution widens as the land is brought under cultivation. It followed agriculture across Russia; and in Siberia, where it was unknown until the introduction of corn cultivation in the eighteenth century, it has advanced as far east as Irkutsk. Like all the finches, it feeds principally on seeds, and no bird known does so much to limit the yield from farms and gardens. In southern Europe there exist several races of sparrows, varying more or less from the one found in central Europe, but the small differences in bodily proportions or even habits, are mostly confined to

the cock. By some naturalists the two principal forms, namely, the Spanish and the Italian, are regarded as distinct races. The Spanish race (*P. domesticus hispaniolus*) is found in Syria and all the countries on the southern shore of the Mediterranean, in Egypt, and throughout the whole of northern Africa, Spain, Sicily, and Sardinia, but not in continental Italy. The Italian race (*P. domesticus italicus*), on the other hand, inhabits Italy, Sicily, Provence, the Balkan Peninsula, and Asia Minor, and is less different from the typical central European bird than its Spanish relative. The eastern sparrow (*P. domesticus indicus*) is a smaller and more



MALE HOUSE-SPARROW.

richly coloured bird than either of the others. Sparrows may be sought in vain in the solitudes of the forest: they are always in the neighbourhood of human habitations, and in greater numbers where there are hedges or trees close at hand in which they can hide in case of danger. They are resident birds, living in couples in their nests, which are generally not far from one another; and they feed their young at first on small caterpillars and later on with larger insects, until their beaks are hard enough to deal with seeds. They breed two or three times a year, and make their nests on buildings and trees at a moderate height from the ground: the nest being an untidy collection of sundries, never without feathers

and generally with straws dangling loosely down. The eggs are nearly, if not quite, an inch long and two-thirds of an inch across, and vary much in markings even in the same clutch. Although the sparrow chirps and calls, it is incapable of anything that can be described as a song. The disappearance of so many insectivorous birds from villages and suburbs is mainly due to the sparrows which mob together to drive them away. Thus the sparrow does injury, not only by its raids on the seeds, but by indirectly encouraging the increase of insects; and the only way in which it can be made of any use is to defer the destruction of the insect-fed young until they are fledged.



A SWALLOW AND ITS NEST.

Swallows. Of other birds, only swallows and martins make their homes in human habitations. Many of these settle in towns and villages and fix their nests on the walls, while others nest on trees, and in holes in the sides of gravel-pits and railway-cuttings. The majority make nests, which consist of little pellets of clay stuck together by saliva. In flight they somewhat resemble swifts, for which they are often mistaken, and only for a momentary rest do they perch on gables or walls, or trees and telegraph-wires. They alight on the ground for the sake of picking up the little lumps of clay of which they build their nest, but move most awkwardly when there, while everything else is

done on the wing; these birds catching their prey in the air or snatching it from twigs and walls as they fly past, and even drinking and bathing on the wing, scarcely touching the water with their bodies or dipping their heads beneath the surface. The swallow (*Hirundo rustica*) is a breeding and migratory bird in the high north as well as in the Sahara and farther south, and is spread all over Europe and western Asia up to the Arctic Circle, and even to Spitzbergen and Novaia Zemlia. The bold and rapid flight—which when low presages rain, owing to the aqueous vapour in the air keeping the insects near the earth—has more dash in it than that of the martin, and is more graceful than that of the swift. The swallow is the first of its relatives to arrive in spring—generally in the first half of April, and it leaves last of all, in November. Before departure, swallows assemble in parties which roost in bushes on the shore or among the reeds, and these, when increased to enormous flocks, start for Africa, augmenting in numbers as they go. The swallow has a distinct call, which may be rendered *whit-seep-cheep, whit-see-cheepit*, but its song is a soft, low warble, to imitate which many vain attempts have been made, including that of the student who discovered that it is *Tityre, tu patula recubans sub tegmine fagi*—pronounced in continental fashion.

Martin.

The martin (*Chelidon urbica*) is distinguished from the swallow by its feathered legs and feet, and the broad, white band round the lower half of the back. It is found all over Europe, in Asia as far east as Tashkent, and in Africa as far south as Natal. Martins never roost in reeds like the swallows, and are moreover distinguished by the construction of their nests, which are never open at the top, and are practically bags of mud with a hole for a doorway. The flight is not quite so fast and buoyant as that of the swallow, and the curves are less sweeping. Martins feed entirely on insects, mostly flies and gnats, and rarely wasps or bees, whose sting is said to be fatal to these birds.

Associated with human habitations are a considerable number of insects; beetles of various kinds being especially numerous. In the five-jointed section we have the common bread-beetle (*Trogosita mauritanica*), which frequents heaps of corn and nuts, but is also found under the bark of trees. This beetle, which has been carried all over the globe, is oblong in shape, with the elytra rather remote from the thorax, and is pitch black in colour with small spots and streaks, and red legs and antennæ, its total length being about one-third of an inch. The destructive hide or lard beetle (*Dermestes lardarius*), of about the same size, is of a somewhat elliptical shape and entirely black in colour; its wings being marked with grey, hairy cross-bands, and having three spots on either side. The larva is hairy all over, and bears on its last segment two horny hooks and a tuft of long hairs. This beetle, like all its relatives, draws its limbs close to the body when touched, to simulate death. It lives on many kinds of animal-matter, such as provisions, lard, and skins, and does much damage in tanneries. To the same family belongs the fur-beetle (*Attagenus pellio*), which is found in houses in winter, but in summer frequents flowers, where it pairs in May. Ovale in shape, and covered with black hairs, it is reddish at the base of the antennæ, and has a few white spots distributed over the thorax and elytra; its length being about one-sixth of an inch. The larva is one of the household grubs that do so much damage

to stuffed specimens. Nearly allied is the museum-beetle (*Anthrenus muscorum*), which is one-eighth of an inch long; its colour is blackish brown, striated with rusty scales; the sides of the thorax and three cross-bands on the elytra bearing whitish scales, while the legs are reddish. It takes its name from the fact of the larva being so destructive to natural history collections, especially insects; the beetle often taking up a position near the joints of cases which it enters in order to deposit its eggs on the bodies of stuffed animals. Another noxious beetle (*Corynetes violaceus*) is cosmopolitan, living in houses on meat, and in the open air on carcases, but also frequenting flowers, where it eats insects and their larvæ. Bright shining blue in colour, it is covered with fine down, and has the antennæ black with pale bars, and the legs greenish brown.

Death-Watch, etc. The so-called wood-worms, which bore holes in wood, at the same time often transforming the substance of the latter into powder, develop into beetles having a hard, horny, oblong, ovate body, a swollen thorax, and elytra embracing the abdomen. In one group the larvæ are blind and covered with short hair and a number of little protuberances. A familiar species is the death-watch beetle (*Anobium pertinax*), which is dusky black in colour, with the thorax convex, covered with down, and bearing posteriorly a bifurcating ridge; on each of its hind angles is a tuft of yellow hairs, and the legs are dull red. This beetle is about one-sixth of an inch long, and bores in old furniture. The male, standing on its two hinder pairs of legs, knocks with its head against the wood, and thus produces a sound similar to the ticking of a watch, which is answered in like fashion by the female. In former times superstition regarded the ticking of this beetle as an omen of approaching death. The death-watch is also called the stiff-necked beetle, because at the slightest touch it draws in its legs and pretends to be dead, not even changing its attitude if pricked by a needle or burnt in a flame. The same may be said of several other beetles of this group, especially the streaked wood-beetle (*A. striatum*), which much resembles the preceding species, although only half its size and with a dorsal channel and a triangular ridge on the thorax. This beetle abounds in old houses, where its larvæ busy themselves in making small cylindrical holes in old furniture and fittings. The bread-borer (*A. panicum*), which rejects wood in favour of substances containing sugar or starch, is dull red in colour with black eyes and a convex thorax, the elytra being spotted and streaked, with rounded tips. It is often found in houses, in stale bread and pastry, and is especially abundant on board ship among the biscuit-stores.

Some beetles of this group feed on animal as well as vegetable matter; that common species in houses, *Ptinus fur*, being one. It is about one-eighth of an inch long, rusty brown in colour, and covered with white down. The antennæ, which like the legs are rusty red, are inserted below the eyes, and the body is elliptical. The female is stouter than the male, and has two interrupted whitish bands across the elytra. The larva thrives on dried skins and stuffed animals and plant specimens—in fact, anything in a collection; as well as in warehouses, shops and cupboards, wherever there are dried stalks and roots. Another member of the group follows man on account of the wood he uses. This is the wharf-beetle (*Lymexylon navale*), famous in a way as the one Linnæus discovered to be the

cause of the destruction of the ship-timber in the Swedish dockyards, and whose ravages he stopped by sinking the wood under water during the season in which these beetles lay their eggs. It is about half an inch long and curiously narrow, variable in colour, but usually brownish yellow, with black head and antennæ and a black edging to the apex of the elytra.

In addition to the above, there are a large number of insects in buildings which live on decaying matter and shun the light. Under mouldering floors, in cellars, under barrels, and in such-like situations may be found from April to autumn the common churchyard-beetle (*Blaps mortisaga*), formerly regarded as an omen of death. Its length is nearly an inch, and it is more than twice as long as it is broad. Like its equally black relatives, this beetle secretes an acrid fluid of peculiar smell. To the same family belongs the meal-worm (*Tenebrio molitor*), found in flour in almost every bakery.



THE CHURCHYARD-BEETLE.

The adult beetle is about half an inch long, and is of an obscure pitchy black, slightly shining and finely spotted, the mouth and anterior edge of the head being dull red like the legs. The yellowish, parchment-skinned larva forms a favourite food for nightingales and other insect-eating birds kept in captivity, and in some places is purposely bred in large quantities for that purpose. Another pest in

bakeries and granaries is the beetle known as *Calandra granaria*, which is only one-sixth of an inch long, pitchy red in colour, shining and spotted, particularly on the thorax, with deeply streaked elytra and reddish legs and antennæ. This beetle never flies, but remains during the winter in granaries, in crevices of the floor, and similar hiding-places, laying its eggs on the tip of each grain, into which the larva enters through an almost invisible hole, to feed and develop within.

Many of the smaller moths likewise frequent houses, one of the most common being *Aglossa pinguinalis*, whose larva lives in butter, grease, suet, lard, and other fatty matters, upon which it feeds. The larvæ, which are often seen in March and April creeping along the walls of larders in order to change into pupæ, have sixteen legs, and are of a brilliant brown colour. They develop into a small moth whose brilliant greyish brown upper wings are marked with two wavy lines and a blackish central spot. The lesser clothes-moth (*Tinea pellionella*) is found in furs, wool, horse-hair, furniture stuffings, etc., in which the female lays her eggs in May. After a fortnight there creeps out a yellowish

caterpillar, which forms little paths in the fur and develops into a moth about half an inch across, with a white head and neck having in the middle of its yellowish grey upper-wings three brownish spots, the lower-wings being greyish white. The caterpillar of another clothes-moth (*T. sarcitella*) leads a similar life, finally developing into a moth of about the same size, with a white spot on each side at the bases of its silvery grey wings. This pest lives in woollen dresses, carpets, upholstery, furs, and such-like, and is fully developed three months after its birth. It then winters, and in the following March or April envelops itself in a brownish grey tissue, in which it is transformed into a chrysalis. The caterpillar of the tapestry, or carriage, moth (*T. tapetzella*) lives in much the same manner. The moth, which is nearly three-quarters of an inch across, has a white head and white tips to the fore-wings. The female of the mischievous corn-moth (*T. granella*) lays its eggs in the middle or end of May on grains of corn, several of which are united together by the silk of the caterpillars as they creep out. This moth is half an inch across, and has a whitish head and fringed fore-wings, which are slightly bent upwards when the insect is at rest. In colour the wings are white, clouded with greyish brown, with a pale fuscous triangular spot on the middle of the inner margin. The caterpillar, which is fully grown in August or September, winters in a case made of tissue and small wood-shavings, which is fixed on a beam. The pupa-stage occurs in March or April, and the moth appears four weeks later; but there is frequently a second brood in August or September.

Flies.

Of the two-winged insects, flies appear in houses in very considerable numbers, and are some of the most mischievous and annoying of all pests. Foremost among them are the typical fly, which are more or less resident throughout the year. The sharp-mouthed fly (*Stomoxys calcitrans*) frequents stables, although also seen in the open air, and in summer very often enters rooms; but the commonest of all in our dwellings is the familiar house-fly (*Musca domestica*). The maggot emerges from the egg in from twelve to twenty-four hours, and is full-grown in a fortnight, when it changes into the pupa, and in another fortnight into the adult fly, which produces several generations in one summer, so that it sometimes becomes quite a plague. The flies are, however, exposed to many dangers, and their numbers are therefore small in proportion to their increase. The blue-bottle (*Calliphora erythrocephala*) is another fly frequenting kitchens and larders during summer; it has a black head, and a glistening bluish white abdomen, marked with blackish cross-lines, the antennæ being reddish yellow. This fly deposits its eggs on meat, and in the wounds of living animals, or on the heads of domestic fowls; but occasionally, deceived by the flesh-like smell, it lays them on certain plants. The maggot of the blue-bottle—the “gentle” of the angler—is bred in considerable numbers for use as bait. The hopping larvæ of the cheese-fly (*Piophilæ casei*) are often found in cheese, into which they bore. The fly is about one-eighth of an inch long, of a brilliant black colour, with the lower part of the face, antennæ, and legs reddish yellow, and the fore-legs and a ring round the thighs black. The vinegar-fly (*Drosophila funebris*) likewise restricts itself to one description of food, being found on the taps and bung-holes of vinegar, wine, or beer barrels, and wherever sweet fluids

or fruit have turned sour. The fly, which is under one-eighth of an inch long, is brick-red on the head, breast, and legs, and black with yellow bands on the abdomen.

Yet another group of insects only too frequent in human habitations are the fleas, which are wingless. Their larvæ, which change into pupæ in a silky tissue, live in crevices of floors, or wherever decaying matter, dust or manure, has accumulated. After eleven days the pupæ develop into fleas, the entire metamorphosis lasting four weeks. The human flea (*Pulex irritans*) is too familiar an insect to need description. Far more repulsive is the bed-bug (*Cimex lectularius*), which belongs to another order, the Rhynchota. This pestilent insect, which was known to the ancient Romans and Greeks, is reported to have come from India; and is stated to have been introduced into London in the bedsteads of the fugitive Huguenots, since which date it has spread all over the world. Four times a year, in March, May, July, and September, it deposits

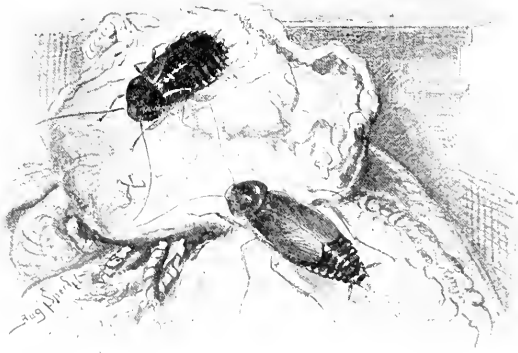


THE CRICKET.

about fifty cylindrical eggs in the narrowest crevices it can find, especially in bedsteads. It is fully grown and capable of propagation in eleven weeks, and those individuals not of the September brood, which always perishes, survive the winter, being capable of standing considerable cold. Although its nutriment is principally the blood of warm-blooded animals, including birds, particularly pigeons, this bug is able to subsist on other fluids, or even to go without food for six months or more, so that its destruction is difficult.

Cricket and Cockroaches. The group of Orthoptera includes a considerable number of household-pests, among them being the cricket (*Gryllus domesticus*), which dwells only in warm places, such as kitchens and bakehouses, where it feeds on bread, flour, corn, and such-like. The male, so often heard chirping at night, is yellowish grey, spotted on the head and breast with dark brown. The German cockroach (*Phyllodromia germanica*) haunts cellars and kitchens all over Europe, and is sometimes met with in forests. This insect was introduced into Russia during the Seven Years' War, whence it was carried into

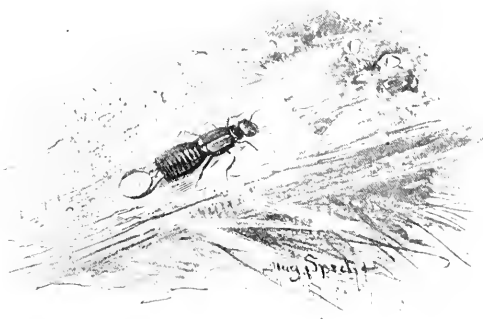
England during the campaign in the Crimea. Equally well known is the cockroach (*Periplaneta orientalis*), generally called the black beetle. Indigenous to Asia, it has spread thence all over Europe, and is now found in almost every house.



COCKROACHES, ADULT AND IMMATURE.

Earwig.

Hiding by day in walls, under stones and bark, and in all kinds of cavities, although not in the human ear, from which their name is derived owing to the shape of the wings, earwigs fly about in the dusk, and feed on the juices of fruits and flowers, particularly carnations and dahlias. The best

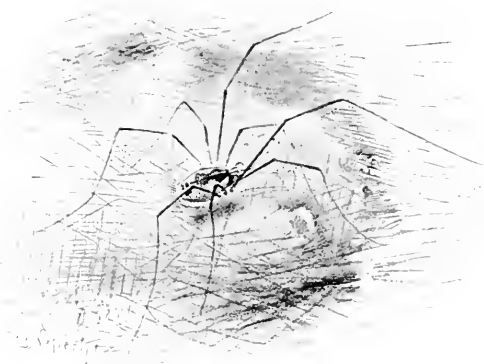


THE EARWIG.

known species is *Forficula auricularia*, which is about half an inch in length, of a brownish colour, with long hairless antennæ formed of fourteen joints. Much rarer is the lesser earwig (*Labiæ minor*), only about half as long, with the end of

the abdomen and the pincers reddish, a spine on the last segment of the abdomen, and twelve-jointed antennæ.

Spiders. Leaving the insects and passing on to the spiders, it may be noticed that the window-spider (*Epeira calophylla*), which is about a quarter of an inch in length, and of a pale yellowish colour with a black edge and stripe on its breast, and a greyish white abdomen, generally selects warm situations for its residences; it is specially characterised by its leaf-shaped back enclosing a few spots and cross lines and having a black and white edge. The web is always placed horizontally. More frequent is the house-spider (*Tegenaria domestica*), which spins its web—also horizontally—in houses, stables, and other places, generally in a corner formed by two walls; the weaver lying concealed in some neighbouring crevice.



WEAVER HARVEST-SPIDER.

Nearly a quarter of an inch long, this spider is dark brown in colour, with a grey mark down the thorax, a rusty red stripe along the abdomen, and light yellow spots on its sides, the legs being marked with yellow circles. It is a member of the group of tube-spiders, so called from their tubular or tunnel-shape webs, which serve at the same time for nests and for the reception of the egg-bags, and have generally two holes, one for entrance and the other for exit. The jumping-spiders, on the other hand, leap at their prey, and, instead of a web, spin only a small bag from which they peep out with their strong and piercing eyes. A common type is the harlequin-spider (*Epidemum scenicum*), which lives on clay, wood, or walls, where it hunts for insects; it is a quarter of an inch in length, and principally black, although there is a white forked spot on its white-edged breast and three cross-bands on the abdomen. In the females the legs are white, but in the males black with brownish yellow foot-joints.

Mites.

Since mites of some kind are to be met with everywhere, they may be looked for in buildings. A noisome creature is the common bird-mite (*Dermanyssus avium*), which lives in pigeon-cotes, fowl-houses, and bird-cages, where it sucks the blood of the slumbering inmates, turning reddish brown in colour from the quantity swallowed. Spotted with white, it is specially distinguished by the very long terminal joints of the legs. In the familiar cheese-mite (*Tyroglyphus siro*) the general colour is whitish yellow, with the beak and legs brownish, occasionally two dark spots on the back, and the head surmounted by a pair of bristles. Nearly allied is the flour-mite (*T. farinae*), which lives in stale flour, and resembles the cheese-mite in many respects, although distinguished by the form of the thorax. The fine powder found in boxes of old figs and prunes is composed almost entirely of these mites.

Harvest-Spider.

The so-called harvest-spiders are minute, long, thin-legged creatures, with short, rounded, and unstalked, although jointed, abdomen. Among them the common weaver harvester (*Phalangium parietinum*) is often found in houses, walls, and gardens; its principal colour is light brown, but on the middle of the abdomen it has an almost rhombic dark brown mark.

Brush-Millipede.

A single species of millipede, the rough-tailed brush-millipede (*Polyxenus lagurus*) so seldom seen, is an inmate of human dwellings, being often found in the crevices of walls, though it also lives under the bark of trees. Consisting of a series of soft circular segments, covered with tufts of hair, it has a brown body, terminating in a white brush, so as to look much like the larva of the cabinet-beetle. The wall woodlouse (*Oniscus muraria*) is a crustacean, being one of the isopods.



WALL WOODLOUSE.



AN OTTER SWIMMING BY MOONLIGHT.

CHAPTER VI

LAKES AND STREAMS

Beaver. COMPARATIVELY few of the mammals of central Europe are entitled to be called denizens of the water or its vicinity; but the claim of the beaver (*Castor fiber*) to be so designated is beyond question. Formerly distributed over the greater part of Europe and northern Asia, and represented by an allied species or race in North America, this rodent has been exterminated from most of its haunts; and the epoch when it inhabited the countries of Europe from the highest north to the Mediterranean, and from the extreme west as far as the Ural River and beyond, has long since passed away. As a wild species it is unknown in the British Isles, where it was formerly widely spread, although beavers have been acclimatised in the island of Bute, where they were introduced in 1874. Some centuries ago beavers are reported to have been still abundant in Switzerland, and in the environs of St. Gall they were well known at the beginning of the nineteenth century, but since then they have disappeared. In Bohemia, where they had been exterminated in the sixteenth century, they were reintroduced from Poland in 1773, and after flourishing for a time were gradually killed off by poachers, the last one dying in 1883. Elsewhere in the Austrian empire no beavers are now to be found except in the lower Danube, where they are preserved by the Emperor. In Bosnia and Herzegovina where, as elsewhere, the names of places indicate the former presence of beavers, and buried skeletons confirm the evidence, the species is now totally unknown.

In Livonia, where beavers disappeared at a still earlier date than from Austria-Hungary, they caused several inundations in 1729 by the construction of their dams. In 1841 the last beaver in that country was shot at the source of the Aa. In Scandinavia, where beavers were at one time common, they now exist chiefly owing to preservation. In eastern Europe the beaver was also a familiar animal in former times; and in the districts of Braslaw and Minsk, many were observed in the smaller rivers so late as 1846, while in 1879 colonies were found on a tributary of the Pripet, so that these rodents may exist there even now. In central Russia the beaver seems to have been exterminated two hundred years ago. In the north some may survive on the Petchora and the Dwina, although none appear to have been recorded since the year 1842. In the Caucasus the beaver was still to be found in 1860, and a freshly killed skin was seen so recently as 1894. It is probably an inhabitant of Asia Minor even now, and has been found lately near Aleppo; but in the Altai, where it must have survived into the nineteenth century, many travellers have looked for it in vain; nor do the records of modern naturalists speak of its existence in eastern Siberia.

Solitary individuals, however, occasionally make their appearance in various continental localities. In September 1883, in the south of France, five beavers were caught on the banks of the Rhone, and lately several have been seen near the mouth of that river. On the lower Bavarian Alps, near the Sur, a stream flowing into the Salzach, and in the neighbouring Austrian territory, beavers were found near Salzburg in 1867, but in 1870 there remained only a few traces of their habitations. They are said to have died out on the Rhine three hundred years ago, but round the river Möhne in Westphalia they lingered longer—the last having been driven down the valley through the Ruhr to the Rhine, and killed at the Werthausen ferry on the 2nd October 1877.

The beaver appears to have been at home on the Elbe for ages. In 1714 Prince Leopold of Anhalt made an arrangement with the Landgrave of Hesse-Cassel by which he received a recruit for each beaver supplied, and a hundred years ago the district between the Anhalt boundary and the Saale, and more especially the Prussian forest of Loderitz, formed the principal area of the Elbe beaver. In those days beavers flourished in the forests round Grünewalde, in the large willow-groves on the right shore of the Elbe, and also near the Nuthe River, which discharges into the Elbe.

When, in 1870, the Elbe Canal from Dornburg to Biederitz near Magdeburg was made, it meant more favourable conditions for the beaver-colonies, inasmuch as the greater part of the then navigable stream was changed into an almost stagnant back-water, extending for about twelve miles, and winding its way between steep banks, covered with willow-groves or leafy forests. The country between the Main and the old Elbe, which had never had a single pair of beavers before, now became a favourite resort for these rodents; and while in 1875 only twenty beavers are said to have existed between Dessau and Magdeburg, the district was in 1890 inhabited by at least a couple of hundred; but the number of beavers thus recorded in 1875 did not include the colonies in Anhalt, nor those in the Prussian province of Saxony. A map, dated 1890, of the area inhabited by beavers between Wittenberg and Magdeburg, shows that in Anhalt and the Prussian royal

forest Heinrichswalde these animals were hardly less numerous than on the banks of the Elbe, farther west. In some parts of the river beavers increased up to 1893, in others they diminished, but since then they have settled and increased on the Mulde. Beavers, of course, are obliged to change their residences when they have used up all the trees required for their food, or when willow-groves and woods have been changed into meadows or dams. A very old beaver-settlement on the Nuthe disappeared, for instance, in 1890, because the wood by which



BEAVERS AT WORK.

it was protected was made into a meadow: and long inhabited haunts in the Worlitz and Dessau district were abandoned because the levelling of the banks by dams made it too difficult for the animals to build again. Sometimes beavers are compelled by floods to move elsewhere; this being the case on the flat and sandy shores of the Mulde, where every flood drives them out and obliges them to save themselves on willows, heaps of dry twigs, or other artificial or natural elevations. After the flood they return and generally find their home in ruins, the entrance broken, and the ground in such a state that they are compelled to



BEAVER

settle elsewhere. These and other changes occur annually and very often lead to the abandonment of the colony. During the floods of the Elbe and Mulde in 1890 the colonies were first undermined, intense cold then set in, and the half-frozen animals were driven by hunger from their hiding-places and wandered with great difficulty over floating ice and snow-covered plains to the open water. Following the warm, waste waters of factories, the Elbe beavers often came near human habitations, and many of them, incapable of escaping, were there killed by the peasants. Floating ice also brings disaster to the beaver, which though an expert swimmer, and often escaping the blocks of ice, is sometimes crushed by them, or perishes from fatigue. The Grünewalde, near Schönebeck, sustained a great loss of beavers so late as 1893. The settlements on the Elbe became blocked by ice, which either stopped up the entrances to the dwellings, or crushed them, so that out of eleven colonies only four were left. Many beavers are caught in the nets of fishermen, and others die in traps intended for otters. In 1889 beavers took up their quarters in a ditch near Wartenburg, and this gave the signal for the almost complete destruction of the numerous colonies near Wittenberg; one man having, it is said, shot nine beavers in three days on a private estate during the flood.

The most remarkable habit of the beaver is its instinct for building, which is shown in many different ways. Where it leads an undisturbed life, near quiet rivers or ponds, it erects large "lodges," which, according to their situation, bear different names. Those on islands are called island-lodges, while those on shore, which barely touch the water, are known as bank-lodges, and those in the water near the shore as water-lodges. Land-lodges are those near the water, but placed on firm ground. Besides the real lodges, the beaver builds mounds supported by thick poles, in front of the entrances from the shore, partly to hide them and partly to serve as provision stores. All these structures are more or less of the same height, which is 6 to 10 feet. So soon as one of the lodges becomes useless in consequence of damage, or by a change in the water-level, an upper storey is added, so that, when consisting of three floors, it reaches the height of 10 feet. The area covered by the lodge is generally circular, the diameter being equal to the height of the hut, but, when required by the conditions of the place, it may be oblong. In Norway there have been found beaver-lodges of the ordinary height, which were from 25 to 50 feet in length. These appear to have been shore and water lodges, which extend so far down into the water that even when the stream is low the entrance is not exposed.

The lodge is oven-shaped, and generally consists of one storey; the floor being smooth, and just above the water-level. It has an arched roof about 20 inches thick, and the space is frequently divided into chambers by vertical walls. This arrangement becomes necessary when several beavers of the same age begin to start their own establishments, as it provides each family with a separate home. When the lodge to be divided is of oblong form, the wall is not built across but down the middle. This appears a strange arrangement, but it is easily explained if we consider that a chamber inhabited by one family and provided with its own entrances and outlets, is really a complete lodge, and consequently must give access to the water; while, on the other hand, it should be

as near the shore as possible. While some lodges or chambers have but one entrance, others possess two. If there be only one entrance, this leads straight to the water, so that it opens from below into the lodge beneath the surface. The principal entrance is longer or shorter, according to its distance from the water, and in many cases is more than 30 feet long. There is also a subterranean passage running from the floor to the place where the beaver gets the wood required for food and the construction or repairing of the lodge. When this corridor opens into the forest, it is generally entirely covered with wood, which is partly pulled into the hole, partly left to lie loosely on the top.

The settlement is always in a place where the conveyance of wood is convenient, and where at the same time there is communication with the water. It may be regarded as a habitation for old beavers and their young of the last two years, and as a home for the female before giving birth to her young. As the safety of the lodge is endangered by floods and ice, and by beasts-of-prey and other enemies, and the old and young males separate from the females while they are with young, the beavers build so-called bank-lodges or burrows, which generally begin with a passage, have a pool for bathing in the middle, and end in a dry and somewhat lofty chamber for resting. Where the ground is not solid enough to prevent its falling in, the beaver supports the roof by wooden posts, and where part of the shore has given way, the hole is roofed in the same way as the principal lodge. If the bank-lodge, as sometimes happens, has a special outlet to the land for the better conveyance of food, it is covered with wooden sticks in the same way as the shore-outlets of the principal lodge. In short, the bank-lodges are of the same construction as the others. This accounts for the fact that male beavers, having had enough of the family lodge or being no more welcome there, retire to these bank-lodges and make them their only and constant dwelling-place. Sometimes whole families have to live in these habitations, especially when the construction of a lodge is connected with great difficulties, or the strength of the family is insufficient for the work.

In Germany the beaver is only found in these bank-lodges, and generally lives alone, or in families, never in large colonies. The lodge is situated on the banks or among the shady islands of the Elbe, or in lakes and ponds near by in places least exposed to the danger of inundation. If the entrance of the main passage lies under water, nothing betrays the existence of the burrow, unless the water is low, when the entrance-holes can be seen; but, besides the main entrance, there are three or four other holes at different heights under water, serving for escape in case of danger; and close to the main lodge there are generally several smaller ones. In districts where it is not absolutely safe, the beaver never makes the entrance-holes so that they show from the outside; and when they are laid open by the sinking of the water, it moves to another place, or carefully covers the entrance with dry twigs. The main gallery leads from the shore upwards on a curve for some yards. It usually ends close beneath the grass in a domed chamber, the floor of which is lined with grass, moss, and reeds, and very often contains the remains of a beaver's meal, pieces of barked wood, shavings, etc. The entrance of air is only possible through the thin covering of grass lying above the entrance-hole, especially in burrows where the entrance is under water. In some

cases, however, there exists a channel, with an opening about as wide as the hand, connecting the burrow with the shore, which is either intentionally made by the beaver, or else accidentally caused by the breaking-down of the grass-covering. When this opening becomes too large, the beaver tries to close it in; sticks and twigs being heaped up on the top of the treacherous spot, which in a few weeks rise to a height of from 6 to 10 feet. If this artificial wood-pile is made solid by reeds and mud in the autumn, it looks exactly like an American beaver-lodge. Besides these, the beaver sometimes raises temporary wooden structures, with an outlet to the land, and of the shape of a large dog-kennel. When driven by a flood from its usual habitation, the beaver tries to swim to a more elevated place, and from there starts on its excursions for food; if the landing-place does not afford sufficient security, sticks and dry twigs are heaped up into a lodge as a shelter until the original haunt is accessible.

The safety of the beaver depends in many places on the entrance to the passage being deep enough under water to remain clear of ice, and on the water around being sufficiently deep and open to afford a refuge in case of need. For this reason beavers throw up dams on rivers in which the water-level changes, so as to keep the water at a certain height or form a larger surface. These dams extend from one bank to the other, and are generally begun in the middle where the current is strongest, and where the beaver finds some support, such as a rock or stump from which it can build towards both banks. Many dams curve towards the stream, as the beaver has to let the materials drift downwards from the fixed point before the dam can be closed. This curve is often slight, and sometimes the dams are straight, while occasionally they curve outwards from the stream. They are flat-topped when curving outwards, and steep when curving upwards, and may be from 10 to 500 feet long or even more, and from 6 to 13 feet high. At the base they are from 16 to 20 feet in width, and on the top from 20 to 40 inches. Since it is necessary that the dam should be firm and allow the water to pass freely over, and also that it should remain safe, regularly worked outlet-holes are made along the upper edge, except when logs are used and there is enough space between them for the water to trickle through. The largest dams are constructed by the organised co-operation of many beavers, but, as is evident from observations in America, they are built by one family, or perhaps by several families of the same age which have been obliged to migrate together. Later on they are probably repaired and completed by other beavers, so that they form gigantic structures, which, in consequence of the ponding-back of the water, give rise to lakes and swamps or peat-mosses. These mosses often completely cover the dams, and are so large that to some dams an age of more than a thousand years is assigned. Wherever beavers are still in undisturbed possession of the country, forest-streams often overflow the valleys for a great distance, thereby causing the trees which are under water to die or fall, and thus forming ponds and lakes, with lilies and other water-plants. In the nearly dry bed of the river below the dam, traversed only by narrow channels, land-plants begin to grow, and soon form a green carpet: the water from the swamps flows to these places, and when, after long years, the floods of spring force the water into its old course, they sweep away the dam, but do not remove every trace of the beavers' work, and on the

bottom of the lake in which the water was stored has been formed a plain, which when covered with grass is the so-called "beaver-meadow."

The beaver habitations of the Old World frequently have no dam, since owing to the height of the water in the lakes and ponds varying so little they would be superfluous. In the spring of 1890, however, a beaver near Wittenburg dammed a ditch with twigs and mud, apparently with the intention of preventing the sinking of the water, and another beaver-dam was built near Dessau. A stream leading from the Kirtman Lake to the Elbe, which is bordered in its widest part on one side by forests and on the other by meadows, forms at a little distance from its mouth a few small ponds, once favourite haunts of beavers. In November 1891, when the Elbe was exceedingly low, the lake discharged such small quantities of water that the entrances of the beavers' burrows became visible, and thus made it impossible for their inhabitants to get out without being seen. One day it was noticed that the water in the stream had risen, and it was discovered that below the burrows, where the pond is narrow, the beavers had made a dam of 5 feet in height and about 10 feet wide, and solid enough to resist the pressure of the water. In the following March the beavers tried to pond back the water at a place situated about three-quarters of a mile farther up the same channel, but this dam remained unfinished, as shortly afterwards the stream became sufficiently provided with water.

For the construction of its dams and lodges the beaver uses branches of considerable length and thickness, which are first barked, and then arranged in layers, one on the top of the other, and held together with sand, mud, or clay. When beginning the structure, and using light wood, the beaver loads the top with stones of several pounds in weight. While swimming, the beaver holds the stones and soil between its fore-paws, and presses them against its chin, but when on land it walks upright with them to the building-place. It is also said to carry the wood in its fore-paws, although others state that it clutches this with its teeth, supporting the poles on its shoulder like a rifle. If possible, it cuts the wood higher up the river so as to take advantage of the current, and so float it to the building-ground, swimming alongside to steer it along. The direction of the current is also taken into consideration when building is commenced, as it has been observed that in some dams the lowest poles are placed in regular order, parallel to each other, with the thicker ends up-stream. When felling timber, the beaver stands upright, supported on its tail, and gnaws deep grooves in the shape of an hour-glass into stems from an inch and upwards in diameter, continuing till the trunk falls in the most convenient direction. Sometimes the work is interrupted for weeks, to be finished apparently when the wind blows from a favourable quarter. During these proceedings the beaver often looks up, so as to be in time to get out of the way of the falling tree. When beginning a dam, it generally chooses the trees close to the bank, cutting them only on one side so that they fall across the river and form a solid basis for the structure. The stumps of the trees are pointed at the top and marked by the teeth with cross-lines and grooves as sharp and smooth as if cut by a chisel. The trees felled are generally those whose soft wood and bark the beaver eats, but sometimes they are hardwood trees, such as oaks, or trees with a bitter taste, such as elms and firs, though the latter are seldom chosen.

First of all the beaver strips the tree of its twigs, and then cuts it into lengths, from which it peels and eats the bark. The thicker a trunk, the shorter are the lengths cut, in order to facilitate their transport, pieces of 5 inches in diameter being generally about a foot long, while those of an inch in diameter may measure a dozen feet. Where there is no water-way, the beaver carries or drags the logs, mud, and stones to the building-ground, thus forming paths from the forest to the bank-entrance of the lodge. This track, especially close to the bank where it is perhaps intentionally deepened by the beaver, is sometimes about 30 inches deep, and gradually slopes down to and often into the water.

All this work, including the gathering of food, is done by night, except in cases of danger or necessity. In daylight beavers are seldom seen, and then only when enjoying the sunshine for a moment on the top of a willow, or near the water. Sometimes they will lie on the bank rolled up like a dog with the head resting on the tail. When the sun is down the beaver comes out and may be seen with the upper half of its head above the water, looking all round as if to make sure once more, and then, with fore-paws extended and laid close to its neck, gliding along and leaving a wide wake behind. A beaver swims with only its nose and eyes out of the water, and, even if it has nothing to carry, holds its fore-paws close to the chin: it is able to remain from five to seven minutes below the surface, swimming for a considerable distance. When danger is scented, these rodents strike the water with the broad tail, which is generally used as a rudder; and then they dive, the smack of the tail on the water being a danger-signal to all the beavers in the neighbourhood, which plunge into the water simultaneously, producing a similar noise as their tails strike the surface. On land beavers are by no means so brisk; they emerge heavily from the water, with a slow, trailing step, and if startled hasten their walk to an awkward run, soon plunging headlong into the stream with a noisy splash. They return home at daybreak to rest, and frequently sleep on their backs, but never on their sides.

Beavers keep their homes very clean, remaining in day and night during hard winters, except during a thaw, when they venture out for a time either to repair the domicile, to find food, or for some other purpose. At the end of February the pairing-time begins, and this lasts till March. In April or May the female gives birth to two or four cubs, which at first are blind, but eight days after birth open their eyes, and, if the weather be favourable, soon accompany their parents into the water, where they at once dive and play, sometimes clinging to their mother's back. After four weeks they are fed by the mother with the bark of trees, and after another six or eight weeks they go out with the old ones to gnaw in the forest. If caught at this age they are easily tamed; beavers being reported to have been taught to follow their masters like dogs.

Young beavers do not set up a home of their own till the third year, when they sometimes separate from the family and begin to build lodges of their own. They seldom establish themselves within the territory of their parents, but settle farther down stream, it being evident that, if they built up-stream, the water-supply would be altered, and perhaps damage done to the parental lodge. Old

beavers are sometimes compelled by circumstances to emigrate to more suitable localities, where they start building immediately, as was observed at Rosen in Norway in 1875.

The beaver will live in captivity until fifty years old, and in the wild state probably attains a greater age. Its food is the bark, young wood, buds, and sprigs of the trees it fells; the favourite trees being aspen, poplar, willow, birch, ash, and alder; hazel, sycamore, and crab-apple are not so much in request. It also feeds on water-plants, and occasionally wild fruits. Before winter begins beavers gather in a store of large pieces of wood, of which only the bark is generally eaten, although in cases of need some of the wood itself. This wood is sunk in the water in front of the entrance of the lodge, and sometimes stands up out of the water; occasionally the provisions are piled up inside the lodge. The colder the winter the larger the store; when a hard frost sets in suddenly, the store is gathered in a great hurry, which seems to show that the beaver has a keen sense of the influence of the weather.

Water-Rat.

Another rodent which must be noticed here is the water-rat (*Microtus amphibius*), which is as common as the beaver is rare, and seems to be always on the increase. In almost all brooks and rivers in Europe water-rats are more or less common, and they extend eastwards, north of the Himalaya to China. They are by no means confined to the river-banks, but are often found in meadows and ploughed fields at a considerable distance from the water. Although the water-rat may, perhaps, eat flesh, it is principally a vegetable-feeder, living on all kinds of water-plants, and in winter not disdaining the bark of trees and shrubs, and is not averse to turnips, potatoes, and other field-crops. While eating, a water-rat sits erect like a squirrel, and takes one piece after another between its fore-feet, to nibble off a little, and then drop it and pick it up again; and when swimming at ease it holds its fore-paws close to its body and uses its hind pair only, but at the least alarm it strikes out with all four and makes for its burrow or dives to the bottom, from which it soon has to rise to breathe, for it cannot stay much longer than a minute under water. The burrow is long and winding, generally having an entrance below the level of the water and always one to the surface of the land. At the mouth of the land entrance the water-rat can usually be seen in the evening and early morning, though it spends most of its time in the water or close to it, along the bank, feeding on the flags and horsetails and plants of similar habit. So long as the burrow is undisturbed it will remain tenanted for years. There are five or six in a litter, and when danger is evident the female will carry her young ones in her mouth as a cat does her kittens and place them in safety, running to and fro until she has taken them all.

Water-rats have been watched by quiet observers for hours, and are undoubtedly more intelligent than they are given credit for. In length they are under nine inches, and in build are much stouter and clumsier than the brown rat, for which they are often mistaken. In colour they are dark reddish brown, mingled with black above and with grey below; the fur is thick and shining, and there is a sort of under-fur of shorter, finer hairs. The head is short and

rounded, the eyes black, the ears very short and hidden in the coat, and the tail is only half as long as the head and body together and almost cylindrical. It is covered with closely adherent hairs, not scales, and somewhat flattened at the tip. The feet are pale flesh-colour and not webbed, and the claws of the fore-feet are short, while those of the others are long, all of them being of a dark purple tint.

Otter.

The otter (*Lutra vulgaris*) is an aquatic carnivore whose relatives are distributed over all the continents of the globe, with the exception of Australia. Such a familiar animal needs nothing in the way of description, and we accordingly pass directly to the consideration of



THE OTTER.

its habits. The otter is more active by night than by day, and though able

to climb across sluices and weirs, with the aid of its sharp claws, it is in the water that it is really most at home. Indeed, it leaves this element only when compelled, and tries to get back when danger threatens. The smooth, long body, the short legs with their paddle-like feet, the long, strong tail which serves as a rudder, and the constantly dry fur, all combine to render this animal specially suited to a sub-aquatic life. Although able to remain under water for a long time, an otter has to come to the surface occasionally to breathe, when it generally raises only its nose to inhale the air. As it exhales air while it dives, a number of small bubbles mark its course under water. When the bubbles become larger, the otter is rising again, and soon it appears on the surface, to swim, perhaps, a little distance, with only its head or nose visible, a rippling wave indicating its course. If ice covers the

water, the otter comes up to breathe at any hole it can find. The animals cross the country only to go from one piece of water to another; and if mortally wounded make for the river-bank, to die either there or in their burrow, which in some districts is known as the "holt" and in others as the "couch." On fine days they bask in the sun in dry places, generally by the side of deep water, and on such occasions they sometimes fall asleep so soundly that they may be surprised and caught. On land an otter runs lightly and silently, although not quickly, stopping from time to time to look around and sniff, and on such occasions it may be easily overtaken by a man.

Sometimes, in parties of four or six, otters wander for miles over land or swamps, visiting such water as may be accessible on the way. Such parties have been seen in Silesia to cross the water-shed of the mountains in order to fish in the Bohemian streams, whence they have returned after a fortnight's sojourn. If an otter be surprised on a nocturnal expedition, it will hide beneath roots or in some hollow trunk, sometimes even in the earth of a badger or fox, remaining quietly in its place of refuge till after sunset, when it continues its pilgrimage. Old female otters during the pairing-season always fish in the company of the males; old males sometimes live together in one burrow, and it has happened that several have been found in the company of one female. Young otters are said to remain for a long time under the protection of their mother. Wherever an otter lives there are sure to be steep paths descending deep into the water, by which it can slide down into the stream after a visit to the shore. Generally it makes its own burrow in some hole or cavity on the bank, the entrance being about half a yard below the surface of the water. This entrance leads to a dry lair heaped up with grass and leaves, from which a second hole, as an outlet, opens into a passage which leads to the surface. An otter generally has several burrows situated on different waters, or at least several safe places of refuge which it inhabits alternately, but apparently only floods drive it away from its original home. At the time of a flood an otter either retires to some hole in the bank, or takes refuge in a tree or hollow trunk. The favourite haunts of these animals are situated under old willows and other trees with bare roots, or on stems lying across the water which give sufficient room for a sunny resting-place. In alder-stumps an otter excavates the side exposed to the sun, and then squeezes its body into a crevice of the same colour as itself. If persistently pursued, an otter abandons its haunt to find, after wandering overland, some other home, the existence of which is betrayed by the smell of decaying fish. Otters do not seem to be exclusively flesh-feeders, and in captivity have been observed to eat vegetables, and to display a special fancy for carrots, pears, plums, and cherries. They will also eat birds and their eggs, and, in case of need, water-rats and frogs. Their favourite food, however, is fish, trout and carp being especially relished; but they will only eat fresh fish, or those captured by themselves. They usually feed only at night, preferring moonlight, but occasionally, when in very quiet waters, they will fish in the daytime. They are not disturbed by the neighbourhood of human habitations, and will fish just as industriously near a mill as in the lonely brooks of a silent forest, and will bask in the sun on river-banks often visited by man as freely as in places remote from human observation.

With the fall of twilight the otter starts fishing, swimming up-stream all the while; it seems to frighten the fish by a piercing whistle, uttered from time to time, driving them to spots where they can be easily taken. It will also drive them into holes in the bank or under stones, by beating the surface of the water with its tail. When a small fish is captured, the otter raises its head from the water and devours it at once, but if a larger fish be the victim, it is carried to the shore, to a stone, or some other elevated spot where it can be eaten at leisure. Before its meal an otter looks cautiously round, and then bites the back of the fish behind the head, tearing off the flesh in strips. When food is plentiful only the best pieces are eaten, the head and tail being left untouched. Beneath the ice an otter swims as easily as in open water; and it will lie for hours by the waterside lurking for its prey, to dart upon it like an arrow as soon as a fish comes near. In catching tame ducks it attacks them from below, or dashes amongst them from the bottom of the water, carrying the victim to the bank, where its bones are soon picked clean. Otters occasionally kill birds which are asleep in flocks among reeds, especially those on migration. The footprint—the so called “seal”—of an otter shows the mark of the five toes with the web, and is not unlike that of the badger, although the marks are wider, rounder, and closer together, while the short prints of the claws are unmistakable. Otter-tracks on snow or soft ground are generally very distinct; they do not form an uninterrupted line, but show gaps at every few steps; and as an otter occasionally comes ashore several times in succession to run round in a circle and dive into the water before taking shelter, it is not always to be found where the trail ends. Sometimes a pair of fresh otter-tracks will lead into a burrow, and although no otter is at home, only a single track leads out; this is owing to one of the animals having left by the opening under the water. The otter often betrays itself by its voice. Males and females call each other by a long, melodious whistling; when in pursuit of fish the whistle is much shriller; if the otter be at its ease, it utters a low gurgle, similar to the laugh of a child; if in a fury, or in pain, it breaks into an ear-splitting shriek, an often and quickly repeated *girk*; and in its agony utters a plaintive whine.

Young otters have been taken at quite different seasons, but pairing seems to take place with a certain regularity at the end of February, the beginning of March, and the end of July. During such times, male and female, while playing together in the water, chase and tease each other. Nine weeks after pairing, which in central Europe is generally in May, the female gives birth in a burrow on land to two or four blind young, which are at first quite black. After nine or ten days they open their eyes, and at the age of about two months are taken by the mother to accompany her on fishing expeditions. They remain for another half year under the superintendence of the parents, and are usually full grown and mature in the second year. The mother places her young on a soft warm grass cushion, nurses them with the greatest care, anxiously tries to hide their whereabouts, never leaving a trace or a footprint that would betray them, brings them up in the way an otter should go, delivers them if possible from captivity, and defends them, when necessary, with great courage, not only against dogs but even against man himself. On the west coast of Ireland, and elsewhere, otters catch their prey in the sea.

Water-Shrew. Locally the water-shrew (*Neomys*, or *Crossopus foliens*), one of the Insectivora, is a fairly common aquatic mammal in central Europe. It is about 5¼ inches in length from the nose to the tip of the tail, the tail being about two-thirds as long. Like other shrew mice, it is at once distinguishable from land-mice by its long nose, while it is specially characterised by the fringes of stiff hair on the tail and feet. Water-shrews are met with throughout Europe and northern Asia as far east as the Altai Mountains. The interesting discovery has recently been made that at least two of the water-shrews of southern Europe differ from the British species by the absence of a fringe of hairs on the lower margin of the tail. One of these species inhabits the streams of the Vaud



THE WATER-SHREW.

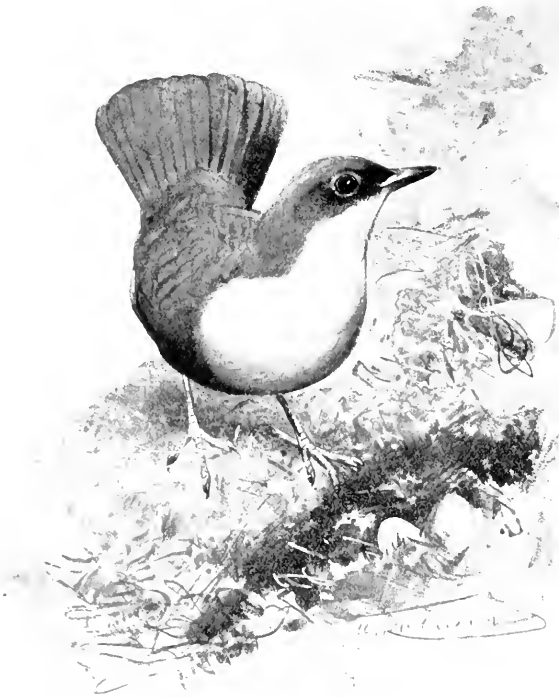
Alps, and has been named *N. milleri*; while the second is a native of Spain, and has been described as *N. anomalus*. The absence of the lower tail-fringe in these continental water-shrews indicates that they are less specialised for an aquatic life than their British representative. Both the continental species are smaller than the latter, the Spanish being distinguished from the Swiss form by its shorter and greyer fur, as well as by certain differences in the shape of the skull. The water-shrew feeds principally on aquatic insects and their larvæ, as well as on crustaceans, particularly the fresh-water shrimp, and it has also been observed to eat fresh-water snails and the fry of fish, including that of the salmon. Frog-spawn and dead mammals and birds are also eaten, so that this shrew is not entirely insectivorous. Its burrow in the river-bank is long and winding, and ends in a terminal chamber lined with grass.

Whiskered Bat, There are three species of bats in central Europe which
 etc. habitually frequent the neighbourhood of water. Of these, the
 whiskered bat (*Myotis mystacinus*) may often be noticed on the wing close to
 the surface of stagnant ponds and slowly flowing streams and brooks where
 insects are abundant. It is generally seen alone, but occasionally lives in small
 companies and sleeps in hollow trees, in buildings, or in caves. Coming out early
 in the evening soon after sundown, it flies till dawn. Daubenton's bat (*M.*
daubentonii) has a still greater partiality for water, and flies so low that it
 would dip its wings in it, were it not for its curiously tremulous flight. It is
 brown above and dirty white beneath. The rough-legged bat (*M. dasycneme*) is
 larger, and the hair of the upper-parts is dark at the base and light brown at the
 tips, while that of the under-parts is black at the base and white at the tips. It
 is found all over central and southern Europe, and the greater part of northern
 Asia, but only in the plains. It is particularly fond of large sheets of water,
 and when in search of food almost always flies low down over the surface, making
 its appearance in the evening towards twilight and sleeping longer during the
 winter, and appearing later in the spring than the two species just noticed.

Water Ousel. A true bird of the waters is the water ousel or dipper
 (*Cinclus aquaticus*), which is nowhere very common, and rather
 local in its distribution. This bird can swim on the water, and under water for
 a considerable distance, even against the current, seeking for its food, which
 consists of small crustaceans, insects, and other forms of aquatic life. It sleeps
 at night beneath banks which have been undermined by the action of the stream,
 creeping into holes and among the roots, whence, when disturbed or alarmed, it
 will rush into the water, swimming away under the surface for a time, and then
 emerging to fly farther in the air. The nest, of much the same character as that
 of a wren, is placed in cavities close to water, especially in places where the stream
 runs noisily, the bird being often obliged to fly through small cascades to get to
 its eggs. In the neighbourhood of warm springs, eggs have been found so early as
 February, but, as a rule, they are laid at the end of April or beginning of May,
 and are from four to six in number and dull white in colour. The water ousel
 seems never tired, and is active even in the severest weather. It is generally
 seen alone on the bank, or on a rock in the middle of some fast-flowing stream.
 In the air its flight is not unlike that of a kingfisher, and under water it swims
 with legs and wings. It has a pleasant song with many variations, containing
 low, twittering, chirping notes, alternating with loud, whistling passages, that
 harmonise wonderfully with the surroundings.

Blue-Throat. Far more numerous than the mammals living on the banks of
 fresh waters are the birds. Amongst them one of the most attractive
 and interesting is the lovely blue-throat, or blue-throated warbler (*Cyanocitta*
wolffi), which forms a link with the woodland birds in the similarity of its abodes,
 its usual haunts being copses covering the sides of streams with a growth of
 willows, alders, rushes, reeds, and low marsh-plants, especially in flat country where
 the river-banks are low. This bird is 5½ inches long, and the full-grown male has
 the throat and the upper part of the breast of a beautiful azure-blue, edged with

black and chestnut below, with a white spot in the centre of the blue background; the female being distinguishable by a paler blue and blackish breast. Both sexes have a dark brown tail, shading to chestnut at the tip and sides, the younger birds having a white throat bordered with blackish spots, and the nestlings being buffish, with black stripes. This bird is found in central and especially western Europe,



THE WATER OUSEL.

migrating in autumn to Africa, as far south as the Equator, returning between the end of March and middle of April. It always travels at night. In central Germany it is seen occasionally, but on the north German plains it is by no means uncommon, especially in those parts often flooded by the larger rivers. It is very shy and retiring in its habits, and generally builds only once a year and then on or near the ground; the nest, which is difficult to find, containing,

as early as the end of April or beginning of May, from five to seven bluish grey eggs marbled with brown. The young birds, which as early as the beginning of June creep with their mother through the bushes like mice, leave the nest altogether as soon as they are able to move about.

This pretty, lively, little warbler hops nimbly about on its long legs, or runs along with the swiftness of a rolling ball. Like the robin, it drops its wings, and jerks its tail up and down, at the same time spreading it out like a fan. On the ground it moves about in the shadow of bushes, where it lives on water-insects, earth-worms, and, it is said, berries. In its song, which is characteristic, clear whistling notes rise above a tinkling like that of a lute; and with its own melody it mingles passages imitated from other birds. Generally singing on a low, solitary bush or a stone lying on the flat ground, or even while running, it is heard most frequently in the early morning or late evening.

Water Warbler. The haunt of the water warbler (*Acrocephalus aquaticus*) is wherever sedges overgrown with underwood abound and reeds are but few. This bird is principally found in central and southern Europe, though it visits France, England, Holland, north Germany, and the south of Denmark. In winter it visits the delta of the Nile, and it breeds in western Asia, north-western Africa, and the Canary Isles. Skilful in concealing itself among the sedges, even when they are only a span high, it runs like a mouse, and keeps close to the ground when in flight. It seldom perches on trees, and builds its nest near the ground, sometimes between the stalks of the sedges and other plants, but generally in more exposed situations sparsely overgrown with bushes, and never among reeds overhanging water. The nest is a deep cup hung among the stems of the plants, and made of moss and grass and lined with horsehair: in it may be found four or five eggs, generally laid about the second half of May or beginning of June. The water warbler is a shy bird, feeding on midges, gnats, and other insects, and endowed with a short, sweet, chirping song. On the ground it runs and walks, rather than hops, and moves in the same way up and down the stems of plants with such quickness that it appears to slide. Five inches in length, in colour it is rusty or brownish yellow striped with black, the under-parts being light yellow without spots; down the middle of the crown there is a buff streak, edged on either side with a broad black stripe, which distinguishes it from the other species of the genus.

Sedge Warbler. The water warbler is frequently mistaken for the sedge warbler (*A. phragmites*), a species ranging all over Europe, even as far north as 70° in Norway and 68° in the valley of the Petchora, and also met with in western Asia, while in Africa it migrates as far south as the Transvaal. Haunting the banks of rivers and marshes covered with bushes, flowering reeds, and other narrow-leaved bog-plants, where dwarf willows, alder-bushes, and other shrubs form an ideal dwelling-place, it is also met with in copses and hedgerows at a considerable distance from river or marsh. It may be distinguished from the water-warbler by having all the crown-stripes brown. The plumage of the back is brown clouded with darker brown, while the under-parts are buff shading into tawny at the sides. The nest is frequently found quite a quarter of a mile from water, and is always near or on the ground, and never over water

or amid reeds. From the middle of May until well on into June it may contain



SEDE WARBLER.

four or five eggs, from which the young are hatched, if not disturbed, in about thirteen days, the young birds only leaving the nest when fully fledged. The sedge warbler will creep through the densest under-wood, and run swiftly up and down any stem, but when at rest and undisturbed, perches with its neck sunk between the shoulders and drooping tail, rarely coming out into the open. While singing, it changes from one bush to another about ten yards away, fluttering about in the air until it drops down in a slanting direction, the peculiar action causing it to clap

the tips of its wings together and then drop to its perch. Besides water-insects, which the bird catches as they hop, and seldom as they fly, the sedge warbler feeds on worms and slugs and elder-berries. Its song contains a particularly characteristic passage—a long-drawn, flute-like shake, which sinks gradually some three tones lower.

Marsh Warbler. The favourite haunt of the marsh warbler (*A. palustris*) is among low-growing willow-bushes and underwood mingled with reeds; but this bird will also frequent any garden through which flows a stream bordered with bushes and aquatic plants, although avoiding large continuous thickets of reeds, and preferring marshy, moderately overgrown places. The marsh warbler is about $5\frac{1}{2}$ inches long; its plumage being similar to that of the reed warbler but rather more olive on the back, with the breast white, tinged with sulphur-buff, the eyes hazel, and the legs flesh-colour. The song is rich in a variety of passages resembling that of the garden warbler, which it much excels in the variety and softness of its notes: so loud, indeed, is the melody

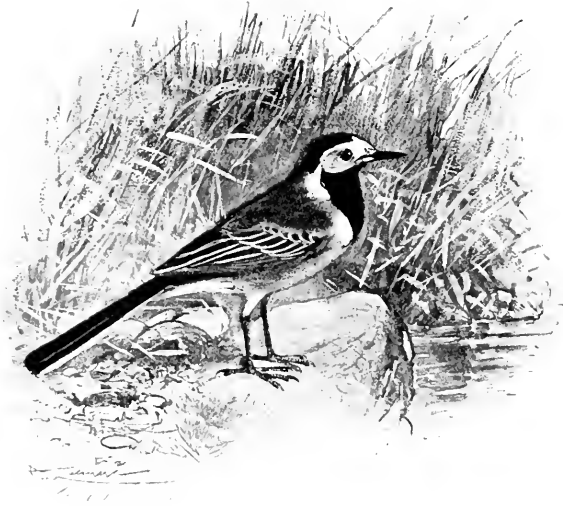
that it can be heard, especially at night, at a great distance. As the song is

long, with many cadences, it inevitably includes apparent imitations of that of other birds. The marsh warbler never builds its nest over water but generally near by; the materials always including cylindrical grass-stems for the cup, and horse-hair for the lining. At the beginning or middle of June, at the earliest, the nest will contain from five to seven white or greenish eggs with underlying grey markings and overlying spots. Its food is similar to that of the reed warbler; but it is by nature a bolder bird than the other members of the genus, and may often be seen sitting on bush or tree, and covers comparatively long distances on the wing. The marsh warbler inhabits the warm and temperate countries of Europe, such as the marshy districts of northern Italy and the deltas of the Rhone and Rhine. It is a somewhat rare visitor to England and is not found very far north, although it appears in Denmark and Russian Finland. When migrating it travels as far south as Natal.

Reed Warbler. The reed warbler (*A. streperus*), as its name implies, prefers thick beds of reeds to any other covert. The nest, shaped like an inverted sugar-loaf, is compactly built of dry grass, reeds, moss, wool, feathers, hair, and thistledown, and hung among reed-stems above the water, sometimes, but rarely, at some distance off; and it contains from four to six white eggs tinged with green and blotched with olive and dark brown. When fancying itself unobserved, this brisk little bird hops among the reeds and rushes with head bowed and feathers ruffled. When surprised, it alternately spreads and folds its tail, jerking it up and down, and then slinks into the densest part of the bushes and reeds, generally to reappear soaring aloft, whence it suddenly drops into safety. It feeds on all kinds of insects, especially small dragon-flies, and in the autumn on berries. The song, which is heard a great deal during the night, is distinguished by frequent repetitions of the syllables, *tiri, zerr, zack, scherk, and tret*, and is of a chirping, chattering character. The warning note is a kind of whirring *scharr*, the call sounding like *taitisch*. The reed warbler inhabits central and southern Europe and western Asia; but its range includes England, Denmark, and southern Sweden in the north, and Baluchistan in the east, and the bird passes down the Nile Valley on migration. The plumage is rusty olive-brown on the back, the wing and tail feathers being dusky with paler edges; the throat and centre of the breast white, washed with brownish buff, and the under tail-coverts, under wing-coverts, and axillaries white. The eye-stripe is pale buff, the beak dark brown above and pale brown below, the eyes are brown, and the legs purplish brown, and not flesh-coloured like those of the marsh warbler.

Greater Reed Warbler. The greater reed warbler (*A. turdoides*), so called because of its large size compared with others of the same genus, lives and builds near the water. The plumage is of rufous light brown above and white and buff below. The wing is proportionately longer than that of the other species of the genus, the longest feather being the second primary. There is a whitish eye-stripe, the base of the beak and the mouth are yellow, and the legs light horn brown, the feet being darker. Its haunt is among rivers and marshes, where abundance of reeds are intermixed with a goodly number of willow and other bushes. The nest, which contains five or six pale greenish blue eggs, boldly blotched with brown, is made of dead reeds, rootlets, and leaves, and lined

with grass and flowers, suspended to reeds growing in the mud and not in the water. The parent-birds hunt for their insect-food through the dense growing reeds and low bushes, keeping generally close to the water: and, where several pairs dwell together, quarrels are frequent, the birds driving one another out of the reeds, and, while wrangling, darting along with a whirr just over the surface of the stream. The song is heard from the beginning till the middle of June during most of the day, and generally late into the evening. It is loud, but entirely wanting in flute-like notes, and at frequent intervals bears some resemblance to the croaking of a frog. The greater reed warbler ranges over southern and central Europe as far north as England and southern Sweden, where it is,



THE WHITE WAGTAIL.

however, an unfrequent straggler. It is also found in western Asia as far as the Caspian, and when migrating, visits the western and northern coasts of Africa, often extending its flight to the Equator and occasionally as far as the Transvaal: it is abundant in certain districts of the Continent, such as the valleys of the Havel and the Spree, in Mecklenburg, the Rhine, and the Danube, especially in the Dobrudscha.

Some of the wagtails are as much birds of the water as the above-named warblers. The white wagtail (*Motacilla alba*), for instance, though frequently found away from water, is much more at home by the side of a stream, and there, as a rule, it builds its nest. In the second half of April or in June the nest contains from five to eight eggs, which have small grey spots on a whitish ground covered all over with reddish brown dots and streaks.

This lively bird is always on the move, has little fear of man, delights in teasing other small birds, and shows a bold front to birds-of-prey, mobbing them with shrill screams and singing a loud song of triumph after they have flown away. When walking or running, it moves quickly, constantly nodding its head and wagging its tail up and down, this action being especially rapid when the bird settles down to rest. The flight is in a series of graceful curves and undulations, which allow of easy turning in any direction. The food consists of aquatic insects, which it seeks as it wades in shallow water, and of all kinds of other insects, in chase of which it runs about on land. In its song, which is more sweet than powerful, it frequently repeats a calling-phrase that sounds like *ziwit* and *zissziss, zississississ*. The yearly visits of this wagtail are prolonged from March till the middle of October, and in Germany these birds sometimes remain during the winter, though only on rare occasions. The species nests nearly all over Europe, its northward range extending to Iceland, Greenland, and Jan Mayen; while eastward it reaches the valley of the Yenesei and northern India. From Europe it migrates into Africa, where it has been found in Senegambia and the interior of the continent. The white wagtail is over 7 inches long, and distinguishable from the pied or water wagtail by its back being grey instead of black, and by having more black on the crown and nape and less on the throat. In all other respects—in habits, nesting-arrangements, and song—the two birds are alike, the pied wagtail (*M. lugubris*) being much commoner in the British Isles, where it is a well-known resident. The latter species is confined to the west of Europe, its eastward range being bounded by Norway, Denmark, Holland, Belgium, and France, and its winter migration taking it into Spain and Morocco, and occasionally, as a straggler, into Italy.

Grey Wagtail. In central Europe the grey wagtail (*M. melanope*) is mainly a bird of the mountain-streams, though occasionally found in the plains when on its travels, and then always by clear running water. It frequents the fields only when there is water in the neighbourhood, and is never met with in meadows where the grass is long. As restless as the other wagtails, it lives in constant feud with its kindred, and feeds on insects which it catches by sometimes creeping on them unawares or springing after them. It is the companion of the trout and the water-ousel, and never remains for any length of time near open water unsheltered by bushes. The grey wagtail builds its nest in hollow banks, in holes in walls, and among heaps of stone, generally near the water, and, as a rule, not very near the ground. The song is stronger and more melodious than that of the white wagtail, the call-note being similar but more musical and of a higher pitch. The grey wagtail ranges all over Europe and its islands, but not so far north as the white wagtail: it is rare in north Germany, but comparatively frequent in the Hartz Mountains, in Thuringia, Saxony, Franconia, southern Germany, Switzerland, France, and the British Isles. It is found in Asia as far east as the Pacific, and also in Burma and the Malay Archipelago; and on migration is met with in northern and central Africa.

Reed Bunting. The one European representative of the buntings found in the neighbourhood of water is the reed bunting (*Emberiza schanidicus*), which inhabits low marshy situations overgrown with reeds and rushes, bushes

of willow and alder and tufts of tall grass, as well as the banks of ponds, brooks

and rivers, reedy ditches lying between meadows and cornfields, and other spots where sedge-warblers, moorhens, lapwings, and snipe congregate. Ranging over northern and central Europe and Asia south of the forest-line right across to Mongolia and Kamchatka, in Greece it is known only as a winter visitor, as also in Africa. A thoroughly migratory bird, it generally leaves the northeastern border of the country it inhabits in September or October, and goes to the south, where it winters until March, although many often spend the winter in Germany, or oftener still in the south of England. During the breeding season it prefers low bushes—particularly willows—growing by the side of the water. In autumn, when the clumps of rush and reed become bare and thin, the reed-bunting betakes itself to stubble-fields, and fields planted with cabbages and other crops, away from water.



THE REED BUNTING.

In appearance it somewhat resembles a cock-sparrow, and is a restless bird, constantly flying hither and thither, sitting at times on branches, or the stems of reeds and other plants, with drooping tail and twitching wings. When flying, it rises in a peculiar slanting direction, descending suddenly with a flutter and a spread of the tail that shows the white

Its food comprises insects during the summer, and seeds in the autumn and winter; and it lives in small companies, often associating with sparrows and chaffinches. It is distinguished from other buntings by its habit of climbing taller plants when in search of food, by flying a great distance to find seed, and by frequenting cabbage-fields in search of caterpillars. The song, which is varied in its stammering delivery, resounds at all times of the day, and even at night, from the beginning of April until late into the summer, giving the impression of being produced with some difficulty, and recognisable at once by the double note repeated several times and ending in a long drawl.

Sand Martin. Another bird that haunts the water, but is not found nesting so near, is the sand martin (*Cotile riparia*), whose home is a burrow in a steep sandy river-bank, or a railway-cutting or similar excavation with water not far off. In mountainous regions, and parts of the country where the soil is stony, the sand martin seldom makes its abode, but in sandy spots gathers in hundreds to form breeding-colonies, single pairs being never seen. In steep banks it always makes its nest high up, tunnelling for its reception a hole perhaps a yard or more in length, which widens out at the end; the nest itself being a mere handful of straw and feathers, and the bank in its upper section being often honeycombed with holes of this description. The sand martin flies mostly over the surface of the water, resting occasionally on some old stump growing out of the bank, and feeds on flying insects, mostly gnats. The young when they leave their parents settle near the water and roost in the reed-beds, but old and young alike join in the migration, which takes them in thousands at least as far as the Equator. The sand martin is widely distributed all round the Northern Hemisphere from the Arctic Circle downwards.

Kingfisher. Of all the European birds frequenting the water none is more beautiful or more familiarly known than the kingfisher (*Alcedo ispida*), which looks like a streak of blue flame, as it darts from its perch upon some unsuspecting fish. If it catch the fish, which does not always happen, it returns to its place, turning the captive round and round in its beak, until it can be conveniently swallowed head first. Besides fish, the kingfisher feeds on snails, crustaceans, and dragon-flies, water-beetles, and other insects; and is often obliged to content itself with these when the water has been rendered turbid by a flood. When watching for fish, it will change its place to another spot if no sport be obtainable, and occasionally move to another part of the water where, hovering overhead like a falcon, it can look out for prey. When flying over the water, it seldom goes farther than a hundred feet at a time, keeping so close to the surface as rarely to rise higher than a yard above it; and when pursued by a hawk it endeavours to escape, not by flying away, but by dashing at once into the stream. This lovely little azure bird chooses the most out-of-the-way places wherein to build its nest, preferring overhanging slopes, where, working with beak and feet, it can hollow out a horizontal cavity. The tunnel often penetrates to a distance of 3 feet into the bank, the entrance lying from 3 to 9 feet above the water; the hole itself being similar in form to a rat-hole, although easily recognisable by the strong smell of fish that permeates the neighbourhood of its

mouth. In the chamber forming the termination of the burrow, the bird places a layer of fish-bones and the harder portions of insects which have been ejected from its throat; and on this foundation are deposited the eggs, to the number of seven, seldom more or less. These are of a glossy pinkish white, and there is but one clutch, which is laid from the middle of April until well on into May. The



A KINGFISHER ON THE WATCH.

temperate and warm countries of Europe, from Denmark and the Baltic provinces to the south, form the breeding-area of the kingfisher in Europe. In Asia, where these birds are particularly numerous on the banks of the clear rivers of the Altai, the breeding-area extends as far as the Irtisch. In Africa the kingfisher is believed to breed on the Senegal: it remains in Spain all the year round, but in Greece, where it is frequently seen in winter, it never breeds. It is well known as a migrant and resident in the British Isles, but is not very



KINGFISHER.

common in Scotland, and is still less often to be met with in Sweden; in Germany it is frequently to be seen on the banks of the clearer streams, although never in great numbers.

Marsh Harrier. Among the birds-of-prey the marsh-harrier (*Circus æruginosus*) is particularly partial to the marsh-lands and watery stretches of Holland and Germany. In dense clumps of reeds or tufts of sedge-grass, among the water-plants, in nettles, in weeping-willow bushes, sometimes in tall growing wheat in the vicinity of water, it builds its rather tall nest, which is flattened at the top, and in which are deposited in the month of May from three to five or rarely six eggs of a uniform greenish white. While the female is sitting upon these the male indulges in innumerable antics in the air above, accompanying these movements with a kind of cat-like "mewing," and concluding with a rush towards the ground, performed with backward jerks and curious gestures, rising again and turning a somersault as it does so. By these performances it betrays the nesting-place, but should the young ones, to whom the parents show the most tender attachment, be surprised by an intruder, the old birds will throw themselves on their backs and defend their offspring courageously with their talons, their eyes gleaming fiercely the while. The marsh harrier's flight is slow, almost lazy; but with an easy swimming motion the bird hovers low over the fields and water, searching right and left for small animals, upon which it precipitates itself the instant it has discovered them, devouring them on the spot. Small mammals, birds, reptiles, frogs, and fish that can be caught close to the surface of the water, form the food of this harrier, which is especially noted as a destroyer of the eggs and young of water-fowl. A marsh-harrier will drive the smaller water-birds away from their nests without much ado, but is in its turn vigorously attacked, when it attempts to rob the larger ducks and geese. It is sufficiently daring to venture upon stealing swans' eggs which have been left unguarded, without however being able to do them much harm, owing to the hardness of their shells; other eggs it carries in its talons, one after the other, to dry ground, there to suck their contents. This timid bird, which can only be surprised in tall grass, does not range very far north in Europe, and is not known eastward of Turkestan, beyond which it is replaced by *C. spilonotus*, which is frequent in the region of the Altai Mountains, but becomes rarer in the basin of the Amur. On migration the European birds journey as far as South Africa.

Black Kite. Woods in the vicinity of stagnant or slowly flowing water abounding in fish, are the favourite abode of another bird-of-prey, the black kite (*Milvus migrans*). In such localities the nest may be found placed on or close to the top of the highest trees, at times also in lower trees at various heights from the ground, and in some treeless districts on bushy wastes and heaths. The nest is made of dried twigs, and always contains a certain quantity of fish-bones which have been swallowed and ejected by the birds, as well as hair, tow, wool, paper, and rags of all kinds, among the latter being sometimes whole aprons, stockings, or handkerchiefs. It is often found in the vicinity of others of the same kind, especially near colonies of herons, from which the kites steal the remains of fish and other refuse. With the exception of frogs, the black kite, which will feed

on carrion, seems to prefer fish to warm-blooded animals, such as young birds, hares, rats, and mice; it is not, however, capable of diving, and can only catch fish which are close to the surface. When flying in search of prey, it is far swifter and more courageous than its cousin the red kite, which it resembles in possessing a singularly graceful action. The young birds are distinguishable by their bold and erect attitude from those of the common kite, which timidly crouch on the ground. Both young and old birds start at the end of September or early in October to winter in Africa, and return to their breeding-area at the end of March or beginning of April. The black kite ranges all over Europe and central Asia, from Spain to the Lena River. In western Europe it is rare, but in the east, in lower Austria, Hungary, and along the Danube it is more frequent, while in Wallachia, southern Russia, and especially the Dobrudscha it is abundant.

Osprey.

The osprey (*Pandion haliaëtus*) is another bird-of-prey living among similar but wilder surroundings. In Germany this bird roosts in the tops of large trees, such as old oaks with dead boughs or half-dead firs, but on the sea-shore or on high mountains it chooses steep cliffs, and inaccessible spots, while in barren steppes and coral-islands it rests on the ground. The nest has everywhere the same character; it is, even for the size of the bird, unusually deep and bulky, and consists of dry twigs and other coarse material built up into a pile four feet, perhaps, in diameter, the eggs being laid in a hollow about a foot across and scarcely a couple of inches deep. In districts where the osprey is frequent, it builds in the neighbourhood of others of its kind, and even allows sparrows and other small birds to establish themselves in the sides of the nest. Its principal food consists of fish, in search of which it flies in a series of rather low circles. On sighting its prey the bird hovers for a moment, and then dashes down with closed wings and extended legs deep into the water, whence it works its way up again by movements of its wings, shaking off the water clinging to its feathers as it emerges, and uttering a scream of triumph as it flies off with the booty to a place of safety. The fish is always struck in such a way that it has the head turned forward, and the claws of the osprey sometimes penetrate so deeply that they have literally to be eaten out by carefully tearing the flesh from the fish's bones. As a rule, the young are so plentifully provided with food that they eat only the front half of each fish, the remainder being left to decay or to become the prey of ravens and kites. The osprey fishes regularly at the same hours, generally from eight to nine in the morning and from twelve to two in the afternoon, and never troubles water-fowl, which consequently exhibit no fear at its presence. Its distribution is cosmopolitan and embraces even Australia; but the bird is more abundant in northern and temperate regions than in those that are warmer. In central Europe it is principally found in Pomerania, Brandenburg, and on the Rhine. It is equally common in Bohemia, and in the large forests of the middle and lower Danube, where it nests, not in the small woods, but in the large forests close to the river, though it there fishes in the ponds and lakes, avoiding the more inhabited parts so long as it finds fish enough elsewhere.

Snipe.

Speaking generally, the plover tribe may be said to be never at home except in the vicinity of water, on the marsh, or on the shore. Of these, the snipe (*Gallinago calestis*) is peculiarly a bird of the swamp, frequenting situations where the ground is not covered either too much or too little with grasses, reeds, or bushes, for it has not only to hide among the plants, but to wade between them through shallow water, and to rise clear of hindrance. No bird is better known as a migrant; it winters in southern Europe, north Africa, and India, and breeds principally in central and northern Europe, as well as in similar latitudes through Asia, mostly below the line of the growth of trees. In northern Germany, Holland, Denmark, Scandinavia, the Baltic provinces, Russia, and Siberia it is very common, as it also is on the Danube, as far down as the Dobrudscha. It is a familiar bird all over the British Isles, and is resident in Iceland and the Faeroes. The nest is placed on hill-ocks in swamps, in tufts of grass on watery meadows, or in open spaces between willow and alder bushes. The building of the nest is begun by pressing down a tuft of grass, or rushes in the middle, and thereby forming a hollow which is



THE SNIFE.

then covered loosely with dry grass or sedge. In the second half of April the nest contains four pointed eggs, from which after sixteen days emerge the spotted young, which leave the nest so soon as they are dry, their parents taking them about with them for some four weeks, by which time they are fully fledged. Above the nesting-place the cock seems to delight in performing strange evolutions during pairing-time, at one moment darting up spirally to the

sky, where it soars in circles and curves, at the same time hovering or fluttering till it begins to descend, at first falling a little distance every six or eight seconds, later on every half minute, then rising again in a curve, and finally darting down with tightly closed wings. Each time the male descends a little there is heard the "drumming," a sound not unlike the bleating of a goat, which is produced by the tail-feathers.

The snipe is solitary by nature, but pairs occasionally travel in company, and exceptionally in Europe it may be seen in flocks, or "whisps," as they are called, up to thirty in number, although such parties are common enough in the swamps of Bengal. When flying, it stretches its wings straight out and points its beak downwards: it flies at great speed, beginning with zigzag curves, and then going in a series of spurts. Its principal food is insects and their larvæ, worms, and small molluscs extracted from the soft ground, so that in winter its condition varies with the weather, food being abundant when it is wet and almost unobtainable in times of frost.

A bird once familiar in the fens of England, but now almost exterminated as a breeding-species, is the ruff (*Pavonella pugnax*). The most remarkable feature about this bird is, that when the cocks wear their breeding-ruffs no two are exactly alike. The ruff and its consort the reeve are restricted to swampy and marshy situations, where they only resort to the parts covered with short grass. They prefer clear open spaces, but although frequently seen near the shore, where they follow other birds at low tide, they are not really sea-birds, as they resort to the coast only for a short time, and never shelter close to the sea. The ruff breeds inland, in many parts of northern Germany, such as Anhalt, the plains of the Elbe and Oder, Posen, Silesia, and east Prussia, and also in the north of France,

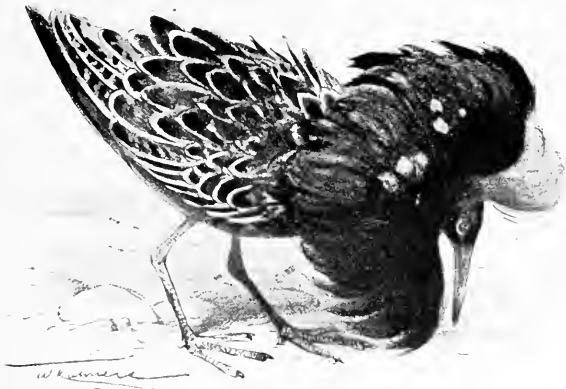


A RUFF CHALLENGING.

but more commonly in Holland, Denmark, Sweden, Norway, Lapland, and Finland, its range extending through Siberia to China, Burma, and Borneo. On migration through Europe to South Africa, it appears in flocks near the Lake of Constance, and also, but not so often, on the Danube, the Neckar, and other continental rivers. Round the Menzaleh Lake in Egypt its numerous flocks consist almost exclusively of females, from which it would seem that the males go farther south, and it has been observed that they start on their migration before the others. The females, and some of the young birds follow; the other young birds moving southwards in July and August. According to the more or less northerly position of their breeding-places, they return to them earlier or later. In some districts the nests consist of depressions in the ground, lined with grass and rootlets, but, as a rule, they are in tufts of grass, and lined with grass and sedge. As soon as the female has begun laying her three or four eggs in May, the male does not trouble any more about her or her offspring. She alone has to protect her brood and lead them about in the high grass, teaching them to find their food, and hide from their enemies.

A ruff can run very quickly in case of need, walks erect and gracefully, and

is speedy and strong on the wing. He is seen at his best in the pairing-season, when he is "showing-off" in his characteristic spring manoeuvres, or "billing," as it is called from the performance always taking place on a slight elevation. From three to eight males then appear at certain intervals on some spot well covered with short grass, and easily recognisable by the herbage about being trodden down and soiled with mud. This is never very far from the pairing-place, and forms more or less of a ring, about 4 feet in diameter. Each cock takes up his station near this, and looks at the others in an aggressive manner until one accepts the challenge, and the duel begins. With quivering bodies, nodding heads, and drooping breasts, the combatants rush upon each other, to stab with their beaks, which, not being very hard, fail to penetrate the bristly shield-like collar, so that no serious damage is done. The round does not last very long, and the birds part to return to their original positions to recover a little and start afresh. Meanwhile



RUFF IN BREEDING PLUMAGE.

another challenge has been accepted and another fight commences, and then another, and when the ring is full of fighting birds the spectacle is very interesting until it ends by the performers becoming tired out. This billing begins soon after the arrival of the birds at their breeding-places about the beginning of May, in June it is at its height, and in July is at an end. In winter the males lose their collars, which grow again next spring, their place being taken by warty growths. Worms and insects and their larvæ form the chief food of this bird, which, however, will feed on rice and other seeds, and is fattened for market on boiled wheat and bread-and-milk.

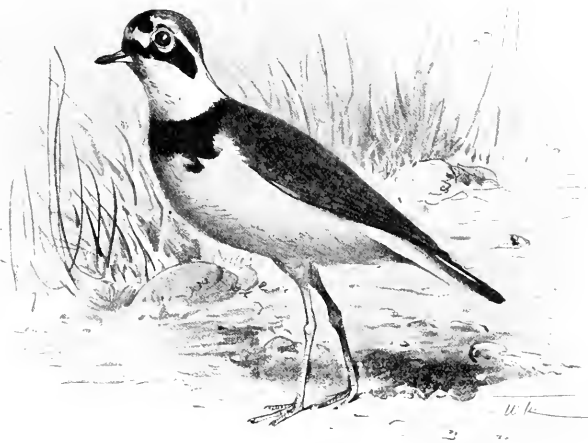
Sandpiper, or Summer Snipe. The sandpiper, or summer snipe (*Totanus hypoleucus*), may be looked for wherever rivers with wide, shallow beds and sandy shores run through meadows and bushes, either in flat or hilly country. It keeps within a short radius of the beach, perching on stones, fences, or bushes; and, living alone or in small parties, keeps well aloof from other birds of the shore,

and is thus an eminently unsociable species. Occasionally it may be pursued by two or three wagtails, when it will show its indignation by violent screams; it is not unlike a wagtail in its habits and gestures, as it is never still and has the same trick of jerking its tail up and down, and moving its head by stretching and drawing back its neck. This bird flies quickly and lightly, at one moment gliding easily with bent wings, and then shooting ahead with many vigorous flaps, generally keeping so low that it seems to touch the surface of the water with the tips of its pinions, which it holds almost upright as it alights and runs. It escapes from danger by swimming and diving, working with both feet and wings and remaining almost for a minute at a time under water.

The nest is a hollow lined with grass or moss, always near water, generally on a sloping bank by the side of a willow-bush or in a heap of drifted wood well protected by plants and small irregularities in the ground, with a clear way to the water-side. Worms and insects, especially gnats and their larvæ, which live in numbers near flowing water, are the principal food of the sandpiper, which prepares for migration in the first half of July, and by the middle of September is only seen in out-of-the-way places. It ranges over Europe, Asia, northern Africa, and North America. In some parts of the Continent it appears on migration, often in districts away from water, and is very rare as a breeding-bird. In length the sandpiper measures rather more than 7 inches. In colour it is brown above, with dark streaks and waves, and white below, while the front part of the neck and the throat are white with thin brown streaks. The wing-feathers are much patched with white, the upper tail-coverts brown, the wings barred with white, the axillaries white and the legs olive.

Another well-known species is the green sandpiper (*T. ochropus*), which lives in situations similar to those frequented by the last, and also on the banks of ponds, rivers, and brooks amid forest-trees, alders, willows, reeds, rushes, and grass, keeping so well under covert that it is seldom seen from a distance. A solitary bird, the green sandpiper walks and stands with the body horizontal, frequently stretching out and drawing back its neck, and nodding its head. It wades but never swims or dives. In flight it is graceful and swift, not opening the wings wide, but moving them powerfully and quickly, and almost closing them as it glides for long distances, though never so low as to skim the water. At pairing-time the male rises in the air like a snipe. The hen rarely nests on the ground but generally in a tree, and though the eggs have been found on patches of moss and lichen, where a branch forks off, as a rule she takes possession of the deserted nest of one of the thrushes or of a wood-pigeon, jay, or crow, or even a squirrel's drey. Essentially a bird of the north, the green sandpiper ranges from the Arctic Circle southwards, never breeding in the British Isles, though it does so in Holstein and the Baltic provinces. South of these it is known only as a migrant, its migration taking it into Africa, India, and China. In central Germany, as in Britain, it remains during the greater part of the year, and goes northwards in the summer to its nesting-grounds. It feeds on worms, insects, and water-snails, and is over 8 inches long, and easily recognisable, especially when on the wing, by the white of its tail and upper tail-coverts, which is shown off by the dark greenish brown of the back and wings.

Wood Sandpiper. The wood sandpiper (*T. glareola*) is not always found in or near a wood, but generally in extensive swamps and marshes with open sheets of water, few trees, and gently sloping banks. It seems to avoid running streams and to prefer the muddy shore of a pond to that of any river. The northern and central regions of Europe and Asia are its breeding-area, and it is often met with by the inland waters of England, Scotland, Germany, Holland, and France. It ranges as far east as China and Japan, and has been found nesting in the Himalaya, and on migration reaches South Africa, southern Asia, the Malay Archipelago, and Australia. The wood sandpiper is a lively bird, active and easy on the wing, and able not only to wade but to swim. The nest is placed close to or in a swamp, in some spot difficult of access, which is generally discovered by the female flying off



THE LITTLE RINGED PLOVER.

when approached. It consists of a small depression lined with a little grass, and contains at the end of April, or in May, four beautifully marked grey eggs, from which in fifteen days the brown-spotted young are hatched. The adult bird, which is over 8 inches in length, in colour is reddish brown above mottled with black and white, while below it is white, the sides of the neck and the breast being greyish marked with brown arrow-heads. The head is ashy brown, the upper tail-coverts are white, and there is a good deal of white in the tail, the central feathers of which are barred with blackish brown.

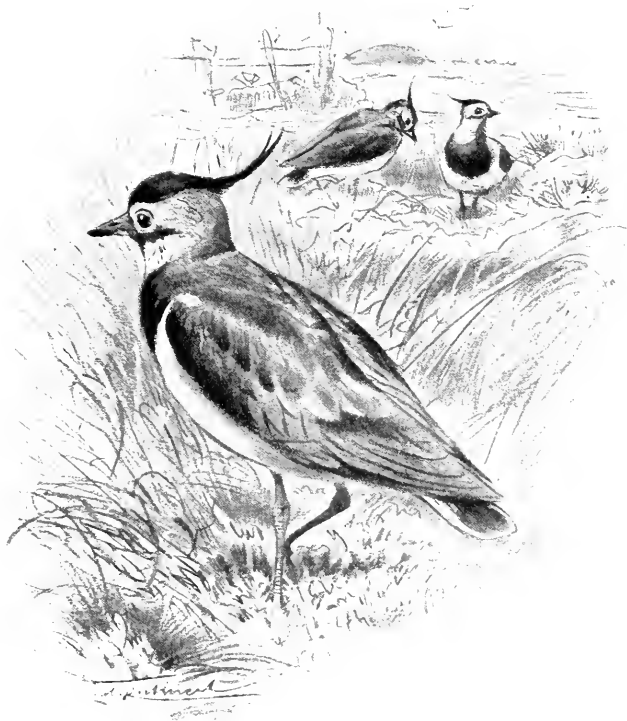
Little Ringed Plover. The little ringed plover (*Egialitis dubica*, or *curonica*) is one of a group of plovers distinguished by the straight beak, thickened by a cap-like elevation at the end, with the slit-like nostrils lying in the groove which extends from the middle to the tip. The birds of this group have generally no hind-

toe, or only a stump of one. They are represented by a large number of species distributed all over the globe, and inhabiting steppes, barren heaths, ploughed ground, sandy banks of rivers and lakes, or mountain moors. The present species is found amid scanty vegetation, on sandy river-banks and the shores of large inland lakes and their islands, though it often nests on sandy plains far distant from water. On migration it always keeps near water, but principally such as flows over a sandy or gravelly bed. The four grey pear-shaped eggs are laid point-inwards in a mere cavity in the sand, and are said to be sometimes abandoned by the female to be hatched by the hot rays of the sun. The little ringed plover is curiously quick in its movements, running at a rate of about eight steps a second, so that even a good walker is scarcely able to overtake it. When running, it draws in its head and neck, and frequently stops to look around. In the main these birds are gregarious, and most lively in the morning and at dusk, when they amuse themselves by running and flying about in chase of each other. They feed on small beetles, flies, and other insects and their larvæ. The species is widely distributed throughout Europe and Asia, its range extending from Iceland to New Guinea. In length it is nearly 7 inches. The beak is black with a small yellow spot at the base of the under half; the legs are dull yellow; the first primary has a white shaft; and there is a broad black ring on the white chest.

Lapwing or Green Plover. The lapwing (*Vanellus cristatus*) dwells on marshes, moors, and fields, from which it seldom wanders far, even on migration. In the Russian Baltic provinces it abounds among the swamps, and it is also common in other marshy parts of the Continent, particularly on the lower Danube. From Europe, where it breeds up to the Arctic Circle, its distributional area extends through Siberia to Japan, and, strange to say, it is found during summer in central Asia on the dry steppes. During winter it appears in flocks in the south of Europe and thence crosses into Africa. Lapwings are gregarious and associate with other birds, but suffer none on their nesting-grounds. From these they drive away even storks, herons, ravens, and the small birds-of-prey with loud screams and furious pecks; but peregrines and the larger hawks they treat with more respect, and endeavour to escape from by various devices. The lapwing has a graceful carriage, and when flying produces a curious noise with its rounded wings, by which its presence is betrayed even in the dark. By day it may be recognised by its call of *pee-wit*, and by this name it is known in every country. Its four eggs—the “plover’s eggs” of the game-dealers—are found as early as the end of March in some small depression in the turf, in which a few stalks of grass have been placed crosswise. As soon as their down is dry, often while they have still fragments of egg-shell on their backs, the young birds leave the nest, under the guidance of their mother, to search for food, which chiefly consists of worms, slugs, and insects.

Water-Rail. Another inhabitant of the marshes is the water-rail (*Rallus aquaticus*), which nests throughout the British Isles and is of very wide distribution in Europe and Asia, having been found as far north as Jan Mayen and as far east as Gilgit. It is resident all over northern Europe up to the Arctic Circle, and breeds as far south as the mountains of Morocco and Algeria. It prefers the back-waters of rivers, the low-lying shores of lakes, and long

stretches of swampy ground overgrown with reeds and bushes. This well known, although seldom - seen, bird winds its eel-like way through the densest shrubs, which it scarcely seems to touch with its slender body, and when it cannot creep beneath the plants, it lightly hops over them. Walking and running lightly and gracefully, it dives and swims with facility, although without webbed feet; but it never takes to the wing except when compelled, and then flies with an effort. Its



LAPWINGS.

flight is straight and low, the legs dangling down while the wings tremble and flap in an awkward manner. The nest, which is built just above the water-level, either in reeds or rushes or beneath willows, is a deep, loosely-woven structure, lined with reeds and flags, and at the beginning of June contains from five to eleven ashy grey eggs marked with brown. The black-downed young run from the nest as soon as hatched to conceal themselves, but are recalled by the parents by whom they are protected, warned of danger, and taught to find their food, which consists

of worms, small snails, fish-spawn, and gnats, beetles, dragon-flies, and other insects and their larvæ. The adult bird is 11 inches long, and has a red beak and hazel eyes. Above, the plumage is fulvous brown with black streaks down the middle of the feathers, and it is bluish grey on the sides of the head, the front part of the neck and under-parts generally: the flanks and axillaries being blackish with white bars.

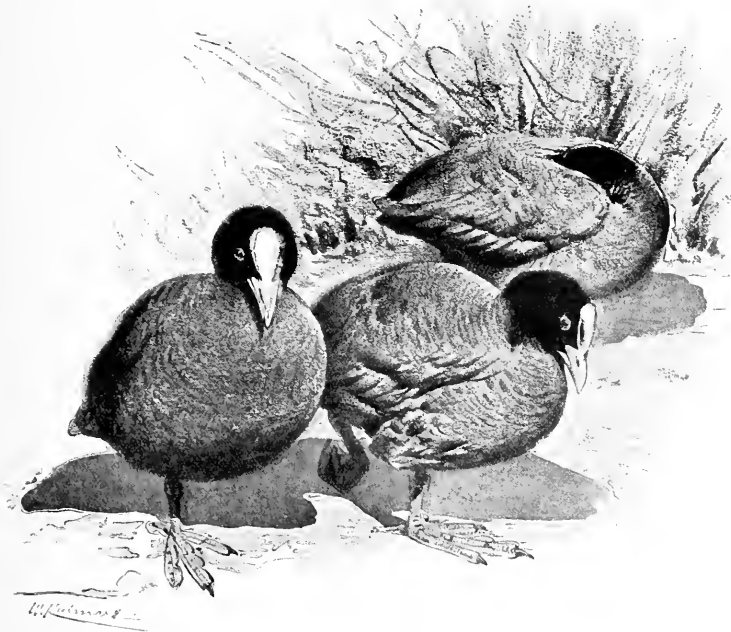


THE WATER-RAIL.

Coot.

That unmistakable bird, the coot (*Fulica atra*), lives on marshy lakes and smaller sheets of water with reedy shores, and is found but rarely among willow-bushes or trees, generally swimming about on the open water or among the reeds where it finds most of its food, which consists of aquatic insects and their larvæ, fish and frog spawn, snails, and worms. It also eats green plants, flower-buds, and all kinds of seeds. It swims easily and smoothly, but rather deep in the water, and accompanies every movement with a nod of its head. In diving, it makes a sort of jump into the water, with its beak downward, and to propel itself when below the surface uses its legs like sculls, seldom remaining under

water for more than a quarter of a minute at a time and coming up with singular abruptness. When chased, it dives and rises alternately, until it has escaped from danger. When starting to fly, it jumps once or twice above the surface, and then rises with quick and short movements of its wings, stretching its neck forward and its legs out behind, the flight being powerful but not fast, and, though having a noisy beginning, ending in silence as the bird glides gently into the water again without making more than a slight ripple on the surface. The coot walks about as awkwardly as a duck, and, like ducks, is frequently shot for food, as in Herzegovina,



COOTS.

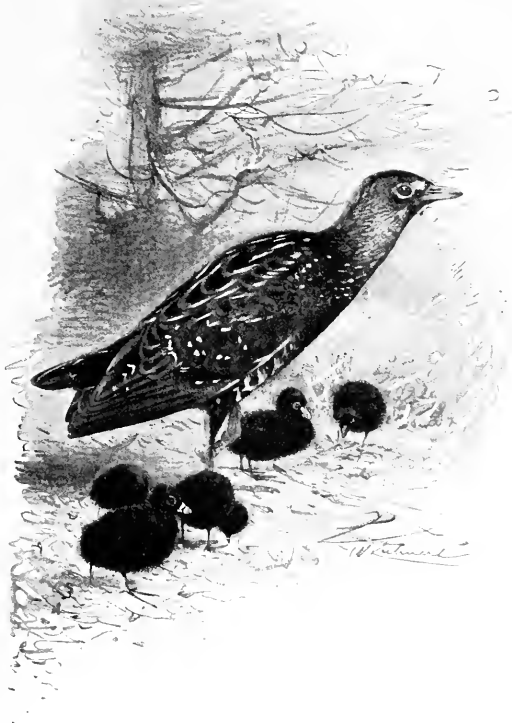
where it is smoked and preserved and forms an important item in the winter-provisions of the people. The nest is compactly built on a foundation of reeds, leaves, and flags, and is frequently a floating raft moored to a reed or allowed to drift. In May, especially in the last half of the month, this contains from seven to twelve eggs, which are of pale yellowish brown as the principal colour, but so spotted with brown and grey that the ground-colour can hardly be seen. The black and fluffy young ones are hatched in three weeks, and immediately leave the nest to swim about accompanied by their mother. In autumn coots begin to assemble on certain lakes in order to migrate to the south in October and November. They fly

in a straight line, and at a considerable height. Along the north coast of the Mediterranean the ponds are literally crowded with these birds in winter. In March and April they return to central Europe, where they appear in great numbers, some to stay, and others to go farther north, some of them ranging into Iceland. Eastward, the coot has been traced into China, and has even been found nesting in Kashmir. In addition to its lobed toes and green legs, it may be recognised by the broad white shield on its forehead and the red eyes. The plumage is grey below and black above with a narrow white wing-bar, the beak being flesh-coloured with a white tip: the total length of the bird is over 15 inches.

Moorhen. The moorhen (*Gallinula chloropus*) does not frequent such large sheets of water as the coot, and, unlike the latter, is often found on running streams. In some localities it is more appropriately known as the water-hen, a much better name, as it is no bird of the moor but of the mire, that is the marsh, the modern spelling being a corrupt rendering of mire-hen. By no means a shy bird, it will frequently come ashore to be fed, and it walks lightly with striding steps, its legs being rather long, and green and yellow in colour with a red garter. As it walks it flirts its tail; as it swims it nods its head; and when diving it works both legs and wings. From the length of its toes the moorhen can walk on the foliage of plants over considerable spaces of still water. When startled it dives and if possible emerges under floating leaves, protruding its beak above the surface and keeping its body submerged until danger is passed, holding itself in position by tightly clasping the plant-stems with its feet, which are but very slightly lobed. It flies low with legs dangling, and seems to rise from the water with much effort, but once on the wing it traverses long distances at a stretch particularly at night, when, as it passes quickly overhead, its peculiar call is clearly distinguishable. It builds its nest generally on the ground, sometimes afloat, and exceptionally 20 feet or more up a tree. The nest itself is a mass of bulrushes and reeds, lined with sedge and grass, and contains some time in May or June about ten eggs, of a pale brown spotted with brownish red. The young birds are hatched in three weeks, and follow their parents with greedy eyes, continually expecting food to be put in their hungry mouths. Later on they take part in the bringing up of a second brood. The food consists of water-insects and their larvæ, as well as worms and seeds. The young frequently fall victims to pike. They are much browner than their parents and do not assume their adult plumage until the following spring. The moorhen is distributed over a large area, reaching to central Sweden in the north, and as far south as Cape Colony, and is generally a resident in the British Isles and the northern half of its range, with a partial southerly migration in severe winters. In length it is about 12 inches, and in colour greenish above and greyish below; the outer wing-feathers and first primary are edged with white, while the sides are streaked with white, as are the under tail-coverts; the beak is red tipped with green and there is a red frontal shield.

Spotted Crane. The spotted crane (*Porzana maruetta*) is another but less familiar frequenter of marshes and the shores of ponds and larger pieces of water bordered by an abundance of reeds, flags, and other aquatic plants. Only during migration, in April and September, is it found in forests or fields.

The large nest is difficult to discover, on account of its similarity to its surroundings, and also because the birds utter only a soft, low, squeaking, long after dusk. Generally surrounded by water, so that the birds can only reach it by swimming, it is a loosely woven mass of reeds and flags lined with soft grass: in the beginning of June it contains from eight to twelve clay-coloured eggs with grey and reddish brown markings. The spotted crake resembles the water-rail in its habits, and is distributed over the warm and temperate countries of Europe, including England and Asia as far east as Yarkand and Gilgit. On migration it passes into Africa, where it goes as far south as Zanzibar. With a total length of 9 inches, it is olive-brown above with dark mottlings and white specks and grey below, shading into white; the under tail-coverts are buff, while the axillaries are barred with white. The crown is brown, spotted with black, like the back, the forehead grey; the beak is yellow, and the legs are green.



SPOTTED CRAKE AND CHICKS.

The
Little Crake. little crake
 (*P. parva*) is a dweller
 in swamps and marshy
 meadows, particularly
 where willow and alder
 bushes abound: its nest

being carefully hidden among reeds and flags, and always placed on wet and marshy ground or over water. The structure is of an unusual shape, the bird bending all the leaves and grasses towards the centre, and thereby forming a deep basin lined with blades of reed. The eggs are hidden among the lining, and the sitting bird is also hidden when in the nest, owing to her forming a kind of bower above her head by drawing down the leaves of the surrounding plants. In June the nest contains from eight to ten eggs of a dull brownish yellow flecked

with grey and brown. The young, which are very small, leave the nest with their mother as soon as they are hatched. Sometimes this crane issues quite boldly from concealment to utter a succession of loud screams; but generally, unless of its own will, is difficult to drive away from its hiding-place. It is an unsociable bird, which, except during the breeding-season, lives alone, feeding mostly on insects and spiders, and occasionally on seeds and vegetable-matter. Not only on the ground, but also over floating leaves, it runs fast and lightly. It nods its head and jerks its tail when swimming, and is an expert diver, hiding in the water with only its beak above the surface. On the wing it is slow and ungraceful and keeps close to the ground, but when migrating its flight is more powerful and steady, and the distances it traverses are surprisingly great. This bird does not appear in central Europe before May, and in September departs alone at night for equatorial Africa. The breeding-area extends as far north as Jutland, but the bird is most abundant in southern and south-western Europe, and is also common in southern Russia, as well as on the salt-lakes of central Asia. In Germany it is less common than the spotted crane, compared to which it is much smaller, being only 8 inches long. In colour it is yellowish brown above, marked on the back and wings with oblong black spots and a few white streaks, the under-parts being mostly grey. The tail-feathers are black with brown edges, and the beak is green with a reddish base. The female is buff below shading into brown on the flanks, the grey being confined to the forehead and eye-stripe.

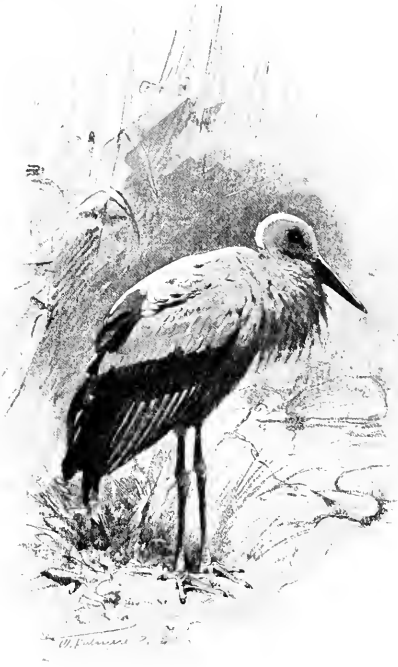
Baillon's Crane. Baillon's crane (*P. baillonii*), which resembles the last in habits and distribution, has bred in the English fens but not farther north, and ranges through central Europe to the Persian Gulf; its place in northern and eastern Asia being taken by the pigmy crane (*P. pusilla*). On migration it is found as far south as Madagascar and Natal. Not much larger than a sparrow, it walks, runs, dives, and swims well, but flies laboriously with the legs dangling. It is probably more frequent than is supposed, owing to its being so difficult to distinguish among its surroundings. In colour it is brown above and grey beneath, the brown back being spotted with black and white, the outer edge of the first primary white, and the under tail-coverts black with white bars. The female is paler above and browner below. In both sexes the eyes are red and the beak is olive-green without any red.

White Stork. The two central European representatives of the storks differ widely in their mode of life; the white stork (*Ciconia alba*) frequenting river-banks, plains, lakes, and marshes, and often breeding among human dwellings. The nest is built of sticks, twigs, lumps of earth, and reeds, and is a shallow basin lined with grass, moss, old rags, paper, and other sundries. It is a yard or more across, and is repaired and occupied by the same bird year after year. By the successive annual repairs it becomes in time as tall as it is broad, when its exterior is frequently taken possession of by sparrows, swallows, and sometimes even starlings and black redstarts, as a nesting-site. In favourable weather the male stork appears on the nest quite unexpectedly at the end of February or in March; arriving during the night, as also does the female, whom he precedes by some days. By the middle or end of April the

nest contains from three to five pure white, or yellowish white eggs, which are incubated by the female alone, who is provided with food by her mate during the whole period. After the young are hatched, one of the parents always remains with the nest while the other is away. It is over a month before the young are able to stand, and quite two before they are strong enough to quit the nest. At first the old birds transfer some of their own half-digested food into the beaks of their progeny, so that the latter have only to swallow the nutriment. Later on the food is placed in the nest, and later still on its edge. The young are fed at first on worms and insects; but in time they get frogs, fishes, birds, and small mammals, and even snakes, which the stork eats after first breaking their heads and then their spines with its beak. At the end of July the storks prepare for migration by wandering about for some time in the neighbourhood of their nesting-place and then assembling in the meadows in large flocks until the end of August, when they leave for the winter in flocks of from five to five thousand at a time. In some of the villages in Poland almost every house has its stork's nest.

At all times a stately bird, particularly when on the wing, the stork flies with its neck and legs stretched out: when about to fly, it first of all takes a few short jumps, and then rises in the air, where it finally glides on without visible movement of its wings.

In spring the male and female often soar to great heights, flying in spiral lines across one another. Even during pairing-time storks seem to have no real cry of their own, although the old birds utter a kind of hiss, while the young both hiss and twitter. The absence of a cry is, however, amply compensated by the clapping together of the two halves of the beak, which generally takes place when the stork is standing up with its head bent backwards. This performance is even practised by the young. The sound made by the cocks is louder than that of the females; it apparently expresses joy, desire, hunger,



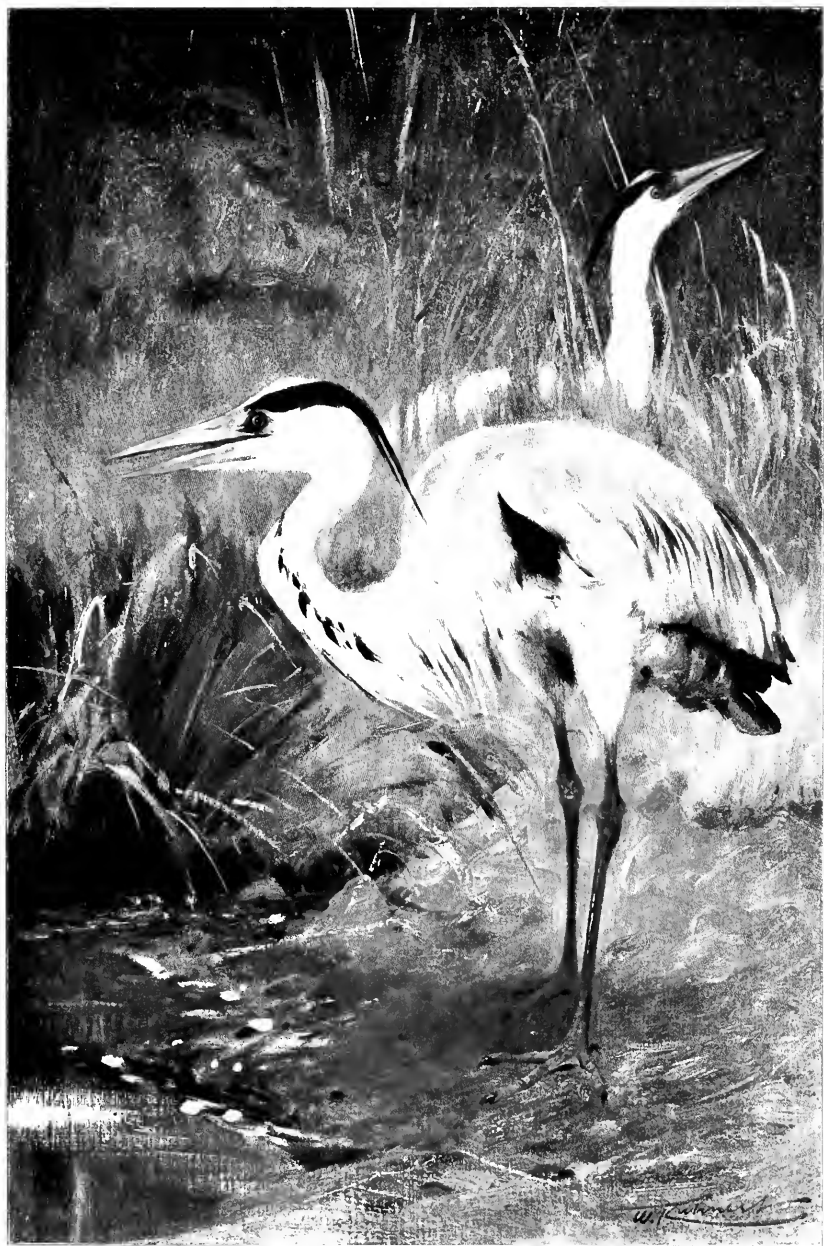
THE WHITE STORK.

and anger, and is heard at the departure of the birds in autumn as well as on their arrival in spring. When a stork stands on one leg to rest, the beak, instead of being hidden in the feathers of the back like other birds, is laid among the long neck-plumes.

Although storks have become rare in many parts of Germany, a number of nests having remained unoccupied for many years, they are still common in Prussia, Schleswig-Holstein, Mecklenburg, Hanover, Oldenburg, and Westphalia, although in central and southern Germany they are less numerous than formerly. In France and Spain they are by no means frequent, and in England are very rare, although abundant in Holland, Denmark, and Poland. They are also common in many parts of Austria-Hungary; in Turkey they are held sacred on account of their destroying locusts, but in Greece, where they are called the "Turk-bird," they are detested and persecuted. From Russia, where in some parts they abound, their range extends to western Asia, and thence north to the 57th parallel of latitude. In winter storks visit the greater part of Africa.

Black Stork. The black stork (*C. nigra*) is found in the same localities as the black kite, and its distributional area is much the same as that of the white stork, although it does not extend farther north than central Sweden. Eastwards this species is met with in northern China, and it journeys as far south as Cape Colony. The black stork is a much rarer bird than the white species, and unlike the latter invariably shuns human habitations, frequenting the neighbourhood of large rivers and sheets of water, although occasionally seen in forests on the plains. The nest is placed on the largest and highest forest-trees, not at the top, but on a strong bough close to the stem. It is of large size, in one instance between 5 and 6 feet across and 2 feet high, and consists of sticks and turfs with an upper layer of green moss. The eggs, when held to the light, are greenish, whereas those of the white stork are yellowish, this being the only difference between the two. While the female is on the eggs the male stands by her side, and the young, unlike those of the white stork, have a sort of call. The food is always fish when procurable, but when none can be obtained, recourse is had to small mammals and reptiles.

Heron. We now come to a familiar and characteristic frequenter of the banks of European waters, namely, the heron (*Ardea cinerea*), which is to be seen by the side of rivers, lakes, and salt-lagoons, wherever human beings are not too numerous and fish are plentiful. It avoids, however, marshes and swamps choked with water-plants, and generally nests in company on the oldest and highest trees. The large flat nest, which is occupied for about five weeks, by which time the young are fully fledged, is nearly a yard across, and built of dry twigs, turf, moss, feathers, hair, and other substances, and in April contains from three to five greenish blue eggs, which, like those of the black stork, are greenish when held up to the light. The young are at first fed from the crops of the old birds, which take the beaks of their offspring bodily into their own, and then force in the food, although later on they only chew the food intended for the young. Their food consists mainly of fish, but includes frogs, water-insects, worms and snails, as well as mice and small birds. A heron on the feed paces



with slow and measured steps along the water-side or in the water, and as soon as it sights its prey, darts out its long neck and strikes an unerring blow with its beak; and when food is in plenty it will continue to gorge till the tail of the fish last taken is left projecting in the back of its throat. When not in search of food, these birds will often remain erect for hours, with the neck bent on the back in a double curve, but stretching it upward when danger approaches, and placing the body in a horizontal position, until they think it time to escape or sink back into the usual attitude of repose. When flying, a heron may be at once recognisable from afar by its long beak held horizontally forwards, the neck doubled back, the legs stretched straight out behind, and the wings bent and flapping slowly. A short while before settling down, it hovers like a stork, although at other times moving its wings. In walking, the heron is slow, solemn, and stiff; in the water it wades breast-deep but never swims unless in case of necessity. It is a shy, distrustful bird, easily alarmed, and particularly agitated during thunderstorms. In March and April herons return from migration, in flocks which fly formed up in a curve or an angle with equal sides. In August they assemble on the shores of large sheets of water in flocks of from twenty to fifty before starting south. Some stragglers are seen even in October, and now and then a solitary bird winters in its breeding-area. The heron is a resident as well as a migrant in many warm countries, and is found throughout the Eastern Hemisphere.

A very different-looking bird is the bittern (*Botaurus stellaris*), which is essentially a dweller in marshes, perching on trees only in case of need or in places where the reeds are not sufficiently high to afford protection. The nest is always built on a reed-bed, frequently close to deep water, and towards the end of May contains from three to five eggs. The young birds, which are fed by their parents on fish-spawn and insects, do not forsake its shelter for a considerable time. If any disturbance drive them from it prematurely, they creep among the reeds, in which they hide without ever falling into the water. Here also the old birds conceal themselves so cleverly that it is almost impossible to find them. Among the tall reeds they stand motionless, with the body, neck, and beak held almost vertically, and their feathers laid so close that they look like dry, brown stems, and among the reeds and other water-plants are easily overlooked. When undisturbed, the neck is bent in a double curve, and buried so completely among the shoulder-feathers that the birds look quite squat and clumsy, till, on a sudden, the beak is darted out, and the normal form resumed. The beak can deal a dangerous blow, and may even penetrate a man's boot and foot till it reaches the bone. The bittern is much more courageous than the heron, and when attacked lies down on its back, so as to use its beak and claws more freely; the smaller hawks never molest it, and the larger ones only attack it from behind. Its food comprises the smaller mammals, birds, snakes, lizards, frogs, and tench, carp, and other fish, as well as insects and worms. The flight is owl-like, silent and low; when once started, the bird stretches its legs backwards and carries its head between the shoulders; when about to settle, it draws in its wings to the body and drops like a stone straight into the reeds. The far-ripping "boom" of the cock-bittern, a sort of *ee-ee-proo-oomb*, is better known

than the raven-like cry uttered by both sexes. There have been various suggestions as to how the "boom" is produced; at one time it was believed that the bittern boomed with his beak full of water, but from observations made in America it would seem that the bird really inhales a quantity of



THE BITTERN.

air, and that the peculiar drum-like sound comes from the dilated crop and from the throat.

Little Bittern. The little bittern (*Ardetta minuta*) is very similar in its habits and its choice of situation to its larger relative. The nest is a substantial structure of reeds and flags, generally hung among reeds a little



BITTERN.

distance above the water, though sometimes built in a pollard willow. Occasionally there are several nests not far from each other, but this is only in places remote from the probable intrusion of man. In the beginning of June the nest contains from five to nine eggs. The young birds are hatched in seventeen days, and are fed by the parents till after they are fully fledged. When danger approaches, the female, although generally very shy, hastens to the spot, and utters pitiful cries, running anxiously up and down among the reed-stems while the male keeps at a safe distance. The little bittern is mainly nocturnal, and like its taller cousin, escapes notice by remaining motionless with its beak pointing upwards.

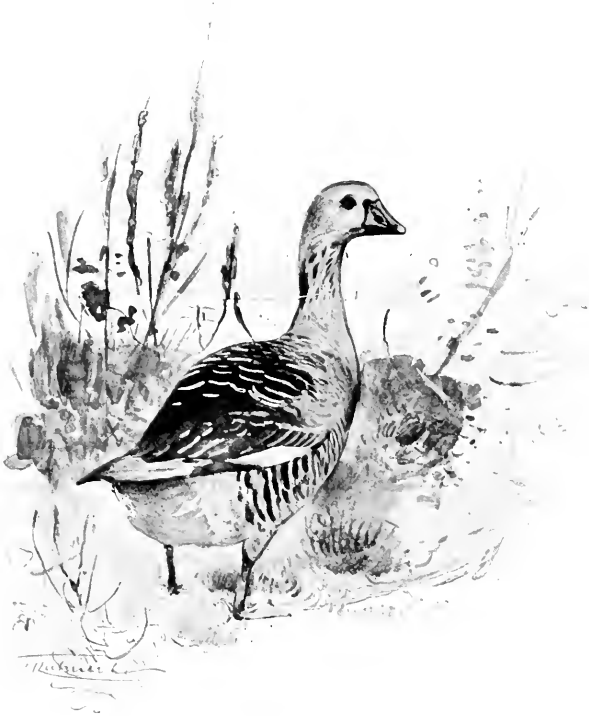
With the
Grey Goose. grey lag-goose
 (*Anser cinereus*), a species easily identified by the white "nail" at the tip of its beak, we come to our first representative of the duck-tribe—a group whose members none can fail to recognise. This species generally nests in bushy situations on the moorlands or on small stretches of ground surrounded by marshes or deep water, and generally far from the shore, particularly in reedy islands. Sometimes it arrives on the breeding-grounds as early as the end of February, though generally not before the first half of March; and it always appears in large parties and with much noise. The nest is

a heap of sticks, reeds, flags, and leaves, with a shallow cavity in the centre, the eggs varying in number from five to fourteen, according to the age of the bird that lays them. As soon as they are laid, the nest is lined with feathers and down plucked by the female from her own breast, and they are covered with down whenever they are left. In four weeks the goslings hatch out, and, after staying in the nest only for a single day, are led to the water and taught to find their own food in the shape of tender grass and other green plants. Later on they are



THE LITTLE BITTERN.

instructed in feeding along the shore, and for some weeks are taken back to the nest every evening. During this time the gander accompanies the family: and, while the mother walks ahead with her progeny all huddled together, he keeps in the rear watching over their safety, prying about with extended neck, and giving an alarm-signal at the slightest suspicion of danger. When danger threatens the brood, the mother induces them by anxious cries to escape into the water, and



THE GREY LAG-GOOSE.

never seeks her own safety by a long flight. The gander, however, has no hesitation in making off, uttering loud cries by which he warns the others; when the danger is past, the mother reassembles the family around her before the gander has time to return. According to popular belief, the old birds when anticipating a drought lead their offspring to some piece of water that is not likely to dry up, sometimes conducting them, for two or three hours at a time, long distances over fields and along roads, and passing houses and villages without fear. In this endeavour nothing stops them, not even if one of the goslings be devoured by a

beast-of-prey or break down from fatigue. When feeding on grass, the grey goose puts its head first on one side and then on the other, in order to bite the blades with the teeth-like plates of its beak.

The grey goose is the progenitor of the domesticated breed, and when killed young, about the end of harvest time, affords excellent food. This species inhabits the temperate countries of Europe, and is more or less a breeding-bird in the British Isles, many parts of Germany, Norway, Sweden, Denmark, Austria-Hungary, Moldavia, Wallachia, Bulgaria, southern Russia, and especially the Dobrudscha. To Turkey, Greece and Asia Minor, it is a winter-visitor. A few grey geese winter in south-western Europe, southern France, and Italy, but in Germany there is not one to be found during the cold months. Fully fledged young birds leave central Europe in advance of their parents towards the end of June, the main body following in August, but some stragglers linger on till September and the beginning of October. Their departure takes place quietly; but they are very noisy on their return at the end of February or in March. They generally fly in large V-shaped flocks, usually known as "skeins"; and they swim with their breast deeper in the water than ducks and draw less water aft.

Mallard or Wild Duck. Ordinary ducks, of which the mallard (*Anas boscas*) is the typical representative, swim relatively high, with the axis of the body resting almost horizontally on the water, and the tail well up above the surface. They dive comparatively seldom, and try to escape by flight when in danger. The nest of the wild duck is placed under willows and alder bushes, among reeds and marsh-plants, in grass, in hollow trees, even in the abandoned nests of crows or birds-of-prey, and consists of dry grass and dead leaves loosely thrown together, with a shallow depression in the centre. In the beginning of April it contains from eight to fourteen smooth eggs, of a greenish or greyish white colour, indistinguishable from those of the domesticated duck. It is said that when the young are hatched on trees the old duck carries them down to the water in her beak; but some observers have seen the young birds simply drop down from the nest, and run to the nearest water with their mother, who takes them to some quiet, safe place, shelters them beneath her wings, and teaches and leads them about until they are fully fledged. At the approach of an enemy the old bird flutters away as if lame to draw attention to herself, then escapes, to return after a long interval to the ducklings, which have dived into the water and come up some distance away, hidden if possible among water-plants with only their beaks and eyes above the surface so as to be difficult of detection. Wild duck are practically omnivorous and very greedy birds. By day they keep together on the water, but in the evening generally rise, and during the night separate to different feeding-places in swamps and marshes. In June, when they begin to moult, they assemble in flocks; towards the end of June they lose the feathers of their wings and tail, and, being then unable to fly, hide carefully away in secluded ponds among bushes and reeds. In common with other ducks, the mallard is much more brilliantly coloured than his partner in the breeding-season, but during part of the year when the males are in the so-called eclipse plumage, the two sexes are practically alike. In October the young birds lose their juvenile plumage and return with their parents to the open waters,

whence, as soon as the frost begins, they migrate to warmer countries, principally at night, but by day as well when haste is necessary. Many mallards winter in



MALLARD OR WILD DUCK.

Spain, southern France, Italy, Greece, and, in small numbers, northern Africa. In February or March the birds return to their breeding-area, which extends from

the Danube, southern Germany, and Switzerland up to the Arctic Circle and includes Britain. The wild duck ranges across Asia, and has been found nesting in Kashmir; while in winter it migrates to India and China. In America it is found as a nesting-bird or a winter migrant from the Arctic Circle. Ducks are acute of hearing, although they do not see very well, and are difficult of approach. There is a good deal of discomfort and disappointment in wild-fowling, whether practised from the shore or from a barrel sunk in a marsh or other ambush, or from a punt fitted with a gun of large calibre with which the destruction is wholesale on the rare occasions when the object is hit. For market-purposes wild ducks are caught in large nets, or in "decoys," which are long tunnels of nets tapering into a trap, such as that at Fritton in Suffolk, which is two and a half miles long and covers two hundred acres.

The mallard, which is the progenitor of European domesticated ducks, is distinguished by the colour of the bright bar on its wing; and many of the other ducks can be recognised in a similar way. For instance, the wing-bar of the mallard is purple, that of the gadwall white, that of the shoveller green, that of the pintail green bordered with red in front and white behind, that of the garganey green with white borders, and that of the teal black, green, and purple, tipped with white. As the bird can be identified by its wing-bar, so is the nest known by the down with which it is lined. The down of the mallard is light brown with white tips, that of the gadwall light brown with a white star, that of the shoveller dark grey with faint white tips, that of the pintail dark brown with white tips and a white star, that of the garganey black with long thin white tips and a white star, and that of the teal dark brown with brown tips and a white star.

Gadwall. Although nowhere very common, the gadwall (*Chaulelasmus streperus*) is widely distributed throughout Europe, Asia, and North America below the Arctic Circle; its winter-resorts being the Nile Valley, India, China, Cuba, and Mexico. It lays from six to twelve greenish eggs, in a ground-nest made of grass, leaves, and rushes, and always near fresh water, as the gadwall is rarely seen by the seashore or on an estuary, and is not conspicuous anywhere owing to its retiring habits. When flying, it may be recognised by the whistling of its wings, the strokes of which are singularly rapid and powerful. It feeds on leaves and seeds, in some districts on rice, but varies this diet with worms, insects, and frogs.

Shoveller. The shoveller (*Spatula clypeata*) ranges all round the temperate zone, migrating as far south as Borneo and Panama. Everywhere it keeps aloof from other ducks, but is almost indifferent to the presence of man, by whom it is not much molested owing to the coarseness of its feeding-habits, though its flesh is of good flavour. It has a rapid, noisy flight, and alights on the water with a considerable splash. Its call is a deep-toned *took-took* in the pairing-season, and an occasional quack at other times; the shoveller being almost a silent bird, which in a quiet business-like way feeds along the margins of the dirtiest ponds intent on swallowing anything it can find. The broad tip of the lead-coloured bill enables the shoveller, to whom nothing vegetable or animal comes amiss, to sift the organic from the inorganic. The rather neat nest of grass is always placed on the ground, in grass or heather, lined with grass and down, and contains from six to nine eggs. The shoveller is distinguished not only by its beak and wing-bar but by its blue wing-coverts.

Pintail. Another genus is represented by the pintail (*Dufila acuta*), which chooses for its residence extensive swamps and marshes, with numerous ditches and much open water, large lakes with plenty of reeds, and neglected ponds in which plants abound. In the second half of April the nest of dead grasses and sedges—not necessarily near water and always in a dry place—contains from eight to ten pale greyish green eggs, similar to those of the wild duck but smaller. Pintail breed in Iceland, Lapland, Bering Island, Alaska, Labrador, Greenland, and as far north as the mallard, and in their winter migration reach the Isthmus of Panama, central Africa, and Borneo, so that they may be said to range all over the Northern Hemisphere. This is one of the commonest ducks on the shores of the North Sea, where its long tail has procured for it the name of sea-pheasant, though it is also known as the winter-duck. It is a good diver, a graceful swimmer, and quiet on the wing, and is frequently found in flocks on the coasts and estuaries twice a year, as it passes on migration. Pintail frequently associate with wigeon, from which they may be distinguished at a distance by the habit of putting their heads under water to feed. They are shy birds, calling only at night, the note being a somewhat gentle *quark*.

Garganey. The garganey (*Querquedula ciria*) appears rather frequently in many parts of the Continent during the summer, arriving later and leaving earlier than the mallard. It is commonest as a breeding-bird in Austria-Hungary, and along the Danube down to the Dobrudscha; the northern boundary of its distributional area in Europe being southern Sweden. In Asia it breeds in Turkestan and southern Siberia, but does not range so far north as the other ducks. In winter it journeys as far south as the Moluccas and Somaliland. It begins migrating in August, and continues all through September and even later, returning to Europe in March and April. It nests in reeds or bushes near swamps, sometimes in dry places away from water, the nest being on the ground, and having a deep cup made of grass and leaves. When pursued by a hawk, this duck flies with great swiftness, making no noise, and trying to evade its enemy by such sudden turns and curves as to tire it out and force it to abandon the chase. In the eastern counties of England the garganey is known as the cricket-teal, from the peculiar jarring sound of the drake's call.

Teal. The teal (*Q. crecca*), which is the typical representative of its genus, makes its appearance on all the seashores of Europe during migration, and nests in almost every county in the British Isles, and throughout northern Europe and Asia up to and beyond the Arctic Circle. As a visitor, it is known in Greenland and Alaska, and as a winter-migrant ranges into Abyssinia and Siam. In England this smallest and prettiest of the resident ducks has its numbers much augmented in winter by flocks on migration, and may frequently be observed in small parties among crowds of mallard and wigeon, from which it keeps itself apart. It nests generally, but not always, in a swamp, the materials being dead rushes and reeds with a lining of grass and leaves and the brown down. Flying more lightly than the other ducks already mentioned, it is a good diver and able to swim some distance under water, only raising its beak above the surface for breathing purposes in case of danger.

Pochard.

From the swimming ducks the diving ducks are distinguished by the broad lobe of the hind-toe. They are more confined to the water than the former, and swim so deep that the tail generally lies on the surface. Although they dive deep, they are unable to pursue their food under water, and only secure it by diving straight down, and coming up within a short distance of where they started. Inland lakes and swamps with open water, and shores clothed with reeds form the usual residence of the pochard (*Fuligula ferina*), which is known as a nesting-bird from Britain to Lake Baikal, though not farther north than 60°, or south of the Caspian, and as a winter-migrant visits North Africa, India, and China. The nest is of dry grass and sedge lined with brownish grey down, having obscure white centres, and the clutch of eggs numbers from seven to thirteen. The nest is by the side of, or floating on, water, and the eggs, which are greenish buff in colour, are seldom laid before the middle of May. Plants growing beneath the surface in fresh-water lakes are favourite food of the pochard, which also eats insects, molluses, and crustaceans, and lives almost entirely on these when it is by the sea. It is netted in fairly large numbers, besides being shot; and when taken on a lake is an excellent table-bird, although if killed on the sea is almost uneatable, owing to the difference in its food. The flight of the pochard is straight and noisy, the bird rising with a jerk and settling with a flutter from beak to tail. In the drake, which measures 18 inches, the beak is black with a broad blue bar in the middle, the head chestnut, the back grey, the wing-bar grey, the chest brownish black, the breast greyish white, and the eye orange, changing from yellow to red as the bird advances in age. The female is about the same size, but much more subdued in colouring, having a white throat, and being whitish round the eye, which is generally brown.

White-Eyed Duck.

While the pochard feeds late in the evening or at night, the white-eyed or ferruginous duck (*Nyroca ferruginea*) feeds oftener during the daytime, frequenting reedy pools and other fresh waters with plenty of shelter along the shores, and being naturally of a shy and retiring disposition. The nest, which is lined with brownish down, is generally quite close to the water, and made of reeds and other water-plants, but sometimes of moss; the eggs being from nine to twelve in number and of a greenish stone-colour. This is the most quarrelsome of the diving ducks, and at pairing-time the fights between the males become so serious that they seem to be only saved from killing each other by the warning calls of the females looking on. In September the families begin to congregate in large flocks, and at the end of October start on migration. At the end of March they return from the south to their breeding-area, which is mainly in the east of Europe. In Hungary, Rumania, and the Dobrudscha, the white-eyed duck is abundant on the shores of the Dniester, the Don, and the Volga. It also breeds in Holland and through central and southern Europe, central Asia, and Kashmir, while it also reaches Abyssinia and Burma. An occasional visitor to the Firth of Forth, it is seldom seen farther north. In size it is rather smaller than the pochard, from which it is distinguished by its ferruginous head, brown back, the white lower part of the breast, white wing-bar and eye, and the mostly blue beak. This species is very laboured and noisy on the wing, and pats the water for some time before it rises, but in the water no bird is more at home.

Cormorant. The cormorants and other members of the group Steganopodes may be at once distinguished from other birds by having all four toes webbed together. They are enabled to perch on trees and cliffs by their hind-toe being placed, as a rule, on the same level as the rest, this digit being long and turned inwardly: but running and walking do not come easy to them, as their legs are mostly very short. They live almost exclusively on fish, which they catch by diving, or in the air when jumping out of the water, and they eat these in enormous



CORMORANTS NESTING

quantities. The cormorant (*Phalacrocorax carbo*) is a bird of the seashore as well as of inland waters, which in the north dwells on bare and rocky shores, but in the south prefers tree-lined beaches by quietly flowing rivers, large lakes, and intermingled marshes and lagoons. Sometimes, indeed, it becomes almost a forest-bird. Nesting on cliffs and high rocks, in bushes and among reeds, and on trees, generally in large colonies, it visits the same places every year and can only be driven away by force. On occasion it takes possession of other birds' nests, especially those of herons and crows, and uses these as the foundation of its own,

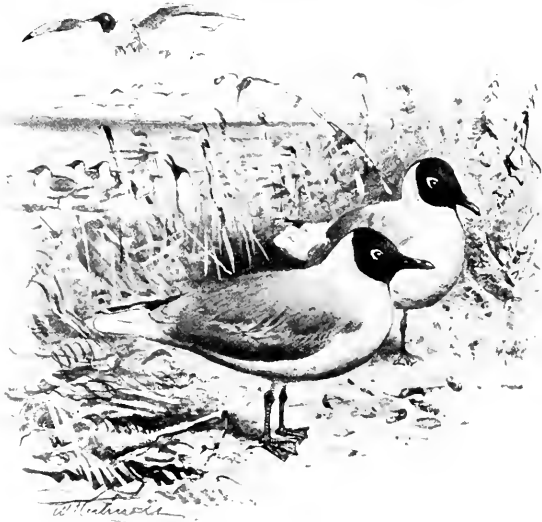
which is always wet and dirty inside, and is an odoriferous mass of twigs, plant-stalks, sea-weed, green leaves, and other matter. In some places there is only one brood a year, but in others there are two; the young of the first brood leaving the nest at the end of June, those of the second in August. The eggs number from three to six, and are pale blue with a greenish white crust, but during incubation they become so soiled that they appear to be marbled olive-brown.

The cormorant is very awkward on dry land, standing huddled up with its breast raised, and its tail drooping, and is more at home when perching on trees, the branches of which it clasps with its splay feet. It often fans its wings in order to dry them, for, strangely enough, they do not readily throw off the water. The flight is straight and low, a few powerful strokes sending the bird gliding along with wings straight out, head stretched forward, and legs tucked up, almost skimming the crests of the waves. In the water it is active and at home, diving noiselessly to a considerable depth, remaining under for three minutes or more at a time, and coming up perhaps a hundred yards from where it went down. It can catch not only the quickest fish but even flat-fish on the bottom, and has been known to bring up soles from a depth of over twenty fathoms; it can swallow fish up to $2\frac{3}{4}$ inches in width and a foot long, and eels, of which it is particularly fond, even when measuring so much as 24 inches.

In England and Scotland the cormorant is mostly a coast-bird, though it journeys for some distance up the larger rivers. In Ireland it is found not only on the coast but on the inland lakes, where it breeds in some places associated with herons on high trees. In north Germany it is most frequent on the lower Oder and in Pomerania, whence, as from a centre, it wanders in all directions, mostly in the autumn, and always up rivers with plenty of fish. On the coast of Scandinavia the cormorant is a common bird, and it inhabits many inland waters in Sweden, Denmark, Holland, France, and Sardinia. In many parts of Hungary it is abundant, especially on the Danube down to the Dobrudscha; on the inland waters of Russia, which are so rich in fish, it is found in great numbers; and in winter it appears on the Mediterranean and in North Africa. Besides Europe, it is spread over Asia, right across to Japan and down to Burma, and beyond; and it also occurs on the Atlantic coast of North America. The cormorant has a hoarse, raven-like voice, and is brilliant greenish black in colour, the feathers of the back and wings being of a dark coppery brown with blackish edges; the face and chin are bare, the cheeks white, the beak brown, and the feet black. In spring the cormorant has a white patch on the thigh, and a crest of white hair-like feathers on the head and neck, which disappear after the breeding-season.

Black headed or Laughing Gull. Although gulls, as a rule, are birds of the seashore, a few live on inland waters, and in central Europe generally the most noticeable of these is the black-headed, or laughing gull (*Larus ridibundus*). Lakes and rivers bordered with reeds, flags, tall grasses, and other marsh-plants, are its summer-haunts, in which it appears about the end of March, and leaves again in July and August. In winter many of these gulls are found in Greece

and Asia Minor, and a few remain in Germany and elsewhere, especially at the mouths of the large rivers. The black-headed gull ranges from St. Kilda to Japan, and from Archangel to the Philippines, while its breeding-area extends from the Faeroes to Kamchatka. It nests in large colonies, which are encouraged owing to the commercial value of the eggs for manufacturing purposes. From one of these colonies in Norfolk as many as forty-four thousand eggs have been collected in one season, though of late years the supply has greatly diminished, owing probably to so few being left to hatch. The nests are little more than heaps of water-plants placed on clumps of rushes or grass or on the bare ground, though sometimes they are afloat, and, rarely, in a tree

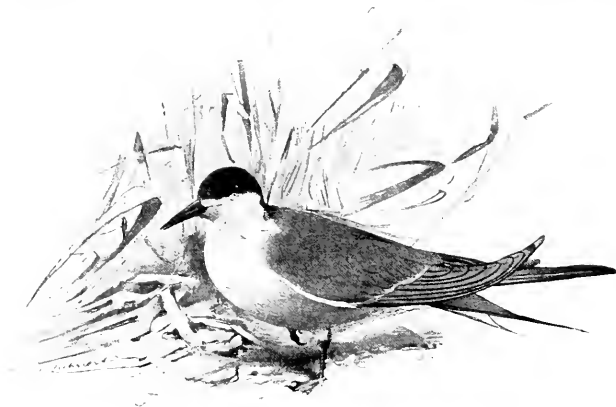


ADULT BLACK-HEADED GULLS.

or on some low building by the water-side. The eggs vary greatly in size and shape and colour: and though three is the normal number, as many as six, seven, or eight have been found in one nest, which need not, however, have been laid by the same bird. Laughing-gulls are no cowards when their young are in danger, and make a brave defence even against dogs and men: herons and swans are mobbed and driven off by pecking them on the head, and birds-of-prey are simply hustled off the gullery without ceremony. On the water these gulls swim with raised tails and crossed wings, but they do not dive, owing perhaps to the lightness of their bodies. The flight is buoyant, with many circles and hovering, and on alighting the tail is spread, the wings are raised, and the feet moved as if running in the air. The food is mainly small fish, captured by dashing into the water while on the wing, but much of the diet consists of insects and worms,

in hunting for which the laughing-gull will follow the ploughman like a rook. The call is a sort of cackle, having a distant resemblance to a laugh, whence the bird's popular name; its other trivial name, that of black-headed gull, is somewhat misleading, as the head is brown, not black, and there is another gull (*L. melanocephalus*) which really has a black head. In winter the head is white, so that the name is then still more unsuitable. The plumage generally is pearly grey above and rosy white below; and the species may be identified by the thirty wing-feathers, of which the three outer primaries are white and black and the remainder grey, tipped and edged with black. The eyes are hazel, and the beak and feet red.

Common Tern. The terns, or sea-swallows, are of smaller and more graceful shape than the gulls, and easily recognisable by their slender beaks and forked tails. They run with great swiftness, but are soon fatigued, and are



COMMON TERN.

not so often seen afloat as the gulls, from which they differ by pointing the beaks downwards when swimming. They capture their prey by swooping on it as they fly, and occasionally disappearing for a moment under the surface in its pursuit. The common tern (*Sterna flavirostris*) is more frequent on rivers and inland waters than on the sea, and breeds in all the temperate countries of Europe, Asia, and North America. In winter it migrates to South Africa, Ceylon, and Brazil, arriving on its breeding-grounds in the second half of April, and leaving again towards the end of July. When nesting on the seashore, it lays its eggs on dry seaweed, or in a hollow in the shingle or the sand, but inland chooses swampy ground and makes a nest of dry grass. The eggs, generally three in number, are olive, blotched with purplish brown and grey, the dark markings being often hardly noticeable. The young are hatched in sixteen and a half days, and are so like the shingle in colour that they are as inconspicuous among it as the eggs. The old birds feed them for a short time from their beaks, but

later on with chewed food or small fish they drop down to them as they fly over. The tern flies low and easily at all speeds, and can be very speedy when required. When pursued by the hobby, it evades the attack with great skill, rising higher and higher after every failure of its enemy, and with many a curve continues its upward flight, until the falcon is too exhausted to follow.

The marsh-terns differ from the typical terns in having a much shorter fork to the tail, in the webs of the toes being more deeply cut, and in the length of the beak not exceeding the width of the head. The black tern (*Hydrochelidon nigra*) takes up its summer abode among the marshes or by still pools, avoiding clear flowing water and the seashore. The nest is generally in some swampy solitude, and is a mere mass of rotting plants rising and falling with the water, or so close to it as to appear as if drifted ashore with the dozen or more that are often within a few yards. There are three eggs of various tints of buff or stone, blotched with grey and brown. The birds arrive from the south at the end of April, or beginning



BLACK TERN AND YOUNG.

of May, and leave towards the end of July or beginning of August. In Germany they migrate in parties of no more than thirty, but in Hungary in hundreds at a time, travelling partly by day and partly by night, circling round some sheet of water that looks promising for food, descending in graceful curves to fish for hours and then rising in spirals into the air, and disappear, without any clue as to their destination. The black tern nests all across Europe south of the latitude of the Shetlands and north of the Alps, and as far eastwards in Asia as Turkestan, and also breeds in the North African marshes, wintering as far south as Abyssinia and Loango. In America it ranges from Canada to Chile. Perching with its neck drawn back, it seems to have longer and narrower wings than other terns,

owing to its habit of crossing them over the tail. Although its wings make it appear much longer, it is really no larger than a song-thrush.

Crested Grebe.

Recognisable at a glance by their peculiar carriage and appearance, and much persecuted for the sake of their lovely soft and warm plumage, the grebes are specially characterised by their lobate toes and rudimentary tails. They are all birds of the inland waters, though some spend much time on the shore. The crested grebe (*Podiceps cristatus*) has much the same haunts as



CRESTED GREBE IN FLIGHT.

the black tern and also appears on the seashore. Its nest is a floating mass of decomposing vegetation moored among reeds, and in it the three or four eggs are frequently covered with moss or leaves to protect them from chill while the brooding-bird is absent. The parents take great care of their young, allowing them to rest and sleep on their backs, and diving with them in that position when danger is imminent. The crested grebe has a wide distributional area, extending from the Shetlands to New Zealand, and from Japan to the Cape of Good Hope, but it has not been noticed in America.

Red-Necked Grebe. The red-necked grebe (*P. griseigena*) differs from the last species in the absence of the white eye-stripe, in the colour of its beautiful reddish brown neck, and in the light ashy grey of its cheeks and throat. Its breeding-grounds are mainly in Russian territory, extending as far east as Turkestan; but it also nests in Germany, although not west of the Weser, and in south Norway. Beyond these limits it is met with mostly as a straggler or a migrant. A few of these birds remain on the North Sea in winter, but most migrate to the south in October, and return in March and April to make themselves heard during pairing-time by unmelodious sounds that have been likened to the neighing of young colts. The nest is similar to that of the crested grebe, in company with which it is often found, but the eggs are smaller and of a paler green.

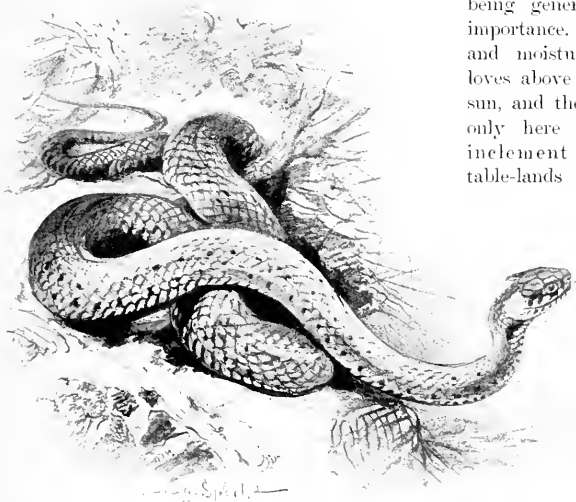
Eared Grebe. The eared or black-necked grebe (*P. nigricollis*) is a much more wary bird, resembling the last in haunts and habits amid remoter surroundings. It is best known as a native of central and southern Europe, though its range includes all temperate Asia; and it is met with in Iceland, Japan, and Cape Colony. It is easily distinguishable by the tufts which rise from the ear-coverts, and by the upward curve of its beak.

Little Grebe, or Dabchick. On all inland waters of whatever kind and extent, the quaint-looking little grebe or dabchick (*P. fluviatilis*) is as familiar as the moorhen. It is quite a fresh-water sailor, for it never goes to sea, but from the Continent migrates in considerable numbers across the Mediterranean to Egypt and Morocco. Its breeding-area runs across Europe and Asia from the British Isles to Japan, but does not extend farther north than Lake Ladoga or include China. The nest in shallow waters frequently rests on the bottom, owing to the mass of vegetation of which it is composed sinking as it is formed; but in ordinary circumstances it is a raft, moored to reeds, like those of other grebes. It contains, in a small hollow, from three to six eggs, which the bird covers with a layer of rotten water-plants when it leaves the nest. The dabchick is an expert in diving, being able to swim under water for a hundred yards or more, disappearing instantly almost without a sound, emerging just as quietly, and often rising no higher above the surface than is sufficient to expose its beak and eyes. When under water, dabchicks present considerable resemblance to frogs, owing to their not using their wings but striking out their lobed feet horizontally, and bringing them together again after each stroke. They feed mainly on small fish and insects. The female is most careful in feeding her young. Leaving them in the nest in charge of her mate, who shelters them under his wings, she darts off and appears at some distance swimming about till she sees something suitable, when she dives and brings it to the surface, and then, after shaking and cleaning it, she reappears after a long plunge by the side of the nest, when she feeds the chicks, who put out their heads from beneath her partner's wings. So long as the water does not freeze, dabchicks will remain, but a long frost drives them southwards in search of open water. In summer the dabchick has a black chin, in winter the chin is white, and the general colour paler. The upper plumage is blackish brown, the lower silvery white with brown mottlings on the chest and sides, and the tail is the smallest of that of any European bird. The beak is horn-coloured, yellowish green at the gape, and the legs are dark green.

Ringed Snake. On the banks of the inland waters of central Europe only two kinds of reptiles occur, one the pond-tortoise, and the other the water or ringed snake (*Tropidonotus natrix*). The latter is evenly and widely distributed, no part of the European continent (except the extreme north) being without it, while it is also found on the islands near the coast, as well as in the more distant island groups, with the exception of Ireland. It does not range so far north as the viper, but goes farther south, its habitat being between the 65th and 35th degrees of latitude, eastwards to Lake Baikal and westwards to the Atlantic.

Whilst the smooth snake prefers light, sunny places in the woods and on the slopes, and the viper marshy and boggy districts, to the ringed snake the presence

of water is essential, the soil and nature of the country being generally of minor importance. Besides water and moisture, this snake loves above all things the sun, and therefore appears only here and there on inclement wind-swept table-lands and mountain



THE RINGED SNAKE.

ridges, and on such mountain-slopes as are exposed to the south and east. In the Swiss Alps it has been met with at a height of 5500 feet, in the Tyrol at a height of 6500 feet, and in Piedmont even as high as 8000 feet. As a rule, however, it prefers the lowlands and smaller hills to the mountains, generally choosing its habitation in the neighbourhood of a pond, ditch, or river, or in a marsh. Where the locality is to its taste, the ringed snake does not mind the proximity of a road, or the neighbourhood of a farm, while it has been found even in the midst of a village. Often enough it takes up its abode near human habitations, or even in a cottage, if this be in a dilapidated condition.

According to the nature of its dwelling-place, the ringed snake finds a refuge amongst rushes or reeds, under bushes and undergrowth, as well as in water.

When driven from its lair, it will make use of any covert which may be at hand. During the day it hunts for prey within a somewhat limited space, unless unfavourable circumstances necessitate a more distant search. Even in the sea it is a steady and persevering swimmer, and has been found far out of sight of land; but it swims so slowly that it can be followed at a walk. In swimming it usually keeps close to the surface, with head held erect well above the water, but at times it glides along midway between the surface and the bottom. This snake seldom climbs, although it will occasionally ascend a bush or branching tree either to sun itself or hunt for tree-frogs. Unlike the viper, the ringed snake when surprised does not assume the defensive, but seeks safety in flight; and when overtaken and seized seldom attempts to bite its captor. It will, however, inflate its body and hiss loudly, by which means, as well as by violent contortions of its body, it sometimes so alarms timid persons as to effect its escape. Towards birds-of-prey its behaviour clearly shows that it does not understand how to bite properly, rushing on them with loud hisses but often missing when it strikes. When frightened it falls into a kind of fit, and becomes rigid; and many an enemy is kept off by its unpleasant odour. This disagreeable smell is less noticeable when a snake becomes reconciled to captivity; and the oftener it is touched the more quickly will the smell disappear, the exhalation being probably due to fright, and being scarcely noticeable when the snake becomes tame. Having once learnt to know its keeper and take food from his hand, it may be taught to eat fish, either whole or cut in slices, and after a time will learn to consume raw beef cut into long strips. The proper food of the ringed snake is however frogs, the common species being captured almost exclusively in the spring when they come to the water for the purpose of pairing, although brown frogs are taken during the whole summer. Although this species does not like the green frogs which live in ponds, it will eagerly devour the tadpoles of all kinds of frogs and toads, which it catches under water, swimming about after them with its mouth wide open. In the same way it catches all kinds of small fish, for which it watches coiled round a post or reed, or lying on a stone so as to be able to strike as they pass and devour them on dry land. The food of the young consists of small fish, newts, and frog-spawn: full-grown snakes will, however, occasionally eat salamanders — when occasion offers, even the spotted salamander — as well as frogs and toads, although toads, as a rule, do not often come in their way, owing to their nocturnal habits, while their broad, flat, thick-skinned bodies are not easily swallowed. When hungry, a snake will devour from three to five large frogs, or several dozen of the small ones or tadpoles, one after the other: before eating its prey it turns it round, so as to take it in head-foremost, fish and frogs not being easily swallowed in any other way. The ringed snake does not appear to eat lizards, mice, or snails, and when the remains of beetles are found in its stomach, these beetles have been swallowed by the frogs it has eaten.

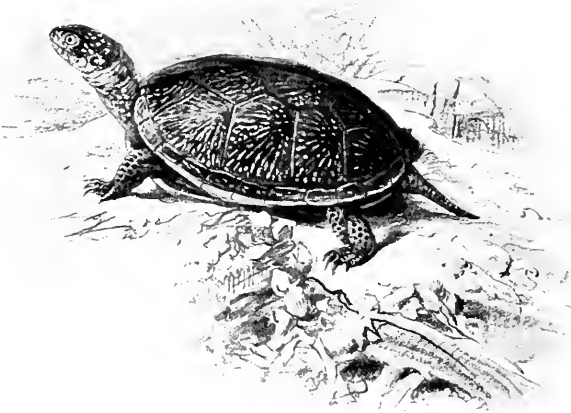
In October or November this snake takes up its abode, often with several of its kind, in manure-heaps, and other suitable situations, to sleep during the winter. At the earliest it leaves its sleeping-place about the middle of March, but generally in April, in order to sun itself for a few weeks, and then to begin its ordinary summer life. The season for pairing lasts from the middle of May to the end of

July, but snakes have been known to pair so early as the end of March and so late as September and October. The difference of sex is easily recognised, the male being much smaller in size; sometimes two snakes will pair when the male is only one-third the size of the female. In favourably situated places a few couples may often be found in company; and several female snakes will often resort to the same spot to deposit their eggs. Should the snakes of one district have discovered a favourable place for this purpose, it is used by almost all the tribe; and it thus sometimes happens that very large numbers of eggs are found together. Similarly, at the time when the eggs are laid, a number of snakes may be found in places where there are generally few or none. Since the pairing of the ringed snake takes place, according to the weather, in May or June, and as the development of the eggs requires about ten weeks, fresh eggs should be looked for in the second half of July or even in the first half of September. The eggs of the larger individuals are from 1 inch to $1\frac{1}{4}$ inches long, and from $\frac{1}{2}$ to $\frac{3}{8}$ of an inch broad. The number of eggs in a clutch seems to depend upon the age of the female; sometimes there are thirty or even forty, but generally only from fifteen to twenty-five. They are of a beautiful oval, rarely pyriform, in shape, and are deposited in the same place at intervals of a quarter or half an hour, or sometimes rather longer, the skin of the fresh eggs being sticky; and, as they are laid in such a way as to touch one another, they join together in a cluster or more rarely in a string. Under ordinary circumstances the eggs are laid in such a state that they require a period of from seven to eight weeks to fully develop; when this time has elapsed a small slit forms in the covering of the egg, out of which creeps the cautious and inquisitive little snake. If the young, which come into the world quite prepared for independent life, leave the eggs late in the year and therefore in cold weather, they at once seek a winter-abode, in which they wait without food for the spring.

Pond-Tortoise. The pond or marsh tortoise (*Emys orbicularis*) is even more fitted for life in the water than the ringed snake, being an almost genuinely aquatic reptile. It is rather widely distributed, ranging from the northern shores of the Mediterranean in the south to Mecklenburg and Courland in the north, and from Portugal in the west to the Sea of Aral in the east. Its occurrence in North Africa is doubtful, but it is found in the Pyrenean Peninsula, and is a well-known inhabitant of the inland waters of the larger islands of the Mediterranean.

This elegantly spotted little tortoise, which is also called the mud-tortoise, avoids rapid, stony, deep, and clear waters, and is therefore chiefly found in ponds surrounded by thickets and choked with reeds, in fish-ponds, bogs, and pools connected with larger ponds and lakes in which there are fish, and in sluggish rivers and other similar water-courses. During the day it generally remains hidden in the water, where it takes up its abode; but when the weather is warm and calm and the sun shines brightly it may be seen swimming at all hours, and in undisturbed spots will often leave the water in order to bask in the sun. As a rule, it becomes lively only in the evening, when on calm, warm, moonlight nights it will swim about and climb out on to the bank, although never going far away from its haunt. In autumn it retires at times to a hole dug by itself in the bank, in which it sleeps during the

winter, but it often remains in the mud at the bottom of the pool, and by the middle or end of April once more returns to its summer life. Even in summer the pond-tortoise lives much in concealment: during the day it is absolutely still and motionless, and when surprised on land withdraws its head into its shell, and with one hind-leg pushes away vigorously, and falls plump into the water like a stone. As soon as it notices anything suspicious it dives, and, should it be surprised at some distance from the water, it will seek to regain the spot with rapid movements, and if not sufficiently quick to make good its escape will draw its head and limbs within the shell. Although it does not live on the land, its movements there are quicker and more dexterous than those of the land-tortoise: and when lying on its back it can turn itself with ease, like all river-tortoises, with the aid



THE POND-TORTOISE.

of its neck and head which act as a lever in assisting its movements. It swims and dives very skilfully, only the raised curve of the shell being visible above water. When diving, its course is marked by a stream of air-bubbles, and on coming to the surface it will steer itself dexterously in a slanting line, swimming about leisurely and inhaling the air in long draughts. On the bottom it creeps along without difficulty, stirring up the earth and sand, and hiding in the mud under stones or aquatic plants, or under the roots of plants on the bank.

The pond-tortoise displays considerable agility in catching its food, which consists of worms, water-insects, snails, frogs, salamanders, and larvæ, as well as fish and carrion. It seizes fish—which it seems to prefer as food—with its jaws by the lower part of the body, and, after endeavouring to cripple them by repeated bites, devours them at leisure. At times, it is said, one of these tortoises will lie upon some flat stone, and catch the passing fish, striking from above, that it

may hold its prey fast, and by the help of its fore-legs, which are in the water, tearing pieces from the body of its victim and devouring them. It will attack frogs sunning themselves on the surface of the water or watching for prey, seizing them suddenly from below by the hind-legs, and in this way pulling them to the bottom, where it will devour the limb of its victim, tearing it off with the help of its own fore-legs, and then proceed to attack the body. Newts, tadpoles, worms, snails, and water-insects give but little trouble; the invertebrate animals caught on land are seized from above and carried into the water, where alone they can be swallowed; and even quite young tortoises will run into the water with worms they have caught on land.

A short time after pairing—which takes place on awakening from the winter sleep about May, and during which the pond-tortoise frequently utters a strange hissing sound, something like *keck*—the female lays from fifteen to thirty eggs as large as those of a pigeon, of oval shape, and enclosed in a greyish white calcareous shell, which hardens soon after they have been deposited. The eggs are laid in a hole about 2 inches wide which has been dug with the tail and hind-legs and narrows towards the base. They are laid in the latter half of May or June, and are covered with earth, and left to themselves, requiring probably for development a period of from two to three months. When the young are hatched, they at once seek the water, remaining on or near the bank and feeding at first on small water-insects, worms, or snails.

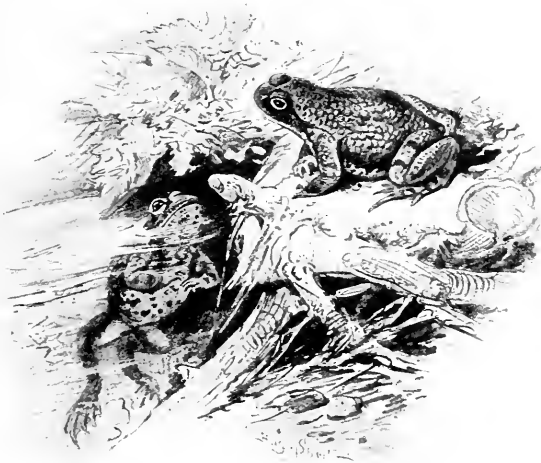
Green Toad. Among the tailless amphibians of aquatic habits, the green toad (*Bufo viridis*) is distinctly an eastern species, ranging, however, as far west as the Rhine, and found in many parts of Germany in common with the natterjack, which it has quite supplanted in the districts east of the Vistula. Northwards it ranges up to Skagen in Jutland, the island of Gothland, and to 56° N. latitude in central Russia and 52° in Siberia. In the south it is to be met with in the whole of northern Africa, from Morocco to Egypt, as well as in Palestine and the south of Persia; the eastern boundary of its area cannot be stated with certainty but certainly extends to Mongolia. From Spain, Portugal, France, Belgium, Holland, Great Britain, and Ireland, this toad is absent, but it is generally distributed in Germany, where it is met with both in the plains and hills, everywhere frequenting wide valleys and stagnant waters. In the Alps it reaches a height of 3600 feet, and in the Himalaya is found at 15,000 feet.

Not particular about the nature of the soil, this toad is limited to the vicinity of marshes, backwaters, ditches, and pools, and remains in the water, not only during spawning-time—which in Germany is chiefly in May—but for some time after, until about the end of June, while it visits the water off and on all through the summer. On dry days later in the season it remains hidden near the water, either under the roots of trees and stones, in the crevices of old damp walls, in stone-heaps and holes in the earth, in ditches in the roads and fields, in gardens, or sometimes in vaults and cellars. At night and on damp sultry days these toads hop about in gardens, fields, meadows, fallow lands, or on railway embankments; the young, which are more diurnal than nocturnal in their habits, being often seen in such situations. Wandering over a fairly large tract of country, the green toad runs comparatively fast, hops like a frog,

and can leap a distance of a foot or more; it digs energetically with its strong hind-legs, and swims well with its head bent low in the water. When pursued, it will endeavour to escape by a succession of leaps, and if caught tries to free itself by kicking with its hind-legs against the hand by which it is held. A fairly lively animal, it does not easily accustom itself to captivity, although it will learn, sooner or later, to know its keeper and take food, such as earth-worms and flies, out of his hand. From others of its kind the male is distinguished by its unusually numerous variations of voice, which have been likened to a melodious trill, the bleating of a goat, the chirping of a cricket, the song of the nightingale, and the grunting of a pig. The only utterance of the female, is, however, a gentle squeak, uttered when in distress. Notwithstanding its love of water, the green toad passes its winter-sleep in holes in the ground, on the banks of ponds, or in cellars and such-like places; the torpor usually lasting from September or October until April or May.

Fire-Bellied Frog. Of the fire-bellied frog (*Bombinator igneus*) there appear to be two local races. One of these races (*B. igneus pachypus*), the yellow-bellied frog, best known under the name of mountain-frog, has a compactly shaped body, and the lower part of the leg as long as the foot without the toes. The upper-parts are clay-coloured or yellowish brown, without black spots; while the under-parts are sulphur or orange yellow dotted with greyish blue spots, the tips of the toes being yellow. The other race, which may be called the fire-bellied frog of the plains, is more slender in build, with the lower part of the leg shorter than the foot measured from the little toe. Above, this frog is dark grey or brown, with two small round green spots between the shoulders; beneath, it is bluish black spotted with white, and orange or vermilion shading to earmine, the tips of the toes being black. The plains race is not so large as the mountain form, which is the western and southern type, the other being restricted to the east and north of Europe. The western or mountain form has hitherto been found in France, Belgium, Holland, Luxemburg, the mountainous and hilly districts of central and southern Germany, Switzerland, upper and central Italy, the Tyrol, and other parts of the Austrian Alps, Dalmatia, Bosnia, Montenegro, Hungary, Transylvania, and Rumania. The eastern or plains form, on the other hand, occurs in southern Sweden, Denmark, the plains of north Germany, Bohemia, lower Austria, Hungary, Transylvania, Rumania, and central Russia. These frogs live, in larger or smaller numbers, in such fish-ponds and pools as have the bottom covered with fallen leaves and decomposing vegetable-matter; being found there both before entering their winter-quarters and after their return. They also frequent marshes, fens, and peat-bogs: but in respect of "station" the two forms present a certain difference, the mountain-race, although preferring stagnant waters of smaller extent, also inhabiting back-waters and disused courses of rivers and brooks, and in mountain districts even frequenting clear cold springs and the streams which flow from them. In the water both forms are generally to be seen not far from the bank, with the head above the surface; but they leave their watery home for a short time in the evening, or early morning, in order to obtain food, which consists chiefly of earth-worms, and in dull and rainy weather may be abroad throughout the day. In the ordinary

course of events these frogs retire to winter-quarters in October, where they hibernate in company with others of their kind, reappearing again in the middle or end of April; their quarters consisting of hiding-places under roots of trees, tufts of grass, heaps of stone, manure-heaps, or holes in the ground, never made by themselves. They are clever swimmers, and avoid danger by diving quickly. On land they move in short, hasty leaps, the movements being very hurried in time of fear or danger, and in consequence often appearing clumsy: if speed cannot save them, they either throw themselves on their backs, or bend back the neck as if they had spasms, clasping the front legs behind the neck, and in this strange position showing the gaudy red and yellow of their under-



FIRE-BELLIED FROGS.

parts, which evidently serve to frighten away many enemies by which they would otherwise be attacked. When frightened or disturbed they eject from the glands of their back and legs a white soap-like, strongly smelling fluid, which has been known to kill other frogs and newts that have come in contact with it when carried in the same bag. Lying with outstretched legs flat on the surface of the water, the head appearing above the surrounding plants, these frogs utter melodious sounds quite different from those of other species; the faint but distinct sounds deceiving many as to the whereabouts of the singer. The voice of the plains form is somewhat louder and clearer than that of the mountain-race, although not so often heard; but the "song" of both is composed of an oft-repeated *Ong ong*, *Ung ung*, each frog having its own tones, higher or lower according to its age or size, so that their united efforts resemble a distant peal of bells.

Moor-Frog. Among the more typical frogs of central Europe, the moor-frog (*Rana arvalis*) may be classed as one of the water-dwellers, and may be distinguished from the agile frog by the shortness of its hind-legs. It attains a length of about 2 inches, and is not often found west of the Rhine; its area extending into Siberia to the east, up to the Arctic Circle in the north, and in the south including Alsace, Hungary, Asia Minor, the Caucasus, and northern Persia. Inhabiting only the lowlands and broad river-valleys within the area of its distribution, this frog is most numerous on the northern European plain and its Siberian continuation, as are also the fire-bellied frog and garlic-toad. The moor-frog's favourite haunt is among marshy places, interspersed with ditches and pools; the common frog sharing, in a similar way to the viviparous lizard and the sand-lizard, the territory it inhabits. It seems, however, that the males,



EDIBLE FROG.

which are provided with larger webs on their feet than the females, are more at home in the water, and it is possible that only males are found in water during the winter-sleep, which lasts from November to February or March.

Edible Frog. The edible frog (*R. esculenta*), which is more decidedly aquatic than the last, is easily distinguishable from the other central European species by its greenish back, the mottled black and yellow back of the hind-leg, and the large webs which extend as far as the tips of the toes. There are several varieties of the species, two of which, the pond and the lake race, are found in central Europe. The lake form is larger and heavier than the other, and its coloration less vivid and more uniform, the upper-parts not being of such a decided green, but more olive-brown, marked with greyish black or bronze-brown spots. The lake race attains a length of $4\frac{1}{2}$ inches, and is differently distributed to the pond form. It inhabits deep, broad streams and river-valleys in central and

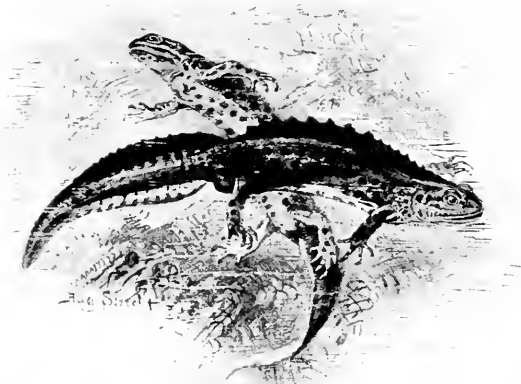
eastern Europe and western Asia; in Europe it is found east of the Rhine near the upper Spree, the Havel, in the valley of the Elster and the lower Saale, near the salt lake of Eisleben, in the northern borders of the Hartz, and in the basins of the upper Elbe, Vistula, and Danube. Passing east from Poland onward through southern Russia, it becomes more frequent than the pond form, increasing as the latter decreases, till in the neighbourhood of the Caspian and the Caucasus it is the only representative of the edible frog. Thence it ranges as far as Turkestan, and also extends over Afghanistan, Persia, Armenia, Asia Minor, Syria, Cyprus, the Greek Archipelago, and Greece. It also occurs in Dalmatia and its vicinity, and in isolated instances in southern Europe, and it seems to be the edible frog of northern Africa. Another variety is found in Italy, Sicily, and the south-east of England, where, however, it has been introduced; a fourth inhabits the Pyrenean Peninsula and the Azores; while the fifth and last is met with in China and Japan. The lake form shows a decided partiality for the lowlands, inhabiting extensive tracts of water on the plains; but the pond-race prefers the streams of hilly and mountain districts, although seldom ascending higher than 3600 feet above sea-level. Pools, ditches, marshes, bogs, and fens are its favourite dwelling-places. Only very occasionally does it wander over land from one piece of water to another; since, except when young, the whole of its existence is passed in the water and on the banks. In Germany its summer-life begins about the latter half of April; and from May onwards, especially on damp warm evenings, this frog joins in the nightly chorus of its kind, until September. During the day it lies on the surface of the water with the head raised above the surface, or may be seen sunning itself on shore and on the look-out for such food as snails, worms, insects, tadpoles, and newts, while it even eats fire-bellied frogs, which are seldom preyed upon by other animals. While on land, it is always on the watch for danger, and, when disturbed or frightened, has been known to leap 3 feet into the water, to hide among the plants or in the mud. It is a lively, active, dexterous, inquisitive, voracious species, which can rarely be tamed; and is to a certain extent destructive, as it devours the spawn of fish, although it may be said to make some compensation for this by its fine flavour, which is much appreciated in Italy, France, and southern Germany.

Crested Newt. Among the tailed amphibians of central Europe four species of newts must be included in this chapter. Of these the crested newt (*Molge cristata*) is found throughout the Continent; the only countries from which it is absent being Spain and Portugal. In the central districts it is to be met with almost everywhere, except in the mountain-ranges. In spring it is one of the ordinary inhabitants of stagnant pools, being fond of water overgrown with plants, and of streams with clayey, chalky, or marly bottoms, its occasional absence being probably due to some unfavourable condition of soil, water, or climate. Although, avoiding the inclement heights of the German mountains, it has been found on Mont Blanc at an altitude of 5000 feet.

Alpine Newt. The Alpine newt (*M. alpestris*) is limited to a much narrower tract, clinging to the hilly districts and avoiding the plains. In the south it inhabits only the Apennines and the mountains of Greece and

occasionally other parts of the Balkan Peninsula. In Germany it is not found in the plain east of the Elbe, although west of that river it appears in a few localities. Smaller than the crested newt, it attains a length of 3 to 4 inches only: its skin, during the greater part of the year, is finely granulated, that of the female being somewhat coarser, except in the breeding-season, when it becomes finer, while the male is almost uniformly smooth.

Common Newt. The common newt (*M. vulgaris*) is even smaller than the last, rarely exceeding 3 inches in length, and having a perfectly smooth skin. This newt is represented in the Mediterranean countries by a variety, but has otherwise much the same distribution as the crested species, although it ranges



MALE AND FEMALE CRESTED NEWTS.

a few degrees farther north, up to 63° N. latitude. the neighbourhood of St. seem to live either in Sweden as in Norway. Its southern same as that of the crested resembles in being absent Spain, Portugal, Corsica, Sardinia, and Sicily, although it ranges a little farther south in Greece. In the west the common newt has established itself in Ireland, but the eastern boundary of its distribution is not known. In the spring this newt may be seen every day in ponds, ditches, marshes, and even in muddy bogs and rain-pools all over its area, not only in the plains but in hilly districts and on the spurs of mountain-ranges, such as those of the Austrian Alps, where it is met with at a height of 5000 feet.

Webbed Newt. The webbed newt (*M. palmata*) is a typical western European species, which has spread farther and farther eastward from France. In Switzerland, where it was discovered in the eighteenth century in the Jura, it is met with north and west of the principal mountains, at an altitude of 2800 feet above the level of the sea. In Germany, where it can be traced down

being found in Norway. Although common in Petersburg, it does not or Russia so far north boundary is about the newt, which this species from the south of France,

the Rhine as far as Holland, it has penetrated as far south as Bavaria, on the Main as far as Ochsenfurt, and northward to Thuringia and the Hartz Mountains. In these districts, as in other mountainous parts, it is to be found in ravines, deep valleys, and forest-marshes, in old river-beds, in either clear or muddy water, in pools which have been formed by melted snow, and in springs, but never in large open ponds.

Although the webbed newt resembles the black salamander in its way of living, it is more sensitive, and more dependent on the woods, and for these reasons is not found everywhere in the Hartz where the Alpine newt is met with: on the other hand, the black salamander occurs wherever the webbed newt exists.

All the central European newts are in general very much alike in their way of living, representatives of all four being sometimes found in the same waters. They complete their metamorphosis, which lasts three months or more, in the water, where they remain for several months in the spring during pairing-time. That they exist entirely in water during this time, is evident from the fact that their tails maintain the oar-like form; the fringes with which this appendage is ornamented at that season not disappearing till the newts prepare to go on land, which some do as early as May, although others do not come out before September.

The common newt sometimes leaves the water in small parties, while the crested and the Alpine species get gradually accustomed to life on shore by leaving the water from June or July in the mornings and evenings, and returning at intervals, till at last they remain on land. Like other newts, they spend the rest of the summer and the autumn in damp places, in holes on the bank, beneath roots of trees and in rocky clefts, and even in cellars, where they hibernate. On emerging from hibernation newts betake themselves to ditches and pools of stagnant water. The mountain newt prefers water with gravel at the bottom, particularly in the forests. The dark winter-coat of the male soon assumes its nuptial colours, while the other sexual features begin to develop on the back, tail, and other parts.

Newts lay eggs instead of giving birth to living young like salamanders. From twelve to eighteen days after the eggs are laid the young appear, and are about a quarter of an inch in length, and in shape and movements like young fish. In three to four months their gills are formed, so that they are not fully developed until August or September.

Occasionally the gill-bearing fry winter as such, and do not assume their mature shape before the following spring. Many die from starvation or are eaten by their own species, especially in the case of the crested newt, or they are killed by the voracious larvæ of large water-beetles, which also destroy the eggs as they adhere to the plants on which they are deposited. Others are sucked by leeches, or caught by frogs, snakes, or fishes. As tadpoles, they live first on small crustaceans and hopping insects, later on they eat the larvæ of gnats, and also worms and other small invertebrates, and occasionally each other. Newts are thus carnivorous throughout life: the crested species being particularly voracious in spring, and especially fond of snails, which it clutches

with its mouth, and by violent shaking of its head gradually pulls out of their shells.

While newts require a great deal of food during their sojourn in the water, at which time they even eat their own skins when just stripped off, their appetites are small when on shore, where they feed principally on worms and slugs. Their movements are lively and graceful only in the water. There they swim quickly about with their tails, rising straight up to the surface to breathe, and then sinking in curves to the bottom, where they often snap their mouths and emit bubbles of air. On land they are much slower and clumsier. Like salamanders, they emit a fluid from the glands of the skin, which, if not exactly acrid and poisonous, is offensive to many animals, though useful to the newts themselves, owing to its stickiness. By means of this fluid they are enabled, not only to adhere to, but to climb glass and other vertical planes. Much as newts enjoy living in water during the spring, they by no means like it later on, when they show their aversion to an involuntary bath by sprawling violently with their feet, and lifting and turning their heads, and trying to escape as soon as possible. Indeed, if they do not succeed they are drowned. Early in the nineteenth century certain observations were published about the voice of these newts, which showed that the crested as well as the common species utters a loud squeak. The voice of the Alpine newt was discovered to be a flute-like sound as clear as a bell, and both male and female of the common newt are also known to have a cry. Whether newts are really so very long-lived as has been asserted, may be doubtful, but they are distinguished from all other vertebrates by the facility with which they reproduce any parts they may lose. Though many statements of their reproductive powers may be exaggerated, it is certain that they are able to replace not only their legs but even their eyes.

Perch, etc. Before referring to the species characteristic of the fresh waters of Europe, a few words are desirable with regard to the structure of fishes, which form one of the lowest class (*Pisces*) of vertebrates, but, owing to the plan of the present work, the notice is brief. Most of the fishes of the present day are clothed with overlapping scales, although a few are naked; some are protected by separate rows of bony shields, and yet others by a complete suit of armour, while others, again, especially in the tropics, have gorgeously coloured skins beneath the scales. The majority, however, display less vivid colours, which change according to age, sex, and season, and disappear soon after death. The reason of this is that within the skin there lie small pigment-cells mostly filled with black, but sometimes with red or yellowish colouring matter; these cells being capable of sudden contraction by which they are so reduced in size as to be almost invisible, while, on the other hand, they are also capable of sudden expansion into star-shaped bodies, which show the colour to the best advantage. By this means a fish is enabled to accommodate its hue to that of its surroundings: and as this change of colour is absent in blind species, it evidently depends on the degree to which the species is sensitive to light. In the skin of many species, especially those of the carp family, there are spots where the black cells are entirely or partly wanting, and the red ones are strongly

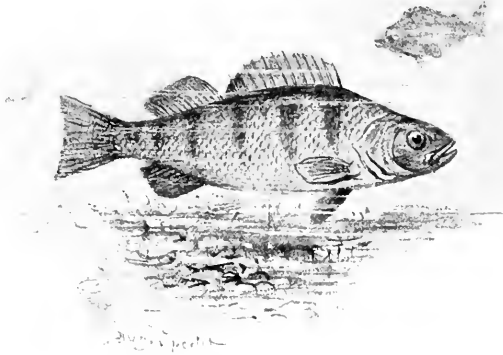
developed. Such fish are kept for ornamental purposes, and, as their colour is inherited, great care is taken in breeding them. In addition to the cells with black and red pigment, in most fishes little silvery spots are observable, which lie along the inner side of the scales in the form of small diamond-shaped plates, and at spawning-time produce in many kinds, the stickleback for instance, the most beautiful colours.

The backbone of a fish consists of only two kinds of vertebrae, those to which ribs are attached and those without ribs. Among the bones of the mouth and throat there are hardly any that may not be provided with teeth. With the exception of those in the snout of the saw-fish, these teeth are never implanted in distinct sockets. Some few fishes, as for instance the sturgeon, have no teeth at all, and in most cases they are in the mouth and throat and not on the jaws. But the number and form of the teeth is in no class of animals subject to so many variations, and it is therefore extremely difficult to exactly divide them into series and define them by name. The fins are mostly expanded like fans by bony or cartilaginous portions of the skeleton forming the so-called fin-rays, the number of which is important in the definition of the species. They are moved by strong muscles and grouped into paired or unpaired fins. The paired fins are named, from their position, either pectorals or pelvics. The pectoral fins are present in almost every fish, and sometimes, as in flying-fishes, are very large. They are always behind the gills, whereas the pelvics may occupy different positions along the body, and in some cases may be wanting altogether. The unpaired fins are the anal, dorsal, and caudal. The anal fin is placed below in front of the tail, the dorsal stands erect on the back, and the caudal fin is at the end of the tail.

Most fishes are provided with a swim-bladder, which varies much in size and shape, and in many cases is connected with the alimentary canal by an air-tube. It may be compressed or expanded at the will of the fish. Although corresponding in its position in the body to the lungs of other vertebrates, this bladder serves in some of the fishes merely as an additional respiratory organ, for all fish breathe either entirely or partially through gills. These gills, which lie at the back part of the head, consist in ordinary fishes of parallel, comb-like fringes, traversed by many blood-vessels. They may be attached to the gill-arches or to the epidermis, but always lie in the gill-cavity, which is connected with the surrounding parts by the mouth, or the so-called gill-slits at the sides of the head. Fishes impart oxygen to their blood by taking into their mouths the water in which they live, shutting their mouths and expelling the water through the gill-slits, and absorbing the oxygen as it comes into contact with the blood-vessels of the gills.

Fishes are, as a rule, the most unsociable of vertebrates, and seem to show the least possible mutual sympathy. Their eyes have a very flat cornea, and an exceedingly large, nearly round, hard, crystalline lens, but some species are blind. Hearing is often supposed to be fairly good, in spite of the absence of external ears; the sense of smell is in the nasal sacs, mostly situated at the point of the muzzle, which, as being unconnected with the cavity of the mouth, in no way assist in respiration. Fish are provided, however, with one peculiar organ of

sense, the so-called lateral line, which is common to many of the tailed amphibians, and consists of a more or less curved arrangement of small pores in adjoining scales on each side of the body, leading to canals beneath the skin. Fishes, as a rule, swallow their food whole; some tear or grind it to a certain extent. Very few eat vegetable matter, most species devouring other fishes, or else lizards, molluscs, worms, or other aquatic animals, as well as insects and their larvæ. The great majority lay eggs (or spawn), which are usually small, round, soft, and without shells. In most cases the spawn is unfertilised when deposited, the males subsequently pouring the milt over the mass; but in a few species it is fertilised while in the body of the female. The number of eggs is much

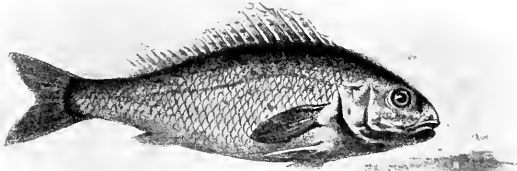


THE PERCH.

larger than in any other vertebrates, a herring having about forty thousand, a carp two hundred thousand, and the sturgeon and codfish several millions. Fishes spawn only once a year, and usually seek well-sheltered shallow spots for this purpose. At the commencement of the spawning-season they often ascend rivers to their smaller tributaries, as many species can live in both salt water and fresh water. Some fishes are great travellers, others lead an almost sedentary life, staying all their lives in their birthplaces, as is the case with so many of the European fresh-water species.

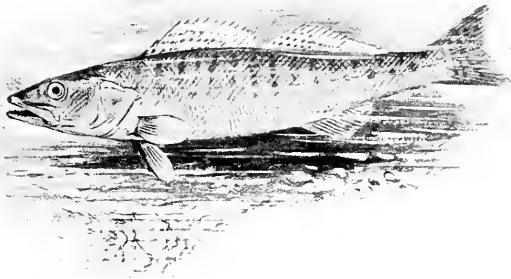
Most of the European fresh-water fishes, excluding those of the Adige in the Tyrol, belong to the bony group (Teleostomi) which take their name from the presence of a bony skeleton; and are further distinguished by possessing a gill-cover. Of these the highest in organisation is the perch (*Perca fluviatilis*), which inhabits

the fresh waters of the whole of Europe and northern Asia. Such a familiar fish requires but little description; it is greenish yellow in colour, marked on the back with six or seven indistinct blackish cross-bands, the fins being reddish in the breeding-season. Of the two dorsal fins, the first has thirteen or fourteen spines,



THE RUFF.

while the anal fin has two spines. The favourite haunt of the perch is in still waters, but it is found in many rivers, particularly those which run sluggishly. In disposition it is bold and greedy, and it is reported to eat not only worms and fishes but newts and small frogs.

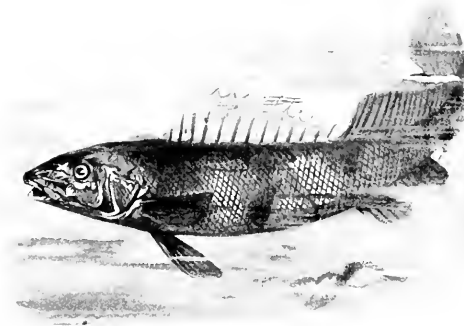


THE PIKE-PERCH.

Ruff. The ruff (*Acerina cernua*), a near ally of the perch, is characterised by the short body, blunt snout, and the olive-green back and sides marked with irregular dark spots and dots, the whitish abdomen, and the presence of rows of blackish spots on the back-fin and tail. The back-fin is continuous, and contains from thirteen to nineteen spines; the anal fin, as in the perch, has two spines. An allied species, the golden perch (*A. rossica*), distinguished by gill-covers glittering

like gold, inhabits eastern Europe; the range of the ordinary species including central Europe and Siberia. Yet another species, *A. schretser*, which has a long body and snout, is lemon-yellow in colour, with three to seven blackish lines along the sides, and rows of dark spots on the spiny part of the dorsal fin. This fish lives exclusively in the rivers discharging into the Black Sea. The only European species of the allied genus *Lucioperca* is the pike-perch (*L. sandra*), which forms a common food-fish on the Continent. It is greenish grey on the the back and sides, and whitish below, with brown indistinct spots running from the back down the sides and sometimes blending into cross-bands. Of the two dorsal fins, the front has from twelve to fourteen spines, while the anal fin has two spines. This fish is indigenous to eastern Europe, and appears to have spread westwards in comparatively recent times, as it was formerly unknown in the Rhine and the Weser. Although it breeds well in lakes, and cannot therefore be called exclusively a river-fish, it only occurs in such lakes as are near large rivers.

Another genus of the perch-family (*Aspro*) contains two species with long cylindrical bodies, mainly confined to the area of the Black Sea, although one, *A. zingel*, also occurs in the tributaries of the upper Danube. This fish is distinguished



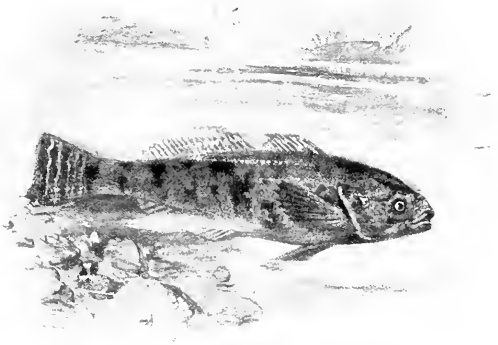
THE ZINGEL.

by an almost triangular head, a short stout tail, and brownish yellow colouring, broken by more or less indistinct blackish cross-bands. The second species, *A. vulgaris*, which is only about half the length of the first, being some 6 inches long, has a rounded head, a long thin tail, and is brownish yellow with four or five blackish crooked bands.

Bullhead.

The small bullhead (*Cottus gobio*), which belongs to another family (*Cottidae*), may be recognised by its wide flat head, rounded in front, the almost cylindrical, scaleless body, and the large and rounded pectoral fins. Inhabiting many of the smaller streams of the area under consideration, this fish is remarkable for the circumstance that the female deposits her eggs in a hole in the

river-bottom excavated by means of her tail, while the male carefully watches the spawn till the fry are hatched. In Russia the peasants use the bullhead as a preservative against intermittent fever, hanging it by a thread from the ceiling in the belief that it always turns its head to the wind, which it necessarily does if suspended horizontally, owing to its heavy head counterbalancing a much larger exposed surface at the tail end. In many parts of England this fish is known from its shape as the miller's thumb. Owing to the very slippery skin, there is no more difficult fish to grasp and pull from its hiding-place. Lurking among the gravel or under stones at the bottom of clear streams, it feeds on insects, worms, and small crustaceans, and has a remarkable way of hiding itself when pursued by



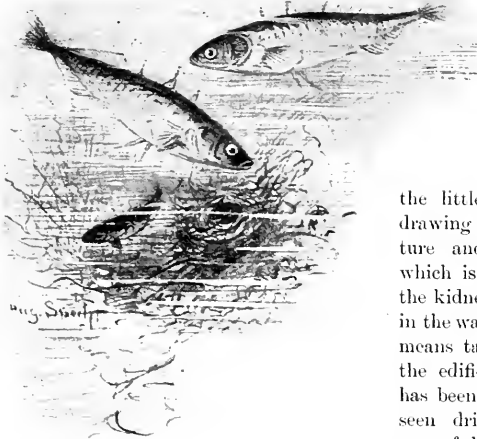
THE BULLHEAD.

enemies. It seldom swims, in the ordinary meaning of the word, but moves in a succession of long leaps, being apparently unable to support itself more than a few inches above the bottom: and it is more changeable in colour than the chameleon, the changes being dependent not only on the colour of the background but on any cause of excitement or gratification.

Another family is represented by the sticklebacks, which inhabit waters near the sea, the sea itself, and fresh waters. The nine-spined stickleback (*Gasterosteus pungitius*) is most common in the fresh waters of northern Europe; its larger relative, the three-spined stickleback (*G. aculeatus*), being more widely distributed. In the latter the back is greyish green, and the sides and abdomen glisten like silver. During spawning-time the male is red on the throat, breast, and under-parts: and while young is marked with dark cross-bands. Of the three-spined species there are several varieties. Both kinds are found in most European rivers, but neither has yet been met with in those which, like the Danube, flow into the Black Sea: the smaller species is everywhere the more

common. Sticklebacks feed on insects, worms, the fry of other fish, and each other. The three-spined species is remarkable for depositing its eggs in a nest made by the male of fibrous materials, which he watches and defends until the fry are hatched.

The sticklebacks and the bullhead are the only British fishes that show any sign of affection. "If the pike is the tyrant of the water," writes Mr. Pennell, "the stickleback is certainly its knight-errant." The male stickleback commences the work of nest-building by dragging water-weeds, algae, and other suitable



NINE-SPINED STICKLEBACKS.

materials to the selected site, and when this is accomplished, solidifies the foundations by strewing a few mouthfuls of sand upon them. The next step is to glue the materials together, which the little fish accomplishes by drawing its body over the structure and depositing a mucus, which is really a secretion from the kidneys, and seems to harden in the water. This is not the only means taken for the stability of the edifice, for after the mucus has been applied, the fish may be seen driving, by means of its powerful fins, currents of water against the nest, evidently for the purpose of finding if a weak place exists. Should a grain of sand or piece of weed be displaced, it is immediately restored to its position and firmly cemented. Sometimes to try the strength of the structure still more vigorously the stickleback rushes against it, and this not only once but repeatedly. The whole building process generally occupies several days; when the foundation is once sure and complete, the next operation is to collect materials and build the walls of the nest. The object of the fish is to build a barrel-shaped structure as smooth as possible inside; and for this purpose the process of selection and rejection sometimes goes on for days and at other times four or five hours. The process of cementing, after the structure is raised, is a long and laborious one, and it is not finished until the whole edifice is perfectly sound and stable from an aquatic point of view. Two apertures are constructed in the nest, one for ingress and

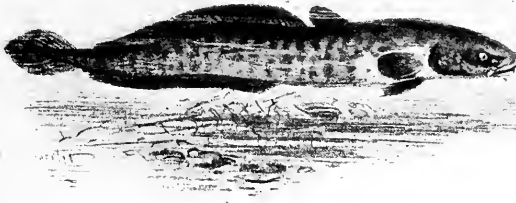
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the other for egress, these being quite smooth and symmetrical, and offering no opposition to the passage of the fish. Should the nest be attacked by an enemy, the builder bravely defends it and generally drives off the invader, returning as soon as the battle is over to repair such damage as may have been done by bringing mouthfuls of weed and other substances, which are arranged and pushed or hammered together by means of the nose of the fish; and after the deposition of the spawn by the female, should any part of the nest be displaced this is repaired by the male to be ready to receive the spawn that follows. This goes on until some six or seven layers of impregnated spawn are spread and the cavity of the nest is filled, with the exception of a small space which the stickleback reserves as a hole through which it may watch, with its marvellously brilliant eyes, the daily progress of incubation.

A century and a half ago sticklebacks were extraordinarily abundant in the fens of Lincolnshire; and every seven or eight years enormous shoals appeared in the river Welland, at Spalding, which they ascended in a great column.

Burbot. The burbot, or eel-pout (*Lota vulgaris*), is a local fresh-water fish which, although it belongs to the cod-family, never enters salt water. Of the two dorsal fins, the first has from ten to thirteen rays, and the pelvics are narrow with six rays: there is a barbel on its chin. This fish, which grows to a length of about one yard, is the only representative of its genus in fresh waters.



THE BURBOT.

Although most abundant in the Swiss lakes, it inhabits nearly all the rivers of Europe and northern Asia; but in England is mainly restricted to the rivers of the fen-districts of Cambridgeshire and Norfolk, where it lurks in rat-holes and other cavities under the banks. When on the move, it seems to use its pelvic fins, and not its barbel, for feeling purposes. It is tenacious of life, and has been kept alive out of water in damp situations for long periods by being fed on small fishes and raw meat. In captivity it grows rapidly, and feeds voraciously at night on small fishes, worms and insects.

Wels. A great number of the fresh-water fish of Europe belong to a group (Ostariophysi) in which the swim-bladder is furnished with a duct, while all the fin-rays are articulated, and the pelvics, when present, are without a spine.

Of the great family of cat-fishes (*Siluridae*), so abundant in Indian, African, and South American waters, the sole central European representative is the wels (*Silurus glanis*), a huge ungainly fish distributed all over Germany and northern Asia. With the exception of the sturgeon, the wels is the largest of European fresh-water fishes, and has a large head with a wide mouth surrounded by six barbels, a naked cylindrical body, a small dorsal fin devoid of spines, and a very long caudal fin. The general colouring is olive-green, with blackish spots above and whitish below. The wels is in much request as a food-fish, and its swim-bladder is used in Russia for making fish-glue. A second species inhabits southern Europe.

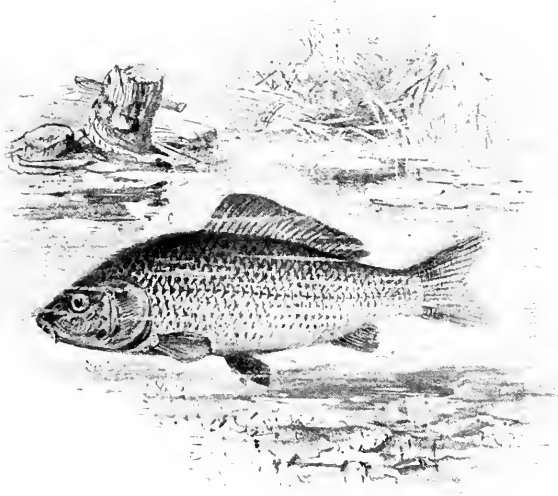


THE WELS.

Carp. The family most numerously represented in European waters is that of the carps (*Cyprinidae*), most of whose members are vegetable-feeders, and therefore suitable for breeding in ponds. The true carp (*Cyprinus carpio*) is distinguished by the large size of its scales, the presence of four barbels, a rounded snout, and a deeply forked tail; the third ray of the very long dorsal fin being bony and toothed on the hind edge. Apparently indigenous to Asia, the carp during the last two hundred years has gradually made its way into northern Europe. Peter the Great imported it into Russia, and latterly it has been introduced into North America. It was introduced into England, probably by the monks, before 1486, for though not mentioned in the Anglo-Saxon Dictionary of Ælfrie who died in 1051, it is described in a sporting treatise of the former date as follows:—"a daynteous fysshe, but there ben but few in Englonde, and therefore I wryte the lesse of him. He is an evyll fysshe to take, for he is so stronge enarmyd in the mouthe, that there maye noo weke harneys hold hym."

Carp thrive best in temperate climates but will endure intense cold. Some have been frozen for thirty-six hours in a pail of water, when they have been so brittle that a sudden concussion would have broken them in pieces like glass, and

they have been thawed out and become as active as ever without any apparent injury. This experiment was undertaken to test Sir John Richardson's statement that when fishing during Franklin's first expedition the fish froze as they were taken out of the water so that by a blow or two of the hatchet they were easily split open, leaving the intestines removable in one lump, and yet retained their vitality to such a degree that the narrator saw a thawed carp recover so far as to leap about with much vigour after being frozen for thirty-six hours. Carp are occasionally found alive in almost dry pools, and they lie dormant throughout the winter in every country in Europe. According to Hessel, they



THE CARP.

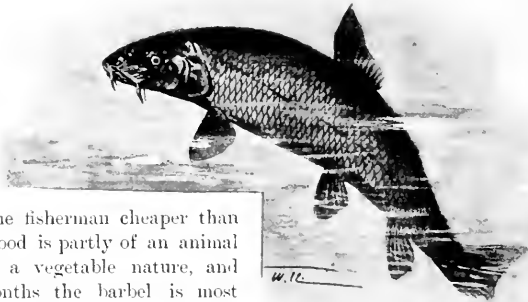
have been found huddled together in concentric circles with their heads close up to one another in the centre and the tails raised. Several breeds have been formed in Bohemia by cultivation in ponds: one of these being the leathery carp, which is devoid of scales, and another the mirror carp, which has only one row of very large scales on each side of its body, while yet others are the blue and the golden carps.

The crucian carp (*Carassius vulgaris*), of Europe and northern Asia, differs by the absence of barbels, and also by a slightly notched tail, straight lateral line, and arched back. This fish lives especially in stagnant or slowly flowing waters with a soft bottom; and in small ponds develops into the Prussian carp, which is more slender in form.

Barbel.

A different type is presented by the barbel (*Barbus vulgaris*), which takes its name from its four barbels, and is further characterised by the projecting upper jaw, slender body, and olive-green colour, which at the sides changes into greenish yellow with dark spots. It is common in the larger rivers of central Europe, especially the Rhine and the Danube, where it grows to a large size, occasionally attaining a weight of 40 lbs.: and it was sufficiently well known and appreciated in the Middle Ages to be used heraldically in the arms of one of the queens of England, Margaret of Anjou, the wife of Henry the Sixth. There is no fish more subject to internal parasites, which is perhaps the cause of its deserved reputation for unwholesomeness, this being alluded to in the aforesaid old sporting book, where the barbel is described as "a quasy mete and a peryllous for manny's bodye." It was, however, in good repute among the Romans,

for Juvenal tells us that Crispinus gave six sestertia for a barbel weighing 6 lbs., and remarks that he might have bought the fisherman cheaper than the fish. Its food is partly of an animal and partly of a vegetable nature, and during the months the barbel is most active it feeds principally on the larvæ of insects and on worms and small fishes. It generally keeps near the ground and will dig into the soft bed of the stream, which



THE BARBEL.

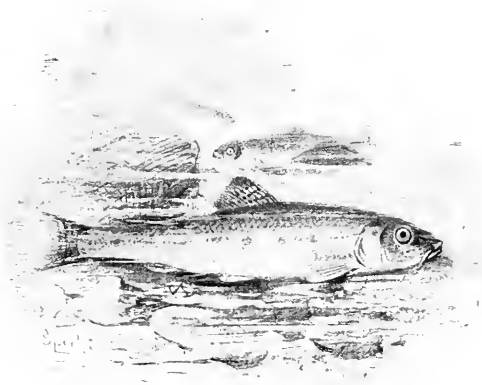
is the reason why anglers stir up the bottom with a gudgeon-rake before commencing operations. The Carpathian barbel (*B. petenji*), from the rivers of the Carpathians and the Vistula, but stated to occur also in the Lohé, a tributary of the Oder, is closely allied. Another species of this genus is the Dalmatian barbel (*B. plebejus*), from Dalmatia, Italy, and perhaps Spain, in which the body is thicker and more rounded, the muzzle shorter and blunter, and the scales are smaller than in the typical species. The Russian barbel (*B. chalybeatus*), from the Caspian region is another form. To this genus also belongs the mahsir or mahasir of India.

Gudgeon.

A near relative of the barbel is the familiar gudgeon (*Gobio fluviatilis*), which has a short dorsal fin without any spine, and a small barbel at each angle of the mouth. Like the barbel, it is carnivorous: and it swims close to the bottom and hides in the mud during winter. Its capture is most easily effected by stirring up the bottom of the stream with a rake, small shoals assembling from considerable distances to feed on the worms and insects disturbed in this manner. During winter this fish lives in deep water, which is

abandoned for sandy or gravelly shallows during the rest of the year. The stone-gudgeon (*G. uranoscopus*), which has fairly large scales, and the dorsal fin in a line with the pelvic pair, resembles the common species in its receding mouth and two barbels. It inhabits the tributaries of the Danube, and some of those of the upper Vistula, and is generally of a lighter colour than the common gudgeon, with cross-bands instead of spots on its back, and one or two rows of spots on its fins.

Another genus is typified by the roach (*Leuciscus rutilus*), one of the best known fish of central and northern Europe. Early in May every year shoals of roach leave Loch Lomond and ascend the tributaries for breeding purposes. The migration lasts for two or three days, and during its continuance no trout are ever caught by the angler owing to their gorging themselves with roach-roe. The same thing occurs in many other lakes, and in the



THE GUDGEON.

opinion of some anglers the females go first in separate shoals, the males following after the former have shed their spawn in order to effect its impregnation. Water-rats and herons, kingfishers, and other fish-eating birds prey upon roach voraciously at this period. Roach are gregarious, and may often be found among a shoal of barbel, especially if the latter be small; the most compact shoals are, however, met with during the winter, when they are in the best condition.

No species is more popular amongst float-fishers, but a river-roach, like that of the Thames, Colne, or Trent, is not to be caught by any tyro. "He has," writes Mr. Manley, "his times and seasons, his offs and ons, and the generally capriciousness of the scaly tribes, being subject to all kinds of atmospheric and terrestrial influences, which affect both the time and manner of his taking the bait. Moreover, roach of a much-fished river, like the Thames, are highly educated and are pretty wide awake to the fisherman's proceedings—the fixing of the punt, the

plumbing of the depth, and the scattering of the ground-bait. Of course the latter attracts them, and they come to see what's up, and if inclined to feed they will constantly take the baited hook for an innocent morsel of favourite food. But to make a good basket of roach, even when they are on, requires very careful attention to a number of details." The largest roach are about 10 inches in length, and in England the species seldom attains a weight of 2 lbs. The food consists largely of crustaceans. The roach is richer and more varied in colour than is usually believed. The upper part of the head and back is dusky and often bright green with reflections in many shades of blue, the greens and blues becoming lighter on the sides, and passing into silvery white below; the eyes are yellow, the cheeks and gill-covers silvery, the dorsal and caudal fins pale brown tinged with red, and the pectorals orange-red, while the other fins are bright red; but these hues are only plainly discernible in healthy, mature examples. An allied species, *L. virjo*, gorgeous in metallic lines, large scales, and orange-yellow pelvic and caudal fins is confined to the Danube; and another kind, *L. meidingeri*, distinguished by the male having large amber-yellow warts on the skin during spawning-time, lives in the very deep Alpine lakes. The rudd (*L. erythrophthalmus*) differs by its copper-coloured fins and glistening golden eye, marked by a red spot at the top. In East Anglia rudd live in the Broads, while roach unaccompanied by rudd seem to prefer the rivers; but, as a rule, rudd are not taken from water in which roach are not present, though roach are frequently found where there are no rudd.

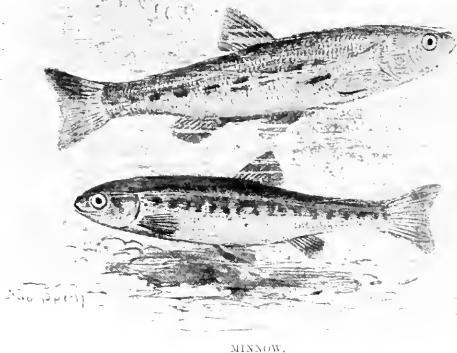
Chub. The chub (*L. cephalus*) is another widely distributed species, ranging into Asia Minor. Most of its scales are edged with black, and in the spawning-season its fins are ornamented with red and yellow. This fish sinks to the bottom instantly at the slightest alarm, even the shadow of a rod, but, as a rule, swims close to the surface in the shade of a bank or tree, and feeds on the worms, insects, and vegetation that fall into the water, as well as the small crustaceans that take refuge in the soft soil of the bank, particularly young crayfish. Chub may be distinguished from dace by the chocolate edges of the tail and back-fin. The scales are also larger, there being from forty-three to forty-eight on the lateral line, which is slightly concave and reaches its lowest point over the tips of the reddish pelvic fins. The very white leathery lips and large mouth are also conspicuous distinctions. The mouth and throat are lined with a tough membrane from which the hook is seldom disengaged without trouble, and in the throat are two rows of large teeth numbering three or five on each side. In England chub have been taken over 20 inches in length and weighing more than 5 lbs., but on the continent the fish is considerably larger.

Dace. The dace (*L. vulgaris*), which ranges over most of the European countries but is absent from Italy, Scotland, and Ireland, is a somewhat slender, graceful fish, bluish above and silvery below; the pelvic fins being greenish, tinged with red, and the anal without any trace of red. In the lateral line, which reaches its lowest point beneath the hind end of the dorsal fin, there are from forty-eight to fifty-two scales, and at the base of each pelvic fin there is an angular scale. In length it occasionally attains 12 inches: one was caught in the Kennet which weighed a pound and a quarter, but the average is much less.

In habits dace resemble roach, but are quicker of sight and hearing and swifter in movement. They are gregarious, though a few solitary individuals have been observed watching for small water-insects and darting on them as they came within range. Groundbait is wasted on the dace, which is a surface-feeding fish. Many are caught by the artificial fly, as dace feed mainly on insects and their larvae, often leaping out of the water to capture them.

Minnow.

The minnow (*L. phoxinus*) is abundant throughout the European area, and in some localities attains a length of 7 inches, especially in streams with gravelly bottoms, but is small and scarce in most limestone districts, and is never found in any great depth of water. Generally a silvery fish, it assumes distinct hues, ranging from carmine and crimson to every shade of blue and green; at times it is as rich in colouring as the stickleback, and at the spawning period phosphorescent. Its colours change according to environment, as was shown by an experiment made by Mr. Keene, who took five ordinary gallipots and painted the interiors of four as follows: black, red, blue, and yellow; the fifth remained untouched, and was, of course, white. The jars were placed in a row in equal light—not sunlight, but light through a frosted pane. When the pots had been filled equally with water from a dark

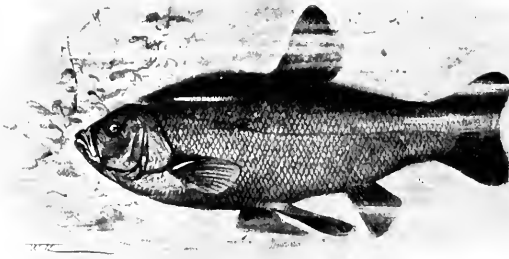


bait-cistern, five strong, lively minnows were severally placed in each receptacle. The colour of each at this time was uniformly dark olive on the back. In the course of two hours each specimen presented a different colour, when all were replaced in a black painted can. The fish in the black jar remained unaffected, the one in the red was somewhat lighter and clearly mottled, that in the blue rather of a browner tint, that in the yellow of a yellowish dirty-brown hue, and that in the white almost straw-colour. When replaced during the same and ensuing day in the pots in a different order, they presented, after various changes, almost immediate results distinctly curious. The experiment led him to believe that the colouring matter was exceedingly sensitive. Small as they are, minnows are excellent as food fish. Izaak Walton made "minnow tanzies" of these fish, and they appear to have been the original whitebait, since at William of Wykeham's dinner to the King and Queen at Winchester on the 16th of September 1394

seven gallons of minnows were served fried, and there are other records of these fish in old accounts.

Orfe. The orfe (*Idus melanotus*), a continental species, remarkable for its golden colour, has been introduced into many English ponds, where it is often mistaken for the golden carp.

Tench. The tench (*Tinea vulgaris*), with its slimy coat, and a barbel at each corner of the small, scornful-looking mouth which provided Cicero with an epithet, is at home in most countries of Europe. It is a fish of still waters, and occasionally lives in sluggish streams, deep down as a rule, but near the surface in hot weather. During the winter it lies torpid in the mud, and at any time will dive into the mud to escape capture, though it is so slow of movement that it can be caught by the hand. It spawns when the wheat is in blossom; and the males are distinguishable from the females by their long shell-shaped

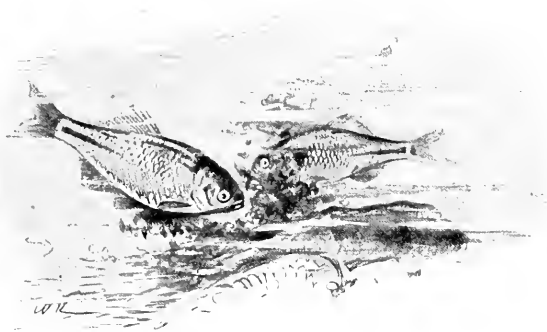


TENCH.

pelvic fins. Tench feed on weeds, worms, and insects, and are almost as tenacious of life as eels, it being a frequent occurrence for them to live a whole day out of water. They sleep in curiously contorted attitudes, often with their heads resting on the bottom. Tench are said to be the only fish that pike will not touch, but a few exceptions to this are on record: they are also said to heal the wounds of other fishes with the slime of their skin, and many instances of this are cited, although the slime has not been found of any therapeutic value in human cases. The species varies much in colouring and has been divided into several races, one of which, gorgeous in gold and black, is peculiar to Silesia and Bohemia.

Beaked Carp. Another genus, of which there are several species in Europe and western Asia, is represented by the beaked carp (*Chondrostoma nuso*) of the Elbe, and the rivers of France, and certain other countries; and also by *C. genei* in the Rhine; both species being mainly confined to the Mediterranean countries and Europe.

Bitterling. The bitterling (*Rhodeus amarus*), a fish about the size of the minnow, is almost as common as that species on the Continent, though unknown in Britain. During spawning-time the male has gleaming blue sides, a bright red abdomen, and deep red, black-edged fins. The female of this small fish has a prolongation of the oviduct which enables her to deposit her eggs in the gills of the fresh-water mussels in which they develop.



BITTERLING.

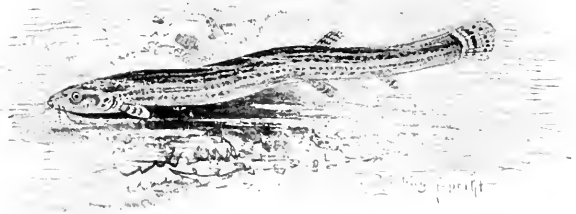
Bream. The bream (*Abramis brama*), which lives largely on quillwort (*Isoetes lacustris*), is an inhabitant of the rivers of central Europe north of the Alps. An allied species, the zarte (*A. vimba*), is found in the same localities as its relative, but seems to be absent from the Rhine. Two other species (*A. melanops* and *A. sapa*) are confined to the rivers flowing into the Black Sea.

The zope (*A. ballerus*), which appears to have been derived from the zarte, is similarly coloured, with the median fins grey and the paired ones yellow, the body being black. It is from 8 to 12 inches long, and is found everywhere in the lower reaches of the larger rivers, and in the large lakes of the continental districts it inhabits. The white bream (*A. blicca*), sometimes called the carp-bream, characterised by the curved, crooked back, and the red colouring of the paired fins, is also common in continental rivers and lakes. The white bream is also known as the bleak-bream, but the characters of the bleaks and breams are more noticeably blended in the rapfen or small carp (*Aspius rapax*), which inhabits the same districts as the barbel.

Bleak. The bleak (*Alburnus lucidus*), which is distributed all over central Europe, is distinguished by having the lower jaw projecting beyond the upper, and a slender, narrow, greenish yellow body with the under surface silvery white. Its scales are largely used in the manufacture of imitation pearls: the bleak is very common in the Seine, and the process was discovered about two hundred and fifty years ago in Paris. Another species (*A. bipunctatus*) is rarer, although distributed over quite as large an area. In this fish the body

is compressed at the sides, but not very slender, and from 4 to 6 inches long; the back is brownish green or blue, the sides are pale green bordered with a black line, and a broad black band extends from the eye to the tail; the pectoral and anal fins being yellow and the others grey. In contrast to this widely distributed fish, its near relative *A. mento* is found almost exclusively in the rivers discharging into the Black Sea. It has a long slender body, slightly compressed at the sides, a bluish green back, silver-white sides, and the pectoral, ventral, and anal fins pale red. Closely allied is *Leucaspis delineatus*, which, like the preceding, is found in the regions inhabited by the barbel. On the back it is olive-green, while on the sides, along which extends a longitudinal stripe, it is silvery white, the lateral line being limited to a few scales. Less common, though present in all the waters east of the Oder, is the sichel (*Pelecus cultratus*), distinguished by its compressed body and the sharp edge on the abdominal surface, unusually long pectoral and anal fins, and the strongly curved lateral line.

Loaches. The small group of loaches, generally grouped with the carps, are distinguished by having a bony case to the air-bladder. They have eel-shaped, slimy bodies with small scales, and six or more barbels on the mouth.

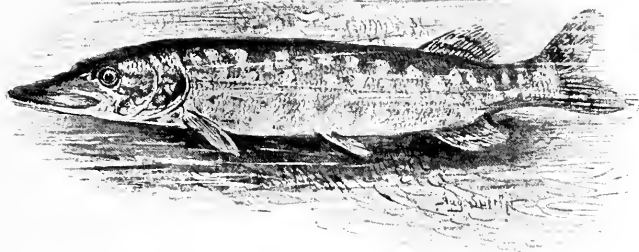


THE LOACH.

The male of this group, which feeds on worms and mud, burrows in the bed of the stream and forms a cavity to receive the eggs: the contents of this receptacle being watched by both sexes and defended from other fishes until the young are hatched. The spiny loach (*Cobitis taenia*), which may be recognised by the forked spine below each eye, is of a yellowish brown colour, with several rows of black spots. This species is widely distributed on the Continent, but the common loach (*Vannichilus barbatus*) is generally met with only in mountain streams frequented by trout. It is of dark green colour, with small brown dots and blotches. The pond loach (*Misgurnus fossilis*), also known as the weather-fish, from its habit of stirring up the mud when the temperature changes, is sometimes kept in glass vessels as a weather-guide. Inhabiting Asia and eastern and central Europe, it is an unpalatable fish, brown merging to black, with yellowish longitudinal stripes above, and orange-yellow below; it has four barbels on the lower jaw and six or eight round the upper lip.

Pike.

The pikes are represented in Europe only by the well-known *Esox lucius*, the other three species being American. Pike, the boldest and strongest among European fresh-water fish, are remarkable for their voracity, swiftness of motion, and acute sense of hearing; while in the wide mouth, furnished with about six hundred long scythe-shaped teeth, they possess a formidable apparatus for the capture of prey. These tyrants of the waters attack not only other fishes, including those of their own species, but even young water-fowl and almost every inhabitant of the water. They vary according to age and the locality in which they live, pike under 4 lbs. being generally called jaek, while such as are spotted with yellow and black are termed king-pike. The female of this species is always larger than the male.

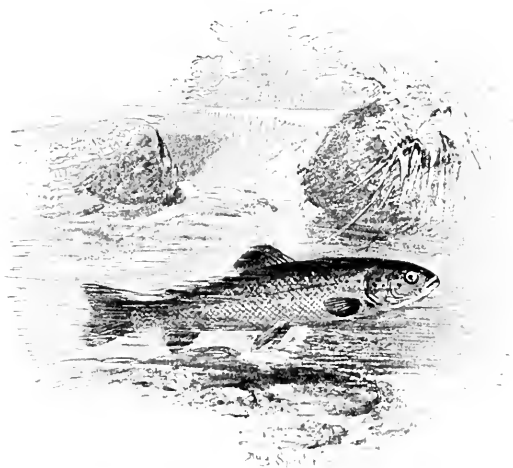


THE PIKE.

Salmon and Trout.

The noblest of all fresh-water fish are the members of the salmon and trout tribe (*Salmonidae*), which are abundantly represented in the northern half of the Eastern Hemisphere, their range being strictly confined to the cooler waters. Owing to their great local variation, no group of fishes is more puzzling to the systematic naturalist. Among the more widely spread types, the river-trout (*Salmo fario*) is olive-green on the back, bronze-coloured below, and yellowish green on the sides, with a larger or smaller number of black spots, mingled with others which are orange-red, or even occasionally bordered with blue. This handsome species inhabits swiftly flowing streams all over its distributional area, whereas the lake-trout (*S. ferox*) is restricted to lakes. The latter species or race is green or bluish green on the back, and silvery white below with the silvery flanks ornamented with round and angular black spots. The sea-trout (*S. trutta*), on the other hand, which has the back bluish grey, the sides silvery with very few black dots, and the under-parts pure silvery, is nearer to the salmon, but coarser in make, and often with more spots on the head. The most trustworthy distinction between the two is to be found in the presence of from fourteen to sixteen scales in an oblique row between the hind border of the fatty fin and the lateral line in the sea-trout, and of only eleven or twelve such scales in the salmon. The root of the tail is also much stouter in the sea-trout than in the salmon. In young

salmon the hind border of the tail-fin is more notched than in the sea-trout, but this difference tends to disappear with age. Differences between the two species are also stated to occur in the form of the gill-cover, but these do not seem to be constant. Often mistaken for salmon, sea-trout spend much of their time in the North Sea and the Baltic, but, like the two foregoing species, spawn exclusively in rivers. The lordly salmon (*S. salar*) is easily recognised by its size, the bluish grey back, the silvery sides marked with few black spots (which may sometimes be wanting), the silvery under-parts, and the dark grey fins. This noble fish is an inhabitant of the northern parts of the Atlantic, but is unknown in the Mediterranean and the Black Sea, and at the commencement of the spawning-season leaves the sea to ascend the larger rivers, where, if salmon-ladders be not placed to assist its ascent,



THE RIVER-TROUT.

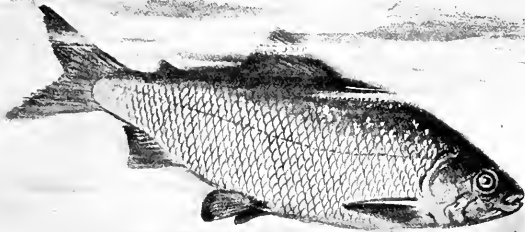
it often leaps apparently impassable weirs with comparative ease. It has been stated that salmon do not feed while in fresh water, being afflicted during their sojourn in rivers with a disease of the lining membrane of the alimentary tract; but later observations discredit the correctness of this view, evidence having been adduced that river-salmon catch and digest minnows and other fish. The presumed disease of the lining of the stomach is stated to be owing

to the fact that the fish examined were not sufficiently fresh. Still, the fact is not disputed that, during the time spent in fresh water, salmon maintain themselves to a very considerable extent on the store of fat accumulated in their tissues during their marine life. During the spawning-season, which lasts from eight to ten days, the female burrows with the flat part of her snout in the loose gravelly bed of the river, to form a receptacle for the spawn; and for some time after spawning, the fish are thin and unfit for table. The voracity of this fish corresponds with its growth and the strength of its teeth.

Very distinct is the charr (*S. salvelinus*), which inhabits the deep mountain-lakes of central and northern Europe; it is a small species, often brilliantly coloured with orange beneath. The northern charr (*S. alpinus*) is confined to northern Europe, including Iceland, and the north of Scotland; *S. willughbii* is only known in Windermere; *S. killinensis* in Loch Killin, Inverness-shire; and *S. grayi* in

Lough Melvin near Donegal Bay; and there are other local species or races. An allied species, the hucho (*S. hucho*), belongs exclusively to the Danube and its tributaries.

Coregonids or False Salmon. The so-called coregonids form a group of fresh-water salmon-like fish found in cold fresh waters. Among the species of this group *Coregonus oxyrinchus* inhabits the North Sea, and ascends the rivers flowing into the same only for spawning. It has a projecting upper jaw, and is silvery white in colour, shading into darker on the back, and nearly black on the tip of the snout. The Baltic marane (*C. lucareus*), on the other hand, inhabits the Baltic where it spawns in the bays and gulfs; it has a truncated upper jaw and is greyish green on the top and lighter on the sides, and silvery grey beneath, its fins being bordered with black. The true marane (*C. marana*), again, which inhabits Lake



WARTMANN'S FALSE SALMON.

Madu in Pomerania, is greyish black on the back, bluish on the sides, and white beneath, with grey, black-bordered fins. It measures from 16 to 20 inches in length. Another kind (*C. ferus*) lives in the deeper Swiss lakes, as well as those of upper Austria and Bavaria; in colour it is blue, shading to black on the back, with a silver sheen on the sides and below, the fins being grey with dark tips. It measures from 16 inches to 2 feet in length. In the depths of Lakes Constance and Ammer lives the kilch (*C. hiemalis*), which has much the same colouring as *C. ferus*, but is paler and smaller. Another species, *C. wartmanni*, lives chiefly in the deep lakes of the north Alpine region. Of other species restricted to particular localities there are *C. steindachneri* of Lake Traun, *C. sulzeri* of Lake Pfaffikon, and *C. macrophthalmus* of Lake Constance. The so-called pigmy marane (*C. albulus*), which is only 6 inches long, inhabits the lakes of Scandinavia, and the deeper inland lakes of the Baltic plateau from Holstein eastwards to the interior of Russia. The gwynial (*C. clupeoides*) of Bala Lake, North Wales, the powan (*C. microcephalus*) of Loch Lomond, and the pollan (*C. pollan*) of Lough

Neagh, together with several other kinds, are British representatives of this group. They are silvery, herring-like fishes.

Grayling. Another member of the family is the well-known and handsomely coloured grayling (*Thymallus vulgaris*), which inhabits swiftly flowing small rivers all over Europe, and is found in the River Reuss in Switzerland at a height of three thousand feet, and in the Inn at five thousand



THE GRAYLING.

feet above the level of the sea. It is distinguished by the unusual size of its long, many-rayed dorsal fin, the body being striped longitudinally. In North America and northern Asia the grayling is represented by other kindred species.

Smelt. A small member of the salmon tribe, characterised by the absence of spots on the body, is the smelt (*Osmerus eperlanus*), which dwells near the coast in the northern parts of the Atlantic Ocean, and



THE SMELT.

ascends most of the estuaries of the rivers in spring for the purpose of spawning. Although unknown in the Rhine, it inhabits some of the lakes of northern Germany, remaining permanently in fresh water without ever journeying to the sea.

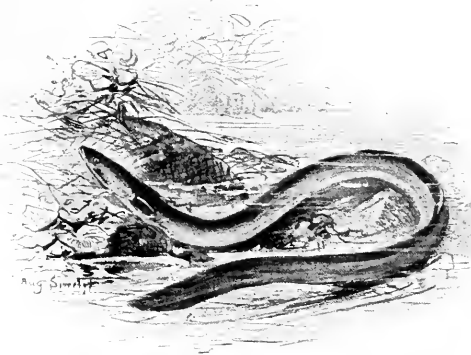
Shad.

Of the herring family (*Clupeidae*) two species live in fresh water, of which, the allis shad (*Clupea alosa*), is found along the coast of the North Atlantic, whence it enters the rivers for the purpose of spawning. It is bluish above and silvery underneath; and when young has a black blotch behind the numerous slender gill-rakers. The twait-shad (*C. pinta*) is a similar fish, but with a more slender body, and stout bony gill-rakers, from twenty-one to twenty-seven in number, or about one-third as many as those of the preceding species.

Eel.

The last group of fresh-water bony fish of central Europe is formed by the members of the eel family (*Muraenida*), all of which are characterised by the elongated, round, or ribbon-shaped body, always flattened at the tail-end, and either scaleless or with rudimentary scales embedded in the skin; the pelvic fins being absent, and the dorsal and ventral fins placed some distance from the head and extending to the tip of or right round the tail. The common eel

(*Anguilla vulgaris*), which is variously coloured, ranges in length from 20 to 60 inches, and weighs up to 22 lbs. There is considerable variability with regard to the sharpness of the snout, which has given rise to the idea of the existence of several species. Eels occur in all rivers and their communicating lakes discharging into the North Atlantic Ocean, as well as



THE EEL.

those flowing into the Mediterranean, but are unknown in the streams flowing into the Black Sea, and are therefore absent from the Danube. They are provided with small gill-slits, which can be closed so as to enable them to remain some time out of water. They are tenacious of life, bite hard, and feed on water-insects, and occasionally on plants.

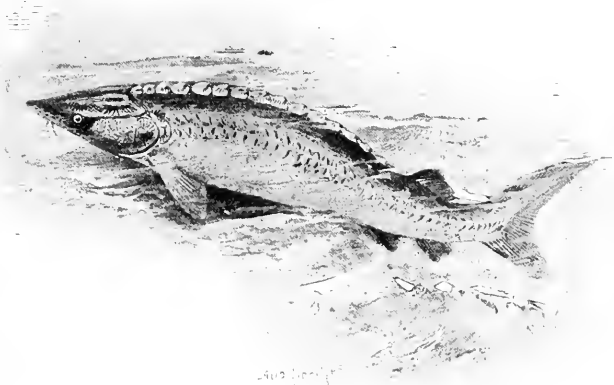
For more than half a century naturalists have been acquainted with a small pellucid marine creature, elongate in shape, and much flattened from side to side, with a disproportionately small head. Such specimens of these fishes as were taken in the early days of its history were captured near the surface, in company with jelly fishes and other transparent creatures; and it was not long before it became evident that there were several kinds of these leptocephalids (*Leptocephalus*), as, from their ridiculously small heads, they were named. One of these leptocephalids living in an aquarium at Roseoff, Brittany, gradually became opaque and cylindrical, till finally it assumed the appearance of a minute conger-eel; and in 1901 it was demonstrated that a leptocephalid living in swarms in deep water near

the Straits of Messina, was the young of the fresh-water eel. It has been named *Leptocephalus brevirostris*, but this title has, of course, to give place to *Anguilla vulgaris*. The specimens taken from time to time at the surface of the ocean were wanderers which, from some cause or other, had been driven out of their own proper zone. As the result of these observations, it is now known that the eel, when full-grown, makes its way down the ditches and streams leading from the ponds it inhabits into the large rivers, and so to the sea, where it descends to a depth of some 560 fathoms. On the way its skin becomes silvery and bright, its eyes grow large and dark, while the reproductive elements (the milt and eggs) develop in both sexes.

Those eels which do not descend into the sea (for some remain landlocked) never develop reproductive organs. In breeding-eels the males have narrower snouts than females; the so-called sharp-nosed and broad-nosed eels being merely immature males and females of one and the same species. Eels spawn at great depths in the middle of winter. The innumerable young hatched from the eggs grow to a length of nearly three inches, as the flat, transparent leptocephalids, which subsequently change their shape to become young eels or elvers. Elvers ascend rivers in millions; "eel-fare" being the English name given to their migration. Some of the young eels climb banks and pass over wet fields till they eventually reach suitable ponds, but others stay in holes in the muddy banks of streams. Their numbers are greatly reduced as the migration proceeds, many of the elvers being eaten by fishes and birds, while vast quantities are caught and sold during the "eel-fare" for human consumption. In warm weather elvers travel by night, but remain in the daytime in quiet gravelly spots under stones or buried in the weeds, and grow larger during their wanderings. When they come upon mill-weirs or other obstructions, they endeavour to ascend in places where water drips through, and are assisted in their efforts at climbing by the stickiness of their skins and the suppleness of their thin bodies; and there are many cases where they have been known to make a circuit over wet ground so as to get round an obstacle or reach other water. Living in the mud during the day and feeding at night, they spend their time in their chosen haunts until old enough to breed, when they endeavour to return to the sea, many of them being caught in the eel-bucks or eel-traps, which in consequence of their habits are always placed with their mouths up-stream. In the cold season they cease their wanderings, moving about occasionally, however, when they are one or two years old, at which time they are caught in large quantities swimming against the current, and sent to fish-breeders, and placed in ponds where they attain their full size.

The sturgeon (*Acipenser sturio*), a so-called royal fish, belongs to a very different and more archaic group, although still included in the great division of the Teleostomi. Instead of being clothed with scales, its body is protected by rows of prominent bony plates, and its head is invested with a number of large flat shields of the same substance. This huge fish is an inhabitant of the North Atlantic, and is unknown in the Mediterranean and adjacent seas. On the back it is furnished with from eleven to thirteen rows of bony plates, high in the middle and lower in front, while on the sides it has from twenty-six to

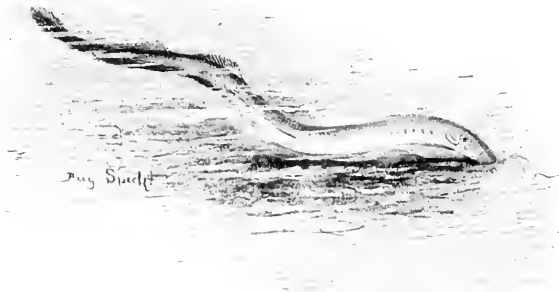
thirty-one larger plates, closely placed, and from eleven to thirteen on the under side. The head is moderately long, triangular in form, and has round barbels, a narrow upper lip, and a thick lower lip parted in the middle line. Occasionally sturgeon are taken in British waters, where they become, *ipso facto*, the property of the sovereign.



THE STURGEON.

Lampreys. Among vertebrate animals, not included in the class of fishes, are the lampreys and hag-fishes (Cyclostomata), broadly distinguished from fishes by their circular, jawless, sucking mouths: they possess only one nostril, are devoid of paired fins, have from six to seven gill-slits on each side of the body, and their skeleton is cartilaginous. In the rivers of Europe they are represented typically by the lampreys, which, by means of the fleshy lips of their round or crescent-shaped sucking-mouths, adhere tightly to certain fishes, drawing back the club-shaped tongue to form a vacuum, and at the same time wounding their prey with the sharp lip-teeth, in order to suck the blood. Lampreys undergo a complex transformation after they emerge from the egg, the larvæ (long regarded as a distinct animal, under the name of *Ammocetes*) are blind, and live at the bottom of rivers, and begin their metamorphosis into full-grown lampreys in the autumn of the fourth or fifth year. The river-lampreys, which enter fresh water from the sea, are about 8 inches long, and when fully developed travel back to the sea, returning to the place of their birth after the lapse of some years, when they are ripe for spawning. Among the three species found in Europe the sea-lamprey (*Petromyzon marinus*), which attains a length of about 3 feet, is greenish in colour with dull yellow and brown spots, and is characterised by a distinctly separated dorsal fin. The river-lamprey (*P. fluvialilis*), on the other hand, which is about 18 inches long, and occurs in nearly all the fresh waters of Europe, as also in those of North America and Japan, is green above, with yellowish sides, and

silver-white beneath, and has one angulated dorsal fin. The brook-lamprey (*P. branchialis*), which, unlike the other species, is distributed all over the Northern Hemisphere, and spends all its life in brooks and small streams, is bluish green above and whitish beneath, with two dorsal fins which join, and a mouth-opening as broad as the head.

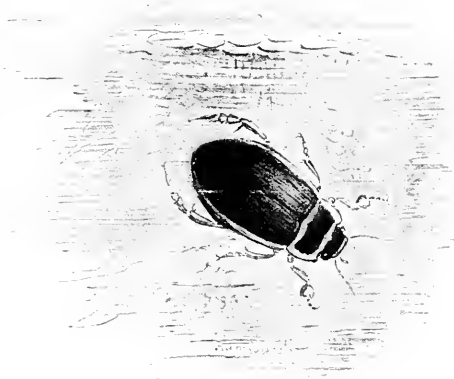


THE RIVER-LAMPREY.

**Brown Water-
Beetle.**

Passing on to the consideration of the aquatic insects and those living near the water, a few of the carnivorous ground-beetles frequenting hedges and banks claim first attention. The species most commonly met with is the common shore-beetle (*Elaphrus riparius*), which is of a bronzy green colour with red legs, and the wing-covers adorned with four rows of violet eye-like spots. A distant relative, the great brown water-beetle (*Dytiscus marginalis*), belongs to a carnivorous family, feeding exclusively on aquatic organisms. Distinguished from other water-beetles by its thread-like feelers, which are carried open even in the water, this insect is from 1 to 1½ inches long, dark olive-green above and yellow below, with a yellow crescent near the tips of the elytra. When caught in a net with other creatures, in a mass of mud and water-plants, it soon attracts attention by its restless behaviour; but when in its usual haunts, and not flying from one stretch of water to another, is by no means conspicuous, as it keeps under water. It is obliged, however, to come frequently to the surface to breathe, and as most of the breathing-apertures are situated under the wings, near the hind extremity, it raises the lower end of the body out of the water for the purpose of respiration, lifting the wing-covers slightly and holding the head obliquely downwards: if disturbed it dives at once. The process of respiration is rapidly performed, and, as the breathing-apertures are generally large, such a quantity of air is inhaled that the beetle becomes very light and has to make great efforts to sink, its diving being generally oblique and scarcely ever in a perpendicular direction. Only the hind-legs are used in swimming: the legs of the

male being covered with two rows of swimming-hairs, of which the female has but one. In swimming, the middle legs, which are provided with a smaller number of hairs, are used to steer with, the front legs being nearly always occupied in catching the prey and conveying it to the mouth. The body, which is unusually flat, is well adapted for cleaving the water. The larvæ are obtainable from stagnant water in the spring, and are among the largest inhabiting fresh water: when fully grown they are a little over two inches long, and recognisable by their large scythe-shaped upper jaws, the inner side of which is toothless, as well as by the absence of any real mouth, and the flatness of the head. When the larvæ rise to breathe, they are obliged to hold their breathing-pores, which are situated at the end of the last ring of the body, above the water, and, in doing so, the insect, which is then twisted into a double curve, hangs on to the surface by means of certain appendages at the back of the body which



THE GREAT BROWN WATER-BEETLE.

are stretched flat on the water. When disturbed in this position, it drops suddenly some distance into the water, with a vigorous movement of the hind part of the body. The larva swims quietly about, using its hair-covered legs as oars, and lives a life of voracity, not like the beetle devouring its prey, but sucking out the juices with the help of the upper jaw, on the inside of which is a groove, open at the top and leading into the alimentary canal. For their metamorphosis into pupæ the larvæ go on land.

Whirligig Beetles.

Some of the most extraordinary of all aquatic insects are the whirligig-beetles, which are sociable insects, swimming about in fine weather on the surface of the water in wavy cross-lines and spiral curves. These beetles not only swim on the surface, but dive in search of food and to protect themselves from bad weather or threatening danger. The eyes are strikingly adapted for a life between air and water, the beetle being enabled to see its surroundings both above and under water, owing to the circumstance that each eye is divided by a broad ridge into two separate portions, one situated on the upper side of the head and the other beneath. One pair of these divisions is used for observing objects above the water, and the other for those beneath; a similar arrangement existing in a species of fish living off the coasts of South America, where it swims on the surface. The legs are so entirely adapted for swimming

that on land the whirligig-beetle is awkward in its movements, although, like all aquatic insects, it can fly from one stretch of water to another. Respiration is performed like that of ordinary beetles, but the larvæ possess so-called air-gills, which are peculiar respiratory organs, by means of which oxygen is extracted from the water, the gills being intersected by air-canals connected with those in the rest of the body. The larvæ, which, like the beetle itself, are carnivorous, leave the water as soon as their metamorphosis is about to take place. This group is represented in Europe by about a dozen different species, the best known being *Gyrinus natator*, which is a quarter of an inch long, ovate, glossy bluish black in colour, with a reddish mouth and legs, the elytra being also reddish on their reflexed edges.

Black Water-Beetle. The large black water-beetle (*Hydrophilus piceus*) belongs to a totally different group from the one containing the common brown species. This beetle is obliged to come to the surface of the water for the purpose of breathing, but, unlike the brown species, holds its head and not its back out of the water, and during this process bends it on one side in such a way that a hairy spot lying near the hollow of the eye touches the water. At the same it lays the hollow side of its hairy club-shaped antennæ in such a way against the head that a tube-like air-canal is formed towards the hairy under part of the body. It then begins to perform a curious pumping motion, alternately lifting and dropping its body, the air being conducted in this manner through the silk-like hairs which extend over the whole breadth of the body on the under side. The wing-cases also contribute towards the retaining of the air on the lower surface of the body; which, on account of the covering of air, glistens like silver. When swimming, the great black water-beetle employs not only its hind-legs, but also the middle pair, using them alternately so as to waddle in the water. Nevertheless, it swims much less vigorously than the brown species. The males are characterised by a hatchet-shaped broadening of the last joint on the front-legs, at the base of the claw: the females, like those of the brown species, are of two types, some having a ridge-like projection on the front part of the edge of the elytra, while others have none. Unlike the brown species, which is carnivorous, the black water-beetle is omnivorous, for, though it is generally said to live on plants alone, it also eats dead insects and such living animals as it can kill. From a substance issuing in threads from tube-like projections in the rear of the body, this beetle and its relatives weave a white, circular web of considerable size, with a continuation on one side in the shape of a chimney; in this the large oval eggs are laid, the larvæ which emerge from them spending the first part of their life in the web, and going on land when the metamorphosis takes place. This web is attached to the under side of a leaf, and seen from the bank looks like a piece of paper dropped into the water. The larvæ, like those of the brown species, feed on water-insects, whose juices they suck with the orifice of the mouth, after first crushing their prey. These larvæ carry their captures to land, and there raise their heads in such a way that the opening of the mouth and the food within are held vertically, and in this peculiar position, which prevents its juices escaping, they devour the prey. If they fed in the water a large portion of the nourishment would be lost, and a quantity of water would get into the alimentary canal

Horned Beetle. On plants growing in stagnant or fresh water may be found the hook-beetles, which when taken are quite dry to the touch, owing to their being completely covered with air while in the water. Among these is the horned beetle (*Parnus prolifericornis*), a species common in stagnant water, oval, and almost cylindrical in shape, and of a greenish grey colour, covered with short hairs, speckled on the elytra, slightly streaked, and a quarter of an inch long. The bronze pond-beetle (*Elmis æneus*) dwells on the rough stones in the bed of streams, clinging to the bottom with its long legs or creeping slowly and clumsily under water; it is blackish, with more or less of a bronze-like glitter, and about an eighth of an inch in length. Another river-beetle is *Heterocerus marginatus*, which is nearly a quarter of an inch long, and digs itself holes in the mud, very often entirely covering itself. It has a dense coating of short black hairs which stand erect, and a few spots on the edges of the back, the corners of the thorax, the elytra, and legs are pale yellowish red.

Thick Legged Beetle. Among beetles which live in water only as larvæ, those known as reed-beetles deserve particular notice. The pale coloured larvæ, which are half an inch long, live in the mud on the roots of white water-lilies, hog-weed, and other aquatic plants. For the purpose of breathing, they use the air which is always found in abundance in the air-canals of water-roots, obtaining this by pressing into the plants two scythe-shaped, brown appendages, placed at the back of the body. These are simply the edges of the orifice of the air-canals extended along the body on one side; by this pressure they open two longitudinal slits at the back of these appendages, and draw in the air through these slits, while two small orifices at the base of the appendages appear to serve for the purpose of exhalation. The larva of the thick-legged beetle, which feeds on water-roots, constructs before its metamorphosis a long, oval-shaped cell, which it fastens to the root so as to enable it to bite into the latter, and thus let the air escape through the hole, expelling at the same time the water from the cell. When this is done, the larva closes the cell, and thus surrounded by air begins its transformation into a pupa. After the adult beetle has emerged, it eats its way out of the cell, and lifted by a stratum of air, which clings to the short silky hairs on the lower part of the body, rises to the surface of the water, where it may frequently be seen. Later on it deposits its eggs near the leaves of certain plants, generally using for this purpose the leaves of the white water-lily. These are bitten through in one place, in order that the eggs may be glued on the lower side of the leaf in two curved rows close to the hole. This beetle (*Donacia crassipes*), which is broad and flat, is metallic green in colour with a violet reflection, and has silver hairs beneath, the legs and antennæ being reddish at their bases: the length is a little under half an inch.

Gnat. Of the numerous flies and gnats frequenting the neighbourhood of water in central Europe, the common gnat (*Culex pipiens*) is one of the best known and the most detested. Its larvæ live in stagnant waters, generally hanging on the surface by means of their breathing-tube, but diving at once if the water be at all disturbed. This gnat, which is a quarter of an inch long, is marked with two longitudinal stripes on the yellowish brown thorax, the back being grey, the wings white, and the legs light grey. The female of this species lays three hundred eggs, and the young are developed after the lapse of from four to

five weeks, the enormous number of gnats in existence being easily accounted for, since from four to six generations may be produced in a single season. Gnats form the favourite food of many birds, especially swallows, but they are most troublesome to mammals, sucking the blood and pursuing their victims day and night, most probably being attracted by the odour of perspiration which emanates from the body; they live also on the juices of plants and other liquids, and in many cases die without having once tasted blood at all, this being especially the case with the males, which bite but seldom. The females, on the other hand, produce painful inflammation by leaving their bite, although they are not the vehicle by which the parasite of malaria is introduced, this being carried by gnats or mosquitoes of the allied genus *Anopheles*, one of which inhabits the Roman Campagna.

Stagnant waters often assume a red appearance from the worm-shaped larvæ of the plumed midge (*Chironomus plumosus*), which belongs to the family of the twitching gnats, so-called because of the convulsive motion of the long front-legs while the insect is at rest. The plumed midge has a pale green thorax with grey streaks on the back of the body, which is dusky brown, while there are lighter ridges and black specks on the centre of the foremost edge of the white wings: the length is about five-eighths of an inch. The bearded midges which belong to the same family also live in water during the larval state, and are found among bushes: their bite is very painful. To this group belong also the black midges (*Ceratopogon pulicarius*), which often attack the natives of Lapland in legions, creeping into the mouth and nose, from which it is almost impossible to expel them.

Still greater torments are the sand-flies (*Simuliidæ*), the larvæ of which live in water under bag-like cells, and are especially abundant in stagnant pools. These minute flies creep into the nose, mouth, and ears of cattle, when the bite is so painful as in some cases to cause death. The crawling sand-fly (*Simulia reptans*), so frequently met with in spring in continental woods, is particularly troublesome, as it generally bites on the most sensitive parts of the face, *i.e.* near the nostrils. In length an eighth of an inch or less, it has white rims to the dark blue thorax, the back is brown shading to black, the legs are brown with white shields, and the front joints of the fore-legs dark black. One of the worst of this group of flies is the Columbatsch fly (*S. columbatzensis*), taking its name from a village in Servia on the right bank of the Danube, where it abounds. About an eighth of an inch long, and ash-grey in colour, with two broad dusky stripes on the ridge of the breast, divided by a fine line, and black spots on the hind part of the body, this fly makes its appearance in Servia in April and May, and again in August in cloud-like masses in the vicinity of woods and water, attacking man and beast, very often entirely covering the body, and causing by its bite inflammation, fever, and convulsions, sometimes resulting in death, in consequence of the swelling which the bite produces. In 1783, in the Banat district, fifty-three horses, one hundred and thirty-one head of cattle, and three hundred and sixteen sheep were killed by this insect: in the year 1830, on the banks of the River March, several hundred horses and cattle died from the same cause; and in 1785 an immense multitude were driven by a storm from Servia into Transylvania, where

they were destroyed by a torrential downpour of rain, after having killed eleven head of cattle in the space of a few hours. The peasants regard the flesh of animals killed by this insect as poisonous, and believe that these gnats—many of which are eaten by fishes as larvæ or snapped up as full-grown insects—come from a cave in Columbatsch, in which St. George is said to have killed the dragon.

Pond-Skater. On the surface of stagnant pools the pond-skaters (*Hydro-metra*) disport themselves side by side with the whirligig-beetles. In these insects the body and lower parts of two pairs of legs are strikingly long and thin, the front-legs (between which lies the proboscis, which is long and provided with stinging bristles) being much shorter and out of proportion. These insects look eccentric enough, whether resting on the water or running about, with their sprawling middle and hind legs resting on the surface of the water, which almost appears as if depressed by their touch: while owing to the fine, hairy, air-retaining covering of the legs, the insects do not sink below the surface. With a simultaneous motion, chiefly made by the middle pair of legs, they glide



POND-SKATERS.

swiftly along in jerks, preying on weaker insects, especially gnats which have recently emerged from the pupæ, whose juices they suck with the proboscis, which is also used for biting. In their way of living and appearance, the larvæ of these insects closely resemble the adults, since they have short backs and are devoid of wings. The best known species are *H. paludum*, which is about half an inch long, and *H. lacustris*, which never measures more than three eighths of an inch.

Water-Scorpion. Another family of the Rhynchota, or bugs, is represented by the water-scorpion (*Nepa cinerea*), which owes its name to the resemblance of the front-legs to a scorpion's claws. The body is comparatively short and compressed, greyish brown in colour, with red markings and red veins in the wings. The swimming powers of this insect are not great, the middle and hind legs, which are used for the purpose in pairs, being only sparsely covered with hairs. When at rest, the water-scorpion hangs head-downwards in a slanting position on some water-plant, to which it clings with the hind-legs, thus having its breathing-tube elevated above the surface. Here it watches motionless for its prey, which it seizes with its pincer-like front-legs. The eggs are deposited on decayed floating reeds, in such a way that each is inserted in the plant, with only the strange

thread-like appendage protruding from the surface. The larvæ which emerge from the eggs have only rudimentary wings, but are otherwise similar to the parent insects, except with regard to their breathing-apparatus.

Water-Boatman. An aquatic insect which, if carelessly handled, makes its displeasure known by a painful sting, and has therefore been given the name of the water-bee, is the water-boatman (*Notonecta glauca*), a creature which always swims on its back, and is coloured accordingly, the under surface being dark, while, owing to the air-bubbles which adhere to it, the surface of the back when under water appears white. These insects swim well, using as sculls the long and powerful hind-legs, which are furnished with hairs; while the front

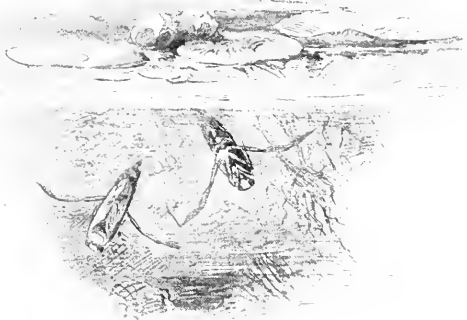


THE WATER-SCORPION.

and middle pair serve for seizing and holding the prey. In order to inhale the air, water-boatmen project the hind end of the body out of the water in the same way as brown water-beetles. The breathing-apertures situated in this part are, however, small, while the larger ones, which are provided with delicate, protecting hairs, and probably serve more especially for the purpose of respiration, are placed some way off, on the side of the thorax, at the root of the wings. Others, again, are situated between the middle and back of the thorax, on the edge of the under part of the body. To these apertures air is conducted in a peculiar manner. The abdomen is ridged, and raised on the edges so as to form two shallow longitudinal grooves on the sides, covered with a sort of roof formed by two rows of hairs, one of which extends along the outer edge of the under side of the body, the other down the middle: the grooves thus forming channels along which the air is conducted from the hind-

end of the body to the breathing-apertures on the thorax. The insect may, indeed, often be seen passing its hind-legs like the bow of a violin, across the back of its body, in order to force the air in one or other direction into the grooves, where the rows of hairs separate for its admission.

Caddis-Fly. Many representatives of the group of insects known as Neuroptera frequent the banks of streams, and when young live in water. Nearly every angler is familiar with caddis-worms, which are insect-larvæ living in cases of their own making, the materials used being fragments of shells, sand, sticks, and leaves. These larvæ, which are mainly carnivorous, though occasionally feeding on vegetable matter, cling by little side-hooks to their dwelling, from which only the fore part of the body protrudes; and in this way they creep about in the water, retiring into their artificial shells at the slightest touch, and closing the opening in front with the horny head-shield. The caddis-flies, to

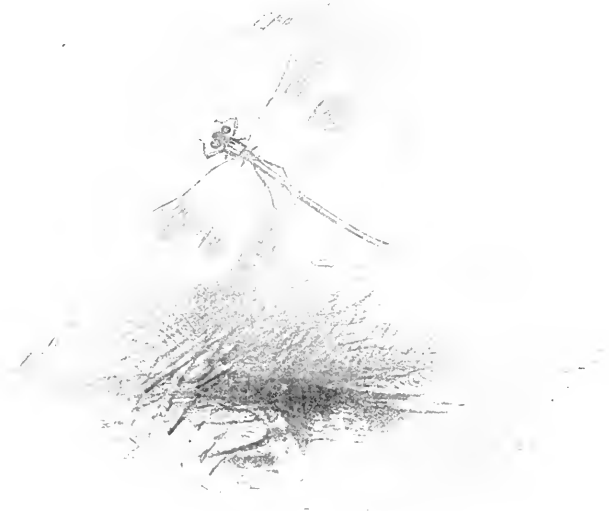


THE WATER-BOATMAN.

which these larvæ pertain, constitute the subgroup Trichoptera, and are characterised by the presence of transverse veins on both pairs of wings, as well as by the hind-pair folding up like a fan so as to be covered, as with a roof, by the front-pair. As full-grown insects they live on the juices of flowers, and are often known as water-moths, owing to their moth-like appearance.

Dragon-Fly. Another subgroup (Odonata) is represented by the dragon-flies, which also live when young in the water. These active insects are specially characterised by well-developed mouth-organs, and the two pairs of long and gauzy wings, which are almost equal in size, as well as by the presence of three joints in the feet. Swift in flight and predaceous in habit, they skim the water like swallows, the females often dropping their eggs as they dip their tails in the water. They live on aquatic insects and fish-spawn; and as larvæ have a large lower lip, divided into two sections, bearing on the end a pair of pincer-like hooks, which may be placed over the face when the insect is resting so as to form a kind of mask. On

the banks of streams, in woods and hilly countries, occurs the large dragon-fly (*Eshaa grandis*), a species from $2\frac{1}{2}$ to $2\frac{3}{4}$ inches in length, with a T-shaped spot on the forehead, a yellow or reddish brown-spotted body, two yellow streaks on the side of the thorax, and blue spots on the back between the wings and on the side of the hind part of the abdomen. Another kind is the beautiful *Culepteryx virgo*, about $1\frac{1}{4}$ inches long, and common everywhere, with the body of the male metallic blue, and that of the female metallic green; the broadly rounded wings of the former being bluish black, and those of the latter reddish brown.



DEMOISELLE DRAGON-FLY.

May-Flies. The day-flies, or May-flies, which belong to the same group, are more remarkable from their number than from their size. These insects have rudimentary mouth-organs, small or rudimentary hind-wings, and two or three slender bristles or tail-like appendages at the end of the body. They are remarkable in their development and mode of life: the fully-developed insect, unlike any other, casting its skin twice, and pairing in the air, after which it often dies in the space of a few hours without having once taken food. The cast skins are left in numbers on plants along the margins of water; and some species appear during August, towards evening, in such numbers on the banks of streams that their bodies have been used as manure. The larvæ, which are provided with leaf-like breathing-organs, live from two to three years in the water, passing through a

stage known as the sub-imago, when they emerge, and moult into the fully developed insect. The common May-fly (*Ephemera vulgata*), known to fly-fishers in the sub-imago state as the "green drake," is over half an inch in length, brown in colour, with three rows of spots on an orange-yellow body, the wings being barred with brown, with a brown stripe on the front pair. Another species is *Palingenia virgo*, which when full grown is about three-quarters of an inch long, and often appears in such numbers that the multitude, as it dances and dies, looks like falling snow.



WHITE MAY-FLY.

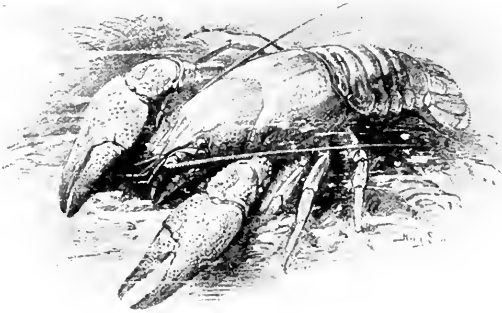
Spiders.

Among reeds by the edge of the water, as well as in woods, may be seen the large wheel-shaped webs of the bank-spider (*Tetragnatha extensa*), which belongs to the tribe of orb-spinners. This species has a long body with legs twice as long, and is of a yellowish green colour, marked with a black feather-like stripe down the middle. About double the size, occasionally attaining the length of three-quarters of an inch, is the water-spider (*Argyroneta aquatica*), which lives in fresh water all over Europe. This species, which is reddish brown in colour, has the grey back dotted with rows of spots; the males being lighter than the females. These spiders, which feed on water-lice and insect-larvæ, live in hollow webs, about the size and shape of a pigeon's egg, with the aperture opening downwards. From this they spin threads, attaching them to the surrounding plants, and when diving they enclose the hind part of the body in an air-bubble, which is carried down to fill the water-tight web with oxygen. The velvet-spider (*Chebion*

holosericea) is another species living on aquatic plants on the banks of ponds and streams, but in autumn under dry leaves. About a quarter of an inch in length, it is of a uniform greenish colour, except on the back, which is covered with soft, silky hairs. Of the same size is one of the wolf-spiders (*Lycosa saccata*), which lives on the shores of ponds and rivers and other damp spots. In colour it is brown shading into black, with a long yellowish white stripe on the hind part of the body, and a streak of the same colour on the thorax, the legs being ringed with varying bars. The female may often be noticed as she carries a cocoon attached to her spinneret.

Crayfish.

Crustaceans are well represented in inland water by the crayfish (*Astacus*, or *Potamobita fluviatilis*), which lives in holes on the banks, or under stones, and seeks its prey at night, devouring in preference dead animals, such as fishes, snails, and worms. The females are distinguished from the males by



THE CRAYFISH.

the smaller claws and broader tail, and the presence of four curved styles on the first two rings of the latter. Both sexes are greenish or brownish in colour, but in rare cases may be blue or red, and when cooked nearly always turn red. They are found in rivers flowing from calcareous ground, and never in granite districts: and their favourite haunts are those parts of the rivers which flow north and south and yield more shade than those running east and west. They cast their skin two or three times during the first year, and afterwards annually: after this process they are for some time soft, and are then called butter-crayfish: in winter they live in holes in the banks and in burrows they make for themselves in streams liable to freeze. The burrows may be more than a yard deep. When the soil is peaty, they work their way into it in all directions, and are often dug out at some distance from the banks. In general appearance they are of the same character as lobsters or prawns. They feed on anything animal or vegetable, living or dead, even on the weaker members of their own species. In size they measure about 4 inches, but

there are crayfishes, inhabiting for the most part the Southern Hemisphere, which are much longer. It may be well to say that crayfishes are purely fresh-water, and that the crawfish, or rock-lobsters (*Palinurus*), which differ from them in several ways, are only found in salt water.

The isopod crustaceans, which live partially on land, are also represented in fresh water by the common water-louse (*Asellus aquaticus*), inhabiting all the ponds and pools of Europe, and creeping about on the bottom, or on stones and water-plants. It winters in the mud, is grey with brownish yellow spots, and is under half an inch long. In deep wells and lakes its place is taken by *A. cavaticus*, which has no eyes, is almost colourless, and measures about a quarter of an inch.

One of the best known crustaceans frequenting the fresh waters of central Europe is the fresh-water shrimp (*Gammarus pulex*), belonging to the amphipod group of the class. It is about half an inch in length, and yellowish brown in colour, with a dark brown longitudinal stripe on each side. Another species of this interesting family is Rosel's fresh-water shrimp (*G. fluviatilis*), distinguished by a pointed spine on the last ring of the body, and found in sluggish waters in marshes and lakes. Here also dwells the well-shrimp (*G. puteanus*), which is as common as the other two, but distinguished by the nearly square leaf-like penultimate joint of the four front-legs. It is found in subterranean waters and at the bottom of lakes, and is sometimes so numerous in wells that the water becomes unfit for use.

In the so-called copepod, or oar-footed, group, the body is long and distinctly divided into segments. The females of one of the common species, *Cyclops coronatus*, carry their eggs in two bladder-like bags, at the hind part of the body, which is pear-shaped in outline, the back being furnished with an appendage tipped with four long bristles. They live in shady brooks in slowly flowing water, swim in jerks and leaps, and are under an eighth of an inch in length.

Another group, the ostracods, possess a bivalve shell, formed of the right and left halves of the carapace, with a ligament to keep them open and a muscle to keep them shut, in a way curiously suggestive of the bivalve molluscs. The best known is *Cypris fusca*, which is found in pools and ditches in great numbers, and takes refuge in the mud when they dry up, ready to appear after every shower. Yet another group, the Cladocera, is so called from the branched antennæ, by means of which these crustaceans swim. They form an important item of food for many kinds of fishes; and are furnished with five or six pairs of legs with leaf-shaped feet. They cast their skins frequently when young, and the females, which are capable of propagating without the males, carry their eggs on their back. One of the commonest species is the water-flea, *Daphnia pulex*, which has a reddish, curved, short-pointed shell.

Of larger size, and with or without a shield-shaped bivalve shell, but always with from ten to forty well-developed leaf-shaped gill-appendages, are the phyllopod crustaceans. They live in ditches, pools, marshes, and similar situations, generally in fresh but sometimes in salt water, although never in the sea, and are characterised by the small percentage of males, which are sometimes entirely wanting for several generations. In some years the stagnant pools may con-

tain *Apus cancriformis*, which has an oval shield, emarginate on the back, and bearing three eyes in front: the hind part of the body branching into two long, many-jointed bristles. In spring this species lives in the mud, to vanish when the water dries up: but, since the eggs possess self-developing powers, the species often reappears after the lapse of several years. These minute creatures swim on their backs: and not till after the skin has been cast several times are their numerous feet developed. From the last, which has no fin-leaves between the bristles on the tail, the species known as *A. productus* is distinguished by a leaf between most of the tail-bristles. The first-named species reappeared recently in England, after having been unknown for many years.



APUS CANCRIFORMIS

Another type, *Branchipus stagnalis*, which also swims on its back, has a narrow, compressed, many-jointed body, with four thread-like feelers, two large eyes, flat-jointed, palmated feet, and a tail branching into two small leaves. This species dwells in fresh water only, but another, the brine-shrimp (*Artemia salina*), which often causes the water in salt-works to appear red, from its great numbers, is found in pools in the vicinity of dykes that keep out the encroachment of the sea. This tiny crustacean has attracted attention from the fact that in the Crimea, by a gradual increase of salt in the water of the saline lakes, it may become modified into the form known as *A. milhauseni*, which is an inhabitant of these lakes: while by diminishing the percentage of salt, it may again be transformed into *A. salina*.

Worms.

Worms are naturally numerous in the vicinity of water. In the sparsely bristled group we have a species known as *Rhynchelmis limosella*, which lives in muddy ditches, and is of a light purple colour, with a long, thin, thread-like bristle on the head: it is flat and angular on the back, and almost square in form. The tube-worms are also inhabitants of the muddy bottoms of ditches, where they live with the fore end of the body stuck into the mud, while the hind part protrudes, and is in a constant state of vibration. Of these the brook-worm (*Tubifex rivulorum*) is often seen in thousands forming red patches on the river-bottom, which disappear at once if stirred with a stick or trodden upon; the worms, which are 1 or 2 inches long, and have a pair of barely visible bristles, retiring into their mud-tubes, to reappear after an interval. Another worm, the beaked naïs (*Nais proboscidea*), unlike the two last, does not live in a tube but on aquatic plants. It is about half an inch long, with the head terminating in a long, thread-like prolongation, and furnished with two eyes; the body being transparent and slightly jointed, with four longitudinal rows of bristles. Nearly allied is the snake-naïs (*N. serpentina*), of rather larger dimensions, and without the prolongation, but with two eyes, and three or four blackish transverse bars on the head. These worms, which appear to the unaided eye as twisting threads, do not as a rule propagate by eggs but by spontaneous self-division.

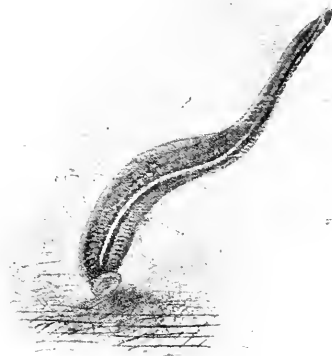
In another group we have *Dendrocaelum lacteum*, about an inch long, which has black eyes with an intestine showing violet through the skin, and the body pointed at the back. Common in ditches, where it creeps about

dragging its body along in jerks, it is tenacious of life, and when cut in pieces joins itself again, even the sucking-tube being capable of performing its function when severed from the other parts. With the worms are often classed the wheel-animalcules, or Rotifera, which appear in such numbers in the height of summer that they form milky coverings to aquatic plants. Nearly all subsist on small animals and plants, which they sweep into their mouths by the movements of the fine hairs, or cilia, on the wheel-like disk.

Leeches.

Representing another class (Hirudinea) are the well-known leeches, of which the most remarkable is the common *Hirudo medicinalis*, once used so largely in medical practice, whose life-history has been so frequently given at length that it need not be repeated on this occasion.

Another familiar member of the group is the horse-leech (*Aulostoma gulo*),



THE LEECH.

which is greenish black above and yellow below, and is common in ditches and stagnant water. A third form is the eight-eyed leech (*Nepheleis vulgaris*), coloured dark brown above, often marked with transverse rows of yellow spots, and yellow beneath. Of smaller size are the so-called snail-suckers (*Clepsine*), which live on the juices of pond-snails.

Pond-Snails. From the small pond to the broad river, the fresh waters harbour multitudes of molluscs of various species, which play an important part in consuming decaying vegetable substances, and thus keeping the water clean and pure. Among these the pond-snails are most worthy of notice. All these are furnished



THE RAMSHORN POND-SNAIL.

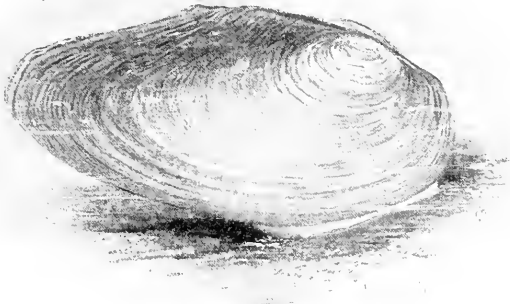
with thin shells, and being lung-breathers are obliged occasionally to rise to the surface for the purpose of respiration. The most common species is *Limnaea stagnalis*, the shell of which is 2 inches long, rather slender in form, in colour like horn, and consisting of seven or eight whorls, with a long spire and deep suture. There are several other species of the genus, and over sixty races, differing mainly in the number of whorls, the size of the lip, and the length of the spire. In the ramshorn (*Planorbis corneus*) the shell has no spire, but is of the shape of a rope coiled flat, with five or six whorls, a deep umbilicus, and a crescent-shaped mouth.

About an inch across, and horn-brown in colour, it may frequently be seen floating on the surface of ponds and sluggish streams in which it lives, or crawling under water in its peculiar jerky manner. Representing another family is *Physa fontinalis*, with a thin, translucent shell, in which the spire is left-handed: it is about half an inch long, with four or five whorls, the spire short, and the colour varying from yellow to reddish. This snail, which lives on aquatic plants, and may often be seen on the leaves above the water, is rather active in its movements.

These three genera are noteworthy for the threads used by certain of the species in climbing to the surface of the water to breathe, and for other purposes. This thread can hardly be said to be spun, being merely a thin line of mucus, and bearing no analogy to the byssus of the bivalves. In *Physa hypnorum* it has been known to attain a length of 14 inches, and the young of this species have

been observed climbing up and down permanent threads of this character for nearly three weeks. It is not used exclusively by the animal that makes it, since three *Physa* and a *Limnaea* have been found on a *Physa* thread together, and often two *Physa* will meet on a thread, and either fight for its possession, or pass one another content with the right of way. Among the molluscs living near water is the amber-snail (*Succinea patris*), the shell of which is about three-eighths of an inch long, and oval in shape, with three or four whorls, the mouth being oval and large. From the colour of the shell the species receives its popular name.

Leaving the air-breathers or pulmonates, we arrive at another order, that of the prosobranchiates, of which there is a well-known fresh-water representative in *Paludina vivipara*, characterised, as its name indicates, by bringing forth its young alive. It has a greenish shell, banded with brownish red, the



THE LARGE RIVER-MUSSEL.

whorls being rather swollen and six and a half in number, with the suture slight and the apex blunt. The shell is about $1\frac{1}{2}$ inches long, or the same length as another species, *P. contracta*, often mistaken for the first, but distinguished by the deep suture and umbilicus. In *Valvata piscinalis* we have a member of the next family, in which the shell forms a broad cone, and the whorls are six in number. As it is only a quarter of an inch in length, this mollusc is often overlooked, though in many places it exists in considerable numbers in ponds and sluggish streams, and particularly in canals. The gill-plume, which is protruded from the round mouth of the shell, has fourteen filaments on each side of the stalk.

Pond and River

Mussels.

Several kinds of bivalve molluscs also dwell in the inland waters of Europe. A common species is the one technically known as *Sphaerium corneum*, which is two-fifths of an inch in length, with a thin, convex shell of yellowish horn colour, having faint concentric bands. Another species, *S. ovale*, is larger and more noticeable, but somewhat local. Of another genus (*Pisidium*) there are several species of small size, the biggest being no larger

than *S. corneum*. In *Sphaerium* the shell is almost equilateral, in *Pisidium* it is inequilateral, and the former has two siphons, while the latter has only one.

By far the greater number of fresh-water bivalves have no siphon. Of these the most common are the river-mussels (*Unionidae*), which as a rule live so deeply embedded in the mud that only the anterior edges of the shell are visible. River-mussels possess an extraordinary adaptability, the different situations where they are found influencing the formation of the shell in a remarkable manner. Indeed, if they be removed by floods from rivers or old water-courses into stagnant water, a modification in form results from the change. These bivalves are represented in central Europe by the two genera *Unio* and *Anodonta*, the former with



THE GREEN HYDRA.

well-marked teeth to the hinge of the shell, the other with teeth rudimentary or absent. The painter's mussel (*U. pictorum*), so called from its shell being used by the old Dutch painters for holding their colours, is fairly common, but does not range north of Yorkshire in England, or very far north on the Continent. It is about 3 inches long, and the shell is nearly straight along its upper and lower margins. The pearl-mussel (*U. margaritifera*), which inhabits only such streams as do not contain much lime, is common to Europe and North America, and is about 5 inches long, with a thick, oblong shell, sometimes containing pearls. Should a certain parasite become embedded between the mantle and the shell, which is lined with nacre, it speedily becomes coated with a deposit of this substance, so as to form, if the grain

does not adhere to anything, a loose pearl. In Bavaria the proportion of pearls found is about one in a hundred mussels, but only those which are white and sufficiently bright are of any value. Several strings of these pearls are preserved in Dresden, which include some specimens as large as peas, clear and white, with a beautiful lustre, while others display less brightness, and yet others are only the so-called sand-pearls which just pass muster. *Anodonta* is represented by two species, one of which (*A. cygnea*) grows to over 5 inches in length, and is the largest of the river-mussels. The zebra-mussel (*Dreissensia polymorpha*) belongs to the *Mytilidae*, a family living chiefly in the sea. It is a three-cornered shell, 1½ inches long, keeled in the middle of both valves, and is the only fresh-water mussel attaching itself through life to other objects by means of a mooring-rope, or byssus, protruding from a slit between the valves. These mussels, which often adhere in clusters, so as to stop up water-pipes, and causing other damage, were originally natives of the rivers flowing into the Black Sea, but have been

transplanted to the waters of northern and western Europe. Adhering to the sides of ships they have been carried to the coasts of the Atlantic, the North Sea, and the Baltic, whence they have ascended the rivers; and they have thus made their way right across Germany, up the Rhine into the Main, by means of the Main Canal into the upper course of the Danube, and down the Danube to their original home in the Black Sea.

Lower Organisms. Leaving the molluses, we may briefly notice a few representatives of the multitude of lower forms of life. Of the Bryozoa the commonest is *Plumatella repens*, a foot or more long, consisting of club-shaped tubes, with about sixty tentacles, arranged in the shape of a horse-shoe, bearing single animals measuring a quarter of an inch. Of the Cœlenterata, which are represented in fresh water by the hydra and a few other forms, the chief characteristics are the radiate structure and the absence of alimentary canal, circulatory system, and respiratory apparatus, the animal being merely a system of cavities, in free communication with one another.

The most common fresh-water species are the green *Hydra viridis* and the brown *H. fusca*. A hydra is essentially a tube, consisting of two layers with a crown of from six to ten hollow tentacles round the mouth; and it can be cut into pieces, and each piece will grow into a complete animal, or it can be turned inside out and go on living as if nothing special had occurred. It fixes itself on aquatic plants, often to the lower side of a duckweed leaf, and feeds on small organisms sufficiently definite in structure to irritate its stinging cells into action.

In many inland waters occur sponges, representing a still lower subkingdom, that of the Porifera. These assume an endless variety of shapes, but in all cases the water passes through the fine pores, and is driven out through the larger ones. The two European species are the pond-sponge (*Spongilla lacustris*) and the river-sponge (*S. fluviatilis*).

Lowest of all among the subkingdoms of the animal series are the Protozoa, which are microscopic and of very simple structure. Among these, the trumpet-animalcule (*Stentor polymorphus*) is $\frac{1}{3}$ of an inch in length, and covered with cilia all along the upper surface, but most abundantly at the edge of the trumpet-like fore-end; and with these cilia it whirls the food into its body. The tongue-animalcule (*Acineta linguifera*) has a body which protrudes like a tongue from a fixed, stalk-



THE TRUMPET-ANIMALCULE.

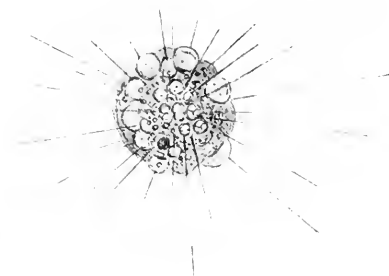
like covering. Equally interesting are the flagellated infusorians, one species of which, *Euglena viridis*, is occasionally found in such numbers as to give the water the appearance of green-pea soup. When at rest it is spindle-shaped, and has a red speck at one end. Another common species is *Volvox globator*, a spherical colony of single cells, which moves forward in the water with a rolling motion. Among the group of Heliozoa is the sun-animalcule (*Actinophrys sol*), which is a globular mass of tissue with radiating thread-like processes.



VOLVOX.

Lastly, the group of Lobosa is represented by *Amoeba proteus*, found on the muddy bottoms of ponds, which is about $\frac{1}{100}$ inch in diameter and constantly changes in shape, gliding along by protruding and retracting its thread-like pro-

cesses or pseudopods, and occasionally swimming as a mere mass of jelly, recognizable only by its nucleus. Another species, *A. princeps*, has several of these fixed



THE SUN-ANIMALCULE.

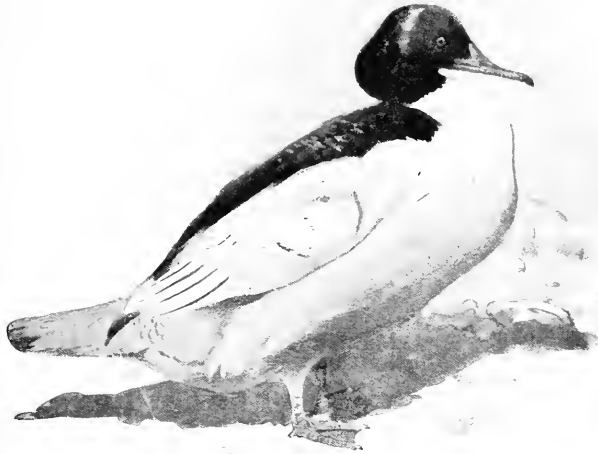
points or nuclei. Rather more definite is *Pelomyxa palustris*, a white egg-shaped sac, about the size of a pin's head, which glides over the mud of stagnant pools, broad end foremost.

EUROPE

(NORTHERN, ALPINE, EASTERN AND SOUTHERN)







THE GOOSANDER.

CHAPTER VII

NORTHERN EUROPE

UNDER the title of northern Europe are included the Scandinavian peninsula, and such portion of European Russia as is situated north of the latitude of the Gulf of Finland. To some extent the fauna of this tract differs from that of the central European area.

Elk.

Among the hoofed mammals indigenous to this large portion of Europe are the roebuck, which does not range higher than 60° N.; the red deer, extending to 65° N., but unknown in northern Russia; and the fallow deer, which, as previously stated, is indigenous to the Mediterranean countries, whence it may have been introduced to these northern districts. In addition to these are several others, which, although originally inhabitants of central Europe, are now partly or entirely exterminated there, as, for instance, the elk (*Alces machlis*), which is a circumpolar species. In former times the range of the elk in the Old World extended as far as Great Britain and France in the west, and to Lombardy in the south. When it became extinct in Italy is

unknown, but in France it was last heard of in the third century. In 764 two courtiers of King Pepin, the father of Charlemagne, killed an elk in the forest of Viergrund, near Nordlingen, in Bavaria, the antlers of which, still preserved in the castle of Ambrose, are represented in a painting in the castle of Moritzburg, near Dresden. In the tenth century we hear of the elk as an inhabitant of Flanders; in the fourteenth century there were still elk in Bohemia; in the sixteenth century they were extinct in Mecklenburg, the specimen killed in Saxony, in 1746, probably having been one of a herd imported into Saxony, Brandenburg, and Dessau between 1720 and 1730. In Poland most of the elk were destroyed in 1828, and in Galicia the last was shot in 1760. In the seventeenth century Hungary still harboured a few elk, but they had all disappeared by the end of the next century; and in West Prussia the elk disappeared about the beginning of the nineteenth century. At the present time Scandinavia forms the western limits of area of the elk in Europe, although in many parts of that peninsula it has long been extinct. The only place in Germany where it still has a home is in the Ibenhorst Forest in East Prussia, which has long been celebrated for its elk. In Lithuania and the Baltic provinces of Russia, as far as the Ural Mountains, and northward and southward of those districts, elk are still here and there met with. Strange to say, the species has spread farther south since about 1850. In Asia the elk lingers in remote places, and ranges from the Urals to the Sea of Okhotsk, and from the Altai Mountains and Manchuria up to the Arctic Circle. From north-eastern Asia, by way of the land which once stretched across Bering Strait, it seems to have found its way into North America, where two races are now recognised.

Apart from the antlers and the so-called "bell" that hangs from the throat, the male elk is distinguished from the hind by being of clumsier and stronger build, and also considerably larger. A well-grown European elk has a total length of about 9 feet; the shoulder-height being about 6 feet, although the tail measures only 4 inches. In colour the hair is reddish brown, becoming blackish brown on the mane and sides of the head, while it is whitish on the legs. In winter the coat is lighter, being rather grey. Young elk are never spotted, and both sexes are of the same colour. The foot of the male is shorter and wider than that of the female, the hoofs being less pointed, and their slot deeper, so that good trackers easily recognise a stag's footprint. The form of its hoofs enables an elk to run lightly and easily on soft and marshy ground. The feet are large, deeply cleft, and provided with triangular, brownish black hoofs; the lateral hoofs being smaller and shorter and less projecting than those of the red deer. In running, the hoofs produce a clapping noise. An elk in running shoots its fore-legs well forward, and impels its body onward by the hind-legs; moving as fast as a red deer although it only trots. Elk are, moreover, excellent swimmers, and generally take up their abode in the wildest, most isolated, marshy country where water is at hand in which they can bathe.

From April to September elk frequent these marshy stretches of forest. but after rutting, that is, from September to the following April, seek more elevated ground not exposed to floods, and therefore having no ice in winter. When the weather is quiet and fine, elk sojourn in thickets of young deciduous

woods, but rain, snow, and fog keep them among the pines. The males, when shedding their antlers, seek open spots apart from the females, and in hot weather take to marshy ground where they cover themselves with mud for protection against flies. In September and October elk repair to winter-quarters in the dense forests for shelter from the cold, but their haunts are changed much sooner than those of other deer when there is not sufficient food or quiet. They cannot exist without water, or, as a substitute, snow licked from the ground. The food, according to season, consists of buds, young sprigs, leaves, bushes—principally willow—and bark, and grass. In February and March elk strip the bark off firs, and later on, in spring, that of soft-wooded deciduous trees. In winter they live principally on leaf-buds, in spring on all kinds of grass, especially the floating leaves of young reeds. On account of its long legs and short neck, the elk has much difficulty in grazing on short grass, and is obliged to lower its fore-quarters considerably, or even to kneel down. Besides cornfields, in which it does more damage by trampling the corn than by grazing, the elk visits fields of hemp, and by preference those of peas and buckwheat. Heather, black alder, and whortleberry bushes form its food in times of want; and cabbage and cherry-trees tempt it to enter gardens in autumn. In the woods, by stretching its head as high as possible up young trees, it bends down the top with its neck, breaks the crown, and eats the twigs; by which process the outer sides of the jaws and part of the neck are denuded of hair. Sometimes, however, an elk will press down young stems with the bare part of its muzzle. In search of food an elk wanders from its favourite haunt, which it leaves for ever when disturbed by dogs or beasts-of-prey. When in safety it feeds both by day and by night; but generally only before sunrise and after sunset, spending the rest of its time in the thickets or the open. On finishing its meal, it lies down in the same manner as a red deer, and rests and ruminates in much the same way as cattle.

Elk are in the main sociable and peaceable animals during most of the year, the adults of both sexes, as well as the calves, grazing together. After the rutting-season and the birth of the young, the family generally consists of an old stag, two hinds, two younger deer, and two calves. The young leave the mother before the pairing season, and the young stags remain apart till that season, which commences at different times in different countries. In East Prussia and Lithuania elk pair at the end of August or September, in Asiatic Russia in September and October; the calves being born forty weeks later. Their habits at this time much resemble those of red deer. Vanquished stags, with no females, become affected with a sort of madness, which makes them wander about, and even find their way to inhabited places, while they become much thinner than the others. During rutting-time the males utter a short feeble call, which has been compared to the voice of a consumptive man. At other times they are silent. The females retire to isolated marshes to give birth to their calves—generally two in number; these are protected by their parent, and if separated from her will follow human beings, from whom they are only driven off with great trouble.

Reindeer.

The reindeer (*Rangifer tarandus*), which is the deer of the north, differs from all the rest of its tribe by the female carrying antlers, although these are smaller than those of the male. The shape and setting-on of

the antlers are entirely different from those of all other deer. The main beam rises from the upper part of the skull far behind the eyes, and the brow-tine (at least on one side) attains a great development, spreading out almost in the shape of a hand, and sometimes touching the muzzle. The antlers are, however, subject to a considerable amount of local and individual variation in this and other respects. Next the brow-tine comes the equally forked and often hand-like bez-tine, above which the beam extends some distance backwards till it turns upwards and forwards at an acute angle terminating in an expanded palm with a number of snags. In build the reindeer is somewhat heavy, with short, thick legs, ending in wide hoofs. The principal hoofs are round, wide, and short, and separated by a deep cleft; and the lateral hoofs are exceptionally large and compressed. When running on snow-fields, the main hoofs spread to the sides, while the lateral pair touch the snow, thereby forming a wide sole and preventing the sinking of the feet into the snow. The reindeer also betrays its northern character by being provided with fairly long hair at the muzzle, and therein differs from other deer. The small ears are closely haired on both sides; the throat is covered with long, stiff hairs; the neck has no mane, and the body is covered with a curly or wavy upper coat, and soft, woolly under-fur. The colour of the hair is principally brownish grey, but whitish on the face, neck, and throat; the nose, ears, and legs being brown. The tail is mostly white, but has a brown hue at its root and on the upper side. The hair above the hoofs is white, the hoofs are black, and the antlers yellowish and partly whitish. Young reindeer are generally uniformly coloured, but afterwards the colour varies considerably, some being partly or almost entirely white. Being spread not only over northern Europe, but also northern Asia and North America, much local variation might be expected, and quite a number of races (regarded by some as species) have been described. Reindeer from different countries vary much in size, some of the American races having a shoulder-height of 4 feet 7 inches, and an average weight of 336 to 442 lbs.

In the Old World reindeer range to the Arctic Ocean, and from Scandinavia to eastern Siberia. Wild reindeer have become rare in Scandinavia, but in Russia they are found in Kasan in 54° N. latitude. In the Urals the southern boundary of their range is about 52° N. latitude in the Kirghiz Steppes, but reindeer are also found wild in the neighbourhood of Orenburg. In these districts they do not seem to be domesticated, as they are in part of Norway, Lapland, the Russian district of Perm, and Siberia. The Scandinavian domesticated reindeer, which is specially used by the Lapp, is much smaller than the wild reindeer. The reindeer of Siberia, which are mostly used for riding, are larger than those of Scandinavia; they are said to be particularly large in the district of Kasan, where the female often lacks antlers. Reindeer breed well in Iceland, where they were introduced in 1870; in Alaska they were imported in 1892. Wild reindeer are indigenous in several Arctic islands; they are absent from the Franz Josef Archipelago, but appear in Novaia Zemlia and Spitzbergen, as well as farther north. In Spitzbergen they are numerous, and there their habits have been best observed. During summer they keep to the grassy plains in valleys free from ice; but later in autumn resort to the sea-shore to eat the weed thrown up by the sea. In winter they visit the mountains in the interior



SCANDINAVIAN REINDEER.

for the sake of the lichen, or "reindeer-moss," which thrives in spite of the cold, returning to the shore in spring, when still very fat. Some weeks later an ice-crust covers the snow, and makes it difficult for the reindeer to ascend the mountains; and they then grow so thin that the flesh is scarcely eatable. In summer reindeer fatten again very quickly, and in autumn are fatter than ever. In Siberia, as in Spitzbergen, reindeer have regular migrations. In eastern Siberia thousands are met with, in parties of 200 or 300, and sometimes these form immense herds travelling towards the forests, in which they spend the winter. Slowly and with measured steps they walk along, led by one of the largest females, their antlers forming a leafless moving forest. These winter migrations may in some degree explain the occurrence of remains of reindeer in southern Europe, such remains being found as far south as the valleys of the Dordogne and Garonne in France with those of the hippopotamus, which can hardly have lived in a cold climate.

Like the elk, the bison (*Bos bonasus*) ranged widely over Europe in former times. Being our first representative of the hollow-horned ruminants, it may be well to mention that the horns of that group grow on bony cores rising from the skull, and are thus quite unlike the solid and branching antlers of the deer. Although the lateral pair may be wanting, there are generally four toes to each foot, the two smaller of which are of no importance in walking. With the exception of a few North American forms, the group is restricted to the Eastern Hemisphere; their largest representatives being the ox tribe, of the genus *Bos*, the appearance of which is familiar to all.

With the exception of the American bison and the domesticated breeds, the ox tribe is confined to the Old World, the only truly wild European species at the present day being the bison, which, with its American cousin, forms a special sub-group, distinguished by the thick, short, cylindrical horns, a relatively low, wide, and arched forehead, and withers raised into a sort of hump from which the back gradually slopes to the hind-quarters. The great development of the fore-quarters, giving considerable height at the shoulder, is all the more striking, since the hind part of the head, the neck, shoulders, and chest are covered with long dark brown hair, reaching down to the fore-legs, and continued from the back to the root of the tail as a kind of crest. In summer this mass of hair, together with the short, somewhat curly and lighter hair of the rest of the body, is shed in large sheets, and at first replaced by quite short mouse-grey hair which makes the skin look almost bare. The tail is not very long, with a tuft at the end. The two members of the group are so closely related that they are best described by pointing out their differences. The European species, which stands about 6 feet at the withers, and is 11 feet 8 inches in length, is the largest land-animal of Europe, being in the main less clumsily built than its American cousin, and standing a little higher and wider in the hips, with much more powerful hind-quarters. The horns are longer and more curved, the forehead is less arched, the hair of the fore-quarters not so long and close, and the tail longer and less bushy than in the American bison, which, by its masses of hair, appears to be a much more formidable animal than is really the case.

The bison must not be mistaken for the aurochs, which as a wild animal is now extinct, although represented by domesticated cattle. The chief haunts of

the bison are swampy forests, where it lives principally on leaves, twigs, and bark. It is active by day and night but generally feeds in the morning and evening. Bison live in small herds, numbering from fifteen to twenty in summer, increasing in winter to thirty or forty, and consisting of cows and young bulls; old bulls join the herds in August or the beginning of September, when the pairing takes place. At this time the bulls often utter a loud short roar, meant as a challenge, and frequently unroot small trees, often breaking the points of their horns in so doing. Their musky odour is more pronounced than at other times, and they often indulge in furious battles with their rivals, which begin as if in play, but generally end in the death of one of the combatants. In May or June the calves are born in the most retired parts of the forest, the cows risking their lives rather than allowing their offspring to be taken from them. The bison is a shy animal, living in secluded places, especially during its early years. Only during pairing-time is it dangerous, when the old bulls will attack human beings or even vehicles, and occasionally take up their position on a road to threaten every traveller. Notwithstanding its apparent clumsiness, the bison trots and gallops quickly, generally fleeing from approaching danger with lowered head and elevated tail. At the present day it is on the verge of extermination, the Caucasus being the only tract where it survives in a purely wild state. Although growing there to a considerable stature, it is said to have shorter hair than the bison preserved in the forest of Bielowitza and the neighbouring park, as well as in the adjoining forest of Swisshotseh, in Lithuania. The bison of the Caucasus represents a distinct race, stated to present certain structural resemblances to the American species.

In prehistoric times the bison and its apparently extinct relative *Bos priscaus* ranged over the greater part of Europe, and were by no means rare in Germany, Switzerland, Italy, France, and England. Fossil remains apparently indicate the former existence of bison in Siberia, and perhaps also in Alaska. Cæsar found bison in Germany and Belgium; they seem to have survived in Poland up to the year 1500, and in 1534 they were so common near Girgau in Transylvania that peasants were sometimes run over and trampled to death by frightened herds, and hunting-parties were formed to diminish their numbers. One killed in East Prussia in 1755 had probably strayed from Lithuania, for the East Prussian bison had been confined to the forest between Tilsit and Labiau since the beginning of the seventeenth century. A list of game taken by the Elector Johann Sigismund from 1612 to 1619 mentions only forty-two bison among 11,861 head of other kinds. King Augustus III. of Poland, who arranged a great bison-hunt in the forest of Bielowitza on the 27th September 1752, shot forty-two, or according to other reports sixty in one day. The King was accompanied by the Queen and the nobility, and the bison, being royal game, were hunted with from 2000 to 3000 beaters, no less than twenty being killed by the Queen herself. The bison were driven between two strong fences forming a V; the illustrious hunters awaiting them on a platform erected in the centre of the angle, from which position they could shoot without difficulty.

Domesticated Cattle. The ancestor of domestic cattle was not the bison but the aurochs (*Bos taurus primigenius*), remains of which are found in almost every country in Europe. There are records of its being hunted in Germany so

late as the first crusade, and in Poland it survived to a much later date. Some of its nearest relatives are the much smaller half-wild white park-cattle of Britain, which are descended from early domesticated animals and not in a direct line from the wild race. Of these the best-known breed is the celebrated herd of Chillingham which has existed for some seven hundred years, the park having probably been enclosed in the thirteenth century. These cattle are small with rather rough, curly hair and short horns growing in an upward direction; the inside of the ears and the part surrounding the muzzle is red, though it seems that two hundred years ago they had black ears, and the red-eared animals have been produced by breeding. Unlike park-cattle, many other domesticated cattle have greatly altered in nature and appearance.

Since it is unknown beyond 55° N. latitude, the wild boar cannot be included among the fauna of northern Europe: and the same is the case with the rabbit, which, as already stated, may have been introduced into central Europe. The brown hare ranges, however, as far north as southern Sweden and the White Sea: beyond which it is represented by the nearly allied mountain-hare (*Lepus timidus*). This species, which measures about 20 inches in length, has shorter ears than the brown hare, so that if bent forward they do not reach the tip of the nose. It inhabits the Pyrenees, Alps, and Caucasus, and ranges from Ireland, Scotland, and Scandinavia over the greater part of northern Europe and northern Asia as far as Japan, while it is represented by a closely allied type in Arctic America. Many local races are now recognised. In Ireland and southern Sweden this hare retains its brownish grey summer coat during the winter: in other countries the coat becomes entirely white in winter, with the exception of the black tips of the ears. In habits the mountain-hare greatly resembles the brown species. Generally it makes its dwelling between rocks or stones: in winter it feeds on mosses and pine-seeds: in summer it retires up the mountains, where it brings forth, apparently but once a year, from four to six young.

The small rodents known as picae or calling hares are distant relatives of the hare. One of them, the Siberian pica (*Lagomys*, or *Ochotona alpina*), ranges from Asia into north-eastern Europe. The European squirrel ranges as far north as there are trees, in Lapland for instance, as does the Siberian flying-squirrel, although its principal habitat (like that of the Siberian ground-squirrel which extends as far west as the Dwina) is northern Asia. The common dormouse is the only member of its kind living in Scandinavia, the squirrel-tailed dormouse extending no farther than East Prussia, and the garden-dormouse only to the Russian Baltic provinces. As regards rats and mice, the hamster ceases to exist from Lat. 60° northwards in Russia, and is absent from Prussia and Scandinavia. The water-rat, however, is found up to the North Cape and the White Sea, while the field-mouse, which in northern Russia, Finland, and Scandinavia ranges up to 66° N. latitude, is unknown beyond. The red-backed field-mouse, on the other hand, is absent only from Iceland and the Arctic countries; and northern Europe, as well as Siberia, possess in the northern field-mouse (*Microtus rattachiceps*) a representative of the group unknown in central Europe. Closely akin to the voles are the lemmings (*Lemmus*), one of which inhabits the north of Europe and is also spread over Siberia. Lemmings turn white in winter, and it is remarkable that, with the assumption of

its winter-dress, one species at least develops an additional claw to each toe, apparently to assist in digging its winter retreat. Among the true rats and mice, northern Europe has the house-mouse and both the black and the brown rat. The black rat has nearly disappeared; and the house-mouse of northern Europe is lighter coloured than usual, having numerous white hairs in the fur. Of the other central European mice only the harvest-mouse is found in the latitude of Finland; the long-tailed field-mouse ranges into Sweden and the corresponding latitude in Russia. The striped gopher or chipmunk (*Tamias asiaticus*), a member of the squirrel family, of northern Europe and Siberia, is unrepresented in central Europe.

Lynx.

Among the beasts-of-prey, the lynx (*Felis lynx*) inhabits the northern districts of Sweden, Norway, and Russia, where the wild cat is unknown. The lynx is distributed throughout the greater part of Asia north of the Himalaya, and through Ladak to Tibet. Formerly it was common in many parts of the Continent, and was probably found everywhere between the Alps and its present habitat in Europe, but the felling of the forests and the decrease of deer has driven it from most of its former haunts and it has almost everywhere been nearly extirpated by man. In the Alps there are now but few lynxes, and in Switzerland probably none at all. They seem to be still common in the Carpathians, but in the lower mountains of France and Germany they have long since been exterminated. The last five were shot in the Thuringian forest between 1773 and 1796, the last survivor in Silesia in the beginning of the nineteenth century, and the last pair in the Hartz Mountains in 1817 and 1818, while the last French lynx was killed in the Haute Loire in 1822, and the last specimen in the Swabian Alps in 1846. Unlike the variety inhabiting Tibet, the European lynx is an animal of the forest, climbing trees with facility. It has always been a denizen of the plains as well as of the mountains, and is everywhere a voracious tyrant, killing more than it eats. A lynx sometimes pounces on its prey from a tree, and it lies in ambush for deer, and, if it can get nothing better, will capture marmots, hares, squirrels, mice, birds, or goats and other domesticated animals. Amid secluded rocks or in caves are brought forth annually from two to three cubs. By many zoologists the lynx is ranked as the representative of a separate genus, in which are included several other species; and it is certainly distinguished from the more typical cats by several characteristic features. It has, for instance, unusually long legs, black tufts of hair on the tips of the ears, a short face, high forehead, and only two premolar teeth in the upper jaw. From the caracal, which it resembles in these points, it differs by the shorter body and tail, the long whiskers, and the soft and close fur. In these particulars it is like all the true lynxes, but it is difficult to draw a line, since the caracal is the connecting link between the former and the rest of the cat family. The colour of the European lynx varies between a light yellowish grey and a greyish rufous, the lower-parts being white. The summer coat seems to be always marked by a number of small black spots, which sometimes, at least in the young, persist during winter. This refers to European lynxes, their Asiatic relatives being at most spotted only on the sides and legs in winter. The lynx has an average length of 32 inches, but varies in size in different parts of its habitat. Alpine lynxes are smaller than those from the north and seldom exceed 44 lbs. in weight, whereas

Norwegian specimens are nearly as large as leopards, and attain a weight of 100 lbs.

Of the members of the dog tribe, the European fox ranges as far as the limit of trees, but beyond that is replaced by the Arctic fox, which inhabits a small part of Europe. A third European representative of the family, the wolf (*Canis lupus*), does not appear to be an indigenous north European animal. Surviving in many countries, it is extinct in Denmark, Holland, and Great Britain. It is still to be met with in the more secluded localities of the forest of Argonne and the Ardennes, as well as in the Vosges and Jura, in southern France and Spain, Italy, the Balkan peninsula, the countries of the lower Danube, Hungary, the Polish and Russian forests, Finland, and Scandinavia. It surrounds, so to speak, Germany in a circle, and now and then crosses its boundaries. Beyond this it ranges over the greater part of Asia from the Himalaya northwards, as far east as Japan, and nearly over all North America, the Japanese and American wolves forming distinct races. Inhabiting open plains as well as forests, the wolf generally lives in pairs or singly, but collects in large packs in winter. It wanders about by night and day, but is generally cowardly; hunger and the company of many of its fellows alone giving it courage. In winter it steals domesticated animals, and even attacks travellers.

The pairing-time occurs between December and April; and about thirteen weeks later the female produces a litter of from six to ten cubs, which are blind for the first nine or fourteen days. They are born in rocky caves, in hollow trees, beneath the roots of a fallen stem, or sometimes in holes in the ground or in a thicket. At the approach of danger they are carried into safety by their parents. They generally remain with the mother until November or December, and become fully grown in the third year: they may live to the age of twelve or fifteen years. Young wolves are tamable, and become accustomed to associate with man like dogs.

The European wolf is about 3 feet 6 inches in length, its tail measuring 18 inches, and the shoulder-height being 33½ inches. The wolf has a short and sharp muzzle, erect, pointed, and broad ears, fairly long legs, and a coat of yellowish grey, mixed with grey above and white below, with black bars on the fore-legs. It is, however, subject to great local variation of colour. It may, for instance, be more reddish or greyish, or paler, or even almost or entirely black. As already said, in different parts of its area it is represented by different races, as in North America and Japan; but the wolf of peninsular India (*C. pallipes*) is a totally distinct species, approaching to some extent the jackals.

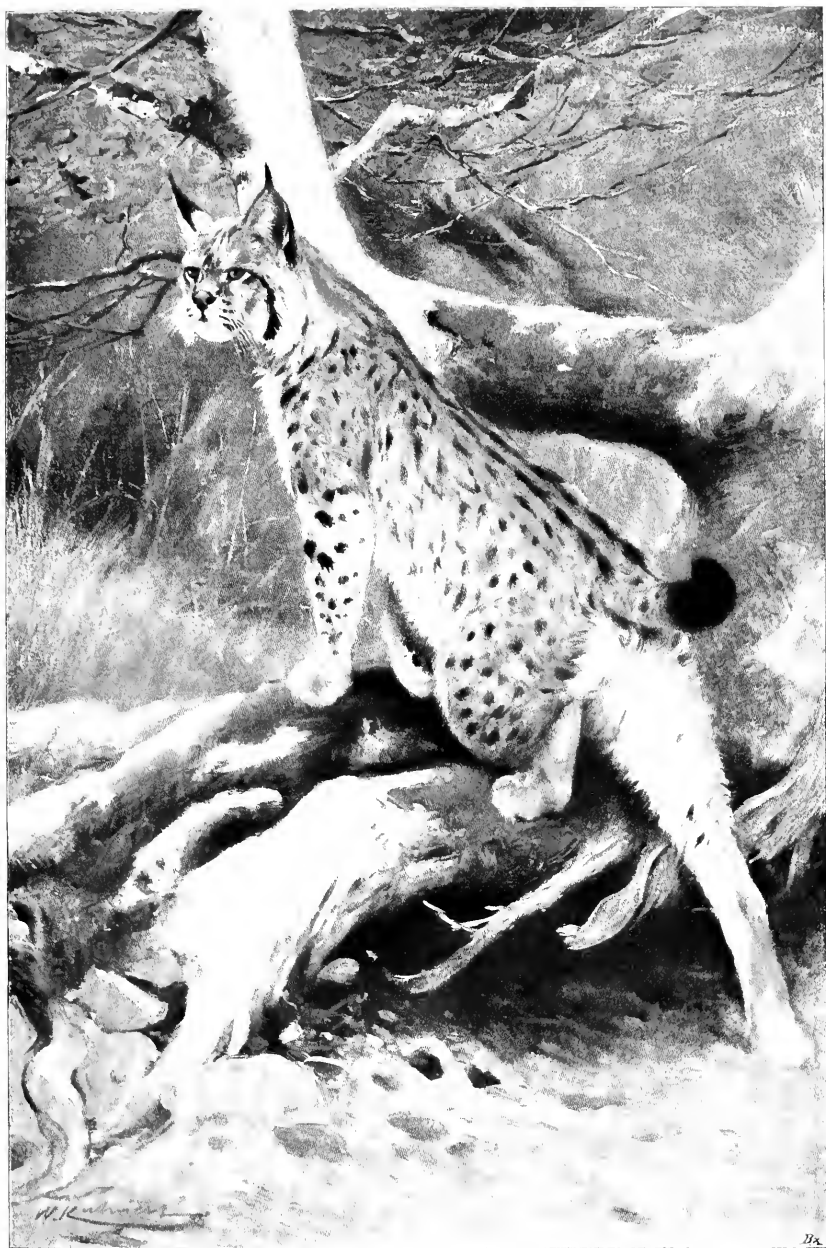
The weasel family is represented in northern Europe by the European Mink. pine-marten; the beech-marten being also within the area, but not ranging so far north. The ermine lives even in the highest north, but the weasel and polecat are not met with beyond the zone of trees. To this zone belongs another species of the group now very rare in central Europe, the European mink (*Mustela lutreola*). Much less known than the other European members of its family, this species at the present day is a characteristic north-east European form, inhabiting especially Finland, Russia, Poland, and Lithuania, ranging from the Baltic to the Urals, and from the Dwina to the Black Sea, and also occurring in Bessarabia, although not at the present day in the Crimea, or east of the Urals.

It is found also in Galicia and in the Glatz district of Silesia, and extended much farther west in the eighteenth century, when it occasionally appeared in Pomerania, Mecklenburg, Brandenburg, and on the Leine near Gottingen, where it was called the stone-dog. As shown by the hunting-registers of the Counts of Schulenburg-Wolfsburg, where it is regularly mentioned, the mink inhabited the marshy plain on the Aller, called the Drönling. In 1852 one was caught on the Stolberg in the Hartz Mountains; and in the vicinity of the Holstein lakes a few were still caught every year up to about 1850. Later still the mink has been met with not only in Holstein but also in Mecklenburg, although it may be regarded as one of the nearly exterminated animals of central Europe. The minks are nearly related to the polecats, from which they are distinguished by the more pointed muzzle and the partially webbed toes, as well as by the absence of long hairs between the pads of the feet. The European mink has a total length of 15 inches and a tail-length of about 5 inches, or double that of the head. In colour this mink is dark brown, with the chin and upper lip mostly white, whereas the American mink



EUROPEAN MINK.

generally has no white upper lip, and is also distinguished by the larger molar tooth in the upper jaw. Occasionally, however, the lip is white in the American animal, which in many respects is not to be distinguished from its European cousin, with which it agrees generally in habits. Mink thus form a European and American type, which, strange to say, does not exist in Asia. They are to a large extent aquatic, and not only swim and dive with ease but are able to remain under water for a long time. Their usual food is fish, frogs, crabs, snails, and other aquatic animals, as well as water-rats, mice, rats, and sometimes birds or their eggs. They hunt by day and night, follow up their prey by scent, and seem to be very unsociable, although sometimes found in small parties. Generally they dwell on the shores of rivers and lakes, where they travel to and from their burrows along well-trodden paths to the water, and not only make daily rounds for their prey, but take longer excursions from which they do not return for eight or fourteen days. In America mink construct a soft nest in their burrows, or in the hollow trunk of a tree, which is lined with feathers and other soft substances. In spring the female brings forth four to six young, which remain with their mother until



LYNX.

the following autumn. Mink emit a stronger smell than any other members of their tribe, being surpassed in this respect only by the American skunks. Formerly mink-fur was so little appreciated that it hardly paid for collecting, but nowadays it is of considerable value; consequently the animal is more sought after, so that the numbers are diminished.

Wolverine. Another representative of the weasel family no longer inhabiting central Europe is the wolverine, or glutton (*Gulo luscus*), which although still found in the north of Europe has a much greater distributional area in northern Asia, under which it will be more fully noticed. The badger is unknown north of latitude 69°, but the otter is indigenous in Lapland. The last of the beasts-of-prey inhabiting the temperate parts of the north is the brown bear, a species formerly distributed all over Europe, which will be dealt with in a subsequent section.

Insectivores. Among the insect-feeders, the hedgehog in Scandinavia ranges to 63° N. latitude, and in Russia to 61° N. latitude, while the mole occurs as far north as the Dwina in Russia and the Dovre Mountains in Norway. The pigmy shrew has been found in 61° N. latitude, but the other central European shrews do not reach so far north.

Bats. The number of northern mammals being comparatively small, it is somewhat surprising to find among a group like the bats, whose members have to undergo a winter sleep, a species peculiar to these chilly regions. This is the northern bat (*Vespertilio borealis*), which is of a dark blackish brown above, and is not unlike the Alpine bat, but lighter below. Its total length is about 4 inches, the tail measures 1¾ inches, and the expanse of its wings is 10½ inches. The species is distributed in a remarkable manner, for it has been observed on the heights of the Scandinavian Peninsula, in Denmark, in northern Russia, where it seems to range up to the neighbourhood of the White Sea, in the central Ural Mountains, and in the Altai. It is an exclusively northern animal, and the only bat which is not found farther south than northern Germany. Its northern nature is apparent even in the Hartz Mountains, where it inhabits only the heights, coming abroad soon after sunset, in order to fly about on the edges of the forest, or in open places, or the neighbourhood of villages, and not returning until dawn. It is indifferent to wind and weather; flies quickly and perseveringly, and darts down on its prey in sharp curves. Sleeping during the winter in nooks and holes inside houses (especially those built of wood) soundly and continuously, it wakes in the first mild days of spring. This bat is remarkable for its wanderings—in northern Russia, like the birds of passage, travelling great distances as the seasons change. It is found almost everywhere from the Baltic to the neighbourhood of the White Sea, but in spring and the beginning of summer is to be nowhere seen in the northern parts of its habitat, to which it migrates in August, when the nights grow longer and darker. It thus appears that the short and light June and July nights of the high north do not agree with this bat, and that in the second half of summer, provided its young are big enough, it migrates to the northern limits of its range, traversing a distance of 10 degrees of latitude.

The parti-coloured, the rough-skinned, and the pipistrelle bats are found in southern Scandinavia and the corresponding latitudes of Russia, while

Natterer's bat is also found in these countries. Farther north, in central Sweden and Finland, the whiskered bat and Daubenton's bat have been observed, while the long-eared bat has been seen up to 60° N. latitude. The barbastelle, representing yet another group, ranges into Sweden, while the other central European species extend but little north of the German frontier, even if they go so far.

Nightingale, Among north European birds there are many which breed
etc. only in central Europe, just as many central European birds do not range far north. The nightingale, for instance, appears only occasionally in southern Sweden, but its near relative, the northern nightingale, is more often found there, although really indigenous to the south-east of Europe. The typical blue-throat again is replaced in northern Scandinavia and northern Russia by the Arctic blue-throat, which extends over a larger part of northern Asia. The redbreast is found up to the Arctic Circle, and the redstart to the Arctic Ocean, but the black redstart ranges no farther north than southern Sweden. Of the two central European chats, we find the whinchat up to 67° N. latitude, and the stonechat in the latitudes of southern Sweden, while the wheatear nests in the far north. The water-ousel is replaced by *Cinclus melanogaster* in Norway, northern Russia, and the corresponding latitudes of Asia and America, which in Germany is only a winter visitor.

Redwing. The song-thrush is distributed all over Europe except in the far north, but in higher latitudes we meet its relative the redwing (*Turdus iliacus*), which has been observed breeding in solitary places in the Allgau Alps and the environs of Memel. This bird is the smallest of the European thrushes, and inhabits as a breeding-area the north of the Old World to the far east, and in Asia appears in the north-western Himalaya and still farther south. England is the only northern country of Europe in which it occasionally winters, though it generally does so in southern Europe, unless it continues its migration to North Africa. When migrating, it travels in large flocks, frequenting the edges of forests with plenty of berry-bearing bushes; in habits it resembles the song-thrush, living on similar food, and singing softly and sweetly in almost every variety of chatter, twitter, and whistle. The redwing, which measures about 8 inches in length, is spotted all over, being olive-brown above and buffish below, with a broad white stripe over the eye, a golden-buff spot on the sides of its neck, and red flanks.

Ring-Ousel. The missel-thrush is also indigenous to northern Europe as a breeding bird. The blackbird breeds up to the northern boundary of tree-growth, while the ring-ousel (*Turdus torquatus*) not only lives in the north, but also in the Alps and other southern mountains, where, however, it is represented by a local race, the Alpine ring-ousel. Considering both these as one species, the breeding-area of the ring-ousel will include the higher mountains of Europe from the Pyrenees to the Caucasus and Ural Mountains, and extends from the Transylvanian, Austrian, and Bavarian Mountains to those of Scandinavia. In Germany, where these ousels are found in the Silesian and Hartz Mountains, the Thuringian and Black Forests, and elsewhere, they generally prefer the higher mountains, ranging as high as food is procurable. Before the middle of September



the autumn migration takes the ring-ousels to the forests of the south of Europe, Asia Minor, Persia, and North Africa, which abound in berries. March and April are the months of their return to the breeding-area, in which they take up their quarters among trees of medium size, and marshy pastures where heaps of rubbish and isolated stones invite them to perch, sing, and nest. In such places, and in the north also among tall heather, the hen makes her compact nest of dry twigs, stalks, moss, and grass, plastering it together with mud. At the end of May or beginning of June this contains four or five eggs. The ring-ousel is a quiet and peaceable bird, with little fear of man; it moves over the ground in long hops, lives on the same food as other thrushes, and sings its loud and melodious, though somewhat melancholy, song in the early morning. This bird is 11 inches long, and brownish black in plumage with a crescent-shaped white band on its chest.

Warblers.

The warblers are represented by the hedge-sparrow as far as the latitude of northern Norway, and by the barred warbler in central Sweden, while the garden-warbler ranges rather farther north. The blackcap and both whitethroats are found in Lapland; but southern Scandinavia forms the northern boundary of the range of the two reed-warblers. The marsh-warbler is rare in the north of Denmark, the water-warbler becomes scarce in northern Germany, while the sedge-warbler reaches 68° N. latitude, and is thus the most northerly of the group. The river-warbler ranges as far north as Lake Ladoga, but the grasshopper-warbler is more of a southern species; the tree-warbler reaches the northern limit of its range in central Sweden, as does the willow-wren, although the latter now and then wanders near the Arctic Circle, or even beyond. In Sweden the wood-wren becomes very rare, although the chiffchaff is still met with in the north of that country. The goldcrest lives wherever there are firs of sufficient size, but the firecrest, which is more at home among pines, does not range so far north. The range of the wren extends to the Arctic Circle.

Titmice,

Larks, etc.

Although the coal-tit does not range farther north than the latitude of Lapland, the marsh-tit has a wider distributional area, and visits Iceland, northern Scandinavia, and northern Russia. The blue tit reaches the latitude of Finland, the crested tit that of southern Sweden, while the long-tailed tits range well into the northern countries. The nuthatch wanders as far north as the Arctic Circle wherever the trees are large enough, its northern representative being spread over northern Asia as well. Like the creeper, it may be numbered among the birds breeding in northern Europe, but it does not range to the extreme north. The same is the case with the larks, the wood-lark reaching central Sweden, and the crested lark Livonia and Finland. The blue wagtail is likewise indigenous to the north of Europe and Asia; the white wagtail ranges into Greenland, Iceland, and Lapland, but its central European relative the grey wagtail begins to be rare in northern Germany. Although the tree-pipit is found beyond the Arctic Circle, the tawny pipit is unknown north of central Sweden; and in Norway and Iceland the meadow-pipit occurs.

Finches.

Of all groups of perching birds the finches are the most numerously represented in the far north, and although the house-sparrow is unknown beyond the limit of cornfields, the tree-sparrow ranges a little higher. The latitude of central Sweden forms the limit of the hawfinch, but the chaffinch

travels to the Arctic Circle, and its relative the mountain-finch breeds in Norway and north Finland, though not in central Europe. The greenfinch is unknown beyond 65° N. latitude, and the linnet finds the northern limit of its range in central Sweden. Strictly confined to the north is the mountain-linnet or twite (*Linota flavirostris*), which inhabits the north of Scotland, Sweden, Lapland, and Russia, to migrate south in autumn, when it is found in Sweden, Denmark, France, Holland, Germany, Switzerland, and northern Italy. Living in barren mountainous districts, where the chief vegetation is stunted bushes, this bird has its feet admirably adapted for walking on the ground, the claws being very slightly bent. In late summer it gathers in flocks, and in November (occasionally earlier) appears in Germany, leaving again in February to return to its breeding-places. Meanwhile it has been wandering about the fields in company with other small winter-migrants, especially linnets. Wherever the twite is seen, it appears to nest in solitude. It is a lively, shy bird, hopping briskly and erectly on the ground, and accustomed in its home to perch on rocks or solitary bushes to sing. The twite, so named from its call, feeds on seeds, specially those containing oil. Its nest, generally on or near the ground, is sheltered by stones or shrubs, and resembles that of the linnet, although more warmly lined with hair, willow-catkins, or cotton-grass. The eggs, which are like those of the canary, are from four to six in number. The length of the bird is about 5½ inches; and the yellow beak is very distinctive. In colour the crown and throat are brown, the rump is red, and the chin buff, but there is no red on the breast. The female has no red at all.

Crossbills and Buntings. The siskin ranges up to 67° N. latitude and the goldfinch to 65°, but the serin never gets farther north than the southern shore of the Baltic. On the other hand, the crossbill belongs to northern more than central Europe, as does the parrot crossbill, which appears more frequently and regularly in Scandinavia, Finland, and northern Russia than farther south. In northern Russia also lives the two-barred crossbill, which as a rare visitor appears in western Europe. The large race of the bullfinch is indigenous to Scandinavia and the north, but is occasionally found in Prussia as a nesting bird, although in the rest of Germany down to Salzburg it is a winter-migrant from the north and east.

The scarlet and the pine grosbeak represent a group distributed in some twenty different forms over the northern countries of Europe, Asia, and North America. Of these, the first-named species delights in damp forests abounding in brushwood, and also well-timbered gardens, and is frequently found on river-banks clothed with willows and reeds, in much the same situations as form the haunt of the reed bunting. Its food consists of seeds, buds of trees, and shoots of plants; the nest being generally situated in a thorn bush near the ground. It resembles that of a warbler, and at the proper season contains five or six bluish green eggs marked with small grey and brown rings and brown or black spots and streaks. The song resembles that of the linnet and the oriole in its flute-like notes. The scarlet grosbeak nests in East Prussia, Pomerania, Silesia, and the Isle of Sylt; and also inhabits north-eastern Europe and Siberia, migrating in winter to milder countries. It is 8½ inches long; the male has a rosy crown and breast, but the female is more sombre in colour, lacking the red patches of her partner. Of the European

buntings, the area of the grey bunting extends into northern Norway, as do those of the yellow bunting, the ortolan, and the reed bunting.

Starling and Crows. The starling is met with up to 70° N. latitude, while the golden oriole is rare in south Sweden and is unknown north of Finland. The rook and the hooded crow are found up to the Arctic Circle, although they begin to be rare in Scandinavia, Finland, and northern Russia; and the blue roller's northern limit is southern Sweden. The jackdaw is absent from both Iceland and Lapland; but the magpie wanders to the latitude of the North Cape. The jay does not go north of southern Sweden; the nutcracker is, however, a more northern bird, being common in central Sweden and the Russian Baltic provinces.

Shrikes and Flycatchers. Shrikes are represented in the high north by the great grey species, which is found even in the Arctic Circle: although the lesser grey shrike becomes rare even in Denmark. The woodchat seldom appears in Sweden or England, but the red-backed shrike ranges into northern Scandinavia. Of the flycatchers of the north, we find the spotted species in Lapland, and the pied flycatcher in Scandinavia, although the white-collared and the red-breasted flycatcher are restricted to the east of Europe.

Woodpeckers, etc. Among the bird-fauna of the high north, swallows, swifts, and nightjars are present, although some of them are unknown beyond south Sweden. The hoopoe does not breed beyond 60° N. latitude; while the kingfisher, which inhabits Livonia and Esthonia, is rarely seen in Sweden; and although the cuckoo straggles to the shores of the Polar Sea, it seldom wanders beyond the Arctic Circle. The wryneck reaches the latitude of Finland and central Sweden, but neither this species nor the woodpeckers can exist beyond the timber-zone. Of the various kinds of woodpecker, the middle-sized spotted species but seldom appears in the north, although its lesser relative is well known in Lapland. The three-toed woodpecker is, however, essentially a northern bird, though it also nests in the Alps and Carpathians, while it is found now and then in Silesia and Brandenburg. From the other European species it is distinguished by the absence of the hind toe. The five woodpeckers of this group (*Picoides*) are indeed distributed all over Europe, northern Asia, and North America; they resemble the spotted kinds in the shape of the tail and also in the colour of their plumage, but differ by the closer and stiffer feathers round the neck. The European species (*P. tridactylus*) inhabits the pine and larch forests of the Alps, but lives in the birch-forests in the north of its area, which embraces the north of Europe and Asia as far east as Kamchatka, and as far north as the tree-line. It is a rare bird generally, in the main resembling the lesser spotted woodpecker in habits, and most frequent in Switzerland, Bohemia, Moravia, and Austrian Silesia. In length it measures 6½ inches; and in colour it is principally black and white, although the male has a yellow spot on the crown, which in the female is replaced by one of silvery white, and both sexes have a white stripe down the middle of the upper part of the back.

Birds-of-Prey. Of the birds-of-prey there are numerous representatives in the north of Europe, the owls being particularly abundant. Of these latter the eagle-owl is found within the Arctic Circle, although the long-eared species does not range higher than latitude 64° N. The short-eared owl (*Asio ae-*

capitrius) might perhaps be called central European, but is more frequent in the north. This bird lives on moors and in marshy lands, hunting by day as well as by night, sheltering among shrubs and plants, and only perching on trees when in fear of danger. In Germany it is principally seen during migration in March and in September or October, when it journeys in smaller or larger parties at the same time as the woodcock. Although occasionally breeding in Germany, England, and Scotland, especially in districts where mice are plentiful, its principal nesting-area is within the Arctic Circle in both hemispheres. This owl is spread, however, over a much wider area, being unknown only in Australia, Polynesia, and western Africa. The nest is generally placed among grass, reeds, or heather, and always on the ground. The prey of this species consists of small rodents, especially lemmings, and also of the larger insects, and occasionally birds. Pursuing its victims with the same noiseless flight as its southern relatives, this owl hovers a few seconds before striking, and when startled rises high in the air. When flying in high latitudes under the midnight sun it looks almost like a kite, which also seeks its prey at a considerable height above the ground. Not unfrequently it is mistaken for the long-eared owl, although its ear-tufts consist only of two or four feathers not exceeding half an inch in length. The beak and eye-discs are blackish brown, the chin is white, and the iris of the eye yellow. On the upper-parts the colour is a rich buff with dark brown patches and streaks; the throat and breast being striped with brown.

In addition to the above, we have two kinds of wood-owl, namely, the tawny owl, which also ranges over a large area in Asia, and the Ural owl (*Syrnium uralense*), which although rare in northern Scandinavia and Russia ranges eastwards right across Asia. This species breeds in pairs in the St. Petersburg district and East Prussia, and less commonly in the Bohemian Forest, the Carpathians, and the Austrian Alps. The nest is built in hollow trees or among rocks, and also in the abandoned nurseries of the buzzard. The bird flies in the open only at twilight, but may be on the wing in the forest during the day. This audacious bird will attack man should he dare to climb its nesting tree; and will defend itself against buzzards and herons. Its prey is hares, rabbits, and forest birds, as well as the smaller mammals, especially mice, and it will even eat beetles. The female sits all day long on her white eggs, which number from two to four, till in the evening she greets her returning partner with a scream of joy, when she flies off in search of food, returning from time to time to see that the nest is safe. The Ural owl, measuring from 20 to 24 inches long, may be distinguished from the tawny owl, which it greatly resembles, by its lighter colouring, greyish face, black claws, and dark brown eyes. Other northern species are the great snowy owl, the Lapp owl, and the hawk-owl, the last of which ranges as far north as the growth of trees, but visits the Bavarian Alps and probably other German mountains, and as a breeding-bird is found in the Carpathians and East Prussia. Tengmalm's owl and the pigmy owl are also met with in the northern parts of Europe.

Of the diurnal birds-of-prey, the kestrel ranges up to the Arctic Circle and even farther north, in company with its relative the merlin, which inhabits northern Europe but is more frequent in Siberia. Of the habitat of the hobby, the northern limit is the latitude of central Sweden; while that of the peregrine

is coincident with the tree-zone. The spotted eagle, although one of the most common birds-of-prey in parts of central Europe, does not wander far north; and the golden eagle, although appearing here and there in Prussia and Sweden, is really a bird of south-eastern Europe. Southern Sweden is the most northerly country inhabited by the buzzard; but the rough-footed buzzard is essentially a Siberian type. The range of the common kite extends to the latitude of southern Sweden, but the black kite is not seen so far north. Although the osprey inhabits almost every European country, its real home is the north; and the sea-eagle is certainly more a bird of the Arctic than of central Europe. The white-tailed sea-eagle (*Haliaëtus albicilla*) resembles the true eagles in general appearance, but is broadly distinguished by its cleft toes, and by the feathering of the legs being restricted to the upper half. Frequenting the seashore and the banks of large rivers, this splendid bird constructs its nest at no great distance away. This bulky structure is often a couple of yards across, and in consequence of annual additions may grow to a yard in height. Towards the end of May it contains two or three white eggs, which generally become stained and blotched during incubation. On the Siberian steppes, and in other lonely situations where trees are wanting, the sea-eagle builds among reeds or low bushes, or even on the sand; but more generally the nest is placed on steep rocks or on cliffs near the sea, where caverns and projecting corners afford safe shelter. When the sea-eagle dwells in the forest, besides its nesting-tree, it generally takes possession of another high tree with dead branches as a resting and sleeping place; and on islands destitute of trees it will spend the night on sand-hills or the rocks and cliffs of the shore. Sometimes, indeed, it will even rest on the water like a duck. In most or all cases it has its favourite places of resort, as in the island of Hiddensee in the Baltic, where about a dozen eagles a year have been shot, all of which roosted on the same tree. The period of incubation of the sea-eagle lasts about five weeks, the young becoming fledged in about three months. So amply provided with food are the young that the surroundings of the nest resemble a slaughter-house, but as soon as they are independent they are driven away by the old birds. After this a period of three or four years elapses before they begin to breed and have a nest of their own. When the young are reared the old birds frequent the shore, or the banks of large rivers, in search of food. They are generally seen in parties of from three to eight; sea-eagles being sociable birds which hunt in company, although they often quarrel over their prey. The flight, which is seldom very high, is powerful and characteristic but not buoyant—the sea-eagle being a heavy bird, not naturally shy, although becoming so on account of the dangers met with on its long journeys. Although sometimes seizing hares, geese, or ducks, it feeds principally on fish. When swooping on the latter, it often disappears beneath the water, until it appears again shortly with a fish struggling in its talons. Sometimes, however, it is stated to be dragged down and drowned by its intended victim.

The habitat of the sea-eagle extends over Greenland, the whole of Europe, and the north of Asia as far as Japan. Its southern breeding-places are the countries along the Danube, such as southern Hungary, and farther down the river to the Servian frontier; it nests more frequently in the Dobruđscla, which is so rich in all kinds of water-fowl, but its chief nesting-grounds are on the

shores of the northern seas, such as Sweden, Denmark, the forests of Jutland, the German borders of the North Sea and Baltic, Mecklenburg, and the islands of Rügen and Hiddensee. In length the male measures about 34 inches, the female being a little larger and at all ages lighter coloured. The beak of the male is blackish in young birds, and light yellow in the adults; the naked part of the leg, as well as the toes, being yellow. The plumage, which is spotted in the young, is uniform dark brown in the old birds; the wedge-like tail, which projects a little beyond the wings, being white with brown coverts, while the head is brown in youth and dirty white in old age.

The hawks are represented by the goshawk and sparrow-hawk as far north as suitable forests are to be found. The marsh-harrier ceases to appear above 60° N. latitude, but the hen-harrier ranges as far as 68° N., while Montagu's harrier is unknown north of the Gulf of Finland.

Game Birds.

Among the game-birds, the capercaillie ranges to the utmost limit of the pine-woods, and is found at the North Cape; the black-cock is found farther north; and the hazel-hen, which is common in southern Scandinavia, Esthonia, and Livonia, appears to range still farther. Besides these, five kinds of ptarmigan (*Lagopus*) are spread over Europe, northern Asia, and North America; all of which may easily be distinguished by their completely feathered feet. The willow-grouse (*Lagopus albus*) is circumpolar, inhabiting the north of Europe, Asia, and America; its favourite haunts being the tundras and open moors, with stunted trees and shrubs. On the tundras it is found both in the plains and the hilly districts, and in Scandinavia inhabits mountains of moderate height. In Germany it is confined to the north-eastern corner of Prussia, but it is common on the eastern moors of Courland, Esthonia, and Livonia, and in the neighbourhood of St. Petersburg, although decreasing in consequence of the spread of agriculture. It is absent from Greenland and Iceland, where the true ptarmigan is indigenous. In south-eastern Siberia the willow-grouse occurs everywhere north of 58° N. latitude: in the Taimur peninsula it is found up to 72° 30', and in North America ranges between 50° and 70° N. latitude.

Some willow-grouse winter in their breeding-haunts, others migrate south to the zone of birch and willow, and return in April or May. The nest is nothing but a small hollow in the ground, lined with dry plants, generally near a bush, and in Norway often close to farmyards. The eggs, which vary from eight to twelve, and sometimes more, in number, are laid in the first half of June or a little later. In colour they are yellowish, with more or less distinct reddish brown spots and dots. The cocks fight each other in defence of their nesting-places, but join in driving back a more formidable enemy, and occasionally force even foxes to retreat; but the female takes the principal share in looking after the young. When unable to defend her brood, the hen feigns lameness, and thus successfully withdraws attention from her young, to which she returns when the danger is past. When pursued by men and dogs, both sexes endeavour to distract attention from the brood, although the male does not accompany the young until after the first fortnight, when they are able to fly. By the beginning of September the young birds are full grown, and in October the various families collect in large parties to search for richer feeding-grounds. When first hatched, the young are downy and spotted;

they are quick on their feet, and run boldly about even in pools of water. At first they feed on grass seeds, tender leaves, and the gnats and their larvæ which abound on marsh and moor during summer; later on their food consists of berries, leaves,



WILLOW-GROUSE IN WINTER.

and stalks. In winter the principal food is birch-catkins and young twigs of birch and willow, grains of corn, and other seeds. The feet of the willow-grouse, like those of all ptarmigan, are closely covered with hairy feathers even under the toes, and are thus prevented from sinking into the snow. The willow-grouse generally walks cautiously and quickly with its head bent down, but when startled stands

upright to scan the enemy. Its straight, quick, noisy flight never takes it high in the air. During the moult these birds press the body flat to the ground, so that only a dog can find them. In winter they exchange the brown plumage for a dress of white, and while the feathers are changing, arrange them so as to hide those which are most conspicuous, for their colour forms their chief protection at all seasons. As the down of the young is of the same colour as the ground, it serves to conceal them even from the sharp eyes of birds-of-prey. The willow-grouse is from 16 to 17 inches in length; in winter it is white, with the exception of the outer feathers of the tail, which are always black; on the other hand the colour in summer is rusty brown with black markings, and white feathers on the feet. The beak is black, and above the eyes is a bare red spot. In summer dress, a willow-grouse much resembles a red grouse. Both are in much esteem as game-birds. In Scandinavia willow-grouse are shot in winter, since at that season they may be sent longer distances. Every year large quantities come to Drontheim, Stockholm, and other large towns in Norway, Sweden, and Denmark, where they are said to form a third of the edible birds on the market. They are also exported in enormous quantities.

The red grouse (*L. scoticus*) is the British insular form of the willow-grouse, and is confined to the British Isles, where it varies much in plumage. In the male there are three distinct types of coloration, and in the female there are five, all of which grade into one another, the only invariable characteristic mark of the species being the primaries, which in all the varieties and at all seasons are blackish brown. In the ptarmigan and willow-grouse there are three moults a year, but the grouse has only two, the male changing his plumage in autumn and winter, and the female changing hers in summer and autumn. The grouse is not found beyond the limits of heath and heather (*Erica* and *Calluna*), its place above that line being taken by the ptarmigan. The nest is a hollow in the ground lined lightly with sprigs, grass, moss, and feathers: and when sitting the hen is almost invisible, owing to her plumage harmonising so well with her surroundings. While she is sitting, her mate is never too far off to give her a warning call at every danger, and he has also a sort of crow with which he greets the dawn, particularly on a frosty morning. The eggs, seven to fifteen in number,—in colour buffish white mottled with red or brown,—are laid in April or May, though they have been found on the 17th of March and early in June. The young are at first clothed in yellow down marked with brown above, but soon begin to resemble their mother, who has a smaller wattle than her mate, is paler in colour, and has no moustache. When the young can fly easily, the families or “coveys” gather in “packs,” the males and females keeping separate. The flight is low, with much gliding on outstretched wings. Grouse feed on bilberries, both fruit and leaves, on the tips of heather and heath, and on grain, in search of which they frequently visit the stubble-fields near their moors. They not only live in Scotland, but in England down to Sherwood Forest, in Wales down to Glamorganshire, in Ireland, and in the Hebrides and Orkneys.

The ptarmigan (*L. mutus*), in which, unlike the willow-grouse, the cock has a black stripe through the eye, inhabits the mountains of Scandinavia, Scotland, Bavaria, Tyrol, Austria, Hungary, Switzerland, and the Pyrenees up to the snow-line.

It lives among rocks, stunted firs, willows, and other bushes; and its range extends not only over Europe but into central Asia. In Norway most of the ptarmigan migrate southwards in winter, and in the Alps they descend the mountains in search of shelter. Some ptarmigan, however, brave the Arctic cold, and have been observed with full crops in the company of lemmings and Arctic hares, in latitude $73^{\circ} 30'$, throughout the winter. The close feathers form an effective protection against the cold, for this bird with its sharp claws digs long tunnels through the snow with such ease that, when pursued by a hawk, it burrows beneath the snow with surprising quickness. The nest, which is similar to that of the willow-grouse, in June contains from six to fifteen eggs. The hen ptarmigan takes the greatest care of her young. During pairing-time the cock has a sort of nuptial flight, and utters a gruff croak, which is answered by the female with a soft "djak djak." In habits the ptarmigan resembles the willow-grouse, but is more sociable, and eats fewer willow-buds. The summer plumage is distinguished from that of the willow-grouse by the paler colouring, with lighter edges and black bands. The hen is without the characteristic black stripe between eyes and beak. A closely allied species, the rock ptarmigan, *L. rupestris*, is of similar habits and almost similar plumage. It is found in northern Asia, Japan, Arctic America, and Scotland, and in Newfoundland is so much like the European bird that it would seem to be merely a variety.

Wood-cock and Snipe. The snipe group is rich in northern species; the woodcock and common snipe being, for instance, found up to 67° N. latitude; that is, up to the tree-line. A relative of the latter, the jack-snipe (*Gallinago gallinula*), is a true northern bird, though it also nests in Germany. Frequenting well-watered, marshy districts, and pastures with soft ground and plenty of alder-bushes, where it lays its pale olive eggs marked with grey, yellowish, or reddish and blackish brown spots, this bird walks with its head between its shoulders, lowering the point of its beak, and keeping its body in a horizontal position. By day it skulks furtively about, but in the evening walks with more assurance. In daylight its flight is low and of short extent, but in the silence of night, or on migration, this snipe flies long distances in the upper regions of the air, descending suddenly to rest on the ground. In cold spring evenings it utters its curious courting cry, which is similar to the hammering of the death-watch, and lasts from four to six seconds. Jack-snipe migrate in spring, during March, April, and May; the autumn migration taking place from August to October. Although in Germany generally known only as a migrant, it is found breeding in pairs in Hanover, Silesia, Brandenburg, and elsewhere. It is a common bird in Lithuania and Finland, more frequent in Russia, and still more so in western Siberia, which is its principal breeding-area; it winters in the Mediterranean countries. This species is the smallest of the European snipe, being not more than 8 inches long. It has a blackish brown crown without a light stripe in the middle, and a reddish brown back with a glossy purple mantle, though in winter the brown of the back becomes very grey.

The great snipe (*G. major*) loves a swampy treeless country with stretches of sand, but in some parts of the Continent also visits meadows near sheets of water, and shallow rivers traversing grassy marshes; it is always, however, very local. It is not so particular as to locality on migration, which in spring lasts

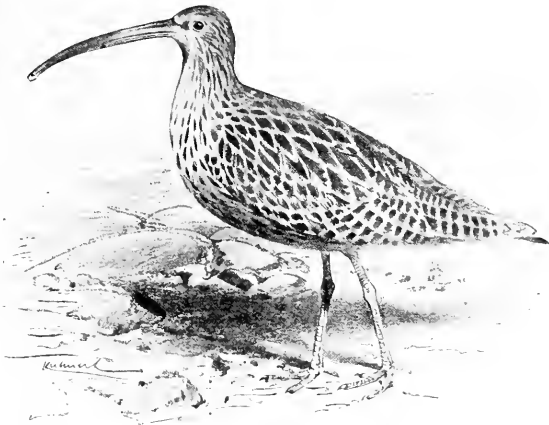
from April to the end of May, and in autumn from the middle of August to the middle of September. The nest, which is ready in central Europe during the latter half of May, but in the Arctic tundra not till towards the end of June, is situated on firm ground in the swamp, where it is made by treading down the grass, and lining the depression with dry grass or moss. The eggs are four in number, and pyriform in shape. The young, which are hatched out in seventeen days, are larger than those of the common snipe, with very short beaks. As in the old birds, their colour harmonises so well with their surroundings that it is most difficult to detect them when lying close. Indeed, a great snipe seldom rises until almost trodden upon by grazing cattle or man, when it gets up with a whirl and flies quickly and rather heavily, but never in a zigzag line like other snipe.

The great snipe feeds mainly on insects and their larvæ, especially those of the daddy-longlegs, but it also consumes slugs and worms. In many parts of the Continent this species is rare as a breeding-bird, but it appears as such in Westphalia, Hanover, Oldenburg, Brandenburg, Pomerania, and elsewhere. On its migration to South Africa it crosses Germany; but its principal nesting area is in north-eastern Europe and north-western Asia, up to 70° N. latitude. It is about 11 inches long, and distinguished by the white tips to the wing crests, and the sixteen tail feathers, of which the outer four are white or nearly so.

Among other northern birds curlews are distinguishable by the long, sickle-shaped beak. In this respect they resemble the ibis; but the short hind-toe, placed higher up than the others, the colouring of the plumage, their movements in walking and flying, and their loud sonorous call indicate at once their affinity to the plovers. The common curlew (*Numenius arcuatus*) is found near water and marsh on heath and steppe. Although resident in the British Isles and in a few places in Germany, especially on the shores of the North Sea, its chief breeding-grounds are in Lapland and the tundras of northern Siberia. From the north of Europe and Asia it journeys south into northern Africa and Arabia, where it is found in company with the ibis. Migrating from August to September, from March to May it returns to its breeding area. The nest is a slight hollow on the ground, or a depression in the grass or heather, and contains four pear-shaped eggs lying with the points towards the centre, as is always the case with eggs of that shape. This curlew feeds on worms, insects and their larvæ, and bilberries, and other berries. A wary bird, flying with the head down on its neck, and extended feet, it always hovers before settling. It also swims well, and has a stately walk. Its name is derived from the loud call of "cur-lew," or "kerr-lei"; but it also utters a sort of rippling alarm-note. In defence of its nest, the curlew will stand up to and drive off dogs, but when attacked by a falcon it immediately takes to flight, and seldom escapes unless by diving. In length the curlew measures about 24 inches; in colour it is light brown above with dark brown spots and streaks, and below is streaked down the middle; the crown is pale brown, the axillaries are white with brown bars, and the lower half of the back is white with black streaks.

The redshank (*Totanus calidris*) is widely distributed in districts where muddy ground is covered with short grasses and marsh-plants, and particularly in bays and tidal harbours, where it often nests close to the sea. The nest would be

difficult to find were it not that the bird itself betrays its whereabouts by its noisy anxiety. Generally it is merely a depression in a tuft of grass or rushes, hidden by the bending of the stems. The four eggs, yellowish with purplish blotches, are laid in April and May, and hatch out in sixteen days. As soon as hatched the young follow the mother in search of food, which consists of water-insects, grasshoppers, beetles, worms, snails, and the tender parts of plants. The redshank is resident in the British Isles and in some parts of central Europe, but is probably only a bird-of-passage in the south. Its principal breeding-places are, however, in Scandinavia, where it ranges up to 70° N. latitude, in Russia up to Archangel, and in Siberia. The redshank is 10 inches long, and easily recognisable by its bright red feet, the beak being red at the base and black at the point. The secondaries are brownish white, the greater and median wing-coverts are flecked



CURLEW.

with white, while the lower part of the back and the whole under surface are white. The sandpiper, a central European relative of the redshank, ranges into Lapland. The greenshank is also a northern bird, but mainly Asiatic. Another member of the group, the little ringed plover, inhabits Lapland and Iceland, but does not extend much farther north than the Arctic Circle: while the dotterel (*Egialitis morinella*) dwells in the barren country bordering the mountain snows. The latter breeds in the British Isles, in Scandinavia, and in the Russian and Siberian tundras, as well as in a few localities on the mountains of central Europe. There is no nest, the three or four stone-coloured eggs being laid on dry grass or moss which has not even been trodden down. Flocks of dotterel migrate through Germany in autumn, to winter on the shores of the Mediterranean. The old birds regularly arrive in Pomerania in the second half of August, but the young ones a little earlier. They stay until September and October, then move farther south,

whence they do not return before the following April, when they come back by a route which never coincides with that taken on the southward journey. The dotterel is an active but stupid bird, with a hurried flight; it derives its name either from its call of "dot, dote," or from the ease with which it allows itself to be caught, or perhaps from both by way of a pun. Dotterel are easier of approach than any other members of the plover tribe, and when one is shot, the others settle again at a little distance. In length it is about 9 inches: in colour greyish brown above, with a dark crown and a broad white loop extending from the eyes round the nape, and a white band across the breast, which is elsewhere brown, the region of the legs being black.

Better known than the dotterel is the golden plover (*Charadrius pluvialis*), which breeds on English heaths and moorlands, as well as throughout the north of central Europe, and still farther north even on the Arctic tundra. It has been found in such desolate localities as Jan Mayen, Novaia Zemlia, and Greenland. On migration it appears in flocks among the cornfields in search of insects. Southwards it travels as far as Cape Colony, and in hard winters resorts in great numbers to the shores of the Mediterranean. The nest is a mere apology, placed in some depression on the ground or in a tuft of grass or heather, and scantily lined with dry grass and moss. The eggs, four in number, are light brown in colour, blotched with purples and greys, and are laid from April to June, the male at times taking the place of the female in their incubation. The food consists mainly of insects, snails, and worms. The golden plover has a clear melodious whistle which may be heard at a considerable distance, and even as the bird passes high overhead beyond the range of sight. The sexes are alike in plumage, being light brown above and black below, but in the female the black does not rise quite so high on the breast. Nearly all round, the black is marked off from the brown by a white edging, and the axillaries are also white.

Among the larger ground-birds of central Europe, the bustard straggles into southern Sweden, but the crane goes no farther north than the region of tree-growth. The water-rail appears in northern Scandinavia, and the cornerake in Lapland, while the northerly range of the spotted crane is confined to central Sweden, and that of the little crane to 55° N. latitude. The eot and moorhen do not range farther north than central Sweden; the black stork is unknown even thus far, and the white stork is found no higher than 57° N. latitude. Neither can the bitterns be called northern birds, although the heron is found at least as far north as 64° N. latitude.

Geese.

Of the water-birds, the grey lag-goose flourishes in Norway and Sweden, although, like its cousin the bean-goose, it is not really indigenous to the north. In the last-named species (*Anser segetum*), which is 34 inches long and has no black on the breast, the feathers of the brownish back are edged with grey, those of the breast being silver grey, those of the sides brown mottled with white, while the feet are orange-yellow, and the beak orange with a black nail. This goose breeds in Scandinavia north of latitude 64°, in Lapland, and eastwards as far as the Yenesei, and it has even been found nesting so far north as Novaia Zemlia.

The descendants of three kinds of geese are kept as domesticated birds. The common goose is descended from the grey lag-goose, the Toulouse breed, which is

distinguished by a large dewlap on its throat and breast, being one of the most valuable. In China the swan-geese (*A. sinensis*), and in America the Canadian goose (*A. canadensis*), have produced domesticated breeds. Canadian domesticated geese differ, however, very little from their wild ancestors.

Another species, the pink-footed goose (*A. brachyrhynchus*), which breeds in Spitzbergen and Iceland, and probably in other parts of the high north, appears regularly on migration in western Europe, particularly in Great Britain, northern France, and Holland. It is considerably smaller than the bean-geese, with pink feet, and a short thick pink beak terminating in a black nail. In hard winters these geese cross Europe to North Africa, but are regular winter-visitors to Italy, Hungary, and Turkey. In nesting and other habits they resemble the grey lag-geese.

From the last, the white-fronted goose (*A. albifrons*), which is mainly Siberian, may be distinguished by its light orange-coloured beak, with a white nail, and the presence of a white, black-edged band on the forehead and black bars on the breast, as well as by the yellowish feet. In other respects its plumage is similar in colour to that of the bean-geese; in length it exceeds 24 inches. Smaller in size is its near relative, the lesser white-fronted goose (*A. erythropus*), distinguished by a larger white patch on the forehead, and a brown-spotted breast of which the ground-colour is almost black. This goose breeds in Lapland and northern Norway. A much larger form (*A. intermedius*) breeds in Iceland, and another (*A. gumbeli*), the largest of the four, is confined to North America. All four are perhaps best regarded as local races of a single species. In September and October the white-fronted goose migrates to the south. In Europe the autumn migration takes these birds to the British Islands (particularly Ireland), southern Sweden, Denmark, Germany, Holland, and the north of France, as well as to Poland, Hungary, the Danubian countries, Greece, the shores of the Caspian Sea, and through Asia Minor up the valley of the Nile, only a few stragglers reaching the south of France, Switzerland, and the coast of Italy. From March to the beginning of June they return to their breeding-area, and on migration associate with the rear-guard of the bean-geese. White-fronted geese are also known as laughing geese, the rapid repetition of their trumpet-like call resulting in a sort of "haw-haw" that sounds like vociferous laughter.

Ducks.

Equally well represented in the north are the ducks, the mallard frequently appearing in Finland, although not reaching the limit of tree-growth, while the shoveller also does not live in the far north. The gadwall reaches Iceland; the pintail ranges rather farther northward than the mallard, but the garganey only straggles as far as southern Sweden, while the teal goes no farther than 65° N. latitude; all these breeding both in central and northern Europe. The wigeon (*Mareca penelope*) breeds in solitary pairs in Germany, but cannot be called an exclusively central European bird, although really a fresh-water species. Only when compelled to do so, does it sojourn in shallow salt water or bays, and in the main it keeps away from the sea, near which it never nests. By preference it lives in well-watered districts, breeding in the north of Scotland, but very rarely in Germany, where its nine to twelve cream-coloured eggs are found in the middle of May. On its autumn migration it is

often met with in estuaries and on the sea-shore; and on its return in March and April it may also be seen in large numbers. The far north forms its real breeding-area, which embraces Iceland, Scandinavia, Lapland, Finland, Russia, northern Asia, and North America. In winter it journeys to Abyssinia, India, Burma, Borneo, and California. Wigeon fly quickly, vigorously, and almost noiselessly. Measuring 18 inches in length, they are chestnut-brown on the head and throat, with a whitish forehead and crown, the back and scapulars being grey with dark vermiculations, and the wing-speculum a deep metallic green with an inner border of white and an outer one of black. The beak is slate-coloured, with a black tip, the legs and feet are greyish blue, and the eyes hazel. The female is brown, marked with blackish brown above, and white below, but in other respects like the male.

Among the diving-ducks the pochard is unknown in the highest north, and



TUFTED DUCK.

neither can the white-eyed duck be called a northern bird, but the golden-eye (*Clangula glaucion*) should undoubtedly be mentioned in this chapter. It is occasionally found breeding in northern Germany, but its principal area extends beyond the Arctic Circle in Europe, Asia, and America. At the beginning of the cold season the golden-eye migrates south, when it visits the British Islands, Holland, France, Germany, and the Mediterranean. Feeding mainly on molluscs and crustaceans, it dives well, and has a noisy whistling flight, which begins with much splashing along the water. The golden-eye makes no nest, but lays its eggs in a hole in a tree; or, when there is no hole, lays them on the top of a pollard, and if even the latter be wanting, on the ground. In no case is there any lining beyond the bird's own light-coloured down. The eggs, ten to nineteen in number, are greyish green, becoming darker during incubation. This bird, which is recognisable from afar by the large white spot below the lores, measures 18

inches in length. With the exception of the aforesaid white spot, the head is of a brilliant greenish black, the back is black, the lower half of the neck, scapulars, speculum, and under-parts are white and the thighs dark brown. The eyes are golden yellow, the beak black, and the feet yellow with black webs. The female, which is smaller than the male, has no white spots, a brown head, and a white collar, with the shoulders iron-grey, and the back and flanks brown.

The tufted duck (*Fuligula cristata*) lives during the breeding season near fresh water rich in molluses; but at other times prefers shallow, sheltered spots near the shore. Its breeding-area is the north of Europe, Asia, and America, its boundaries being 50° N. and 70° N. latitude. In winter it migrates up the Nile valley to Abyssinia, and farther east has been recorded so far south as the Pelew Islands. It breeds in all the British Isles and in some of the northern parts of Germany. The nest, which is always close to water, and hidden in a tuft and made of grass or sedge with a lining of down, contains in May or June from eight to twelve pale eggs, grey or olive-green in colour. The tufted duck is an exceedingly quick diver, with the tendency to dive in case of danger distinguishing all the diving ducks from the swimming ducks, which seek their safety in flight. It is 16 or 17 inches long, black above and white below, with a white speculum. The head is purplish, the beak pale blue with a black nail, the feet greyish blue, the eyes pale yellow, and the feathers on the crown elongated to form a crest or tuft. In the female the colour is brown above and grey below, and the crest is shorter.

Mergansers.

The mergansers, of which three species are indigenous not only to central Europe but also to the north, resemble ducks in the conformation of their feet, wings, and tail, but are distinguished by the slenderer, more cormorant-like body and the narrow beak with its sharp marginal serrations. They fly like ducks, frequent running waters, nest on the ground or, occasionally, on trees, and feed on fish and other denizens of the water captured by diving.

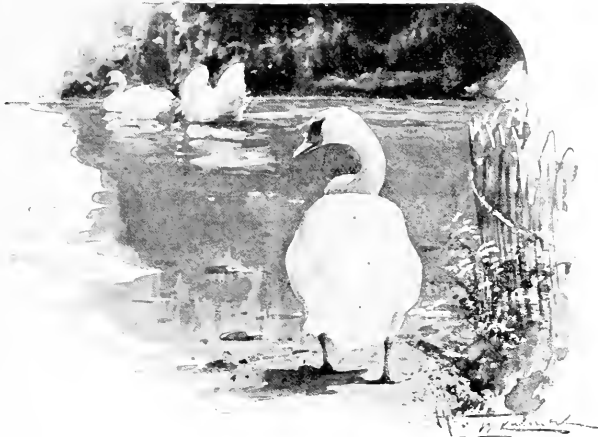
Of the three species, the goosander (*Mergus merganser*) lives as a rule in forest country on the bushy banks of rivers and lakes, but sometimes contents itself with open water in marsh-lands, or even with barren rocky shores, and is often found on the coasts of islands and isthmuses. It inhabits Europe and Asia from the far north down to about 54° N. latitude, and in some cases still farther south. In Asia it breeds around Lake Baikal, and in Europe comes south from Iceland to the British Isles, Holland, Denmark, Germany, France, and Switzerland. Though one of the best known of the mergansers, it is not very common in many parts of the Continent; it journeys inland from the Baltic and North Sea along the courses of the rivers and appears on the Lake of Constance and the Danube. Resident in the highlands of Scotland, it has been found nesting in Switzerland, and once in Bosnia. The nest is rarely far from water; and, like that of all the ducks with light-coloured down, is usually placed in a hollow tree, but may sometimes be situated in a depression in the ground hidden among plants and bushes. Sometimes, again, it is perched on cliffs, and occasionally the abandoned nests of crows or birds-of-prey are annexed. The goosander subsists mainly on fish, frequently caught by several birds hunting together. As indicated by its build, the goosander swims fast, and dives well and almost noiselessly, being able to remain under water for two minutes or more at a time, and darting about under the surface with the

rapidity of a fish. In flight the wings are noticeably long, the bird descending with a swoop and diving as it settles. Unlike most ducks, it dives when shot and lies under water. In length the goosander is 26 inches: the head is brilliant greenish black, the fore part of the back and shoulders jet black, the lower part of the back and tail grey, the primaries mostly black, and the rest of the plumage buffish white: the beak is deep red, with a black nail, the eyes are brownish red and the feet bright red.

The red-breasted merganser (*M. serrator*) inhabits the same countries as the goosander, and nests up to 70° N. latitude, its breeding-area being circumpolar. It is resident in Scotland and Ireland, in eastern Holstein, and among the lakes that skirt the southern coast of the Baltic. The nest—a mere hollow lined with down and seldom anything else—is generally well hidden and often approached by a tunnel through the herbage: occasionally it is in a rabbit-burrow. The eggs are olive in colour with a slight tinge of green, and from six to twelve in number. The young take to the water at once under the guidance of their mother, the male bird accompanying them at a short distance to give warning of approaching danger and then hurrying off, leaving his family to shift for themselves. The red-breasted merganser is 24 inches long, the male being distinguished from the female by having two bars in the speculum instead of one. The head is greenish black with a drooping crest, the breast reddish brown spotted and variegated with black, and the lower part of the back white, instead of grey as in the goosander.

Among the swans, the so-called mute species (*Cygnus olor*) is really indigenous to northern Europe, though it breeds so far south as the lower Danube. Living on open sheets of water in which there are islands with plenty of reeds and flags, this swan never places its nest amid plants, but on some spot affording a wide view, generally a small island. The nest, which is perhaps a yard or more across, is a bulky mass of sticks, roots, and reeds, and is used year after year, the greenish white eggs varying from as few as three to (rarely) as many as twelve in number. They are laid in April or May, their incubation being undertaken only by the female although the male is always on guard. In from thirty-four to thirty-six days the grey downy cygnets are hatched. On the first day these remain in the nest sheltered by their mother, but on the second they are taken out on the water, and continue under the care of their parents until fully fledged, feeding at first on small aquatic creatures, and soft vegetable matter such as the roots of reeds. Adult swans are principally vegetable-feeders, although now and then they may devour a small fish, lizard, mollusc, worm, or water-insect, caught by accident. They prefer the roots and seeds of water-plants and feed under water. Swans swim by turns slowly and softly, or quickly and powerfully, generally with half-raised wings; they fly high and vigorously with their necks stretched straight out, the wings giving an audible swish at each stroke. No bird dare attack them in the air or on the water, and they do not even fear a dog, when they have to defend their brood. Their strong wings serve as weapon and shield at the same time. Male swans occasionally fight fiercely with each other, clutching one another at their breasts, entwining their necks together, and beating each other furiously with their wings, until one is conquered, when the victor often presses the head of the vanquished under the water till the

latter is drowned. The male and female are, however, affectionate and inseparable, billing and cooing, intertwining their necks, and exchanging many other signs of affection. On migration, swans are fairly sociable with their fellows; they collect in larger or smaller flocks and fly very high in the air, following one behind the other or formed up in echelons. Though called mute, this swan really has a loud trumpet-like voice, and can also hiss like a goose. A full-grown mute swan is 5 feet long, though it does not look so large on the water. The species may be distinguished from other swans by the reddish yellow beak and black tubercle, which is larger in the male than in the female.



THE MUTE SWAN.

Grebes.

Finally, mention may be made of the grebe family, in which the hooded grebe is restricted to southern Sweden in the north. The little grebe appears very seldom in Scandinavia, the red-necked grebe is unknown farther north than central Sweden, while the black-necked species belongs principally to the temperate zone. None of these is therefore a true northern bird, although the eared grebe, which is principally spread over northern Asia, may be mentioned as such.

**Reptiles and
Amphibians.**

Northern Europe possesses exclusively neither reptile nor amphibian, although the central European viviparous lizard is found in Lapland, and the blind-worm ranges even beyond 65° N. latitude. The viper reaches the Arctic Circle, the ringed snake is found as far as latitude 65° N., and the smooth snake in southern Norway.

The northern boundary of the edible frog is 59° N. latitude, the common frog ranges into northern Scandinavia, and the moor-frog a little above 65° N. latitude. The brown toad-frog and the fire-bellied frog go no higher than southern Sweden, which is also the northern boundary of the natterjack and the tree-frog. The

green toad ceases to exist north of latitude 58°, while the common toad is absent only in the extreme north. The common newt extends up to 63° N. latitude, but the crested species does not reach quite so far.

Fishes.

Although the fresh-water fishes of the north are to a great extent identical with those of central Europe, there are a certain number of more or less distinctly northern types. Among these may perhaps be included the asp (*Aspius rapax*), a member of the carp family, which, although found in Austria and the adjacent countries, is common in Norway and in all rivers flowing into the North Sea, whence it extends through Russia. In the salmon family several of the species of charr (*Salvelinus*) are essentially northern fishes. Charr differ from salmon and trout (*Salmo*) by the circumstance that the teeth attached to the element of the palate, known as the vomer, are restricted to a group at the head of that bone. Within the Arctic Circle, and as far south as Iceland, there occur several kinds of migratory charr, which descend to the sea in autumn and return to the river in spring to spawn. Other species, on the contrary, are restricted to lakes, which they never leave; resembling in this respect the southern species. Among the migratory species is the Alpine charr (*S. alpinus*) of Scandinavia, Lapland, and Iceland; while a nearly allied Icelandic species, *S. nivalis*, is non-migratory. A small Norwegian non-migratory species has been named *S. rutilus*. Several of the salmon-like fishes of the genus *Coregonus* are also northern, such as the Swedish *C. Lloydii* and *C. gracilis*, as well as *C. lapponicus* of Lapland, and *C. widgreni* of Sweden and Finland.



ALPINE SNOW-MOUSE.

CHAPTER VIII

ALPINE EUROPE

THE European Alps contain a strange mixture of zoological stations. In the high mountains reigns a northern climate, while the lower slopes border central and southern Europe, as well as the south-eastern and western countries. Accordingly, the fauna of the Alps is composed of northern types surrounded by central, southern, western, and eastern forms, mingled with a few that are distinctively Alpine.

The foot of the Alps and of the other high mountains of Europe is surrounded by a forest-zone, which in the lower portion consists of deciduous trees, and higher up of conifers; this being succeeded by a belt of upland meadows, followed in turn by the true Alpine region. The beauty decreases with the elevation, the forests giving place to isolated groups of low trees, succeeded by meadows with alders and dwarf firs. In the higher regions the plants become less and less frequent: the eye meets nothing but peaks and ridges, intercepted by abysses, and streaked by glaciers or covered with perpetual snow. Above the forest-zone are found most of the animals indigenous to the Alps, or other high ranges, or the north, while the forest-zone, in addition to some of these, has much of the fauna of the adjoining country.

One of the animals indigenous to this region is the largest of the hollow-horned animals of the Alps, the ibex, steinbok, or bouquetin (*Capra ibex*), restricted at the present day to a small territory in the Savoy Alps and in the wild country between Valais and Piedmont. Formerly it was frequent in the higher mountains of Germany and Switzerland, while in prehistoric times it inhabited even the countries at the foot of the Alps. Ibex were

often exhibited by the Romans in the arena in herds of a hundred or more; but these goats increase slowly, and in course of time have become almost exterminated by being constantly hunted. When they inhabited the lowlands, the climate was probably much colder than at the present day. In the fifteenth century ibex were



THE ALPINE IBEX.

fairly common in Switzerland: but it is definitely known from the record of Conrad Gesner that in his time (sixteenth century) they belonged only to the wildest Alpine regions, and in 1550 the last survivor was killed in the canton of Glarus. In Graubünden they had been destroyed long before: but previous to this they were often tamed by the peasants, and abounded in the mountains of the Upper

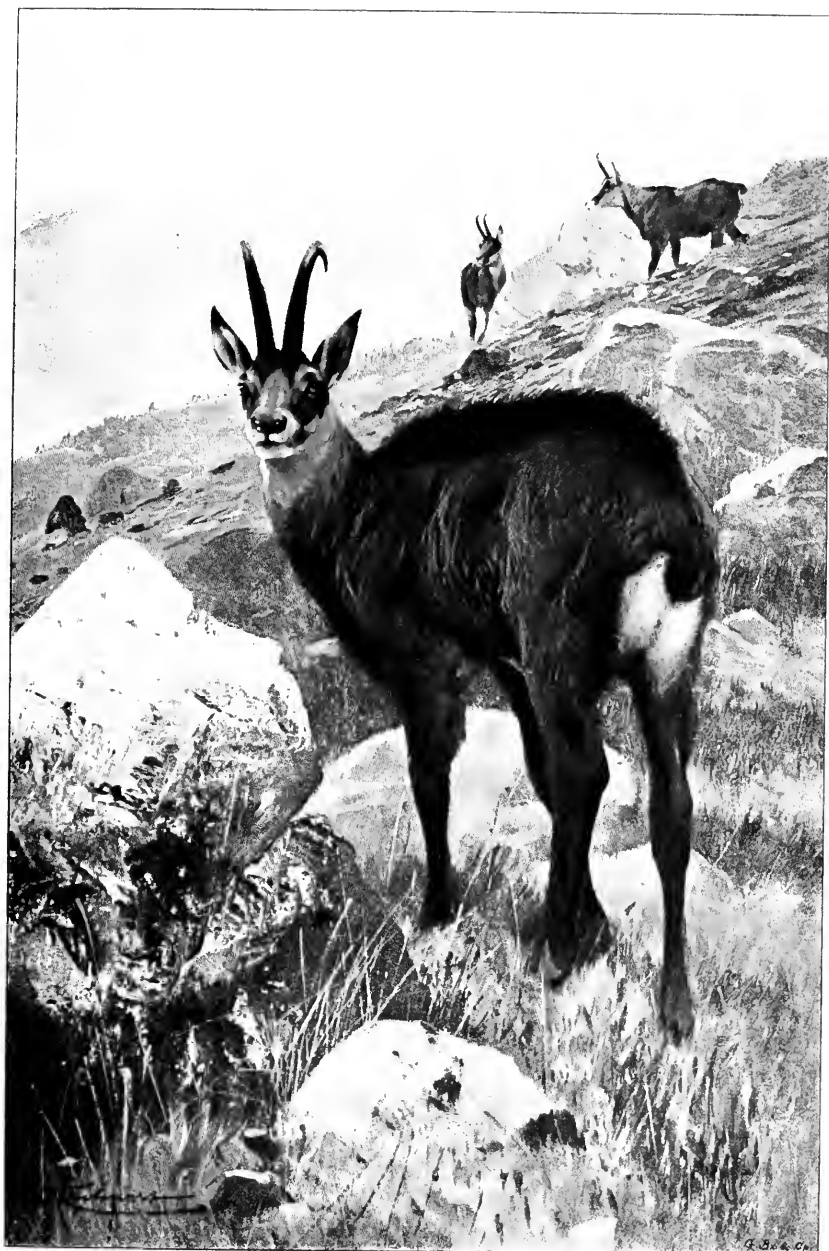
Engadine, Kleven, Rheinwald, and Bregaglia. In the sixteenth century they had decreased so much that in 1612 hunting was prohibited under pain of a heavy fine. On the St. Gothard, however, they were not quite exterminated a hundred years ago; but they have survived longest in the Alps of Valais, between Monte Rosa and Mont Blanc, whence they have spread to the mountains of Faucigny. From Salzburg and Tyrol the ibex, in spite of the protection of the Archbishops of Salzburg, who gave many away as presents to other princes, have disappeared for more than a century. Some years ago, ibex existed in considerable numbers near Monte Rosa, where about forty were seen in the year 1770, but no more for a space of fifty years. In Piedmont ibex are not allowed to be shot, and consequently many are found on the southern slopes of Monte Rosa and the neighbouring mountains. On 26th July 1873 some persons ascending the Grand Paradis (13,500 feet) saw nineteen chamois and ten ibex; and a few days after two ibex on the neighbouring Glacier de la Tribulation. The number of ibex in these parts is believed to be more than 400, and skins, as well as young live specimens, at £40 apiece, may be obtained from this district at any time. The Alpine ibex is 5 feet long and stands $31\frac{1}{2}$ inches high. Its scimitar-shaped and knotted horns, which are from 18 to 27 inches long, give it a very stately appearance. The horns of the does are much flatter and shorter than those of the bucks, and only measure 7 inches in length. In summer the ibex wears a brownish coat, with isolated white hairs, and a dark brown stripe down the back: the forehead and nose being brown, the cheeks yellowish, the lips white, the throat grey, the hind part of the head dark brown and whitish, the neck whitish grey, the hind-legs chestnut, the lower part of the body white with a few black hairs, and the upper side of the tail blackish brown. The winter coat consists of longer and darker hair; and in winter the chins of the bucks carry small brushes of stiff hair which can scarcely be considered proper beards, and disappear in spring. The weight of the male ranges up to 220 lbs., the horns weighing about 22 lbs. The body is cylindrical, the throat and neck, as well as the very sinewy but relatively thin legs, are very strong and muscular; the head, which is held low when at rest, and bent back when in flight, being proportionately small. The buck has a smaller head and a more arched forehead than the female; the short ears are placed towards the hind part of the head, the eyes are bright, and the tail, which ends in a chestnut-brown tuft, measures from 5 to 6 inches.

When walking on slippery ground, ibex spread their hoofs, which are as hard as steel, and uneven below. They use their horns for scratching, and for defence against other bucks; and when kicking, which they do like a goat, they stand on their hind-legs and hold the head on one side. Ibex live in herds of from six to fifteen head, the older members of which combine with one another to resist the attack of foes. At the approach of danger, the old bucks whistle like chamois, only more sharply and shortly, and when suddenly alarmed, utter a short sneezing sound. These old bucks separate from the others and lead a solitary life. The pairing, which is accompanied by the usual fights between the males, takes place in January; these ruminants being quite insensible to the cold, and often standing for hours on rocks during a snow-storm while the tips of their ears are freezing.

Towards the end of the year the doe brings forth a woolly, goat-like fawn, the size of a cat, which soon runs alongside its mother, and becomes fully grown in five years. Ibex descend to the forests to graze during the night, but such places are never more than a quarter of an hour's journey from the rocks. In the Cogne Mountains ibex will sometimes spend the night in cave-like hollows of the rocks. At sunrise the herd moves upwards, to spend the greater part of the day ruminating or sleeping on the highest and sunniest spots. They are best observed in the morning before 6 a.m. and after 4 p.m. when they are down in the forests grazing. Old bucks often remain in the same place for days, if it offer a wide view and is protected from attack, while the does and young generally keep somewhat lower down. Ibex always avoid the society of chamois, although they sometimes associate with herds of goats. In winter they retire to the forests, living on buds, mosses, and fruits, while at other times they feed on grasses, herbs, young shoots of willows, birches, and raspberry bushes. Like goats and chamois, they are fond of licking salt rocks. An ibex will ascend a rock of from 12 to 15 feet high in three jumps, clinging to almost vertical places for some seconds at each spring. In captivity one has been known to stand on the edge of a door and leap from the ground on to a man's head, where it stood firmly; and another has been seen to run up a wall which had nothing else to which to cling save the places where the mortar had crumbled away.

Chamois.

The chamois (*Rupicapra tragus*) is an inhabitant of the zone of upland meadows bordering the higher forests of the Alps and other European mountains. In structure it is somewhat between a goat and an antelope, and is about the size of a blackbuck. The body is rather short and strong than slender, the back being higher towards the rump than in the middle; the head is short, and the forehead nearly vertical and growing suddenly narrower at the nostrils, which are placed close together, hardly leaving space for the narrow, grooved upper lip. The chamois has slender jaws but strong teeth well adapted for grazing the shortest grass and capable of masticating the driest and toughest food. The teeth begin to change in the second year, but are not fully developed till the fifth year; in old age they turn a brownish colour. Both sexes have nearly vertical cylindrical black horns, which from the base to the middle are covered with numerous transverse rings, and at the tips are smooth and hooked backwards. The horns of the buck are more sharply hooked, and shorter than those of the female. The distance between the horns and their thickness and length are not necessarily distinctive signs of sex, but depend greatly on the different conditions under which the chamois live. The summer dress of the chamois is close and coarse and, except in a few places, only an inch and a quarter long; the winter coat being three times as long as the summer growth. The middle line of the neck and back is surmounted for the whole of its length by a mane of from 8 to 9 inches in length. Chamois-hair is very easily electrified, especially this mane, which is black with a yellowish tint at the tips of the hairs, brown being the prevailing colour of the coat. In spring the Alpine chamois is brownish yellow, but it changes to fawn-colour in summer, the lower part of the body turning to a pale reddish yellow, while the back bears the so-called "cel-stripe," which widens at the upper part of the neck, branching into a dark brown band



CHAMOIS

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CHAMOIS GLISSADING.

running across the ears and eyes down to the nose. The back of the nose as well as the lower jaw and throat are of a pale yellow colour, with reddish yellow spots above the eyes, on the nose and the upper lip, the hair being darkest on the chest. The legs are dark on the outside but reddish yellow on the inner side, the hind-surface being whitish yellow, and the tail black above and pale grey below. The coat is lighter in summer than in winter, when it is dark brown, or sometimes even almost black, the under-parts being dull white, the head-stripes dark brown, and the legs yellowish white: this change of colour takes place very gradually. The so-called coal-chamois, which is dark grey or black, is a variety living in a few districts: but white, pale yellow, and dappled individuals may occur anywhere. In old age the coat turns grey.

The fawn is born twenty-one weeks after pairing, at the end of April or beginning of May, and becomes capable of breeding in its third year. The first

time the doe has generally but one kid, later on two, or rarely three. Although an inhabitant of the highest forest-zones, the chamois is distributed over all the Alpine region; nor does it live exclusively in open regions, seeming to prefer the quiet of the forests to the bare parts of the mountains, and liking to retire to the woods for rest, although some of those born in the regions near the snow-line are said to prefer the rocks. The chamois is a diurnal animal, seeking the pastures early in the morning, where it grazes until nine or ten in the forenoon. After a short noonday rest it wanders to some forest thicket or among the snow, where it lies down to ruminate. Between four and five o'clock the herd slowly wends its way to a pasture where it remains till nightfall, the members lying down in picturesque groups. By moonlight the chamois prolong their grazing until ten or eleven in the evening; and after having licked the salt-rocks in the forenoon seek springs where they may quench their thirst, although if necessary they are capable of going without water for a long time. While grazing, chamois often pick up roots and other indigestible substances, and when licking their coat while ruminating will often swallow a few hairs. Such foreign matter collects in the stomach into a so-called "chamois-ball," which sometimes attains the size of a walnut or an egg. Excitement much influences the appearance of a chamois; when grazing quietly it is by no means a beautiful animal, but the moment it scents a human being it becomes transformed, and when speeding along, every movement is alive with strength and grace. During flight chamois are most active in climbing and leaping, surmounting every difficulty and taking advantage of every corner. In unknown localities they will pry about for some time on every side until they find the safest and easiest way; and if cut off by a ravine, will spring across to stand firmly on a spot no larger than the palm of the hand. When pursued they may sometimes slip with one or two feet, without stopping in their flight, and even if on rare occasions they miss their spring and fall into the abyss, they come to no harm unless the descent be of unusual depth. In ascending a rock covered with loose stones one of the flock goes first, the second not following till the loose stones have ceased to fall. When descending steep mountain ridges, they look awkward, but when danger causes them to hurry, they will spring from 30 to 45 feet, and if there be no other way of escape will even slide down a steep face of rock by spreading out their legs to diminish the rapidity of their descent.

Very remarkable are the climbing-lessons given by the doe to her kid. Taking it first of all to some neighbouring meadow or grassy spot, she will playfully run off to a hill close by, leaving the kid uttering plaintive cries, which she answers in a low voice. If the kid refuses to follow and continues to cry, the doe hurries back, jumping around until she induces it to follow. In a few days she will spring on to a rock more difficult of access, and although the kid will bleat plaintively after an unsuccessful leap, the mother continues her encouragements until the young one follows. In about four weeks the kid learns to run, climb, and jump with facility, and at the end of three months follows the mother anywhere. Kids of one or two years old, which as a rule are still with the doe, take part in the education of the younger ones; when old enough, they begin to form herds by themselves, the bucks keeping at first apart, and roaming about either

alone or in twos and threes. The bucks avoid the kids, old bucks as a rule living entirely alone. A herd of chamois forms a most interesting picture, but as soon as they see a gunner all the members make off, and even if the sportsman does not move, continue their flight up the mountain, looking cautiously around, and if in summer not returning to the same place that day. One of their favourite occupations is sliding down the slopes of snow. On one occasion several chamois were observed at the top of a snow-field; one slid half-way down, the second drew up its hind-legs in a crouching attitude, worked with its body until it was in motion, and then slid down the slope with great rapidity. Several others followed suit, and this performance lasted about three-quarters of an hour.

Chamois are watchful in the highest degree, and any bird of medium size is looked upon by the old does with great distrust. They do not usually heed the calls of small birds, but when a thrush gives its warning note the whole family of chamois rises at once. The call of the black woodpecker startles them for a moment, but the scream of the jay produces a great effect; on the other hand the call-note of the nutcracker troubles them little, as does that of the jackdaw, unless a whole flock of these birds alarm them with their ear-piercing cries. Occasionally the call of the ptarmigan attracts their attention, while that of the rook excites in the doe signs of feverish agitation, and if the herd hear the voice of the golden-eagle they are thoroughly frightened. The mountain-chamois is shyer than the forest-chamois. Both are able to find certain spots a second time, to which they know the nearest way. A place where one chamois has met with an accident is sure to be avoided by the rest, especially if the carcase remain there for any time. Good pastures and salt-rocks are frequented by these animals by day and night, and even great changes—as a fall of rock—cannot make them mistake their way. If a pasture be destroyed they will seek a new one, becoming as accustomed to the change after a few days as if they had been there for years. Although chamois are nowise formed for swimming, in case of need they do not fear the water. During summer they lead a pleasant life, but in autumn when much hunted they become very wary and retire to the higher mountain regions. In the latter part of September they are again left in peace. Meanwhile several of the does and kids have formed into herds, with bucks of three or four years old; the older bucks still wandering about in twos and threes, but later on joining the herd, at first shyly, but gradually becoming bolder, and performing all kinds of amorous antics with the does, and fighting harmlessly among themselves. Pairing-time begins about the 20th of October, when the bucks are feverishly restless. During the breeding-season the bucks get so thin that they look nothing but skin and bone, and after it is over they retire—especially the old ones—to quiet places lower down the mountain-side.

Meanwhile winter has set in, and as the season advances the scarcer grows their food, especially when the snow becomes frozen; and in hard winters many perish, although they shelter in the pine-forests, where they feed on the pine-needles. Occasionally a large branch freed from the weight of snow springs back into position, taking with it the chamois which has become entangled by the horns, so that it dies suspended in the air, the skeleton or skull being found in the spring. Among the enemies of the chamois, man ranks first; it is the poacher, however,

and not the sportsman who is its most dangerous enemy; and the destruction of chamois by other animals is small in proportion to that wrought by the men who shoot it out of season. In the vast forests of the Bukowina and Transylvania, the chamois is pursued by the bear, which springs upon it suddenly from its lurking place. Wherever wolves exist they unite in packs to hunt chamois, generally capturing the kids. In the Carpathians the lynx lurks in the grass and undergrowth to leap upon them, while the wild cat attacks the young and feeble. The fox also preys upon the old or sick. In the Carpathians, Transylvania, and the Pyrenees the lammergeier not only carries off the kids but endeavours to drive the does over precipices, the golden eagle also acting in the same way. The kids form the prey of owls and ravens; and occasionally a chamois is killed by a poisonous snake. In hard winters food is so scarce that chamois begin the spring in a famished condition, and so greedily attack the young blades of grass that they die from surfeit; while others perish from devouring poisonous plants, especially hellebore. In captivity the greatest care has to be taken in the choice of food: well-fed chamois make charming pets, though they are only tameable when caught young. The kids generally perish under injudicious treatment, but occasionally are successfully reared. If carefully nursed they are generally healthy animals, and become good friends with men and dogs, although never agreeing with sheep. When in captivity the chamois retains its characteristics; the kids are amusing, the does trustful, while even the bucks are generally tame, although in some cases they get mischievous and bad-tempered.

Chamois range from the Pyrenees where they are known as the izard, to the Caucasus where they are called atchi; and these local representatives of the species constitute distinct races, one of which is peculiar to the Abruzzi. Of late years the numbers of the chamois, especially in Austria, have increased considerably. The hunting-grounds of the Mallnitz valley are the best in Carinthia, those of the Tauern range, in the Gail valley, the Carinthian Alps and the Karawanken, being also famous. Chamois are numerous in Lower Austria, and Salzkammergut in Upper Austria is particularly favoured by them, although this cannot be said of the Tyrol, the Vorarlberg, or Croatia. In the maritime parts of Austria, chamois are only seen when migrating from place to place, but in Hungary and the adjoining countries they inhabit the Carpathians and their spurs, which comprise a much larger area than the Alps. In Galicia and Bukowina, chamois are only migratory, but in Transylvania are resident. The inaccessible peaks of Bosnia and Herzegovina shelter many chamois, and in Dalmatia they inhabit the Dinarian Alps, while they are also found in Bavaria and Rumania, as well as Greece. The izard or Spanish chamois, which has thinner horns, and a coat almost foxy-red in colour, inhabits the Spanish parts of the Pyrenees (being exterminated on the French side), and the Cantabrian Mountains, the Serania de Ronde, the Sierra de Gredos, the Cordillera Capata, the Sierra Nevada, and the Almansor, where it ranges up to 8700 feet. Chamois also inhabit the mountains of Asia Minor.

Marmot.

As well known as the chamois is the Alpine marmot (*Arctomys marmotta*), which lives on small isolated stony areas amid glaciers, where there are neither trees nor shrubs. Although a rodent, it is not endowed

with the agility of its cousin the squirrel, or even the mouse, although it is adapted for a partially subterranean existence. Marmots content themselves with a small area surrounding their holes, driving away their enemies by biting and scratching; and sleeping during winter. The cleft upper lip is furnished with stout bristles, and discloses the strong, curved, chisel-like teeth, which in old animals are golden yellow, although white in the young. The head has brilliant black staring eyes, with circular pupils, and small round well-covered ears lying flat against the crown. The cheeks are covered with long hair and look puffy, the neck is short and thick, the legs are short and strong, and the close and coarse fur is often much worn by passing into and out of the hole. In colour the body is yellow or reddish grey above, yellowish brown below, rusty brown at the throat, and black or bluish grey on the crown. The black nose and muzzle are edged with white, the whiskers are yellow, and the strong fore-feet covered with dull yellow hair right down to the long black burrowing nails. The tail is 7 inches long, and covered with hair on both sides, two-thirds being reddish brown, with a black tassel at the tip.

Marmots are exclusively herbivorous; they eat sitting up on the hind-legs, holding the food with the fore-paws, and they very rarely drink. At day-break the old marmots are the first to appear at the mouth of the hole, putting out their heads cautiously and prying about: after listening a few seconds, they venture slowly into the open, and take a few steps upwards, assuming curious attitudes, and finally begin to graze. They nibble the short grass, but are particularly fond of the blossoms of the smaller Alpine plants. After the adults the young soon appear in front of the burrow, and when they have finished their meal the whole family lie down in the sun, always on the same spot, generally on some convenient stone not far from the entrance to their home, the paths leading to which are polished by constant use. They spend their time playing and resting. After a sufficient meal they sit up and look around, scratch, comb and clean each other, playing and indulging in various grotesque antics, the young trying to walk on their hind-legs. When one of the adults perceives a bird-of-prey, a fox, or human being, even some way off, it whistles several times through the teeth so loudly that the sound is carried through the air to a great distance, the call being rather deep than high, plaintive and yet shrill and piercing. This whistle, heard many times a day in the Alps, is uttered only by the individual which has seen the enemy; all the rest hurrying noiselessly into their burrows. They bolt in this manner only when danger is near, at other times the animal giving warning remains outside to repeat it from time to time, thus calling the attention of all the marmots far and wide to the approaching danger. Should the enemy be perceived by all at once, their cries are heard in every direction, but if the foe conceal himself behind a rock they are suddenly silent, remaining, however, on the alert, whistling as soon as he reappears, and taking to the burrows at his slightest movement; those marmots which have obeyed the warning but not really seen the enemy being the first to reappear. Marmots retire daily to their burrows as soon as the sun goes down, but in autumn generally shortly after noon, or even earlier, remaining in their holes all night, and in bad weather not appearing for days. During summer they live in pairs or families on the green meadows sur-

rounded by banks and precipices, but always choose dry places on the sunny side of the mountain. Their summer dwelling is a passage of from one to four yards in length, so narrow as not to allow the entrance of a hand, leading into a wider chamber. The passage is generally situated in the open sward, but often between stones and rocks with an outlet on the outer side; it is sometimes divided into two arms, one leading to the dwelling, the other used as a refuse-hole. Sometimes the summer dwelling is also used in winter, when the chamber is enlarged, but should the marmot have a winter dwelling as well, it descends from a height of 8500 feet or so, to a lower altitude of from 7500 or 6500 feet, often coming down within the limit of tree-growth. The principal passage in the winter burrow seldom measures less than one or two yards, but is often from eight to ten yards. It is made in an upward direction, opening into an oblong or round chamber of about a couple of yards in diameter, with a depth of a yard or more under the grass. In August this is lined with dry grass and herbs. Before the family, numbering from five to fifteen, retire to hibernate, the neighbourhood of the burrow is betrayed by the wisps of dry grass lying about in front. Marmots generally move to winter-quarters in the middle of October, especially if the season be cold, when they stop up the entrance to the burrow with grass, earth, and stones to the depth of a few feet; a dwelling used only for the summer never contains grass. In late autumn the burrows are easily recognisable by the absence of snow above them, the rest of the ground being covered with a thin layer of white. The winter burrow has generally a side avenue like the summer burrow, probably owing to the fact that the animals have changed the direction of the passage. In burrowing the earth is only partly thrown out, most of it remaining in the hole, where it is firmly trampled down; but the old grass is all thrown out, often in such quantities that it is more than a man can carry away at a time. In the winter burrows, from ten to fifteen marmots are often found lying in a death-like torpor, each one huddled up with its nose touching the tail, and the soles of the hind-feet at the side of the head. During this period digestion ceases for six or eight months, the stomach being empty and the limbs stiff; their bodies are cold and insensible to wounds, owing to the sluggish circulation, and breathing is scarcely perceptible, the result being that they do not become thin during the period of hibernation, but merely lose their fat a short time after awakening, which takes place at the end of May or April, when their tracks may be seen all over the snow, as the hungry animals run about to find grass on uncovered spots. Soon after hibernation they pair, the young appearing in June, to the number of from one to six. At first they are ashy blue in colour, but change later to yellowish brown. The young, which remain with their parents until the following summer, are never seen outside the hole before they reach a certain size, and are suckled by the mother, who sits on her hind-legs like a dog, with her fore-paws outspread. Those families which do not possess a summer dwelling make long excursions to flowery pastures, where they do not tolerate intruders, driving them away by drumming them with the fore-paws on the head and back. Marmots are captured by digging them out of their burrows, a practice now prohibited in many places; they are also caught in traps, when as a rule only the older animals are taken; and they are hunted by dogs specially trained for the purpose. Marmots are found exclusively on the



ALPINE MARMOT.

upland meadows and lower snow-regions of the Alps, the Carpathians, and the Pyrenees, but are rare in the Carpathians and the Tyrolese Alps, where they have been driven up to the more inaccessible parts.

Alpine Vole. The Alpine vole or snow-mouse (*Microtus nivalis*) leads a life of which nothing was known for years. It was first discovered in 1841, simultaneously on the St. Gothard and the Faulhorn. The total length from the nose to the tip of the tail is 6 inches, the tail measuring 3 inches. The colour is dark ash-grey above, lighter brown at the sides, the neck, lower part of the body, and legs being whitish, the feet whitish grey, and the long, closely growing whiskers black and white. The eyes are small, and the longish ears, rounded and more than a third the length of the head, are covered at the tip with reddish grey hair. The thick tail is tipped with longer hairs, and the hair of the body is close and soft. This vole, which is unknown below an altitude of 4000 feet, ranges to the boundary of perpetual snow, where it lives during a winter lasting from nine to ten months. In summer it finds sufficient food in the rich and plentiful vegetation of the higher Alps, which abounds in umbelliferous plants. The food of the species comprises the blossom of the Alpine avens, and its relatives the cinquefoils, as well as the leaves and roots of catchflies, chickweeds, gentians, arabis, saxifrage, and various kinds of clover. These are eaten by the vole while sitting up on its hind-legs and holding the food between its fore-paws, turning it round all the time. Not very active and by no means shy, it is best observed and caught towards the evening, when it may be seen out in the open or in the Alpine huts. In summer these voles have from two to three litters of from three to six young ones, which are brought forth in a nest of dry grass placed in the subterranean runs, between stones, or in a corner of a hut. In winter they neither breed nor hibernate, but live underneath the thick coating of snow, which keeps out the cold, the temperature in the runs not falling below freezing-point. The Alpine vole inhabits the mountains of Bavaria and the Tyrol, as well as the western Alps and the Pyrenees.

Alpine Shrew-Mouse. The Alpine shrew-mouse (*Sorex alpinus*) is peculiar to the Alps. In length it measures $5\frac{1}{2}$ inches, with a tail of about $2\frac{1}{2}$ inches; and in colour is greyish black or dark grey, with a brownish tint above and paler below. It seems to inhabit the whole chain of the Alps, living in the forest region, chiefly in the upper and middle zone of pines, at an altitude of 7200 feet. Although no swimmer, it frequents the vicinity of water, and resembles in its habits the common shrew-mouse.

Alpine Bat. Our notice of the mammals of the Alps may be brought to a close with the Alpine bat (*Pipistrellus savii*), which is dark brown above, looking as if powdered with gold, and paler beneath. The two terminal joints of the tail protrude beyond the web joining the hind-legs. In length it measures $3\frac{1}{4}$ inches, the tail being $1\frac{1}{4}$ inches, and the wing-spread 9 inches. This species seems to inhabit the whole of the Alps to beyond the limit of tree-growth, in higher regions than any other bat, though it probably winters in a warmer climate. Flying quickly and erratically, it does not appear to mind wind or warm rain. It comes forth in the evenings at dusk to fly in search of food

around the edge of the forests or Alpine meadows, retiring in the morning to the roofs of the mountain huts.

Alpine Ring-Ousel. Many of the birds living in the Alps have been already noticed, but there are a few so characteristic as to deserve special mention. Among the latter, the Alpine ring-ousel (*Turdus torquatus alpestris*) lives in the



ALPINE ACCENTOR.

Alps, Carpathians, the mountains of Silesia, and many other ranges, and seems to breed in the Taunus.

Alpine Accentor. The Alpine accentor (*Accentor collaris*) is a true mountain-bird, often living beyond the region of the higher vegetation, among the upland meadows and rocks. Occurring in the mountains of Silesia and Bavaria, as well as all the other high mountains of central and southern Europe, it has been found as far east as northern Persia. In all these countries it is resident, but moves down to lower regions in autumn. This bird never alights on trees

or shrubs, but perches on stones among short grass and on plants. In colour the throat is white with black shell-shaped spots, although in the young the spots are wanting and the ground-colour grey. The wings are ornamented with two white bars formed by the tips of the coverts; the breast is grey, and the tail dark brown with a white tip on the inner web of the outer feathers.

This bird, which is about $7\frac{1}{2}$ inches long, breeds in the crevices of rocks and under bushes, the nest being formed of fine grass and rootlets, lined with moss wool, hair, and a few feathers. In May and June it contains from four to five pale bluish eggs. In character and habits the Alpine accentor generally resembles its cousin the hedge-sparrow, the few differences in these respects being due to the colder climate of its home. As soon as the snow covers the seeds, it leaves the mountains and migrates to the shores of the Mediterranean.

Titmice and Creepers. In the Alps titmice are represented by the Alpine form of the marsh tit (*Parus palustris borealis*), a race also found in the north, where it ranges up to the Arctic Circle. The creepers, on the other hand, have a characteristic Alpine species, the handsome crimson-winged wall-creeper (*Tichodroma muraria*), which inhabits all the higher mountains of central and southern Europe, as well as the corresponding latitudes of Asia as far east as northern China, and Africa as far south as Abyssinia. In Europe this bird nests in Spain, France, Italy, the Balkan peninsula, Austria, Switzerland, and upper Bavaria; in all cases being found close up to the snow-line. Winter sometimes drives it down the mountains, when it arrives as a straggler in many parts of Germany as far as Coblenz on the Rhine, in northern France, and rarely in the British Isles. Seldom seen on trees or bushes, the wall-creeper generally climbs some vertical rocks in a zigzag course, flying down after a moment to ascend an adjacent cliff in the same jerky manner. In climbing it supports itself by the wings, and not by the soft-feathered tail. As it ascends, it searches every crevice with its beak for flies and other insects and spiders, often catching the flies while in the air. In its ascent the head is held erect or bent backwards on the neck. During the night, which is passed in some crevice of the rocks, this creeper, unlike other birds, rests on its stomach; and it enters and leaves its resting-places with the greatest precaution. It roosts till late in the morning, until, in fact, the hoar-frost has thawed from off the rocks. It has a peculiar flight, curiously like that of a large butterfly. Although living in solitude, it is always brisk: its call being a short, flute-like whistle, and its song, which is also short, decidedly melodious. Towards the end of May the nest contains from three to five white eggs, marked with small brownish dots. This is placed in a crevice of the rocks, and neatly built of moss, grass, rootlets, hair, and feathers. In colour the wall-creeper is pearly grey with blackish wings and tail: the latter being tipped with white and grey. The wing-coverts are crimson, and five of the primaries are spotted with white.

Water-Pipit. Among the pipits, mention may be made of the water-pipit (*Anthus spipoletta*) as an Alpine bird, which lives among rocks and mountain-streams. Widely distributed in Europe, it extends eastwards to the Altai; and breeds in colonies, constructing its nest mainly of dry grass, with a little moss and a few rootlets, and lining it with wool, hair, and feathers. The nest is always on the ground in a dry place, and generally among stones or under

a bush. The water-pipit resembles its cousin of the meadows in its song and habits, although it wades in shallow water with as much assurance as a wagtail, jerking its tail in the same characteristic fashion. Its food consists chiefly of

insects, worms, and molluscs, especially during the spring migration from March to May. In September it migrates to north Africa and southern Asia, although some individuals never cross the Mediterranean. The total length of this bird is about 6½ inches. A peculiarity of the species is the great curvature of the claw of the hind-toe, which is also longer than the toe itself. In summer the throat and breast are reddish, and the

lower parts unspotted; in winter the colour below is yellowish white, while the throat and breast are spotted with brown. The upper part of the body is greyish or olive brown

with indistinct blackish grey spots, without the yellowish green tints distinguishing other pipits. There is a white eye-stripe, and

the ear-coverts are greyish brown; while the wing-coverts have pale edges, and the tail-feathers are tipped with white, the light part of the outer pair being white, instead of brown as in the rock-pipit.

The snow-finch (*Montifringilla nivalis*) is an inhabitant of all the higher mountains of Europe and Asia between the tree-limit and snow-line, except in winter when it moves towards the plains. This mountain-bird, which never perches on trees, places its nest among crevices in rocks on which the snow does not lie, but at the Hospice of St. Bernard under projecting roofs or similar shelter. The nest, which is compactly built of grass and other materials,



WALL CREEPER.

including feathers, contains five white eggs towards the end of May. The snow-finch is a sociable bird, and takes its young close to the snow-boundary, mostly on the sunny side of the mountains, where it may be seen in parties of from twelve to fifteen, busily hunting on the ground. Hopping along the edge of the rocky ridges, these birds search diligently for their food, which consists of insects and seeds, especially pine-seeds. The twittering song, although always welcome amid the solitudes, is not particularly rich or melodious. In length the snow-finch measures about 7 inches; the plumage is mainly white and black, though the head is grey and the back brown. The lesser redpoll (*Linuria rufescens*), the Alpine representative of the linnets, breeds in the Alps, and also in Great Britain, France, Belgium, Holland, and western Germany. It is a near relative of the mealy redpoll, and in winter appears in lower Austria.

Among the crow tribe, the chough (*Pyrrhocorax graculus*) is

Chough. a denizen of rocks and cliffs as well as of mountain forests. In autumn frequenting the sunny side of the mountains, this bird in winter visits the mountain valleys. Every night it returns to the heights, which it rarely leaves except on its wanderings. A few flocks of probably young birds migrate to warmer regions in October, whence they return in March. In May the nest is built in some cave or hole in a cliff, and consists of a shallow cup of rootlets and twigs, with a lining of wool and hair. The eggs, from three to six in number, are creamy white with lighter and darker spots. In distribution this bird is extremely local, but its range extends from Spain and Britain through central and southern Europe as far as China, and from the Canaries and the Atlas to Abyssinia. Everywhere it is restricted to certain spots, while from many others, apparently just as suitable, it is absent; Palma, for instance, being the only one of the Canary Islands inhabited by the chough. In Europe choughs appear in great numbers in Spain, Portugal, and the Pyrenees, as well as in the Swiss Alps. A few inhabit certain lofty cliffs in Carinthia and the Tyrol, and some a few localities along the rocky coasts of the British Isles, whence the species sometimes strays to East Friesland; and the Carpathians, the Balkans, the Caucasus, and the Urals also claim it as a resident. In length the chough measures about 15 inches. It is easily distinguished, by its long, curved coral-red beak, from the Alpine chough, in which the beak is short, straight, and yellow. The plumage of both species is jetty black, but the legs of the chough are red, while those of the Alpine species are yellow. The female chough is rather smaller than her mate. Young birds have the beak and legs dull orange till September, after which they acquire the permanent colour.

The Alpine chough (*P. alpinus*) is a somewhat smaller bird

Alpine Chough. living in similar situations, and ranging more or less over the same area. It is, however, absent from the Carpathians, although very common on the Swiss Alps, to a height of over 8000 feet, where it spends its life among the same rocks, which are whitened with the remains of its food. Never leaving the mountains for good, although migrating in the cold season to warmer parts, this chough is met with in the plains. In many respects it resembles the jaekdaw, being just as restless and brisk in its movements, and wandering about in flocks of hundreds at a time. The Alpine chough breeds in colonies, building amid rocks and ravines, not unfrequently even on high peaks and crags. The nest, which is

always placed at a considerable height, is constructed of rootlets, twigs, and grass, neatly lined with hair. The four or five brown-spotted, light brown eggs are laid in April or May.



CHOUCHS.

Although a bird of the Mediterranean countries, the Alpine swift (*Hirundo alpestris*) is also characteristic of the mountains from which it takes its name. Inhabiting the cliffs of both the northern and southern shores of the Mediterranean, this bird ranges over the mountains of north-western

Africa and Abyssinia, southern Europe, and south-western Asia from Spain to the Sea of Aral, Persia, and the Himalaya. Nesting in a few localities in Bavaria, the Tyrol, and Carinthia, it is much more frequent in Switzerland. In a short time after its arrival, it may be seen in bad weather hovering above swamps and waters in pursuit of low-flying insects, but later on, when insects frequenting higher levels of the atmosphere are abroad, it is found only in the mountains. On the ground it is even more awkward than the common swift, and has the same difficulty in starting to fly. At nesting-time the males quarrel so furiously that their claws get entangled and they fall to the ground, where they are also often captured when benumbed with cold. The nest, a shallow dish-like structure, is generally placed at a considerable height, and consists of leaves, feathers, and other materials collected in the air and stuck together with saliva. In the beginning of June it contains two or three, rarely four, eggs, but there are never more than three young, which are fed by the old ones with insects. The fledglings trust at once to the strength of their wings, but are lost should they fall to the ground on their first attempt at flight. The Alpine swift is 8 inches long; in colour it is dark greyish brown, the throat and under surface being white with a brown bar across the breast.

The largest of the Alpine birds-of-prey is the lammergeier
Lammergeier. (*Gypaëtus barbatus*), which although frequently classed with the vultures is broadly distinguished by its completely feathered head. Now driven from many of its former haunts, this splendid bird is essentially a dweller in the mountains, although in Spain and Greece it prefers the regions of moderate altitude to the highest peaks, and even occasionally visits the plains at the foot of steep rocky ravines. In the German and Austrian Alps the lammergeier is exterminated, although it still lingers in a few districts of Switzerland. Equally scarce in the Apennines and Dalmatia, it is still common in the Sardinian and Spanish mountains, as well as in Transylvania, the Balkans, the Caucasus, and the higher ranges of central Asia, such as the Himalaya, Tian-Shan, and the chains westward of Peking. Closely allied is the bare-legged lammergeier (*G. ossifragus*) of the Atlas, the mountains bordering the Red Sea, and the Abyssinian Highlands, which differs by its smaller size, and white cheeks, as well as in other particulars. It is said to be a weak cowardly bird of small intelligence which wanders about market-places, and camps with other carrion-eating species, now and then killing a weakly animal. The lammergeier of the Alps is much bolder, and is reported to kill chamois and carry off children, although many of these accounts of its former depredations are doubtless much exaggerated. Considering that but few remains of slaughtered animals fall in its way, the Alpine lammergeier is quite likely to be more audacious, especially when driven by hunger, than its southern relative; and even more so than many eagles. In Spain and Greece it is regarded as a harmless bird, feeding on carcases, bones, tortoises, and small mammals. Tortoises and bones are carried to a considerable height, and dropped on a rock: bones of the size of a man's fist, especially those with marrow, even if splintered, being swallowed and digested without difficulty.

The lammergeier searches every portion of its hunting-ground regularly every day. When anything attracts its attention, it flies in spiral curves above and

around, till it gradually descends to the ground, where it runs up to its prey like a raven. The young are amply provided with carcases, bones, and other kinds of food, which are broken up and torn by the old birds. The young do not leave

the nest before they are fully fledged, which is not before the end of July. The nest, which is never defended by the old birds, is placed on bare, steep cliffs, or in deep clefts or cavities, in the most inaccessible places, and is always sheltered from above against weather and sun. It is constructed of branches, twigs, and stalks, the thicker sticks below, the thinner towards the top, the cup being lined with rootlets, heather, grass, and hair. It is about 5 feet wide, by a yard high, and contains, in January, February, or March, according to the climate, two eggs of a dull white covered with bluish red spots and dull brownish red blotches. One of the pair is generally unfertilised, and consequently later on only one fledgling is found, which grows to a length of 42 inches, the female being a little larger than the male. The lammergeier may be easily distinguishable from other birds-of-prey by the stiff bristly feathers covering the eyelids, nostrils, and the base of the beak, and more



LAMMERGEIER.

especially by the beard on the chin, from which it derives its name of bearded vulture.

Game-Birds.

The game-birds are represented by the red-legged partridges, in which the beak as well as the legs are red, these birds being further distinguished by the spur on the hind surface of the leg, and the rows of shields on

the front of the same, the rest of the leg being covered with smaller shields. One species, the rock or Greek partridge (*Caccabis saxatilis*), is a true Alpine bird, inhabiting Switzerland, the Tyrol, and Upper Bavaria, where it dwells in the higher regions during summer, but descends to lower levels in autumn. Its home is among the rocks, especially on the sunny side of the mountains: but it also resorts to districts covered with shrubs, grass, and heather. In Italy and Greece, where it frequents the cornfields, it may be either resident or migratory, according to the food-supply. In winter these partridges congregate in coveys or packs, but in spring separate into pairs, each of which chooses its feeding-ground, which is defended against intruders by the cock. The hen scratches a small hollow in the ground under a bush, a tuft of grass, or projecting rock, or among stones, and on a few stalks and leaves lays her twelve to fifteen pointed eggs,—in the higher Alpine regions in May, but in the warmer parts of Greece in March. The Greek eggs are yellowish, and either devoid of spots or covered with numerous yellow or brownish markings of different shapes and sizes. The Swiss eggs, on the other hand, are brownish, with large irregular spots at the thin end, crowded into a sort of cross. It is also said that the northern birds lay larger eggs than their southern kindred.

The Greek bird, which is slightly smaller than the Alpine form, is by some ornithologists regarded as a race of the Asiatic *C. chukar*, a species but little removed from *C. saxatilis*. In the sixteenth century these partridges frequented the Rhine Mountains near St. Gall: and at the present day, besides the Bavarian



ROCK PARTRIDGE.

and Salzburg Alps, they inhabit the Tyrol and other parts of Austria, Switzerland, southern France, upper Italy, Sicily, Sardinia, and Greece and its archipelago. The Alpine bird, which is 14 inches long, is principally grey, with a black band round the head and throat, and black lores. The sides are marked with short black and white or rusty yellow cross-bands; the tail is reddish brown; and the lower part of the back and tail-coverts are ochre-yellow.

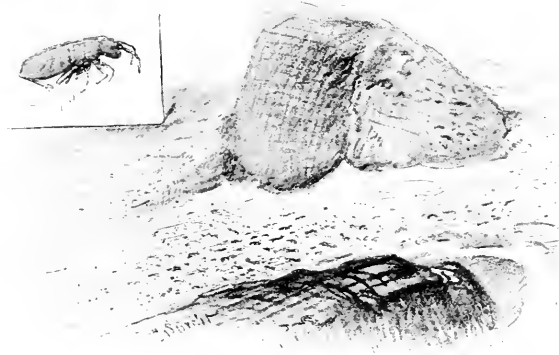
Black Salamander. (*Salamandra atra*), which measures from 4 to 6 inches in length, and resembles in many respects its yellow-spotted cousin, although readily distinguished by its sable livery. The distributional area of this species comprises the Savoy, the north Italian, Swiss, Tyrolese, Salzburg, lower Austrian, Styrian, Carinthian, Carniolan, and German Alps, as well as a few of the Alpine spurs in the south of Würtemberg. Nocturnal in habits, and living by preference near the edges of forests, this salamander comes out by day only in rainy weather, or when the air is hot and dry, at other times lying hid beneath moss or stones or in hollows of trees. Although during the day scarcely one of these somewhat loathsome creatures may be visible, after a shower in the early morning they appear as if by magic in considerable numbers. The more disagreeable the weather, the livelier becomes the black salamander, although generally it seems quite sluggish. Although it is not known why they become so active after rain, it is certainly not in order to capture their prey, for they hurry about so quickly that they have scarcely time even to seize a worm. While the young of the spotted species are furnished at birth with gills and four legs, and develop in water into creatures breathing by means of lungs, the young of the black kind appear in the world already fitted for a life on land, having shed most of their gills. The reason of this difference is that if the black species were to develop in the ordinary way, the tadpoles would frequently perish by the freezing or drying up of the small Alpine pools which formed their birth-place. The female produces only one or two young, which live before birth thirty or forty days upon the eggs destined never to come to maturity.

Fishes. Many of the fishes of central Europe are also found in the Alpine streams, although others are elsewhere restricted to the basin of the Danube, or to the rivers discharging into the Mediterranean. It is noteworthy that the Lake of Geneva and the Lake of Bourget, in Savoy, both belonging to the Mediterranean drainage-area, have each their own form of the otherwise central and northern European genus *Coregonus*, the other fishes of their group living in that area having been introduced.

Beetles. Among the Alpine insects, the beetles, especially the carnivorous and running types, occupy a prominent place. These insects, being unable to fly, and living in great numbers in sheltered spots, seem to feed principally on flying insects carried by the currents or by rising fogs to the higher regions of the atmosphere, and settling with extended wings on the snow-sheet, at the edges of which live their enemies, whose lack of wings protects them from a similar fate.

Butterflies and Moths. The butterflies and moths of the Alps are generally smaller than their relatives of the lowlands, and furnished with longer fore-wings adapted for flying in the attenuated mountain-air, while they are also dark in colour,

in order to absorb more readily the solar heat. Their caterpillars, again, are furnished with a coat of long hair to protect them from the cold, and undergo a quick metamorphosis in harmony with the brief duration of the Alpine summer. Many of the species are unknown in central Europe, but reappear in the north either in the same form or as closely allied types. Noticeable among the butterflies is the Apollo (*Parnassius apollo*), a large white species with a pair of red spots on the hind-wings and three or more irregular black ones on the front pair. It measures over 2 inches across the wings; and inhabits not only the Alps and other high European mountains, but also visits gardens in Scandinavia. A yellow butterfly of the north German moors (*Colias palena*) also occurs in the Alps; its wings are bordered with black rose-festooned fringes. One of the fritillaries (*Argynnis pales*) inhabiting the Alps and Pyrenees, reappears in Lapland as *A. lapponica*, which differs only in the width of the black markings. One of the blues, (*Polyommatus pheretes*), common to the Alps and Scandinavia, is about an



THE GLACIER-FLEA.

inch across, with the hind-wings marked by two oblique rows of round white spots. A skipper (*Hesperia andromeda*) is known from the Alps, Sweden, Norway, and Lapland. Of the red-spotted burnet-moths, the mountain species (*Zygena exulans*) ranges, above the tree limit, from the Alps and the Caucasus to Lapland. A yellow form of the purple tiger-moth (*Arctia purpurea flava*) is restricted to the Alps and Urals: while of the owl-moths, or *Noctua*, we find *Agrotis hyperborea* in the Alps, Hungary, Norway, and Lapland; *A. recussa* in the Alps, Pyrenees, Norway, Lapland, and the Altai; and *Plusia hoehenworthi* in the Alps, Scandinavia, Lapland, and Labrador. A few moths, such as *A. decora*, are exclusively restricted to the Alps and their immediate neighbourhood.

Other Insects, In spite of their minute size and delicate form, midges brave
 etc. frost and snow; their larvae developing amid wet moss at a height of 8000 feet above sea-level. They are thus true mountain insects, and alone represent the flies in the high Alps. A peculiar kind of earwig (*Forficula biguttata*) is solely Alpine. A remarkable inhabitant of the highest snow-fields

and glaciers is the so-called glacier-flea (*Desoria glacialis*), a member of the Thysanura. Thousands of these hairy insects may be taken below the peak of the Fingenhorn. A harvest-spider (*Phalangium glaciale*), found at a height of 11,500 feet, is bluish white in colour with cloudy grey marks, black angular spots on the abdomen, and white circles round the legs; its length being about a quarter of an inch.

Snails and Worms. A few of the snails of the lowlands are represented by allied species or races in the Alps. The Roman snail (*Helix pomatia*) occurs, for instance, in a local form up to 6000 feet above the sea, while one of the garden-snails (*H. arbustorum*) is represented by a small variety at a height of 7000 feet, where the glass-snail (*Vitrina diaphana*) is replaced by the ice-snail (*V. glacialis*). Of the worms it must suffice to say that the Alpine flat-worm (*Planaria alpina*) is remarkable on account of being blind when dwelling in dark caves or in deep water, although it can see in situations where vision is of use.



BROWN BEAR BATHING.

CHAPTER IX

EASTERN EUROPE

THE fauna of eastern Europe, as mainly represented by the basin of the Black Sea and its affluents, is so characteristic and so different from that of central and western Europe that it imperatively demands separate treatment.

Bear. Foremost among the mammals of this tract is the brown bear (*Ursus arctus*), a species presenting great local variation, and ranging over a large portion of the Northern Hemisphere. The size of this bear varies considerably; in the Himalaya it seldom attains a length of more than about $6\frac{1}{2}$ or 7 feet, the average being about 5 feet, but in Europe it is known to reach as much as 8 feet, while its Kamchatkan and Alaskan representatives are far larger. In Transylvania bears not unfrequently attain a length of $6\frac{1}{2}$ feet or more, with a height of over 3 feet, but, as in other countries, specimens of all sizes are found there, the brown bear varying in this respect perhaps more than any other mammal. Equally marked differences in weight are noticeable among bears, a Transylvanian specimen of 345 lbs. being at least one of the heaviest known. In

all bears the female is smaller than the male, less clumsily built, with the features less coarse and the fore-quarters not so powerfully developed. The coat also varies, even in bears of the same country; in winter it is long, close, and soft; in summer shorter, thinner, and darker, and on the lower part of the body generally woolly, but never without some brown. In Transylvania are found spotted, black, brown, brownish yellow, and greyish bears. The peasants distinguish between the large nearly black bear, with valuable fur, and the short, low, broad-headed and short-muzzled entirely brown bear. The colour generally varies from very light to very dark brown; but many bears are almost cream-coloured on some parts of their body, others are almost black, many chestnut-coloured, while others, on account of the white tips to the hairs, appear of a silvery hue. Young bears have in most cases a white, or at least a light, band round the neck, which runs along the front part of the back, and on the top of the neck is forked, the first branch extending to half an inch behind the ear, while the other runs along the back and curves at the end towards the front. This marking is also subject to variation; the collar round the neck is seldom closed, some young individuals do not possess it at all, while some of the fully grown retain it till death. The brown bear is now rare in Europe, and can only be observed in numbers in a few districts, one of which is Transylvania, where twenty-five to forty bears are killed every year. In many parts of Russia bears are quite as numerous, averaging in the Rokitno marshes one to each square mile of country. These marshes form one of the largest swamps in Europe, comprising several hundred square miles in the south of the Government of Minsk, and being traversed by vast morasses of the wildest character. Only in winter do the Rokitno bears retire to drier ground. Transylvanian bears, on the contrary, live all the year in the forests, and never stay very long among the swamps. Their favourite haunts are among oaks and beeches, where one would expect to find woodcocks rather than bears. In summer they take up their quarters among rocks, or in trees on the mountains.

In spite of their clumsy, heavy build, bears are very active, leaping well, and climbing with ease. Old bears only climb trees with strong branches; smooth trunks offering difficulties even to young animals, although trees with rough bark are easily ascended. In climbing slender trunks bears embrace them with the fore-legs, pressing their breasts hard to the stem, and planting the naked soles of the hind-paws firmly on the bark. Should the trunk be thick, they can support themselves by their claws, and on horizontal branches are able to walk to and fro with perfect ease, or even to stand upright. When turning round on a branch, in the upright posture, they grip a higher one with the fore-legs, or even hang their whole weight on this support. If there is no higher branch within reach, they lie down full-length and swing the body round. On the ground bears move the two legs of the same side simultaneously, thus causing their ungainly walk; nevertheless, their long legs enable them to progress rapidly. In deep snow they lift the fore-legs very high, and put them down quite together, one almost above the other. When the snow is so deep that they cannot withdraw their legs, they push through with the chest as if swimming, at the same time throwing up the snow with their paws.

When walking slowly, these animals hold their claws close together, but



W. Fisher

BROWN BEAR.

G. B. & Co.

when walking through swamps or when attacked they spread them out. The strong and muscular fore-paws are the parts of the body most used; with these



BROWN BEAR TAKING HONEY.

they climb, dig, and drag or carry heavy carcases, while they are also employed to maul their foes or their prey. The fore-limbs are indeed much more powerful than the hind-legs; the claws being longer and sharper, and the muscles more massive. With one stroke of these powerful paws they are able to knock down

an animal as large as a cow; while the short neck and broad chest possess such power that they can carry as great a weight by their teeth as with their paws; and it is said that while walking erect they can carry the carcase of a cow through water. With this strength is combined a marvellous capacity for enduring hardships and wounds. Bears will often carry ten shots or more without succumbing, and even when mortally wounded frequently retain strength enough to rush on an adversary. On one occasion in the Rokitno marshes a bear in its last agonies was seen to break pine-stems of from $3\frac{1}{2}$ to $4\frac{1}{2}$ inches in diameter like straws. Sometimes bears will recover after being most severely wounded; many having been found with old bullets in what would be thought vital spots, and others with reunited bones.

A bear's eyesight is by no means particularly good, while it is frequently asserted that the sense of hearing in these animals is far from being acute. The latter can, however, hardly be the case, since it is stated that in still weather one of these animals will hear the cocking of a rifle at a distance of 70 paces, the snapping of a twig as thick as a finger at 135 paces, and a low whistle at 60 paces. In all such cases bears immediately raise their heads, and move their ears rapidly and continuously in different directions so as to locate the noise. Their sense of smell enables them to detect food or foes at considerable distances. Honey—as trials with young bears have shown—is scented at 30 paces against the wind, and at 20 paces if buried at a depth of 18 inches or so in a mole-hill. When honey has been placed in a tall cupboard, young bears in passing have been seen to rise on their haunches in order to get at the dainty. Others have endeavoured to pull down or climb a 12-foot pole baited at the top with honey; and bears have been known to run about excitedly on the bank of a pond and finally enter the water in order to seize a floating mass of the same delicacy.

The mental faculties of bears appear as well developed as those of any other beast-of-prey in a wild state; and although their intellect seems limited, yet many of their actions display calculation and reflection. They are said, for instance, to be able to decoy elks by imitating the call of the males, and old bears have been known to walk backwards in winter, apparently in order to mislead the sportsman as to the direction in which they travelled. In confinement bears will watch distrustfully a man's every action, although apparently taking no notice: and they will follow every step or movement, endeavouring to prevent approach by moving sideways or backwards. When the bears are discovered—although not further molested—in their winter-quarters in the Rokitno marshes, they will follow the foresters and not return to their dens until they feel themselves out of danger. Bears, however, are neither cruel nor bloodthirsty, but, on the contrary, good-natured, although, being extremely fond of comfort, they soon become irritated. When they attack, it is with a certain degree of openness, in which respect they contrast favourably with the wolf and the lynx, the two other dangerous European beasts-of-prey.

On quitting their winter-quarters in spring, when in consequence of the protracted sleep they move with difficulty, bears are compelled to be satisfied with vegetable food pure and simple, eating moss and berries, and grazing on the sprouting grass. Soon after, for want of something better, they feed on funguses

dry berries, acorns, nuts, and such other forest-produce as has been under the snow; but these only just serve to keep them alive, so that in some districts during spring they are very destructive to cattle. When strawberries, bilberries, and cranberries ripen, the bears greedily seek them out, especially the last. Even bears in the higher mountains of Transylvania which have become used to sheep and cattle lifting, are also fond of bilberries, raspberries, blackberries, and in fact berries of all kinds, holding the bushes to their mouths in their fore-paws, and licking off the fruit. In the same district they also devour wild apples and pears, while when maize-cobs change in autumn from the milky to the hard condition, the bears come for miles round to the maize-fields at the foot of the mountains, where they feed while sitting on their haunches. In the Rokitno country they often enter oat-fields, especially when the corn is green, as well as fields of buckwheat and peas, gliding along on their haunches, drawing the plants towards them right and left with their fore-paws, and forming regular lanes through the crop, which they often completely ruin. Bears are also partial to mushrooms, and in autumn withdraw into the woods among oaks and beeches, where they fatten on acorns, beechmast, hazelnuts, and other fruits. Honey is, however, their favourite delicacy, and from hollow trees inhabited by wild bees they scratch and bite off great pieces of bark and wood, in order to be able to thrust in one of their fore-paws and scoop out the honey.

As a rule, bears strike their prey on the back, the long sharp fore-claws penetrating deeply into the flesh, and not unfrequently tearing out large pieces at a time. While holding on by the back with their paws, they usually kill their prey by biting its throat, although the paws are always more used than the jaws. If the animal be too heavy to be knocked down by the first stroke, others follow in rapid succession. Dogs which cannot be disabled by a single blow are usually seized between the fore-paws in such a manner as to break their ribs; but neither in the case of dogs nor men is hugging ever the mode of attack. When cattle are not overcome by the first onset, bears will chase them about until completely exhausted, when they fall an easy prey to their pursuers, who sometimes give vent to roars of triumph. In flight and pursuit a bear is astonishingly fast, although by no means always successful in capturing his quarry. Once, however, the prey is in his grip it seldom escapes; and on several occasions bears have been seen to carry their victims across a mountain torrent by walking across some tree-trunk that has so fallen as to form a bridge. Bears commence to break up a carcase by tearing open the chest; and when their hunger has been satisfied the remnants of the feast are roughly hidden or covered with twigs, to be dug out again when wanted. In Transylvania they destroy a certain number of wild swine and deer, as well as cattle, although they rarely secure the chamois, which is much too active and quick-sighted to be caught.

In Transylvania bears come down in autumn from the high mountains to the lower forests, where they subsequently enter winter-quarters. The time for doing this depends on the season, the fine autumn weather sometimes lasting till the middle of November, or even till December, when the bears remain abroad half the winter. As a rule, however, frost and snow appear by the middle of November, and force them to seek shelter; the first snow-fall, especially if sudden and ac-

accompanied by drifts, seeming to make a great impression on them. As if by magic, they all hide away forthwith, so that no bear-tracks are seen on the first snow. In a few days, however, they reappear, but seem anxious and ill at ease, and soon make a start for their permanent refuge: on such journeys they almost always follow the same track year by year. Some bears, mostly old ones, remain during the winter in their own district, while others travel long distances from their summer to their winter haunt of sometimes as much as thirty or forty miles, or even more. In the Rokitno district bears usually enter their retreat between the 10th November and 1st December, although here, too, the date depends on the weather. While some hasten straight to their quarters, others approach them in a roundabout fashion, halting at recognised spots on the way.

The lair, which is kept for many years, is usually occupied by only one bear. She-bears with cubs always keep together, and are sometimes joined by another bear. Sometimes young bears, probably after having lost their mother, invade the territory of an old male. If a district satisfy its requirements, a bear is by no means afraid of the vicinity of human dwellings. In the Rokitno marshes bears will take up their quarters in low-lying swampy districts, although on raised spots, which enable them, both when quitting in the spring and while the surroundings are partly under water, to keep on dry land. The lair is always more or less sheltered; glades free from dense undergrowth or fallen timber, marshland, bogs, or meadows never harbour bears in winter. Where, however, there is much fallen timber in pine districts, in plantations of young trees, among willows, and among shrubs, bears may be expected. When possible they choose a slight depression for their lair; and to ensure protection from wind a favourite place is under the branching roots of some fallen tree. Sometimes they form the depression by scraping away the earth or snow; at others, however, they lie on the bare snow behind or between fallen timber. In the Rokitno marsh a bear once broke up a stack of wood, in the midst of which he made himself a lair of branches; and in the same district these animals often take possession of the troughs dug in summer to supply water. In Transylvania they winter in holes or hollow trees, or amid wind-fallen timber and thickets. Holes in the ground, if too small, are enlarged to a sufficient width: cavities in rocks are preferred even to hollow trees. In Transylvania holes dug by themselves are covered in such a manner with roots and turf that the opening faces south or west. Hollow trees are cleared from rotten wood; and in the thickets bears will break down and cover themselves with branches, and so let themselves be snowed up.

In their lairs bears lie curled up, although not so much so that the head touches the hind-quarters; and when in confinement lie mostly in such a position that they can rise quickly. Sometimes, however, they lie at full length, with their hind-paws beneath the body and the fore-paws stretched forward close together and supporting the head, which may be bent a little to one side. In such a position they are found on level spots in fine sunny weather, or when disturbed by a noise that has caused them to start up with the head raised. The winter sleep of these animals cannot in any way be compared with that of other mammals, such as the marmot and the dormouse, since it is extremely light, and hardly a true sleep, but rather a drowsiness. During its continuance they never relax their

native cautiousness, their hearing being as acute as ever. Some bears, indeed, wake up every fortnight or so during the winter—even in deep snow and intense cold—to wander to another lair; but these are mostly old and extremely cunning animals, accustomed to walk in several directions before retiring, and to take to flight at the slightest suspicious sound.

In Transylvania bears leave their winter resorts towards the middle or end of February, more rarely not till March, when the thaw begins in earnest. On leaving their lairs they stretch and lick themselves, and after yawning a few times, place themselves with their fore-paws against a tree, which they scratch vigorously once or twice, finally rolling themselves in the snow or sand, and shaking out their dishevelled fur. Their first thought is food, which, as already said, usually consists at this time of the berries which grow in profusion in the Rokitno marsh. Crouching and gliding along on their haunches, the bears collect with their paws the berries preserved beneath the mantle of snow, or covering the ground as with a red carpet after the thaw. In winter-quarters they feed only under certain circumstances, such as a sudden thaw, generally fasting during the period immediately preceding the retirement.

On the approach of winter female bears retire earlier than the males, and devote more care in preparing the lair, which is lined with a soft warm bed of twigs, leaves, moss, grass, and other dry materials. They put on more fat than the males, and in mid-winter give birth to two cubs in the first year, later on to three or sometimes even four, but when aged never produce more than one at a time. Unlike the males, the females, when suckling their young, frequently change their haunts; and they also play with their cubs on the snow. They leave their winter-quarters only when the cubs can follow them; and even then undertake no distant expeditions, but remain for weeks or months in the neighbourhood diligently teaching the cubs to climb and search for food. When the cubs can stand hardship the family begins to wander, and then the mother suspiciously scrutinises every object, and is specially anxious about any indications of the presence of man.

Bears are still to be met with in the Asturias, the Pyrenees, the Alps, Scandinavia, and northern Russia, but none are now seen in most parts of Germany. In the Bavarian Alps a few are occasionally reported.

Desman. All the other Carnivora, such as the lynx and the wolf, which have inhabited Europe since the prehistoric period, are met with in its eastern division; but of much more interest than these is the small insectivorous mammal locally known as the desman, and technically as *Myogale moschata*. This curious animal, which is peculiar to eastern Europe, is about 16 inches in total length, with a tail of about $6\frac{1}{2}$ inches. Clothed in a thick rough otter-like coat of stiff bristles and woolly under-fur, it is reddish brown and ashy grey above, but looks silvery in certain lights. From its smaller cousin of the Pyrenees it is distinguished by the laterally compressed tail. Inhabiting the banks of the rivers and lakes of a great part of the south-east Russian steppes, these creatures live in holes like a water-rat, and are as thoroughly aquatic as otters, passing most of their time in the water, and resorting to their burrows—which are dug by themselves and terminate in a chamber above water-level—principally to rest and look after

their young. When disturbed, a desman gives utterance to a sharp hissing noise. Desmans subsist chiefly on water-insects and small fishes, searching for food with their long snouts under stones and other refuges for insects and grubs. They owe their scientific name to a musk-like scent attaching to the secretion of a gland under the tail. Although the flesh is unpalatable, the peasants hunt desmans for the sake of their soft beaver-like fur, which is in best condition in early autumn.

The rodents of the eastern districts are for the most part similar to those of central Europe; but it is noteworthy that the squirrel is wanting in the Crimea as well as in the Caucasian borderland between Europe and Asia. The family is, however, well represented by a marmot, the bobac (*Arctomys bobac*), as well as by the suslik, which occurs also in the extreme east of Germany. Susliks are characterised by the somewhat slender body, long head, the rudimentary first toe of the fore-feet, and the short tail with longish hair on



SUSLIK.

the side. They are restricted to Europe, Asia Minor, Asia north of the southern slopes of the Himalaya, and North America. With the exception of one from northern Asia, all the Old World members of the group are short-tailed, in which respect they differ markedly from their Transatlantic cousins.

The common suslik (*Spermophilus citillus*), which frequents dry, treeless plains with a sandy or clayey soil, fields, and large meadows, but never forest and marshy districts, when fully grown is about $9\frac{1}{2}$ inches in length of body, with a tail of $2\frac{3}{4}$ inches. The soles of the feet are haired to the roots of the toes; there is a short claw on the first toe of the fore-foot, the eyes are very small, and the loose and rather stiff fur is yellowish grey and spotted above, but rusty yellow below and white on the chin and throat. Susliks construct burrows in the ground a couple of yards or more in depth, which serve alike as dwelling-places and store-rooms. The deepest are those of the females, in which from four to eight young are born in the spring; these burrows have but one aperture, serving alike for

ingress and egress, and even this is stopped up in autumn as soon as the cold becomes severe. From the store-rooms of their burrows the susliks dig, before the winter sleep, a new channel leading nearly to the surface of the ground so as to be ready for opening the following spring, and also for use as an outlet to the store-room in summer. In this abode, the age of which may be ascertained by the number of obliterated holes, susliks store their food, which consists of seeds, roots, fruit, herbage, and sometimes birds and mice. By the inhabitants of the steppes the susliks themselves are eaten; if caught sufficiently early they can be easily tamed, and make satisfactory pets. In central Europe the species occurs only in the neighbourhood of Vienna, in the south-east of Bohemia, and in Silesia, but it has a wider range than the other forms, extending from Germany through the south of Russia, southern Siberia, and the Kirghiz steppes eastwards to the Altai.

To what extent the beaver may occur in eastern Europe cannot yet be determined with certainty; although it may probably dwell here and there in the Rokitno marshes. The squirrel-tailed dormouse of central Europe is represented in the Caspian area, but the garden species does not apparently range farther east than Hungary and Galicia. Its place is taken by the somewhat larger tree-dormouse (*Glis dryas*), which is reddish brown in colour, and easily recognised by the black stripe on each side of the head running from the nose through the eye to the ear. The range of this species extends from upper Silesia and Vienna to the Caucasus and Siberia, where its favourite haunts are among hazel-bushes and oak-forests.

Several ungulate and other mammals mainly characteristic of Asia extend more or less widely into eastern Europe, where are also found some of those already mentioned under the heading of Central Europe. Among the latter the red deer, which is absent from the greater part of eastern Europe, reappears in the Crimea and the immediate vicinity of the Caucasus where, as probably in the eastern Carpathians, it is represented by the large dark-coloured race known as the eastern red deer (*Cervus elaphus maral*). In the Caucasus also occurs the bison, now widely separated from its fellows in Lithuania, although in past time the species probably ranged over much of the intervening area. The Caucasus is likewise the habitat of two peculiar species of goat known as tur, as well as of the wild goat, but these are best noticed among the fauna of western Asia. The same is the case with the great mole-rat (*Spalax typhlus*), as well as certain smaller rodents, which are found in some parts of eastern Europe.

The bird-fauna of eastern Europe closely resembles that of the Northern Nightingale. Mediterranean countries in its southern portion, and that of central, and partly also of northern, Europe in the western and northern districts. Nevertheless the main distributional area of certain species lies well within the area under consideration. Among these latter is the so-called northern nightingale (*Daulias philomela*) which, like the true nightingale, dwells in bushy situations near water, especially along river banks overgrown with willows and alders and covered with dry foliage. It differs from the true nightingale by the dark grey upper portion of the breast, and is also distinguished by being darker brown above, as well as by the darker tail and smaller bastard primary, and by the white throat being indistinctly bordered with grey. About half an inch

longer than the true nightingale, it is more sedate in its habits. In its food, as well as in the selection of the place for its nest, and the construction of the latter, it closely resembles the southern species, as it does in the colour of its eggs and young: its song is, however, rather different, being much stronger, and including certain bars that appear to have been imitated from the song-thrush. The song is more powerful than that of any other bird of equal size; the tone being deeper and bolder than that of the true nightingale, while the time is slower, and the cadences are divided by longer rests, and so shorter and more impressive. The breeding-area of this bird includes the eastern countries of Europe, commencing at the Oder. Towards the north it extends to Denmark, south Sweden, central Russia, and the valleys of the Ural. In Greece this bird is only a migrant, and eastwards it ranges through the Caucasus to northern Persia and Turkestan.

Golden Eagle. The majority of the golden eagles of Europe nest in the higher parts of the Carpathians, and the extensive forests of Prussia, Russian Poland, and Russia. In the Alps there are now but few of these noble birds left, this being largely due to the incessant persecution to which they are subjected. Nowhere much harm can, however, be done to the eyries, which are situated either on inaccessible cliffs or the uppermost branches of tall forest trees. Frequently the "horst" is a yard in height, and perhaps twice as much in diameter, with a flat top on which is a bed of green herbage, fern, heather, and moss. On this in March and April are laid two or three eggs, which may be of almost any shade from rich chestnut-brown to white, and are generally spotted. Seldom more than two young are found, often only one; and round the eyrie there is always a supply of food brought by the parent birds. Mammals and birds of many species, including the smaller deer, badgers, foxes, martens, wild cats, rats, bustards, cranes, storks, herons, woodcock, and quail, constitute the prey of the golden eagle, which seems, however, to prefer hares and grouse. Long after sunset the two old birds start to hunt for prey. In the mountains they generally hunt along a rocky ledge in the neighbourhood of the nest, one always flying at some distance from the other. Having completed their quest there, they cross the valley in order to repeat the operation on the other side. After a midday rest and drink, a second expedition follows in the afternoon. The golden eagle can seize the swiftest mammals as they run, and swoop down on all birds as they fly. After a successful attack, when the prey is rendered helpless, the eagle frequently utters a joyful cry as it stands with raised wings, outspread tail, and bristling neck-feathers. These birds are able to render harmless the teeth of foxes by twisting the talons of one foot round the animal's muzzle, while they drive those of the other into the body, at the same time pressing down the victim with all their might, and keeping their balance by flapping their wings. Sometimes before the unhappy fox is quite dead the eagle will commence to tear it in pieces: but as a general rule it chokes its victim by seizing the throat as it drives in its talons. Golden eagles fly high with a powerful flight, the neck and feet being drawn in, and they seldom hover.

The golden eagle (*Aquila chrysaëtus*) is met with in Europe in Sweden and eastern Prussia, and as far west, but rarely, as Spain, France, and Britain. In Hungary, Bohemia, Moravia, Austria, and Transylvania it is still far from



GOLDEN EAGLE

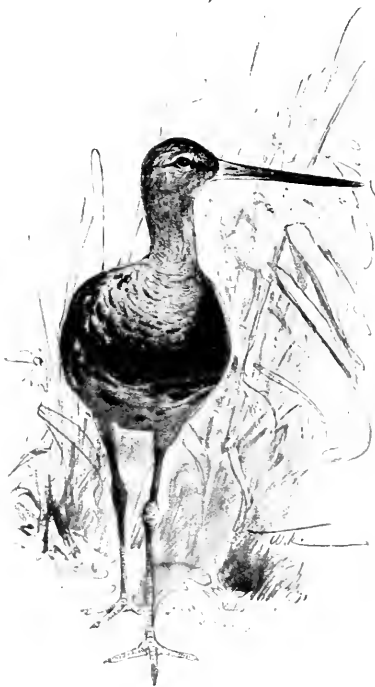
uncommon. From Europe the range of the species spreads over the corresponding latitudes of Asia and North America. The species is feathered down to the toes, has brown wings streaked with black, and a brown tail, mottled with dark grey, and blackish at the tip; unlike the imperial eagle, there is no white patch on the scapulars. The length of the golden eagle varies from 32 to 36 inches, the spread of the wings being 6 feet or more; the female is somewhat larger, and less brightly coloured than the male.

Pelicans.

Pelicans are at once distinguishable by their long straight beak, with the flat upper half hooked at the tip, and the lower half furnished with a dilatable pouch. The white or roseate species (*Pelecanus onocrotalus*) is an inhabitant of shallow bays, large inland-lakes, wide estuaries and deep swamps. Rare in Italy, it is more common in southern Hungary, Turkey, Greece, and the Delta of the Danube, where there is a large nesting-colony on floating islands. Thence its range extends through the Crimea to southern Asia, and through western Arabia to Africa. Pelicans in thousands may be seen on the lakes near the coast of Egypt, on the Nile, and on the Red Sea. From this district they arrive in Hungary in flocks of from four hundred to six hundred at the end of April or beginning of May, and at once disperse to their breeding-colonies on different waters. The nest, generally placed among tall reeds, is a flat structure, composed of reeds, flags, water-plants, and dry grass, and containing two or three bluish white eggs, covered with a chalky crust, from which the naked young are hatched in about five weeks. The latter, which are soon covered with white and grey down, are somewhat owl-like in appearance, and very noisy. They feed on fish; and so long as they are nestlings obtain their food from the pouches of the old birds, the female opening her beak and pressing the lower half against her breast in order that the young can reach the fish more easily. Although fish is their chief food, pelicans also eat young ducks and small crabs, probably when fish is scarce. As a rule, these birds fish in parties and literally beat the water, stationing themselves at equal distances from each other, and swimming along in a curved line, splashing with their wings and driving the frightened fishes together as the horns of the curve approach each other. As only one species of pelican (*P. brachyrhynchus*) dives, the others are restricted to shallow water, the bottom of which they reach with their necks and beaks. The skeleton is remarkable for the extent of its air-cavities, and the bird is much more active than its bulk would indicate. When rising, a pelican beats the water with its wings, gives a few rapid strokes and soon settles into a steady, powerful flight with the neck resting on the back and the beak on the throat. Occasionally these birds hover like storks, or soar in a wide spiral to a great height, and descend in wider sweeps: but sometimes the whole flock suddenly swoop on a shoal of fish. Where much pursued by man, pelicans are wary and difficult of approach, but elsewhere, as in harbours, where they swim up to ships to be fed, they are quite fearless. They are soon tamed, and in this state defend themselves with their beaks against children and dogs, without doing serious damage. In the villages on the Egyptian lakes pelicans visit the fish-market, stand beside the customer, and beg until food is given to them: others starting out in the morning to find their own food, and

return in the evening. The white pelican, which is as large as a swan, measuring 5 feet in length, has the primary wing-feathers black, the secondaries blackish on their inner webs, a yellowish patch on the chest, and the rest of the plumage pinkish white. A crest curving forwards on to the beak distinguishes the species from the Dalmatian pelican (*P. crispus*), in which the feathers of the forehead curve back sharply on the base of the beak.

The latter species inhabits the lower Danube in the Dobrudscha, Dalmatia,



BLACK-TAILED GODWIT.

Greece and southern Russia, the Caspian, and Egypt and Nubia. In colour it is white with a greyish tinge, the yellow patch on the throat is larger than in the common species, and there is more black on the primaries, scapulars, and greater wing-coverts. The legs and feet, instead of rosy pink, are deep grey, and the length of the bird frequently reaches 72 inches. The crested *P. mitratus*, which resembles the roseate species but is pure white and much smaller, sometimes not larger than a goose, is found in the countries round the Black Sea and Caspian, and rarely in Moldavia and other parts of eastern and southern Europe, although it is mainly African, and most common in lower Egypt.

**Black-Tailed
Godwit.**

A not uncommon bird in eastern Europe, belonging to a very different group, is the black-tailed godwit (*Limosa melanura*), which inhabits the larger swampy districts. The nest, which is built amid short grass, not far

from water, is merely a slight depression without much lining; and towards the end of April contains four eggs. The black-tailed godwit is well known in England, but rare in Germany, where it is found only at a few places in the west of Schleswig-Holstein, in Oldenburg, and Friesland, and more seldom in Brandenburg, Pomerania, and Silesia. In some districts of Holland, Belgium, and France, and more especially in Hungary, it breeds frequently. A very wary bird, it avoids the neighbourhood of human beings, and on the approach of anything suspicious stands for a few moments upright, never crouching



PELICAN.

after the manner of snipe. When standing thus with straight legs, and raised throat and breast, it presents a somewhat stork-like appearance; but it can hardly be mistaken when flying with the neck stretched out in front and the legs extended backwards. The flight is easy and the walk graceful. The male hovers over the breeding-place with outstretched wings and expanded tail, uttering his yödel-like song. In August and September this godwit generally leaves for the interior of Africa, although many individuals often stay in the south of Europe for the winter. In April and May it returns to the breeding-district, which comprises temperate Europe and western Asia, the head-quarters being perhaps in Poland. In length it measures 16 inches, and may be distinguished by the long head, the flat forehead, long tail, and slightly upturned beak. Above, the body is dark brown mottled with black, while below it is whitish; there is a conspicuous white wing-bar, the upper tail-coverts are white, and the tail feathers black, except at the base.

Red-Crested Pochard. Among the many handsome members of the duck tribe, few are more striking than the red-crested pochard (*Fuligula rufina*), which mainly belongs to the fauna of south-eastern Europe and central Asia. In Persia and India it is common, being especially numerous by the salt-lakes of the Kirghiz desert and near the Caspian Sea. It straggles into England, generally in the winter, and in Germany is met with so far north as Mecklenburg, breeding in a few localities in the south. It is seen more frequently during the spring migration in March and April than during its autumn journey in October and November. In length it measures about 21 inches. The crest, head, and upper part of the neck are chestnut, the rest of the neck and breast blackish, the back pale brown, the scapulars, flanks, and wing-speculum white, the beak crimson, with a white nail, and the legs and feet bright orange. The female is much quieter in colour, being pale brown with a darker forehead, greyish white cheeks and throat, and dull red beak and legs.

Fishes. Eastern Europe is inhabited by a few reptiles and batrachians unknown to central Europe, but of more importance are its fishes; amongst these being one of the umbres, of which only two species are known, one inhabiting North America, the other (*Umbra krameri*) dwelling in the mud of the marshes in the valley of the Danube. The sturgeon is represented by several allied species in the same area, one of which, the hausen or giant sturgeon (*Acipenser huso*), lives in the Caspian Sea and its tributaries, ascending the Danube as far as Vienna. Less familiar are the smooth sturgeon (*A. glaber*), the scherg (*A. stellatus*), the dick (*A. schypa*), and the wax-sturgeon (*A. gueldenstadti*), the last of which yields more than a quarter of the isinglass and caviare exported from Russia. All these ascend the rivers for spawning purposes. The sterlet (*A. ruthenus*), so highly prized for its flesh, inhabits the rivers flowing into the Caspian, and only rarely enters the sea.



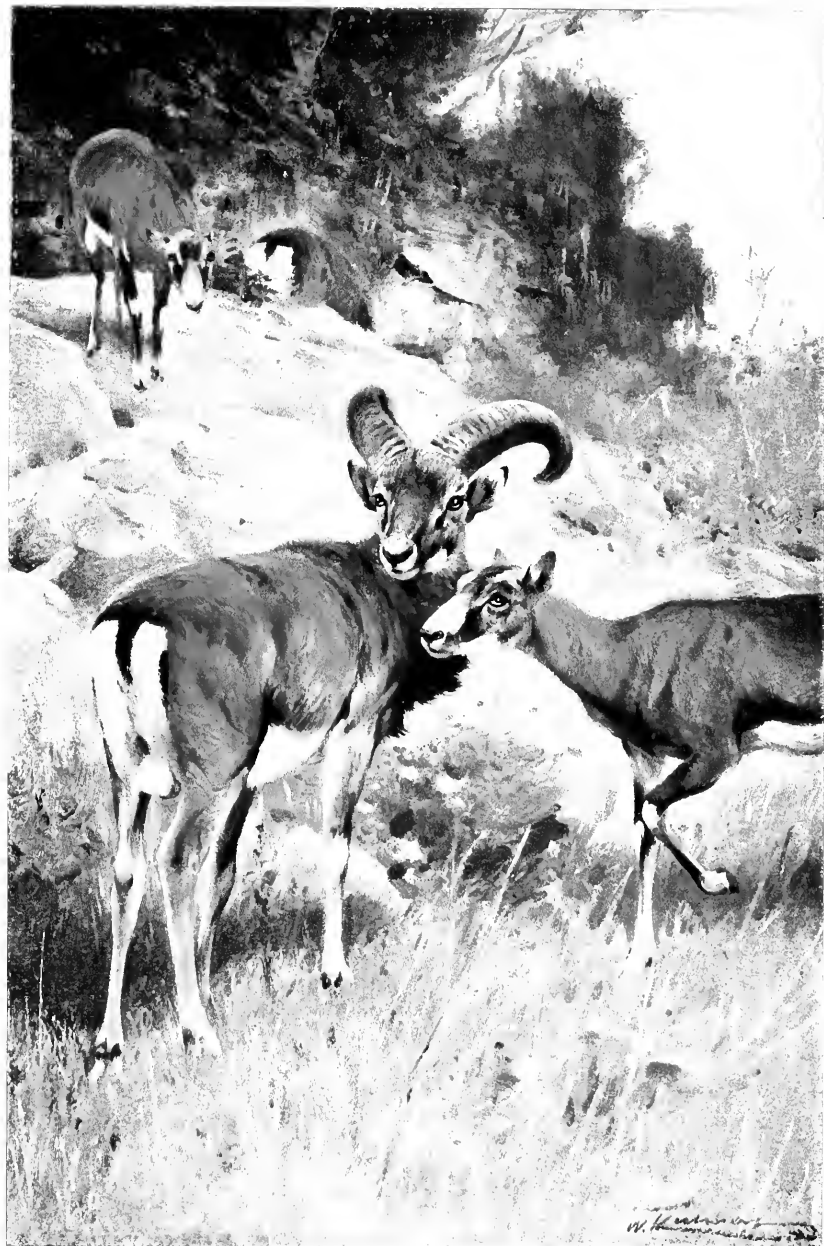
GREEK TORTOISE.

CHAPTER X

SOUTHERN EUROPE

SOUTHERN Europe in its animal life is so closely connected with the Mediterranean countries of Asia and Africa that our remarks will be confined to species entirely or chiefly limited to this area or more fully observed there than elsewhere.

Perhaps the most noticeable is the Spanish ibex (*Capra pyrenaica*), which presents a greater resemblance to the tur or wild goats of the Caucasus than to the Alpine ibex. The horns of this handsome goat, which curve upwards and outwards with a slight twist towards the tip, are flattened in front and keeled behind, showing a pear-shaped section. When seen from the front, they are somewhat in the shape of a lyre, and on the outer side are more or less distinctly knotted. The male has a shoulder-height of from about 27 to 32 inches, the horns attain a length of from 24 to 31 inches, and the chin bears a thick, and at some seasons long, black beard. The general colour is light brown, but much darker around the nose, the forehead, and the back of the head, while a triangular patch on the back, a stripe on the flanks, and the front of the legs are black: the upper lip, cheeks, the sides of the throat, and the back of the legs being grey, and the rest of the under-parts white. The colour varies, however, with the season, and to a certain degree also with locality; the hair, which is mixed with a thick under-fur, being much longer in winter than in summer. The species, of which two local races have been described, inhabits the Pyrenees, some of the mountains of central Spain, and the highest ranges of Andaluca and Portugal. The largest form is found in the Pyrenees, where the horns of old bucks often become comparatively smooth and nearly devoid of knots, thus approaching those of one of the Caucasian tur. On the other hand, the horns of the considerably smaller Andalucaian race, although often as long as those from the Pyrenees, are generally flatter, while those from the central Spanish Cordillera,



MOUTTON

which are heaviest in weight, are more distinctly knotted. The does, especially in late spring, move to the southern mountain-slopes, and in the middle of winter descend even to the vicinity of villages, while the old bucks, which are less affected by snow and cold, remain on the highest and most exposed summits. At pairing-time, in November, when stubborn fights take place between the bucks, the herds of the two sexes come together, but in December they again separate; the one to three year old bucks remaining, however, with the females. When the herd is grazing or resting, the individual first to notice approaching danger (for there does not seem to be a specially posted sentinel) informs its companions, whereupon the entire herd takes to flight. In so doing even the kids of a few hours old are able to follow their mothers over the roughest ground.

Mufloon. Southern Europe is also the home of a peculiar species of wild sheep, the mufloon (*Ovis musimon*), now confined to the islands of Sardinia and Corsica. Standing about 27 inches high, with horns varying from 20 to 34 inches in length, the European mufloon is an elegantly built ruminant, clothed with short, close fur; the rams having a short mane on the neck and a fringe on the throat. The colour is chestnut, with a brown stripe on the back, and a grey or white saddle-patch on the backs of the rams. The head is grey, and the lips, a stripe on the rump, the sides, and the tail, the lower portion of the body, and the legs are white. Each of the two islands named appears to have a distinct race of mufloon; the females being probably horned in the one and hornless in the other. In April or May the ewe brings forth one or two young, which a few days after their birth are able to follow their mother. Occasionally a mufloon will leave its companions to associate with ordinary sheep, while sometimes a motherless domesticated lamb will join a flock of mufloon—both these facts proving the close relationship existing between the two animals, and suggesting that at least some tame sheep are descended from the present species. Many domesticated sheep are, however, distinguished by the greater length of the tail from these and all other wild sheep, except the arui (*Ammotragus lervia*) of northern Africa, which differs so markedly from the rest in the shape of its horns that it is scarcely likely to have been an ancestor of the domesticated breeds.

Rodents. The western countries of southern Europe are, as mentioned above, considered to be the original home of the rabbit, which still lives wild both on the European and African sides of the Mediterranean. Another south European rodent is Savi's vole (*Microtus savi*), which inhabits Italy and the south of France. This vole is rusty grey above and whitish beneath, with white feet. On the sole of the hind foot are five pads. The length of the body is 3½ inches, the tail being an inch long. The species, which usually inhabits dry districts, multiplies nearly as rapidly as the European short-tailed field-mouse.

Another rodent of the south of Europe is the crested porcupine (*Hystrix cristata*), also inhabiting the north and west of Africa, which is characterised by its well-known "quills." Some of these are long and slender, but others short and stout; most of them being white with black rings; while all are simply thickened hairs, every intermediate gradation between the two types being discoverable. These spines are mainly defensive, but are used occasionally in attack, when the animal suddenly darts backwards and thrusts them into its pursuer.

The fact that a few old ones drop out when it bristles them up has led to the legend that they are shot at the foe. Porcupines live principally on roots, and for vegetable-eaters have singularly strong teeth and jaws; another noteworthy feature is the convexity of the skull in which the nose-chamber is larger than the brain-case. In habits the porcupine is nocturnal, living in rocky places or in burrows of its own making; and at pairing-time it makes its nest, a mere collection of leaves, grass, and rootlets, on which are born the young whose flexible spines harden when exposed to the air. In colour this porcupine is black and white, though the bristly crest is brown at the base; it is one of the largest of rodents, the body alone frequently measuring 28 inches.

Southern Lynx. Among the cat tribe, the southern lynx (*Felis pardina*), inhabiting Spain, Sicily, Sardinia, Greece, and Turkey, deserves special mention, since it is restricted to southern Europe and does not even extend to North Africa. It is one of the handsomest of its kind, being distinctly spotted all the year round. The ground-colour of the fur is reddish yellow above, with round black spots not only on the body but on the limbs and tail as well.

Savi's Mole. In the south of France, Italy, Dalmatia, Greece, and parts of Switzerland the place of the common mole is taken by the nearly related Savi's mole (*Talpa savi*), so called on account of its eyes being covered with a delicate transparent membrane so as to be invisible. In its habits and peculiarities this mole greatly resembles the common species, from which it differs by boring tunnels of less extent and nearer to the surface, and also by the circumstance that the nest for its young, unlike that of the common mole, is not situated in its abode, but some distance away.

Pyrenean Desman. One species of desman has been already noticed under the heading of Eastern Europe; the second or Pyrenean species (*Myogale pyrenaica*), frequents both slopes of the Pyrenees. It is only half as large as the Russian species, from which it is distinguished by the tail being round instead of laterally compressed.

Rock-Thrush. Of the birds of southern Europe a large number are common to other parts of the Continent, so that many of them have been mentioned in the earlier chapters of this work. A few are, however, more or less decidedly characteristic of the area under consideration, and therefore demand special notice in this place. Among these is the rock-thrush (*Monticola saxatilis*), a well-known species frequenting mountain-cliffs and rock-faces with a southern aspect, and avoiding wooded districts. The nest is built in rocky crevices or between stones, and in May contains four or five, rarely six, blue eggs. The cock disports himself in the vicinity of the nest, singing loudly during a graceful flight, which ends on the perch whence it began. The song, which is melodious and rich in changes, is continued till well into the summer. Besides berries, worms, and small snails, the rock-thrush feeds on flying insects which it skilfully catches on the wing. About 8 inches in length, this bird is noticeable for the shortness of its tail, which, with the exception of the dark brown middle feathers, is chestnut; the general colour of the upper-parts is bluish grey, but the wings are dark brown. The females and young are brown above with whitish throat and under-parts. The range of the rock-thrush extends through the south of Europe into



Asia as far as China. On migration it visits northern Africa between Abyssinia and Morocco; and as a straggler it is known in southern Germany and a few localities farther north. The migrations take place in April and August.

Warblers. The Sardinian warbler (*Sylvia sarda*) deserves brief notice on account of being apparently restricted to Sicily, Sardinia, Corsica, the south of France, and the Iberian Peninsula. Another common species, Bonelli's warbler (*Phylloscopus bonelli*), is mainly African though often breeding north of the Mediterranean. Generally arriving in May, it departs again towards the end of July. In length it measures $4\frac{1}{2}$ inches. Above, the colour is light brown suffused with yellow, and beneath white. There is an indistinct whitish eye-stripe, and the axillaries are brilliant sulphur-yellow. The favourite haunts of this warbler are amongst forests sloping towards the south, where it nests in the latter half of May.

Buntings. Southern Europe is the home of two buntings whose breeding-areas extend far beyond the shores of the Mediterranean; the first of these, the meadow-bunting (*Emberiza cia*), ranging through Asia Minor and western Asia to the Himalaya, and migrating in autumn to India, Persia, and northern Africa. As a rule, it frequents open hills covered with brushwood, in the neighbourhood of water, where it builds on the ground or a little above under the shelter of a shrub. On the Rhine the nest is most frequently situated in vineyard walls, in crevices and hollows surrounded with low bushes. The eggs are whitish grey marked with grey spots and dark brown lines. In length the meadow-bunting measures 6 inches. In colour it is brown, with grey on the crown and neck, and black on the sides of the head, with a black stripe through the eye, and another extending from the gape of the beak to the ear-coverts. The second kind, the ciril bunting (*E. cirilus*), is resident not only in central and southern Europe but also in Asia Minor and north-western Africa, its breeding-range extending through Germany and France into England, while as a straggler it is known farther afield. In haunts and habits this bird resembles the rather smaller yellow bunting, but it is more wary, and the song is somewhat similar, but without the long final note. The ciril bunting may readily be distinguished by the olive-brown head, the yellow eye-stripe, the black lores and ear-coverts, the black and yellow throat, the brown and yellow breast, and the brown streaks on the flanks.

Ciril Finch. Although the ciril finch (*Chrysomitris citrinella*) is sometimes found breeding in brushwood, it prefers sunny mountain declivities. It is a lively, cautious bird, never resting long on one spot, and keeping to a great extent to the upper branches of trees, although when in search of food, hopping on the ground. Seeds and young tree-buds and blossoms constitute its chief food, although it may also consume grubs and caterpillars. Its song is a trilling, melodious whistle, not unlike that of the canary. The young resemble grey canaries, and are fed from the crop. The cocks ascend with a fluttering courting flight, like that of the woodlark, although not so high. The females and young migrate in flocks in October to warmer countries, to return in April, although they often have to wait till May for the snow to melt. This bird, which is nearly five inches in length, is chiefly green in colour; but the nape and sides of the throat are

grey, the forehead and throat yellowish, the flanks grey, the under-parts unspotted, and the wings marked with a pair of yellowish bars.

Rock-Sparrow. The rock-sparrow (*Petronia stulta*) inhabits southern Europe from Spain to Asia Minor, the southern coast of the Mediterranean as well as Madeira and the Canaries, and central Asia as far east as Pekin. Haunting the ruins on the Rhine and Moselle and other German localities in small numbers, this bird frequents the cliffs of Spain in swarms, and also breeds in numbers in hollow cork-trees in Servia. Although preferring lonely places, it never goes far into forests, and avoiding the plains in winter, appears with other birds near villages. In manner it is very sparrow-like; the flocks when on trees making a prodigious noise, each member continually wagging its tail, and bristling up its head-feathers. It also eats the same food as the common sparrow, preferring oily to mealy seeds; but it is a far better singer. In length the rock-sparrow measures about 6 inches. A light brown stripe over the eye and a white spot on the inner side of the grey tail-feathers, are two of its conspicuous features. The back is brown marked with darker brown and white, and a large yellow patch on the centre of the chest adds brightness to the whole plumage.

Azure-Winged Magpie. In certain districts of Spain and Portugal the crow tribe is represented by the handsome azure-winged magpie (*Cyanopica cooki*), a species remarkably local in its distribution, being unknown elsewhere, while there is but one other member of the same genus, and that an inhabitant of distant China and Japan. This lively bird has a grey back, black head, blue tail, and black and white wings, so that its colouring is decidedly conspicuous. In its long and graduated tail it resembles the magpies, but the beak is straight and jay-like, although without a hook at the point; and the nests, which are built in settlements, are of the same general type as those of the jays.

Dwarf Horned Owl. A small representative of the eared or horned owls (*Scops giu*), which has its head-quarters in the south of Europe, takes its Latin title from its mournful cry, which is heard only at night. Only after sunset does this owl venture out; it flies low, somewhat in the manner of a falcon, when hunting for prey, which includes mice, moles, birds, and beetles, and other large insects. During the daytime this bird sleeps safely concealed in holes or in thick-leaved trees, with its body pressed close to the stem or hidden amid the foliage, and always sits so still that its presence is never revealed except by accident. In central Europe it is by no means unfamiliar, but it does not range far north, and is unknown in Scandinavia, although occasionally straggling to the British Isles. In Switzerland and lower Austria the nest is sometimes found in May with the usual five or six round white eggs. The species is abundant in Styria, the Tyrol, Carinthia, Carniola, Croatia, and Hungary, and is still more numerous in Spain, the south of France, and especially Turkey, Greece, and the Archipelago, noticeably in the island of Naxos, where it nests in the scaffold-holes of houses, whilst elsewhere it builds in holes in trees and clefts in rocks. The breeding-range extends into North Africa. In winter it migrates as far south as Senegambia and Sennaar, and in summer is met with as far east as Turkestan. It may be found in all kinds of country, although most frequently among rocks, as it always avoids large forests. This species, which is under 8 inches in length, is somewhat like a small eagle-owl



ROCK THRUSH

in appearance. The plumage is greyish brown above and greyish white below; the legs are feathered, the toes bare and brown, the beak black, and the radiating discs of feathers not extending above the eyes; the ear-tufts are grey and brown, with whitish markings.

**Eleonoran
Falcon.**

Inhabiting the Greek islands as well as central parts of southern Europe, and also found in Syria and north-western Africa, the Eleonoran falcon (*Falco eleonore*), which nests on the bare ground, mostly under shelter of an overhanging rock or bush, is remarkable from the fact of its breeding-time being different from that of all other birds, the two or three eggs not being laid till the beginning of August, or exceptionally the end of July. This peculiarity is probably at least in part connected with the fact that swarms of birds on migration pass through this falcon's nesting-area in August and September, and afford abundance of food for the young. The young leave the nest by the beginning of October, and at the end of that month or in November depart on migration to return in April to their breeding-places. Both sexes of this falcon are dark slate-colour, with a black moustache-mark on the side of the grey throat; the legs and feet and the base of the lower half of the beak being yellow.

Harrier-Eagle.

The haunts of the harrier-eagle (*Circæetus gallicus*) are marshy places on plains, or open forests in hill-country. The eyrie of this species is placed in some old and thick tree, occasionally barely at the height of a man from the ground; it is built of dry twigs and branches, sometimes covered with oak-leaves or fresh beech-twigs, and at other times shaded by a few green branches. In the first half of May it contains one or two eggs: the old birds are so careful of their young that if disturbed they take their offspring away to another eyrie. The food of this eagle consists chiefly of snakes. Seizing these with one foot just behind the head, and the other along the body, it renders them powerless by a bite in the neck, and then swallows them head-first. Its mode of attack, close feathering, and hard scaly feet usually protect it from bites, but should it be bitten by a venomous snake it succumbs like most other animals. In addition to snakes, it devours rats and other small mammals, blindworms, and other reptiles, as well as frogs, snails, worms, and fishes. Occasionally found as a breeding-bird in the Palatinate, Silesia, and a few other localities in Germany, it prefers the warmer countries of Europe, such as Spain, Italy, and the Balkan States; its range extending to India and the Malay Islands. The harrier-eagle is 26 inches in length; in colour the cere is whitish, the feet are drab brown, the iris is orange-yellow, and the short toes yellow. Above, the plumage is brown, below white with pale brown or rusty grey spots; the chocolate-brown tail having three black bars.

Little Bustard.

The little bustard (*Otis tetrax*) is another south European bird, of which a few stragglers wander as far north as England and Sweden. In Hungary, upper Italy, the south of France, and especially Spain, it is as common in rough rocky districts and sandy plains as it is in southern Russia about the Caucasus and in the Kbirgiz steppes. In winter it crosses the Mediterranean into Africa, and the Asiatic birds cross the Pamirs into north-western India. In Germany it occurs but rarely, although for many years a small flock has been preserved in Thuringia. On arriving at the breeding-grounds the males fight for the females at certain places, which are often trodden as firm as a threshing-floor.

In May from three to five glossy greenish eggs, faintly clouded and spotted with brown, are laid in a shallow depression on the bare ground, scratched out by the female and lined with a little dry grass. The young live on insects, the full-grown



THE HARRIER-EAGLE.

birds on green corn and seeds. The little bustard is brisk in its movements, and runs quickly, springs on the wing at once, flies fast, continuously, and easily, and ends its descent with a long run. The whole flock takes to flight when alarmed, but isolated birds invariably squat flat on the ground. In length this bustard ranges from 16 to 17 inches. The head is pale brown, with dark grey

cheeks, and throat on which is a white loop, a black collar followed by a white band, and then a black gorget. Above, the general colour is pale brown, underneath it is white. The females have no bands on the throat and breast, but are more spotted with black on the back.

White-Winged

Black Tern. unapproachable, the widely distributed white-winged black tern (*Hydrochelidon leucoptera*), recognisable at a distance by its sharply defined coloration, swarms over its nesting-sites. Abundant in certain localities in Spain, Italy, Dalmatia, Hungary, and the Dobrudscha, it is not common farther north and but seldom seen in Sweden or England. Eastwards it ranges through temperate Asia, and journeys southwards to the Transvaal and India, whence through the Malay Archipelago it reaches Australia and New Zealand, while now and then it even crosses the Atlantic, having been shot in Wisconsin. It is 9½ inches long: the body is mainly black with the lesser wing-coverts white; the black and grey wings are broadly edged with white, the upper tail-coverts are white, while the tail, which is deeply forked, is white both above and below. The feet-webs are deeply indented; the feet themselves as well as the legs are red, and the bill a darker shade of the same colour.

Flamingo.

The flamingo (*Phœnicopterus roseus*) ranges across northern Africa from Senegambia and Morocco to the Red Sea, and also through south-western Asia into India, occurring only occasionally in Asia Minor. It also lives round the Black Sea, the Caspian, and the Sea of Aral, and other large lakes of the Kirghiz steppe. In Europe it breeds on the plains of the Guadalquivir in Spain, where, as well as in the south of France, Italy, Sardinia, and Sicily, it occurs in large flocks. Its favourite haunts are the mouths of rivers, and marshes and lagoons near the seashore. Feeding on small worms, molluscs, crustaceans, and vegetable-matter, it searches the mud for its food with its beak, sinking the head and long neck deeply into the water, with the arched upper half of its beak placed on the mud, and the lower half turned upward. Flamingoes are very wary, and when standing erect, with the neck elevated, are little shorter than an average man, and therefore able to overlook a wide extent of ground, particularly as they keep to open plains, and never conceal themselves among marsh-plants. When a flock alights, the first act of its members is to stand in line, stretch out their necks and look round; after which they disperse in search of food, which they seek standing in the water up to their knees, and frequently bending their neck in a double curve. These stately birds walk quickly and gracefully, and when at rest draw up one leg close to the body. When about to fly, they take a series of jumps, half running, half flying, along the surface of the water; but once on the wing they fly rapidly and strongly, looking, with the long legs stretched backwards, the long horizontal neck, and the narrow wings, like crossbows. In the young the beak is straight and used in the normal manner, but gradually it acquires the sudden bend characteristic of the adult.

Tortoises

Of several reptiles peculiar to the south of Europe, the Greek tortoise (*Testudo graeca*) is a familiar species, which when full-grown measures about 10 inches in length, and weighs from 4½ to 5½ lbs.

Distinguished by its convex shell being devoid of keels, with a smooth margin, in colour it is yellow or greenish yellow broadly bordered with black, and each shield marked with a dark brown centre: the plastron, or lower shell, is yellow, and the head and legs yellowish; the shields are marked by faint grooving running parallel with their borders, and the tail terminates in a conical nail-like point. These tortoises feed on cabbage and lettuce and other juicy vegetables, and although popularly supposed to do so, never eat insects; they may live for over thirty years, and always sleep through the winter. They have a well-developed sense of locality, and are not insensible to music. In the pairing-season, which begins in May, they utter a feeble piping cry. The eggs, two to four in number, are buried in the ground. This tortoise is not only a native of Greece but of the whole Balkan Peninsula, as well as of Italy and the south of France. The very similar *T. marginata* ought properly to be called the Grecian tortoise, as it is confined to Greece. It agrees with *T. græca* in the absence of a tubercle on the posterior surface of the thigh, but differs in the form of the shields on the shell.

Green Lizard. Of the lizards found abundantly in the Mediterranean countries of Europe, and demanding notice here, the green lizard (*Lacerta viridis*) attains a length of 17 inches. The males are green above, with small whitish and yellowish dots, and greenish yellow below, with a blue patch on the throat in the breeding-season; the tail being greyish or brownish towards the tip. The females, on the other hand, never develop a blue patch, and are browner, with black-bordered yellowish spots on the sides. The home of the green lizard is south and south-eastern Europe, and south-western Asia: but it also occurs in a few localities in central Europe, being found not only as far to the north-west as the valley of the Moselle, but also in the island of Jersey. Its favourite haunts are rocky districts where there is plenty of sunshine and warmth, although it lives in the Alps up to 4000 feet. Difficult of approach, and swift in flight, this lizard, when taking refuge on a tree, as it often does, will jump from a great height to the ground without injury, in a desperate effort at escape. It leaps as it runs, climbs well, and swims excellently.

Wall-Lizard. The wall-lizard (*L. muralis*) is on the average about 8 inches in length, and has a long depressed head with a pointed muzzle, and a series of granules between the shields above the eyes and, as a rule, only six rows of ventral scales. It varies so much in colour that several races or subspecies have been described, but these all grade into one another, the typical form being brownish grey with a bronzy sheen, spotted and streaked with black. Several of the varieties are confined to particular localities; there is, for instance, a special form in one of the islands of the Cyclades group, another on the island of Milo, and others, again, on Pelagosa in the Adriatic, Filfola south of Malta, Faraglione near Capri, Monacone east of Capri, and Galli between Capri and Analfi. The one inhabiting Faraglione is blackish above and rich blue below: a very similar coloration characterising those of some of the smaller Balearic Isles. Wall-lizards are principally distributed over the Mediterranean countries, but range north up the valley of the Danube into Austria, and down the Rhine valley to Holland: they are also found in Portugal, France, Switzerland, Belgium, etc.: in



FLAMINGO.

Germany they are confined almost exclusively to the Rhine district, principally between Basle and Bonn. The wall-lizard, which requires warm, dry, sunny glades, has been found as high as 5000 feet in the mountains.

Æsculapian Snake. Of three kinds of serpents that demand notice as being inhabitants of the southern countries of Europe, the Æsculapian snake (*Coluber longissimus*) is a harmless species, growing to a length of between 4 and 5 feet. A special character of this species is the arrangement in from twenty-one to twenty-three longitudinal lines of the smooth shiny scales, which are sometimes slightly keeled on the hind part of the body. In colour it is generally greyish yellow above, or brownish, slightly dotted with whitish, while the under-parts are pale yellow. There is a yellow patch on the temple, and a dark streak behind the eye, and the upper lips are yellow. Great individual variation in colour is, however, common. Its distributional area extends from the west of France and Spain to the western shore of the Caspian. In the south of France the species is common; in the southern parts of Switzerland it is also often met with, as it is in the south of Tyrol; it likewise occurs in Salzburg, Carinthia, on the Austrian littoral, in Carniola, down the valley of the Danube from Pressburg, to the Bukowina, and rarely in Hungary and the Carpathian countries. In the Balkan Peninsula it is unknown, and in Russia has only been recorded from a few localities. In southern Europe this snake is mostly found on rocky or stony ground sparsely overgrown with bushes; and in Switzerland it is found at a height of 4000 feet, in Tyrol at over 5000 feet. In spring it apparently dwells in the mountains, to descend into the valleys towards the middle of the summer; it pairs near water, and after the deposition of its eggs returns to higher ground as the summer closes.

Tesselated Snake. The tesselated snake (*Tropidonotus tessellatus*), which belongs to the same genus as the ringed snake noticed in an earlier chapter, like the latter, has nineteen horizontal lines of scales, and an elongated, three-cornered head, with a dark chevron behind. In colour it is yellowish brown or olive above, with four, often indistinct, horizontal lines of alternately placed blackish spots, and below it is marked with yellow and black or red and black chequers. This snake, which attains a length of about 31 inches, inhabits chiefly the middle and eastern basin of the Mediterranean, ranging southwards into Egypt, and northwards to the middle Rhine and Bohemia, westwards to Lorraine and Champagne, and eastwards to Turkestan. It is not known in the Iberian Peninsula, or in the south of France; it is found in Italy only on the mainland, and in Switzerland seems to be confined to the Canton Ticino.

Southern Viper. So little does the southern viper (*Vipera aspis*) differ from the common species that it is often described as a mere variety. As a rule it may be distinguished at once by the snout being turned up at the end, as well as by having two rows of scales, instead of one, between the eye and the upper lip-shields. Although clearly pertaining to the central section of the south European fauna, its range extends westward to the coast of France, eastward to the Austrian littoral, and northward to the 49th parallel of latitude. From France this viper spreads into Lorraine where its recurrence is, however, limited to the Rocher de Phraze, between the villages Dornot and Novéant, near Metz. It occurs

on the Rhine at Basle, and in the greater part of Switzerland, and in the southern part of the Black Forest. In Italy it is the commonest of venomous snakes; and it also occurs in Sicily, although not in Sardinia, Corsica, or Malta. In the Austrian Alps it is found only in the Tyrol. Nowhere does it ascend far up the mountains, although it has been seen exceptionally in the southern Tyrol at a height of 7500 feet; usually, indeed, it confines itself to the uplands where it lurks among rocks and stone heaps.

Agile Frog. Southern Europe is comparatively rich in amphibians, particularly those of the tailed group. Of the frogs it must suffice to mention the so-called agile frog (*Rana agilis*), which differs from the common and moor frogs by its longer hind-legs, as well as by the absence of the two internal vocal sacs. Its eyes are peculiar in that while the upper half is yellow, the lower half is dark brown. The range of this species extends as far north as the north of France, central Germany, and Bohemia, and as far east as the Caucasus.

Newts. Passing on to the newts of south Europe, we find the mountain newt (*Molge montana*) confined exclusively to Corsica, where it may be found rarely in the lowlands and on the coast, but commonly in the mountains. Another kind, Rusconi's newt (*M. rusconi*), has hitherto only been found in Sardinia, where it appears to specially affect mountainous districts in the north and the interior of the island. The Iberian newt (*M. waltlii*) inhabits the south of the Pyrenees, and has also been found in a few localities at Ceuta and Tangier on the north-west coast of Africa, but not yet in Algeria. The marbled newt (*M. marmorata*) is another Spanish species, met with most frequently in the north and west, though its range extends into France. Yet another kind, Bosca's newt (*M. boscai*), is limited to Spain and Portugal. Lastly the Pyrenean newt (*M. aspera*) is only known in the range from which it takes its name, where it lives in lakes deriving their supply from glaciers.

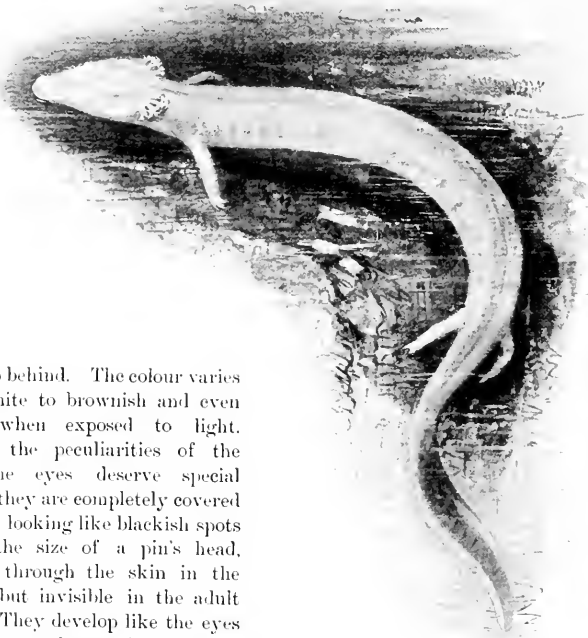
Spanish Salamander. Among a number of interesting types of tailed amphibians, the Spanish salamander (*Chioglossa lusitanica*) is met with only in a few localities in the Iberian Peninsula, mainly in the west and north-west. This species has a long forked tongue supported in such a way as to be free all round except in the middle of the front, and capable of being protruded an inch or more from the lips. In length it measures from 5 to 6 inches, two-thirds of which are taken up by the tail. In colour it is glossy dark brown with a blackish line along the middle of the back, margined on each side by a border which is golden in the Portuguese and reddish in the Spanish form. The haunts of this salamander are apparently pine-forests in the vicinity of water, where, during the dry season, it lives underground, coming out in late autumn and early spring, even occasionally in January when the weather is mild. At such times it may often be seen outside its hiding-place in the twilight, but during the day mostly remains in moss under stones and fallen leaves. It is extremely active, and when disturbed seeks to hide itself quickly in deep water, where it passes its tadpole stage.

Salamanders. The handsome spectacled salamander (*Salamandrina perspicillata*), which is about 3 or 4 inches long and is the only species with four toes to each foot, is confined to Italy. With a rather broad flat

back, a rounded under side, a flat head distinctly marked off from the body, and a long, flat tapering tail, which is bright red underneath, it is dark brown in colour, with a yellow spectacle-bar extending from eye to eye, and a yellowish stripe down the back, the throat being black with a white patch, and the rest of the under-parts white with red specks and black spots. This salamander seems most at home in bushy ravines watered by narrow streams, where it is frequently abundant, coming out in the evening to look for millepedes and beetles and other insects, which it catches by quickly protruding its glutinous tongue, and swallows with much gulping. The summer sleep it undergoes seems sometimes to be deeper and to last longer than its hibernation, as even in midwinter one of these salamanders may occasionally be seen about, the climate in which it lives being rarely very cold. Against attack it appears to be protected by a skin-secretion of a poisonous nature, at least on small animals, such as salamanders; and when touched or frightened it spits water, and becomes stiff as though feigning death.

The last member of the group to be noticed here is the cave-salamander (*Spelerpes fuscus*), alone representing in Europe a genus which ranges into central America. Attaining a length of about 4 inches, it is characterised by a mushroom-shaped protrusile tongue, a moderately long, almost cylindrical, body, a fairly large head, a round tail shorter than the body, and well-developed legs and feet of which the webs do not reach the tips of the toes. In colour it is glossy brown above and paler below with a few patches and speckles. Believed to be confined to Sardinia and the mountains round the Gulf of Genoa, it lives in limestone caves, obtaining the needful moisture from the percolating water, and passing most of its time adhering by its toes to the rocky walls. In rainy weather, however, it quits its hiding-place and also wanders about after night-fall. This creature, which is said to feed on spiders and insects, and to die if it swallows an ant, is most lively in March, April, and October. After a continuous rain of several days in February and September it will often venture out of its retreat, but in the height of summer remains in the caves, feeding wholly on such insects as shun warmth and light. In the cave of Garesio in the Alpes Maritimes, where the water never accumulates in pools, the salamanders are said to breed, but how these salamanders pair is still unknown. Another haunt of this salamander is Grotto di Ponte di Nava, near Ormea, where water continuously drips, and by such continuous dripping slowly collects to form a few pools. Here the creature dwells in complete darkness, literally incarcerated within walls as the owner keeps the cave closed. These cave-salamanders cannot swim, and are easily drowned in shallow water, although they can easily be taught how to climb out of a bath when kept in captivity, sometimes in a single lesson. In confinement they enter the water before casting their skin and remain sitting there for a few days, after which they go on land, where they easily throw off their skin, which has meanwhile become quite pale in colour. In their new dress they have a very brilliant appearance, looking as though powdered with gold-dust. When exposed for a long period to dry air, they change their skin as soon as they arrive at a damp place, from which it would seem that in their native state they do not require a bath. Apparently these salamanders have no lungs, and breathe only through the skin, the movements of the throat serving merely to draw in the air by the nostrils and facilitate the act of smelling.

olm. A kind of halo of romance enircles the olm (*Proteus anguineus*), the sole European representative of a group of salamanders furnished with persistent feather-like external gills. This remarkable creature is found only in the subterranean waters of Carniola, Carinthia, Croatia, and Dalmatia. It is about 10 inches long, with an eel-like body, a rather broad head, long snout truncated in front, small eyes, three pairs of bright red bunches of gills, and two gill-slits on each side. The legs are very short and thin, with three toes in front



THE OLM.

and two behind. The colour varies from white to brownish and even black when exposed to light. Among the peculiarities of the olm, the eyes deserve special notice: they are completely covered by skin, looking like blackish spots about the size of a pin's head, shining through the skin in the young, but invisible in the adult stage. They develop like the eyes of other vertebrates, but the lens gradually disappears till finally there remains only the vitreous humour, which originally filled the space between the lens and the retina.

Olms live in running water in the caves and are by no means so sluggish as they sometimes appear in confinement. They are quick in their movements and, propelling themselves with their tails, swim so fast that they are by no means easy to catch. Moreover, they are far from sluggish even in captivity; and so long as they receive sufficient food swim about at night, especially in spring, when they are often so lively that the splashing of the water may be heard in an adjacent room. They feed on toad-spawn, worms, tadpoles, small molluses,

water-insects and their larvæ, and crustaceans. Specimens caught in the Magdalene Cavern near Adelsberg in Carniola, the contents of whose stomachs were examined, contained fresh-water shrimps in all stages of digestion. At pairing-time olms become not only more lively, but more voracious. At this season the males change their skins, and become darker in colour, while clear, round spots appear in two lines on the tail, which is also decorated with a membranous fringe. The skin of the female likewise changes and, probably in consequence of the larger influx of blood, assumes a reddish hue; a fringe to the tail being also acquired. The females lay eggs $\frac{2}{3}$ of an inch in diameter, which are fastened separately to the stalactites in the pools of water. About ninety days afterwards the slender tadpoles hatch out. These have a total length of $\frac{7}{8}$ of an inch and a tail-length of $\frac{3}{16}$ of an inch. The tail is furnished with a large fin-like fringe, extending along three-quarters of the length of the back. As in the adult, the fore-legs terminate in three well-developed toes, but there are no toes on the hind-feet. In this state the eyes are functional. The Magdalene Cave near Adelsberg has been celebrated for its olms since the year 1797; but now more than forty such places are known. The majority of the olms kept in confinement come from Adelsberg. In the spring, when the Poik, a partly subterranean river, is swollen with snow-water, they are floated into the Magdalene Cave, where, notwithstanding that numbers are exported, they seem as numerous as ever.

Insects.

Of some commercial importance is the fact that the branches of a south European oak (*Quercus coccifera*) form the abode of a cochineal insect, known as kermes to the ancient Greeks and Romans. This insect (*Chermes vermilio*), which belongs to the group Rhynchota, is largely exported from Spain and the islands of the Ægean, and also thrives in numbers near Maina in Greece. Many of the country people, especially shepherds and children, are occupied in the collection of kermes, which is used for dyeing the well-known Turkish fez. The chief supply of cochineal is not, however, obtained from this species but from *Coccus cacti*, a Central American insect which has been introduced into Tenerife, Algeria, Iowa, and Australia.

Another insect deserving special mention is the praying mantis (*Mantis religiosa*), the only member of its kind occurring in Europe. The *Mantida* form, however, a large group spread over the warmer countries of the globe. The European species, which is from 2 to 3 inches in length, has the peculiar habit of raising its fore-legs and the fore part of the body in order to catch insects passing on the wing.

Spiders.

Among the spiders of southern Europe are the trap-door spiders, whose habit it is to burrow in the ground with their upper jaws, and line their holes with cobwebs, closing them with a cover. One of these, the mason-spider (*Nemesia cementaria*), is abundant in the Riviera. Much dreaded in many parts of south Europe is the net-spider (*Latrodectes tridecemguttatus*), a black species half an inch in length with thirteen red spots on its abdomen. This species, which spins single threads among stones and hollows, has a bite occasioning dangerous inflammation even in human beings, several Calabrian peasants having died from the effects in 1830 and 1833. On the other hand, the bite of the tarantula (*Lycosa tarantula*)—named after the town of Tarentum or Taranto—is no more injurious than the sting of a bee. Neither is it in any way the cause of

the so-called tarantula dance of southern Italy, which must not be mistaken for the harmless and favourite tarantella dance of the same country.

Centipedes. The spider-centipede (*Scutigera coleoptrata*), so named from its long and many-jointed legs, is found in the vine-growing districts and also in central Europe, and on both shores of the Mediterranean. Rather less than an inch in length, it is furnished with fifteen pairs of long, thin legs, of which the hindmost are not used for running but are held high off the ground like the bristle-shaped feelers. This loathsome creature, which shuns the light, lives by preference in human habitations. With its legs and feelers groping in all directions, it appears at night running on the walls of rooms in search of flies and the like, which it encircles, quick as lightning, with its many-jointed legs, and poisons as it bites them. Should other flies approach while it is feeding on one, they also become its prey; and in this way it has been observed to catch four flies whilst eating one and to hold them in its legs until one after another had been devoured.

Crustaceans. Of the crustaceans of the area under consideration, the river-crab (*Telphusa fluviatilis*) is notable as being the only European species of a genus numerously represented in the warmer countries of the earth and consisting entirely of fresh-water species. This crab lives beneath stones on the borders of rivers and lakes and, as it was in ancient times, is often eaten at the present day.

Summary. While the fauna of central Europe differs somewhat considerably from that of the southern division, a great similarity exists between it and that of western Europe north of the Pyrenees. Several of its conspicuous species are, however, absent from the British Isles, where, on the other hand, we find amongst others the red grouse (*Lagopus scoticus*) and a local form of coal-tit (*Parus ater britannicus*). On the whole, however, the west European fauna is the same as that of central Europe, although less rich in the matter of specific types.

As southern Europe together with North Africa and south-west Asia form the Mediterranean region, so a large part of western Europe, consisting of the northern coast of Spain, the greater part of France, with Belgium, Holland, and the British Isles, form part of the Baltic province to which also belong northern and central Europe, with the exception of the Danube valley. The far north of Europe together with the corresponding latitudes of Asia and America form the Boreal province of the great Holarctic region; that region including all that part of Europe lying north of the Mediterranean region. In like manner the Siberian province is a continuation of the Baltic province, the two collectively forming the Baltic-Siberian area. Much the same may be said of the Eastern and Mediterranean areas, which, together with the Caspian district, form a life-region extending eastward to the Chinese Empire. Europe is indeed to a certain extent an appanage of Asia, so that in Asia north of the Himalaya a fauna in many respects similar to that of Europe may be looked for.

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